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HONDA 360/400/600 SEDAN & VAN SHOP MANUAL (2nd Edition)

FOREWORD

This manual is prepared to provide the service personnel of Honda dealers with complete information on the maintenance and repair of Honda Car Models N360, N400, N600 and Station Wagon Model LN360 and their variants.

The information and instructions are grouped according to the type of work to be performed, such as diagnosis and testing, frequently performed adjustments and repairs, overhaul, etc. Specifications, special tools and maintenance instructions are found at each major section.

The section index on this page enables the reader to quickly locate any desired section. At the beginning of each section is a table of contents, which gives the locations of the major subjects in the respective section.

This manual should be kept where mechanics working on those Honda cars are able to reach easily at any time. If this manual is properly utilized and referred to, the workshop will be able to provide owners of Honda cars with better service and good reputation for reliable service.

This manual supersedes the manuals formerly provided for N600, N360 and LN360, and the future revisions to it will be made by means of revisional pages whenever the occasion calls for it.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make any changes at any time, without notice.

For any inquiry and/or suggestions regarding this manual, please write to Publications Department, Service Division.

June 1970

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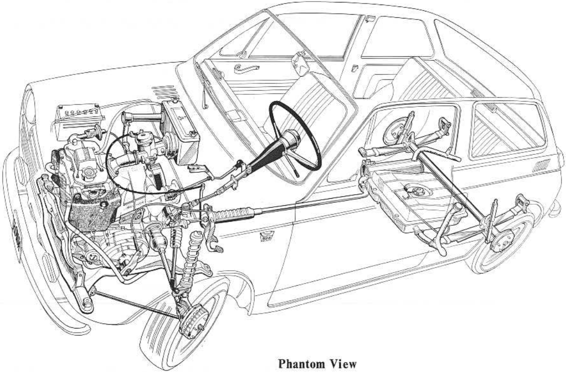
Section Index

SECTION 1

GENERAL INFORMATION



Phantom View

A. Model and Type

The following is a table of models and types described in this shop manual.

Type	Engine	Model	Transmission
N360	354cc (21.4 cu-in.)	2-door Sedan	Manual
A360		2-door Sedan	Automatic
LN360		Van	Manual
N400	401cc (24.4 cu-in.)	2-door Sedan	Manual
N600	594cc (36.5 cu-in.)	2-door Sedan	Manual
A600	594cc (36.5 cu-in.)	2-door Sedan	Automatic

B. Serial Number and Identification Plate

1. Standard vehicle

The serial number plate is fixed on a fender on the right-hand side of the vehicle, as shown in Fig. 1B-1.

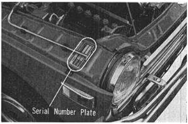
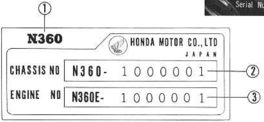


Fig. 1B-1



① Type . . . . N360/A360/LN360/N400/N600/A600/AN600 (Model for USA, Manual vehicle)/AA600 (Model for USA, Automatic vehicle)/N600G(DELUXE)

② Chassis No. N360/A360/LN360/N400/N600/A600/AN600/AA600
360 Vehicle—starts with 1,000,001
400 Vehicle—starts with 1,000,001
600 Vehicle—starts with 1,000,001

③ Engine No. . . . . . . N360E—N360 and LN360 starts with 1,000,001
A360 starts with 8,000,001
N400E—N400 starts with 1,000,001
N600E—N600 starts with 1,000,001
A600 starts with 5,000,001

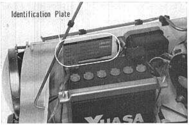


Fig. 1B-2

2 . Vehicles destined for export to Germany, Denmark, Finland, Switzerland, Norway and Sweden.

The identification plate is fixed on the right side front fender inner panel, on the back side of the battery, as shown in Fig. 1B-2.

SPECIFICATIONS

MAKE: HONDA | CHASSIS NO: 1000001 ④

① TYPE: N360

② ENGINE TYPE: N360E | ENGINE NO: 1000001 ⑤

NO OF AXLES: 2 | PASSENGER CAPACITY: 4

③ MAX WEIGHT: 855 kg | MAX ALLOWED WEIGHT ON AXLE ⑥

MODEL SEDAN | F. 430 kg

DATE OF MANUFACTURE: | R. 430 kg

HONDA MOTOR CO.,LTD. JAPAN

① Type N360/A360/N400/N600/A600/N600G

② Engine type N360E/N400E/N600E

③ Max. weight . . . . N360 855 kg
A360/N400/N600 900 kg
A600 930 kg
N600G 950 kg

④ Chassis No. N360/A360/N400/N600/A600
360 Vehicle—starts with 1,000,001
400 Vehicle—starts with 1,000,001
600 Vehicle—starts with 1,000,001

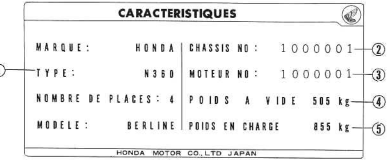
⑤ Engine No. . . . . N360E—Starts with 1,000,001 (N360)
N360E—Starts with 8,000,001 (A360)
N400E—Starts with 1,000,001
N600E—Starts with 1,000,001 (N600)
N600E—Starts with 5,000,001 (A600)

⑥ Max. allowed weight on axle

	N360	A360	N400	N600	A600	N600G
F	430 kg	510 kg	510 kg	480 kg	510 kg	510 kg
R	430 kg	465 kg	480 kg	465 kg	480 kg	480 kg

3. Vehicles destined for export to France.

The identification plate is fixed on the right-side front fender inner panel, on the back side of the battery, as the one above. (Refer to Fig. 1B-2)



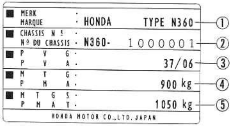
① TYPE
② CHASSIS No.
③ MOTEUR No.

} Same as Section 2. Refer to Section 2 on the preceding page.

	N360	A360	N400	N600	A600	N600G
④ POIDS A VIDE	505 kg	550 kg	540 kg	550 kg	570 kg	550 kg
⑤ POIDS EN CHARGE	855 kg	900 kg	900 kg	900 kg	930 kg	950 kg

4. Vehicles destined for export to Belgium.

As in the case of a standard vehicle described in Section 1, the serial number plate is found on the right fender. (Refer to Fig. 1B-1)



① TYPE
② CHASSIS Nº
Nº DU CHASSIS

} Same as Section 1

	N360	A360	N400	N600	A600	N600G
③ PVG PVA	37/06	37/06	40118	37/05	37/05	40.182
④ MTG PMA	900 kg	900 kg	900 kg	900 kg	900 kg	950 kg
⑤ MTGS PMAT	1050 kg	1050 kg	1050 kg	1150 kg	1150 kg	1200 kg

5. Vehicles destined for export to the U.S.A.

The vehicles shipped to the U.S.A. has the identification plate at the front edge of the instrument panel. The specification placard is attatched in the glove box and the certificate plate is located on LH center pillar while the vehicle emission control information plate is on the LH fender inner panel.

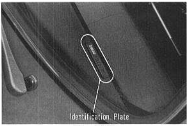


Fig. 1B-3

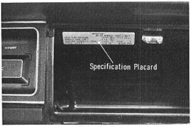


Fig. 1B-4a

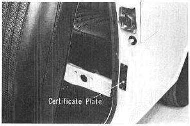


Fig. 1B-4b

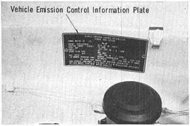


Fig. 1B-4c

Identification Plate

AN600 – 1 0 1 9 3 2 3

A carved stamp of the chassis number is fixed on the identification plate.

Specification Placard

IMPORTANT
UP TO VEHICLE LOAD LIMIT
COLD TIRE PRESSURE: FRONT 30 psi REAR 24 psi
VEHICLE LOAD LIMIT: 650 lbs,
SEATING CAPACITY : TOTAL 4 FRONT 2 REAR 2
TIRE SIZE : 5.20-10 BIAS PLY

Certificate Plate

MFD IN JAPAN BY HONDA MOTOR CO., LTD. :
3 / 70 : THIS VEHICLE CONFORMS TO ALL APPLICABLE
U.S. FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN
EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE:
V.I.N. AN600-1019620

Vehicle Emission Control Information Plate

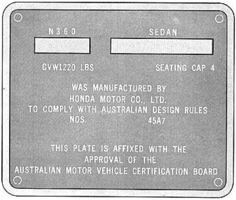
VEHICLE EMISSION CONTROL INFORMATION
HONDA 600 SEDAN

HONDA MOTOR CO., LTD.

ENGINE DISPLACEMENT : 36.5 CU IN (598CC)
IGNITION TIMING (STATIC) : 10° BTDC
POINT GAP : .012 — .016 IN (.3 — .4MM)
DWELL : 90°
SPARK PLUG TYPE : NGK B8ES
GAP : .028 — .032 IN (.7 — .8MM)
IDLE SPEED : MANUAL TRANSMISSION 1100-1200 RPM
(AT NORMAL OPERATING TEMP.) AUTOMATIC 900-1000 RPM IN 'D' RANGE
SEE HONDA SHOP MANUAL FOR ADDITIONAL INFORMATION
THIS VEHICLE CONFORMS TO U.S.DEPT. OF H.E.W. REGULATIONS APPLICABLE TO
1970 MODEL YEAR NEW MOTOR VEHICLES

6. Vehicles destined for export to the Australia

The compliance plate is attatched on the right side front fender inner panel which is on the back side of the battery.

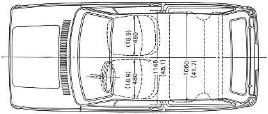


C. General Data and Specifications

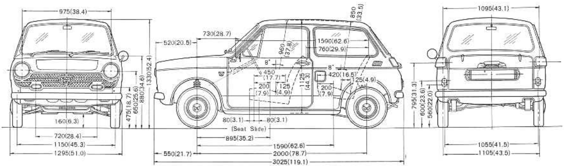
	N360	A360	LN360	N400	N600	A600	Model for U.S.A. AN600	Model for U.S.A. AA600
DIMENSIONS								
Overall length		3,025mm (119.1 in.)		3,125mm (123.0 in.)	3,100mm (122.0 in.) 3,125mm-N600G		3,175mm (125.0 in.)	
Overall width		1,295mm (51.0 in.)					1,335mm (52.6 in.)	
Overall height		1,330mm (52.4 in.)						
Minimum ground clearance		160mm (6.3 in.)						
Overhang: Front		550mm (21.7 in.)				605mm (23.8 in.)		
Rear		475mm (18.7 in.)			505mm (19.9 in.)		572mm (22.5 in.)	
Wheelbase		2,000mm (78.7 in.)						
Tread: Front		1,150mm (45.3 in.)					1,170mm (46.1 in.)	
Rear		1,105mm (43.4 in.)					1,135mm (44.7 in.)	
WEIGHT								
Curb weight	505kg (1,114 lbs)	550kg (1,213 lbs)	545kg (1,201 lbs)	550kg (1,213 lbs) 600kg (1,323 lbs) -N600G		580kg (1,279 lbs)	615kg (1,356 lbs)	
Seating capacity	4	4	4 (or 2)	4	4	4	4	4
Maximum cargo capacity	—	—	200kg (441 lbs)	—	—	—	—	—
Distribution of weight:								
Unloden: Front	338kg (745 lbs)	375kg (827 lbs)	350kg (772 lbs)	365kg (805 lbs)	370kg (816 lbs) 400kg-N600G	395kg (871 lbs)	882 lbs (400 kg)	
Rear	167kg (368 lbs)	175kg (386 lbs)	195kg (430 lbs)	185kg (408 lbs)	180kg(397lbs) 200kg-N600G	185kg (408 lbs)	474 lbs (215 kg)	
Maximum loaded: Front	430kg 50% (948 lbs)		434kg 44.9% (957 lbs)	460kg 51% (1014 lbs)	480kg 53% (1058 lbs) 495kg 52.1% -N600G	490kg 52.7% (1080 lbs)	1113.5lbs51.8% (505kg)	
Rear	430kg (948 lbs)		531kg (1,171 lbs)	440kg (970 lbs)	465kg,-N600 (1025 lbs) 455kg-N600G	440kg (970 lbs)	893 lbs (405kg)	
Power unit weight	87kg (192 lbs)	108kg (238 lbs)	87kg (192 lbs)	96.5kg (192 lbs)	96.5kg (213 lbs)	114kg (251 lbs)	213 lbs (96.5 kg)	251 lbs (114kg)

	N360	A360	LN360	N400	N600	A600	Model for U.S.A.	
							AN600	AA600
PERFORMANCE Maximum power output	31 bhp/8,500 rpm (SAE) 27 ps/8,000 rpm (DIN)			33bhp/8,000rpm (SAE) 29 ps/7,500rpm (DIN)	45bhp/7,000rpm (SAE) 42 ps /6,600rpm (DIN) Modified engine 36bhp/6,000rpm (SAE) 32 ps /6,000rpm (DIN)		36bhp/6,000rpm (SAE) 32 ps /6,000rpm (DIN)	
Maximum torque	3.0 kg-m/5,500 rpm (21.7 ft-lb/5,500 rpm)			3.1 kg-m/ 5,500 rpm	5.2kg-m/5,000rpm (37.6ft-lb/5,000rpm) Modified engine 4.4kg-m/4,000rpm (31.8ft-lb/4,000rpm)		4.4kg-m/4,000rpm (31.8ft-lb/4,000rpm)	
Fuel consumption with full load	220 g/ps-h (at, 5,500 rpm)							
Maximum safe tilting angel (right and left)	46°	48°	46°	48°	47°	48°	48°	48°
Turning circle	9.4m (30.8 ft.)			9.5m (31.2 ft.)				

Physical Dimensions, HONDA N360/A360

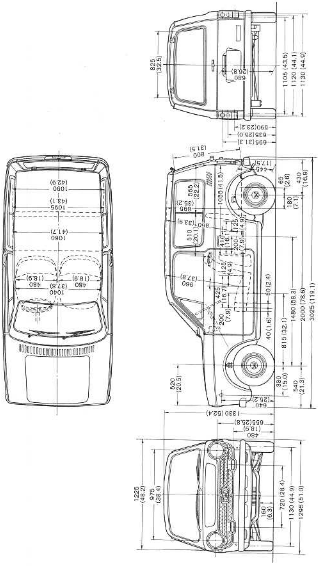


Unit: mm(in.)



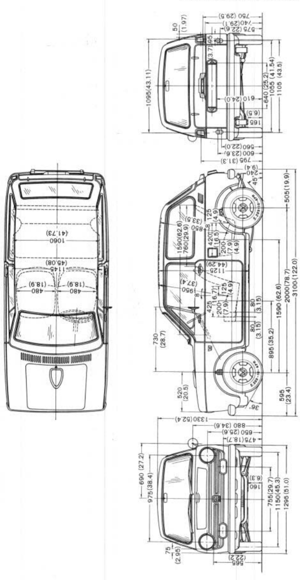
Physical Dimensions, HONDA LN360

Unit: inch

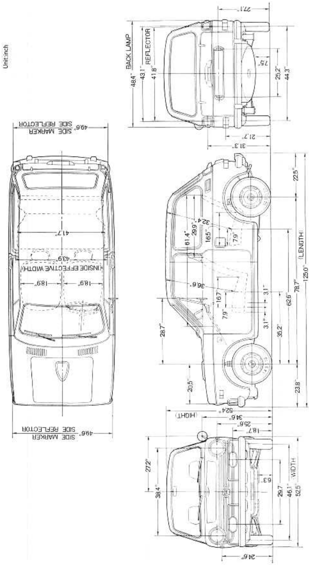


Physical Dimensions, HONDA N600/N400/A600

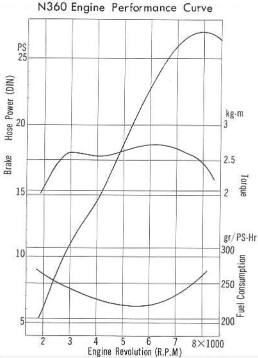
Unit : mm(in)

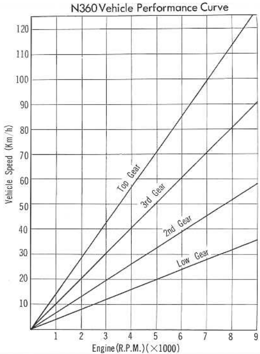


Physical Dimensions, HONDA600 (Model for U.S.A.)

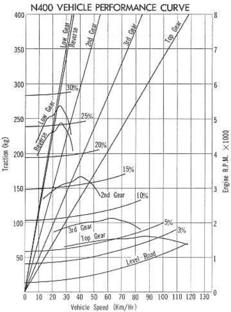


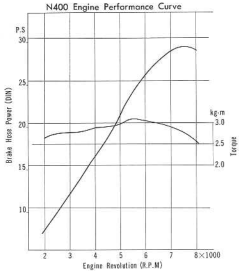
Performance Curve, HONDA N360/LN360



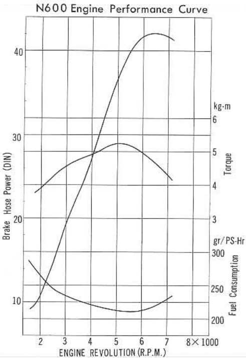


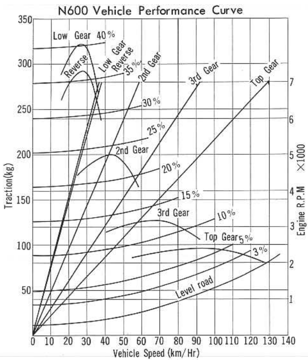
Performance Curve, HONDA N400



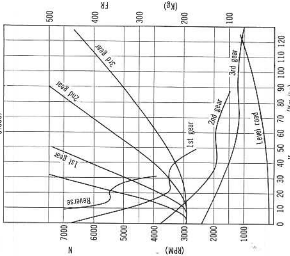


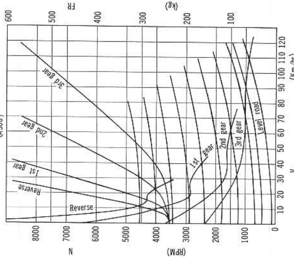
Performance Curve, HONDA N600





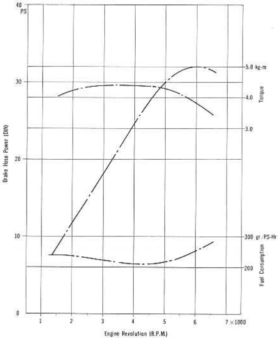
Performance Curve, HONDA A360/A600



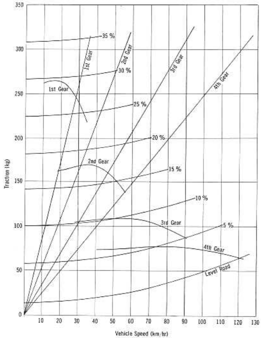


Performanec Curve, HONDA New N600

New N600 Engine Performance Curve.



New N600 Vehicle Performance Curve.



Performance Curve, HONDA New A600

This curve is to follow.

D. Keys and Locks

Locks of the identical structure are used for the ignition switch, doors and trunk lid so that a single key can serve a multiple purpose of ignition, and opening and closing of both door locks and the trunk lid.

Fig. 1D-1 shows the ignition switch assembly and the key, Fig. 1D-2 the door locks, Fig. 1D-3 the trunk lid lock and the key.

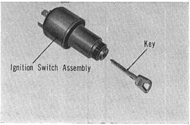


Fig. 1D-1

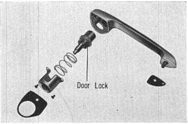


Fig. 1D-2

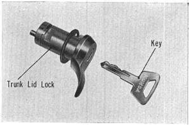


Fig. 1D-3

a. Key

A six digit number is engraved on each key. The first figure of a number on a key represents its groove shape and the rest is angular shapes.
A blank key with only a groove shape and without angular shapes has been prepared which makes it possible to duplicate a key by cutting angular shapes into it.

It is necessary for a motorist using the key to have a duplicate ready before he loses the key or when he wants spare keys on hand. Otherwise it may become necessary to change all three lock assemblies.

How to duplicate:

After finding proper blank key, properly position both the original and the blank on a key cutter; and cut the key teeth on the blank key by tracing the teeth of original.

Original key is positioned on the adaptor; tracing needle traces the profile of the original. Thus the blank is processed by the cutter.

Since such a cutter is available world over, it should be easy to prepare duplicates with the blank keys.

If it ever becomes necessary to change a lock assembly, do it properly by following procedures described in sections b, c,and d.

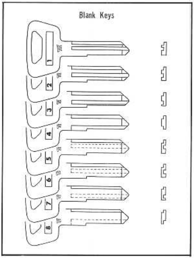


Fig. 1D-4

Fig. 1D-5

b. Ignition switch assembly

By using an ignition switch wrench in the special tool set, remove the ignition switch lock nut. Take out the washer and also the ignition switch assembly from the back side of the instrument panel.
The switch assembly can be detached if the wire harness is pulled out of the switch.

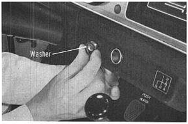


Fig. 1D-6

Make sure to replace the washer before screwing the lock nut when reassembling the switch. (Fig. 1D-6)

Fig. 1D-7

Firmly insert the wire harness into the ignition switch assembly before fixing it on the instrument panel. (Fig. 1D-7)

B terminal — white
IG terminal — black with yellow stripes
ST terminal — black with white stripes

Vehicles destined for shipment to Germany and Denmark have both the igniton switch and the steering lock assembly installed on the steering column.

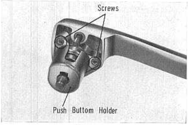


Fig. 1D-8

c. Door lock assembly

Detach the outside handle from the door by first removing the door lining and then two nuts from the inside of the door.
(For details, refer to SECTION 18. BODY).

Next, detach the lock assembly by removing the two screws and the push-button holder. (Fig. 1D-8 and 1D-2)

d. Trunk lid lock assembly

Open the trunk lid and remove the bolts holding the lock assembly. **(Fig. 1D-9)**

Next, take out the lock cylinder setting spring using a screwdriver. Both the lock cylinder and the lock holder can be detached. **(Fig. 1D-10)**

When reassembling the trunk lid lock, make sure to fix the gasket in its original place in the lock cylinder as it prevents water from entering the rear compartment.

The setting spring is fit into the groove of the lock cylinder. **(Fig. 1D-11)**

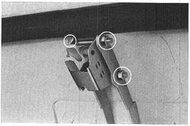


Fig. 1D-9

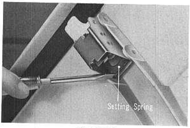


Fig. 1D-10

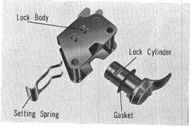
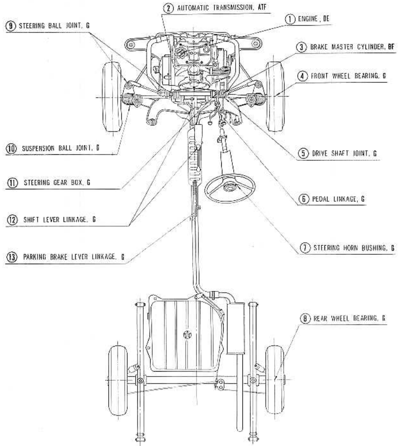


Fig. 1D-11

E. Lubrications

Lubrication Chart



Remarks ;

- OE: Engine Oil
- G: Grease
- ATF: Automatic Transmission Fluid
- BF: Brake Fluid

No.	Oil and gease Inlets	Type of Oil and Grease	First 1,000 km (600 miles)	5,000 km (3,000 miles) when running	Remarks
1	Engine, Transmission Differential	Engine oil	Change	Change	Only for gear-transmission cars
	Engine	Engine oil	Change	Change	Hondamatic only
2	Automatic transmission	ATF	Add if necessary. Change after every 20,000 km (12,000 mile)		Hondamatic only
3	Brake master cylinder	Brake oil	Add if necessary after checking		
4	Front wheel bearing	Grease	Supply or change after every 50,000 km (30,000 miles)		
5	Drive shaft joint	Grease	Factory sealed-lubrication system, oil supplied only during overhaul.		
6	Pedal linkage	Grease			
7	Steering horn bushing	Grease			
8	Rear wheel bearing	Grease	Supply or change after every 50,000 km (30,000 miles)		
9	Steering ball joint	Grease	Factory sealed-lubrication system, oil supplied during overhaul.		
10	Suspension ball joint	Grease			
11	Steering gear box	Grease			
12	Shift lever linkage	Grease			
13	Parking brake lever linkage	Grease			

*Refer to page 1—22 "Lubricants" when selecting both the type and quality of oil and grease to be used.

1. Changing Engine Oil

In the vehicles equipped with gear transmissions, engine oil is supplied to the engine, transmission and differential. It is not necessary to supply transmission and differential oils. In the vehicles equipped with automatic transmission, the engine is lubricated by engine oil, and the transmission and differential by A.T.F. as in the case of torque convertors.
Although engines are sufficiently lubricated with high quality Honda Ultra Oil before the cars are shipped out, it is still desirable to have the oil changed as indicated on page 1-22 depending on the time of delivery and the period of storage prior to sale.

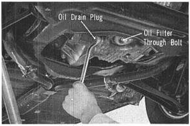


Fig. 1E-2

Change oil according to the following instructions after new cars have traveled 1,000 km (600 miles) and after every 5,000 km (3,000 miles) thereafter. Remove the drain plug after detaching the filler cap and drain oil completely. If the drain plug is too tight for easy removal, strike its edge with a hammer to loosen it slightly.
It is desirable to change engine oil when the engine is still warm. This is to ensure complete drainage of old oil.

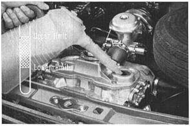


Fig. 1E-3

Tighten the drain plug firmly after oil has been drained completely and supply new oil to the engine. (Fig. 1E-3)
Pour oil up to the upper limit of the oil level gauge.

Capacity:

Gear-transmission car 3.0 lit. (2.6 Imp. qt., 3.2 US qt.)
Hondamatic car 2.5 lit. (2.2 Imp. qt., 2.6 US qt.)

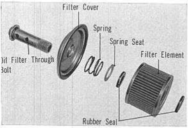


Fig. 1E-4

Changing Oil Filter Element

The oil filter element is changed after the first 5,000 km (3,000 miles) and every 10,000 km (6,000 miles) thereafter.
Remove the filter cover after taking out the oil filter through bolt to detach the element. (Fig. 1E-2 and 1E-4)
Inspect the presence of any oil leak by starting the engine. Do this after installing the new element.

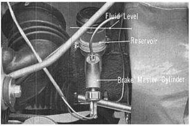


Fig. 1E-5

2. Automatic Transmission Fluid

After every 5,000 km (3,000 miles), check the condition of automatic transmission fluid and add some if the quantity is insufficient.
Change the fluid after every 20,000 km (12,000 miles). For detailes of instruction on changing the fulid, refer to SECTION 7. TRANSMISSION-HONDAMATIC.

3. Brake Master Cylinder

Check the amount of fluid in the brake after the first 1,000 km (600 miles) and supply fluid if necessary. Make the next check after 5,000 km (3,000 miles), and then every 5,000 km (3,000 miles) thereafter. (Fig. 1E-5)

4. Front Wheel Bearing

There is unnecessary to grease the front wheel bearing during the first 50,000 km (30,000 miles). A grease nipple is not installed at this location as a result. Even after the 50,000 km (30,000 miles), it may not be necessary to change grease at the time of the check.
A supplementary supply of grease is normally adequate.

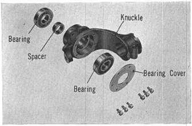


Fig. 1E-6

5. Joint Section of Drive Shaft

The joint of the drive shaft consists of the outboard joint and the inboard joint and is of the factory sealed lubrication system. There is, consequently, no need to regularly supplement oil or to change it.
In vehicles in the 360cc class, a double cross universal joint is used for the outboard joint and aconstant speed ball joint for the inboard joint.
The constant speed ball joint is used for both the outboard and inboard joints of cars belonging in the 400cc and 600cc classes.
Check the bellows for damage There is no need to change grease if the bellows is not damaged. Inspection of the double cross universal joint is necessary to replenish grease and also change the cross shaft and the needle bearing if tear and wear is obvious. Refer to SECTION 9. DRIVE SHAFT for instructions.

6. Pedal Linkage

7. Steering Horn Bushing

It requires only light greasing at the time of an overhauling.

8. Rear Wheel Bearing

Refer to Section 4. for instructions as they are the same as those for the front wheel bearing
As for instruction related to changing, refer to SECTION 13 REAR AXLE.

9. Steering Ball Joint

Being a factory sealed-lubricantion system, it requires only light greasing at the time of an overhaul.
Refer to SECTION 10. STEERING for details.

10. Suspension Ball Joint

There is no need for either greasing or oiling because the ball joint section of the front suspension lower arm has been lubricated at the time of assembly. Change parts if weat and tear is considerable during inspection at the time of overhaul.

11. Steering Gear Box

Even though this box is of the factory-sealed-lubrication type, apply grease to it by fitting the greasing adapter whenever irregular noise is heard.
Refer to SECTION 10. STEERING for details.

12. Shift Lever Linkage

13. Parking Brake Lever Linkage

Although the linkage is of the factory-sealed-lubrication type, it is desirable to apply grease lightly at the time of overhaul.

Lubricants

To get the maximum benefit from vehicle, it is vitally important to pay attention to the type of oil and grease to be used, in addition to performing daily inspection. Generally, in automobile engines, the characteristic will differ for each type, such as, the operating temperature, lubrication system, oil breather diameter, the various clearances etc., therefore, the oils to be used must be compatible to the respective type engine. The oils must also be changed at the intervals specified in the servicing schedule. By so doing, an economical and extended trouble-free operation can be maintained.

The extended use of dirty oil or oil which has become diluted will seriously damage the engine and will shorten its serviceable life. It is recommended that quality oil of API Service Classification with MS grade or better be used. This class oil is superior in heat and oxidation stability, in addition, considerable attention had been given to the compounding of chemical additives to obtain higher load carrying and detergency characteristics so that it will be able to cope with conditions encountered under different driving situations. Further, select from the table the oil which has the proper viscosity for the temperature. In other words the selection of oil should be based on the quality and the proper viscosity which is suited to the operating conditions.

	TEMPERATURE	GRADE	CLASS	
			API Service	ASTM
Single Grade	−20°C (−4°F) to 0°C (32°F)	SAE 10W	MS	G-1V
Single Grade	0°C (32°F) to 15°C (59°F)	SAE 20W SAE 20	MS	G-1V
Single Grade	15°C (59°F) to 30°C (86°F)	SAE 30	MS	G-1V
Single Grade	Above 30°C (86°F)	SAE 40	MS	G-1V
Multigrade	Above −15°C (5°F)	SAE 10W/40	MS	G-1V
Multigrade	−15°C (5°F) to 30°C (86°F)	SAE 10W/30	MS	G-1V
Multigrade	Above 0°C (32°F)	SAE 20W/40	MS	G-1V
Grease	Multipurpose	NL GI No. 2	Multipurpose Type	

Note:

1. Temperature indicated in the table is the average atomospheric temperature antici-pated: which is provided as a standard of the temperature zone.
2. Engine, transmission and differential are integral unit sowed in the crankcase, there-fore, lubricant is required only in the crank-case. (Manual transmission gearshift car.)
3. In an extremely cold area, where the average atmospheric temperature is below -20°C (-4°F), grade SAF 5W oil may be used. However, make sure to change to the suitable oil when the atomospheric temperature rises.

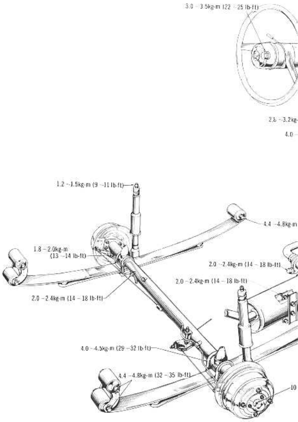
F. Fuel

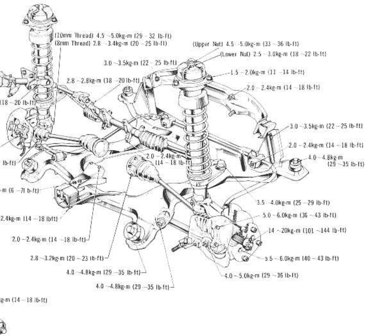
Regular grade gasoline is used for all cars under N-series . Since the combustion chamber form is designed in such a way as to be exceptionally strong aginst knocking, it is not necessary to use high octane gasoline.

However, overseas where gasoline of low octane value is marketed, it is desirable to obtain gasoline contain-ing a high value of octane for its use.

In case of severe knocking after rapid acceleration during running, delay the time of ignition by 5° as compared to standard ignition since it is caused by gasoline containing a low octane value. Refer to SECTION 2. ENGINE TUNE-UP, for adjustment of the ignition timing.

G. TORQUE SPECIFICATIONS



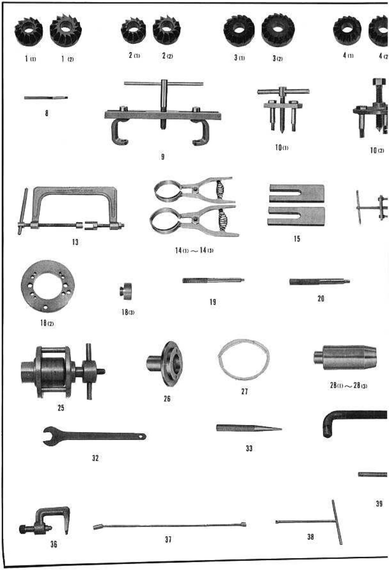

(10mm Thread) 4.5 -5.0kg-m (29 - 32 lb-ft)
(8mm Thread) 2.8 -3.4kg-m (20 - 25 lb-ft)
(Upper Nut) 4.5 -5.0kg-m (33 - 36 lb-ft)
(Lower Nut) 2.5 - 3.0kg-m (18 -22 lb-ft)
3.0 -3.5kg-m (22 - 25 lb-ft)
1.5 - 2.0kg-m (11 -14 lb-ft)
2.8 - 2.8kg-m (18 -20 lb-ft)
2.0 - 2.4kg-m (14 -18 lb-ft)
3.0 -3.5kg-m (22 - 25 lb-ft)
2.0 - 2.4kg-m (14 -18 lb-ft)
2.0 - 2.4kg-m
(14 - 18 lb-ft)
4.0 - 4.8kg-m
(29 -35 lb-ft)
3.5 -4.0kg-m (25 -29 lb-ft)
5.0 - 6.0kg-m (36 - 43 lb-ft)
14 - 20kg-m (101 -144 lb-ft)
2.0 - 2.4kg-m (14 -18 lb-ft)
2.8 -3.2kg-m (20 - 23 lb-ft)
5.5 - 6.0kg-m (40 - 43 lb-ft)
4.0 -4.8kg-m (29 -35 lb-ft)
4.0 - 5.0kg-m (29 -36 lb-ft)
4.0 -4.8kg-m (29 -35 lb-ft)

H. SPECIAL SERVICE TOOL LIST (See page 7-174 for automatic trans

Standard Tools

REF.NO.	TOOL NAME	TOOL NO.	MODEL N360/LN360	MODEL N400	MODEL N600	REMARKS
1−1	Inlet Valve Seat Cutter, 90°	07001-55101	○	○		
−2	〃	07001-56801			○	
2−1	Exhaust Valve Seat Cutter, 90°	07002-55101	○	○		
−2	〃	07002-56801			○	
3−1	Inlet Valve Seat Cutter, 120°	07003-55101	○	○		
−2	〃	07003-56801			○	
4−1	Exhaust Valve Seat Cutter, 120°	07004-55101	○	○		
−2	〃	07004-56801			○	
5−1	Inlet Valve Seat Cutter, 38°	07005-55101	○	○		
−2	〃 58°	07005-56801			○	
6−1	Exhaust Valve Seat Cutter, 40°	07006-55101	○	○		
−2	〃 48°	07006-56801			○	
7	Valve Seat Cutter Holder	07007-55101	○	○	○	
8	Valve Guide Reamer	07008-55101	○	○	○	
9	Brake Drum Puller	07009-57906	○	○	○	
10−1	Steering Wheel Puller (A)	07010-51201	○	○	○	
−2	〃 (B)	07019-51201			○	For servicing N600G and N600 Deluxe only
11−1	Rotor Remover	07011-55101	○	○		
−2	〃	07011-56801			○	
12	Rotor Holder	07023-56802			○	
13	Valve Lifter	07031-25001	○	○	○	
14−1	Piston Ring Compressors	07032-55101	○			
−2	〃	07032-59301		○		
−3	〃	07032-56801			○	
15	Piston Seats	07033-25001	○	○	○	
16−1	Front Damper Spring Compressor Main	07034-55110	○	○	○	} Set No. 07034-55103
−2	〃 Flange	07034-55115	○	○	○	
17	Bellows Band Fastener	07043-55101	○	○	○	
18−1	Drive Shaft Replacer Main	07045-56805	○	○	○	} Used as a unit (07045-56801)
−2	〃 Flange	07045-56810	○	○	○	
−3	〃 Attatchment	07045-56820	○	○	○	For servicing 22mm thread dia. spindle only
19	Valve Guide Driver	07046-55101	○	○	○	
20	Shift Rod Pin Driver	07047-55101	○	○	○	
21	Front Wheel Bearing Driver A	07048-55110	○	○	○	
22	Front Wheel Bearing Driver B	07048-55101	○	○	○	
23	Rear Wheel Bearing Driver	07048-56725	○	○	○	
24	Oil Seal Driver A (Camshaft)	07054-55102	○	○	○	
25	〃 C (Differential Gear)	07054-56801	○	○	○	
26	〃 B (Clutch)	07057-55103	○	○	○	
27	Air Bleeder Tube	07059-55102	○	○	○	
28−1	Exhaust Pipe Fitting Driver	07066-55101	○	○		
−2	〃	07066-56801			○	Area : B,D,E,F,N,P,Q,R,T,U,V
−3	〃	07066-56802			○	4.1mm larger in dia. than 07066-56801 Area : A(except Hawaii),C,G,J,S
29−1	Exhaust Pipe Removing Adapter	07066-55121	○			
−2	〃	07066-56811		○		Area : B,D,E,F,N,P,Q,R,T,U,V
−3	〃	07066-56812			○	4.1mm larger in dia. than 07066-56811 Area : A(except Hawaii),C,G,J,S
30	Exhaust Silencer Fitting Driver	07066-55111	○	○	○	
31	Ignition Switch Wrench	07071-56801	○	○	○	
32	Crankshaft Pulley Holder	07079-55105	○	○		
33	Valve Clearance Adjusting Bar	07071-55101	○	○	○	
34−1	Wrench Handle	07083-60105	○	○	○	
−2	Socket (32mm)	07083-60110	○	○	○	
−3	〃 (27mm)	07083-60115	○	○	○	
35	Roof Lining Tool	07089-55101	○	○	○	
36	Tie-rod Ball Joint Puller	07092-55103	○	○	○	
37	10mm Universal Joint Socket Wrench	07093-55101	○	○	○	
38	Universal Joint Socket Wrench Holder	07093-55105	○	○	○	
39	Spark Plug Wrench	07094-55101	○	○	○	
40	Reamer Handle	07996-99944	○	○	○	
41	Valve Seat Cutter Case	07997-55101	○	○	○	
42−1	Tools Set (N360/N400)	07000-55107	○	○		Area : all
−2	〃 A-1 Set (N600)	07000-56803			○	Area : B,D,E,F,N,P,Q,R,T,U,V
−3	〃 A-2 Set (N600)	07000-56811			○	Area : A,C,G,J,S
43−1	Tool Cace (N360/N400)	07790-55105	○	○		
−2	〃 A-1 Set (N600)	07790-56805			○	
−3	〃 A-2 Set (N600)	07790-56810			○	

ssion tools)



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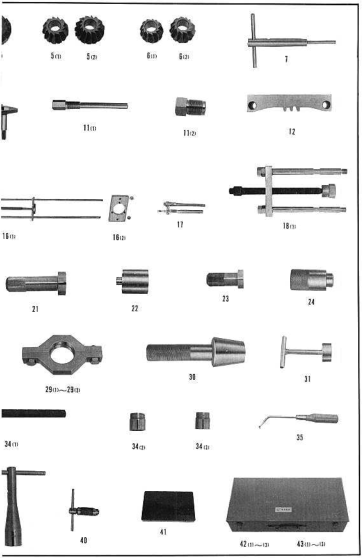

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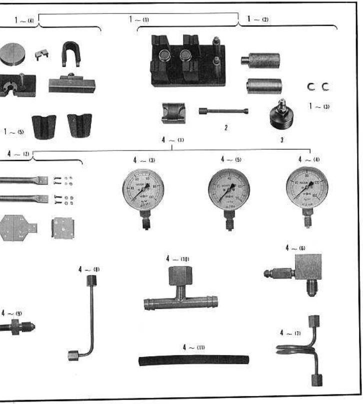
al Tools

TOOL NAME	TOOL NO.	MODEL N360/LN360	MODEL N400	MODEL N600	REMARKS
g Set Drive Shaft Overhaul	07043-55150	○			
eplacer Unit Needle Bearing	07043-55110	○			
pacer	07043-55113	○			
eplacer Unit Center Pin	07043-55120	○			
atcher	07043-55125	○			
rive Shaft Replacing Socket Wrentch	07093-55104	○	○		
reasing Adapter	07099-55801	○	○	○	Used only for late models
acuum Booster overhaul Set	07145-57950			○	
verhaul Unit	07043-57915			○	
ressure Gauge A	07145-57905			○	
〃 B	07145-57901			○	
acuum Gauge	07145-57910			○	
ttatchment C	07145-57920			○	1 set consists of 2 parts
〃 D	07145-57925			○	〃
〃 E	07145-57930			○	
〃 F	07145-67935			○	1 Set consists of 2 parts
〃 I	07145-57955			○	
〃 J	07145-57960			○	



SECTION 2

ENGINE TUNE-UP

D. Compression Test

The compression check is very important and should always precede other engine tune-up procedure.

(Test procedure)

1. Check the battery for full charge.
2. Check the level and quality of crankcase oil.
3. Be sure the engine is at normal operating temperature.
4. Remove the air cleaner element.
5. Set the choke and the throttle valve to the fully open position.
6. Remove all the spark plugs.
7. Install a compression gauge.

(Normal compression pressure)

Model	Engine Revolution at 400 rpm
360 and 400	11.5~12.5 kg/cm^2 (164~178 psi)
600	10.5~11.5 kg/cm^2 (149~164 psi)

(Test conclusion)

Indication	Possible Cause
Pressure reading is above normal.	Excessive carbon deposit inside the combustion chamber.
Pressure reading is below normal. However, compression is increased after a tablespoon of heavey oil is injected into the combustion chamber and engine is cranked several times.	Faulty and/or worn piston rings.
Pressure reading is below normal. Compression is not increased even if heavy oil is injected into the combustion chamber.	Faulty valves or leak through cylinder head gasket.
Pressure readings varies at each compression test.	Sticking valve.

E. Valve Adjustment

Since the camshaft is driven directly by the crankshaft through an endless chain, the crankshaft has to be removed before installing or removing the chain. Cam chain vibration is prevented by a synthetic rubber cam chain guide roller located midway between the camshaft and hydraulic cam chain tensioner. (Refer to "ENGINE MECHANICAL" for details.)

When cam chain noise is high, the cause is either an inoperative hydraulic cam chain tensioner or excessively stretched cam chain. Incorrect valve timing or valve clearance, or both, are often the main cause of poor compression, low engine power, engine overheating, hard starting, unstable idling etc.

(Valve timing)

In case cam chain noise become excessively high and the hydraulic cam chain tensioner is operating properly, check the valve timing as retarded valve timing indicates the cam chain is stretched.

To check valve timing, turn the crankshaft clockwise and align the "T" mark on the crankshaft.

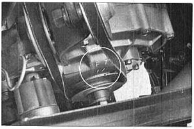


Fig. 2E-1

At the position, if the line mark on the sprocket is horizontal, parallel to the flange surface of the camshaft housing, valve timing is correct.

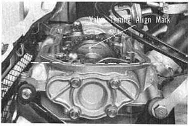


Fig. 2E-2

(Valve clearance)

Incorrect valve clearance attributes not only to higher valve noise but to poor engine performance as well.

If valve clearance is excessive, the valve opens too late and closes too soon, causing poor engine output, increased fuel consumption, and valve noise. Further, wear of the camshaft lobe is accelerated because the rocker arm is unable to follow the pattern of the camshaft lobe, causing a shock contact.

If the valve clearance is too small, the valve opens too early and closes too soon causing poor compression, rough engine idling, and back firing,

NORMAL VALVE TAPPET CLEARANCE (Intake and exhaust)

0.08~0.12mm (0.003~0.005 in)

Be sure that the engine is cold to check or adjust valve clearance, or both, because the clearance varies according to engine temperature. Valve clearance tends to increase as the engine temperature rises due to different coefficients of heat expansion between the aluminum cylinder head and the steel valve system.

For this reason, it is advisable to provide a slightly larger clearance in cold districts and during winter while a slightly smaller clearance is recommended in hot districts and during summer.

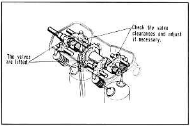


Fig. 2E-3

(Valve clearance adjustment)

Since the camshaft is supported at both ends by plain aluminum bearings (camshaft holders), there is a certain amount of allowable play between the camshaft journal and the bearing. Therefore, the camshaft will be inclined to one side when only one valve is lifted. Set the camshaft at the position that both left and right valves are lifted and camshaft is horizontally pressed downward. At this position, the correct valve clearance adjustment can be made.

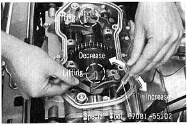


Fig. 2E-4

Loosen the rocker arm locking bolt and turn the rocker arm shaft inward to reduce valve clearance, or outward to increase valve clearance.

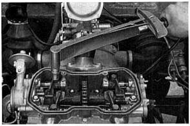


Fig. 2E-5

Tighten the locking bolt with a torque wrench to **4.0 kg-m (28.9 lb-ft)** after completing adjustment.

Note:
Valve clearance varies as the locking bolt is tightened. Insure that valve clearance is correct after tightening the locking bolt.

F. Air Cleaner

(Filter element)

After removing the air cleaner case cover, remove the retainer spring to extract the air cleaner element.

To clean the filter element: Hold and tap the filter element against a wooden surface, freeing the element of dirt and dust, then blow compressed air from the inside.

Note:
Do not clean the element with solvent or cleaning solution.

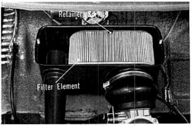


Fig. 2F-1

(Air cleaner case)

Clean the air cleaner case and cover with compressed air and solvent. Check the bellows for air-sealing. Tighten the bellows band if necessary.

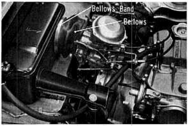


Fig. 2F-2

G. Carburetor

(General)

The horizontal variable venturi type CV (Constant Vacuum) carburetor is standard equipment. It consists of two main passages, a slow passage, and an accelerator pump.

One of the two main passages, the secondary main passage, is regulated by a vacuum operated free piston. The slow passage is equipped with a electromagnetic valve—a fuel solenoid valve which prevents "run off." Should the fuel solenoid valve fail, the engine cannot be idled because the slow passage remains closed.

Before any attempt to improve carburetor operation, be sure the engine compression and ignition system are correct.

(Choke adjustment)

The choke cable is clamped at the carburetor body. Adjust the cable so that the choke is fully open when the choke button is not pulled.

Fig. 2G-1

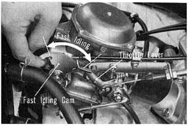


Fig. 2G-2

(Fast idle adjustment)

During cold engine starting and the engine warm-up period, specially enriched fuel mixture is required.

When the choke valve is closed, the fast idle cam opens the throttle valve slightly, through contact of the throttle lever with the cam to provide the proper fuel richness.

To make fast idle adjustment, first loosen the throttle valve stop screw to let the throttle valve fully close by itself. Then, bend the throttle lever so that the first idle cam starts to lift the throttle lever at the punch mark.

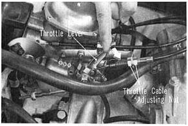


Fig. 2G-3

(Throttle adjustment)

Two persons are required to make throttle cable adjustment. Press the accelerator pedal fully and make throttle cable adjustment so that the throttle valve fully opens.

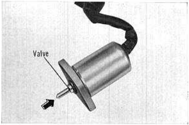


Fig. 2G-4

(Fuel solenoid valve)

When the solenoid is energized, the needle valve will move in and open the slow passage of the carburetor to allow idling.

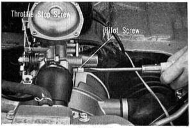


Fig. 2G-5

(Pilot screws adjustment)

The standard setting for the pilot screw is 4/8~6/8 (N360, N400), 1-1/8~1-3/8 (N600 D1 setting),2-1/8 ~2-3/8 (N600 D1 setting) turn open from full close.

To make pilot screw adjustment, first set the screw to 5/8 (N360, N400), 1-1/4 (N600 D setting), 2-1/4 (N600 D1 setting) from fully close and then turn it in both directions to locate the position at which the engine idles smoothly. Do not excessively tighten the pilot screw as the slow passage will be damaged.

Note:
The engine should be warmed to the normal operating temperature before this adjustment.

(Idling adjustment)

Adjust engine revolution (1,100~1,200 rpm) with the throttle stop screw (Fig. 2G-5). In case a revolution counter is unavailable, set the idling speed so that the charge lamp at the instrument panel goes out just as the accelerator pedal is slightly pressed.

(Accelerator pump)

Extra fuel for quick acceleration is supplied by a diaphragm type accelerator pump.

The pump stroke is adjusted by selecting the position at the cotter pin on the rod.
Refer to pages 14-8 and 14-14 for proper clearance and adjusting procedure.

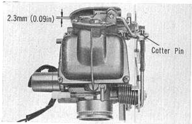


Fig. 2G-6

(Cleaning and inspecting)

In a long period of operation, dust, gum, water, carbon etc. accumulate in the carburetor. For efficient carburetor operation, the carburetor should be cleaned and inspected periodically. Wash all carburetor parts including the filter screen inside carburetor in clean solvent and dry them with compressed air. Also blow compressed air in all passages.

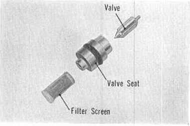


Fig. 2G-7

(Float level)

Set the carburetor on end as shown in the figure and with the finger lightly move the float back and forth and locate the point where the tip of the float valve barely touches or a clearance of 0.1mm exists between the tip of the float valve and the float arm. In this condition measure the distance "h".

Refer to "Table of carburetor setting mark" on page 14-8 for "h" dimension.

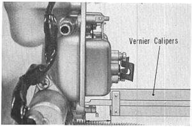


Fig. 2G-8

There is a spring incorporated in the end of the float valve which will permit the end of the float valve to submerge into the valve and will result in improper measurement; therefore exercise care in determining the point of contact between the float valve and the float arm. If the float level is not correct, bend the float arm tab to obtain the specified dimension.

(Trouble diagnosis)

The following troubles and diagnosis concerns only to carburetor. See "ENGINE TROUBLE DIAGNOSIS" for troubles not listed below.

1. Rough idling
    * Idling speed is too low.
    * Incorrect pilot screw adjustment.
    * Slow passage is restricted with dirt, gum, and carbon.
    * Improper float level.
    * Fuel valve unit is worn or not seated well.
    * Loosely mounted valve unit.
2. Engine does not idle.
    * Inoperative fuel solenoid valve.
    * Clogged slow passage.
    * Incorrect float level.
3. Flooding
    * Leaking or collapsed float.
    * Improper float level adjustment.
    * Valve unit is worn or not seated well.
    * Loosely mounted valve unit.
4. Engine does not return to idling speed.
    * Faulty carburetor link.
    * Improper throttle cable adjustment.
    * Throttle valve touches with carburetor body and does not fully close.
    * Throttle valve shaft is too tight.

H. Fuel System

Water and dirt accumulate in the fuel tank after long a period of usage, especially when poor quality fuel is used. Also, when the fuel tank is not full, the moisture in the air is condensed inside the tank.

Unless water and dirt accumulation is removed periodically, the entire fuel system becomes restricted and inoperative.

(Fuel tank and lines)

1. Check for gas leakage especially at the fuel meter unit on the fuel tank and all connecting joints of fuel lines.
2. Check fuel lines for damage.
3. When the fuel strainer is clogged drain the fuel from the tank and blow out line debris from the fuel filter to the tank and flush the tank.

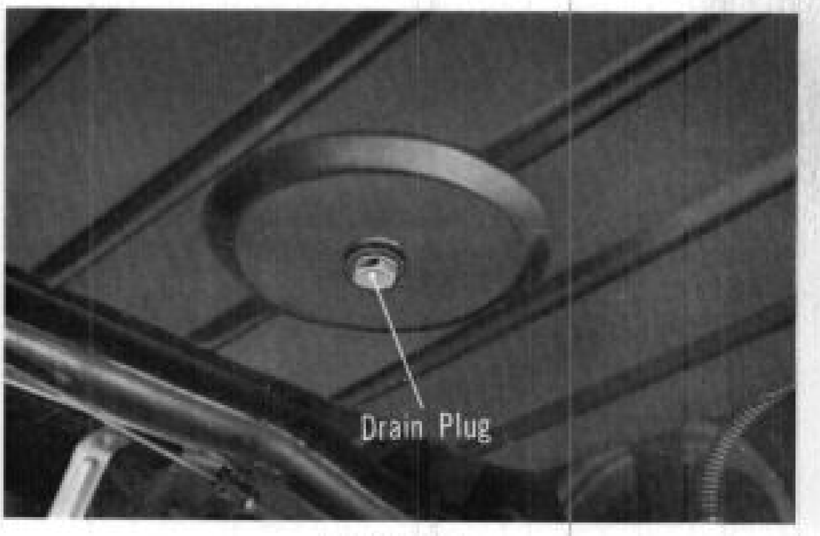


Fig. 2H-1

(Fuel filter)

The fuel strainer is a cartrige type and cannot be cleaned. Replace it with a new strainer if clogged. To replace the strainer, disconnect the fuel feed tube at the fuel intake of the strainer and at the outlet of the fuel pump, and remove the strainer with the fuel pump as a single unit.

Note:
When cleaning the fuel filter, the fuel screen inside the carburetor should be cleaned also. **(Fig. 2G-7)**

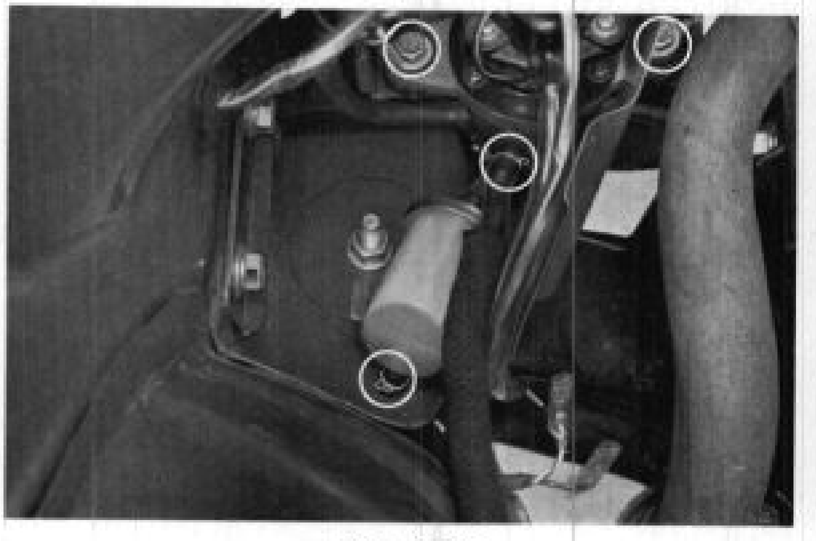


Fig. 2H-2

(Fuel pump)

Incorrect fuel pump pressure or low fuel delivery, or both, result in poor engine performance:

CAPACITY VOLUME AND PRESSURE TEST

Fit vinyl tubes of 6mm (15/16 in) inside diameter to the inlet and outlet. Extend the tube 500mm (19.7 in) below the inlet and 500mm above the outlet. Turn on the switch. Fuel flow should be more than 500 cc/min. (30.5 cu-in/min.) For more precise measurement reduce the inside diameter of the outlet to 1.4mm (0.055 in). The flow should exceed 250 cc/min. (15.2 cu-in/min.) at this time, and the discharge pressure should be 0.145 kg/cm^2 (2.1 lb/sq-in).

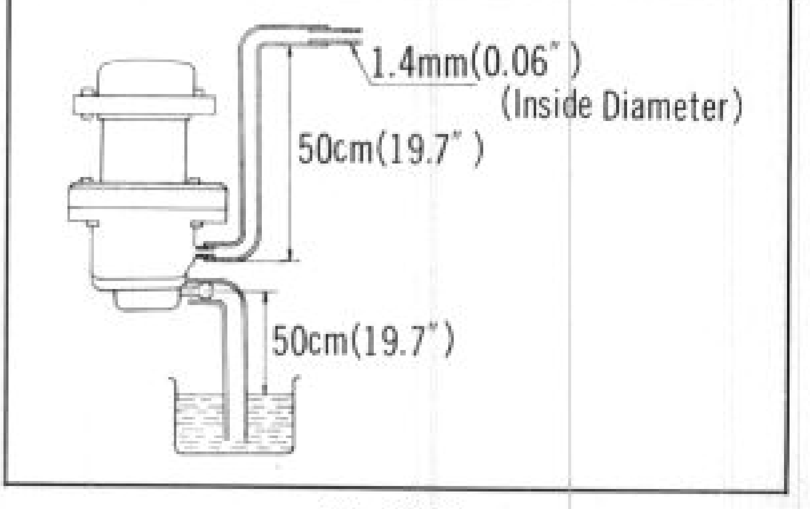


Fig. 2H-3

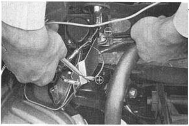


Fig. 2H-4

ELECTRICAL COMPONENT TEST

Disconnect the connector at the (+) terminal and measure with an ohmmeter between the (+) terminal and ground (body).

Normal reading: 5 ohms.

Check the contact of the ground cable. A loose or corroded ground will make the fuel pump inoperative even if the pump is in good condition.

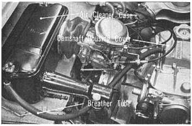


Fig. 2I-1

I. Crankcase Ventilation

A closed crankcase ventilator is standard equipment. Blow-by gas is led from the top of the engine camshaft housing cover into the air cleaner case through a breather tube, and is not discharged to the atmosphere, to prevent air pollution.

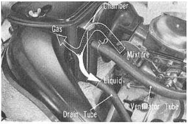


Fig. 2I-2

The blow-by gas and the oil vapor are condensed in the chamber of the air cleaner case and are separated into liquid and gas. This gas is harmful and is sucked into the intake manifold through air cleaner element while the liquid either settles in the chamber of the air cleaner case (vehicle exported to U.S.A. only) or is discharged to the atmosphere.

J. Ignition Timing

CONTACT BREAKER

(Cleaning)

A dirty contact point should be cleaned with a fine-cut contact file. A contact point which has been used several thousand kilometers will have a gray, rough surface but this is not necessarily an indication that they are not functioning satisfactorily. The roughness between the point matches so that a large contact area is maintained and the point will continue to provide satisfactory service.

(Point gap adjustment)

Slowly rotate the crankshaft and locate the position where the breaker point is at maximum opening (the point where the heel is at the highest point of the breaker cam). Measure point gap in this position with a feeler gauge. Point gap: 0.3~0.4mm (0.012~0.015 in).

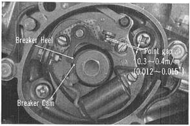


Fig. 2J-1

Perform point gap adjustment by loosening the two set screws and move the point with a screwdriver to obtain proper clearance. After completing adjustment, retighten the set screws.

Note; Slightly larger point gap is advisable for the newly installed contact breaker since the point gap is prone to decrease fast due to initial wear of breaker heal.

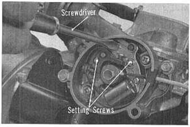


Fig. 2J-2

(Dwell angle)

Dwell angle correlates with contact point gap. Check dwell angle with a dwell meter while the engine is thoroughly warmed up.

Normal dwell angle; 90 degrees

(Timing)

Initial igniton timing-Static ignition timing

Align the "F" mark on the crankshaft pulley with the mark on the generator cover (360 and 400 vehicle) or on the flywheel housing cover (600 vehicle).

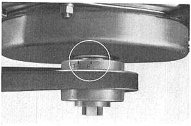


Fig. 2J-3

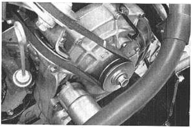


Fig. 2J-4

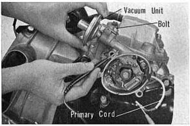


Fig. 2J-5

Centrifugal ignition advancer-Dynamic ignition timing

Loosen the lock bolt and reset the vacuum unit at the position where spark jumps between the contact point by moving the vacuum unit "out" to advance timing or "in" to retard it. An accurate method is hooking up a 12V lamp to the primary lead. Turn the ignition switch on and adjust so that the lamp goes off when the "F" mark is aligned to the mark on the generator cover or on the flywheel housing cover. Another method is the use of a service tester.

1. Put several marks on the crankshaft pulley before the "F" mark at 5 degrees intervals for reference in determining the amount of spark advance.

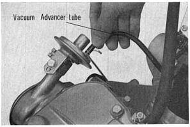


Fig. 2J-6

2. Disconnect the vacuum advance tube from the vacuum unit, rendering the vacuum advance inoperative.
3. Hook up a strobotachometer and take several redings of the ignition timing at various engine revolutions.
4. Plot the readings on the following diagram to see if the centrifugal advance is normal.

Mechanical Spark Advancer Characteristics

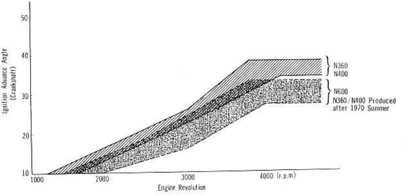


Fig. 2J-7

(Vacuum ignition advancer)

Disconnect the vacuum advancer tube at the carburetor end and suck on the tube with mouth while engine is idling. Then, read the ignition timing at the crankshaft pulley with a strobotachometer. The maximum reading value should 27~33 degrees.

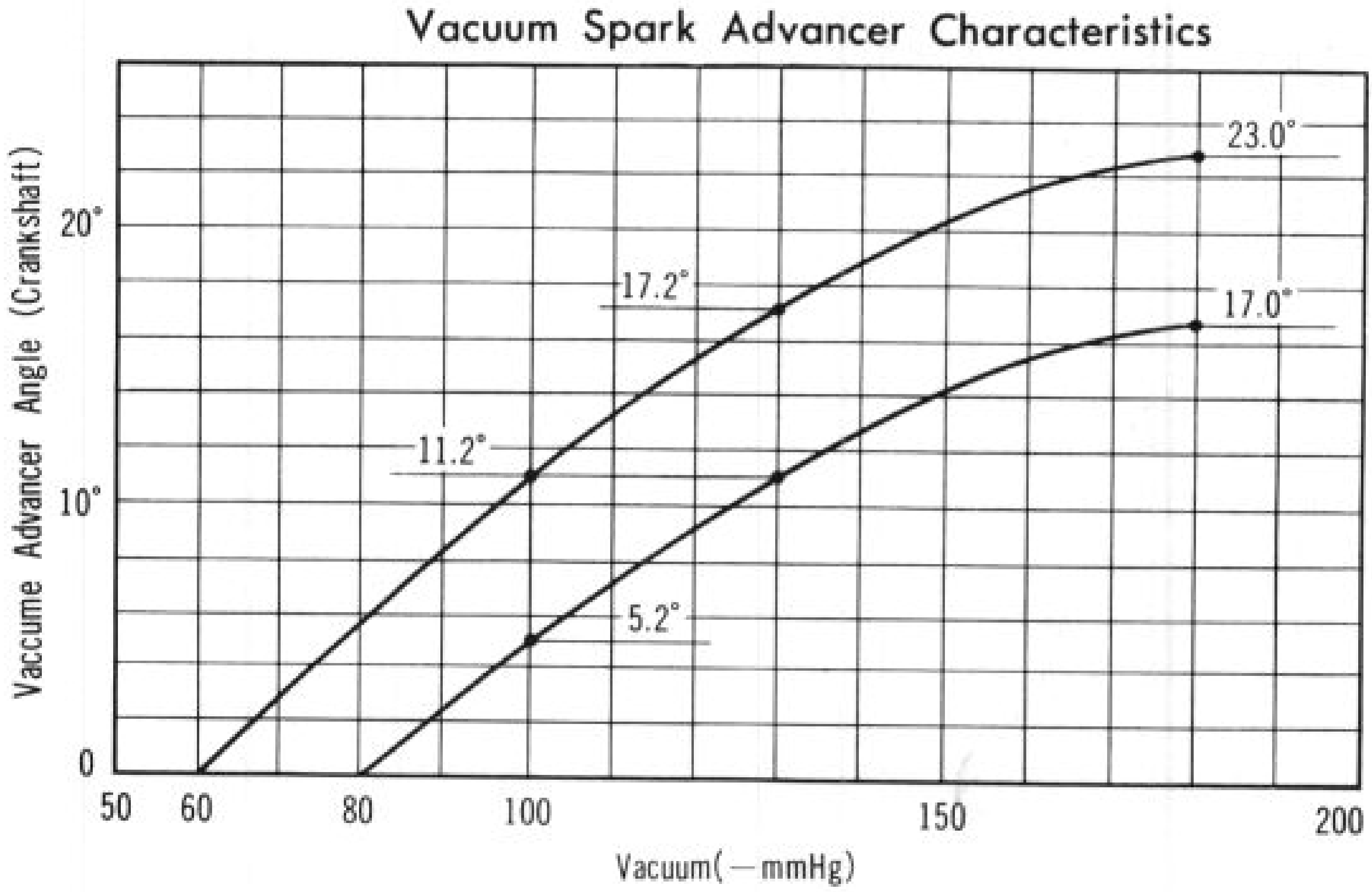


Fig. 2J-8

K. Spark Plug

Spark plug consists of the center electrode, insulator, and metal shell. The spark plug with a long insulator nose retains heat enough to burn off oil and combustion deposits under light load conditions. The spark plug with a short insulator nose dissipates heat rapidly and prevents preignition and detonation under heavy loaded conditions.

NGK B-8ES spark plugs or ND W-24ES spark plugs are original equipment on N series sedans and vans. However, the following spark plugs are available for various operating conditions.

	NGK	ND
Hotter	B-7ES	W-22ES
Standard	B-8ES	W-24ES
Colder	B-9E	—

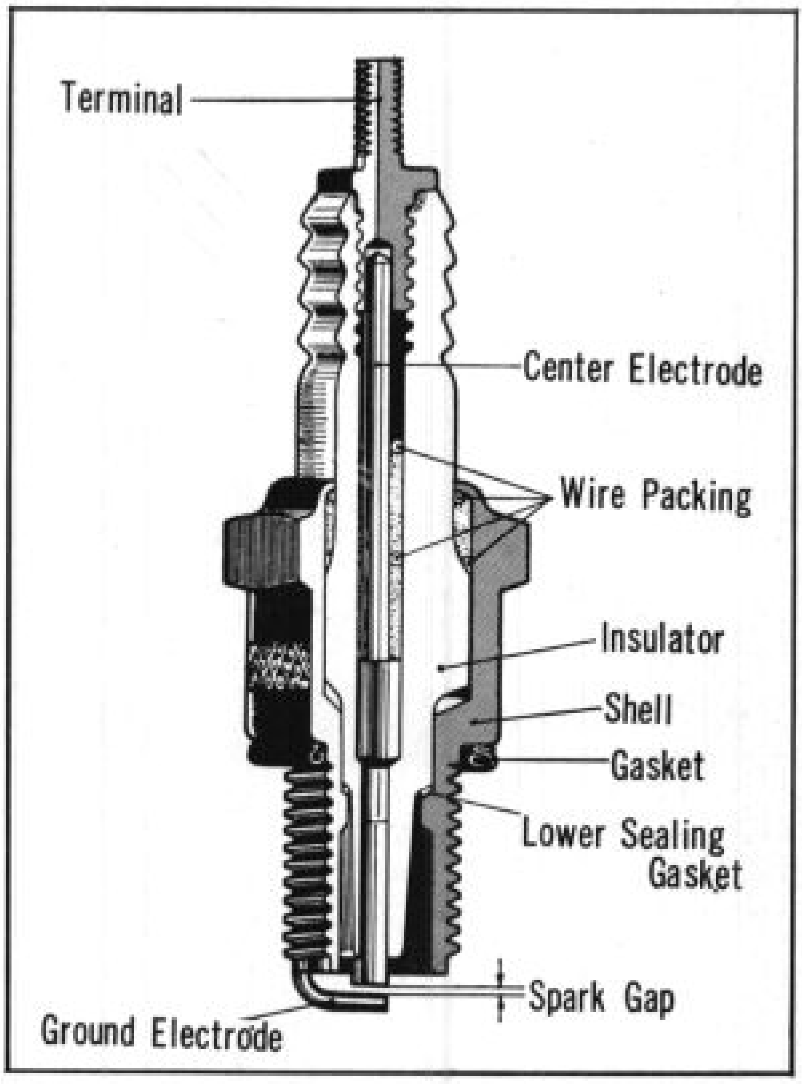


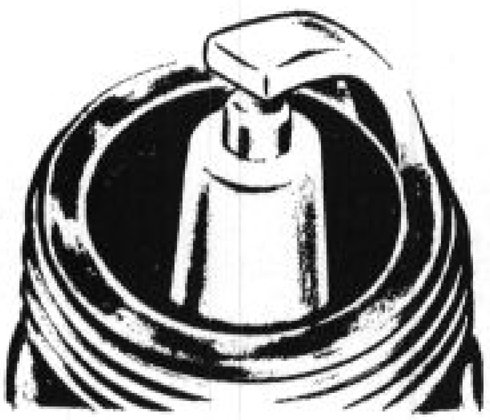
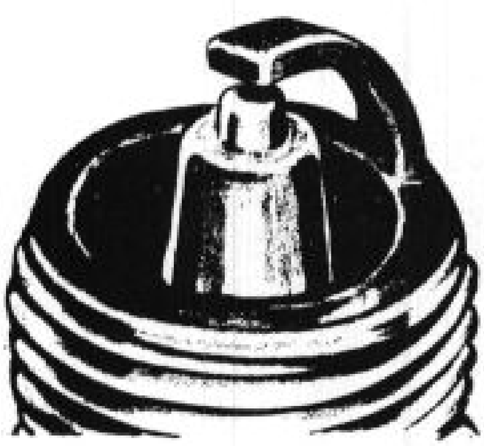
Fig. 2K-1

(Removal and installation)

1. Remove dust and other foreign materials from around spark plugs.
2. **Avoid spark plug removal while the engine is hot.** Since the cylinder head threads for spark plugs is aluminum, spark plug becomes tight due to the different coefficients of heat expansion.
3. In case a spark plug is too tight to be removed even if the engine is cold, apply a solvent around spark plug, after which apply oil once the solvent has penetrated the spark plug threads of the cylinder head.
   Be sure the engine is cold to perform this procedure.
4. Whenever installing a spark plug, apply oil on the threads of spark plug to prevent the plug from sticking.
5. To install a spark plug, first thread it in with the fingers, then tighten it securely with a plug wrench. If the gasket is new, the degree of turning is from 180 to 240°.
   Note:
   All spark plugs must be of the same make and number or heat range.

(Inspection)

To insure peak performance spark plugs should be checked intervals of less than 10,000 km (6,000 miles). Spark plug life is governed to a large extent by operating conditions, and varies accordingly. Faulty or excessively worn spark plugs should be replaced immediately to avoid more serious engine troubles. To examine engine operating conditions, it is helpful to check spark plugs for types of deposit and the degree of electrode wear.

Condition	Identification	Cause
	NORMAL Brownish-white or greyish-white deposit	*Brownish-white deposit Regular or unloaded gasoline *Greyish-white deposit Highly leaded gasoline
	CARBON FOULED	* Bad quality gasoline * Too cold plug * Too rich gas mixture * Clogged air cleaner element * Weak ignition * Excessive idling * Slow speed driving by top gear

Condition	Indentification	Cause
	OVERHEATING White insulator and bluish-burnt appearance electrode	*Too hot spark plug *Engine overheating *Wrong ignition timing *Loosely installed spark plug or cylinder head threads for spark plug is damaged. *Too lean gas
	OVERHEATING OR BURNT Excessively blistered insulator or eroded electrode.	Same
	OIL FOULED Black or brawn excessive cabon deposit.	*Worn piston ring *Worn piston or cylinder *Excessive clearance between valve guide and valve stem.

(Cleaning and regapping)

Even if spark plug selection is corrected, deposits and carbon accumulate on the plug firing end after long-period operation. To clean spark plugs, an abrasive type plug cleaner is highly recommended, but if one is unavailable, use a needle or a piece of wire and gasoline. Do not heat spark plugs to clean them, nor should abrasive blasting be prolonged, as this erodes the insulator and electrodes.

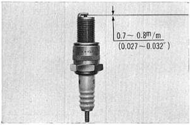


Fig. 2K-2

File spark plug center electrode flat before adjusting plug gap. Normal spark gap shall be 0.7~0.8mm (0.027~0.032 in). In adjusting spark plug gap, bend the ground electrode, never the center electrode, which extends through porcelain insulator.

L. Battery

The service life of a battery depends on the maintenance it receives. To assure satisfactory battery service the following instructions must be carefully observed.

Cleaning and inspection

1. Always keep the battery, cable clamps, and terminals clean and dry. After cleaning, apply vaseline to battery clamps and terminals to prevent corrosion.
2. Check battery retaining nuts for tightness, and tighten the battery terminal clamp to secure connection. Never tap the terminal clamps with a hammer in attempting to tighten the clamp. Nor should the battery cable be pulled to free the clamp.

   Before connecting or disconnecting the positive clamp from the battery terminal, always disconnect the negative grounded cable from the battery first.

Electrolyte level

Check the level of electrolyte in each cell. Water is the only element that evaporates, so only distilled water need be to bring the level to the bottom of split ring in the cell filter, never add sulfuric acid. Do not overfill battery or spill electrolyte because it is highly corrosive.

Checking battery state of charge

Battery charge may be tested by measuring specific gravity of electrolyte. To check specific gravity, use a hydrometer. The specific gravity reading should be taken under the following conditions.

(1) Correct electrolyte level.

(2) Temperature: 15~20°C (59~77°F)

(3) Sufficient time after an electrical load has been applied to the battery.

(4) Allow sufficient time lapse to bring the level to the upper level after adding distilled water.

Specific gravity of a fully-charged battery is 1.280 [electrolyte temperature: 20°C (68°F)]. The specific gravity varies 0.0007 per 1°C (1.8°F) of electrolyte temperature. (Specific gravity decreases with the rise of electrolyte temperature and increases with the drop of temperature.)

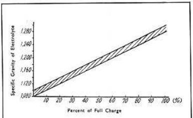


Fig. 2L-1

It is important that this condition be understood to prevent starting difficulties in cold weather and damage to the battery in hot weather. A fully charged battery at standard temperatures should be 1.280, for tropical areas 1.260, and during extremely cold weather 1.200.

Battery charging

(Slow charge)

The battery should be charged continuously with a low charging current until it is fully charged. From 3 to 3.5 amperes may be used for charging. The battery is considered fully charged when the specific gravity reading in each cell does not increase for three hours when taken at hourly intervals.

(Quick charge)

Although the slow charging is recommended, quick charging can be applied when time does not permit a complete slow charging. When quick charging, remember that the battery is only receiving a partial or temporary charge and that the electrolyte is being heated. During charging, if the battery temperature rises above 45°C (113°F), quick charging has to be discontinued.

Note: **Disconnect the silicon diode P terminal on 600 vehicles when quick charging the battery.**

Trouble diagnosis

Location of Trouble	Identification	Cause	Symptons	Countermeasure
Positive Plates	Dropping of active material	a) Excessive charge cycling (charging and discharging) b) Excessive charging current c) Working at low temperature d) High electrolyte density	Capacity decreases markedly. Terminal voltage drops rapidly as the battery discharges. Internal short circuit will eventually develop.	Before deposits accumulate heavily, wash the inside of the battery and replace electrolyte.
	Buckling and expansion	a) Excessive discharge b) Excessive charge cycling at high current c) Working at high temperature d) Electrolyte contaminated with impurities	Internal short circuits. During charging, voltage drops, or temperature rises excessively. Voltage drops suddenly during discharging. Battery capacity decreases.	If a short circuit has occurred, the battery is useless. If impurities have contaminated the electrolyte, change the electrolyte.
	Grid broken due to corrosion	a) Battery worn-out b) Excessive temperature increasing battery density c) Electrolyte contaminated by nitric acid or organic acids. d) Frequent charging.	The capacity is decreased. Short circuit will eventually occur.	Replace the battery, no repair is possible.
Negative-Plate	Shrinkage and solidification	a) Repeated high discharge rates. b) Repeated charging at high currents. c) Repeated overcharging.	Battery will charge well but its capacity is decreased.	There is no positive countermeasure. If trouble is not serious, a slow, over-discharge followed by a careful re-charging may help.

Location of Troubles	Identifi-cation	Cause	Symptoms	Countermeasure
Negative Plates	Sulfation	a) Battery left in discharged condition b) Battery left in fully charged condition for long period c) Working in a low state of charge d) Electrolyte level has decreased exposing plates e) High electrolyte density f) Electrolyte contaminated with electrolyte (oil or other organic compounds).	Plate surface becomes white or white spotted and becomes hard. Specific gravity drops, capacity decreases. When charging, voltage rises rapidly, battery gasses strongly, but specific gravity does not increase Charging is impossible.	If trouble is not serious, it can be corrected by overcharging at a current equal to 1/20 times the amp-hour capacity of the battery. For more serious trouble, repeat charging and discharging. In this case, start discharging at a current equal to 1/10 times the amp-hour, capacity of the battery and finish discharging at a rate equal to 1/20 times the capacity. Charge cycling as above with 1.05 specific gravity sulphuric acid, also helps. There is no countermeasure for extreme sulfation.
Separator	Carboni-zation	a) Excessive battery temperature b) High electrolyte specific gravity c) Bucking of positive plate	Short circuit will occur the rotor crumbles.	Impossible to cure
Electrolyte	Loss of electro-lyte	a) Craked battery case b) Excessive battery cell temperature due to trouble such as a short circuit.	Specific gravity will be high, level will be low.	Discover and eliminate cause of temperature rise. Restore fluid level with distilled water. There is no repair for a damaged case.
	Decrease in specific gravity	a) Short circuit b) Insufficient charge c) Sulfation d) Excessive water added e) Water leaking in from outside	Specific gravity low.	Inspect carefully for actual cause and take suitable steps to correct. If excess water has entered the battery, the specific gravity can be adjusted by adding additonal electrolyte. The battery should be first charged until the specific gravity becomes constant.

Location of Trouble	Identification	Cause	Symptoms	Countermeasure
Electrolyte		a) Impurities such as sea water hydrochloric acid, copper, iron nickel, or managanese have become mixed with electrolyte. b) Impure water has been added.	Can be discovered by status of battery capacity, terminal, voltage, and gas generation, and by discoloration (whitening) of electrolyte in some cases.	Discharge battery and drain electrolyte. Wash inside of cells with water several times and finally wash with distilled water. Then, refill with electrolyte of specific gravity 0.03 to 0.05 higher than the electrolyte that was drained. Full charge the battery and adjust specific gravity to the specified value.
Battery in General	Internal Short-Circuit	a) Short-circuit due to spongy lead at side and or upper and lower portions of plates. b) Separator broken due to buckled plate. c) Short-circuit at lower part of plates due to sediment. d) Separator not correctly installed. e) A metallic piece caught between plates. f) Cell divider is broken	Voltage and specific gravity do not increase much during charging. If one or two cells have abnormally high temperature, they are probably shorted. After discharging, shorted cells will be lower in voltage and specific gravity than normal cells.	Impossible to cure.
	Self discharge	a) Impurities in electrolyte. b) High electrolyte specific gravity when charged. c) High temperature	In spite of the fact that no load has been applied, the specific gravity drops and the capacity decreases. Specific gravity will be low.	Replace contaminated electrolyte. Adjust improper specific gravity electrolyte.
	Reverse Porarity	a) Battery was charged with reverse polarity.	Since polarity is reversed, a voltmeter will detect this problem. Temperature will rise abnormally when discharging, gas will be evolved.	If trouble is not serious, recharging in the proper direction at low current will restore battery operation.

M. Generator and Regulator

a. Checking Circuit for 360 and 400 Vehicles.

GENERATOR

DC 12 volts motor-generator is standard equipment for 360 and 400 vehicles.

(Cleaning and inspection of motor-generator)

If the brush is worn to the grooved limit mark or if the remaining length measures less than 12mm, the brush should be replaced.

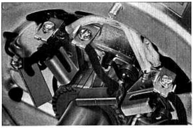


Fig. 2M-1

Check brush springs for tension. If the tension reading is less than 500 grams (1.1 lbs), replace with a new spring.

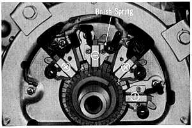


Fig. 2M-2

When commutator wear is extensive (circulating is lost as a result of uneven wear) correction is made by grinding. After grinding, undercut mica from 0.5 to 0.8mm (0.020 to 0.032 in).

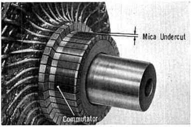


Fig. 2M-3

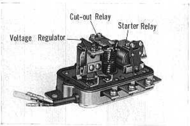


Fig. 2M-4

REGULATOR

The regulator consists of two elements, a 2-contact type voltage regulator and a starter relay which functions as a magnetic switch when operating as a starter. The wiring diagram is shown in "SECTION 17. ELECTRICAL".

(Specification)

Adjusted voltage:	14.8 to 15.8V
Voltage when loaded:	13V or higher (with load of 8A)
Cut-in voltage:	12.5 to 13.5V
Reverse current:	4 to 12A

TROUBLE DIAGNOSIS

(i) NO CHARGING OR CHARGING IS IMPROPER (360 and 400)

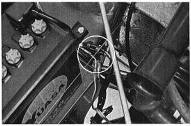


Fig. 2M-5

(MOTOR GENERATOR)

Disconnect connector wiring, and ground the F terminal (white/red lead) at the motor-generator for a very short period of time. Gradually reduce engine speed to 2,000 rpm. Check the generator voltage at the D terminal at this time, and if more than 15V is present the motor-generator is normal. (Fig. 2M-6)

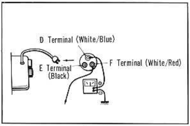


Fig. 2M-6

If the voltage is below 15V, check brush and commutator contact and commutator cleanliness.

(REGULATOR)

(First stage)

Connect a voltmeter to the D terminal of the regulator, disconnect the B terminal, and observe the voltmeter as engine speed is increased to 2,000 to 4,000 rpm. The voltage reading 14.8V to 15.8V is satisfactory. If the reading is out of this range, check and adjust the voltage regulator.

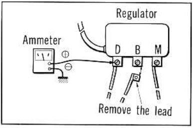


Fig. 2M-7

(Second stage)

Connect an ammeter to the B terminal (+) of the regulator and reconnect the disconnected battery terminal (−). Check output current.

If the charging current under load (headlamps, wiper, etc.) is 10A or more, the condition is normal. Engine speed at this time is between 2,000 and 3,000 rpm.

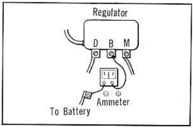


Fig. 2M-8

(ii) GENERATOR BRUSHES WEAR RAPIDLY.

* Heavy electrical load

* Commutator unevenly worn.

b. Checking Circuit for 600 Vehicle.

The 600 vehicle charging circuit employs an AC generator, and the output of the generator is rectified to DC by a silicon diode. Current generated by the generator is regulated by a combination tirril regulator and AC generator. The AC generator is installed on the right side of the engine, and the rotor is mounted on the right side of the crankshaft. The rectifier using silicon diodes is installed in position with the right side of the front bumper stay installing bolt and connected to the AC generator with the lead wires.

(AC GENERATOR)

1. Check the rotor coil for disconnection and condition of insulation. Inspect continuity between the two slip rings with a testing device. No continuity represents that the rotor coil is disconnected. In this case, replace the rotor coil. If there is continuity between the slip rings and the shaft or core, the coil or the slip rings are grounded. In this case, also replace with a new part.

   Rotor coil resistance: 5.19Ω

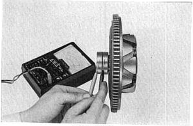


Fig. 2M-9

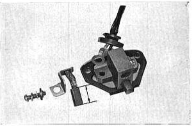


Fig. 2M-10

2. Unlike the DC generator, brush wear is extremely less. If the length of the brush is worn to 7.0mm (0.276 in) or less, replace the brush.

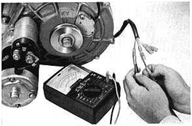


Fig. 2M-11

3. Check the stator coil for insulation and disconnection with a testing device. If there is no continuity between the terminals, the coil is disconnected. In this case, replace with a new coil. If there is continuity between the stator coil terminals and the fly-wheel housing or core, it means the coil grounded. Replacement is necessary.

   Stator coil resistance: 0.115Ω

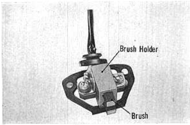


Fig. 2M-12

4. Check the operation of the brush in the brush holder. With the hand press the brush end, and check the operating condition of the brush and brush spring.

   Reference:
   To correctly measure the tension of the brush spring, push in the brush to the depth corresponding to the degree of brush wear plus 2mm. Then confirm that the tension of the spring is 0.255 to 0.345kg. In addition, the length of a new brush is 14.5mm.

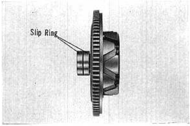


Fig. 2M-13

5. Check the rotor slip ring surfaces. If the surfaces are stained or rough, smoothen them with fine emery cloth.

(REGULATOR)

1. Remove the regulator cap, and check the point. If the point is rough, grind it with a fine emery cloth.

   ① Voltage coil
   ② Adjuster
   ③ Armature
   ④ Lower contact
   ⑤ Upper contact

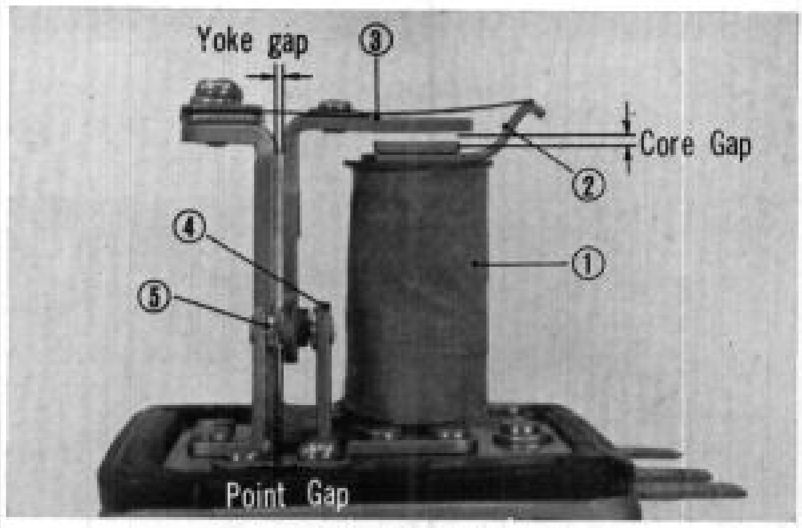


Fig. 2M-14

2. Check the gaps and if they are not correct, adjust.

   Yoke gap: 0.9~1.0mm (0.035~0.039 in)
   Core gap: 0.8~1.2mm (0.032~0.047 in)
   Point gap: 0.4~0.5mm (0.016~0.020 in)

   Gap adjustment should be performed in the sequence of yoke gap, core gap, and point gap. **(Fig. 2M-15 and 2M-16)**

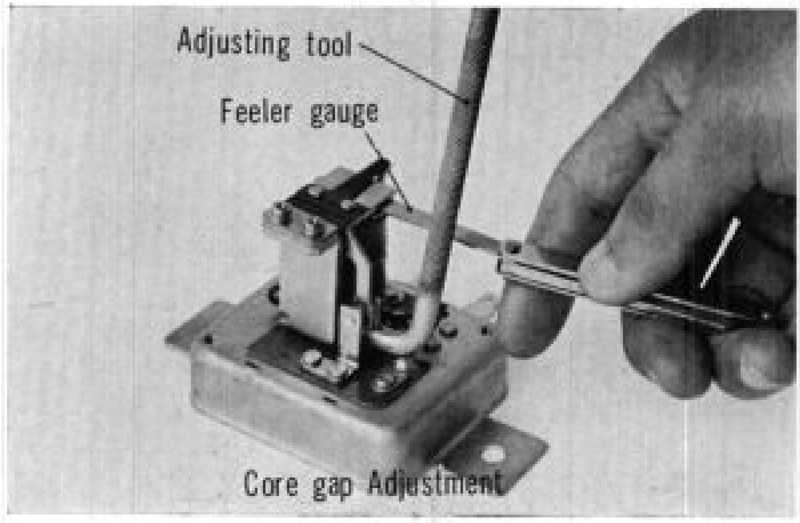


Fig. 2M-15

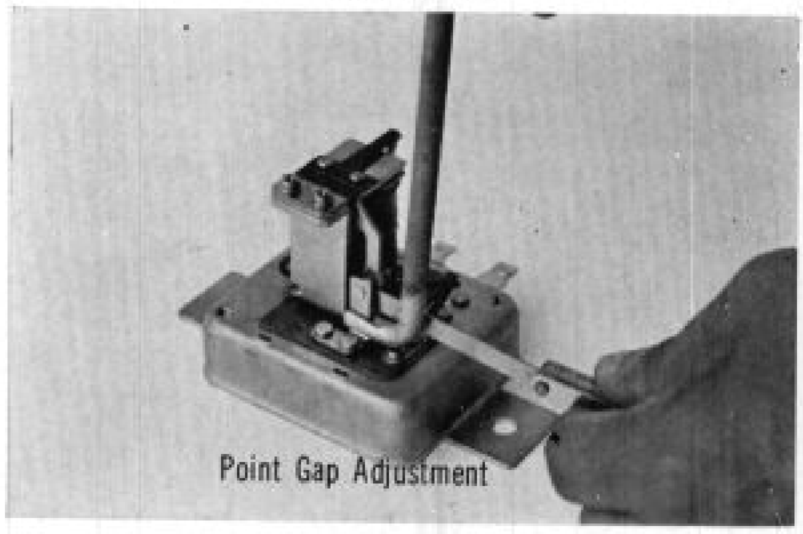


Fig. 2M-16

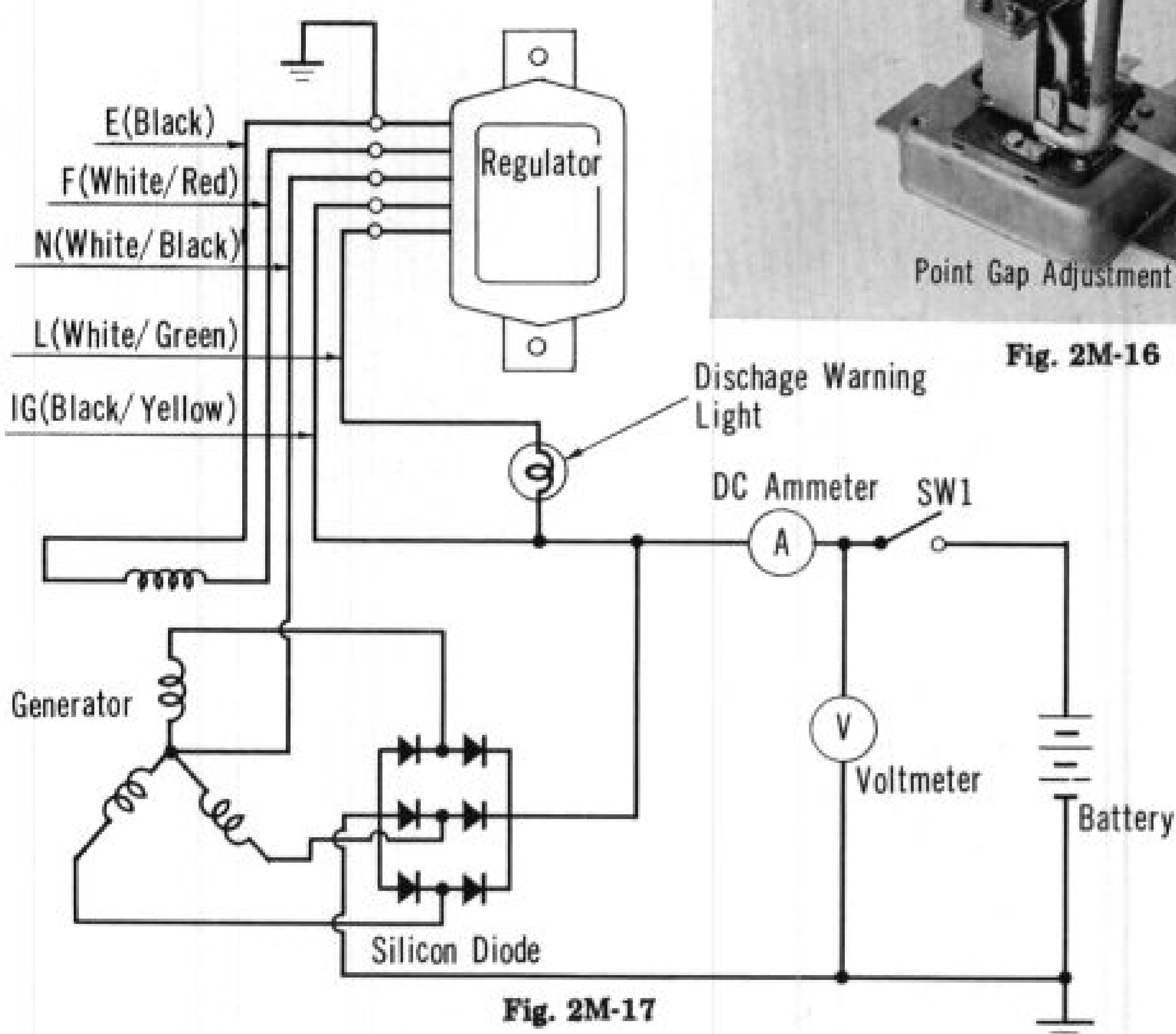


Fig. 2M-17

3. Prepare a DC voltmeter, ammeter, and contact them as illustrated in **Fig. 2M-17**.
4. When regulating no-load voltage, close the switches SW1 thereby allowing exciting current to flow from the battery to the generator rotor coil. After generator speed is raised (approximately 8,000 rpm), set the switch SW1 OFF.

   Note:
   In the case of a DC generator, when a regulator is combined with the generator to increase generator speed, voltage rises. In the case of an AC generator, however, voltage is not generated as prescribed unless the rotor is initially excited with the DC current flowing into the rotor coil from the battery. When speeding up the generator after stopping it once, set switch SW1 ON and let current flow from the battery. When voltage is generated, set the switch **OFF**, and check no-load voltage.
5. Raise generator speed to the rated value of 5,000 rpm, and regulate no-load voltage with the regulator.
6. If no-load voltage is lower than the rated voltage (13.5V), bend the adjuster upward and regulate it to the rated value. **(Fig. 2M-18)**
7. If no-load voltage is higher than the rated voltage of 14.5V, conversely, lower the adjuster and regulate it to the rated value. **(Fig. 2M-18)**

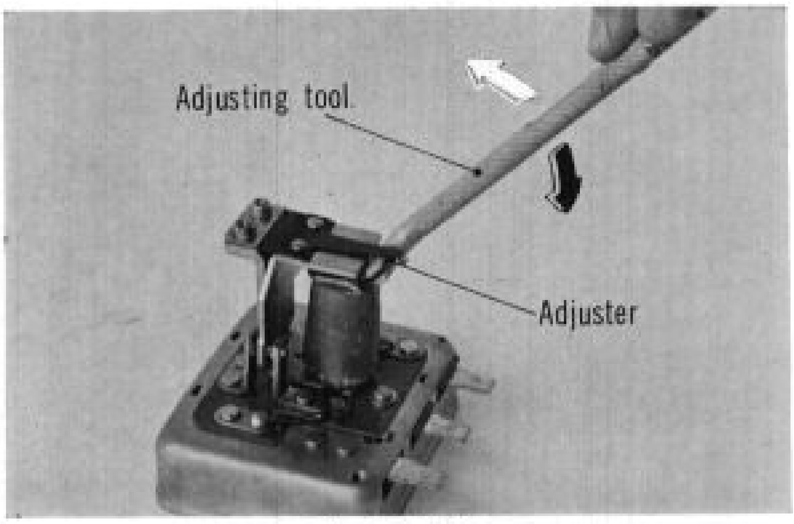


Fig. 2M-18

8. Now, voltage regulator adjustment has been completed. For confirmation of adjustment results, stop the generator and raise generator speed to 5,000 rpm and ascertain that voltage is as rated.

⬅ Lower the voltage

⇦ Raise the voltage

9. Generator voltage after completing adjustment is as shown in **Fig. 2M-19**. When generator operation is changed from low speed (with the lower contact actuated) to high speed (with the upper contact actuated), there is a voltage fluctuation. This voltage change does not matter. Approximately 0.5V voltage rise is desirable in the adjustment.

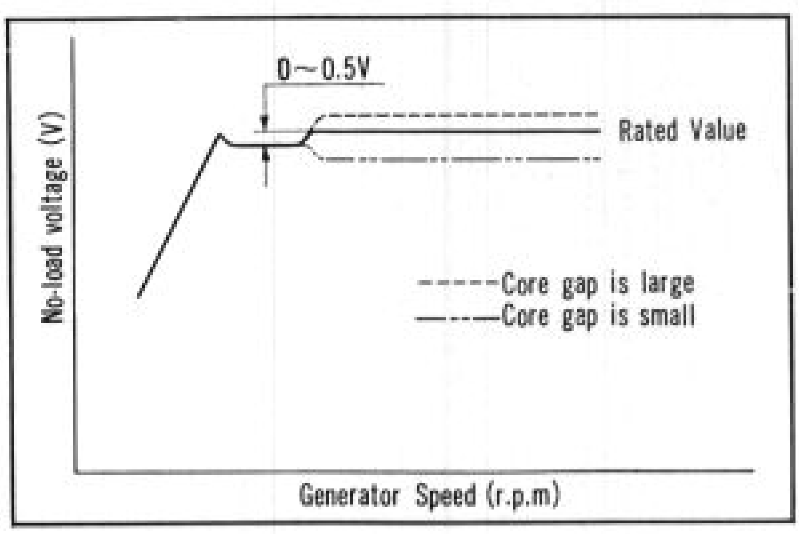


Fig. 2M-19

10. If there is voltage change exceeding 0.5V, or if there is voltage drop when generator operation is changed to high speed, inspect the core gap again. If core gap is too large, voltage rises and if too small, voltage drops.

11. Discharge warning relay.

    When adjusting the operating (cut-in) voltage of the discharge warning relay, raise generator speed, as prescribed 4 and 5 above, check the operating (cut-in) voltage.

Operating (cut-in) voltage	Tensile force of coil spring	Adjustment
High	Strong	Put hanger upward
Low	Weak	Lower hanger

(SILICON DIODE)

To judge the functional quality of the silicon diode,disconnect the AC generator stator coil and silicon diode and check the characteristics of the silicon diode in the normal direction and the reverse direction with an appropriate testing device. If there is continuity only in the normal direction, the silicon diode is defectless. If there is continuity in both directions, or if there is continuity in neither direction, the silicon diode is defective. In this case, replace the silicon diode.

Note:
Do not use a megger. If a megger is used for continuity testing, the silicon diode is damaged by the high voltage.

Handling Precautions

1. Connect silicon diode correctly to the battery while paying attention to battery polarity. If the silicon diode is misconnected, the battery is shorted with the silicon diode.
   Under this condition, overcurrent flows, thus resulting in damaged silicon diode or seized wire harness.

2. Connect the terminals correctly.
3. Do not turn the generator at high speed with the silicon diode P terminal circuit disconnected. If this precaution is not observed, high voltage is generated and the silicon diode is sometimes damaged.
4. When charging the battery from outside, such as quick charging, disconnect the silicon diode P terminal.

c. Trouble Diagnosis

(1) Battery is not charged.

Faulty Part	Cause of Trouble	Corrective Action
Wiring and ammeter	Disconnection, short circuit, or displaced connector.	Repair or replace.
Generator	1. Disconnected coils, grounding, or short circuit.	Replace
Regulator	1. Faulty silicon diode.	Replace.
	2. Lead wire, short or disconnection.	Repair or replace.
	3. No-load voltage is lower than the rated voltage.	Reajust.

(2) Battery is discharged due to insufficient charge.

Wiring	Early stage of disconnection and short circuit, or loosely connected part.	Repair or retighten.
Generator	1. Rotor coil layer short circuit.	Replace.
	2. Stator coil layer short circuit.	Replace or rewind.
	3. Stator coil one phase disconnected.	Replace or rewind.
	4. Stained slip rings.	Clean.
	5. Improper contact of brush.	Correct.
	6. Faulty silicon diode.	Replace.

(3) Battery is overcharged due to excessive charging.

Wiring	The A terminal circuit and F terminal are shortened to be a shunt generator.	Repair.
Battery	Interior short circuit.	Replace.
Regulator	1. Abnormal rise in the no load voltage.	Repair.
	2. Defective regulator grounding.	Correct grounding.
	3. Disconnected coil lead wire.	Repair or replace.

(4) Unstable charging current.

Faulty Part	Cause of Trouble	Corrective Action
Wiring	As the vehicle body vibrates, the part of the wire with the broken shield is shortened or the lead wire is disconnected. This disconnected lead wire sometimes contacts.	Repair or replace.

N. Road Test

After a series of engine tune-ups, a road test should be conducted for the final engine performance check. Check for poor acceleration, missing, stalling, and surging. Be sure to check the brake system, suspension, and tires before the road test.

(Engine performance test items)

1. Cold engine starting
2. Vehicle starting
3. Slow speed performance
4. Quick accleration
5. Constant speed performance
6. High speed performance
7. Fuel economy

If any irregularity is found in engine performance, refer to "TROUBLE DIAGNOSIS" in each section or the section entitled "ENGINE TROUBLE DIAGNOSIS".

O. Engine Trouble Diagnosis

1. Starter Does Not Operate.

Possible Cause	Corrective Action
Corroded or loose battery connections or starter motor connections, or all three.	Clean and tighten clamps.
Weak battery.	Check and recharge battery.
Faulty magnetic switch equipped on the starter motor (N600).	
Worn brushes of motor generator, (N360/LN360/N400)	Check and replace with new brushes. Also clean and check commutator.
Defective starting motor.	
Damaged ignition switch contacts.	

2. Engine Will Not Start.

Possible Cause	Corrective Action
Improper ignition timing.	Initial set: 10 degrees BTDC
Faulty spark plugs and/or improper spark plug gap.	Spark gap: 0.7~0.8mm (0.028~0.032 in)
Distributor breaker contact point is dirty, oxidized, pitted or improper point gap (or both).	Clean and grind contact point and replace if excessively pitted.
Carburetor flooded or fuel level is not proper (or both).	Clean valve unit and check for wear.
Faulty fuel pump.	Determine the cause and replace with new pump if necessary.
Overheated engine.	Determine the cause of overheating.
Weak or faulty coil.	Check coil and replace by a new one.
Loose or broken ignition cables from coil to spark plug.	Tighten or replace with new parts.
Improper valve timing.	Correct the valve timing and replace the parts such as stretched cam chain if necessary.
Excessive or insufficient valve clearance.	Correct the valve clearance.
Low compression.	Check cylinder head gasket and reface the valve if necessary.
Carburetor icing.	

3. Engine Stalls.

Carburetor idling speed set is too low.	Proper idling speed is 1,100~1,200 rpm.
Insufficient engine warming up.	Use choke while engine has not warmed up.
Stiff carburetor links and throttle cable.	Locate the cause and replace if necessary.
Engine overheating.	Determine the cause of overheating.
Carburetor valve unit inoperative.	Clean and check for wear.
Incorrect carburetor float level or carburetor flooding (or both).	Adjust and replace the parts if necessary.
Incorrect pilot screw position.	Reposition the pilot scres.
Clogged filter screen in the carburetor and slow passage.	Clean by compressed air.
Faulty ignition system.	Locate the trouble.
Fouled spark plug.	Clean and replace if necessary.
Carburetor icing.	

4. Idling Is Not Stable.

Possible Cause	Corrective Action
Carburetor idling speed set is too low.	Proper idling speed is 1,100~1,200 rpm.
Incorrect pilot screw adjustment.	Locate the proper position where the engine idles smoothly.
Carburetor valve unit inoperative or loosely mounted.	Clean and check valve for wear and screw in valve seat tightly.
Incorrect carburetor float level.	Correct float level.
Engine overheating.	Determine the cause of the overheating.
Faulty ignition system.	Locate the cause.
Incorrect valve clearance.	Correct to the specified value.
Incorrect valve timing.	Check cam chain for stretch.

5. Poor Fuel Economy.

Note:
Before any attempt is made to improve fuel economy, the actual gas mileage should be checked by your servicemen by either a road test or with a fuel consumption tester.

When making a road test, do not rely on the fuel gauge mounted within the vehicle. Instead, completely fill the fuel tank with gasoline and measure how much gasoline is consumed on the test by filling gasoline up to the original level. Poor gas mileage is often attributed to driving conditions, and the driving habits of the owner.

Dragging brakes.	Determine the cause of brake dragging.
Insufficient tire pressure.	Inflate to the specified tire pressure.
Improper tire size.	Use the specified size.
Wrong size speedometer gear.	Replace with correct gear.
Gasoline leakage from fuel lines and tank.	Locate the leakage and repair.
Incorrect ignition timing.	Initial set: 10 degrees BTDC
Faulty centrifugal/vacuum ignition advancer.	Replace with a new part.
Faulty spark plugs.	Inspect the electrode and determine the cause.
Clogged air cleaner.	Clean and replace if necessary.

(Continued)

(Continued)

Possible Cause	Corrective Action
High float level.	Correct.
Carburetor valve unit inoperative.	Determine the cause.
Incorrect valve clearance.	Correct to the specified value.
Low compression.	Determine the cause referring to section "COMPRESSION TEST".
Improper pilot screw adjustment.	Reposition to the specified value.
Improper accelerator pump adjustment.	For adjustment, refer to section "CARBURETOR".

6. Engine Does Not Develop Full Power.

(Ignition system)	
Incorrect ignition timing.	Initial set: 10 degrees BTDC.
Worn contact breaker point.	Reface the point and replace if the wear is excessive.
Weak spring to contact breaker point.	Replace with a new part.
Faulty or improperly adjusted spark plugs.	Clean and regap. Change to the proper heat range spark plug.
Faulty ignition coil and high tension cord.	Replace.
Faulty centrifugal/vacuum ignition.	Replace.
(Fuel system)	
Low grade fuel.	
Restricted air cleaner.	Clean and replace if necessary.
Restricted fuel strainer.	Replace.
Defective fuel pump.	Replace.
Incorrect fuel level.	Correct the fuel level.
Clogged jets.	Clean.
Vacuum piston in carburetor sticking.	Correct.
Improper accelerator pump adjustment.	Readjust.
Improper throttle cable adjustment.	Adjust.
Improper choke adjustment.	Adjust.
Improper valve timing.	Determine the cause.
Improper valve clearance.	Adjust to the specified value.
Poor compression.	Locate the cause.
Engine overheating.	Determine the cause.

7. Spark Plugs Quickly Accumulate Carbon

Possible Cause	Corrective Action
Poor fuel quality.	
Too cold plug.	Use hotter B-7ES (NGK) or W-22E (ND)
High float level.	Adjust.
Needle valve unit in carburetor inoperative.	Determine the cause.
Improper valve clearance.	Correct.

8. Camshaft and Camshaft Holders Are Seized.

Insufficient engine oil.	Oil capacity: 3 liters. (Standard engine). 2.5 liters. (Automatic transmission engine)
Faulty oil pump.	Replace oil pump body assembly.
Oil pump mounted loosely.	Tighten oil pump mounting bolts.

9. Back Firing Occurs.

Insufficient engine warm up.	
Improper choke adjustment.	Check the choke valve for full opening.
Spark plug has excessive carbon accumulation or gap is incorrect or both.	Clean and regap. Determine the cause of excessive carbon accumlation.
Incorrect valve timing or valve clearance (or both).	In cold districts or driving in winter, a slightly larger valve clearance is recommended.
Air leakage into intake manifold.	Check the O-ring and secure the clamp.
Worn contact breaker point.	Grind and replace if necessary.
Improper ignition timing.	Correct.
Malfunctioning carburetor.	Determine the cause.

10. Engine Noise is Excessive.

Excessive valve clearance.	Proper valve clearance is 0.08~0.10mm (0.003~0.005 in)
Exhaust gas leaking.	Locate the gas leak.
Weak spring in hydraulic cam chain tensioner.	Install a shim or replace with a new spring.
Worn check valve in hydraulic cam chain tensioner.	Replace entire part with a new one.
Stretched cam chain.	Replace with a new chain.

11. Oil Leakage from Cylinder.

Possible Cause	Corrective Action
Loose nuts of cylinder stud-bolts.	Oil leak through the cylinder stud-bolts.
Defective plain washers of the cylinder stud-bolts.	Use new washer or flanged cap nut.
Cap nuts are not used with correct cylinder stud bolts.	For correction, refer to "ENGINE MECHANISM".

12. Oil Leakage from Camshaft Holder

Shrinked exhaust rocker arm shaft spacer rubber.	Replace with a new part.

P. Special Tool

Refer to section 4, "ENGINE MECHANICAL".

SECTION 3

DISMOUNTING AND MOUNTING OF POWER UNIT

A. Description

The power unit is extremely compact, single-unit (engine, clutch, transmission, differential, etc.) mounted at the front of the vehicle by means of the sub-frame to provide frontwheel drive.

Dismounting or remounting the power unit is made as an assembly together with the sub-frame, drive shaft, front wheels, etc. Either operation is easily accomplished in a short period of time.

In addition to the foregoing, another feature of N-seriese sedan and van is that engine parts (with the exception of the crankshaft, transmission, and differential) can be replaced without dismounting the engine from the vehicle. Even pistons can be replaced within a very short period of time by disassembling the engine from the head.

Disassembling the cylinder from the engine.

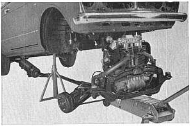


Fig. 3A-1

Exploded views of the power unit shown separately on the following two pages indicate to what extent the engine can be disassembled and reassembled without dismounting the power unit from the vehicle. All parts with the exception of those within the crankcase can be disassembled and reassembled without dismounting the power unit.

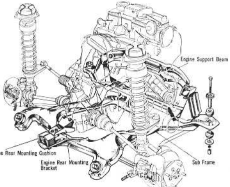


Fig. 3A-1a

By using the special tool (universal joint socket wrench), the primary drive mechanism as well as the oil pump within the engine's interior can be removed and inspected without dismounting the engine. (Fig. 3A-2)

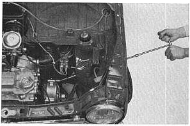
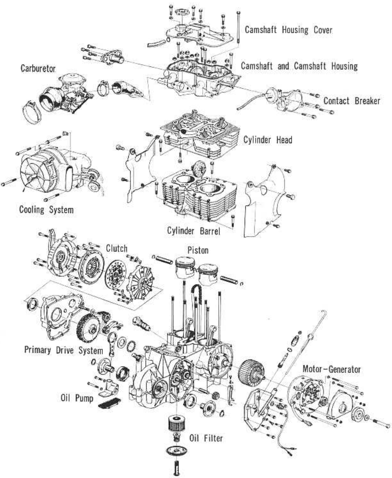
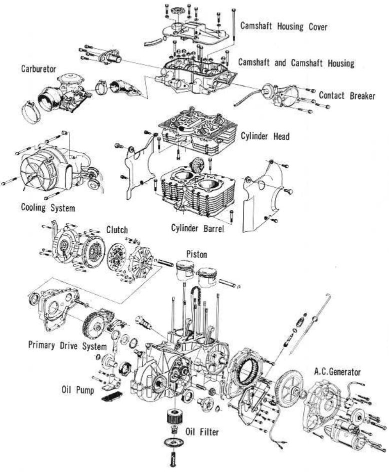


Fig. 3A-2

360/400 Engine



600 Engine


Camshaft Housing Cover
Carburetor
Camshaft and Camshaft Housing
Contact Breaker
Cylinder Head
Cooling System
Clutch
Cylinder Barrel
Piston
Primary Drive System
A.C.Generator
Oil Pump
Oil Filter

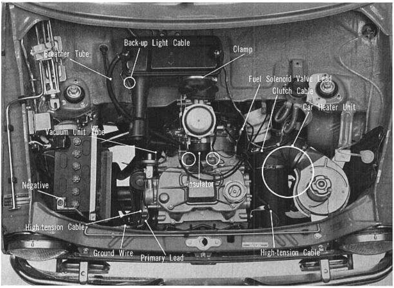


Fig. 3B-1

B. Dismounting

1. Drain the engine oil. (Refer to SECTION 1 E. Lubrications.)
2. Remove the battery cable from the negative terminal.
3. Remove the car heater unit (for the model equipped with the exhaust car heater type) from the vehicle. (Refer to SECTION 16. HEATER AND VENTILATION)
4. Disconnect electrical wiring from the engine.
   1) Engine ground wire
   2) Ignition primary lead
   3) High-tension cables
   4) Fuel solenoid valve lead
   5) Back-up light cable
   6) Generator cable
   7) Starter cable
5. Detach the following cables:
   1) Clutch cable (Refer to SECTION 3. CLUTCH)
   2) Speedometer cable
   3) Throttle cable and choke cable
6. Separate the vacuum unit tube from the vacuum unit and the breather tube from the camshaft housing cover.
7. Loosen the clamp and separate the bellows from the air cleaner case.
8. Separate the fuel feed tube from the carburetor.
9. Remove the two insulator mounting bolts and then remove insulator, carburetor, and bellows from the camshaft housing as a unit. Do not lose the O-ring located between the camshaft housing and insulator. (Refer to Fig. 3C-3)
   Loosen the heater hot-air duct clamps and separate them from the cooling fan housing. (for the model equipped with the engine car heater type).

10. (For Engine type heater)
    Pull out the heater control rod joint pin to disconnect the rod from the heater drum and then force the rod toward the interior of the vehicle (Fig. 3B-2)
11. Drive out the joint pin by means of the special tool shift rod pin driver, and separate the gear shift column from the gear shift rod. (Fig. 3B-3 and Fig. 3B-4)
12. Retract the gear shift rod toward the engine as shown in Fig. 3B-4.

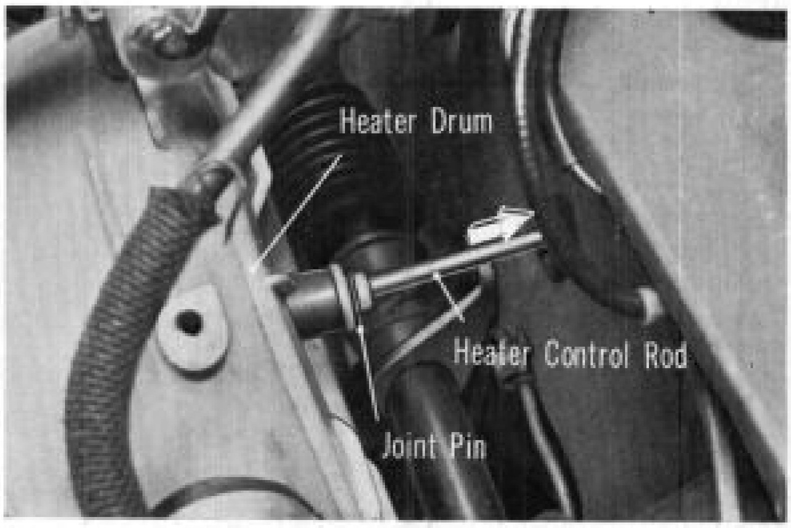


Fig. 3B-2

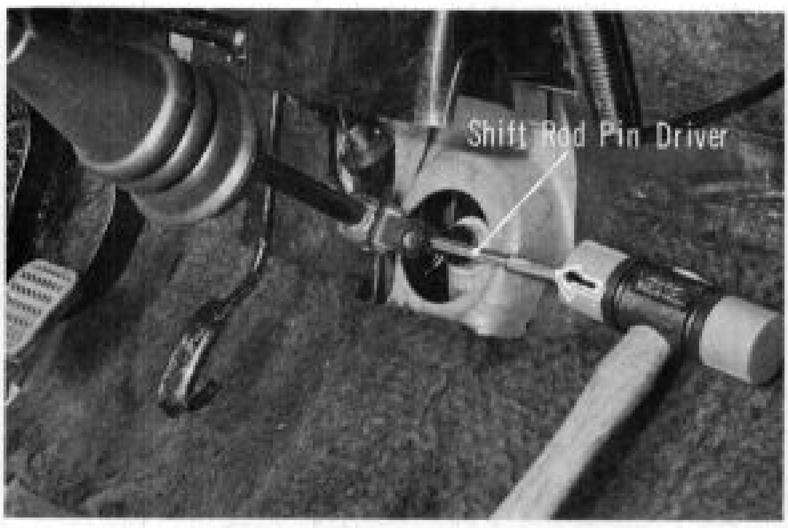


Fig. 3B-3

Fig. 3B-4

13. Disconnect wirings of turn signal lights, R and L. (Fig. 3B-5)

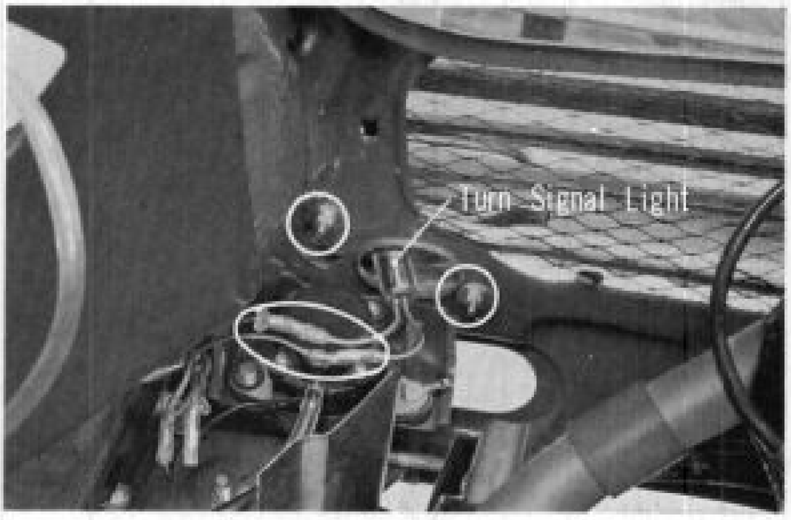


Fig. 3B-5

14. (For the 360 Seriese)
    Remove the front grille and front grille screen by removing the five retaining screws. (Fig. 3B-6)

    (For the 400 and 600 Series)
    Remove the turn signal light lenses and bolts mounting the front grille on both sides, and the three screws at the top. The front grille can be then separated. (For details see SECTION 18. D. Front Grille and Bumper)

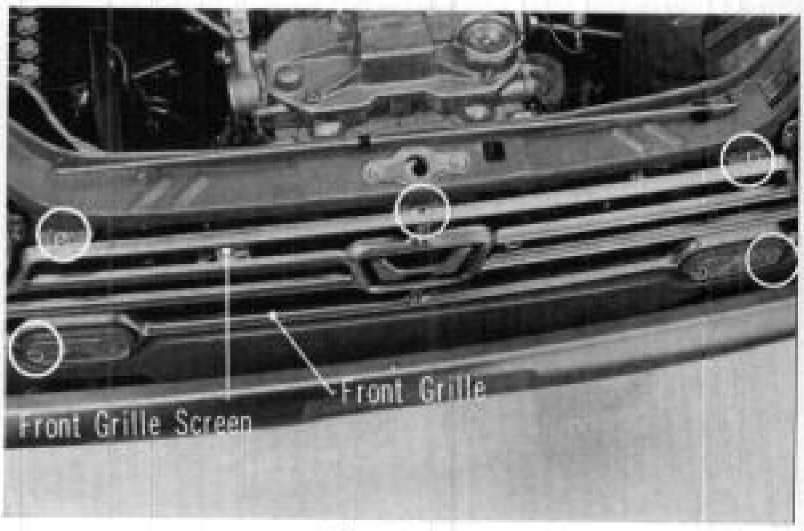


Fig. 3B-6

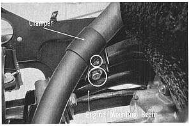


Fig. 3B-7

15. Loosen the exhaust pipe clamper retaining nut, and release the clamper by removing the bolt securing it to the engine mounting beam.

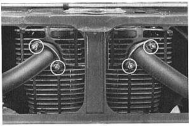


Fig. 3B-8

16. Separate the exhaust pipe from the cylinder head. It is unnecessary to remove the exhaust pipe from the engine compartment as this is done after it has been dismounted with the engine.
17. Loosen the front wheel nuts and wheel bearing nuts.
18. Jack up the engine lower crankcase and raise the vehicle. Place a support beneath the front of the vehicle body as shown in Fig. 3B-11. The height of the support should allow a distance of 730mm (28.7 in.) or more between the ground and the front bumper. (See Fig. 3B-16)

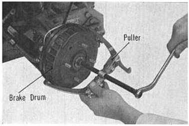


Fig. 3B-9

19. Remove the wheel and wheel bearing nut on both sides.
    Remove the brake drum by using a suitable tool, puller from the axle shaft. (Fig. 3B-9)
20. Separate the back plate from the knuckle after removing four plate mounting bolts. (Fig. 3B-10)
    This work does not require the trouble some air bleeding of the brake system after remounting the power unit.

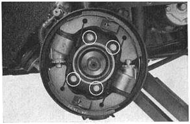


Fig. 3B-10

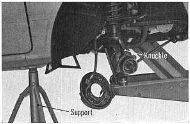


Fig. 3B-11

21. Remove the knuckle clamp bolt and separate the knuckle from the front damper. If it is hard, insert a screwdriver into the knuckle opening and wrench it, and they can be easily separated.

To dismount the power unit, there is another way which does not require disassembling front brake system and front dampers from the knuckles. According to this method, front dampers should be dismounted from the body shell by removing 8mm nuts as single with power unit / sub frame / front suspension while front brake hoses should be also disconnected.

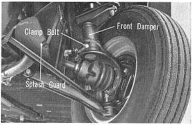


Fig. 3B-12

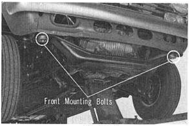


Fig. 3B-13

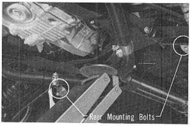


Fig. 3B-14

22. (For Engine type car heater) Remove the right and left splash guards.

23. Remove the front and rear sub-frame mounting bolts. (Fig. 3B-13 and Fig. 3B-14)

24. Remove the two bolts retaining the exhaust silencer on the vehicle body, and remove the rubber. (Refer to SECTION 15. EXHAUST SYSTEM)

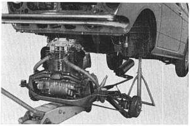


Fig. 3B-15

25. Slowly dismount the power unit, sub-frame, exhaust pipe and silencer as an assembly and check to see that no lead wires or cables were overlooked. Upon completion, the power unit is completely saparated from the vehicle body subframe, and exhaust pipe, as an assembly by pulling in a forward direction.

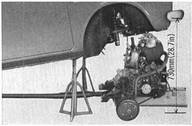


Fig. 3B-16

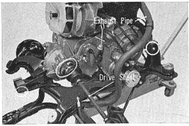


Fig. 3B-17

26. Remove the starter from the engine (N600), and remove the exhaust pipe.
    Remove the drive shaft from the differential. Remove the front engine mounting beam and the rear mounting bolt, and separate the engine and sub-frame; also at this time, separate the exhaust pipe from the engine. **(Fig. 3B-17)**

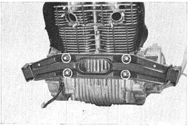


Fig. 3B-18

27. Remove the four front engine mounting beam bolts and separate the beam from the engine. Power unit dismounting is thus completed. **(Fig. 3B-18)**

C. Mounting

Power unit mounting is the reverse of dismounting, but note the following:

1. The power unit is mounted onto the sub-frame with the bolts placed through the rubber cushions. Avoid incorrect installation of rubber cushions and washer plates. Fig. **3C-1** shows the front engine mounting rubber cushion arrangement, and Fig. **3C-2** the arrangement at the rear.

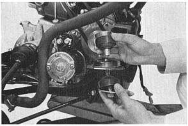


Fig. 3C-1

Check the rubber cushions for deterioration.
When tightening the mounting bolts and nuts, avoid metal to metal contacts among body shell, sub-frame, and sheath to have a complete noise insulation to passenger room.

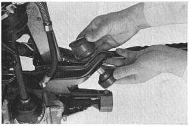


Fig. 3C-2

2. Connect the wirings and cables according to their colors (colors should match).
3. When installing the insulator, do not forget to install the insulator O-ring.
4. Check the front wheel toe-in and adjust it if necessary.

   Toe-in . . . . OUT 2mm
   (Refer to SECTION 10. STEERING)

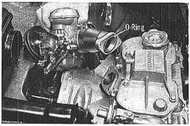
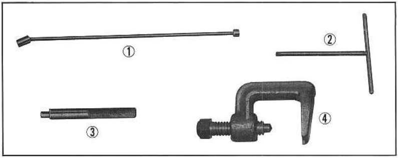


Fig. 3C-3

TORQUE SPECIFICATIONS

Description	Size (mm)	Torque kg-m (lbs-ft)
Engine support beam-to-sub frame	10	3.0-3.5 kg-m (22-26)
Engine-to-support beam	8	2.0-2.4 kg-m (15-18)
Engine rear mounting bracket-to-sub frame	8	2.0-2.4 kg-m (15-18)
Engine rear mounting cushion-to-bracket	6	0.81-1.0 kg-m (6-8)
Front wheel hub nut	20	14-20 kg-m (101-145)
	22	14-20 kg-m (101-145)
Knuckle clamp bolt	10	4.5-5.0 kg-m (33-37)
	8	2.8-3.4 kg-m (20-25)
Drive shaft-to-differential	8	2.8-3.2 kg-m (20-24)
Exhaust pipe clamp bolt	8	2.0-2.4 kg-m (15-18)
Exhaust pipe-to-engine	8	2.0-2.4 kg-m (15-18)
Heat exchanger mounting nut	10	4.0-4.8 kg-m (21-24)
Front shock absorber mounting bracket-to-body	8	1.5-2.3 kg-m (11-15)

D. Special Tool



Ref. No.	Tool No.	Description	N360 LN360	N400 N600
1.	07093-55101	Universal joint socket wrench, 10mm	○	○
2.	07093-55105	Universal joint socket wrench handle	○	○
3.	07047-55101	Shift rod pin driver	○	○
4.	07092-55103	Tie-rod end puller	○	○

SECTION 4

ENGINE MECHANICAL

4

A. Description

The HONDA N-series vehicle employs an overhead camshaft, two-cylinder arranged in transverse, air cooled engine.

The production engine serial number is stamped on the left side upper crankcase beside the clutch housing. **(Fig. 4A-1)**

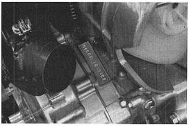


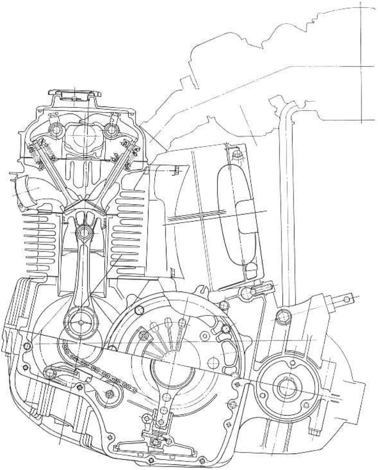
Fig. 4A-1

B. Technical Data

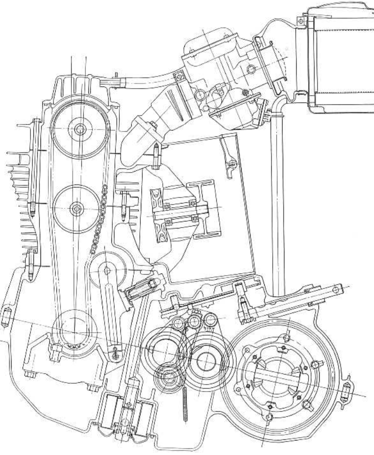
	360	400	600
Type	Forced air cooled, 4-stroke engine		
Location	Front		
Weight (including transmission and differential)	87kg (191.8 lbs) —N360, LN360 108kg (238.1 lbs) —A360	87kg (191.8 lbs)	96.5kg (212.7 lbs) —N600 114kg (251.4 lbs) —600
Number of cylinders	2, transverse installation 3° backward-inclined		
Starting system	Motor generator		Starter motor
Bore x Stroke	62.5x57.8mm (2.46x2.28in.)	66.5x57.8mm (2.62x 2.28in.)	74x69.6mm (2.91x2.74in.)
Piston displacement	354cc (21.4 cu-in.)	401cc (24.5 cu-in.)	598.4cc (36.5 cu-in.)
Compression ratio	8.6	8.5	8.3
Compression pressure (at 400 rpm)	12.0±0.5kg/cm² (170±7 lbs/in²)		11.0±0.5kg/cm² (156±7 lbs/in²)
B.M.E.P. (at 5,000 rpm)	10.6kg/cm² (151 lbs/in²)		10.5kg/cm² (149 lbs/in²)
Combustion chamber	Hemi-spherical with valves eccentrically arranged		
Piston type	Offset pin		
Piston material	Cast alloy aluminum		
Number of piston ring	Compression 2, Oil 1		
Valve clearance (IN and EX)	0.10±0.02mm (0.004±0.0008in.), cold		
Valve timing (at 1mm, 0.039in. cam lift)			1969 Model / 1970 Model
Inlet valve: open	B.T.D.C. 0°		B.T.D.C. 0° / 5°
close	A.B.D.C. 30°		A.B.D.C. 40° / 20°
Exhaust valve: open	B.B.D.C. 40°		B.B.D.C. 40° / 40°
close	A.T.D.C. 0°		A.T.D.C. 0° / 10°
Ignitino timing: B.T.D.C.	10°/1,650 rpm	10°/1,650 rpm	10°/1,650 rpm
B.T.D.C.	36°/4,000 rpm (30°/4,000 rpm for 1970 model)	36°/4,000 rpm	30°/4,000 rpm

	360	400	600
PRIMARY DRIVE			
Type	Two single row chains. . . . . .Manual Single row chain . . . . Automatic		
Reduction ratio (between crankshaft and transmission)	2.812 . . . . Manual 3.542 . . . . Automatic	2.812	2.050 . . . . Manual 3.542 . . . . Automatic
COOLING SYSTEM			
Type	Forced air-cooling		
Fan belt tension	15~20mm (0.59~0.78in.) between two belts		
LUBRICATION SYSTEM			
Oil pump type	Plunger . . . . Manual Trochoid . . . . .Automatic		
Oil pump delivery rate	3.1 lit/min. at 2,800rpm engine speed . . . . Manual (2.728 Imp. qt/min., 3.277 US qt/min.) 5.5 lit/min. at 4,000rpm engine speed . . . . Automatic (4.8 Imp. qt/min., 5.8 US qt/min.)		
Oil filter type	Paper		
Oil pan capacity	3.0 lit (2.64 Imp. qt., 3.17 US qt.) . . . . .Manual 2.5 lit (2.23 Imp. qt., 2.64 US qt.) . . . . .Automatic		
Lubrication methods			
Main bearings	Pressure fed and splash fed		
Connecting rods	Pressure fed		
Hydraulic cam chain tensioner	Pressure fed		
Primary chain	Nozzle sprayed . . . . Manual		
Cylinder walls	Splash fed		
Camshaft bearing	Splash fed		
Oil pump body inside diameter . . . .Manual	22.1~22.2mm (0.870~0.874in.)		
Oil pump plunger outside diameter . . . .Manual	21.93~21.96mm (0.863~0.865in.)		
CYLINDER			
Bore diameter	62.50~62.51mm (2.4606~2.4610in.)	66.50~66.51mm (2.6181~2.6185in.)	74.00~74.01mm (2.9134~2.9138in.)
Diametrical difference	0.01mm (0.0004in.)		
Roundness	0.01mm (0.0004in.)		
PISTON			
Top land diameter	61.95~62.00mm (2.439~2.441in.)	65.95~66.00mm (2.596~2.598in.)	73.40~73.45mm (2.890~2.891in.)
Skirt diameter	62.45~62.47mm (2.458~2.459in.)	66.45~66.47mm (2.616~2.617in.)	73.95~73.97mm (2.911~2.912in.)
Pin bore diameter	17.002~17.008mm (0.6694~0.6696in.)		
Piston ring side clearance			
Top ring	0.045~0.075mm (0.0018~0.0030in.)		
2nd and oil ring	0.015~0.045mm (0.0006~0.0018in.)		
Piston ring end gap	0.2~0.4mm (0.008~0.016in.)		
Piston pin diameter	16.994~17.000mm (0.6691~0.6693in.)		

	360	400	600
VALVE			
Valve stem diameter IN.	6.58~6.59mm (0.2591~0.2594in.)		
EX.	6.55~6.56mm (0.2579~0.2583in.)		
Valve head thickness IN.	0.9~1.1mm (0.0350~0.0433in.)		
EX.	1.4~1.6mm (0.0550~0.0630in.)		
Clearance between stem IN.	0.01~0.04mm (0.0004~0.0016in.)		
and valve quide EX.	0.04~0.07mm (0.0016~0.0028in.)		
VALVE SPRING			
Free length Inner	42.0mm (1.65in.)		
Outer	44.8mm (1.76in.)		
Tensile force Inner	10.8~12.5kg/34.5mm (23.8~27.6 lbs/1.36in.)		
Outer	22.5~25.5kg/36.5mm (49.6~56.2 lbs/1.44in.)		
IGNITION SYSTEM			
Spark plug: make	NGK (Nihon Tokushu Togyo Co., Ltd.) ND (Nihon Denso Co., Ltd.)		
Type: standard	B-8ES (NGK), GE-W24ES (ND)		
optional	B7ES, GE-W24ES, B-9E		
Size	14mm thread, 19mm reach		
Gap	0.8mm (0.032in.)		
Distributor: Type	Non-rotor		
Make	Nippon Denso Co., Ltd.		
Breaker point gap	0.35±0.05mm (0.014±0.002in.)		
Condenser capacity	0.22μFb10%		
Cam angle (dwell angle)	90 degrees		
Centrifugal advance	26 degrees (crank angle) 20 degrees for 1970 model		20 degrees (crank angle)
Vacuum advance	20 degrees (−180mm Hg) (crank angle)		
Static ignition timing	10 degrees B.T.D.C.		
Timing marks	Dimple on generator cover, marks on crankshaft qulley		Dimple on flywheel cover, marks on crank-shaft pulley



ENGINE CROSS SECTION (1)



ENGINE CROSS SECTION (2)

C. Engine Lubricating

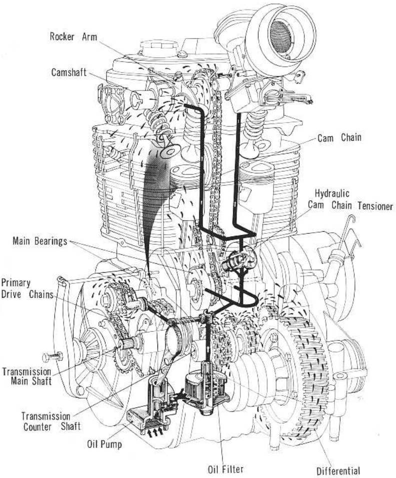


Fig. 4C-1

a. Description

Because of the fact that this engine is a high-speed and high performance engine, importance has been placed on the proper lubrication of the various engine components.

The engine oil is contained in the lower crankcase which is provided with cooling fins. This is a contrast to the conventional engine where the oil is contained in the oil pan. The transmission and the differential gears are also lubricated by the engine oil, making it unnecessary to have separate oil supplies for the transmission and differential.

The lubricating system, the lubricant is pressurized by a plunger type oil pump (manual shift vehicle), is branched into two main routes. One route supplies oil to the oil nozzle which lubricates the primary chains; the other route is further divided to lubricate the crankshaft, and the cylinder head section.

The oil, which is fed through the center of the crankcase, lubricated the bearings and, in addition, lubricates the crank pins and the large end of the connecting rods. This oil is further sprayed on the pistons, the small end of the connecting rods, and the cylinder sleeves to lubricates those areas, and then it drops back into the lower case. The oil which is supplied to the cylinder head provides part of it to operate the hydraulic cam chain tensioner, however, the main flow of the oil is sent to the head section through the two holes in the cylinder block and into the camshaft housing where it is pooled and used to lubricates the camshafts, rocker arm shafts, rocker arms and then it also drops back in to the lower crankcase.

1. Engine oil

   Since precision by manufactured parts are required for this high performance engine, it is recommended that a high quality oil of MS oil grade be used. Refer to GENERAL INFORMATION E. Lubrication for details.

2. Oil pump

   The plunger pump is so designed to operate with a reciprocating motion to deliver the oil which lubricates the entire engine. It is operated through the pump rod installed on the primary driven sprocket hub.

3. Oil filter

   The oil filter is of a filter paper type which filters the oil delivered from the oil pump. The oil filter is installed at the bottom of the crankcase for easy replacement of the filter element.

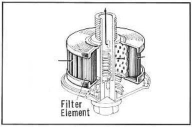


Fig. 4C-3

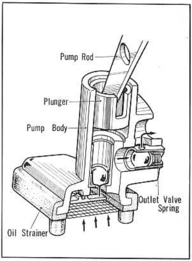


Fig. 4C-2

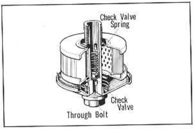


Fig. 4C-4

4. Check valve

   Usually, the oil coming from the pump enters the filter from around the filter element and passes through the oil passage in the through bolt. After being filtered, clean oil flows out of the filter.
   If the filter element is clogged and the oil pressure increases, the check valve is pushed upward to allow the oil to flow directly to the through the bolt without passing through the element.

b. Maintenance

a) Disassembly

The oil pump can be removed with the engine mounted on the vehicle.

1. Remove the clutch and left side cover. (Refer to SECTION 5. CLUTCH for removal procedure.)

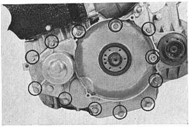


Fig. 4C-5

When removing the left side cover without dismounting the engine, it is difficult to remove the lower bolts, so jack up the engine lower crankcase and lift the engine slightly.
Bolt removal is easy under this conditions. (Fig. 4C-6)

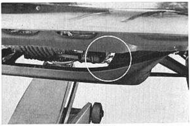


Fig. 4C-6

2. The oil pump is dismounted together with the primary driven sprocket, primary drive sprocket, and primary chain as an assembly. Remove the driven sprocket circlip and remove the washer from the main shaft. Remove the drive sprocket retaining bolt and washer. Remove the two oil pump retaining bolts and special washers.
   Draw out the oil pump with the drive and driven sprockets as an assembly by holding these two sprockets manually.

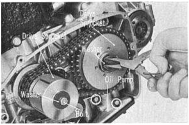


Fig. 4C-7

3. For disassembling the oil pump, remove the pump rod and plunger from the pump body. The plunger can be removed from the pump rod after removing the pin. The strainer is fit in the pump body with rubber. (Fig. 4C-8)

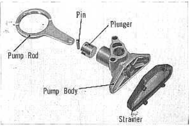


Fig. 4C-8

4. The driven sprocket internal hub is equipped with an eccentric cam.
When the driven sprocket turns, the pump rod is moved vertically, thus performing pumping action. (Fig. 4C-9)

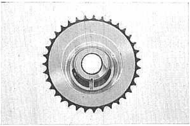


Fig. 4C-9

b) Inspection and cleaning

1. Pour a clean detergent into the oil pan and clean the oil strainer. Be sure to replace a damaged strainer with a new one.


Fig. 4C-10

2. Pour fresh oil into the oil pan, and immerse the oil pump in it. Check the oil pump for discharge volume while vertically moving the pump rod manually.

   Pump discharge volume:
   Pump speed 500 rpm: 1.55 lit./min.
   Pump speed 1,000 rpm: 3.10 lit./min.

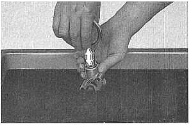


Fig. 4C-11

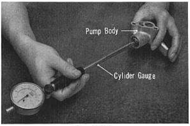


Fig. 4C-12

3. In case of malfunction, check the pump cylinder and the plunger for scratches and scores, and also check the relative dimensions of the parts to see if they are within serviceable limits. If the parts are worn beyond serviceable limits, replace them. **(Fig. 4C-12 and 4C-13)**

	Cylinder I.D.	Plugner O.D.
Serviceable limit	Replace if over 22.05mm(0.8681in)	Replace if under 21.91mm(0.8626in)

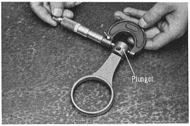


Fig. 4C-13

4. If the plunger and the cylinder are found to be serviceable but the discharge rate is insufficient, the trouble is defective valves. Therefore, replace the pump body assembly with a new part.

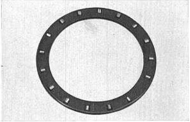


Fig. 4C-14

5. Check to see if the oil pump thrust needle bearing is worn or seized at the base. Any defective parts should be replaced.

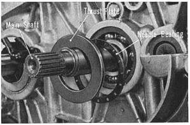


Fig. 4C-15

c) Assembly

1. Insert the needle roller bearing and thrust plate into the outer race of the transmission main shaft bearing.

   Note:
   Check to see that the needle bearing rollers are not out of position. **(Fig. 4C-15)**

2. Insert the oil pump assembly into the primary driven sprocket.

   Note:
   Insert the pump with the oil grooved side of pump rod facing the driven sprocket. If installed reversely, the pump cannot be installed into the mainshaft.

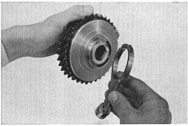


Fig. 4C-16

For reassembly, follow the reverse sequence of the procedures used in disassembly.

3. Special washers (made of iron) are used with oil pump installing bolts.
   Avoid the use of aluminum washers with these bolts.
4. For installation of the primary drive and driven sprockets, refer to M. PRIMARY DRIVE.
5. When installing the left side cover, ascertain that knock pins (two) are attached. Replace with new packing. (Fig. 4C-17)

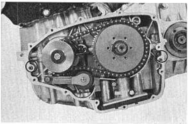


Fig. 4C-17

D. Engine Cooling

a. Description

The engine is cooled by forced air and is designed to use the hot air for the compartment heating during cold weather (Engine type car heater).

Engine cooling equipment consists of a cooling fan, drive mechanism, fan belt and pulleys, the cooling fan housing, heater drum and fan shrouds around the cylinder head and cylinders. The cooling air is taken in from the front of the engine. Thus, during driving sufficient cooling is provided through the "ramming" effect. The cooling air is guided around cylinder head and cylinders by the fan shrouds and then driven out of the fan housing by the cooling fan.

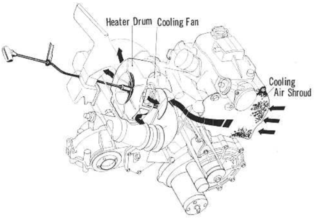


Fig. 4D-1

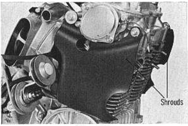


Fig. 4D-2

Cooling air shrouds:

The cooling air shrouds are installed on both sides of the camshaft housing and the cylinder, and serve to improve the cooling effect by concentrating the flow of cooling air. Each shroud is secured in three different positions through cushion rubber placed between the upper mounting bolts and the shroud. Consequently, no abnormal sounds due to vibration are produced. (Figs. 4D-2 and 4D-3)

Removal and Installation:
Remove two upper mounting bolts and pull the shroud upward. (Fig. 4D-3)

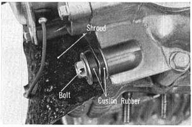


Fig. 4D-3

b. Maintenance

a) Disassembly

1. Loosen the adjusting nut, press the adjusting pulley completely against the engine, and sufficiently loosen the belt.
   Remove the fan belt from the pulley. Inspect the fan belt. If it is excessively worn or damage, replace.

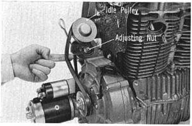


Fig. 4D-4

Fan belt replacement:

After removing the fan belt from the crankshaft pulley, remove it from the cooling fan pulley and pull the belt with the idle pulley moved to the outside. Then the fan belt is completely removed. (Fig. 4D-5)
When mounting a new belt, mount it on the cooling fan pulley in advance to facilitate mounting.

Fig. 4D-5

2. Cooling fan housing is mounted on the engine with four 6mm bolts, unscrew these bolts to remove the fan housing from the engine.
3. The heater drum is installed with two bolts through leaf springs.
4. Check the cooling fan bearing for looseness or any unusual noise; if any undesirable condition is found pull the fan pulley out (shaft and cooling fan are integral unit) and disassemble the bearings.

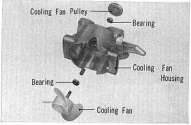


Fig. 4D-6

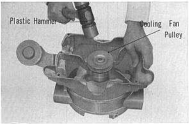


Fig. 4D-7

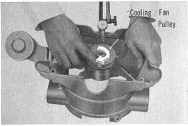


Fig. 4D-8

b) Inspection and repair

Turn the cooling fan by hand and check for defects in the cooling fan bearings.
If any defects are found, remove the fan pulley by using a puller and replace the bearing.

Note:
The cooling fan and shaft are an integral unit and cannot be disassembled. After replacing the bearings, also replace the fan pulley with a new part and assemble it with the shaft by accurately press fitting.
After making the installation (Fig. 4D-7), make sure that the pulley is press fitted squarely to the shaft by aid of the dial gauge (Fig. 4D-8). Check the idle and the pulley bearings for wear and vibration.
Also check the heater drum stopper spring for wear. Replace any parts which are found to be defective.

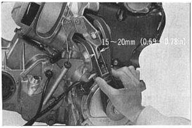


Fig. 4D-9

c) Assembly

Reassembly is the reverse sequence of disassembly. Check the tension of the fan belt. Pinch the belt part (between two pulleys) by fingers as illustrated in Fig. 4D-9 and make sure that the clearance is in the standard range of from 15 to 20mm (0.59 to 0.78 in.).

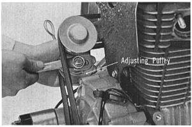


Fig. 4D-10

Adjustment should be performed by the adjusting pulley. Loosen the adjusting pulley nut and move the adjusting pulley so that appropriate belt tension is obtained. (Fig. 4D-10)

E. Ignition

a. Description

The ignition system consists of battery, ignition coil, contact point breaker, spark plugs, and primary and secondary windings.
These components are electrically connected as shown in Fig. 4E-1.
The engine is of two-cylinder type and the pistons are shifted 360 degrees. Thus, ignition for the two cylinders occurs simultaneously. A distributor is not required because of this.
Current from the battery flows to the contact point breaker through primary winding of the ignition coil.
The breaker points open or close through point cam operation.
High voltage is induced in the secondary coil through induction, and this resultant high voltage is used for ignition.

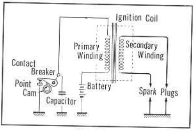


Fig. 4E-1

b. Ignition Coil

Description:

The ignition coil consists of a primary coil with 380 turns of enameled 0.3mm (0.012 in.) diameter wire and two secondary coils with 15,000 turns of 0.06mm (0.02 in.) diameter enameled wire wound around the primary coil, with an iron core of laminated sillicon steel sheets in the center. Each secondary coil has a high tension cable that leads to one spark plug. Insulating bobbins are located between layers of the secondary and primary coils.

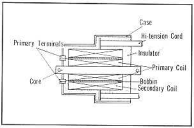


Fig. 4E-2

Maintenance:

1. Pull out the high tension terminal from the spark plug and the primary lead from the contact breaker.
   Remove the ignition coil mounting nut. The ignition coil can then be detached from the body.

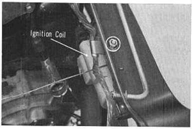


Fig. 4E-3

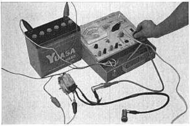


Fig. 4E-4

2. Connect the battery and ignition coil to service tester, and check sparking. If the spark is less than 5mm (0.2 in.) long, replace the ignition coil.

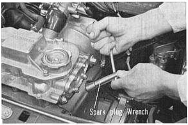


Fig. 4E-5

c. Spark Plug

See SECTION 2. ENGINE TUNE-UP

Special tool, spark plug wrench:

The handle of the plug wrench can be slided. Use the wrench by sliding the handle properly to obtain proper torque.

Note:
When reinstalling a spark plug in the cylinder head, thread in by hand, and make final tightening with the wrench.

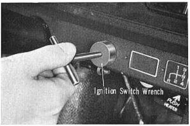


Fig. 4E-6

Special tool, ignition switch wrench:

When the ignition switch fails and replacement is required, use the special tool, ignition switch wrench to remove and install the switch.

d. Contact Point Breaker

Description:

The contact point breaker assembly is attached to the right side of the camshaft housing. The breaker cam is mounted on the right end of the camshaft that is compact in its construction. In both combustion chambers the spark plugs are ignited simultaneously by means of two secondary windings of the ignition coil and as the result of this system, the distributor is not used making the construction simple and servicing easy.

Maintenance:

1. Remove the breaker lid and pull off the snap ring which retains the vacuum unit rod to the breaker plate, and then disconnect the primary lead at the connector.
   Remove the breaker plate set screws and the breaker plate can be disassembled.

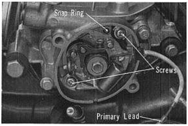


Fig. 4E-7

2. Remove the bolt and pull out the breaker cam and spark advance.

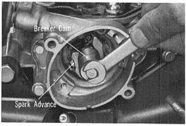


Fig. 4E-8

3. Check the spark advance spring for loss of tension and also the weight pin for excessive wear; replace any part found worn excessively or defective.
   Check the centrifugal advance characteristics in accordance with the diagram on page 2-12.
   If the maximum centrifugal advance is not within the specifications, adjust by bending the weight stopper.

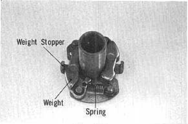


Fig. 4E-9

4. Check the right camshaft holder for any oil leaks; if oil leaks are found to be serious, check the oil seal for defects and check camshaft for excessive axial side play. Faulty check valve of cam chain ten sioner can also be responsible for oil leaks.

   (Refer to F. CAMSHAFT DRIVE for disassembly procedure.)
   When assembling the spark advance, align the groove of the advance and the dowel pin on the camshaft. (Fig. 4E-10)

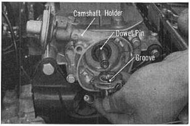


Fig. 4E-10

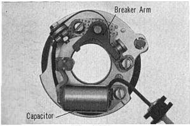


Fig. 4E-11

5. Check the condition of the breaker plate points. If excessively pitted or dirty, disassemble the point and dress with an oil stone. At the same time, test the capacitor and if found defective, it should be replaced.

   Capacity: $0.22\mu F \pm 10\%$

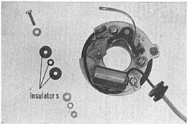


Fig. 4E-12

6. When replacing the breaker or condenser, care should be taken not to overlook installing the insulators.
   The part will be grounded if this precaution is not taken.

F. Camshaft Drive

a. General Description

The engine is an efficient high-performance overhead camshaft engine with the camshaft located in the camshaft housing above the cylinder head. To meet high speed operation, the camshaft is made rigid with short length and comparatively large diameter against torsional and bending forces. It is supported at both ends by the camshaft holders and driven by a centrally located sprocket.

The camshaft is driven directly from the crankshaft through an endless chain. The cam chain vibration is prevented by a synthetic rubber cam chain guide roller located midpoint between the camshaft and the crankshaft, and a hydraulic cam chain tensioner, which consists of a guide roller mounted on the crankshaft center bearing holder and a push rod holder assembly.

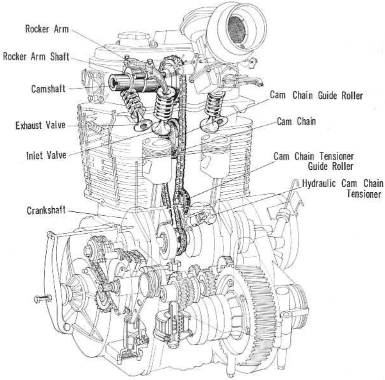


Fig. 4F-1

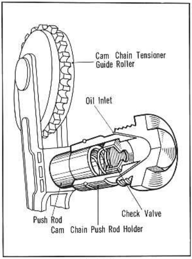


Fig. 4F-2

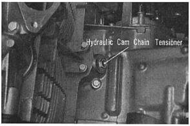


Fig. 4F-3

b. Hydraulic Cam Chain Tensioner

Description

The cam chain tensioner consists of a hydraulic mechanism installed in the upper crankcase and a guide roller mounted on the crankshaft center bearing cap.

Maintenance

Hydraulic tensioner:

The cam chain tensioner is a hydraulic mechanism to apply a constant pressure on the cam chain. The oil in the holder is supplied with pressure by the oil pump. When the chain becomes loose, the spring within the holder will take up the slack by extending the push rod, and when the chain increases tension, the push rod acts as a hydraulic plunger operating against a closed check valve. This principle of operation performs the automatic chain tension control and prevents the cam chain from skipping, as well as reducing the chain noise. The hydraulic cam chain tensioner can be removed after the carburetor and the cooling fan housing are removed with the engine mounted on the body.
To remove the hydraulic tensioner, use a socket wrench, do not use an open wrench. If the part is tight and will not come loose, use a plastic hammer and gently tap the top of the tensioner. The shock will free the part.

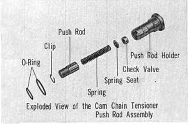


Fig. 4F-4

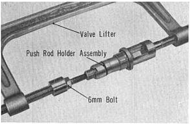


Fig. 4F-5

To disassemble the hydraulic mechanism, retract the push rod by the use of a valve lifter and a 6mm bolt, and then remove the set clip.

Since the check valve is press-fitted in the push rod holder to prevent the oil from leaking in the latest model it cannot be disassembled.

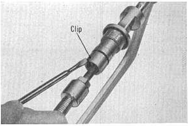


Fig. 4F-6

When cam chain noise becomes high or mechanical engine noise around cylinder barrel and cylinder head becomes high, the possible cause is a defective hydraulic cam chain tensioner. When the part fails to work and the engine is kept running, the cylinder barrel and cylinder head are damaged as shown at the end.

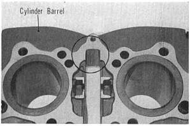


Fig. 4F-7

To check the hydraulic cam chain tensioner for a worn check valve, immerse the part in clean engine oil and fill by pumping the push rod several times with the thumb. If the push rod retracts inspite of full oil inside the push rod holder in a short time, the check valve is defective.
Replace it with a new check valve and push rod holder set. The check valve is press-fitted into the push rod holder.

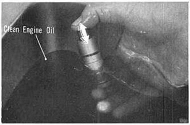


Fig. 4F-8

Cam chain tensioner guide roller:

Tensioner guide roller assembly consists of a synthetic rubber roller, rubber cushion pad which receives the push rod, and the arm which is mounted on the crankshaft center bearing cap. The crankshaft center bearing cap supports the two center main bearings of the four and serves to prevent the cam chain from skipping by incorporating a chain stopper pin.

1. Check the chain contact surface of the rubber roller for wear by turning and inspecting several places.
2. Check the rubber cushion pad for secure mounting.

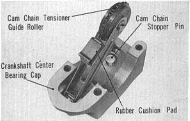


Fig. 4F-9

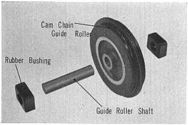


Fig. 4F-10

c. Cam Chain Guide Roller and Cam Chain Slipper

The cam chain guide roller is located at the mating surface between the cylinder barrel and the cylinder head, and serves to prevent the cam chain from the "whipping".

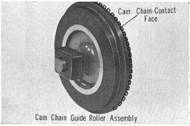


Fig. 4F-11

Check the chain contact surface for wear, and replace it if wear is excessive. An excessively worn roller will not only cause faster wear of the chain and hydraulic cam chain tensioner, but will also result in noise and chain "jump".

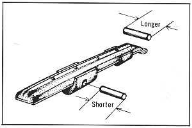


Fig. 4F-11a

The N360 and N400 cam chain slippers are secured to the cylinder barrel with a pin while N600 employs two pins. For the N600, the shorter pin should be installed in the center hole of the slipper.

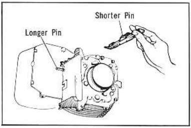


Fig. 4F-11b

(N600)
Place the longer pin in the groove of cylinder barrel at the top. Then, install the cam chain slipper in the cylinder barrel with the shorter pin in the slipper. The cam chain slipper is secured to the wall of the barrel with two pins.

d. Camshaft and Rocker Arm

Description

Conventional overhead valve engines are of such construction that the camshaft is mounted wholly within the cylinder head. In the Honda N's engine, however, the camshaft is installed in the camshaft housing separated from the cylinder head.
Consequently, the camshaft housing can be separated from the cylinder head easily by removing the camshaft from the drive chain and its service operation can easily be performed.

Disassembly

1. Remove the carburetor together with the intake manifold from the engine.
   (Refer to SECTION 14. FUEL SYSTEM)
2. (For vehicle equipped with Engine type car heater)
   Pull out the pin from the end of the heater control rod and push the rod in toward the interior. Loosen air duct clamps and separate air ducts from the cooling fan housing.

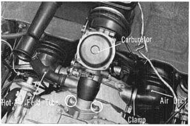


Fig. 4F-12

3. Separate the cooling fan housing from the engine. Disconnect the fan belt from the pulley. (Refet to D. ENGINE COOLING)
4. Remove the hydraulic cam chain tensioner.
   (See Fig. 4F-3 Page 4-20)
   Note:
   In performing this task, use a socket wrench, not a spanner. If the part is tight and will not loosen, use the plastic hammer and gently tap the top of the tensioner.
   The shock willcause the part to loosen easily.

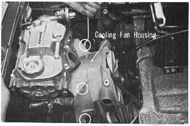


Fig. 4F-13

5. Remove the camshaft housing cover and separate the right camshaft holder.

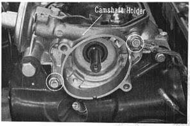


Fig. 4F-14

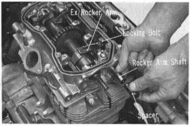


Fig. 4F-15

6. A spring is installed to the inlet rocker arm shaft while a rubber spacer (or a spring for the models made at certain period) is installed to the exhaust rocker arm shaft. For those models which employ springs both to the inlet and exhaust rocker arm shaft, be sure to install correctly when reassembling. (See Fig. 4F-32 Page 4-28) Incorrect positioning may cause oil leak through the cylinder stud bolts.

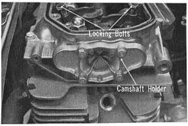


Fig. 4F-16

7. Remove the left camshaft holder.
   Remove the rocker arm shaft and the rocker arm in the same manner as was done for the right side.

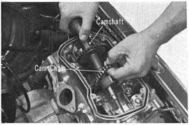


Fig. 4F-17

8. Remove the cam chain from the sprocket and pull out the camshaft. (Fig. 4F-17)

   Note:
   The camshaft can be removed only to the left side.
9. Remove shrouds from both sides and separate the camshaft housing from the cylinder head. Unscrew the bolt from the bottom on the intake manifold and then unscrew the nuts and bolts from the top in the sequence numbered in the figure. (Fig. 4F-18 and 4F-19)

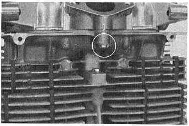


Fig. 4F-18

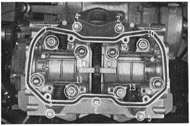


Fig. 4F-19

Inspection

1. Check the wear of rocker arm shaft boss, using the dial gauge.

	Serviceable limit
Outer I. D.	Replace if over 17.05mm (0.671 in.)
Inner I. D.	Replace if over 12.05mm (0.474 in.)

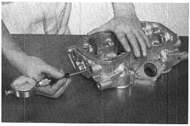


Fig. 4F-20

2. Check the condition of the gasket between camshaft housing and cylinder head. If it is found to be defective, remove the gasket, being careful not to damage the machined surface. Any pits, scratches or roundness to the machined surfaces should be removed by using an oil stone on the surface in the figure-eight motion until the surfaces are smooth and clean.

   Note:
   The flat side of the oil stone should be used. If there is any indication of oil leakage, the machined gasket surface should be checked for flatness on the surface plate by using red lead or bluing and high spots should be reworked with the oil stone to obtain a flat surface.

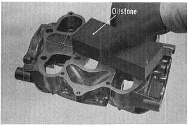


Fig. 4F-21

3. Inspecting the camshaft for bend
   Mount the camshaft on two V blocks and check for bend with dial gauge while gently rotating the camshaft.

	Serviceable limit
Camshaft bend	Replace if over 0.04mm (0.0016 in.)

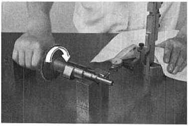


Fig. 4F-22

4. Inspect the cam lobe for wear by using the micrometer.

	Standard Value	Serviceable limit
360/400 In. cam	39.73~40.89mm (1.566~1.610 in.)	Replace if under 39.70mm (1.563 in.)
Ex. cam	40.25~40.41mm (1.585~1.591 in.)	Replace if under 40.22mm (1.583 in.)
600 In. cam	41.21~41.37mm (1.622~1.629 in.)	Replace if under 41.18mm (1.621 in.)
Ex. cam	40.73~40.89mm (1.604~1.610 in.)	Replace if under 40.70mm (1.602 in.)

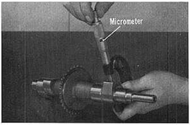


Fig. 4F-23

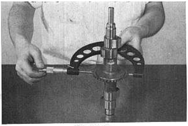


Fig. 4F-24

5. Inspect the sprocket root diameter for wear. Measure the sprocket at two points perpendicular to each other.

	Standard Value	Serviceable limit
Root diameter	79.65~79.73mm (3.136~3.139 in.)	Replace if under 79.1mm (3.114 in.)

Fig. 4F-25

6. Inspect the camshaft journal for wear.

	Standard Value	Serviceable limit
Camshaft journal D.	23.92~23.95mm (0.942~0.943 in.)	Replace if under 23.9mm (0.941 in.)

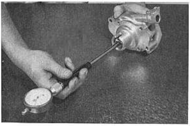


Fig. 4F-26

7. Inspect the camshaft holder inside diameter for wear by measuring two points perpendicular to each other.

Unit: mm (inch.)

	Standard Value	Serviceable limit
Camshaft holder I. D.	24.00~24.02 (0.9448~0.9456)	Replace if over 24.05mm (0.9468)

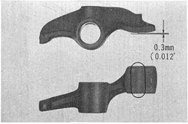


Fig. 4F-27

8. Inspect the rocker arm on these cam bearing surfaces of the rocker arm by comparing it with a new rocker arm. If the wear is greater than 0.3mm (0.012 in).) then the rocker arm should be replaced with a new unit.

Assembly

Reassembly should be made in the reverse of disassembly. Replace the gaskets with new ones.

1. Reassemble the camshaft housing in the reverse order of disassembly and tighten the nuts and bolts in the reverse order of removal. Be careful not to mis-install the nuts. The cap nut must be installed in its correct location to prevent oil leakage. (Fig. 4F-19, 4F-28 and 4F-35)

   Tighten the nuts to the following values:
   10mm nut: 2.8~3.2kg-m (20.3~23.1 lb-ft)
   6mm nut: 0.9~1.2kg-m (6.5~8.7 lb-ft)

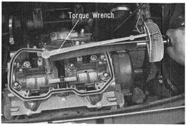


Fig. 4F-28

2. Install the camshaft and cam chain.
   Turn the crankshaft in the normal direction of rotation and align the "T" mark on the crankshaft pulley to the index mark, and then align the camshaft so that the horizintal mark on the sprocket is at the top and parallel to the flange surface of the camshaft housing. In this position pull both ends of the cam chain to remove any slack and mount the chain on the sprocket.

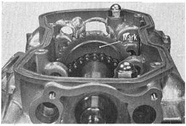


Fig. 4F-29

3. The rocker arms are marked "R" and "L". "R" must be installed on the right side as viewed from the direction of travel, and "L" on the left side.

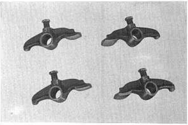


Fig. 4F-30

4. The rocker arm and the camshaft holder on the right side must be installed first.
   Install the rocker arm with the punch mark toward the top. This will provide the maximum tappet clearance and will make the reassembly much easier.
   The longer rocker arm spring is inserted into the exhaust rocker arm shaft (The valve clearance adjusting holes are located near the slender journal) with a rocker arm and presses the rocker arm outward against camshaft housing while the shorten rocker arm spring is installed outside the inlet rocker arm shaft and presses the shaft inward.

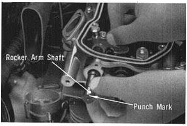


Fig. 4F-31

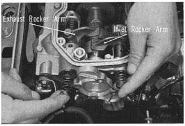


Fig. 4F-32

In 600cc engine, instead of rubber spacers, the spring is installed outside the exhaust rocker arm shaft as well as outside the inlet rocker arm shaft and presses the shaft inward. (Fig. 4F-32)

Note:
Position the camshaft so that the piston is at the top-dead-center of the compression stroke and hold the cam to prevent its turning.

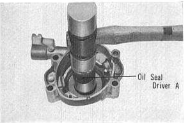


Fig. 4F-33

5. Inspect the oil seal (20x30x5) of the right side camshaft holder and if it is worn excessively, replace it by using the special tool, oil seal driver A as shown in Fig. 4F-33.

6. Install the right side camshaft holder with new gasket.

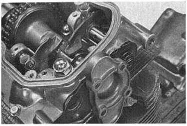


Fig. 4F-34

7. After the right side has been installed, rotate the crankshaft one complete revolution and realign the "T" mark on the crankshaft pulley and the index. Then install the left camshaft holder by off-setting it 90° as shown in Fig. 4F-34. In this position, assemble the rocker arms and rocker arm shafts, follow by rotating the camshaft holder to the correct position, and tighten the bolt to the specified torque.

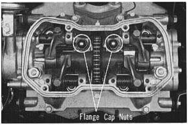


Fig. 4F-35

8. Make an adjustment of valve tappet clearance. See SECTION 2, E. Valve Adjustment, Page 2-3 to 2-4.

9. Flange cap nut location:

   The camshaft housing is mounted by six 6mm bolts and eight 10mm nuts.
   Two flange cap nuts should be tightened at the inlet side as shown in Fig. 4F-35 in the 600cc engine to prevent oil leakage. While 360cc and 400cc engine, four flange cap nuts are used. **(See Fig. 4F-19)**

G. Valve Train

a. Description

As the engine is an overhead camshaft type, the cylinder head incorporates both intake and exhaust valves at the top of the combustion chamber.
The combustion chamber is hemi-spherical, and is designed to make the air-fuel mixture flow toward one point in the chamber at the time of compression.
The fuel thus trapped in the chamber, when ignited, explodes in such a manner that good thermal efficiency can be obtained. To assure higher intake and exhaust efficiency, the intake and exhaust valves are positioned off-center, permitting the use of large diameter valves.

b. Disassembly

1. After disassembling the camshaft housing, remove the front grille and screen, and remove the exhaust pipes from the cylinder head.
   (Refer to SECTION 15 EXHAUST SYSTEM for removal of exhaust pipes.)

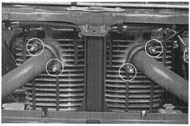


Fig. 4G-1

2. Remove the bolt below the intake manifold. Separate the cylinder head from the cylinder by lifting the cylinder head off the cylinder.

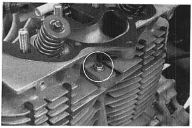


Fig. 4G-2

3. After separating the cylinder head, remove the carbon from within the cylinder head. In the process, excercise care not to damage or scratch the combustion chamber.

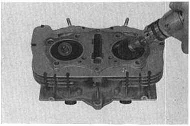


Fig. 4G-3

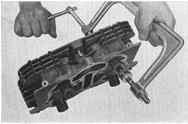


Fig. 4G-4

4. After cleaning, remove the valve and valve spring by using the special tool valve lifter.

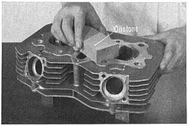


Fig. 4G-5

c. Inspection

1. Remove the gasket from the cylinder head machined surface. Excercise care not to damage the cylinder head machined surface when removing the gasket and if necessary use the oil stone to clean any rough spots.

   Note:
   Use the smooth flat surface of the oil stone. Use a figure-eight motion when reworking the surface with an oil stone.
   If the cylinder head machined surface is badly pitted or heavily marked, use a surface plate and red lead or bluing to check the flatness of the cylinder head.

2. Inspect the width of the valve seat by measuring at least four places 90° apart.

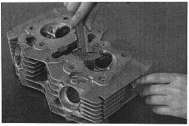


Fig. 4G-6

	Standard Value	Serviceable limit
Valve seat width	0.8~1.0mm (0.032~0.039in.)	Repair if over 1.5mm (0.059 in.)

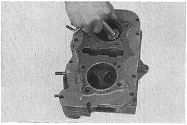


Fig. 4G-7

When valve seat surfaces of the cylinder head are worn of has carbon accumulated, fit the cutter holder to the valve seat cutter and scrape the seat and seat surface in accordance with the following procedure.

(a) Place the inlet valve seat cutter (angle of 38° for 360 and 400, 58° for 600) on the holder; for the inlet side, or the exhaust valve seat cutter (angle of 40° for 360 and 400, 48° for 600) for the exhaust valve side. Scrape the part as shown in Fig. 4G-8.

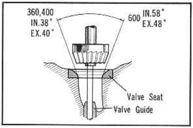


Fig. 4G-8

(b) Next, with another valve seat cutter (angle of 120°), scrape parts shown in Fig. 4G-9 for both inlet and outlet sides. Under this procedure, the seat surface width becomes narrow.

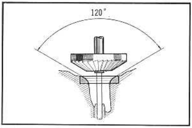


Fig. 4G-9

(c) Scrape the seat surface as shown in Fig. 4G-10 with another valve seat cutter (angle of 90°) for both inlet and outlet sides, so that the seat surface width becomes 0.8 to 1.0mm (0.031 to 0.040 in.)

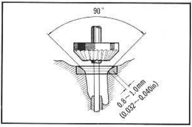


Fig. 4G-10

3. Inspect the diameter of the valve stem.

	Standard Value	Serviceable limit
In. Valve Stem D.	6.58~6.59mm (0.2591~0.2594 in.)	Replace if under 6.56mm (0.2583in.)
Ex. Valve Stem D.	6.55~6.56mm (0.2579~0.2583 in.)	Replace if under 6.53mm (0.2571 in.)

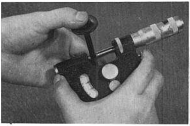


Fig. 4G-11

To inspect for bent valve stem, use V-block and dial gauge. Replace valve if stem is beyond 0.02mm (0.0008 in.) T.I.R. (Fig. 4G-12)

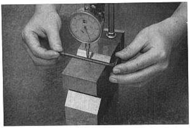


Fig. 4G-12

4. Inspect the valve face and if it is worn, reface the valve face with a valve face grinding equipment. If the thickness of the valve head is beyond the serviceable limit, it will cause the head to wear rapidly and eventually result in the condition where preignition will occur. After the valve face has been ground, check to make sure that it is within the serviceable limit and if not, the valve should be replaced.

Head thickness	Standard Value	Serviceable Limit
In. Valve	0.9~1.1mm (0.035~0.043in)	Replace if below 0.6mm(0.024in)
Ex. Valve	1.4~1.6mm (0.055~0.063in)	Replace if below 0.85mm(0.034in)

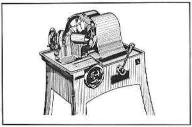


Fig. 4G-13

Note:
(1) Make sure that the refacing stone is properly dressed.
(2) Check the valve chuck angle at 45°.
(3) After properly checking the valve, perform the valve facing with care.

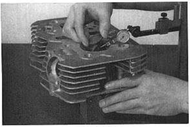


Fig. 4G-14

5. Inspect the clearance between the valve stem and valve guide.

Unit: mm (inch)

	Standard value	Serviceable limit
Inlet	0.01~0.04 (0.0004~0.0016)	Replace if over 0.08 (0.0032)
Exhaust	0.04~0.07 (0.0016~0.0028)	Replace if over 0.11 (0.0043)

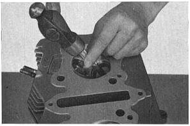


Fig. 4G-15

When the clearance exceeds the serviceable limit, remove valve guide with the valve guide driver and replace with a new guide.

Note:
When replacing the valve guide, do not forget to reinstall the clip.

6. After completing the installation of the valve guide, the guide must be cleaned out with a reamer. The new valve guides are purposely made undersize to allow for final reaming. Therefore, the new guides must be cleaned up with the reamer before the installation of the valve. If the guide is not cleaned up, the valve stem will seize in the guide during operation. Proper procedure in performing reaming is to apply several drops of oil to the reamer during reaming operation.
   If it is found that the reamer comes hard in turning, then the reamer should be removed and the chips taken off the reaming process continued.

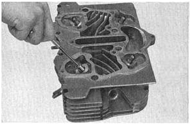


Fig. 4G-16

7. Inspecting the free length of valve spring.

	Standard value	Serviceable limit
Inner spring	42.0mm (1.654 in.)	Replace if under 41.0mm (1.614 in.)
Outer spring	44.8mm (1.764 in.)	Replace if under 43.8mm (1.724 in.)

Measure the trueness of the valve on the surface plate using the square and thickness gauge. If the valve spring is tilted greater than 1.5mm (0.006 in.), replace it with a new one.

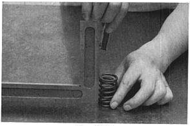


Fig. 4G-17

8. Inspect the compression of the valve spring. Set the valve spring in the valve tester and compress several times to condition the valve, and then compress the valve to the installed dimension and read the compression lead on the scale.

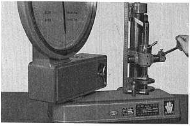


Fig. 4G-18

	Standard value	Serviceable limit
Inner spring compression /installed length	10.8~12.5kg/ 34.5mm (23.8~27.6 lbs /1.36 in.)	Replace if under 9.3kg/34.5mm (20.5 lbs/1.36 in.)
Outer spring compression /installed length	22.5~25.5kg/ 36.5mm (49.6~56.2 lbs /1.44 in.)	Rplace if under 19.65kg/36.5mm (43.33 lbs/1.44in.)

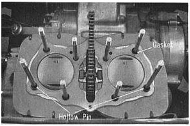


Fig. 4G-19

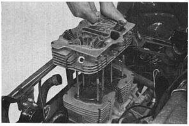


Fig. 4G-20

d. Assembly

Instruction for assembly:

1. Perform reassembly in the reverse order of disassembly.
2. Always install new gaskets.
3. When installing the cylinder head, make sure that the two hollow pins are installed in the correct locations.
4. Hook up a wire to the cam chain so that the chain does not drop into the crankcase, and then gently lower the cylinder head on to the cylinder.

H. Piston and Cylinder

a. Description

The piston is made of aluminum alloy suited for a high-speed engine. It transmits and disperses heat efficiently, and is less liable to the distortion at high temperature. Further, it is designed for the minimum moment of inertia. The piston pin of a fully-floating type, secured with a snap ring at both ends.

The cylinder is of such a structure that high corrosion-resistant special cast iron sleeves are press-fitted in the aluminum die-cast barrel at a room temperature for 360 and 400.
As for 600, the sleeves are cast in unit with barrel. Between the sleeves is a chamber for the camshaft driving chain, so that both banks of the cylinder are cooled evenly.

Another feature is the use of high heat-resistant cushion rubber bars at several places around the barrel. They serve to prevent cooling fins from producing vibratory noise.

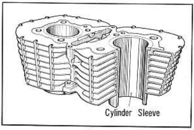


Fig. 4H-1

b. Disassembly

1. Remove the cam chain guide roller from the cylinder.

   Note:
   If repair necessitates piston replacement, there is no need to remove the chain: hook a wire to the cam chain to prevent its dropping into the crankcase.

2. Remove one forward and two rear cylinder mounting bolts. (Fig. 4H-3 and 4H-4)

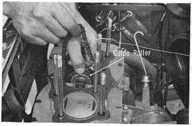


Fig. 4H-2

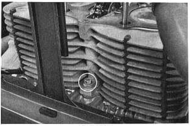


Fig. 4H-3

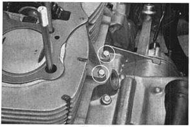


Fig. 4H-4

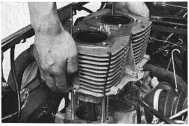


Fig. 4H-5

3. Gently raise the cylinder barrel and separate it from the crankcase.

   Note:
   If the cylinder barrel is stuck fast to the crankcase by the gasket, use a screw driver and gently tap all the way around the cylinder barrel and gently pry the cylinder barrel loose from the crankcase, being especially careful not to damage the machined surface and the cooling fins.

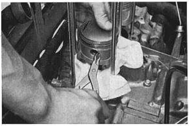


Fig. 4H-6

4. Place a rag at the base of the piston to prevent any object from dropping into the crankcase and then remove the circlip from the piston pin, followed by pushing the piston pin out and separating the piston from the connecting rod.

Fig. 4H-7

5. Remove the piston ring from the psiton. Remove the ring by applying the thumb at the piston ring gap and spreading the rings outward and gently lifting off. Remove the carbon from the piston ring groove and also from the oil hole in the piston ring groove.

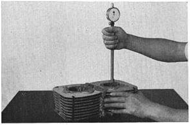


Fig. 4H-8

c. Inspection

1. Remove all the old gaskets from the machined surface of the cylinder barrel and rework any rough spot on the machined surface in the same manner as was done for the cylinder head.
2. Inspect the cylinder base, difference between minimum and maximum diameter and the out of roundness of the cylinder using a dial gauge.

Unit: mm (inch)

Cylinder D.	Standard value	Serviceable limit
360	62.50~62.51 (2.4606~2.4610)	Replace if over 62.60 (2.4646)
400	66.50~66.51 (2.6181~2.6185)	Replace if over 66.60 (2.6220)
600	74.00~74.01 (2.9134~2.9138)	Replace if over 74.10 (2.9173)
Diametrical difference	0.01 (0.0004)	0.05 (0.0020)
Roundness	0.01 (0.0004)	0.05 (0.0020)

If the cylinder wear is beyond the serviceable limit, the cylinder should be re-bored to accommodate one of the oversize pistons which are available in oversize increments of 0.25mm (0.0098 in.).

3. Inspect the diameter of the piston with a micrometer. (Fig. 4H-9)

Unit: mm (inch)

		Standard value	Serviceable limit
Top land diameter	360	61.95~62.00 (2.439~2.441)	Replace if below 61.95 (2.439)
	400	65.95~66.00 (2.596~2.598)	Replace if below 65.95 (2.596)
	600	73.40~73.45 (2.890~2.891)	Replace if below 73.40 (2.890)
Skirt diameter	360	62.45~62.47 (2.458~2.459)	Replace if below 62.40 (2.456)
	400	66.45~66.47 (2.616~2.617)	Replace if below 66.40 (2.614)
	600	73.95~73.97 (2.911~2.912)	Replace if below 73.90 (2.909)

If the cylinder has been re-bored, make sure that the proper oversize piston is used.
Also check the skirt for scratches and seizure.

4. Inspect the piston pin bore at two places 90° apart. (Fig. 4H-10)

Unit: mm (inch)

	Standard value	Serviceable limit
Piston pin bore	17.002~17.008 (0.6694~0.6696)	Replace if over 17.055 (0.6715)

5. Piston ring side clearance (Fig. 4H-11)
Measure the clearance of the ring at four places 90° apart using a feeler gauge. Before making ring clearance measurement, the ring groove should be cleaned off (all carbon should be removed).

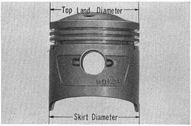


Fig. 4H-9

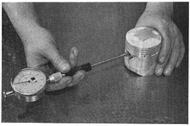


Fig. 4H-10


Fig. 4H-11

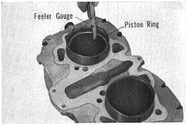


Fig. 4H-12

Fig. 4H-13

Fig. 4H-14

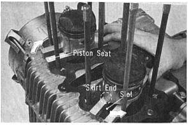


Fig. 4H-15

Unit: mm (inch)

Ring	Standard value	Serviceable limit
Top	0.045~0.075 (0.0018~0.0030)	Replace if over 0.105 (0.0413)
2nd and Oil	0.015~0.045 (0.0006~0.0018)	Replace if over 0.105 (0.0413)

6. Inspecting the piston ring end gap (Fig. 4H-12) Install the ring squarely into the cylinder skirt at the point about 20mm (0.8 in) from the bottom of the skirt and measure the end gap by using the feeler gauge.

	Standard value	Serviceable limit
Top, 2nd and Oil ring	0.2~0.4mm (0.008 ~0.015 in.)	Replace if below 0.6mm (0.023in.)

7. Inspecting the piston pin diameter.

Unit: mm (inch)

	Standard value	Serviceable limit
Piston pin diameter	16.994~17.000 (0.6691~0.6693)	Replace if below 16.97 (0.6681)

d. Assembly

Perform the reassembly operation the reverse of disassembly.

Install piston rings. Make sure that lettered side faces upward.

1. **When installing the piston to the connecting rod, the "IN" mark on the piston head should be toward the air inlet side.**

2. **When installing the cylinder barrel, use the special tools-piston seats and piston ring compressors. Place the piston seats below the pistons and turn them in the direction shown in the picture. In this position, the piston skirt end will not bottom in the slot of the piston seat as the piston is lowered.**
Position piston rings so that the open ends will not align in the pin boss direction. The open ends of the top ring and the oil ring should face fore while the second ring's open end faces aft.

3. Clamp the rings with the piston ring compressor, as shown in Fig. 4H-16.

   Note:
   Grip the rings with the taper-machined side upward.
4. Insert the hollow pins on the right and left.
5. A new gasket should be used.

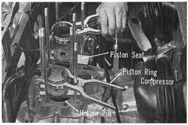


Fig. 4H-16

6. Gently slide the cylinder barrel on from the top and after the ring has been inserted into the cylinder remove the piston seat and ring compressor, and push the cylinder barrel down on the crankcase.

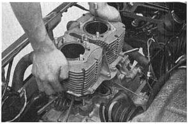


Fig. 4H-17

7. Inspect the operation and also check for wear of the cam chain guide roller.
   If necessary, replace with a new one.

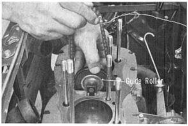


Fig. 4H-18

I. Crankshaft

a. Description

There are many unique design features incorporated into the crankshaft to withstand high speed rotation. It is composed of five precisionally machined parts that are press-assembled into a integral unit. The crankshaft is supported at four points on needle roller bearings for high speed, noiseless operation. The connecting rods are likewise integral with crankshaft assembly by means of needle roller bearings and especially designed for high-speed operation. Employment of needle roller bearings also results in very low power loss at high speed, and this in turn results in better engine performance and economy.

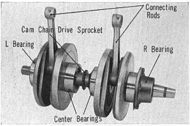


Fig. 4I-1

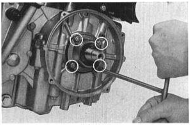


Fig. 4I-2

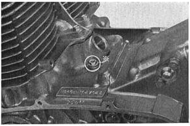


Fig. 4I-3

b. Disassembly

1. Remove the camshaft.
   (See F. Camshaft Drive)
2. Remove the camshaft housing and cylinder head unit.
   (See F. Camshaft Drive)
3. Remove the cylinder barrel and pistons.
   (See H. Piston and Cylinder)
4. Remove the generator.
   (See SECTION 17. ELECTRICAL)
5. Unscrew the four 6mm bolts retaining the right main roller bearing retainer holder. (Fig. 4I-2)
6. Remove the crankcase right side cover.
7. Disassemble the clutch.
   (See SECTION 5. CLUTCH)
8. Remove the crankcase left side cover.
   (See Fig. 4C-5, page 4-8)
9. Disassemble the primary driven and drive sprockets with the oil pump.
   (See J. Primary Drive)
10. Unscrew the mounting bolt. (Fig. 4I-3)
    Note an aluminum washer is used.
11. Turn the engine upside down; but do not support it at the gear shift rod.
    Separate the lower crankcase from the upper crankcase by removing the ten 6mm and eight 8mm bolts, retaining the upper and lower cases. (Fig.4I-4)

Note:
Five aluminum washers are used (shown marked *) to prevent oil leakage. (Fig. 4I-3 and 4I-4)

12. Unbolt and remove the crankshaft center bearing cap.
13. Remove the crankshaft.

Note:
Since the crankshaft is a press-assembled unit and the right and left main bearings are the only parts which can be removed.
Carefully check the right and left journals of the crankshaft.

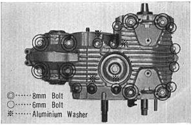


Fig. 4I-4

c. Inspection and Adjustment

1. Inspecting the crankshaft for bending.
   Support the crankshaft on a V block at the center journal and turn the crankshaft slowly with the connecting rods while taking a reading with the dial gauge. Take a reading on both right and left journals.

   Standard tolerance:
   0.03mm (0.0012 in) max. TIR
   Serviceable limit:
   If bending is greater than 0.04mm (0.0016 in), make correction by tapping lightly with a soft metal faced hammer.

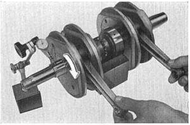


Fig. 4I-5

2. Inspecting connecting rods
   Twist:
   Insert a machined rod of 17.00~17.01mm (0.6693~0.6697 in) diameter and 100mm (3.937 in) long into the small end of the connecting rod and measure the height of the rod from the surface plate at both ends and determine the difference in height.

   Standard tolerance:
   0.03mm (0.0012 in)
   Serviceable limit:
   If over 0.2mm (0.0079 in) correct.

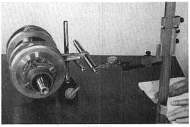


Fig. 4I-6

   Bend:
   Position the connecting rod in the vertical position and measure in the manner described above.

   Standard tolerance:
   0.03mm (0.0012 in)
   Serviceable limit:
   If over 0.1mm (0.0037 in) correct.

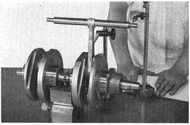


Fig. 4I-7

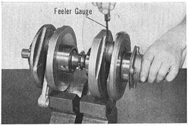


Fig. 4I-8

Axial clearance:

Standard tolerance:
0.12 to 0.33mm (0.0047 to 0.0130 in)
Serviceable limit:
If over 0.49mm (0.0193 in),
replace the crankshaft assembly.

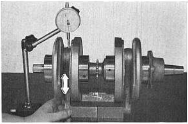


Fig. 4I-9

Radial clearance:

Place the dial gauge on the large end of the connecting rod and measure the play when the connecting rod is moved in the vetical direction.

Standard tolerance:
0 to 0.010mm (0.004 in)
Serviceable limit:
If over 0.04mm (0.0016 in),
replace the crankshaft assembly.

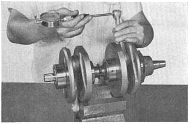


Fig. 4I-10

Wear of the connecting rod small end:

Use a cylinder gauge and measure. If the diameter is over 17.043mm (0.6709 in), replace the crankshaft assembly.

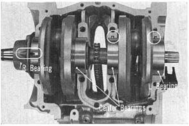


Fig. 4I-11

d. Assembly

Assemble the cam chain on the crankshaft before mounting the crankshaft on the upper crankcase. The alignment of the crankshaft on the crankcase is performed by three dowel pins. It should be noted that two of the dowel pins fit into the recesses on the crankcase parting surface and one fits in at the top of the center main bearing right holder.

If the crankshaft is properly assembled in the crankcase, the oil passage holes to the center bearing will be in the horizontal position as shown in Fig. 4I-13.

There are no dowel pins installed in the right bearing outer race to position the bearing. Further, oil return hole must be toward the top of the engine or in the up position when the crankshaft is being mounted. (Fig. 4I-11)

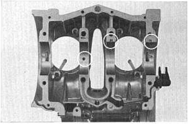


Fig. 4I-12

Assemble the crankshaft center bearing cap and torque the four mounting bolts uniformly to 3.5 to 4.0 kg-m (25.31 to 28.93 lb-ft.). (Fig. 4I-14)

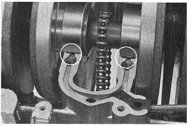


Fig. 4I-13

Apply liquid gasket to the lower crankcase machined parting surface, install the two dowel pins, assemble the upper and lower cases, and install the case mounting bolts. To prevent oil leakage from the head of the 6mm mounting bolts, aluminum washers are used. (shown marked * in Fig. 4I-3 and 4I-4).

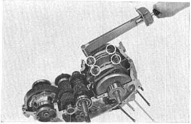


Fig. 4I-14

Bolt torque table

	Quantity	Torque
6 mm bolt	11	0.9~1.2kg-m (6.5~8.7 lb-ft)
8 mm bolt	8	2.3~2.8kg-m (16.6~20.3 lb-ft)

Finally, mount the right bearing holder with four 6mm bolts and uniformly tighten them to a torque of from 0.9 to 1.9 kg-m (6.5 to 8.7 lb-ft). (Fig. 4I-2)

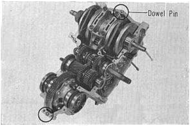


Fig. 4I-15

J. Primary Drive

a. Description

The power is transmitted from the primary drive sprocket on the left of the crankshaft to the primary driven sprocket through two single row chains and further transmitted to the transmission through the clutch. In the course of transmitting the power through the mechanism, the crankshaft speed is reduced to the ratio of 1.75 for 600, and 2.82 for 360 and 400 between the primary drive sprocket and driven sprocket. To prevent the chains from vibrating, with a primary chain tensioner, damping rubbers are incorporated in both the drive and driven sprocket for 600 and the driven sprocket only for 360 and 400. These are vital in the reduction of chain noise.

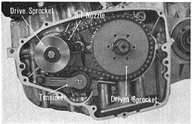


Fig. 4J-1

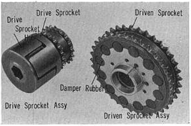


Fig. 4J-2

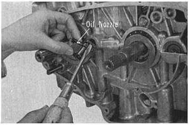


Fig. 4J-3

The chains are lubricated by the oil sprayed from the oil nozzle, to meet high speed, heavy load operation.

The oil nozzle is made of rubber and can thus be replaced without disassembly of the crankcase.

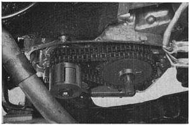


Fig. 4J-4

b. Disassembly

Disassembly is made with the engine mounted on the body. Refer to the section C. Engine Lubricating for details.

Remove the clutch assembly and the crankcase left side cover.

When removing the driven sprocket, make sure the two pump mounting bolts are removed. Remove the driven sprocket with oil pump together in order not to deform the oil pump rod.

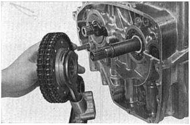


Fig. 4J-5

c. Inspection

1. Check the tension of the primary chain tensioner spring.
   Loop a cord around the cam chain tensioner guide roller and pull the tensioner arm away from the chain, using spring scale.
   Read the value of the spring scale just before the rubber stop on the tension arm touches the lower case.

   Normal tension:

360 and 400	1.7~2.1kg (3.74~4.63 lbs)
600	2.3~2.9kg (5.07~6.39 lbs)

   Replace the spring if tension is below 1.6 kg (3.53 lbs) for 360 and 400, 3.6 kg (7.92 lbs) for 600.

   Also check the contact surface of the primary chain tensioner rubber roller which is in contact with the chains for wear and damage.

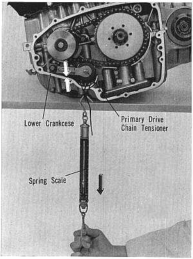


Fig. 4J-6

2. For the 600:
   Check the side clearance of the drive sprocket. Excessive clearance may cause faster chain wear.

   Standard value: 0~0.2mm (0~0.0078 in)

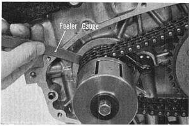


Fig. 4J-7

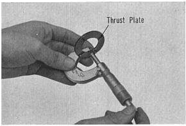


Fig. 4J-8

If the side clearance is found excessive, the probable cause is a worn thrust plate or failed damper rubbers. Check the thickness of the plate with a micrometer.

Standard value:
2.94~3.06mm (0.1157~0.1204 in)

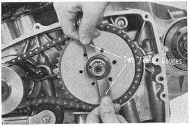


Fig. 4J-9

3. Check the side clearance of the primary driven sprocket using two feeler gauges. If the side clearance is excessive, it may not only be attributable to the rapid wear of chains but oil leakage through the 67x82x8 oil seal. Therefore, the primary driven sprocket hub and thrust washer should be checked for wear and distortion. Defective parts should be replaced.

   Standard clearance:
   0.1~0.3mm (0.0039~0.0118 in)

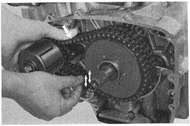


Fig. 4J-10

4. Check the difference in length of the two chains. Apply uniform pressure at the top of the chain loop with the finger and from the opposite side check relative tension of both chains. If the difference is excessive, check the damping rubbers within the driven sprocket and the length of both chains to determine the cause.

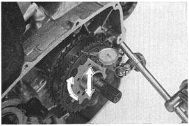


Fig. 4J-11

5. Check the driven sprocket for eccentricity and the radial direction play using a dial gauge. Both of these are closely related to chain wear.

   Standard value: 0~0.3mm (0.118 in)

If the dial reading is excessive, check the driven sprocket with two feeler gauges for excessive radial direction play caused by worn sprockets, driven sprocket hub, and/or setting plate.
Standard Reading: 0.018~0.053mm (0.00071~0.00209 in)

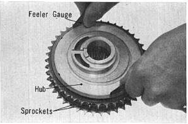


Fig. 4J-12

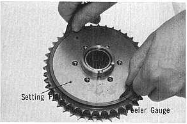


Fig. 4J-12a

Check the driven sprocket needle bearing for excessive wear

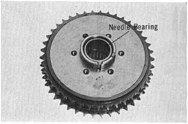


Fig. 4J-12b

Also check the transmission mainshaft for bending and the mainshaft bearing for radial direction play to determine the cause of the excessive eccentricity.

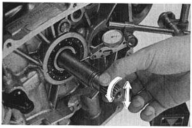


Fig. 4J-12c

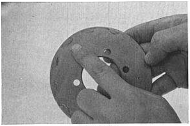


Fig. 4J-12d

6. Check the setting plate for excessive wear or scoring. Excessive driven sprocket side play may be attributed to the worn setting plate.

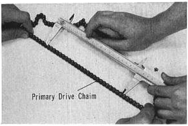


Fig. 4J-13

7. Check the stretch in the primary chain. Two persons are necessary to perform this measurement. While one person stretches the chain by hand with as much power as possible, the other measures the chain with venier calipers, taking several measurements and summing them for the full length of the chain. The difference in length of the chains should be less than 0.3mm (0.0118 in.)

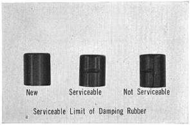


Fig. 4J-14

8. Check the damping rubbers incorporated in the primary driven sprocket for deformation.

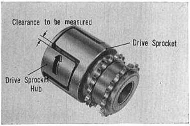


Fig. 4J-15

(600)

9. Check the drive sprocket damping rubbers for serviceability. When damper rubbers are worn or if they are improperly installed, they no longer absorb shock on the primary chains, expediting chain wear.

To insure the damper rubbers are serviceable or properly installed, torque sprocket hub with a special jig (Fig. 4J-16), and measure the clearance between the drive sprocket and the drive sprocket hub (Fig. 4J-15), and the corresponding torque value by locking the sprocket with a vise.

Then, refer to the diagram below to determine if values are within the serviceable limit.

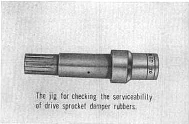


Fig. 4J-16

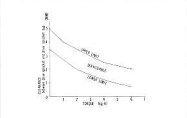


Fig. 4J-17

9. Check the drive sprocket for looseness of the press-fitted part.

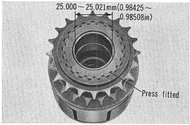


Fig. 4J-18

10. Check the drive sprocket for eccentricity and radial play.
    Disassemble the drive sprocket assembly into the drive sprocket hub drive sprocket, and dampter rubbers, and fit the drive sprocket to the crankshaft, then take a dial gauge reading.

    Serviceable limit: 0.15mm (0.005)

    If the reading is beyond the serviceable limit, check the crankshaft and drive sprocket determine the cause.

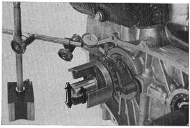


Fig. 4J-19

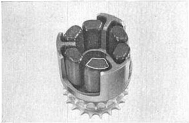


Fig. 4J-20

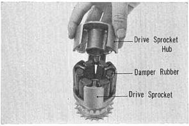


Fig. 4J-21

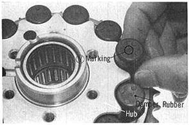


Fig. 4J-22

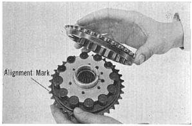


Fig. 4J-23

d. Assembly

1. Drive sprocket (600)

   Apply grease on the damper rubbers to make drive sprocket assembly easier. Then, install the damper rubbers into the sprocket as shown in Fig. 4J-20.

   Assemble the drive sprocket hub on the sprocket. If the drive shaft fitting into the sprocket is difficult, apply more grease on the damper rubbers and use a vise to assemble.

2. Driven sprocket

   After installing one sprocket on the driven sprocket hub, plug the damper rubbers with point mark upward. Apply grease on the rubbers if plugging is difficult.

   Note:
   The letter Ⓨ is marked on the damper rubbers instead of point mark in the latest model.

   After making sure that all damper rubbers are tightly installed, proceeded to another sprocket. The inner and the outer sprocket are idential and can be interchanged.
   For N360, N400 and N600 (except 1970 year model), align the punch marking on the outer sprocket to the marking on the inner sprocket.

For N600 1970 year model, install the sprockets to the hub so that the aligning mark on the outer sprocket is separated about 180 degrees from the mark on the inner sprocket as shown in the picture.

Ensure that the teeth on the outer sprocket is shifted for a half pitch from the teeth on the inner sprocket.

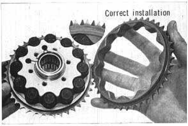


Fig. 4J-23a

Having made sure the set plate is not distorted nor worn excessively, install it with the chamfered side facing the sprocket hub.

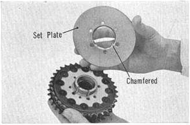


Fig. 4J-24

3. Loop the chains over both the primary drive and driven sprockets. Check the fit of the chains by holding the sprockets and chains as shown in Fig. 4J-25.

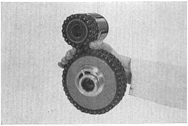


Fig. 4J-25

4. (600)
   Before installing the drive sprocket, install the thrust plate with the grooved face outward.

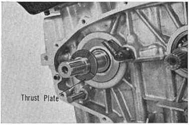


Fig. 4J-26

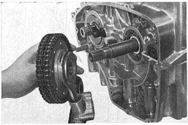


Fig. 4J-27

5. Install the primary driven sprocket assembly with the drive sprocket, the primary drive chains, the oil pump, and the thrust plate in single unit. Mount the oil pump securely with the two bolts.

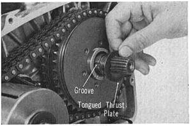


Fig. 4J-28

6. Assemble the tongued thrust plate on the driven sprocket and secure with a circlip.

   Note:
   The tongue fits into the groove on the sprocket hub.

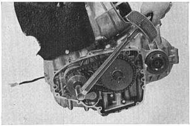


Fig. 4J-29

7. Tighten the drive sprocket with torque of 2.5 kg-m (18 lb-ft).

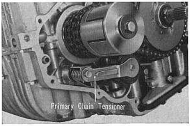
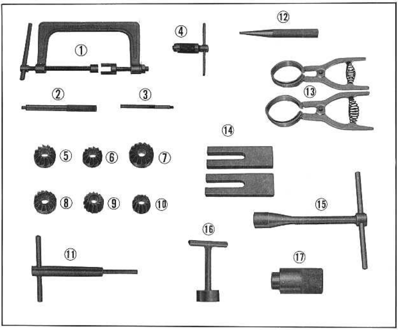


Fig. 4J-30

8. Install the primary chain tensioner.

K. Special Tool



Ref. No.	Tool No.	Description	360	400	600	Ref. Page
1.	07031-25001	Valve lifter	○	○	○	4-30
2.	07046-55101	Valve guide driver	○	○	○	4-32
3.	07008-55101	Valve guide reamer	○	○	○	4-33
4.	07996-99944	Reamer handle	○	○	○	4-33
5.	07001-55101	Inlet valve seat cutter, 90°	○	○		4-30
	07001-56801	Inlet valve seat cutter, 90°			○	4-30
6.	07002-55101	Exhaust valve seat cutter, 90°	○	○		4-30
	07002-56801	Exhaust valve seat cutter, 90°			○	4-30
7.	07003-55101	Inlet valve seat cutter, 120°	○	○		4-30
	07003-56801	Inlet valve seat cutter, 120°			○	4-30
8.	07004-55101	Exhaust valve seat cutter, 120°	○	○		4-30
	07004-56801	Exhaust valve seat cutter, 120°			○	4-30
9.	07005-55101	Inlet valve seat cutter, 38°	○	○		4-30
	07005-56801	Inlet valve seat cutter, 58°			○	4-30

Ref. No.	Tool No.	Description	360	400	600	Ref. Page
10.	07006-55101	Exhaust valve seat cutter, 40°	○	○		4-30
	07006-56801	Exhaust valve seat cutter, 48°			○	4-30
11.	07007-55101	Valve seat cutter holder	○	○	○	4-30
12.	07081-55102	Valve clearance adjusting bar	○	○	○	4-28
13.	07032-55101	Piston ring compressor	○			4-39
	07032-59301	Piston ring compressor		○		4-39
	07032-56801	Piston ring compressor			○	4-39
14.	07033-55101	Piston seat	○	○	○	4-38
15.	07094-55101	Spark plug wrench	○	○	○	4-16
16.	07071-56801	Ignition switch wrench	○	○	○	4-16
17.	07054-55102	Oil seal driver A	○	○	○	4-28

SECTION 5

CLUTCH

5-2 CLUTCH

a. Structure

The clutch is of a dry, single-disk type, which uses a diaphragm spring.
Engine power is transmitted from the crankshaft by means of the primary drive chains to rotate the clutch drum and pressure disk assembly, bolted to the primary driven sprocket (which is fitted freely on the transmission mainshaft).
As the driver releases pressure on the clutch pedal, the pressure disk applies pressure to the friction plate causing the friction disk and the mainshaft to rotate together with the clutch drum.

1. Diaphragm spring
   The diaphragm spring not only applies pressure to squeeze the friction plate to the clutch drum but serves as a coil spring type clutch release lever. Its weight being distributed uniformly, the spring is well balanced and can therefore apply its load evenly.
2. Friction plate
   The friction plate lined with friction material on both sides is located between the pressure disk and the clutch drum. The plate, when pressed hard between these disks, turns to transmit the engine power to the transmission.
   The friction material on one side differes from that on the other so that they may be worn and disperse heat evenly. In the hub flange are installed four pieces of torsional rubber to absorb torsional vibrations at the time of clutch engagement and disengagement.
3. Pressure disk
   The pressure disk is secured to the pressure disk retainer with three torque springs. These torque springs serve to absorve engagement and disengagement shocks in the direction of thrust as well as to transmit power from the pressure disk retainer to the pressure disk.

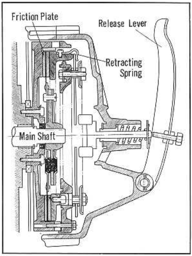


Fig. 5A-2

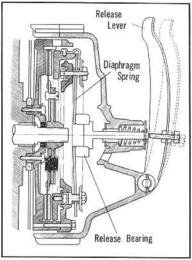


Fig. 5A-3

b. Operation

Fig. 5A-2 shows the clutch in the engaged state. In this state, the diaphragm spring squeezes the pressure disk, through the friction plate splined-connected on the mainshaft, against the clutch drum which is bolted to the driven sprocket being driven with engine power through the primary chains. Accordingly, the clutch drum, friction plate, and pressure disk rotate together, revolving the mainshaft.

Fig. 5A-3 shows the clutch in the disengaged state with the clutch pedal depressed. When the clutch pedal is depressed, the release lever connected to the pedal through a cable is actuated to slide the release bearing inward, pushing the finger section of the diaphragm spring. The edge of the diaphragm spring moves in the opposite direction (outward) with the fulcrum rings as its pivot. The diaphragm spring is secured around its edge to the pressure disk by means of four retracting springs so that the movement mentioned above for the diaphragm spring moves the pressure disk outward and away from the friction plate. Thus, no engine power is transmitted to the friction plate.

B. Technical Data

	360/400	600
Type	Single dry plate	
Clutch Spring Type	Diaphragm Spring	
Pressure	320~370kg (706~816 lb)	350~380kg (772~838 lb)
Friction Plate Facing O.D. Facing I.D. Facing Area Thickness Number of Torsion Rubber	 165 mm (6.50 in) 110 mm (4.33 in) 118 cm^2 (18.4 in^2) 7 mm (0.28 in) 4	
Release Bearing	Sealed Ball bearing	
Pedal Lash	3 mm (0.2 in) at the tip of the release lever	

C. Maintenance

a. Disassembly

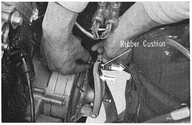


Fig. 5C-1

1. Loosen the release lever lock nut and sufficiently loosen the adjusting bolt so that release lever play is maximum. Hold the clutch cable manually, remove the rubber cushion from the release lever while pushing in the release lever, and separate the clutch cable and the release lever. (Fig. 5C-1)

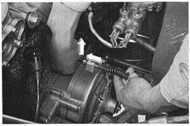


Fig. 5C-2

2. Pull the clutch cable on the engine side, and separate it from the clutch cover.

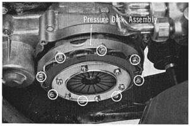


Fig. 5C-3

3. Remove the clutch housing cover.

   Tightening torque:
   0.9 to 1.2 kg-m (6.5 to 8.7 lb-ft)
4. After removing the clutch housing cover, disassemble the clutch pressure disk by removing bolts.

   Bolt torque value:
   0.9 to 1.2 kg-m (6.5 to 8.7 lb-ft)

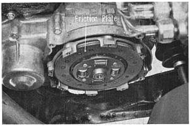


Fig. 5C-4

5. Pull off the friction plate from the splined shaft.

6. Remove the clutch drum, with care not to damage the oil seal.

   Bolt torque value:
   0.9 to 1.2 kg-m (6.5 to 8.7 lb-ft)

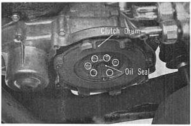


Fig. 5C-5

7. Remove retracting springs, the diaphragm setting plate and fulcrum ring, followed by disassembly of the pressure disk and diaphragm spring.

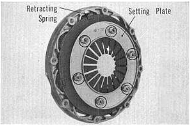


Fig. 5C-6

8. Extract the cotter pin from the clutch housing, detach the release bearing shaft and spring from the housing.

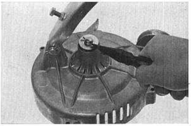


Fig. 5C-7

9. Remove the circlip and push out the release bearing shaft bushing from the housing.

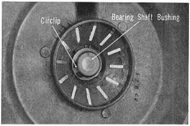


Fig. 5C-8

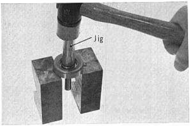


Fig. 5C-9

10. Remove the release bearing by tapping lightly with a hammer and appropriate jigs.

b. Inspection

1. Check the release lever pivot pin for excessive play.

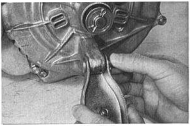


Fig. 5C-10

2. Check the clutch housing bushing for excessive wear. Excessively worn bushing and/or pivot pin (Fig. 5C-10) may be attributable to the vibration and the rattling noise from the clutch.

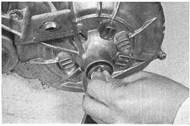


Fig. 5C-11

3. Inspect the clutch drum and the pressure disk to see that they are free of oil and grease. If oil is on the faces, clean them with alcohol or grind the faces. Note the clutch drum and pressure disk face cannot return to the original condition even if oil is wiped off completely with cloth.

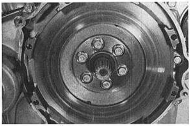


Fig. 5C-12

4. Check the clutch drum for excessive scores and cracked surface. If the clutch drum is scored excessively, refinish the surface by grinding.

   Standard Dial Gauge Reading; 0 to 0.05mm (0 to 0.002 in).

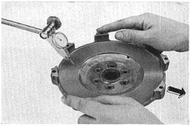


Fig. 5C-13

5. Check the condition of the clutch drum oil seal (67x82x8) and replace the seal if it is found to be excessively worn or damaged.
   The oil seal incorporates helical grooves to prevent the oil leakage hydrodynamically.

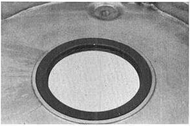


Fig. 5C-14

Apply a light coat of high melting point grease to the oil seal lips. Fit the oil seal to the special tool—oil seal Driver B with the **side lip upward.**

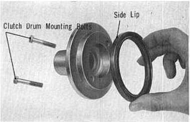


Fig. 5C-15

Screw in the clutch drum mounting bolts and force the oil seal into the LH crankcase side cover with oil seal driver B.

Fig. 5C-16

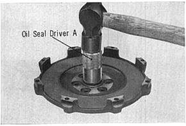


Fig. 5C-17

6. Check the condition of another clutch drum oil seal (20x30x5) and replace the seal if it is found to be excessively worn or damaged.
   When installing a new oil seal, use a special tool, oil seal driver A, and carefully drive in the oil seal.
   Apply a light coat of high melting point grease to the oil seal lips.

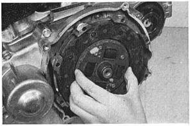


Fig. 5C-18

7. Check friction plate fit to the transmission mainshaft for excessive looseness and binding.

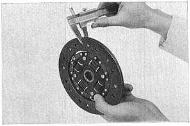


Fig. 5C-19

8. Inspecting the friction plate for wear. Measure the thickness of the facing at four points, 90° apart using vernier calipers. Replace the friction plate if it is found to be excessively worn, or if walk spring tension is lost, or if there is a loose or damaged rivet.

   Thickness of friction plate
   Standard tolerance:
   7.15 to 7.85mm (0.28 to 0.31 in)
   Serviceable limit:
   Replace if under 5.75mm (0.23 in)

   The friction disk is serviceable if the disk is flat and there is proof of surface contact over the entire area of the drum and pressure disk.

9. Check cushion rubber
   If it is excessively worn, or if the play on both sides is excessive, replace with a new friction plate.
   Excessive play on either the right or left may result in the generation of abnormal noise and vibration when the clutch is being engaged.

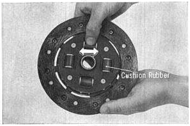


Fig. 5C-20

10. Check the contact condition of the clutch facing if the facing is unevenly worn (waveform) or is otherwise abnormal, replace it with a new one. Waveform wear may result in the generation of noise.

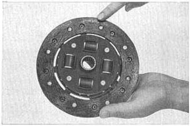


Fig. 5C-21

11. Check the pressure plate for excessive wear and warpage.
Position the dial gauge on the surface table and measure the amount of wear by moving the surface of the pressure disk under the dial gauge. Check the warpage by placing the surface of the pressure disk against a flat surface plate and measuring with a thickness gauge.

	Standard tolerance	Serviceable limit
Wear of the-disk	0~0.05mm (0~0.002 in)	Replace if over 0.1mm (0.004 in)
Warpage	0~0.03mm (0~0.0012 in)	Replace if over 0.05mm (0.002 in)

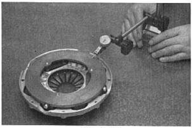


Fig. 5C-22

12. Check the release bearing. If it is noisy or excessively worn, replace the bearing.

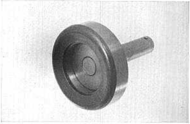


Fig. 5C-23

13. Inspecting the wear of the clutch housing bushing and the release bearing shaft.

	Standard tolerance	Serviceable limit
Bushing inside dia.	12.07~12.12mm (0.475~0.477 in)	Replace if over 12.5mm (0.49 in)
Bearing shaft dia.	11.95~11.98mm (0.470~0.472 in)	Replace if over 11.5mm (0.453 in)

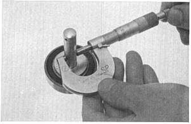


Fig. 5C-24

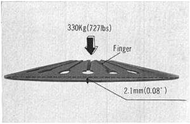


Fig. 5C-25

11. Check the condition of the diaphragm spring and if damaged or excessively worn at the fingers, replace it, If the diaphragm spring is distorted or worn, the spring force should be measured. Measure the force required to compress the spring to the height of 2.1mm (0.0827 in). The spring should be replaced if the force is less than 300kg (662 lbs) for 360/400, 330kg (727 lbs) for 600.

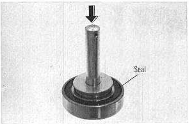


Fig. 5C-26

c. Assembly

Reassembly is the reverse of disassembly.

1. When installing the shaft on the release bearing, be careful that the bearing is not installed in reverse. The shaft should be installed from the side which has the bearing seal.

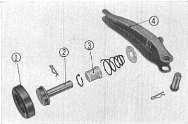


Fig. 5C-27

2. ① Release bearing
   ② Release bearing shaft
   ③ Release bearing bushing
   ④ Release lever
   Install the shaft after applying grease between the shaft and bearing bushing.

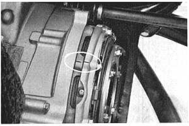


Fig. 5C-28

3. When installing the pressure disk assembly on the clutch drum, perform the job depending on the aligning marks.

   Remarks:
   The clutch drum and the pressure disk assembly are balanced in order to eliminate vibration and abnormal noise.

d. Adjustment

1. Pedal Height Adjustment

Clutch pedal height adjustment should be made before pedal lash adjustment.
By tightening in or out of the adjusting bolt after loosening the lock nut, adjustment of pedal height is made. Adjust the pedal height to brake pedal height.

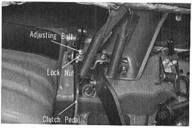


Fig. 5C-29

2. Clutch Pedal Lash

Check the clutch release lever for pedal lash at the tip of the lever. The specified pedal lash is 3mm (0.12 in). Adjust the pedal lash by means of the adjusting bolt Check the clutch cable for movement and damage at the release lever end and the clutch pedal end.

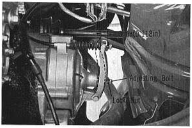
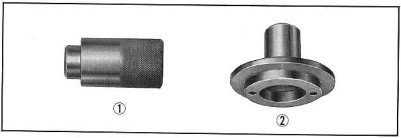


Fig. 5C-30

D. Special Tool



Ref. No.	Tool No.	Description	360 400 600	Ref. Page
1.	07054-55102	Oil seal driver A	○	5-7
2.	07057-55103	Oil seal driver B	○	5-7

E. Trouble Diagnosis

Possible Cause	Corrective Action
Fail to release	
Improper adjustment	Adjust release lever
Weak retracting spring	Replace springs
Faulty friction plate	Replace plate
Oil leakage	Install new friction plate Replace oil seal
Bound release bearing shaft	Correct
Slipping	
Improper adjustment	Adjust release lver
Oil leakage	Replace oil seal Install new friction plate
Worn facing or facing torn from disk	Replace friction plate
Warped pressure disk	Replace pressure disk
Weak diaphragm spring	Replace diaphragm spring
Bound release bearing shaft	Correct
Battling	
Weak retracting spring	Replace springs
Weak friction disk cushion rubber	Replace friction disk
Abnormal worn facing	Replace friction plate
Noisy	
Worn release bearing	Replace bearing
Abnormal wonr facing	Replace friction plate
Difficult to disengage	
Improper clutch adjustment	Adjust release lever
Warped friction disk	Replace
Bound release bearing shaft	Correct

A. Description

Clutch Assembly-Disassembled View

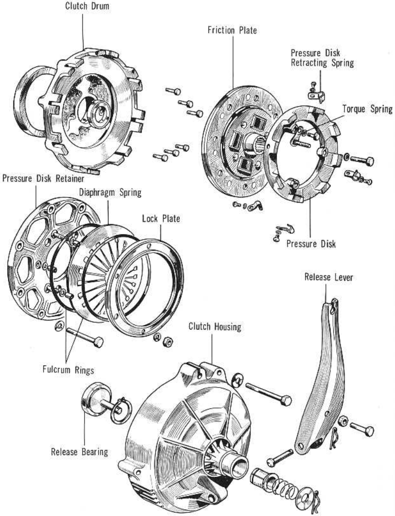


Fig. 5A-1

SECTION 6

TRANSMISSION-MANUAL

6

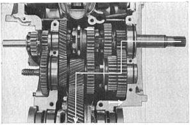


Fig. 6A-3 First

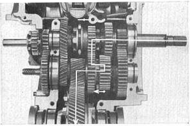


Fig. 6A-4 Second

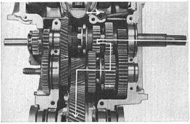


Fig. 6A-5 Third

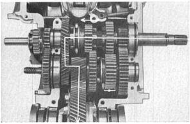


Fig. 6A-6 Top

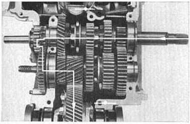


Fig. 6A-7 Revers

B. Technical Data

Type	Constant-mesh, 4 foreward speeds and 1 reverse	
Gear ratios		
First Speed	2.529	
Second Speed	1.565	
Third Speed	1.000	
Forth Speed	0.714	0.649 (LN360)
Reverse Speed	2.437	
Clearances		
Main and Counter shaft side clearance	0.15 to 0.20mm (0.0059 to 0.0079 in)	
Main shaft Third gear side clearance	0.2 to 0.3mm (0.0079 to 0.018 in)	
Main and Counter shaft bearing side clearance	0.03 to 0.05mm (0.0012 to 0.0019 in)	

C. Transmission Gear

a. Disassembly and Assembly

1. Remove the crankcase right side cover. Unbend the lock washer and remove the bolt in preparation to removing the reverse gear shift fork.

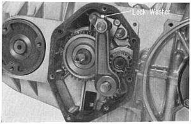


Fig. 6C-1

2. Remove the reverse gear shift fork together with the reverse gear from the reverse gear shift fork shaft. **(Fig. 6C-2)**

3. Separate the engine lower crankcase from the upper crankcase. (Refer to SECTION 4 I. Crankshaft, Page 4-41)

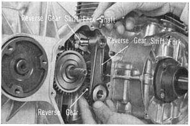


Fig. 6C-2

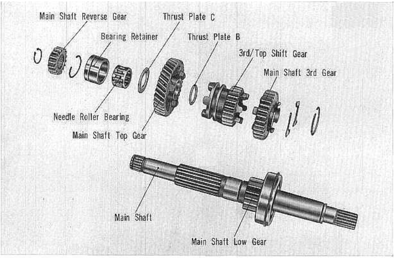


Fig. 6C-3 Disassembled view of main shaft

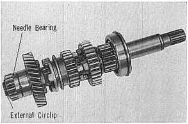


Fig. 6C-4

4. Remove the main shaft assembly from the upper crankcase.

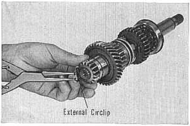


Fig. 6C-5

5. Remove the external circlip from the transmission main shaft.

6. Remove the main shaft reverse gear from the serrated section of the transmission main shaft.
7. Remove the set ring from the needle bearing retainer.
8. Remove the right needle bearing retainer.

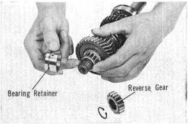


Fig. 6C-6

9. Unfasten the needle bearing ring.
10. Remove the needle bearing.

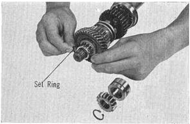


Fig. 6C-7

11. Disassemble thrust plate C.
12. Remove the main shaft top gear from the serrated section of the main shaft.
13. Disassembly the thrust plate B.

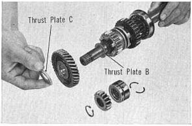


Fig. 6C-8

14. Remove the third/top shift gear from the main shaft.
15. Disassemble the third gear and set ring.
16. Remove the third gear from the main shaft.

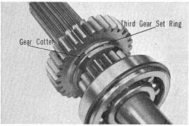


Fig. 6C-9

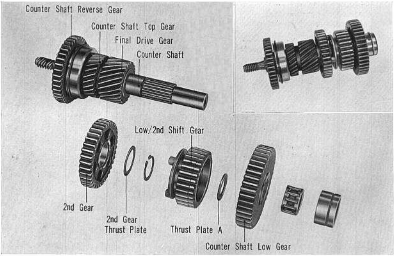


Fig. 6C-10 Disassembled view of countershaft.

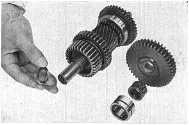


Fig. 6C-11

17. Separate the countershaft from the upper crankcase.
18. Unfasten the left needle bearing retainer set ring.
19. Remove the left needle bearing retainer.
20. Remove the needle bearing.
21. Remove the countershaft low gear.
22. Disassemble the thrust plate A.

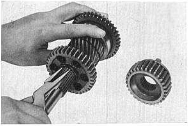


Fig. 6C-12

23. Remove the low/2nd gear from the serrated section of the countershaft.
24. Unfasten the external circlip and disassemble the thrust plate.
25. Remove the countershaft second gear.

Remarks:
The countershaft reverse gear is pressfitted to the countershaft and therefore on attempt should not be made to disassemble the reverse gear and ball bearing from the countershaft.

Perform reassemble operation the reverse of disassembly.

b. Inspection

1. Measure the clearance between the needle roller bearing and the main shaft top gear and between the needle roller bearing and the countershaft low gear using a thickness gauge.

   Main and Counter shaft side clearance:

   Standard tolerance
   0.15 to 0.20mm (0.0059 to 0.0079 in)
   Serviceable limit
   Replace if beyond 0.4mm (0.0158 in)

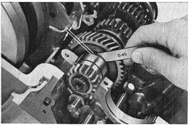


Fig. 6C-13

2. If side clearance are beyond the serviceable limits, adjust by replacing thrust plate C (main shaft) and thrust plate B (countershaft). After measuring the thickness of the installed thrust plates, determine the thickness of newly used thrust plates.

   Thrust plate A and B

(1) Thickness:	1.50mm
(2) Thickness:	1.75mm
(3) Thickness:	2.00mm

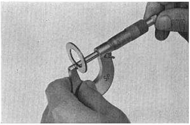


Fig. 6C-14

3. Measuring the side clearance of the main shaft third gear.
   Measure the clearance of the gear cotter within the main shaft groove, using a thickness gauge as shown in the Figure 6C-15.

   Third gear side clearance:

   Standard tolerance
   0.2 to 0.3mm (0.079 to 0.0118 in)
   Serviceable limit
   Replace if beyond 0.5mm (0.0197 in)

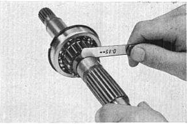


Fig. 6C-15

4. Measure the radial clearance of the main shaft top gear and third gear, and also for the clearance of the countershaft low gear and 2nd gear.
   Perform the measurement of the shaft diameter and also the gear inside diameter for the respective gear, using a micrometer of cylinder gauge.

   Gear Radial Clearance (every gear):

   Standard tolerance
   0.02 to 0.06mm (0.008 to 0.0024 in)
   Serviceable limit
   Replace if beyond 0.1mm (0.0039 in)

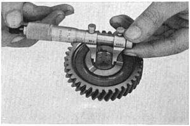


Fig. 6C-16

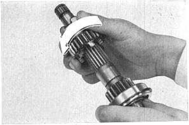


Fig. 6C-17

5. Check the clearance between the serration and the shift gear by turning the gear as shown in the figure and determine if the clearance is excessive.

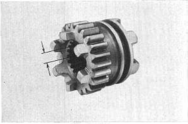


Fig. 6C-18

6. Measure the wear of the 3rd/top shift gear and the low/2nd shift gear dog, using a venier calipers.

3rd/top shift gear	
3rd gear side:	Replace if below 9.6mm (0.3780 in)
Top gear side:	Replace if below 9.4mm (0.3701 in)
Low/2nd shift gear	
2nd gear side:	Replace if below 9.2mm (0.3701 in)

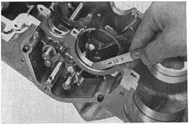


Fig. 6C-19

7. Measure the right and left bearing side clearances of both the main shaft and countershaft as shown in the figure, using a thickness gauge.

   Main and Counter shaft bearing side clearance:

   Standard tolerance
   0.03 to 0.05mm (0.0012 to 0.0019 in)
   Serviceable limit
   Replace if beyond 0.07mm (0.0028 in)

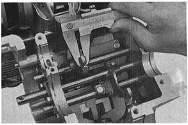


Fig. 6C-20

8. Measure the wear to the low/2nd shift fork and the 3rd/top shift fork, using vernier calipers as shown in the figure.

   Wear to the shift fork finger:

   Standard tolerance
   4.7 to 4.8mm (0.1850 to 0.1890 in)
   Serviceable limit
   Replace if below 4.6mm (0.1811 in)

9. During the assembly of the main shaft and the countershaft, the washer must be installed so that the chamfered side of the washer is toward the filler on the shaft, as shown in the figure.
10. Determine the amount of backlash in the transmission gears by fixing one side of the gear pair and lock the mating gear.

Backlash
- Standard tolerance:
  - 0.064 to 0.128mm (0.0025 to 0.0050 in)
- Serviceable limit:
  - Replace if beyond 0.2mm (0.0079 in)

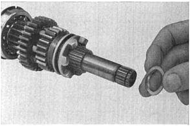


Fig. 6C-21

D. Gear Shift Mechanism

a. Description

1. Operation

The gear shifting mechanism consists of shift plates, shift fork and fork shaft, and locking device.

A locking device which is comprised of a steel ball and a spring is provided with the shift plates. The locking device insures positive shifting into the speed positions which is distinguishable to the driver by feel.

Each fork shaft is slotted and contains a steel ball and an interlock pin to lock the shaft, thus preventing double gear engagement. In addition, to prevent the overtravel of the shift lever into the reverse position, a spring is provided to increase the shift plate resistance so that the driver can shift by feel. There are three shift plates: the third/top, low/second, and the reverse shift plate. A slit is provided at the center of each plate and is fitted with top end of the shift fork. The shift plate is moved by the shift arm mounted at the end of the gear shift rod. Gear shift is performed by moving the shift fork along the slit in the shift plate.

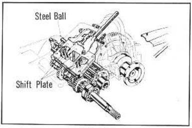


Fig. 6D-1

2. Interlock mechanism (prevention of double gear engagement)

The interlock mechanism serves to prevent double gear engagement by locking the fork shaft with steel balls and interlock pins.

In the neutral position, the steel balls are only fitted partly into the fork shaft slot, and when the fork shafts are moved axially by the shift lever, the four balls and interlock pins are forced out of the slots. The slots for the steel balls and interlock pin on the other two fork shafts are much deeper and when the steel balls and interlock pin are seated, it is much harder to move. Thus, shifting to any other gear is prevented.

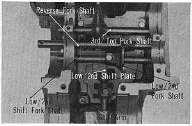


Fig. 6D-2

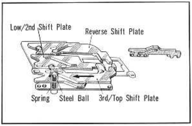


Fig. 6D-3

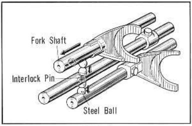


Fig. 6D-4

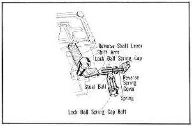


Fig. 6D-5

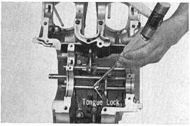


Fig. 6D-6

3. Gear shift overtravel preventing mechanism
   The function of this mechanism is to provide a greater resistance when shifting to the reverse gear than required for shifting to any of the forward speed gears, so that error in gear shift can be prevented and at the same time the driver can definitely feel that a shift to a desired position has been made. When the shift arms tends to slide sideways into engagement with the reverse shift plate, the reverse select lever restricts the arm, preventing the shift arm from engaging with the plate. The reverse select lever is thrusted with the reverse pin, forcing the shift arm away from the reverse shift plate. However, if a greater force is applied which overcomes the spring force of the reverse pin, this force causes the shift arm to slide sideways, and the shift arm moves into the reverse shift plate. At the same time, the steel ball pressed hard in the reverse pin slot by a spring is forced out from the slot, and the reverse pin is pushed outward. At this time, the driver can feel, through the gear shift lever, that the steel ball is forced out from the taper slot. Therefore, not only a shift into the reverse gear can be made perfectly but also, even when a shift is made erroneously into the reverse gear, the reverse select lever forces the shift arm away with a great force; and therefore the driver can feel definitely that, unlike in a shift into the forward speed gears, the gear shift lever moves not so smoothly. Further, the gear shift lever, even if some kind of force is applied, can be prevented from overtraveling into the reverse gear, unless the force is great enough to push the reverse select lever by overcoming the tension of the spring which is pushing the reverse pin.

b. Disassembly

1. Loosen the lock plates of the respective top shift fork, low shift form, and the reverse shift fork.

2. Loosen also the locking bolts of the respective lock plates and disassemble the shift fork and shift fork shaft.

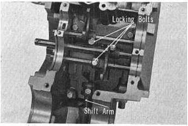


Fig. 6D-7

3. Loosen the set bolt and remove the interlock guide plate.

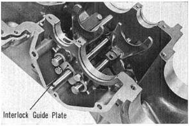


Fig. 6D-8

4. Disassemble the interlock pin and two steel balls.
5. Disassemble the top, low, and reverse shaft fork while pulling out the shift fork shaft.

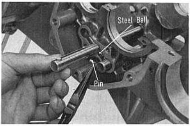


Fig. 6D-9

6. Loosen the lock ball spring retaining bolt and disassemble the spring retaining bolt washer, lock ball spring, and steel ball.

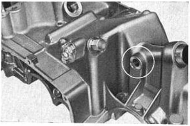


Fig. 6D-10

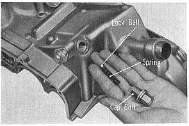


Fig. 6D-11

7. In the same manner, loosen the lock ball spring retaining bolt and disassemble the spring retaining bolt washer, lock ball spring, and steel ball.

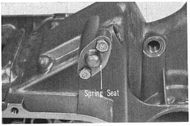


Fig. 6D-12

8. Unscrew the seat set bolt, remove the reverse pin return spring seat and the seat gasket, followed by removal of the reverse gear pin spring and the reverse gear restriction pin.

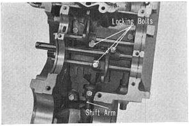


Fig. 6D-13

9. Loosen the lock washer and remove the shift arm set bolt.
10. Pull out the gear shift rod and disassemble the gear shift arm, oil seal seat, and the oil seal.

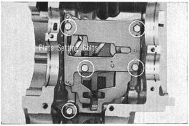


Fig. 6D-14

11. Remove the gear shift guide plate set bolt and separate the gear shift guide plate assembly from the lower crankcase.

12. Disassemble the gear shift plate.
    Remove the shift plate setting screws. (Fig. 6D-15)
    Remove the reverse select lever pivot bolt. (Fig. 6D-16)
    Disassemble the gear shift guide lower plate.
    Disassemble the stopper ball spring retainer, the stopper ball pressure spring, and steel ball. (Fig. 6D-17)

    A . . . . Reverse Shift Plate.
    B . . . . Low/2nd Shift Plate.
    C . . . . 3rd/Top Shift Plate.

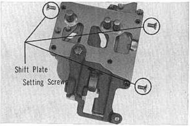


Fig. 6D-15

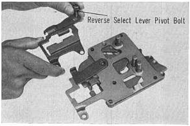


Fig. 6D-16

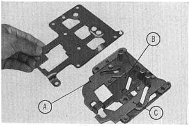


Fig. 6D-17

c. Assembly

Assembly of the gear shift mechanism is made in the reverse order of disassembly.

Note:
Torque the lock ball spring retaining bolts (Fig. 6D-18 and 6D-19) to from 3 to 4 kg-m (21.7 to 28.9 lb-ft).

Fig. 6D-18 . . . . . . Torquing the lock ball spring retaining bolt for the reverse gear restricting pin.
Fig. 6D-19 . . . . . . Torquing the lock ball spring retaining bolt for the gear shift rod.

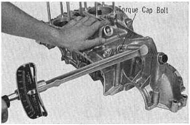


Fig. 6D-18

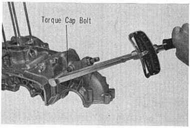


Fig. 6D-19

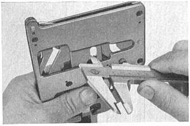


Fig. 6D-20

Gear shift plate inspection:

Measure the; amount of wear to the 3rd/top shift plate, low/2nd shift plate, and the gear shift on the reverse shift plate.

Standard tolerance:
7.2 to 7.3mm (0.284 to 0.287 in)
Serviceable limit:
Replace if beyond 7.5mm (0.295 in)

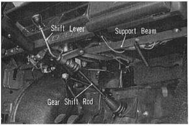


Fig. 6E-1

E. Gear Shift Lever and Rod

a. Description

The direct type gear shift rod is employed. The shift lever is directly connected to the transmission rod. In addition, the support beam is equipped with a bracket for supporting the shift lever and rod. Unlike the floor shift, this system has no lever on the floor and results in spaciousness. Compared with the column shift, the lever is located closer to the operator, and the instrument is therefore easier to read.

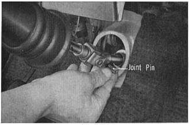


Fig. 6E-2

b. Maintenance

1. Remove the joint pin with a shift rod pin driver (special tool) and separate the shift rod. (Refer to Fig. 3B-3 on page 3-5)
   When the shift lever is set to the first gear position, the joint pin is moved forward (toward the interior) to facilitate removal.
2. When reinstalling, insert the joint pin with the shift rod pin driver. (Fig. 6E-2)

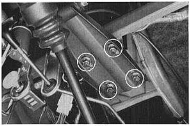


Fig. 6E-3

3. The shift lever bracket is installed with four nuts and washers. The lever position can be adjusted as required in the hole. (Fig. 6E-3)

4. The shift rod and the lever are connected with a universal joint. Move the bellows and lightly coat the joint and spring with grease. (Fig. 6E-4)

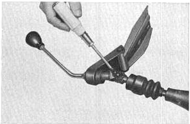


Fig. 6E-4

5. Shift lever positional adjustment.
   When the shift lever is set to the first gear or third gear position, confirm that the lever is located from 50 to 70mm (2.0 to 2.8 in) from the knob end to instrument pad end. The shift lever can be adjusted so that the operator will find setting the lever to each position convenient.
   If it is desired to install the lever at a lower level, move the bracket to the rear. (6E-3 and 6E-5)

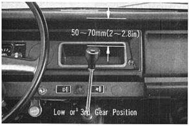


Fig. 6E-5

Checking shift lever play.

Set the lever in the neutral position, and make sure the stroke is from 50 to 60mm (2.0 to 2.4 in) when lightly moved to the left. If the lever stroke is too large, a worn joint is the cause. This being the case, replace the shift lever. (adjustment is impossible)

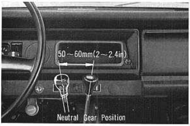


Fig. 6E-6

6. The shift rod bellows are grooved. The panel is set in this groove. After inserting the joint pin, be sure to set the bellows in position securely. (Fig. 6E-7)

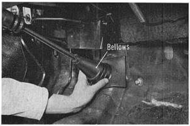


Fig. 6E-7

F. Special Tool

07047-55101 Shift rod pin driver

G. Trouble Diagnosis

Possible Cause	Corrective Action
Noisy in Low and Excessive shock when shifting	
Idle speed is too high	Adjust to specification
Clutch not releasing fully	Adjust clutch
Excessive tension on primary drive chain	Correct to specification
Worn or Damaged primary driven sprocket bearing	Replace primary driven sprocket hub
Noisy	
Main or Counter shaft bearing worn or damaged.	Replace damaged bearing
Gears worn or damaged	Replace damaged gear
Clutch improperly adjusted	Adjust clutch
Clutch friction plate stuck	Replace oil seal and/or friction plate
Slips out of gears	
Shift gears damaged	Replace damaged gear
Interlock mechanism damaged	Replace damaged part
Weak interlock spring	Replace spring
Tending to misengagement in reverse when shifting to 2nd gear	
Weak reverse interlock ball spring	Replace spring or install shim

H. Floor Shift

N600G is equipped with a floor shift type select lever including a gear shift console. The gear shift mechanism, however, is similar to the other type N series vehicle. Refer to section D "gear shift mechanism" and section E "Gear shift lever and rod" on pages 6-9 and 6-14 respectively, for the further information.

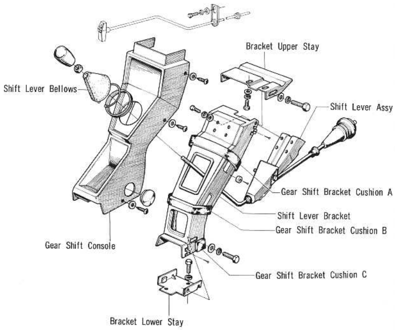


Fig. 6H-1

Disassembly and Assembly

1. In order to simplify the removal of the gear shift console, remove two bolts which fasten the parking brake lever and lay to one side.

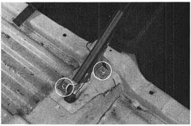


Fig. 6H-2

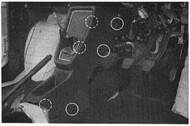


Fig. 6H-3

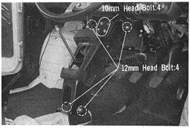


Fig. 6H-4

2. Remove the knob from the select lever.

3. Remove the six screws which fasten the console on the shift lever bracket, then the console can be separated from the bracket.

4. Remove four 12m/m head bolts and four 10m/m head bolts as hown in Fig. 6 H-4, then the gear shift lever bracket can be removed from the floor board.

5. The reassembly of the system can be performed in the reverse order of disassembly.

A. General Description

The transmission is a constant-mech four-speed type with one speed in reverse. The driving power is transmitted from the crankshaft to the transmission mainshaft through the primary drive chains and sprockets where it is reduced in speed and then passed on to the clutch assembly. It is further transmitted to the differential gear after speed has been controlled by the transmission gears which are selected by the cam plate type gear change selector mechanism.
The gearing of the constant-mesh transmission incorporates dogs on the shift gear as shown in the figure and engages with the dogs of the mating gear to positively transmit the power. Combined with the interlock device which will be described in a later chaper, this dog engaging method secures positive engagement.
However, on the countershaft low gear, the teeth on the shift gear is made to engage with the grooves machined into the low gear, and the engagement of the second gear with the shift gear is made by the shift gear dog engaging into the groove machined on the second gear.

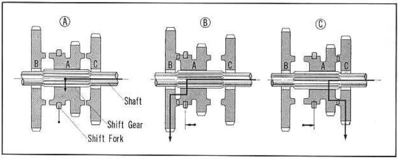


Fig. 6A-1

Transmission Power Train

The feature of this transmission system is that each gear on the main shaft and the countershaft rotates independently of the shafts and is in constant mesh with its matching gears. The driving power is transmitted and controlled by shifting the shift gears which are slide fitted on the shafts.

(Figs. 6A-2, 6A-3, 6A-4, 6A-5, 6A-6 and 6A-7)

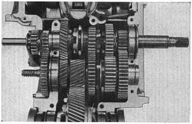


Fig. 6A-2 Neutral

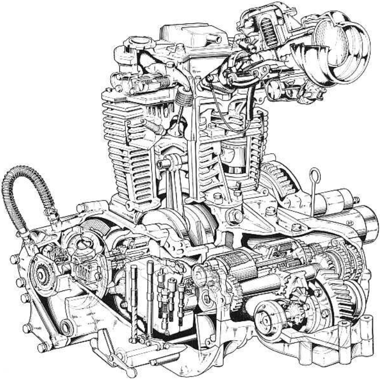
SECTION 7

TRANSMISSION-HONDAMATIC

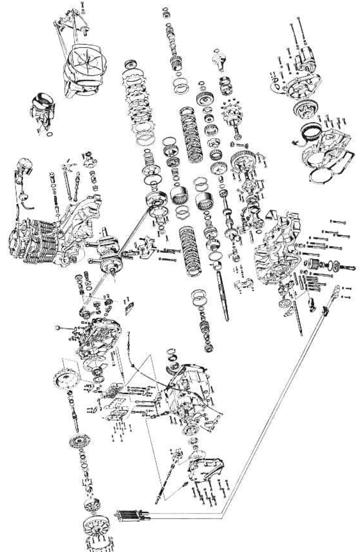
GENERAL SPECIFICATIONS

Description	A360	A600
Torque converter: Type	3 elements, 1 stage, 2 phases	
Primary drive: Type	Single row chain	
Reduction ratio (between crank-shaft and transmission)	2.118	1.526
Clutch: Type	Multi-plate, wet-type	
TRANSMISSION Type	Constant-mesh, 3 forward and 1 reverse speeds	
Selector mechanism	1, 2, 3, D N, R, P positions, remotely controlled	
Gear ratios: First	2.556	2.421
Second	1.357	1.357
Top	0.861	0.838
Reverse	3.857	3.857
FINAL DRIVE Drive gear and pinion type	Helical gear	
Reduction ratio	3.542	
TRANSMISSION HYDRAULIC FLUID Pressure pump: Type	Gear pump	
Delivery rate	4.0 lit/min. at 1,000 rpm engine speed (3.52 Imp. qt/min., 4.23 US qt/min.)	
Filter: Type	Wire screen, 50 mesh	
Fluid capacity	3.2 lit (2.82 Imp. qt or 3.38 US qt)	
Lubrication method	Wet-sump	

ENGINE/TRANSMISSION/DIFFERENTIAL CUT-AWAY



HONDAMATIC TRANSMISSION EXPLODED VIEW



6-2. Timing Valve Body

Disassembly

1. Disassemble the roller spring, interlock rollers from the timing valve body. (Fig. 7B-76)

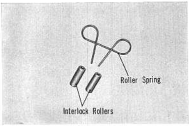


Fig. 7B-76

2. Loosen the bottom cover mounting screws and separate bottom cover from the timing valve body. (Fig. 7B-77)

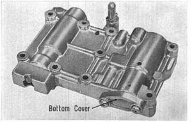


Fig. 7B-77

3. Remove the timing valve and the timing valve spring from the timing valve body. (Fig. 7B-78)

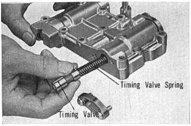


Fig. 7B-78

4. Loosen the top cover mounting screws and separate top cover from the timing valve body. (Fig. 7B-79)

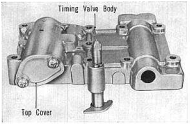


Fig. 7B-79

A. Torque Converter

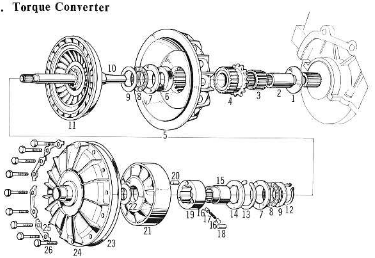


Fig. 7A-3 Torque Converter Exploded

1	Washer, thrust, 32 x 21 x 21	1	14	Plate, stator side	1
2	Coupling, torque converter pump shaft	1	15	Hub, stator	1
3	Bearing, needle, 28 x 33 x 7	1	16	Cap, roller spring	12
4	Sprocket, primary drive	1	17	Spring, stator roller	6
5	Housing, torque converter	1	18	Roller	6
6	Oil seal, 28 x 46 x 8	1	19	Cam, stator	1
7	Race, thrust, 32 x 52 x 2	2	20	Pin, dowel, 6 x 10B	1
8	Bearing, thrust, needle 30 x 47	2	21	Stator, torque converter	1
9	Race, thrust, 30 x 47 x 1	2	22	Washer, thrust, 30.7 x 42.5 x 2	1
10	Shaft, torque converter pump	1	23	O ring, 146 x 3.1	1
11	Impeller, pump	1	24	Turbine, torque converter	1
12	Circlip, external, 22 mm	1	25	Plate, lock, 6 mm	1
13	Circlip, internal, 55 x 1.2	1	26	Bolt, hex., 6 mm	7

a) Construction

Contained within the torque converter housing(Fig.7A-4)are the pump, a turbine, a stator, a one-way clutch and their related parts.

The input end of the pump shaft is connected to the crankshaft by means of a splined collar to transmit the torque.

The torque which is transmitted to the turbine is further transmitted to the primary drive sprocket through the fluid-filled housing supported by needle bearings on the pump shaft.

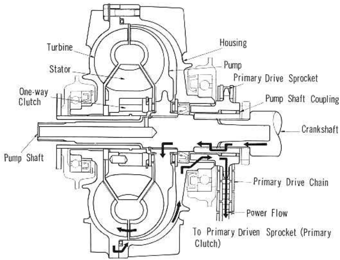


Fig. 7A-4 Sectional View of the Torque Converter

b) Operation

The hydraulic torque converter consists of a pump, a turbine, and a stator. A one-way clutch is incorporated in the stator and the complete assembly is contained within the fluid-filled housing.

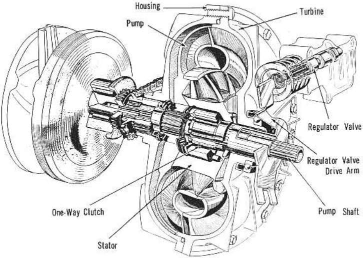


Fig. 7A-5

When the engine is running, the crankshaft rotation is directly transmitted to the pump shaft and as the pump revolves, the fluid within the torque converter produces a spiral flow pattern around the pump shaft and flows from the pump to the turbine and back to the pump through the stator due to centrifugal force.

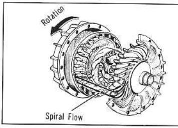


Fig. 7A-6

1. Torque Converter in Action

When the car is standing still with the transmission in DRIVE [D] range and the engine idling, there is very little torque transmitted from pump to turbine.

2. At Stall

As the engine is accelerated, pump speed increases and fluid is thrown into the turbine "A" with increasing force. After leaving the turbine, the fluid strikes the stator "B". As the stator is forced backward by the fluid, the overrunning clutch will be locked-up; fluid is then diverted and enters the pump "C". As this spiral flow increases in speed, more and more torque is transmitted to the turbine.

Fluid is thrown from the pump into the turbine 'A". Fluid leaving the turbine strikes the stator "B" and is deflected into pump "C" at proper angle, and with inertial velocity. (Fig. 7A-7)

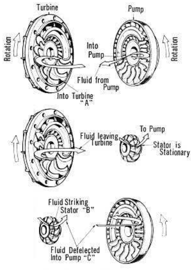


Fig. 7A-7 Fluid Flow Diagram

3. Spiral Flow

Spiral flow in the torque converter is much faster than that in a fluid coupling. This is accomplished by the increased velocity of the pump reentry provided by the stator. The higher the spiral flow velocity, the greater is the torque transfer. As the vehicle speed builds up and the turbine speed approaches the pump speed, spiral flow is slowed down and the torque converter acts move like the fluid coupling. Fig. 7A-8 and Fig. 7A-9, illustrate the spiral flow during torque multiplication and during the fluid coupling conditions.

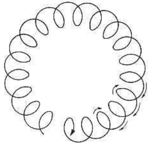


Fig. 7A-8 Torque converter spiral flow

Spiral flow is very rapid in torque converter, especially at stall.

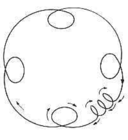


Fig. 7A-9 Spiral flow at the coupling point

Spiral flow has almost stopped when the coupling point is reached. Coupling point is when pump and turbine are traveling at the same speed and there is no torque multiplication any longer.

This spiral fluid flow produces a maximum torque multiplication of about 2.4 to 1 when the turbine is stalled(Fig.7A-10).When sufficient torque is developed by the pump, the turbine starts to rotate. Converter torque multiplication is expressed as torque ratio. As the turbine speed approaches the pump speed, the torque multiplication diminishes and eventually a maximum effectiveness of 85.5% is attained. When the turbine is driven at the speed ratio approximately 0.83 of the pump, the torque ratio is 1:1. This point is known as the "coupling point" or "clutch point" (Fig. 7A-11).

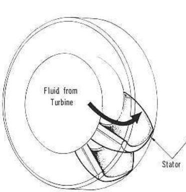


Fig. 7A-10 Maximum torque is produced at stall point when fluid flow strikes vanes most effectively.

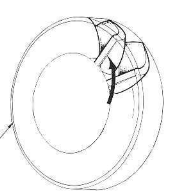


Fig. 7A-11 The stator begins running free of the turbine at coupling point. At this point, torque ratio is lowest (1:1).

When the turbine speed is below the coupling point, the torque is being multiplied by the converter. The fluid which leaves the turbine strikes the front face of the stator blades with considerable force. As long as the fluid force is against the front face of the stator blades, the one-way clutch is locked-up and prevents rotation in the reverse direction.

The HONDAMATIC transmission utilizes the reaction of this force to operate the regulator valve by actuating the regulator valve drive arm. The movement of the regulator valve setting results in a greater system pressure to be produced, and consequently greater hydraulic force is applied against the primary clutch plates to prevent slipping.

4. Torque Converter Performance Curve (A360/600)

The ratio of torque multiplication ranges from STALL to COUPLING POINT is illustrated in the diagram. Notice how torque multiplication drops as the turbine speed increases.

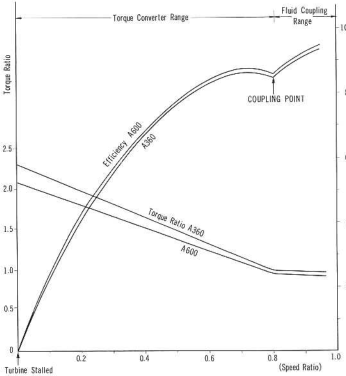


Fig. 7A-12

c) One-way Clutch

The one-way clutch (overrunning clutch) incorporated in the stator is a roller type clutch. It consists of six units of spring, spring cap and roller. The stator is located on the stator cam with a dowel pin and is free to rotate in the direction of the turbine rotation but locks-up with the stator hub to prevent rotation in the reverse direction.

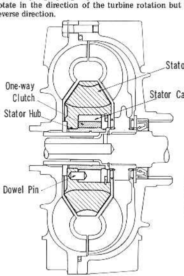


Fig. 7A-13

Sectional view of one-way clutch

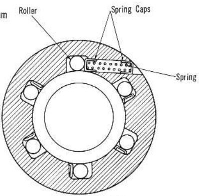


Fig. 7A-14

Location of rollers in the clutch showing details of construction

As shown in the figure, the rollers are assembled into the tapered grooves of the stator cam and are forced against the taper by the spring and spring caps. The stator and the stator cam are free to rotate in the counter clockwise direction-(Fig.7A-15),however, if an attempt is made to rotate the stator in the clockwise direction, the rollers will be pushed toward the narrow end of the slot, causing the stator cam and the stator hub to lock-up and thus prevent the stator from rotating. (Fig. 7A-16)

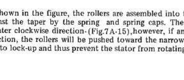


Fig. 7A-15

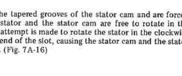


Fig. 7A-16

Action of the roller segments.

d) Regulator Valve Drive Arm

As explained in the earlier section on the torque converter, a reaction force is constantly applied to the stator. Whenever the torque multiplication is greater than one, increased engine torque is applied to the primary and secondary clutches. This requires that the clutch capacity be increased during this period. To satisfy this requirement, the HONDAMATIC transmission provides a greater line pressure to the fluid control system for a higher clutch piston pressure.

The clutch capacity must be increased when the torque multiplication is the greatest, or when the reaction against the stator blade is great and there is a force attempting to reverse the direction of the stator in relation to the pump and turbine. As stated in the previous section, due to the one-way clutch, the stator becomes locked. However, the regulator valve drive arm is spline fitted to the stator hub, and the force applied to this arm is applied to the spring cap, increasing the system regulated pressure. The reaction force applied to the stator blades will produce a movement of 10 mm (0.39 in) max. at the spring cap; this increases the line pressure and provides a greater piston force at the clutches, thus increasing its capacity (refer to section on Line Pressure).

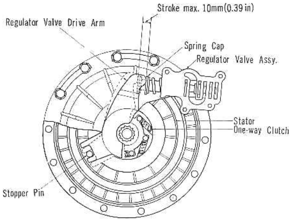


Fig. 7A-17

Construction of the valve spring cap and regulator valve drive arm and operation by the action of the one-way clutch.

B. Power Flow

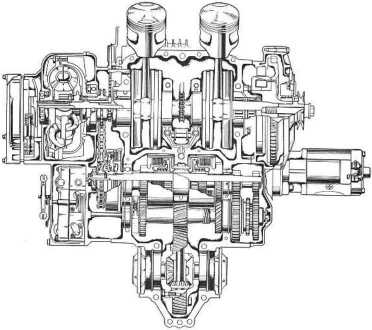


Fig. 7A-18 HONDAMATIC transmission sectional view

a) Primary Drive Mechanism

The primary drive sprocket is located at the left end of the crankshaft where the splined collar connects the torque converter pump shaft to the crankshaft. It is mounted on the pump shaft coupling through a needle bearing which also serves as a concentric mounting. Splines connect the primary drive sprocket to the converter housing.

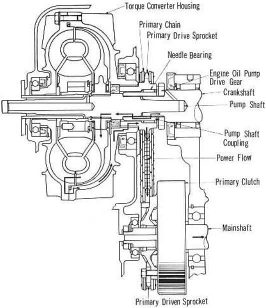


Fig. 7A-19 Primary drive power train

The power is transmitted from the converter housing to the primary drive sprocket and to the primary driven sprocket through the primary chain. The primary driven sprocket is an integral part of the primary clutch drum and rotates together with the primary clutch, transmitting the power to the transmission mainshaft.

The crankshaft torque is converted into fluid energy within the converter and, converted back to mechanical energy and reduced in speed in the ratio of 1.526 for A360 (2.118 for A600) between the primary drive and driven sprockets as a primary reduction.

An automatic primary chain tensioner is incorporated between the sprockets to maintain the chain tension at the specified value and to absorb any sudden shocks, thereby, preventing chain stretch.

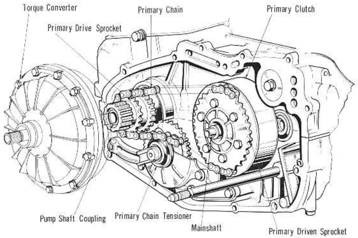


Fig. 7A-20 Primary drive system installation.

b) Primary Clutch

1. Description and Operation

The primary clutch is located at the left end of the mainshaft and it is where the power transmitted through the primary chain and primary driven sprocket is engaged or disengaged.

The primary driven sprocket is an integral part of the clutch drum. When the primary clutch is disengaged, the clutch drum will rotate freely. The clutch hub is fixed to the mainshaft by spline, and incorporates driven plates (friction discs) which are alternately positioned with drive plates (clutch plates) incorporated in the clutch drum. When the clutch is engaged, the power is transmitted from the clutch drum to the clutch hub and to the mainshaft.

Hydraulic pressure applied to the primary clutch piston is transmitted in the direction shown by the arrow in Fig.7A-21 i.e., from the main valve body to the mainshaft and is applied between the primary clutch drum and the piston. As the pressure increases, greater force is applied by the piston against the drive plates; the power is transmitted in turn to the driven plates, clutch hub and to the mainshaft.

As can be seen in the figure, the basic construction of the HONDAMATIC transmission is identical to that of the A360/600. The transmission system and the differential system are laid out parallel to the crankshaft with the torque converter and the pressure pump installed on the left side of the crankshaft.

The power transmitted to the mainshaft of the transmission is reduced in speed by the primary chain before entering the primary clutch. The transmission is parallel to the constant mesh low, second and third gears which incorporate hydraulically operated clutches, and the engagement or disengagement of the clutches on the mainshaft performs the gear changes. (low and reverse gears are splined to the right end of the mainshaft)

The second, third and the final drive gears are integrated on the countershaft A low gear incorporating a one-way clutch and the reverse select gear are also mounted on the countershaft and they are, also, shifted automatically. The hydraulic control operating system, fluid passages and many related components are very compactly arranged in the crankcase.

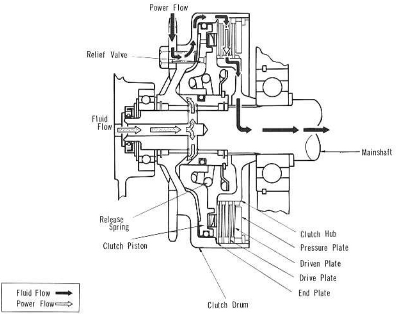
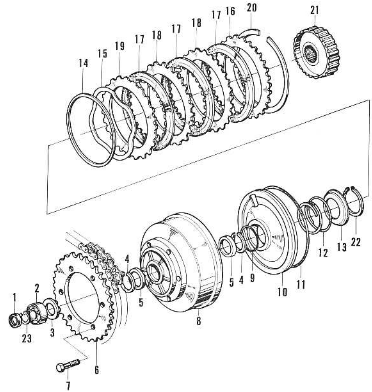


Fig. 7A-21 Primary clutch fluid flow and power flow.

When the hydraulic pressure is released from the piston, the piston is forced back by the piston release spring to its normal position (disengaged) and the force against the pressure plate is relieved, thus the driven plates are freed. The clutch drum now rotates freely on the mainshaft, allowing the mainshaft to stop revolving.

The primary clutch is actuated when the selector lever is positioned to Drive Range, Manual Range or Reverse. However, it is not actuated in the Neutral or Parking position.



1.	Oil seal, 12 x 24 x 6	1	13.	Seat, primary clutch release spring	1
2.	Bearing, ball, 20 x 42 x 8	1	14.	Plate, wave spring, 83.6 x 97.5 x 0.5	1
3.	Plate, thrust, 20 x 34 x 1.5	1	15.	Spring, primary clutch wave	1
4.	Circlip, internal, 28 x 10	2	16.	Plate, primary clutch pressure	1
5.	Oil seal, 20 x 26 x 3	2	17.	Plate, primary clutch driven	3
6.	Sprocket, primary driven	1	18.	Plate, primary clutch drive	2
7.	Bolt, hex., 6 x 12	6	19.	Plate, primary clutch end	1
8.	Drum, primary clutch	1	20.	Circlip, internal, 112 x 1.5	1
9.	O ring, 29.5 x 2.3	1	21.	Hub, primary clutch	1
10.	Piston, primary clutch	1	22.	Circlip, 35 mm	1
11.	O ring, 99 x 3	1	23.	Circlip, 24 mm	1
12.	Spring, primary clutch release	1			

Fig. 7A-22 Primary clutch exploded

2. RELIEF VALVE

Hydraulic fluid within the primary clutch flows out by the action of the primary clutch piston release spring. However, there will be residual fluid remaining within the primary clutch; if it is permitted to remain, the centrifugal force produced by the rotating clutch will create sufficient hydraulic pressure to cause clutch engagement. To prevent this, a relief valve is installed in the system.

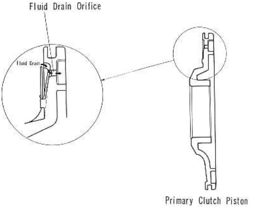


Fig. 7A-23 Relief valve and fluid drain passage way

c) Secondary Clutches

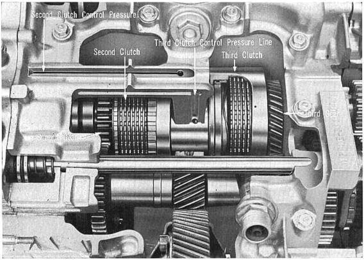


Fig. 7A-24 Mainshaft assembled

The secondary clutches mounted on the mainshaft within the crankcase control the selection of second and third gears.

The basic construction of the secondary clutches is identical to that of primary clutch, both are hydraulically operated. The clutch drum and the piston guide are spline fitted to the mainshaft.

With the exception of the clutch hubs, the internal components of both the second and third clutches are similar.

1. Second Clutch

When the selector is in Drive Range 2nd gear or in Manual Range 2nd gear, the hydraulic pressure will flow from the main valve body through the left crankcase side cover, upper crankcase and the second/third seal ring guide and supply the hydraulic fluid to the space between the second clutch piston and the piston guide. As the hydraulic pressure rises, the clutch is engaged. As the clutch engages, the power is transmitted to the mainshaft second gear, and further transmitted through the constant mesh countershaft second gear, countershaft final drive gear and differential gear and to the drive shafts which finally drive the front wheels.

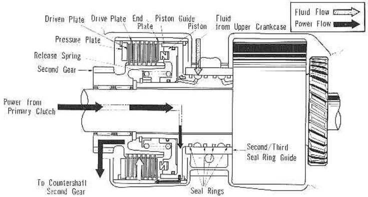
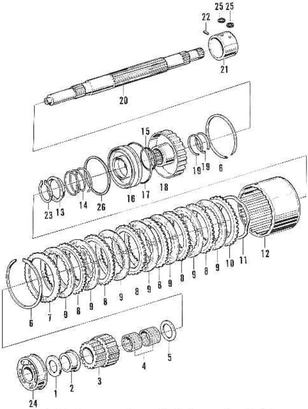


Fig. 7A-25 Second clutch fluid and the power flow.

When transmission shifts out of second gear, the fluid pressure in the second gear clutch decreases and the release spring forces the piston backward, thus, the clutch is disengaged but the clutch hub and integral second gear continue to rotate because they are in constant mesh with the countershaft second gear.

This is possible because the clutch hub is free to rotate on the mainshaft when the clutch is disengaged.



1.	Plate, thrust, 25.2 x 38 x 2	1	14.	Spring, secondary clutch release	1
2.	Collar, distance	1	15.	O ring, 37.6 x 1.9	1
3.	Gear, mainshaft second	1	16.	Piston, secondary clutch	1
4.	Bearing, needle, second gear	2	17.	O ring, 79.5 x 2.5	1
5.	Plate, thrust, 29.5 x 40 x 2	2	18.	Guide, secondary clutch piston	1
6.	Circlip, internal, 92 x 1.5	2	19.	Ring, oil seal	2
7.	Plate, secondary clutch pressure	1	20.	Mainshaft	1
8.	Plate, secondary clutch drive	6	21.	Guide, seal	1
9.	Plate, secondary driven	7	22.	Pin B, hollow, 6 x 10	1
10.	Plate, secondary clutch end	1	23.	Circlip, 36 mm	1
11.	Spring, secondary clutch wave	1	24.	Bearing, ball, 6305 (w/set ring)	1
12.	Drum, secondary clutch	1	25.	O ring, 5 x 3.5	2
13.	Seat, secondary clutch release spring	1			

Fig. 7A-26 Component parts of the second clutch.

2. Third Clutch

The third clutch is located at the right end of the mainshaft. It operates when the selector is in the Drive Range 3rd gear or in Manual Range 3rd gear. The power is transmitted from the mainshaft through the mainshaft 3rd gear to drive the constant mesh countershaft 3rd gear in the same manner as in the case of the second clutch.

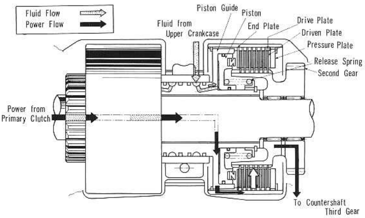
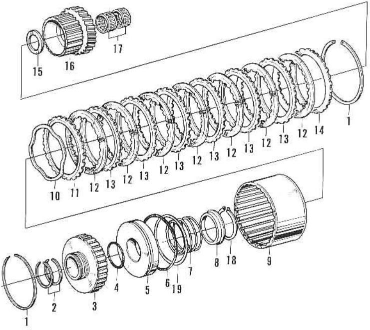


Fig. 7A-27 The fluid flow and power flow of the third clutch.

Note: Construction and operation are identical to those of the second clutch.



1.	Circlip, internal, 92 x 1.5	2	11.	Plate, secondary clutch end	1
2.	Ring, oil seal	2	12.	Plate, secondary clutch driven	7
3.	Guide, secondary clutch piston	1	13.	Plate, secondary clutch drive	6
4.	O ring, 37.6 x 1.9	1	14.	Plate, secondary clutch pressure	1
5.	Piston, secondary clutch	1	15.	Plate, thrust, 25.2 x 42 x 2	2
6.	O ring, 79.5 x 2.5	1	16.	Gear, mainshaft third	1
7.	Spring, secondary clutch release	1	17.	Bearing, needle, third gear	2
8.	Seat, secondary clutch release spring	1	18.	Circlip, 36 mm	1
9.	Drum, secondary clutch	1	19.	Washer, 70 x 80 x 0.5	1
10.	Spring, secondary clutch wave	1			

Fig. 7A-28 Third clutch disassembled.

d) One-way Clutch in Low Gear

1. Description

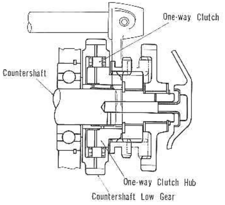


Fig. 7A-29

A sectional view of the one-way clutch showing its construction and the location of the "sprag" one-way clutch.

A one-way clutch is incorporated between the countershaft low gear and the countershaft as shown in the figure above.

The one-way clutch used here is a sprag type which is different from the roller type clutch used in the stator of the torque converter.

The sprag clutch employs sprags which function as cams. It is simple in construction and provides a high degree of dependability.

2. Operation (Sprag Clutch)

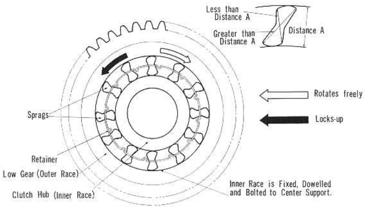


Fig. 7A-30

Sectional view of sprag clutch; rotates freely in clockwise direction, but locks-up when counterclockwise rotation is attempted.

The sprag clutch functions in much the same manner as the roller and ramp type freewheel device, however, uniquely shaped sprag segments are employed instead of rollers. It is a device having irregularly shaped members which wedge between two concentric races.

It consists basically of three components, i.e., the one-way clutch hub (inner race), the countershaft low gear (outer race), and a unit comprising sprags and retainer which is fitted into the space between two races.

It transmits power from one race to another by a wedging action of the sprags which can be are carefully designed for the best contact and wedging action.

As shown in the figure on the following page, counterclockwise rotation of the outer race forces the inner race to rotate, as the power is transmitted via the sprags wedged between the outer race and the inner race by the spring action of the sprag retainer. Clockwise rotation of the outer race does not engage the sprags so it rotates freely. In the case where the inner race carrys the power, counterclockwise rotation of the inner race is not transmitted to the outer race, but clockwise rotation causes a lock-up between the inner and outer races and forces the outer race to rotate together.

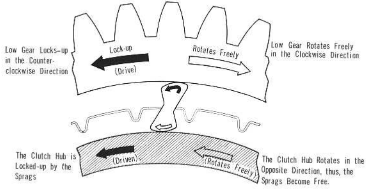


Fig. 7A-31 The action of the sprag segments.
This action transmits rotation in one direction only.

When the countershaft low gear rotates in the clockwise direction, the sprags will tilt in the forward direction, permitting the low gear to rotate freely on the clutch hub, whereas, when the low gear rotates in the counterclockwise direction, the sprags will rise and cause a lock-up by their wedging action between the outer race (low gear) and the inner race (clutch hub). Therefore, the countershaft clutch hub can only be driven in the counterclockwise direction by the countershaft low gear.

In other words, when starting from low speed, countershaft low gear (outer race) rotation will be faster than the rotation of clutch hub (inner race). The relative speed is as shown in the above figure for counterclockwise rotation. The sprags will rise within the space between the outer race and inner race and cause a lock-up, permitting the power to be transmitted from the mainshaft to the countershaft and further to the final drive system.

When the selector is positioned in Drive Range (second or third gear engaged) or to the Manual Range (second or third gear), the clutch hub will rotate faster than the countershaft low gear. The relative speed in the clockwise direction is as shown above. The one-way clutch will slip and there will be no transmission of power between the countershaft low gear and clutch hub.

In the reverse gear position, the one-way clutch hub will disengage from the reverse select gear due to the reverse selector being moved to the reverse position and become independent of the operation of the one-way clutch.

C. Reverse System

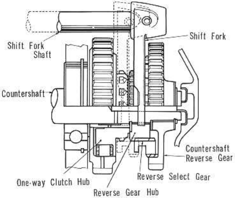


Fig. 7A-32

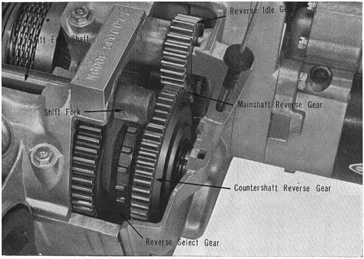


Fig. 7A-33

The figures on the previous page indicate the assembly and sectional view of the countershaft reverse gear, including operation of the shift fork.

When the reverse position is selected at the selector lever, hydraulic pressure actuates the servo piston (to be described later) and the shift fork shaft connected to the piston will cause the shift fork to move the reverse select gear toward the countershaft reverse gear. The reverse select gear disengages from the low gear (one-way clutch hub), slides across the reverse gear hub and engages with the countershaft reverse gear.

The power will flow from the mainshaft to the splined mainshaft reverse gear, to the reverse idle gear where the direction of rotation is changed; then to the countershaft reverse gear. The countershaft reverse gear will transmit power through the previously shifted reverse select gear to the reverse gear hub; and finally to the countershaft.

D. Parking Pawl Mechanism

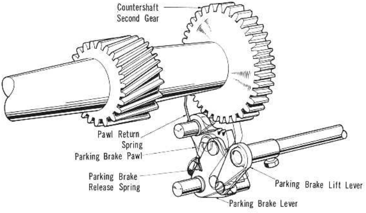


Fig. 7A-34 Parking pawl assembly.

By mechanically engaging the parking brake pawl in the countershaft second gear teeth, the wheels become locked when parking range is selected. With the Hondamatic transmission, parking locks the front and the rear wheels by the mechanical parking brake, providing parking brakes on all four wheels.

When the selector lever is set to the parking position, the parking brake pawl teeth will engage with the countershaft second gear teeth.

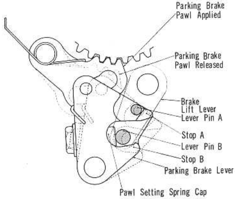


Fig. 7A-35

Fig.7A-35 indicates this operation. The solid lines indicate the state where parking brake is actuated; while broken lines indicate the released state. For actuating the parking brake the lever pin B of the lift lever should force the pawl setting spring cap of brake lever upward; thus parking brake pawl engages with the second gear teeth. The parking brake pawl can be disengaged very smoothly due to the cam action.

For disengagement, the brake lift lever A pushes the stop A of brake lever first, then the lever pin B pushes the stop B. Thus the parking brake lever is forced back to the original position. Simultaneously, parking brake pawl is released from the gear teeth.

If the parking pawl should rest on top of the countershaft second gear teeth, the parking brake lift lever spring will maintain a force against the parking pawl, the shift lever shaft will lock in the parking position due to the slot in the shift quadrant and if the countershaft second gear attempts to turn, the parking pawl will engage in the gear teeth due to the action of the parking brake lever spring.

E. Power Transmission

a) Neutral N Range

With the selector in N position, hydraulic pressure is not acting on the primary clutch and the clutch will not engage. Power flows from the crankshaft through the pump, turbine, primary drive sproket, primary drive chain, primary driven sprocket to the primary clutch drum in that order; however, since hydraulic pressure is not acting power will not be transmitted only further.

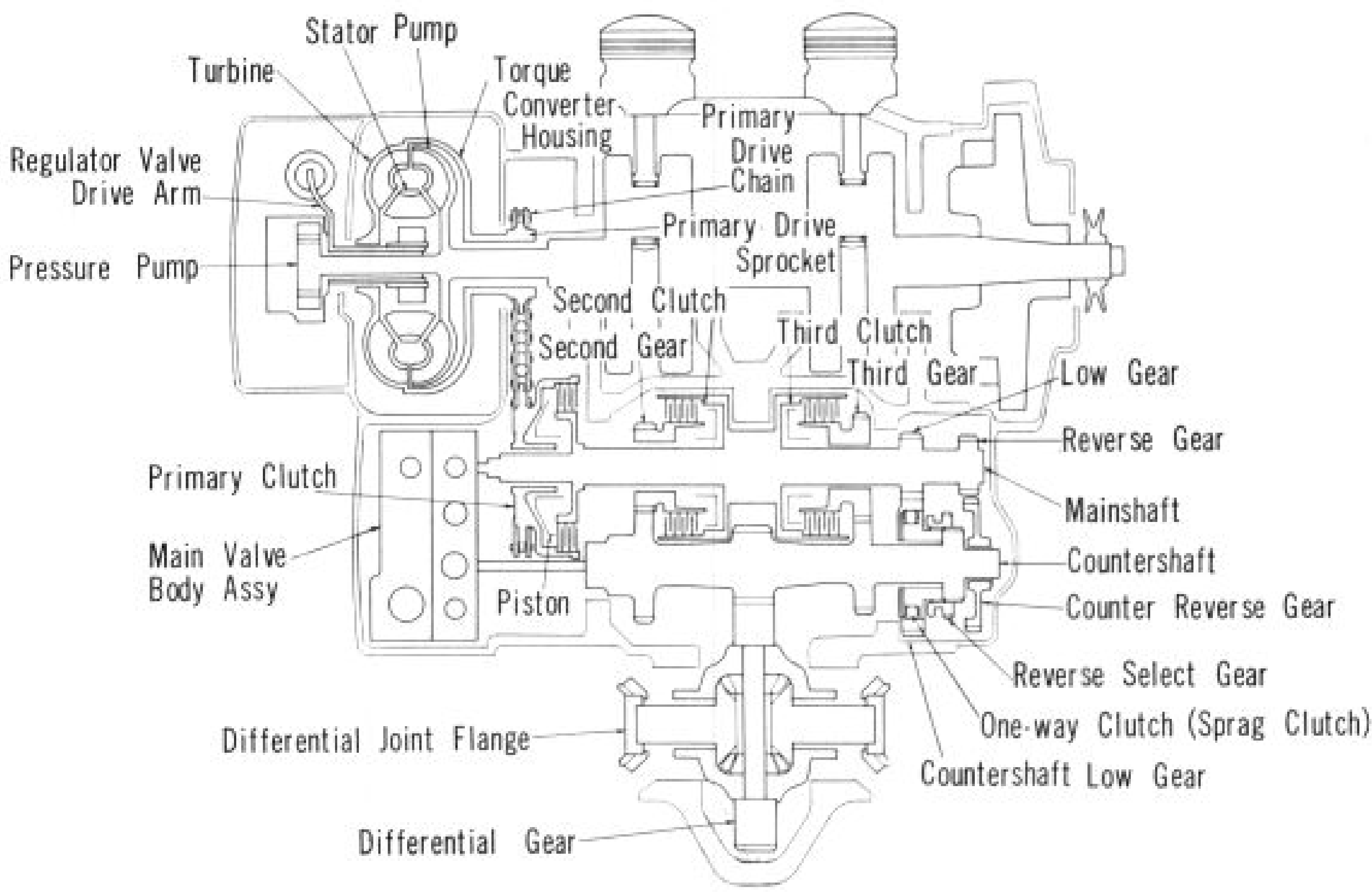


Fig. 7A-36

b) Manual $\boxed{1}$ or $\boxed{D_1}$ Range

1. The pump coupled directly with the crankshaft transmits power through the fluid to the turbine.
2. From the turbine the fluid flows through the torque converter housing to the primary drive sprocket.
3. The primary drive chain transmits power to the primary driven sprocket and to primary clutch drum.
4. Hydraulic pressure acting on the primary clutch transmits power to the mainshaft. (since hydraulic pressure is not acting on the second or third clutch, the second and third gears are rotating freely.)
5. The low gear on the mainshaft transmits power to the countershaft through the countershaft low gear sprag clutch.

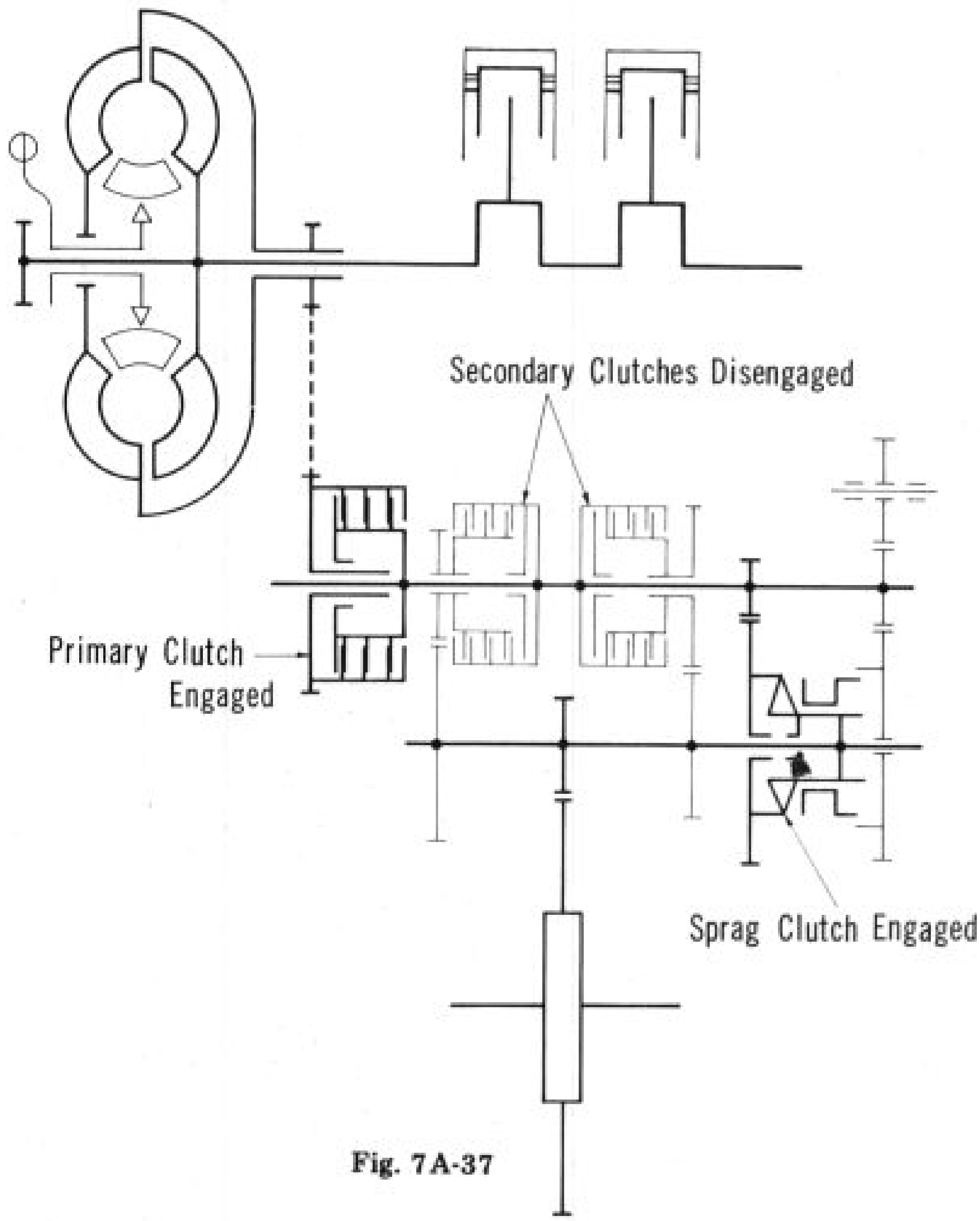


Fig. 7A-37

6. Power flows through the one-way clutch (sprag clutch) to the one-way clutch hub, to the reverse select gear and to the reverse gear hub.
7. The reverse gear hub splined to the countershaft transmits power thereto.
8. Then, power flows from the final drive gear on the countershaft to the final driven gear and through the differential gears to the drive shafts.

c) Manual [2] or [D2] Range

With the primary clutch engaged,the power flows to the mainshaft in the same manner as in the manual [1] or [D1] range described earlier.

1. Hydraulic pressure acting on the second clutch engages it,and the second clutch hub will revolve with the mainshaft as a unit. Power flows from the mainshaft second gear to the countershaft second gear.
2. Then it flows through the final drive gear, final driven gear and differential gear to the drive shafts.

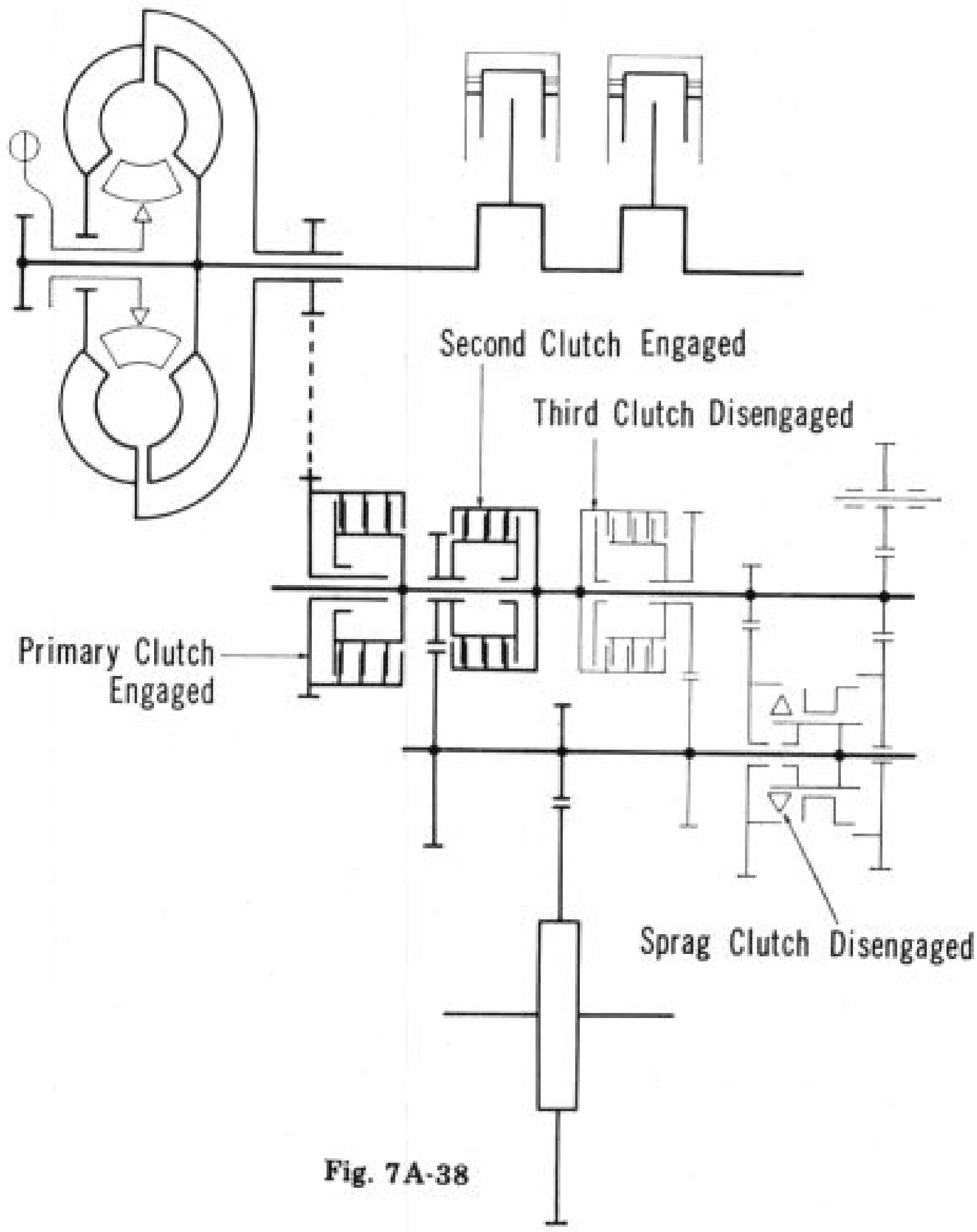


Fig. 7A-38

Remarks:
The mainshaft low and countershaft low gears are also rotating, however, the inner race of the one-way clutch (sprag clutch), i.e., the one-way clutch hub, is rotating faster than the countershaft low gear and the one-way clutch becomes disengaged. This indicates that no dual engagement exists between second and low gears.

d) Manual [3] or [D3] Range

With the primary clutch engaged the power flows to the mainshaft in the same manner as in the manual [1] or [D1] range described earlier.

1. Hydraulic pressure acting on the third clutch engages it and the third clutch rotates with the mainshaft as a unit. (When hydraulic pressure is acting on the third clutch, the second clutch is disengaged). Power flows from the mainshaft third gear to the countershaft third gear.
2. Then it flows through the final drive gear, final driven gear and differential gears to the drive shafts.

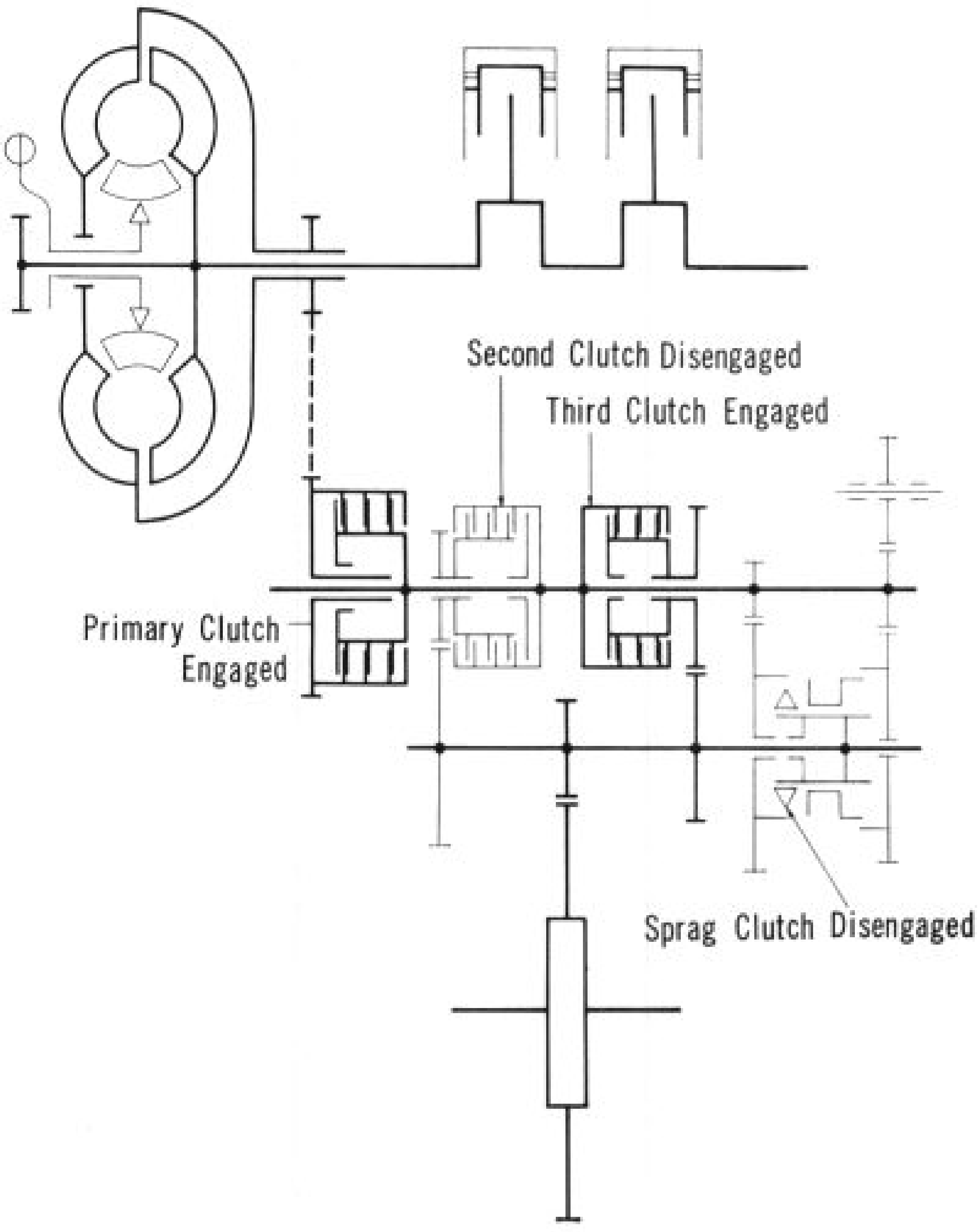


Fig. 7A-39

Remarks:
In this case again, faster revolution of the one-way clutch hub disengages the sprag clutch.

e) Reverse [R] Range

1. With hydraulic pressure acting on the servo valve piston, the reverse select gear engages with the countershaft reverse gear and at the same time hydraulic pressure acts on the primary clutch and thus the power flows to the mainshaft.
2. From the reverse gear splined to the mainshaft, the power flows to the reverse idle gear and to the countershaft reverse gear.
3. From the countershaft reverse gear it flows through the reverse select gear and reverse gear hub to the countershaft, then to the differential gears and the drive shafts.

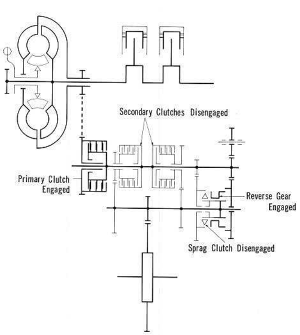


Fig. 7A-40

F. Range Selection

The selector quadrant has seven position. [1], [2], [3], [D], [N], [R] & [P] (see Fig. 7A-41).

The neutral position on the selector lever is [N]. Moving the selector lever to the right will select positions [D], [3], [2] and [1]. Before moving the selector lever to the right, it must first be pulled toward the driver.

Shifting to the left from [N] requires the selector lever to be pulled toward the driver to shift into [R]. Shifting to [P] requires the selector lever to be pulled toward the driver again before moving to the left. Shifting from [N] to [P] can be made in one motion by holding the selector lever pulled.

Motions for right-hand-drive vehicles are opposite to the above.

Fig. 7A-41 Shift indicator

Fig. 7A-42 Selector lever shift pattern

[D]– Drive range is used for all normal driving conditions and it provides maximum fuel economy. The drive range gives a 3 speed fully automatic gear shifting from start to normal driving speed and includes the gear ratios for low, second and third gears, requiring the operation of the accelerator pedal only. When sudden acceleration is required, depress the accelerator pedal full. This will open the carburetor throttle valve fully and makes an automatic kick-down shift from 3rd gear to 2nd gear or from 2nd gear to 1st gear, and provides the required acceleration (refer to the section of kick-down).

[M]– Manual range will give the driver the satisfaction of selecting the required ratio manually.It is convenient to use in traffic or on hilly or mountainous roads. The manual range also has 3 selectable speeds. The starting speed ratio is identical with that of the drive range, however, automatic shift-up can be prevented when extra acceleration is desired. Manual range can also be used for braking under engine compression. Manual range can be selected at any vehicle speed, and the selected gear will be retained until the selector lever is moved to a different position.

Note:
In order to prevent over-loading to the transmission, for safety and to assure longer engine life, shift-down in Manual Range must be made within the speed ranges shown in the table below.

Manual Range	A360	A6000
3—2	73 km/h (46 mph) max.	83 kg/h (52 mph) max.
2—1	40 km/h (25 mph) max.	45 kg/h (28 mph) max.

[N]– Neutral position enables the engine to be started and operated without driving the vehicle.

[R]– Reverse enables the vehicle to be driven in a reverse direction.

[P]– Parking position positively locks the countershaft second gear to the transmission case by means of the parking brake pawl, thereby, preventing the vehicle from rolling in either direction by locking front wheels. Parking position should be selected whenever the driver leaves the vehicle. The engine can be started in parking position.

Gear	Selector Lever Position	Primary Clutch	Sprag Clutch (Low gear)	2nd Clutch (2nd gear)	3rd Clutch (3rd gear)	Gear Ratio	
						A360	A600
Low	[1] or [D]	On	On	Off	Off	2.556	2.421
Second	[2] or [D_2]	On	Off	On	Off	1.357	1.357
Third	[3] or [D_3]	On	Off	Off	On	0.861	0.838
Neutral	[N]	Off	Off	Off	Off		
Reverse	[R]	On	Off	Off	Off	3.857	3.857
Parking	[P]	Off	Off	Off	Off		

Clutch and Gear Ratio Application Table

G. Hydraulic Controls

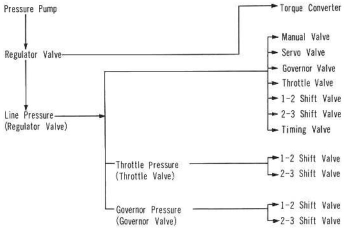


Fig. 7A-43

Description

The hydraulic pressure produced by the pressure pump is maintained constant by the regulator valve, and becomes the line pressure. Part of the pressurized hydraulic fluid is supplied to the torque converter.

The line pressure is the basis of the hydraulic pressure system, and is connected to all valves. The governor pressure and throttle pressure are formed by the respective valves by controlling the line pressure.

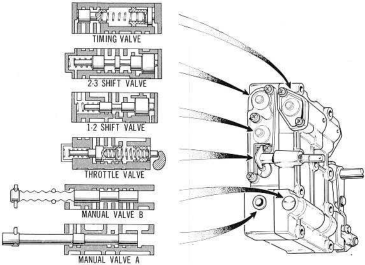
Therefore, during driving the throttle pressure and the governor pressure are applied to either side of the 1-2 and 2-3 shift valves. The ideal ratio is automatically selected in accordance with the changes in respective pressures.

Operation

The operation of the Hondamatic transmission is controlled by hydraulic pressure. Demands made on the transmission by changes in the carburetor throttle opening, vehicle speed or manual selection by the driver are met by corresponding changes in hydraulic pressures.

In order for one to understand how fluid flow and pressure are controlled by the carburetor throttle opening, and vehicle speed for controlling the gear speed selection, the basic understanding of the hydraulics is required.

The function of the manual valve, throttle valve and the governor valve must be clearly understood, however, their valves will be explained later.



Exterior View of Main Valve Body Assembly and Position of Each Valve in Neutral Position.

Fig. 7A-44

Fig.7A-75 shows the valve body of the HONDAMATIC transmission. It can be seen that there are many valves contained within the body. All are interconnected by a complicated system of hydraulic passages and operate in conjunction with each other.

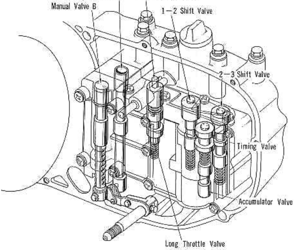


Fig. 7A-45

MEMO

a) Characteristic Diagram

As has been explained, an automatic transmission performs the shifting to provide the proper gear ratio without the need for the driver to operate the gear shift lever.
It performs these functions automatically based on the engine speed, vehicle speed, road condition and the desired driving condition. In order for the automatic transmission to be able to do this, it must possess the following characteristics, which are important, and must be clearly understood. The terms "HYSTERISIS" and "KICK-DOWN", and their effects will be explained later.
Note that the conditions described apply only with the "DRIVE" range.

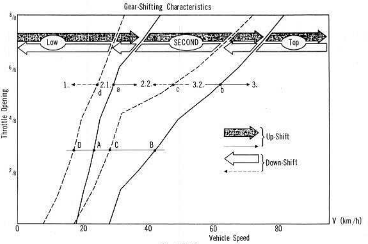


Fig. 7A-46

The solid lines indicate the gear shift points during acceleration and the broken lines indicate gear shift points during deceleration.

The points (a), (b), (c) and (d) depict the gear shifting 1-2, 2-3, 3-2, 2-1 respectively. The reason why point (a) and point (b) are separated is that in the vicinity where shifting takes place, the up-shift and down-shift will occur repeatedly with constant throttle opening and small changes in speed if the two points were close together. Therefore, to prevent this condition, the up-shift point from 1st to 2nd speed has been staggered from the point where down-shift from 2nd to 1st speed occurs. In the same manner, the 2nd to 3rd up-shift point is staggered from the 3rd to 2nd down-shift point.

For example, if the accelerator pedal position is constant, the up-shift from $\boxed{D_1}$ to $\boxed{D_2}$ occurs at point "A" and the up-shift from $\boxed{D_2}$ to $\boxed{D_3}$ at point "B". Under deceleration the down-shift from $\boxed{D_3}$ to $\boxed{D_2}$ occurs at point "C" and from $\boxed{D_2}$ to $\boxed{D_1}$ occurs at point $\boxed{D}$.

The speed differential between points "A" and "D", and points "B" and "C" is important in preventing "Hunting" and will be explained later. The entire range of gear shifting is controlled by the combination of throttle opening and vehicle speed.

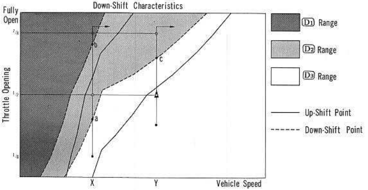


Fig. 7A-47

The kick-down is used to shift to a lower gear when greater acceleration is needed.

When driving with the selector in the D position, press the accelerator to the floor. If vehicle speed is below the down-shift limit, a kick-down to D_2 range or D_1 range will be occur.

The carburetor throttle opening then, becomes large (the throttle pressure rises), shift-down from D_2 range to D_1 range or from D_3 range to D_2 (or further to D_1 range) can be obtained. This is called kick-down.

Therefore, kick-down cannot be applied unless the driving speed is within the D_2 or D_3 range.

Fig.7A-47 indicates the characterisitics of down-shift. Here is an example. Assume that the vehicle speed is X, throttle opening is 1/8 and driving in the D_3 range. If the throttle is opened to ½, kick-down to D_2 range occurs at point (a), and if throttle is further opened and passes the point (b), further kick-down to D_1 will be achieved.

In the case of vehicle speed Y in the figure, kick-down to D_2 range is made when the point (c) is passed. But, even if throttle is fully open, kick-down to D_1 range will never be made at this speed.

Thus kick-down is achieved when the throttle is suddenly open and reaches the different range (lower speed range).

By making up-shift points higher than the down-shift points, the frequent shifting which would occur when the vehicle is driven at speeds near the shift points is prevented. This also stabilizes the shift points. This difference in the shift speeds is due to HYSTERESIS effect.

b) Control Pressure

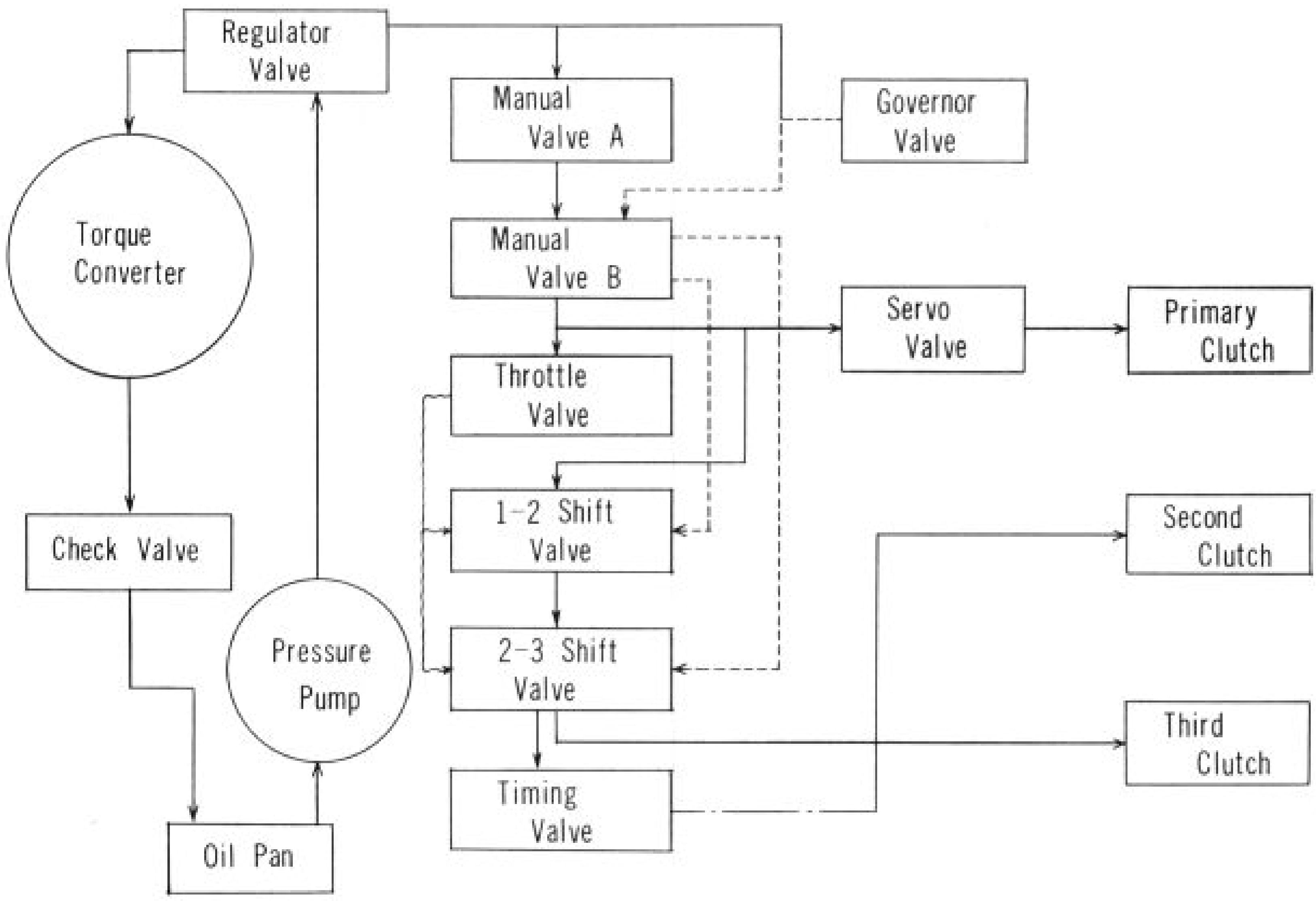


Fig. 7A-48 Hydraulic control diagram

As shown in the diagram, the fluid regulated by the regulator valve is separated into two systems, the torque converter pressure fluid and the line pressure fluid. The line pressure is further regulated. One of the control systems is modulated by the governor, the other is pressure modulated by the throttle valve.

1. Line Pressure

The line pressure is the operating pressure in the line after the pump discharge pressure is regulated by the regulator valve. Normal line pressure is: 6.5 kg/cm^2 (92.5 psi) for A600; 5.0 kg/cm^2 (71.1 psi) for A360.

After passing through the manual valves A and B, the line pressure is transmitted to the servo valve, primary clutch (71.1 psi), throttle valve, 1-2 shift valve, 2-3 shift valve, secondary clutches (second/third clutch) and the timing valve. When the engine speed is below the coupling point and torque is multiplied, the spring cap of the regulator valve will be depressed by the action of the stator and as the result, the line pressure will increase. When the torque converter becomes stalled, the spring cap will move the maximum amount of 10 mm (0.394 in) and a maximum pressure of A600: 13.1 kg/cm^2 (186.3 psi) and A360: 10.2 kg/cm^2 (145.1 psi) will be produced.

The increased line pressure produces a large force at the clutch piston which applies a large clutch friction force. On the line pressure characteristic chart, the horizontal axis is the spring cap movement, and it can also be said that it corresponds to the speed ratio from 0 to 0.82. In other words, the torque ratio from 2.4 to 1 divided into 10 equal units.

When shifting from low to 2nd, with a constant line pressure, the second clutch will receive the full pressure in a short time, causing the sudden engagement of the clutch. To reduce this shock, a timing valve has been incorporated to perform the clutch engagement over a short period of time so that the clutch pressure will be built up gradually.

As shown in the chart, with the vertical axis for the line pressure and the horizontal axis for the time, at the time of up-shift the pressure will be 0 and a short period of time is required before pressure is built up, providing sufficient time to engage the clutch.

	Line Pressure	Maximum Pressure (at stall)
A360	5.0 kg/cm^2 (71.1 psi)	10.2 kg/cm^2 (145.1 psi)
A600	6.5 kg/cm^2 (72.5 psi)	13.1 kg/cm^2 (186.3 psi)

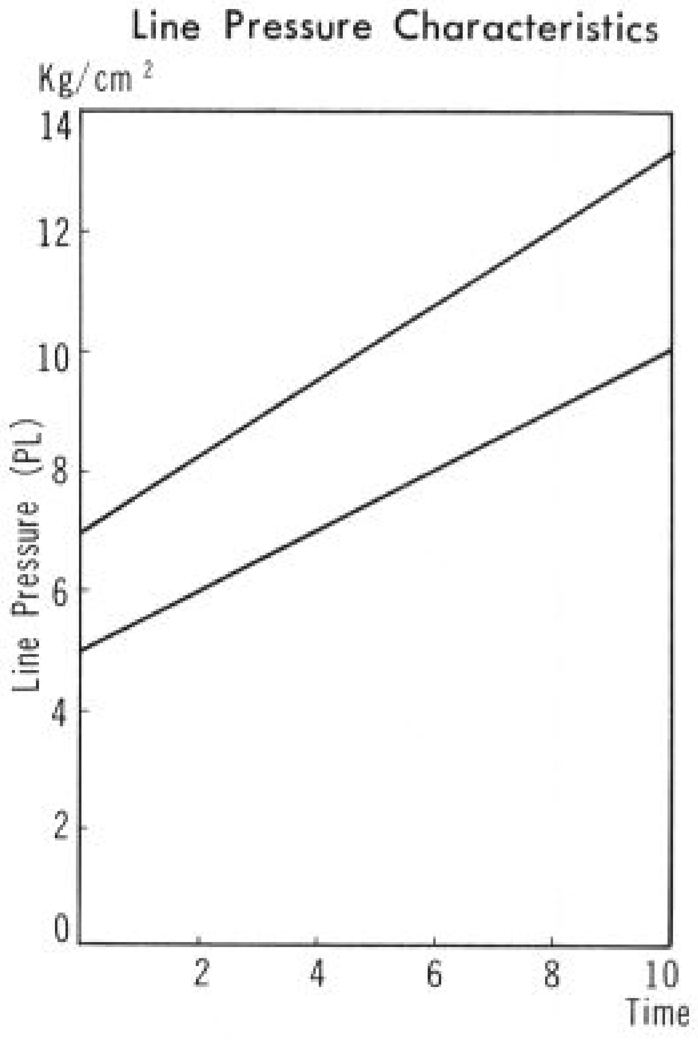


Fig. 7A-49 Spring cap movement due to stator reaction.

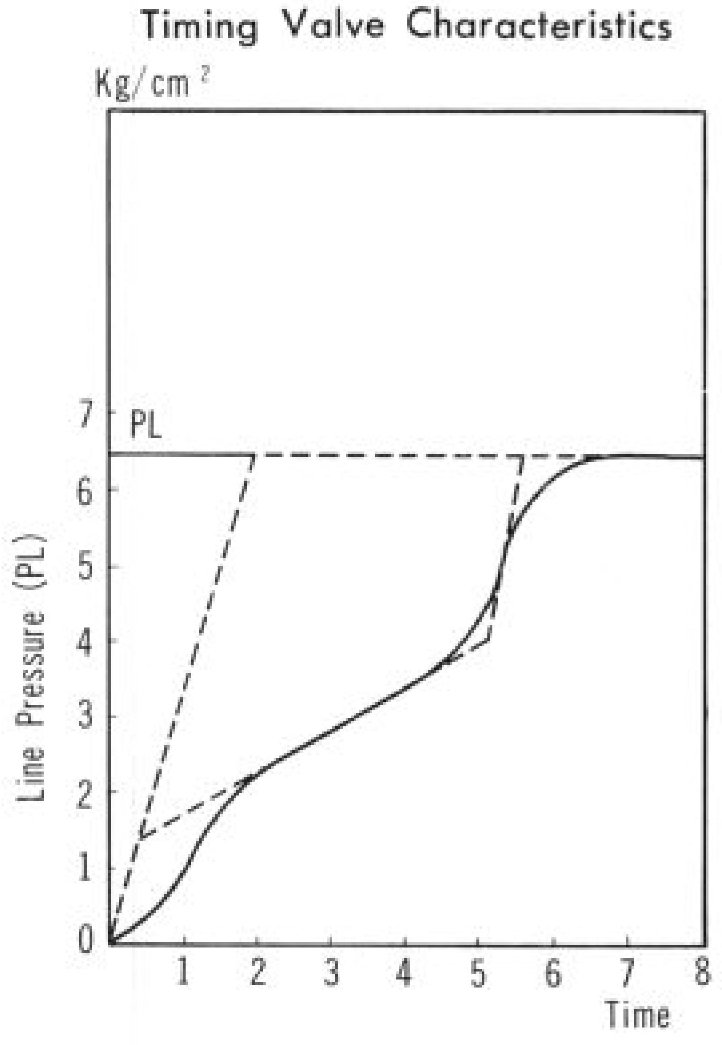


Fig. 7A-50

2. Throttle Pressure

The throttle pressure is produced by modulating the line pressure. This pressure varies corresponding to the degree of throttle opening. When the throttle pressure is produced, this pressure is directed to the throttle pressure line of the 1-2 and 2-3 shift valves.

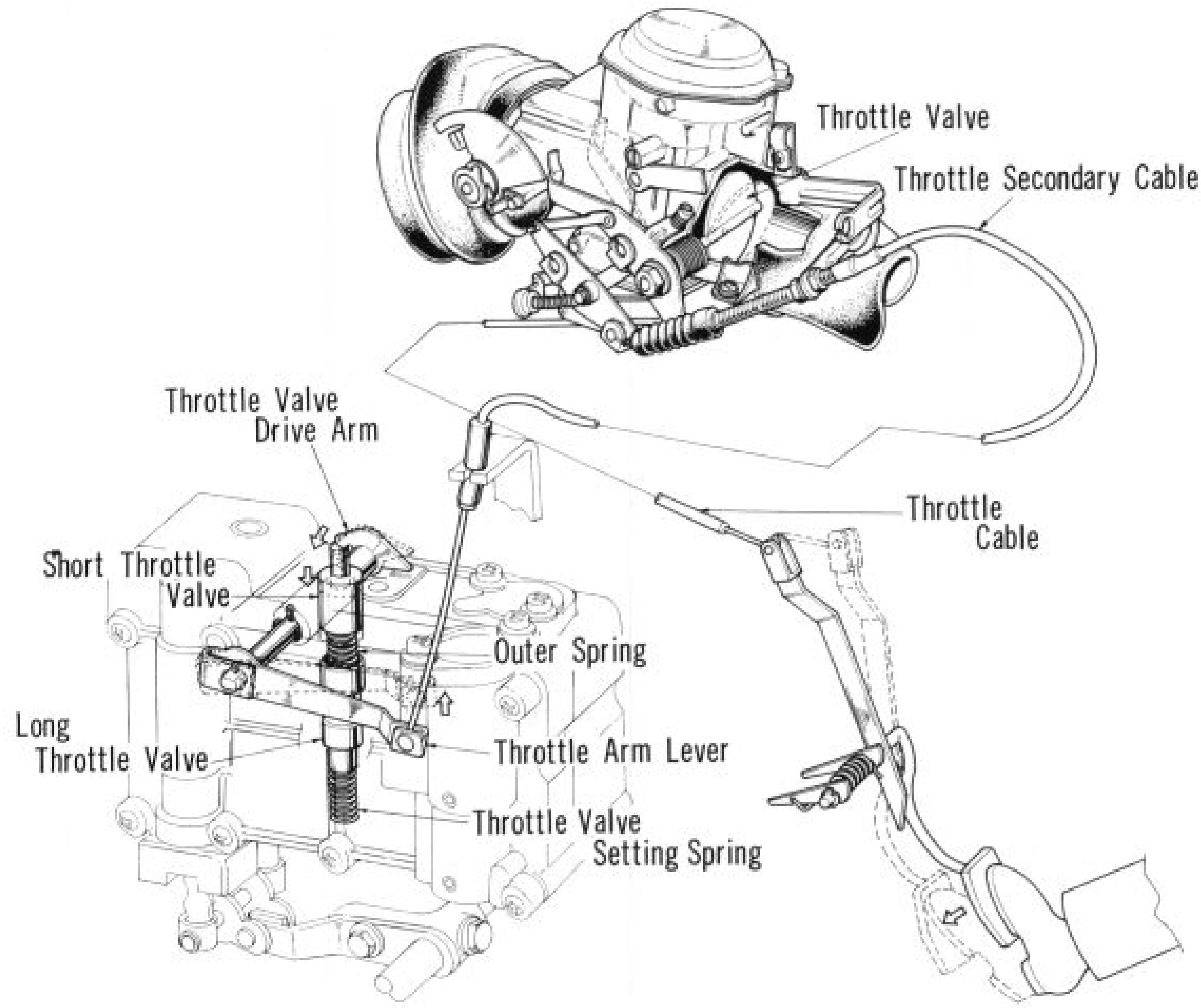


Fig. 7A-51

When the accelerator pedal is depressed, the throttle valve pressure is increased according to the movement of the throttle valve drive arm until the throttle valve pressure becomes equal to line pressure.

The changes in throttle valve pressure at this time are as shown in Fig. 7A-51.

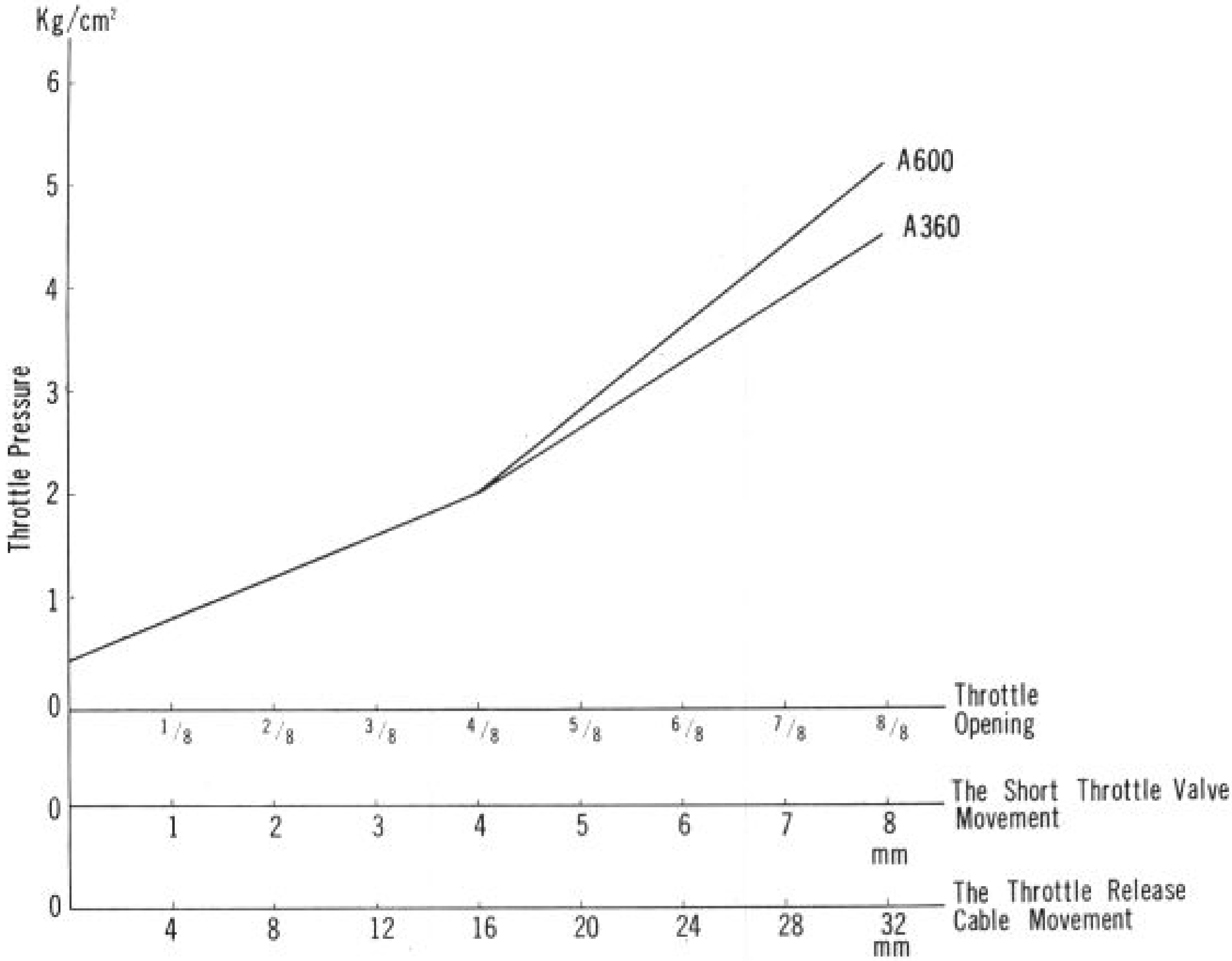


Fig. 7A-52

3. Governor Pressure

The governor pressure varies corresponding to the vehicle speed. The pressure is changed by the centrifugal force of the governor weights mounted on the left end of the countershaft.

This is one of the control pressures which operates the 1-2 shift valve and 2-3 shift valve. The centrifugal force is proportional to the square of the revolution, however, alternate actuation of the two governor weights results in producing a hydraulic pressure which is varied in a direct proportion.

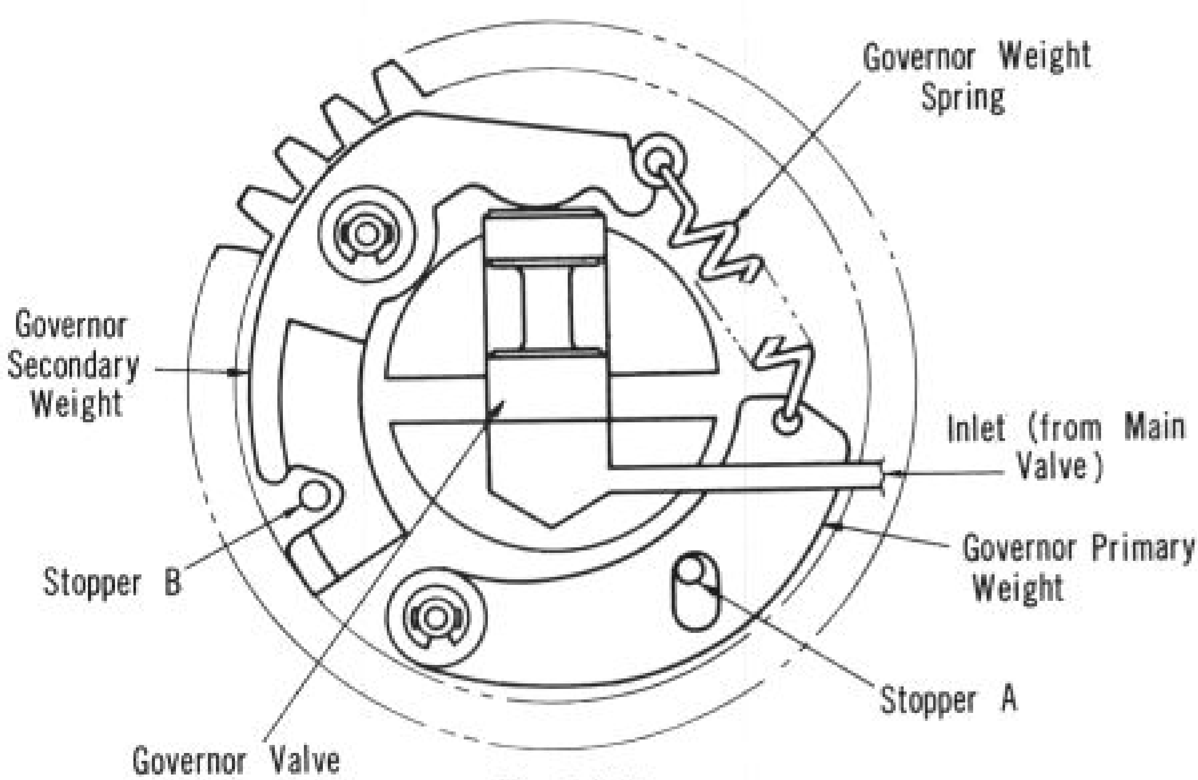


Fig. 7A-53

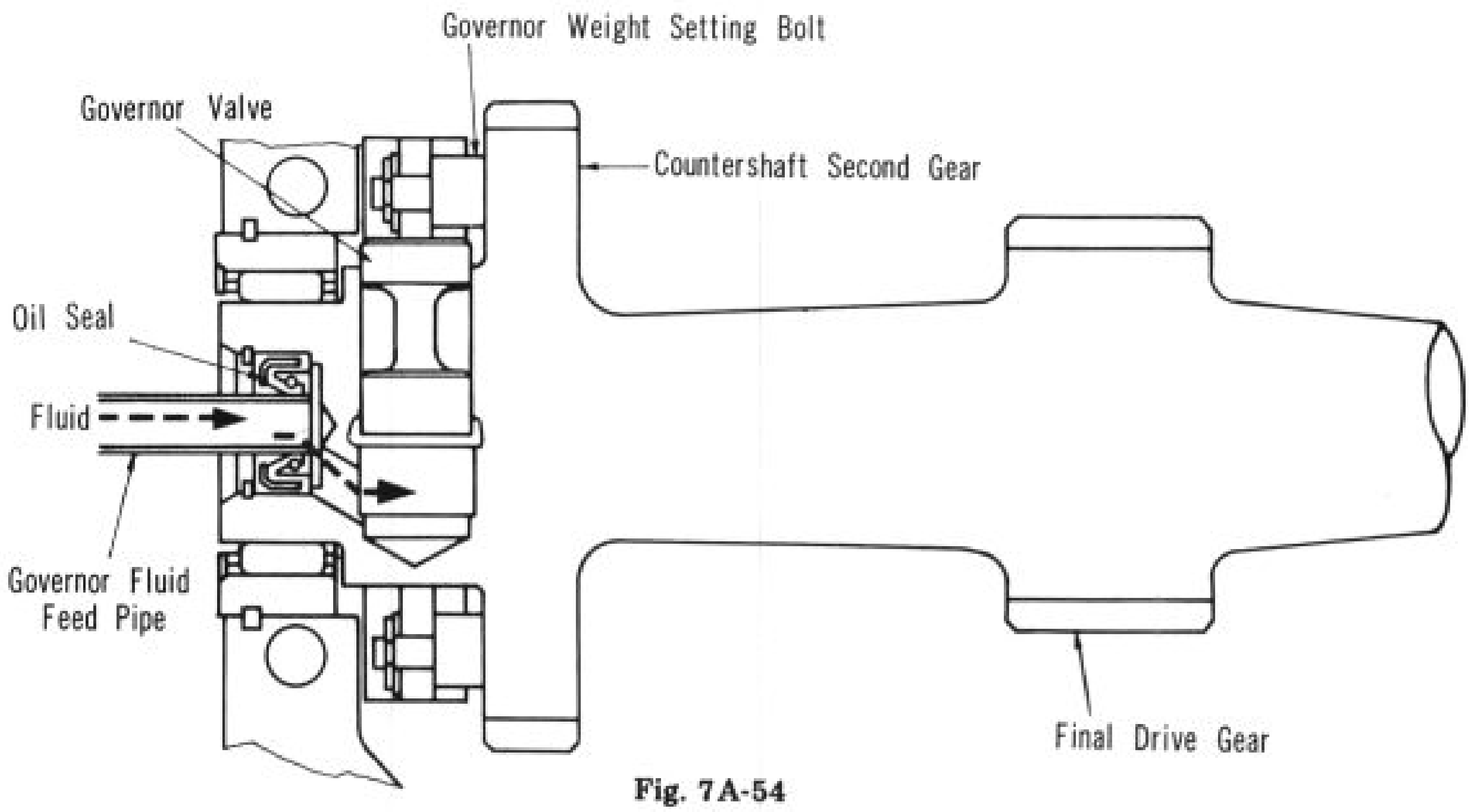


Fig. 7A-54

When vehicle speed is low, the force exerted by the governor weights and spring is balanced by the fluid pressure acting on the governor valve and fluid which is exhausted through the orifice. With the primary weight on the stopper, the secondary weight continues to move until the governor valve closes off the exhaust orifice and governor pressure becomes equal to the line pressure.

The governor action described above is illustrated in Fig.7A-54. Curve 'A' shows the action of both weights and the spring with a slight peak where the primary weight reaches the stopper. Curve 'B' shows the action of the secondary weight.

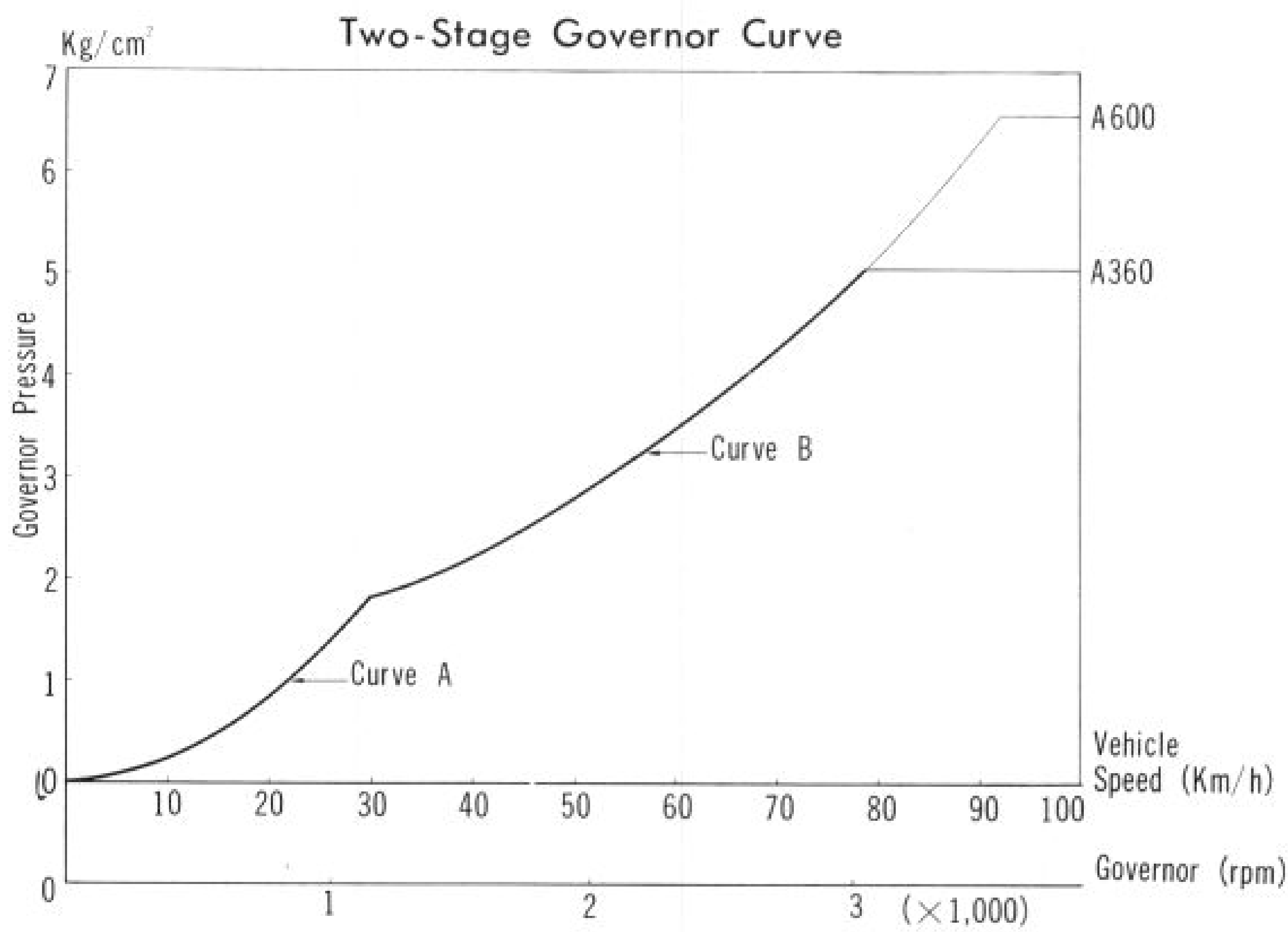


Fig. 7A-55

c) Pressure Pump

1. Description

The pressure pump together with the torque converter pump (impeller) is driven directly by the crankshaft. The pressure pump not only supplies lubricating oil to the moving and friction surfaces of the bearings and gears, but also provides oil to operate the transmission controls. In the automatic transmission, the hydraulic fluid is pressure fed to the fluid passages of the precision machined regulator valve which regulates the fluid pressure, and also to the control mechanisms. Fluid is also provided to the torque converter, check valve and the related components.

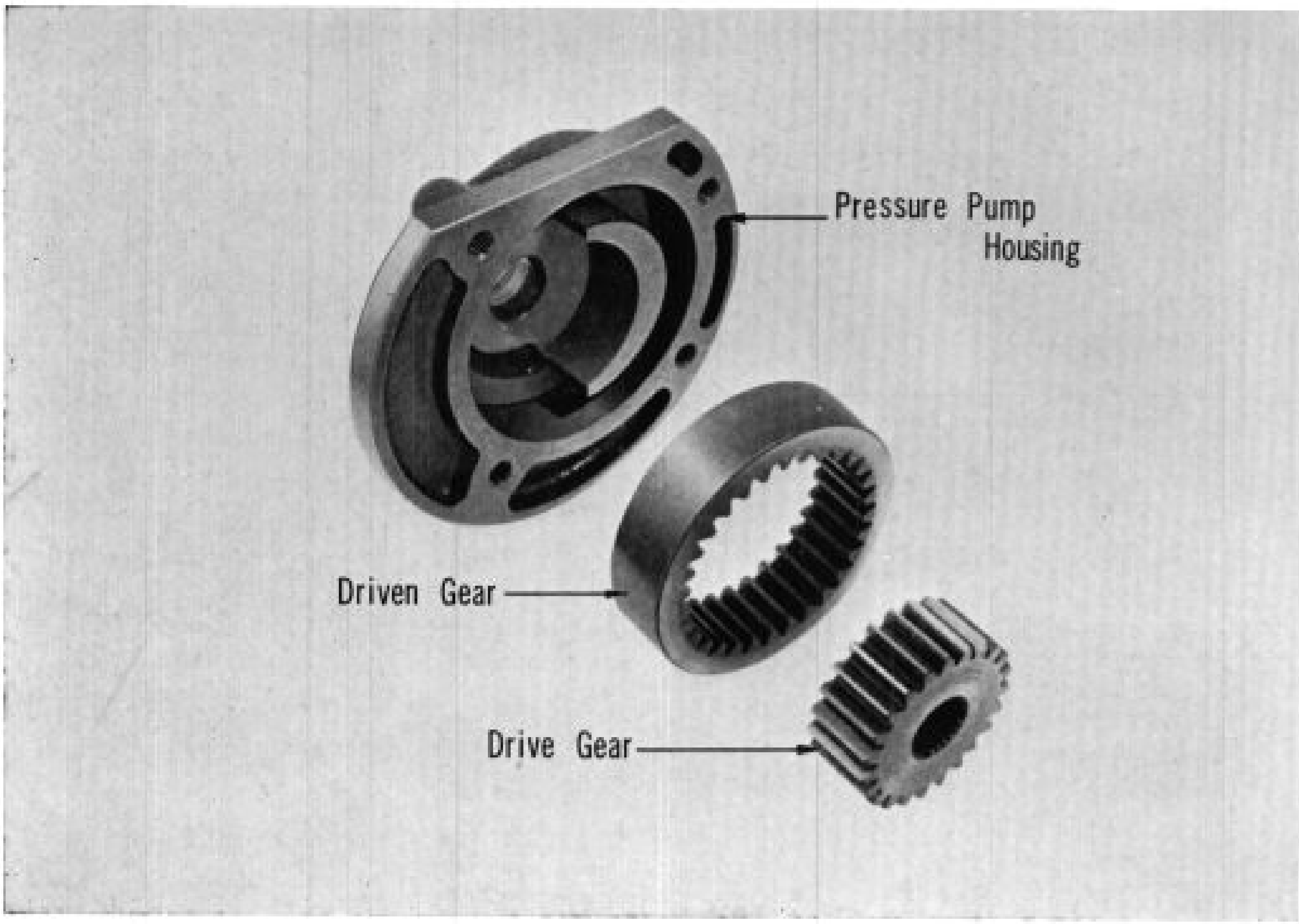


Fig. 7A-56

2. Flow of Hydraulic Fluid

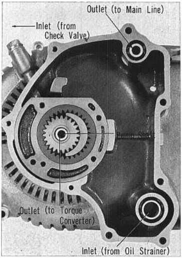


Fig. 7A-57

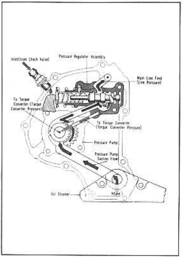


Fig. 7A-58

Locations of inlets and outlets for pressure pump

When the engine starts and the oil pressure pump is driven, the hydraulic fluid is sucked into the pump from the oil strainer through the fluid passages in the crankcase left side cover and torque converter case.

The fluid flow within the torque converter case cover (from oil strainer to main line feed via regulator valve) is shown in the figure above. The flow of hydraulic fluid is controlled by the pressure regulator, and is divided into line pressure and torque converter pressure before delivery to each section.

The line pressure enters the main valve body after passing through the torque converter case cover, torque converter case and crankcase left side cover.

The torque converter pressure passes through the torque converter case cover from the regulator valve, then enters the torque converter housing through the torque converter pump (impeller) shaft.

d) Hydraulic Control Valves

1. Regulator Valve

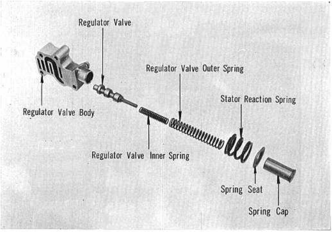


Fig. 7A-59

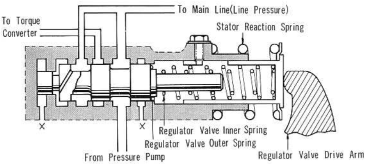


Fig. 7A-60

The fluid from the pressure pump enters the regulator valve passage and is forced through the orifice in the regulator valve, pushing the valve from the left side of the regulator. The regulator valve at this time is under spring force of regulator valve outer spring from the right side. When the fluid pressure overcomes the spring force, the regulator valve moves toward the right, exposing the fluid port to the torque converter, and causing the fluid pressure from the pressure pump to drop.

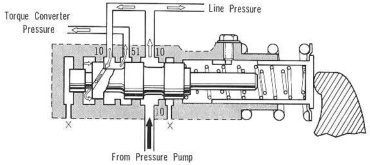


Fig. 7A-61 When engine speed is low

In this way a balance is maintained between the fluid pressure operating against the valve, and the force of the regulator valve outer spring forcing the valve in the opposite direction. At this time the fluid pressure is referred to as the line pressure. This line pressure is the standard operating pressure of the system. In the A360, this pressure is 5 kg/cm² (71.1 psi) and the A600,the pressure is 6.5 kg/cm² (92.5 psi).

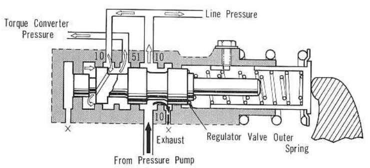


Fig. 7A-62 When engine speed is high and pumping volume is great.

As the engine speed increases, the pressure pump discharge volume also increases and the valve moves toward the right, enlarging the area of the passage leading to the torque converter so that a balanced condition is maintained. When the engine is stopped, the valve is pushed toward the left by spring force closing the port leading to the torque converter and preventing the fluid from flowing out of the torque converter.

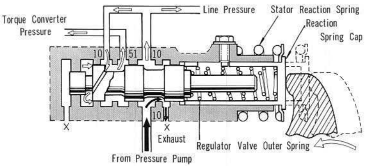


Fig. 7A-63 When stator reaction force is at its maximum. (Line pressure further increases due to spring).

The operation of the regulator valve inner spring and the stator reaction spring will be discussed next.

Within the torque multiplication range of the torque converter, greater torque is applied to the primary clutch. Therefore, its capacity must be increased in the HONDAMATIC. This is accomplished by increasing the line pressure which actuates the primary clutch.

At maximum torque multiplication the reaction force applied by the regulator valve drive arm will produce a 10 mm movement of the stator reaction spring cap. This movement applies extra pressure to the regulator valve through the regulator valve inner and outer springs. In order for the valve to remain balanced, fluid pressure which actuates the valve must be increased and line pressure increases accordingly.

2. Throttle Valve

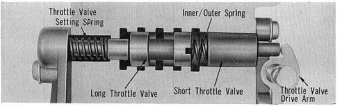


Fig. 7A-64

Throttle valve functions to modulate the throttle pressure in correspondence with the degree of throttle opening. Accelerator pedal and the throttle valve drive arm are connected by the throttle cable and throttle secondary cable with the carburetor in between. Thus, the throttle valve drive arm actuates the short throttle valve in proportion to the carburetor throttle opening, which produces the throttle pressure.

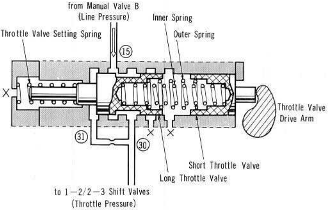


Fig. 7A-65 The throttle valve in idle condition

As shown in Fig. 7-65 with the throttle valve in the idle position, the throttle valve drive arm is in light contact with the short throttle valve.

1. Initially, when the carburetor throttle opening is zero, the drive arm is only in contact with the short throttle valve.
2. The long throttle valve is set so that there is only a little flow between 15 and 30, when no line pressure is produced, i.e., in the Neutral and in the Parking positions.
3. The throttle valve setting spring and inner spring are set so that the long throttle valve only moves slightly to a produce throttle pressure of 0.4 kg/cm^2 (5.69 psi).
4. As the accelerator pedal is depressed, the throttle valve inner spring is compressed and pressure at 31 increases, accompanied by very little movement of the long throttle valve. In other words, the pressure at 30 increases with the throttle opening, and when opened to 1/2, the throttle pressure becomes 2 kg/cm^2 (28.5 psi).

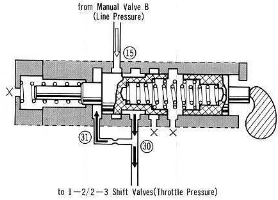


Fig. 7A-66 D2 range with 1/2 throttle opening

5. As the accelerator pedal is further depressed to 1/2 throttle opening, the throttle valve outer spring starts to function. Thus, the force of the outer spring and inner spring will balance, and the throttle pressure is modulated.

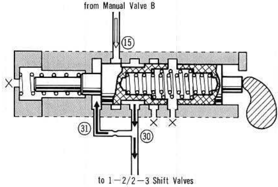


Fig. 7A-67 D3 range with 3/4 throttle opening

6. With the throttle fully open, the throttle pressure of A600 becomes 6 kg/cm² (85.3 psi) and for A360, 4.5 kg/cm² (64.0 psi)

   Note:
   The short throttle valve transmit the force by the way of the inner and outer springs to the long throttle valve and never comes in contact. The function of the throttle valve setting spring is merely to position the long throttle valve when the line pressure of 15 is 0.

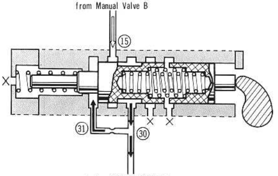


Fig. 7A-68 D_3—D_2 kickdown (throttle fully open)

3. Governor Valve

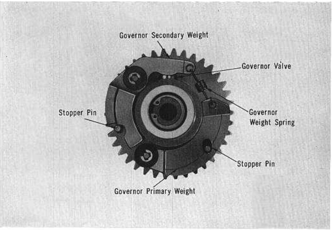


Fig. 7A-69 Governor valve assembly

The governor valve is mounted on the transmission countershaft second gear and is operated by the centrifugal force acting upon the governor weights. It produces the fluid pressure which represents speed of the countershaft (vehicle speed). This valve operates only when the vehicle is in motion. The variation in governor pressure is one of the factors that determines the speed at which the gears change. There are two different weights installed on the governor, the primary weight and the secondary weight. They operate together and perform the shifting according to vehicle speed and engine loading. The primary governor weight is made heavier and at low speed it, and the secondary governor weight, together with the governor spring cause the governor valve to operate; however, at high speed, a stopper pin restricts the movement of the primary governor weight and the secondary governor weight and spring take over and provide the required fluid pressure.

As shown in Fig.7A-70 when the vehicle is stationary, the governor valve is forced to the top by the fluid. The fluid restricted by the orifice pours out from the exhaust port producing no pressure rise. As the countershaft begins to rotate the governor weights also start to rotate and at low speed the centrifugal force produced by the governor weights forces the governor valve to move downward causing the balanced pressure rise of the fluid.

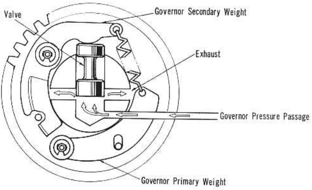


Fig. 7A-70 Governor valve open position

When a certain speed is exceeded (3900 rpm for A360, 3300 rpm for A600), the force produced by the governor weights equals the line pressure applied against the governor valve and closes the fluid outlet port. (Fig. 7A-71)

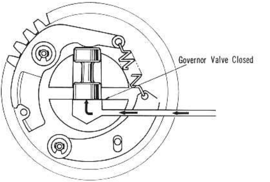


Fig. 7A-71 Schematic of governor valve in the closed position
Note that line pressure fluid cannot pass governor valve.

The reason for the primary and the secondary governor weights being used together is that centrifugal force varies as the square of the speed of rotation as has been previously explained. By using two governor weights in series, the vehicle speed and the governor pressure can be made to vary in direct proportion. The governor pressure is effected by the centrifugal force of the governor weights, and provides the line fluid pressure which is proportional to the countershaft speed. The purpose of the orifice located in the passage between the main line and the governor valve is to prevent the line pressure from dropping which would otherwise result from the lowering of the governor pressure.

4. Servo Valve

In the HONDAMATIC transmission, only the reverse shift is the dog engaging transmission type. The servo valve causes the reverse select gear to shift, placing the primary clutch in the disengaged position momentarily. By shifting the manual valve to the "R" range, the fluid pressure is directed into the reverse line and is applied to the servo piston, forcing it to move. A groove is machined in the shift fork shaft which is connected to both the servo piston and the shift fork, serving as the valve spool.

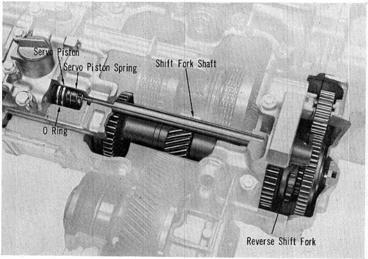


Fig. 7A-72

As the reverse shift fork shaft begins to move, the line pressure to the primary clutch is blocked off. Line pressure is re-directed to the primary clutch through the line pressure passage from manual valve (B) toward the end of the shaft travel. When the shift from R to N is made, the reverse shaft returns to its normal position by spring force.

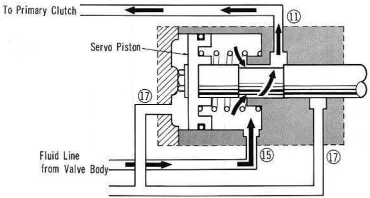


Fig. 7A-73

In the reverse range, the servo piston/shift fork shaft is moved toward the right by force B built up from the line pressure A. This pressure is also directed to the passage leading to the primary clutch, engaging the primary clutch.

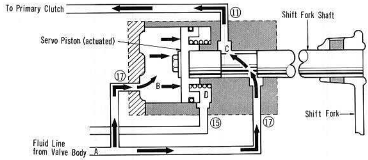


Fig. 7A-74

5. Main Manual Valves

Manual Valves A and B

The manual valves are connected to the selector lever and permits the driver to perform the selection by operating this lever. The P, R, N, D, 3, 2 and 1 positions can be selected to formulate the respective hydraulic control circuit. The use of a single valve would necessitate a long valve, therefore, the valve is made into two sections with both sections of the valve operating simultaneously. **(Fig. 7A-75)**

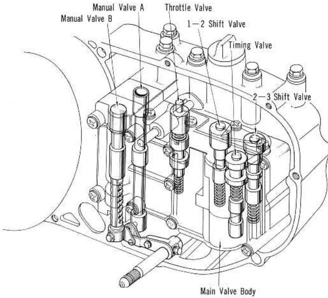


Fig. 7A-75

[N] Neutral

In this position, passages 15 and 17 are open and the primary clutch is disengaged. The governor pressure circuit is the same as in the "D" position. Regulator pressure is blocked at passage 10, and the residual pressures in the second and third clutches are relieved through the 1-2 and 2-3 shift valves, and the manual valve. Throttle pressure is not produced because passage 15 is open.

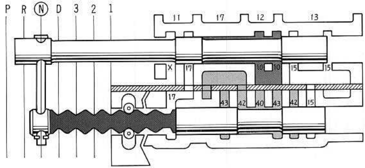


Fig. 7A-76

[D] Drive (automatic shifting)

Passage 17 is opened and the residual pressure from the reverse side of the servo cylinder is exhausted. Line pressure 10 is connected to passage 15; pressure from the regulator first fills the front side of the servo piston and then engages the primary clutch. The pressure in passage 15 produces the pressure which is consistent with the opening of the throttle valve, and becomes the operating pressure for the secondary clutches. Governor pressure consistent with the vehicle speed is supplied from passage 40 to passages 42 and 43, and applying pressure to the governor pressure side of the 1-2 and 2-3 shift valves.

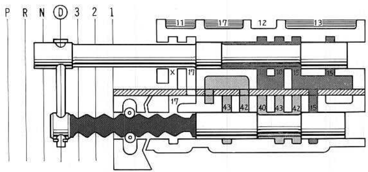


Fig. 7A-77

[1] Low (manual shifting)

Passage 17 is opened, passage 15 is connected to passage 10, and similar to position [D], the primary clutch is engaged, throttle pressure is produced, and the secondary clutch operating pressure is directed to the 1-2 shift valve. Since passage 40 is blocked, governor pressure consistant with the vehicle speed is produced only within this passage and does not operate the shift valves. Passages 42 and 43 are open and there is no pressure at the governor end of the 1-2 and 2-3 shift valves. The valves are held toward the governor end by the force of the spring and throttle pressure. The secondary clutch operating pressure is blocked by the 1-2 shift valve and no pressure is directed to operate the secondary clutch. The residual pressure from the second and third clutches is relieved through the 1-2 and 2-3 shift valves.

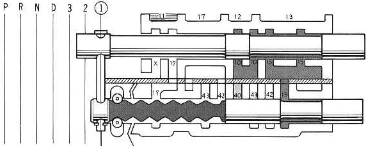


Fig. 7A-78

[2] Second (manual shifting)

Passage 17 is opened, passage 15 is connected to passage 10, and similar to position (D), the primary clutch is engaged, throttle pressure is produced, and the secondary clutch operating pressure is directed to the 1-2 shift valve. Since passage 40 is blocked, governor pressure consistant with the vehicle speed is produced only within the passage. Passage 42 is connected to passage 10 through passage 15 and as a result, line pressure is directed to the governor pressure end of the 1-2 shift valve. Therefore, the 1-2 shift valve is moved toward the throttle pressure side, permitting the line pressure to be directed to the secondary clutch. Passage 43 is opened and the pressure directed against the governor pressure end of the 2-3 shift valve drops to zero. The valve is moved toward the governor pressure side by the force of the valve spring and throttle pressure, and the clutch operating pressure is directed to engage the second clutch. The residual pressure from the third clutch is relieved through the 2-3 shift valve.

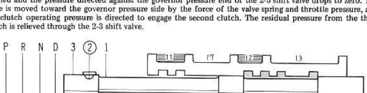


Fig. 7A-79

[3] Third (manual shifting)

Passage 17 is opened. Passage 15 is connected to passage 10, the primary clutch engages as for position (D) throttle pressure is produced and the secondary clutch operating pressure is directed to the 1-2 shift valve. Since passage 40 is blocked, governor pressure consistant with the vehicle speed is produced only within this circuit. Passages 42 and 43 are connected to passage 10 through passage 15, applying line pressure to the governor pressure end of the 1-2 and 2-3 shift valves. Therefore, even if the throttle pressure increases to equal the line pressure, the 1-2 and 2-3 shift valves remain at the throttle pressure end due to the larger valve surfaces of the governor end. Without regard to vehicle speed or throttle opening, the clutch operating pressure is directed through the 1-2 and 2-3 shift valves and then to the third clutch. The residual pressure of the second clutch is relieved through the 2-3 shift valve.

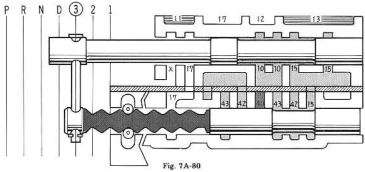


Fig. 7A-80

[R] Reverse

Pressure in circuit No. 15 is relieved and the residual pressure within the back end of the servo cylinder is dissipated. The line pressure 10 from the cylinder will be directed into circuit No. 17, forcing the servo piston to move and causing the reverse select gear to mesh. This opens the servo valve on the reverse side and fluid pressure from circuit No. 17 is directed to the primary clutch. If oil pressure is not directed to the governor with reverse selected, the governor weights would start to vibrate which might cause damage, therefore, circuits 40, 42 and 43 are connected to produce governor pressure suited to the vehicle speed. This governor pressure is directed to both the 1-2 and 2-3 shift valves, but as the pressure in circuit No. 15 is relieved, there is no pressure to engage the 2nd clutch and 3rd clutches. The residual pressures of the 2nd clutch and the 3rd clutch is relieved from the 1-2 and 2-3 shift valves or the manual valve as the pressure in circuit No. 15 is relieved, throttle pressure does not develop.

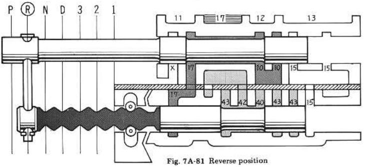


Fig. 7A-81 Reverse position

[P] Parking

The circuits No. 15 and 17 are relieved, the residual pressure from the primary clutch is dissipated, the clutch is disengaged and the engine torque is not transmitted. The pressure from the regulator is blocked at the passage No. 10. The drive wheel is mechanically locked. The governor pressure circuit 42 and 43 leading to shift valves 1-2 and 2-3 are relieved by circuits No. 42 and the residual pressures from the 2nd clutch and 3rd clutch are relieved through shift valves 1-2 and 2-3. As the pressure in circuit No. 15 is relieved, throttle pressure does not develop.

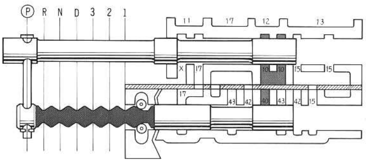


Fig. 7A-82 Parking position

6. 1-2 Shift Valve

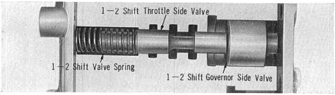


Fig. 7A-83

The 1-2 shift valve performs the automatic engagement or disengagement of the secondary clutches, depending upon the throttle opening and the vehicle speed within the " D " range. In addition to the 1-2 shift valve, there is a 2-3 shift valve which performs the shifting between the second and third speeds. Description will be given in the following section.

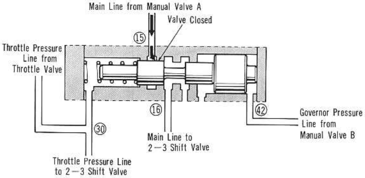


Fig. 7A-84 Stationary condition

At low speed, the 1-2 shift valve will move, and next,when a certain predetermined vehicle speed is attained, the 2-3 shift valve will start to move, this being one of the primary conditions. In other words, the line pressure for the 2-3 shift valve will be supplied through fluid passage after the 1-2 shift valve is operated. The pressure actuating area differential between the governor side and the throttle side of the 1-2 shift valve is greater than that of the 2-3 shift valve, and the spring force of the 2-3 shift valve is greater than that of the 1-2 shift valve. When the governor pressure is low, the 1-2 shift valve only will start to operate, and when in the stationary condition where the governor pressure is non-existent and only the throttle pressure is in operation, the throttle pressure and the valve spring force on the throttle pressure side of the 1-2 shift valve will push the 1-2 shift valve to the right, close the main line, and open the passage to the second clutch After the vehicle starts moving and until such time that the governor pressure reaches a certain pressure, gear will remain in low without engaging the secondary clutches.

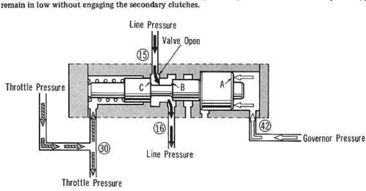


Fig. 7A-85 Operating condition

As the vehicle speed increases and governor pressure rises, the 1-2 shift valve spring and the throttle pressure will be overcomed and the 1-2 shift valve will move to the left, blocking off the drain passages marked with an "X". Line pressure will be directed through passage 16, through the 2-3 shift valve, to the timing valve and then engages the second clutch.

Governor pressure is applied to area "A" on the governor side of the 1-2 shift valve and throttle pressure to area "C" on the throttle of the 1-2 shift valve. If governor pressure now begins to decrease, assuming a constant throttle pressure governor pressure must be considerably less than that required for the up-shift before a down-shift will take place. This is due to the difference in cross-sectional area between areas "A" and "C" of the valve.

Therefore, line pressure is directed between "B" and "C" sections of the shift valve, however, since the sectional area of the "C" section is larger, the shift valve will move toward the left. This effect is known as the "Hysterisis Effect" and has been designed into the system in order that the down-shift will take place at a lower speed than the up-shift. This prevents the constant up and down shifting which would otherwise occur when the vehicle is being operated at speeds close to the shift point.

7. 2-3 Shift Valve

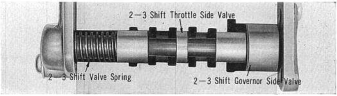


Fig. 7A-86

As the vehicle speed decreases, the hysteresis effect in the 2-3 shift valve will be the same as that in the 1-2 shift valve.

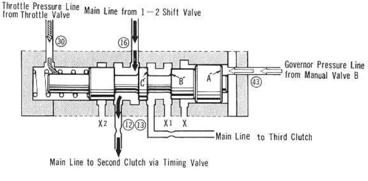


Fig. 7A-87 Shift valve when running in second

While driving in second gear in (D) range and with an increase in speed (governor pressure increase), the 2-3 shift valve will start to move toward the left, while the 1-2 shift valve is maintained in an operational status as previously described. The 2-3 shift valve up to this time is held at the right side by the force of the 2-3 shift valve spring together with the throttle pressure overcoming the lesser counter force of the governor pressure. Under this condition, the line pressure from the 1-2 shift valve is directed through an orifice and the timing valve to the second clutch.

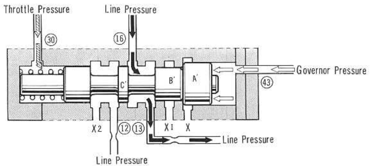


Fig. 7A-88 Shift valve when running in third

As the vehicle speed increases, the force of the governor pressure overcomes the combined spring and the throttle pressure forces of the 2-3 shift valve, and moves the shift valve toward the left, closing the X1 drain hole and opening X2 drain hole. At this time, the line pressure which was directed to the second clutch is now redirected to the third clutch; the residual pressure in the second clutch is relieved from passage X2. This completes the shifting to the third gear.

Next, as the vehicle speed decreases, hysterisis takes place since the shift valve diameter of C section is larger than that of B section, the action will be the same as for the 1-2 shift valve, however, the only difference is that for the 1-2 shift valve the line pressure is blocked when shifting from second to low gear and the residual pressure from the second clutch is relieved from the drain hole; but in the 2-3 shaft valve, when shifting from third gear to second gear, the main line pressure which was directed to the third clutch will be redirected to the second clutch and the residual pressure from the third clutch is relieved from the X1 drain hole. The 1-2 shift valve will continue to function. The restricter orifices located in the second clutch and the third clutch passages are to prevent sudden pressure surge when shifting up or down from the respective gears. Within the manual range, the governor pressure is blocked by the manual valve B, and the shift valves are operated by applying the line pressure or relieving the pressure at the governor pressure ends of the shift valves.

8. Timing Valve

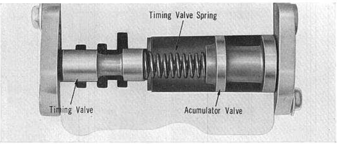


Fig. 7A-89

When shifting from low to second gear, a large pressure surge in a form of a shock will be produced. To prevent this undesirable condition, a timing valve is installed between the 2-3 shift valve and the second clutch. It serves to provide a smooth action when shifting from third to second gear.

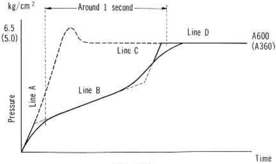


Fig. 7A-90

As shown in Fig. 7A-90, when shifting from low to second, a pressure sugre(dotted line)is produced which would cause a harsh shift. To prevent this harsh shift, a timing valve is installed between the 2-3 shift valve and the second clutch. The timing valve controls the surge giving the gradual pressure rise shown by the solid line.

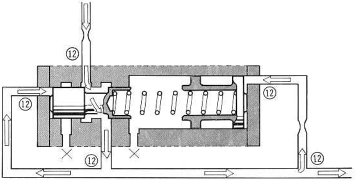


Fig. 7A-91 When the line pressure flows from the 2-3 shift valve it flows through the timing valve in the fluid passage to the second clutch and furnish fluid over to both sides of the valves.

When there is no line pressure from 2-3 shift valve, the accumulator valve and timing valve are moved to the right and left respectively by the timing valve spring. When the line pressure starts to flow from the 2-3 shift valve, the fluid enters the second passage through the timing valve, and also into the left side of the timing valve and into the right side of the accumulator valve through the orifice B. After filling the cavity in the passage, the second clutch operating pressure begins to increase at the same time. Until the operating pressure increases to a certain pressure, the timing valve spring force surpasses the operating pressure force and holds the inlet port of the timing valve open **(Fig. 7A-91, line A in Fig. 7A-92).**

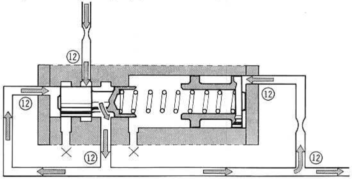


Fig. 7A-92

When the second clutch operating pressure reaches a certain pressure, the pressure force toward the right balances with the timing valve spring force toward the left, and the operating pressure is controlled by the spring force. The orifice installed in the fluid passage restricts the fluid flow to the accumulator vâlve, which moves gradually toward the left. As the accumulator valve moves toward the left, the timing valve spring is compressed and the second clutch operating pressure increases gradually corresponding with the timing valve spring force **(Fig. 7A-91, Fig. 7A-92).**

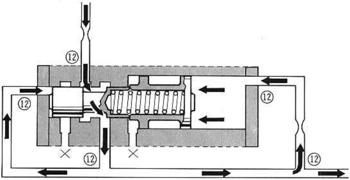
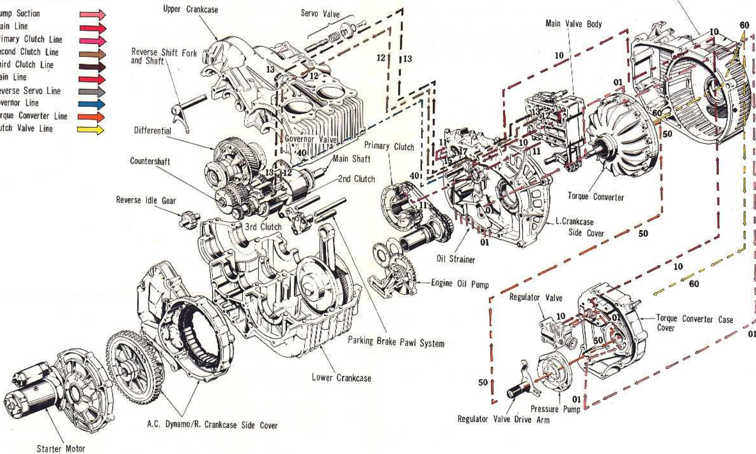


Fig. 7A-93

When the accumulator valve and the timing valve are in contact, the spring is no longer active and the valves move toward the left by the surpassing force of the accumulator valve, and the inlet port of the timing valve is opened (Fig. 114). The operating pressure rises rapidly until it reaches the line pressure. An orifice A is incorporated into the line to give a smooth and gradual pressure rise **(lines C and D in Fig. 7A-92).**

HYDRAULIC FLUID CIRCULATION

Code No.	Description of Pressure	Color
01	Pump Suction	
10	Main Line	
11	Primary Clutch Line	
12	Second Clutch Line	
13 ·	Third Clutch Line	
15	Main Line	
17	Reverse Servo Line	
40	Governor Line	
50	Torque Converter Line	
60	Clutch Valve Line	



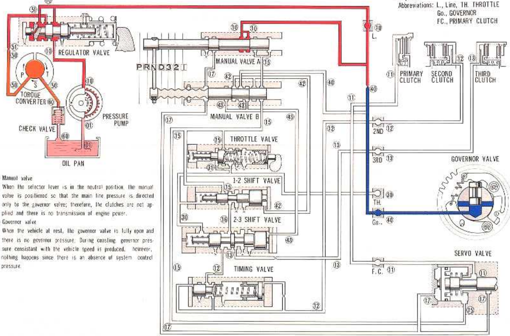
Hydraulic circuit codes and description

Code No.	Identi-fication	Description of pressure	Theoretical pressurerange (kg/cm 2		Remarks
			N360AT	N600AT	
01		Pump suction	Less than 0		
10		Line	5.0～10.02	6.5～13.1	According to torque converter speed
11		Primary clutch line	5.0～10.2	6.5～13.1	In D,1,2,3 and R
12		Second clutch line	5.0～10.2	6.5～13.1	In D and 2
13		Third clutch line	5.0～10.2	6.5～13.1	In D and 3
15		Line	5.0～10.2	6.5～13.1	In D,1,2 and 3
16		Line	5.0～10.2	6.5～13.1	In D,2 and 3
17		Reverse line	5.0～10.2	6.5～13.1	In R
30		Throttle	0.4～4.5	0.4～5.2	According to depression of accelerator pedal
31		Throttle controlled by orifice	0.4～4.5	0.4～5.2	
40		Governor	0～5.0	0～6.5	According to vehicle speed
42		Governor	0～5.0	0～6.5	In D,2 and 3
43		Governor	0～5.0	0～6.5	In D and 3
50		Torque converter	0.8～1.5	0.8～1.5	
51		Torque conver-ter inlet	0.8～5.0	0.8～6.5	
60		Check valve	0.8～1.2	0.8～1.2	

"N" Range
THROTTLE OPENING:
CLOSED (ENGINE IDLING:1,200rpm)

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



* Manual valve

When the selector lever is in the neutral position, the manual valve is positioned so that the main line pressure is directed only to the governor valve; therefore, the clutches are not applied and there is no transmission of engine power.

* Governor valve

When the vehicle at rest, the governor valve is fully open and there is no governor pressure. During coasting, governor pressure consistant with the vehicle speed is produced. however, nothing happens since there is an absence of system control pressure.

"D1" Range

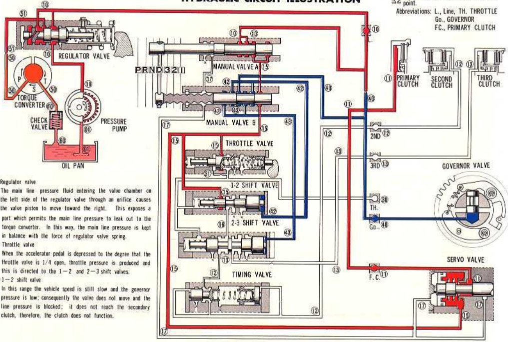
THROTTLE OPENING: 1/4

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.

Marks indicate fluid pressure check point.

Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



*Regulator valve

The main line pressure fluid entering the valve chamber on the left side of the regulator valve through an orifice causes the valve piston to move toward the right. This exposes a port which permits the main line pressure to leak out to the torque converter. In this way, the main line pressure is kept in balance with the force of regulator valve spring.

* Throttle valve

When the accelerator pedal is depressed to the degree that the throttle valve is 1/4 open, throttle pressure is produced and this is directed to the 1—2 and 2—3 shift valves.

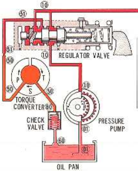
*1—2 shift valve

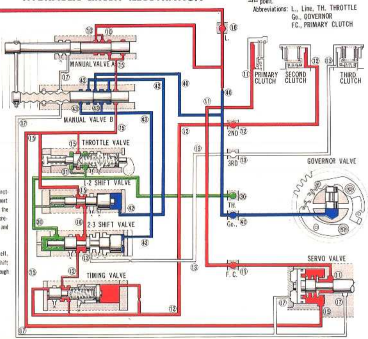
In this range the vehicle speed is still slow and the governor pressure is low; consequently the valve does not move and the line pressure is blocked; it does not reach the secondary clutch, therefore, the clutch does not function.

"D2" **Range**
THROTTLE OPENING : 1/2

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH





* Throttle valve

When the accelerator is depressed to the degree that the throttle is 1/2 open, the throttle valve drive arm pushes the short throttle valve which in turn pushes the long throttle valve to the left by way of a spring in between. This produces a throttle pressure which is balanced by the throttle valve setting spring and the inner/outer springs.

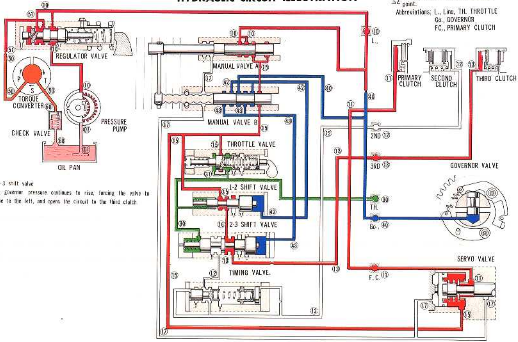
* 1−2 shift valve

As the governor pressure rises, the valve moves toward the left, opening the circuit to the 2−3 shift valve. The 2−3 shift valve does not move, therefore, the pressure is directed through the timing valve to the second clutch.

HYDRAULIC CIRCUIT ILLUSTRATION

"D3" Range
THROTTLE OPENING: 3/4

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH

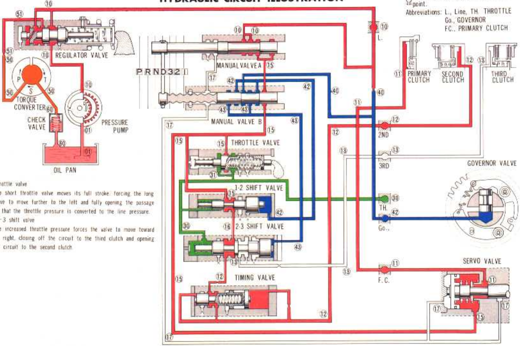


* 2—3 shift valve
The governor pressure continues to rise, forcing the valve to move to the left, and opens the circuit to the third clutch

"D3"—"D2" **Kick-down**
THROTTLE OPENING: Fully open

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
F.C., PRIMARY CLUTCH



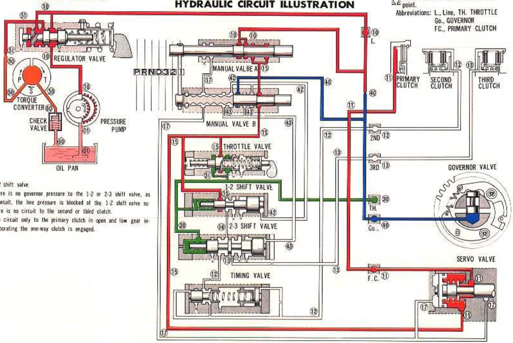
* Throttle valve
The short throttle valve moves its full stroke, forcing the long valve to move further to the left and fully opening the passage so that the throttle pressure is converted to the line pressure.

* 2—3 shift valve
The increased throttle pressure forces the valve to move toward the right, closing off the circuit to the third clutch and opening the circuit to the second clutch.

HYDRAULIC CIRCUIT ILLUSTRATION

"M1" **Range**
THROTTLE OPENING: 1/2

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



* 1-2 shift valve

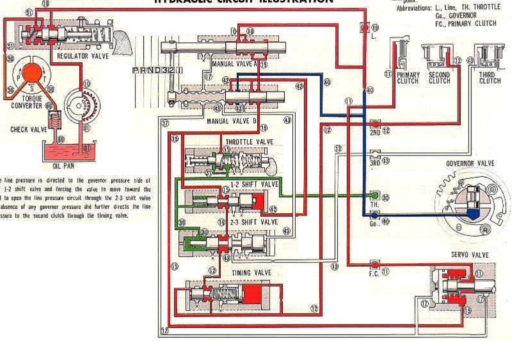
There is no governor pressure to the 1-2 or 2-3 shift valve, as a result, the line pressure is blocked at the 1-2 shift valve so there is no circuit to the second or third clutch.

The circuit only to the primary clutch in open and low gear incorporating the one-way clutch is engaged.

HYDRAULIC CIRCUIT ILLUSTRATION

"M2" Range
THROTTLE OPENING: 1/2

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
F.C., PRIMARY CLUTCH

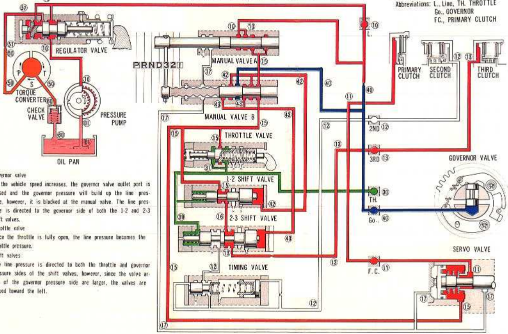


* The line pressure is directed to the governor pressure side of the 1-2 shift valve and forcing the valve to move toward the left to open the line pressure circuit through the 2-3 shift valve in absence of any governor pressure and further directs the line pressure to the second clutch through the timing valve.

"M3" Range
THROTTLE OPENING: Fully Open

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



* Governor valve

As the vehicle speed increases, the governor valve outlet port is closed and the governor pressure will build up the line pressure, however, it is blocked at the manual valve. The line pressure is directed to the governor side of both the 1-2 and 2-3 shift valves.

* Throttle valve

Since the throttle is fully open, the line pressure becomes the throttle pressure.

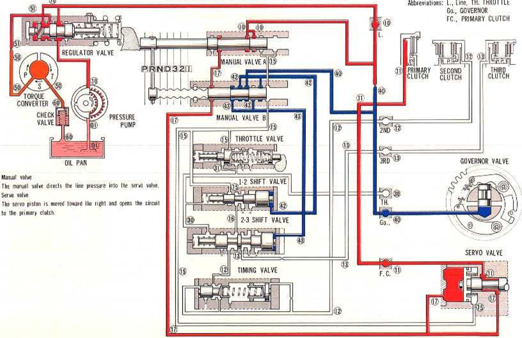
* Shift valves

The line pressure is directed to both the throttle and governor pressure sides of the shift valves, however, since the valve areas of the governor pressure side are larger, the valves are moved toward the left.

HYDRAULIC CIRCUIT ILLUSTRATION

"**R**" **Range**
THROTTLE OPENING: 1/4
(Vehicle Speed 15km/hr)

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH

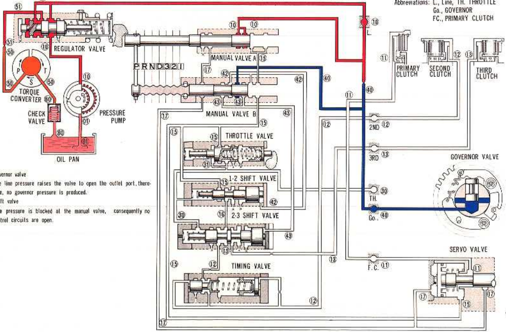


* Manual valve
The manual valve directs the line pressure into the servo valve.
* Servo valve
The servo piston is moved toward the right and opens the circuit to the primary clutch.

HYDRAULIC CIRCUIT ILLUSTRATION

"P" Range
THROTTLE OPENING:
CLOSED(ENGINE IDLING:1,200rpm)

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



* Governor valve
The line pressure raises the valve to open the outlet port, therefore, no governor pressure is produced.

* Shift valve
Line pressure is blocked at the manual valve, consequently no control circuits are open.

J. Dismounting and Mounting of Engine/Transmission Assy.
Dismounting Procedure

Description

The HONDAMATIC transmission is basically identical in design to the N series manual shift transmission. It is incorporated within the crankcase as an integral part of the engine assembly.
Further, dismounting of the engine with the HONDAMATIC transmission from the car body is performed in the same manner as for the N series engine, together with the front wheel drive shafts, front suspension and the sub-frame.

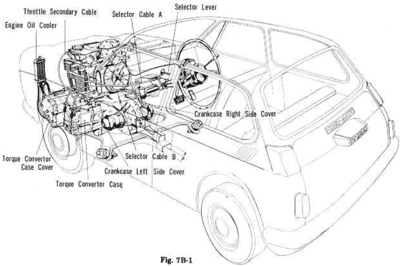


Fig. 7B-1

Dismounting Procedure

Since the dismounting of the engine/Hondamatic assy, is identical as mentioned earlier, refer to the Section 3 "DISMOUNTING POWER UNIT" for detailed procedures.

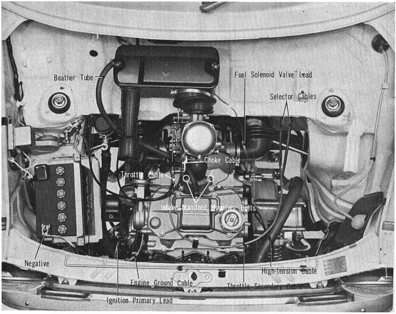


Fig. 7B-2

Note:

1. Drain the oil and remove the battery cable from the negative terminal.
2. Disconnect electrical wiring indicated below from the engine.
   1) Engine ground cable.
   2) Ignition primary lead.
   3) High-tension leads.
   4) Fuel solenoid valve lead.
   5) Generator cable.
   6) Starter cable.
3. Detach the following cables.
   1) Speedometer cable.
   2) Throttle cable and choke cable.
   3) Separate the vacuum spark advancer tube from the spark advancer vacuum unit and the breather tube from the camshaft housing cover.
   4) Loosen the clamp and separate the bellows from the air cleaner case.
   5) Remove two intake manifold mounting bolts and then remove intake manifold, carburetor, and bellows from the camshaft housing as a unit.
   Do not lose the O-ring located between the camshaft housing and intake manifold. Loosen the heater air duct clamps and separate the ducts from the cooling fan housings.

1. Loosen the lock nut on the throttle secondary cable and detach the cable from the carburetor. **(Fig. 7B-3)**

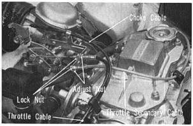


Fig. 7B-3

2. Loosen the lock nuts from the selector cables A and B, and disconnect the cable end balls from the selector strap arm. **(Fig. 7B-4)**

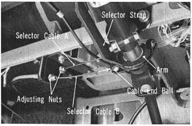


Fig. 7B-4

3. Disconnect the selector cables A and B from the manual select lever. **(Fig. 7B-5)**

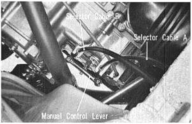


Fig. 7B-5

4. Loosen the exhaust manifold clamp retaining nut at the tail end of the exhaust manifolds, remove the bolt and release the clamp plate which is mounted on the torque converter case cover. Separate the exhuast manifolds from the cylinder head. **(Fig. 7B-6)**

   Note:
   It is unnecessary to remove the exhaust manifolds from the engine compartment while the engine is mounted since they can be removed after dismounting the engine.

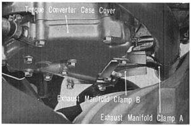


Fig. 7B-6

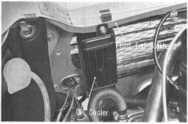


Fig. 7B-7

5. Separate the oil cooler from the front end bulkhead. (Fig. 7B-7)

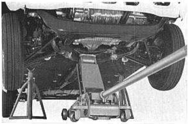


Fig. 7B-8

Raise the front of the vehicle by placing a jack under the engine crankcase; support the front end of the floor board with rigid racks and remove the front brake hoses, knuckle setting bolts and the splash guards on both sides. **(Fig. 7B-8)**

Note:
An alternate method of dismounting the engine without bleeding the brake system is by removing the front wheels and brake drums while the front brakes hoses remain connected, and separate the back plate assembly from the knuckle after removing four plate mounting bolts.

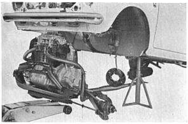


Fig. 7B-9

7. Remove the two bolts attaching the exhaust silencer to the floor board, and remove the silencer mounting rubber ring.

Note:
Slowly dismount the engine, sub-frame, exhaust pipe and silencer as an assembly and check to see that no leads or cables were overlooked.
Upon assuring that the engine is completely separated from the vehicle body, fully lower the jack and draw out the engine, sub-frame, and exhaust manifolds as an assembly in the forward direction. **(Fig. 7B-9)**

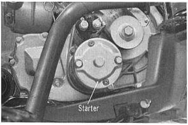


Fig. 7B-10

8. Remove the starter from the engine. **(Fig. 7B-10)**

9. Remove the drive shafts at the differential joint flanges by removing the ball joint setting bolts. **(Fig. 7B-11)**

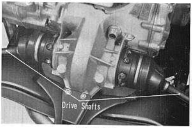


Fig. 7B-11

10. Remove the four engine front mounting beam bolts from the beam. **(Fig. 7B-12)**

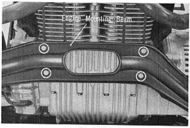


Fig. 7B-12

11. Remove the two sub-frame mounting bolts and separate the beam from the sub-frame. **(Fig. 7B-13)**

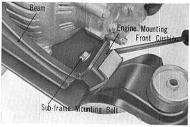


Fig. 7B-13

12. Remove the engine bracket mounting bolts, and separate the engine and sub-frame: also, at this time, separate the exhaust manifolds from the engine. **(Fig. 7B-14)**
13. Finally, remove the engine from the jack, and place the engine on the work stand.

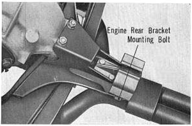


Fig. 7B-14

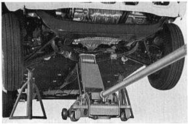


Fig. 7B-15

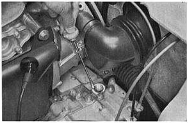
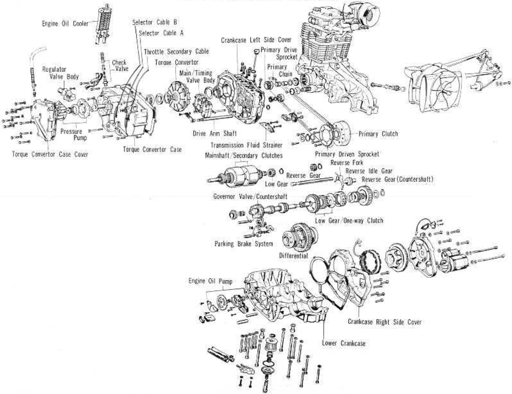


Fig. 7B-16

Installation Procedure

Remount the engine/transmission assy., in the reverse order of dismounting procedure, however, give particular attention to the following points. Carefully jack up the engine unit consisting of the exhaust manifolds and silencer into the engine compartment; making sure that the leads, cables and tubings are not binding or hung up against anything. After the engine is in the mounting position, properly install the mounting bolts, clean the areas an finally inspect all of the mountings. Connect and adjust the throttle cable, throttle secondary cable, and the selector cables A and B. Finally,check the engine oil level and the ATF level, and replenish if necessary.
When the installation of the engine is completed, perform engine idling check and adjustment, check parking brake pawl operation, and conduct the stall speed test.
Further, perform the check of the up-shift and down-shift points and the operating pressure of the automatic transmission fluid by testing on a dynamometer or by road test.

K. Hondamatic Transmission Exploded View



L. Removal and Assembly of Hondamatic Transmission

Description

The engine with HONDAMATIC transmission is basically identical to the engines of N series cars with standard transmission. The only difference is that the addition of the automatic gear shifting feature is present on the HONDAMATIC model.
The description on the construction and design was given in the preceeding section and, therefore, will not be duplicated here. The following sections will contain the procedures on disassembly, inspection, reassembly and adjustment.

A. This section will contain the information of the HONDAMATIC transmission. Other information relative to the vehicle is the same as the N series vehicle and, therefore, use the Section 4 "ENGINE MECHANICAL and the Section 8 "DIFFERENTIAL" as the basic guide.
B. The disassembly of the transmission is described in the following sequence: torque converter on the left side, low gears/reverse gears on the right side, upper crankcase, lower crankcase and finally the mainshaft/countershaft.

a. Disassembly Procedure from LH Side

Ref. No.	Description
1.	Torque Converter Case Cover
2.	Regulator Valve
3.	Pressure Pump and Regulator Valve Drive Arm
4.	Torque Converter Case
5.	Torque Converter
6.	Main Valve Body
6-1.	Main Timing Valve Body
6-2.	Timing Valve Body
7.	Crankcase Left Side Cover
8.	Transmission Fluid Strainer
9.	Primary Drive Mechanism
10.	Primary Clutch
11.	Engine Fluid Pump
12.	Servo Valve

b. Disassembly Procedure from RH Side

1.	Crankcase Right Side Cover
2.	Reverse Gears and Shift Fork
3.	Low Gears
4.	Speedometer gear

c. Disassembly Procedure from Bottom

1.	Lower Crankcase
2-1.	Mainshaft System
2-2.	Secondary Clutches
3-1.	Countershaft System
3-2.	Governor Valve
4.	Differential
5.	Parking Brake System

Hondamatic is machined extraordinarily precisionly and accurately at every section of it, therefore, exterior of the engine/transmission unit should be well cleaned prior to dismantling.
Since the material is light alloy, when separating the matched faces or when detaching components, do not wrench with screwdriver or the like. If separation cannot be easily made, apply a little force with a wooden or plastic hammer lightly and relevantly. Avoid hitting with an old deformed hammer, but always use new clean one so that the chips of the old hammer will not splash around.

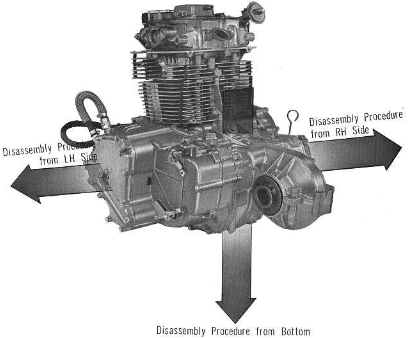

Disassembly Procedure from RH Side
Disassembly Procedure from LH Side
Disassembly Procedure from Bottom

Fig. 7B-18

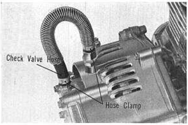


Fig. 7B-19

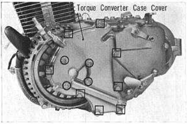


Fig. 7B-20

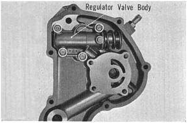


Fig. 7B-21

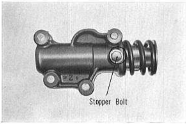


Fig. 7B-22

a. Disassembly Procedure From LH Side

1. Torque Converter Case Cover

1. After unscrewing screws, remove the check valve hose from the torque converter case and corner. (Fig. 7B-19)
2. Remove the bolts from the torque converter case cover and separate the cover from the torque converter case. (Fig. 7B-20)

Note:
Remove the (□) marked bolts in the figure, and the torque converter case cover together with the regulator valve and pressure pump can be separated from the torque converter case. By removing both (□) and (○) marked bolts, the cover can be separated and the regulator valve with the pressure pump will remain in the torque converter case.
During reassembly, torque the bolts to:

1.2kg-m (9ft-lbs). . . . .(□) bolts
1.0kg-m (7ft-lbs). . . . .(○) bolts

2. Regulator Valve

1. Remove the mounting bolts and separate the regulator valve unit from the cover. (Fig. 7B-21) During reassembly, torque the bolts to 1.2kg-m (9ft-lbs)
2. Exercise extreme care in removing the regulator valve spring cap stopper bolt and then remove the regulator valve, springs, spring seat and the spring cap. (Fig. 7B-21)

Note:
When unscrewing the stopper bolt, the spring cap must be held against the body with considerable force to prevent the cap and spring from flying apart.

Installation and inspection of the regulator valve and torque converter case cover.

1. Clean the regulator valve and interior of the valve body with compressed air; inspect the respective parts for wear and damage, apply clean ATF during assembly, and check for smooth operation. If there are any scores found on the surface of the body sleeve, the valve assembly should be replaced.
   Any deformation or irregularity of the regulator valve and pressure pump mounting surface of the torque converter case cover should be lapped on the surface plate and inspected with bluing or red lead to assure flatness. Check all fluid passages and remove any foreign objects.
2. Perform the reassembly in the reverse order of disassembly.

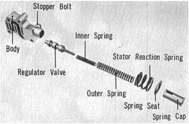


Fig. 7B-23

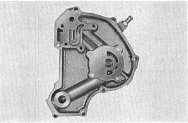


Fig. 7B-24

3. Pressure Pump and Regulator Valve Drive Arm

Removal and Installation

1. Remove pressure pump housing together with pump drive and driven gears as a unit from the pump shaft. **(Fig. 7B-25)**

   Note:
   If the pump housing is stuck fast to the torque converter case, exercise care not to damage or mark the case during removal.

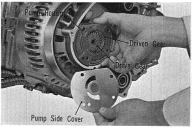


Fig. 7B-25

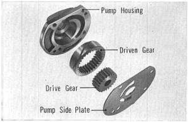


Fig. 7B-26

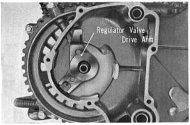


Fig. 7B-27

2. Remove the regulator valve drive arm from the pump shaft. **(Fig. 7B-27)**

   Note:
   The regulator drive arm stopper pin is a press fitted assembly and removal is not required.

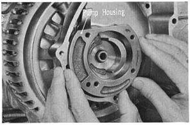


Fig. 7B-28

3. Install the pressure pump housing after the regulator valve drive arm is assembled. **(Fig. 7B-28)**

   Note:
   Exercise care not to damage the oil seal during the installation of the regulator valve drive arm.

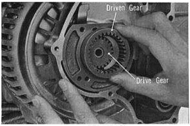


Fig. 7B-29

4. Assemble the pressure pump drive gear on the pump shaft and then install the drive gear. **(Fig. 7B-29)**

   Note:
   After installing the pressure pump, check the squareness of the pressure pump housing, drive gear and the driven gear.

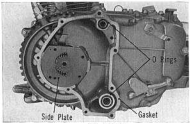


Fig. 7B-30

5. After installing the case cover gasket and O rings as shown in the figure, assemble the torque converter case cover together with the pump housing side plate. **(Fig. 7B-30)**

   Note:
   Check the condition of the case cover gasket and the O ring during reassembly. Further, it is recommended that they be replaced with new parts.

6. Over-torquing the case cover may cause the drive and the driven gears to rub against the side plate; causing wear. To prevent this type of trouble, torque the mounting bolts to the specified value.

   During reassembly, torque bolts to 1.0 kg-m (7 ft-lbs).

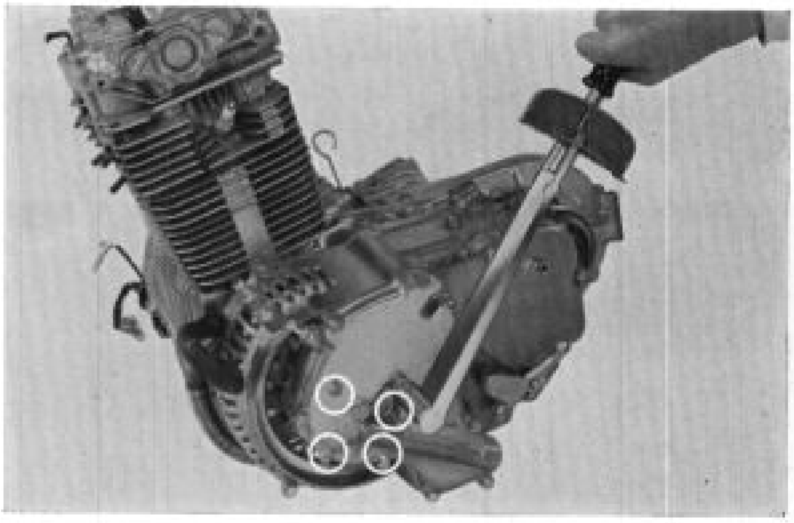


Fig. 7B-31

Inspection

1. Housing clearance
   If the clearance between the driven gear and the housing is greater than 0.12mm (0.005 in), check the parts and replace the one that is worn.

Item	Standard Value	Serviceable Limit
Housing clearance	0.030~ 0.106 mm (0.001~ 0.004")	Replace if beyond 0.12 mm (0.005")

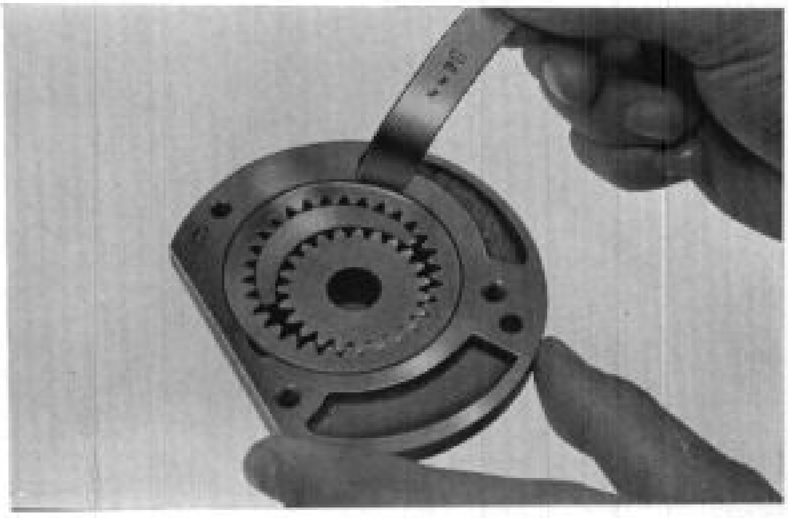


Fig. 7B-32

2. If the clearance between the driven gear and the housing cresent is greater than 0.01mm (0.004 in) replace the worn part.

Item	Standard Value	Serviceable Limit
Tip clearance	0.025~ 0.080 mm (0.001~ 0.004")	Replace if beyond 0.01 mm (0.004")

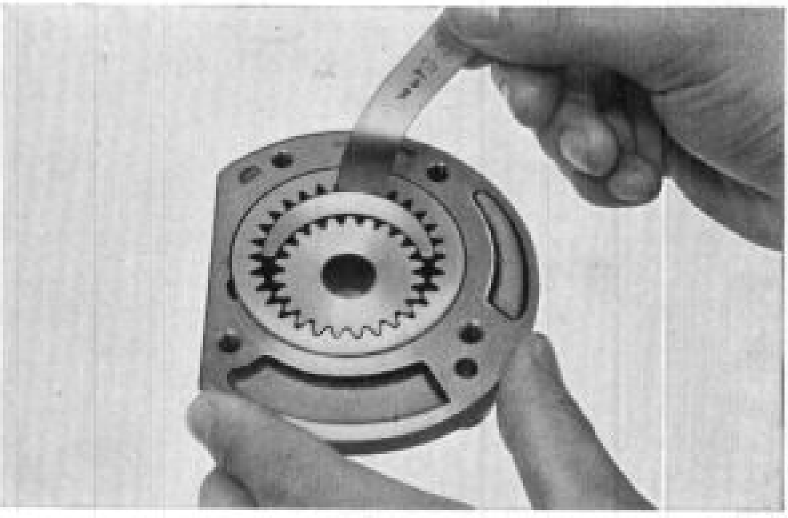


Fig. 7B-33

3. Side clearance
   Measure the clearance between the side plate mounting flange and the drive and driven gears using a thickness gauge or by using a micrometer to measure the amount of wear in the gears. If the clearance is greater than 0.08mm (0.03 in), replace the gear which is worn.

Item	Standard Value	Serviceable Limit
Side clearance	0.03~ 0.07 mm (0.001~ 0.003")	Replace if beyond 0.08 mm (0.003")

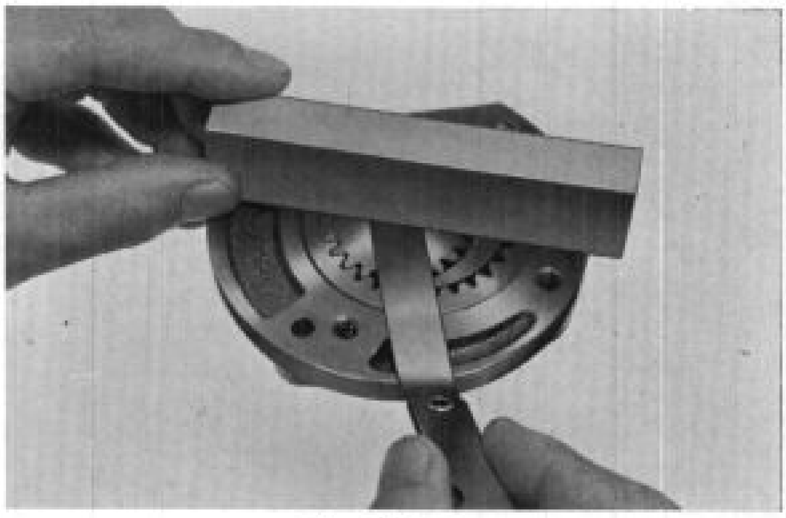


Fig. 7B-34

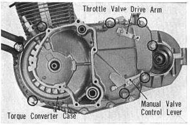


Fig. 7B-35

4. Torque Converter Case

Removal

1. After removing the throttle valve drive arm and the manual valve control lever, unscrew the case mounting bolts and detach the torque converter case. (Fig. 7B-35)

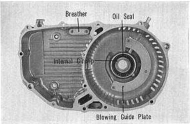


Fig. 7B-36

2. Remove the oil seal retaining internal circlip from the torque converter case using snap ring pliers. (Fig. 7B-36)

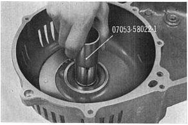


Fig. 7B-37

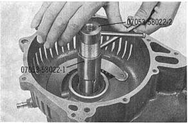


Fig. 7B-38

3. Install the bearing remover catcher on the ball bearing inner race and then screw the remover bolt into place. After assuring that the catcher is properly installed to the bearing inner race, fit the remover slider into the remover bolt and then use the slider weight to apply the shock force to remove the ball bearing together with the oil seal.

Ref. No.	Tool No.	Description
11	07053-58021	SLIDER, ball bearing remover
	07053-58021-1	A. WEIGHT, ball bearing remover slider
	07053-58021-2	B. PIN, ball bearing remover slider
12	07053-58022	REMOVER, ball bearing (torque converter case)
	07053-58022-1	A. CATCHER, bearing remover
	07053-58022-2	B. BOLT, ball bearing remover

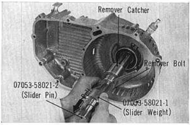


Fig. 7B-39

Inspection and Installation

1. Wash and check the condition of the torque converter case, oil seal, and ball bearing. Replace the seal and bearings if they are found to be excessively worn or damaged.

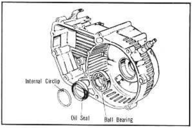


Fig. 7B-40

2. Set the guide base and ball bearing guide on the press bed and then place the torque converter case on the ball bearing guide. Screw the drive handle (A) into the bearing driver, fit the ball bearing over the driver guide and press the bearing into the converter case with the press.

   Note:
   Before press fitting the ball bearing into the case, make sure that the bearing housing is clean. If there are any burrs remaining after the bearing has been installed into the housing, they should be removed.

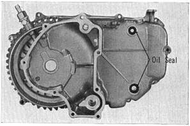


Fig. 7B-41

Special Tools

Ref. No.	Tool No.	Description
14	07053-58024	BASE, guide
15	07053-58025	GUIDE, bearing (torque converter case)
16	07053-58026	DRIVER, bearing (torque converter case)
17	07053-58027	DRIVER, oil seal (torque converter case)

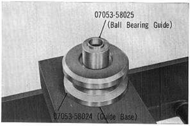


Fig. 7B-42

Fig. 7B-43

3. Next install the oil seal into the torque converter case in the same manner as for the ball bearing using the oil seal driver. **(Fig. 7B-44)**

   Note:
   Similar to the ball bearing, clean the casing and check the oil seal after installation to make sure that there are no rubber chips remaining on the circumference of oil seal.

Fig. 7B-44

4. After the ball bearing and the oil seal have been installed, set the circlip into the housing groove using the snap ring pliers.

5. Fit the gasket on the crankcase left side cover and assemble the torque converter case. Install the cover mounting bolts and torque in a diagonal pattern to the specified torque value.

   Note:
   Torque the bolts to 1.2 kg-m (9.0 ft-lb)

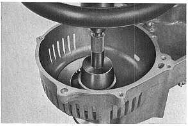


Fig. 7B-45

5. Torque Converter

Removal

Important:
Torque converter is made of light alloy to a relatively high degree of precision, and dynamically balanced to a very high degree, therefore, during disassembly do not use a screwdriver or similar tool which may cause damage. If difficulty is encountered on disassembly, tap the mating surfaces of the torque converter lightly with a wooden or plastic hammer around the entire circumference uniformly to loosen. Chips from the hammer should be completely removed from the torque converter and the main valve body before making the reassembly.

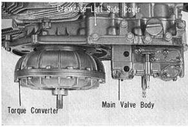


Fig. 7B-46

1. Remove the torque converter assembly from the crankcase left side cover (it may require considerable force to separate). **(Fig. 7B-47)**
2. Unscrew the torque converter mounting bolts and remove the lock plates. Disassemble the torque converter into housing, turbine, pump with pump shaft, stator and needle bearing, and the thrust washer.

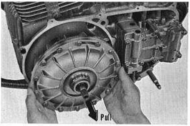


Fig. 7B-47

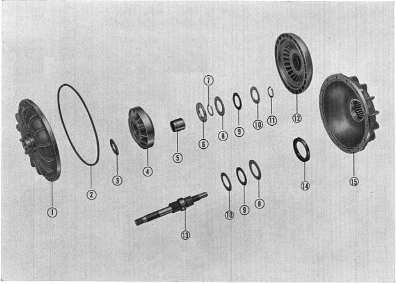


Fig. 7B—48 Torque Converter Exploded

① Turbine
② O Ring
③ Thrust Washer
④ Stator
⑤ Stator Hub
⑥ Stator Side Plate
⑦ Internal Circlip
⑧ Thrust Race
⑨ Thrust Needle Bearing
⑩ Thrust Race
⑪ External Circlip
⑫ Pump Impeller
⑬ Pump Shaft
⑭ Oil Seal
⑮ Torque Converter Housing

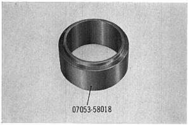


Fig. 7B-49

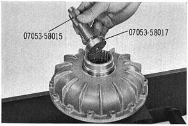


Fig. 7B-50

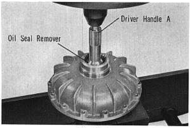


Fig. 7B-51

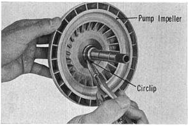


Fig. 7B-52

3. Torque converter housing

   Place the torque converter housing oil seal remover adapter on the bed of the press position the converter housing over the adapter, screw handle A into the oil seal remover and fit it to the oil seal, then drive out the oil seal from the housing.

Special Tools

Ref. No.	Tool No.	Description
7	07053-58017	REMOVER, oil seal (torque converter housing)
8	07053-58018	ADAPTER, oil seal (torque converter housing)

4. Pump impeller and pump shaft

   Remove the external circlip from the pump impeller shaft using snap ring pliers and separate the pump impeller and the pump shaft.

5. Stator and one way clutch

   Remove the internal circlip from the stator using a long nose pliers and then remove the stator side plate from the stator. Then disassemble the one way clutch.

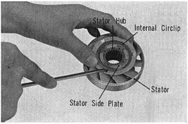


Fig. 7B-53

Inspection and Reassembly

Perform the reassembly in the reverse sequence of disassembly.

1. Stator and one way clutch

   Before reassembling the one way clutch, check the stator cam, hub and side plate for condition of wear. Further, check the roller spring tension and the free length, and then perform the reassembly. The respective parts of this assembly are very small, therefore, exercise care that none of the parts are left out during the reassembly. After reassembly, turn the stator hub in both directions to assure that it is operating smoothly.

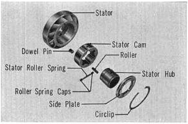


Fig. 7B-54

2. Pump impeller/pump shaft

   Before reassembling the pump impeller, clean the entire unit. Further, check all of the vane to make sure that there are no damages or distorsion; if any defects are found, the impeller should be replaced. Further, also measure the side clearance between the pump impeller and the external circlip for wear with a feeler gauge.

	Standard Tolerance
Side clearance	0.1~0.3 mm (0.004~0.012")

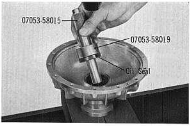


Fig. 7B-55

3. Torque converter housing

   The torque converter is dynamically balanced and, therefore, check the condition of the housing fins and if any are found to be damaged or cracked, the housing should be replaced. Set the converter oil seal driver adapter on the base of the press. Place the converter housing, which had been cleaned by compressed air, on the driver adapter. Screw handle A into the oil seal and slide the oil seal on the driver. Fit the oil seal and the driver assembly on the oil seal guide and press the oil seal into the housing.

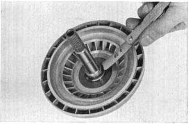


Fig. 7B-56

Fig. 7B-57

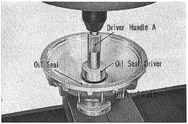


Fig. 7B-58

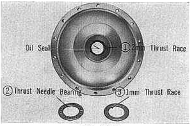


Fig. 7B-59

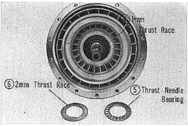


Fig. 7B-60

Note:
By applying a small amount of converter fluid on the torque converter housing and oil seal, press fitment of the oil seal can be made easier. Further, after the oil seal has been press fitted in place, make sure that there are no rubber chips from the oil seal remaining on the needle bearing thrust race seat as this will cause converter housing to be misaligned to the impeller shaft when assembling the converter.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	Handle A, driver
9	07053-58019	DRIVER, oil seal (torque housing converter)
10	07053-58020	ADAPTER, oil seal (torque converter housing)

4. Assemble the ① 2mm thrust race, ② thrust needle bearing and the ③ 1mm thrust race into the torque converter oil seal housing in that sequence and then install the pump impeller/pump shaft subassembly. **(Fig. 7B-59)**

5. Next assemble the ④ 1mm thrust race, ⑤ thrust needle bearing and ⑥ 2mm thrust race on the pump shaft in this sequence. (Fig. 7B-60)

6. Follow this by mounting the stator assembly on the pump shaft and the ⑦ 2mm thrust washer. On the turbine, temporary fit the O ring and then set the assembly into the torque converter housing. **(Fig. 7B-61)**

   Note:
   Do not forget to install the O ring.

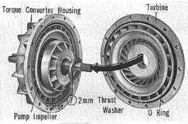


Fig. 7B-61

7. Arrange the lock plates around the torque converter and install the mounting bolts and torque uniformly in a diagonal pattern to the specified torquing value. **(Fig. 7B-62)**
   Torque to 1.0kg-m (7.2 ft-lb)

   Note:
   Torqúe to 1.0kg-m (7.2 ft-lb)

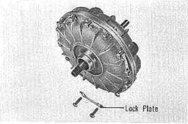


Fig. 7B-62

8. Install the torque converter assembly on the pump shaft coupling and then mount it to the spline of the primary driven sprocket. **(Fig. 7B-63)**

   Note:
   Prior to installation, check the oil seal for wear, damage or oil leaks and replace the parts if necessary.

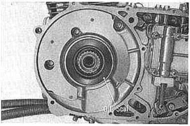


Fig. 7B-63

6. Main/Timing Valve Body

Removal

Important:
The function of the main/timing valve body is to detect the changes of pressure in the different systems and to automatically perform the hydraulic control function. The various fluid passages to the valves are designed in a very intricate pattern with their dimensions machined to a very close tolerances, therefore, all of the parts in the valve body with the exception of the screws, clips and the hollow pins are non-replaceable parts and if any defects are found after disassembly and inspection, the assembly must be replaced.

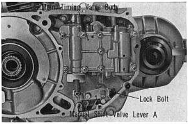


Fig. 7B-64

1. Remove the lock bolts from the manual shift valve lever A.
2. Remove the 9 screws mounting the main/timing valve body to the left crankcase side cover and separate the valve body. **(Fig. 7B-64)**
3. Remove the drive arm fixing plate with long nose pliers this will permit the drive arm and the drive arm pin to be detached from the manual shift valves A and B. **(Fig. 7B-65)**

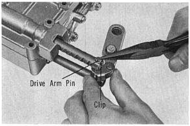


Fig. 7B-65

4. Extract the manual shift valves A and B from the main/timing valve body.

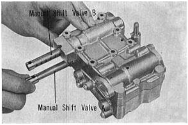


Fig. 7B-66

5. Support the short throttle valve or the tip of the drive arm by hand and carefully separate the main valve body, timing valve body and the separator plate.

Note:
A separator plate is held between the main valve body and the timing valve body with hollow alignment pins. During the disassembly, do not use a screwdriver but carefully separate the parts so that they are not damaged.

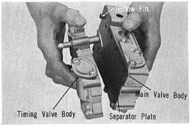


Fig. 7B-67

6-1. Main Valve Body

Disassembly

1. Loosen the cover screws and remove the top cover from the main valve body. **(Fig. 7B-68)**

   Note:
   The cover is held in place by a spring, therefore, unscrew the four screws uniformly and then remove the cover.

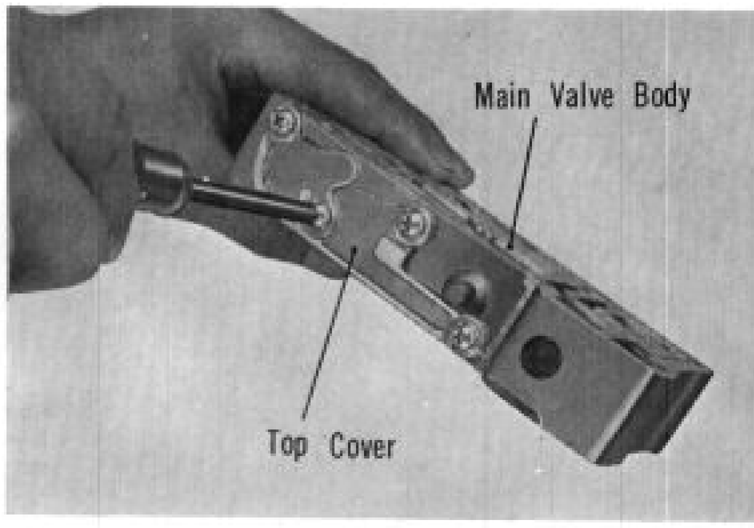


Fig. 7B-68

2. The valve components which can be taken out of the main valve body by removing the top cover are. **(Fig. 7B-69);**
   1. Short throttle valve
   2. Inner/outer springs
   3. Long throttle valve
   4. 1-2 shift governor side valve
   5. 2-3 shift governor side valve

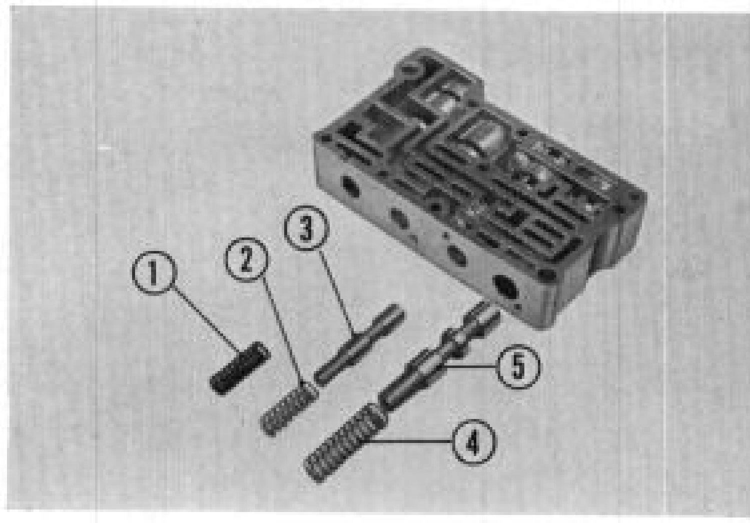


Fig. 7B-69

3. Loosen the bottom cover mounting screws and remove the bottom cover from the main valve body. **(Fig. 7B-70)**

   Note:
   The bottom cover is held in place by springs, therefore, loosen the three screws uniformly and then separate the cover.

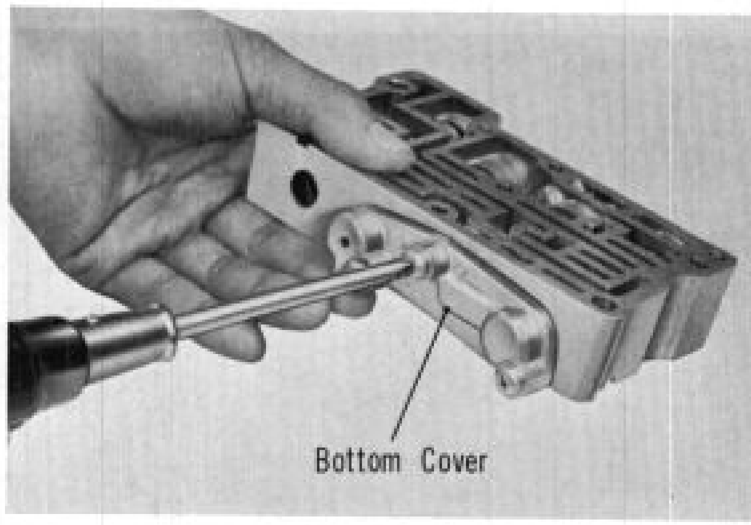


Fig. 7B-70

4. The valve components which can be taken out by removing the bottom cover is removed are; **(Fig. 7B-71)**
   1. Throttle valve setting spring
   2. 1-2 shift valve spring
   3. 1-2 shift side valve
   4. 2-3 shift valve spring
   5. 2-3 shift side valve

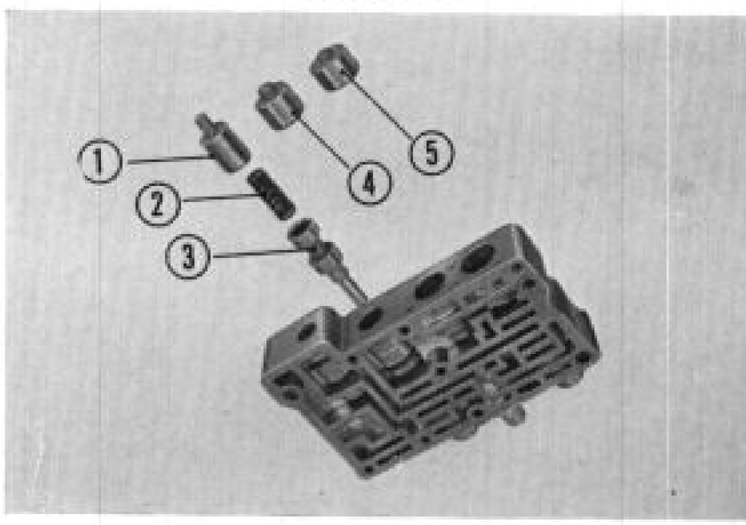


Fig. 7B-71

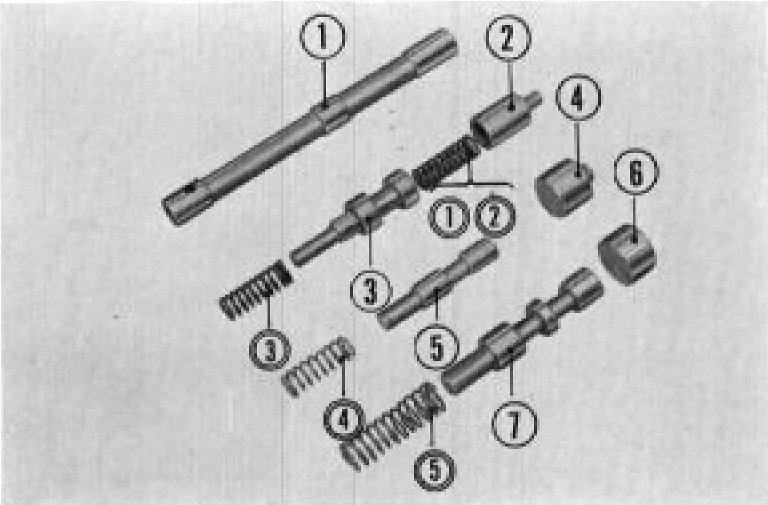


Fig. 7B-72

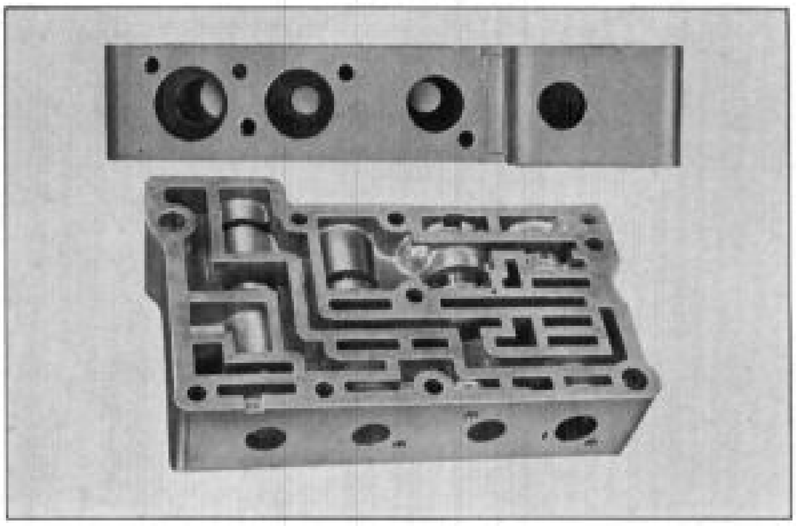


Fig. 7B-73

Inspection

Wash all the components throughly in clean gasoline or kerosene and dry by compressed air.

(Fig. 7B-72 & 73)

1. Inspect the respective valves for damage and wear. Reinstall the components listed below into their respective locations and check by rotating each component to make sure that the operation is smooth.
   1. Manual shift valve A.
   2. Short throttle valve
   3. Long throttle valve
   4. 1-2 shift governor side valve
   5. 1-2 shift side valve
   6. 2-3 shift governor side valve
   7. 2-3 shift side valve
2. Inspect the respective springs
   Replace any broken or badly distorted spring.
   1. Throttle valve outer spring
   2. Throttle valve inner spring
   3. Throttle valve setting spring
   4. 1-2 shift valve spring
   5. 2-3 shift valve spring
3. Inspect the valve body
   1. Check the friction surfaces of the valve for damage and wear.
   2. Check oil passages to make sure that none is clogged.
4. Check for burrs on the valve and valve body and for sticking valve. The valves play the most importance role in the Hondamatic system, therefore, install each valve to its original bore and position with utmost care. Turn the body over and inspect if the respective valve moves smoothly by its own weight.

Assembly

> **Important:**
> **Check to make sure that all of the valves and springs are reinstalled back in there original locations. The respective valves and springs may appear identical, however, each one is different, therefore, it is of utmost importance that they are not installed in the wrong places. Further, during reassembly, check to make sure that the valves do not become damaged or corroded due to improper handling or by being exposed for long time after disassembly, and then, remove any dust before reassembly. Soak all the components in the automatic transmission fluid before reassembly into the valve block.**

1. Perform the reassembly in the reverse sequence of disassembly.
2. Insert those valves and valve springs off the bottom, into the main valve body from the bottom and then install the bottom cover. **(Fig. 7B-74)**
3. Install those valves and valve springs, which were taken out of the top into the main valve body from the top and then install the top cover. **(Fig. 7B-75)**

   Note:
   Both the top and bottom covers are under the spring force, therefore, when installing the screws, they should be tightened uniformly. When installing the valves into the valve body sleeves do not force or strike. Slightly rotate the valves to insert, and assure that the operation is smooth.

Fig. 7B-74

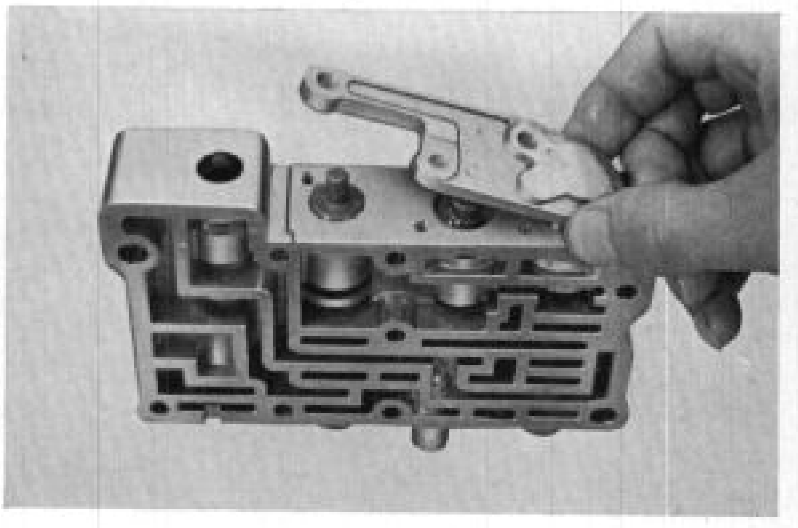


Fig. 7B-75

6-2. Timing Valve Body

Disassembly

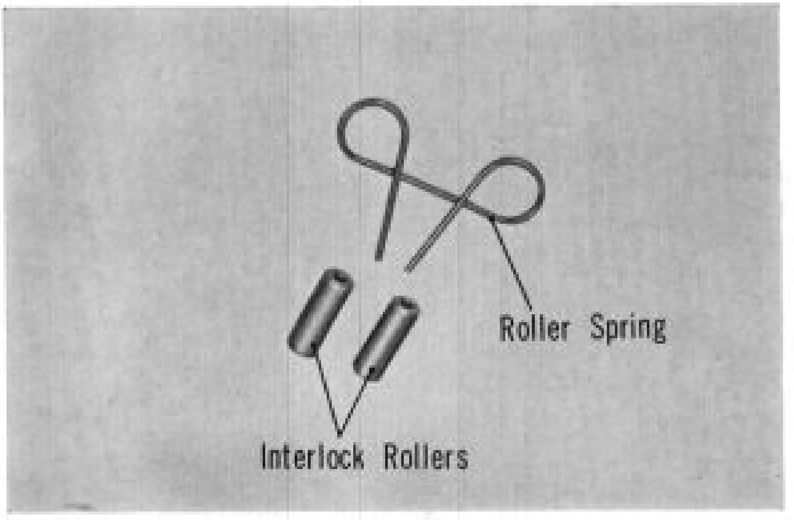


Fig. 7B-76

1. Disassemble the roller spring, interlock rollers from the timing valve body. (Fig. 7B-76)

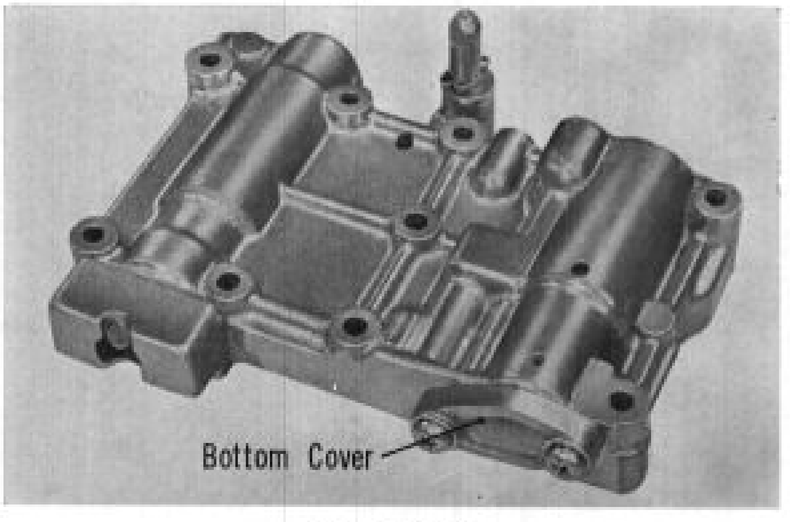


Fig. 7B-77

2. Loosen the bottom cover mounting screws and separate bottom cover from the timing valve body. (Fig. 7B-77)

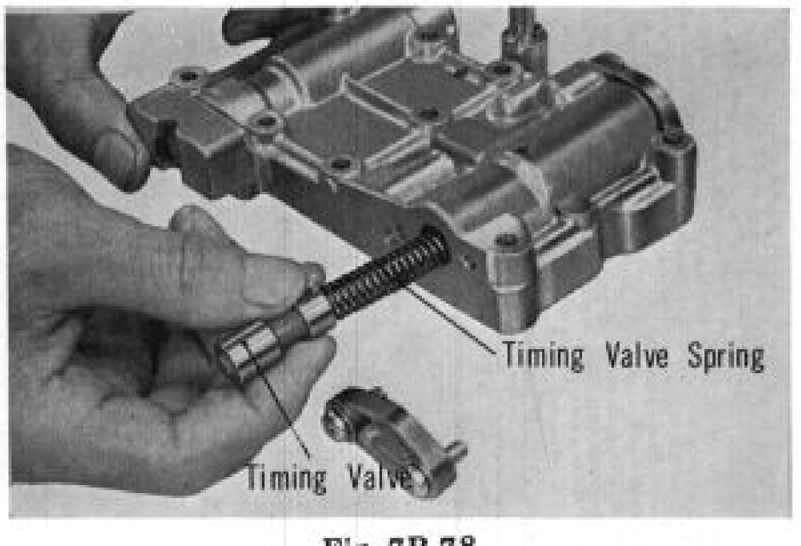


Fig. 7B-78

3. Remove the timing valve and the timing valve spring from the timing valve body. (Fig. 7B-78)

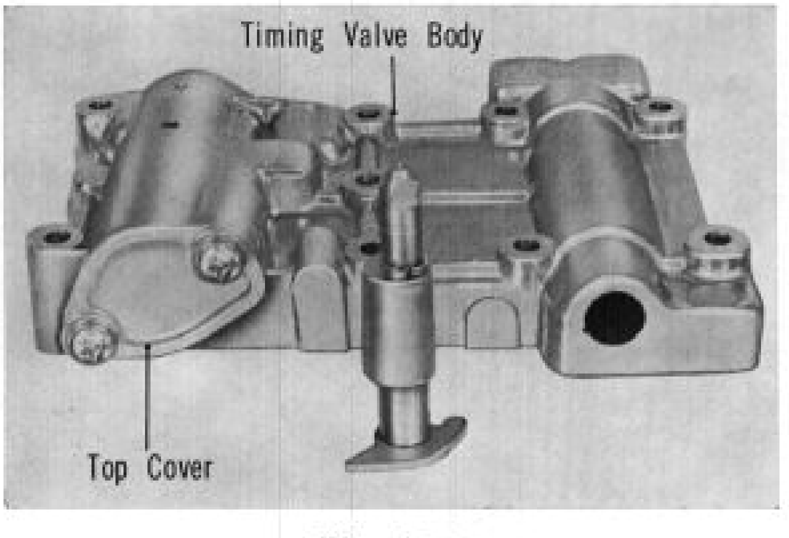


Fig. 7B-79

4. Loosen the top cover mounting screws and separate top cover from the timing valve body. (Fig. 7B-79)

5. Remove the accumulator valve from the timing valve body. **(Fig. 7B-80)**

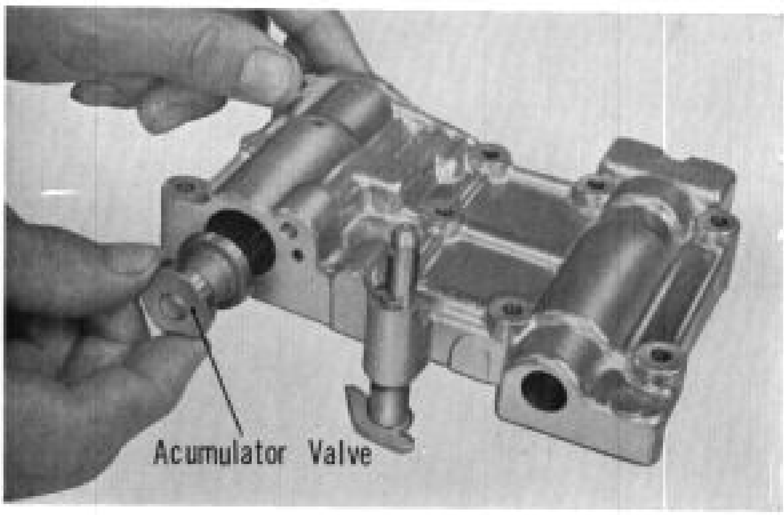


Fig. 7B-80

6. By removing the drive arm retaining clip, the drive arm and the arm collar can be removed from the timing valve body. **(Fig. 7B-81)**

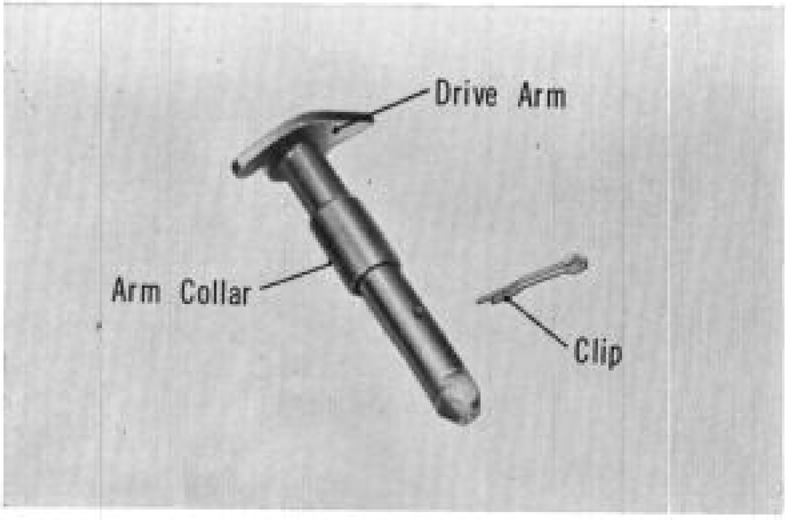


Fig. 7B-81

Inspection and Reassembly

Wash the components of the main valve body after disassembly, in the same manner as for the main valve body; dry by compressed air after washing. Insert the valve into the valve bore by slightly rotating and assure that the movement is smooth. **(Fig. 7B-82)**

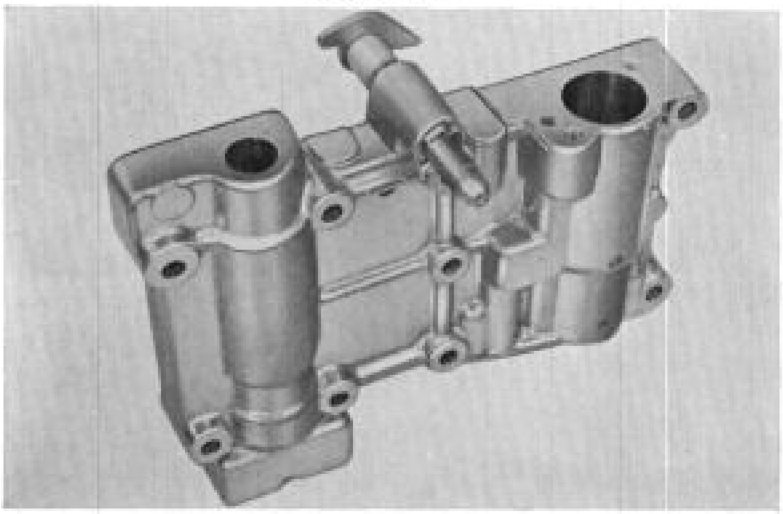


Fig. 7B-82

1. Perform the reassembly in the reverse sequence of disassembly. After installing the timing valve, install the interlock rollers and the roller springs to the manual shift valve B. **(Fig. 7B-83)**

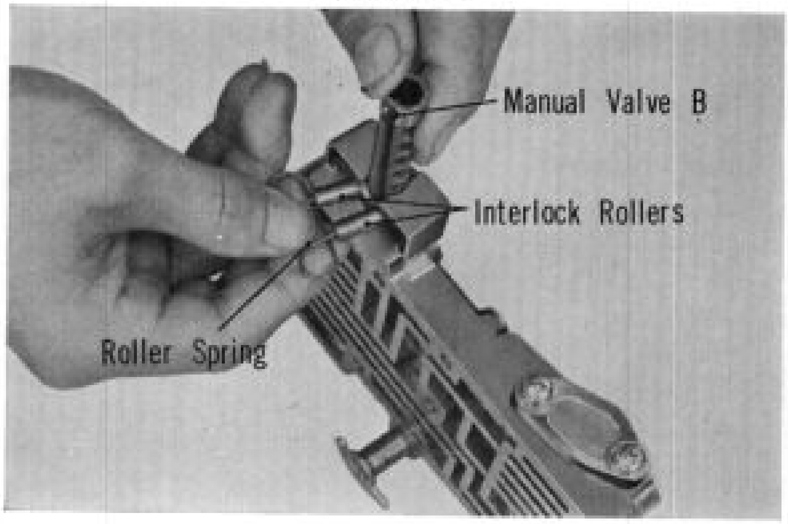


Fig. 7B-83

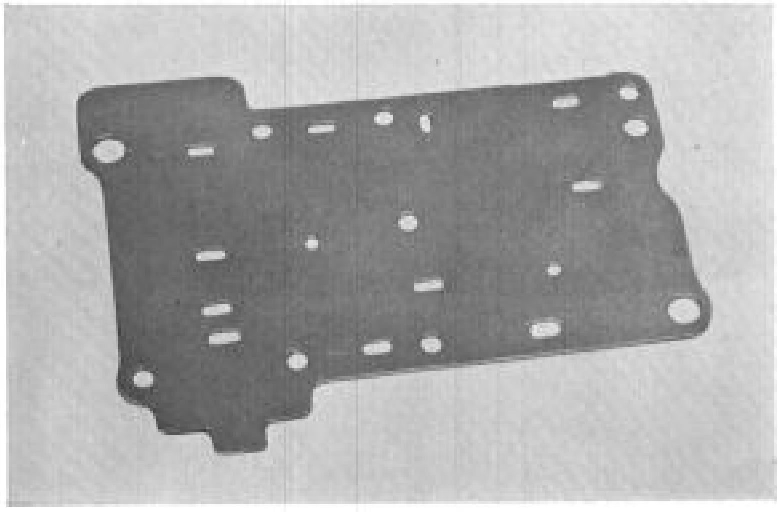


Fig. 7B-84

2. Check the separator plate specially for distortion, clogging of the passages and contamination, further, handle the plate carefully to prevent damages to the plate surfaces.
   Plates with any surface defects should be replaced. Surface scratches will cause pressure fluid to leak into the ajoining passages and affects the automatic shift control. Exercise care not to produce any scratches. **(Fig. 7B-84)**

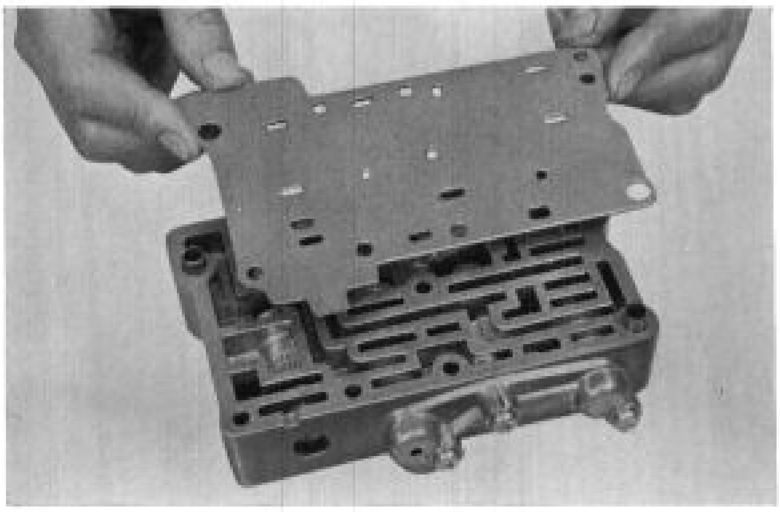


Fig. 7B-85

3. Install the separating plate and the timing valve body to the main valve body. **(Fig. 7B-85)**

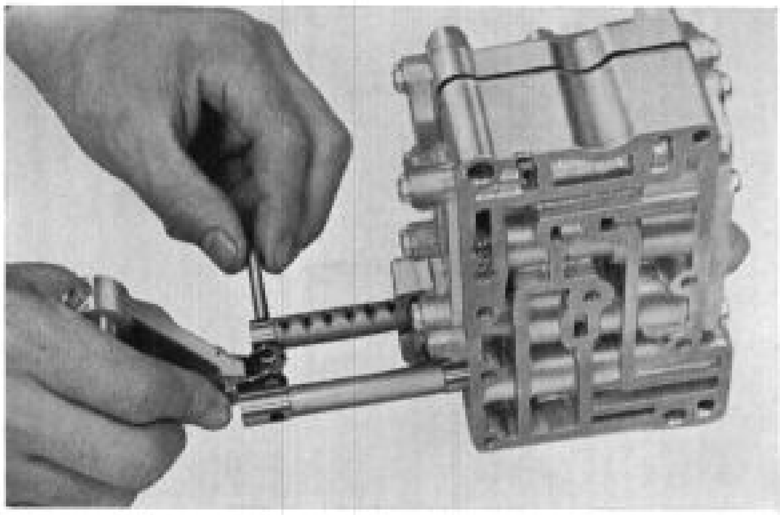


Fig. 7B-86

4. Install the manual shift valve A and B into the valve body and set the drive arm, arm pin and the retaining clip. **(Fig. 7B-86)**

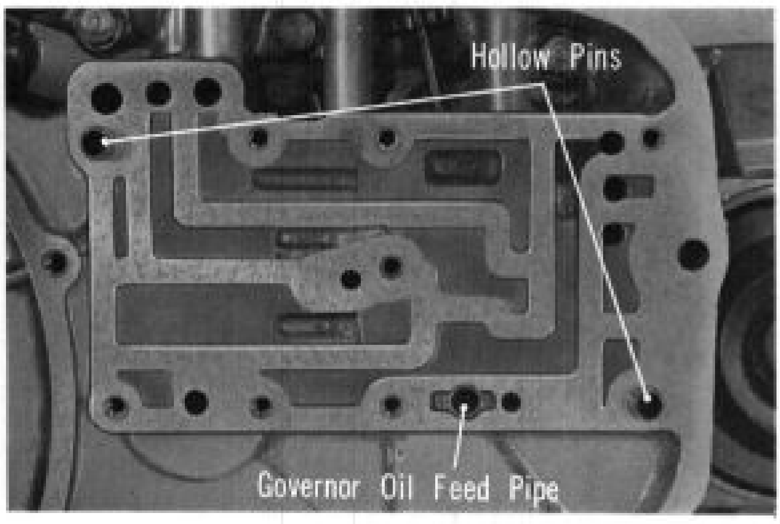


Fig. 7B-87

Installation

1. Before installing the valve body assembly to the crankcase lift side cover, check the side cover mounting area and blow out the oil holes and passages by compressed air check the hollow pins and governor oil feed pipe. **(Fig. 7B-87)**

2. After cleaning, set the valve body assembly on the crankcase left side cover and fix with screws; torque to the specified value: 0.5-0.7 kg-m (3.6-5.1 lb) **(Fig. 7B-88)**

   Note:
   Torque the screws in the sequence shown in the figure.

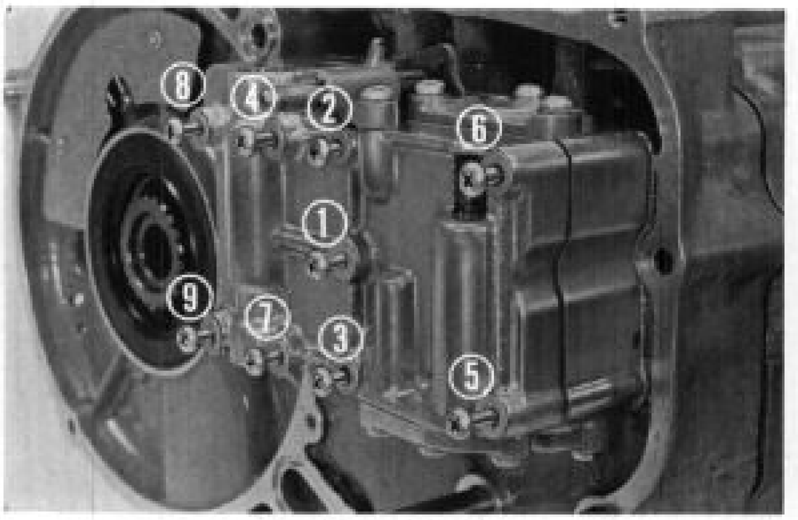


Fig. 7B-88

3. Adjustment of manual shift drive arm. **(Fig. 7B-89)**

Adjustment of parking brake is made by the adjustment of manual shaft drive arm.
After temporarily fitting manual valve control lever to drive arm shaft, force the control lever in the direction shown by the arrow until the joint link of drive arm contaxts manual valve stopper pin. Then tighten adjusting nut.

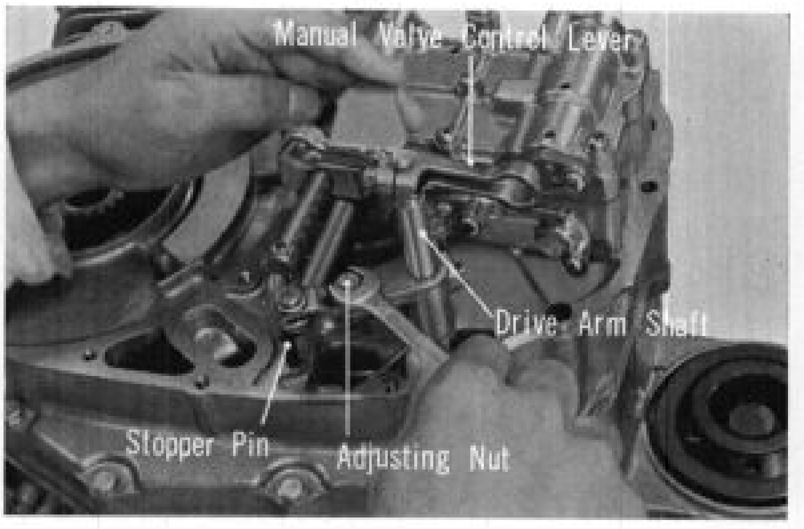


Fig. 7B-89

7. Crankcase Left Side Cover

Removal

1. Loosen the crankcase left side cover mounting bolts and separate the side cover from the upper/lower crankcase. (Fig. 7B-90) Remove the transmission fluid strainer.

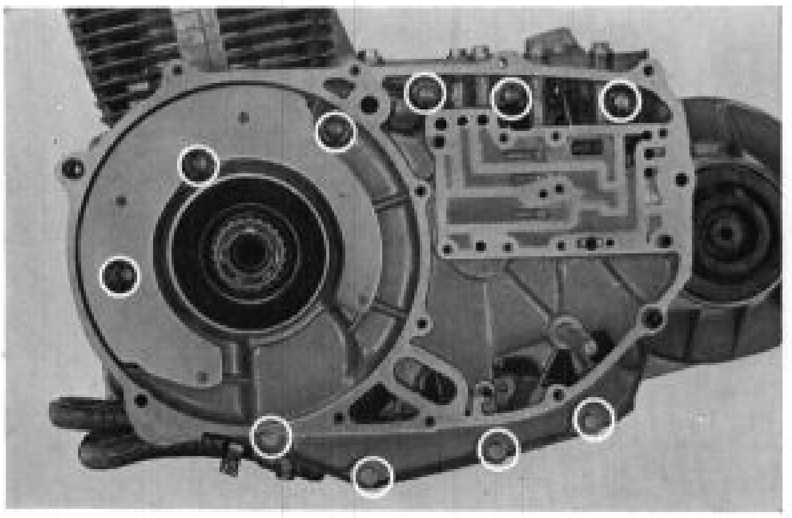


Fig. 7B-90

2. Install the remover catcher on the inner race of the mainshaft support bearing, assemble the puller and knock out the bearing. Remove the oil seal retaining circlip and remove the oil seal.

Special Tools

Ref. No.	Tool No.	Description
11.	07053-58021	SLIDER, ball bearing remover
	07053-58021-1	WEIGHT, ball bearing remover slider
	07053-58021-2	PIN, ball bearing remover slider
12.	07053-58023	REMOVER, ball bearing (L, crankcase side cover)
	07053-58023-1	CATCHER, ball bearing remover
	07053-58023-2	BOLT, ball bearing remover

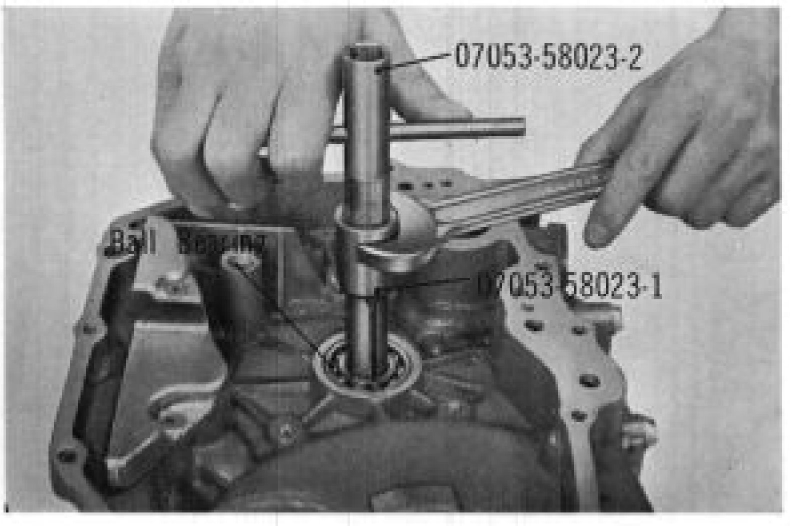


Fig. 7B-91

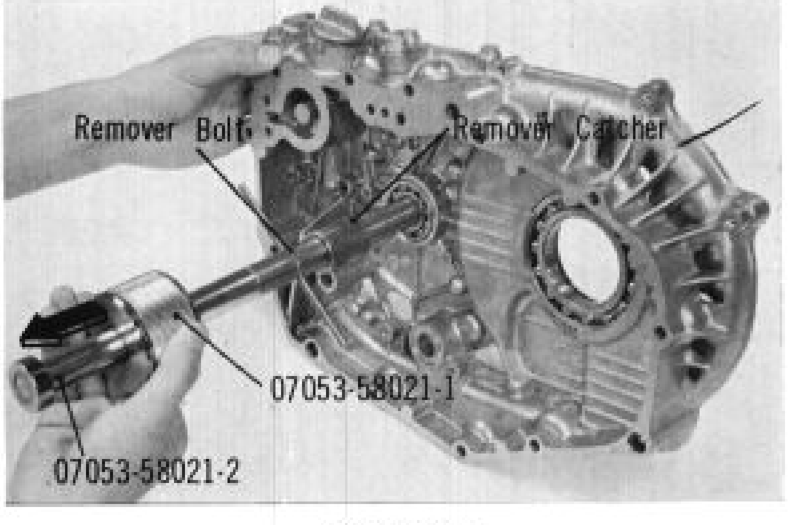


Fig. 7B-92

3. Set the remover guide base (07053-58029) on the press bed, position the crankcase left side cover on top and press out the ball bearing and oil seal.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
18	07053-58028	REMOVER; ball bearing (L, crankcase side cover)
19	07053-58029	BASE, remover guide (L, crankcase side cover)

Fig. 7B-93

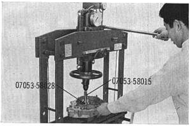


Fig. 7B-94

Inspection and Installation

Clean the ball bearing housing area of the crankcase left side cover and dry by compressed air. At this time, remove the check plugs located on the top of the cover clean out the oil passages by compressed air and check the passages. (Fig. 7B-95 & 96)

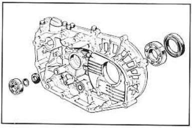


Fig. 7B-95

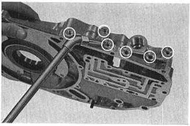


Fig. 7B-96

1. Set the guide base (07053-58024) on the press bed and place the crankcase left side cover on top of the guide base. Fit the ball bearing as shown in figure and press in the bearing with the ball bearing driver.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
14	07053-58024	BASE, guide
20	07053-58030	DRIVER, ball bearing (L, Crankcase side cover)
21	07053-58031	DRIVER, oil seal (L, crankcase side cover)

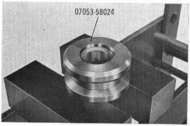


Fig. 7B-97

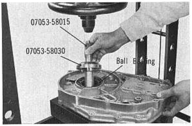


Fig. 7B-98

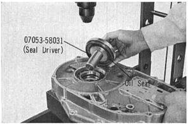


Fig. 7B-99

2. Press fit the oil seal in the same manner as done for the bearing in the preceding paragraph, and then install the internal circlip.

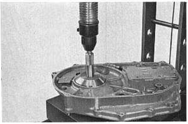


Fig. 7B-100

3. Set the guide base (07053-58024) on the press bed and set the ball bearing guide (07053-58034) on top. Lightly press fit the oil seal first.

Note:
Do not forget to install the circlip after the oil seal is press fitted.

Special Tools

Ref. No.	Tool No.	Description
14	07053-58024	BASE, guide
23	07053-58033	DRIVER, oil seal (L, crankcase side cover)
24	07053-58034	Guide, ball bearing (L, crankcase side cover)

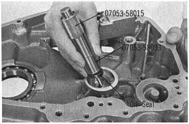


Fig. 7B-101

4. Next install the ball bearing in the same manner that the oil seal was pressed in the preceding paragraph. Drive the bearing in using a light pressure.

Note:
When installing the oil seal and ball bearing by driving with hammer, protect the main valve body mating surface of the crankcase left side cover so that it does not get damaged.

Special Tools

Ref. No.	Tool No.	Description
14	07053-58024	BASE, guide
22	07053-58032	DRIVER, ball bearing (L, crankcase side cover)
24	07053-58034	Guide, ball bearing (L, crankcase side cover)

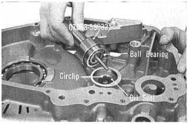


Fig. 7B-102

5. Lightly press fit the governor oil feed pipe in to the crankcase left side cover at right angle. (Fig 7B-103)

Note:
Unless the pipe is fitted at right angle, oil leakage from the governor oil seal on the countershaft may result.

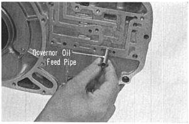


Fig. 7B-103

8. Transmission Fluid Strainer

Removal

Remove the transmission fluid strainer mounting bolt on the back side of the crankcase left side cover and then remove the strainer. (Fig 7B-104)

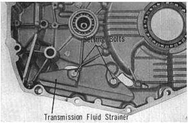


Fig. 7B-104

Inspection and Installation

Before installing the strainer body on the crankcase left side cover, check the fit of the O ring in the O ring seat. The reason for checking the fit of the O ring is that there is possibility of sucking air in if good sealing is not obtained. (Fig 7B-105)

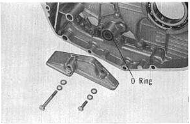


Fig. 7B-105

9. Primary Drive Mechanism

Removal

1. Remove the crankcase left side cover. (Fig 7B-106)

   Note:
   After removing the cover, check and remember the position of thrust washer whether it is on the mainshaft or stuck to the ball bearing inner race of the cover. Retain this thrust washer untill reinstallation.

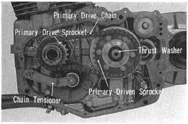


Fig. 7B-106

2. The chain tension can be easily removed by releasing the tensioner spring. (Fig 7B-107)

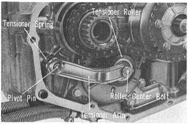


Fig. 7B-107

3. Remove the primary drive sprocket drive chain and the clutch assembly together. (Fig 7B-108)

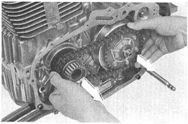


Fig. 7B-108

4. Remove the needle bearing, pump shaft coupling and the thrust washer. (Fig 7B-109)

   Note:
   When installing the primary clutch on the mainshaft, rotate the chain back and forth so that the clutch hub will slide on to the mainshaft spline.

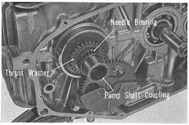


Fig. 7B-109

Inspection and Installation

1. Check the tension of the primary drive chain tensioner spring.
   Loop a cord around the chain tensioner guide roller and pull the tensioner arm away from the chain, using spring scale.
   Read the value of the spring scale just where the tip of the tensioner roller touches the lower case.
   Normal tension is 540~660g (1.2~1.3 lbs) for A360 and A600.
   Replace the spring if tension is below 480g (1.0 lbs).
   Also check the contact surface of the primary drive chain tensioner rubber roller, which is in contact with the chain, for wear and damage.

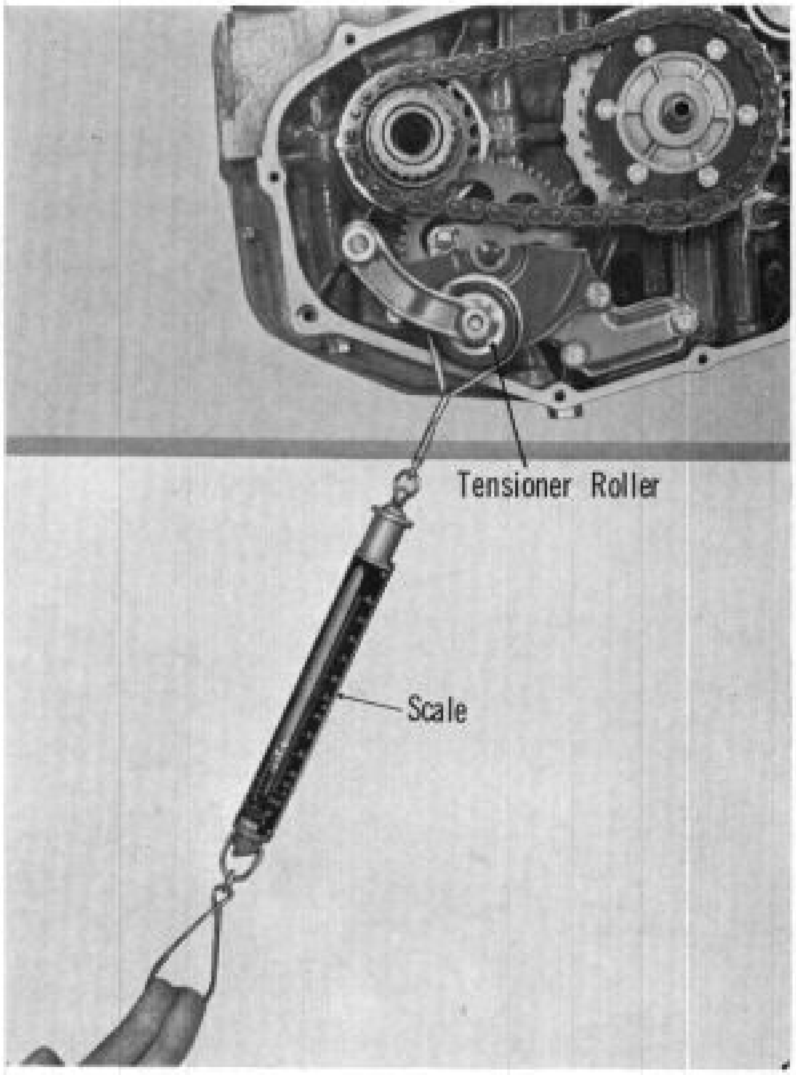


Fig. 7B-110

2. Fit the thrust washer and pump shaft coupling to the left crankshaft spline.
3. Fit the needle bearing on the pump shaft coupling. **(Fig 7B-111)**

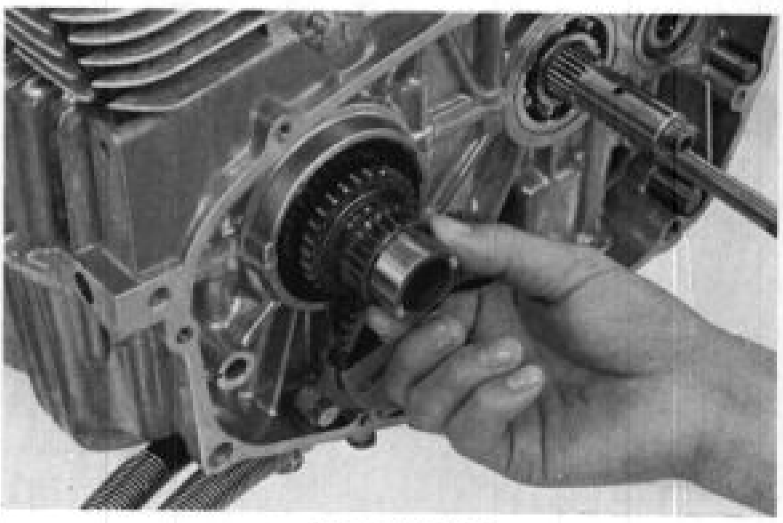


Fig. 7B-111

4. Group the primary drive sprocket, drive chain and the primary clutch assembly, and install the group on to the crankshaft and to the main shaft. **(Fig 7B-112)**

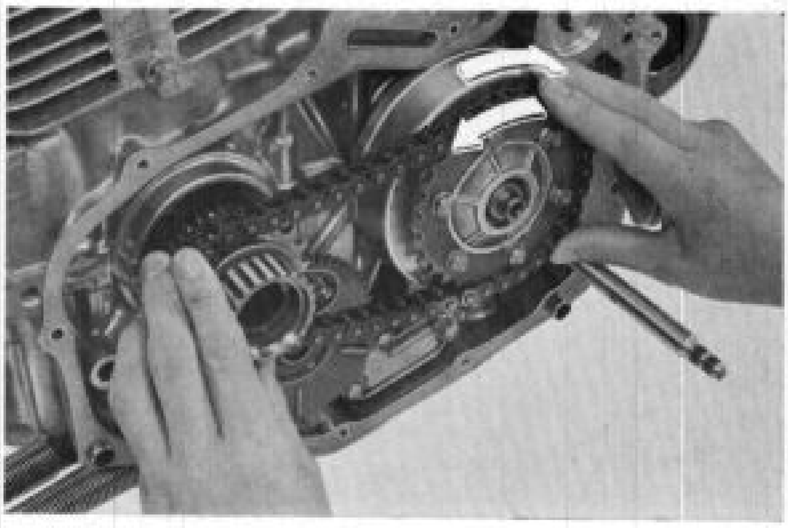


Fig. 7B-112

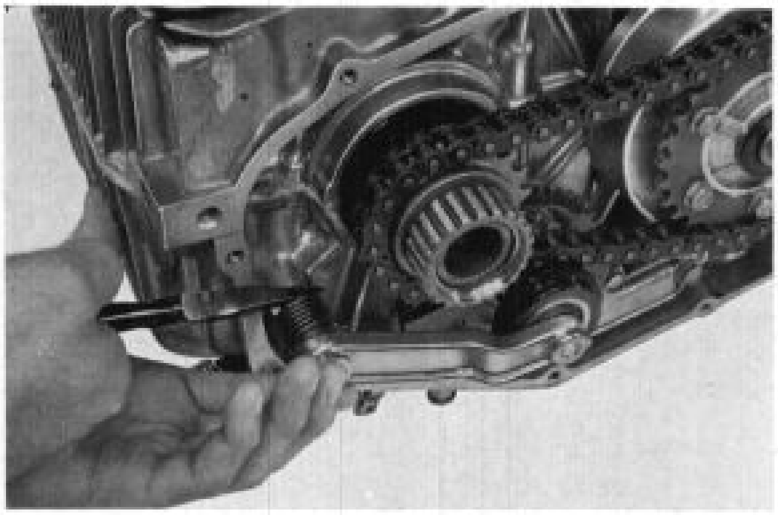


Fig. 7B-113

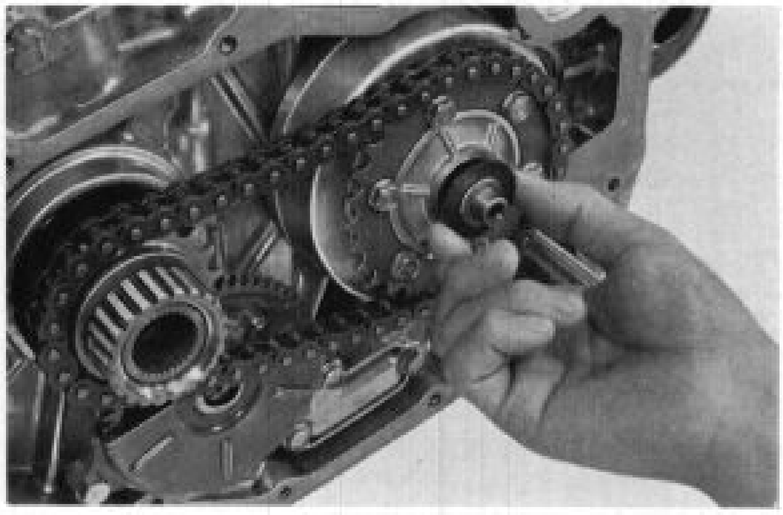


Fig. 7B-114

5. When reassembling the chain tensioner spring it should be so installed that the end of the spring rests on the base. (Fig. 7B-113)

6. Fit the thrust washer on the end of the crankshaft outside of primary clutch. (Fig. 7B-114)

   Note:
   Before installing the crankcase left side cover, check to make sure that the thrust washer is fitted on the mainshaft.

10. Primary Clutch

The primary clutch can be disassembled to the following:

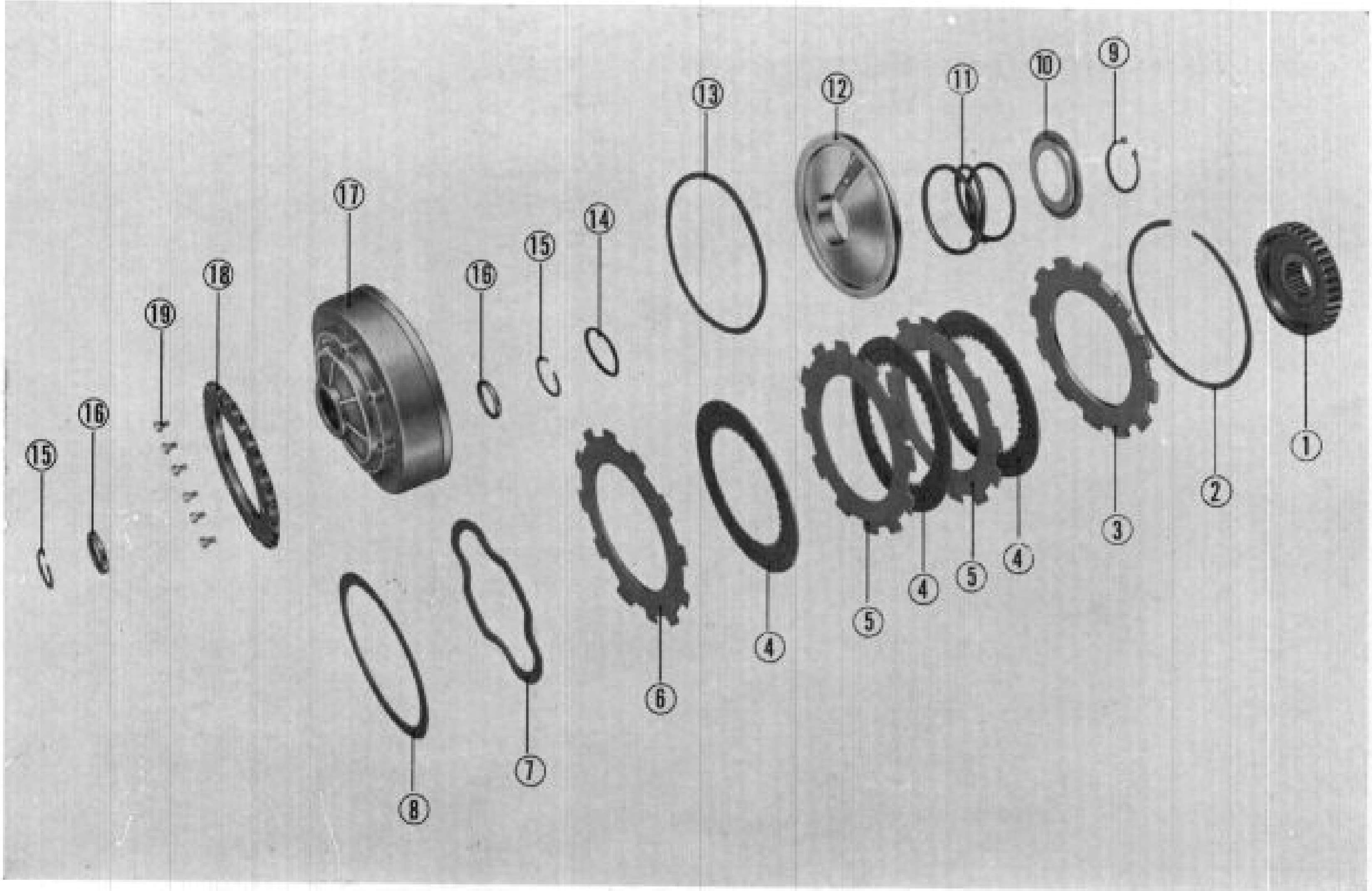


Fig. 7B-115

No.	Description	%	Note when: Disassembling	Note when: Assembling	Remarks
1	Clutch hub	1			
2	Internal circlip	1			
3	Pressure plate	1	Check for wear		
4	Drive plates	3	Soak new plates in ATF before installing		
5	Drive plates	2	Check for wear		
6	End plate	1	Check for wear		
7	Wave spring	1	Check for tension		
8	Spring plate	1			
9	Circlip	1	Press seat together to remove and install		
10	Spring seat	1			
11	Release spring	1	Check for tension		
12	Clutch piston	1	Check the relief valve		
13	Outer O ring	1		Replace with new one	
14	Inner O ring	1		Replace with new one	
15	Internal circlip	2			
16	Oil seal	2		Replace by new one	
17	Clutch drum	1	Check for wear, replace if necessary		
18	Drive sprocket	1	Check for wear		
19	Hex. bolt	6			

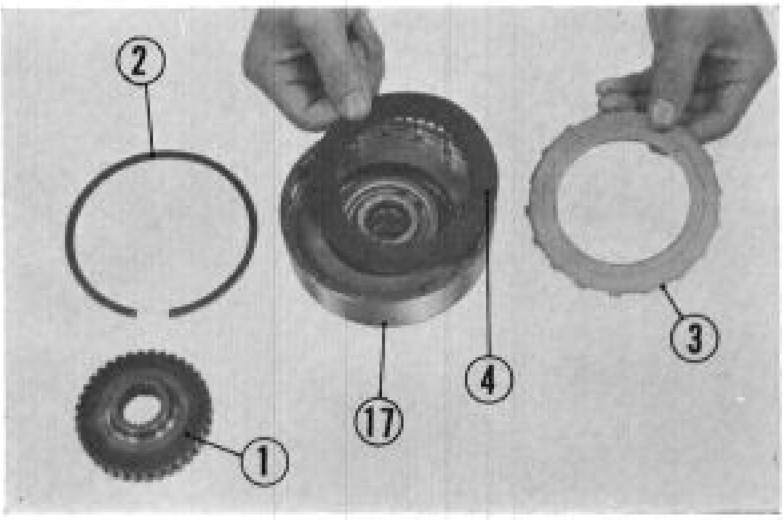


Fig. 7B-116

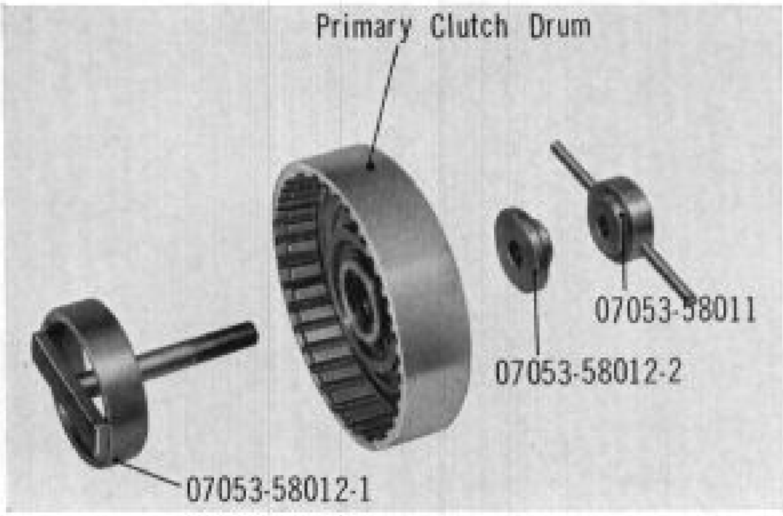


Fig. 7B-117

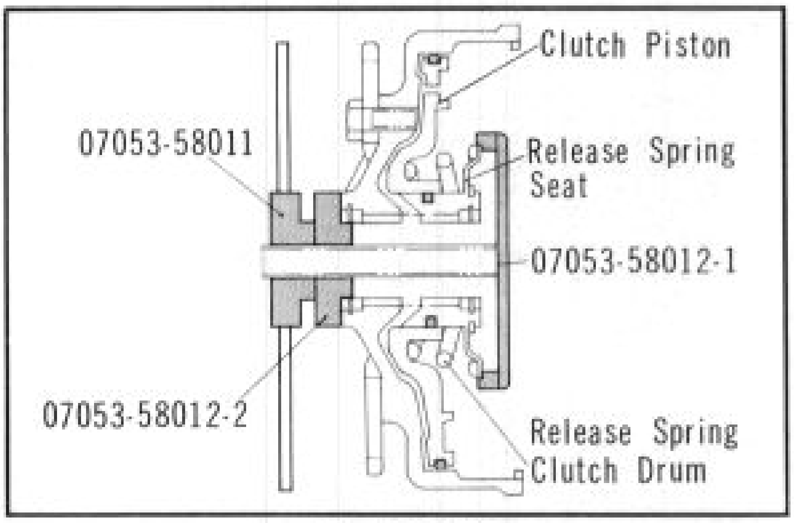


Fig. 7B-118

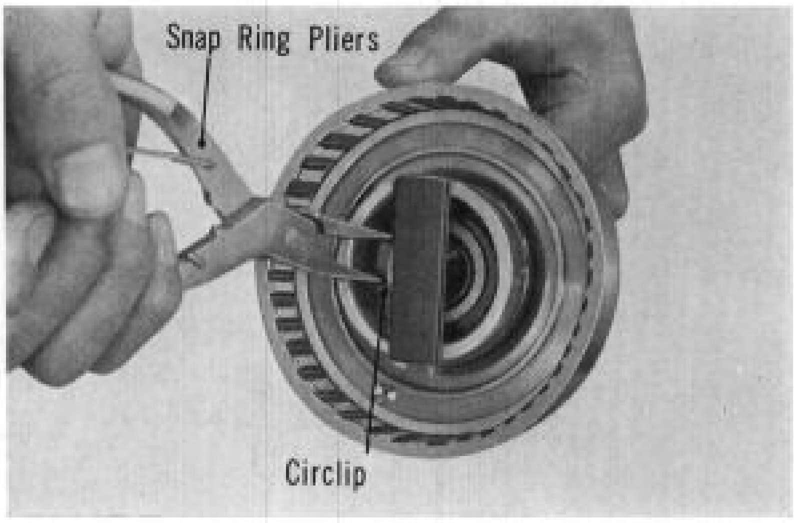


Fig. 7B-119

Disassembly

1. Separate the clutch hub (1) from the clutch drum (17) and remove the internal circlip (2) with a screwdriver. The pressure plate (3), driven plates (4), drive plates (5), wave spring (7) and spring plate (8) can now be separated.

2. To remove the release spring, use the release spring compressor to compress the spring and then remove the retaining circlip with the snap ring pliers.

   Procedure:
   Insert the release spring compressor into the clutch drum, fit the handle adapter and screw in the compressor handle.
   After the compressor retainer compresses the release spring by the force applied against the spring seat, the circlip will become free for removal using snap ring pliers (open type).
   Use the same procedure to set the release spring.

   Special Tools

Ref. No.	Tool No.	Description
1	07053-58011	HANDLE, compressor
2	07053-58012	COMPRESSOR, release spring (Primary clutch)
	07053-58012-1	RETAINER, compressor
	07053-58012-2	ADAPTER, handle

Note:
Apply the spring compressor at the point where the spring and spring seat are closely mated.

3. To remove the clutch piston from the clutch drum, use the clutch piston remover adapter and apply compressed air. **(Fig 7B-120)**

Procedure:
Install the primary clutch piston remover adapters as shown in **Fig. 7B-120** and then screw in the compressor handle. Blow compressed air into the air passage using air gun as shown in **Fig. 7B-121.**
The air pressure will be applied to the back of the piston, forcing it out.

Special Tools

Ref. No.	Tool No.	Description
1	07053-58011	HANDLE, compressor
	07053-58012-1	ADAPTER, handle
3	07053-58013	ADAPTER, piston remover (primary clutch)
	07053-58013-1	Adapter A, piston remover (primary)
	07053-58013-2	Adapter B, piston remover (primary)
	07053-58013-3	Adapter C, piston remover

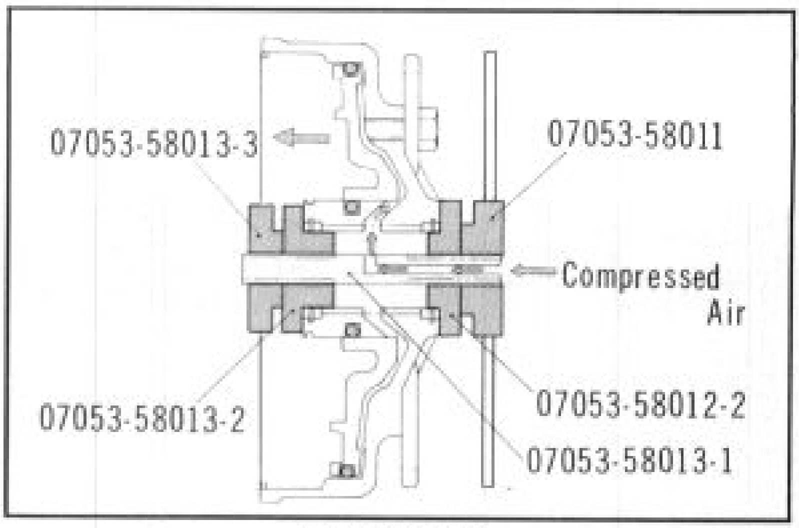


Fig. 7B-120

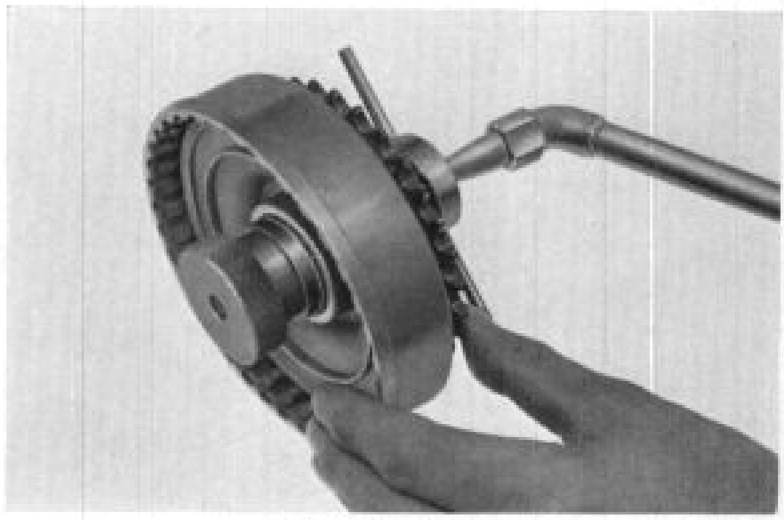


Fig. 7B-121

4. Remove the bolts and separate the drive sprocket from the clutch drum. **(Fig. 7B-122)**

Note:
Torque to 1.2 kg-m (8.7 ft-lbs) during assembly.

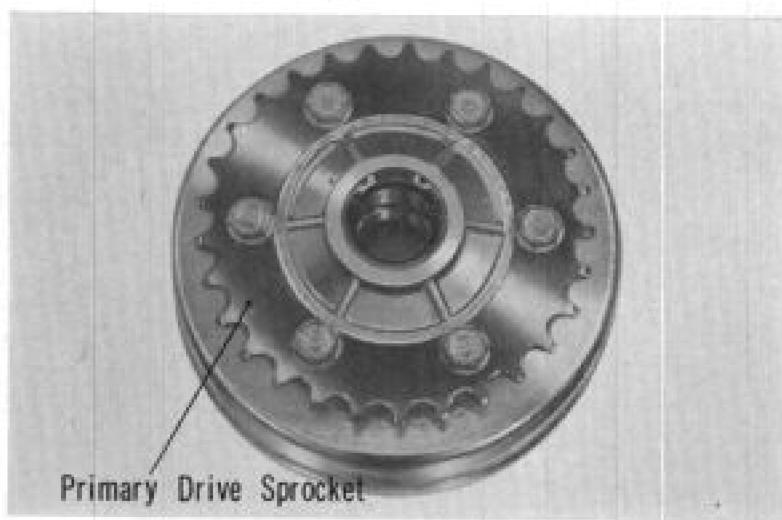


Fig. 7B-122

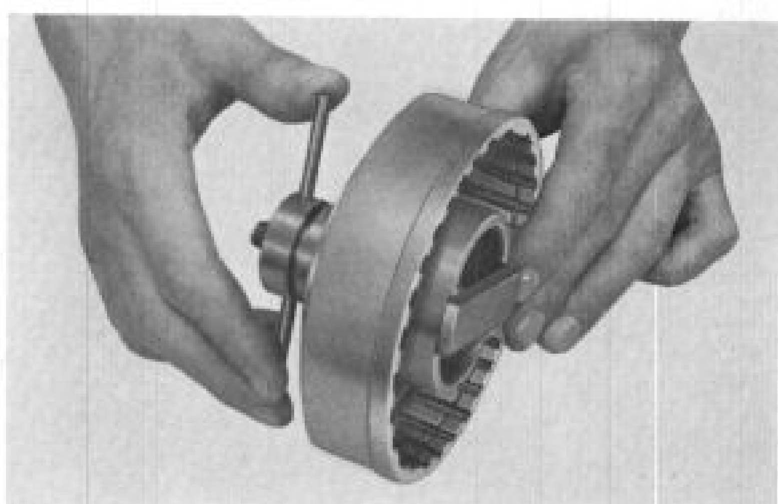


Fig. 7B-123

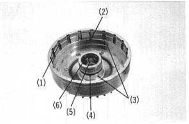


Fig. 7B-124

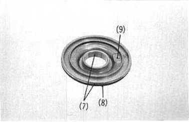


Fig. 7B-125

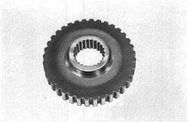


Fig. 7B-126

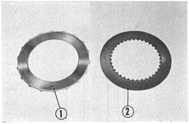


Fig. 7B-127

Inspection

After disassembly, wash all the components in gasoline or kerosene and dry with compressed air before performing the inspection.

1. Clutch drum (Fig 7B-124)
   a) Check the slotted mating surfaces of both the clutch drum and the driven plate (1) for damage and wear.
   b) Check the internal circlip setting groove (2) on the drum for damage.
   c) Check the piston contact surface (3) on the bore of the drum for damage and wear.
   d) Check the inner O ring (4) of the drum for damage and wear.
   e) Check the drum bushing (5) for damage and wear.
   f) Check the drum oil seal (6) for damage and wear.
2. Clutch piston (Fig. 7B-125)
   a) Check both the internal and external friction surface of the piston (7), which come in contact with the drum, for damage and wear.
   b) Check the outer O ring (8) of the piston for damage and wear.
   c) Check the piston relief valve (9) for operating condition and security of the staking.
3. Clutch hub (Fig. 7B-126)
   a) Check the condition of the spline area (1) which mates with mainshaft.
   b) Check wear and fitting condition of the spline area (2) which mates with the driven plates.
4. Drive and driven plates (Fig. 7B-127)
   a) Check drive plates (1). The plates must not be scored or grooved.
   b) Check driven plates (2) for damage, signs of burning and wear.

5. Release spring **(Fig. 7B-128)**
Check the release spring for breakage or for loss of tension, using a spring tester. If the spring is weakened beyond serviceable limit, it should be replaced.

Item	Standard Value	Serviceable Limit
Installed	38.7~47.3 kg/ 18.5 mm	Replace if beyond
Load/Length	(85.3~ 104.3 lbs/0.728")	38.7 kg/ 18.5 mm (85.3 lbs/ 0.728")

*The standard spring free length is 36.5mm (1.437 in).

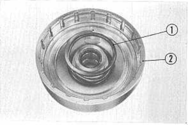


Fig. 7B-128

Reassembly

1. If the oil seal has been removed from the clutch drum, use the oil seal driver to reinstall the seal.

Procedure:
The clutch drum oil seal should prevent the hydraulic fluid under pressure from leaking, therefore, exercise extreme care when installing. After installation, make sure that the seal is properly installed to the full depth, however, do not apply excessive force as the sealing lip may be damaged.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
32	07053-58042	DRIVER, clutch drum oil seal

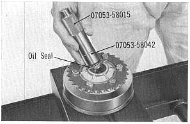


Fig. 7B-129

2. Reinstall all new O rings into the drum and piston grooves. Make sure that the O rings are not twisted. **(Fig. 7B-130)**

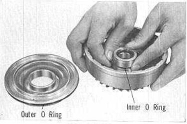


Fig. 7B-130

3. Apply fluid on the O ring contact areas on both the drum and piston, and insert the piston into the drum with care not to damage the lip on the seal. **(Fig. 7B-131)**

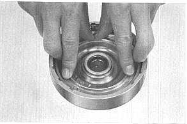


Fig. 7B-131

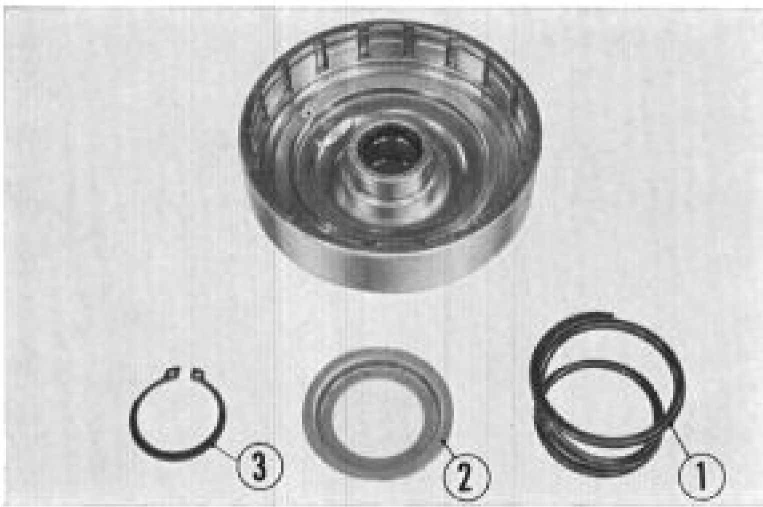


Fig. 7B-132

4. Install the release spring (1) into the drum and then assemble the spring seat (2) and circlip (3) on top. Use the spring compressor in the same manner as for disassembly to compress the spring for installation, followed by installing the retainer circlip using the snap ring pliers. **(Fig. 7B-132)**

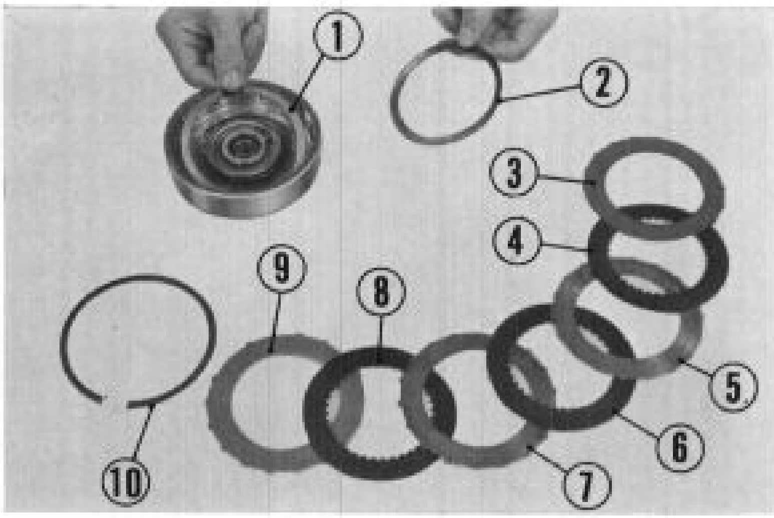


Fig. 7B-133

5. Install the spring seat, wave spring and the drive/driven plates in sequence shown in the figure. **(Fig. 7B-133)**

   Note:
   The new driven plates should be immersed in AT fluid for at least 1 hour before they are installed.

6. After all the plates are positioned, apply force against the pressure plate to permit the installation of the internal circlip.

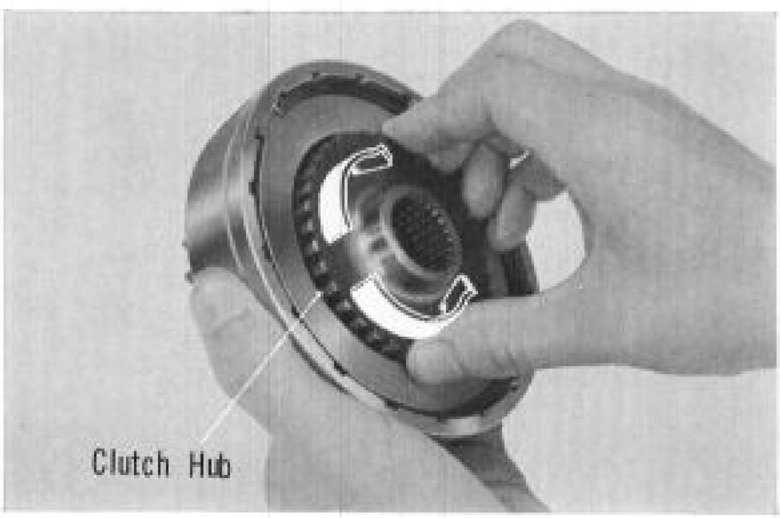


Fig. 7B-134

7. Finally, assemble and rotate the clutch hub to insure that there are no farsh dragging of the driven plates. **(Fig. 7B-134)**

11. Engine Oil Pump

The engine oil pump consists components shown in the figure.

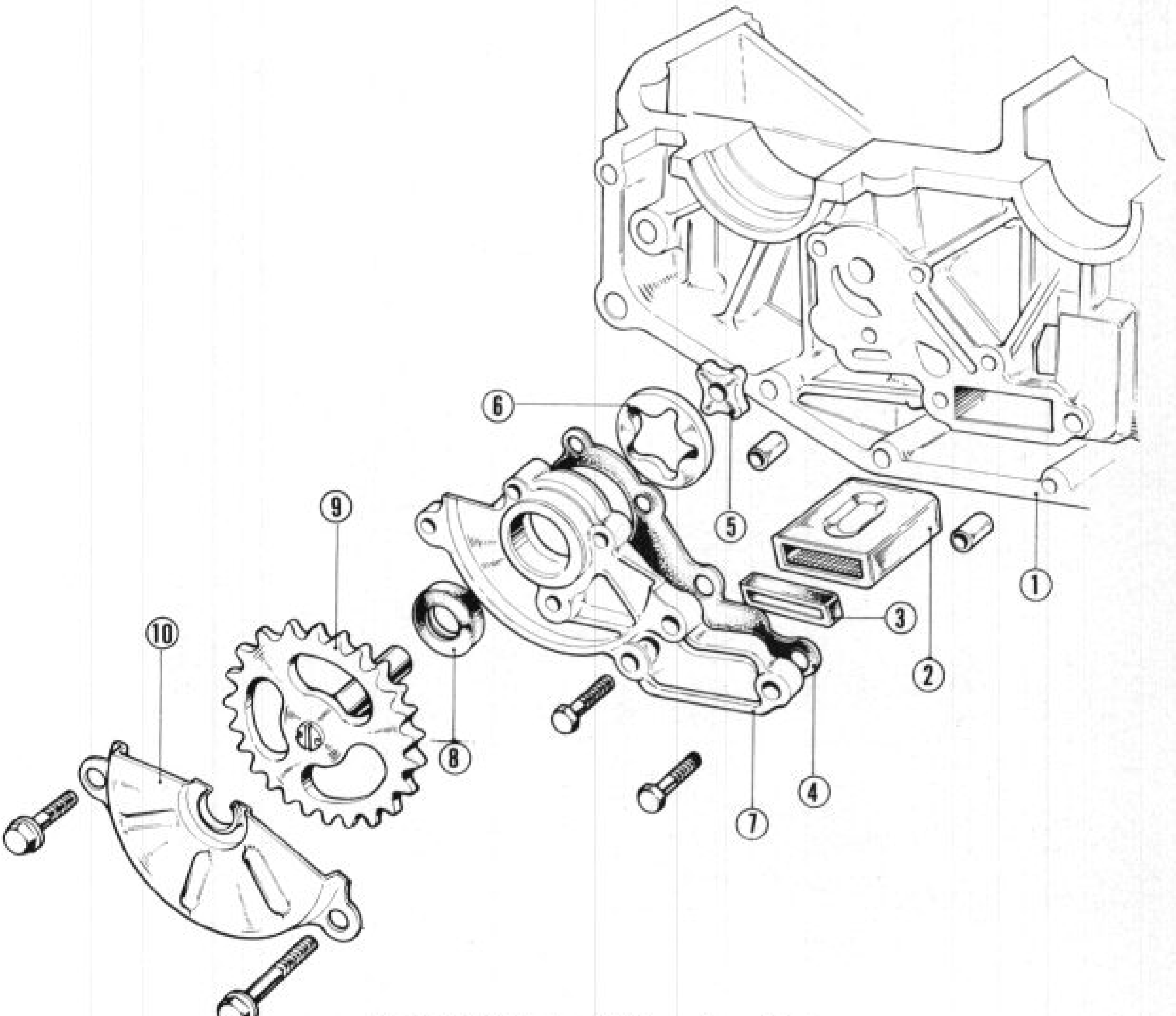


Fig. 7B-135 Engine Oil Pump Assembled

① Lower crankcase	⑥ Outer rotor
② Strainer	⑦ Pump housing
③ Strainer seal	⑧ Oil seal
④ Pump housing gasket	⑨ Driven gear
⑤ Inner rotor	⑩ Pump cover

Removal

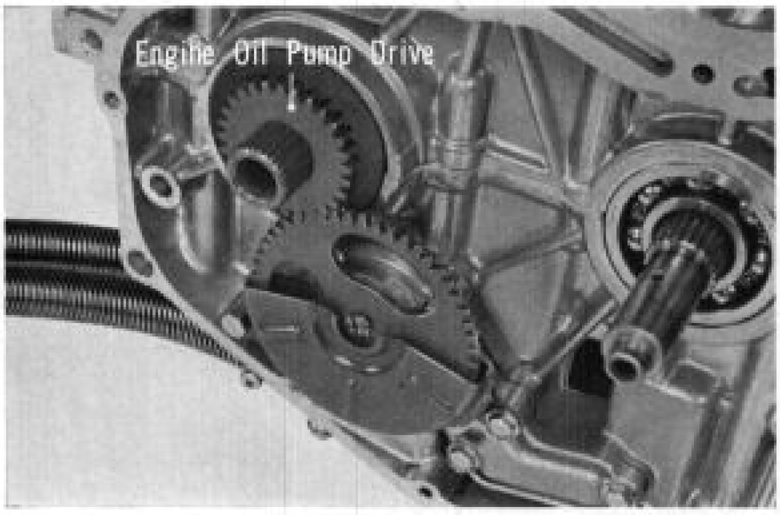


Fig. 7B-136

1. Remove the engine oil pump driven gear from the end of the crankshaft spline section. (Fig. 7B-136)

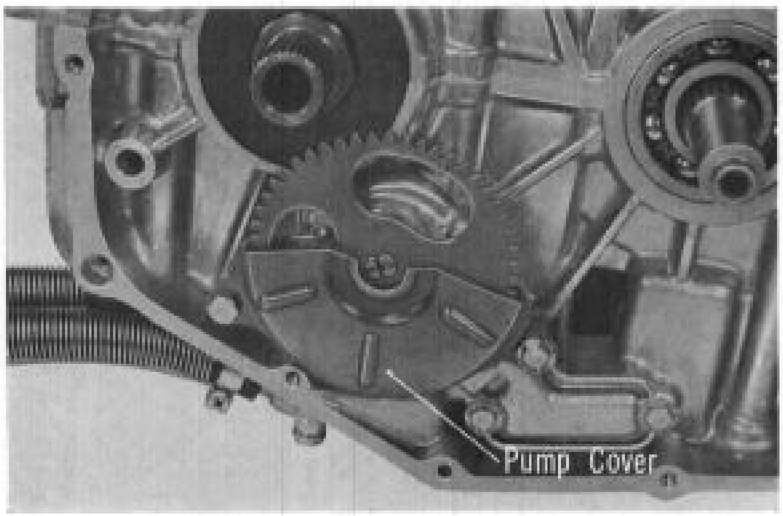


Fig. 7B-137

2. Unscrew the two pump cover mounting bolts and remove the cover. (Fig. 7B-137)

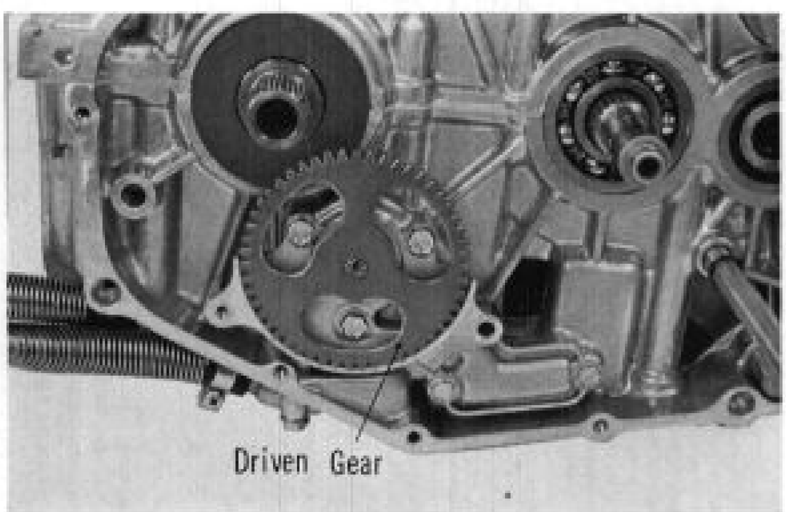


Fig. 7B-138

3. Aligned the openings in the pump drive sprocket to the pump mounting bolts, and unscrew those three bolts in addition to the other two pump mounting bolts and then remove the oil pump assembly from the lower crankcase. (Fig. 7B-138)

   Note:
   Torque the bolts to 1.0 kg-m (7.2 ft-lbs) during reassembly.

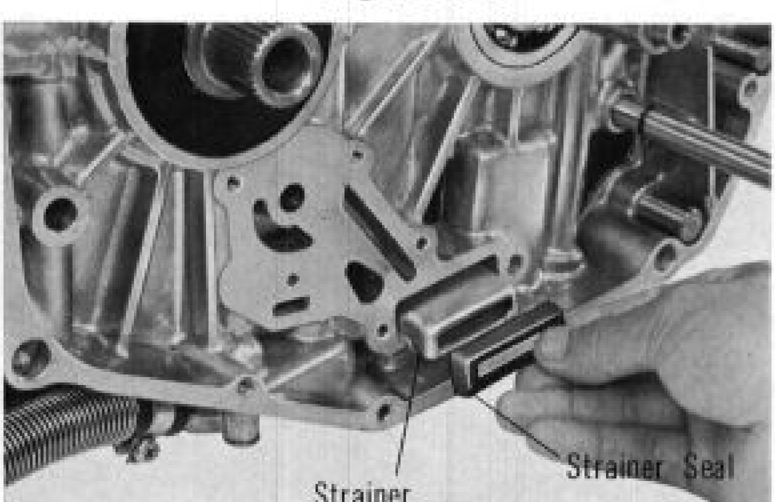


Fig. 7B-139

4. Remove the strainer and the strainer seal from the lower crankcase. (Fig. 7B-139)

Inspection and Installation

1. Inspection pump inner rotor tip clearance.

Item	Standard Value	Serviceable Limit
Tip clearance	0.08~ 0.12 mm (0.0032~ 0.0047")	Replace if beyond 0.25 mm (0.010")

2. Inspect the outer rotor to housing clearance and side clearance.

Items	Standard Value	Serviceable Limit
Body clearance	0.1~ 0.155 mm (0.0039~ 0.0067")	Replace if beyond 0.3 mm (0.0118")
Side clearance	0.1~ 0.17 mm (0.0039~ 0.0067")	Replace if beyond 0.3 mm (0.0118")

3. Use the oil seal driver to lightly drive the oil seal to the pump housing.

Procedure:
Set the oil seal in the driver guide and drive the oil seal into the pump housing with a hammer.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
31	07053-58041	DRIVER, oil seal (engine oil pump housing)
	07053-58040-1	DRIVER, oil seal
	07053-58041-2	GUIDE, oil seal driver

4. Insert the shaft of the driven gear into the oil seal on the pump housing. Rotate the shaft while inserting, and exercise care that the lip on the oil seal is not damaged.
Insert both the outer and inner rollers into the pump housing. **(Fig. 7B-143)**

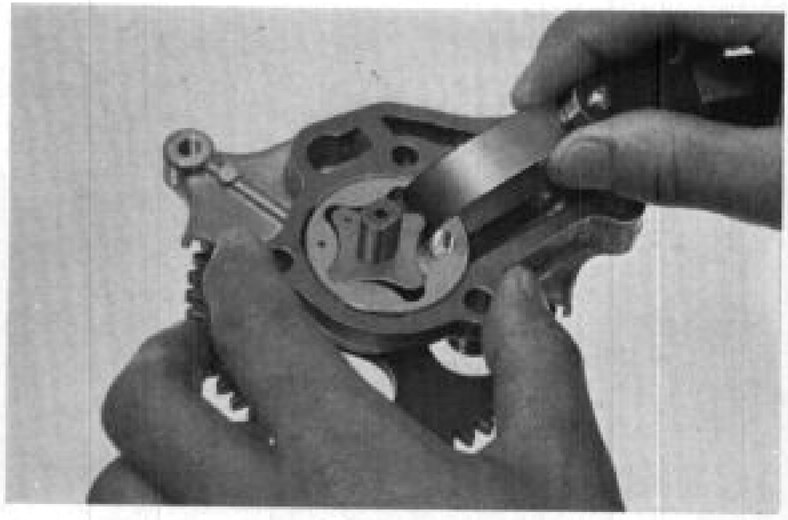


Fig. 7B-140

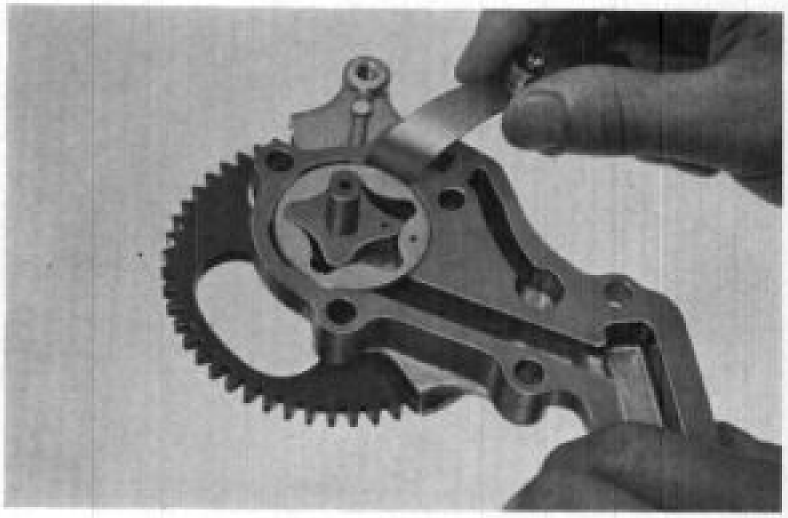


Fig. 7B-141

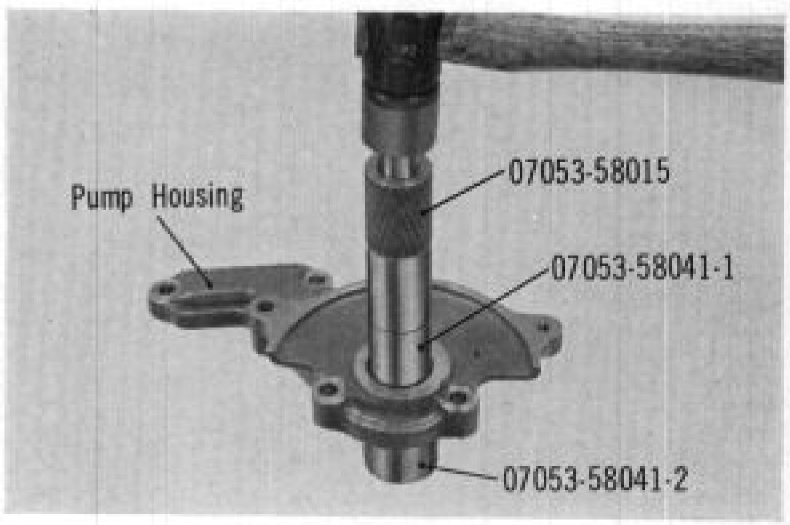


Fig. 7B-142

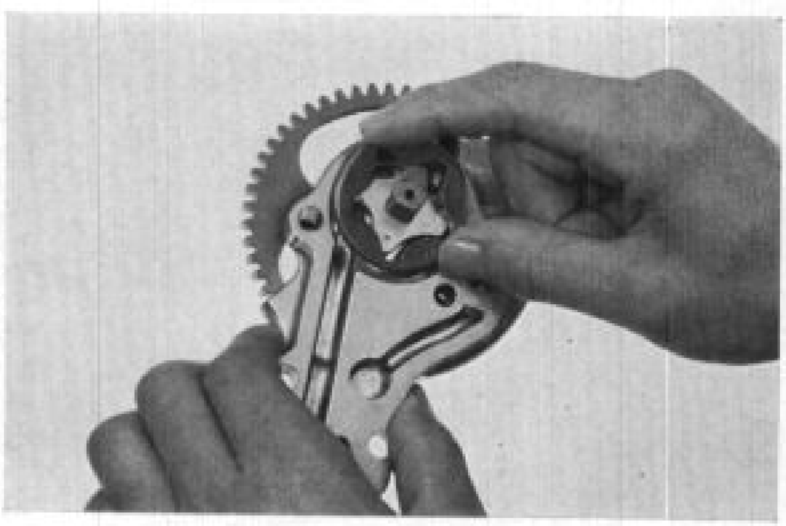


Fig. 7B-143

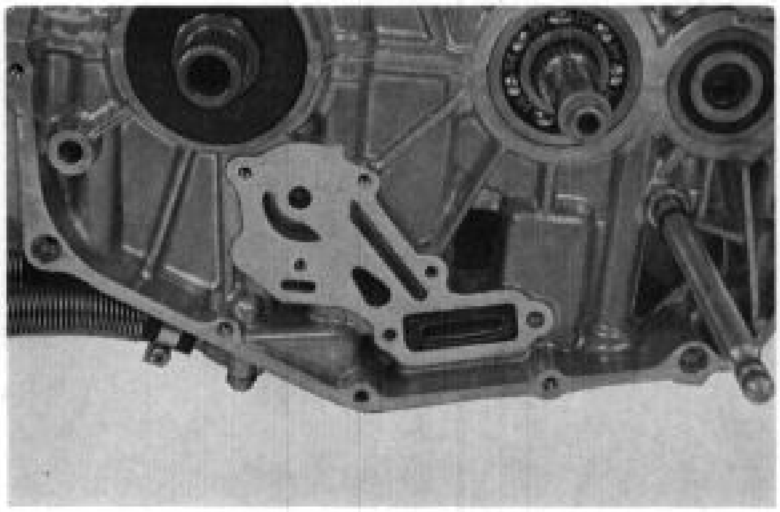


Fig. 7B-144

5. Install the strainer and the strainer seal on the lower crankcase followed by the installation of the hollow pin, housing gasket and then the pump assembly. And while uniformly torquing the housing bolts, turn the rotor by hand to make sure that it is rotating smoothly without binding against the housing. Torque the housing bolts to 1.0 kg-m (7.2 ft-lbs).
   Finally, mount the oil pump drive gear on the crankshaft spline.

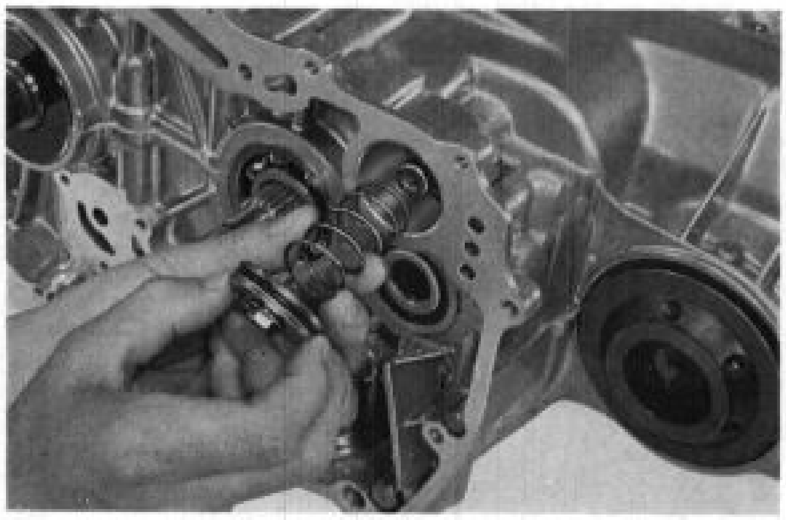


Fig. 7B-145

12. Servo Valve

Removal

Loosen the bolt and remove the servo piston and the piston return spring from the upper crankcase.

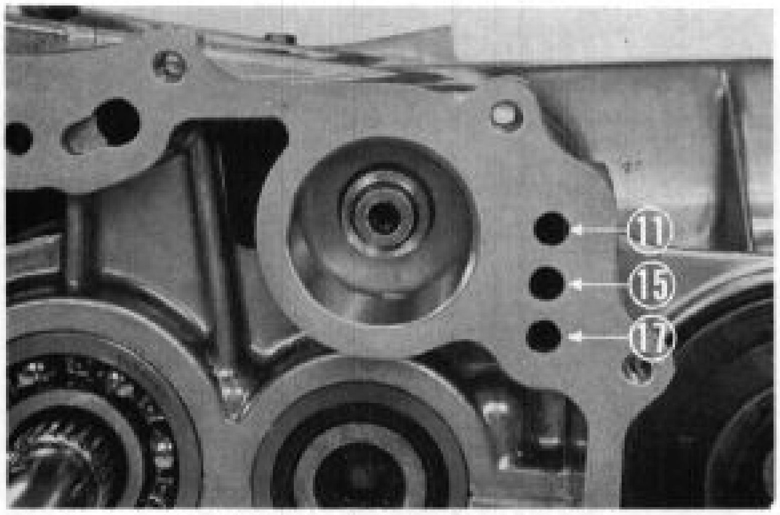


Fig. 7B-146

Inspection

1. Check the interior of the valve (upper crankcase) for damaged and wear.
2. Check oil passages to make sure that none is clogged.
3. Replace any broken or badly distorted springs.

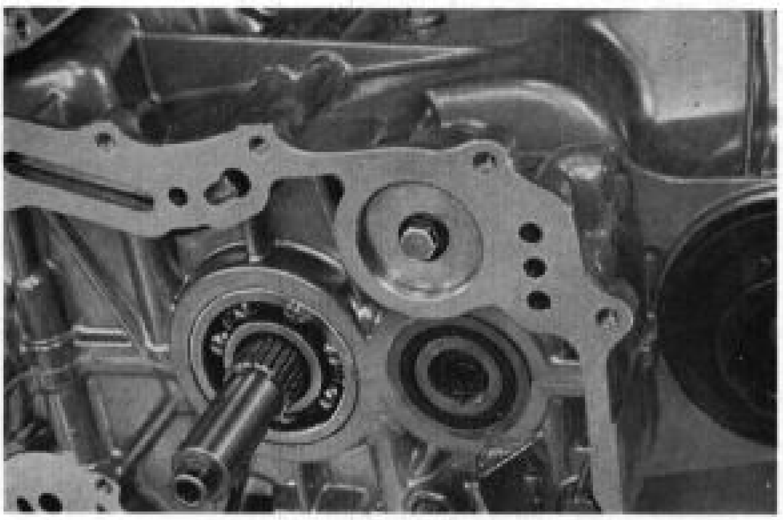


Fig. 7B-147

Installation

Perform the assembly in the reverse order of disassembly.

b. Disassembly Procedure From RH Side

1. Crankcase Right Side Cover

Removal

The A360 mounts the same type motorgenerator as the N360. The A600 incorporate the same type starter motor and AC generator as the N600. The disassembly and assembly of the respective components are identical.

Remove the bolts from the crankcase right side cover and separate the cover from the upper and lower crankcases. Torque the cover bolts to 1.2kg-m(9ft-lbs)

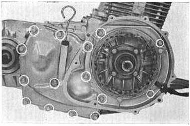


Fig. 7B-148

Installation

After making sure that the oil guide plate, hollow pins and the crankcase right side cover gasket are properly installed, reinstall the crankcase right side cover. **(Fig. 7B-149)**

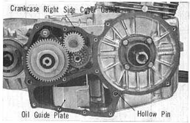


Fig. 7B-149

2. Reverse Gears and Shift Fork

Removal and Installation

1. Remove the reverse idle shaft and gear.
2. Disassemble the circlip and the reverse gear from the mainshaft.
3. Disassemble the circlip, thrust washers, reverse gear, gear hub, and cotters from the countershaft.

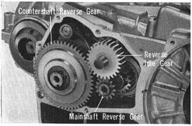


Fig. 7B-150

4. Pull the shift fork shaft and remove the spring pin followed by removing the selection gear and reverse gear shift fork together from the countershaft. **(Fig. 7B-151)**
5. Reassemble the parts in the reverse order of removal.

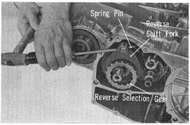


Fig. 7B-151

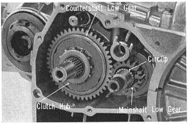


Fig. 7B-152

3. Low Gears

Removal and Installation

1. Remove the circlip and disassemble the lower gear from the mainshaft.
2. Disassemble the clutch hub, one-way clutch assembly, low gear, distance collar and thrust washer from the countershaft. **(Fig. 7B-152)**
3. Perform the assembly in the reverse order of disassembly.

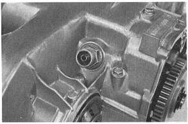


Fig. 7B-153

4. Speedometer Gear

Removal and Installation

1. Remove the speedometer gear assembly. **(Fig. 7B-153)**

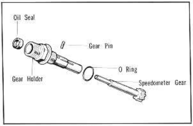


Fig. 7B-154

2. Disassemble the gearbox holder by removing the gear pin and oil seal. **(Fig. 7B-154)**

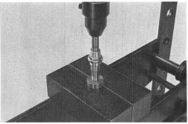


Fig. 7B-155

3. Install the oil seal into the gear box holder by using a oil seal driver.

Procedure:
Set the holder and oil seal on the driver guide and press fit the oil seal into the speedometer gearbox holder.

Special Tools

Ref. No.	Tool No.	Description
30	07053-58040	DRIVER, oil seal (speedometer gear box holder)
	07053-58040-1	DRIVER, oil seal
	07053-58040-2	GUIDE, oil seal driver

4. Install the speedometer gear assembly. **(Fig. 7B-156)**

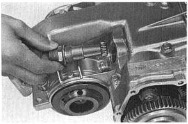


Fig. 7B-156

c. Disassembly Procedure From Bottom

1. Lower Crankcase

Removal and Installation

1. Separate the upper and lower crankcase by removing the bolts and washer **(Fig. 7B-157, 158 & 159)**. The transmission and the differential are assembled in the upper crankcase.

   Note:
   When assembling, tighten the bolts is the reverse order of removal. Torque the bolts to
   1.2 kg-m (9ft-lbs) .... (○) bolts.
   2.5 kg-m (18.1ft-lbs) .... (□) bolts.

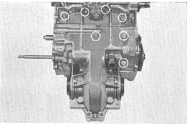


Fig. 7B-157

2. Detach the engine oil joint by removing the bolts. **(Fig. 7B-158)**

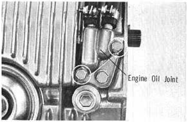


Fig. 7B-158

3. Tighten the bolts diagonally starting from the inside and working out. **(Fig. 7B-159)**

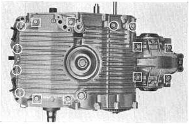


Fig. 7B-159

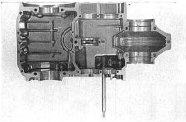


Fig. 7B-160

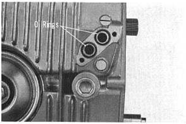


Fig. 7B-161

4. Wipe off the lower crankcase mating surface free of oil and apply liquid gasket to thickness of 0.05-0.08mm (0.0020-0.0030") and allow to dry before installation.

5. Wipe off any oil from the mating surface of the upper crankcase before installing the lower crankcase. **(Fig. 7B-160)**

6. When installing the engine oil joint, caution not to forget the O rings on the oil hole grooves of the lower crankcase. **(Fig. 7B-161)**

2-1. Mainshaft Assembly

Description

After removing the mainshaft assembly from the upper crankcase, it can be disassembled as shown in the figure below. The disassembly can be easily performed by removing the ball bearing using the special tool.

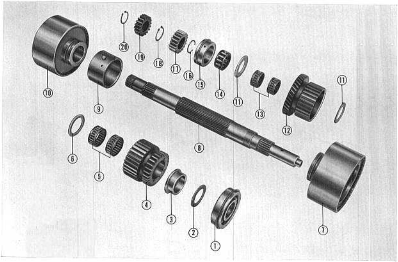


Fig. 7B-162 Mainshaft Disassembled

① 6305 ball bearing (w/set ring)
② Thrust plate
③ Distance collar
④ Mainshaft second gear
⑤ Second gear needle bearing
⑥ Thrust washer
⑦ Second clutch
⑧ Mainshaft
⑨ Sealing ring guide
⑩ Third clutch
⑪ Thrust plate
⑫ Mainshaft third gear
⑬ Third gear needle bearing
⑭ Mainshaft needle bearing
⑮ Mainshaft bearing holder
⑯ Set ring
⑰ Mainshaft low gear
⑱ External circlip
⑲ Mainshaft reverse gear
⑳ External circlip

Disassembly

1. Separate the mainshaft from the upper crankcase. **(Fig. 7B-163)**

   Note:
   During reassembly, do not forget the O ring on the mainshaft sealing ring guide. Further, make sure that the 2nd/3rd clutch control pressure line hole in the upper crankcase is aligned to the hole in the sealing ring guide.

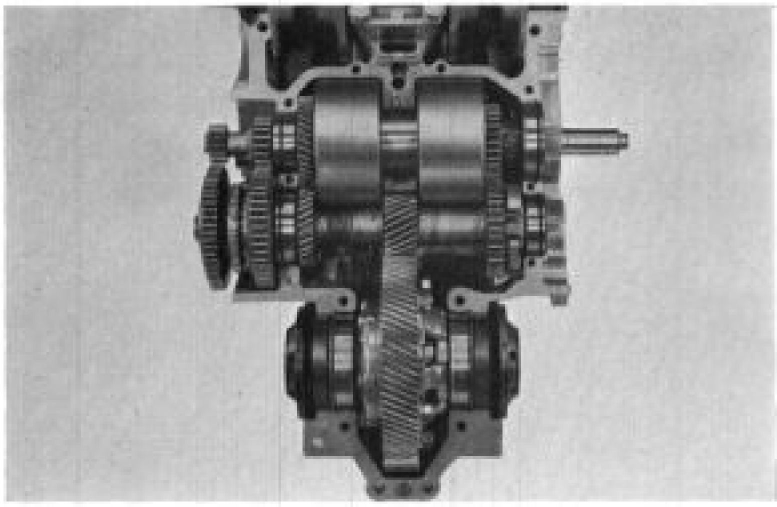


Fig. 7B-163

2. After removing the external circlips, disassemble the reverse and low gears from the serrated section of the mainshaft. **(Fig. 7B-164)**

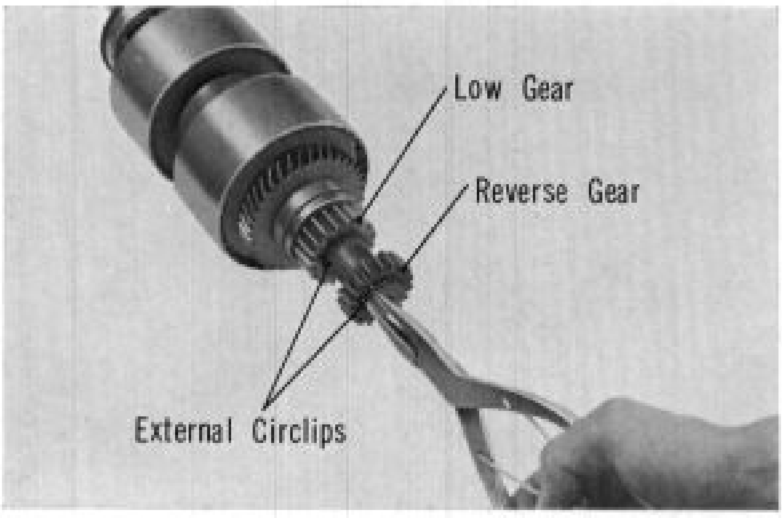


Fig. 7B-164

Fig. 7B-165

3. Remove the needle bearing holder and the needle bearing. **(Fig. 7B-166)**

4. Remove the set ring from groove of the mainshaft.

Fig. 7B-166

5. Disassemble the thrust washer and the third gear from the mainshaft. **(Fig. 7B-167)**

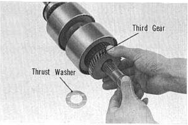


Fig. 7B-167

6. Remove the needle bearings and thrust washer. **(Fig. 7B-168)**

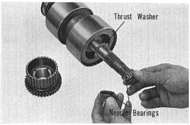


Fig. 7B-168

7. Separate the third clutch assembly from the mainshaft. **(Fig 7B-169)**

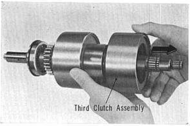


Fig. 7B-169

8. Remove the seal ring guide. **(Fig 7B-170)**

Fig. 7B-170

Fig. 7B-171

9. Separate the second clutch assembly from the mainshaft. (Fig. 7B-171)

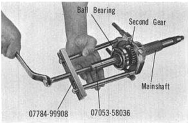


Fig. 7B-172

10. Remove the ball bearing together with the second gear from the mainshaft by using a bearing puller. (Fig. 7B-172)

Procedure:

Install the adapter on the second gear and using the universal bearing puller as shown in the figure, remove both the gear and ball bearing from the mainshaft.

Special Tools

Ref. No.	Tool No.	Description
25	07784-99908	PULLER, universal bearing
26	07053-58036	ADAPTER, mainshaft bearing puller

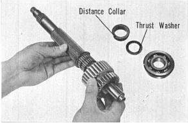


Fig. 7B-173

11. After disassembling the gear and bearing, check the distance collar and thrust washer for wear. (Fig. 7B-173)

Assembly

1. Install the thrust washer and the needle bearings on the mainshaft. (Fig. 7B-174)

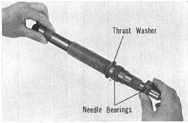


Fig. 7B-174

2. Install the ball bearing on the mainshaft.

Procedure: **(Fig. 7B-175)**

Using the ball bearing driver, install the bearing on the mainshaft.

Position the bearing so that the bearing number is exposed.

Special Tools

Ref. No.	Tool No.	Description
28	07053-58038	DRIVER, mainshaft bearing

Fig. 7B-175

3. Perform the assembly in the reverse order of disassembly. **(Fig. 7B-176)**

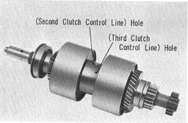


Fig. 7B-176

4. During the assembly make sure that the 2nd/3rd clutch control pressure line in the upper crankcase is aligned to the hole in the seal ring guide. **(Fig 7B-177)**

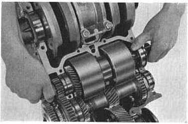


Fig. 7B-177

2-2. Secondary Clutches

The basic construction of the secondary clutches is identical to that of the primary clutch; both are hydraulically operated. The clutch drum and the piston guide are spline fitted to the mainshaft.
With the exception of the clutch hubs (Second/Third gears), the internal components of both the second and third clutch are similar.

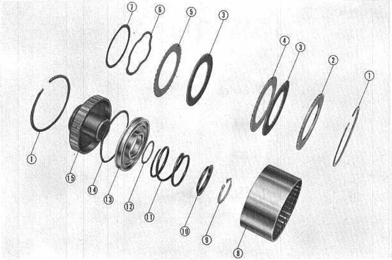


Fig. 7B-178 Secondary Clutch disassembled

No.	Description	Q'ty	Note When: Disassembly	Note When: Assembly	Remarks
1	Internal circlips	2			
2	Pressure plate	1	Check for wear		
3	Driven plates	7	Soak new plates in AT oil before installing		
4	Drive plates	6	Check for wear		
5	End plate	1	Check for wear		
6	Wave spring	1	Check for tension		
7	Spring seat	1			
8	Clutch drum	1	Check for wear, replace if necessary		
9	Internal circlip	1	Press seat together to remove and install		
10	Release spring seat	1			
11	Clutch release spring	1	Clutch for tension		
12	Inner O ring	1		Replace by new one	
13	Clutch piston	1			
14	Outer O ring	1		Replace with new item	
15	Piston guide	1	Check for wear, replace if necessary		

Disassembly

1. Remove the internal circlip with a screwdriver. (Fig. 7B-179)

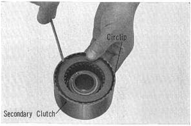


Fig. 7B-179

2. After removing the pressure plate, disassemble the driven plates, drive plates and end the plate.

   Note:
   1. Internal Circlip
   2. Pressure Plate
   3. Driven Plates
   4. Drive Plates
   5. End Plate

   Perform the disassembly in accordance with the numbers in figure 7B-180 and keeping the parts in order will facilitate when reassembling.

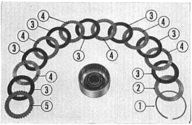


Fig. 7B-180

3. Remove the wave spring and wave spring seat from the groove of the clutch piston. (Fig. 7B-181)

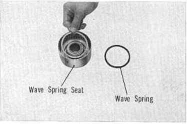


Fig. 7B-181

4. Turn the clutch drum and remove the internal circlip. (Fig. 7B-182)

Fig. 7B-182

Fig. 7B-183

5. Separate the piston guide assembly from the clutch drum. **(Fig. 7B-183)**

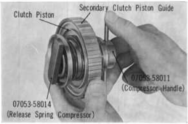


Fig. 7B-184

6. Use the release spring compressor tool and remove the release spring from the secondary clutch piston guide. **(Fig. 7B-184)**

Procedure:

To separate the piston and piston release spring from the secondary clutch piston guide, insert the primary clutch release spring compressor into the piston guide and screw the handle in. The release spring will be compressed and the spring seat freed.

Ref. No.	Tool No.	Description
1	07053-58011	HANDLE, compressor
4	07053-58014	COMPRESSOR, release spring (secondary clutch)
	07053-58014-1	RETAINER, release spring compressor
	07053-58014-2	ADAPTER, handle

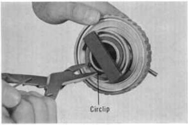


Fig. 7B-185

7. Remove the circlip with snap ring pliers. **(Fig. 7B-185)**

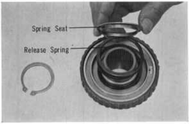


Fig. 7B-186

8. Disassemble the spring seat and release spring. **(Fig. 7B-186)**

9. Remove the piston from the piston guide. (Fig. 7B-187)

Note:
To remove the piston from the piston guide place the drum on the top of a wooden block and lightly tap two or three times.

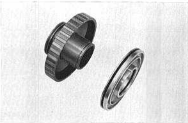


Fig. 7B-187

Inspection

After disassembly, wash all the parts in gasoline or kerosene and dry with compressed air before performing the inspection.

1. Clutch drum (Fig. 7B-188)
   a) Check the teeth and grooves on both clutch drum and drive plates (1) for damage and wear.
   b) Check the circlip setting groove (2) in the drum for damage.
   c) Check the drum (3) exterior for wear and distortion.

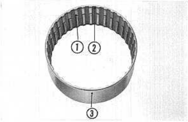


Fig. 7B-188

2. Clutch piston (Fig. 7B-189)
   a) Check both the internal and external diameter surface of the piston (4) which come in contact with the piston guide, for damage and wear.
   b) Check the circlip setting groove (2) in the drum for damage.
   c) Check the drum (3) exterior for wear and distortion.

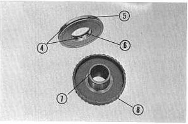


Fig. 7B-189

3. Clutch hub (Fig. 7B-189)
   a) Check the condition of the spline area (7) which mates with the mainshaft.
   b) Check the wear and fit condition of the spline area (8) which mates the driven plates.
4. Drive and driven plates (Fig. 7B-190)
   a) Check drive plate (1). The plates must not be scored.
   b) Check driven plate (2) for damage, signs of burning and wear.

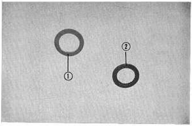


Fig. 7B-190

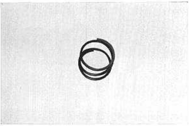


Fig. 7B-191

5. Release spring (**Fig. 7B-191**)
   Check the release spring for break or for loss of tension, using a spring tester. If the spring is beyond serviceable limit, it should be replaced.

Items	Standard Value	Serviceable Limit
Installed Load/Length	38~46 kg/ 18.2 mm (83.8~101.4 lbs/0.72 in)	Replace if beyond 38 kg/18.2 mm (83.8 lbs/0.72 in)

*The standard dimension of the spring free length is 45.6mm (1.80 in)

Assembling

1. If the O ring has been removed from the clutch piston, reinstall new O ring into the piston groove. Make sure that the O ring are not twisted.
2. Apply fluid on the O ring of both the piston guide and piston, and assemble the piston into the drum, exercising care not to damage the lip on the seal. (**Fig. 7B-192**)

Fig. 7B-192

3. Install the release spring into the guide and then assemble the spring seat and circlip on top. Use the spring compressor in the same manner as during disassembly to compress the spring for installation, followed by installing the external circlip using the snap ring pliers.

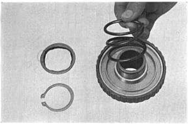


Fig. 7B-193

4. Install the piston/piston guide assembly into the clutch drum and then, install the circlip followed by assembling the plates in the number sequence shown in the **Fig. 7B-194**. Finally install the circlip.

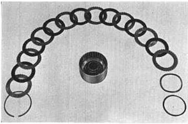


Fig. 7B-194

5. After completing the assembly of the secondary clutches, reassemble the 2rd or the 3nd gear by inverting as shown in figure 7B-195.

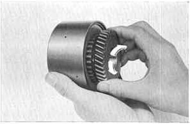


Fig. 7B-195

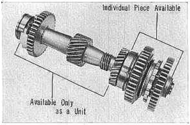


Fig. 7B-196

3-1. Countershaft Assembly

Description

The governor valve mounted countershaft can not be disassembled, however, as shown in figure, the reverse gear, low gear, one way clutch, ball bearing and needle bearing are available as individual parts and can be removed and replaced. The governor valve weight spring and weights will effect functioning of the governor, therefore, they should not be handle roughly when removing nor should they be droped and caused to become damaged.

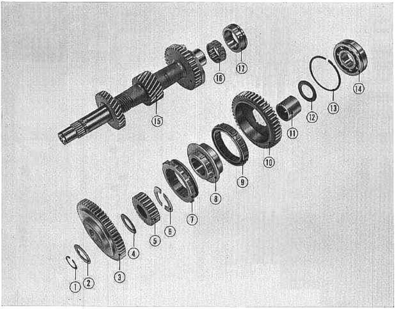


Fig. 7B-197

1 External circlip
2 Thrust washer
3 Countershaft reverse gear
4 Thrust washer
5 Reverse gear hub
6 Cotter
7 Reverse selector gear
8 One-way clutch hub
9 One-way clutch assy.,
10 Countershaft low gear
11 Distance collar
12 Thrust washer
13 Set ring
14 6305 ball bearing
15 Countershaft (w/governor valve)
16 Needle bearing
17 Bearing holder

Removal

1. Remove the circlip from groove of the counter-shaft.(Fig. 7B-198)

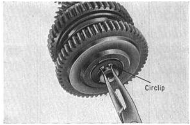


Fig. 7B-198

2. Remove the thrust washer.(Fig. 7B-199)

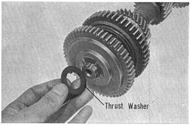


Fig. 7B-199

3. Separate the reverse gear. (Fig. 7B-200)

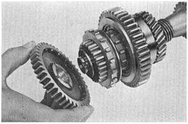


Fig. 7B-200

4. Remove the reverse select gear and gear hub. (Fig. 7B-201)

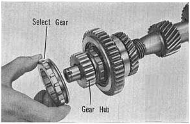


Fig. 7B-201

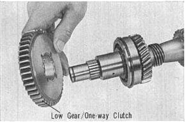


Fig. 7B-202

5. Disassemble the low gear and one way clutch. **(Fig. 7B-202)**

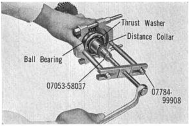


Fig. 7B-203

6. Remove the distance collar, thrust washer and ball bearing with the bearing puller. **(Fig 7B-203)**

Procedure:
Install the adapter on the ball bearing and using the universal bearing puller as shown in the figure, remove the ball bearing.

Special Tools

Ref. No.	Tool No.	Description
25	07784-99908	PULLER universal bearing
27	07053-58037	ADAPTER, countershaft bearing puller

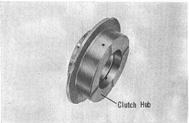


Fig. 7B-204

Inspection

Check the low gear and the one way clutch for damage and wear. Further, to perform a simple inspection, assemble the low gear (outer race), one way clutch (spray clutch) and the clutch hub (inner race), and then, rotate the clutch hub back and forth to check for smooth operation and also to see if the clutch is positively locking or whether it operates smoothly without locking.

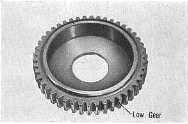


Fig. 7B-205

Low gear (Fig. 7B-205)

a) Check the race of the low gear to see if there are any trace of pitting or burning cause by the sprag.
b) Check the guide area (1) of the clutch hub race for any indication of burning.

One-way clutch (Fig. 7B-206)
a) Check the sprag for damage and wear.
b) Check for any damage of the strainer.
c) Check the drag strip for wear.

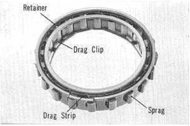


Fig. 7B-206

Assembly

1. Install the ball bearing on the countershaft by using a ball bearing driver.

   Procedure:
   Using the bearing driver, install the bearing on the countershaft. Position the bearing so that the bearing number is exposed.

   Special Tools

Ref. No.	Tool No.	Description
29	07053-58039	DRIVER, countershaft bearing

2. And then, assemble the thrust washer and distance collar. Make the installation in the reverse order of removal.

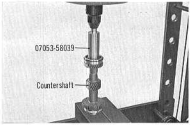


Fig. 7B-207

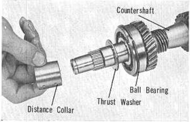


Fig. 7B-208

3-2. Governor Valve

Description

The countershaft units mounting the governor weight can not be disassembled, and therefore, before disassembling the transmission, make a preliminary check of the governor pressure and if the governor pressure is found to be improper, remove the countershaft unit incorporating the governor valve and check the governor weight, governor weight spring visually from the exterior and if any defective condition is found, the assembly should be replaced as a unit. The procedure of disassembly and assembly are described in this manual so that the construction and its operation can be understood.

Fig. 7B-209

Removal and Checking

1. Remove the bearing holder and needle bearing from the countershaft. **(Fig. 7B-210)**

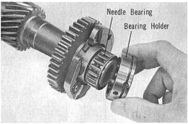


Fig. 7B-210

2. Remove the clips and washers from the governor weight setting bolts. **(Fig. 7B-211)**

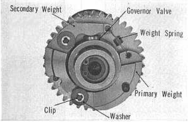


Fig. 7B-211

3. Pull out the primary weight and secondary weight with the weight spring, and then remove the governor valve. (Fig. 7B-212)

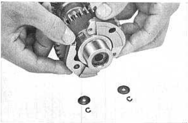


Fig. 7B-212

4. Remove the governor weight setting bolts. (Fig. 7B-213)

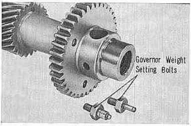


Fig. 7B-213

5. After removing the circlip, remove the oil seal. (Fig. 7B-214)

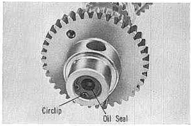


Fig. 7B-214

6. Check the mounting hole of the weight spring and setting bolts of the primary weight mounting hole. (Fig. 7B-215)
7. Check the condition of the mounting hole of the secondary weight spring and setting bolt.
8. Check the governor valve for distortion of the outer surface, scratches and burrs.
9. Check the weight spring.

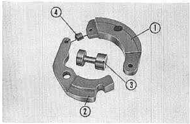


Fig. 7B-215

10. Check the friction surface of the governor body valve for damage and wear. (Fig. 7B-216)
11. Check the mini-ball bearing for wear and galling.

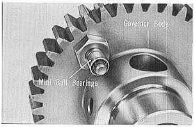


Fig. 7B-216

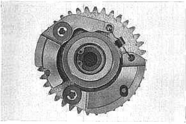


Fig. 7B-217

Assembly

1. After installing the governor weights, check to make sure that they operate smoothly.
2. The oil seal must be assembled in the proper manner. (Fig. 7B-217)

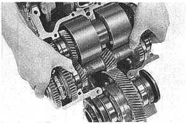


Fig. 7B-218

3. Perform the installation in reverse order of removal. (Fig. 7B-218)

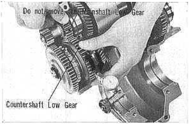


Fig. 7B-219

4. Inspect backlash of the low gears. (Fig. 7B-219)

Unit: mm (inch)

Item	Standard tolerance	Serviceable limit
Backlash	0.044~0.088 (0.002~0.004)	Replace if beyond 0.1 (0.004)

Fig. 7B-220

5. Inspect backlash of the second gears. (Fig. 7B-220)

Unit: mm (inch)

Item	Standard tolerance	Serviceable limit
Backlash	0.046~0.094 (0.002~0.004)	Replace if beyond 0.1 (0.004)

6. Inspect backlash of the third gears. (Fig. 7B-221)

Unit: mm (inch)

Item	Standard tolerance	Serviceable limit
Backlash	0.0046~0.094 (0.002~0.004)	Replace if beyond 0.1 (0.004)

Fig. 7B-221

4. Differential

Refer to the Section 8 "DIFFERENTIAL" for the information on the differential.

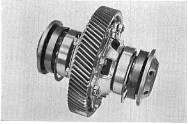


Fig. 7B-222

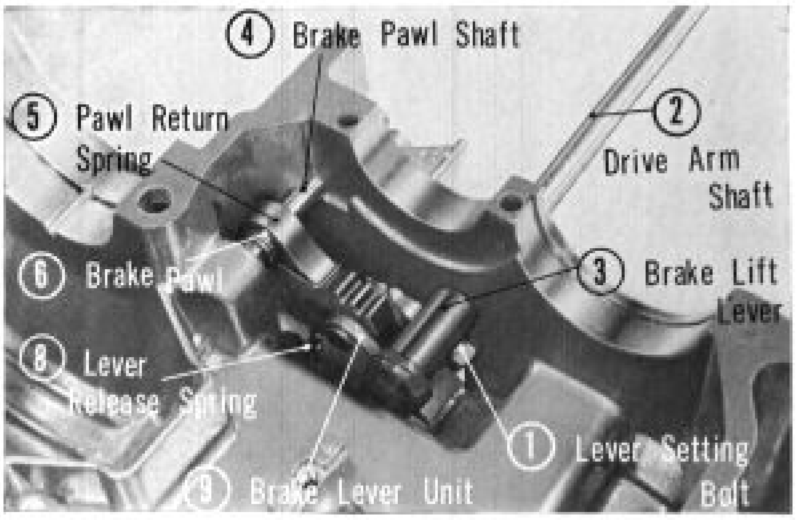


Fig. 7B-223

5. Parking Brake System

Removal

1. Remove lever setting bolt (1), and dismount drive arm shaft (2) and brake lift lever (3) from lower crankcase.
2. Extract brake pawl shaft (4) and remove pawl return spring (5).
3. Draw out brake lever shaft (7) and dismount brake lever unit (9) from lower crankcase together with lever release spring (8) and brake pawl (6).

1. Remove lever setting bolt (1), and dismount drive arm shaft (2) and brake lift lever (3) from lower crankcase.
2. Extract brake pawl shaft (4) and remove pawl return spring (5).
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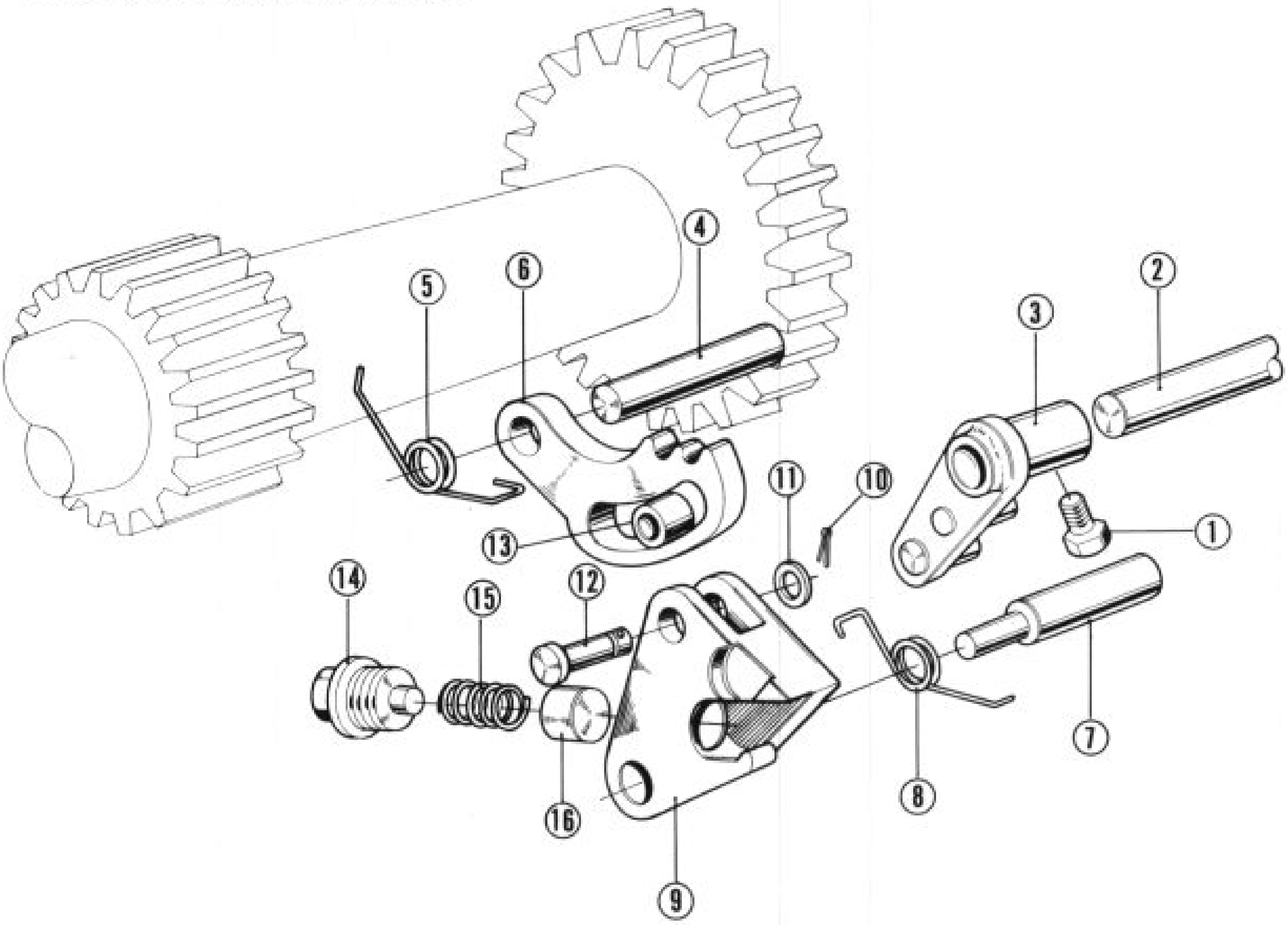


Fig. 7B-224 Parking Brake Disassembly

① Lever setting bolt	⑨ Parking brake lever
② Drive arm shaft	⑩ Cotter pin
③ Brake lift lever	⑪ 7mm washer
④ Brake pawl shaft	⑫ Roller pin
⑤ Pawl return spring	⑬ Parking brake pawl roller
⑥ Parking brake pawl	⑭ Release spring retaining bolt
⑦ Brake lever shaft	⑮ Lift lever return spring
⑧ Brake lever release spring	⑯ Lift lever return spring cap

Inspection

1. Replace the broken or weakened springs with new ones.
2. Make sure that the friction surfaces operate smoothly.
3. Check the tips of parking brake pawl teeth for damage and wear.

Assembly

1. Fit lift lever return spring cap and lift lever return spring into the parking brake lever and tighten retaining bolts.

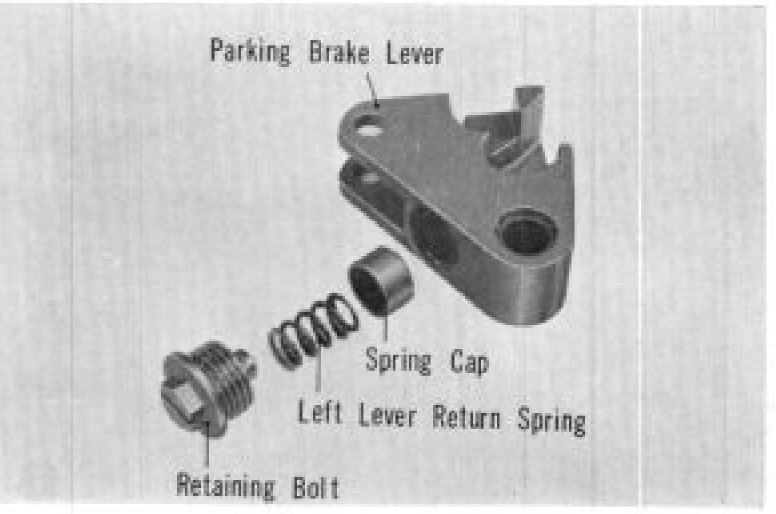


Fig. 7B-225

2. After inserting rollers into the brake pawl, fit roller pin and 7mm washer on the brake lever and fix by cotter pin.**(Fig. 7B-226)**

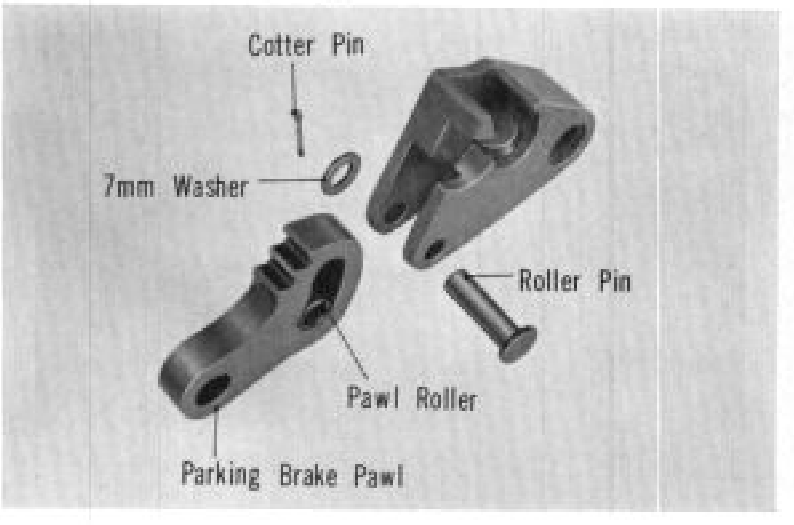


Fig. 7B-226

3. Fit brake lever unit and lever release spring on the lower crankcase; mount lever shaft. **(Fig. 7B-227)**

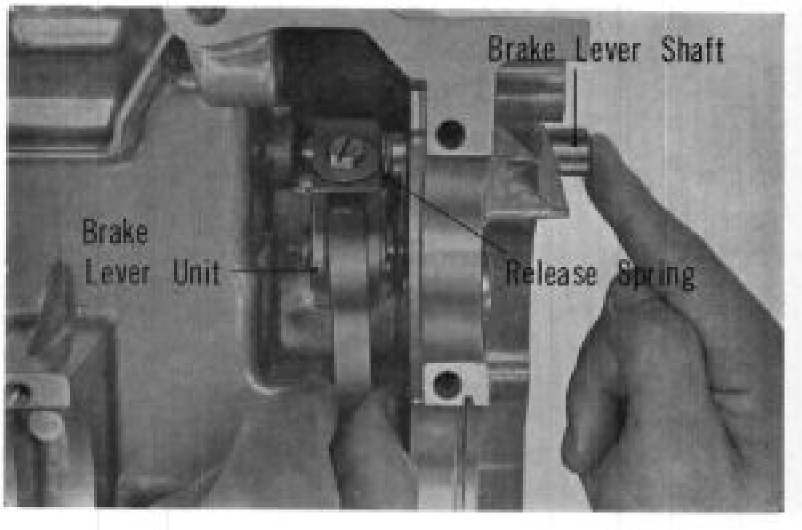


Fig. 7B-227

4. Mount brake pawl, pawl return spring on the lower crankcase with the pawl shaft.**(Fig. 7B-228)**

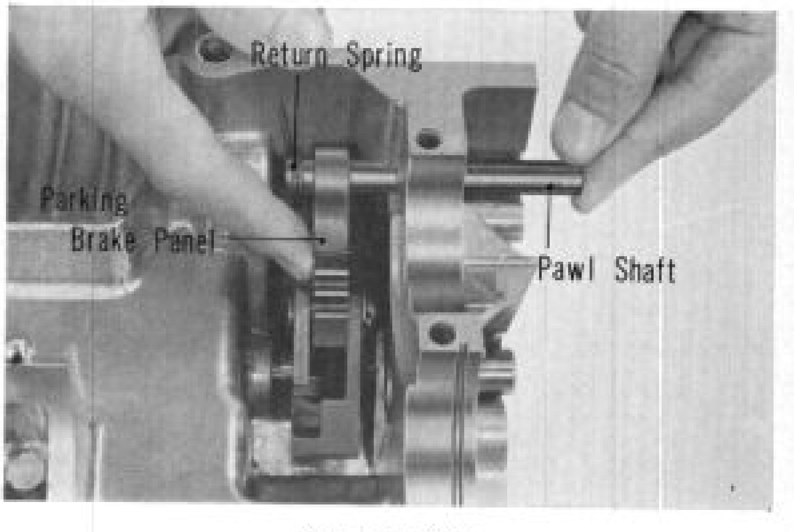


Fig. 7B-228

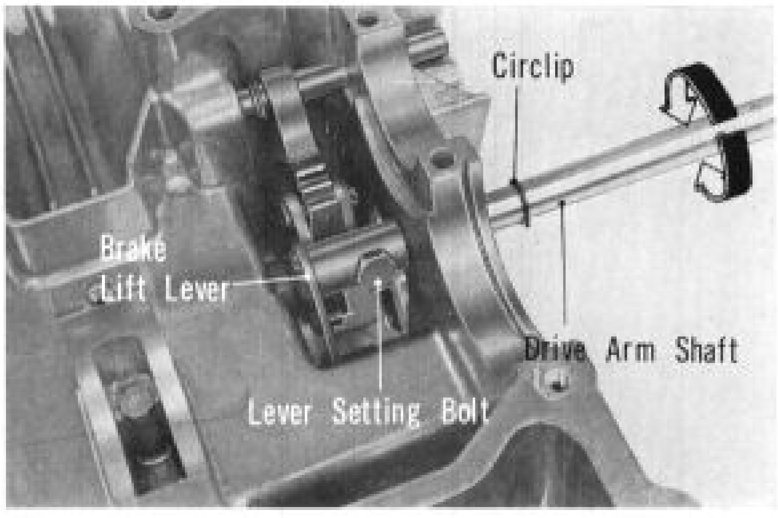


Fig. 7B-229

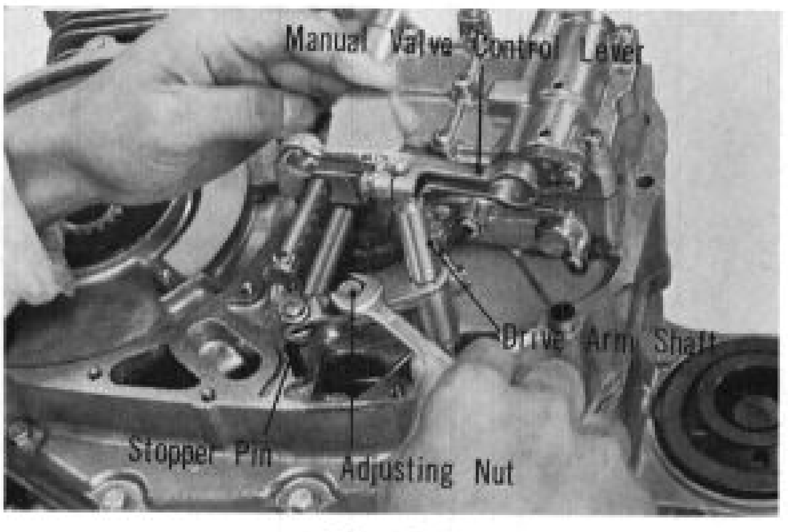


Fig. 7B-230

5. Install drive arm shaft and brake lift lever to the lower crankcase; tighten with lever setting bolt.
6. After assembling parking brake, check the operation by turning drive arm shaft to the right and the left.
7. Finally, set circlip on drive arm shaft.**(Fig. 7B-229)**

Adjustment of Manual Shift Drive Arm

Adjustment of parking brake is made by the adjustment of manual shaft drive arm.
After temporarily fitting manual valve control lever to drive arm shaft, force the control lever in the direction shown by the arrow until the joint link of drive arm contacts manual valve stopper pin. Then tighten adjusting nut.

M. Selector

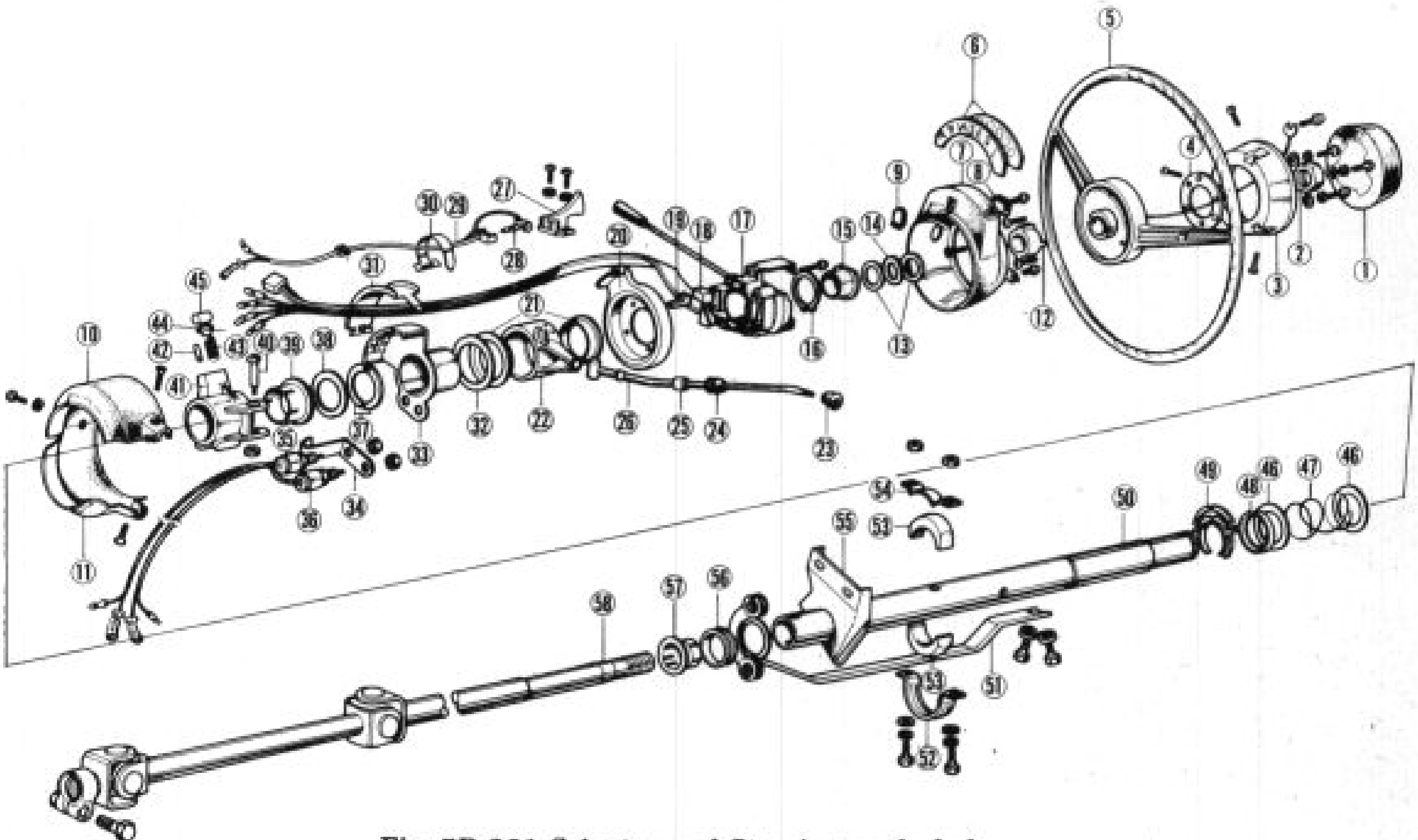


Fig. 7B-231 Selector and Steering exploded

1	Pad, Crash (horn)	1
2	Nut, Steering column	1
3	Retainer, Pad	1
4	Plate unit, Steering	1
5	Wheel, Steering	1
6	Plate unit, Selector position	1
7	Cover, Steering column top	1
8	Nut, Special	2
9	Plug, Column top cover	1
10	Cover, Steering column upper	1
11	Cover, Steering column lower	1
12	Cam. Turn signal canneling	1
13	Washers, Canceling cam spring	2
14	Spring, Canceling cam	1
15	Bushing, Column housing top	1
16	Cirelip, External, 25mm	1
17	Switch Assy., Turn signal (combination)	1
18	Piece, Locking	1
19	Cotter, Quadrant	1
20	Guide A, Wiring	2
21	Bushings, Lever holder	1
22	Arm. Selector	1
23	Knob, Selector lever	1
24	Boot, Selector lever	1
25	Bushing, Selector lever	1
26	Lever, Selector	1
27	Indication, Selector position	1
28	Bulb, Indicator light	1
29	Wiring Assy., Indicator light	1
30	Band, Wiring	1
31	Protector, Wiring	1
32	Washer, Selector arm	1
33	Quadrant, Selector	1
34	Guide B, Wiring	1
35	Switch Assy., Back-up light	1
36	Switch Assy., Inhibitor	1
37	Stoppers, Quadrant	2
38	Damper, Quadrant	1
39	Bushing, Selector	1
40	Screw, Selector lever	1
41	Body, Selector	1
42	Pin, Selector guide	1
43	Spring, Selector roller	1
44	Cap, Roller spring	1
45	Roller, Selector	1
46	Washer, Damper spring	2
47	Spring, Selector body damper	1
48	Adapter, Spring sleat	1
49	Sear, Damper spring stopper	1
50	Housing, Steering column	1
51	Strap, Selector	1
52	Stay, Column housing	1
53	Adapters, Column housing stay	2
54	Seat, Column housing	1
55	Support, Steering column housing	1
56	Bushing, Selector strap	1
57	Bushing, Column housing bottom	1
58	Column, Steering	1

Removal

1. Loosen the lock nut and the remove the selector cable. A and B from the selector strap arm. **(Fig. 7B-232)**

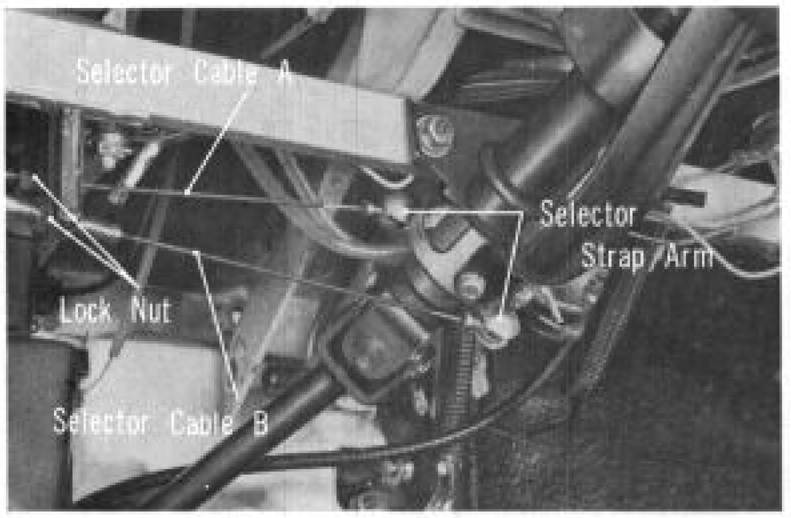


Fig. 7B-232

2. Disconnect electrical wiring. **(Fig. 7B-233)**

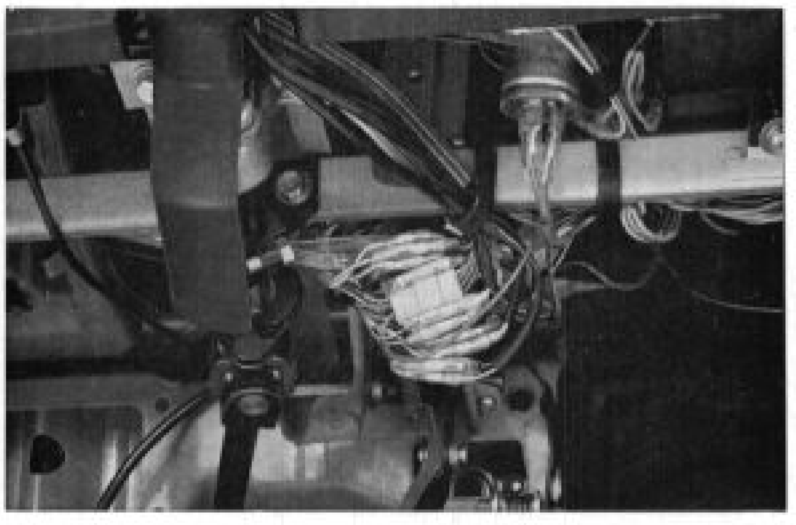


Fig. 7B-233

3. Remove the clamp bolt from the steering column and pinion gear connection. **(Fig. 7B-234)**

   Note:
   When assembling, torque the bolt to 2,8 kg-m (20.3 ft-lbs).

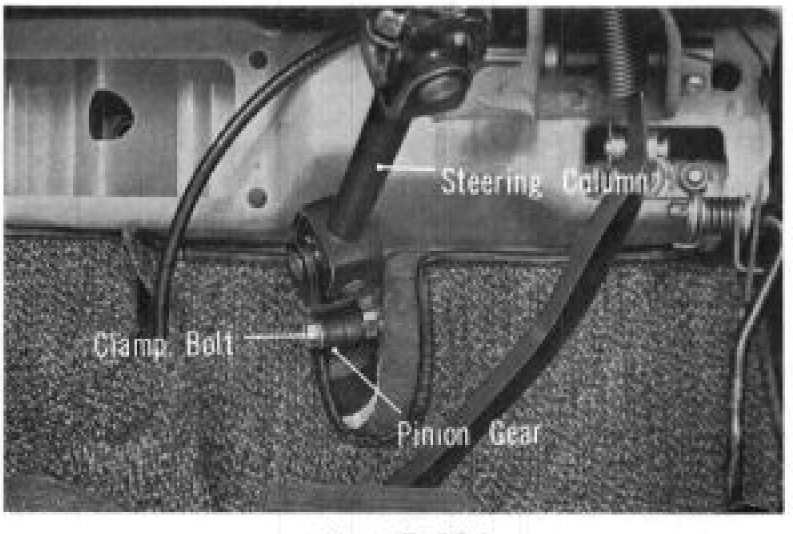


Fig. 7B-234

4. Remove the four bolts retaining the steering column to the instrument panel. **(Fig. 7B-235)**

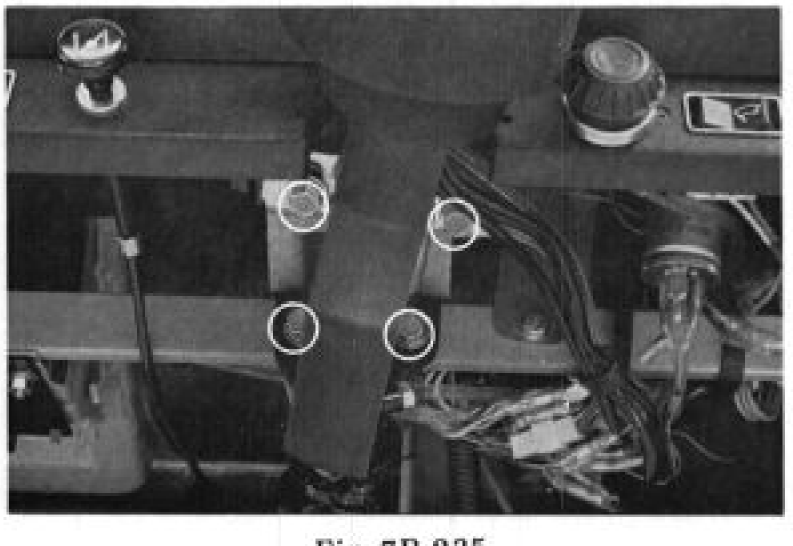


Fig. 7B-235

5. Remove the three screws and separate the crash pad.**(Fig. 7B-236)**

Fig. 7B-236

6. Remove the screw and disconnect the horn plus lead.**(Fig. 7B-237)**
7. After removing the steering column nut, remove the two screws and separate the horn switch contact plate.

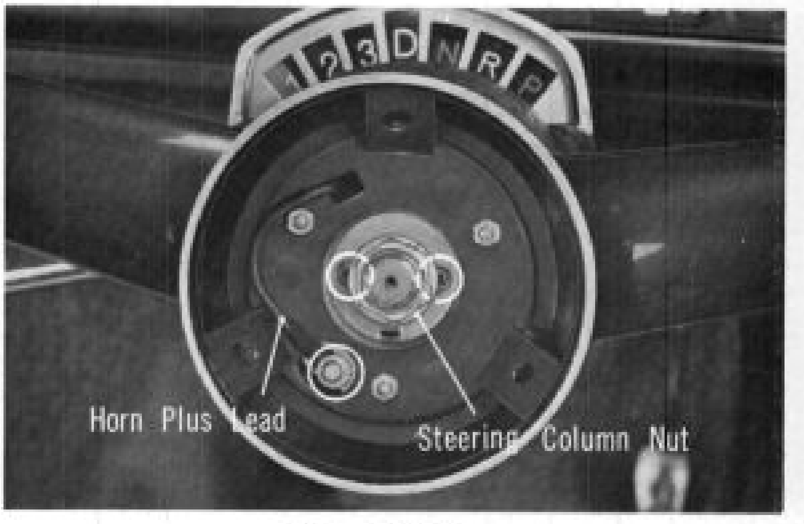


Fig. 7B-237

8. Remove the steering wheel by using the steering wheel puller.**(Fig. 7B-238)**

Special Tool

Ref. No.	Tool No.	Description
—	07010-51201	PULLER, steering wheel

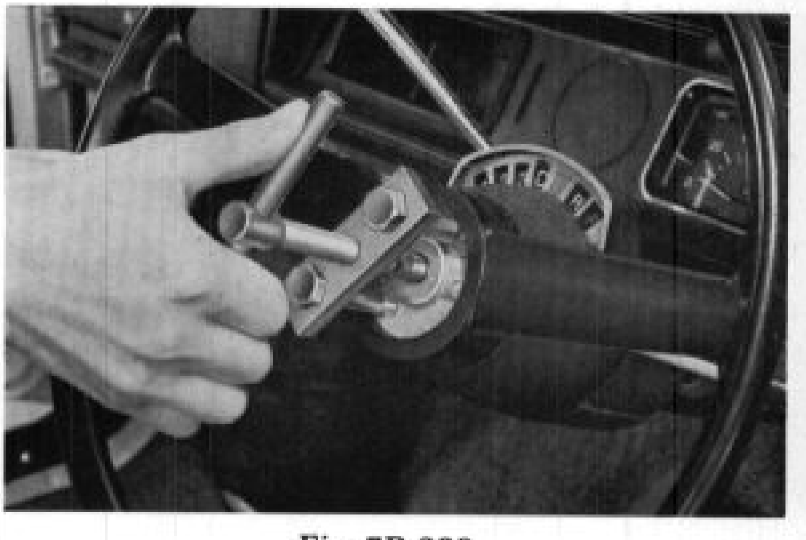


Fig. 7B-238

9. After removing the steering wheel, disassemble the turn signal canceling cam, canceling cam spring and canceling can spring washers.

10. Slide out the steering column assembly from the pinion gear serration.**(Fig. 7B-239)**

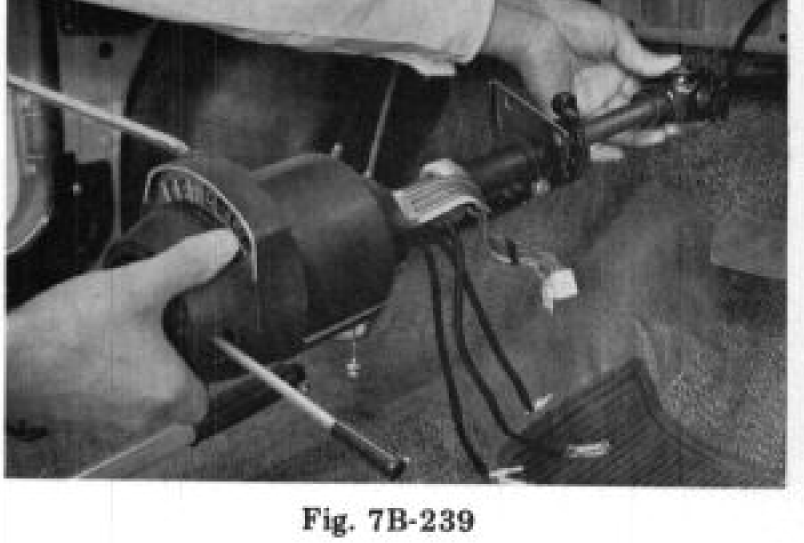


Fig. 7B-239

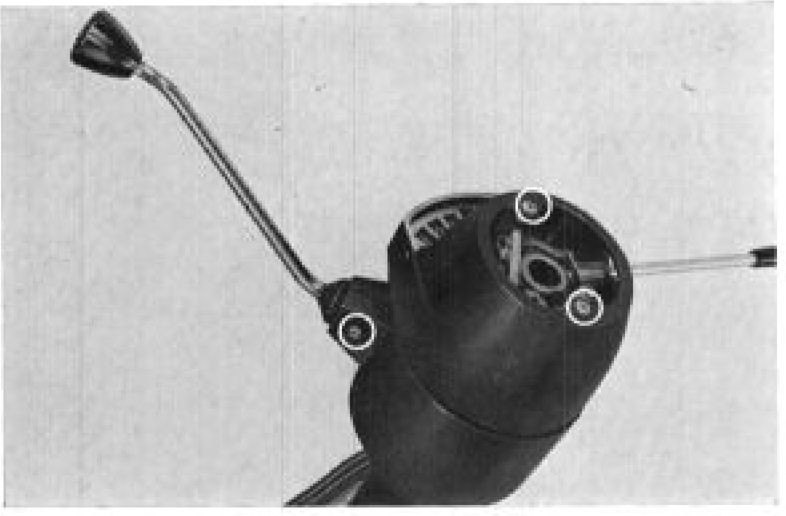


Fig. 7B-240

11. To remove the steering column covers, remove the setting screws.**(Fig. 7B-240)**

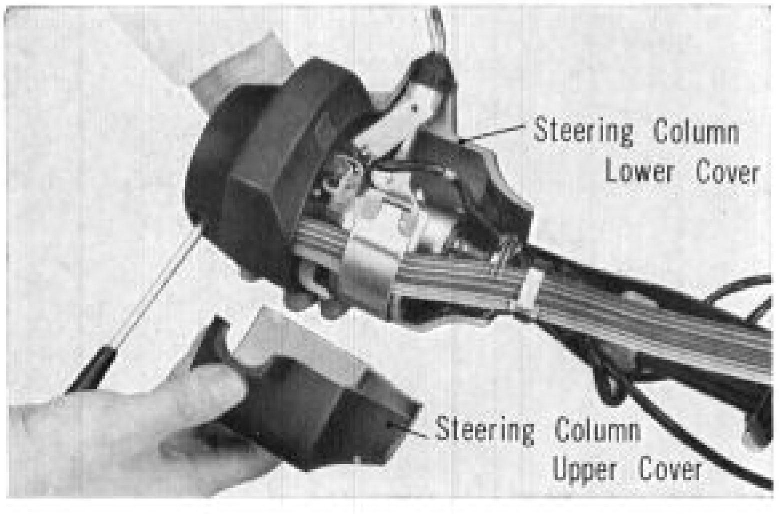


Fig. 7B-241

12. Remove the steering column upper and lower covers.**(Fig. 7B-241)**

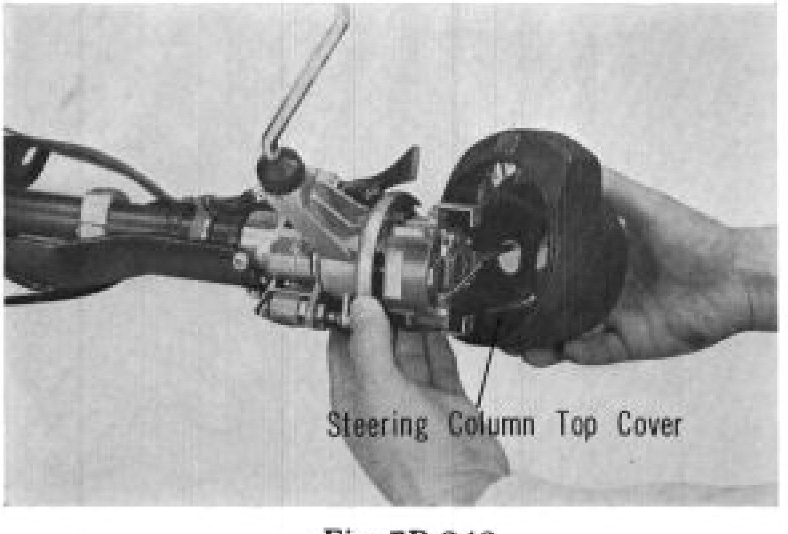


Fig. 7B-242

13. Remove the steering column top cover. **(Fig. 7B-242)**

Fig. 7B-243

14. To remove the selector strap, remove the setting screws.**(Fig. 7B-243)**

15. Remove the selector strap from the steering column housing.**(Fig. 7B-244)**

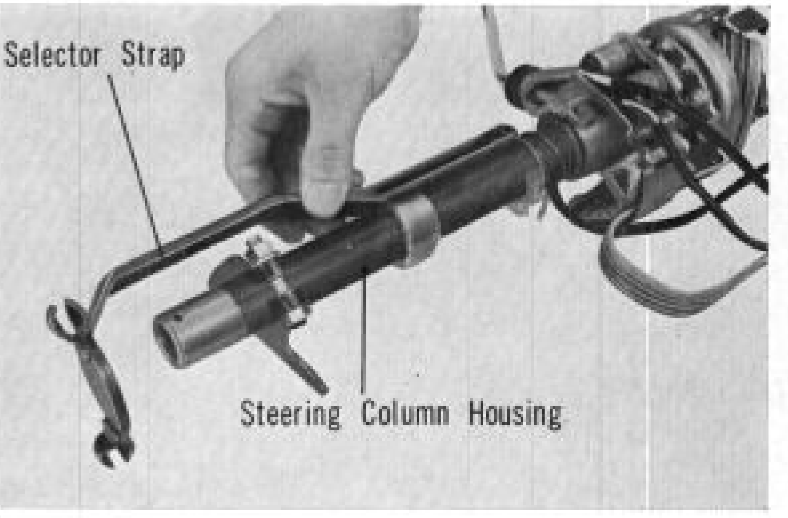


Fig. 7B-244

16. Remove the external circlip and loosen the screw completely and tap the top of screw with a screw driver.**(Fig. 7B-245)**

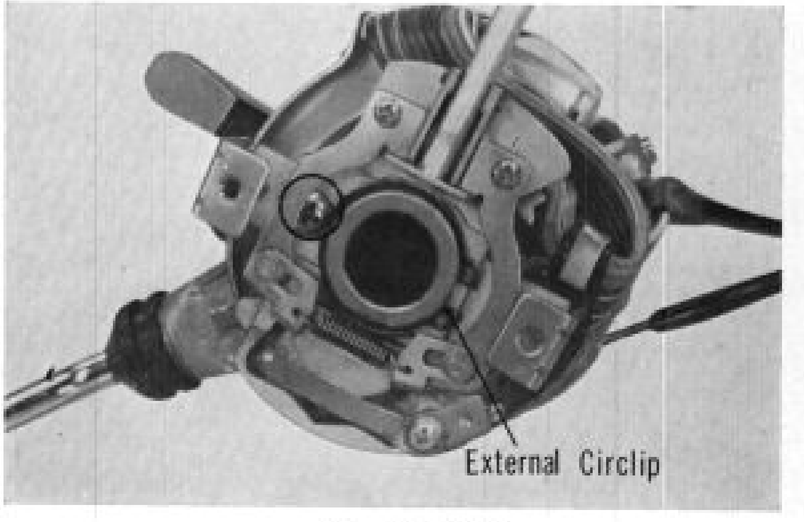


Fig. 7B-245

17. After tapping the screw, remove the screw and separate the turn signal switch assembly from the steering column housing.**(Fig. 7B-246)**

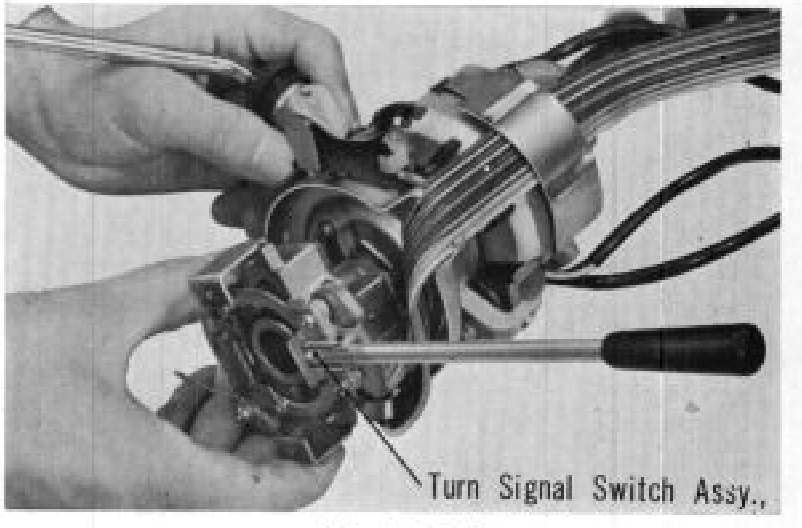


Fig. 7B-246

18. After installing the screw, remove the quadrant cotter with a screw driver.**(Fig. 7B-247)**

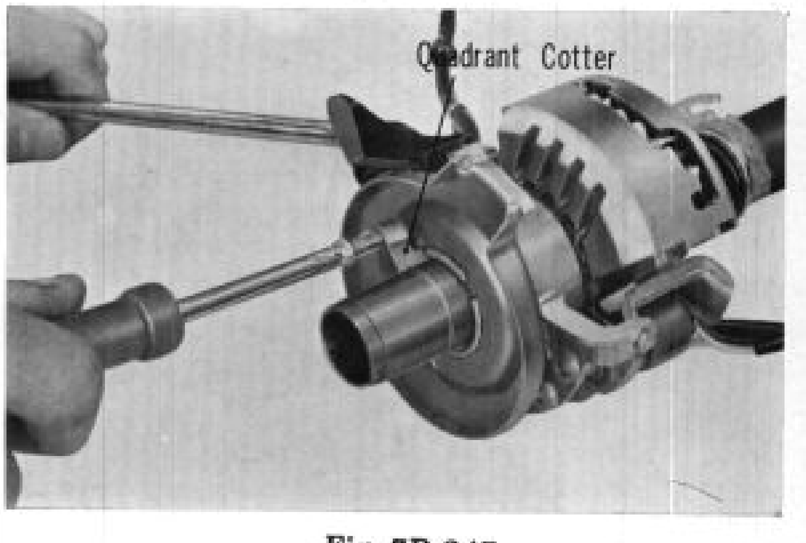


Fig. 7B-247

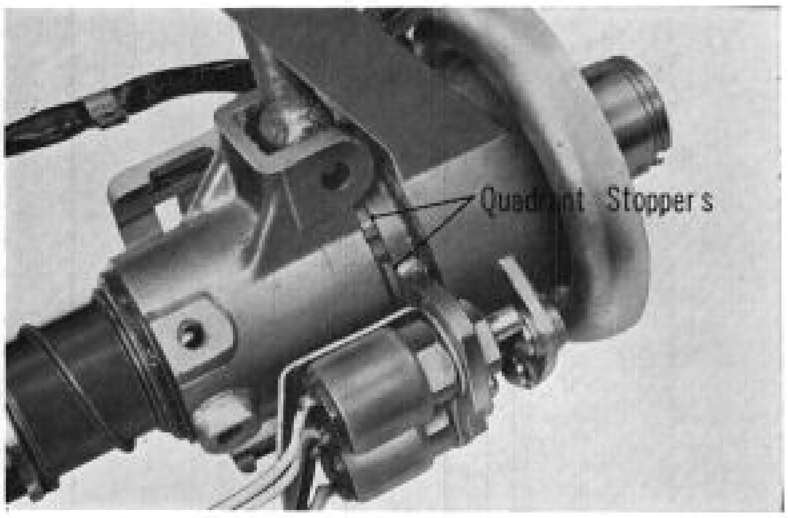


Fig. 7B-248

19. Remove the quadrant stoppers.**(Fig. 7B-248)**

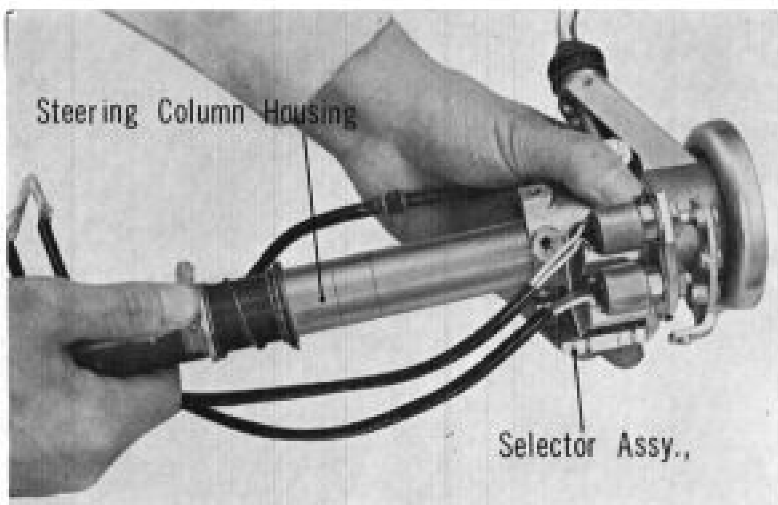


Fig. 7B-249

20. Remove the selector assembly from the steering column housing.**(Fig. 7B-249)**

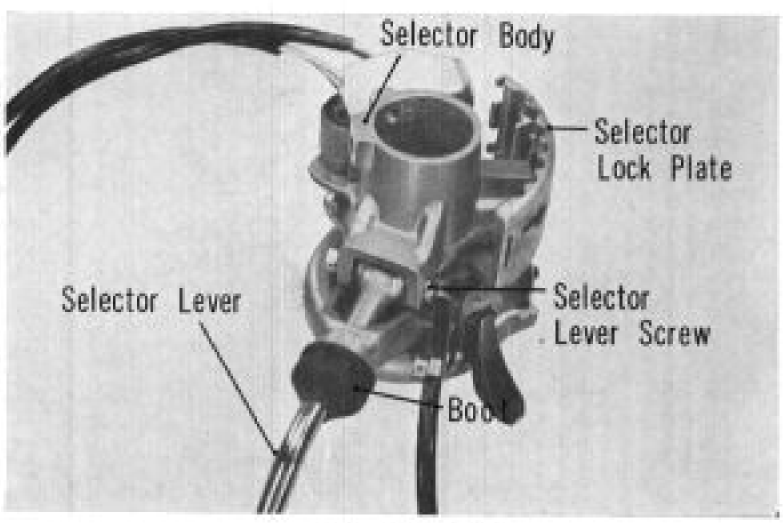


Fig. 7B-250

21. Remove the nut and unscrew the selector lever screw.**(Fig. 7B-250)**
22. Remove the selector body from the selector lock plate.

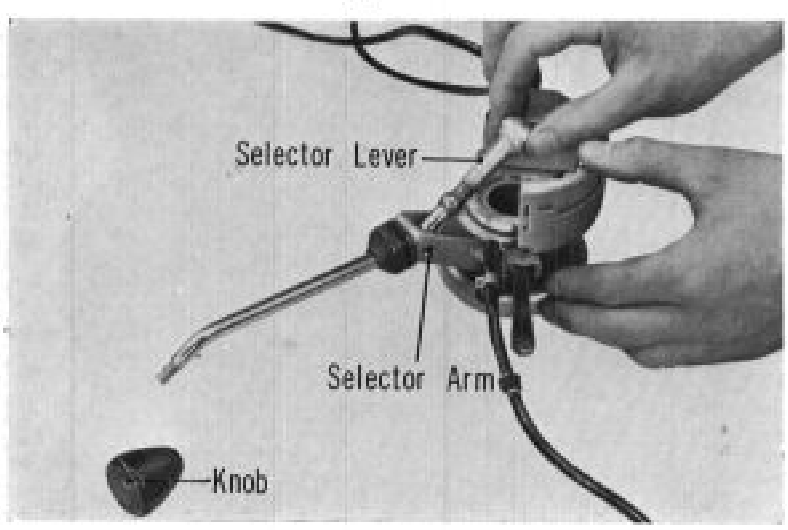


Fig. 7B-251

23. Remove the selector lever from the selector body.**(Fig. 7B-251)**

24. Remove the screws, selector position indication, indication light wiring assembly and bulb. (Fig. 7B-252)

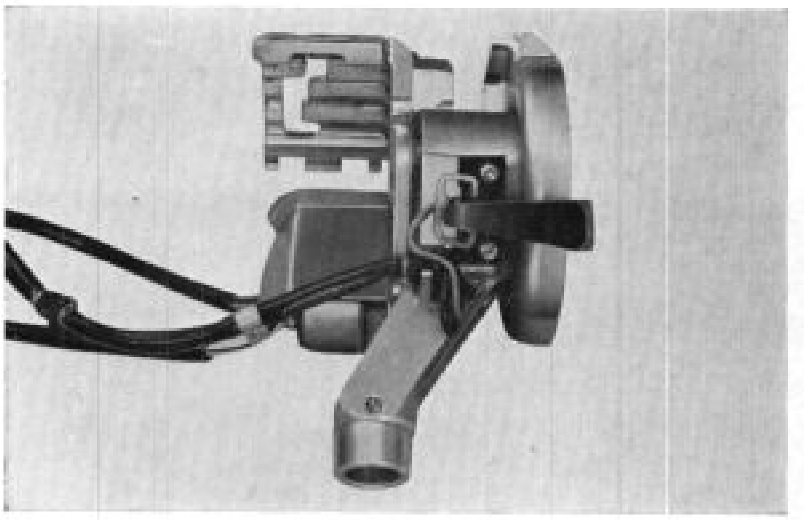


Fig. 7B-252

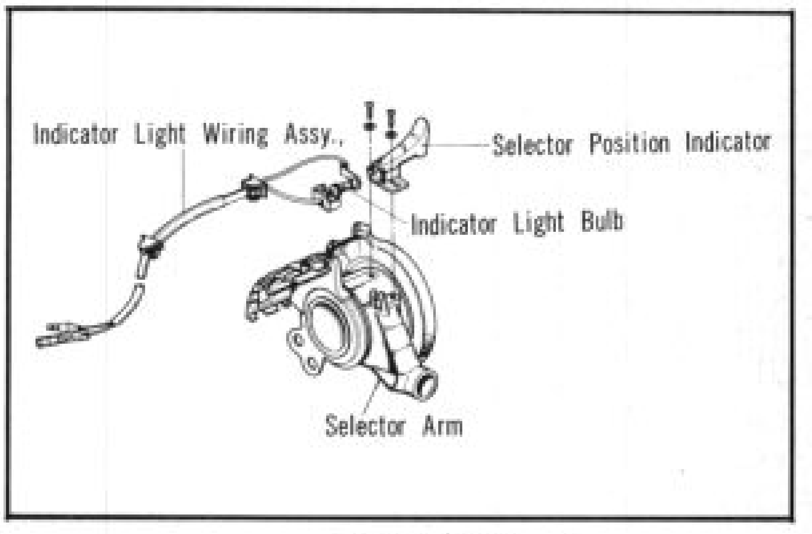


Fig. 7B-253

25. Remove the nuts back-up light switch assembly and inhibitor switch assembly. (Fig. 7B-254)

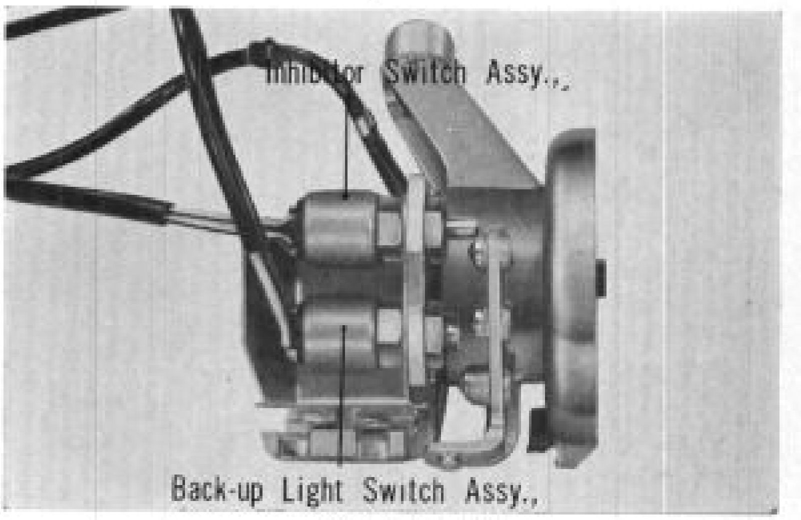


Fig. 7B-254

Assembly

1. Perform the assembly in the reverse order of disassembly.
2. Install the selector roller spring and spring cap into the selector body. (Fig. 7B-255)
3. Place the selector roller on the selector body. (Fig 7B-256)

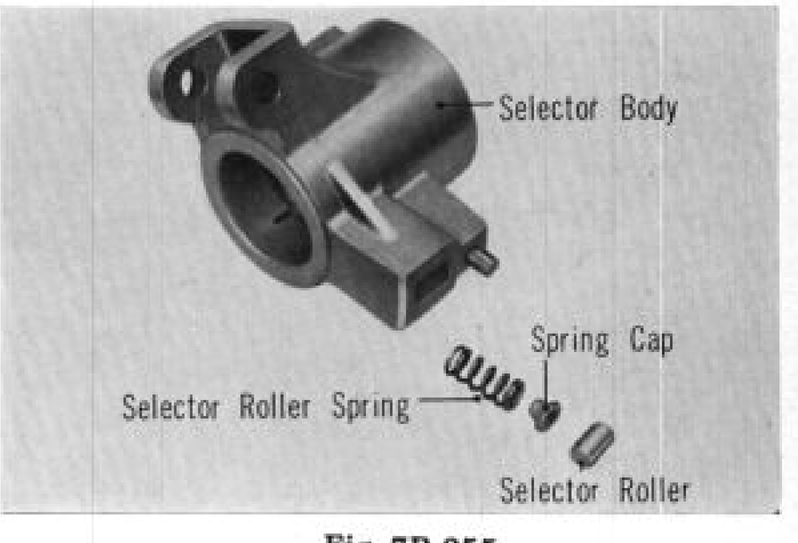


Fig. 7B-255

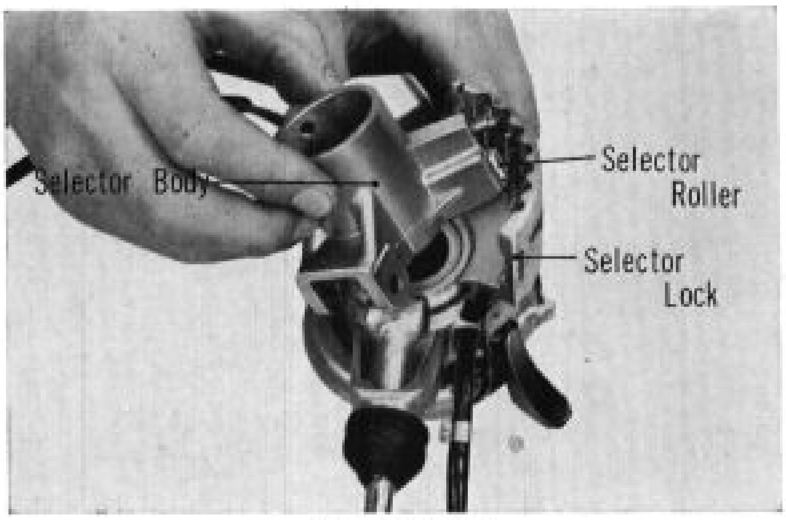


Fig. 7B-256

4. Install the selector body on the selector lock plate.**(Fig. 7B-256)**

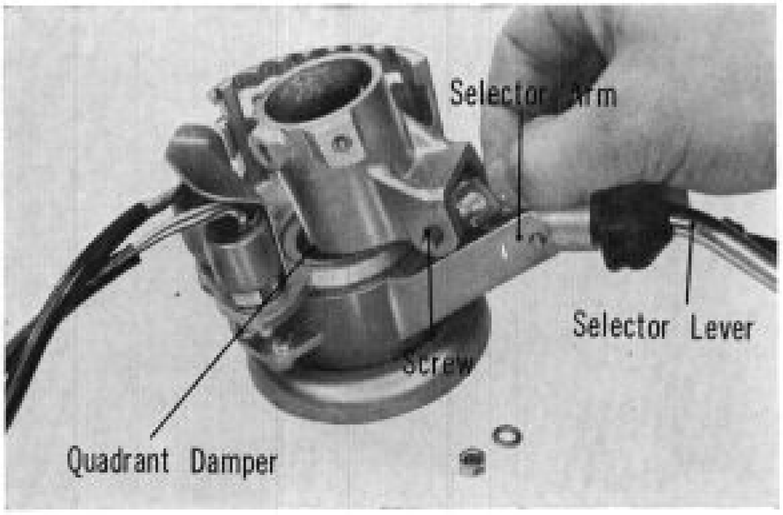


Fig. 7B-257

6. After installing the quadrant damper on the lock plate, install the selector lever, selector lever screw and nut.**(Fig. 7B-257)**

   Note:
   Apply grease to all friction surface.

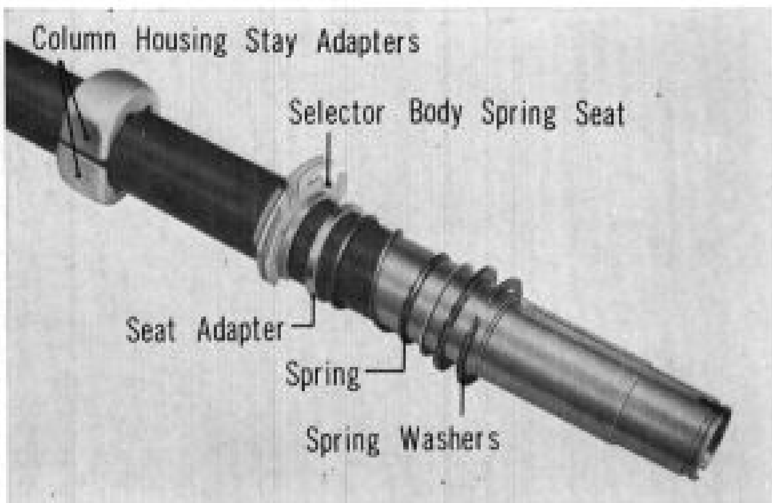


Fig. 7B-258

7. Install the column housing stay adapters.
8. Install the selector body spring seat, seat adapter, spring and washers on the column housing.**(Fig. 7B-258)**

Fig. 7B-259

9. Install the selector assy., on the column housing.**(Fig. 7B-259)**

10. Install the quadrant cotter.**(Fig. 7B-260)**
    Note:
    Align the both grooves of the selector arm and the column housing.

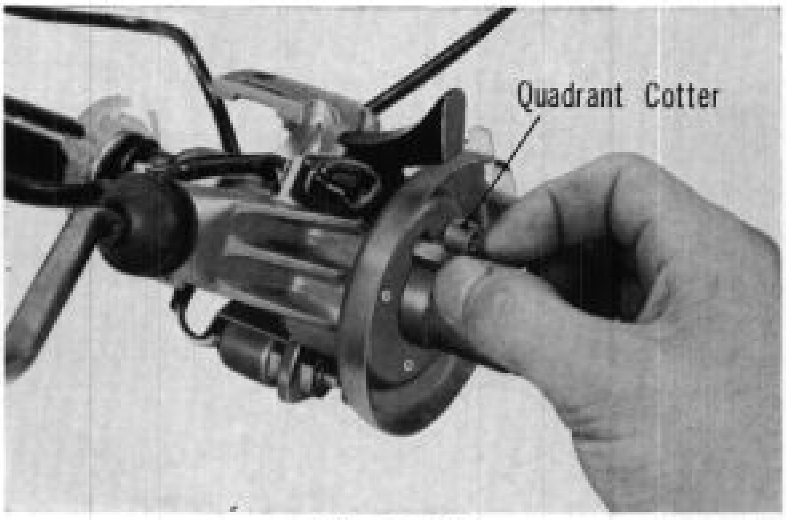


Fig. 7B-260

11. Install the turn signal switch assy.,**(Fig. 7B-261)**
    Note:
    The tapered locking piece secures the turn signal switch to the column housing.
    Note the circular side faces the column housing and tapered side faces the switch.
12. Install the circlip and column housing top bushing.

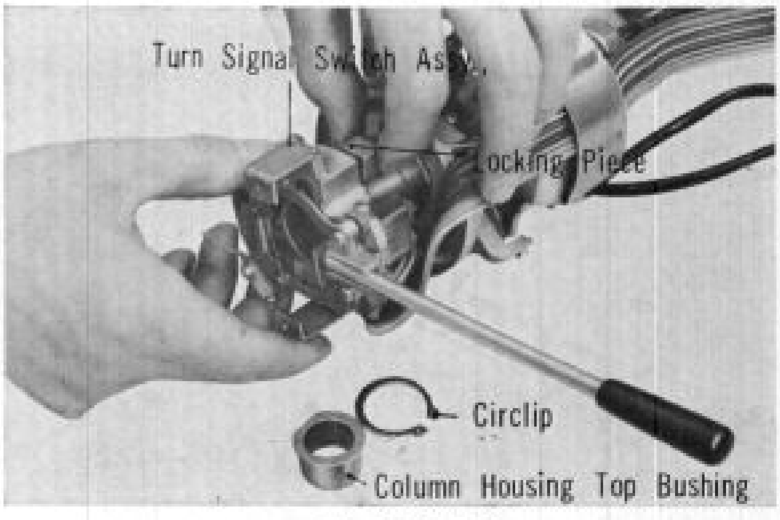


Fig. 7B-261

13. Install the switch setting screw.**(Fig. 7B-262)**

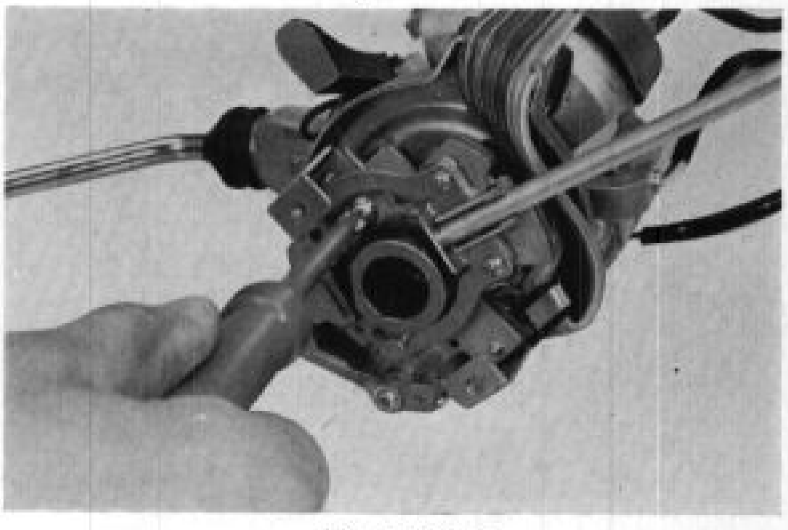


Fig. 7B-262

14. After installing the selector strap, install the setting screws.**(Fig. 7B-263)**

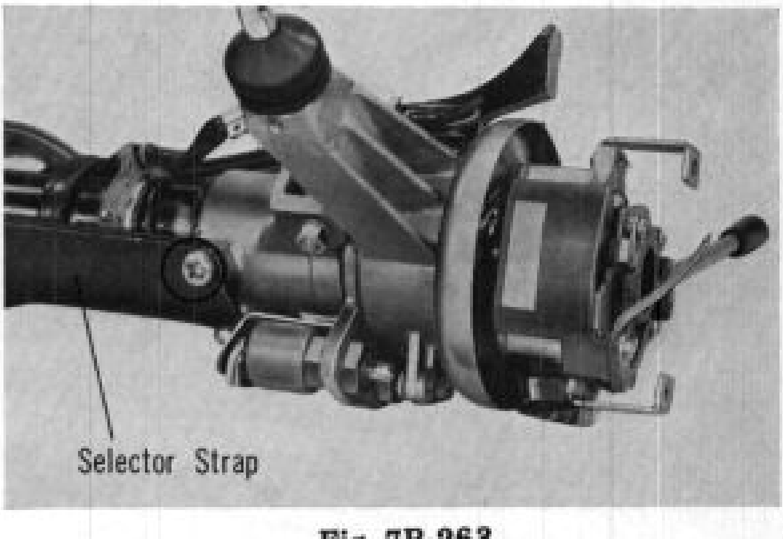


Fig. 7B-263

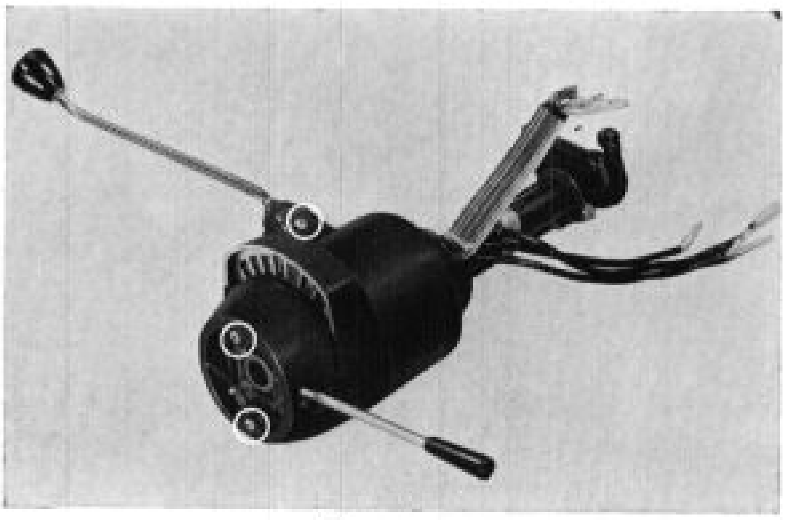


Fig. 7B-264

15. Install the steering column upper, lower and top cover.(Fig. 7B-264)

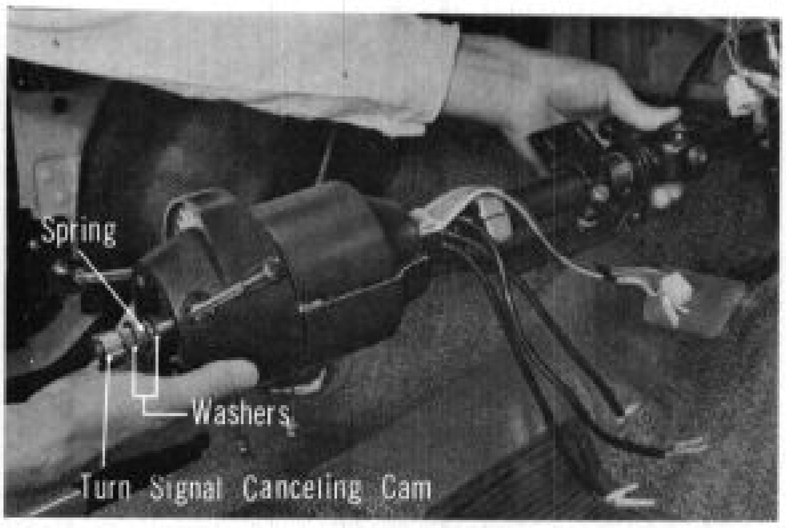


Fig. 7B-265

16. Install the steering column assy., to the steering column.(Fig. 7B-265)
17. Install the turn signal canceling cam spring washers, canceling cam spring and canceling cam.

Note:
Apply grease to the canceling cam.

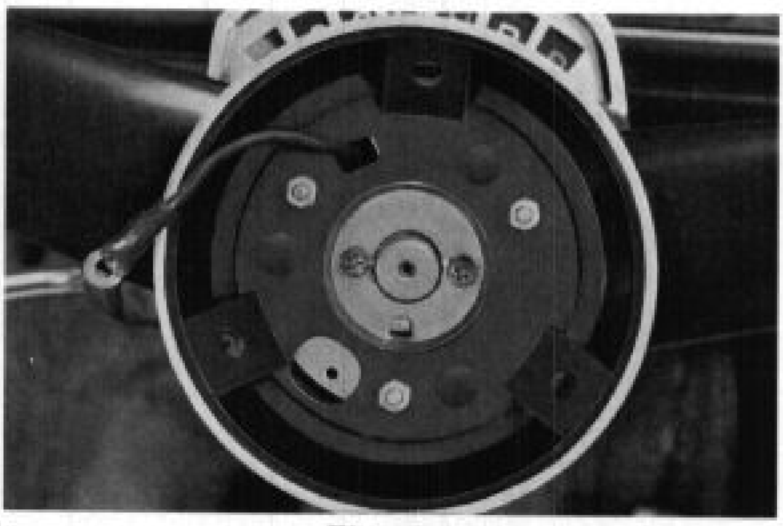


Fig. 7B-266

18. Install the steering wheel and column nut. (Fig. 7B-266)

Note:
Tighten the column nut to a torque of 6 kg-m (43.4 ft-lbs).

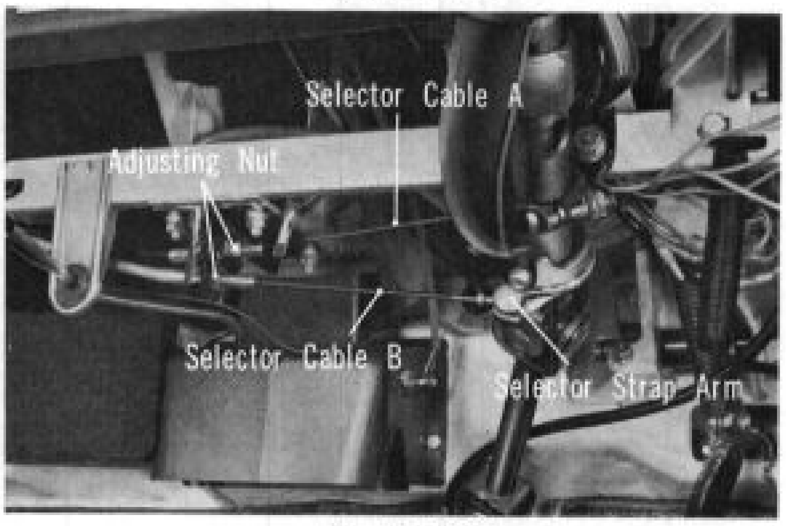


Fig. 7B-267

19. Install the selector cable A and B on the selector strap arm.(Fig. 7B-267)
20. Next, adjust the selector cables.

N. HONDAMATIC TRANSMISSION-MAINTENANCE

GENERAL DATE

The following operations must be carried out during the maintenance service:

A.T.F. Capacity

Dry fill	3.2 lit (5.6 Imp. pt)
Normal fluid change	1.7 lit (3.0 Imp. pt)

A.T.F. Level Check

Check fluid level in Hondamatic transmission every 5,000 km (3,000 miles) and replenish if required.

* The fluid level is checked with the dipstick, with engine running at idling speed, fluid handwarm and selector level in [3] position with parking brake applied. Wipe dipstick only with clean, lint-free cloth. The fluid level gauge dipstick is located on the opposite side (left hand side of the vehicle) of the engine oil level gauge dipstick.
* It is essential to the operation of the automatic transmission that the fluid level is correct. That is why the level must be checked very carefully. The level should be between the upper and lower marks on the dipstick. If the fluid is low, add "Automatic Transmission Fluid" to bring the level up to the top mark. Do not overfill because too much fluid will affect the operation of the transmission, therefore, the excess fluid should be drained off. When transmission is cold or very hot, the fluid level can be outside the marks. For this reason the fluid must be checked when it is warm.
  The difference between the upper and lower marks on the dipstick is 0.5 Imp. pt).

> Important:
> **When the A.T.F. consumption is excessive, locate the cause and after making, the repair, replenish the fluid.**

The reason why the A.T.F. fluid level check is made with the engine idling and selector lever in manual range [3] is:

* The A.T.F. level during idle is relatively constant and when the engine stops, all the fluid flows back to a central pool. The level gauge is also marked for measurement in the idle position, therefore, accurate fluid level measurement can only be made in this condition.
* When measuring the fluid level, the surface of the fluid should not be in motion. The check can be made in positions [1] [2] [3] [D] [R], the positions where the primary clutch is engaged, however, it is recommended from the standpoint of safety that measurement is performed in [3] in which position the vehicle hardly creeps out if parking brake is applied.
  In positions [N] and [P], the primary clutch is disengaged, causing the fluid to be agitated and accurate measurement, therefore, will not be made.

> Important:
> **Only the A.T.F. recommended for HONDAMATIC transmission fluids may be used.**

A.T.F. Change

Change fluid at 20,000 km (12,000 miles) internal.

Fluid can be drained most effectively when the engine is warm. When installing the A.T.F. drain plug, wipe the area clean with a rag so that inspection for leaks can be performed.

Add fluid so that the level reaches the upper mark in the dipstick. Normal volume of fluid required for change is 1.7 liters (3.0 Imp. pt). The full fluid capacity is 3.2 liters (5.6 Imp. pt), however, since the fluid in the torque converter, fluid control passages etc. cannot be completely drained during A.T.F. fluid change, less fluid is required to bring the fluid level to the full mark.

> Important:
> **The fluid cannot be drained from the converter.**

The fluid recommended for the HONDAMATIC transmission is an SAE standard A.T.F. type A oil.

O. HONDAMATIC TRANSMISSION-CHECKING OPERATION

A certain degree of experience with automatic transmission and knowledge of the working principles is an advantage when assessing the functioning of the HONDAMATIC transmission and trying to locate defects. Otherwise it is advisable to use another vehicle on which the automatic transmission is known to be working properly as a means of comparison.
For the operation of the transmission, it is essential that the engine is running properly. Inadequate engine performance due to incorrect adjustments or defective parts can, in certain circumstances, give the impression that something is wrong with the automatic transmission. For this reason, always check the engine and rectify any incorrect adjustments before starting to look for defects in the transmission.

Important:
All works on the vehicle which entail running the engine must only be carried out with the selector lever at P position and the parking brake applied. The only exceptions are in the case of pressure testing and when checking the stall test speed.

The following equipments are required to test the HONDAMATIC transmission:

1. Pressure gauge having a range of 0~20 kg/cm^2 (285 psi) with connecting hose for measuring the line pressure, primary clutch pressure, 2nd clutch pressure and 3rd clutch pressure.
2. Pressure gauge having a range of 0~10 kg/cm^2 (142 psi) with connecting hose for measuring the throttle pressure and governor pressure.
3. Electronic revolution counter for the engine speed.

Pressure check can be made with two 20.0 kg/cm^2 (285 psi) pressure gauges equipped with connecting hoses and an electronic revolution counter. There is, however, a special HONDAMATIC transmission fluid pressure tester (Tool No. 07053-58045)available. See section P, page 7—170.

a). General Checks

The following operations should be carried out before every transmission check and if defects are found they must be rectified before proceeding any further.

1. Check engine settings.
2. Slow speed (idling) adjustment.
   Normal idling speed is 1,200 rpm in the [N] position.

Important:
If the idling speed is too high, the vehicle will creep. Further, after adjustment, recheck should be made to assure that there is no creep in the [D] position.

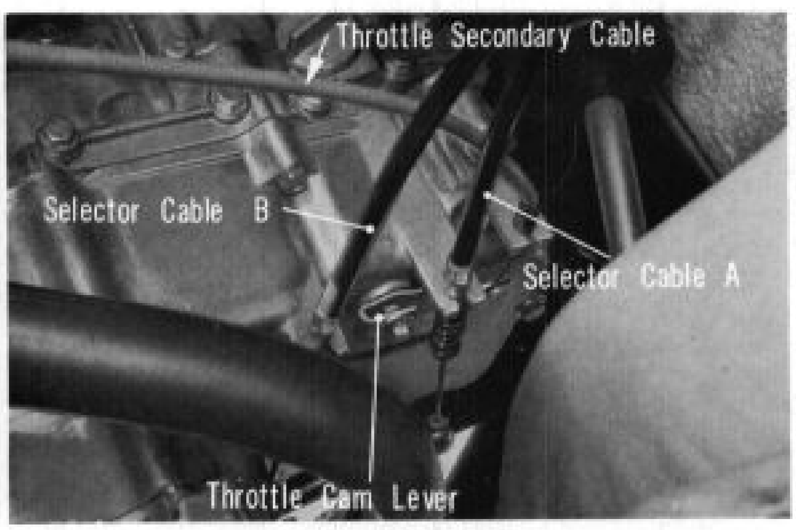


Fig. 7B-268

3. Check adjustment of throttle secondary cable.
   Check the play of the throttle cam lever mounted on the torque converter case. In other words, adjust the throttle valve drive arm and the short throttle valve to zero. Next, adjust the throttle secondary cable mounted on the carburetor with the adjuster nut.

   Note:
   This adjustment will affect the gear shifting characteristics, therefore, adjustment should not be attemped unless it has been determined that adjustment is required.

4. Check adjustment of selector cables A & B.
   Adjust the tension of the selector cables A and B so that selector indicator mark "△" is aligned to the manual shift control lever.
   Perform the adjustment with the adjuster nut at the control cable bracket.
   When checking the fluid level, the appearance of the fluid and the smell should also be checked.

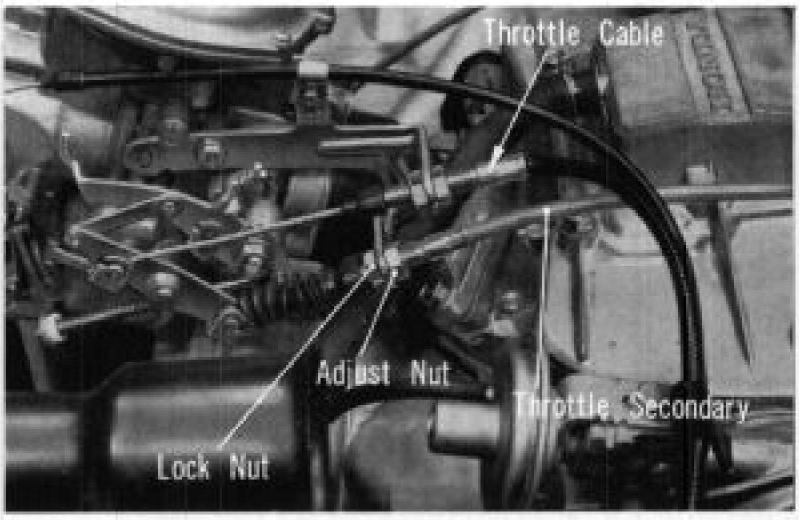


Fig. 7B-269

Burnt driven plates (friction linings) will make the fluid smell burnt. Dirty fluid can cause trouble in the hydraulic control system. Too much and too little fluid can also affect the operation of the transmission. The fluid level should, therefore, be checked very carefully in order to avoid unnecessary repair work.

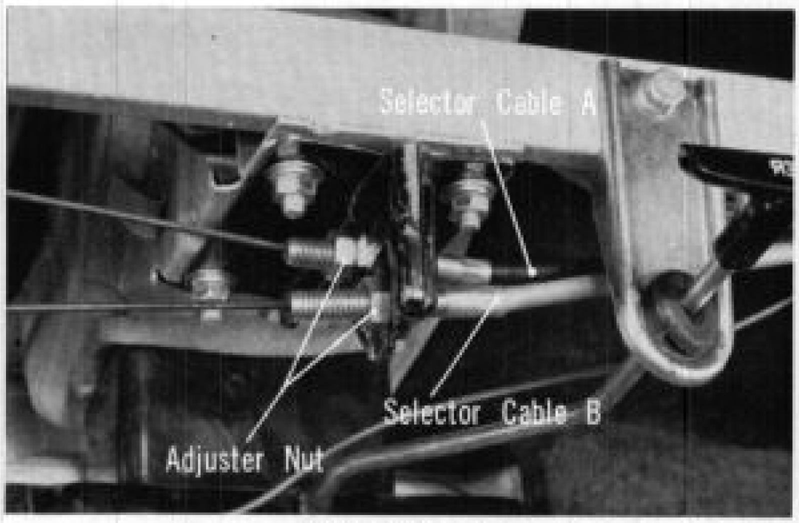


Fig. 7B-270

b). Road Test

Road test the vehicle (unless there is obvious mechanical damage). During the test, the vehicle should be driven and observed carefully in all ranges and all possible road conditions so that as much information as possible is gained. In particular, the shift points for up-and-down shifts and the smoothness of gear changing should be noted.

All shifts should take place quickly and without interupting the power flow. Listen for any sign of engine run-up during gear shifts as this indicates slipping of clutches. After the road test, check transmission for oil leaks.

1. Checking the shift point.
   The up-shift point is checked by driving on a level road or on the chassis dynamometer. Set the selector lever in $\boxed{D}$ range and accelerate repidly by depressing the speeds at which the up-shifting to 2nd and 3rd gears takes place.

   Table below shows the standard up-shift points.

Up-shift	A360 Up-shift Speed	A600 Up-shift Speed
1st gear to 2nd gear	35 km/hr (22 mph)	42 km/hr (26 mph)
2nd gear to 3rd gear	65 km/hr (40 mph)	80 km/hr (50 mph)

2. Adjusting the shift point.
   Adjust the shift point with the adjuster nut on the throttle secondary cable. To delay the shift points; tighten the adjuster nut to shorten the inner cable. To fasten the shift points; loosen the adjuster nut, and provide a slack to the inner cable.

> **Note:**
> **It is not possible to change the shift point of only one of the gears. In other words, the change to shift point into second gear cannot be made without also affecting the shift point into third gear. If shift point of 1-2 is delayed, the 2-3 shift point will also be delayed.**
> **If the interval between 1-2 and 2-3 shift points is excessive the whole main valve body unit should be replaced together.**
> **Normally the up-shift from 2nd to 3rd gear is adjusted with the throttle fully open: this will assure proper up-shift point from 1st to 2nd gear.**

c). Stall Speed Test

This test provides a rapid check on the functioning of converter. It should be carried out only against such troubles as the vehicle does not reach maximum speed and the acceleration is poor.
In this test, the drive wheel is completely locked and measurement of the engine top speed is performed in positions [D], [1], [2], [3]. The general automatic transmission performance can be determined.

Stalling speed

Stalling speed is determined by the balance between the engine torque output and the torque absorbed by the torque converter pump. When the engine torque increases, the stalling speed will increase and visa versa.
Further, with the engine torque constant, the stalling speed will increase with the decrease in the amount of torque absorbed by the torque converter and when the amount of torque absorbed increases, the speed will drop.
The engine torque output is affected by the condition of the engine, also, the torque absorbed by the torque converter will be affected by the operating fluid condition and the performance of the one-way clutch within the stator.
Generally, foam in the fluid will decrease the amount of torque absorbed and when the locking function of the one-way clutch is defective, the torque advance increases. Because of the existance of these phenomena, the condition of the engine and the performance of the torque converter can be determined by measuring the stalling speed.

1. Check the operation of both parking and foot brakes, and block the wheels.
2. Connect an electronic revolution counter and place it on the front seat where it is visible.
3. Start the engine and apply both the parking and foot brakes to prevent rolling. Next, position the selector lever in [D] and depress the accelerator pedal lightly for a short period. This is a stall condition and this peed is called the stalling speed.
   The stalling speed is proper if it is within the range between 2,900~3,200 rpm for A360 and 2,600~2,900 rmp for A600.
   Perform the test in positions [2], [3] and if the stalling speed is within the range indicated above, the condition is satisfactory.
   If the engine does not reach the specified stall speed despite the fact that all engine adjustments are correct, the converter is not in order. If the engine speed is higher than specified, it indicates that the clutches and/or the low gear one-way clutch are faulty.
4. When stalling speed is too low.
   Stalling speed will be lower than specified when the engine is malfunctioning and power output is short. The stalling speed will be unusually low when the stator one-way clutch is slipping; it may drop as low as 1,900 to 2,00 rpm.
   Engine adjustment is the same as for vehicle with manual shift, however, vehicle with automatic transmission has a throttle secondary cable and this should be checked to make sure that when the accelerator pedal is fully depressed, the main throttle valve is also fully open.
5. When the stalling speed is too high.
   If the torque converter fluid level is normal with the line and primary pressure also operating normally, and the clutch is not slipping, the probable cause of the trouble is whether the air leaking into the torque converter through a defect in the fluid inlet passage or excessive foaming of the fluid.
   If the stalling speed is normal in the [D] and [1] but high in [2] or [3] it is probable that the 2nd clutch or the 3rd clutch is slipping.

> **Important:**
> **During this test the transmission fluid heats up very quickly so do not continue test longer than the time required to read the instruments.**

d). Adjusting the Idling Speed

Improper idling speed will result in either the engine stalling or severe creeping, therefore, the idling speed should always be properly adjusted.
Set the engine speed to 1,200 rpm for A360 and 1,000 rpm for A600 with the carburetor throttle stop screw with the selector lever in the N position. Adjustment should be performed after the engine is warmed-up.

Note:
If the engine speed is set to 1,200 rpm for A360 and 1,000 rpm for A 600 in the N position the speed should drop to 1,000 rpm (800 rpm for A600) when the selector lever is moved to D position. This is because the engine is loaded in driving the torque converter.

e). Pressure Test

In this test the six most important fluid pressures which develop in the automatic transmission are measured. It is essential for the correct operation of the transmission that the pressures reach the specified valve.

Six different pressures to be measured are:

1. Line pressure L
2. Primary clutch pressure .... FC
3. 2nd clutch pressure 2ND
4. 3rd clutch pressure 3RD
5. Throttle pressure .... TH
6. Governor pressure .... GO

Install the pressure gauges into the six sealing plug locations on the crankcase left side cover and check the pressures.

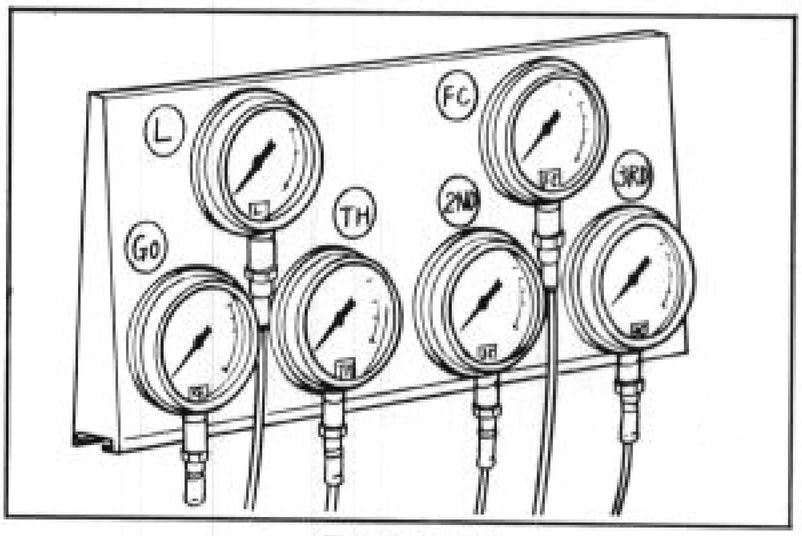


Fig. 7B-271

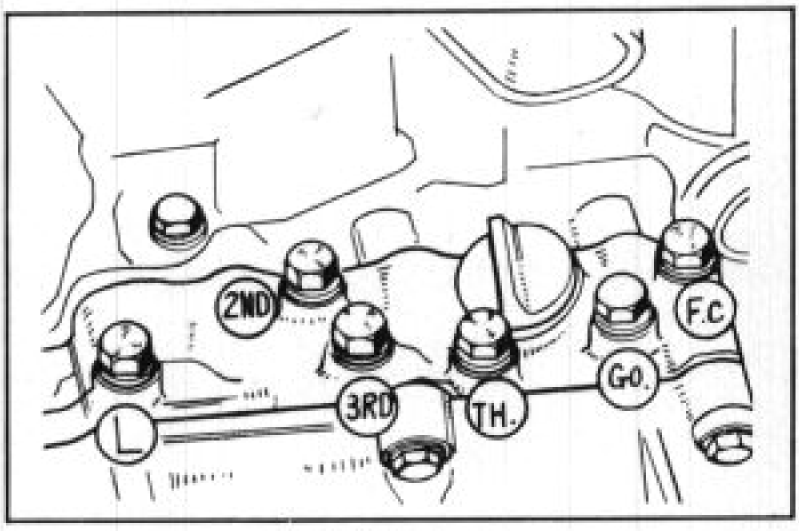


Fig. 7B-272

Pressure check should be performed under no load running condition, therefore, the check should be conducted on the chassis dynamometer.
The check is made at 3,000 rpm engine speed and fluid temperature at 50~80°C (122~176°F):

a) Line pressure (P_L)

Load	A360	A600
No load (3,000 rpm)	4.5~5.5 kg/cm² (64~78 psi)	6.0~7.0 kg/cm² (85~100 psi)
Full load (2,700~3,100 rmp)	9.0~11.0 kg/cm² (128~157 psi)	9.0~14.0 kg/cm² (128~199 psi)

b) Primary clutch pressure (P_F)
2nd clutch pressure (P_2)
For the A 360: 4.5~5.5 kg/cm² (64~78 psi) at 3,000 rpm under no load conditon.
For the A 600: 6.0~7.0 kg/cm² (85~100 psi) at 3,000 rpm under no load condition.

c) Throttle pressure (P_{TH})
With the throttle valve normal at full open, check the throttle pressure in 1 positon.

Throttle Opening	A360	A600
Full close	0~0.4 kg/cm^2 (0~5.7 psi)	0.4~0.7 kg/cm^2 (5.7~10.0 psi)
Full open	5.0~5.5 kg/cm^2 (71~78 psi)	5.2 kg/cm^2 (74 psi)

d) Governor pressure (P_G)
Check the fluid pressure in response to vehicle speed in 3 position.

		Vehicle Speed: km/hr (mph)		
A360		0	36.5 (22.8)	68 (42.5)
	PG: kg/cm^2 (psi)	0	2.05 (29.0)	4.1 (58.3)
A600		0	41.5 (25.9)	77 (48.1)
	PG: kg/cm^2 (psi)	0	2.3 (32.7)	4.9 (69.7)

f).Verify the locations of the selector lever and the positions of the manual shift valves (A, B).

This check is to determine the relative alignments of the selector lever positions and the manual valves by either driving or with the pressure gauge.

g). Adjustment Procedure for Selector Cable A and B

1. Position the selector lever so that indicator is pointing to [N] on the quadrant. (Fig. 7B-273)

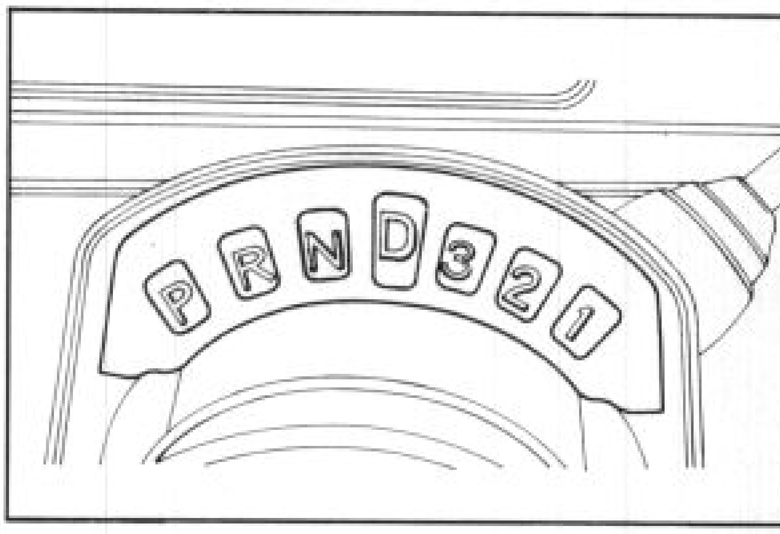


Fig. 7B-273

2. Position the manual shift control lever on the transmission to neutral range. (Fig. 7B-274)
   -1. Align the punch marks on the drive arm shaft and control lever.
   -2. Install the control lever cam so that it becomes forward direction.
   3. Align the punch mark on the control lever to the neutral position indicator mark on the torque converter case. The transmission is now set to the neutral range.

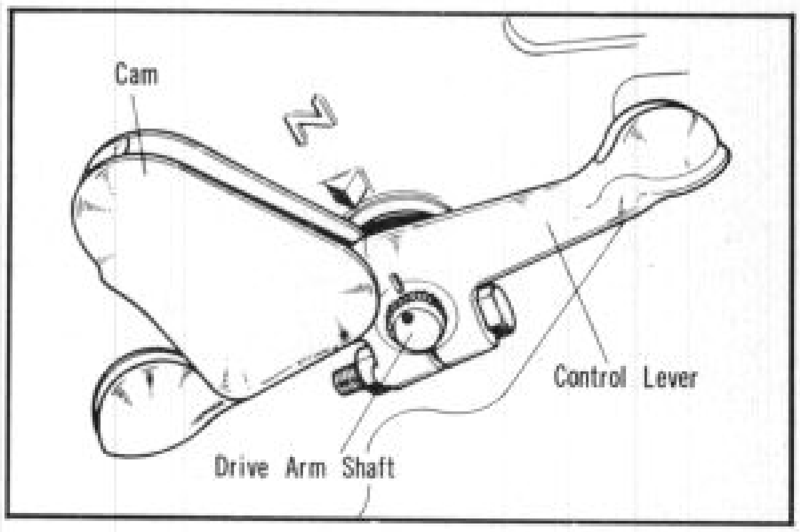


Fig. 7B-274

3. Connect the lower ends of the selector cables A and B to their respective points on the control lever. (Fig. 7B-275)
   -1. Before connecting the cables, check them for damages.
   2. Apply grease on the cable end balls and ball reciever sockets on the lever.

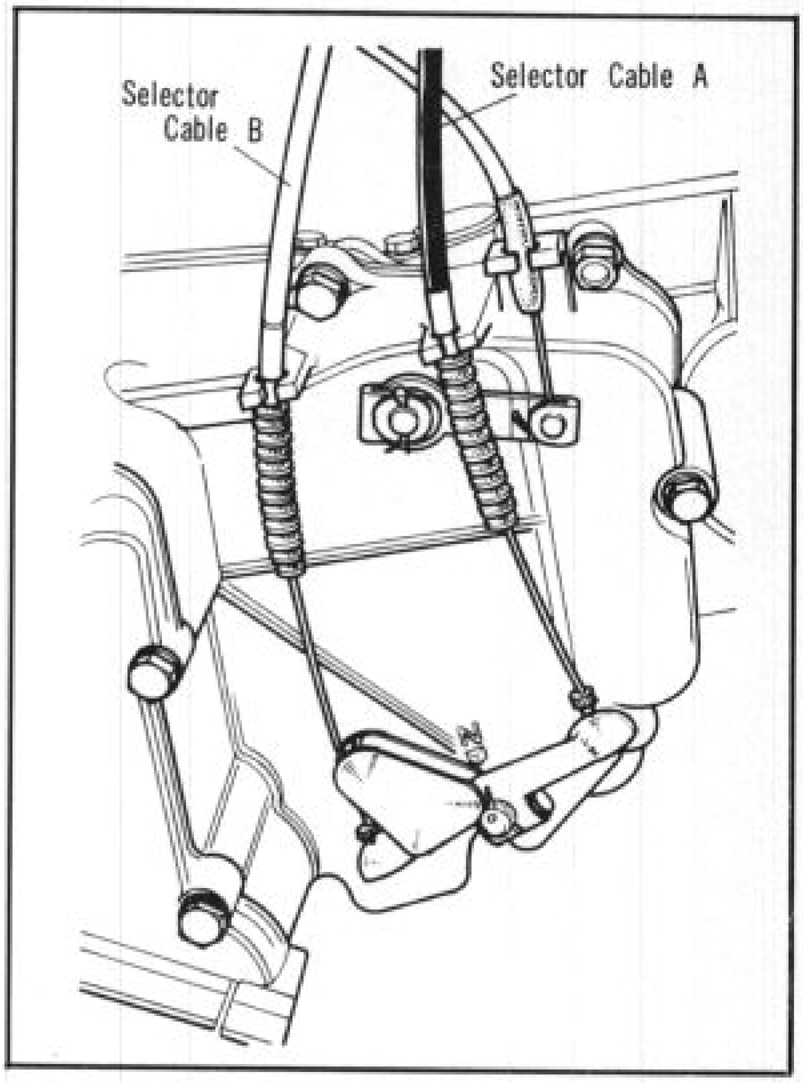


Fig. 7B-275

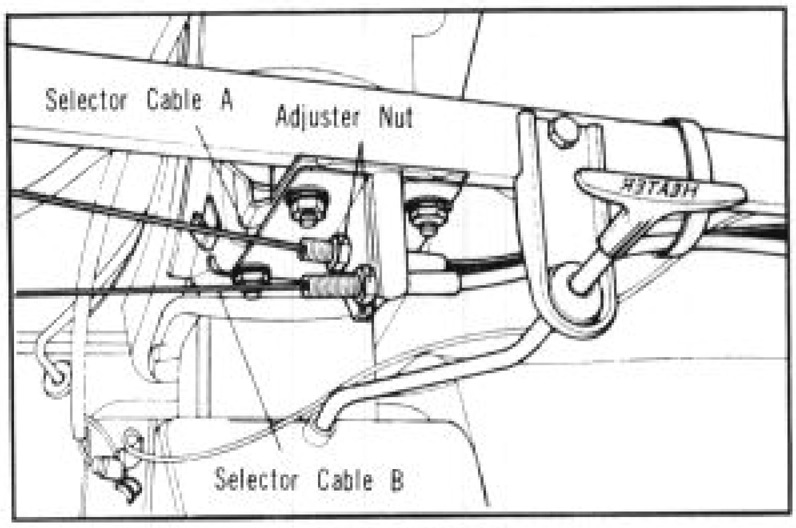


Fig. 7B-276

4. Connect the upper ends of the selector cables A and B to the hooks on the selector strap of the selector lever.
5. Adjust the adjuster nuts so that there are no slack in either of the selector cables complete the adjustment by backing off 1/2 turn on the adjuster nuts before tightening the lock nuts. (Fig. 7B-276)

6. Position the selector lever to both the [1] and [P] positions and then make sure that both cables A and B have the proper tension and that indicator plate.
7. Move the selector lever to the right and left of the [N] position and check to make sure that the selection of the respective gears is smooth.
   -1. With the selector lever in the [P] position release the parking brake and make sure that the front wheels are locked when the vehicle is pushed back and forth.
   -2. When shifting into [R] and [P] positions, check to make sure that the gears engage when the indicator has moved 1/3 of the distance into the indicator plate window.
8. Start the engine and shift through the complete range and make sure that the indicator points to the proper positions on the indicator plate.
   Also perform this check during road test. The action of the selector lever and the engagement of the gears should be smooth.

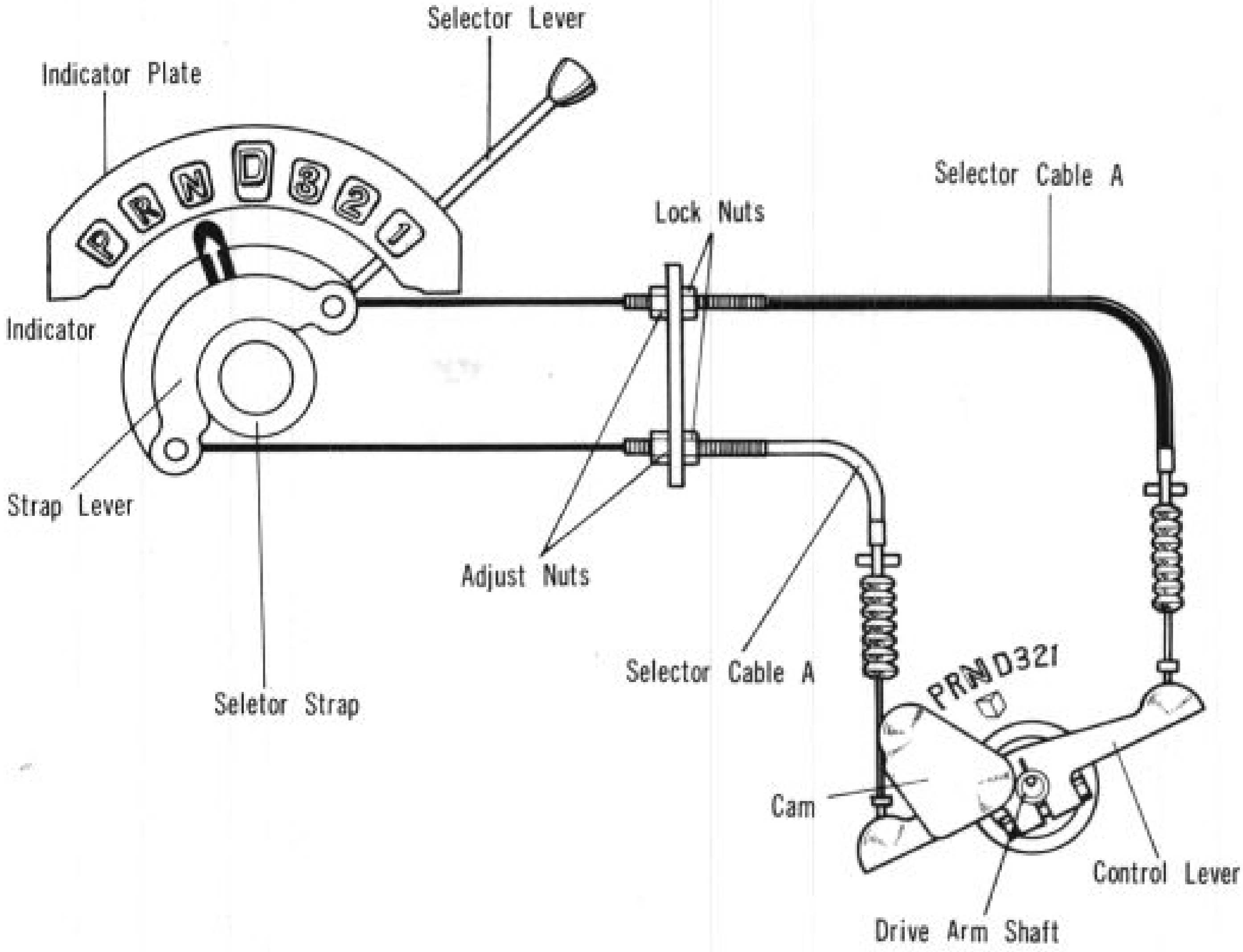


Fig. 7B-277

Upon completing the adjustment by the procedure described above, perform the check below to assure the adequacy of the adjustment.

1. In selector position [1], both selector cables A and B should have "0" slack.
2. In selector position [D], both selector cables A and B should have 2~4mm (0.080~0.160 in.) of slack.
3. The load on the respective cables should be 1 kg (2.2 lbs).
4. The relative position of the indicator plate window and the indicator during range engagement.

-1. [N] ⇨ [R]
The gears should engage [R] range when the indicator has moved 1/3 of the distance into the indicator plate window.

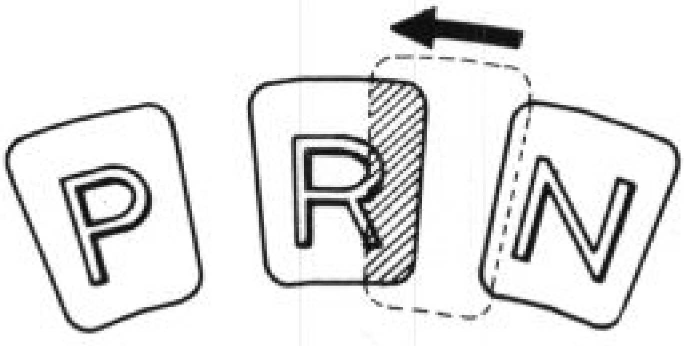


Fig. 7B-278

-2. [R] ⇨ [P]
The gears should engage [P] range when the indicator has moved 1/3 of the distance into the indicator plate window.

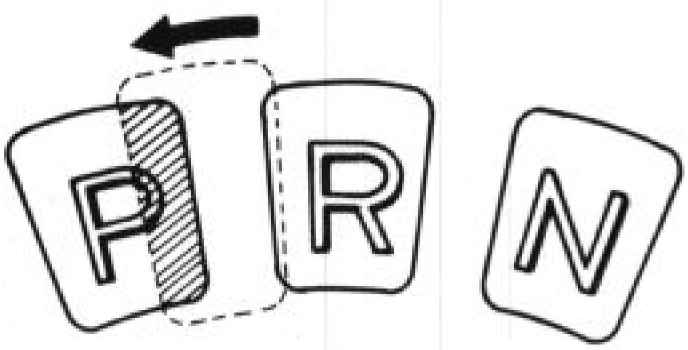


Fig. 7B-279

-3. [P] ⇨ [R]
The gears should engage [R] range when the indicator has moved 2/3 of the distance into the indicator plate window.

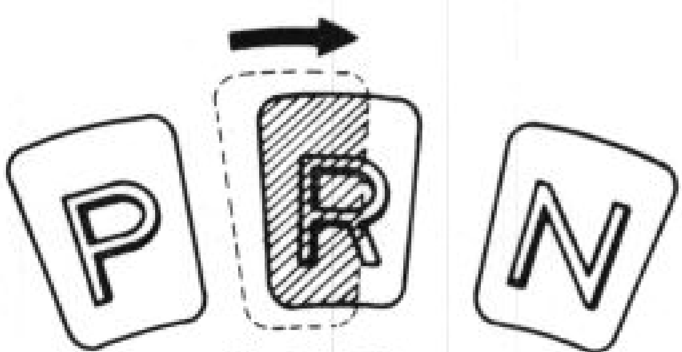


Fig. 7B-280

The relative position of the indicator plate window and the indicator for the other range engagements are the same as above.

Note:

1. Apply a wrench on the adjuster nut when tightening the lock nut to prevent disturbing the adjustment.
2. Do not forget to lubricate the linkages and joints with grease or oil.
3. Check the tightness of the bolts attaching the selector strap to the selector body.

P. PRESSURE TESTER OPERATING PROCEDURE

This tester was developed to use with the HONDAMATIC transmission. With the use of this tester, the respective oil pressure in the system can be checked and at the same time the conditions of the respective control circuits and the mechanical functions can also be determined easily and quickly.
Further, this tester can be used in conjunction with the various performance curves to verify the performance conditions.

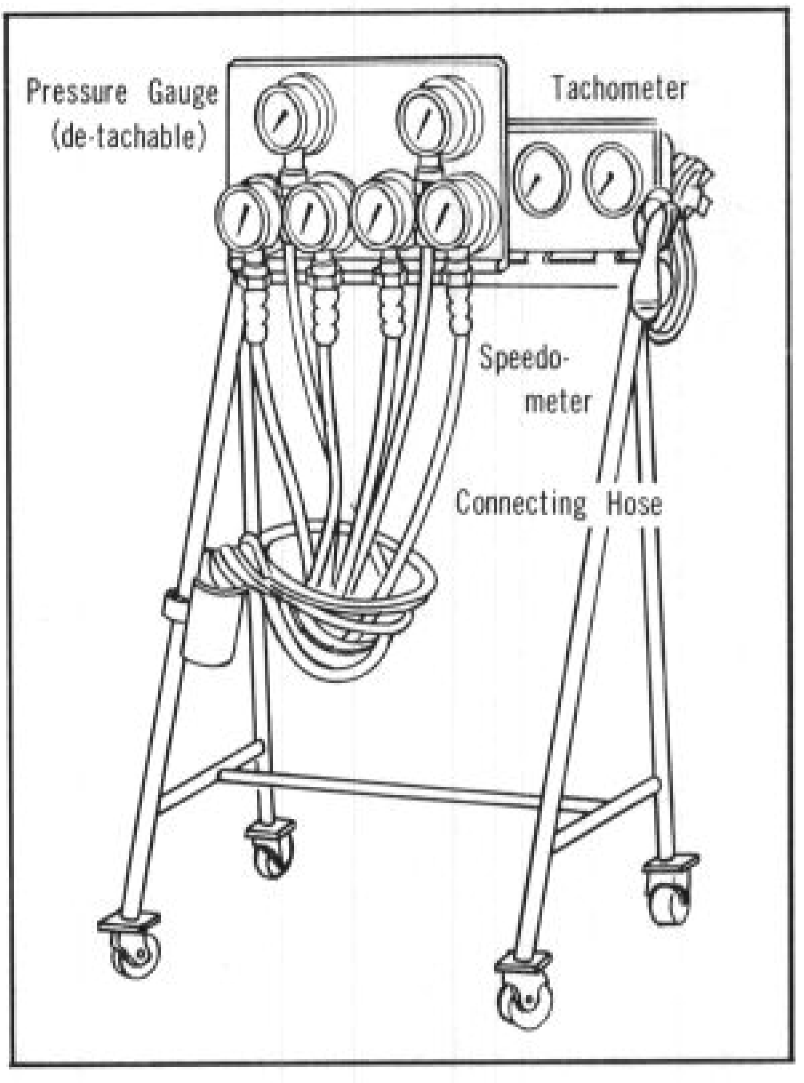


Fig. 7B-281

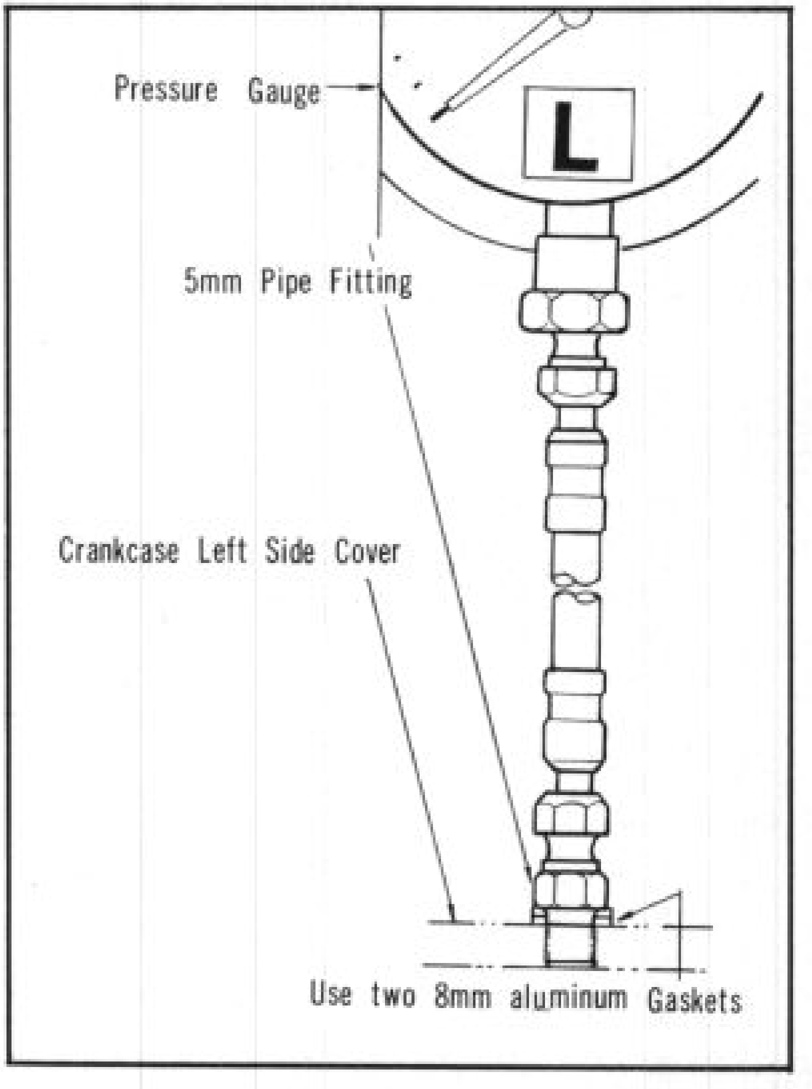


Fig. 7B-282

This service tester is designed with the following features. (Tool No. 07053-58045)
Pressure gauge, 6 each with adapter hoses.

a) 20 kg/cm^2 (285 psi) pressure gauge for checking line pressure, primary clutch pressure, 2nd clutch pressure and 3rd clutch pressure.
b) 10 kg/cm^2 (142 psi) pressure gauge for checking, throttle and governor pressures.
c) Electronic revolution counter for measuring engine speed.
d) Speedmeter for checking vehicle speed.

Operating Procedure

For A 360/600 with Hondamatic Transmission.

Pressure gauges for transmission system pressures.

Revolution counter for engine speed.
Speedmeter for vehicle speed.

The performance of the automatic transmission is checked by comparison with the performance curves.

Methods of Performing Checks

1) Test the engine independently.

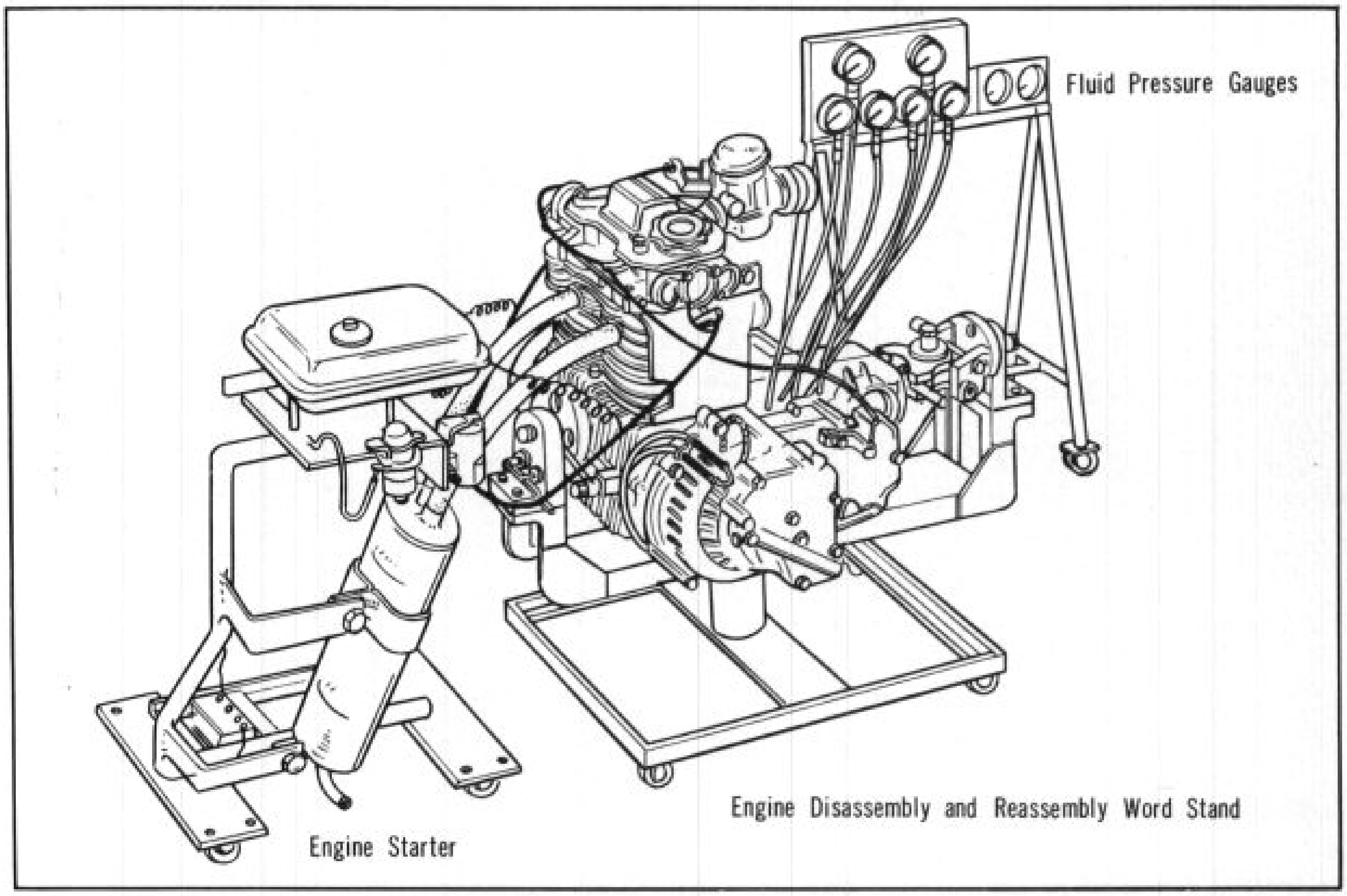


Fig. 7B-283

When the engine/transmission assembly is dismounted from the car body for repair, it will be easier to test it independently before mounting it on the car body.

2) Test on chassis dynamo meter.
For performing a diagnosis or a test of required vehicle, a better result can be attained under the running condition. It is, therefore, recommended to perform diagnosis or test on the chassis dynamo-meter.

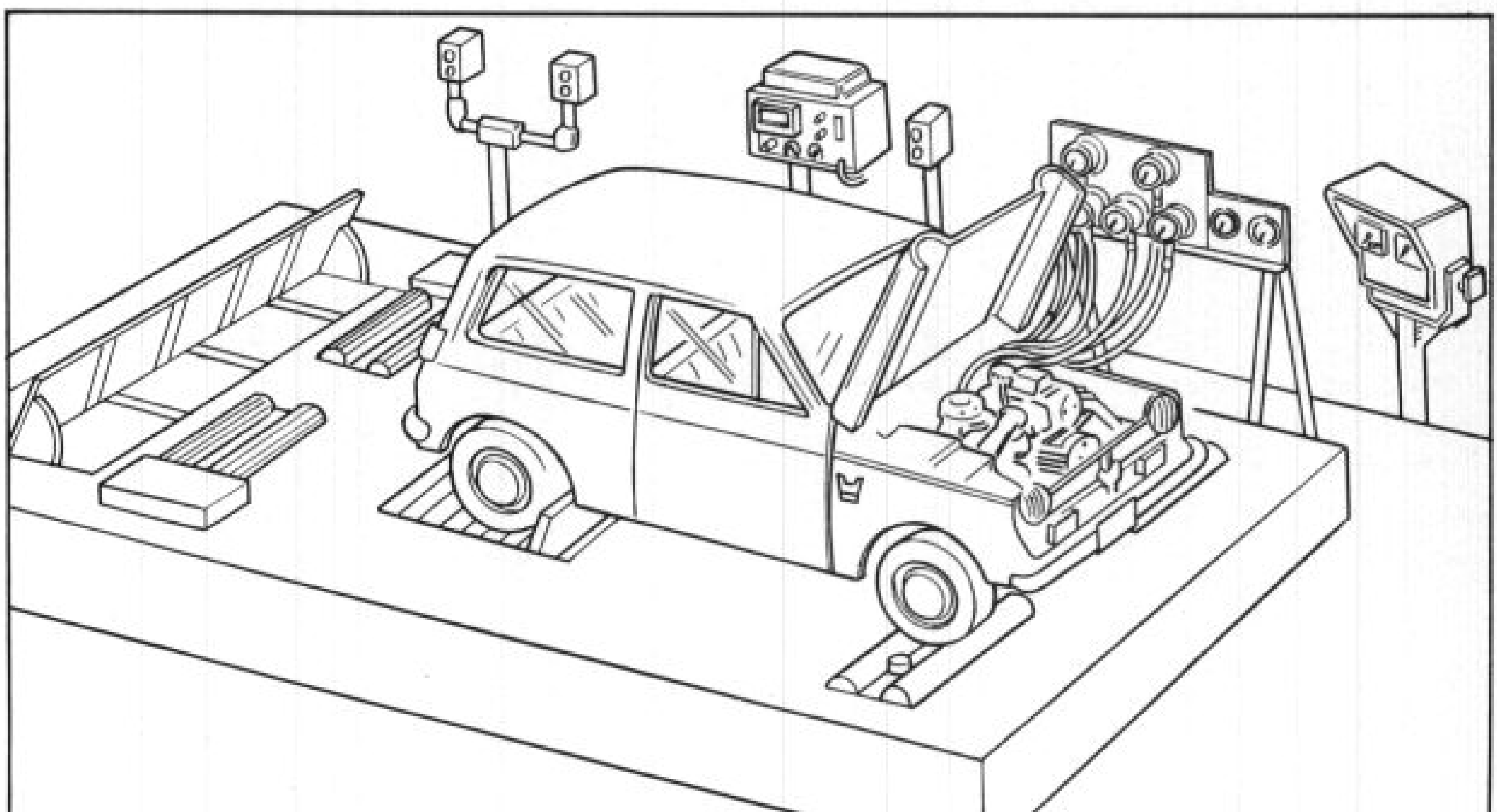


Fig. 7B-284

3) Road running test.
A diagnosis and a complete behicle test can be performed with the fluid pressure gauges (Fig. 7B-276) and the tachometer which are loaded on the front seat of the vehicle.

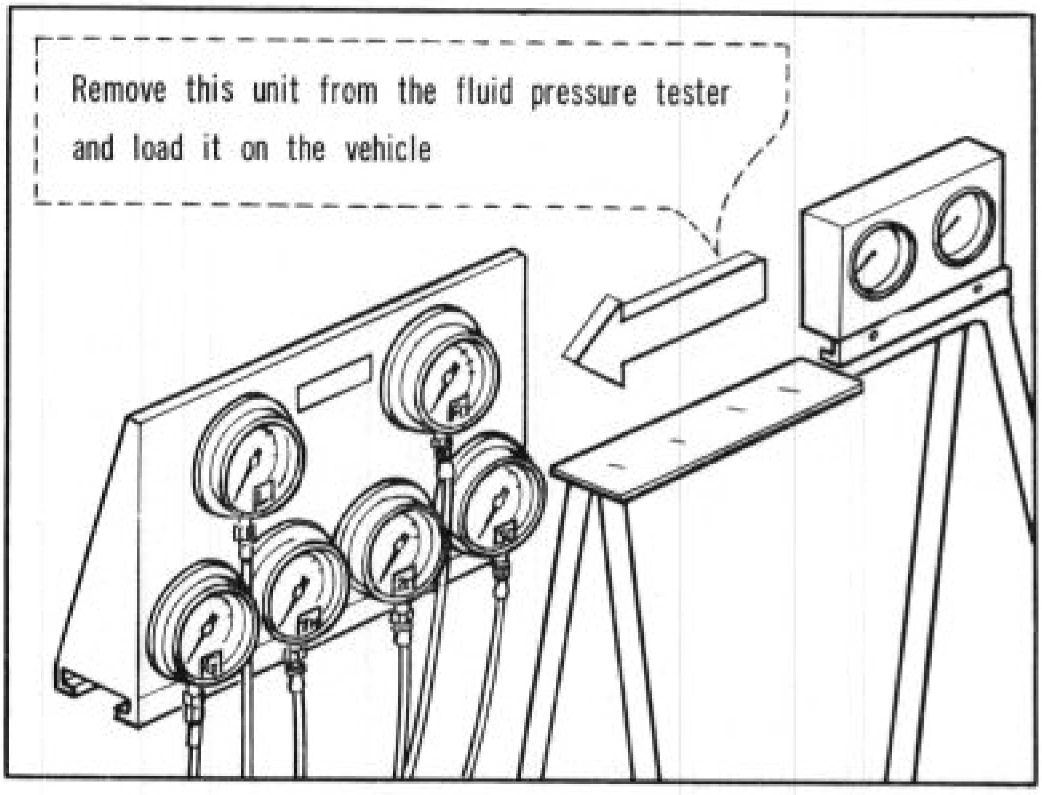


Fig. 7B-285

Installation of Testing Equipments

1) Connecting the fluid pressure gauges.
Remove all six (6) check plugs at the fluid pressure check points on the crankcase left side cover. Abreviated terms of the fluid pressures in each function of the automatic transmission are provided at these check points on the crankcase left side cover as follows:

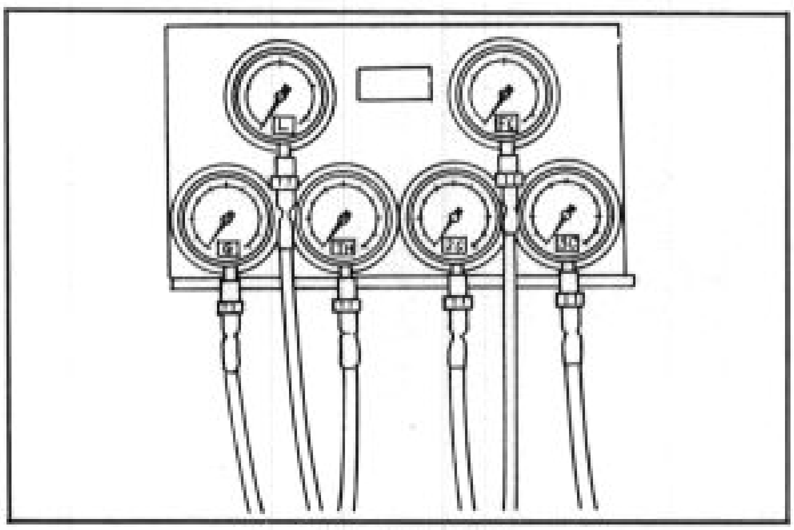


Fig. 7B-286

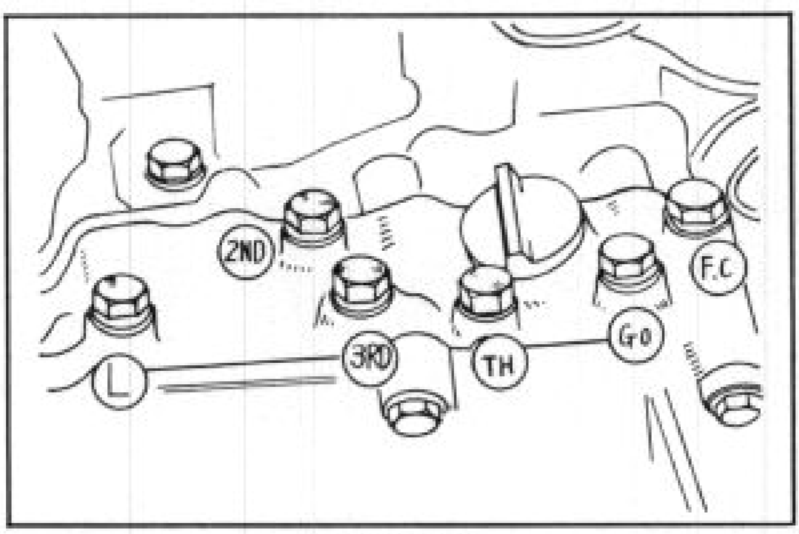


Fig. 7B-287

Arrangement of the check points on crankcase left side cover.

2) Connecting the speedometer.
   Connect the speeometer cable with the speedometer for performing a test on the independent engine/transmission assembly.
3) Connecting the tachometer.
   The revolution counter is an electric type so that the wiring should be made as shown in the wiring diagram below.
   a) Clip the ground earth cable to the engine.

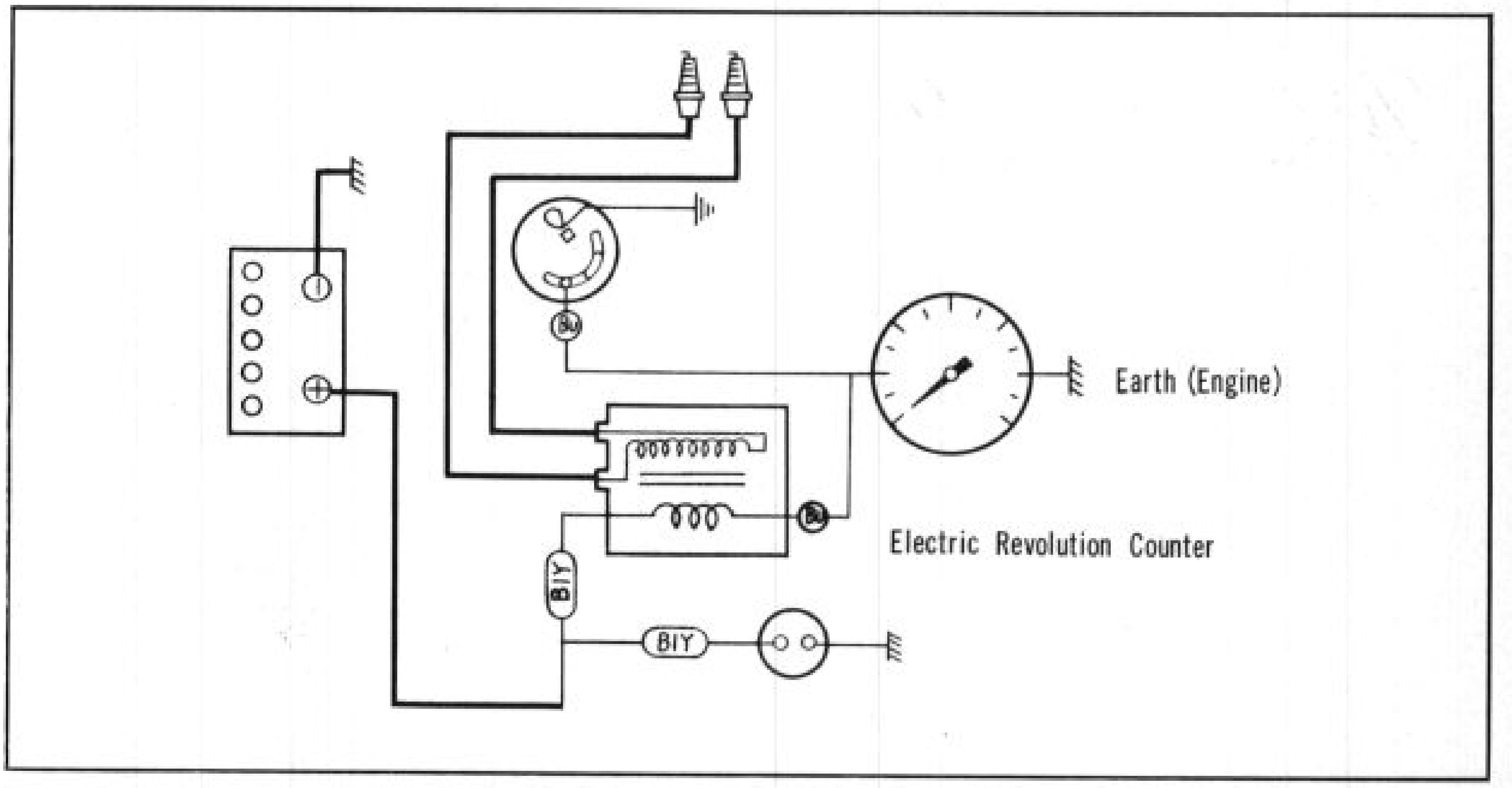
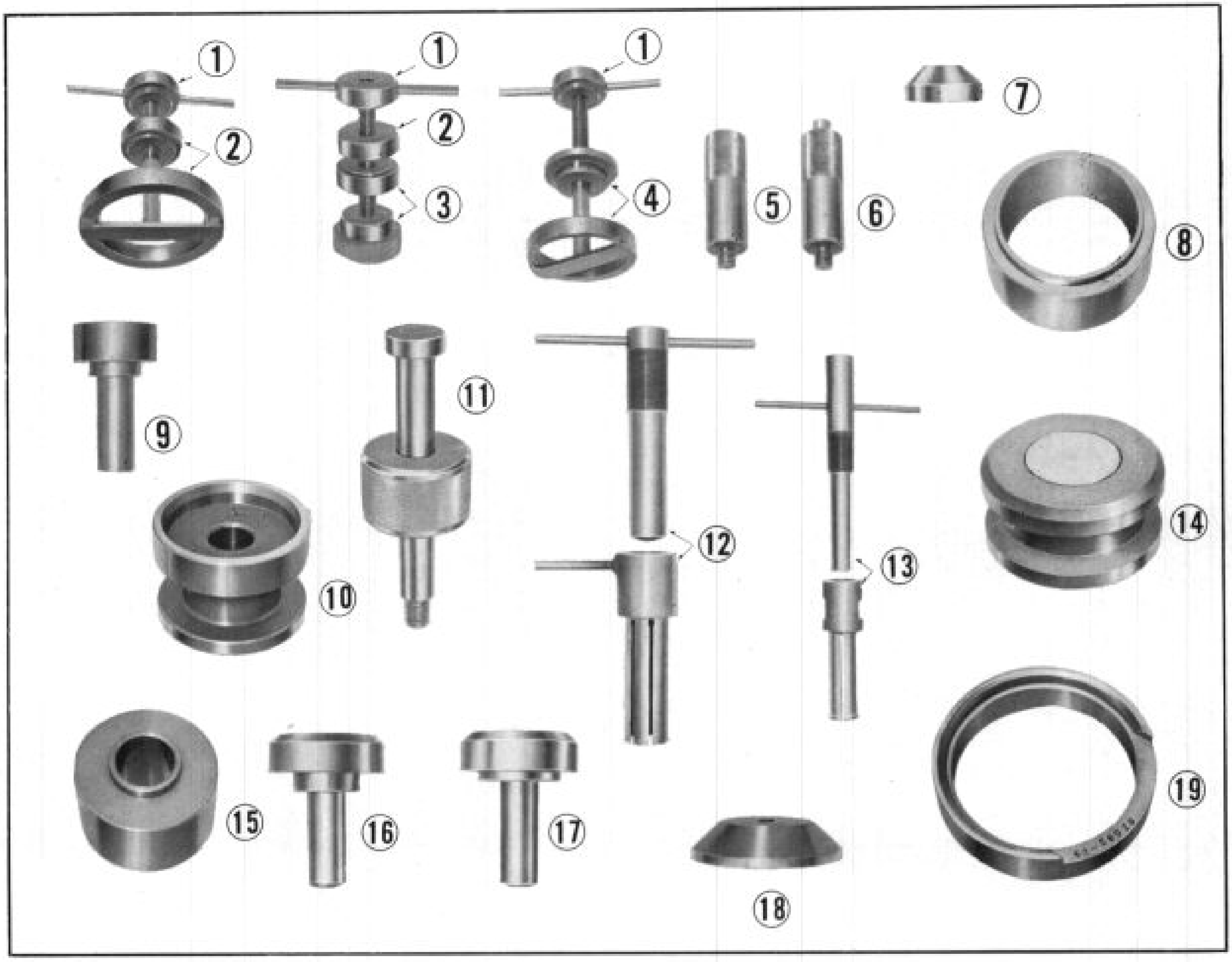
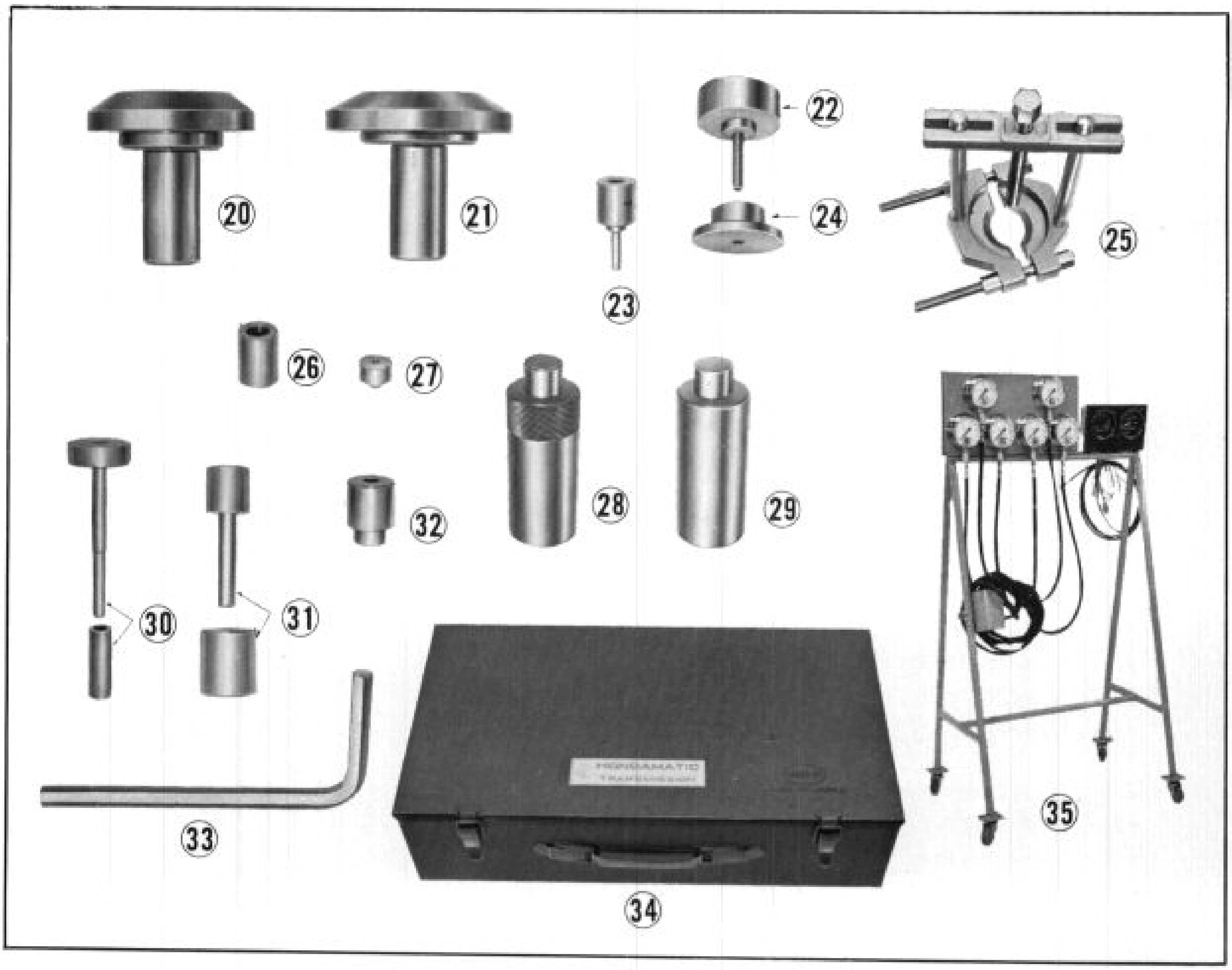


Fig. 7B-289

Q. Special Tools (for transmission disassembly and assembly)



Ref. No.	Tool No.	Description
	07000-58011	Special tool set, Hondamatic Transmission
1	07053-58011	Handle, Compressor
2	07053-58012	Compressor, Release Spring (Primary)
3	07053-58013	Adapter, Piston Remover (Primary)
4	07053-58014	Compressor, Release Spring (Secondary)
5	07053-58015	Handle A, Driver
6	07053-58016	Handle B, Driver
7	07053-58017	Remover, Oil Seal (Torque Converter Housing)
8	07053-58018	Adapter, Oil Seal Remover (Torque Converter Housing)
9	07053-58019	Driver, Oil Seal (Torque Converter Housing)
10	07053-58020	Adapter, Oil Seal Driver (Torque Converter Housing)
11	07053-58021	Slider, Ball Bearing Remover
12	07053-58022	Remover, Ball Bearing (Torque Converter Case)
13	07053-58023	Remover, (Ball Bearing (L. Crankcase Side Cover)
14	07053-58024	Base, Guide
15	07053-58025	Guide, Bearing (Torque Converter Case)
16	07053-58026	Driver, Bearing (Torque Converter Case)
17	07053-58027	Driver, Oil Seal (Torque Converter)



Ref. No.	Tool No.	Description
18	07053-58028	Remover, Ball Bearing (L. Crankcase Side Cover)
19	07053-58029	Base, Remover Guide (L. Crankcase Side Cover)
20	07053-58030	Driver, Ball Bearing (L. Crankcase Side Cover)
21	07053-58031	Driver, Oil Seal (L. Crankcase Side Cover)
22	07053-58032	Driver, Ball Bearing (L. Crankcase Side Cover)
23	07053-58033	Driver, Oil Seal (L. Crankcase Side Cover)
24	07053-58034	Guide, Bearing (L. Crankcase Side Cover)
25	07784-99908	Puller, Universal Bearing
26	07053-58036	Adapter, Bearing Puller (Mainshaft)
27	07053-58037	Adapter, Bearing Puller (Countershaft)
28	07053-58038	Driver, Mainshaft Bearing
29	07053-58039	Driver, Countershaft Bearing
30	07053-58040	Driver, Oil Seal (Speedometer Gearbox Holder)
31	07053-58041	Driver, Oil Seal (Engine Oil Pump Housing)
32	07053-58042	Driver, Clutch Drum Oil Seal
33	07053-58043	Wrench, A.T.F. Drain Plug
34	07790-99912	Case, Tool
35	07053-58045	Tester, Fluid Pressure (Tool SET not including Ref. No. 35)

R. HONDAMATIC TRANSMISSION TROUBLE DIAGNOSIS GUIDE

Trouble	Items to Check
Range selector defects ([D] and [R] operation)	
Harsh shifting from [N] to [D]	E T K
Harsh shifting from [N] to [R]	E T j k
Operation is slow when shifted from [N] to [D]	B E S a g i
Operation is slow when shifted from [N] to [R]	B E s a g i m
Drive defects (starting up)	
No drive in any range	
Torque converter not rotating	l
Torque converter rotating	B S a b f g i m
Pressure stalls in [D], [1], [2], [3] and [R]	v w
Torque converter does not rotates unless engine speed is increased	h
No forward drive	m u
No drive in [D] or [1]	r m
No reverse drive	
Engine overspeeds	c m t
Pressure stalls	c s
Moves forward in [N] when engine speed is increased	c j
Shifting defects (shift point)	
No up-shift from [D_1]	r
No drive in [2] or [3]	u
No drive in [2] only	Y n_2 q
Normal drive in [2]	Z
No up-shift from [D_2] to [D_3]	
Second gear engages with [3]	V
Drive speed does not respond to engine speed	n_2 q
Engine overspeeds on up-shift from [D_2] to [D_3]	n_3 q
Normal drive in [2] and [3]	Z
Up-shifts from [D_1] to [D_3] ([D_2] is jumped off)	V
Up-shifts occur at low drive speed	D U V W
Hysterisis is large	T U V
Harsh shifting	
Harsh shifting from [D_1] to [D_2] and [D_3] to [D_2]	X p_2
Harsh shifting rom [D_2] to [D_3]	p_3
Braking occurs when shifted from [D_2] to [D_3]	o_2
Severe braking occurs when shifted from [D_3] to [D_2]	o_3
Escessive engine noise when shiften from [D_3] to [D_2]	Y n_2 q
Stall speed defects	
High	B S a e g i m
Low	F G c
Miscellaneous	
Parking does not hold	C x

Trouble	Items to Check
Transmission overheats	A c d
Poor drive acceleration	
Poor acceleration at slow speed	c n_2 q
Poor acceleration at high speed	A F d n_3 q
Poor acceleration in all drive ranges	B D G S a e g i

Preliminary Adjustment Faults

A. Improper engine oil level.

B. Improper AT fluid level.

C. Improper installation or adjustment of selector cables (A and B).

D. Improper installation or adjustment of throttle secondary cable.

E. Improper engine idle speed.

F. Improper installation or adjustment of throttle cable.

G. Improper adjustment of ignition timing, valve timing, carburetor or improper compression pressure.

Hydraulic Control Fault

S. Stuck regulator valve, foreign prticle on valve seat, weak or damaged spring.

T. Stuck regulator spring cap.

U. Stuck 1-2 shift valve, foreign particle on valve seat, weak or damaged spring.

V. Stuck 2-3 shift valve, foreign particle on valve seat, weak or damaged spring.

W. Stuck throttle valve, foreign particle on nalve seat, weak or damaged spring or worn throttle drive arm.

X. Stuck timing valve foreign particle on valve seat, weak or damaged spring.

Y. Clogged 0.8mm orlifice in separator plate or defective accumulator valve

Z. Worn oil seal on end of countershaft, worn or malfunctioning governor valve Damaged governor weight, or weak or damaged weight spring; clogged 1.2mm orifice in the main valve body separator plate.

Mechanical Faults

a Excessively worn teeth or side face of the pressure pump gears.

b Defective pump impeller shaft or drive mechanism.

c Slipping one-way clutch is torque converter stator.

d Seized one-way clutch in the torque converter stator.

e Insufficient torque converter fluid due to defective torque converter housing oil seal.

f Defective torque converter housing spline or defective primary drive chain.

g Clogged ATF strainer screen or air sucked in from strainer.

h Clutch malfunction due to drop off of internal circlip on the primary clutch drum.

i Worn or slipping primary clutch driven plates. Worn primary clutch piston O ring, worn oil seal on the crankcase left side cover (mainshaft end) or oil leak from relief valve.

j Seized primary clutch, distorted drive plates, drop out of the wave spring, malfunction of the relief valve.

k Weak or broken primary clutch wave spring.

l Broken or damaged pump impeller shaft, drive coupling or crankshaft drive mechanism.

m Worn or damaged servo piston O ring; stuck servo valve due to foreign particle. Servo malfunction due to freeze-up of reverse select gear and reverse gear hub.

$n_{2(3)}$ Worn or slipping 2nd (3rd) clutch driven plates; worn or damaged piston O ring.

$o_{2(3)}$ Seized 2nd (3rd) clutch; distorted drive plates; drop-out of wave spring, weak or broken release spring.

$p_{2(3)}$ Weak or broken 2nd (3rd) clutch wave spring.

q Worn or damaged oil sealing ring.

r Slipping one-way clutch on low gear.

s Seized one-way clutch on low gear.

t Defective mainshaft reverse gear.

u Seized countershaft reverse gear.

V Seized mainshaft ball/needle bearings; seized reverse idle gear.

w Seized differential shaft ball bearings.

x Defective parking pawl.

S. Hondamatic Transmission Trouble Diagnosis Chart

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
Engine starts but no drive in any of the selector lever position.	Selector lever has unusual feeling.	Selector cable system defective	a. Selector cable broken. b. Control lever damaged. c. Drive arm shaft damaged.	a. Replace selector cable. b. Replace control lever. c. Check and replace drive arm shaft.
	Torque converter does not rotate.	Torque converter drive system defective.	a. Drive coupling damaged. b. Torque converter pump impeller spline damaged.	a. Replace drive coupling. b. Replace torque converter pump impeller.
		No line pressure.	a. Low fluid level. b. Pump impeller or pump impeller shaft damaged.	a. Check fluid level, correct source of leak if any, and replenish fluid. b. Check pump impeller or pump impeller shaft and crankshaft; replace if defective.
		Regulator valve defective.	a. Weak or failed regulator valve spring. b. Regulator valve stock or foreign object lodged, causing malfunction.	a. & b. Check regulator valve and clean; replace the whole unit if defective.
	Torque converter rotates, but no forward drive.	Primary drive system defective.	a. Torque converter pump housing spline defective. b. Primary drive chain defective.	a. Replace torque conveter pump housing. b. Replace primary drive chain.
		Low primary clutch pressure (Clutch defective.	a. Primary clutch oil seals defective. b. Primary clutch piston outer and inner O rings damaged. c. Malfunction of piston relief valve. d. Primary clutch drum damaged. e. Mainshaft end oil seal in the crankcase left side cover defective.	a. Replace oil seals. b. Replace O rings. c. Replace clutch piston. d. Check primary clutch drum; replace if necessary. e. Replace oil seal.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
		Servo defective.	a. Servo piston Oring worn or damaged. b. Servo piston stuck or foreign object lodged, causing malfunction. c. Reverse select gear locked to reverse gear hub.	a. Replace servo piston Oring. b. Remove foreign object and replace defective parts if necessary. c. Replace both reverse select gear and reverse gear hub.
		Differential gear mechanism defective.	a. Differential gear case defective. b. Drive shaft defective.	a. Check and replace if defective. b. Replace drive shaft.
	Torque convertor stall occurs in D, M and R ranges. During idling, vehicle can be pushed forward in the ranges N, D_1 and 1, however, it becomes immpbile in 2 and 3.	Transmission shaft and gear system defective.	a. Reverse idle gear seized on shaft. b. Bearings on both ends of the mainshaft seized.	a. Check both reverse idle gear and shaft, and replace if necessary. b. Check mainshaft and both bearings; replace if necessary.
	With engine stopped, the front wheels are locked in all ranges except P.	Countershaft and differential system defective.	a. Both bearings on the countershaft seized. b. Bearings on the differential case seized.	a. Check bearings; replace if necessary. b. Check the ball bearings; replace if necessary.
Reverse drive is possible but no forward drive.	Stall occurs in D and M ranges. Vehicle may be pushed forward in N range when idling but wheels are locked in 2 and 3 ranges.	Transmission shaft and gear system defective.	a. Counter reverse gear seized on the countershaft.	a. Check the countershaft and countershaft reserve gear; repair if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
No drive in D and 1 range.	Drive is possible in 2, 3 and R ranges only.	Low gear system defective.	a. One-way clutch in low gear slipping or their engaging areas worn. b. One-way clutch hub spline defective.	a. Check one-way clutch in low gear; and repair if necessary. b. Check one-way clutch hub; replace if necessary.
Drive is possible in D and 1 ranges only but no forward drive in other ranges.	Vehicle may be pushed forward in N range when idling, but is locked in other ranges.	Low gear system defective.	a. One-way clutch sized to counter low gear and one-way clutch hub.	a. Check one-way clutch in low gear, counter low gear and one-way clutch hub; replace if defective.
No reverse drive.	D, 1, 2 and 3 ranges are normal.	Transmission shaft and gear system defective.	a. Servo malfunctioning due to seizure of reverse select gear and reverse gear hub. b. Worn and damaged mainshaft reverse gear spline. c. Damaged counter low gear spline.	a. Check reverse select gear and one-way clutch hub; repair if necessary. b. Check mainshaft and mainshaft reverse gear; repair if necessary. c. Check counter low gear; replace if necessary.
No drive in D range.	Drive is possible in 1, 2, 3 and R ranges.	Governor defective.	a. Governor weight damaged or governor weight spring defective. b. Governor valve worn. c. Oil seal on end of countershaft worn.	a. & b. Replace countershaft unit together with governor c. Replace oil seal.
			1.2mm orifice in separator plate of main valve body clogged.	Disassemble main valve body and clean separator plate.
No up-shift into D_2	No up-shift into 2 or 3	1-2 shift valve defective.	a. Malfunction of 1-2 shift valve due to foreign substance being stuck.	a. Check and clean 1-2 shift valve; and replace the whole unit of main valve body if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
	Function in other ranges is normal.	Pressure to 2nd clutch is low.	a. Malfunction of accumulator valve in the timing valve due to sluggish movement. b. Orifice in separator plate of main valve body logged. c. 2nd clutch piston O ring worn or defective. d. Oil seal ring worn or defective.	a. Check and clean timing valve; replace whole unit of main valve body if defective. b. Disassemble main valve body and clean separator plate. c. Check 2nd clutch piston O ring; replace if defective. d. Check oil sealing ring and guide; replace if defective.
		2nd clutch defective.	a. 2nd clutch driven plates worn or burned. b. Wave spring broken. c. 2nd clutch spline worn or damaged.	a. Check and repair 2nd clutch. b. Replace wave spring. c. Check clutch piston guide; repair if defective.
No up-shift into $\boxed{D_3}$	Shift to $\boxed{3}$ range results in shifting into $\boxed{2}$ range.	2-3 shift valve defective.	a. Malfunction of 2-3 shift valve due to foreign substance beings stuck.	a. Disassemble and clean 2-3 shift valve. If it still malfunctions, sheck and replace whole unit of main valve body.
	Function in other ranges is normal.	Pressure to 3rd clutch is low.	a. Orifice in the separator plate clogged. b. O ring in 3rd clutch piston worn or damaged. c. Oil sealing ring worn or defective.	a. Disassemble main valve body and clean separator plate. b. Check 3rd clutch piston O ring and replace if necessary. c. Check sealing ring guide and oil sealing ring; replace if defective.
		3rd clutch defective.	a. 3rd clutch driven plates worn or burned. b. Wave spring broken. c. 3rd clutch spline worn or damaged.	a. Check and repair 3rd clutch. b. Replace wave spring. c. Check clutch piston guide; replace if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
Selector lever indication and drive ranges are misaligned.		Improper adjustment of selector cables A and B.	a. Selector cables stretched.	a. Readjust selector cables; replace if unadjustable.
Poor acceleration (poor climbing performance).	Stall speed is low.	Poor acceleration at high speed, maximum speed is poor. Torque converter defective.	a. Engine power is inusufficient.	a. Check ignition timing, valve timing, compression pressure and carburetor, and make necessary adjustment.
	Stall speed is high.	Primary clutch slipping.	a. Pressure to primary clutch low. b. Primary clutch driven plates worn and burned.	a. Check and repair primary clutch. b. Check and replace primary clutch driven plates.
		Stall pressure is low.	a. Regulator valve stuck or foreign object lodged, causng malfunction.	a. Check regulator and clean; replace the whole unit if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
incorrect vehicle speed at shifting point.		Line pressure is low.	a. Excessive wear to pressure pump gear teetch and/or gear side face. b. Weak or failed regulator valve spring. c. ATF strainer clogged or O ring failed. d. Fluid leaking from passage.	a. Replace both pressure pump drive and driven gears. b. Check regulator valve (spring) and clean; replace the whole unit if defective. c. Check strainer and clean. d. Correct the source of leak and replenish fluid to the proper level.
	Vehicle speed is low at shifting point.	Low throttle pressure.	a. Throttle release cable too long. b. Throttle valve drive arm worn. c. Throttle valve spring weak or broken.	a. Adjust (shorten) throttle release cable. b. Replace throttle valve drive arm. c. Check throttle valve (spring); replace whole unit of main valve body if defective.
		Low governor pressure.	a. Oil seal on end of countershaft worn or damaged. b. Governor valve worn. c. Governor weight damaged or governor weight spring weakened or broken.	a. Check oil seal on end of countershaft; replace if defective. b. & c. Replace countershaft unit together with governor valve.
	Up-shift from $\boxed{D_1}$ to $\boxed{D_2}$ range takes place when vehicle speed is low.	Malfunction of 1-2 shift valve.	a. 1-2 shift valve spring weakened.	a. Check main valve body; repalce the whole unit if defective.
	Up-shift from $\boxed{D_2}$ to $\boxed{D_3}$ range takes place when vehicle speed is low.	Malfunction of 2-3 shift valve.	a. 2-3 shift valve spring weakened.	a. Check main valve body; replace the whole unit if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
Hysteresis is large when up of down shifting.	$\boxed{D_3}$ to $\boxed{D_2}$ range, hysteresis is large.	2-3 shift valve defective.	a. Malfunction of 2-3 shift valve due to sluggish movement.	a. Check 2-3 shift valve; replace whole unit of main valve body if defective.
	$\boxed{D_2}$ to $\boxed{D_1}$ range, hysteresis is large.	1-2 shift valve defective.	a. Malfunction of 1-2 shift valve due to sluggish movement.	a. Check 1-2 shift valve; replace whole unit of main valve body if defective.
	Hysteresis is large.	High line pressure.	a. Regulator valve spring cap stuck causing malfunction.	a. Check regulator valve (spring cap); replace valve unit if defective.
Transmission shock is large.	Transmission shock is large when up-shifting from $\boxed{D_1}$ to $\boxed{D_2}$ and when down-shifting from $\boxed{D_3}$ to $\boxed{D_2}$ range.	Pressure to 2nd clutch rises rapidly.	a. Timing valve spring weakened or damaged. b. Timing valve stuck causing malfunction.	a. & b. Check timing valve; replace whole unit of main valve body if defective.
		2nd clutch wave spring defective.	a. 2nd clutch wave spring weakened or damaged.	a. Replace 2nd clutch wave spring and other damaged clutch components, if any.
	Transmission shock is large when up-shifting from $\boxed{D_2}$ to $\boxed{D_3}$ range.	3rd clutch wave spring defective.	a. 3rd clutch wave spring weakened or broken.	a. Replace 3rd clutch wave spring and other damaged clutch components if any.
Braking takes rapid hold unusually when up and downshifting.	Braking occurs when up-shifting from $\boxed{D_2}$ to $\boxed{D_3}$ range.	2nd clutch wave spring defective.	a. Excessive wear to 2nd clutch driven plates and wave spring which causes wave spring to slip off and drag. b. 2nd clutch release spring weakened, broken or dragging caused by drop off of internal circlip.	a. & b. Check and repair 2nd clutch.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
	Braking occurs when down-shifting from [D3] to [D2] range.	3rd clutch wave spring defective.	a. Excessive wear to 3rd clutch driven plates and wave spring which causes wave spring to slip off and drag. b. 3rd clutch release spring weakened, broken or dragging caused by drop off of internal circlip.	a. & b. Check and repair 3rd clutch.
Shifting shock is large.	Shifting shock is large when shifting from [N] to [D] range.	High line pressure.	a. Regulator valve spring cap stuck.	a. Check regulator valve; replace valve unit if defective.
		Improper idling adjustment.	a. Idle speed is too high.	a. Adjust idling speed properly.
		Primary clutch defective.	a. Primary clutch wave spring weakened or broken.	a. Replace primary clutch wave spring and other damaged clutch components, if any.
	Shifting shock is large when shifting from [N] to [R] or [R] to [N] range.	Primary clutch defective.	a. Excessive wear of primary clutch driven plates and wave spring which causes wave spring to slip off the groove on piston. b. Primary clutch relief spring weakened, damaged or dragging caused by drop off of internal circlip.	a. & b. Check and repair primary clutch.

MEMO

SECTION 8

DIFFERENTIAL

8

A. Description

The differential is driven directly by the final drive gear which is an integral part of the transmission countershaft. By this arrangement, the differential is enclosed in the crankcase together with the transmission and the crankshaft; all being lubricated by the engine oil. The principal gears used are a helical type, which afforts quiet operation.

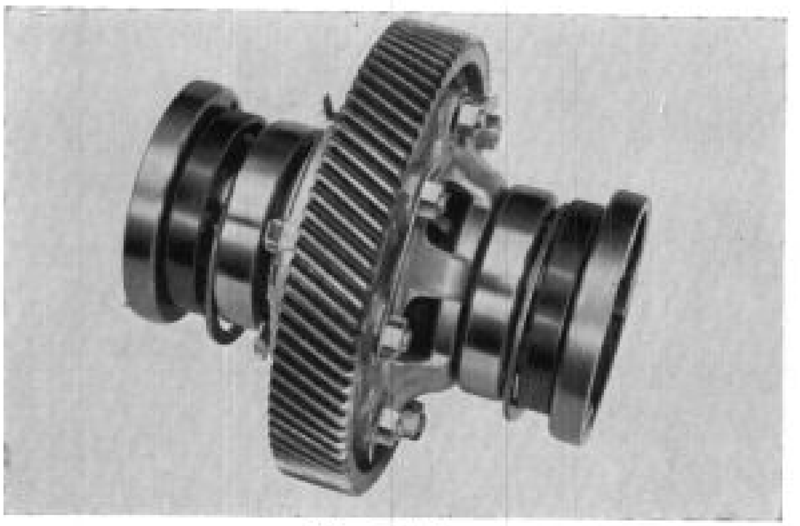


Fig. 8A-1

B. Technical Data

Reduction Gear Type	Helical Gear
Reduction Ratio	
N360	3.192
LN360	3.954
A360	3.542
N400/N600	3.037
A600	3.542
Defferential Gear Type and Number	Straight Bevel, 2 ea.
Backlash	
Pinion to Side Gear	0.1 to 0.4 mm (0.0039 to 0.0158 in)
Clearance	
Pinion Shaft to Pinion Inside Diameter	0.03 to 0.09 mm (0.0012 to 0.0035 in)
Pinion Side to Differential Gear Case	0.1 to 0.2 mm (0.0039 to 0.0079 in)
Final Driven Gear Eccentricity	0 to 0.07 mm (0 to 0.0027 in)

C. Maintenance

a. Disassembly

Disassemble the differential unit refering to the Fig. 8C-1 below.

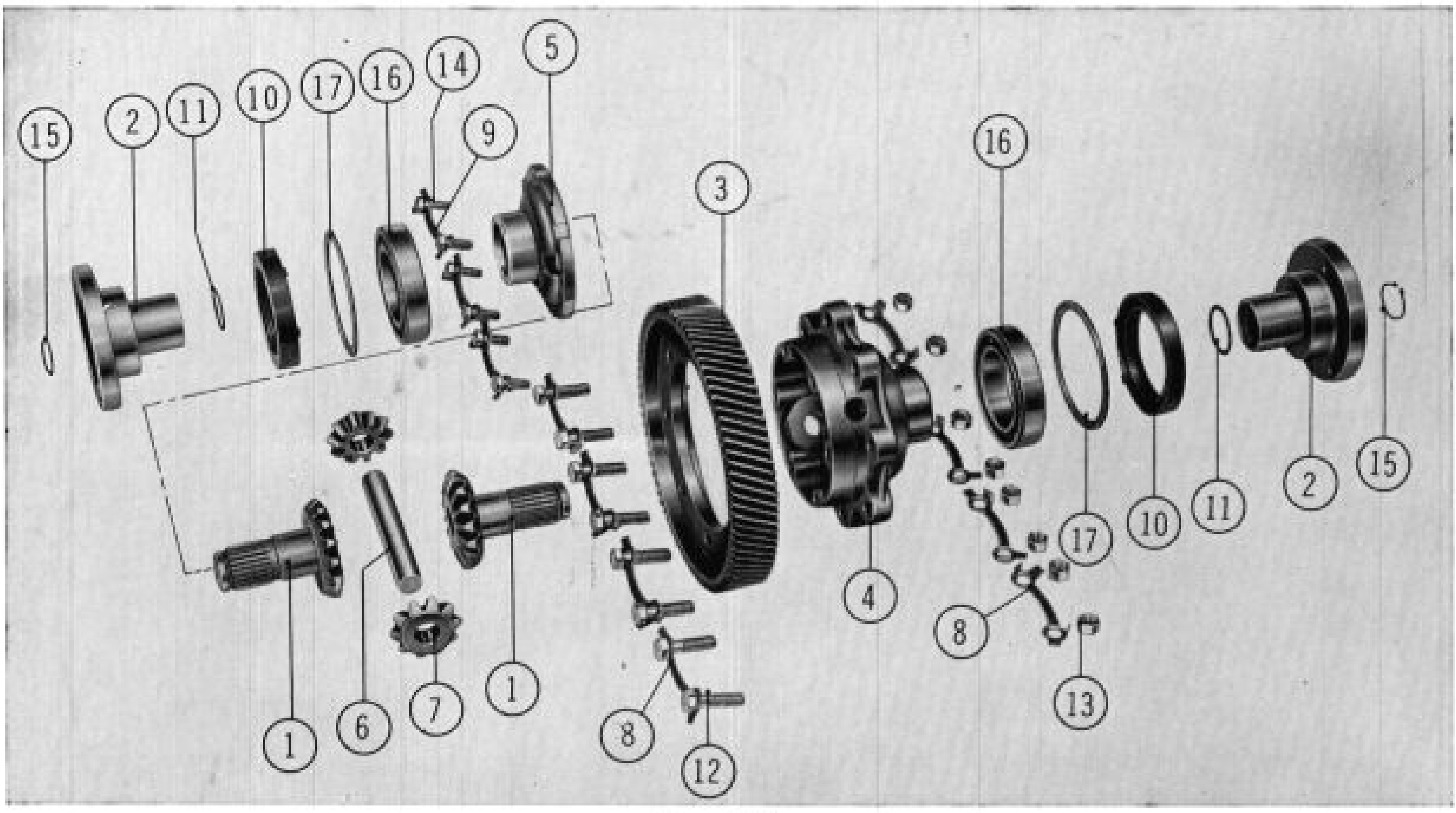


Fig. 8C-1

1 Differential side gear
2 Joint Flange
3 Final driven gear
4 Differential gear case
5 Differential gear case cap
6 Differential pinion gear shaft
7 Pinion gear
8 Lock plate
9 Lock plate
10 Oil seal (54 x 75 x 12)
11 O-ring
12 Setting bolt
13 Setting nut
14 Setting bolt
15 Circlip
16 Ball bearing
17 Thrust plate

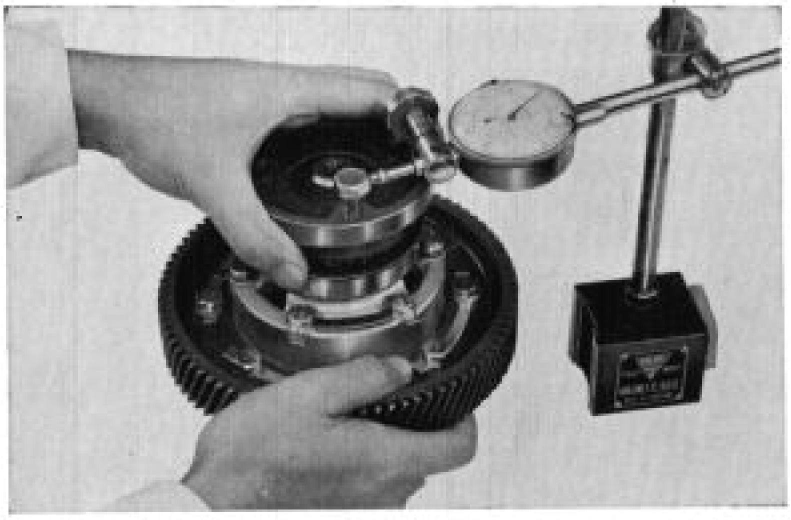


Fig. 8C-2

b. Inspection and Adjustment

1. Checking the backlash
   Lock the ring gear and one side of the joint flange, and check the backlash by moving the opposite joint flange and take measurement using a dial gauge.

   Standard tolerance:
   0.1 to 0.4mm (0.0039 to 0.0158 in)

   If the backlash is excessive, perform the following corrective action.

Check the wear of the spline on the differential side gear and if found to be excessive, replace with a new part.

Check the side clearance of the pinion gear with a thickness gauge. **(Fig. 8C-3)**
It should be 0.1 to 0.2mm (0.0039 to 0.0079 in), if found to be greater than 0.3mm (0.0118 in), install shims to obtain the proper clearance. **(Fig. 8C-3)**

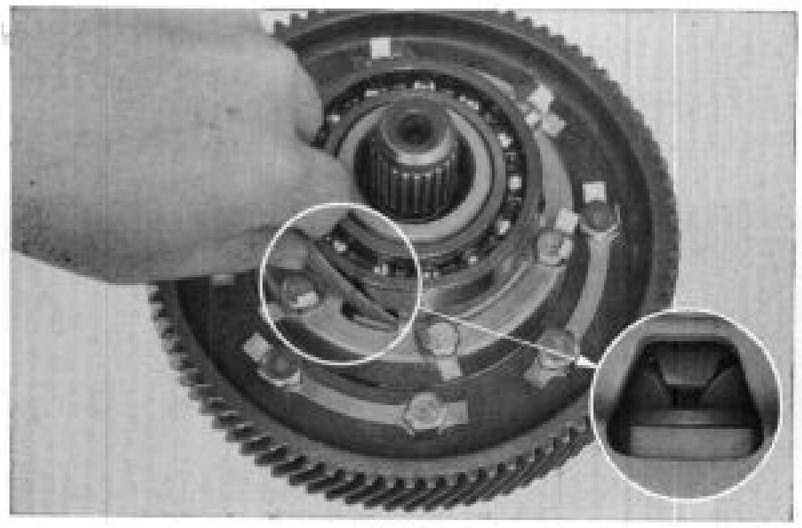


Fig. 8C-3

2. Checking the ring gear for eccentricity
Rotate the ring gear and check the entire circumference of the ring gear to determine if the gear is eccentrically mounted. If it is found to be improperly mounted, remove the ring gear from the differential case and remount.

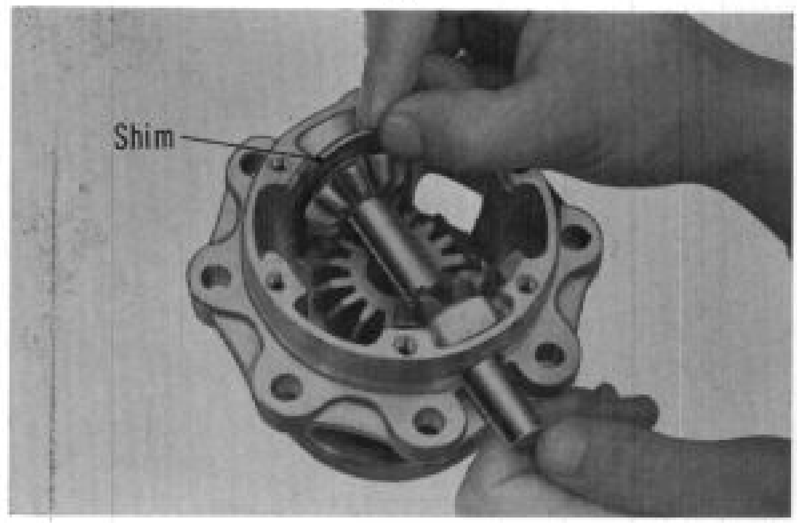


Fig. 8C-4

3. Checking the clearance between the differential pinion shaft and the differential pinion. Measure the shaft diameter and the pinion inside diameter with micrometer and then compute the radial clearance. **(Fig. 8C-5)**

   Standard clearance:
   0.03 to 0.09mm (0.0012 to 0.0035 in)

   If the clearance is greater than 0.15mm (0.0059 in), replace the worn part.

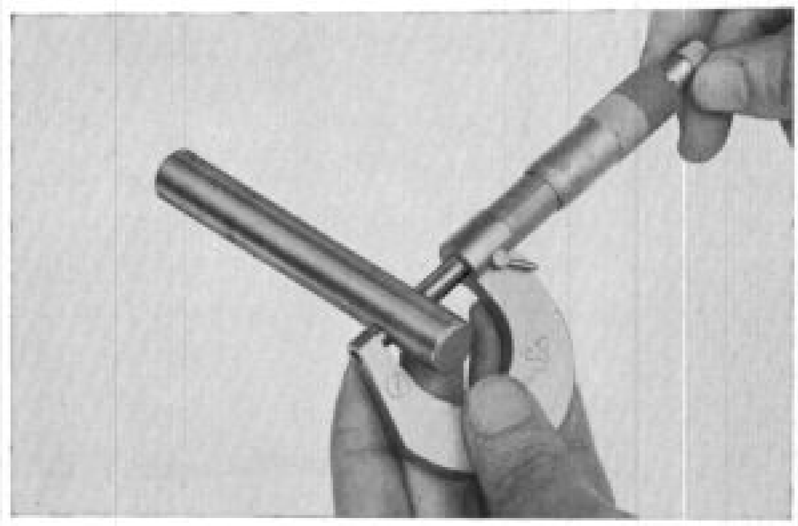


Fig. 8C-5

4. Measure the eccentricity of the differential final gear. Support the bearings on both sides with V-blocks, and measure the eccentricity of the gear in at least four different positions at interval of 90°. If eccentricity exceeds 0.1mm (0.0039 in) loosen the gear retaining bolt and adjust it with a plastic hammer. If eccentricity is excessive, replace the gear with a new one.

   Standard tolerance:
   0 to 0.07mm (0 to 0.0027 in)
   Serviceable limit:
   Repair if over 0.1mm (0.0039 in)

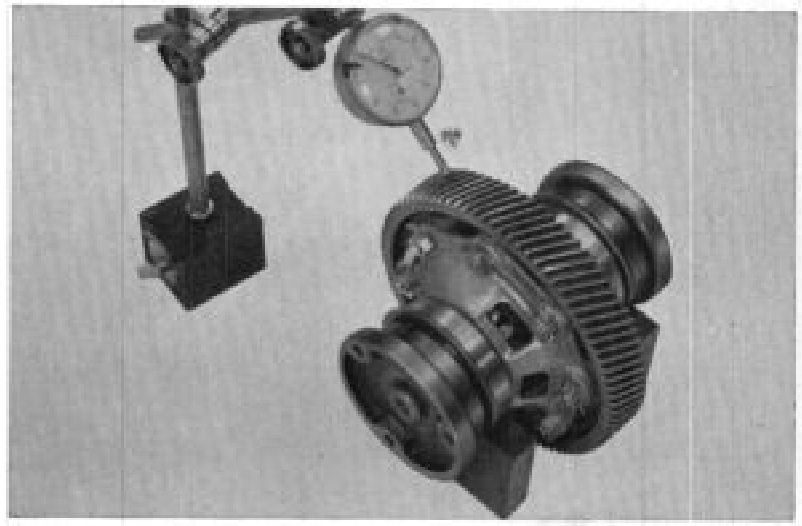


Fig. 8C-6

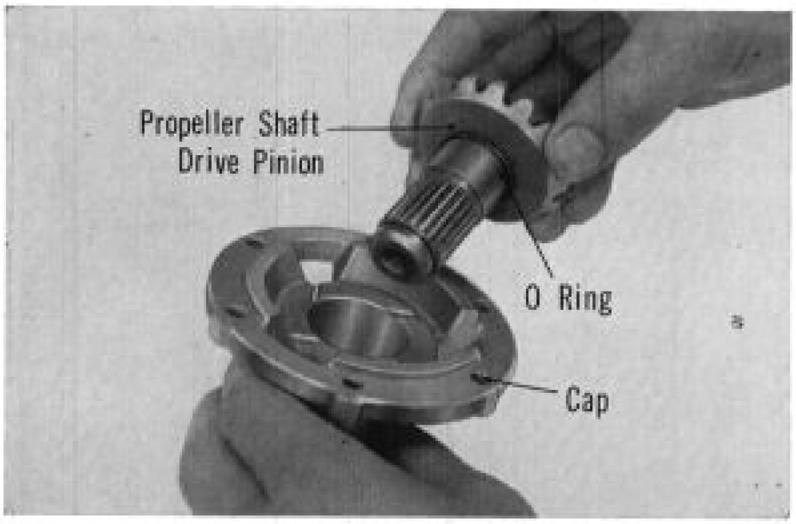


Fig. 8C-7

c. Assembly

Refer to the exploded view in **Fig. 8C-1** to make assembly. Before installing the differential side gear check the 24.8 x 1.8 O-ring which is used as an oil seal to assure that it is not damaged.

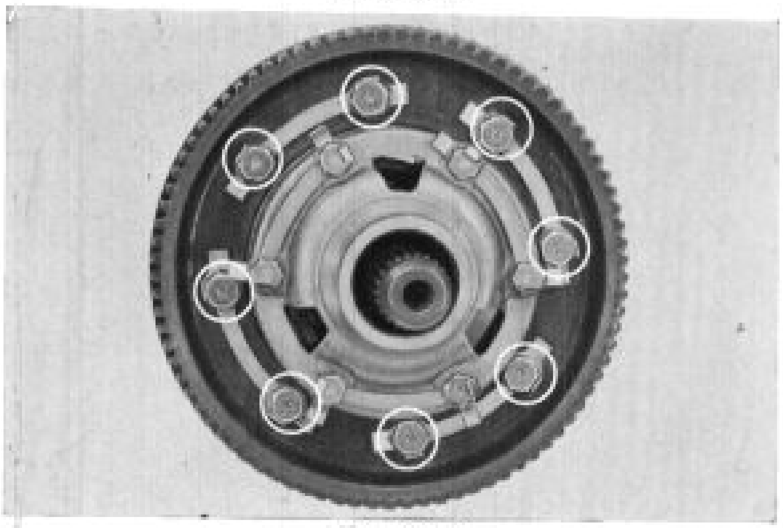


Fig. 8C-8

Assemble the ring gear into the differential case, install and torque the 8mm mounting bolts to from 2.8 to 3.0kg-m (20.25 to 21.70 ft-lb). Use all new lock washers.

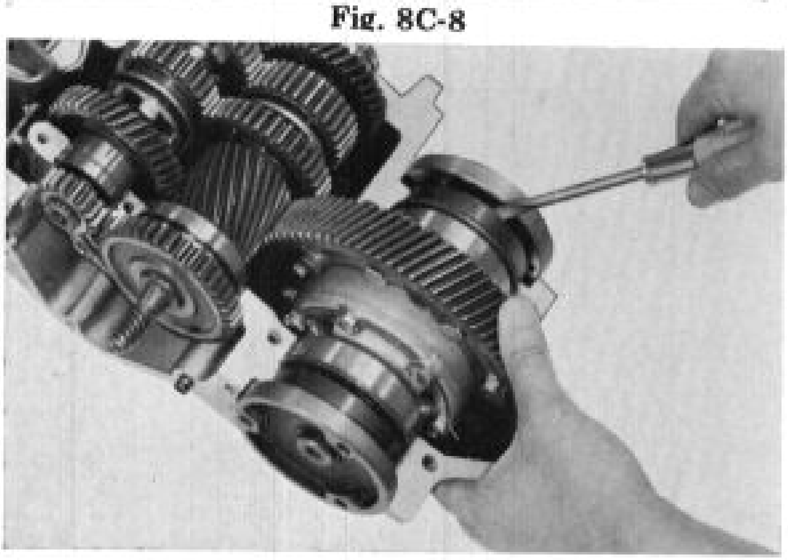


Fig. 8C-9

Before assembling the differential assembly into the lower crankcase make sure that the oil seals are mounted against the bearings. **(Fig. 8C-9)**
Oil seals can be replaced with the engine mounted on the chassis.

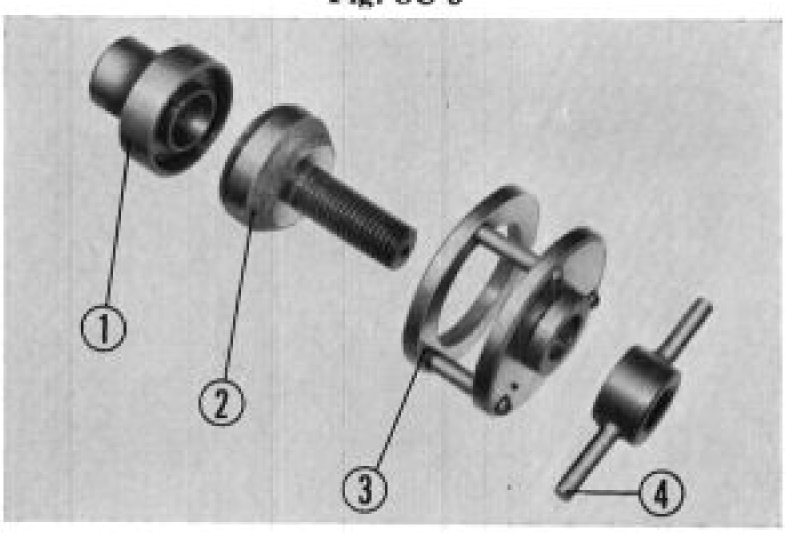


Fig. 8C-10

d. Replacement of differential oil seal
(54 x 75 x 12)

Oil leakage from the differential gear is mainly due to a worn oil seal (54x75x12) or a defective O-ring. If the oil seal is found defective upon checking, replace it using the oil seal driver C (special tool). When this replacement is made with the engine unit disassembled, use of the tool is unnecessary. For an engine installed in a vehicle, however, observe the following procedure: **(Fig. 8C-10)**

1. Jack up the vehicle, and drain the engine oil (approximately 1.5 litters).
2. Clean the linkage between the drive shaft and the differential shaft and in the neighboring vicinity.
3. Disconnect the drive shaft from the differential joint flange. (Refer to SECTION 9. DRIVE SHAFT)
4. Remove the external circlip (22mm) with snap ring pliers and remove the joint flange by pulling it out with the bolt attached. **(Fig. 8C-11)**

   Note:
   The oil may spill out at this time, so position a container to catch it beforehand.

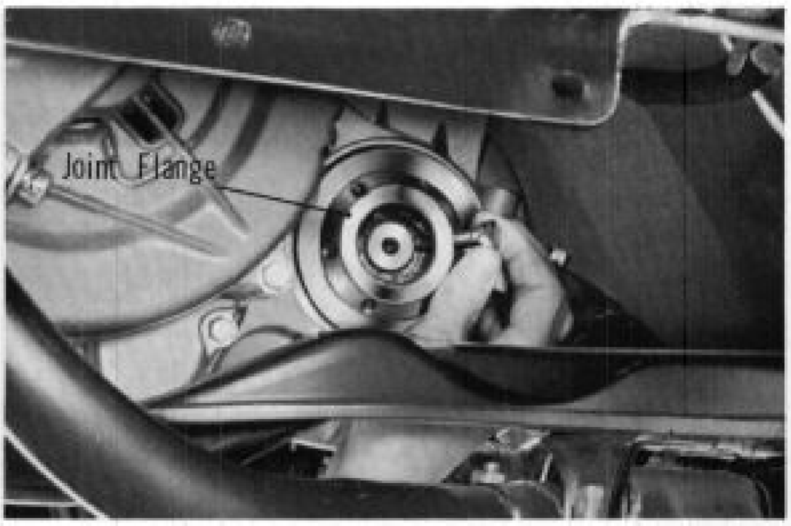


Fig. 8C-11

5. Draw out the defective oil seal with a puller. Check to see if any springs have been left in the differential gear case after removal. **(Fig. 8C-12)**
6. Relocate the O-ring on the side gear to the location adjacent to the spline using a thin wire for correct sealing.

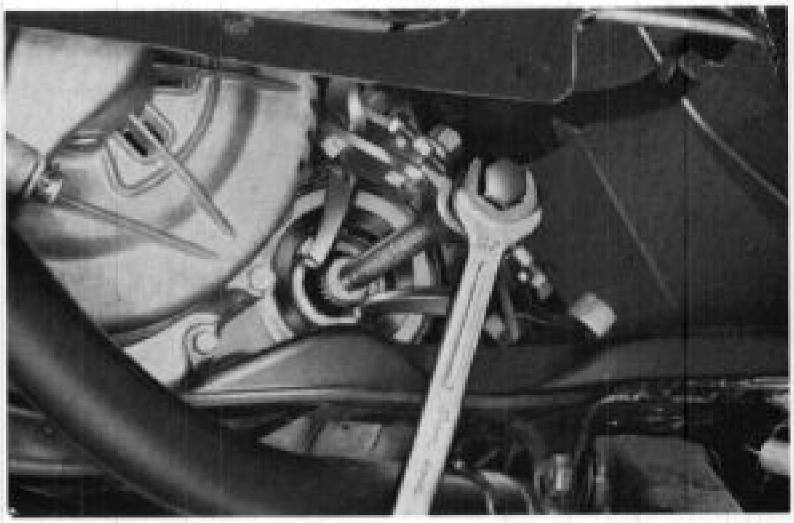


Fig. 8C-12

7. Insert ① of oil seal driver C into the side gear, and fit the external circlip (22mm). **(Fig. 8C-13)**

   Note:
   The circlip must be securely inserted.

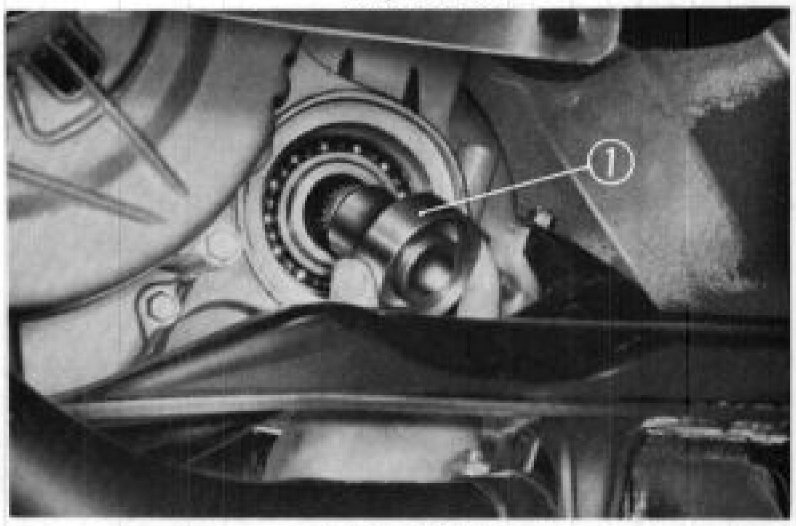


Fig. 8C-13

8. Thread ② of the tool into ①. **(Fig. 8C-14)**
9. The oil seal has grooves (refer to the **Fig. 8C-15**) for return of oil into the differential gear and to prevent leakage. Because of this, has to be installed correctly. The arrow mark and the R and L mark on the side of the oil seal, indicate the direction of rotation and position of installation, respectively: "R" for right side, "L" for left side. **(Fig. 8C-15)**

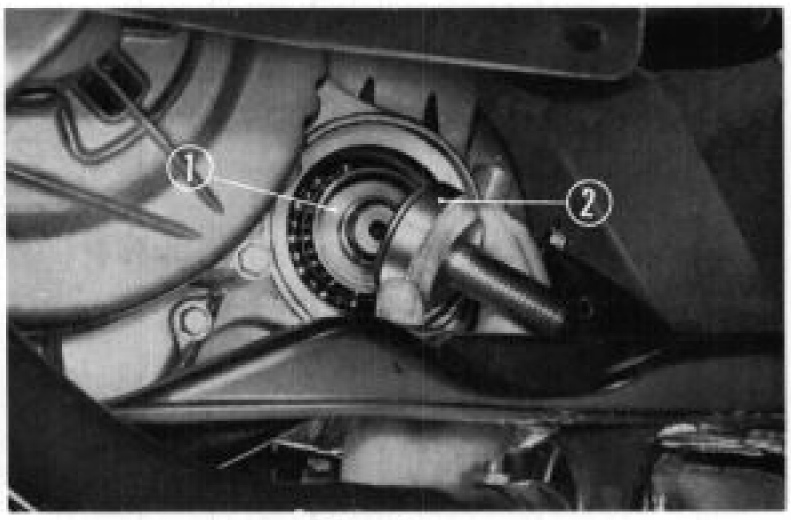


Fig. 8C-14

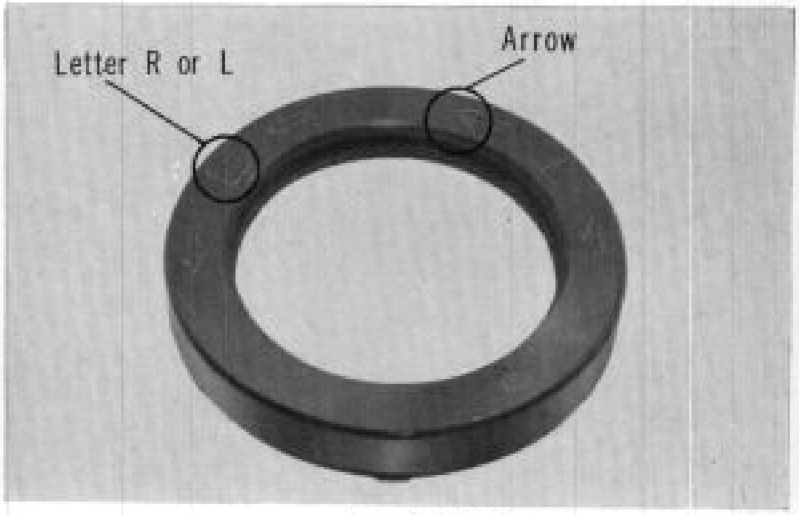


Fig. 8C-15

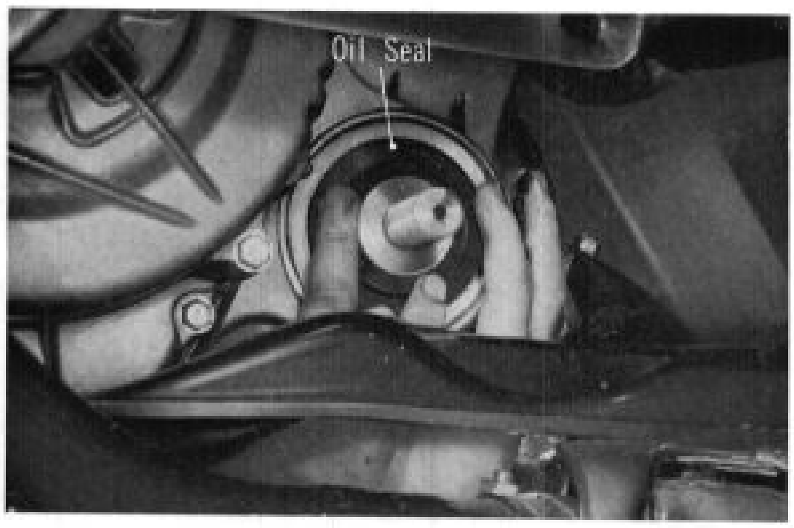


Fig. 8C-16

10. After confirming right and left positions fit the oil seal over the entire circumference, and apply a soapy water solution or grease to the outer periphery of the oil seal to facilitate fitting. **(Fig. 8C-16)**

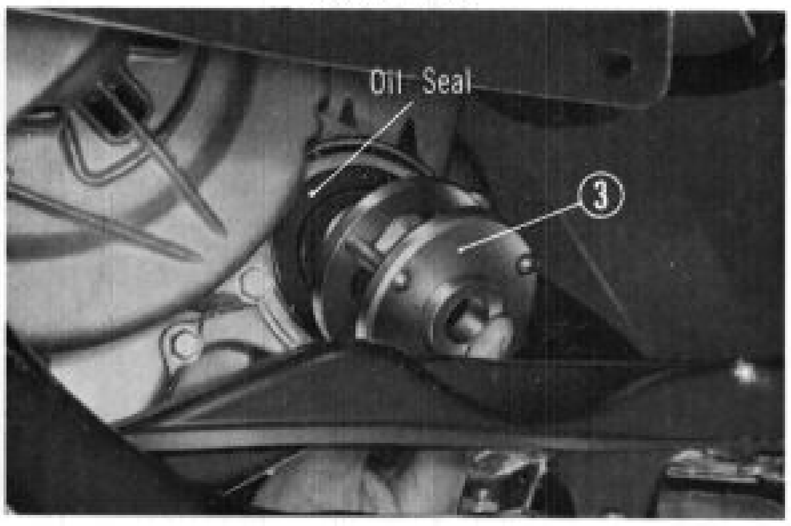


Fig. 8C-17

11. Attach ③ of the tool to the oil seal. **(Fig. 8C-17)**

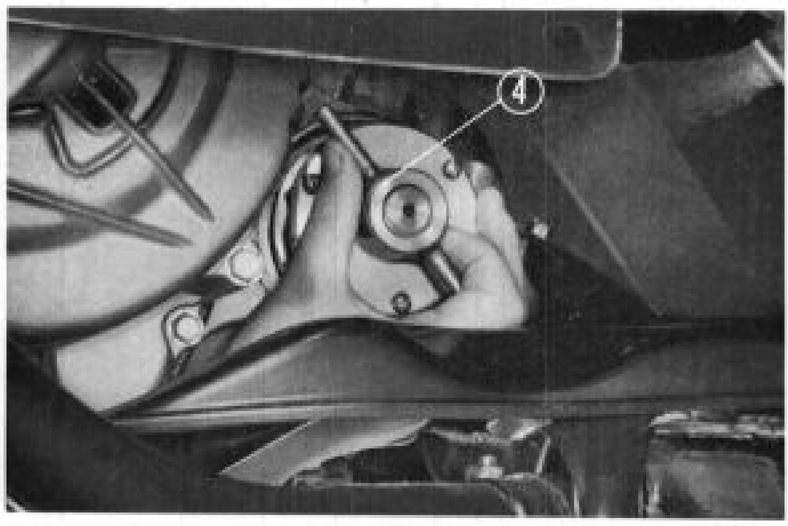


Fig. 8C-18

12. Force the oil seal into position by threading handle ④ of the oil seal driver C onto ③. **(Fig. 8C-18)**
13. After confirming the oil seal fitted completely, remove the tool and fit the external circlip 22mm.

D. Special Tool

07054-56801 Oil seal driver C

MEMO

SECTION 9

DRIVE SHAFT

9

A. Description

The front drive shaft assembly consists of a axle shaft and a drive shaft jointed with two universal joints. A constant velocity ball joint is employed for the inner universal joint of all models and the outer joint of N400/N600 models. (Fig. 9A-2) while a double cross universal joint is employed for N360 outer joint (Fig. 9A-1). The constant velocity ball joint are factory-packed with special grease and they are enclosed in sealed rubber boots. The outer constant velocity ball joint employed for N400 and N600 cannot be disassembled except for removal of the rubber.

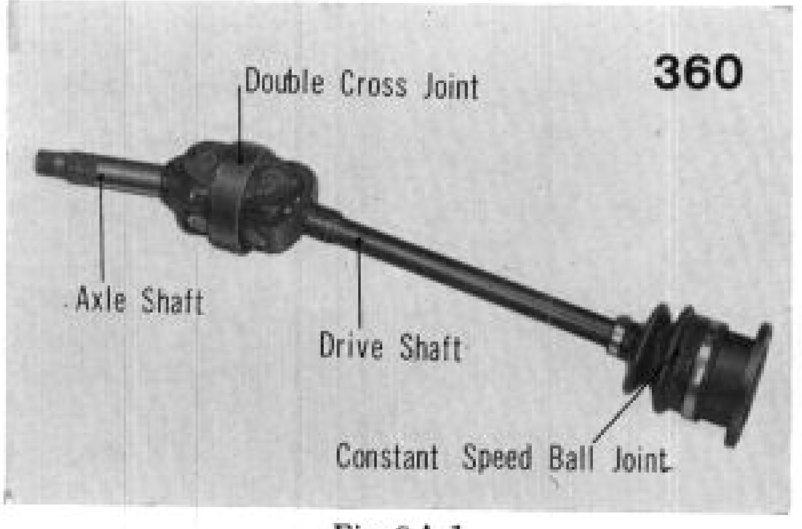


Fig. 9A-1

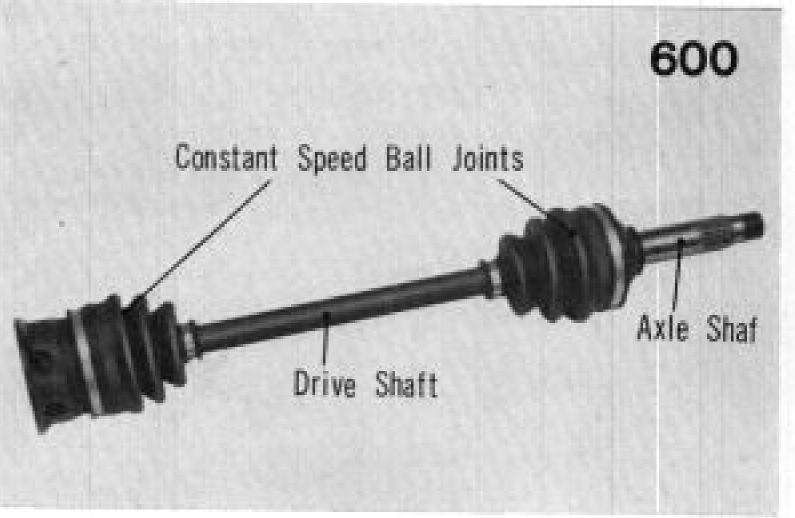


Fig. 9A-2

B. Maintenance

a. **Inspection of the drive shaft**

1. Clean and check the bellows for damage or deterioration. Replace if necessary

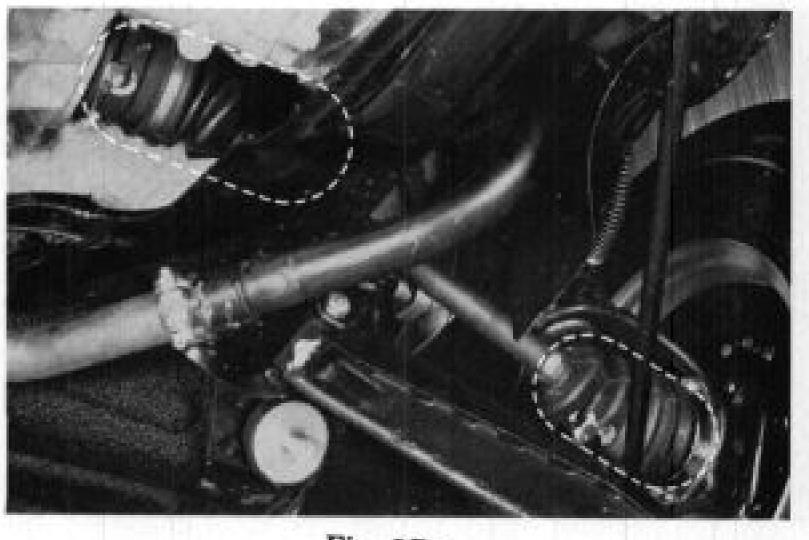


Fig. 9B-1

2. Raise front wheels off ground and check the drive shaft for excessive play in both rotational and axial directions. If excessive play is found, check the outboard joint for excessive wear. Worn joint may cause rattling noise.

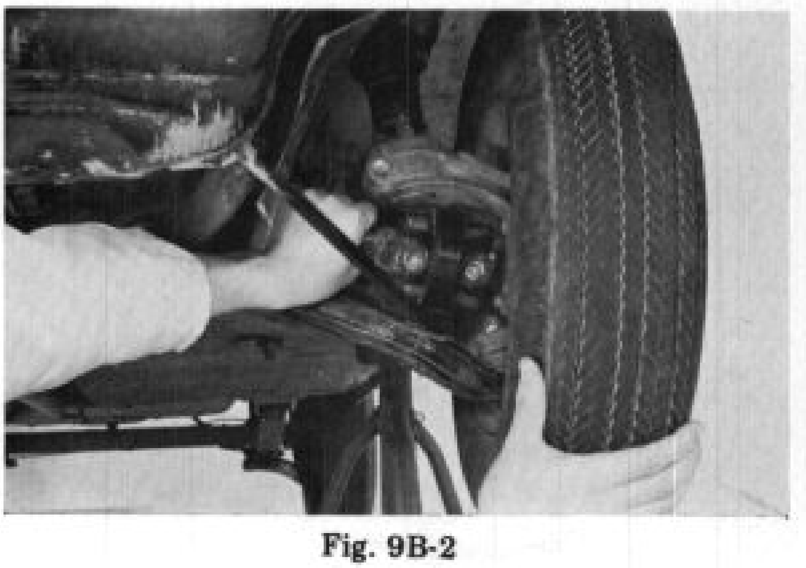


Fig. 9B-2

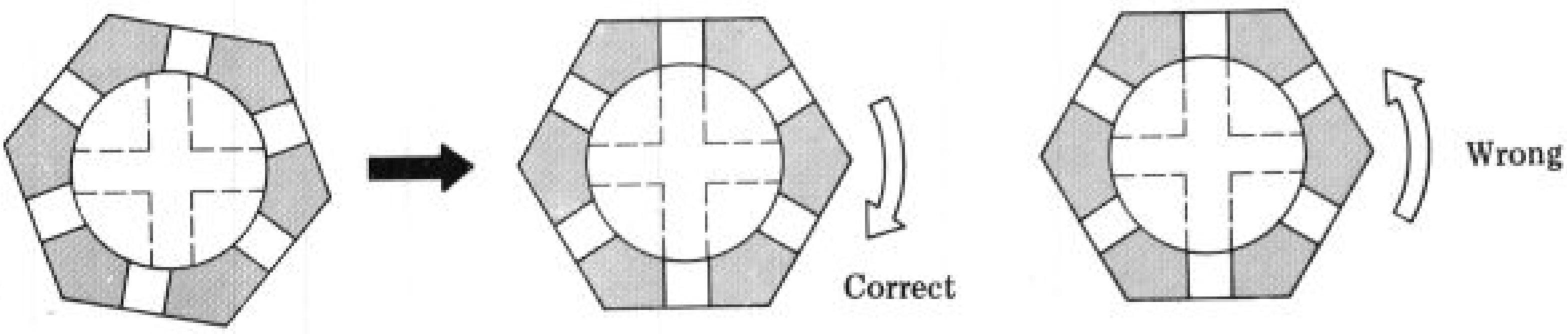
Fig. 9B-3a

3. The front wheel hub nuts should be inspected and tightened to specification periodically. A loose wheel hub nut may cause shimmy and vibration. There are two different hub nuts employed.
   They should be secured with same torque as follows.

Size of thread (mm Dia.)	Torque Kg-m (lb-ft)
20	14~20 (101~145)
22	14~20 (101~145)

(Note)
To align the hub nut slot with cotter pin hole in the spindle, always turn the nut in the direction of increased torque as shown below.

In order to avoid tightening the nut excessively, it is advisable to torque the nut first to 14 kg-m by means of torque wrench prior to aligning the slot with the hole. If the slot happens to be aligned with the hole, turn the nut another 30 degrees and align the next slot.



(Aligning the pin hole)

Fig. 9B-3b

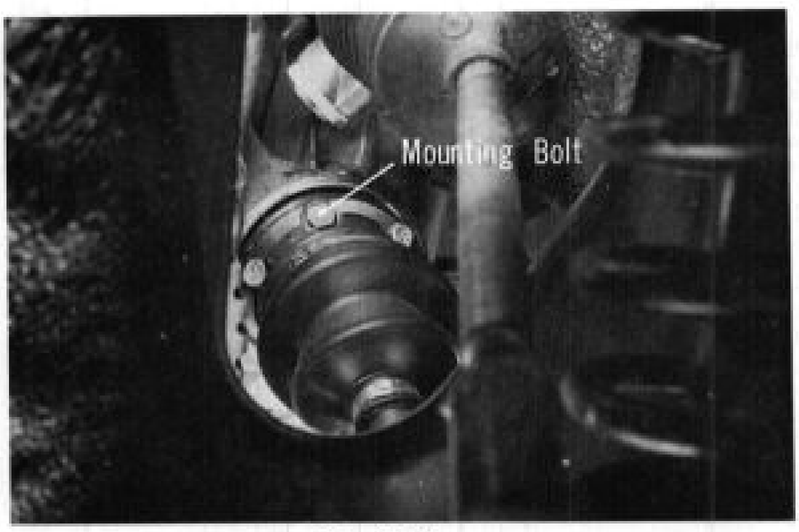


Fig. 9B-4a

4. Check the drive shaft mounting bolts for looseness.

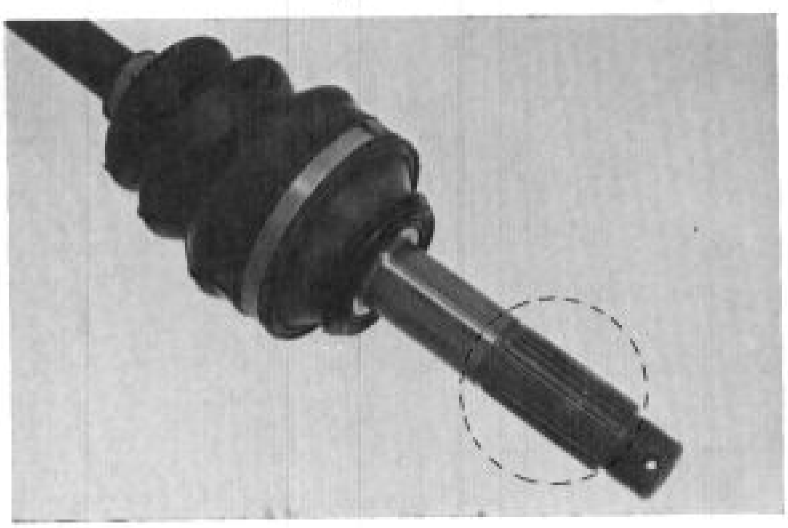


Fig. 9B-4b

5. Check the splines for excessive wear.

b. Removal of the drive shaft

1. Jack the vehicle up and remove the front wheels and brake drums (or disk brake hubs).

2. Remove the backing plate from the knuckle, or the dust seal cover for the disk brake equipped vehicles.
   Note:
   Removal of the brake line necessitates bleeding air from the brake line; therefore, it should not be removed.

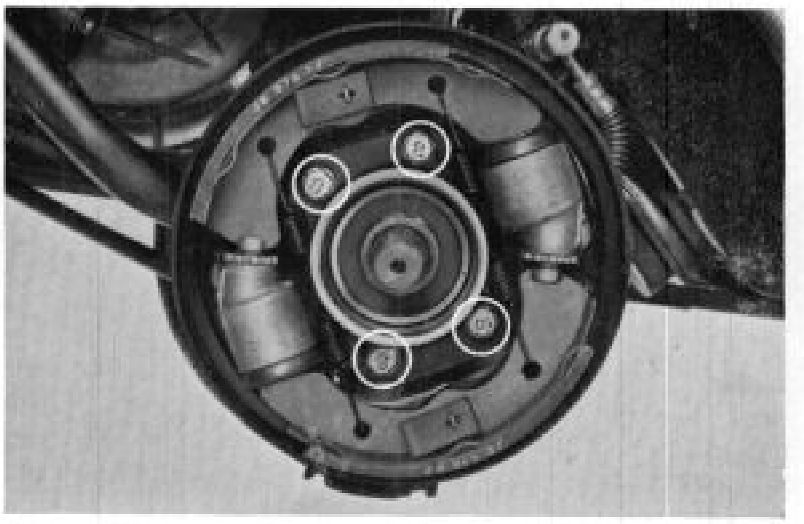


Fig. 9B-5a

3. Disconnect the drive shaft from the differential joint flange. This is done by removing the six bolts (for 600 series vehicle, three for 360 and 400 series vehicles) after straightening the lock plate. The bolts on 360 and 400 series vehicles are easily loosened with a 12mm socket wrench (special tool).

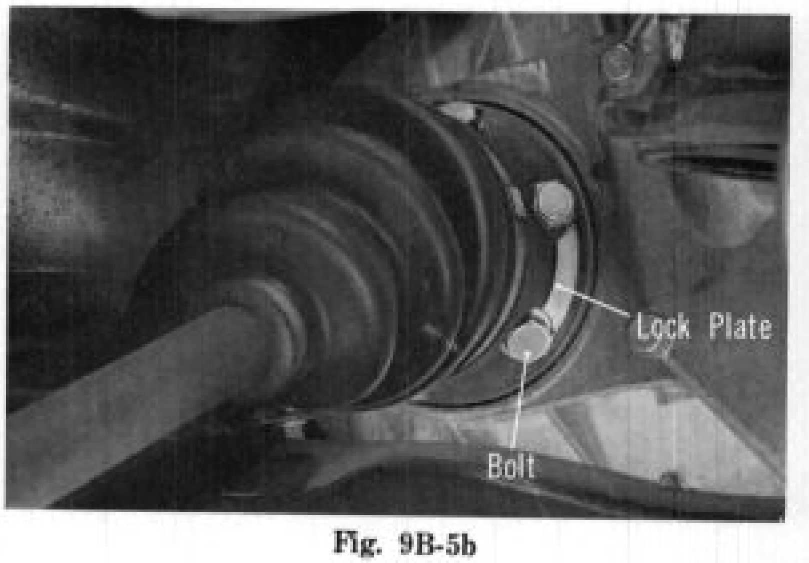


Fig. 9B-5b

4. Mount the special tool-Drive Shaft Replacer (Flange) on to the knuckle.

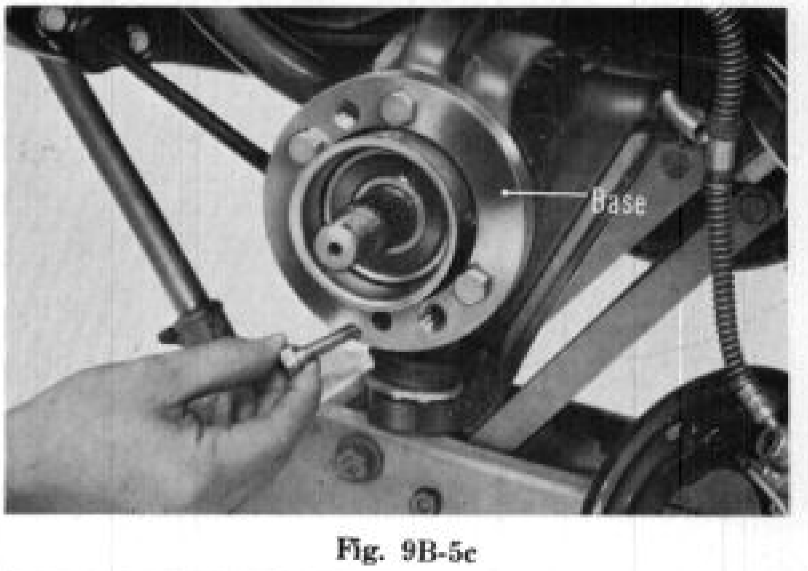


Fig. 9B-5c

5. Attach the special tool-Drive Shaft Replacer Main (shaft and the center bolt) on to the flange as shown in the picture.
   Then, thread the retainer on to the drive shaft ensuring that they are in the same axis.
   Apply oil on the threads of the center bolt.
   Note:
   Shafts should be fully threaded into the flange and lock nuts securely tightened.

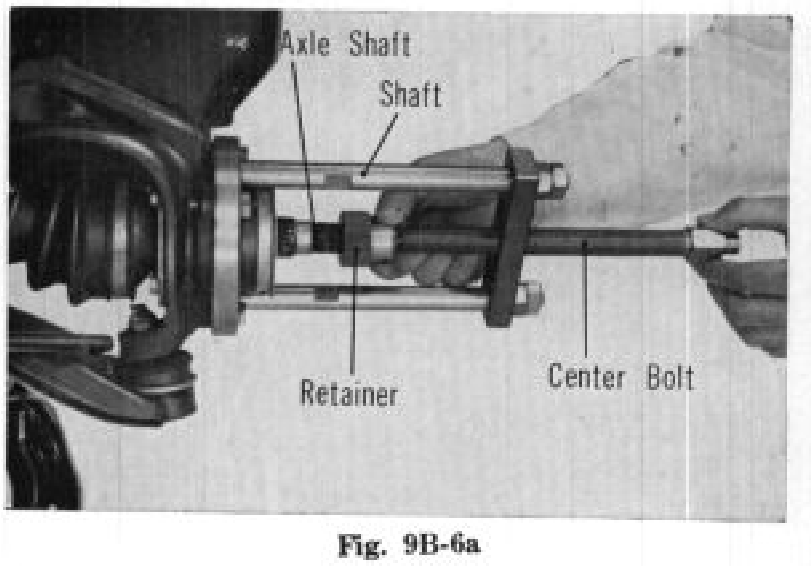


Fig. 9B-6a

9-3-1 DRIVE SHAFT

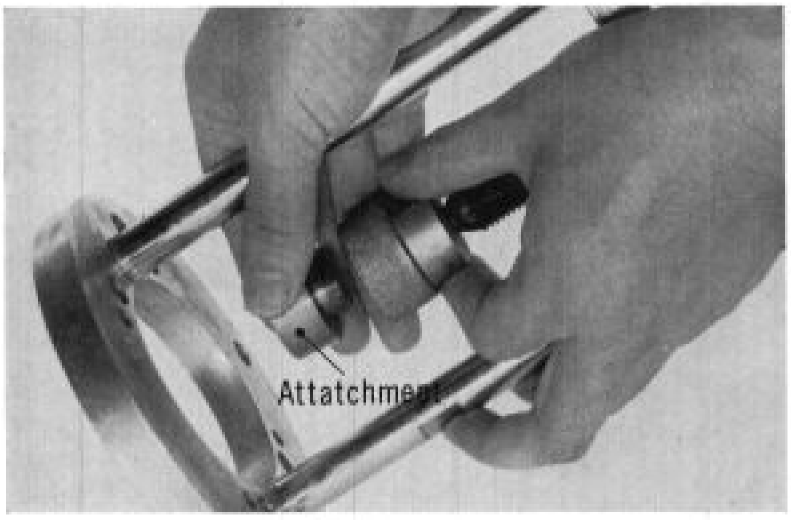


Fig. 9B-6b

Install the special tool-Drive Shaft Replacer Attachment when servicing 22mm thread dia. drive shaft.

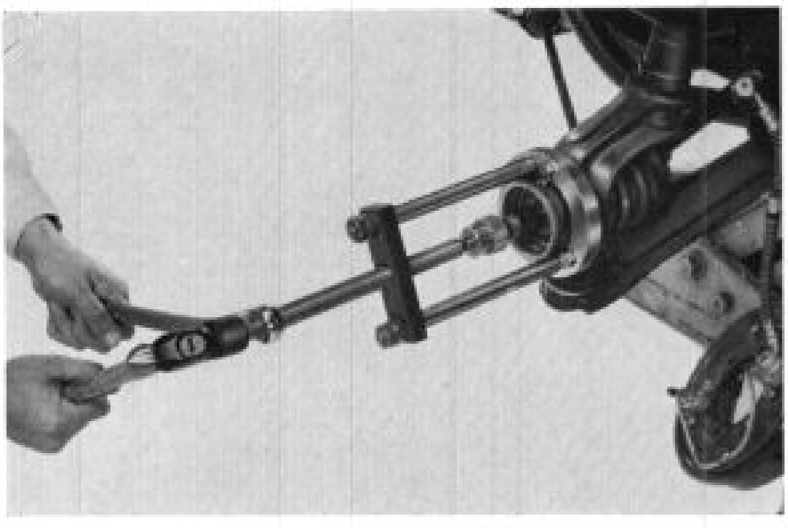


Fig. 9B-7a

6. Tighten the center bolt with the socket wrench while tapping with a hammer.

   Note:
   Take care to prevent interference between the drive shaft inboard joint and the engine.

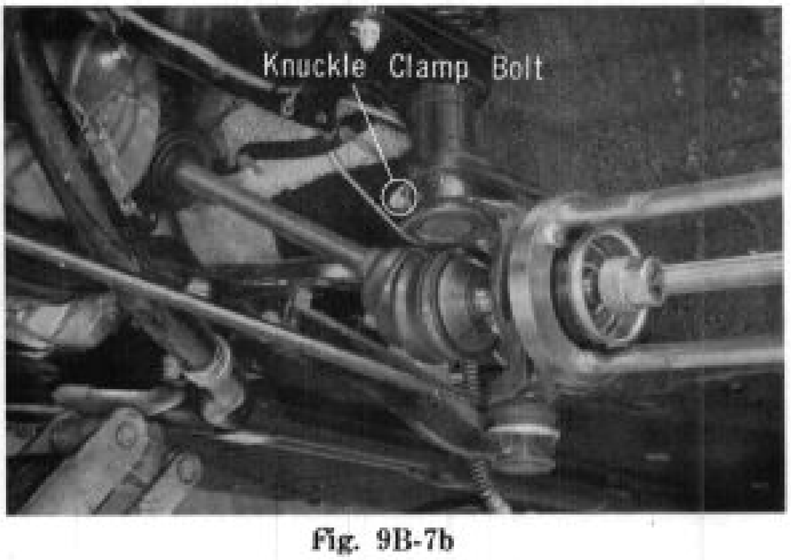


Fig. 9B-7b

7. When the axle shaft has been pushed out about two-thirds of its length, remove the knuckle from the front damper by tapping the knuckle downward with a copper hammer after the knuckle clamp bolt has been removed.

   (Knuckle Clamp Bolt Tightening Torque)

8mm	2.8 to 3.4 kg-m (20 to 25 lb-ft).
10mm	4.5 to 5.0 kg-m (33 to 37 lb-ft).

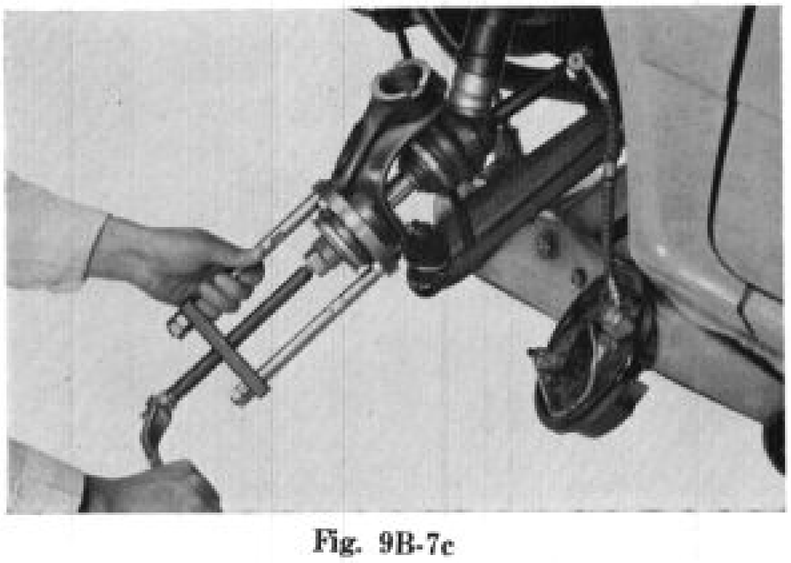


Fig. 9B-7c

8. Screw the center bolt further and separate the drive shaft from the knuckle.

C. Installation of the drive shaft

1. **Assembly of the front bearings**

   Use the special tool—Front wheel Bearing Driver A to install the inner and the outer bearings.

2. **Installation of the drive shaft**

   The outer wheel bearing may be loose upon completion of assembly; correct by using the Bearing Driver A (Fig. 8B-8a)

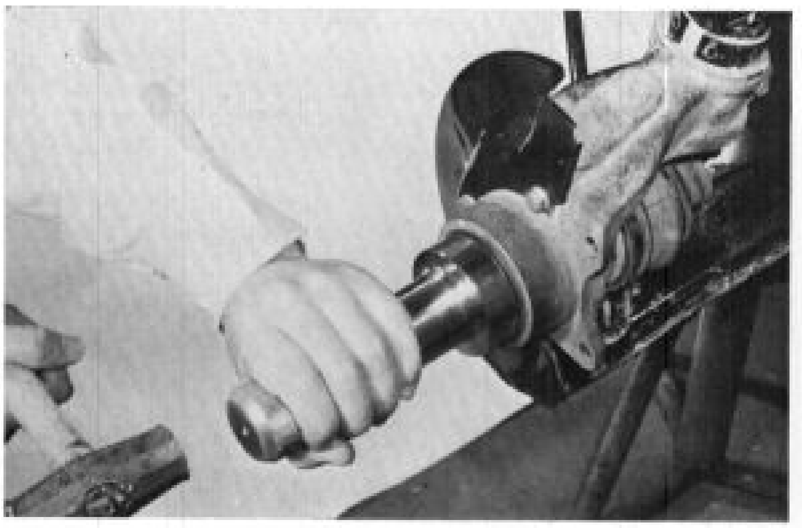


Fig. 9B-8a

3. Dust seal is installed by means of the special tool front wheel bearing Driver B.

Fig. 9B-8b

b. Constant speed ball joint

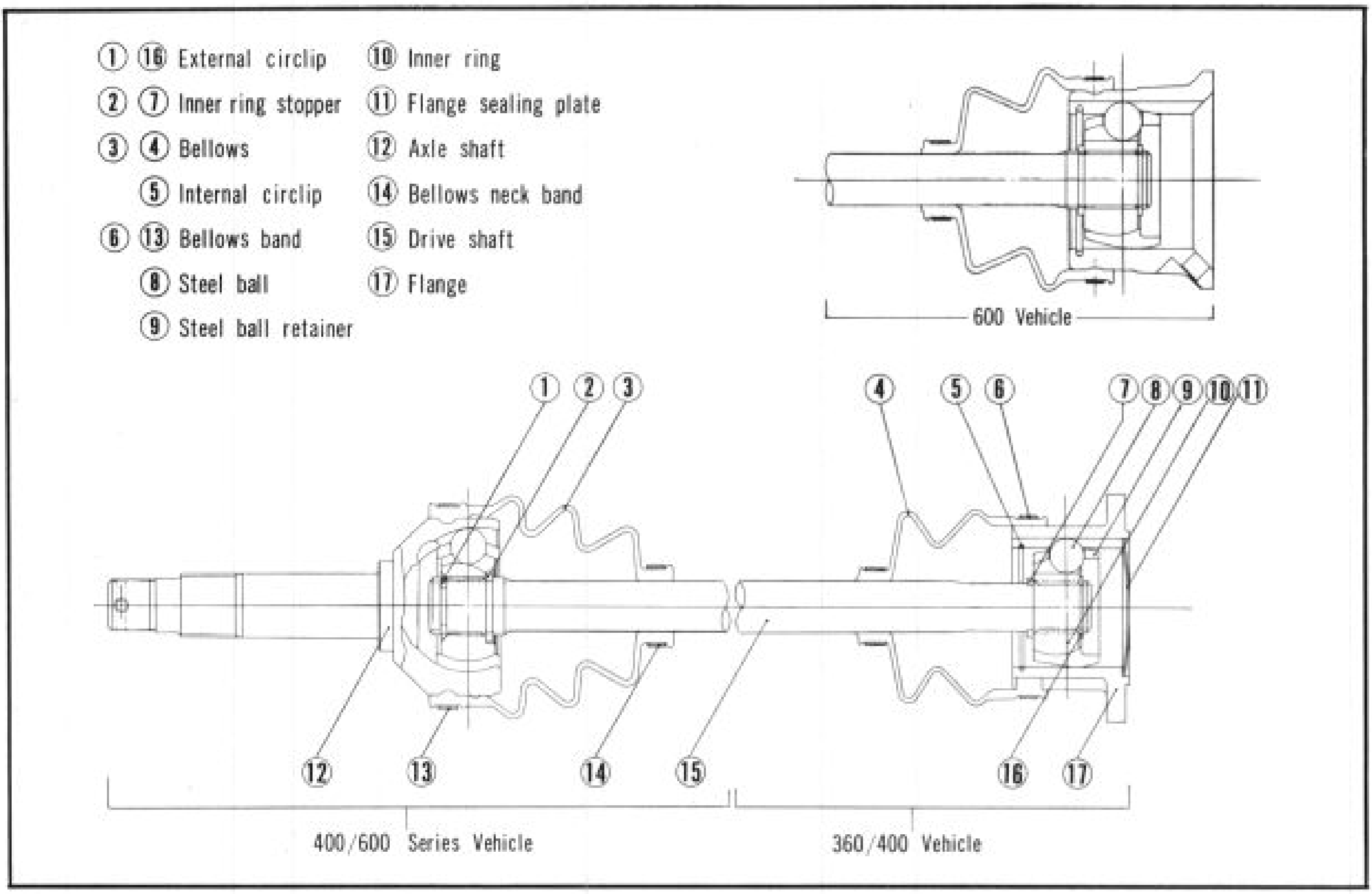


Fig. 9B-9

The drive shaft of 400 and 600 series vehicles employs constant speed ball joints on both inboard and outboard side; in 360 series vehicles a ball joint is used on the inboard side and a double cross universal joint on the outboard side.
The constant speed ball joint has the advantages of having outstanding constant-speed characteristics, a wider operating angle, higher resistance against overload and shock, and a longer service life with less maintenance. Replacement of damaged bellows and grease should be conducted as follows.

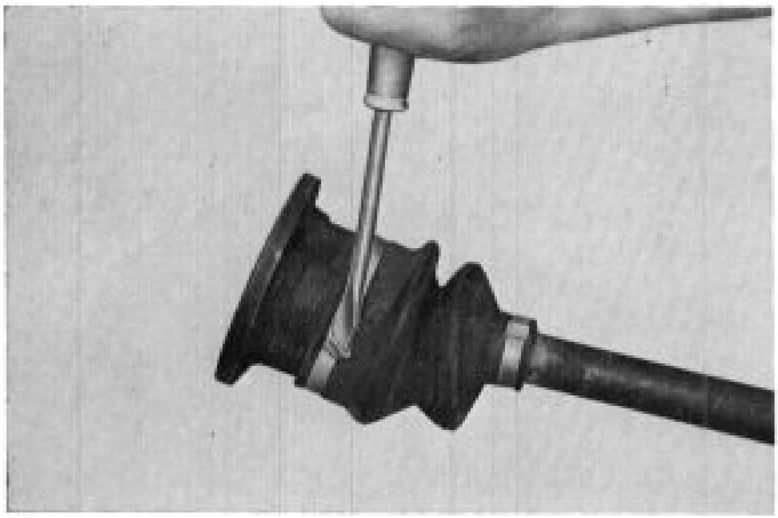


Fig. 9B-10

1. Removing the bellows band.
   After peeling off the end with a pliers remove the band by tapping a screwdriver (held as shown in **Fig. 9B-10**) with a hammer. Do this carefully to prevent damaging the bellows.

2. Move the bellows, and remove the circlip in the flange with a screwdriver. Separate the flange and the drive shaft. **(Fig. 9B-11)**

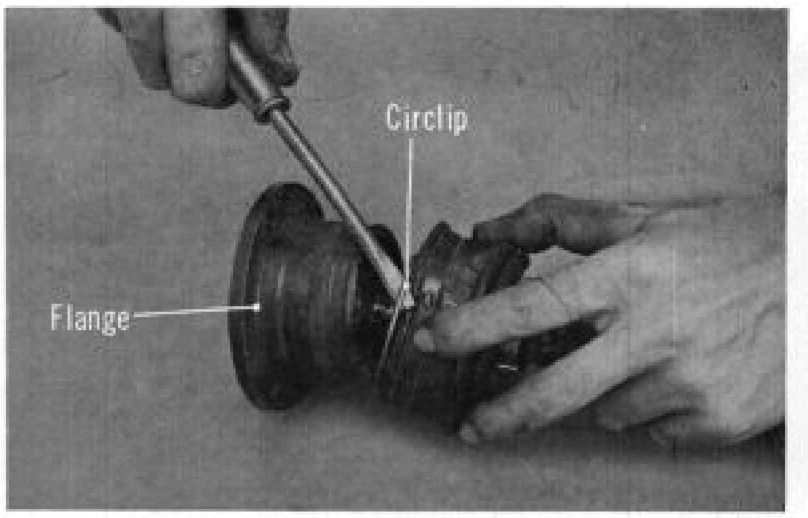


Fig. 9B-11

3. Remove the inner ring set circlip, and withdraw the steel ball and retainer from the drive shaft. Clean both after removal. **(Fig. 9B-12)**

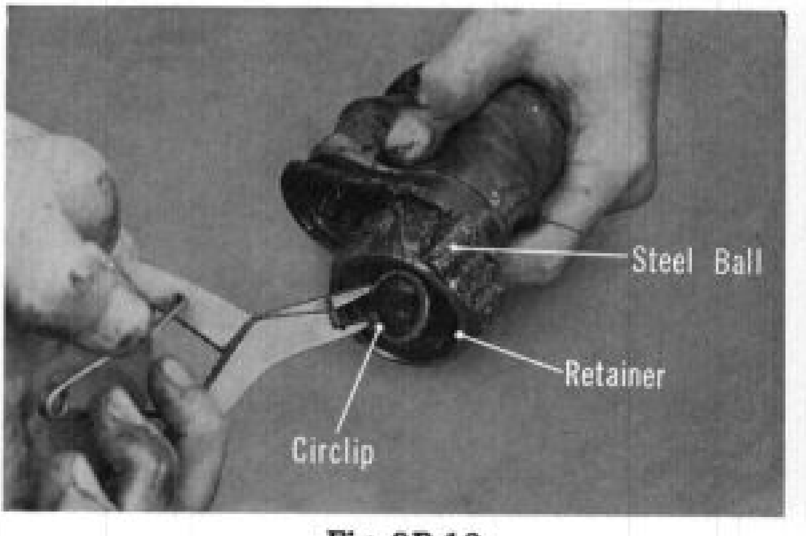


Fig. 9B-12

c. Assembly

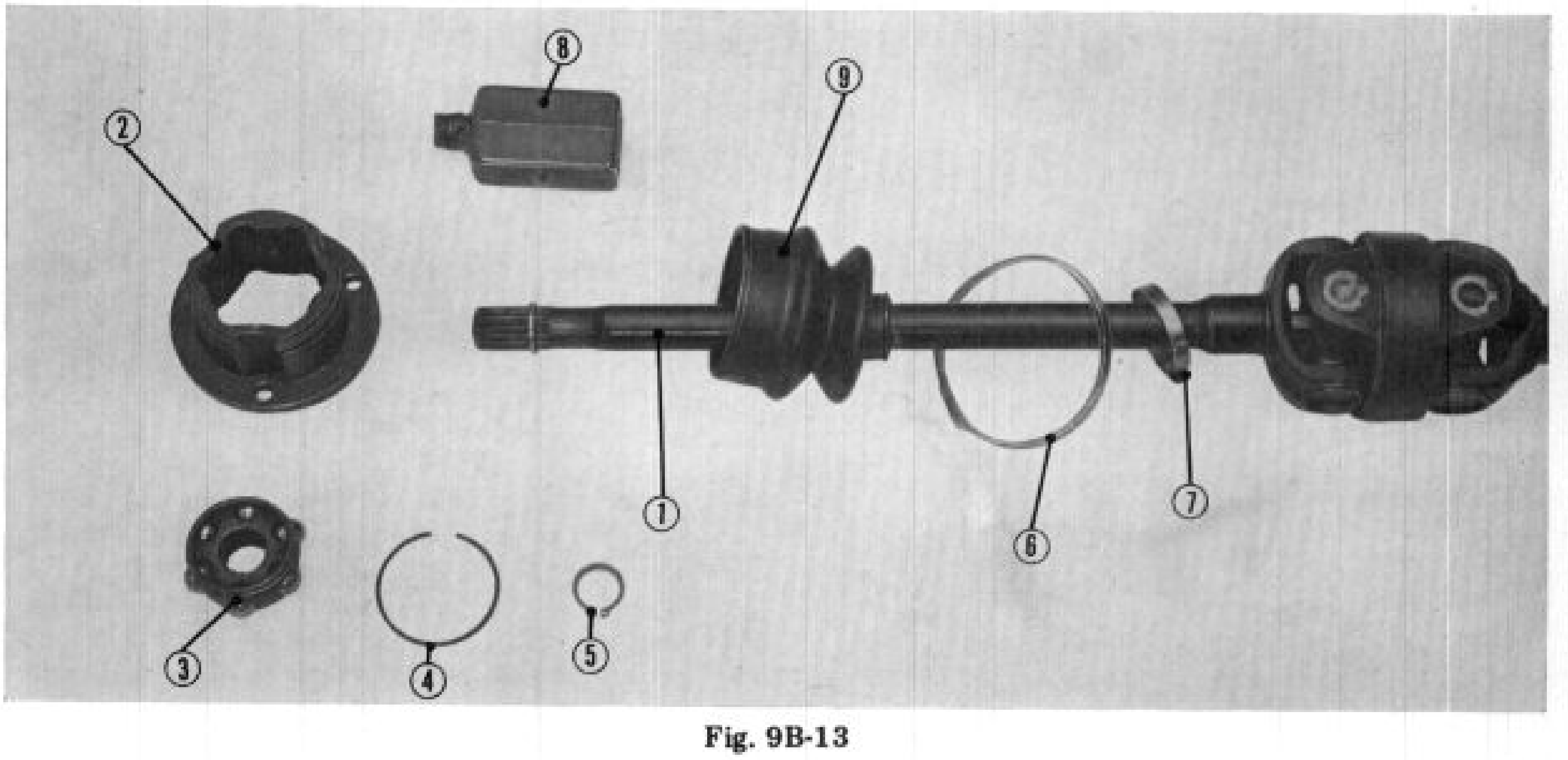


Fig. 9B-13

1 Drive shaft
2 Flange
3 Inner ring, Retainer, Steel ball
4 Internal circlip
5 External circlip
6 Bellows band
7 Bellows neck band
8 Grease (50g)
9 Bellows

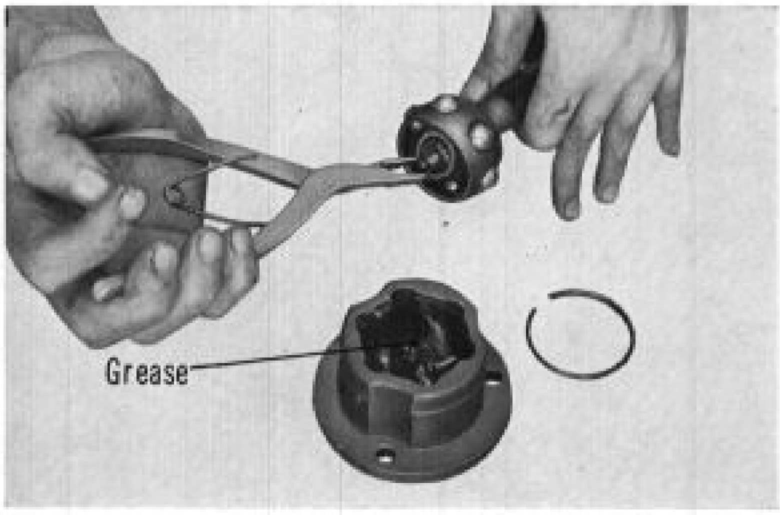


Fig. 9B-14

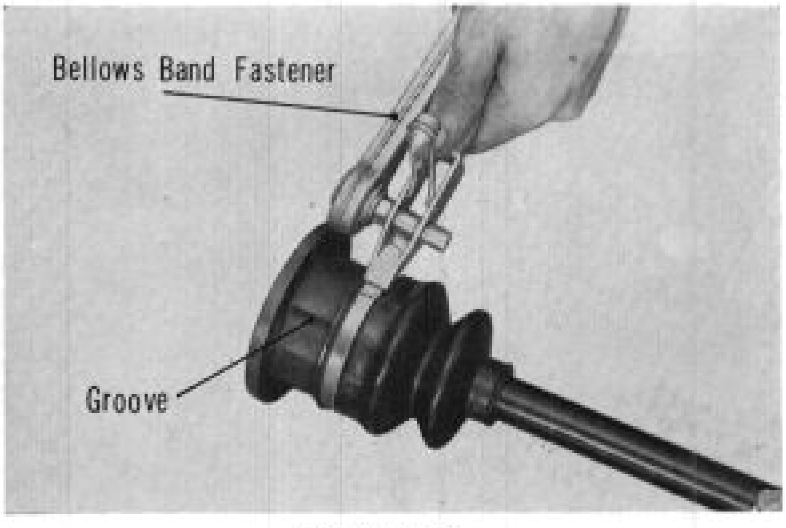


Fig. 9B-15

Fig. 9B-16

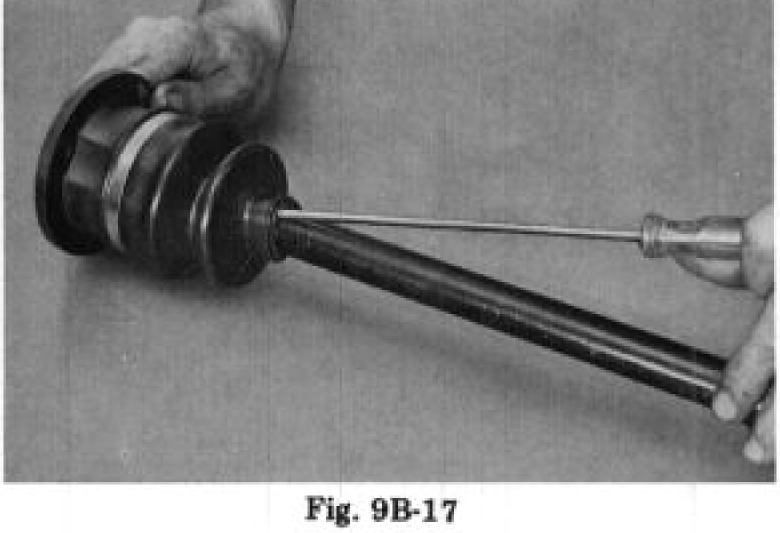


Fig. 9B-17

4. Insert the bellows neck band, bellows band, and bellows in this sequence into the drive shaft as shown in **Fig. 9B-13**.
5. Fill the flange with grease (approximately 30g or 2/3 the capacity).
6. Set the steel ball in the inner ring and retainer by hitting with a copper hammer.
7. Insert the retainer into the drive shaft in the direction as shown in **Fig. 9B-14**, and secure with circlip.
8. Raise the drive shaft with the flange side down, and insert the drive shaft into the flange until a small portion of the grease comes out. (360)
9. Pour the remaining grease (1/3) into the flange; do not pour it into the bellows.
10. Mount the bellows on the flange by aligning it with the flange's peripheral groove. Tighten the bellows band with the bellows band fastener, special tool.
11. Tightening should be effected between the grooves on the periphery of the flange bolt hole position. (**Fig. 9B-15**)
12. Lock the bellows band end with a punch. (**Fig. 9B-16**)
13. After locking, remove the fastener, and cut the band end at a position so that approximately 10mm (0.4 in) of it is left. Bend the left end.
14. Positioning the bellows neck band.
    If the bellows neck band position is not correct, bellows projecting piece may be worn out due to changes in drive shaft slide and operating angle caused. Therefore, the bellows neck band position should be determined by adjusting the air volume in the bellows to a normal value. Insert a thin screwdriver into the bellows as shown in **Fig. 9B-17**. After confirming that the bellows are shaped normally, remove the screwdriver, and tighten the band in this position. If the bellows projecting piece makes contact with the drive shaft when the shaft is bent to full operating angle, it represents that the band is positioned too near the flange. Or, if there is a hollow in the bellows when it is extended fully it represents that the air volume in the bellows is too low. Even after tightening the band, it is possible to slightly move the band. So, the band position should be set properly without fail.

15. (360/400)
Inspection and correction of flange sealing plate.
When reinstalling the used flange do not forget to check the sealing plate. To check push the drive shaft in completely, and make sure that there is no grease leakage from the periphery of the sealing plate. If grease is found coming out, fix the plate periphery with a screwdriver, and further caulk in 6 position. Caulk should be approximately 2mm (0.008 in) from the edge as shown in Fig. 9B-18.

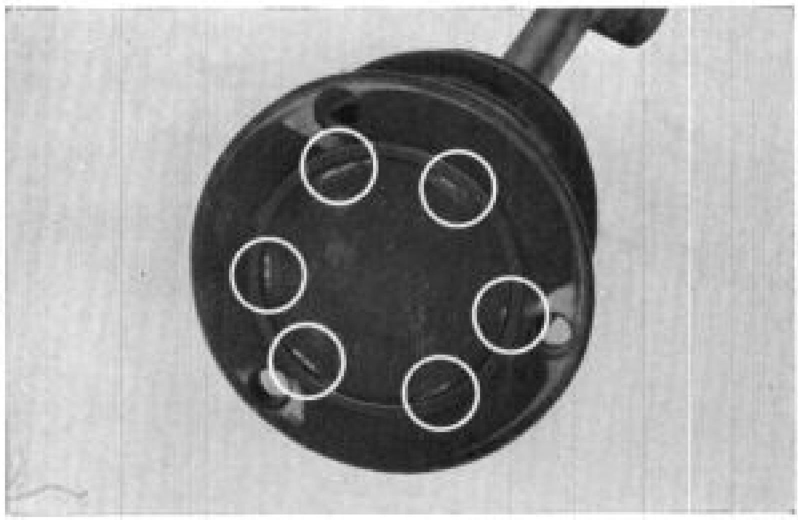


Fig. 9B-18

C. Double cross universal joint (for 360 vehicle)

Checking the drive shaft

1. Place the vehicle in slow forward movement (in low or 2nd transmission gear shift lever position) and. while turning the steering to either the left or right, determine if abnormal sounds originate from e drive shaft.
2. If so, jack up the vehicle and make a thorough check of drive shaft parts.
   (1) Insert a long screwdriver into the axle shaft yoke and lock the axle shaft. With a firm hand-hold on the drive shaft, move it all directions up and down, right and left, and forward and backwards, and determine if there is any play.
   (2) Position the dust seal on the double cross joint.
   (3) Properly position the circlip on the bearing case.
   (4) Make sure there is no water in the grease.
3. If any defects are found as a result of these four check items, disassemble and make necessary repairs. Examine both drive shafts carefully (left and right) if either is found defective. Disassembly and repair of both is recommended.

Tools necessary for disassembly and assembly

Drive shaft service jig set:

1 Base
2 Bearing case support
3 Cross shaft driver A
4 Cross shaft driver B
5 Center yoke fitting
6 Spacer
7 Center shaft press-in adaptor
8 Center shaft height gauge
9 Center shaft press-out adaptor
10 Center shaft holder
11 Center shaft clamper

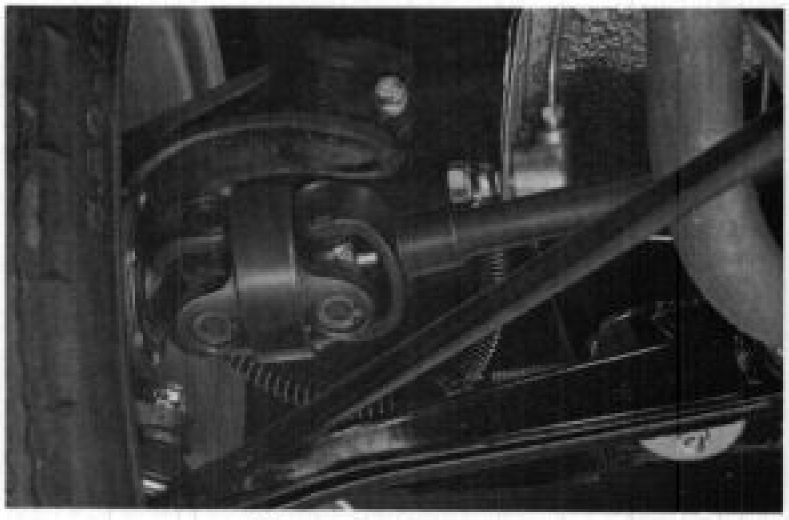


Fig. 9B-19

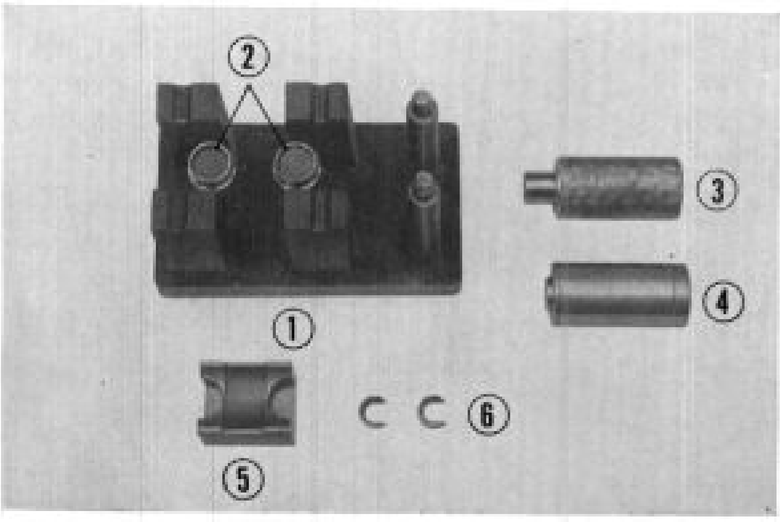


Fig. 9B-20

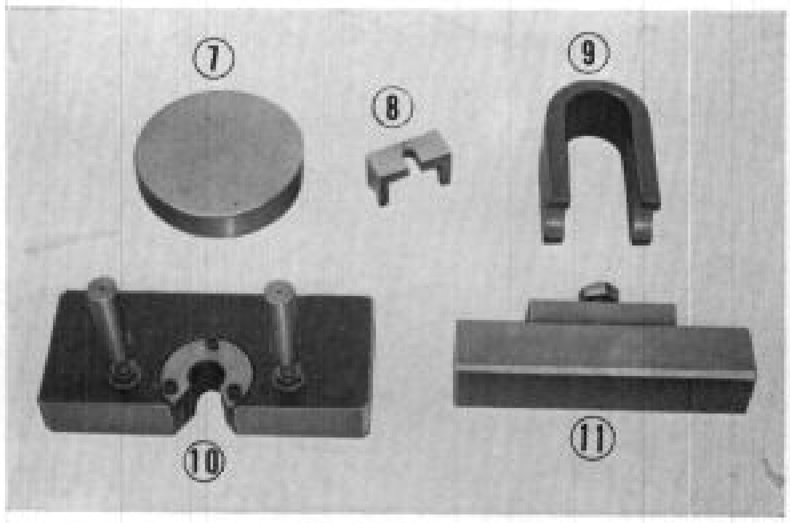


Fig. 9B-21

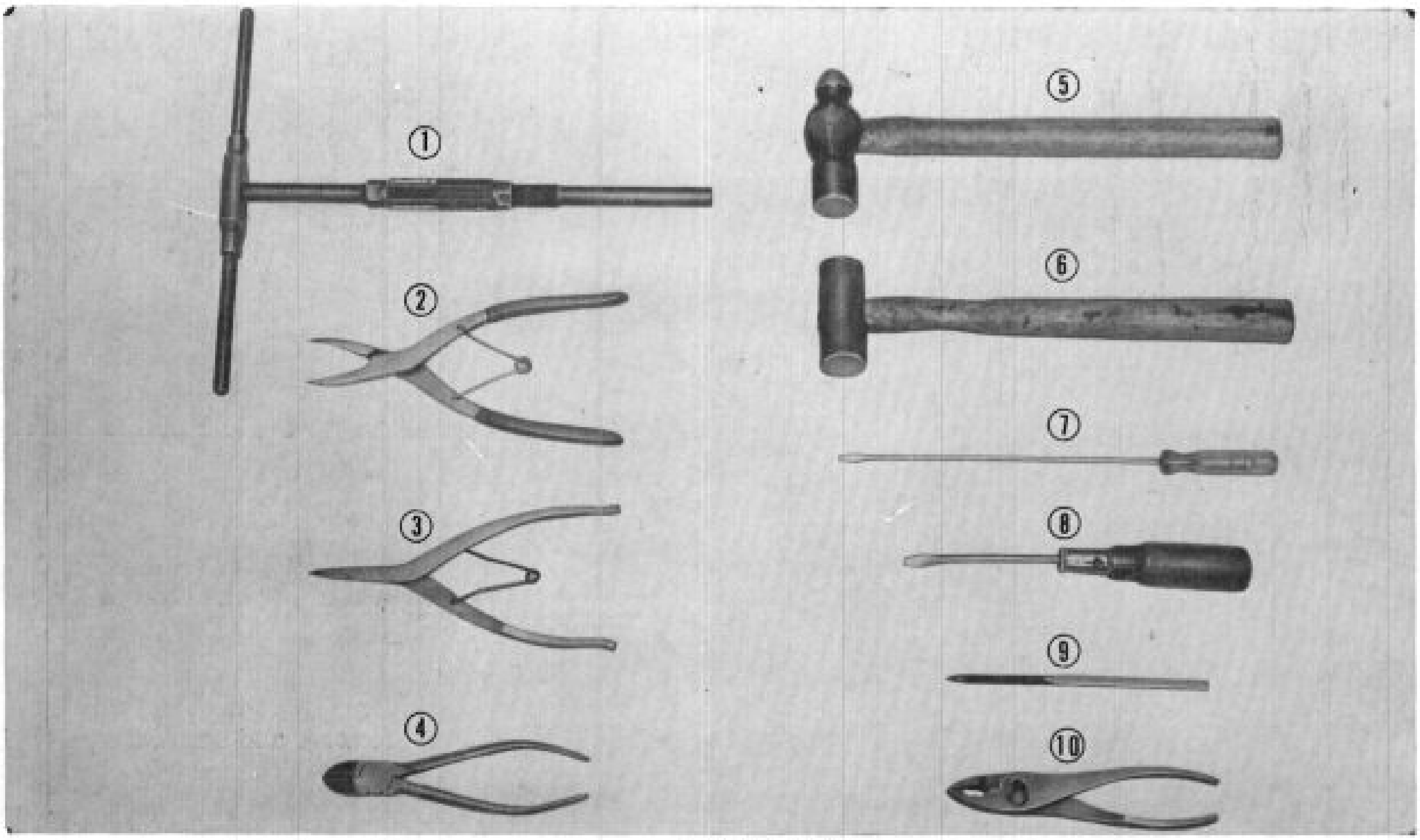


Fig. 9B-21-2

1 Reamer, 22mm
2 Snap ring pliers (open end)
3 Snap ring pliers (closed end)
4 Wire cutter
5 Hammer
6 Copper mallet
7 Screwdriver
8 Screwdriver
9 Punch or chiesl
10 Combination pliers
11～1 Press (capacity: five tons or more)
～2 Bellows band fastener (special tool)

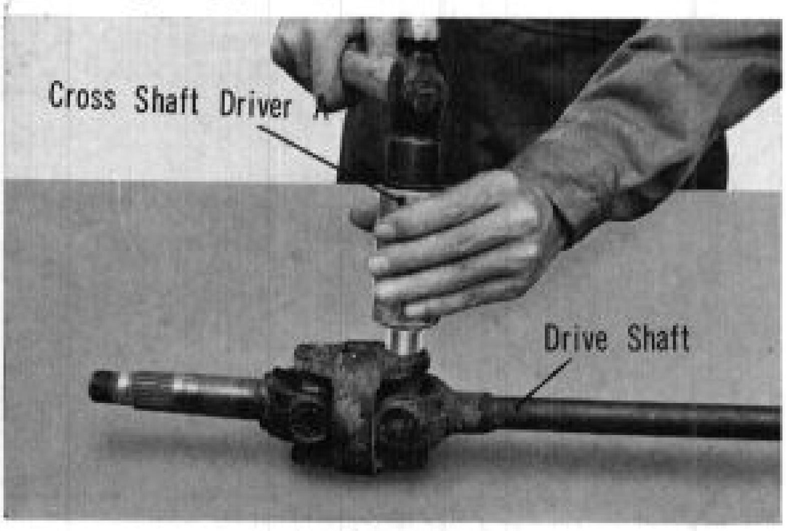


Fig. 9B-22

Disassembly, Inspection and Assembly.

1. **Remove the double cross joint circlips**

   Tap the circlips (eight), through cross shaft driver A with a hammer, and remove they with the snap ring pliers. Tapping should be limited to loosening the circlips; they should not be tapped completely free.

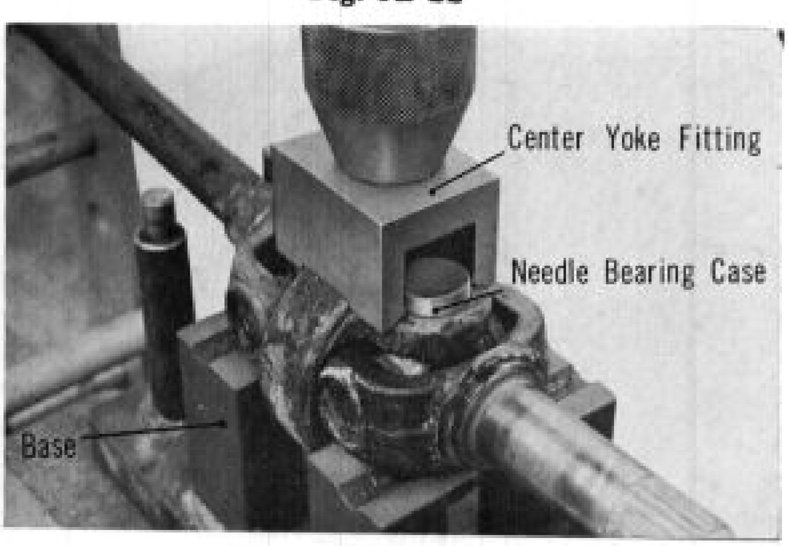


Fig. 9B-23

2. When the eight circlips have been removed, set the base of the jig on the press and the drive shaft assembly on the base of the jig in the direction shown in Fig. 9B-23.
3. Mount the center yoke jig fitting, and operate the press. When pressure equivalent to two tons is obtained, the needle bearing case will protrude approximately 7mm (0.28 in).

4. Release the oil pressure, and insert the two jig spacer into the clearance between the cross shaft and bearing case.
   Mount each spacer so that the stepped side faces the cross shaft, as shown in Fig. 9B-24.

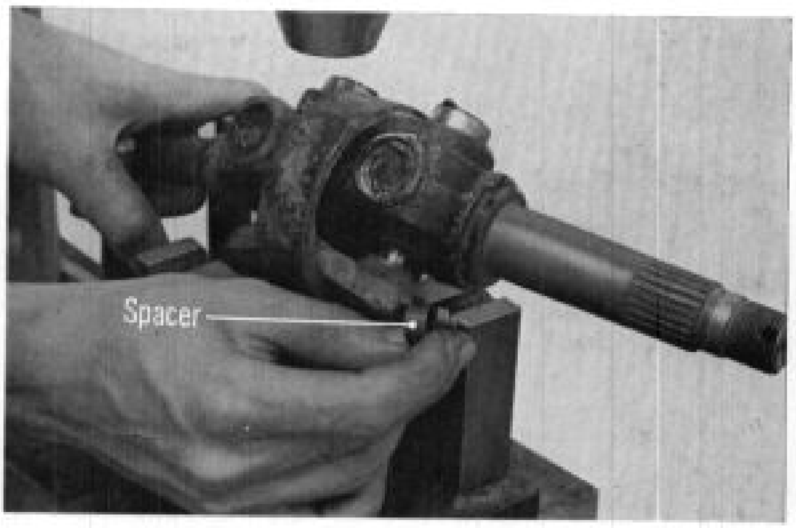


Fig. 9B-24

5. Reverse the drive shaft assembly and again operate the press through the center yoke fitting until the bearing case is drawn out. Re-check spacer mounting if the bearing case is too tight.

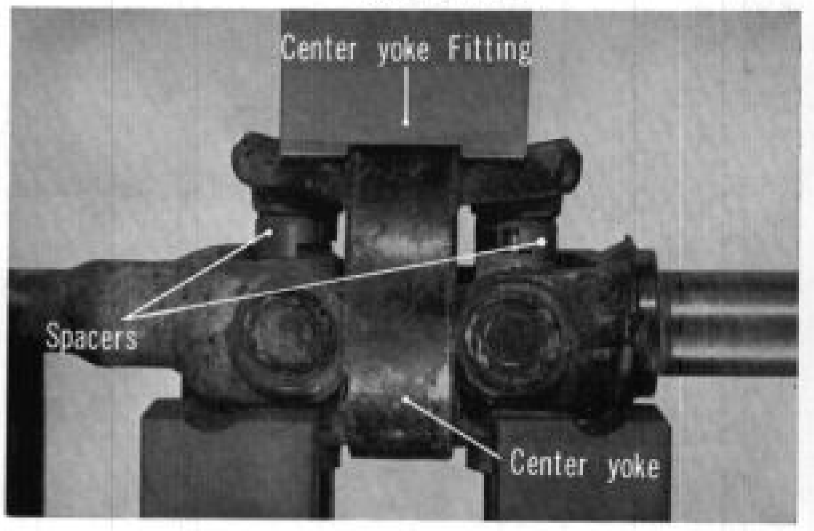


Fig. 9B-25

6. Disconnect the axle shaft and drive shaft from the center yoke, and, holding the axle shaft and drive shaft by hand, remove the cross shaft from the center yoke by pushing the former downward. (Fig. 9B-26)

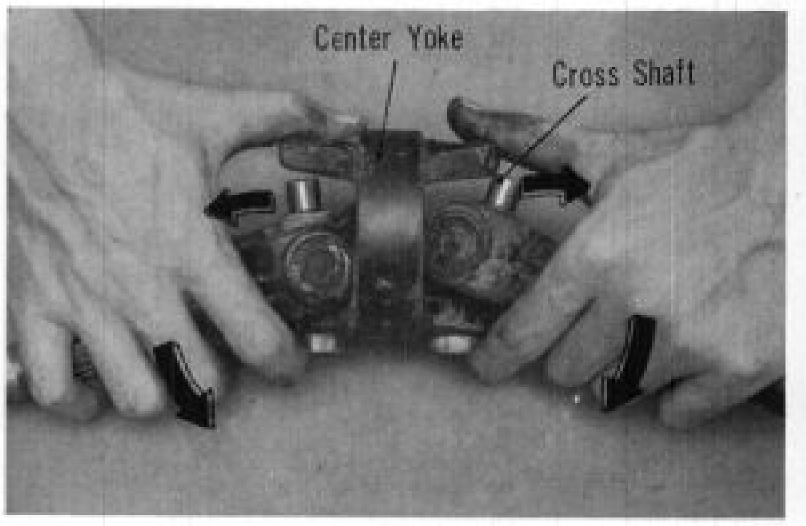


Fig. 9B-26

7. Remove the bearing case from the center yoke. Mount the yoke on the base, and remove the bearing case together with the center yoke fitting. (Fig. 9B-27)

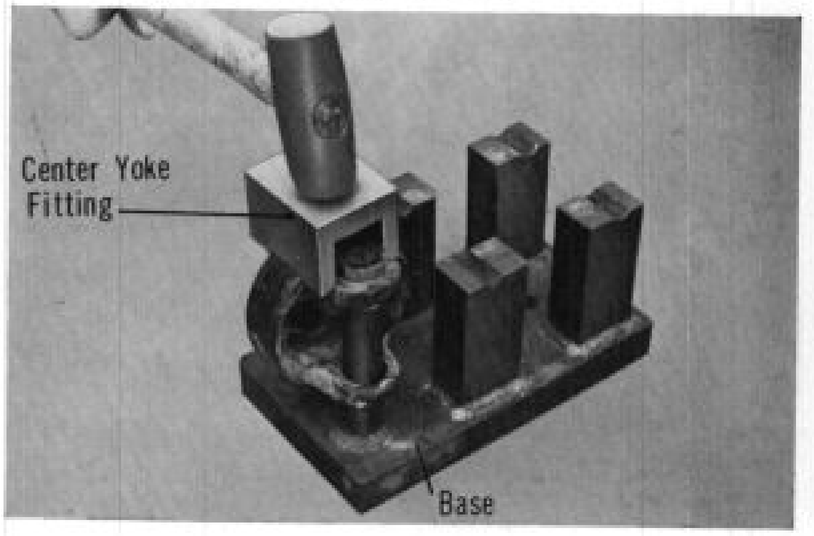


Fig. 9B-27

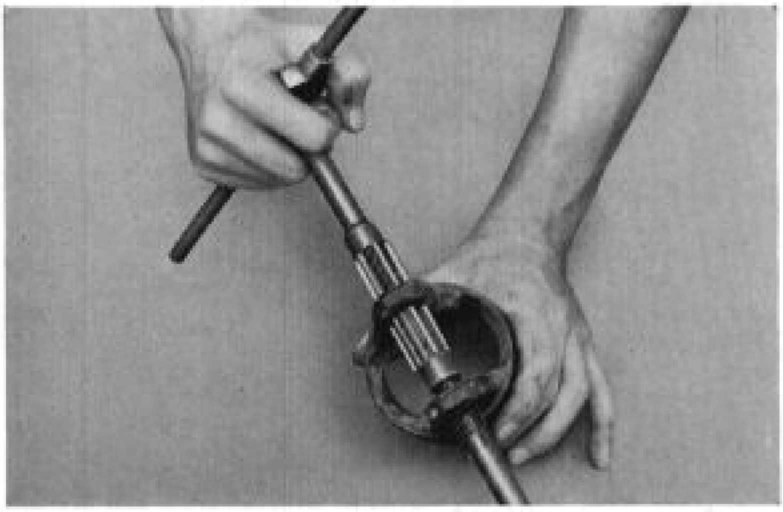


Fig. 9B-28

8. Check the center yoke and make any correction necessary.
   (1) Ream the center yoke to remove surface defects.
   (2) Check the circlip groove, and correct surface damage, if any, with a punch or file.

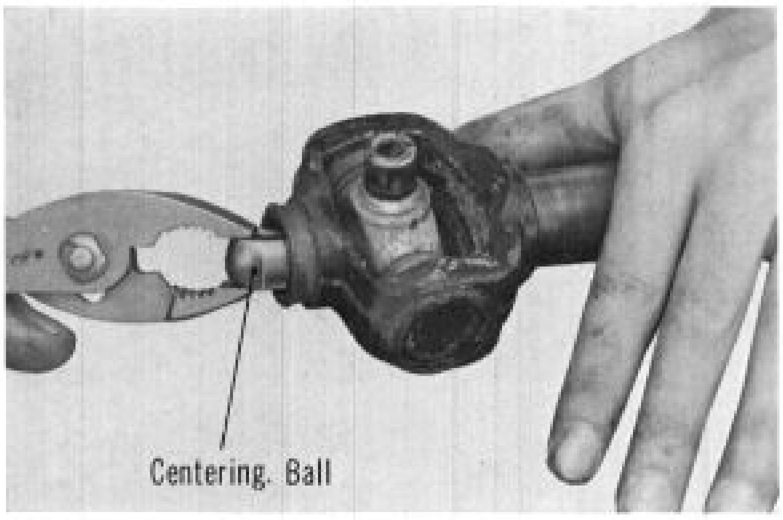


Fig. 9B-29

9. Inspect the axle shaft.
   (1) Removing the centering ball.
   The centering ball can be easily removed when placed as shown in **Fig. 9B-29.**
   (2) Clean the centering ball and axle shaft ball receptable, and check for scars and cracks. Replace the part if defective.
   (3) Check the bearing section and threaded portion of the axle shaft. Replace defective parts.

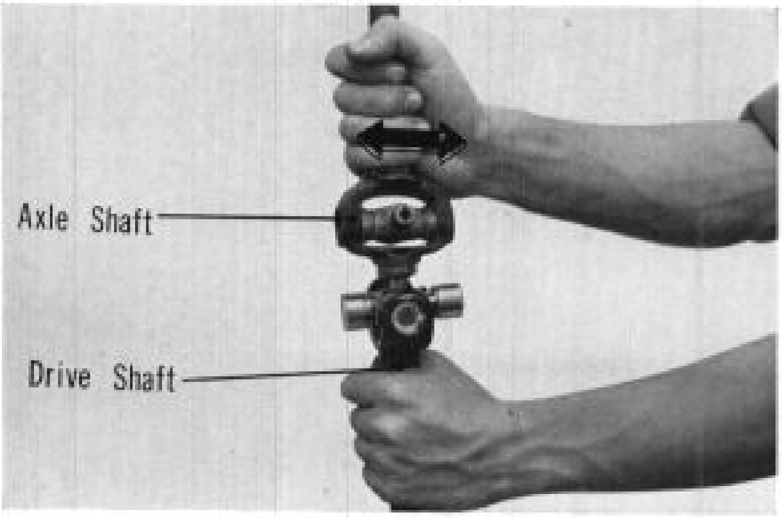


Fig 9B-30

   (4) Check the centering ball for wear.
   Reassemble the centering ball in the axle shaft, and insert a new drive shaft. As shown in **Fig. 9B-30,** check for axle shaft play by moving the axle shaft to the left and right. Replace the axle shaft if play exists.

   Standard value:
   0.05 to 0.06mm (0.0020 to 0.0024 in)
   Serviceable limit:
   0.2mm (0.008 in)

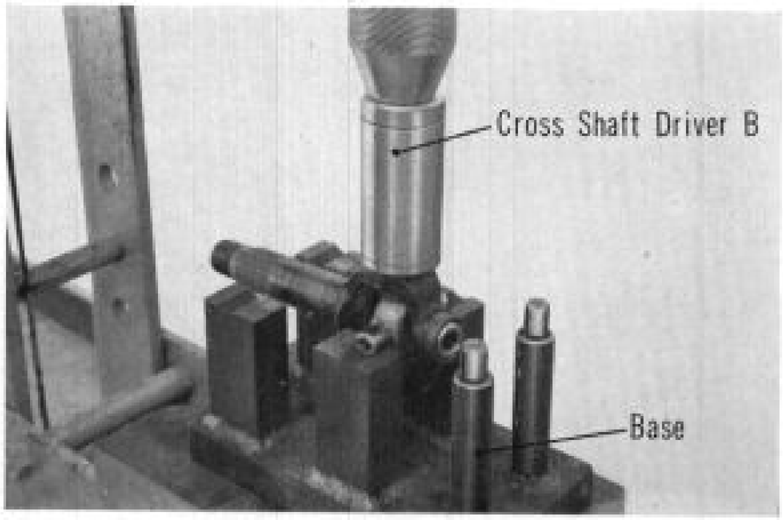


Fig. 9B-31

10. If no axle shaft defects are found as a result of checking, remove the cross shaft and replace the bearings.
    (1) Set the axle shaft on the base, and press it with cross shaft driver B.

(2) After pressing approximately 7mm (0.28 in), mount the spacer.
Repress the axle shaft after reversing it, and then remove the cross shaft from the axle shaft. **(Fig. 9B-32)**

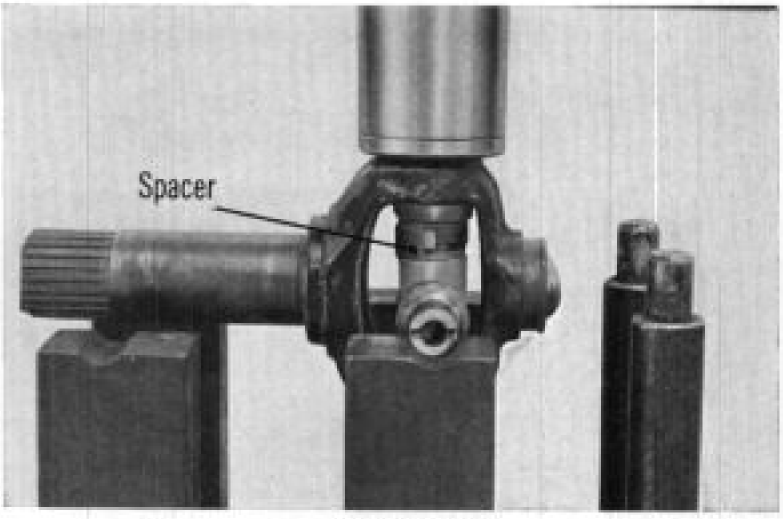


Fig. 9B-32

Replacement of the Center shaft (Item No. 11 to 17)

11. To press the center shaft out from the drive shaft, first supply a few oil to the chuck of the clamper and insert the center shaft among them, and torque the bolt from 5 to 7kg-m (36 to 50 lb-ft). (Fig. 9B-33)

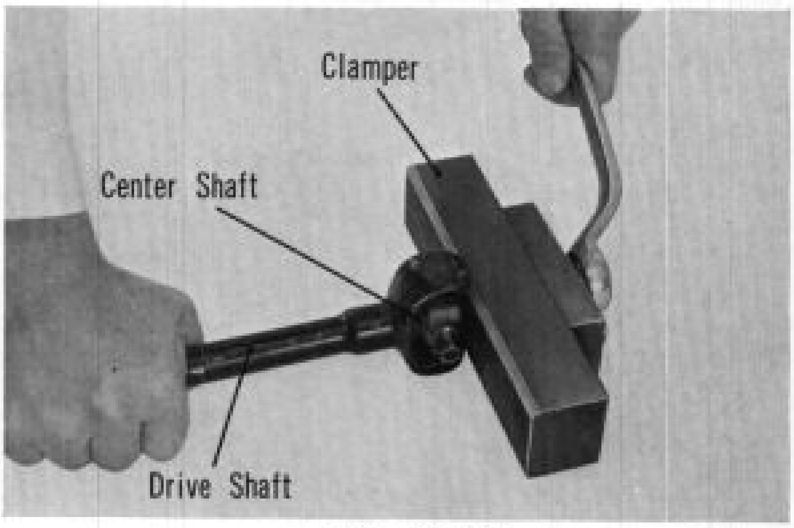


Fig. 9B-33

12. Set the center shaft clamper with the drive shaft, the center shaft adaptor and the center yoke fitting on the press, as shown in Fig. 9B-34.
Operate the press until the center shaft is drawn out.

13. Replace the cross shaft assembly with new one as the same manner described in No. 10, page 9-10.

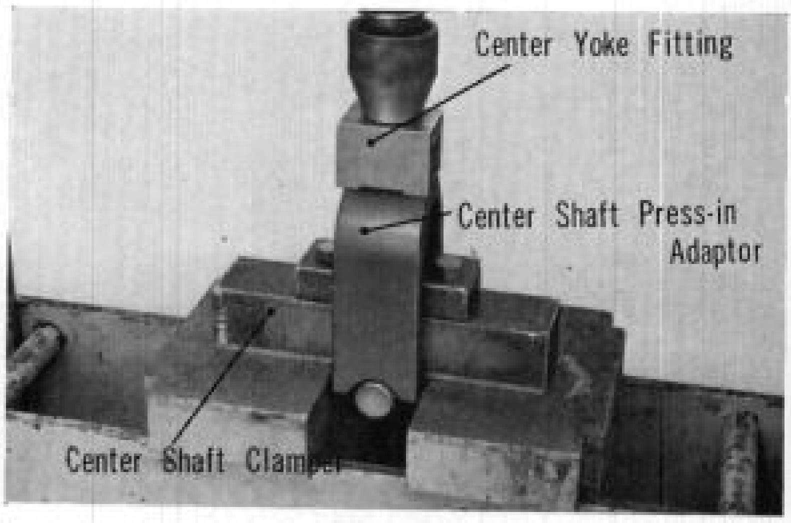


Fig. 9B-34

14. The center shaft should be pressed-in a oversized one which marked with yellow paint. After assembling new cross shaft (refert to 22~29 page 9-14~9-16), apply a few grease around the shaft and tap the center shaft with a copper mallet until it is driven in about 2 or 3mm (0.79 or 0.118 in). **(Fig. 9B-35)**

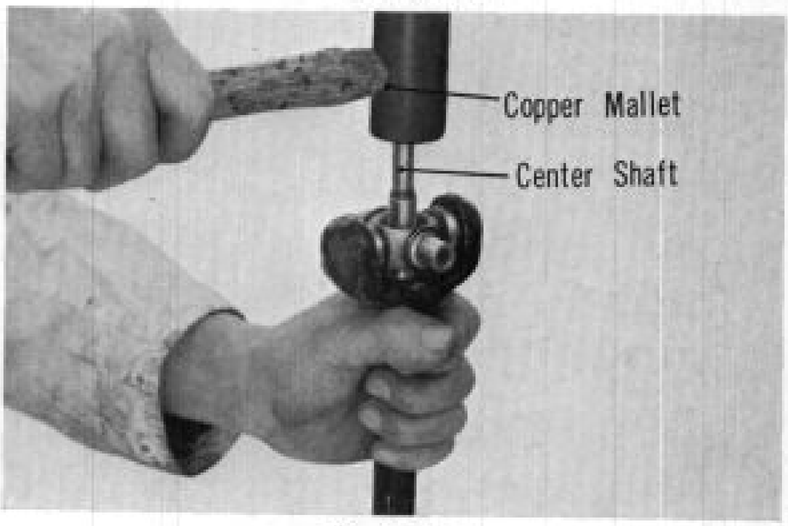


Fig. 9B-35

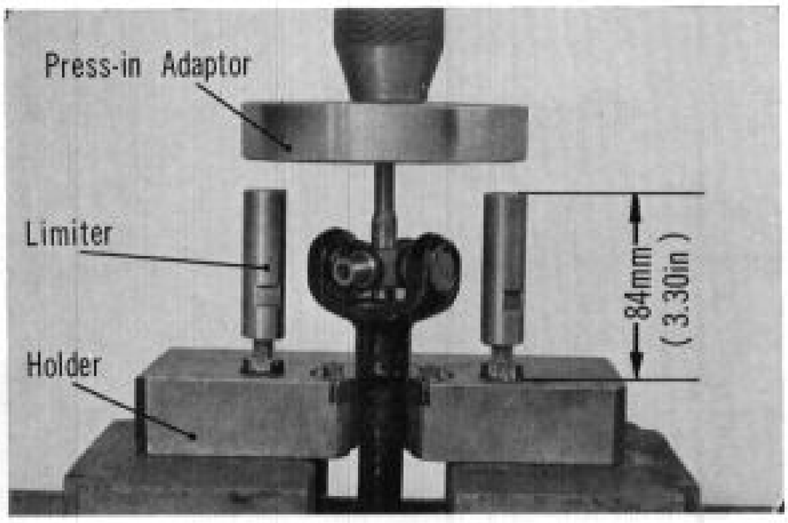


Fig. 9B-36

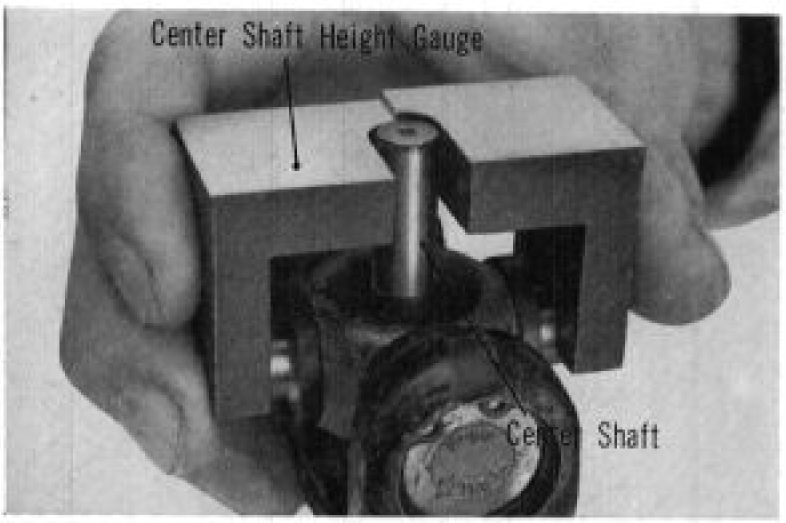


Fig. 9B-37

15. Assemble the two limiters in the center shaft holder.
    Height of limiter should be 82.5 to 84mm (3.25 to 3.30 in).
16. Set the drive shaft with the center shaft on a press and operate the press through the center shaft press-in adaptor until the adaptor touches on the limiter.
    The press load should be 2 tons or more, if less than 2 tons, replace the drive shaft with new one. (Fig. 9B-36)

17. Inspect the height of center shaft with the center shaft height gauge as shown in Fig. 9B-37.
    The height should be in the step of the gauge.

Assembling the drive shaft

The following components parts are available. (Fig. 9B-38)

① Ball joint kit A (Flange, Retainer, Steel balls and Sealing plate)
② Ball joint kit B (Bellows, Grease 50g, Bellows band)
③ Ball joint kit C (Kit A and Kit B)
④ Drive shaft set (Center shaft, Cross shaft set and Drive shaft)
⑤ Cross shaft set (Cross shaft, Bearing case with needle bearing, Oil seals and Dust seals)
⑥ Axle shaft (w/centering ball)
⑦ Dust seal clip (for centering ball), 20mm
⑧ Dust seal, centering ball, 20mm
⑨ Dust seal clip (for centering ball), 20mm
⑩ Dust seal, centering ball, 22mm
⑪ Bellows band
⑫ Bellows neck band
⑬ Bellows
⑭ Sealing plate, flange
⑮ Center shaft, over size
⑯ Oil seal, cross shaft
⑰ Dust seal, cross shaft
⑱ Grease, BJ68, 30g
⑲ Grease, BJ68, 300g

Note:
The diameter of the centering ball for the former 360 series vehicle has been changed from 20mm to 22mm. When the axle shaft for models earlier than N360-1142414 (body serial number), is used use item ⑦ and ⑧ instead of ⑨ and ⑩.

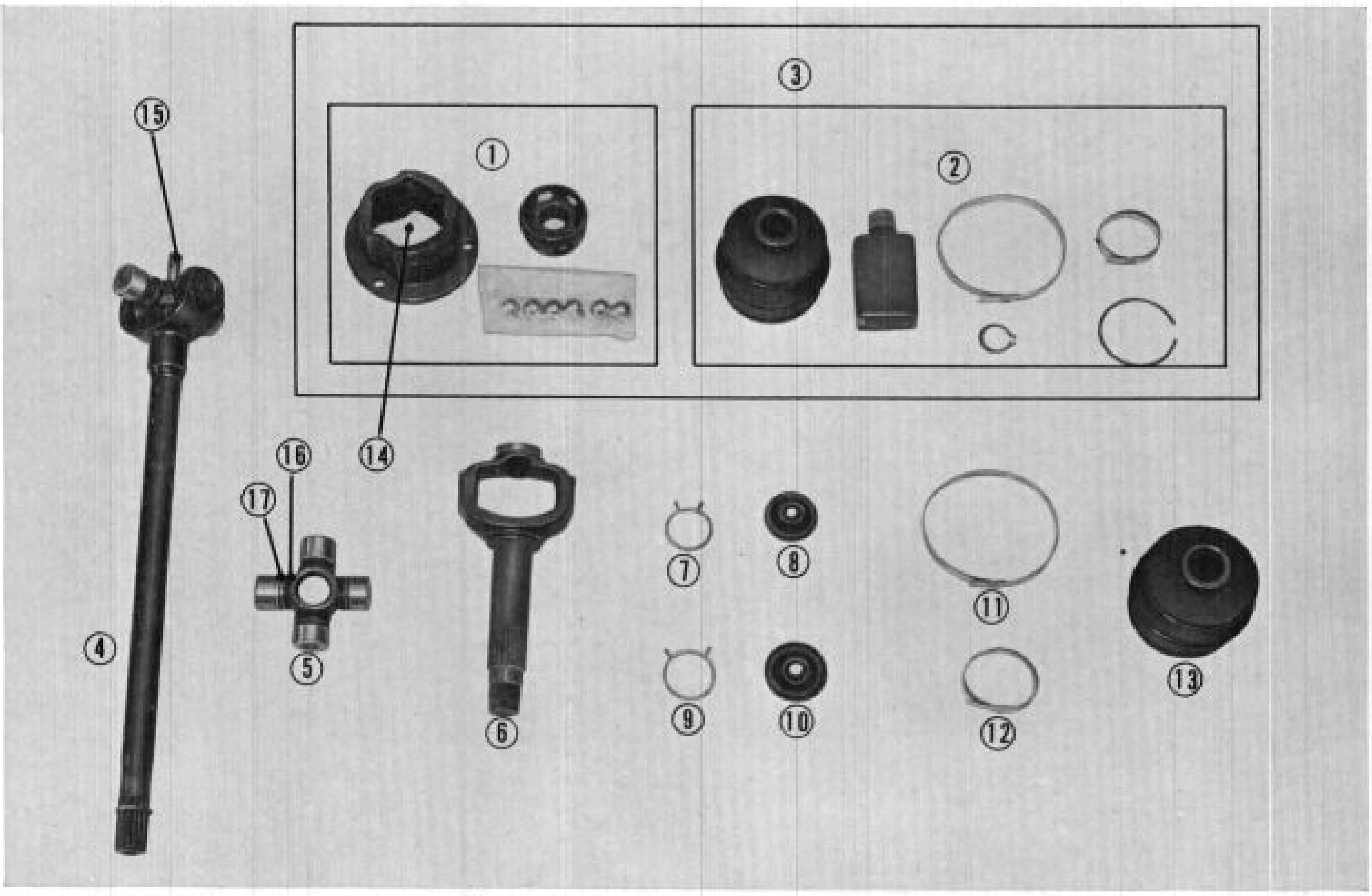


Fig. 9B-38

18. Insert the centering ball into the axle shaft, and fill with grease.
    Grease should be applied in such an amount that it effuses slightly from the periphery of the ball.

Fig. 9B-39

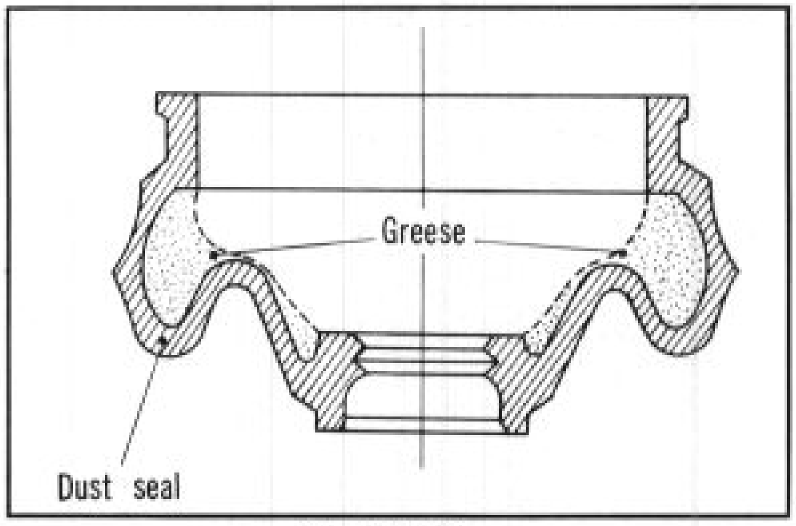


Fig. 9B-40

19. Apply grease to the dust seal.
    See Fig. 9B-40 for amount of grease.

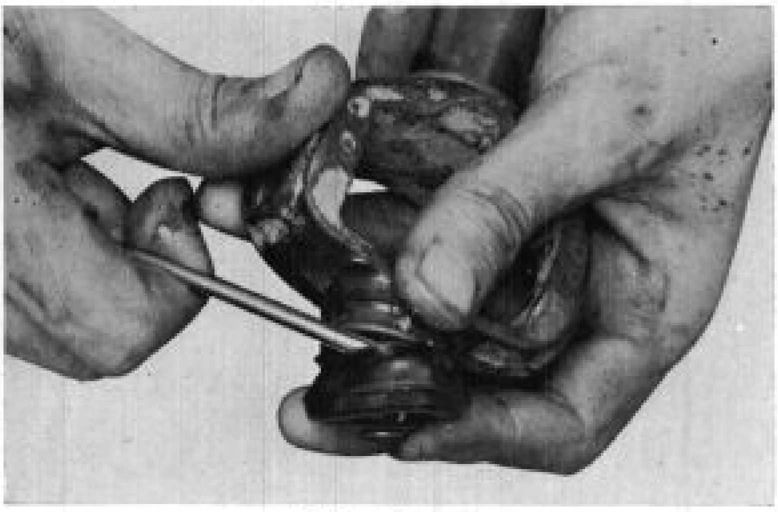


Fig. 9B-41

20. Mount the dust seal on the axle shaft:
    Use a screwdriver and hold the end with the fingers to prevent the grease from coming out. (Fig. 9B-41)

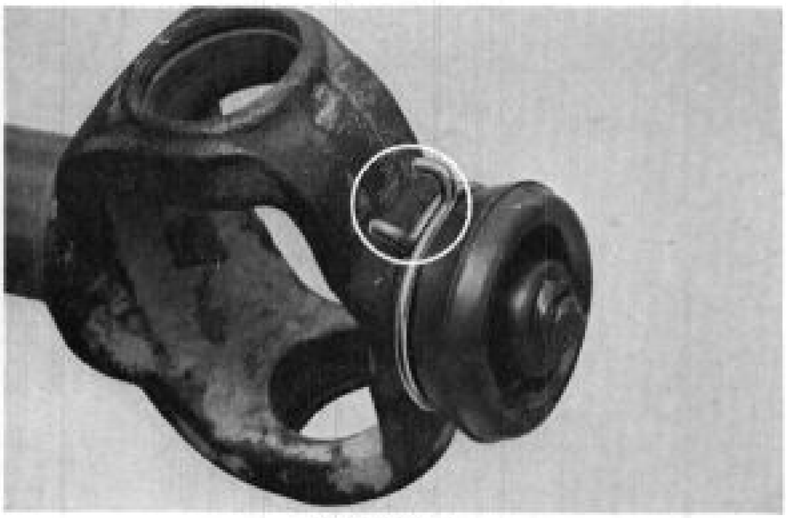


Fig. 9B-42

21. Mount the dust seal clip on the dust seal. Carefully mount the clip in the direction shown in Fig. 9B-42.

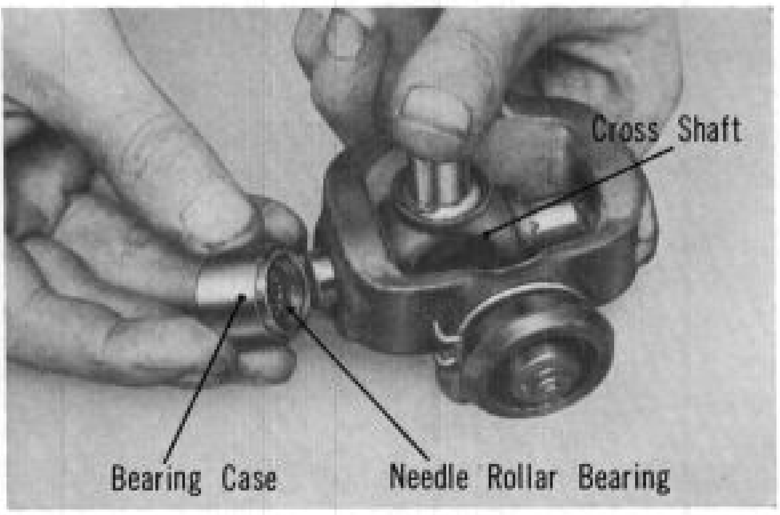


Fig. 9B-43

22. Remove the bearing case from the cross shaft, set and arrange the bearings evenly with the fingers.
    Mount the cross shaft on the axle shaft, and set the bearing case in position. (Fig. 9B-43)

23. Mount the two bearing case support on the base of the jig.
24. Set the base in a press, and mount the cross shaft onto the base while holding it so that it does not dislocate from the bearing case. (Fig. 9B-44)

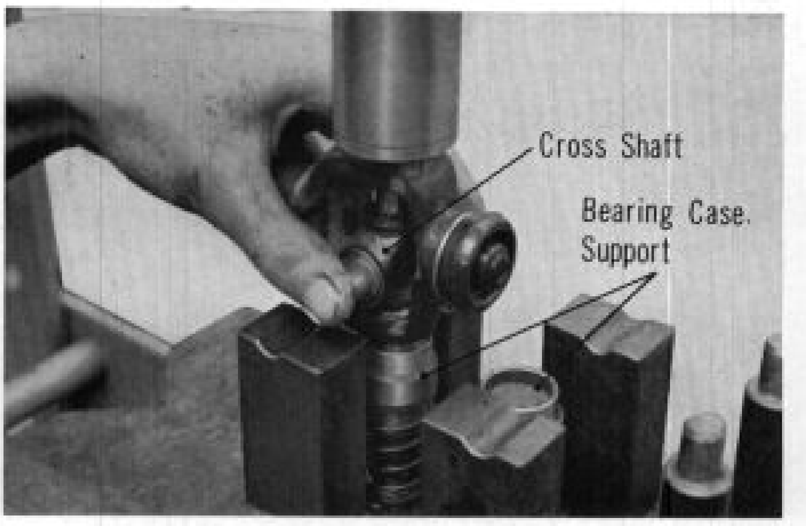


Fig. 9B-44

25. Set the cross shaft driver B, and effect oil pressure.
Hold both ends of the cross shaft, and pushing it downward against the air compressed by the press between the bearing case and the shaft, swing the cross shaft to the right and left so that centering is not disordered.
Continue the application of the press until the clearance between the dust seal and axle shaft inside (horizontal line in Fig. 9B-45) becomes zero.

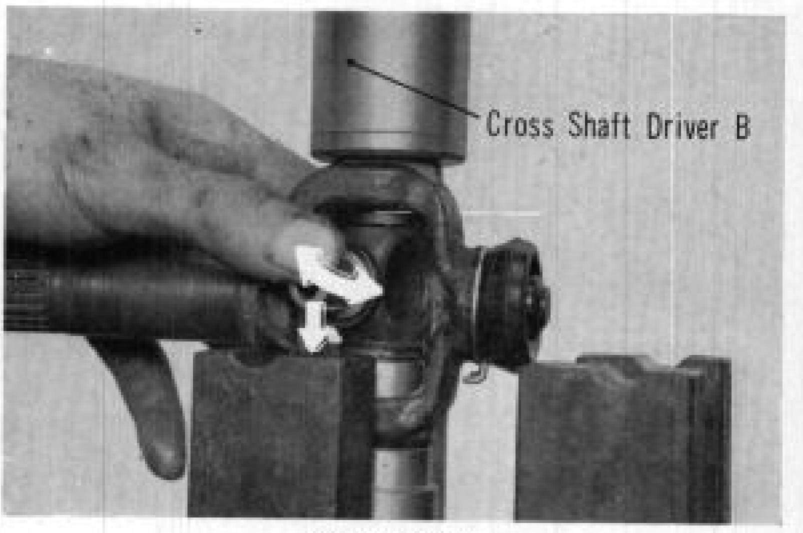


Fig. 9B-45

26. Mount a bearing case on the opposite side of shaft with the bearing case pressed in.
27. Insert circlip into the pressed-in bearing case while holding the bearing case by hand.

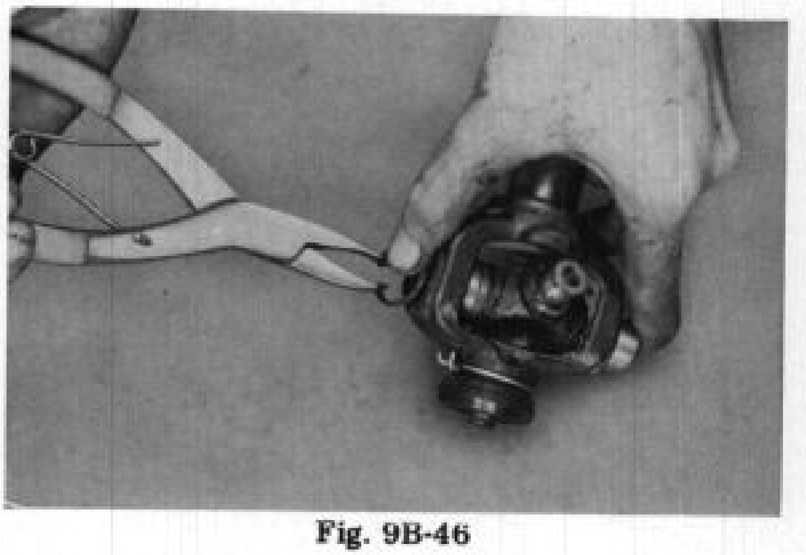


Fig. 9B-46

Note:
The circlip is slanted along one section of its periphery.
Carefully insert the circlip in the correct direction. See Fig. 9B-47.

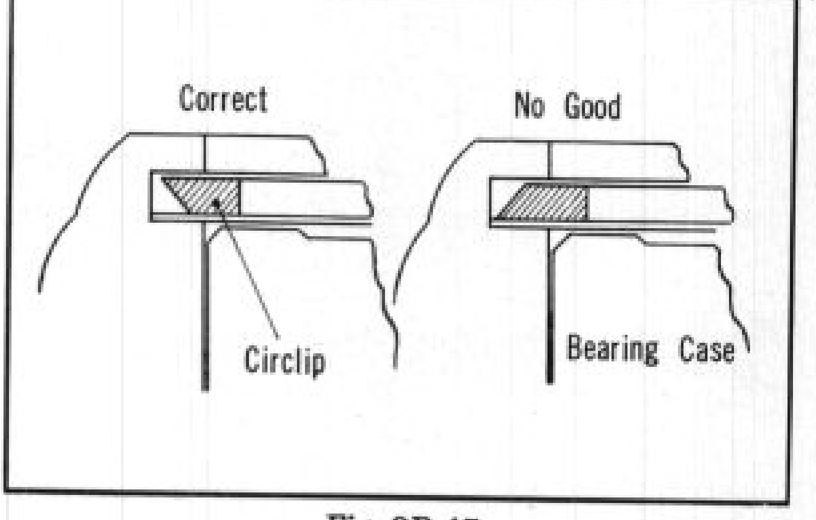


Fig. 9B-47

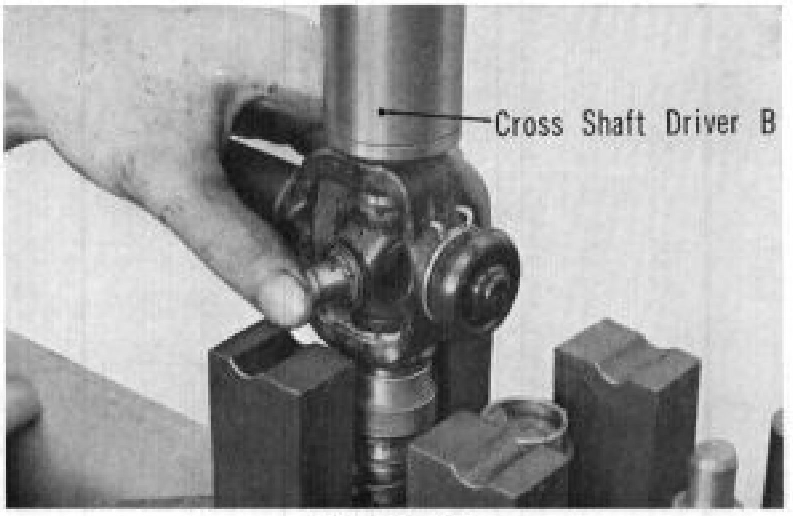


Fig. 9B-48

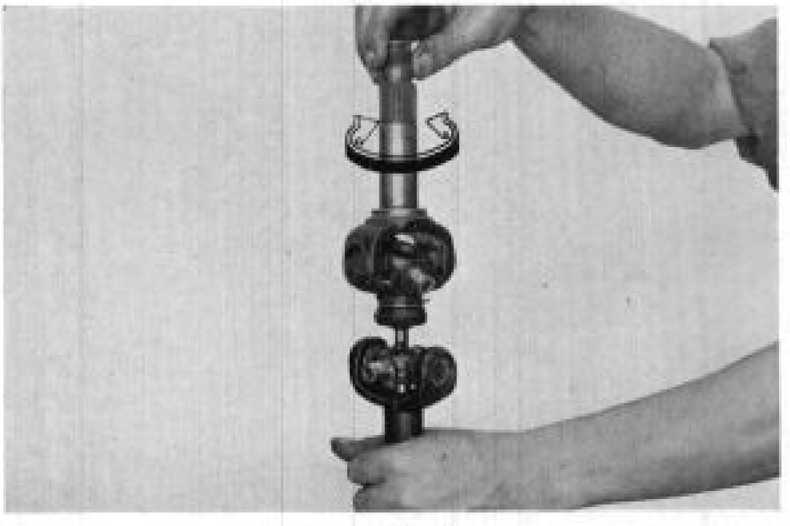


Fig. 9B-49

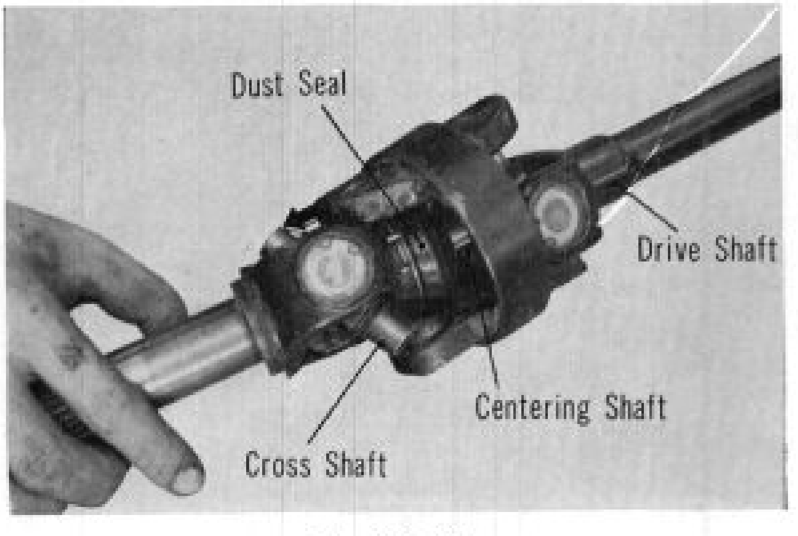


Fig. 9B-50

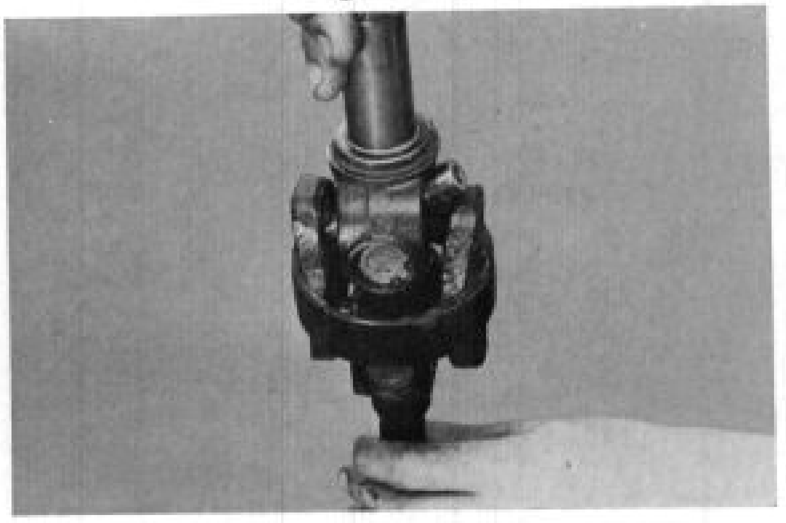


Fig. 9B-51

28. Mount the bearing case on the base with the circlip inserted side up (so that it contacts the cross shaft driver B), and effect the press within two tons.
    Be sure in this case to rotate the cross shaft to the right and left so that centering is not disordered.

    Note:
    Do not apply two tons or more of oil pressure. If otherwise, the cross shaft will fail to move to the right and left.

29. Insert the circlip in the bearing pressed-in side. The circlip acts as an adjusting shim for the bearing clearance in the shaft direction. Therefore, choose the optional type of circlip out of the list below. If the circlip used is too loose, a thicker one should be used, If the thicker circlip is difficult to insert, tap the bearing case with a hammer through the cross shaft driver A. In this case, it is better to hit the other side of the bearing case with a hammer so that the circlip on the opposite side not bent out.

    Internal Circlip, 1.0mm thickness
    Internal Circlip, 1.1mm thickness
    Internal Circlip, 1.2mm thickness
    Internal Circlip, 1.3mm thickness

Connections of center yoke, axle shaft, and drive shaft. (Item No. 30 to 39)

30. Position the centering ball in the axle shaft. This is for the vacilitation of assembling.
    (1) Make the centering ball flat by holding the dust seal end by hand.
    (2) Erect the drive shaft vertically, and insert the ball into the centering shaft by the weight of the axle shaft while turning the axle shaft slowly to the left and right. (**Fig. 9B-49**) Then remove the axle shaft vertically. Thus, the ball has been rightly positioned with the grease enclosed therein.

31. Tilt the cross shaft assembled in the axle shaft fully to one side.

32. Assemble the cross shaft (inserted in the drive shaft) into the center yoke as shown in **Fig. 9B-50**. Then insert the drive shaft center shaft into the axle shaft dust seal. In this case, be careful not to allow the shaft to contact the centering ball.

33. Erect the axle shaft vertically as shown in **Fig. 9B-51**, and insert the centering ball slowly into the center shaft. Simultaneously, insert one side of the cross shaft into the center yoke. If it is difficult to insert the centering ball, the centering ball should be again positioned. (Refer to 30).

34. Move the center yoke fully to one side, and set the axle shaft cross shaft in the center yoke by hand. **(Fig. 9B-52)**

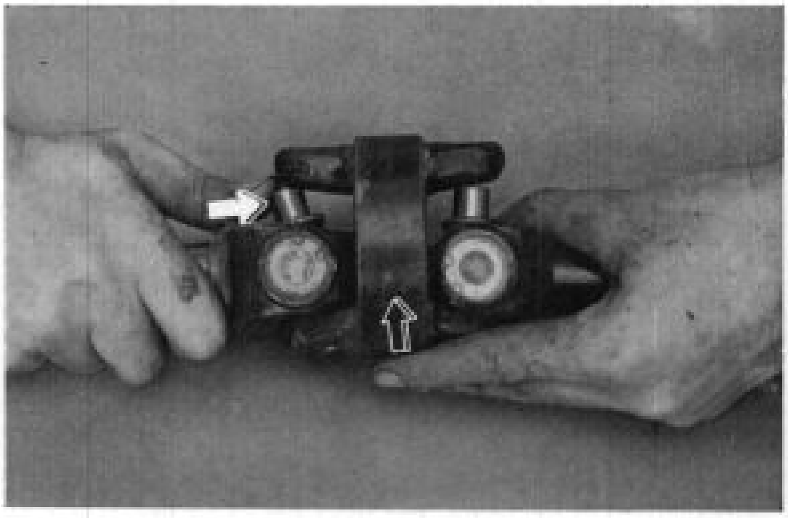


Fig. 9B-52

35. Check the needle bearings for tilt or uneven arrangement, and mount two bearings on the bearing case support. **(Fig. 9B-53)**

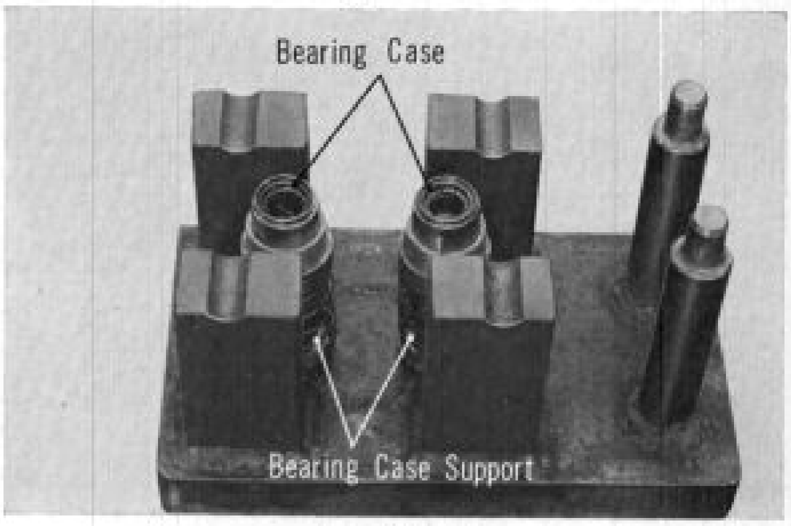


Fig. 9B-53

36. Press the center yoke through the center yoke fitting, and insert the bearings. **(Fig. 9B-54)**

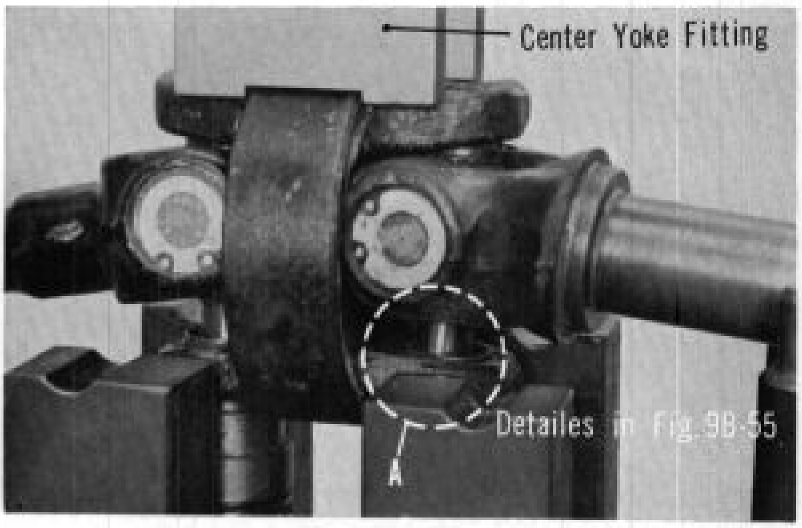


Fig. 9B-54

Note:
Press in the needle bearings as follows so that they do not tilt: Mount the cross shaft slantingly on the edge of the bearing case as shown in Fig. 9B-55.
Then insert the bearing case so that the bearing case contacts closely the inside of yoke.

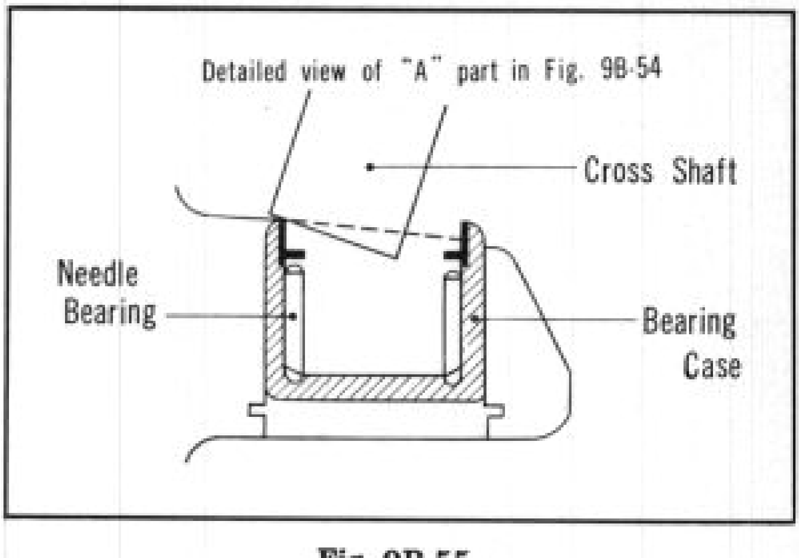


Fig. 9B-55

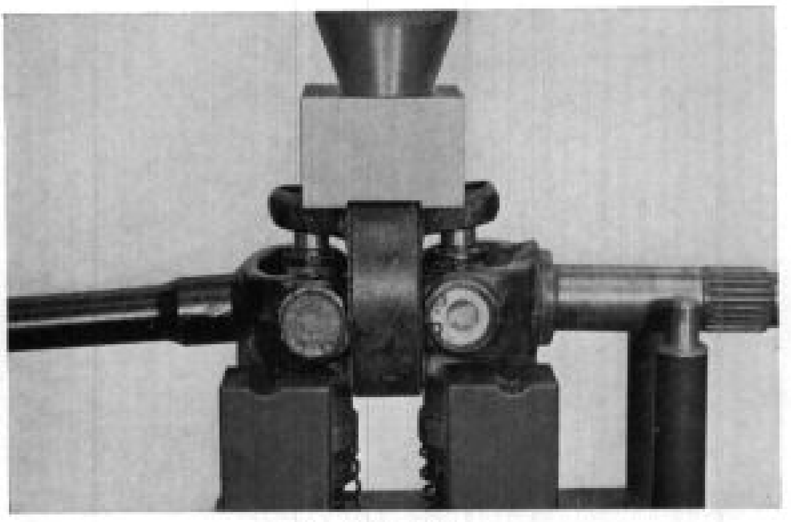


Fig. 9B-56

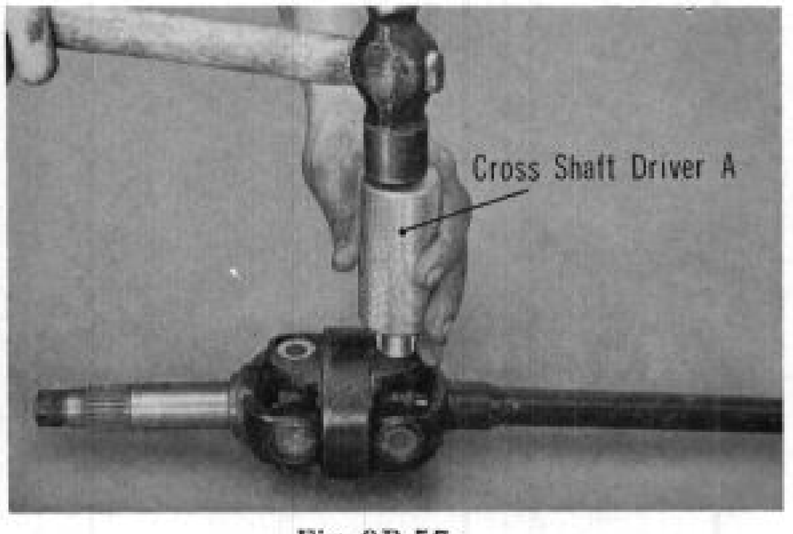
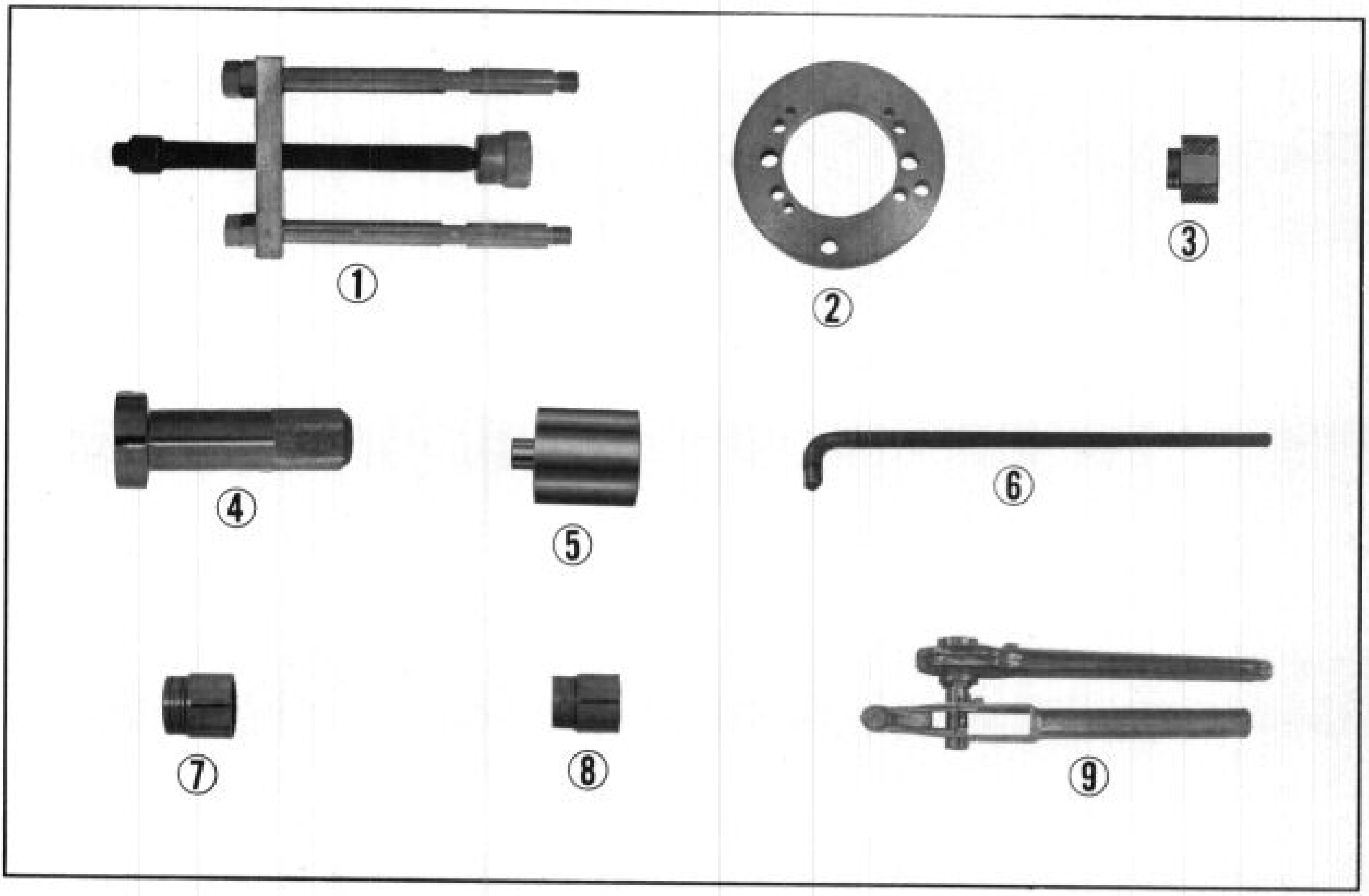


Fig. 9B-57

37. After pressing in the bearing case, insert the cross shaft. Insertion should be moderately concluded while swinging the shaft to the right and left so that the needle bearings do not tilt.
38. Insert circlip.
39. After reversing, press in the other side of the bearing case while swinging the cross shaft to the right and left while taking care not to tilt the bearings. 3.5 tons of oil pressure can be used for insertion.
40. Since the bearing case is filled with grease, insertion may sometimes be not completed evern with 3.5 tons of oil pressure. If the circlip is difficult to insert, therefore, knock with cross shaft driver A. Use chosen circlip (refer to 29.). After inserting the circlip, make sure that the axle shaft is not lowered by its own weight while holding the drive shaft horizontal by hand. If the axle shaft is lowered, replace with a thicker circlip, and adjust.

C. Special Tool



Ref. No.		Description	360 400	600
1.	07045-56805	Drive shaft replacer main	○	○
2.	07045-56810	Drive shaft replacer flange	○	○
3.	07045-56810	Drive shaft replacer attachment	○	○
4.	07048-55110	Front wheel bearing driver A	○	○
5.	07048-55101	Front wheel bearing driver B	○	○
6.	07083-60106	Wrench handle	○	○
7.	07083-60110	Socket (32mm)	○	○
8.	07083-60115	Socket (27mm)	○	○
9.	07043-55101	Bellows band fastener	○	○

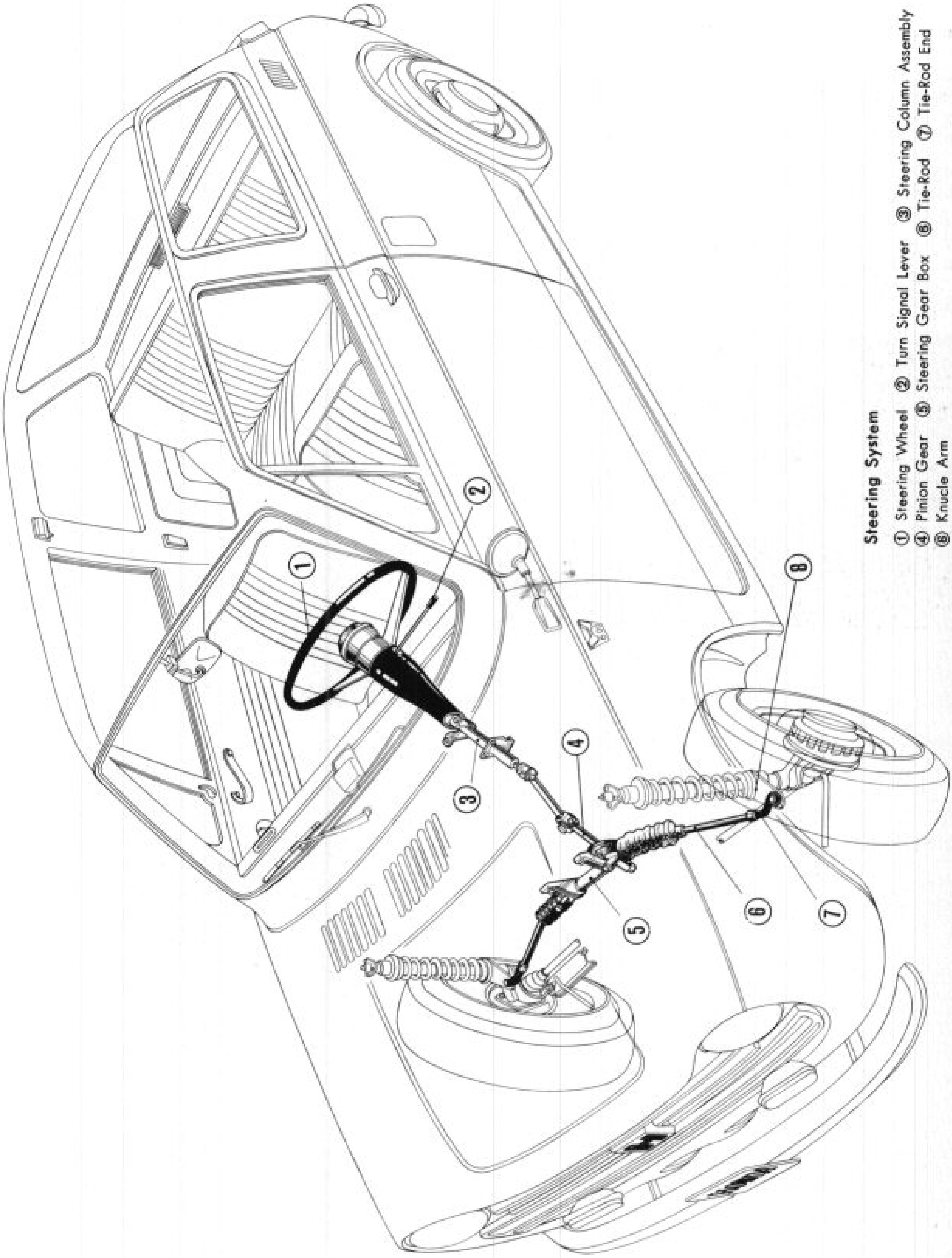
OPTIONAL

10.	07043-55110	Drive shaft overhaul jig set	○ Used as a set (Fig. 9B-20, 21)
11.	07043-55113	Drive shaft overhaul spacer	○
12.	07093-55113	Drive shaft replacing socket wrentch	○ Used on drive shaft-to-differential mounting bolts

MEMO

SECTION 10

STEERING



Steering System

① Steering Wheel ② Turn Signal Lever ③ Steering Column Assembly
④ Pinion Gear ⑤ Steering Gear Box ⑥ Tie-Rod ⑦ Tie-Rod End
⑧ Knucle Arm

A. General Description

The steering assembly is a rack and pinion type. The steering column is divided with two universal joints and is bent. This mechanism and also the crash pad on the steering wheel protect the driver in the case of a head-on collision. The steering gear box is located on the firewall and is positioned horizontally with four bolts. The pinion gear is connected to the steering column with serration and secured with clamp bolts. Thrust applied to the pinion gear is received by the U-shaped thrust plate fitted to the groove near the pinion gear head, and end play of the pinion gear is adjusted by pinion adjusting bolt.

Backlash between the pinion gear and rack increases due to wear. Backlash is adjusted by adjusting bolts on the back of the rack (near both ends of the steering gear box).

The pinion gear and rack gear ratio is 15.2. The steering wheel diameter is 380mm (14.96 in). On both ends of rack, rack ends having ball joint connections are threaded and connected, and secured with lock washers. In addition, the tie-rod connected to the rack end ball joint is also threaded and secured to the tie-rod end by a lock nut. When adjusting toe-in, loosen this lock nut and adjust the length of the tie-rod by threading in or out.

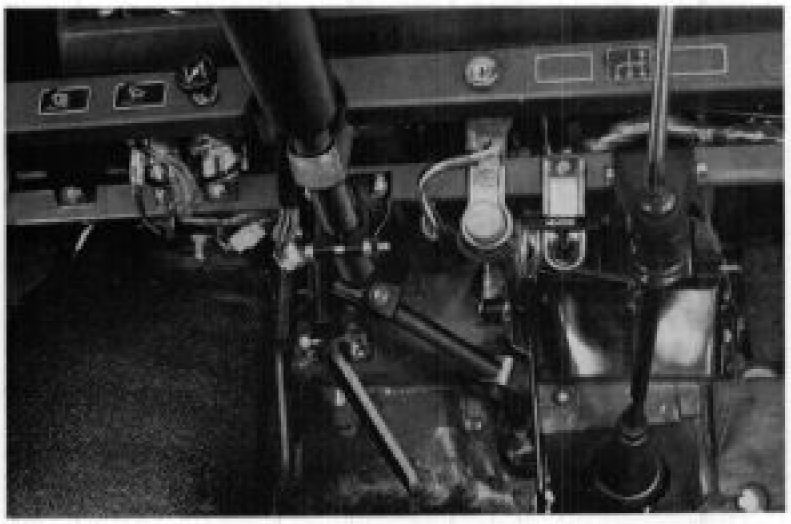


Fig. 10A-1

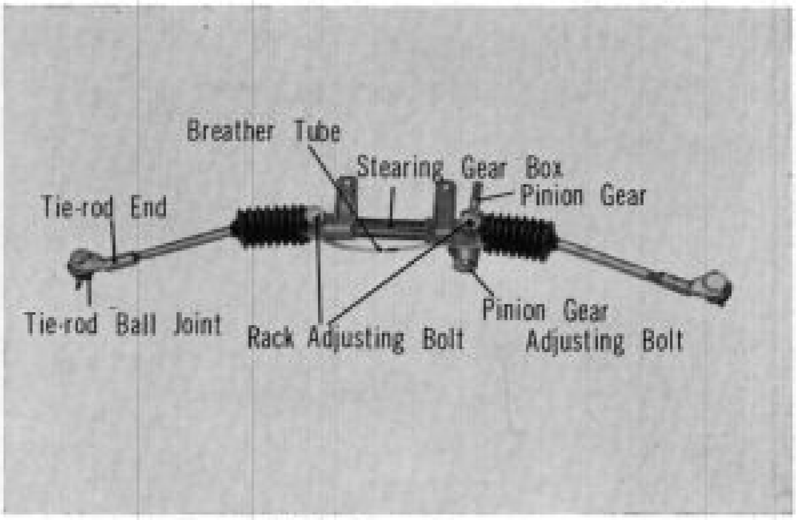


Fig. 10A-2

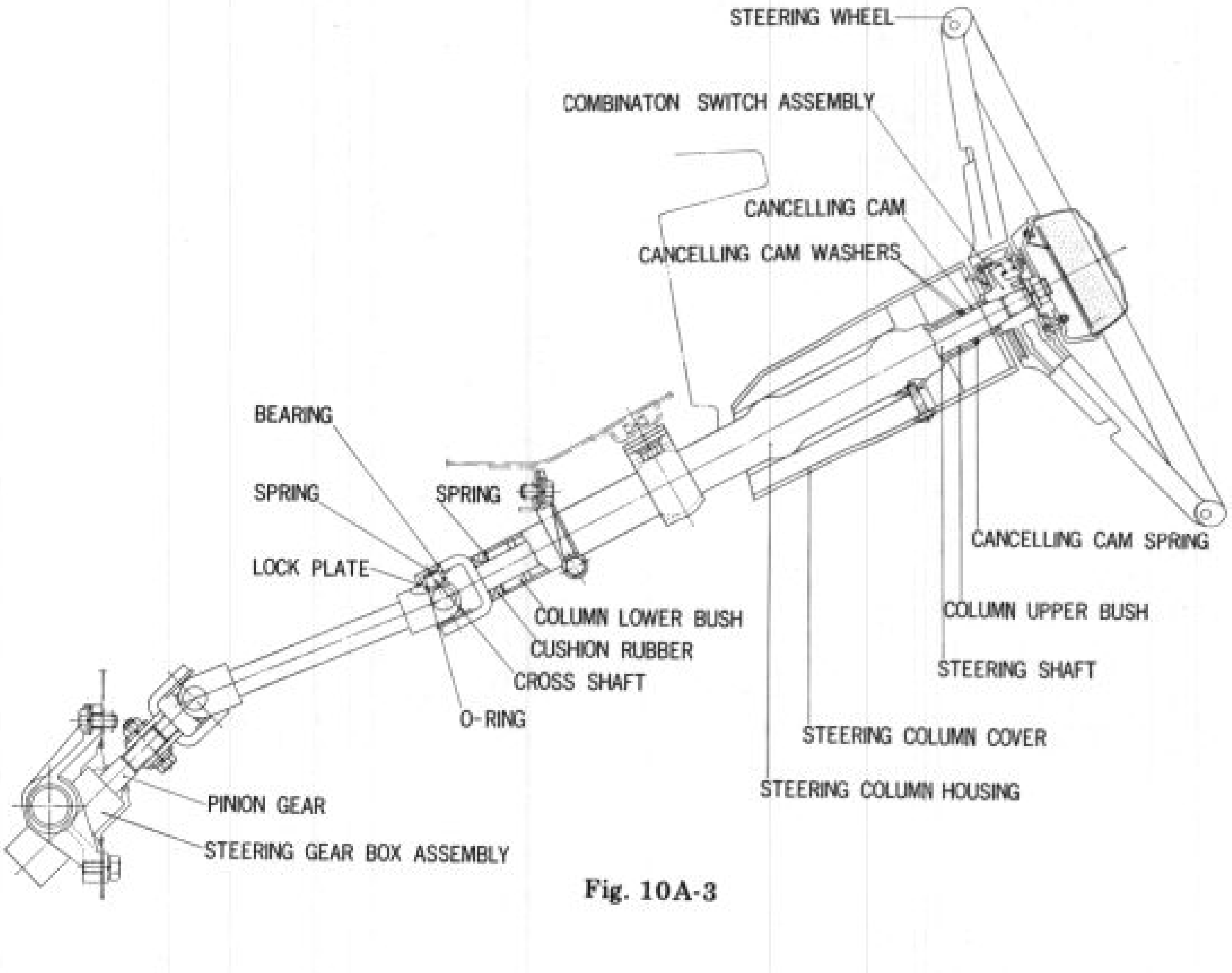


Fig. 10A-3

B. Technical Data

(Specification)

TYPE.	Rack and Pinion
STEERING GEAR RATIO.	17.4 : 1
STEERING WHEEL DIAMETER	0.380m (14.96 in)
TURNS LOCK TO LOCK	3.1
OUTSIDE WHEEL ANGLE	
WITH INSIDE WHEEL AT 27°33′	35°12′
TURNING CIRCLE	9.5 m

(Tightening torque)

Steering gear box mounting	2.0~2.4 kg-m (14.5~17.4 lb-ft)
Rack and ball joint-to-rack gear	4.5~5.0 kg-m (32.5~36.2 lb-ft)
Tie-rod end lock nut	4.5~5.0 kg-m (32.5~36.2 lb-ft)
Tie-rod ball joint	3.5~4.0 kg-m (25.3~28.9 lb-ft)
Steering wheel nut	3.0~3.5 kg-m (21.7~25.3 lb-ft)

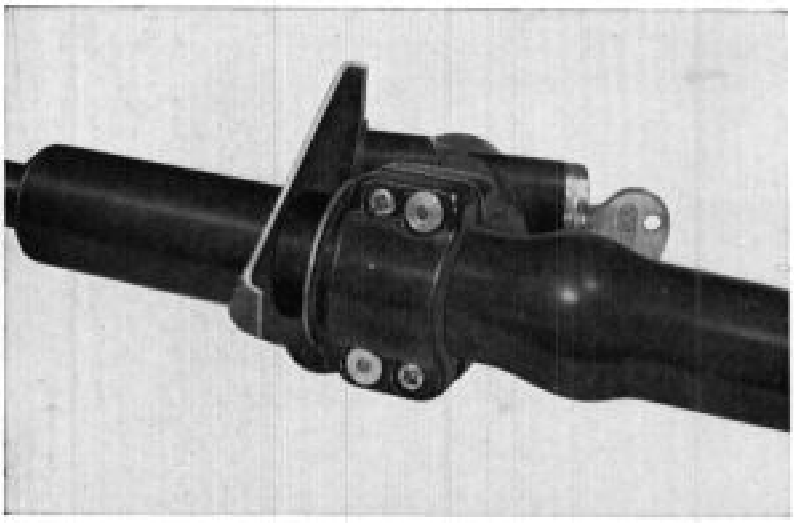


Fig. 10C-1

C. Steering Wheel

Description

The steering wheel center has a safety crash pad which protects the driver in case of accident.
The steering column is suspended from the instrument panel with four bolts.
For vehicles exported to Germany and other countries, the steering column is equipped with a locking mechanism and key. (Fig. 10C-1)

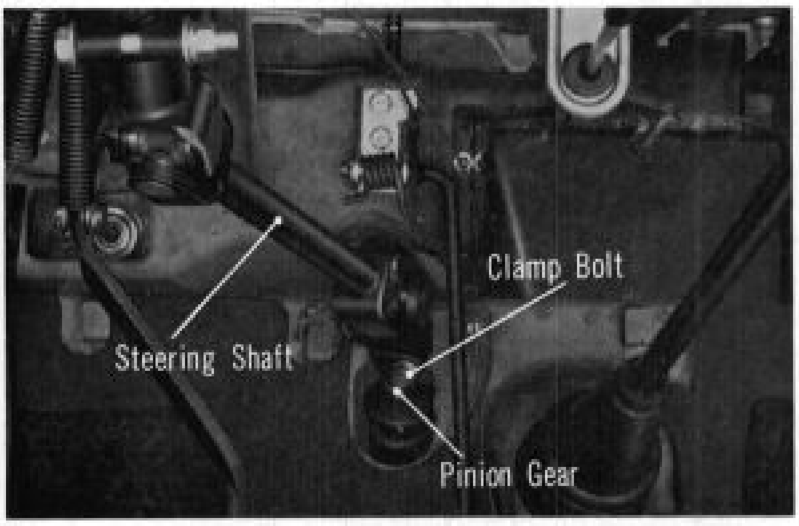


Fig. 10C-2

Removal and Disassembly

1. Removing column assembly
   * Loosen clamp bolt at steering shaft and pinion gear connection.

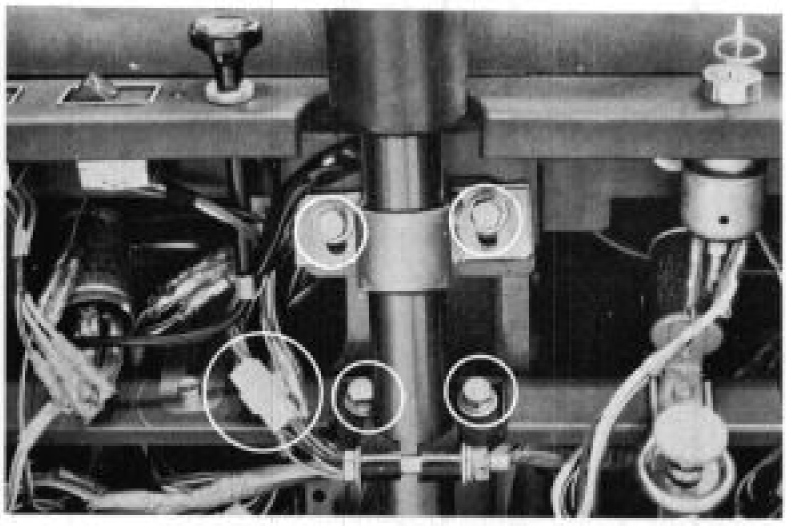


Fig. 10C-3

   * Disconnect electrical wiring and remove the four bolts retaining the steering column to the instrument panel.

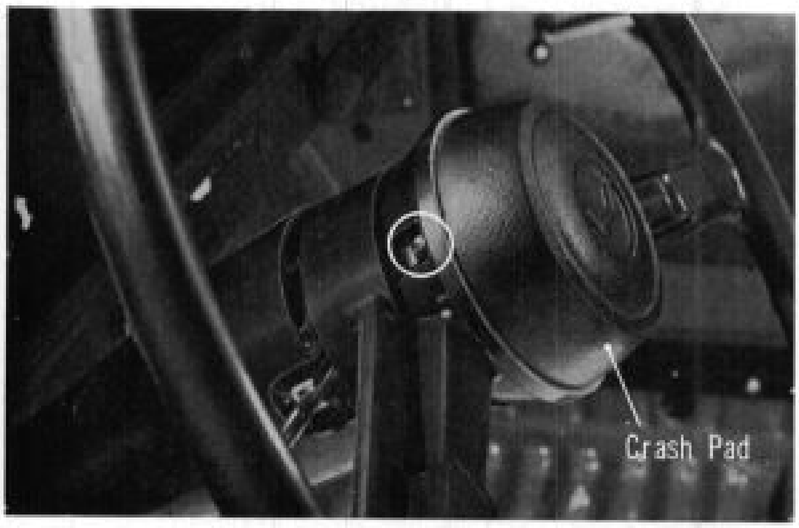


Fig. 10C-4

2. Disassembling steering wheel and column
   * Remove the three screws and separate the crash pad.

* Remove the screw and disconnect the horn plus lead. Remove the steering shaft nut.

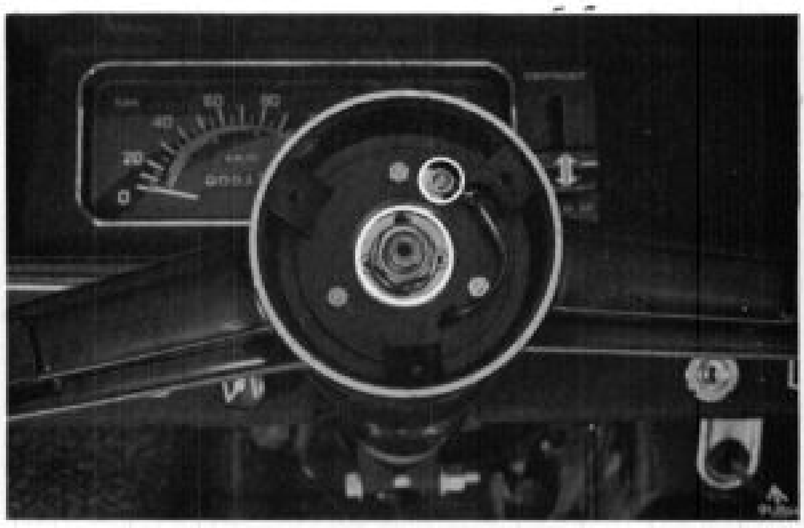


Fig. 10C-5

* Remove two screws and separate the horn switch contact plate.

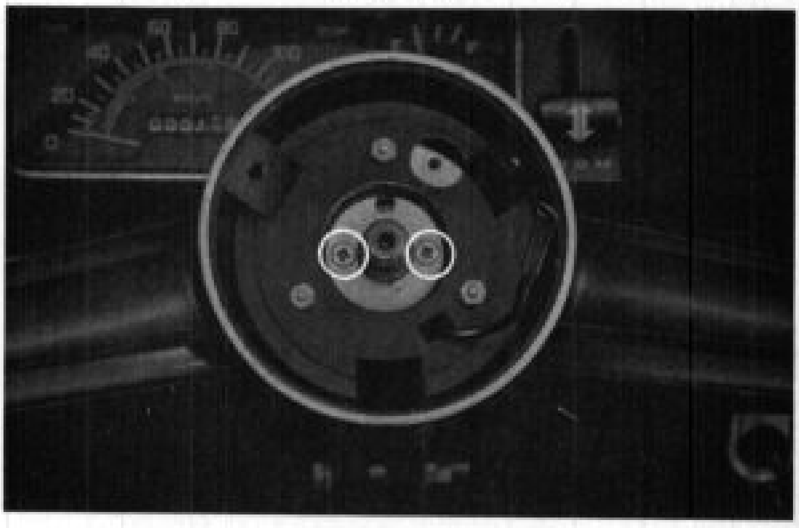


Fig. 10C-6

* Remove the steering wheel by using the special tool ("steering wheel puller A" for the standard steering wheel and "steering wheel puller B" for the spoke steering wheel)

Fig. 10C-7

* Remove the turn signal canceling cam and spring washers.

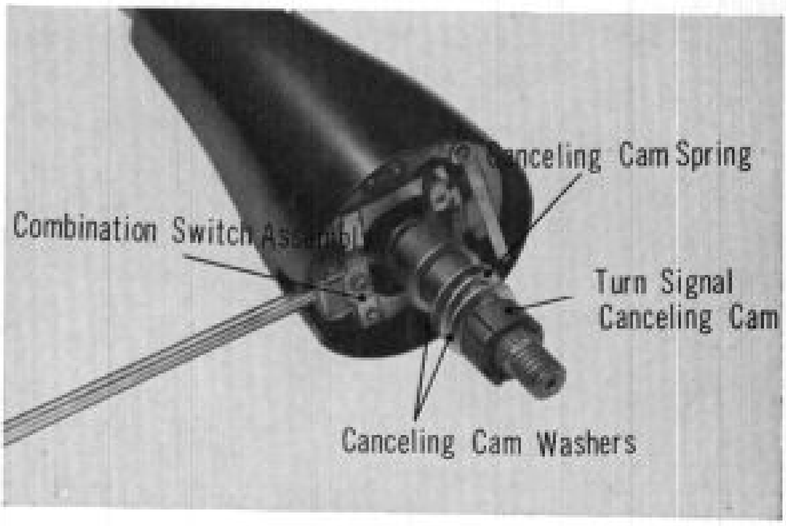


Fig. 10C-8

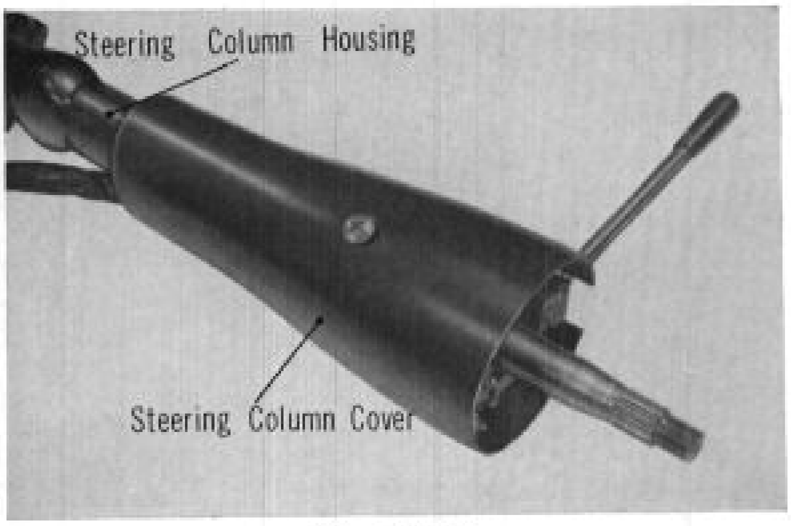


Fig. 10C-9

* To remove the steering column cover, remove one screw.

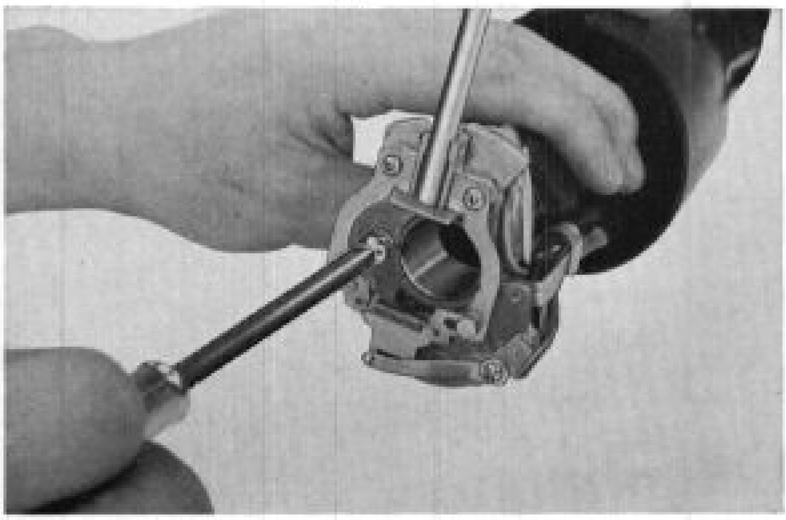


Fig. 10C-10

* Loosen the screw completely and tap the top of the screw with a screw driver, then the combination switch is separated from the steering column housing.

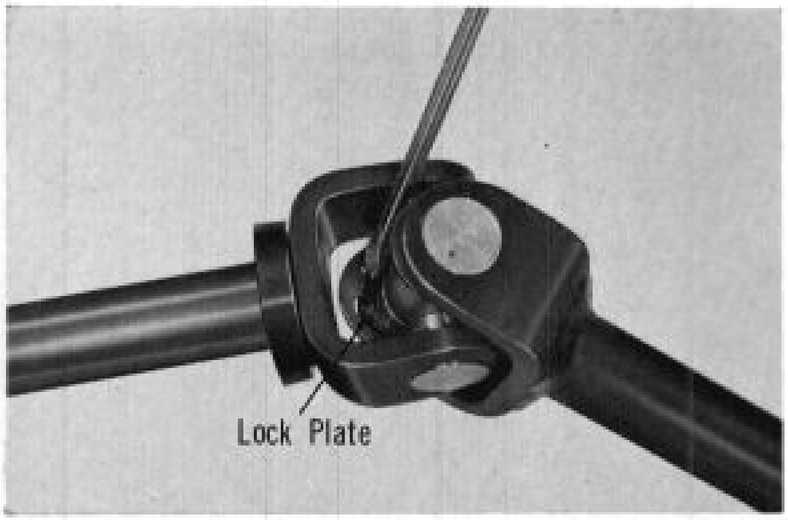


Fig. 10C-11

* Remove the lock plates with a screw driver to disassemble the universal joints.

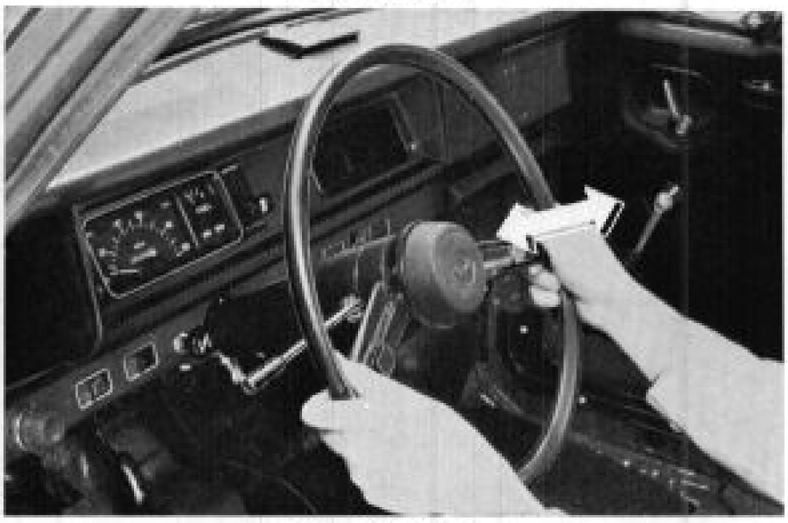


Fig. 10C-12

Inspection

1. Check the steering wheel play in the axial direction. If found excessive:
   * Check the steering column mounting bolts for looseness.
   * Check the steering wheel nut for looseness.
   * Check the cushion rubber for wear. (Fig. 10C-22)

2. Check the steering column top bushing for excessive wear. Excessive play due to worn bushing may cause rattling noise from the steering wheel.

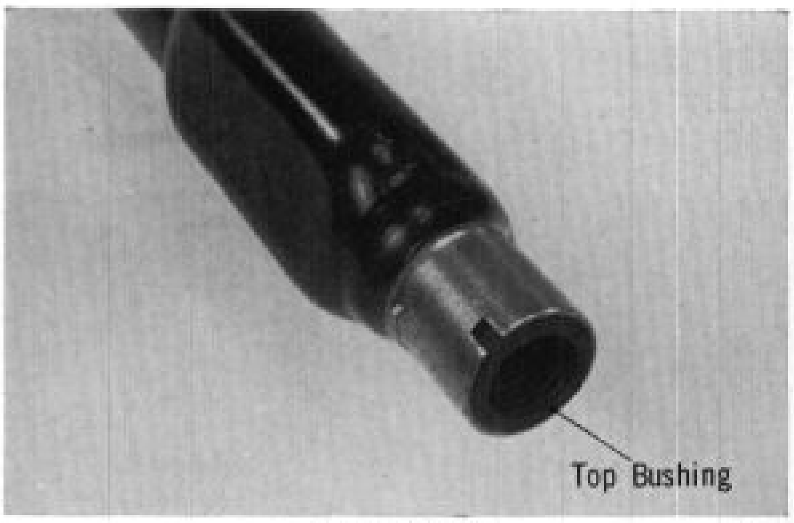


Fig. 10C-13

3. Check the universal joint of the steering shaft for excessive play as shown.

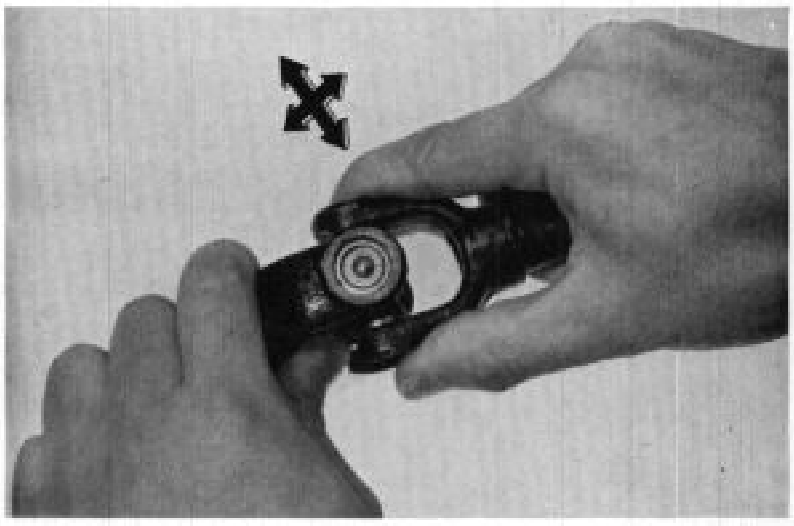


Fig. 10C-14

(Standard joint)

If an excessive play is found at the joint, trunnion caps and/or lock plate may be worn excessively. Replace the worn parts with new ones.

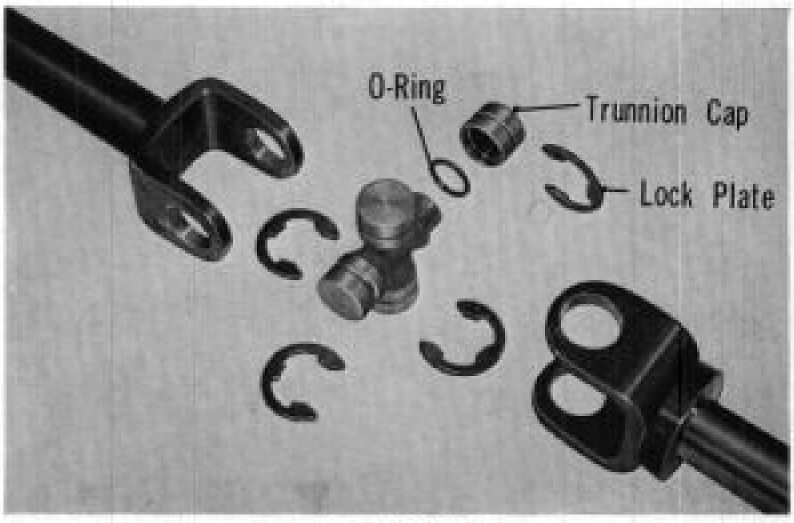


Fig. 10C-15

(Factory sealed - lubrication type joint)

This type of joint cannot be disassembled. If excessive play is found at the joints, punch the inner edge of the yoke with a center punch as shown in the picture. If the play cannot be eliminated by this job, the entire steering shaft assembly should be replaced.

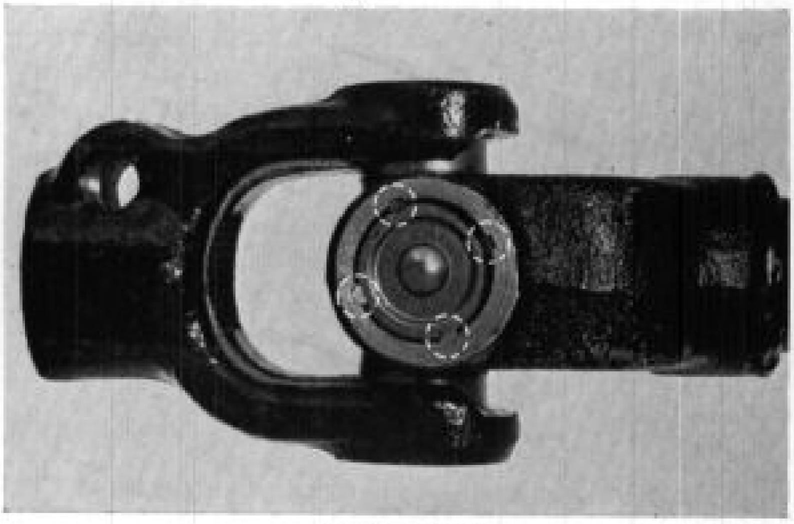


Fig. 10C-16

Fig. 10C-17

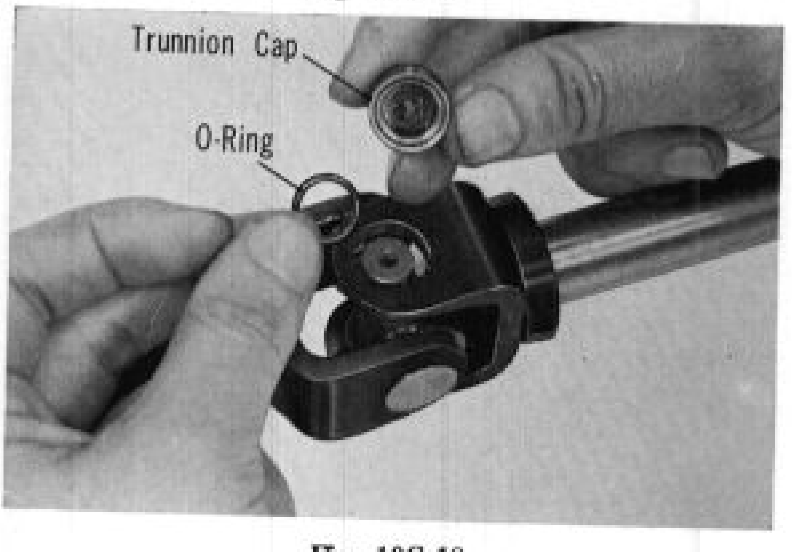


Fig. 10C-18

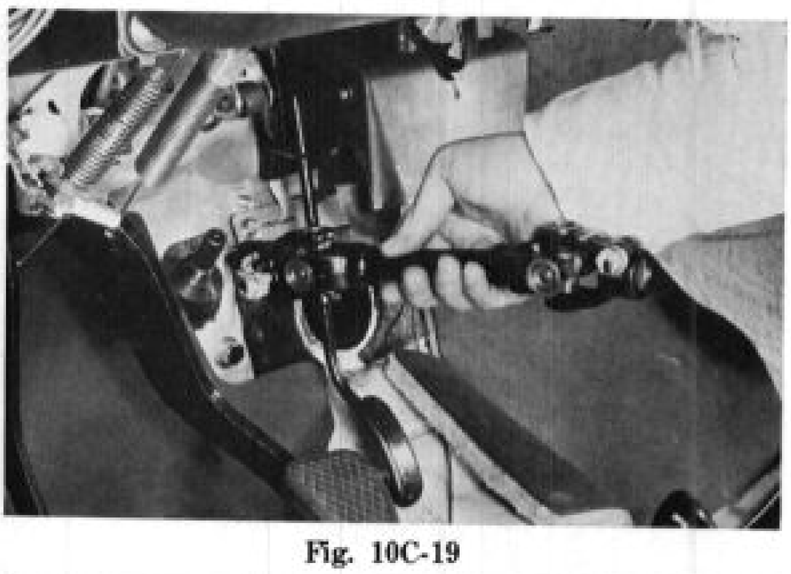


Fig. 10C-19

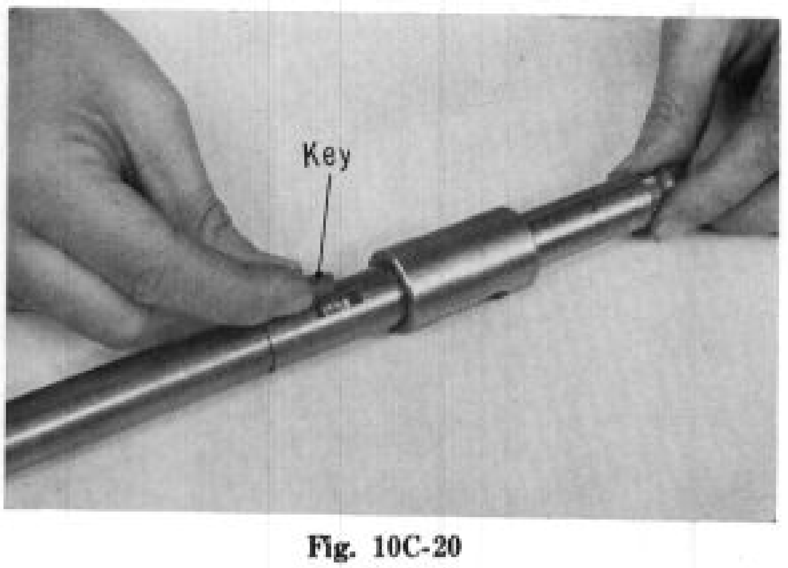


Fig. 10C-20

To relieve excessive tightness of the universal joints, tap the yoke lightly.

Assembly and installation

1. (Assembly of steering shaft universal joins)
   Install the trunnion cap after placing the O-ring in the groove.
   To minimize the play, either select-assemble the lock plates or install wave springs (Fig. 10-A-3) inside two trunnion caps locating them perpendicularly.
   There are four different lock plates available as following.

	Thickness
Lock plate A	1.7mm (0.067 in)
Lock plate B	1.9mm (0.075 in)
Lock plate C	1.3mm (0.051 in)
Lock plate D	1.5mm (0.059 in)

2. (Installation of steering shaft)
   Install the steering shaft with the longer serrated yoke toward the steering gear box.

3. (Assembly of steering column)
   Install the key into the steering shaft to position the steering lock sleeve.

Steering lock sleeve is secured with a circlip at the top, and spring/circlip at the bottom.

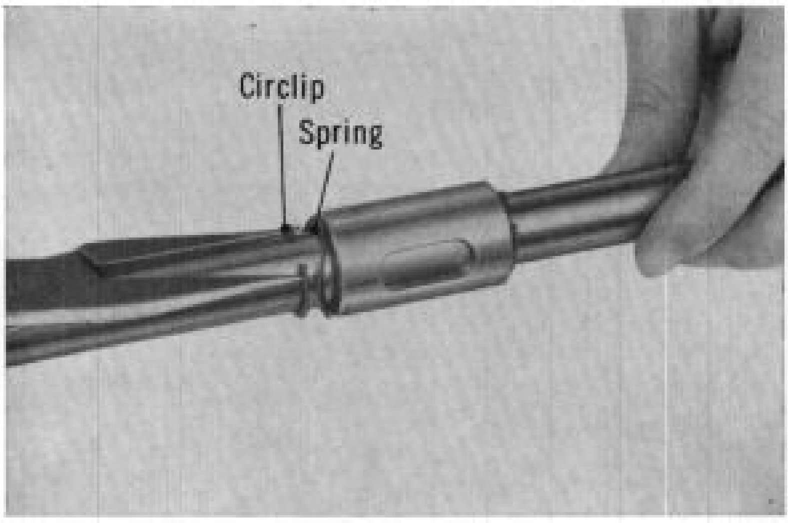


Fig. 10C-21

Insert the cushion rubber and the spring. The cushion rubber should be installed with the flat side upward.

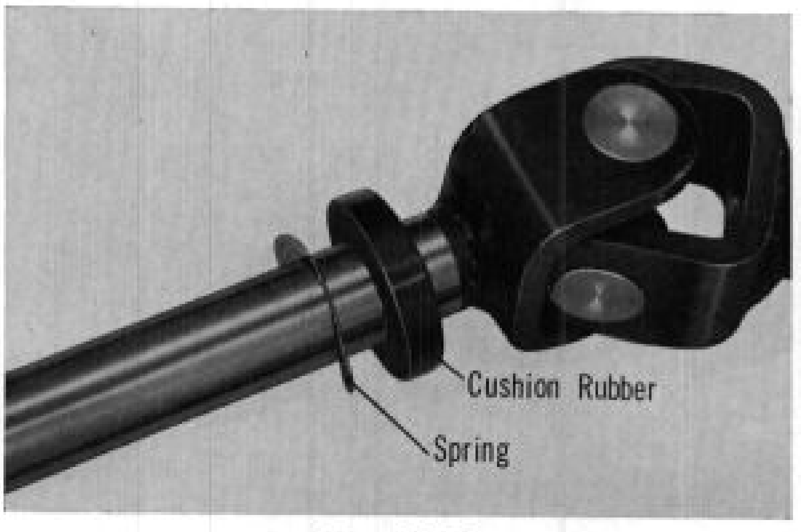


Fig. 10C-22

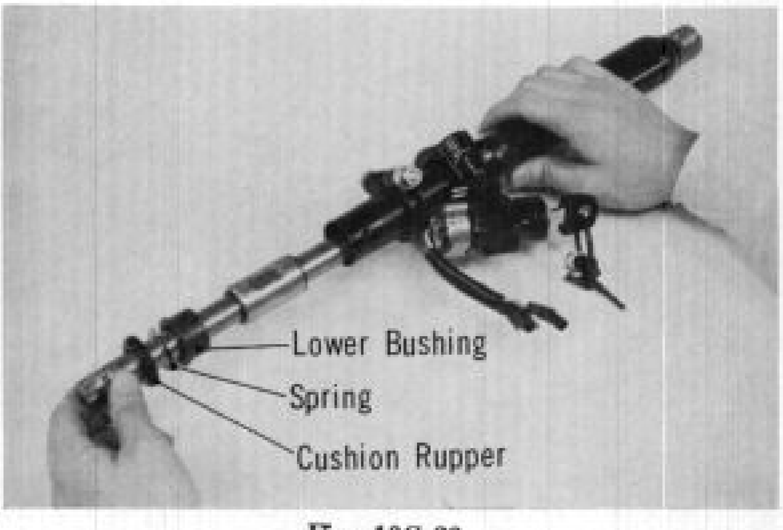


Fig. 10C-23

4. Steering column lock alignment
   (Vehicles equipped with anti-theft switch only)
   Set the front wheels in the straight ahead position.
   Remove the key and connect the steering column assembly to the lower steering shaft, Mount the steering column assembly into the position loosely.

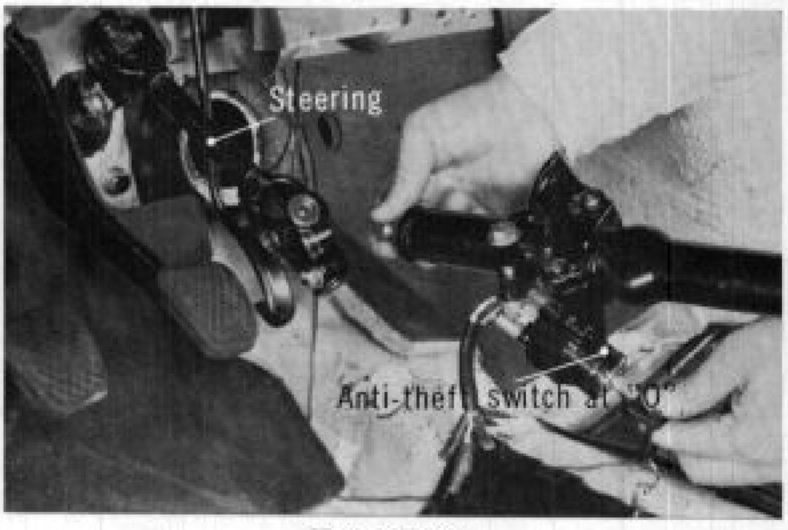


Fig. 10C-24

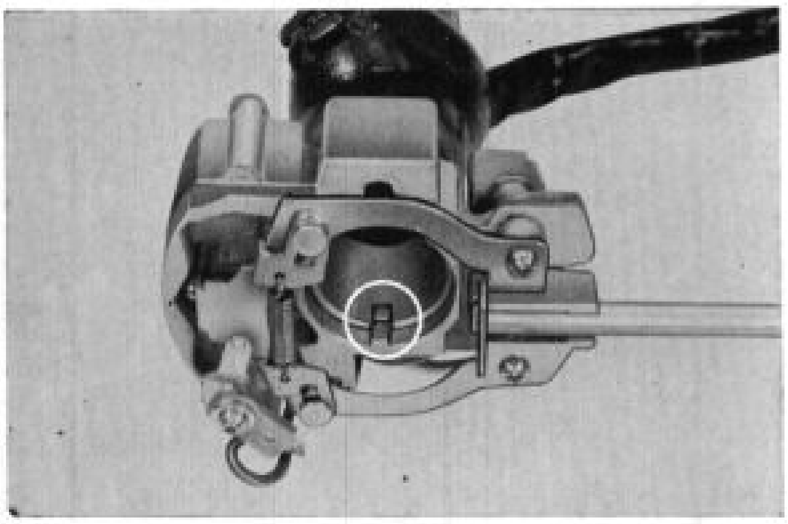


Fig. 10C-25

5. Align both grooves of the combination switch and the steering housing.

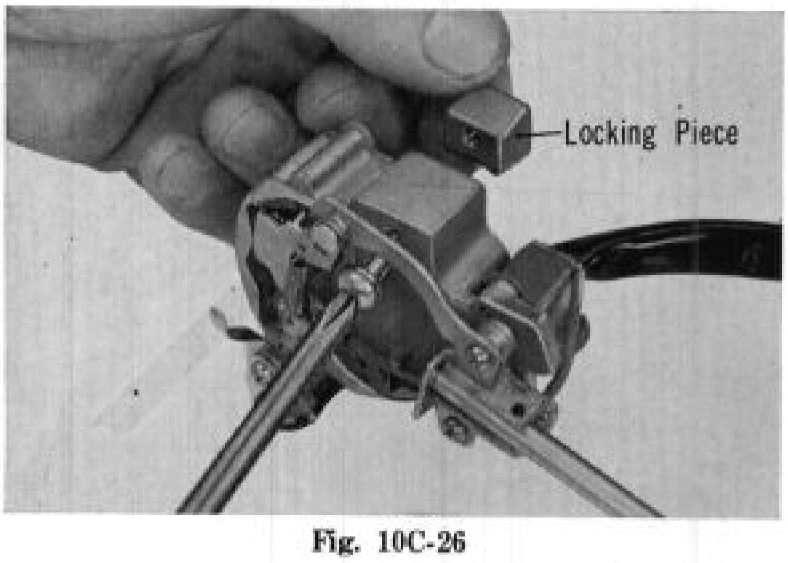


Fig. 10C-26

The tapered locking piece secures the combination switch to the steering housing. Note the circular side faces to the steering housing and tapered side faces the switch.

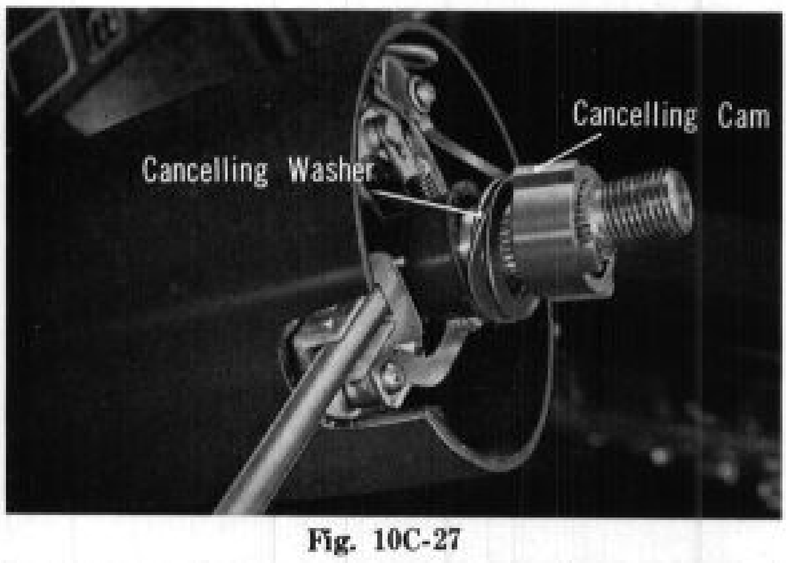


Fig. 10C-27

6. Apply grease to the cancelling cam.

   Prior to installing cancelling cam, ensure the turn signal switch is in the neutral position. This will prevent damage to the switch when steering wheel is installed.

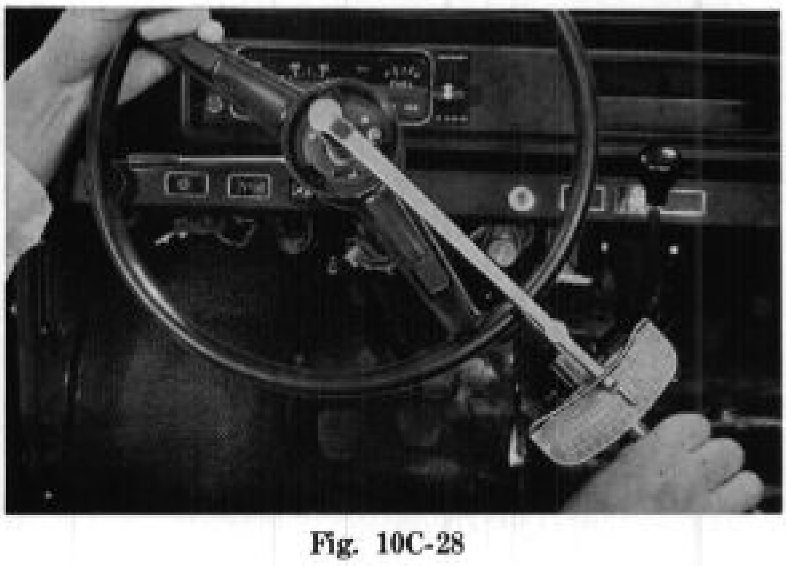


Fig. 10C-28

7. Set the front wheels in the straight ahead position and align the steering wheel spoke position.

   Tighten the wheel nut to a torque 3.0~3.5kg-m (21.7~25.3 ft-lbs).

8. Prior to tightening the steering column mounting bolts, position the steering column housing in the proper position and eliminate the play between the steering shaft and the housing. If the steering wheel operation is too tight, the cushion rubber may be compressed due to improper column housing positioning. Readjust if necessary.

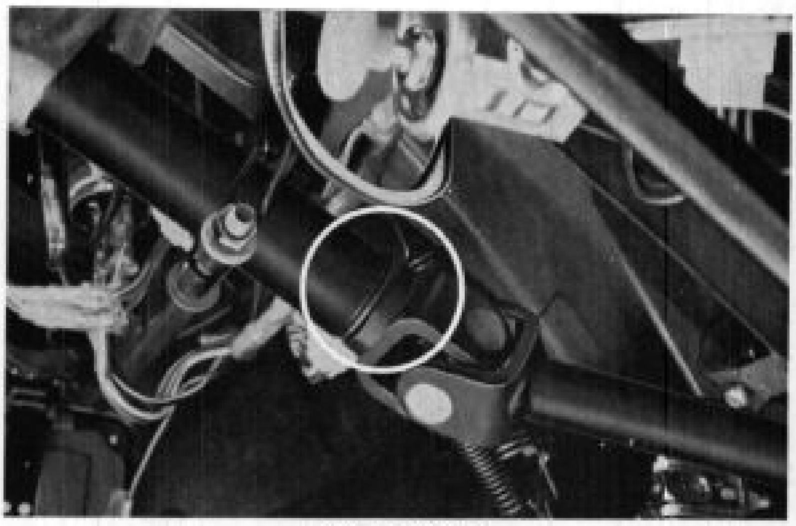


Fig. 10C-29

9. Position the column housing cover to have a clearance of 1~4mm between the steering wheel and the cover.

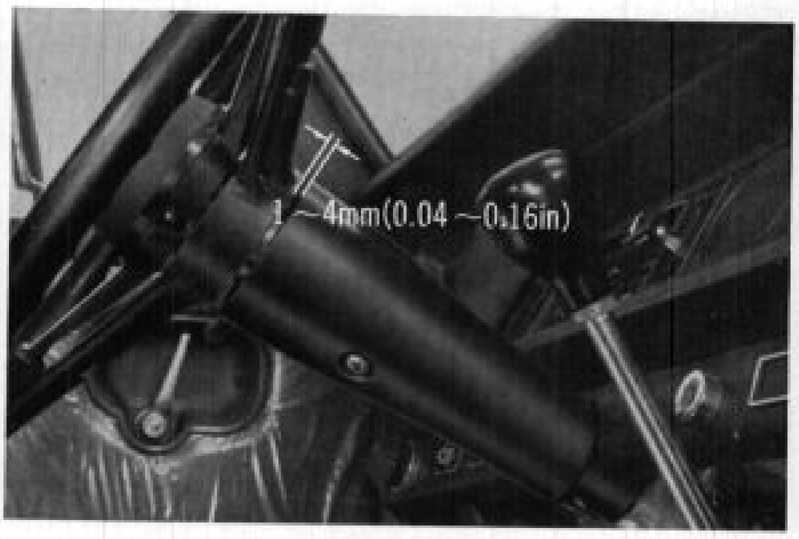


Fig. 10C-30

D. Steering Gear Box and Tie-Rods

Description

The gear is rack-and-pinion type and it is mounted on the firewall. The pinion gear is positioned and secured by means of the U-thrust plate and the lock bolt. There are rack adjusting bolts provided on both ends of steering gear box to allow pinion/rack gear backlash adjustment.

A breather tube is connected between right and left tie rod bellows to prevent the bellows from becoming negatively pressurized when turning the steering wheel. Should negative pressure exist, water and dust enter the bellows and result in rapid wear of the rack end ball joints.

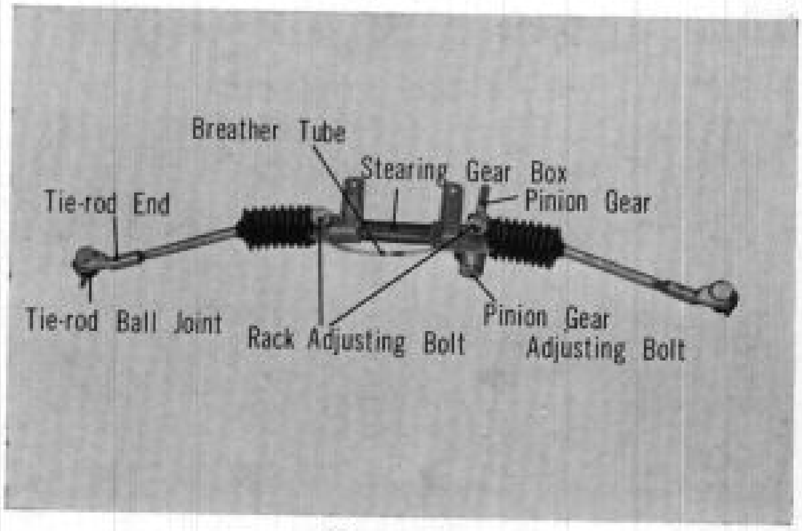


Fig. 10D-1

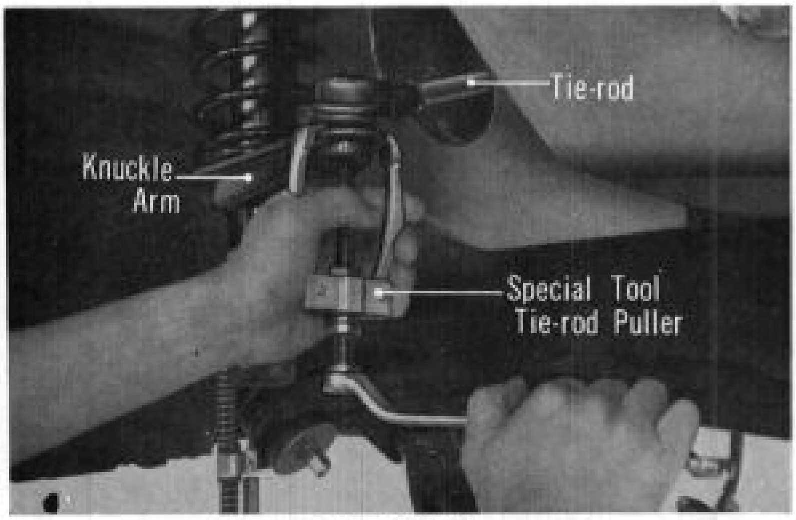


Fig. 10D-2

Removal and Disassembly

1. Removing steering gear box and steering linkages.
   * Remove the tie-rod from the knuckle arm with the special tool (tie rod end puller).

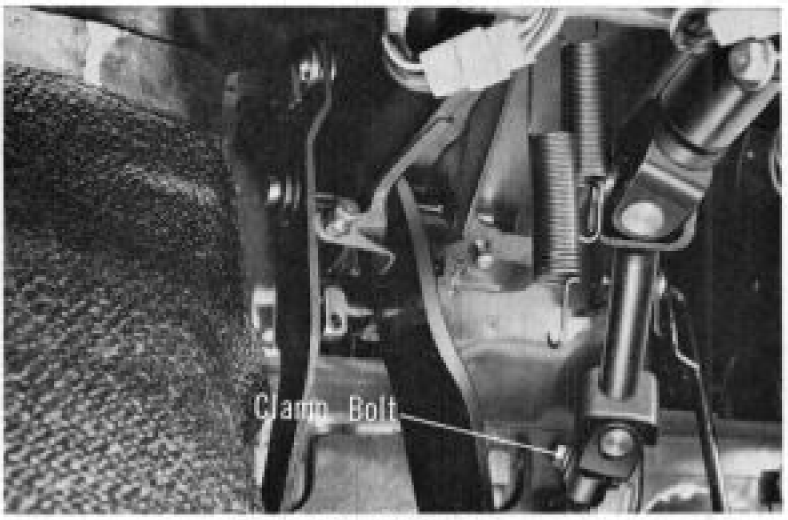


Fig. 10D-3

* Disconnect the steering shaft and pinion gear after dismounting the steering column assembly from the instrument panel.

* Remove the four bolts and separate the steering gear box from the firewall.

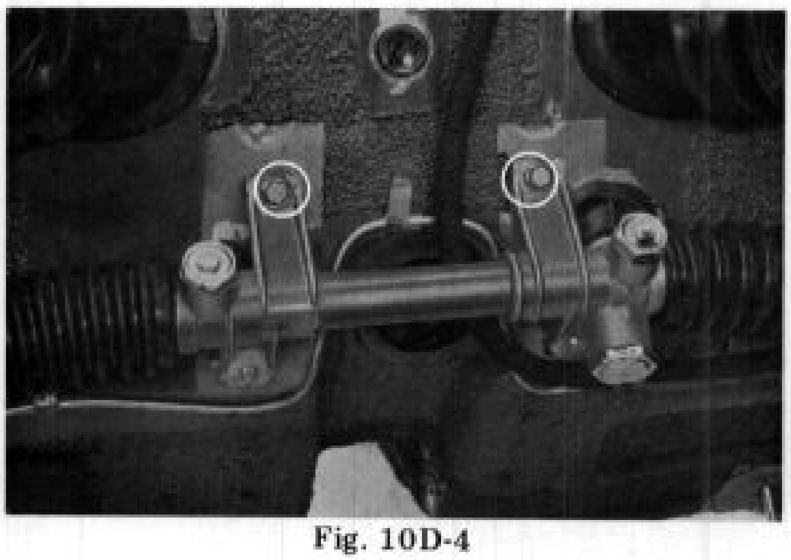


Fig. 10D-4

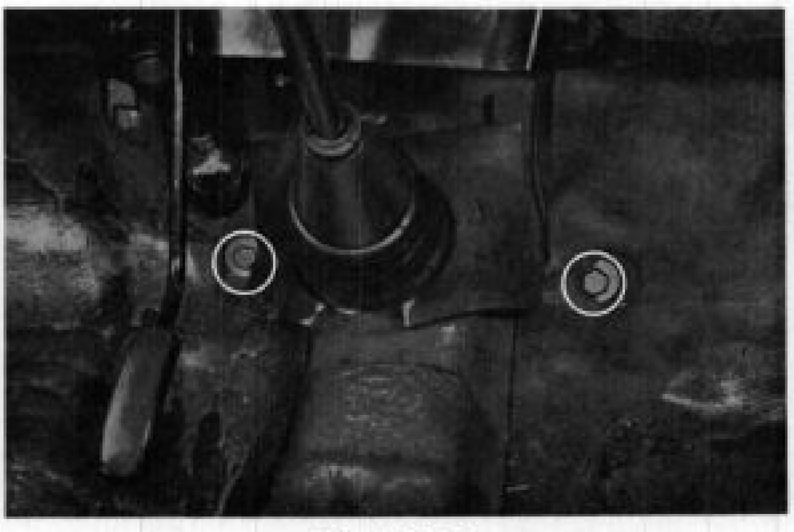


Fig. 10D-5

2. Disassembling steering gear box and steering linkages.

   * Unlock the lock washer and remove the rack end from the rack.

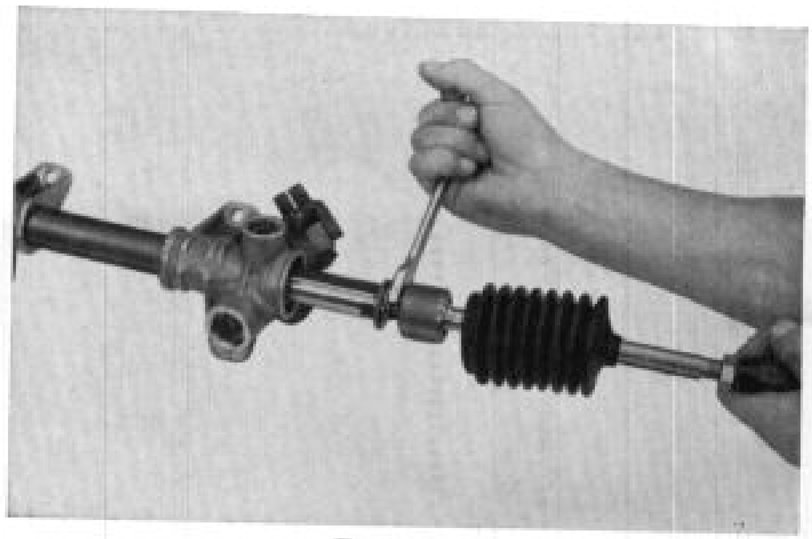


Fig. 10D-6

   * Pull out the rack from the steering gear box.

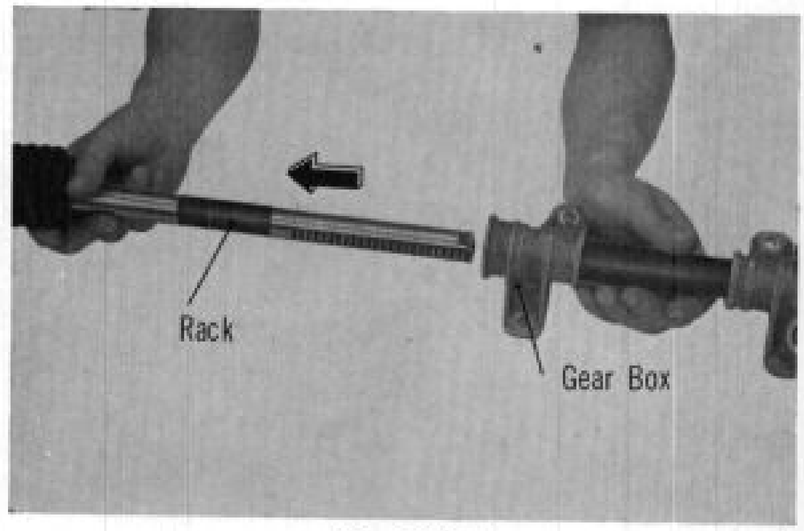


Fig. 10D-7

   * Loosen the lock nut and remove the pinion and rack backlash adjusting bolt.

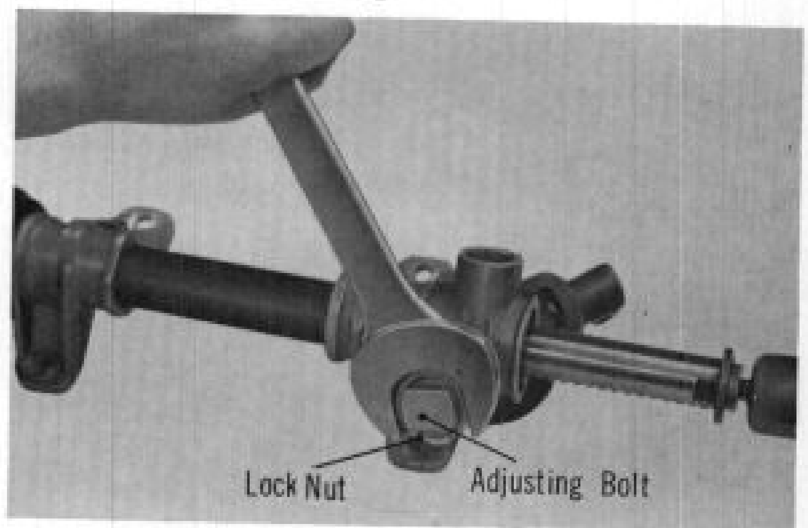


Fig. 10D-8

   * Remove the pinion thrust plate and drive out the pinion gear from the gear box.

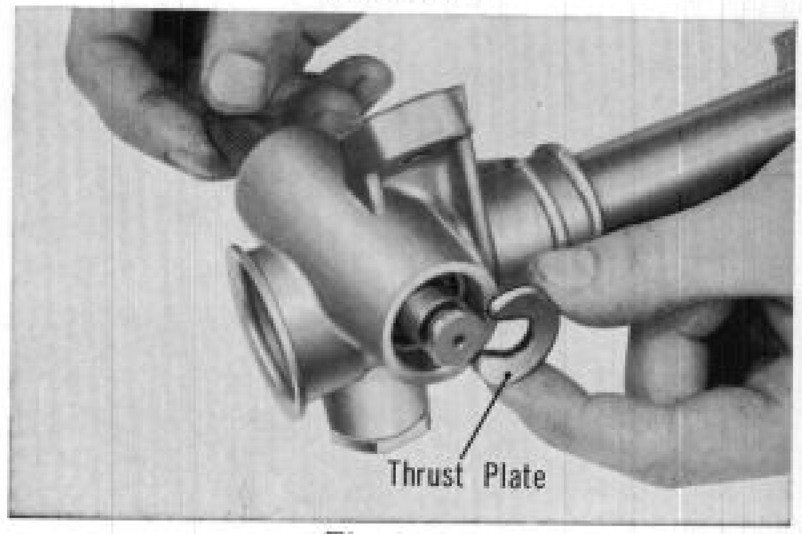


Fig. 10D-9

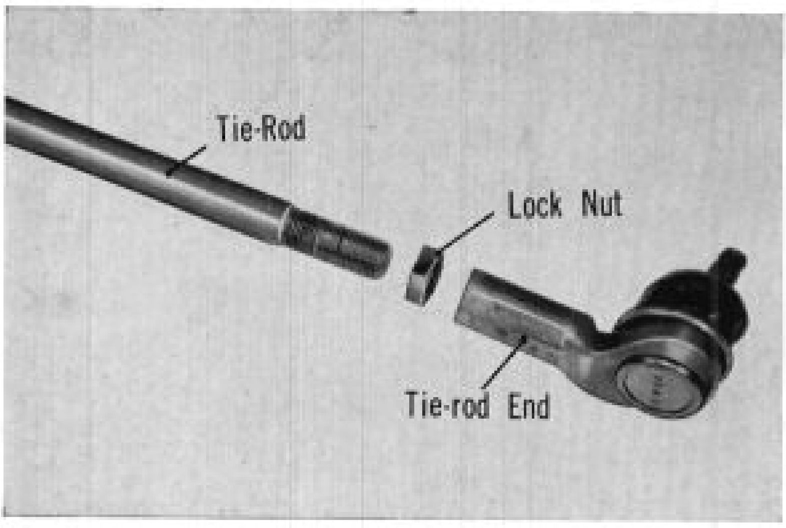


Fig. 10D-10

* Loosen the lock nut and unscrew the tie-rod end.

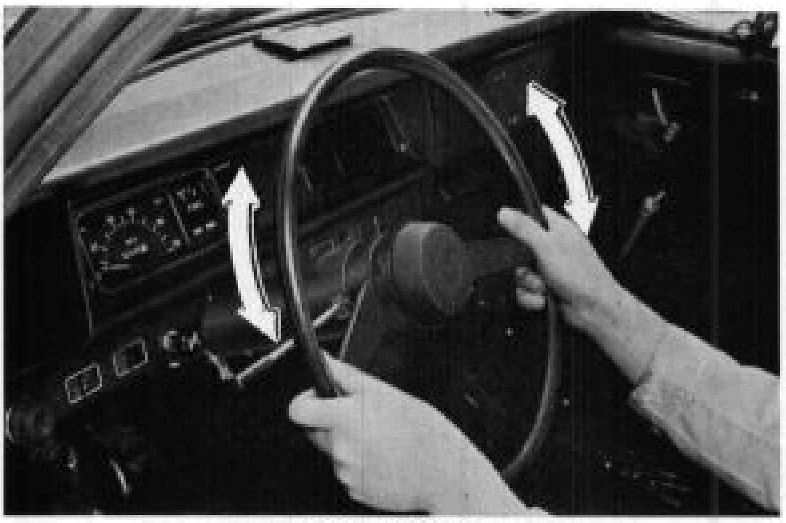


Fig. 10D-11

Inspection

1. When the steering wheel is turned to the left and right with the front wheels straight forward, the distance at the periphery of the steering wheel immediately before the front wheels start to turn is 1 to 3mm (0.04 to 0.12 in).
   If the value is beyond the specification, the probable causes are
   (1) Worn steering shaft universal joints
   (2) Worn steering gears
   (3) Worn steering linkages
   (4) Worn wheel bearings.

2. Check the pinion gear for any play in the axial and the radial directions.
   If axial play is found, check the U-thrust plate (Fig. 10D-9) and the steering gear box for wear and damage.

Fig. 10D-12a

If excessive play exists in the radial direction, check both the pinion gear and the bushing wear. The pinion gear bushing is press fitted in the gear box with damper rubber incorporated. Check the damper rubber for wear, and make a replacement if found excessive.
When replacing the upper pinion gear bushing, always install an oversized cap to hold new pinion gear bushing securely.

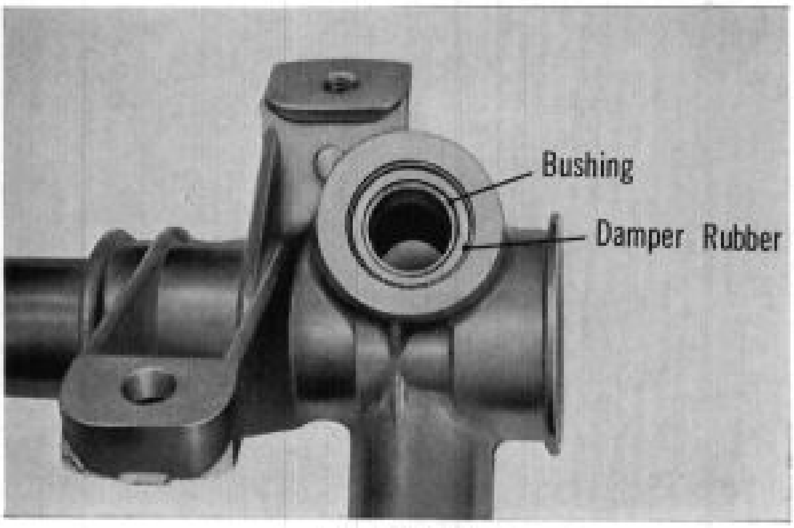


Fig. 10D-12b

3 Jack the front of the vehicle up, place the front wheels straight forward, apply a spring scale to the steering wheel and read the load when the front wheels begin to move.
Standard value: Less than 1.5kg (3.3 lbs).

If the reading value is beyond 1.5 kg, the probable causes are:

(1) Improper pinion gear and rack gear backlash adjustment.
(2) Improper steering column housing positioning. (Fig. 10C-20)
(3) Tight rack end ball joint. (Fig. 10C-14b)

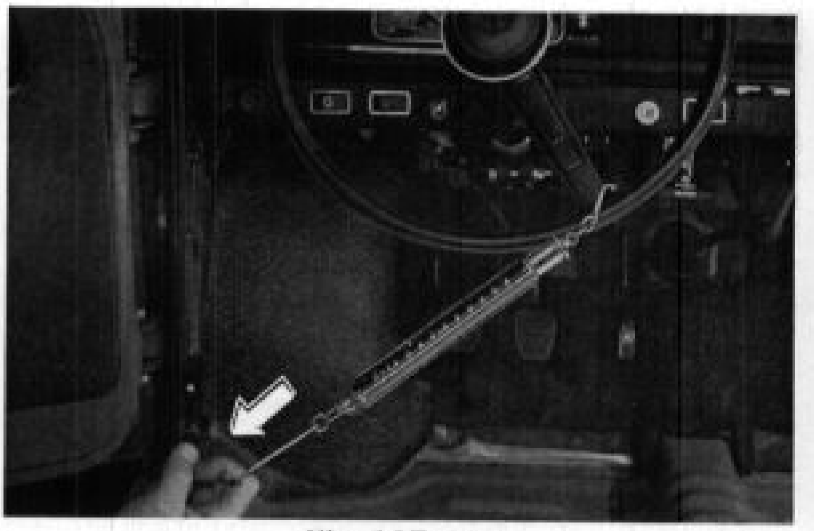


Fig. 10D-13

4. Check the rack end ball joint for looseness on the car as shown. A loose ball joint may cause a rattling noise from the steering gear box.

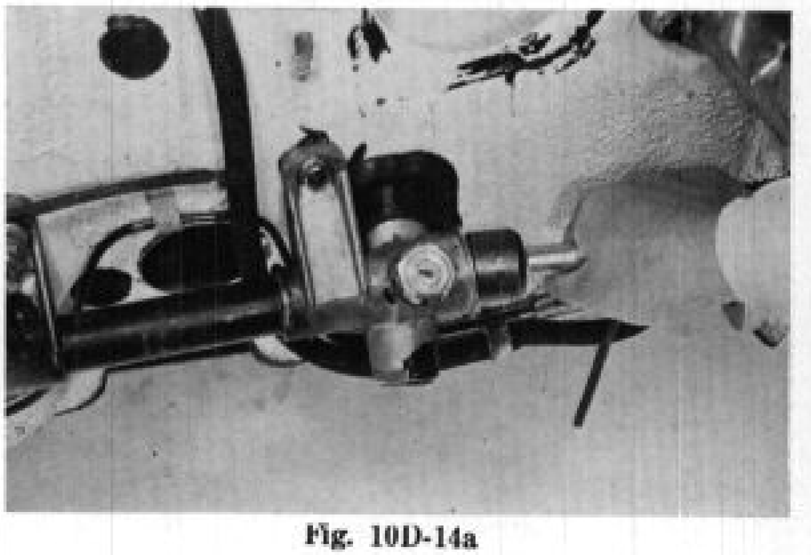


Fig. 10D-14a

5. Inspect the rack end ball joint operation by swinging the tie rod to and fro.
Measure the force required to move the tie rod by means of a spring scale.
Standard reading; 0.26~1.5kg (0.57~3.3 lbs)

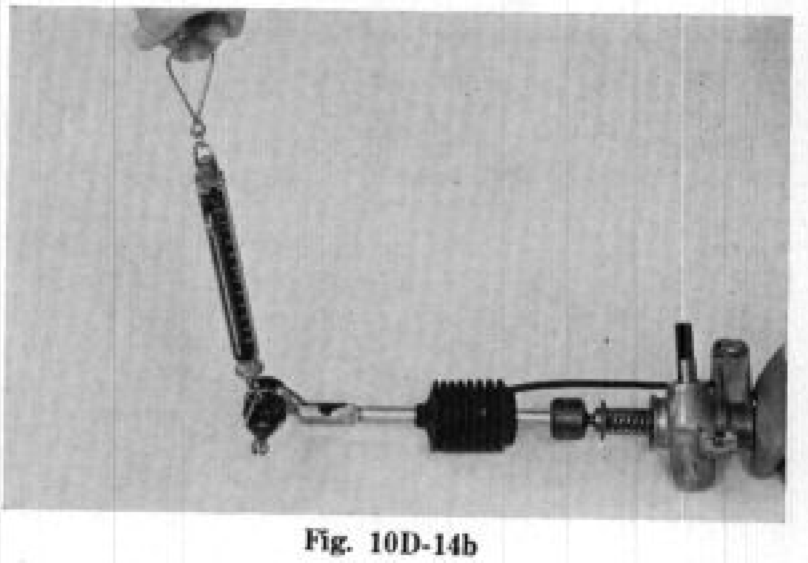


Fig. 10D-14b

6. Check the rack gear bushing for excessive wear. If the play is more than 0.06mm (0.00236 in), rattling noise may develop. Replace the steering gear box with a new part.

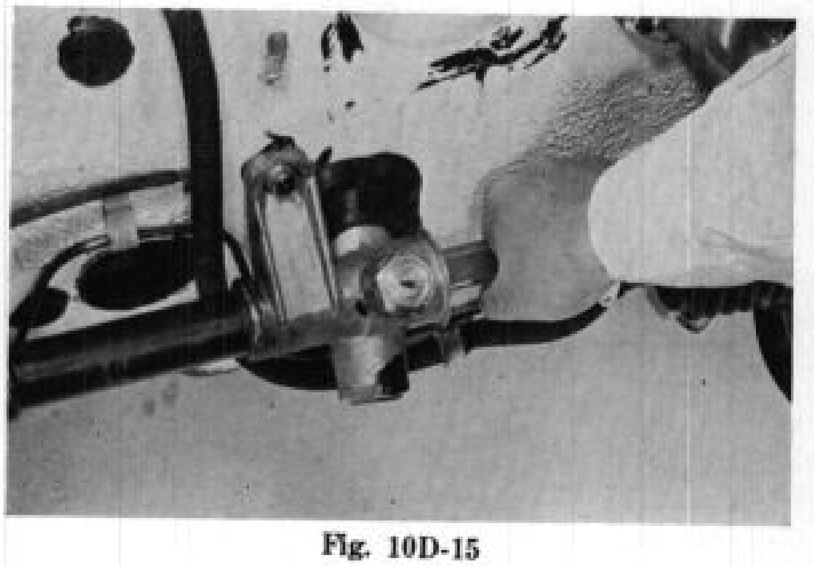


Fig. 10D-15

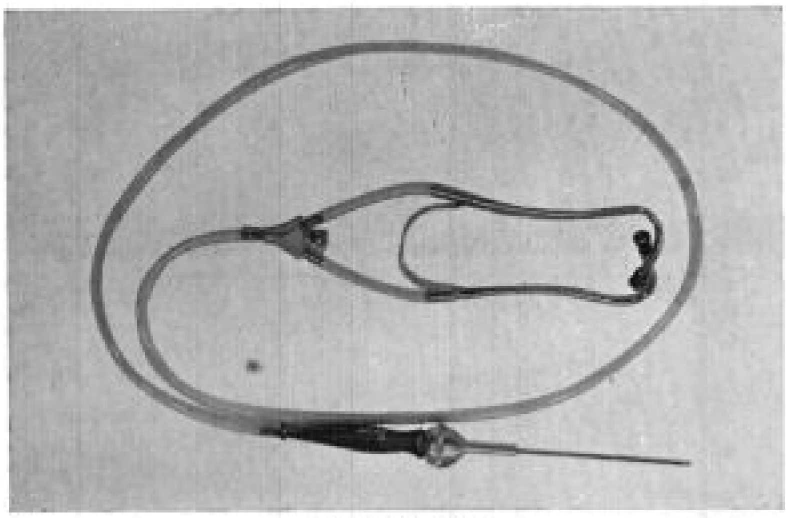


Fig. 10D-16

5. If noise is heard from the steering gear box or around it, locate the exact source of the noise with the sound scope. **(Fig. 10D-16)**

Place the sound scope to the right and left rack adjusting bolts, and check for noise by shaking the rack gear or moving the front wheel to and fro.

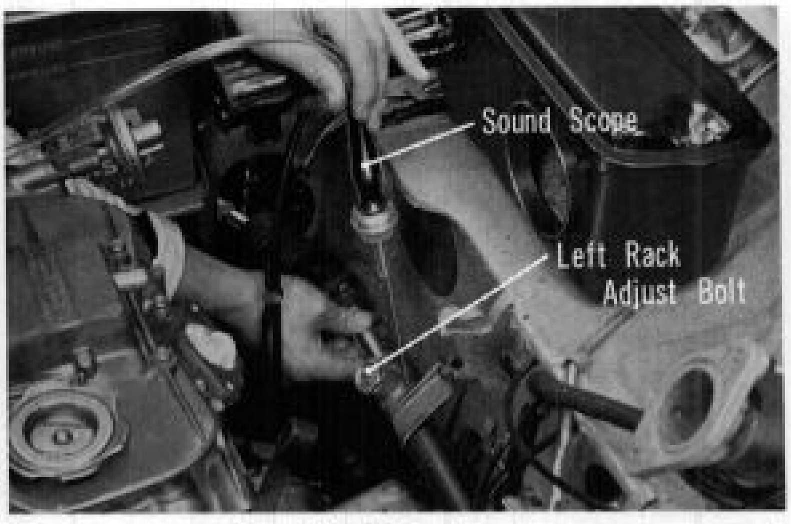


Fig. 10D-17

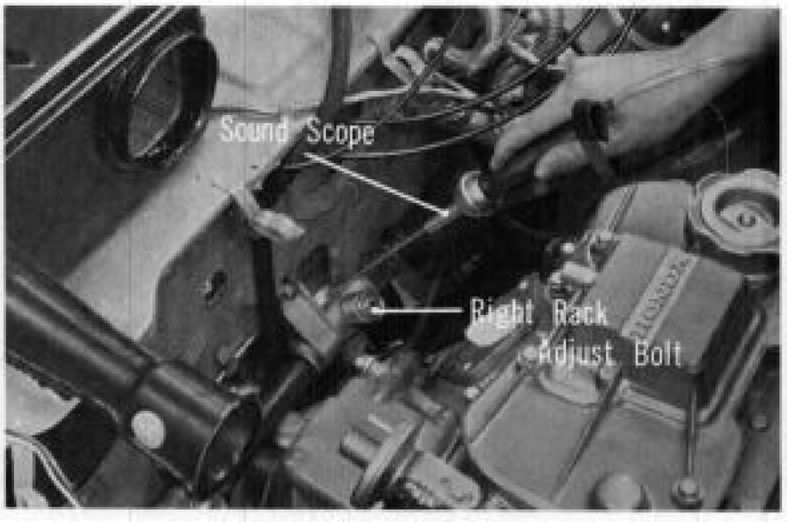


Fig. 10D-18

If the noise exists in these parts, add grease to the gear box through the grease nipple when the steering gear has such nipple; or when nipple is not provided, attach a greasing adapter (special tool) in place of the rack adjusting bolts and supply grease. Turn the steering wheel either to the extreme right for greasing through the right hand side nipple or greasing adapter, or to the extreme left for greasing through the left hand side nipple or greasing adapter. Noise noted in the steering gear box during vehicle running after sufficiently greasing indicates improper adjustment of the rack adjusting bolts or the pinion adjusting bolts. Readjust them by referring to "Assembly".

Fig. 10D-19

Fig. 10D-20

Check the lock plate in the link between the rack end ball joint and the rack gear for looseness; then check the rack end ball joint for noise by means of the sound scope.

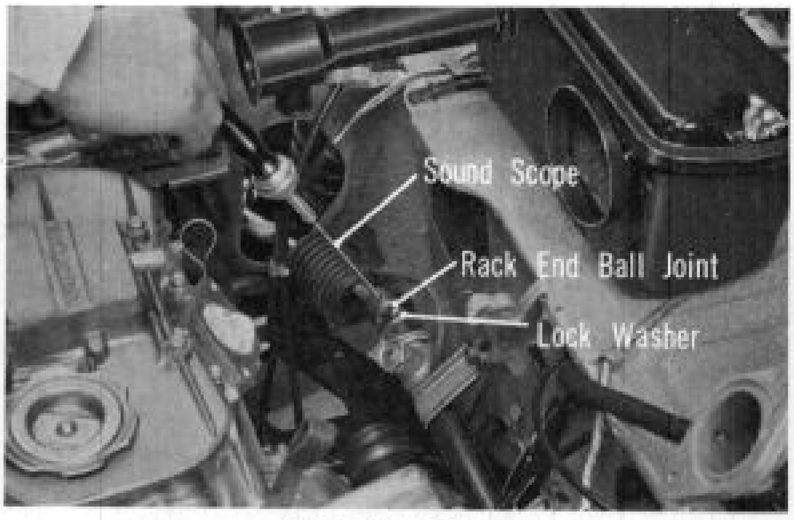


Fig. 10D-21

Assembly

1. Place the pinion in the gear box.
   Grease (graphite grease) the pinion gear, U-thrust plate, and pinion gear mounting bolt.
   The U-thrust plate should be installed with the round-edge-face inward.

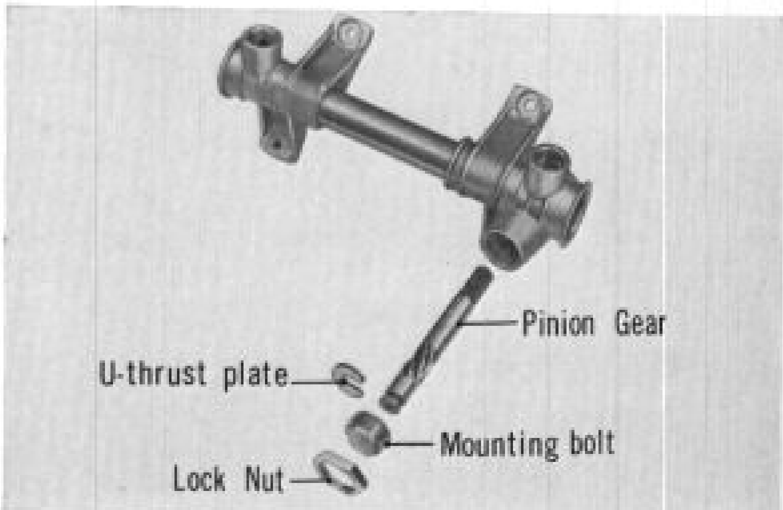


Fig. 10D-22

Tighten the pinion gear mounting bolt and secure with the lock nut.

Note: Do not tighten the lock nut too hard to prevent the damage to the threads of steering gear box.

(Tightening torque) 2.0~2.5kgm (14.5~18.1 lb-ft)

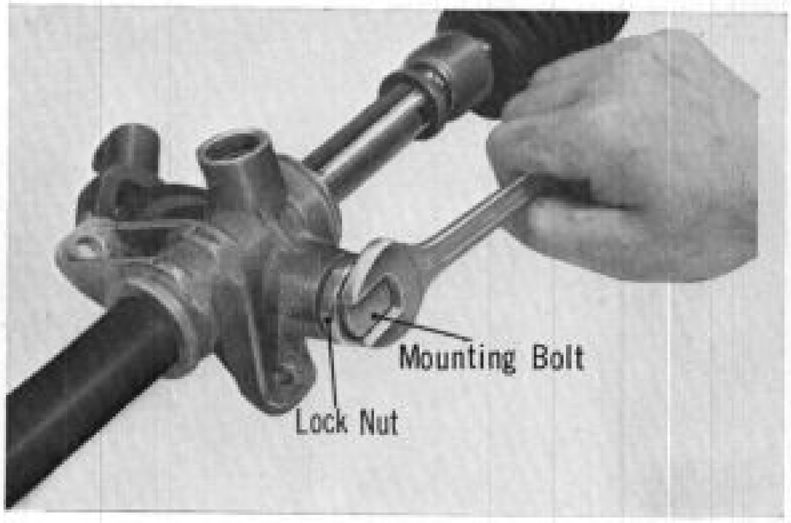


Fig. 10D-23

2. Grease the steering rack and insert it into the gear box.

Fig. 10D-24

3. When rack end is threaded in tightly to the rack, secure with the lock washer. Lock washer should be replaced with a new part when reassembling.

   Note:
   The tongue of the tie-rod lock washer fits to the groove of the rack gear.

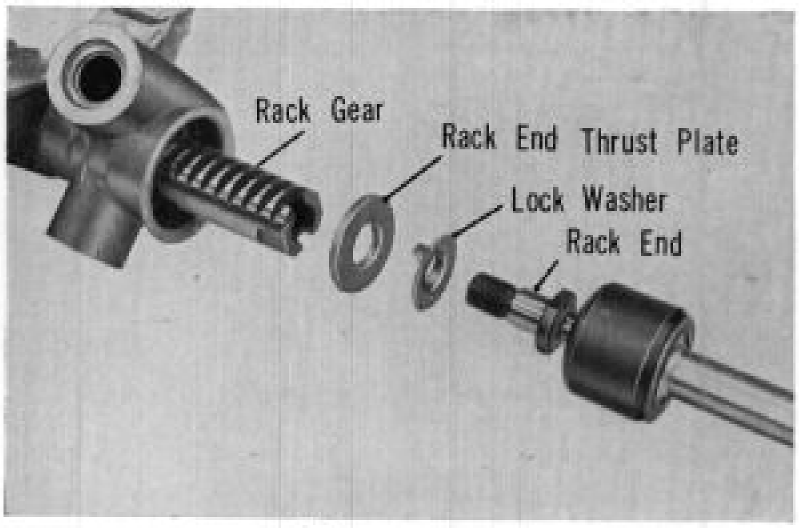


Fig. 10D-25

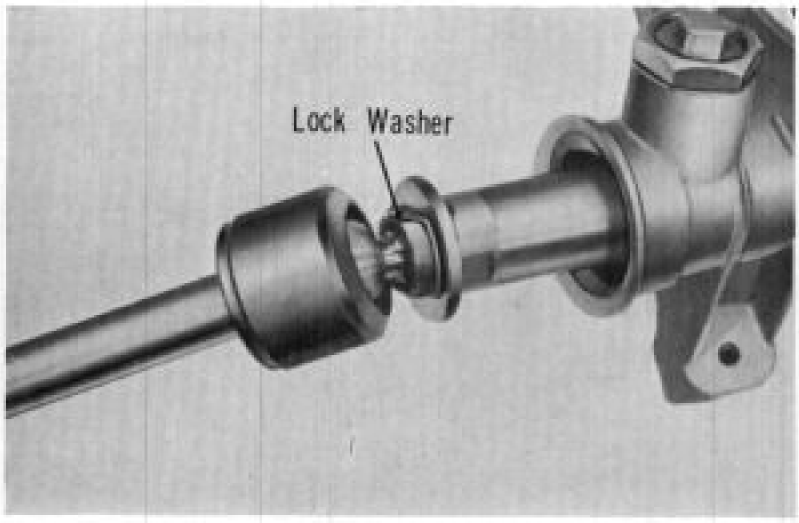


Fig. 10D-26

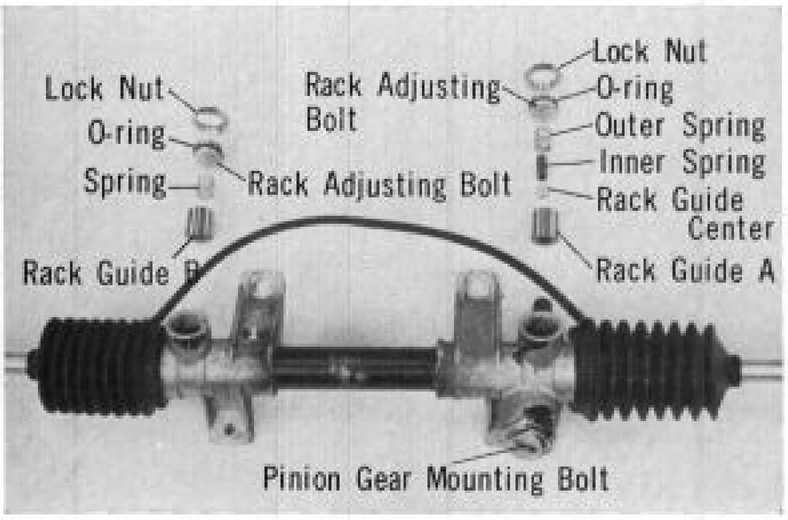


Fig. 10D-27

4. Grease the rack guides A and B and install them into the specified positions with claws toward front.
   Do not interchnage the rack guides. Check the O-rings fitted to the rack adjusting bolts for any damage and deterioration.

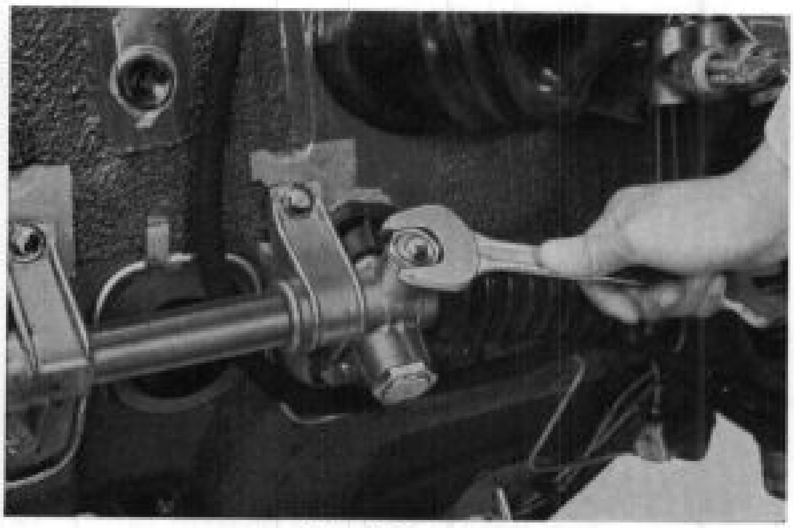


Fig. 10D-28

5. Prior to adjusting rack guide A near the pinion gear, adjust the rack guide B. Tighten the adjusting bolt until it does not rotate and back off the bolt about 20 degrees. This is the correct position. Secure with the lock nut.
   Then, adjust the rack guide A in the same manner.

Note: Do not tighten the lock nuts too hard to prevent damage to the threads of the steering gear box.
Tightening torque: 2.0~2.5kg-m (14.5~18.1 lb-ft)

E. Checking and Adjusting Front Wheel Toe-in

When checking wheel alignment, place the unloaded car on a level surface. It is imperative that all checks of steering linkage for bends, wear, and other damage (spring damage, bent frame wheel distortion, deformed fires, tire pressure, worn wheel bearings, steering gear backlash) be made and faults corrected before performing this test. If these checks are not made in advance, no accurate test of the wheel alignment can be made.

1. Checking Toe-In

Set the front wheels in the straight ahead position. Chalk a mark line at the center of each front tire and measure distance between the chalked lines. Turn wheels 180 degrees and measure the distance at the rear. Toe-in equal (rear measured value) — (Front measured value)

The standard value of the toe-in is −2mm (−0.08 in) OUT.

2. Adjustment

Toe-in can be adjusted by loosening the lock nuts at each of the ties rods. To increase toe-in, turn the right tie-rod in the direction of wheel rotation when the car moves forward; turn the left tie-rod in the opposite direction. Turn both tie-rods an equal amount until toe-in becomes −2mm.

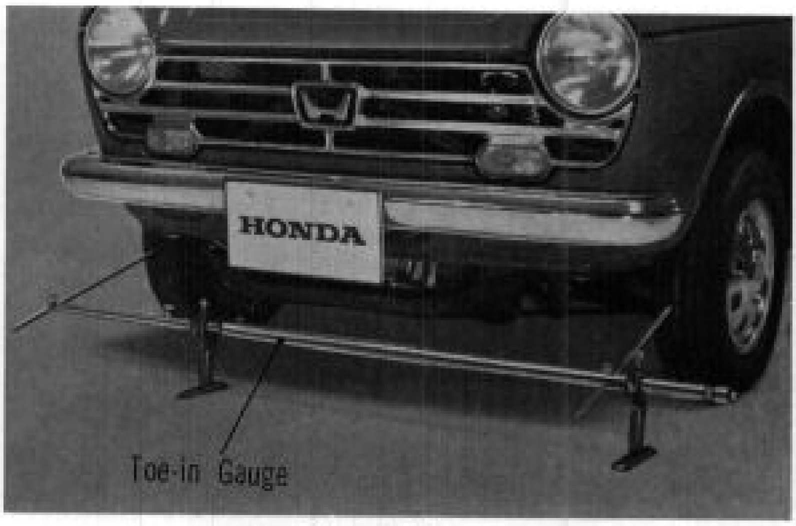


Fig. 10E-1

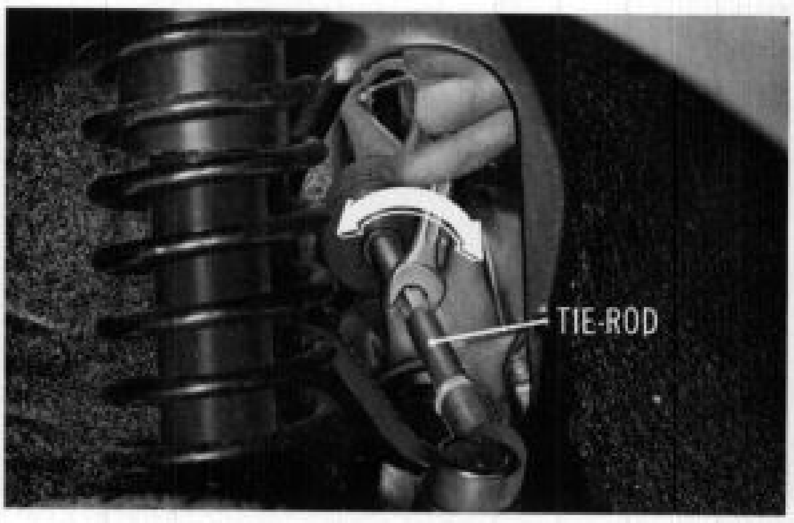
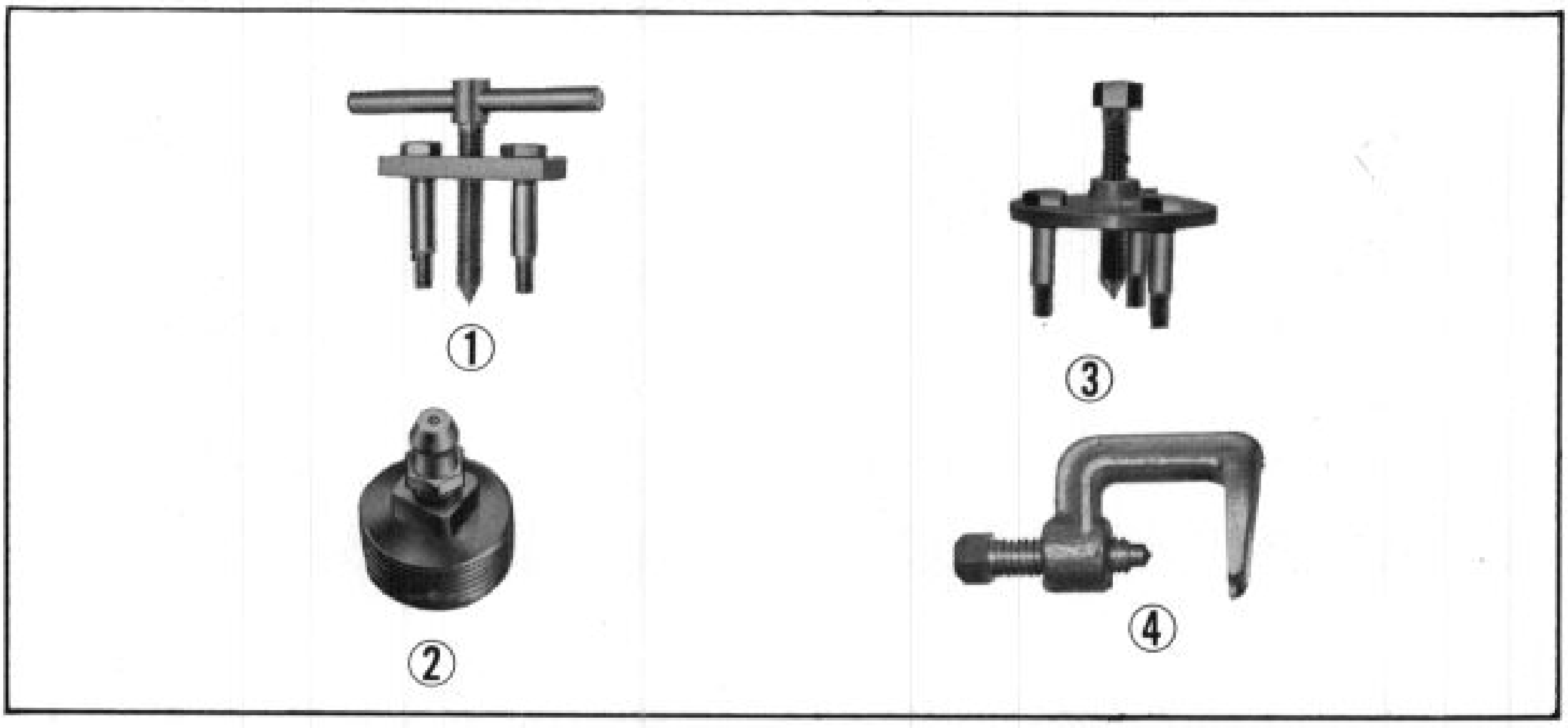


Fig. 10E-2

F. Special Tool



Ref. No.	Tool No.	Description
1	07010-51201	Steering wheel puller A
2	07019-51201	Steering wheel puller B
3	07099-56801	Greasing adapter (Optional)
4	07092-55103	Tie-rod end puller

G. Trouble Diagnosis

(a) Hard steering and poor return steering

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Insuffcent tire pressure	Correct fron tire pressure to 1.7kg/cm^2 (24 psi) for standard tire and 1.8kg/cm^2 (26 psi) for radial tire
2. Incorrect front wheel alignment	Correct fron wheel alignment. Toe-in: −2mm (−0.08in) (Toe "OUT" 2mm) Camber: 0.5° Caster: 1.0°
3. Incorrect adjustment of the rack adjusting bolts	Readjust
4. Improper steering column housing position.	Reposition the column housing so that there is 0~0.2mm (0.008in) play in the aixal direction between the steering column and the column housing.
5. Tight rack end ball joints and/or tie-rod end ball joints.	These ball joints will be somewhat tight when new, but will become smooth after mileage of about 3000km (1800 miles).
6. Worn pinion gear bushing damper rubber.	Replace the pinion gear bushing.

(b) Steering gear box chuckles or rattles

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Insufficient amount of grease inside gear box.	Add grease. Refer to section "steering gear box" for detail.
2. Improper adjustment of rack adjusting bolts and pinion gear adjusting bolt.	Readjust.
3. Loose linkage between rack gear and rack end ball joint.	Tighten and secure with new lock washer.
4. Worn rack end ball joint.	Replace with new ball joint. Make sure the front wheel alignment is correct.

(c) Excessive wheel return or loose steering

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Lash in steering shaft univershal joints.	Select-assemble the lock plates of the trunnion caps, or install wave springs inside the trunnion caps.
2. Incorrect front wheel alignment.	Adjust to specified value.
3. Loose wheel bearings.	Replace with new parts.
4. Worn rack end ball joints and/or tie-rod end ball joint.	Replace with new parts.
5. Loose rack end and rack linkage.	Tighten and secure with new lock washer.

(d) Steering column vibrates

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Excessive play between steering column and column bushings.	Replace with new part.
2. Loose steering column mount.	Mount securely with four bolts.
3. Loose steering wheel mount.	Tighten the nut to a torque of 3 to 3.5kg-m (21.7~25.3 ft-lbs)
4. Excessive lash in the steering shaft universal joints.	Select-assemble the lock plates of the trunnion caps, or install waves springs inside the trunnion caps.

(e) Car leads to one side

POSSIBLE CAUSE	CORRECTIVE ACTION
Incorrect wheel alignment	Adjust

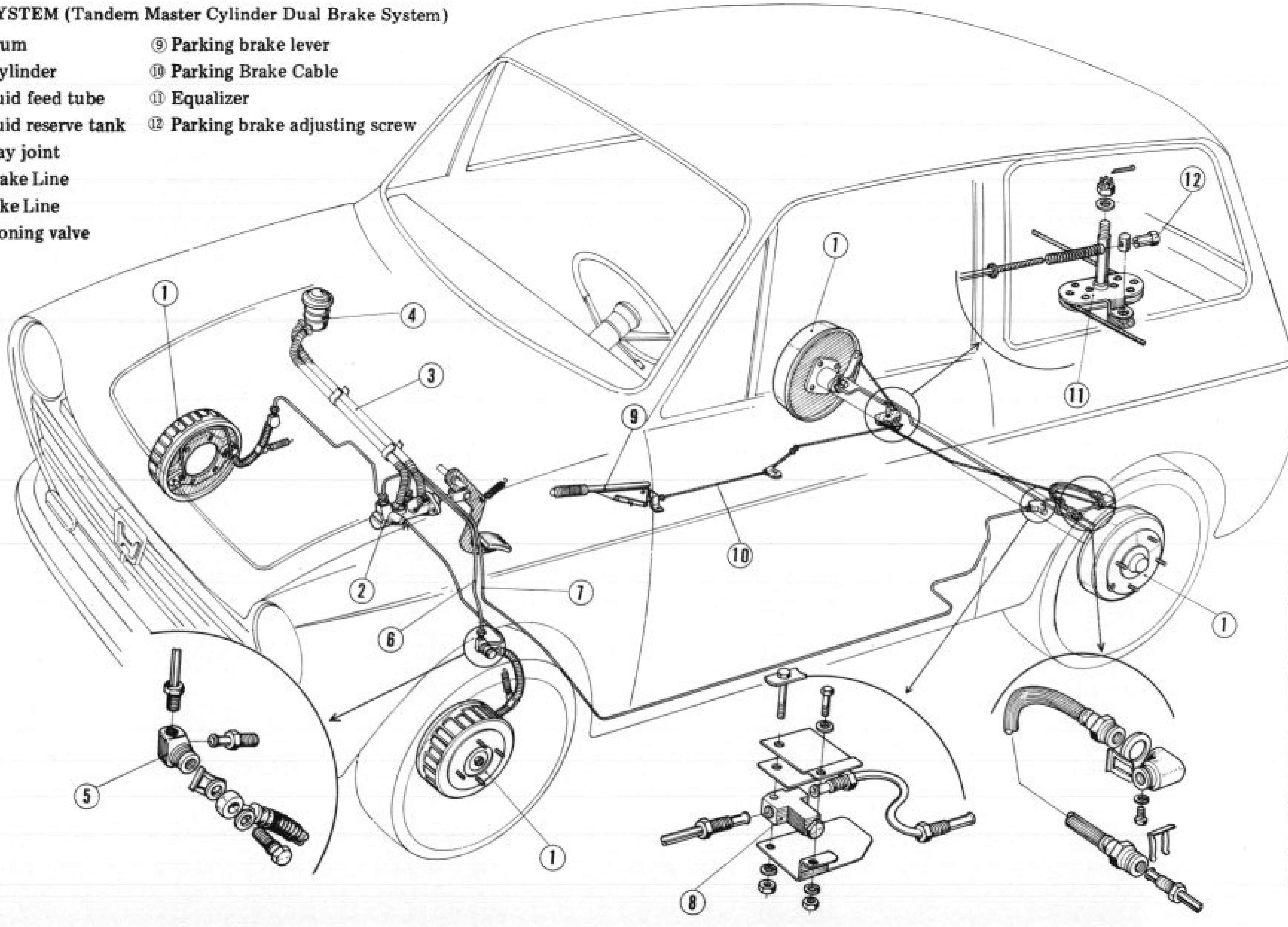
SECTION 11

BRAKES AND WHEELS

11

BRAKE SYSTEM (Tandem Master Cylinder Dual Brake System)

① Brake drum
② Master cylinder
③ Brake fluid feed tube
④ Brake fluid reserve tank
⑤ Three-way joint
⑥ Front brake Line
⑦ Rear brake Line
⑧ Proportioning valve
⑨ Parking brake lever
⑩ Parking Brake Cable
⑪ Equalizer
⑫ Parking brake adjusting screw



A. General Description

The HONDA N-series sedans and vans incorporate two different brake systems. The first type is the single brake system which is used on the 360,400, and 600 vehicles not exported to the U.S., European countries, or Australia.

The second type is a dual brake system which offers inproved driving safety because the front and rear brake function independently and one system remains in operaiton if the other one fails. This dual brake system is utilized on the 600 series exported to the U.S., European countries, and Australia.

The dual brake system vehicles are divided into the following three types.

1. Parallel master cylinder vehicles
   Chassis No. N600-1000001~1010298
2. Tandem master cylinder vehicles
   Chassis No. N600-1010299~
3. Tandem master cylinder vehicles with a booster
   Chassis No. N600-1013096~

The leading/trailing type drum brake is employed for rear wheel braking on all models, and either the leading/trailing drum brake, two-leading type drum brake, or disk brake for front wheel brakes.

The parallel type master cylinder N600 is equipped with a bypass valve to balance the effect between the front and rear wheels during sudden braking.

All vehicles delivered to the United States are equipped with a warning lamp on the instrument panel. The lamp is positioned so that it can be easily observed, and it lights up on occurrence of a brake system defect. The dealers are advised to have the customer check to insure that the lamp is not lighted, and the dealer himself should verify this at regular inspections intervals.

B. Technical Data

(DRUM BRAKES) Unit: mm (inch)

MODEL	Drum inside diameter (Front and rear)		Shoe lining	
	Nominal	Serviceable limit	Front	Rear
360	180 (7.087)	181 (7.126)	Leading/Trailing 141.5×35×5–198 sq cm (5.56×1.38×0.20–31.54 sq in)	Leading/Trailing 141.5×35×5–198 sq cm (5.56×1.38×0.20–31.54 sq in)
400 600	180 (7.087)	181 (7.126)	Two Leading 141.5×35×5–198 sq cm (5.56×1.38×0.20–31.54 sq in)	

(DISK BRAKES)

Disk Diameter		
(outdise)	182 mm	(7.17 in)
(inside)	94 mm	(0.37 in)
Disk Thickness	9.5 mm	(0.374 in)
Caliper cylinder Bore Diameter	42.85 mm	(1.688 in)
Lining Pad Area	18.7 sq-cm (2.89 sq-in) Per segment	
Lining Pad Thickness		
(nominal)	10.3 mm	(0.406 in)
(serviceable limit)	2.0 mm	(0.079 in)

(MASTER CYLINDER)

MODEL		Bore diameter
		Front and Rear
360 and 400		19mm (0.748 in.)
600 (Single)		19mm (0.748 in.)
600 (Dual)	Parallel	14mm (0.551 in.)
	Tandem	19.05mm (0.750 in.)

(WHEEL CYLINDER)

Bore diameter	
Front	Rear
25.40mm (1.0000 in.)	14.29mm (0.5626 in.)
	15.87mm (0.6248 in.) for the U.S.

Tightening Torque

Front Wheel Hub Nut		
(20 mm)	14~20 kg-m	(101~145 lb-ft)
(22 mm)	14~20 kg-m	(101~145 lb-ft)
Rear Wheel Hub Nut	10~12 kg-m	(73~ 87 lb-ft)
Disk Brake Hub-to-knuckle	5~6 kg-m	(37~ 44 lb-ft)
Disk Brake Caliper Mounting Bolt	5.5~6.0 kg-m	(40~ 44 lb-ft)
Brake pipe	1.8~2.0 kg-m	(13~114 lb-ft)
Rear Brake Hose	2.0~2.4 kg-m	(15~18 lb-ft)

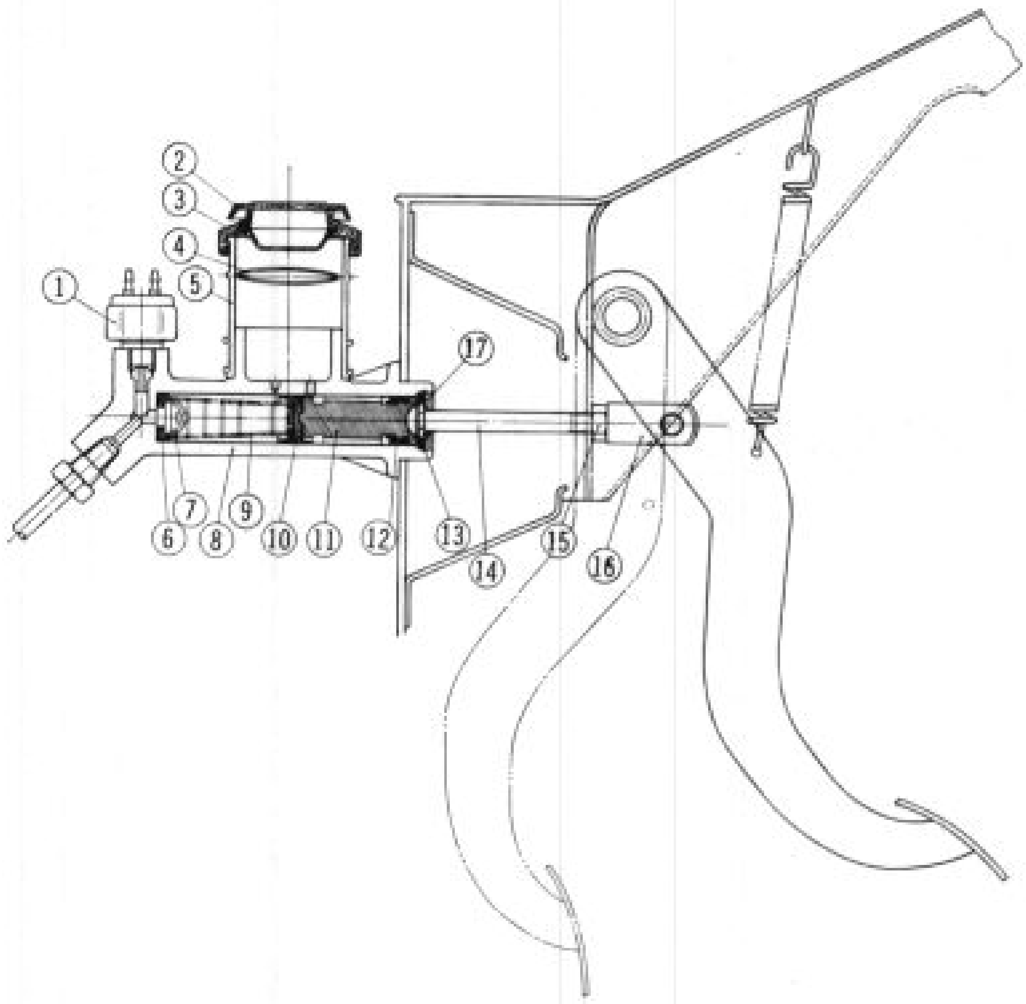
C. Master Cylinder

Description

The master cylinder piston is joined to the brake pedal by the push rod. Force on the brake pedal is doubled mechanically because of the linkage and is applied to the piston.

The brake fluid reservoir is made of a clear material so that the fluid level can be readily observed.

The pressure-actuated stop switch is installed on the end of the master cylinder and is operated by fluid pressure to close the contact which completes the stop light circuit.



① Stop switch	⑦ Check valve	⑬ Circlip
② Reservoir cap	⑧ Cylinder body	⑭ Push-rod
③ Reflector	⑨ Return spring	⑮ Lock nut
④ Float	⑩ Primary cup	⑯ Clevis
⑤ Brake fluid reservoir	⑪ Piston	⑰ Dust seal
⑥ Check valve seat	⑫ Secondary cup	

Fig. 11C-1 Brake master cylinder and linkage.

(Single Brake System)

There are five types of master cylinders differing according to vehicles; model 360 and 400 vehicle employ a single-cylinder master cylinder since they use a drum type single brake system: while the 600 vehicle is manufactured in two models, one employing a single brake system, the other a dual brake system, itself further classified into the drum brake and disk brake. The master cylinder for the drum brake and that for the disk brake differ in construction of the check valve (Fig. 11C-1 No. 7) housed in the master cylinder. The check valve for the drum brake is designed to provide a residual pressure to prevent vapor lock caused by air mixed in the brake fluid, while the check valve for the disk brake is not designed to provide a residual pressure to make a complete release of the disk brake.

600 vehicles having a dual brake system and bearing a chassis No. from N600-1000001 to N600-1010298 are equipped with parallel master cylinder, and those bearing a chassis No. N600-1010299 and above are equipped with a tandem master cylinder.

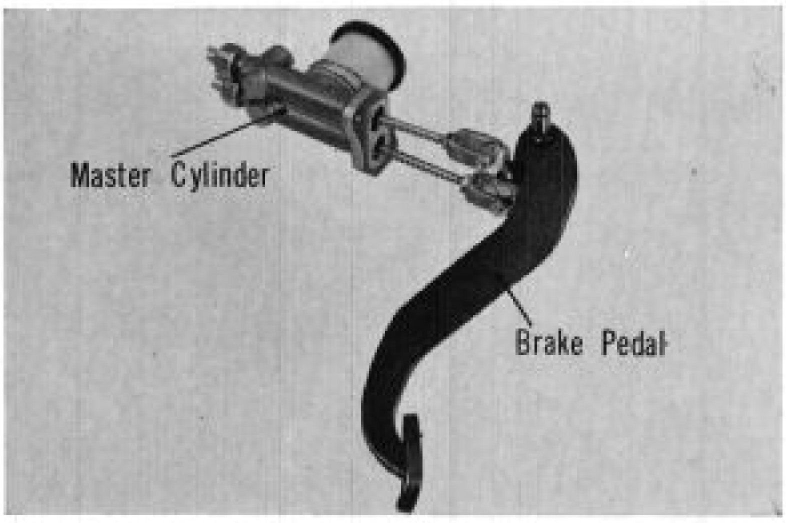


Fig. 11C-2

(parallel master cylinder)

The front and rear master cylinders are arranged as a unit in parallel. The pedal linkage consists of two push rods connected by the equalizer, which is installed on the brake pedal and serves to balance the braking force applied on the front and rear wheel.

(Tandem master cylinder)

Arranged end to end in the same cylinder, the primary piston and the floating secondary piston operate synchronously to cause independent actuations of the front and rear brakes. The tandem master cylinder has no equalizer.

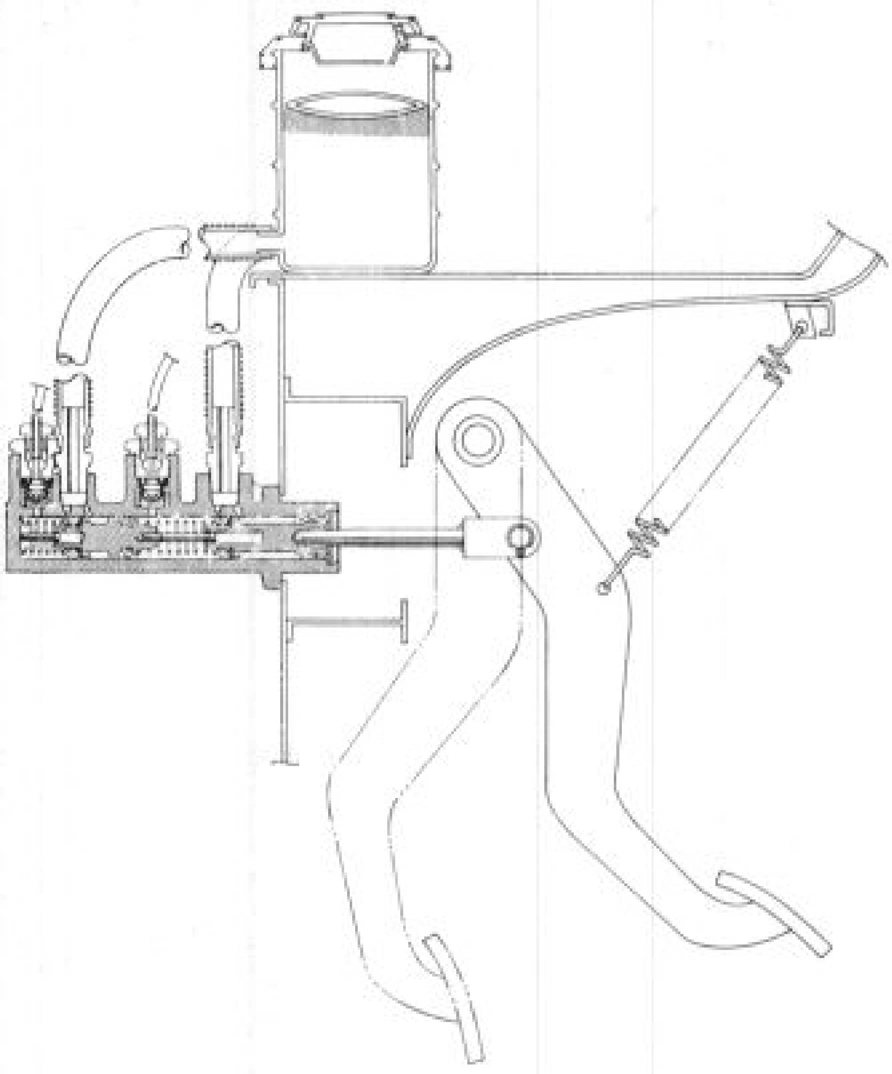


Fig. 11C-3

Removal and Disassembly

1. Disconnect the brake pedal and the master cylinder push rod by removing the lock pin (Fig. 11C-4). For the parallel type master cylinder, disconnect the equalizer link and the master cylinder push rod by removing the lock pin.

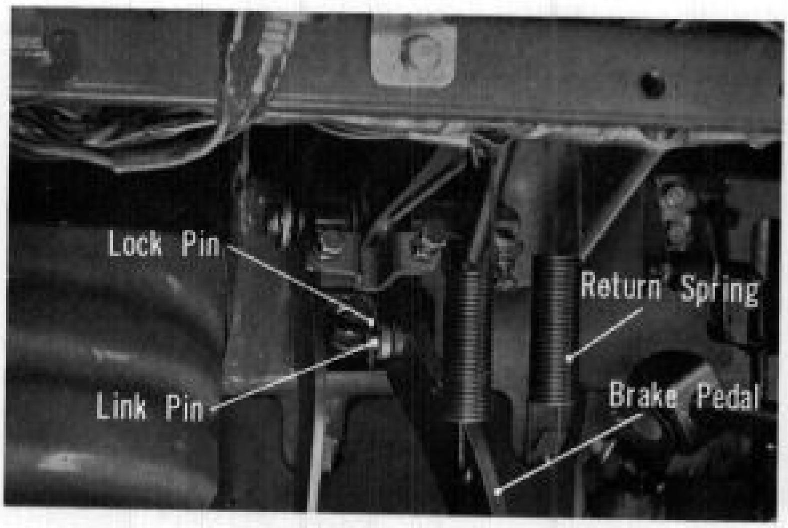


Fig. 11C-4

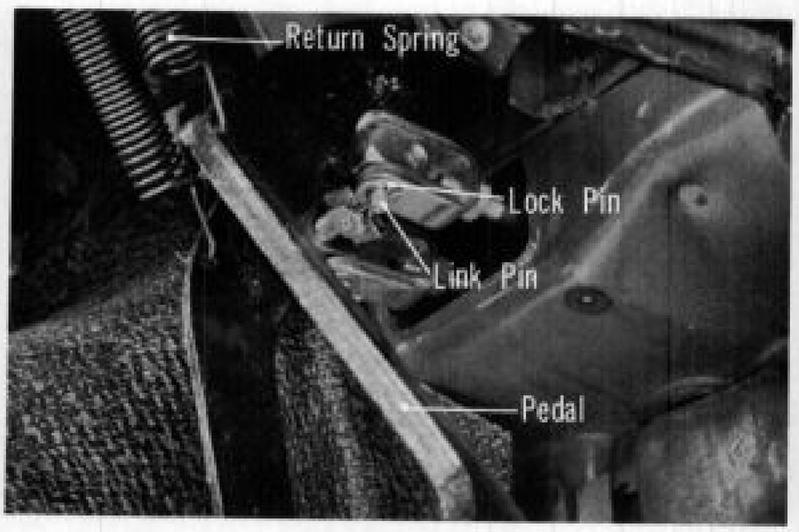


Fig. 11C-5

2. Disconnect master cylinder electrical wiring, and remove the brake fluid pipe connecting the wheel and the master cylinder, and the pipe connecting the reservoir and the master cylinder on the master cylinder side. Remove the mounting master cylinders bolts.

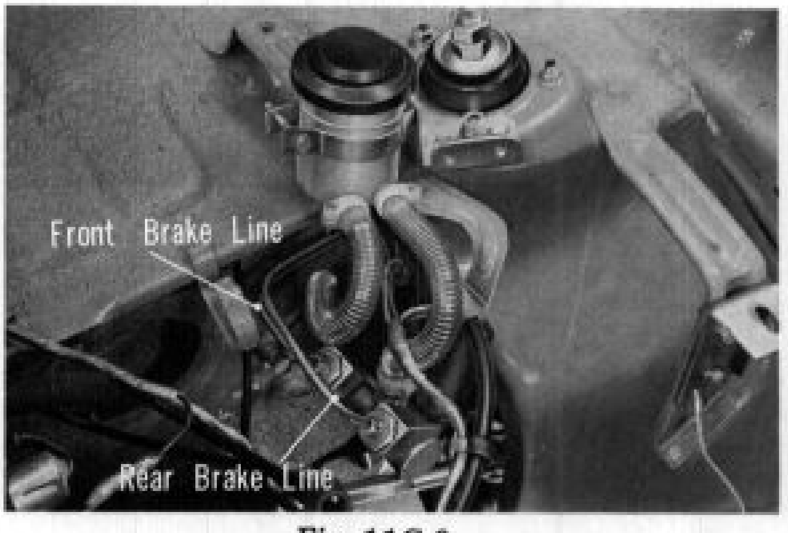


Fig. 11C-6

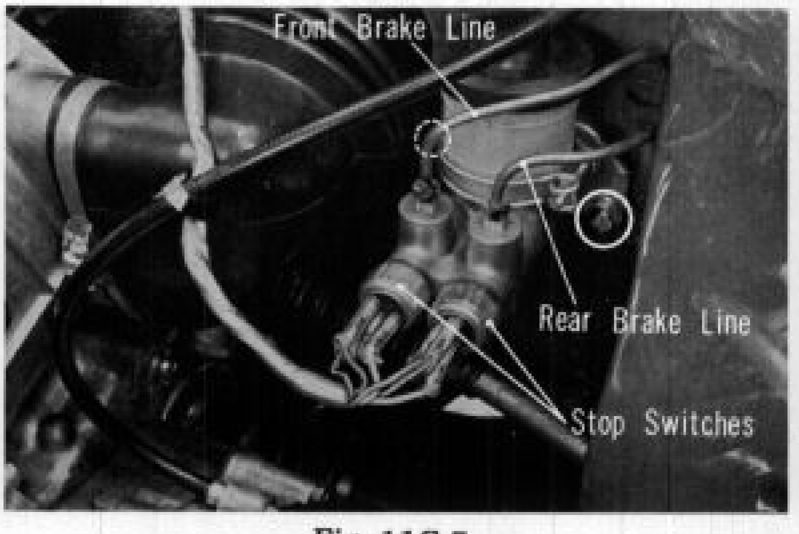


Fig. 11C-7

3. Remove the circlip and extract the push rod, piston, return spring and check valve from the cylinder body. For the tandem type master cylinder, the push rod can be extracted without removing the circlip.

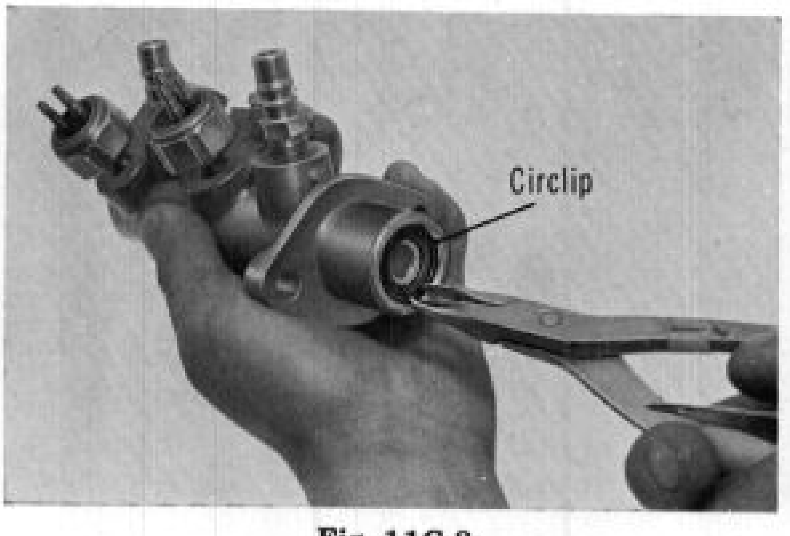


Fig. 11C-8

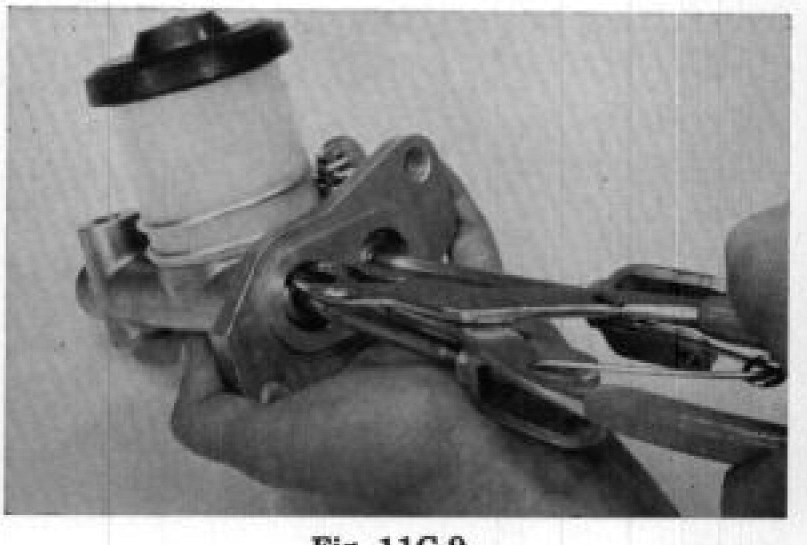


Fig. 11C-9

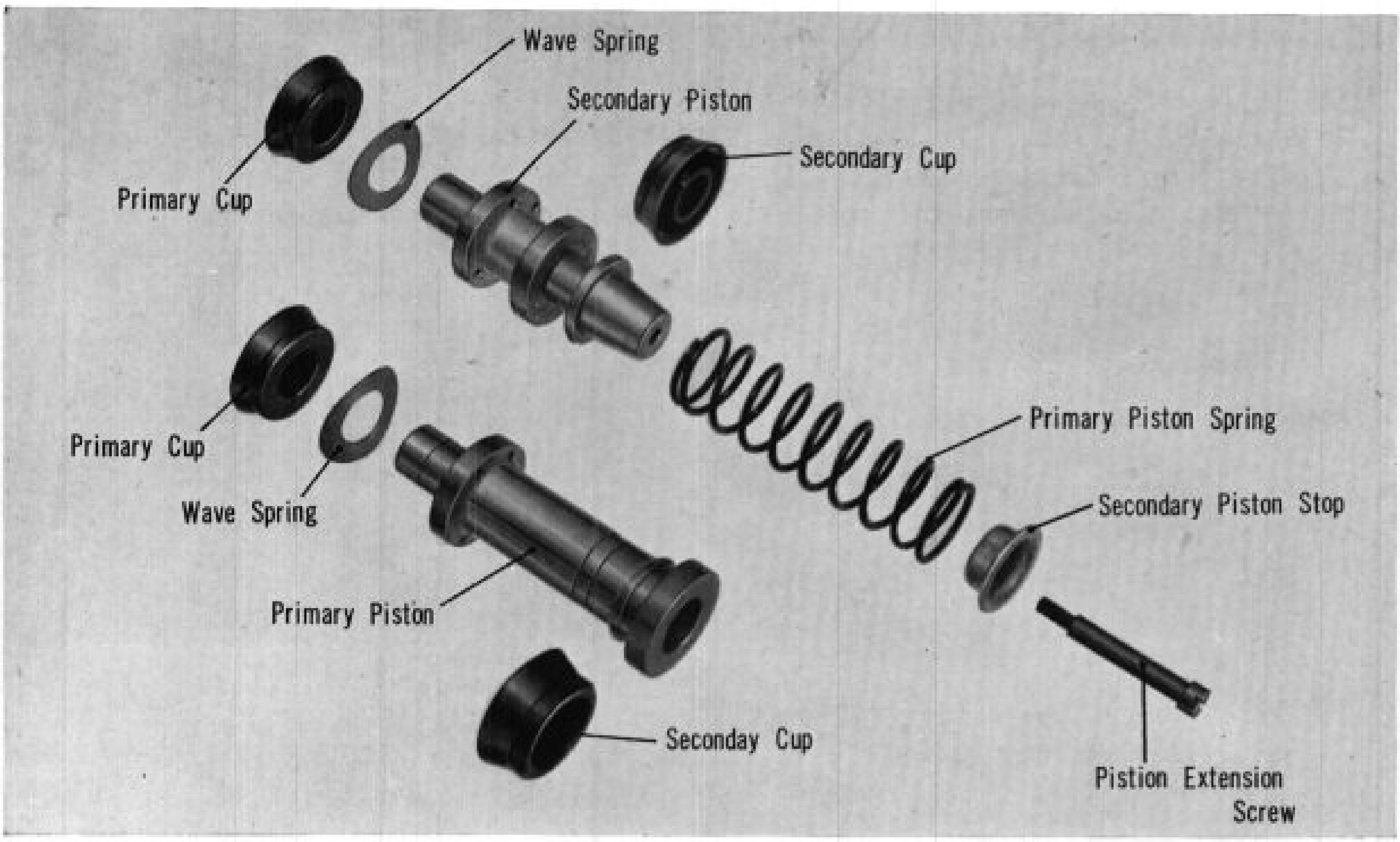


Fig. 11C-10 Tamdem Master Cylinder Piston

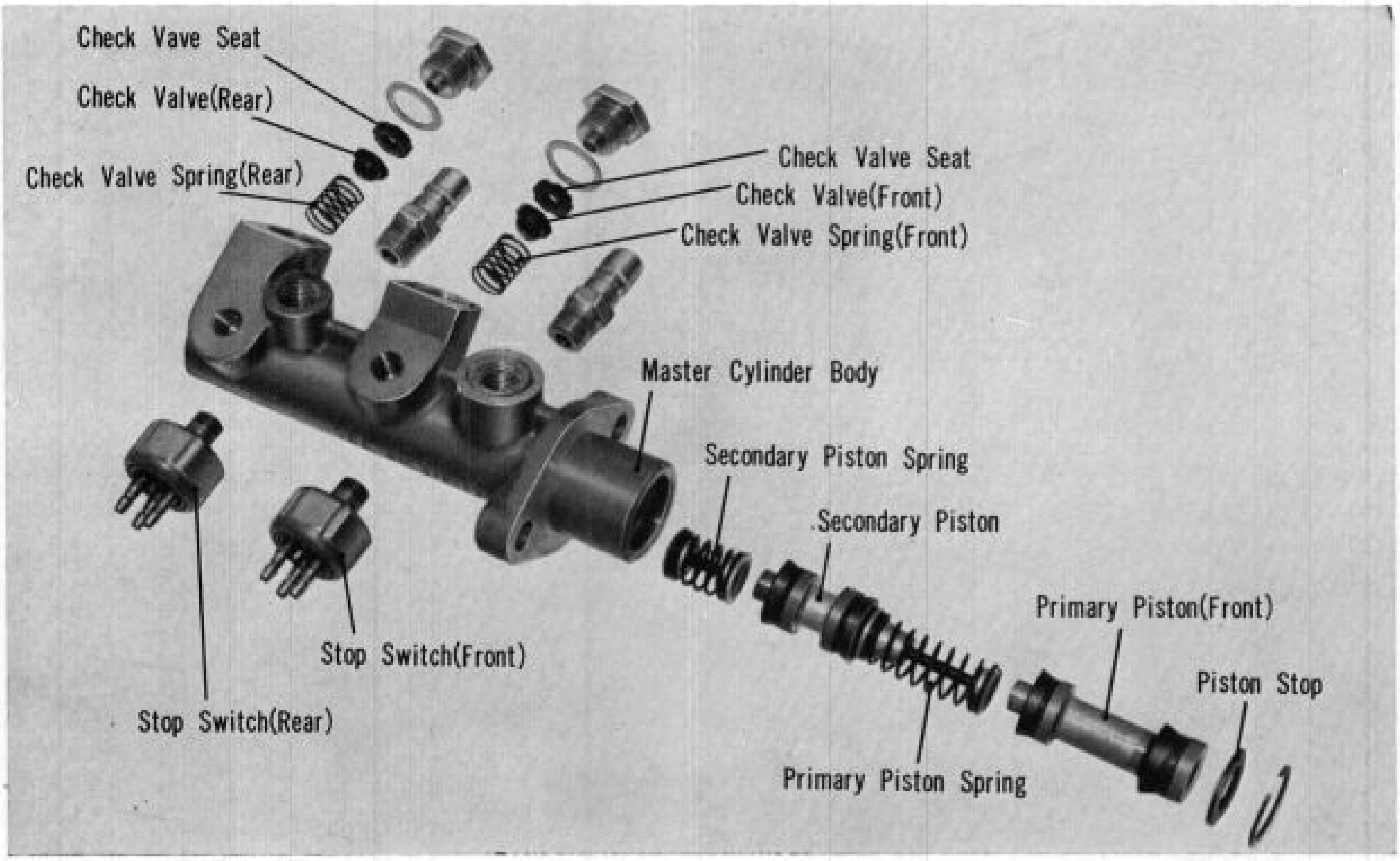


Fig. 11C-11 Tandem Master Cylinder

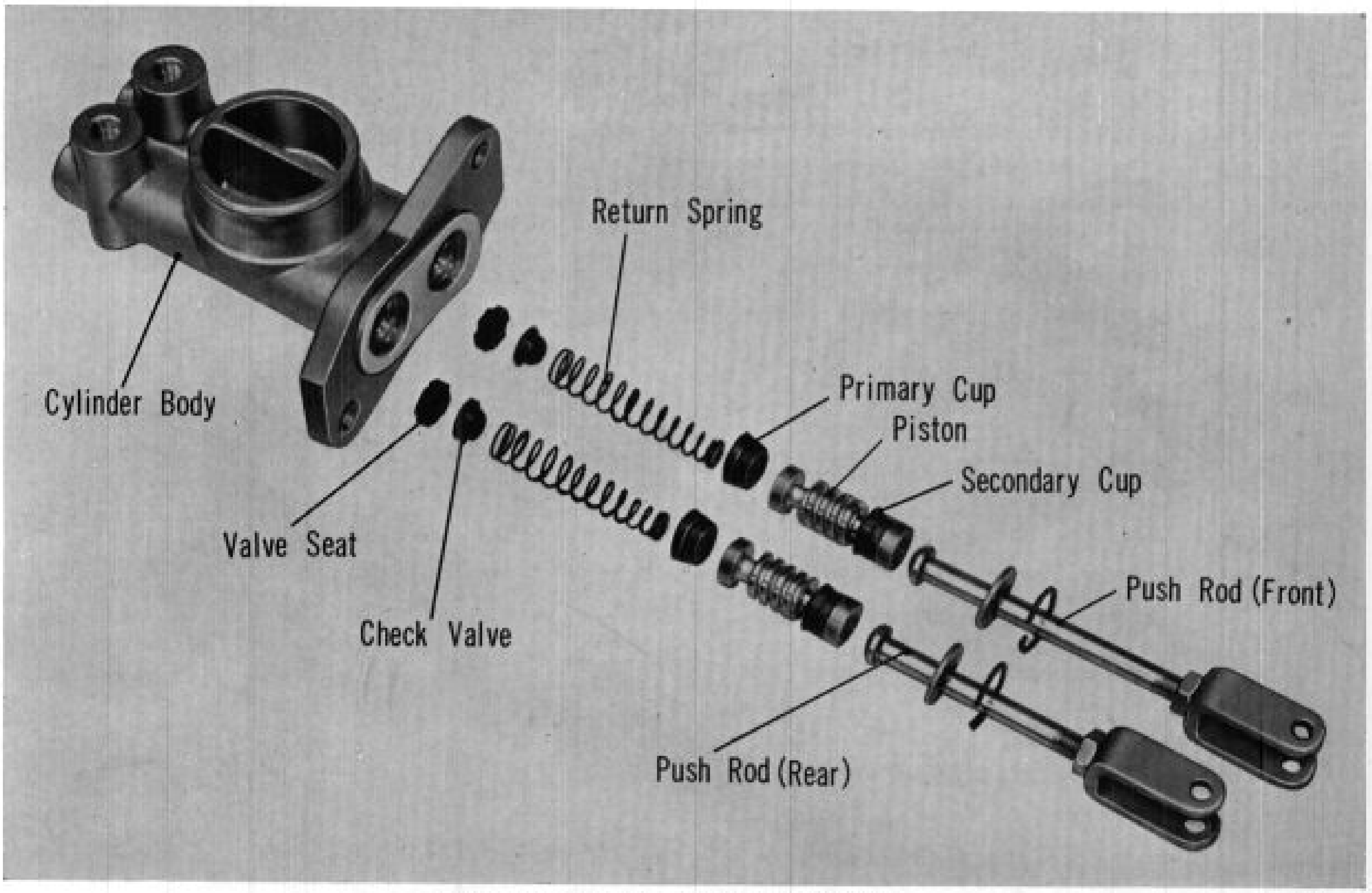


Fig. 11C-12 Parallel Master Cylinder.

4. Remove the valve seat using a wire. Avoid damaging the cylinder during removal.

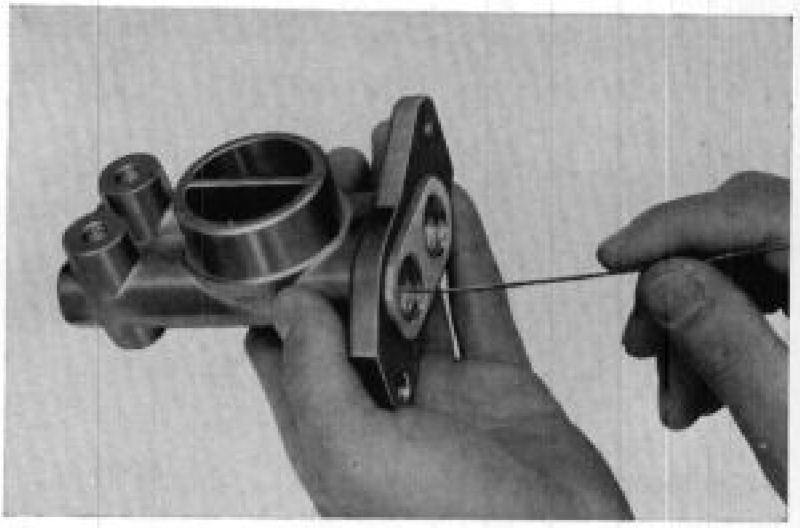


Fig. 11C-13

Cleaning and Inspection

1. Immerse all disassembled parts in clean alcohol or brake fluid, and clear them with a brush. Dry the parts with compressed air and blow air through the compensating port, fluid inlet port, piston bleeder holes, etc.

   Note:
   Do not clean parts in use mineral oil or gasoline.

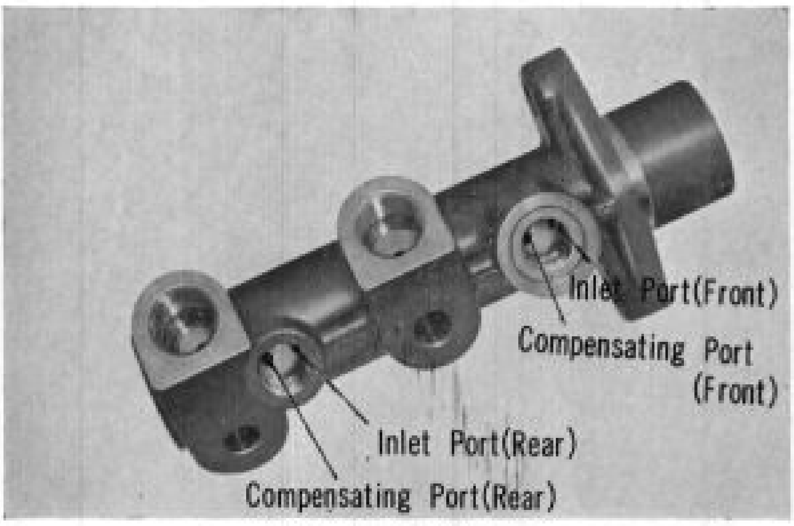


Fig. 11C-14

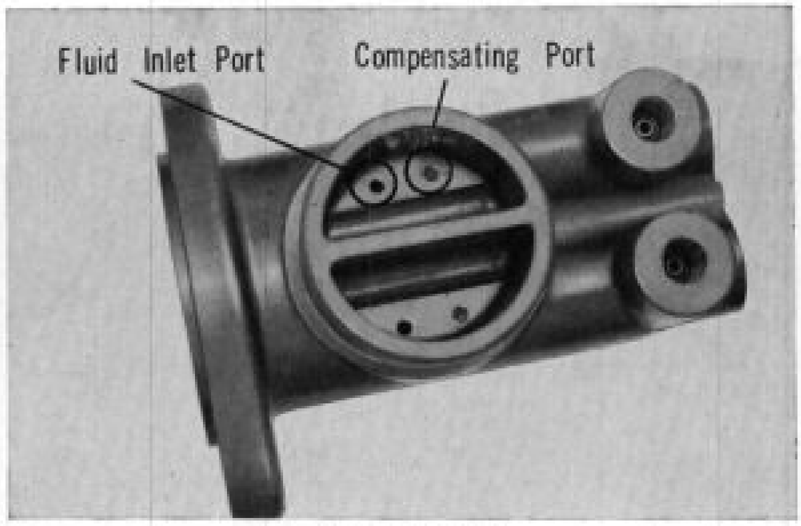


Fig. 11C-15

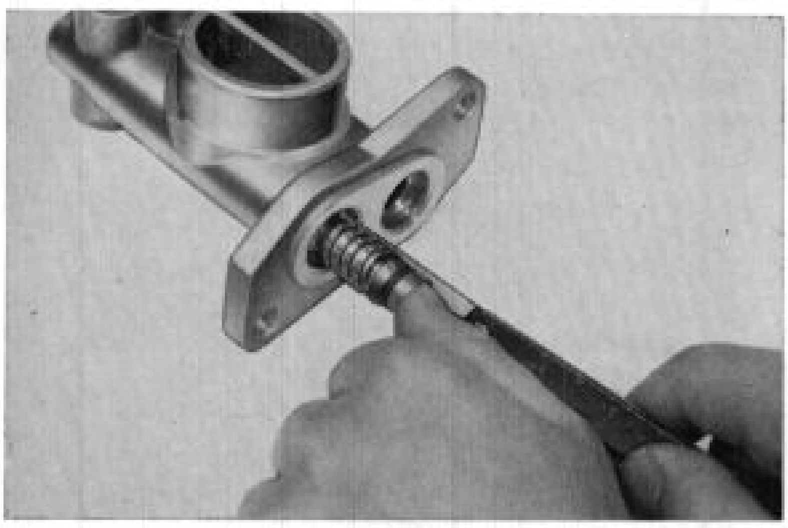


Fig. 11C-16

2. Check the cylinder bore for smoothness.
3. Measure the clearance between the piston and cylinder bore with a feeler gauge.

Unit: mm (inch)

	Standard value	Serviceable limit
Clearance	0.020~0.105 (0.00079~0.00413)	Replace if more than 0.15 (0.0059)

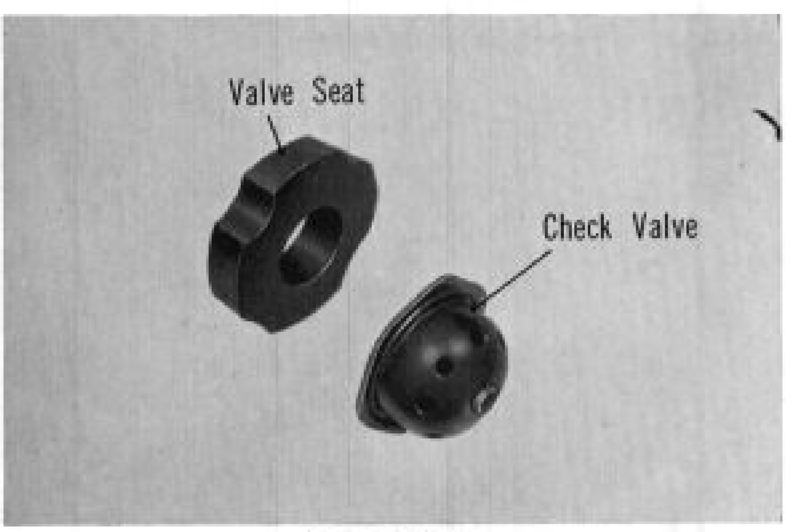


Fig. 11C-17

4. Check for any damage (including permanent strain) to the primary cup, secondary cup, valve, and valve seat. Permanent strain is the result of cleaning the parts in mineral oil, gasoline, or a fluid other than clean alcohol or brake fluid.
   Replace any defective parts.

(PARALLEL MASTER CYLINDER)

The cylinder bores and piston on the front and rear sides are the same size, but the push rods on both sides are not. The front push rod is longer than the rear push rod, so be careful not to reverse their order when installing. Each push rod is installed in accordance with its size.

Therefore, do not adjust the length by loosening the lock nut. If it is necessary to remove the clevis, record the threaded clevis position before removal, and reinstall to this point.

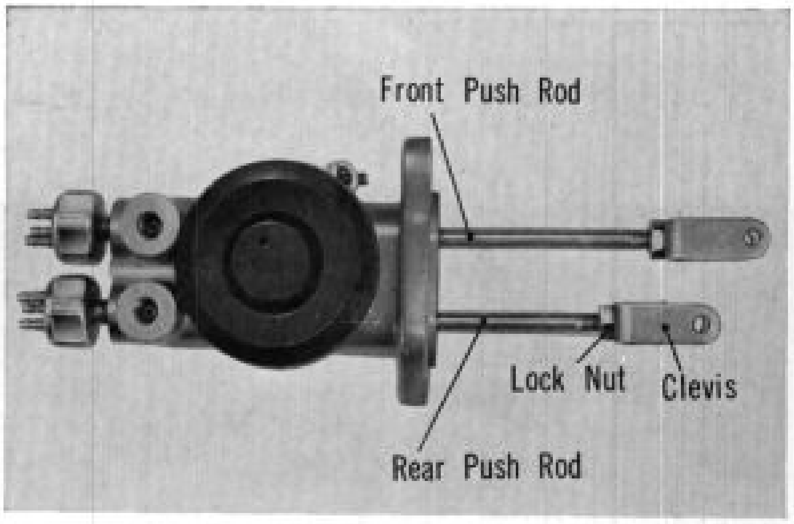


Fig. 11C-18

The equalizer joints on the right and left sides are interchangeable. These are threaded to half length. Install with the threaded side out.

Also, install the front push rod on the side marked "F" on the equalizer.
The equalizer joint should be tightened so that one thread projects from it.

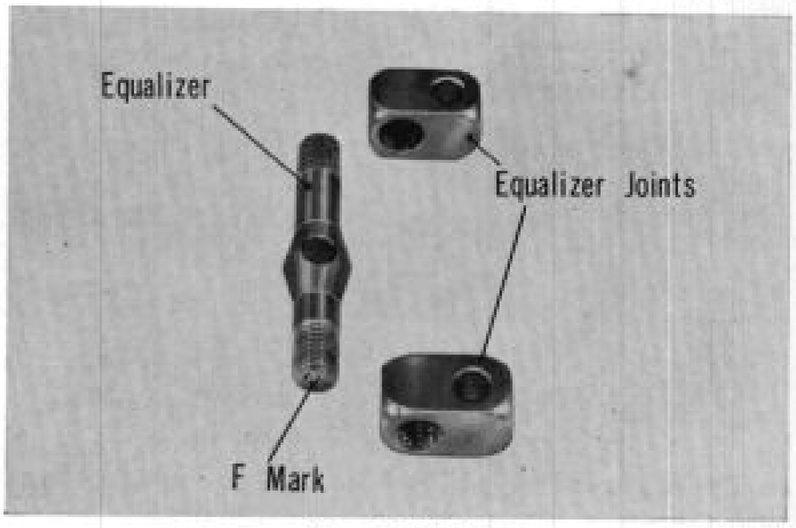


Fig. 11C-19

D. Drum Brake

Description

The drum of the front and rear wheel brakes is an external expansion type. The front brake is either a leading/trailing type or a two-leading type, and the rear brake is a leading/trailing type for all model vehicles.

In the leading/trailing brake system, two brake shoes are supported by anchor plate and wheel cylinder, and pulled to the inside by two return springs. Simultaneously, they are pressed against the backing plate by shoe clamp springs. The parking brake arm is installed on the rear brake leading shoe.

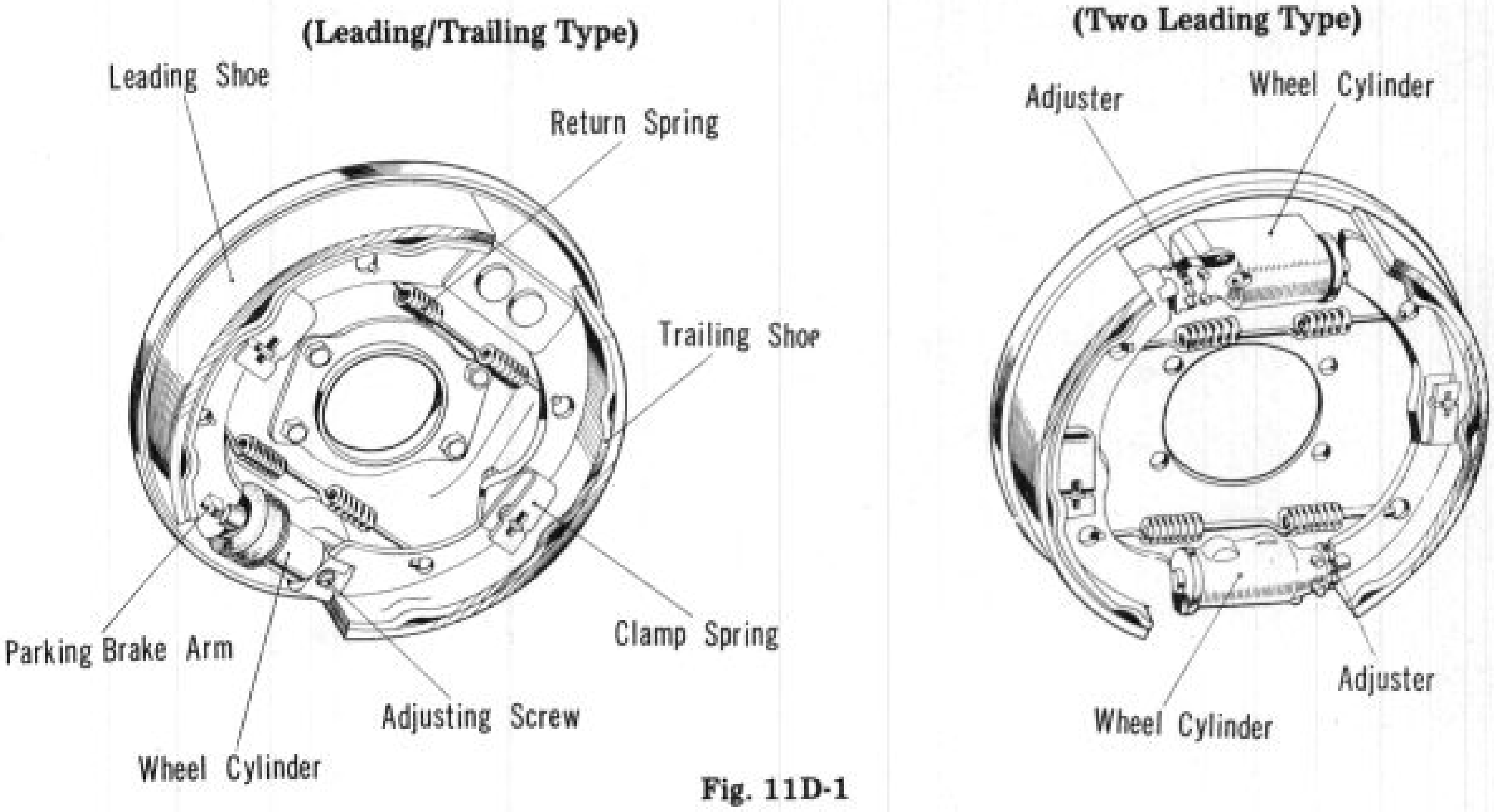


Fig. 11D-1

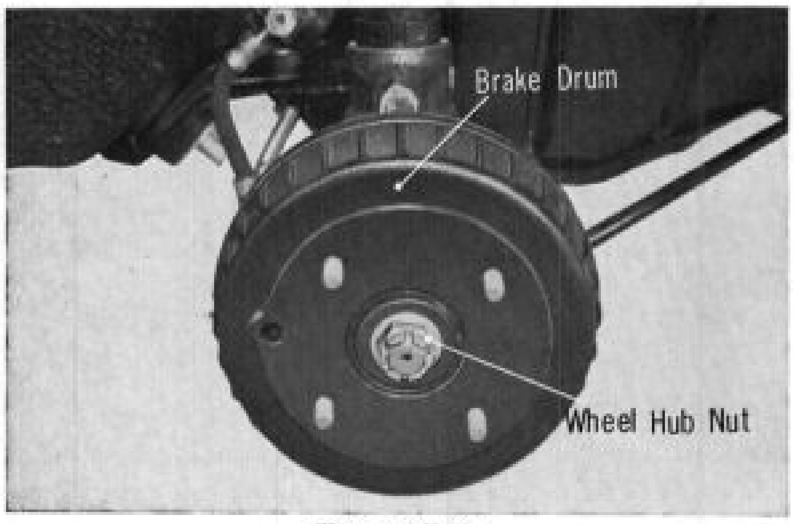


Fig. 11D-2

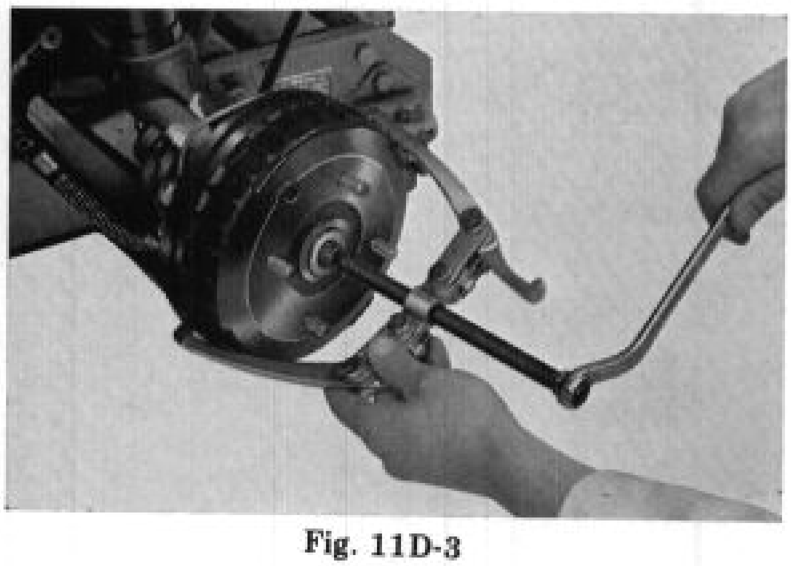


Fig. 11D-3

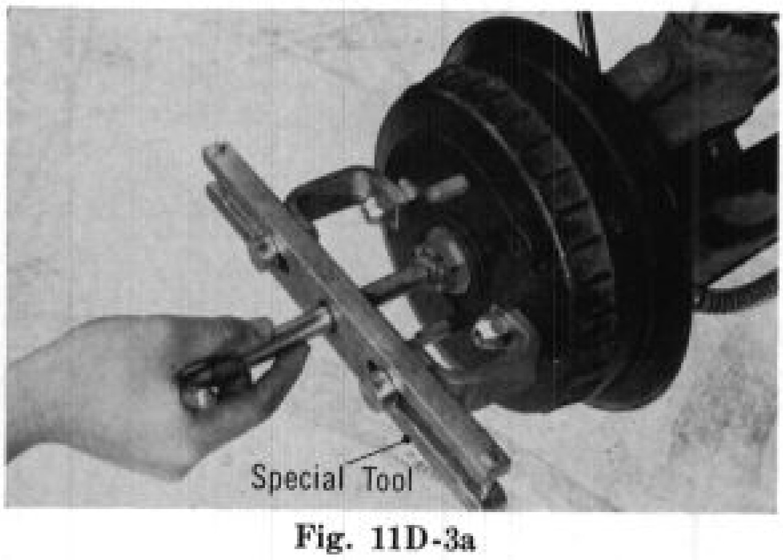


Fig. 11D-3a

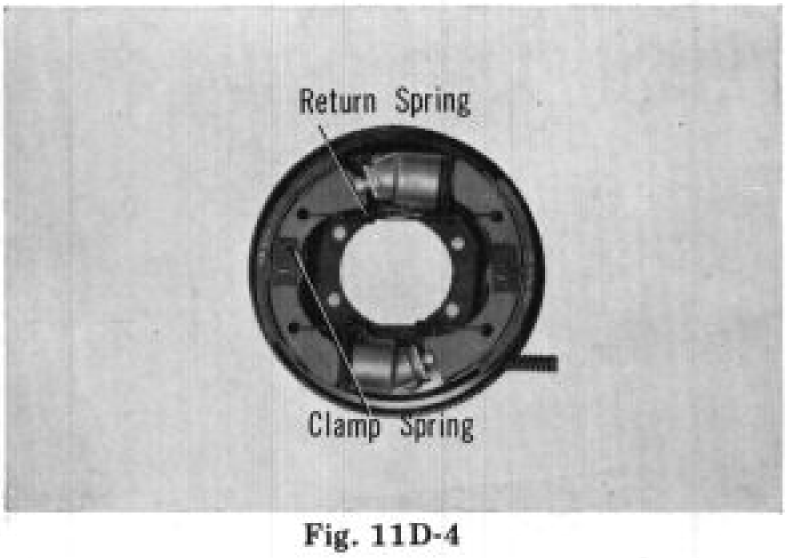


Fig. 11D-4

Removal and Disassembly

a. Brake Drum and Shoe

1. Remove the wheel cap and loosen the wheel nut.
2. Remove the cotter pin, and loosen the wheel hub nut with a wrench (special tool). This nut should be slightly loosened so that it can be easily removed after the vehicle is jacked up.
3. Jack the vehicle up and provide additional support.
4. Remove the wheel nuts and the wheel.
5. Remove the wheel bearing nut and then the brake drum with a puller or special tool—Brake Drum Puller.
6. When replacing shoes, separate the brake shoe from the backing plate by unhooking the shoe return spring and clamp spring.

b. Wheel Cylinder
(Leading/Trailing type)

1. Drain the brake fluid.
2. Separate the brake shoe from the backing plate.
3. Remove the flexible brake hose from the wheel cylinder.
4. Remove the parking brake cable from the parking brake arm of the rear brake.
5. Remove the backing plate from the rear axle or knuckle.

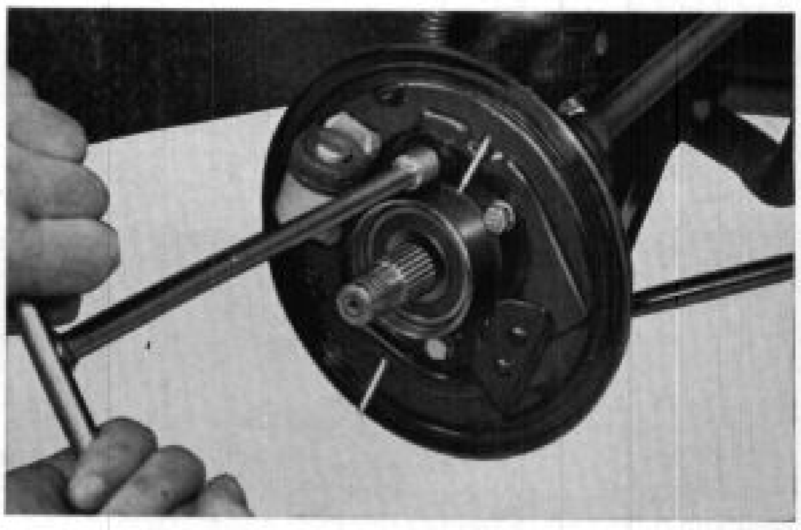


Fig. 11D-5

6. Remove the dust seal and take out the clip plate with long nose pliers. Separate the wheel cylinder from the backing plate by removing the pressure spring.
7. Remove the parking brake arm of the rear brake.

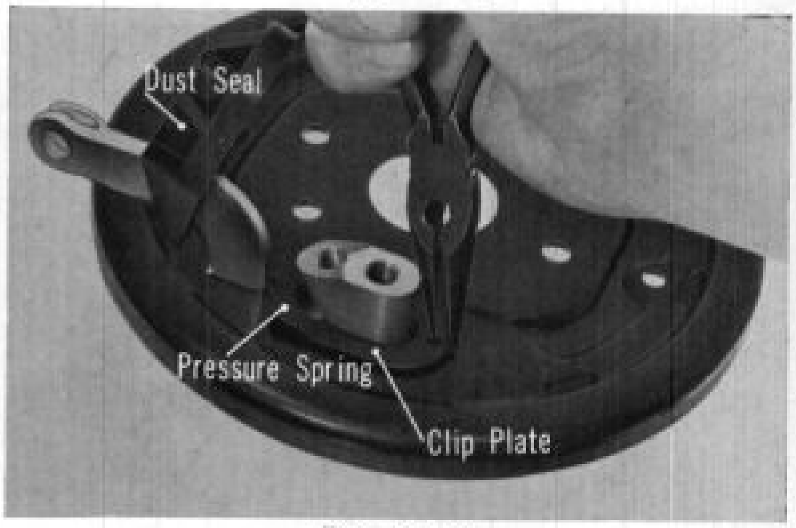


Fig. 11D-6

8. Remove the clip, the rubber boot and the piston from the cylinder body.

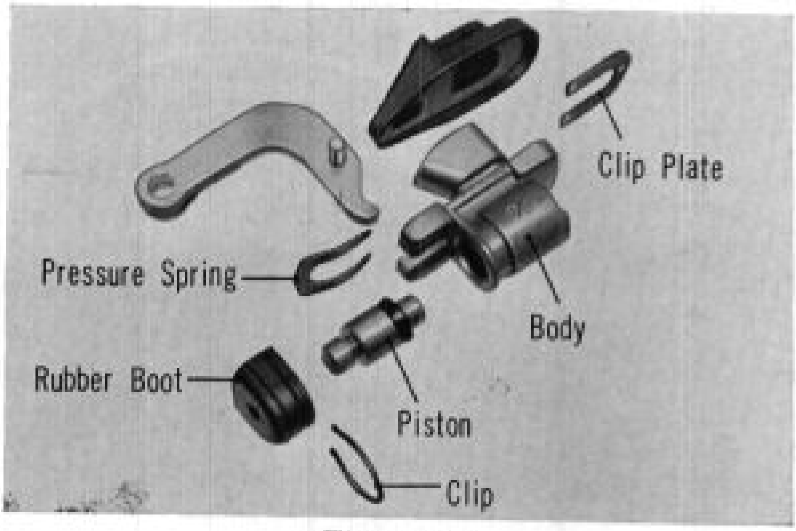


Fig. 11D-7

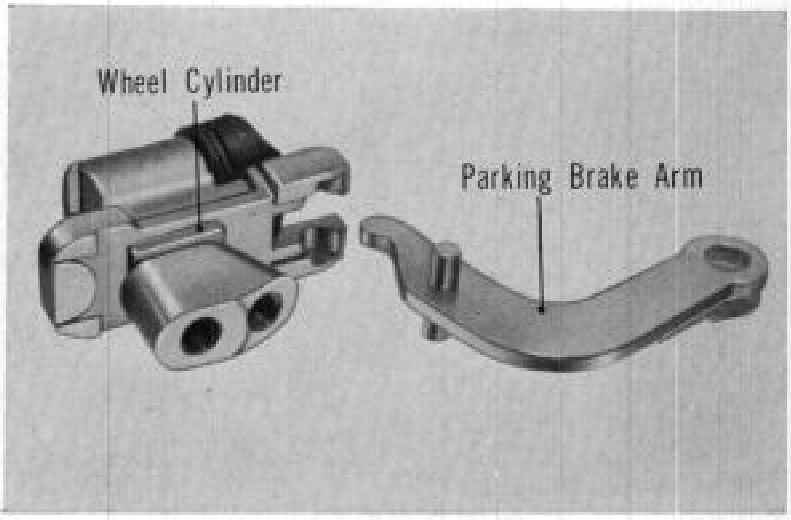


Fig. 11D-8

1. Remove the brake hose, the bridge line, and the wheel cylinder mounting nuts and spring washers. The wheel cylinder can be separated from the backing plate.

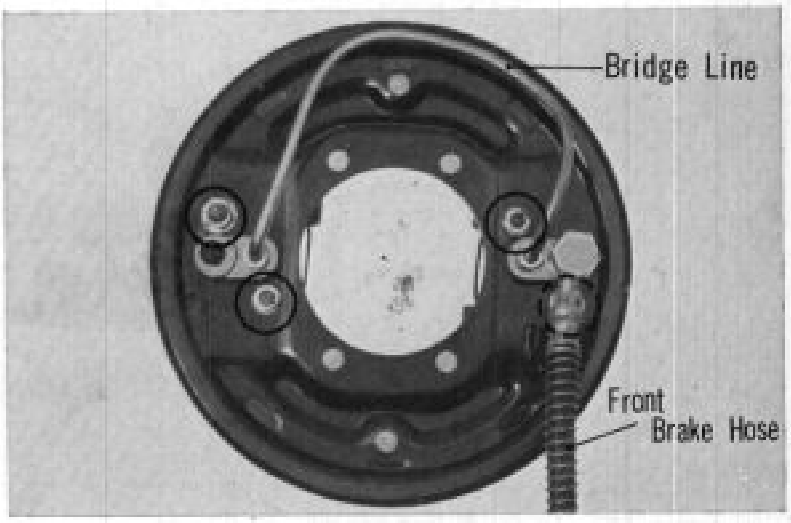


Fig. 11D-9

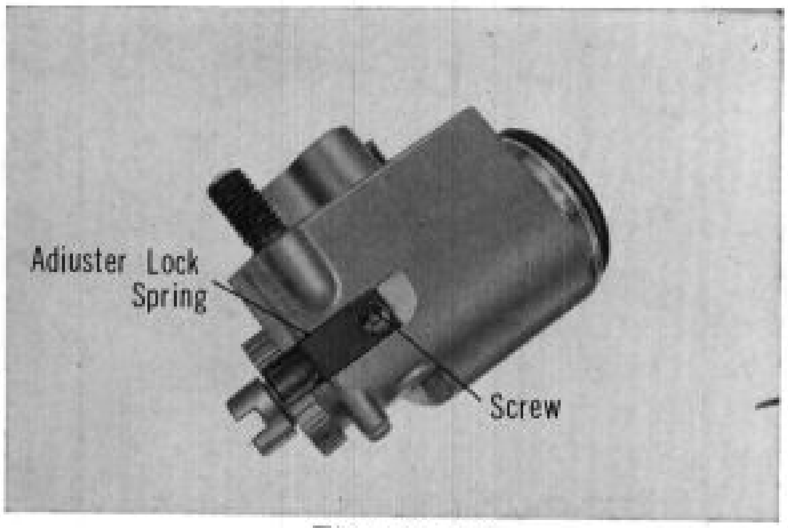


Fig. 11D-10

2. Loosen the adjuster lock spring screw and remove the adjuster and adjusting screw.

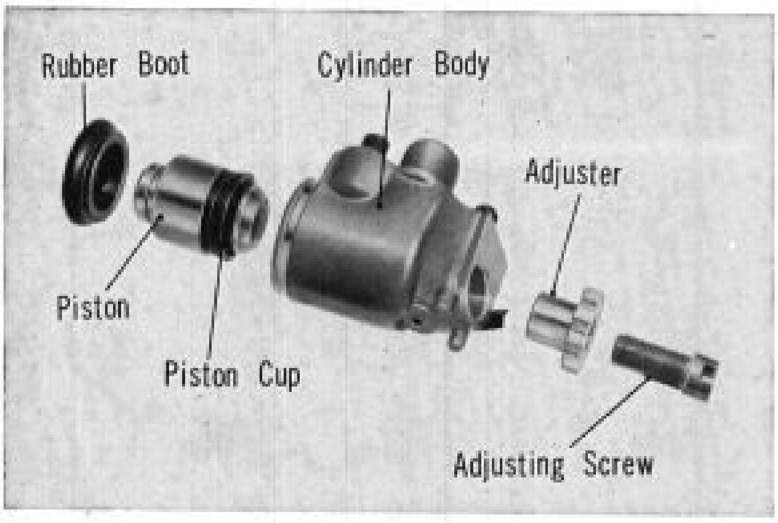


Fig. 11D-11

3. Disassemble the wheel cylinder as shown in the figure.

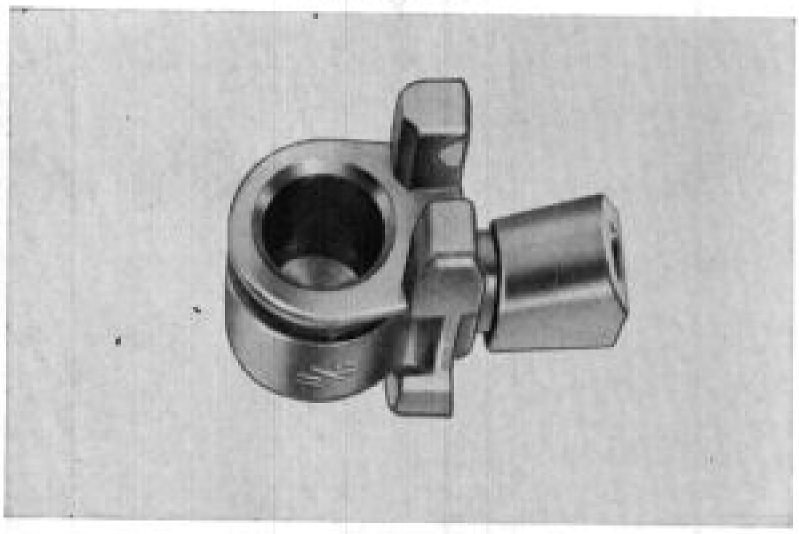


Fig. 11D-12

Inspection and Assembly

a. Wheel Cylinder

1. Wash all metal parts in clean alcohol or brake fluid.
2. Check the cylinder bore. If scratches or other damage is found, replace the cylinder.

Fig. 11D-13

3. Check the piston cup for damage or swelling. Replace the cup if necessary.

4. Check clearance between the piston and the cylinder bore. This is accomplished by inserting a feeler gauge, or measuring the piston with a micrometer and the cylinder bore with a cylinder bore gauge and taking the difference.

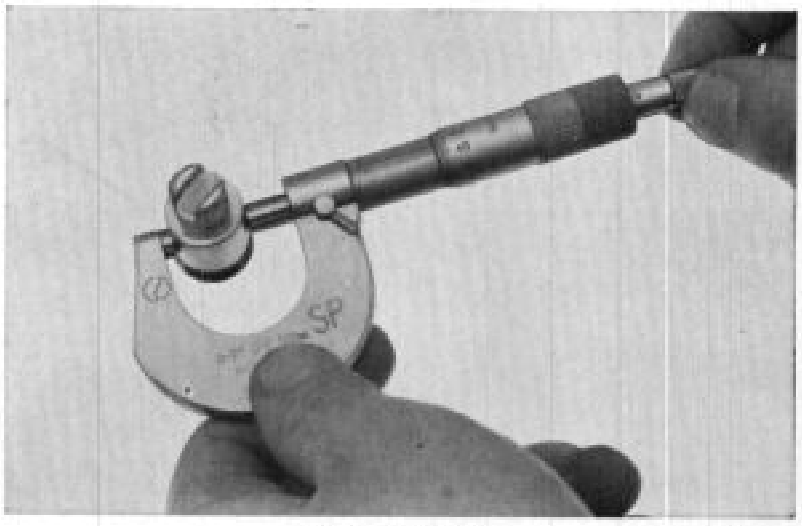


Fig. 11D-14

Unit: mm (inch)

	Standard value	Serviceable limit
Clearance	0.0020~0.105 (0.00079~0.00413)	Replace if more than 0.15 (0.0059)

5. Install the wheel cylinder assembly on the backing plate.

Note:

(1) The wheel cylinder assembly of the leading/trailing type must move smoothly, so apply a light coating of grease around the contact surface.
Assemble by placing the curved side of the pressure spring up, as shown in Fig. 11D-15.

(2) Greasing, as mentioned above, is not necessary for the two-leading type. Tighten the nut (securing the wheel cylinder assembly to the backing plate) to a torque 2.1 to 2.4 kg-m (15.2~17.4 lb-ft).

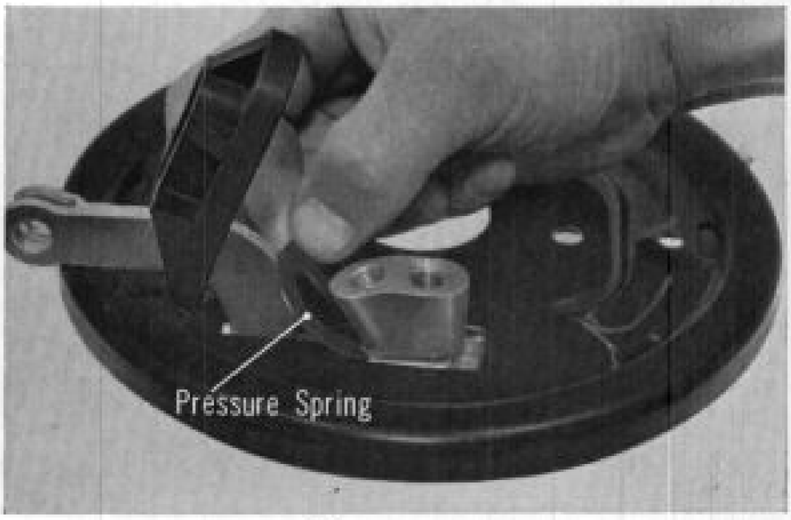


Fig. 11D-15

6. Check the O-ring for any damage.

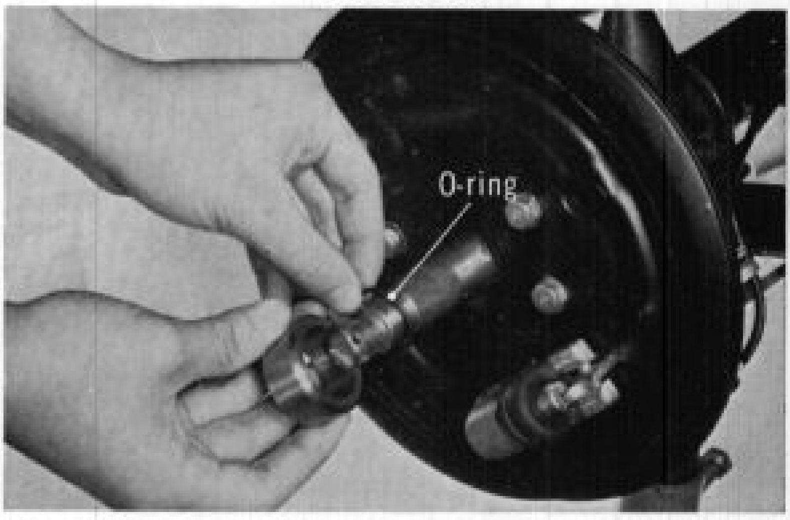


Fig. 11D-15a

7. Apply light coat of grease to the specified points on the backing plate.

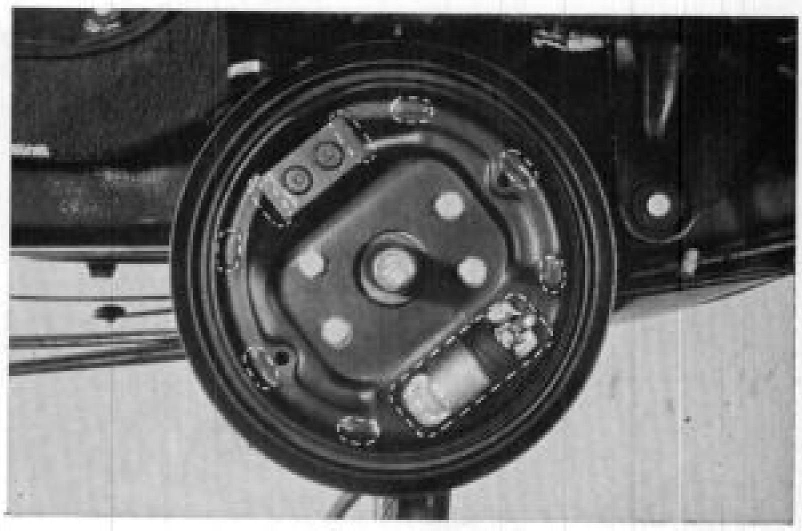


Fig. 11D-15b

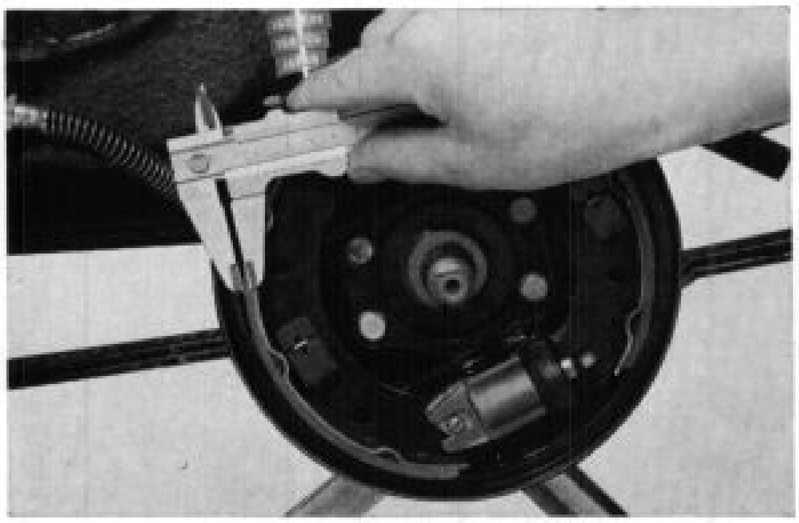


Fig. 11D-16

b. Brake Shoe

(Measuring thickness of the shoe lining.)
If the shoe lining is less than 1.4mm (0.055 in) thick when measured with vernier calipers, it should be replaced.

Note:
Replace the shoe on all four wheels at the same time. In case of uneven wear between the front and rear wheels, however, replace only the shoes of front wheels or rear wheels.

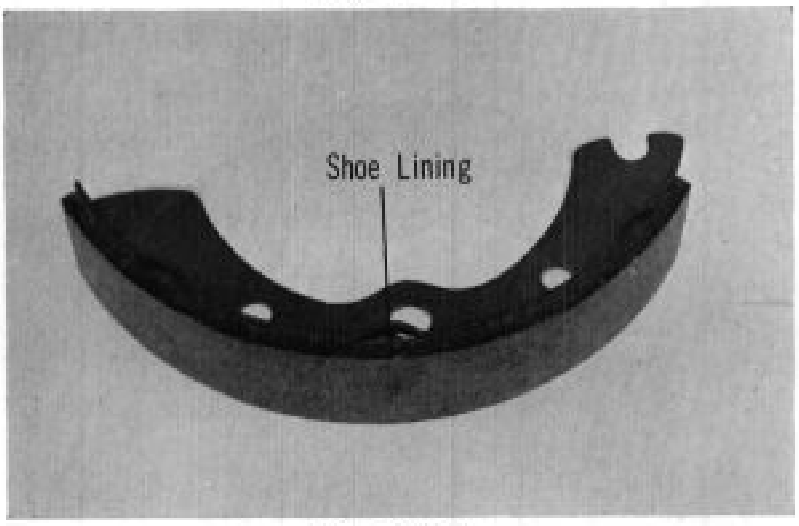


Fig. 11D-17

If shoe has been replaced, check the new lining for cracks and other damage.
Make sure that the lining surface is free from grease or oil. Always handle the shoe with clean hands.

Note:
Whenever checking the brake shoes, remove rust and dirt from the shoe contact faces on the backing plate and apply a light coating of grease on the faces.

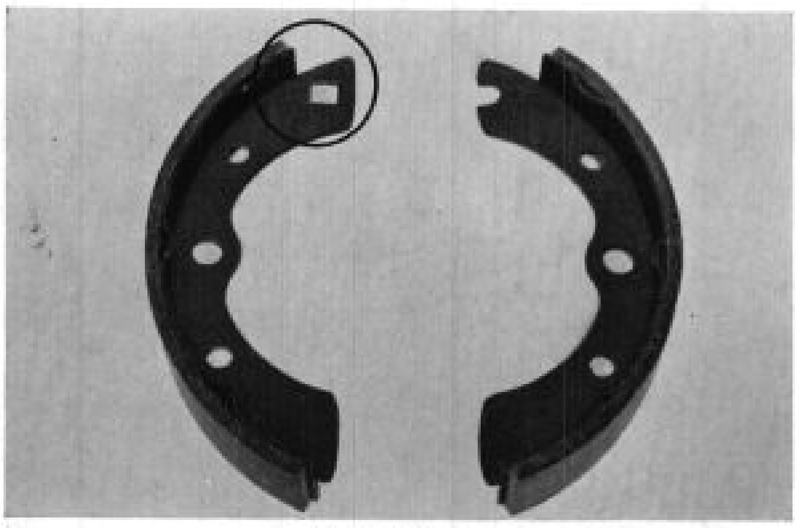


Fig. 11D-18

When replacing the rear brake shoes, make sure that positioning is correct. There is a groove into which the parking brake arm enters.

Before fitting the drum, turn the shoe-to-drum clearance adjusting screw counterclockwise for the "leading/trailing type" brake (**Fig. 11D-19**) or the star adjusting screw inward for the "two leading type" (**Fig. 11D-20**) to its extreme to obtain maximum clearance.

c. Brake Drum

Check the drum for cracks; the inner surface of the shoe for excessive wear and damage. Permissible play of the brake drum inner circumference is less than 0.05mm (0.00197 in) with respect to the center of the spline shaft. Deviation from the true should be less than 0.01mm (0.00039 in). A larger deformity can result in brake and squeaking which requires correction by grinding within the permissible depth of up to 0.5mm. Check the wheel bearings and oil seals for defects, then fit the brake drum and secure with the wheel hub nut.

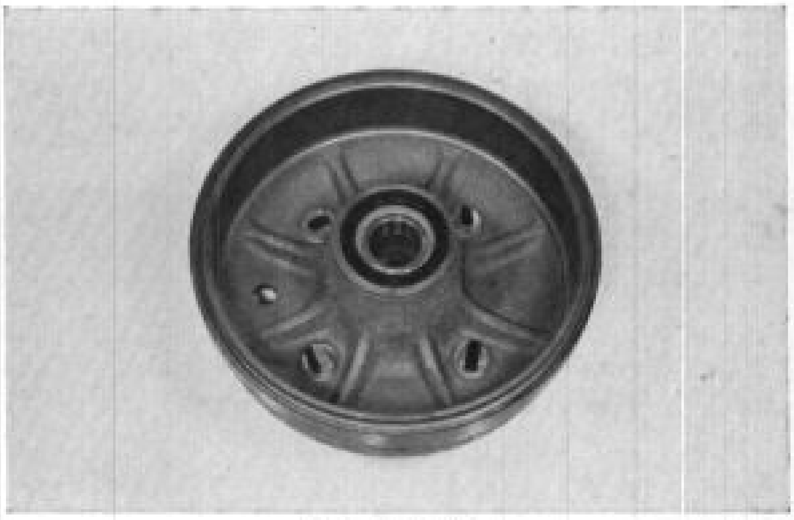


Fig. 11D-18a

d. Brake Shoe Adjustment

After mounting the brake drum, adjust the clearance between the shoe and drum as follows.

1. Turn the adjusting screw clockwise for "leading/trailing type" Fig. **11D-19** or turn the star adjusting screw outward for "two leading type" Fig. **11D-20** to the point where the brake drum is locked.

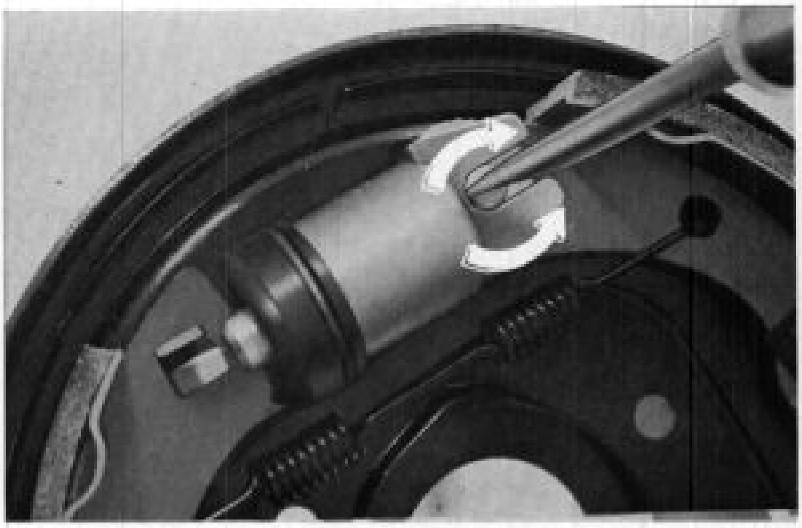


Fig. 11D-19

2. Back off the adjusting screw the minimum amount necessary to allow the drum to rotate freely.

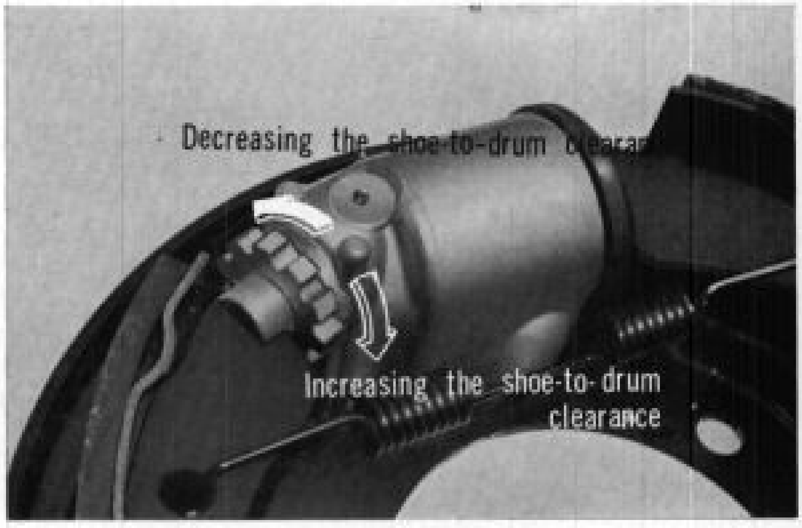


Fig. 11D-20

3. After adjustment, a check with respect to brake release should be made by turning the wheel after having actuated the shoes through a single depression of the brake pedal, otherwise, a proper brake shoe clearance can appear to be improper. This is, therefore a very important check and it should be conducted again after the brake pedal has been depressed several times.

Brake shoe adjustment for the two leading type, which has two cylinders per wheel, should be made independently for each wheel cylinder to insure equal performance of both, prevent brake squeaking, and at the same time insure the utmost braking efficiency.

E. Disc Brake

Description

The Annett type disc brake installed on Honda N600 consists of a cast steel cylinder body mounted on the spindle knuckle, and surrounding this cylinder is a yoke made of pressed steel plate incorporating a guide to permit movement.

There are two pistons within the cylinder, the outer piston axis is fitted through the yoke bias ring located at one end of the cylinder. When the hydraulic pressure is applied, the inner piston applies force directly to the inner pad while the outer piston applies force against the yoke on which the outer pad is mounted. This causes both pads to apply force against the brake disc from both sides to perform the braking function. The feature of the Annett type disc brake is that the outer pad which is supported by the yoke is moved along the cylinder axis by being guided along the groove in the body.

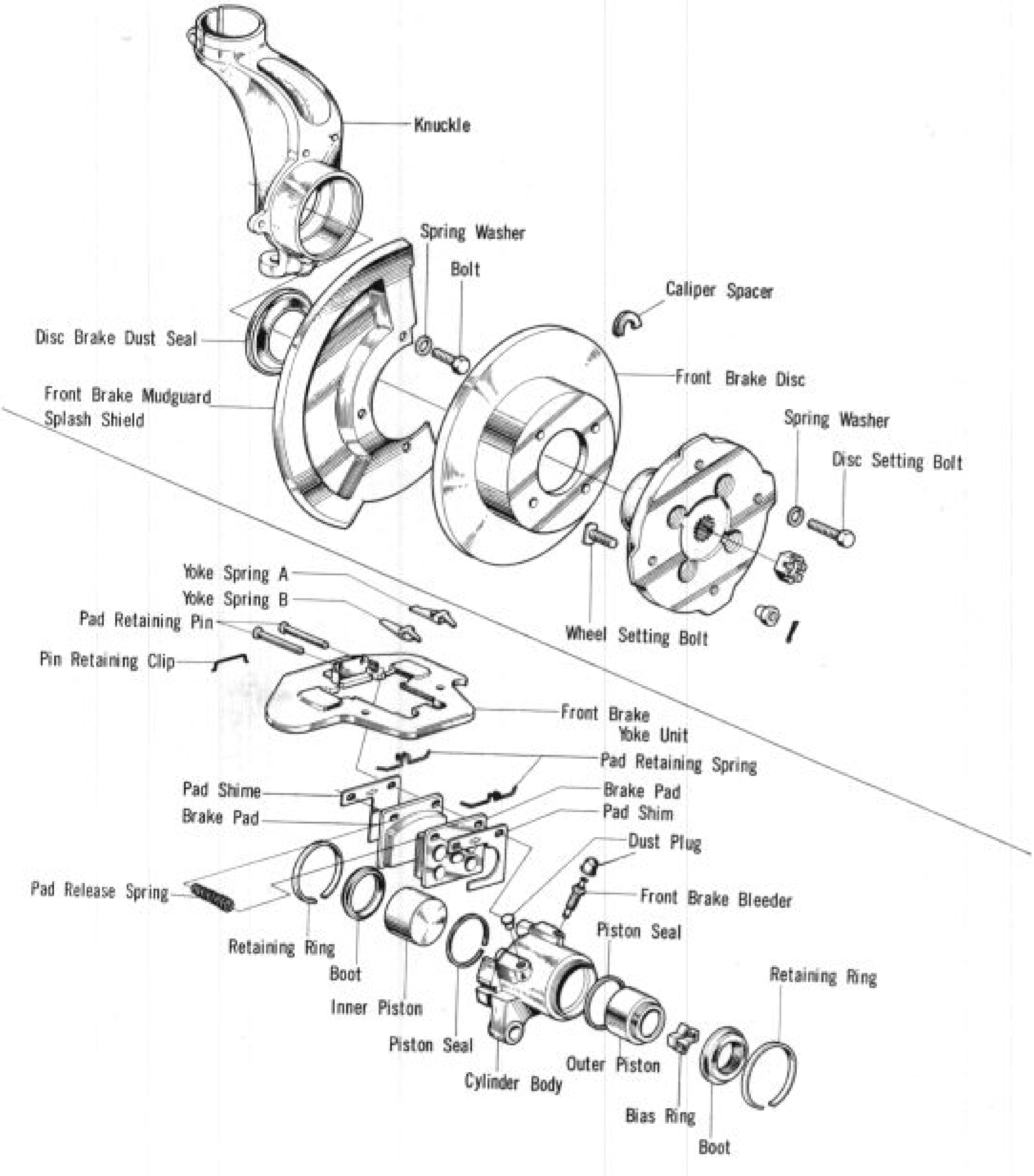


Fig. 11E-1

Specifications

The specifications of the annett type disc brake used on the N600 are as follows:

Designation	10/12A	
Cylinder diameter	42.87mm	(1.69 in.)
Cylinder area	14, 4cm^2	(2.23 sq in.)
Pad braking surface	20. 6cm^2	(3.20 sq in.)
Pad lining thickness	10. 3mm	(0.406 in.)
Pad lining effective thickness	8.3 mm	(0.327 in.)
Effective radius	70mm	(2.756 in.)

Inspection of Brake Pad

In addition to periodical check every 3000 miles, the disk brake lining should be inspected whenever the wheels are removed for any reason.

Fig. 11E-1a

Disk brake pads should be replaced when approximately 2.0mm (0.8 in) lining thickness remains. It is strongly advisable to replace all pads at the same time.

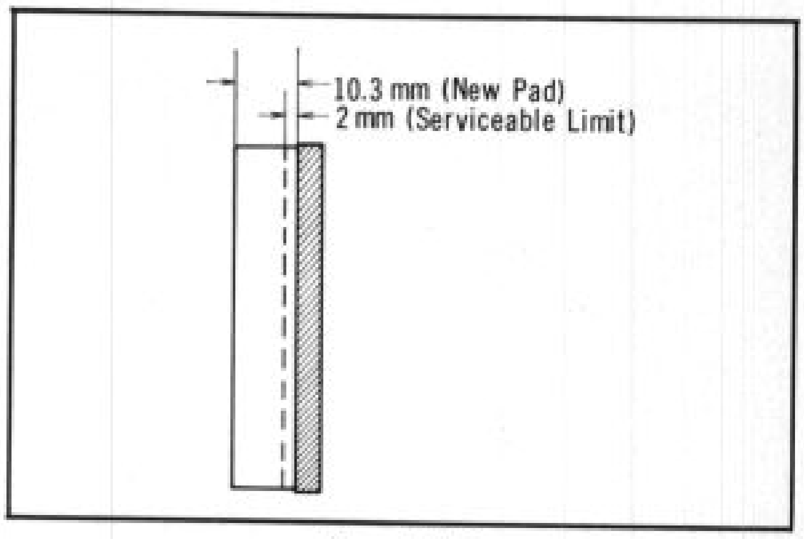


Fig. 11E-1b

A slightly tapered wear condition of the lining is normal and does not require replacement unless there is less than the minimum thickness.

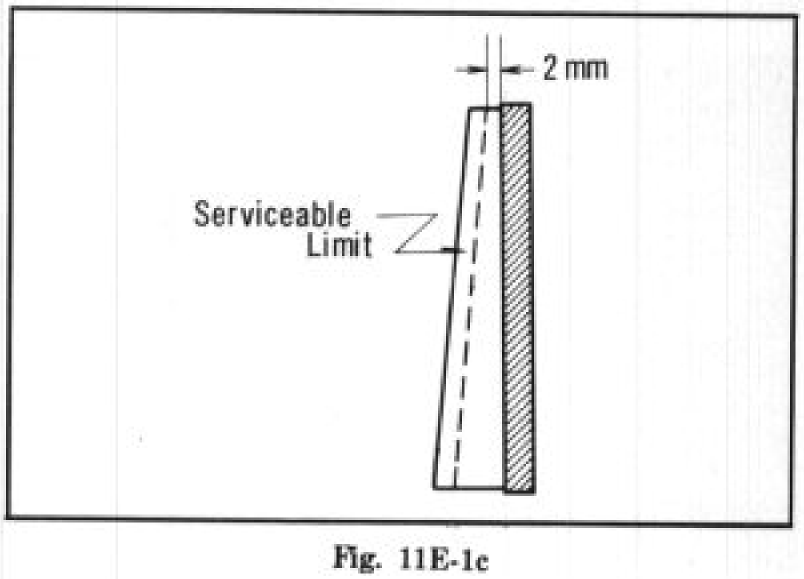


Fig. 11E-1c

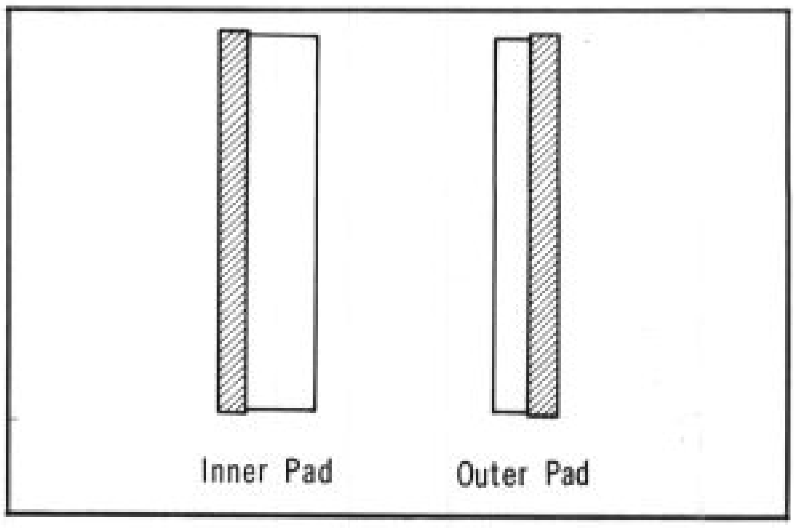


Fig. 11E-1d

If lining wear differs extremely between inner and outer pad, check the operation of the caliper. (Fig. 11E-30).

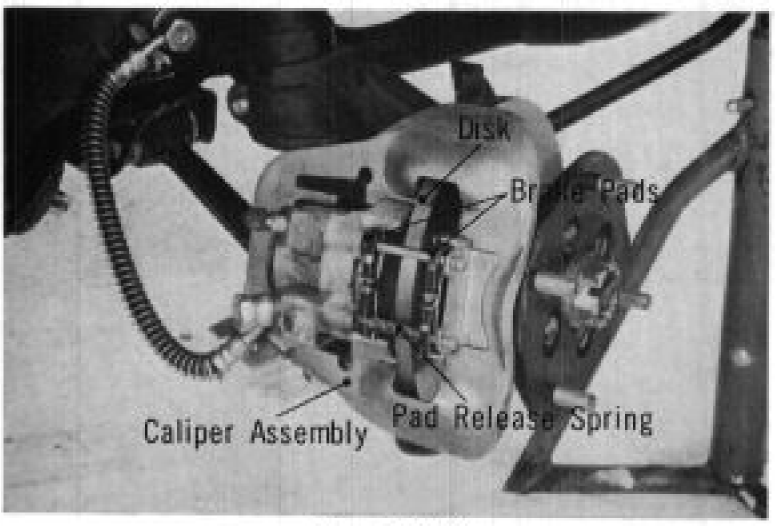


Fig. 11E-2

Replacement of Brake Pad

(Removal)

1. Raised the front wheels off the ground, and remove the wheels.

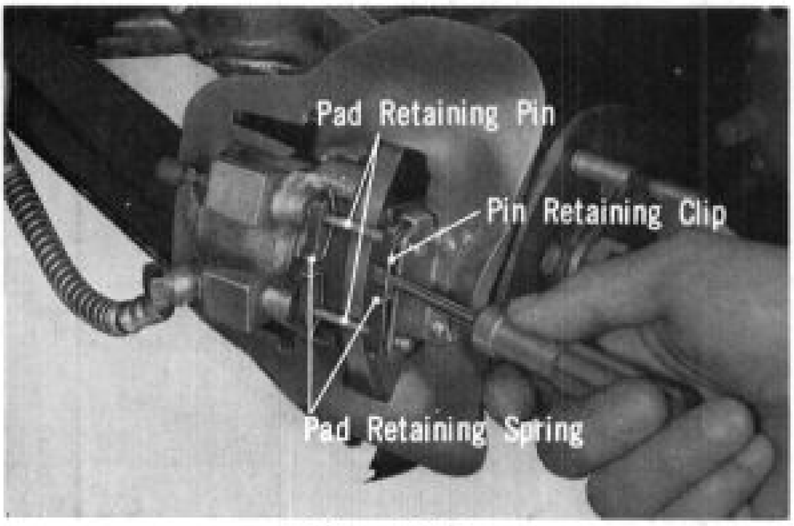


Fig. 11E-3

2. Remove the pin retaining clip which is fitted into the hole in the pad retaining pin.

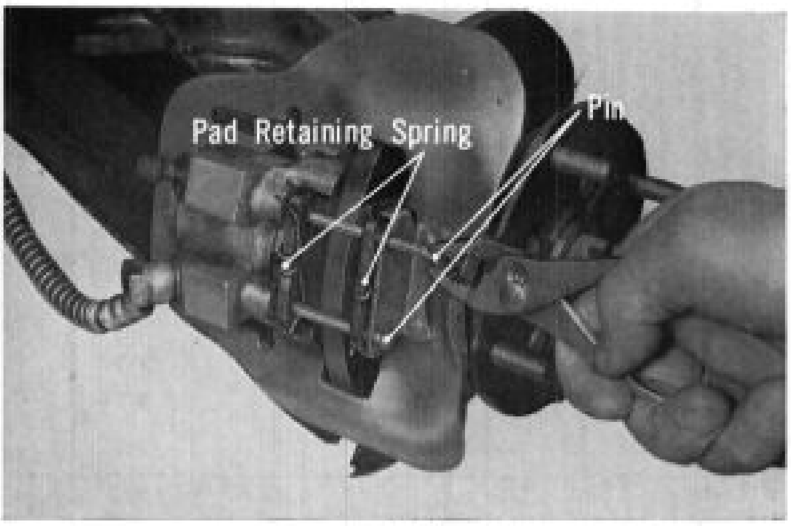


Fig. 11E-4

3. Remove the two pad retaining pins and the two pad retaining springs with a plier as shown in Fig. 11 E-4.
   In removing them, care must be taken to prevent springs from flying apart.

4. The pad can be removed together with the shim after removing the springs and pins. If the pads are difficult to remove, open the bleeder valve and move the yoke in the direction of the piston. The pads will become loose and can be easily removed.

   Note:
   After the pad is removed, the brake pedal must not be touched.

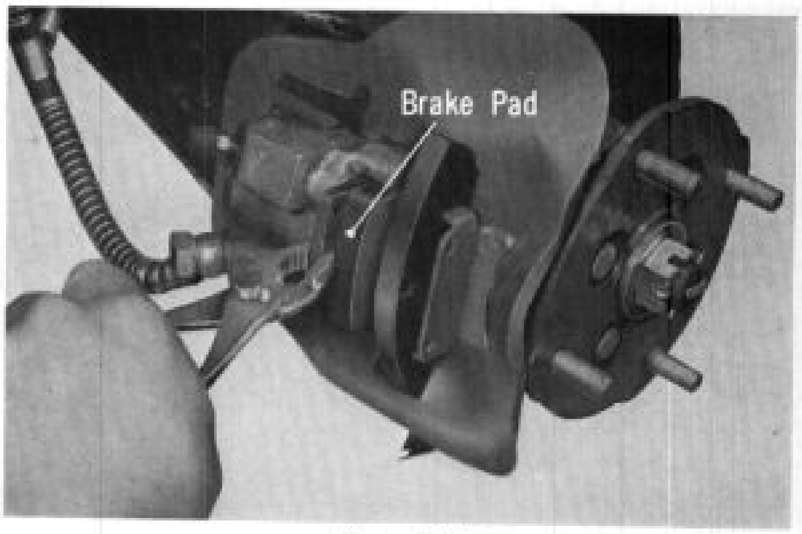


Fig. 11E-5

(Reinstalling New Pad)

5. Before starting to reassemble, the exposed areas such as the guide grooves, piston head and yoke sliding surface should be cleaned, preferably with a solvent such as alcohol.
6. Loosen the bleeder valve and push the inner piston back into the cylinder so that the piston is butted against the boot retaining ring.
7. Also push back the outer piston by applying pressure on the yoke so that the piston butts against the retaining ring.
8. After providing space to install the new pads on both sides of the disc, close the bleeder valve and insert the pad. Insert a shim behind each pad and in the direction so that the arrow on the shim is pointing up. (Fig. 11E-7)

   Note: When installing new pads without bleeding, do not overflow the brake fluid reservoir.

   The shims to be installed behind the four pads on both front wheels are interchangeable with one another.

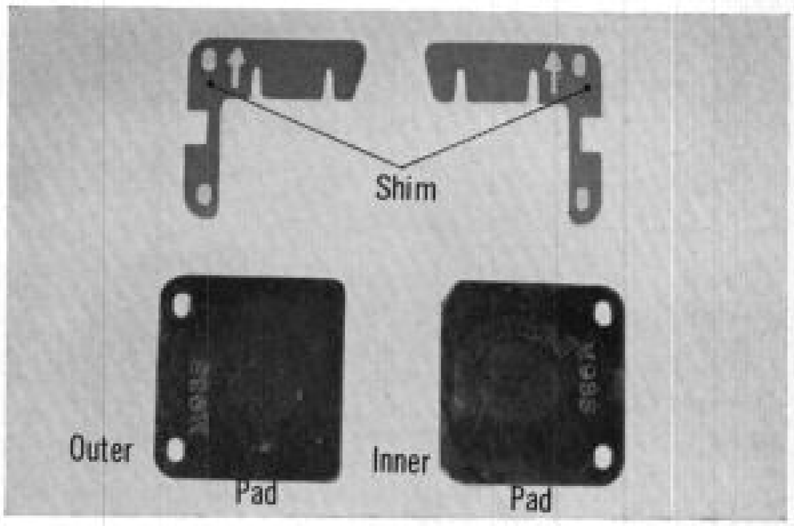


Fig. 11E-6

9. Incorrect installation of shims may cause squeaking brakes.

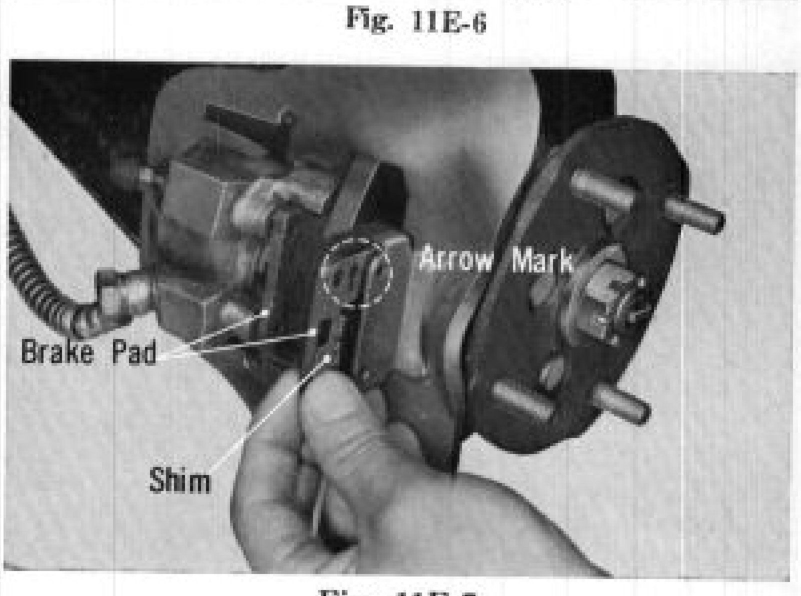


Fig. 11E-7

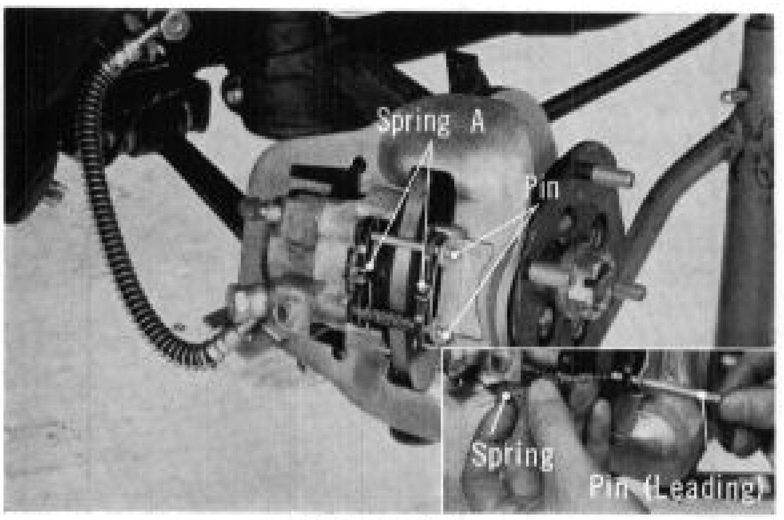


Fig. 11E-8

10. First install one of the pins and then hook one end of the pad retaining spring on this pin, clip the center loop over top of the pad and hold down the opposite end of the spring while pushing the pin through to align with the inside pad and mounting hole. Insert the pin retaining clip into the hole under the head of the pin.
A coil spring is provided (should be installed only to the leading pin) to help the pads release fully.

11. Apply the brake pedal so that the pad will position itself against the disc, and then check for proper pedal travel. If the travel is excessively large, air bleeding of the brake system is necessary.
12. Reinstall the tire and then spin the wheel by hand with the brake released. For normal condition, it should require 2—3 kg (4.4 lb) force at the outer circumference of the tire to spin the wheel. If greater force is required, the wheel bearing may be excessively worn or the disc is out of alignment and causing the wheel to bind. Under such a condition, the tire should be removed and the runout of the disc be checked, to see if it is within the 0.10 mm (0.004 inch) tolerance.

Note:

1) The superior braking performance of the disc brake, though small in braking surface, is the result of the pads being manufactured of special compounded material and molded under closely controlled prosesses.
The imitation brake pads which may be available in certain areas will not give the braking performance or the service life of the genuine brake pad recommended by Honda.

Always insist on the genuine part which is stamped "TOKIKO" on back of the pad.

2) Even the slightest oil, grease, or thumbmark on the frictional surface of the pad may affect the braking performance as it is so small in size.
When replacing the brake pad or performing air bleeding, exercise care not to contaminate the friction surface.
3) When replacing brake pads, they should be replaced in pairs and also on both sides to assure balanced braking performance.
Replacement of brake pads only on one side may result in uneven braking which will cause the vehicle to pull to one side.

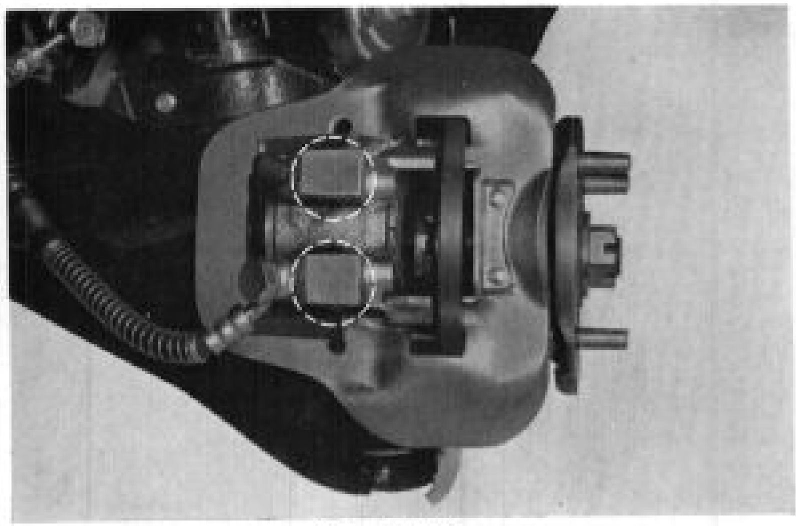


Fig. 11E-9

Removal and Disassembly

1. Unscrew the hub nuts and remove the wheel.
2. The caliper housing is mounted to the knuckle with 10mm bolts. Remove these bolts from the bottom side using a universal socket wrench. The hydraulic system (brake hose) need not be removed this time. Between the caliper and the knuckle at the fastening points are installed two adjusting shims.
Care must be taken not to lose them.
(The two 10mm bolts are located behind the cylinder. These locations are indicated with dotted round marks).

3. Remove the spindle nut, and extract the hub using a wheel puller.

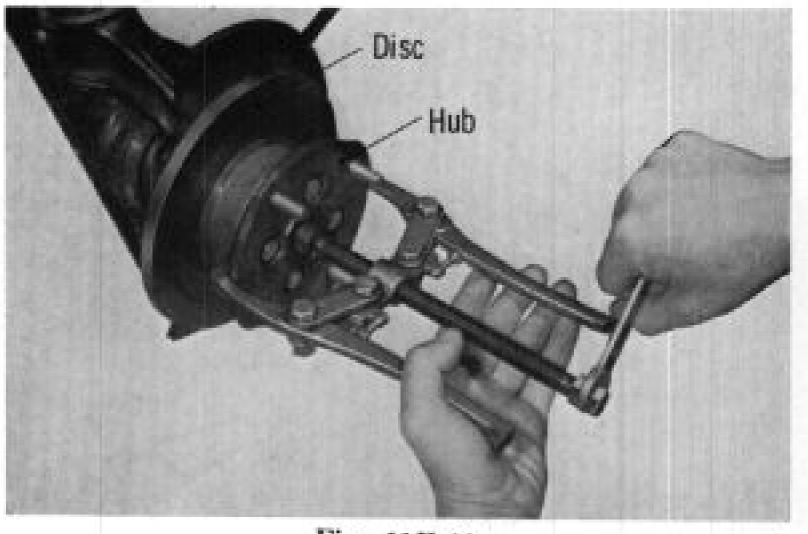


Fig. 11E-10

4. That splash shield plate is attached to the knuckle with three 8 mm bolts.

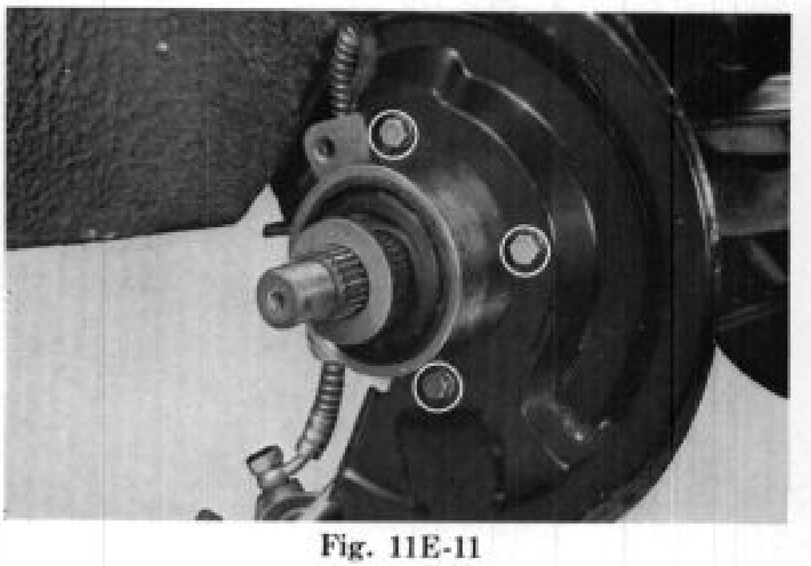


Fig. 11E-11

5. Remove the disc brake pads from the caliper assembly in accordance with the description in section "Removal of Brake Pad".

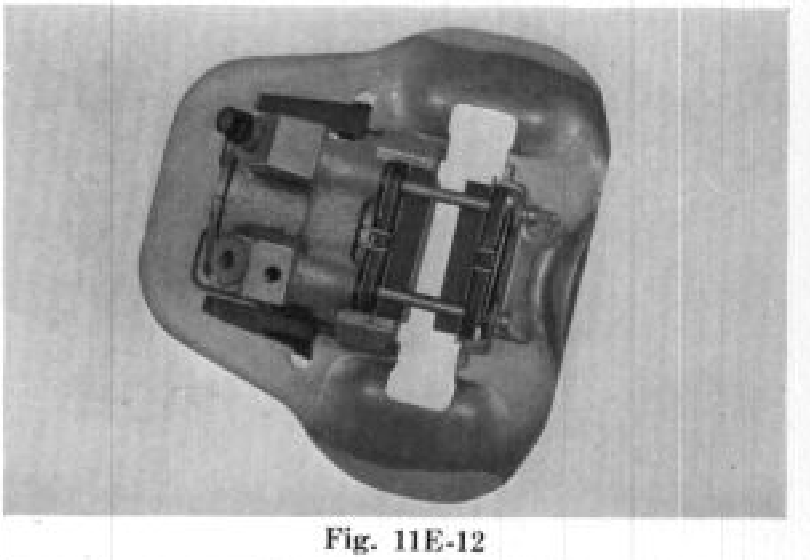


Fig. 11E-12

6. Tap the cylinder body lightly with a plastic hammer at the points shown in Fig. 11 E-13 to lightly remove the cylinder body.
remove the cylinder body from the caliper assembly. Exercise extreme care to avoid damage to the cylinder body.

At this time, if only the cylinder body moved while the outer piston is held stationary on the caliper, a gentle tap on the piston should loosen the piston. Refrain from hitting the rubber boot to prevent its damage.

The round marks in the Figure show the position to be tapped with the hammer.

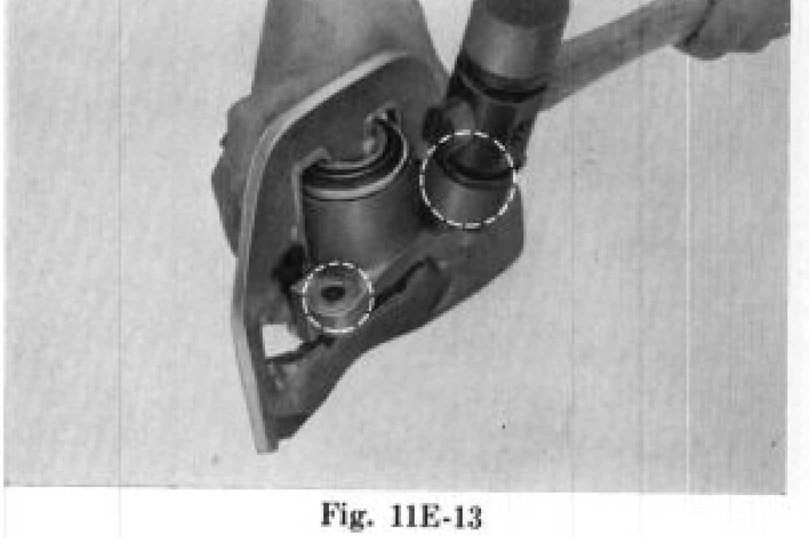


Fig. 11E-13

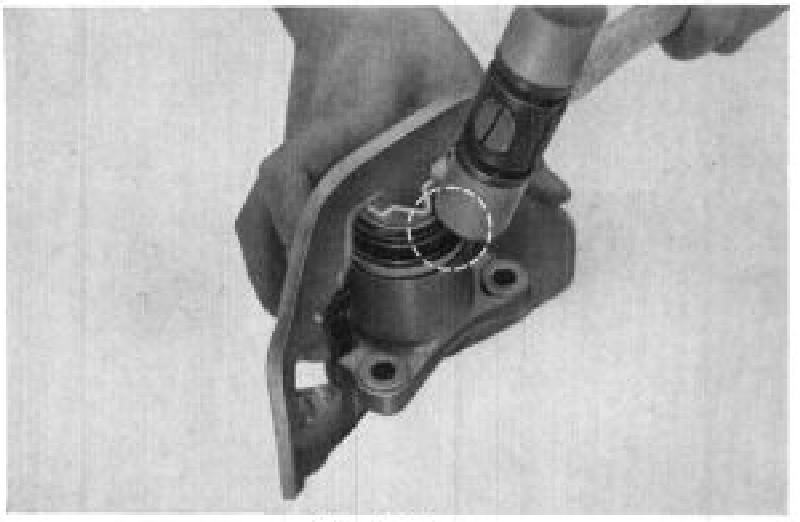


Fig. 11E-14

7. Fig. 11 E-14 shows the tapping point to loosen the piston.

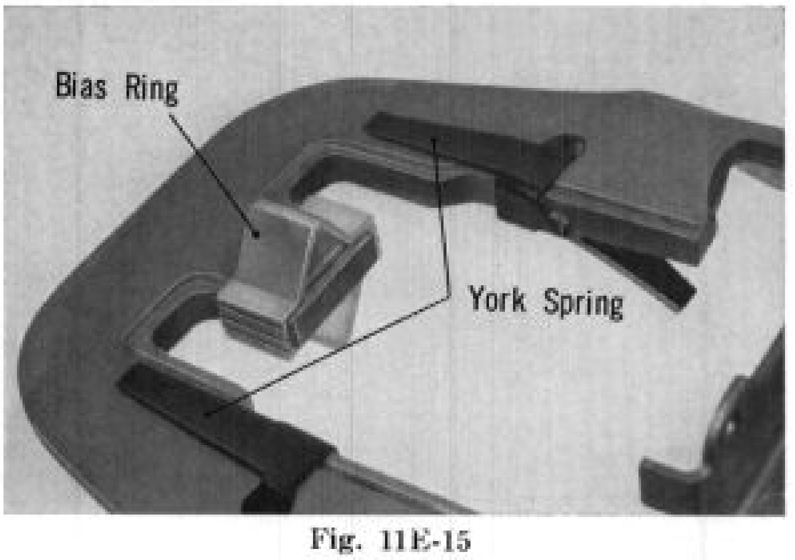


Fig. 11E-15

8. Remove the bias ring and also the two yoke spring from the caliper.

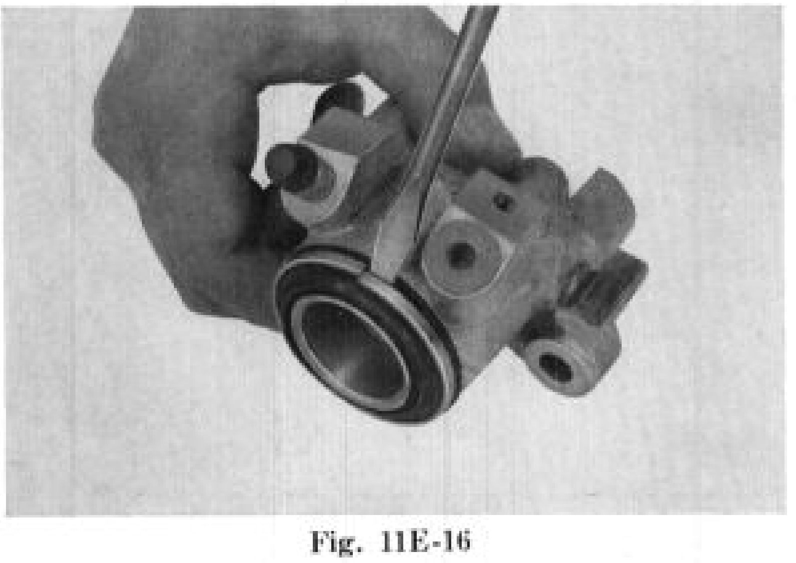


Fig. 11E-16

9. Remove the piston boot retainer rings at the both ends of the cylinder, using a driver and exercising care not to damage the rubber boots.

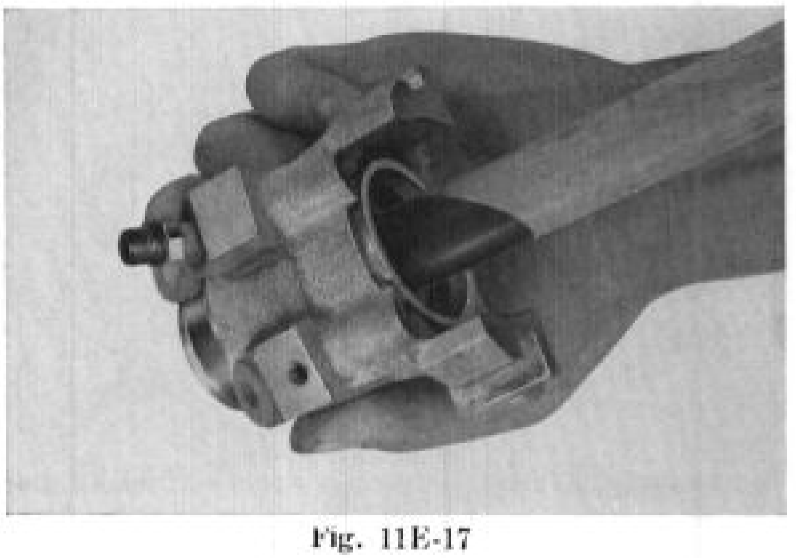


Fig. 11E-17

10. Both pistons (inner and outer) can be removed from the cylinder body by pushing through from one end, using a wooden rod as shown in Fig. 11 E-17.

11. Remove the piston seals installed on the inside of the cylinder at the both ends usińg a screw driver.

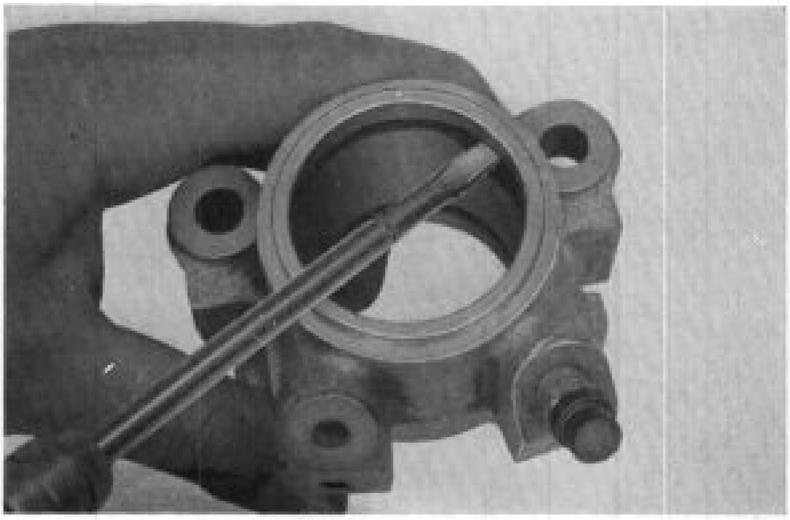


Fig. 11E-18

Assembly

12. Clean all the parts in solvent and dry thoroughly with compressed air.

13. Apply brake grease on the grooves and sliding surfaces and install the yoke springs with the tongue positioned toward the disc as shown in Fig. 11 H-19.

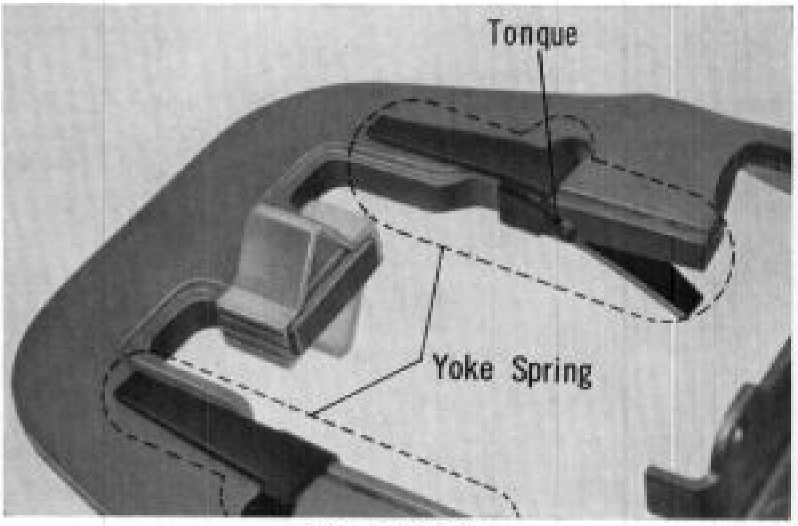


Fig. 11E-19

14. Apply rubber grease to the new piston seals as well as in the seal grooves and install the seal as shown in the detail in Fig. 11 E-20 bottom right. A piston seal installed in the incorrect way will result in oil leaks. Install the seals in the correct position without fail.

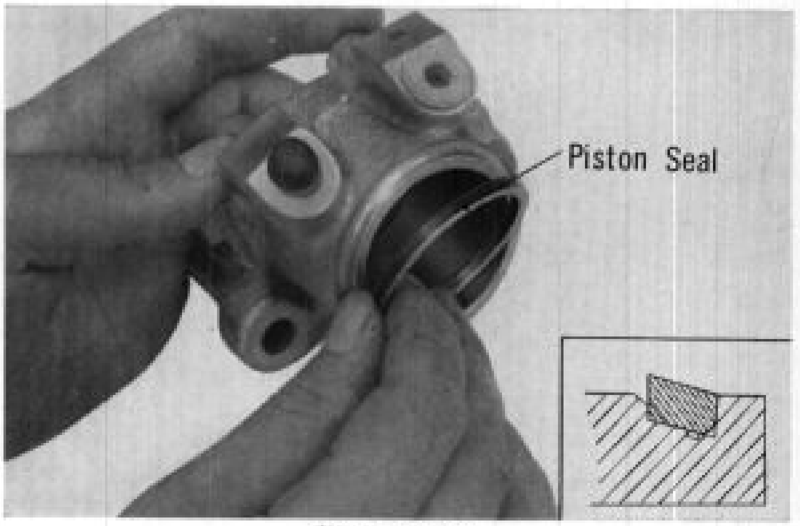


Fig. 11E-20

15. Apply rubber grease sparingly on the inside surface of the cylinder and insert the pistons into the cylinder untill the end of the piston skirt is even with the end of the cylinder. The outer piston and inner piston are not interchangeable, therefore, care should be taken so that the pistons are located correctly.

16. Insert a new bias ring into the outer piston which has been cleaned and dried. The bias ring must be installed to the full depth with the round brim toward the bottom. Whenever the cylinder is removed from the yoke, the bias ring should be replaced with a new one.

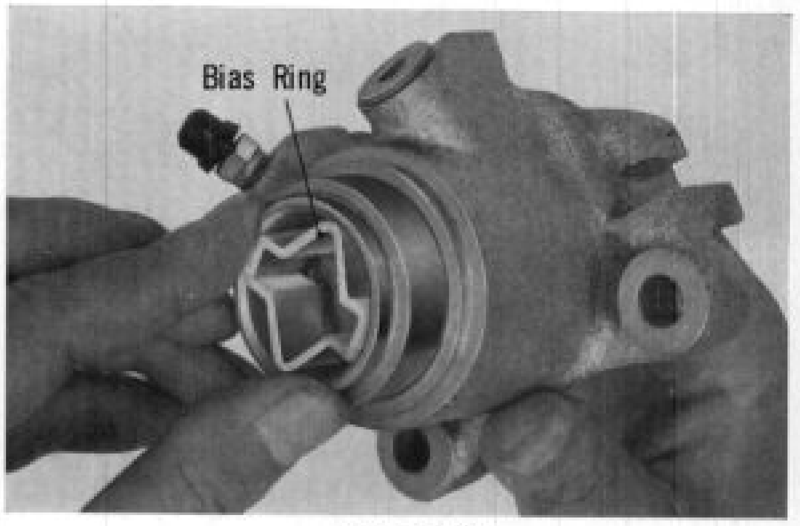


Fig.11E-21

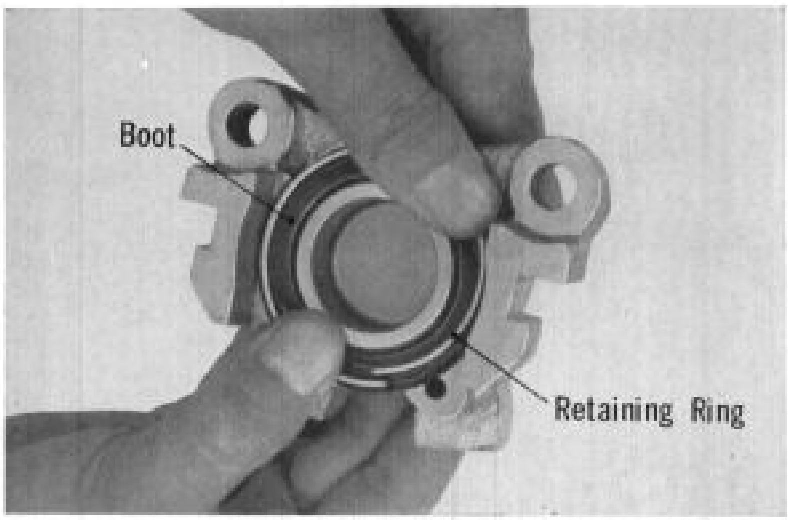


Fig. 11E-22

17. Install boots over both pistons and fix with retaining rings as shown in Fig. 11 E-22. Care should be taken so as not to damage the boots when installing the retaining rings.

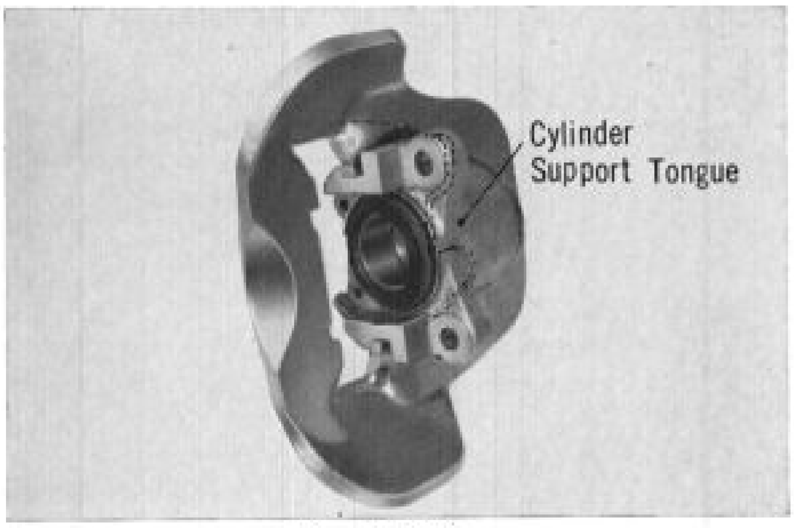


Fig. 11E-23

18. Apply grease on the sliding surfaces of the caliper and cylinder body.
Align the bias ring which is assembled in the outer piston so that the slot in the ring will fit on the cylinder support tongue of the caliper. Use extreme care not to damage the rubber part.

Installation and Inspection

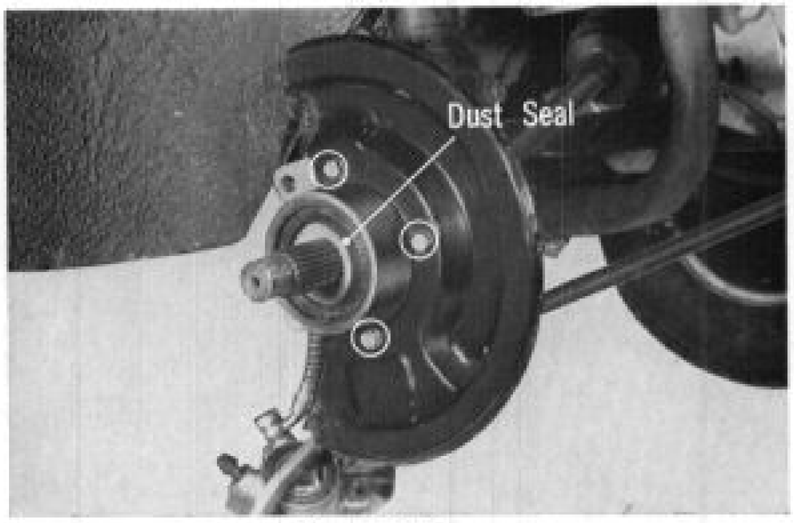


Fig. 11E-24

19. Install the splash shield plate on the knuckle, and install the dust seal to both the wheel bearing and the thrust plate.

20. Install the disc together with the hub on the spindle with the hub nut. Torque the nut to specifications.
Note:
Use new cotter pin.

21. Check the perpendicularity (runout) of the disc with respect to the spindle. Runout greater than 0.10mm (0.004 in.) at point near the disc circumference should be corrected or the disc should be replaced.

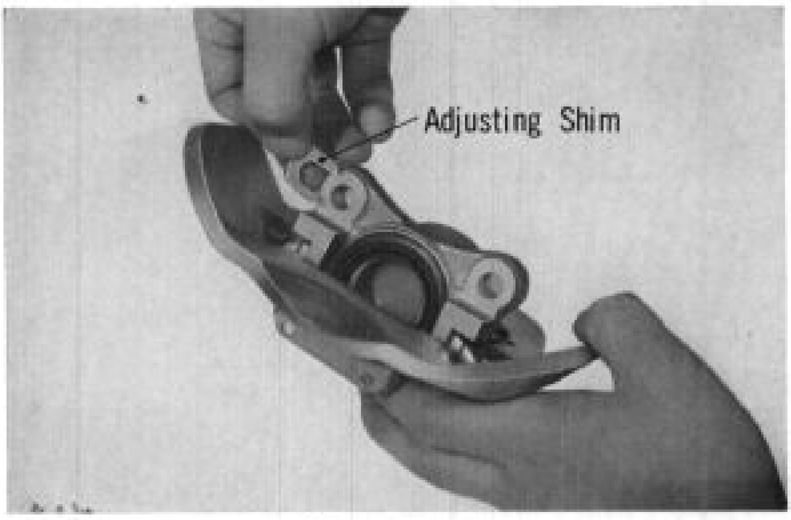


Fig. 11E-25

22. Adjusting shims should be installed between the knuckle and the cylinder body on those vehicles whose brake pads are difficult to fit when newly replaced.

Thickness are as follows:
(1) 0.4 mm (0.016 in.)
(2) 0.6 mm (0.024 in.)

Note:
Never replace them with those of different thickness. The proper shim has been selected in the factory.

23. Tighten the two bolts which fasten the caliper on the knuckle to a torque value of 5.0 kg-m~6.0 kg-m (37~44 lb-ft).

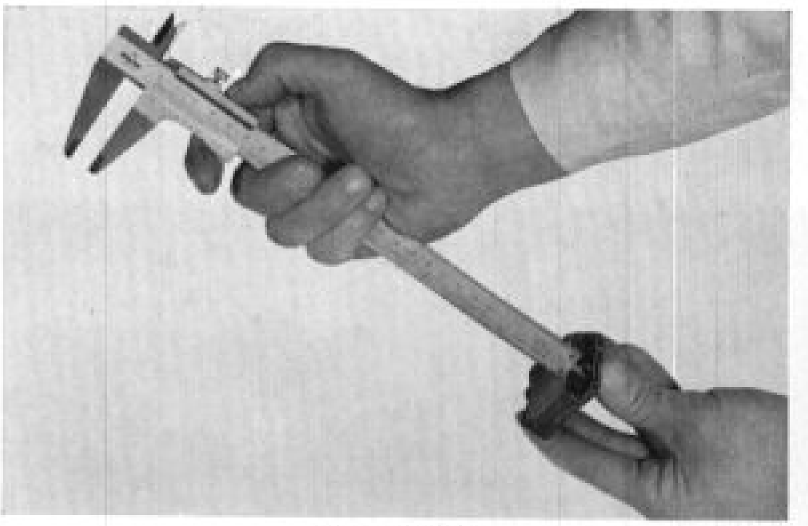


Fig. 11E-26

24. New brake pad lining has a thickness of 10.3mm (0.406 in.).
They should be replaced when worn to 2.00mm (0.08 in). Refer to the instruction in "Replacement of Brake pad".

25. The brake disc will develop circular scores as shown in Fig. 11 E-27 after long or even short usage when brake is applied frequently. Excessive scoring not only causes a squealing brake but also shortens the service life of the brake pads.

However, light scoring of the rubbing surface not exceeding 0.4mm (0.015 in) in depth, may result from normal use and is not detrimental to brake operation.

Worn Disc
Fig. 11E-27

26. Machining of the disc having an initial thickness of 9.6 mm (0.378 in.) will result in a reduced thickness. The disc must not be ground beyond the serviceable limit of 7.6 mm (0.299in).

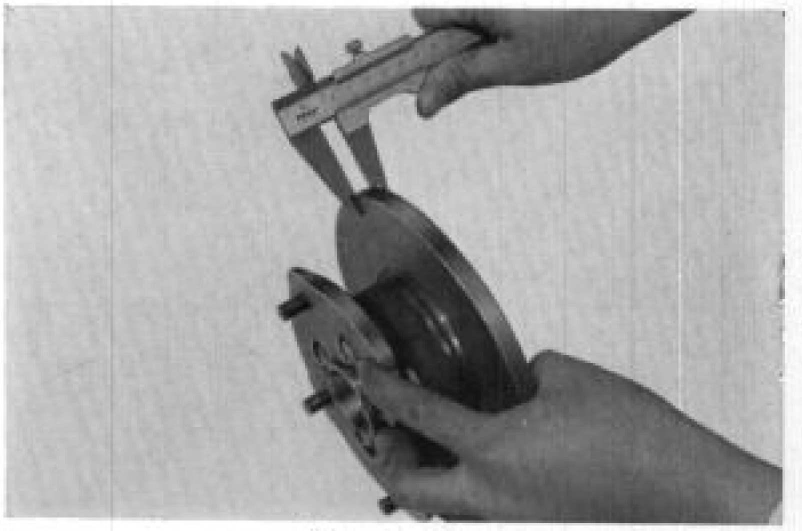


Fig. 11E-28

Check the wheel bearings for excessive play and replace if necessary. Measure the total lateral runout of the disk by turning slowly. Do not push the disk in the axial direction as this will give a false reading. The maximum permissible runout is 0.10mm (0.004 in).

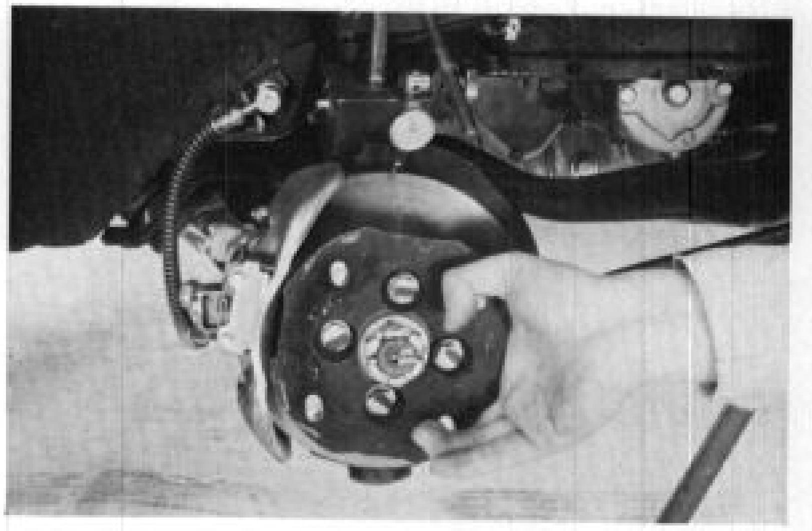


Fig. 11E-29

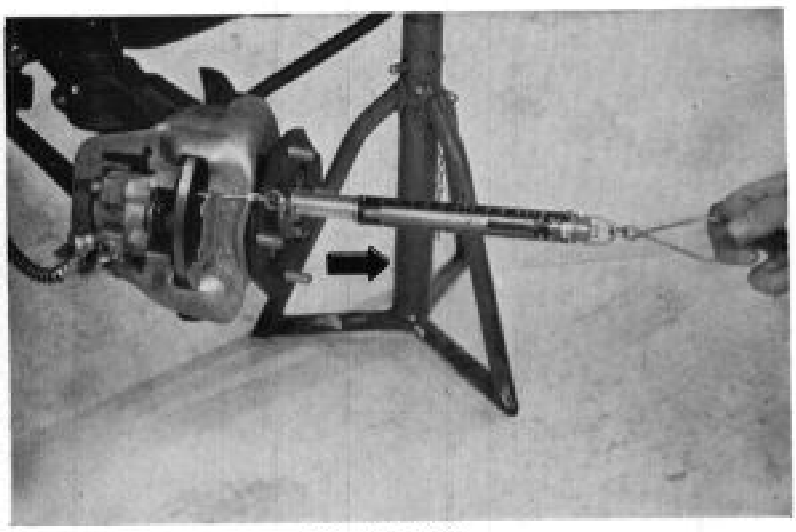


Fig. 11E-30

Inspect the caliper operation. If lining wear differs extremely between inner and outer pads, the caliper may be unable to move peoperly due to rust and dust at the sliding surfaces.
Clean the sliding part of the caliper and apply brake grease. Measure the amount of force required for sliding the caliper from the neutral position with a spring scale.

Standard reading; 25 kg (55 lbs)

Disk Brake Trouble Diagnosis

Trouble	Cause of Trouble	Corrective Action
Excessive vibration or large pedal stroke	1. Air present in fluid pressure system	Bleed air
	2. Oil leakage from fluid pressure system	Repair
	3. Faulty master cylinder piston, cup and seal	Replace
	4. Insufficient brake oil	Replenish and bleed air
	5. Worn front brake pad	Replace
	6. Unevenly worn front brake pad	Repair or replace
	7. Malfunction of pedal link system	Adjust
	8. Excessive runout of brake disc	Adjust
Squealing noise	1. Dragging of brake	Refer to the section on dragging
	2. Worn brake pad	Replace
	3. Deteriorated brake lining surface	Replace
	4. Improperly installed shim	Correct
	5. Foreign particle deposited on the friction area of disc.	Clean
	6. Runout or damaged disc	Correct by machining
	7. Disc surfaces not parallel	Correct by machining or replace

Trouble	Cause of Trouble	Corrective Action
Uneven braking	1. Improper inflation of tire	Inflate properly
	2. Water or oil deposited on the brake pad surface or disc	Clean or replace
	3. Worn or damaged (strain, rust) disc and drum	Correct by machining or replace
	4. Poor contact of pad surface	Correct or replace
	5. Carbonized or faulty pad	Replace
	6. Loose caliper mounting bolt	Retighten
	7. Malfunction of brake cylinder	Check and replace, if necessary
	8. Improper tightening of wheel bearing	Retighten
	9. Different pad material used on the left and right wheels	Replace
	10. Improperly aligned front wheel	Realign
	11. Clogged fluid pressure system	Clean
	12. Improper action of caliper yoke	Clean and apply brake grease
Dragging of one or both wheels	1. No pedal play	Adjust
	2. Weak or broken brake pedal return spring	Replace
	3. Malfunction of pedal link system	Adjust
	4. Clogged master cylinder return port	Repair
	5. Poor action of caliper yoke	Clean and apply brake grease
	6. Loose wheel bearing	Retighten
	7. Clogged fluid pressure system	Clean

Trouble	Cause of Trouble	Corrective Action
Insufficient braking force	1. Worn brake pad	Replace
	2. Water and oil on the brake pad contact area	Clean or replace
	3. Insufficient brake fluid	Replenish
	4. Air mixed into brake fluid	Bleed air
	5. Oil leakage from the fluid pressure system	Check and repair
	6. Oil leakage from master cylinder and caliper body seal	Check and replace
	7. Use of imitation or inferior pad	Replace with genuine part (brand name "TOKICO" marked on the back surface)
	8. Deteriorated pad and poor contact	Repair or replace
	9. Improper action of caliper yoke	Clean and apply brake grease
	10. Clogged fluid pressure system	Check and clean

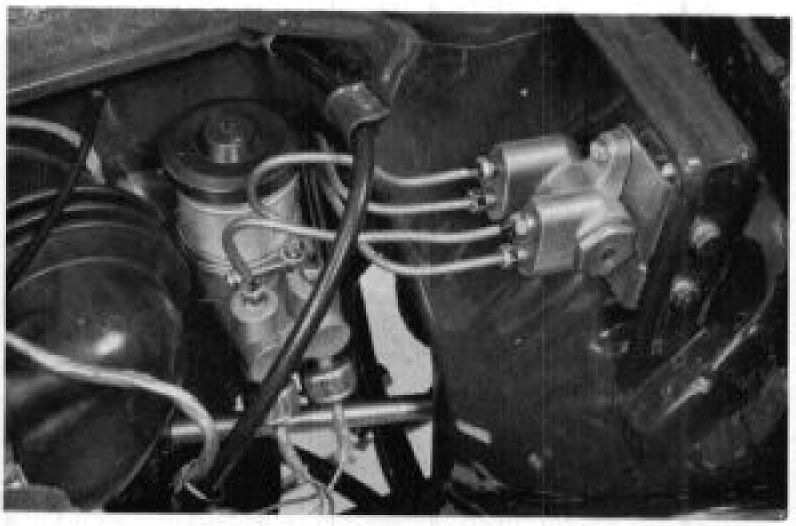


Fig. 11F-1

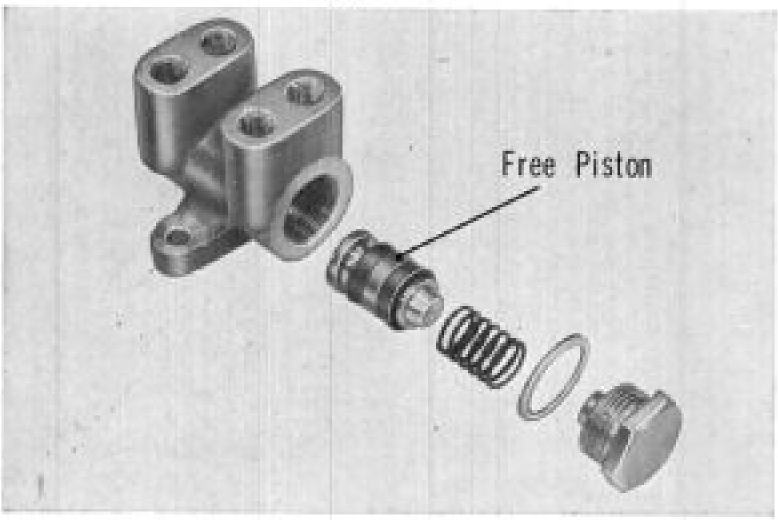


Fig. 11F-2

F. Bypass Valve

The bypass vlave is provided for all N600 Model vehicles equipped with a dual brake system and parallel master cylinder. Since the N600 is the front wheel drive car, its weight districution favors front wheels to provide greater vehicle tracking force. This also means the braking force is greater on the front wheels than on the rear. Thus, wear of the front wheel shoes occurs quicker than that of rear wheel shoes. For the parallel master cylinder, the equalizer, a link functions to balance the hydraulic pressure between the front and rear brake system (refer to Section C "Master Cylinder" for details).

However, this balancing can exceed control of the equalizer when wear of the front wheel shoes becomes excessive, resulting in greater oil pressure on the rear wheels than the front wheels; at worst, rear brake locks before front wheels. The bypass valve on the stay of the spare tire is provided to prevent this trouble. (Fig. 11F-1)

As shown in the Fig. 11F-2, the bypass valve contains a free piston, which functions during braking to maintain equal oil pressure in the front and rear brake system.

G. Proportioning Valve

Description

With the front engine and front wheels drive vehicles (Model FF), the front wheels (driving axles) are designed to receive greater body weight than the rear wheels to insure greater driving performance. However, since there is greater weight on the front wheels and further increases during sudden braking, the weight on the rear wheels decreases in turn. In this state, as the rear wheels have a smaller body weight load, they brake easier, causing locking at the time of sudden brake, if equal oil pressure were applied at both the front and rear.

The proportioning valve prevents this trouble. It is located under the floor of the rear compartment, and functions to reduce the amount of oil pressure on the rear wheels and to balance the braking effect between the front and rear wheels.

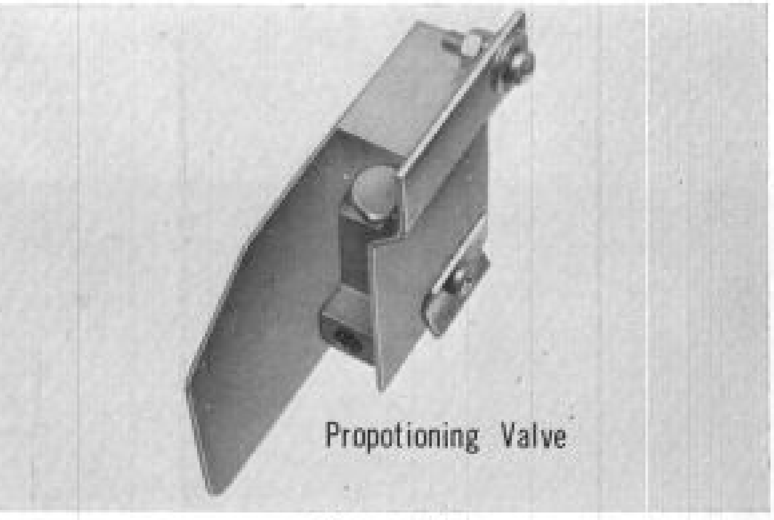


Fig. 11G-1

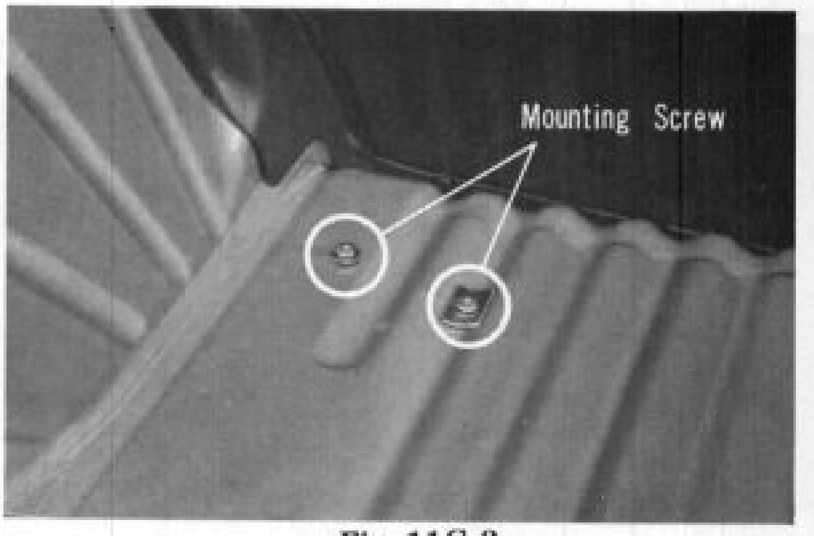


Fig. 11G-2

Remove the two nuts from the bolts which secure the proportioning valve and the protection cover.

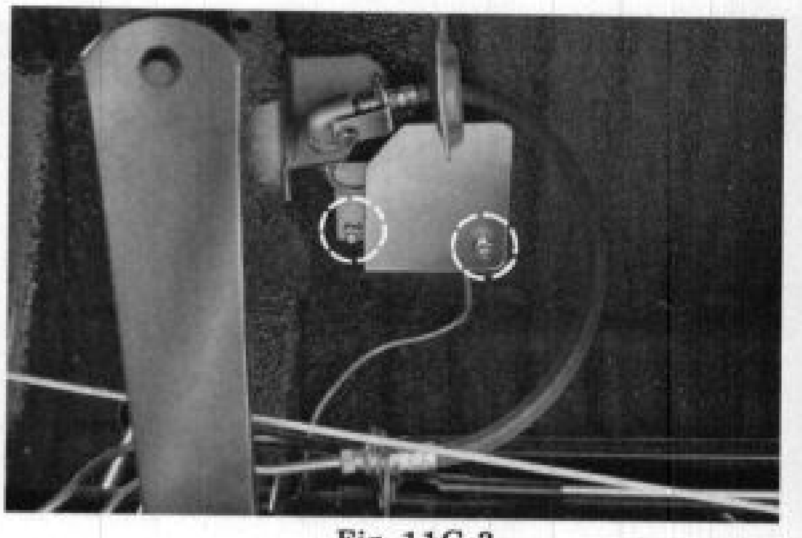


Fig. 11G-3

Remove the brake pipe from the proportioning valve.

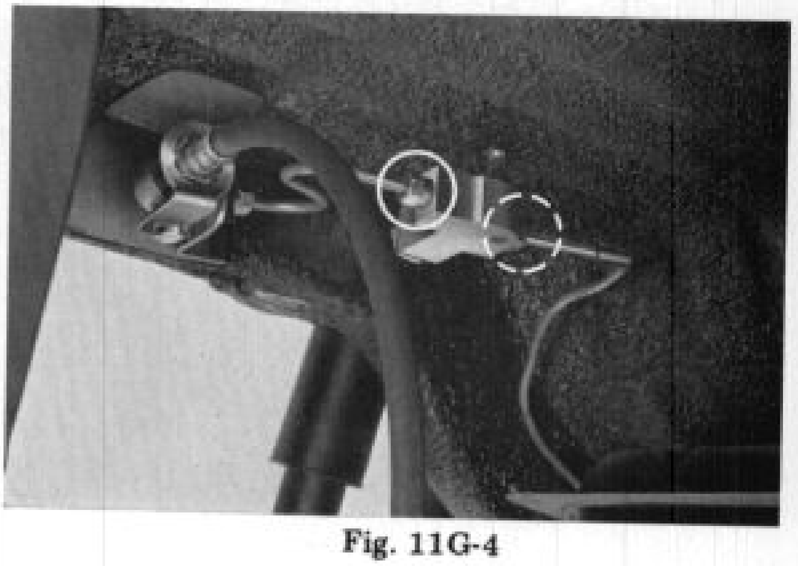


Fig. 11G-4

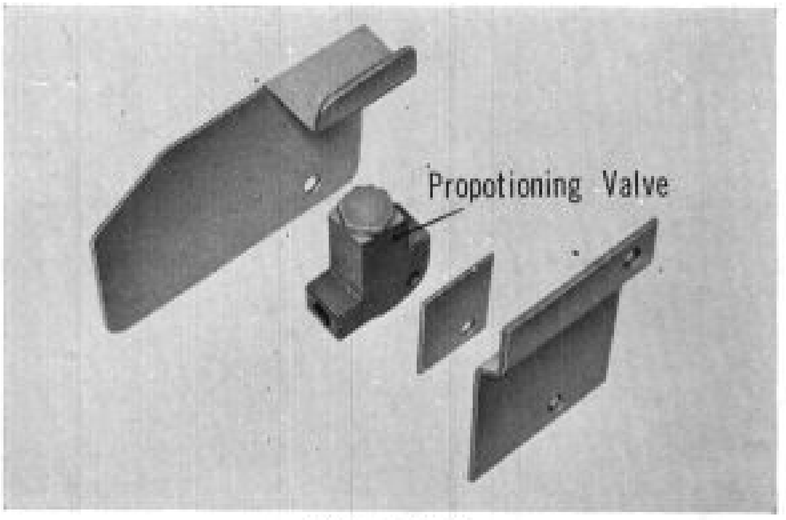


Fig. 11G-5

Avoid disassembling of the proportioning valve if possible. Make replacement as an assembly when found defective.

H. Vacuum Booster

Description

Major components of the diaphragm type vacuum booster are the relay valve, the power cylinder and the hydraulic cylinder.

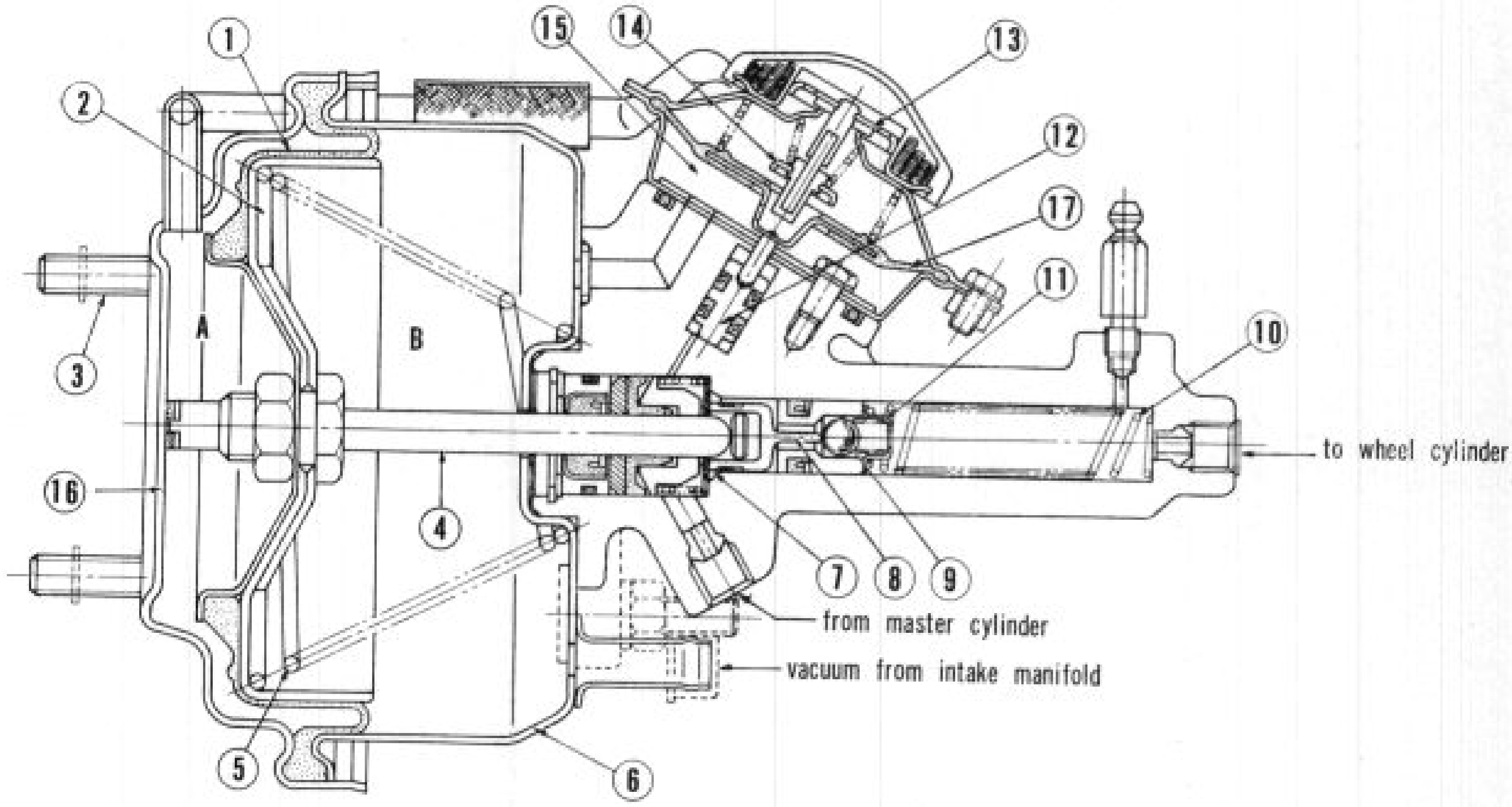


Fig. 11H-1

(1) Diaphragm
(2) Diaphragm plate
(3) Cylinder stud
(4) Push rod
(5) Power piston return spring
(6) Power cylinder front housing
(7) Piston stopper washer
(8) Yoke
(9) Ball check valve
(10) Piston return spring
(11) Hydraulic piston
(12) Relay valve piston
(13) Air valve
(14) Vacuum valve
(15) Relay valve
(16) Power cylinder rear housing
(17) Relay valve diaphragm

1) Vacuum booster in static condition

Fig. 11 H-1 shows the condition where the brake system is not in operation.

In this state, the vacuum from the engine intake manifold is admitted to compartment "B" of the power cylinder through the check valve and also enters compartment "A" through the relay valve.
Since both compartments "A" and "B" are in a state of vacuum, the power piston is forced toward the left (compartment A) by the return spring. The hydraulic piston is also at the left within the hydraulic cylinder against the piston stopper washer by the force of the piston return spring. The yoke is now bottomed, holding the ball check valve in the open position, allowing the hydraulic fluid from the master cylinder to pass through the center hole in the hydraulic piston and to the wheel cylinders. Further, even through the vacuum booster is not in operation, the brake system will still function in the conventional manner.

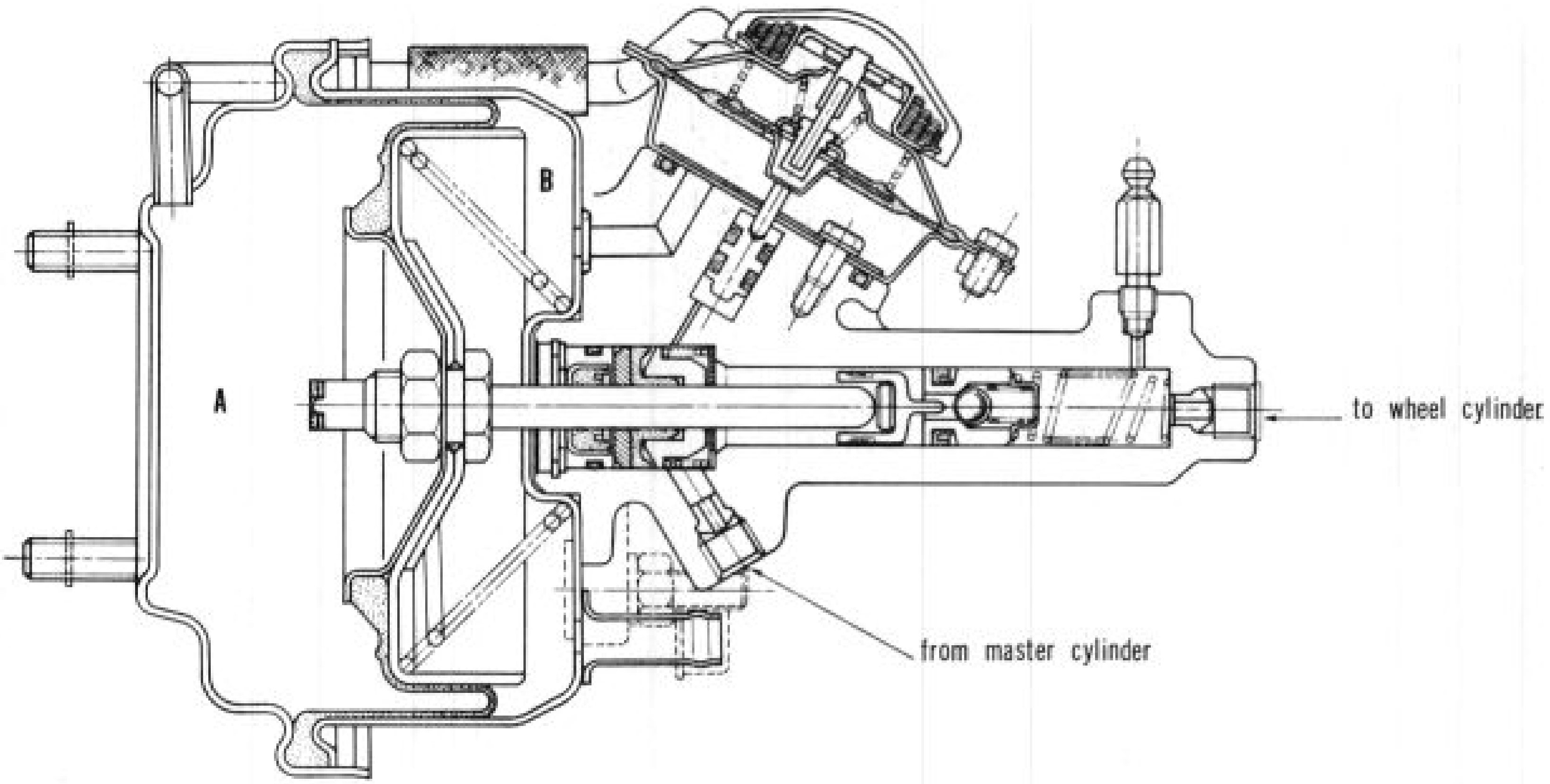


Fig. 11H-2

2) Vacuum booster in operating condition

Fig. 11H-2 shows the vacuum booster in operation. As pressure is applied to the brake pedal, the hydraulic pressure produced within the master cylinder is transmitted to the relay valve piston and the hydraulic cylinder. This causes the relay valve piston to be shifted upward, flexing the diaphragm and closing off the vacuum valve. As the pressure rises in the cylinder, the air valve is lifted off its seat and permits the filtered air to enter compartment A of the power cylinder.

At this time, since a differential in the piston moves toward the right as there is lower pressure in compartment B. The push rod attached to the power piston applies the booster force produced by the power piston directly against the hydraulic piston to start it moving, and the yoke which was in contact with the piston stopper washer becomes separated and blocks the ball check valve. This shuts off the flow of hydraulic fluid between the master cylinder and wheel cylinder and prevents the reverse flow of the high pressure fluid from the wheel cylinders. In this case, the total pressure applied to the wheel cylinders is the sum of the force applied to the push rod by the power piston and the force from the master cylinder applied directly to the hydraulic piston.

3) Released condition

When the brake pedal is released, the pressure applied to the relay valve piston drops, the air valve seals the inlet port and closes off the atmospheric pressure. The diaphragm separates from the vacuum valve and allows the vacuum to enter both chambers "A" and "B" of the power cylinder through the interconnecting passage. The air in the power cylinder is drawn into the intake manifold to recreate a state of vacuum within the vacuum booster.

Further, the power piston returns toward the left by the force of the power piston return spring; at the same time, the hydraulic piston also returns to its former position by the force of the hydraulic piston return spring. The yoke comes in contact with the piston stopper washer and opens the ball check valve.

Specification

Type	Power cylinder		Hydraulic cylinder		Relay valve piston	Color of label
	Effective dia.	Stroke	Diameter	Stroke		
DHM 4500/1Z	114.3 mm dia.	35.0 mm	14.3 mm dia.	35.0 mm	12.7 mm dia.	blue
DHM 4500/1Z	same as above	same as above	17.5 mm dia.	35.0 mm	same as above	red

Note:
A vacuum booster with a blue label fixed on the power cylinder has a hydraulic cylinder of 14.3 mm dia., while the one with a red label has the cylinder of 17.5 mm dia. Accordingly, the component parts should be selected by the color of the label.

Removal and Disassembly

1. The vacuum booster is mounted on the upper dash board adjacent to the air cleaner housing and also the check valve which prevents the pressure from being transmitted reversely is installed in the intake manifold at the end of the connecting hose.

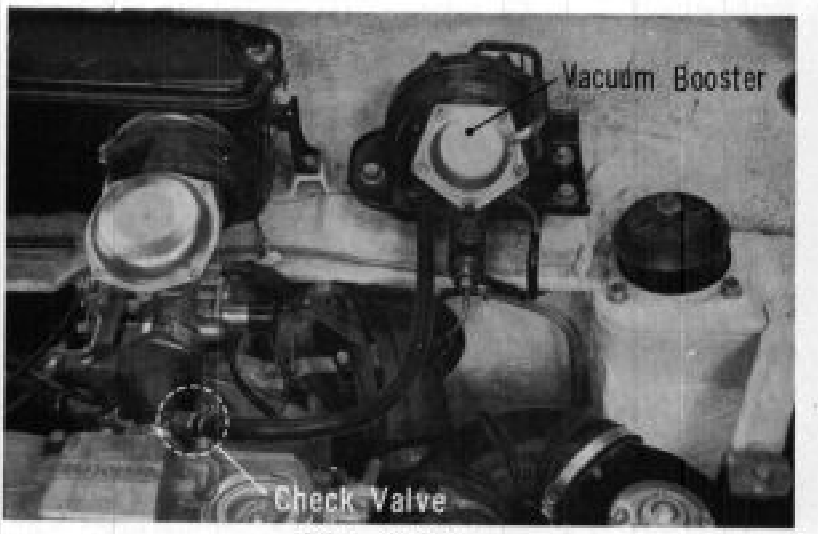


Fig. 11H-3

2. Disconnect the vacuum tube which connects the vacuum booster and the intake manifold, at the vacuum booster fitting.

3. Disconnect the master cylinder brake pipe and the wheel cylinder brake hose at the vacuum booster.

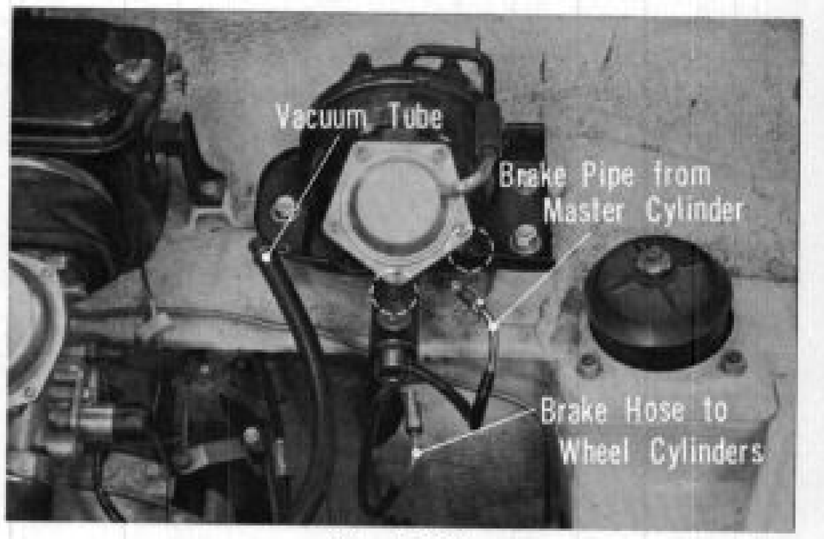


Fig. 11H-4

9. To disassembly the power cylinder, clamp the base of the special tool in the vise as shown in Fig. 11 H-9 and place the power cylinder on the base so that the three stud bolts on the front housing fit into the matching holes in the base.

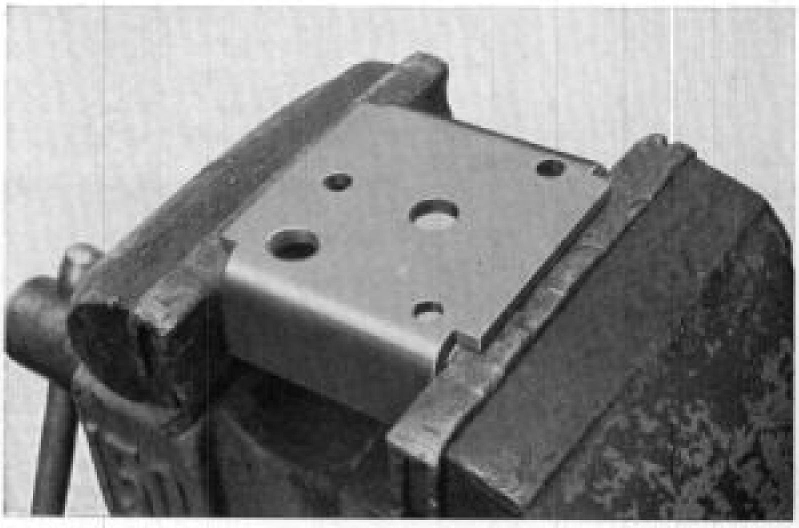


Fig. 11H-9

10. Mount the driver fitted with handles on the four stud bolts on the rear housing. The front and rear housings of the power cylinder can be separated by applying firm pressure on the driver handles in the counter clockwise direction.

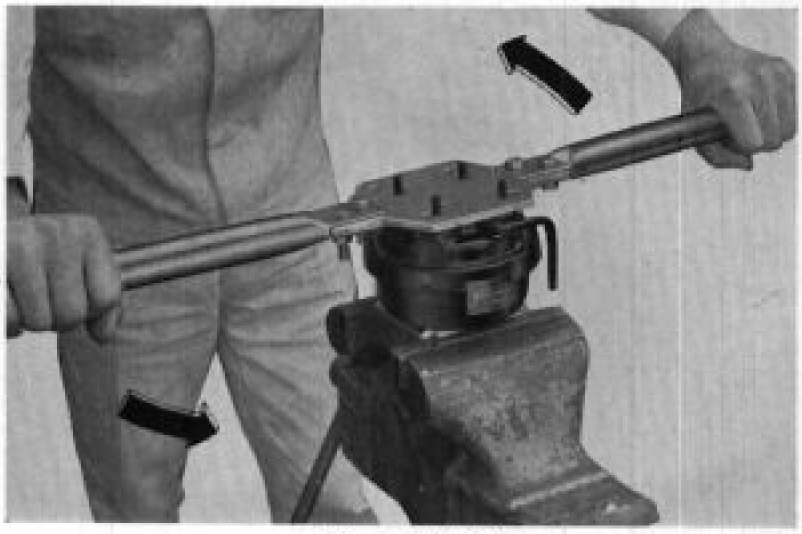


Fig. 11H-10

11. Fig. 11 H-11 shows the component parts of the power cylinder (the relay valve is mounted to show the relative positions of the air vent pipes.

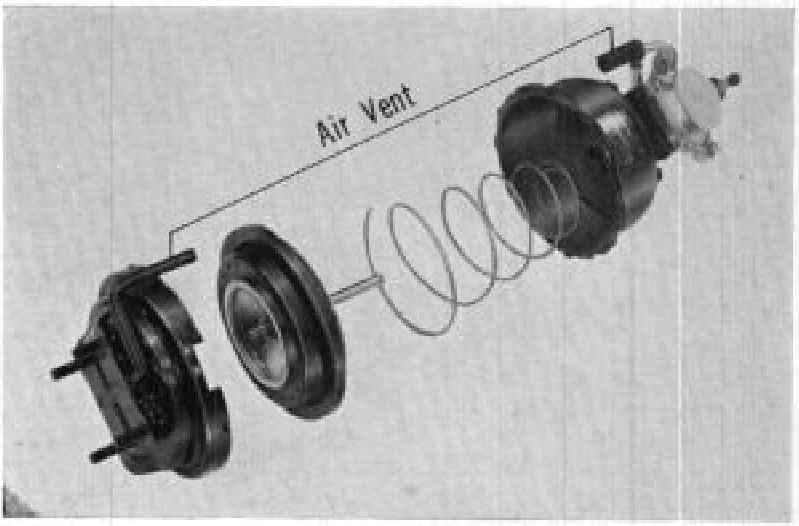


Fig. 11H-11

12. The rubber diaphragm can be removed from the diaphragm plate by slightly stretching it by hands as shown in Fig. 11 H-12.

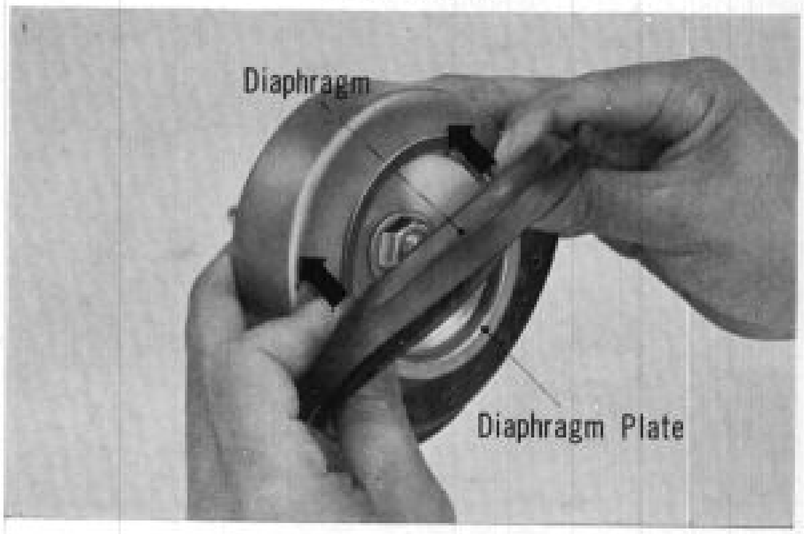


Fig. 11H-12

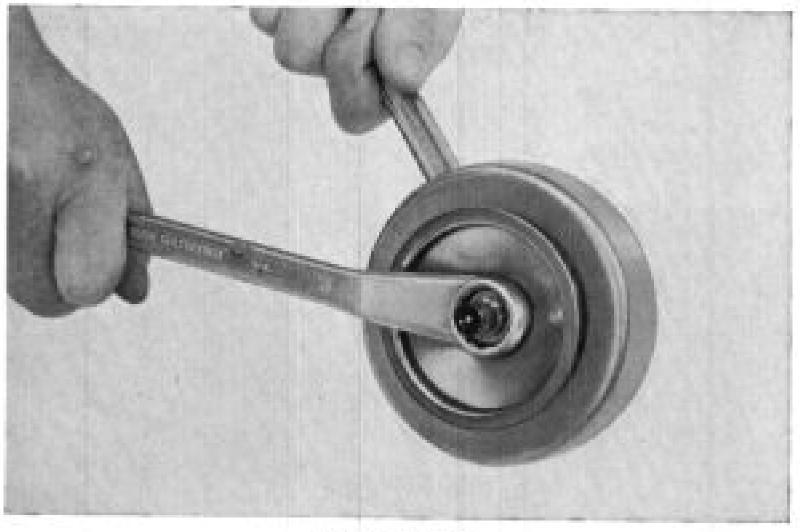


Fig. 11H-13

13. Separate the diaphragm retainer from the diaphragm plate by loosening the assembly bolt using two 16mm box wrenches (one should be a 15° offset head).

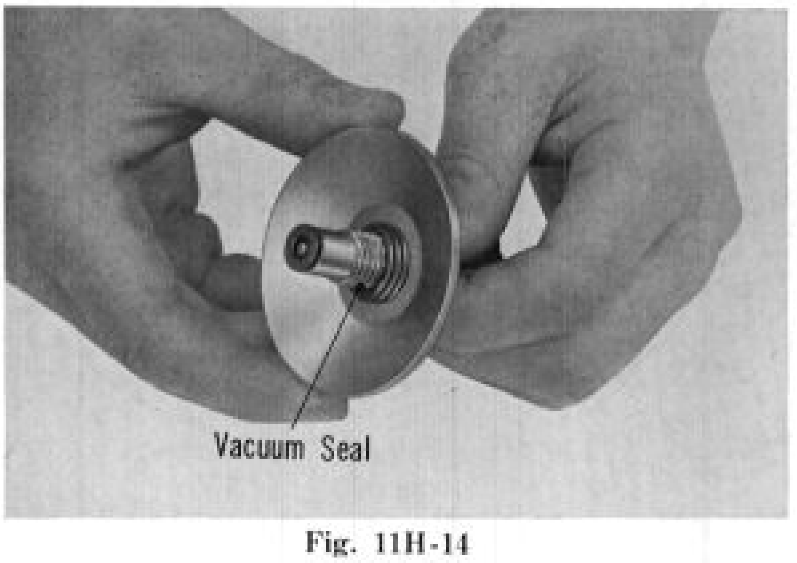


Fig. 11H-14

14. As shown in Fig. 11 H-14, a rubber vacuum seal is installed between the diaphragm plate and the diaphragm retainer. The seal must be replaced with a new item whenever the diaphragm plate is disassembled.

Fig. 11H-15

15. (Disassembly of Hydraulic Cylinder)
    Remove the hydraulic cylinder from the power cylinder housing in accordance with the description in paragragh 8. (Fig. 11 H-8 and Fig. 11 H-15).

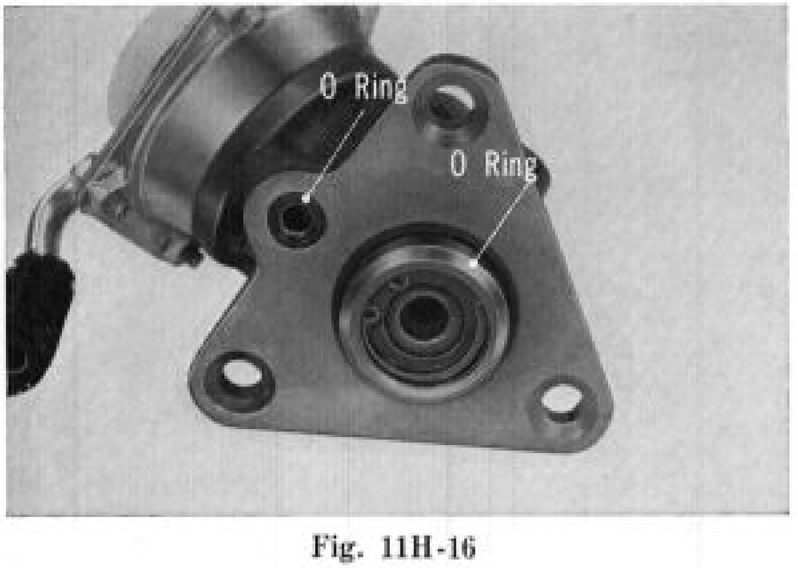


Fig. 11H-16

16. Remove the two 0 rings which are installed between the hydraulic cylinder and the power cylinder housing. Make sure that new 0 rings are installed during reassembly, regardless how the old ones appear. (Both of them are included in the repair kit).

17. Remove the circlip with a plier holding the other end with a finger as shown in Fig. 11 H-17. Extreme care should be taken as the valve on the inside is under pressure of the inner spring and will pop out.

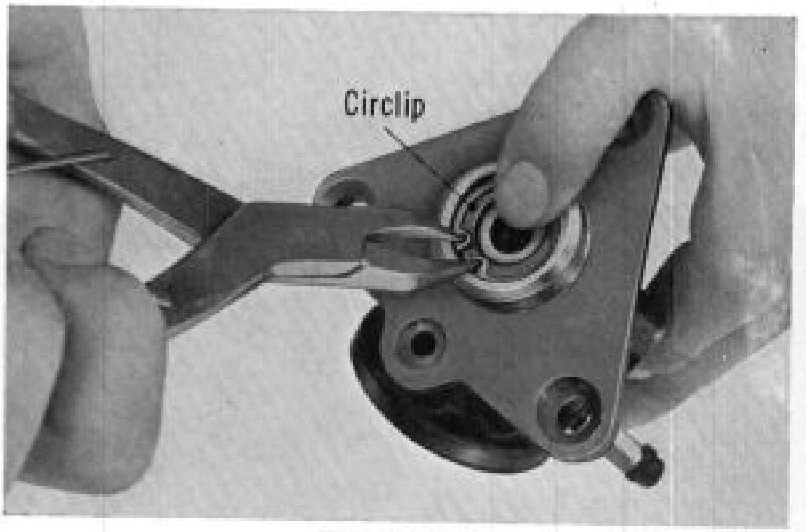


Fig. 11H-17

18. To keep the relative position of all the components within the cylinder in order, insert a screwdriver or a similar rod into the cylinder as shown when removing (Fig. 11 H-8 and Fig. 11 H-19).

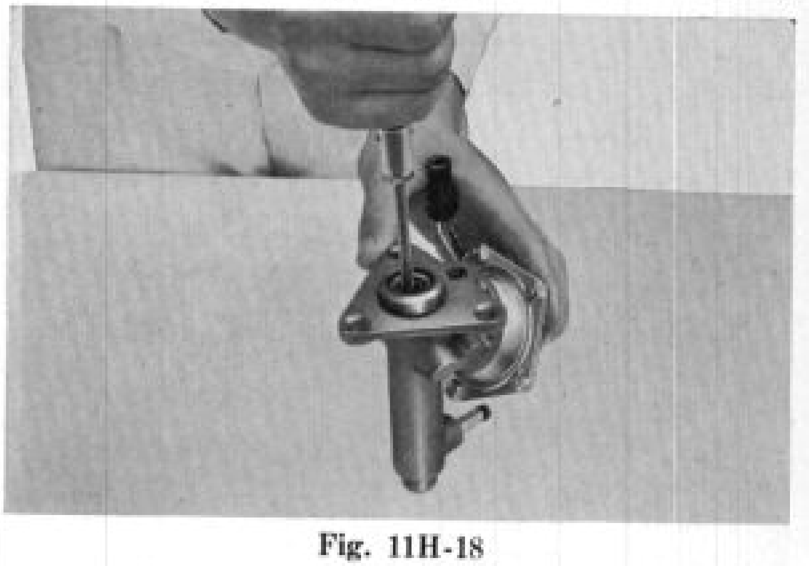


Fig. 11H-18

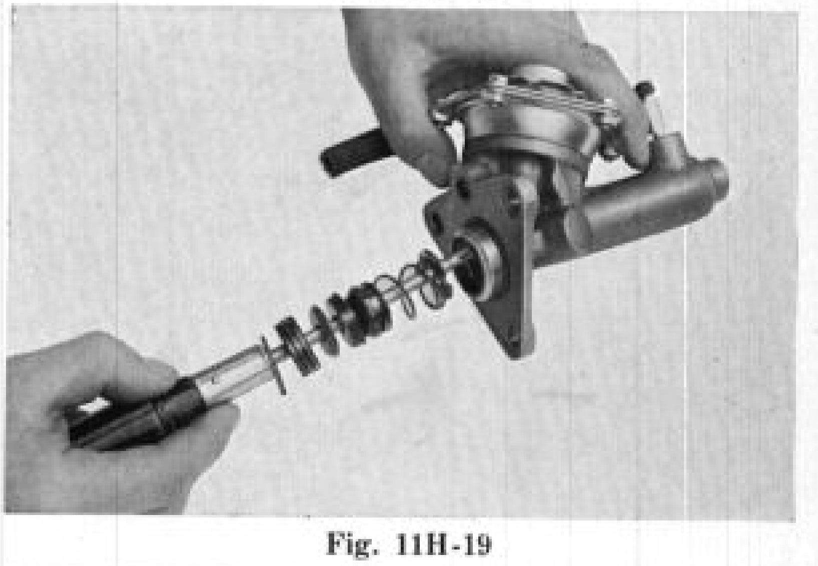


Fig. 11H-19

19. Remove the valve body cap with a screwdriver as shown in Fig. 11 H-20. Exercise care as the cap is easily broken.

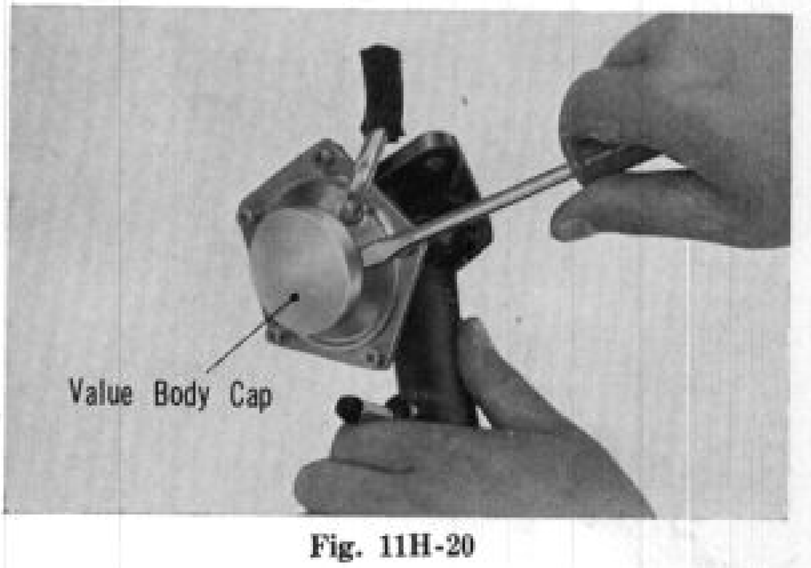


Fig. 11H-20

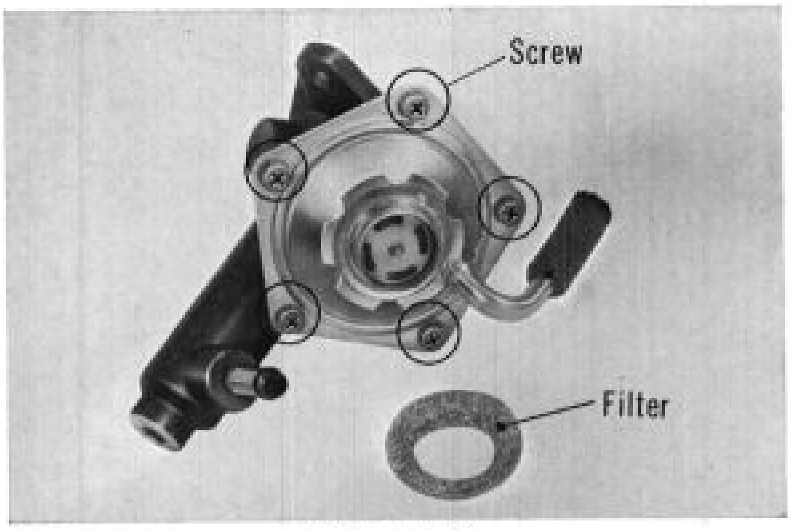


Fig. 11H-21

20. The steel wool filter ring contained within the valve body cap should be washed in gasoline and dried with compressed air whenever the cap is removed (Fig. 11 H-21).

    Perform this operation at every periods maintenances.

Fig. 11H-22

21. Remove five screws to disassemble the relay valve assembly from the diaphragm housing.

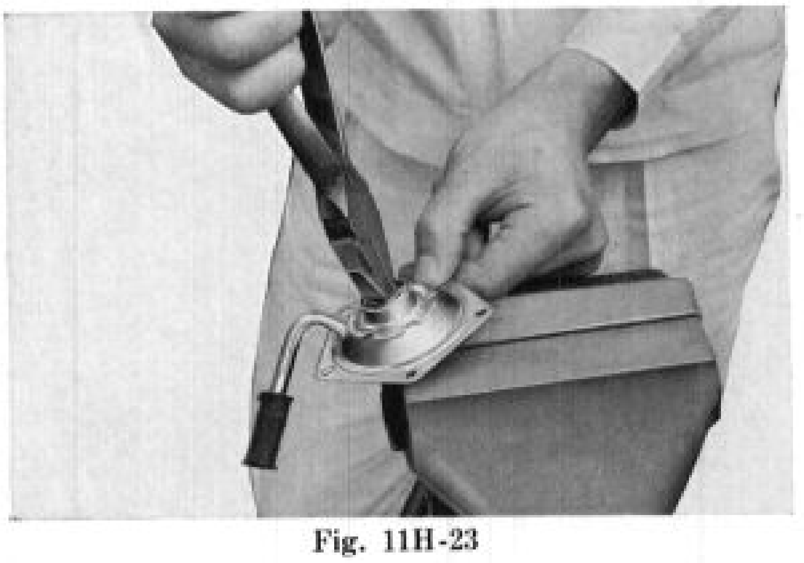


Fig. 11H-23

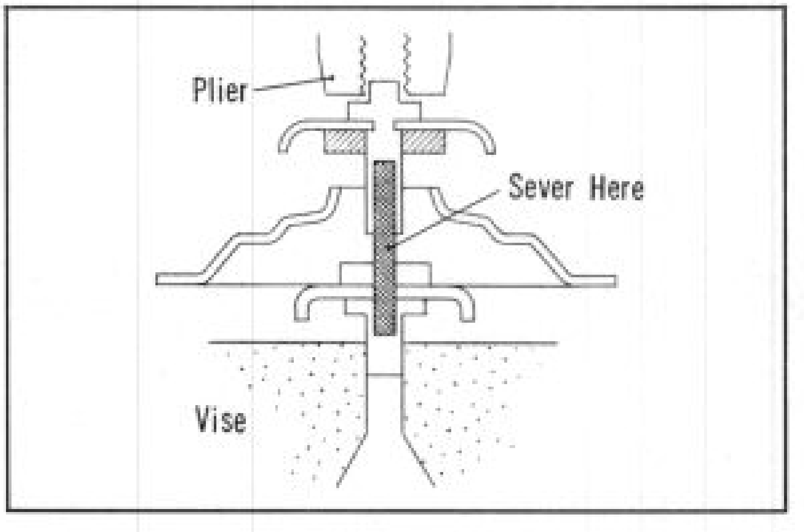


Fig. 11H-24

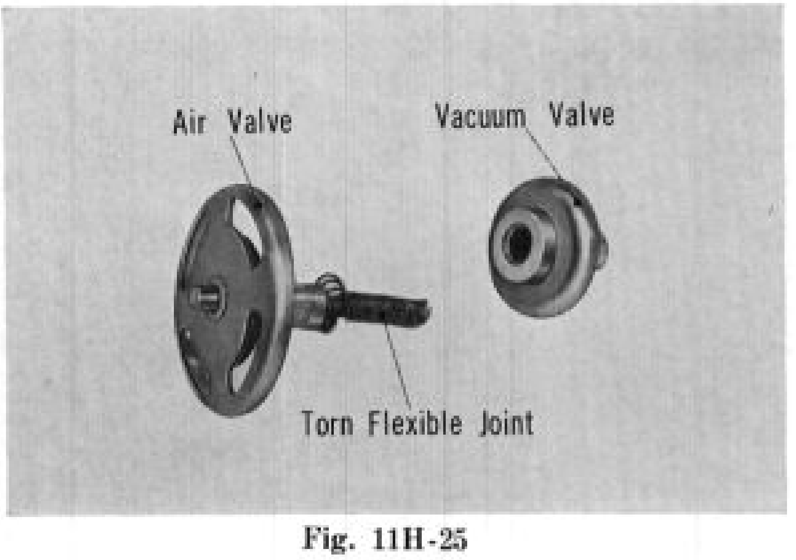


Fig. 11H-25

22. The factory assembled relay valve can not be disassembled without severing the stem as it is assembled by swaging.

    Firmly clamp the lower end of the valve assembly in a vise and pull the top of the valve with a plier (Fig. 11 H-23 and Fig. 11 H-24) to sever the flexible stem.

23. Fig. 11 H-25 shows the relay valve disassembled by severing the flexble stem.

24. The replacement relay valve is assembled by screw assemblying the vacuum valve and air valve. This permits easier servicing and future replacement.
    Fig. 11 H-26 shows the disassembled relay valve for replacement.

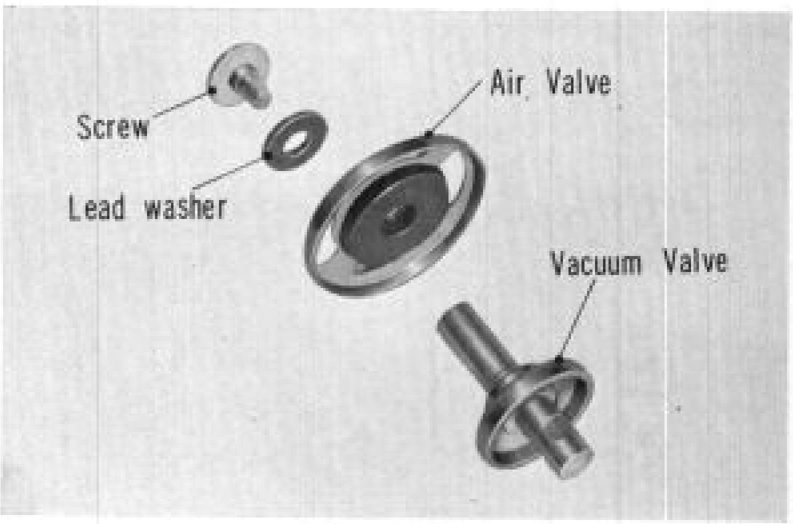


Fig. 11H-26

25. The relay valve housing can be disassembled as sohwn in Fig. 11 H-27.

26. If the relay valve diaphragm is not easily removable, apply compressed air through the bleeder hole.

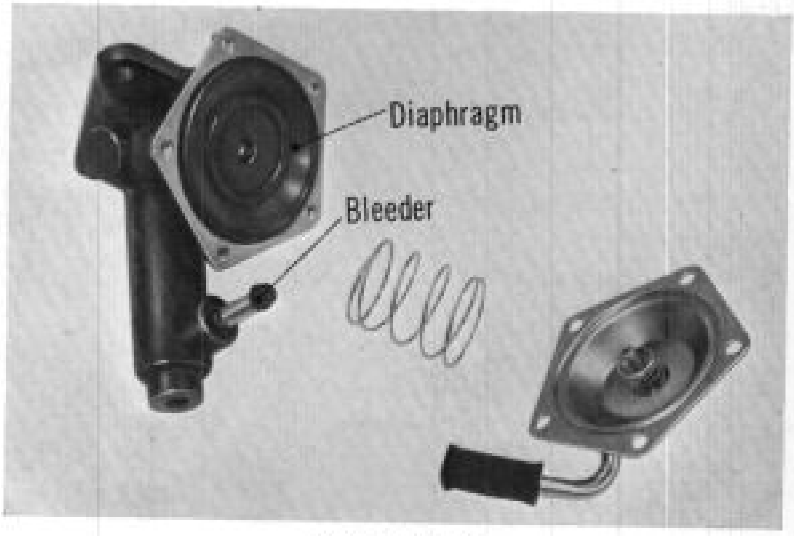


Fig. 11H-27

27. Remove the rubber diaphragm from the diaphragm retainer by stretching the inner diameter of the diaphragm by hand. Whenever the relay valve housing has been disassembled, always replace the rubber diaphragm with a new item regardless of the condition of the old one.

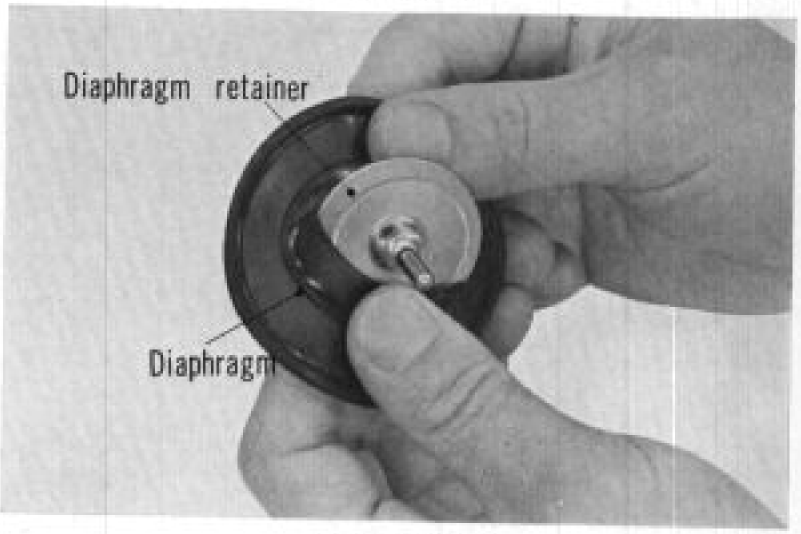


Fig. 11H-28

28. Remove the three screws which mounts the relay valve housing to the cylinder body. (Fig. 11 H-29 and Fig. 11 H-30).

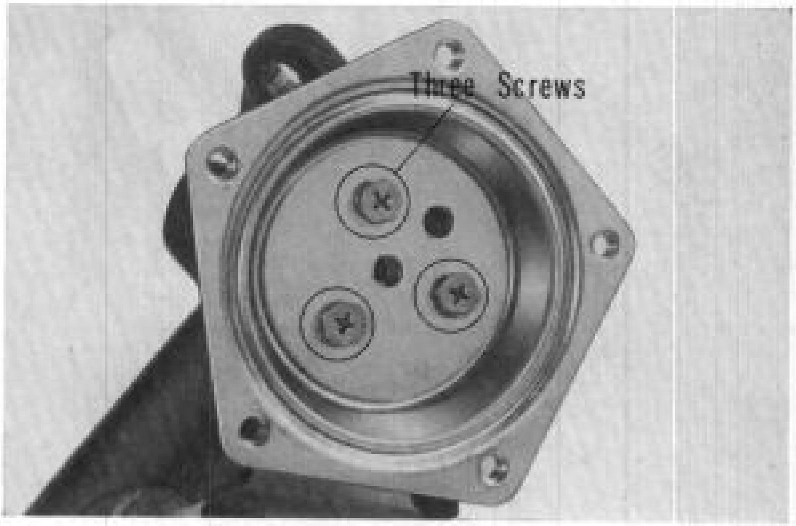


Fig. 11H-29

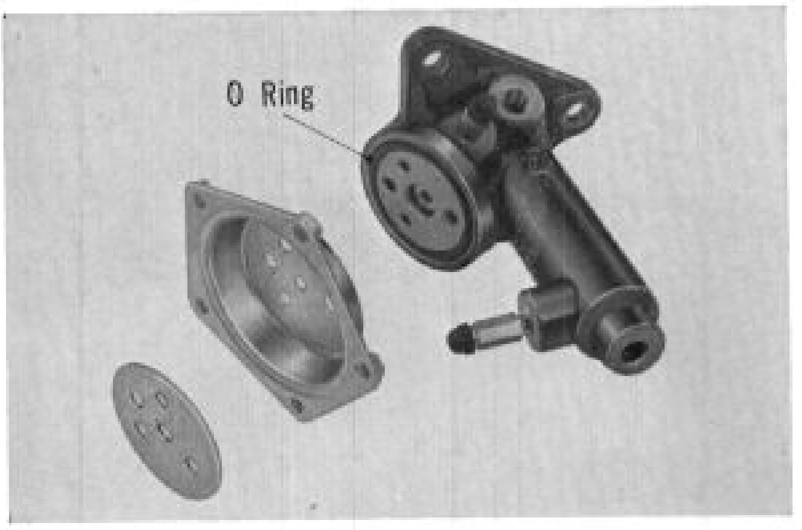


Fig. 11H-30

Assembly and Servicing

Rubber parts play vital roles in the function of the vacuum booster used in the N600. Any deformation or the slightest scratch to these rubber parts will affect the braking performance. For servicing the vacuum booster, a repair kit (Fig. 11H-31) is available, which contains the 12 rubber component parts, relay valve assembly and a tube of silicon grease. All parts of the kit must be replaced with a new items whenever the vacuum booster is disassembled, regardless of their condition. Further, the above parts must be replaced every two years.

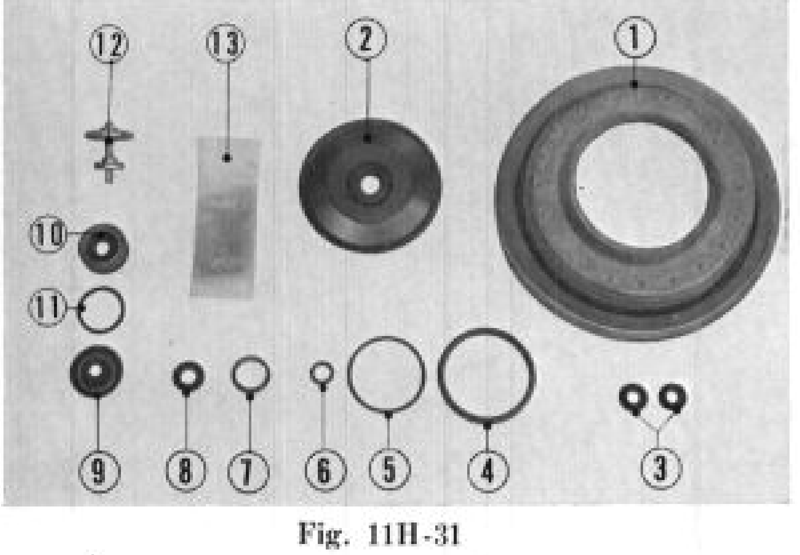


Fig. 11H-31

A set of repair kit for servicing N600 vacuum booster is shown in Fig. 11 H-31.
All the component parts included in the repair kit should replace the old ones whenever the vacuum booster is disassembled for servicing.

Repair Kit Parts List

1) Diaphragm
2) Relay valve diaphragm
3) Relay valve piston cup (2 pieces)
4) Relay valve unit O ring
5) Front housing O ring
6) Vacuum vent O ring
7) Vacuum seal
8) piston cup
9) Spring retainer cup
10) Push rod oil seal
11) Oil seal O ring
12) Relay valve assy.
13) Silicon grease

1. Replace the new relay valve with a new item. Insert the vacuum valve part from the bottom of the upper relay valve housing after removing the top screw along with a lead washer and the vacuum valve. Fix the air valve through the relay housing and fasten it with a screw and washer.

   Note that the top screw has LH threads.

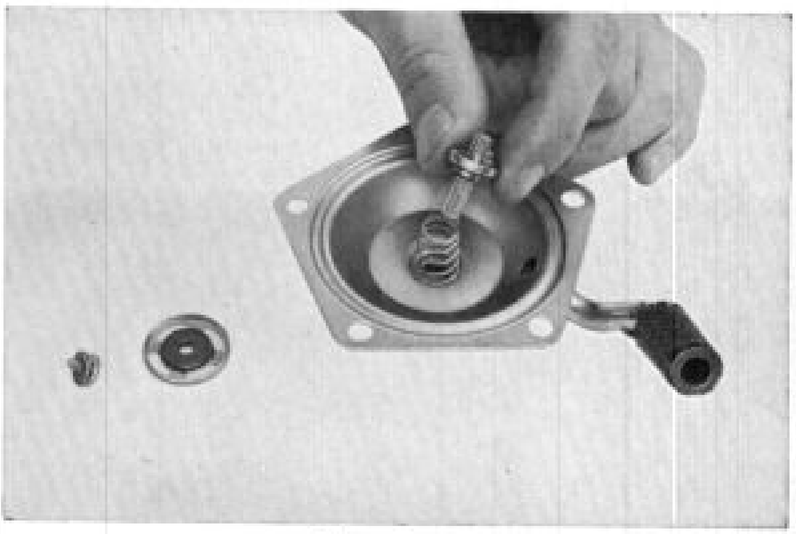


Fig. 11H-32

2. Assemble the new relay valve diaphragm on the relay valve retainer, exercising care not to damage the diaphragm when installing it.

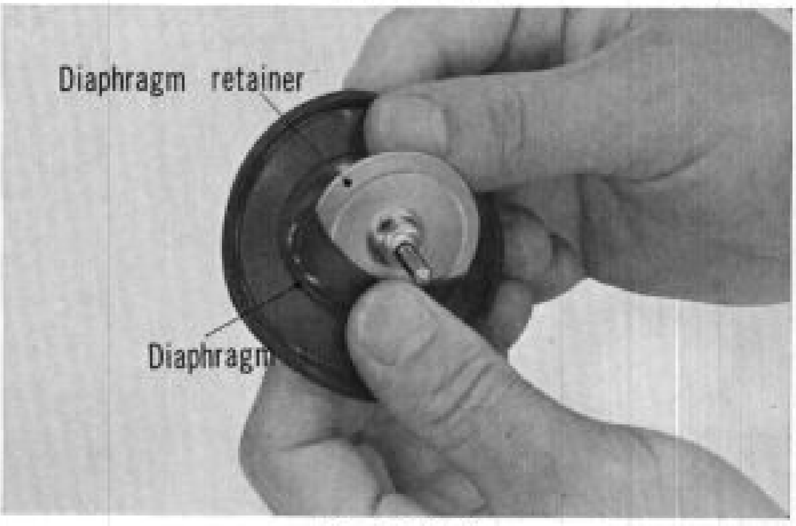


Fig. 11H-33

3. Fig. 11 H-34 shows the relay valve viewed from the top being installed into the relay valve housing.

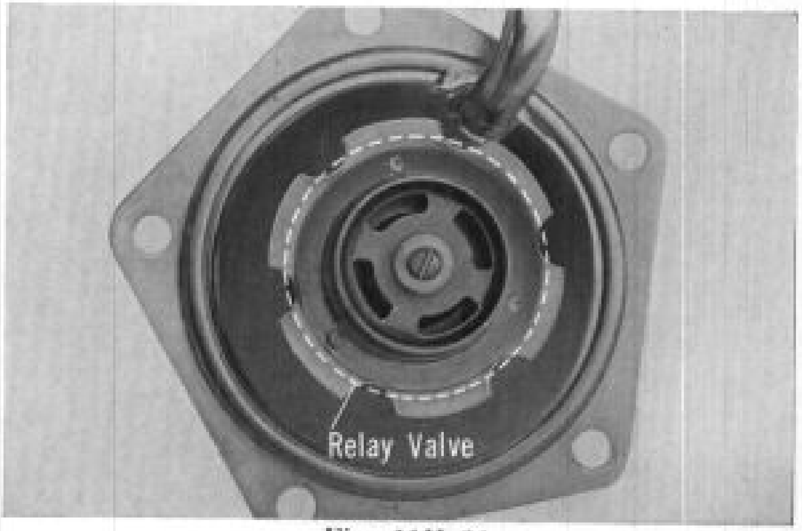


Fig. 11H-34

4. (Installation of diaphragm plate)
   Install the new vacuum seal between the diaphragm plate and the diaphragm retainer.

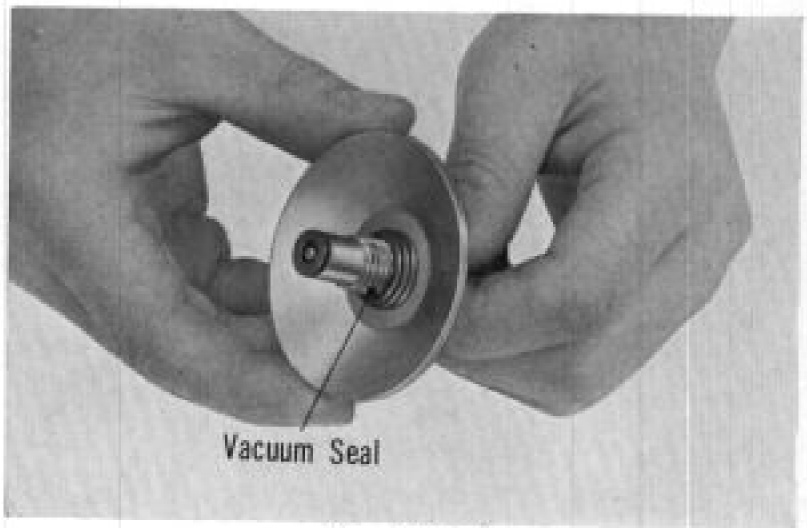


Fig. 11H-35

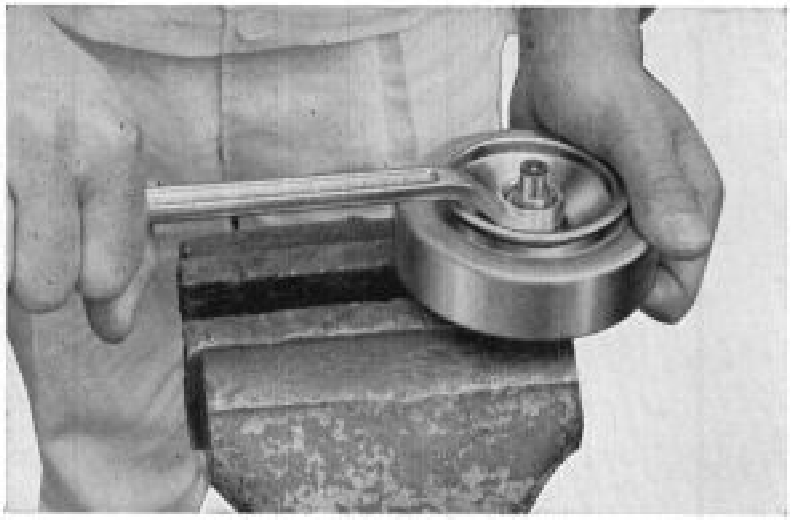


Fig. 11H-36

5. Hold the machined hex of the push rod in the box wrench clamped in the vise, assemble the diaphragm plate and retainer, and torque the retaining nut to 2—3 kg-m (14.5—21.7 ft-lbs). To prevent the vacuum seal from damage or shifting, hold both the diaphragm plate and retainer firmly by a hand while torquing the nut.

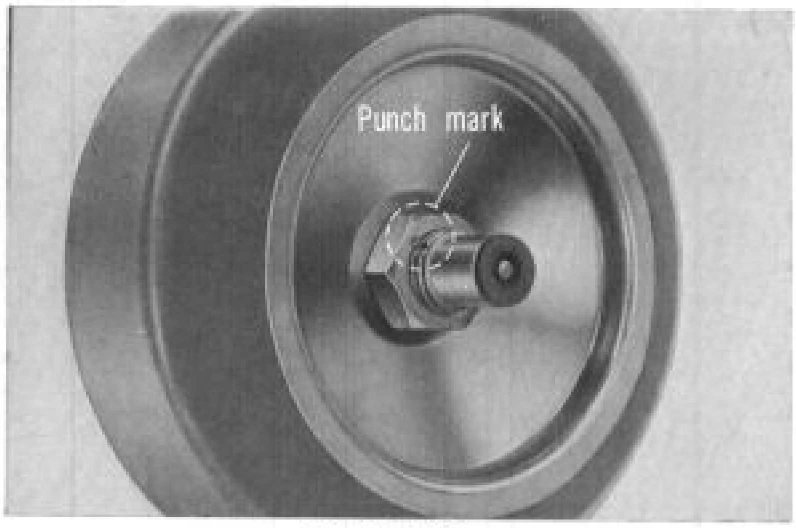


Fig. 11H-37

6. After assemblying the diaphragm plate, stake the nut adjacent to the thread using a center punch to prevent loosening (Fig. 11 H-37).

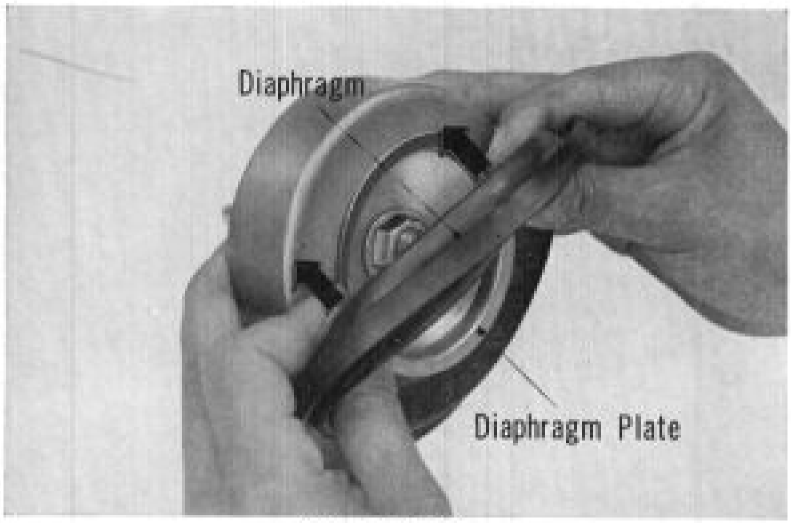


Fig. 11H-38

7. Carefully install the new power cylinder diaphragm on the diaphragm plate (Fig. 11 H-38).

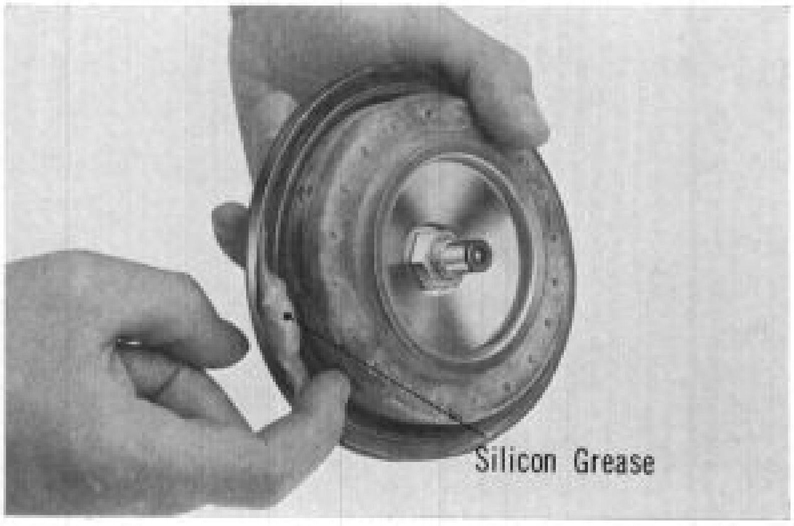


Fig. 11H-39

8. Apply a light coating of silicon grease around the surface of the diaphragm lip to prevent it from deformation when assemblying it into the vacuum cylinder.

9. Assemble the two new rubber cups on the relay valve, making sure that they are positioned in the proper direction. Apply brake fluid on the cups to facilitate its installation and to prevent damage.

10. Carefully insert the piston into the hydraulic cylinder body, rotating slowly to prevent the lips of the cups from curling.

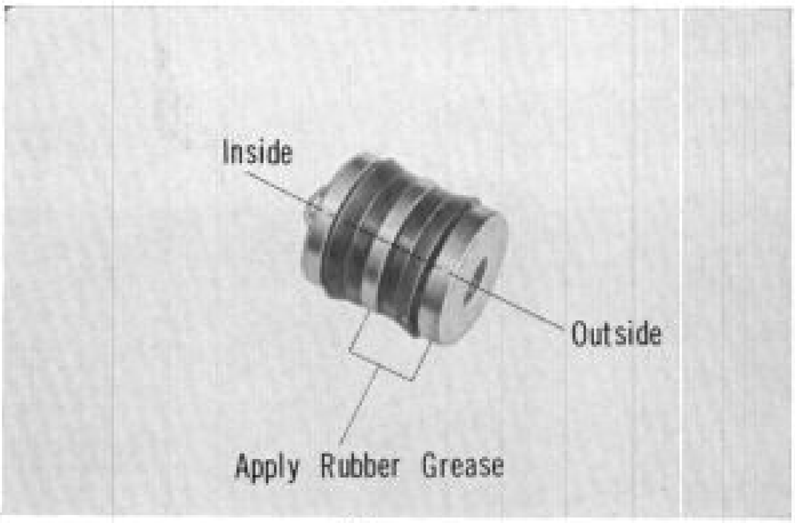


Fig. 11H-40

11. Install the new 0 ring into the groove of the hydraulic cylinder as shown in Fig. 11 H-41.

12. Assemble the relay valve housing and plate on the hydraulic cylinder as shown in the figure and install the three flat head screws.

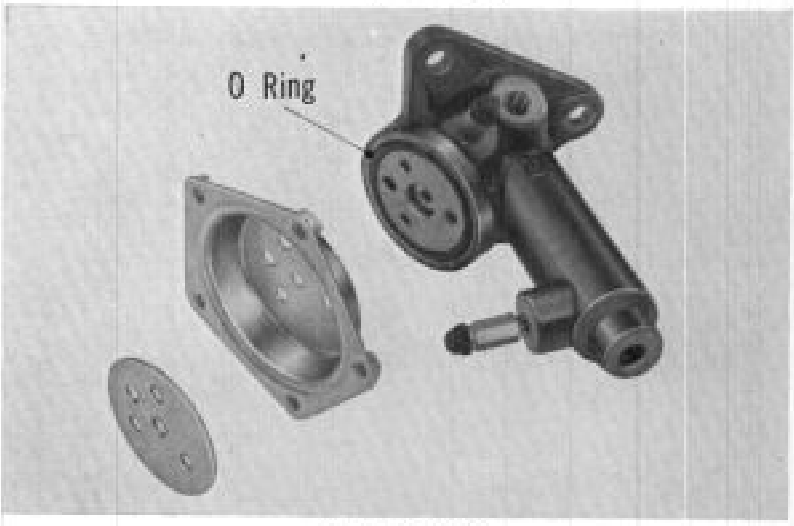


Fig. 11H-41

13. Install the new relay valve diagram and return spring on the valve housing. Fasten the upper relay valve housing with five mounting bolt. The air vent pipe must be parallel with the hydraulic cylinder.

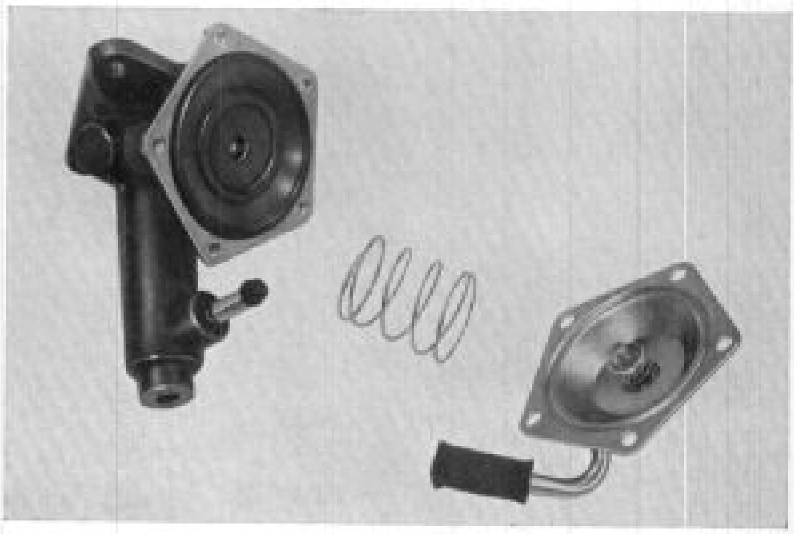


Fig. 11H-42

14. The relative positions of the hydraulic cylinder internal components are shown in Fig. 11 H-43.

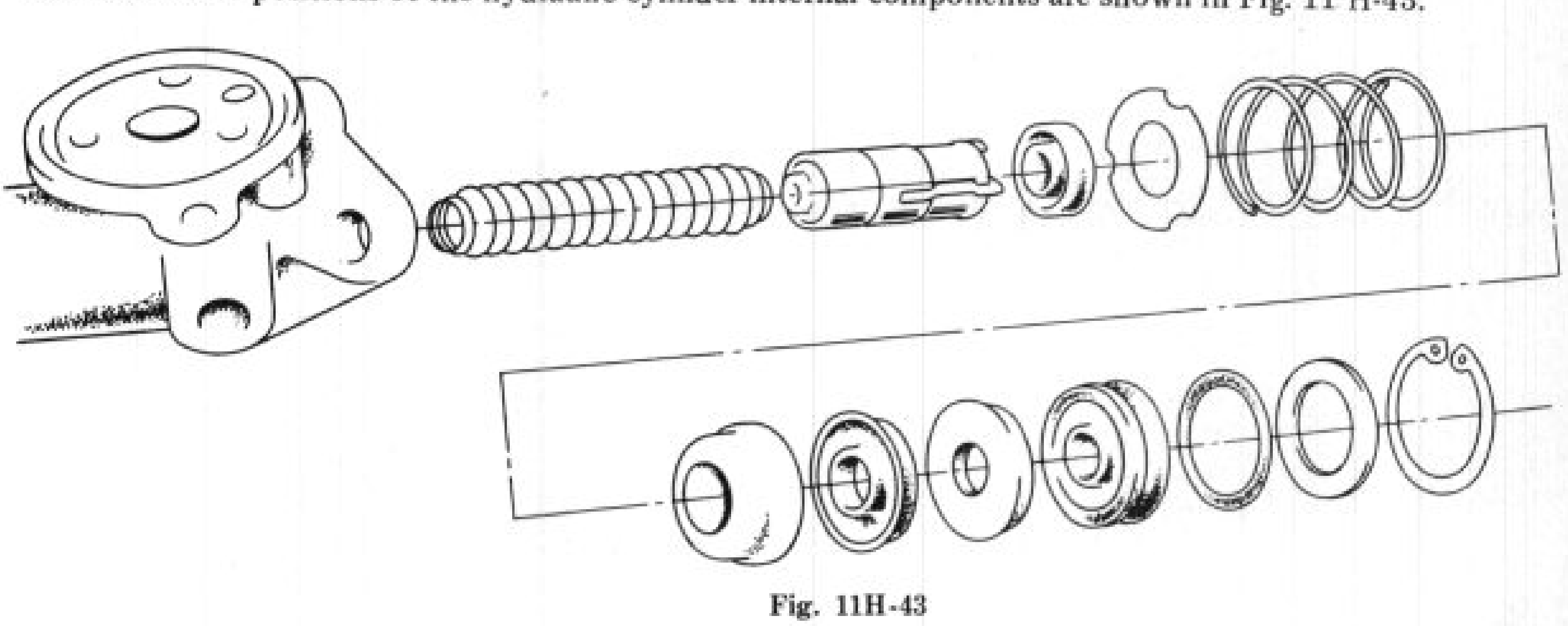


Fig. 11H-43

Fig. 11H-44

15. Before assemblying the hydraulic cylinder, replace the piston cup with a new item included in the repair kit and apply brake fluid on the piston to facilitate its installation. Exercise care not to score the piston or cup.

    Fig. 11 H-44 shows the relative positions of the piston and piston cup upon which it is to be installed.

    Note that the piston cup be installed in the correct direction.

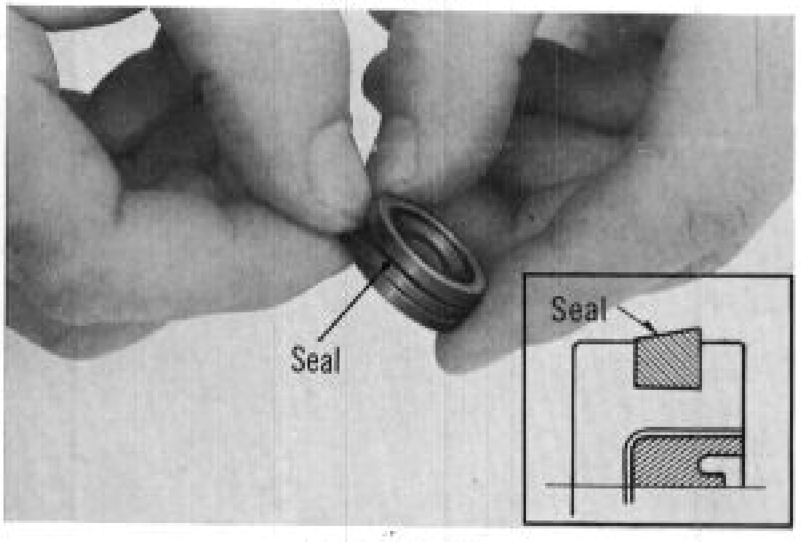


Fig. 11H-45

16. Replace the oil seal with a new item together with the new 0 ring. Dip the seal in brake fluid before installing. This seal must be replaced whenever any part of the booster hydraulic component is disassembled. Make sure that the seal is installed in the proper direction. (Fig. 11 H-2 and Fig. 11 H-43).

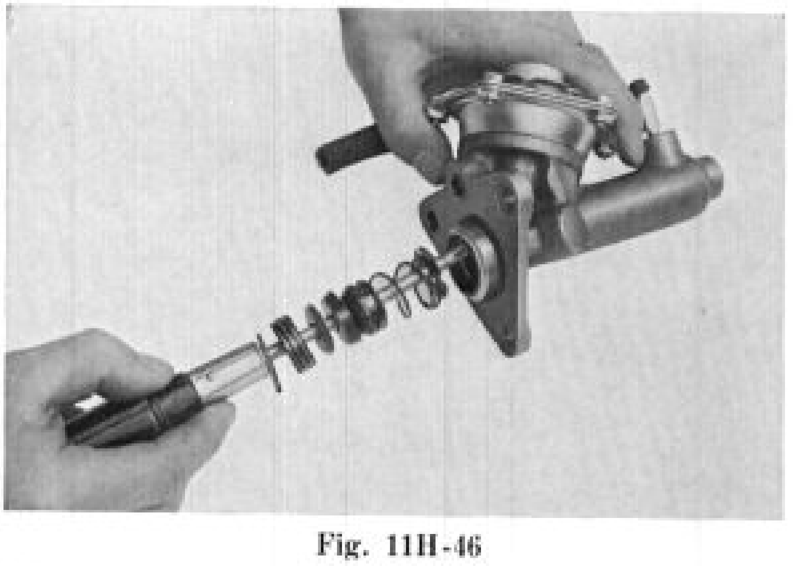


Fig. 11H-46

17. Carefully assemble the components into the cylinder in their proper order. Close fitting parts should be dipped in brake fluid and rotated while inserting to prevent the lip of the cups from turning up.

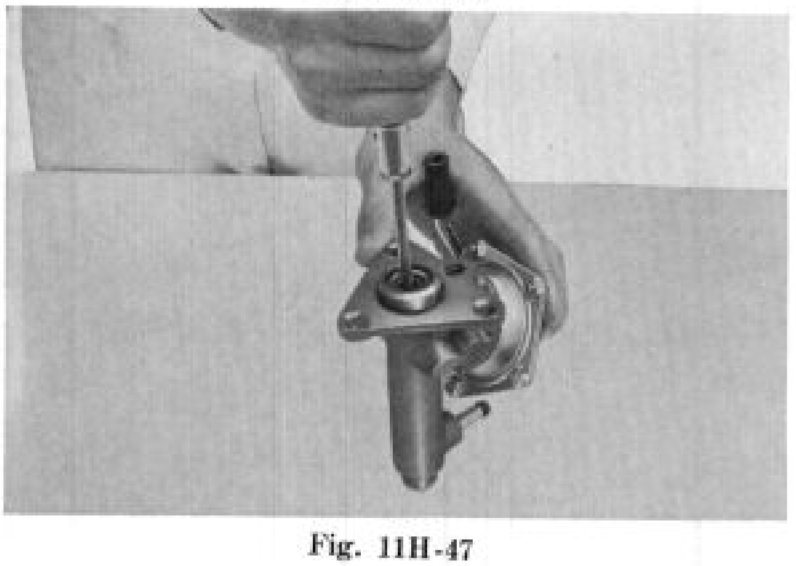


Fig. 11H-47

18. Force all the components in place against the force of the spring using a screwdriver or a similar rod (Fig. 11 H-1, Fig. 11 H-43 and Fig. 11 H-47).

19. Finally, install the circlip into the groove of the cylinder. Rotate the circlip with the circlip pliers to assure that it is properly seated. Incorrectly installed circlip may cause serious damage to the vacuum booster.

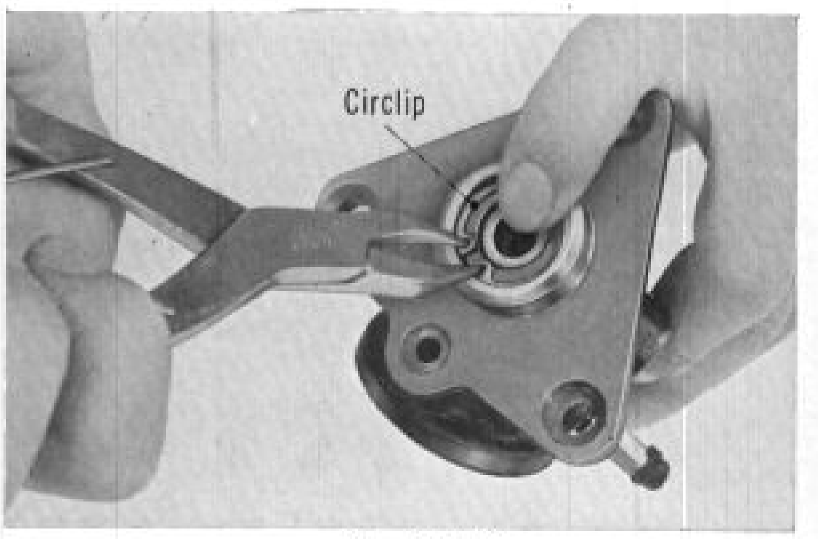


Fig. 11H-48

20. Assemble the components of the power cylinder in the order shown in the figure and position the housings so that air vent pipes of both the front and rear housings are aligned.

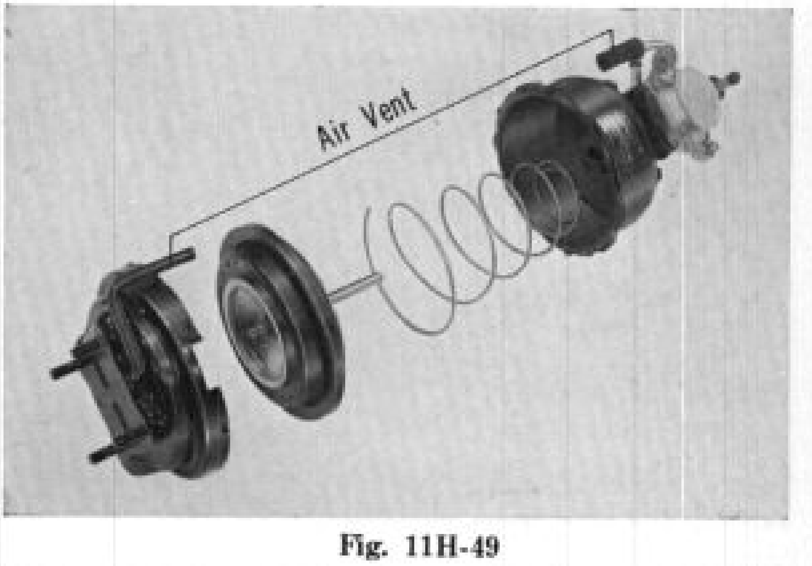


Fig. 11H-49

21. Set up the special tool (07145–57950) for reassembly in the same manner as was set for disassembly of the power cylinder assembly. Perform the reasembly of the power cylinder in the reverse order of disassembly. Make sure that the front and rear housings are properly assembled by checking to the that the tongues of the front housing are oligned to the cutout sections of the rear housing.

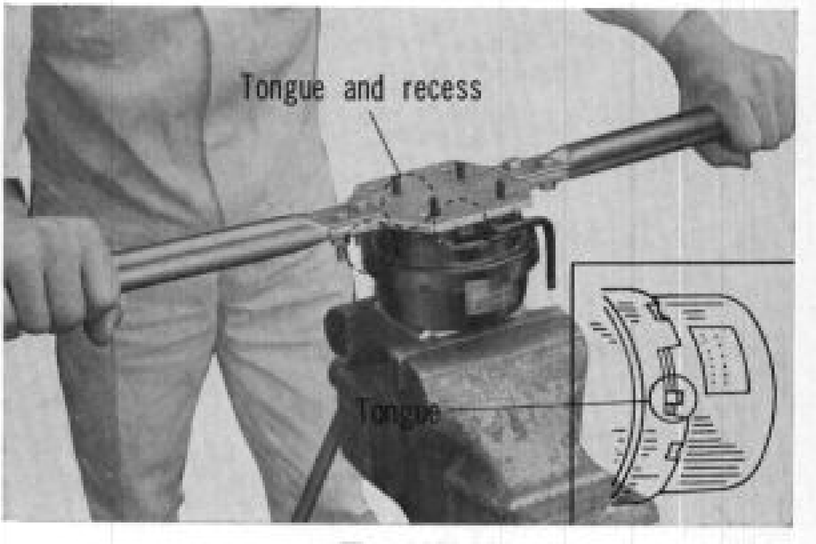


Fig. 11H-50

22. Complete the vacuum booster assembly by mounting the hydraulic cylinder on the power cylinder housing with three bolts.

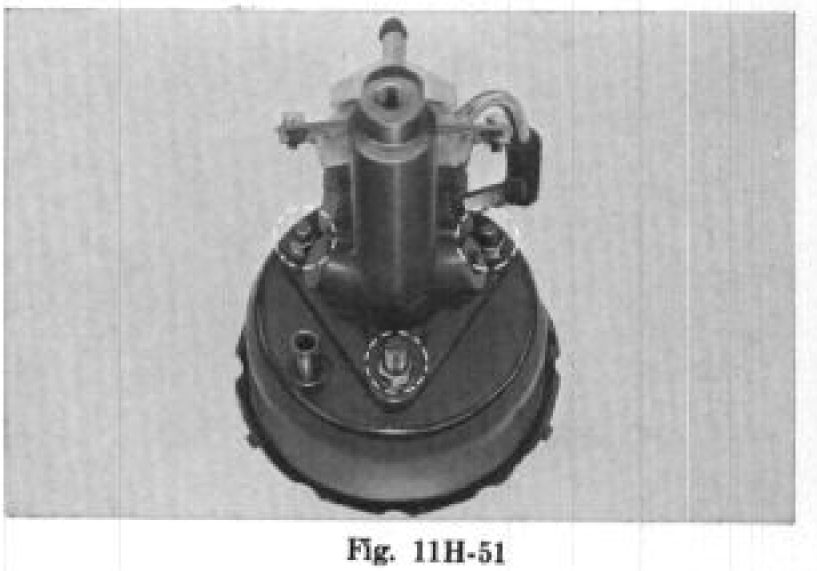


Fig. 11H-51

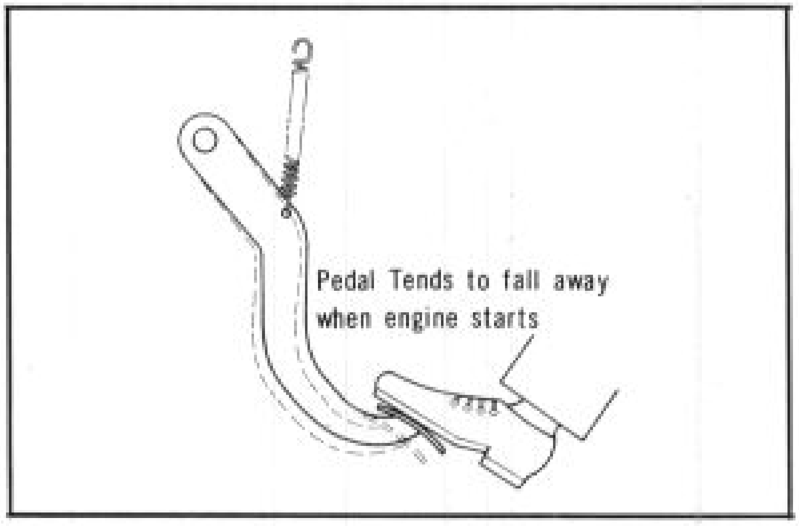


Fig. 11H-52a

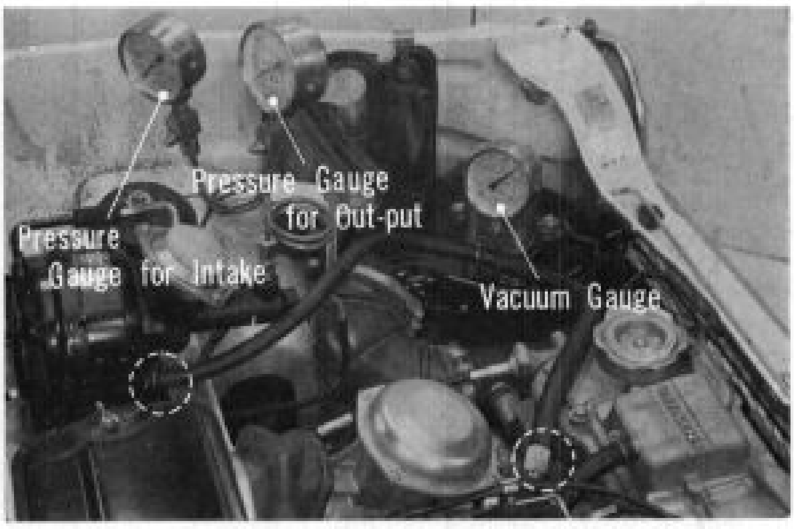


Fig. 11H-52b

Performance Test

A. **Preliminary Test**

Stop the engine and depress the brake pedal several times to exhaust all vacuum in the system. Then, depress the pedal and hold it in the applied position. Start the engine. At this moment, if one can feel brake pedal fall away under foot pressure, the vacuum booster is functioning. If the vacuum booster seems to be inoperative, proceed to a more accurate test described below

B. **Precise Test**

To test the vaccum booster system, connect two pressure gauges and one vacuum gauge as shown in Fig. 11 H-52. These gauge can be seen by the person in the driver's seat who depresses the acceler-ator pedal. A gauge of minimum reading 100 kg/cm^2 shall be installed on the intake side and a gauge of minimum reading 160 kg/cm^2 on the output side.

then stop the engine. The reading should drop approximately 20 mmHg in 15 seconds. If the drop in reading is greater than 20 mmHg in 15 seconds, the check valve and the vacuum hose should be checked for defect.

1. After maintaining the reading on the vacuum gauge to 500mmHg by controlling the accelerator pedal, stop the engine. The reading should drop approximately 25 mm Hg in 15 seconds.

   If the drop in reading is greater than the above value for the 15 second period, it is an indication that a vacuum leak exists somewhere in the vacuum system including the vacuum booster check valve and a vacuum passage (hose and connector).

2. Disconnect the vacuum hose which connects the intake manifold and vacuum booster at the side of the vacuum booster, then close the end of the hose with the thumb as shown in Fig. 11 H-53.
   Start the engine and adjust the accelerator pedal until the indication of the gauge reaches 500mmHg, then stop the engine. The reading should drop approximately 20 mmHg in 15 seconds. If the drop in reading is greater than 20 mmHg in 15 seconds, the check valve and the vacuum hose should be checked for defect.

Fig. 11H-53

3. After making sure that the check valve and vacuum hose are both vacuum-proof by performing the test descr bed in item 2, repeat the test described in item if the drop in reading exceeds the serviceable value. The vacuum booster should be inspected in such a case, as it indicates vacuum leakage from the vacuum booster.

4. (Inspection of Pressure Gauge)
Inspect the operation and oil leakage of the brake system, refering to Section 11 BRAKE AND WHEEL, followed by, returning the reading of the vacuum gauge to 0. Depress the accelerator pedal so that the reading of the pressure gauge or the intake side reaches 20 kg/cm² if any difference exists between the pressure readings of the intake and output sides, the pressure gauges should be checked because there is a possibility that one of them is malfunctioning.

5. (Inspection of Vacuum Booster Performance)
For inspection of the vacuum booster performance, sit on the driver's seat and maintain the reading of the intake pressure gauge to 15 kg/cm² by controlling the pedal and using accelerator pedal. (In order to properly check the performance of the vacuum booster, the reading of the vacuum gauge must be at 500 mmHg. In case the vacuum fails to maintain reading of 500 mmHg, release the accelerator pedal to decrease the vacuum and try again to create 500 mmHg constant vacuum pressure.
After making sure that the reading of the vacuum gauge is 500 mmHg and that of the intake pressure gauge is 15kg/cm², check to see if the reading of the output pressure gauge is within the serviceable limits indicated below. If the reading exceeds the serviceable limits the vacuum booster should be checked and readjusted.
The reading should be: 43 kg/cm²—53kg/cm* for the vacuum booster with blue label and 31 kg/cm²—41kg/cm² for the vacuum booster with red label. (Refer to Fig. 11H-55)

6. After completing the test, air bleeding should be performed as shown in Fig. 11 H-54 before the pressure gauges are removed. The air bleeding should be made on the pressure gauge of output side and then on the one of intake side.

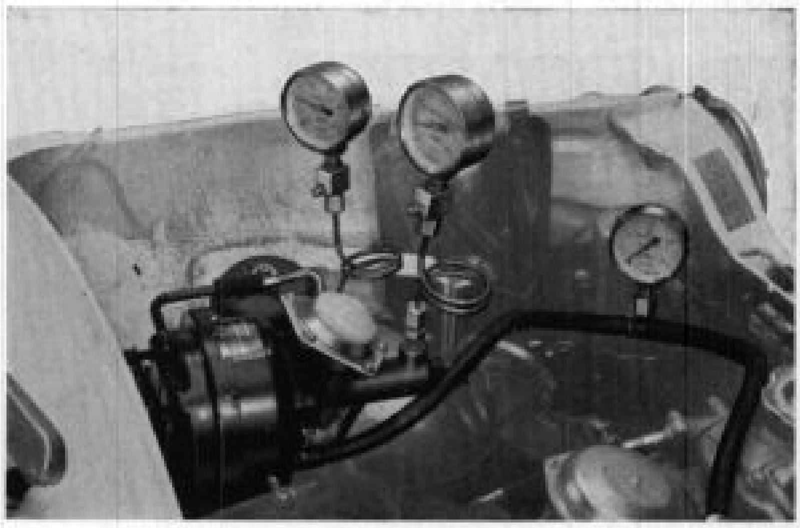


Fig. 11H-54

Vacuum Booster Characteristic

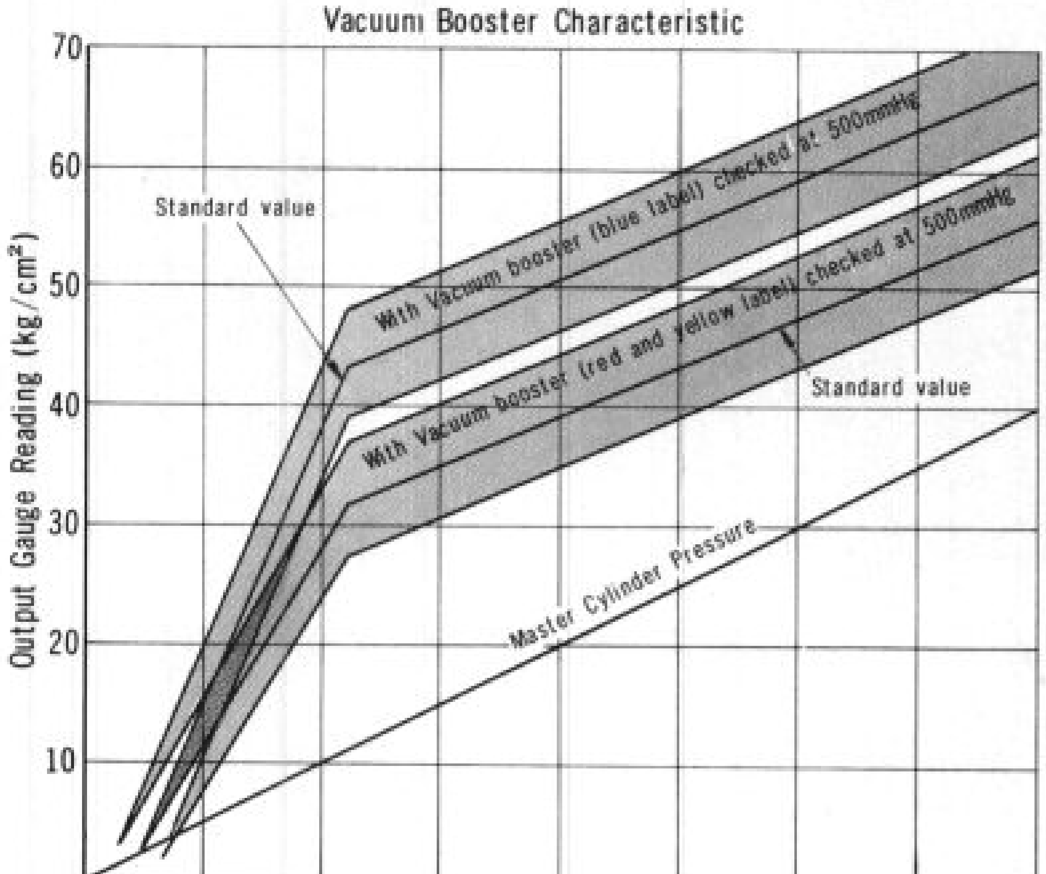


Fig. 11H-55

Fig. 11 H-55 shows the performance curve of the N600 vacuum booster with yellow, red and blue labels. If the output reading corresponding to any given input reading beyond 11 kg/cm² is within the dotted zone in the above diagram, the vacuum booster is satisfactory.

I. Brake Lines and Connection

In addition to periodical check every 3000 miles, brake line, hoses, and cable should be inspected for brake fluid leak, chafing, corrosion, deterioration, or other damages whenever the car is raised on a lift for any reason.

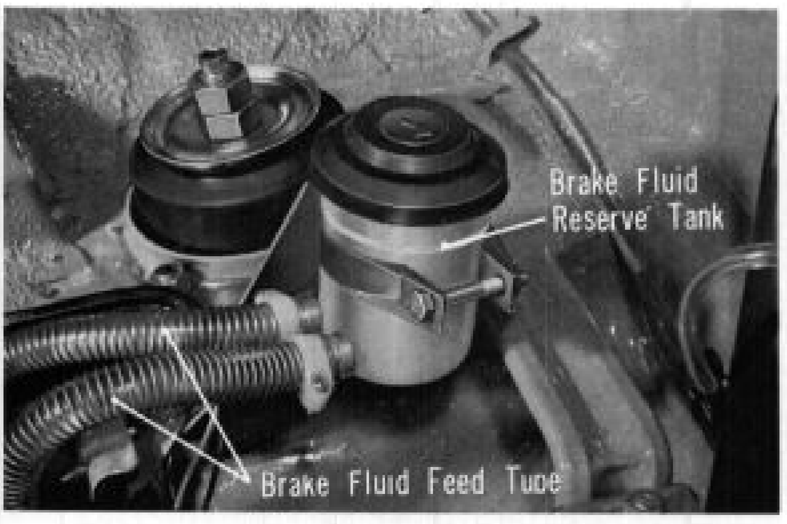


Fig. 11I-1

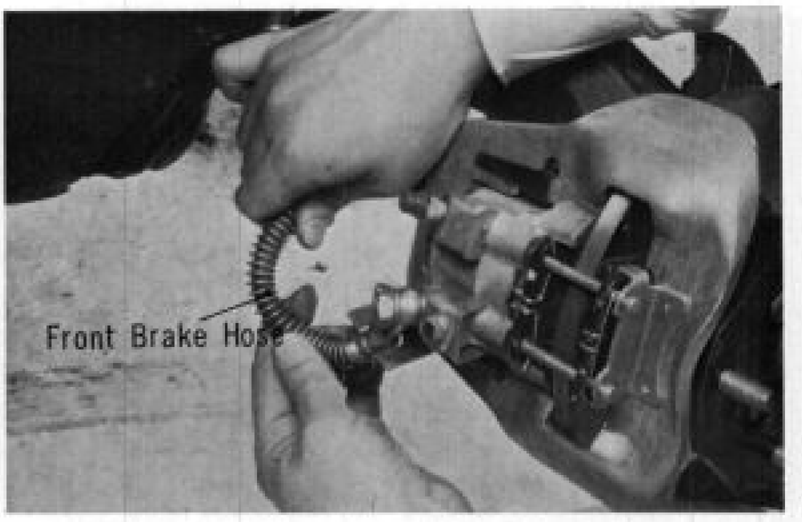


Fig. 11I-2

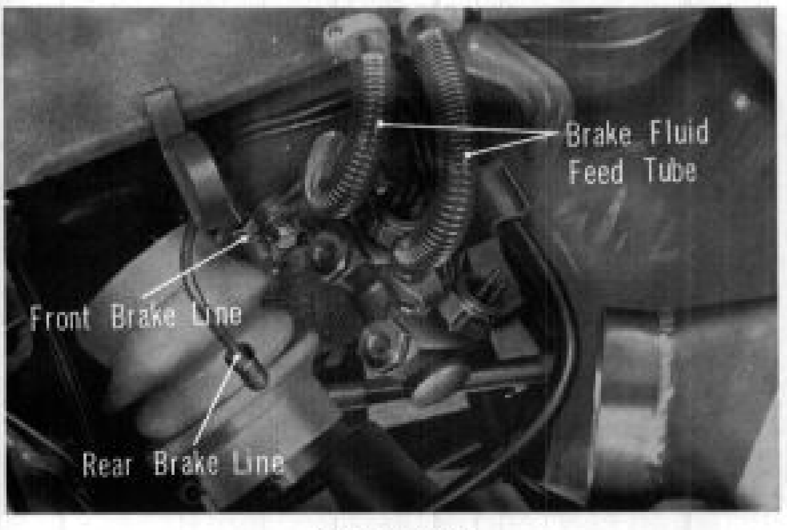


Fig. 11I-3

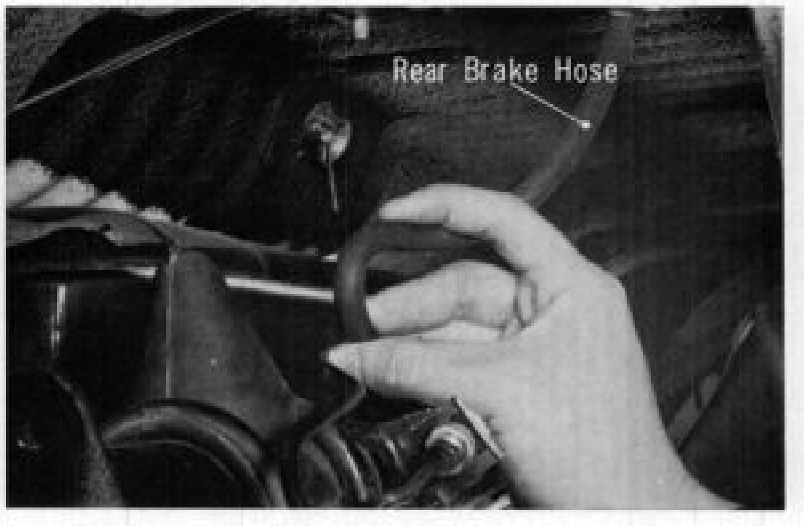


Fig. 11I-4

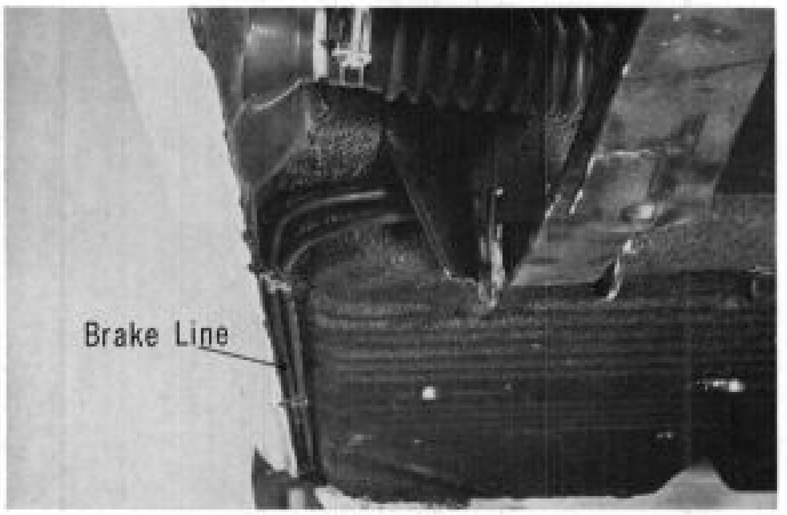


Fig. 11I-5

J. Parking Brake

Description

The parking brake is of mechanical type which applies braking force to the rear wheels. The parking brake lever is located between the front seats. The cable which is attached to the tail end of the parking brake lever extends to the equalizer and to the right and left rear wheel brakes. (See the figure on page 11-1)

When the lever is pulled, the cable becomes taut (pulling both right and left parking brake arms, after being equalized) to actuate the rear brake shoes.

The lever is fitted with a parking brake indicator light switch

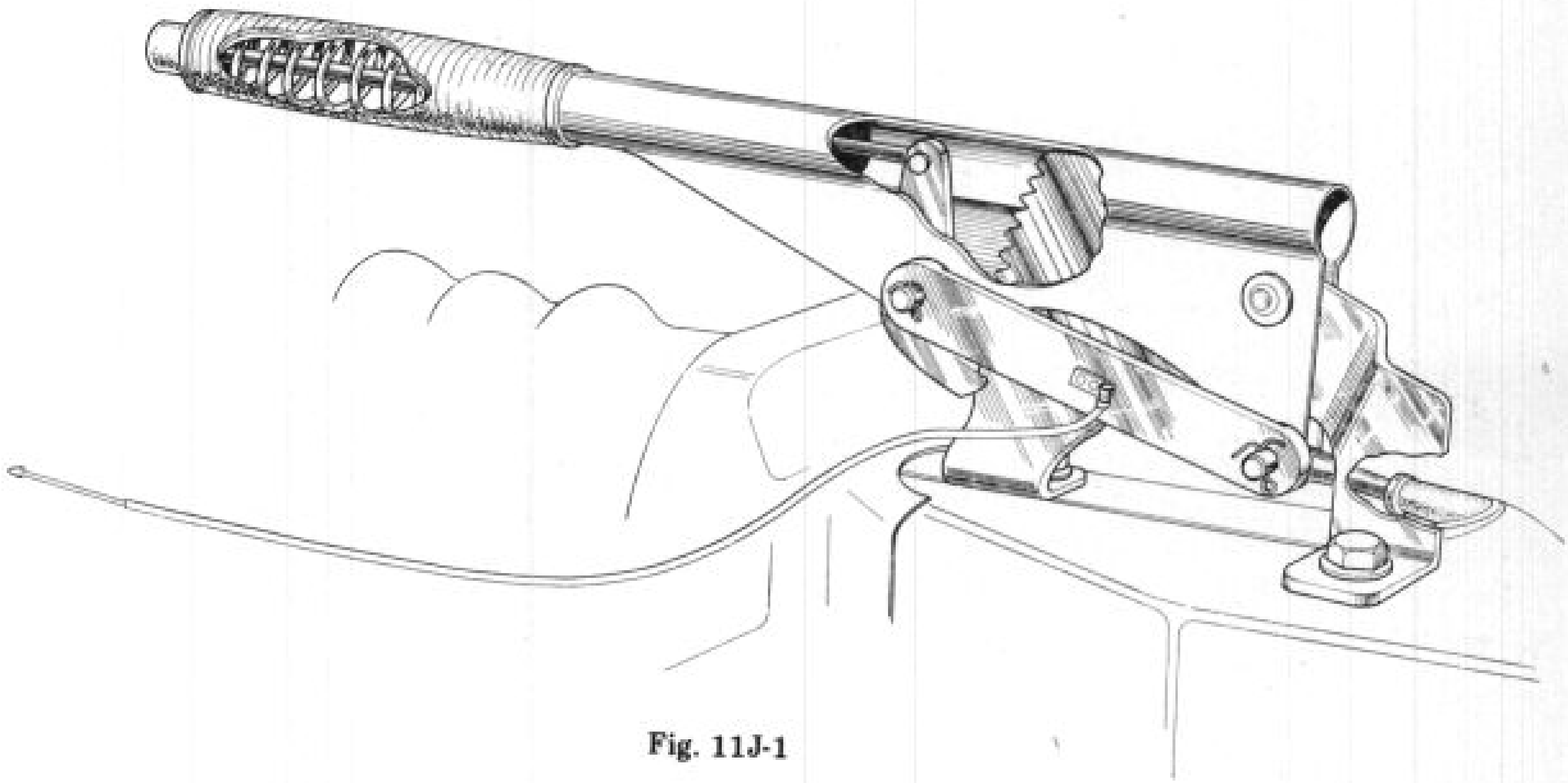


Fig. 11J-1

Removal

1. Remove the primary cable adjusting nut from the equalizer mounted on the rear axle, and separate the primary cable from the equalizer.

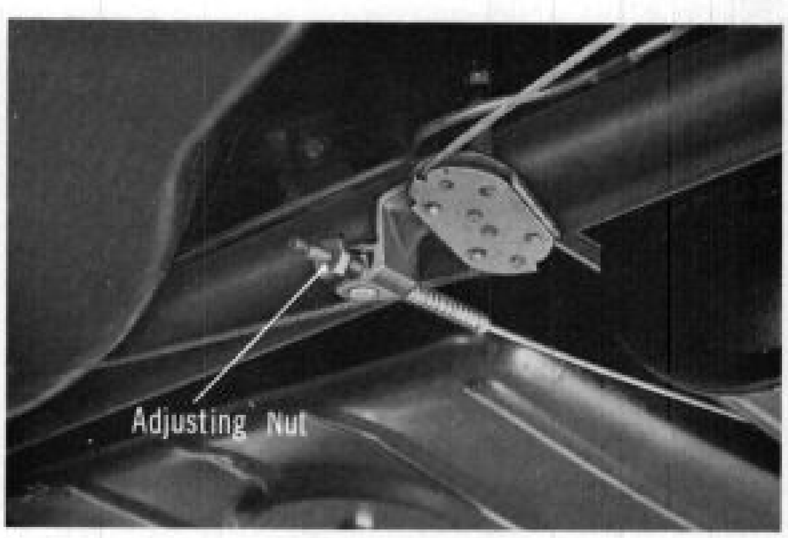


Fig. 11J-2

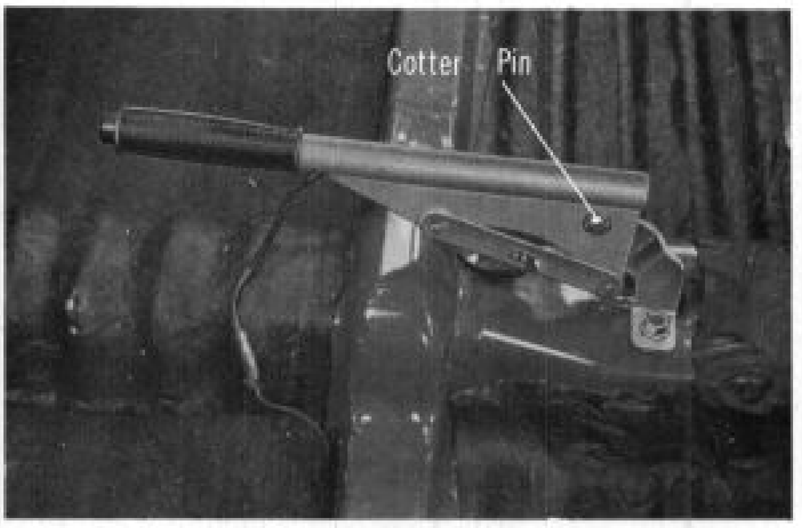


Fig. 11J-3

2. Set the parking brake lever to the fully released position.
   Remove the cotter pin from the pin connecting the cable end and lever, and draw out the pin using pliers.

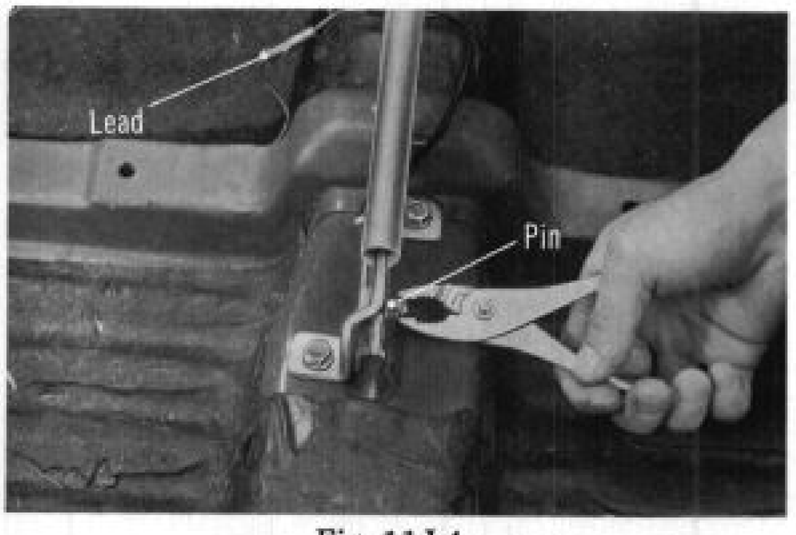


Fig. 11J-4

3. Separate the wiring (lead) of the parking brake indicator light switch at the connector.

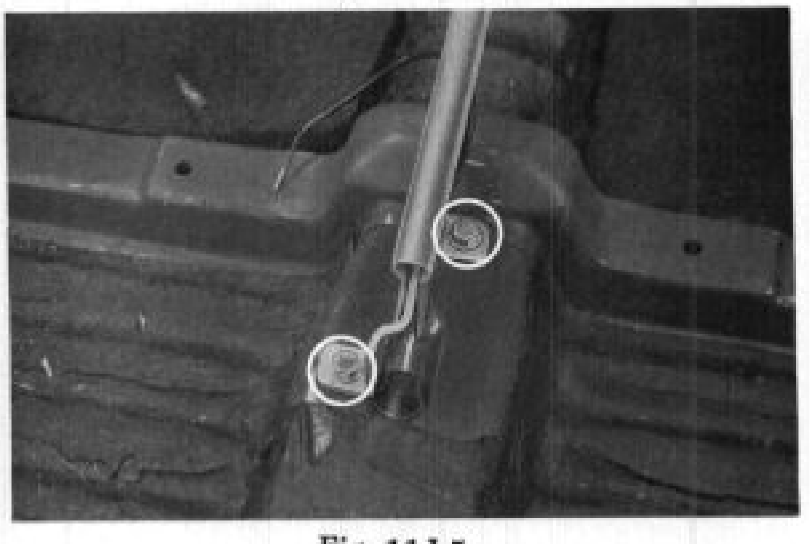


Fig. 11J-5

4. Remove the brake lever from the floor by removing the two mounting bolts.

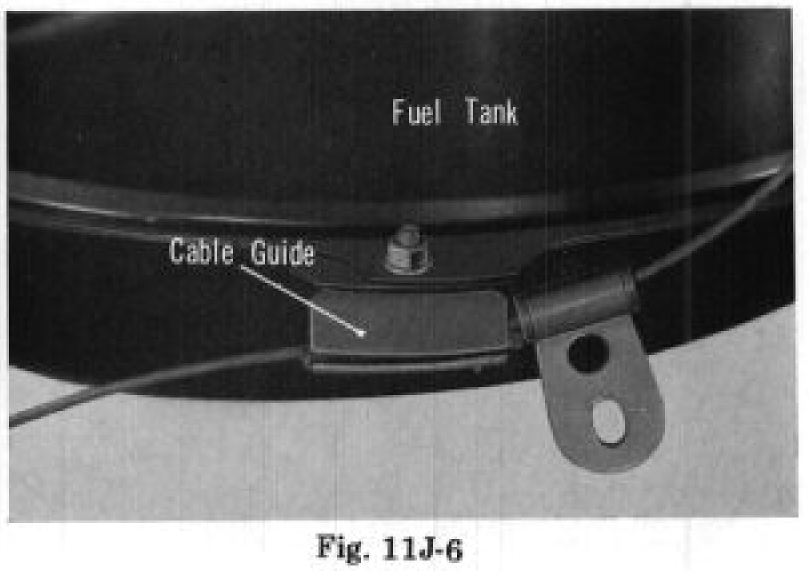


Fig. 11J-6

5. Detach the cable from the guides at the front and right side of the fuel tank. The guide in place at the front of the fuel tank is held by a mounting bolt.

Inspection and Adjustment

Check the condition of the indicator light switch mounted on the parking brake lever.

Check the rachet and pawl of the lever for wear and other damage; replace if necessary.

Adjust the lever travel to 30~50% (2~3 notches) of the full stroke by turning the equalizer adjusting nut. (Refer to Fig. 11J-7)

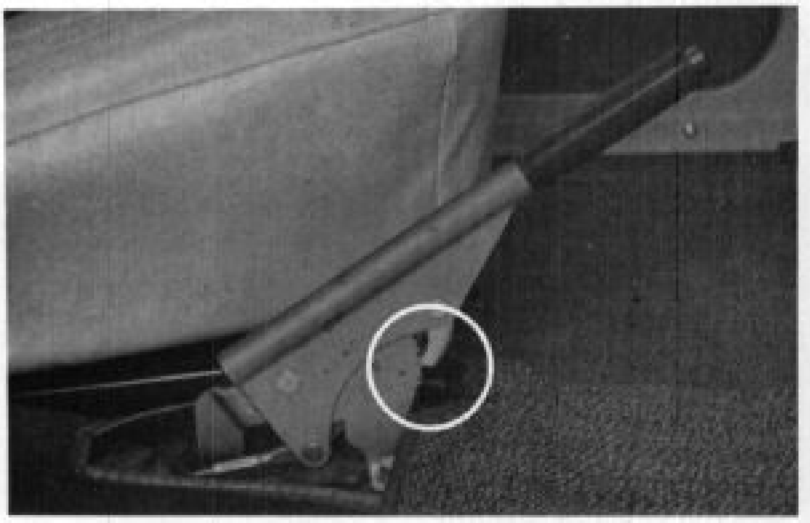


Fig. 11J-7

If cable guide is excessively worn or cracked, replace it.

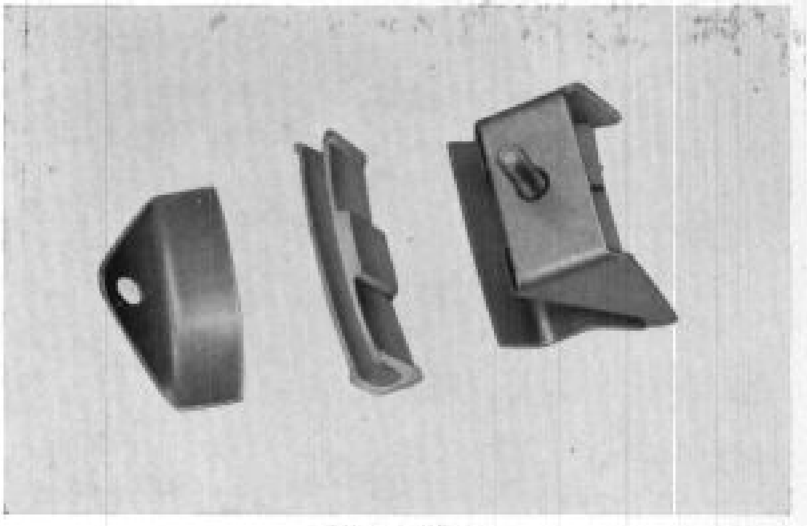


Fig. 11J-8

Apply grease to the cable and the guide.

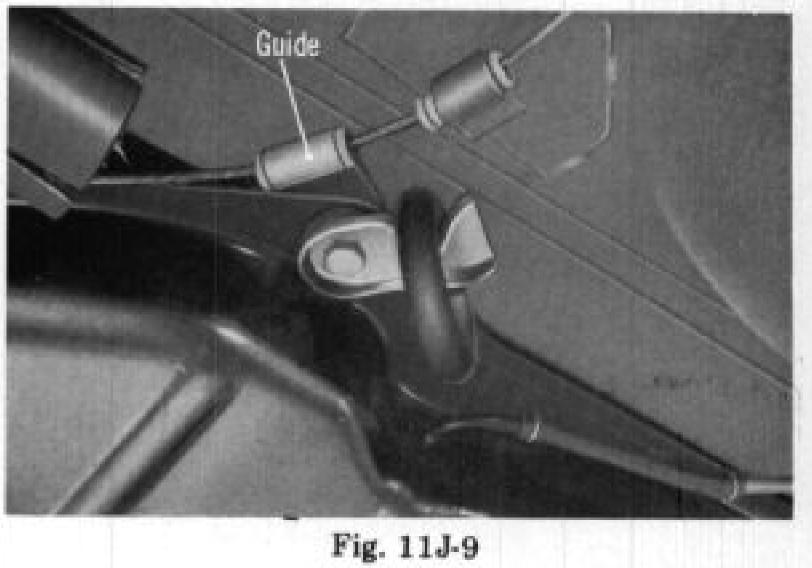


Fig. 11J-9

K. Pedals and Pedal Linkages

Removal

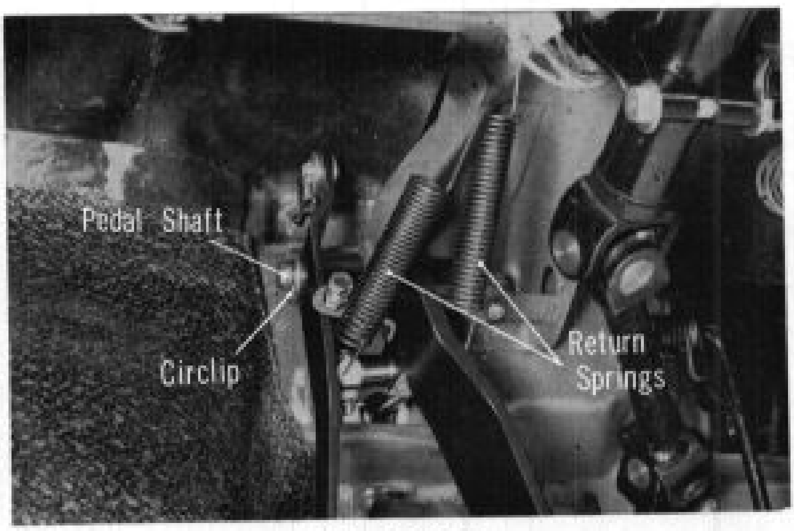


Fig. 11K-1

1. Unlock the pedal return springs from the clutch and brake pedal.
2. Remove the circlip and washer from the pedal shaft.

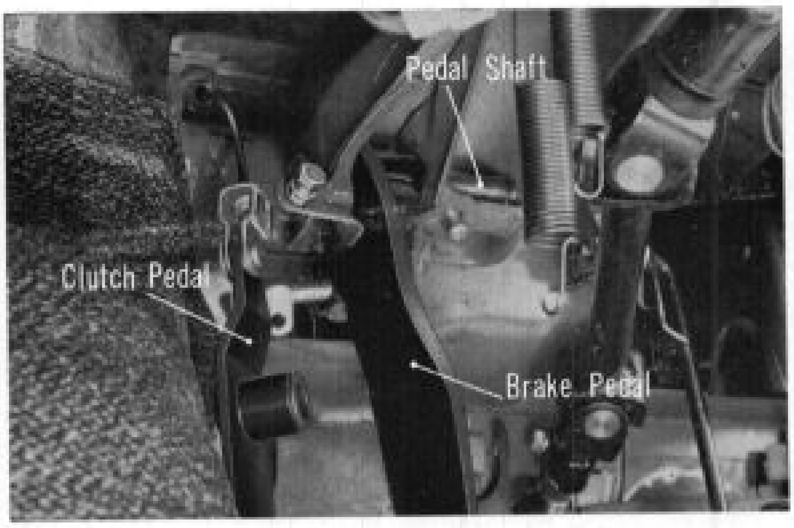


Fig. 11K-2

3. Push the pedal shaft to the interior and separate the clutch pedal from the shaft.
4. Remove the lock pin and clevis pin of the brake push rod, and disconnect the brake pedal from the brake master cylinder. (Refer to C. Master Cylinder.)

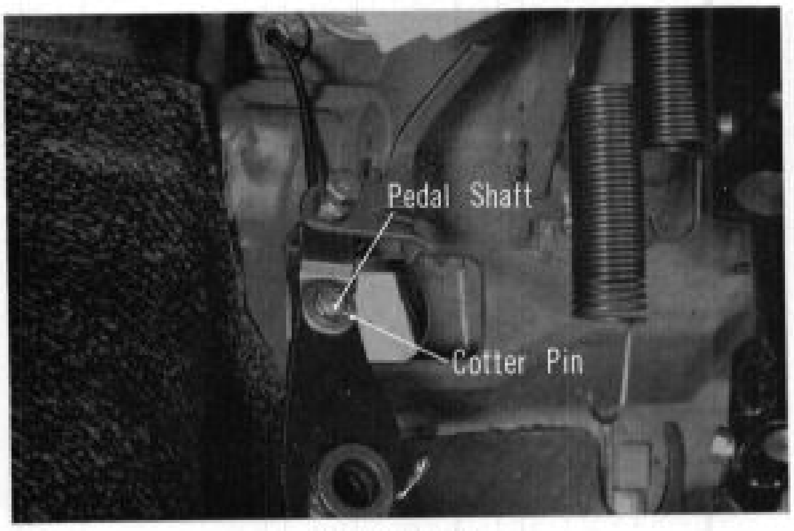


Fig. 11K-3

5. Draw out the pedal shaft from the pedal bracket and remove the brake pedal.
6. Disconnect the clutch pedal from the clutch cable by removing cotter pin and pedal pin.

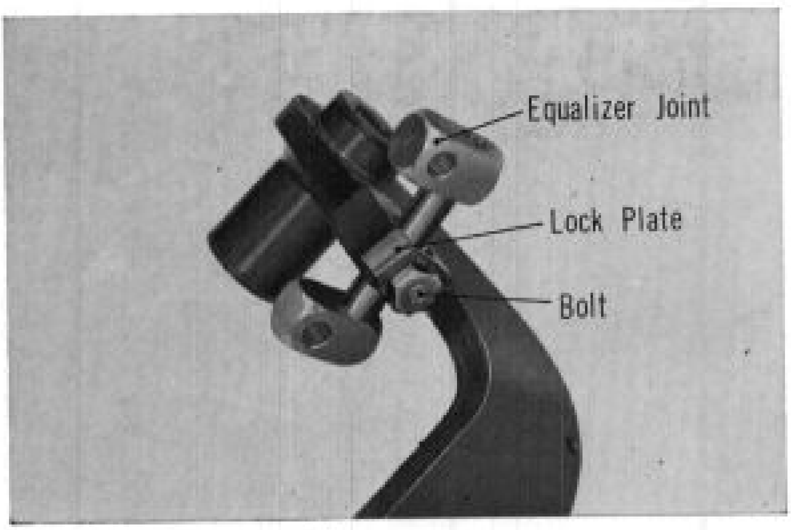


Fig. 11K-4

7. (Parallel Master Cylinder)
   Remove the equalizer joints and the lock plate and bolt.

8. (Removal of the accelerator pedal.)
   Remove the two bolts mounting the accelerator pedal bracket, and disconnect the throttle cable from the accelerator pedal.

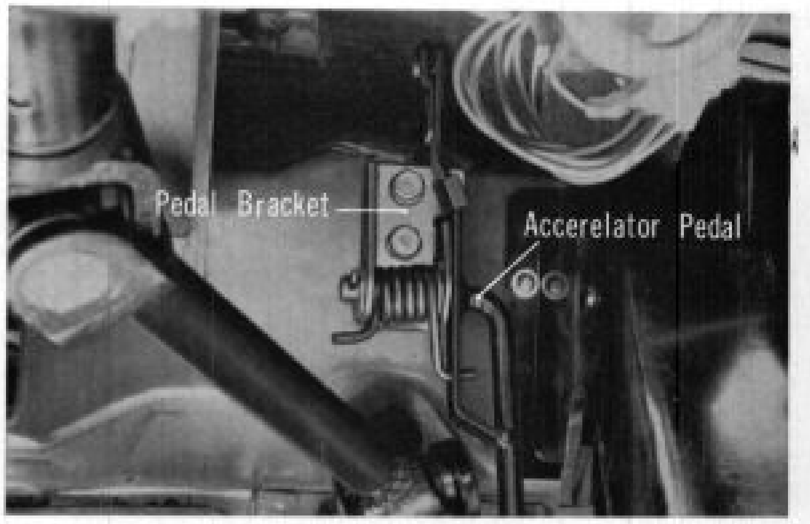


Fig. 11K-5

9. Unlock the return spring from the pedal, remove the cotter pin, then separate the pedal from the bracket.

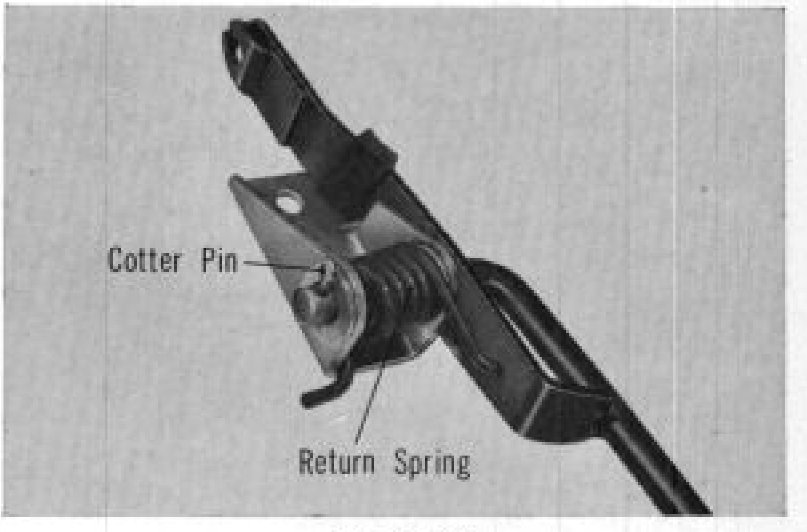


Fig. 11K-6

Inspection

1. Clean all parts with a good cleaning solvent.
2. Inspect all pedal bushings and the pedal shaft for wear and damage. Replace any part if necessary.

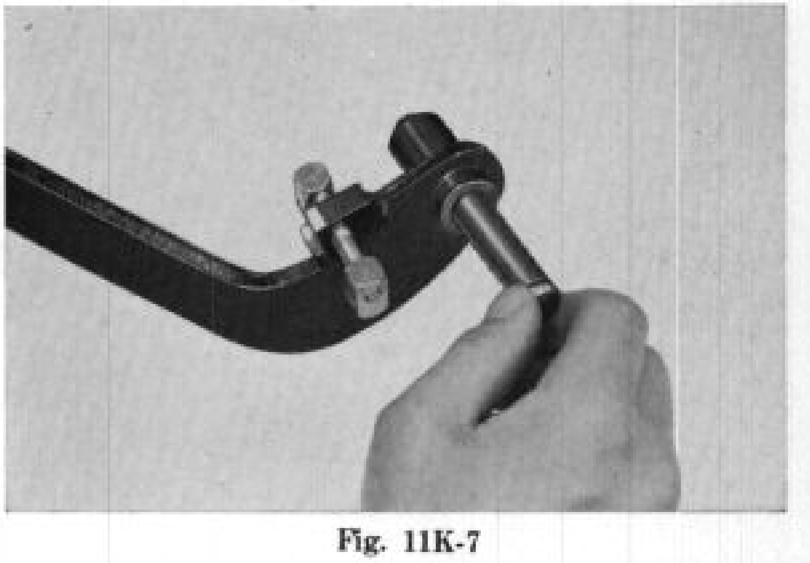


Fig. 11K-7

3. Removing the pedal bushing.
   Apply a screwdriver or appropriate tool on the inside of the bushing and tap the screwdriver with a hammer.

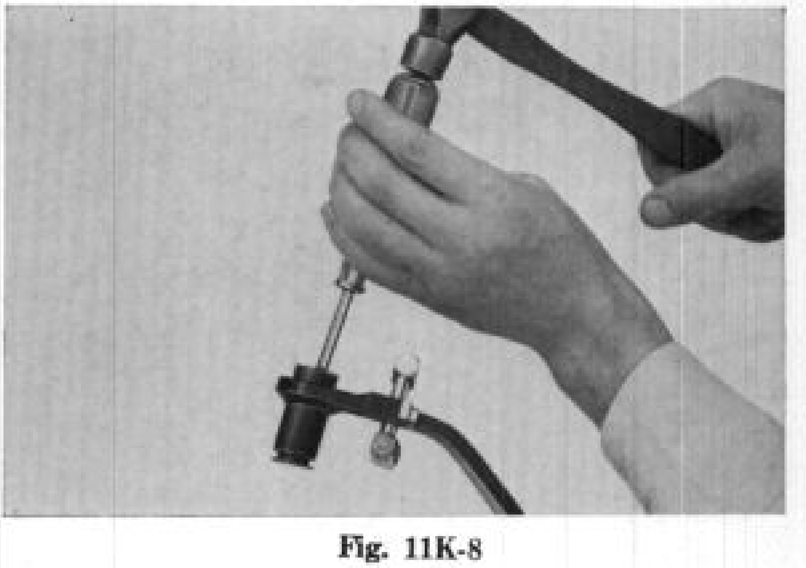


Fig. 11K-8

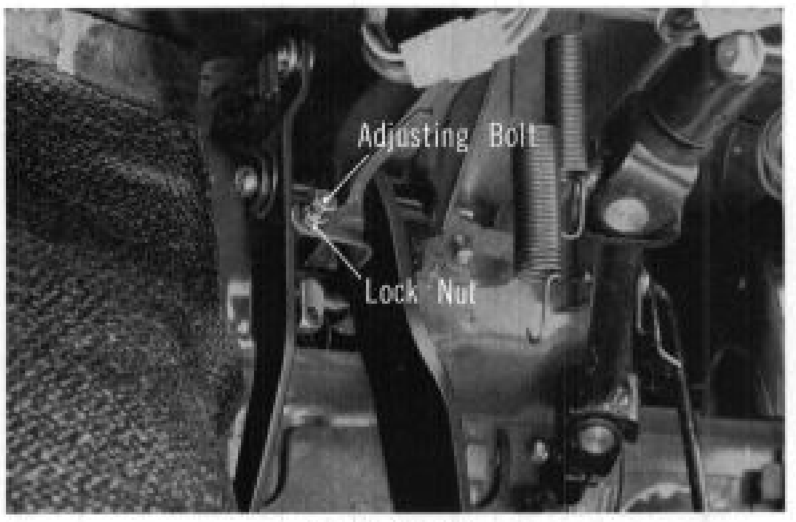


Fig. 11K-9

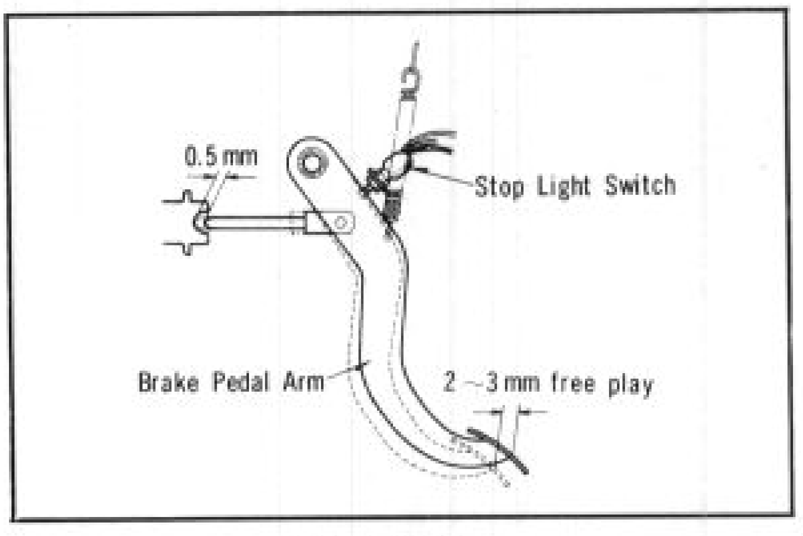


Fig. 11K-10

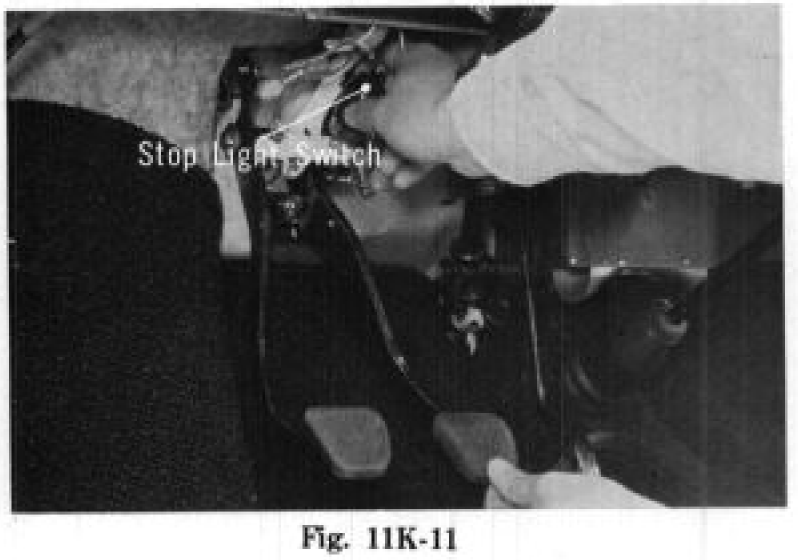


Fig. 11K-11

Installation

Install in reverse of removal.

Note:
1. Lubricate the pedal shaft and bushing (both must operate freely) .
2. Refer to C. Master Cylinder for the equalizer of the brake pedal.
3. After installation, align the clutch pedal with the brake pedal using the adjusting bolt. (Fig. 11K-9)

(Brake pedal height adjustment)

For those vehicles equipped with the mechanical operating stop light switch above the brake pedal arm, brake pedal height and the stop light switch should be inspected periodically.

Check for air in the hydraulic system and correct brake adjustment before any attempt is made to adjust brake pedal height. Brake Pedal hight adjustment is made by means of the stop light switch adjustment. Screw in the stop light switch until the push rod free play is eliminated, and back off a half turn to allow the master cylinder push rod 0.5mm (0.02 in) free play. By this adjustment about 2–3 mm (0.08–0.12 in) proper free play is provided at the brake pedal pad.

Inspection of Mechanical Stop Light Switch

The brake pedal arm operates the switch. Check to see that the pedal is in the fully returned position by lifting slightly by hand.

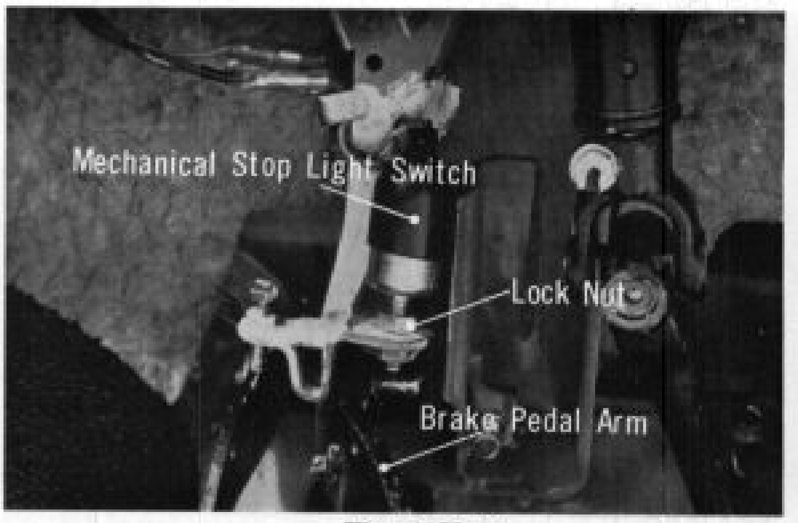


Fig. 11K-12

To check the operation of stop light switch, remove it from the bracket and check the continuity with a service tester while releasing the plunger from fully depressed position.

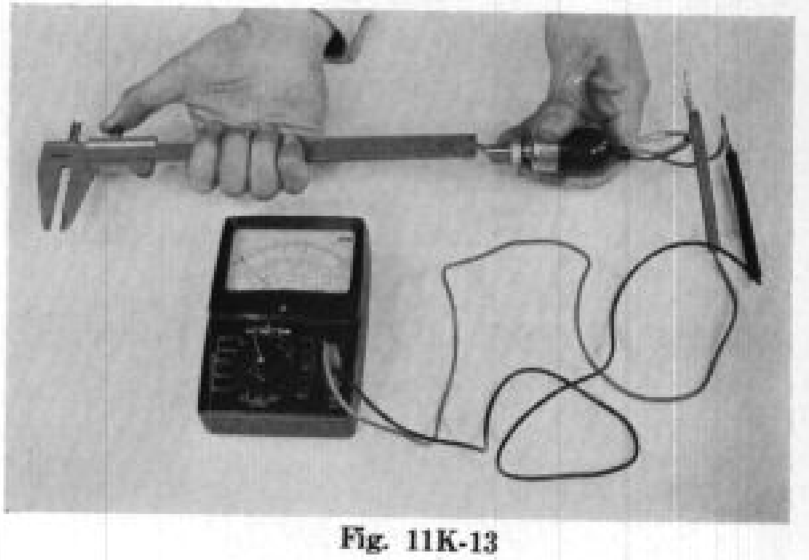


Fig. 11K-13

If there is complete continuity at the position shown in the picture, the stop light switch is serviceable. Upon completion of the check, apply a light coat of grease to the plunger

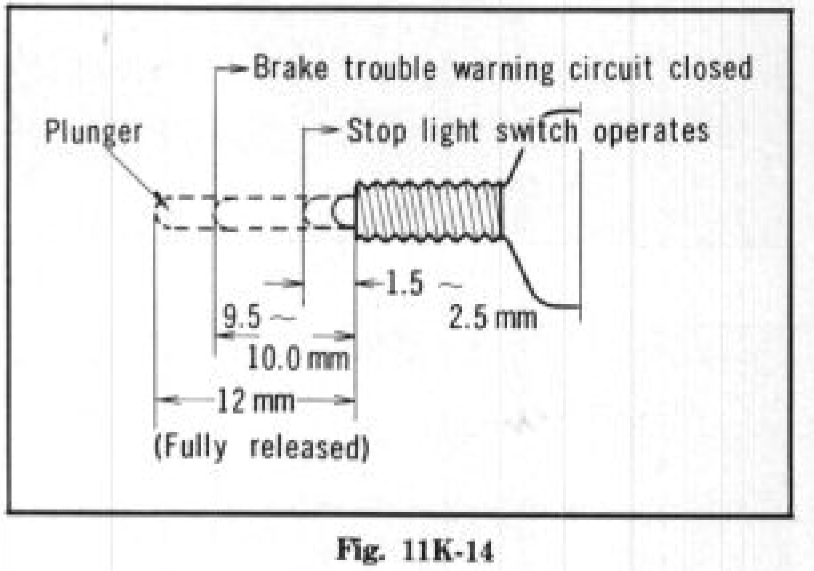


Fig. 11K-14

Inspection of Brake Trouble Warning Circuit (Verhicles for U.S.A.)

Periodical check every 24,000 miles or 24 months is required. However, inspection of brake trouble warning circuit should be made any time major brake work is done.

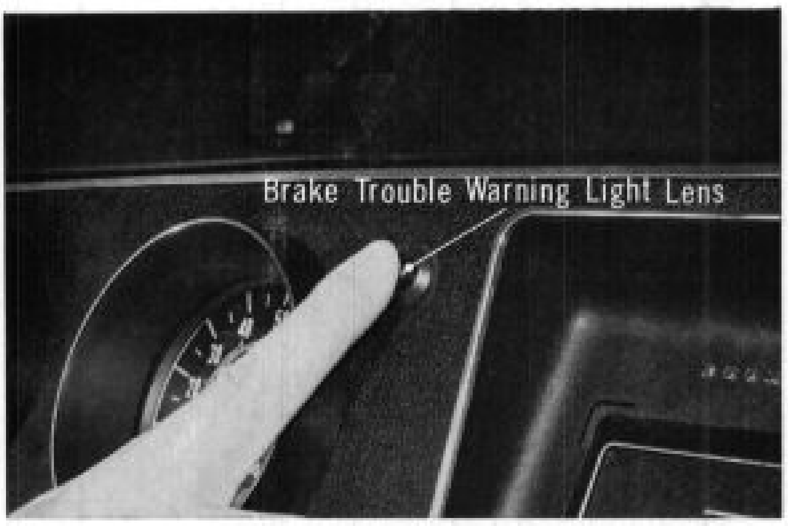


Fig. 11K-15

(Inspection Produre)

1. Make sure the bulb is functioning by depressing the brake trouble warning light.
2. Check the brake fluid level and add if necessary.

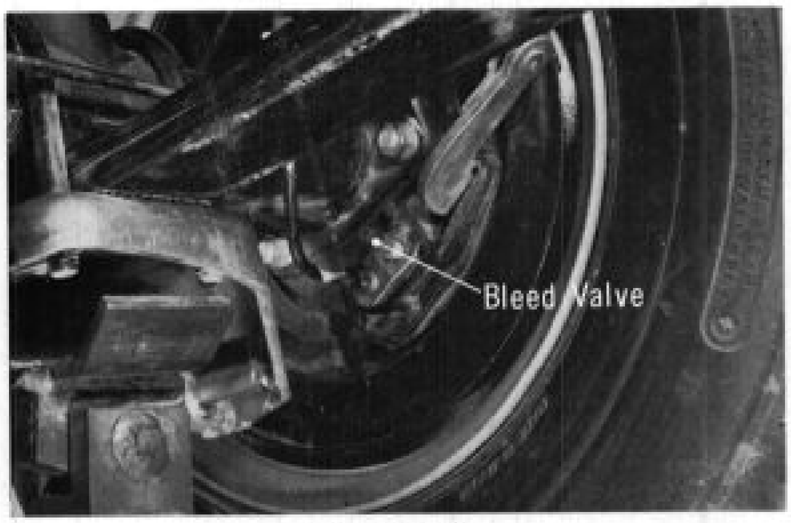


Fig. 11K-16

3. Open the wheel cylinder bleed screw in the rear wheel while depressing the brake pedal. The light should come on due to pressure difference.
   Note:
   Do not release the pedal while the bleed valve is open as air will enter the hydraulic system.

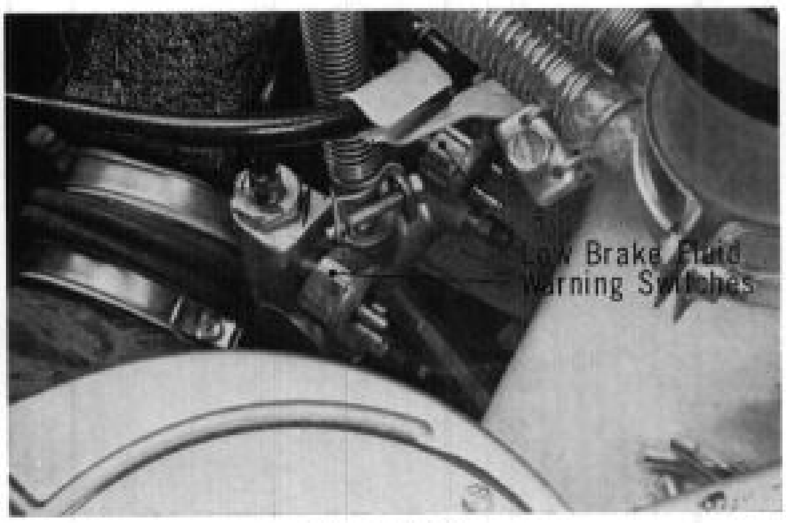


Fig. 11K-17

4. If the brake trouble warning circuit is inoperative, check the stop light switch and the low brake fluid warning switches for defect.

L. Wheels and Tires

Description

The wheels are mounted with right-hand-thread tapered nuts. The standard tire sizes are 5.20-10-2PR and 5.20-10-4PR.

(Tire inflation pressure under cold conditions)

Vehicle Model		Type of tire		Tire pressure Front	Tire pressure Rear
Sedan	Manual transmission	2Ply Bias		1.4kg/cm² (20psi)	1.0kg/cm² (14psi)
		4Ply Bias		1.7kg/cm² (24psi)	1.5kg/cm² (22psi)
		4Ply Radial		1.8kg/cm² (26psi)	1.5kg/cm² (22psi)
		6Ply Bias		2.0kg/cm² (29psi)	1.7kg/cm² (24psi)
	Handamatic transmission	4Ply Bias		1.8kg/cm² (26psi)	1.5kg/cm² (22psi)
		4Ply Radial		1.8kg/cm² (26psi)	1.5kg/cm² (22psi)
		6Ply Bias		2.0kg/cm² (29psi)	1.7kg/cm² (24psi)
Van	LN360	4Ply	Unloaded	1.7kg/cm² (24psi)	1.5kg/cm² (22psi)
			Loaded	2.0kg/cm² (29psi)	2.4kg/cm² (34psi)

Both right and left wheels must be balanced uniformly.
Wheel balance, however, may change gradually due to the non-uniform wear of tires, tire repair work or replacement, or brake drum replacement. Unbalanced wheels may cause noise and vibration and eventually will shorten vehicle life. When noise and vibration occur, pay attention to the noisy or vibrating part as well as to the unbalanced wheel to determine the exact cause of the trouble.

Static Wheel Balancing

Static balancing shows that the weight distribution of the wheels and tires relative to the rotating axis is in balance. If the vehicle is operated in an unbalanced wheel condition, "bouncing" may occur and result in vibration, the generation of noise and, consequently shorten the life of the vehicle.

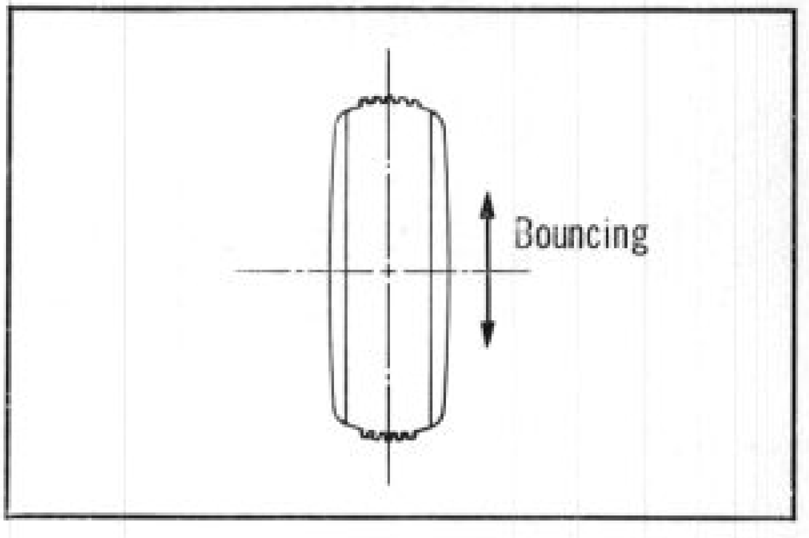


Fig. 11L-1

Dynamic Wheel Balancing

If the weight distribution of the wheels and tires relative to the rotational plane is not in balance even if static balancing is perfect, shimmy causes fairly strong vibration of the steering wheel. This vibration may become serious when attempting to manipulate the steering wheel.

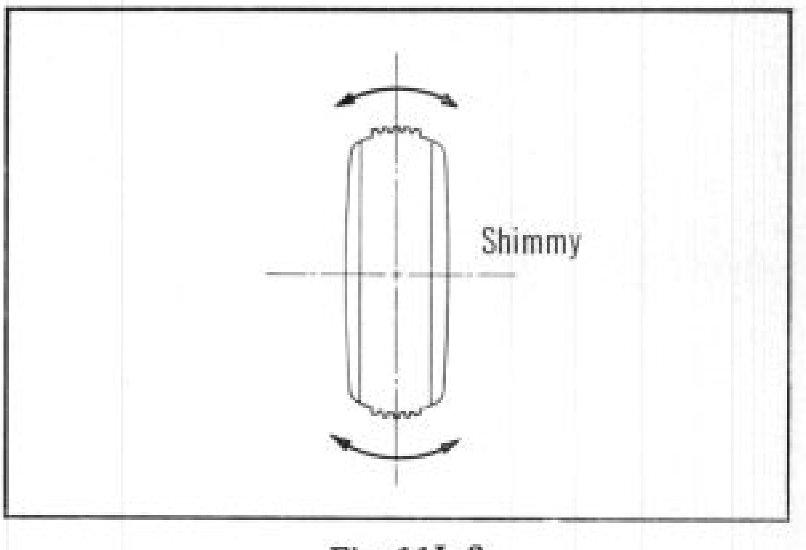


Fig. 11L-2

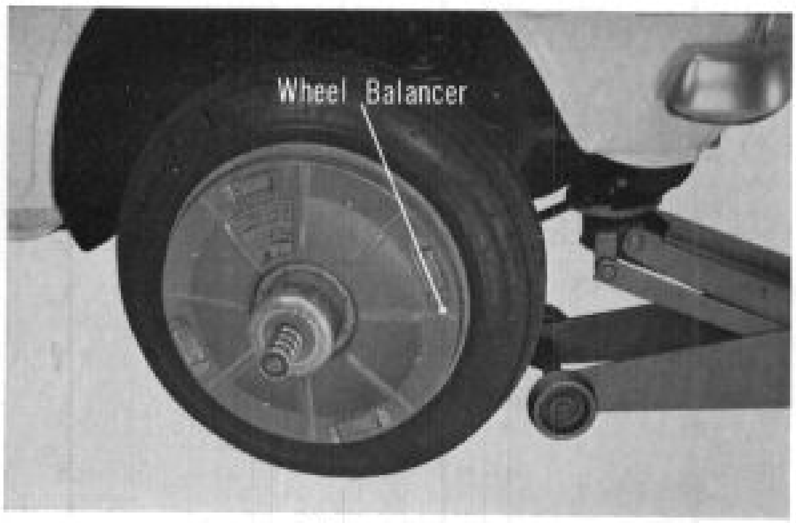


Fig. 11L-3

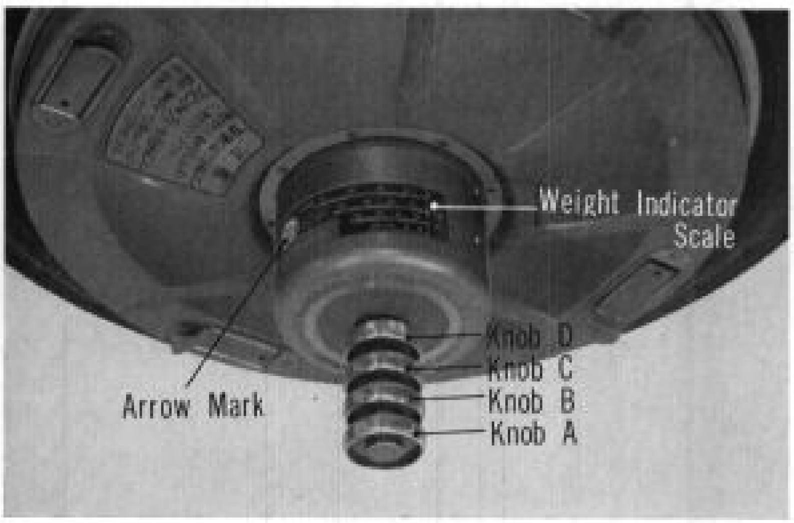


Fig. 11L-4

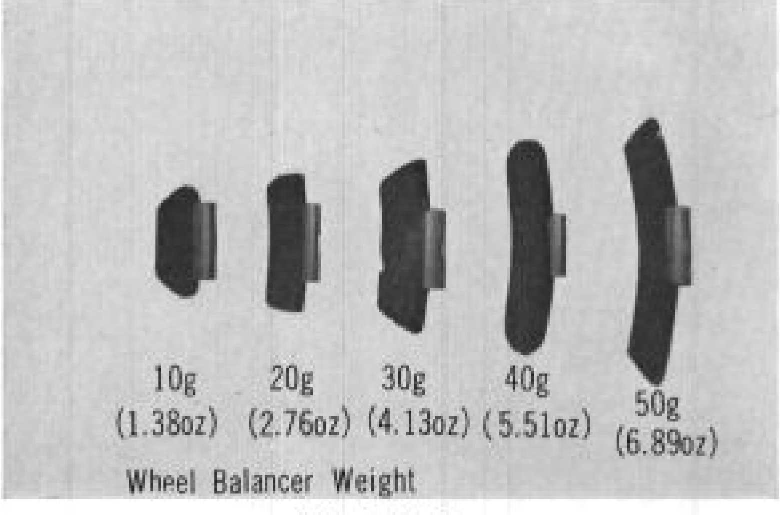


Fig. 11L-5

Inspection before Balancing Wheel and Tires

1. After jacking the vehicle up, spin the wheels by hand to check wheel bearing play.
2. Check the tire for roundness.
3. Check tire for wear and other damage; and also for stones, dirt, etc. between threads.
4. Make sure that the tire pressure is correct.

Balancing Procedure

There are a variety of balancing instruments and equipment and these can be divided generally into two types, those used with the wheels in place and those used with the wheels removed. The former type is used in the procedure outlined below. If a different type of instrument, is used, follow manufacturer's instruction.

1. Front Wheels
   * Jack the vehicle up at the front until the wheels clear the ground, and install the wheel balancer.
   * Start the engine and spin the front wheels at a speed equivalent to 60 km/hr. (approx. 38 mph).
   * Hold knob A which turns in unison with the wheels with the fingers. Release the finger grip a little after the position where vibration is minimum, is obtained.
   * Hold knob B and release the finger grip where vibration is minimum.
   * Hold knob C and release the finger grip a little beyond the point where vibration is minimum.
   * Hold knob D and release the finger grip where vibration is minimum.

   * If the above procedure stops the vibration, stop the engine and wait for the wheels to come to a stop on their own.
   * When the wheels have stopped, read the weight indicator scale of the wheel balancer, as shown ing Fig. 11L-3, and put the correct balancing weight on the outer edge of the rim in a straight line from the arrow on the wheel balancer.
   * Remove the balancer and start the engine to check whether or not wheel balancing is correct and vibration eliminated.

2. Rear Wheels
   * Jack the vehicle up at the rear until the wheels clear the ground and place the roller of the wheel spinner in contact with each wheel in turn.
   * Push the control lever to drive the wheel.
   * Repeat the procedure in the order given for the front wheels.

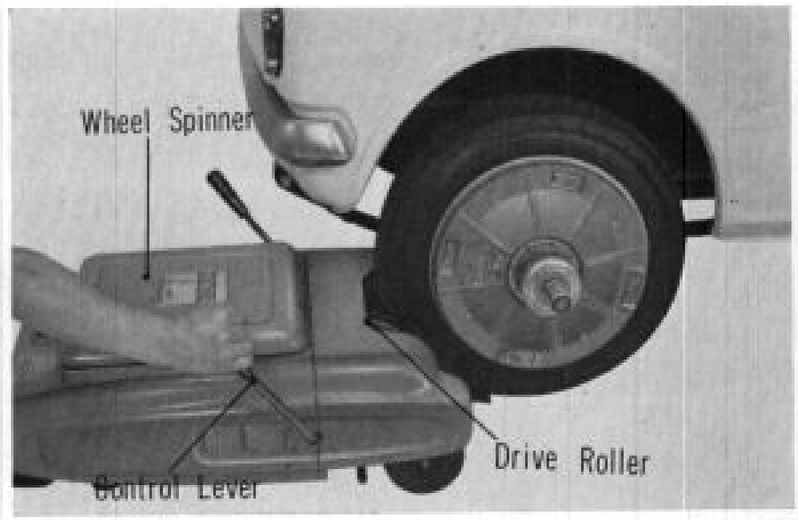
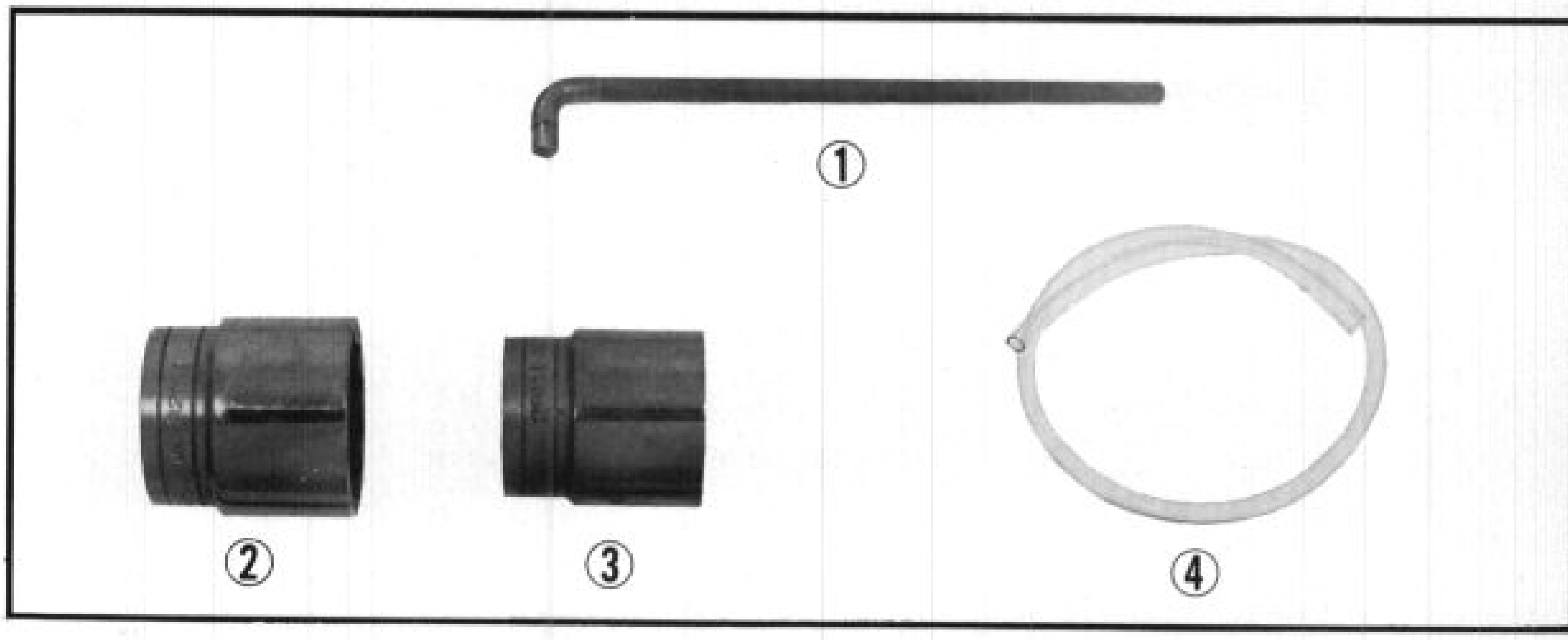


Fig. 11L-6

M. Special Tools



Ref.No.	Tool No.	Description
1.	07023-60106	Wrench Handle
2.	07083-60110	Socket (32 mm)
3.	07083-60115	Socket (27 mm)
4.	07059-55102	Air Bleeder Tube

N. Trouble Diagnosis

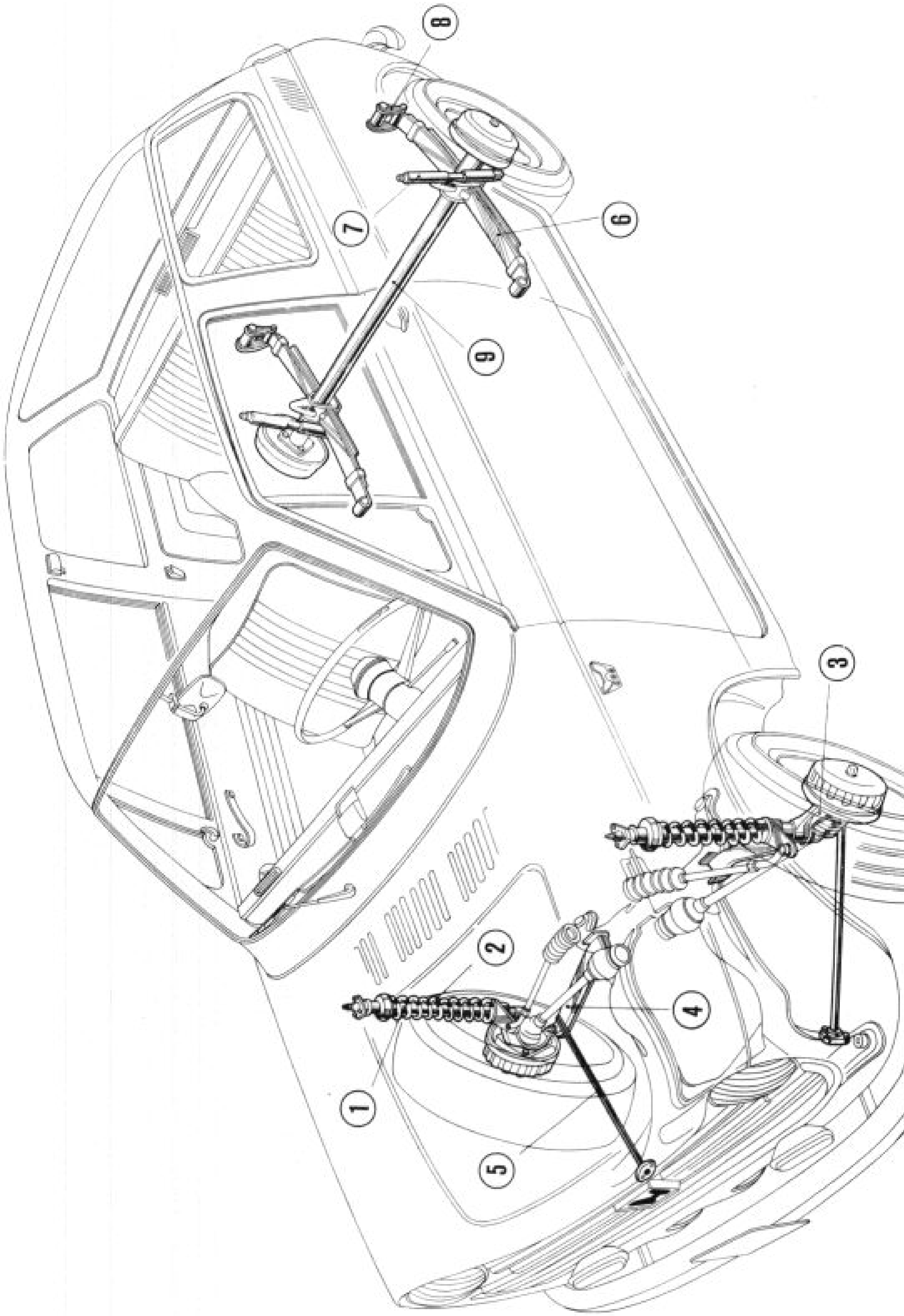
PHENOMENON	POSSIBLE CAUSES
a) Poor braking.	1. Brake adjustment incorrect. 2. Excessively worn brake lining. 3. Water or oil on brake lining surface. 4. Change in the brake lining surface; uneven shoe contact. 5. Air trapped in hydraulic system. 6. Fluid leakage in hydraulic system. 7. Compensating port clogged. 8. Rusted wheel cylinder. 9. Malfunctioning caliper yoke (Disk brake).
b) Vehicle pulls to one side.	1. Maladjustment of tire pressure. 2. Water or oil on the surface of the brake lining, the disc brake, or the drum. 3. Worn or damaged (warped, rusted, etc.) disc or drum. 4. Hardened brake lining. 5. Uneven brake lining surface contact. 6. Carbonized or damaged brake lining. 7. Malfunctioning of the brake cylinder. 8. Improper mounting of wheel bearing. 9. Use of pad lining of different material on the left and right wheels. 10. Improper alignment of the front wheels. 11. Clogged pressure system 12. Difference in the left and right sides of the road condition. 13. Loose caliper mounting bolts. 14. Malfunctioning caliper yoke. 15. Water, mud, etc., in brakes.

PHENOMENON	POSSIBLE CAUSES
c) Wheels drag.	1. Brake adjustment incorrect. 2. Oil, etc., in system. 3. Clogged compensating port. 4. Improper returning action of the parking brake. 5. Insufficient play of the brake pedal. 6. Broken or weakened brake pedal return spring. 7. Malfunctioning pedal linkage. 8. Malfunctioning rear brake and shoe, or weakened spring. 9. Loose wheel bearing. 10. Malfunctioning wheel cylinder. 11. Malfunctioning caliper yoke. (Disk brake) 12. Missing knuckle to caliper adjusting shim.
d) Pedal stroke changes or becomes larger.	1. Air bubbles in the brake fluid. 2. Fluid leakage in the fluid pressure system. 3. Worn or defective piston, cup and/or seal. 4. Insufficient amount of brake fluid. 5. Worn front and rear brake linings. 6. Unevenly worn front and rear brake lining. 7. Malfunctioning pedal linkage. 8. Excessive runout of the disc. (Disk brake) 9. Tilting of the rear brake shoe or incorrect return.
e) Brake squeaks.	1. Dragging of the brake shoe. 2. Worn brake lining. 3. Change in the surface of lining. 4. Lodging of foreign matter on the disc or drum. 5. Runout or damage on the sliding surface of the disc or drum. 6. Unevenly worn disc surface. (Disk brake) 7. Dirt or dust inside the brake. 8. New linings not yet fully burnished. 9. Rusty wheel cylinder. 10. Incorrect installation of brake pad shims (Disk brake)

PHENOMENON	POSSIBLE CAUSES
f) Pedal reaches floorboard when fully depressed.	1. Excessively worn brake lining. 2. Excessive clearance between brake drum and lining. 3. Insufficient fluid in master cylinder. 4. Leaking hydraulic lines or cylinders. 5. Air in brake line. 6. Damaged master cylinder rubber cap. 7. Worn master cylinder piston or piston cup. 8. Defective master cylinder check valve. 9. Defective wheel cylinder piston cup. 10. Clogged brake line.
g) Brakes lock, not released properly.	1. Clogged brake line. 2. Clogged master cylinder return port. 3. Malfunctioning master cylinder check valve. 4. Poor return action of wheel cylinder.
h) Parking brake action is poor.	1. Excessive brake lever stroke. 2. Excessive adjustment of brake cable or rod. 3. Incorrect clearance between brake shoe and drum. 4. Oil on brake shoe.

SECTION 12

SUSPENSION



Suspension
① Front Damper ② Front Coil Spring ③ Knuckle ④ Lower Arm
⑤ Radius Rod ⑥ Rear Leaf Spring ⑦ Rear Shock Absorber
⑧ Shackle ⑨ Rear Axle

A. Technical Data

(Specifications)

TOE-IN	−2 mm (−0.08 in) (TOE-OUT 2 mm)
CAMBER	0.5°
CASTER	1.0°
KING PIN INCLINATION	14.5°
TRAIL	5 mm (0.197 in)

(Tightening torque)

Front Suspension

Lower arm-to-sub frame	4.0~4.8 kg-m (29~35 bl-ft)
Radius rod-to-sub frame	4.0~4.8 kg-m (29~35 lb-ft)
Lower arm ball joint nut	4.0~4.5 kg-m (29~32 lb-ft)
Knuckle clamp bolt	
8mm	3.0~3.5 kg-m (22~25 lb-ft)
10mm	4.5~6.0 kg-m (32~43 lb-ft)
Damper rod nut A (upper)	4.5~5.0 kg-m (32~36 lb-ft)
Damper rod nut B (lower)	2.5~3.0 kg-m (18~22 lb-ft)
Front damper assembly-to-body (8mm bolts)	1.5~2.0 kg-m (11~14 lb-ft)
Stabilizer bracket-to-subframe	2.0~2.4 kg-m (14~17 lb-ft)
Stabilizer shaft-to-lower arm	4.5~5.0 kg-m (32~36 lb-ft)

Rear Suspension

U-bolts	4.4~4.8 kg-m (32~35 lb-ft)
Leaf spring bolts	4.4~4.8 kg-m (32~35 lb-ft)
Rear damper assembly-to-body (8mm bolts)	1.2~1.5 kg-m (9~11 lb-ft)

B. Check and Adjustment of Front Wheel Alignment

There are a variety of wheel alignment instruments and equipments. The following equipment is one of the types. If a different type of instrument or equipment is used, follow manufacturer's instructions.

Before making this check, the following items that effect steering should be considered:

1. Check tire inflation and bring to recommended pressure.
2. Check front wheel bearing play and correct if necessary.
3. Check wheel and tire for excessive unbalance.
4. Check shock absorber for leak or lack of control.
5. Check front suspension for deform and damage.

a. Checking Caster Angle

1. Set the turning radius gauge. Lift the rear of the vehicle, placing rear wheels on the same level as the turning gauge.

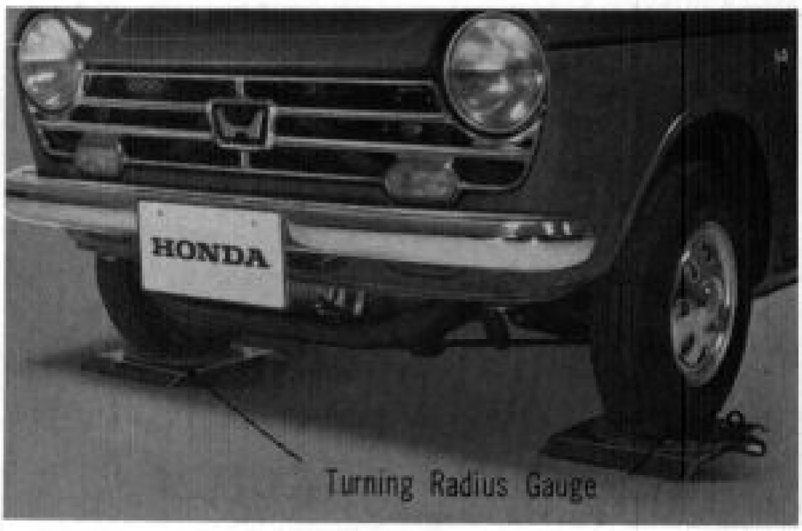


Fig. 12B-1

2. Pull out the lock pin of the turning radius gauge and set the gauge to zero.

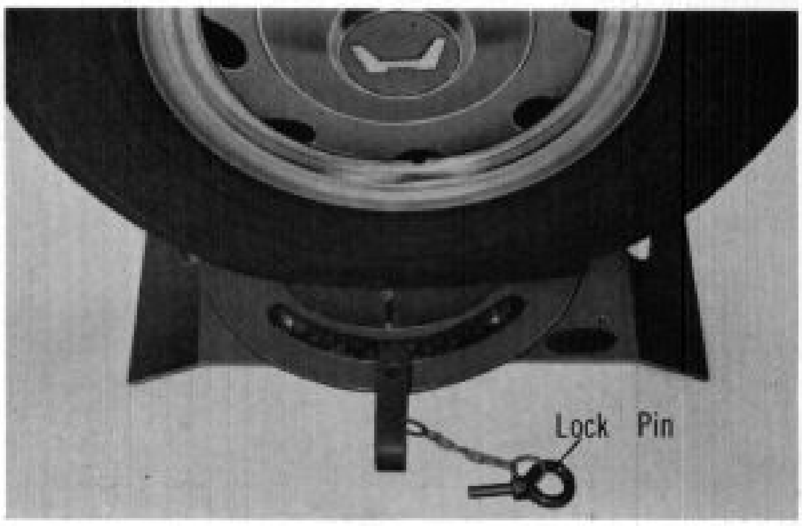


Fig. 12B-2

3. Set alignment tester to the front wheel and turn the wheel 20 degrees outward.

   Note:
   When turning the wheels, depress the brake pedal.
4. Set the caster gauge bubble to zero.
   Turn the wheels 20 degrees inward (turn the wheel back).
5. With the kingping inclination angle gauge bubble set to "5", read the position of the caster gauge bubble.
   The standard value of caster is 1°.

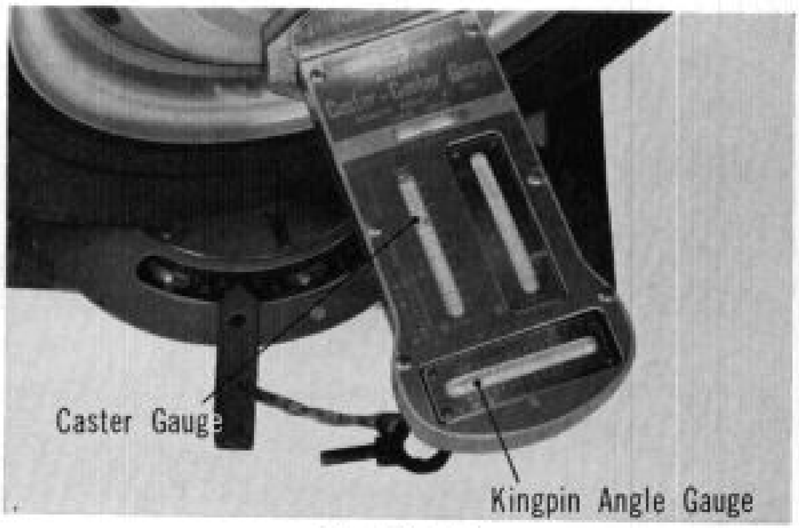


Fig. 12B-3

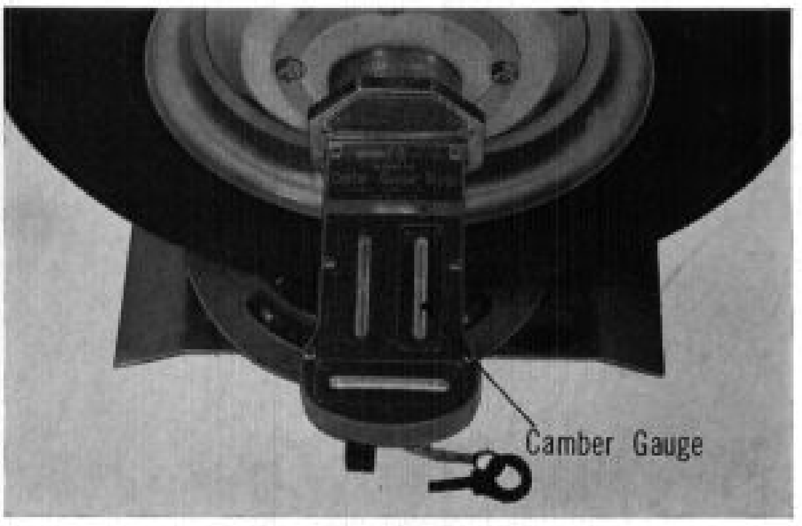


Fig. 12B-4

b. Checking Camber Angle

1. Set front wheels in the straight-forward position.
2. Set the kingpin inclination angle gauge bubble to five.
   In this state, read the position of the camber gauge bubble.
   The standard value of camber angle is **0.5°**.

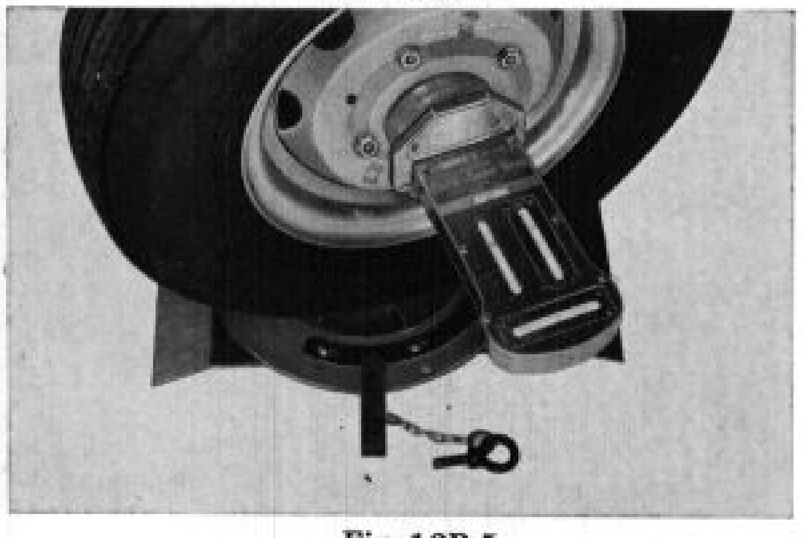


Fig. 12B-5

c. King pin Inclination Angle

1. As the measurement of caster, turn the wheel 20 degrees outward.
2. Set the kingpin inclination angle bubble to zero.
   Note:
   Set the bubble to zero on the right of the gauge for the right-hand wheel, and to zero on the left for the left-hand wheel.
3. With the wheel turned 20 degrees backward, read the position of the kingpin inclination angle gauge bubble. The standard value of the kingpin inclination angle is **14.5°**.

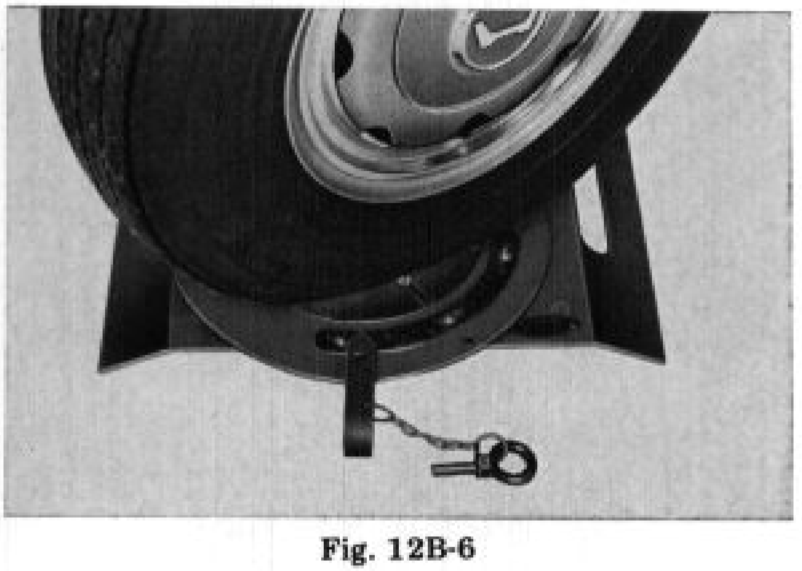


Fig. 12B-6

d. Steering Angle

1. Set the front wheels in the straight-forward position.
2. Set the turning radius gauge to zero for both the right-and-left wheel, and then pull out the lock pin.
3. Read the gauge with the steering wheel turned fully in either direction.
   Note:
   Measurement of the steering angle is made with the brake pedal depressed. The standard value is 35°12′ inward and 27°33′ outward.

e. Toe-in

Refer to section 10 "STEERING".

C. Front Suspension

Description

The front suspension is strut type. Principal components are shock absorber, coil spring, knuckle, lower arm, radius rod, and ball joint. The lower end of each shock absorber is secured to the top end of the knuckle, while the top end of the shock absorber is attached to the vehicle body. The lower arm is connected to the bottom end of the knuckle with the ball joint and the radius rod is welded to this arm. The knuckle arm on the shock absorber is joined to the tie-rod end.

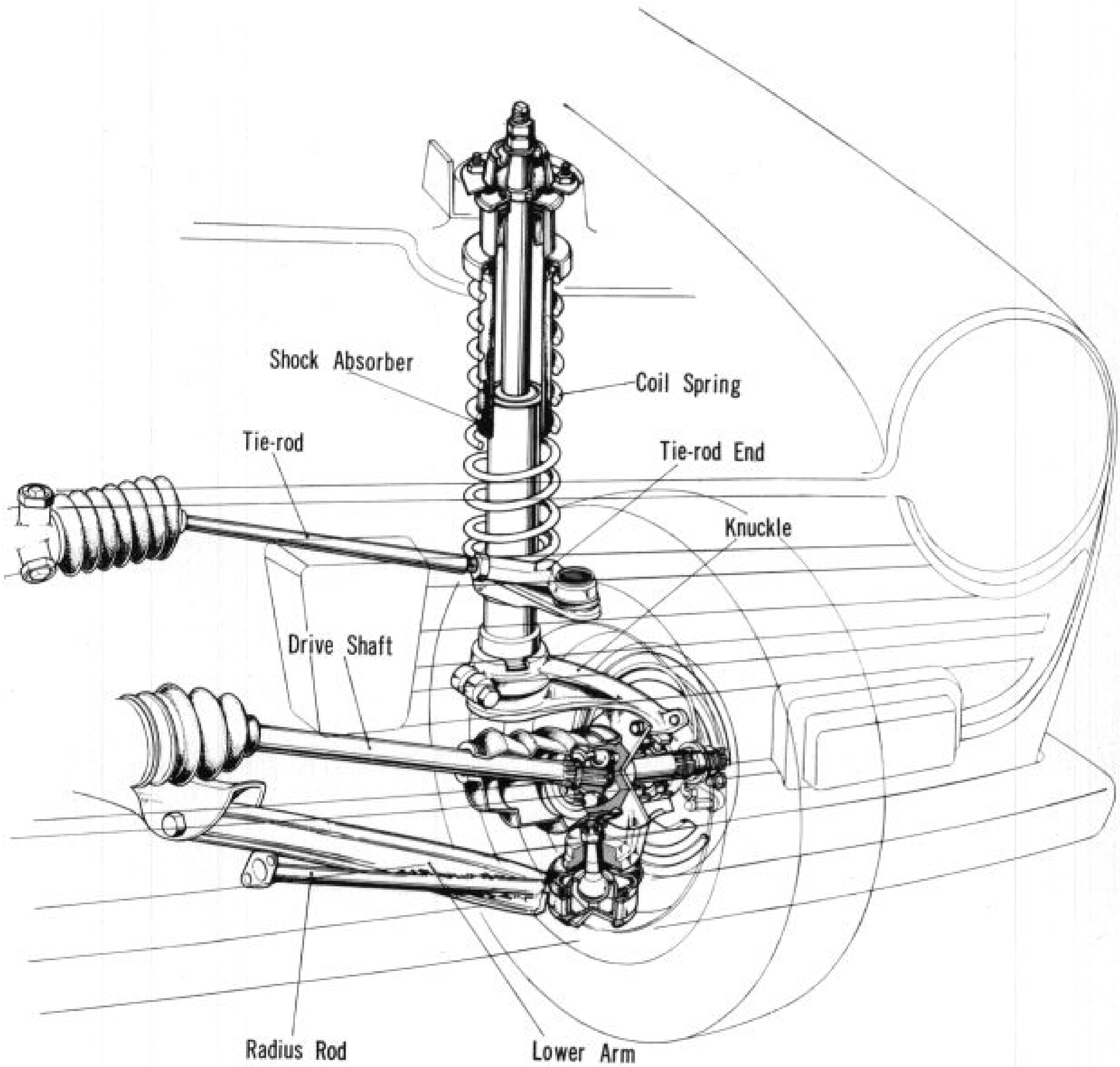


Fig. 12C-1

12-5-1 SUSPENSION

Vehicles exported to the U.S.A., Canada etc. incorporate stabilizer instead of the radius rods employed on the standard model. Modified front damper assembly is also shown below in exploded view.

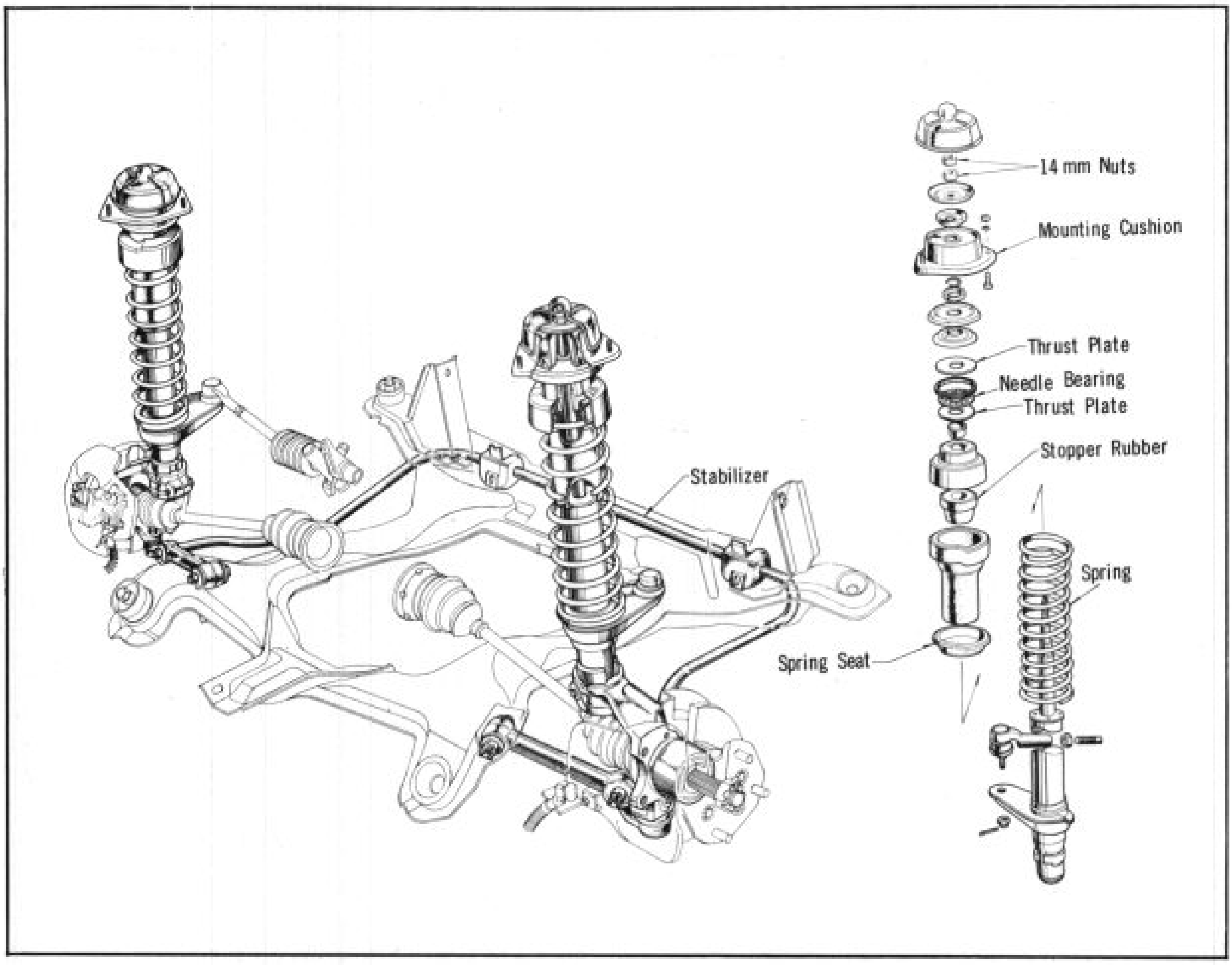


Fig. 12C-1a

Stabilizer Link

(Removal)

1. Raise front end of the vehcle so that lower arms hang free.

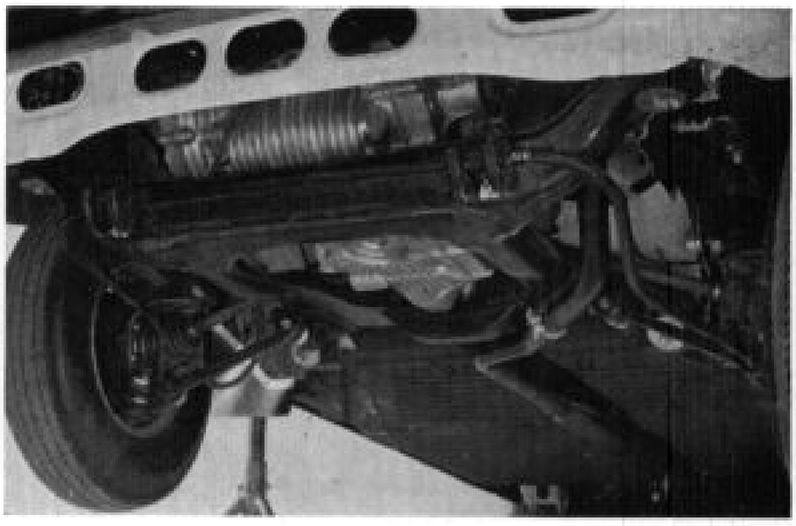


Fig. 12C-1b

2. Remove the castle nuts at both ends and two bolts at the front to disconnect stabilizer link.

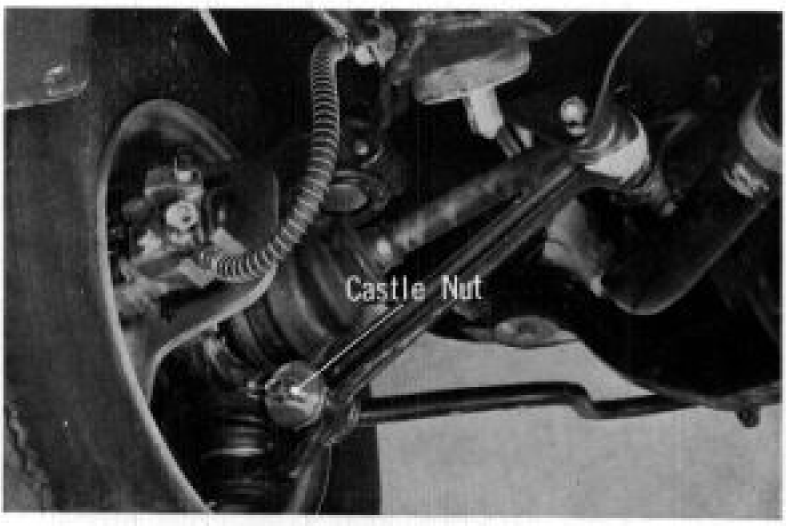


Fig. 12C-1c

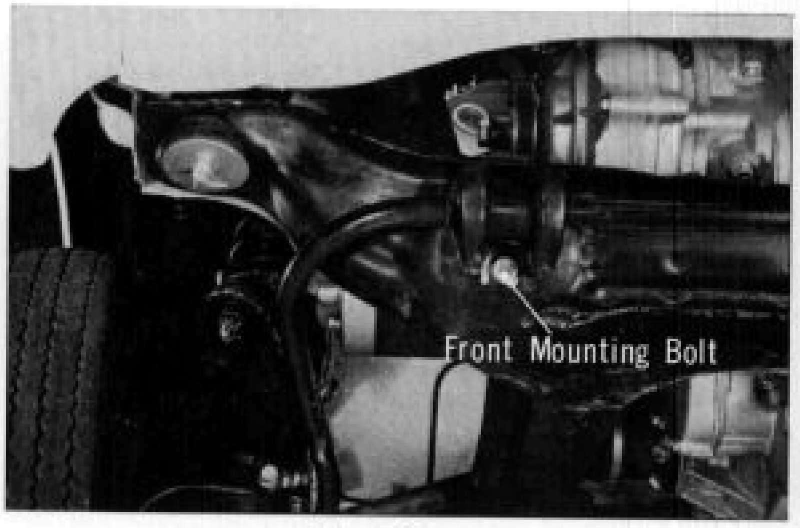


Fig. 12C-1d

(Installation)

V-edged front support bracket is longer than another and it should be installed on the left while shorter bracket on the right.

Tightening torque

Stabilizer-to-Lower Arm	4.5~5.0 kg-m (32~36 lb-ft)
Bracket-to-Sub Frame	2.0~2.4 kg-m (14~17 lb-ft)

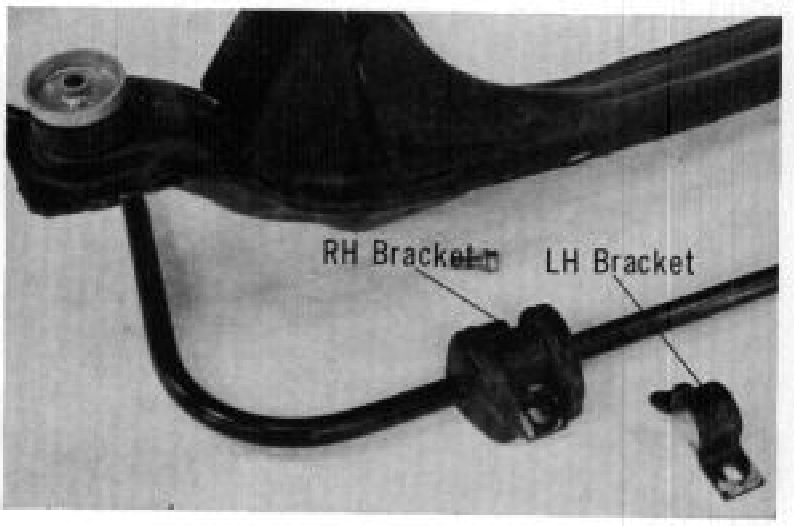


Fig. 12C-1e

12-6 SUSPENSION

a. Front Damper

Removal and disassembly

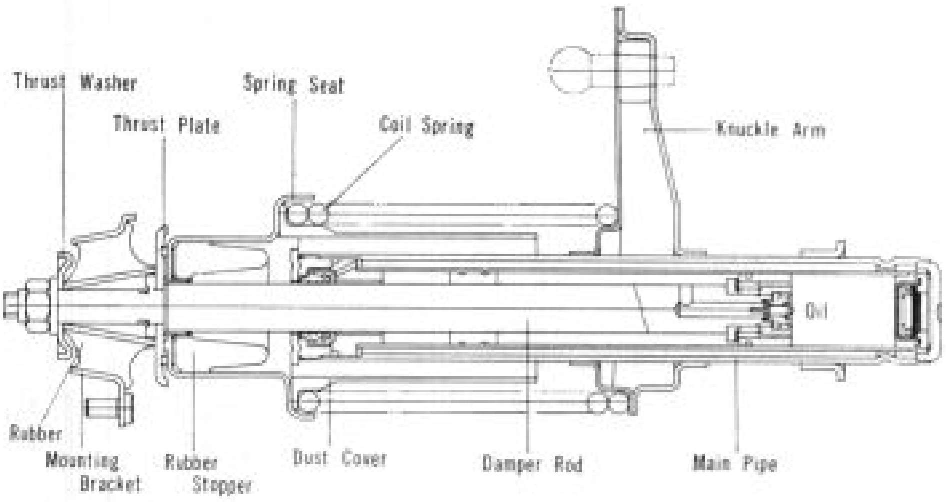


Fig. 12C-2

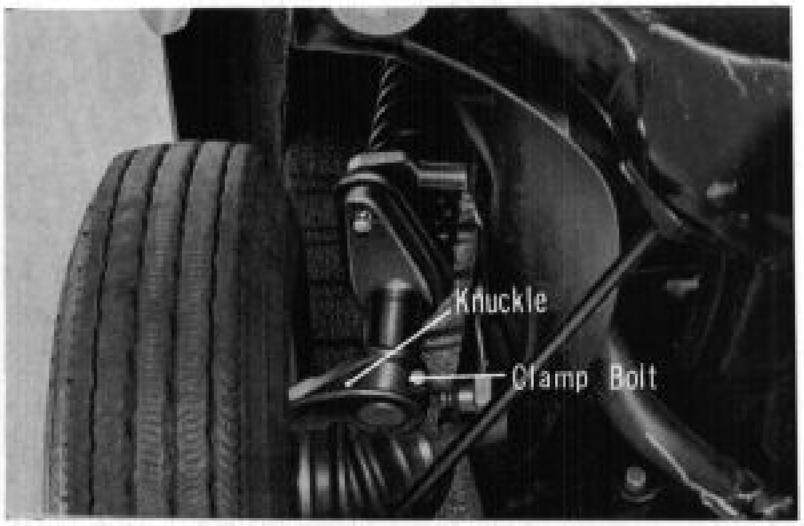


Fig. 12C-3

1. Put the jack and raise the vehicle.

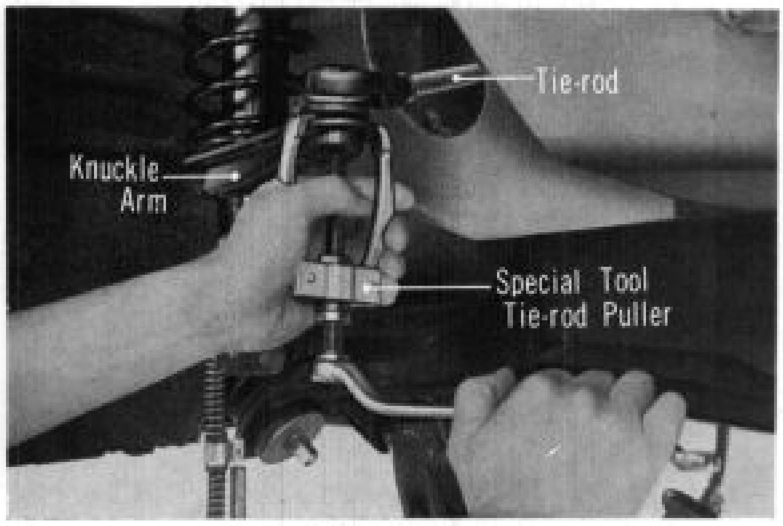


Fig. 12C-4

2. Remove the tie-rod from the knuckle arm with the special tool (tie rod end puller).
3. Remove clamp bolt retaining the lower end of the damper and separate it from the knuckle. (Fig. 12C-3)

4. Loosen the damper rod nuts (12mm) "A" and "B" since these nuts are too tight to loosen after separating the damper assembly from the body.

   Tightening torque:
   Nut A 4.5~5.0 kg-m (32~36 lb-ft)
   Nut B 2.5~3.0 kg-m (18~22 lb-ft)

5. Remove the three nuts (8mm) and spring washers and separate the front damper assembly from the body.

   Tightening torque:
   1.5~2.0 kg-m (11~14 lb-ft)

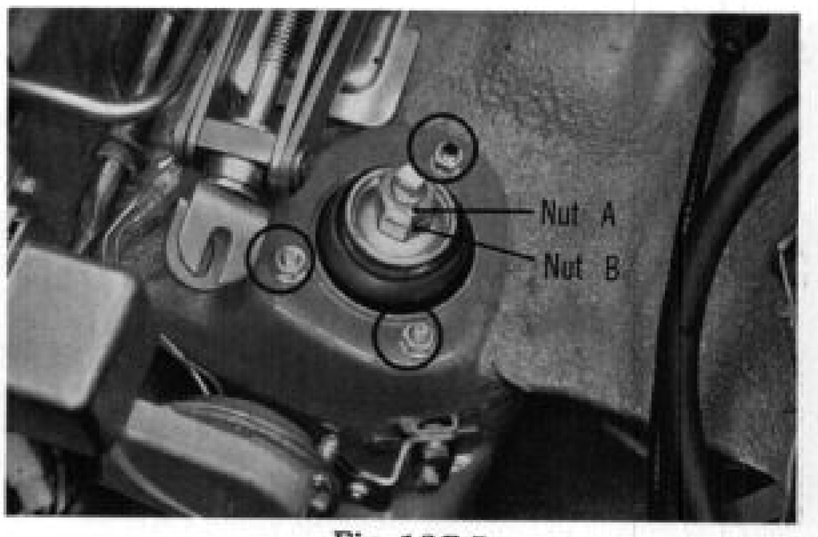


Fig. 12C-5

6. Remove the damper rod nuts, the washers and the mounting bracket.

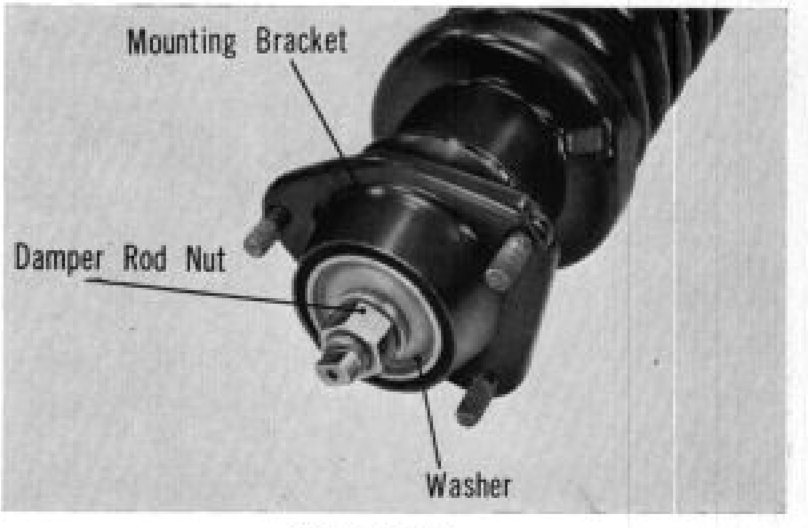


Fig. 12C-6

7. Install the front damper spring compressor. Align the center with three adjusting screw.

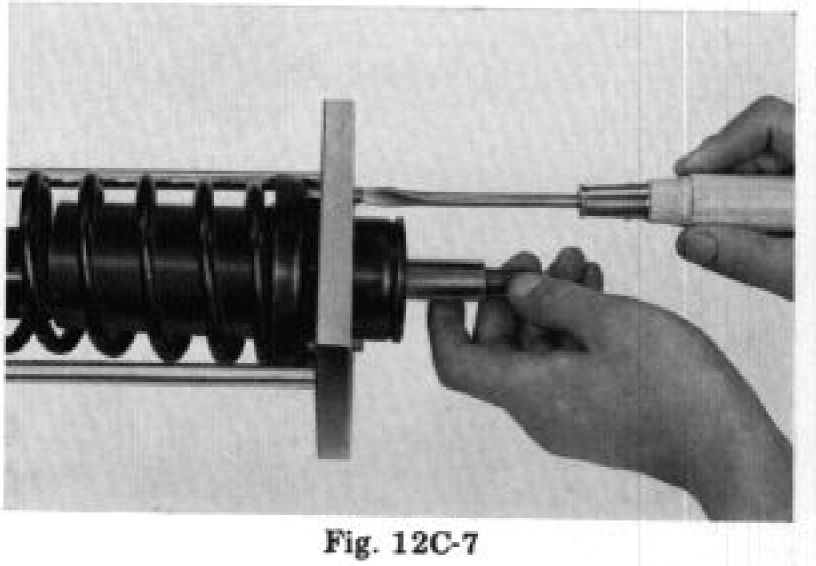


Fig. 12C-7

8. Turn the handle slowly, gradually compressing the spring.

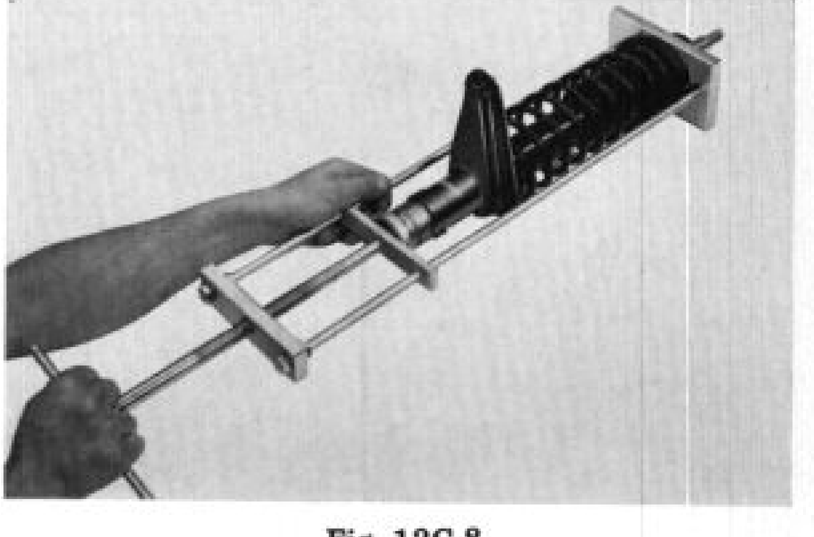


Fig. 12C-8

9. When the spring is compressed to such a level that the ring stopper can be removed, remove the stopper and release the handle. The coil spring can now be separated from the shock absorber. The front damper cannot be disassembled. When riding is not stable or oil is leaking, make replacement.

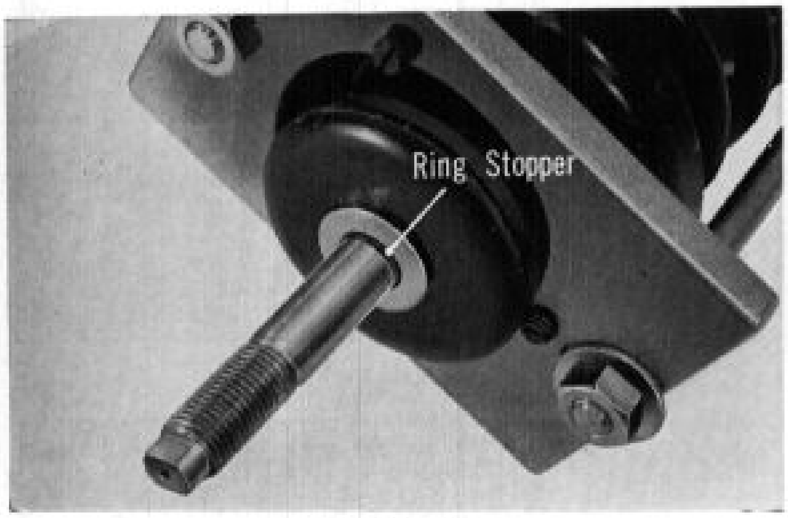


Fig. 12C-9

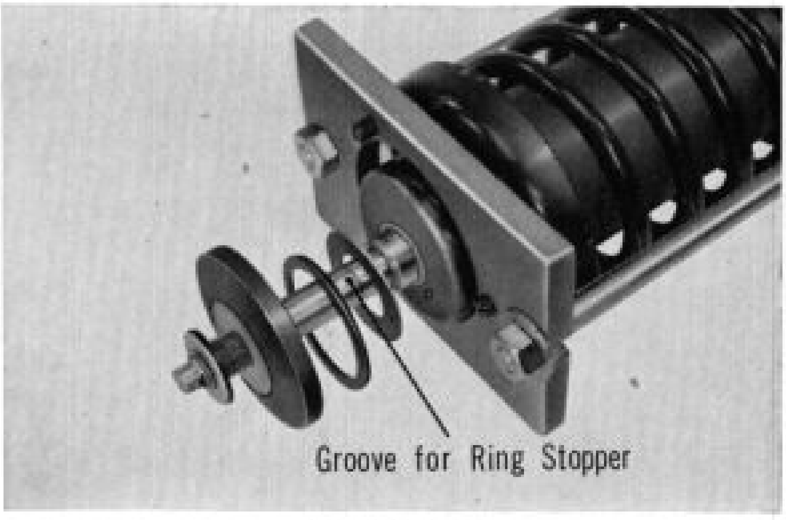


Fig. 12C-10

10. Exploded view of the front damper. (Modofied front damper is shown in fig. 12-1a)

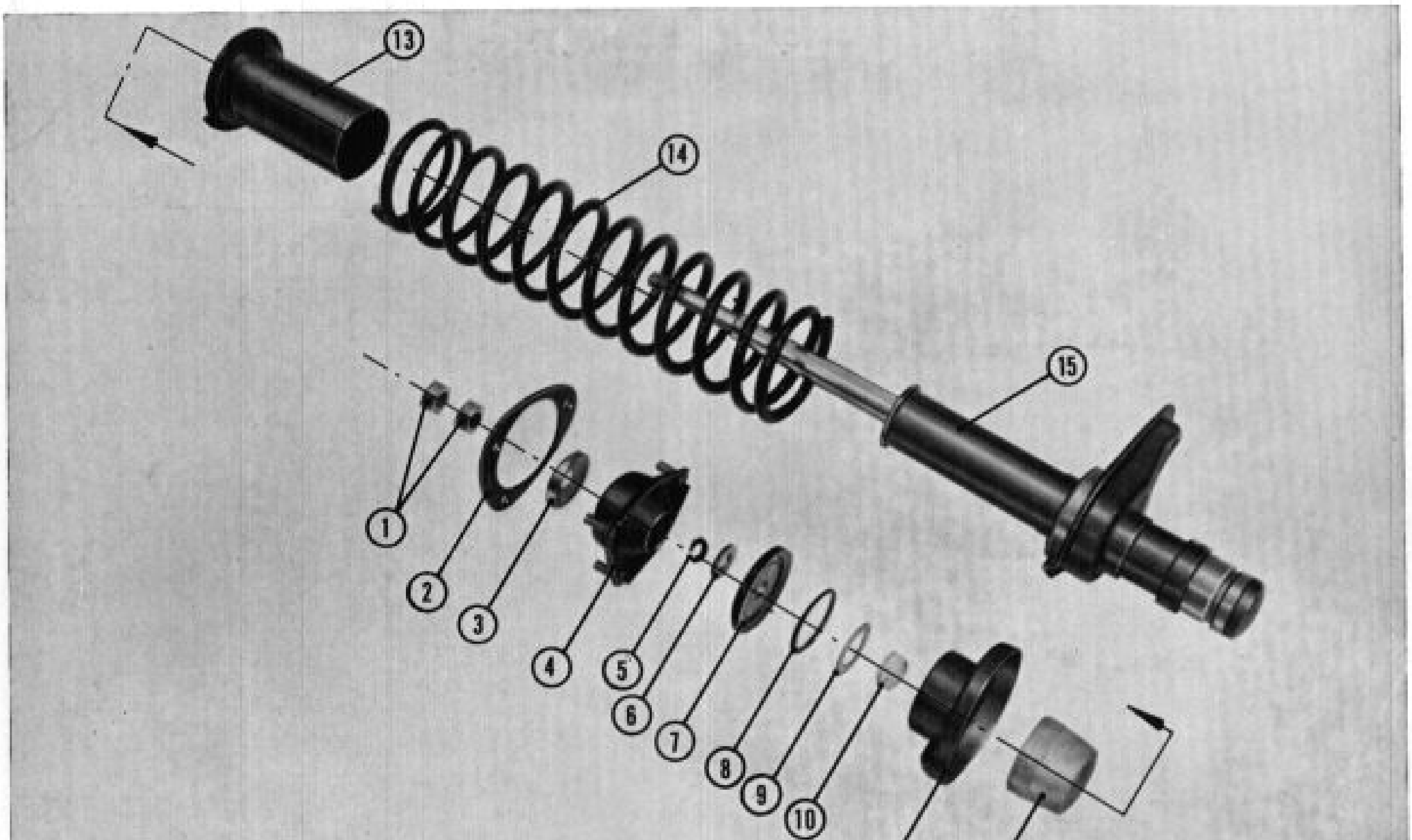


Fig. 12C-11

① 14mm nut
② Spacer
③ Washer A
④ Cushion
⑤ Ring stopper
⑥ Washer B
⑦ Thrust plate
⑧ O-ring
⑨ Thrust bearing
⑩ Bushing
⑪ Spring seat
⑫ Bumper
⑬ Dust cover
⑭ Spring
⑮ Front damper

b. Knuckle and Lower Arm

Removal and Disassembly

1. Remove both the drum and brake back plate. Refer to section "BRAKES AND WHEELS" for detail.

2. Extract the drive axle shaft from the knuckle. Refer to section "DRIVE SHAFT" for detail.

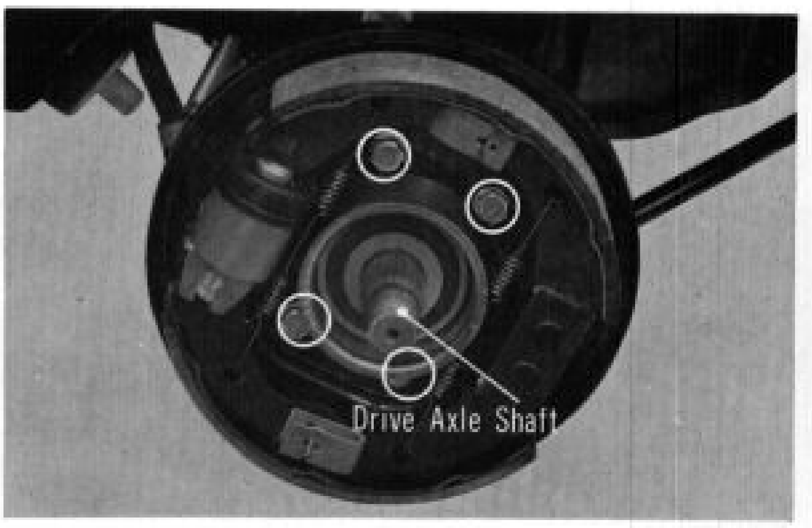


Fig. 12C-12

3. Pull out the lower ball joint cotter pin, remove the nut, and separate the lower arm from the knuckle.

   Tightening torque:
   4.0 to 4.8 kg-m (29 to 35 lb-ft).

   Note:
   If disconnection is difficult, tap the knuckle. (Fig. 12C-13a)

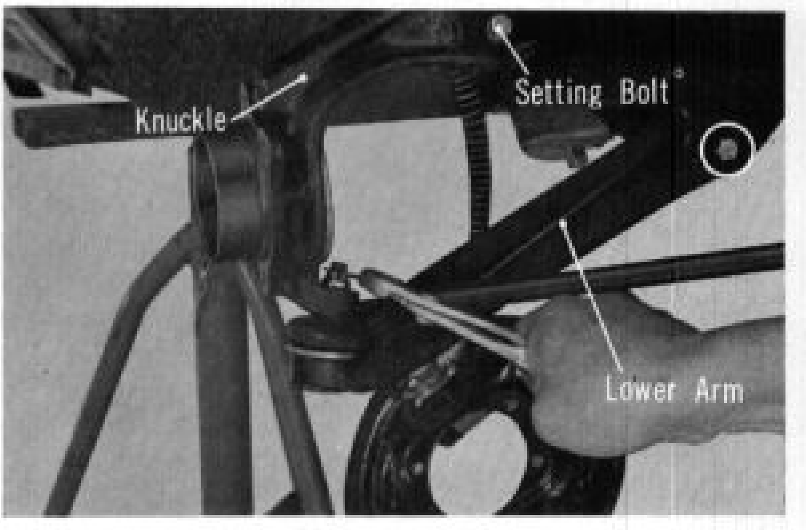


Fig. 12C-13

4. Disconnect the lower arm from the sub frame.
   Tightening torque:
   4.0 to 4.8 kg-m (29 to 35 lb-ft)
5. Loosen the knuckle clamp bolt, and separate the knuckle from the shock absorber.
   Tightening torque:
   8 mm 3.0~3.5 kg-m (22~25 lb-ft)
   10 mm 4.5~5.0 kg-m (32~37 lb-ft)

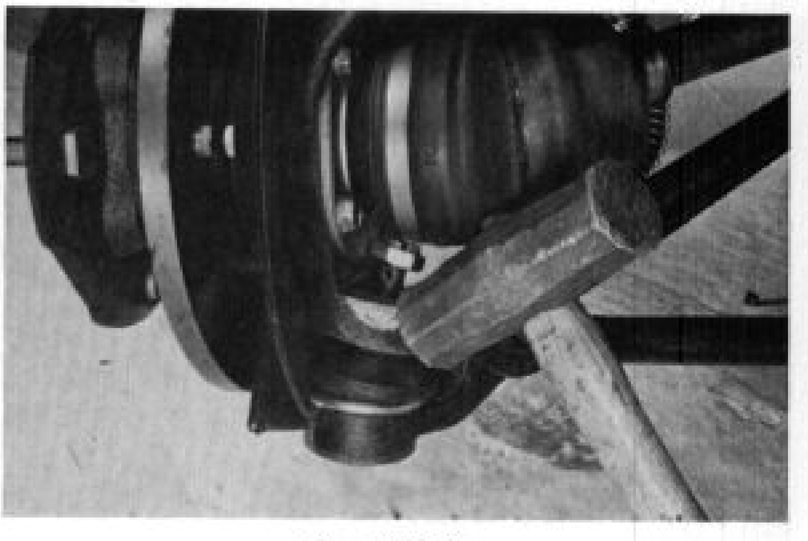


Fig. 12C-13a

6. Disconnect the radius rod from the sub-frame (engine support beam).

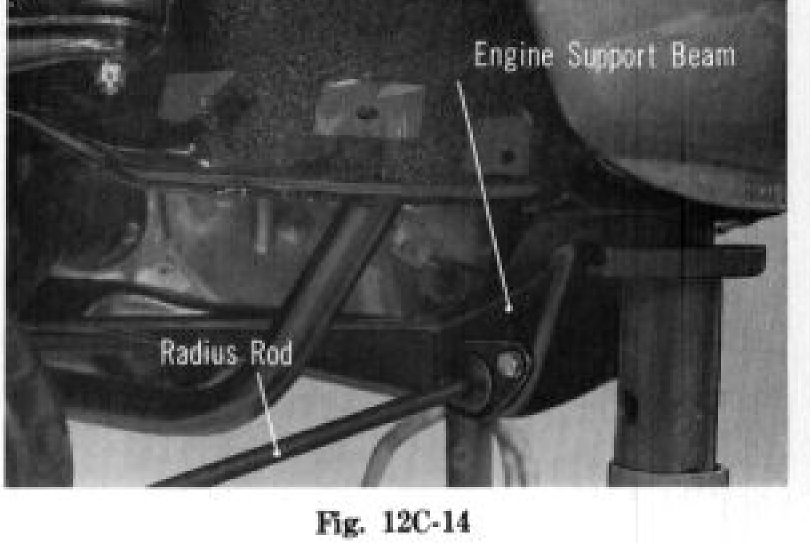


Fig. 12C-14

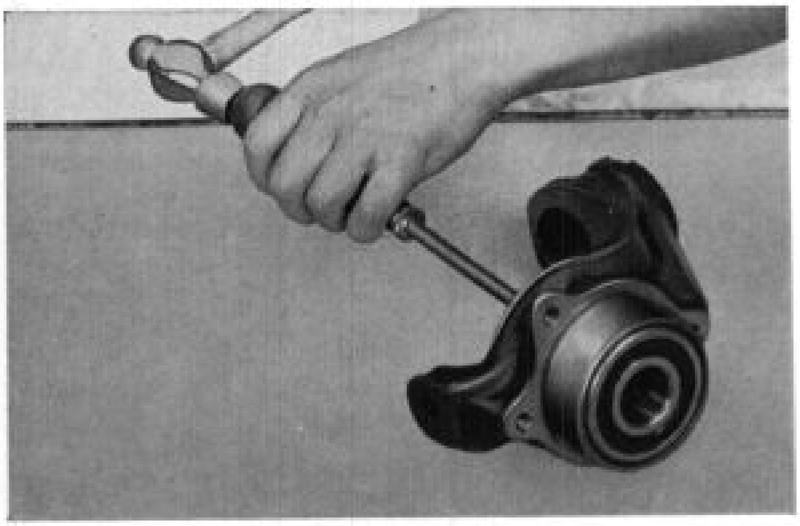


Fig. 12C-16

7. Inspect the bearing. If there is unusual noise or excessive wear, make replacement.

8. Remove the bearing cover.

9. Apply a screwdriver to the bearing, tap the screwdriver lightly with a hammer, and drive out the bearing. Two bearings are used. Drive the bearing out from the inside. A spacer is used between bearings.

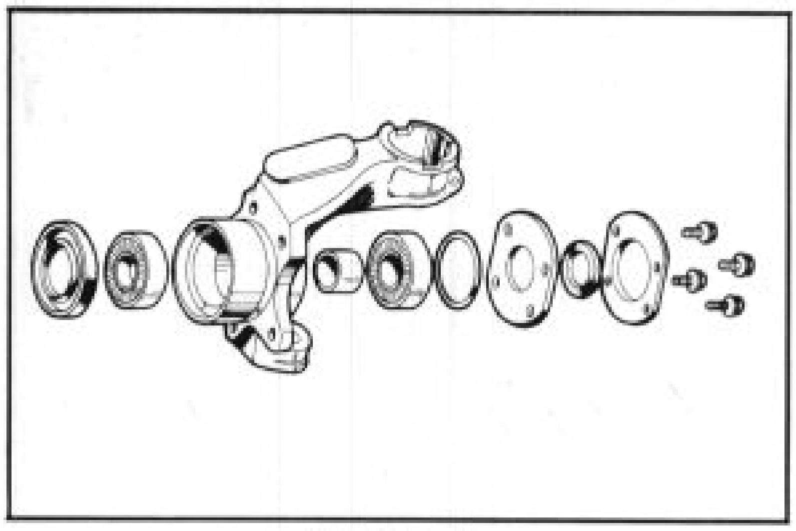


Fig. 12C-17

10. To tap bearing, apply something flat and drive with a hammer. Never apply a force to the inner race of bearing.

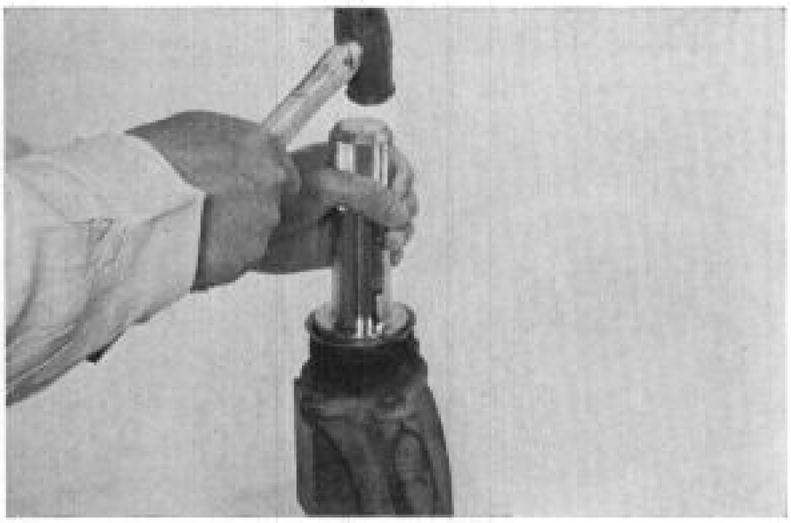


Fig. 12C-18

When installing, use the special tool—bearing driven A or tap the bearing only at the outer race.
The dust seal is installed by means of special tool—bearing Driver B.

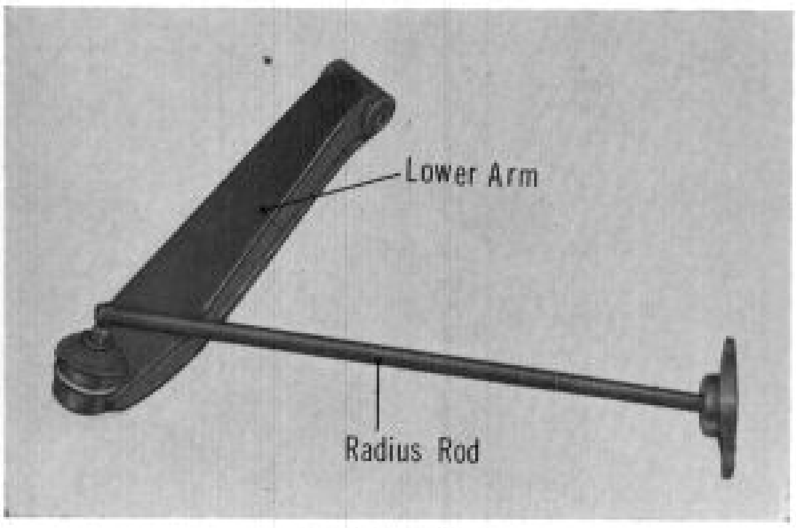


Fig. 12C-19

11. Check the lower arm ball joint for wear and disassemble if defective.
Check the lower arm and radius rod for cracks, deformation, etc.
If bent, replace since a bent lower arm and/or radius rod affect wheel alignment.

12. Remove the boot and circlip, and tap lightly with a hammer to remove the ball joint.

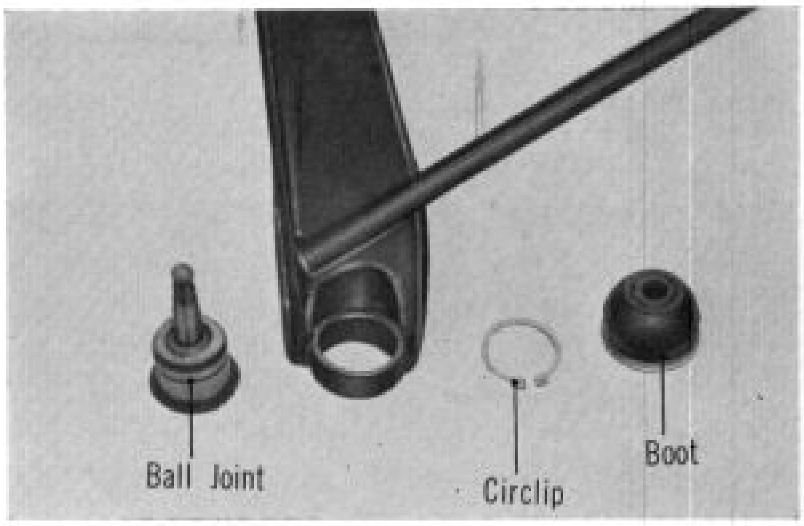


Fig. 12C-20

13. When reconnecting the radius rod to the sub-frame, do not forget to place rubber cushions to both sides of the flange.

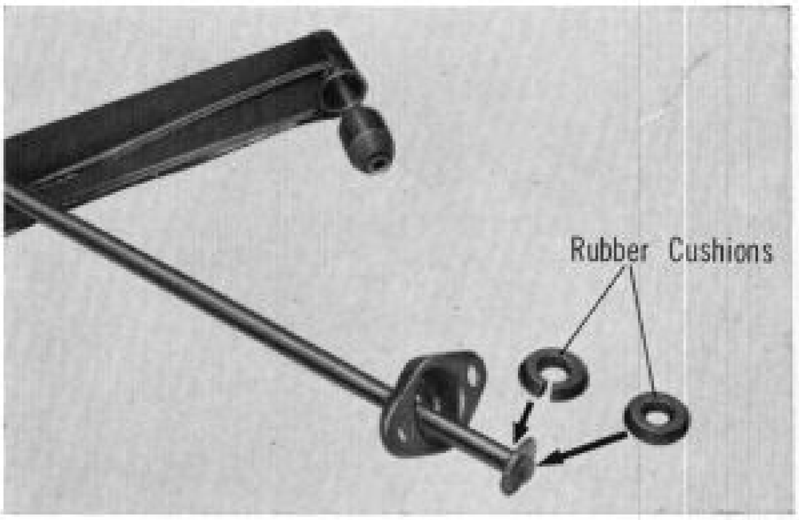


Fig. 12C-21

D. Rear Suspension

The rear suspension consists of semi-elliptic leaf springs and De Carbon type shock absorbers which incorporate nitrogen gas chamber at the bottom of the cylinder. The spring eyes and the shackle hanger are fitted with rubber bushes. The springs and bump rubbers are mounted onto the rear axle with U-bolts.

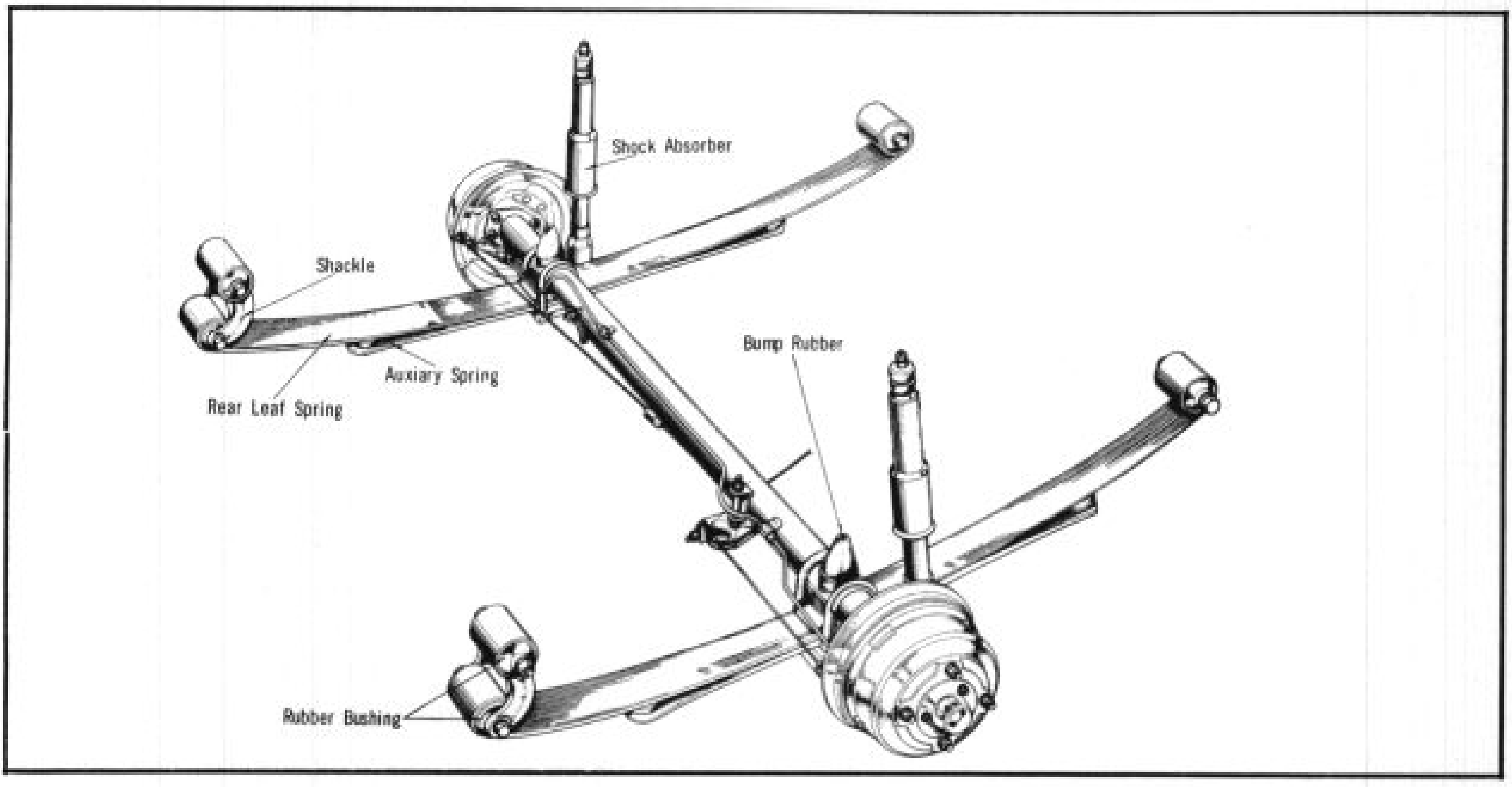


Fig. 12D-1

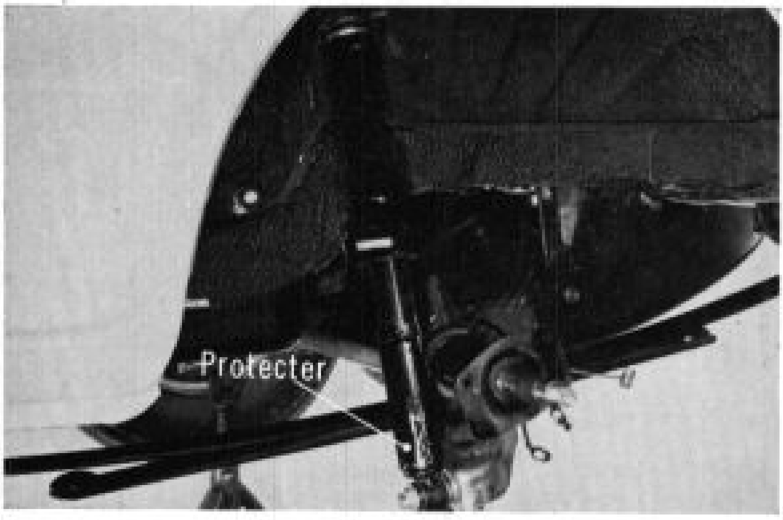


Fig. 12D-2

Install the shock absorber with the protecter cover forward.

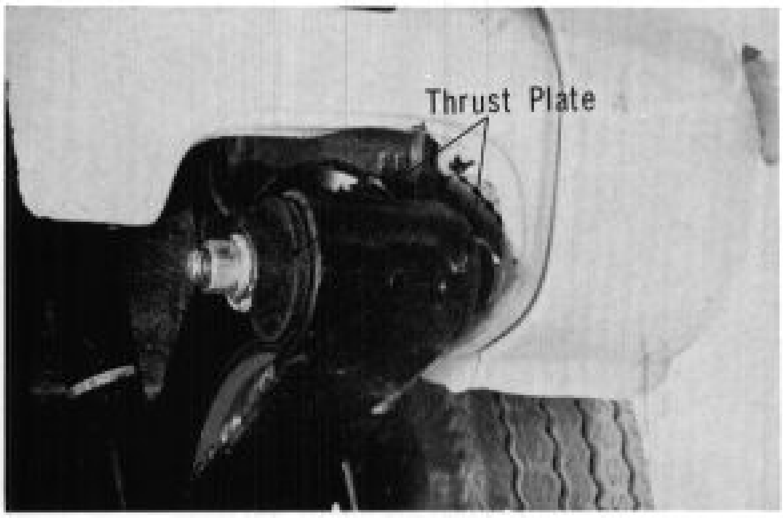
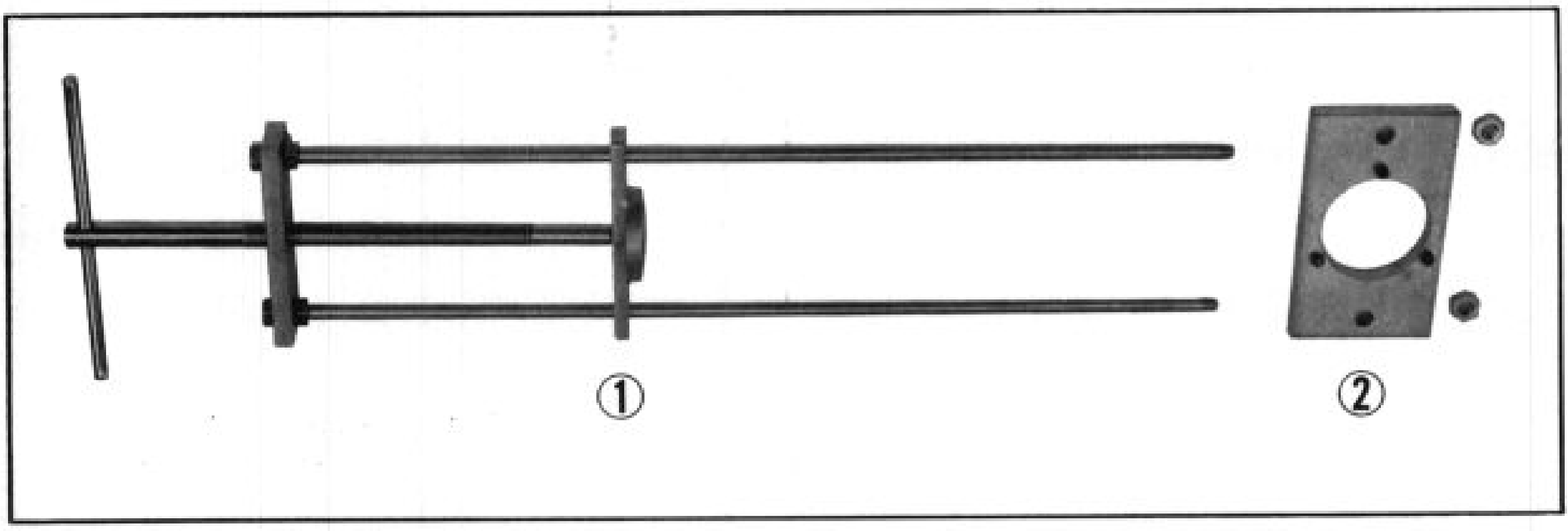


Fig. 12D-3

If squeaking noise develops aroun the shackle, apply grease to the thrust plate.

E. Special Tool



Ref. No.	Tool No.	Description
1.	07034-55110	Front damper spring compressor main
2.	07034-55115	″ flange

F. Trouble Diagnosis

(a) Car pulls to one side

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Low or uneven lire pressure	• Correct tire pressure to the specified valve.
2. Incorrect toe-in	• Adjust
3. Incorrect camber and caster	• Replace the defective parts with new parts.
4. Sagged front springs	• Replace with new spring.

(b) Side tire wear

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Incorrect toe-in	• Adjust
2. Incorrect camber and caster	• Replace the defective parts with new parts.
3. Worn wheel bearing.	• Replace

(c) Vehicle high differs between right and left.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Sagged springs	• Replace
2. Improperly fastened spring bolts (Rear)	• Loosen and retighten.

MEMO

SECTION 13

REAR AXLE

Description

The rear suspension is a semi-elliptical, leaf-spring type. The rear axle of unit construction is fitted to the vehicle body through leaf spring.

The outstanding features of this suspension are simple construction, easy servicing, and less vehicle rolling when cornering.

The rear axle is secured with U-bolts to the center of the leaf springs on each side. The front end of each spring is connected with a pin to the vehicle body through a rubber cushion and bushing, while the rear end has a shackle for the change of span. As the leaf spring rebounds, the shackle changes its position, gradually increasing the spring constant when the spring is heavily loaded or rebounds. At the rear end of the leaf spring and the vehicle-side end of the shackle are installed rubber bushings which help the spring to return to its former position and absorb minute vibrations.

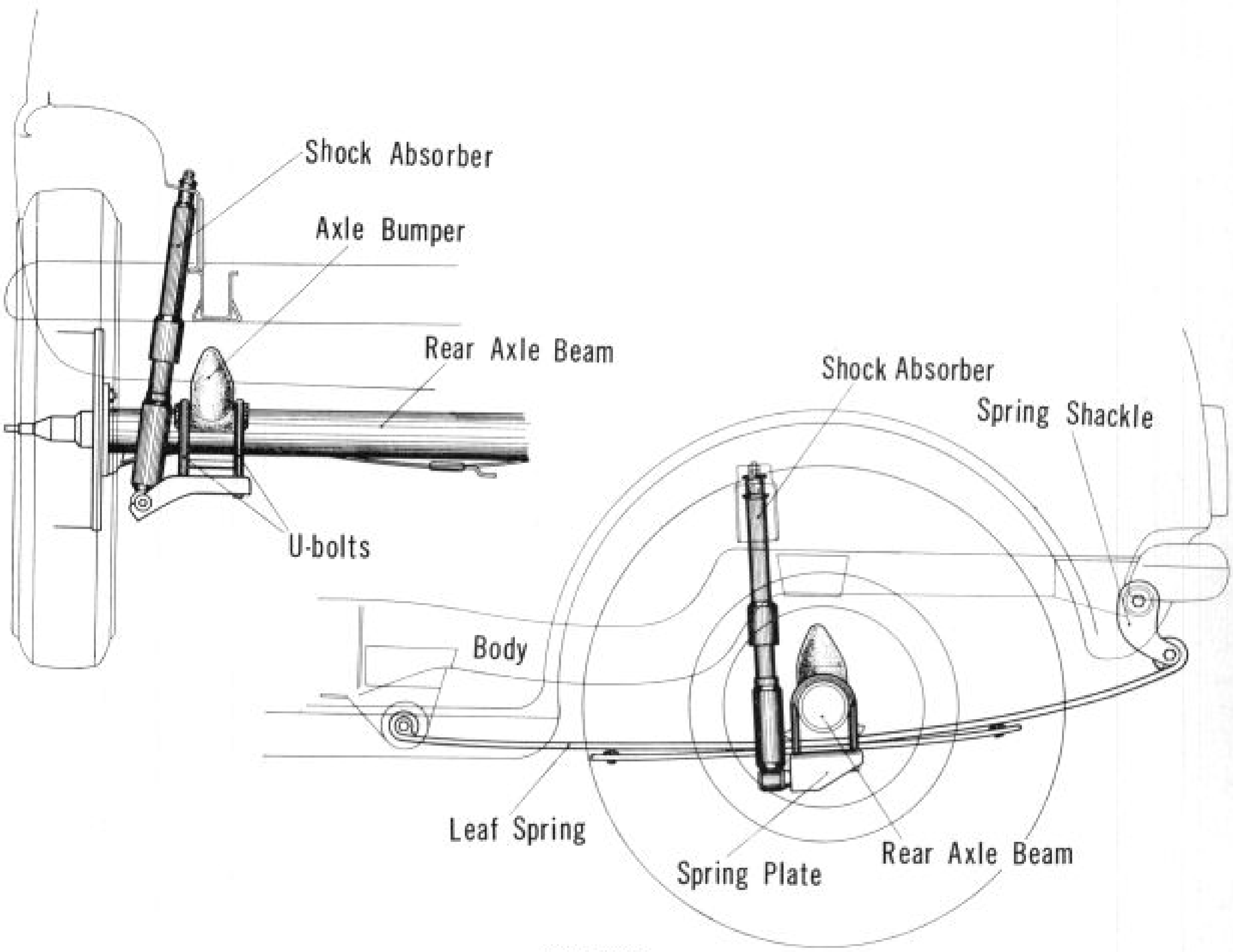


Fig. 13-1

Removal

1. Remove the wheel hub nuts. Jack up the vehicle and place supports under the rear cross member.
2. Remove the wheels. Disconnect the parking brake cable from the equalizer.

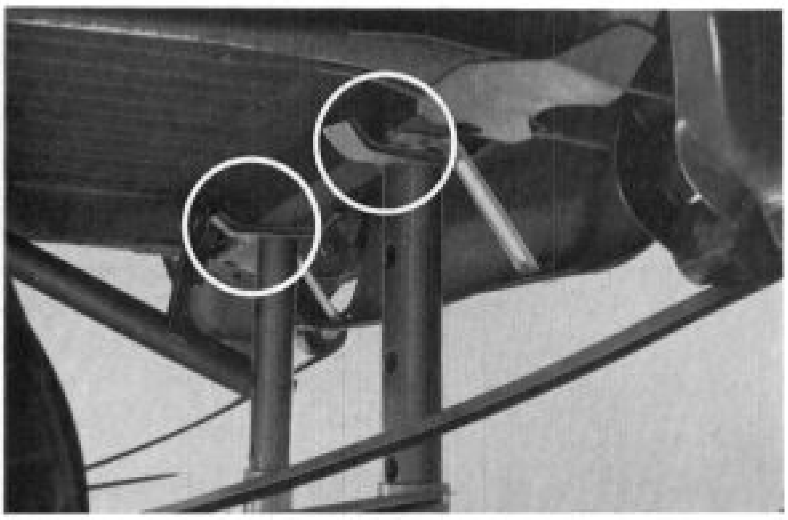


Fig. 13-2

3. Drain the brake fluid from the system. Separate the flexible brake hose from the brake line.

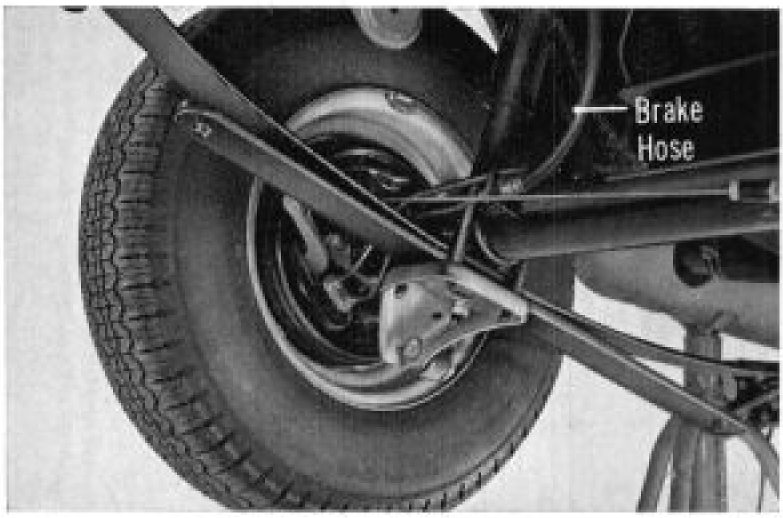


Fig. 13-3

4. Remove the shock absorber lower mounting nut, and separate the shock absorber from the spring plate.

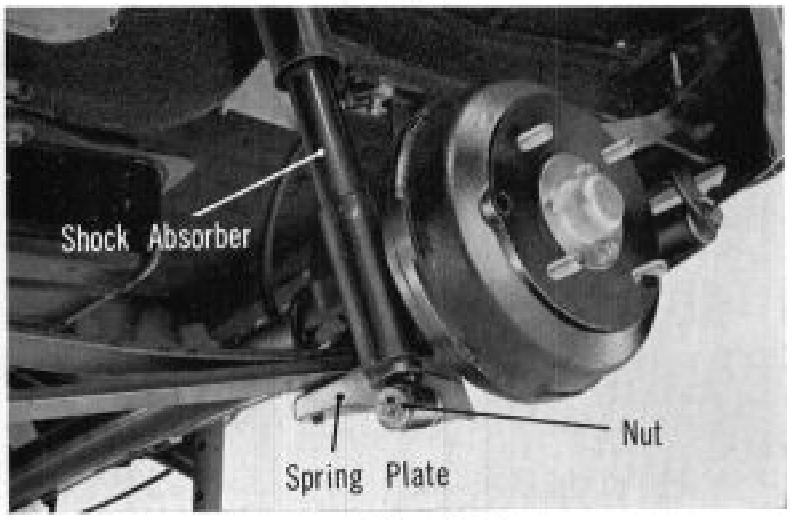


Fig. 13-4

5. Remove the shackle bolt on the body side.

   Tighting torque:
   4.0 to 4.8 kg-m (28.9 to 34.7 lb-ft)

Fig. 13-5

6. Remove the bolt, and separate the spring from the spring hanger. The axle shaft and leaf spring can then be removed as a unit.

   Tightening torque:
   4.0 to 4.8 kg-m (28.0 to 34.7 lb-ft)

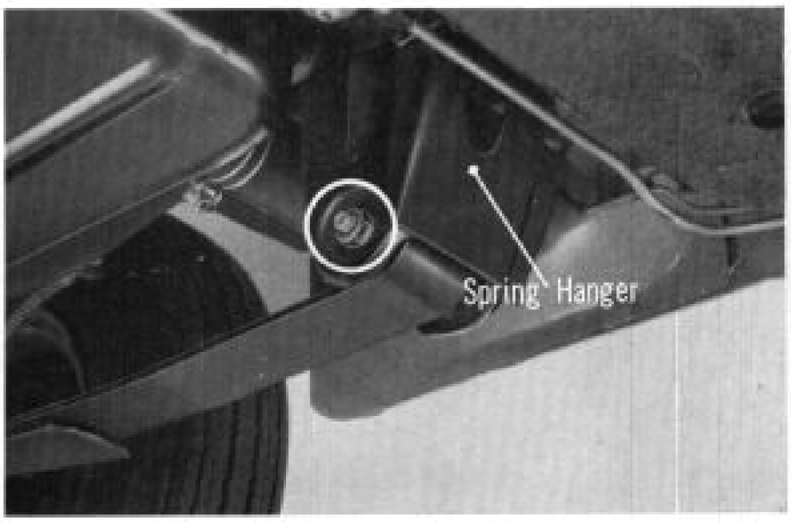


Fig. 13-6

7. The leaf spring can be separated from the axle shaft by removing leaf spring U-bolts.

   U-bolt tighting torque:
   4.0 to 4.8 kg-m (28.9 to 34.7 lb-ft)

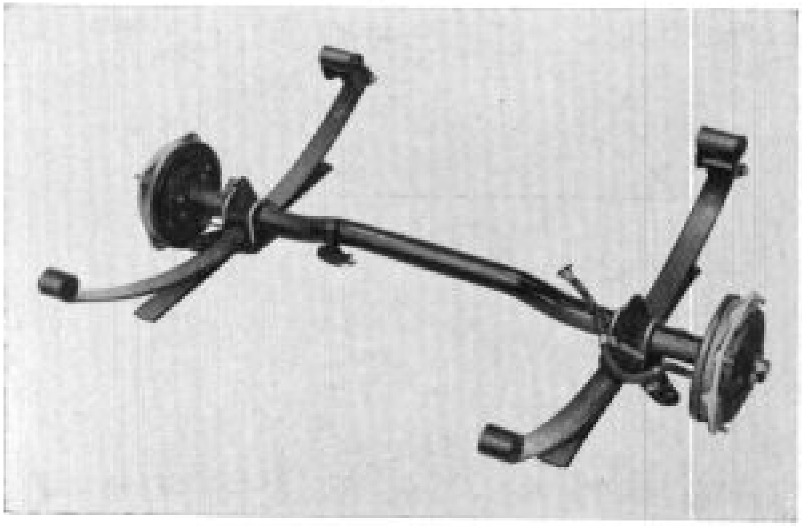


Fig. 13-7

8. When replacing the leaf spring with a new one, make sure that the marked side is positioned toward the front. Lead springs having the same mark should be installed on both sides in set.

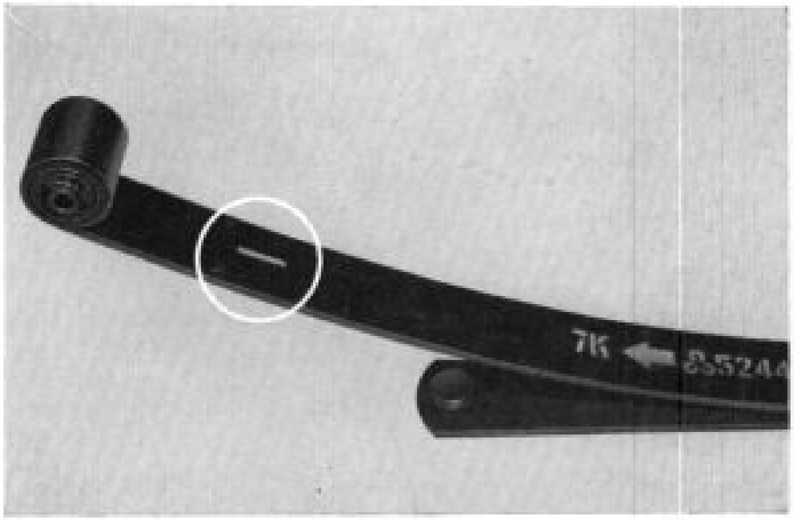


Fig. 13-8

9. The shock absorber is detached by removing the upper mount.
   Note the shock absorber is installed with the protect cover forward. (Fig. 12D-2)

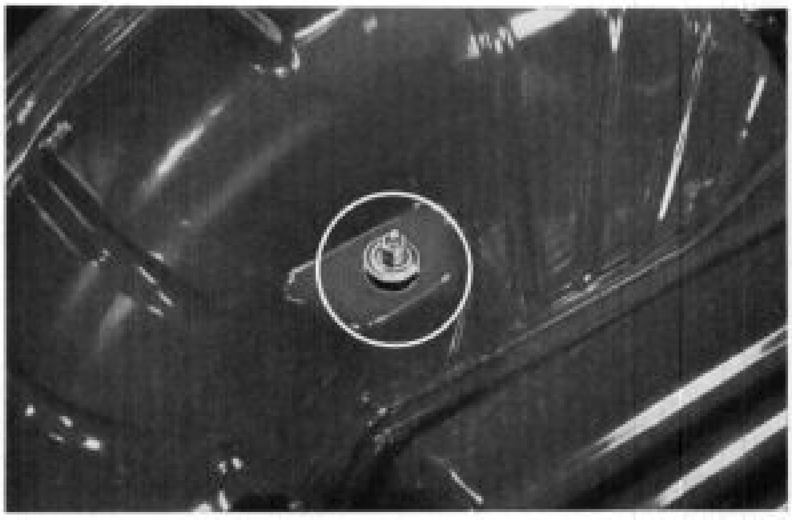


Fig. 13-9

Installation

Installation is the reverse of removal.

When frame height differs between the rear right and rear left, the cause is improper fastening of spring bolts. Loosen two spring bolts of the higher side and retighten them while another service man ride on the car at the higher side and tilt the car as shown in Fig. 13-10

Fig. 13-10

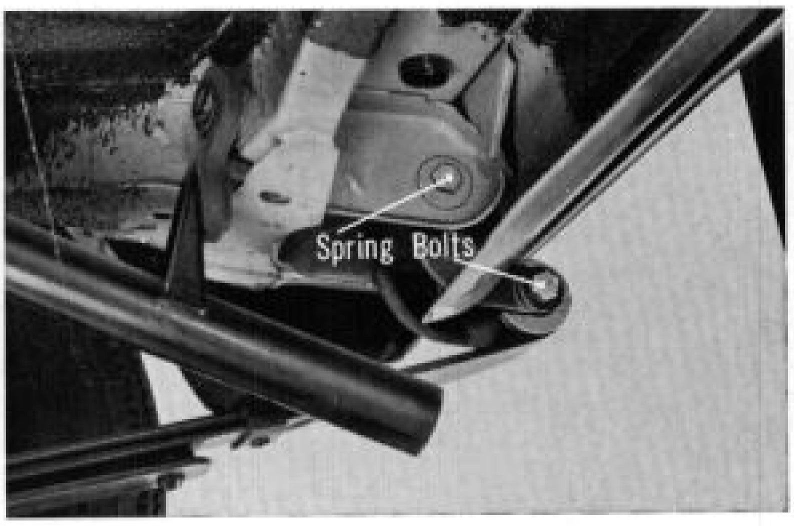


Fig. 13-11

(Rear Suspension Alignment Check)

Upon completion of the installation, check the rear suspension for misalignment or "dog tracking" of front and rear wheel tread. This test will be conducted at a partly wet paved place. Drive the car on a wet section to let the tires wet, and thereafter drive straight ahead and stop. The rear tire inprint should appear an equal distance slightly inside the front tire tracks.

SECTION 14

FUEL SYSTEM

A. Carburetor

a. Description

The carburetor in a gasoline engine has the following requirements.

1. Controls engine output by adjusting the amount of air fed into the engine.
2. Feeds a uniform fuel and air mixture to the engine.
3. Efficiently vaporizes the fuel to effectively feed it into the engine.

Attempts have been made to meet the above requirements through carburetor improvements. In addition, the recent trend toward higher engine output and wider speed ranges requires modification and improvement of the carburetor. Higher engine output requires a greater intake of air and the diameter of the carburetor must therefore be made larger. Consequently, conventional single barrel carburetors have the following disadvantages although they are efficient during high-speed operation.

1. Good economic operation is difficult to obtain when cruising.
2. Maintenance of engine power is lost during low-speed operation with the throttle wide open.

The two-stage double barreled carburetor has been developed to overcome these disadvantages. In this type of carburetor, the primary carburetor is used for low and medium speed operation and with light loads while the secondary carburetor is used for high-speed operation and with heavy loads. Most existing four wheel vehicles employ a double barreled carburetor.

However, this type of carburetor also has several disadvantages which can be attributed to its structural features. One of the most important of these is the unsmooth switching between the primary and secondary carburetors caused by the slow air speed when the secondary venturi tube is started as shown in Fig. 14A-1.

The CV carburetor used in the Honda engine has been developed to eliminate the disadvantages of the double barreled carburetor. This carburetor consists of one large diameter venturi tube (which corresponds to the secondary venturi) throttled with a vacuum piston as shown in Fig. 14A-3 so that it can operate as the primary venturi. As the negative intake pressure of the engine increases, the vacuum piston automatically rises to maintain the amount of intake air the same. At maximum output, the vacuum piston moves fully up and the secondary venturi is completely actuated. Consequently, when the secondary ventri begins to move it acts as a ventri whose area is continously variable. Under this condition, the air flow speed does not drop even when the secondary venturi begins to operate as shown in Fig. 14A-2 thus eliminate the major shortcoming of conventional double barreled carburetors.

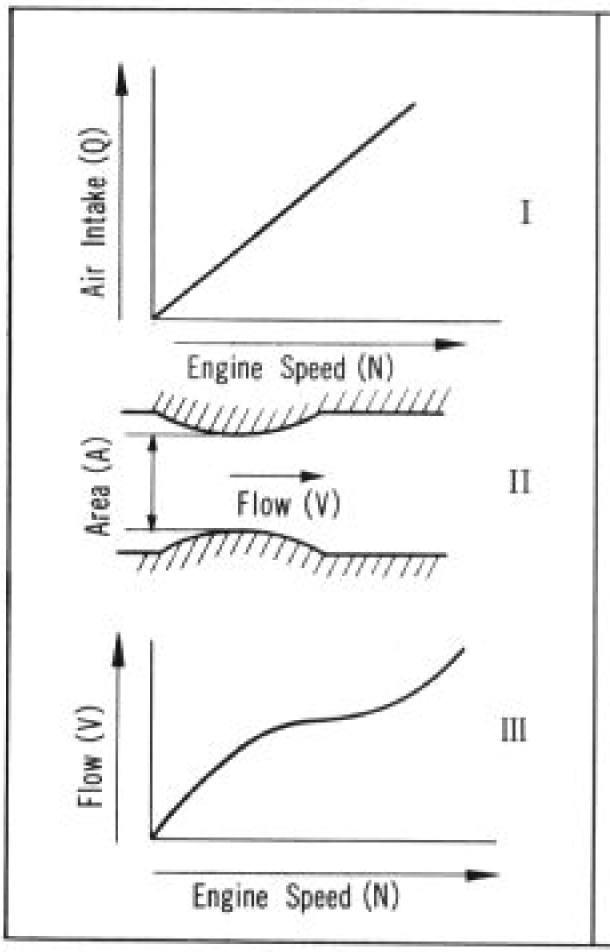


Fig. 14A-1

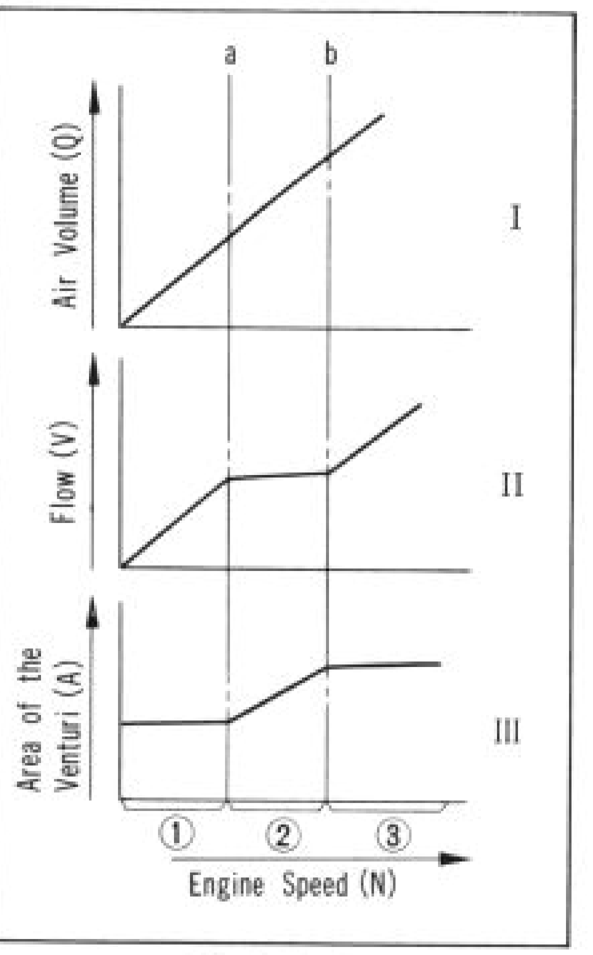


Fig. 14A-2

Theory of Operation

No matter what type of carburetor is used, the amount of air (Q) fed to the engine must increase proportionally with engine speed (N) as shown in **Fig. 14A-2** in order to satisfy engine performance.
If the air speed in the venturi is assumed to be V as shown in **Fig. 14A-1** or the volume fed into the engine (Q) is $Q=A \times V$.

Since venturi area A of conventional fixed venturi carburetors remains constant, flow V increases in proportion to engine speed N but is retarded at about the midpoint of the curve as shown in **Fig. 14A-1** III.
In respect ot the venturi area, the flow and air velocity of the CV carburetor in the range marked ① in **Fig. 14A-2** or before the vacuum piston starts to function remains at the bottom and acts as a primary venturi, venturi area A remains constant as in the case of a fixed venturi. Air velocity V increases in proportion to engine speed N and so does the air volume. On the other hand, the vacuum pistons starts operating in the range of ② and venturi area A increases in proportion to engine speed N, while a velocity V remains unchanged, but the result is again an increase of air volume Q in proportion to the engine speed N.
At the final stage of the vacuum piston stroke, ③ in the figure, where it is completely opened, it becomes a secondary venturi, the area equals that of the fixed venturi carburetor resulting in air velocity V againe increasing to a volume proportional to the engine speed N as in the case of ①.
Fir volume Q therefore increases with the speed but is independent of the area of the venturi as shown in **Fig. 14A-2.**

Air System (Fig. 14A-3)

Air is fed to the engine through the venturi and throttle valve. The vacuum piston is pressed toward the venturi by a spring in the direction which reduces the venturi area. When the air volume fed to the engine is small, the vacuum piston moves to its lowest position, becomes a primary venturi, and maintains the air flow in the venturi constant. As the air flow and venturi negative pressure increase, the negative pressure applied to the top surface of the diaphragm above the vacuum piston automatically increases the venturi area to maintain the required air volume.

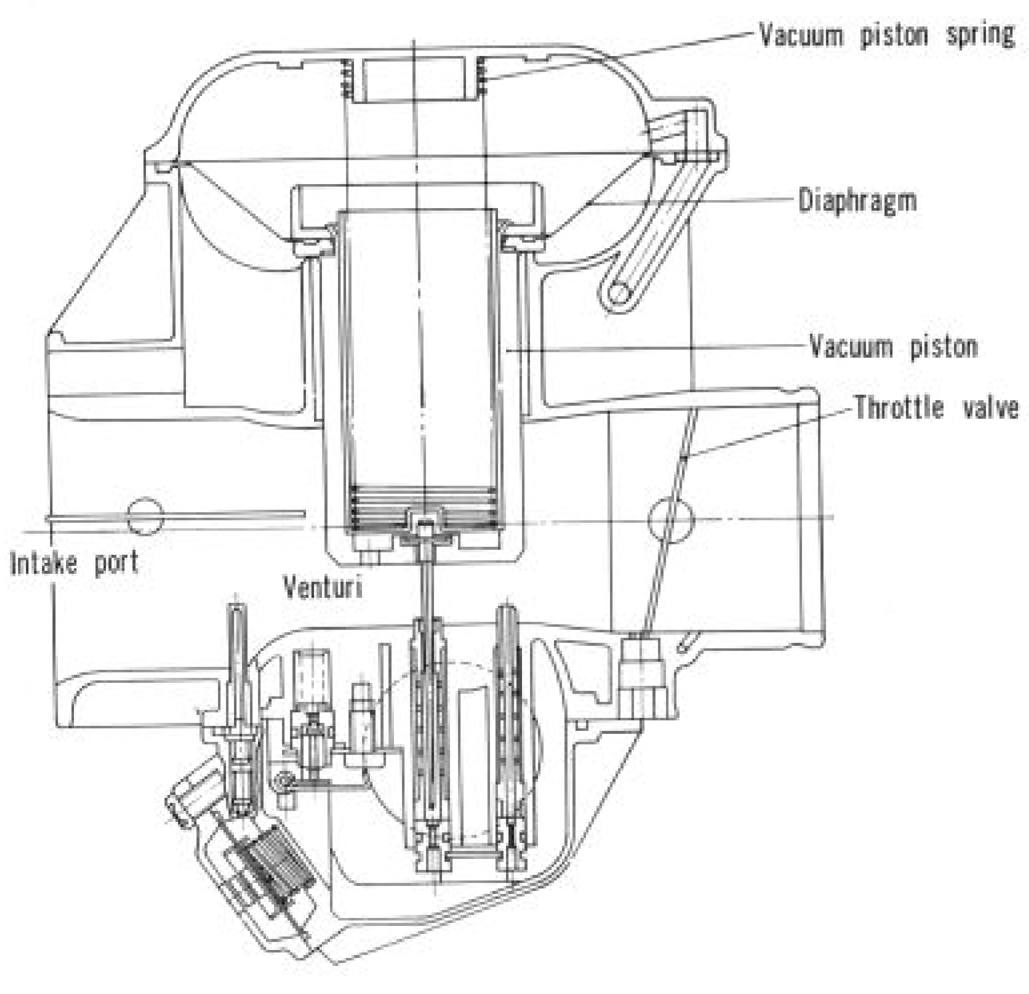


Fig. 14A-3

Float System (Fig. 14A-4)

Fuel from the fuel tank passes through path, valve seat, float valve, and enters float chamber. Strainer above the valve seat filters foreign matter from the fuel. The float is raised as fuel is stopped when the float valve blocks the seat. As the fuel in the float chamber decreases, the float lowers with the drip in the fuel level and the float valve moves from the valve seat thus allowing fuel to enter the float chamber. This closing and opening action of the valve is alternately repeated o maintain the fuel in the float chamber at a constant level.

The float valve has a spring between itself and the lip. This speing serves to stablize the fuel level even under abnormal vibrations produced during vehicle operation on rough road surfaces and to prevent valve wear due to the friction between the valve and seat.

Idle System (Fig. 14A-4)

During idling, the throttle valve is held nearly closed by a stop screw. The volume of fuel is subjected to a coarse regulation by the primary main jet, fine adjustment by the slow jet, and then mixed with the air supplied from the idle air passage, before being ejected through the pilot outlet connected from the solenoid valve. The adjustment of the fuel and air mixture is performed by the pilot screw, which, is turned to the right (clockwise) to reduce the air and to the left to increase it. The idling speed is adjusted with the throttle stop screw.

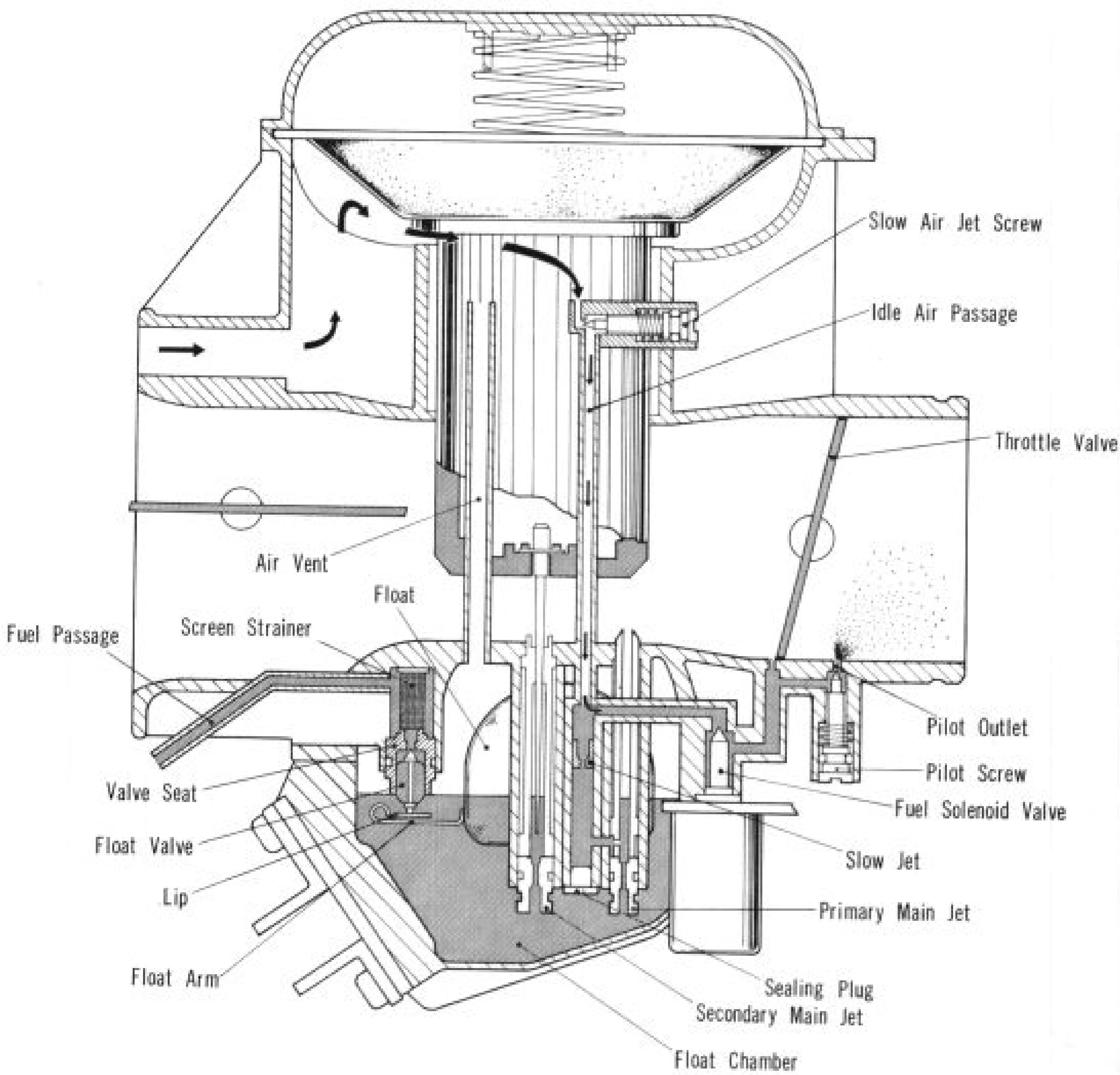


Fig. 14A-4

The slow air jet of 360 and 400 vehicles is fixed and cannot be adjustable. The slow air jet of 600 vehicles can be adjusted by means of a screw. However, adjustment is not normally necessary since it is already factory adjusted. The adjustment diameter of the orifice is 1.2mm.
This is at a position 1-½ backed off from the complete close position of the screw. It is advisable to use a gas density meter for this adjustment to permit as little gas as possible to keep the atmosphere clean.

Off-idle System (Fig. 14A-5)

Since the throttle valve is somewhat open in this state, the fuel will be chiefly exhausted from the orifice discharge port. The orifice discharge port continues to discharge the fuel until the speed of the air ejected from the primary main jet reaches the required value at the venturi. The fuel injected by the primary main jet nozzle when the throttle valve opens does not stop at the orifice idle discharge port but only decreases to a volume proportional to the speed of the engine.

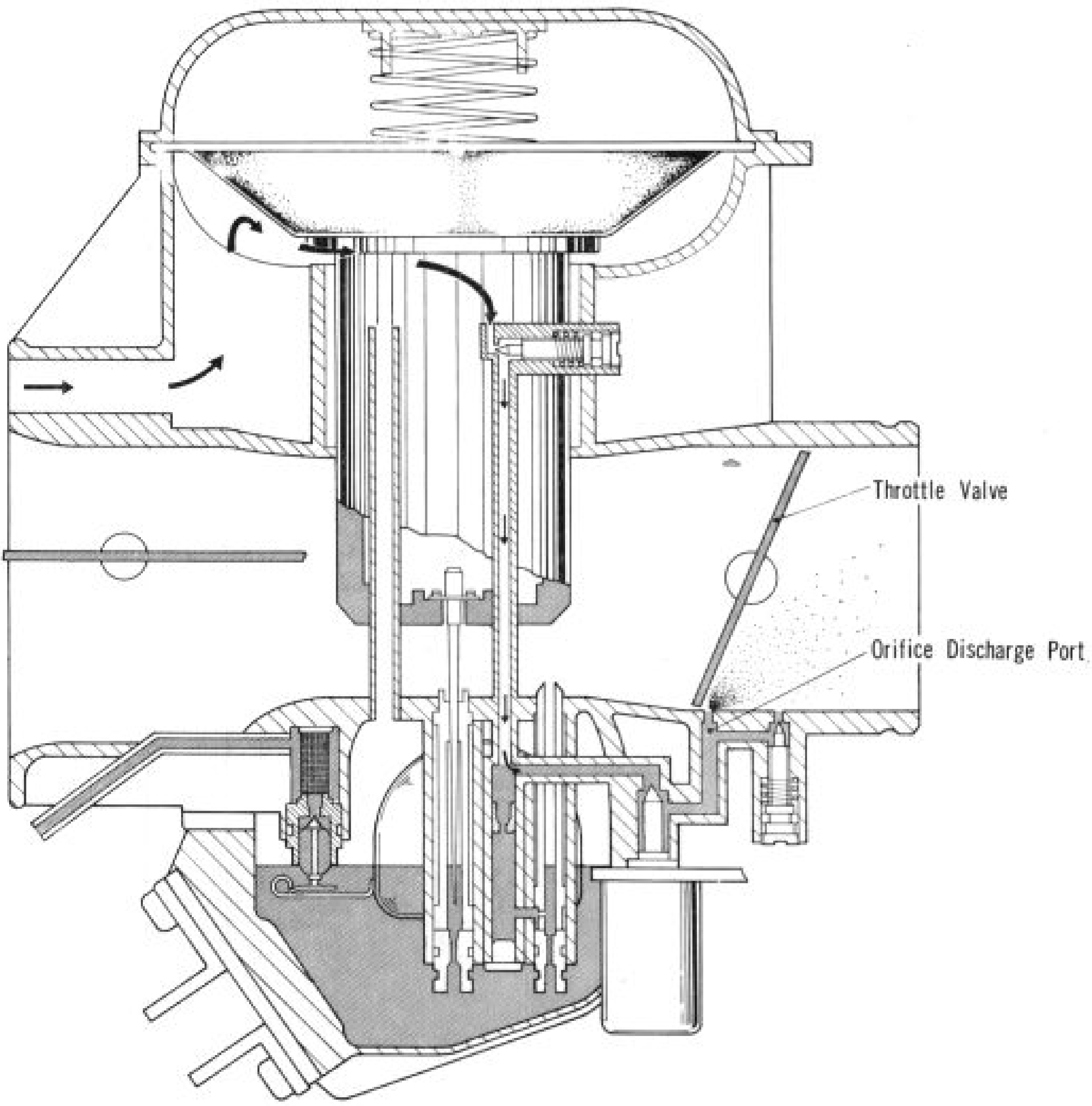


Fig. 14A-5

Medium Speed System (Fig. 14A-6)

The throttle valve aperture is further increased, but not to the extent that the vacuum piston starts. The fuel is regulated by the primary main jet, mixed with air by the primary main air jet, and ejected through the primary main jet nozzle.

Therefore, the adjustment of the air mixture requires replacement of the primary main jet for the different sizes of the orifice. For details of this adjustment refer to the next stage of operation since the secondary main jet nozzle also participates in injection of the fuel in unison with this jet and hence they affect each other.

High-speed System (Fig. 14A-7)

The aperture of the throttle valve becomes still wider and the vacuum piston starts moving up with the carburetor functioning as a variable venturi.

The flow of air in the venturi increases, the vacuum piston chamber is set pu in a negative pressure condition, the piston stroke advances upward as it overcomes the force of the spring, and the jet needle move up.

The fuel regulated by the secondary main jet, is then mixed with the air supplied from the air bleeder and is blown out of the secondary main jet nozzle. The jet needle keeps rising as the air flow increases, increasing the injection of the fuel.

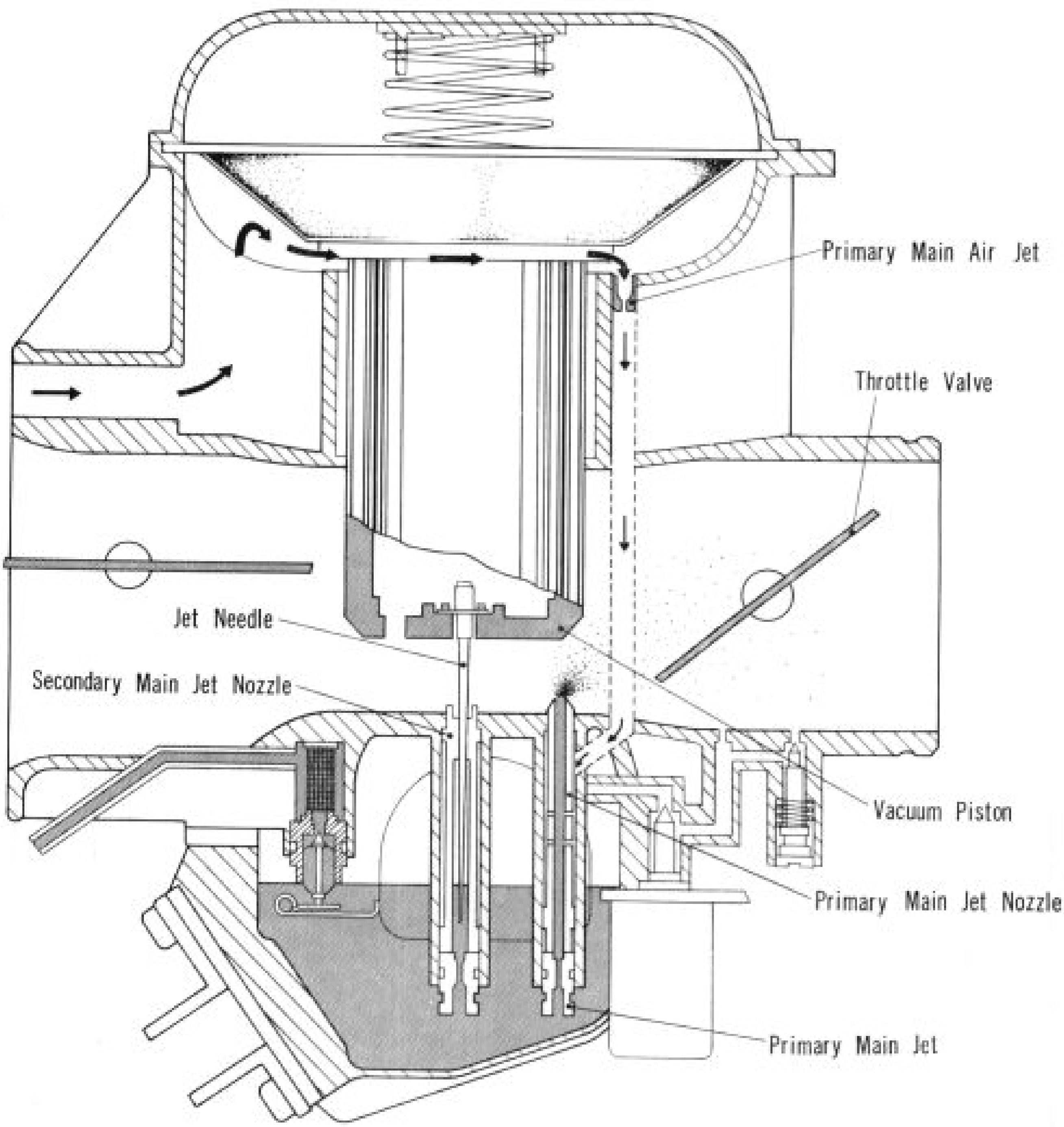


Fig. 14A-6

Acceleration System (Fig. 14A-8)

This is provided to maintain the required rate of fuel mixture or even to make it thicker for greater power when the accelerator pedal is depressed suddenly from low speed operation.
Its operating sequence is such that when the acceleration pedal is depressed, the pump rod strokes to press down the diaphragm which forwards the fuel from the pump chamber to be ejected through the pump nozzle. As the accelerator pedal is released, the rod returns, the diaphragm is returned by the force of the spring to return the fuel to the pump chamber from the float chamber. The pump chamber has check valves at the inlet and outlet.

Starting System (Fig. 14A-9)

The necessity of supplying a thicker fuel mixture to the engine at the start of vehicle operation in extremely cold weather is met by the use of the fast idle mechanism and choke button at the front of the drivers seat which is pulled out to actuate the throttle lever through the choke link cam which then sets the throttle valve to the predetermined aperture.
The choke valve closes at the same time to reduce the air intake. (Cont'd)

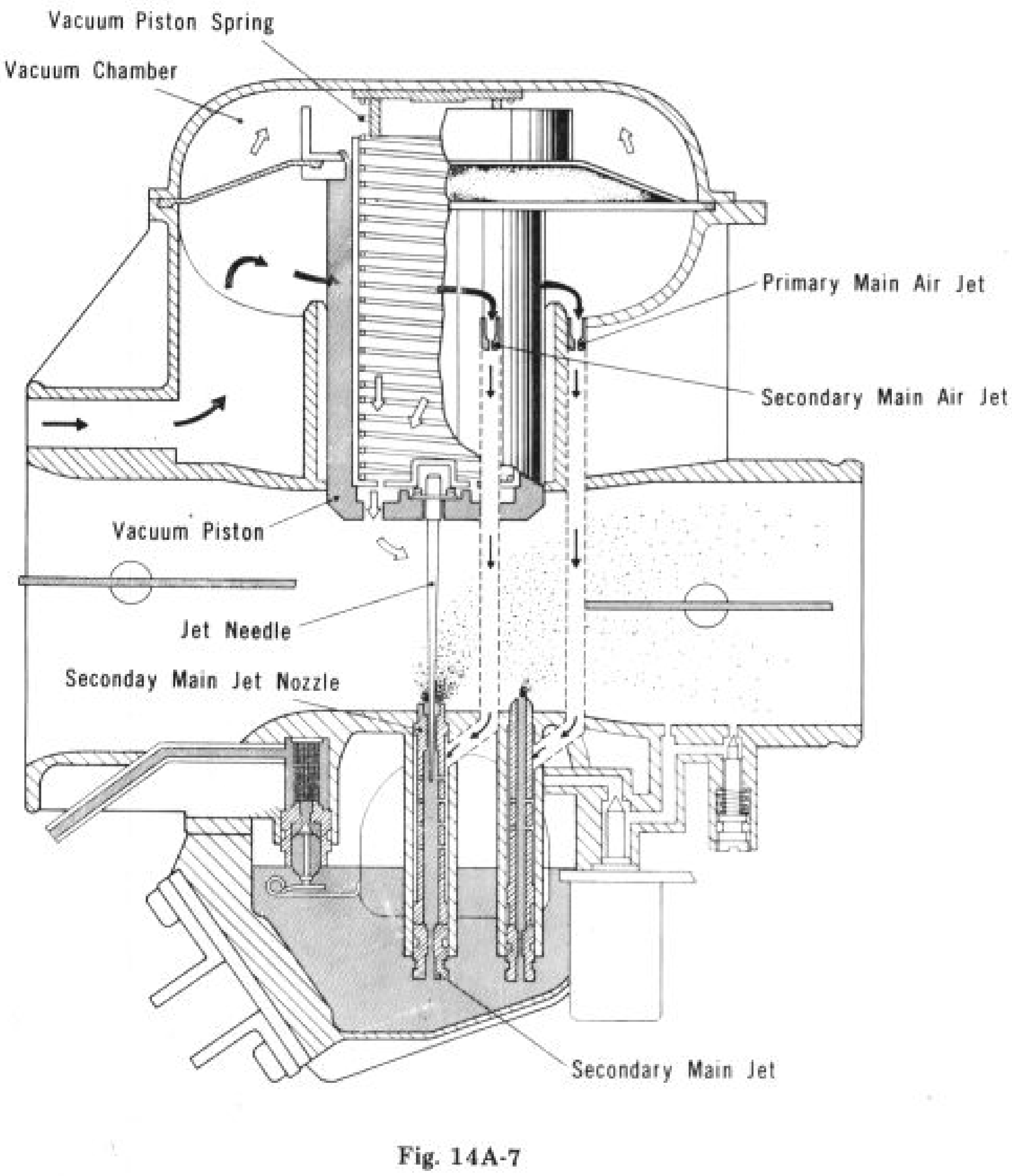


Fig. 14A-7

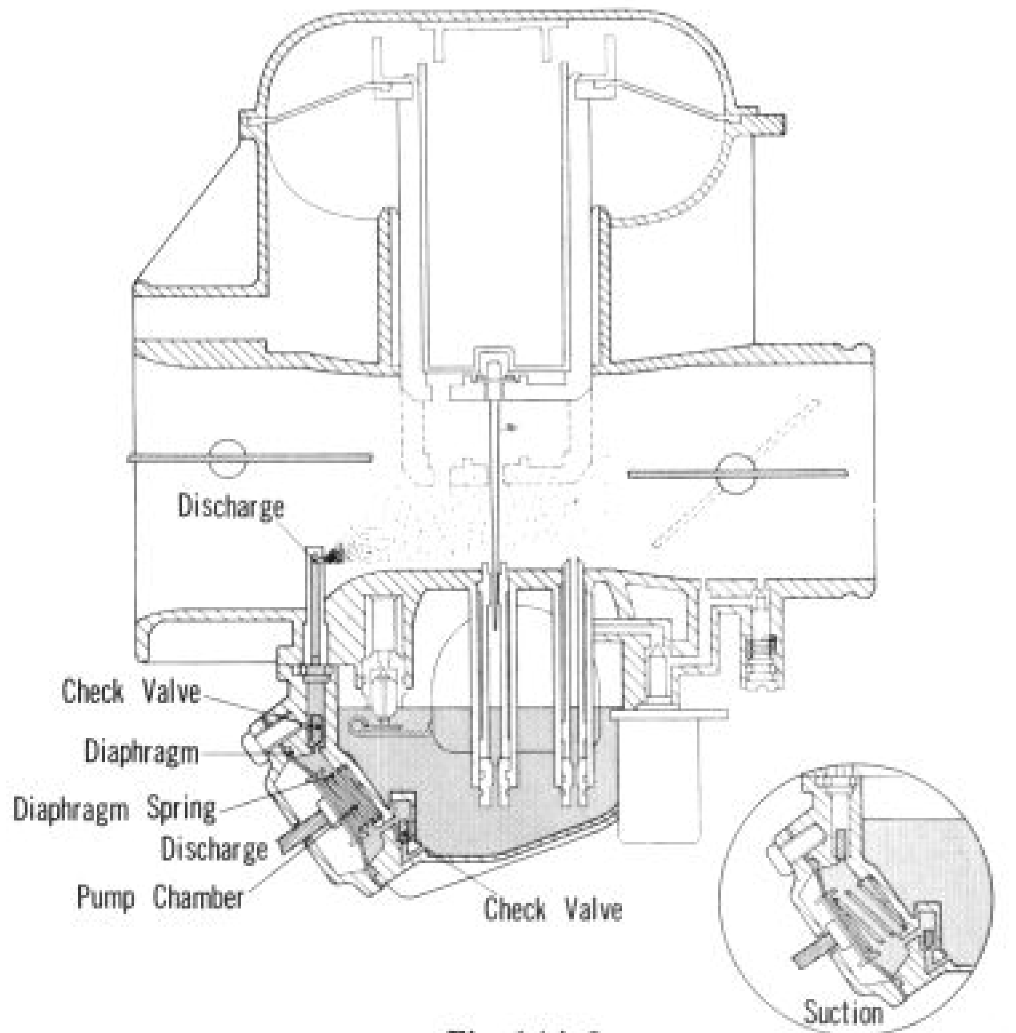


Fig. 14A-8

Reduction of the air supply increases the negative pressure in the main bore and causes an outlet of fuel from the needle jet, orifice discharge port, and pilot outlet, and also causes the choke valve to open to the extent determined by the suction negative pressure in order to adjust the air to the amount required for an optimum fuel mixture for starting. Resetting the choke button recovers the normal idling condition with the choke valve opening and throttle valve returning to the idling position.

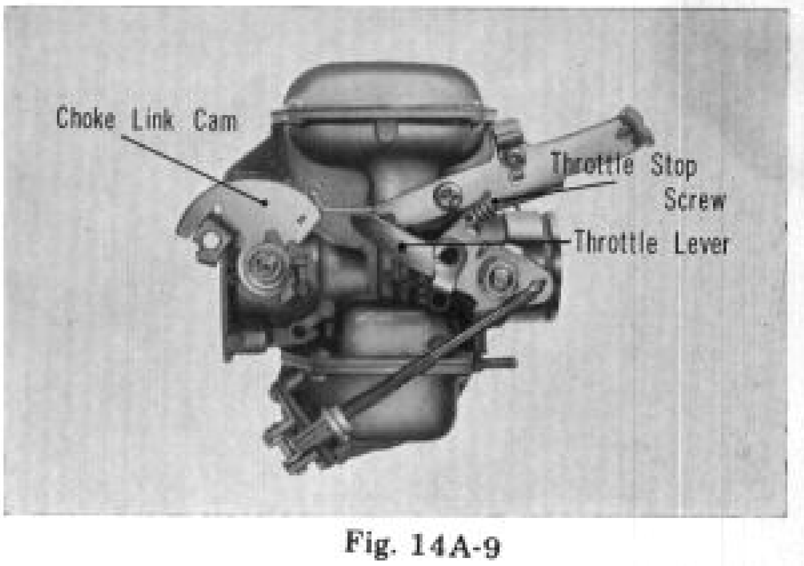


Fig. 14A-9

Setting Mark

Setting marks are printed on the body of the carburetor for identification of the carburetor settings. (Fig. 14A-10)
The 360 vehicles have an improved setting system, effected with NE.
The mark "N4A" is printed on the 400 vehicle, "N6B" "N6C" or "N6D" on the 600 vehicles, and thereafter, requiring confirmation of the marks during disassembly.

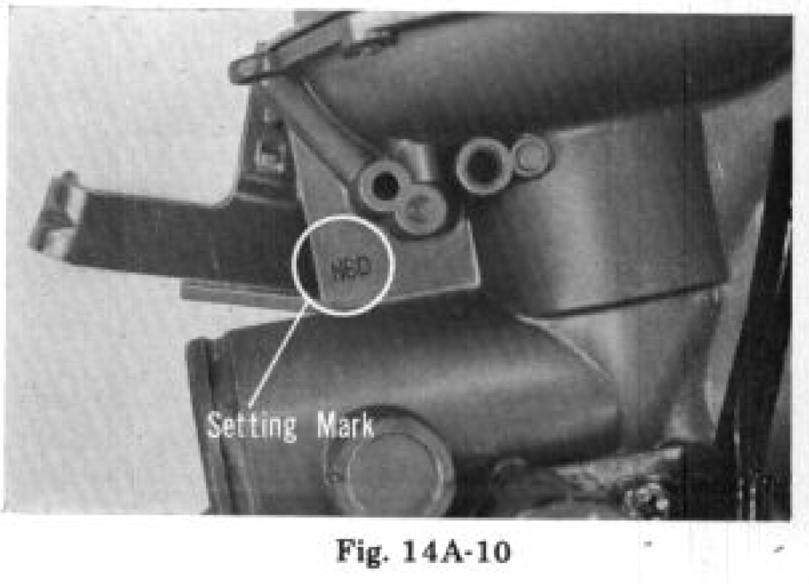


Fig. 14A-10

TABLE OF CARBURETOR SETTING MARK

Model	Setting Mark	Advance	Main Jet		Air Jet		Jet Needle	Slow Jet (No.)	Slow Air Jet (No.)	Pilot Screw	Valve Seat Diameter (ϕ)	Float Level (mm)	Fast idle Dimension (mm)	Accelerator Pump		Remarks
			Secondary (No.)	Primary (No.)	Secondary (No.)	Primary (No.)								Volumn /Stroke (cc)	Stroke (mm)	
360	NE	Performance improvement	145	80	90	50	223302	35	90	3/4	1.4	17	0~0.5	0.25±0.05	2.4±0.5	See Note 1
	NF	Feeling performance improved	145	80	90	50	223302	35	80	5/8	1.4	17	0~0.5	0.20±0.05	2.4±0.5	See Note 1
	NH	Corrosion proofing for vacuum piston	135	82	90	50	223303	35	80	5/8	1.4	17	0~0.5	0.20±0.05	1.6±0.5	See Note 1
	NI	Feeling performance improved	135	82	90	50	223303	35	80	5/8	1.4	17	0~0.5	0.20±0.05	2.3±0.5	See Note 2
	NJ	Overall performance improved	135	82	90	50	223303	35	100	5/8	1.4	17	0~0.5	0.20±0.05	2.3±0.5	See Note 3
			145	82	130	90	304304	Primary 45 Secondary 100	Rimary 90 Secondary 100	1-3/8	1.4	20.5		0.15±0.05		Idle limitter jet 75 Note 4
400	N4A		135	82	90	50	223307	35	100	5/8	1.4	23.5	0~0.5	0.20±0.05	1.6±0.5	
600	N6B	Entering mass production stage	150	85	70	70	234301	35	Identical to 120	1-1/4	1.8	16	0.5~1.0	0.20±0.05	1.6±0.5	
	N6C	Overall performance improved	140	88	50	50	234002	35	Identical to 120	1-1/4	1.8	16	0.5~1.0	0.35±0.05	2.8±0.5	
	N6D	Acceleration performance improved	140	88	50	50	234003	35	Identical to 120	1-1/4	1.8	16	0.5~1.0	0.20±0.05	1.6±0.5	
	N6D1	Overall performance improved	140	88	50	50	〃	35	Identical to 120	2-1/8	1.8	22	0.5~1.0	0.20±0.05	2.3±0.5	
	N6D2		〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
	6NM		135	92	90	50		6	130	1-1/4		23.5		0.30	2.3±0.5	

Note:
1. Misposition of the jet needle (Model 360 NE~NH) can be corrected by replacing the jet needle retainer of the one used in NI or NJ.
2. The float chamber is not interchangeable with type NH or ealier vehicle.
3. Type NJ carburetor is only for vehicles A360.

b. Maintenance

Disassembly

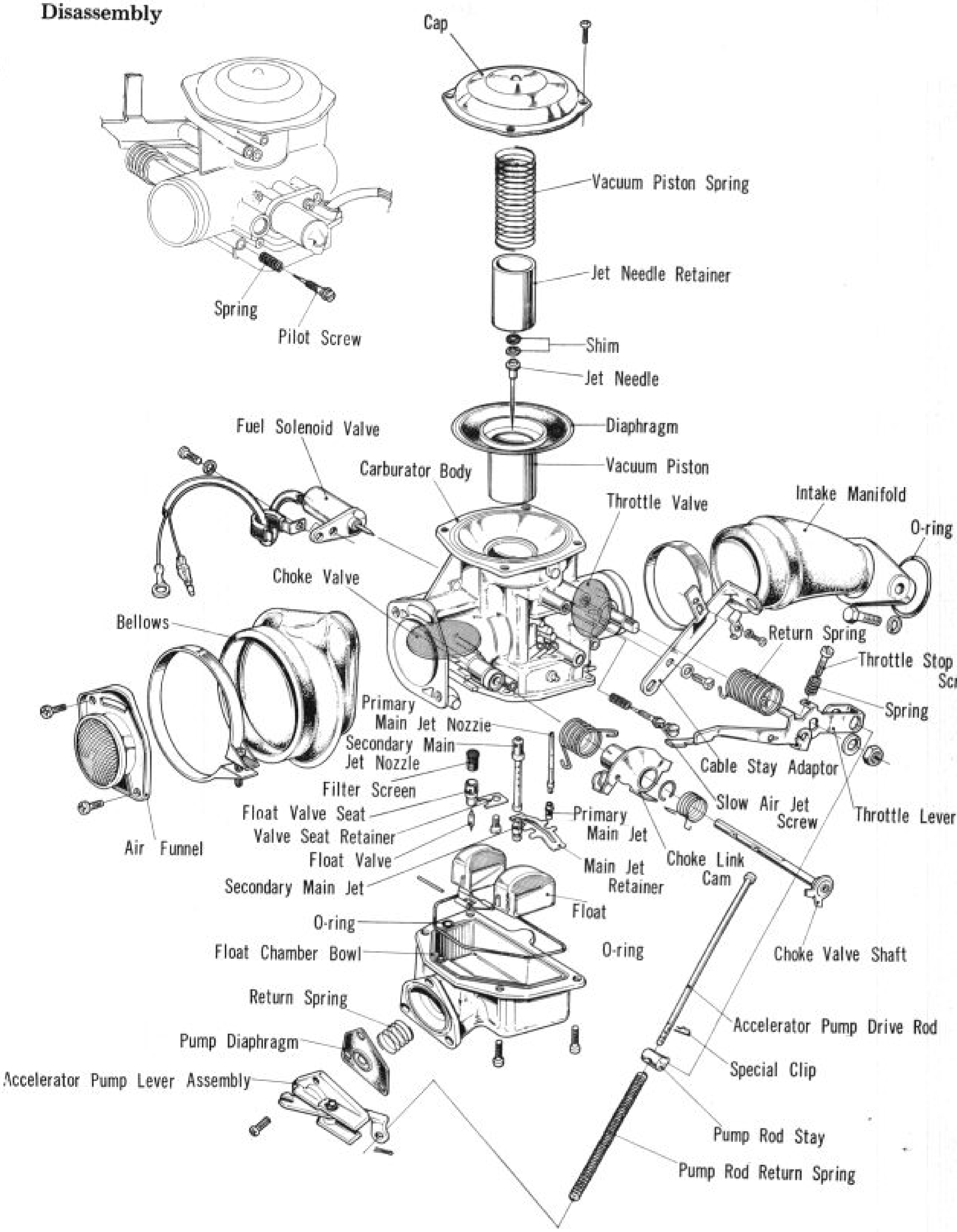


Fig. 14A-11 Disassembled View, N6D Carburetor

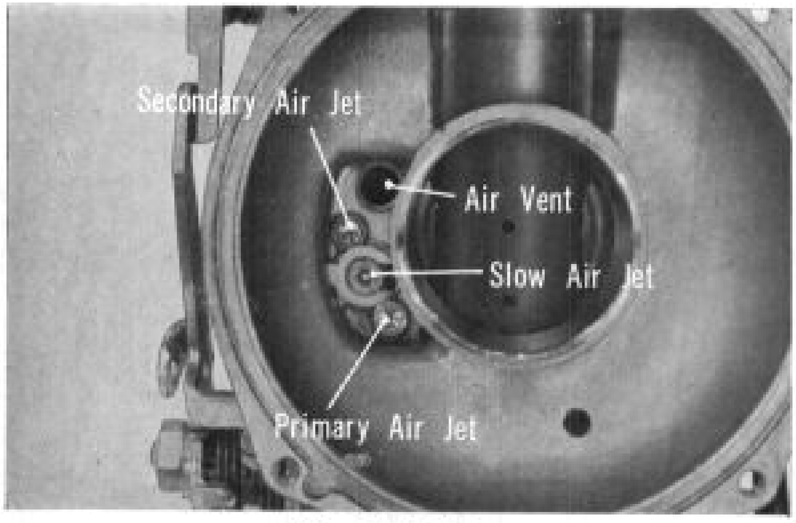


Fig. 14A-12

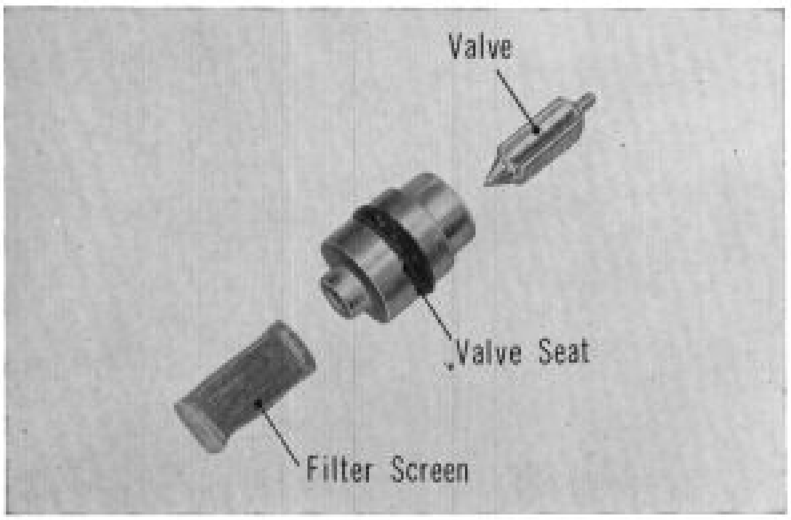


Fig. 14A-13

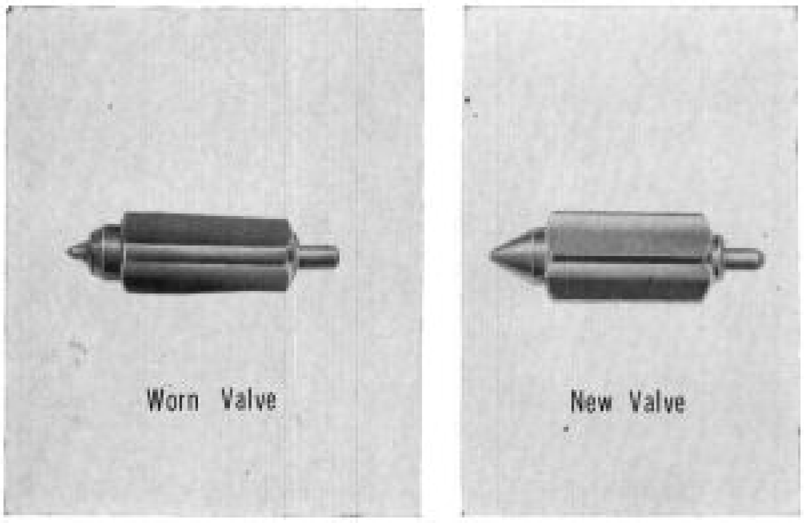


Fig. 14A-14

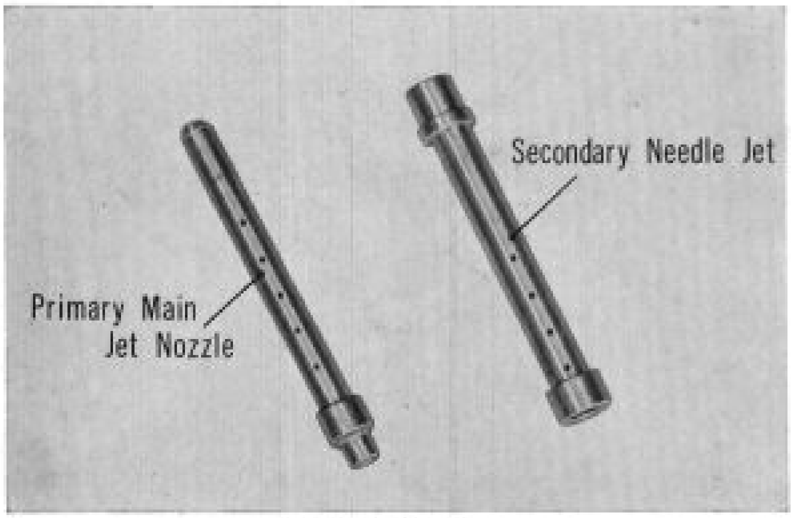


Fig. 14A-15

Perform disassembly as illustrated in **Fig. 14A-11.**

Note:

1. Avoid disassembling the throttle valve and choke valve, since they are assembled by the factory for utmost precision.
2. The primary and secondary main air jets are force fitted and cannot be disassembled, except for the slow air jet which is held by screws. (Fig. 14A-12)
3. The check valve collar of the accelerator pump is made of resin, and should not be disassembled.

Inspection

1. Wash the valve, valve seat, and the filter screen in clean gasolin.
2. Inspect the float valve for wear of the seat contact area.
3. Inspect the O-ring for cuts, damages and folds; replace if defective.
4. Clean out the primary main jet nozzle, secondary needle jet, and the various fuel and air passages by applying compressed air.

5. Clean the primary and secondary main jets and the slow air jet.
   Also inspect the main jet O-ring for damage.

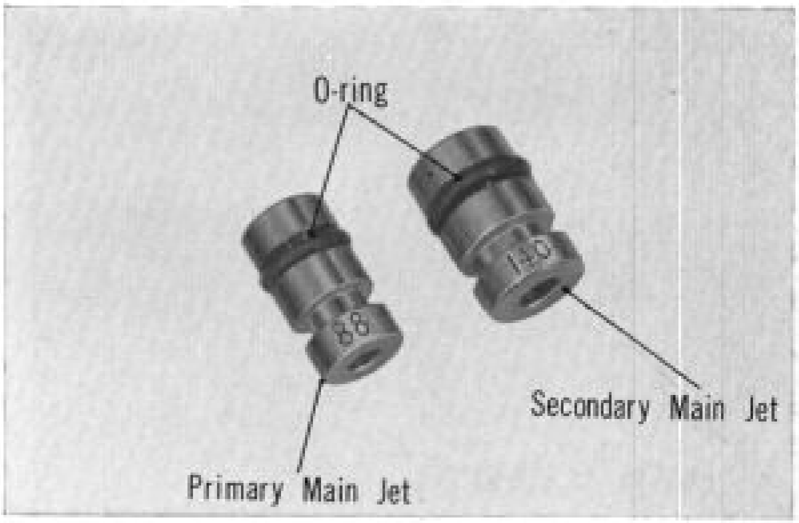


Fig. 14A-16

6. Clean the interior of the accelerator pump and inspect the diaphragm, spring and check valve.

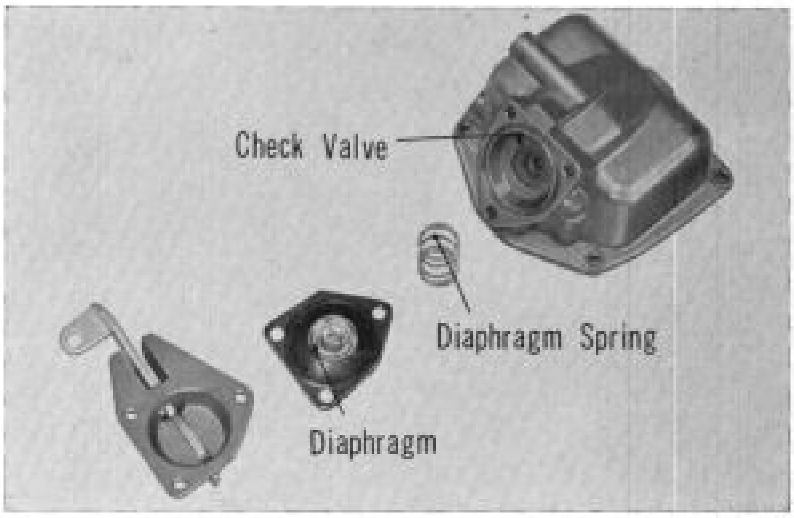


Fig. 14A-17

Assembly and Adjustment

Perform reassembly in the reverse order of disassembly. Note the following items.

1. Note the bend in the valve seat retainer spring. Make sure that it is not installed in reverse. The curved side of the valve retainer spring is installed against the float chamber bowl.

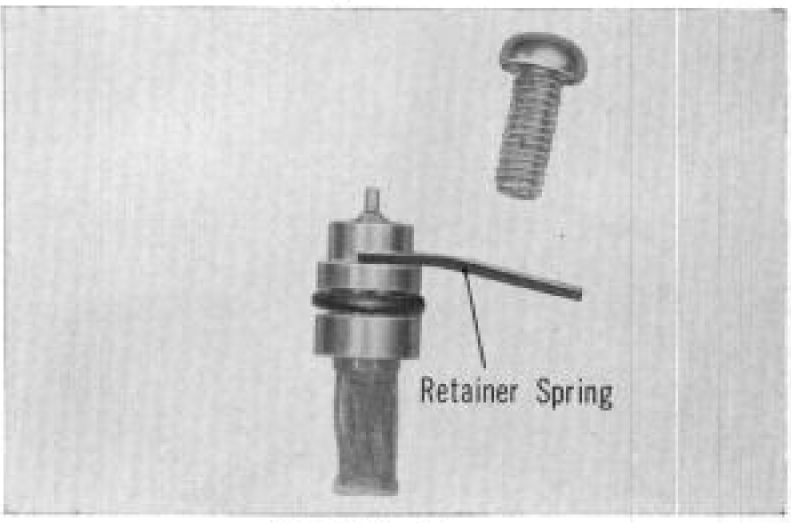


Fig. 14A- 18

2. Inspect the float level and adjust if necessary. Set the carburetor on its end as shown in the fugure and with the finger lightly move the float back and forth and locate the point where the tip of the float valve is just barely touching or there exists a clearance of 0.1mm between the tip of the float valve and the float arm. In this condition measure the distance "h". There is a spring incorporated in the end of the float valve which will permit the end of the float valve to submerge into the valve and will result in improper measurement; therefore, exercise care in determining the point of contact between the float valve and the float arm.
   "h" 360 . . . . 16.0 to 18.0mm (0.63 to 0.70 in.)
   "h" 400 . . . . 22.5 to 24.5mm (0.93 to 0.96 in.)
   "h" 600 . . . . 15.0 to 17.0mm (0.59 to 0.67 in.)

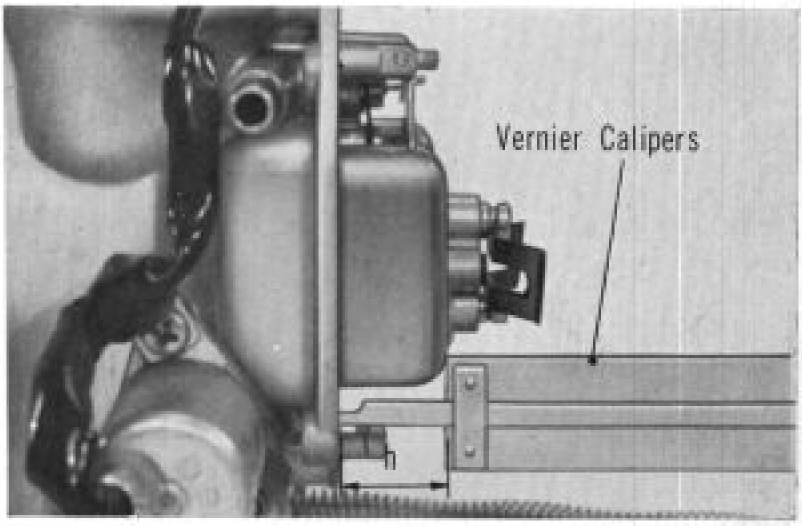


Fig. 14A-19

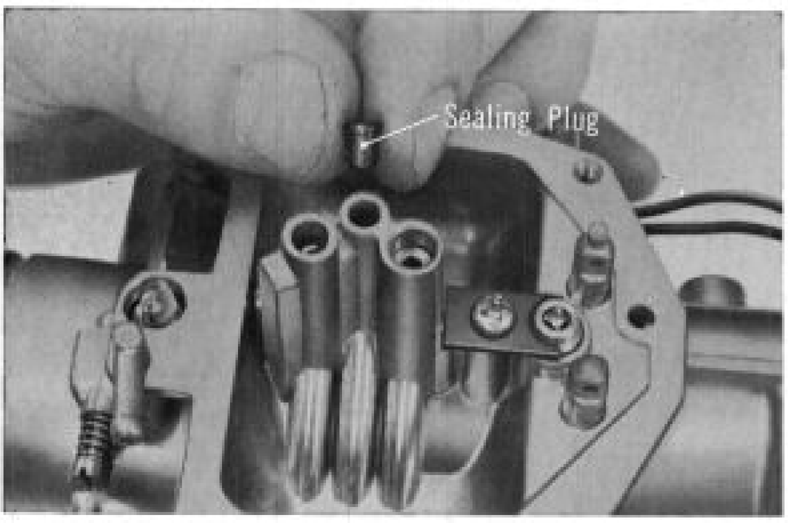


Fig. 14A-20

3. Do not forget the slow jet sealing plug which must be installed securely to prevent loosening.

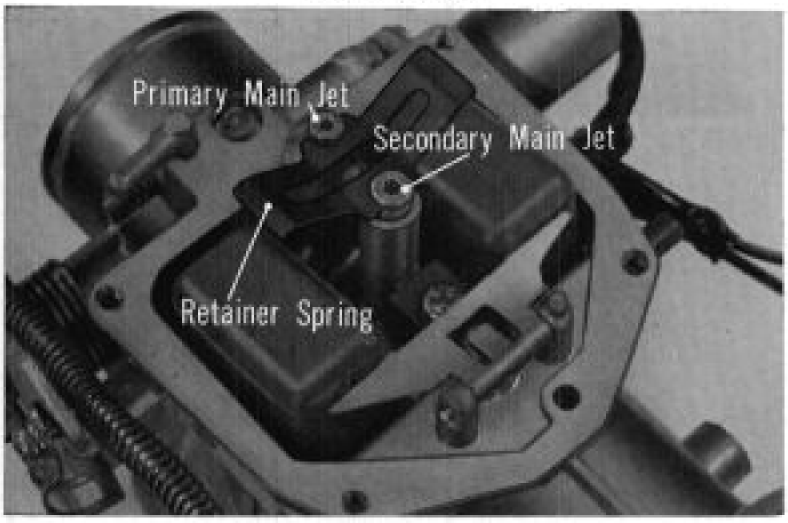


Fig. 14A-21

4. Notice the direction of the retainer spring.
   The tips of the retainer spring is installed against the float chamber bowl as shown in Fig. 14A-21.

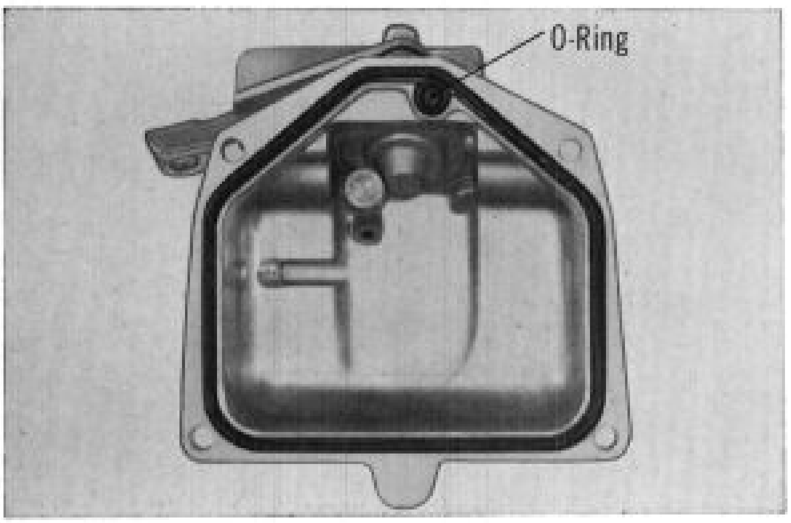


Fig. 14A-22

5. When assemblling the float chamber bowl, the installation of the O-ring must not be forgotten at the accelerator pump passage outlet.

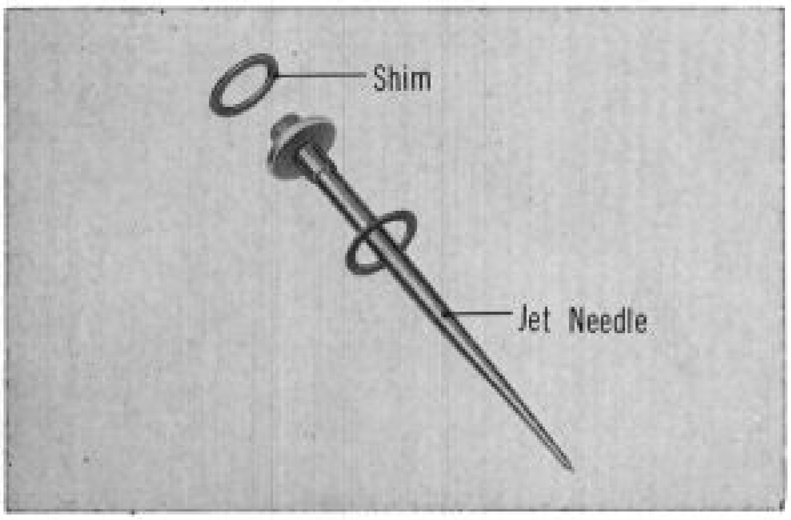


Fig. 14A-23

6. There are two adjusting shims (0.4mm thickness x 2) provided at the top and bottom of the jet needle upper flange.
   When it is necessary to raise gas density in a cold district or on a high land, attach two shims to the bottom of the jet needle upper flange.

7. After installing the jet needle on the vacuum piston, install the jet needle retainer into the piston and fix in place with the vacuum piston spring.

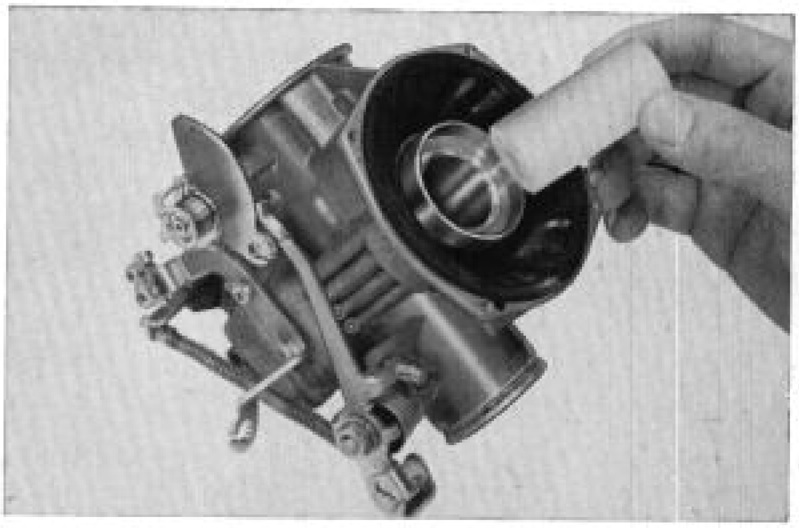


Fig. 14A-24

8. There is a small protruding section on the outside perimeter of the cacuum piston upper diaphragm which is used to determine the position of the vacuum piston. By aligning this protruding section onto the groove in the body, the position of the vacuum piston will be set.

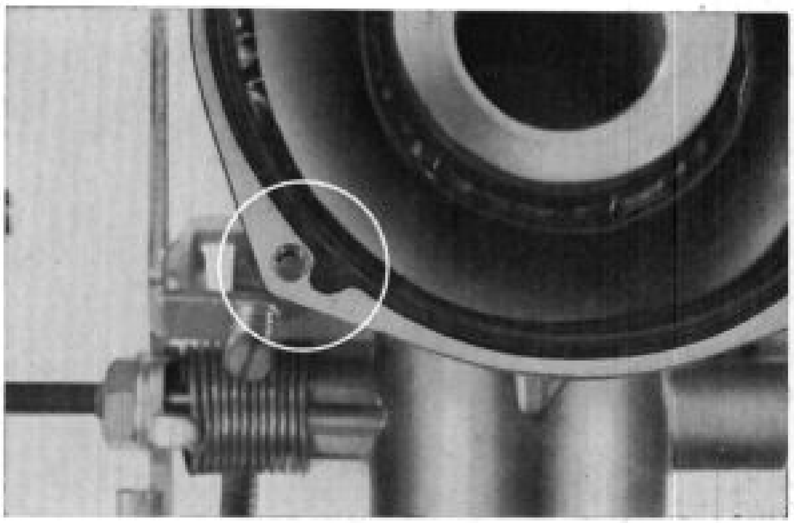


Fig. 14A-25

9. Inspect the operation of the vacuum piston. Install the carburetor cap without assembling the vacuum piston spring and then gently tilt the carburetor. If the piston slides by its own weight, the operation of the vacuum piston is satisfactory.

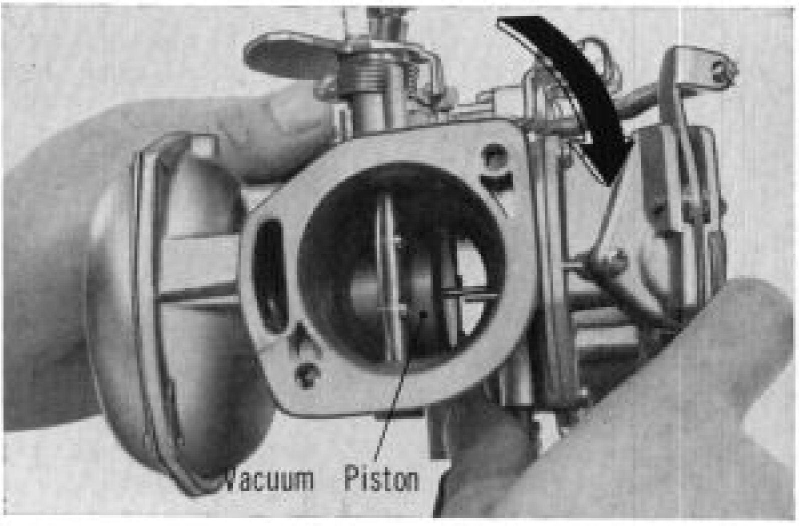
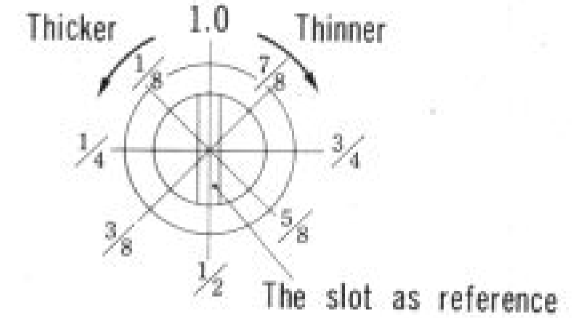


Fig. 14A-26

10. Adjusting pilot screw
    (a) Back-off pilot screw the standard number of turns.
    (b) Bring engine speed down to an idle with the throttle stop screw.
    (c) Then turn the pilot screw one half of a rotation and set it to the point where the engine run smoothly at the highest speed within the range.
    (d) Back off the throttle screw and set the engine to the normal idling speed (1,100 to 1,300 rpm).
    (e) Make sure that this is the normal speed by turning the pilot screw a little to the right.



Refer to the list of settings for the standard number of back-off turns.

Fig. 14A-27

Note:
Pilot screw adjustment should be made when the engine is warm.

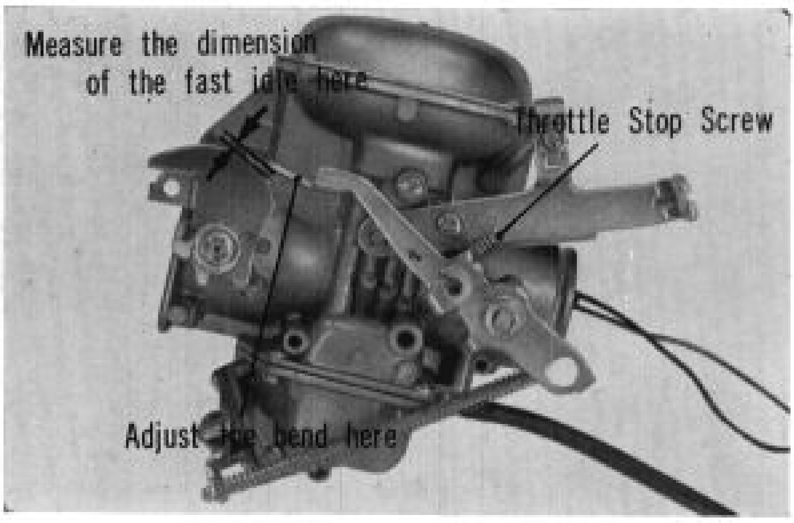


Fig. 14A-28

11. Adjusting for fast idling
    (a) Completely open the choke valve.
    (b) Completely close the throttle valve by backing off the throttle stop screw.
    (c) Next, adjust the degree of bend at the tip of the throttle lever to an angle at whcih the specified clearance is obtained between the throttle lever and the fast idle cam.
    (d) The standard fast idling speeed is 3,500 to 4,500 rpm when the engine is warm. (with the choke button set to the highest engine speed). Refer to the list of setting for dimensions. (page 14-8)

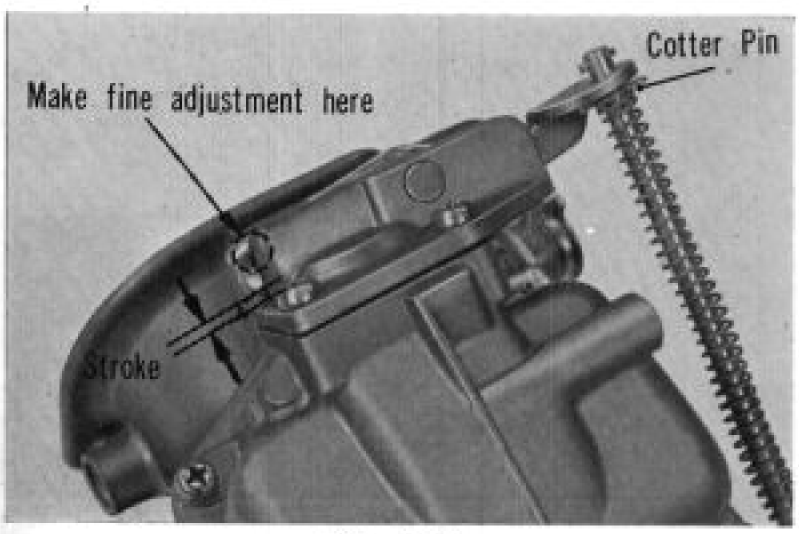


Fig. 14A-29

12. Adjusting accelerator pump discharge volume. See Figs. 14A-29 and 14A-30, and 14A-31, 14A-32 for the former carburetor in 360 and 600 vehicles.
    - Carry out the adjustment with the throttle stop screw threaded fully out.
    - The adjustment method will differ depending upon the setting.
    - Refer to the list of setting for the correct stroke. (page 14-8)

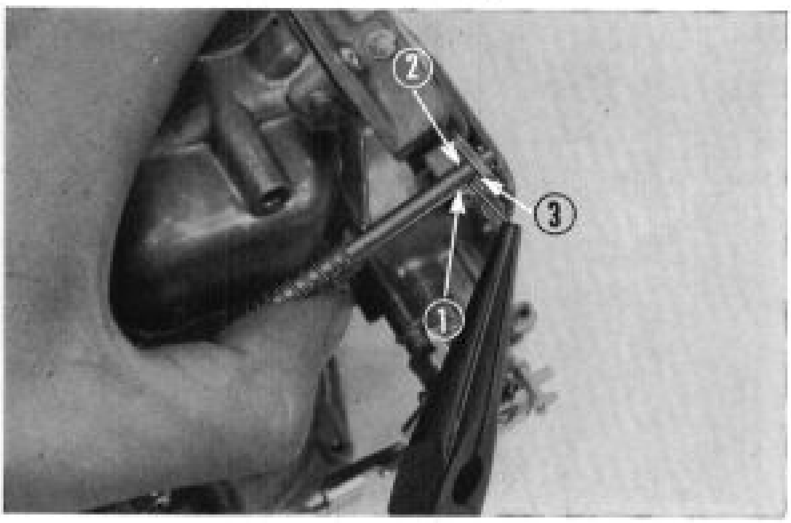


Fig. 14A-30

Fig. 14A-29 and 14A-30
Position ② is standard.
Discharge is approximately 0.35 to 0.40cc/stroke at position ① and 0.08 to 0.10cc/stroke at position ③.

Fig. 14A-31
Discharge volume is increased by threading in the adjusting nut.

Fig. 14A-32
Discharge volume is reduced by threading in the adjusting nut.

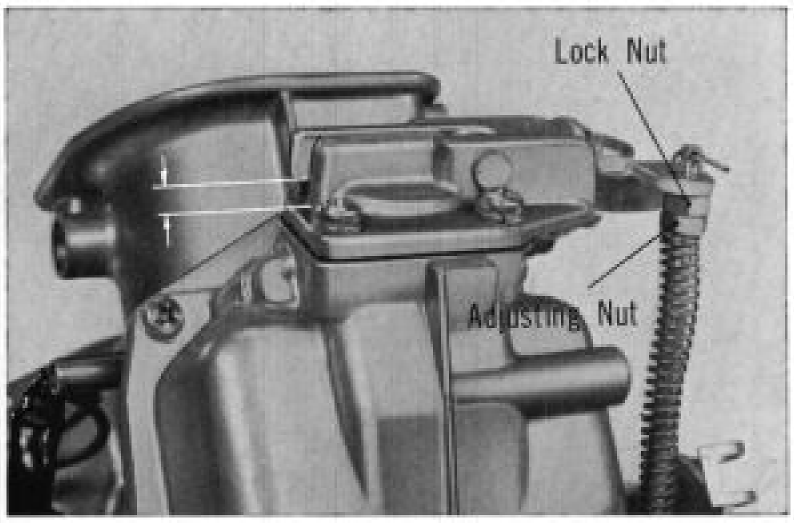


Fig. 14A-31

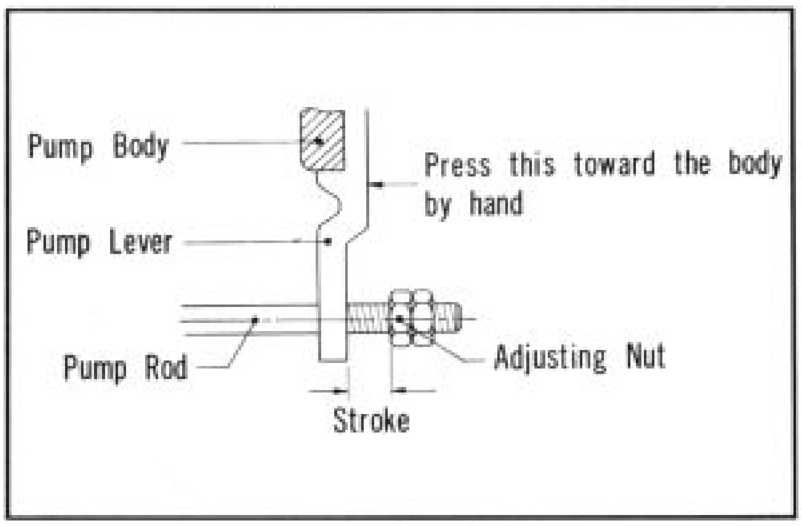


Fig. 14A-32

13. Checking solenoed valve
The solenoid valve is provided to prevent "run-off" once the ignition switch is set to OFF. At this time, the electric current is removed from the solenoid, and the valve is forced out by the spring contained in the valve to block the flow of the fuel to the orifice discharge port and pilot outlet.
   (a) To check the operation of the solenoid valve, set the engine switch to ON with the vehicle parked in a quiet location, and disconnect and reconnecting the lead of the solenoid valve at the plug (connection), checking for either an operating sound or vibration at the time of contact.
   (b) Emergency engine starting procedure when the solenoid valve malfuctions:
   Since the solenoid valve serves to open and close the fuel path of slow system (idling and low speed operation), emergency starting may be made by either removing the solenoid valve and sealing the port with a flat plate or by fixing the valve while in the depressed potition.

Note:
Replace only the solenoid valve when this part is defective, not the carburetor assembly. Neither nor should the assembly be replaced together with the solenoid valve when the carburetor is defective.

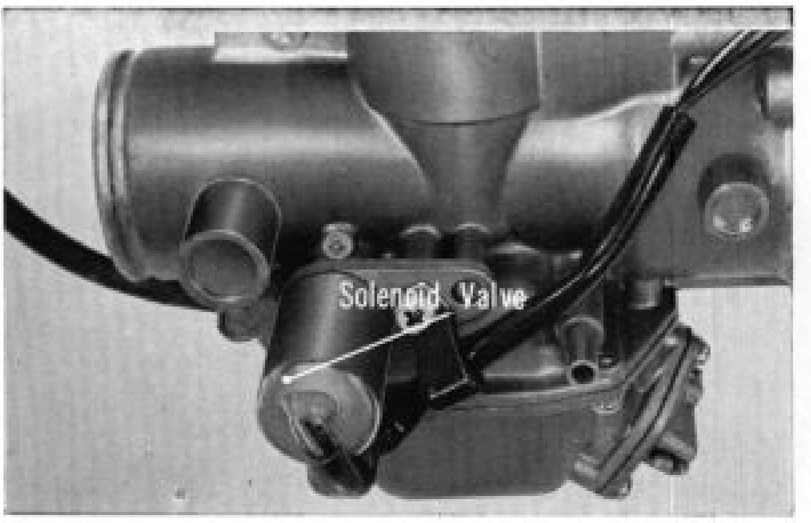


Fig. 14A-33

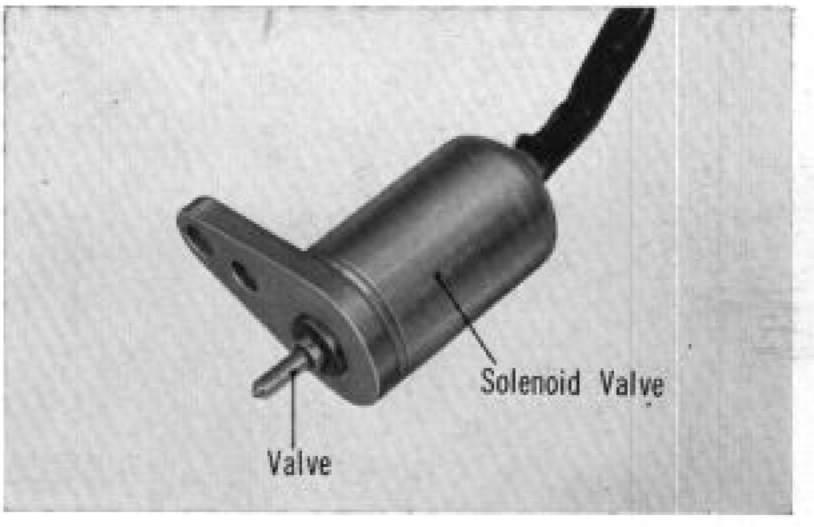


Fig. 14A-34

c. Trouble Diagnosis

Suggestions on trouble shooting:

- ○ The adjustment of the carburetor should be begun after confirming that there are no defects in the engine and the electrical system. (engine compression, ignition timing, sparking, tappet clearance, valve timing, etc.)
- ○ Take caution to avoid misplacement of parts, contamination, and hitting the parts with hard material during disassembly. Clean off dirt and water by blowing with air. (In case the body happens to be droped, check that there might not be malfunction of the parts.)
- ○ If the wires, etc. are removed, check operations for the complete close and open. (throttle valve and choke valve)
- ○ In the column of "check point", mark • indicates the adjustments are chiefly applicable to N360 (NB to ND), mark ○ to N360 (NE) and thereafter, and 400 and 600, and ♦ to the setting of all vehicles.

Defects	Check point	Repair and Adjustment
Defective starting	♦ Is the fuel supplied to the carburetor?	Turn on the ignition switch and disconnect the fuel tube from the carburetor fuel joint.
	♦ Does overflow not exist?	Clean the carburetor. (Refer to the column of "Overflow".)
	♦ Does the choke valve functions correctly?	Repair so that the choke moves smoothly.
	♦ Is the relief spring hooked to the right position?	Replace to the specified position.
	♦ Does the engine start? Since an accelerator pump is used, fuel will be sucked in excess if the accelerator pedal is stepped on many times.	Start the engine with the accelerator pedal at complete press to floor. (in case of fuel is sucked in excess.)
Defective idling	♦ Are the pilot screw adjustment method and the number of back-off turns proper?	Adjust the pilot screw.
	♦ Is the idling speed normal?	Adjust the stop screw to Engine speed 1,200 rpm±100. If the speed is not reduced by loosening the stop screw, check for contact of the fast idling lever.
	♦ Is the solenoid valve operating?	Replace if defective
	♦ Does the solenoid valve have the O-ring?	Provide if not.
	♦ Is the slow jet not clogged?	Clean with air.
	• Is the slow jet loose?	Tighten.
Defective slow speed	♦ Are the method of the pilot screw adjustment and the number of back-off turns proper?	Adjust the pilot screw.
	♦ Is the slow jet not clogged?	Clean with air.
	• Is the slow jet not loose?	Tighten.
	○ Is the slow path provided with the rubber cap or is the rubber cap not damaged?	Porvide or replace if damage.
	♦ Is the slow jet not clogged?	Clean with air.
	♦ Is the vaccum unit tube provided or, if provided, not damaged?	Provide or replace if damaged.

Defects	Check point	Repair and Adjustment
Defective medium and high speeds	● Is the diaphragm not cracked?	Replace the vacuum piston assembly.
	♦ Is the vacuum piston installed in the correct position?	Correct.
	♦ Does the vaccum piston operate normally?	Clean
	♦ Is the vacuum piston spring expanded too long?	Replace the spring.
	● Is the needle jet set screw loose?	Tighten.
	○ Is the jet needle installed properly?	Replace the jet needle retainer with modified one
	♦ Is the jet needle not lost or is the bushing not loose?	Replace the jet needle.
	♦ Is fuel supplied to the specified level?	Adjust to the specified level.
	♦ Are the jets not clogged or loose?	Clean and tighten.
	○ Is the main jet O-ring not broken?	Replace the O-ring.
	○ Is the jet needle retainer installed properly?	Correct.
Defective acceleration	♦ Is the discharge volume of the accelerator pump adjusted correctly?	Adjust the discharge volume of the pump.
	♦ Is the pump ejecting?	If air is contained in the pump, fully stroke the pump lever 4 to 5 times by hand.
	○ Are the U-ring, colar, and outlet valve installed?	Reinstall or replace.
	○ Is the path to the pump not clogged?	Clean with air and replace the float chamber.
	○ Is the locker arm not interfered by anything?	Replace the pump cover.
	♦ Is fuel supplied to the specified level?	Adjust to the specified level.
	♦ Does the vacuum piston operate properly?	Clean.
	♦ Is the diaphragm not broken?	Replace the vacuum piston assembly.
Increased fuel consumption	♦ Are the method of the pilot screw adjustment and the number of back-off turns proper?	Adjust the pilot screw.
	● Is the slow jet not loose?	Tighten.
	♦ Are the air jets not clogged?	Clean.
	♦ Is the pump discharge volume not too great?	Adjust the pump discharge volume
	♦ Is float level normal?	Adjust to the specified float level.
	♦ Is the vacuum unit tube not damaged or is it installed?	Replace the tube or install as required.
	♦ Does overflow or fuel leakage not exist?	Clean (Refer to "Overflow")
	♦ Is the jet needle shim positioned properly?	Adjustable 0.5 of a step by means of shims.

Defects	Check point	Repair and Adjustment
Overflow	♦ Is the float functioning properly?	Adjust.
	♦ If float valve contact good?	Replace the valve seat assembly.
	♦ Does any foreign matter exist between the float valve and the valve seat?	Clean.
	♦ Is the discharge pressure of the fuel pump normal?	Replace the pump.
	♦ Is float level normal?	Adjust to the specified float level.
	♦ Is the float lip set right angles to the float valve?	Adjust it as specified.
	♦ Is the valve seat retainer spring installed properly?	Adjust it as specified.
	♦ Is the valve seat O-ring not damaged?	Replace the O-ring.

B. Air Cleaner

a. Description

The air cleaner is mounted in the engine compartment on the upper dashboard, and the filter element is made of paper. Air used to cool the engine is introduced to the nozzle of the air cleaner cause through a hot air feed tube. The hot air prevents the carburetor from icing and improves the engine performance by facilitating the fuel atomization.
The gas produced in the engine crankcase is introduced from the breather tube into the air cleaner case The case contains chambers which separate oil from the gas. The gas is fed into the carburetor through a filter element, and the oil is discarded from the chamber through a drain tube.
Models to be exported to the U.S. will have no drain tube, and the port will be sealed with a rubber plug. Periodically drain the oil by removing the plug.

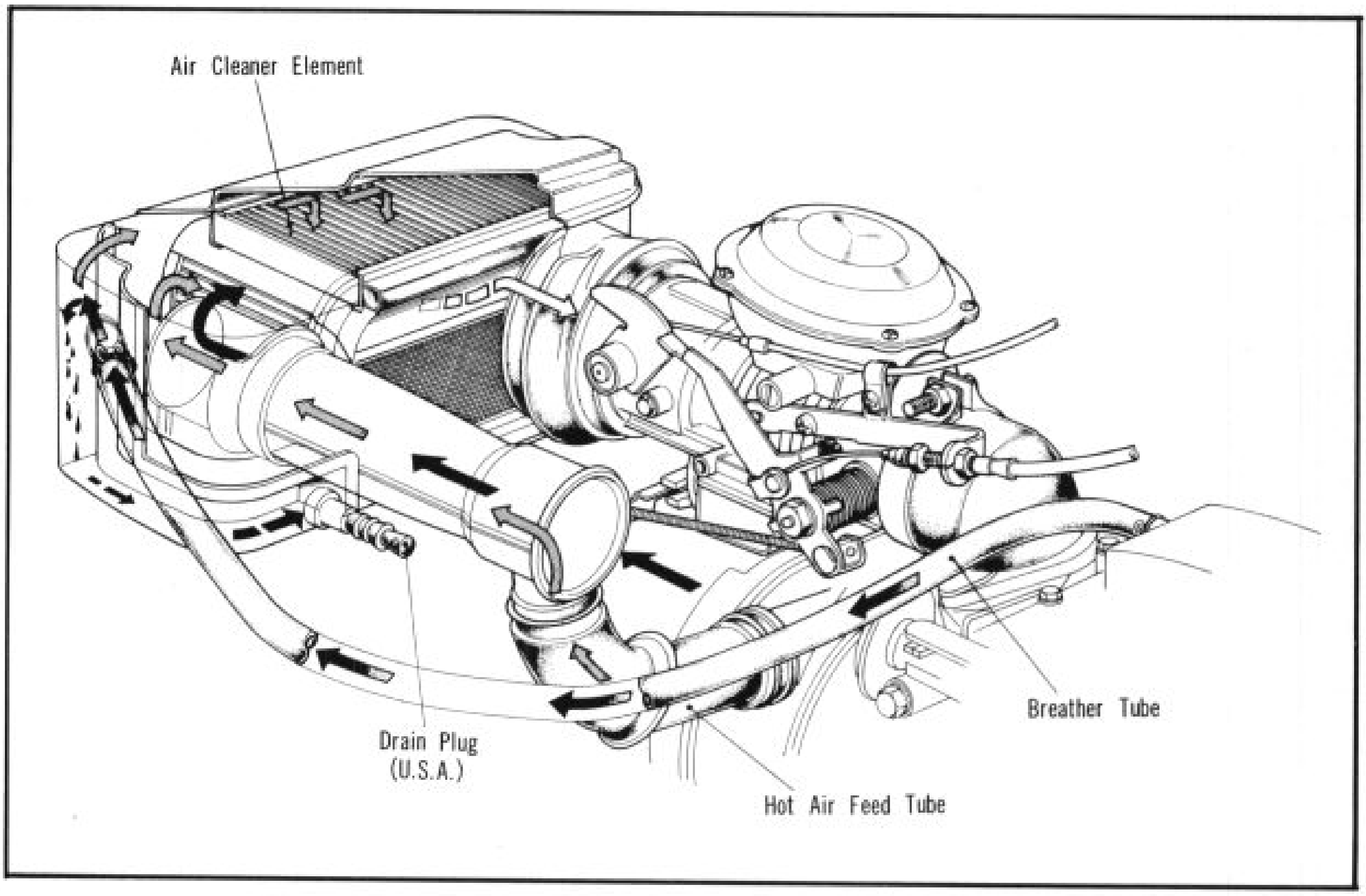


Fig. 14B-1

The drain tube has a slit in the tip, through which accumulated oil is automatically discharged. **(Fig. 14B-2)**

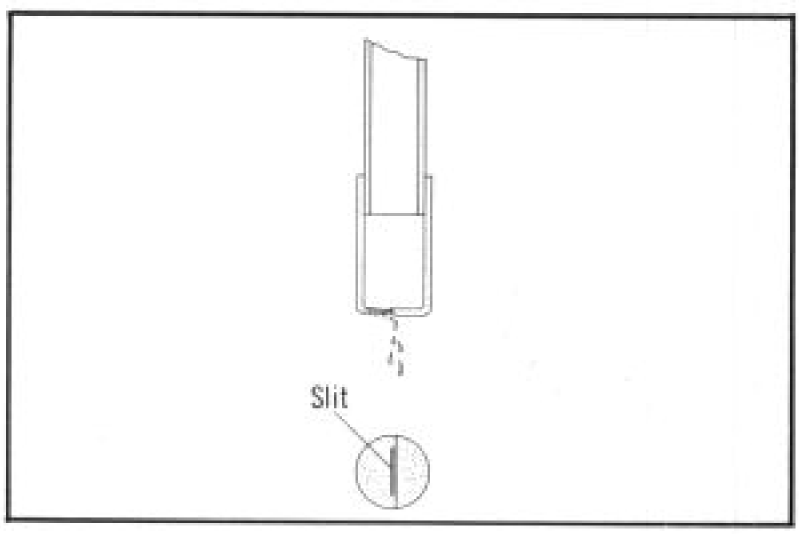


Fig. 14B-2

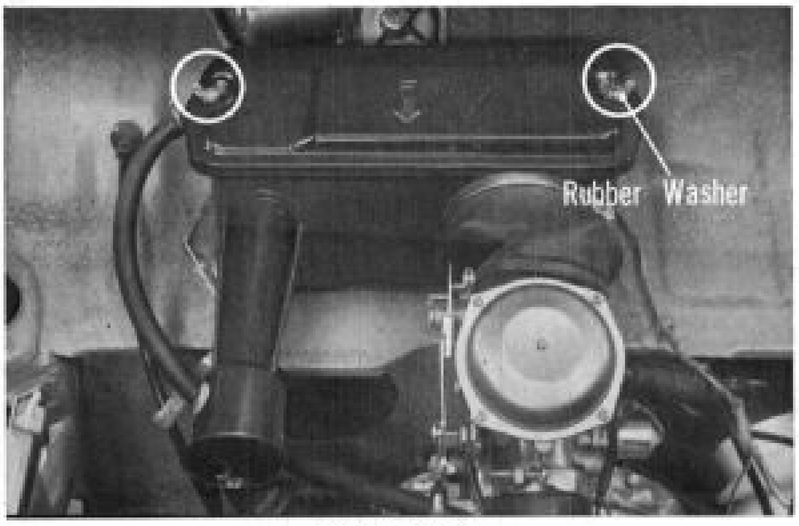


Fig. 14B-3

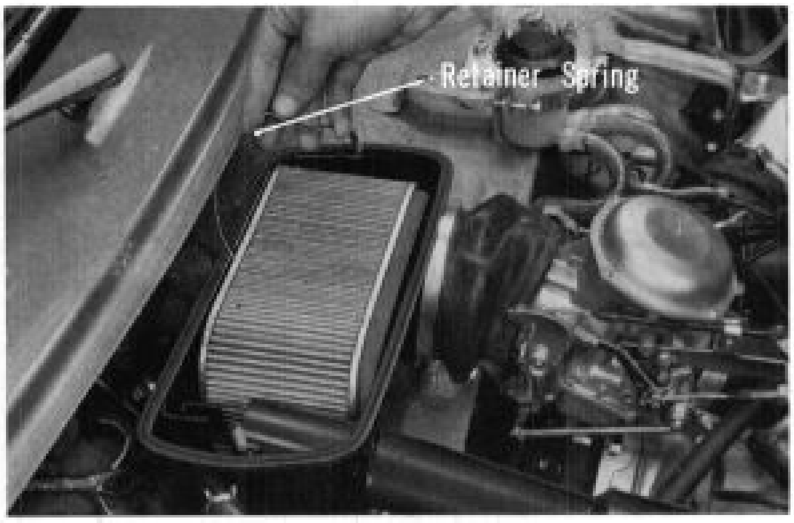


Fig. 14B-4

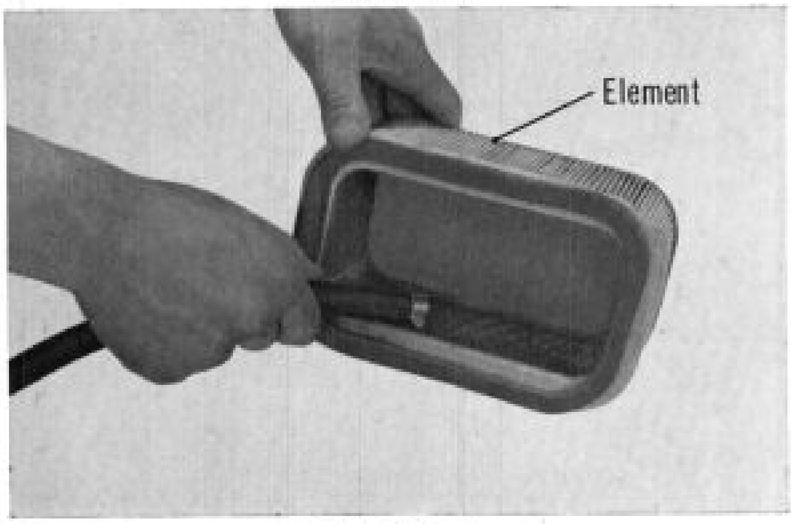


Fig. 14B-5

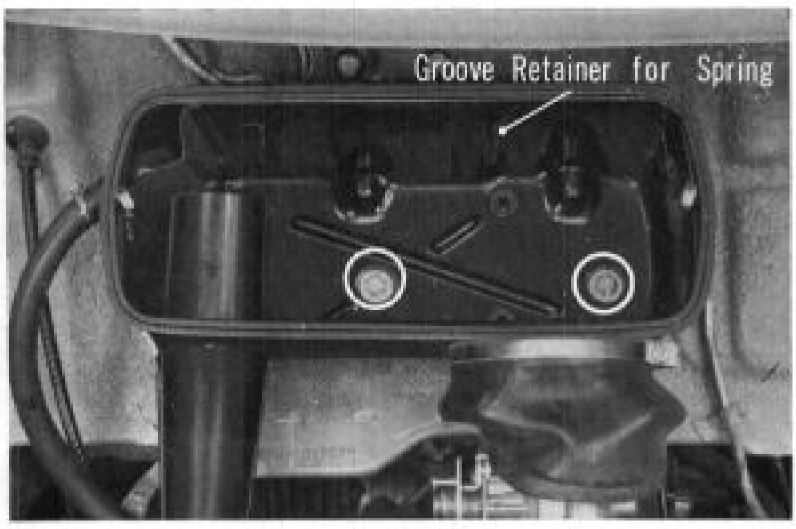


Fig. 14B-6

b. Maintenance

The air cleaner element is generally cleaned after 5,000km (3,000 miles) of vehicle operation, replaced after 15,000km (9,000 miles), cleaned after 25,000km (15,000 miles), and then, replaced again after 35,000km (21,000 miles), after which cleaning and replacement are alternated every 15,000km.
These periods are standard, but can modified depending upon the local conditions under which the vehicle is used. Cleaning and replacement may be necessary more frequently in dusty environments.

1. Remove the cover from the air cleaner by unthreading the wing nuts.
   Note:
   Since the rubber washer serves to prevent water from entering, be sure to install it. **(Fig. 14B-3)**

2. Remove the element by removing the retainer spring.
   The tension of the retainer spring functions in the direction to hold the element toward the carburetor. Install the spring in the correct direction. **(Fig. 14B-4)**

3. Clean the element by blowing out dust with compressed air from the inside. Replace it if it is extremely dusty or cloggged. **(Fig. 14B-5)**

4. The air cleaner is fixed to the upper dashboard with two bolts by way of a rubber washer.
   When removing the case, remove the bellows band, and separate it from the carburetor; remove the breather tube, and case mounting bolts. The case has a groove for the retainer spring. **(Fig. 14B-6)**

5. The 600 series air cleaner case will be modified as of 1969 for the purpose of reducing suction noise. Where as the current type is directly attached to the dashboard upper simply using a rubber washer, the new one will be installed with supporters as well as with a rubber washer. (Fig. 14B-7)

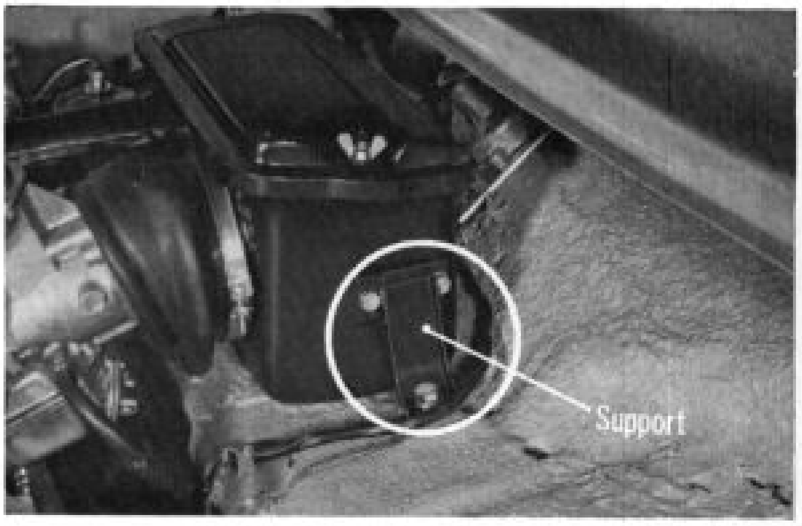


Fig. 14B-7

C. Fuel Pump

a. Description (See Fig. 14C-1 and 14C-2)

The fuel pump is an electromagnetic type mounted on the left side of the engine compartment. The pump is divided into a pump and electromagnetic section.
The pump section consists of a pump base ⑫, diaphragm ⑩, valve chamber ③, cap ①, and valve ⑦. A suction valve is mounted in the cap and a discharge valve in the valve chamber. The valve chamber is divided into two sections, suction side (a) and discharge side (b). Each valve is mounted in the valve chamber with a stopper ring ④, and is pressed against the surface of a seat ⑧, by a valve slring ⑥.
The section and discharge valves are located opposite each other. When the section side opens, the discharge side closes. When the discharge side opens, the suction side closes, thereby preventing reverse flow of fuel.
The diaphragm ⑩, mounted to one end of the diaphragm shaft ⑭ accomplishes the function of sucking and discharging fuel. It is held down by a spring ⑪. The plunger ⑮ of the electode section is mounted to the diaphragm shaft with a pin ⑯. The lower bearing ⑬, is located between the diaphragm and plunger.
The electomagnetic section consists of a coil and a switch. One end of the coil ⑳ is connected to the lead ㉝ and the other end to the fixed ontact ㉗ of the switch. The moving contact ㉖ is grounded through the lever B ㉔ to the main body.
Current flows from the connector plug ㉞ to the main body ⑰ via the coil ⑳, fixed contact ㉗, moving contact ㉖, and lever B ㉔ and is grounded through the pump mountijg screws. In the meantime if a current flows through the coil, the magnetic lines form a circuit from the plunger holder ⑱ to the plunger ⑬ via the main body ⑰ and the magnetic conductor ⑲ and attracts the plunger to the plunger holder.
The lever ㉓ is driven by the motion of the diaphragm shaft ⑭ mounted to the plunger and is switched by the function of the spring ㉙.

b. Specification

Rated voltage	12V
Minimum operating voltage	Less than 9V
Out blocked discharge	Below 0.145kg/cm^2
Current	Less than 0.6A (average value)
Insulation resistance	More than 5MΩ with 500V megger
Discharge capacity 10V	More than 220cc/min.
12V	More than 250cc/min.

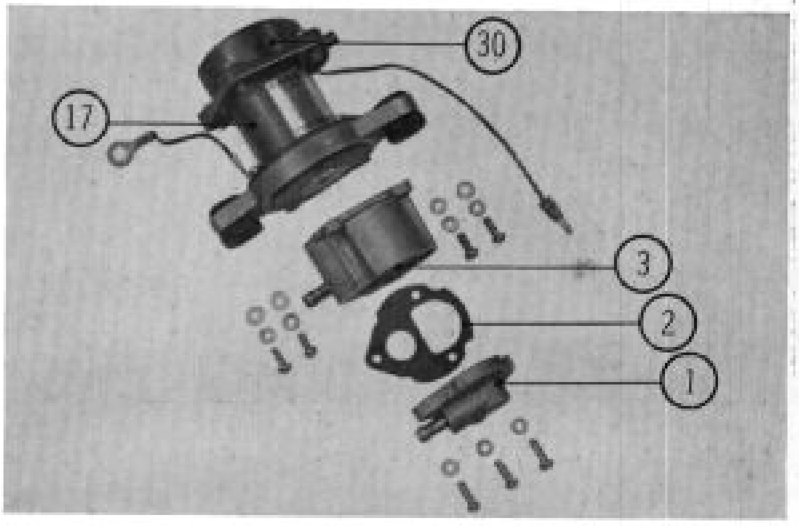


Fig. 14C-1

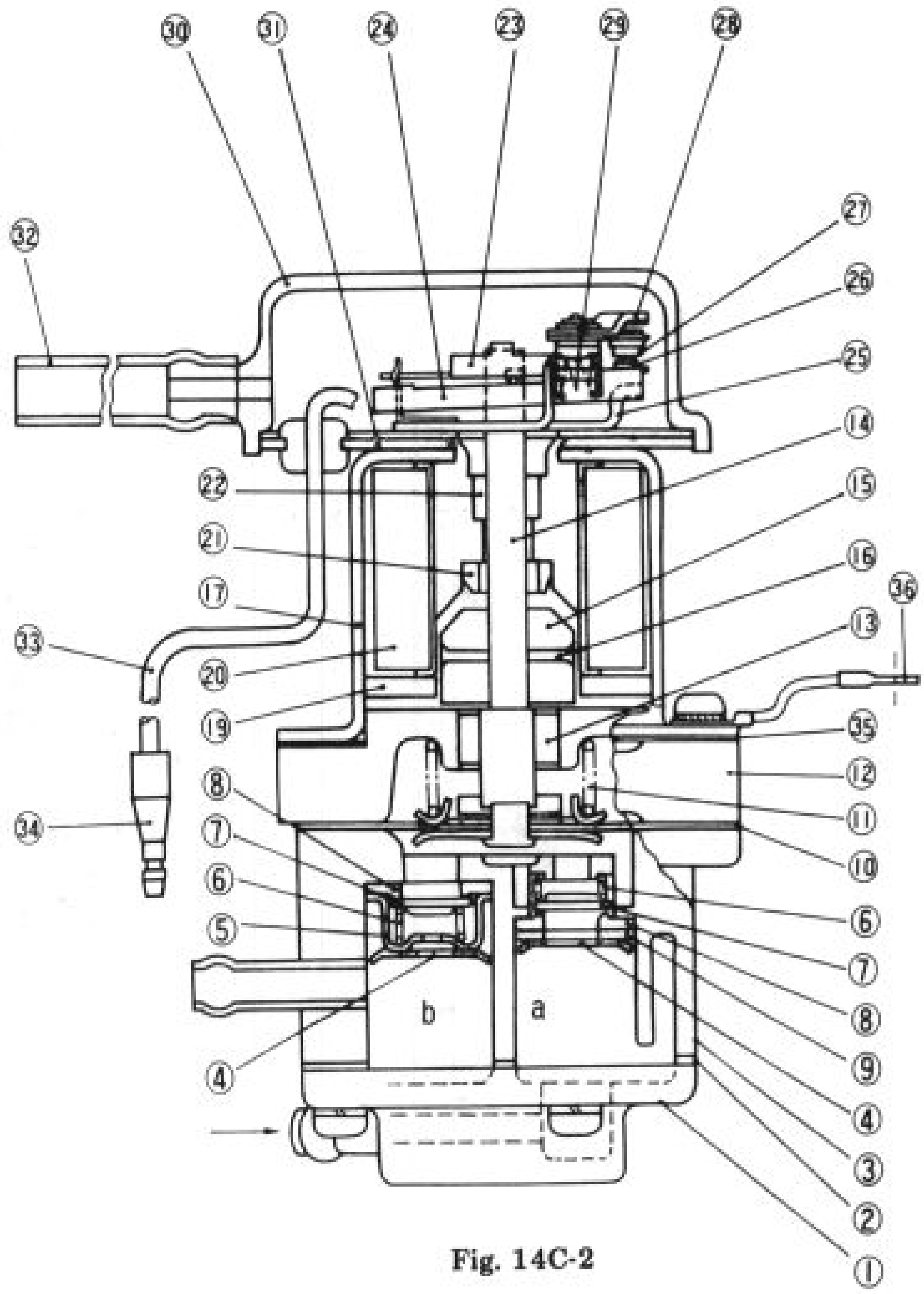


Fig. 14C-2

1 Cap
2 Gasket
3 Valve chamber
4 Stopper ring
5 Valve holder
6 Valve spring
7 Valve
8 Valve seat
9 Washer
10 Diaphragm
11 Spring
12 Pump base
13 Lower bearing
14 Diaphragm shaft
15 Plunger
16 Pin
17 Main body
18 Plunger holder
19 Magnetic conductor
20 Coil
21 Cushion spring
22 Upper bearing
23 Lever A
24 Lever B
25 Lower stopper
26 Moving contact
27 Fixed contact
28 Upper stopper
29 Fast switching spring
30 Cover
31 Cover packing
32 Breather pipe
33 Lead
34 Connector plug
35 Adjusting sandwich plate
36 Ground cable

c. Maintenance

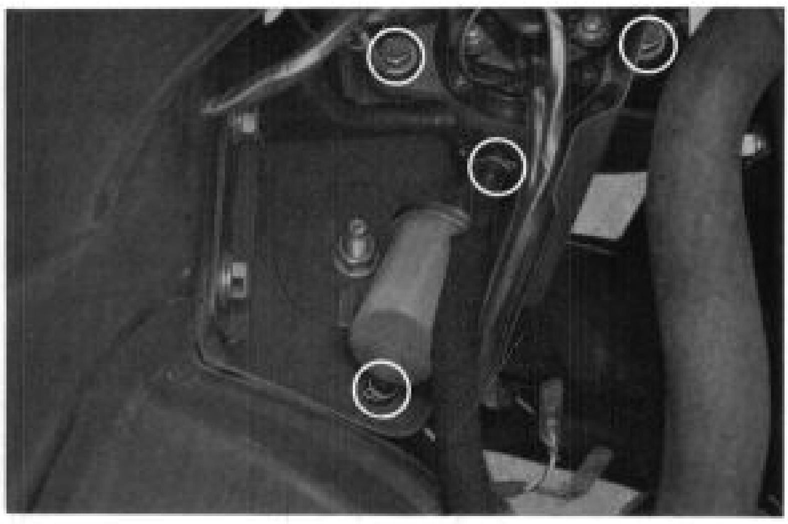


Fig. 14C-3

Removal and Installation

1. Disconnect leads at the connector and remove the rubber tubes at the intake of the fuel strainer and at the outlet of the fuel pump.
2. Remove two mounting bolts from the fuel pump and separate the pump from the body.
3. Install the pump by reversing the above procedure.

   Note:
   Do not disassemble the electromagnetic components.

Inspection and Trouble Shooting

1. Measure the pump terminal voltage. Turn on the engine key switch. Connect a DC voltmeter across the (+) terminal of the pump and the body. If 12V is not indicated, check the terminal voltage of the battery or look for open wiring in the harness.

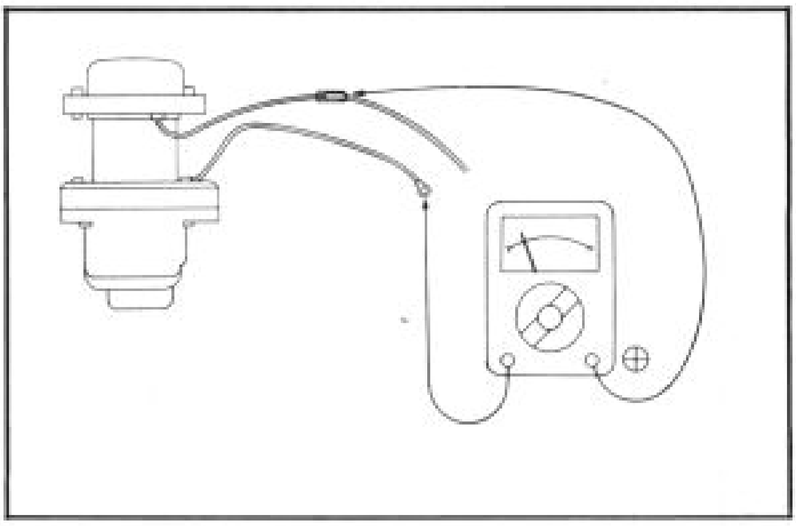


Fig. 14C-4

2. Check the resistance of the pump coil. Disconnect the connector at the (+) terminal and measure with an ohmmeter between the (+) terminal and ground (body). A reading of 5Ω is satisfactory.

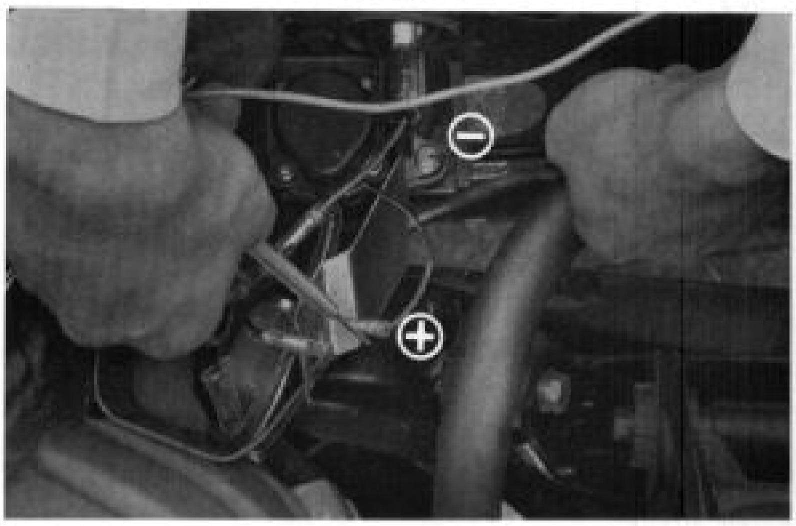


Fig. 14C-5

3. Pump Discharge Test
   Simple Test Procedure:
   Disconnect the fuel line from the carburetor and place the end in a container. Turn on the engine switch and check the fuel flow. If extremely low, check clogging of the fuel strainer. Replace the pump if there is no operating noise.

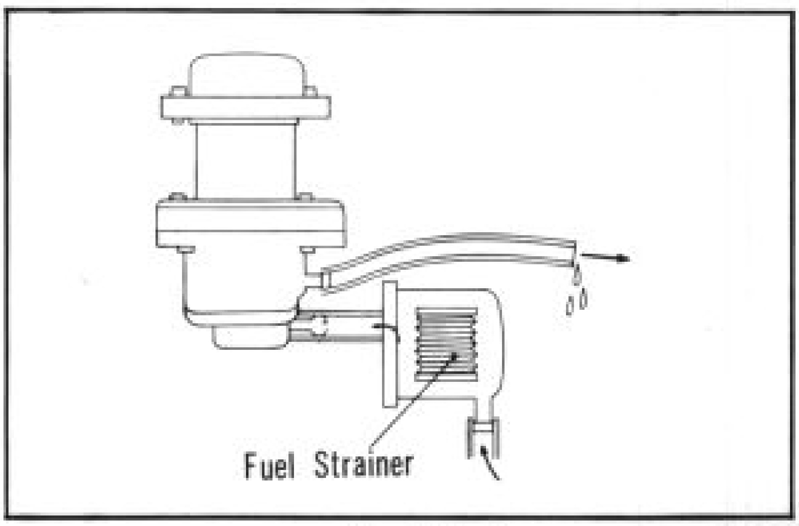


Fig. 14C-6

   Precision Test Procedure:
   Separate the pump body and strainer. Fit vinyl tubes of 6mm (0.236 in.) inside diameter to the inlet and outlet. Extend the tube 500mm (19.7 in.) below the inlet and 500mm above the outlet. Turn on the switch. The fuel flow should be more than 500cc/min. (30.5cu in/min.) For more precise measurement reduce the inside diameter of the outlet to 1.4mm (0.055 in.). The flow should exceed 250cc/min. (15.2cu in/min.) at this time, and the discharge pressure should be 0.145kg/cm^2 (2.1 lb/sq in.).

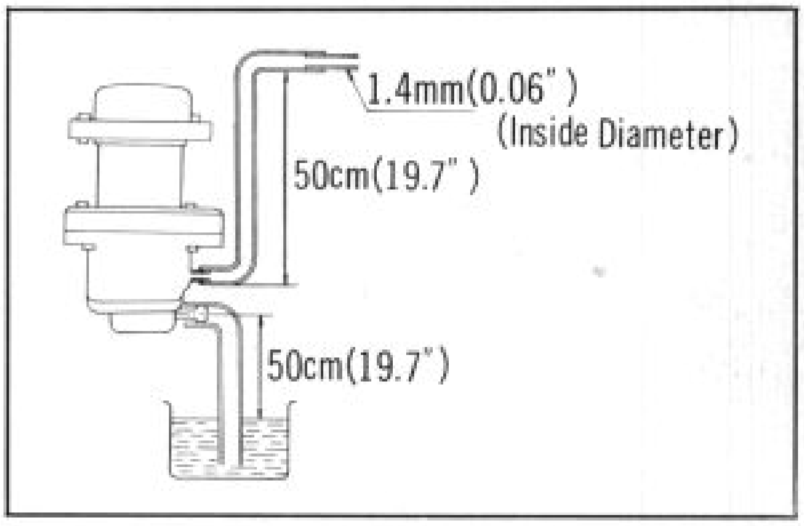


Fig. 14C-7

4. If no trouble of the pump body is found, check the contact of the ground cable secured by the mounting bolt. A loose or corroded ground will cause pump failure even if the pump is in good condition.

D. Fuel Tank

a. Description

The fuel tank is rubber mounted under the rear floor of the rear axle. The fuel tank capacity is 26 liters (6.86 U.S. gal or 5.72 Imp. gal.). To fill the tank, open the door on the left side, pull the filler release lid knob and remove the filler cap.

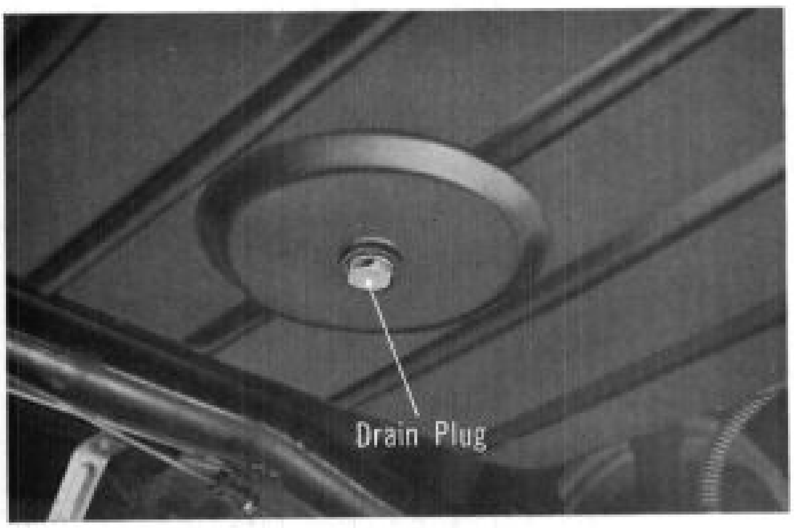


Fig. 14D-1

b. Maintenance

1. Before removing the fuel tank, remove the plug and drain the fuel.

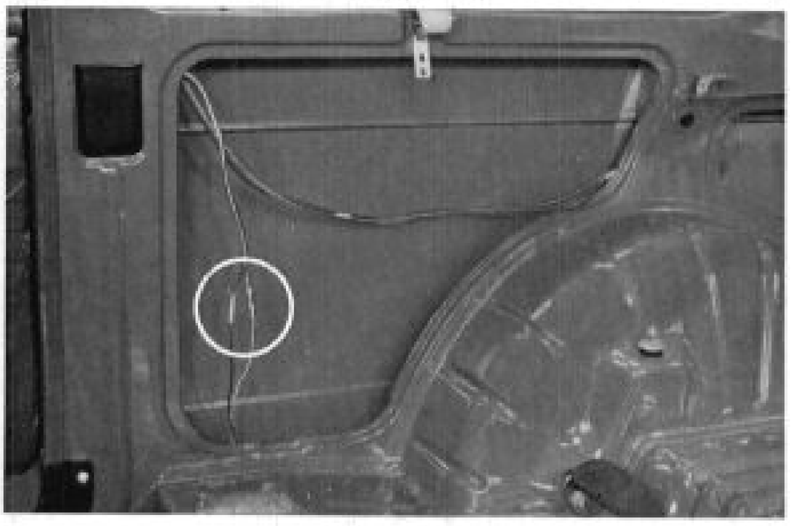


Fig. 14D-2

2. Remove the rear right side gadget tray and disconnect the fuel meter lead wire in the connector position.

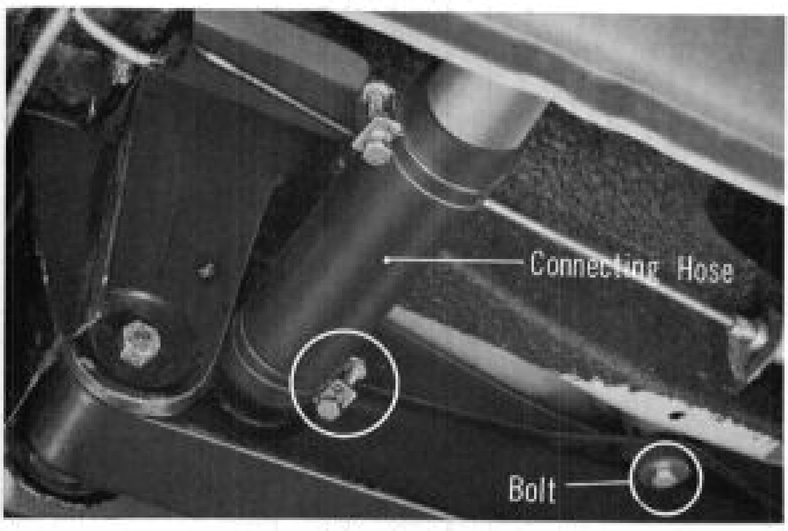


Fig. 14D-3

3. Remove the hose connected to the fuel tank and the filler neck.
4. Disconnect the parking brake cable guide from the tank.

5. Remove the rubber tube between the fuel tank and pipe. Remove the four mounting bolts and lower the tank. Check the fuel pipe for chafing, corrosion and other damages. Check the fuel tube for deterioration and any damage.

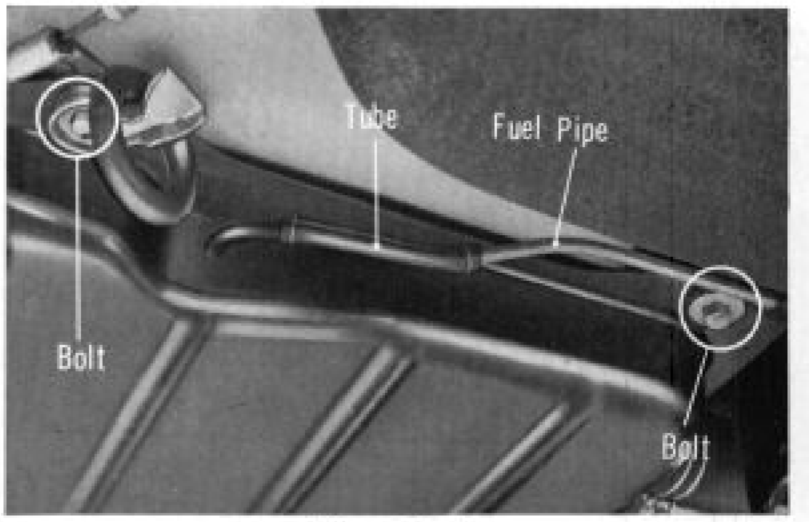


Fig. 14D-4

To dismount the tank, disconnect the breather tube. Inspect the breather tube if it is not kinked nor compressed between the tank and the body when installing the fuel tank. Always secure the tube connections.

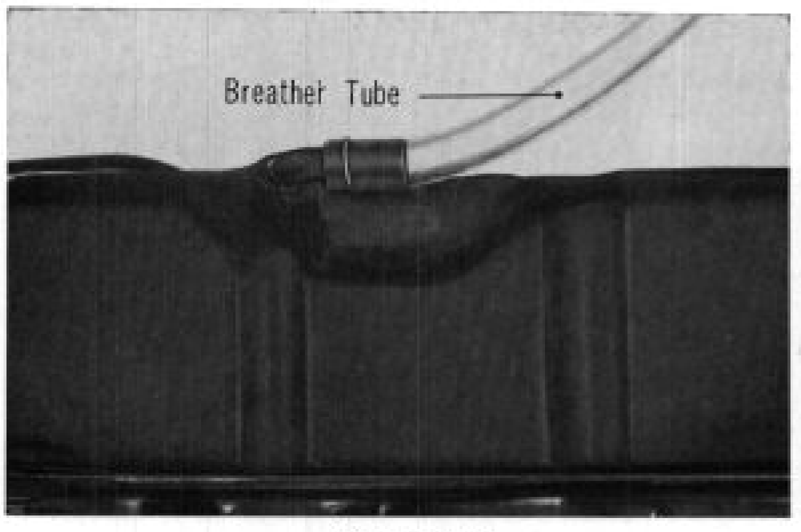


Fig. 14D-5a

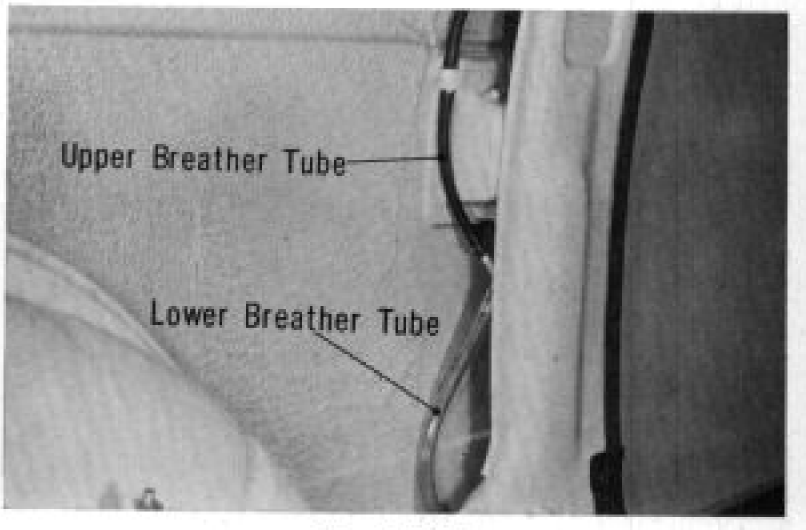


Fig. 14D-5b

When assembling the meter unit, apply liquid sealer to position of thread of mounting screw and gasket to prevent fuel leakage.

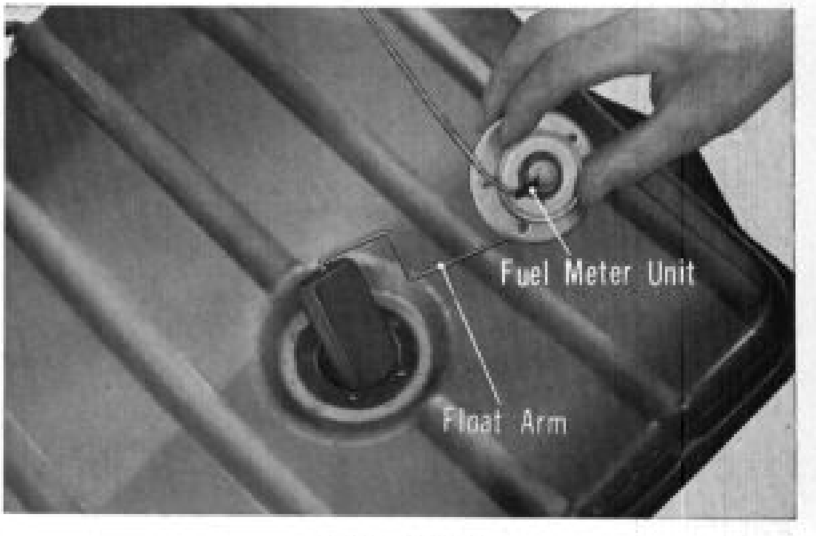


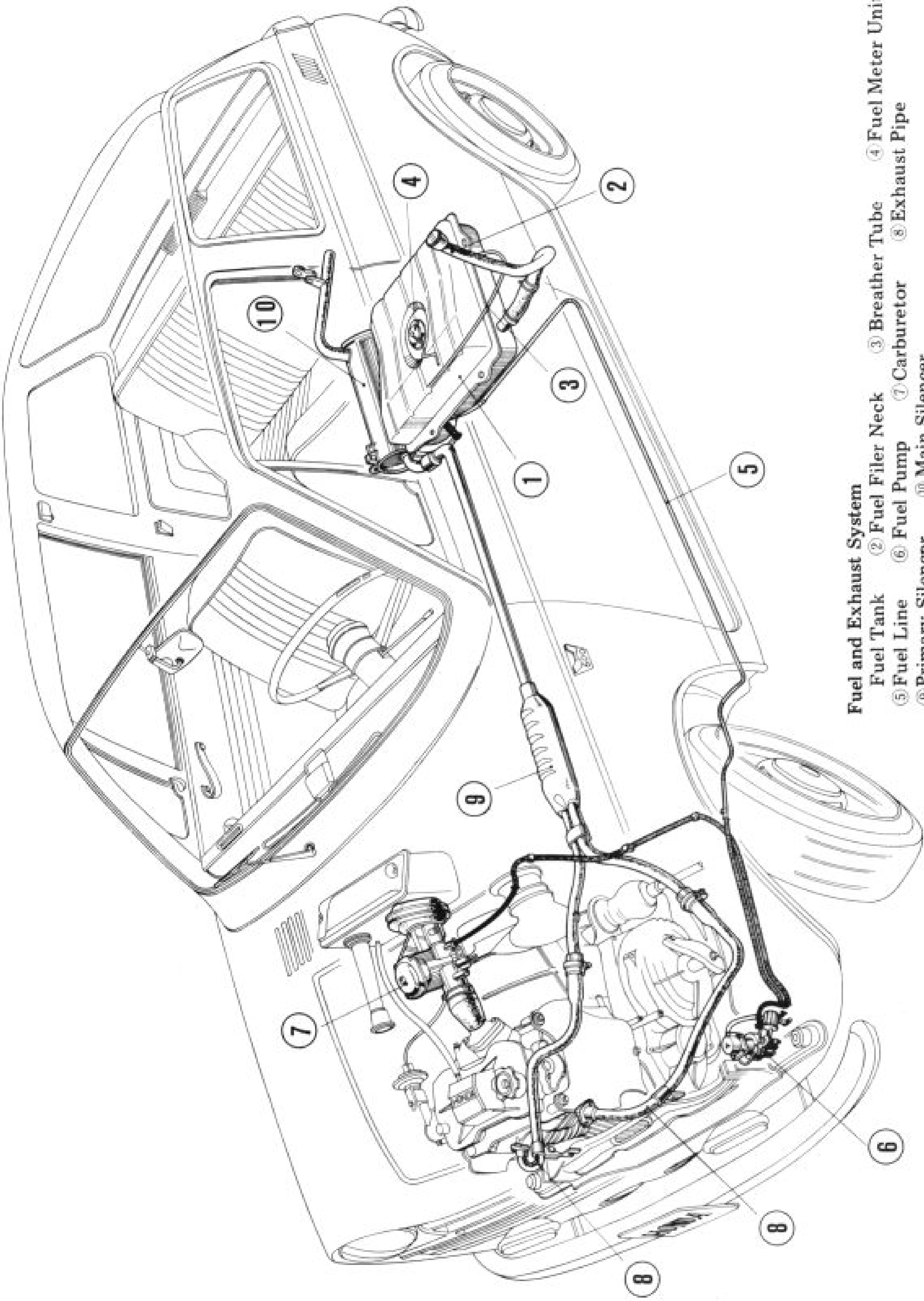
Fig. 14D-6

MEMO

SECTION 15

EXHAUST SYSTEM

15



Fuel and Exhaust System

① Fuel Tank ② Fuel Filer Neck ③ Breather Tube ④ Fuel Meter Unit
⑤ Fuel Line ⑥ Fuel Pump ⑦ Carburetor ⑧ Exhaust Pipe
⑨ Primary Silencer ⑩ Main Silencer

Fig. 15A-1

A. Description

The exhaust system consists of exhaust pipe, primary silencer, and main silencer. (See Fig. 15A–1 and 15A–2)
The exhaust pipes, R and L, project from the cylinder head and are connected to the primary silencer beneath the differential.
The primary silencer is connected to the main silencer, and gas is exhausted through the tail pipe to the rear beneath the rear right bumper.
The exhaust system is fitted at the following points: the exhaust pipe is fitted to the front engine support beam by bolt; the primary silencer supported by the rubber ring (tightened together with the fuel tank by bolt); the main silencer fitted by the bracket to the rear spring hanger with rubber between; and the tail pipe is fitted by rubber ring. Thus, it is designed so that vibration by exhaust has no affect on the body.

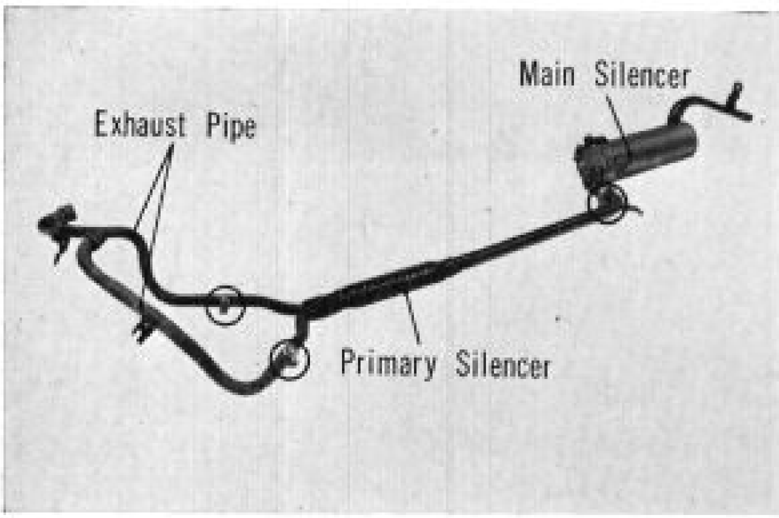


Fig. 15A-2

In the exhaust car heater type (Refer to SECTION 16 Heater and Ventilation), heat from the heater is taken from the exhaust pipe on the left side. The flange section on the cylinder head side of the exhaust pipe is a double pipe construction reinforced so that it does not cause pipe splitting.
The joint of the primary silencer and the exhaust pipe is a spigot type and tightened by the clamp hold.

The main silencer is divided into four chambers (See Fig. 15A–4), the exhaust gas goes into pipe A and is silenced by the glass wool inside, and then into chamber④, where it is expanded to decrease exhaust temperature. Next, the gas is led through pipe B to chamber①, and then through pipe C to chamber②, to chamber ③ through pipe D, and from chamber③ through pipe E and is exhausted. The joints of pipes A and B and the silencer are reinforced by a double construction.

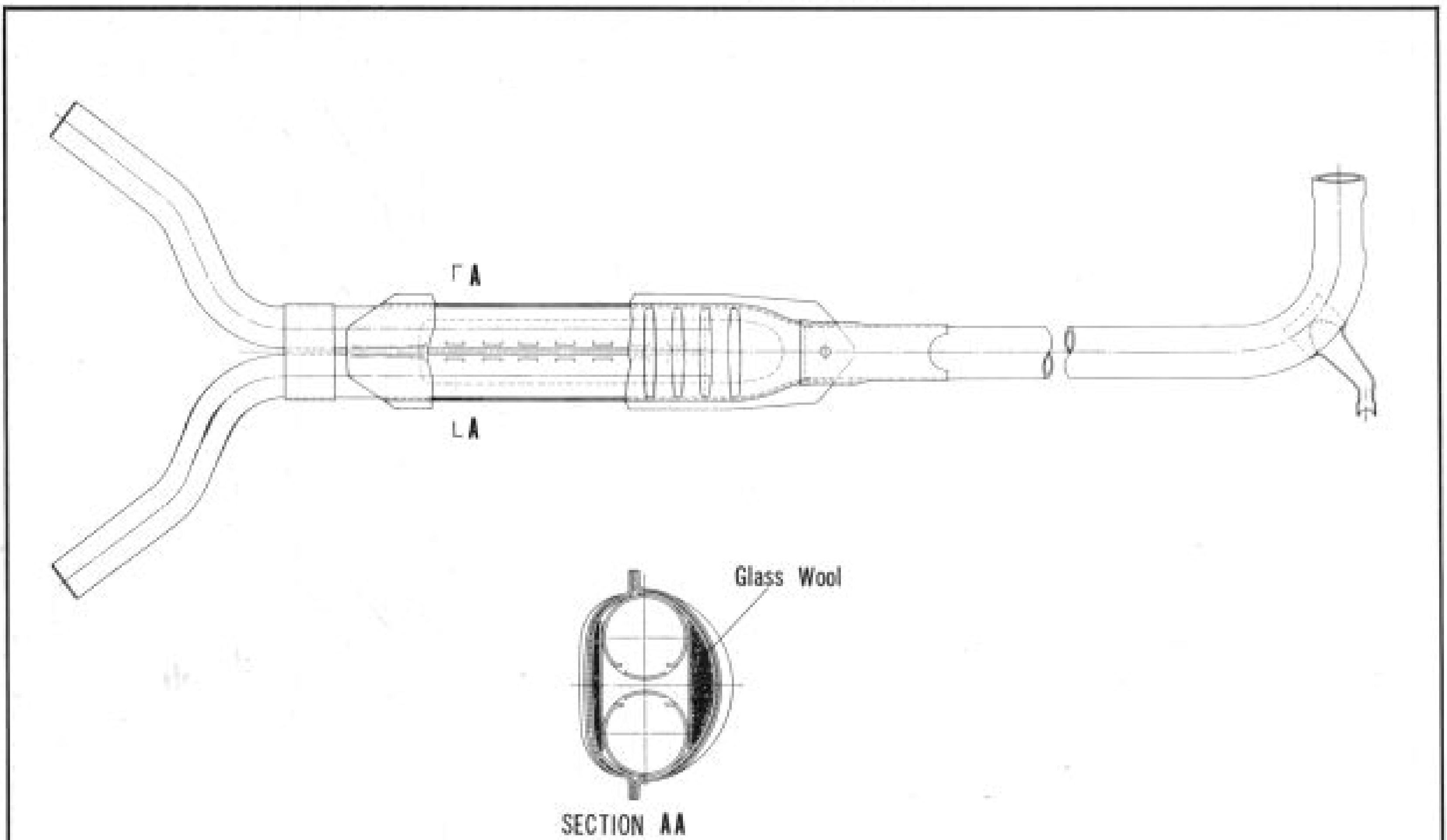


Fig. 15A-3 Primary Silencer

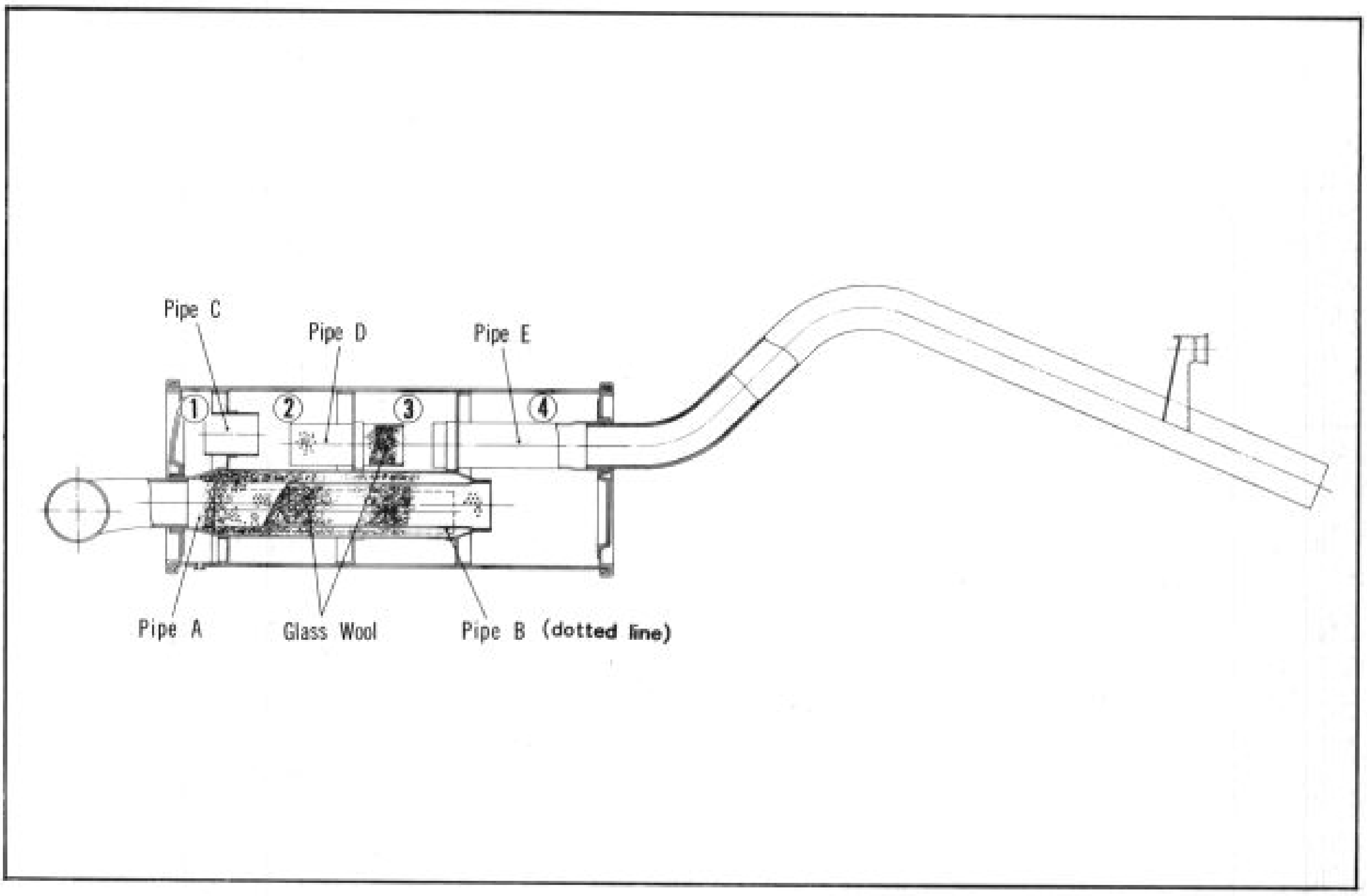


Fig. 15A-4 Main Silencer

B. Maintenance

a. Exhaust Pipe

1. The exhaust pipe is installed on the cylinder head through the flange, inserted into the primary silencer, and secured with a clamp. On the other hand, it is supported by the front engine support beam through clamp plate. Separate the clamp plate from the front engine support beam. Loosen the nut and remove the bolt, and the clamp plate can be freed from the exhaust pipe. (Fig. 15B—1)

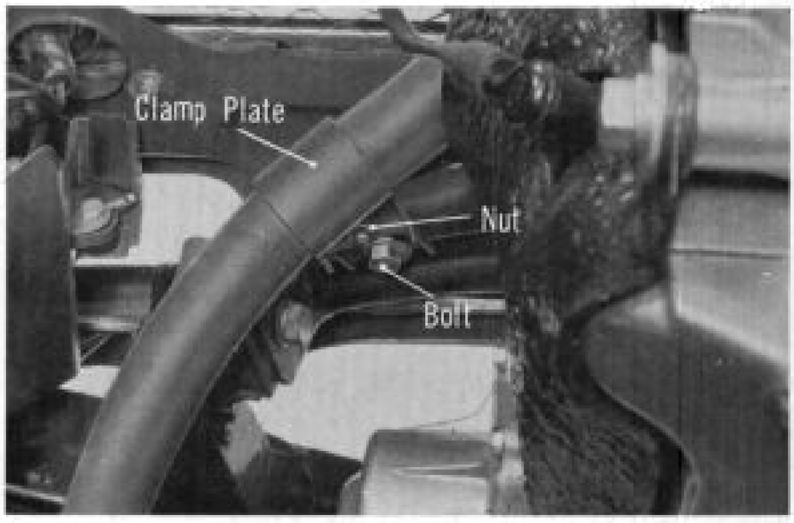


Fig. 15B-1

2. Remove the front grille and screen.
3. Remove the exhaust pipe installing nut from the cylinder head, and separate the exhaust pipe from the cylinder head.

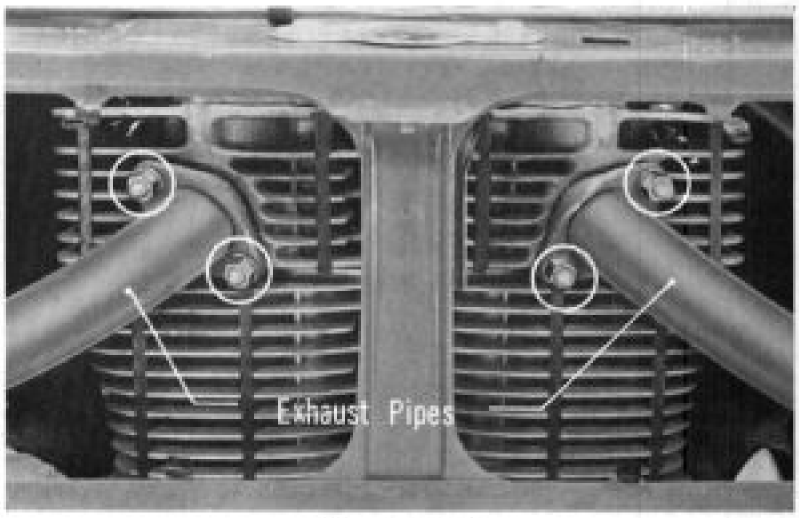


Fig. 15B-2

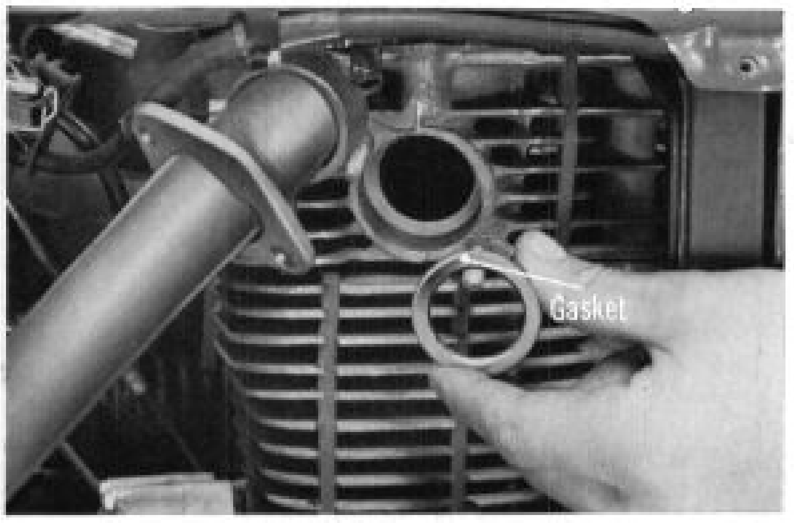


Fig. 15B-3

When reinstalling the exhaust pipe, replace the gasket with a new one and secure the exhaust pipe.

Tightening torque:
2.5 to 2.8 kg-m (18.1 to 20.3 lb-ft)

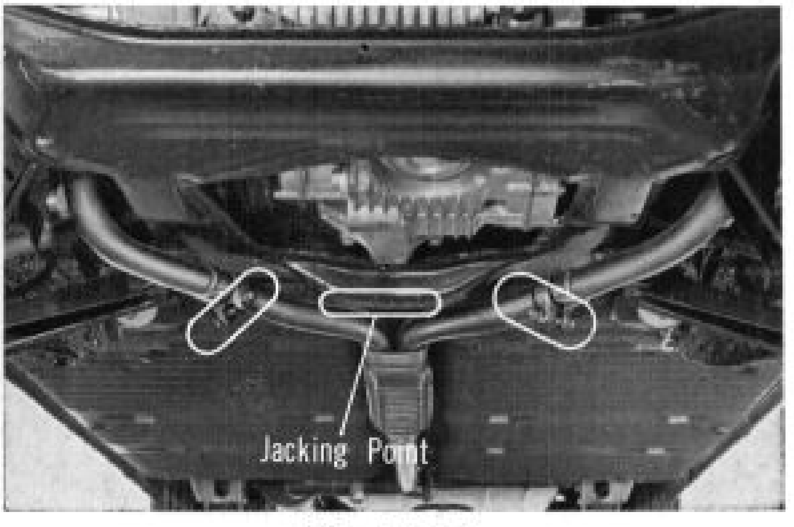


Fig. 15B-4

b. Exhaust Silencers

1. Separate the primary silencer and exhaust pipe. Jack up the Vehicle and place supports beneath it. Do not place a support under the engine crankcase. Completely loosen the clamp bolt and move it from the inserted position.

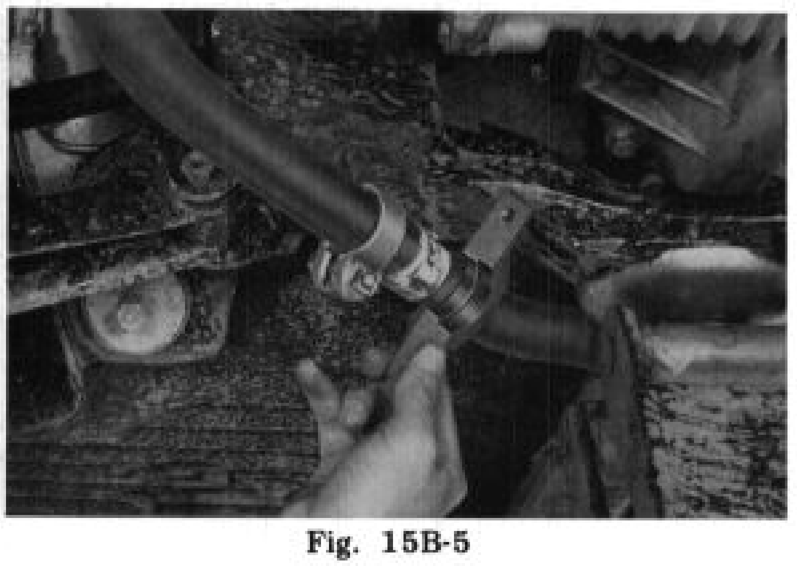


Fig. 15B-5

Attach the exhaust pipe removing adaptor, (special tool). When installing the tool, pay special attention to its installing direction, since it has a stepped inside.

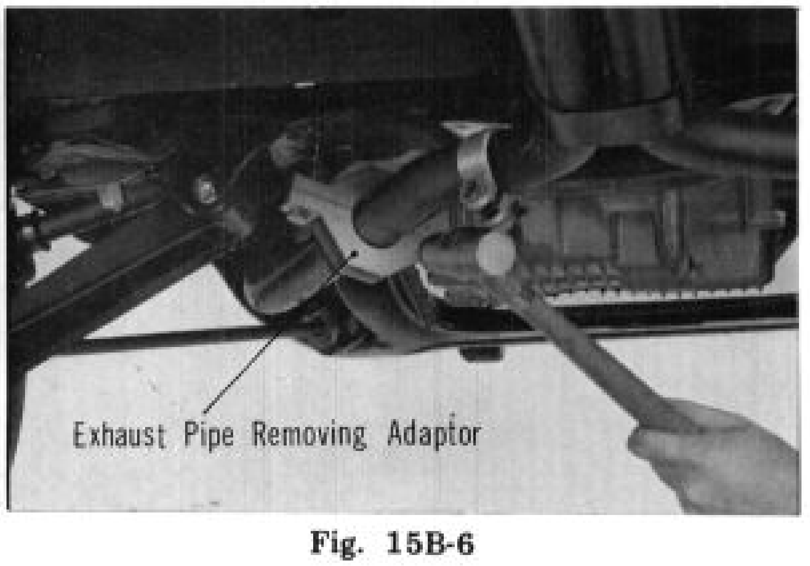


Fig. 15B-6

After securely installing the tool, knock the tool with the copper hammer, thus removing the exhaust pipe.

When reconnecting, use the special tool, exhaust pipe fitting driver and expand a little the joint lips (installing position). **(Fig. 15B-7)**

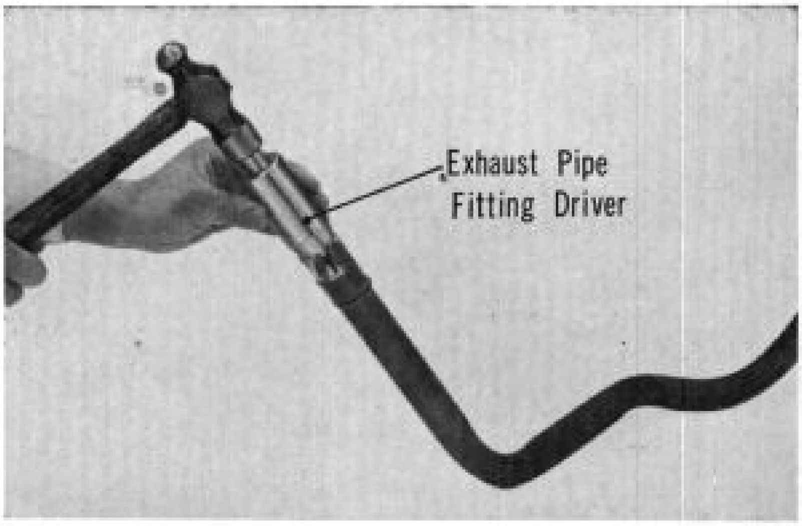


Fig. 15B-7

Apply liquid sealer on the pipe contact surface before connecting, and tighten the clamp bolt.

Clamp bolt tightening torque:
2.0 to 2.4 kg-m (14.5 to 17.4 lb-ft)

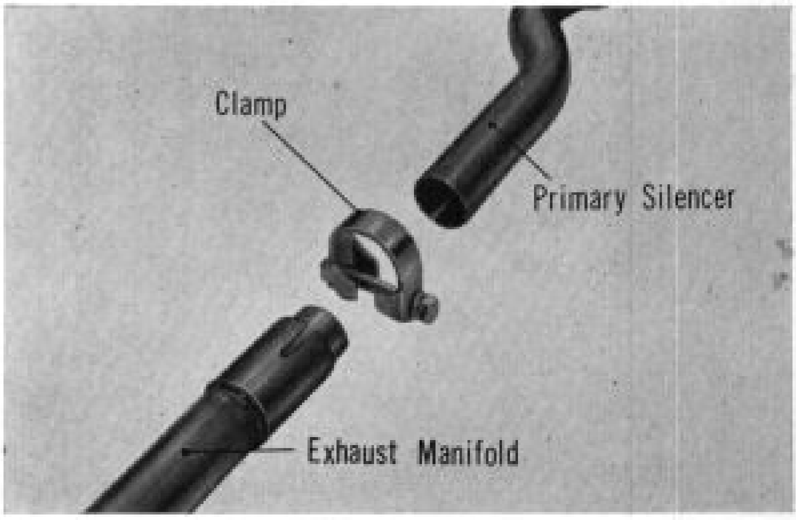


Fig. 15B-8

2. The primary silencer is joined to the main silencer with a clamp, and supported by rubber ring.
   Loosen the clamp bolt and pull out the primary silencer, and remove the rubber ring.

   Clamp bolt tightening torque:
   2.0 to 2.4 kg-m (14.5 to 17.4 lb-ft)

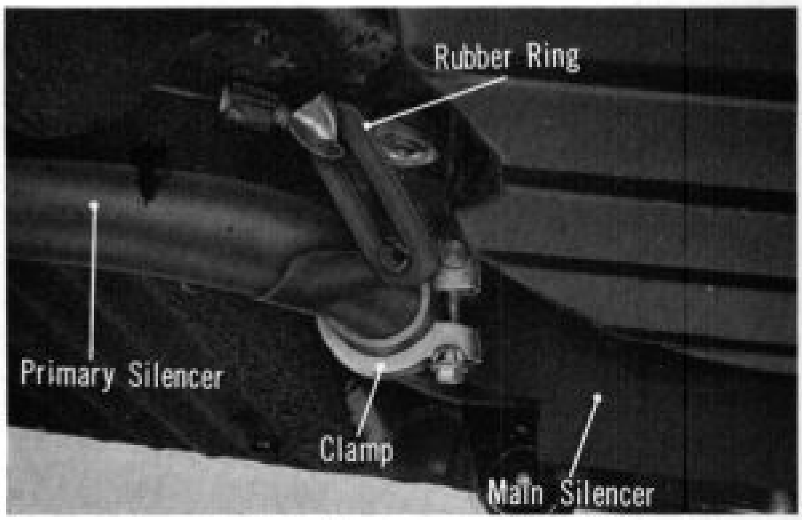


Fig. 15B-9

When reinstalling, remove the seized asbestos, and expand the primary silencer installing position by using a silencer fitting driver (special tool) on the main silencer. Install new asbestos and insert the primary silencer into position. If the rubber ring is loosened, twist it to be installed in a figure eight shape.

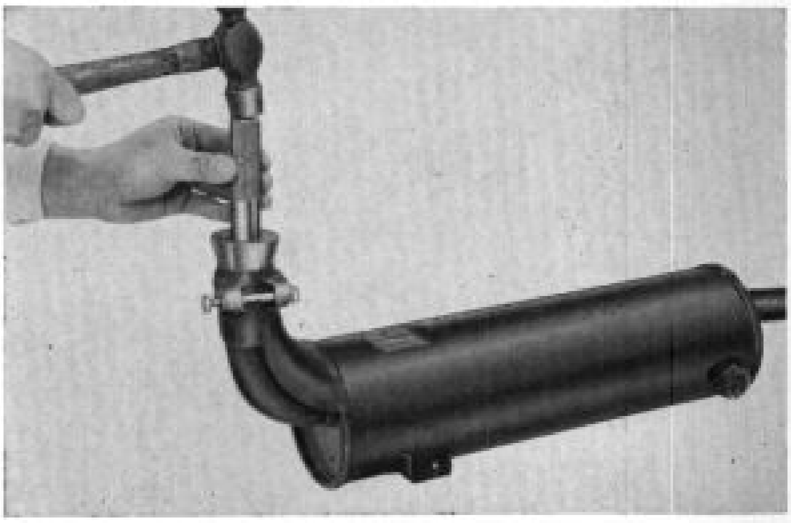


Fig. 15B-10

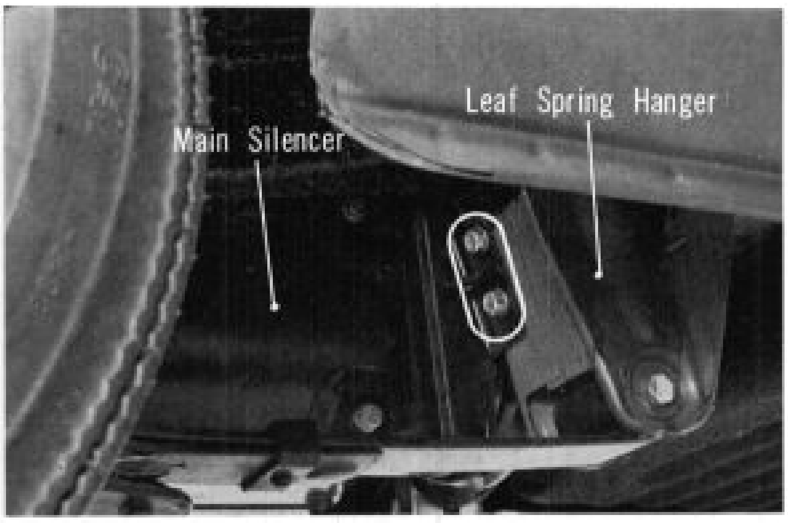


Fig. 15B-11

3. The main silencer is mounted on the spring hanger. Remove the two bolts.

   Tightening torque:
   2.0 to 2.4 kg-m (14.5 to 17.4 lb-ft)

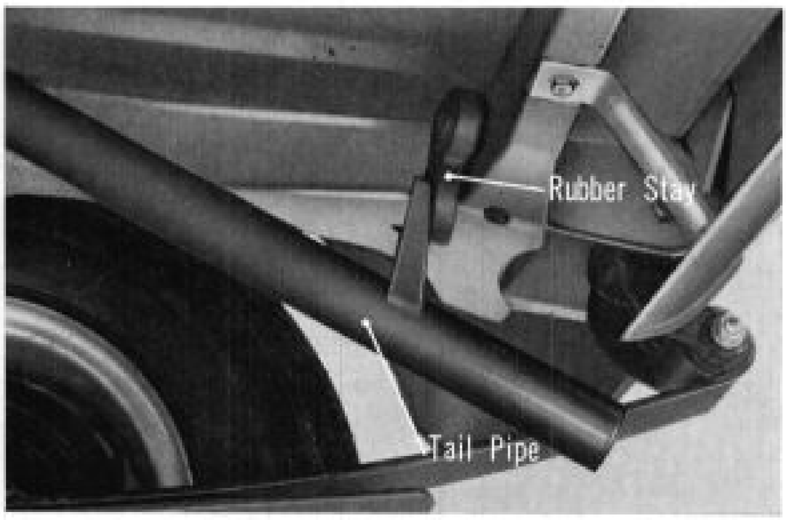
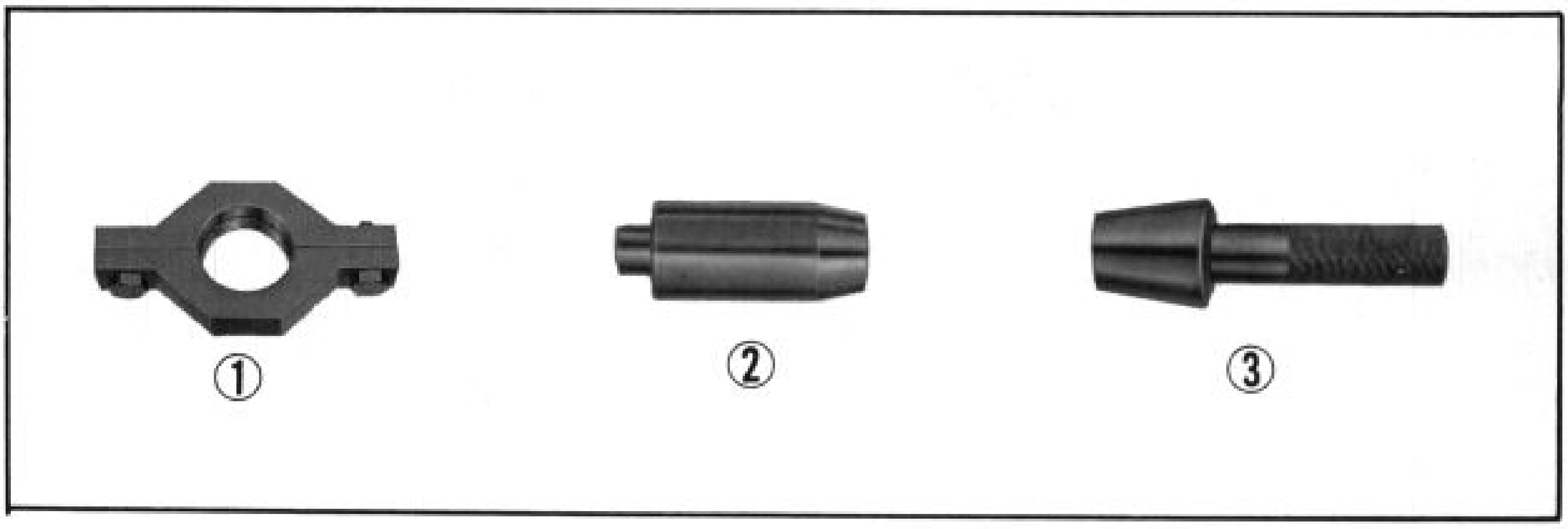


Fig. 15B-12

4. When tail pipe rubber stay is removed, the silencer and tail pipe can be removed as a set.

C. Special Tool



Ref. No.	Tool No.	Descriptio	360 400	600
1.	07066-55121	Exhaust pipe removing adaptor	○	
	07066-56811	Exhaust pipe removing adaptor		○
	07066-56812	Exahust pipe removing adapter		○
2.	07066-55101	Exhaust pipe fitting driver	○	
	07066-56801	Exhaust pipe fitting driver		○
	07066-56802	Exhaust pipe fitting driver		○
3.	07066-55111	Exhaust silencer fitting driver	○	○

SECTION 16

HEATER AND VENTILATION

16

A. General Description

The body ventilating system takes in fresh air from the periphery of the headlights. The intake air is guided into the interior from the front ventilator lids both sides of the instrument panel, and goes out by way of the rear gadget tray to the luggage compartment. From the luggage compartment, air is discharged into the atmosphere through rear ventilator lids.
Two types of heaters are employed, an engine type **(Fig. 16A-1)** and an exhaust type. The engine type utilizes air which has been to cool the engine, and the exhaust type heats fresh air by way of the exhaust pipe and forces the air by way of a blower into the interior of the vehicle. When the heater/defroster control lever, installed on the instrument panel, is switched to the "defrost" position, the heated air run along the inside of the front windshield for defrosting while the heated air turns its direction to the front floor when the lever positioned at the "room".

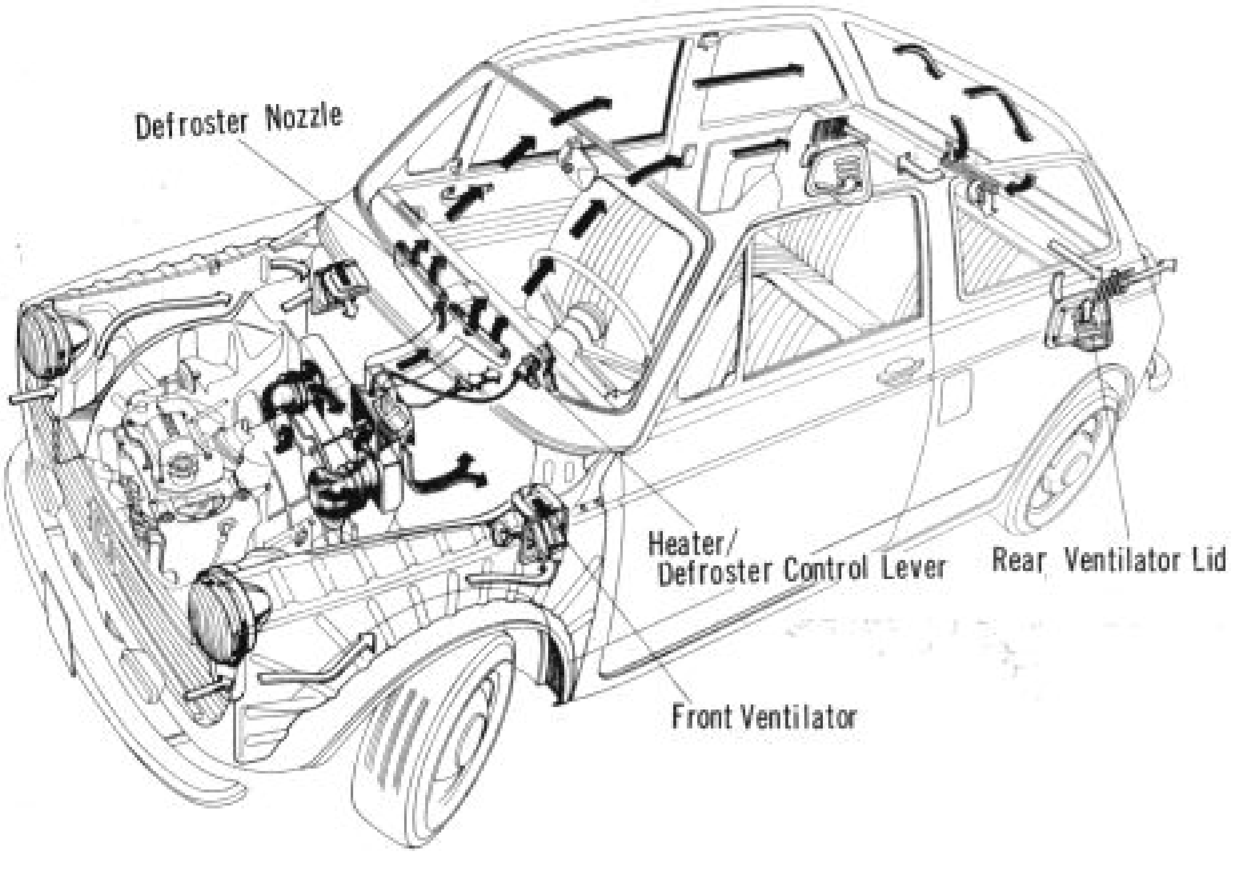


Fig. 16 A-1

B. Ventilation

Removal of front ventilator

1. Remove the four tapping screws and the front ventilator can be removed.
   The front ventilators are installed on the right and left sides, and are different in the direction of vanes.

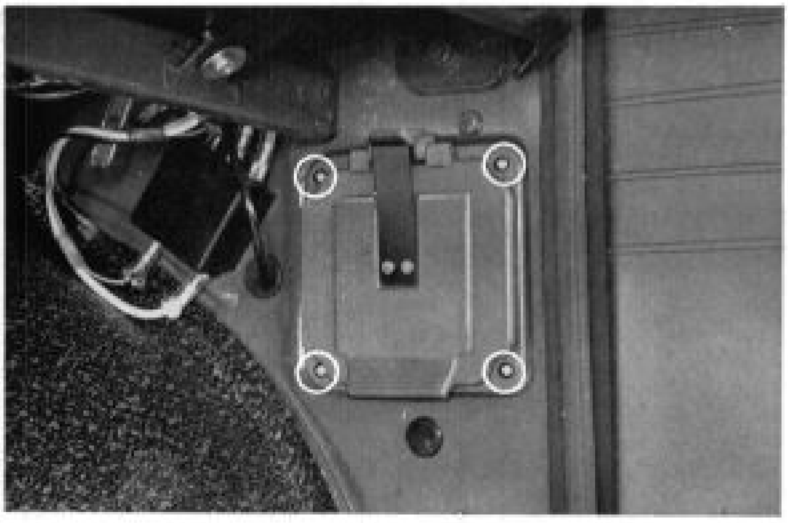


Fig. 16 B-1

Removal of rear ventilator

1. The rear ventilator lid is made of polyethylene (HD), and is inserted in the vehicle body with the pawls, provided in three different positions. To remove the rear ventilator, merely wrench out the periphery of it with a screwdriver.
2. When romounting it, set it in position by tapping lightly by hand.

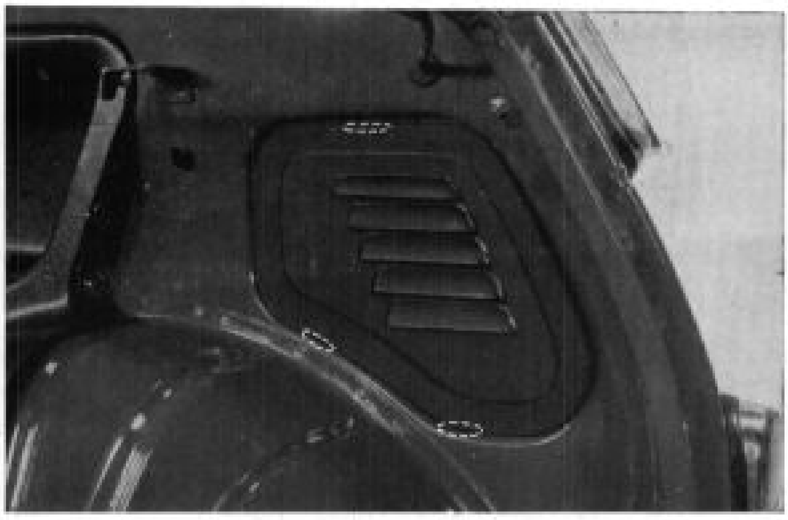


Fig. 16 B-2

3. To prevent the entry of rain into the luggage compartment, a vinyl curtain is placed on the body panel. (Refer to Fig. 16B-3)

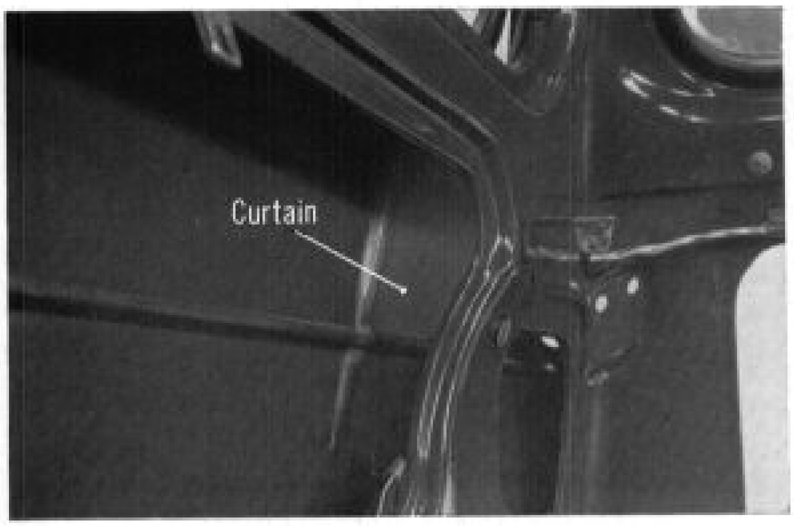


Fig. 16 B-3

C. Engine Type Heater

Description

Air warmed as it is sucked in by the cooling fan (into the space between the cylinders and the cylinder head to cool the engine) is introduced through a duct into the passenger compartment. This system is such that no power is required to operate the heater, and as the construction is simple, operation remains trouble free.

The introduction of hot air (produced by cooling the engine) into the passenger room or its discharge directly into the atmosphere are accomplished by either pushing the heater drum in or drawing it out. The hot air is further controlled by a valve in the heater/defroster control housing so as to provide air supply to the defroster or to the passenger compartment.

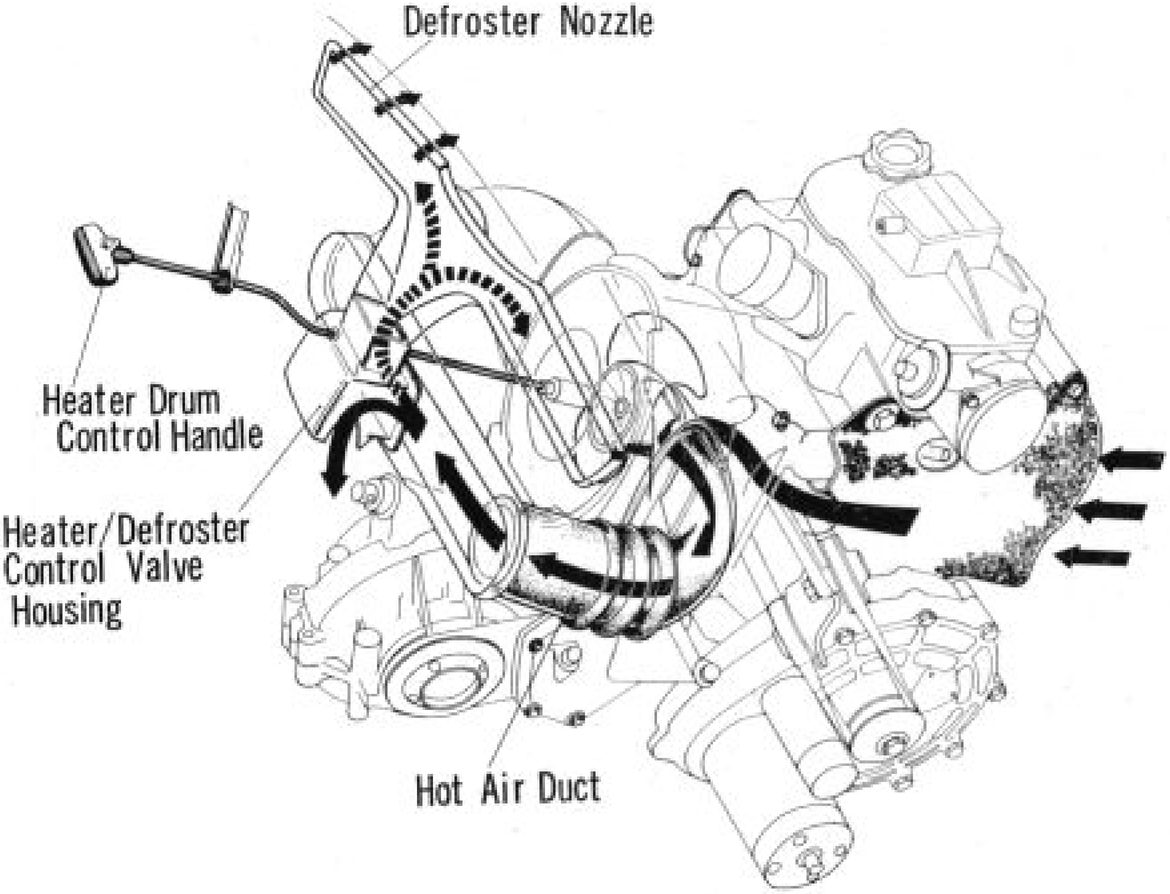


Fig. 16C-1

Removal and Disassembly

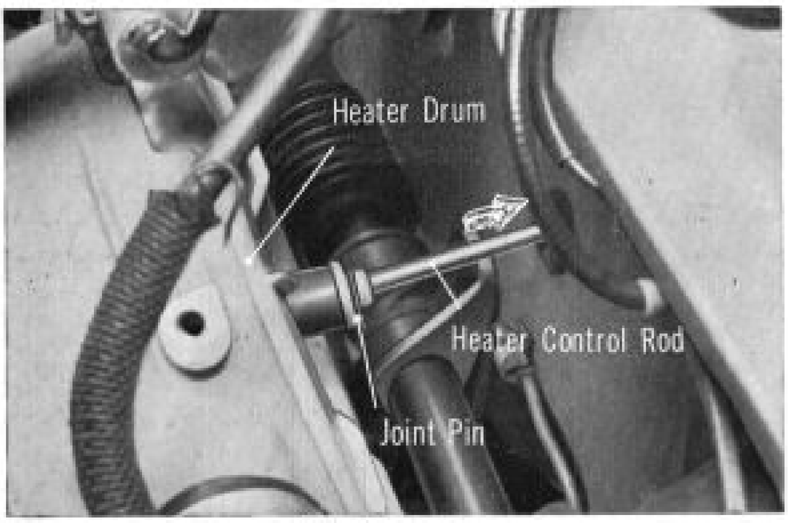


Fig. 16 C-2

1. Pull out the heater control rod joint pin to disconnect the rod from the heater drum and then force the rod toward the interior of the vehicle.

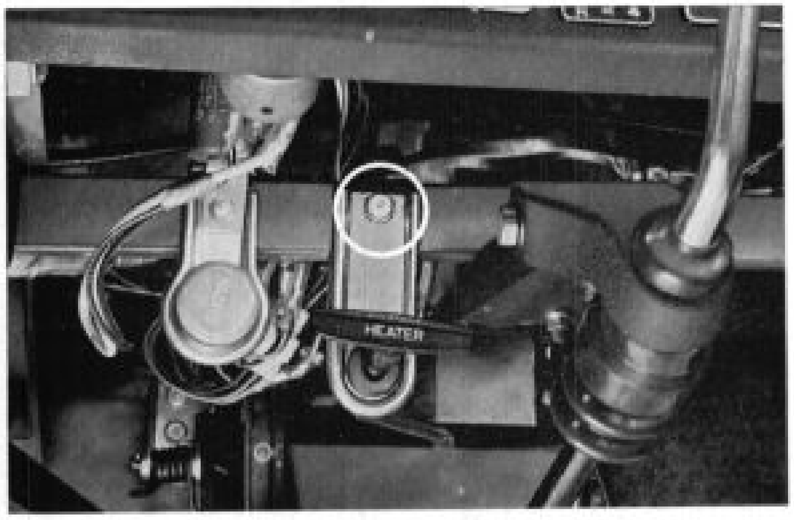


Fig. 16 C-3

2. Remove the control lever bracket,and remove the rod from the housing.

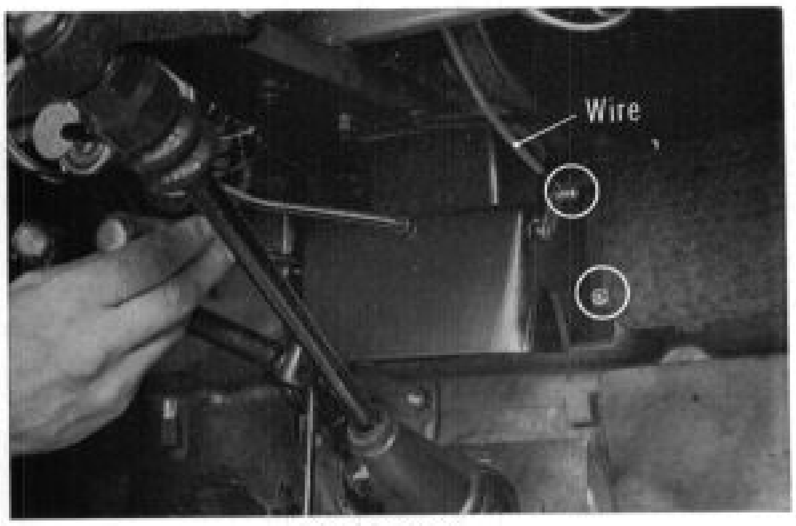


Fig. 16 C-4

3. Loosen the screw and remove the wire mounted of the valve lever.

4. Remove the two control valve housing installation screws and separate the housing.

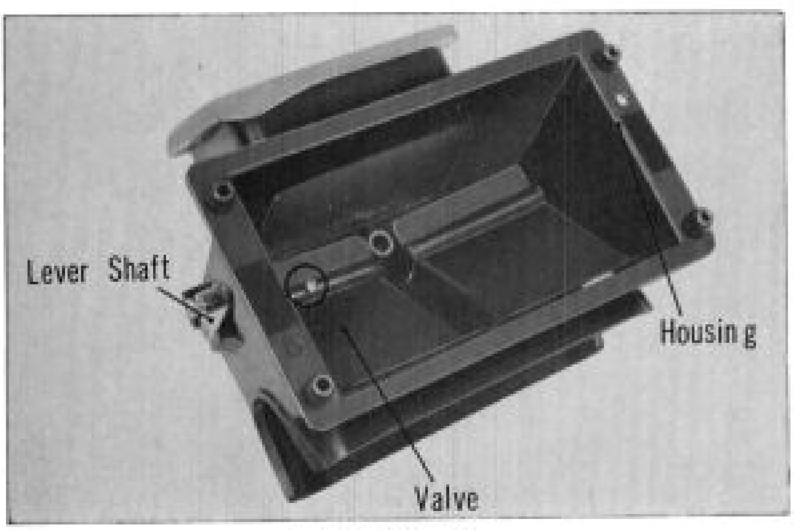


Fig. 16 C-5

5. The control valve is installed on the shaft with a screw. After removing the screw, remove the lever shaft from the housing.

6. Loosen the screw, and separate the heater/defroster control lever knob from the lever. (Fig. 16C-6)

Fig. 16 C-6

7. The heater/defroster control lever assembly is installed on the instrument panel with two screws provided on the back side of the panel. (Fig. 16C-7)

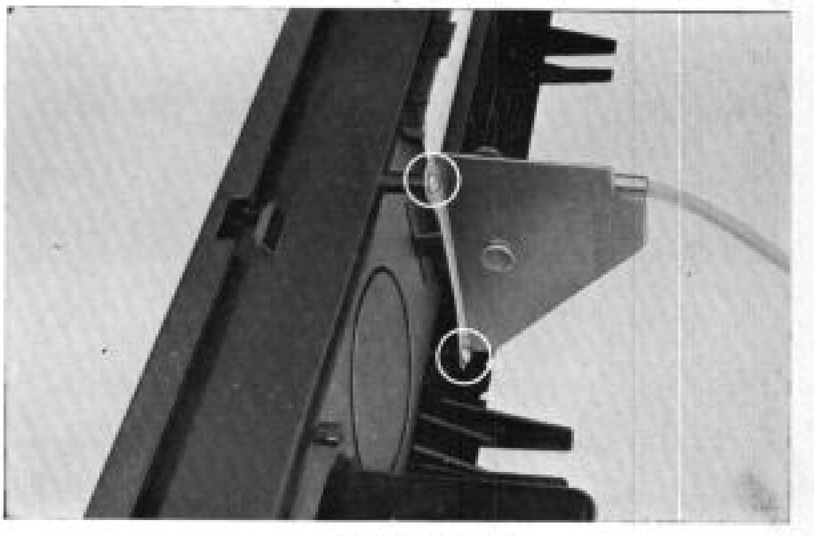


Fig. 16 C-7

D. Exhaust Type Heater

Description

Fresh air is introduced through the port on the left-hand side of the head light, and forcedly fed by a blower through air inlet duct into the heat exchanger integrated with exhaust pipe. The air warmed here is then introduced into the passenger room through the heater control valve and the hot air duct. The hot air supplied to the defroster or to the interior is controlled by a heater/defroster control valve. When hot air is not utilized for interior heating, it is discharged outside the engine room through the hot air discharge duct. An idle stop relay is installed in access to the regulator to open the blower motor circuit when the main switch is turned off. If the circuit is not opened, the blower motor works as a generator while free rotating and the generating current will flow back to the electrical system causing engine running off.

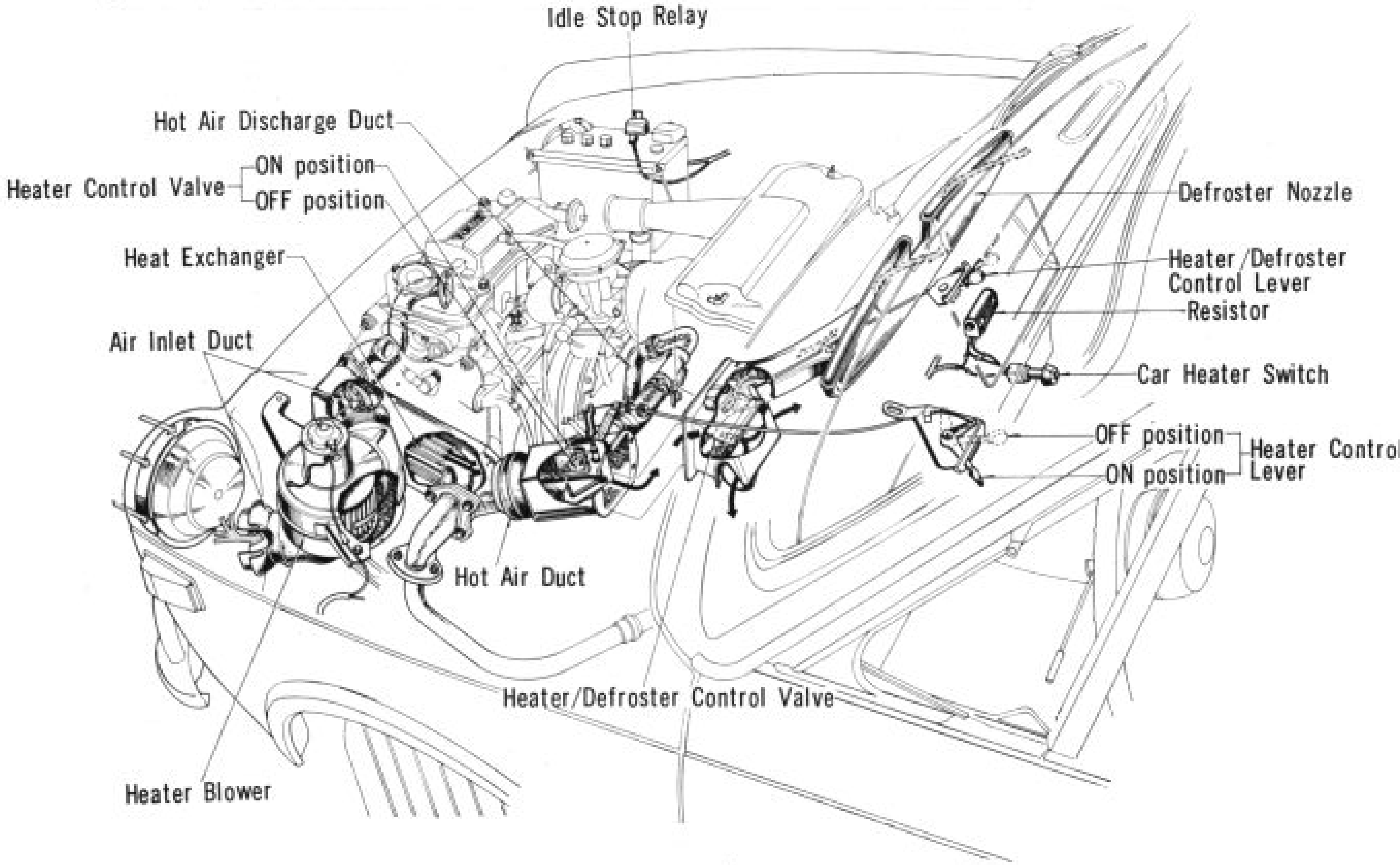


Fig. 16D-1

Removal and Disassembly

a. HEAT EXCHANGER AND BLOWER

The heat exchanger is connected to the exhaust pipes at the head and the tail by flanges, and supported at the bottom.

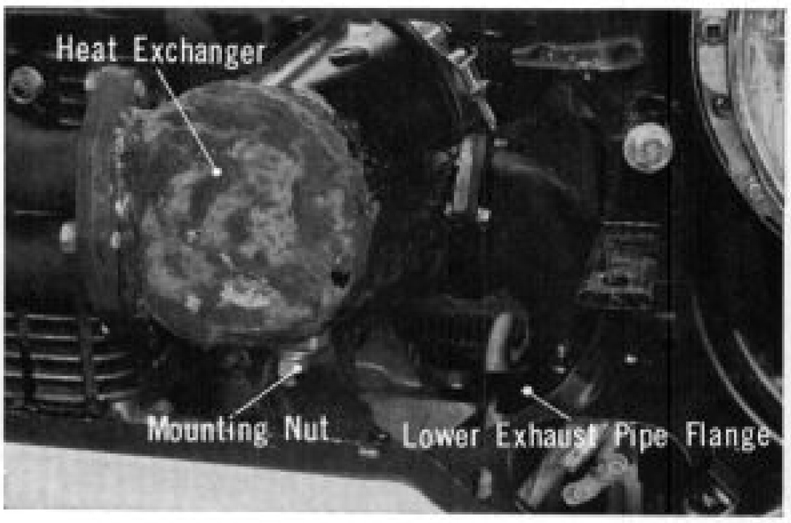


Fig. 16 D-2

Remove the air inlet duct B. Disconnect the electrical lead (+), and then remove the blower assembly. Air intake duct A is connected to the blower. Disconnect this duct; otherwise the blower assembly cannot be taken from the engine room.

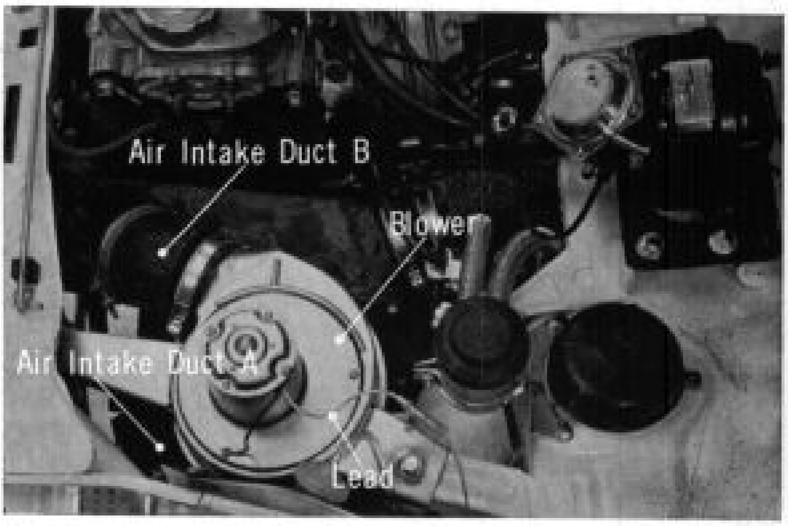


Fig. 16 D-3

Periodical checking of the mounting bolts will be required to prevent gas leakage, which may be caused by loose bolts and nuts at the junctions.

Tightening Torque	8 mm bolt and nut	2.0~2.4 kg-m	(15~18 lb-ft)
	10 mm heat exchanger mounting nut	4.0~4.8 kg-m	(29~35 lb-ft)

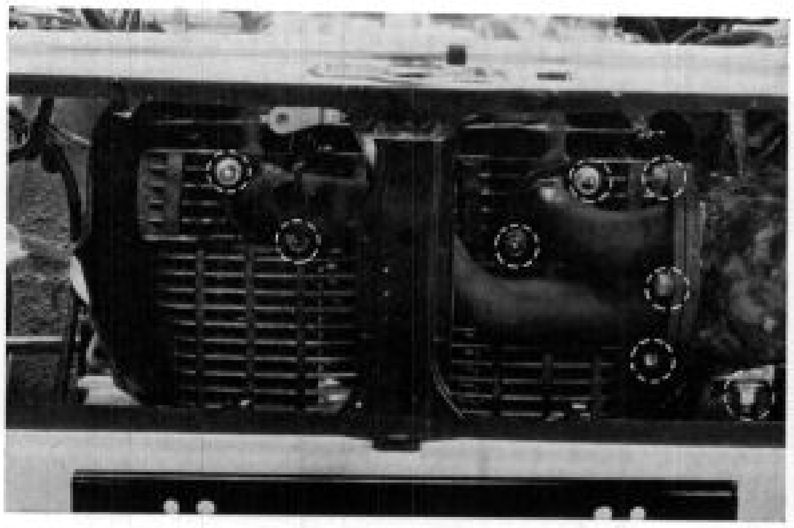


Fig. 16 D-4

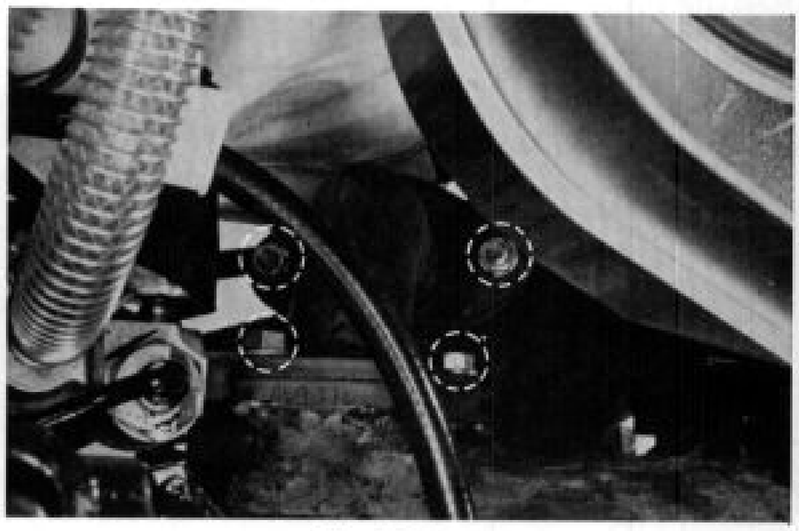


Fig. 16D-5

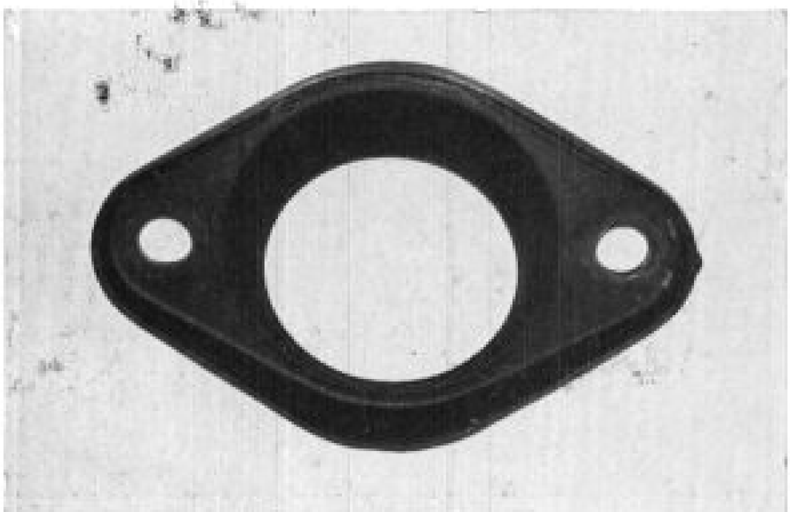


Fig. 16D-6

Installation

1. Discard old gaskets and install new gaskets whenever reinstalling the heat exchanger and/or exhaust pipes.
   Further, the lower exhaust pipe flange is recommended to be replaced as the old flange may be permanent-strained.

2. If the exhaust pipes and heat exchanger are not mounted neutrally, they may be cracked or broken soon due to strain concentration on a particular point. When reassembling exhaust pipes and heat exchanger, first loosely mount them and place all mounting nuts and bolts. Then, torque the nuts and bolts evenly and alternately. Work from the front of the car toward the rear and progressively adjust the components. Upon completion, tighten the nuts and bolts to specification as follows.

Tightening torque:

8 mm bolts and nuts	2.0~2.4 kg-m (14~18 lb-ft)
10 mm nuts	40~4.8 kg-m ((29~35 lb-ft)

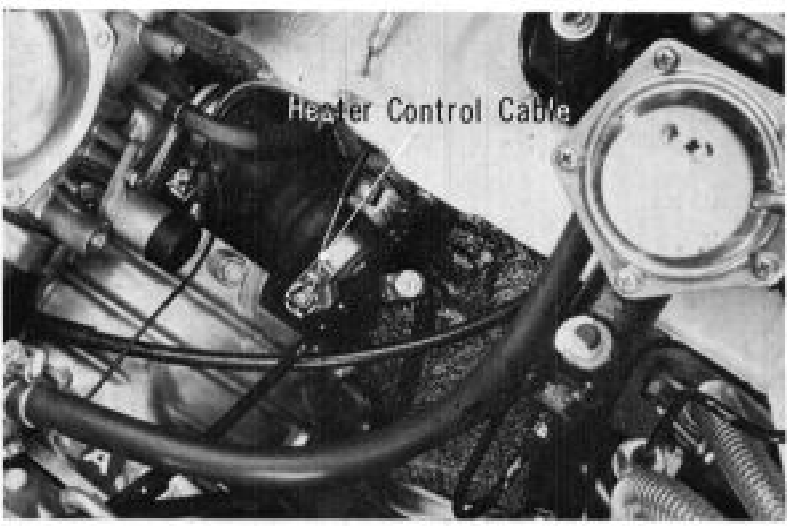


Fig. 16D-7

3. (Adjustment of Heater Control Cable)

   Adjust the control cable at heater control valve "shut" position.

   Shut the valve by hand and adjust the cable while positioning the heater control lever at SHUT position.

Loosen the screw, and separate the heater/defroster control lever knob from the lever.

Fig. 16 D-10 (Standard Instrument Panel)

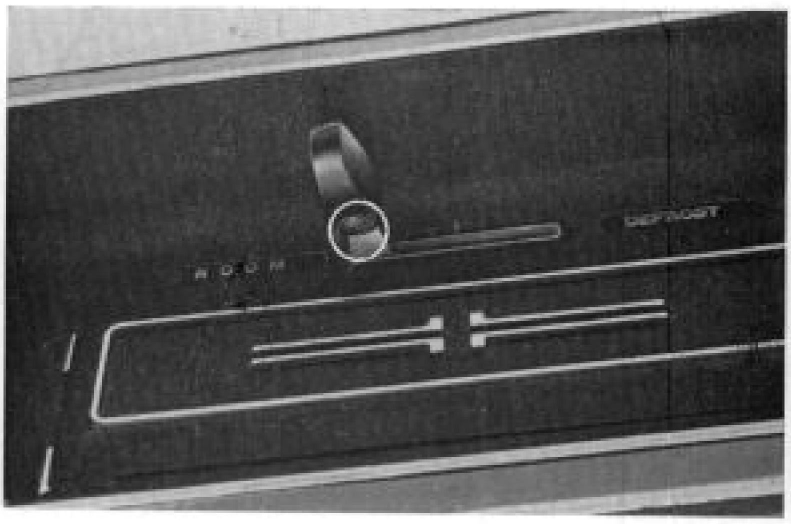


Fig. 16 D-11 (Deluxe Instrument Panel)

The heater/defroster control lever assembly is installed on the instrument panel with two screws provided on the back side of the panel.

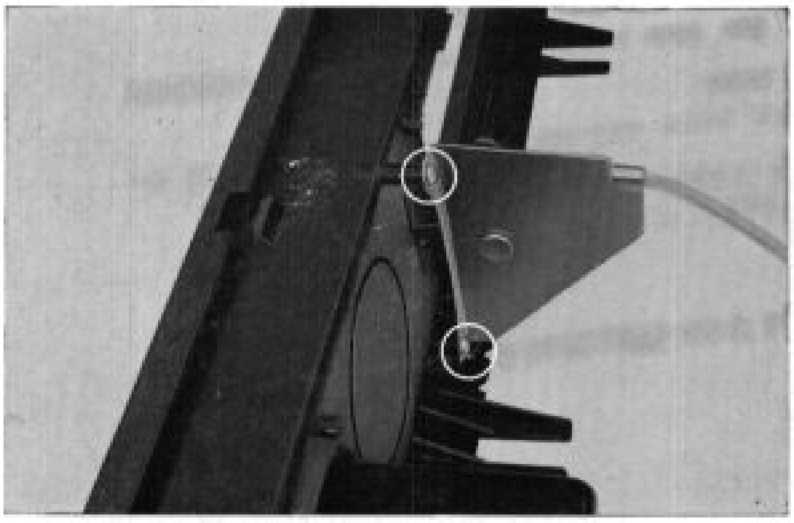


Fig. 16 D-12 (Standard Instrument Panel)

Fig. 16 D-13 (Deluxe Instrument Panel)

c. CONTROL VALVE HOUSING AND DEFROSTER NOZZLE

Loosen the screw and remove the wire mounted on the valve lever.

Remove the two control valve housing installation screws and separate the housing.

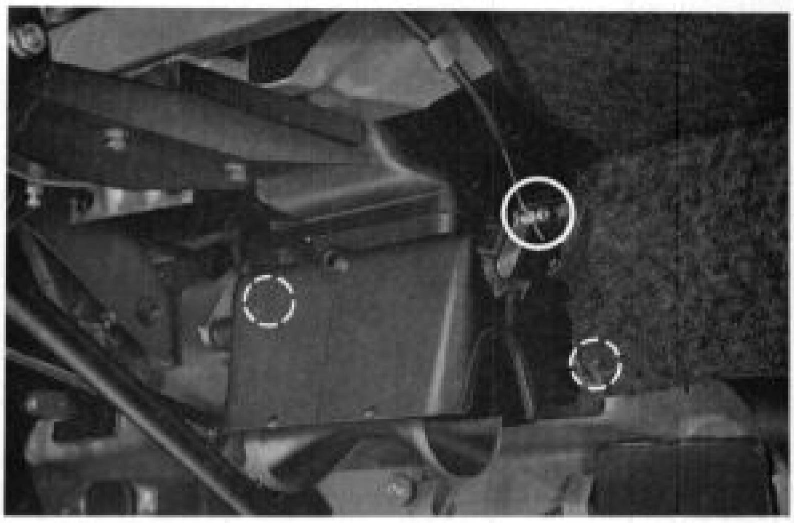


Fig. 16 D-14

The defroster nozzle is mounted at three points.

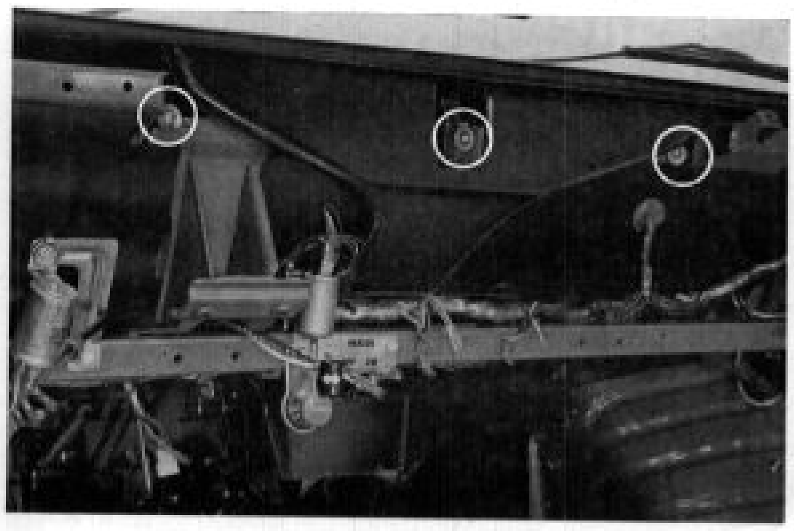


Fig. 16 D-15 (Standard Instrument Panel)

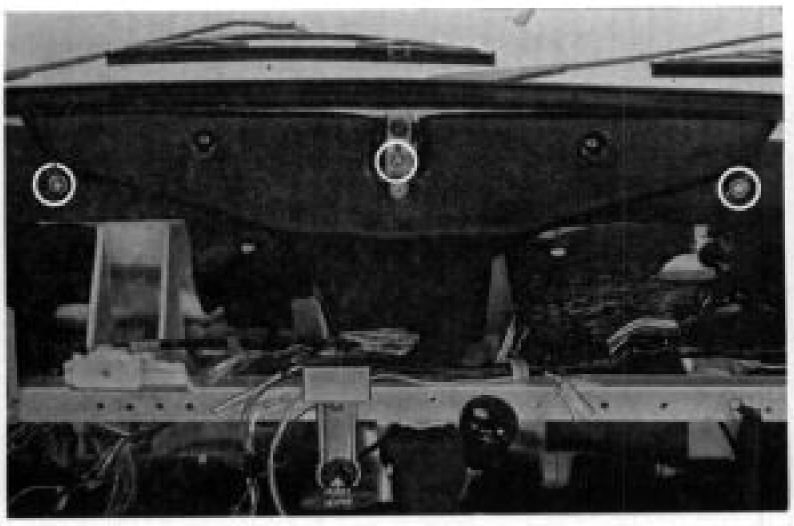


Fig. 16 D-16 (Deluxe Instrument Panel)

Check the defroster nozzle seals for air leakage.

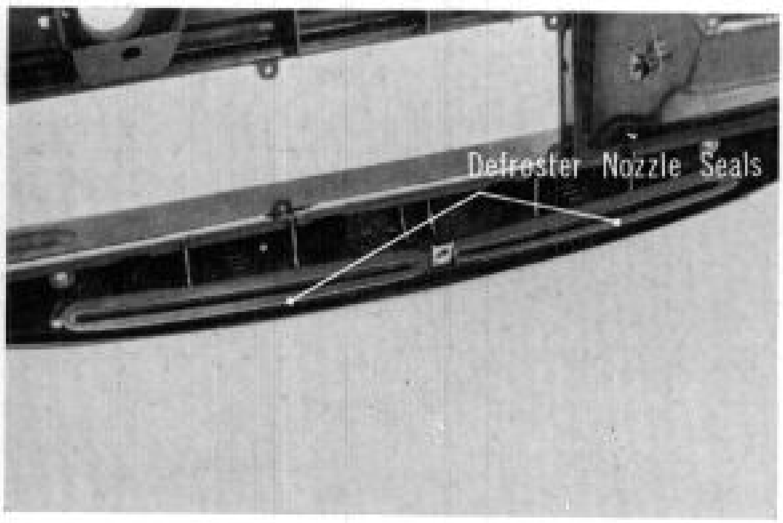


Fig. 16 D-17

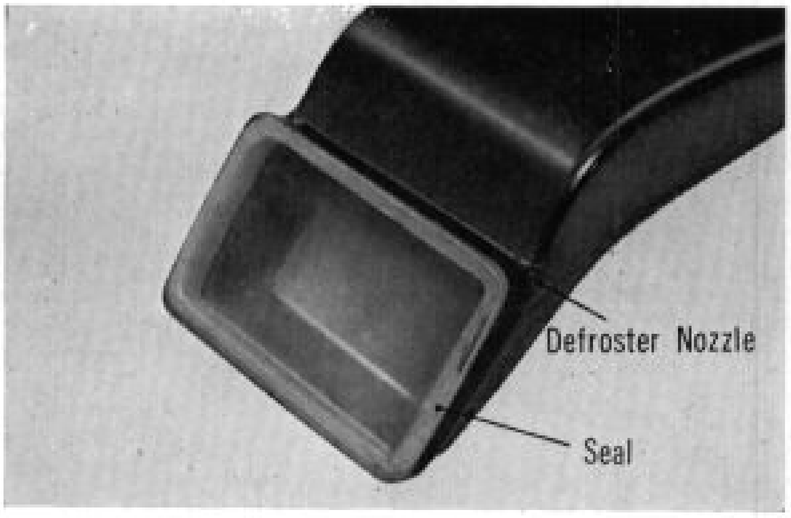


Fig. 16 D-18

E. Electrical Wiring Diagram (Exhaust Type Car Heater)

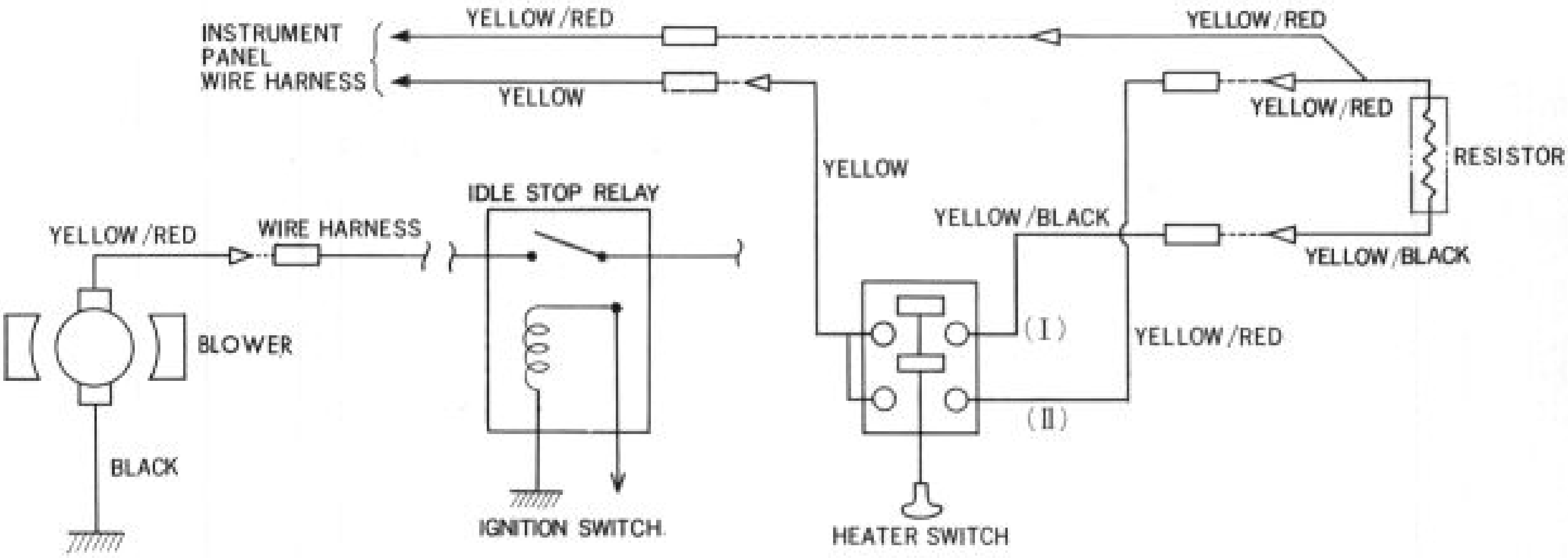


Fig. 16D-19

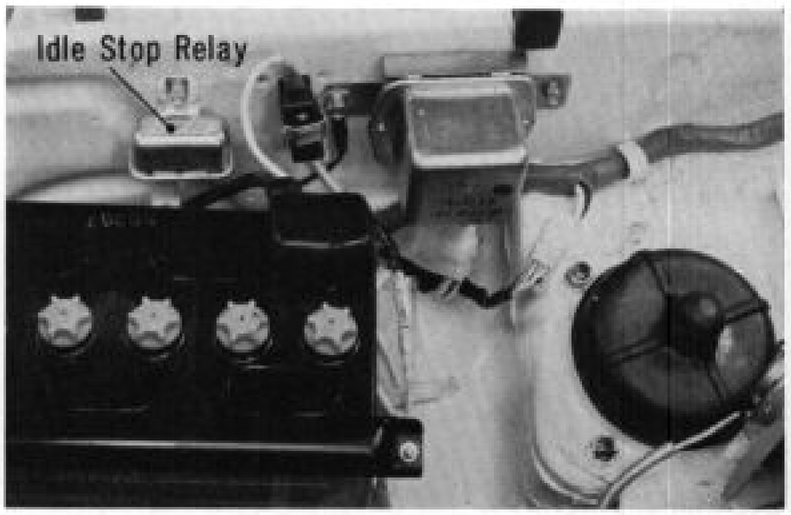


Fig. 16D-20

MEMO

SECTION 17

ELECTRICAL (1)

ENGINE ELECTRICAL SYSTEM

17

ELECTRICAL (2)

A. Description

The electrical system of the engine can be classified into three basic groupes:

1. Ignition circuit
2. Starting circuit
3. Charging circuit

In the 360 and 400 vehicles, the motor-generator is used for starting and charging circuit, and as a result, inspection and maintenance is easy.
In the 600 vehicle, an AC generator is used for charging circuit and a starter motor for starting circuit.

Battey:

The battery supplies power to all circuit, and inspection and maintenance is necessary. When trouble shooting any circuit, inspection must start with the battery, and then proceed to the individual system.
Battery maintenance and inspection is described in the SECTION 2. ENGINE TUNE-UP and SECTION 19. PERIODIC MAINTENACE.

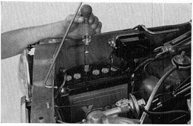


Fig. 17A-1

B. Ignition System

See SECTION 4. E. IGNITION.

C. Starting and Charging Circuit (360 and 400)

a. Description

The starting and charging circuit consists of the battery, motor-generator, ignition switch, and related wiring. These are electrically connected as shown in Fig. 17A-2 below.

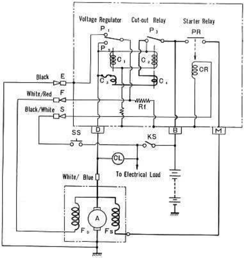


Fig. 17A-2

b. Technical Data

Motor-Generator		
Motor characteristic	Output (rated)	350W
	No-load Speed	Below 1,000 rpm
	Torque (no-load)	Over 0.5kg-m Over 350 rpm, at 10.6 V, 50A.
	Torque (locked)	Over 2.7 kg-m, Below 180A
Generator characteristic	Output (rated)	250W
	Speed (no-load)	Below 1,350 rpm at 13.5V, 25°C.
	Speed (loaded)	Below 1,700 rpm at 13.5V, 18A (cold-20 to 30°C)
Brush Length		26mm (1.02 in)
Regulator	Adjusted voltage	14.8 to 15.8V
	Voltage (loaded)	13V or higher (with load of 8A)
	Cut-in voltage	12.5 to 13.5V
	Reverse current	4 to 12A
Starter Relay	Operating voltage	Less than 8V
	Operating current	Less than 2.5A (when operated 8V)
	Contact resistance	Less than 0.2V (100A)
	Weight	0.7 kg (1.54 lbs)

c. Maintenance

The rotor of the motor-generator is installed on the crankshaft end at the right hand side of the engine The crankshaft pulley is located at the end of the rotor. The motor-generator operates not only as a starter to start the engine but also charges the battery and supplies power to the load as a generator.

It is a DC 12V type, and compactly arranged field coils (eight) are installed on the stator.

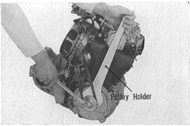


Fig. 17A-3

1. Remove battery.
2. Remove crankshaft pulley.
   The crankshaft pulley has two flat surfaces inward. The pulley holder (special tool) is inserted and forced against these surfaces to grip the pulley. The pulley bolt is loosened by using a socket wrench. **(Fig. 17A-3)**

   Note:
   This tool is not tightened but is used to grip the pulley.

3. Remove generator cover with special tool generator cover nut wrench. (Fig. 17A-4)

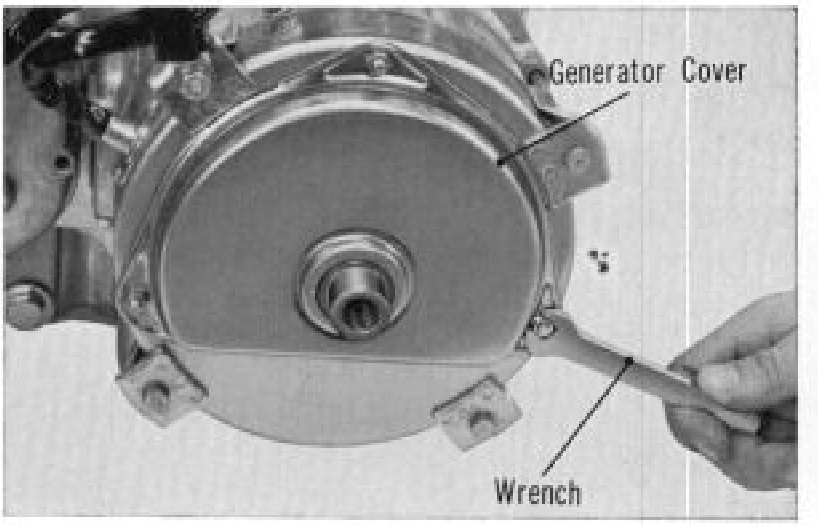


Fig. 17A-4

4. Check brush wear.

   If the length is less than 12mm (0.47 in), replace with new brushes. (Groove indicates the wear limit.)

Fig. 17A-5

5. Remove the stator.
6. Thread in the special tool rotor remover fully, and tap the remover lightly with a hammer. The rotor can then be pulled off the crankshaft.

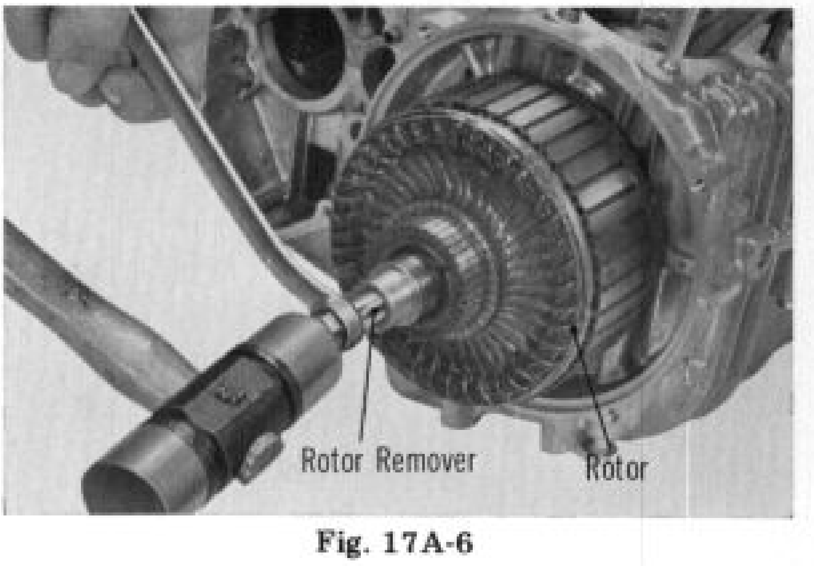


Fig. 17A-6

When reinstalling, match the crankshaft guide pin and rotor limit.

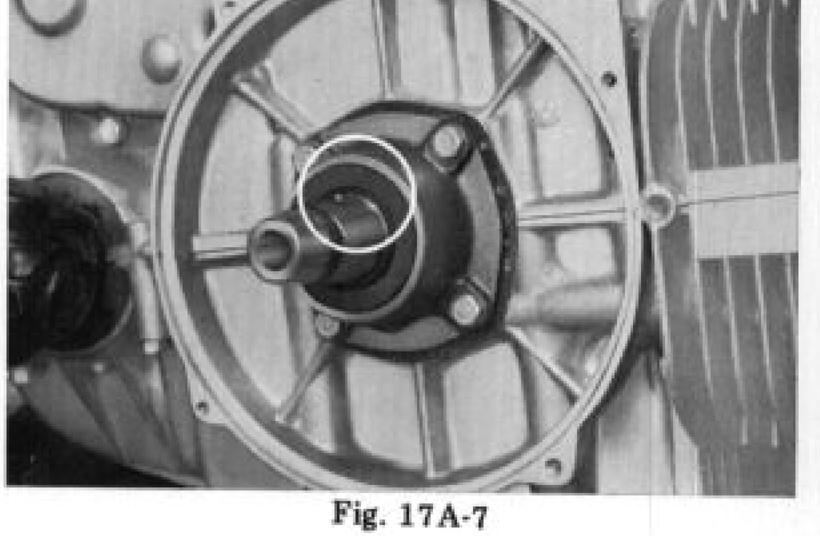


Fig. 17A-7

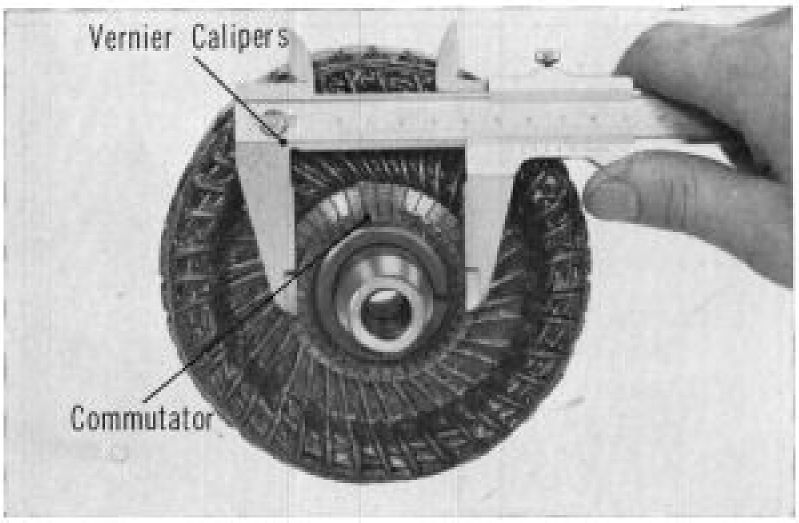


Fig. 17A-8

7. Measure commutator wear with vernier calipers.

   If the commutator outer diameter is less than 49mm (1.93 in), replace.

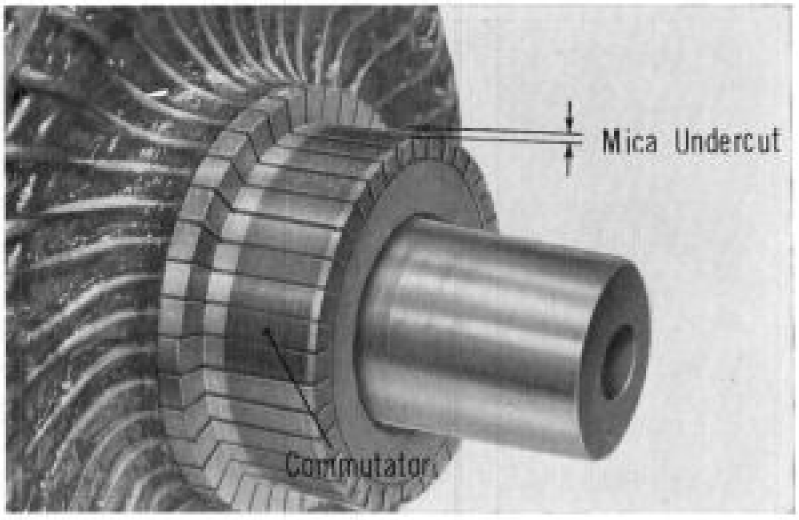


Fig. 17A-9

8. Measure the mica undercut.

   If the depth is less than 0.2mm (0.008 in), undercut to 0.5 to 0.8mm (0.020 to 0.032 in).

Fig. 17A-10

9. Measure resistance between the rotor coil and shaft. If the value is 10MΩ or more, the condition is satisfactory.

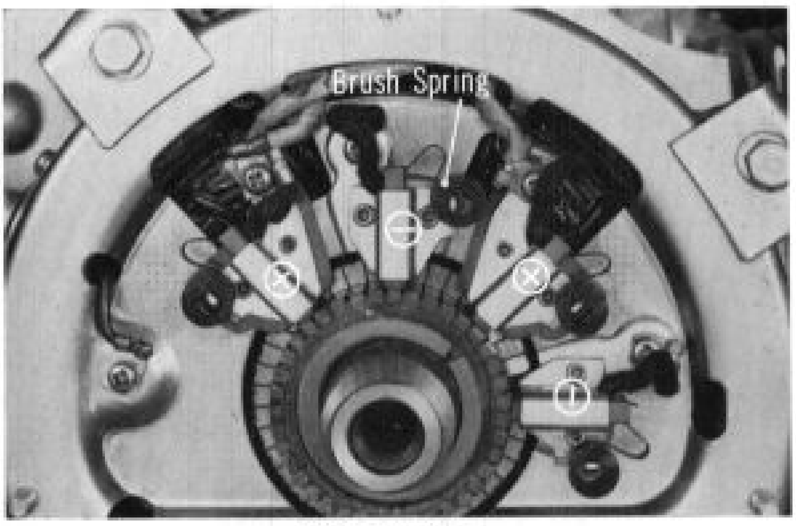


Fig. 17A-11

10. Measure brush spring tension.

    With a new brush installed, measure tension with a spring scale. If less than 500 grams (1.102 lb), replace.

11. Regulator

The regulator consists of two elements, 2-contact type voltage regulator and starter relays which function as a magnetic switch when operating as a starter. Wiring is shown in Fig. 17A-2.

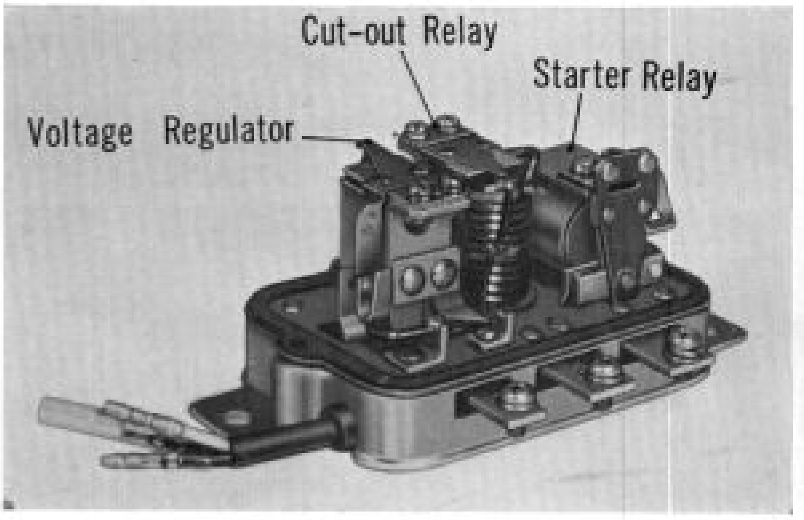


Fig. 17A-12

d. Trouble Diagnosis

1. When not charging or when charging value is low:

   Disconnect connector wiring, and ground the F terminal (white/red lead) at the motor-generator for a very short period of time. Gradually reduce engine speed to 2,000 rpm. Check voltage generated at the D terminal at this time; if more than 15V, the condition is satisfactory.

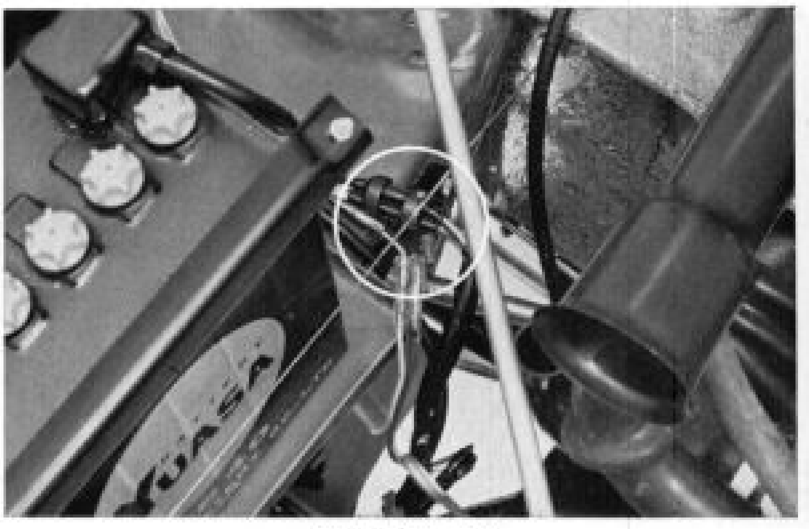


Fig. 17A-13

   When the voltage is below 15V, check brush and commutator contact and commutator cleanliness.

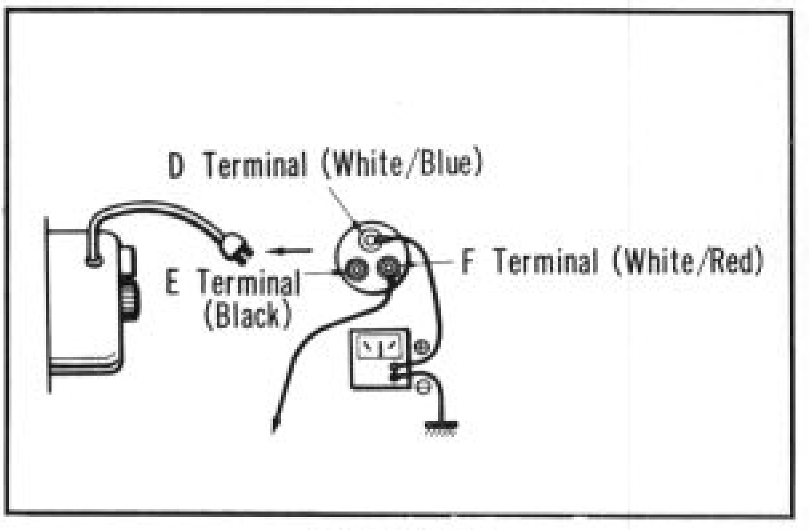


Fig. 17A-14

2. When motor-generator does not operate:

   Use a completely charged battery, and apply battery voltage directly to the M terminal of the motor-generator.

   If the unit does not operate, check brush and commutator contact and commutator cleanliness.

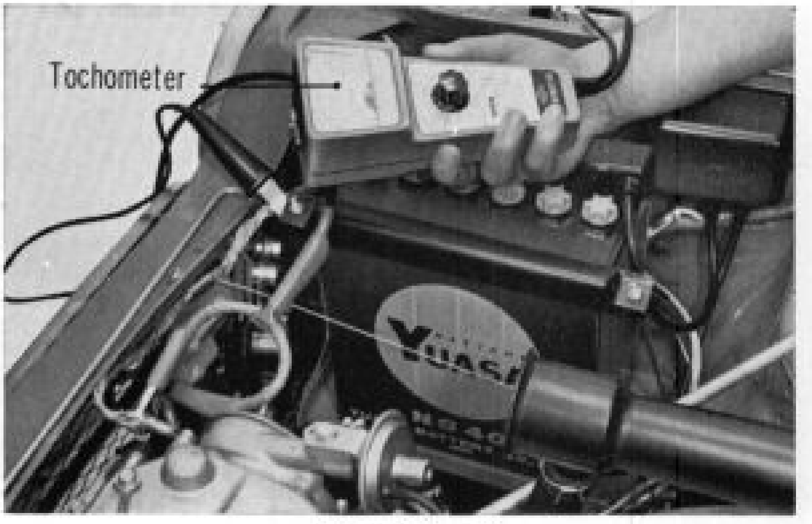


Fig. 17A-15

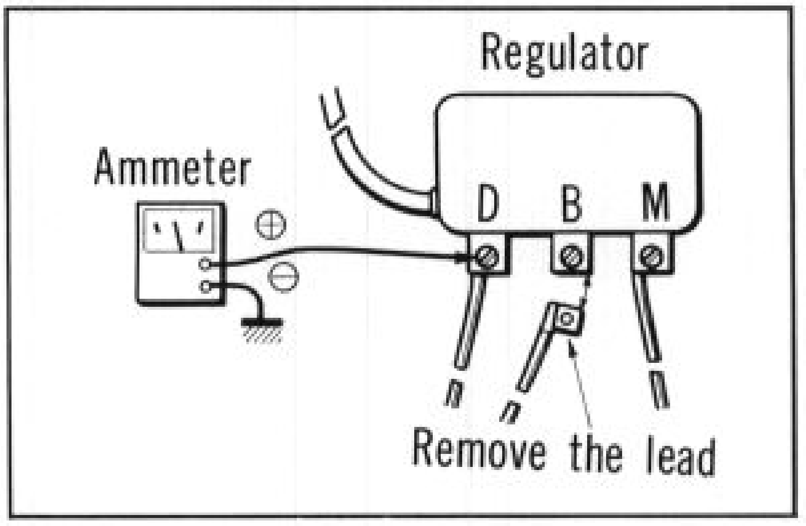


Fig. 17A-16

3. When charging is improper, check adjusted voltage of the voltage regulator. Connect a voltmeter to the D terminal of the regulator, disconnect the B terminal and observe the voltmeter as engine speed is increased to 2000 to 4000 rpm. If the voltage is in the range of 14.8 to 15.8V, the condition is normal.

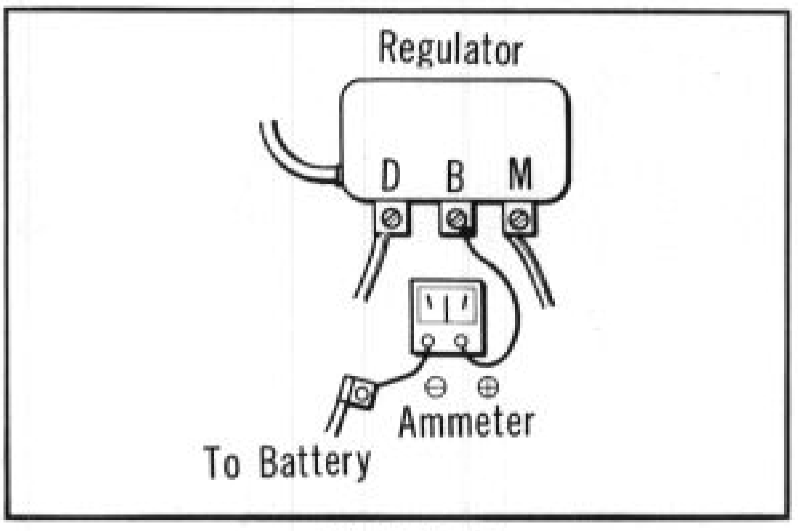


Fig. 17A-17

Connect an ammeter to the B terminal (+) of the regulator and reconnect the disconnected battery terminal (—). Check output current.

If the charging current under load (head lamps, wiper, etc.) is 10A or more, the condition is normal. Engine speed at this time is between 2000 and 3000 rpm.

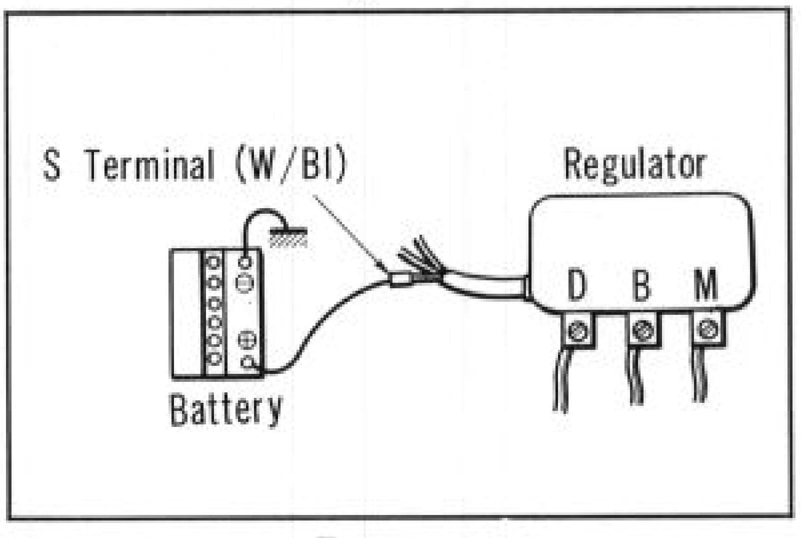


Fig. 17A-18

4. When motor-generator does not rotate:

With a separate lead, connect the battery (+) terminal to the S terminal of the regulator (white/black lead) and insure that the operating sound of the starting relay inside the regulator is normal.

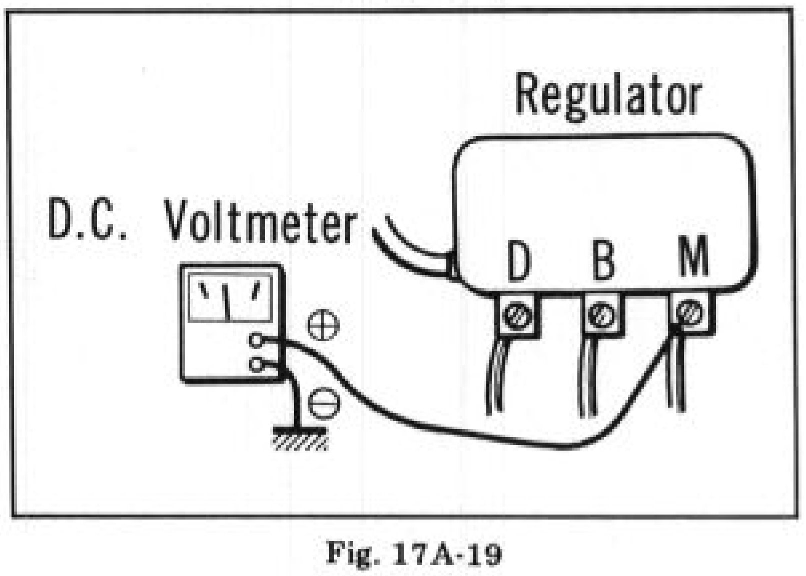


Fig. 17A-19

With the regulator connected to the motor-generator, connect a voltmeter between the M terminal of the regulator and ground. Read the voltmeter indication when the starting relay operates. If the value is 8V or more, the condition is normal.

D. Starter Motor (600 vehicle)

a. Description

Construction

The starter motor employed for 600 vehicle consists mainly of magnetic switch, motor, and pinion. The magnetic switch serves not only to engage and disengage the pinion through the shift lever by moving the plunger but also starts and stops the starting by opening and closing the main contact. Further, the magnetic switch is specially constructed to facilitate adjustment. A DC series motor with large starting torque is used. The pinion is equipped with an engine overrunning clutch which shuts off the force imposed by the engine when the engine is started.

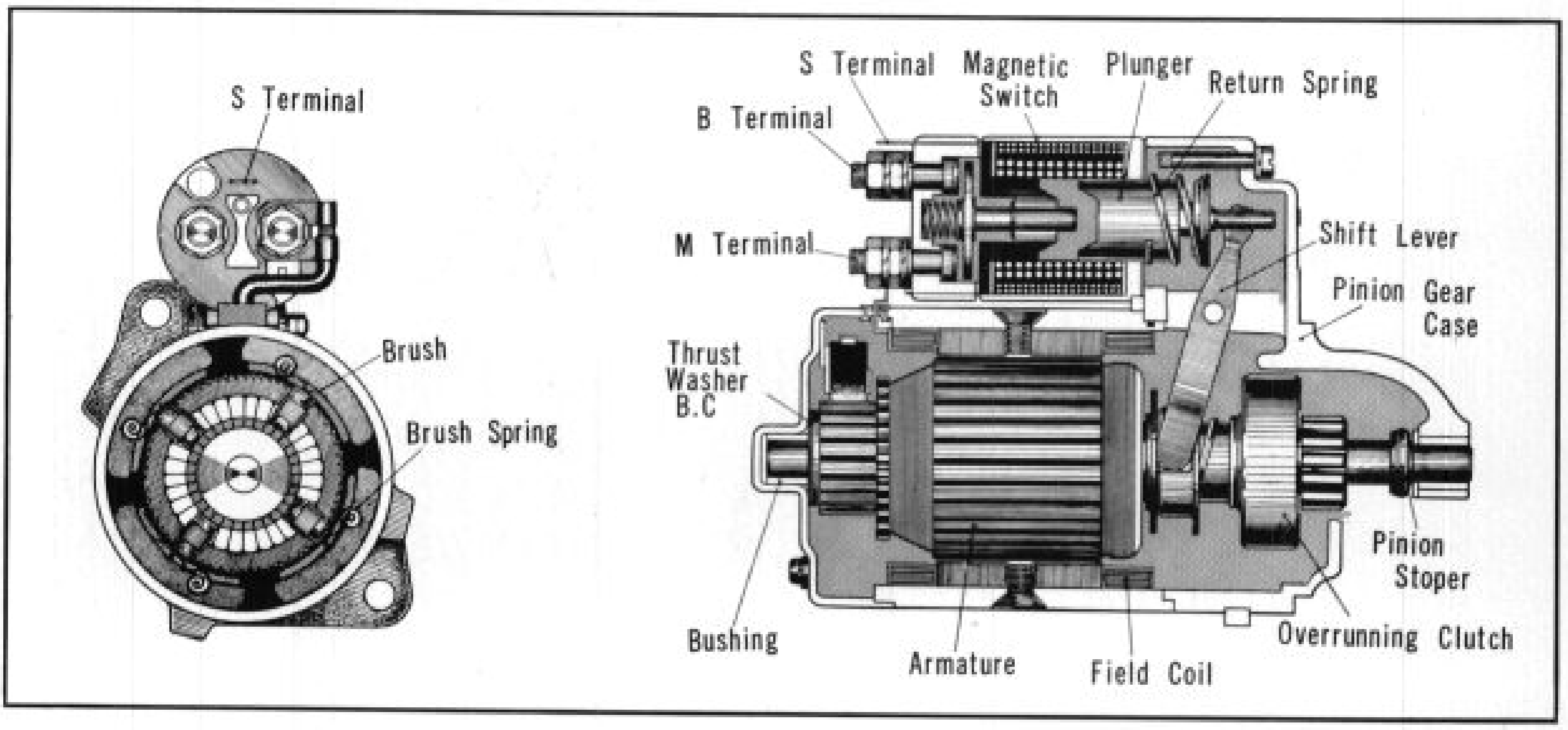


Fig. 17A-20

Overrunning clutch

The overrunning clutch is installed on the armature shaft, and is used to cut off engine torque immediately after the engine is started. This clutch consists of pinion collar, roller and clutch outer. The roller is constantly held under spring force, and its filled part of the clutch outer is tapered. (Fig. 17A-21)

The pinion and clutch outer can be idled in the rotating direction where it is positioned in the wider part of the tapered section of the clutch outer. In the rotating direction where the roller is positioned in the narrower part of the tapered section (clockwise as viewed from the pinion side or the rotating direction of the starting motor), the roller serves as a "key", transmitting rotation. (Fig. 17A-22)

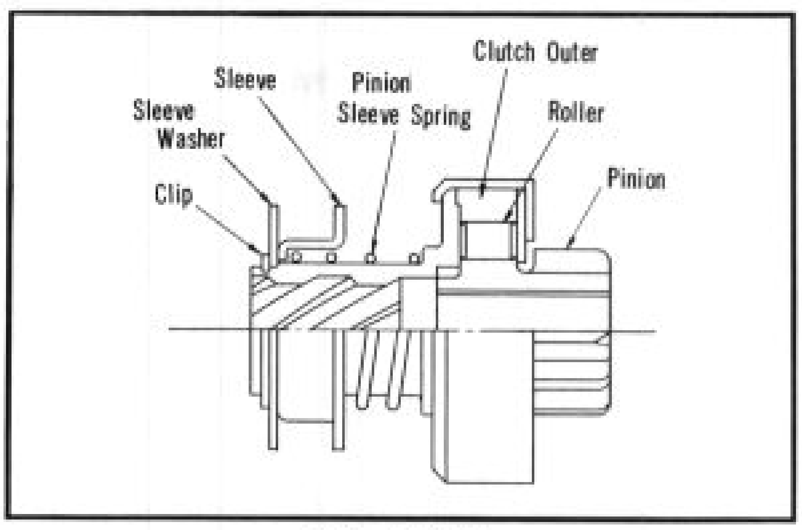


Fig. 17A-21

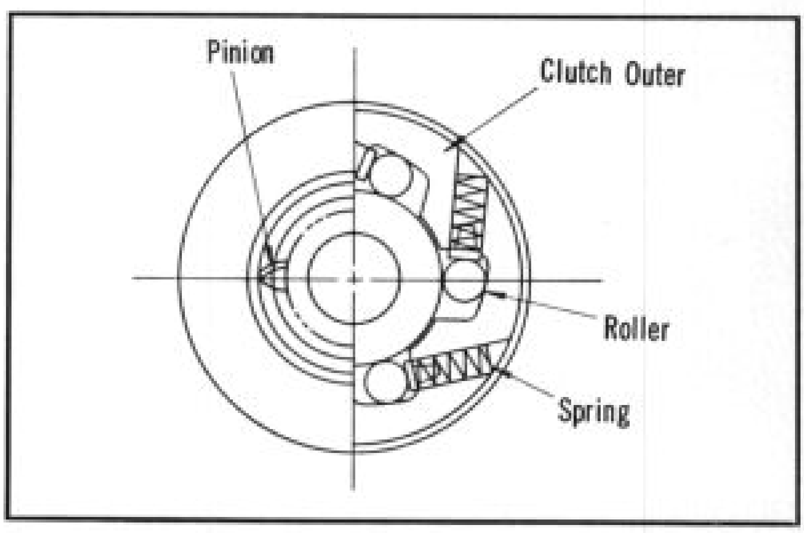


Fig. 17A-22

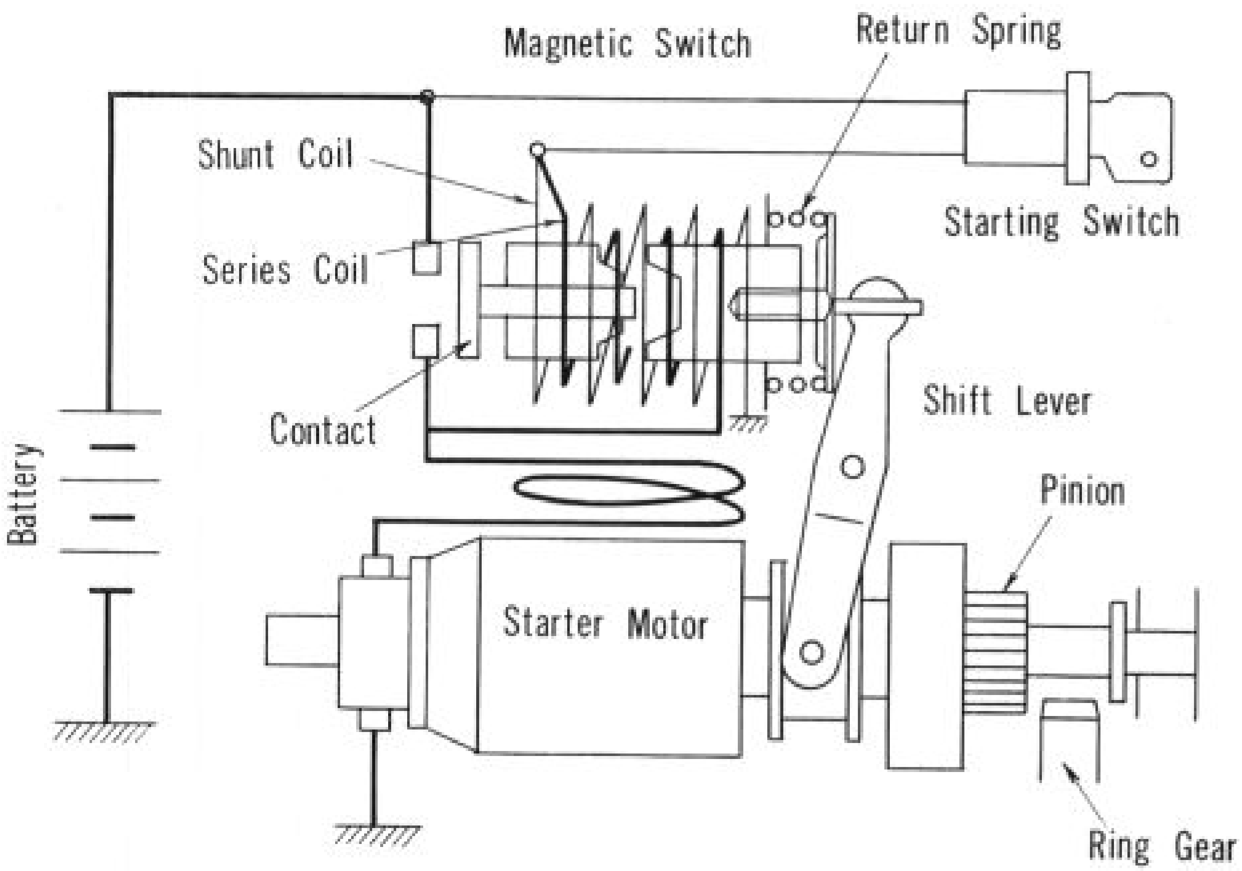


Fig. 17A-23

Principle of operation

The principle of operation is explained in sequence as follows:

(1) Turn on the starting switch.

(2) Current flows through the shunt coil and series coil of the magnetic switch. Under this condition, the plunger is attracted and the pinion is pushed out of the shift lever.

(3) At the same time, current flows through the magnetic switch series coil to the motor. As a result, the armature rotates slow rotation, thereby facilitating engagement of pinion and ring gear.

(4) When the pinion teeth and ring gear teeth are meshed, the pinion sleeve spring is compressed and the plunger moves.

(5) The contactor closes and current is directly applied to the motor by the battery. Under this condition, the armature rotates. The result is the pinion and ring gear mesh.

(6) When the pinion and ring gear mesh completely, the latter turns.

(7) The engine starts.

(8) When the engine starts, open the starting switch.

(9) The magnetic switch loses its attraction and the pinion returns to its original position through the shift lever. The pinion and ring gear then unmesh, and the motor stops.

b. Technical Data

Output	0.8kw	No-load terminal voltage	12 V	Outside dia. of armature	60mm
Rated time	30 sec.	No-load current	60A or less	No. of poles	4
Weight	5.8 kg	No-load speed	700 rpm or more	Brush material	MH-32
Rotating direction (viewed from pinion side)	Clockwise	Constrained terminal voltage	6 V	Series coil resistance	0.312Ω at 20°C
Clutch system	Overruning clutch	Constrained current	460A or less	Shunt coil resistance	0.93Ω at 20°C
		Constrained torque	1.1 kgm		
Engagement system	Magnetic shift system	Overall length of starter	220.5 mm		
		Outside diameter of yoke	90 mm		

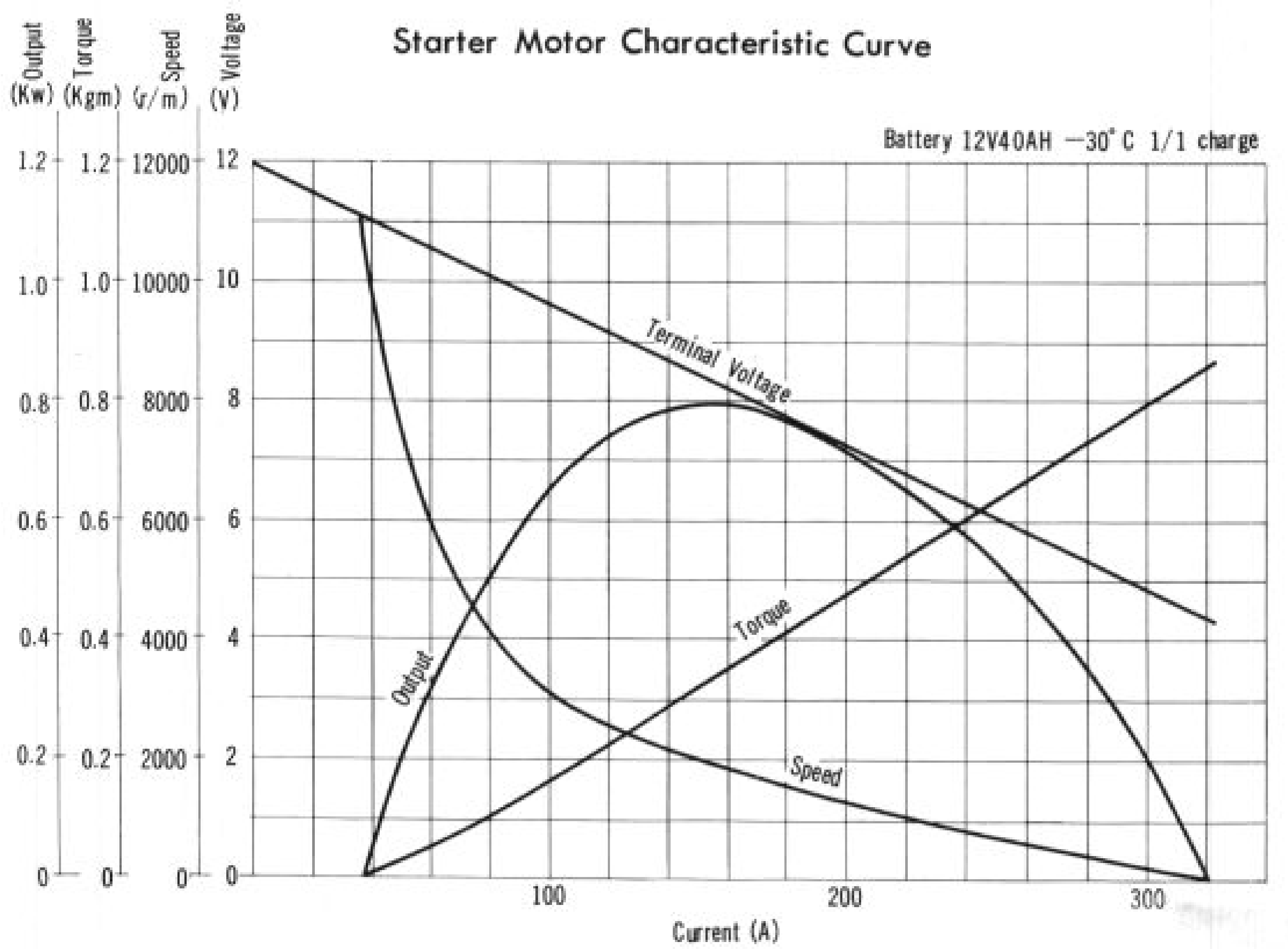


Fig. 17A-24

Maintenance Standards are shown on page 17-15.

c. Maintenance

Removal and Disassembly

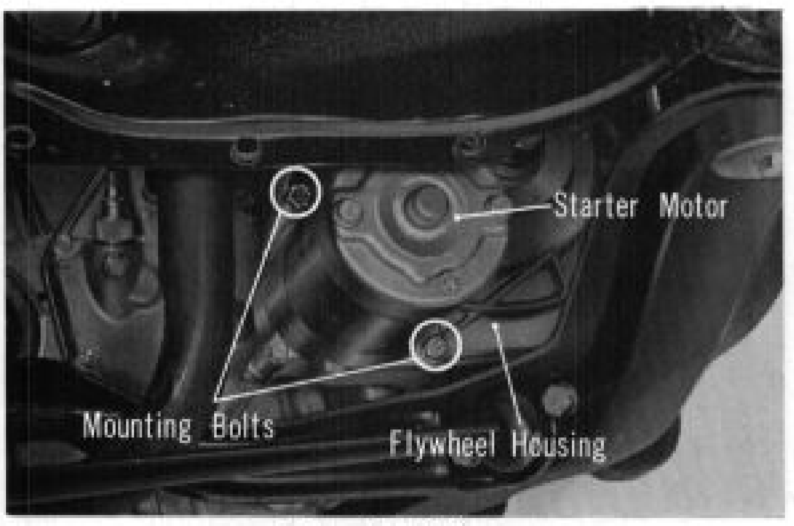


Fig. 17A-25

1. Remove the splash guard.
2. Remove the battery cable from the (−) terminal of the battery.
3. Remove the starter cable and the black and white lead from the B and S terminal of the magnetic switch (remove black lead then white lead).
4. Remove the two starter motor retaining bolts, and remove the starter motor from the flywheel housing.

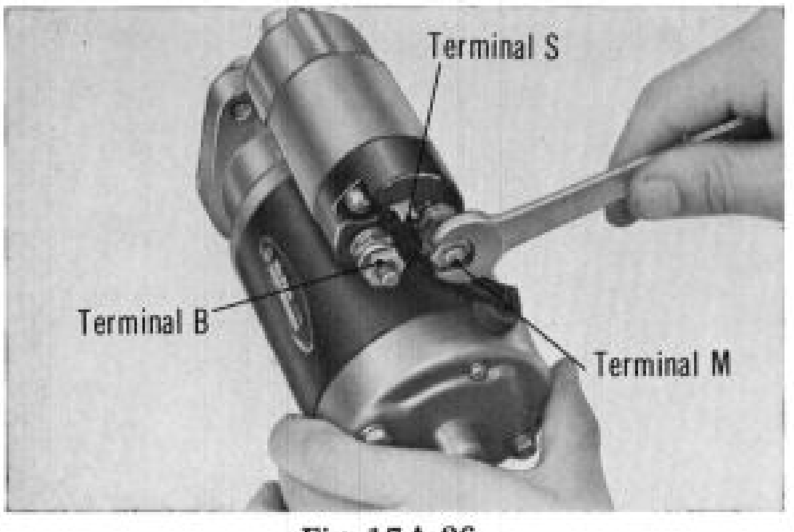


Fig. 17A-26

5. Loosen the M terminal nut and remove the cable.

Fig. 17A-27

6. The magnetic switch is installed to the pinion gear case with three screws. Remove these screws with a screwdriver and take the magnetic switch together with the return spring **(Fig. 17A-20)** from the starter motor.

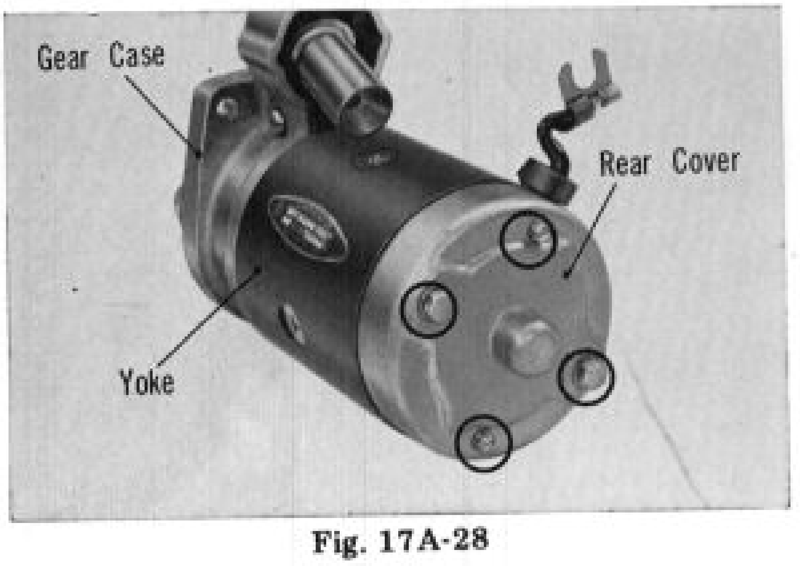


Fig. 17A-28

7. The two rear cover screws secure the brush holder (to the rear cover), while the rear cover bolts retain the rear cover and yoke on the pinion gearcase. Remove these bolts and screws and detach the rear cover from the yoke.

8. Draw out the four brushes from the brush holder, and remove the brush holder.
9. Separate the yoke from the gear case. The yoke is provided with a hole in which the gear case lock pin is inserted. This is for yoke positioning.

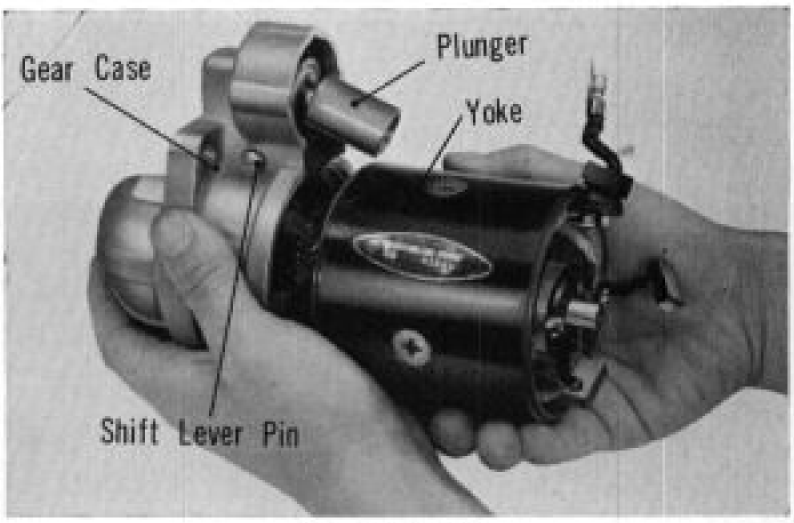


Fig. 17A-29

10. Remove the shift lever pin, and then the plunger from the shift lever. **(Fig. 17A-29)**
11. Draw out the armature from the gear case, and remove the shift lever.

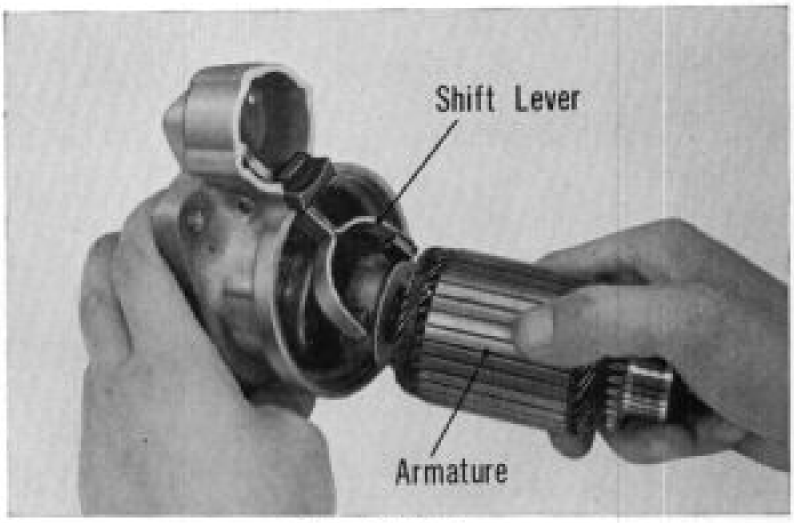


Fig. 17A-30

12. Armature Disassembly
    (1) Thrust plate A (1.6 t)
    (2) Pinion stopper washer
    (3) Pinion stopper clip
    (4) Pinion stopper
    (5) Pinion assembly
    (6) Shift lever
    (7) Plunger
    (8) Plunger return spring
    (9) Armature
    (10) Thrust plate B, C

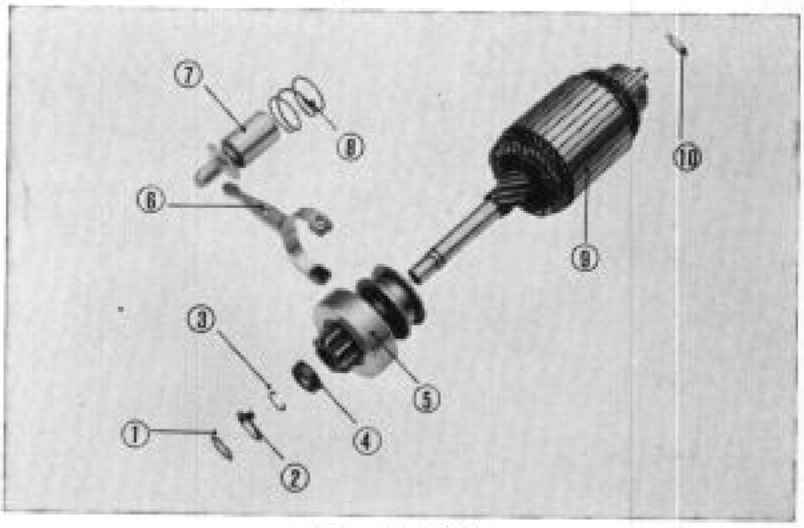


Fig. 17A-31

After removing the thrust plate A from the shaft, remove the pinion stopper washer by wrenching it out with a screwdriver. **(Fig. 17A-32)**

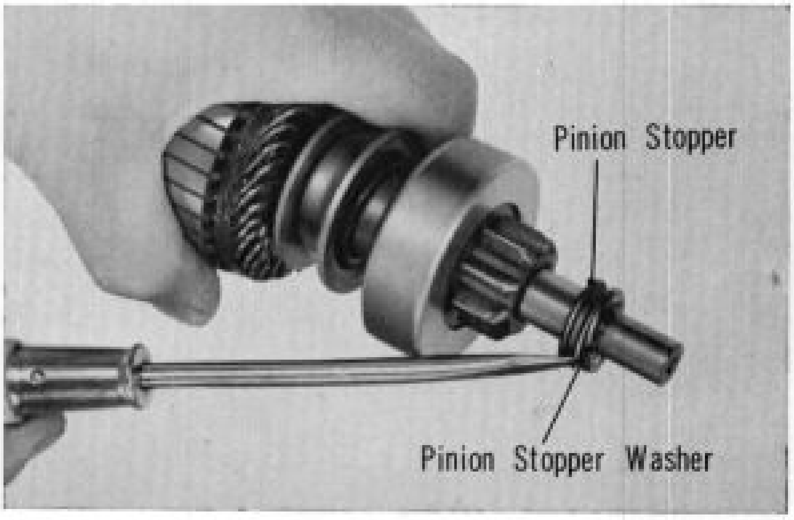


Fig. 17A-32

Fig. 17A-33

Next, slide the pinion stopper toward the armature and remove the pinion stopper clip with pliers. **(Fig. 17A-33)**

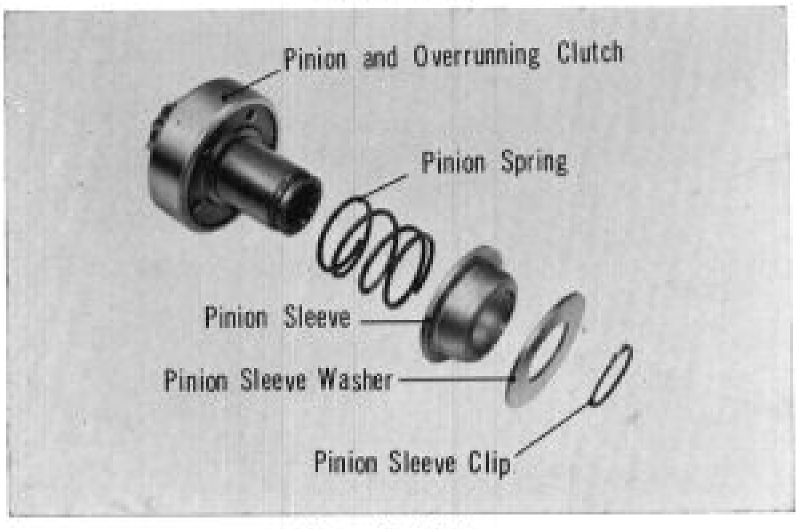


Fig. 17A-34

Remove the pinion sleeve clip, and the pinion assembly can be disassembled as illustrated in **Fig. 17A-34.**

The overrunning clutch cannot be disassembled.

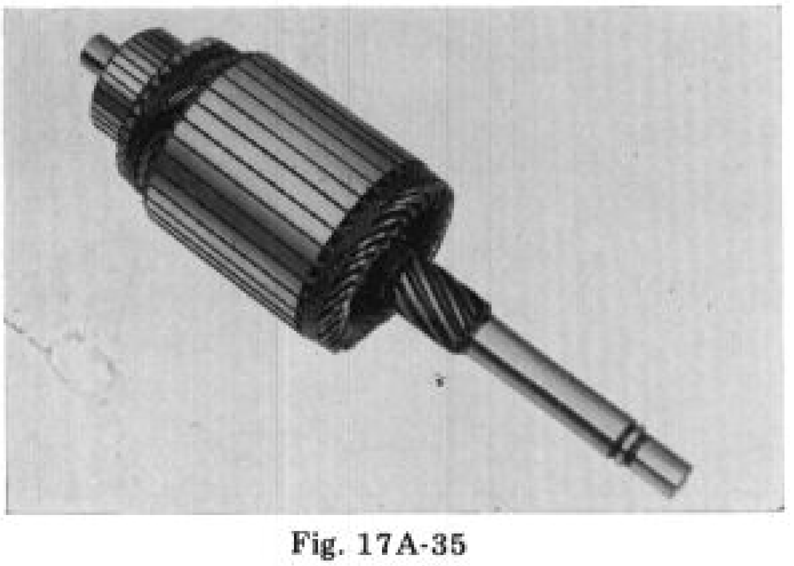


Fig. 17A-35

Inspection

1. Inspect the armature shaft for bending.
   Place both ends of the armature shaft on a center stand, attach a dial gauge to the shaft, and measure. The degree of shaft bending is one half the value indicated by the needle of the dial gauge. If bending is 0.1mm (0.004 in) or more, correct the armature shaft using a press.

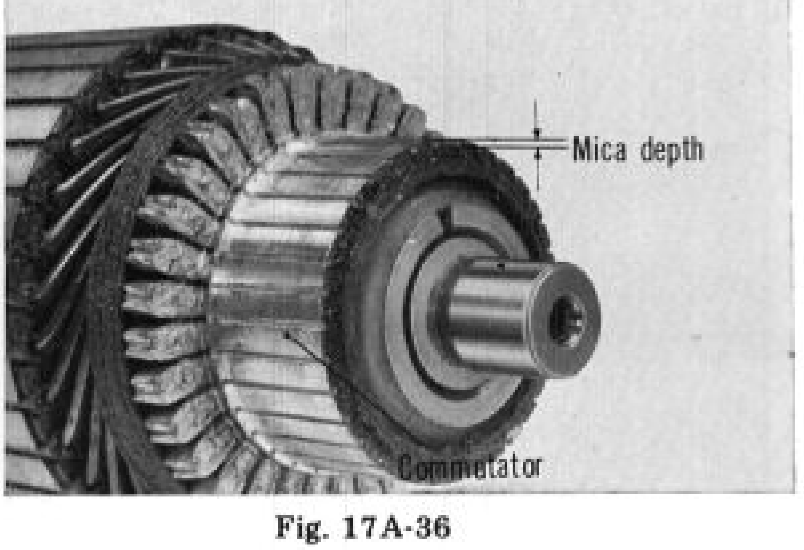


Fig. 17A-36

2. Inspect the surface of the commutator for roughness. If the commutator is not smooth, grind the surface with #500 or #600 Emery cloth. If the commutator surface is excessively rough, or if commutator deflection is 0.2mm (0.008 in) or more, correct using a lathe and finish with Emery cloth. Measure the depth of the mica between segments of the commutator. The measured value is 0.2mm (0.008 in) or less, undercut it to 0.5 to 0.8mm (0.020 to 0.032 in).

3. Check the armature coil grounding conditions with a testing device. Check continuity between the commutator and the armature shaft (or armature core). If there is continuity, the armature coil is grounded. This being the case, replace with a new armature assembly.

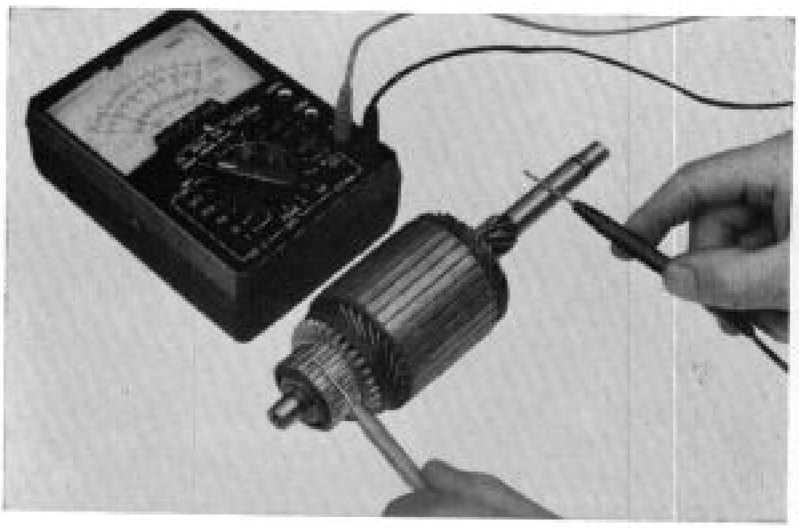


Fig. 17A-37

4. Check the armature coil for shorting with a growler tester. Mount the armature on the growler tester, and turn the armature while holding a saw piece (or piece of iron) in contact with the armature. If the saw piece or piece of iron vibrates, the coil is shorted. Replace with a new armature assembly.

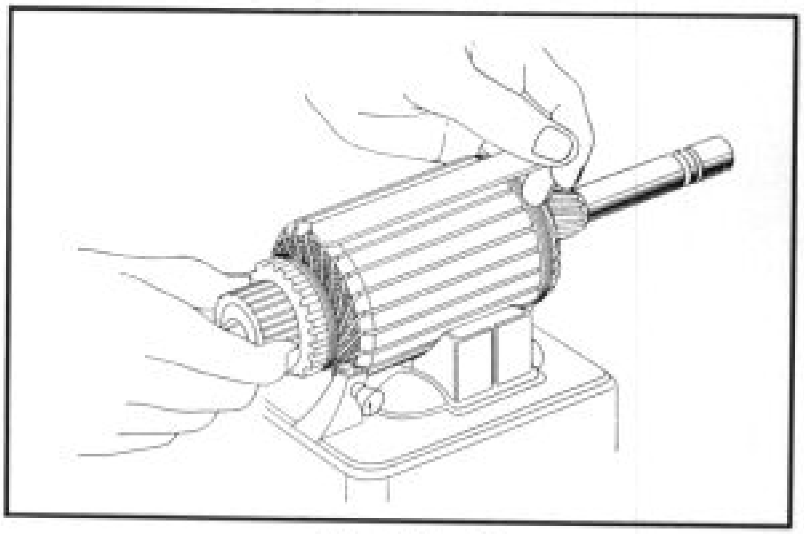


Fig. 17A-38

5. Check the field coil for disconnection using a testing device.
   Check the field coil between terminals for continuity. If there is no continuity, replace with a new field coil.
6. Check the field coil for grounding with a grounding tester. Check continuity between one side of the field coil terminal and the yoke. If there is continuity, replace with new field coil.

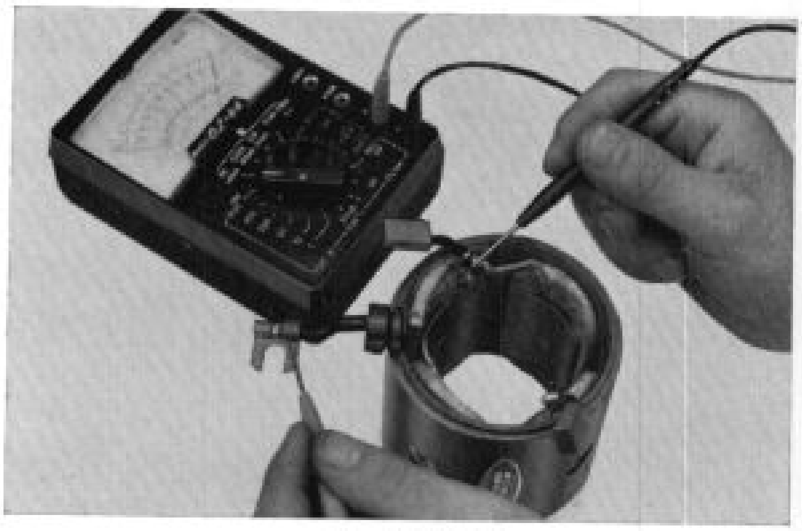


Fig. 17A-39

7. Check the brushes for wear.
   Measure the overall length of each brush with slide calipers, and if brush length is less than 12.5mm (0.492 in), replace the brushes with new ones.

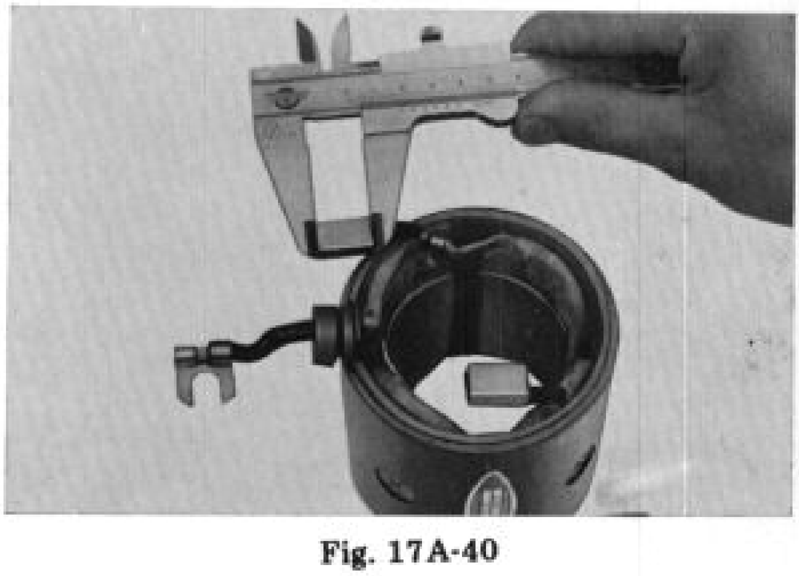


Fig. 17A-40

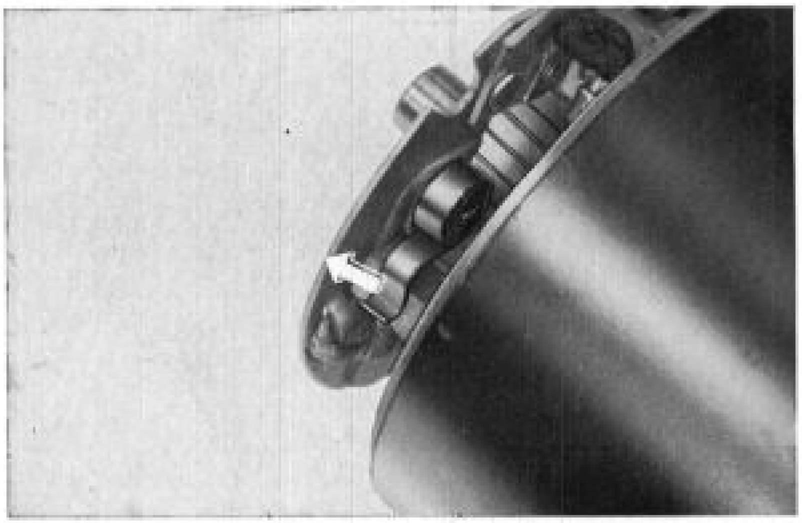


Fig. 17A-41

8. Measure the tension of the brush springs.
   Connect a thread to the brush processing surface of the spring and measure the tensile force of the spring. If spring tension is less than 0.7 kg (1.5 lbs), replace with new brush springs (if more than 0.9 kg (1.98 lbs), adjust to the correct value).

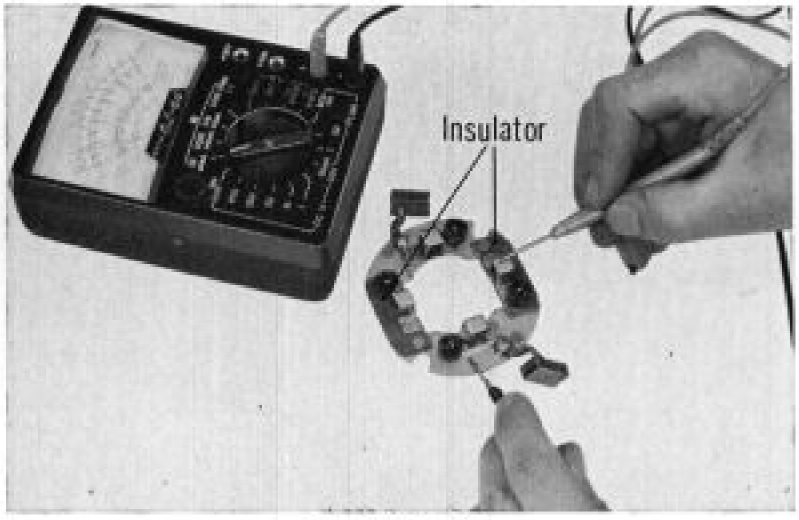


Fig. 17A-42

9. Check brush motion

   If brush movement is incorrect, check the brush holder for bending and for stained slide surfaces. Correct and clean as necessary.
10. Check the insulated brush holder for grounding with a testing device. Inspect continuity between the insulated brush holder (on the (+) side) and the brush holder assembly base (on the grounded side). If there is continuity, replace with a new brush holder.

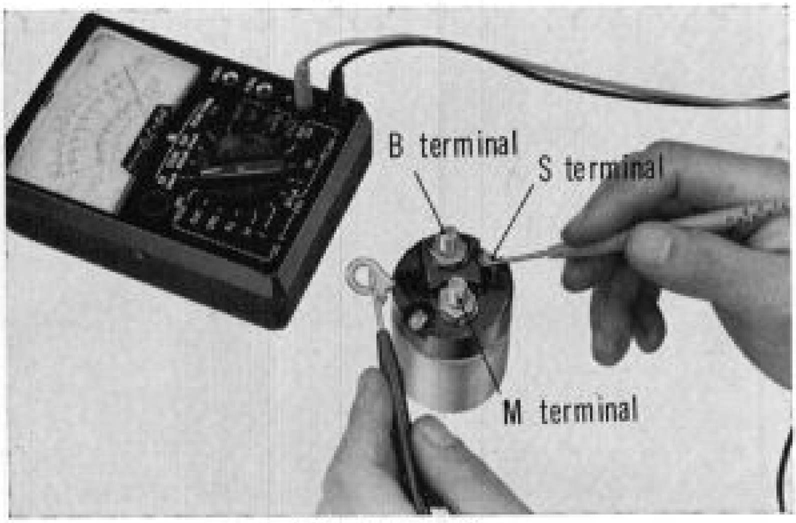


Fig. 17A-43

11. Check the magnetic switch shunt coil for disconnection. Check continuity between the S terminal of the magnetic switch and coil case (metallic part). If there is no continuity, replace.
12. Check the series coil for disconnection.
    Inspect continuity between the M terminal and S terminal of the magnetic switch. If there is no continuity, replace.

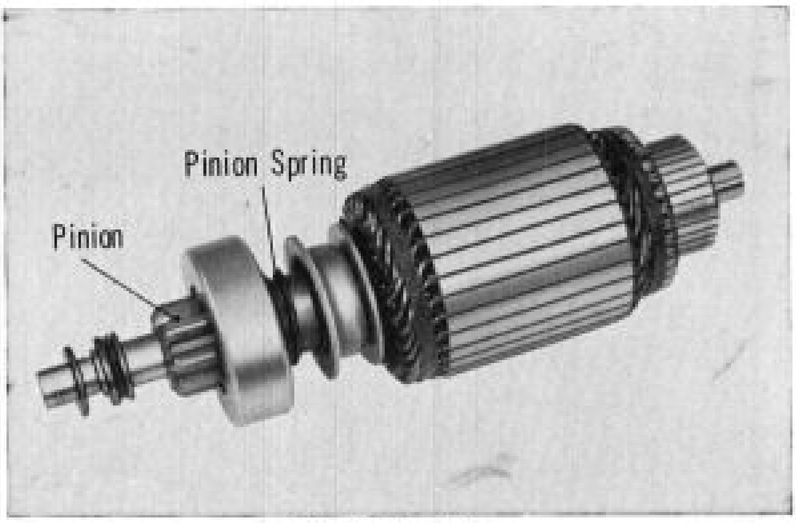


Fig. 17A-44

13. Inspect the pinion teeth for wear and damage. If they are defective, replace with new pinion.
14. Check the pinion spring for damage. If it is damaged, replace.

15. Check and make sure that the pinion slides smoothly. If it is scarred, split, or if it sticks, make the necessary correction.
16. If the overrunning clutch is seized or if it slips, replace with a new part.

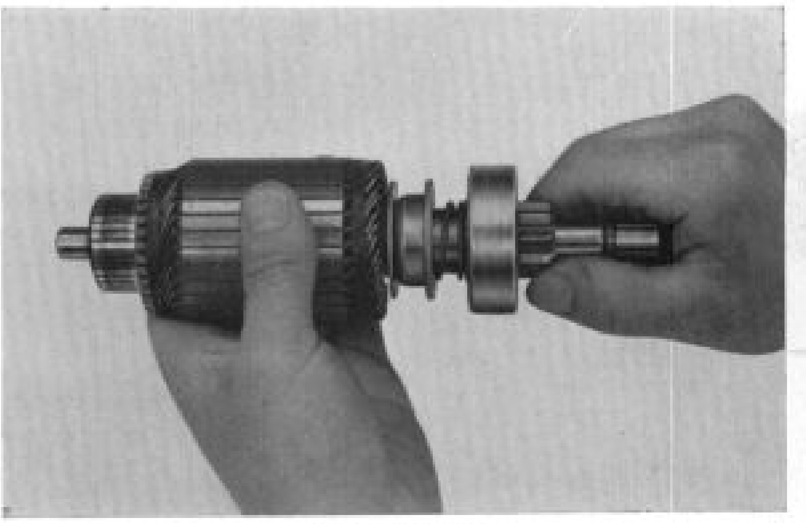


Fig. 17A-45

Table of Maintenance Standards

Type			S114-111. 112
Brush	Material		MH-32
Brush	Standard height		18.5mm (0.728 in)
Brush	Serviceable limit		12.5mm (0.492 in)
Standard strength of brush spring			0.8kg (1.76 lbs)
Commutator	Outside diameter	Standard outside diameter	35mm (1.378 in)
Commutator	Outside diameter	Serviceable limit	33mm (1.299 in)
Commutator	Difference between max. diameter and min. diameter	Serviceable limit	0.4mm (0.016 in)
Commutator	Difference between max. diameter and min. diameter	Repair precision	0.05mm (0.0020 in)
Commutator	Depth of mica between segments	Serviceable limit	0.2mm (0.008 in)
Commutator	Depth of mica between segments	Repair precision	0.5~0.8mm (0.020~0.032 in)
Shaft bend serviceable limit			0.08mm (0.032 in)
Standard Dimensions	Bearing on the brush side	Shaft diameter	11.450~11.468mm (0.4508~0.4515 in)
Standard Dimensions	Bearing on the brush side	Inside diameter	11.500~11.521mm (0.4527~0.4536 in)
Standard Dimensions	Pinion Sliding Section	Shaft diameter	12.950~12.968mm (0.5098~0.5105 in)
Standard Dimensions	Pinion Sliding Section	Inside diameter	13.030~13.051mm (0.5130~0.5138 in)
Standard Dimensions	Bearing on the pinion side	Shaft diameter	10.950~10.968mm (0.4311~0.4318 in)
Standard Dimensions	Bearing on the pinion side	Inside diameter	11.000~11.018mm (0.4331~0.4338 in)
Shaft and bearing gap		Serviceable limit	0.2mm (0.008 in)
Shaft and bearing gap		Repair precision	0.03~0.1mm (0.0012~0.0039 in)
Allowable shaft diameter underside			0.1mm (0.0039 in)
Magnetic Switch		Series coil resistance	0.312Ω
Magnetic Switch		Shunt coil resistance	0.93Ω

Lubrication

Oilless bearings are employed on the gear case side and the brush side. Whenever they are removed or disassembled, apply grease (Shell Alvania Grease No. 2) at the lubricating positions as illustrated in **Fig. 17A-46.**

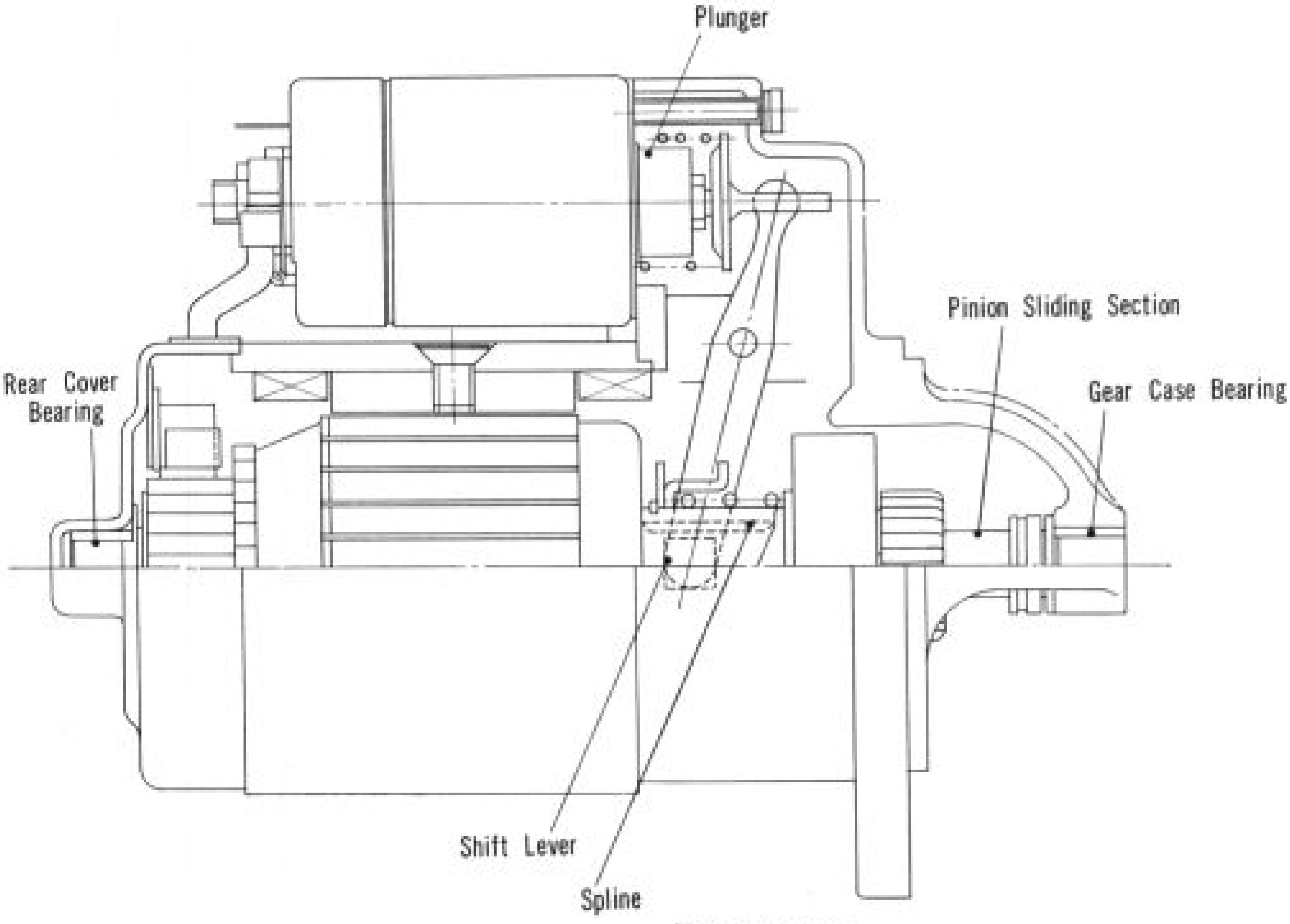


Fig. 17A-46

Adjustment and Reassembly

For reassembly and reinstallation, follow the reverse sequence of disassembly.

1. When assembling the yoke in the gear case, be sure to align the gear case dowel pin and yoke hole. **(Fig. 17A-47)**

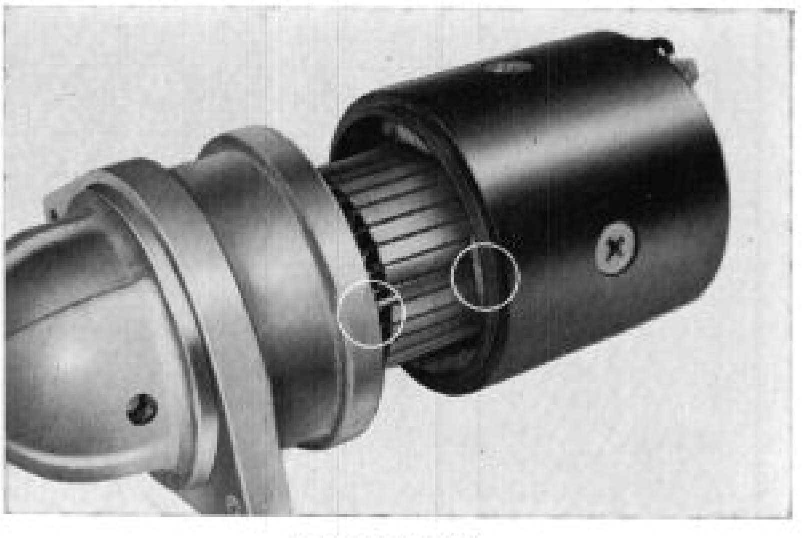


Fig. 17A-47

2. When installing the magnetic switch, securely fix the return spring and adjusting plate (dust cover).

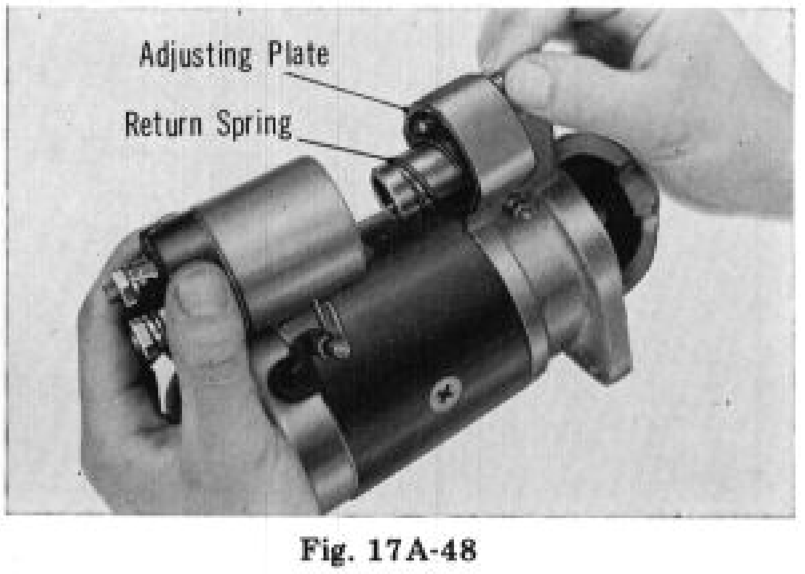


Fig. 17A-48

3. Pinion protruding position adjustment

   Connect the (+) to the S terminal, and the (−) to the metallic part of the magnetic switch; the pinion thus protudes as a result of plunger attraction. Push out the pinion with the finger to eliminate pinion play, and measure the distance from the pinion end to the piston stopper with a feeler gauge. The standard length is 0.3 to 1.5mm (0.012 to 0.059 in). (Fig. 17A-49)

   If this size is not correct, an abnormal meshing sound is produced and the service life of the pinion and ring gear is shortened. To eliminate this trouble, the size should be adjusted to the prescribed value. The size can be adjusted by changing the adjusting plate between the magnetic switch and the gear case.

   Two types of adjusting plates are available:

   0.4mm thick

   0.8mm thick

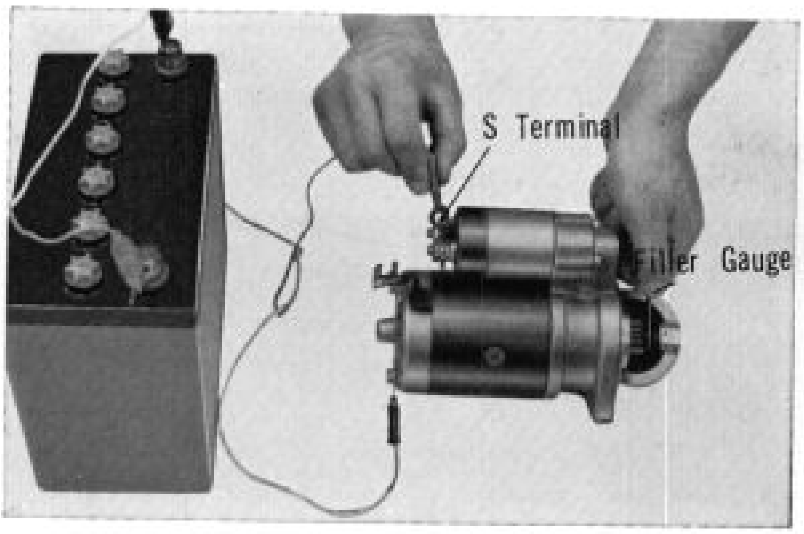


Fig. 17A-49

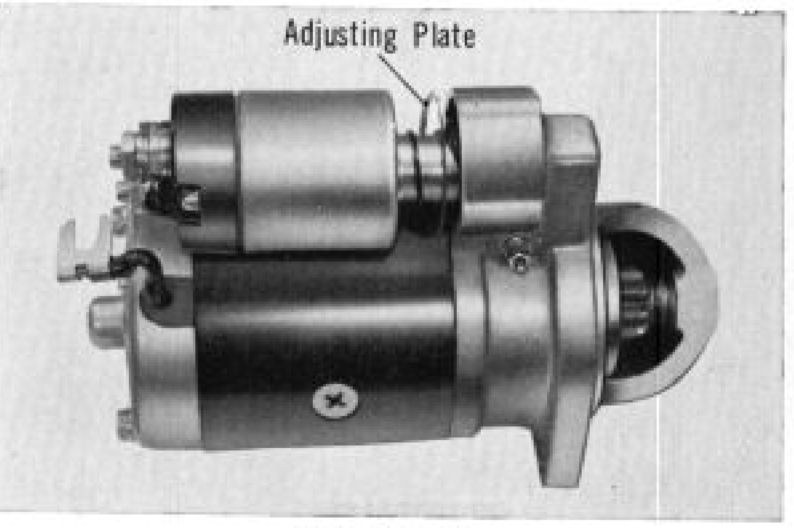


Fig. 17A-50

4. To install the starter motor, completely secure the gear case to the flywheel housing.

   Tightening torque:

   3.8~4.2 kgm (27.4~30.3 lb-ft)

   In addition, securely tighten the wiring. If it is incompletely tightened larger contact resistance may result, thus causing starting difficulty.

Fig. 17A-51

d. Trouble Diagnosis

(1) The pinion does not advance when the starting switch is turned on.

Faulty Part	Cause of Trouble	Corrective Action
Wiring	Disconnection, or loosened battery and switch terminals.	Repair or retighten.
Starting switch	No current flows due to improper contact.	Correct the contacting conditions or replace.

Faulty Part	Cause of Trouble	Corrective Action
Startor motor	The pinion does not move, because the thread portion engaging the armature shaft pinion section is bitten.	Repair the threaded part.
Magnetic switch	Incorrect operation of the magnetic switch plunger, or disconnected or shortened coil.	Repair or replace.

(2) Startor motor does not rotate, although pinion and ring gear mesh.

Wiring	Wiring connecting battery and magnetic switch is disconnected; or ground, magnetic switch, and motor terminal connection wires are improperly tightened.	Retighten, or replace with new wire.
Starter motor	Incorrect meshing of pinion and ring gear.	Repair the teeth.
	Improper installation.	Reinstall.
	Worn brushes, or contact of the bush spring.	Replace.
	Stained commutator.	Repair.
	Faulty armature field coil.	Repair or replace.
Magnetic switch	Field coil and bush connecting section is incompletely tightened.	Retighten.
	Improper conditions of the cantactor.	Repair.
	Roughened contact surface of the contactor.	Repair or replace.

(3) Motor attains full speed before pinion and ring gear mesh.

Startor motor	Worn pinion sleeve spring.	Replace.
Magnetic switch	Incorrect plunger dimension	Replace.

(4) Motor torque is not transmitted to the engine, although the pinion and ring gear mesh and motor rotation is normal.

Starter motor	Faulty overrunning clutch.	Replace.

(5) After starting engine, motor does not stop even when starting switch is set to OFF.

Starting switch	No current flows even when the switch is set to OFF.	Repair or replace.
Magnetic switch	The switch remains ON with the contactor displaced.	Replace.

E. Charging Circuit (600 vehicle)

a. Description

The 600 vehicle's charging circuit employs an AC generator, and the output of the generator is rectified to DC by a silicon diode. Current generated by the generator is regulated by a combination tirril regulator and AC generator. The AC generator is installed on the right side of the engine and the rotor is mounted on the right end of the crankshaft. The rectifier using silicon diodes is installed in position with the right side of the front bumber stay installing bolt and connected to the AC generator with the lead wires.

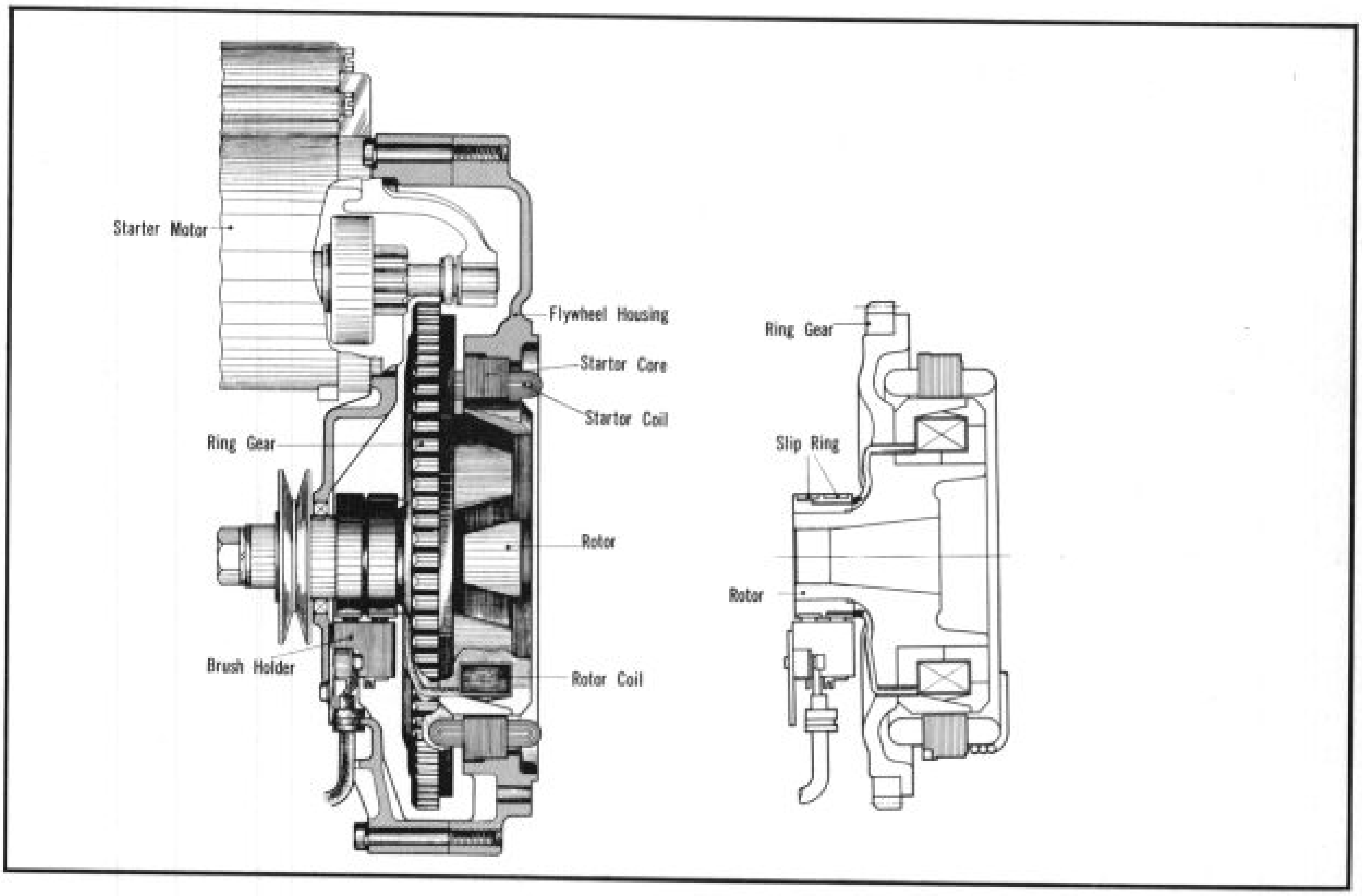


Fig. 17A-52

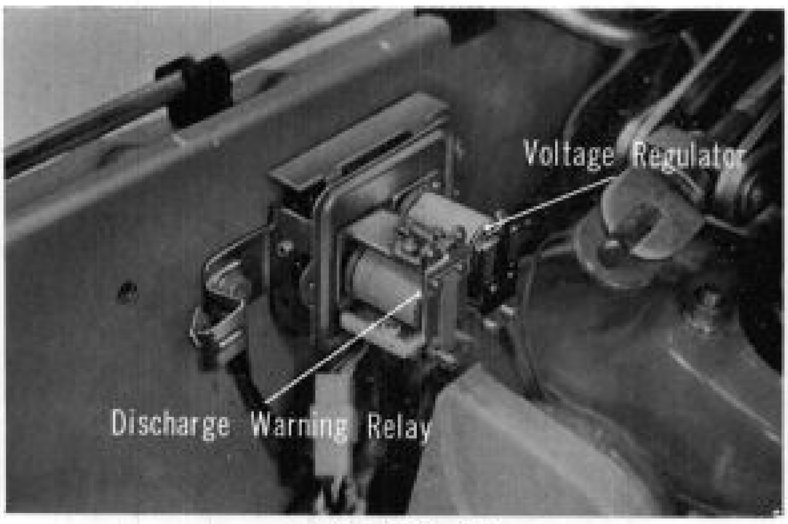


Fig. 17A-53

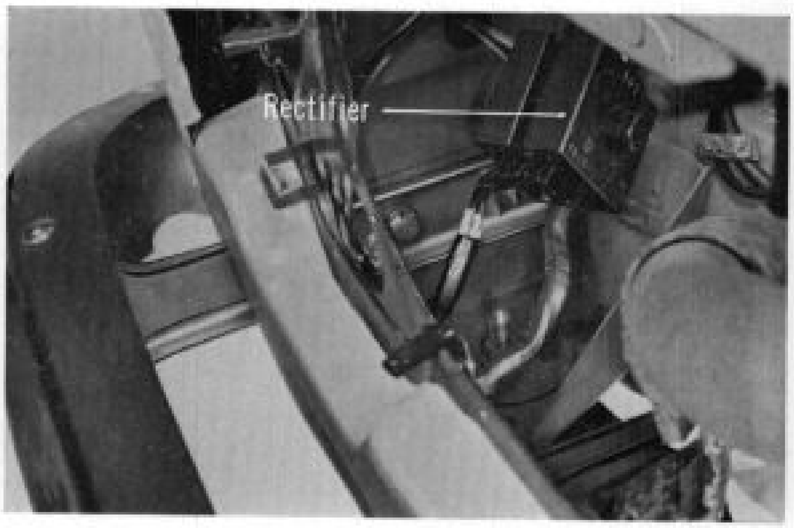


Fig. 17A-54

Connection

Electrical connection is as shown in **Fig. 17A-55.** When the exciting current flowing through the rotor coil is regulated by the voltage regulator, constant voltage is applied to the stator. The current generated by the generator runs through the silicon diode and is supplied to the battery, lamps, and other loads from the P terminal.

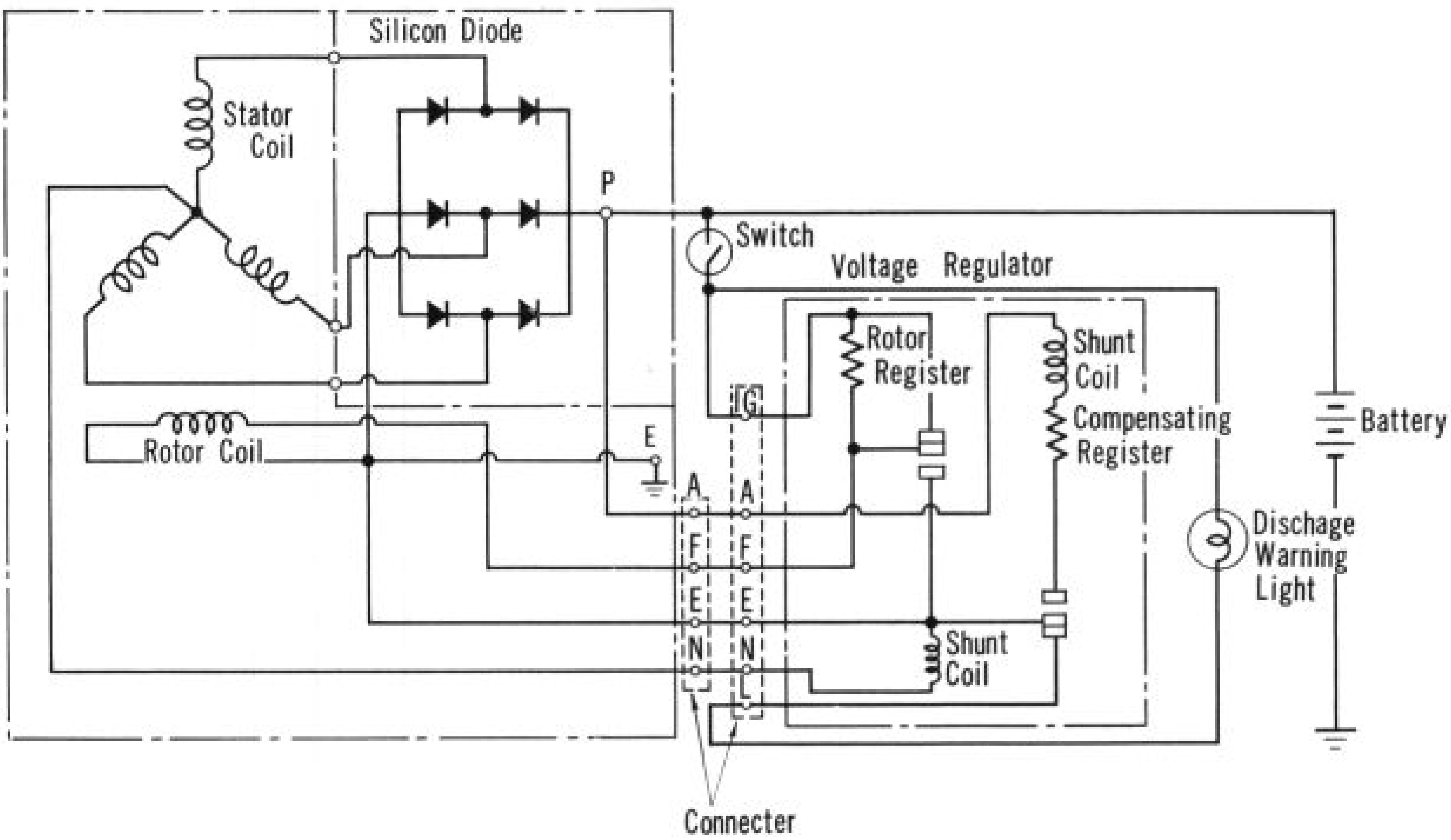


Fig. 17A-55

Principle of operation

(1) AC generator

Current flows from the battery, through the slip ring, to the rotor coil. When the rotor turns, voltage is generated in the stator coil which is secured to the stator. Further details concerning principle of operation are given below in accordance with **Fig. 17A-56.**

In the figure, when rotors N and S rotate in the direction indicated by the arrow current flows in the stator coil in the direction of a turn, the current begins to flow in the reverse direction (indicated by the dotted arrow), but this current is checked by diode D. The result is that current in one direction flows to the battery and is charged like DC. In this case, the waveform of current is as that shown in **Fig. 17A-57** (a). However, in the case of an AC generator for practical use, three-phase AC is "all-wave" with six silicon diodes and the wave form is as that shown in **Fig. 17A-57** (b).

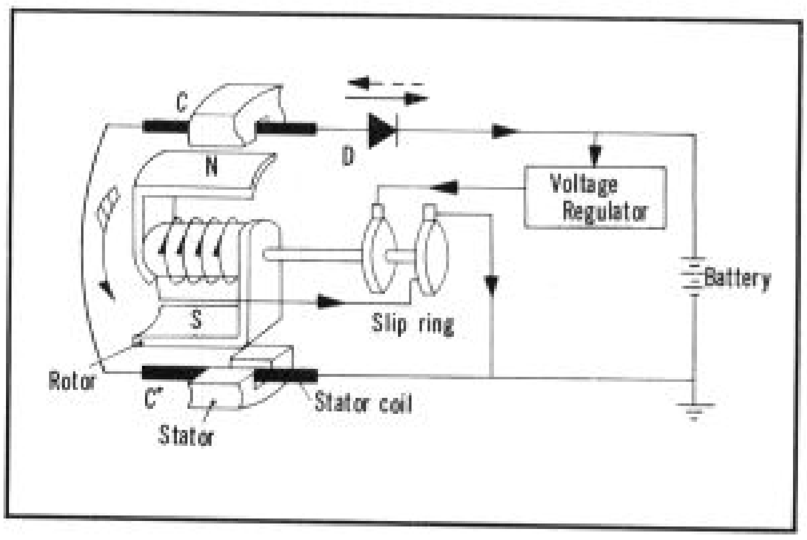


Fig. 17A-56 Principle of operation of A.C. generator

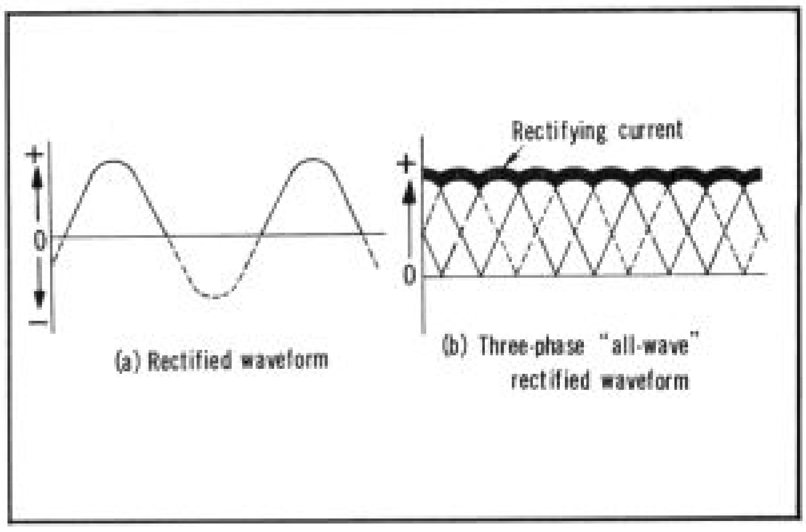


Fig. 17A-57 A.C. generator output current waveform

(2) Silicon diode

The silicon diodes allow current flow in one direction only, preventing the flow of current in the reverse direction. It works, in other words, like the conventional cut-out relay.

(3) Tirril regulator

The system of regulation has rotor resistance inserted in the rotor to maintain generator voltage constant by short circuiting. The principle of operation is explained in accordance with **Fig. 17A-58**

If generator speed is low, or if it is heavily loaded, the lower contact is opened and closed by the moving contact with the magnet attractive power increased and decreased proportionally with generator voltage. Under this condition, the rotor resistance RF is inserted and field current is regulated by short circuiting, thereby maintaining generetor voltage constant. If generator speed is high, of it is opened and closed. Under this condition, the rotor coil is inserted and voltage is maintained constant through short circuiting.

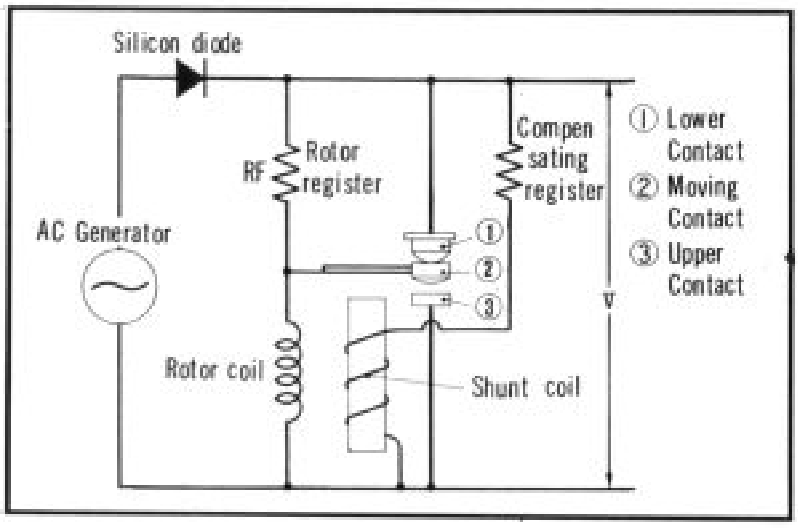


Fig. 17A-58 Two-contact type regulator operating principle

b. Technical Data

Specification

1. AC generator

Type and Make	LD 130-01, LD 130-03 (for U.S.A.), Hitachi Ltd.
Rating	Continuous
Battery voltage	12V
Output	12V 30A, 35A (for U.S.A.)
Weight	5.99 kg, 6.15 kg (for U.S.A.)
Polarity	(−) ground

2. Rectifier

Type and Make	SB 6B-5, SB 6B-8A (for U.S.A.) Silicon Diode Hitachi Ltd.
Battery voltage	12V
Polarity	(−) ground
Output	12V 35A, 40A (for U.S.A.)
Connection	3-phase, Bridge
Weight	0.45 kg, 0.48 kg (for U.S.A.)

3. Regulator

Type and Make	Tirril TL 1Z-33, Hitachi Ltd.
Battery voltage	12V
Polarity	(−) ground
Weight	0.35 kg

Performance

Operating speed		1,200 to 7,500 rpm
Rated speed		5,000 rpm
14V speed (normal temperature)		1,200 rpm or less
Output	Speed	5,000 rpm
	Voltage	14V
	Current	30A or more, 35 or more (for U.S.A.)

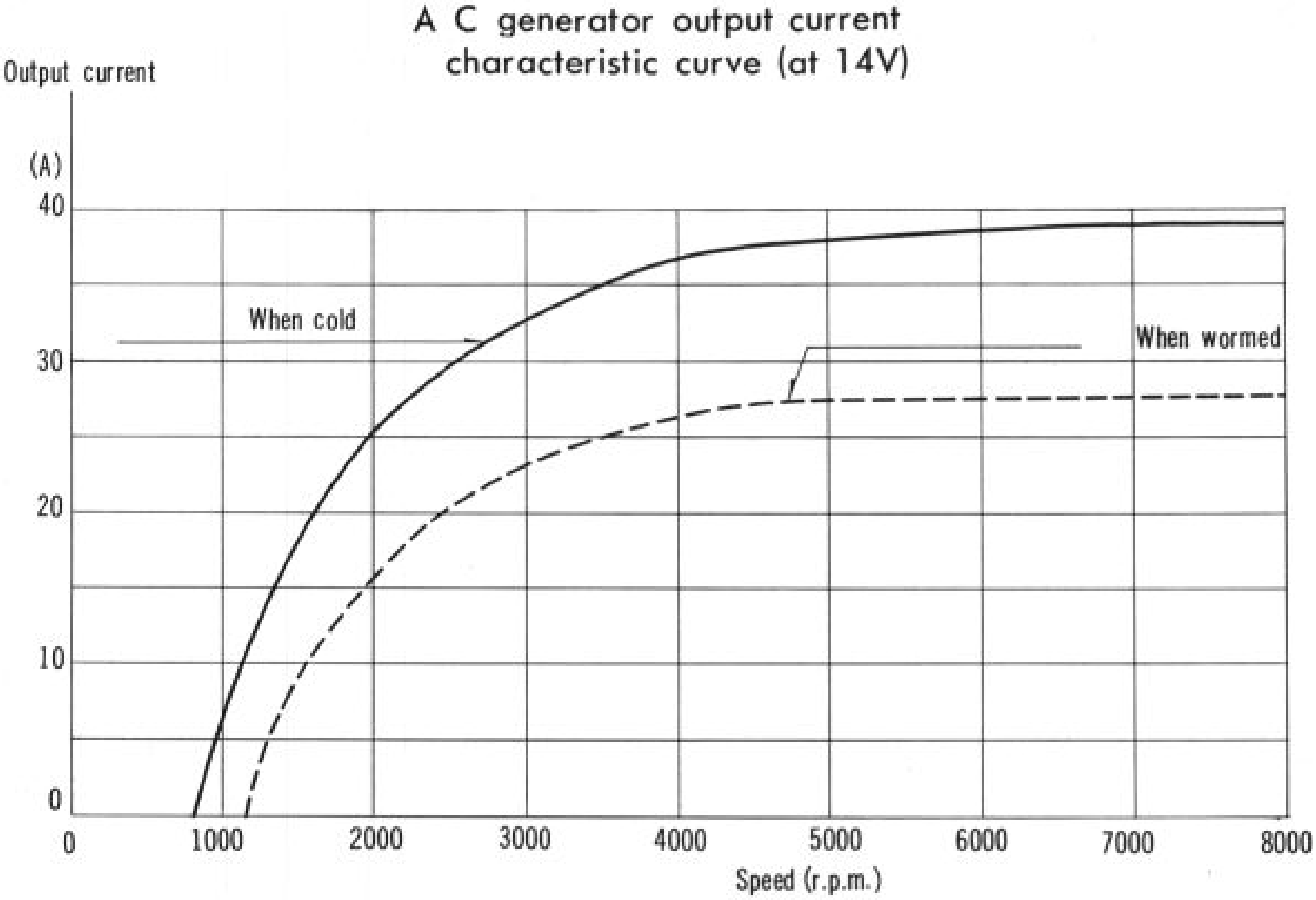


Fig. 17A-58

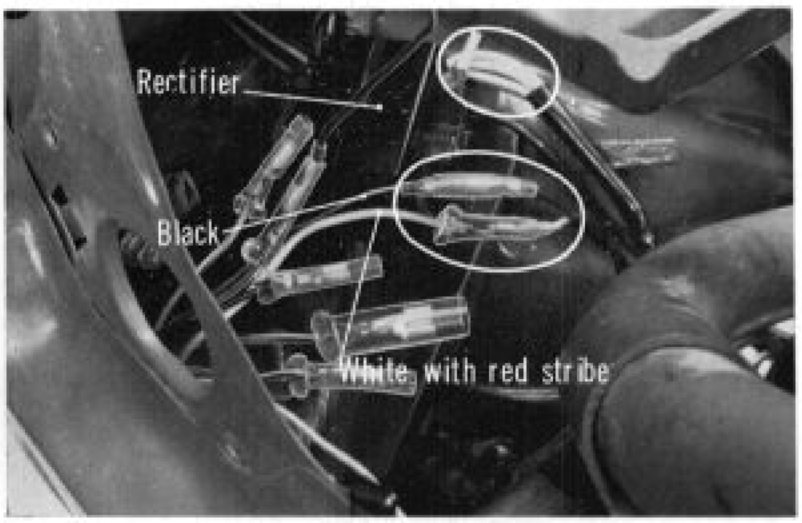


Fig. 17A59

c. Maintenance

AC Generator

Removal

1. After removing the (−) terminal of the battery, remove the four white lead wires from the rectifier.
2. Separate the white with red striped lead from the black lead, connected to the brush of the generator at the connector positions.

3. Remove the starter motor.
4. Remove the cooling fan belt from the crankshaft pulley. (Refer to SECTION 4, D.Engine Cooling.)
5. Set a 22mm wrench on the crankshaft pulley shaft to hold it securely, and remove the retaining bolts with a box wrench.

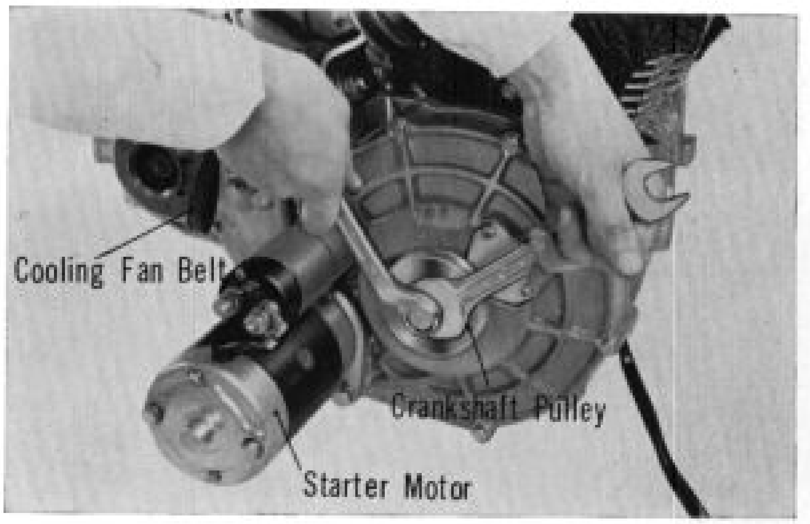


Fig. 17A-60

6. Remove the two brush holder set screws, and remove the brush holder assembly.
7. Remove the flywheel housing cover set bolts, and then the cover.

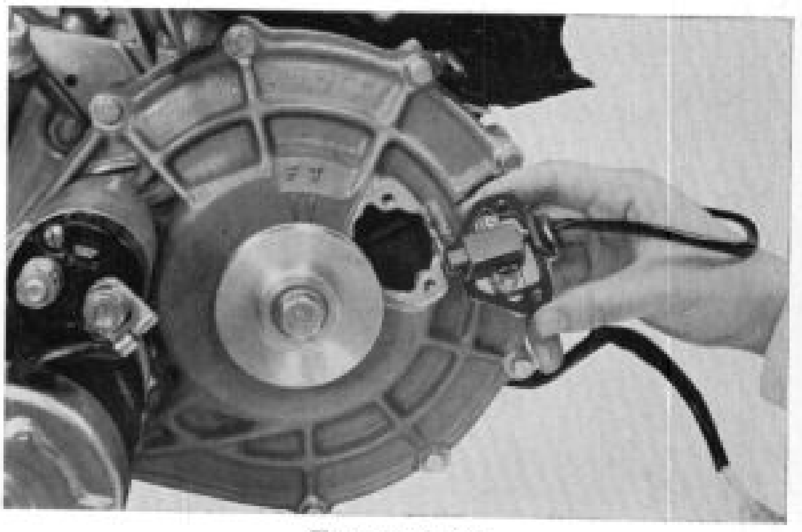


Fig. 17A-61

8. When removing the rotor, install a rotor holder (special tool) as shown in Fig. 17A-62 with two flywheel housing installing bolts. Then fully thread in a rotor remover, and tap the rotor out while hammering the head of the rotor remover lightly. The rotor is taperfitted in the crankshaft.

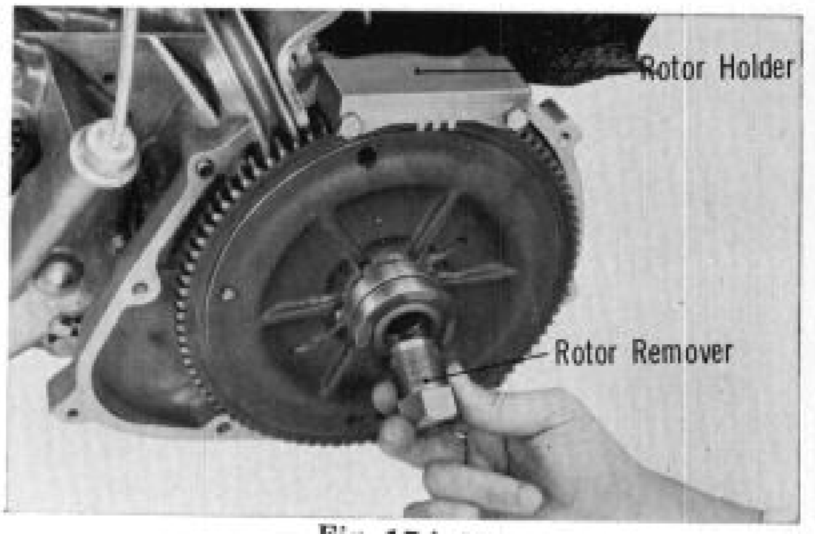


Fig. 17A-62

9. The stator is installed in the flywheel housing. Separate the flywheel housing from the engine after removing the four bolts.

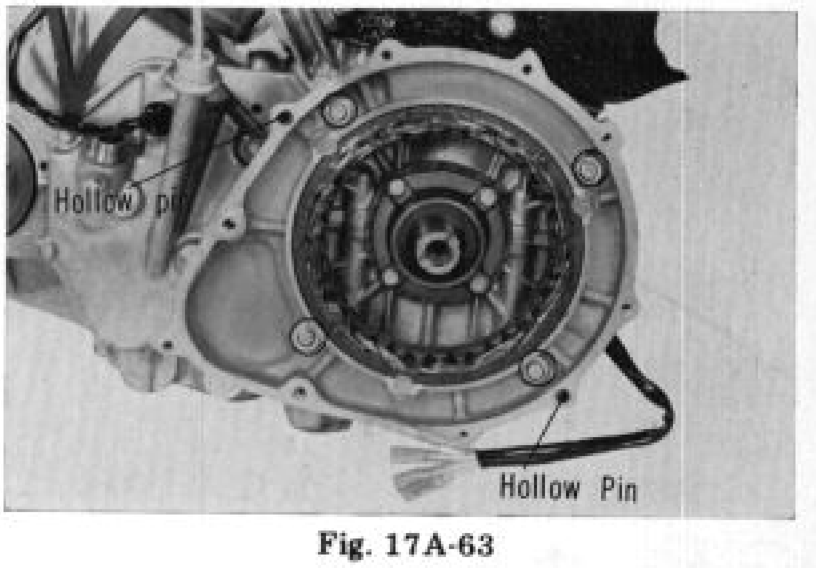


Fig. 17A-63

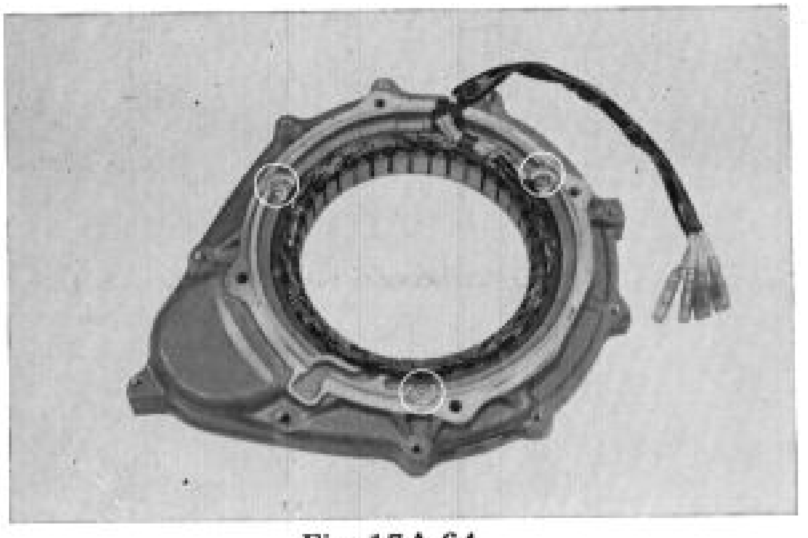


Fig. 17A-64

10. When it is necessary to replace the stator because of a disconnection, etc., remove the bolts and nuts at three different positions.

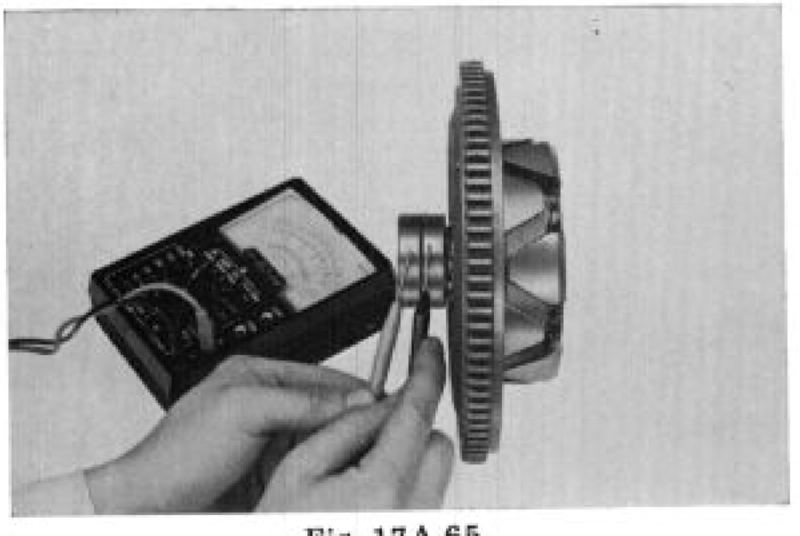


Fig. 17A-65

Inspection

1. Check the rotor coil for disconnection and condition of insulation. Inspect continuity between the two slip rings with a testing device. No continuity represents that the rotor coil is disconnected. In this case, replace the rotor assembly. If there is continuity between the slip rings and the shaft or core, the coil or the slip rings are grounded. In this case, also replace with a new part.

   Rotor coil resistance: 40A—4.05 Ω
   30A—5.19 Ω

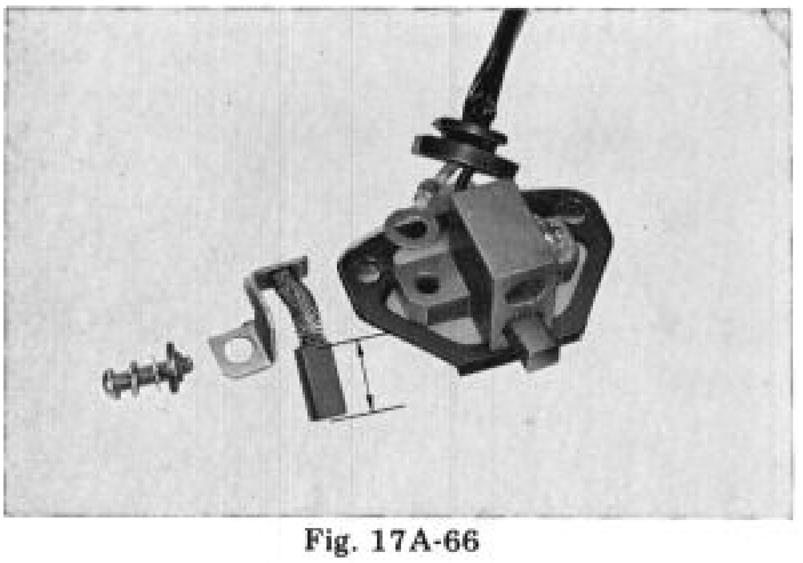


Fig. 17A-66

2. Unlike the DC generator, brush wear is extremely less. If the length of the brush is worn to 7.0mm (0.276 in) or less, replace the brush.

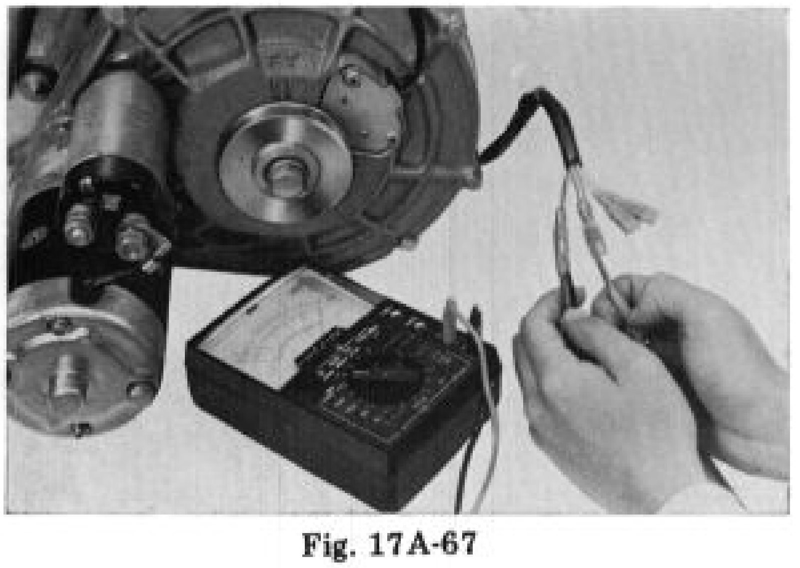


Fig. 17A-67

3. Check the stator coil for insulation and disconnection with a testing device.
   If there is no continuity between the terminals, the coil is disconnected. In this case, replace with new coil. If there is continuity between the stator coil terminals and the flywheel housing or core, it means the coil grounded. Replacement is necessary.

   Stator coil resistance: 0.115 Ω

4. Check the operation of the brush in the brush holder. With the hand press the brush end, and check the operating condition of the brush and brush spring.

   Reference: To correctly measure tension of the brush spring, push in the brush to the depth corresponding to the degree of brush wear plus 2mm. Then confirm that the tension of the spring is 0.255 to 0.345 kg. In addition, the length of a new brush is 14.5mm.

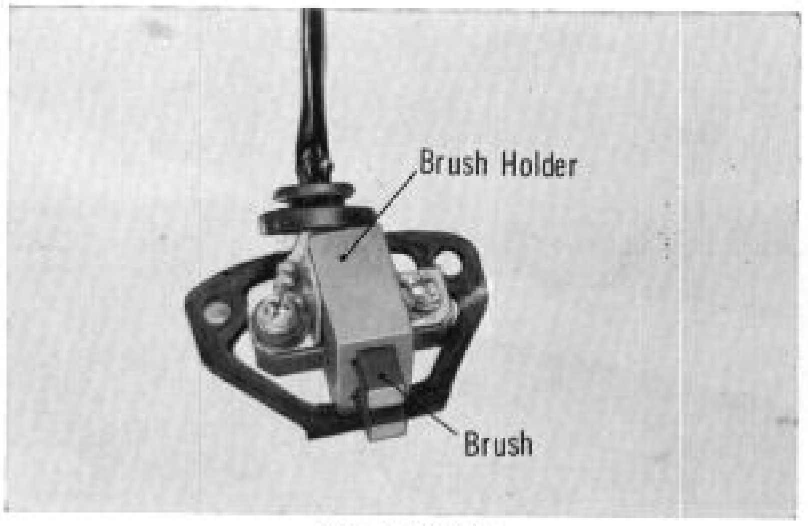


Fig. 17A-68

5. Check the rotor slip ring surface. If the surfaces are stained or rough, rework the slop rong.

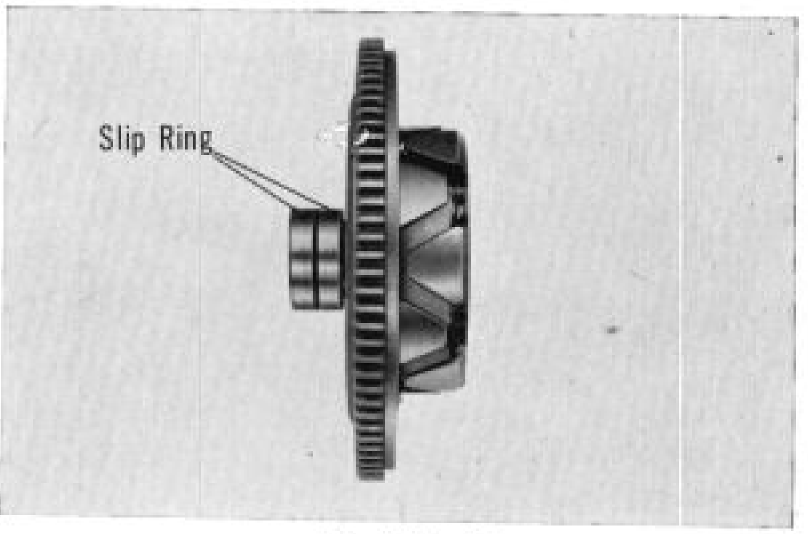


Fig. 17A-69

Installation

Installation is the reverse sequence of removal.

Note:

1. When installing the flywheel housing cover, ascertain that the flywheel housing is provided with two hollow pins. (Refer to **Fig. 17A-63**)
2. When installing the pulley, align the pulley shaft pawl with the end notch of the crank-shaft. **(Fig. 17A-70)**

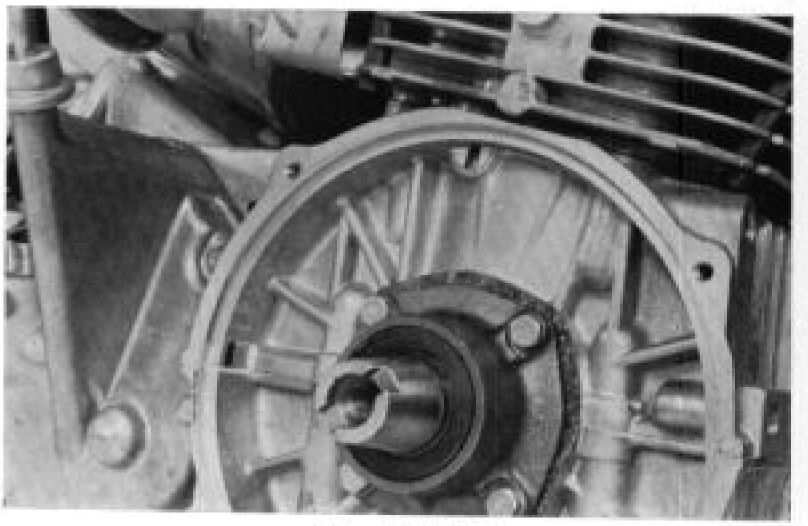


Fig. 17A-70

Voltage Regulator and Discharge Warning Relay

Removal and Installation

Remove all the regulator terminal lead wires.
Remove the right side of the headlight, hold the regulator installing nut with the hand, and remove the bolt. Then the regulator can be removed from the vehicle body.

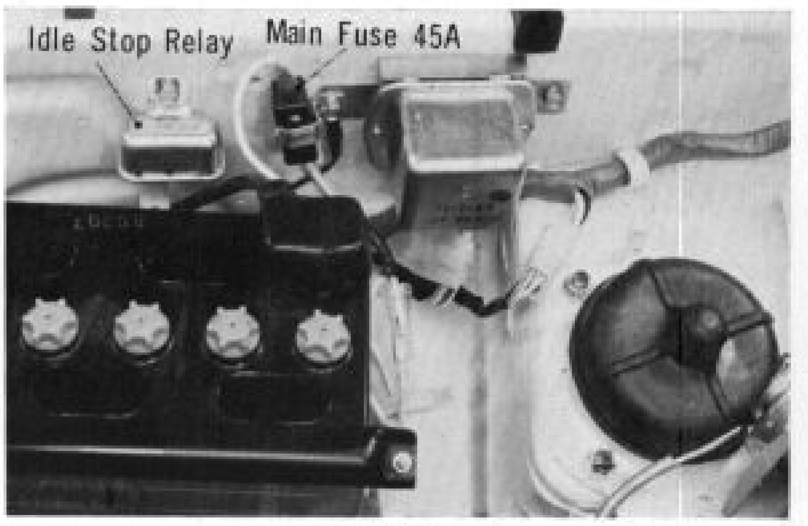


Fig. 17A-71

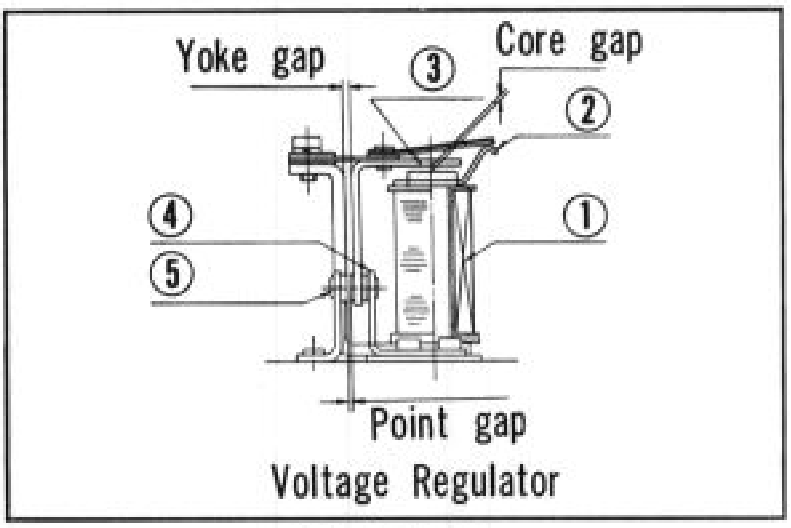


Fig. 17A-72

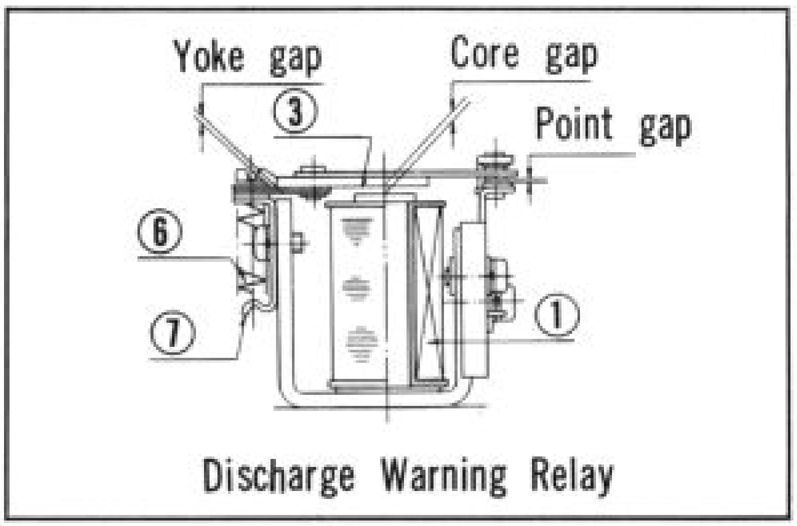


Fig. 17A-73

(Fig. 17A-72 and 17A-73)

① Voltage (shunt) coil
② Adjuster
③ Armature
④ Lower contact
⑤ Upper contact
⑥ Spring
⑦ Hanger

Inspection and Adjustment

1. Remove the regulator cap, and check the point. If the point is rough, grind it with a fine emery cloth.
2. Check the gaps in various parts and if they are not correct, adjust. **(Fig. 17A-74 to 77)**

Voltage Regulator:

Yoke gap	0.9 to 1.0 mm (0.035 to 0.039 in)
Core gap	0.8 to 1.2 mm (0.032 to 0.047 in)
Point gap	0.4 to 0.5 mm (0.016 to 0.020 in)

Discharge Warning Relay:

Yoke gap	0.2 mm (0.008 in)
Core gap	0.5 to 0.6 mm (0.020 to 0.024 in)
Point gap	0.4 to 0.5 mm (0.016 to 0.020 in)

Gap adjustment should be performed in the sequence of yoke gap, core gap, and point gap.

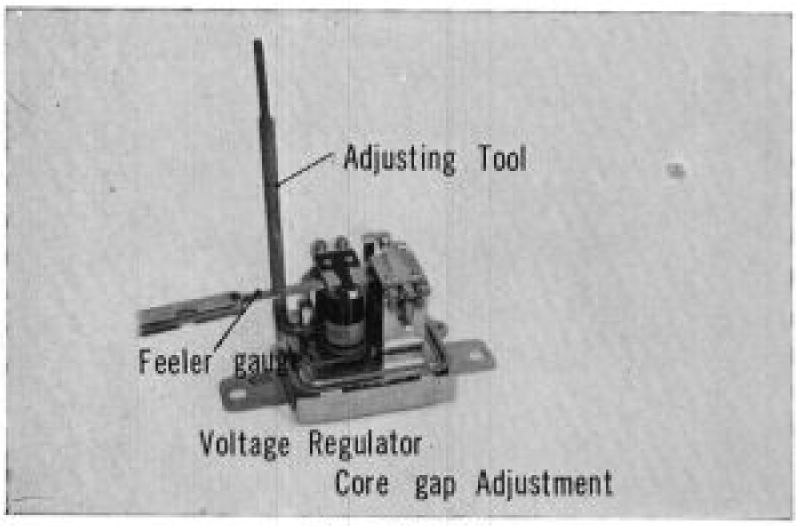


Fig. 17A-74

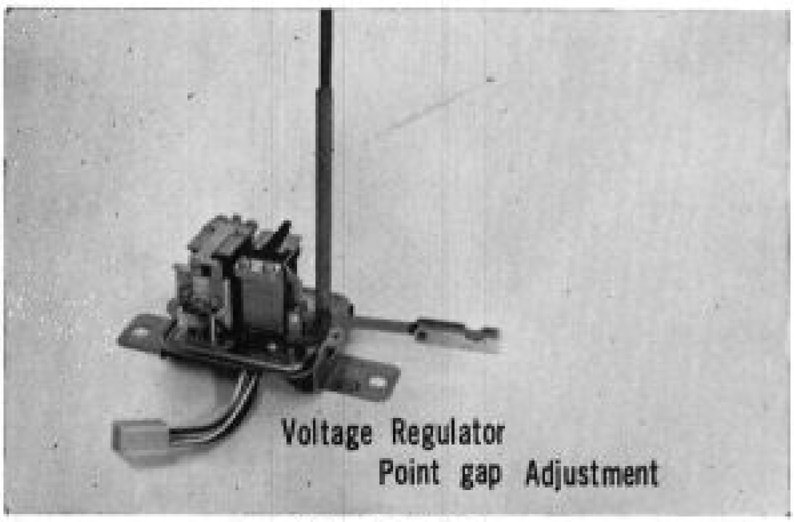


Fig. 17A-75

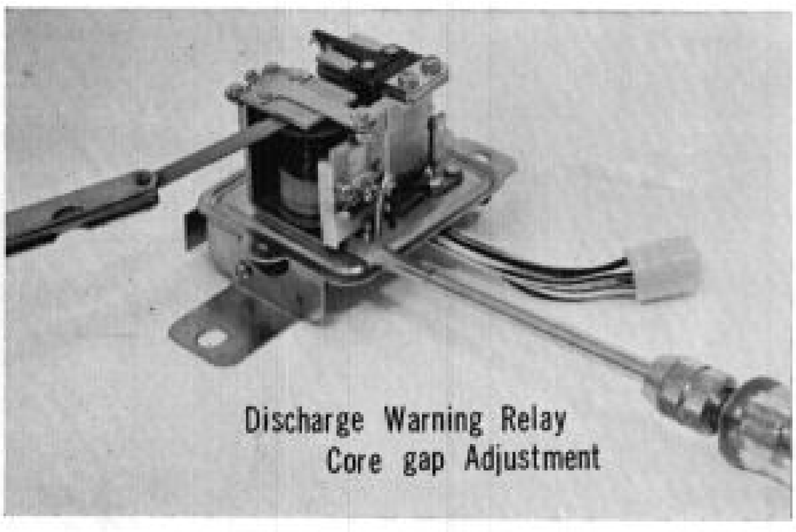


Fig. 17A-76

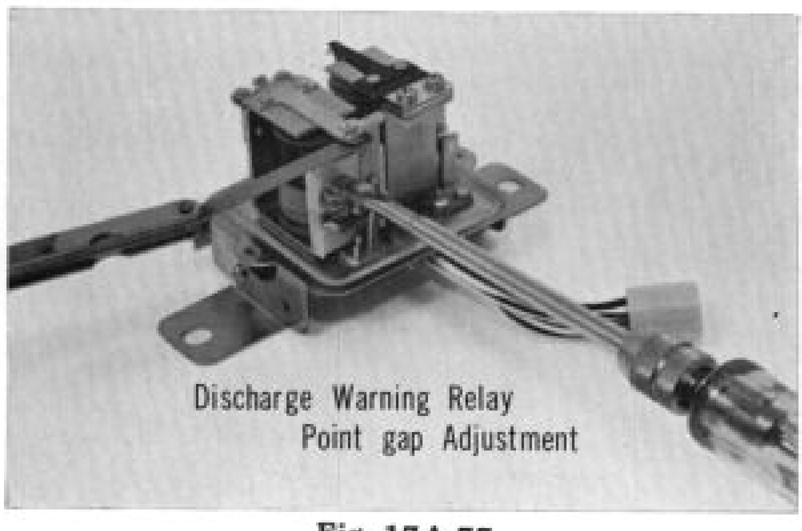


Fig. 17A-77

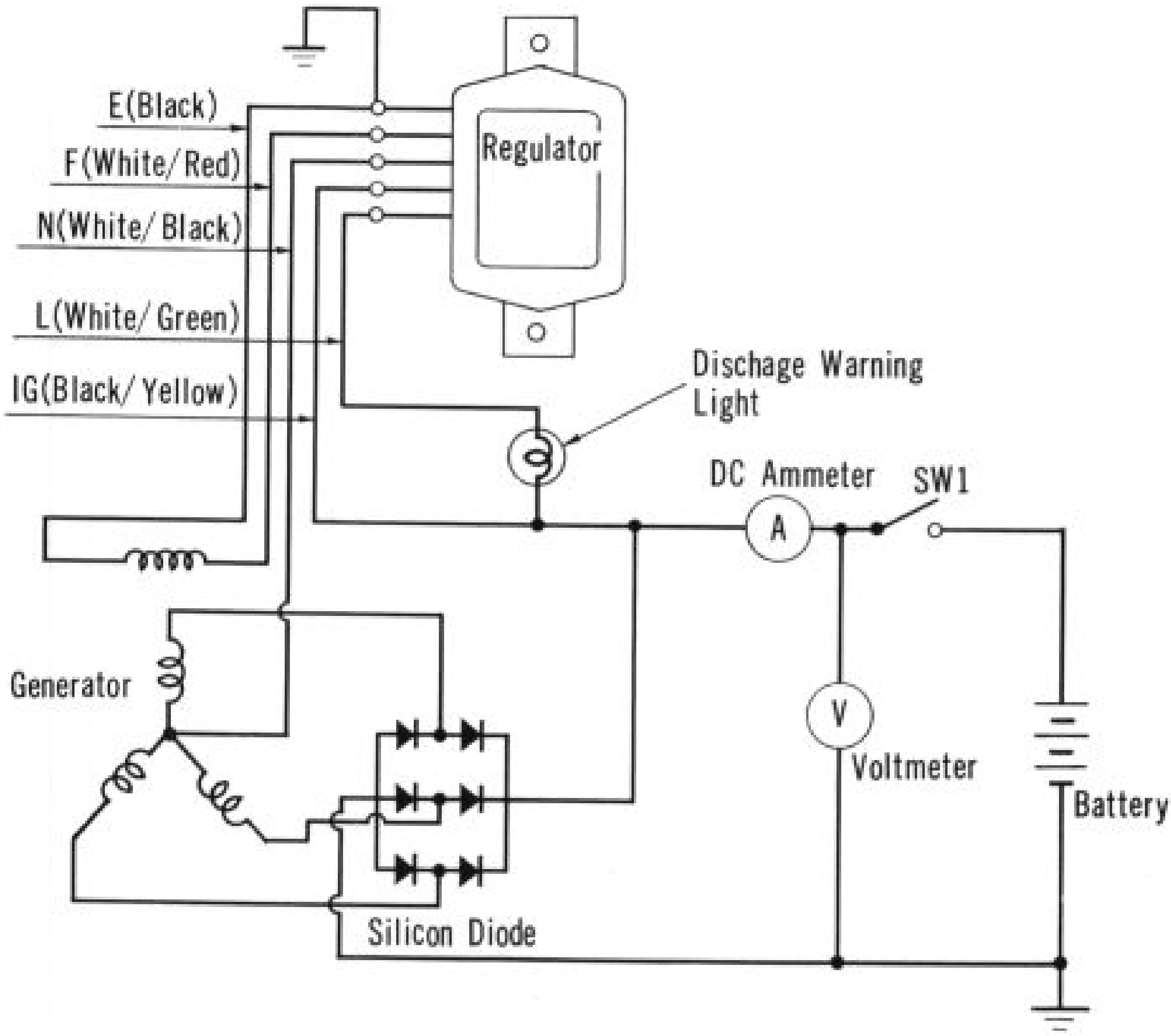


Fig. 17A-78

3. Prepare a DC voltmeter, ammeter, and contact them as illustrated in Fig. 17A-78
4. When regulating no-load voltage, close the switch SW1 thereby allowing exciting current to flow from the battery to the generator rotor coil. After generator speed is raised (approximately 800 rpm), set the switch SW1 OFF.

   Note:

   In the case of a DC generator, when a regulator is combined with the generator to increase generator speed, voltage rises. In the case of an AC generator, however, voltage is not generated as prescribed unless the rotor is initially excited with the DC current flowing into the rotor coil from the battery. When speeding up the generator after stopping it once, set switch SW1 ON and let current flow from the battery. When voltage is generated, set the switch OFF, and check no-load voltage.
5. Raise generator speed to the rated value of 5,000 rpm, and regulate no-load voltage with the regulator.
6. If no-load voltage is lower than the rated voltage (13.5V), bend the adjuster upward and regulate it to the rated value. **(Fig. 17A-79)**

   ⬅ : Lower the voltage

   ⇦ : Raise the voltage
7. If no-load voltage is higher than the rated voltage of 14.5V, conversely, lower the adjuster and regulate it to the rated value. **(Fig. 17A-79)**
8. Now, voltage regulator adjustment has been completed. For confirmation of adjustment has been completed. For confirmation of adjustment results, stop the generator and raise generator speed to 5,000 rpm and ascertain that voltage is as rated.

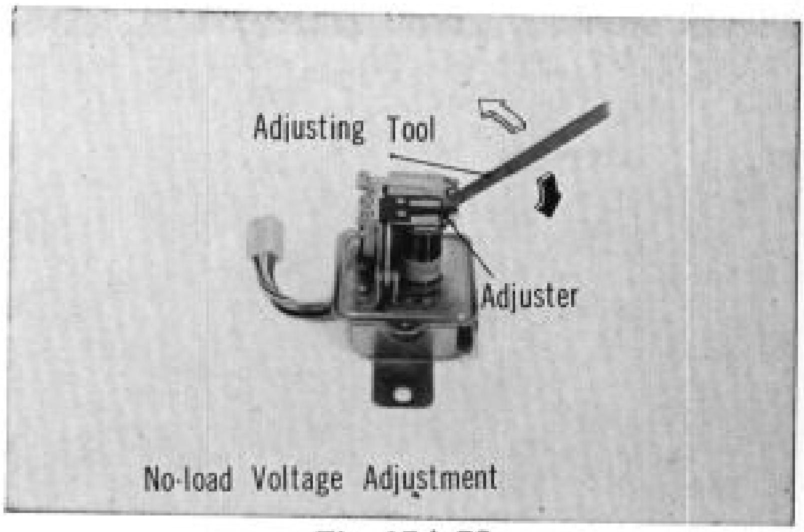


Fig. 17A-79

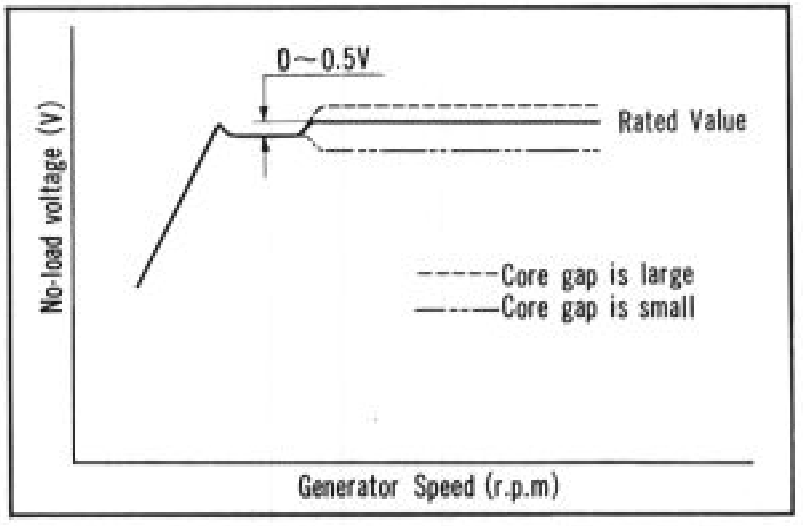


Fig. 17A-80

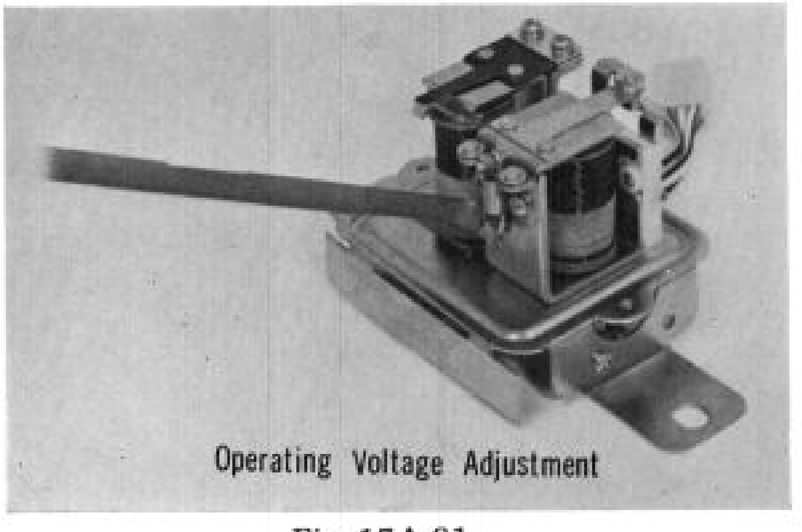


Fig. 17A-81

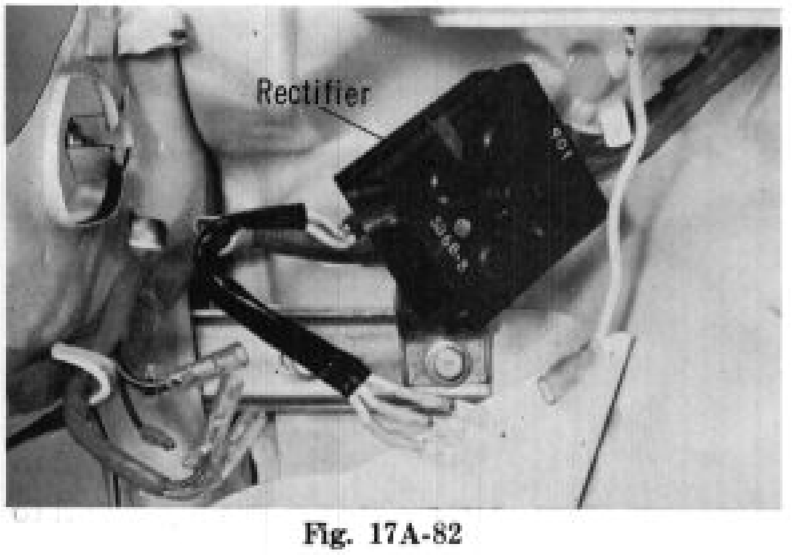


Fig. 17A-82

9. Generator voltage after completing adjustment is as shown in **Fig. 17A-80.**

   When generator operation is changed from low speed (with the lower contact actuated) to high speed (with the upper contact actuated), there is a voltage fluctuation. This voltage change does not matter. Approximately 0.5V voltage rise is desirable in the adjustment.

10. If there is voltage change exceeding 0.5V, or if there is voltage drop when generator operation is changed to high speed, inspect the core gap again. If core gap is too large, voltage rises and if too small, voltage drops.

11. Discharge Warning Relay
    When adjusting the operating (cut-in) voltage of the discharge warning relay, raise generator speed, as prescribed 4 and 5 above, check the operating (cut-in) voltage.

    Operating voltage:
    8 to 10V at P terminal

Operating Voltage	Tensile force of coil spring	Adjustment
High	Strong	Put hanger upward
Low	Weak	Lower hanger

To judge the functional quality of the silicon diode, disconnect the AC generator stator coil and silicon diode, and check the characteristics of the silicon diode in the normal direction and the reverse direction with an appropriate testing device. If there is continuity only in the normal direction, the silicon diode is defectless. If there is continuity in both directions, or if there is continuity in neither direction, the silicon diode is defective. In this case, replace the silicon diode.

Note:
Do not use a megger. If a megger is used for continuity testing, the silicon diode is damaged by the high voltage.

Handling Precautions

1. Connect silicon diode correctly to the battery while paying attention to battery polarity. If the silicon diode is misconnected, the battery is shorted with the silicon diode. Under this condition, over current flows, thus resulting in damaged silicon diode or seized wire harnes..
2. Connect the terminals correctly.
3. Do not turn the generator at high speed with the silicon diode P terminal circuit disconnected. If this precaution is not observed, high voltage is generated and the silicon diode is sometimes damaged.
4. When charging the battery from outside, such as quick charging disconnect the silicon diode P terminal.

Table of Maintenance Standards

AC Generator			
Register			
	Stator coil		0.115Ω
	Rotor coil		5.19Ω
	Regulator	Shunt coil	10.5Ω
		Rotor register	10Ω
		Compensating register	25Ω
Discharge warning relay shunt coil			33.2Ω
Brush			
	Standard length		14.5 mm
	Serviceable limit		7.0 mm
	Spring tension		0.3 kg
Regulator			
	Yoke gap		0.9 to 1.0 mm
	Core gap		0.8 to 1.2 mm
	Point gap		0.4 to 0.5 mm
Discharge warning relay			
	Yoke gap		0.2 mm
	Core gap		0.5 to 0.6 mm
	Point gap		0.4 to 0.5 mm
	Operating voltage		8 to 10V at P terminal

d. Trouble Diagnosis

(1) Battery is not charged.

Faulty Part	Cause of Trouble	Corrective Action
Wiring and ammeter	Disconnection, short circuit, or displaced connector.	Repair or replace.
Generator	1. Disconnected coils, grounding, or short circuit.	Replace.
	2. Faulty silicon diode.	Replace.
Regulator	1. Lead wire, short or disconnection.	Repair or replace.
	2. No-load voltage is lower than the rated voltage.	Readjust.

(2) Battery is discharged due to insufficient charge.

Wiring	Early stage of disconnection and short circuit, or loosened connected part.	Repair or retighten.
Generator	1. Rotor coil lay er short circuit.	Replace.
	2. Stator coil layer hort circuit.	Replace
	3. Stator coil one phase disconnected.	Replace
	4. Stained slip rings.	Clean
	5. Improper contact of brush.	Correct.
	6. Faulty silicon diode.	Replace.

(3) Battery is overcharged due to excessive charging.

Wiring	The A terminal circuit and F terminal are shortened to be a shunt generator.	Repair.
Battery	Interior short circuit.	Replace.
Regulator	1. Abnormal rise in the no-load voltage.	Repair.
	2. Defective regulator grounding.	Correct grounding.
	3. Disconnected coil lead wire.	Repair or replace.

(4) Unstable charging current.

Wiring	As the vehicle body vibrates, the part of the wire with the broken shield is shortened or the lead wire is disconnected. This disconnected lead wire sometimes contacts.	Repair or replace.

BODY ELECTRICAL SYSTEM

Electrical System, N600

① Battery ② Ignition Coil ③ Spark Plug ④ A. C. Generator
⑤ Starter Motor ⑥ Voltage Regulator ⑦ Rectifier ⑧ Horn ⑨ Fuel Pump
⑩ Fuse Box ⑪ Wiper Motor ⑫ Turn Signal Relay ⑬ Stop Light Switch
⑭ Ignition Switch ⑮ Door Switch ⑯ Head Light ⑰ Front Turn Signal Light
⑱ Rear Combination Light ⑲ Back-up Light ⑳ License Plate Light
㉑ Interior Light ㉒ Idle Stop Relay

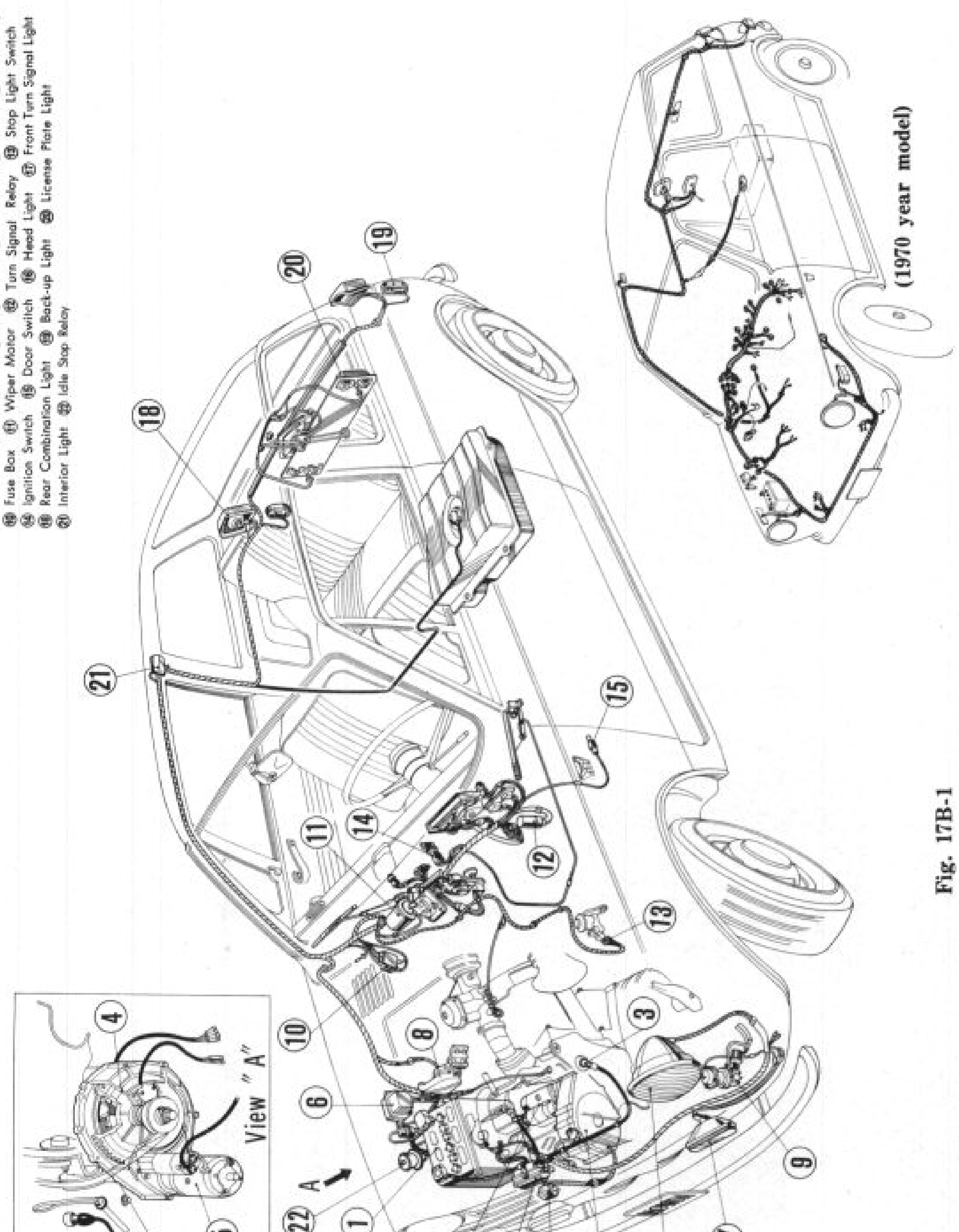


Fig. 17B-1

Instrument Panel Wiring (Vehicles delivered to U.S.A., Canada, and etc.)

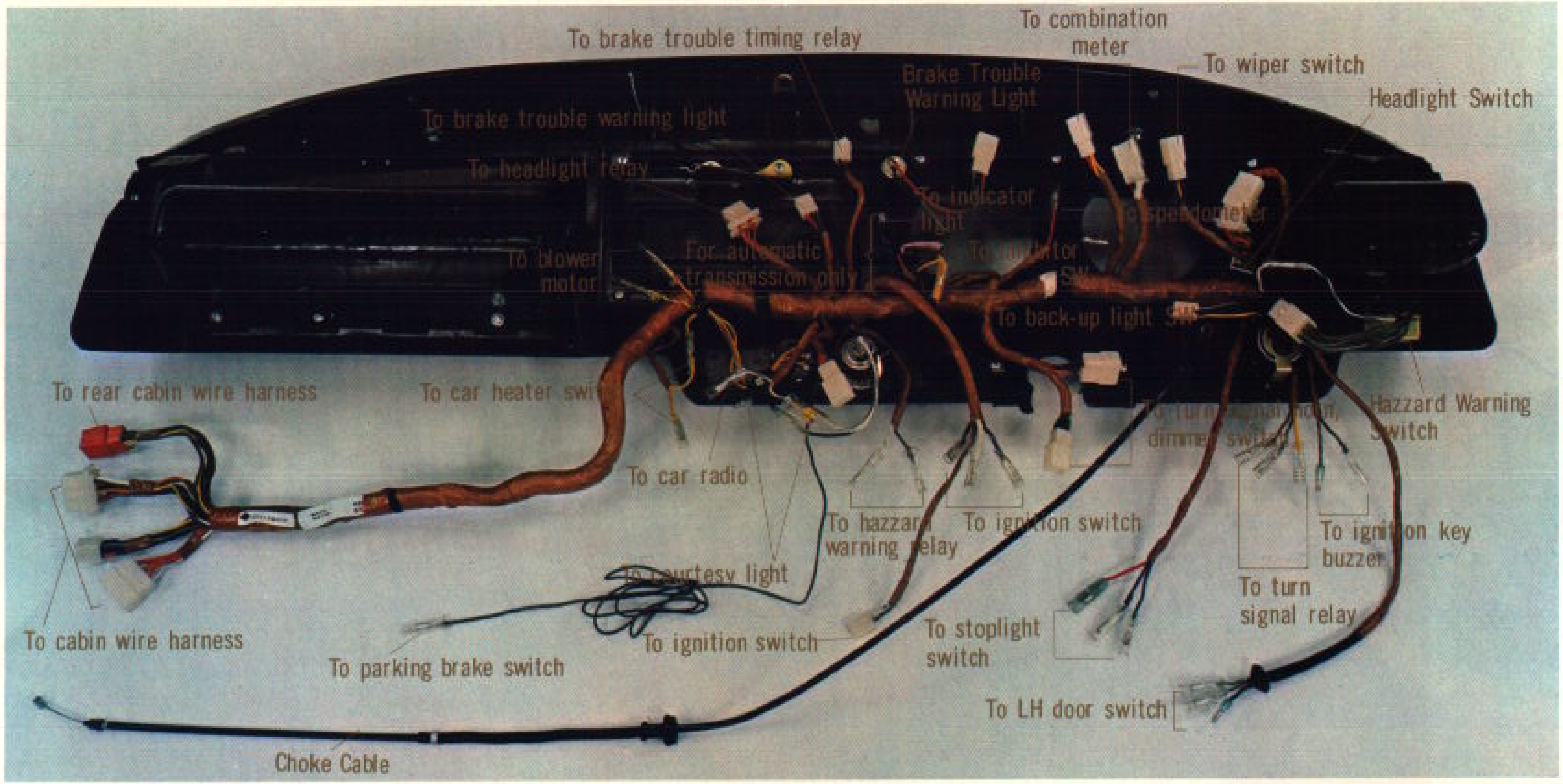


Fig. 17B-1a

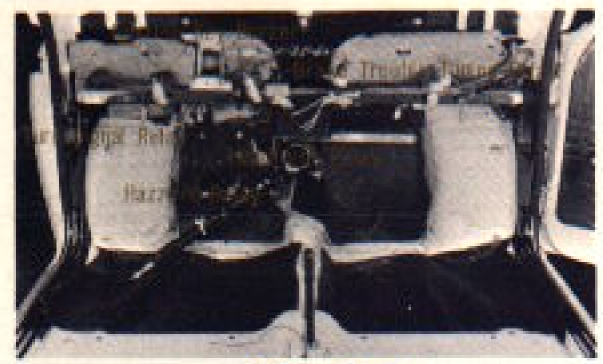


Fig. 17B-1b

A. Fuse Box

The fuese box is located on the upper dashboard in the engine compartment (Fig. 17B-3) or in front of the ventilator lid at the right corner of the cabin (Fig. 17B-2).

Vehicles delivered to the following countries have the fuse box on the upper dashboard of the engine compartment and 12P fuse box (See Fig. 17B-5), while other vehicles have it in the cabin and 3P fuse box (See Fig. 17B-6).

Germany, France, Italy, Portugal, Denmark, Belgium, Netherlands, Luxemburg, Finland, Switzerland, Norway, and Sweden.

From the following "Body applicable serial number", the vehicle for the above countries have 8P fuse box shown in Fig. 17B-4.

N360-1253455, LN360-1014822, N400-1000013, N600-1085151

Vehicles delivered to U.S.A.,Canada,etc incorporate 4P fuse box (Fig. 17B-6a)

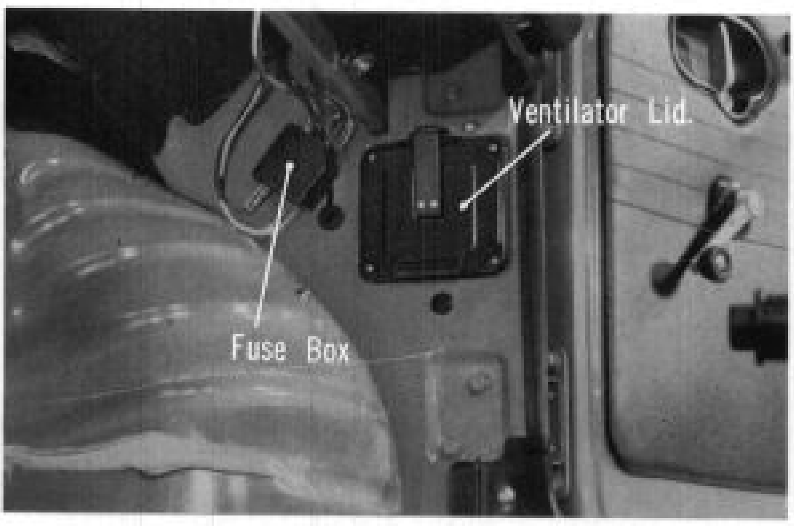


Fig. 17B-2

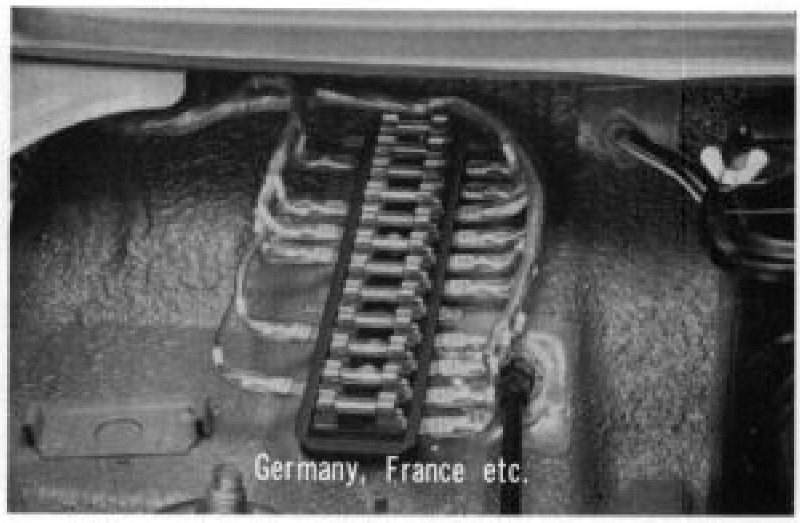


Fig. 17B-3

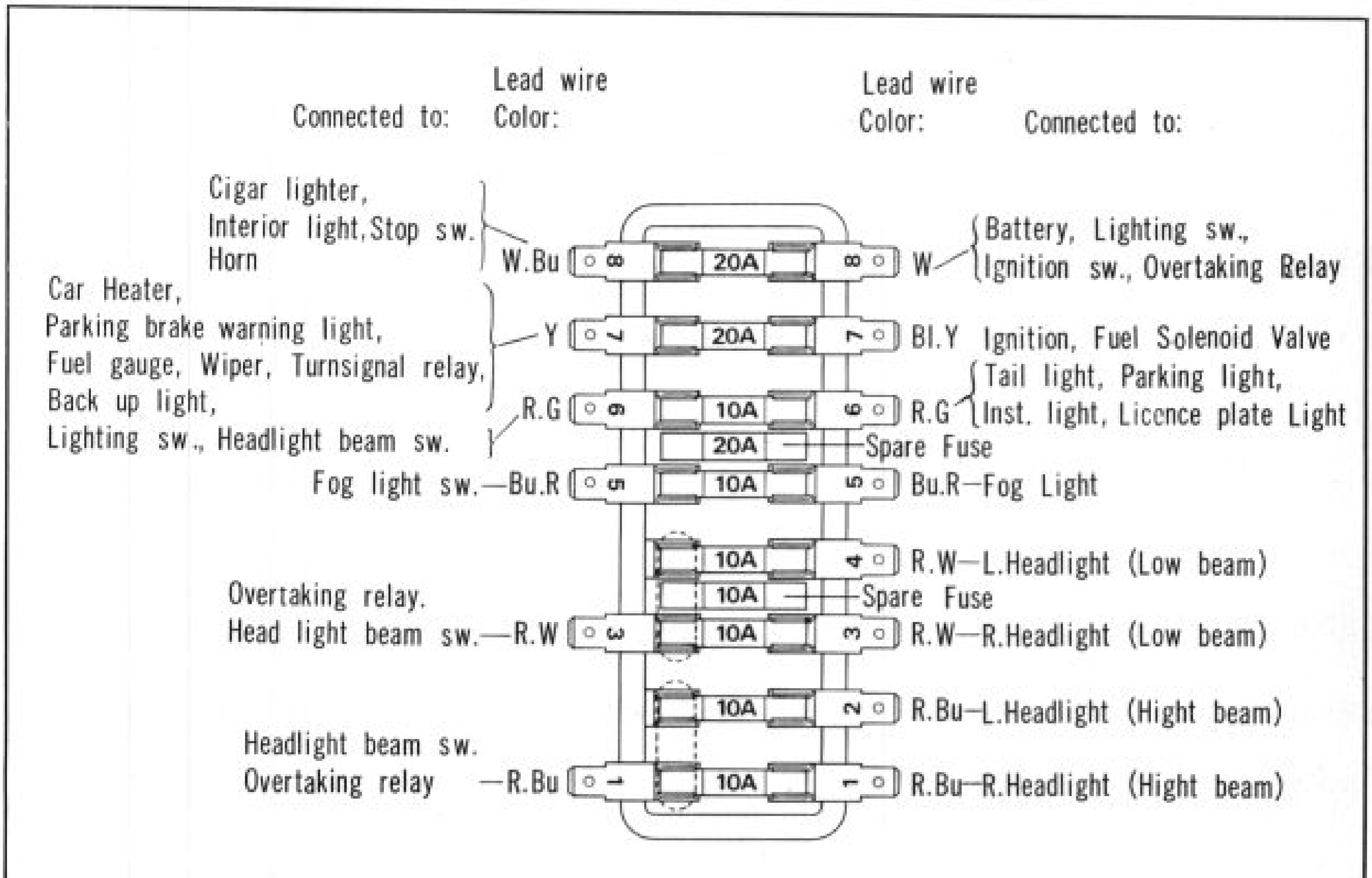


Fig. 17B-4

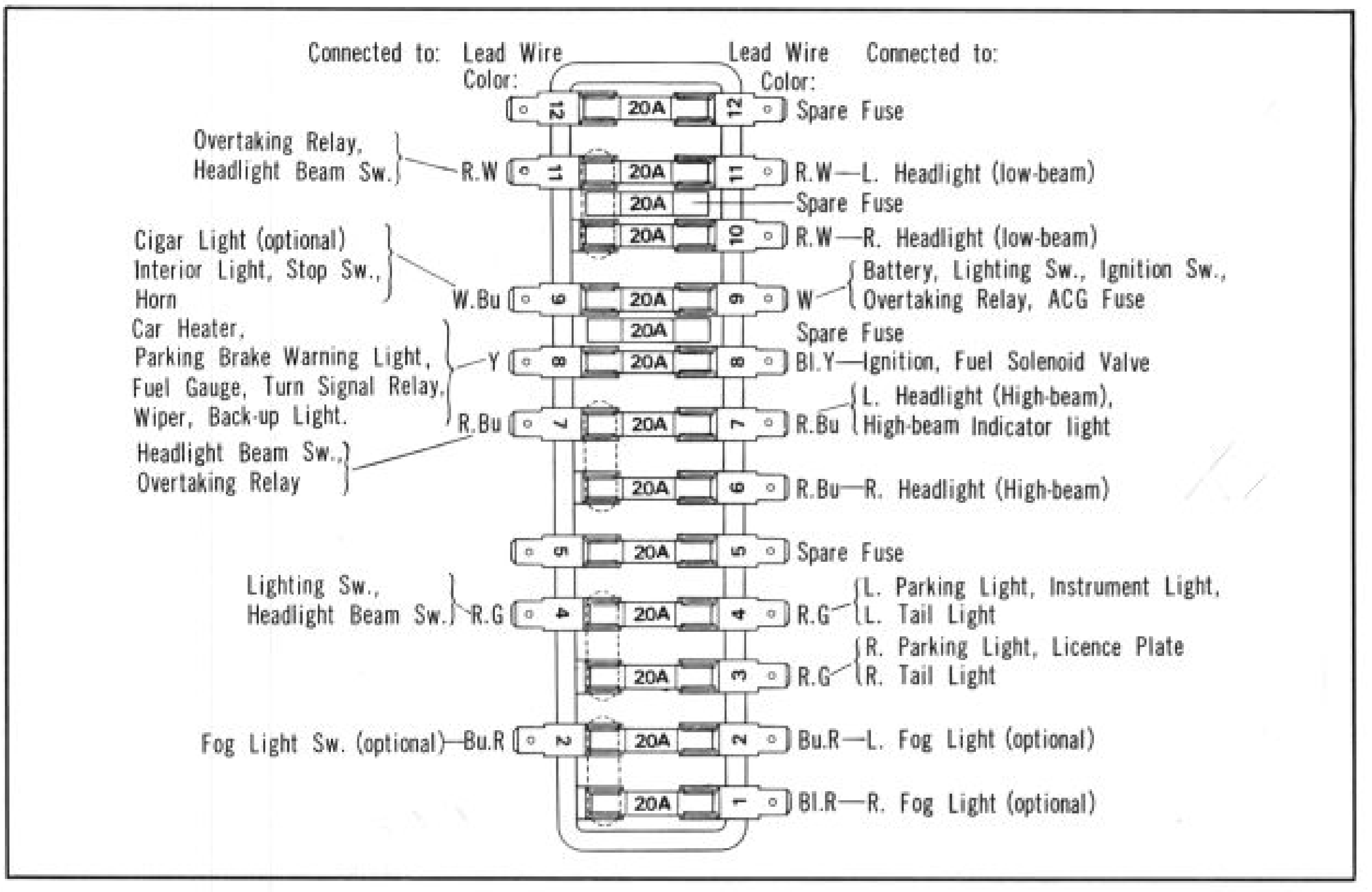


Fig. 17B-5

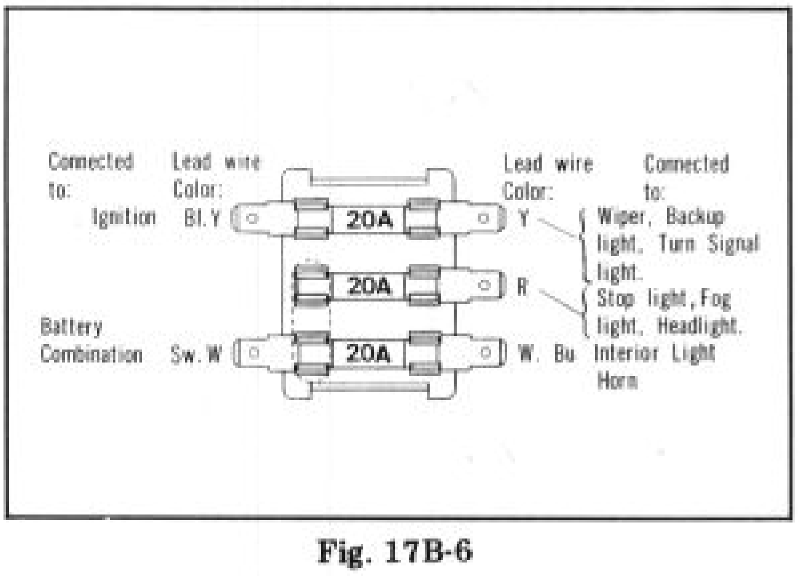


Fig. 17B-6

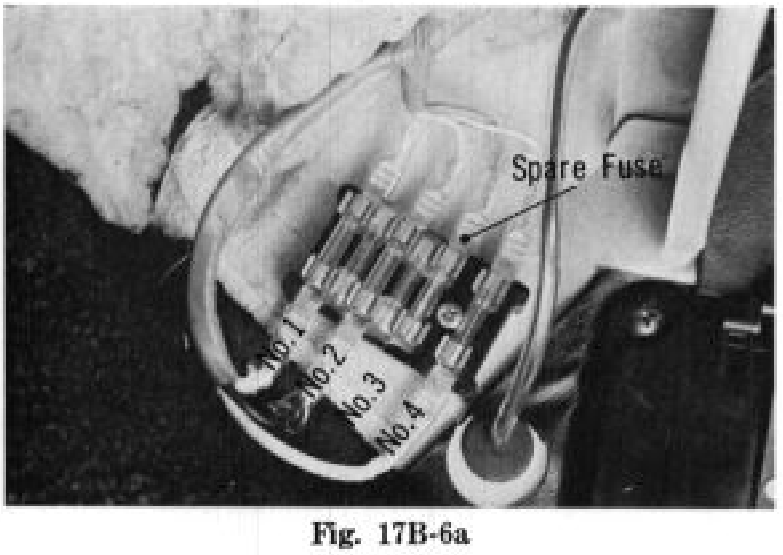


Fig. 17B-6a

R.W . . . . .Red with White stripe
W.Ru . . . . .White with Blue stripe
W . . . . .White
Bl.Y . . . . .Black with Yellow stripe
Y . . . . .Yellow
R.Bu . . . . .Red with Blue stripe
R.G . . . . .Red with Green stripe
Bu.R . . . . .Blue with Red stripe
Bl.R . . . . .Black with Red stripe
R . . . . .Red

(Fuse Box for U.S.A.)

No. 1 . . . . .15A
Car Heater Blower Motor

No. 2 . . . . .15A
Back-up Light
Turn Signal Light
Wiper Motor
Fuel Gauge

No. 3 . . . . .20A
Side Marker Light
Tail Light
Licence Light
Stop Light
Headlight

No. 4 . . . . .20A
Horn
Cigar Lighter
Interior Light
Radio
Hazard Warning Light

B. Lighting Circuit

a. Headlight

There are four types of headlights classified according to countries to which vehicles are exported. Their disassembled views are given in Fig. 17B-7, 8, 9 and 10 respectively.

(1) Standard . . . . Fig. 17B-7
(2) Germany, Denmark, Switzerland, Norway, Sweden and Finland . . . . Fig. 17B-8
(3) France, Belgium, Italy, Portugal, Netherland, Luxemburg . . . . Fig. 17B-9
(4) USA . . . . Fig. 17B-10

The headlights delivered to countries (3) self-contain parking lights (4W).

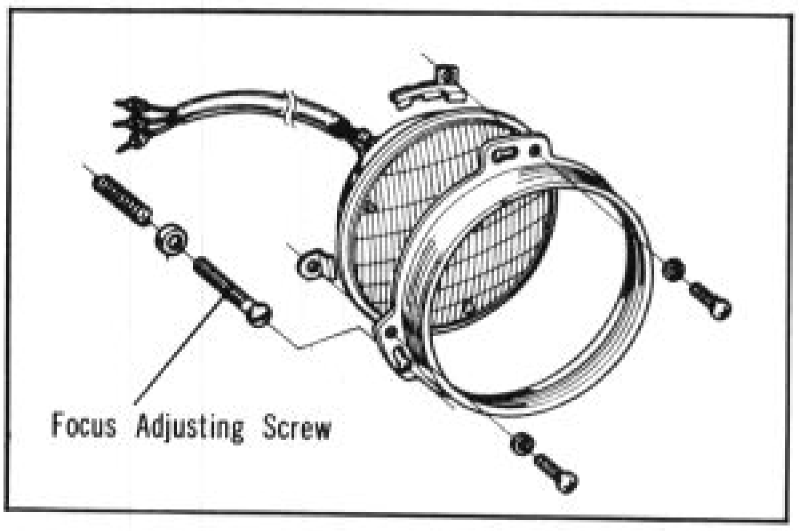


Fig. 17B-7

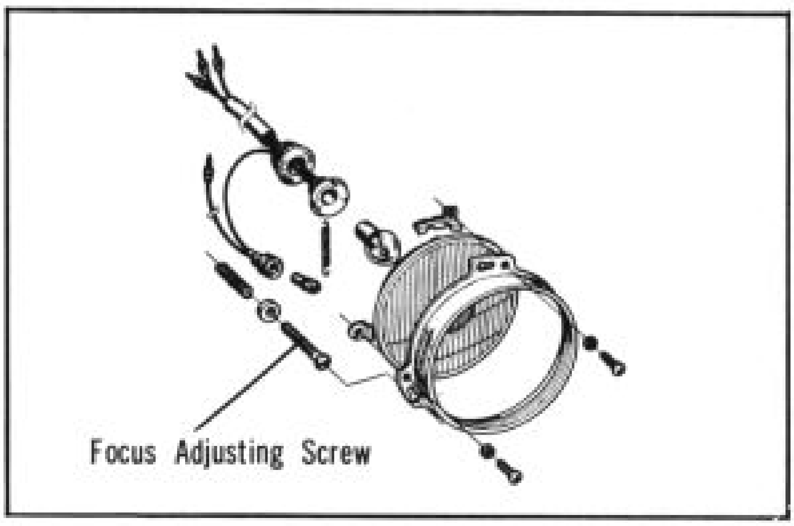


Fig. 17B-8

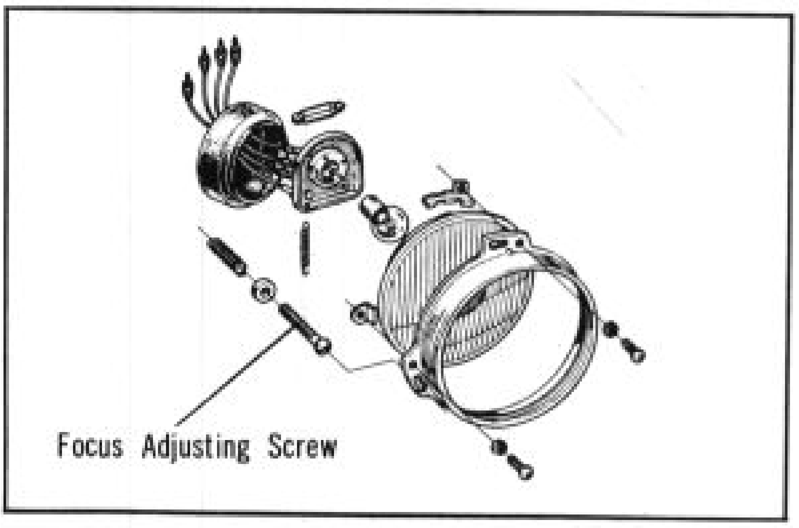


Fig. 17B-9

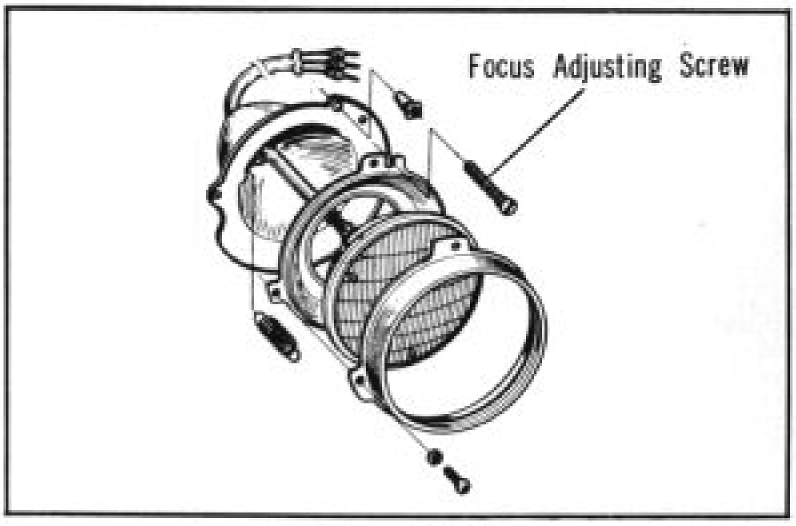


Fig. 17B-10

The disassembly and reassembly of the headlights are described in the following taking the headlight delivered to USA as an example.

1. Since this is a sealed beam type, the headlight can be disassembled as illustrated in Fig. 17B-11 by removing two screws from the retaining ring and the connector from the lamp.

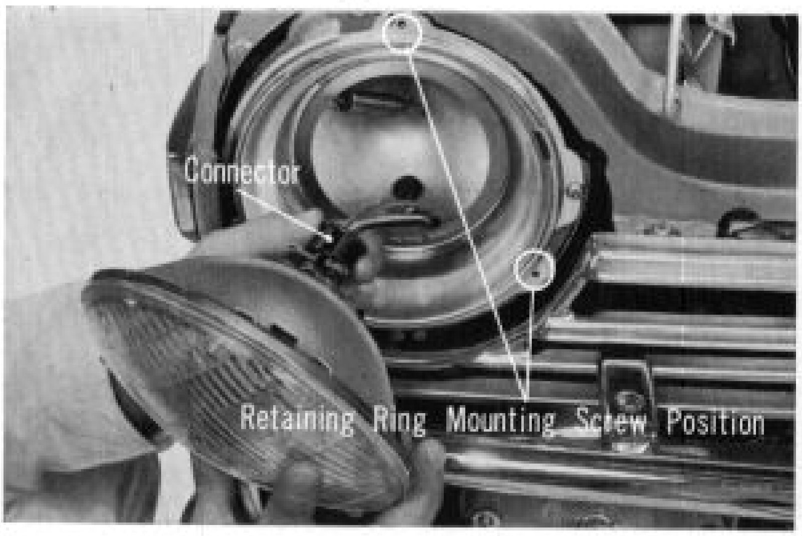


Fig. 17B-11

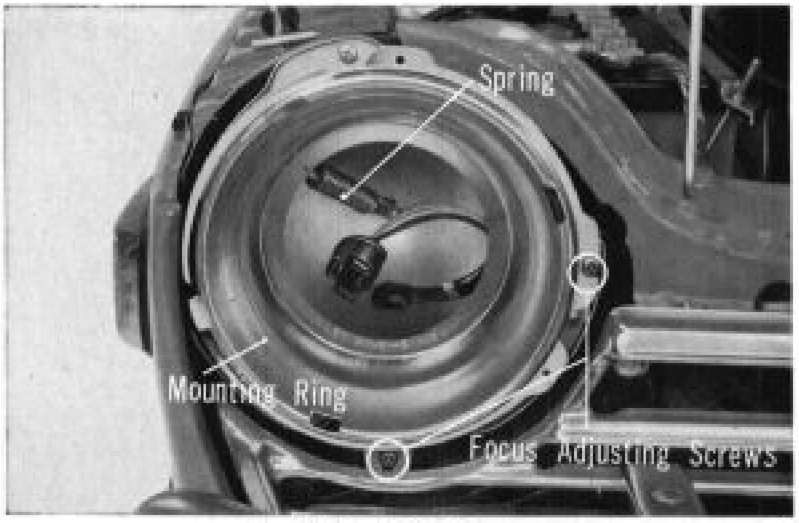


Fig. 17B-12

2. The mounting ring can be removed by removing the spring and two focus adjusting screws. (Fig. 17B-12)

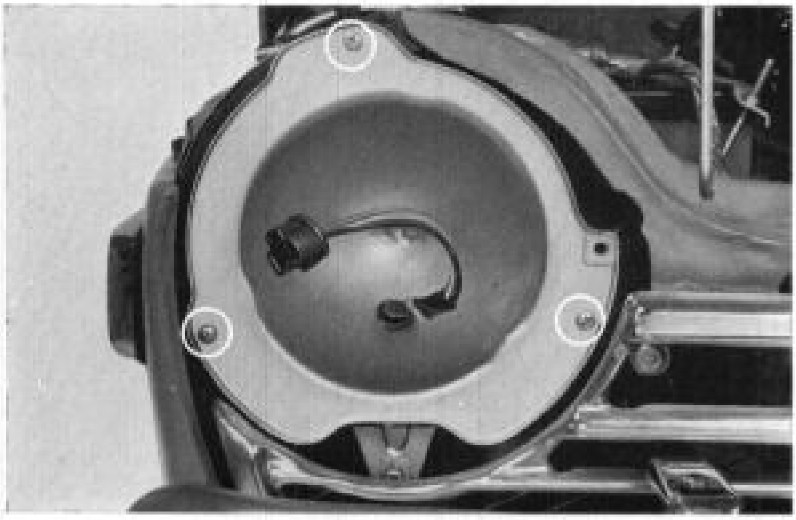


Fig. 17B-13

3. Then remove the three screws from the headlight housing. (Fig. 17B-13)

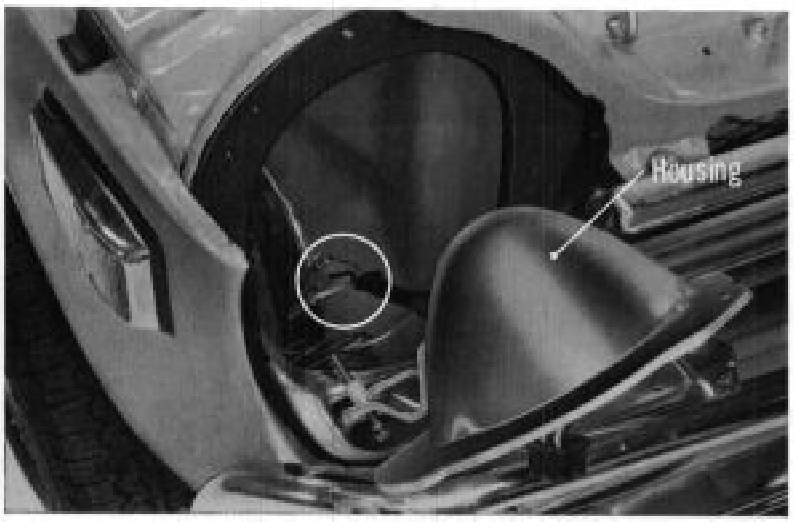


Fig. 17B-14

4. The housing can be separated from the vehicle by unhooking the connector from the wire harness. Match the colors of the wire harness when reconnecting it. (Fig. 17B-14)

5. The focus can be adjusted right and left by means of the screw on the right, and up and down by means of the screw at the bottom. (See Fig. 17B-12.)

Headlight Alignment

Headlight alignment may differ among the countries due to their own regulations. Vehicles delivered to U.S.A., Canada, etc are adjusted as follows.
Park the car in front of the wall screen with 7.62 m (25 ft) dislance from the screen. Then level the car by bouncing both the front and the rear. Note the headlight alignment test is conducted with 10 literes fuel (less than a half-full) in the tank, with a driver seated in the car, the car unloaded except for the spare tire and tools. Ensure that the tires have the correct inflation pressure.

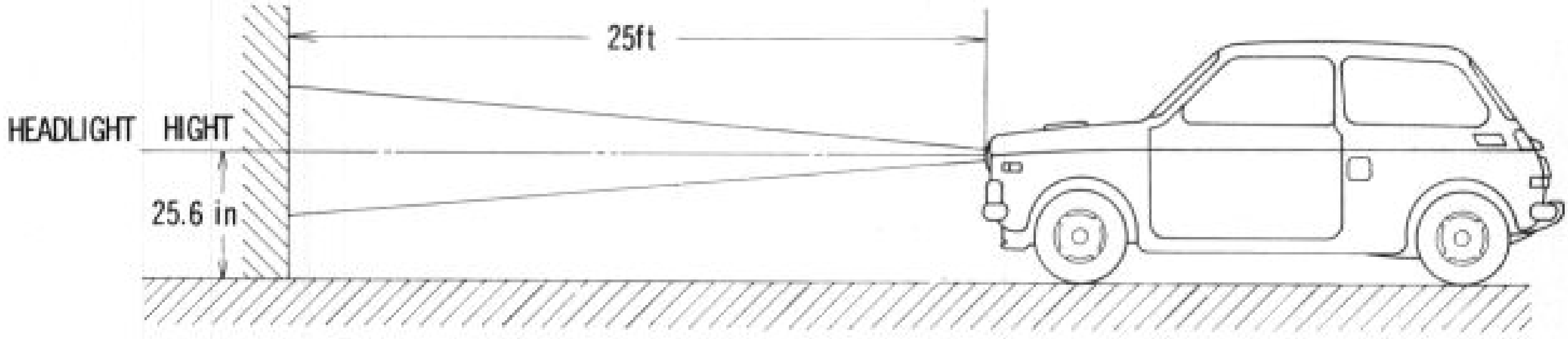


Fig. 17B-14a

Alight the headlights as shown in the picture. Each headlight can be adjusted by means of screws located under the headlight trim ring. (Fig. 17B-13)

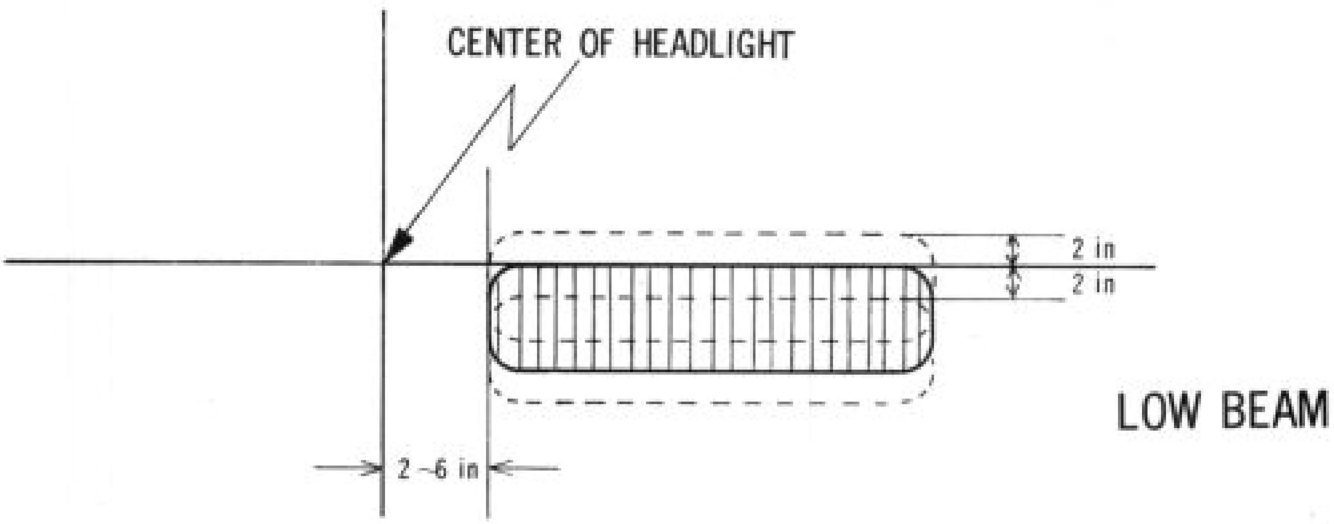


Fig. 17B-14b

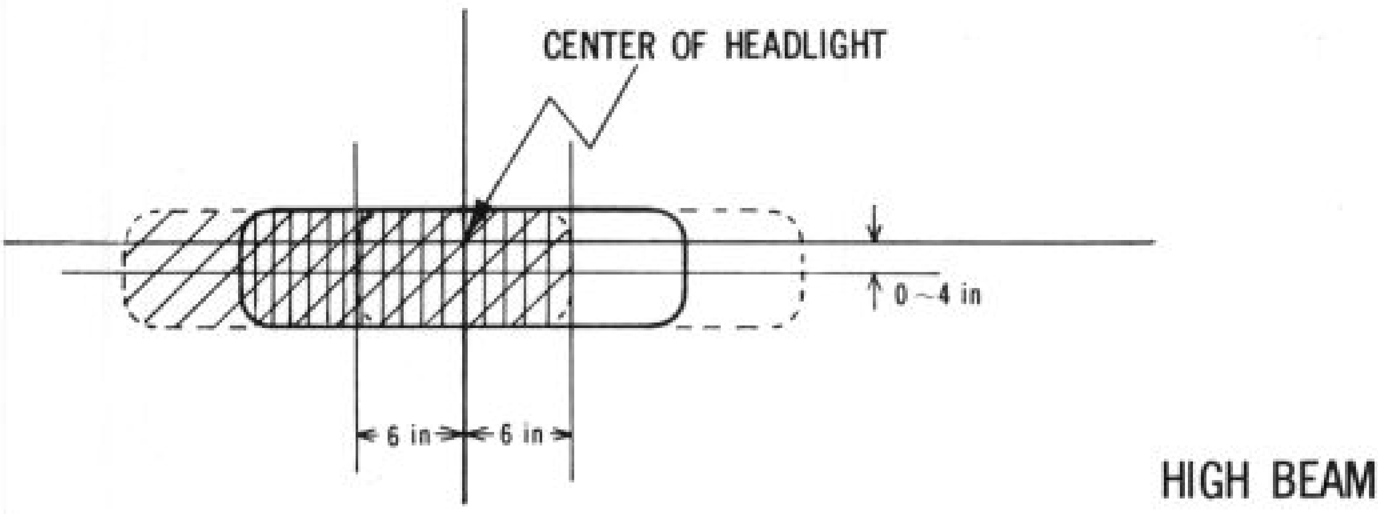


Fig. 17B-14c

b. Rear Combination Light

Standard

To inspect and replace the bulb, open the rear compartment lid, remove the two installing bolts in the rear compartment, and separate the rear combination light from the vehicle body. Since the bulb socket is inserted in the light body, the bulb socket can be removed by pulling. The bulb uses a combined filament, and therefore must be installed in the correct direction. The metallic part of the bulb has differently stepped pawls. Set the bulb in the socket by aligning the pawls with the socket grooves.

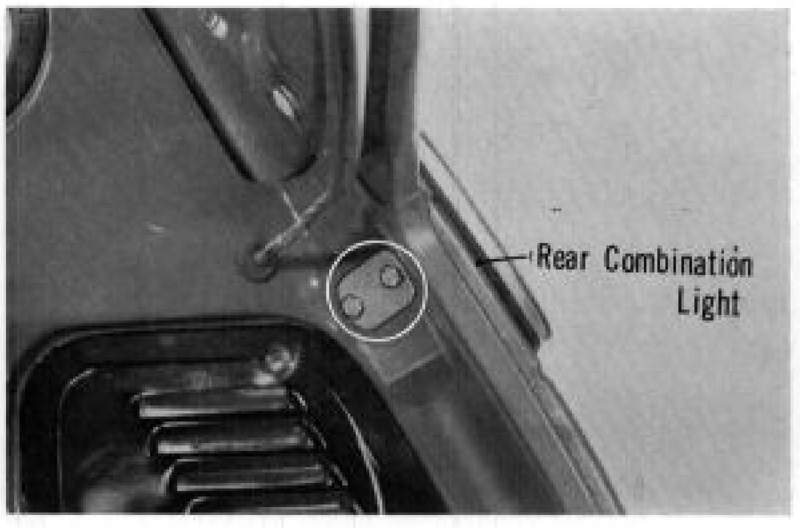


Fig. 17B-15

Fig. 17B-16

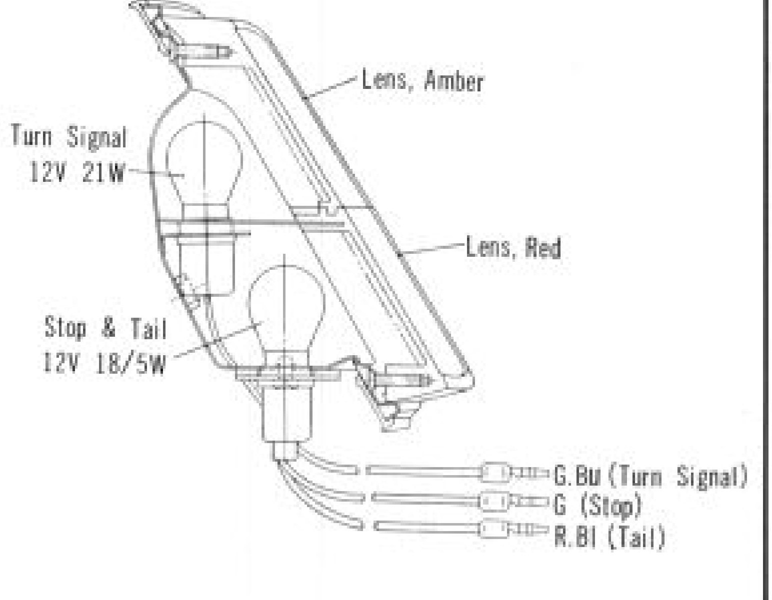


Fig. 17B-17

Vehicles delivered to England and Ireland

The turn signal lights are on top, and the stop and tail lights are at the bottom. These bulbs can be replaced or inspected in the same manner as those that are standard. (Fig. 17B-17)

c. Front Turn-signal Light

Remove the front turn signal light lens, and remove the bulb from the socket by turning it counterclockwise. When installing the bulb in the socket, pay attention to the bulb pawls to be aligned with the socket grooves.

Turn signal 25W
Parking light 8W

Fig. 17B-18

Check for the installation direction of the rubber seal when fitting the lens. The rubber seal has a groove to drain water contained in the light. Install the rubber seal with the groove facing downward. (Fig. 17B-19)

Bulbs except for those delivered to France and Belgium contain two filaments in the same envelope; one for turn signaling and the other for parking.

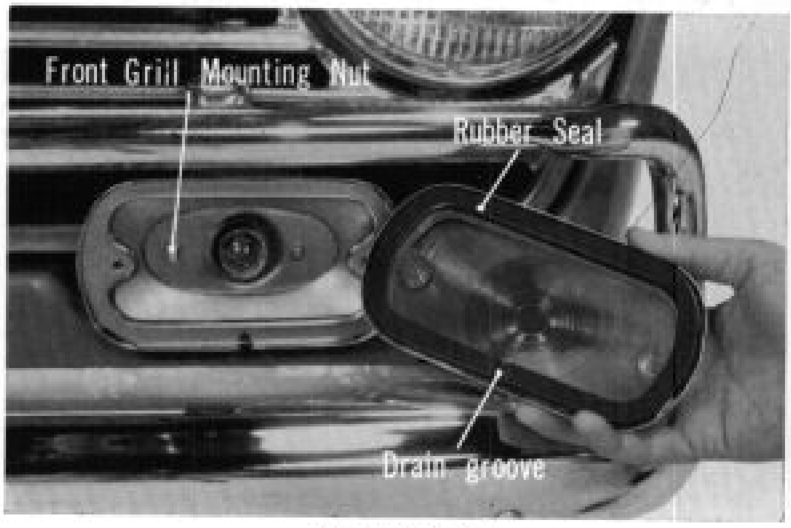


Fig. 17B-19

d. Back-up Light

Remove the two screws. Then, the lens and light assembly can be separated from the vehicle body.

Back-up light 10W

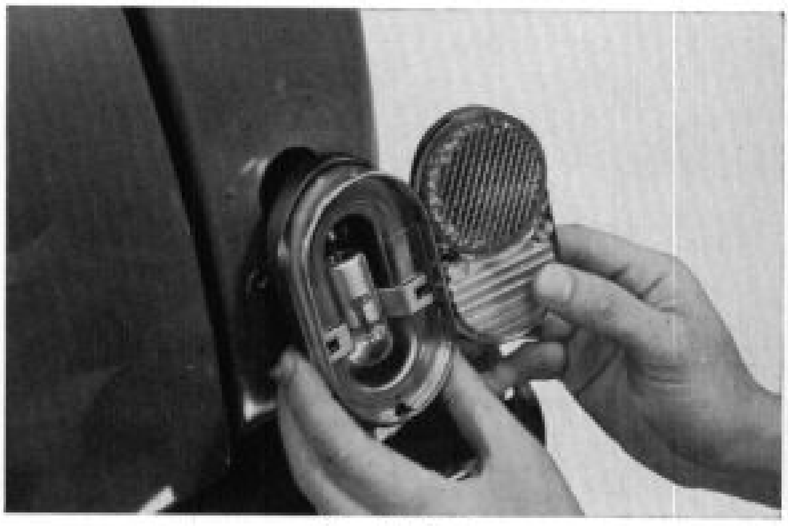


Fig. 17B-20

e. Front Side Marker Light (Only for the U.S.A.)

The front side marker lights are equipped on the right and left front fenders. The lens are a reflex reflector type.

Bulb 12V 4cp

1. Remove the lens.
2. Then, remove the screw from the socket mounting. (For replacement and inspection of the bulb) (Fig. 17B-21)

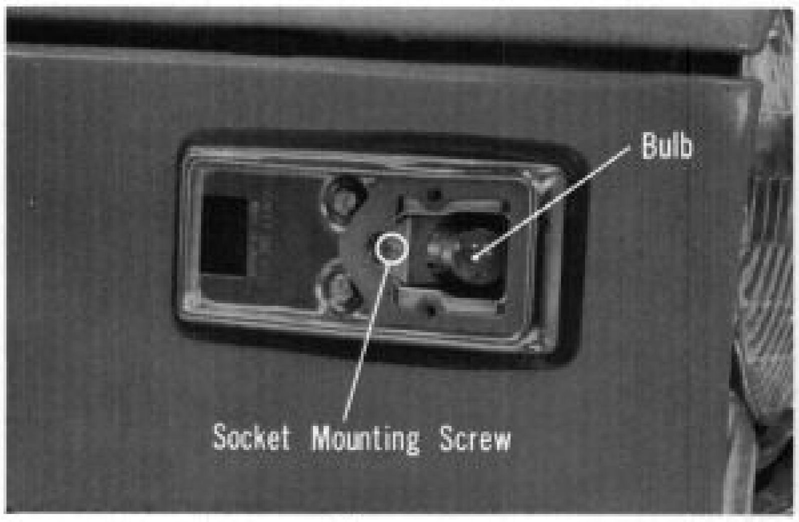


Fig. 17B-21

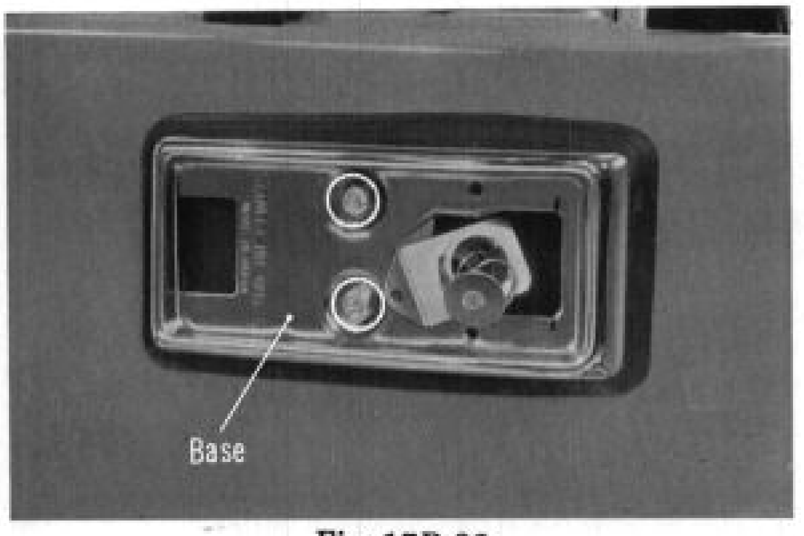


Fig. 17B-22

3. The light base is fixed to the fender with two bolts. (Fig. 17B-22)
4. Before replacing the base seal or the socket, remove the headlight and disconnect the connector from the wire harness. (Fig. 17B-23)

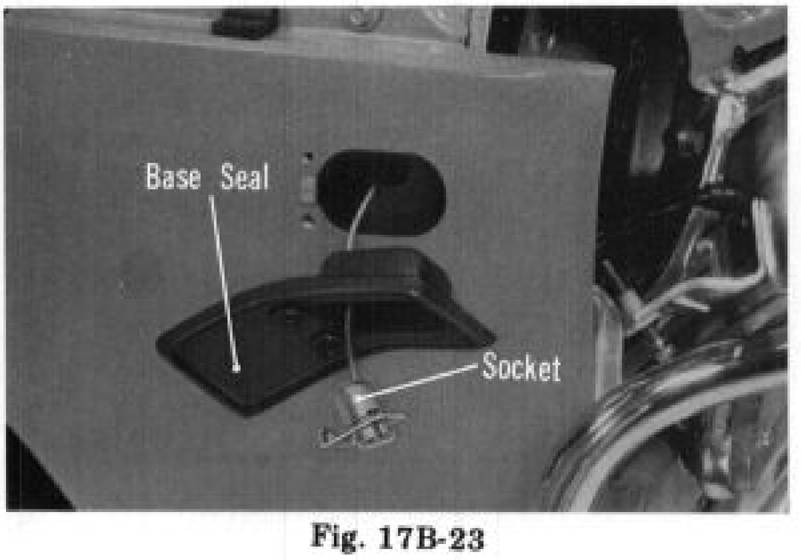


Fig. 17B-23

f. Rear Side Marker Light and Back-up Light (Only for USA)

Model 600 to be delivered to USA have rear side marker light and back-up light beside the rear combination light.

1. Remove the lens to replace the bulbs.

Side marker light	12V 4cp
Back-up light	12V 15cp

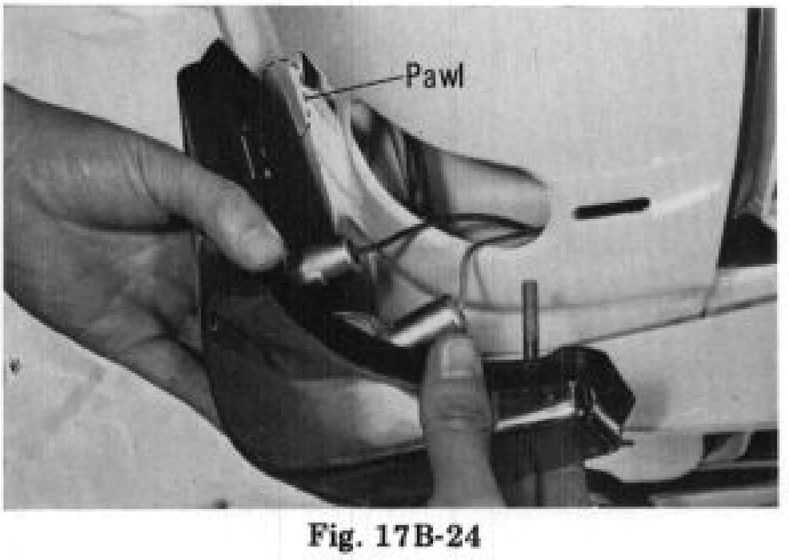


Fig. 17B-24

2. The rear side marker light is mounted by means of a pawl at the front and a nut at the rear

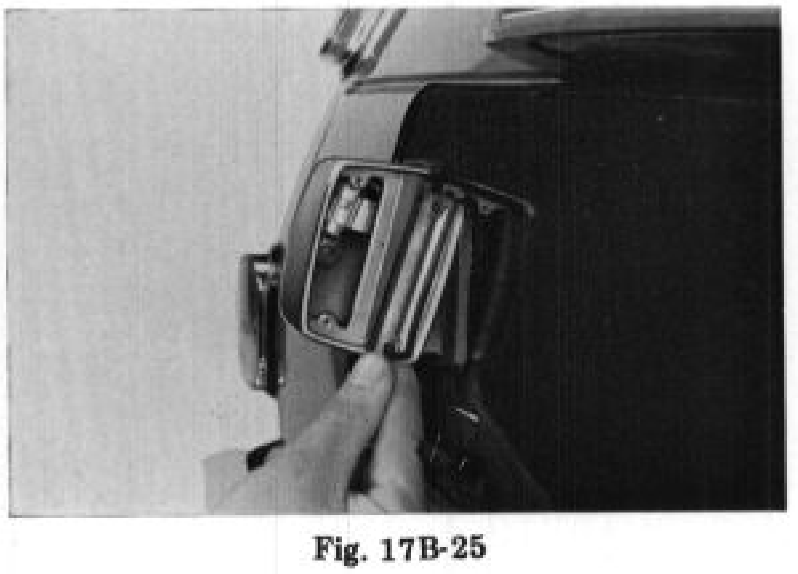


Fig. 17B-25

g. Licence Plate Light

The side licence plate light is installed on the base of the licence plate (except for models to be shipped to France and Belgium, and the standard model). To replace the bulb, remove the lens. (Fig. 17B-26) To replace the licence plate light (installed at the base of the licence plate), open the rear compartment lid and remove the screw on the reverse side of the lid.

C. Windshield Wiper

a. Description

- The wiper assembly incorporates a stable ferrite-magnet motor as the power source whose speed is reduced by a speed reduction gear (worm gear) to the required speed, at which the output shaft of the wiper motor turns to swing the wiper shafts (the shafts on which the blade arms are attached) by means of links and rods so as to wipe off water and dirt from the surface of the windshield.
- In the case of the two-speed reduction system, employed by vehicles to be shipped to the USA, the motor has an additional brush besides the two ordinary brushes and the speed is changed by alternating these brushes electrically by means of the wiper switch at the driver seat position. The motor has no field winding since a permanent magnet is used.
- Automatic wiper stopping is performed by a dynamo brake, which will neither have electrical troubles nor change its stopping position.
- Since the link mechanism and the arm blades have elasticity and sufficient strength and the arm pressure, arm blade dimensions, and wiping angle are made appropriate, the wiping performance is quite reliable under all rainy conditions. The water sealing is trouble-free.

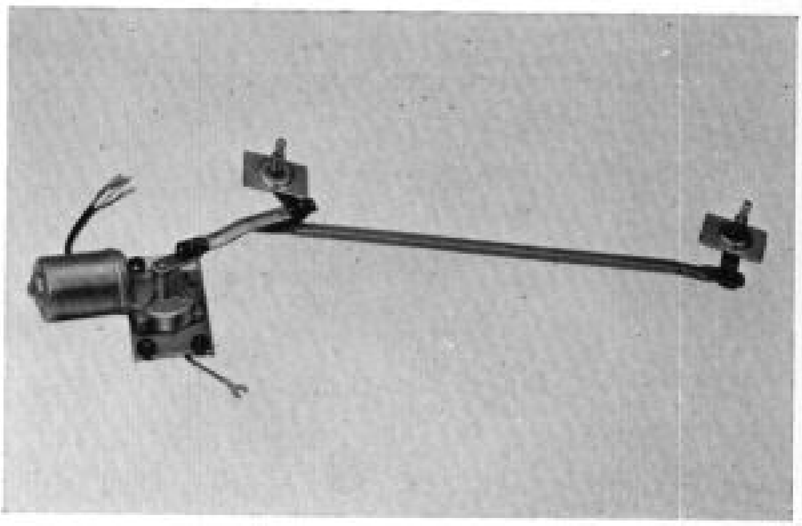


Fig. 17B-27

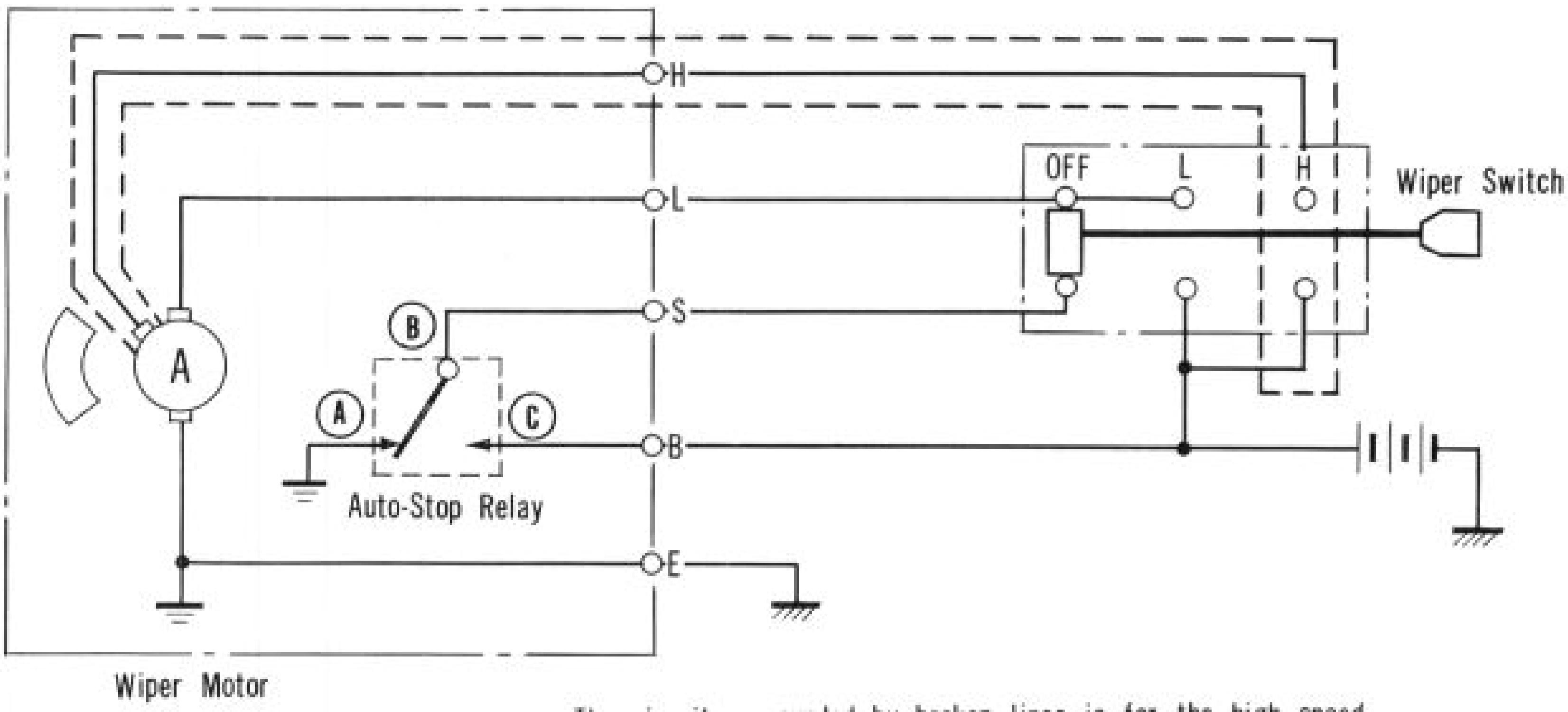
b. Specifications

Motor	
Rated voltage	12V
No-load speed	60 rpm
No-load current	Less than 1.5A
Reaction torque	Greater than 100kg-cm
Current under load	Less than 17A
Link	
Wiping angle (When wet)	88° on the driver seat side 101° on the assistant seat side
Arm shaft diameter	8φ
Arm	
Blade pressure	450±30g
Linkage	By M5° bolts
Blade	
Type	Designed for use with curved Surface of glass
Length	NWB 300mm
Linkage	7.2mm (width) Bayonet type

c. Speed Switch and Auto-stop Mechanism

1. When the wiper is inoperative.

   Fig. 17B-28 shows the state in which the wiper is inoperative. Since no voltage is applied to the (+) brushes (connected to terminals L and H) in this state, no current flows in the motor.

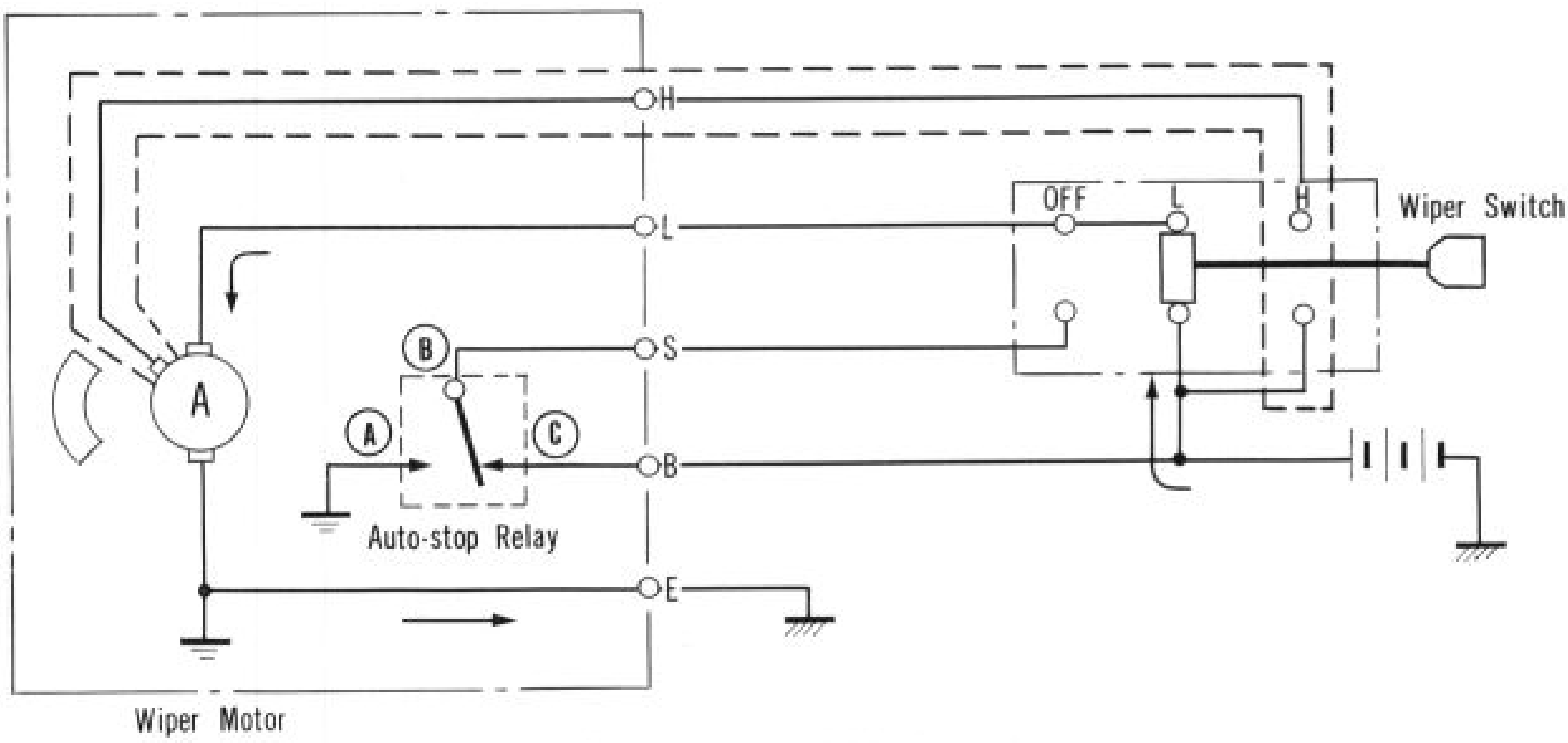


The circuit surrounded by broken lines is for the high speed.

Fig. 17B-28

2. At the low wiper speed.

Fig. 17B-29 is the state in which the wiper is operating at low speed. In this state battery terminal (+) and terminal L is connected by the wiper switch. Current flows in the order of battery (+), the switch, terminal L, the rotor, terminal E, and battery (—) regardless of the position of the auto-stop relay, and the motor turns.

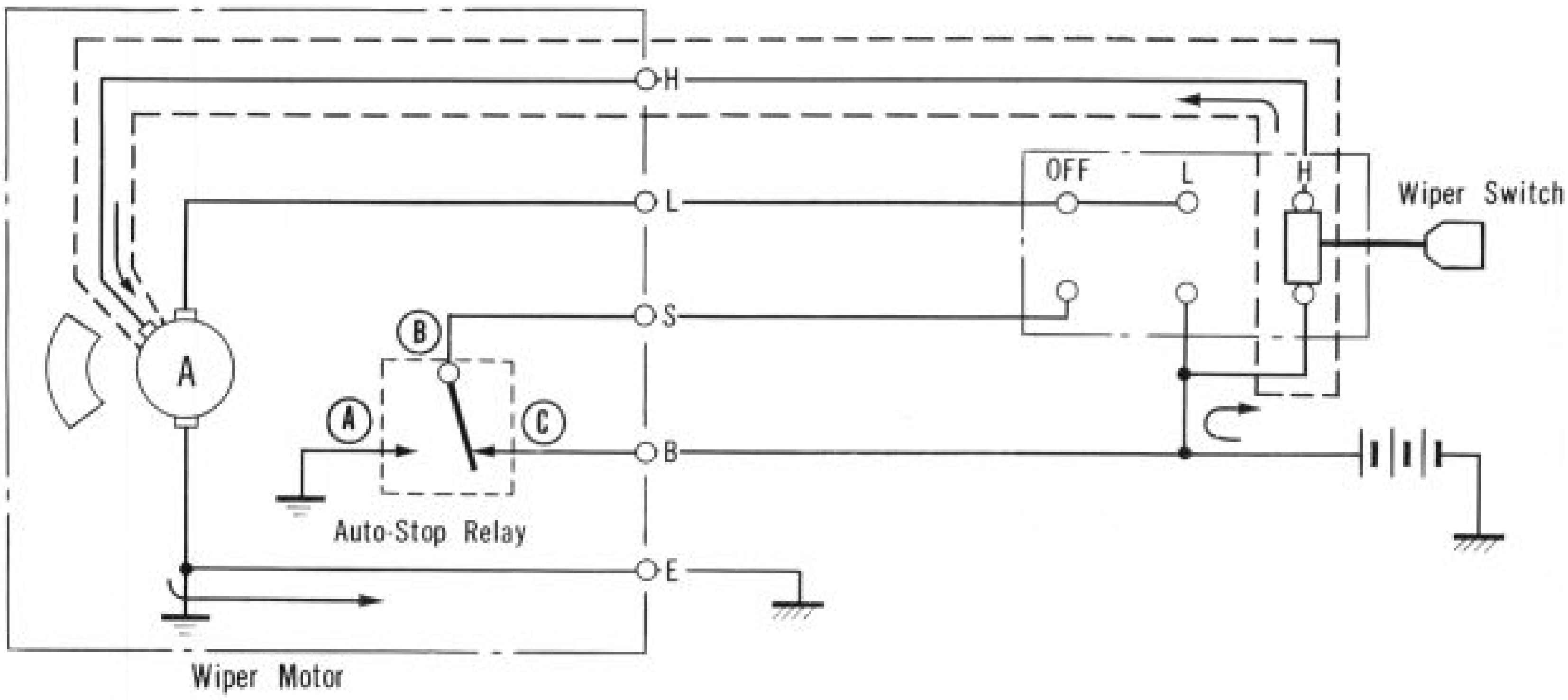


The circuit surrounded by broken lines is for the high speed.

Fig. 17B-29

3. At high wiper speed (in the case of two-speed operation).

When the wiper switch is set to high speed as shown in **Fig. 17B-30**, current flows through the third brush as indicated by the arrow, part of the magnetic flux is not used, and the wiper turns at the high speed. Also at this high speed, the position of the auto-stop relay has nothing to do with the motor operation.

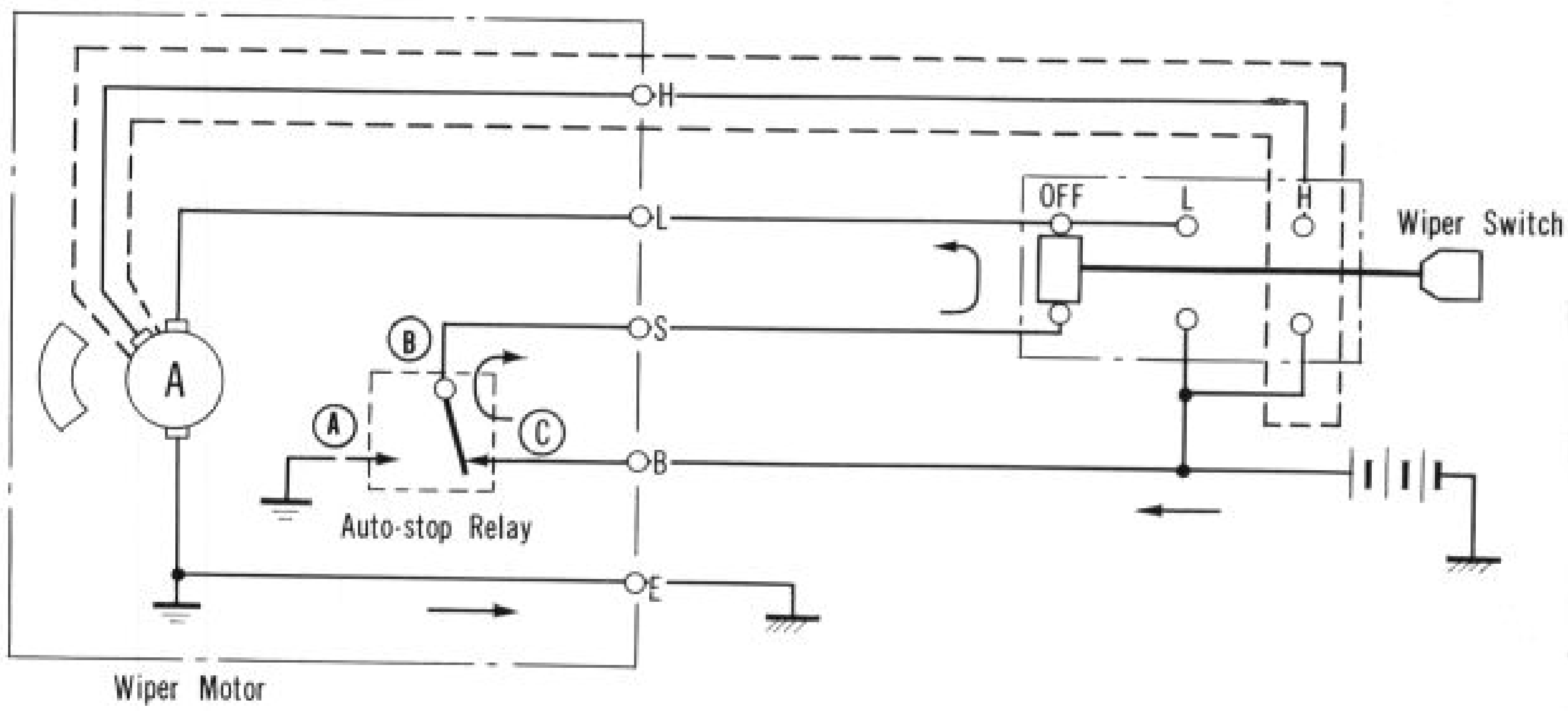


The circuit surrounded by broken lines is for the high speed.

Fig. 17B-30

4. When the wiper switch is at STOP.

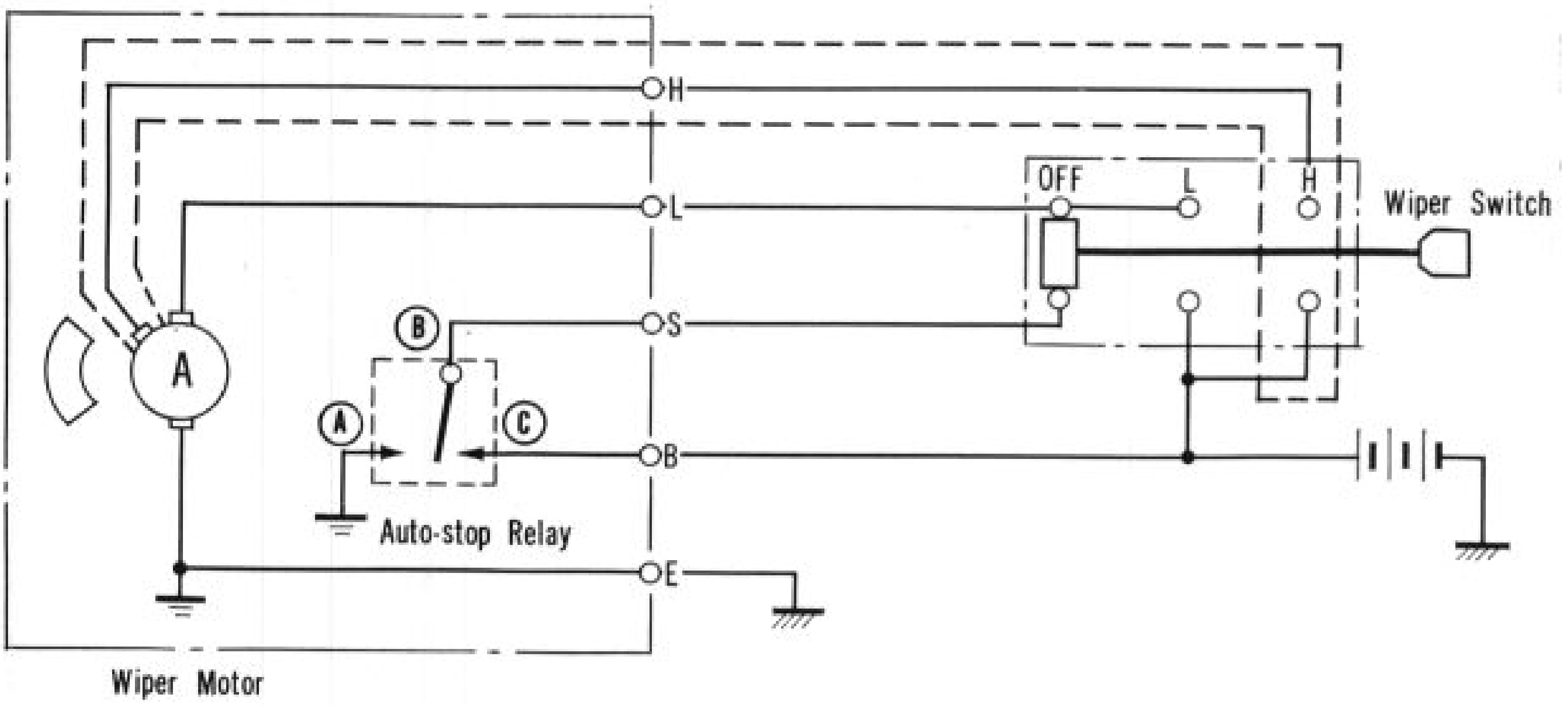
(a) When contact Ⓑ and contact Ⓒ are closed by the auto-stop relay current flows as shown in Fig. 17B-31 and the wiper operates at a low speed.



The circuit surrounded by broken lines is for high speed.

Fig. 17B-31

(b) When contact Ⓑ is connected to neither contact Ⓐ nor contact Ⓒ of the auto-stop relay, no current flows in the motor and the wiper keeps turning by inertia. (Fig. 17B-32)



The circuit surrounded by broken lines is for high speed.

Fig. 17B-32

(c) **If contact Ⓑ is connected to contact Ⓐ of the auto-stop relay, a closed circuit is established by the rotor, resistor, terminal S, switch, and the rotor as whon in Fig. 17B-33. In this state, the rotor turning in the magnetic field acts as a generator, and current flows in the above closed circuit due to the voltage generated by the rotor. That is, current must be supplied to keept the rotor turning or otherwise the inertia force of the motor is rapidly consumed and the rotor is stopped. Thus, the stopping mentioned in 1 is brought about.**

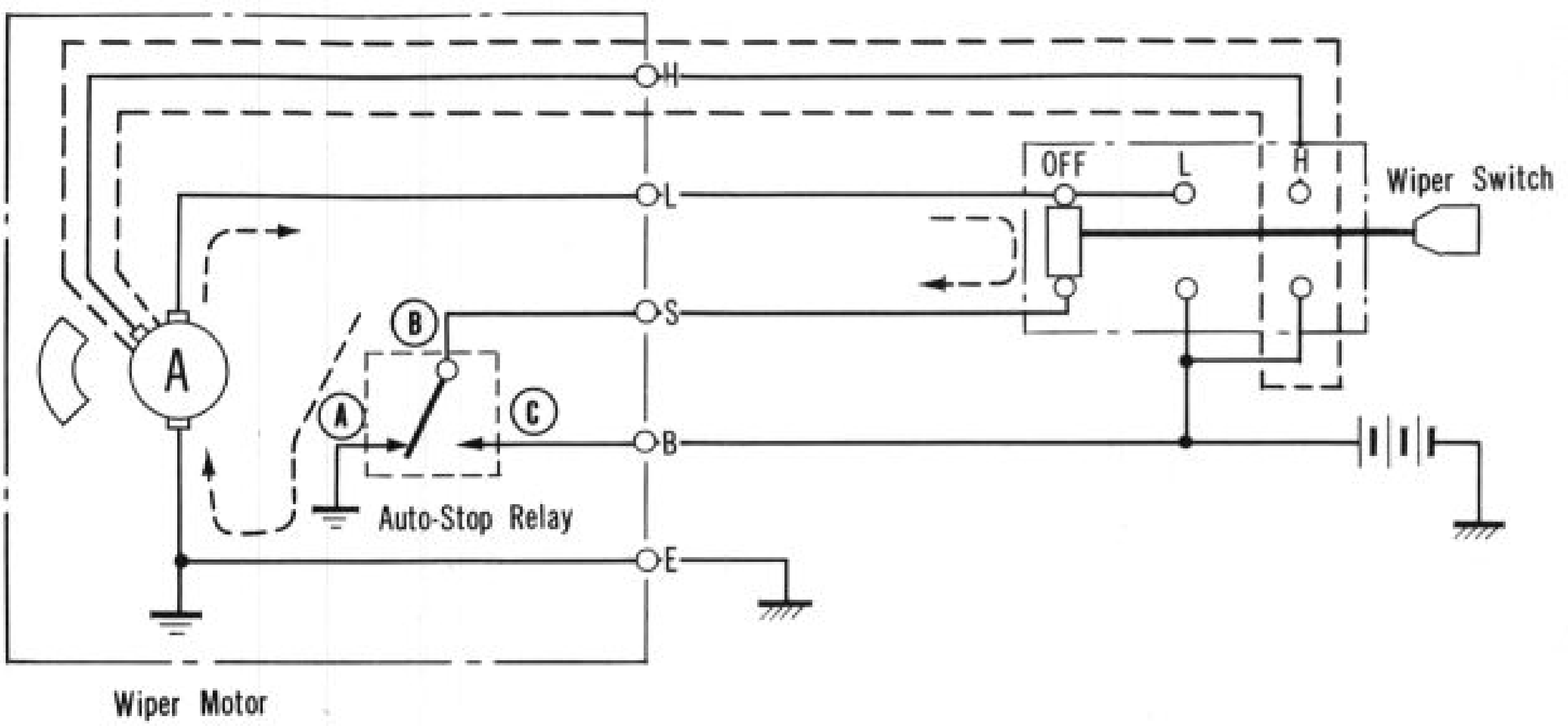


Fig. 17B-33

Auto-stop relay

A relay plate having a shape shown in **Fig. 17B-34** is fitted in the driven gear or the worm wheel, in the gear box. In **Fig. 17B-34**, the inner and outer areas (parts A) are conductors, the intermediate portion (part B) is insulator, and the two dotted circles are the tracks which conductor pieces are in contant while the relay plate is turning. Leads are connected to these circular conductors through conductor pieces.

The outer conductor piece (connected directly to the power source) only contacts the outer conductor of the relay plate, and the inner conductor piece contacts the outer conductor of the relay plate → the insulator → the inner conductor → the insulator → the outer conductor. The inner conductor of the relay plate is grounded to the body of the motor. In **Fig. 17B-35** (a), the inner conductor piece is in contact with the outer conductor.

When inner conductor piece is on the insulator, the relay takes the position shown in **Fig. 17B-35** (b). And the relay with the inner conductor piece being in contact with the inner conductor is shown in **Fig. 17B-35** (c). **Fig. 17B-35** (a) though **17B-35** (c) correspond to **Figs. 17B-31** and **17B-33** in effecting the auto-stop.

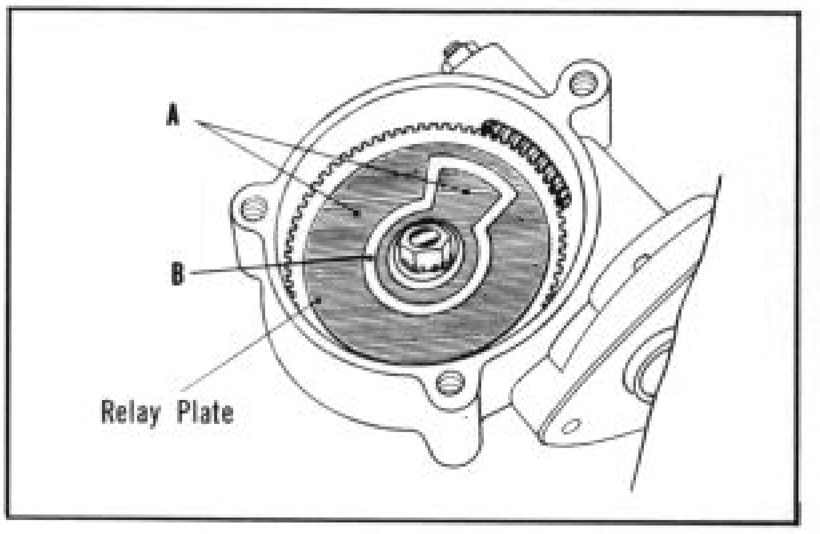


Fig. 17B-34

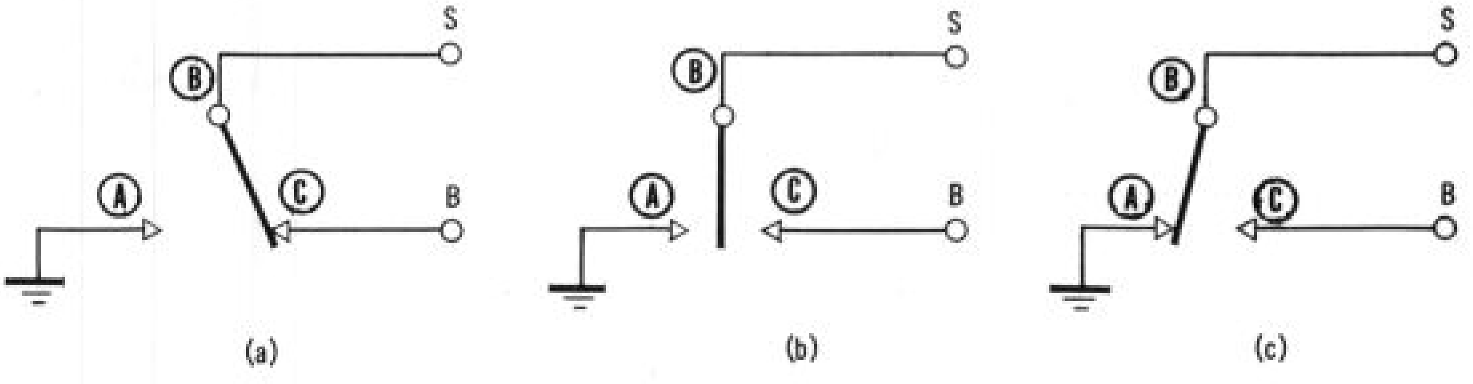


Fig. 17B-35

d. Suggestions Concerning the Wiper

- Avoid removal and disassembling of the motor, link, and arms. Particularly, the motor will be difficult to disassemble and reassemble without special jigs.
- The wiper blades should be replaced when the rubber is so worn that they do not wipe satisfactorily.
- When installing the wiper arm, confirm that the motor automatically stops at the correct position by turning the motor, and then align the blades so that they are parallel to the bottom edge of the glass before securing them with bolts. (Tightening torque of 40 to 50 kg-cm is preferable.)
- During cleaning of inspection of the vehicles avoid opening the engine compartment lid with the blades set up from the glass surface, or the arm blades would be damaged.
- Rewiring of the motor leads after disconnection should be made with the colors matched, or erroneous connections would damage the motor or result in the blown fuse.
- A large volume of snow accumulated over the glass may make it impossible to operate the wiper. If this is the case, remove the snow.
- The blades may be frozed fast to the glass under cold weathers. Melt the ice before turning on the wiper switch.
- Turning on the wiper switch when the wiper cannot operate due to snow or freezing can result in motor damages.
- When the wiper stops due to heavy snow or freezing, the large current will be retained in the motor circuit by the automatic mechanism even after the wiper switch is turned off. This can result in motor damages. Always turn off the wiper switch while normally operating the wiper by setting up the blades from the glass, and stop the wiper at its auto-stop position.

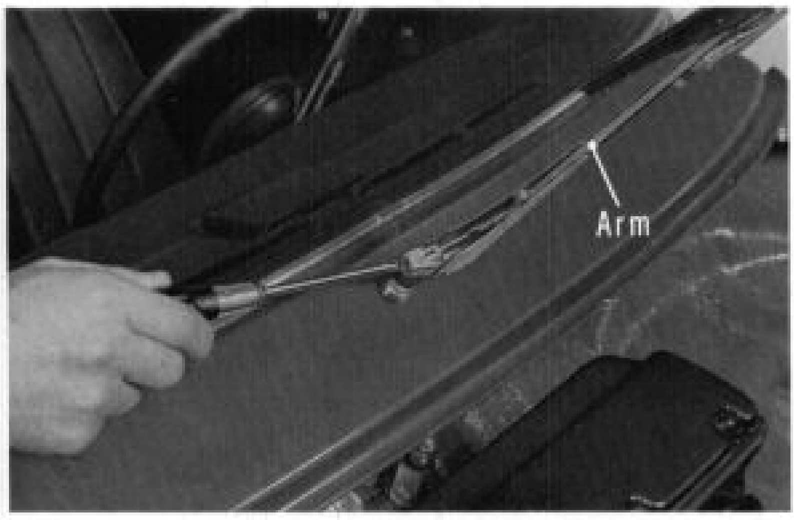


Fig. 17B-36

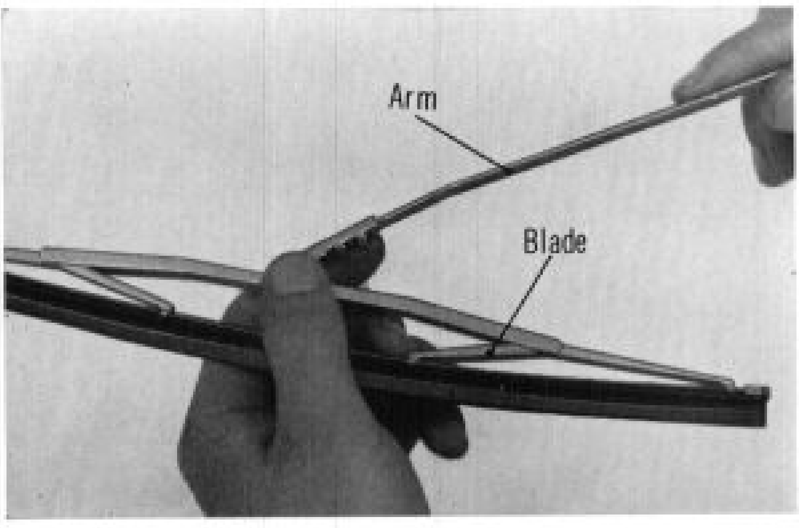


Fig. 17B-37

e. Maintenance

1. Inspect blade rubber for deterioration, hardening cracks, and lack of arm contact pressure against windshield.
2. When replacing the wiper arm, remove the lock bolt which secures the arm **(Fig. 17B-36)**

   Tightening torque:
   40~50 kg-cm (2.9~3.6 lb-ft)

3. The wiper blade can be removed by depressing the arm link where the blade is connected to the arm, and pulling it out. When inserting, depress until the arm locks.

4. Remove the cotter pin, separate the link from the motor, and try to operate without a load. If the motor speed is 45~55 rpm, the motor is normal. If the motor does not rotate, a defective switch or wiring is most probable. Inspect the motor unit first.

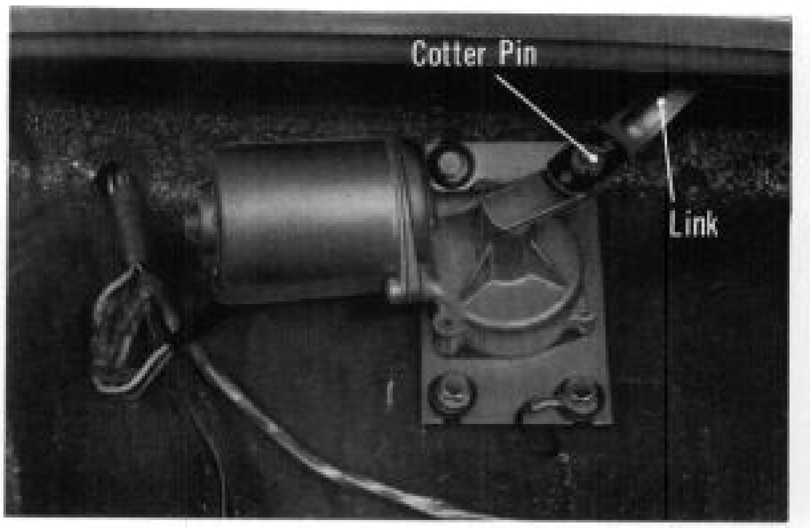


Fig. 17B-38

5. Check the stop position

   Short the motor S1 terminal and S2 terminal with a separate lead as shown in figure, and operate the motor at low speed. In addition, connect the B terminal and battery (+) terminal, and disconnect the S2 terminal and battery (+) terminal connection. Make this test several times, If the motor clamp plate stops at a fixed position, the condition is satisfactory.

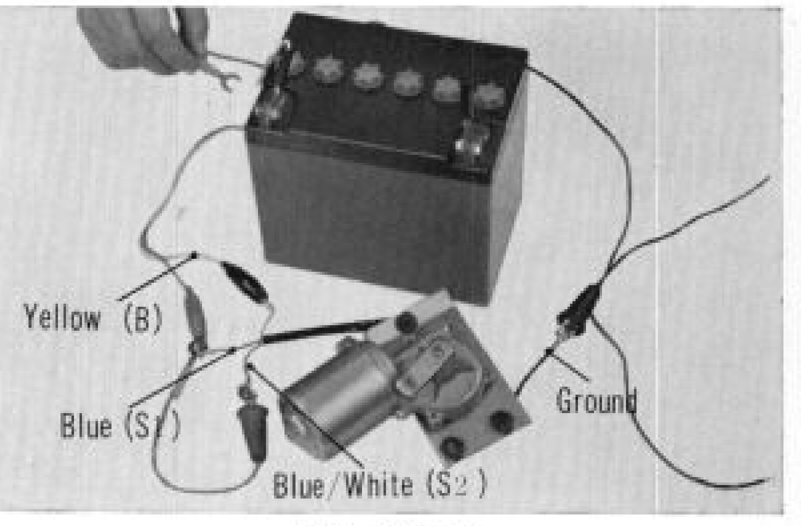


Fig. 17B-39

6. Trouble shooting.

   When the wiper motor becomes unoperatable, first insure that the fuse is not blown. If the fuse is normal, check voltage between the wiper motor blue cable and ground. If the value is between 10 and 12V, the condition is normal. Check continuity and insure that no open line exists.

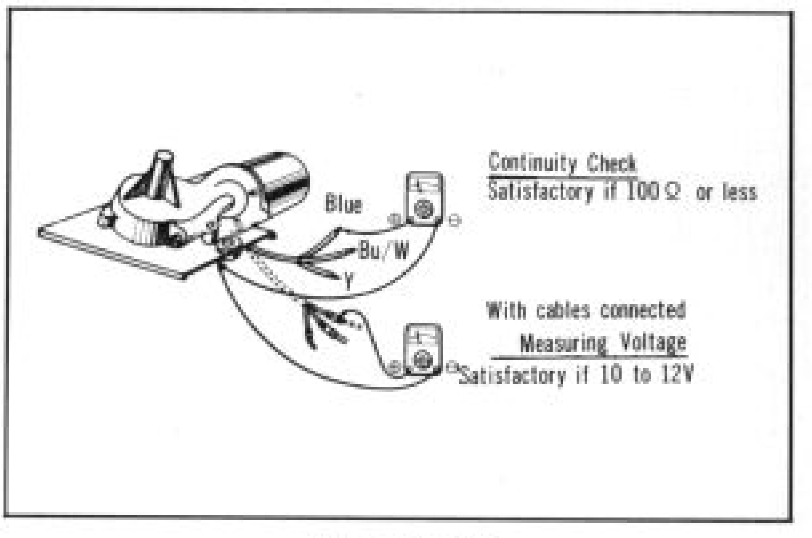


Fig. 17B-40

D. Horn

a. Ratings

Model	Voltage (V)		Current (A)	Sound magnitude (dB)	Frequency (C/S)
	Rated voltage	Operating range			
UH-2D	12	9 − 15	Less than 3.5	98 − 108	440 ± 30
UL-2D	12	9 − 15	Less than 3.5	98 − 108	520 ± 30

b. Construction

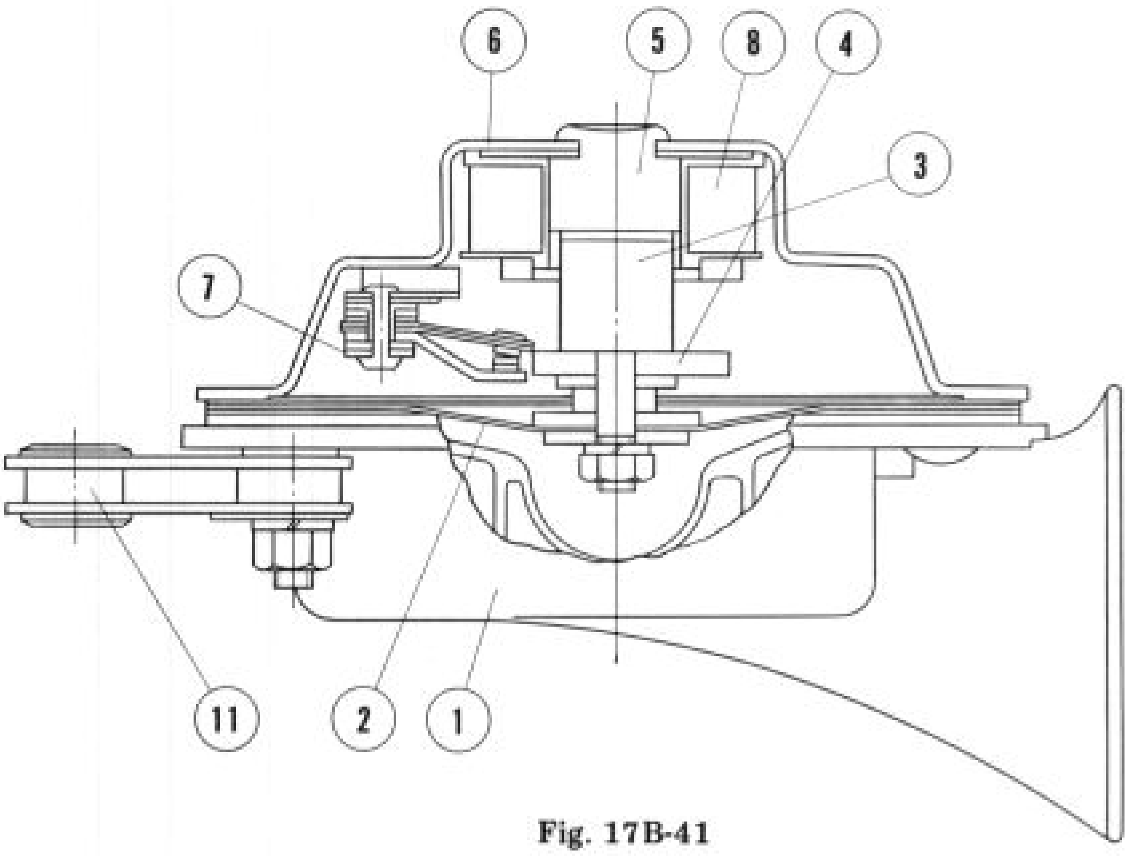


Fig. 17B-41

(1)	Car ring horn	Acoustic amplification and radiation
(2)	Diaphragm	Vibratory element (Sound source)
(3)	Pole B	Linkage between the armature and the vibratory element, and magnetic field.
(4)	Armature	Magnetic field (Sound source).
(5)	Pole A	Magnetic field.
(6)	Case	Mounting base, magnetic field, and protection for internal parts.
(7)	Contact assembly	Current switching for vibration.
(8)	Coil	Serves to magnetize the poles and armature (Source of the attractive force).
(9)	Cord A	Lead for electrical connection. **(Fig. 17B-43)**
(10)	Cord B	Lead for electrical connection. **(Fig. 17B-43)**
(11)	Clamp unit	Mounting fixture (incorporates spring to prevent acoustic interference between the horn and the body of the vehicle)

c. Electrical Connection

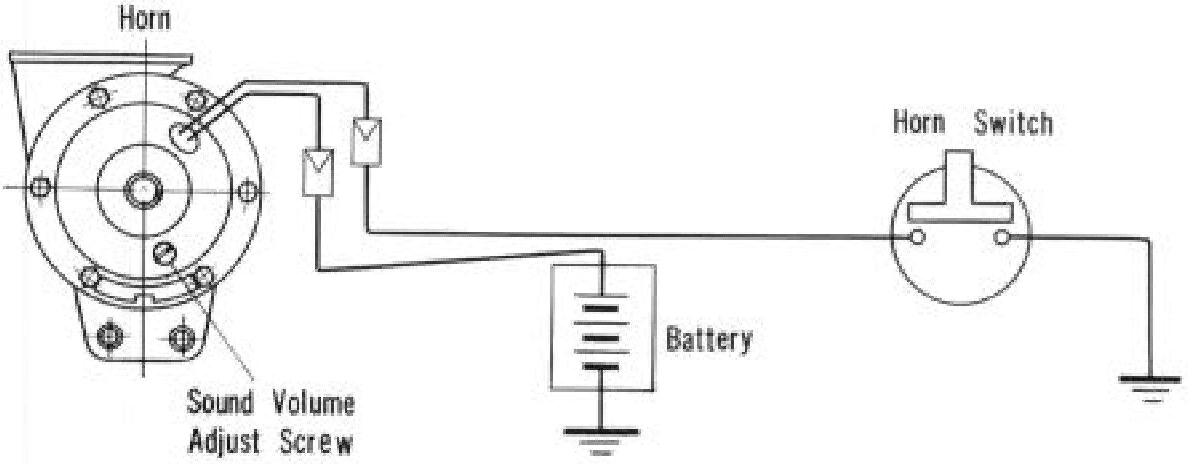


Fig. 17B-42

d. Operating Principle

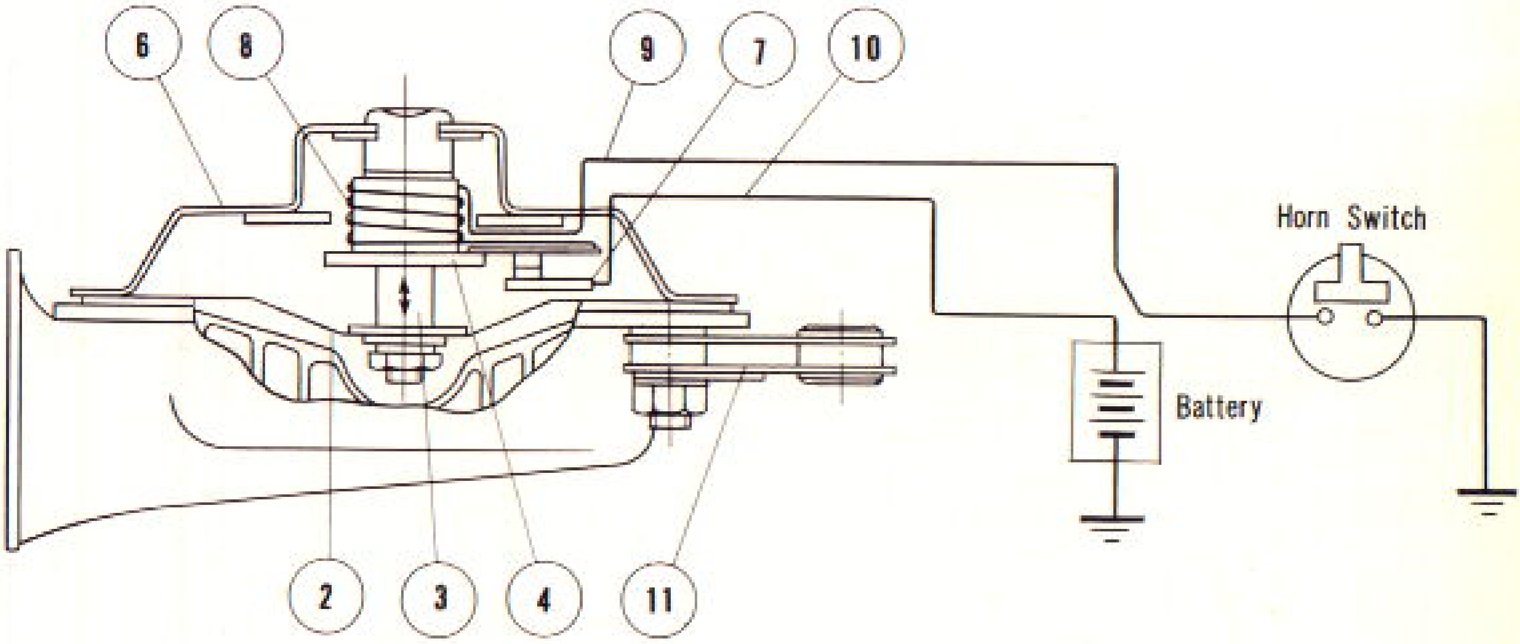


Fig. 17B-43

When the switch is closed, current flows from cord A ⑨, to coil ⑧, contact assembly ⑨, (contact plate B, point, contact plate A, and contact stay), cord B ⑩ , and to the battery.

This current sets up the electromagnetic field to attract the armature. When the attracted armature reaches the cylinder in the core, the contacts of the contact assembly open to remove the current, and thus the core no longer holds the armature but the armature is returned by the replusive force of the vibrating element connected to the armature by pole B. When the armature returns, the contacts again, close to allow the current to flow from cord A to the coil, and to the contact assembly (contact plate B, point, contact plate A) and to magnetize the core which attachs the armature. This series of action is repeated while the horn switch is closed; the vibrating element makes regular vibrations to produce sounds which is amplified by the spiral horn to effect the sound into the atmosphere.

e. Operational Suggestions

(A) Avoid disassembling the horn since the mechanism is carefully adjusted with instruments.

(B) Water entering the horn will be trapped in the vibrating element chamber, rendering it impossible to operate the horn. Caution is required during washing the car.

(C) When the necessity of adjusting the sound volume arises, turn the sound volume adjust screw on the point assembly gradually while listening to the sound. To increase the sound volume, turn the screw to the right; and to reduce it, to the left.

f. Trouble Shooting and Repair

In case the horn delivers a reduced sound volume, poor tone quality, or does not operate at all, check for the causes as follows.

<table>
<tr><th colspan="2">Trouble</th><th colspan="5">Trouble shooting</th><th>Corrective action</th></tr>
<tr><td rowspan="3">Trouble other than in the horn itself</td><td>Low battery vbltage or overcharge</td><td colspan="5">Check the battery voltage with a multimeter</td><td>Charge the battery</td></tr>
<tr><td>Loose electrical connection, open circuit, or the mounting fixture is not grounded electrically.</td><td colspan="5">Check for open wires, loose bolts, and especially conditions in the junctions.</td><td>Resolder or retighten the bolts.</td></tr>
<tr><td>Defective horn switch</td><td colspan="5">Check the contact of the horn switch with a multimeter, and also check the grounding.</td><td>Polish the contact or replace the horn switch (*)</td></tr>
<tr><td colspan="2" rowspan="9">Defective horn</td><td rowspan="9">Directly connect the horn to the battery with a lead</td><td colspan="2" rowspan="4">When it does not operate at all</td><td rowspan="2">When the armature is not attached (examine from the operating sound)</td><td>Open coil or lead wire</td><td>Resolder or replace the coil (This should be made at the workshop)</td></tr>
<tr><td>Lost point or excessive wear</td><td>Replace the contact assembly (*)</td></tr>
<tr><td rowspan="2">When the armature is attached (examine from the operating sound)</td><td>Worn contact (Increased contact resistance)</td><td>Replace the contact assembly (*)</td></tr>
<tr><td>Close contacts</td><td>Sound adjust screw (Note)</td></tr>
<tr><td colspan="2" rowspan="2">The horn operated but with a reduced sound volume</td><td colspan="2">Worn contact (increased contact resistance)</td><td>Replace the contact assembly (*)</td></tr>
<tr><td colspan="2">Insufficient current due to inappropriate adjustment</td><td>Adjust with the sound volume adjust screw (*)</td></tr>
<tr><td rowspan="3">Poor sound quality</td><td rowspan="2">Hissy and broken sound</td><td colspan="2">Too high current due to inappropriate adjustment</td><td>Adjust with the sound volume adjust screw (*)</td></tr>
<tr><td colspan="2">Insufficient gap between the armature and the core</td><td>Adjust the gap (*)</td></tr>
<tr><td>Poor and hollow sound</td><td colspan="2">Cracked vibratory element</td><td>Replace the vibrating element (*)</td></tr>
</table>

Note: Since troubles marked (*) will be difficult, have the workshop repair them.

E. Fuel Gauge and Unit

When the tank is filled with fuel and the gauge does not indicate, check in accordance with the following instructions:

1. Pull out the gauge unit lead from the rear wheel housing, connect a new unit, and move the flat vertically. If the new gauge operates, check the old gauge.

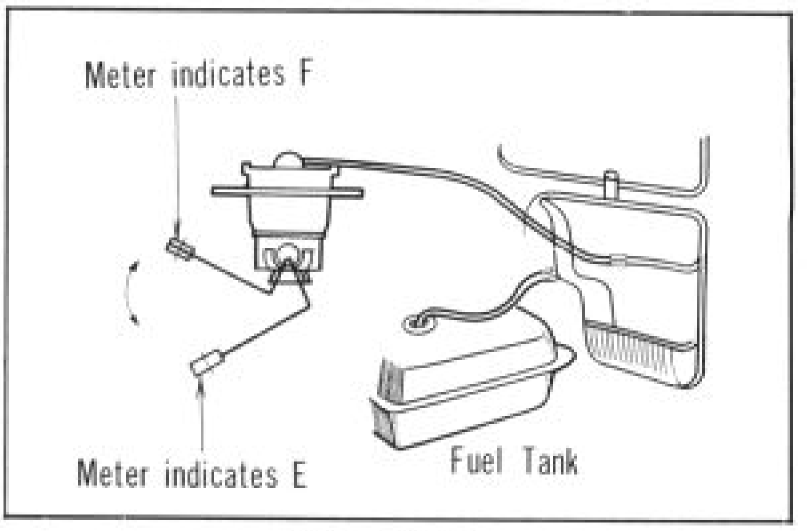


Fig. 17B-44

2. Measure resistance by using an ohmmeter. Rated resistance is 30 to 34Ω.

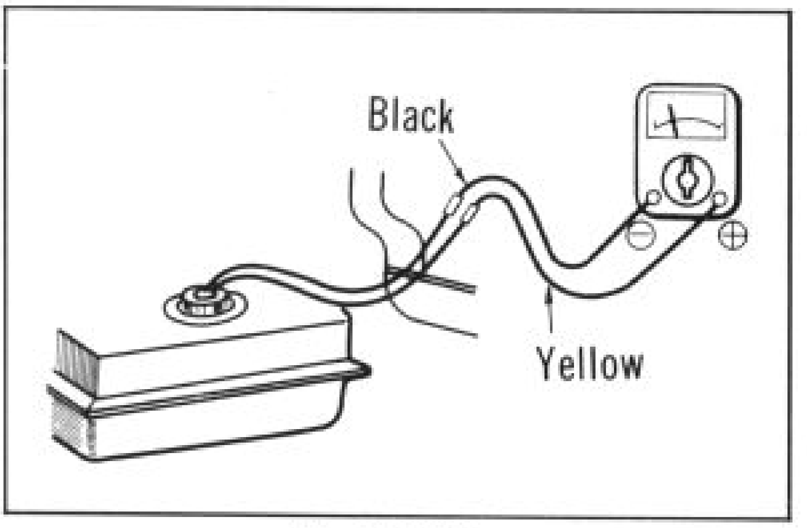
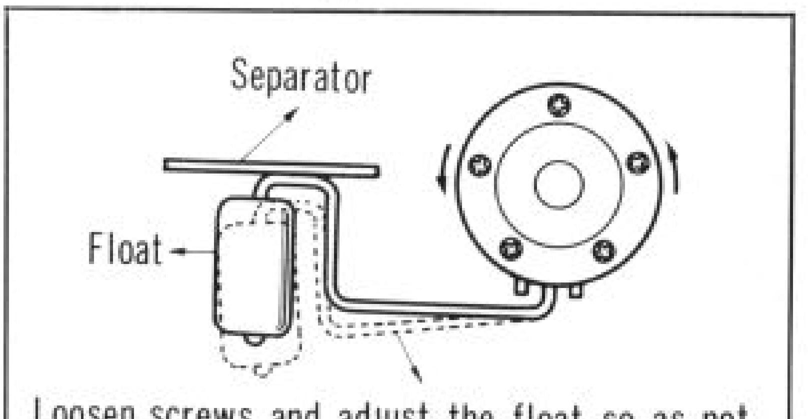


Fig. 17B-45

3. Make sure that the gauge unit is not coming in contact with the separator in the fuel tank.



Loosen screws and adjust the float so as not to come contact with the separator.

Fig. 17B-46

4. When the gauge does not operate under the arrangement indicated in "1" above, measure resistance between the gauge terminals with ohmmeter. (Disconnect wiring to the gauge unit beforehand.) If resistance is less than 100Ω, the condition is normal. If resistance exceeds 100Ω, replace the gauge. **(Fig. 17B-47)** **(Fig. 17B-48)**

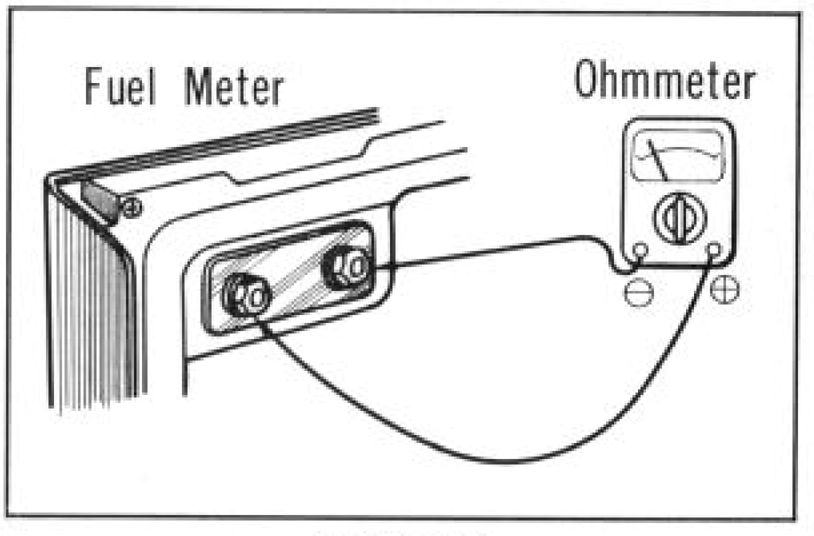


Fig. 17B-47

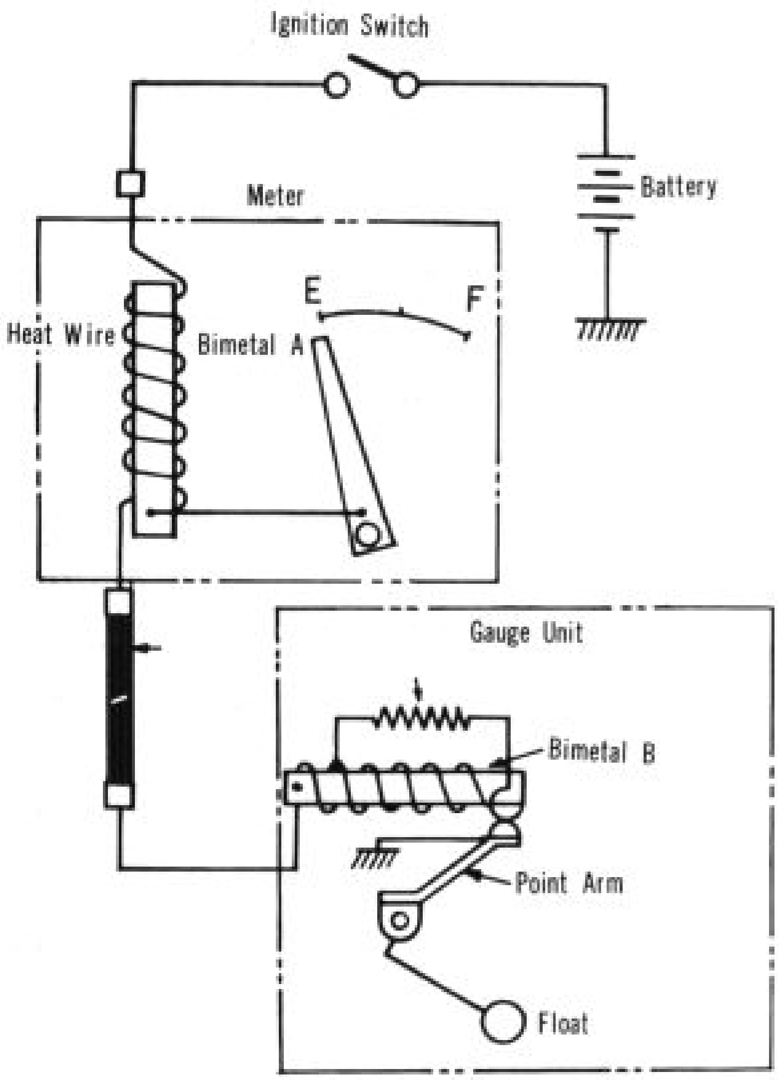
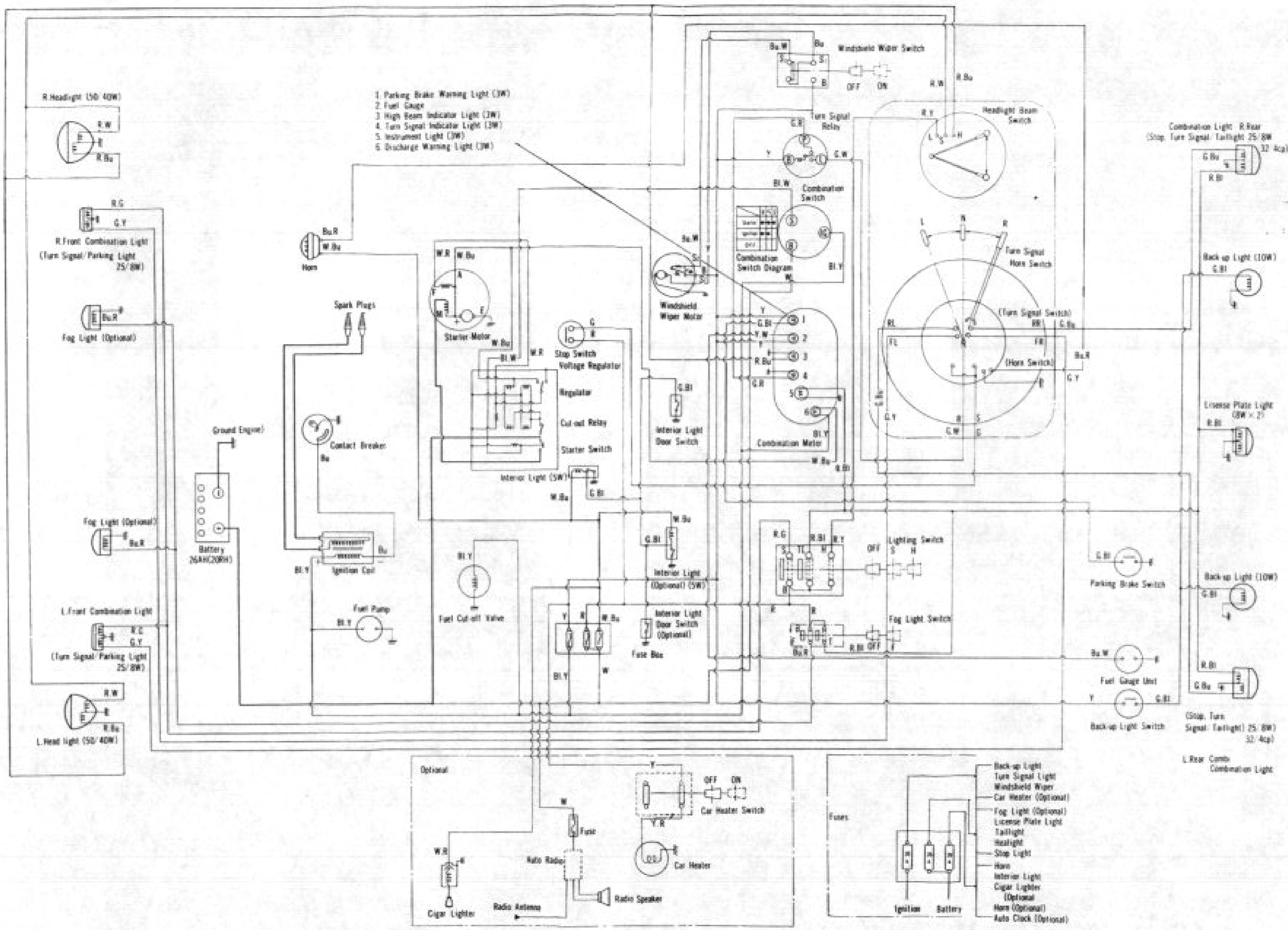

Ignition Switch
Battery
Meter
E
F
Heat Wire
Bimetal A
Gauge Unit
Bimetal B
Point Arm
Float

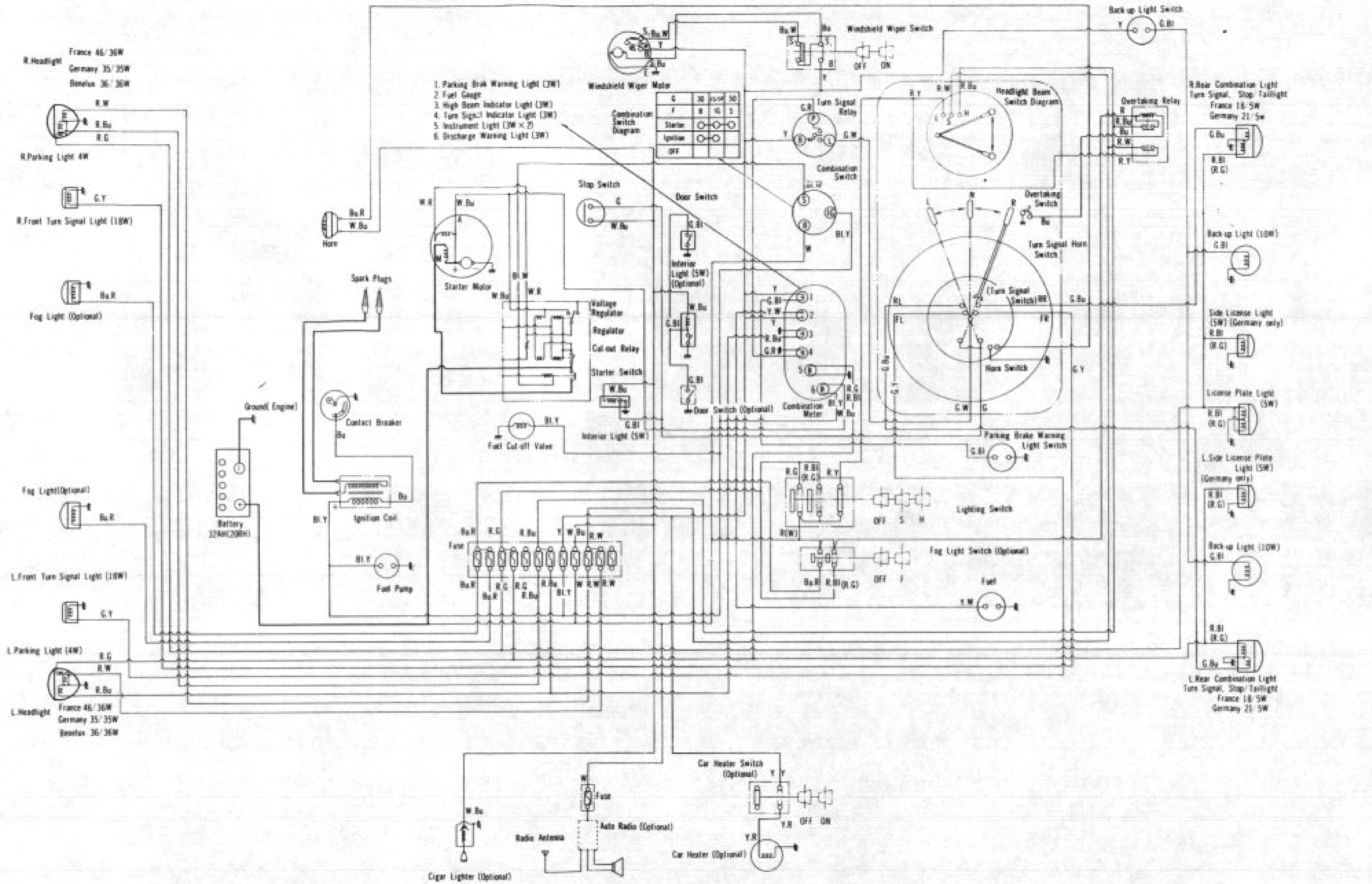
Fig. 17B-48

1. N360 ; Standard



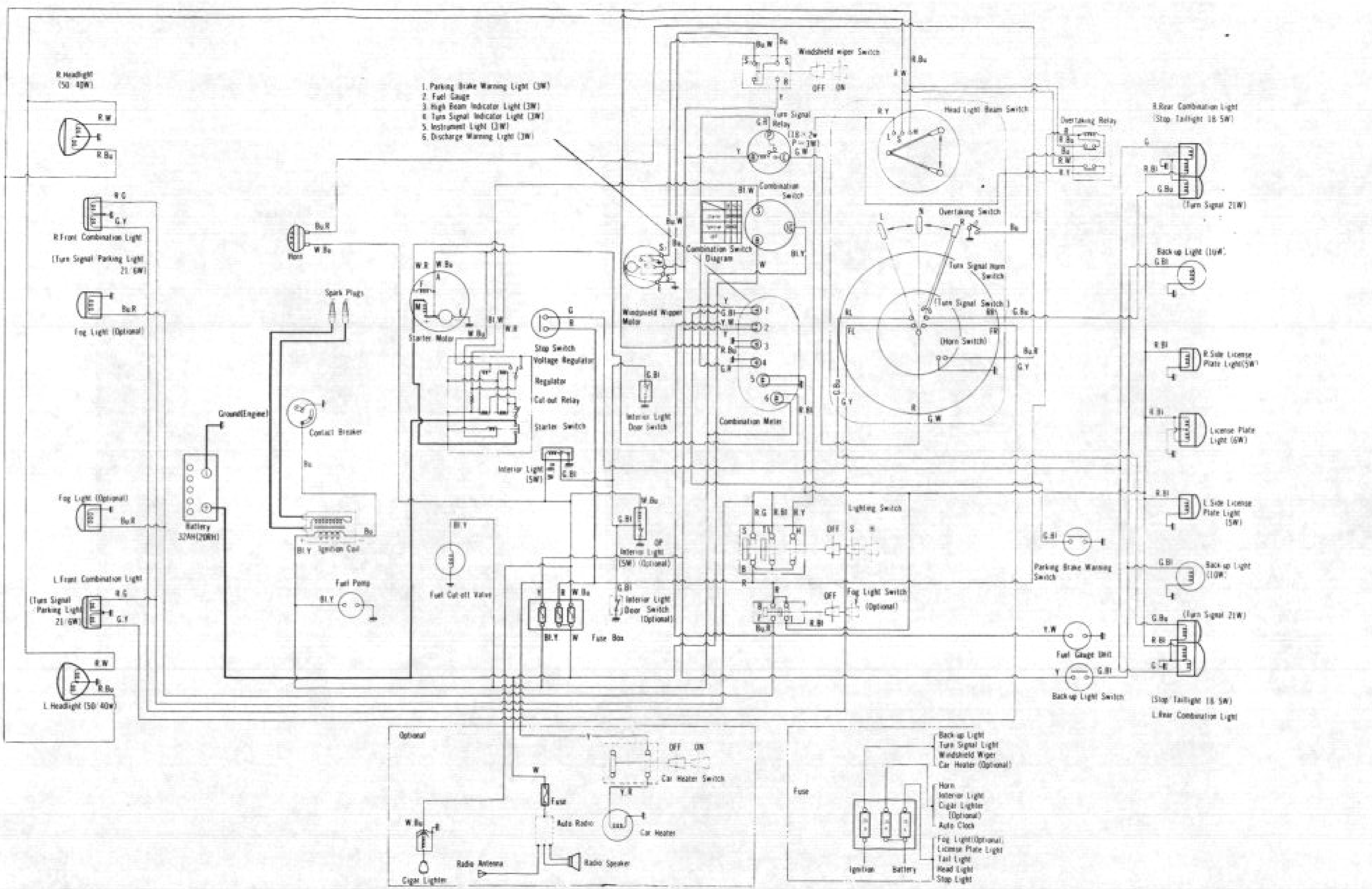
R. ....Red	R.Y ....Red/yellow stripe	G.W ....Green/white stripe	Bu.Y ....Blue/yellow stripe	Y.R ....Yellow/red stripe	W.R ....White/red stripe
R.Bl ....Red/black stripe	G ....Green	G.Y ....Green/yellow stripe	Bl ....Black	Y.W ....Yellow/white stripe	W.Y ....White/yellow stripe
R.Bu ....Red/blue stripe	G.Bl ....Green/black stripe	Bu ....Blue	Bl.W ....Black/white stripe	W ....White	
R.G ....Red/green stripe	G.Bu ....Green/blue stripe	Bu.R ....Blue/red stripe	Bl.Y ....Black/yellow stripe	W.Bu ....White/blue stripe	
R.W ....Red/white stripe	G.R ....Green/red stripe	Bu.W ....Blue/white stripe	Y ....Yellow	W.G ....White/green stripe	

2. N360 ; Europe Continent



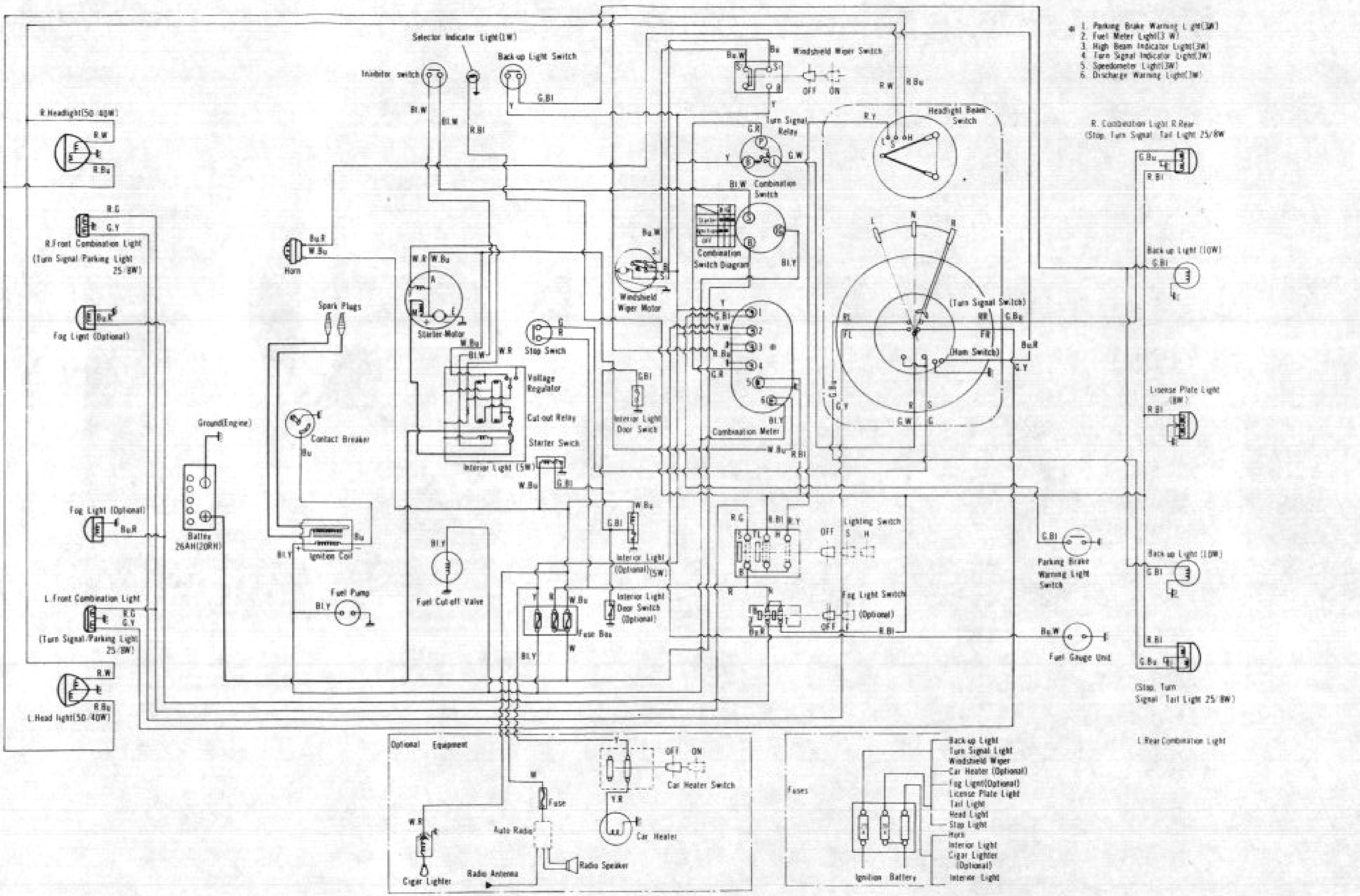
R. ········ Red	R.Y ········ Red/yellow stripe	G.W ········ Green/white stripe	Bu.Y ········ Blue/yellow stripe	Y.R ········ Yellow/red stripe	W.R ········ White/red stripe
R.Bl ········ Red/black stripe	G ········ Green	G.Y ········ Green/yellow stripe	Bl ········ Black	Y.W ········ Yellow/white stripe	W.Y ········ White/yellow stripe
R.Bu ········ Red/blue stripe	G.Bl ········ Green/black stripe	Bu ········ Blue	Bl.W ········ Black/white stripe	W ········ White	
R.G ········ Red/green stripe	G.Bu ········ Green/blue stripe	Bu.R ········ Blue/red stripe	Bl.Y ········ Black/yellow stripe	W.Bu ········ White/blue stripe	
R.W ········ Red/white stripe	G.R ········ Green/red stripe	Bu.W ········ Blue/white stripe	Y ········ Yellow	W.G ········ White/green stripe	

3. N360 ; U.K. and Australia



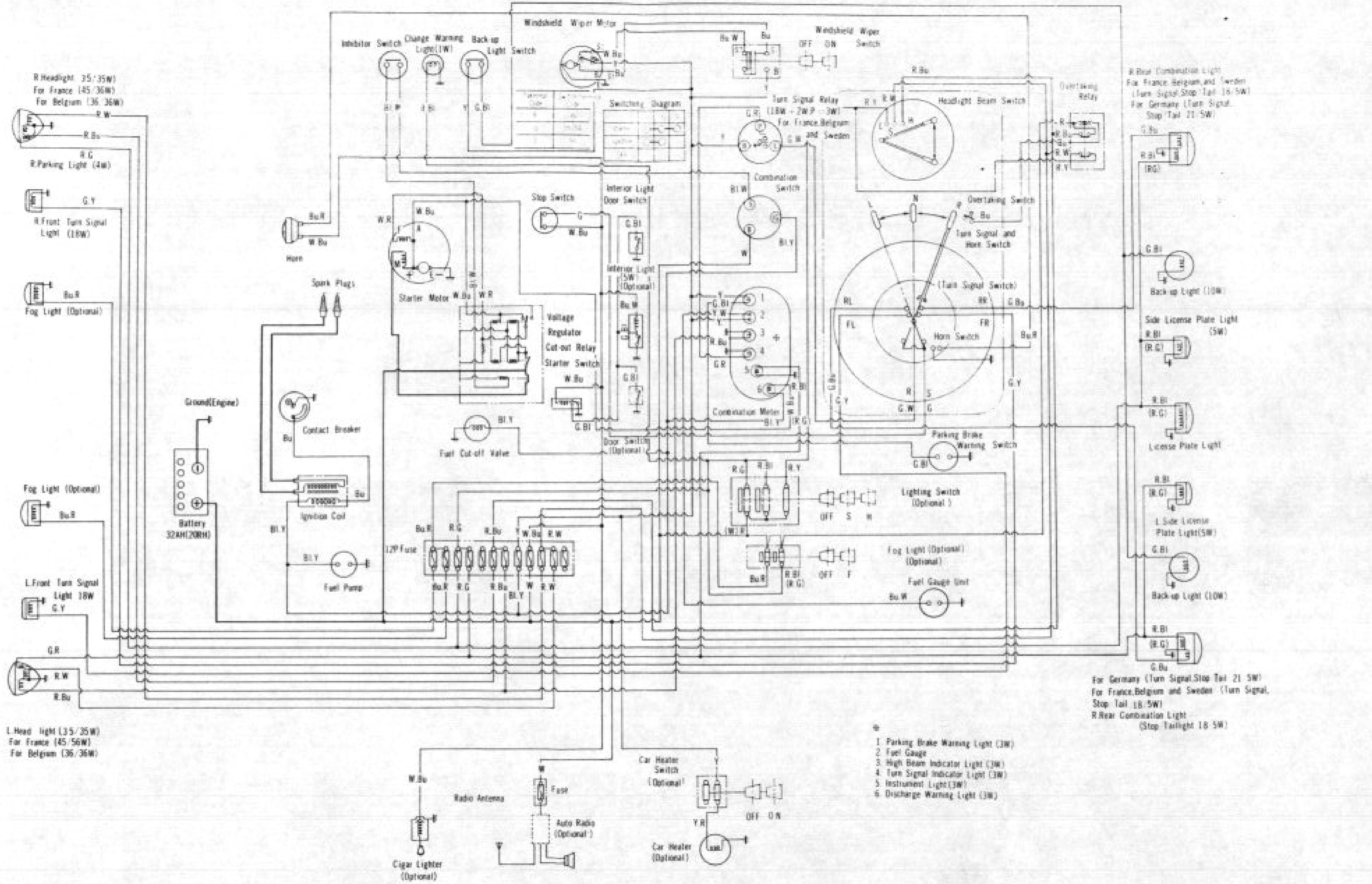
R. ········Red	R.Y ········Red/yellow stripe	G.W ········Green/white stripe	Bu.Y ········Blue/yellow stripe	Y.R ········Yellow/red stripe	W.R ········White/red stripe
R.Bl ········Red/black stripe	G ········Green	G.Y ········Green/yellow stripe	Bl ········Black	Y.W ········Yellow/white stripe	W.Y ········White/yellow stripe
R.Bu ········Red/blue stripe	G.Bl ········Green/black stripe	Bu ········Blue	Bl.W ········Black/white stripe	W ········White	
R.G ········Red/green stripe	G.Bu ········Green/blue stripe	Bu.R ········Blue/red stripe	Bl.Y ········Black/yellow stripe	W.Bu ········White/blue stripe	
R.W ········Red/white stripe	G.R ········Green/red stripe	Bu.W ········Blue/white stripe	Y ········Yellow	W.G ········White/green stripe	

4. A360 ; Standard



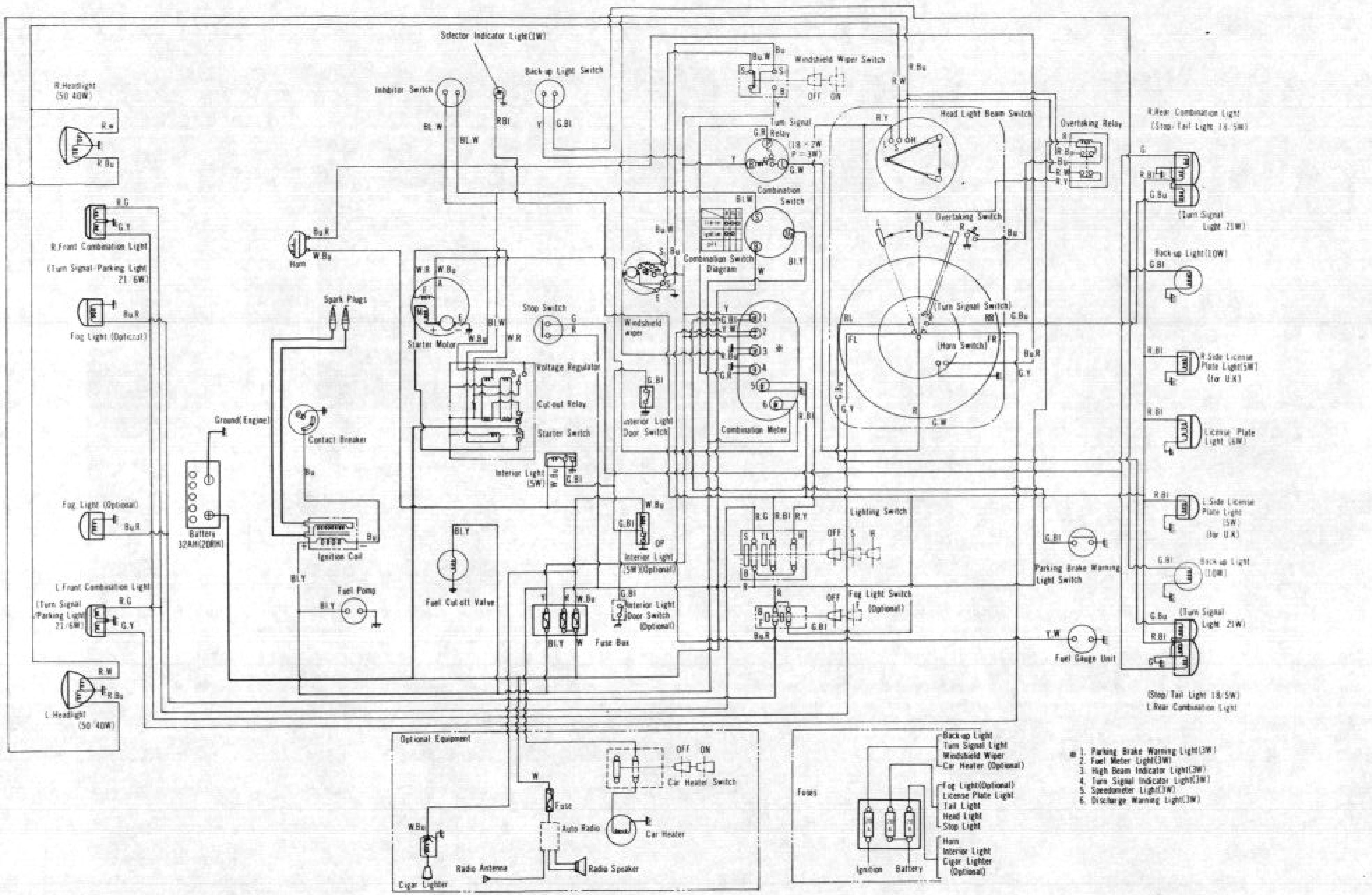
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

5. A360 ; Germany, France and Belgium



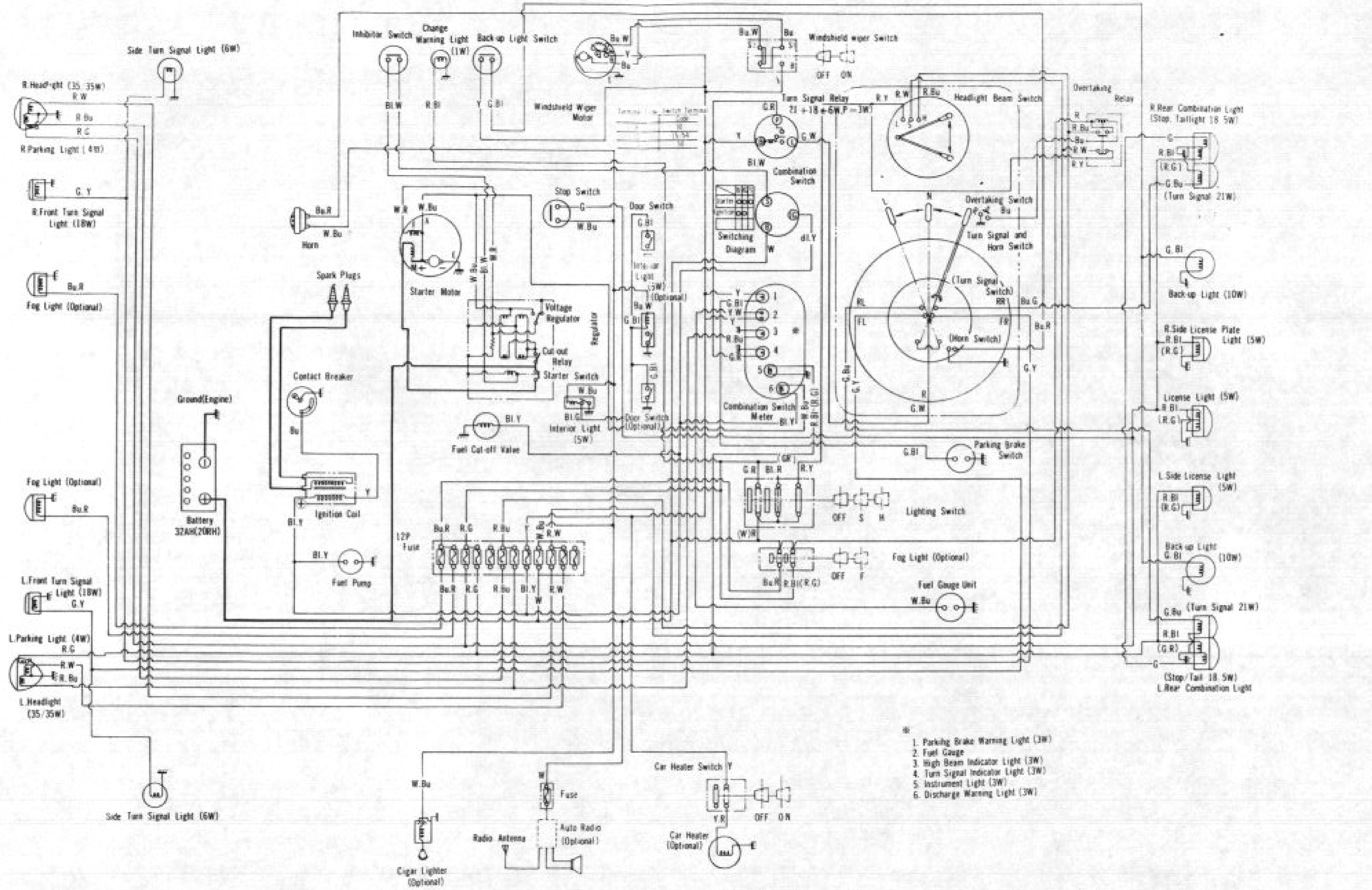
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

6. A360 ; U.K. and Australia



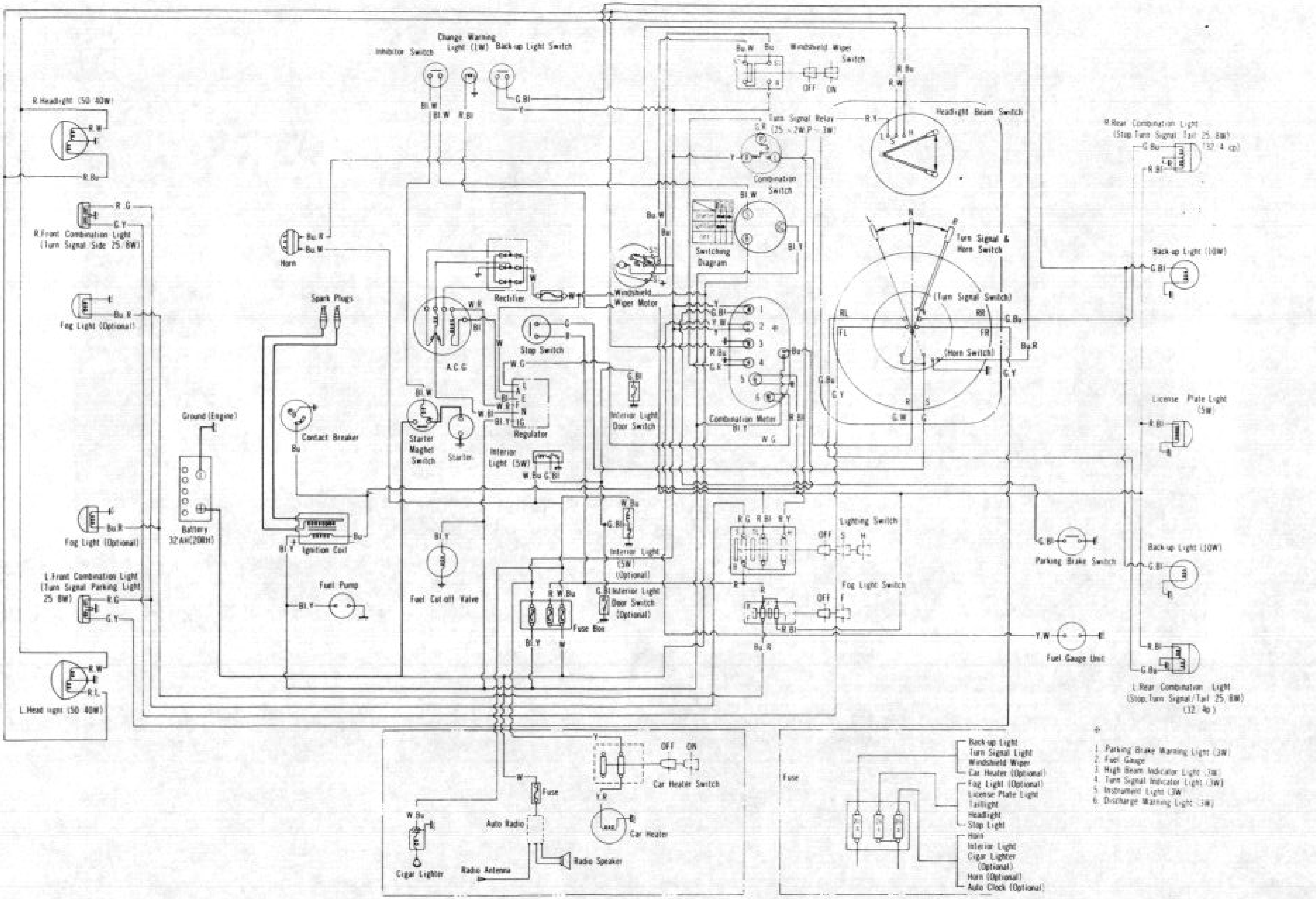
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

7. A360 ; Denmark



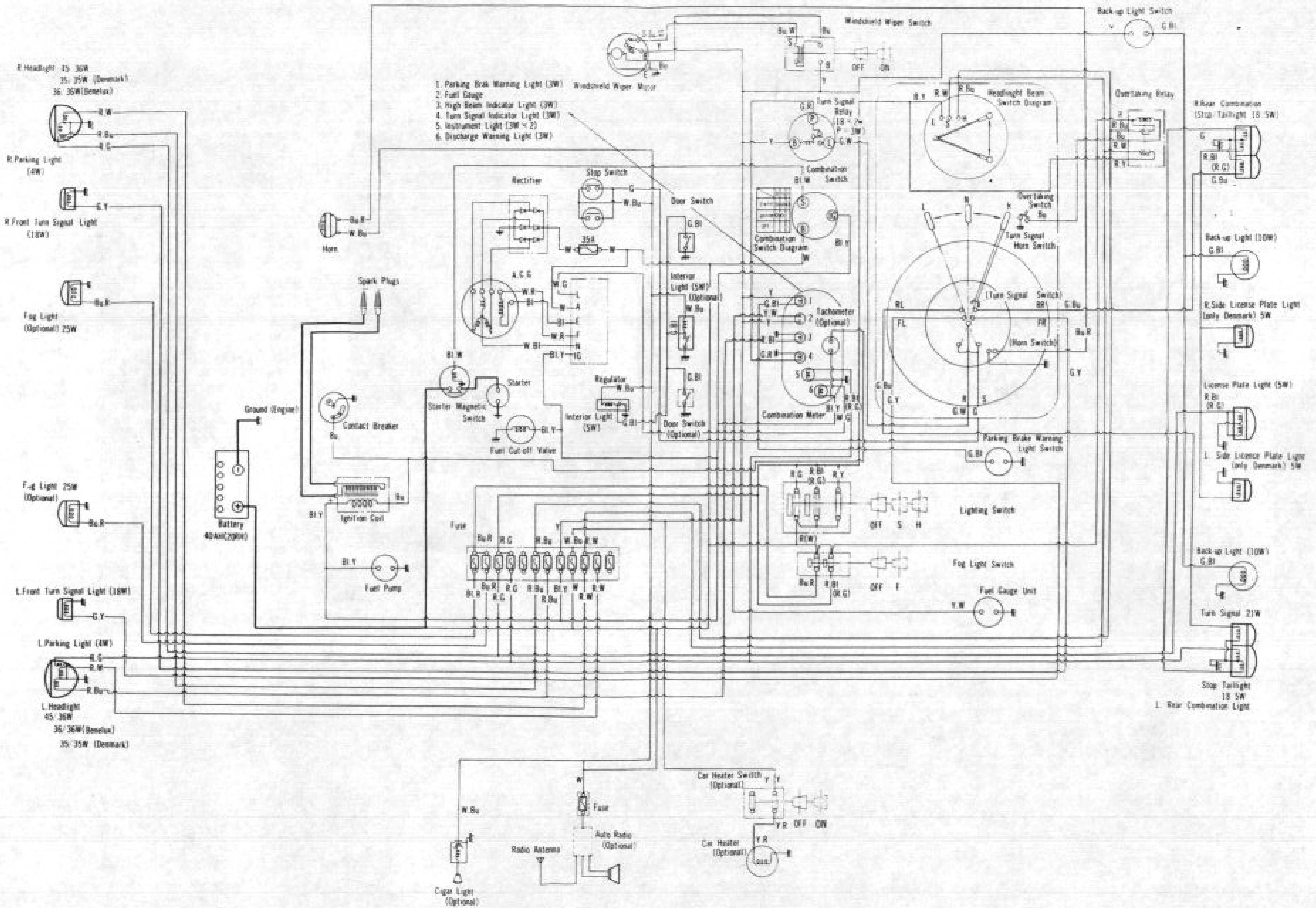
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

8. N600; Standard



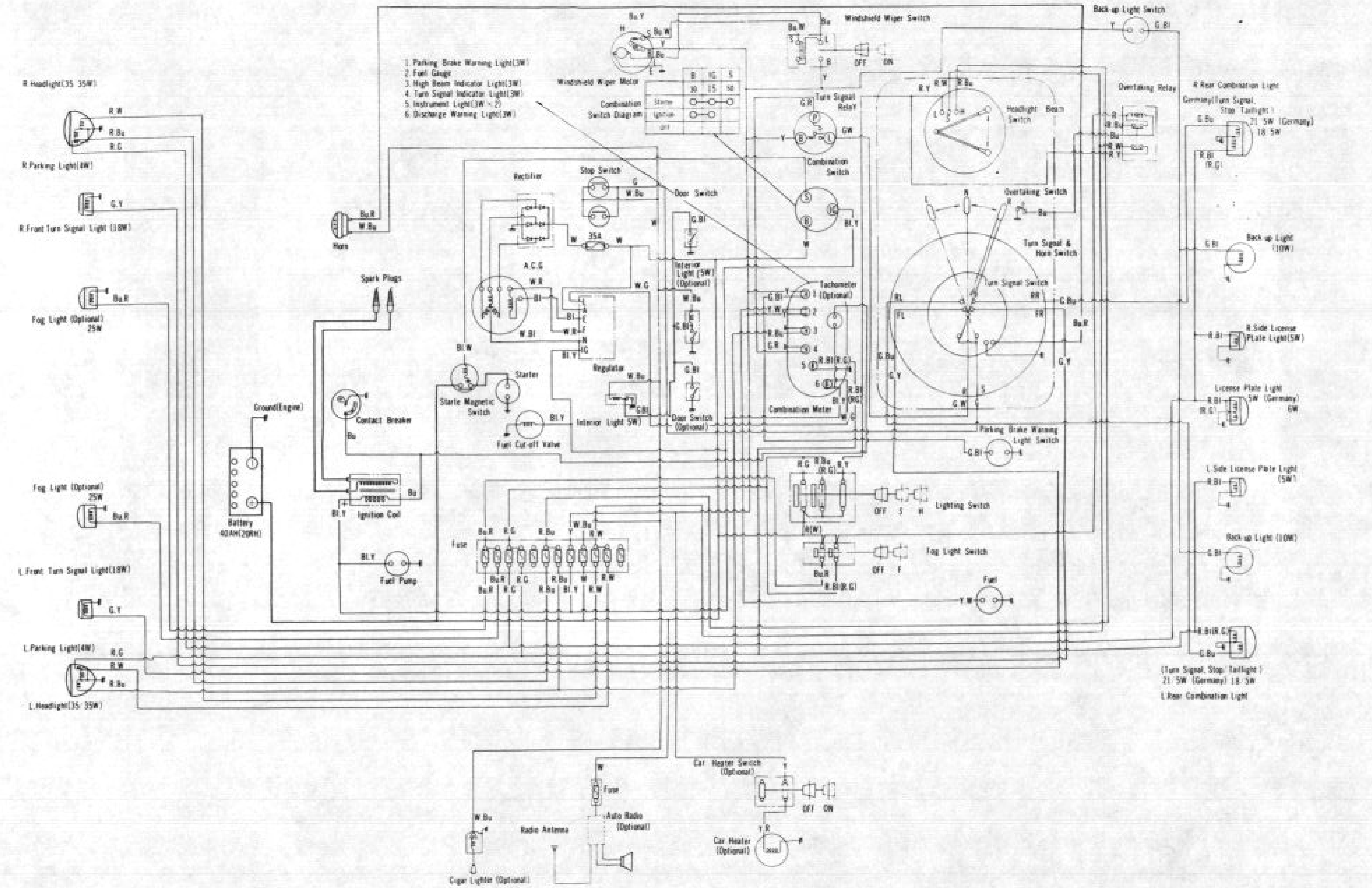
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

9. N600; France, Italy, Portugal, Denmark and Benelux



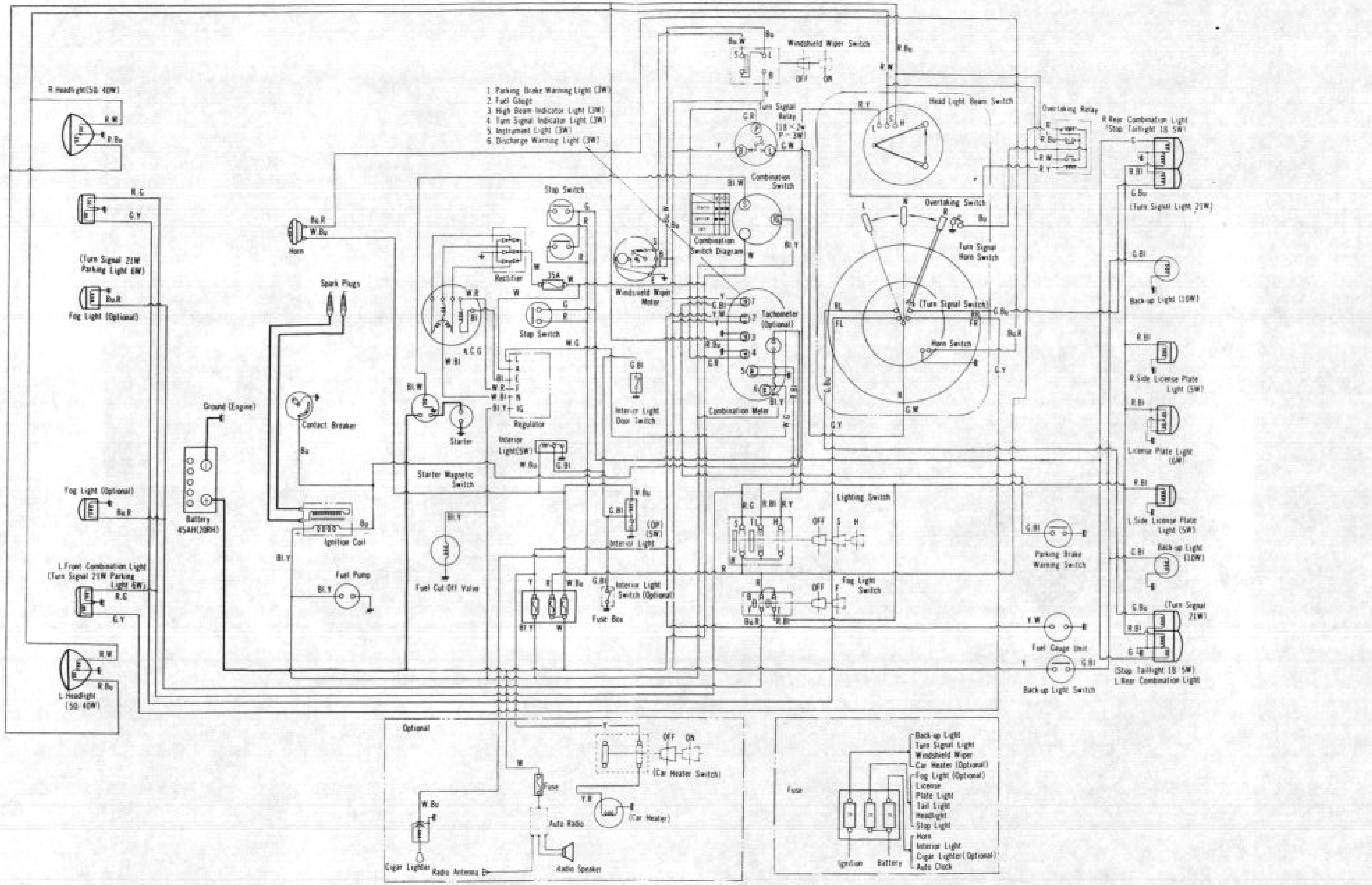
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

10. N600; Germany, Finland, Switzerland, Norway and Sweden



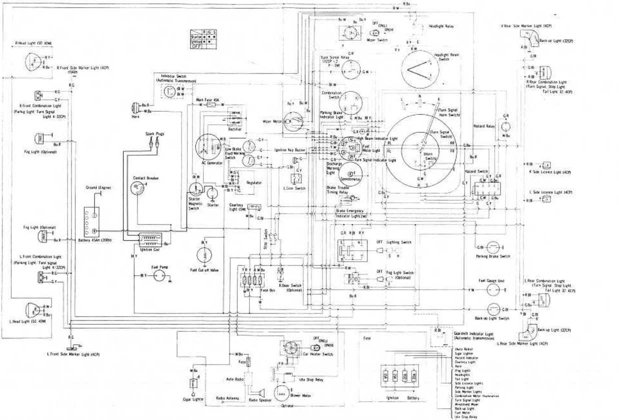
R. ....Red
R.Bl ....Red/black stripe
R.Bu ....Red/blue stripe
R.G ....Red/green stripe
R.W ....Red/white stripe
R.Y ....Red/yellow stripe
G ....Green
G.Bl ....Green/black stripe
G.Bu ....Green/blue stripe
G.R ....Green/red stripe
G.W ....Green/white stripe
G.Y ....Green/yellow stripe
Bu ....Blue
Bu.R ....Blue/red stripe
Bu.W ....Blue/white stripe
Bu.Y ....Blue/yellow stripe
Bl ....Black
Bl.W ....Black/white stripe
Bl.Y ....Black/yellow stripe
Y ....Yellow
Y.R ....Yellow/red stripe
Y.W ....Yellow/white stripe
W ....White
W.Bu ....White/blue stripe
W.G ....White/green stripe
W.R ....White/red stripe
W.Y ....White/yellow stripe

11. N600; U.K. and Australia



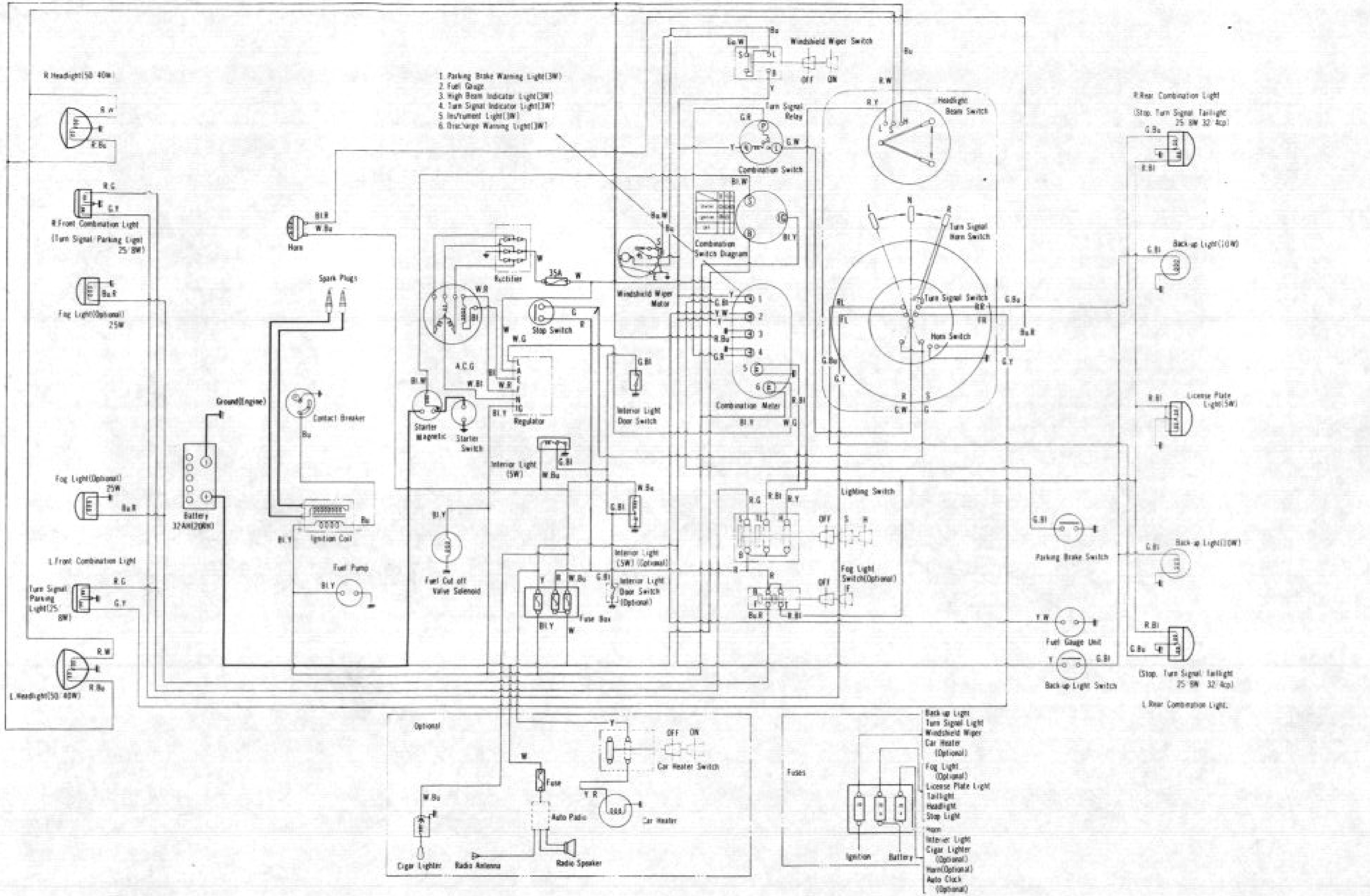
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

12. AN600; U.S.A., Puerto Rico, and Canada



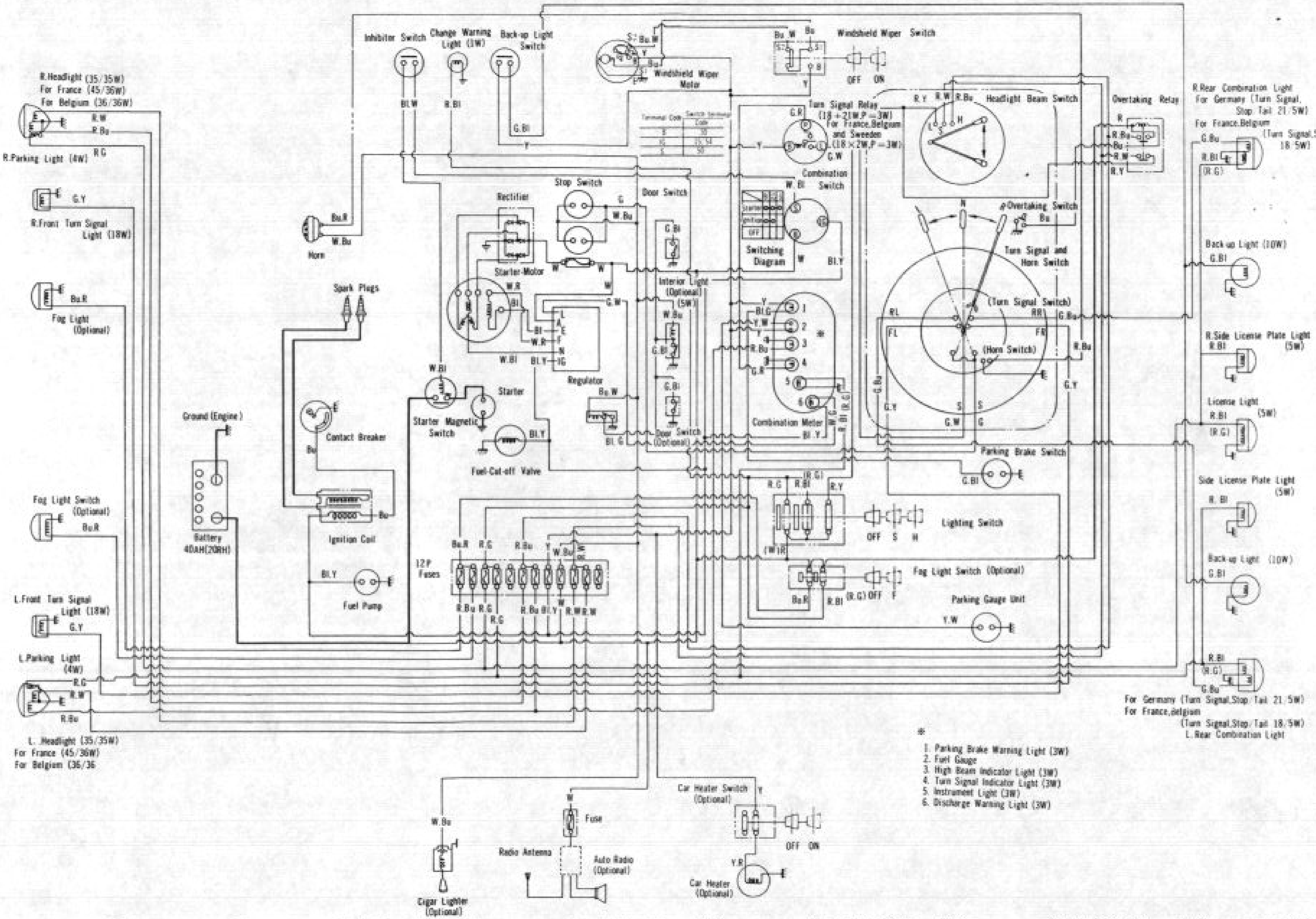
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

13. A600 ; Standard



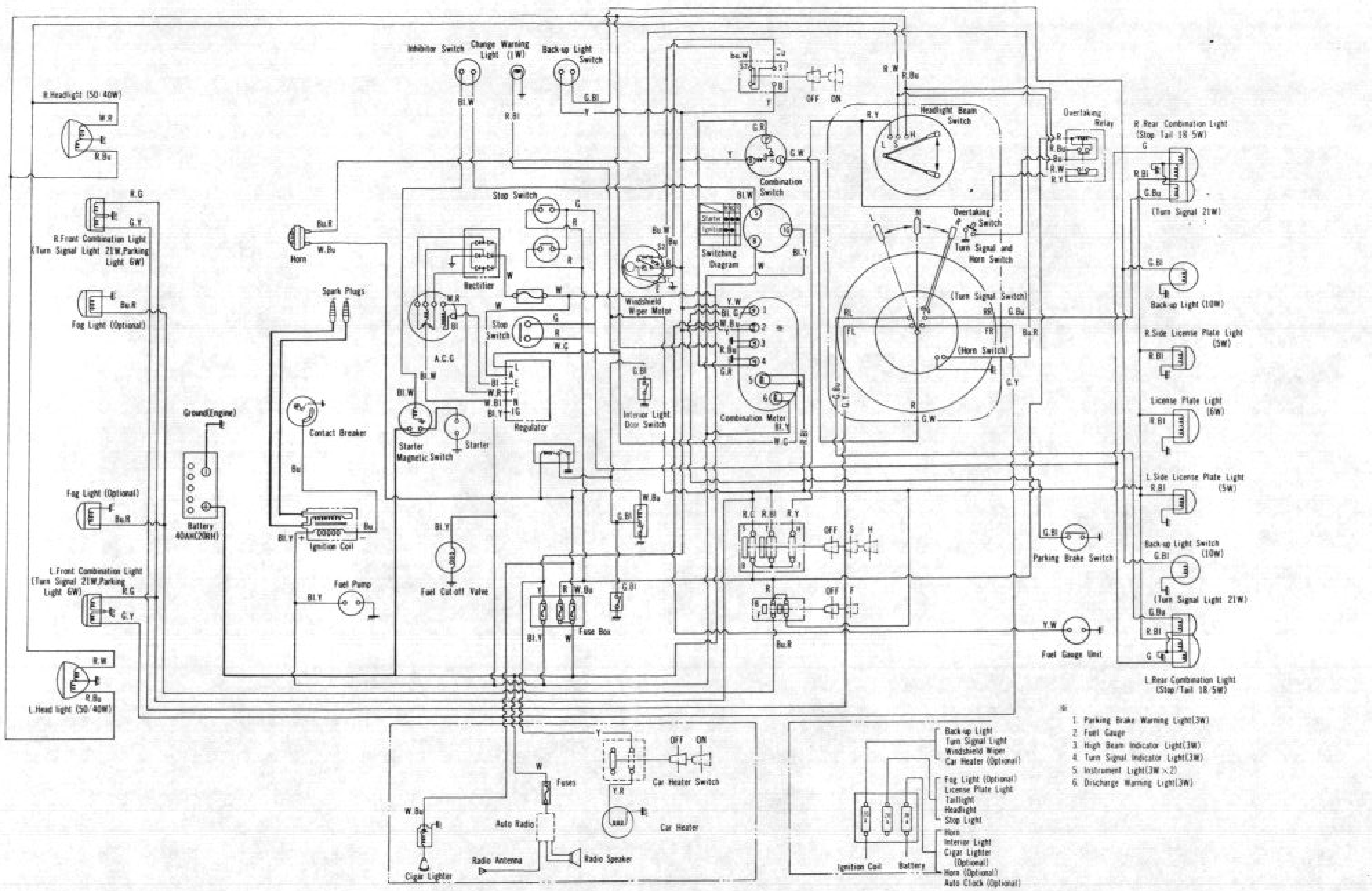
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

14. A600; Germany, France and Belgium



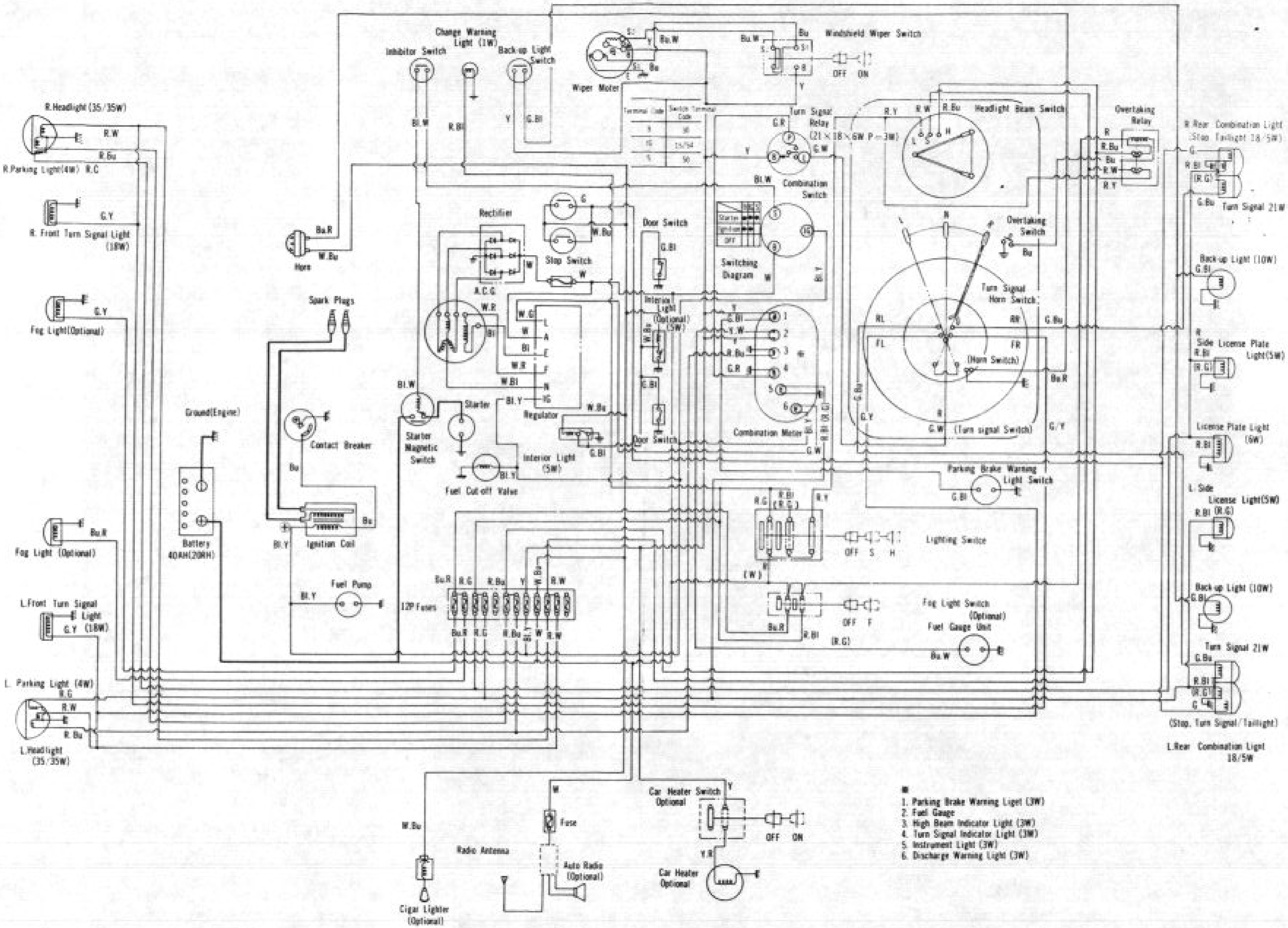
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

15. A600; U.K. and Australia



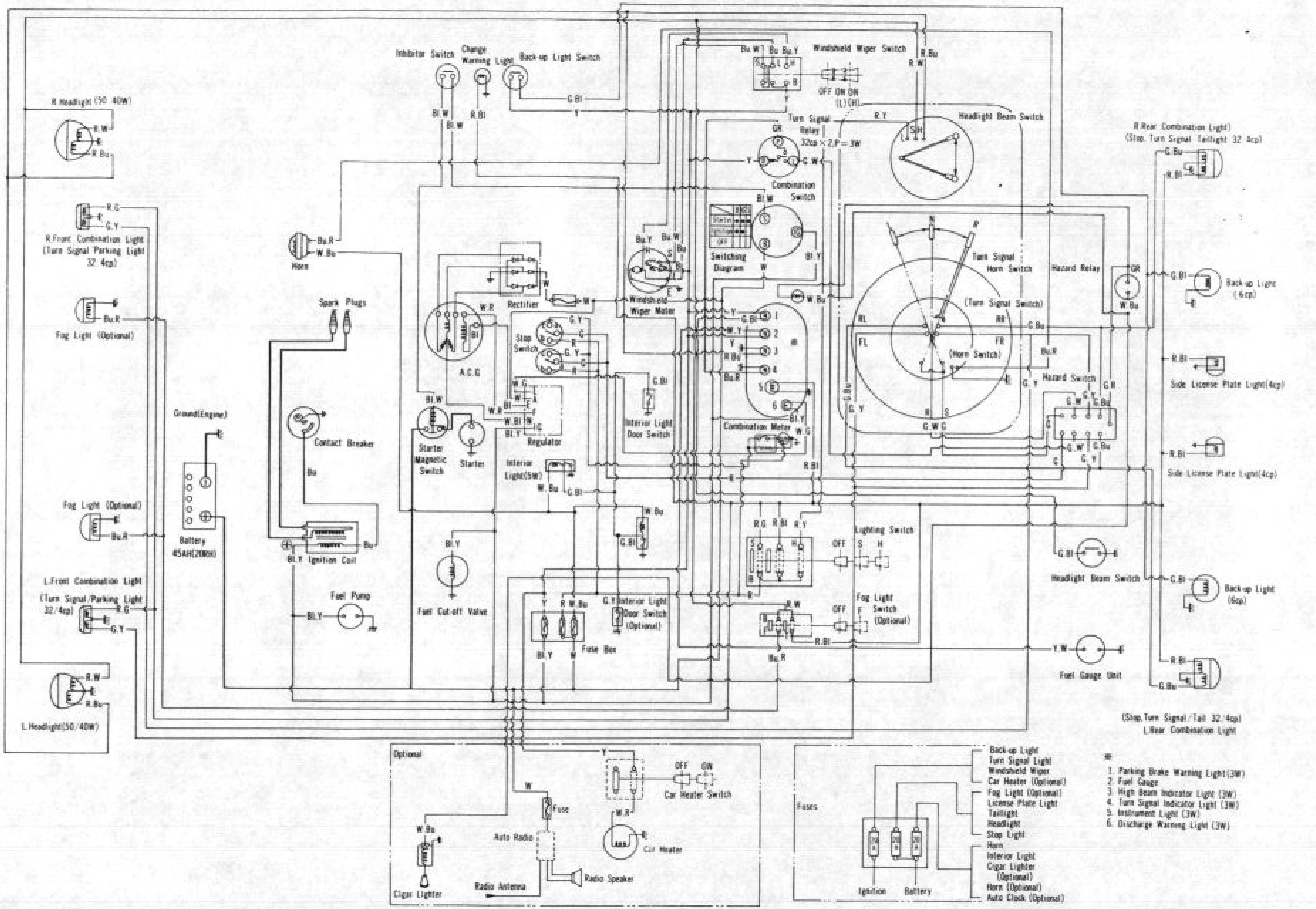
R. ······ Red	R.Y ······ Red/yellow stripe	G.W ······ Green/white stripe	Bu.Y ······ Blue/yellow stripe	Y.R ······ Yellow/red stripe	W.R ······ White/red stripe
R.Bl ······ Red/black stripe	G ······ Green	G.Y ······ Green/yellow stripe	Bl ······ Black	Y.W ······ Yellow/white stripe	W.Y ······ White/yellow stripe
R.Bu ······ Red/blue stripe	G.Bl ······ Green/black stripe	Bu ······ Blue	Bl.W ······ Black/white stripe	W ······ White	
R.G ······ Red/green stripe	G.Bu ······ Green/blue stripe	Bu.R ······ Blue/red stripe	Bl.Y ······ Black/yellow stripe	W.Bu ······ White/blue stripe	
R.W ······ Red/white stripe	G.R ······ Green/red stripe	Bu.W ······ Blue/white stripe	Y ······ Yellow	W.G ······ White/green stripe	

16. A600 ; Denmark



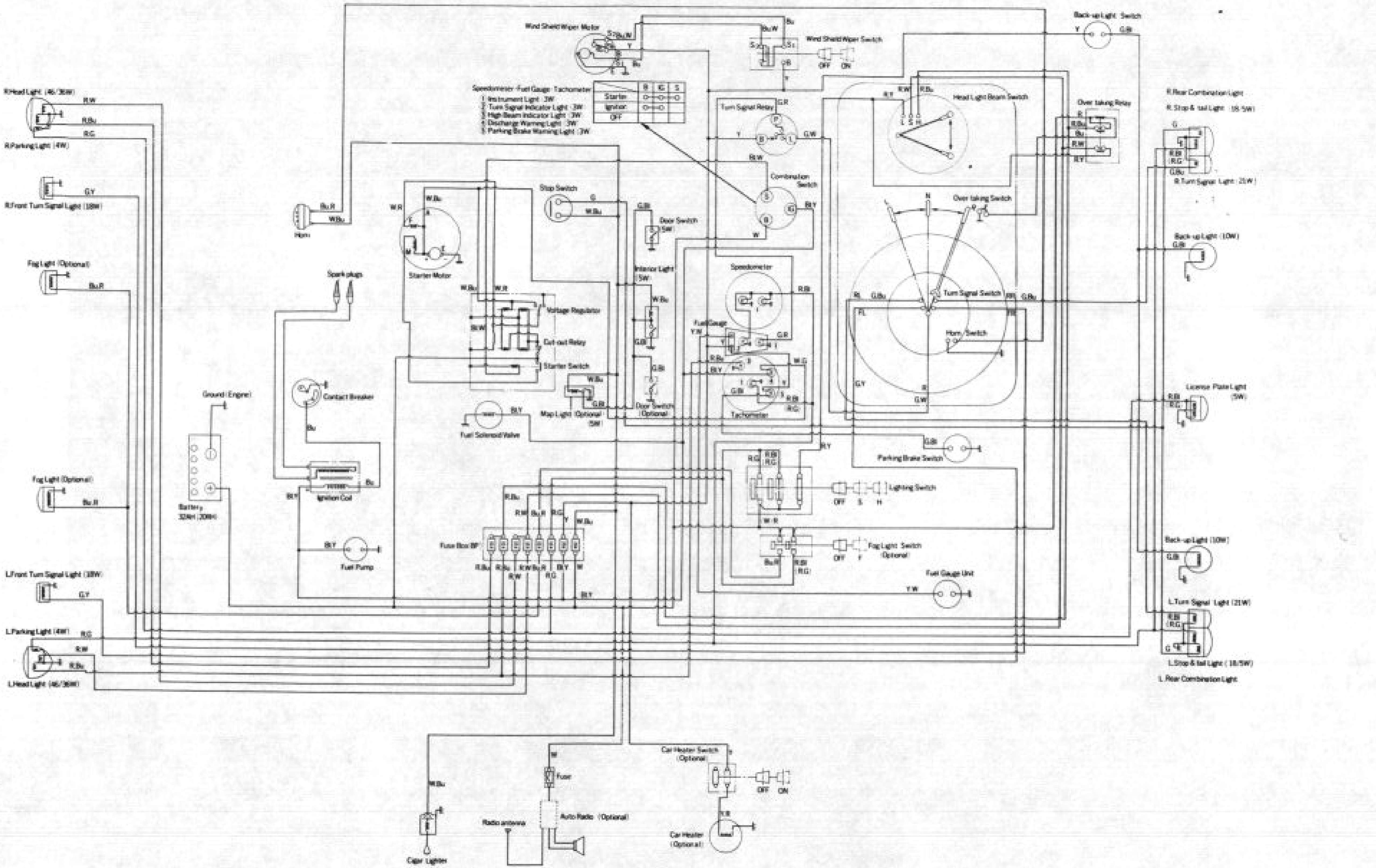
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

17. AA600; U.S.A. and Canada



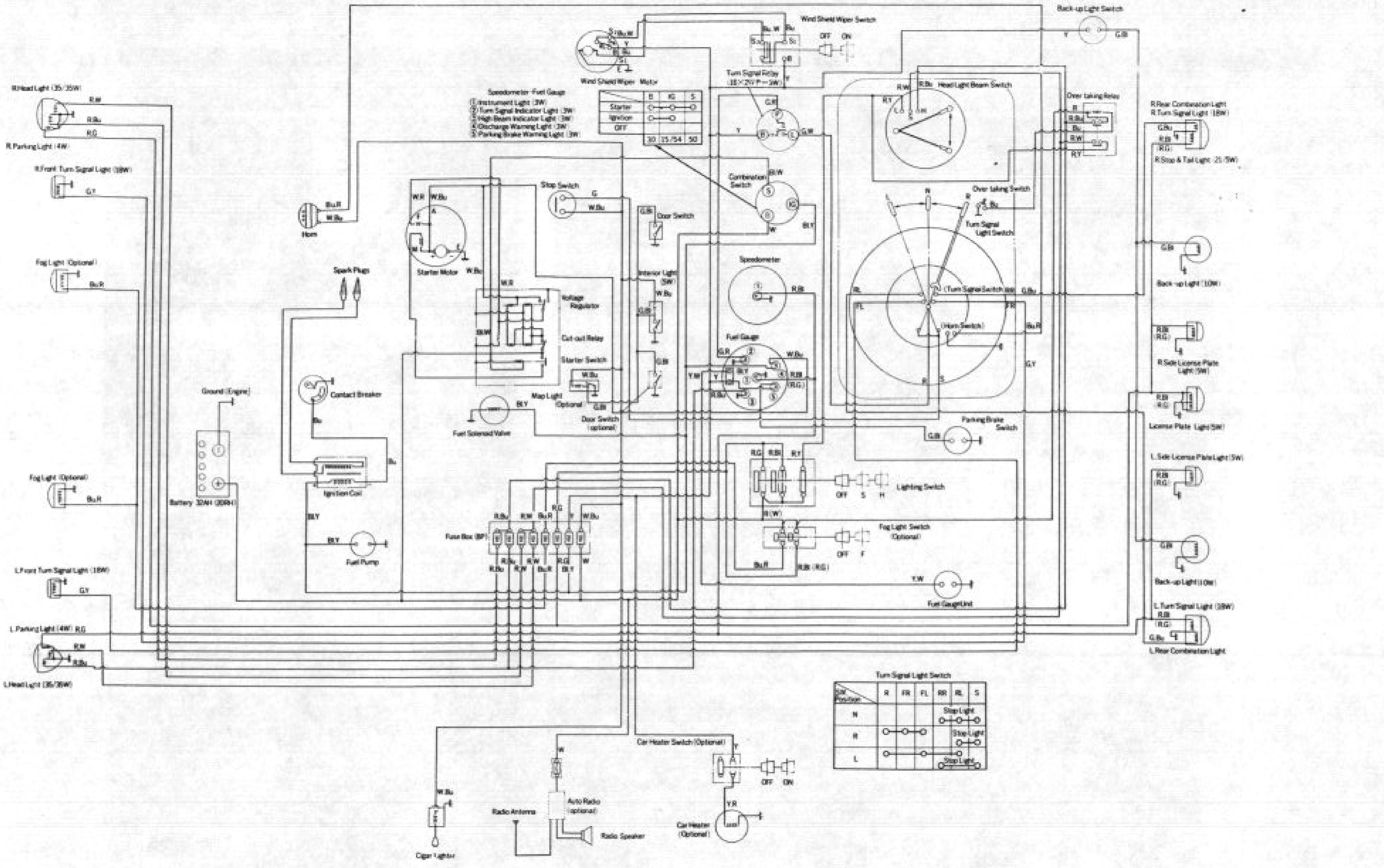
R. ······Red	R.Y ······Red/yellow stripe	G.W ······Green/white stripe	Bu.Y ······Blue/yellow stripe	Y.R ······Yellow/red stripe	W.R ······White/red stripe
R.Bl ······Red/black stripe	G ······Green	G.Y ······Green/yellow stripe	Bl ······Black	Y.W ······Yellow/white stripe	W.Y ······White/yellow stripe
R.Bu ······Red/blue stripe	G.Bl ······Green/black stripe	Bu ······Blue	Bl.W ······Black/white stripe	W ······White	
R.G ······Red/green stripe	G.Bu ······Green/blue stripe	Bu.R ······Blue/red stripe	Bl.Y ······Black/yellow stripe	W.Bu ······White/blue stripe	
R.W ······Red/white stripe	G.R ······Green/red stripe	Bu.W ······Blue/white stripe	Y ······Yellow	W.G ······White/green stripe	

18. N400 ; France



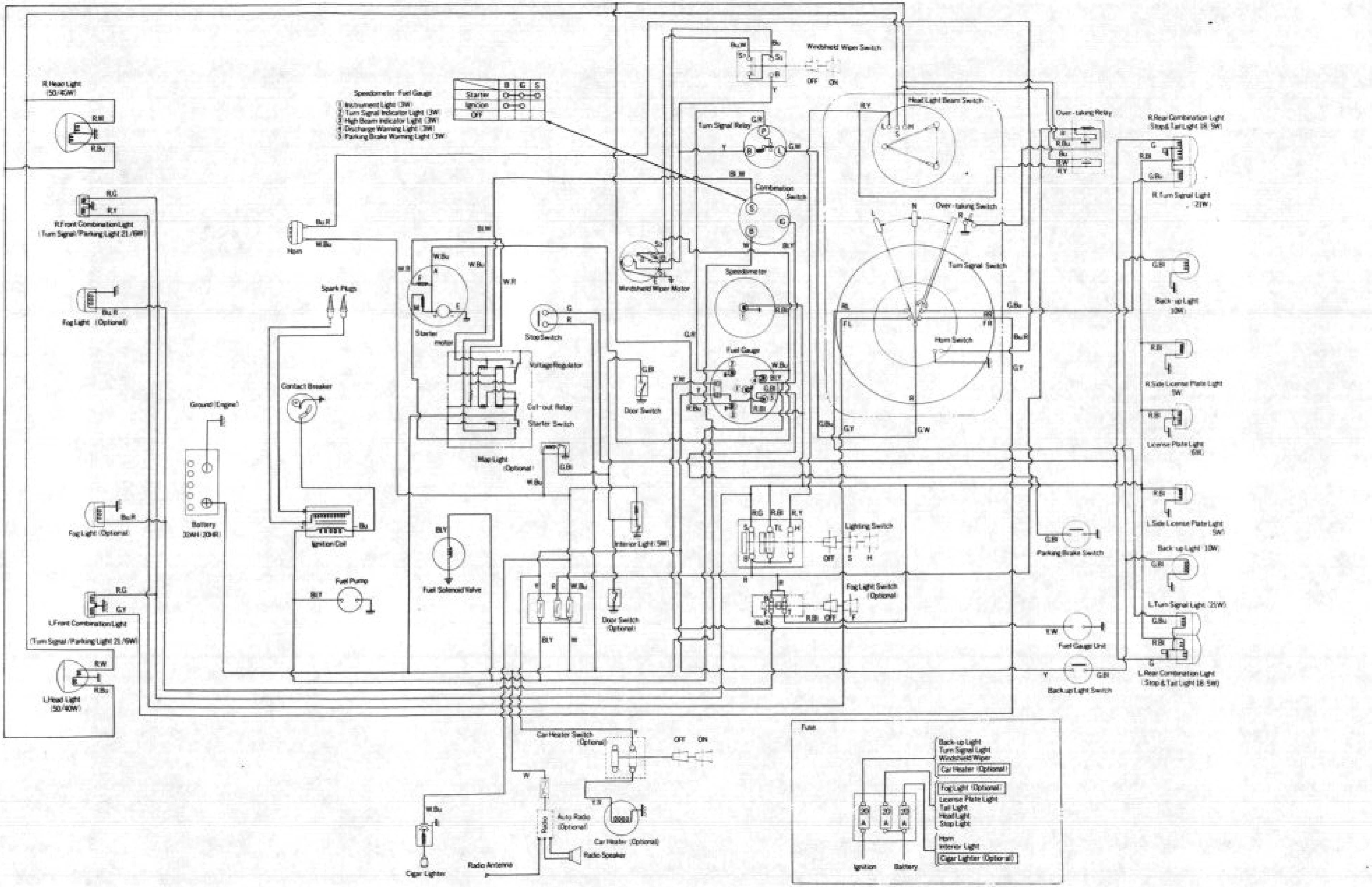
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

19. N400 ; Germany



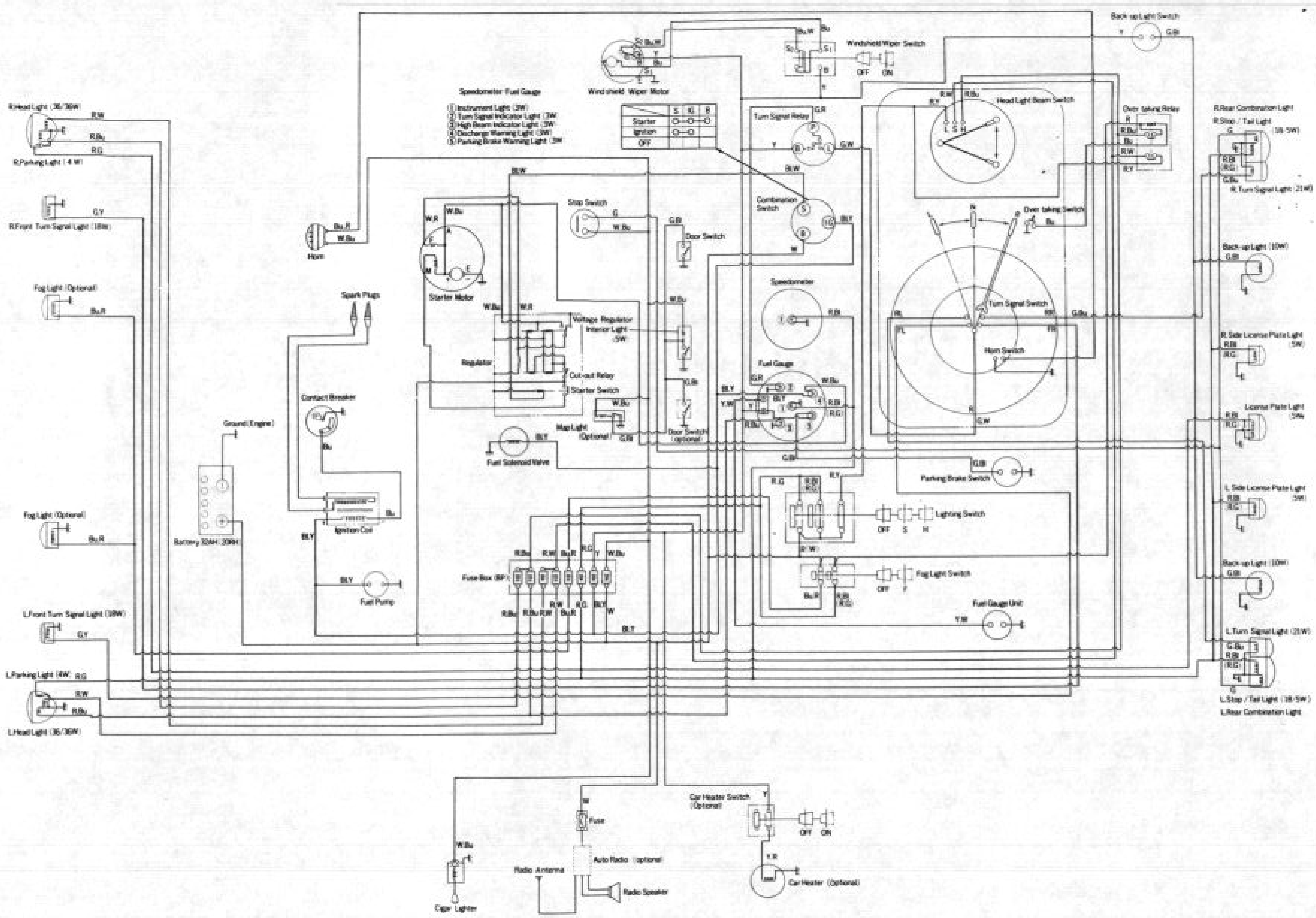
R. ··············Red
R.Bl ··············Red/black stripe
R.Bu ··············Red/blue stripe
R.G ··············Red/green stripe
R.W ··············Red/white stripe
R.Y ··············Red/yellow stripe
G ··············Green
G.Bl ··············Green/black stripe
G.Bu ··············Green/blue stripe
G.R ··············Green/red stripe
G.W ··············Green/white stripe
G.Y ··············Green/yellow stripe
Bu ··············Blue
Bu.R ··············Blue/red stripe
Bu.W ··············Blue/white stripe
Bu.Y ··············Blue/yellow stripe
Bl ··············Black
Bl.W ··············Black/white stripe
Bl.Y ··············Black/yellow stripe
Y ··············Yellow
Y.R ··············Yellow/red stripe
Y.W ··············Yellow/white stripe
W ··············White
W.Bu ··············White/blue stripe
W.G ··············White/green stripe
W.R ··············White/red stripe
W.Y ··············White/yellow stripe

20. N400 ; U.K.



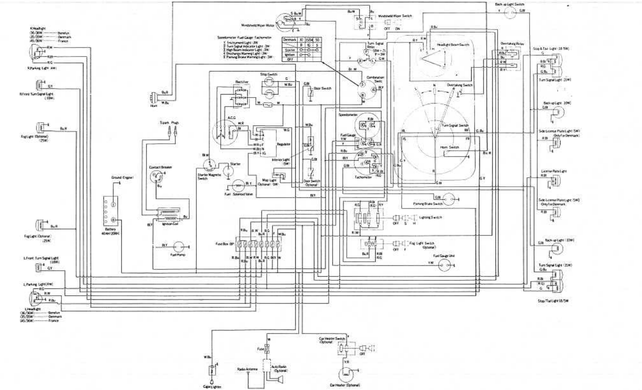
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

21. N400 ; Belgium



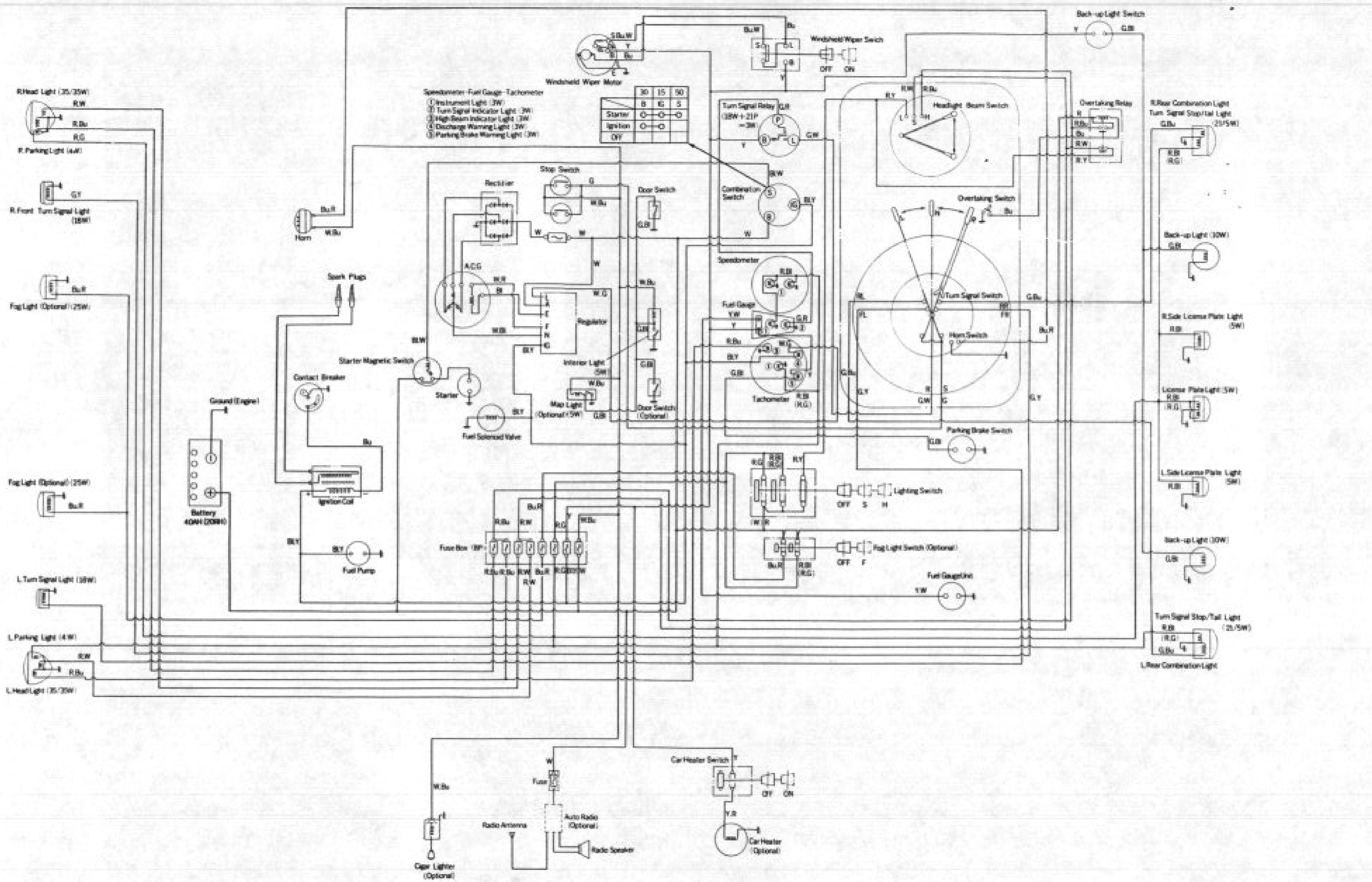
R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

22. N600G ; France, Belgium and Denmark



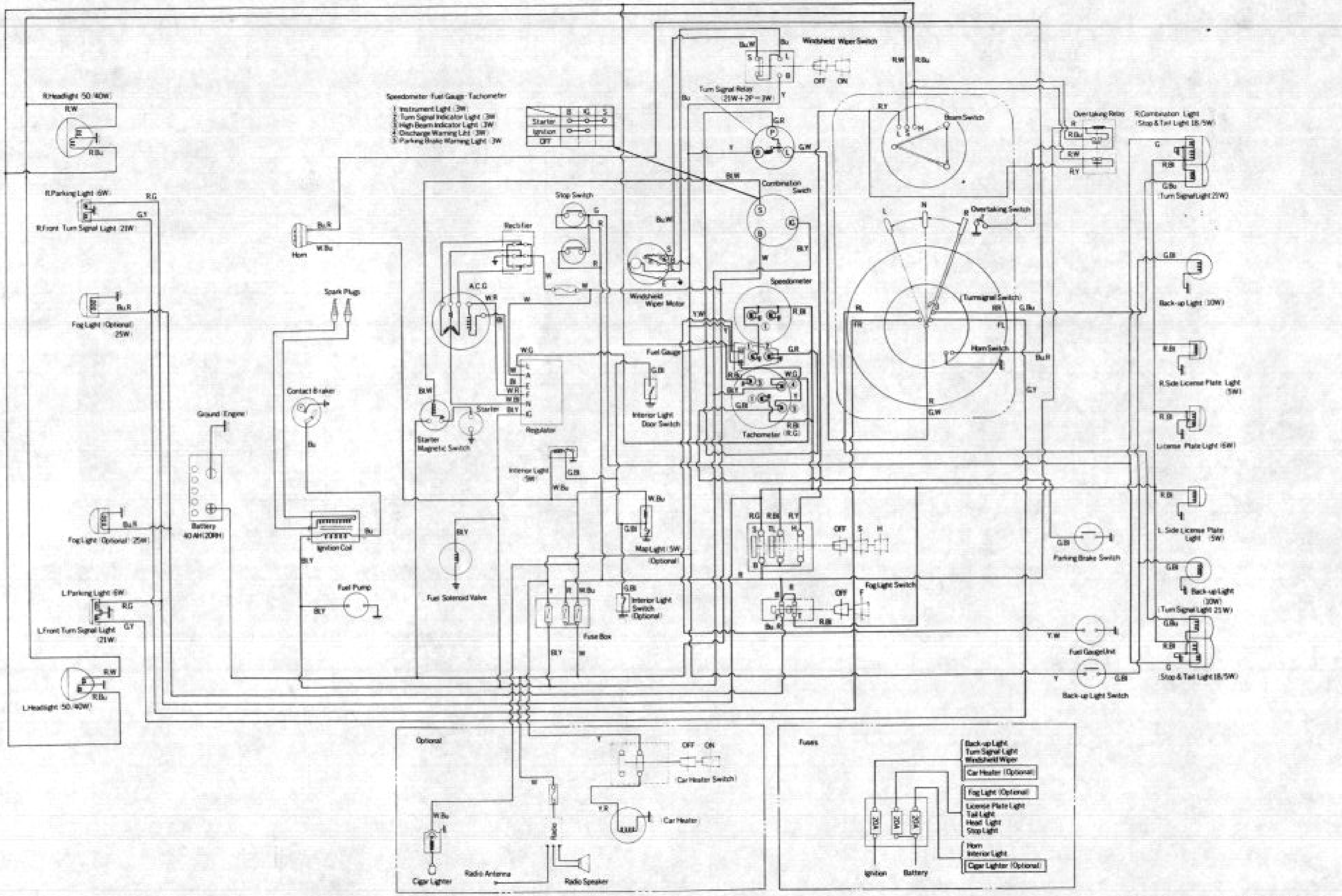
R. ....Red
R.Bl ....Red/black stripe
R.Bu ....Red/blue stripe
R.G ....Red/green stripe
R.W ....Red/white stripe
R.Y ....Red/yellow stripe
G ....Green
G.Bl ....Green/black stripe
G.Bu ....Green/blue stripe
G.R ....Green/red stripe
G.W ....Green/white stripe
G.Y ....Green/yellow stripe
Bu ....Blue
Bu.R ....Blue/red stripe
Bu.W ....Blue/white stripe
Bu.Y ....Blue/yellow stripe
Bl ....Black
Bl.W ....Black/white stripe
Bl.Y ....Black/yellow stripe
Y ....Yellow
Y.R ....Yellow/red stripe
Y.W ....Yellow/white stripe
W ....White
W.Bu ....White/blue stripe
W.G ....White/green stripe
W.R ....White/red stripe
W.Y ....White/yellow stripe

23. N600G; Germany



R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

24. N600G ; U.K.



R.	Red	R.Y	Red/yellow stripe	G.W	Green/white stripe	Bu.Y	Blue/yellow stripe	Y.R	Yellow/red stripe	W.R	White/red stripe
R.Bl	Red/black stripe	G	Green	G.Y	Green/yellow stripe	Bl	Black	Y.W	Yellow/white stripe	W.Y	White/yellow stripe
R.Bu	Red/blue stripe	G.Bl	Green/black stripe	Bu	Blue	Bl.W	Black/white stripe	W	White		
R.G	Red/green stripe	G.Bu	Green/blue stripe	Bu.R	Blue/red stripe	Bl.Y	Black/yellow stripe	W.Bu	White/blue stripe		
R.W	Red/white stripe	G.R	Green/red stripe	Bu.W	Blue/white stripe	Y	Yellow	W.G	White/green stripe		

SECTION 18

BODY

A. Body Sheet Metal

Honda N series sedans and vans are of the monocoque construction type designed for high rigidity with minimum weight. When the car has an accident and the body is twisted or cracked, a thorough knowledge of body construction and welding seams are essential for body repairing.

The following is the picture and the list of the available body sheet metal components.

BODY SHEET METAL COMPONENTS OF N SERIES SEDANS

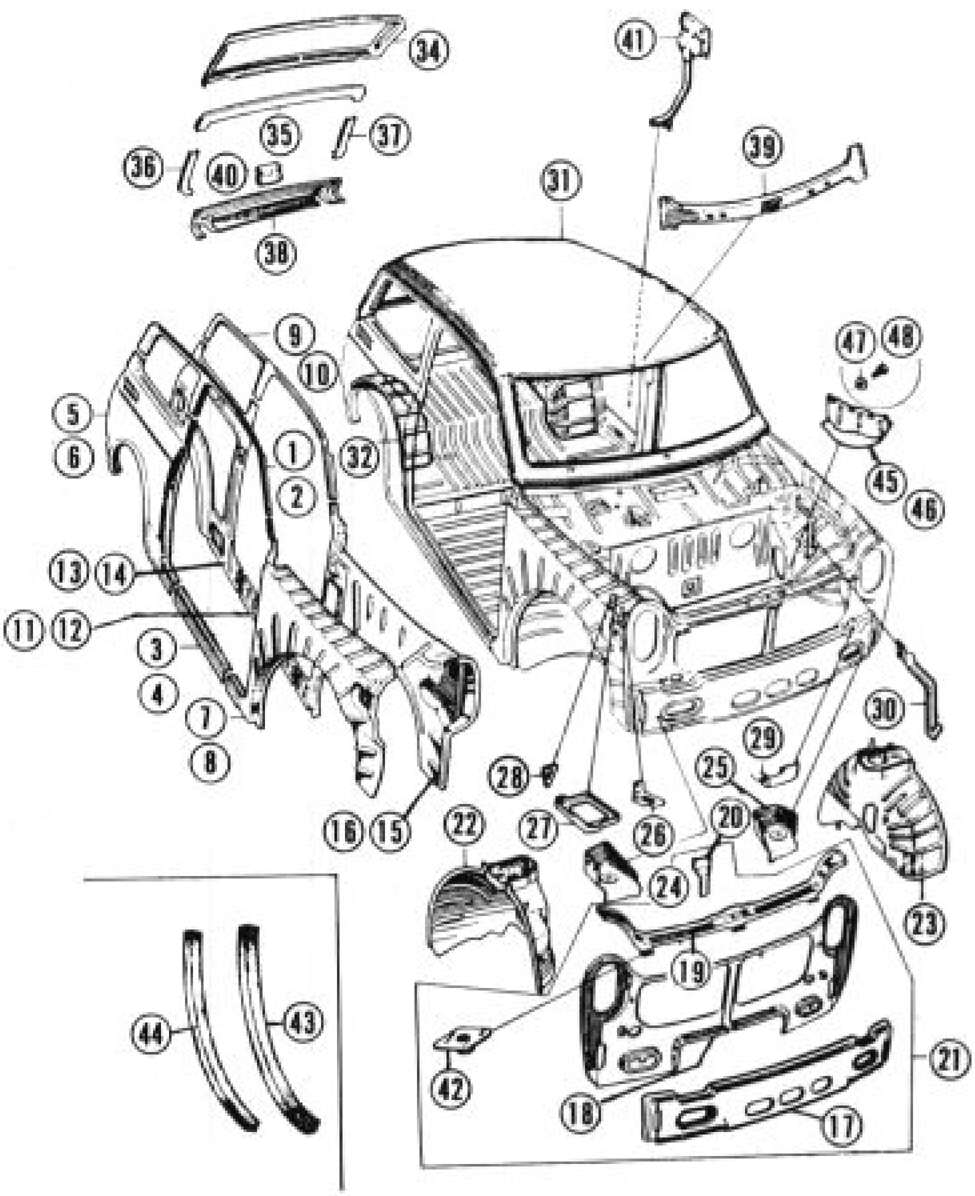


Fig. 18A-1

Ref. No. Description

1. Roof side edge outer panel R
2. Roof side edge outer panel L
3. Door sill outer panel R
4. Door sill outer panel L
5. Rear fender outer panel R
6. Rear fender outer panel L
7. Front fender middle panel R
8. Front fender middle panel L
9. Roof side edge inner panel R
10. Roof side edge inner panel L
11. Door sill inner panel R
12. Door sill inner panel L
13. Rear fender inner panel R
14. Rear fender inner panel L
15. Front fender inner panel R
16. Front fender inner panel L
17. Front skirt panel
18. Front end bulkhead
19. Front end tie member
20. Tie member stiffener
21. Front end bulkhead assembly
22. Front wheel housing R
23. Front wheel housing L
24. Sub-frame front bracket R
25. Sub-frame front bracket L
26. Battery stay bracket
27. Battery stay
28. Battery stay rear bracket
29. Fuel pump bracket
30. Spare tire support
31. Roof panel
32. Rear wheel housing R
33. Rear wheel housing L
34. Luggage compartment opening frame

UNDER BODY ALGNMENT (Unit: mm)

After the damaged area is repaired, the underbody should be alwasy checked with utmost accuracy and any distortion should be corrected as specified in Fig. 18A-2a (standard) and Fig. 18A-2b (American Type)

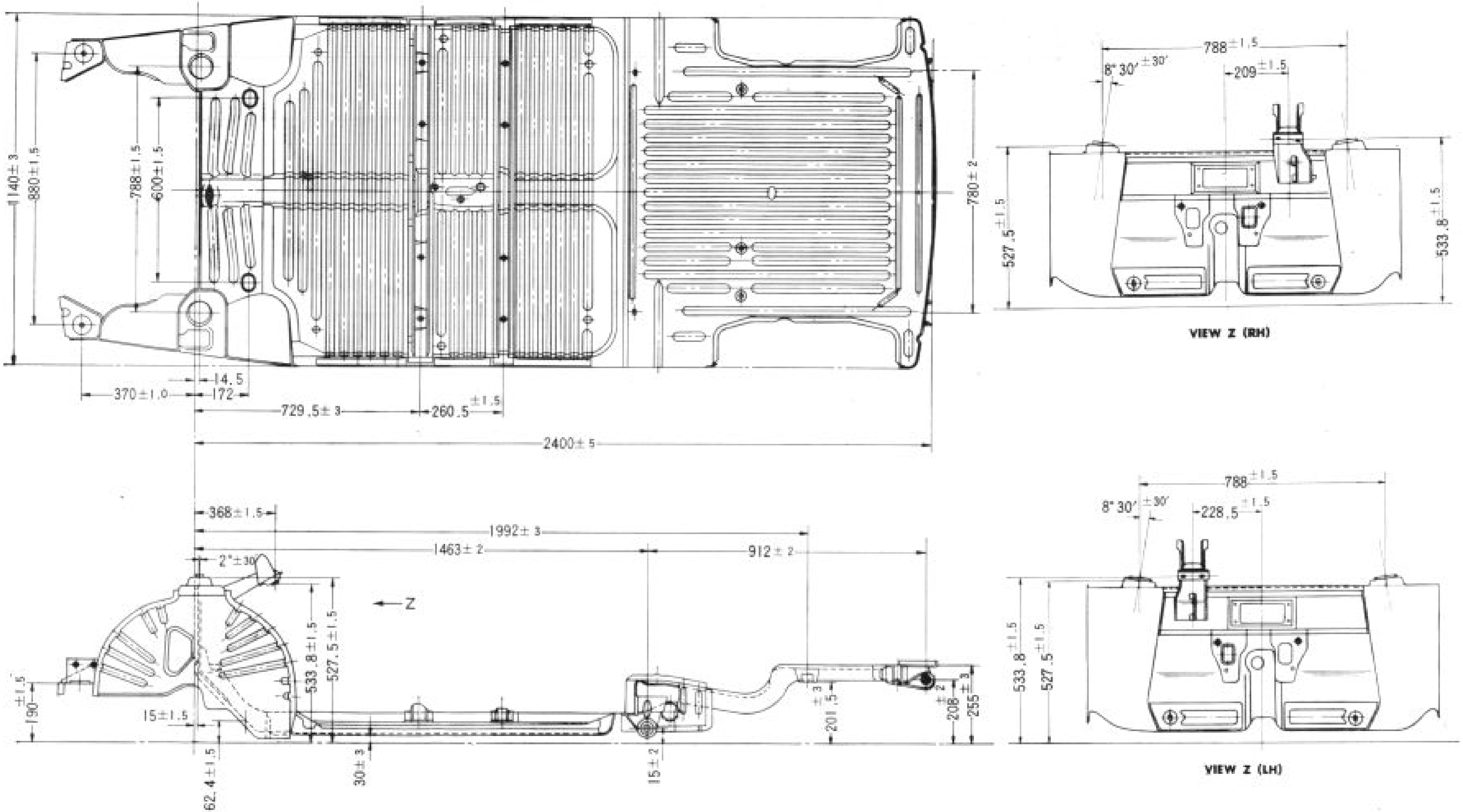


Fig. 18A-2a Standard

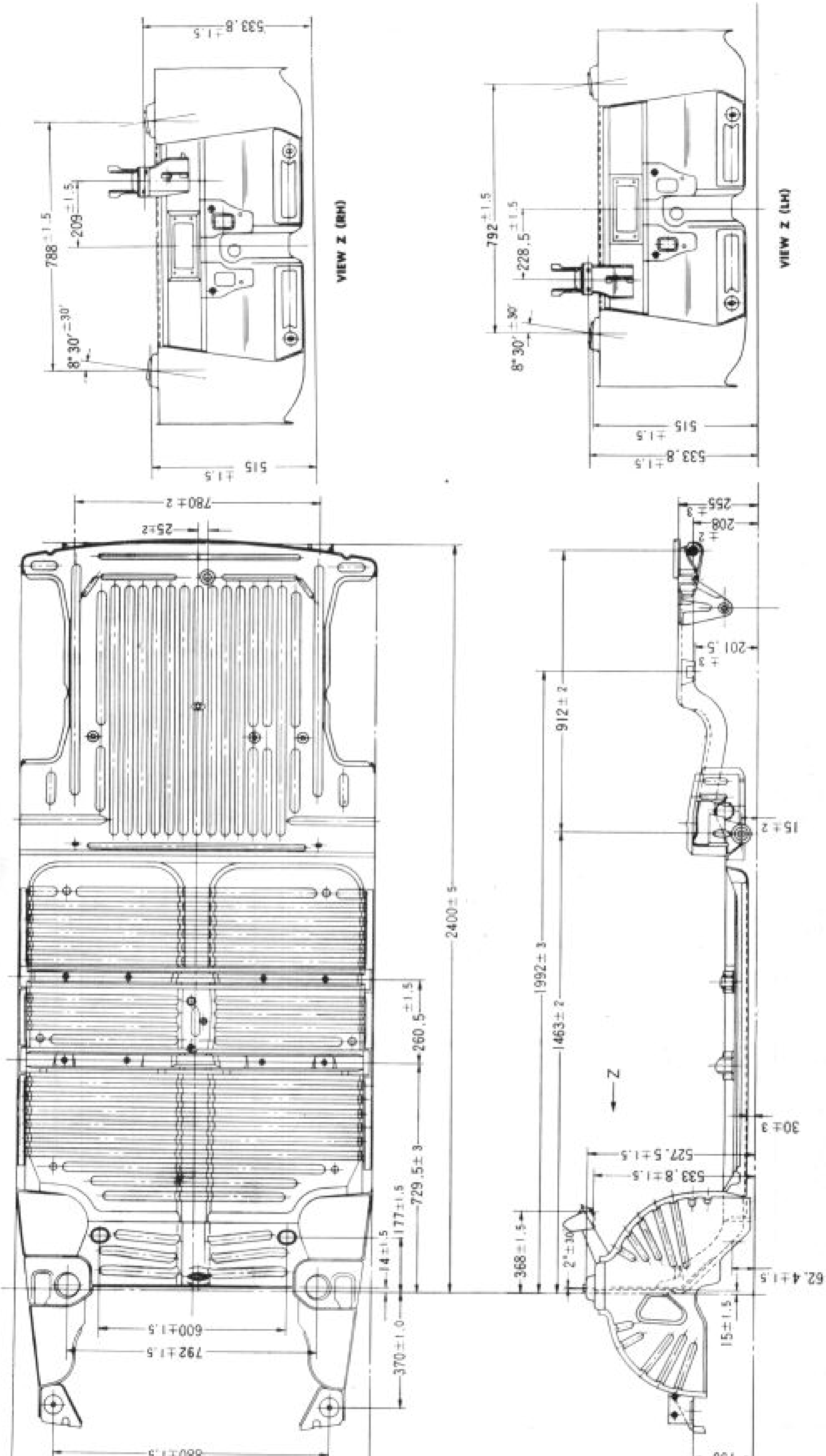


Fig. 18A-2b American Type

B. Bonnet and Rear Compartment Lid

a. BONNET

The installation or removal of the bonnet is made with four mounting bolts at both left and right hinges.

For adjustment of the bonnet position to the fore and aft, right and left, or up and down, large hinge holes are used. Adjust the bonnet position and retighten the bolts.

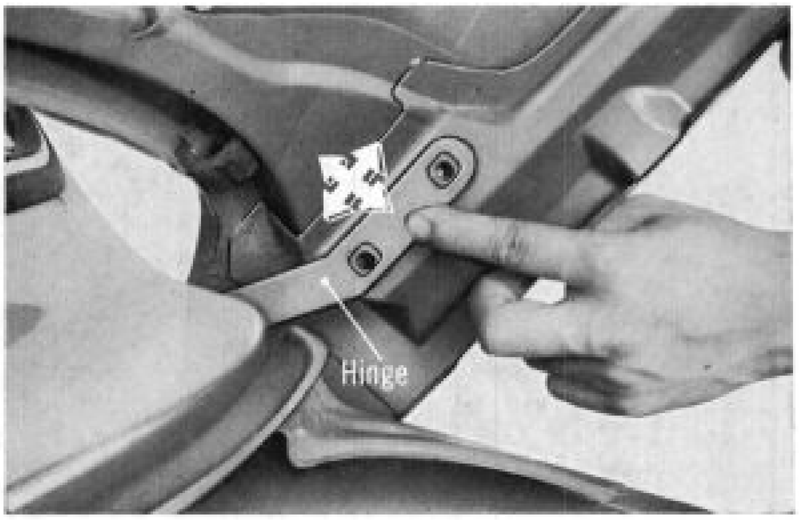


Fig. 18B-1

Loosen the lock nut on the bonnet lock dowel and turn the dowel inward to adjust the bonnet tighten or outward to adjust loosen.

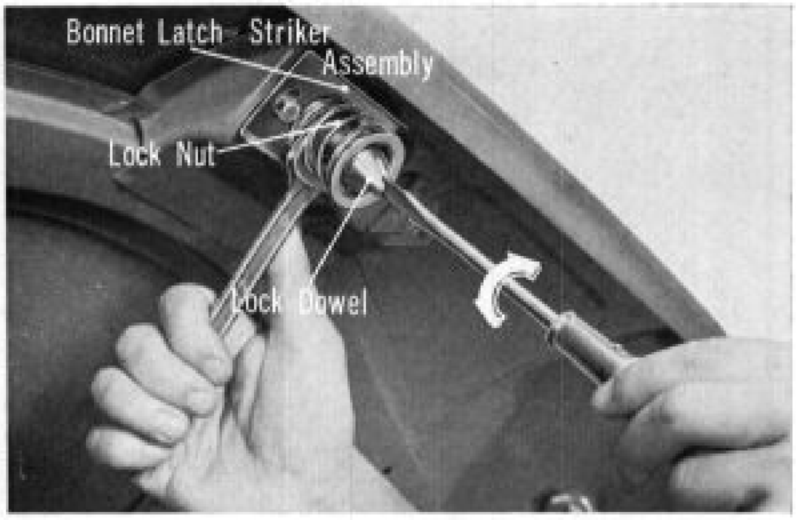


Fig. 18B-2

Improper bonnet opening and closing may be due to poor lock dowel and bonnet latch hole center alignment. The bonnet latch striker can be slid freely all directions. Loosen mounting bolts and adjust by sliding the bonnet latch striker.

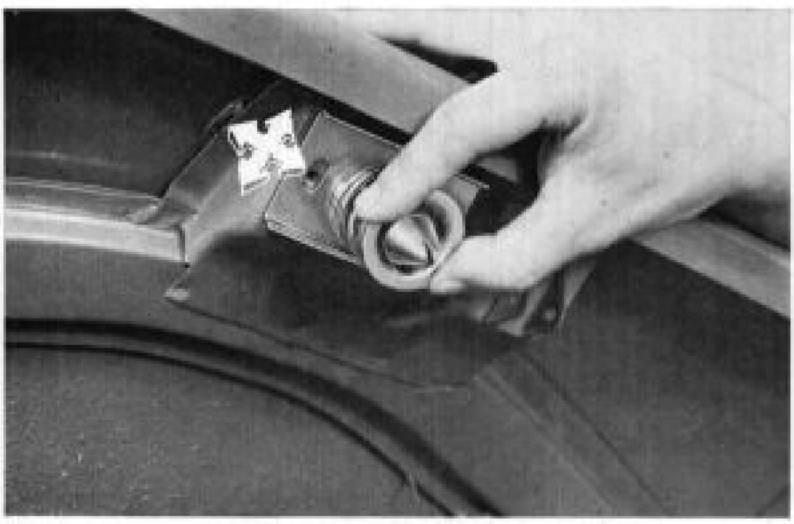


Fig. 18B-3

Grease upon completion of adjustment.
Also check the bonnet safety catch for security.

Fig. 18B-4

b. REAR COMPARTMENT LID

The rear compartment is made of ABS resin and suspended by two hinges.

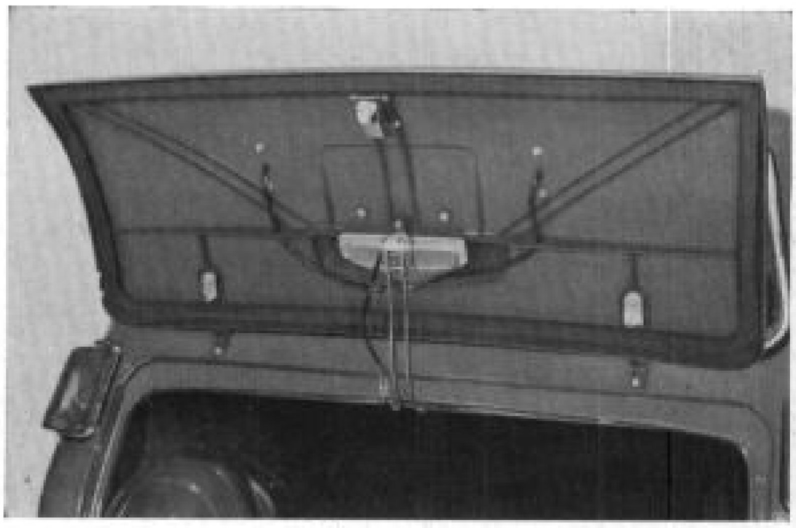


Fig. 18B-5

To disassemble the lid make the lid open stay narrower to separate it from the body, and disconnect the leads of the license plate light.

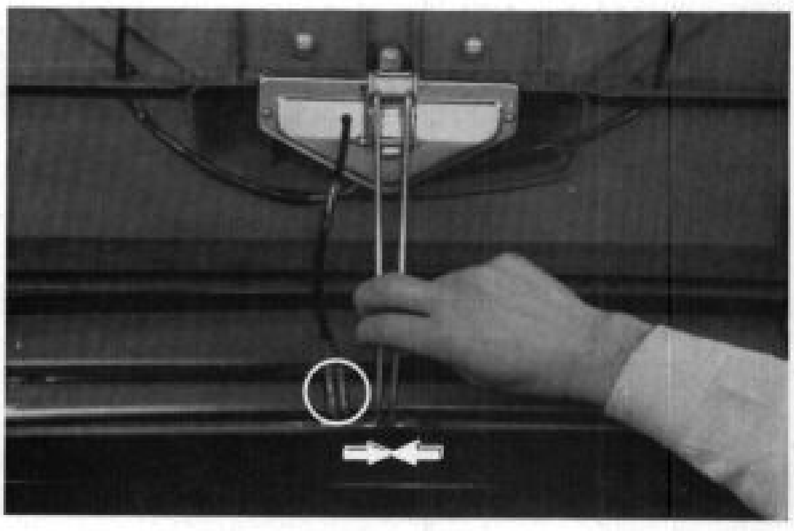


Fig. 18B-6

Unscrew the nuts of both the right and left hinges, and remove the mounting washer to separate the rear compartment lid from the hinges.

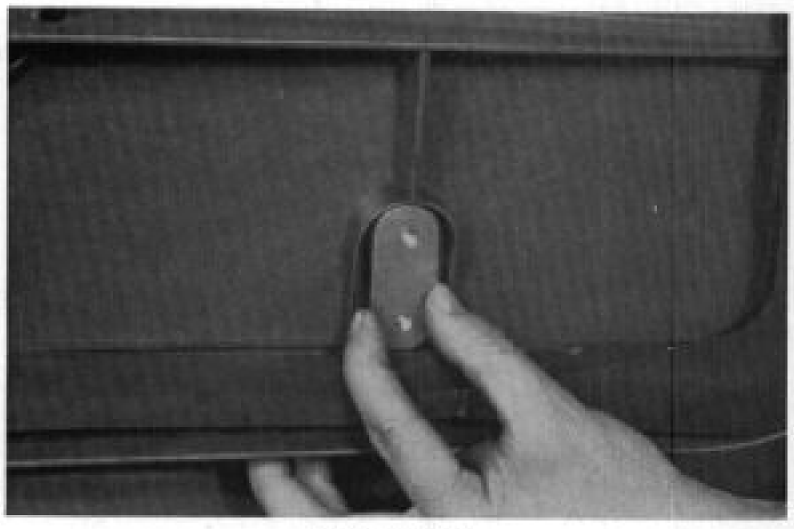


Fig. 18B-7

For assembly, note the holes of the rear compartment lid are made large so that the lid position can be adjusted horizontally and laterally.

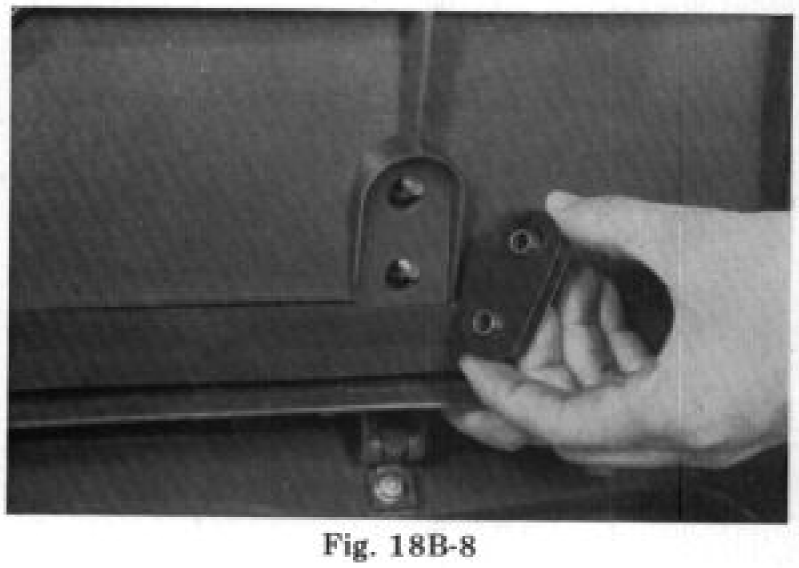


Fig. 18B-8

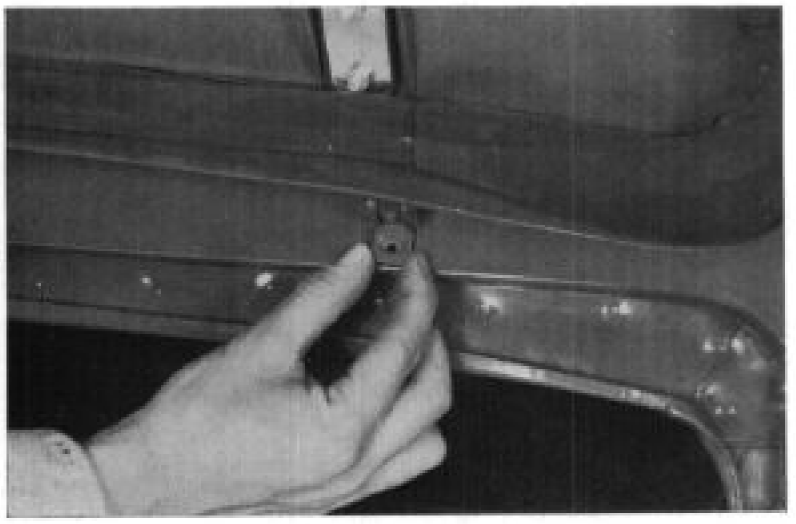


Fig. 18B-9

The adjustment of the lid position in the horizontal direction can also be made with the male hinge.

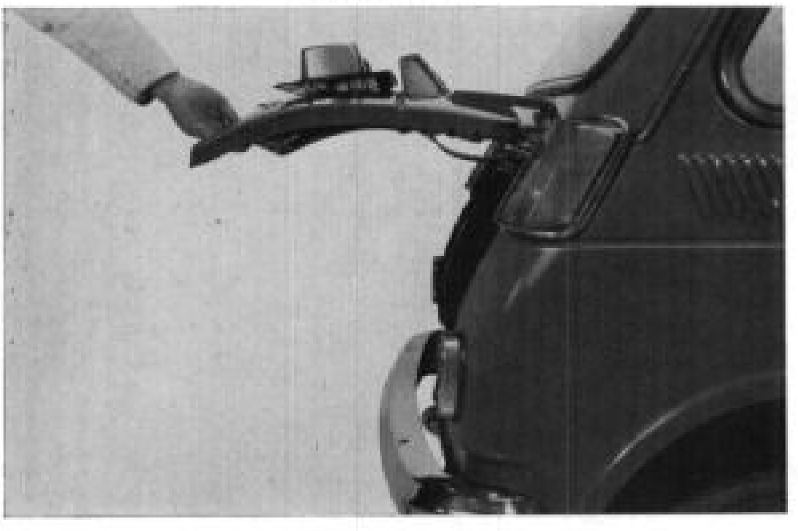


Fig. 18B-10

Check the rear compartment lid for improper closing by dropping from the horizontal open position. If the lid shuts completely and the opening is not firm, the trunk lid lock and the trunk lid catch are proper.

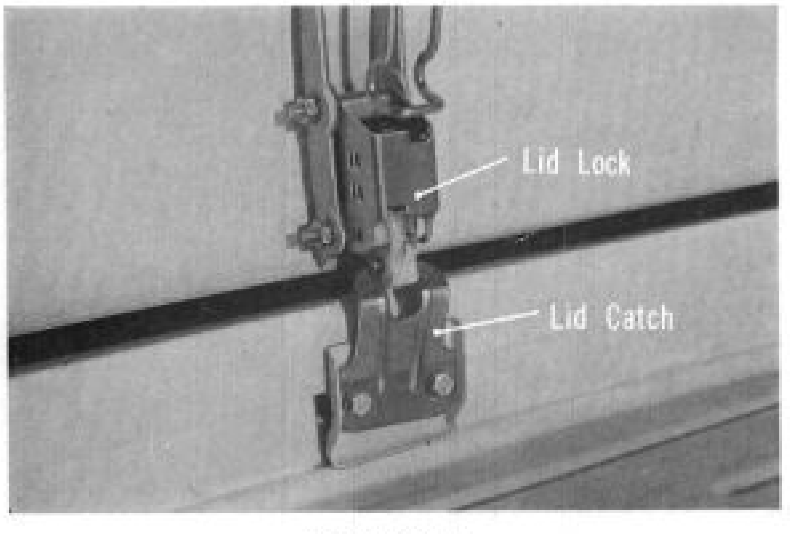


Fig. 18B-11

Improper lid closing is due either defective trunk lid lock or improper position of the trunk lid lock catch. If the lid does not close completely and opening/closing is not firm, slide the trunk lid lock catch downward (Fig. 18B-12) or bend inward with a hammer. (Fig. 18B-13)

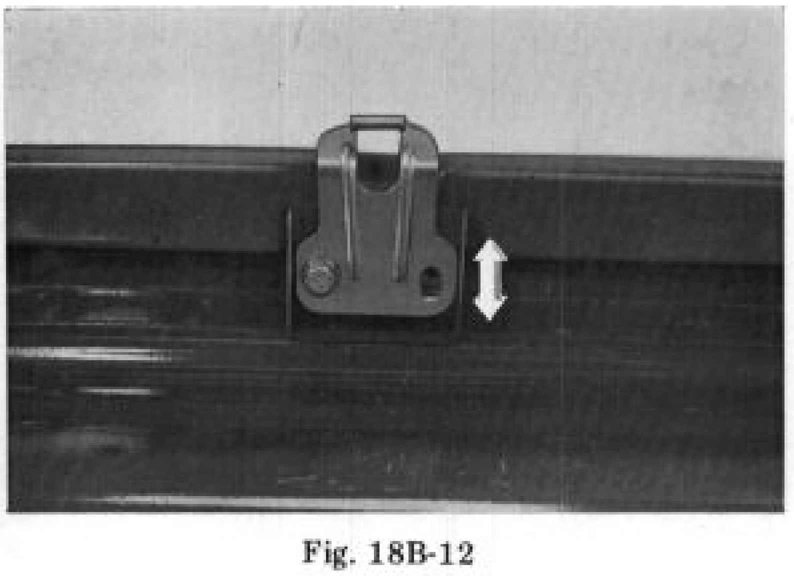


Fig. 18B-12

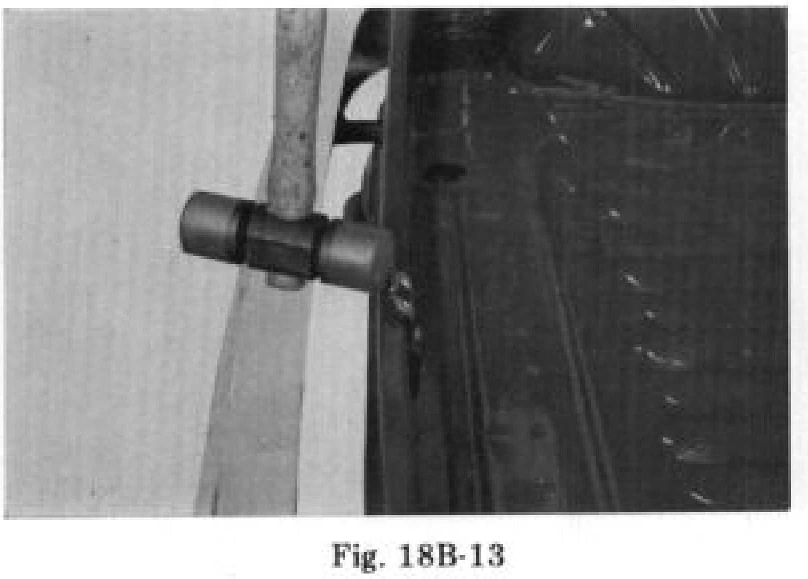


Fig. 18B-13

C. Front Fender and Splash Guard Plate

Splash guard plate is mounted on the body with three 6mm bolts, and prevents water from entering the engine room. (only for the vehicle equipped with engine type car heater.)

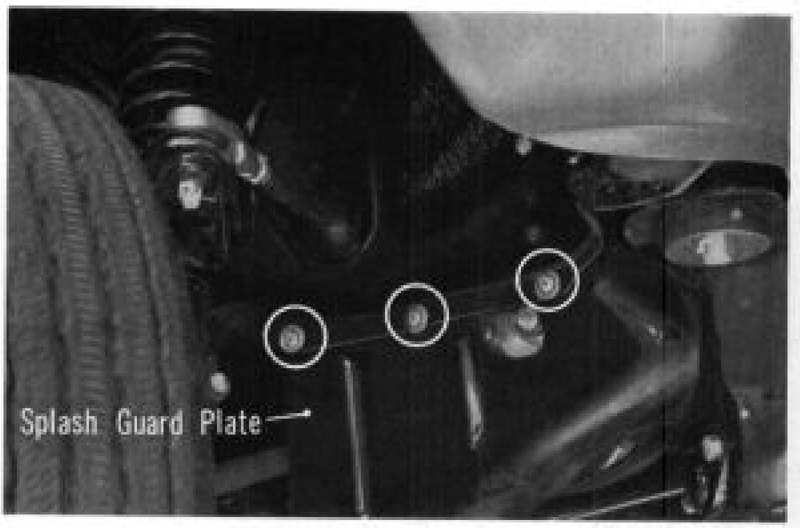


Fig. 18C-1

Front fender is secured to the body with eight bolts.

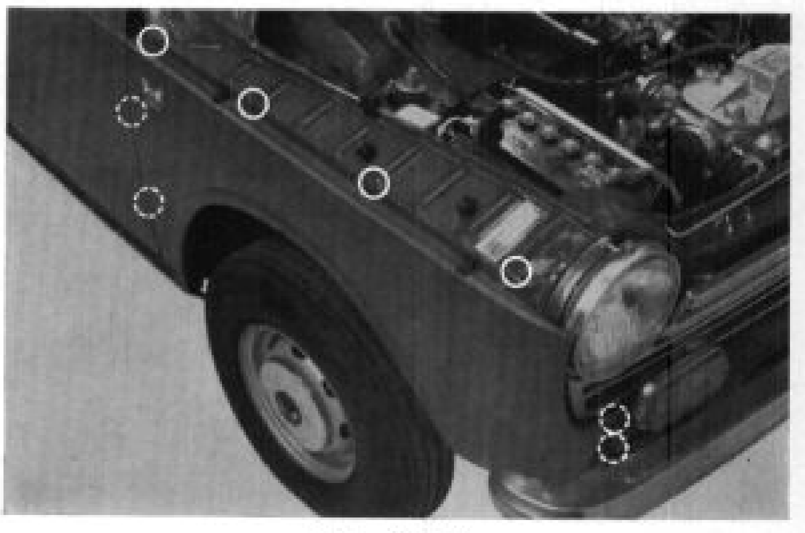


Fig. 18C-2

D. Front Grille and Bumpers

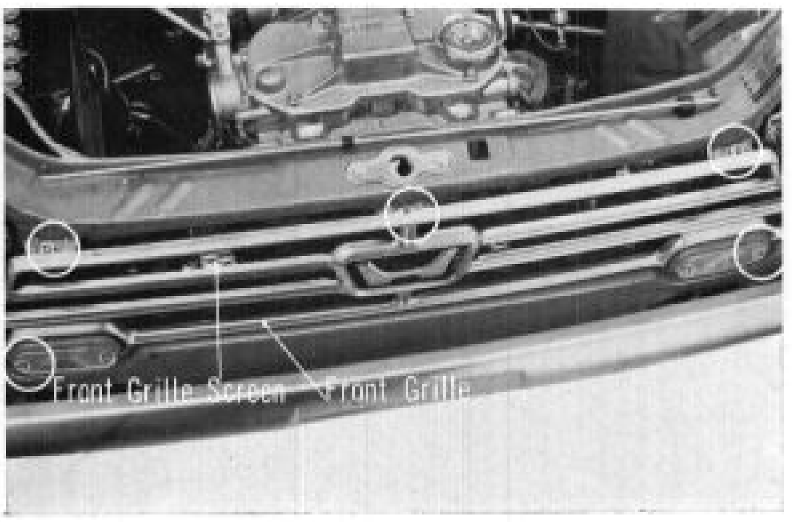


Fig. 18D-1

a. FRONT GRILLE

Remove the front grille and front grille screen by removing the five retaining screws.

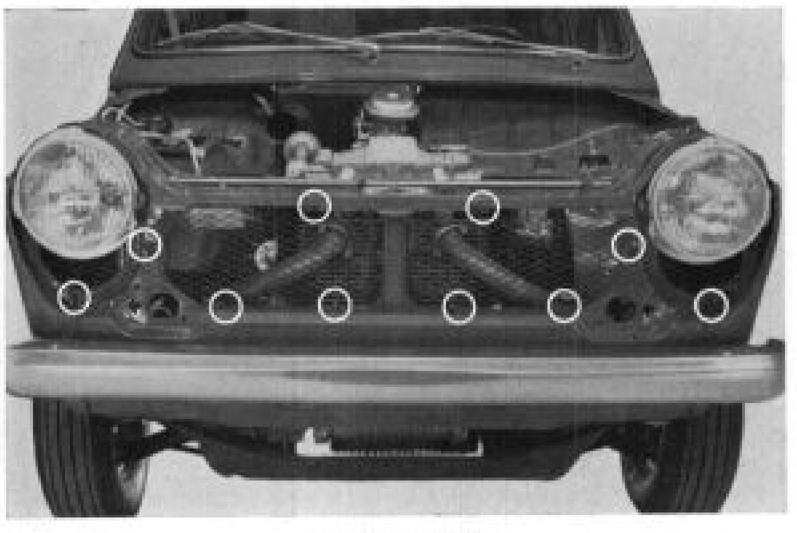


Fig. 18D-2

Unbend the lock plate to remove the screen.

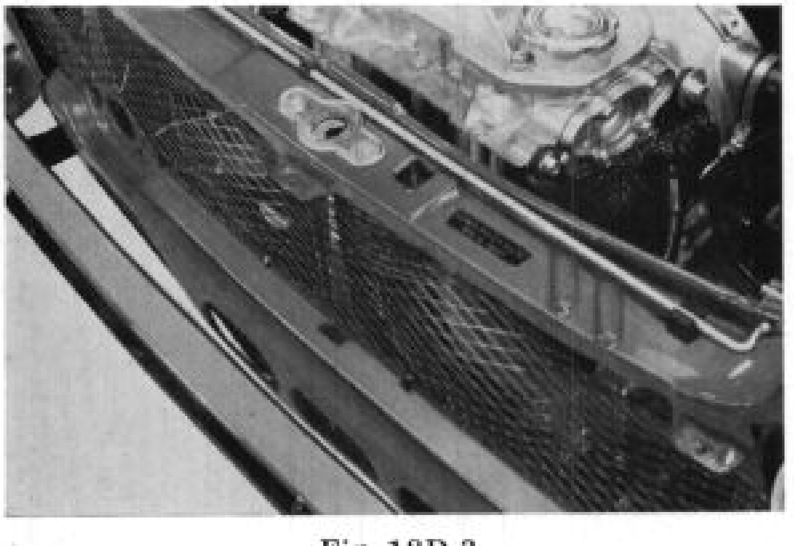


Fig. 18D-3

N600: When installing the screen, note the convex side faces outward to avoid the exhaust pipes.

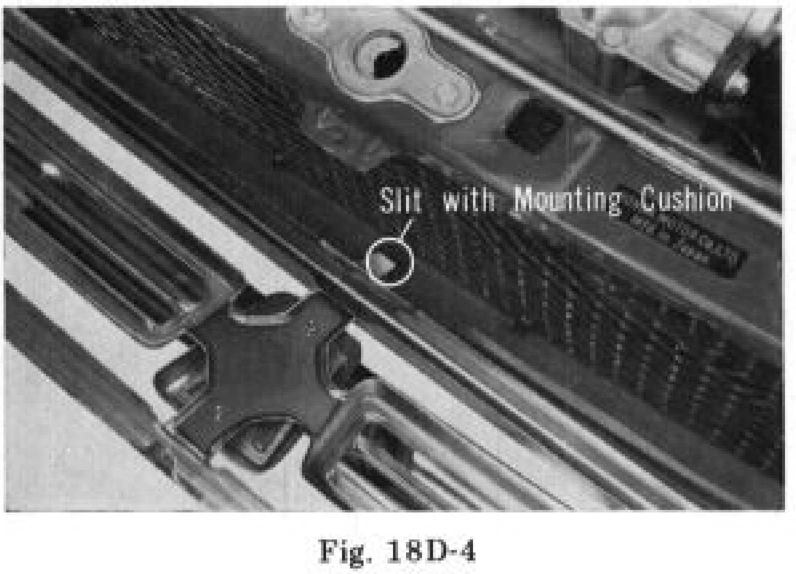


Fig. 18D-4

Insert the front grille into a body slit with a mounting cushion.

b. FRONT BUMPER

Front bumper is secured with four mounting bolts. Do not damage the silicon rectifier when bolting or unbolting.

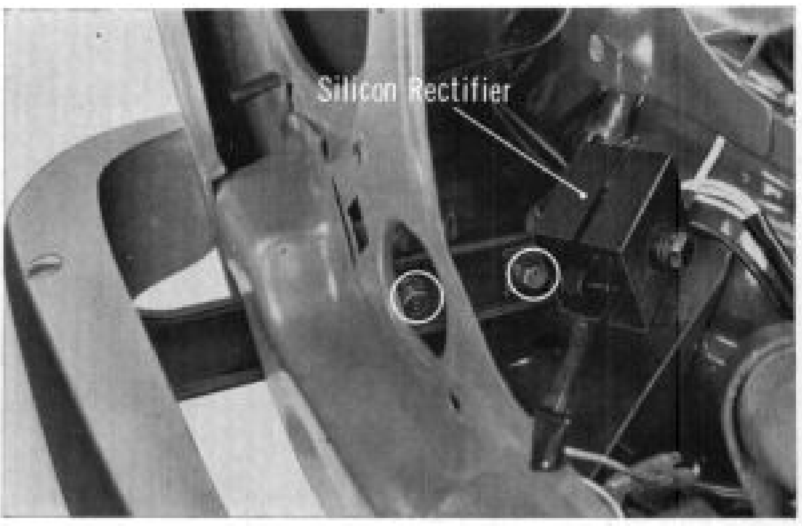


Fig. 18D-5

Bumper guard is supported at the front bulkhead with a bracket. (U.S.A. only)

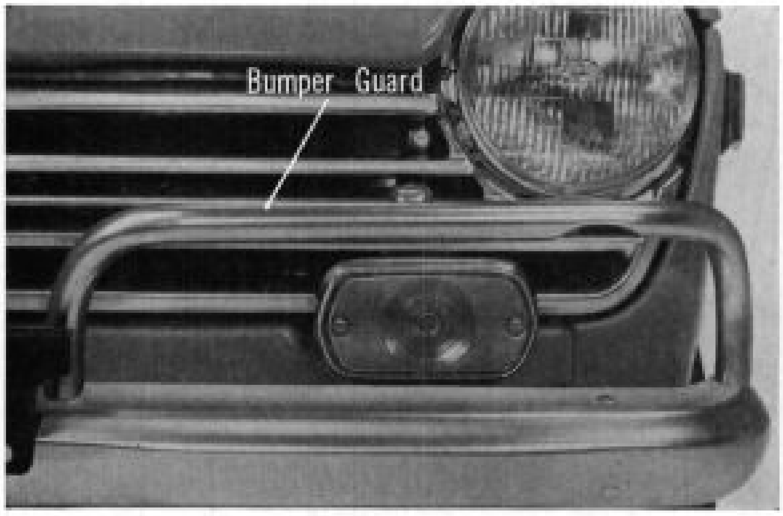


Fig. 18D-6

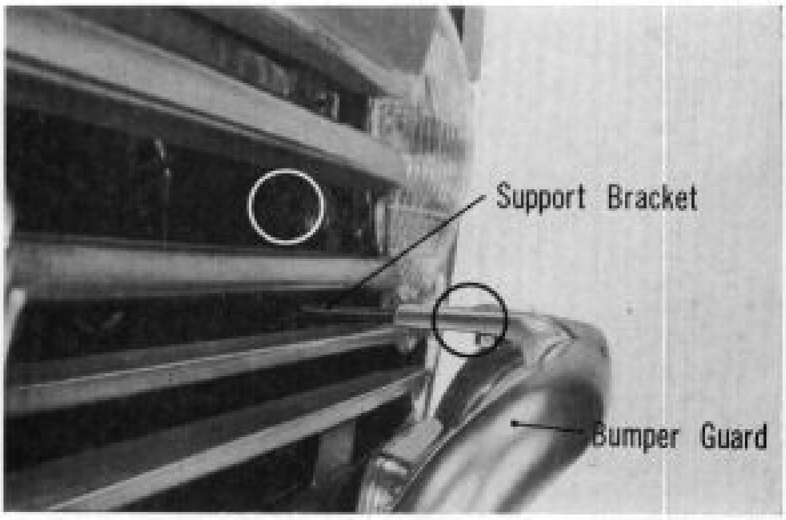


Fig. 18D-7

c. REAR BUMPER

The rear bumper is also assembled to the body through bumper stay and secured with four bolts.

Fig. 18D-8

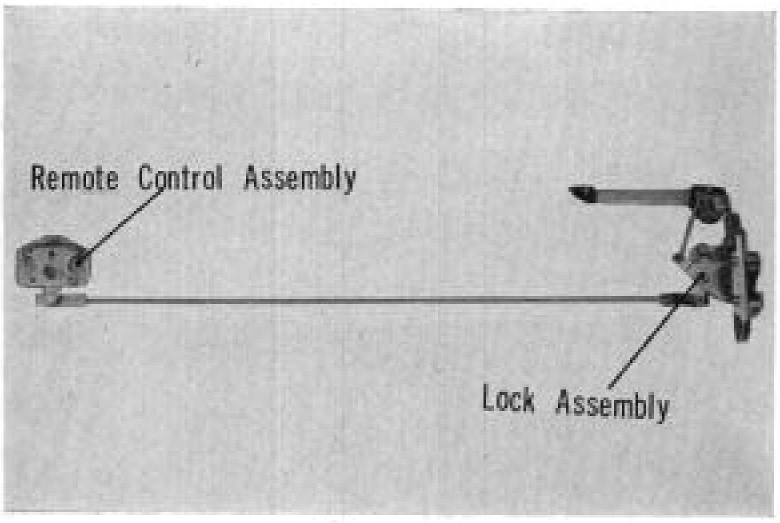


Fig. 18E-1

E. Door

Assembly

1. Apply grease both to the remote control assembly and lock assembly. Then, join the lock assembly to the remote control assembly.

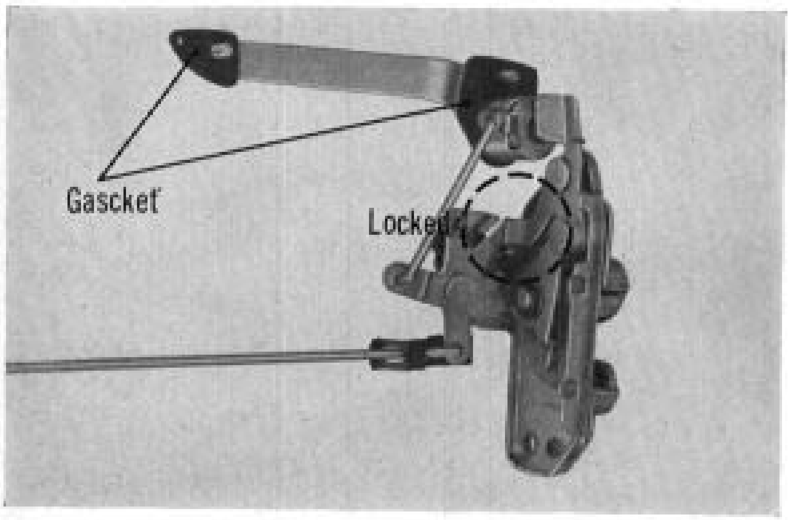


Fig. 18E-2

Fig. 18E-3

2. Install the remote control assembly and the lock assembly in a single unit in the door.
   Check the operation of the door lock. Then, install a piece of sponge suchion at the middle of the lock control rod.

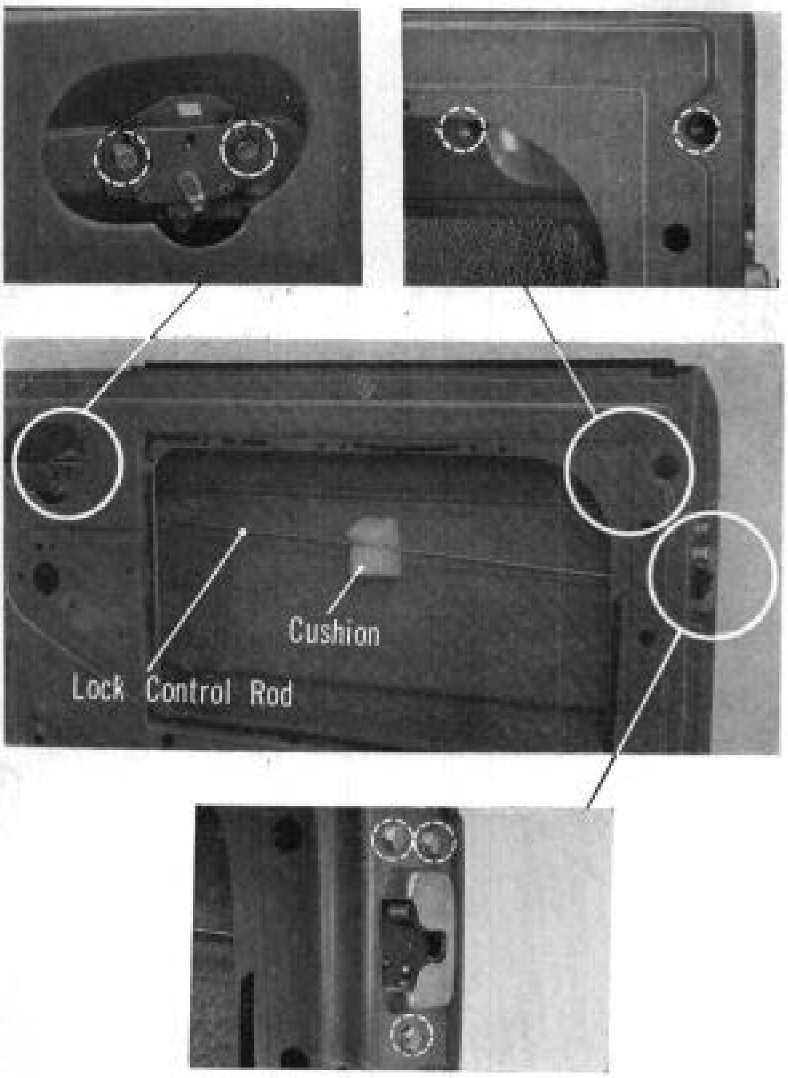


Fig. 18E-4

3. There are two types of regulator. **(Fig. 18E-5 and Fig. 18E-6)**

   Mount the door window regulator assembly on the door with seven screws. Do not deform the regulator. If the regulator is deformed, window action becomes tight. Apply a coating of grease on the regulator in advance.

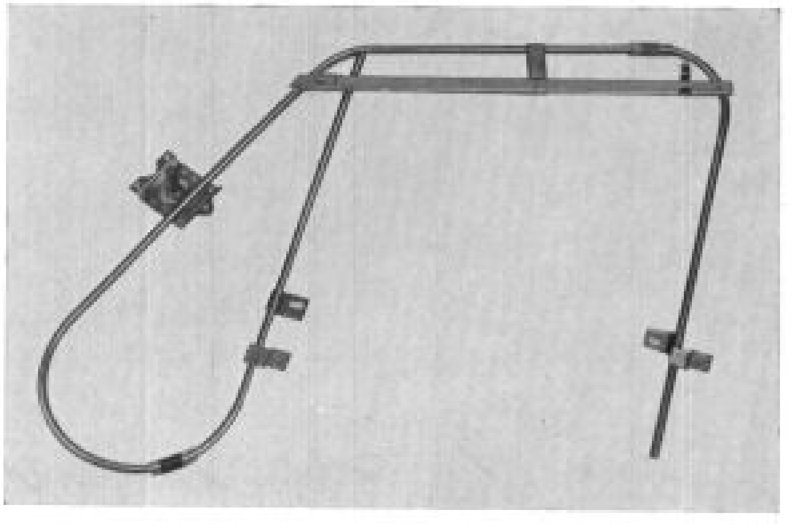


Fig. 18E-5-Type A

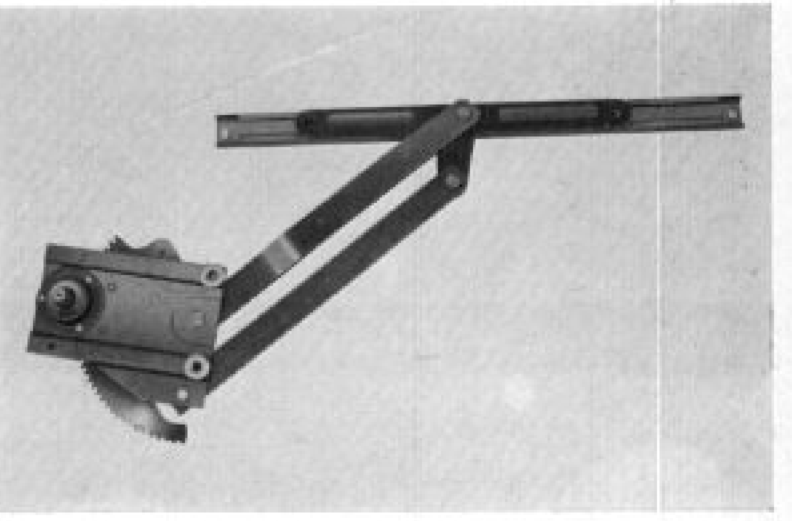


Fig. 18E-6-Type B

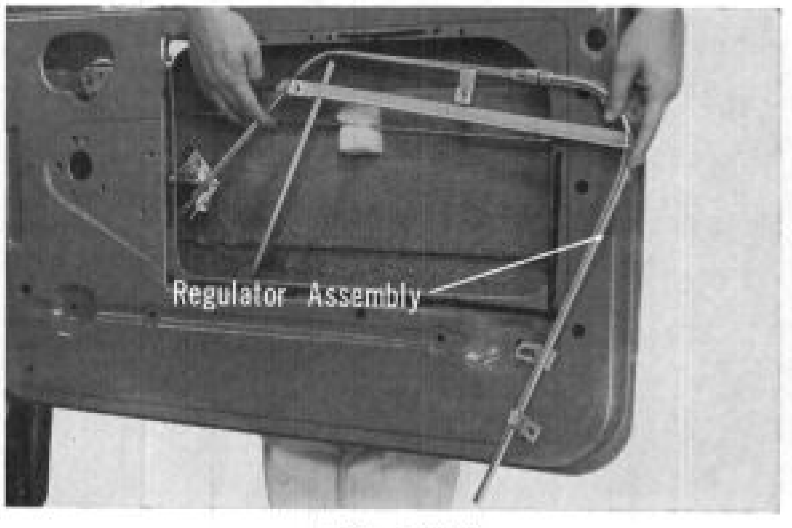


Fig. 18E-7

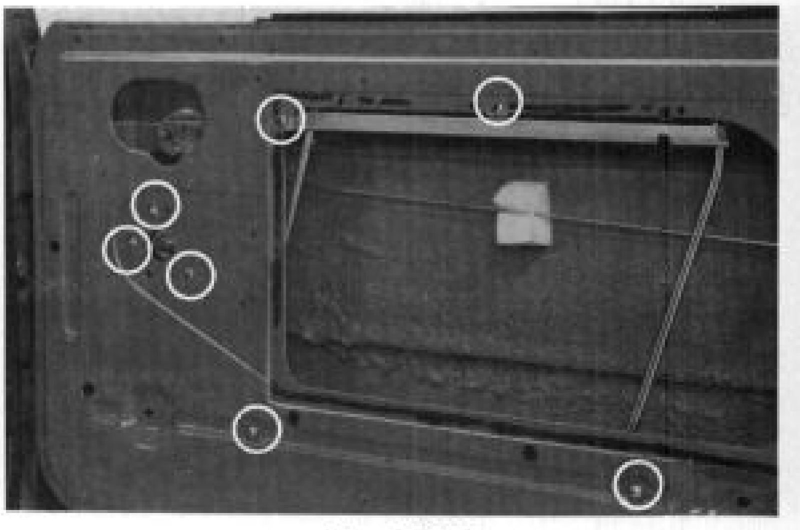


Fig. 18E-8

4. Check the ventilator glass open/close action. Adjust with nuts if necessary.

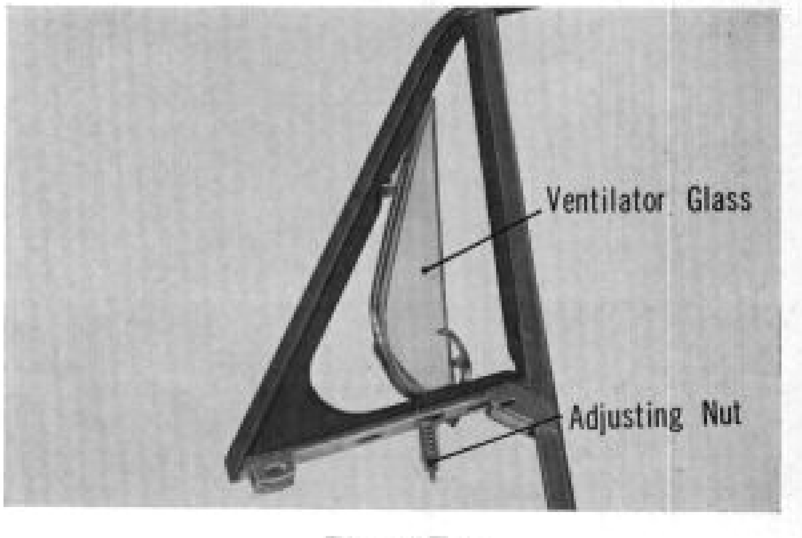


Fig. 18E-9

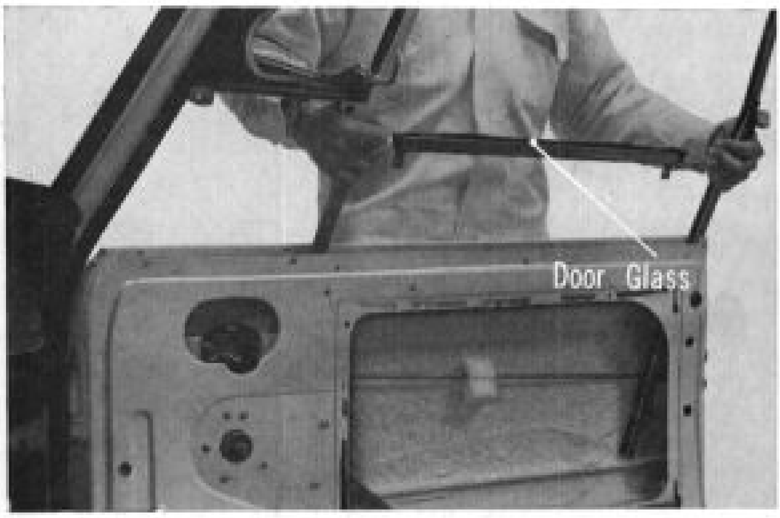


Fig. 18E-10

5. With the door glass fitted to the door sash, place it on the door.

   Do not drop the glass.

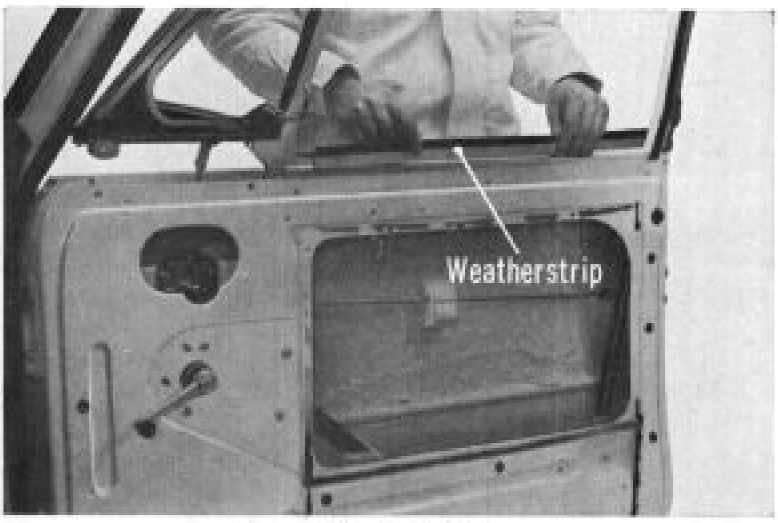


Fig. 18E-11

6. Check the outer weather strip clips for proper contour and reform if necessary.

   Drop the door glass carefully and install the outer weather strip.

7. Temperarily install the window regulator handle, turn it, and raise the door glass holder mounting part as shown (※) in Fig. 18E-12 and Fig. 18E-13, and join with the glass. Secure the door sash with five bolts. (Fig. 18E-12)

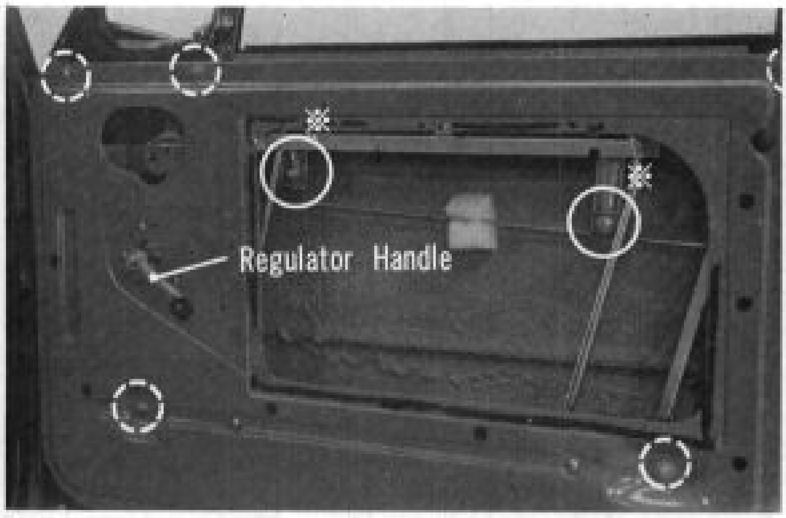


Fig. 18E-12-Type A

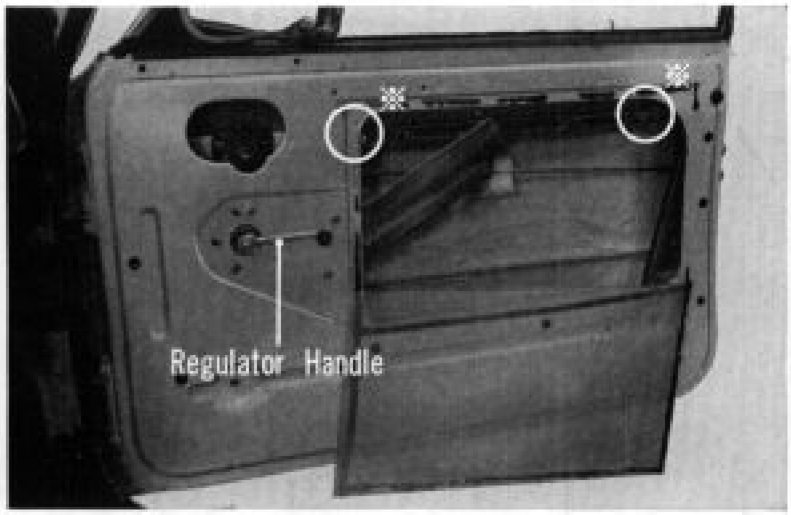


Fig. 18E-13-Type B

8. Upon completion of sash setting, turn the regulator handle and insure that glass action is normal and light.

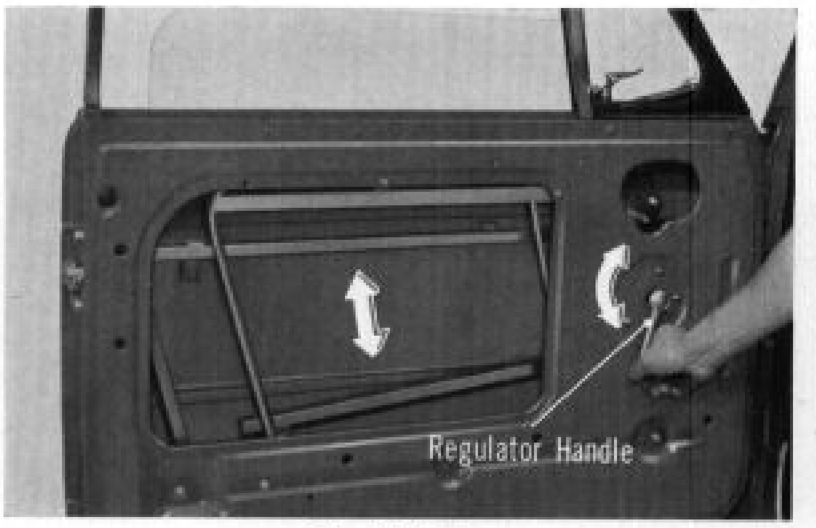


Fig. 18E-14

9. Seal the panel with vinyl film as shown.

   Note:
   Stretch the door panel center seal so that no winkle occurs in the seal. Winkle may cause water leakage.

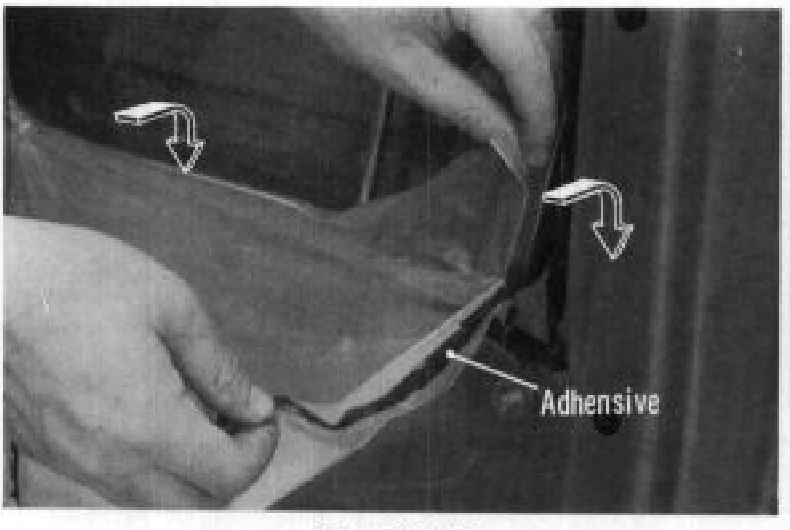


Fig. 18E-15

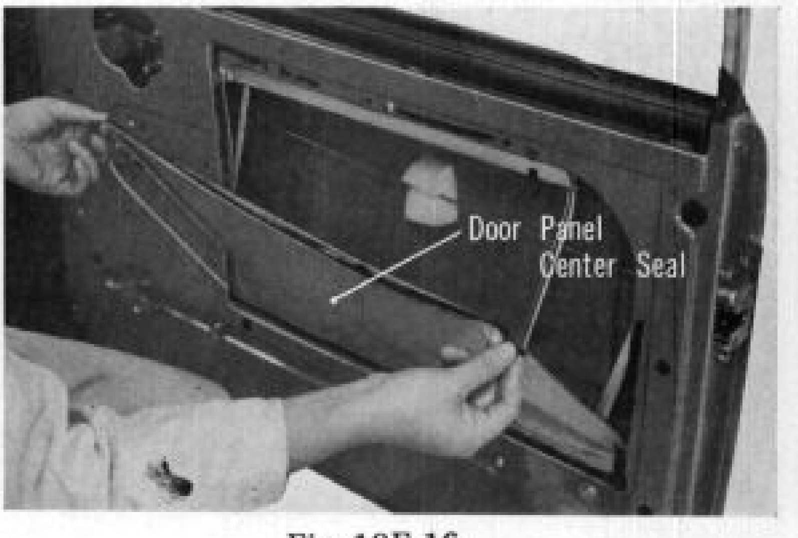


Fig. 18E-16

10. Place the inner weatherstrip and secure with the garnish.

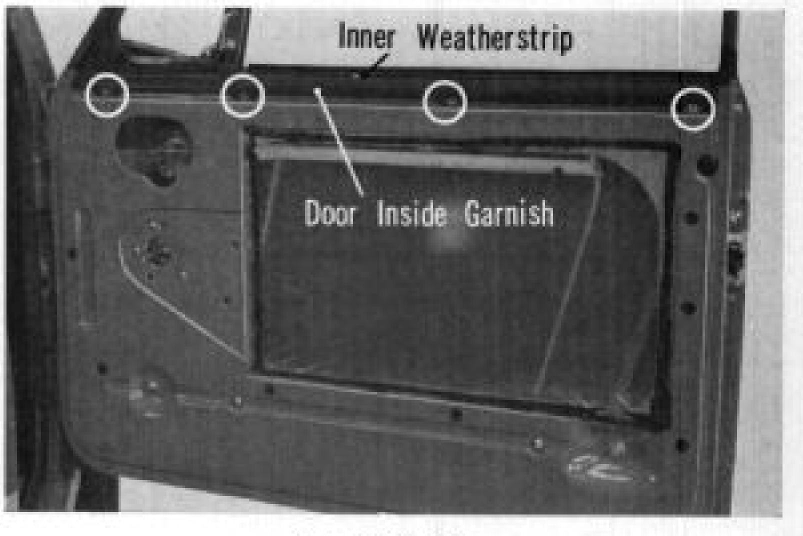


Fig. 18E-17

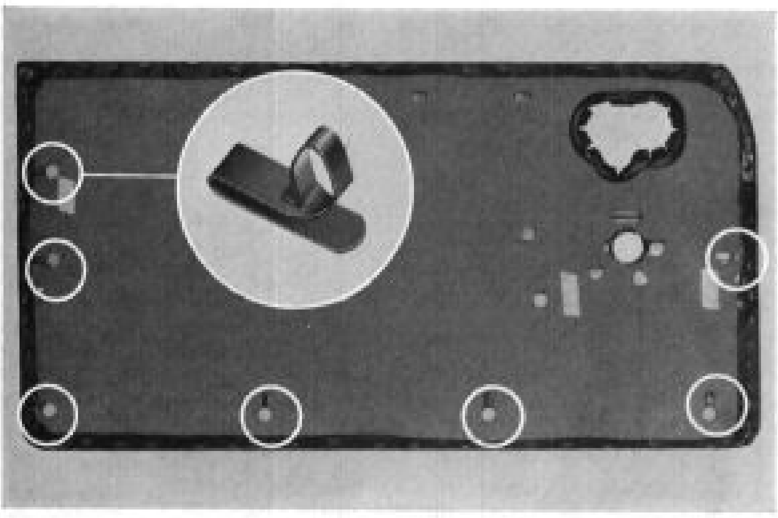


Fig. 18E-18

11. Check door lining clips for proper countour and reform if necessary.
    Then, install the lining to the door.

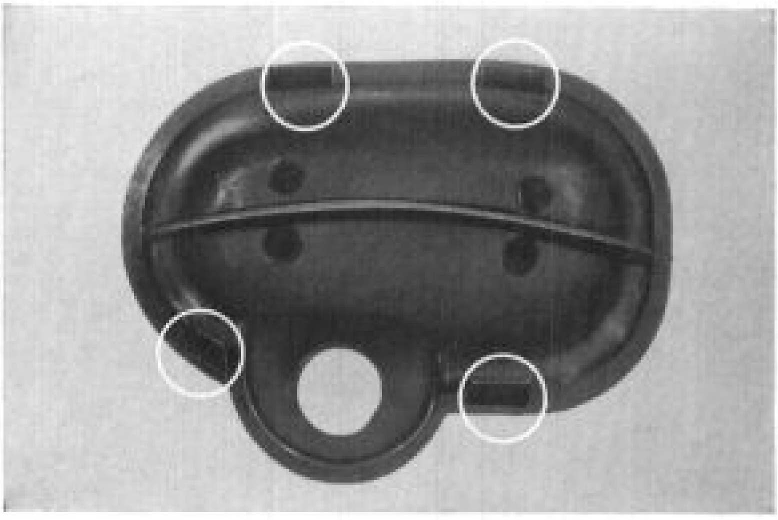


Fig. 18E-19

12. Install the lock lever housing. The housing has four claws which fit door panel.
    Then, install the door lock lever with a screw.

13. Raise the door window fully by turning the temperarily installed regulator handle and reset the lever at the position shown in Fig. 18E-20 and secure with a retainer (Fig. 18E-21)

Fig. 18E-20

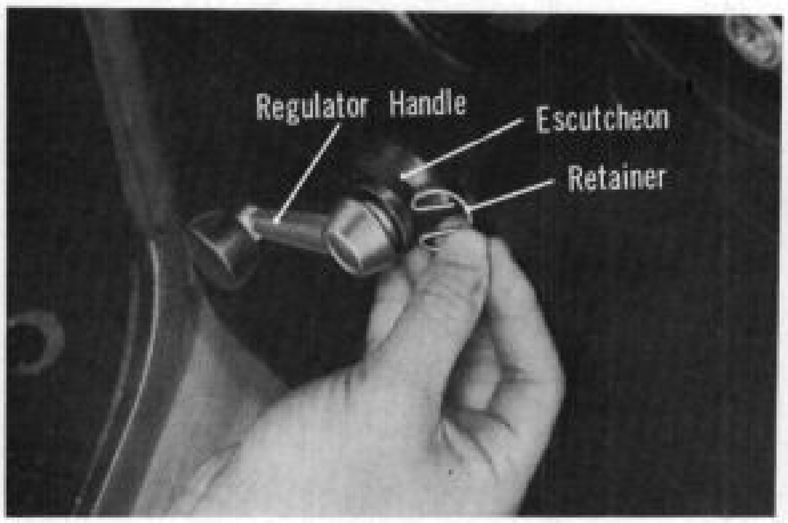


Fig. 18E-21

Installation

Although the door can be detached by removing either hinge-to-door bolts or hinge-to-body bolts, the door cannot be installed without attaching the hinges to the door.

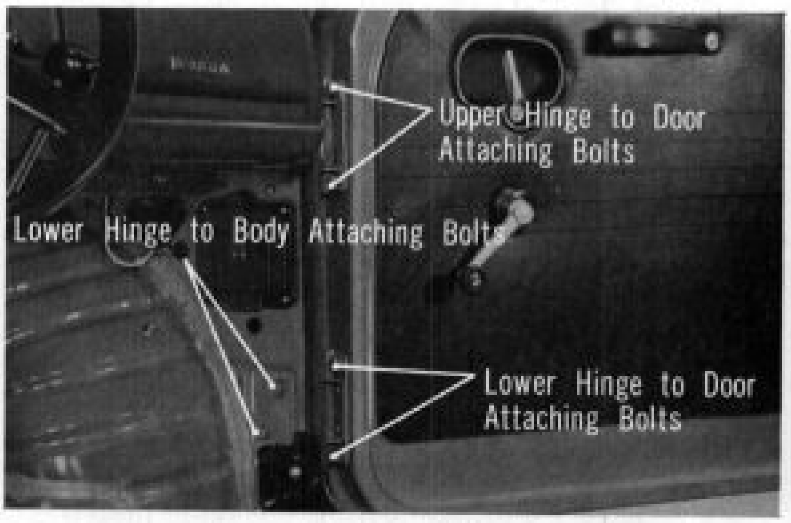


Fig. 18E-22

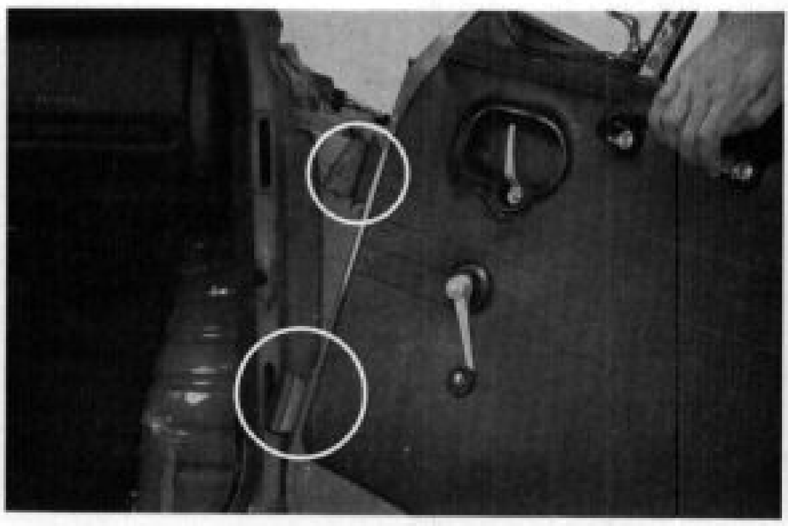


Fig. 18E-23

Adjustment

1. Door In/out, Up/Down, and Fore/Aft adjustment
   In/Out, Up/Down, or Fore/Aft is provided at door hinge pillar and/or with adjusting shims.
   (1) For **Fore/Aft adjustment,** loosen the hinge-to-body attaching bolts and adjust the door.

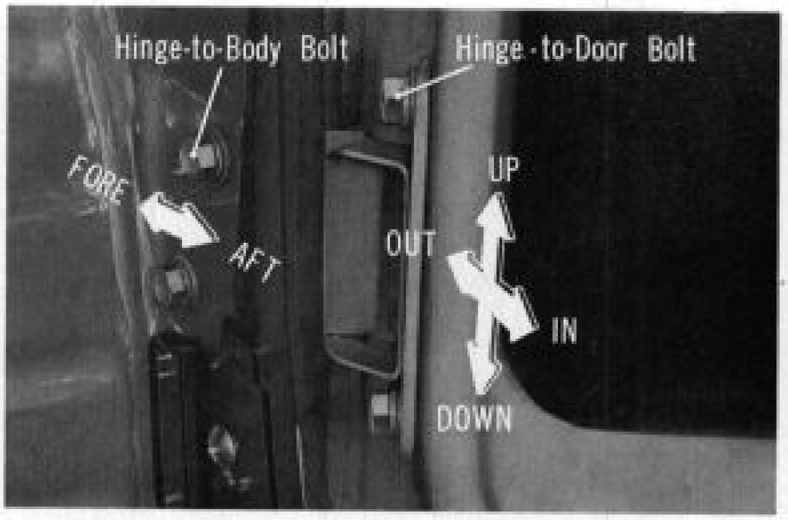


Fig. 18E24

   (2) For **In/Out or Up/Down adjustments,** loosen the hinge-to-body bolts and adjust the door.
   If the door is beyond this adjustment, use adjusting shims **(Fig. 18E-25)**

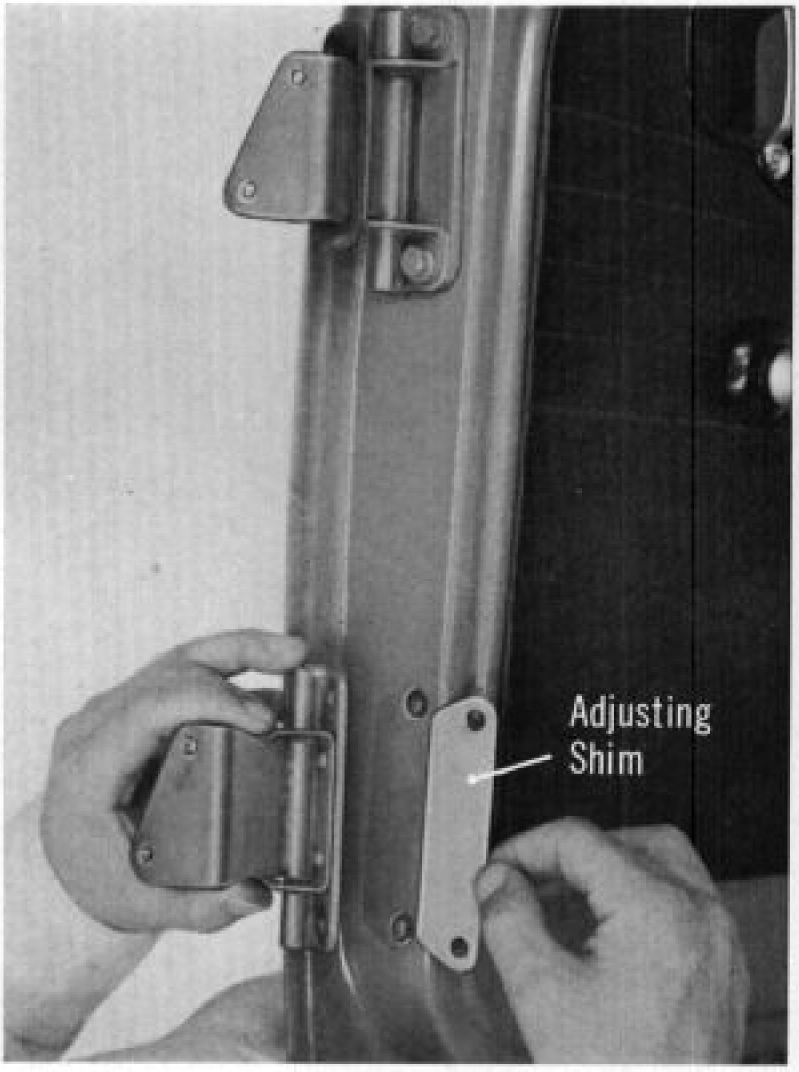


Fig. 18E-25

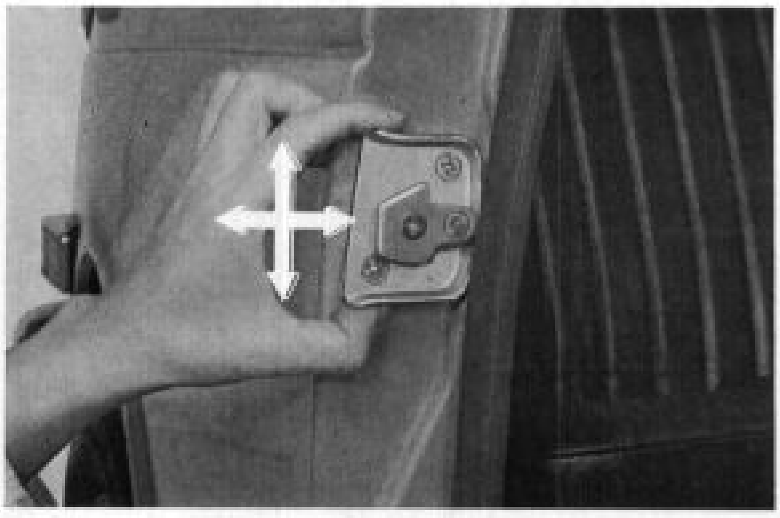


Fig. 18E-26

Fig. 18E-27

2. **Door Open/Close action adjustment.**

   (1) If the door does not close completely and opening/closing is not firm, slide the striker plate toward the inside to increase the door closing stroke. Conversely, if the door closing stroke is too deep and it is hard to close the door, slide the striker plate toward the outside.
   Open and close the door slowly, while checking striker contact. If there is contact at the bottom (top) of the striker, lower (raise) the striker plate slightly. Repeat this operation until the door opens and closes smoothly.

   (2) When the door lock roller and striker are shifted toward the front and door closing action is poor, adjust with shims.

F. LN360 Tale Gate

There are two type LN360s which are distinguished by the type of tail gate used. The single tail gate type has a single unit tail gate hinged at the right, and thus open/close is made horizontally. The dual tail gate type has two independent tail gates, an upper and a lower, as shown in the figure.

Fig. 18F-1

a. Lower Tail Gate

The lower tail gate is mounted with two hinges and two supporters on both sides. To adjust the gate position, loosen the hinge bolts and slide the hinge to the proper position. Hinge holes are made large to allow adjustment. The lower tail gate panel is mounted with eight screws.

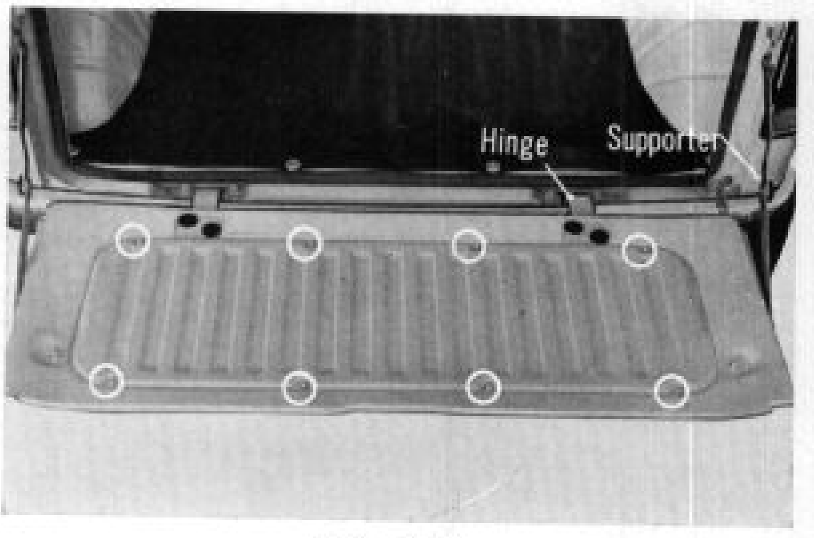


Fig. 18F-2

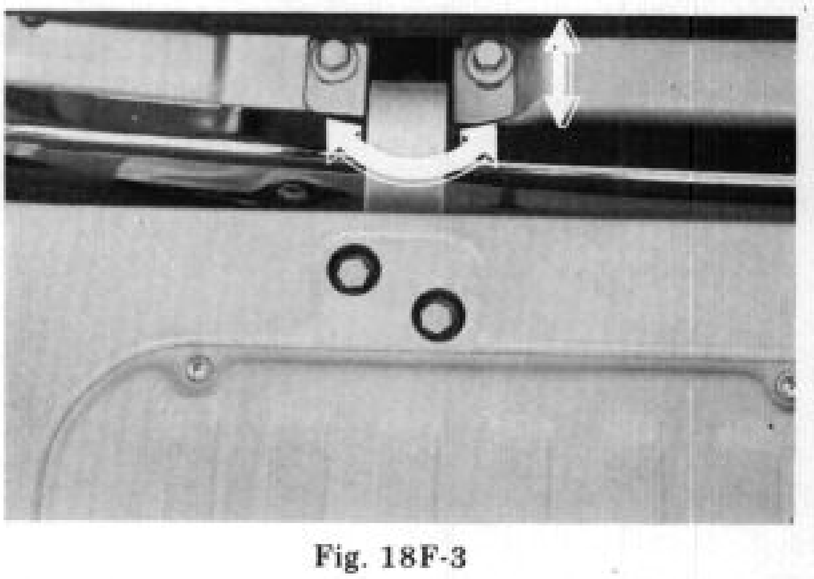


Fig. 18F-3

When opening or closing action of the lower is too firm or too soft, the probable cause is improper door striker positioning or a gate lock malfunction. Striker holes are made large to allow adjustment.

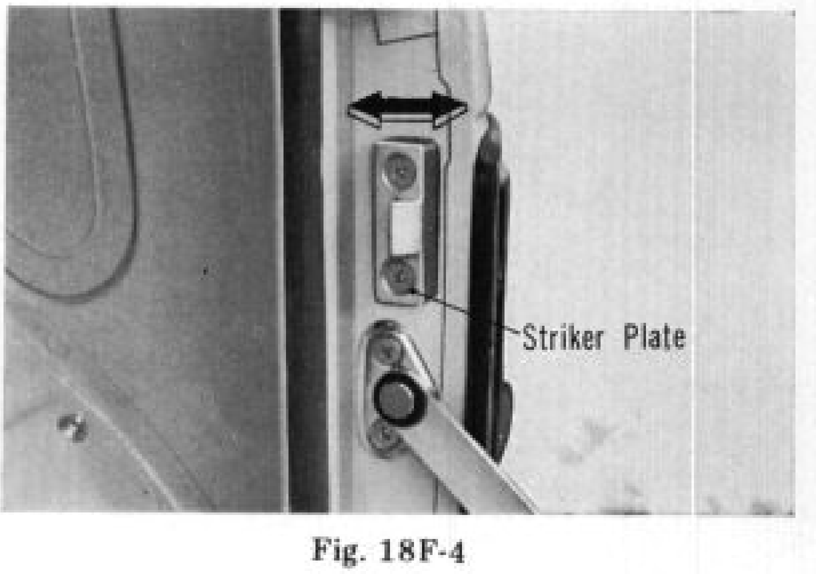


Fig. 18F-4

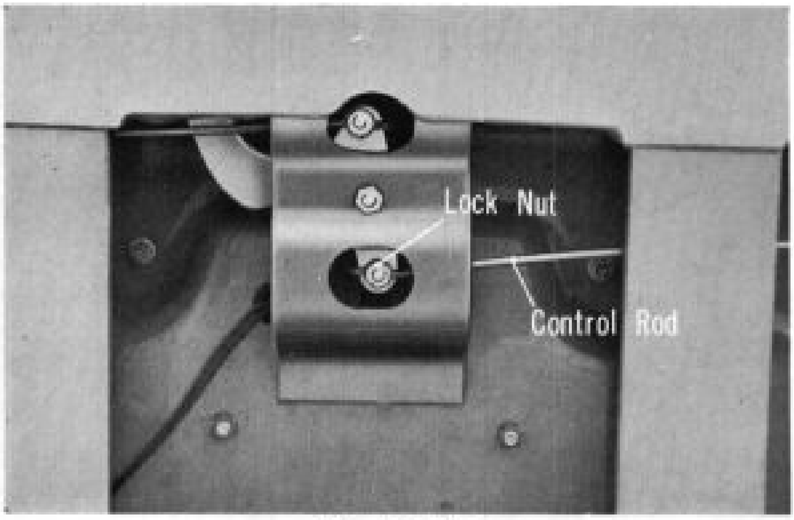


Fig. 18F-5

To repair the gate lock, remove the eight tail gate panel mounting screws, shown in Fig. 18F-2. Loosen the lock nut and adjust the length of the rods.

Fig. 18F-6

b. Upper Tail Gate

The upper tail gate is mounted with two hinges and supported with expansion supporter.
Repositioning of the gate is accomplished by loosening the hinge bolts on the gate.

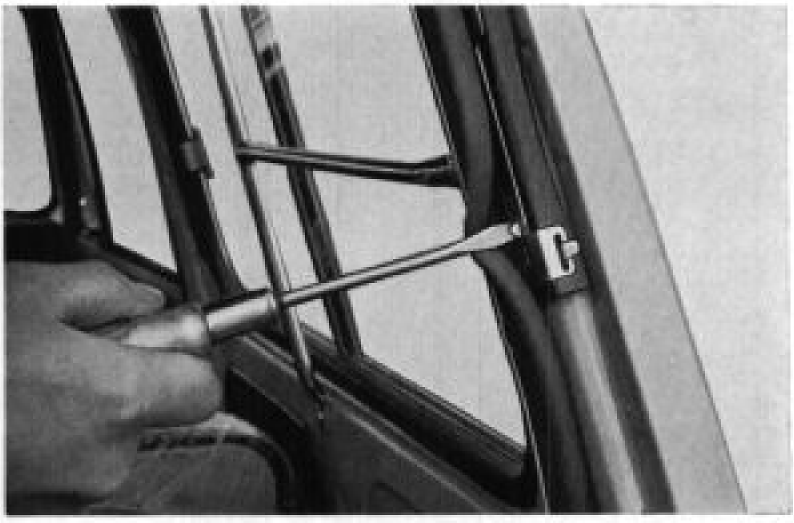


Fig. 18F-7

Rubber bellows are installed between the gate and the roof panel to prevent water drip when the gate is opened. Unlock the ten lock plates to remove the bellows.

Fig. 18F-8

To test gate closing action, free the tail gate from the horizontal opening position.
The gate should close and lock without further effort.

If the gate does not close completely or if it closes "weakly", slide the striker to the correct position.

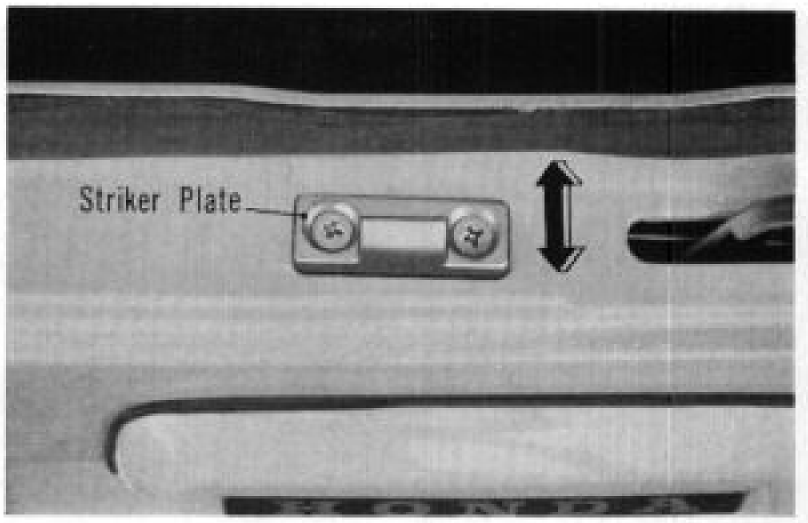


Fig. 18F-9

G. Windshield Glass

Fit weatherstrip to the glass. Place a 3.5 meter (11.5 ft) draw cord with a diameter of 6mm (0.236 in) in the groove. Apply rubber lubricant such as soap water to weatherstrip to make the installation easy.

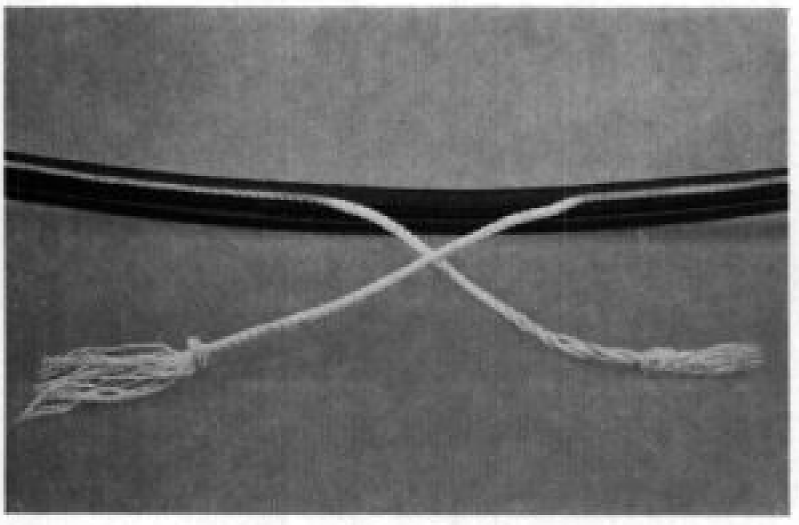


Fig. 18G-1

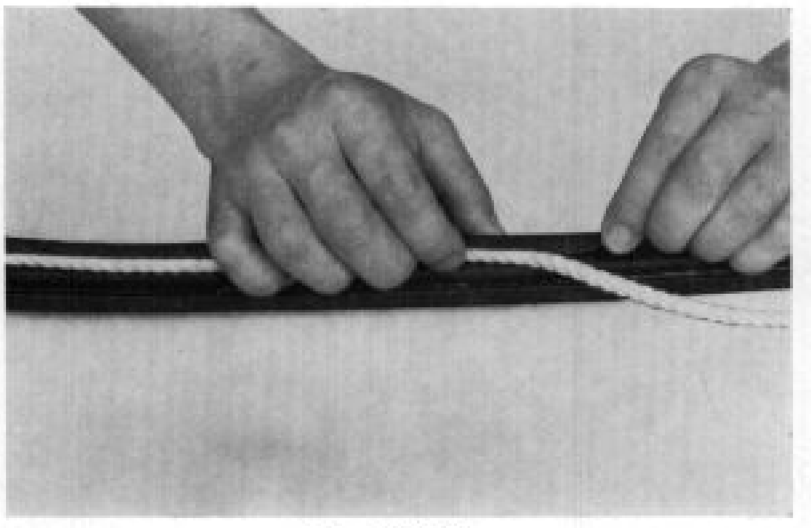


Fig. 18G-2

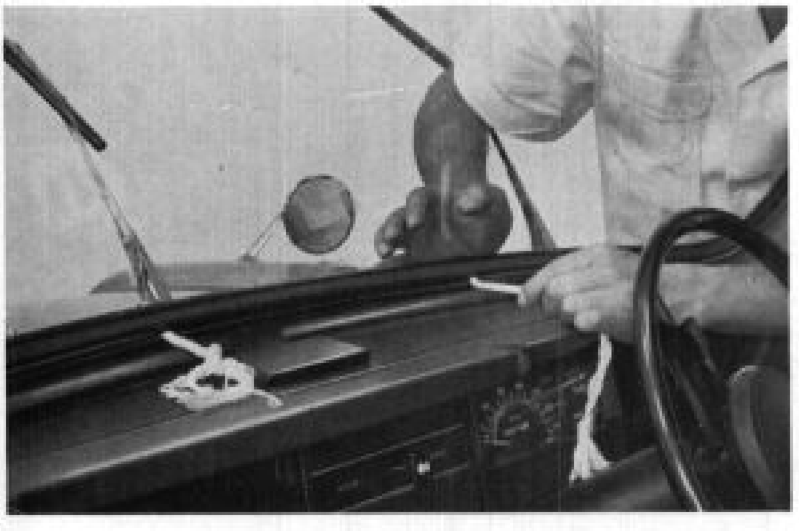


Fig. 18G-3

Insert the draw cord ends into the vehicle interior, force the windshield against the body directly by hand without using a hammer, and slowly pull out the rope. Two workers are required.

Fig. 18G-4

After insuring that weatherstrip is correctly positioned, squeeze rubber lubricant into the groove at molding retaining clips. Using the tool shown in Fig. 18G-4 or a screwdriver, spread the groove and fit molding retaining clips.

H. Windshield Washer

The windshield washer consists of the container bag which is suspended at the left front portion of the engine compartment, and nozzle located at the center of the bonnet, and the bulb
(There are two types as shown in **Fig. 18H-2** and **Fig. 18H-3**.)

Installed at the instrument panel.

No power is required to operate the washer.
The washer operates when the bulb is depressed by hand several times. (Principle of water pump applies.)

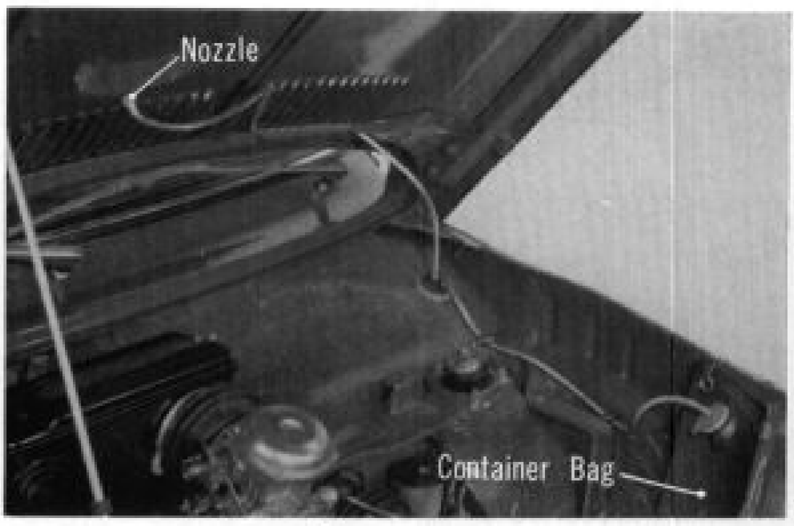


Fig. 18H-1

Fig. 18H-2

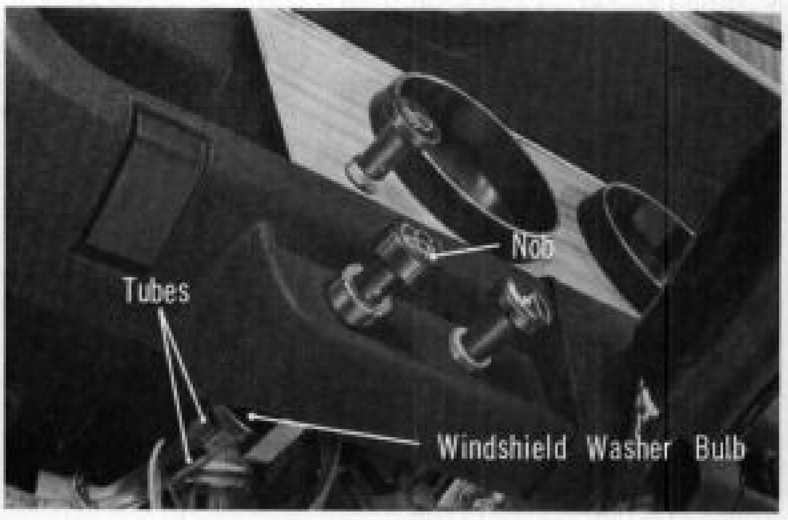


Fig. 18H-3

For the removal of windshield wiper/washer unit, use special tool.

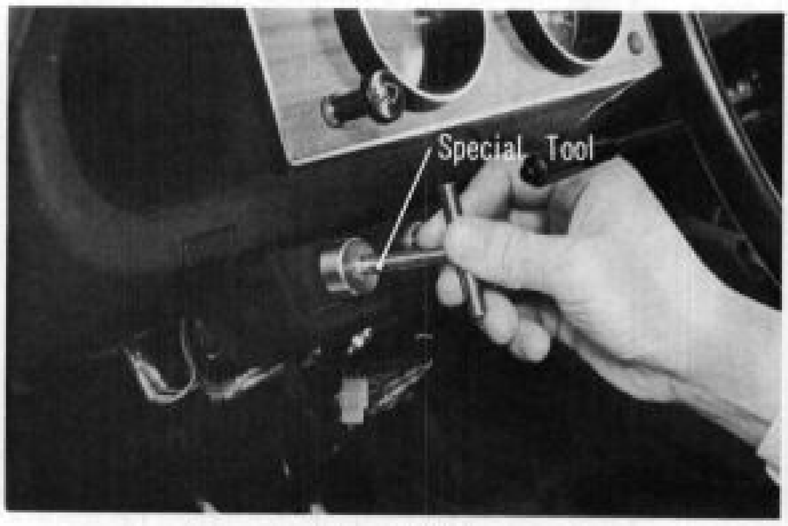


Fig. 18H-4

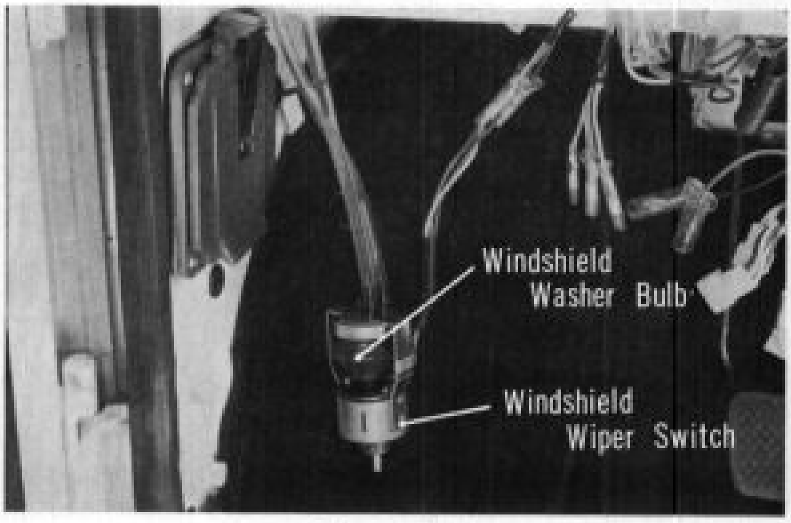


Fig. 18H-5

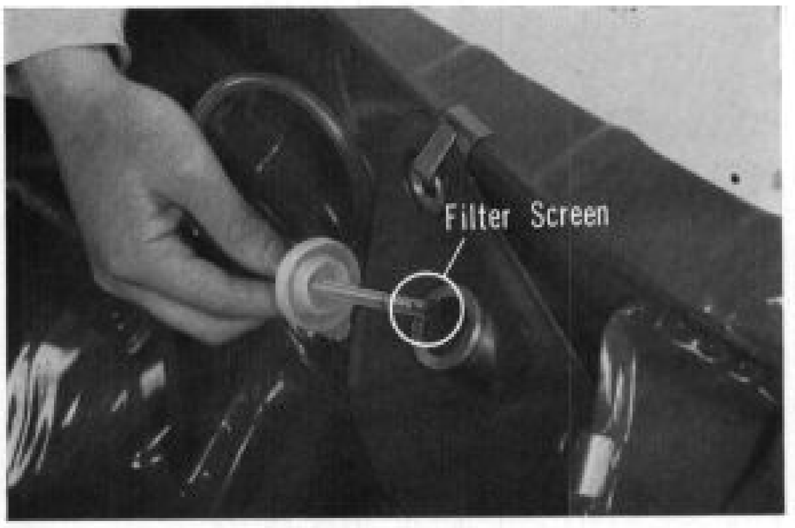


Fig. 18H-6

If the washer does not work, check the filter screen for clogging.

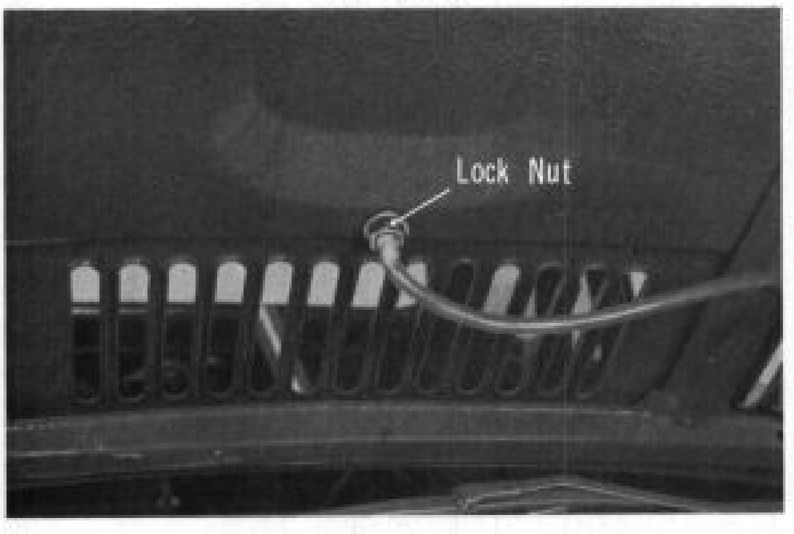


Fig. 18H-7

Make adjustment of the nozzle direction by loosening the lock nut when improper.

I. Quarter Window Glass

The quarter window glass is suspended by a channel hanger with two corrugated springs inserted into body slits. The bottom is secured with the quarter window lock assembly and opens with the channel hanger acting as a hinge.

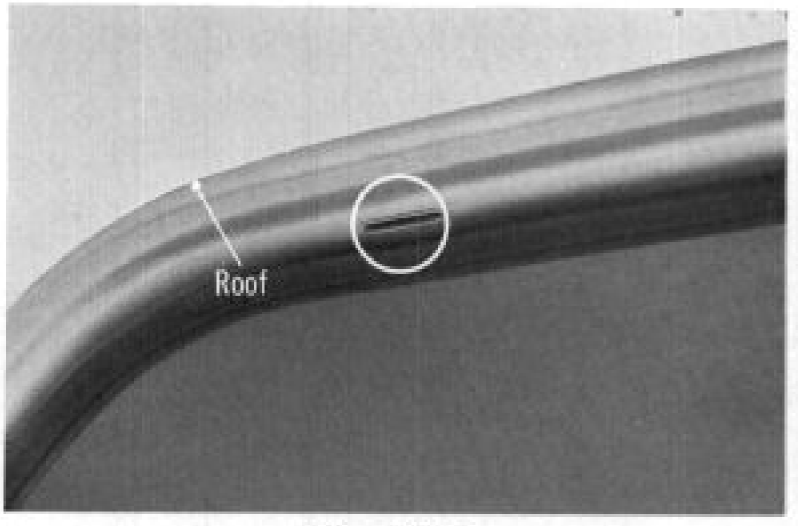


Fig. 18I-1

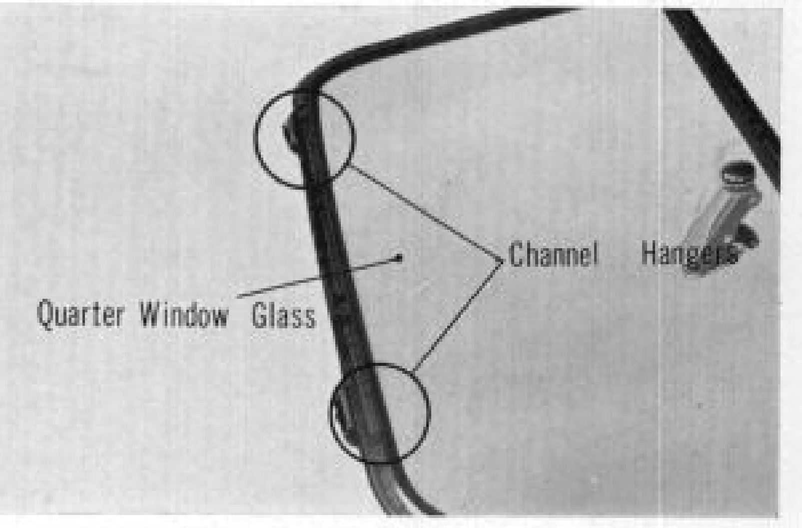


Fig. 18I-2

When disconnecting the quarter window lock assembly from the body, be sure not to drop the window.

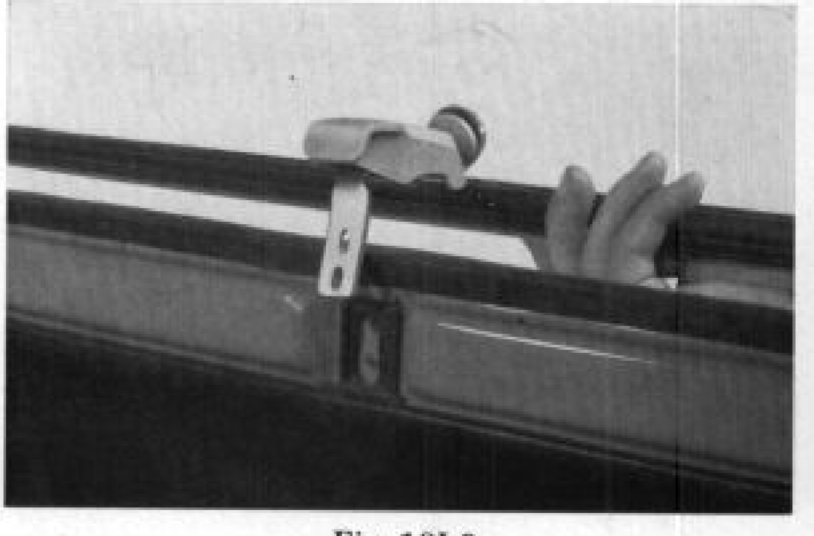


Fig. 18I-3

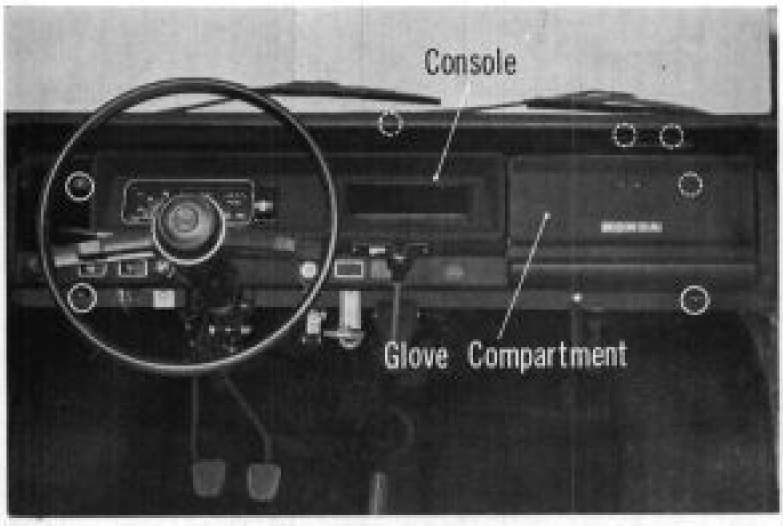


Fig. 18J-1

J. Standard Instrument Panel

The instrument panel is made of ABS resin material and trimmed with non-reflecting padded material to protect the driver in case of accident. The instrument panel assembly consists of instrument console, glove compartment and instrument panel.

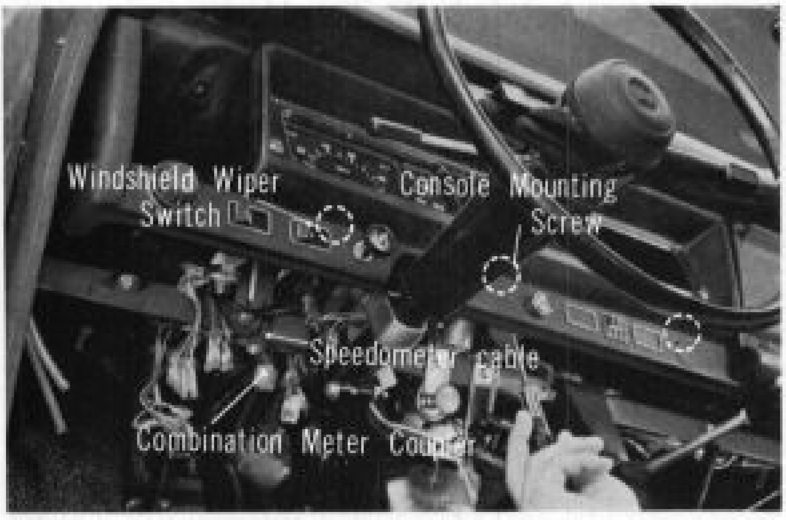


Fig. 18J-2

a. Instrument Console

1. Removal of instrument console

Disconnect the electrical wiring coupler of the combination meter, and the speedometer cable. Remove the three console mounting screws.
Note that the left screw cannot be removed with some models unless the windshield wiper switch is first removed.

Fig. 18J-3

Also disconnect the speedometer cable and heater/defroster select cable at the valve end.

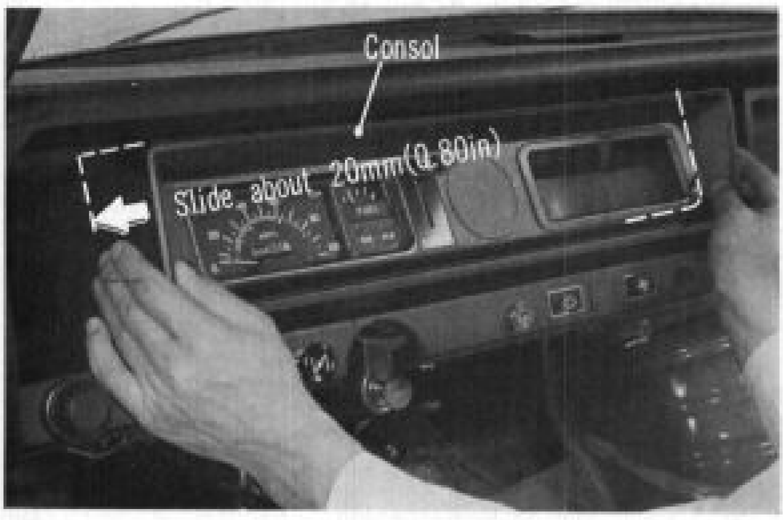


Fig. 18J-4

Slide the console assembly about 20mm (0.80 in) outward.

Separate the console from the instrument panel. Note that the console cannot be removed from the instrument panel unless the console locking with sliding rail on the instrument panel are released.

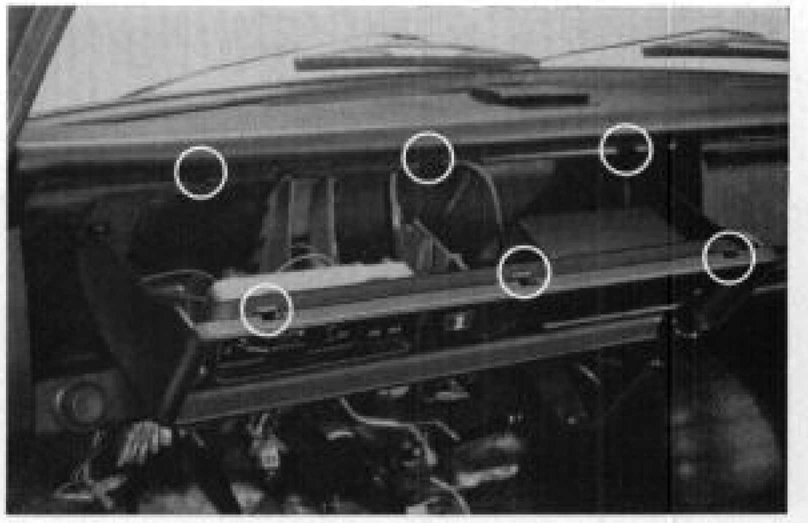


Fig. 18J-5

2. **Removal and disassembly of combination meter.**

To separate the combination meter from the console, remove the five screws shown in the figure. Do not drop the glass when separating the meter assembly.

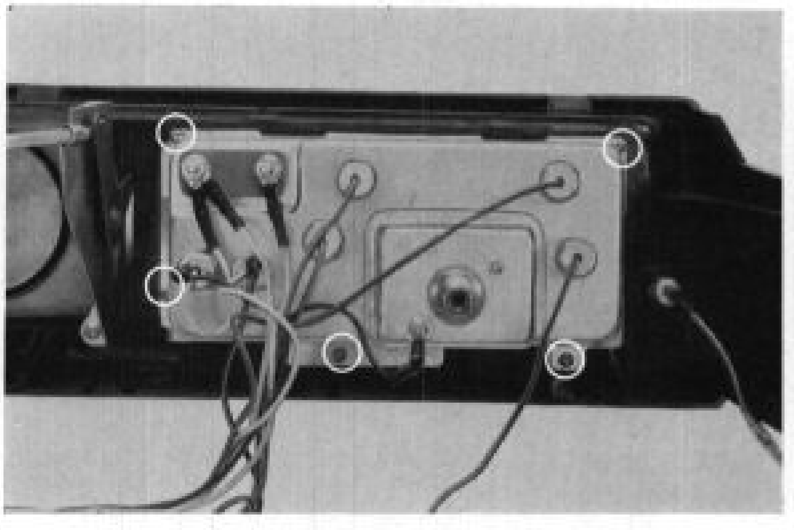


Fig. 18J-6

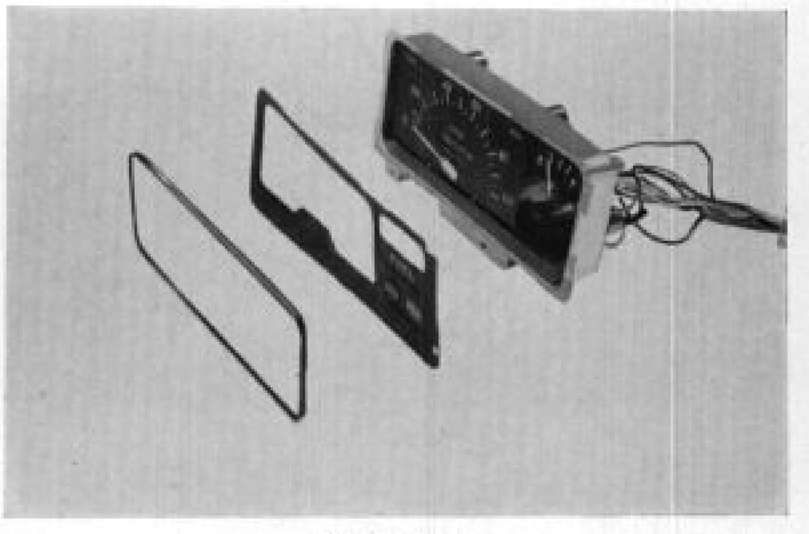


Fig. 18J-7

Turn the pilot lamps counterclockwise to remove.

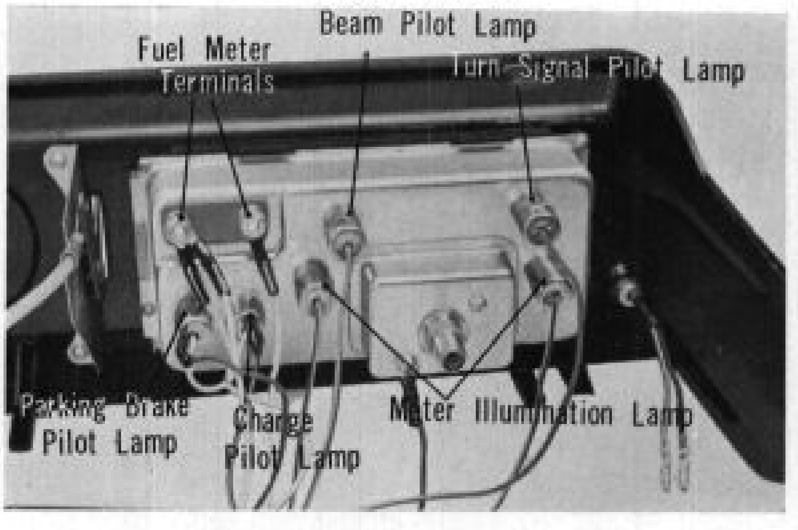


Fig. 18J-8

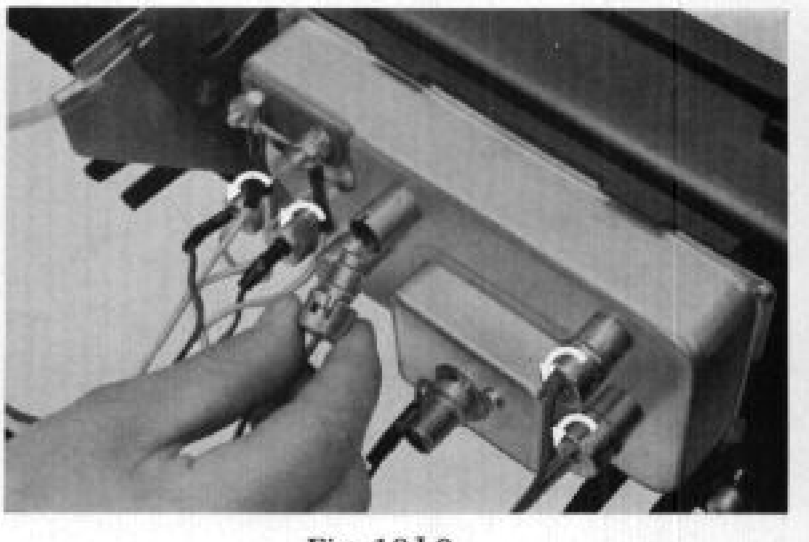


Fig. 18J-9

b. Glove Compartment

To disassemble the glove compartment, remove the two color-matching screws and slide the glove compartment about 20mm (0.80 in) inward. Note that the glove compartment cannot be separated from the instrument panel unless the glove compartment claws are released (The claws lock the sliding rails of the instrument panel).

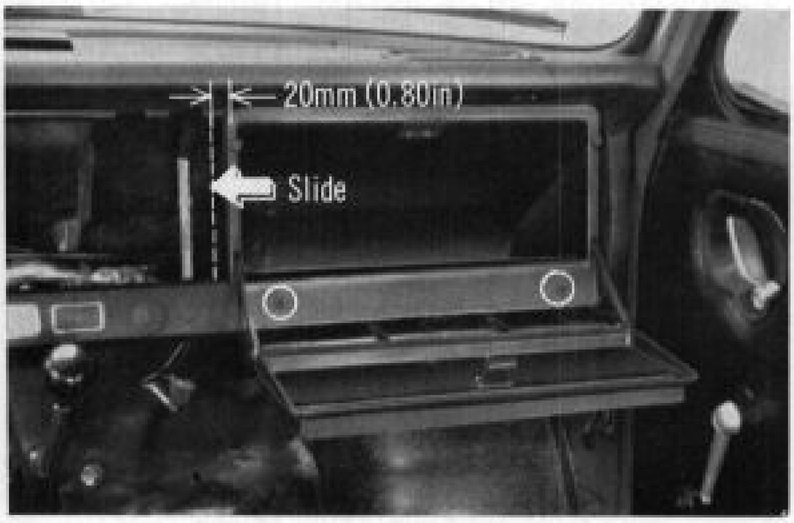


Fig. 18J-10

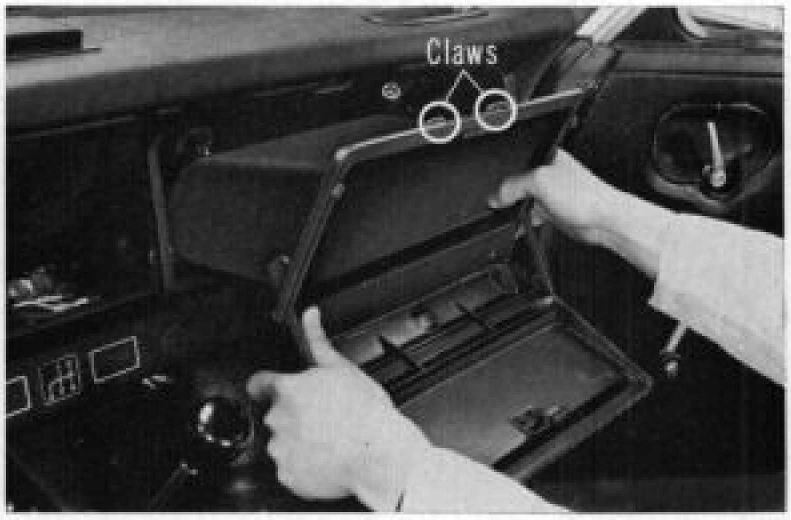


Fig. 18J-11

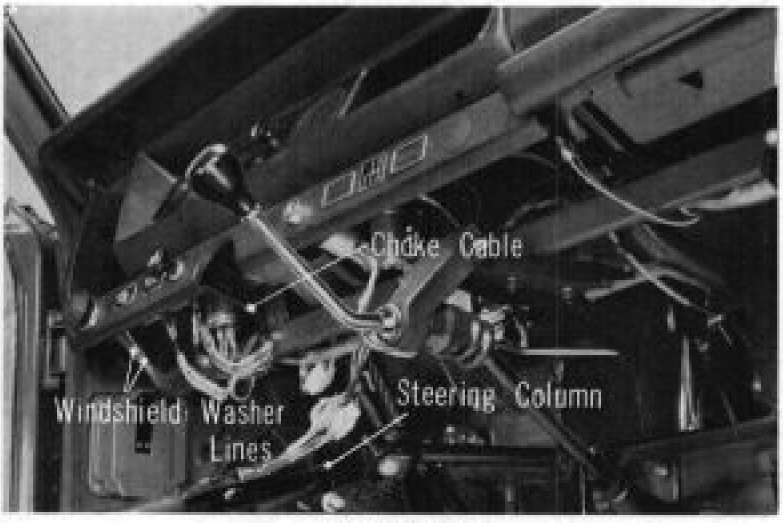


Fig. 18J-12

c. Instrument Panel

1. Removal of instrument panel
   * Disconnect all electrical wirings.
   * Dismount the steering column assembly from the bracket and lay down on the floor.
   * Remove the console assembly and glove compartment. (Refer to section "console" and "glove compartment.")
   * Disconnect the choke cable at the carburetor end and extract the cable inside the passenger room.
   * Disconnect the windshield washer lines.

* Remove the instrument panel mounting screw beneath the ashtray. To remove the ashtray, first lift at the front to unlock the ashtray mounting spring and then slide ahead.

Fig. 18J-13

Fig. 18J-14

* Remove two instrument panel mounting screws at the passenger grip. Do not lose cushion rubbers fitted in the screws **(Fig. 18J-21)**

The grip is made of polypropylene. Squeeze the grip and lift by a screwdriver for removal.

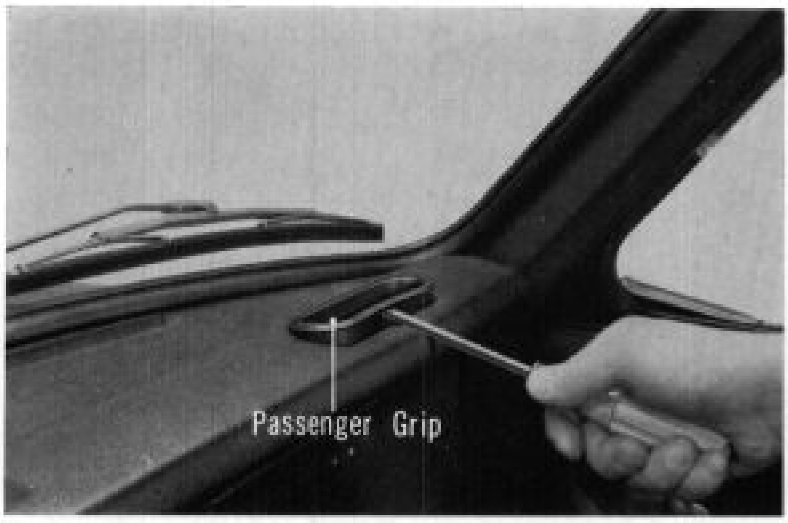


Fig. 18J-15

Fig. 18J-16

* Remove the rest of three mounting screws, then the instrument panel is ready for removal.

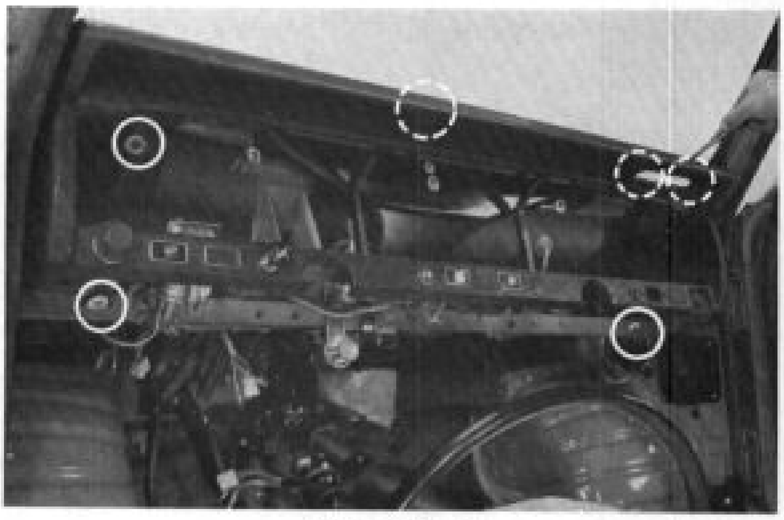


Fig. 18J-17

2. **Assembly of the instrument panel.**
   Fit the top crash pad onto the instrument panel.

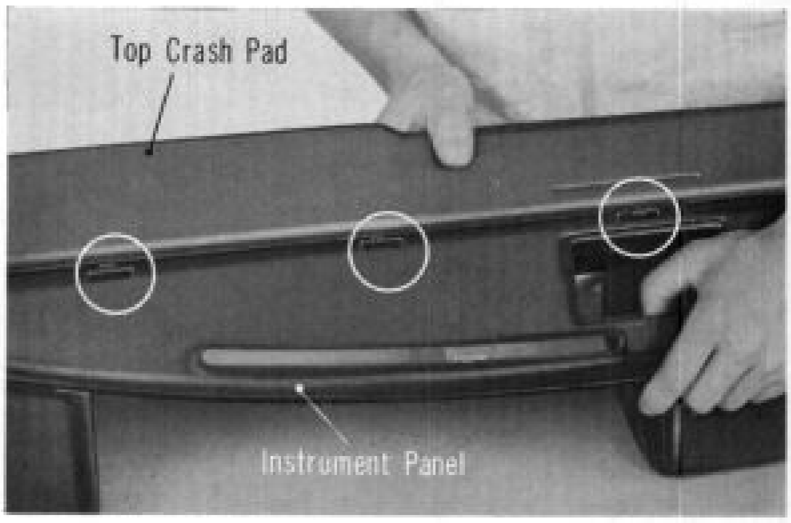


Fig. 18J-18

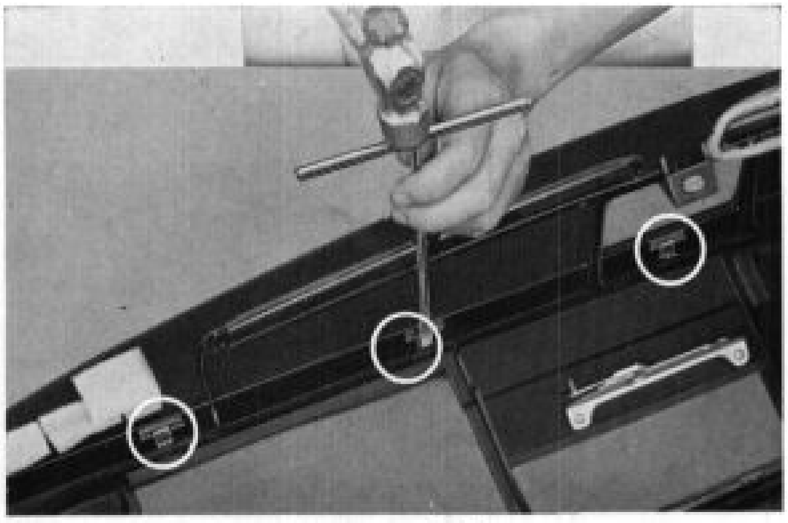


Fig. 18J-19

If hokking is not made correctly, the pad becomes slack. Bend the hooks carefully.

Fig. 18J-20

Fit the glove compartment bottom crash pad to the instrument panel. Bend hooks carefully.

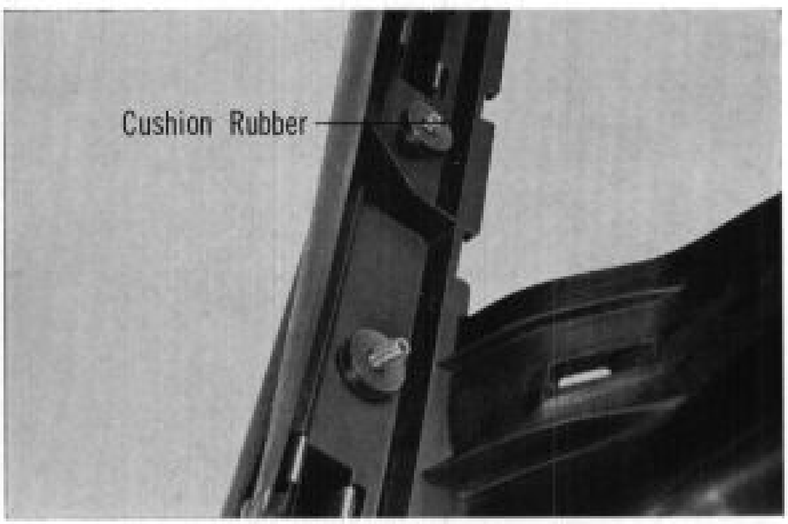


Fig. 18J-21

Install the instrument panel on the dashboard. Make sure that the instrument panel is rubber mounted at the passenger grip.

Squeeze the grip using a screwdriver and fit into the instrument panel. Do not place the grip in the opposite direction.

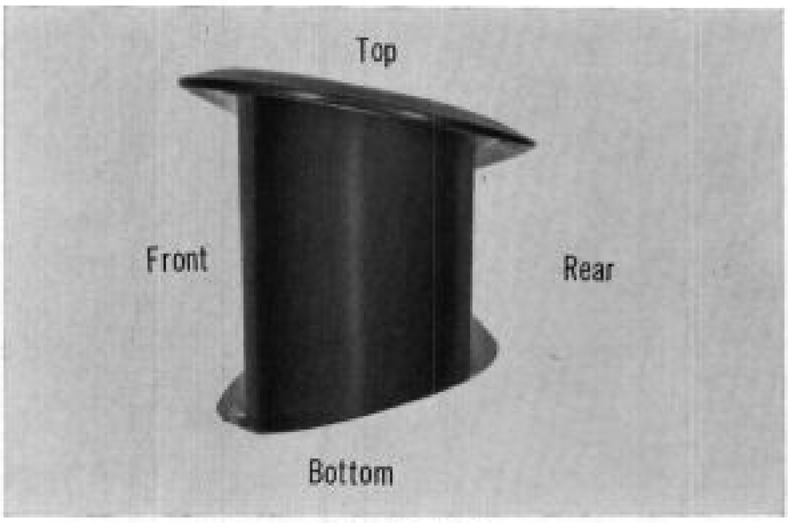


Fig. 18J-22

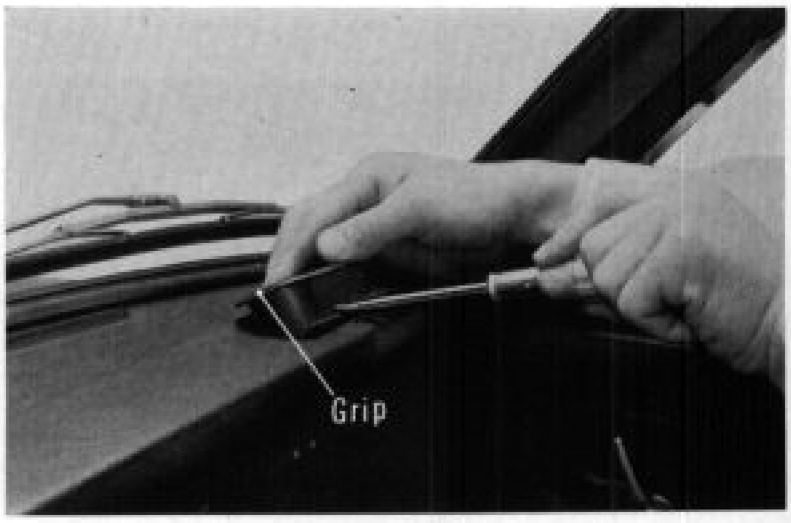


Fig. 18J-23

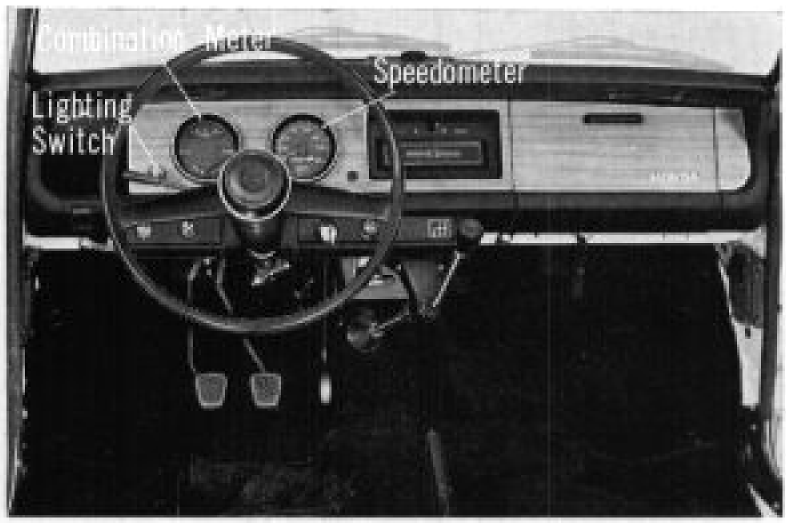


Fig. 18K-1

K. Deluxe Instrument Panel

The deluxe instrument panel consists of the circular speedometer, combination meter and the pull-type switches. The glove compartment of the deluxe instrument panel is of a integral construction with the instrument panel body and cannot be separated while the glove compartment of the standard instrument panel is independent and is fitted in the instrument panel.

a. Speedometer and Combination meter

Both the speedometer and the combination meter is fitted into the holes of the instrument panel and fixed with tension springs.

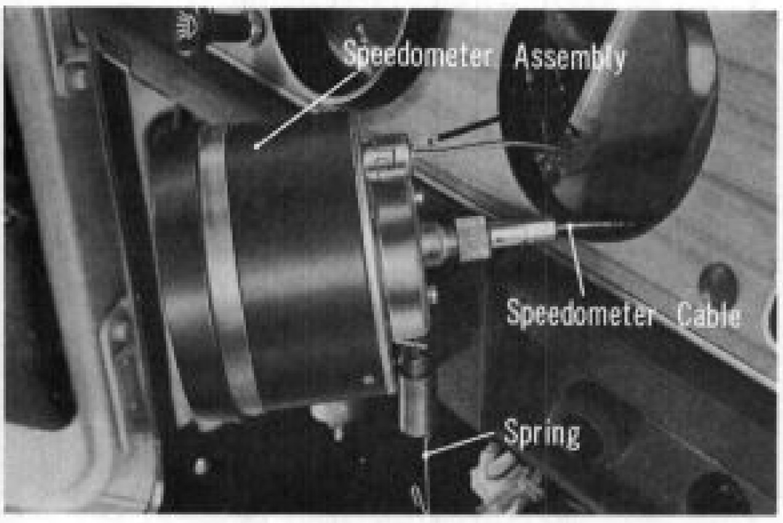


Fig. 18K-2

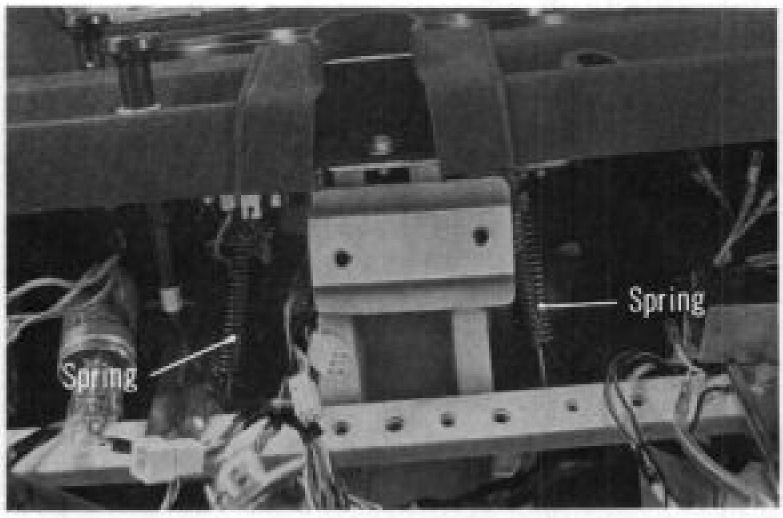


Fig. 18K-3

Turn the pilot lamps counterclockwise for the removal.

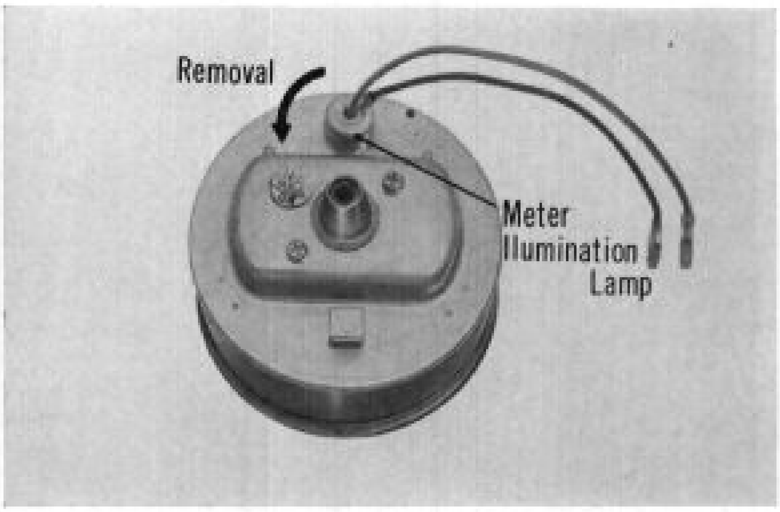


Fig. 18K-4-Speedometer

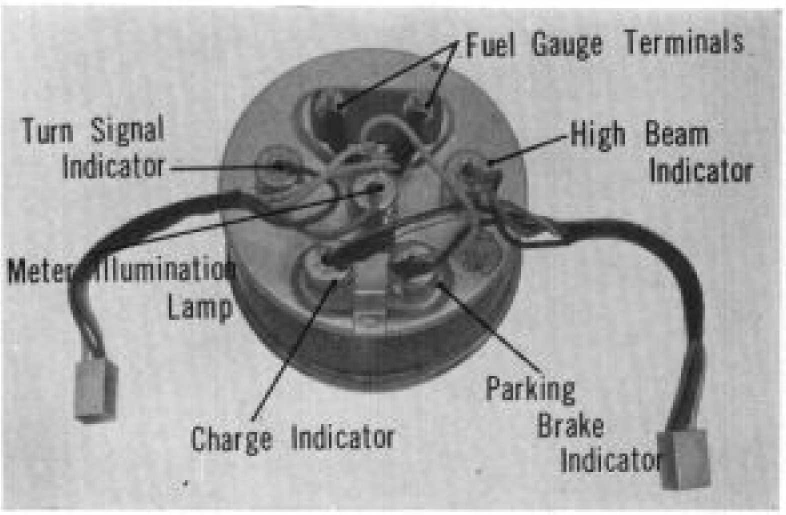


Fig. 18K-5-Combination meter

b. Instrument panel

1. **Removal of instrument panel assembly**
   - Disconnect all electrical wirings.
   - Dimount the steering column assembly from the bracket and lay down on the floor.
   - Disconnect the windshield washer lines.
   - Disconnect the choke cable at the carburetor end and extract the cable inside the passenger room.

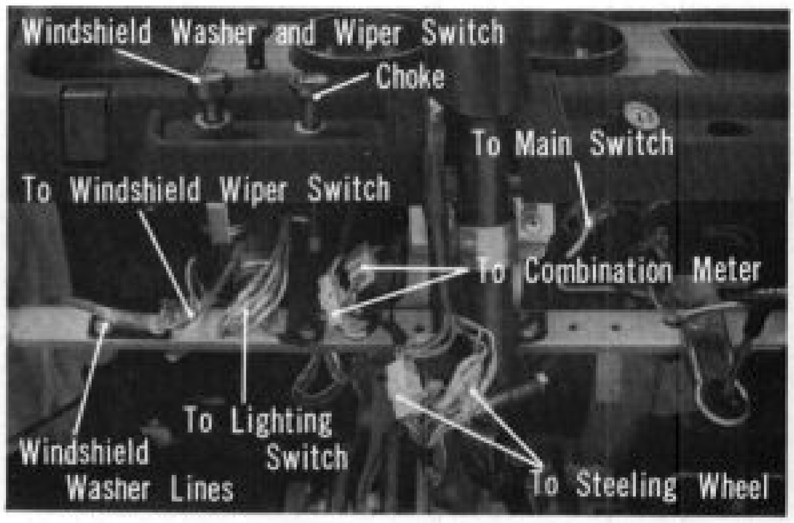


Fig. 18K-6

- Remove six mounting screws to detach the instrument panel assembly from the dashboad.

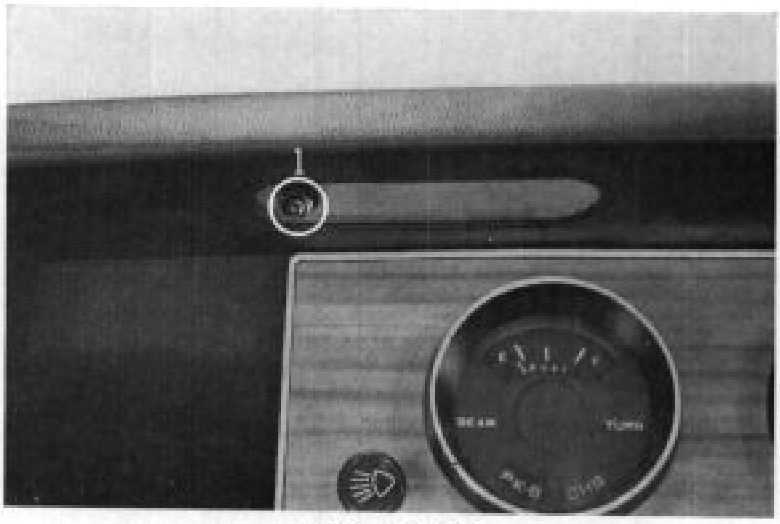


Fig. 18K-7

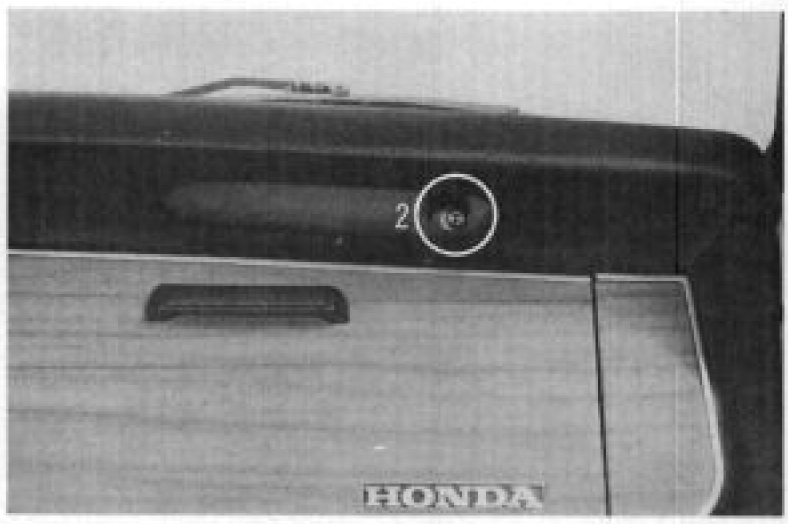


Fig. 18K-8

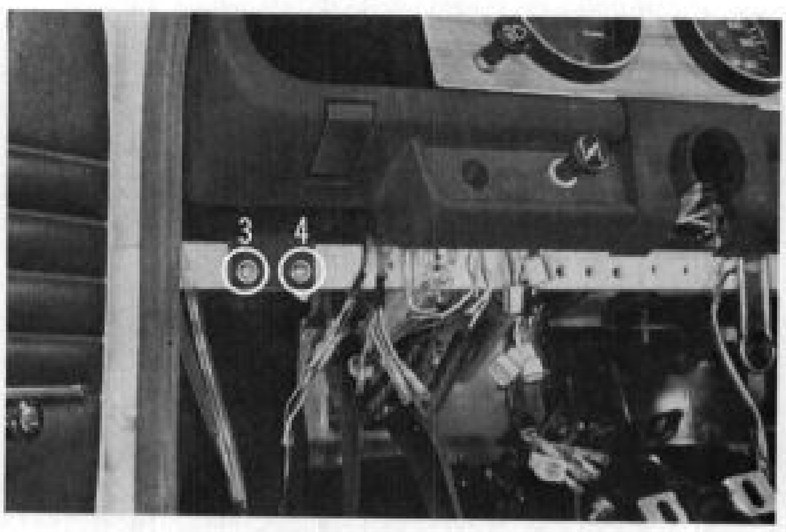


Fig. 18K-9

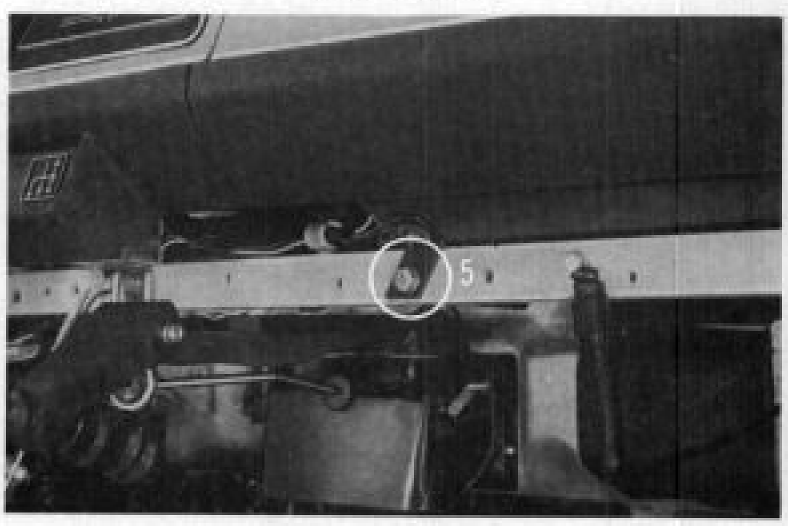


Fig. 18K-10

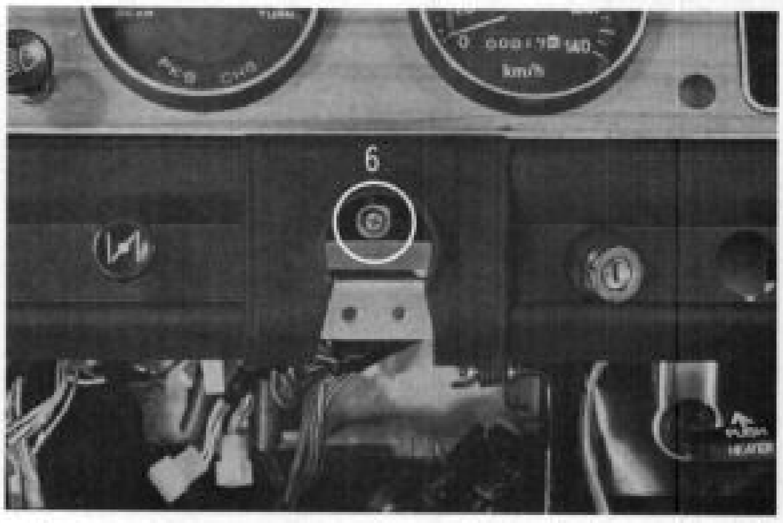


Fig. 18K-11

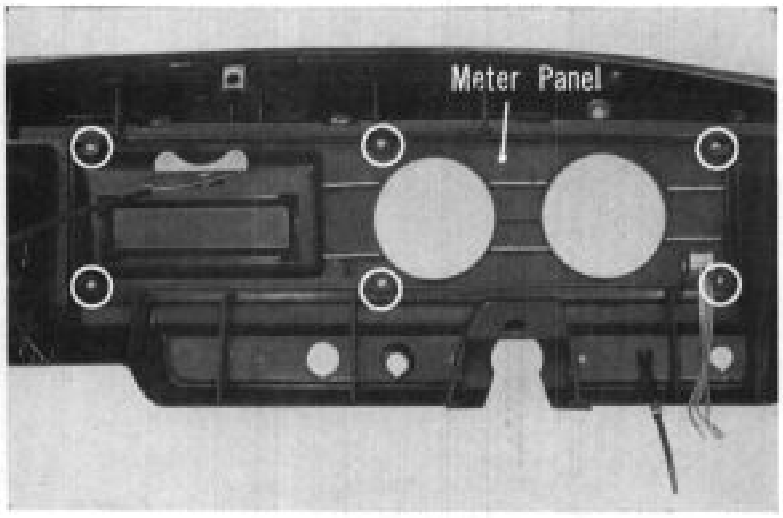


Fig. 18K-12

2. **Disassembly of meter panel**
   Remove six mounting screws.

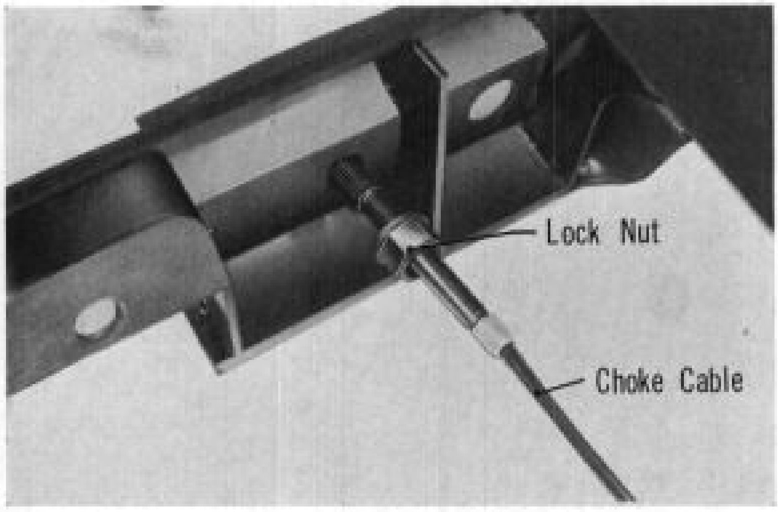


Fig. 18K-13

3. **Removal of choke cable**
   Loosen the lock nut and extract the choke cable from the instrument panel.

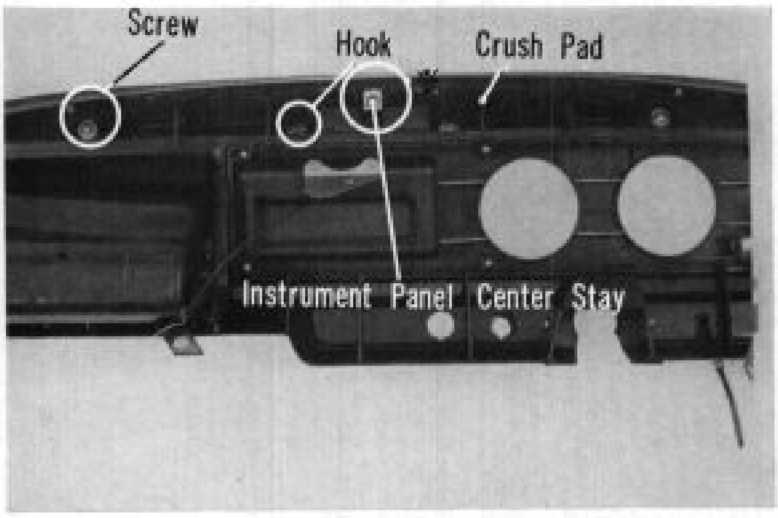


Fig. 18K-14

4. **Assembly and installation of instrument panel**
   * Assemble the crash pad to the instrument panel with screws and hooks.

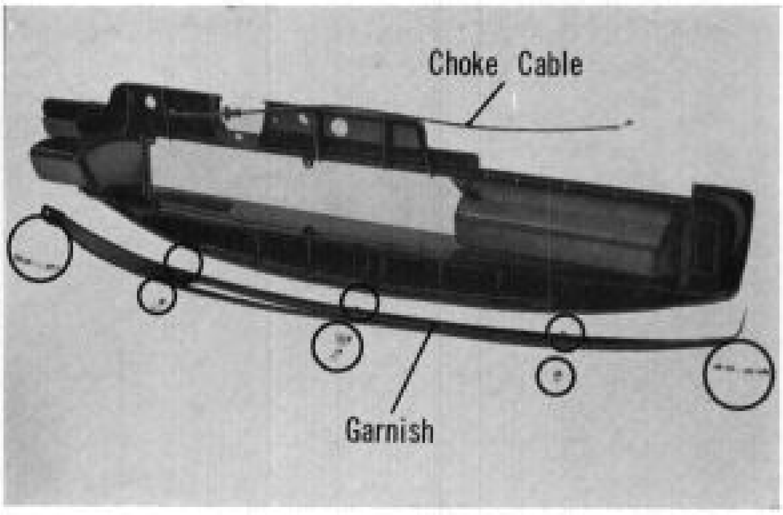


Fig. 18K-15

   * Assemble the garnish to the instrument panel with five screws.

※ Fit the instrument panel center stay ※ in **Fig. 18K-14** to the pin.

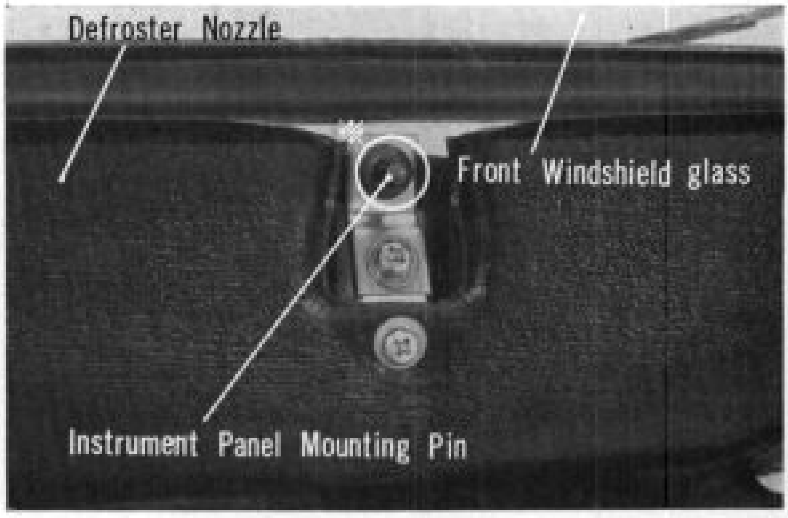


Fig. 18K-16

c. Glove Compartment

The glove compartment is a single unit with instrument panel and cannot be disassembled.
The glove compartment lid is attached to the instrument panel with a hinge and two support arm at both ends.

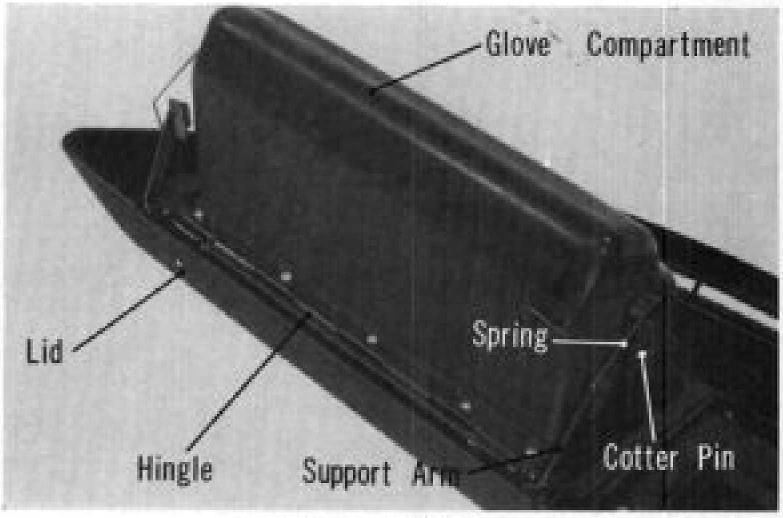


Fig. 18K-17

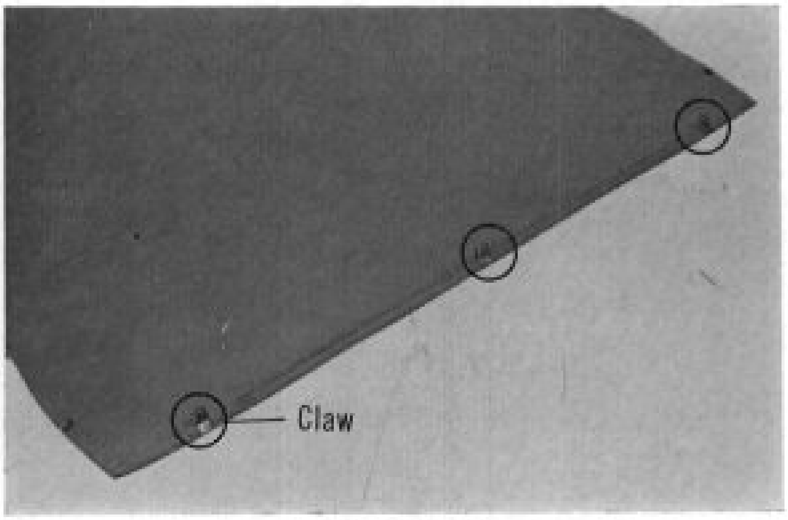


Fig. 18L-1

L. Body Accessories

a. Top Lining

The lining has three claws, at the front and the rear, and by them it is secured to the roof panel. On the other hand, both sides of the lining is supported by merely being fitted in the groove on the body side panel.

To remove or install the lining, use a special tool. When installing or removing, place the tool aside the claw. Never place the tool on the claws since the tool bends the claws and drives them deep into the frame. This results in difficult unhooking. The location of the front end hooks is shown in **Fig. 10L-3**. The rear end claws are located in the center (one claw) and at the same position with the front end side claws (the remaining two claws).

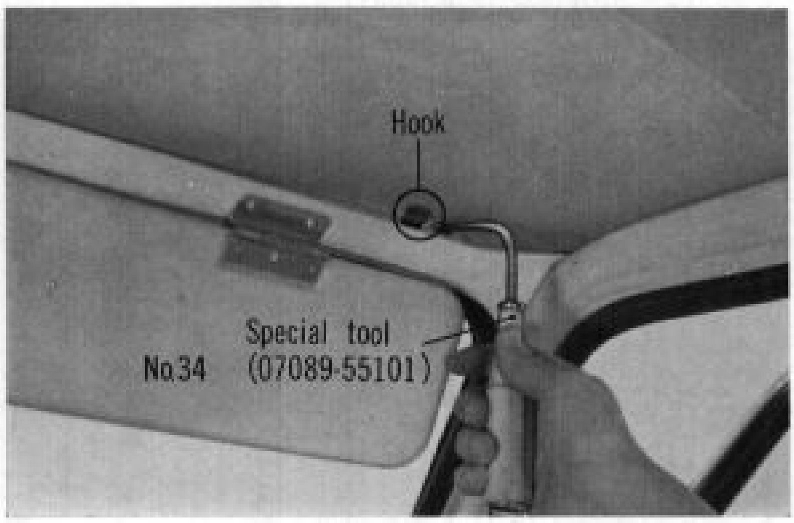


Fig. 18L-2

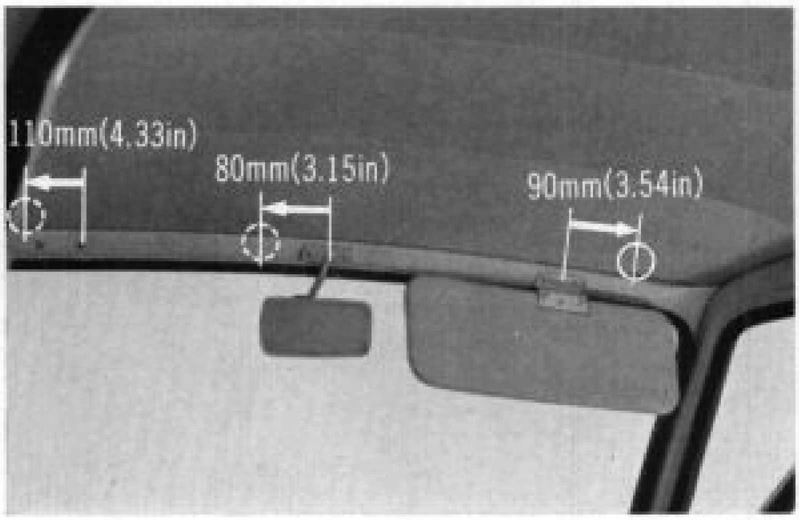


Fig. 18L-3

Fig. 18L-4

b. Rear Side Gadget Tray

The rear side gadget tray is made of polyethylene and can be detached from the body after unscrewing the two quarter window mounting screws. Extra care should be taken not to drop the quarter window when these screws are removed.

M. Special Tool

① ② ③

Ref. No,	Tool No.	Description
1.	07071-56801	Ignition switch wrench
2.	07076-59301	Lighting switch wrench
3.	07089-55101	Roof lining remover

MEMO

SECTION 19

PERIODIC MAINTENANCE

A. General Description

The latest car has undergone much improvement and its periodical intervals have been considerably extended. Yet the periodical maintenance remains an indispensable necessity. If the following instructions are strictly followed, the periodc maintenace will contribute to maintain the performance and the durability of the car. On the other hand if the periodic maintenance is neglected and the car is driven continuously, serious troubles resulting in more time and money to repair can develop.

The periodic maintenance procedure are described in the following with accompanying illustrations so that servicemen can easily follow.

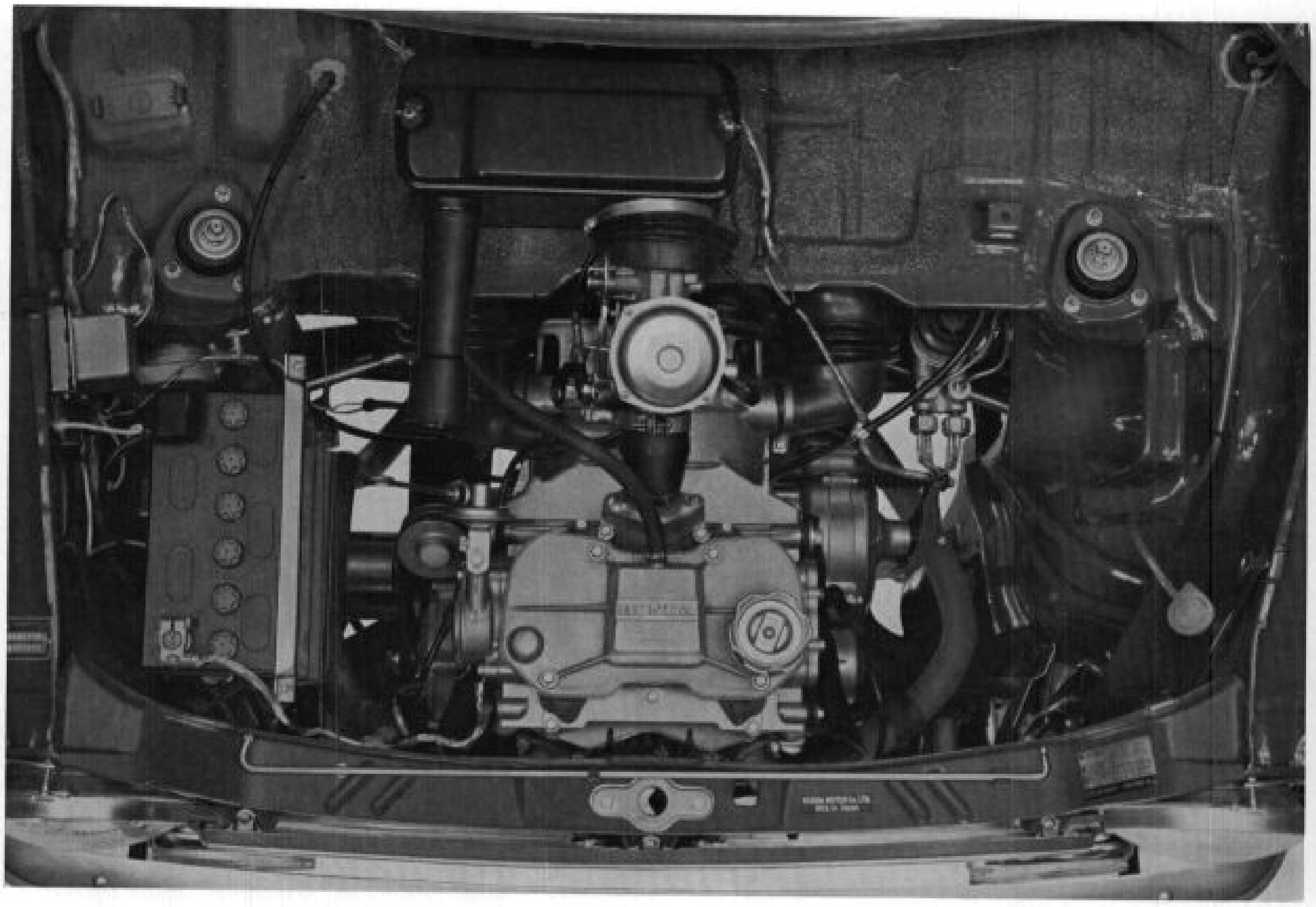


Fig. 19A-1

B. Periodic Maintenanec Schedule

Group	No.	Maintenance operations \ Mileage covered km / mile	1,000 / 600	5,000 / 3,000	10,000 / 6,000	15,000 / 9,000	20,000 / 12,000	25,000 / 15,000	30,000 / 18,000	35,000 / 21,000	40,000 / 24,000	45,000 / 27,000	50,000 / 30,000	Remarks
1. Engine	1-1	Change engine oil	●	●	●	●	●	●	●	●	●	●	●	
	1-2	Change oil filter element			●		●		●		●		●	
	1-3	Check valve adjustment		●	●		●		●		●		●	
	1-4	Clean air filter element			●		●*		●		●*		●	*Change every 1200 miles
	1-5	Drain air filter oil chamber	●	●	●	●	●		●		●		●	
	1-6	Check breaker point gap and ignition timing	●	●	●		●		●		●		●	
	1-7	Clean and adjust spark plugs			●		●*		●		●*		●	*Cahnge every 1200 miles
	1-8	Check cooling fan belt tension		●	●		●		●		●		●	
	1-9	Check carburetor adjustment	●	●	●	●	●	●	●	●	●	●	●	
	1-10	Change fuel filter					●				●			
	1-11	Check motor generator brushes and change if necessary					●				●			N360/N400 only
2. Automatic transmission	2-1	Check automatic transmission fluid level		●	●	●	●	●	●	●	●	●	●	
	2-2	Change automatic transmission fluid					●				●			
	2-3	Check shift lever control cable adjustment	●		●		●		●		●		●	
	2-4	Check upshift speed in the D position	●		●		●		●		●		●	
3. Clutch		Check clutch pedal free play	●		●		●		●		●		●	
4. Brakes	4-1	Check wear of front brake pads		●	●	●	●	●	●	●	●	●	●	
	4-2	Adjust rear brakes and parking brake		●	●	●	●	●	●	●	●	●	●	
	4-3	Check wear of rear brake lining			●		●		●		●		●	
	4-4	Check brake system for leaks or damage		●	●	●	●	●	●	●	●	●	●	
	4-5	Change brake fluid									●			Change every 24000 miles or 24 months whichever occurs first
	4-6	Clean vacuum booster filter			●		●		●		●		●	
	4-7	Overhaule vacuum booster												Change every 24000 miles or 24 months whichever occurs first
5. Steering & wheels	5-1	Check steering operation and tie-rod end	●	●			●		●		●			
	5-2	Adjust rack guides												
	5-3	Grease steering gear box					●				●			
	5-4	Check front wheel alignment			●		●		●		●		●	
	5-5	Rotate tires, check tire pressure and wheel balance		●	●	●	●	●	●	●	●	●	●	
6. Battery & all mounting bolts	6-1	Check all engine, heat exchanger, exhaust silencer and suspension mounting bolts			●		●		●		●		●	
	6-2	Check battery electrolyte and add distilled water if necessary	●	●	●	●	●	●	●	●	●	●	●	

C. Maintenance Procedure

1. Engine

1-1. Engine Oil

(CHECK)
When checking the oil level, park the car on a flat and horizontal floor and wait until engine oil returns from the cylinder head to the crankcase.

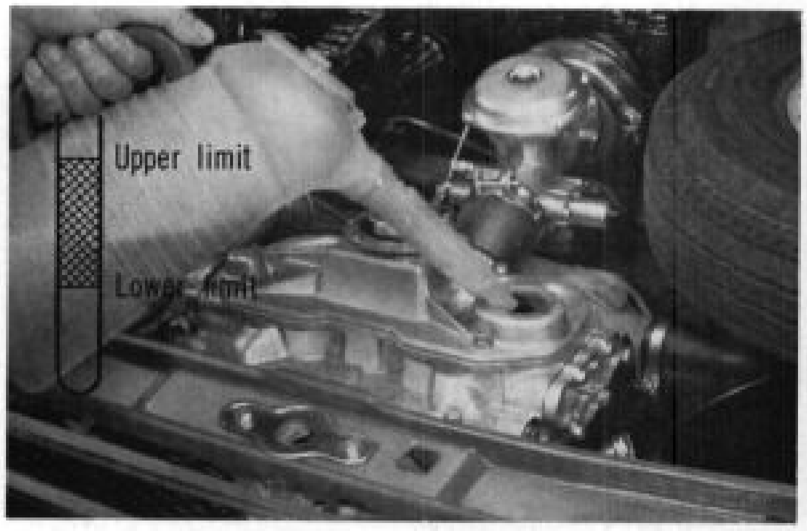


Fig. 19C-1

(CHANGE)
Remove the filter cap and the drain plug, and let the oil drain completely. When the drain plug is tight, first tap the top of the plug and loosen it. Change the oil at every 5,000 kgm or 3,000 miles.

Note:
Engine oil draining should be performed while the engine is still warm so that the oil can be thoroughly

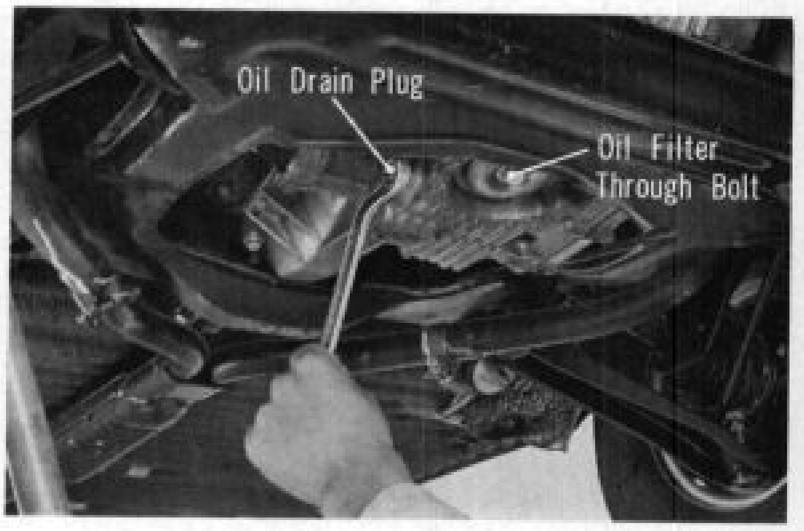


Fig. 19C-2

Oil Capacity
Standard Engine:
3.0 l (2.6 Imp.-qt., 32. Us-qt.)
Automatic Transmission Engine:
2.5 l (2.2 Imp.-qt., 2.6 Us-qt.)

Oil Grade

TEMPERATURE		GRADE	CLASS	
			API Service	ASTM
Single Grade	-20°C(-4°F) to 0°C(32°F)	SAE 10W	MS	G-IV
Single Grade	0°C(32°F) to 15°C(59°F)	SAE 20W SAE 20	MS	G-IV
Single Grade	15°C(59°F) to 30°C(86°F)	SAE 30	MS	G-IV
Single Grade	Above 30°C(86°F)	SAE 40	MS	G-IV
Multigrade	Above -15°C(5°F)	SAE 10W/40	MS	G-IV
Multigrade	-15°C(5°F) to 30°C(86°F)	SAE 10W/30	MS	G-IV
Multigrade	Above 0°C(32°F)	SAE 20W/40	MS	G-IV
GREASE	Multipurpose	NL GI No. 2	Multipurpose Type	

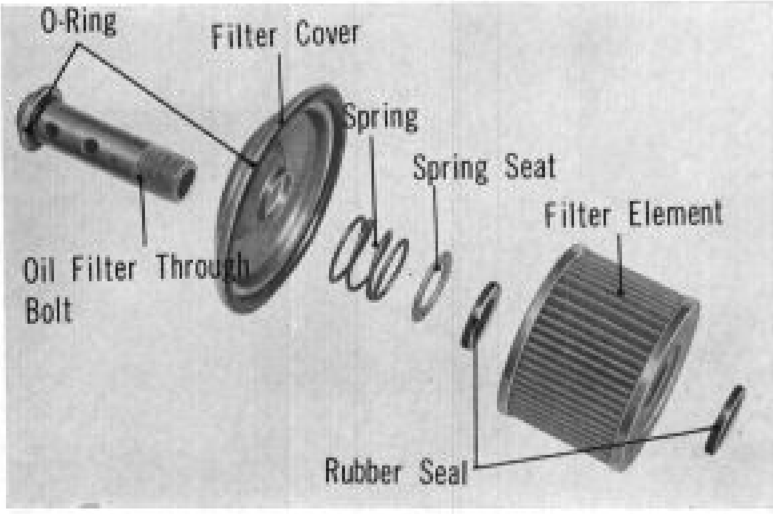


Fig. 19C-3

1-2. OIL Filter Element

Remove the through bolt. Remove the filter cover. And take out the filter element.
Check the O-rings for damages before assembling.
Replace the oil filter element with new one at first **5,000 km (or 3,000 miles) and at every 10,000 km (or 6,000 miles) intervals thereafter.**

Note:
After installation, run the engine and check for the presence of oil leakage and exudation.

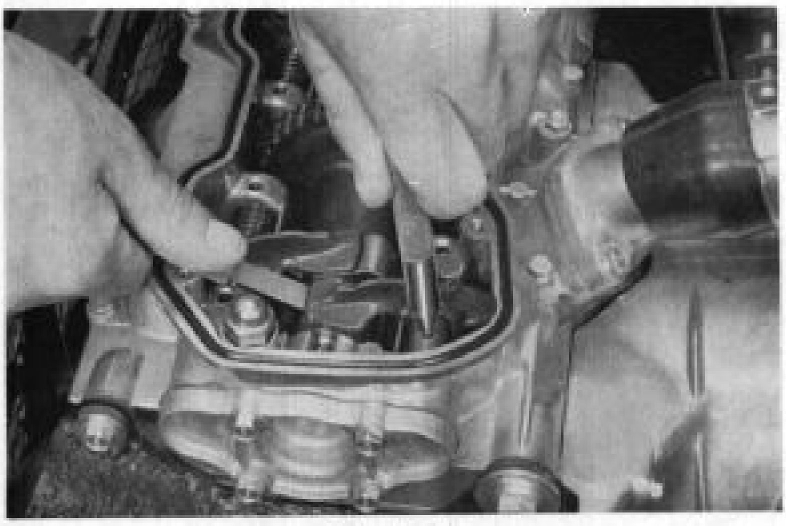


Fig. 19C-4

1-3. Valve Clearance Check and Adjustment

Check and adjust the valve clearance with cold engine.
Refer to section "ENGINE TUNE-UP" and "ENGINE MECHANICAL" for detail.

NORMAL VALVE CLEARANCE
(Both inlet and exhaust valves)

0.08~0.12mm (0.003 in~0.005 in)

Note:
A slightly larger valve clearance in extremely cold district and a slightly smaller valve clearance in hot district are recommended.

Be sure to tighten the locking bolts to a specified torque, 4.0 kg-m (29 lb-ft) upon completion of the valve clearance adjustment.

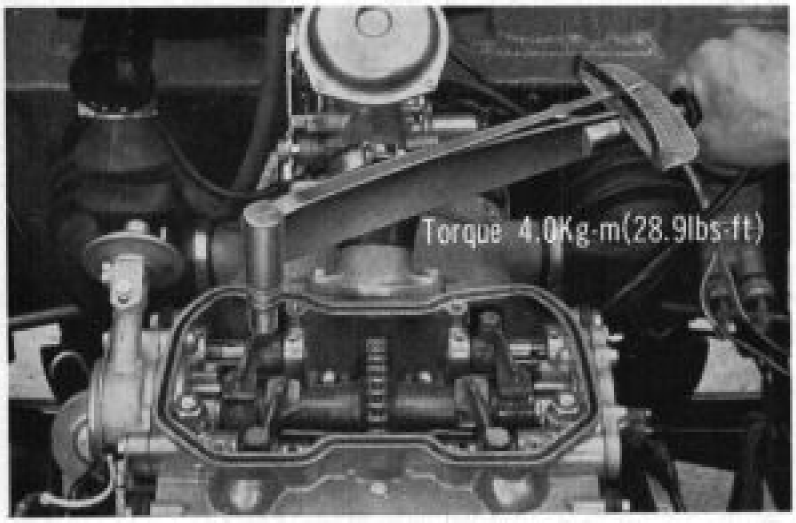


Fig. 19C-5

1-4. Air Cleaner Element

Hold and tap the filter element against a wooden surface, freeing the element of dirt and dust, then blow compressed air from the inside.
Note:
Do not clean the element with solvent or cleaning solution.

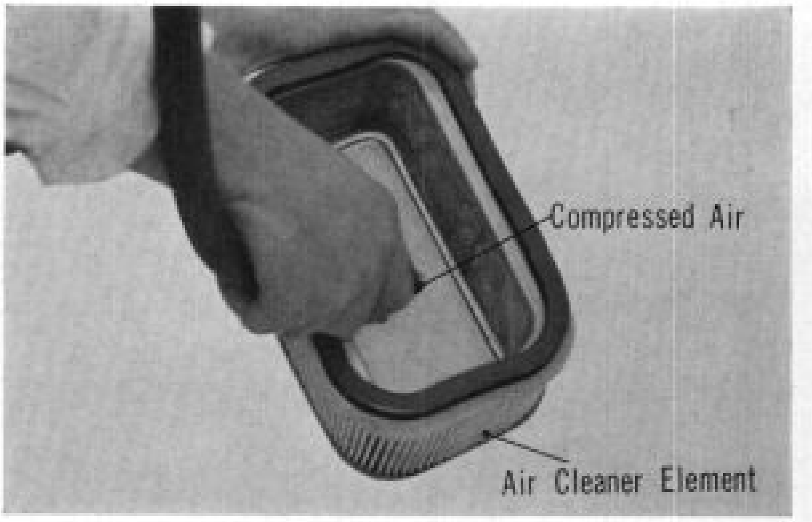


Fig. 19C-7a

1-5. Air Filter Oil Drainage

A mixture of blow -by gas and oil vapor is led from the crankcase into the air cleaner case where it is condensed. As a result of this, liquid accumulates in the condensing chamber and periodical drainage is required. Remove the rubber plug and drain periodically.

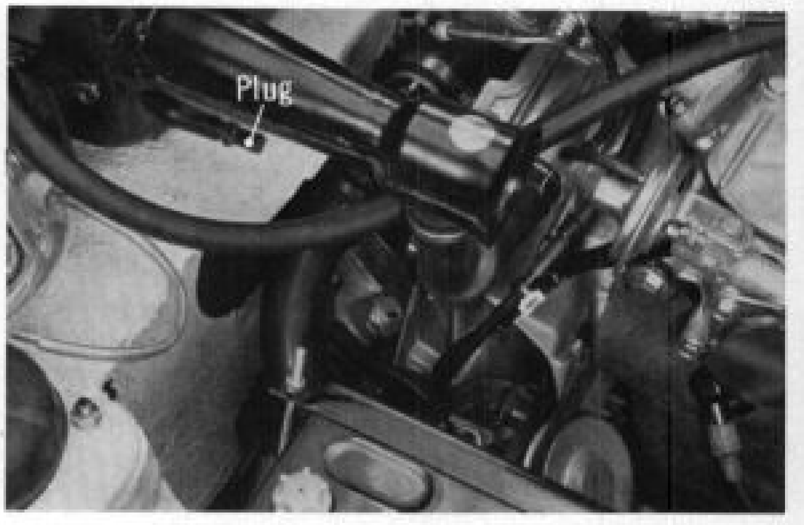


Fig. 19C-7b

1-6. Contact Breaker Point and Ignition Timing

Remove the contact breaker compartment lid; turn the crankshaft pulley clockwise so that the point gap is at its maximum. And measure the point gap with feeler gauge.
Point gap should be 0.3~0.4mm (0.012 in~0.016 in).
Point gap adjustment is made by moving the contact breaker after loosening the adjusting screws.

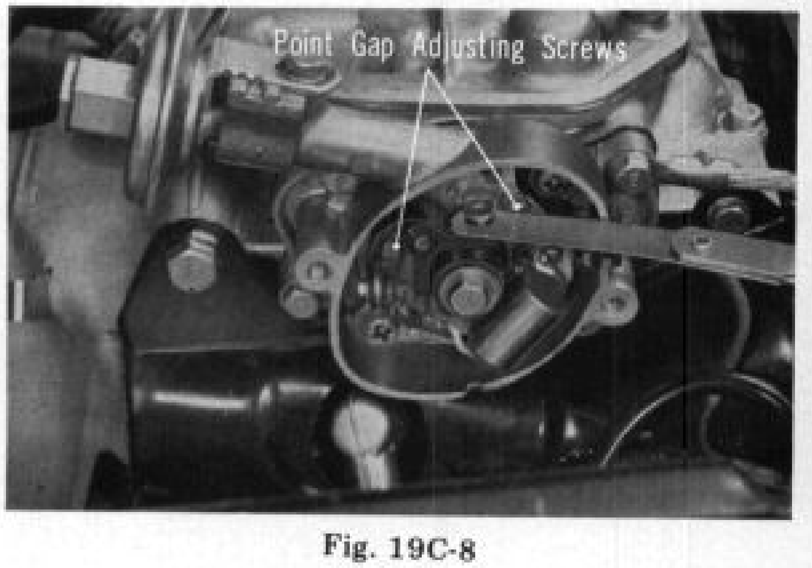


Fig. 19C-8

Turn the crankshaft pulley clockwise. Check to see if the point begins to open when "F" mark is aligned with the mark on the dynamo cover for N360 (including LN360 and N400) and on the flywheel housing cover for N600.

An accurate method is hooking up a 12V lamp to the primary lead. Turn the ignition switch on and adjust that the lamp goes off when "F" mark is aligned to the mark on the dynamo cover or on the flywheel housing cover. Another method is the use of a service tester.

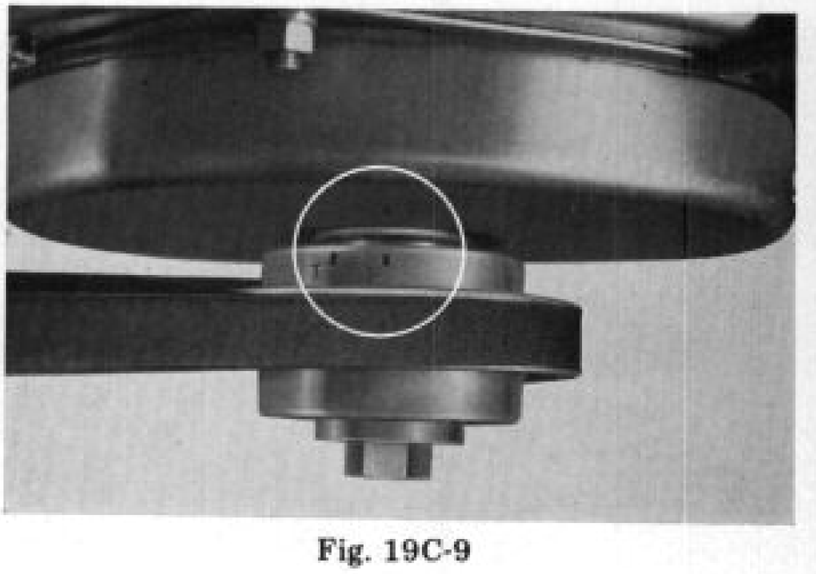


Fig. 19C-9

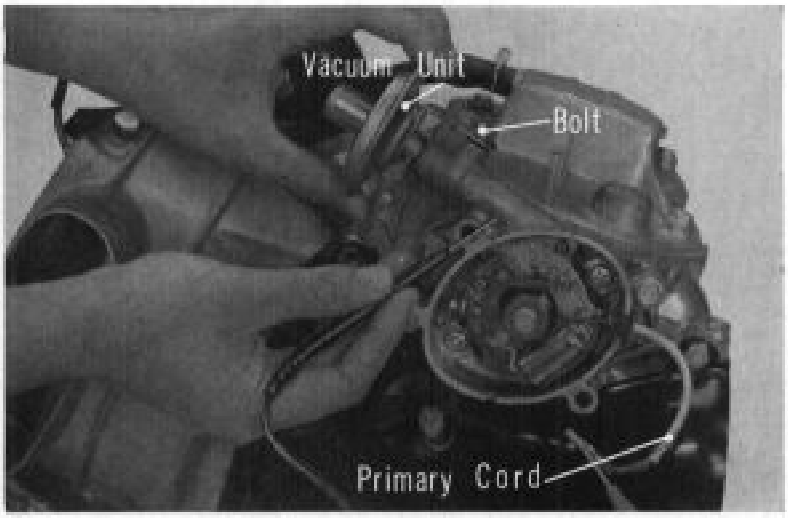


Fig. 19C-10

Ignition timing adjustment is made by moving the vacuum unit out for advancing the timing and in for retarding.

1-7. Spark Plug

Remove spark plugs. Clean them with a plug cleaner. Check for burnt electrodes and broken insulator, and select the proper heat range spark plug. Also check the spark gap..Spark gap shall be: **0.7~0.8mm** (0.028"~0.032").

MAKE	HOTTER	STANDARD	COLDER
NGK	B-7ES	B-8ES	B-9E
ND	W-22ES	W-24ES	—

Note:
Never heat the electrodes with fire. To install a plug, first thread in with fingers and fingers and tighten it securely with a plug wrench.

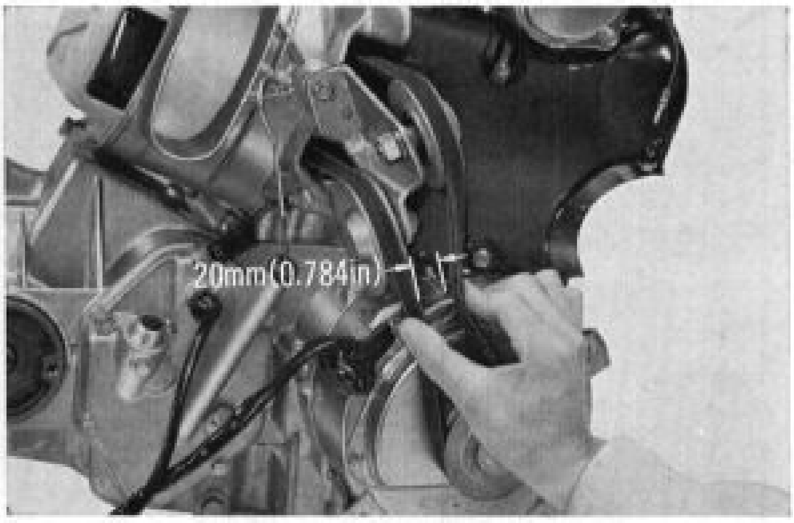


Fig. 19C-11

1-8. Fan Belt

Check the fan belt for tension by narrowing it with fingers at a midway point between pulleys. If the inner distance is 20mm (0.787 in), the belt tension is satisfactory.

1-9. Carburetor

(Inspection of choke)
Check that the choke valve opens fully when the choke button is pushed in.

Fig. 19C-11a

(Throttle Cable Adjustment)

Check that the throttle opens fully when the accelerator pedal is pressed down all the way. Adjust the throttle cable if necessary.

(Throttle Stop Screw Adjustment)

Insure that spark plugs are functioning satisfactorily and ignition timing is correct. Adjust engine revolution 1100~1200 rpm with the throttle stop screw.

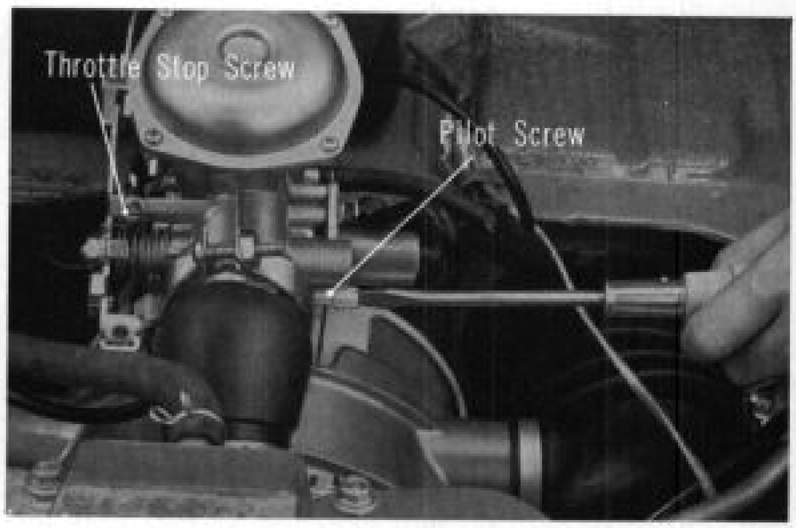


Fig. 19C-12

(Pilot Screw Adjustment)

The engine should be warmed to the normal operating temperature before attempting any carburetor adjustment. Adjust the slow stop screw and set the idling speed to the specifications. Position the pilot screw to the specified turns from the fully close and them turn it both directions within ¼turn and locate the position at which engine idles smoothly. (See page 14-8 for specifications)
After completing the pilot screw adjustment, reset the throttle stop screw to enable the engine to idle at the specified speed.

1-10. Fuel Strainer

Disconnect fuel tubes and remove the fuel strainer with the fuel pump in a single unit. Drain the water from the strainer. If the strainer is clogged, replace with a new strainer.
The fuel strainer, which is a cartridge type, cannot be disassembled or cleaned. When installing, be careful not to invert the inlet and outlet sides.

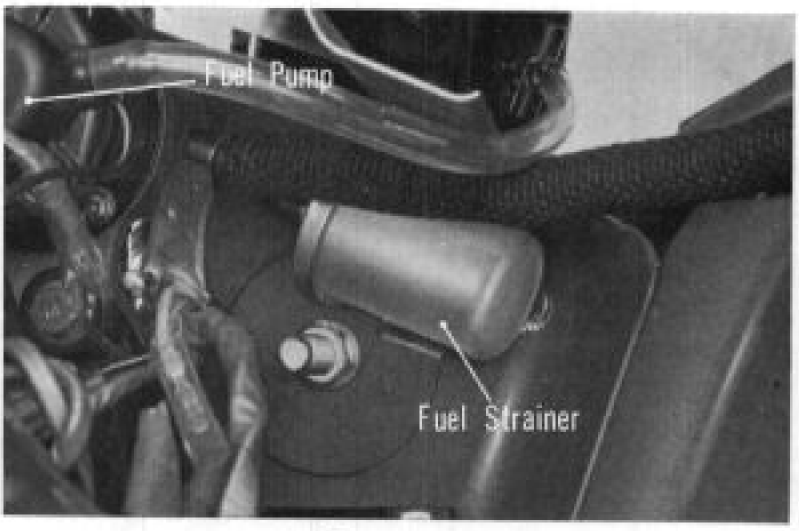


Fig. 19C-13

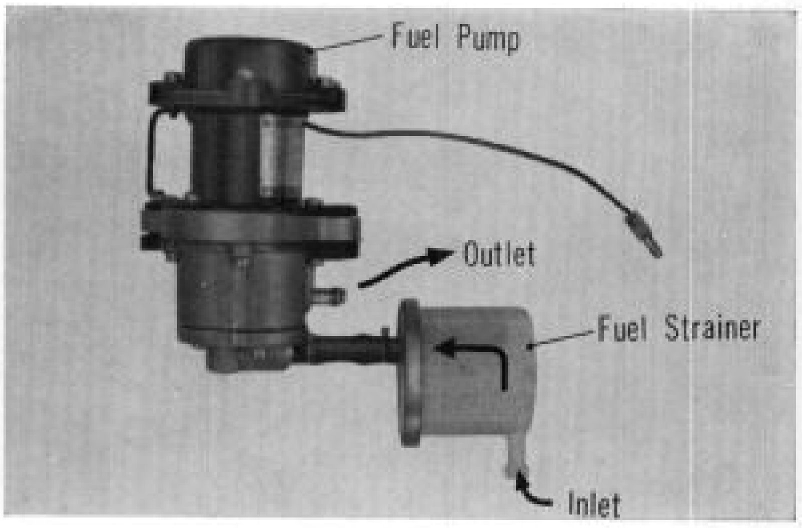


Fig. 19C-14

Fig. 19C-15

1-11. Motor Generator Brush (N360, LN360 and N400 only)

If the length is less than 12mm (0.47 in), replace with new brushes. (Groove indicates wear limit. Replace when worn to the groove.)

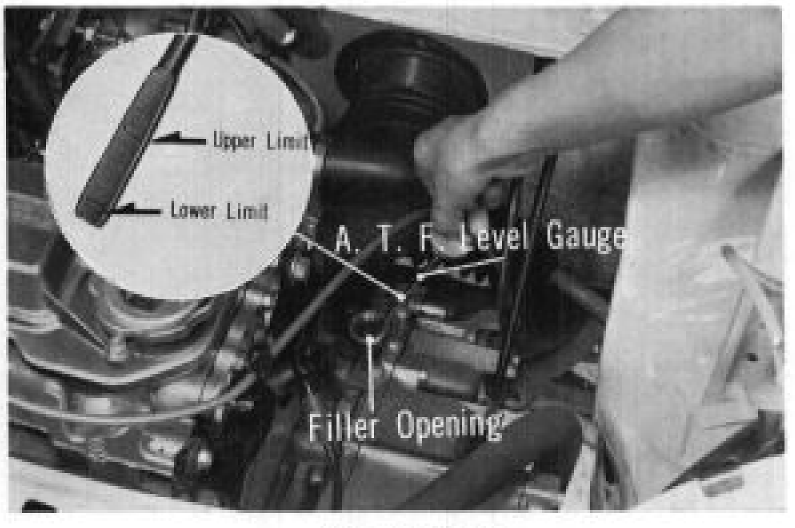


Fig. 19C-16

2. Automatic Transmission

2-1. Automatic Transmission Fluid Level

Check fluid level at 5,000 km (3,000 miles) intervals and replenish as needed up to upper limit mark. When checking the fluid level, the transmission selector lever should be in 3 position with parking brake, the car reasonably level and the engine idling. The fluid gauge dipstick is located on the opposite side of the engine oil dipstick.

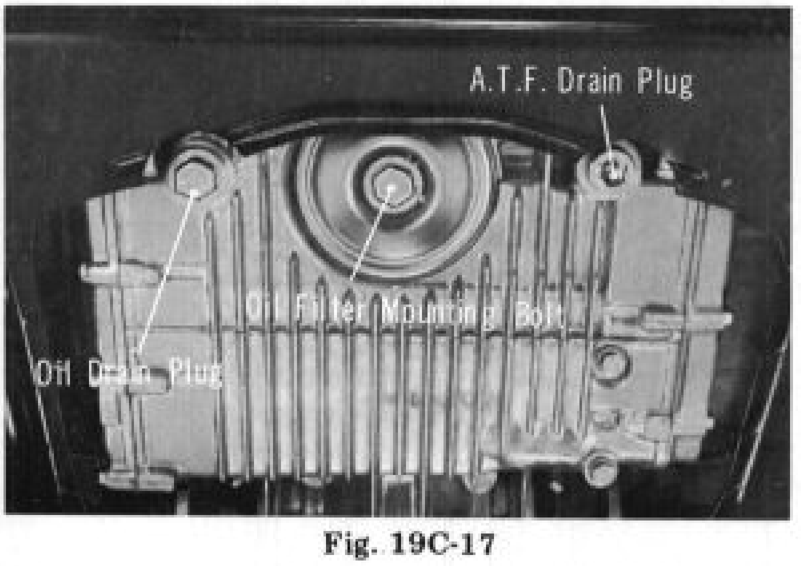


Fig. 19C-17

2-2. Fluid Change

Change fluid at 20,000 km (12,000 miles) intervals. Remove the drain plug and drain the fluid thoroughly; tighten the plug securely before filling fluid through the filler opening. Add fresh fluid until the level reaches the upper mark on the dipstick, (capacity 3.2ℓ, 5.6 Imp. pt.).

Note:
Use a good quality A.T.F. Type A.

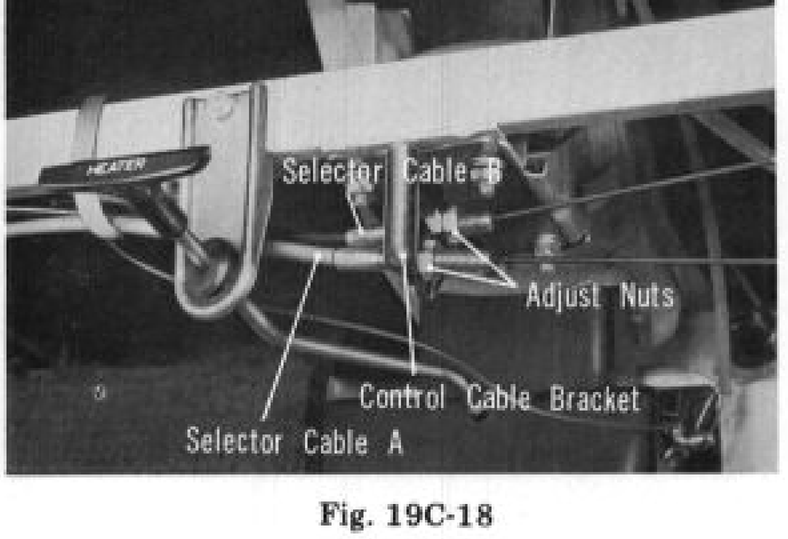


Fig. 19C-18

2-3. Selector Cables Adjustment

Position the select lever into "P" (Parking) and adjust the selector cable A (Black) with adjusting nuts so that the slack of the cable becomes zero. Then, position the selector lever into 1st to adjust the selector cable B (white).

2-4. Throttle Secondary Cable Adjustment

Open the throttle arm lever fully until it stops by hands and check the throttle secondary cable for slack by opening the carburetor throttle valve fully. If any slack on the cable, adjust the cable with adjusting nuts.

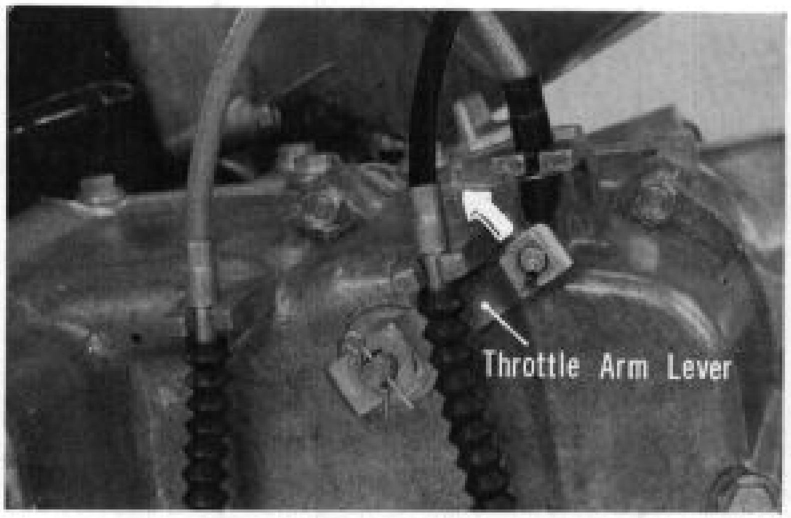


Fig. 19C-19

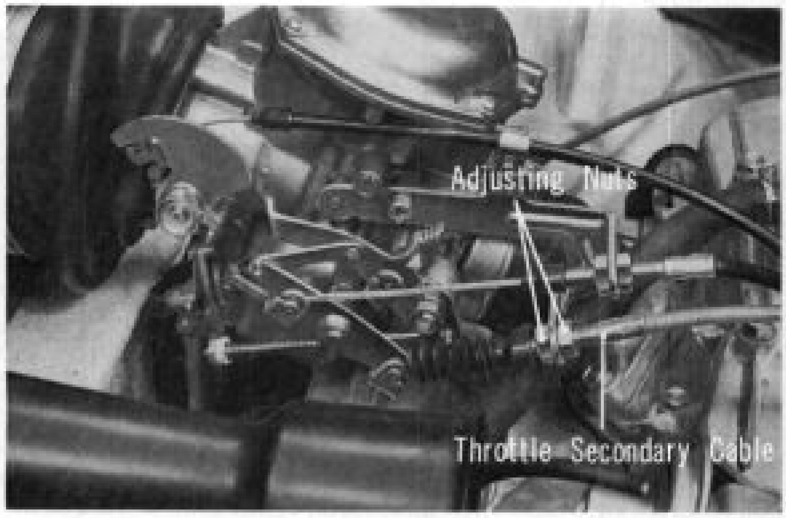


Fig. 19C-20

3. Clutch

Check the clutch release lever for free play at the tip of the lever. The speficied play is 3mm (0.12 in). Adjust the free play by means of the adjusting bolt by loosening the lock nut. Check the clutch cable for movement and damage at the release lever end and the clutch pedal end.

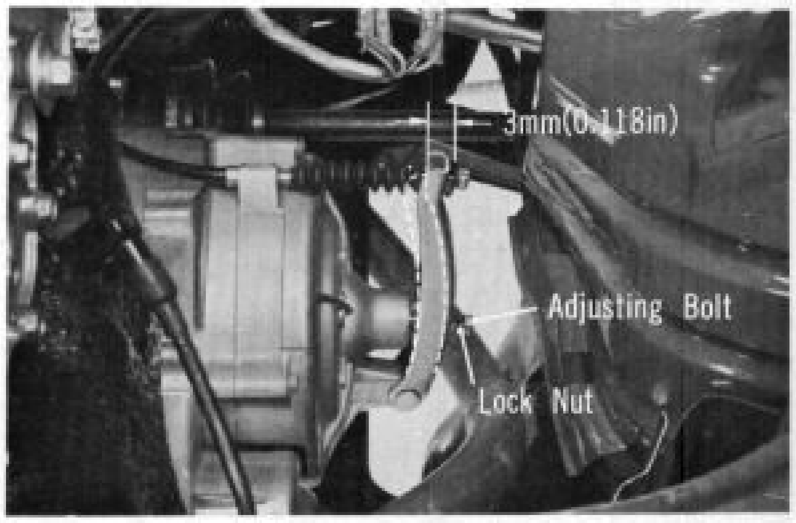


Fig. 19C-21

4. Brakes

Foot Brakes

(Air Bleeding)

Air bleeding shall be started with the wheel cylinder located farthest from the master cylinder while taking a care to the fluid leve in the reservoir.

Connect a vinyl tube to the bleed screw. Depress the brake pedal several times. Then, with the pedal kept depressed; repeat turning the bleed screw back and in quickly until no air bubbles appear in the fluid
By the same manner, bleed other wheels. And finally refill the reservoir with the brake fluid up to the prescribed level.

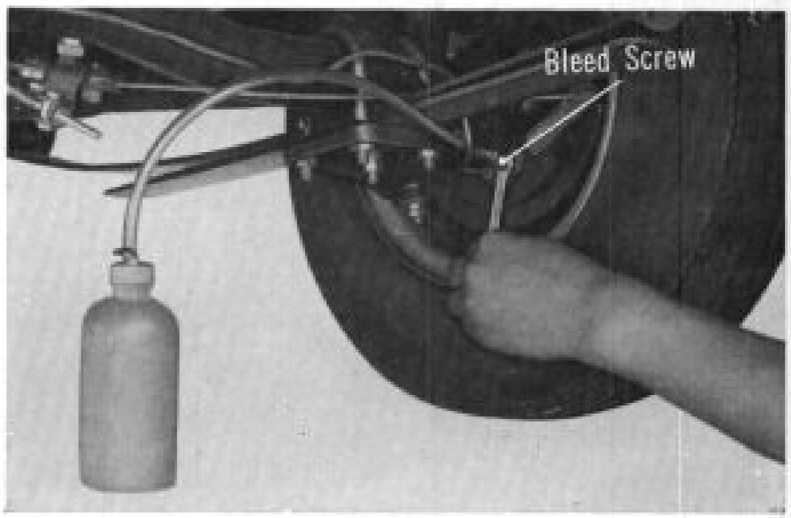


Fig. 19C-22

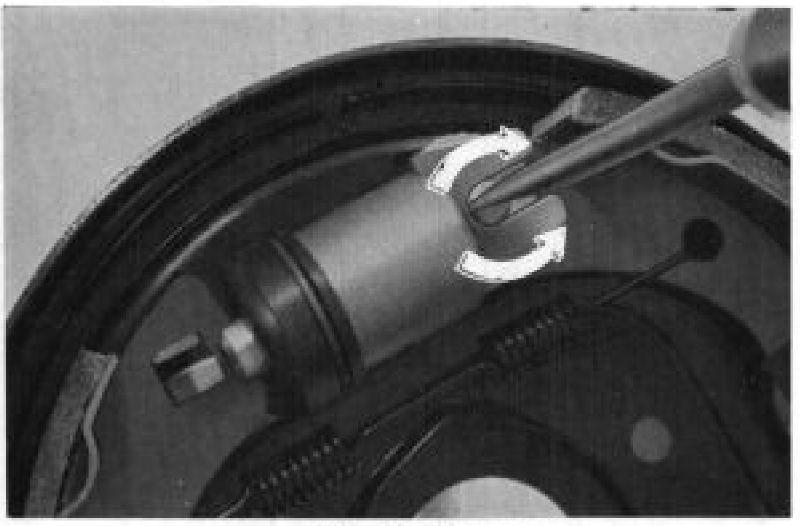


Fig. 19C-23

(Leading/Trailing Drum Brake Adjustment)

Turn the adjusting screw clockwise and back off the minimum amount necessary to allow the drum to rotate freely.

Note:

Press the brake pedal several times to centralize the brake shoes before checking the brake shoe release.

Fig. 19C-24

(Two Leading Drum Brake Adjustment)

(Two Leading Drum Brake Adjustment)

Turn the star adjusting screw outward till the brake drum is locked, and back off as explained in leading/trailing brake adjustment.

Perform these procedures with two wheel cylinders in each wheel uniformly.

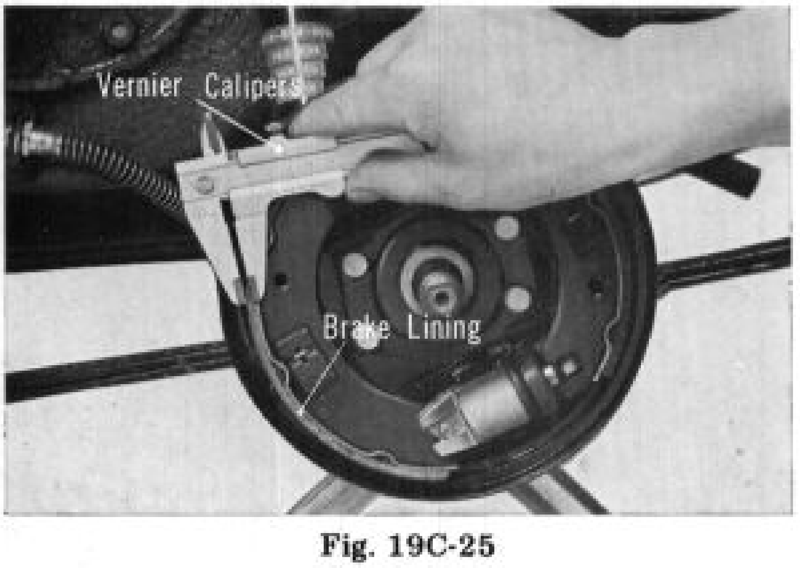


Fig. 19C-25

(Wheel Cylinder and Brake Shoe)

The wheel cylinder assembly of the leading/trailing type must slide smoothly, so apply a light coating of the grease.

If the shoe lining is less than 1.4mm (0.055 in) thick when measured with vernier calipers, it should be replaced.

Note:

Replace shoe on all four wheels at the same time. In the case of uneven wear between front and rear wheels, however, only the front or rear wheel shoes may be replaced.

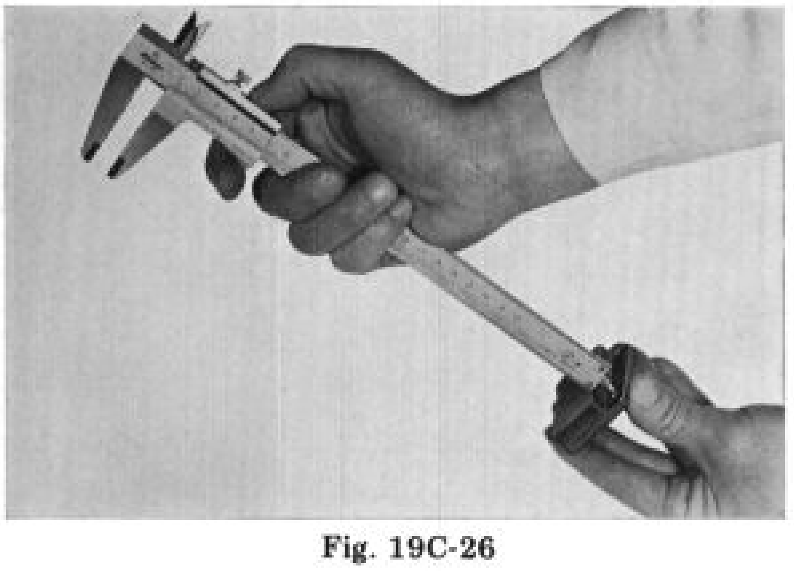


Fig. 19C-26

(Disk Brake Pad)

New brake pads have a thickness of 10.3mm (0.405 in). They must be replaced when worn to 2mm (0.079 in).

Parking Brake

When the lever stroke is appropriate, the rear wheels are locked at 30 to 50% (2~3 notches) of the full lever stroke. Parking brake lever stroke adjustment shall be made by means of the adjusting nut located at the rear axle beam after the footbrake is adjusted. Thread in the adjusting nut to reduce the lever stroke when excessive.

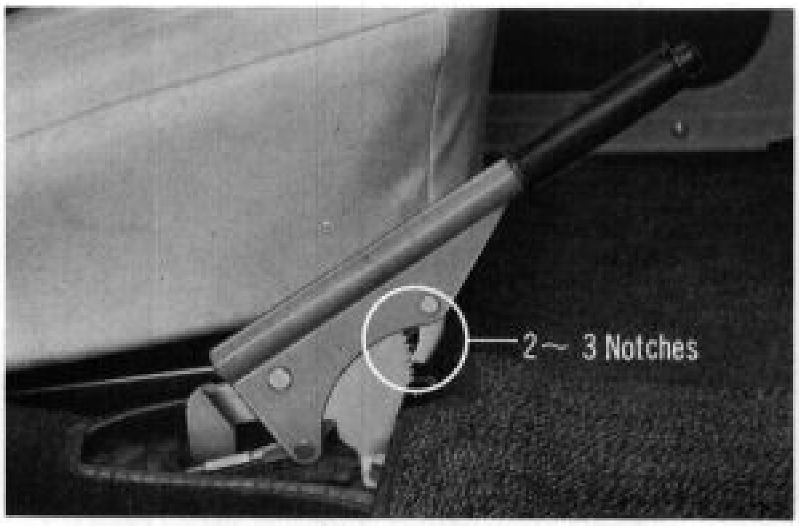


Fig. 19C-27

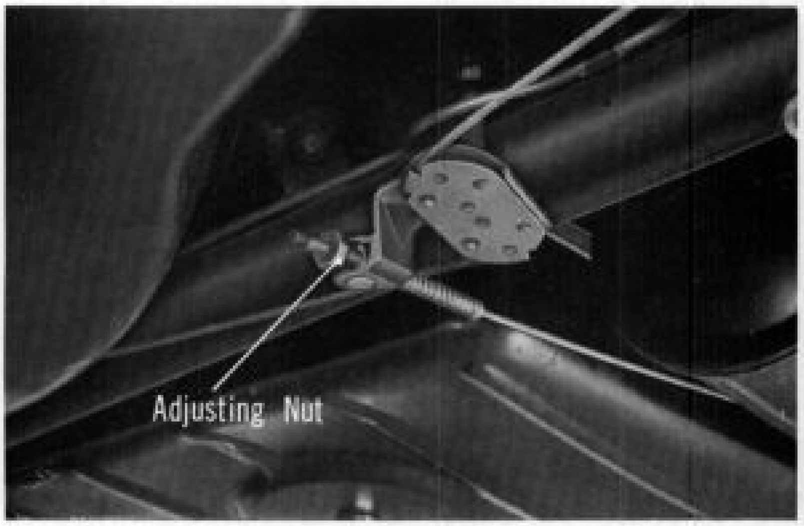


Fig. 19C-28

Brake Hydraulic System

In addition to periodical check every 3000 miles, brake line, hoses and cable should be inspected for brake fluid leak, chafing, corrosion, deterioration, or other damages whenever the car is raised on a lift.

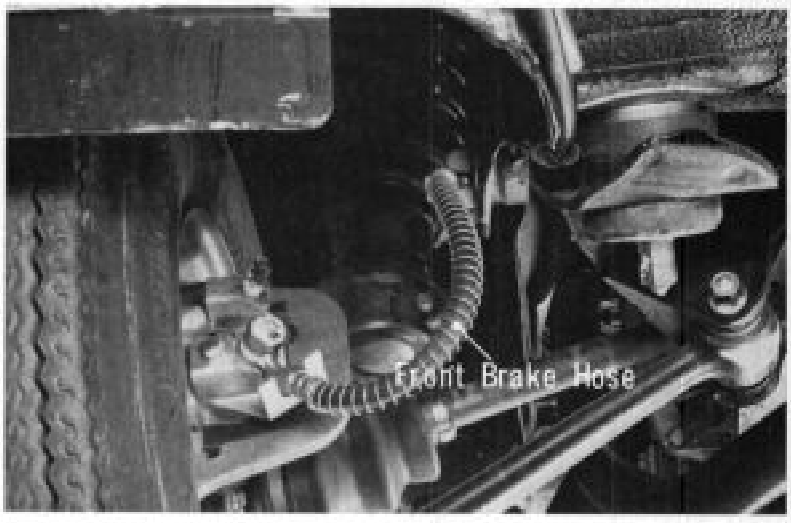


Fig. 19C-29a

Vacuum Booster Filter

Remove the valve body cap with a screw driver and detatch the air filter. Air filter should be washed in clean alcohol and air-dried.

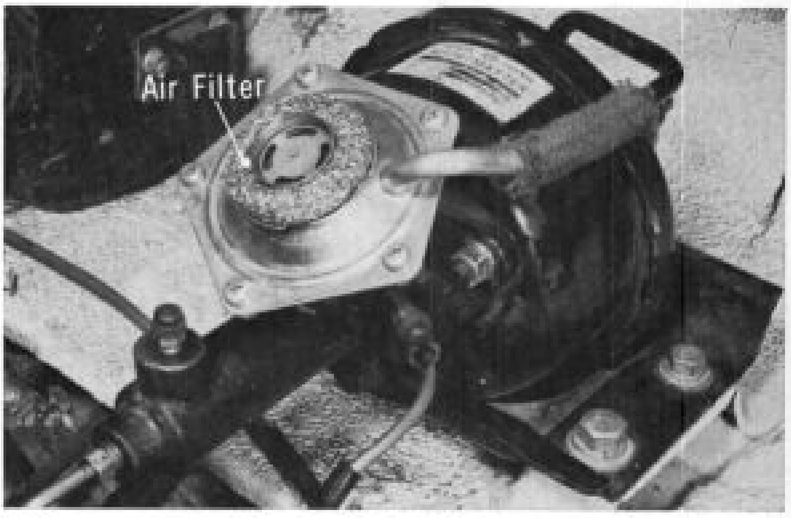


Fig. 19C-29b

Overhaul of Vacuum Booster

Whenever overhauling the vacuum booster for any reason, replace all rubber material parts. A repair kit shown in page 11-29-7 is available for overhauling.

Brake Fluid Level

With the brake fluid reservoir cap removed, check to see if the fluid level reaches the mark on the wall and also the condition of the fluid. If the fluid level is too low, add the recommended fluid. The fluid, if dirty, should be changed.

Note:
Be careful not to spill the fluid on painted sufaces as it will corrode the paint.

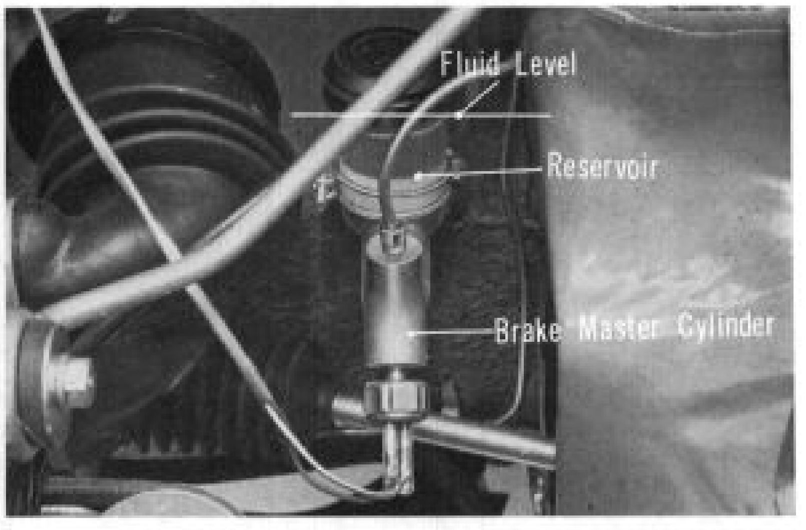


Fig. 19C-29c

5. Steering and Wheels

5-1. Steering Operation and Tie-rod End.

(Loose Steering Wheel)

To check for looseness of the steering wheel; move it back and forth, and right and left.If the steering wheel is loose, check the following items;

Fig. 19C-30

1 worn or improperly adjusted steering gear box.

2 Worn or loose wheel bearings.

3 Worn or loose steering linkages.

4 Steering column housing mounting bolts are loose.

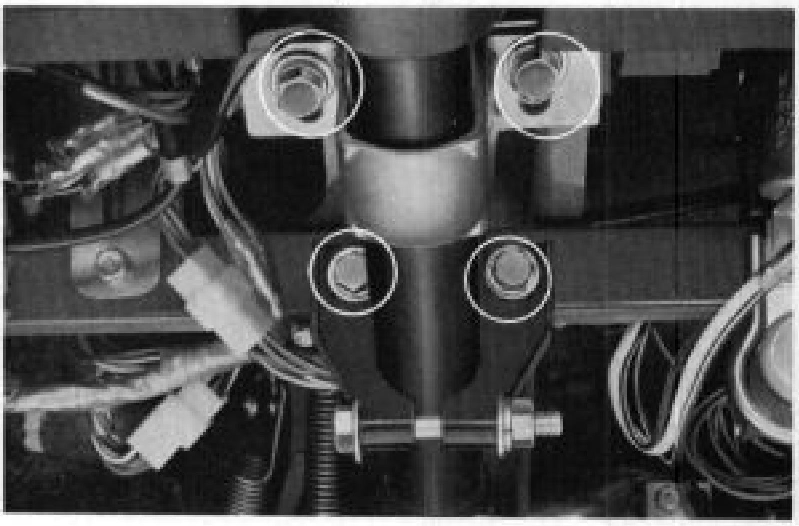


Fig. 19C-31

5. Steering shaft connections are loose. Tighten the clamp bolts.

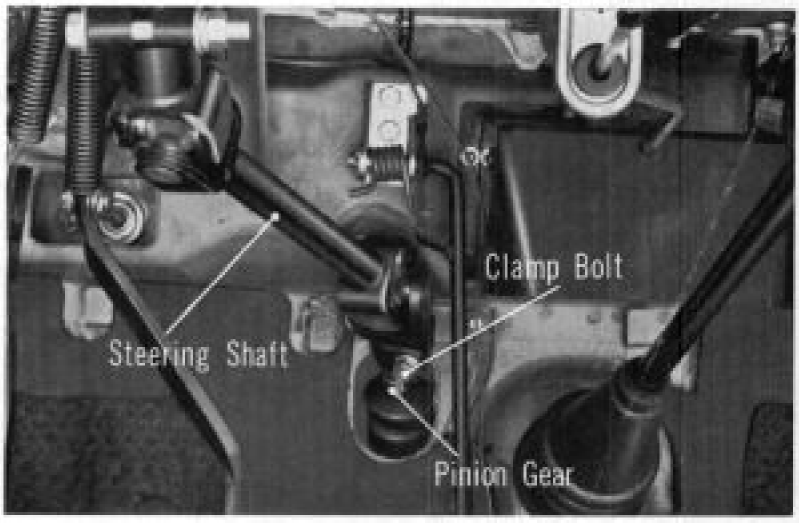


Fig. 19C-32

6. Steering shafts universal joints are loose.

* Factory-sealed-lubrication universal joints. Correct the joints in accordance with the methods described in section "STEERING."

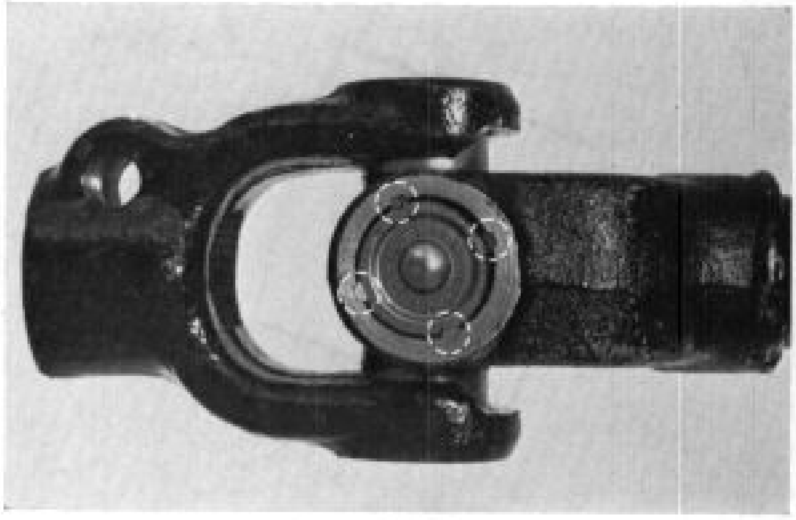


Fig. 19C-33a

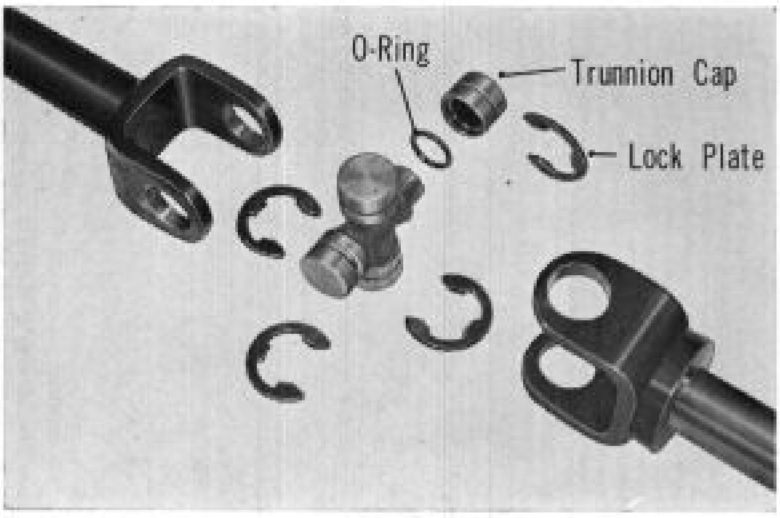


Fig. 19C-33b

* Standard joints
Select assemble the lock plate to minimize the play or install wave springs inside trunnion cap. There are four different lock plates available.

	Thickness
Lock plate A	1.7 mm (0.067 in)
Lock plate B	1.9 mm (0.075 in)
Lock plate C	1.3 mm (0.051 in)
Lock plate D	1.5 mm (0.059 in)

Fig. 19C-34

7 Steering wheel nut is loose.

Tightening torque:
3.0~3.5 kg-m (21.7~25.3 lb-ft)

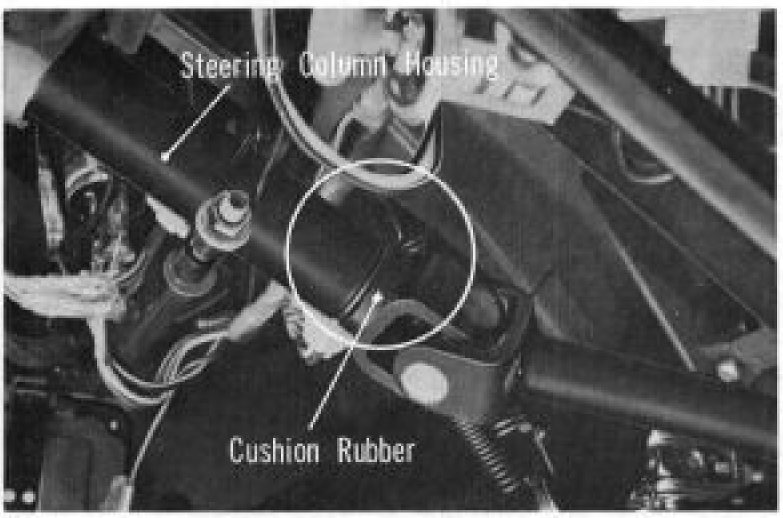


Fig. 19C-35

8 Steering column housing is improperly positioned or the cushion rubber between the column housing and the steering shaft universal joint is worn.

(Steering Wheel Turning Force)

Check the turning force by hooking a scale to the steering wheel, with the front wheels set in straight, forward position and freed (off the ground).
In this state, the steering wheel must turn with the operating torque of 1.5 kg (3.3 lbs) or less.
If the steering is found heavy, the possible causes are:

(1) Improperly positioned steering column housing.

(2) Rack adjust-bolts adjusted too tight.

(3) Rack end ball joints are tight during the first 3,000 km (2,000 miles) mileage.

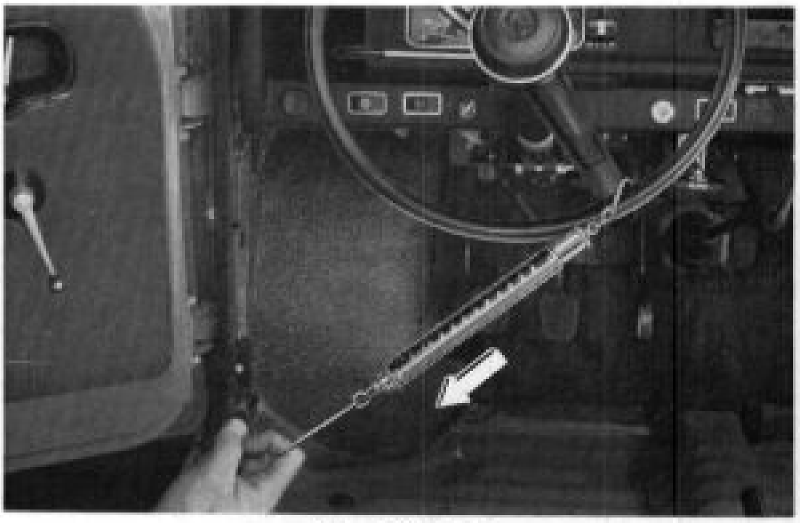


Fig. 19C-36

(Steering Gear Box)

Check steering gear box mounting bolts for looseness, and the tie-rod dust seals for damage. Check the pinion gear for play in axial, radial, and rotational directions by hands. Grease the gear box through the greasing nipple or special tool-greasing adaptor.

Fig. 19C-37

(1) **Excessive play in radial direction**

Check the pinion gear and the bushing wear. The pinion gear bushing is press fitted in the gear box with damper rubber incorporated. Check the damper rubber for wear, and make a replacement if it is worn excessively.

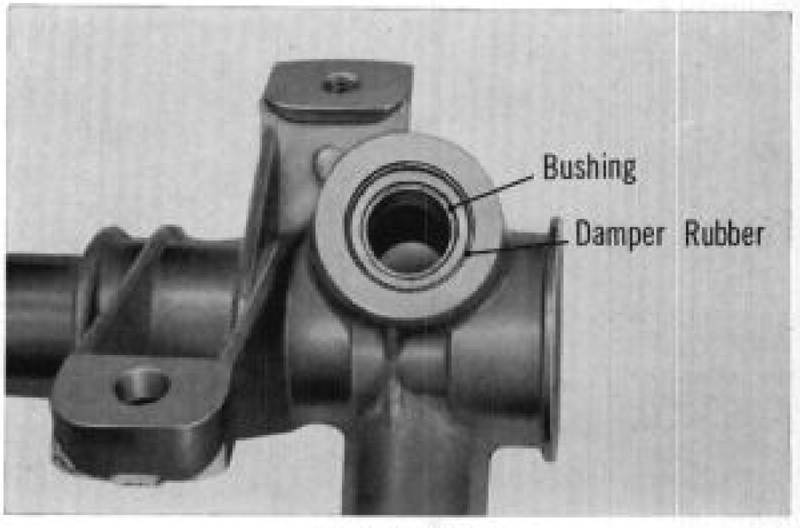


Fig. 19C-38

(2) **Escessive play in axial direction**

Tighten the pinion gear mounting bolt and eliminate the pinion gear end play. Secure with the lock nat.

(3) **Excessive play in rotational direction**

Adjust the rack adjusting bolts at both ends of the steering gear box.

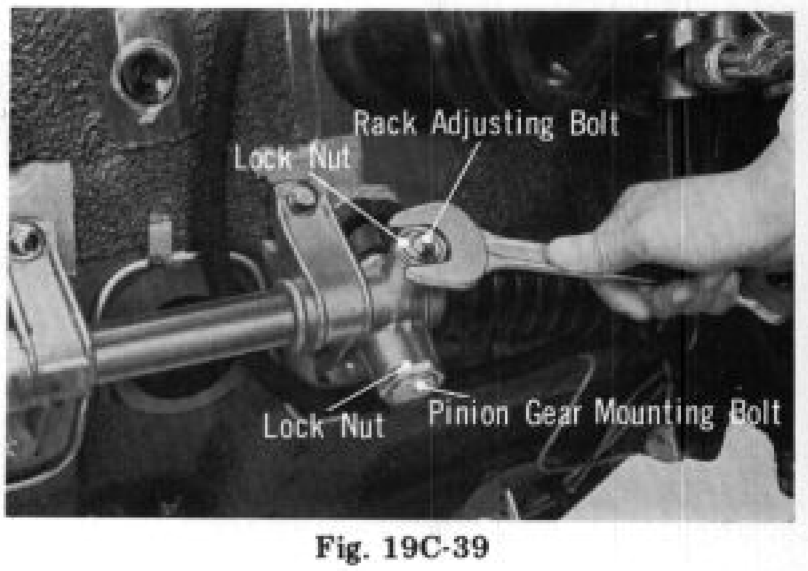


Fig. 19C-39

(Steering Linkages)

Check the ball joints for wear and the loose connection to the rack gear.
Tighten to a torque 4.5~5.0 kg-m (32.5~36.2 lb-ft) and secure with the lock washer.

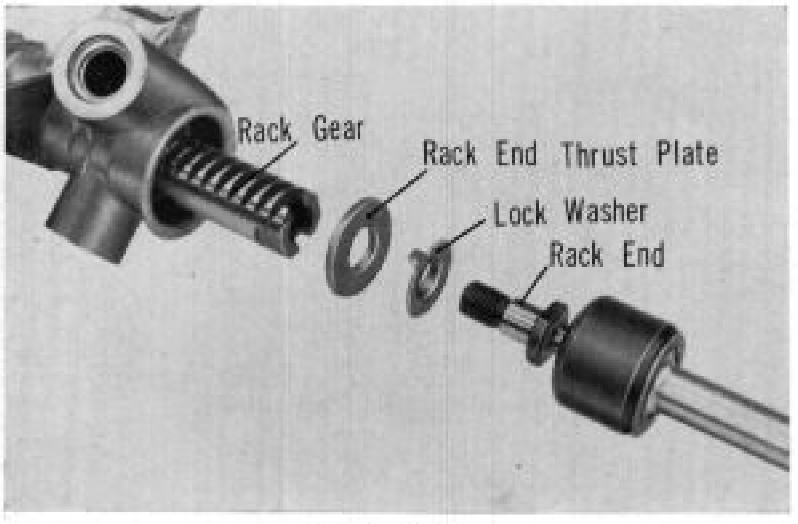


Fig. 19C-40

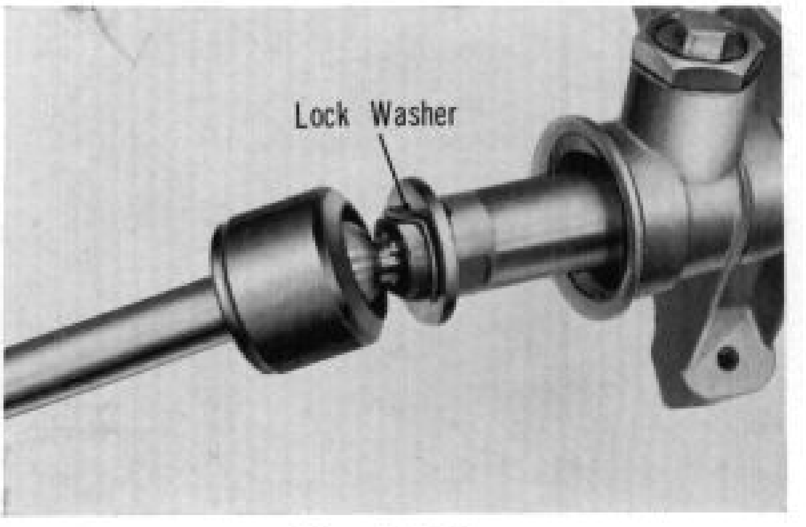


Fig. 19C-41

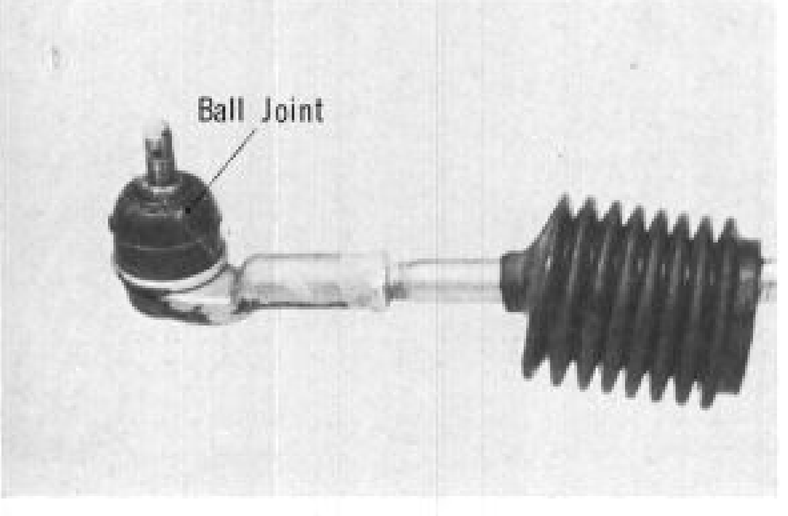


Fig. 19C-41a

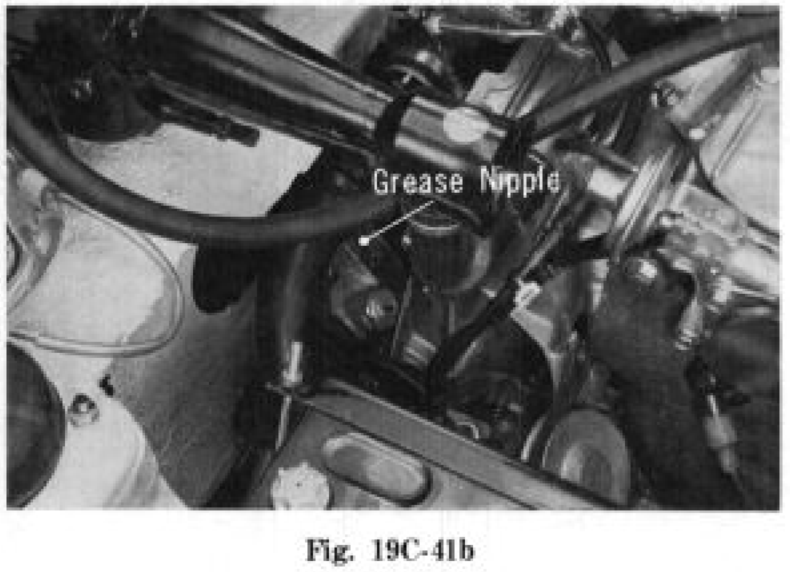


Fig. 19C-41b

(Greasing the Steering Gear Box)

Turn the steering wheel to the extremely right for LH car on extremely left for RH car and grease the steering gear box through the nipple.

5-2. Wheel Alignment

When checking wheel alignment, place the unloaded car on a level surface. It is imperative that all checks of steering linkage for bends, wear, and other damage (spring damage, bent frame, wheel distortion, deformed tires, tire pressure, worn wheel bearings, steering gear backlash) be made and faults corrected before performing this test. If these checks are not made in advance, no accurate test of the wheel alignment can be made.

(1)	Camber	0.5°
(2)	Caster	1°
(3)	Trail	5mm (0.197 in)

For checking and adjusting the above items, see section 12 "SUSPENSION"

(4)	Toe-in	out 2mm

Checking Toe-In:

Set the front wheels in the straight ahead position. Chalk a mark line at the center of each front tire and measure distance between the chalked lines. Turn wheels 180 degrees and measure the distance at the rear.
Toe-in equals (rear measured value) − (Front measured value)
The standard value of the toe-in is −2 mm (−0.08 in) OUT.

Adjustment:

Toe-in can be adjusted by loosening the lock nuts at each of the ties rods. To increase toe-in, turn the right tie-rod in the direction of wheel rotation when the car moves forward; turn the left tie-rod in the opposite direction. Turn both tie-rods an equal amount until toe-in becomes −2 mm.

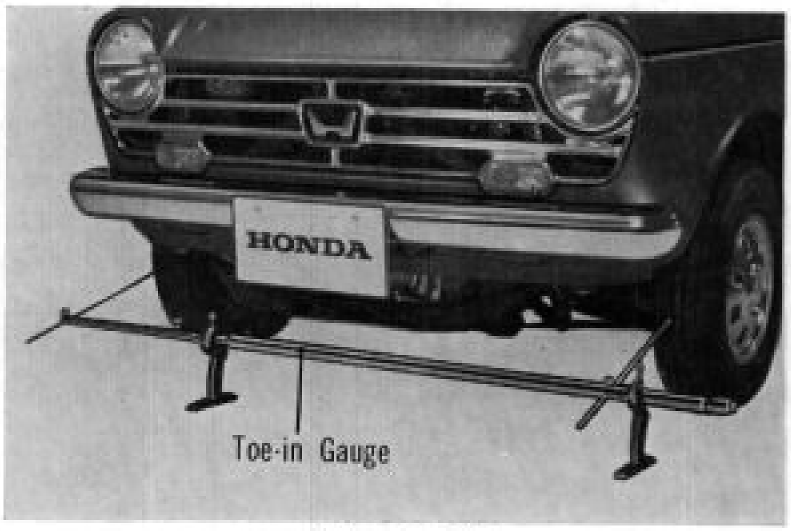


Fig. 19C-42

Fig. 19C-43

5-3. Wheels and Tires

(Tire Inflation Pressure)

Check the inflation pressure of tires. If it is too low, check its cause and correct to the specified air pressure. Check inflation pressure of the spare tire at the same.

	(Tire Inflation Pressure)	
	Front	Rear
2PR Tire	1.4 kg/cm² (20 psi)	1.0 kg/cm² (14 psi)
4PR Tire (Standard)	1.7 kg/cm² (24 psi)	1.5 kg/cm² (22 psi)
4PR Tire (Radial)	1.8 kg/cm² (26 psi)	1.5 kg/cm² (22 psi)
6PR Tire	2.1 kg/cm² (30 psi)	1.7 kg/cm² (24 psi)

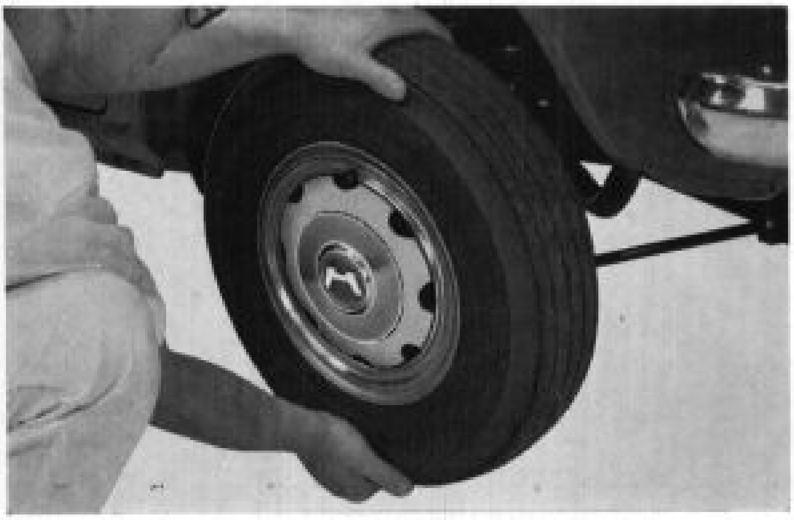


Fig. 19C44

(Wheel Bearing Play)

Jack up to make each wheel free respectively. Grasp the wheel and shake up and down to check the wheel bearing play.
If any exists, tighten hub nuts to a specified torque again and, if any play still exists, replace the bearing.

Note:
Over-tightening of hub nuts will cause hard bearing rotation, resulting in unsmooth wheel rotation.
Specified tightening torque is 16~18 kg-m (116~123 lb-ft) for front hub nuts.

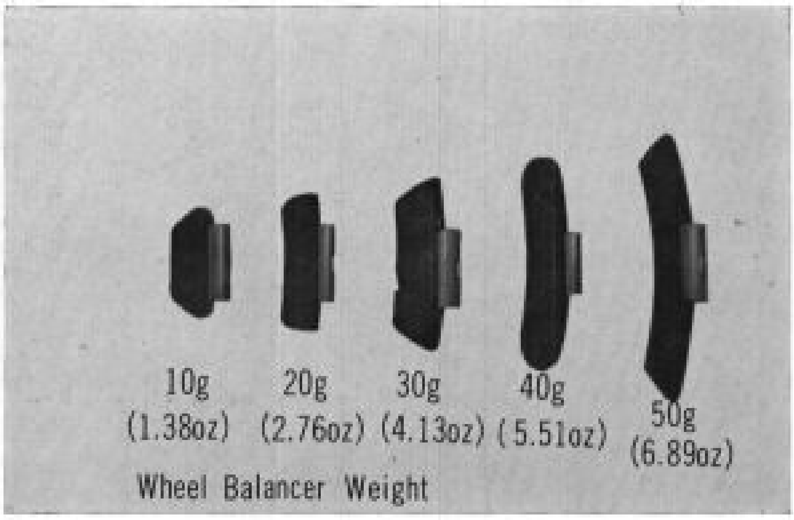


Fig. 19C-45

(Wheel Balance)

When tire is replaced or tire wear is non-uniform, balance the wheel with wheel balance weight shown in the figure.

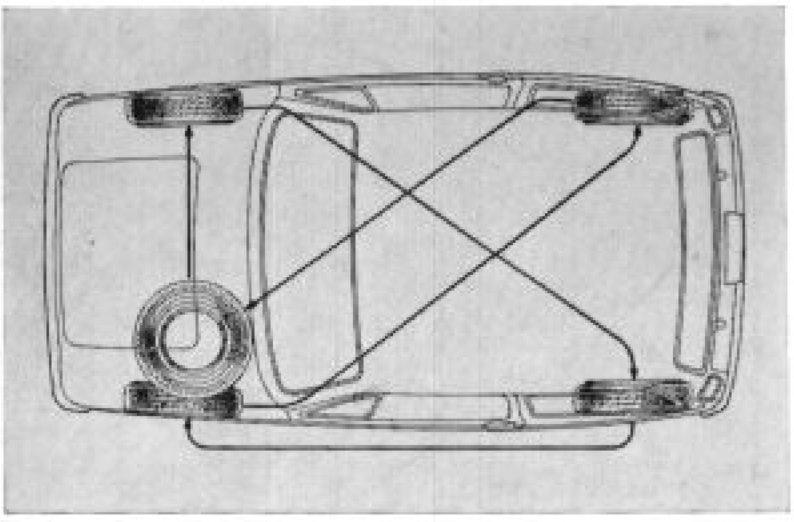


Fig. 19C-46

(Tire Rotation)

Tire, if used for a long period of time at the same position, will become worn unevenly, resulting in short tire life and poor driving performance. To prevent this, rotate tires as illustrated.
Standard period of tire rotation is 5,000 km (3,000 miles) of drive.

6. Battery and all Mounting Bolts

6-1. Mounting Bolts and Nuts

The following are examples
See "Torque Specifications" is section GENERAL for details

1. Tighten the shock absorber mounting nuts.
   Tightening torque:
   (12 mm)
   Nut A 4.5~5.0 kg-m (32~36 lb-ft)
   Nut B 2.5~3.0 kg-m (18~22 lb-ft)
   (8 mm)
   Nut 1.5~2.0 kg-m (11~15 lb-ft)

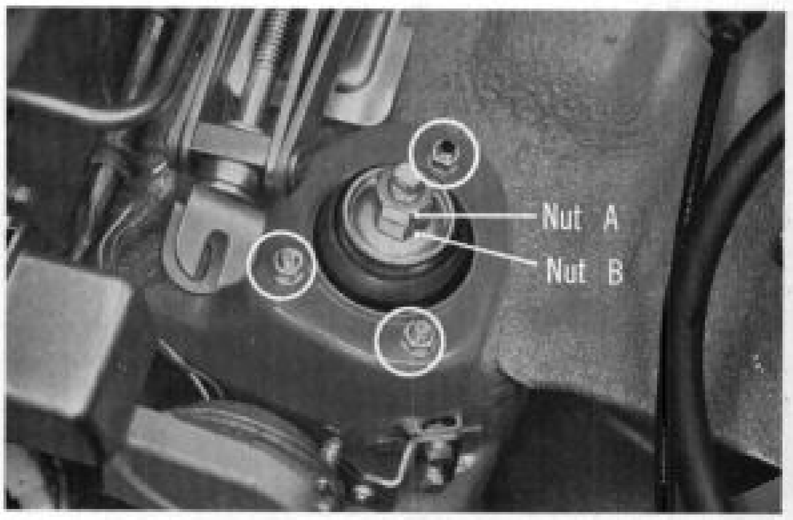


Fig. 19C-47

2. Tighten the front damper clamp bolts.
   Tightening torque:

8 mm Bolt	3.0~3.5 kg-m	(22~25 lb-ft)
10mm Bolt	4.5~ 5.0 kg-m	(29~93 lb-ft)

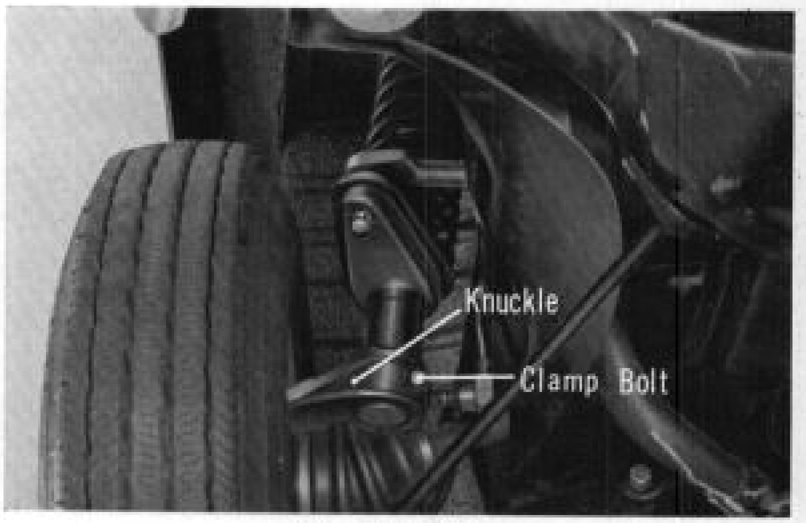


Fig. 19C-48

3. Tighten the radius rod mounting bolts and lower arm mounting bolts.
   Tightening torque:
   4.0~4.8 kg-m (29~35 lb-ft)

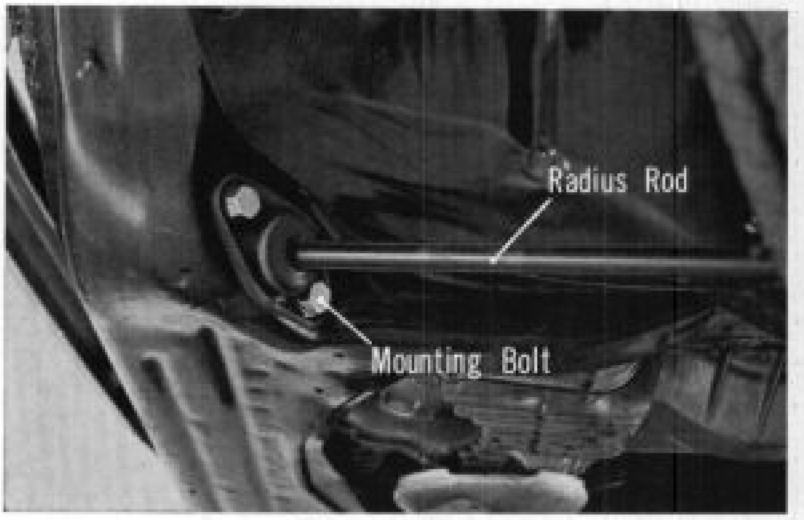


Fig. 19C-49

4. Tighten the tie-rod end ball joint nut.
   Tightening torque:
   3.5~4.0 kg-m (25~29 lb-ft)

5. Tighten the U bolt nuts.
   Tightening torque:
   4.4~4.8 kg-m (32~35 lb-ft)

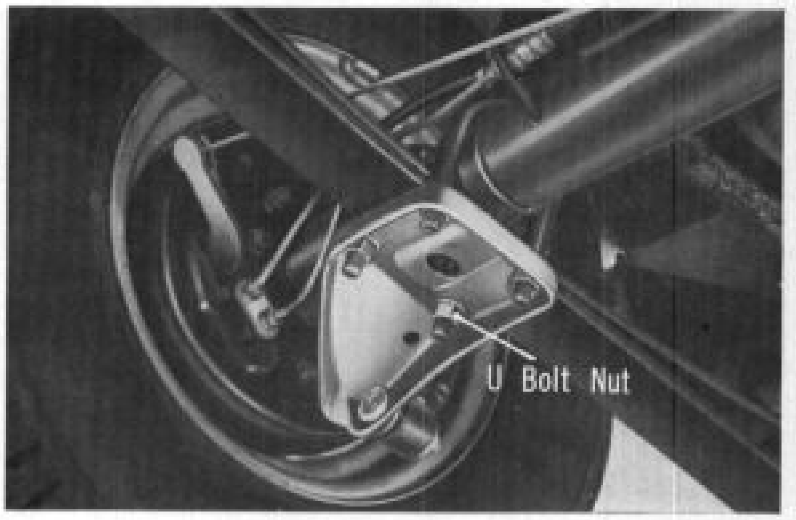


Fig. 19C-50

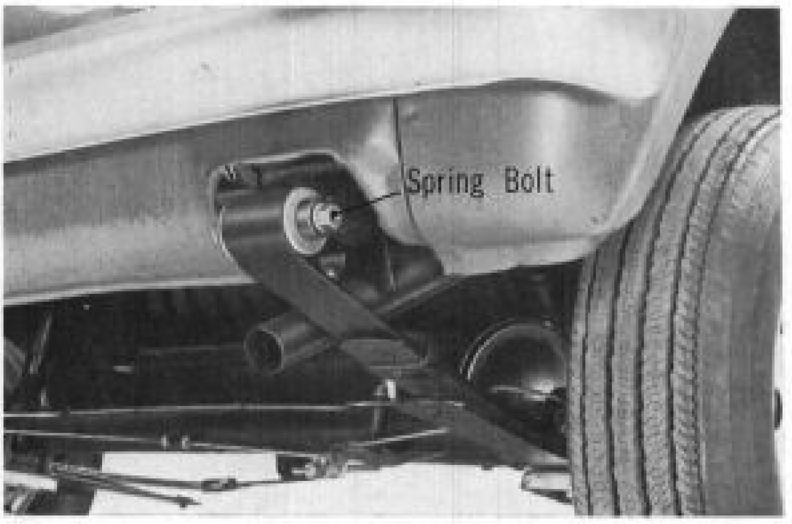


Fig. 19C-51

6. Tighten the spring bolts and shackle bolts.
   Tightening torque:
   4.4~4.8 kg-m (32~35 lb-ft)

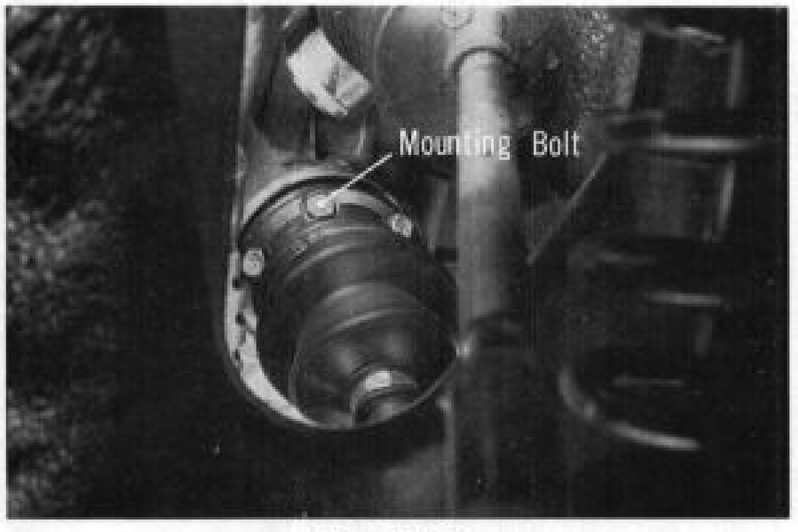


Fig. 19C-52

7. Tighten the drive shaft mounting bolts.
   Tightening torque:
   2.8~3.2 kg-m (20~22 lb-ft)

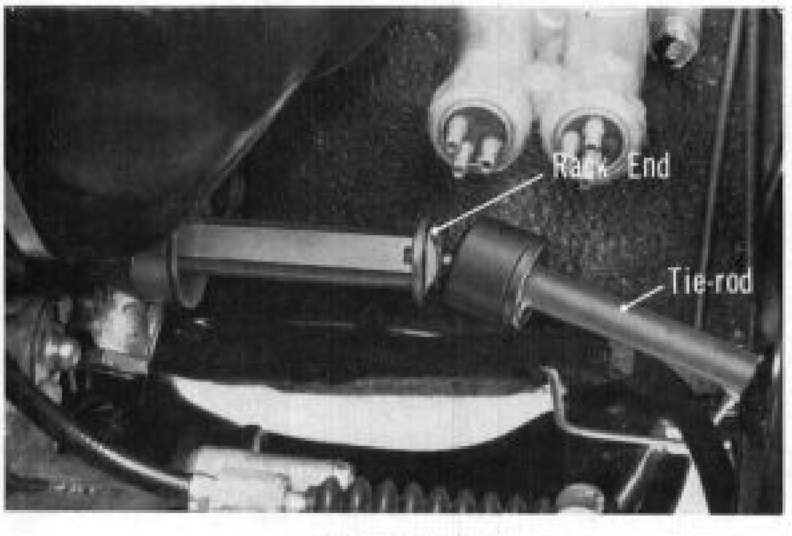


Fig. 19C-53

8. Tighten the rack end and tie-rod end lock nut.
   Tightening torque:
   4.5~5.0 kg-m (33~36 lb-ft)

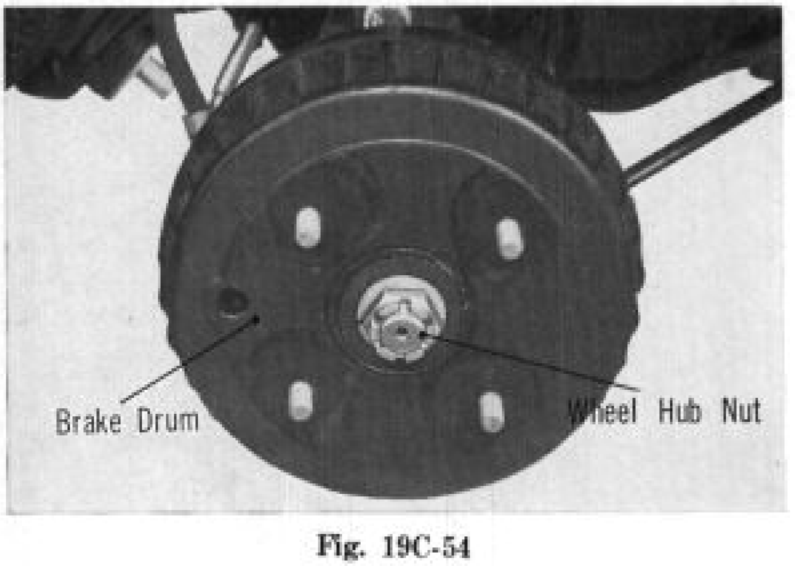


Fig. 19C-54

9. Tighten the wheel hub nuts.
   Tightening torque:
   14~20 kg-m (101~145 lb-ft)

10. Tighten the exhaust pipe mounting nuts and the clamp bolts of the primary silencer and exhaust pipe (manifold).

    Tightening torque:
    2.5~2.9 kg-m (18.1~20.3 lb-ft)

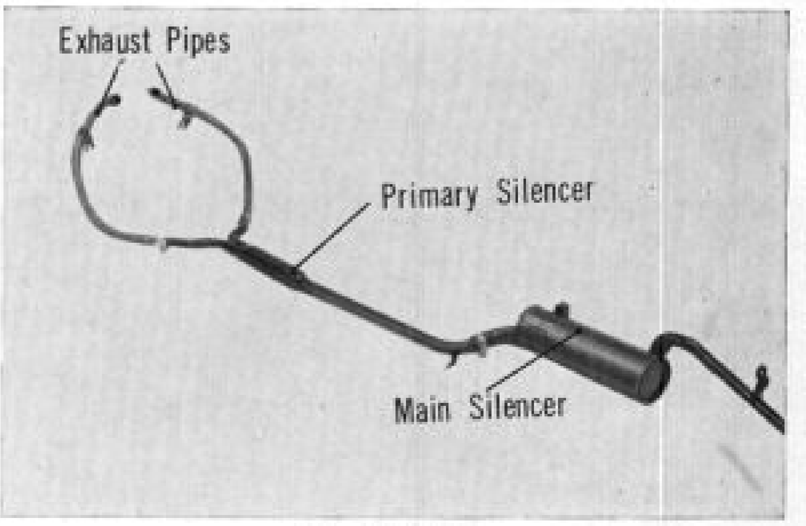


Fig. 19C-55

11. Tighten the sub-frame mounting bolts (four).

    Tightening torque:
    4.0~4.5 kg-m (28.9~32.5 lb-ft)

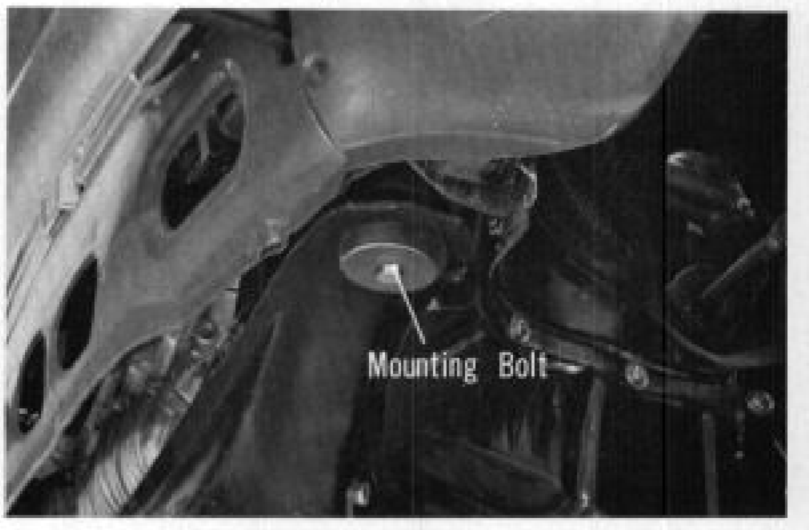


Fig. 19C-56

6.2. Battery

Battery Electrolyte Level

The battery electrolyte shall always be kept above the lower level. If the electrolyte is short, remove the six filler plugs and supply distilled water up to the uuper lever.

Note:
Acid should not be used for electrolyte.
Distilled water shall be filled to each cell up to the same level as viewed from outside.

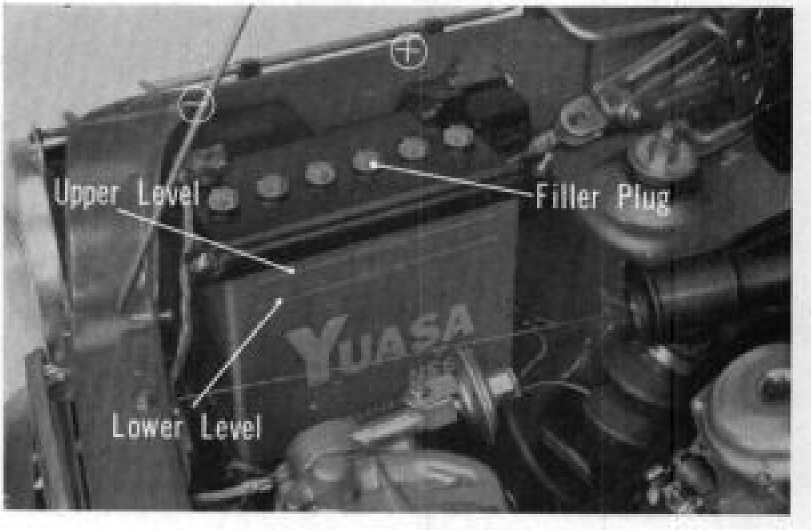


Fig. 19C-57

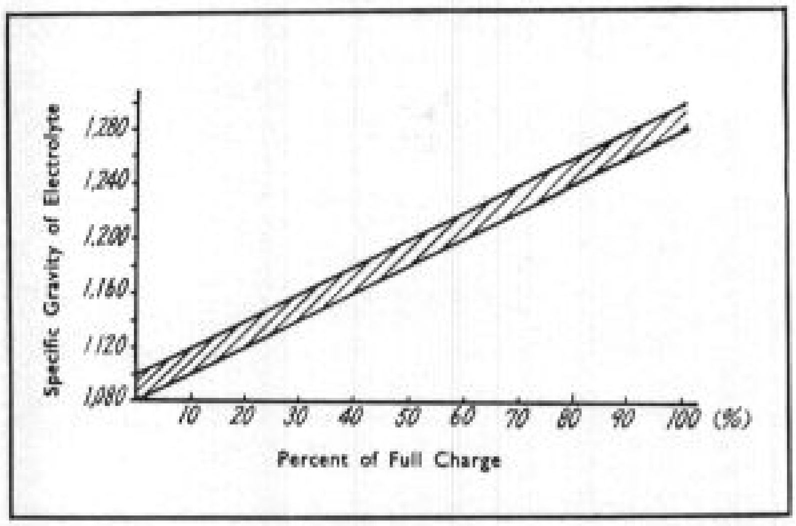


Fig. 19C-58

Temperature		Specific Gravity
°E	°F	
50°	(122°)	1.259
40°	(104°)	1.266
30°	(86°)	1.273
20°	(68°)	1.280
10°	(50°)	1.287
0°	(32°)	1.294
−10°	(24°)	1.301
−20°	(26°)	1.308

Fig. 19C-59

Contamination and Damage of Terminals

Check battery terminals for contamination and damage. The terminals, if dirty, should be cleaned with hot water and coated with grease or petrolatum.

Specific Gravity

Measure specific gravity of electrolyte in each cell. If it is less than 1.220, charge the battery.

Note:
Specific gravity of a fully-charged battery is 1.280 (electrolyte temperature: 20°C, (68°F)). The specific gravity varies 0.0007 per 1°C (1.8°F) of electrolyte temperature. (Specific gravity decreases with the rise of electrolyte temperature and increases with the drop of temperature.)

It is important that this condition be understood to prevent starting difficulties in cold weather and damage to the battery in hot weather.

A fully charged battery at standard temperature should be 1.280; for the tropic 1.260 and for extremely cold weather, it should be 1.200.

SECTION 20

ALPHABETICAL INDEX

This section is to follow.

— (E) —

— (F) —

— (G) —

— (H) —

— (I) —