SERVICE MANUAL

SUBARU 360 SEDAN

AUTO-CLUTCH

FUJI HEAVY INDUSTRIES LTD.
TOKYO JAPAN

CONTENTS

FOREWORD

This service manual has been prepared as reference for effective service and maintenance of the Subaru 360 Sedan Auto-Clutch vehicle.

Please utilize this manual fully together with the Subaru 360 series Service Manuals "Body Section and Engine Section" to ensure complete maintenance work for satisfying our customers by keeping their vehicles in the best condition.

When it is necessary to replace parts during maintenance, be sure to use genuine Subaru parts.

FUJI HEAVY INDUSTRIES LTD.

CHAPTER 1 OUTLINE OF SUBARU 360 SEDAN AUTO-CLUTCH

1. PRINCIPLES

SUBARU 360 SEDAN AUTO-CLUTCH employes an electromagnetic powder system clutch.
When iron powder approaches a magnet, the iron grains connect to form a chain and the resultant binding power is produced.
Based on this principle, the magnetic grain (iron compound specially processed) is placed between the drive member with a coil and a driven member, and when the current applied to the drive member coil, a magnetic force generates, thus the drive member and driven member are joined through the magnetic grain connected in the form of a chain and the driving power thereby transmitted.
This binding power (the transmitting torque) is in proportion to the current strength. When the current is turned off, the binding power disappears completely and this characteristics can be utilized to the operation of a clutch. Therefore, this new type clutch will take the place of the conventional friction clutch.

SUMMARY OF BASIC OPERATIONAL PRINCIPLES

(1) By applying the initial increasing current from the generator when starting a vehicle, the most proper transmitting torque can be obtained according to the increase of engine speed.

(2) A switch incorporated into the gear shift lever knob makes it possible to shift gears, since the clutch is disengaged by this switch operation when a force is applied to the knob for the purpose of shifting gears.

(3) When the vehicle speed reduces under a certain speed, a device which desengages the clutch automatically prevents the engine from stopping.

2. OPERATIONS

A. WHEN STARTING THE VEHICLE

When the accelerator pedal is pressed, the current from the generator increases in proportion to the engine speed. The current flows through the clutch exciting coil, and consequently the transmitting torque increases gradually, while the clutch slip decreases gradually.
Thus the vehicle starts smoothly regardless of individual driving skill. If the vehicle speed is over 20 km/h (12 mph), the signal generator installed on the end of the main shaft of the transmission operates and the governor relay inside the control box changes the power supply from the generator to the battery. The generator starting performance is suitably controlled when starting the vehicle, so that the charging characteristics at low speed becomes inefficient.
In order to restore this insufficient characteristics to the original characteristics and prevent the torque from fluctuating, above conversion of the power supply.

B. WHEN CHANGING SPEED

When shifting the gear, the switch incorporated into the knob is turned on by holding the gear shift lever knob and the reply inside the control box serves to

switch the circuit. Then, the exciting current is turned off, the reverse exciting current flows simultaneously and the residual torque is eliminated. As a result the clutch is immediately disengaged and the gear shifting is easily operated. When the gear shift lever knob is released after shifting the gear, the clutch will be engaged again.

C. AT LOW SPEED

When the vehicle speed reduces under 20 km/h (12 mph), the signal generator signals and the governor relay inside the control box serves to turn off the current flowing through the exciting coil, and as a result clutch is disengaged also. This prevents the engine from stopping.

3. DRIVING INSTRUCTION

A. STARTING THE ENGINE

Start the engine after making sure that the gear shift lever is set to neutral, otherwise the vehicle is likely to rush out unexpectedly when the accelerator pedal is depressed.

B. STARTING THE VEHICLE

(a) Always start the vehicle with low gear.
Though the vehicle can be started also with second gear, the electromagnetic clutch will be damaged by undergoing several times as much load as with low gear. Especially if starting with second gear is repeated, the clutch will be remarkably reduced in life or even spoiled by burning.

(b) Normal start, rushing start and start on a hill
You have only to depress the accelerator pedal less or more strongly when starting the vehicle slowly or rapidly. When starting on a hill, the brake can be operated with the left foot. Thus, it is not necessary to apply the hand brake as in vehicles with manual clutch.

C. SHIFTING THE GEAR

When shifting the gear, hold the gear shift lever knob and release the knob as soon as possible after shifting the gear.
The knob of the gear shift lever has a built-in switch. When the gear shift lever is tilted, this switch is actuated to disengage the clutch. It is desirable at that time to release the accelerator pedal fully.

D. STOPPING

When stopping the vehicle, even though the brake pedal is deprossed, the engine will not stop. When stopping on a hill with the engine running for a while, apply the hand brake. Do not attempt to stop the vehicle with half engaged condition.

E. PARKING

When parking the vehicle, be sure to use the hand brake. The clutch cannot be engaged while the engine is not in operation, so that no gear parking is possible.

F. STARTING BY EMERGENCY SWITCH

When the starter does not operate because of dead battery, make use of the emergency switch.
When this switch is depressed, a current is supplied directly from the battery to the clutch, thus the clutch is engaged. Shift the gear into the second gear position and push the vehicle. When the vehicle reaches a proper speed, push the switch and continue to push the vehicle until the engine is started. Then release the switch and select a gear according to the running speed.
After that, run the engine at neutral for a while with the switch depressed to charge the battery.
Further, as a special application of this switch, it can be used for engine braking at low speed on a down hill.

(CAUTION)

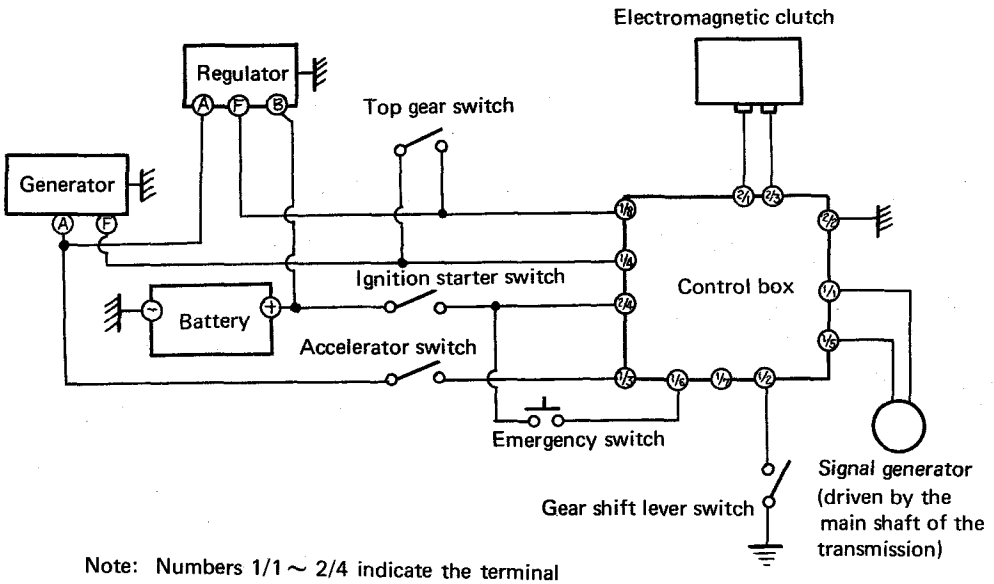
(1) Generator V-belt
The output of the generator is utilized for starting the vehicle.
Therefore, a broken V-belt or any failure of the generator would make starting impossible or out of order.

(2) Engine idling speed
Increase of the idling speed may cause a shock in starting.
About 900 rpm is adequate.

(3) As the clutch is adapted to be disengaged when the knob of the gear shift lever is tilted, take care not to touch the knob of the gear shift lever by the knees or hands during running. Otherwise, the clutch will be disengaged and idle running of the engine will occur.

CHAPTER 2 ELECTROMAGNETIC CLUTCH AND CONTROL CIRCUIT

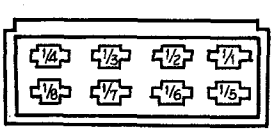
ELEMENTS & CONNECTING DIAGRAM OF AUTO-CLUTCH



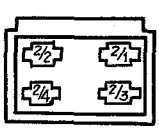
Note: Numbers 1/1 ~ 2/4 indicate the terminal numbers of the connectors.

Fig. 1 Elements and connections of auto-clutch

TERMINAL NUMBERS OF CONNECTORS



8P Connector



4P Connector

Fig. 2

1. ELECTROMAGNETIC CLUTCH

A. PRINCIPLE

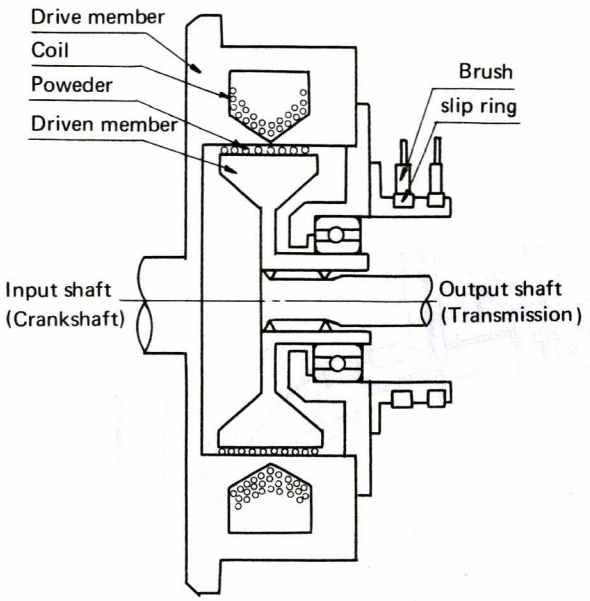


Fig. 3

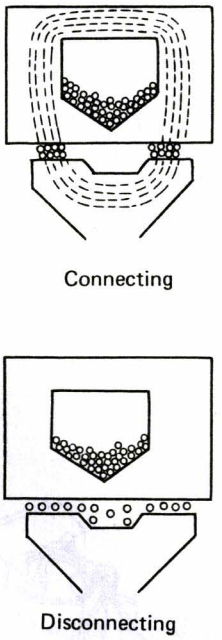


Fig. 4

There are electromagnetic clutches of the rotating coil type and the standing coil type. The SUBARU 360 SEDAN AUTO-CLUTCH is equipped with the rotating coil type clutch. This electromagnetic clutch consists of a drive member coupled to the crankshaft and a driven member coupled to the transmission.
The exciting coil is wound inside the drive member.
When the current flows to this exciting coil through the brush and the slip ring, a magnetic flux is generated as shown in Fig. 4.
The magnetic flux connects the powder provided between the drive and driven members so as to make it chain-formed, and as a result torque is transmitted from the drive member (output side) to the driven member (transmission side).

When no current flows through the exciting coil, the clutch is disengaged and no torque is transmitted. At that time, the powder adheres to the inner surface of the drive member by centrifugal force.

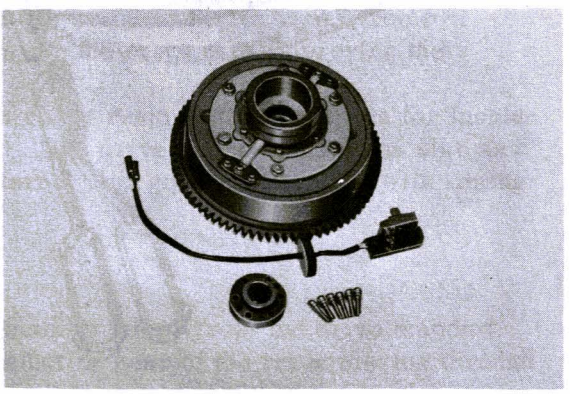


Fig. 5

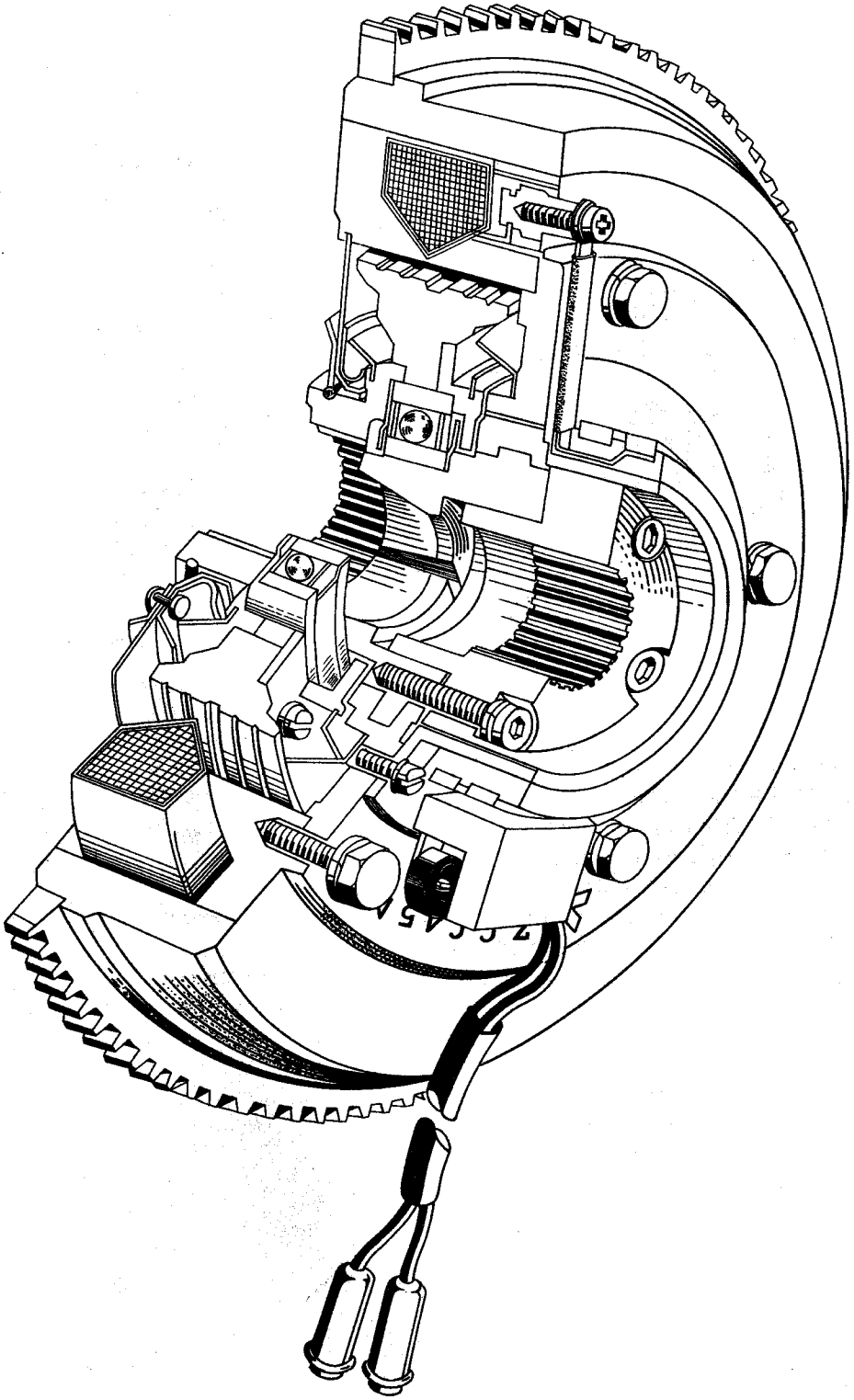


Fig. 6

B. CONSTRUCTION

The electromagnetic can be grouped into six parts as shown in Fig. 7.

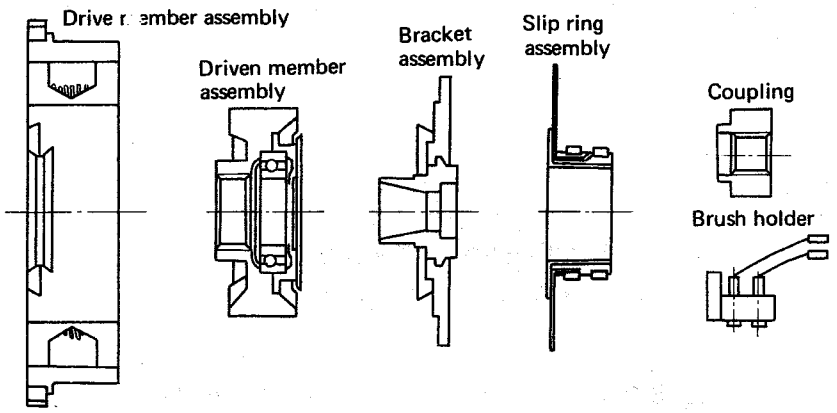


Fig. 7

(a) BRACKET ASSEMBLY

The bracket which is fixed to the drive member with the six bolts, is fitted on the crankshaft at the tapered section and transmits the power from the engine to the drive member.
The ball bearing is fitted on the bracket assembly and supports the driven member.
In order to prevent the magnetic flux from escaping, the bracket is made of die cast aluminium about the boss of carbon steel.

(b) DRIVE MEMBER ASSEMBLY

The drive member assembly transmits power from the bracket assembly through the powder to the driven member.
It contains an exciting coil and its outside portion forms a magnetic circuit for the magnetic flux induced by the exciting coil. The material is low carbon steel.
The inside surfaces of the drive member are plated with hard chrome of several decades microns in thickness for the purpose of improving their resistance to heat and wear.
The coil is vacuum-impregnated with epoxy resin containing silica for insulation and fixing to the drive member. This drive member functions also as a flywheel, and is equipped with an external ring gear and stamped with timing marks on the outside periphery.

(c) DRIVEN MEMBER ASSEMBLY

The driven member assembly transmits power from the drive member through the powder to the primary reduction gear of the transmission through the spline.
It is supported by the bearing on the bracket assembly.

The external periphery of the driven member assembly is chrome-plated in the same way as for the drive member and has several grooves to improve the release characteristic of the clutch (torque attenuation characteristic when the exciting current is switched off). Its outside portion is also a magnetic circuit and material is low carbon steel. The bearing is of the closed type and silicone grease is used from the viewpoint of heat resistance and prevention of leakage to the powder gap.

(d) SLIP RING ASSEMBLY

The slip ring assembly supplies electric current to the rotating coil by slipping the brushes. It is mounted on the bracket assembly with six screws and its two terminals are attached to the coil terminals of the driving member with screws.

(e) COUPLING

The coupling is fixed to the bracket with six screws and is connected to the shaft with its spline to drive the distributor and the generator.

(f) BRUSH HOLDER ASSEMBLY

Two carbon brushes contact with the slip ring and feed electric current to the coil. The brush holder assembly is fixed to the clutch housing cover with two bolts and the two lead wires are connected to the lead wires from the control box.

(g) FUNCTION OF LABYRINTH

One labyrinth is provided in the bracket assembly and two are provided in the drive member. The purpose of these labyrinths are to prevent the powder from leaking.

(h) TIGHTENING BOLT (6 mm, Length = 14 mm)

This bolt serves for transmission of power. Therefore, its material is high carbon steel treated so as to improve mechanical strength. For identification, it is stamped with "7T" on the head.

(i) POWDER

The powder is pulverized chrome steel of under 300 meshes in size and has excellent properties in magnetic performance, heat resistance, wear resistance and fluidity.
It does not vary its mechanical and magnetic properties even at high temperature of about 300°C (570°F).

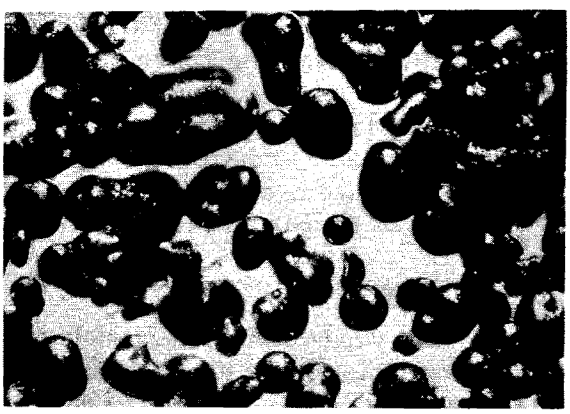


Fig. 8

C. PERFORMANCE

The three performances of the powder clutch will be explained.

(a) PERFORMANCE 1 (CURRENT-TORQUE CHARACTERISTIC)

The transmitted torque increases nearly in proportion to the current. As the resistance of the clutch coil increases with temperature, a torque of about 1.4 times the engine torque i.e. 4.5 kg-m, results at a current of 2.2 A when 12 V is applied in the hot. (Fig. 9)

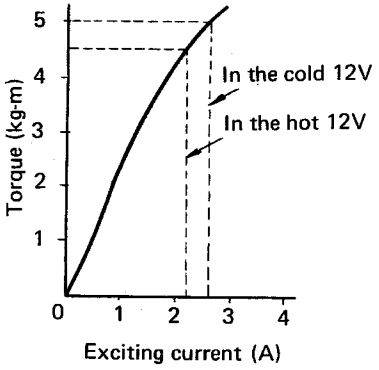


Fig. 9 Current-torque characteristic

Fig. 10 shows the slip characteristic. As apparent from the curves, the torque is nearly constant regardless of the slip and the speed of revolution, displaying an ideal constant-torque property.
This property is the greatest feature of the Electromagnetic clutch and freedom from shock when engaging or rotating vibration is to be attributed to this.

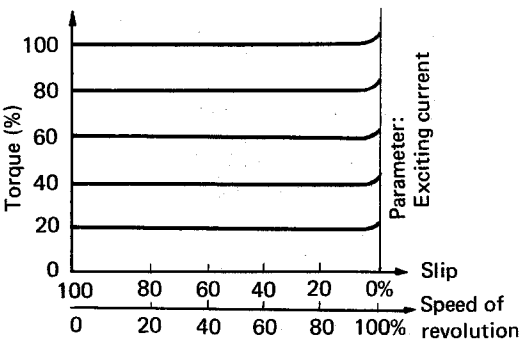


Fig. 10 Torque-slip characteristic

(b) PERFORMANCE 2 (Inverse exciting current-residual torque characteristic)

After the exciting current of the clutch has been completely cut, torque due to residual magnetism still remains. When inversely excited, the residual torque is reduced and attains the minimum at a current of about 70 mA, then increases again.
Hence, the control box allows an inverse exciting current of about 70 mA to flow when the clutch is disengaged. (Fig. 11)

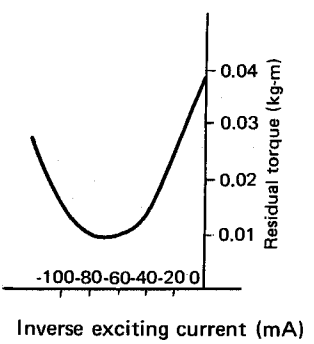


Fig. 11 Inverse exciting current -residual torque characteristic

(c) PERFORMANCE 3 (Transient characteristics of current and torque)

When the switch S is closed, the current rises according to a time constant determined by the inductance (L) and resistance (R) of the clutch coil and the torque rises also in almost the same proportion slightly later than that. It attenuates likewise slightly later than the current when the switch S is opened. (Fig. 12)

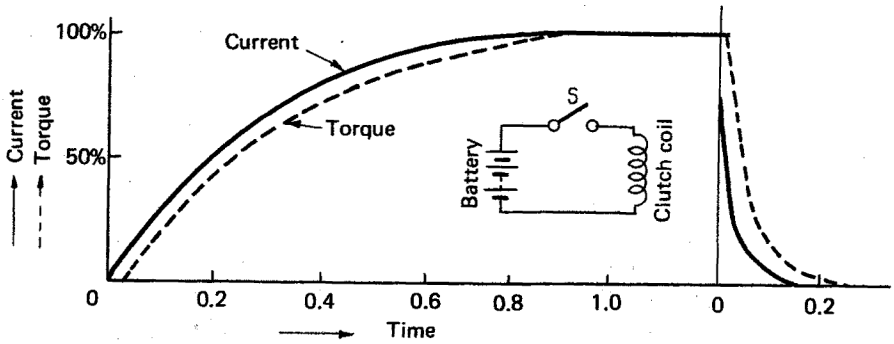


Fig. 12 Characteristics of current and torque

2. CONTROL CIRCUIT

A. OUTLINE OF THE CONTROL CIRCUIT

The parts illustrated in Fig. 2 are connected by the wiring harness to display of their functions. As for only the clutch, connections are as shown in Fig. 13.

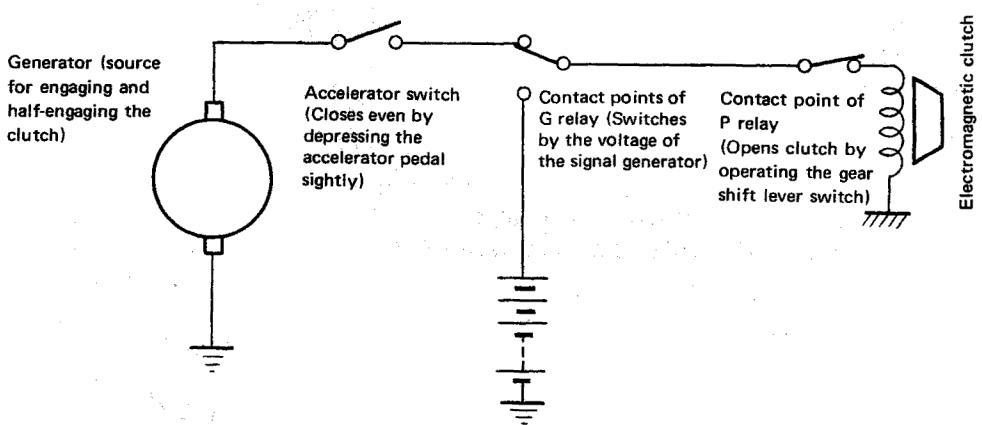


Fig. 13

The construction and operation of these control circuit elements will be explained:

B. ACCELERATOR PEDAL SWITCH

The accelerator pedal switch is turned on when the accelerator pedal is depressed and off when it is released. This switch is provided on the front bulk head and connected to the end of the accelerator pedal through the rod.

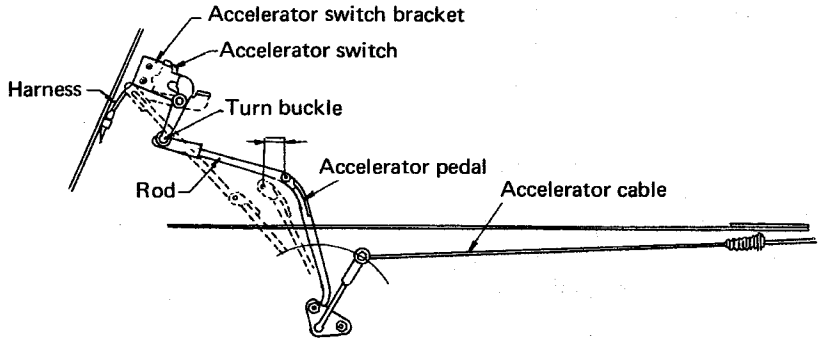


Fig. 14

C. DYNAMO CORRECTION

As described before, the electromagnetic clutch is capable of transmitting any torque by variation of the current.
Therefore, in order to engage the clutch without engine stop in starting or running at very low speeds, it is necessary to supply a proper current in accordance with the torque of the engine. For this purpose 360 Sedan Auto-clutch utilizes the simplest method of dynamo correction.

Fig. 15 shows the generated voltage as a function of the engine speed. In order to attain the clutch transmitting torque suitable to the engine torque as shown in Fig. 16, self-excited and separately excited resistances are inserted in the field coil as shown in Fig. 17 to vary the generated voltage as shown in Fig. 15. Application of the modified voltage to the clutch permits smooth clutch engaging. This method is called "dynamo correction". The correcting resistances lie in the control box.

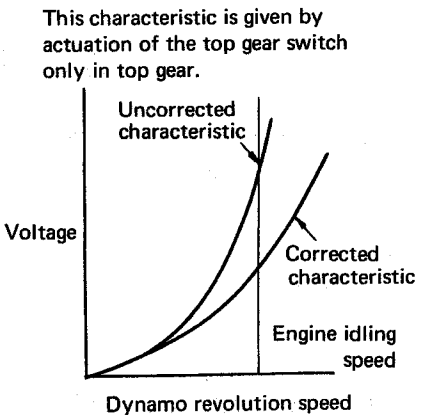


Fig. 15

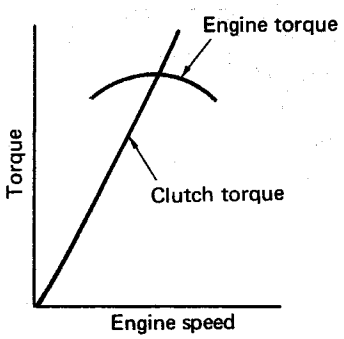


Fig. 16

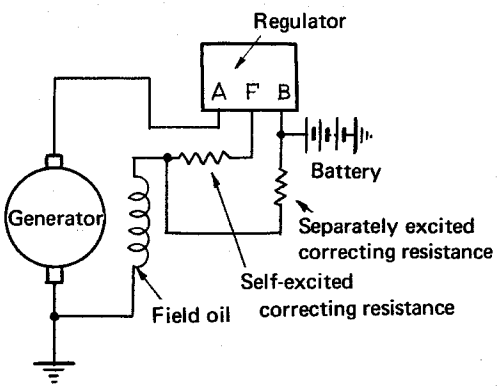


Fig. 17

D. SIGNAL GENERATOR AND G-RELAY

While running at low speed where the exciting current is being supplied from the generator, the clutch does not transmit the maximum torque of the engine, but slips.
The generator cannot supply the voltage to other parts than the clutch, as its excitation is corrected. It is necessary for these two reasons to connect the clutch directly to the battery to short-circuit the dynamo correcting resistances, when the vehicle reaches a certain speed.
This operation is undertaken by the signal generator and the G-relay in the control box.

(a) Signal generator

This is a small-sized generator of the rotary magnet type and attached to the transmission case. It generates voltages in proportion to the vehicle speed.
As shown in Fig. 18, this signal generator consists of a stator and a rotor. The stator is formed as a housing of aluminium in which a coil is provided, and attached to the transmission case with the three bolts.
The rotor is a small-sized eight-pole permanent magnet and its shaft is supported by metals at both ends.
The end of the shaft on the transmission side is formed as a pawl and driven by the main shaft.

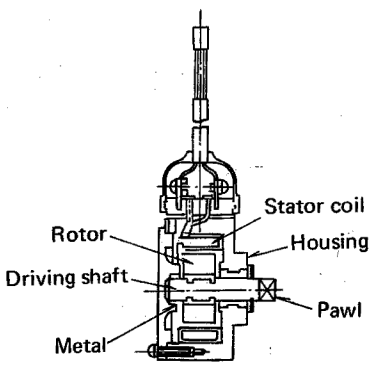


Fig. 18 Signal generator

SPECIFICATION OF THE SIGNAL GENERATOR

Generated voltage		6.6 ± 0.2 V at 600 rpm
Housing spigot		30 mm $^{-0.040}_{-0.092}$ (1.1811 $^{-0.0016}_{-0.0036}$ in)
Width of pawl		4 mm $^{-0.04}_{-0.07}$ (0.1575 $^{-0.0016}_{-0.0028}$ in)
Diameter of bearing system	Shaft	10 mm $^{-0.025}_{-0.047}$ (0.3937 $^{-0.0010}_{-0.0018}$ in)
	Metal	10 mm $^{+0.022}_{-0}$ (0.3937 $^{+0.0009}_{-0}$ in)

(b) Operation of G-relay

The relay located on the left side in the control box (seen with the wiring harness down) is called G-relay and has three contacts. These contact points serve, respectively, for:

1) Changing dynamo excitation and battery excitation (Fig. 19).

2) Introducing and removing the dynamo correcting resistances (Fig. 20).
The G-coil lies in an exciting circuit as shown in Fig. 21 and operates in the same way as a cut-out relay.
Change the contacts in accordance with the voltage of the signal generator.

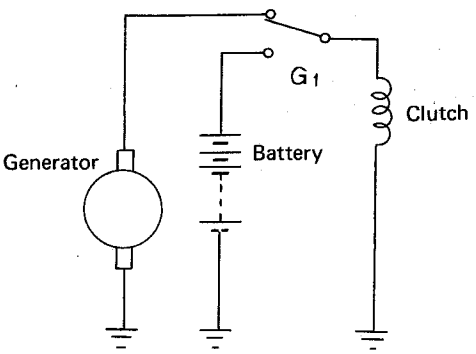


Fig. 19

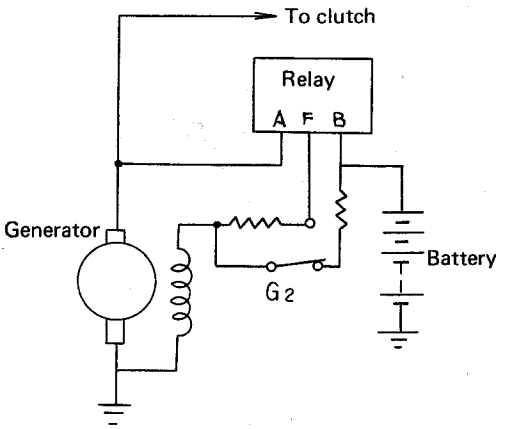


Fig. 20

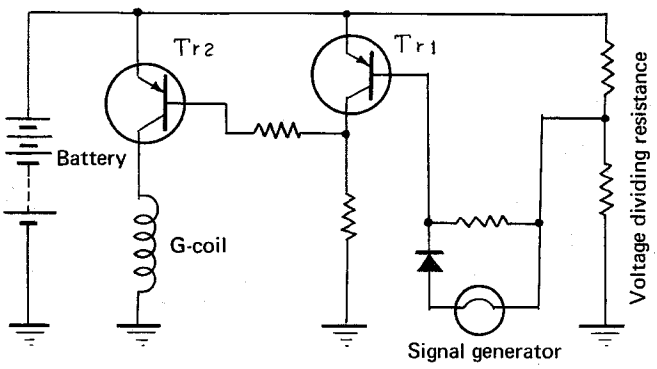


Fig. 21

G-relay	Car speed	Voltage of signal generator	Source of clutch exciting power source	Generator
ON	17 - 20 km/h (11 - 12 mph)	7.3 - 8.6 V	Battery	Normal
OFF	15 - 18 km/h (9 - 11 mph)	6.4 - 7.7 V	Generator	correcting (Not charging)

E. GEAR SHIFT LEVER AND P-RELAY

While the gear shift lever has only to shift the transmission in the vehicle with mechanical clutch, it must also function to disengage the clutch in case of the vehicle with auto-clutch, as there is no clutch pedal. This function is undertaken by the contact built in the knob and the P-relay in the control box.

(a) Gear shift lever

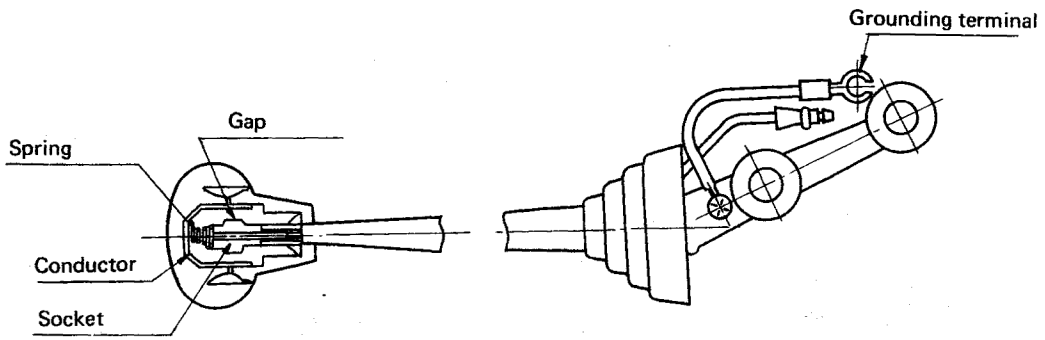


Fig. 22

As shown in Fig. 22, the knob has built-in contact. The outer contact is grounded when the knob is tilted.
They must keep the circuit open while the knob is free and be sure to close it with a side pressure of under 1.5 kg (3.3 lb.) on the knob.

(b) Operation of P-relay

The circuit of the P-relay in the control box is so arranged that the P-relay is excited to change over the contacts P1 and P2 when the contact in the gear shift lever knob is closed. To the clutch flows the current through the resistance R and P1 and P2. With this, inverse current is given to minimize the residual torque of the clutch, as shown in Fig. 25, thus facilitating the speed change operation.

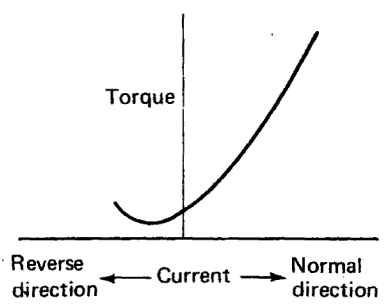


Fig. 23

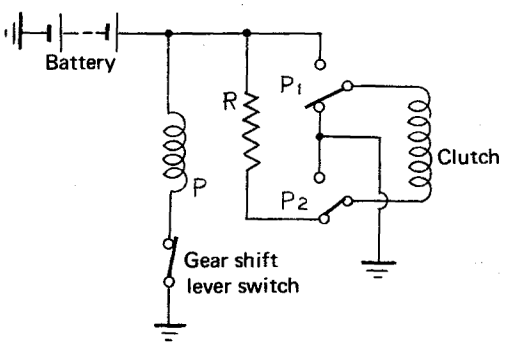


Fig. 24

F. EMERGENCY SWITCH

The emergency switch is formed as a push button and fitted on the center of the instrument panel.
It is turned on by pushing and off by releasing.
When this button is pushed, the G-relay in the control box is excited and the clutch is energized directly from the battery to come into perfect engagement.

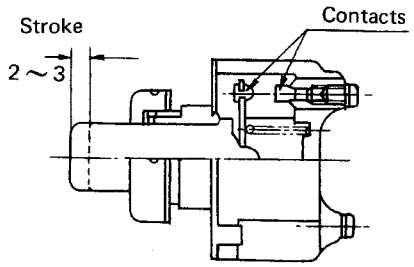


Fig. 25

G. TOP GEAR SWITCH AND ITS FUNCTION

As the auto-clutch is reduced in life by starting in top gear or running at low speed for a long period, a circuit for preventing overheat of the clutch by using a top gear switch is provided.
The circuit of the top gear switch is so arranged as to avoid dynamo correction (insertion of the resistance in series with the field coil) only when the gear is shifted into the top gear position.

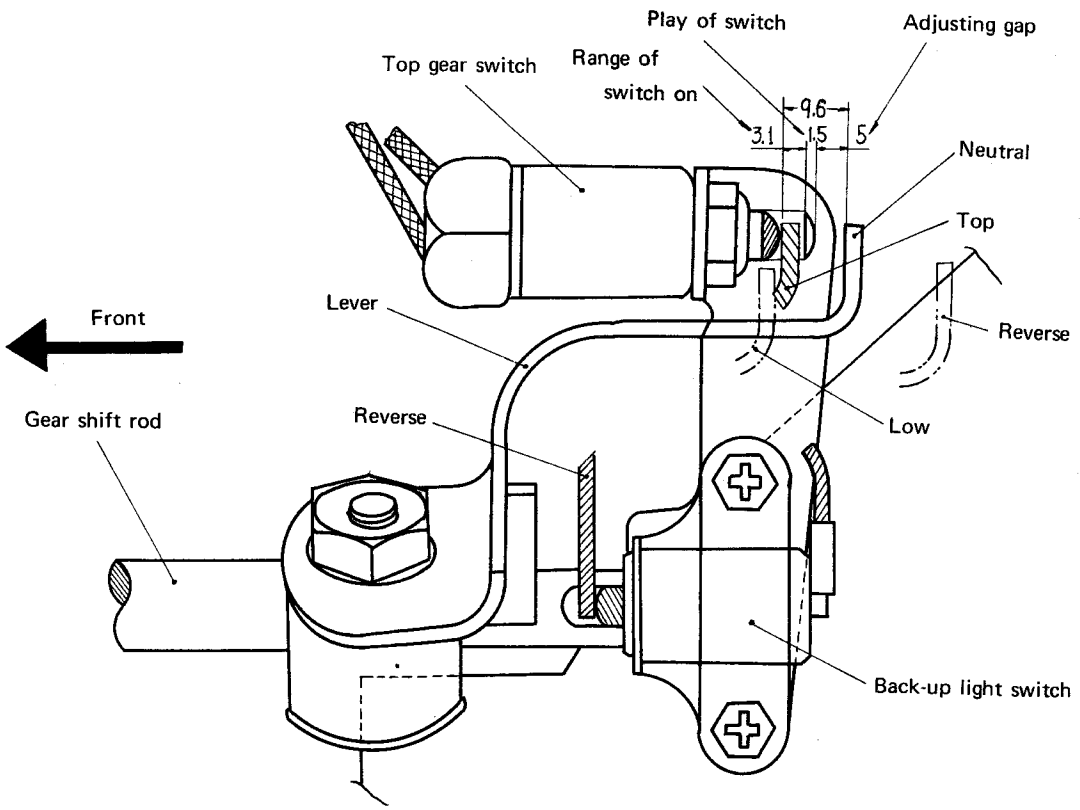


Fig. 26

As shown in Fig. 26, the top gear switch is mounted on the transmission case and adjusted so as to turn on only in top gear by means of a lever which moves with the gear shift rod.

H. CONTROL BOX

The control box comprises the relays mentioned above.
Its appearance and inside circuit are shown in Fig. 27 and Fig. 28, respectively.

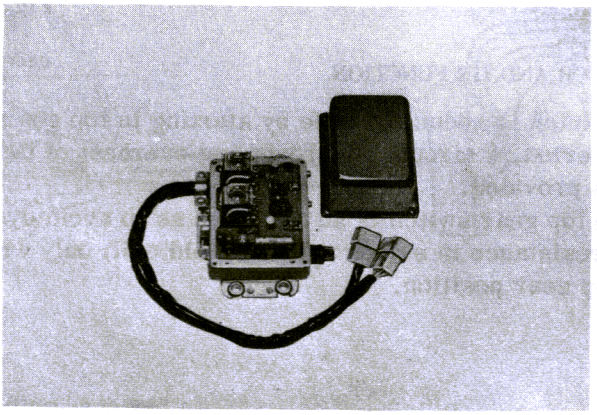
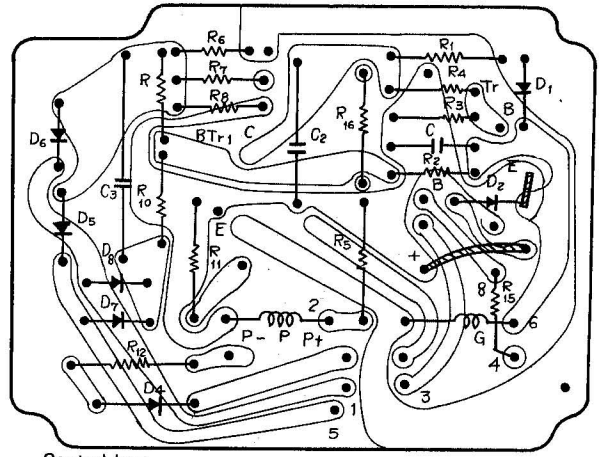


Fig. 27

Back of the control box (terminal marks as same Fig. 55)



Elements and connections of auto-clutch

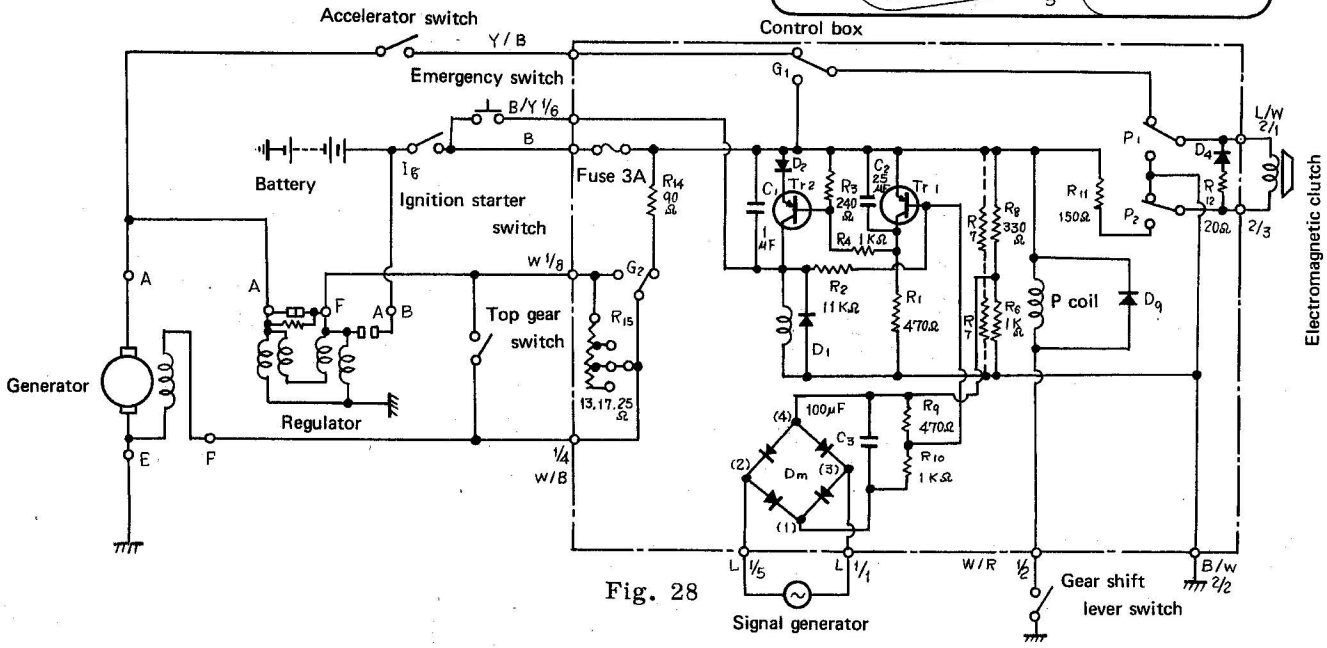


Fig. 28

CHAPTER 3 MAINTENANCE

1. REMOVAL AND INSTALLATION OF THE AUTO-CUTCH PARTS

The operations mentioned in this section can be accomplished without removing the engine from the body.

A. REMOVING THE CLUTCH ASSEMBLY (INCLUDING REMOVING THE BRUSH ASSEMBLY).

(a) Removing of the battery grounding band

Open the front hood and remove the 6 mm nut to disconnect the battery grounding band.

(b) Removing the engine room under cover

Remove the 8 mm bolt (holding together the under cover and the diagonal member) and the four 6 mm bolts to detach the under cover.

(c) Removing the generator

Loosen the three 8 mm bolts and remove the V-belt (generator). Then remove the three 8 mm bolts to detach the generator.

(d) Removing the clutch housing cover

(1) Remove both spark plug caps and pull out the high tension cord from the ignition coil. Then remove the primary wire from the distributor.

(2) Remove the 8 mm bolt and the five 6 mm bolts.

(3) Disconnect the two lead wires of the brush assembly from the wiring harness. Pull up the plug from the clutch housing cover so that the brush can be seen. When the lead wire has been carefully pulled out, the two brushes may be separated from the brush springs and they will be released from the slip ring of the clutch assembly. If the lead wire is pulled too strongly, the brush may jumped out. In this case, difficulties will be created in setting the brush. Therefore, special care should be taken.

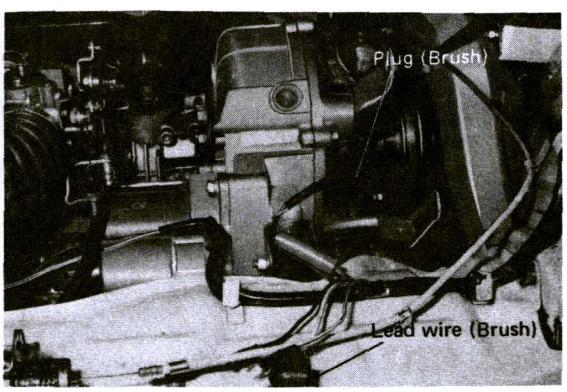


Fig. 29

(4) Remove the clutch housing cover, with the distributor and generator pulley attached. If the clutch housing cover cannot be removed easily, remove while tapping arround the fitting section uniformly with a mallet.

(e) Removing the coupling

SPECIAL TOOL	Of 899610100, 899610101 & 899610102 × 2 Of 899520120, 899521402

Remove the six 5 mm socket bolts to detach the coupling. If the coupling cannot be removed easily, pull out by using the special tool mentioned above.

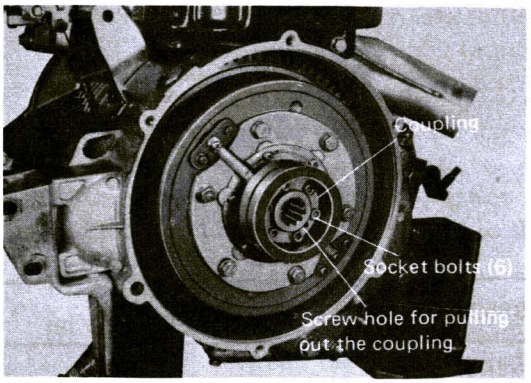


Fig. 30

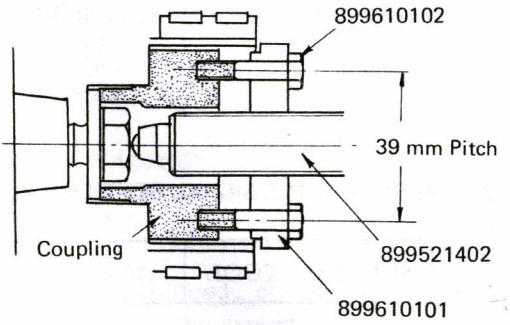


Fig. 31

(f) Removing the clutch assembly

SPECIAL TOOL	Of 899610100, 899610101, 899610102 × 3 & 899610103 Of 899520120, 899521402

(1) Insert 899610103 between the ignition timing inspection hole of the clutch housing and clutch assembly.
Next, mesh the notch of 899610103 with the ring gear of the clutch assembly, and then insert a driver into the 10 mm hole of 899610103 through the inspection hole to stop the rotation of the clutch assembly.

(2) Loosen the clutch installation bolt.

(3) Install 899610101 to the clutch assembly with the three 899610102 with coupling installation screw holes use.

(4) Then, screw in 899521402 to detach the clutch assembly from the crankshaft.

(5) Remove the clutch installation nut and pull out the clutch assembly.

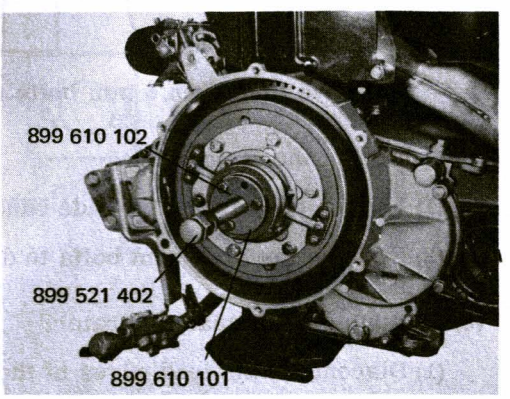


Fig. 32

(g) Removing the brush assembly.

To remove the brush assembly from the clutch housing cover, remove the two 4 mm screws.
Remove the two 4 mm nuts of the lead wire and separate the lead wire and the brush assembly.

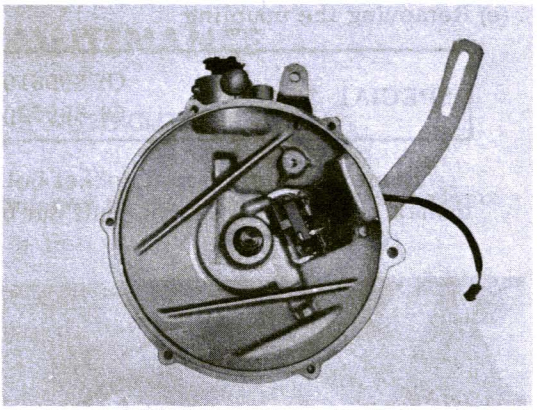


Fig. 33

B. BEMOVING THE SIGNAL GENERATOR

SPECIAL TOOL	Of 899520120, 899520101, 899521402, 899521404

(a) Removing the lower duct

(1) Remove the band (boot) and detach the bolt (duct).

(2) Remove the 6 mm bolts to detach the lower duct.

(b) Removing the fan.

(1) Remove the three 4 mm screws to remove the spinner (fan).

(2) After loosening the 14 mm nut tightening the fan, pull out the fan with 899520120.

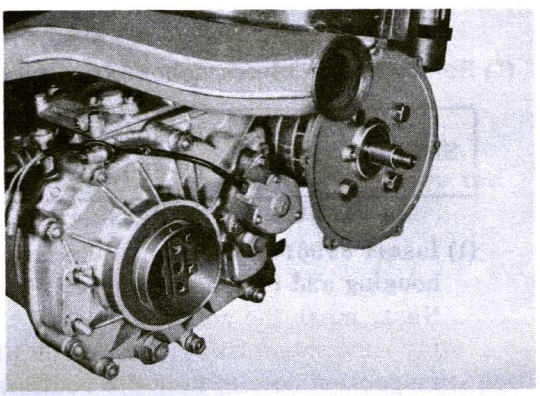


Fig. 34

(c) Removing the air duct

Remove the seven 6 mm bolts to detach the air duct.

(d) Removing the fan cover

(1) Loosen the carburetor side band of the air cleaner hose.

(2) Remove the six 6 mm bolts to detach the fan cover.

(e) Removing the signal generator.

(1) Disconnect the lead wires of the signal generator.

(2) Remove the three 5 mm bolts and then remove the signal generator from the transmission case.

C. REINSTALLING THE CLUTCH ASSEMBLY

(a) Inspection before reinstallation.

(1) Carefully clean the brush sliding surface on the slip ring with a dry cloth.

(2) Carefully clean the spline portion of the driven member with a dry cloth.

(3) Carefully clean the spline portion of the coupling with a dry cloth.

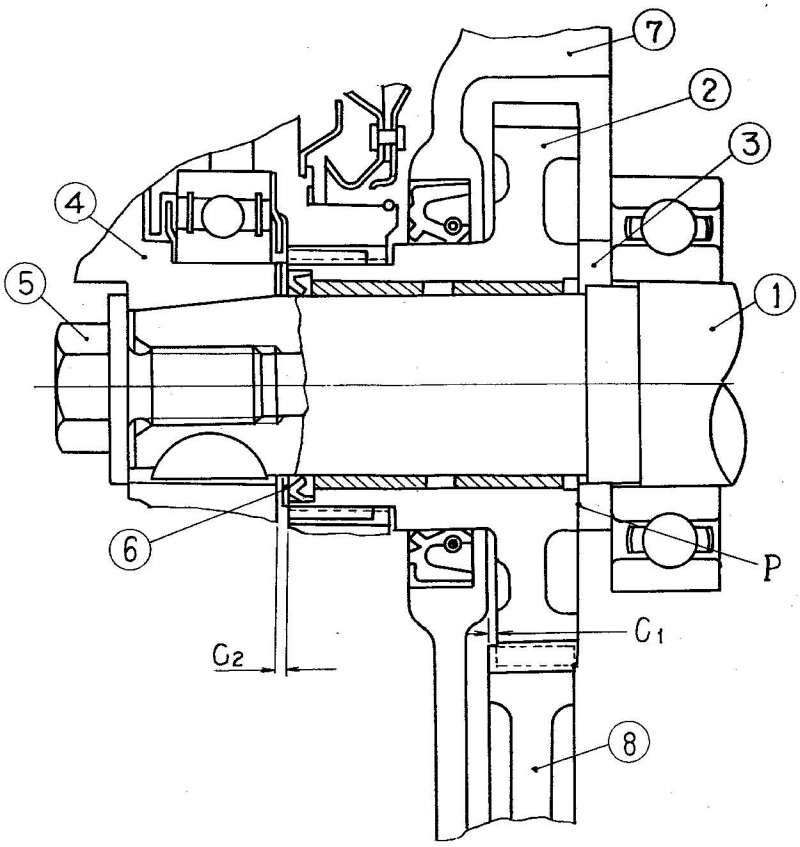
(NOTE) Do not apply a grease to the spline portion of the coupling. If apply, may penetrate into the clutch causing the insufficient disengagement of the clutch.

If the brush wear exceeds the useable limit line, replace it with a new one.

(4) Carefully clean the spline portion of the distributor drive shaft with a dry cloth. Do not apply a grease to this spline portion.

(5) Carefully clean the brush.

(6) When the clutch assembly or primary pinion is replaced, check the clearance "C" between the primary reduction pinion and the clutch. If necessary, select the washer and spacer in the following order.



① Crankshaft
② Primary reduction pinion
③ Spacer (Primary reduction pinion)
④ Clutch assembly
⑤ Bolt (12 × 20 × 20)
⑥ Washer (27 ×36 ×0.5 - 1.2)
⑦ Clutch housing
⑧ Primary reduction gear

Fig. 35

(6-1) Selecting the spacer (Primary Reduction pinion) ③
Select the spacer so that the height "H" is less than 0.2 mm. (0.0079 in)
Thickness of the spacer : 3.6 mm (0.1417 in)
3.8 mm (0.1496 in)
4.0 mm (0.1575 in)

(6-2) Selecting the washer ⑥
Fit the clutch assembly ④ on the crankshaft with the bolt ⑤.
(Tightening torque: 6.0 kg-m or 43.4 lb-ft)
Select the washer ⑥ so that the clearance "C" is 0.2 - 0.35 mm (0.0079 - 0.0138 in).
Thickness of the washer : 0.5 mm (0.0197 in)
0.7 mm (0.0276 in)
0.8 mm (0.0315 in)
0.9 mm (0.0354 in)
1.0 mm (0.0394 in)
1.1 mm (0.0433 in)
1.2 mm (0.0472 in)
The clearance "C" can be measured as follows:
* When the clutch housing cover is detached; measure the clearance "P" between the primary reduction pinion and spacer with a thickness gauge.
* When the clutch housing cover is attached;
Place the fuse wire between the primary reduction pinion and clutch assembly and tighten the bolt ⑤ with the specified torque.
Measure the thickness of the fuse wire after removing the clutch assembly.

b) Precaution

(1) When handling the clutch assembly and brush assembly, utmost care should be taken to clean off all grease and the like. Benches and hands should be kept clean and dry.

(2) The clutch assembly should be handled with care and shocks should be avoided.

c) Installation

Installation may be done in the reverse sequence of the removal, however special care should be taken to the items mentioned in the following.

(1) The tightening torque of the clutch installation bolt is 5.7 to 6.2 kg-m (41.2 - 44.8 lb-ft.)

(2) When installing the clutch housing cover, always lift up the brush before installation.
Otherwise, the brush may be damaged when it bump against the slip ring.

(3) After installing the clutch assembly, start the engine and lightly, two or three times, step on the accelerator pedal with the lead wire of the clutch remaining disconnected. This operation makes it possible to uniformly spread the powder.

D. INSTALLING THE SIGNAL GENERATOR

Install the signal generator to the transmission case through the gasket. Properly fit the projection on the end of the signal generator armature to the groove at the end of the transmission main shaft.
After confirming the fitting condition by turning the signal generator body two or three times, fit the signal generator to the transmission case with the three 5 mm bolts.

E. ADJUSTMENT STANDARD TABLE

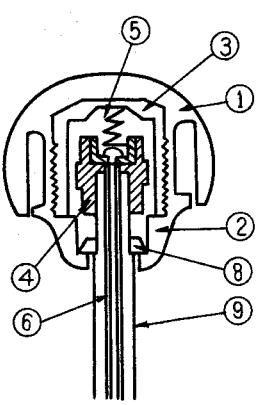
Item	Standard	Limit
Brush spring load	0.32 - 0.38 kg (0.71 - 0.84 lb)	—
Brush length	19 mm (0.75 in)	13 mm (0.51 in)
Clearance between the drive member boss and primary pinion	0.20 - 0.35 mm (0.0079 - 0.0138 in)	—
Backlash of drive member spline	0.54 - 0.148 mm (0.0021 - 0.0058 in)	0.5 mm (0.0197 in)
Backlash of distributor drive shaft spline	0.118 - 0.206 mm (0.0046 - 0.0081 in)	0.5 mm (0.0197 in)

2. INSPECTION AND ADJUSTMENT OF CIRCUIT PARTS

The auto-clutch vehicle is equipped with various equipment, such as the control box, signal generator, accelerator pedal switch, gear shift lever switch etc., by which the clutch operates automatically.
Therefore, when any one of these are defective, or when there is only one disconnection, the vehicle cannot only display its maximum performance but also operate at all. When repairing the vehicle, special care should be directed to handling of various portions.

A. INSPECTION OF THE GEAR SHIFT LEVER SWITCH

If the switch gets out of order, the operations such as disengaging the clutch, starting the vehicle, etc. will be impossible.



① Knob (upper)
② Knob (lower)
③ Movable contact point
④ Fixed contact point
⑤ Spring
⑥ Lead wire
⑦ Gear shift lever
⑧ Stopper

Fig. 36

(1) When checking if the gear shift lever switch operates electrically, disconnect the connector (8P) which combines the control box with the body harness, and then connect a circuit checking device such as an electric tester between the connector terminal (1/2) (wiring color; white/red) at the body harness side and the ground to measure resistance.
Normal resistance indicates $\infty\Omega$ when the gear shift lever knob is not operated. Check if resistance is approximately 0Ω when the gear shift lever knob is inclined. When these test are repeated two or three times, and $\infty\Omega$ and 0Ω are securely indicated in every test, the gear shift lever switch will be normal electrically. If 0Ω or accuracy is not indicated, this may means defective contact in the wiring system or switch interior, therefore remove the boot (gear shift lever), and then disconnect the wiring of the gear shift lever from the body harness to measure conductivity of the harness.

(2) When it is considered that the switch interior is defective, turn the upper and lower portions of the knob counterclockwise to disassemble.
In this case, take care not to lose the spring inside the switch.
When disassembling, check the following points.
Connection between the knob (upper) and movable contact point ③.
* Whether the spring is normal or not.
* Each contact surface between movable contact point ③ and fixed contact point ④. If there is considerable black dirt, polish lightly with a fine sand paper.
* Conductivity of leading wire.

INSPECTION AND ADJUSTMENT OF THE ACCELERATOR PEDAL SWITCH

If this switch is defective or adjustment is improper, it will cause troubles entioned below.

(1) The vehicle does not start.

(2) The vehicles does not start smoothly.

(3) Car-knocking occurs frequently.

(4) The vehicle starts of itself.

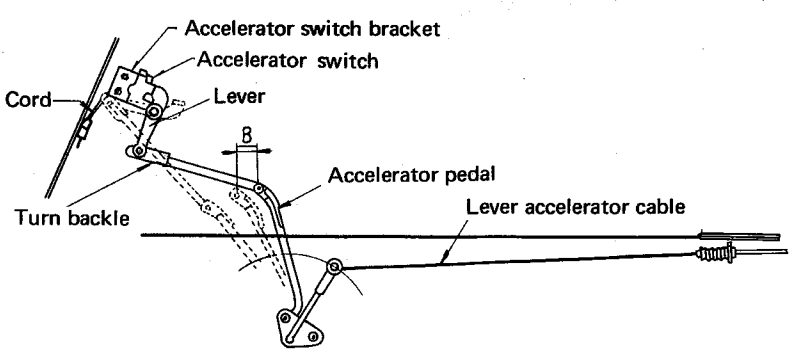


Fig. 37

(a) Checking method.

(1) Disconnect the connector (8P) connecting harness of control box to the body harness, and connect an electric tester or circuit checking device between the connector terminal (1/3) (wiring color; yellow/black) of the body harness and the ground to measure the conductivity.
Normal resistance shows $\infty\Omega$ when the accelerator pedal is not depressed.
When the accelerator pedal is depressed, if the pointer of the electric tester indicates immediately approximately 0 - 2 Ω, the switch is normal.

(2) When the test result is different from the above mentioned values, disconnect the lead wire from the accelerator switch assembly and check the switch unit and body wiring harness with the electric tester in the same way as above.

(b) Adjusting method.

(1) Remove the cotter pin and pin at the end of the lever (or accelerator pedal) to disconnect the rod from the lever or accelerator pedal.

(2) Check if the accelerator pedal is in the normal return position in the above condition.

(3) Push the lever toward the front bulkhead and release the hand from the lever. Check if the lever stops with a faint clicking sound from the switch.
Or, connect an electric tester in the same manner as (a) - (1).
Check if the resistance changes to $\infty\Omega$ from 0Ω when the lever comes in contact with the switch. In this case, lever should be moved slowly.

(4) Hold the lever so that it contacts with the switch.
Then, turn and adjust the turn buckle so that the holes of the lever (or accelerator pedal) matches with the hole of the turn buckle.

(5) Confirm that the switch operates normally within a range of 5-6 mm (0.2 in) when depressing the accelerator pedal. In this case, the electric tester shows 0Ω when the pedal is not depressed and it shows $\infty\Omega$ when the pedal is depressed.

(6) Adjust the accelerator cable length at the carburetor side so that the carburetor throttle valve starts to open when the accelerator pedal is depressed and the switch is turned on.

C. INSPECTION OF THE TOP GEAR SWITCH

When the vehicle is running at the speed of 20 km/h (12 mph) or less in the 3rd gear position, the top gear switch will operate to avoid the clutch slipping.

(a) Circuit

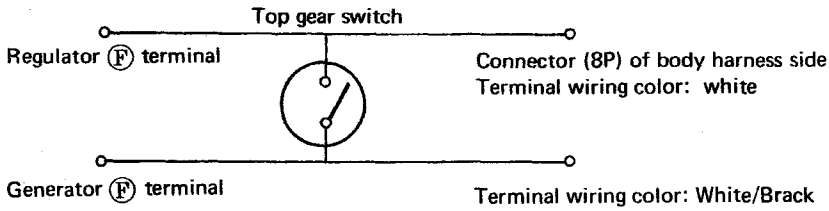


Fig. 38

(b) Checking method

(1) Disconnect the wiring harness of the control box from the body harness, and connect an electric tester between the terminals (1/8) and (1/4) of the connector (8P) of the body harness.
Then, measure the resistance.

(2) The resistance should be 0Ω when the gear shift lever is in the 3rd gear position and it should be approximately 4Ω when in the other positions.

(3) If the resistance is not 0Ω in the 3rd gear position or 4Ω in the other positions, the switch is damaged; connection of the harness is poor or the lever adjustment is improper (See Fig. 26).

(4) When inspecting the switch, connect an electric tester between the switch terminals and measure the resistance. The normal resistance is 0Ω when pushing the switch button in 1.5 mm (0.06 in) or more and is ∞Ω when releasing the button.

(c) Adjusting the lever (See Fig. 26.)

(1) Remove the right side trap door on the rear bulkhead and check if the switch can be pushed in 4.6 mm (0.18 in) when the gear shift lever is in the 3rd position.
If not, adjust by bending the lever or by shifting the switch position. Then, make sure that the lever does not contact with the top gear switch when shifting the gear shift lever into the first gear position.

(2) Then, confirm that the back-up light switch is pushed by the lever (back-up light switch) in the reverse gear position only.

D. CHECKING METHOD OF THE CLUTCH CIRCUIT AND THE MEASURING METHOD OF THE CURRENT THROUGH THE CLUTCH CIRCUIT.

(a) Clutch circuit

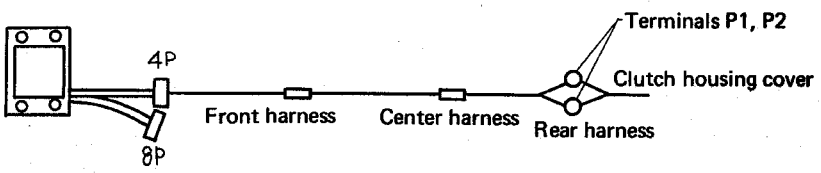


Fig. 39

(b) Checking method

(1) Disconnect the control box harness from the body harness at the connector (4P) and connect on electric tester between the terminals (2/1) (wiring color: blue/white) and (2/3) (wiring color: blue/white) of the body harness side connector. Then, measure the resistance.

(2) The resistance should be 4 - 5 Ω before starting the engine and at a temperature of 20°C (68°F).
On the other hand, it should be 5 - 7 Ω during or immediately after running the engine.

(NOTE) As the measured resistance value includes the contact resistance between the brush and slip ring surface of the clutch, clutch coil resistance, etc. the resistance is increased if the slip ring surface is dirty.

(3) When the resistance is not 4 - 7 Ω, or when it is not unstable, check the body harness, or remove the clutch housing cover for interior check.

(c) Clutch current measuring method

(1) Disconnect the one side brush lead wire from the body harness and connect an ammeter (DC 3A) between the terminals of the body harness and brush lead wire to measure the current flowing through the clutch coil.

(2) Turn the ignition-starter switch one step (do not start the engine) and operate the gear shift lever switch for checking direction of the pointer deflection of ammeter.

(3) If the pointer of the ammeter deflects in the plus direction, reversely connect the terminals of the ammeter.

(NOTE) When the gear shift lever switch is operated, current flows in the reverse direction of the clutch current.

(4) Shift the gear shift lever into the neutral position and start the engine. When depressing the accelerator pedal, the current flows through this circuit.
This current is called the clutch current.
The clutch current increases in proportion to the engine speed up to a certain speed, but it is almost constant when the engine speed exceeds above speed.

E. CHECKING METHOD OF THE EMERGENCY SWITCH CIRCUIT

With employment of the emergency switch, clutch can be engaged even with the engine not running.
Therefore it is usable when the engine does not start due to a dead battery. As long as this switch is pushed, the clutch will be engage, whereas when releasing the switch, it will be disengaged.

(a) Emergency switch circuit

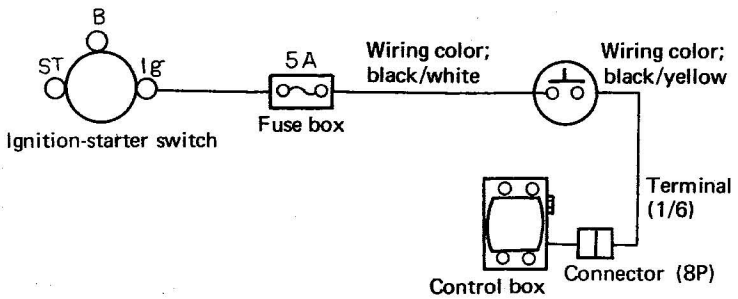


Fig. 40

(b) Checking method

(1) Disconnect the harness of the control box from the body harness, and then connect an electric tester or a volt meter (DC. 15V) between the body harness connector terminal (1/6) (wiring color; black/yellow) and ground. Turn the ignition-starter switch one step (do not start the engine) and measure the voltage.

(2) When the switch is not pushed, normal voltage is OV.

(3) When switch is pushed, normal voltage is approximately 12.5 V.

(4) Or connect the connectors of the control box harness and body harness and turn the ignition-starter switch one step.
Then, make sure that the clicking sound is heard from the control box relay when the switch is pushed.

3. DISASSEMBLY AND REASSEMBLY OF THE CLUTCH

A. DISASSEMBLING THE CLUTCH

(PRECAUTIONS)

(1) Keep the benches, tools and hands clean and dry.

(2) Utmost care should be take to clean off grease and oil.

(3) Be careful not to damage the plated surface.

(a) Disassembling the clutch assembly

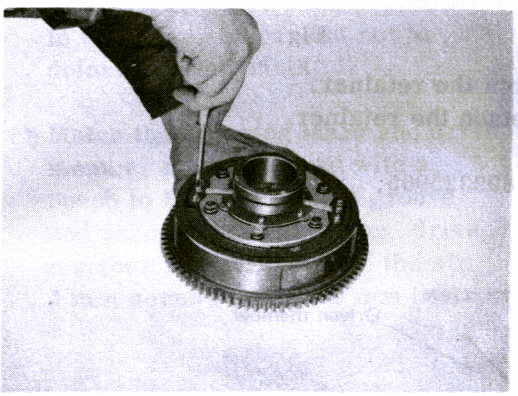


Fig. 41

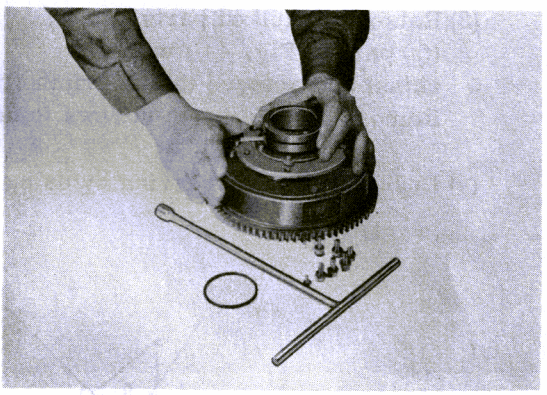


Fig. 42

(1) Remove the "O" ring from the driven member and remove the two 4 mm screws to detach the slip ring terminals from the drive member. (See Fig. 41)

(2) Remove the six 6 mm bolts and pull up the bracket assembly with the driven member assembly attached. (See Fig. 42)

(b) Inspection

(1) If oil, water or dust enters into the gap between the drive member and driven member, repair the damaged portions and replace the powder with a new one. Especially check the outer and inner oil seals of the primary reduction pinion for damage.

(2) If the ball bearing is noisy or does not rotate lightly, replace with a new one.

(c) Removing the ball bearing

SPECIAL TOOL	899325900 (consists of 899325901, 899325904 & 899325905)

(1) Remove the six 4 mm screws and detach the slip ring from the bracket assembly.

(2) Secure 899325901 to the driven member and place the 899325904 on the center of the bracket.
Then, press the 899325904 and remove the bracket from the driven member assembly.
(See Fig. 43)

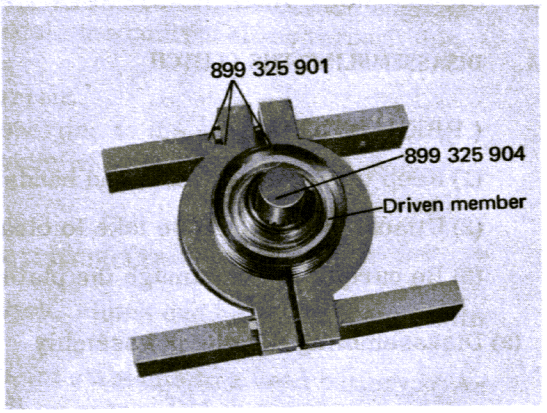


Fig. 43

(3) Raise the caulked parts (ⓐ part in Fig. 44) with a chisel and remove the labyrinth from the retainer.
Remove the six 4 mm screws to detach the retainer.

(4) Push out the ball bearing by using 899325905.

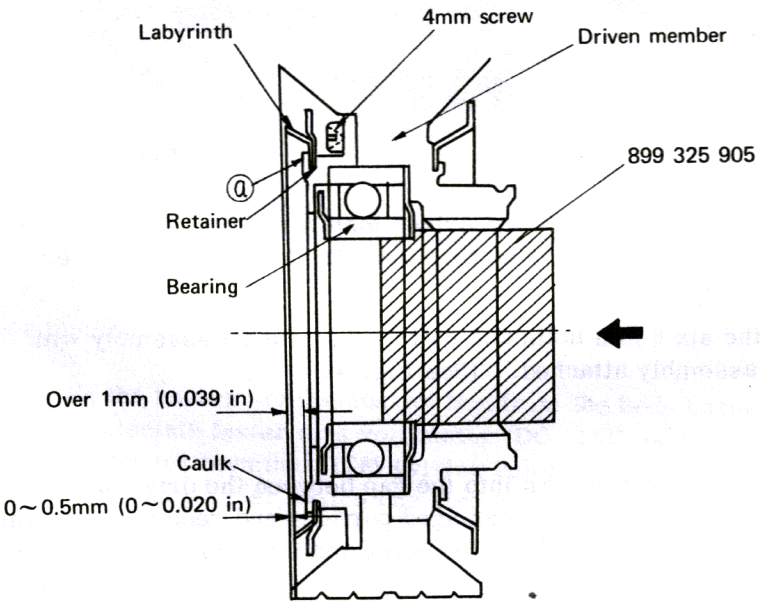


Fig. 44

3. REASSEMBLING THE CLUTCH

Reassembly is performed in the reverse sequence of disassembly.

(a) Clean the all parts except the bearing with new benzine and dry tehm completely.

(b) Put in the powder uniformly around the outer labyrinth part of the drive member.
If spilling the powder, do not collect it but replace with a new one.

(c) Fit the ball bearing into the driven member by using 899325905 and attach the new retainer with the six 4 mm screws.
Then, place the new labyrinth on the retainer and caulk it as shown in Fig. 44.
In this case, be careful not to deform the labyrinth.

(d) Match the slip ring mark and drive member mark stamped with a punch to the bracket key groove and assemble the slip ring, drive member and bracket with the six 4 mm screws and six 6 mm bolts.

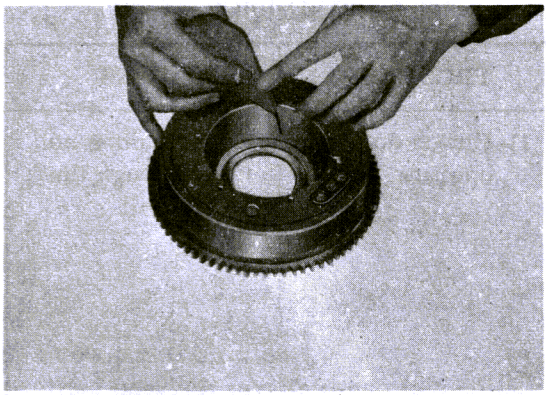


Fig. 45

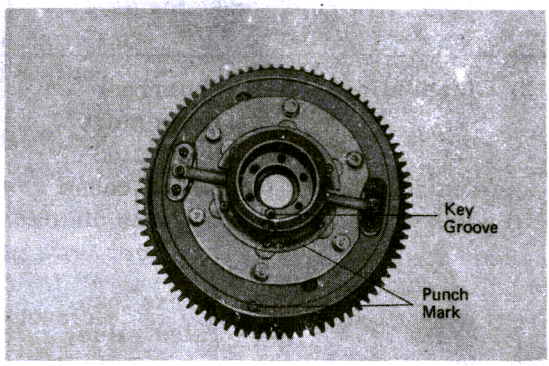


Fig. 46

TIGHTENING TORQUE OF 6 mm BOLT	0.8 - 1.0 kg-m (5.8 - 7.2 lb-ft)

Then, match the coupling mark to the clutch mark mentioned above and secure the coupling to the clutch with the six 5 mm socket bolts.

TIGHTENING TORQUE	0.5 - 0.6 kg-m (3.6 - 4.3 lb-ft)

(NOTE) After assembling, do not turn the clutch assembly upside down or do not shock it.

(e) Install the clutch assembly on the engine with the 12 mm bolt.

TIGHTENING TORQUE	5.7 - 6.2 kg-m (41.2 - 44.8 lb-ft)

(1) Spread the powder uniformly by starting the engine and lightly stepping the accelerator pedal two or three times with the lead wire of the clutch remaining disconnected.

(2) Then, reduce the exciting current to 0.5 - 1.0 ampere connecting a 2 - 4 Ω resistance to the clutch coil in series and twenty times, repeat alternately such operations as turn on the gear shift lever switch in five seconds and turn off it in ten seconds.

C. TROUBLE AND REMIDIES

TROUBLES	CAUSES	INSPECTION & REMIDIES
1) Clutch does not operate	Current does not flow through the clutch coil	(1) Check the resistance or insulation of the clutch coil. If it is not normal, replace with a new one. (2) Check the surface of the slip ring. If it is dirty, clean. (3) Check the lead wires to the battery, control box and brush. If the wires are broken, repair. If terminals are loosend, retighten. If contact is poor, correct.
2) Clutch slips	(1) If current flows more than rated value, cause is in the clutch interior. (2) If less than rated value, cause is in the other parts.	(1) In this case, disassemble the clutch and check the interior parts. (2-1) Check the resistance or insulation of the clutch coil. If it is not normal, replace with a new one. (2-2) Check the terminal for looseness or contact. If it is loosend or poor, retighten or correct. (2-3) Check the surface of the slip ring. If dirty, clean. (2-4) Check the length of the brush. If it exceeds limit, replace with a new one.
3) Clutch does not disengage fully	(1) Oil enters into the powder gap. (2) Insufficient grease in ball bearing. (3) Interference of labyrinth.	Disassemble the clutch and check the interior parts.

4. CHECKING THE CONTROL BOX

A. CHECKING AND RELACING THE FUSE

The vehicle is able to drive even with blown fuse of the control box, but the following failures will result:

(a) No engine braking functions at all.

(b) Charging is insufficient.

Check the fuse and replace it with a new one if blow out.
The fuse is 3A. Be sure to use a specified one. If larger capacity fuse is used, the inner elements of the control box would be likely to be burnt.
When the fuse is blown out soon after replacement, something will be wrong with the wiring harness or the clutch.
Check them, especially for earthing failure.

B. CHECKING AND REPLACING THE TRANSISTOR

When stopping the vehicle, if the clutch is not disengaged and the engine stops with vibrations of the body, check the transistor in the control box and replace it with a new one if defective in the following way:
Remove the transistor Tr_2, shown in Fig. 47 "Plane view of control box", using a soldering iron. Proceed this as fast as possible, so that it does not damage the transistor and the printed board by heat.
Test it by means of an Ohm meter, as illustrated in Fig. 48.
The testing current must be under 5 mA. An Ohm meter for radios is appropriate.
If the tested transistor shows the following results, it is acceptable, and rejected if not so:

RESISTANCE BETWEEN BASE AND EMITTER:

When ⊕ of the tester is connected to base and ⊖ to emitter, the resistance is under 100 Ω .

When ⊖ of the tester is connected to base and ⊕ to emitter, the resistance is above 10 k Ω .

RESISTANCE BETWEEN BASE AND COLLECTOR:

When ⊕ of the tester is connected to base and ⊖ to collector, the resistance is under 100 Ω .

When ⊖ of the tester is connected to base and ⊕ to collector, the resistance is above 10 k Ω .

RESISTANCE BETWEEN EMITTER AND COLLECTOR:

When ⊕ of the tester is connected to collector and ⊖ to emitter, the resistance is above 1 k Ω .

When ⊖ of the tester is connected to collector and ⊕ to emitter, the resistance is above 10 k Ω .

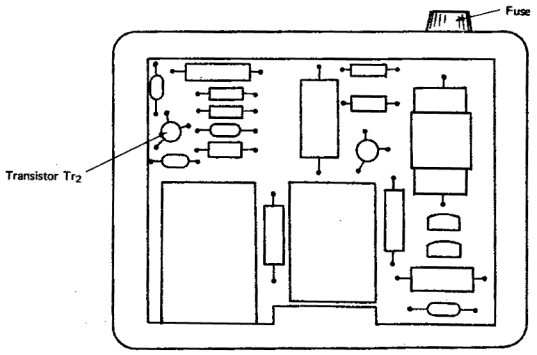
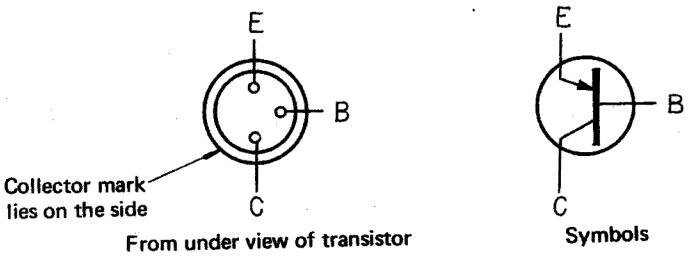


Fig. 47 Plane view of control box



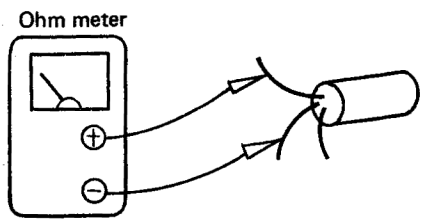


Fig. 48 Testing the transistor

5. MEASUREMENT AND ADJUSTMENT OF STALL REVOLUTION SPEED

Stall revolution speed means engine speed on the crossing point of engine torque and clutch transmitting torque.

Stall revolution speed influences on the starting and crimbing performances. Therefore, when the clutch is disassembled or replaced, measure and adjust to keep the rated value in the following method.

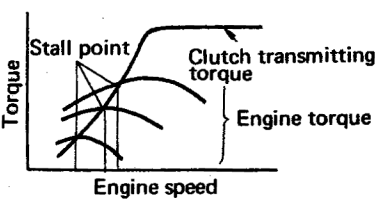


Fig. 49

A. MEASUREMENT

(a) Measure the stall revolution speed by using the calibrated engine tachometer (pulse type etc.).

(b) Proceed the measurement as fast as possible after spreading the powder uniformly in the powder gap by starting the engine and depressing the accelerator pedal lightly two or three times.

(c) Shift the gear shift lever into the first position, apply the foot or hand brake and depress the accelerator pedal gradually.
When the accelerator pedal is depressed 50% to 75% of stroke, the engine speed reaches the highest speed.
Measure this speed.

(d) Rated speed is 1,800 ± 150 r.p.m.

B. ADJUSTMENT

Clutch transmitting torque characteristic is determined with the dynamo correction resistance value.

Therefore, adjustment of stall revolution speed can be made by changing this resistance value.

Resistance selector switch is installed on the control box. When this switch is set to the position with "O" mark, the stall revolution speed increases. Adjust the stall revolution speed to the rated value by changing this switch.

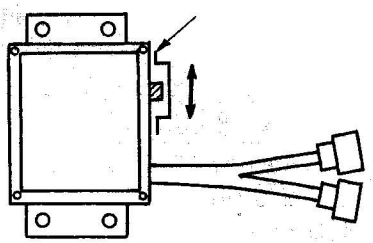
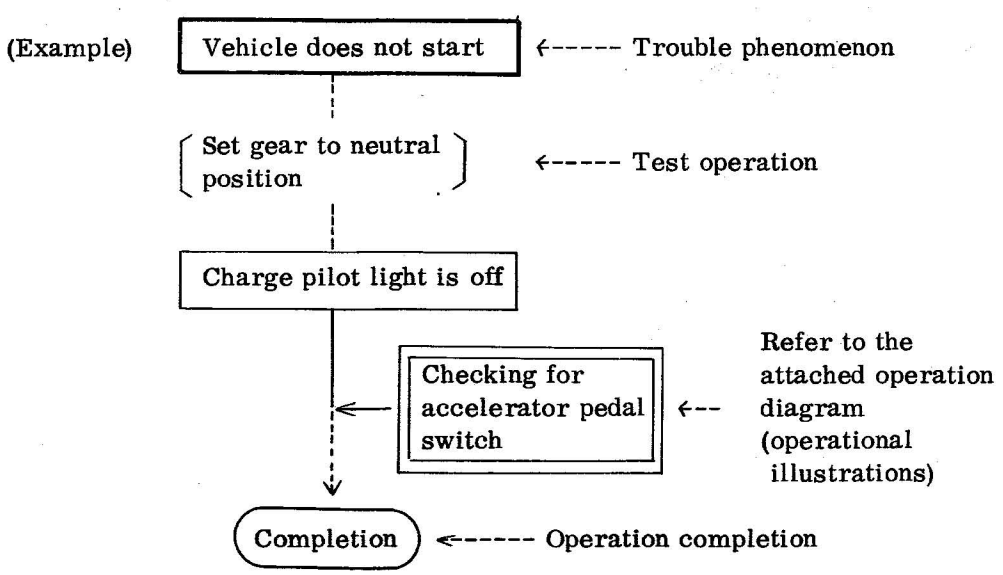


Fig. 50

6. TROUBLE SHOOTING

A. TROUBLE SHOOTING CHART



1. Vehicle does not start

Shift the gear into the neutral position and start the engine. Depress the accelerator pedal and check if the charge pilot light is off.

← Make sure the lamp is not damaged.

When charge pilot light is off.

When the charge pilot light is not off.

See 2-B
Check the accelerator pedal switch.

Check the V belt, generator and regulator.

Completion

See Fig. 53
Measure the voltage between 2/1 and 2/3 terminals of the control box by a voltmeter (DC 30A) while depressing the accelerator and increasing the engine speed.

When voltage generates

When voltage does not generates.

Correct an ammeter (DC 5A) to the clutch circuit.
Measure the clutch current while depressing the accelerator pedal.

See 2-A
Check the gear shift lever switch

Defective control box

Completion

Clutch current flows normally (approx. 2A at 3000 rpm of the engine speed.)

Clutch current does not flow.

Defective clutch

See 2-D
Check the clutch circuit

Completion

Completion

2. Vehicle does not start in spite of normal accelerator pedal operation, but it starts suddenly when engine speed reaches certain speed.

See 2-B

Improper adjustment of the accelerator pedal switch

Completion

NOTE: When this phenomenon occurs rarely overhaul the gear shift lever switch.

3. Poor accelerator when starting

When the clutch tends to slip

See 3-A

Check the fuse of control box.

1) Shift the gear into the neutral position

2) Connect an Ammeter (DC 5A) to the clutch circuit.

3) Depress the accelerator pedal and keep the engine speed at 3000 rpm.

Normal clutch current (approx. 2A)

Defective clutch

Completion

Engine speed does not increase smoothly.

See 3-2

Check the top gear switch.

Improper adjustment of the engine

See Fig. 55

Only when the vehicle starts on an ascent, measure the selfexcited resistance and separately excited resistance of the control box.

Completion

Insufficient clutch current

Check the V belt (generator for tension.

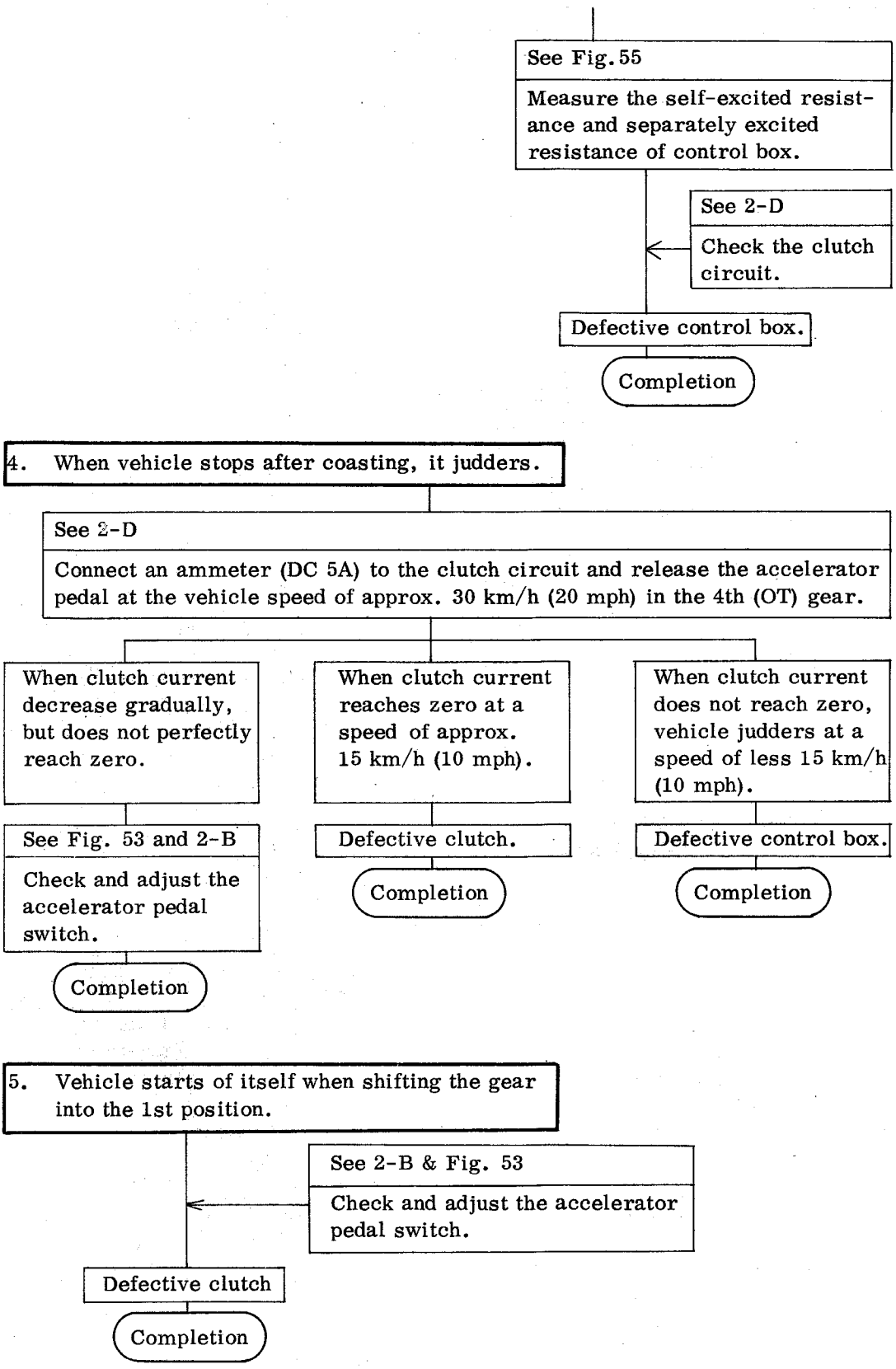
Short-circuit terminals A and F of regulator.

Normal clutch current

Defective generator, or regulator

Completion

Insufficient clutch current


See Fig. 55
Measure the self-excited resistance and separately excited resistance of control box.
See 2-D
Check the clutch circuit.
Defective control box.
Completion
4. When vehicle stops after coasting, it judders.
See 2-D
Connect an ammeter (DC 5A) to the clutch circuit and release the accelerator pedal at the vehicle speed of approx. 30 km/h (20 mph) in the 4th (OT) gear.
When clutch current decrease gradually, but does not perfectly reach zero.
When clutch current reaches zero at a speed of approx. 15 km/h (10 mph).
When clutch current does not reach zero, vehicle judders at a speed of less 15 km/h (10 mph).
See Fig. 53 and 2-B
Check and adjust the accelerator pedal switch.
Completion
Defective clutch.
Completion
Defective control box.
Completion
5. Vehicle starts of itself when shifting the gear into the 1st position.
See 2-B & Fig. 53
Check and adjust the accelerator pedal switch.
Defective clutch
Completion

6. When gear shift operation is very difficult, or considerable gear-noise is heard when operating gear shift lever.

See 2-A & Fig. 54

Check the gear shift lever switch.

See 2-D

1) Connect an ammeter (DC 5A) to the clutch circuit.

2) Shift the gear into the neutral position and start the engine.

Confirm that clutch current is zero when the accelerator pedal is released.

Depress the accelerator pedal and keep the engine speed at 3000 rpm. Then, hold the gear shift lever switch and measure clutch current (approx. 2A) and inverse exciting current (approx. 0.1 A).

When inverse exciting current of the clutch flows.

Stop the engine and shift the gear shift lever

Easy shifting

Defective clutch

Completion

When inverse exciting current of the clutch does not flow.

Defective control box

Completion

Difficult shifting

Defective transmission or gear shift mechanism

Completion

7. When vehicle has frequent engine stops with sudden starting.

1) Shift the gear into the neutral position

2) Connect an ammeter (DC5A) | See 2-D

3) Start the engine and depress the accelerator pedal until the switch begins to operate.

Clutch current changes according to the engine speed.

Defective clutch

Completion

When engine speed is low (above 1000 rpm) clutch current flows approx. 2-3A.

Confirm that the F. terminals of the generator and the regulator are not connected.

Defective top gear switch.

Completion

Defective control box.

Completion

8. When the vehicle speed is above 20 km/h (13 mph) and the accelerator pedal is released, no engine braking functions at all. But feel the shock when depressing the accelerator pedal again.

See Fig. 56

When the vehicle speed is approx. 20 km/h (13 mph), measure the voltage between the terminals 1/1 and 1/5 (Wiring Color: Blue) of the connector (8P) with an electric tester or an A.C. voltmeter (A.C. 30V).

Normal voltage (5V~10V)

Defective control box.

Completion

Insufficient voltage (less than 5V)

Defective signal generator

Completion

9. Battery is dischanged very often.

Battery dischange is excessively affected by the running condition and using condition of the vehicle.
Check the mileage, starting times, average speed, running percentage of day and night, etc.

Make sure that the ignition switch, lighting switches are turned off. Disconnect the cable from the plus terminal of the battery and connect an ammeter (DC 5A) between this terminal and the cable.

Current does not flow.

(Remove the ammeter)

Current flows.

Checking and repairing the defective parts.

Completion

Connect an ammeter and engine tachometer so that the clutch current and engine speed can be measured. Set the resistance changing switch of the control box to the position with "o" mark.

Accelerate vehicle gradually until the vehicle speed increase to 15 km/h (9 mph) from 10 km/h (6 mph) in 2nd gear. Measure the engine speed when the clutch current changes suddenly.
STANDARD SPEED:
1700-2000 rpm.

After starting the engine, check no load voltage of the regulator. In this case, shift the gear in the neutral position and measure the voltage while pushing the emergency switch.
STANDARD VOLTAGE:
15V-16V/3000 rpm.

Insufficient voltage

Adjust or change the regulator.

Completion

Standard voltage

Defective or improper running condition

Completion

Current does not change

Measure the voltage between the terminals 1/1 and 1/5 (Wiring Color: Blue) of connector (8P) with an electric tester or an A.C. volt meter (30 V) when the vehicle speed is about 20 km/h (16 mph).

When the voltage is 5-10 V.

Defective control box.

Completion

When the voltage is less than 5 V.

Defective signal generator.

Completion

Current changes at 2000 rpm or more.

Improper adjustment of the control box.

Completion

B. HOW TO USE THE A.T.C. TESTER

The circuit check can be performed by general electric testing devices but A.T.C. tester is prepared in order to check the circuit simply without removing the parts.
When using A.T.C. tester, read this section carefully.

(a) Inside wiring diagram of A.T.C. Tester

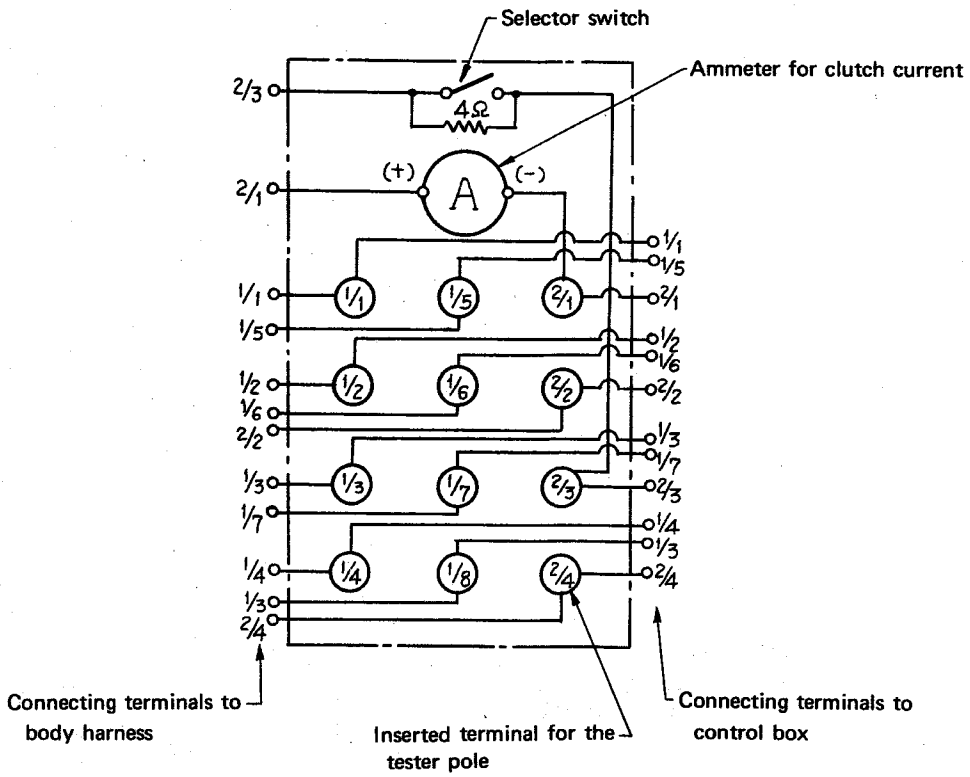


Fig. 51

(b) Connection of the A.T.C. tester

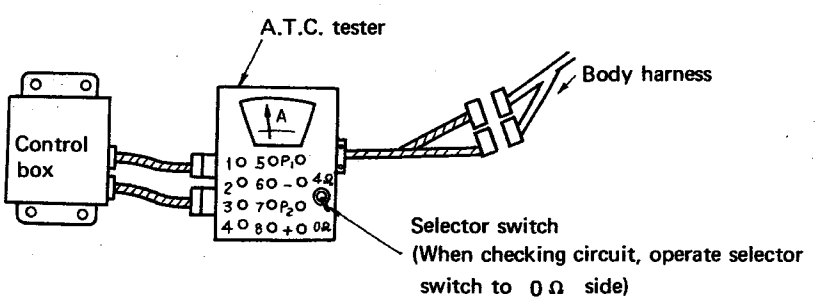


Fig. 52

(1) When the tester is connected as shown in the diagram, it enables direct checking without removal of the socket, because of the control box with number corresponding to each terminal.
The measuring of clutch current is possible any time with the ammeter provided A.T.C. tester.

(2) The selector switch is used only when breaks in the powder (magnet powder) in the clutch, therefore it should be usually kept in the 0Ω.

(3) D.C. voltmeter
A.C. voltmeter
Bridge or resistance meter

These meter should be kept on hand as required.
Prepare these tools if necessary.

(c) Inspection of accelerator pedal switch.

Shift the gear into the neutral position and start the engine.
Connect a voltmeter (DC 30V) between the terminals 2/1 and 2/3.
When the accelerator pedal is not depressed, the voltage should be zero.

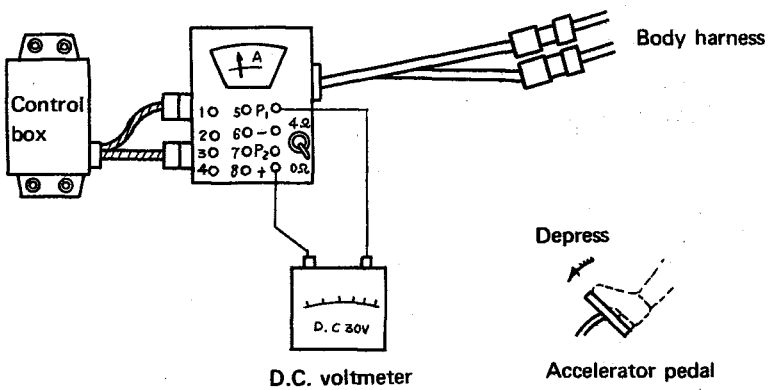


Fig. 53

When the accelerator pedal is depressed, the voltage should increase in proportion to the engine speed.

(d) Inspection of gear shift lever switch.

Connect a D.C. voltmeter (DC 30V) between the terminals 2/1 and 2/3 and turn the ignition starter switch to he first position. While pushing the emergency button, move the gear shift lever knob to the left and right sides alternately. (Do not start the engine).
When the voltmeter shows approximately 12 V (battery voltage) intermittently, this means normal condition.

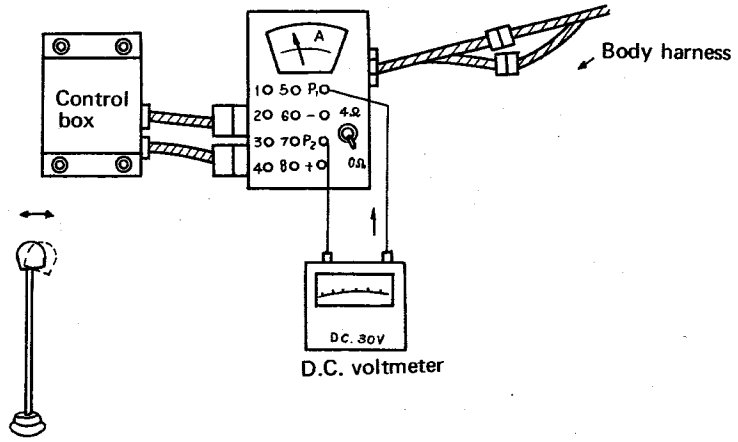


Fig. 54

(e) Measurement of self-excited resistance and separately excited resistance of the control box.

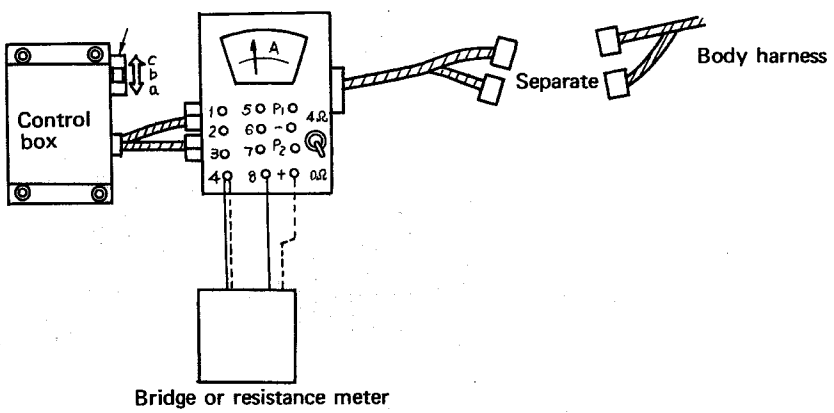


Fig. 55

(1) Measurement of self-excited resistance.

Connect the bridge or resistance meter between the terminals 1/8 and 1/4 and measure the resistance.

Position of selector switch	Resistance value
a	Approx. 13
b	Approx. 17
c	Approx. 21

(2) Measurement of separately excited resistance. Connect the bridge or resistance meter between the terminals 1/4 and 2/4 and measure the resistance.

Resistance value : 90

(f) Measurement of the signal generator's voltage

When running the vehicle at a speed of approx. 20 km/h (13 mph). Measure the voltage between the terminals control box 1/1 and 1/5 by an A.C. voltmeter (AC 30V).

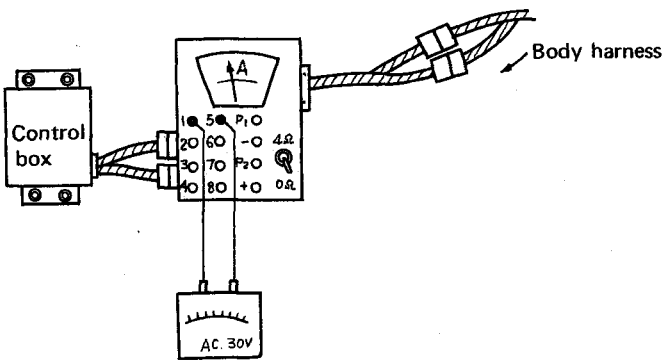


Fig. 56

If no defects, the voltage is approx. 5 to 10V.

(g) Inspection of emergency switch circuit.

Connect a D.C. voltmeter (D.C. 30V) between the terminals 1/6 and 2/2 and turn the ignition starter switch the first position.

(1) Check if the voltmeter indicates the battery voltage (Approx. 12V), when the emergency switch is depressed.

(2) When the voltmeter indicates 0 volt with the emergency switch depressed, the emergency switch is defective.

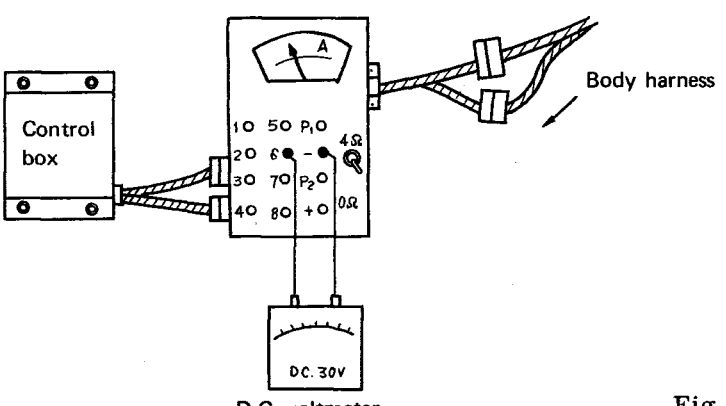


Fig. 57