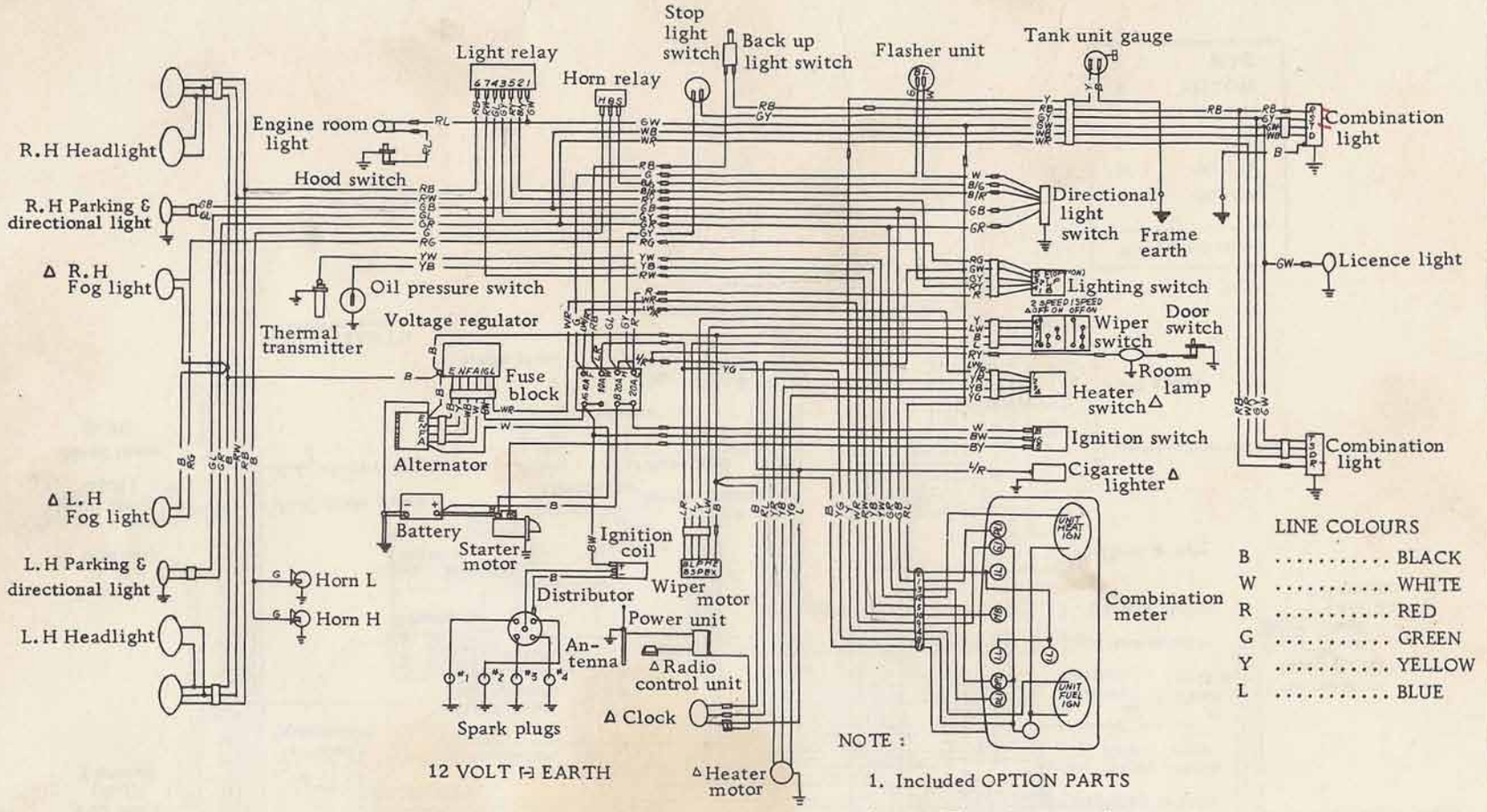


LINE COLOURS

B	..... BLACK
W	..... WHITE
R	..... RED
G	..... GREEN
Y	..... YELLOW
L	..... BLUE

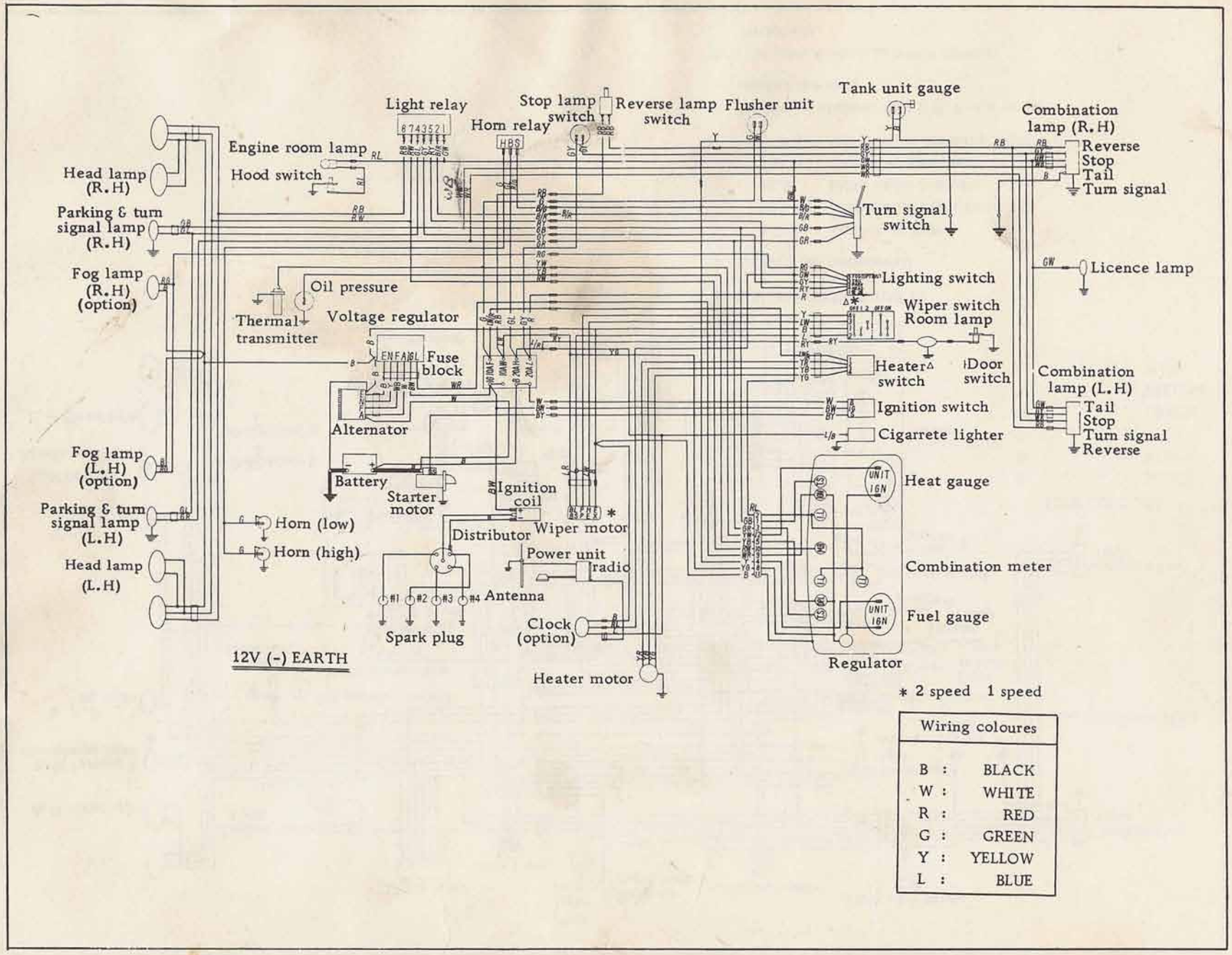
NOTE :

1. Included OPTION PARTS
2. LIGHTS (at Instrument)

   I.L. ; Instrument light
   D.L.I. ; Directional Light Indicator
   M.B. ; Main Beam Indicator
   G.I. ; Generator Indicator
   O.P.L. ; Oil Pressure Warning Light

3. The size of electric line is 0.5 mm except marked the size.
4. The parts marked Δ means optional equipment.

ELECTRICAL SYSTEM


Light relay
Stop lamp switch
Reverse lamp switch
Flusher unit
Tank unit gauge
Combination lamp (R.H)
Reverse
Stop
Tail
Turn signal
Horn relay
Engine room lamp
Hood switch
Head lamp (R.H)
Parking & turn signal lamp (R.H)
Turn signal switch
Licence lamp
Fog lamp (R.H) (option)
Oil pressure
Thermal transmitter
Voltage regulator
Lighting switch
Wiper switch
Room lamp
Fuse block
Heater switch
Door switch
Combination lamp (L.H)
Tail
Stop
Turn signal
Reverse
Ignition switch
Cigarrete lighter
Alternator
Fog lamp (L.H) (option)
Battery
Starter motor
Ignition coil
Heat gauge
Parking & turn signal lamp (L.H)
Horn (low)
Horn (high)
Wiper motor
Distributor
Power unit
radio
Head lamp (L.H)
Antenna
Combination meter
Fuel gauge
Spark plug
Clock (option)
Regulator
12V (-) EARTH
Heater motor
* 2 speed 1 speed
Wiring coloures
B : BLACK
W : WHITE
R : RED
G : GREEN
Y : YELLOW
L : BLUE

ALTERNATOR

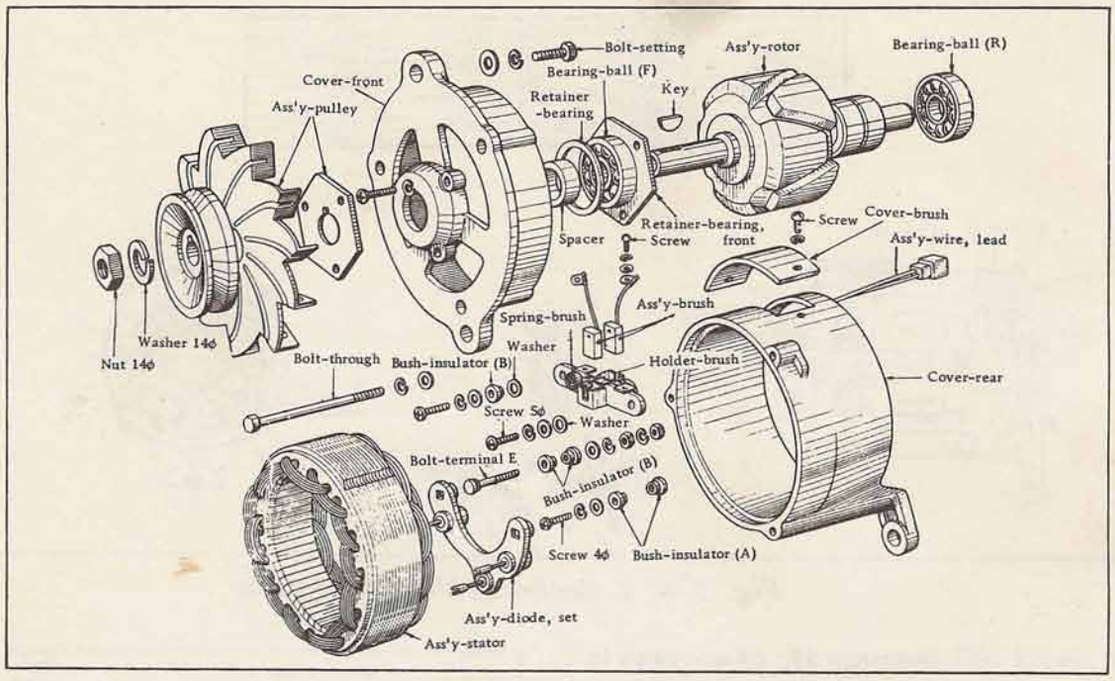


Fig. 1-2 Alternator

ALTERNATOR

Alternator			
Nominal output		12 volt - 300W	
Constant revolution		2500 rpm.	
RPM to get 14 bolt		Under 1000 rpm.	
No load (normal temp.)	rpm.	2500	
	voltage	14.5 ± 0.5 V	
Polarity	rpm.	2500 rpm.	⊖ earth
	voltage	14V	
Out put current	current	21.5A more than	24.5A more than

Pilot lamp relay (3 contact point type)

Put-off voltage	Put-on voltage
4.5～5.2V	0.5～3V

GENERATOR

Construction and Feature

Different from the DC generator, the AC generator turns the magnetic pole and fixes the armature making it generates 3-phase alternate current, and rectifies all waves with the silicon diode, (+), (-) each three, that are built within, and takes out as direct current.

1	Starter	11	A Terminal Ass'y	20	Terminal bolt	29	Nut
3	Roter	12	Hex bolt	21	Front bracket	30	Spring washer (7)
4	Seal washer	13	Round head	22	Front bracket	31	Grommet
5	Ball bearing	14	Insulator (5)	23	Seal washer	33	Clip
6	Rear bracket Ass'y	15	Insulator (5)	24	Ball bearing	34	Brush holder
7	Rear bracket Ass'y	16	Filter washer	25	Bearing retainer	35	Brush
8	Diode (-)	17	Washer	26	Round head	36	Brush cover
9	Diode Ass'y	18	Spring washer (5)	27	Through bolt	37	Spring washer
10	Diode (+)	19	Stopper nut	28	Pulley Ass'y	38	Round head

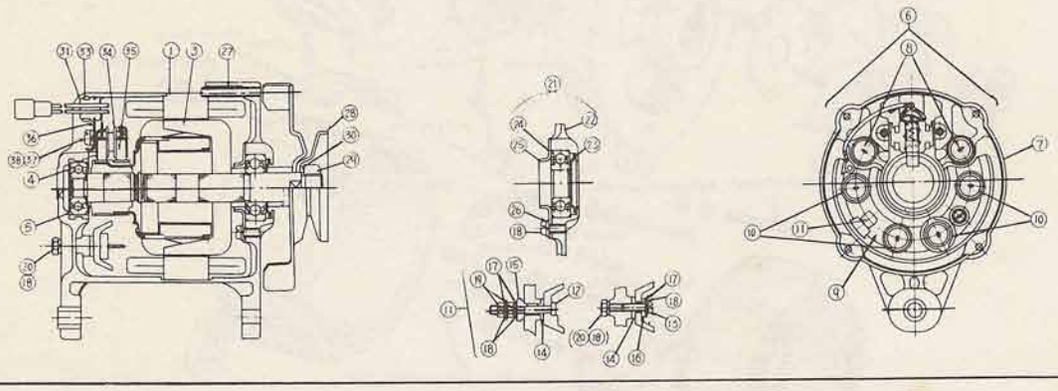


Fig. 2-1. 1 Sectional View of Dynamo

The sealed ball bearings ⑫, ⑬ are used to support the rotor. Clearance between the brush and brush holder is also made so as to prevent if from dust. Thus the AC generator will increase milage without maintenance. Each 3 diodes are pressed in the rear cover and the diode base respectively.

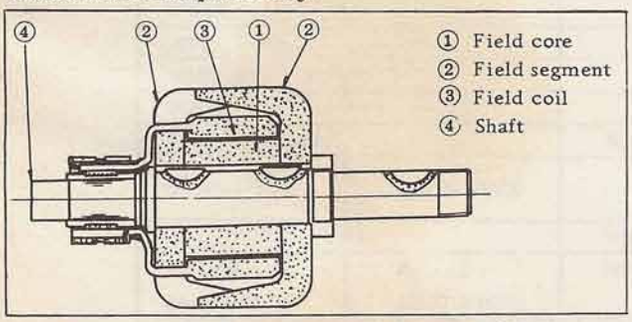


Fig. 2-1. 2 Sectional View of Rotor

The clip ring pressed in the shaft is soldered at both ends of the field coil to pass magnetic current.

The pole of rotor makes out the magnetic circuit as shown in Fig. 1-3 and all the poles are magnetized by doughnut coil.

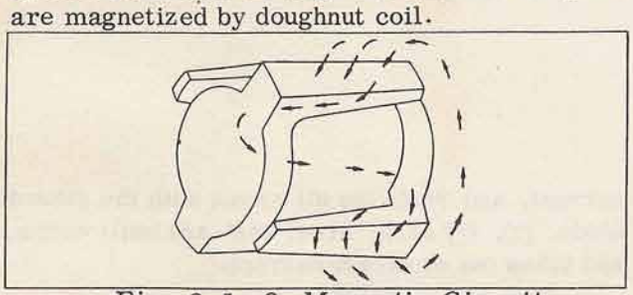


Fig. 2-1. 3 Magnetic Circuit

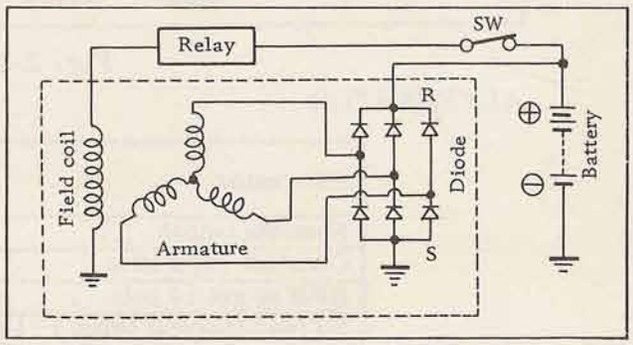


Fig. 2-1. 4 Connection within Dynamo

The armature is of a three phase Y connection type and the silicon diode rectifies all waves. It pulls out the neutral point and adds voltage having conducted 3 phase half wave rectification in the circuit of relay and controls the voltage coil of the pilot lamp relay.

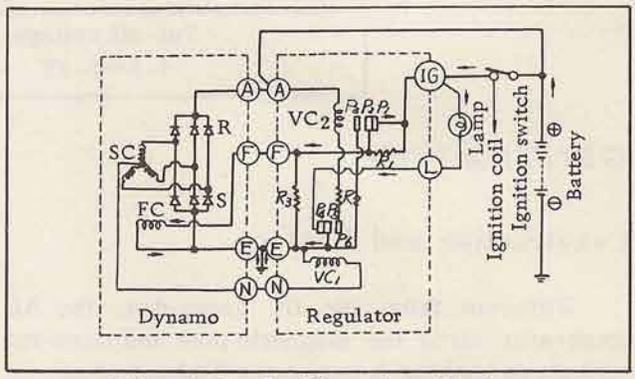


Fig. 2-1. 5 Charging System

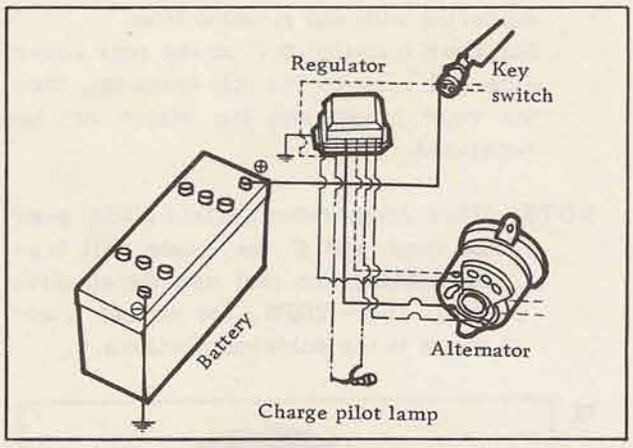


Fig. 2-1. 6 Outside Connection

When the ignition switch is put on, the battery current flows in the arrow marked direction passing through the dynamo E terminal, brush slip ring, field coil, slip ring, rbush, dynamo F terminal, relay F terminal and IG terminal and completes the filed circuit. It in difficult for the dynamo to stand up only by residual magnetism of the field core, so that magnetization is necessary until voltage rises to suit charging after the engine has started.

This is because the diode is used and when the voltage to add to it is so low, large proportional resistance shows up and current does not flow through the field coil unless the dynamo makes very high revolution.

Disassembly and Assembly

A. Disassembly

The dynamo is disassembled in the following order.

a)

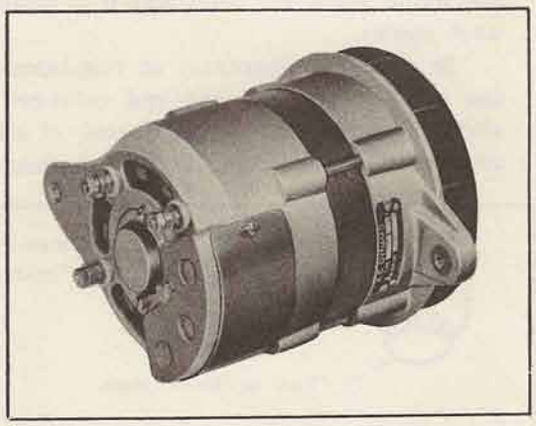


Fig. 2-2. 1

b)

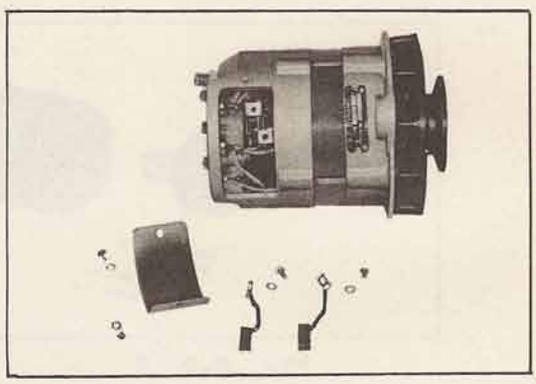


Fig. 2-2. 2

Remove the brush cover and pull of the brush, 2 ea.

c)

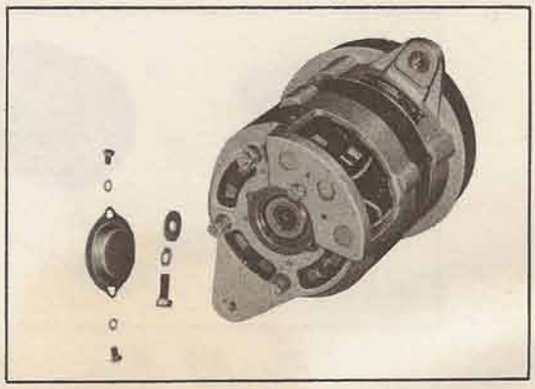


Fig. 2-2. 3

Remove the cover of bearing and take off the hex. bolt of shaft.

d)

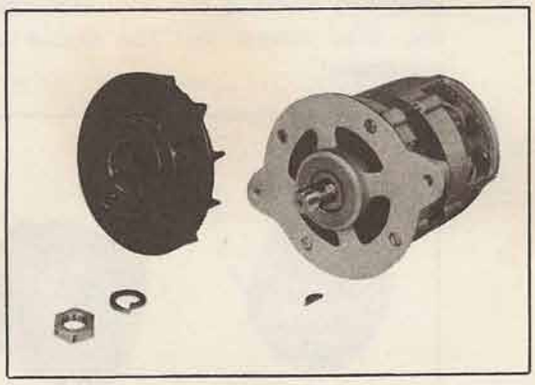


Fig. 2-2. 4

Remove the hex. nut of pulley and pull off the pulley and the half-moon key. Be careful not to injure the fan when the nut is removed.

e)

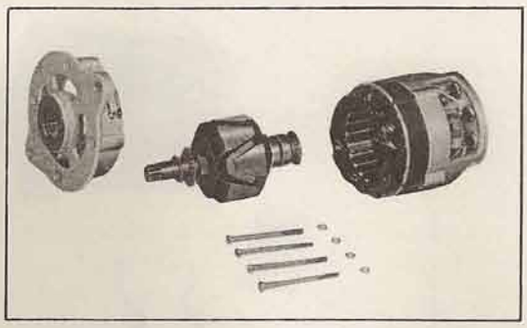


Fig. 2-2. 5

Remove the through bolt tightening bolt front cover and rear cover, pull off the front cover and rotor.
Use a hammer of wood or plastic if necessary.

f)

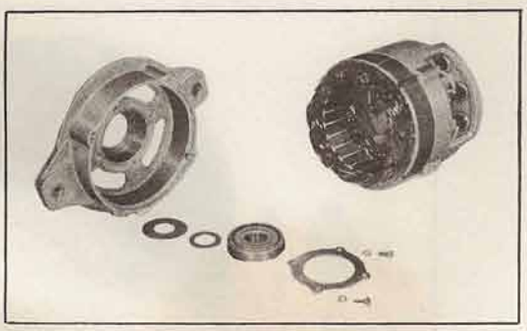


Fig. 2-2. 6

Remove the ball bearing from the front cover. Remove the bolt or tightening the bearing plate and or pull off the bearing with such as a hand press.
Slacken N terminal bolt on the rear cover side and remove the clip terminal, then the rear cover and the stator can be separated.

g)

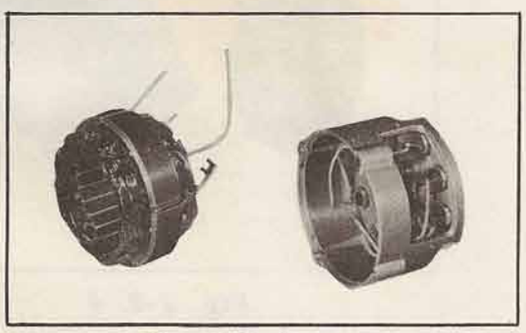


Fig. 2-2. 7

Remove the rear cover and stator.
Separate the silicon diode, 3 ea. from the stator coil lead wire, 3 ea. by melting soldering with and electric iron.
Slacken N terminal bolt on the rear cover side and remove the clip terminal, then the rear cover and the stator can be separated.

NOTE: When temperature within diode gear up over 150° C the diode will lose functioning, so that use the electric iron, 100 ~ 200W, for around 2 seconds at the soldered portions.

h)

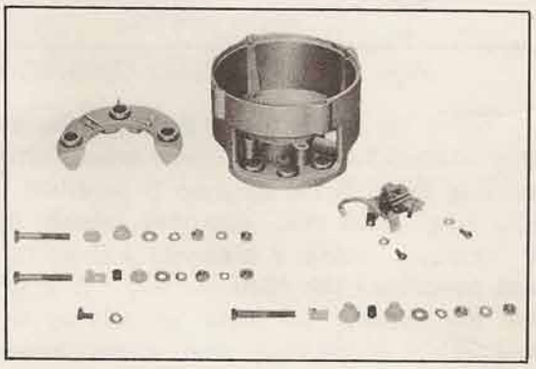


Fig. 2-2. 8

Remove the diode set and brush holder from the rear cover.
When be careful not to lose small parts such as screws, washers and bushings.

B. Assembly

Assembly is done in the reverse sequence of disassembly.

Always make sure the polarity of alternator or regulator before replacing the diode either positive or negative. The polarity of alternator or regulator is usually marked on the name plate or label which is attached to each model.

In case the alternator or regulator shows the positive ground, the red coloured diode should be mounted in the frame of slip ring end the black coloured diode in the heat sink.

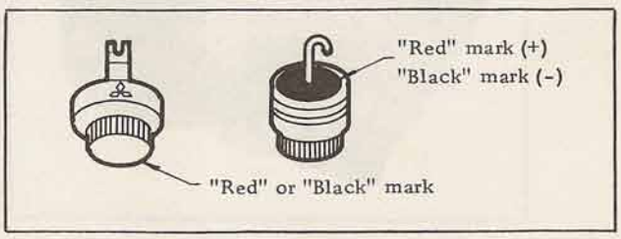


Fig. 2-2 9

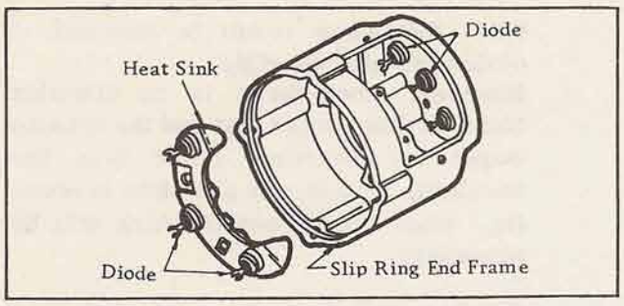


Fig. 2-2. 10 Exploded View

Removal

To remove a diode, use a suitable tool to support the end of the frame, or heat sink, and push the diode out by using an arbor press as shown the below.

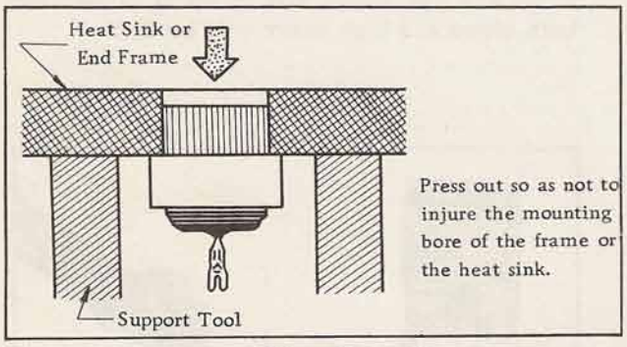


Fig. 2-2. 11

Installation

Support the heat sink or end frame with a suitable tool and then press the diode in the heat sink and end frame by using the tool shaped Ⓐ which fits over the outer diode edge A portion.

Press down perfectly the diode in the mounting bore of C portion to the lower edge of B portion of the diode.

Checking the replaced diodes.

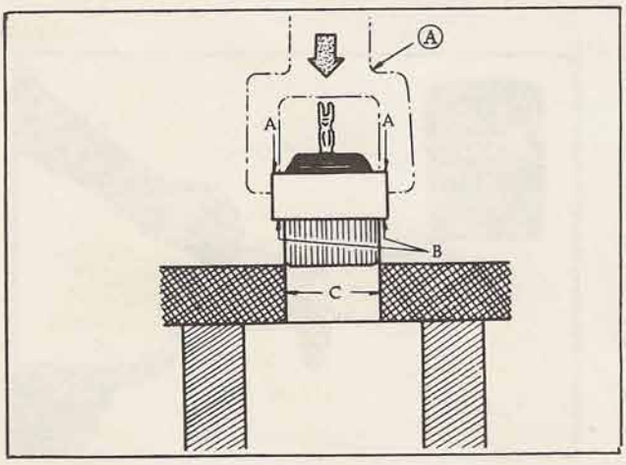


Fig. 2-2. 12

Inspection of Troubles

A. Inspection of Output

For inspection of output, remove the dynamo from the vehicle and connect wiring as shown in Fig. 3. 1 and drive it with motor. (For inspection of output of dynamo without removing it from the vehicle, refer to "Inspection of AC generator" to be published later.)

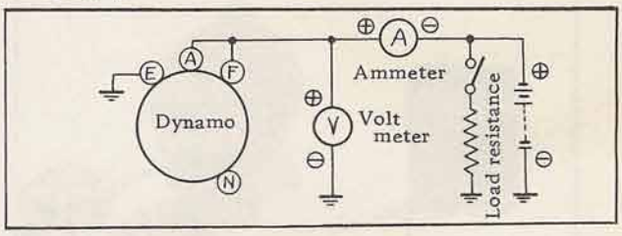


Fig. 2-3. 1

Note: Use the battery charged in full up to the normal capacity.

Through the wiring shown in Fig. 3. 1, magnetic current flows from the battery to the filed coil of dynamo. In this state, raise revolution of dynamo slowly up to the speed where there is no reverse flow (2 A approx.) to the field coil and read the revolution. Correct revolution is approx.
1000 rpm. without load.

Next, increase load resistance to the maximum and almost stop flowing of load current, and put off the switch. Then, raising the load current slowly, increase revolution of dynamo. Observe thus increasing output current as revolution of dynamo increases. If there is no large difference from the specification, it is correct.

No matter how the battery is overcharged or discharged, if the charging current is small, first make sure either the dynamo or the relay is in disorder. See the charging current by inserting the ammeter between A terminal of relay and the battery.

Disconnect wire passing from the dynamo F terminal to the relay F terminal at the relay F terminal and make the removed lead wire short circuits at the relay A terminal, when if the charging current highly increases, the relay is in disorder.

B. Short Circuits on Diode "-" Side

It can be judged as the pilot lamp does not flare even if the key switch is turned on. Actually a trouble such as "diode open" is very rare and short circuits at the polar line are also rare. Ordinarily, there are many cases of "+" side short circuits.

C. Inspection of Diode with Tester

a) Simple Inspection

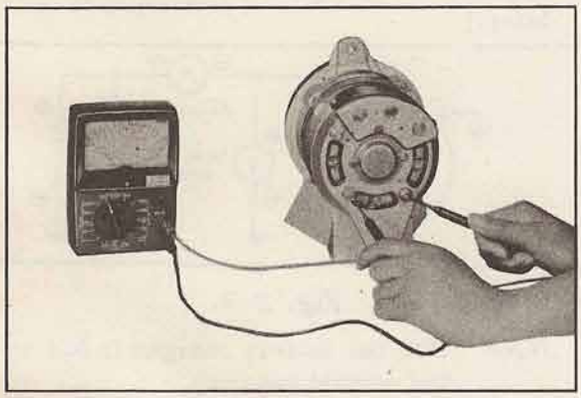


Fig. 2-3. 2

Check between the terminals, A - N as shown in Fig. 3. 2.
Set the dial of tester for conductivity and put the tester needles at both terminals alternately.
When one shows low resistance and the other shows pretty high resistance, the 3 diodes in the diode set are all right.

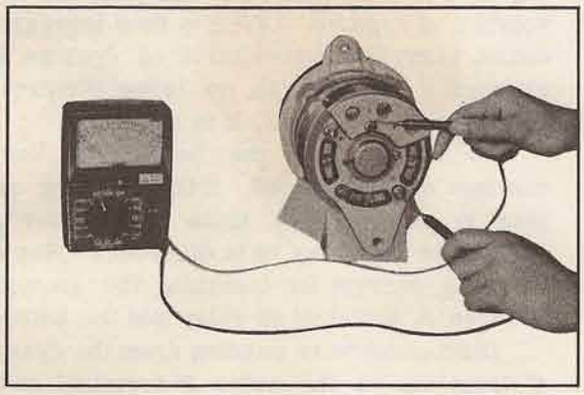


Fig. 2-3. 3

Check between the terminals, A - E same as above.

When the same result is obtained, 3 diodes are also all right.
However, when there is no disorder found in this simple test and the dynamo output is somewhat lower than the standard, 1~2 diodes are often in opening, when one by one checking will be necessary.

b) Separate Inspection

Check resistance with the tester between the diode base commonly used for 2 diodes and lead wire on the rear cover -2 times changing the poles. When one side shows low resistance and the other shows high resistance, there is no disorder. If both sides are low, there will be short circuit and both sides are high there will be open.

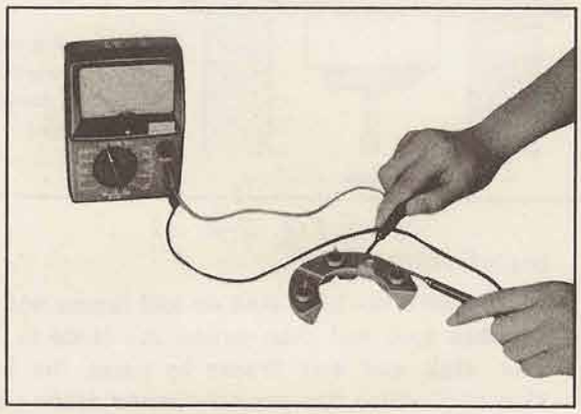


Fig. 2-3. 4

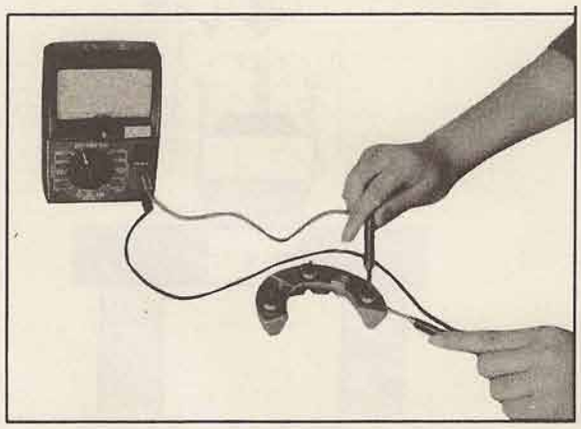


Fig. 2-3. 5

D. Inspection of Diode with Lamp

a) Simple Inspection

Check positive diodes

Test Method	Test Connection	Lamp	Method Result
Should be conductive Ⓐ to Ⓑ	Connect ⊕ to Ⓐ and ⊖ to Ⓑ	Light	Good
		No light	Defective
Should be non-conductive Ⓑ to Ⓐ	Connect ⊖ to Ⓐ and ⊕ to Ⓑ	No light	Good
		Light	Defective

Check negative diodes

Test Method	Test Connection	Lamp	Method Result
Should be non-conductive Ⓐ to Ⓑ	Connect ⊖ to Ⓐ and ⊕ to Ⓑ	Light	Good
		No light	Defective
Should be conductive Ⓑ to Ⓐ	Connect ⊖ to Ⓑ and ⊕ to Ⓐ	Light	Defective
		No light	Good

The soldering for the lead wires should be performed in less than 20 seconds, as the excessive heat may damage the diodes.

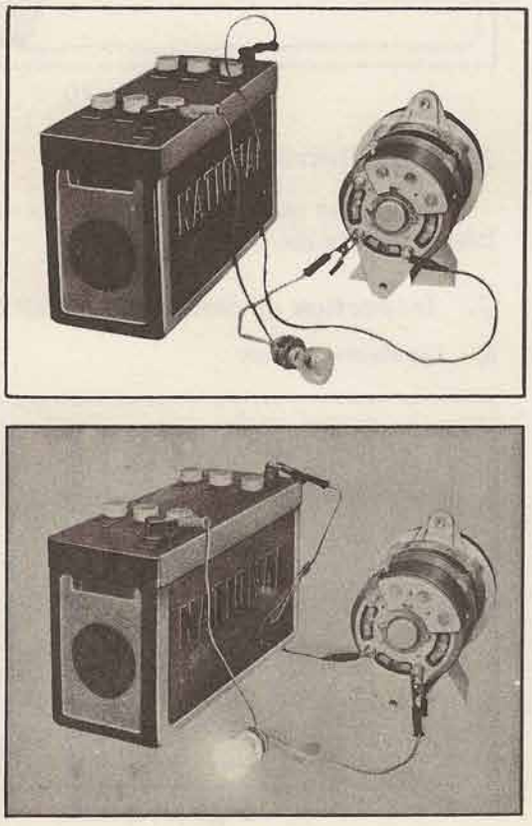


Fig. 2-3. 6

Check between the terminals, A - N as shown in Fig. 3. 6.
Connect with the lamp (12V) in straight and put both ends at A and N terminals alternately. On one side the lamp flares and on the other the lamp is off, when 3 diodes of the diode set are all right.

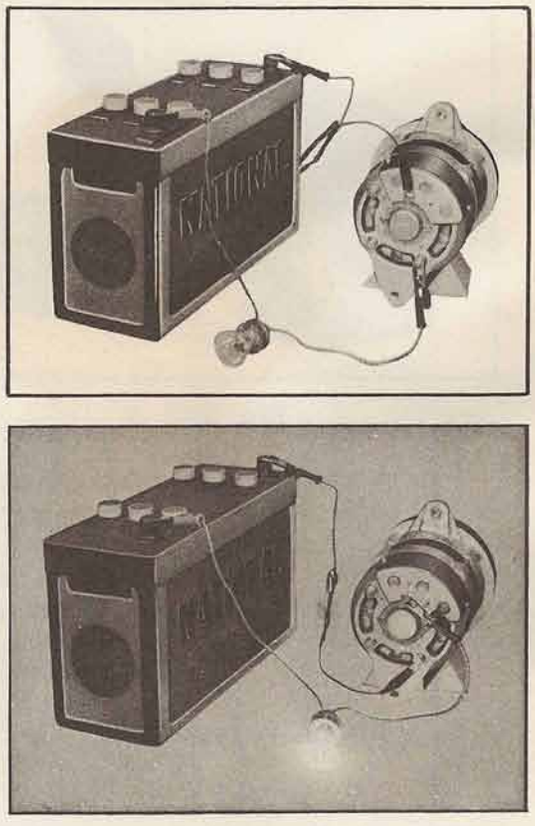


Fig. 2-3. 7

The same step is taken between the terminals, N - E. When the same result is obtained, 3 diodes pressed in the cover are

all right. However, if the simple test is all right, but when the dynamo output is lower than the standard, 1 ~ 2 diodes may often be opening, so that one by one check will be necessary.

b) Separate Inspection

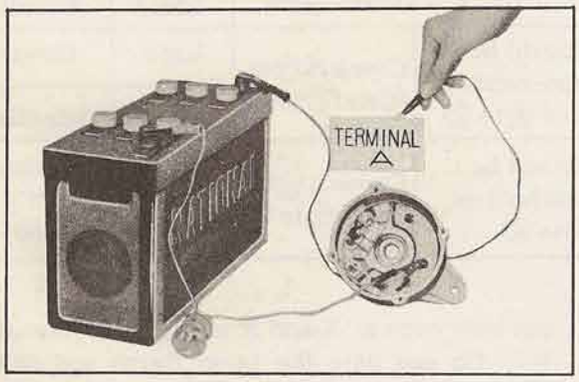


Fig. 2-3. 8

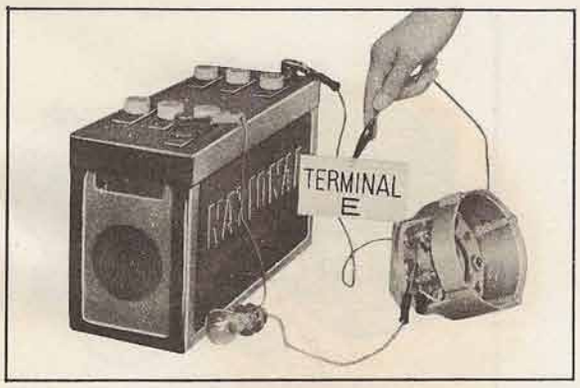
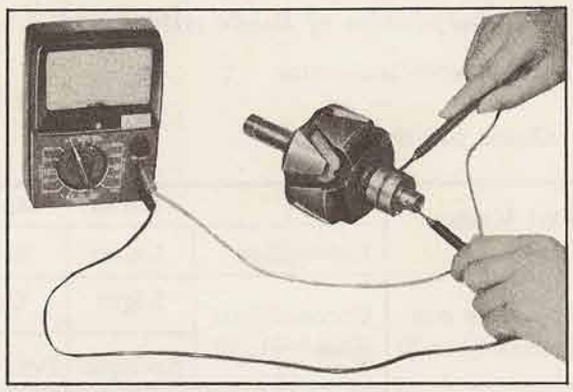


Fig. 2-3. 9

Check between the lead wire and the diode set common with the other 2 diodes or the rear cover with the lamp and battery. It is all right if one side flares and the other is off. If both sides flare, there is short circuit and both sides are off, there is open.

E. Inspection of Field Coil

As shown in Fig. 3. 10, put the tester between the slip ring of rotor and if there are 6 ~ 7 Ω, it is all right. Make sure there is no conduction between the rotor slip ring and the shaft.



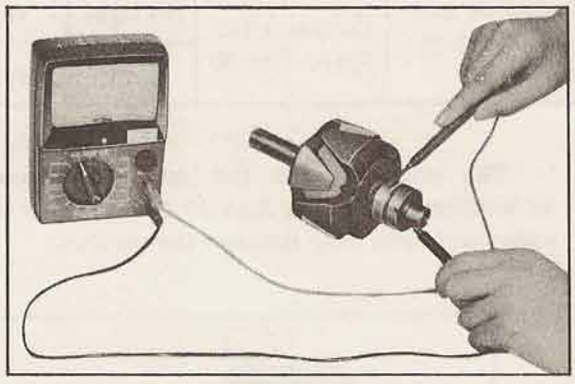


Fig. 2-3. 10

F. Ball Bearing

Both sides sealed ball bearing is used, so lubrication is not necessary.

G. Inspection of Stator (Armature)

a) Conduction Test

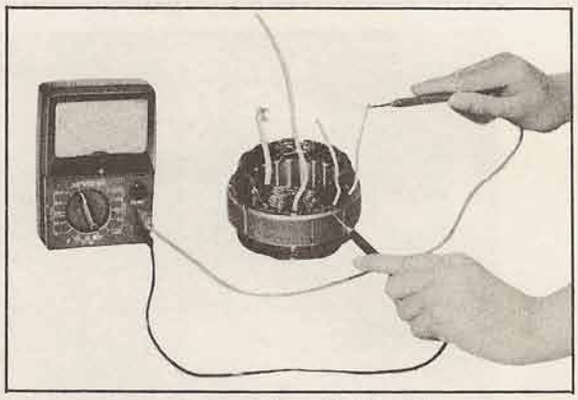


Fig. 2-3. 11

If the terminal connected to the diode is not conductive with the stator core, that is all right.

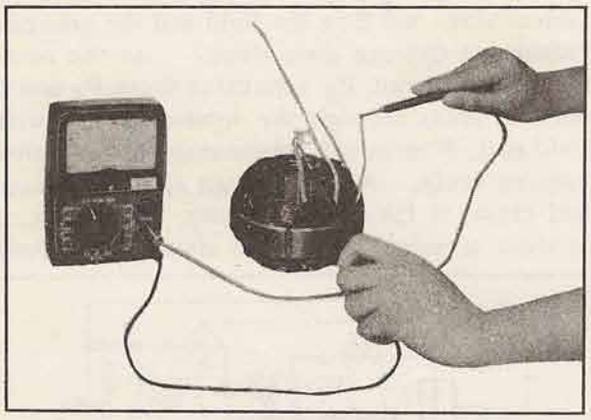


Fig. 2-3. 12

If each terminal of the coil and the terminal connected to N terminal are not conductive, that is all right.

b) Layer Test

Connect the tester cord to 100 V wire, put the stator on the test stand and make the tester one turn reading the ammeter. If there is short circuit on the coil, swings of the ammeter abruptly increase and if there is no trouble, there will be no changed.

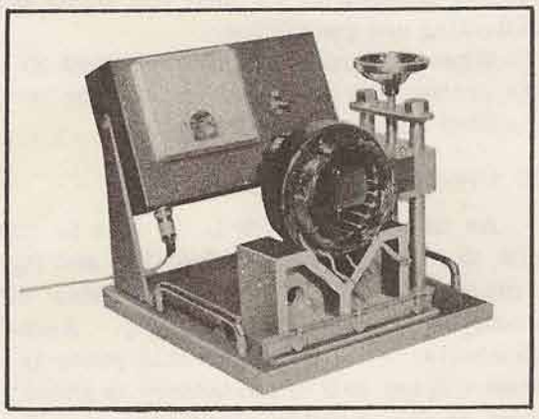


Fig. 2-3. 13

H. Inspection of Brush

Wipe with clean cloth when oil or dust is on the contact surface of brush and slip ring.

Same as in case of DC generator, replace the brush when wear of it reached to the wear limig.

REGULATOR

1. Construction and Operation

(1) Construction

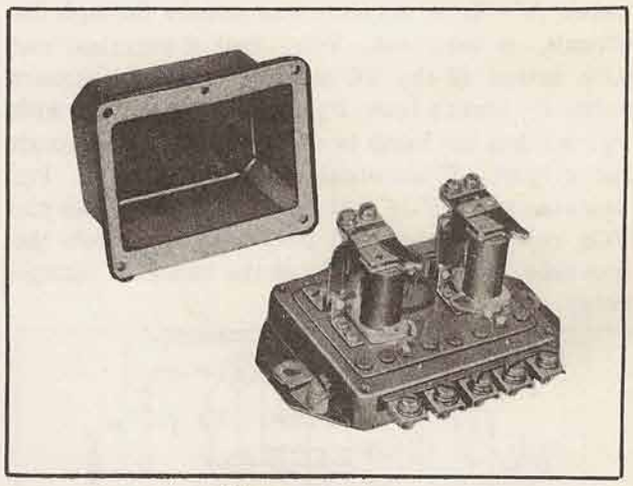


Fig. 3-1. 1

(2) Operation of Constant Voltage Relay

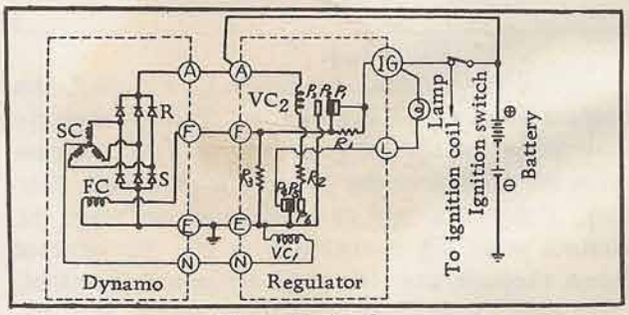


Fig. 3-1. 2

When the ignition switch is on, current from the battery passes through the dynamo E terminal, field coil, contact points P_2, P_1 and the dynamo is magnetized.

While it also flows the regulator E terminal, contact points P_5, P_4 and the lamp flares.

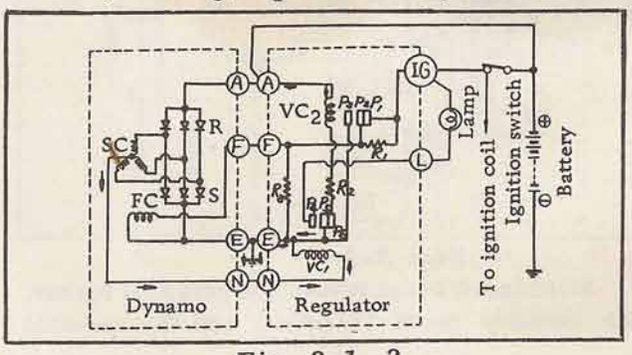


Fig. 3-1. 3

When the engine starts and the dynamo is driven, three phase alternate current generates on the stator coil, passing through the three phase all wave rectifier (diode) and changes to direct current between the terminal A - E for charging.

At the N terminal, voltage, half of that between A - E, generates and passes through the circuit, N terminal, VC_1, coil E terminal and with action of the VC coil, the movable contact point P_5 leaves from P_4 and makes contact with P_6, so that the lamp is off and it passes through the circuit, E terminal, contact points P_5, P_6, resistance R_2, VC_2 coil and A terminal, then the VC_2 coil animated and prepares to vibrate the movable contact point P_2 of the constant voltage relay.

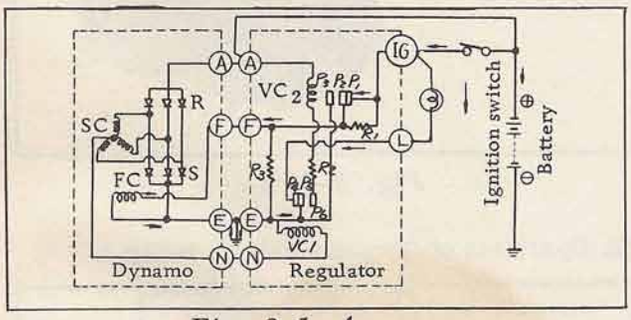


Fig. 3-1. 4

When the dynamo revolution gets higher, the contact point P_2 separates from P_1 with electric magnetism of the VC_2 coil and the field current from the circuit of the dynamo E terminal, field coil, F terminal and resistance R_1 and when the contact point P_2 contacts with P_1, the current flows through the circuit of dynamo E terminal, field coil, F terminal, contact points P_2, P_1. This is repeated according to vibration of the contact point P_2 and the dynamo terminal voltage is kept evenly and continues charging.

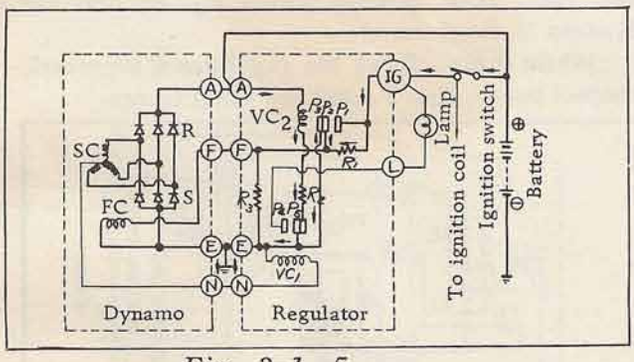


Fig. 3-1. 5

When the dynamo revolution gets still higher, the movable piece is drawn and the movable contact point P_2 sticks to P_3, so that current almost does not flow the field and the generated voltage of dynamo goes down. As the result, the contact point P_2 separates from P_3 and the current from through the dynamo E terminal, field coil, F terminal, resistance R_1 and voltage goes up again. At such a high speed, with open and close of the contact points, P_2 and P_3, the dynamo terminal voltage is always kept evenly.

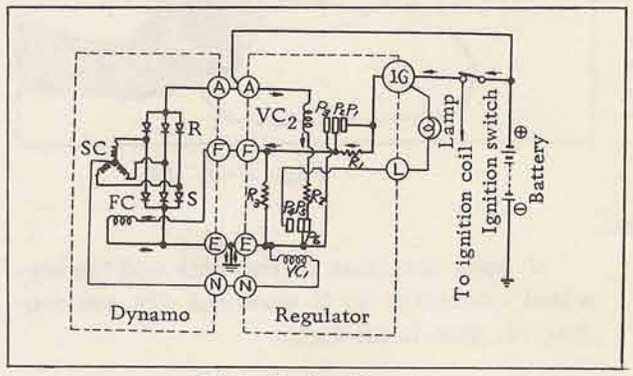


Fig. 3-1. 6

The operation of this time is called a high speed operation and the adjust voltage is called a secondary voltage.

When the dynamo revolution goes down and charging capacity reduces, the voltage between the terminals, N - E, also lowers.

As the result, the electric magnetism of VC_1 coil weakens and the contact point P_5 fixed with the movable piece can not continue contact with P_6 and changes to P_4 side and lights the lamp indicating non generation.

When the ignition switch is turned off to stop the engine, the lamp goes out and the current to the filed coil is suspended.

(3) Operation of Pilot Lamp Relay

As shown in Fig. 3-1. 2, this is made up with the contact points, P_4, P_5, and P_6. The contact point P_5 is on the movable side and usually makes contact with P_4. Between the terminals, N - E, the movable piece is drawn when voltage half of the battery is added and P_5 fixed to the movable piece separates from P_4 and makes contact to P_6. When the voltage between N - E terminals is conspicuously reduced, P_5 makes contact with P_4 again.

The voltage between N - E terminals necessary for P_5 to make contact with P_6 is "Put-off voltage" and that P_5 changes from P_6 to P_4 is "Put-on voltage".

2. Adjustment

(1) Check Adjust Value of Constant Voltage Relay

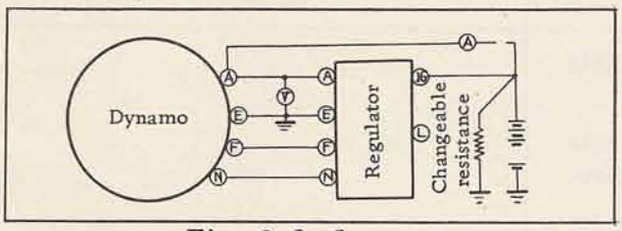


Fig. 3-2. 1

Connect the battery almost charged in full as shown, and make the dynamo revolution with 4000 rpm.

When the voltage of this time is 14 ~ 15V, it is all right.

(2) Check Voltage of Put-off, Put-on Pilot Lamp Relay

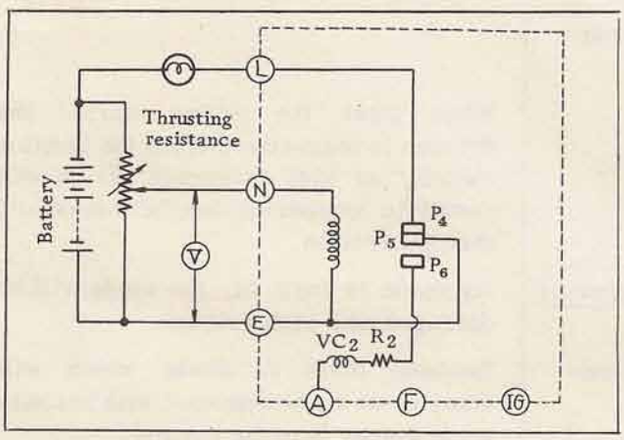


Fig. 3-2. 2

First, put on the lamp with connection as shown in Fig. 2. 2 and read the voltage between N - E by putting off the lamp moving the volt split point of the rubbing resistance. This is a put-off voltage.

From this state, move the rubbing resistance volt-pilot point and lower the voltage and read the voltage when the lamp flares.

This is a put-on voltage. If the put-off voltage is 0.5 ~ 0.3V, it is all right.

(3) Adjustment of Gap (Constant Voltage, Pilot Lamp Relay)

The voltage adjust values of the constant voltage relay and the pilot lamp relay must be as shown in Fig. 2. 3.

	Gap		
	G_1	G_2	G_3
Constant Voltage Relay	0.8 ~ 1.0	0.7 ~ 0.9	0.3 ~ 0.4
Pilot Lamp Relay	0.8 ~ 1.2	0.8 ~ 1.1	0.8 ~ 1.1

(4) Adjustment of Voltage

Put-off voltage of the constant voltage relay and pilot lamp relay.

Adjust the voltage by bending the stopper up

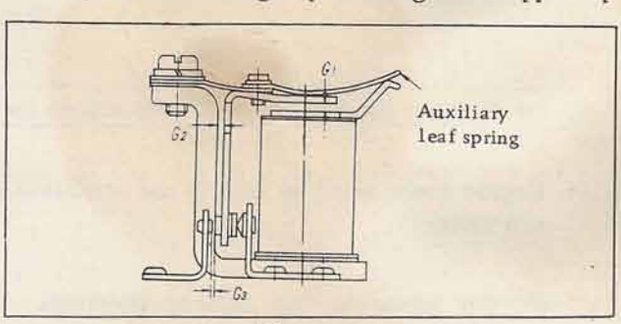


Fig. 3-2. 3

and down. Bend upward to heighten adjust value and bend downward to lower adjust value.

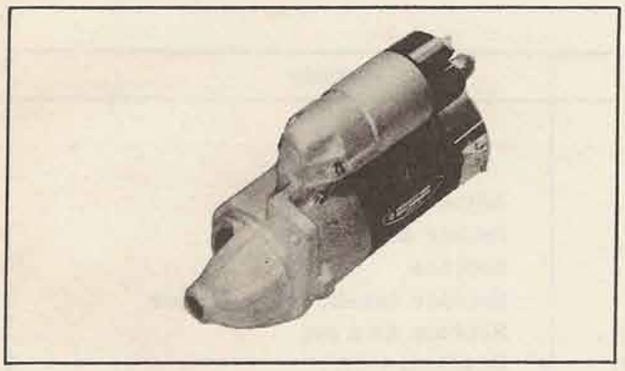
14 ITEMS ON HANDLING

Prohibition	Reason
(1) When mounting on vehicle, polish the contact points on both sides removing point, rust or oil.	
(2) Make sure the engine side pitch and dynamo side pitch of the front cover are well fitted together.	
(3) Be attentive to the belt tension.	
(4) Regulator is sealed with lead. If the seal is removed during the claim period, the claim will invalid.	
(5) If the earth is not correctly set, the adjust value will change.	
(6) Connect the dynamo and battery with full attention.	When the battery poles are connected in reverse, large current flows from battery to dynamo, resulting in damages of diode or lead wire.
(7) Make sure the whole circuit is completely composed.	
(8) Change wiring with full attention.	When after the engine started the dynamo is magnetized from the ignition switch, so that incorrect wiring will result in hampering magnetization and then generation.
(9) Do not use the high voltage tester such as megger.	As diode is built in, the diode will be damaged with high voltage.
(10) Engine room must be kept in the condition of standard usage.	Because there is diode which will deteriorate or be damaged with temperature higher than the normal.
(11) Do not separate the battery terminal (dynamo terminal) during driving vehicle.	Separation of the terminal causes serge voltage within battery and damages diode.
(12) When cleaning with steam cleaner, do not expose dynamo to steam directly. When washing with water, dynamo must be free from reckless pour of water.	If the diode is moistened, the performance will be lowered.
(13) When the battery is quickly charged with the quick charger, the lead wire or regulator A terminal (dynamo A terminal) should be disconnected.	Serge voltage of the quick charger will also damage diode.
(14) Put the key switch off when the engine is in a stop except when particularly needed.	When the key switch is on, magnetic current always flows on the field coil and might damage the dynamo and often causes over discharge of battery.

TROUBLE SHOOTING LIST

Trouble & Cause	Remedy
5-1 Over-discharge of battery	
1. Slackness of fan belt	Adjust
2. Earth or breakage of stator coil	Repair or replace
3. Breakage of rotor coil	Replace
4. Mal-contact of brush and slip ring	Replace brush, clean holder
5. Mal-function of diode	Replace as a set
6. Adjust voltage of constant voltage relay is low.	Readjust
7. Mal-contact of low speed side contact point of constant voltage relay.	Polish contact point
8. Adherence of high speed side contact point.	Replace
9. Shortage or unfitness of electrolyte.	Add distilled water, check S.G.
10. Mal-function of battery pole. (short circuit)	Replace or repair
11. Mal-contact of battery terminal	Clean, retighten terminal
12. Mal-contact or breakage between ignition switch and relay IG terminal.	Repair
13. Mal-contact or breakage between regulator F terminal and dynamo F terminal.	Repair
14. Excessive electric load.	Check power consumed
5-2 Over-charge of battery	
1. Constant voltage relay adjust voltage is too high.	Readjust
2. Constant voltage relay coil breakage or rare short.	Replace
3. Constant voltage relay coil straight resistance breakage.	Replace
4. Constant voltage relay low speed side contact point adherence.	Replace
5. Constant voltage relay high speed side contact point mal-contact.	Polish contact point
6. Breakage or rare short of pilot lamp relay.	Replace
7. Mal-contact of pilot lamp relay contact point.	Polish contact point
8. Mal-function of regulator earth.	Adjust
9. Mal-contact or breakage between regulator N terminal and dynamo N terminal.	Repair
5-3 Noises of Dynamo	
1. Mal-function of bearing.	Replace
2. Mal-function of diode.	Replace diode as a set.
3. Earth or rare short of stator coil.	Replace.

STARTER MOTOR



Type S114-92 Starting Motor

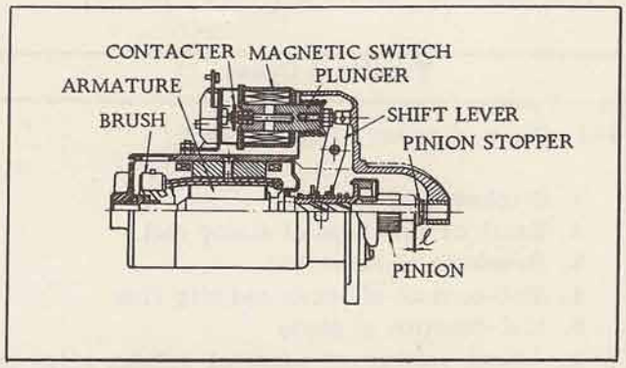


Fig. 1 Magnetic Shift Type

Type		S114-92
Rated Output	V-Kw	12-1.0
Meshing Device		Magnetic
No Load Current	V-A	Under 12-60
No Load Rev.	rpm	Above 7,000
Brush Normal Height	mm	14
Brush Wear Limit	mm	4.5
Brush Spring Tension	kg	0.8
Commutator Dia.	mm	33
Commutator Wear Limit Dia.	mm	2
Pinion Operating Voltage	V	Under 8
Pinion Gap	mm	3-5

Construction and Operation

The starter motor is a 1.0 horsepower sliding inertia type electric motor for use in starting. The motor when mounted on the engine is on the front right side of the transmission with its pinion gear directly opposite to the ring gear. The construction of the starter motor is similar to that of the generator but differs only in that its armature shaft extends out backwards with a pinion group installed on the end as shown in Fig. 1 & 2.

The connection diagram for the starter is shown in Fig. 3.

The starter switch is a key type combined with the ignition switch. By turning switch to the right driection, the relay on the magnetic switch move to permit current to flow to the starter and cause the armature to start turning suddenly.

After advancing about 14 mm, the pinion completes the meshing into the ring gear and drives it with a powerful torque. The direction in which the pinion moves is from the end of the shaft towards the starter bracket, thus reducting the bending torque. After the engine starts and its speed becomes greater than the no-load speed of the starter, the pinion is kicked back to unmesh and return to its former position.

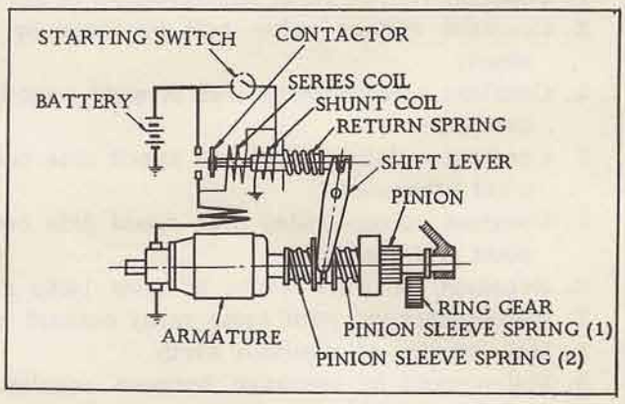


Fig. 2 A View of Starter System

Operational Precautions

The instructions to be observed when starting the engine are as follows:

(1) The starter should be securely mounted on the engine and should not show any looseness.

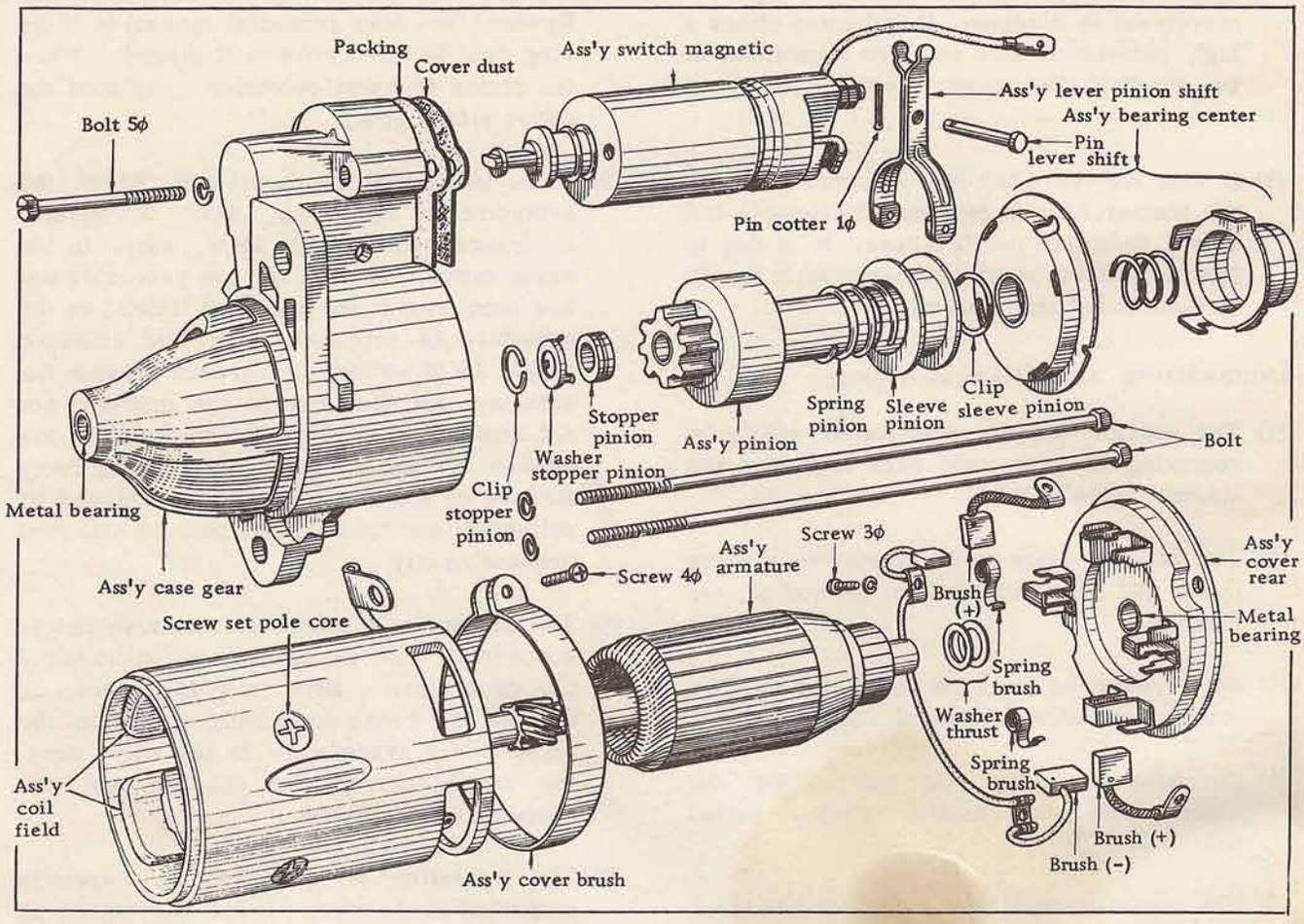


Fig. 3 Starter Motor (Hitachi)

(2) The starter switch should be operated properly and should be release immediately when the engine starts.
Excepting in extremely cold weather, the engine should normally start within 10 seconds.

(3) The starter switch should not be operated when the engine is running. If the engine fails to start, allow time for the pinion to come to rest before turning the starter switch again.

(4) When the engine fails to start after turning the starter key for over 10 seconds, do not continue turning the key time after time but try to save the battery. In this case, check for the cause of the trouble and correct so that the engine will start.

Checking While in Operation

(1) With a fully charged battery and with the lamps lighted, the starter switch is used. If the lamps become dim, especially when the engine does not start, the current is flowing through the starter motor coil but for some reason the armature is not turning. Careful check should be made since the starter pinion may be locked in the flywheel ring gear and unable to return, a trouble usually caused by turning on the starter while the engine is still running.

(2) When the starter switch is turned up and the starter motor fails to turn although the lights remain bright, the switch should first be checked. If the switch is in satisfactory condition, then the condition of all the terminal and ground connections of the battery, starter switch and starter are

checked. If the starter motor runs but its movement is sluggish, it indicates either a high resistance due to loose connection in the starter circuit or a badly discharged battery.

(3) If after the above troubles are corrected and the starter fails to operate occasionally and shows defective performance, it is due to internal defects so that in this case, it should be dismantled and checked.

Dismantling and Disassembling

(1) The starter can be dismantled easily by removing the two stud nuts mounting the starter on the engine.

(2) The two stay bolts on the starter rear cover (front end when mounted on the engine) are removed.

(3) After removing the band cover, the rbushes and lead wires are removed.

(4) By properly protecting and holding the starter body, the armature shaft is pulled out.

(5) The armature and the front cover are taken out together.

(6) To remove the pinion group from the armature shaft, the cotter pin on the end of the shaft is pulled out and by removing the pinion nut, the pinion group is removed.

Inspection and Repairing Parts

The same procedure as that for the generator parts is followed, the parts being cleaned and inspected after which determinations are made as to whether they can be reused or if repairs or replacements are necessary.

(1) The pinion is inspected for defects and if the tooth face is worn or the tooth edge is damaged, the pinion should be replaced. Worn or broken teeth will not only make the gear mesh poorly but will hasten the wear on the opposing gear and also, poorly meshing gears will cause bending in the armature shaft. For this last reason, care should be taken, when inspecting, to also check the flywheel and take remedial measures if the ring gear is found worn or damaged. When the pinion is found defective, replaced the entire pinion group.

(2) When inspecting the armature, check the armature to core gap, shaft to bushing clearance, bending in shaft, etc., in the same manner as that for the generator and are corrected to the specified limits, or the armature is replaced. Special attention should be given to the clearance between the armature and the core to see that they are not contacting, and corrosion found on the outside surface of the armature or the inner surface of the core should be removed by polishing, and the surfaces painted with rust preventive oil.

(3) The armature is inspected and repaired in accordance with the procedures outlined for the generator. Especially to improve or correct the brush contacting condition, the brushes are reseated. At the same time, the brush spring are checked and are corrected or replaced.

(4) The insulation on the wires are carefully inspected and wires found with weak or damaged insulation should be replaced.

(5) An armature found with one part especially damaged by buring should be strictly tested by the insulation test.

ADJUSTMENT

a. Meshed Pinion Position by Magnetic Switch

The correct clearance between the pinion stopper and pushed out pinion which is shown by ℓ dimension in Fig.4 must be following. ℓ=0.3 -1.5 mm.

In case that the ℓ dimension is incorrect, adjust plunger gap of the magnetic switch by following paragraph b. Pay attention that the ℓ dimension must be measured when the pinion is atmostly pushed out by the shift lever of the plunger and the back lash of the pinion is eliminated by pushing gear inward with finger as Fig. 3 shows. If the ℓ dimension is incorrect, it will be the

possible cause of large meshing noises or early wear and damage of the pinion and ring gear.

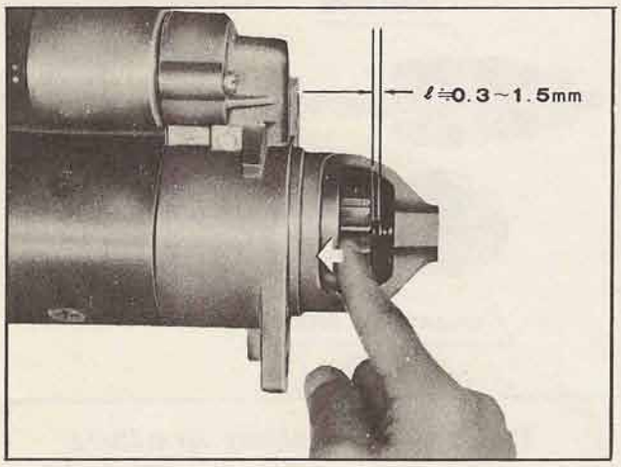


Fig. 4 Checking Dimension ℓ

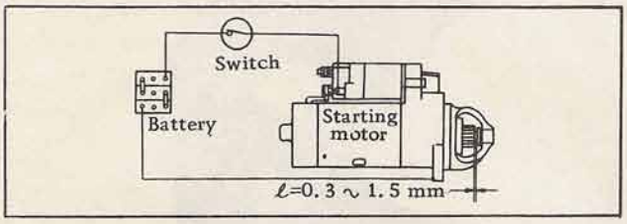


Fig. 5 Cable Connection of Dimension Adjust

b. Adjustment of Plunger Gap of Magnetic Switch

The L dimension when the plunger gap is compressed to 0, must be following in Fig. 6.
L = 31.7-32.3 mm

This adjustment is carried out at the adjuster and the adjusting nut.

DISASSEMBLING AND ASSEMBLY OPERATION

5-1 Disassembling the Armature, Gear Case and Pinion

Disassembling order is shown by Fig. a to Fig. c.

Disassembly is operated by removing magnetic switch fixing bolts, through bolts and the armature shaft clip. Before disassembling main body, remove brushes by unscrewing brush fixing screws as Fig. 6.

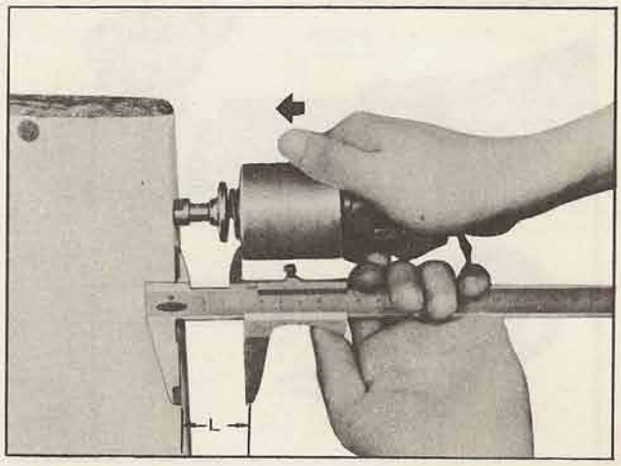


Fig. 6 Measurement of Plunger Gap

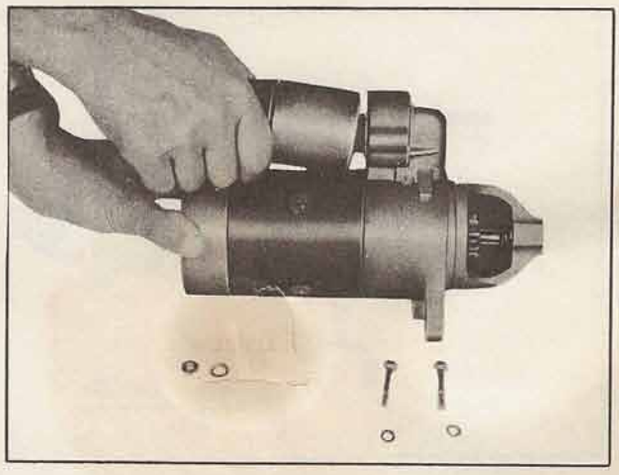


Fig. a Removing Magnetic Switch

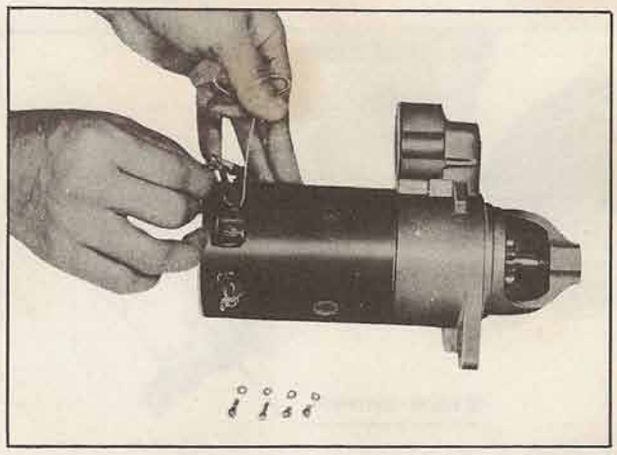


Fig. b Drawing out Brushes (After removing fixing screw)

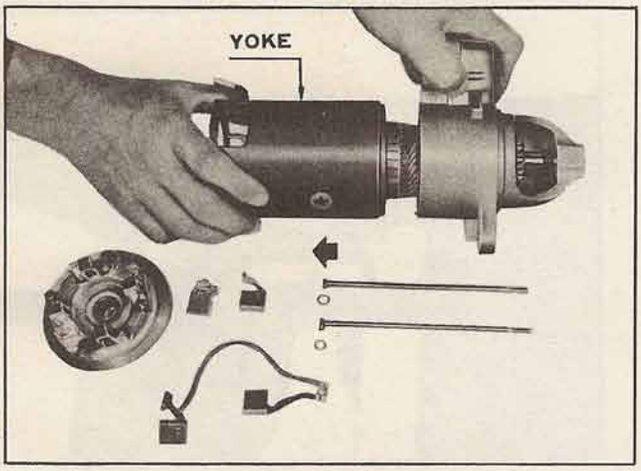


Fig. c Drawing Out Yoke

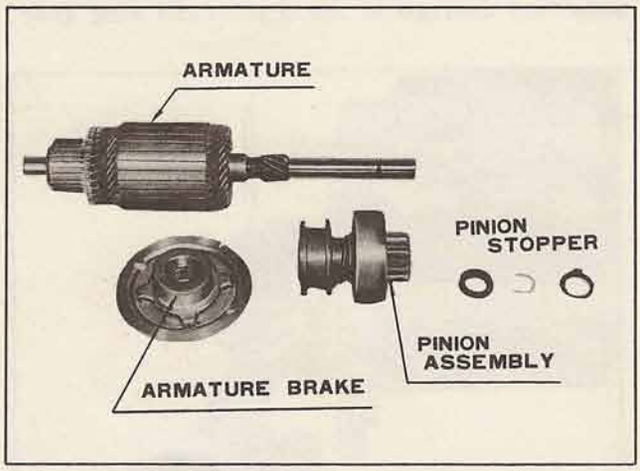


Fig. f Disassembling Armature

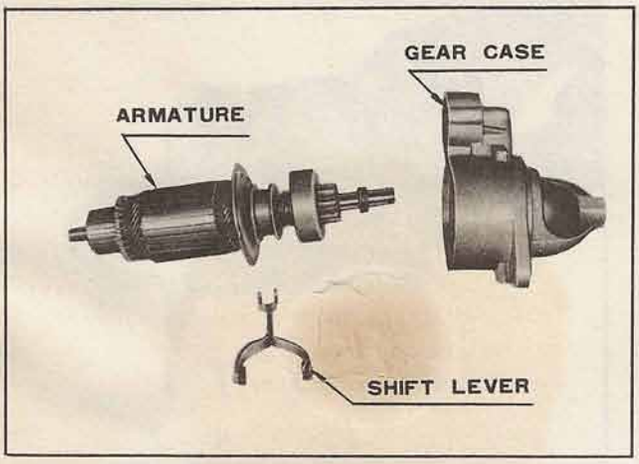


Fig. d Disassembling Armature and Gear Case

Fig. g Removing Pinion Clip

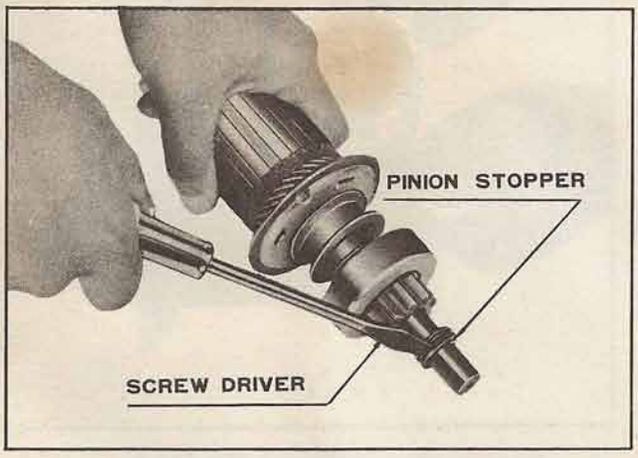


Fig. e Removing Pinion Stopper

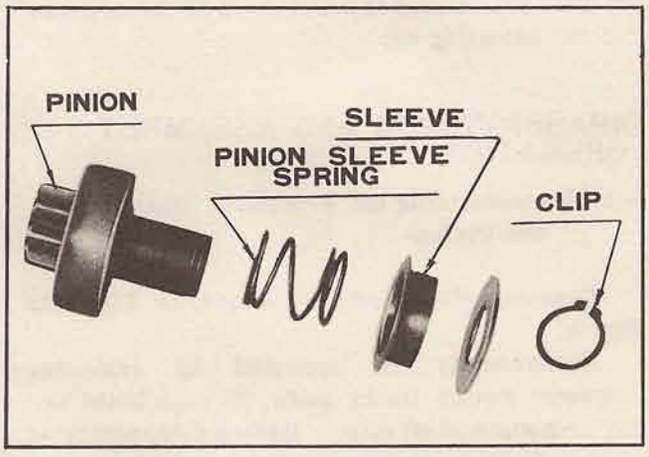


Fig. h Disassembling Pinion Subassembly

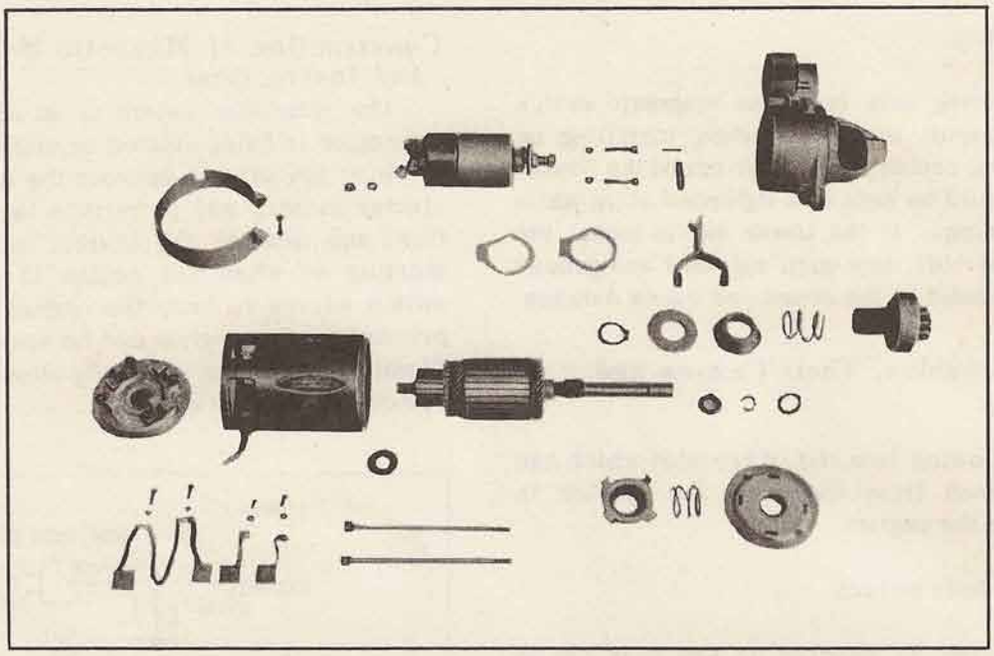


Fig. i Display of all Component

Disassembling Pinion

Disassembling is carried out by removing pinion clip as Fig. g.

Assembling will be done in reverse sequence of disassembling operation. At assembly, check each dimension and major specification standard.

Assembling and Testing Starter

Reassembling is performed by following the reverse procedure for disassembling. All frictional parts are lubricated with mobile oil (SAE 30) while the bearings are coated with a small amount of grease circuit in the magnetic switch and causes the main circuit S_2 in the magnetic circuit to close. Releasing the starter switch opens the magnetic circuit which also opens S_2.

(1) Causes for magnetic switch failing to operate can be divided into electrical and mechanical sources.
Causes for electrical troubles.

(A) Current failure in magnetic circuit.
When the starter switch in pressed and the current falls to pass through the magnetic circuit, most of the trouble is due to broken soldered connection between the magnetic coil wire add the magnetic switch (+) terminal, and defective ground connection from the coil wire to the magnetic switch body.

(B) Defective contact in main circuit S_2.
When the magnetic circuit is satisfactory and S_2 is closing but only a small current flowing due to high contact resistance, and the opposite case of switch S_1 opening but S_2 remaines closed. In either case, the trouble lies in the faulty moving of the core or roughness of the contacting point surface. Therefore polished the surface well, then the operation will become satisfactory.
Causes for mechnical troubles.
Failure to operate is caused in many cases by the guide shaft on the moving core of the magnetic switch main circuit S_2 sticking against the cover hole.
Correction can be made in this case by loosening the cover screws (4 pieces) and retightening them so that the shaft moves freely.

(2) Precaution

In removing nuts from the magnetic switch main circuit terminals when installing or removing cables, the lower nut of the double nuts should be kept in a tightened state while unscrewing. If the lower nut is loose, the terminal bolt may turn together and ground the terminal to the cover and cause damage.

Starter Troubles, Their Causes and Remedies

The following is a list of troubles which can be determined from the state the starter is installed on the engine.

(1) Starter fails to turn.

The engine is checked to see if it can be cranked by hand.
If it cannot be cranked, the engine is at fault and should be checked. If it can be cranked easily, the starter including the wiring should be checked and correction made accordingly.
Is the battery run down? Check the specific gravity of the battery fluid to see if it is over 1.240 and recharge or replace the battery as found necessary.
All loose battery and ground cables should be cleaned and properly tightened.
(Magneto grease or Gargoyle (BRB No. 1).
All cord connections are carefully tightened and special attention given to the condition of insulation. The assembly check is made by testing the starter as a single unit using a fully charged battery. Tests are made with a starter motor tester or with the apparatus shown in Fig. 4 by which braking torque is measured. In this case, the normal value should be 0.9 m-kg.

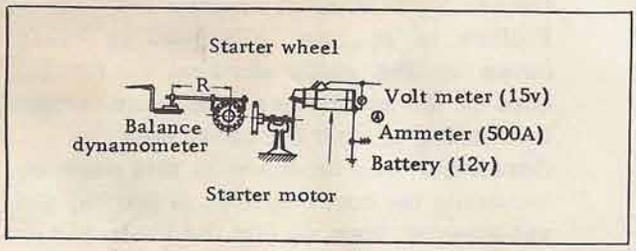


Fig. 7 Torque Testing Apparatus

Construction of Magnetic Switch and Instructions

The magnetic switch is an apparatus when the engine is being started by shift lever, serves to close the circuit between the battery and the starter motor, and permits a large current to flow and actuate the starter motor. After starting or when the engine is stopped, the switch serves to keep the circuit open. The principles of operation can be seen from Fig. 7. Closing the starter switch S_1 allows the current to flow through the magnetic.

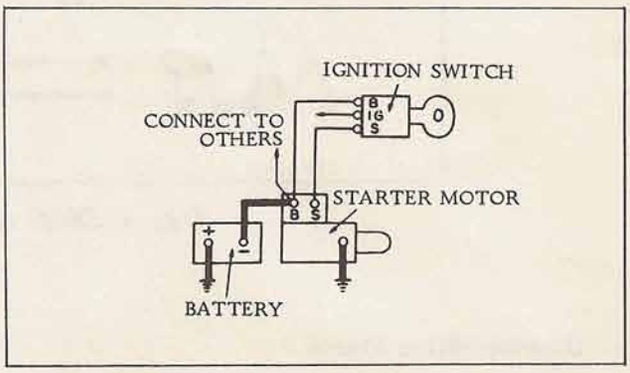


Fig. 8 Magnetic Starter Circuit

If there is trouble in the magnetic circuit, it should be corrected.

For improperly contacting starter brushed, the brushes together with the armature should be checked, and corrections or replacement made as found necessary.

If all of the above checks with their corresponding repairs have been made and the starter still fails to operate, the trouble can be assumed to be in the starter itself so that it should be removed from the engine and checked.

This is exceedingly rare but care should be taken to see that the starter pinion is not locked into the flywheel ring gear. Cases like this are usually caused by badly worn gears meshing improperly and if the defect is not too severe, it can be remedied by placing the gear shift lever into fourth speed and rocking the car back and forth to free the gears. If this trouble is frequently repeated, the starter should be dismantled from the engine for checking and repairs.

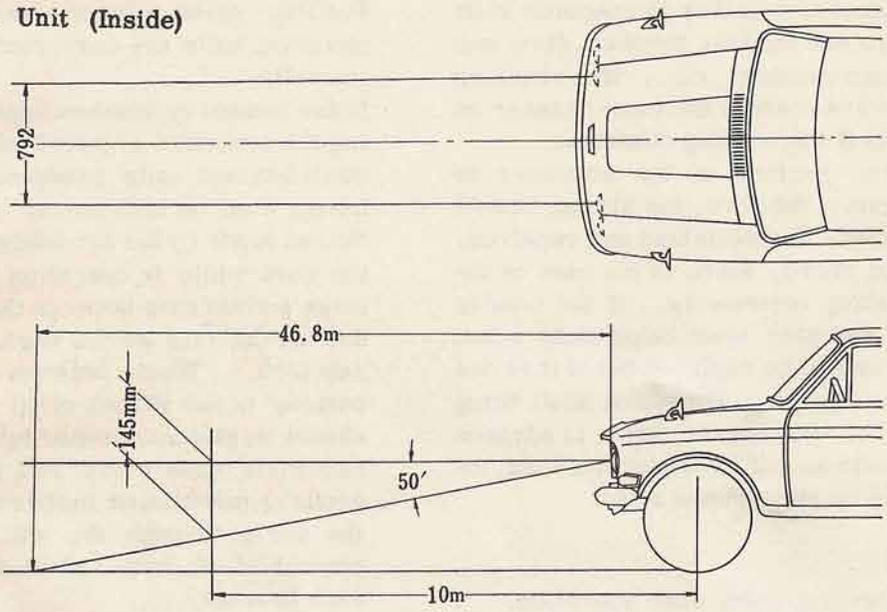
(1) Starter turns but its turning power is weak and fails to start the engine.
If the trouble is due to a run down battery, loose terminals, troubles in magnetic shift switch, worn and sticking brushes, dirty and damaged commutator, etc., the checking and repairs are made in the same manner as described in the preceding chapters.
If the outer surface of the armature is rubbing against the core, the starter should be dismantled, disassembled and repaired.
Besides the above, there is the case of the pinion meshing improperly. If the trouble is due to the gear teeth being badly worn, the gears should be replaced but if it is due to the screw guide on the pinion shaft being dirty and not allowing the pinion to advance smoothly and causing improper meshing, the shaft should be cleaned and oiled.

(2) Starter exceeding noisy when operation.
The flywheel ring gear is checked and if the teeth are deformed, they should be repaired or the gear replaced.
Rattling noise caused by loose starter mounting bolts are corrected by retightening the bolts.
Noise caused by brushes improperly contacting the armature required correcting as this condition not only produces noise but will hasten wear on both parts.
Noises made by the armature rubbing against the core while in operation is caused by too large a clearance between the armature shaft and the bushing so the worn parts should be replaced. Wear between the shaft and bushing is due to lack of oil so that attention should be given to proper lubrication.
Lubricate once every half year using good grade of machine or mobile oil and lubricate the parts through the oil nipples. The amount of oil required is about 0.5 cc. for each bracket.

ADJUSTING FOR THE HEAD LAMPS (WITHOUT LOADING)

When the inside unit is adjusted, the outside unit must be covered with a blind.

No. 1 Unit (Inside)



No. 2 Unit (Outside)