

REI

# WISCONSIN

*Air Cooled*

# HEAVY DUTY ENGINES

## INSTRUCTION BOOK AND PARTS LIST

RONALDSON TIPPETT No. 203  
(WISCONSIN ISSUE MM-304)

## MODELS S-10D and S-12D

MANUFACTURED IN AUSTRALIA UNDER LICENCE BY

# RONALDSON BROS. & TIPPETT LTD.

BALLARAT, VICTORIA

**BOOK OF INSTRUCTIONS**

**WISCONSIN** *Air-Cooled*  
**SINGLE CYLINDER ENGINES**

**MODEL S-10D**

3-1/4" Bore - 3" Stroke

24.89 cu. in. Displacement

**MODEL S-12D**

3-1/2" Bore - 3" Stroke

28.86 cu. in. Displacement



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Supplementary Instructions and Parts List for  
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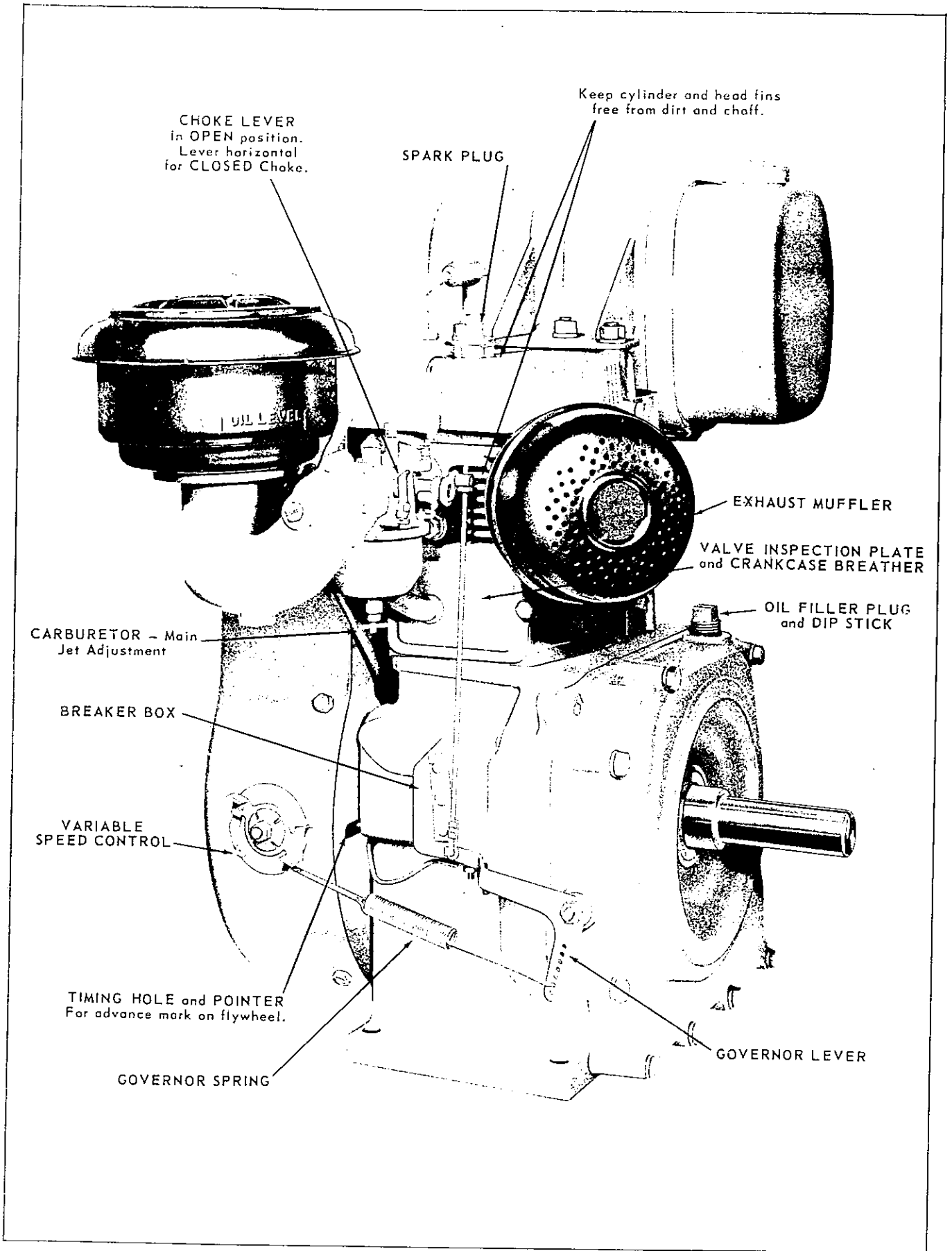


Fig. 1  
TAKE-OFF (rear) and RIGHT HAND SIDE VIEW of ENGINE

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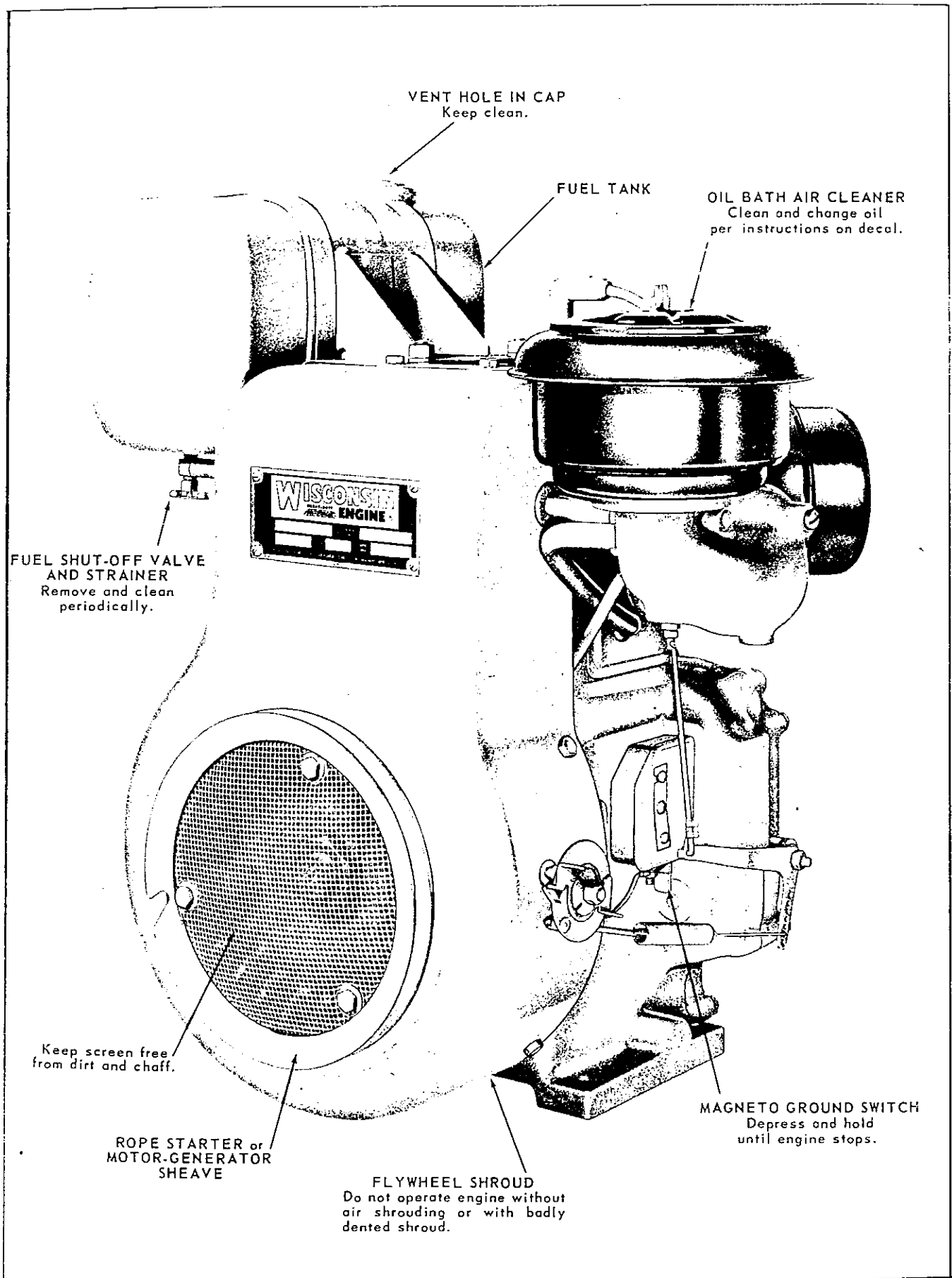


Fig. 2

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FAN END (front) and RIGHT HAND SIDE VIEW of ENGINE

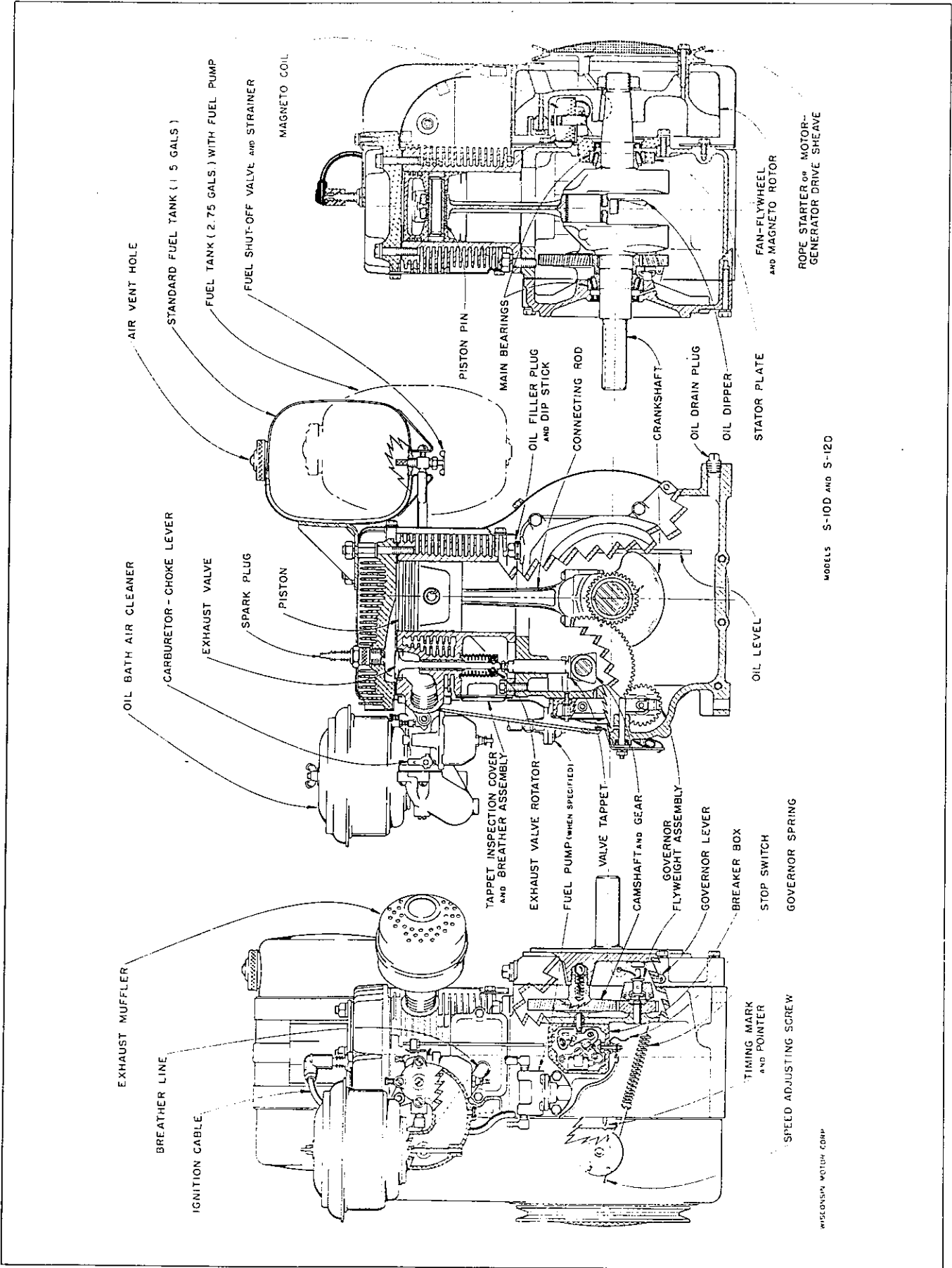


Fig. 3  
SECTIONAL VIEWS OF ENGINE

WILSON MOTOR CORP.

MODELS S-10D AND S-12D

## GENERAL DESIGN

Wisconsin engines are of the *four cycle type*, in which each of the four operations of *suction, compression, expansion* and *exhaust* constitutes a complete stroke. This gives one power stroke for each two revolutions of the crankshaft.

### COOLING

Cooling is accomplished by a flow of air, circulated over the cylinder and head of the engine, by a combination fan-flywheel encased in a sheet metal shroud. The air is divided and directed by ducts and baffle plates to insure uniform cooling of all parts.

*Never operate an engine with any part of the shrouding removed, because this will retard the air cooling.*

*Keep the cylinder and head fins free from dirt and chaff. Improper circulation of cooling air will cause engine to overheat.*

### CARBURETOR

The proper combustible mixture of gasoline and air is furnished by a balanced carburetor, giving correct fuel to air ratios for all speeds and loads.

### IGNITION

The spark for ignition of the fuel mixture is furnished by a high tension *flywheel magneto*. A stator plate functions as an engine bearing plate as well as a support for the coil and core. The permanent magnet is mounted to the flywheel, and a breaker box on the side of the crankcase contains the points, condenser and stop switch. A push pin, actuated by the engine camshaft, operates the breaker arm at *half engine speed*.

### LUBRICATION SYSTEM

An oil dipper attached to the connecting rod provides for a splash type lubrication system. The action of the dipper striking the oil in the crankcase provides ample lubrication for all internal parts of the engine.

### GOVERNOR

A governor of the centrifugal flyball type controls the engine speed by varying the throttle opening to suit the load imposed upon the engine. These engines are equipped with either a *fixed speed* or *variable speed regulator*, to control the governed speed of the engine.

### ROTATION

The rotation of the crankshaft is *clockwise* when viewing the flywheel or starting end of the engine. This gives *counter-clockwise* rotation at the power take-off end of the crankshaft.

*Horsepower* given in the accompanying chart is for an atmospheric temperature of 60° Fahrenheit at sea level and at a Barometric pressure of 29.92 inches of mercury.

## HORSEPOWER

R.P.M.	Models	
	S-10D	S-12D
1600	5.3	6.3
1800	5.9	7.2
2000	6.6	8.1
2200	7.3	9.0
2400	8.2	9.8
2600	8.7	10.5
2800	9.4	10.9
3000	9.7	11.6
3200	10.2	11.9
3400	10.4	12.2
3600	10.5	12.5

For each inch lower the Barometric pressure drops, there will be a loss in horsepower of 3½%.

For each 10° temperature rise there will be a reduction in horsepower of 1%.

For each 1000 ft. altitude above sea level there will be a reduction in horsepower of 3½%.

The friction in new engines cannot be reduced to the ultimate minimum during the regular block test, but engines are guaranteed to develop at least 85 per cent of maximum power when shipped from the factory. The power will increase as friction is reduced during the first few days of operation. The engine will develop at least 95% of maximum horsepower when friction is reduced to a minimum.

For continuous operation, allow 20% of horsepower shown as a safety factor.

## INSTRUCTIONS FOR STARTING AND OPERATING

### LUBRICATION

Before starting a new engine, fill crankcase base with the correct grade of engine oil, as specified in "*grade of oil chart*". Fill thru the filler plug opening, illustrated in *Fig. 4*, with **2 quarts** of oil.

For *run-in of new engines*, use same oil as recommended in *Grade of Oil Chart*.

The oil level mark is indicated by a groove on the dip stick, as illustrated in *Fig. 4*. Check oil level by resting the bottom of plug at the top of the oil filler opening on the gear cover. (Do not thread in place to check oil level).

Too much emphasis cannot be given to the matter of oil selection. High grade oil of the body suited to the requirements of your engine is the most important single item in the economical operation of the unit, yet it is the cheapest item of operating cost. Select your oil solely on equality and suitability — never on

price – for no one thing is so sure to bring about unsatisfactory performance and unnecessary expense as incorrect lubrication.

High-grade highly refined oils, corresponding in body to the S. A. E. (Society of Automotive Engineers) Viscosity Numbers listed in *Grade of Oil Chart*, will prove economical and assure long engine life.

**Important:** S.A.E. Viscosity Numbers classify oils in terms of body only, without consideration of quality or character. Therefore, we list certain grades of *Mobil oil* as typical examples of lubricants possessing the qualities we believe desirable in oils for *Wisconsin* engines. We plainly state that these grades of *Mobil oils* are listed because of their recognized quality and world-wide distribution. *There are other high quality oils on the market that are equally satisfactory for Wisconsin engines.*

### SERVICE CLASSIFICATION OF OIL

In addition to the S.A.E. Viscosity grades, oils are also classified according to severity of engine service.

Use oil classified as *Service MS*. This type of oil is for engines performing under unfavorable or severe operating conditions such as: high speeds, constant starting and stopping, operating in extreme high or low temperatures and excessive idling.

### GRADE OF OIL

SEASON OR TEMPERATURE	GRADE OF OIL	EXAMPLE
Spring, Summer, or Autumn + 120°F to + 40°F	SAE 30	Mobiloil A
Winter + 40°F to + 5°F	SAE 20–20W	Mobiloil Arctic
+ 5°F to – 20°F	SAE 10W	Mobiloil 10W
Crankcase Capacity		2 Quarts

Follow summer recommendations in winter, if engine is housed in warm building.

**Check oil level every 8 hours. Change oil every 50 hours of operation.**

To drain oil, remove drain plug illustrated in *Fig. 4*. Oil should be drained while engine is hot, as it will then flow more freely.

### FUEL

The fuel tank should be filled with a *good quality* gasoline free from dirt and water. The capacity of the standard tank is *1½ gallons*. Some of the poorer grades of gasoline contain gum which will deposit on valve stems, piston rings, and in the various small passages in the carburetor, causing serious trouble in operating, and in fact might prevent the engine from operating at all.

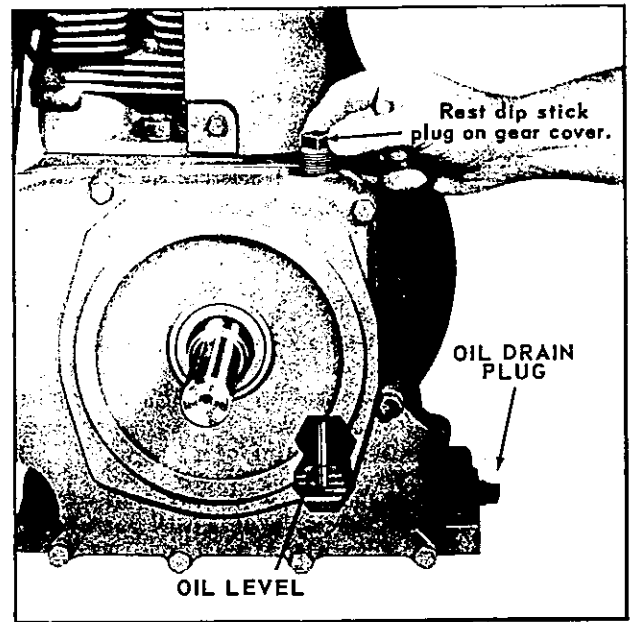


Fig. 4

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**Use only reputable, well known brands of gasoline of the REGULAR GRADE.**

The gasoline should have an octane rating of at least 90. Fuel with a low octane rating will cause detonation, and if operation is continued under this condition, severe damage will result to the engine. The cylinder and piston will be scored, head gasket blown out, bearings will be damaged and etc.

Be sure that air vent in fuel tank cap is not plugged with dirt, as this would prevent fuel from flowing to the carburetor.

### FUEL PUMP

An engine equipped with fuel pump; when starting for the first time, or when engine has been out of operation for a while, should be primed to prevent hard starting. To prime the engine, first disconnect the ignition wire at the spark plug to prevent the engine from accidentally starting. Then, turn the engine over about 6 or 7 times, by means of the rope starter sheave, to actuate the fuel pump and thus fill the carburetor bowl with gasoline. Be sure and connect ignition wire after priming has been accomplished.

Fuel pump is an optional accessory. Due to special machining of crankcase, fuel pump can be furnished only upon request when engine is ordered. Instructions for fuel pump maintenance and repair are located in the back of this manual.

### STARTING

#### STARTING PROCEDURE (Fig. 5 and Fig. 6)

1. Check crankcase oil level and gasoline supply. Open fuel shut-off valve.
2. The *main jet adjustment* on the carburetor is made when engine is tested at the factory. Refer to '*Carburetor-Adjustment*' for further information.

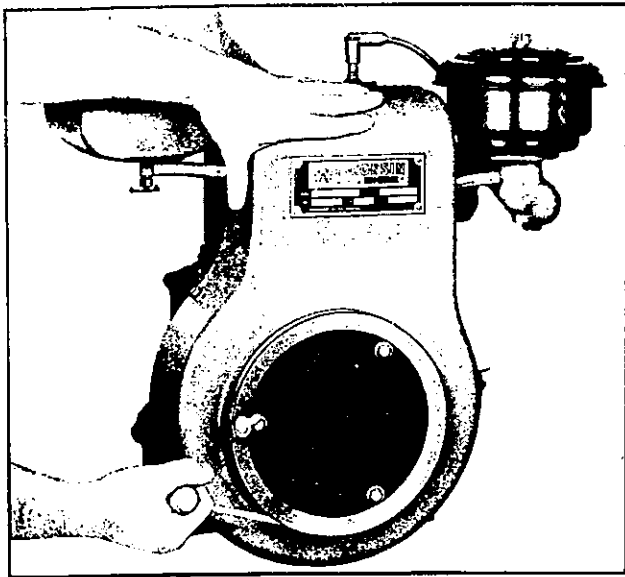


Fig. 5

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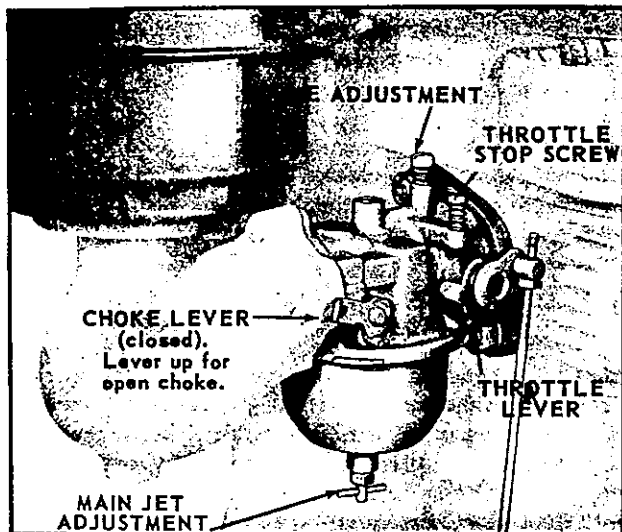


Fig. 6

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3. Disengage clutch, if furnished.
4. Set throttle about 1/2 open if variable speed governor control is furnished. With a fixed speed governor, spring will hold throttle open for starting.
5. Close choke on carburetor by pushing choke lever down (*lever in horizontal position*). Turn engine over to compression with starter sheave and then turn back one-half turn. Wind rope fully on sheave and *pull briskly* to turn crankshaft over.

Above 30°F, it may be necessary to open the choke halfway, if engine does not start after two or three pulls.

With *starting motor*, pull out ignition switch, (*tag reads 'To Stop Push In'*), and depress starter button.

6. After engine starts *open choke fully* (push lever up). Less choking is necessary in warmer weather or when the engine is warm, than when it is cold. Should flooding occur, open choke fully and continue cranking.

If all conditions are right, engine will start promptly after one or two attempts. After engine starts, allow it to warm up a few minutes before applying load, as prescribed in 'Warm-Up Period' paragraphs.

New engines started for the first time should be "run-in" gradually to insure trouble-free service and long engine life. Refer to "Starting and Operation of New Engine", on the inside front cover of this manual, for correct "running-in" procedure, with the exception that the initial break-in speed for the first half hour should be 1600 to 1800 R.P.M.

## WARM-UP PERIOD

The engine should be allowed to warm up to operating temperature before load is applied. This requires only a few minutes of running at moderate speed. *Racing an engine or gunning it*, to hurry the warm-up period, *is very destructive* to the polished wearing surfaces on piston, rings, cylinder, bearings, etc., as the proper oil film on these various surfaces cannot be established until the oil has warmed up and become sufficiently fluid. This is especially important on new engines and in cool weather.

*Racing an engine by disconnecting the governor*, or by doing anything to interfere with the governed control engine speed, *is extremely dangerous*. The governor is provided as a means for controlling the engine speed to suit the load applied, and also as a safety measure to guard against excessive speeds, which not only overstrain all working parts, but which might cause wrecking of the engine and possible injury to bystanders.

All parts of the engine are designed to safely withstand any speeds which might normally be required, but it must be remembered that the stresses set up in rotating parts increase with the square of the speed. That means that if the speed is doubled, the stresses will be quadrupled, and if the speeds are trebled, the stresses will be nine times as great.

*Strict adherence to the above instructions cannot be too strongly urged, and greatly increased engine life will result as a reward for these easily applied recommendations.*

## STOPPING ENGINE

The breaker box on the side of the crankcase has a magneto ground switch for stopping the engine. *Depress and hold down until engine stops.*

If the engine has been running hard and is hot, do not stop it abruptly from full load, but remove the load and allow engine to run idle at 1000 to 1200 R.P.M. for three to five minutes, depending on how hot the engine has been. This will reduce the internal temperature of the engine much faster, minimize valve warping, and of course the external temperature, including the manifold and carburetor will also reduce faster, due to air circulation from the flywheel.

Two main troubles resulting from abruptly shutting off a hot engine are *vapor lock* and *dieseling*. Vapor lock will prevent the flow of fuel in the lines and carburetor passages, which will result in hard starting of the engine. This can be overcome by choking the engine when cranking, or waiting until the engine has cooled off sufficiently to overcome the vapor lock.

*Dieseling* is caused by the carbon and lead deposits in the cylinder head being heated up to such an extent that they continue to fire the engine and keep it running after the ignition has been shut off. By idling the engine, as previously mentioned, the carbon and lead deposits cool off, break up and will blow out thru the exhaust. If engine should continue to diesel, by suddenly opening up the throttle wide and at the same time shutting off the ignition, the engine will stop.

### CARBURETOR - ADJUSTMENT

The carburetor can be adjusted in the following manner, and with reference to *Fig. 6*.

Turn *main jet adjustment in*, (clockwise) until it seats. Then turn *out*, (counter-clockwise)  $2\frac{1}{4}$  turns. After the engine is started and warmed up for several minutes and running at normal operating speed, the needle valve should be readjusted for best operation. This adjustment need only be made the first time the engine is started. After that, the needle should be left in that position. In cold weather, starting may be facilitated by opening the needle valve slightly more, then readjusted to normal running position after engine is started.

The correct amount of throttle plate opening for the proper low idle speed is obtained by means of the *throttle stop screw*. However, this is set at the factory so that no immediate adjustment is necessary. The *idle adjustment* is for smooth low speed operation and this adjustment, if necessary, must be made with the carburetor throttle lever closed. Normal idle setting is approximately  $1\frac{1}{2}$  turns off seat.

For further information on the carburetor, see the Zenith operating and service instructions in the rear of this manual.

### AIR CLEANER - OIL BATH

Before starting a new engine, unscrew wing nut and remove the cover and filtering element from air cleaner. See *Fig. 7*. Fill bowl to *oil level line* with the same grade of oil as used in the crankcase.

The air cleaner must be serviced frequently, depending on the dust conditions where engine is operated. Daily attention to the air cleaner is one of the most important considerations in prolonging engine life.

*Once each week*; the filtering element should be thoroughly washed in a solvent. Remove oil and clean out air cleaner bowl. Add fresh oil to the level line indicated on the bowl, using the same grade oil as is used in the crankcase.

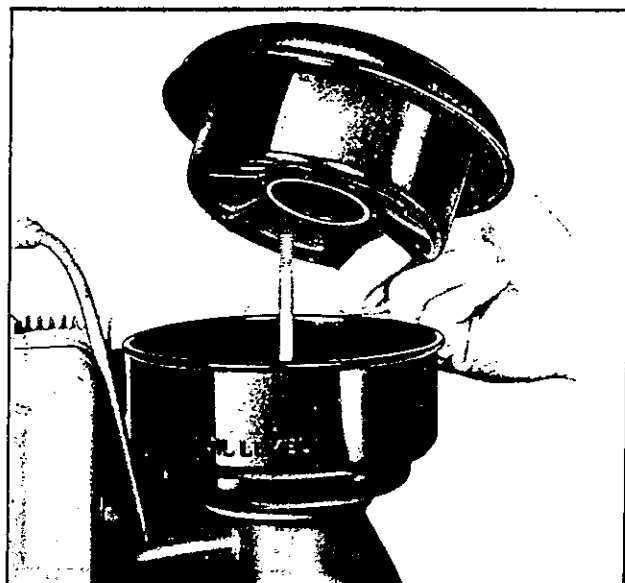


Fig. 7

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*Service daily*, if engine is operating in very dusty conditions. Detailed instructions are printed on the air cleaner.

*Operating the engine under dusty conditions without oil in the air cleaner or with dirty oil, may wear out cylinder, piston, rings and bearings in a few days time, and result in costly repairs.*

### CRANKCASE BREATHER

A *reed type breather valve* is an integral part of the valve tappet inspection cover, as illustrated in *Fig. 8*. The valve maintains a partial vacuum in the crankcase, and thus eliminates internal crankcase pressure that would cause oil leaks at the seals, gaskets and breaker box. Keep complete breather system free from dirt. Clean breather valve by washing in solvent, and in reassembly mount with drain hole facing down.

*Oil in breaker box* may be the result of faulty breather action caused by dirt stuck between reed and seat. This condition can be remedied in the following manner:

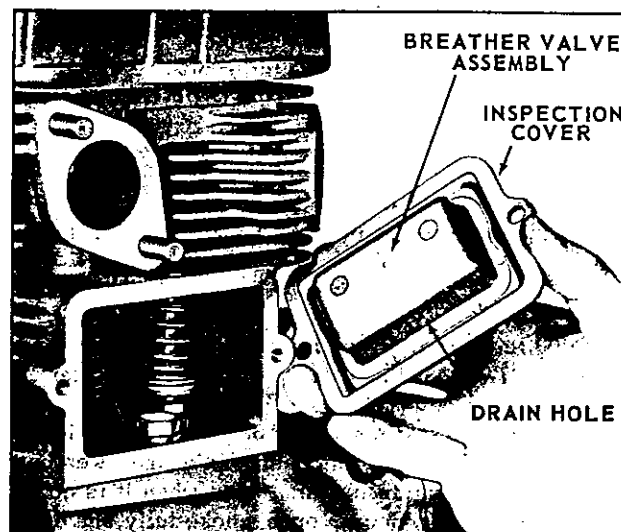


Fig. 8

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1. With engine running at operating speed, pinch neoprene breather line so that it is completely shut off.
2. Hold tubing closed, for a period of not more than 20 seconds, and then release.
3. If oil leak continues, repeat procedure after a 5 minute interval. If this does not remedy the condition; stop engine, take off inspection cover-breather assembly and wash in solvent.

### MAGNETO IGNITION SPARK

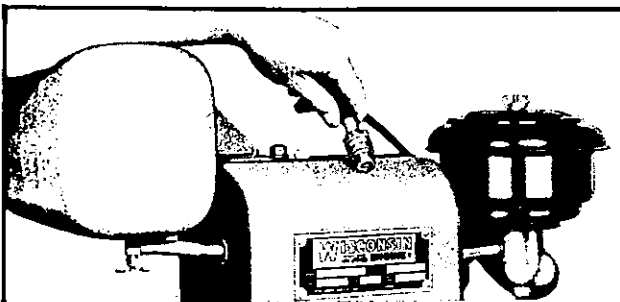
If difficulty is experienced in starting the engine or if engine misses firing, the strength of the ignition spark should be checked: remove spark plug from cylinder head and connect ignition wire to it. Turn engine over several times by means of the rope starter sheave, as illustrated in Fig. 9, and observe the spark at the plug gap. If a good strong spark occurs, the ignition system can be eliminated as the source of trouble. If there is a weak spark or no spark at all, follow instructions in "Magneto Breaker Point Adjustment" paragraphs. Also check ignition wires, spark plug, condenser and coil.

### MAGNETO

The flywheel magneto used on this model of engine is made up of three component parts; *flywheel*, *stator plate* with coil, and *breaker assembly*. The *breaker box* mounted on the right hand side of the crankcase contains the *points*, *condenser* and *ground switch*.

A *push pin*, actuated by a striker plate mounted to the camshaft, operates the breaker points at *half engine speed*. When ever points are replaced, inspect push pin for possible wear and replace if necessary.

If *oil leaks* from breaker box, refer to "Crankcase Breather" for cleaning of breather valve seat.



### CLEANING CONTACT POINTS

When contacts become fouled through oil entering contact box, the contact faces should be cleaned in the following manner:

Turn engine over until the contacts are closed, separate points using screwdriver, and insert strip of clean paper  $\frac{1}{4}$ " wide, 2" long. Close points and withdraw paper, repeat 2 or 3 times using clean paper each time. This procedure will remove all oil film from contact faces.

Should contacts be pitted, they must be removed and refaced using a fine abrasive stone or emery cloth. Thoroughly clean before replacing, then adjust to gap shown on decal on contact box cover.

MS 172 : 370

## MAGNETO BREAKER POINTS

### REPLACEMENT and ADJUSTMENT

The magneto *breaker points*, Fig. 10, are contained in the *breaker box* on the right hand side of the engine.

At least twice each season or when ignition spark becomes weak, remove breaker box cover, inspect the points and check the gap opening. If there is evidence of pitting or pyramiding and it becomes necessary to resurface or replace points, it will also be necessary to readjust the gap to its proper clearance, and re-time the engine.

**Replacement of points:** Turn crankshaft over so that breaker push pin is at its inner most position (low point of camshaft striker plate). Mount breaker assembly to crankcase by means of brass *fulcrum pin*, and tighten pin to *22 inch pounds torque* (do not over-tighten). Be sure breaker arm spring is squarely mounted (if spring is cocked, points will be out of line). Mount lock screw with washer and proceed with point adjustment and timing.

The normal breaker point gap is  $\overset{.023}{.020}$  inch at full separation. However, the fixed *running spark advance* of  $\overset{18^\circ}{15^\circ}$  is regulated by the point opening, and thus a

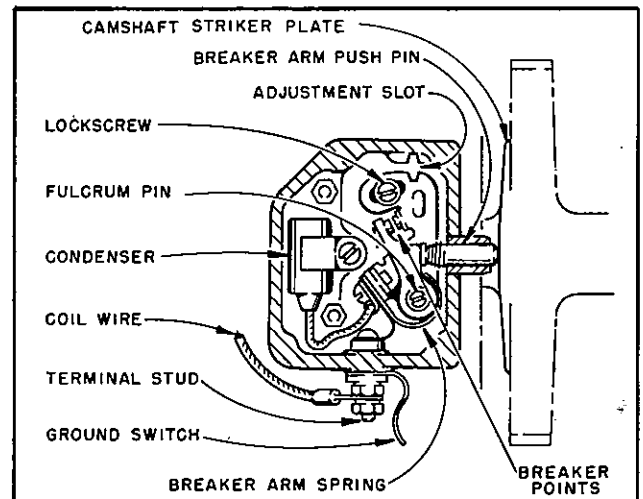


Fig. 10

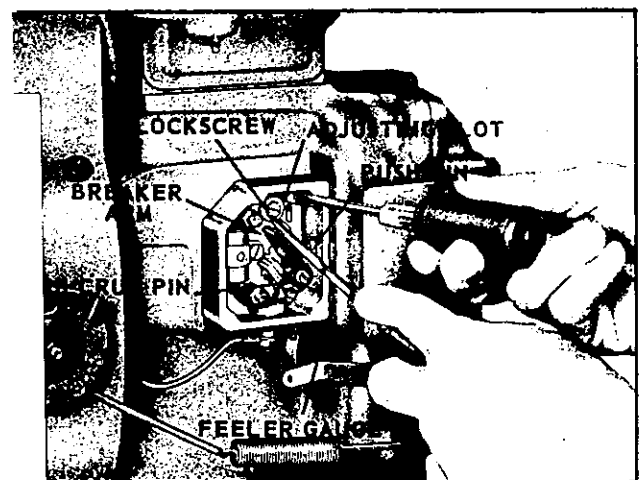


Fig. 11

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slight variation in gap opening may occur when obtaining an accurate spark advance with a timing light.

With reference to *Fig's. 10 and 11*, adjust breaker point gap as follows, and then proceed as per instructions in *Timing* paragraphs.

1. Turn engine over by means of the starter sheave until *breaker arm push pin* is at the high point of the striker plate (maximum point opening).
2. Loosen contact support plate *lockscrew* very slightly (just enough so that plate can be moved).
3. Place a <sup>023</sup> *.020* inch feeler gauge between the points.
4. Insert a screw driver into *adjusting slot* and open or close the points as required, until a slight drag is felt while sliding the feeler gauge between the points.
5. Securely tighten *lockscrew* and recheck point gap.

## TIMING

The fixed *running spark advance* of 15° is regulated

by the breaker point opening and reasonably accurate timing is obtained by simply setting the breaker point gap *.020* inch, as explained in "*Magneto Breaker Point Adjustment*". However, *static timing* with a *continuity light*, as illustrated in *Fig. 12*, is more accurate and advisable. The timing light is Wisconsin Motor part number *DF-81-S1*.

The accuracy of the timing can be checked with a *neon lamp* and the engine running at operating speed. It is however, not advisable to adjust the timing while engine is running. See "*Static Timing Procedure*".

A *pointer* is located in the crankcase, just to the left of the breaker box, to visibly check the *advance timing mark* on the rim face of the flywheel.

### STATIC TIMING PROCEDURE: See *Fig. 12*.

1. Disconnect *coil primary wire* at bottom of breaker box. Remove breaker box cover.
2. *Timing mark* on *flywheel* can be observed thru the hole in back plate of flywheel shroud, just to the left of the breaker box.

Since breaker arm operates at *half engine speed*,

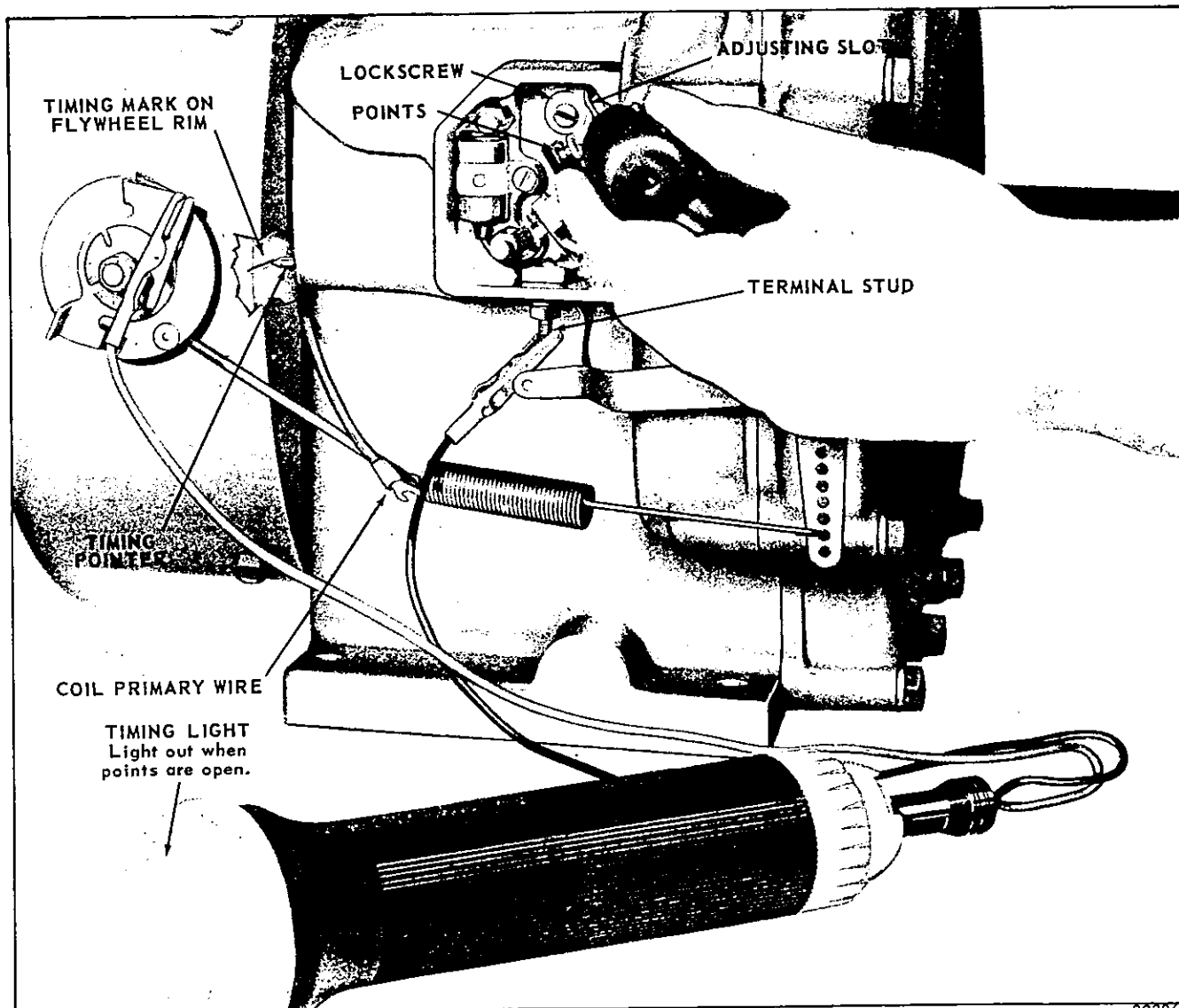


Fig. 12

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it is necessary to line up *flywheel timing mark* with *pointer*, while engine is on *compression stroke*. The compression stroke can be determined by turning starter sheave in a clockwise direction and watch for breaker arm movement by push pin in breaker box.

3. Connect one lead wire of the *timing light DF-81-S1* to ground and the other to the *terminal stud* at bottom of breaker box. (With points closed, the timing light will be on).
4. Slightly loosen *lockscrew* on contact support plate (just enough so that plate can be moved).
5. Insert a screw driver into support plate *adjusting slot* and close points so that light is *on*, then turn screw driver slowly in the opposite direction until the *light just goes out*. Retain points in this position and securely tighten *lockscrew*.
6. As a final check; turn flywheel counter-clockwise until timing light is *on*. Then, slowly rotate flywheel clockwise, and stop immediately when *light goes out*. At this point, *mark on flywheel* should be in line with timing *pointer* in crankcase.
7. Assemble coil primary wire to terminal stud and mount breaker box cover.

3. Check points for cleaning and adjustment. If badly worn or corroded, points and condenser should be replaced. Refer to "*Magneto Breaker Points*", replacement and adjustment paragraphs.

4. **Coil replacement** should be done by a competent mechanic using adequate test equipment. The coil can be tested in the following manner and without removing the flywheel:

Position the flywheel so the keyway is at the bottom.

Remove the coil primary lead from the terminal connection on the breaker box and the spark plug lead from the plug. The coil can now be tested using the primary lead, the high tension lead, and the engine block as the ground connection.

It is recommended that a new coil be selected from stock and used as a master coil to calibrate the tester. If the tester is set up with a "*good-bad*" range or "*variable spark discharge gap*", it can be used with whatever primary input is required to bring it into the desired range.

If the coil does not test to specification, the flywheel will have to be removed to replace the coil.

The *high tension wire* can be removed by unscrewing it from the coil.

## MAGNETO SERVICE INSTRUCTIONS

If engine will not start or if it is hard to start and does not run properly, make the following tests to see if the magneto is at fault:

1. Check carefully for loose, corroded, broken or worn ignition wires.
2. Check the spark; refer to "*Magneto Ignition Spark*" and "*Spark Plug*" paragraphs.

## ELECTRICAL EQUIPMENT

### MOTOR-GENERATOR

The combination *motor-generator* functions as a cranking motor when the *starting switch* is closed. When the switch is open and the engine is operating, the unit will function as a generator. The generator output and circuit voltage for the various battery and

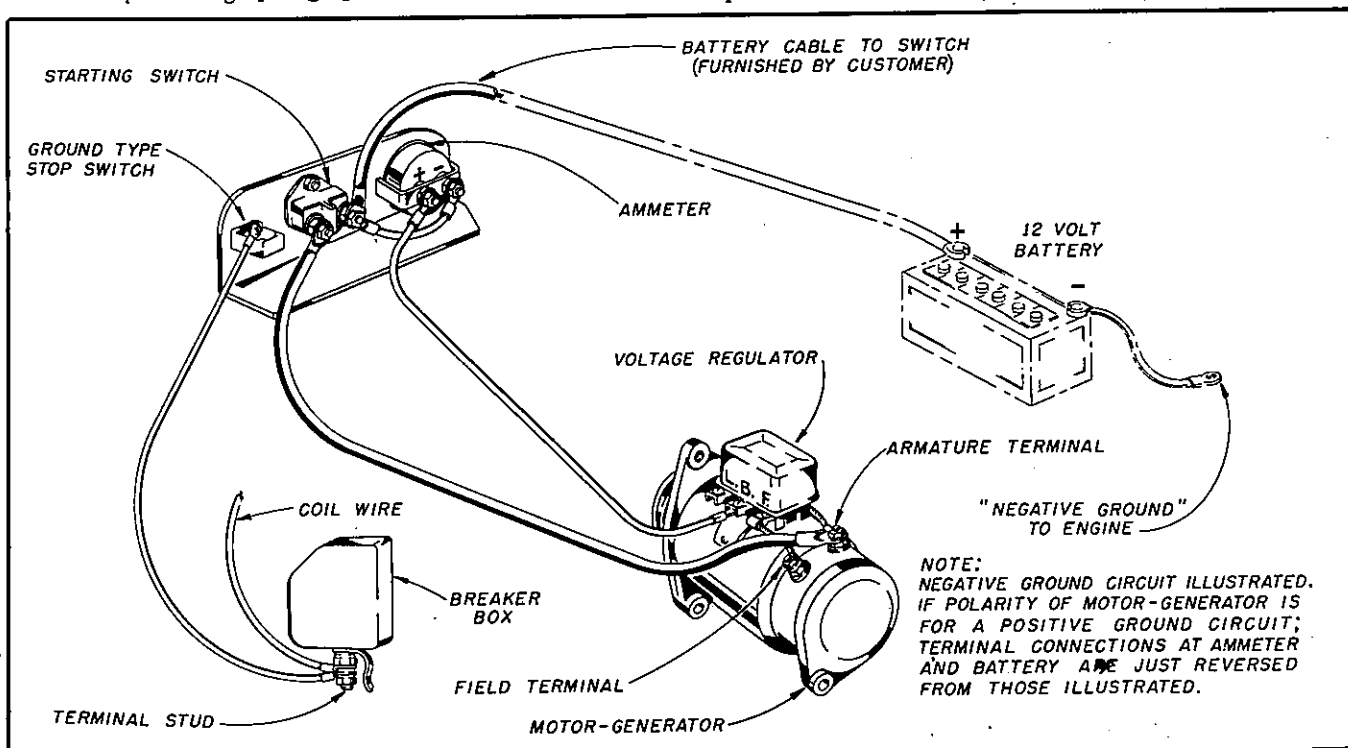


FIG. 13 - ELECTRICAL EQUIPMENT WIRING DIAGRAM

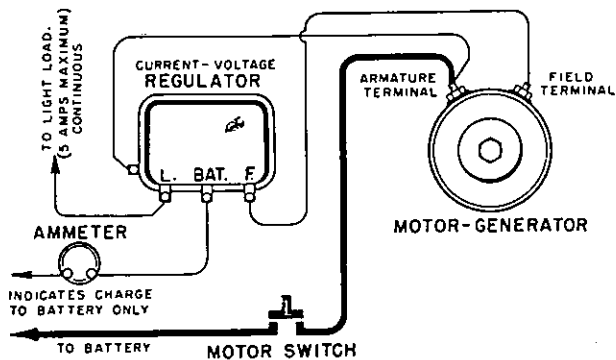


Fig. 14

operating requirements are controlled by a **current-voltage regulator** mounted to the generator.

See wiring diagram, Fig. 13.

**Caution:** Wire circuit according to polarity of motor-generator. Polarity is indicated by a tag attached to the unit, or by referring to the motor-generator part number in "Parts List" section.

The total electrical output of this **12 volt** combination motor-generator is **12 amperes**. However, all of the current is not taken off of a single terminal. There are **two terminals** on the current-voltage regulator, illustrated in Fig. 14, for distributing the generator output. One terminal is marked '**BAT**' and a wire is connected from it to the battery, thru an **ammeter**. The other terminal marked '**L**' is for operating lights or some other customer accessory. The maximum continuous load from this terminal should not exceed **5 amps**. Current from the '**L**' terminal is uninterrupted and not affected by the regulator windings. Whereas, the current to the '**BAT**' terminal goes thru the regulator windings and is controlled to suit the requirements necessary to keep the battery charged.

**The ammeter in this circuit indicates only the current going into the battery to keep it charged and does not indicate the total generator output.** If it is necessary to check the amount of current coming from the '**L**' terminal, it will be necessary to put a second ammeter in the circuit between the '**L**' terminal and the load. Add the two values indicated on the ammeters to get the total generator output.

To check if the generator is charging, it is only necessary to observe the ammeter that is connected in the battery circuit. If it shows a charge, the system is functioning properly. If it shows a discharge, remove the load connected to the '**L**' terminal, until the ammeter does register a charge.

Periodically inspect the motor-generator and the external wiring for conditions which may affect its operation.

Bearings are **pre-lubricated**, therefore no external oiling is required.

Inspect the brushes for wear, approximately every **200** hours of operation. If they are worn to less than half their original length, they should be replaced.

The combination **motor-generator** is manufactured by

Delco-Remy of Anderson, Indiana. Refer to the rear section of this manual for service replacement parts list.

## SPARK PLUG

The spark plug should be removed periodically, cleaned and re-gapped. The width of the gap between the points of the two electrodes needs to be very carefully and precisely set, because incorrect settings will have an adverse affect on engine operation. Check spark plug gap with a wire type gauge and regap as shown in Fig. 15.

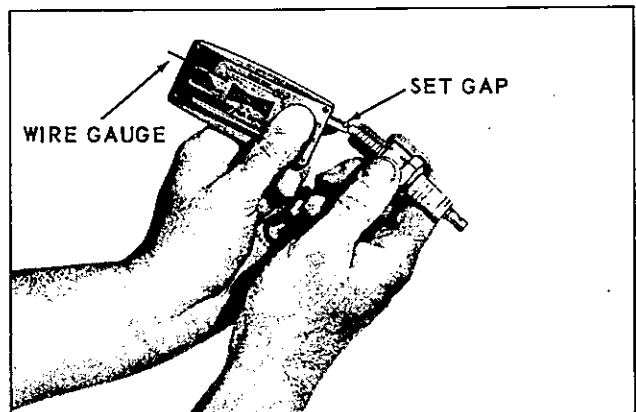


Fig. 15

27779C

**Spark plug gap - .030 of an inch.**

Use a new spark plug at the beginning of the next season. Replacement plug must be of the correct heat range, like Champion No. D-16J, AC No. C86 commercial or equal. Thread size is 18mm.

Use a new gasket when mounting either old or new plug and thoroughly clean threads in cylinder head before installation. Tighten spark plug **28 to 30 foot pounds torque**. If torque wrench is not available, tighten plug until it begins to seat on the gasket, then turn  $1/2$  to  $3/4$  of a turn more.

## RESTORING COMPRESSION

On a new engine or one which has been out of operation for some time, the oil may have drained off the cylinder so that compression will be weak. This may cause difficulty in starting. To remedy this condition, remove the spark plug and pour about a fluid ounce of crankcase oil through the spark plug hole. Turn the engine over several times with the rope starter to distribute oil over the cylinder wall. Reassemble the spark plug and compression should be satisfactory. When compression is proper, considerably more resistance will be felt in cranking on the compression stroke than on the other three strokes.

## CLUTCH AND REDUCTION GEARS

### CLUTCH TAKE-OFF (Fig. 16).

The clutch in the take-off assembly, that can be furnished with this model of engine, is of the multiple disc type running in oil. Use the same grade of oil in the clutch housing as is used in the crankcase of the

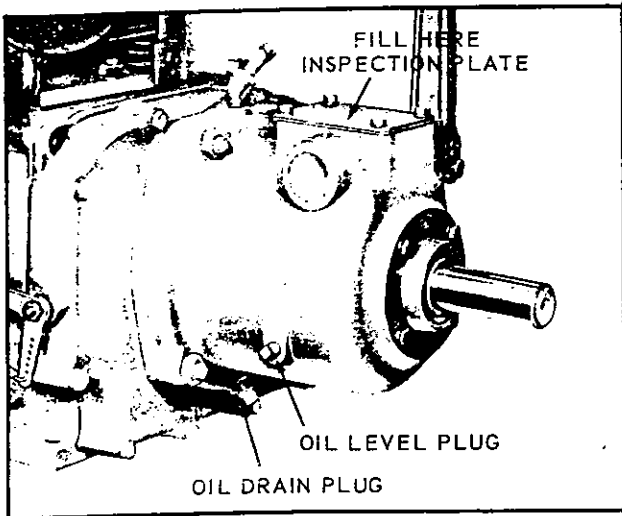


Fig. 16 296109C

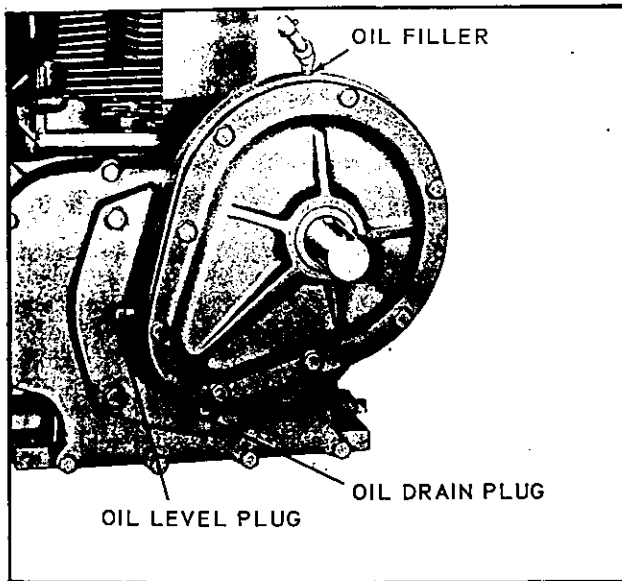


Fig. 17 296110C

engine. The oil should be filled to the height of the oil level plug in the clutch housing. Fill through the inspection plate opening; about 1 pint of oil is required.

#### REDUCTION GEARS (Fig. 17 and Fig. 18).

Reduction gears are furnished in several different ratios, some with spur gears, others with chains. All are of the same general design, except that some are furnished with clutches, others without.

*Use same grade oil as used in engine crankcase.*

For different installations these gears are assembled to the engines in various positions. Several plugs are furnished so that the lubrication may be properly taken care of regardless of the position of installation. For instance, there will always be one plug on top to be used for filling oil. There will always be one plug below for draining oil, and there will be one plug on the side, slightly above the bottom, to be used as an oil level plug. The oil should always be filled when the engine is at rest. When the oil becomes dirty it

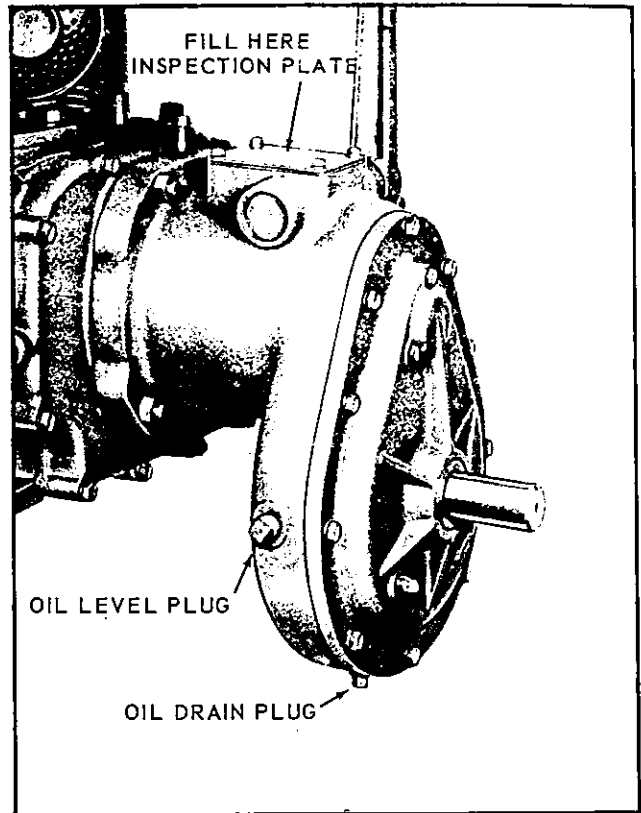


Fig. 18 296111C

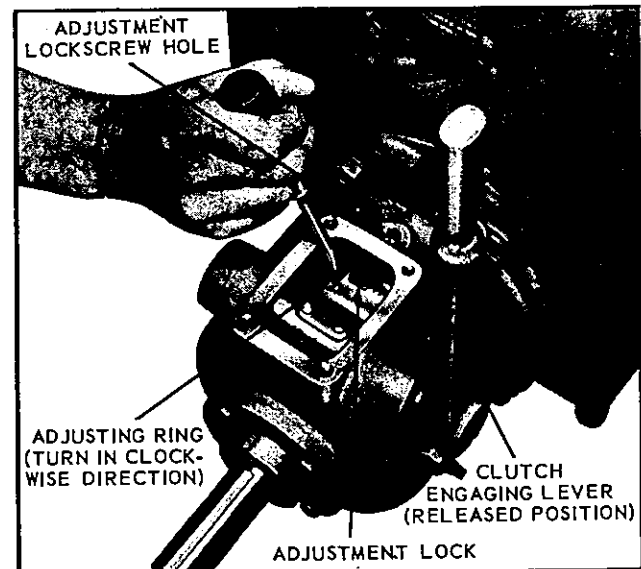


Fig. 19 244949C

should be drained while the engine is hot, and fresh oil added. The frequency at which these oil changes should be made depends entirely on the kind of service in which these gears are used, but even with light service;

*Change oil at least every 500 hours of operation.*

Add sufficient oil between changes to keep oil up to the oil level plug. The oil capacity for the *reduction unit* shown in Fig. 17 is  $\frac{2}{3}$  pint, and for the *clutch reduction unit*, Fig. 18, 1 pint.

#### CLUTCH ADJUSTMENT (Fig. 19)

If the clutch begins to slip, it should be readjusted to

prevent it from becoming overheated and damaged. The clutch in the *clutch take-off* and *clutch reduction units* is adjusted by first removing the clutch inspection plate which will expose the notched *adjusting ring*. Release the *clutch*, by pushing the *engaging lever* forward (toward engine).

Turn engine over by means of the rope starter sheave, until the clutch *adjustment lock* is visible thru the inspection opening of the housing. Loosen *adjustment lock screw*, one full turn. On *take-off units*, the lock-screw is accessible thru the pipe plug hole behind the inspection opening.

Keep the clutch from turning by holding the rope starter sheave firmly in place with the left hand. Then, by means of a screw driver, turn the *adjusting ring* one notch at a time in a clockwise direction, until a definite pressure is felt on the clutch lever when engaging. When properly adjusted, the clutch will engage with a slight snap. Tighten *lock screw* and mount inspection cover. Be sure cover gasket is in good condition.

### WINTER STORAGE

To protect the cylinder, piston, rings, valves, and keep them from rusting and sticking, a half and half mixture of kerosene and good engine oil, (the same kind of oil as used in the crankcase of the engine), should be injected into the pipe tap opening on the air cleaner bracket while the engine is warm and running at moderate speed. About a quarter of a pint is necessary, or enough so that a heavy bluish smoke will appear at the exhaust. The ignition switch should then be shut off and the engine stopped. This fogging operation will give a coating of oil on the above mentioned parts, protecting them from the atmosphere. After the engine has stopped, disconnect the spark plug cable and turn engine over slowly until the fly-wheel key or take-off shaft keyway is up, or in the 12 o'clock position and on compression stroke. Both valves will then be closed and the piston will be on top in the cylinder bore. This will minimize rusting of the cylinder bore and help in retaining the oil fog previously injected into the engine.

Drain crankcase oil while engine is warm.

Drain fuel system, including gasoline lines, carburetor, fuel pump and tank of all gasoline, to prevent lead and gum sediment interfering with future operation. Gasoline fumes from gradual evaporation is a dangerous *fire hazard*.

The oil bath air cleaner should be thoroughly cleaned of all oil, and the accumulated dust and sediment removed from the oil cup. The air cleaner and exhaust openings should be taped or otherwise sealed off for the duration of the storage period.

The outside of the engine, including the cooling fins on the cylinder and head, should be thoroughly cleaned of all dirt and other deposits. All exposed unpainted metal parts should be coated with grease or heavy oil.

Before adding new crankcase oil the next season, drain base of condensation which may have accumulated during the storage period.

*Be sure to fill the crankcase with a good quality of crankcase oil to the high level point, before starting the engine. Do not use any oil heavier than S.A.E. No. 30. Also be sure to put oil to the proper level in the air cleaner.*

It is also recommended to use a new spark plug at the beginning of the next season, especially if the engine has given considerable service.

Refuel engine and follow the starting instructions as shown on preceding pages of this manual.

*It is highly recommended that machines be stored inside a building through the winter. If this is not possible, the engine should be protected from snow and ice by a proper covering.*

## TROUBLES CAUSES AND REMEDIES

Three prime requisites are essential to starting and maintaining satisfactory operation of gasoline engines. They are:

1. *A proper fuel mixture* in the cylinder.
2. *Good compression* in the cylinder.
3. *Good spark, properly timed*, to ignite the mixture.

If all three of these conditions do not exist the engine cannot be started. There are other factors which will contribute to hard starting; such as, too heavy a load for the engine to turn over at a low starting speed, a long exhaust pipe with high back pressure, etc. These conditions may affect the starting, but do not necessarily mean that the engine is improperly adjusted.

As a guide to locating any difficulties which might arise, the following causes are listed under the three headings: *Fuel Mixture*, *Compression*, and *Ignition*.

In each case the causes of trouble are given in the order in which they are most apt to occur. In many cases the remedy is apparent, and in such cases no further remedies are suggested.

### STARTING DIFFICULTIES

#### FUEL MIXTURE

No fuel in tank or fuel shut-off valve closed.

Fuel pump diaphragm worn out, so pump does not supply carburetor with fuel.

Carburetor not choked sufficiently, especially if engine is cold. See '*Starting Procedure*', Page 8.

Water, dirt, or gum in gasoline interfering with free flow of fuel to carburetor.

Poor grade or stale gasoline that will not vaporize sufficiently to form the proper fuel mixture.

Carburetor flooded, caused by too much choking especially if engine is hot. See '*Starting Procedure*', Page 8.

Dirt or gum holding float needle valve in carburetor open. This condition would be indicated if fuel continues to drip from carburetor with engine standing idle. Often tapping the float chamber of the carburetor very lightly with the handle of a screw driver or similar tool will remedy this trouble. Do not strike carburetor with any metal tool.

If due to flooding, too much fuel should have entered the cylinder in attempting to start the engine, the mixture will most likely be too rich to burn. In that case the spark plug should be removed, the engine then turned over several times with the starting sheave so the rich mixture will be blown out through the spark plug hole. The choke on the carburetor should of course be left open during this procedure. The spark plug should be dried off, assembled, and starting tried again.

### COMPRESSION

If the engine has proper compression, considerable resistance will be encountered in the pull on the starting sheave. If this resistance is not encountered, compression is faulty. Following are some reasons for poor compression:

Cylinder dry due to engine having been out of use for some time. See *'Restoring Compression'*, Page 14.

Loose or broken spark plug. In this case a hissing noise will be heard in cranking engine due to escaping gas mixture on compression stroke.

Damaged cylinder head gasket or loose cylinder head. This will likewise cause hissing noise on compression stroke.

Valve stuck open due to carbon or gum on valve stem. To clean valve stems, see *'Valves and Seat Insert'*, Page 19.

Valve tappets with insufficient clearance under valve stems. See *'Tappet Adjustment'*, Page 24.

Piston rings stuck in piston due to carbon accumulation. If rings are stuck very tight this will necessitate removing piston and connecting rod assembly, and cleaning parts. See *'Connecting Rod and Piston'*, Page 22.

Scored cylinder. This will require reboring of the cylinder and fittings with new piston and rings. If scored too severely an entirely new cylinder block may be necessary.

### IGNITION

See *'Magneto Ignition Spark'*, Page 11. No spark may also be attributed to the following:

Ignition wires disconnected from magneto coil, spark plug or breaker box.

Broken ignition wires causing short circuits.

Spark plug cable wet or oil soaked.

Spark plug insulator broken.

Spark plug wet or dirty.

Spark plug point gap wrong. See Page 14.

Condensation on spark plug electrodes.

Magneto breaker points pitted or fused.

Magneto breaker arm sticking.

Magneto condenser leaking or grounded.

Oil in breaker box. See *'Crankcase Breather'*, Page 10.

Spark timing wrong. See *'Timing'*, Page 12.

### ENGINE MISSES

Spark plug gap incorrect. See Page 14.

Worn and leaking ignition cable.

Weak spark. See *'Magneto Ignition Spark'*, Page 11.

Loose connections at ignition wires.

Magneto breaker points pitted or worn.

Oil in breaker box. See *'Crankcase Breather'*, Page 10.

Water in gasoline.

Poor compression. See *'Compression'*, Page 17.

### ENGINE SURGES OR GALLOPS

Carburetor flooding.

Governor spring hooked into wrong hole in lever, or governor rod incorrectly adjusted. See *'Governor Adjustment'*, Page 25.

### ENGINE STOPS

Fuel tank empty.

Water, dirt or gum in gasoline.

Gasoline vaporized in fuel lines due to excessive heat around engine (Vapor Lock). See *'Stopping Engine'*, Page 9.

Vapor lock in fuel lines or carburetor due to using winter gas (too volatile) in hot weather.

Air vent hole in fuel tank cap plugged. Engine scored or stuck due to lack of oil.

Ignition troubles. See *'Ignition'*, Page 17.

### ENGINE OVERHEATS

Crankcase oil supply low. Replenish immediately.

Ignition spark timed wrong. See *'Timing'*, Page 12.

Low grade of gasoline.

Engine overloaded.

Restricted cooling air circulation.

Part of air shroud removed from engine.

Dirt between cooling fins on cylinder head.

Engine operated in confined space where cooling air is continually recirculated, consequently becoming too hot.

Carbon in engine.

Dirty or incorrect grade of crankcase oil.

Restricted exhaust.

Engine operated while detonating due to low octane gasoline or heavy load at low speed.

### ENGINE KNOCKS

Poor grade of gasoline or of low octane rating. See 'Fuel', Page 8.

Engine operating under heavy load at low speed.

Carbon or lead deposits in cylinder head.

Spark advanced too far. See 'Timing', Page 12.

Loose or burnt out connecting rod bearing.

Engine overheated due to causes under previous heading.

Worn or loose piston pin.

### ENGINE BACKFIRES THROUGH CARBURETOR

Water or dirt in gasoline.

Engine cold.

Poor grade of gasoline.

Sticky inlet valves. See 'Valves and Seat Insert', Page 19.

Overheated valves.

Hot carbon particles in engine.

## DISASSEMBLY AND REASSEMBLY OF ENGINE

Engine repairs should be made by a mechanic who has had experience in such work. When disassembling the engine it is advisable to have several boxes available so that parts belonging to certain groups can be kept together. Capscrews of various lengths are used in the engine, therefore great care must be exercised in reassembly so that right screws will be used in the proper places.

Tighten the capscrews of the cylinder head, gear cover, connecting rod, stator plate and the spark plug to the specified torque readings indicated in the paragraphs of reassembly, relative to these parts.

With the disassembling operations, instructions on reassembling are also given, as often it will not be necessary to disassemble the entire engine. If it is desired to disassemble the entire engine, the reassembly instructions can be looked up later under the headings of the various parts.

While the engine is partly or fully dismantled, all of the parts should be thoroughly cleaned. Use all new gaskets in reassembly and lubricate all bearing surfaces.

The following procedure is for complete disassembly of an engine. As disassembly progresses, the order

may be altered somewhat, as will be self-evident to the mechanic. Reassembly of the engine should be made in the reverse order.

### TESTING OF REBUILT ENGINE

An engine that has been completely overhauled, such as having the cylinder rebored and fitted with new piston, rings and valves, should go through a thorough "run-in" period before any load is applied to it.

The engine should be started and allowed to run for about one-half hour, at about 1600 to 1800 R.P.M. without load. The R.P.M. should then be increased to engine operating speed, still without load, for an additional three and one-half to four hours.

The proper "running-in" of the engine will help to establish polished bearing surfaces and proper clearances between the various operating parts and thus add years of trouble free service to the life of your engine.

### DRAIN OIL FROM CRANKCASE BEFORE DISASSEMBLY

### ACCESSORIES

Remove muffler and disconnect ignition wire from spark plug. If engine is to be completely overhauled, remove all accessories.

On engines equipped with a combination motor-generator; disconnect wires and adjusting strap at the generator. Remove bracket and motor-generator from side of crankcase as a complete unit.

**Caution:** In reassembly, do not put too much tension on drive belt.

### FUEL TANK (Fig. 20)

Close fuel valve at tank and disconnect fuel line. Remove three nuts and washers which hold tank bracket to cylinder head studs. Fuel tank and bracket can then be removed as a complete unit.

### CARBURETOR and AIR CLEANER (Fig. 21)

The carburetor and air cleaner should be removed both

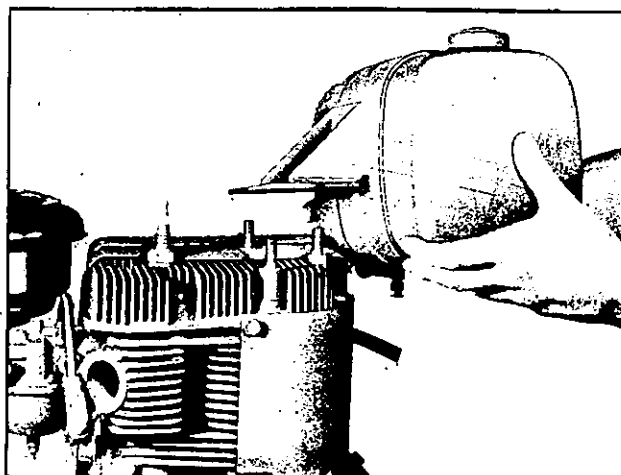


Fig. 20

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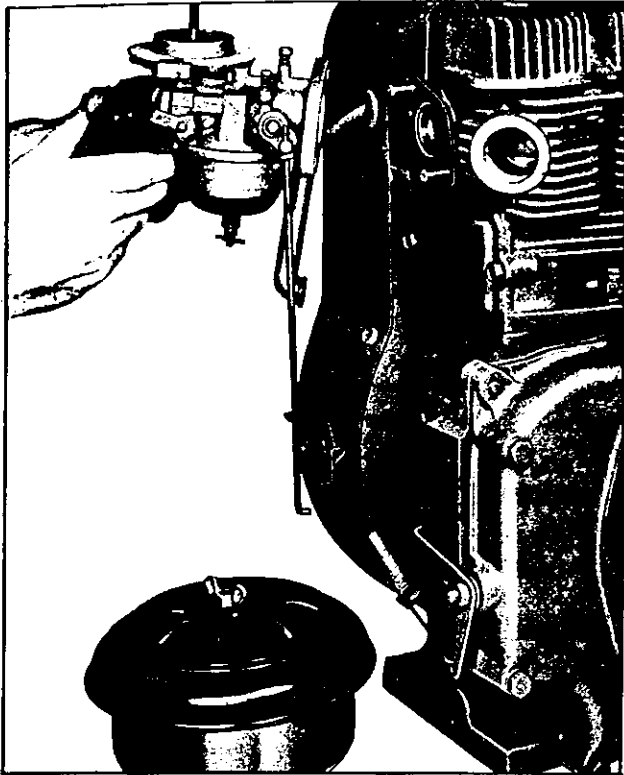


Fig. 21 293052C

to facilitate working on the engine and to prevent damage to these parts. Unscrew wing nut and remove air cleaner. Be careful of oil in cleaner. Disconnect breather line at inspection cover, throttle rod clip at governor lever and fuel line. Take out the two nuts holding carburetor flange to cylinder, and remove carburetor - air cleaner bracket as a complete unit.

#### STARTER SHEAVE and FLYWHEEL SHROUD (Fig. 22)

Remove *starter sheave* and *screen* by taking out the three screws and washers that mount them to the flywheel.

Take off *top cover* and *cylinder side shroud*. Unhook governor spring and remove four screws holding flywheel shroud to back plate. *Flywheel shroud* can then be removed, but back plate should be kept in place

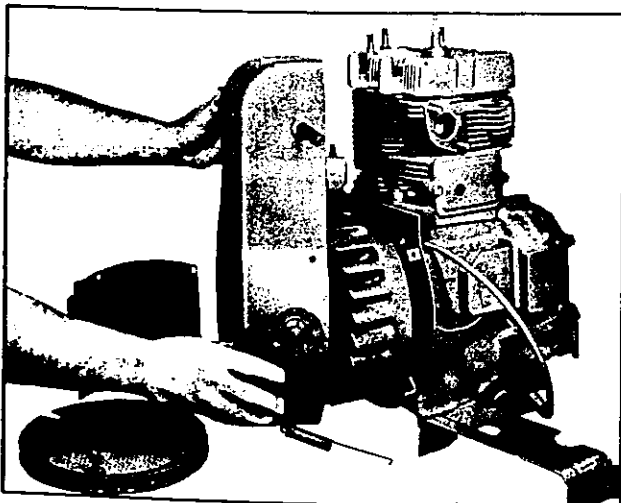


Fig. 22 293066C

and removed only if necessary after flywheel is removed.

#### CYLINDER HEAD and SPARK PLUG (Fig. 23)

Remove spark plug and take out the three cylinder head studs and five capscrews. After removal of cylinder head and gasket, clean out all carbon deposits from combustion chamber and dirt from between cooling fins.

*In reassembly*, use new cylinder head and spark plug gaskets. **Note:** Internal contour of cylinder head gasket at inlet and exhaust valves are not the same. Mount gasket to cylinder block with the larger internal radius located at the inlet valve. See Fig. 23.

Apply a mixture of graphite and oil to the threads of the cylinder head studs and capscrews. **Torque** to 32 ft. lbs. in three alternate stages: 16 ft. lbs., 24 ft. lbs. and finally 32 ft. lbs.

Leave spark plug off temporarily, for ease in turning engine over for remainder of assembly and for timing adjustments. When mounting spark plug, tighten 28 to 30 ft. lbs. torque.

#### VALVES and SEAT INSERTS (Fig's. 24, 25, 26)

Take off the combination valve inspection cover and breather assembly. By means of a standard automotive valve lifter, remove retainer locks and take out valves from top of cylinder block.

Clean out carbon and gum deposits from the valves, seats, ports and guides. Replace valves that are badly burned, pitted or warped.

The *exhaust valve face* and replaceable *exhaust seat insert* are of *stellite* material. A positive type *valve rotator* is furnished as standard equipment on the exhaust valve only. Clean and inspect operation of rotator. Faulty rotator action might result in a burned exhaust valve.

The inlet and exhaust valve *seat inserts* can be removed, when replacement becomes necessary, by means of Wisconsin Motor DF-66-A insert puller. See Fig. 25.

*Grinding of valves and seats* should be done by an authorized Wisconsin service station. See directory in rear of manual.

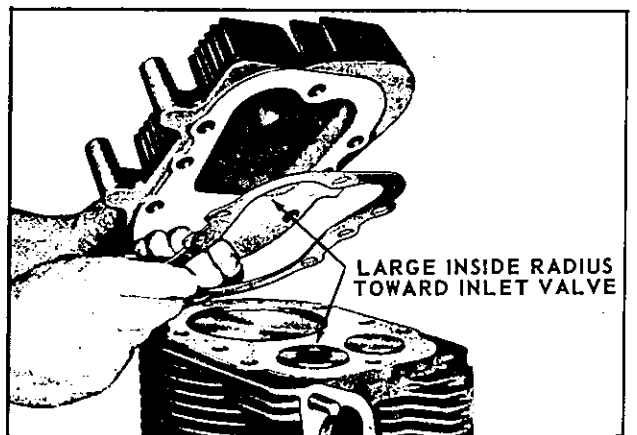


Fig. 23 293067C

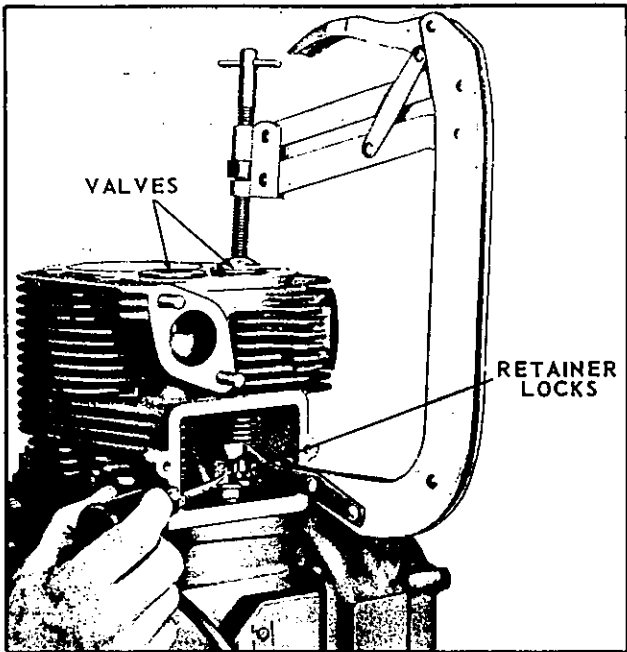


Fig. 24

293044C

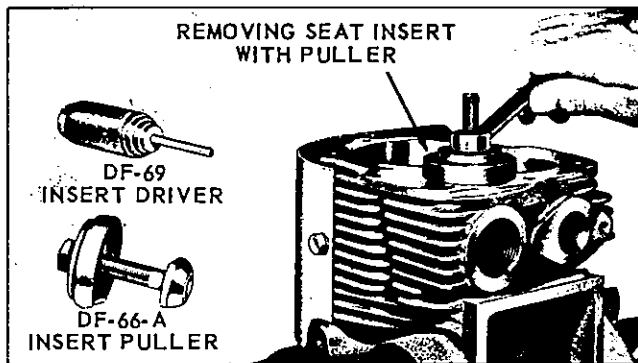


Fig. 25

284070C

Before grinding valves, inspect valve guides for possible replacement. Refer to Fig. 27 for proper method of driving out guides, and see chart, Fig. 26, for valve, seat and guide specifications.

After grinding, lap valves in place until a uniform ring will show entirely around the face of the valve. Wash valves and block thoroughly with gasoline or kerosene to remove all traces of grinding and lapping compound.

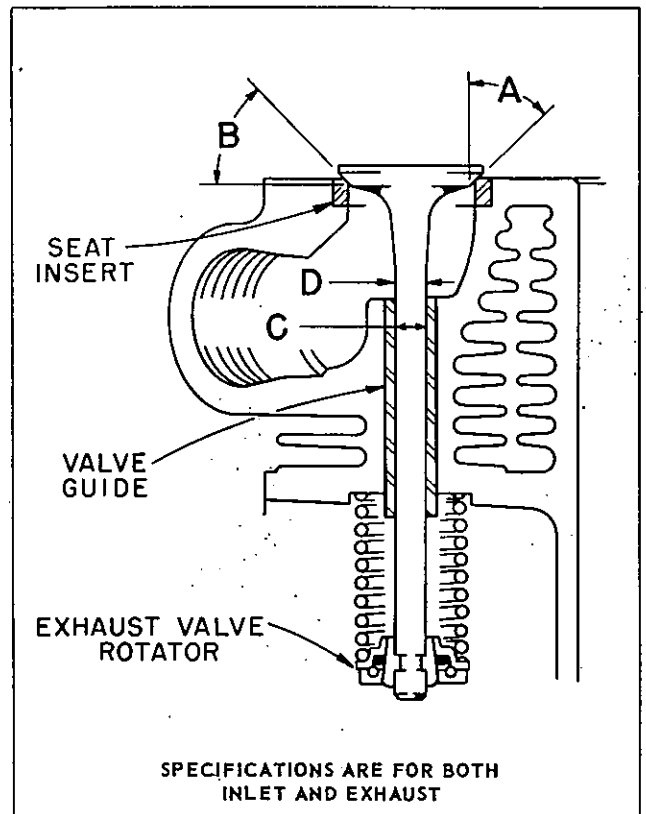
### VALVE GUIDES

When valve stem clearance becomes excessive, the valve guides should be driven out, as illustrated in Fig. 27, and new guides pressed in place. Use Wisconsin Motor DF-72 valve guide driver. In reassembly, press guides into valve ports using the same driver tool. Refer to Fig. 26 for clearance specifications and proper assembly.

### FLYWHEEL (Fig's 28 and 29)

**Caution:** If flywheel is to be removed it must be loosened at this time. **Do not** attempt to loosen flywheel after gear cover is removed. Striking the crankshaft, without support from gear cover, would inflict damages to the crankshaft, rod and piston.

Straighten tab of star lockwasher that is bent over on



SPECIFICATIONS ARE FOR BOTH INLET AND EXHAUST

A - VALVE FACE ANGLE	45°
B - SEAT INSERT ANGLE	45°
C - GUIDE INSIDE DIAMETER	.312 - .313
D - VALVE STEM DIAMETER	.308 - .309
MAXIMUM ALLOWABLE CLEARANCE BETWEEN C AND D	.007

Fig. 26

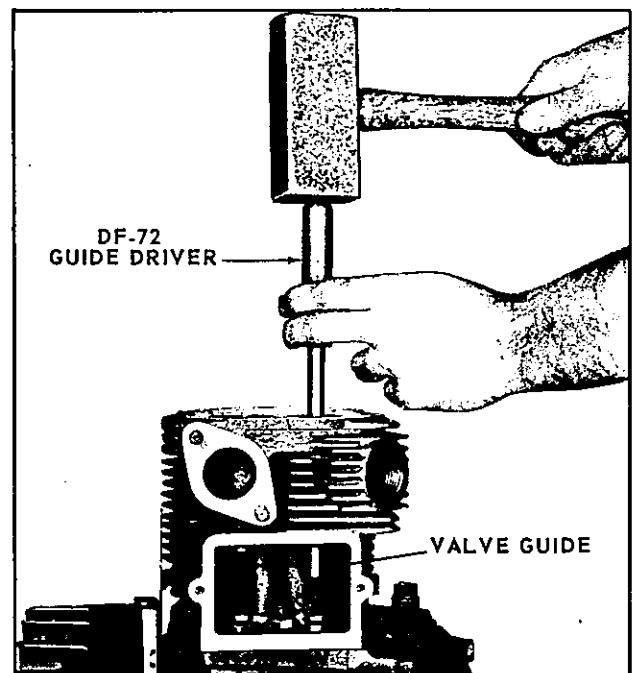


Fig. 27

293045C

flat of flywheel nut. Place a 1-11/16" box or socket wrench on to flywheel nut and give the wrench a sharp

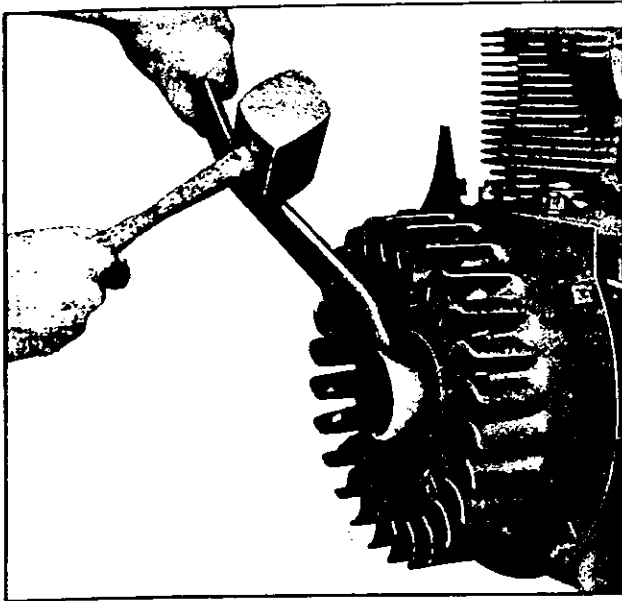


Fig. 28 293061C

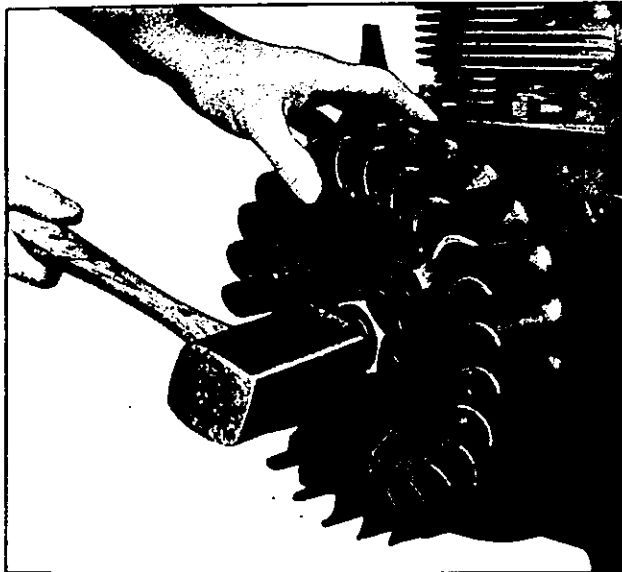


Fig. 29 293042C

blow with a soft hammer. **Do not remove nut**, simply unscrew it flush with end of shaft.

The flywheel is mounted to a taper on the crankshaft. Take a firm hold on the flywheel fins, pull outward and at the same time strike the end of the crankshaft with a babbitt hammer. The flywheel will slide off the taper of the crankshaft. Do not use a hard hammer as it may ruin the crankshaft and bearings.

**Loosen flywheel but do not remove:** It is necessary that the flywheel be left on to support crankshaft during removal of gear cover and connecting rod, and thus prevent damage to the oil seal in stator plate. **Take flywheel off after piston and connecting rod are removed.**

**In reassembly,** mount flywheel immediately after crankshaft is mounted; be sure **woodruff key is in position** on crankshaft and is properly lined up with keyway in flywheel hub. **Do not drive flywheel** on to taper of crankshaft. Place a short piece of pipe against hub of flywheel and tap end of pipe with a soft hammer to

seat flywheel on to taper. Mount star lockwasher with tab inserted in flywheel keyway. Assemble nut and tighten only enough to hold flywheel in place. Then, **after end play is set (see End Play paragraph)** tighten flywheel nut by placing wrench on nut and giving handle of wrench several sharp blows with a soft hammer. Bend one tab of star washer over flat on flywheel nut.

### GEAR COVER (Fig's. 30 and 31)

Remove gear capscrews and take off governor lever. Tap the two **dowel pins** with a hammer, from crankcase side, and gear cover will break loose from crankcase. **Caution:** Steel ball for camshaft end thrust will probably fall out when gear cover is removed. Take thrust spring out from end of camshaft to prevent it from becoming lost.

**In reassembly;** insert thrust spring into end of camshaft and lubricate bearings, gear train and tappets.

Tap dowel pins into gear cover until they extend about 1/8" past the flange face. Place a dab of low melting grease into hole of gear cover to retain camshaft thrust spring ball in place. Lubricate lip of oil seal and add a light film of oil to gear cover face to hold gasket in place.

Place **sleeve tool Fig. 31**, in oil seal, drop steel ball into grease filled hole and assemble gear cover by tapping in place with a soft hammer.

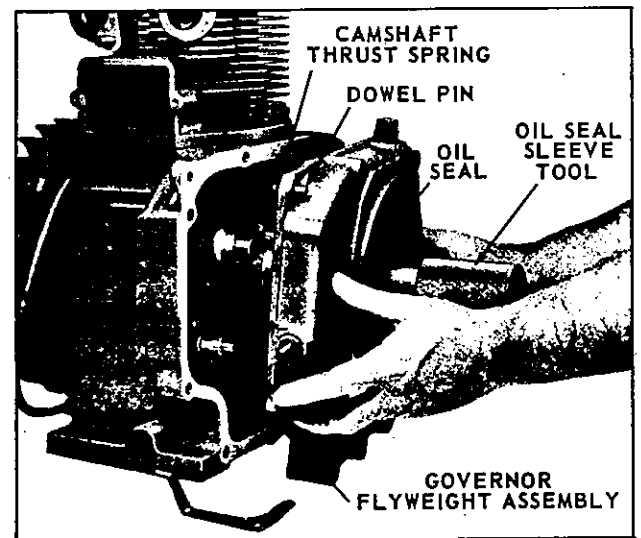


Fig. 30 293062C

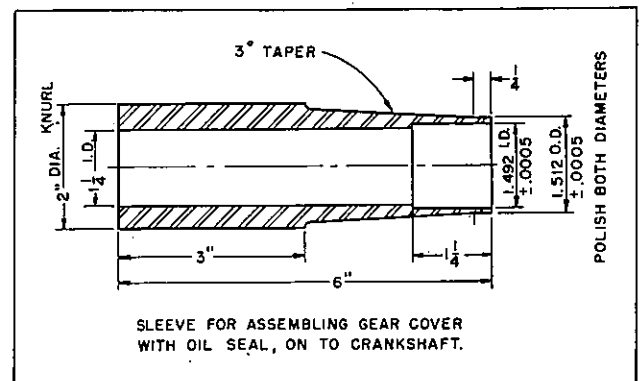


Fig. 31

**Caution:** Be sure timing marks on crankshaft and camshaft gear, Fig. 40, remain correctly mated when end of camshaft is pressed into bearing hole of gear cover.

**Note:** Governor yoke must straddle governor shaft extension and bear against thrust sleeve.

Remove oil seal sleeve, tighten gear cover capscrews to 18 ft. lbs. torque and hammer dowel pins in place. Mount governor lever.

### GOVERNOR FLYWEIGHT ASSEMBLY (Fig's. 32, 33)

The governor gear and flyweight assembly rotates on a stationary pin pressed into the crankcase and is held in place with a snap ring.

**To disassemble:** Spread flyweights apart and remove governor thrust sleeve. By means of a snap ring pliers, snap ring can be removed and the gear-flyweights slipped off the shaft.

**Reassembly** is made in reverse order. Maintain a clearance of .003 to .005" between gear hub and face of

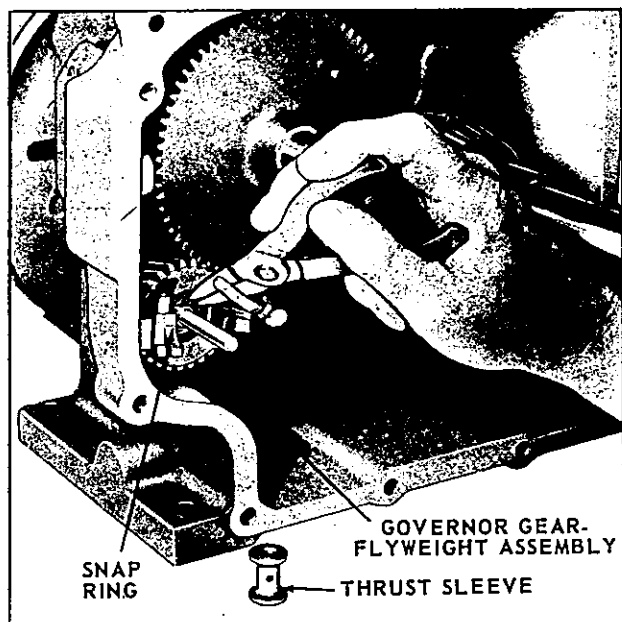


Fig. 32

293043C

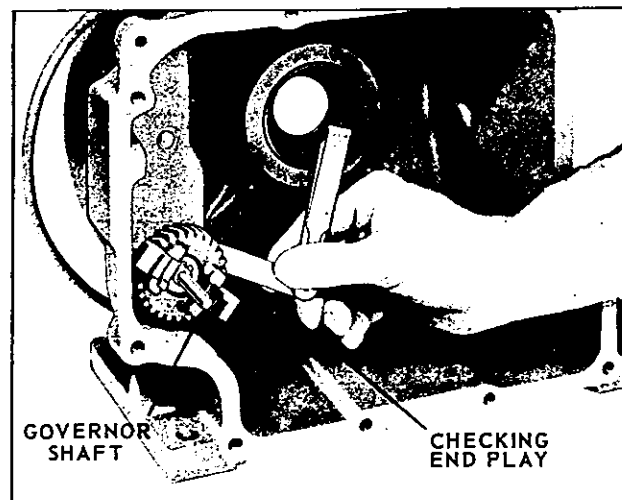


Fig. 33

293047C

governor shaft boss in crankcase. This end play can be adjusted by tapping the governor shaft in either direction. Clearance between shaft and gear is .0005 to .002". When clearance becomes .005", replace worn parts.

### CONNECTING ROD and PISTON (Fig's. 34, 35, 36)

By means of a 1/2" socket wrench, loosen and remove hex nuts from connecting rod bolts. Oil dipper will come off when nuts are removed. Then, by tapping the ends of the bolts lightly, the connecting rod cap will break free from the bolts.

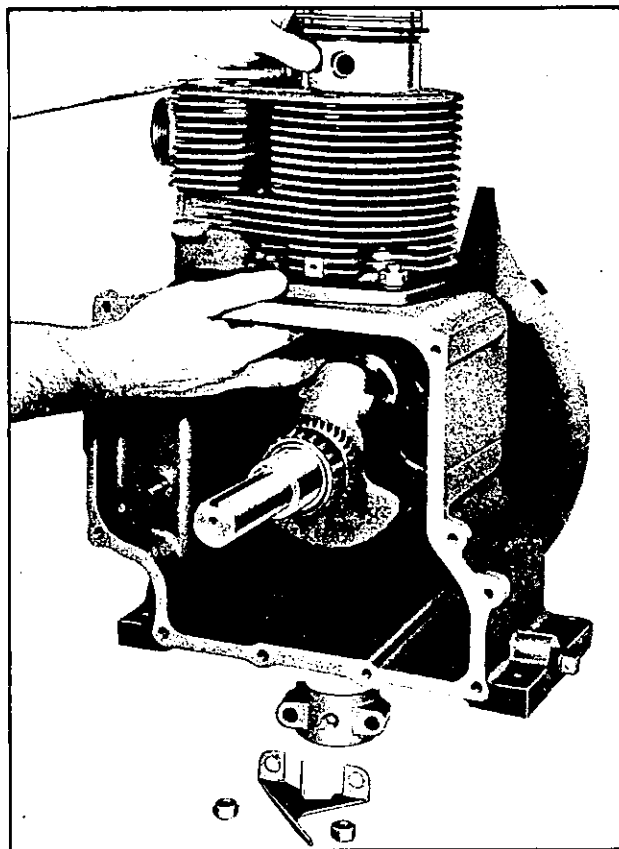


Fig. 34

293046C

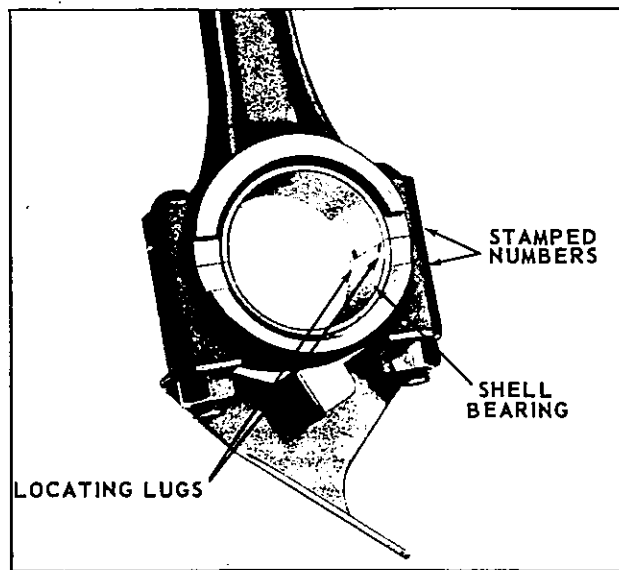
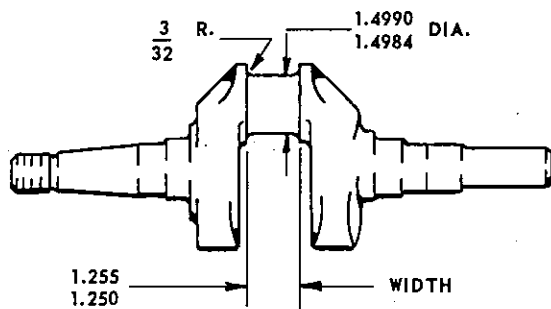


Fig. 35

293048C

## PISTON, RING AND ROD CLEARANCE CHART

PISTON TO CYLINDER AT PISTON SKIRT THRUST FACES	MODEL S-10D	MODEL S-12D
		.0025 to .003"
PISTON RING GAP		.010 to .020"
PISTON RING SIDE CLEARANCE IN GROOVES	TOP RING	.002 to .004"
	2nd RING	.002 to .004"
	OIL RING	.0015 to .0035"
Connecting Rod to Crank Pin - Side Clearance		.004 to .013"
Connecting Rod Shell Bearing to Crank Pin		.0005 to .0015"
PISTON PIN TO CONNECTING ROD BUSHING		.0005 to .0011"
PISTON PIN TO PISTON		.0000 to .0008" tight



STANDARD CRANK PIN DIMENSIONS

Fig. 36

Scrape off all carbon deposits that might interfere with removal of piston from cylinder. Turn crankshaft until piston is at top, then push connecting rod and piston assembly upward and out thru top of cylinder. Be careful not to mar the crank pin by allowing the rod bolts to strike or scrape across it.

The connecting rod has a removable shell bearing and care should be taken *in reassembly* to mount bearing properly. The cap should be assembled to the rod so that the *locating lug* on both bearing halves will be on the same side, see Fig. 35. Refer to chart, Fig. 36, for proper clearance between shell bearing and crank pin.

The piston skirt is *cam-ground* to an elliptical contour. Clearance between the piston and cylinder must be measured at the center of the thrust face of the piston skirt. Refer to Chart, Fig. 36, for proper clearance. The thrust face on the piston skirt is 90° from the axis of the piston pin hole.

*In reassembly*; use a ring compressor and stagger the piston ring gaps 90° apart around the piston. Oil the piston, rings, wrist pin, rod bearings and cylinder walls before assembly.

**Note:** Mount piston and rod assembly with the *stamped number* on the connecting rod bolt boss facing toward the open end of the crankcase. Assemble connecting rod cap in like manner so that the two numbers are on the identical side. Turn crankshaft to lower end of stroke and tap piston down until rod contacts crank pin. Mount dipper so that cap nuts are accessible from

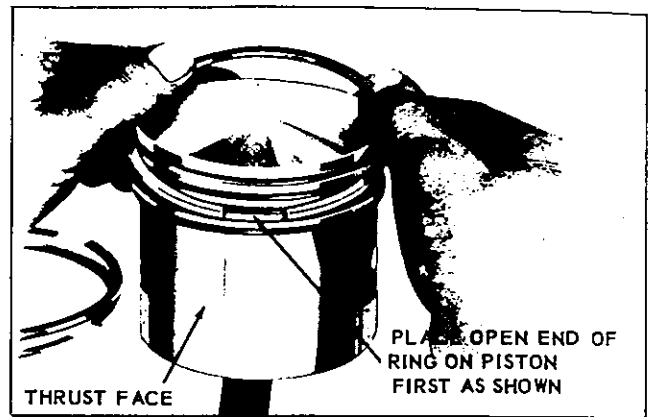


Fig. 37

71152C

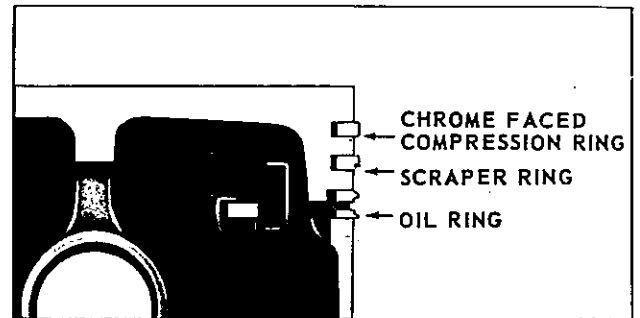


Fig. 38

296112C

open end of crankcase. Tighten connecting rod nuts to 24 foot pounds torque.

### PISTON RINGS (Fig's. 37 and 38)

If a ring installation tool is not available, install rings by placing the open end of the ring on piston first, as shown in Fig. 37. Spread ring only far enough to slip over piston and into correct groove, being careful not to distort ring. A *pit mark*, or the word *'top'* is stamped on the rings, to indicate the correct placement of the rings on the piston. Scraper ring must be mounted with scraper edge down, otherwise oil pumping and excessive oil consumption will result.

### CYLINDER BLOCK

Clean all dirt and foreign deposits from between the cylinder block fins.

The cylinder block does not have to be removed, unless the cylinder bore is worn more than .005 inch oversize. In this case, the block should be reground and fitted with oversize piston and rings. This work should be done by an authorized 'Wisconsin Service Station'.

In reassembly, tighten the four cylinder block mounting nuts, 40 to 50 foot pounds torque. The capscrew in valve spring compartment should be tightened to 32 foot pounds torque.

### CAMSHAFT and VALVE TAPPETS (Fig's. 39, 40, 41)

To prevent tappets from falling out and becoming damaged when camshaft is removed, turn crankcase over on its side as shown in Fig. 39. Push tappets inward to clear cam lobes and remove camshaft.

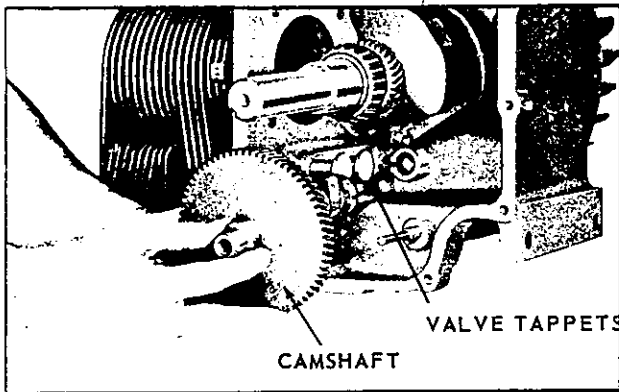


Fig. 39 293059C

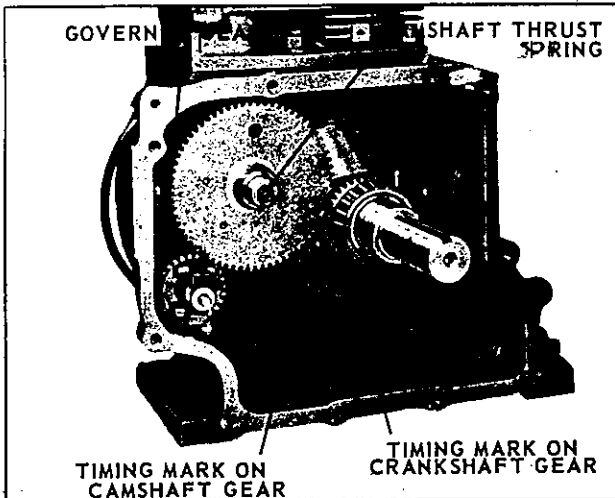


Fig. 40 293041C

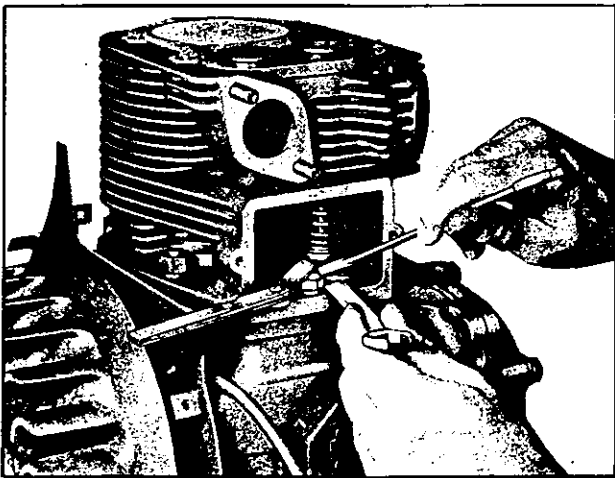


Fig. 41 293060C

Remove tappets; check face for scuffing and inspect body for wear. Body diameter of .6245/.6235" has a clearance of .0005 to .0025" in guide hole.

*In reassembly:* Tappets must be inserted in crankcase before camshaft is assembled. Mount camshaft so that *timing mark* on cam gear matches up with *marked gear tooth* on crankshaft gear. See Fig. 40. If valve timing is off, engine will not function properly or may not run at all. Be sure thrust spring is in place in end of camshaft.

*Tappet adjustment* can be made immediately after assembling the valves, springs and locks, See Fig. 41.

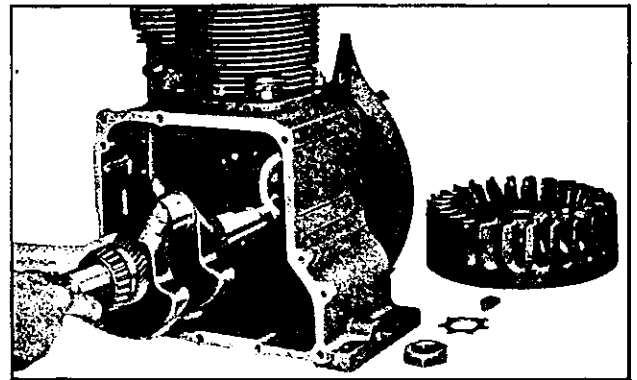


Fig. 42 293063C

With the tappets in their lowest position and the engine cold, the clearance should be:

*inlet* - .007 inch  
*exhaust* - .016 inch

#### CRANKSHAFT (Fig. 42)

Take off flywheel nut and remove flywheel. Knock out woodruff key and pull crankshaft out from open end of crankcase.

*In reassembly;* mount flywheel after crankshaft is assembled, and hand tighten flywheel nut. Flywheel will support crankshaft for mounting of connecting rod and piston. Flywheel nut is tightened after gear cover is mounted, and previous to checking end play.

#### STATOR PLATE and END PLAY (Fig's. 43, 44)

The stator plate functions as an adapter for the magneto coil as well as a front bearing support. Since the crankshaft end play is adjusted by means of the stator plate gaskets, it is advisable not to remove the plate unless replacement is necessary.

To remove stator plate, take out four capscrews and tap plate from inside crankcase with a wooden hammer handle.

*In reassembly:* Use new gaskets having the same total

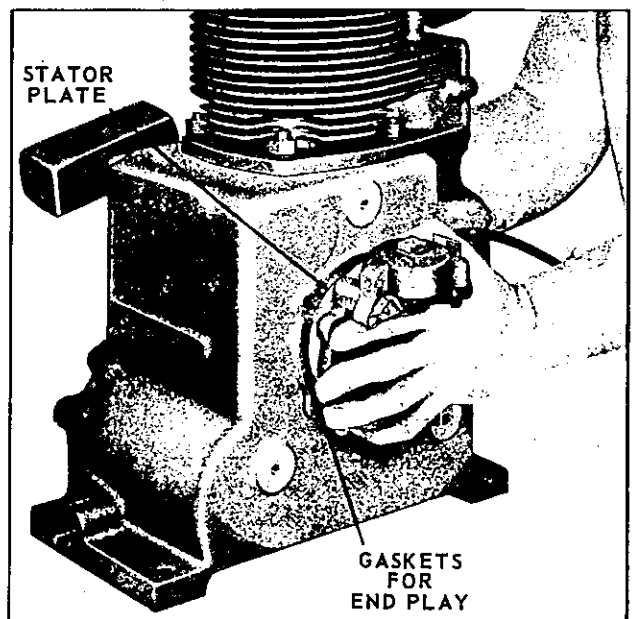


Fig. 43 293049C

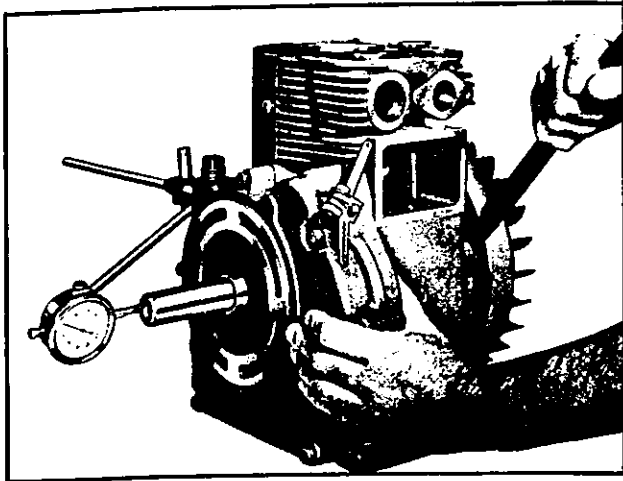


Fig. 44

284080C

thickness as those removed.

Torque stator plate capscrews to 18 ft./lbs.

**End play** is checked after crankshaft, gear cover and flywheel are mounted. The end play should be .001 to .004 inch with engine cold, and can be determined as illustrated in Fig. 44. Wedge a lever between the flywheel and crankcase, and move the crankshaft forward and backward against a dial indicator. If there is too much end play, a corresponding thickness of gasket will have to be removed from behind stator plate. Not enough end play and gasket will have to be added.

If new tapered crankshaft main bearings have been installed, seat the bearings by alternately striking each end of the crankshaft several sharp blows with a lead hammer. Then proceed to check crankshaft end play.

After end play is set, refer to flywheel reassembly paragraphs, for final instructions on tightening of flywheel nut.

## GOVERNOR

### OPERATION

Two flyweights are hinged to lugs on the governor gear. Hardened fingers on the flyweights bear against a thrust sleeve, moving it back and forth as the flyweights move in or out. The motion of the thrust sleeve is transmitted through a yoke connected to the governor lever, which in turn is connected to the carburetor throttle. A spring connected to the governor lever tends to hold the governor flyweights to their inner position, also to hold the carburetor throttle open. As the engine speed increases, centrifugal force from the flyweights acts against the spring and closes the throttle to a point where the engine speed will be maintained practically constant under varying load conditions. This speed can be varied to suit conditions by adjusting the governor spring tension.

### GOVERNOR ADJUSTMENT (Fig. 45)

The governor rod connection to the carburetor must be very carefully adjusted for length, otherwise the gov-

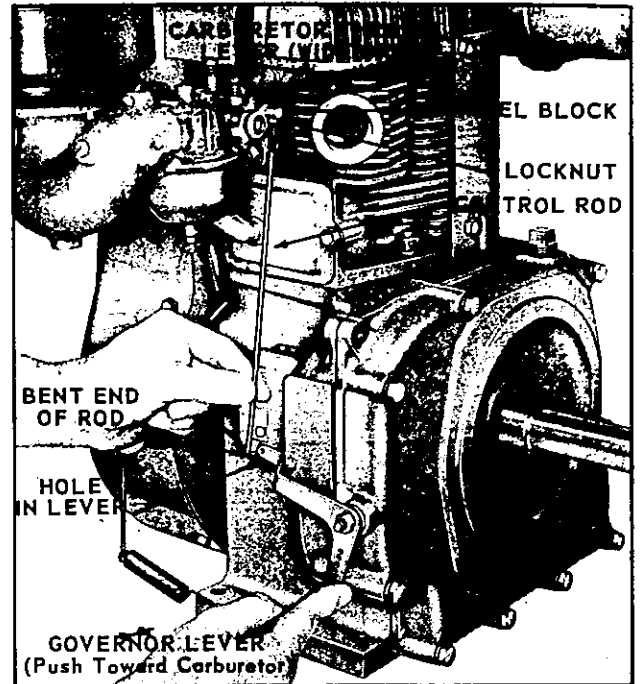


Fig. 45

293050C

ernor will not function properly and may cause the engine to surge badly. With the engine at rest, the governor spring will keep the flyweights in, and the control rod must be of such length as to hold the carburetor throttle wide open at that point.

With the control rod disconnected from the governor lever, as illustrated in Fig. 45, push the rod toward the carburetor as far as it will go. This will put the carburetor throttle lever in a wide open position. The governor lever should then be extended as far as possible in the same direction. Holding both parts in the above position, the rod should be screwed in or out of the swivel block on the carburetor, until the bent end of the rod will register with the hole in the lever.

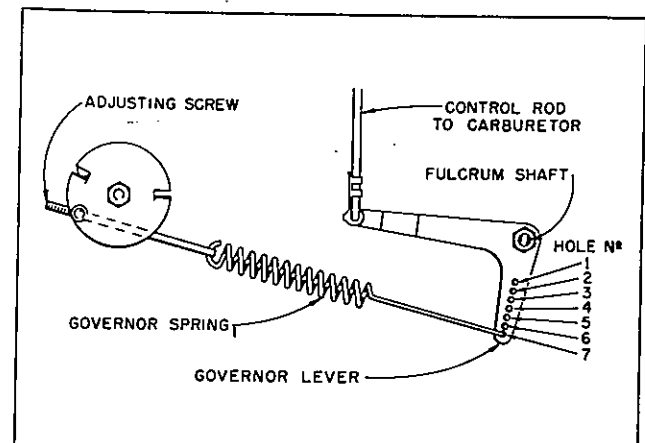
Snap control rod retainer clip in place and tighten locknut against swivel block on carburetor throttle lever.

### CORRECT ENGINE SPEED (Fig. 46)

**Engine speed** is adjusted by hooking governor spring in correct hole of governor lever, and then regulating spring tension by means of an adjusting screw. The governor lever has 7 holes for the governor spring, with the No. 1 hole closest to the fulcrum shaft.

The governor lever chart in Fig. 46, shows the load and no load speeds and the corresponding governor spring hole. After hooking spring into the lever hole relative to the desired load speed, run the engine without load and regulate the spring tension by means of the adjusting screw until the required no load speed is obtained. The governor spring will have to be disconnected from governor lever each time screw is turned in or out.

A tachometer or revolution counter should be used against the crankshaft to check speed while adjusting the governor spring tension. The engine speed with-



LOAD R.P.M.	NO LOAD R.P.M.	HOLE NO.	LOAD R.P.M.	NO LOAD R.P.M.	HOLE NO.
1600	1760	1	2700	2810	4
1800	1975	2	2800	2940	5
1900	2040	2	2900	3010	5
2000	2120	2	3000	3150	6
2100	2260	3	3100	3230	6
2200	2340	3	3200	3360	7
2300	2400	3	3300	3455	7
2400	2580	4	3400	3520	7
2500	2650	4	3500	3590	7
2600	2720	4	3600	3680	7

Fig. 46

out load will vary, from 75 to 180 revolutions per minute higher than the speed with load. For instance; if the engine is to operate at 3000 R.P.M. under full load, the speed with no load will be 3150 R.P.M. and this should be kept in mind when adjusting the governor. Refer to the governor lever chart, Fig. 46 for the variation between load speed and no load (high idle) speed.

# FLYWHEEL ALTERNATOR



## with solid state regulation

12 Volt - 10 amp and 25 amp Systems For  
WISCONSIN Single, Two and Four Cylinder Engine Models

### DESCRIPTION of Change

Beginning with engine serial No. 5188288, a new *two module* flywheel alternator system replaces the previously furnished three module system, that included an isolation diode module, and the two unit system without the isolation diode.

The *isolation diode* module was incorporated into the old system to eliminate battery discharge problems during shut down, cranking and idling.

### INTERCHANGEABILITY

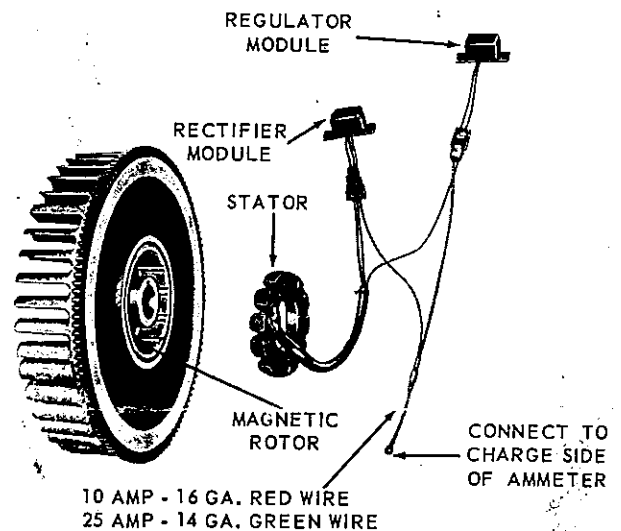
The *Regulator module* was not changed and is completely interchangeable between the new and old systems. The *Rectifier module* and *Stator assembly* have been modified to incorporate the advantages of an isolation diode without adding a third module. These new parts are *not* interchangeable with the old unless both rectifier and stator are replaced simultaneously. The new system has a *three prong* plug connector between the rectifier and stator - the old system has a two prong connector.

### DESCRIPTION and OPERATION

This flywheel alternator is of the permanent magnet type and has *no brushes, commutator, belts or adjustments*. A series of coils (stator) is mounted to the engine gear cover, and the magnetic flux is provided by a permanent magnet in the flywheel which rotates around these stationary coils. Only four components make up this light weight space saving system; a *flywheel* with magnetic rotor, *stator*, *rectifier* module and *regulator* module.

The *center-top* rectifier arrangement prevents damage to the alternator system when arc welding, because the winding acts as a choke and its inductance prevents the transient voltage from damaging the diodes.

Since the physical appearance of both 10 amp and 25 amp alternator systems are very similar, the 25 amp



319423C-1

*unit* can be distinguished from the 10 amp unit by the ammeter calibrations, and by a 14 gage green wire in place of a 16 gage red wire, from the ammeter to the stator-regulator connector.

**PRECAUTIONS** to be exercised in the use of this flywheel alternator:

1. *Do Not* reverse battery connections. This is for a *negative ground* system only.
2. Connect booster batteries properly - positive to positive and negative to negative.
3. *Do Not* polarize the alternator.
4. *Do Not* ground any wires from stator or modules which terminate at connectors.
5. *Do Not* operate engine with battery disconnected from system.
6. Disconnect at least one battery lead if a battery charger is used.

 **TELEDYNE WISCONSIN MOTOR**

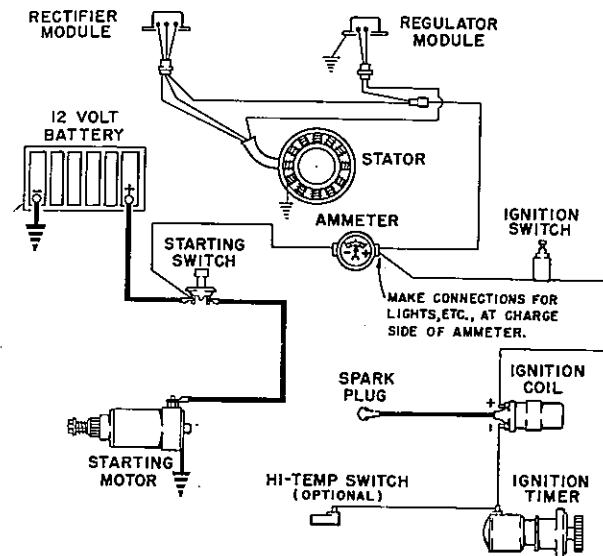
MILWAUKEE, WISCONSIN 53219

Printed in U.S.A.

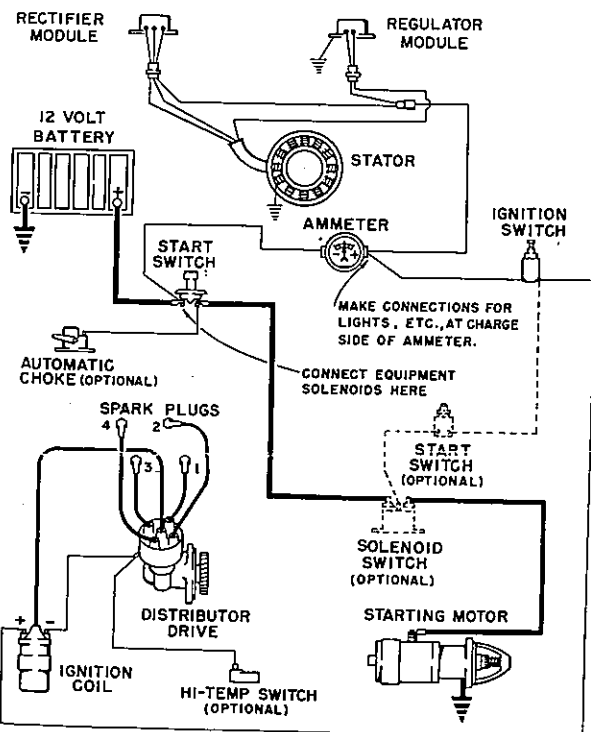
## WIRING CIRCUIT

The fool-proof type connectors used prevent incorrect wiring from the stator to the rectifier and regulator modules. To disconnect plugs, squeeze outer ends of receptacle and pull apart.

The rectifier is insulated from ground, but the stator and regulator module are grounded to the engine through their mounting surface. The regulator module therefore should not be removed and mounted at some remote location. This is a *negative ground circuit*. Connect ground strap from negative post of battery to starting motor flange, or good clean grounding surface on engine.



WIRING DIAGRAM  
For Single Cylinder Models



WIRING DIAGRAM  
For Two and Four Cylinder Models

## SERVICE PROCEDURE:

Prior to electrical testing, a thorough visual inspection should be made to eliminate conditions that may be interpreted as a defected alternator. Examine leads for broken or loose connections, and make sure modules are securely mounted. The *regulator module* must be mounted to a metal surface for grounding purposes, while the *rectifier module*, although insulated from ground, should be securely mounted for heat dissipation. The mounting surfaces must be clean and free of contaminants, oil, grease, etc. When assured that the problem is with the alternator, follow the tests outlined in 'Trouble Shooting'.

## TROUBLE SHOOTING

### 10 and 25 amp Flywheel Alternator

Problem: Battery Overcharge	Possible Cause & Remedy
Test 1.0 With engine running at full RPM, check battery voltage w/ DC Voltmeter.	
1.1 If voltage is over 15.0	1.1 Regulator not functioning properly. Replace module.
1.2 If voltage is under 15	1.2 Alternator functioning properly. Check battery condition.

Problem: Low/No Charge	Possible Cause & Remedy
Test 1.0 With engine running at full RPM, check battery voltage w/ DC meter. If voltage is greater than 14 volts, place * load on battery to reduce voltage below 14 volts.	
1.1 If the charge rate increases -	1.1 Alternator functioning properly. Battery was fully charged.
1.2 If the charge rate does not increase -	1.2 Proceed with Test 2.0.

\* Place as many 12 volt light bulbs across battery as required to reduce voltage below 14 volts. A carbon pile resistor may be used in place of bulbs.

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**Problem: Low/No Charge**

**Possible Cause & Remedy**

**Test 2.0** Conditions and procedure the same as Test 1.0 except the regulator module is disconnected.

**2.1** If the charge rate increases -

**2.2** If the charge rate does not increase -

**Test 3.0** Test conditions and procedure the same as 1.0 except with new rectifier module plugged in.

**3.1** If the charge rate increases -

**5.2** If the charge rate does not increase -

**Test 4.0** With engine stopped, unplug all connectors between modules and stator. Start engine and run at 2400 RPM. With AC voltmeter check voltage between each of the black stator leads and ground.

**4.1** If one of the two voltages is zero or they are over 10% apart -

**2.1** Regulator was at fault. Replace regulator module.

**2.2** Regulator is not at fault. Continue with Test 3.0.

**3.1** Rectifier module at fault. Permanently install new rectifier module.

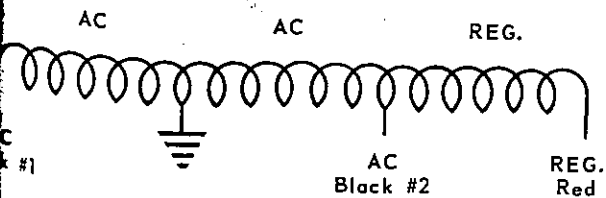
**3.2** Continue with Test 4.0.

**4.1** The stator is faulty and should be replaced.

Further testing can be done on the component level with the engine stopped, and the stator and module connections including output lead uncoupled.

**TO CHECK STATOR**

Use an ohmmeter and check continuity as follows:



**NOTE:** Wire numbers indicated for probe connections are for convenience only and are not indicated on the connectors.

**For 10 amp unit STATOR**

METER PROBE CONNECTIONS		METER VALUE	REPLACE STATOR
+	-		
Black #1 to Black #2		APPROX. 2.0 ohms 1.0 ohm 1.0 ohm 3.0 ohms 1.0 ohm	0 Indicates Short Circuit. ∞ Indicates Open Circuit.
Black #1 to Eng. Gnd.			
Black #2 to Eng. Gnd.			
Black #1 to Red			
Black #2 to Red			

**For 25 amp unit STATOR**

METER PROBE CONNECTIONS		METER VALUE	REPLACE STATOR
+	-		
Black #1 to Black #2		APPROX. 0.40 ohm 0.20 ohm 0.20 ohm 3.20 ohms 2.80 ohms	∞ Indicates Open Circuit.
Black #1 to Eng. Gnd.			
Black #2 to Eng. Gnd.			
Black #1 to Red			
Black #2 to Red			

**STATOR IDENTIFICATION:**

10 amp - 3/8" wide flange : 25 amp - 5/8" wide flange

**TO CHECK RECTIFIER MODULE, Part No. YJ-68**

The same module is used for both the 10 amp and 25 amp systems. It can be distinguished from the regulator by the three lead wires instead of two and the identification decal. Use an ohmmeter and static check continuity as follows:

METER PROBE CONNECTIONS		METER INDICATION
+	-	
White lead to Black #1		No Continuity
Black #1 to White lead		Continuity
White lead to Black #2		No Continuity
Black #2 to White lead		Continuity

**Note:** Continuity shall be in one direction only. If readings are not as indicated, replace module.

**TO CHECK REGULATOR MODULE, Part No. YJ-60**

The same Regulator module is used for both the 10 amp and 25 amp systems. Use an Ohmmeter and static check as follows:

METER PROBE CONNECTIONS		METER INDICATION	REPLACE MODULE
+	-		
Red to Eng. Gnd.		No Continuity	Continuity
Eng. Gnd. to Red		↓	↓
Red to Black			
Black to Red		↓	↓
Black to Eng. Gnd.			
Eng. Gnd. to Black			

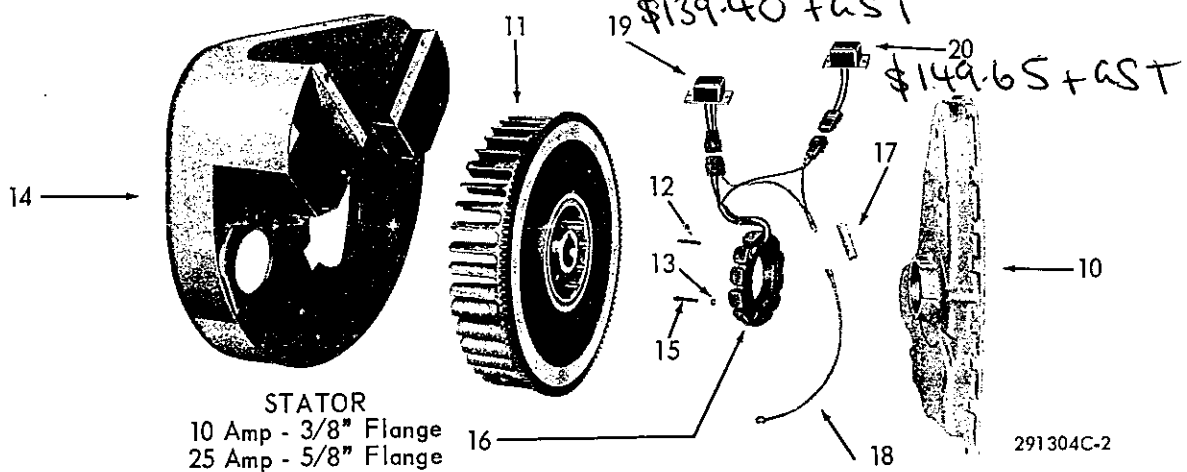
**AMP OUTPUT regulated by engine speed**

MODEL	MAXIMUM ENGINE SPEED	10 AMP SYSTEM	25 AMP SYSTEM
S-12D, S-14D			
AENL, TJD	3600 RPM	10 amps	25 amps
AGND	3200 RPM	10 amps	23 amps
VH4D	2800 RPM	9 amps	20 amps
VG4D	2400 RPM	8 amps	17 amps

# FLYWHEEL ALTERNATOR 12 VOLT - 10 AMP and 25 AMP Systems

For Engines beginning with Serial Number 5188288

**SERVICE PARTS LIST:** The following items are in addition to, or replace similar parts found in the parts manual for each specific engine model. The parts illustration is for the VG4D engine, but can be applied to all models.



REF. NO.	DESCRIPTION	NO. REQ.	PART NUMBER PER ENGINE MODEL					
			AENL	AGND	S-10D, S-12D, S-14D	THD, TJD	VF4D, VH4D	VG4D
10	GEAR COVER ASSEMBLY BEARING RETAINER PLATE - flywheel end	1 1	BG-344-S1	BG-343-S1	BG-350A-S1	BD-103J-S1	BD-100K-4-S1	BD-101B
11	FLYWHEEL with rotor and ring gear For 10 amp alternator circuit For 25 amp alternator circuit	1 1	N-104-5 N-104-9	N-103-5 N-103-9	N-105-2 N-105A-3	N-102-5 N-102-9	N-101-6 N-101-10	N-100-5 N-100-9
12	ROLL PIN - For 10 amp stator For 25 amp stator	2 2	PA-336 PA-362	PA-340 PA-340		PA-368 PA-340	PA-368 PA-340	PA-368 PA-340
13	LOCKWASHER, No. 10, for stator mt'g.	4	PE-14	PE-14	PE-14	PE-14	PE-14	PE-14
14	FLYWHEEL SHROUD	1	SE-154-A	SE-217-H	SE-289-A w/ SE-301B-1 PI.	SE-135-AT	SE-74-YA	SE-124
15	SCREW - For 10 amp stator mt'g. For 25 amp stator mt'g.	4 4	XB-114 XB-110	XB-113 XB-106	XB-113 XB-106	XB-113 XB-106	XB-113 XB-106	XB-113 XB-106
16	STATOR ASSEMBLY - For 10 amp circuit For 25 amp circuit	1 1	YB-81 YB-82	YB-81 YB-82	YB-81 YB-82	YB-81 YB-82	YB-81 YB-82	YB-81 YB-82
17	INSULATOR - ammeter wire connector	1	YD-350	YD-350	YD-350	YD-350	YD-350	YD-350
18	WIRE ASSEMBLY - stator plug to ammeter For 10 amp stator For 25 amp stator	1 1	YL-381-6 YL-380-6	YL-381-6 YL-380-6	YL-381-18 YL-380-18	YL-381-14 YL-380-14	YL-381-18 YL-380-18	YL-381-18 YL-380-18
19	RECTIFIER MODULE - For 10 and 25 amp	1	YJ-68	YJ-68	YJ-68	YJ-68	YJ-68	YJ-68
20	REGULATOR MODULE - For 10 amp and 25 amp circuit	1	YJ-60	YJ-60	YJ-60	YJ-60	YJ-60	YJ-60

## PARTS REQUIRED - NOT ILLUSTRATED

CRANKCASE	1	AA-91B-10	BA-54-20					
ENGINE BASE	1	BB-128A-5						
CLIP for stator wires	1	PG-630-1	PG-430					
GROMMET for stator wires	1			PH-198B-1				
GASKET for bearing retainer plate	1	QD-833						
NUT, #10-32, for mounting modules	4	PD-115	PD-115	PD-115	PD-115	PD-115	PD-115	PD-115
LOCKWASHER, #10 I.E.T., for mounting modules	4	PE-78-A	PE-78-A	PE-78-A	PE-78-A	PE-78-A	PE-78-A	PE-78-A
SCREW, #10-32, for mounting modules	4	XA-7	XA-7	XA-7	XA-8	XA-8	XA-8	XA-8

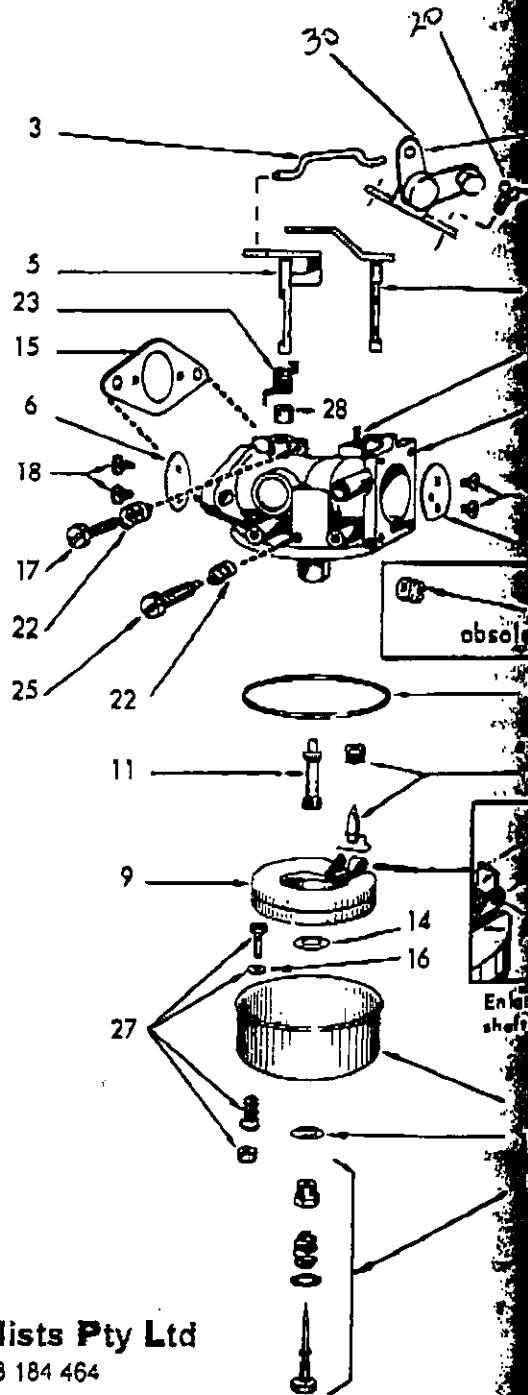
\* NOTE: Because of the available variations in Flywheels, Flywheel Shrouds and Crankcases - give Engine Model, Specification and Numbers when ordering.

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### L106 Series (Walbro Carburetor Model)

Att: Nick  
Fax: 82332223



**Stationary Engine Specialists Pty Ltd**  
 ACN 053 184 464 ABN 22 053 184 464  
 48 Trigg Street  
 Blair Athol S.A. 5084  
 Ph: 08 8262 2022 Fax: 08 8262 3390