SECTION 2

ENGINE TUNE-UP

D. Compression Test

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

(Test procedure)

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

(Normal compression pressure)

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

(Test conclusion)

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

E. Valve Adjustment

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

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

(Valve timing)

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

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

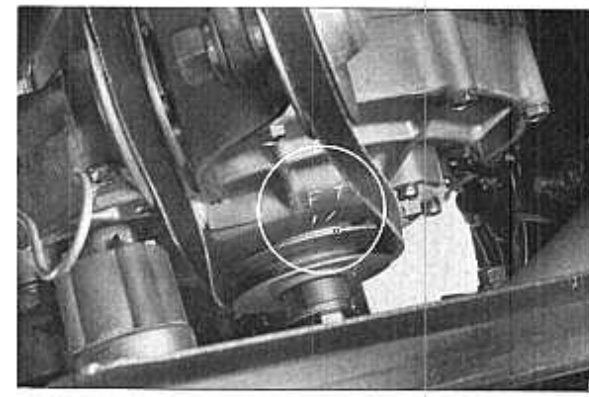

Fig. 2E-1

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

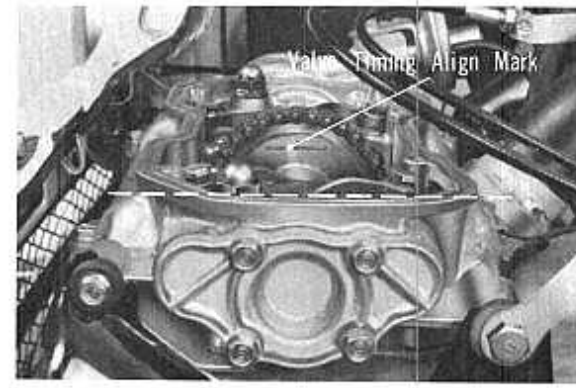

Fig. 2E-2

(Valve clearance)

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

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

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

NORMAL VALVE TAPPET CLEARANCE (Intake and exhaust)

0.08~0.12mm (0.003~0.005 in)

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

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

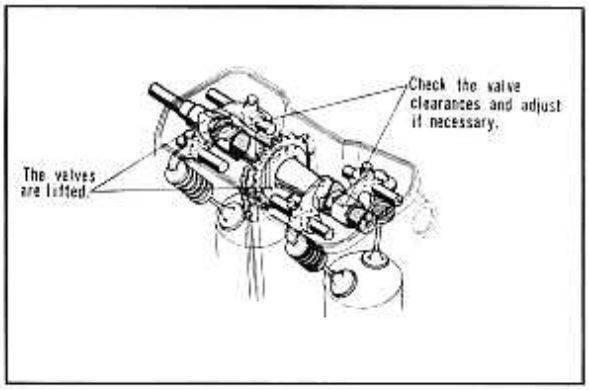

Fig. 2E-3

(Valve clearance adjustment)

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

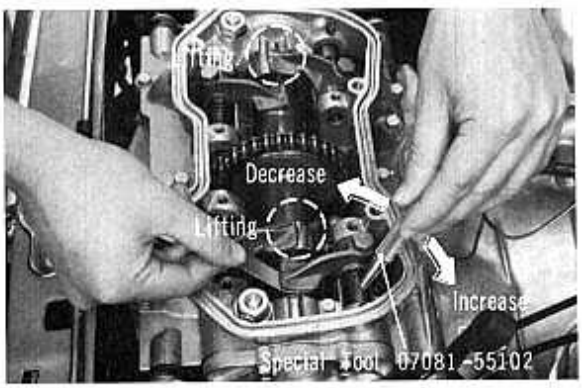

Fig. 2E-4

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

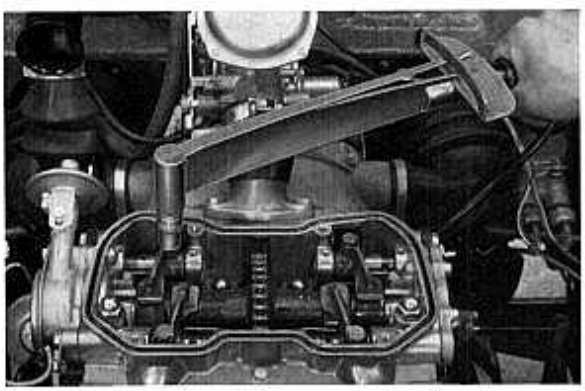

Fig. 2E-5

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

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

F. Air Cleaner

(Filter element)

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

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

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

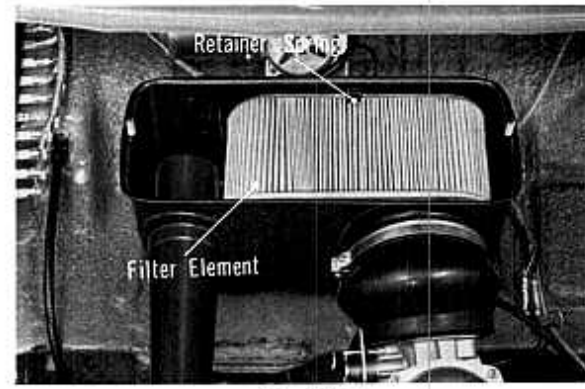

Fig. 2F-1

(Air cleaner case)

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

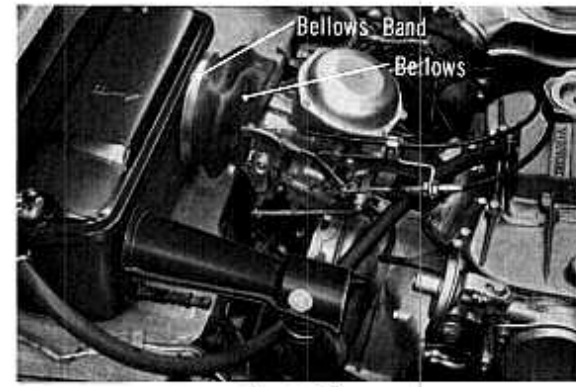

Fig. 2F-2

G. Carburetor

(General)

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

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

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

(Choke adjustment)

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

Fig. 2G-1

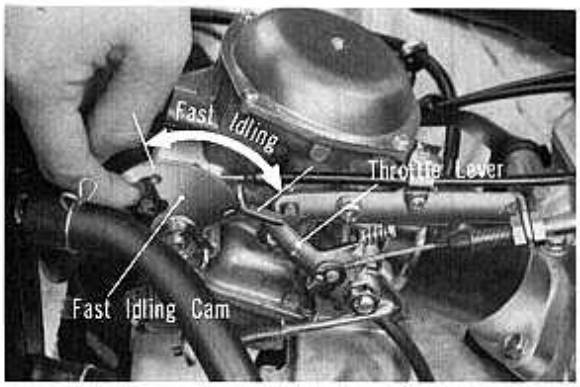

Fig. 2G-2

(Fast idle adjustment)

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

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

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

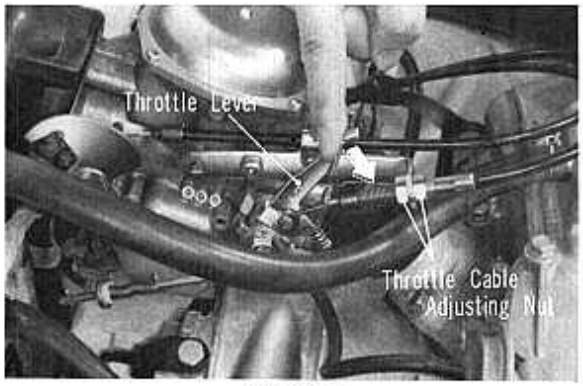

Fig. 2G-3

(Throttle adjustment)

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

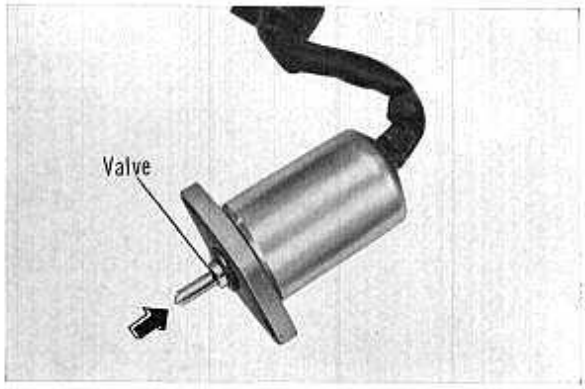

Fig. 2G-4

(Fuel solenoid valve)

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

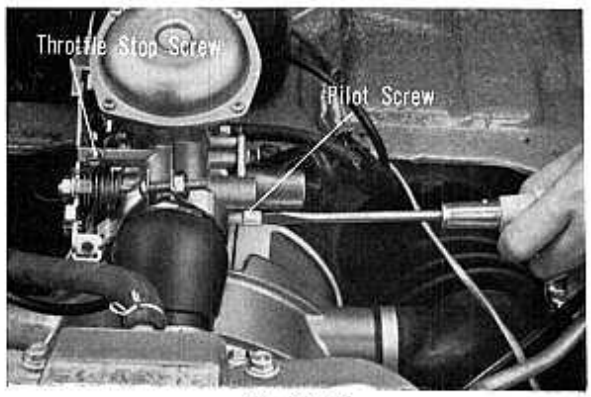

Fig. 2G-5

(Pilot screws adjustment)

The standard setting for the pilot screw is 4/8~6/8 (N360, N400), 1-1/8~1-3/8 (N600 D_1 setting),2-1/8 ~2-3/8 (N600 D1 setting) turn open from full close.

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

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

(Idling adjustment)

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

(Accelerator pump)

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

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

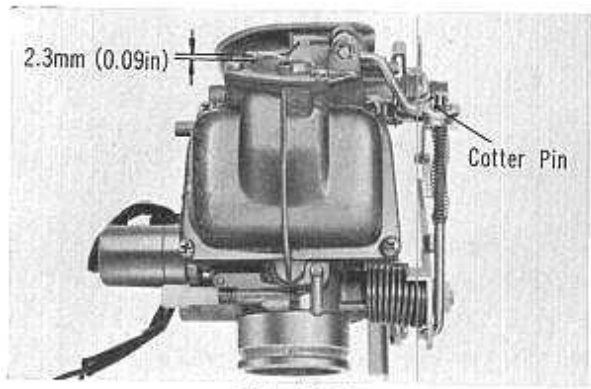

Fig. 2G-6

(Cleaning and inspecting)

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

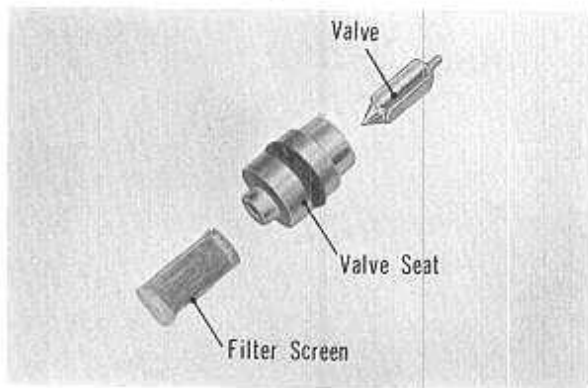

Fig. 2G-7

(Float level)

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

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

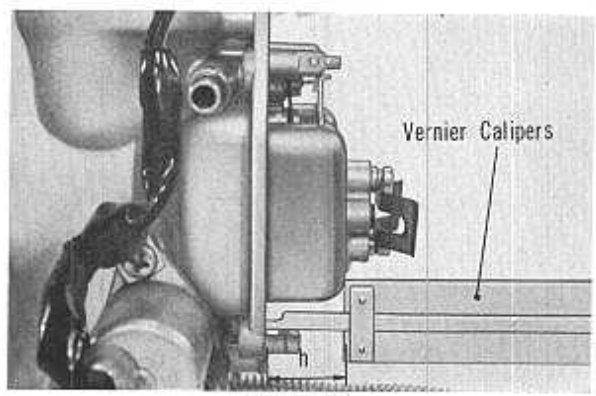

Fig. 2G-8

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

(Trouble diagnosis)

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

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

H. Fuel System

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

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

(Fuel tank and lines)

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

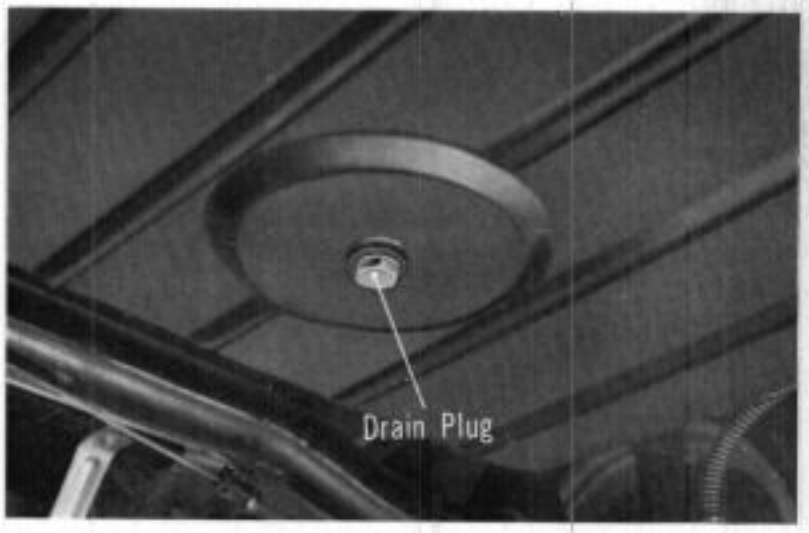

Fig. 2H-1

(Fuel filter)

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

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

Fig. 2H-2

(Fuel pump)

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

CAPACITY VOLUME AND PRESSURE TEST

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

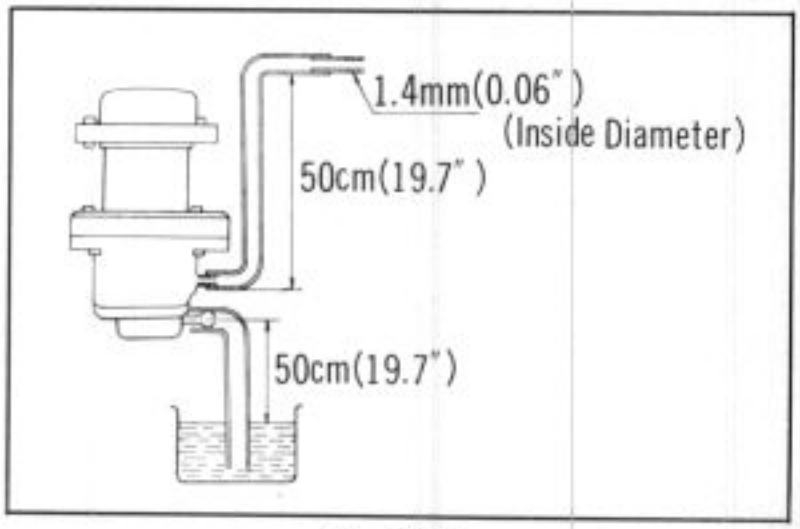

Fig. 2H-3

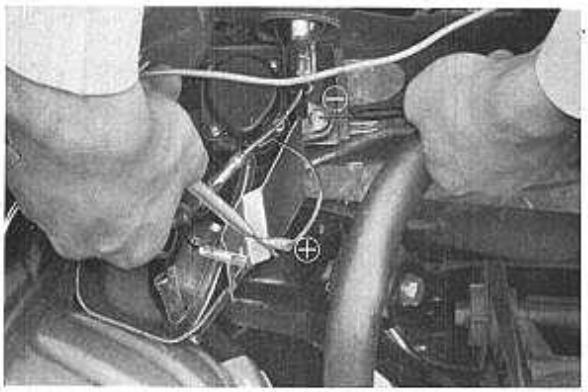

Fig. 2H-4

ELECTRICAL COMPONENT TEST

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

Normal reading: 5 ohms.

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

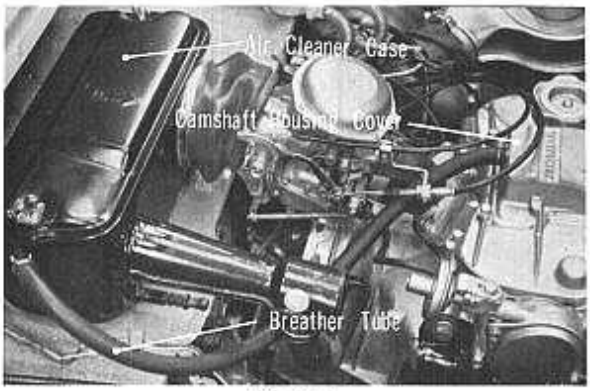

Fig. 2I-1

I. Crankcase Ventilation

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

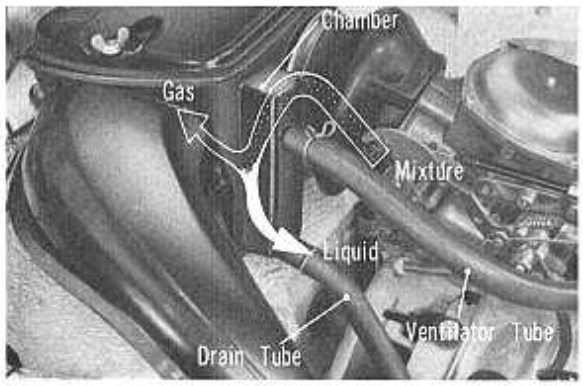

Fig. 2I-2

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

J. Ignition Timing

CONTACT BREAKER

(Cleaning)

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

(Point gap adjustment)

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

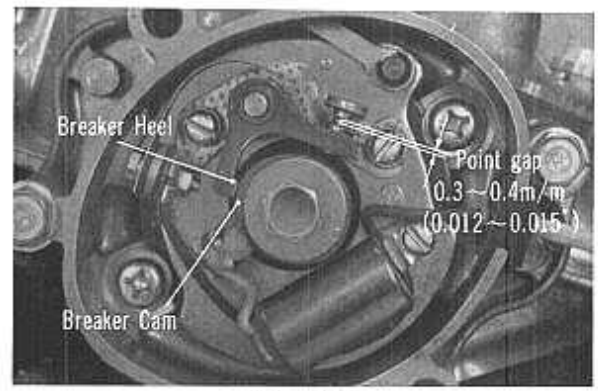

Fig. 2J-1

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

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

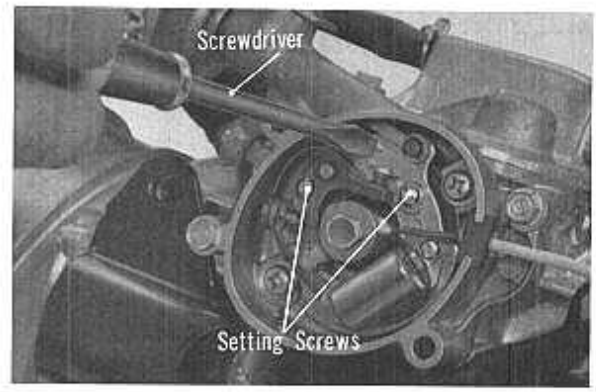

Fig. 2J-2

(Dwell angle)

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

Normal dwell angle; 90 degrees

(Timing)

Initial igniton timing-Static ignition timing

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

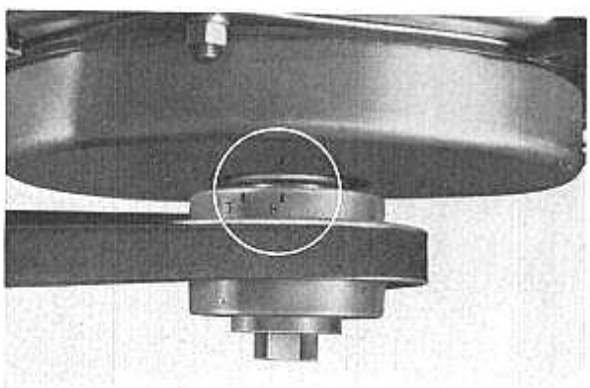

Fig. 2J-3

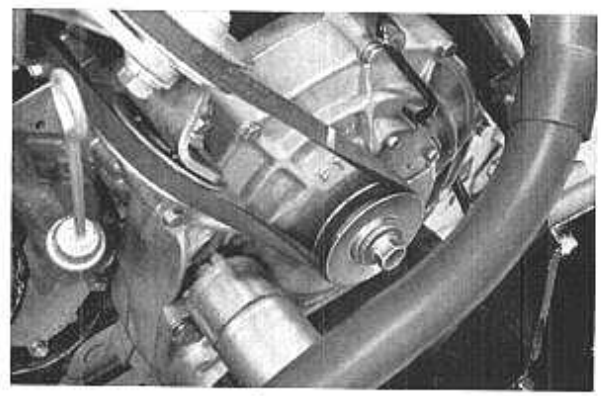

Fig. 2J-4

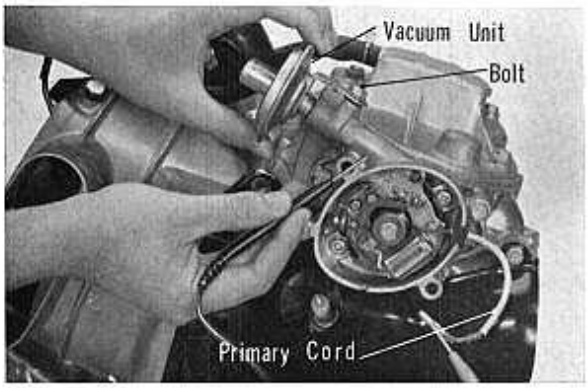

Fig. 2J-5

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

Centrifugal ignition advancer-Dynamic ignition timing

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

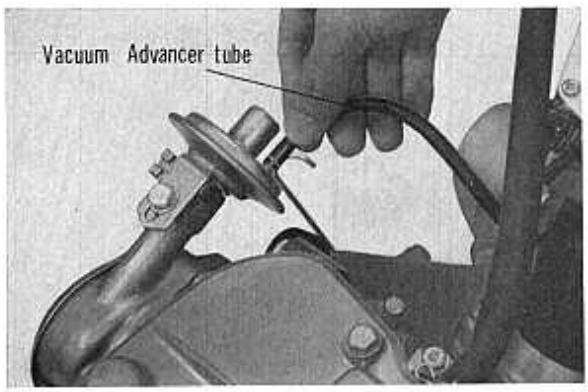

Fig. 2J-6

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

Mechanical Spark Advancer Characteristics

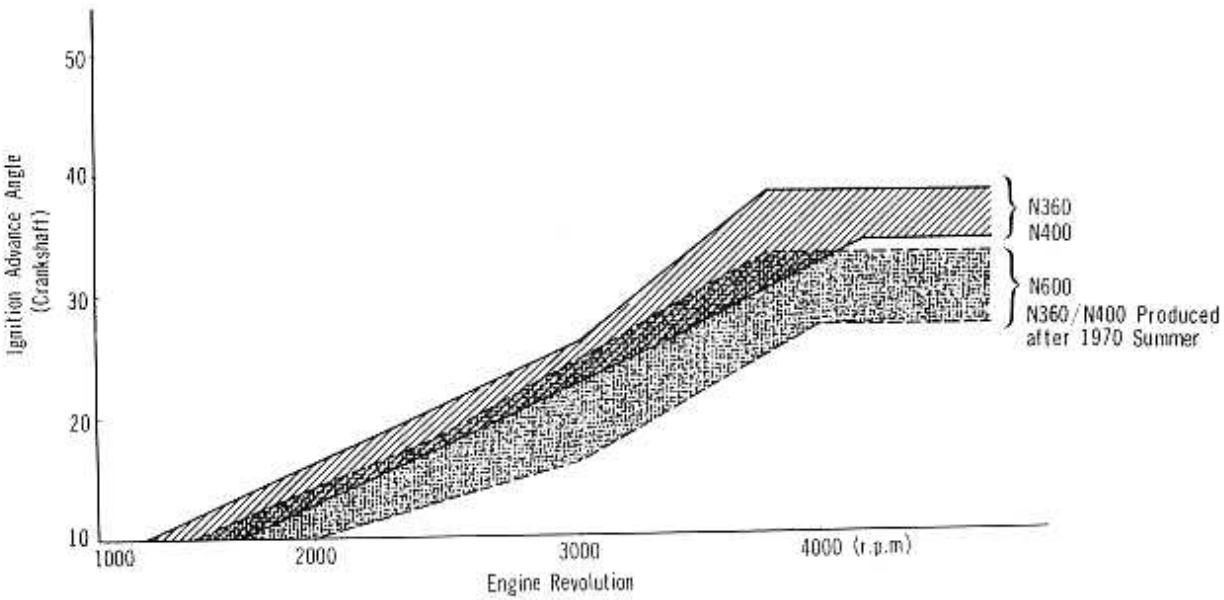

Fig. 2J-7

(Vacuum ignition advancer)

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

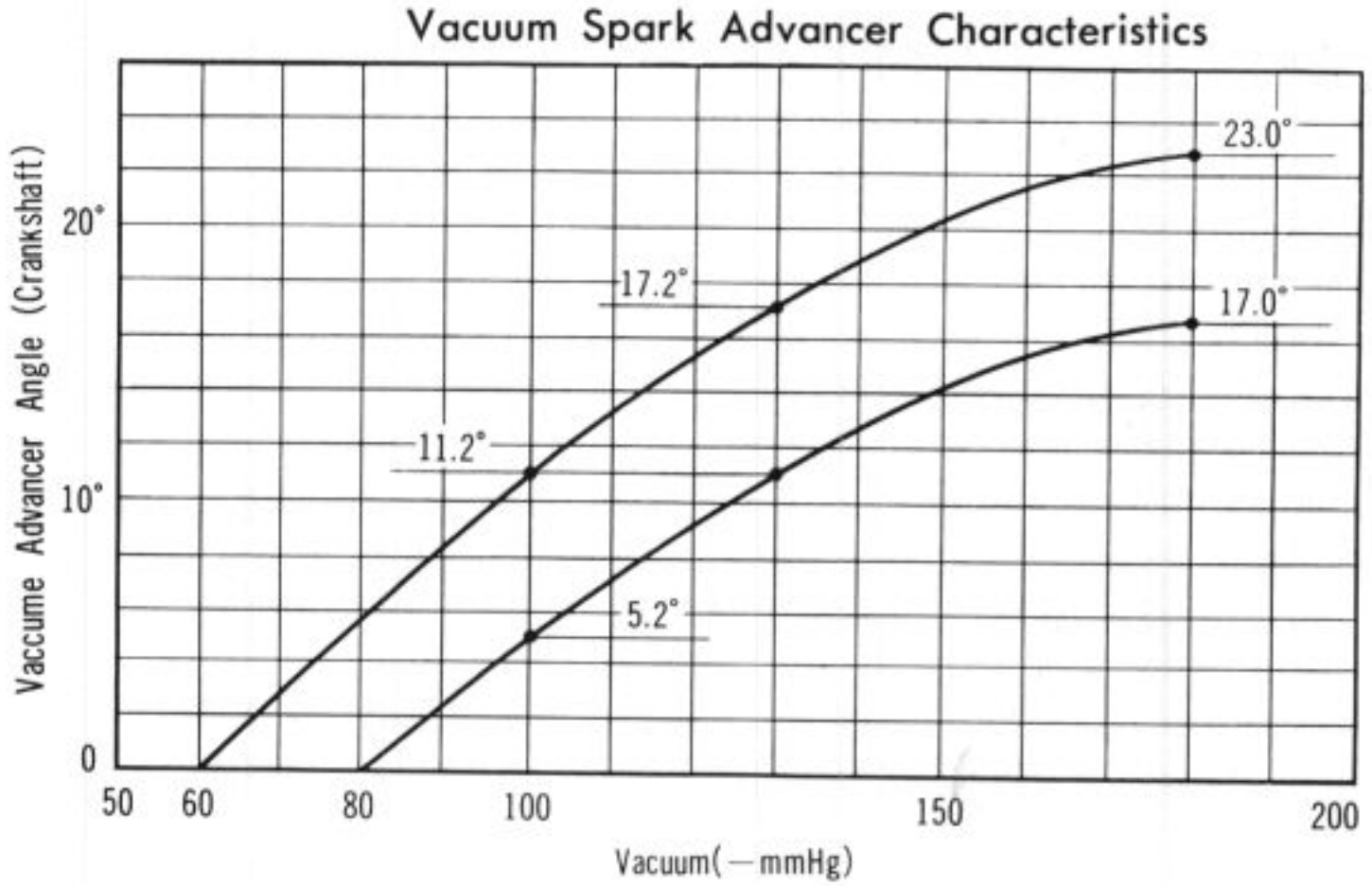

Fig. 2J-8

K. Spark Plug

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

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

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

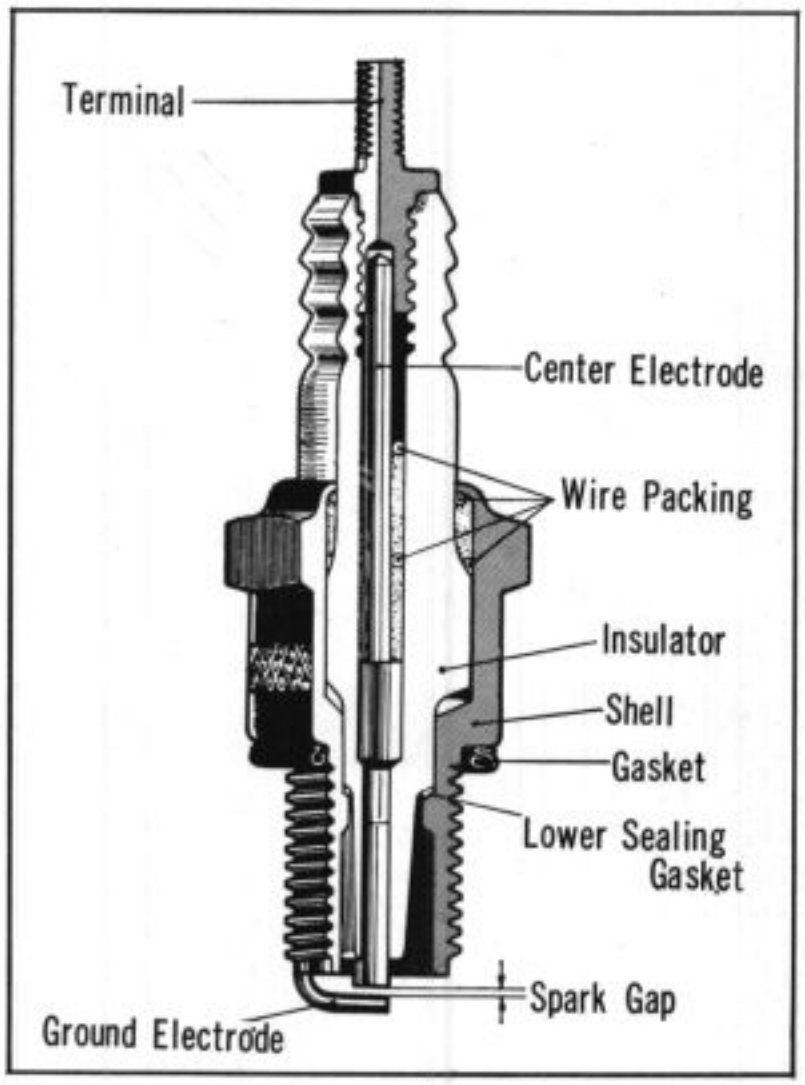

Fig. 2K-1

(Removal and installation)

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

(Inspection)

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

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

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

(Cleaning and regapping)

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

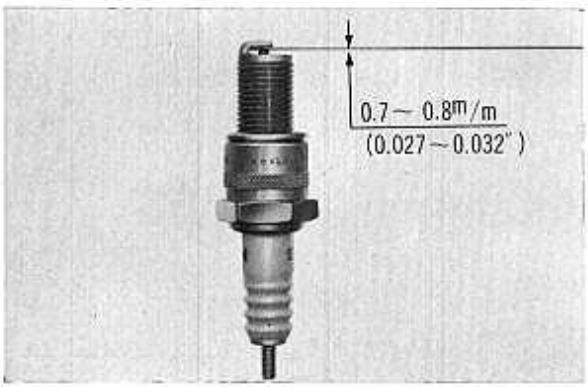

Fig. 2K-2

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

L. Battery

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

Cleaning and inspection

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

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

Electrolyte level

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

Checking battery state of charge

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

(1) Correct electrolyte level.

(2) Temperature: 15~20°C (59~77°F)

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

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

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

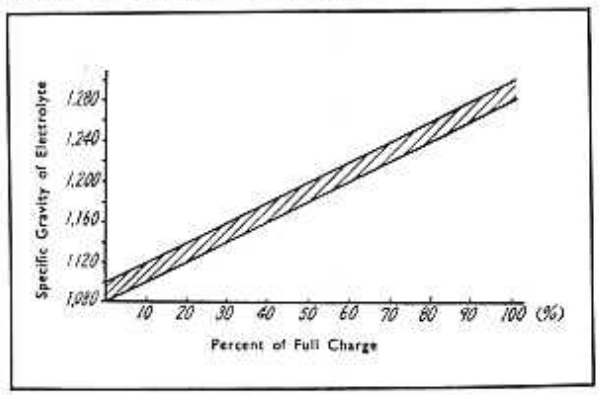

Fig. 2L-1

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

Battery charging

(Slow charge)

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

(Quick charge)

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

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

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

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

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

M. Generator and Regulator

a. Checking Circuit for 360 and 400 Vehicles.

GENERATOR

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

(Cleaning and inspection of motor-generator)

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

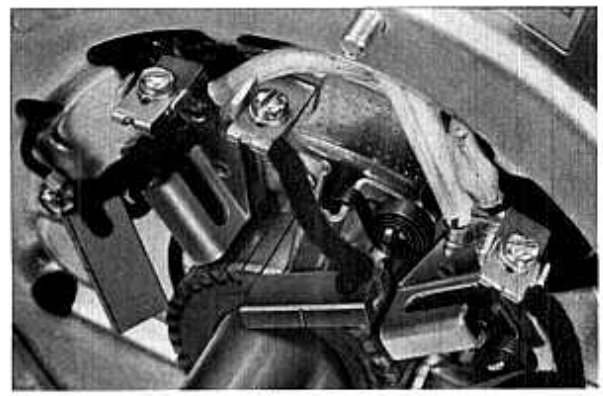

Fig. 2M-1

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

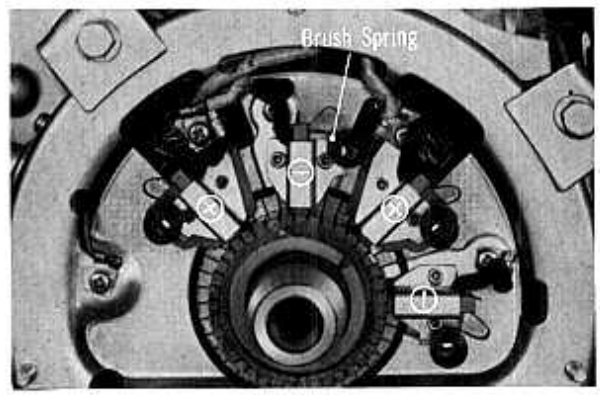

Fig. 2M-2

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

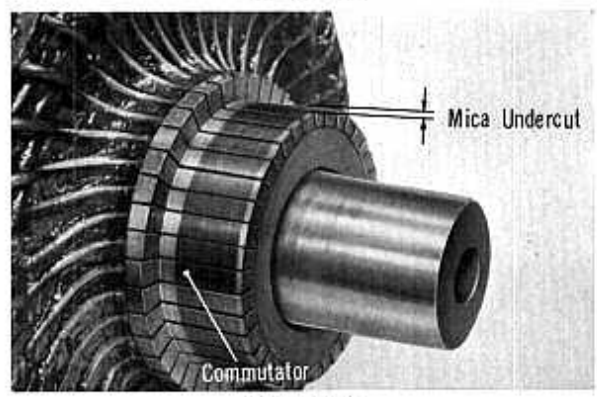

Fig. 2M-3

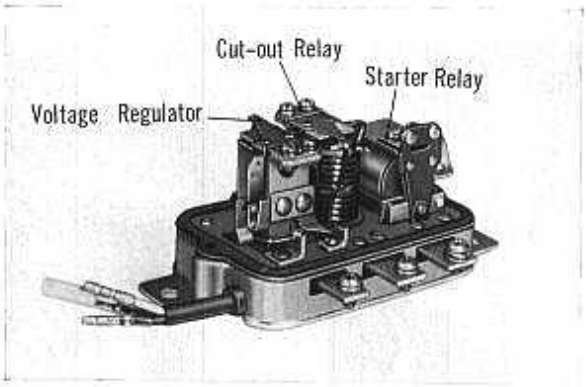

Fig. 2M-4

REGULATOR

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

(Specification)

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

TROUBLE DIAGNOSIS

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

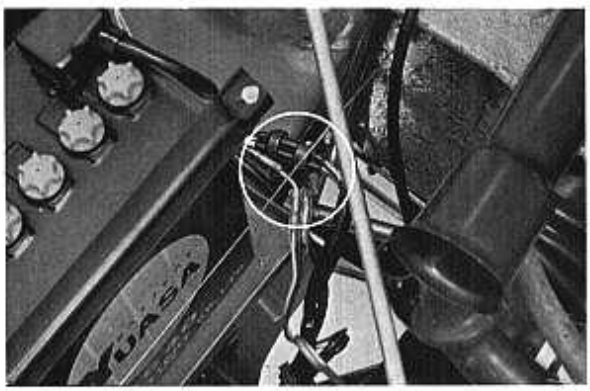

Fig. 2M-5

(MOTOR GENERATOR)

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

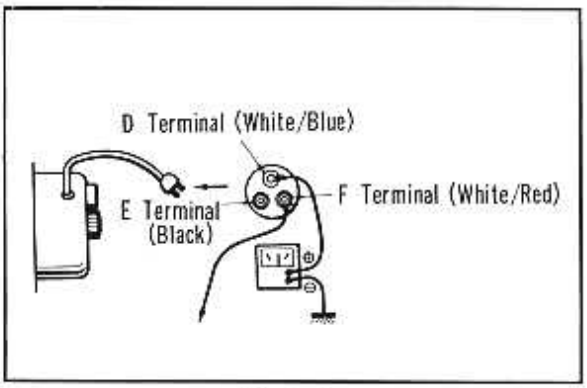

Fig. 2M-6

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

(REGULATOR)

(First stage)

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

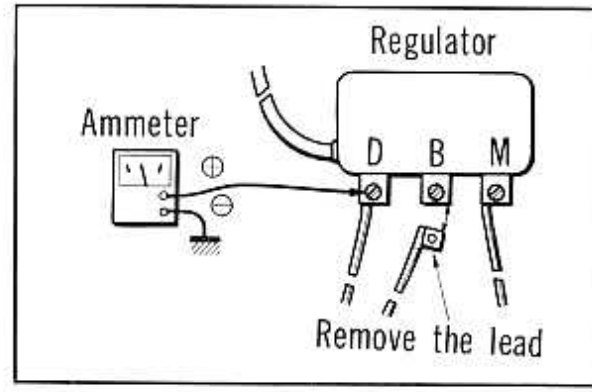

Fig. 2M-7

(Second stage)

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

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

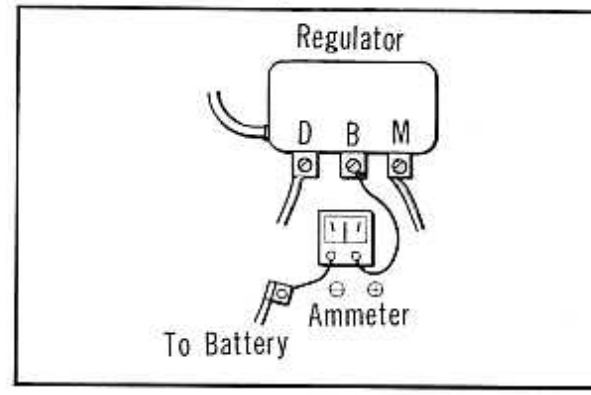

Fig. 2M-8

(ii) GENERATOR BRUSHES WEAR RAPIDLY.

* Heavy electrical load
* Commutator unevenly worn.

b. Checking Circuit for 600 Vehicle.

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

(AC GENERATOR)

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

   Rotor coil resistance: 5.19Ω

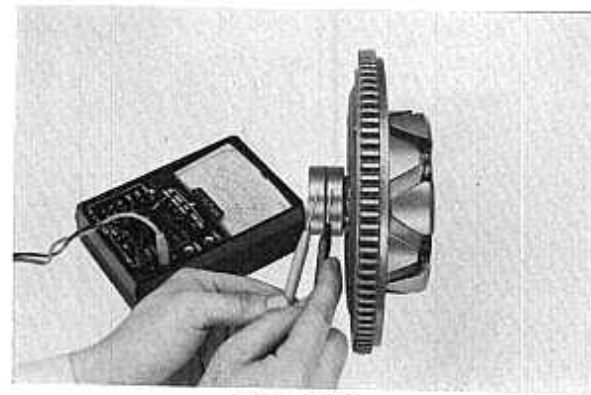

Fig. 2M-9

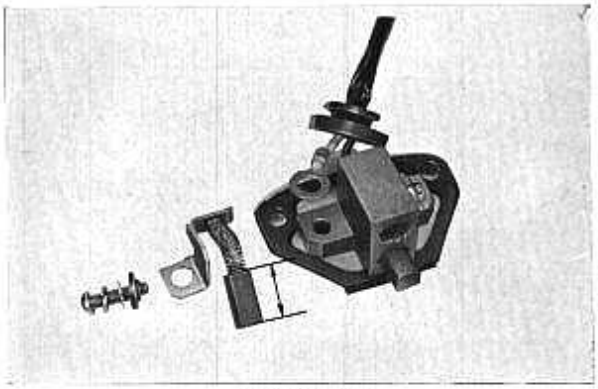

Fig. 2M-10

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

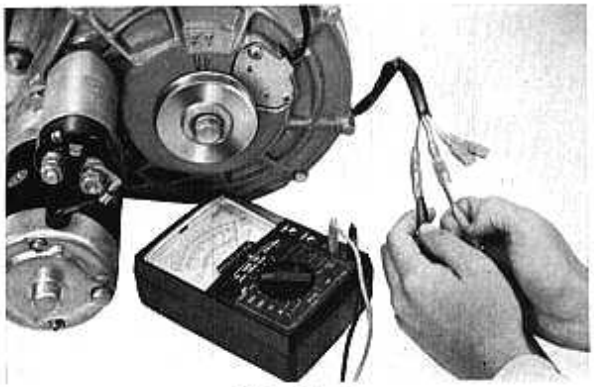

Fig. 2M-11

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

   Stator coil resistance: 0.115Ω

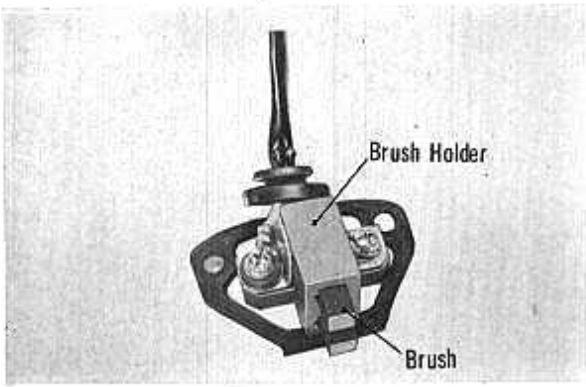

Fig. 2M-12

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

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

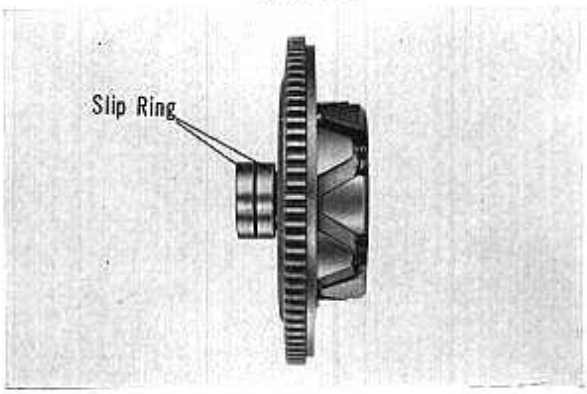

Fig. 2M-13

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

(REGULATOR)

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

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

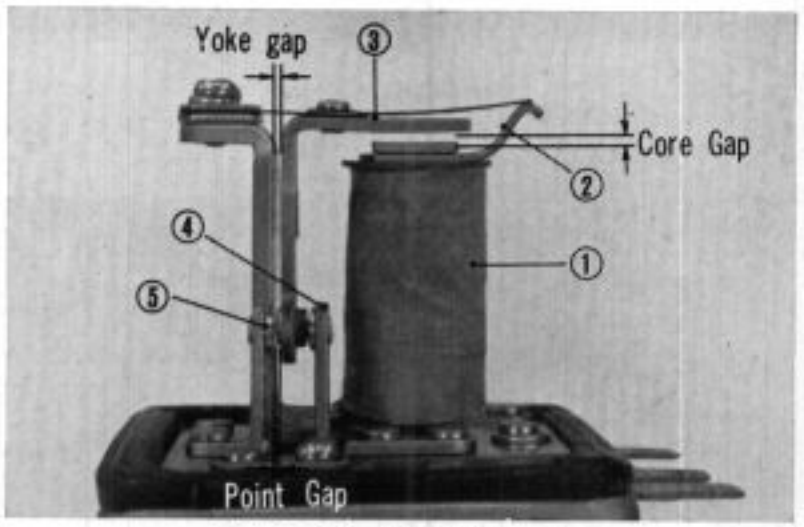

Fig. 2M-14

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

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

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

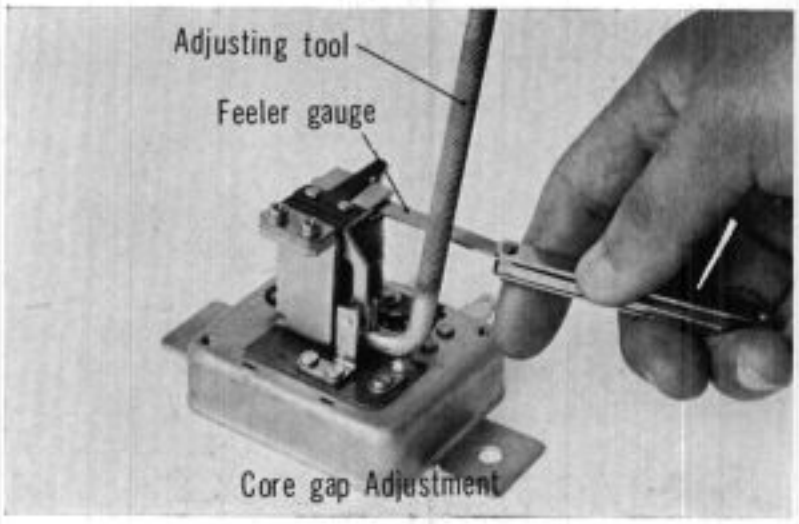

Fig. 2M-15

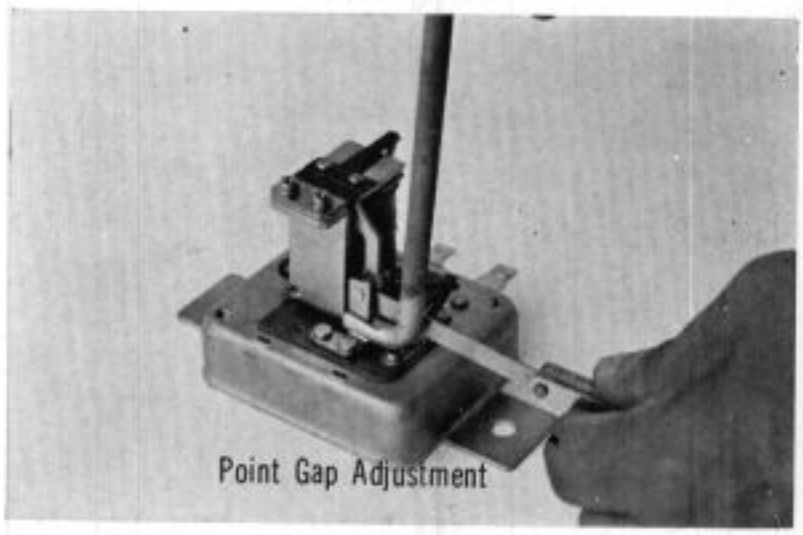

Fig. 2M-16

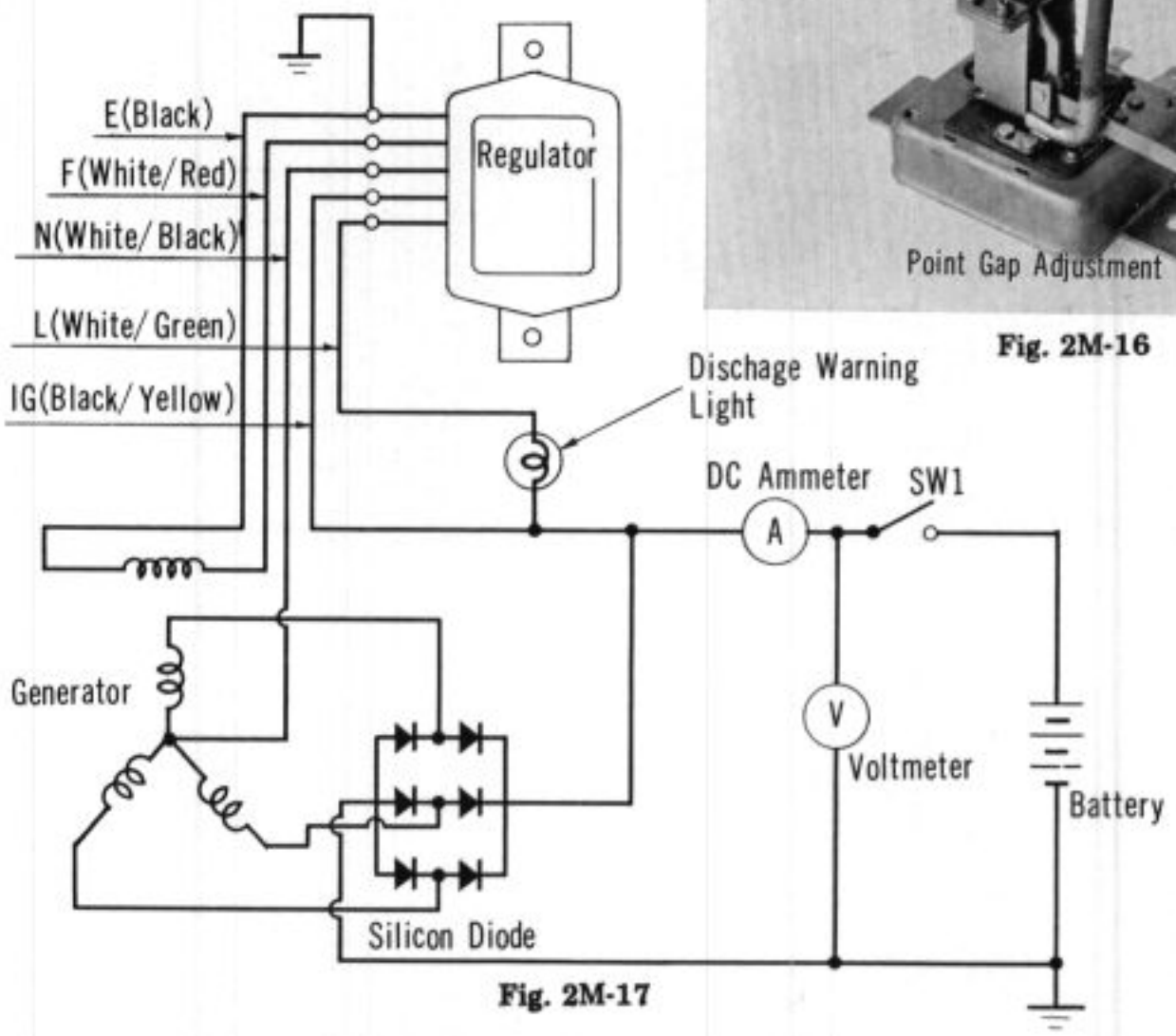

Fig. 2M-17

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

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

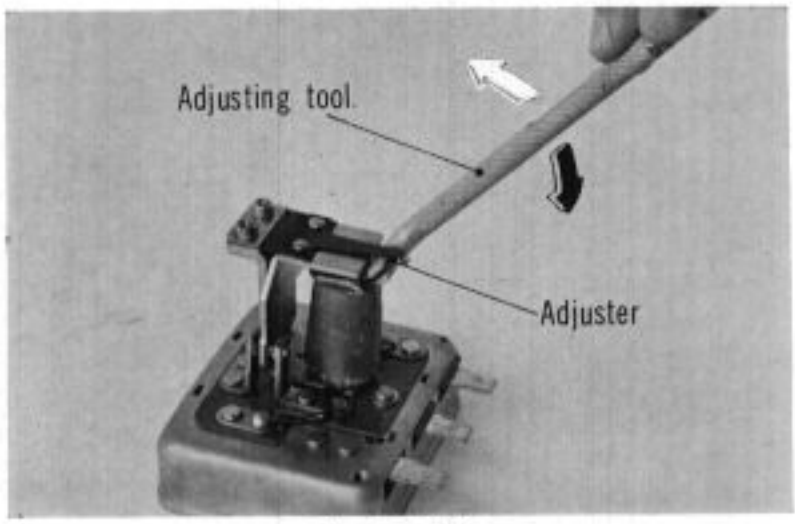

Fig. 2M-18

7. If no-load voltage is higher than the rated voltage of 14.5V, conversely, lower the adjuster and regulate it to the rated value. **(Fig. 2M-18)**
8. Now, voltage regulator adjustment has been completed. For confirmation of adjustment results, stop the generator and raise generator speed to 5,000 rpm and ascertain that voltage is as rated.

   ⬅ Lower the voltage

   ⇦ Raise the voltage

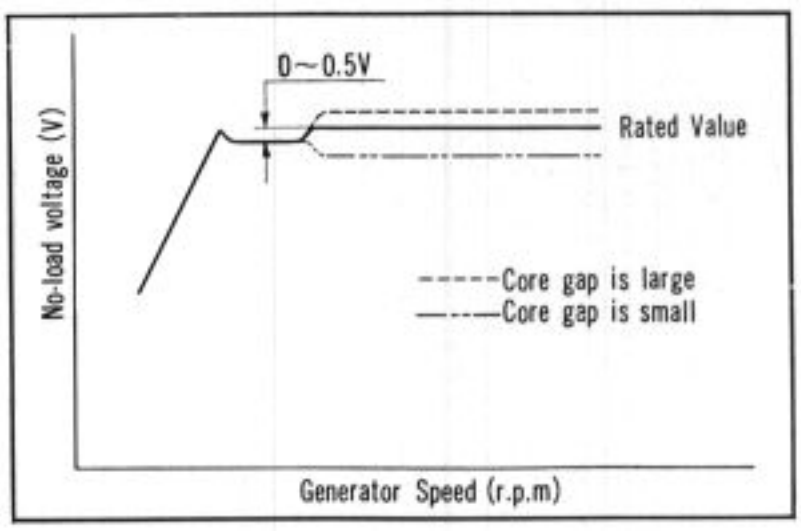

Fig. 2M-19

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

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

11. Discharge warning relay.

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

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

(SILICON DIODE)

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

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

Handling Precautions

1. Connect silicon diode correctly to the battery while paying attention to battery polarity. If the silicon diode is misconnected, the battery is shorted with the silicon diode.
   Under this condition, overcurrent flows, thus resulting in damaged silicon diode or seized wire harness.
2. Connect the terminals correctly.
3. Do not turn the generator at high speed with the silicon diode P terminal circuit disconnected. If this precaution is not observed, high voltage is generated and the silicon diode is sometimes damaged.
4. When charging the battery from outside, such as quick charging, disconnect the silicon diode P terminal.

c. Trouble Diagnosis

(1) Battery is not charged.

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

(2) Battery is discharged due to insufficient charge.

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

(3) Battery is overcharged due to excessive charging.

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

(4) Unstable charging current.

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

N. Road Test

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

(Engine performance test items)

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

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

O. Engine Trouble Diagnosis

1. Starter Does Not Operate.

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

2. Engine Will Not Start.

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

3. Engine Stalls.

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

4. **Idling Is Not Stable.**

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

5. **Poor Fuel Economy.**

Note:

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

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

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

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

6. **Engine Does Not Develop Full Power.**

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

7. **Spark Plugs Quickly Accumulate Carbon**

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

8. **Camshaft and Camshaft Holders Are Seized.**

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

9. **Back Firing Occurs.**

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

10. **Engine Noise is Excessive.**

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

11. Oil Leakage from Cylinder.

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

12. Oil Leakage from Camshaft Holder

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

P. Special Tool

Refer to section 4, "ENGINE MECHANICAL".