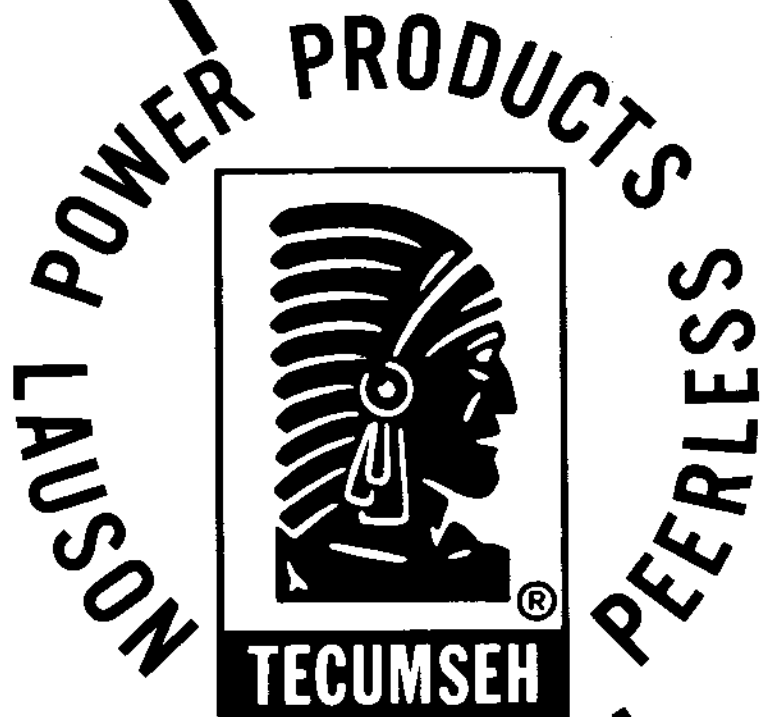




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**POWER PRODUCTS
MECHANIC'S HANDBOOK
2-STROKE CYCLE ENGINE**

**TECUMSEH PRODUCTS COMPANY
PARTS DEPOT DIVISION
GRAFTON, WISCONSIN 53024**

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PART I. GENERAL INFORMATION

SECTION 1. INTRODUCTION

A. GENERAL. The purpose of this handbook is to give up-to-date instructions on the care, service, and repair of Power Products engines, carefully explaining and illustrating the applicable procedures. By following this handbook, you will do a faster, better, more profitable job of servicing Power Products engines for greater customer satisfaction.

B. TYPES OF ENGINES. This handbook covers small 2-cycle engines manufactured by POWER PRODUCTS Division of TECUMSEH Products Company.

C. USE OF THIS HANDBOOK.

- (1) Use this handbook with the Lauson-Power Products Master Parts Manual, referring to the parts manual for the exploded view of the particular engine or component being serviced. Illustrations in this handbook are not intended to show the exact parts for all engine models covered. This handbook points out procedures and methods, paying particular attention to those points where factory

recommendations must be followed to achieve the proper repair or adjustment.

- (2) This handbook has been divided into major sections as shown in the Table of Contents covering general service information. To achieve full benefit from the information given, read each major section in its entirety before making any repairs or adjustments to a part of the engine. Complete understanding will avoid time consuming errors and rework.

D. INFORMATION NOT COVERED IN THIS HANDBOOK. This handbook contains all information normally required to service or repair Power Products engines. Answers to special problems will be found in the Bulletin sections of the Lauson-Power Products Mechanics Manual. For additional information contact your authorized Lauson-Power Products Central Distributor. Be sure to include the engine type number and serial number with any request for information. However, make it a practice to check the handbook first to determine for certain that the problem is not covered.

SECTION 2. ENGINE IDENTIFICATION

1

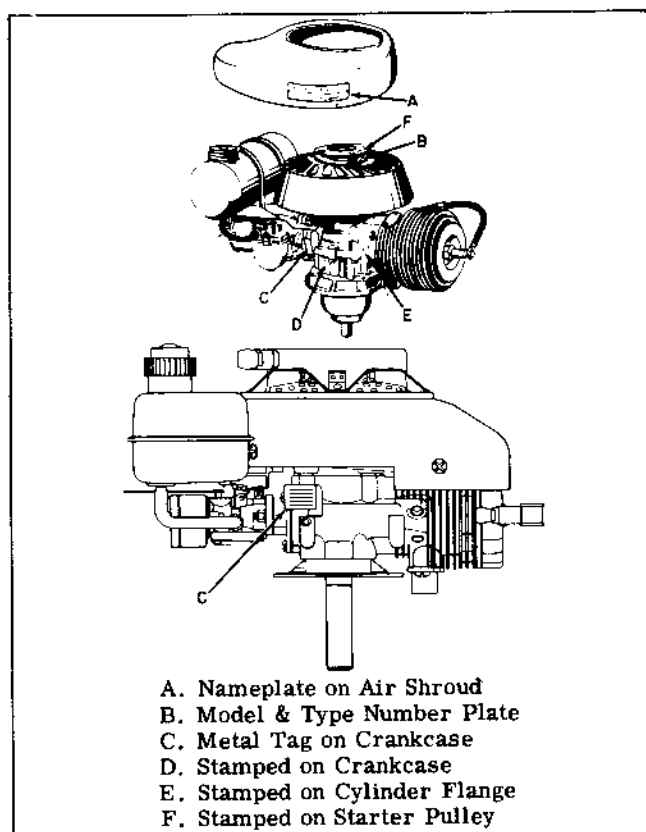


Figure 2-1. Location of Identification Numbers on 2-Cycle Engines

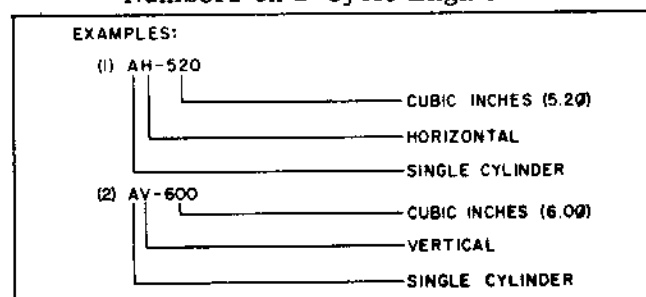


Figure 2-2. Model Number Interpretations

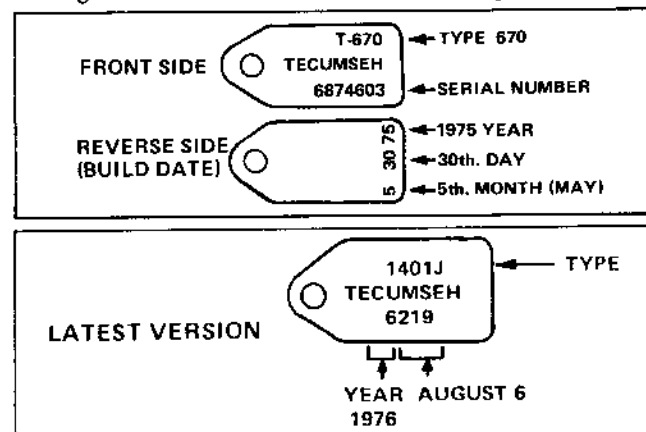


Figure 2-3. Typical Identification Tag

A. POWER PRODUCTS 2-CYCLE ENGINES.

- (1) Look for Power Products 2-cycle engine identification tags at one of a number of locations (Fig. 2-1). The TYPE NUMBER must be included in all parts orders to insure delivery of correct parts.
- (2) Early Power Products engines listed the type number as a suffix of the serial number. For example, if the indicated number is 365341 P 238; 238 is the type number. In 2616758 G 606-01A; the type number is 606-01A.
- (3) Important in either case, is the TYPE NUMBER. Always refer to the TYPE NUMBER in correspondence concerning the engine.

B. SHORTBLOCKS.

- (1) When repairing an engine by using a shortblock, be sure the original engine tag containing the type number, is placed in a similar position on the shortblock.
- (2) For further identification, all identification tags on the shortblock should remain there.

C. TYPE NUMBER TO MODEL NUMBER.

Each 2-cycle engine has a model number as well as a type number. Since parts identification are referenced by type number only, the model cross reference has been dropped from Part VI. An example of the build date code is shown on the reverse side of tag. See Figure 2-3.

D. 2-CYCLE MODEL NUMBER INTERPRETATION (Newer Models)

If there is occasion to refer to a 2-cycle by the model, see explanation of letters and numbers per Figure 2-2.

SECTION 3. OPERATION, VARIATIONS AND TERMS

2-CYCLE ENGINES - BASIC SERVICE

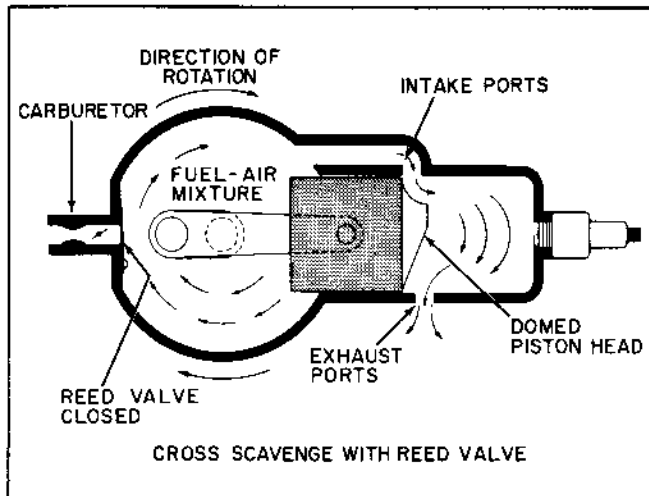


Figure 3-1

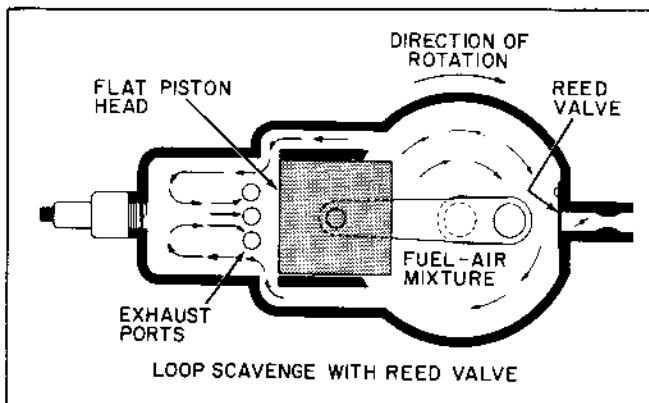


Figure 3-2

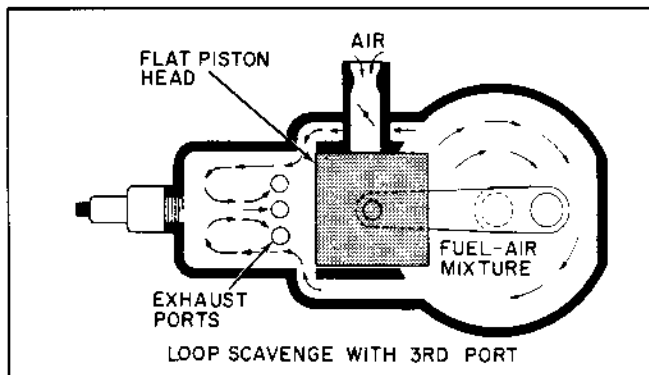


Figure 3-3

A. 2-CYCLE DESIGN VARIATIONS.

CROSS SCAVENGE DESIGN - The fuel air mixture enters the combustion chamber on one side of the cylinder. The domed piston head directs the mixture to the top of the combustion chamber and assists in sliding the exhaust gases out through the exhaust ports. Fig. 3-1.

REED VALVE - is a flap or flutter valve that is activated by crankcase pressure. Fig. 3-1. A reduction in crankcase pressure opens the valve allowing the fuel air and oil mixture to enter the crankcase. Increased crankcase pressure closes the valve, prohibiting escape of the fuel-air and oil mixture back through the carburetor.

Figure 3-2 illustrates the loop scavenge design and again uses the vacuum-pressure activated reed valve. Here the ports are located on three sides of the cylinder; the intake ports are on two sides opposite each other and the exhaust ports are illustrated by the three holes just above the head of the piston.

The flat piston is used in this design. As the mixture shoots into the combustion chamber through the two sets of intake ports it collides and is directed to the top of the combustion chamber looping when it strikes the cylinder head, thus forcing all spent gases out through the open exhaust ports before it.

Figure 3-3 also shows the loop scavenge design, but the reed valve has been eliminated. The carburetor has been moved from the lower crankcase end to the cylinder. Along with the intake and exhaust ports a 3rd port has been added. The 3rd port forms the passageway from the carburetor to the crankcase and is opened and closed by the piston skirt as the piston moves back and forth in the cylinder.

The carburetor appears to block off the path from the crankcase to the intake ports, however, these gases pass around the carburetor and 3rd port.

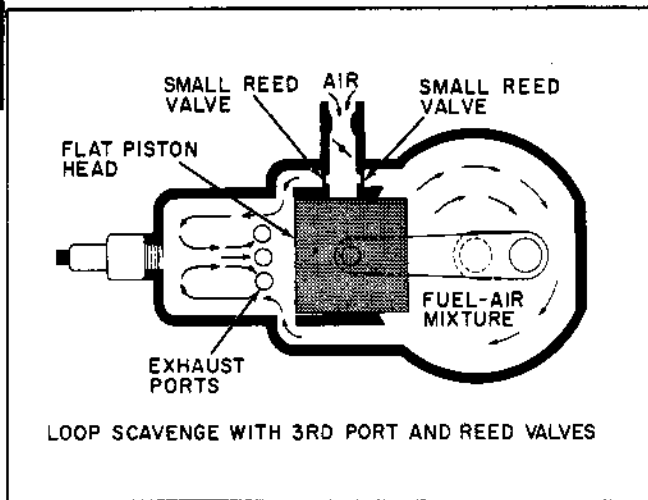


Figure 3-4

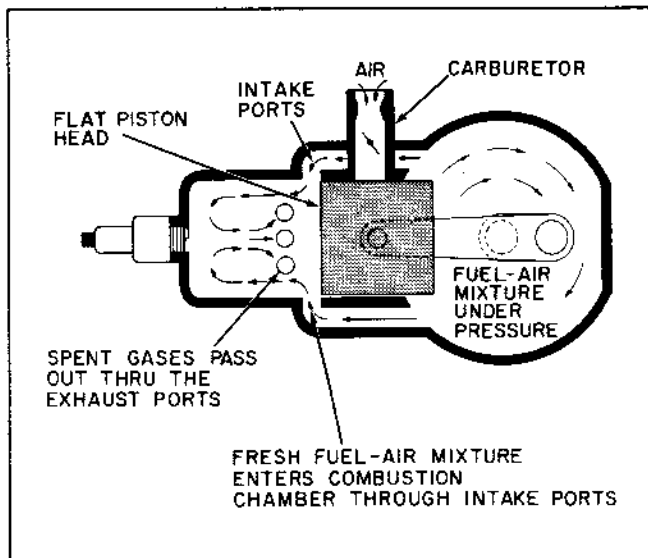


Figure 3-5

Figure 3-4 is essentially the same loop scavenge, 3rd port design as shown in Figure 3-3, the only difference is the two small reed valves are located on the adapter cover from the carburetor to the 3rd port. These reed valves open early by vacuum created as the piston starts to rise. An extra amount of fuel-air mixture passes through these reed valves before the piston skirt opens the 3rd port. This extra charge of fuel-air mixture increases engine horsepower.

B. TERMS USED IN 2-CYCLE THEORY.

EXHAUST or SCAVENGE PHASE - The phase resulting from the burning of air and fuel. The burned gases must be cleared out of the combustion chamber and replaced by a fresh charge of fuel-air mixture. The exhaust passes out through the exhaust ports into the outside air.

EXHAUST PORTS - Allow the burned gases to pass out of the combustion chamber.

PORTS - Small openings in the cylinder allowing gases to pass into and out of the combustion chamber. The ports are open or closed by the upward and downward movement of the piston.

THIRD PORTS - A third port, is for entry of the fuel-air and oil mixture to the crankcase. From the crankcase the fuel-air mixture enters the combustion chamber through the intake ports and the oil lubricates the moving parts. The third port is controlled by the piston skirt. See Figure 3-4.

LUBRICATION - Tecumseh 2-cycle engines utilize an oil mist lubrication. The correct quantity of oil is mixed with the fuel and enters the crankcase through the carburetor with the fuel-air mixture. The oil then clings to the moving parts and lubricates the bearing surfaces.

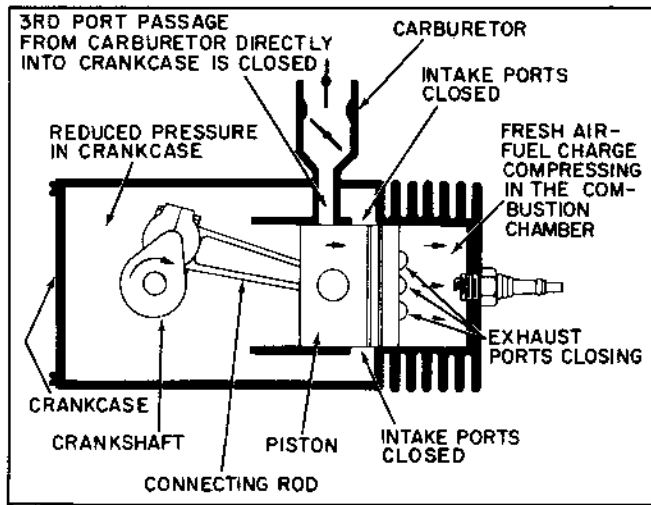


Figure 3-6

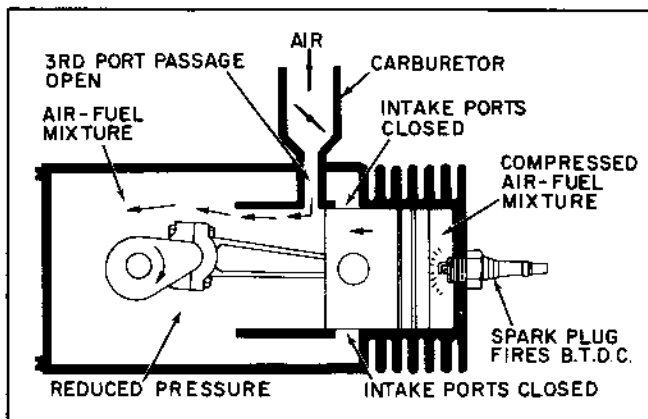


Figure 3-7

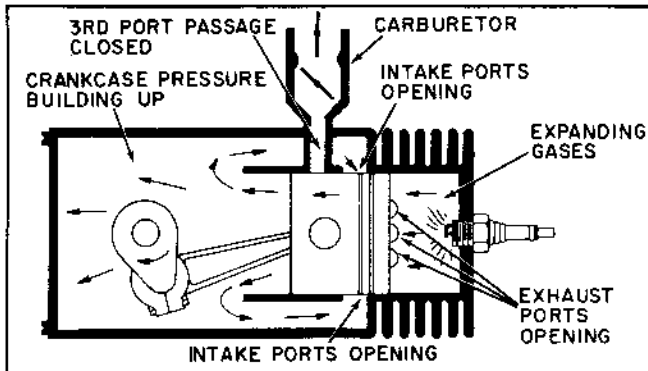


Figure 3-8

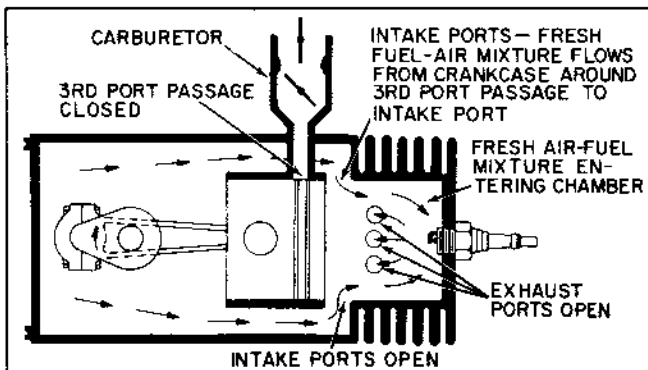


Figure 3-9

C. THIRD PORT OPERATION.

The piston moves up toward the top of the combustion chamber. All ports are closed creating a reduced pressure within the crankcase and a compressed fuel-air mixture within the combustion chamber.

At a point BEFORE the piston reaches TOP DEAD CENTER (TDC) the spark plug ignites the fuel air mixture. The third port opens allowing the fuel and air mixture to enter the crankcase to equalize the reduced pressure.

As the expanding gases from combustion force the piston toward the bottom of the cylinder, crankcase pressure increases.

The continued downward movement of the piston uncovers the exhaust ports and intake ports. The pressurized fuel air mixture within the crankcase flows through the open intake ports and the burned gases are forced out through the exhaust ports. The sequence then repeats itself.

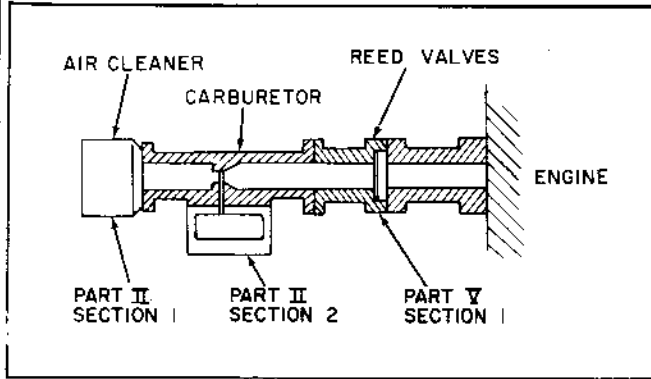


Figure 3-10. Check Carburetion

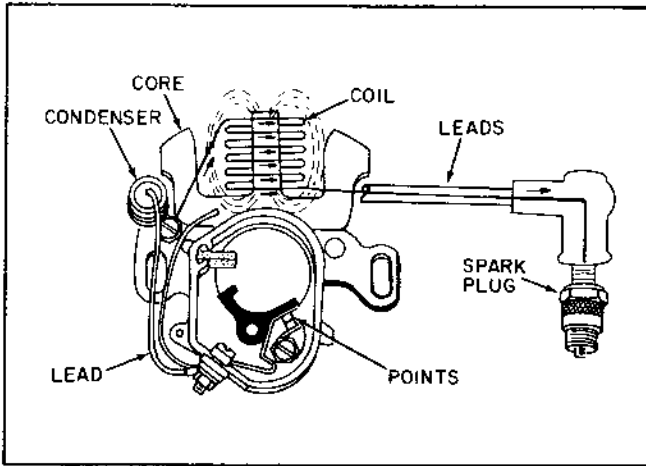


Figure 3-11. Check Ignition

D. PRE-OVERHAUL CHECK OF TWO-CYCLE ENGINES. A thorough check of the two-cycle engine before overhaul will frequently point up cause of improper operation. If check of carburetion (Part II) and ignition systems (Part IV) reveals no faulty operation, check following items:

- (1) Crank engine slowly, checking for noise, binding, scraping, or other signs of improper operation. These symptoms may be due to damaged bearings, or to a bent crankshaft or connecting rod.
- (2) Rock crankshaft back and forth to check for excessive play. Excessive play indicates worn rod bearings or a worn piston pin.
- (3) Check seals at ends of crankcase for evidence of oil leaks, indicating a faulty seal. A leaking crankcase or crankcase seals will result in faulty fuel metering, erratic operation, and hard starting. For engines without lower crankcase seal, check bearing surface on lower half of crankcase.
- (4) On split crankcase models, check around entire crankcase for leaks where crankcase halves are joined. Leaks are usually indicated by oil deposits.
- (5) If applicable, remove the carburetor and check the reed plate assembly. Reeds should not be open more than 0.010 inch, and should not be warped, bent, chipped, or cracked.

SECTION 4. ENGINE CARE

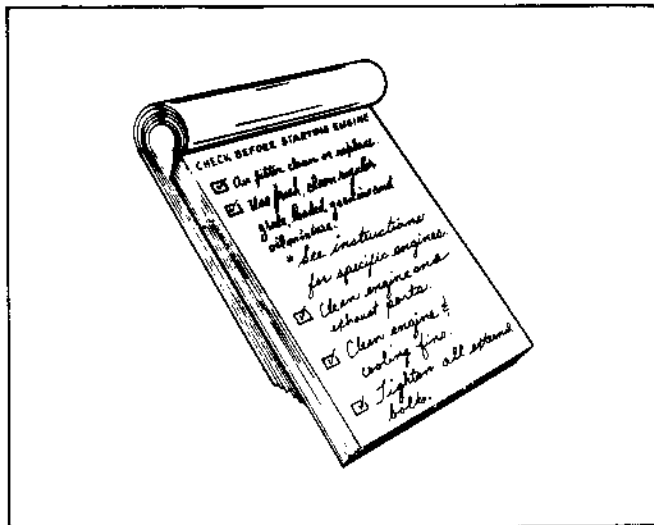


Figure 4-1. 2-Cycle Operator's Maintenance Rules

A. MAINTENANCE RULES to insure proper engine operation.

These rules should be observed.

- (1) Clean air filter regularly as required by operating conditions.
- (2) Use clean, fresh gasoline.
- (3) Use correct fuel and oil mixture.
- (4) Keep fuel tank cap vent hole open.
- (5) Maintain proper cooling of engine. Keep engine shrouds free of dirt, grass, and other foreign matter.
- (6) Clean engine and exhaust ports frequently to prevent carbon buildup.
- (7) Make sure governor maintains correct speed range for application. Never run with a disconnected governor on governed models.
- (8) Tighten all fasteners, especially mounting bolts, to keep damaging vibration at a minimum.
- (9) If driven equipment is balanced, vibration will be cut down considerably.

1

A TYPICAL 2-CYCLE GAS/OIL MIXING CHART

SEE OWNERS MANUAL AND OPERATING INSTRUCTIONS FOR INDIVIDUAL ENGINE

FUEL MIXING TABLE	Gasoline	Amt. of SAE30 Oil To Be Added
	1 Gallon	3/8 Pint or 6 Oz.
	2 Gallons	3/4 Pint
	5 Gallons	1 Quart*
		*20:1 Mixture

Figure 4-2. Typical Owners Guide Fuel Mix Instruction

FUEL MIXTURE

Mix in a clean container, 3/8 pint of SAE 30, outboard or 2-cycle oil per gallon of gasoline. This mixture assures positive lubrication.

Warranty void if multi-viscosity (10W-30) oils are used.

(Taken from typical owner's manual. See specific owner's manual for specific engine.)

WARNING 24:1

Mix oil with gas. Mix 1/3 pint (5 oz.) SAE 30 or 40 outboard or 2 cycle oil per gallon of gas. Disregard conflicting instruction on oil containers. Do not mix directly in engine fuel tank. Do not use multi-viscosity oils.

Figure 4-3. Typical Owner's Guide Fuel Mixture Instructions

B. FUELS AND LUBRICANTS.

- (1) Power Products 2-cycle engines are mist-lubricated by oil mixed with the gasoline.

NOTE

Follow fuel and engine oil requirements listed in the Owners Manual and Operate. Disregard conflicting instruction on oil containers.

For best performance use regular grade, leaded gasoline (unleaded automotive gasoline is an acceptable substitute). With two-cycle or outboard oil rated S.A.E. 30 or S.A.E. 40 (the terms two-cycle and outboard are used by various companies in various ways to designate oil specification they have designated for use in two-cycle engines).

CAUTION

Multiple weight oils such as all season, 10W-30, are not recommended.

- (2) Cleanliness of fuel and oil is essential for proper engine operation. Make sure that gasoline and oil are stored in clean, covered, rust-free containers. Dirt in fuel can clog small ports and passages of carburetor causing engine failure. Use fresh gasoline only. Gasoline, standing for long periods of time, develops a gum that will result in fouled spark plugs, clogged fuel lines, carburetors, and fuel screens. Dirty oil causes engine wear. When servicing engines showing indications of dirty gasoline or oil, report the condition to the engine owner, cautioning him against continued use of contaminated fuels or lubricants.

- (3) To assure thorough mixing of oil and gasoline - fill container with gasoline to one quarter full, add oil per chart, shake container vigorously and then fill remainder of container with gas. Once mixed, oil and gasoline will not separate.

C. ENGINE MOUNTING. The engine must be firmly and rigidly mounted on the associated equipment. Keep mounting bolts tight to prevent excessive vibration of the engine. On rotary lawnmowers, keep the blade properly balanced to eliminate vibration. Check equipment for free operation to prevent engine overloading.

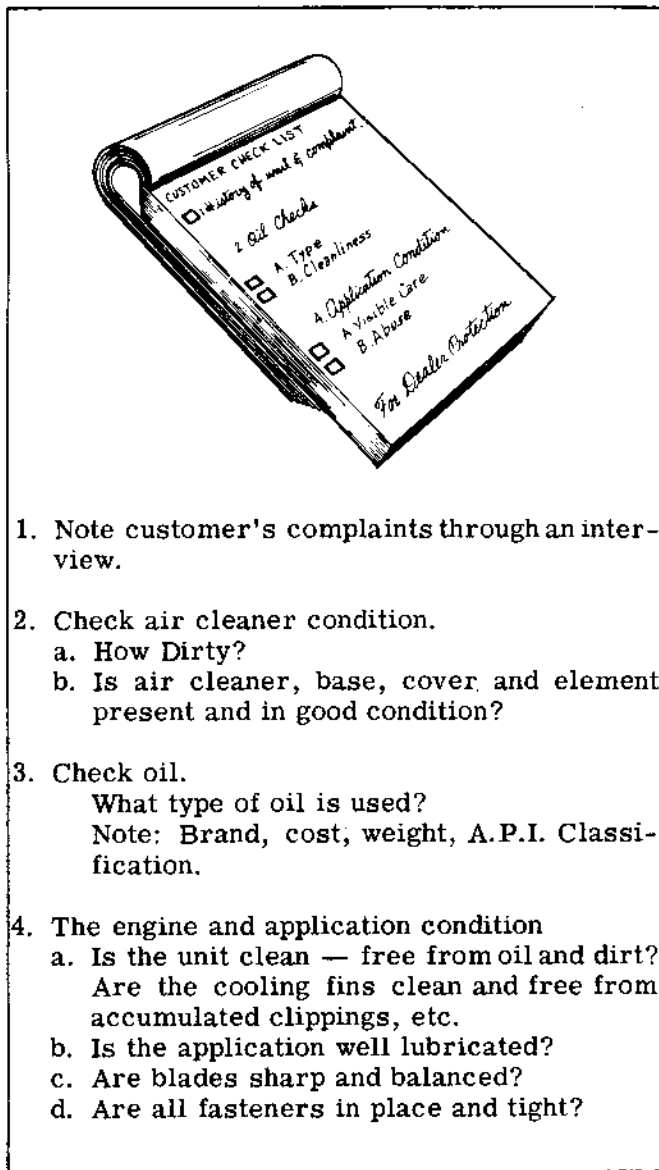


Figure 4-4

1. Note customer's complaints through an interview.
2. Check air cleaner condition.
 - a. How Dirty?
 - b. Is air cleaner, base, cover and element present and in good condition?
3. Check oil.

What type of oil is used?

Note: Brand, cost, weight, A.P.I. Classification.
4. The engine and application condition
 - a. Is the unit clean — free from oil and dirt? Are the cooling fins clean and free from accumulated clippings, etc.
 - b. Is the application well lubricated?
 - c. Are blades sharp and balanced?
 - d. Are all fasteners in place and tight?

D. ENGINE TUNE-UP PROCEDURE. Upon receiving an engine for repair, learn the history of the unit from the customer.

- (1) Service or replace air cleaner. (Part II Section 1)
- (2) Clean fuel lines, filter, and tank.
- (3) Check engine compression with gauge. The crankshaft should resist turning as the piston approaches top-dead-center, then snap over sharply as top-dead-center is passed. Low compression engines should be overhauled. Check 2-cycle compression per Table of Specifications (Part VI).
- (4) Clean and regap, or replace spark plug, (Part IV, Section 2). Use only liquid solvent type cleaner.
- (5) Check governor operation. Adjust governor according to information given in Part II, Section 5.
- (6) Check magneto, Part IV, Section 2, Paragraph G. Adjust breaker point gap (Part IV, Section 2, Paragraph E). Inspect magneto, condenser, and breaker point connections.
- (7) Fill fuel tank with correct fuel (Part I, Section 4, Paragraph B).
- (8) Start engine. If engine does not start, refer to trouble chart (Part V, Section 8).
- (9) Adjust carburetor (Part II, Section 2, Paragraph K).
- (10) Run engine, checking frequently for signs of improper operation.
- (11) Clean carbon from head, bore, piston, ports, and exhaust.
- (12) Check for pressure and vacuum leakage at crankshaft, seals, gaskets or reeds.

E. RUNNING 2-CYCLE ENGINES. If the driven equipment, as a mower blade, or other device is detached from the crankshaft where a side-mount starter is used (Part III, Section 1), a flyweight must be fabricated for attachment to the crankshaft. See Bulletin Number B-94 of the mechanic's manual.

F. STORAGE.

- ⚠ NEVER STORE ENGINE WITH FUEL IN TANK INDOORS OR IN ENCLOSED, POORLY VENTILATED, ENCLOSURES, WHERE FUEL FUMES MAY REACH AN OPEN FLAME OR SPARK.**

If engine is to be stored over 30 days, prepare for storage as follows:

1. Remove all gasoline from carburetor and fuel tank to prevent gum deposits from forming on these parts and causing possible malfunction of engine.

- ⚠ DRAIN FUEL INTO APPROVED CONTAINER OUTDOORS, AWAY FROM OPEN FLAME.**

- A. Run engine until fuel tank is empty and engine stops due to lack of fuel.
 - B. Remove fuel line at tank or carburetor and drain any remaining gasoline from system.
2. Pull starter handle slowly until resistance is felt due to compression pressure, then stop. Release starter tension slowly to prevent engine from reversing rotation due to compression pressure. This position will close both the intake and exhaust ports for storage.
 3. Clean engine by removing any clippings, dirt, or chaff from exterior of engine.

Tecumseh manufactures and is responsible only for the quality engine used on this power equipment. If repair or service is needed for unit, other than engine, contact service source as recommended by equipment manufacturer.

PART II. AIR CLEANERS, CARBURETORS, GOVERNORS & LINKAGE

SECTION 1. AIR CLEANERS

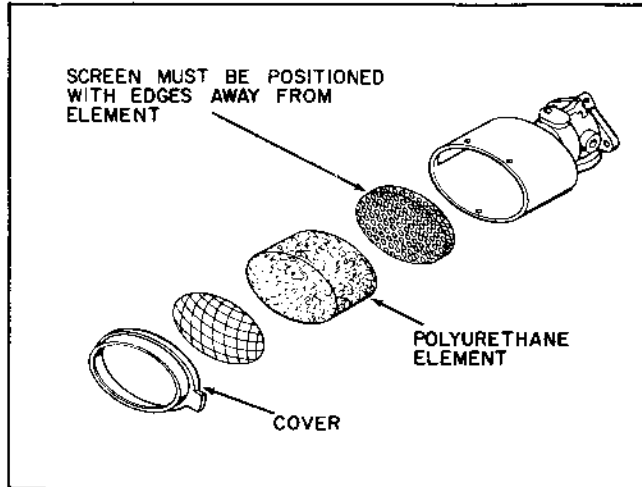


Figure 1-1

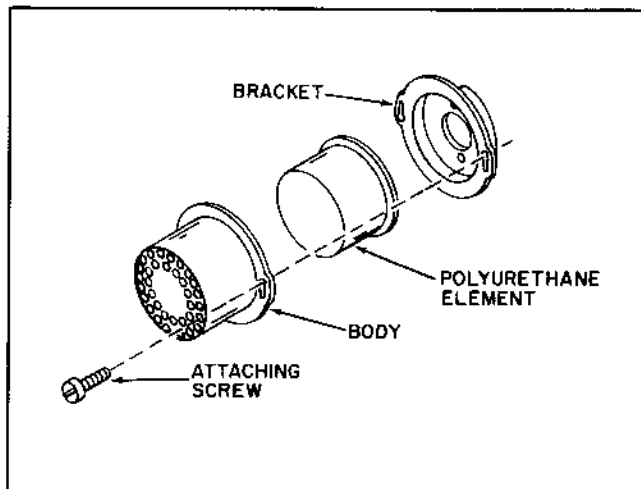


Figure 1-2

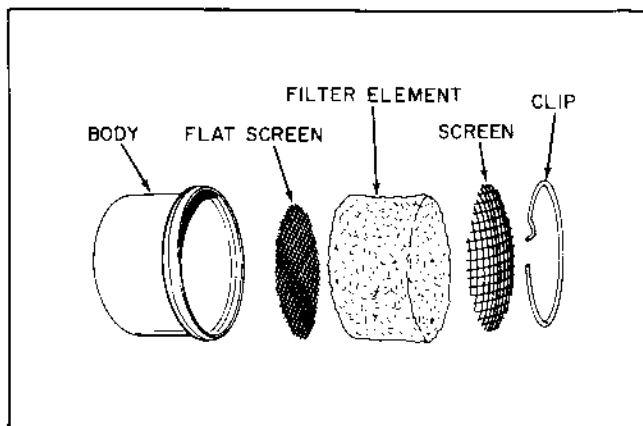


Figure 1-3

A. AIR CLEANER SERVICE. Service the air cleaner frequently to prevent clogging of the cleaner and to prevent dust and dirt from entering the engine. Service the air cleaners as follows:

B. POLYURETHANE TYPE AIR CLEANER. These types have a polyurethane element which will plug up with use to indicate that they are performing properly. Clean and service elements in the following manner:

- (1) Unsnap the front cover from the air cleaner housing.
- (2) Pull out the polyurethane element.
- (3) Wash element in a solvent or wash in detergent and water solution by squeezing similar to sponge.
- (4) Clean air cleaner housing and cover with the same solution. Dry thoroughly.
- (5) Dry element by squeezing or with compressed air if available.
- (6) Apply generous quantity of oil to element sides and open ends. Squeeze vigorously to distribute oil and to remove excess oil.
- (7) To reassemble, place cupped screen into housing with edge against carburetor end of housing. Screen should be installed to hold element away from housing to allow full utilization of air cleaner element.

C. ALUMINUM FOIL TYPE AIR CLEANER.

- (1) Remove the retainer cover or ring (Fig. 1-3) from the filter body and remove the screens and the aluminum foil filter element.
- (2) Dip the aluminum foil filter in solvent. Flush out all dirt particles.
- (3) Shake out filter thoroughly to remove all solvent, then dip filter element in oil. Allow oil to drain from filter. Clean screens and filter body.
- (4) The concave screen and retainer cover or ring are not used on later models. They are replaced with a clip which rolls into the groove in the lip of the body.

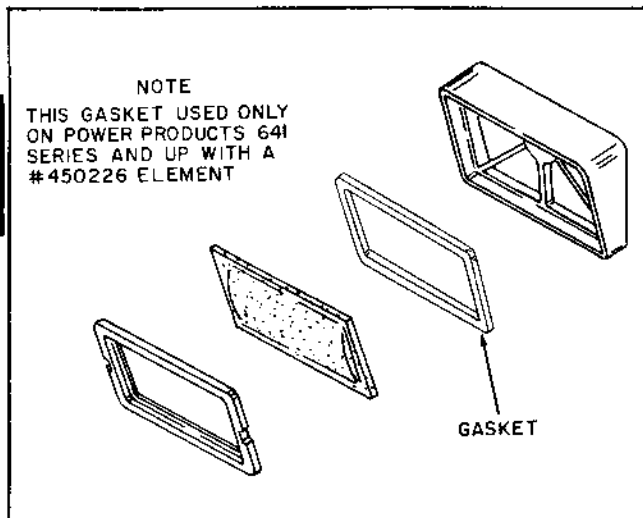


Figure 1-4. Felt Type Air Cleaner

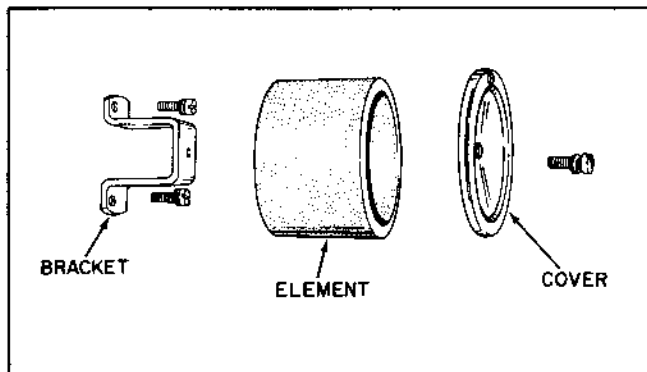


Figure 1-5. Fiber Element Air Cleaner

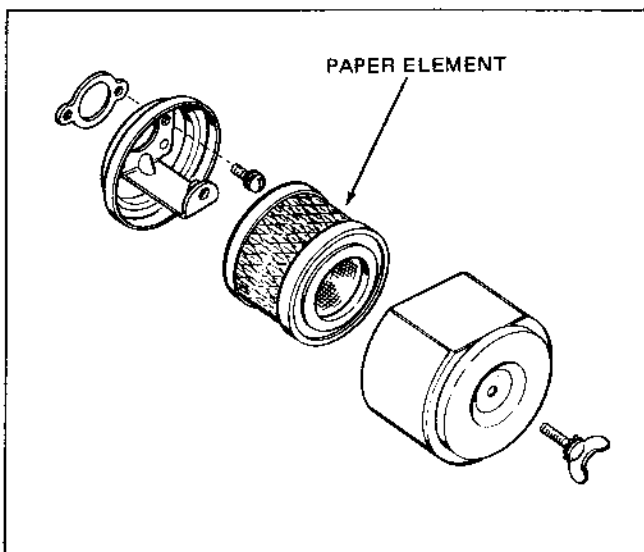


Figure 1-6. Paper Element Air Cleaner

D. FELT TYPE AIR CLEANERS.

To clean felt air cleaners, merely blow compressed air through element in reverse direction to normal air flow.

Felt elements may also be washed in non-inflammable solvents or soapy water. Blow dry with compressed air.

Power Products type numbers 641 and up, use a gasket (510275) between the element (450226) and the base. The gasket is used only with this element. Earlier versions did not have gasket.

E. FIBER ELEMENT TYPE AIR CLEANER.

Remove filter and place cover in normal position on filter. With filter element down to semi-seal it, use compressed air through the cover hole to reverse air flow, forcing dirt particles out.

Clean the cover mounting bracket with damp cloth.

F. DRY TYPE PAPER AIR CLEANERS.

Remove paper cleaner element and tap on workbench or any solid object to dislodge accumulated dirt.

Wash element (Figure 1-6) in soap and water solution and thoroughly flush or rinse element from inside until water is free of soap.

Allow element to completely dry, use LOW pressure compressed air to aid in quick drying element. Blow air through element from inside.

Inspect the element for cracks and holes. If there is any doubt concerning filters's condition, replace.

SECTION 2. CARBURETORS - GENERAL INFORMATION

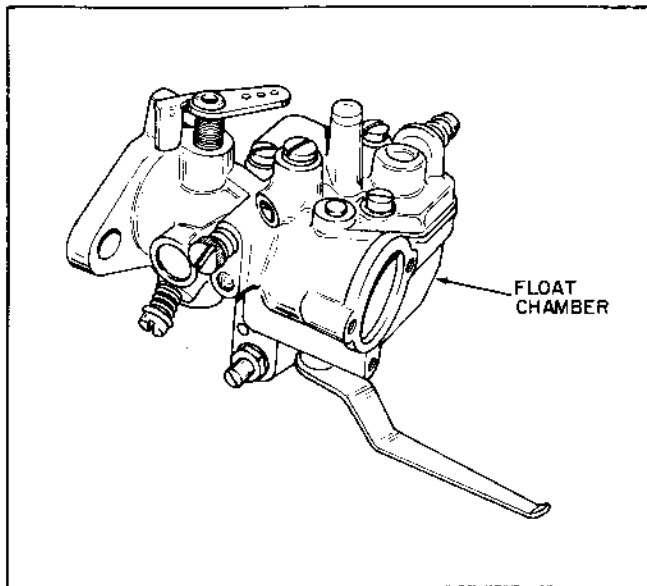


Figure 2-1

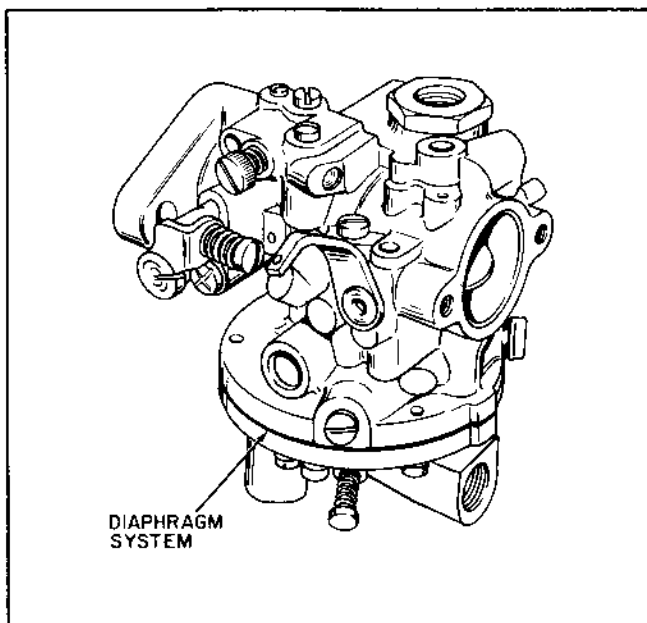


Figure 2-2

A. GENERAL.

- (1) The fuel system of Lauson and Power Products engines consists of a carburetor, air cleaner, fuel tank, and fuel lines. The function of the fuel system is to mix fuel and air in the proper proportion so that the mixture will burn efficiently in the engine at any rate of speed.
- (2) Though a number of different models of carburetors are used on Lauson and Power Products engines, basically they operate in one of two ways. The one type uses a float feed system while the other uses a pressure differential system. All models of the float feed system operate in the same general manner and all models of the pressure differential system operate in the same general manner.

B. FLOAT FEED CARBURETORS. Float feed carburetors (Fig. 2-1) use a hollow metal float to maintain the operating level of fuel in the carburetor. As the fuel is used, the fuel level in the carburetor bowl drops and the float moves downward. This actuates the inlet needle valve to allow fuel to flow by gravity into the fuel bowl. As the fuel level in the bowl again raises, it raises the float. This float motion closes the needle valve to stop the fuel flow at the proper level.

C. DIAPHRAGM (PRESSURE DIFFERENTIAL) CARBURETORS (Fig. 2-2).

Diaphragm type carburetors have a rubber-like diaphragm that is exposed to crankcase pressure on one side and to atmospheric pressure on the other. As the crankcase pressure decreases the diaphragm moves against the inlet needle allowing the inlet needle to move from its seat. This permits the fuel to flow through the inlet valve to maintain the correct fuel level in the fuel chamber.

An advantage of the diaphragm system carburetor over the float feed system is that the diaphragm system will operate in any position.

D. CARBURETOR OPERATION. (Fig. 2-3)

- (1) The carburetor is designed to provide the correct fuel mixture to the engine at any operating speed.
- (2) In the CHOKE or start, the choke shutter is closed, and the only air entering the engine enters through openings around the shutter. As the starting device is operated to start the engine, the air pressure in the carburetor is reduced as air is drawn into the engine. Since the air passage is blocked by the choke shutter, fuel is drawn from the main nozzle and from both idle fuel discharge ports and mixes with the air that passes through the throttle shutter. This makes a very rich fuel mixture which is needed to start a cold engine.
- (3) At IDLE, a relatively small amount of fuel is required to operate the engine. The throttle is almost closed, shutting off the fuel supply from all except the one idle fuel discharge orifice, so that the suction created by the engine draws fuel only from that orifice.
- (4) During INTERMEDIATE operation, a second orifice is uncovered as the throttle shutter opens, and more fuel is allowed to mix with the air flowing into the engine.
- (5) During HIGH SPEED operation, the throttle shutter is fully opened. Air flows through the carburetor at high speed. The venturi, which decreases the size of the air passage through the carburetor, further accelerates the air flow. This high speed movement of the air decreases the air pressure, and fuel is drawn into the air stream through the main nozzle that opens into the venturi, mixing with the air in the air passage. As the engine load increases, air is automatically bled into the main nozzle through the air bleed tube located in the air horn. This allows liquid fuel to be metered freely from the main nozzle.

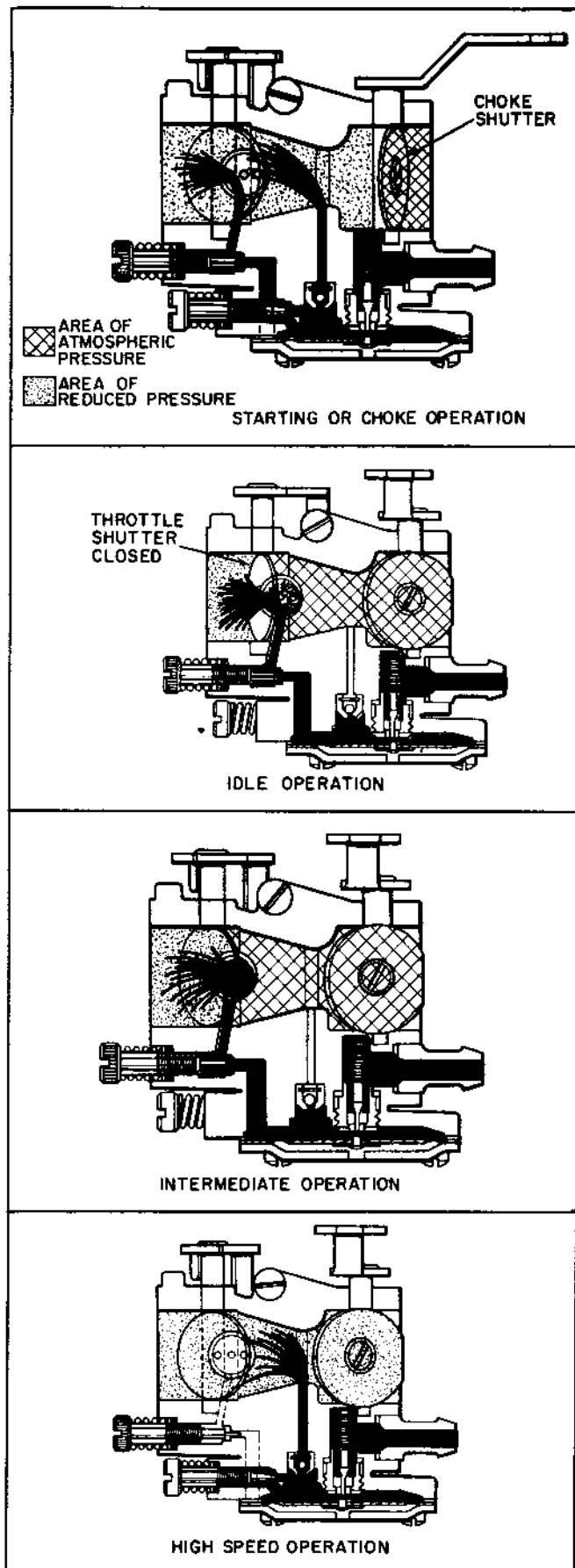


Figure 2-3. Carburetor Operation -
Diaphragm Type Shown

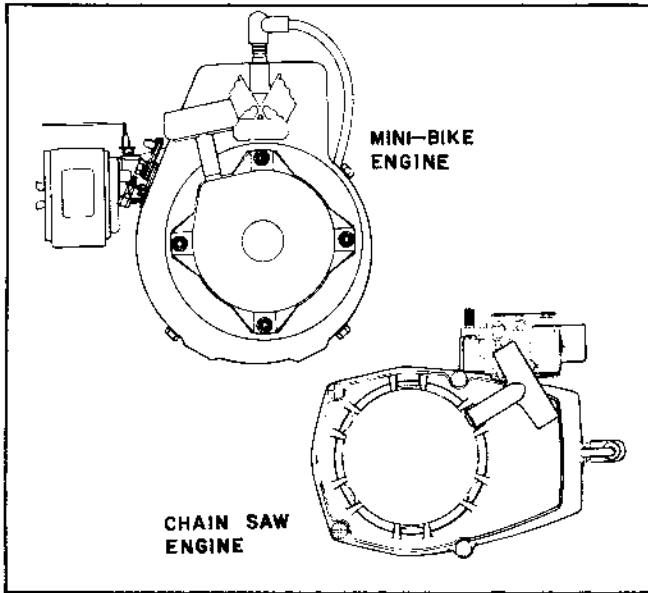


Figure 2-4

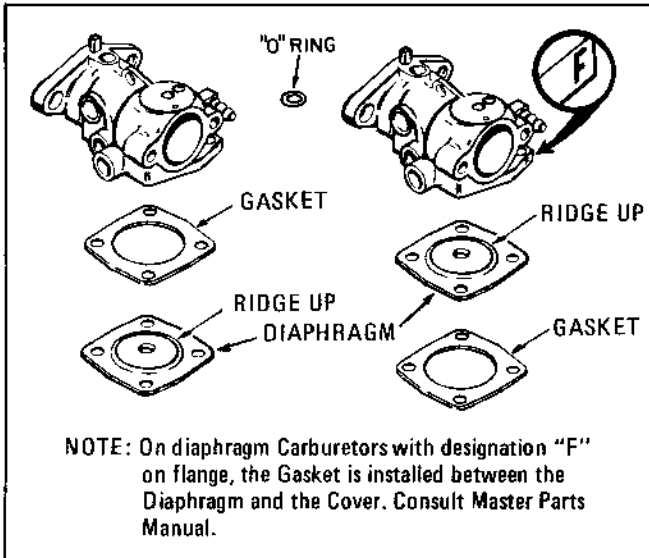


Figure 2-5

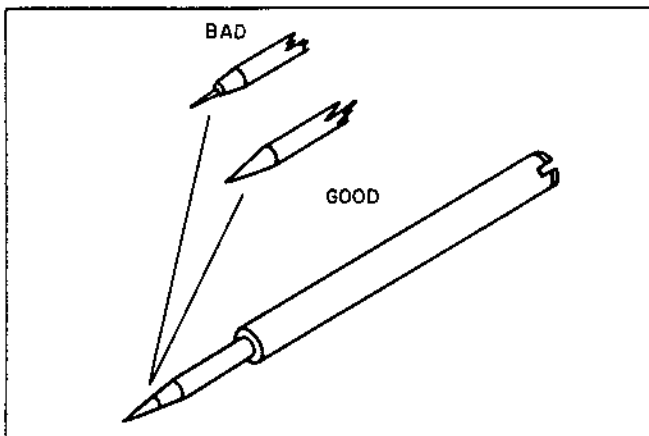


Figure 2-6

E. CARBURETOR REMOVAL AND DISASSEMBLY.

- (1) Remove air cleaner and disconnect carburetor fuel lines. Drain fuel tank.
- (2) If necessary, remove any shrouding or control panels to provide access to carburetor.
- (3) Disconnect choke or throttle control wires from carburetor.
- (4) Remove cap screws, or nuts and lock-washers that hold carburetor to engine; remove carburetor.
- (5) Consult parts manual for exploded view drawing of carburetor.
- (6) Carefully disassemble carburetor removing all non-metallic parts, i.e. gaskets, viton seats and needles, "O" rings, fuel pump valves, etc.

NOTE

Nylon check balls as used in some diaphragm carburetor models may or may not be serviceable. Check to be sure of its serviceability before attempting removal.

- (7) Clean all metallic parts with solvent.

NOTE

Nylon can be damaged if subjected to harsh cleaners for prolonged periods.

F. INSPECTION OF CARBURETOR PARTS.

- (1) Check all needle valves for wear. Figure 2-6 shows a worn needle valve and a good needle valve. Replace needle valves that are worn.
- (2) Check carburetor inlet needle seat for wear, scoring, or other damage.
- (3) Check carburetor float for dents, leaks, worn float hinge or other damage.
- (4) Check carburetor body for cracks, clogged passages, and worn bushings. Clean clogged air passages with clean, dry, compressed air.
- (5) Check diaphragm of diaphragm carburetors for cracks, punctures, distortion, or deterioration.

2

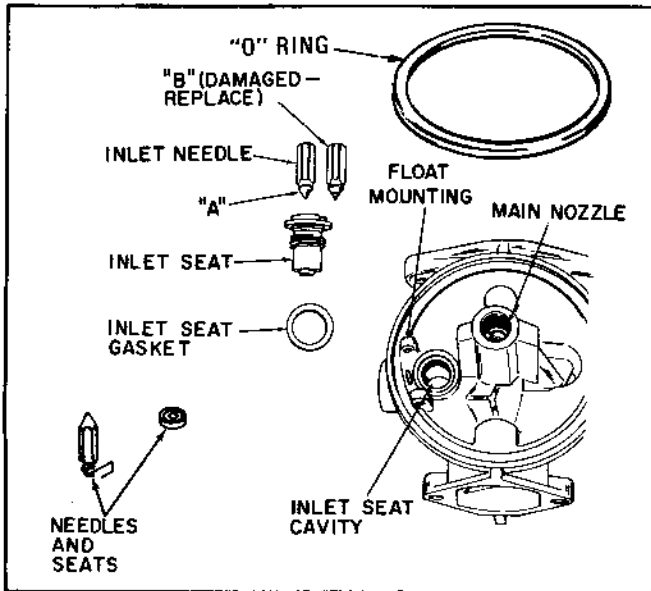


Figure 2-7

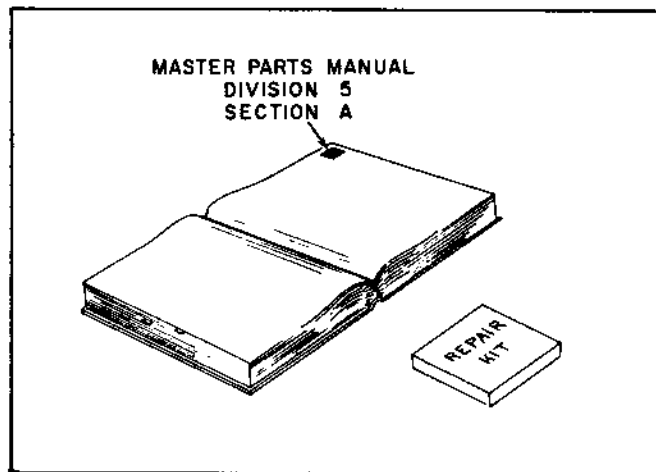


Figure 2-8

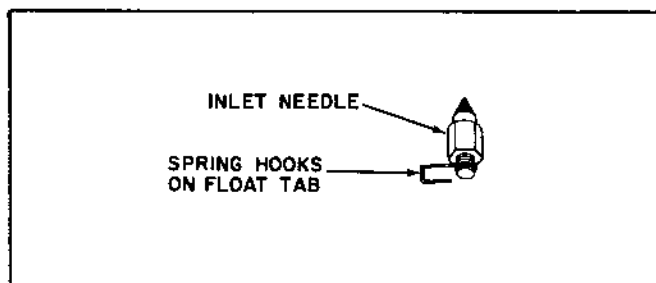


Figure 2-9

- (6) Check all shafts and pivot pins for wear on the bearing surfaces, distortion, or other damage.

G. CARBURETOR REASSEMBLY AND INSTALLATION.

- (1) Refer to exploded view drawing of carburetor in parts manual for carburetor reassembly.
- (2) Each time a carburetor is disassembled, it is good practice to install a repair kit. Repair kit parts are designated with an asterisk (*) in the parts manual.
- (3) In applications with excessive vibration, the inlet needle has a tendency to lift off the seat allowing fuel to flow, thus causing a flooding condition.
- (4) A damper spring is used to assist in holding the float against the inlet needle thus minimizing the flooding condition.
- (5) Two types of springs are available; the float shaft (hinge pin) type and the inlet needle mounted type.
- (6) Float shaft spring positioning.
 - a. Spring is slipped over shaft.
 - b. Rectangular shaped spring end is hooked onto float tab.
 - c. Shorter angled spring end is placed onto float bowl gasket support.

H. INLET NEEDLE DAMPER SPRING.

The spring (clip) fastened to the inlet needle has been revised to provide a damping effect on the needle. It fastens to the needle and is hooked over the float tab.

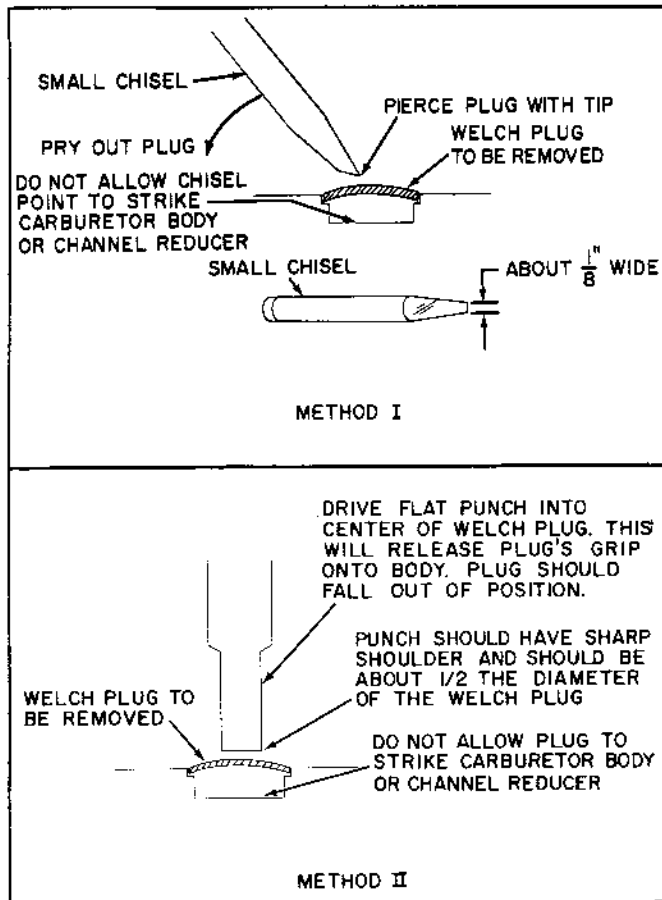


Figure 2-10

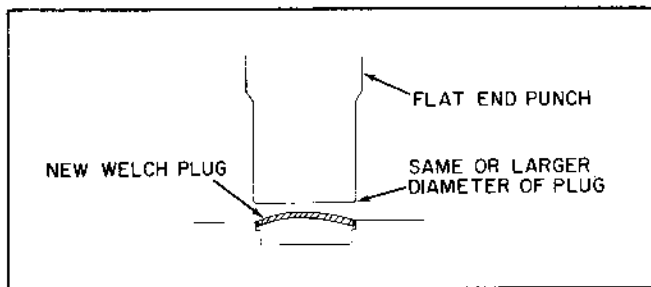


Figure 2-11

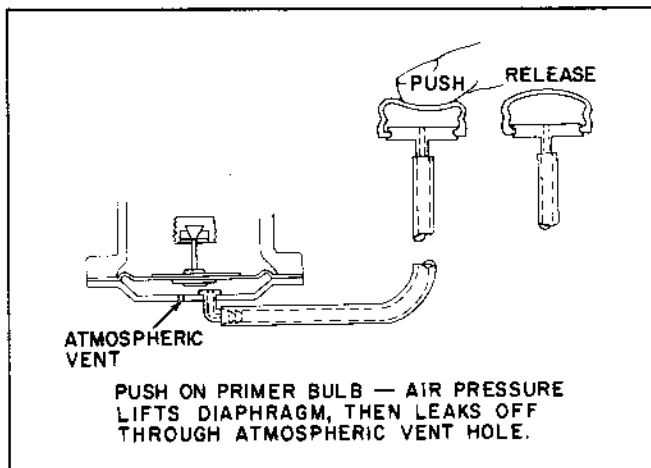


Figure 2-12

I. WELCH PLUG SERVICE.

Removing Welch Plug

Method I

- (1) Drive small chisel into welch plug.
- (2) Push down on chisel to pry plug out of position.

Sharpen small chisel to sharp wedge as shown in figure.

Method II

- (1) Select flat punch size equal to about $\frac{1}{2}$ the diameter of welch plug.
- (2) Drive punch into center of plug. Dent in plug will release its grip on carburetor body and plug will fall out of position.

Installing New Welch Plug

- (1) Clean receptacle in carburetor body thoroughly.
- (2) Place welch plug into receptacle with convex (raised portion) up.
- (3) With punch that is equal or greater than size of plug, flatten plug by striking punch with hammer.

CAUTION: Merely flatten welch plug. Do not dent or drive the center of the plug below the top surface of the carburetor.

J. FUEL PRIMERS.

- (1) The Primer Bulb. Pressing the bulb forces air pressure against the diaphragm. As the diaphragm lifts, the inlet needle is lifted off its seat and the fuel within the reservoir is forced up through the passages into the air horn. A one way valve in the body prevents the fuel from being forced back up into the fuel tank.

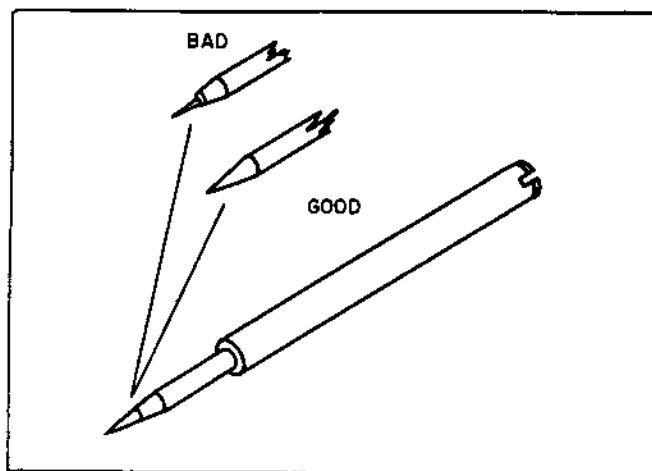


Figure 2-13. Comparison of a Good and Worn Needle Valve

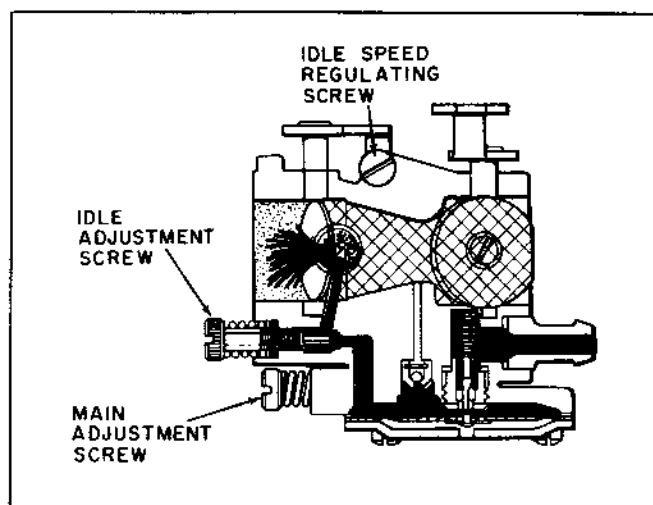


Figure 2-14

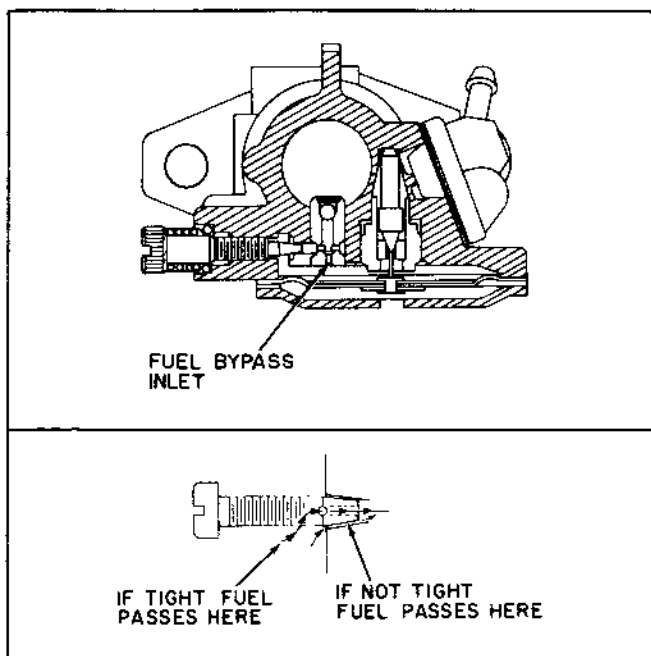


Figure 2-15

K. FUEL MIXTURE ADJUSTMENTS.

- (1) Check adjustment screw tip for damage. If ridge ring on seat area can be felt with thumb nail, needle must be replaced. See Fig. 2-13.
- (2) Three screws must be adjusted before attempting to operate a newly overhauled carburetor.

<u>ADJUSTMENT</u>	<u>APPROXIMATE SETTING</u>
Main Mixture and Idle Mixture Needles	Turn completely in finger-tight and then back out 1 turn.
Idle Speed (Top of Carburetor) Screw	Back out screw. Then turn in until screw just touches throttle lever and continue 1 turn more.

NOTE 1: Some carburetor models have fixed main mixture and/or idle mixture jets. The absence of the adjustment screw and receptacle indicate fixed jet.

NOTE 2: Some applications have a fuel inlet bypass built into the carburetor itself. (See top half of figure 2-15.)

NOTE 3: On some carburetors that do not have a fuel bypass built into the carburetor in order not to dangerously lean out the fuel, there is a minimum/maximum main adjustment screw. (See bottom half of figure 2-15.)

The fuel orifice size is predetermined at the factory thus the fuel mixture cannot be leaned any further by the adjustment screw.

Normal setting for this screw is finger tight. Screw can be loosened slightly to enrich mixture if engine performs smoother.

Litho in U.S.A.

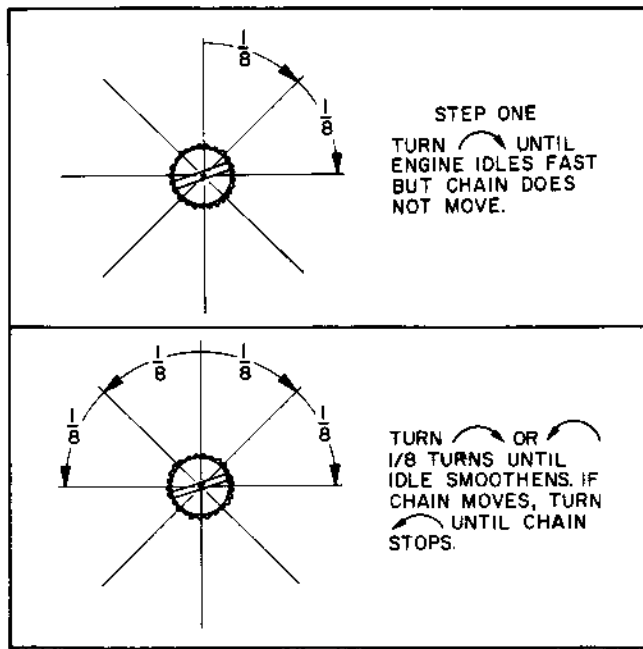


Figure 2-16. Chain Saw Idle Adjustment

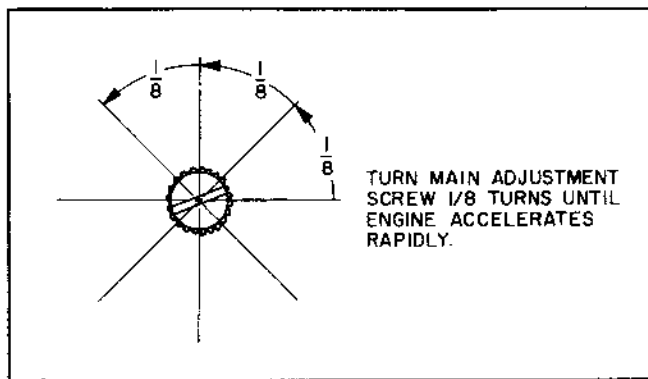


Figure 2-17. Chain Saw Main Adjustment

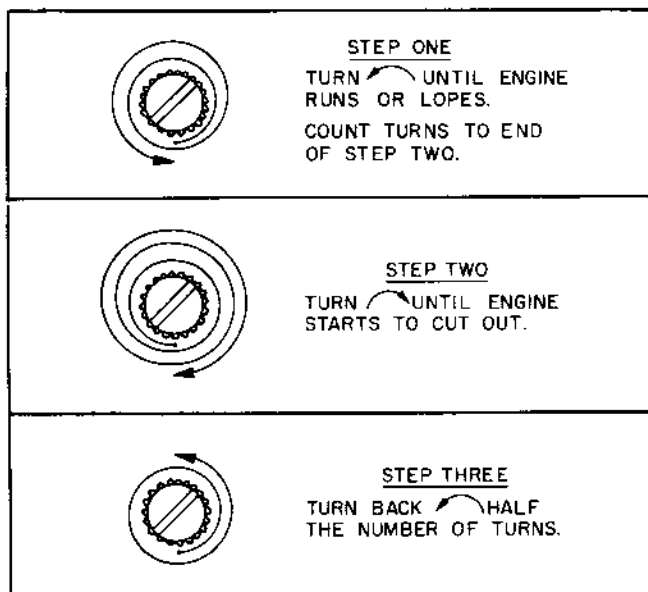


Figure 2-18. General Application Adjustments

L. FINAL CARBURETOR ADJUSTMENTS.

(1) Chain Saw Carburetors

- After making the approximated settings warm up engine by making a cut or two. Open the choke and release throttle to let engine idle. If engine stops, turn idle speed screw in (clockwise) $\frac{1}{8}$ turn at a time until engine idles fast but chain does not turn.
- Now set for smooth idle. Turn idle mixture screw $\frac{1}{8}$ turn clockwise or counterclockwise until maximum idle speed is obtained. If chain turns, turn idle speed screw counterclockwise until chain stops.
- Now, check for acceleration by squeezing throttle quickly. If engine does not accelerate, or hesitates on accelerating, open (counterclockwise) main mixture screw $\frac{1}{8}$ turn at a time until engine accelerates rapidly.

(2) Adjustments for general applications.

Allow engine to warm up to normal running temperature. With engine running at maximum recommended RPM, loosen main metering screw until engine "lopes" or rolls, then tighten screw until engine starts to cut out. Note the number of turns from one extreme to the other. Loosen screw to a point midway between the extremes.

Refer to the appropriate chapter for specific information on the particular carburetor being repaired.

M. CARBURETOR REINSTALLATION.

- Secure carburetor on engine.
- Install shrouding or control panels. Connect choke and throttle control wires.
- Position control panel to carburetor. Connect carburetor fuel lines.
- Install air cleaner.
- Adjust carburetor as described in Paragraph K. Adjust carburetor linkage for control panel operated carburetors as described in Part II, Section 6.

N. TROUBLESHOOTING CARBURETION

POINTS TO CHECK FOR CARBURETOR MALFUNCTION

TROUBLE	CORRECTIONS
Carburetor out of adjustment	3-11-12-13-15-20
Engine will not start	1-2-3-4-5-6-8-11-12-14-15-19-24-25
Engine will not accelerate	2-3-11-12-24
Engine hunts (at idle or high speed).	3-4-8-9-10-11-12-20-21-24-26-27
Engine will not idle	4-8-9-11-12-13-14-20-21-22-24-25-26-27
Engine lacks power at high speed	2-3-6-8-11-12-20-21-24-25-26
Carburetor floods	4-7-17-21-22-25-26
Carburetor leaks	6-7-10-18-23-24
Engine overspeeds	8-9-11-14-15-18-20
Idle speed is excessive	8-9-13-14-15-18-20-25-26-27
Choke does not open fully	8-9-15
Engine starves for fuel at high speed (leans out) .	1-3-4-6-11-15-17-19-21-26
Carburetor runs rich with main adjustment . . .	7-11-17-18-19-21-25-26
needle shut off	
Performance unsatisfactory after being serviced.	1-2-3-4-5-6-7-8-9-10-11-15-16-17-18-19-20-21-25-26

1. Open fuel shut off valve at fuel tank — fill tank with fuel.
2. Check ignition, spark plug and compression.
3. Clean air cleaner — service as required.
4. Dirt or restriction in fuel system — clean tank and fuel strainers, check for kinks or sharp bends.
5. Check for stale fuel or water in fuel — fill with fresh fuel.
6. Examine fuel line and pick-up for sealing at fittings.
7. Check and clean atmospheric vent holes.
8. Examine throttle and choke shafts for binding or excessive play — remove all dirt or paint, replace shaft.
9. Examine throttle and choke return springs for operation.
10. Examine idle and main mixture adjustment screws and "O" rings for cracks or damage.
11. Adjust main mixture adjustment screw — some models require finger tight adjustment. Check to see that it is the correct screw.
12. Adjust idle mixture adjustment screw. Check to see that it is the correct screw.
13. Adjust idle speed screw.
14. Check position of choke and throttle plates.
15. Adjust control cable or linkage to assure full choke and carburetor control.

16. Clean carburetor after removing all non-metallic parts that are serviceable. Trace all passages.
17. Check inlet needle and seat for condition and proper installation.
18. Check sealing of welch plugs, cups, plugs and gaskets.
19. Check fuel pump operation — pump element, inner and outer one way valves.
20. Adjust governor linkage.

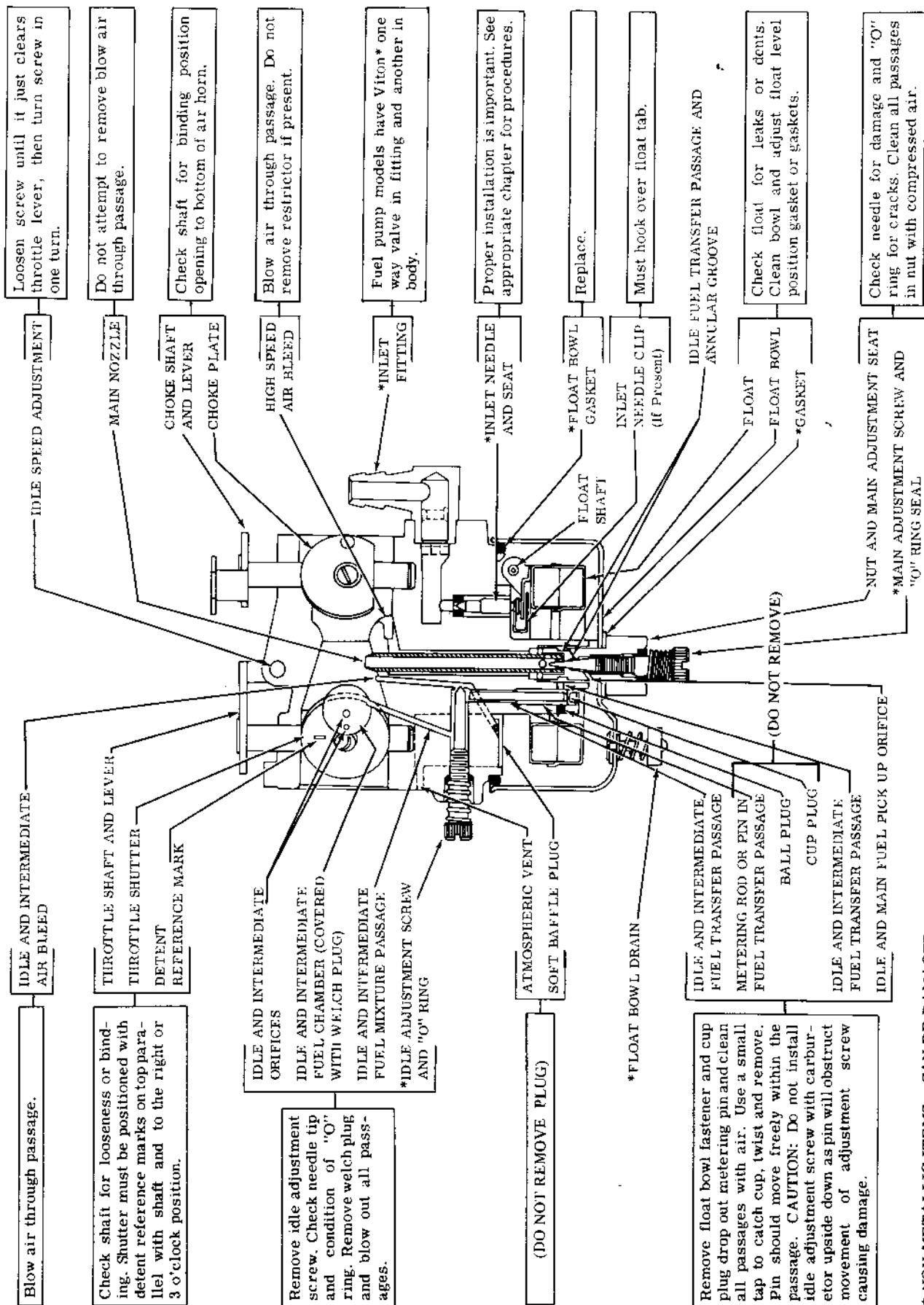
FLOAT CARBURETOR CHECKS

21. Adjust float setting.
22. Check float shaft for wear and float for leaks or dents.
23. Check seal for fuel drain or bowl gasket.
24. Is carburetor operating at excessive angle — 31° or more?

CHECKS FOR DIAPHRAGM CARBURETORS

25. Check diaphragm for cracks or distortion and check nylon check ball for function.
26. Check sequence of gasket and diaphragm for the particular carburetor being repaired.
27. Check spring tension on idle governor (if present).

O. SERVICE HINTS FOR FLOAT FEED CARBURETORS



2



* NON METALLIC ITEMS - CAN BE DAMAGED BY HARSH CARBURETOR CLEANERS

SECTION 3. FLOAT FEED CARBURETORS - SPECIFIC MODELS

2

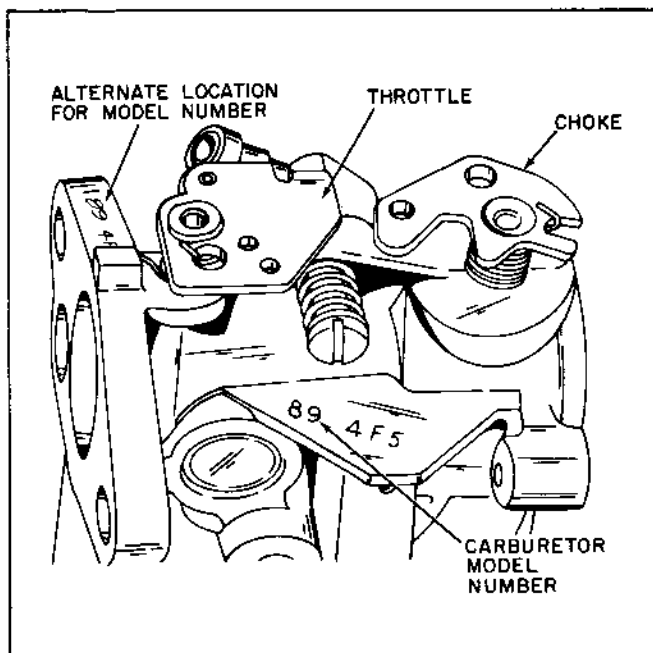


Figure 3-1. Tecumseh Float Carburetor Identification Number

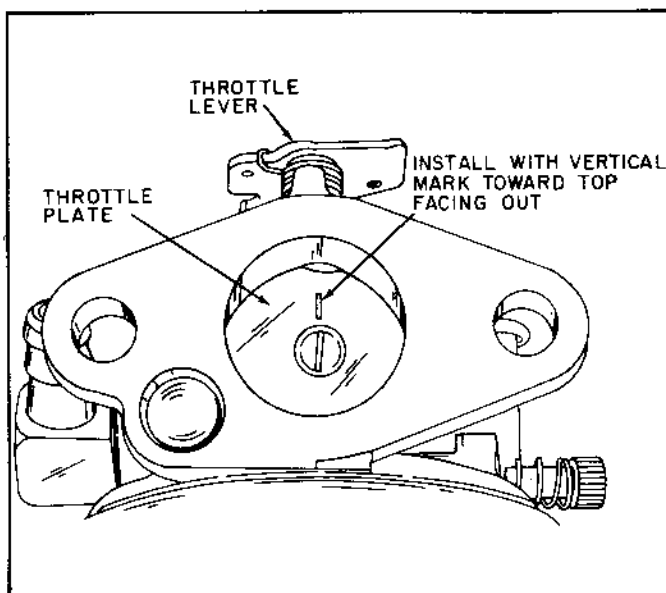


Figure 3-2. Throttle Assembly

A. TECUMSEH IDENTIFICATION.

- (1) When servicing this carburetor, use the engine model number and the Master Parts Manual for the proper service parts information. Further identification of the carburetor is stamped on the carburetor body as shown in Figure 3-1. Refer to the standard service part number and the identification number on the carburetor body (Fig. 3-1), in any correspondence.
- (2) This Tecumseh carburetor is a conventional float type carburetor with refinements for better operation and ease of servicing.

B. DISASSEMBLY AND SERVICE INSTRUCTIONS.

- (1) Remove the carburetor from the engine. Normally, it is easier to remove the intake manifold and carburetor assembly from the engine, disconnect the governor linkage, fuel line and grounding wire, and disassemble the carburetor from the intake manifold at the work bench.
- (2) The following instructions are in a sequence to be followed for complete overhaul of this carburetor. If it is necessary to service only a portion of the carburetor, follow the instructions pertaining to that service.

C. THROTTLE. Examine the throttle lever and plate prior to disassembly. Replace any worn parts.

- (1) Remove the screw in the center of the throttle plate and pull out the throttle shaft lever assembly (Fig. 3-2).
- (2) When reassembling, it is important that the lines on the throttle plate (Fig. 3-2) are facing out when in the closed position. Position throttle plates with two lines, at 12 and 3 o'clock. The throttle shaft must be held in tight to the bottom bearing to prevent the throttle plate from riding on the throttle bore of the body, causing excessive throttle plate wear and governor hunting.

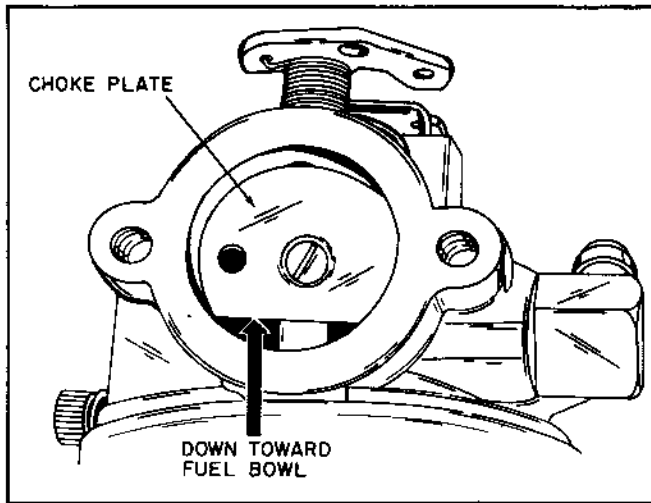


Figure 3-3. Choke Assembly

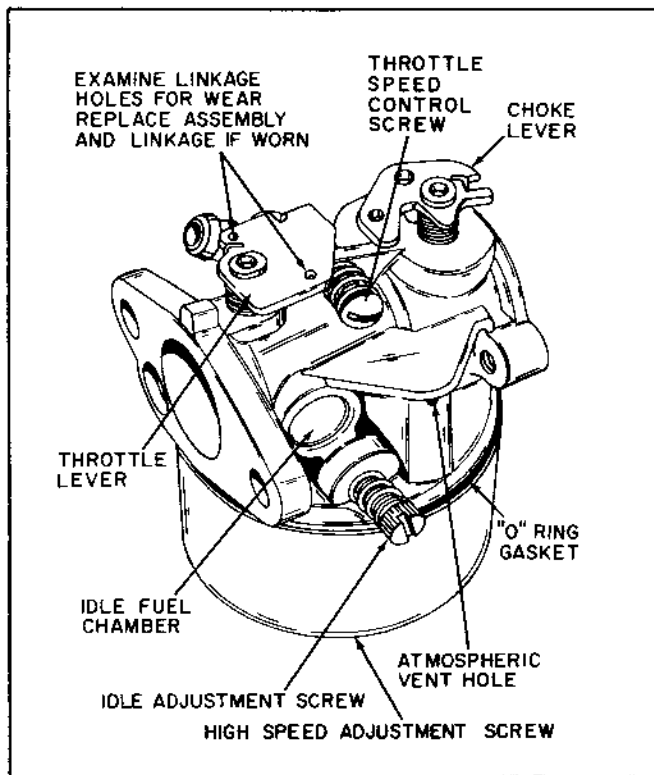


Figure 3-4. Lauson-Power Products Float Carburetor

D. CHOKER. Examine the choke lever and shaft at the bearing points and holes into which the linkage is fastened (Fig. 3-4), and replace if worn. The choke plate is inserted into the air horn of the carburetor in such a position that the flat surface of the choke (Fig. 3-3) is toward the fuel bowl. Record the choke plate movement. Choke plates will operate either clockwise or counterclockwise. Hold the choke shaft securely into the bearing bore when replacing the choke plate. This will prevent binding and excessive choke plate wear.

E. IDLE ADJUSTING SCREW.

Remove the idle screw from the carburetor body and examine the point for damage to the seating surface on the taper. If damaged, replace the idle adjusting needle. Tension is maintained on the screw with a coil spring and sealed with an "O" ring. Examine and replace the "O" ring if damaged.

F. HIGH SPEED ADJUSTING SCREW.

- (1) For service examine the taper of the high speed adjusting screw. If the taper is damaged at the area where it seats, replace the screw and fuel bowl retainer nut as an assembly.
- (2) The fuel bowl retainer nut contains the seat for the screw. Examine the sealing "O" ring, the high speed adjusting screw. Replace if it indicates wear or cuts.
- (3) During high speed adjusting screw reassembly, position the coil spring on the adjusting screw, followed by the small brass washer and the "O" ring seal.

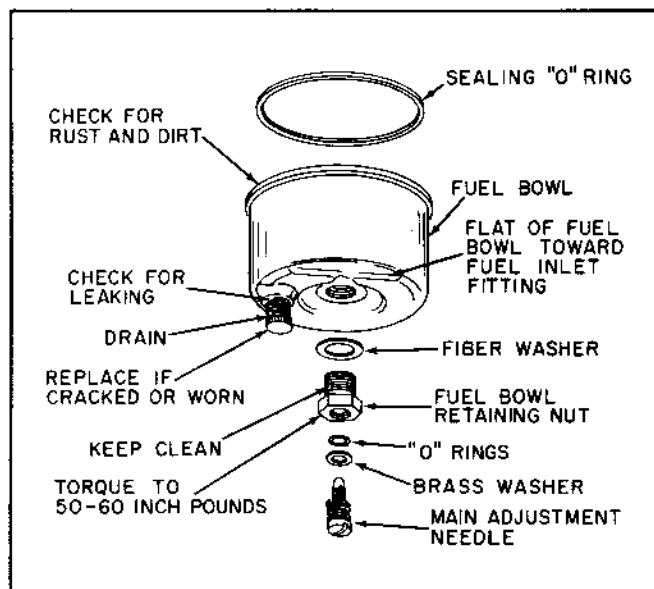


Figure 3-5

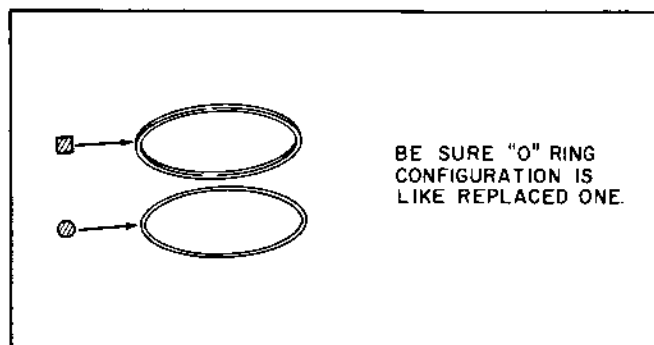


Figure 3-6

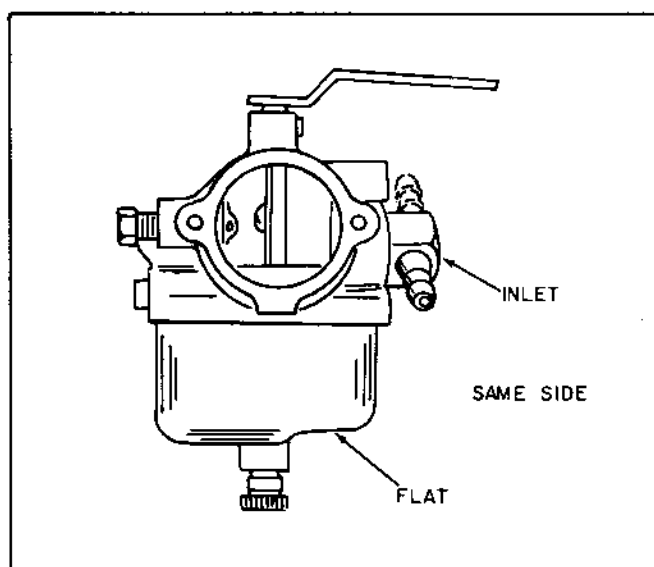


Figure 3-7

G. FUEL BOWL RETAINING NUT. Remove the fuel bowl retaining nut and fiber washer. (Fig. 3-5). Replace the washer, if cracked or worn.

(1) The retaining nut contains the transfer passage through which fuel is delivered to the high speed and idle fuel system of the carburetor. It is the larger hole closest to the hex nut end of the fitting. If a problem occurs with the idle system of the carburetor, examine the small fuel passage in the annular groove in the retaining nut. This passage must be clean for the proper transfer of fuel into the idle metering system.

(2) When replacing, torque the fuel bowl nut to 50-60 inch pounds.

H. FUEL BOWL. Fuel bowl should be examined for rust and dirt. (Fig. 3-5). Thoroughly clean before replacing. If it is impossible to properly clean the fuel bowl, replace it.

(1) Check the fuel bowl drain for leaking. Replace the rubber gasket on the inside of the drain valve.

(2) The large "O" rings (Figs. 3-5 & 3-6) sealing the fuel bowl to the carburetor body must be in good condition to prevent leakage. Examine the "O" ring for swelling or cuts. Moisten the "O" ring seal with either water or a very small amount of fuel or oil to allow the fuel bowl to slide onto the "O" ring properly. Hold the carburetor body in an inverted position and place the "O" ring on the carburetor body and then position the fuel bowl.

CAUTION

The fuel bowl flat surface is usually positioned on the same side of the carburetor as the fuel inlet fitting. (Fig. 3-7). On some outboard powerhead applications, the location of the bowl drain is dictated by the position of some adjacent parts.

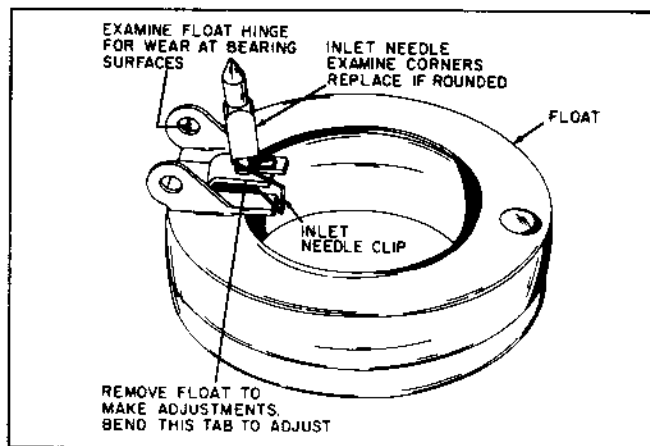


Figure 3-8. Float, Inlet Needle, and Clip

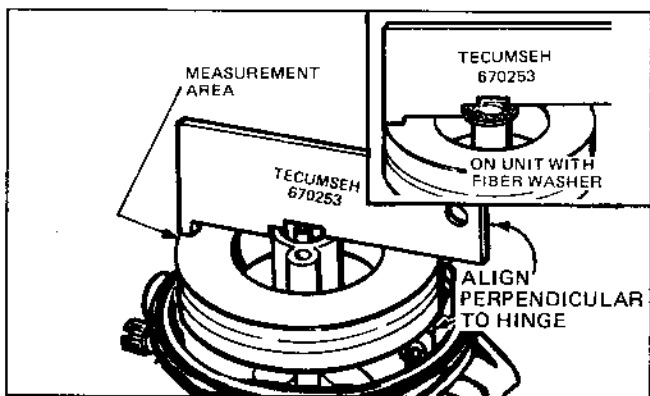


Figure 3-9. Measuring Float Height

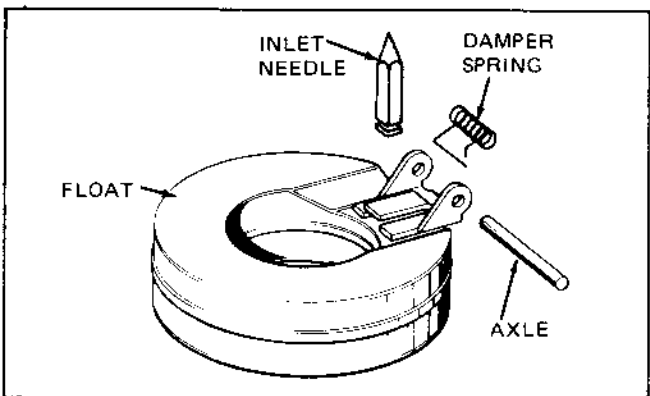


Figure 3-9A

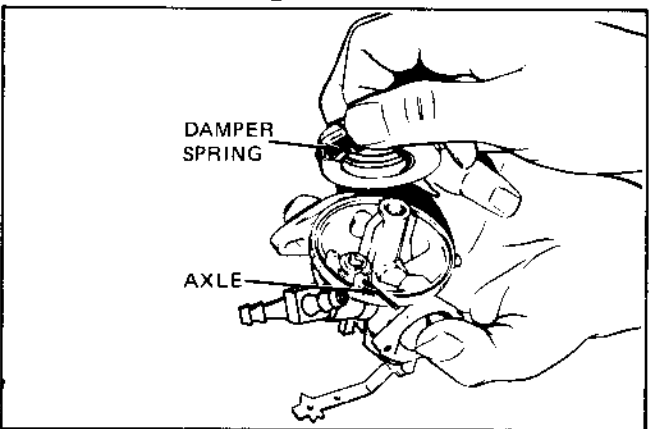


Figure 3-9B

I. **FLOAT.** Remove the float (Figure 3-8) from the carburetor main body by pulling out the float axle with a pair of needle nose pliers.

CAUTION

When the float is being removed from the carburetor body the inlet needle will be lifted off of the seat, because it is attached to the float with an anchoring clip.

- (1) Examine the float for crushing or holes. Examine the float hinge (Figure 3-8) bearing surfaces through which the float axle passes and replace if worn. Excessive wear on the tab of the float hinge that contacts the inlet needle will require replacement of the float to assure proper fuel metering within the carburetor.

SETTING THE FLOAT

With the float setting tool part No. 670253 check position of float as shown in Figure 3-9 for all Tecumseh carburetors. The tab edge of the measurement tool must rest without force or a gap on the float. If the float is too high or too low adjust the height by removing the float and bend the tab accordingly. See Figure 3-9A.

If the required adjustment is minor the tab adjustment may be made without removing float and carefully inserting a small bladed screwdriver to bend the tab. Be careful not to affect other parts.

NOTE: On carburetors equipped with a fiber washer between the bowl and casting, use the fiber washer with the float setting tool as pictured in Figure 3-9.

CAUTION

Do not direct compressed air into the fuel inlet fitting when the carburetor is assembled, this will collapse the float.

If compressed air is used, disassemble carburetor by removing float, then always direct low pressure air through system opposite normal fuel flow to dislodge foreign matter toward reverse taper of any restricting passages.

- (2) Figure 3-9A shows a float damper spring used on some outboard carburetors. The carburetor does not have an inlet needle clip. The damper spring stabilizes the float and prevents unnecessary bouncing when the engine is operated in rough water.

To assemble the float and spring, position carburetor as shown in Figure 3-9B. Start the axle, hook the long end of the damper spring under the float tab, facing the choke end of the carburetor; put tension on the other end of the spring either with thumb or index finger. Push the axle through the hinge and spring, release the end of the spring and it will anchor on the carburetor casting as shown in Figure 3-9C.

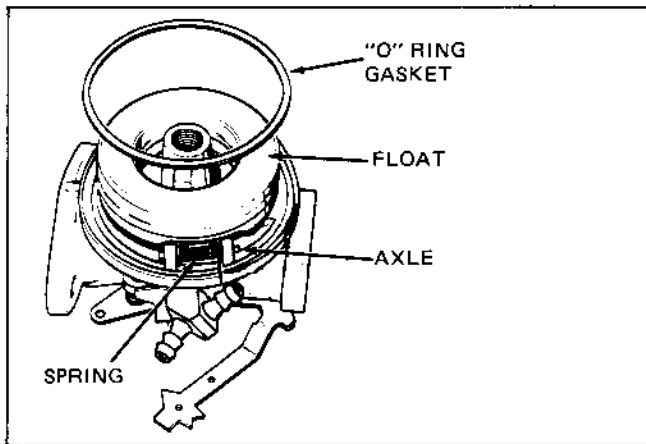


Figure 3-9C

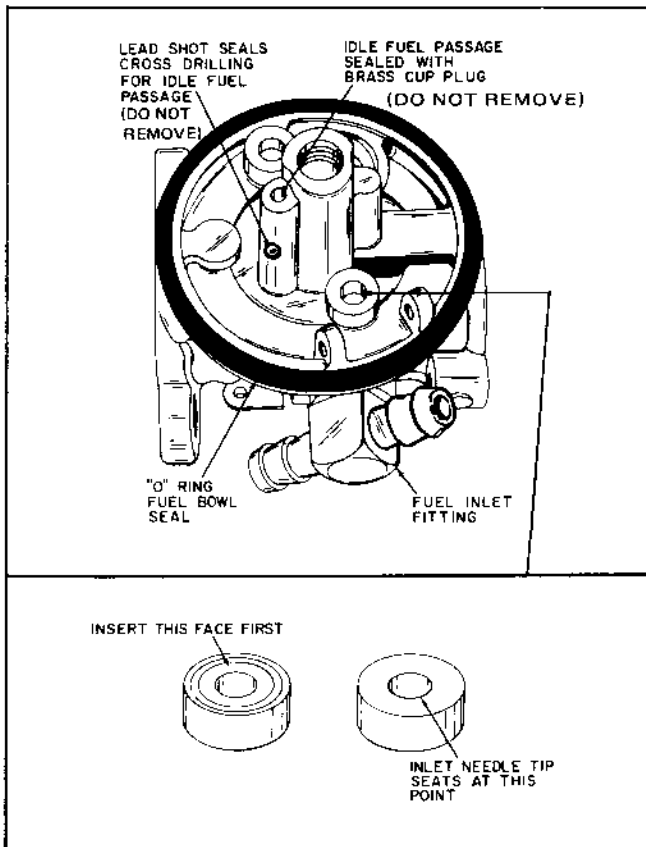


Figure 3-10

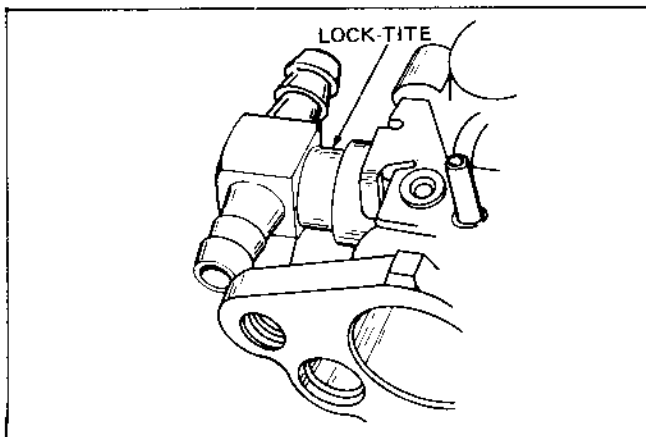


Figure 3-11. Replacing Fuel Inlet Fitting

NOTE: The long end of the spring that hooks on the float tab must point toward the choke end of the carburetor.

The gasket fits over the float spring as shown in Figure 3-9C to avoid cutting by the spring during bowl assembly.

J. INLET NEEDLE AND SEAT. (Figure 3-10). There is no inlet seat fitting to remove during disassembly. The inlet needle is anchored to the float tab by a clip, (Figure 3-8) to assure proper movement of the inlet needle off of the seat when the float drops. The inlet needle clip must be positioned as shown in Figure 3-8 and 3-12 during reassembly.

- (1) Examine the inlet needle. If any wear is evident, or any of the corners show signs of rounding, the needle should be replaced.
- (2) The inlet needle seals on a Viton rubber seat in the carburetor body. To remove, put a few drops of heavy engine oil on the seat. Place an air hose to the inlet fitting and allow a short blast of air to pass through blowing out the seat. The seat may also be pried out with a short piece of hooked wire. Examine for cuts and scratches. The seat (Figure 3-10) is inserted grooved side first. Moisten the cavity with oil and use a flat faced punch to press the inlet seat into position.

K. FUEL INLET FITTING.

- (1) The fitting may be removed from the carburetor by twisting and pulling. Make a note of the position in which the fitting was originally installed for proper fuel flow when the carburetor is re-installed on the engine.
- (2) When inserting the fitting into the carburetor body, seal it with Lock-tite grade A. Insert the tip of the fitting (Figure 3-11) into the carburetor body, then coat the remainder of the shank with Lock-tite grade A. Press the fitting in until the shoulder contacts the carburetor.

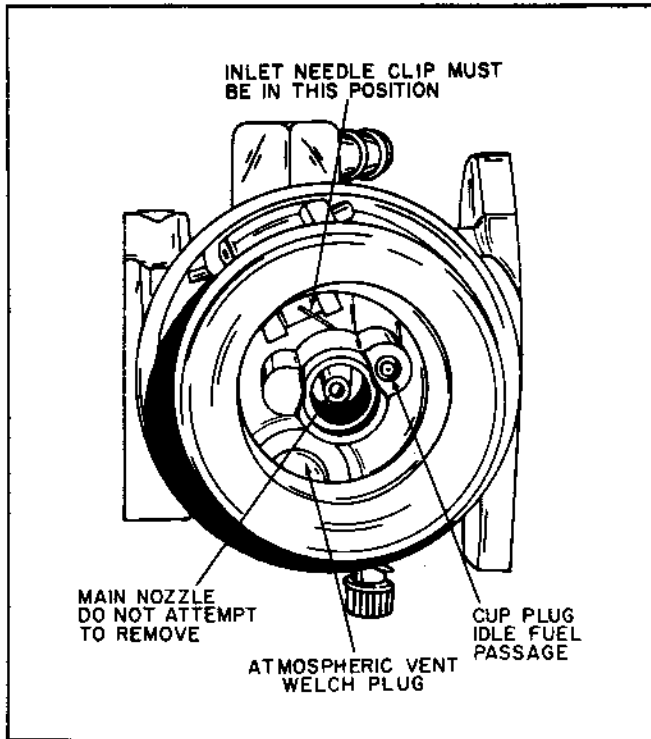


Figure 3-12

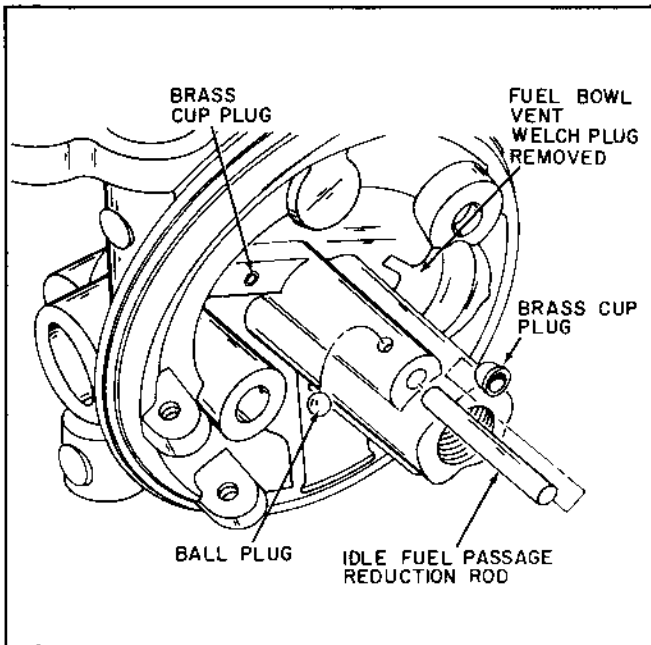


Figure 3-13. Cleaning Idle Fuel System

L. CARBURETOR BODY. Examine the carburetor body for wear and damage.

- (1) It may be necessary to remove the large welch plug (Figs. 3-12 and 3-13) if excessive dirt has accumulated in the atmospheric vent cavity, or it may be possible to clean this cavity with carburetor cleaner or compressed air without removing the welch plug.

See page 2-2-5 for Welch Plug Service.

- (2) The carburetor body contains a main nozzle tube (Fig. 3-12) pressed into the carburetor body to a predetermined depth and positioning within the venturi of the carburetor. Do not attempt to remove this main nozzle. Any movement of this nozzle will seriously affect the metering characteristics of the carburetor and will require replacement of the entire carburetor.

- (3) Clean the accelerating well surrounding the main nozzle with compressed air and carburetor cleaning solvents. With the choke plate and shaft removed, compressed air may be blown in through the high speed air bleed, (located just behind the lower choke shaft bearing and immediately in front of the venturi) to remove any dirt that may have accumulated.

- (4) The carburetor body contains two cup plugs (Fig. 3-13).

- (a) A cup plug, located near the inlet seat cavity, high up on the carburetor body, seals off the idle air bleed. This is a straight passage drilled into the carburetor throat. If removed, a new plug must be used to assure proper sealing of the passage.

- (b) Another cup plug is located in the base (Figs. 3-12 and 3-13) where the fuel bowl nut seals the idle fuel passage. Removal of this plug will allow removal of the metering rod (Fig. 3-13) from the idle fuel passage. A new plug must always be used for replacement, and must be tightly sealed when it is replaced.

- (c) A small ball plug (Fig. 3-13) located on the side of the idle fuel passage allows access to the idle fuel cross passage. This small fuel passage has been calibrated. Do not insert improper sized drill rods for cleaning purposes. If removed, it is very important that the cross passage be tightly sealed with a new plug.

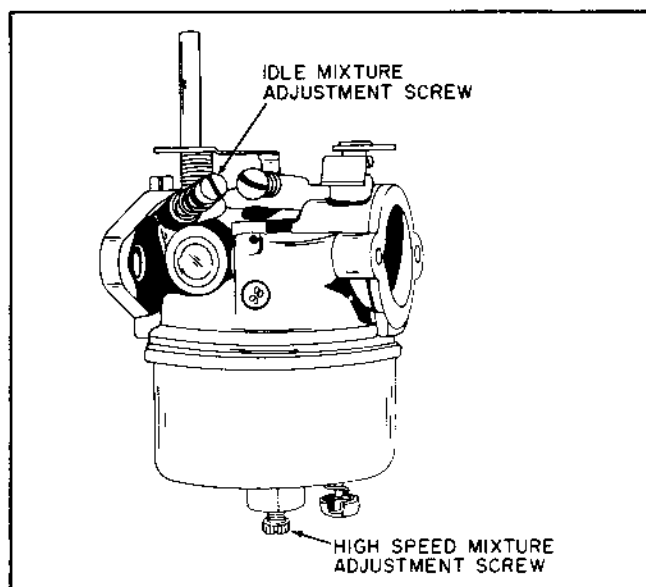


Figure 3-14

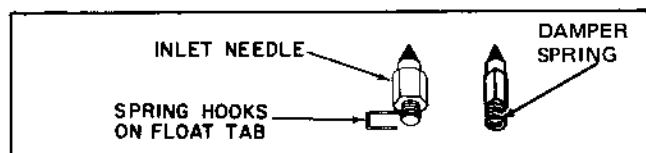


Figure 3-15

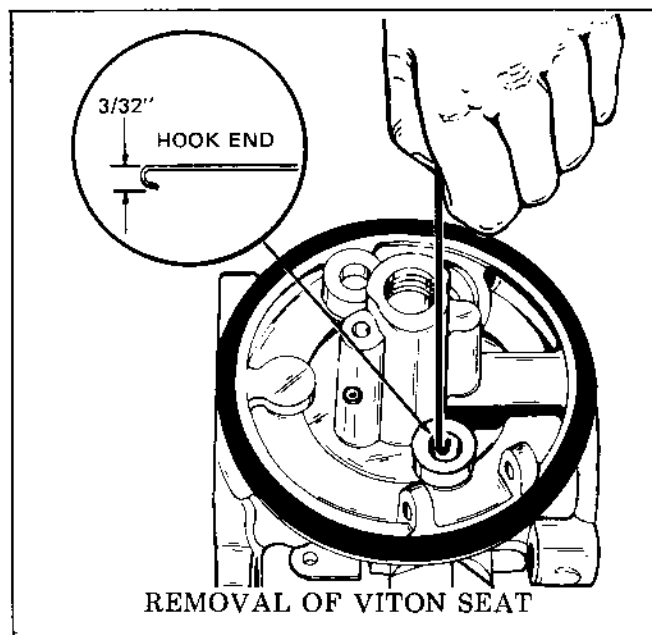


Figure 3-16

- (5) A Welch plug on the side of the carburetor body, just above the Idle Adjusting Screw seals the Idle Fuel Chamber. (Fig. 3-14). This Welch plug may be removed for thorough cleaning of the idle fuel mixture passage and the Primary and Secondary Idle Fuel discharge ports. Clean with solvent and compressed air. DO NOT use any tools that may change the size of the discharge ports.

M. SERIES II FLOAT CARBURETOR.

The Series II is very similar to the original with few exceptions. The idle air adjustment needle has been relocated to facilitate adjustment of both air and fuel in the idle section. The original allows only the AIR bleed to be controlled by the idle adjustment needle.

The series II carburetor has two types of inlet needles and seats. Both are of the resilient type with one having a hard needle and a resilient Viton seat and the other having a rigid brass seat and a resilient Viton tipped needle. Each type is to be serviced differently.

- N. RESILIENT TIP NEEDLE SERVICE. Merely replace the inlet needle. Do not attempt to remove or replace seat.

O. SERVICING THE VITON SEAT

REMOVAL (Figure 3-16) Do not attempt to remove the brass cup containing the Viton seat. If the seat is to be replaced, use the bent end of a paper clip or wire with a $\frac{3}{32}$ " hook. Push the hook through the Viton seat hole. Then with hook, pull Viton seat out of brass cup. Replace with a new seat. The clip must be properly bent so as not to hook over brass cup edge.

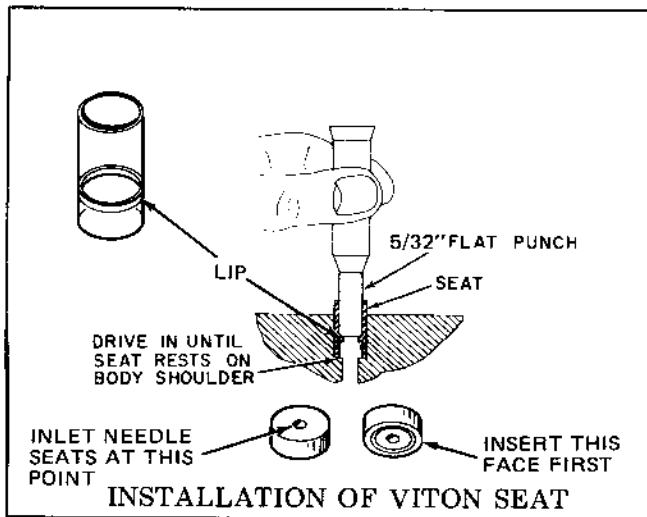


Figure 3-17

P. VITON SEAT REPLACEMENT

After thoroughly cleaning the cavity, moisten the seat with oil, position seat over the receptacle with the smooth side of the seat facing the flat on the punch.

Insert the seat with the grooved side into the brass cup. Press the Viton seat squarely into the base of the cup with a 5/32" flat punch. Be sure the Viton seat passes over the lip at the base of the brass cup. (See Figure 3-17.) Service to the rest of the carburetor is the same as other float carburetors.

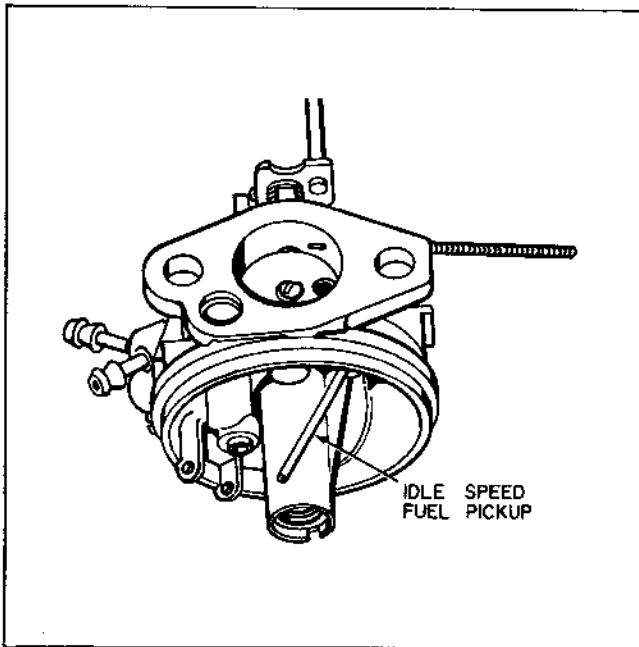


Figure 3-18. Float Carburetor with Separate Idle Fuel Pickup

Q. LAUSON POWER PRODUCTS FLOAT CARBURETOR WITH SEPARATE IDLE FUEL PICKUP.

- (1) This float carburetor is one of several types used on an outboard engine application.
- (2) The type shown in Figure 3-18 is characterized by a separate idle pickup tube which is a passage for fuel in the idle engine speed position.

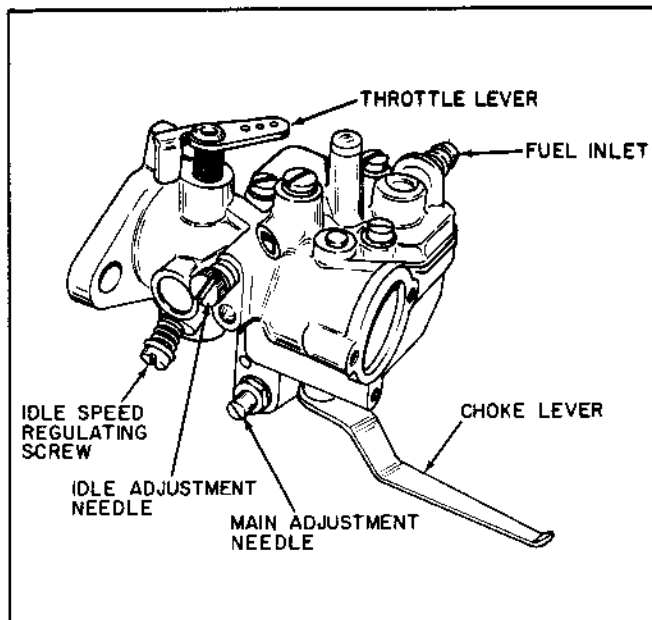


Figure 3-19. Tillotson MT Float Feed Type Carburetor

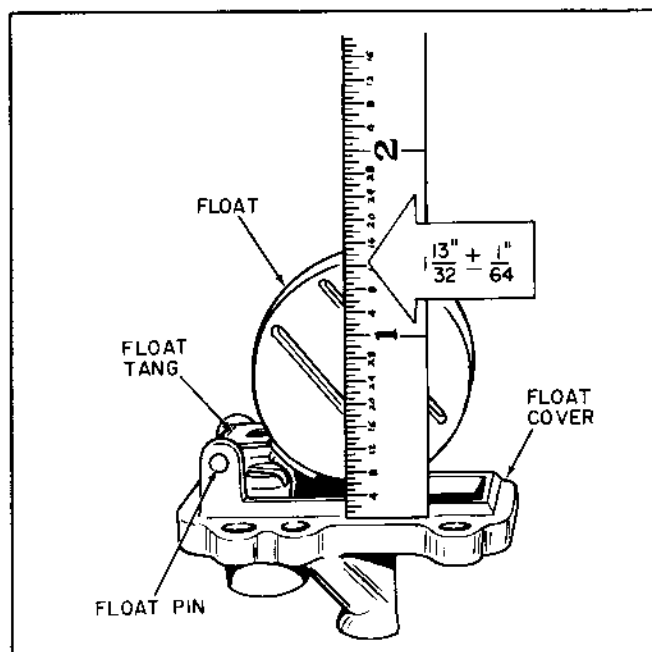


Figure 3-20

R. TILLOTSON FLOAT FEED CARBURETOR ADJUSTMENT (Models MT-50A and MT-51A).

- (1) The carburetor illustrated in figure 3-19 is a typical Tillotson MT Series carburetor. Other models in MT Series have slight modifications from model shown, but each is adjusted in a similar manner.

For MT-61 Series carburetor omit all references to idle adjustment. There was no external idle adjustment screw on the MT-61 Series carburetor.

- (2) Adjust idle and main metering screws as covered in Part II, Section 2, paragraph K.
- (3) Start engine and allow to warm up to operating temperature, make sure choke is fully opened after warming up. Run engine at full throttle speed but with no load.
- (4) Hold throttle half way open and turn main adjusting needle in or out from initial setting to achieve smoothest operation of engine. A slightly rich adjustment is preferred for lawnmower applications to compensate for the added engine load during mowing.
- (5) Back off idle speed regulating screw so that it is out of engagement with throttle. Move throttle lever so that engine will operate at its slowest speed without stalling. With throttle lever held in this position, adjust idle adjustment needle in or out from its initial setting until smoothest idle operation is attained.
- (6) Turn idle speed regulating screw in until an idle speed of 1800 rpm is attained. Use a tachometer to determine the correct speed.
- (7) Allow engine to idle a short time and then move throttle lever to operating speed. Repeat several times. If engine does not pick up speed immediately, or if it has a tendency to stall, readjust main adjusting screw to provide proper fuel mixture.
- (8) On Tillotson MT, to check float level, (Fig. 3-20) invert float and cover assembly so that valve inlet needle is fully seated and measure from the edge of the float cover to the top edge of the float. This dimension should be $1\frac{13}{32}$ inches $\pm$ $\frac{1}{64}$ inch. To adjust float level, remove float pin and float, and carefully bend tang on float up or down to obtain correct measurement.

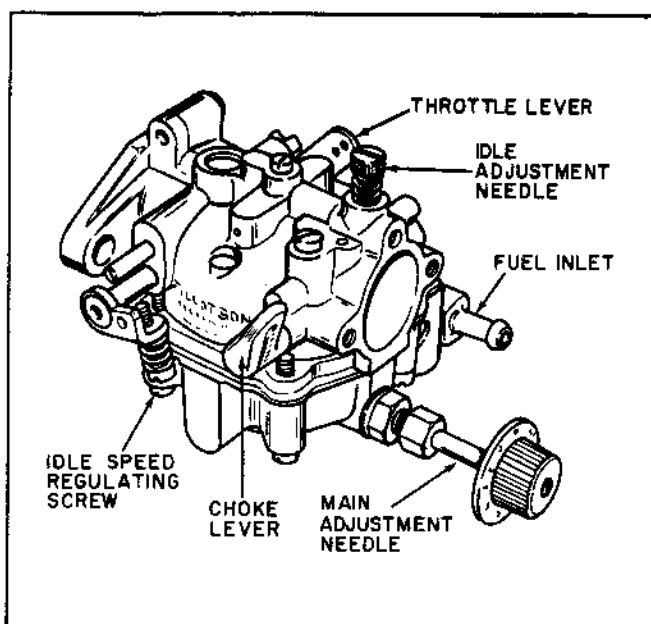


Figure 3-21. Tillotson MD Float Feed Type Carburetor

S. TILLOTSON MD FLOAT CARBURETORS.

NOTE

Adjust idle and main metering screws as covered in Part II, Section 2, Paragraph K.

- (1) Start engine and follow final carburetor adjustment procedures as used on the MT Model. See Paragraph R.

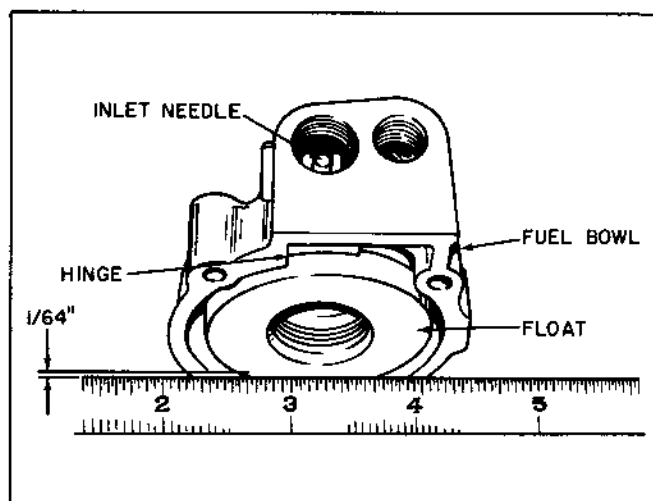


Figure 3-22. Checking Float Level on Tillotson MD Carburetor

- (2) When disassembling Tillotson MD type carburetors, turn out main adjusting needle before attempting to separate carburetor halves to prevent damage to needle. Check clearance between straightedge and float. It should be $1/64$ inch. To adjust float level, remove float pivot screw and remove float. Carefully bend vertical float lever tang to obtain the correct measurement. Make sure both arms of forked tang are in same plane. Reassemble fuel bowl and float and recheck adjustment.

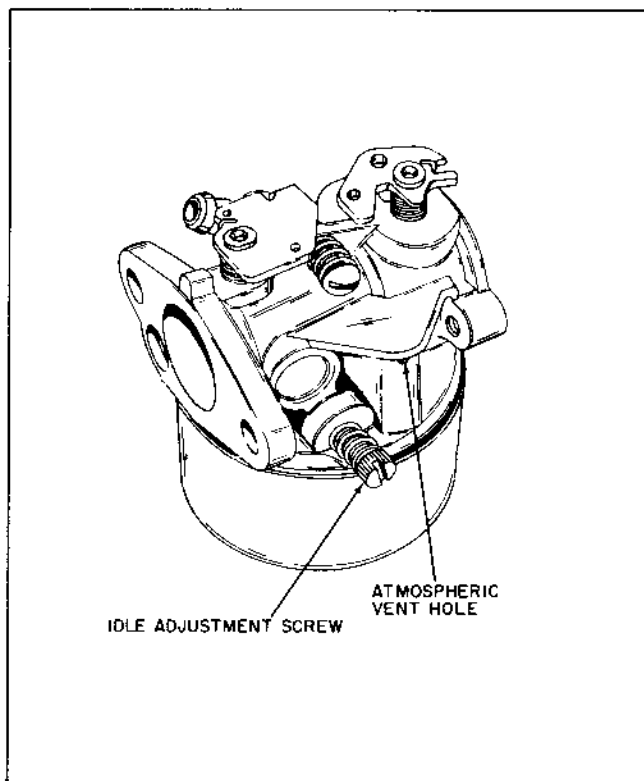


Figure 2-22

T. FIXED MAIN JET TYPE CARBURETOR. This type carburetor functions similar to the conventional, fully adjustable carburetor, except the fuel retaining bowl nut has the fixed main jet incorporated. Figures 2-22, 2-23.

This carburetor is unlike the Automagic carburetor (see Part II, Section 4, Page 2-4-1) in that it does contain a choke shutter to decrease the intake for starting.

IDLE ADJUSTMENT

With engine running at low speed, adjust low speed screw clockwise to lean mixture and counterclockwise to richen mixture until smooth operation is obtained. Upon completion of this setting, engine should run smoothly at slow, as well as all other speeds. The float setting, service and maintenance is covered under Part II, Section 3, Pages 2-3-1 through 2-3-8.

ATMOSPHERIC VENT ON A FIXED MAIN JET CARBURETOR

The atmospheric vent holes may be found either in type shown in Figure 2-22 or the atmospheric vent hole may be located at the top of the casting. (See Figure 2-23.)

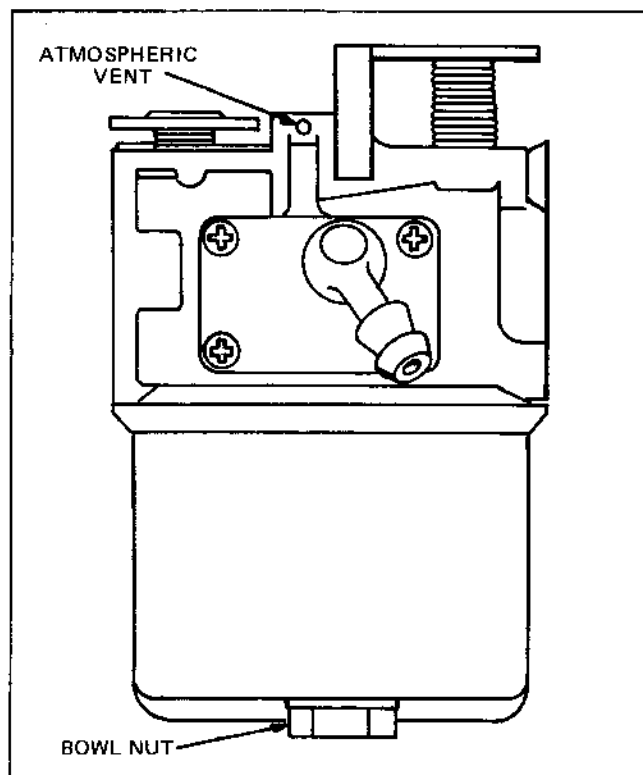


Figure 2-23

SECTION 4. DIAPHRAGM (PRESSURE DIFFERENTIAL) CARBURETORS

2

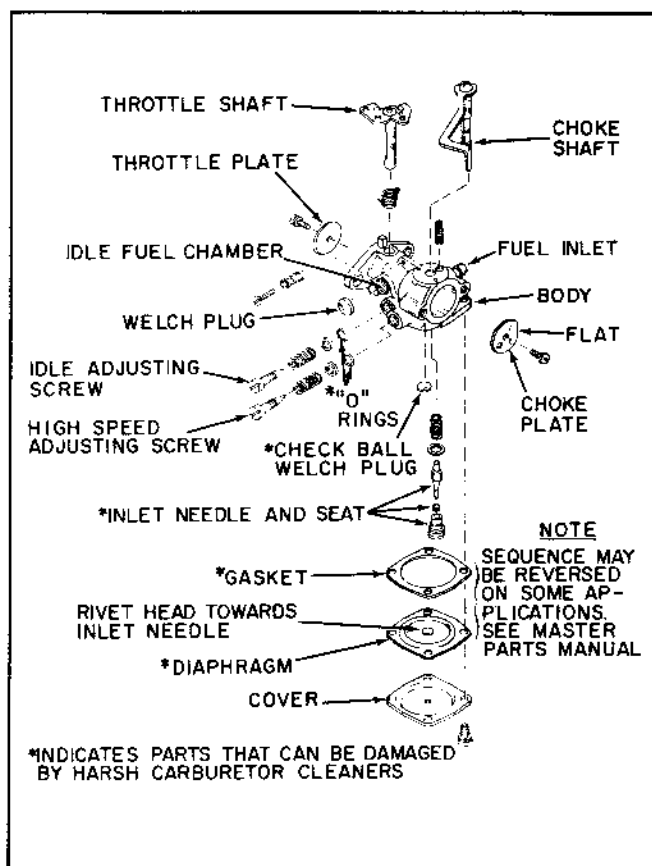


Figure 4-1. Tecumseh Diaphragm Carburetor (Exploded View)

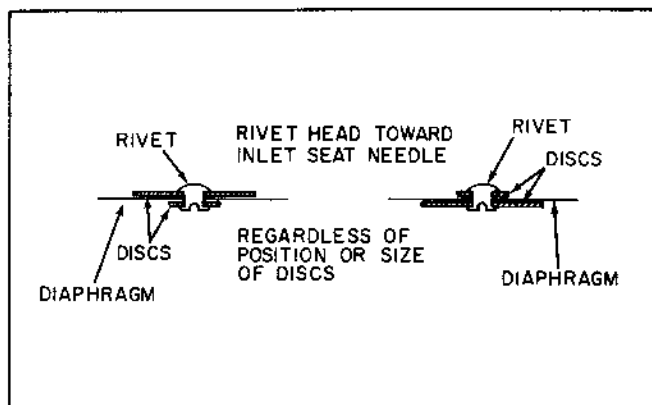


Figure 4-2

A. TECUMSEH DIAPHRAGM CARBURETORS.

NOTE

Use a good brand of clean carburetor cleaner. Soak only metal parts (except inlet seat fitting). Use new gaskets when servicing. Refer to Master Manual for necessary parts. Carburetor Model Number is stamped on flange.

- (1) **THROTTLE PLATE** . . . Install throttle plate with short line stamped in plate to top of carburetor, parallel with throttle shaft, and facing out when throttle is closed.
- (2) **CHOKE PLATE** . . . Install with flat of choke plate toward fuel inlet side of carburetor. Mark to face in and parallel with choke shaft.
- (3) **IDLE ADJUSTING SCREW** . . . SPRING loaded, with neoprene "O" ring seal. Do not soak "O" ring in carburetor cleaner. Idle adjusting screws vary in design - observe during removal for proper replacement.
- (4) **HIGH SPEED ADJUSTING SCREW** . . . SPRING loaded, with neoprene "O" ring seal. Do not soak "O" ring in carburetor cleaner. Replace if damaged.
- (5) **IDLE FUEL CHAMBER** . . . Welch plug can be removed if carburetor is extremely dirty. Remove by drilling hole OFF CENTER - toward top and pry out with suitable tool.
- (6) **DIAPHRAGMS** . . . are serviced and replaced by removing four screws retaining diaphragm cover to carburetor body. When cover is removed diaphragm and gasket may be serviced. **DO NOT SOAK** diaphragm in carburetor cleaner. Inspect diaphragm for cracks, tears. Replace if necessary and prevent wrinkling when replacing.
- (7) Regardless of metal disc size, always replace diaphragm rivet head toward inlet needle valve. Always replace diaphragm with identical one. To be sure of placing the new diaphragm and gasket correctly, refer to the Master Parts Manual (Section 5A) for applicable carburetor.

2

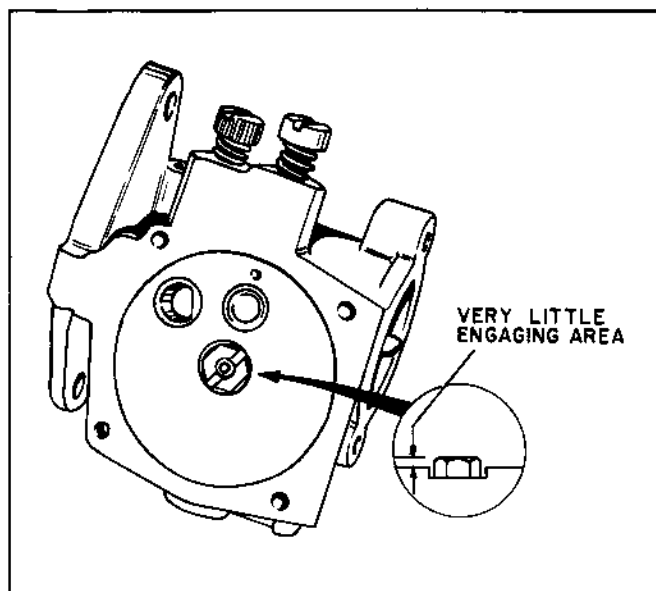


Figure 4-3. Tecumseh Carburetor

- (8) **INLET NEEDLE AND SEAT (Early Type).** Use slotted screw driver to remove. Figure 4-3. (Late Type) Use 9/32" socket to remove hex head inlet seat. Grind chamfer off socket for better grip. (Figure 4-3).

CAUTION

Inlet needle is spring loaded. Exercise care during removal to prevent loss of spring. Inlet seat fitting is metal with neoprene seat. **DO NOT SOAK** in carburetor cleaner or remove seat. Always remove old gasket from carburetor main body and replace.

- (9) **FUEL INLET FITTING.** Diaphragm carburetor inlet fittings have a strainer which is an integral part of the fitting.

To clean, either reverse flush, or use compressed air after removing the inlet needle and seat.

If the strainer is lacquered or otherwise unable to be cleaned, replace the inlet fitting.

Refer to Section 3, Par. K, for proper procedure. Always use a new fitting whenever one is removed.

- (10) **CLEANING . . .** by soaking the carburetor is permissible after the "O" rings, diaphragm, and fuel inlet seat are removed.

B. ALL POSITION IDLE CARBURETOR. The carburetor used in chainsaw applications has a separate idle and intermediate circuit.

The idle circuit runs through the carburetor body, gaskets, and offsets and is directed to bottom parts of the engine crankcase where it atomizes.

Air for this system enters the engine through the air horn as metered by the offset shutter.

A restrictor in the carburetor fuel passage meters the fuel flow through the circuit.

The intermediate circuit connects to idle circuit, but feeds through the air horn in the conventional manner (but without first being mixed with air in the pocket).

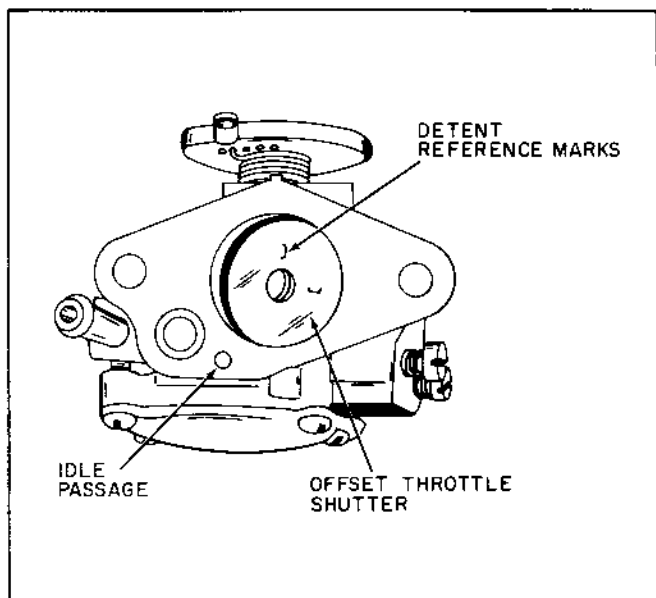


Figure 4-4

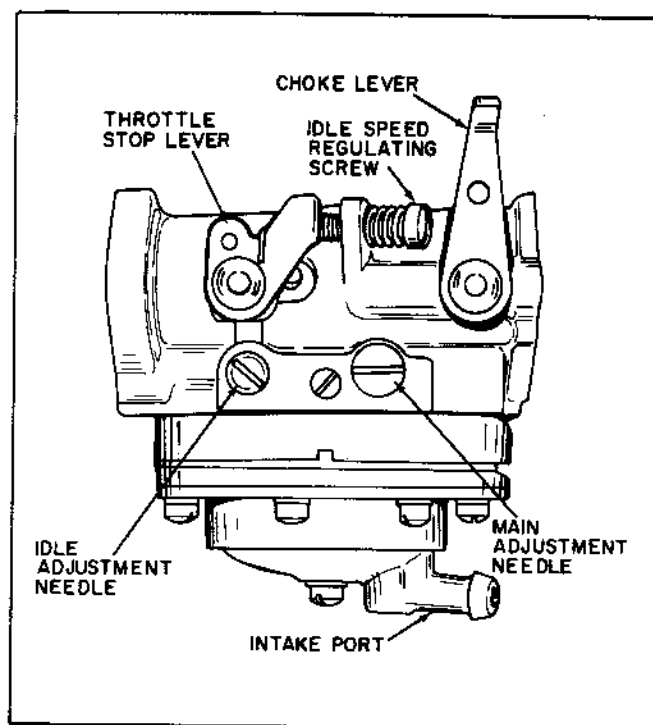


Figure 4-5. Tillotson Diaphragm Type Carburetor with Pump

C. TILLOTSON HC CARBURETOR.

- (1) Disassemble and clean all passages thoroughly. Follow general carburetor service procedures, Section 2, for service procedures.

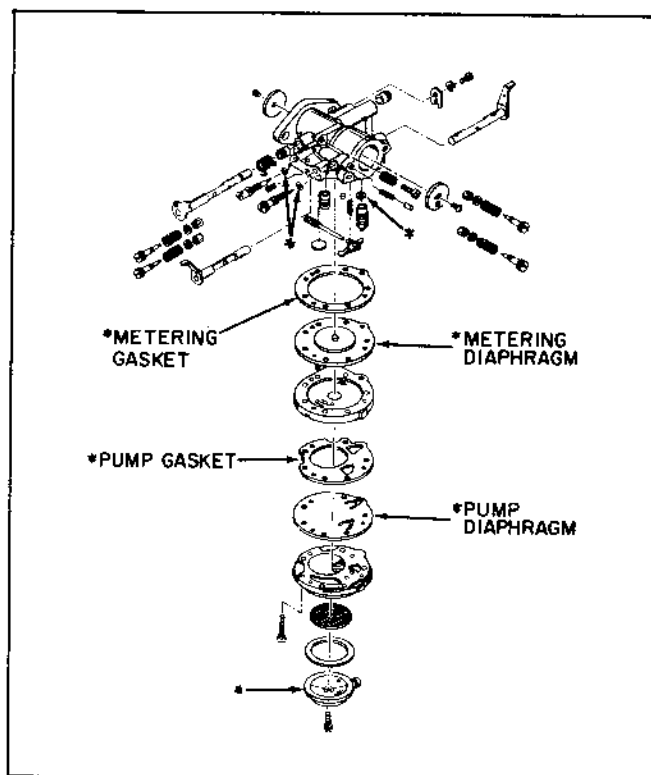


Figure 4-6

- (2) Diaphragm and gasket sequence is important in the fuel metering and pump sections of the HC carburetor. Arrange as shown in figure 4-6.

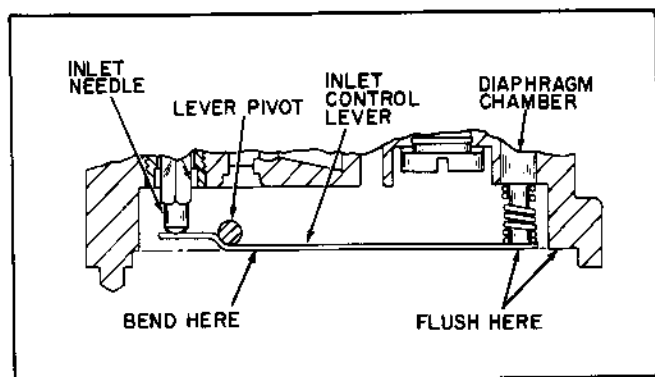


Figure 4-7. Checking Inlet Control Lever Position on Tillotson Diaphragm Type Carburetor

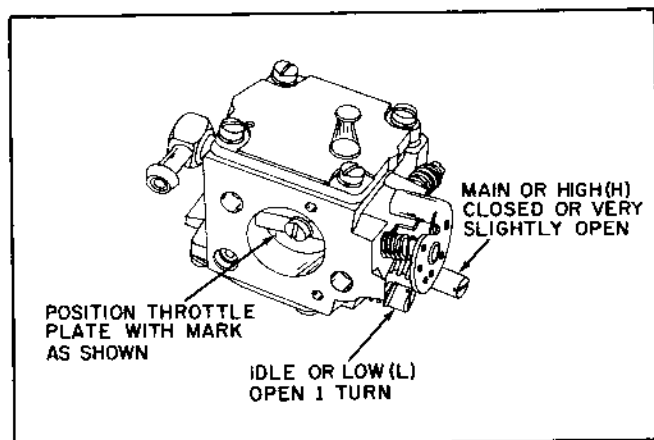


Figure 4-8. "HS" Model Carburetor

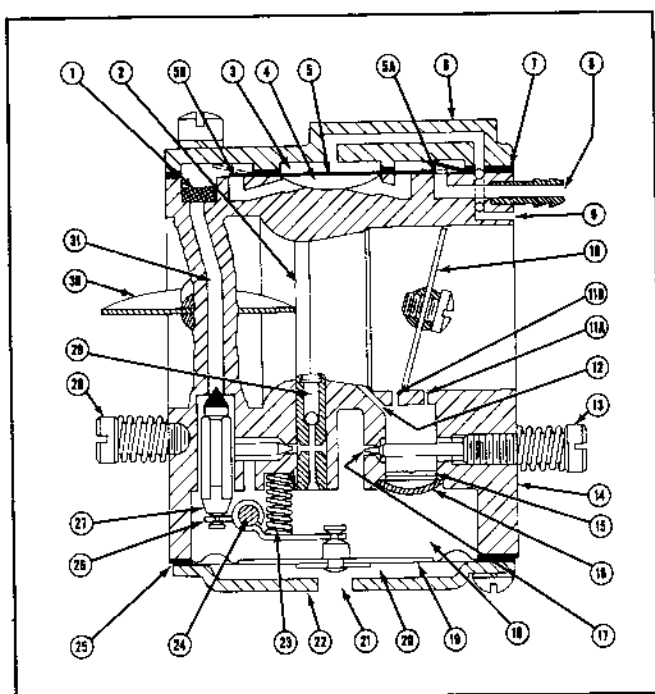


Figure 4-9. Schematic Diagram - HS Carburetor

- (3) On diaphragm type carburetors, the inlet control lever (Fig. 4-7) must be properly formed to assure proper metering of inlet valve. When inlet needle is fully seated, inlet control lever must be flush with the inner edge of diaphragm chamber as shown in figure 4-7. If necessary, bend inlet control lever at point shown to correct measurement.

D. TILLOTSON "HS" CARBURETOR.

- (1) Open main adjustment screw one and one-quarter (1-1/4) turns. Open idle adjustment screw one turn.

NOTE: IN MAKING CARBURETOR ADJUSTMENTS, TURN SCREWS CAREFULLY. DO NOT RAM ADJUSTMENTS INTO SEAT.

1. Filtering Screen
2. Venturi
3. Pulse Chamber
4. Fuel Chamber
5. Fuel Pump Diaphragm
- 5A. Diaphragm Pump Inlet Valve
- 5B. Diaphragm Pump Outlet Valve
6. Fuel Pump Body
7. Fuel Pump Gasket
8. Fuel Inlet
9. Impulse Channel
10. Throttle Shutter
- 11A. Primary Idle Discharge Port
- 11B. Secondary Idle Discharge Port
12. Air Bleed Passage
13. Idle Fuel Adjustment Screw
14. Body
15. Body Channel Reducer
16. Welch Plug
17. Idle Fuel Adjustment Orifice
18. Metering Chamber
19. Diaphragm
20. Atmospheric Chamber
21. Atmospheric Vent
22. Diaphragm Cover
23. Inlet Tension Spring
24. Fulcrum Pin
25. Diaphragm Gasket
26. Inlet Control Lever
27. Inlet Needle
28. Main Fuel Adjustment Screw
29. Main Nozzle Discharge Port and Check Ball Assembly
30. Choke Shutter
31. Fuel Inlet Supply Channel

Litho in U.S.A.

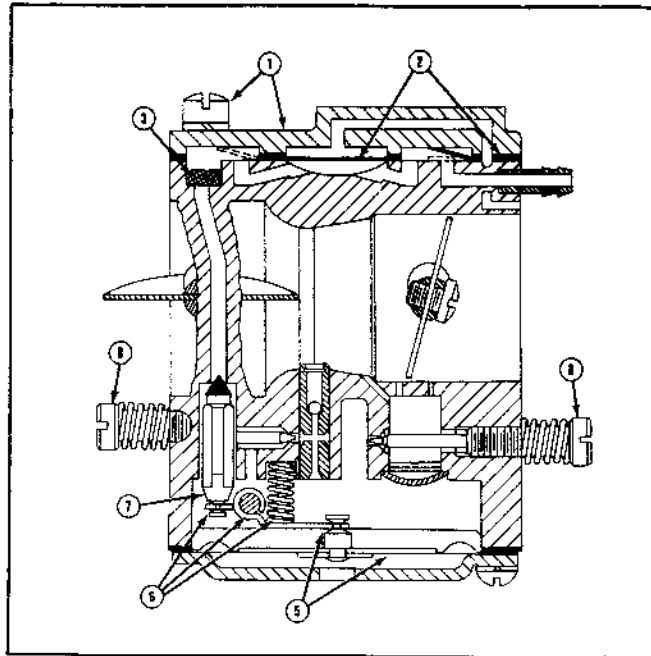


Figure 4-10. Carburetor - Schematic

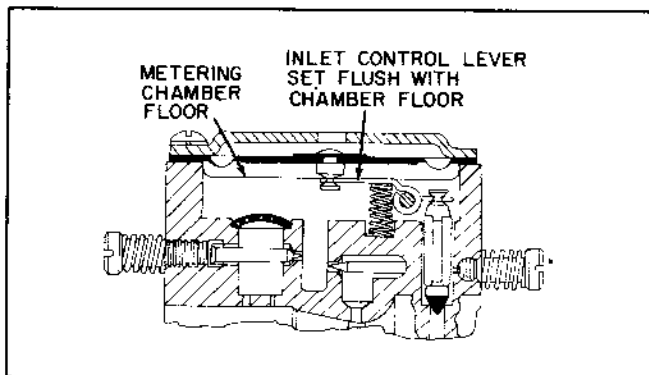


Figure 4-11. Inlet Control Lever

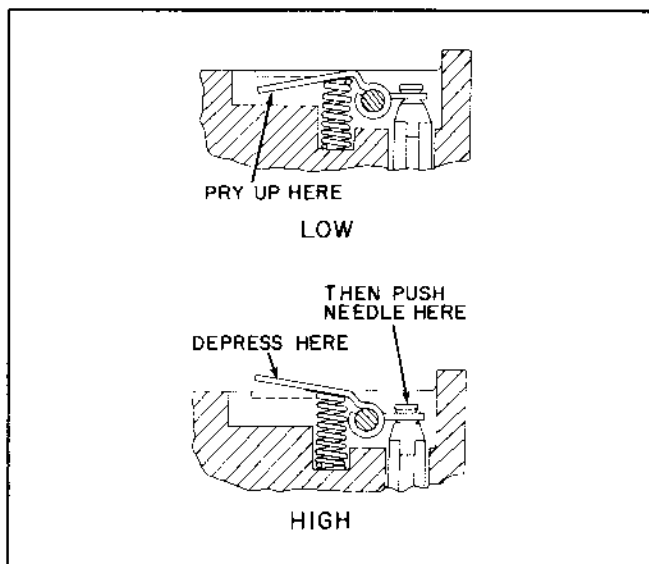


Figure 4-12. Inlet Control Lever Settings

(2) Before disassembling carburetor it is imperative to flush it clean of sawdust and dirt by pouring a non-inflammable solvent over the carburetor body. Use clean tools and hands.

- a. Remove pump diaphragm cover screws and cover.
- b. Remove pump gasket and pump diaphragm.
- c. Remove filtering screen.
- d. Remove main diaphragm cover screws and cover.
- e. Remove main diaphragm and gasket (slide diaphragm towards adjustment screws approximately $\frac{1}{16}$ th of an inch and pull up to unhook from the control lever).
- f. Remove fulcrum pin screw, pin, control lever and spring.
- g. Remove inlet needle.
- h. Replace idle and main adjustment screws and springs.

(3) Commercial carburetor cleaner can be used on all parts except diaphragms and gaskets. Before reassembling, rinse all parts in clean solvent and blow off with compressed air. Do not use cloth as tiny particles of lint adhering to carburetor parts will cause malfunction. Channels in the metering body can be cleaned by blowing through idle and main adjustment orifices. Do not use wires or drills to clean orifices.

(4) When reassembling the inlet control lever and spring, care should be taken to see that the spring rests in the well of the metering body and locates on the dimple of the inlet control lever.

CAUTION: Do not stretch spring.

(5) Inlet control lever is properly set when flush with the floor of the diaphragm chamber. If diaphragm end of control lever is low, pry up. If lever is high, depress diaphragm end and push on needle for proper adjustment. (See illustration). On some models the inlet control lever is hooked to both the inlet needle at one end and the metering diaphragm at the other. Special care is required when reassembling these parts to insure proper operation.

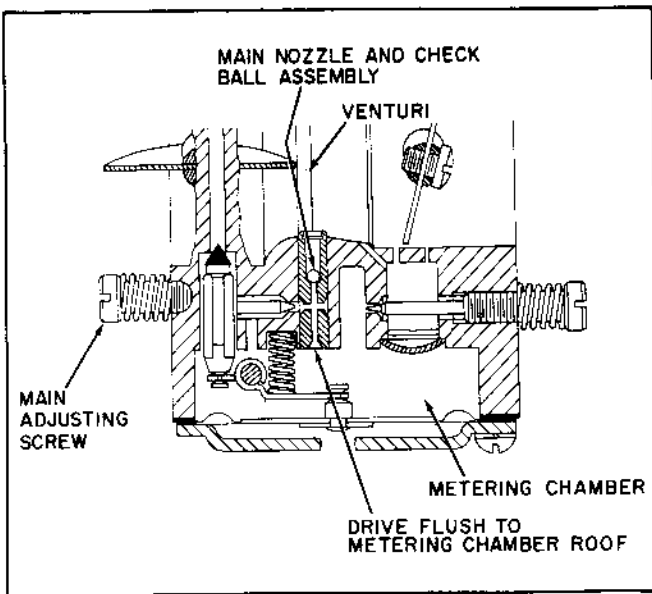


Figure 4-13

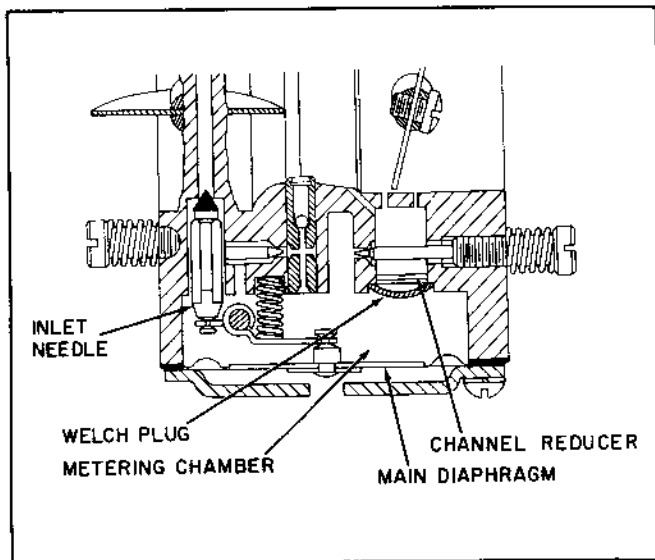


Figure 4-14

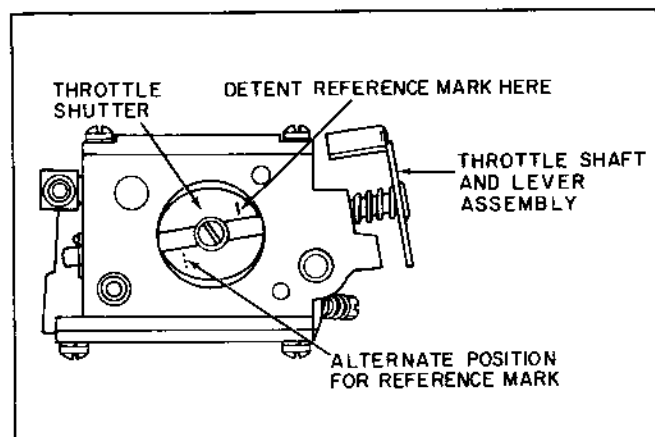


Figure 4-15

(6) MAIN NOZZLE AND CHECK BALL SERVICE.

CAUTION: Remove main adjustment screw before attempting to remove the main nozzle or damage may occur.

Drive the check ball assembly out of the body and into the venturi.

Drive the new assembly into the body from the metering chamber side.

Assembly should be flush with the metering chamber surface.

(7) CHANNEL REDUCER.

The channel reducer floats loosely in the idle fuel chamber. It is keyed into position therefore must be installed one way only.

Access to the reducer can be gained by removing the welch-plug that seals the chamber. **CAUTION:** Do not damage the nylon reducer while removing the welch-plug.

(8) THROTTLE SERVICE.

Note throttle shutter position before attempting to remove. Shutter is not round and must be carefully positioned within the air horn.

Small mark on shutter should be positioned as shown in the figure. Mark can be located either above and to the right of the shaft or below and to the left.

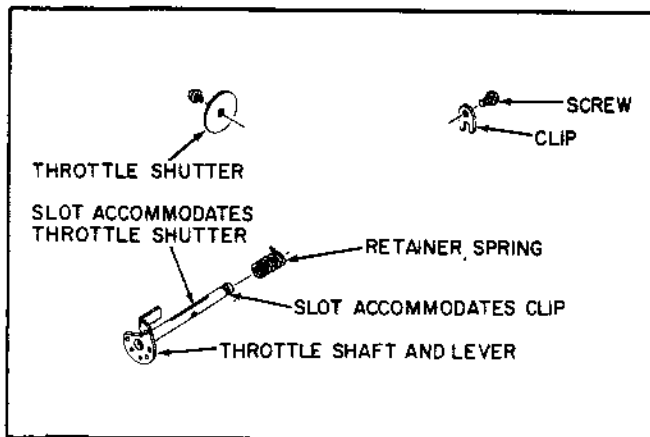


Figure 4-16

Remove shaft clip, relieve tension of retainer spring and lift shaft out of body. Replace in reverse sequence.

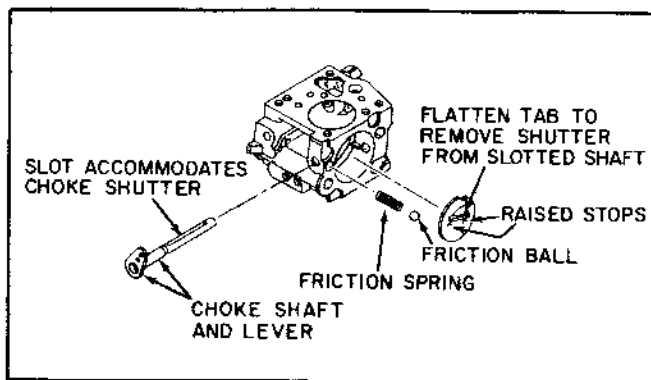


Figure 4-17

(9) CHOKE SERVICE.

Flatten raised tab of choke shutter and slide out of shaft.

Watch for spring loaded friction ball as choke shaft is lifted from body. Re-install shaft using reverse procedure.

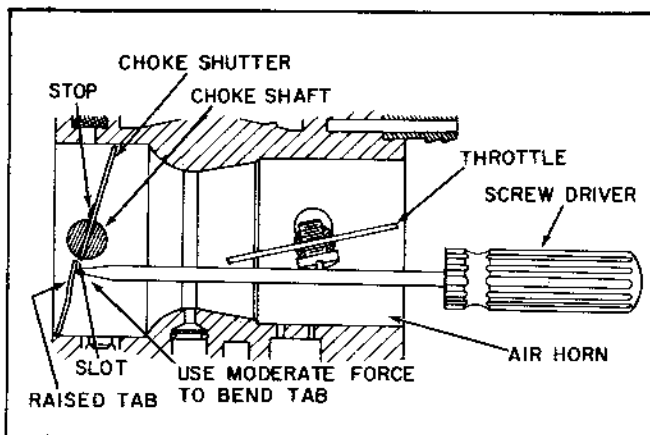


Figure 4-18

Slide choke shutter into shaft slot until the two raised stops strike choke shaft.

Place long punch through throttle end of air horn and strike choke shutter on tab near slot; raised tab will secure shutter. See figure.

E. CARTER ND SERIES.

To Assemble

- (1) Install throttle shaft, return spring and valve. Valve must be installed with trademark "C" on side toward idle port when viewing from flange side. Always use new screws. With valve screws loose and throttle lever set screw backed out, seat valve by tapping lightly with a small screw driver. Hold in place while tightening screws.

2

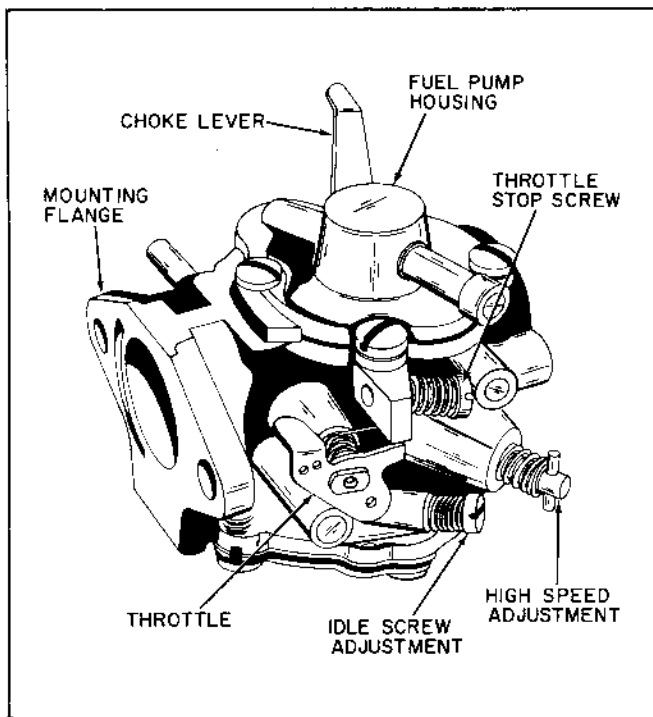


Figure 4-19

- (2) Install strainer (round tower away from needle seat), needle seat, needle, fuel control lever spring, lever, pin and screw.
- (3) Set fuel control lever to give $5/32$ " from the floor in casting to the top surface of the lever as shown in illustration. To adjust bend lip of lever nearest the needle.
- (4) Install fuel control diaphragm assembly, then gasket, between diaphragm and cover. Tighten cover screws (6) evenly and securely. Be sure vent hole in cover is not plugged up.
- (5) Install choke shaft locking ball and spring, pump diaphragm and housing. Tighten housing screws (4) evenly.
- (6) Install idle adjusting screw and spring. Seat the screw lightly against its seat and back out approximately $1/2$ to $3/4$ turn open. Do not use force as it may damage idle screw.
- (7) Install high speed adjusting needle. Turn needle in until it just seats in body then back out $1-3/4$ to 2 turns.

(8) High Speed and Idle Screw Adjustment

- a. After rebuilding and installation on engine is complete, the high speed and idle screw adjustments must be made. With the high speed needle turned counter-clockwise (from closed position) $1-3/4$ to 2 turns and idle screw turned $1/2$ to $3/4$ turn open, start engine.
- b. With the engine at normal operating temperature, accelerate engine and check response. Adjust the high speed needle for the optimum mixture which will allow satisfactory acceleration. If the engine misses and backfires, the high speed mixture is too lean and the high speed adjustment needle must be turned counterclockwise $1/10$ turn at a time to correct this condition. If the engine loads (heavy exhaust) and is sluggish, the mixture is too rich and the high speed adjustment needle must be turned clockwise $1/10$ at a time to correct. To make final check of the high speed adjustments, operate the engine under load and adjust.

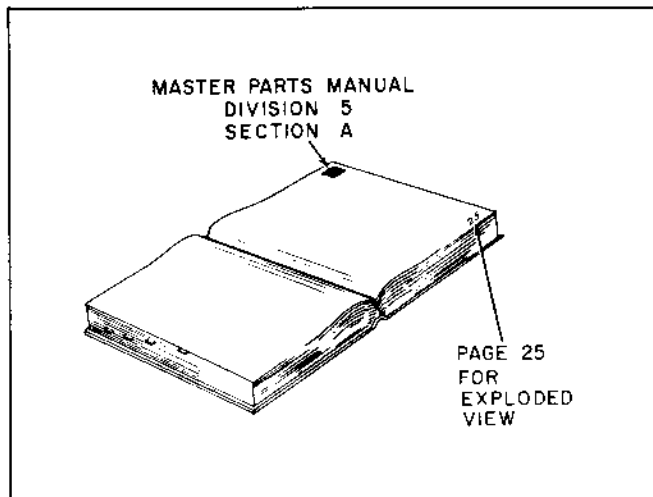


Figure 4-20

- c. The idle screw should be adjusted intermittently while making the high speed adjustment. **DO NOT USE FORCE ON THE HIGH SPEED NEEDLE OR IDLE SCREW AS DAMAGE MAY RESULT.**

SECTION 5. GOVERNORS

2

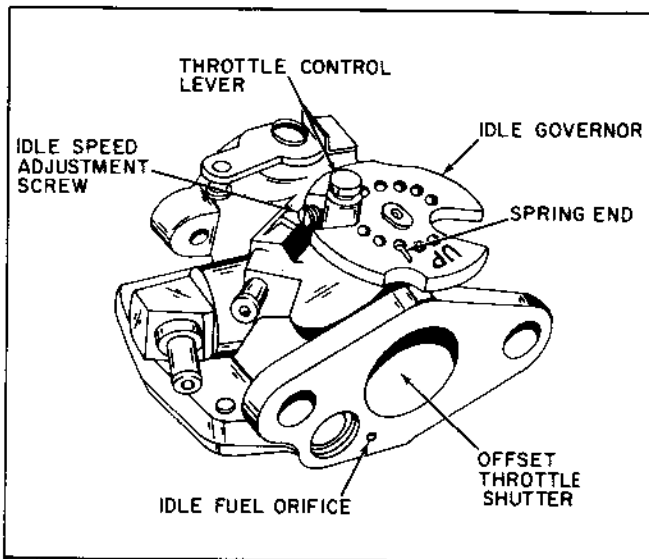


Figure 5-1

A. IDLE GOVERNOR. The idle governor controls throttle shutter movement at idle speed only. It reduces the effects caused by fuel "puddling" within the crankcase, thus allowing the engine to idle smoothly for prolonged periods.

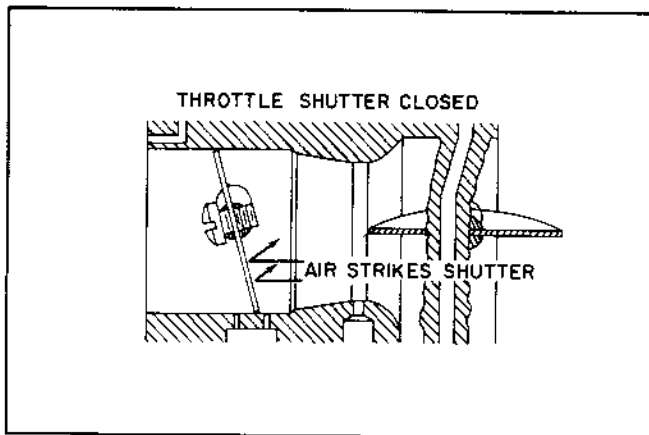


Figure 5-2

- (1) HOW IT WORKS - Air rushing through the air horn strikes the offset throttle shutter, closing the throttle.

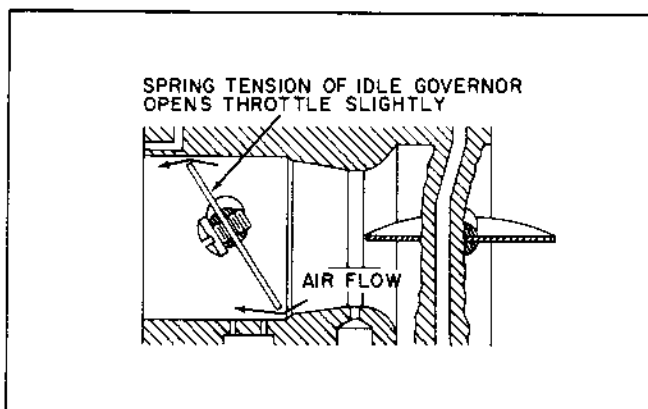


Figure 5-3

The spring tension in the idle governor has a tendency to hold the throttle slightly open. As the closed throttle reduces the air velocity, the spring tension on the throttle shaft overcomes the reduced pressure of the air and reopens the throttle.

2

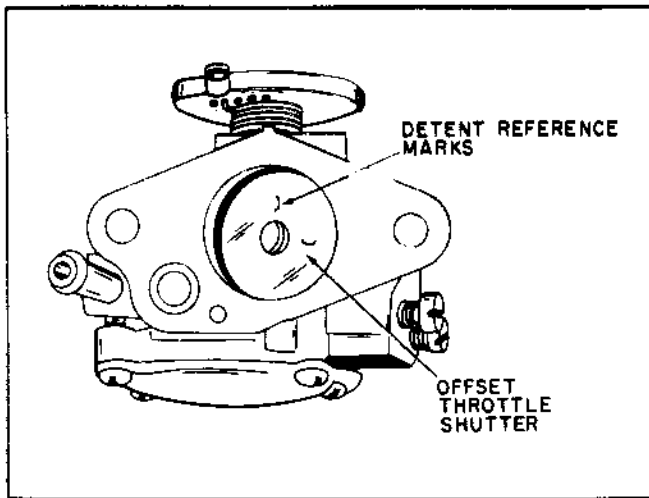


Figure 5-4

- (2) TO SERVICE IDLE GOVERNOR - Note position of throttle shutter. Reference marks on shutter must be positioned as shown in figure 5-4.

Remove shutter fastener and allow shutter to drop out of air horn.

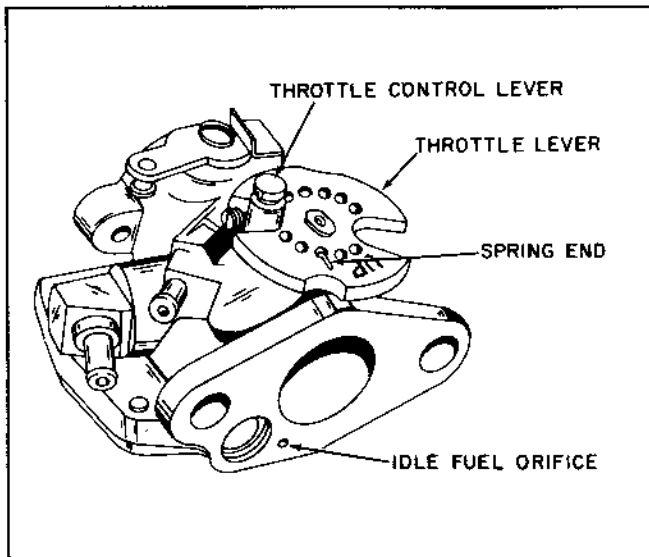


Figure 5-5

Note location of spring end in disc-shaped throttle lever. Spring should be placed into the same hole during reassembly.

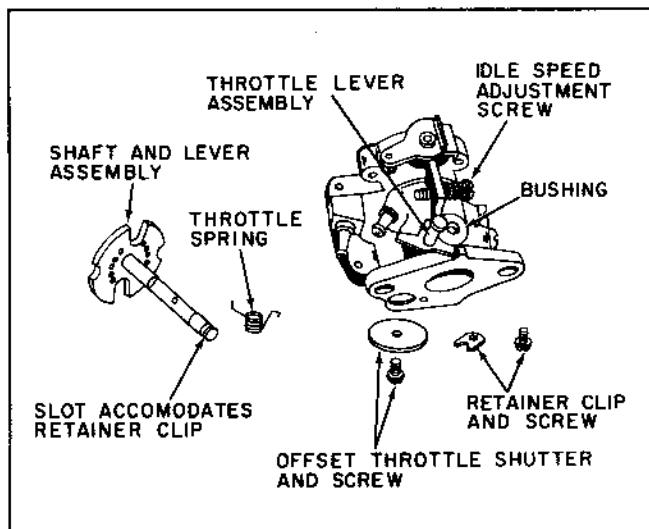


Figure 5-6

Remove retainer clip and lift out throttle shaft.

Replace all worn parts and reassemble in reverse order.

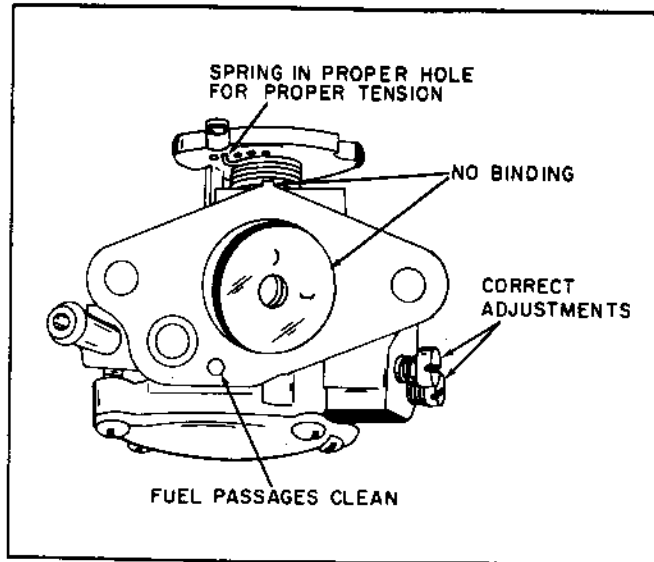


Figure 5-7

(3) TO TROUBLESHOOT IDLE GOVERNOR.

- a. Idle and high speed adjustments must be properly set before attempting to adjust idle governor.
- b. Check for sticking throttle shaft.
- c. Make sure all internal carburetor parts are in good condition.
- d. Idle speed must be between 2500-2900 RPM.
- e. Check throttle spring tension on throttle lever and shaft.
 1. Usually spring end is located in center hole on lever disk.
 2. Too much tension will cause engine to hunt or surge irregularly. Excessive tension will make it impossible to adjust proper idle RPM which will tend to be too high.
 3. Inadequate tension causes a slow reacting governor. Engine will slow down noticeably before throttle will reopen.

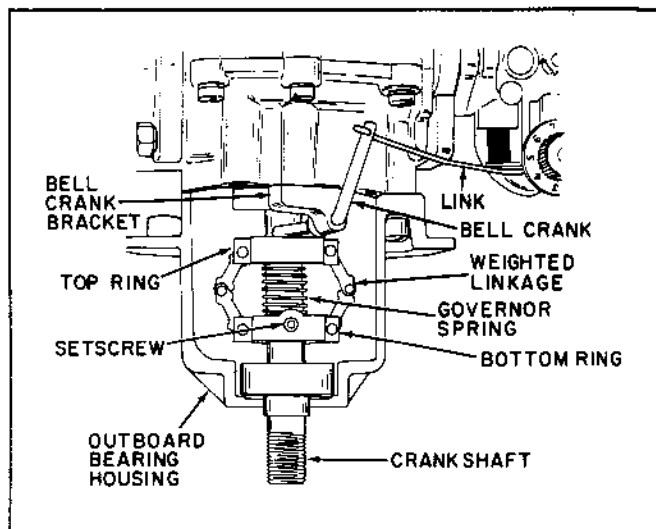


Figure 5-8. Power Take-Off End Mounted Governor

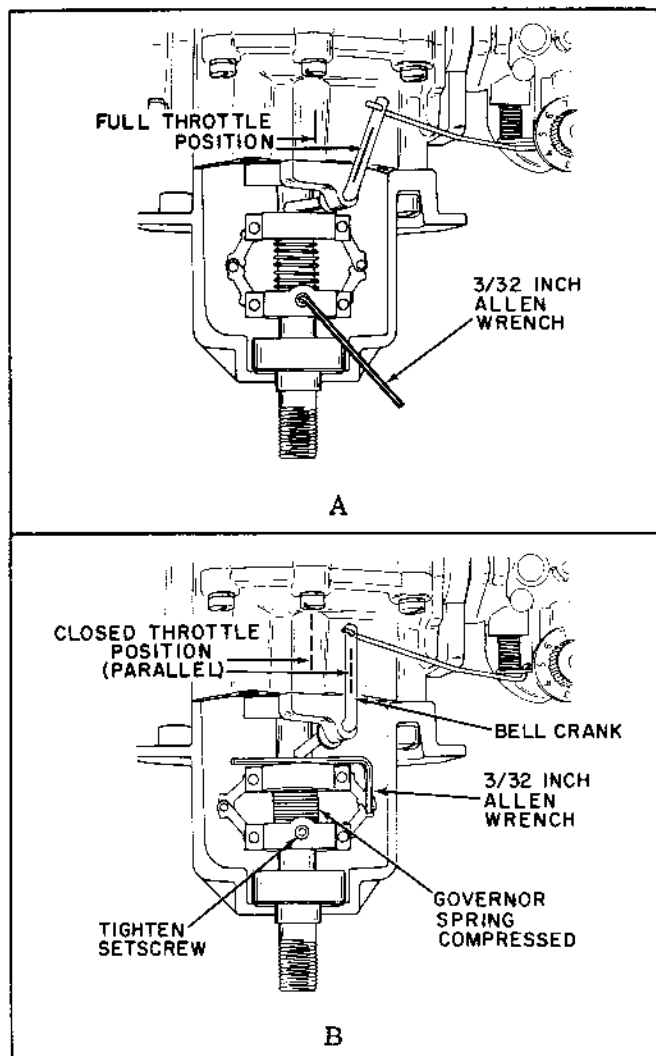


Figure 5-9. Governor Adjustment

B. ADJUSTING POWER TAKE-OFF END GOVERNORS (2-Cycle Engines)

(1) The governor assembly consists of two rings (Fig. 5-8) a weighted linkage, and the governor spring. The lower ring is secured to the crankshaft, so the governor assembly rotates with the crankshaft. As rotational speed increases, weighted linkages are thrown outward by centrifugal force. The top ring must move toward the bottom ring. The governor bell crank contacting the top ring follows it, permitting the throttle to close, slowing down the engine speed. The centrifugal force decreases, the governor spring moves the top ring upward, overcoming the throttle spring to open the throttle, and maintain a constant operating engine speed. Adjust these governors as follows:

- (2) Remove outboard bearing housing. Use a 3/32-inch allen wrench to loosen the set-screw (A, Figure 5-9).
- (3) Squeeze the top and bottom governor rings, fully compressing the governor spring. Hold upper arm of bell crank parallel to crankshaft and insert a 3/32-inch allen wrench as shown in B, Figure 5-9. Slide governor assembly on crankshaft so that allen wrench just touches bell crank, as shown in B, Figure 5-9. Tighten setscrew to secure governor to crankshaft.
- (4) Install bearing adapter, mount engine, and check engine speed with tachometer. At this setting, engine speed should be 3200 to 3400 rpm.

CAUTION

Never attempt to adjust governor by bending bell crank or link.

- (5) If engine speed is not correct, loosen set-screw and adjust position of governor on crankshaft. To increase engine speed, move governor assembly toward crankcase. To decrease engine speed, move governor assembly away from crankcase. Always tighten setscrew securely after adjusting position of governor.

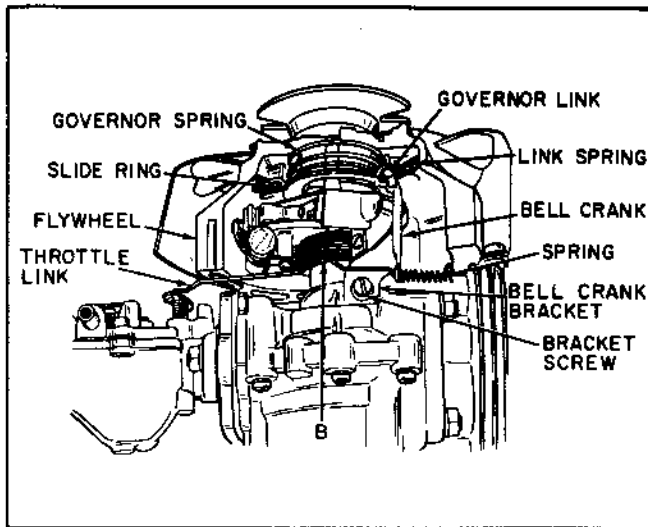


Figure 5-10. Flywheel Mounted Governor Assembly

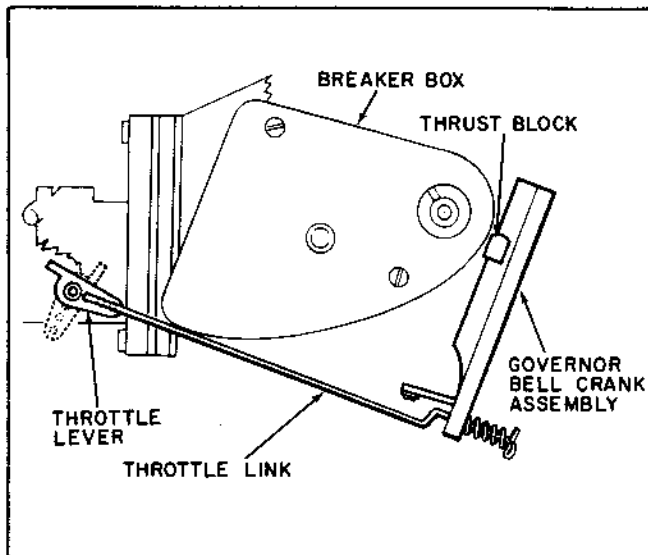


Figure 5-11. Checking Flywheel Mounted Governor Adjustment

C. FLYWHEEL GOVERNORS. THROTTLE CONTROL TYPE.

- (1) A cutaway view of this governor is shown in Figure 5-10. An engine speed increase throws links outward compressing link springs. Links apply a thrust against slide ring, moving it upward and compressing governor spring. As slide ring moves away from thrust block of bell crank assembly, throttle spring causes thrust block to maintain engagement and closes throttle slightly.

As throttle closes, engine speed decreases; force on slide ring decreases so it moves downward pivoting bell crank out to overcome force of throttle spring and open throttle to speed up engine. In this manner, operating speed of engine is stabilized to adjusted governor setting. Adjust flywheel mounted governor as follows:

- (2) Loosen bracket screw and slide governor bell crank assembly toward or away from flywheel. Toward flywheel increases engine speed; away from flywheel decreases engine speed. Tighten screw to secure bracket mounting.
- (3) Install flywheel and check engine speed with tachometer. If engine speed is far off, reposition governor bell crank bracket. Always make primary speed adjustment by adjusting position of bell crank bracket. Close adjustment only should be made by bending throttle link.
- (4) Make minor speed adjustments by bending throttle link at point B in Figure 5-10. Bending link increases speed. Always remove throttle link before bending to prevent distorting bell crank or throttle lever.
- (5) If carburetor is equipped with throttle lever (Fig. 5-11) having more than one hole, place throttle link in hole nearest lever pivot point as shown. When throttle is in the open position, thrust block must clear breaker point box by at least $1/32$ inch but not more than $1/16$ inch. Make sure all parts move freely when thrust block is moved up and down.

CAUTION

Do not lubricate governor assembly or governor bell crank assembly of flywheel mounted governors.

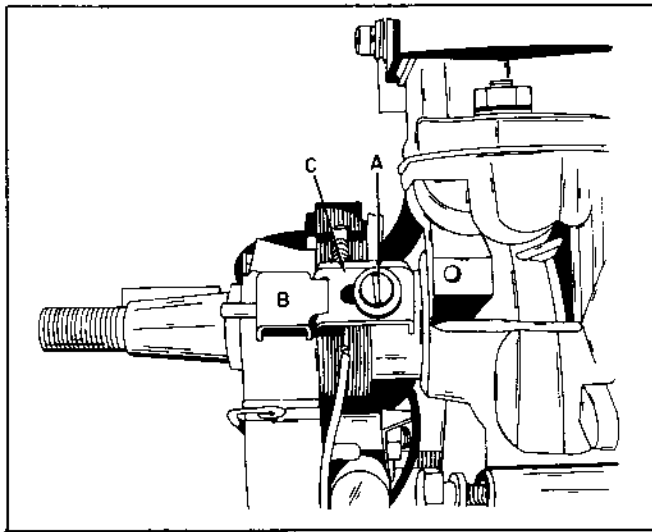


Figure 5-12. Ignition Type Governor

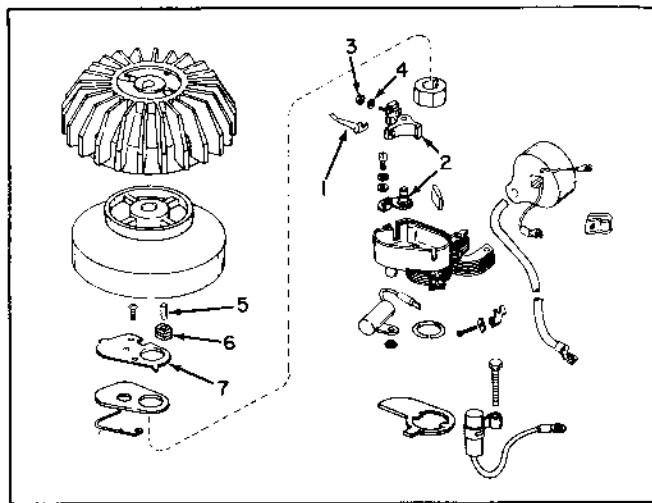


Figure 5-13. Magneto Showing Cut-Out Governor

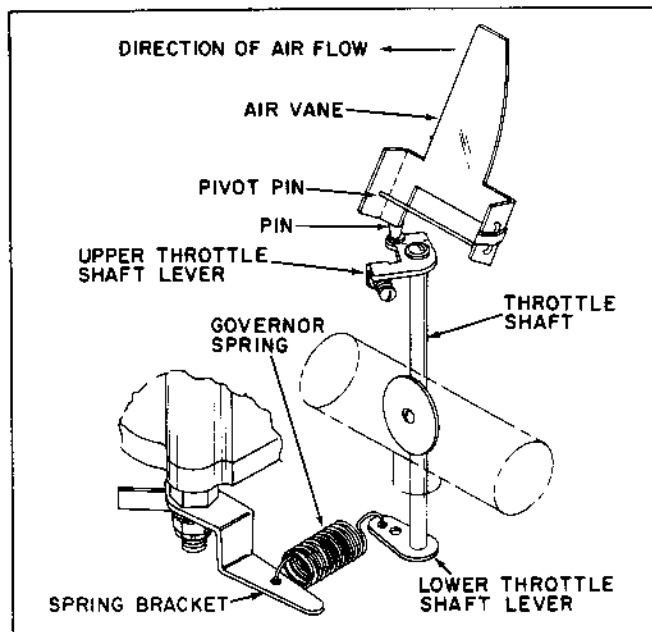


Figure 5-14. Air Vane Governor Operation

C. FLYWHEEL GOVERNORS. THROTTLE CONTROL TYPE (Cont.)

2-CYCLE IGNITION GOVERNOR. The ignition governor shorts out the ignition system when the engine reaches a certain maximum RPM. The factory setting of the Ignition Governor Assembly is 4400 to 5000 RPM. To adjust, loosen screw "A" as shown. Move body bracket "B" toward the magneto flywheel to increase RPM; move body bracket away from the magneto flywheel to decrease RPM. Bracket "C" is attached to the magneto stator. **CAUTION:** Adjustments must not be attempted while engine is running.

2-CYCLE CUT-OUT GOVERNOR. Engines using this device are pre-set to operate between 4500 and 4700 RPM. Do not adjust engines to operate beyond that speed. If a follower (5) is replaced, the spherical end should be against the slide ring. After replacement, if the engine does not come up to proper RPM, remove follower and grind down flat end.

D. AIR VANE GOVERNORS.

(1) **Air Vane Governor Operation.** As the engine speed increases, the air flow rate increases, tending to pivot the air vane against the tension of the governor spring. This movement is transferred to the throttle lever and shaft to partially close the throttle. 2-Cycle - usually a direct connection between vane and lever. As the throttle closes, the fuel flow to the engine is decreased, so engine speed decreases, in turn decreasing the amount of air that is directed against the air vane. The governor spring becomes controlling and pivots the air vane toward the fan. This movement is transferred to the throttle lever to open the throttle increasing the fuel flow to the engine. As fuel flow increases, engine speed increases. In this manner, engine speed is stabilized, and engine maintains a constant speed regardless of engine load.

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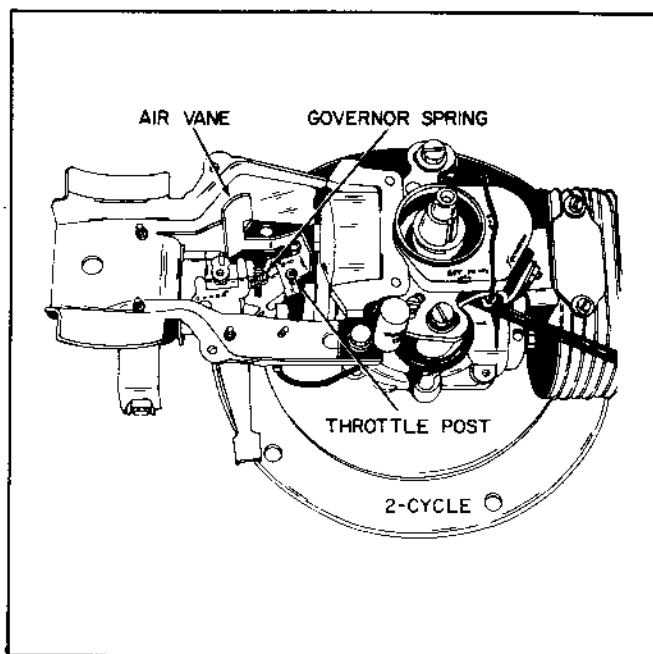


Figure 5-15. Air Vane Governor Assembly

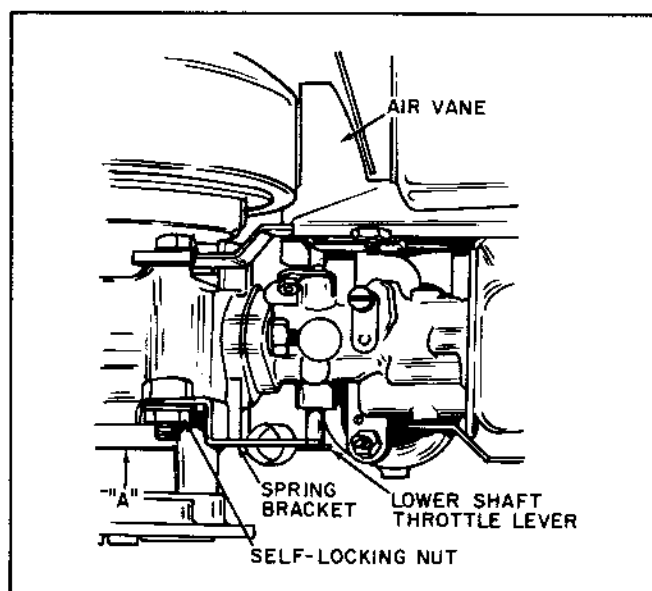


Figure 5-16. Air Vane Governor Adjustment

(2) 2-Cycle Air Vane Governors

- a. Loosen self-locking nut (Fig. 5-16) that holds governor spring bracket to engine crankcase.
- b. Adjust spring bracket to increase or decrease governor spring tension. Increasing spring tension increases speed. Decreasing spring tension decreases speed.
- c. After adjustment, the spring bracket should not be closer than $1/16$ inch to crankcase at point A in Figure 5-16.
- d. Tighten self-locking nut and check speed with a tachometer. Readjust speed as required by adjusting position of spring bracket.

SECTION 6. CARBURETOR CONTROL LINKAGE

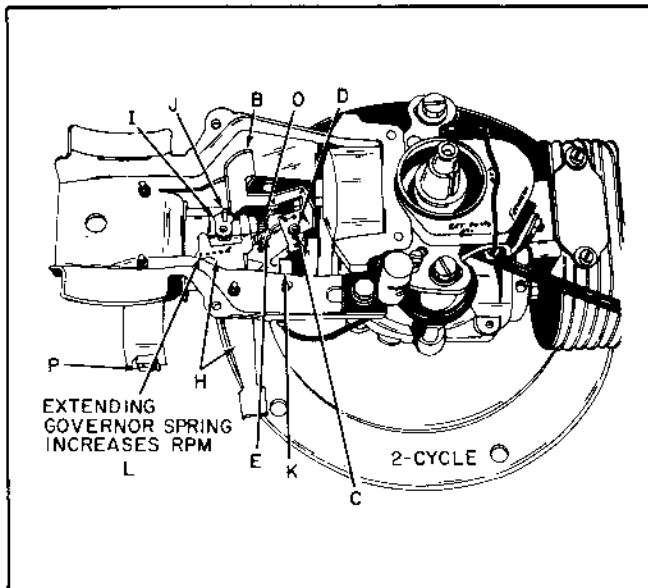


Figure 6-1

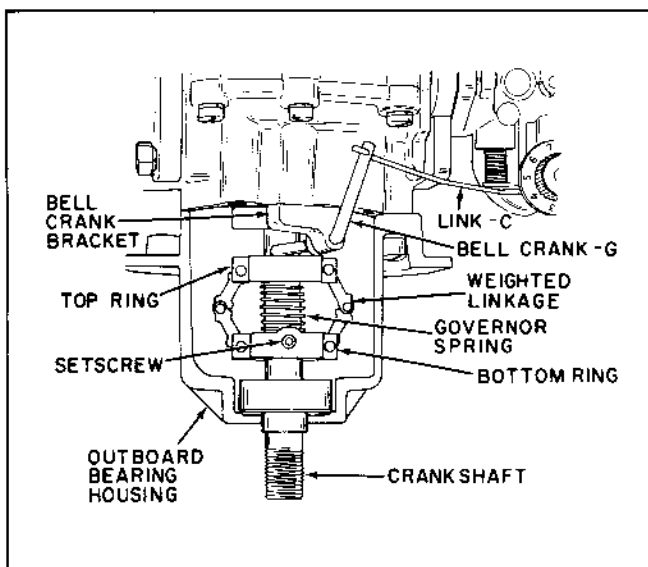


Figure 6-2. Power Take-Off End Mounted Governor

A. GENERAL. Use the following text both (1) to explain the purpose or function of the different carburetor parts and (2) as a key to the accompanying illustrations.

Note that, although, the various linkage systems can assume very dissimilar appearing set-ups, the common numbering system can apply to all, at least insofar as items within the illustration can be identified.

Use the text and the illustration to determine the system being worked upon, and practice any service notes shown.

To elaborate, the governor lever Paragraph B will be referred to in all illustrations as B, solid linkage Paragraph C as C, throttle lever Paragraph D as D.

B. GOVERNOR LEVER (Governor in Case of Air Vane Type). This lever attaches to the governor rod and rotates with the rod in response to governor action. The governor action in turn is affected by engine R.P.M., and governor spring pressure.

C. SOLID LINKAGE. This non-adjustable link always attaches the governor lever to the throttle lever. Therefore, any movement of the governor lever produces a corresponding movement in the throttle lever. This linkage should never be deformed in hopes of helping increase engine efficiency.

D. THROTTLE LEVER. Physically connected to the throttle shaft and shutter so that any rotative movement in the lever causes like movement in the other parts.

E. GOVERNOR SPRING. Connects between the governing system (usually at the governor lever, but can connect to a bend in the solid linkage, and the control system (to the control lever or other spring linkage). Variable tension puts a resistance to movement on the governing system. With no tension, the governor is free to move as soon as a few hundred R.P.M. will cause sufficient force to move the weights (such as while at idle). With full tension, the engine must attain full operating R.P.M. (such as 3600 R.P.M.) for the centrifugal force of the weights to activate the governor mechanism.

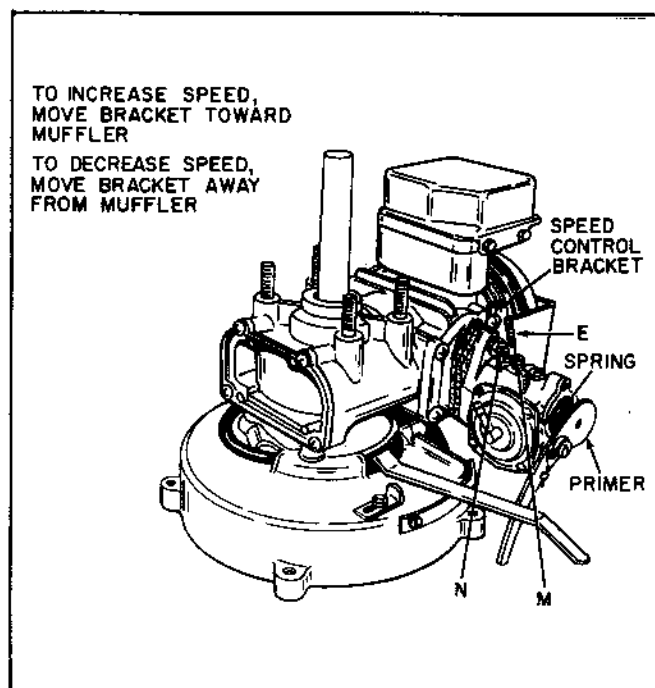


Figure 6-3. 2-Cycle Carburetor Controls

F. GOVERNOR SPRING LINKAGE. Usually connects between the governor spring and control lever when used. In most cases, it (like the solid linkage) should not be deformed. In a few instances, however, it is the means of varying governor spring tension. In such cases, the illustration will be noted.

G. BELLCRANK. It can be considered part of the governor spring linkage. Its particular purpose is to serve as a fulcrum point to change linkage direction and/or ratio of linear movement (movement along a line).

H. CONTROL LEVER. Mounted on a control panel, it is the operator's means of controlling engine speed by varying governor spring tension.

I. CHOKE LEVER. Physically connected to the choke shaft and shutter so that any movement transmitted to the lever also affects shutter position.

J. CHOKE CONTROL LEVER. It can be a manually actuated lever (in which case it could also be the choke lever), or a tang on the control lever, or linkage which positively controls the choke lever.

K. STOP SWITCH. A switch or bare metal leaf spring, insulated from other metal parts and connected to a magneto lead from the points. When the control lever is moved into contact with it, the lever grounds out the points, stopping the engine.

L. ALIGNMENT HOLES. Holes located in various control parts which, when aligned correctly, cause the proper operation between each other.

M. MAIN ADJUSTMENT NEEDLE. A metering screw to regulate the fuel-air mixture entering the air horn for smooth, efficient engine operation.

N. IDLE ADJUSTMENT NEEDLE. A metering device to regulate the pre-mixed fuel-air entering the air horn for smooth engine idling operation.

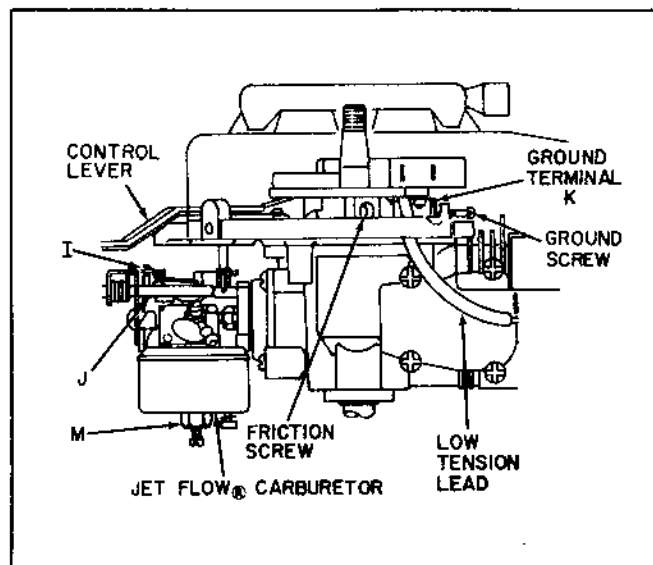


Figure 6-4. Side View of Solid State Equipped Engine

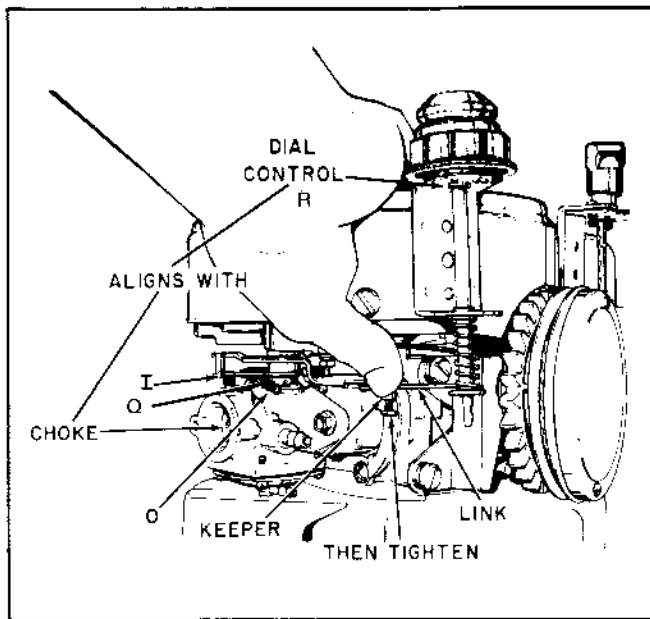


Figure 6-5

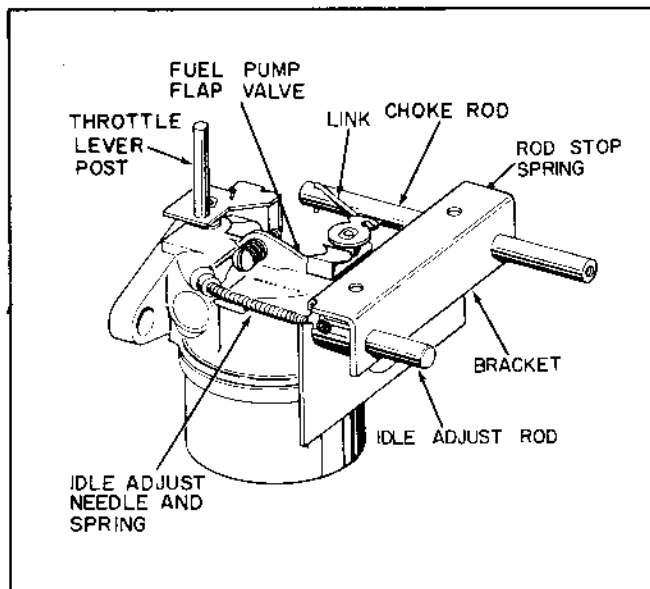


Figure 6-6

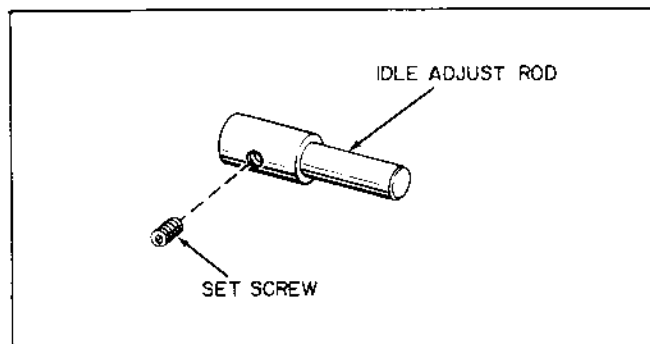


Figure 6-7

O. IDLE SPEED REGULATING SCREW. A screw threaded through a boss on the carburetor body to act as a throttle lever stop, thereby controlling low idling speed.

P. BOWDEN WIRE CLAMP LOCATIONS. Threaded angle brackets which will receive a screw and clamp arrangement to hold the Bowden wire cover in a rigid position for proper operation.

Q. GYRO PAN HEAD SCREW. When servicing the gyro assembly always apply a coating of Loc-tite No. 277 to screw threads and then tighten the lock screw.

NOTE: All control assemblies of this type as found on vertical shaft engines must have Loc-tite applied to the lock screw prior to installing the screw.

R. 2-CYCLE ENGINE DIAL CONTROL.

- (1) Position control in choke slot.
- (2) Loosen lock screw so that link moves within the keeper. Press on the keeper to actuate the linkage closing the choke, then tighten the lock screw.

Check by moving dial to any position so that choke opens completely. Move back to choke to see that choke closes completely. If not, readjust.

S. OUTBOARD CONTROL PANEL.

- (1) Install idle adjustment rod into bracket, then screw setscrew into the rod a few turns.
- (2) Position the choke rod spring extended end on the idle adjustment rod and align the springs with the choke rod holes in the bracket. Press the choke rod through the bracket and spring, with the link attaching hole toward the carburetor side.
- (3) Install the choke shaft link in the rod, then install the other end in the choke lever.
- (4) On the other side, bend the idle adjustment coil into the rod, making sure that the set-screw is down (6 o'clock position).

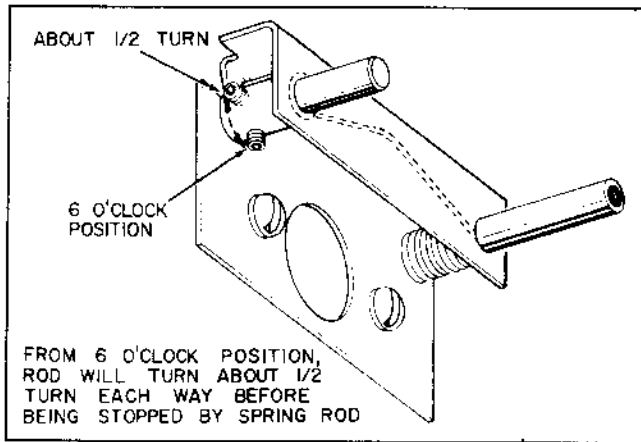


Figure 6-8

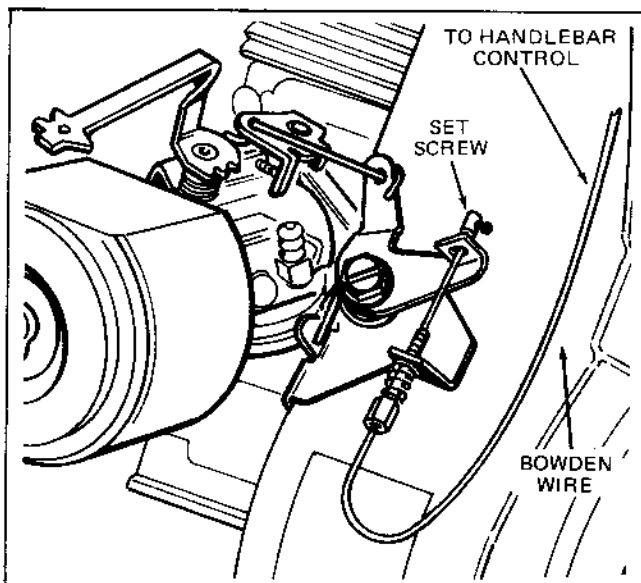


Figure 6-9

- (5) Install the control bracket to the carburetor, but do not tighten screw completely.
- (6) Tighten the setscrew to secure the rod to the coil. The rod should turn each way about half a turn before contacting the choke spring extended end.
- (7) It is important to remember, therefore, that the idle adjustment screw be one full turn from closed and that the rod setscrew be down when connecting the rod and coil.
- (8) Tighten the control bracket screw. Pull the choke rod to see that the choke closes.

T. THROTTLE CONTROL on a model AH8.17 2-cycle engine employed in industrial uses and suitable for mini-bikes, snowmobiles, mini-dune buggies and dune cycles. The control pictured in Figure 6-9 is used currently as a mini-bike control. A bowden wire is run up through the hollow screw with one end attached with a set screw to the control lever. The other end of the bowden wire is attached to the handlebar. When adjusting the wire to the control be sure all the slack is removed before locking the wire in place. There must be tension on the torsion spring so that when the control is released the engine will return to idle. To accomplish this, loosen set screw and turn the handlebar control to the extreme idle position, raise the lever so that it just begins to open the carburetor throttle lever — then tighten the set screw. Check to determine that when handlebar is at the idle position — the engine idles and when handlebar is turned off the idle position it will increase engine speed.

SECTION 7. TECUMSEH CARBURETOR BUILT-IN FUEL PUMP SYSTEMS

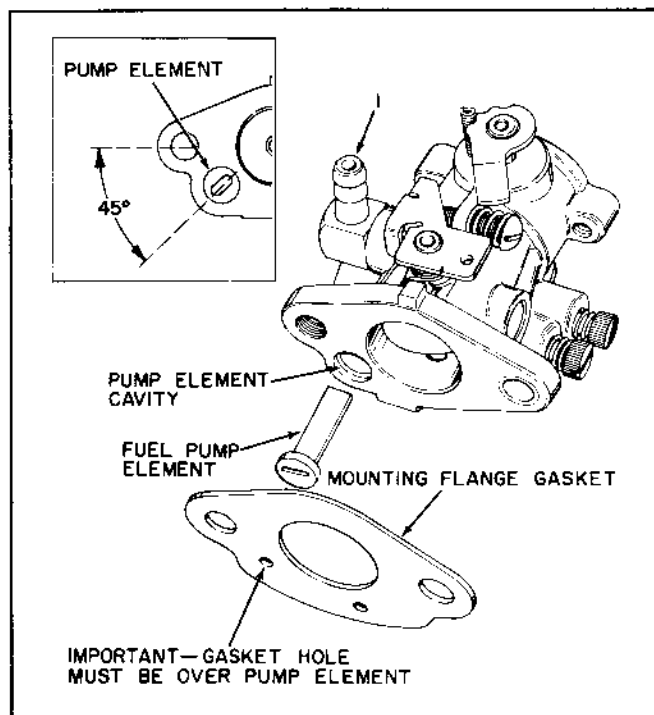


Figure 7-1. Placement of Pump Element in Diaphragm Carburetor

A. GENERAL (Diaphragm Carburetor).

- (1) The Tecumseh diaphragm carburetor, with a built-in fuel pump, is very similar to the original Tecumseh diaphragm carburetor, with the exception of the addition of a Fuel Pumping Element and the two disk valves to control the direction of fuel flow. The pump element is inserted into an opening in the mounting flange end of the carburetor body with the slot opening at a 45° angle. (Figure 7-1). A gasket fits between mounting flange of carburetor and cylinder.

NOTE

Be careful to place hole of gasket directly over pump element.

The hole of gasket must be directly over the pump element to allow the crankcase pulsations to operate the pump element.

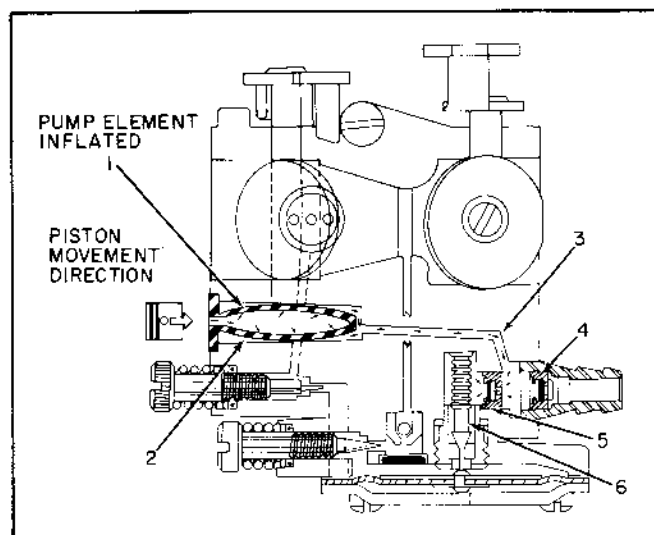


Figure 7-2. Diaphragm Carburetor with Inflated Fuel Pump

NOTE

The following operation refers to Figure 7-2 and 7-3.

- (2) Rapid deflation (1) draws fuel through the passage (3) and inlet fitting check valve (4) into the pump element cavity (2).
- (3) Rapid inflation (1) forces fuel out of the element cavity (2), through the passage (3) and blocks it at the inlet fitting check valve (4). The body check valve (5) opens to allow fuel passage into the carburetor.

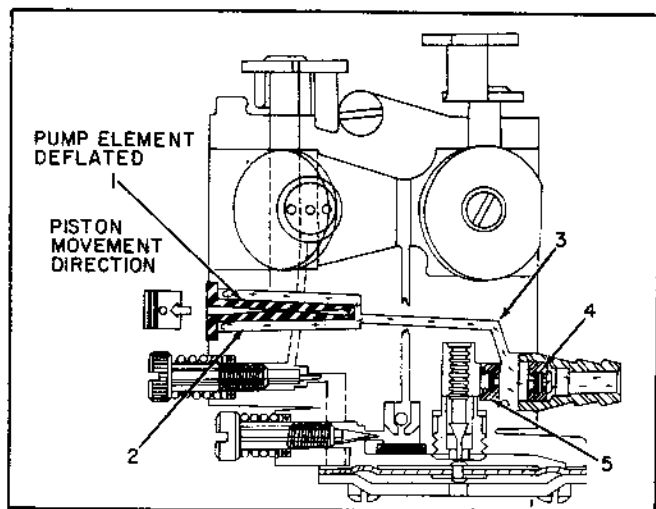


Figure 7-3. Diaphragm Carburetor with Fuel Pump Deflated

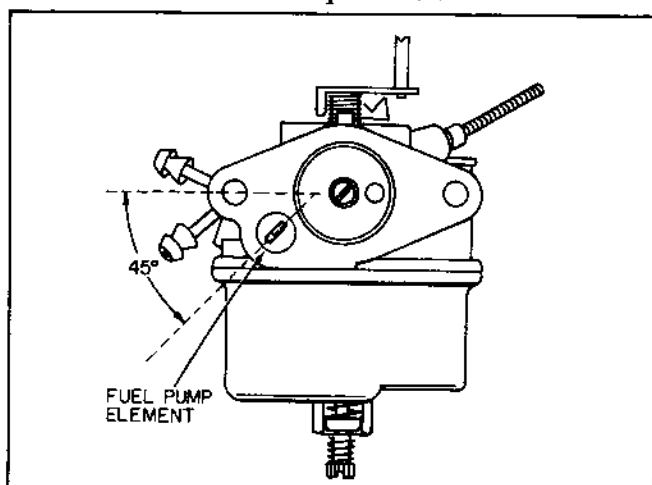


Figure 7-4. Placement of Pump Element in Float Carburetor

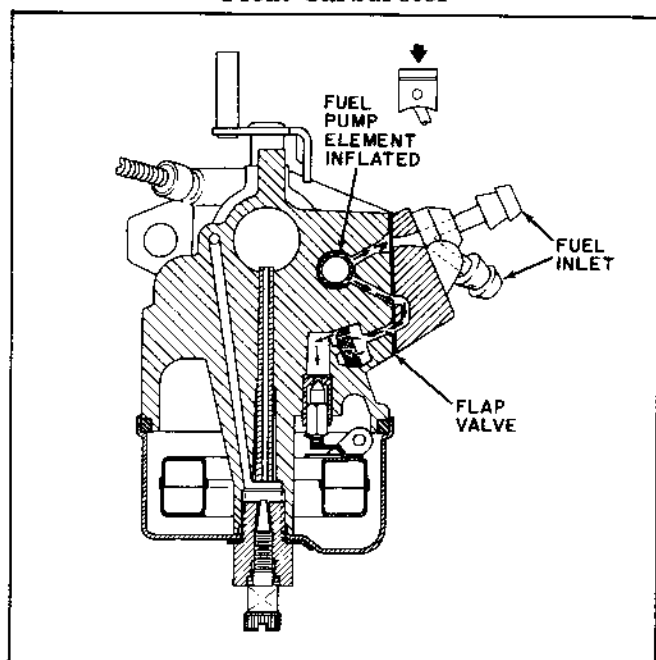


Figure 7-5. Float Carburetor with Inflated Fuel Pump

B. FUEL PUMP SYSTEM SERVICE.

- (1) If the engine is not running properly, make normal idle and high speed screw adjustments.
- (2) Check fuel supply and tank position. Fill with proper, clean fuel.
- (3) Check tank fuel valve for open.
- (4) Check fuel pick-up tube for cracks and flexibility.
- (5) Remove carburetor to check for pulsation passage alignment.
- (6) Check condition of pump element.
- (7) Check for air leaks at gasket surface.

C. GENERAL (Float Carburetor).

- (1) The Tecumseh float carburetor, with a built-in fuel pump, is very similar to the original Tecumseh float carburetor, with the exception of the addition of a Fuel Pumping Element and the two flap valves to control the direction of fuel flow. The pump element is inserted into an opening in the mounting flange end of the carburetor body, with the slot opening at a 45° angle (Figure 7-4). A gasket fits between mounting flange of carburetor and cylinder.

NOTE

Be careful to place hole of gasket directly over pump element.

The hole of gasket must be directly over the pump element to allow the crankcase pulsations to operate the pump element.

- (2) The engine piston, moving out of the crankcase area, creates a partial vacuum which collapses the fuel pump element in the carburetor. On the outside of the element, suction opens the inlet flap allowing a supply of fuel to flow from the tank and lines into the cavity created by the deflating pump element. Suction pulls the outlet flap closed, sealing the outlet port so that fuel isn't pulled from the area of the inlet needle and seat. See Figure 7-5.

Litho in U.S.A.

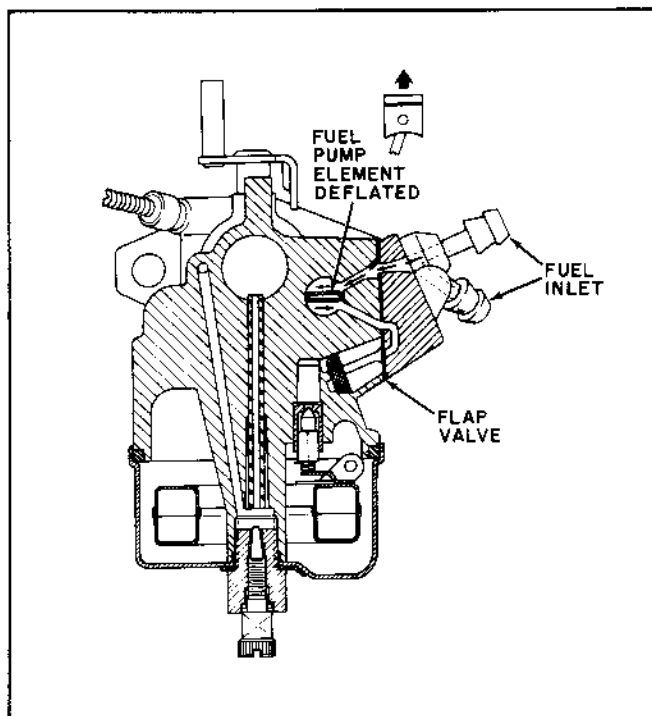


Figure 7-6. Float Carburetor with Fuel Pump Deflated

(3) With the piston downward stroke, crankcase pressure enlarges the pump element forcing fuel out of its cavity. This pressurized fuel acts against the outlet flap valve, opening it, to allow a head of pressurized fuel to be transmitted to the inlet needle and seat port. The inlet valve is pressed against the inlet port, sealing it so that pressurized fuel does not escape back into the fuel tank and lines. See Figure 7-6.

(4) The valve cover assembly contains the inlet tube (two inlet tubes in an outboard engine) from the fuel supply.

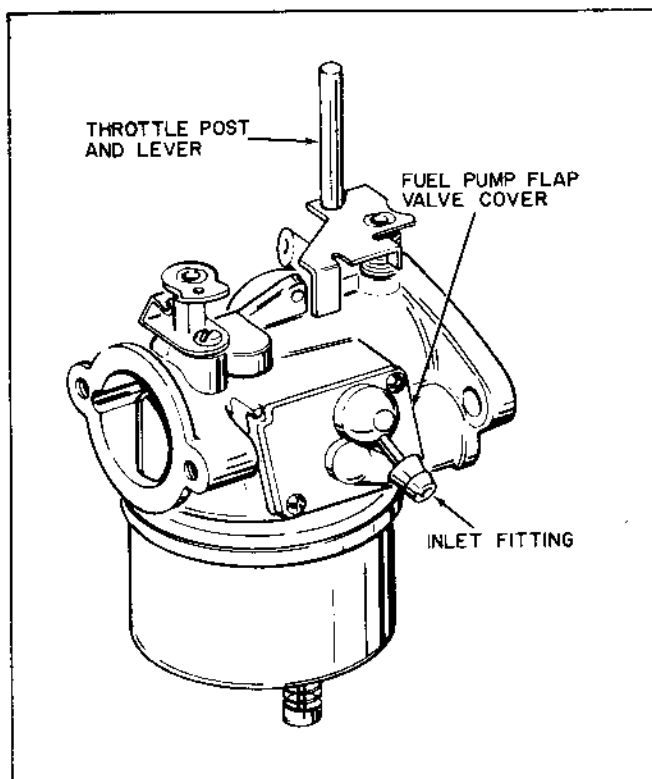


Figure 7-7

(5) a. The flap valve goes between the cover and gasket. See Figure 7-8.

b. Notches on the carburetor body insure that the gasket, valve and cover can only be fit to the body correctly. See Figure 7-8.

c. Cover screw torque is 6-8 in. lbs.

(6) Clean or replace the strainer periodically.

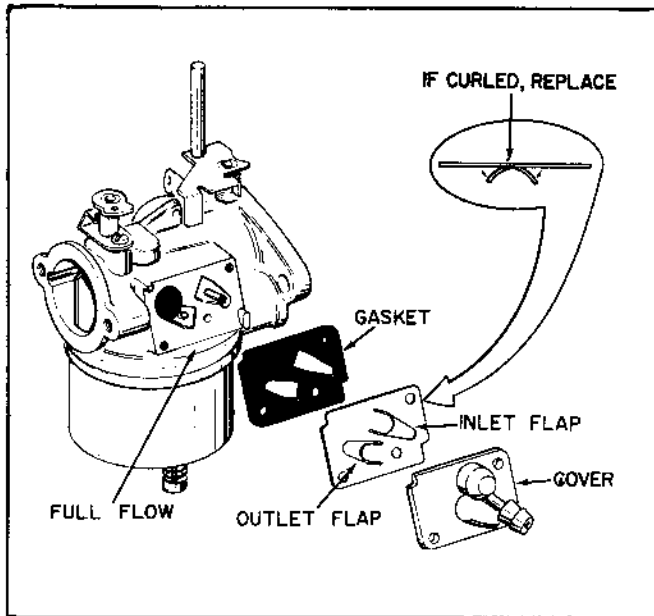


Figure 7-8

D. FUEL PUMP SYSTEM SERVICE (Float Carburetor)

- (1) If the engine is not running properly, make normal idle and high speed screw adjustments.
- (2) Check fuel supply and tank position. Fill with proper, clean fuel.
- (3) Check fuel tank valve and make sure it's open.
- (4) Check fuel pick-up tube for cracks and flexibility.
- (5) Remove carburetor to check for pulsation passage alignment.
- (6) Check condition of pump element.
- (7) Check for air leaks at gasket surface.
- (8) If flaps are curled (Figure 7-8), replace.

CAUTION

Do not use compressed air - check with mouth pressure only.

E. VALVE CHECKS.

- (1) Inlet Fitting Valve. Place short length of fuel line with end cut perfectly flat over fuel pump element cavity (Figure 7-5). Place finger over fuel inlet fitting to close (Figure 7-5). Suck out air through fuel line - valve should close (Figure 7-6). Be sure fuel line is held tightly against the carburetor body. If valve leaks, blow in gently and repeat.
- (2) Carburetor Body Valve. Place short length of fuel line on fuel inlet fitting. Gently suck on tube which should cause valve to close and hold (Figure 7-6). If valve does not hold, blow in gently and repeat sucking action. Replace fuel inlet fitting.

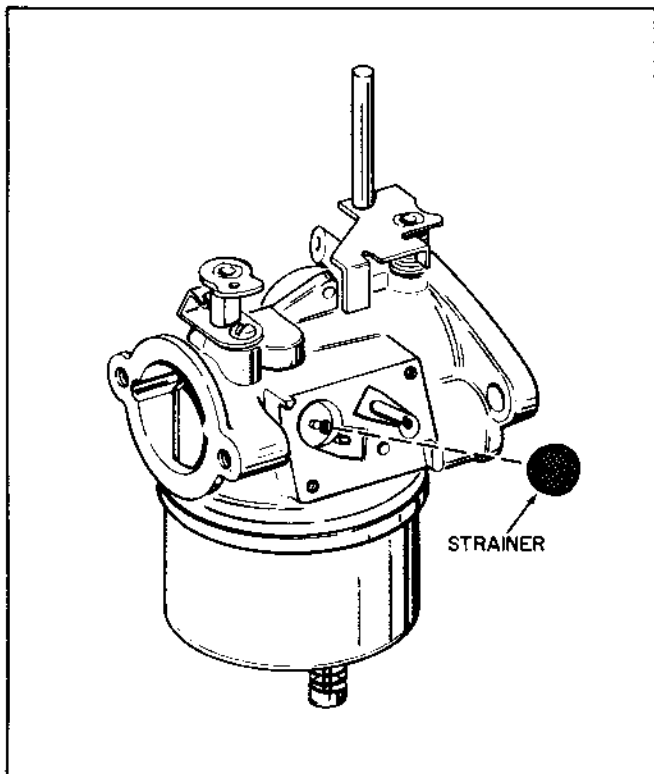


Figure 7-9

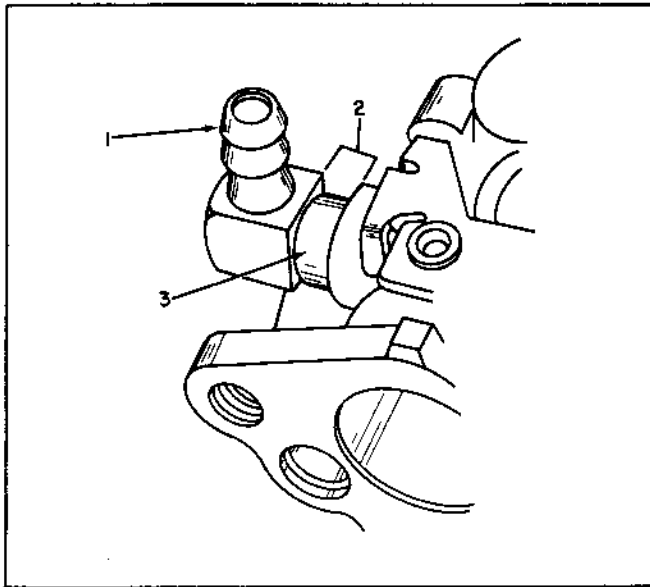


Figure 7-10. Replacing Fuel Inlet Fitting

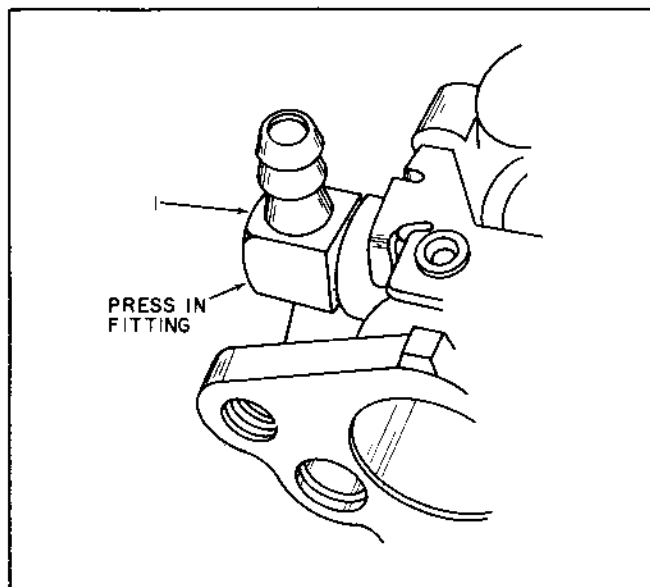


Figure 7-11. Replacing Inlet Fitting

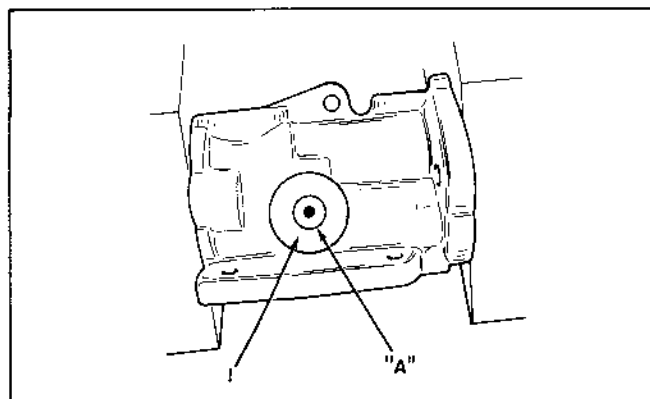


Figure 7-12. Removal of Inside Valve

F. FUEL FLOW VALVE CHECKING.

CAUTION

Do not use compressed air - check with mouth pressure only.

- (1) Inlet Fitting Valve. Place short length of fuel line with end cut perfectly flat over fuel pump element cavity (Fig. 7-1, No. 2). Place finger over fuel inlet fitting to close (Fig. 7-1, No. 1). Suck out air through fuel line - valve should close (Fig. 7-2, No. 5). Be sure fuel line is held tightly against the carburetor body. If valve leaks, blow in gently and repeat.
- (2) Carburetor Body Valve. Place short length of fuel line on fuel inlet fitting (Fig. 7-1, No. 1). Gently suck on tube which should cause valve to close and hold (Fig. 7-2, No. 4). If valve does not hold, blow in gently and repeat sucking action. Replace fuel inlet fitting.

REPLACEMENT

- (1) Inlet Fitting Valve.
 - a. Observe and record the angle of the fuel inlet fitting (No. 1, Fig. 7-10) before removal. Remove the fuel inlet fitting by twisting and pulling. Examine for dirt or leaking.
 - b. To replace the fuel inlet fitting, clean the carburetor body and fuel inlet fitting to remove all gasoline or oils.
 - c. Position the fuel inlet fitting in the carburetor body at the proper angle, but DO NOT press in more than 1/3 into carburetor body. (No. 2, Fig. 7-10).
 - d. Coat portion of exposed fuel inlet fitting shoulder (No. 3, Fig. 7-10) with Lock-tite, Grade "A" and press it until bottomed. (No. 1, Figure 7-11).

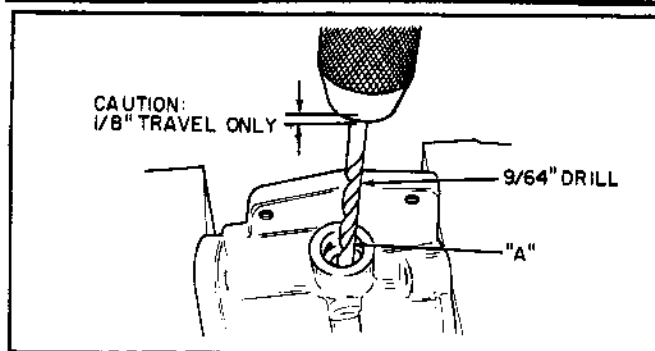


Figure 7-13. Removal of Inside Valve

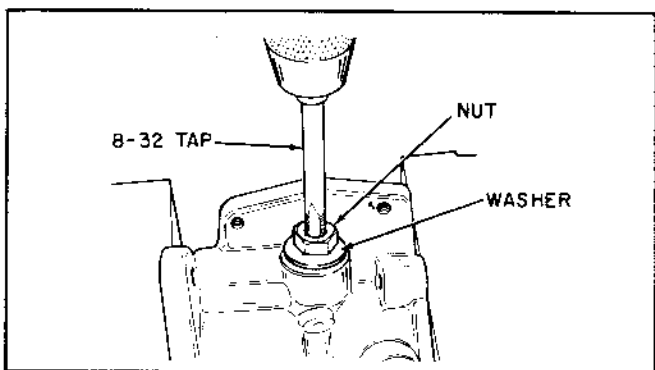


Figure 7-14. Removal of Inside Valve

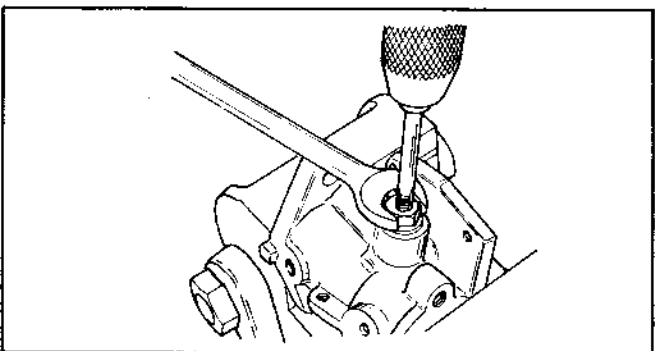


Figure 7-15. Removal of Inside Valve

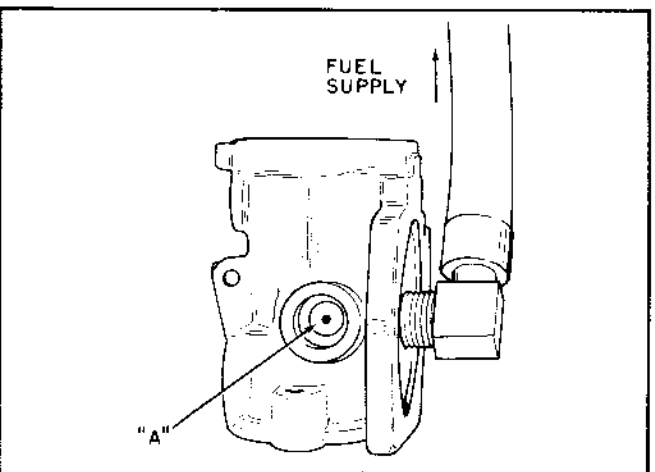


Figure 7-16. Check for Leaking Between the Valve Body and Carburetor Body

(2) Carburetor Body Valve, Figure 7-12 through 7-15.

- a. With $9/64$ " drill enlarge hole "A" in valve. (Fig. 7-12 and 7-13).

CAUTION: Do not allow drill to travel more than $1/8$ " when drilling valve body hole. Care must be taken to prevent drill from bottoming, this would damage carburetor body.

- b. Turn a nut onto an 8-32 tap and slide on a washer. (Fig. 7-14).

- c. Turn the tap, with nut and washer on tap (Fig. 7-14), into valve body until the tap begins to protrude through the valve body when viewed through the inlet needle and seat opening.

- d. Turn nut (Fig. 7-15) clockwise to cause washer to tighten against carburetor body. Continue to turn nut (Fig. 7-15); this will pull the inside valve body out of the carburetor body. Clean carburetor body and blow out with compressed air to remove all chips.

INSTALLATION AND CHECKING

- (a) Install the new valve by placing it in the carburetor body and driving it into position with a $5/16$ " flat-face punch. The valve face should be flush with the surrounding base of the cavity in the carburetor body (Figs. 7-12 and 7-16).

- (b) Check for leaking between the valve body and carburetor body (Fig. 7-16). Screw a NYLON fuel tank fitting into the inlet seat opening, attach a length of fuel line and connect to a fuel supply above the carburetor. Valve should not leak at "A" when fuel supply is above carburetor.

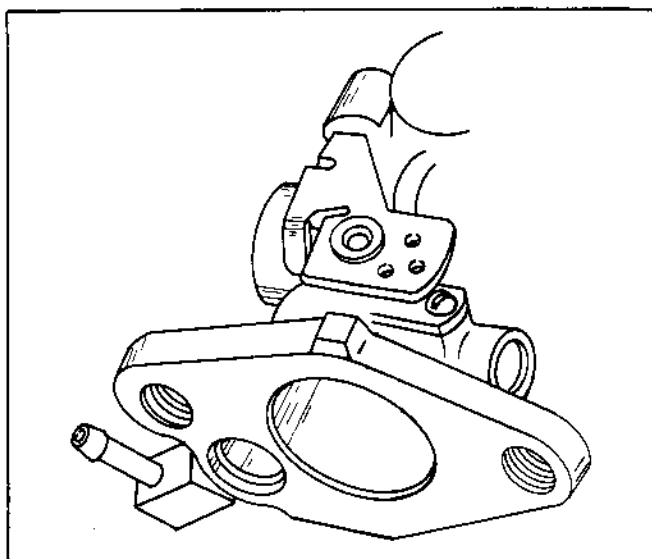


Figure 7-17. Inlet Elbow Location

G. FUEL INLET FITTING ON CARBURETOR MOUNTING FLANGE. The fuel inlet fitting opening on some model diaphragm carburetors enters the fuel cavity area (pump element area) through the mounting flange. The old exterior hole is sealed with a welch plug. The new inlet fitting contains a nylon check ball which allows fuel passage into the carburetor and stops fuel flow in the reverse direction.

Service for this carburetor applies as in Section 7, Paragraphs A through B and Paragraph F for similar parts.

CAUTION: The use of cleaners other than those recommended, may be injurious to some parts; particularly the nylon check ball fitting.

NOTE: Determine pump element is at a 45° angle when installing. See Section 7, Paragraph A.

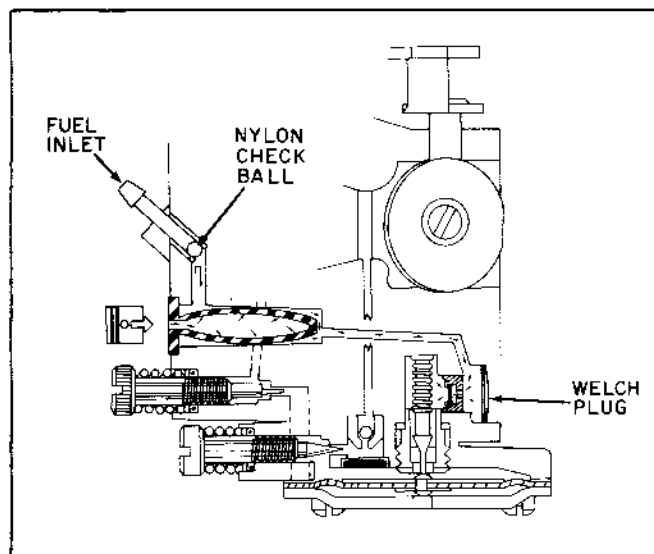


Figure 7-18. Operation Schematic

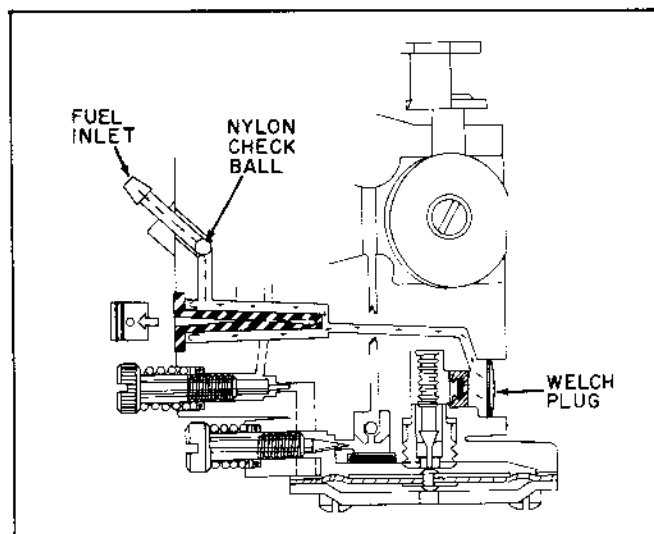


Figure 7-19. Operation Schematic

PART III. STARTERS AND ALTERNATORS

SECTION 1. REWIND (RECOIL) STARTER SERVICE

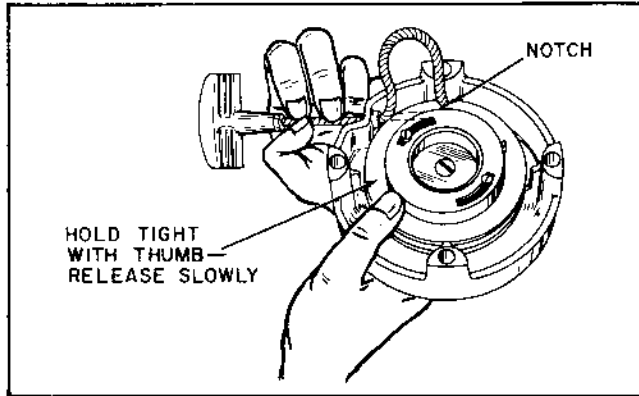


Figure 1-1. Releasing Spring Tension

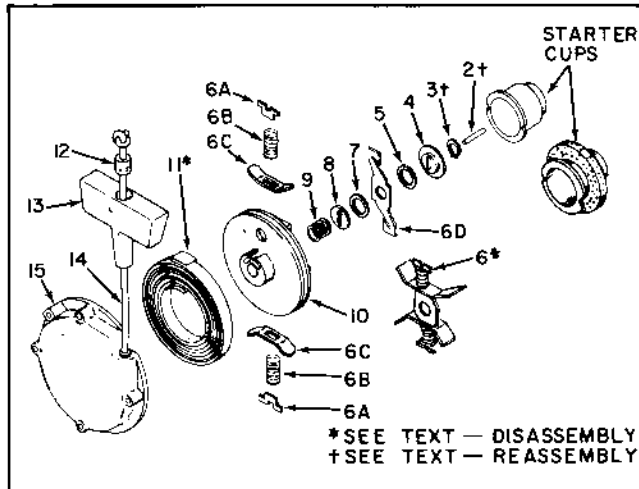


Figure 1-2. Disassembly/Reassembly Sequence

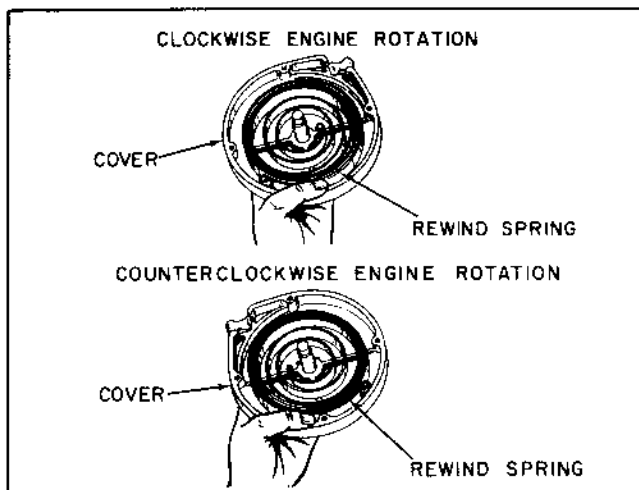


Figure 1-3. Spring Rotation for Clockwise and Counterclockwise Rotating Engines

A. OPERATION.

- (1) Pulling the starter rope rotates the pulley and cams the starter dogs into engagement with the starter hub, providing the energy to turn the engine over. Some starters have the inside of the starter hub notched to receive the dog. On some starters, the inside of the hub is smooth to engage the sharpened edges of the friction shoes.
- (2) Releasing the starter rope on rewind starters, moves the starter dog (or friction shoes) out of mesh with the starter hub. The powerful clock type spring recoils the pulley in reverse direction to rewind the rope.
- (3) The side mount starter, used on low silhouette vertical shaft engines, differs from the rewind starters in that a gear moves along a shaft to engage a flywheel with geared teeth on its outer rim.

B. REWIND STARTER - FRICTION SHOE TYPE.

NOTE

FOR DISASSEMBLY - Follow numbering on Figure 1-2. (*) Numbers are elaborated upon in text. FOR REASSEMBLY - Follow reverse numbering on Figure 1-2. (†) Numbers are elaborated upon in text.

C. DISASSEMBLY.

- (1) Relieve spring tension before disassembly. Hold rotor with thumb after guiding rope in rotor notch then slowly let spring unwind.

(6*) Note position of friction shoes for re-assembly.

(11*) Be cautious when removing or installing spring; be sure it winds in correct direction.

D. ASSEMBLY.

- (3†) Use new retaining ring.
- (2†) Use centering pin where applicable.
- (1) Place rope in rotor notch, then wind about six times. Slowly let recoil wind up rope. Check for proper tension.

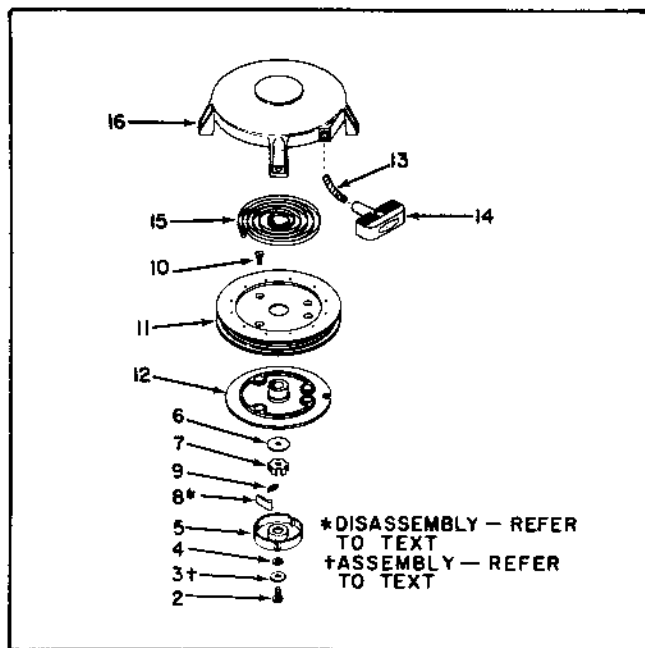


Figure 1-4. Recoil Starter - Dog Type

E. REWIND STARTER - DOG TYPE (590405)

NOTE

DISASSEMBLY - Follow numbering on Figure 1-4. (*) Numbers are elaborated upon in text. ASSEMBLY - Follow reverse numbering on Figure 1-4. (†) Numbers are elaborated upon in text.

F. DISASSEMBLY.

- (1) Relieve spring tension before disassembling. Hold pulley with firmness after guiding rope into pulley notch, then slowly let spring unwind.

(8*) Note position of dog for correct re-assembly.

(15*) Be cautious when removing or installing spring. Be sure it winds in correct direction.

G. ASSEMBLY.

- (3†) Spacer washer must seat between brake washer and brake.

H. REWIND STARTER - DOG TYPE.

NOTE

DISASSEMBLY - Follow numbering on Figure 1-5. (*) Numbers are elaborated upon in text. ASSEMBLY - Follow reverse numbering on Figure 1-5. (†) Numbers are elaborated upon in text.

I. DISASSEMBLY.

- (1) Relieve spring tension before disassembly. Hold pulley firmly with thrust after guiding rope into pulley notch, then slowly let spring unwind.

(13*†) Be cautious when removing or installing spring. Be sure it winds in the correct direction.

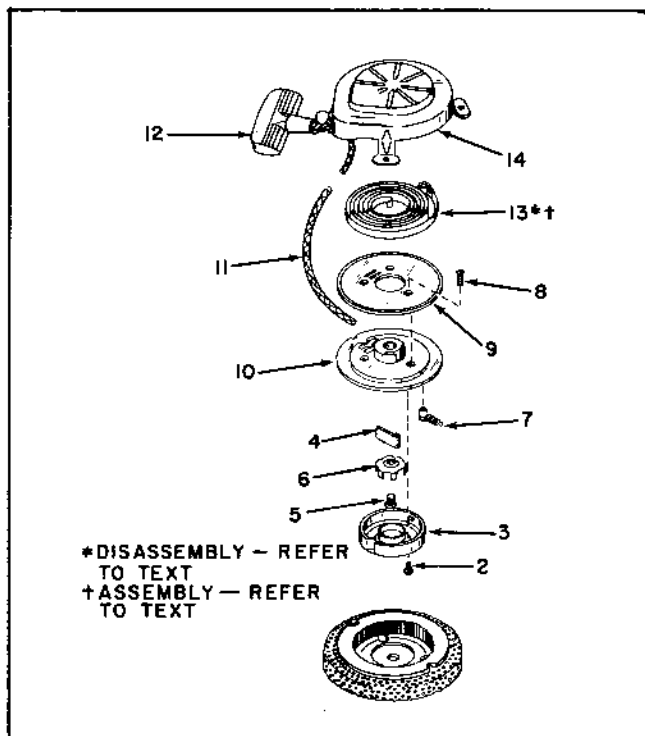


Figure 1-5. Recoil Starter - Dog Type

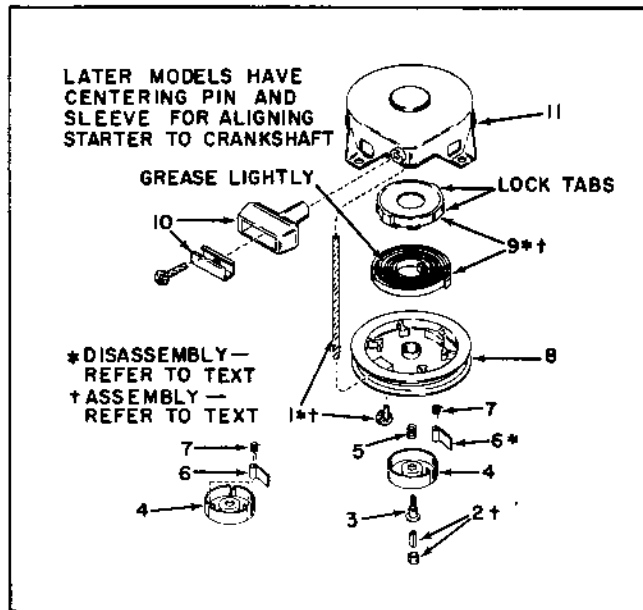


Figure 1-6. Recoil Starter - Dog Type

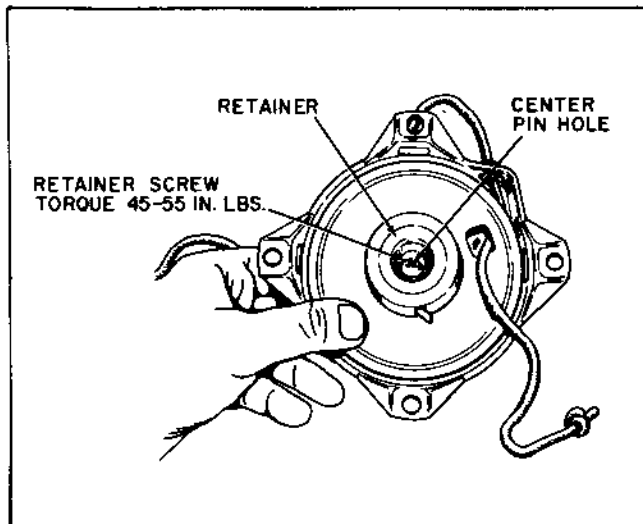


Figure 1-7. Rope Replacement

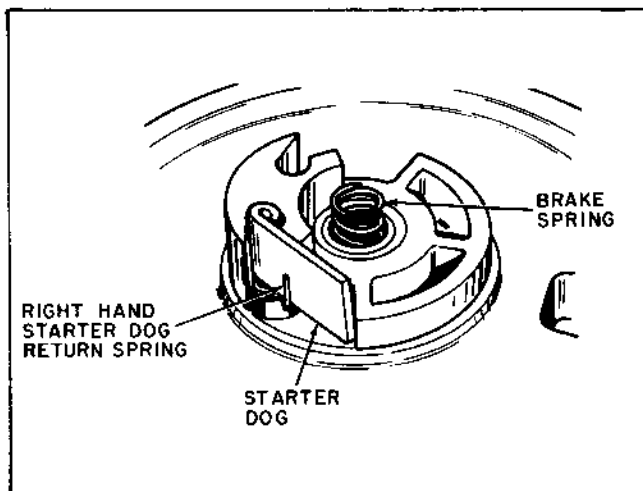


Figure 1-8. Starter Dog Positioning

J. REWIND STARTER - DOG TYPE (SER. No. 590408 and Variations).

NOTE

For DISASSEMBLY - Follow numbering on Figure 1-6. (*) Numbers are elaborated upon in text. For ASSEMBLY - Follow reverse numbering on Figure 1-6. (†) Numbers are elaborated upon in text.

SERVICE

Note position of starter on engine before removal and replace in same position. If starter dogs don't emerge immediately after rope is pulled, tighten retainer screw to 65-75 in. lbs.

K. DISASSEMBLY.

- (1*) Release spring tension before disassembly. Hold pulley with thumb firmly after removing handle and pull rope out of pulley. Ease tension to slowly unwind spring.
- (6*) Note position of dog for correct replacement upon assembly.
- (9*†) Remove and replace spring and keeper as an assembly. Be careful not to yank spring. Replace in correct position.
- (2†) If centering pin is used, be sure to align with crankshaft.

L. ASSEMBLY.

- (1†) To put tension on spring, wind until tight, then allow to unwind until hole in pulley for rope lines up with hole in housing, then reinstall rope and handle.

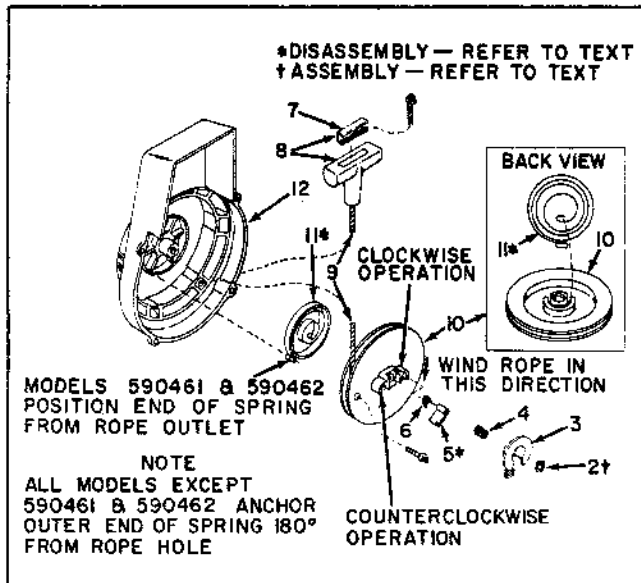


Figure 1-9. Recoil Starter - (Service No. 590461 or 590331B and variations)

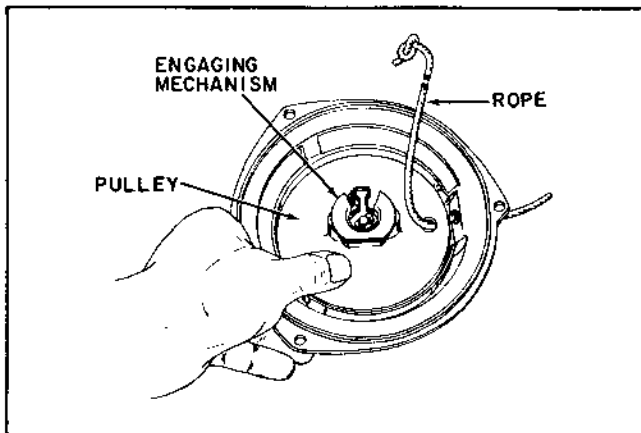


Figure 1-10. Rope Replacement

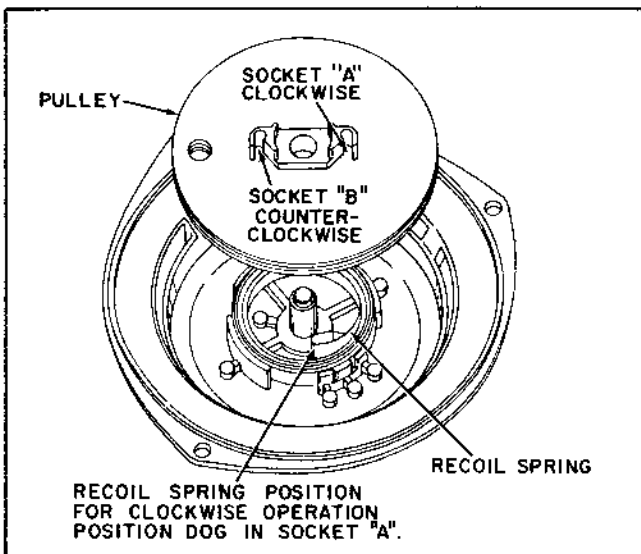


Figure 1-11. Determining Correct Assembly of Parts to Match Rotation

M. REWIND STARTER (Service No. 590461 or 590331B and variations).

NOTE

FOR DISASSEMBLY - Follow numbering on Figure 1-9. (*) Numbers are elaborated upon in text. FOR ASSEMBLY - Follow reverse numbering on Figure 1-9. (†) Numbers are elaborated upon in text.

N. DISASSEMBLY.

- (1) Relieve spring tension. Untie rope at handle and pull through pulley while holding pulley firmly with thumb. Slowly allow pulley to slip and unwind.
- (5*) Note location of dog. Mark if necessary for proper reassembly.
- (11*†) Remove and replace spring and keeper as an assembly. Be careful not to yank spring. Replace in correct position.

WARNING

PERSONAL INJURY CAN RESULT FROM IMPROPER HANDLING OR DISCARDED SPRING AND KEEPER ASSEMBLY. DESENSITIZE, IF POSSIBLE BY HEATING.

O. ASSEMBLY.

- (2†) Check used retaining rings carefully for spring action. If ring seems sprung, replace.

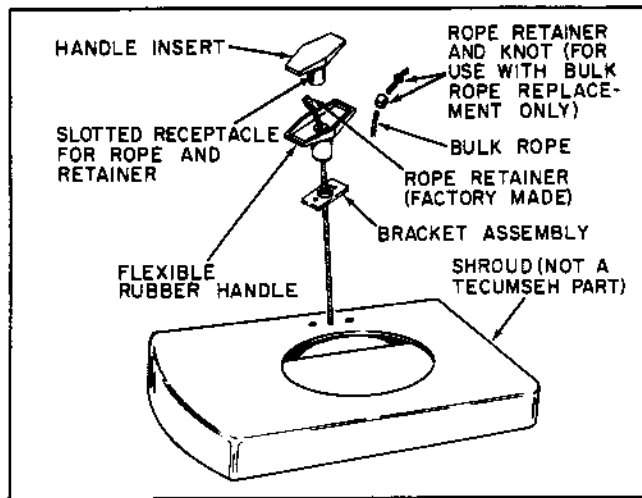


Figure 1-12

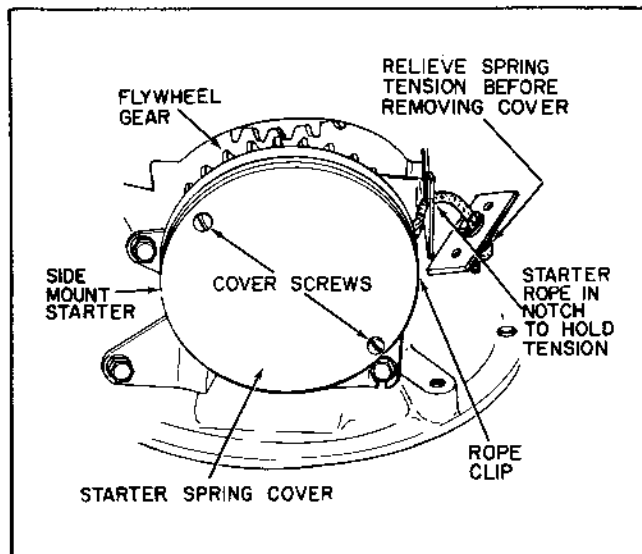


Figure 1-13

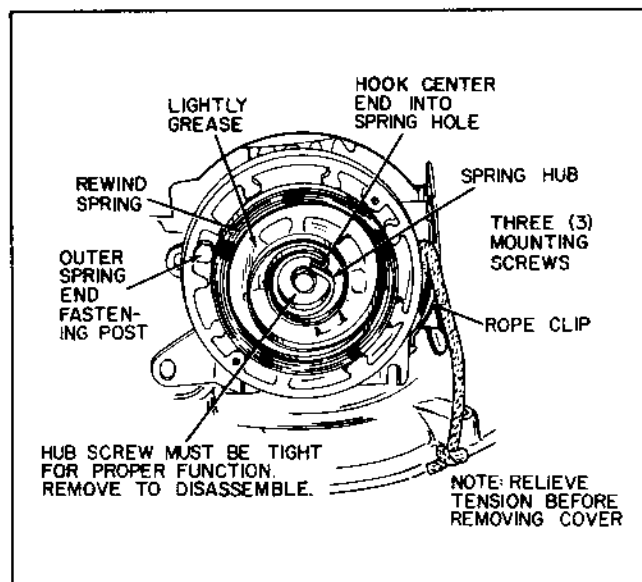


Figure 1-14

P. THE SIDE MOUNTED STARTER - The essential difference between starter versions is the mounting brackets and mounting hole locations. The two versions of the Brake Spring are interchangeable. See Fig. 1-16 for a comparison.

CAUTION

On engines equipped with a side mount starter, do not start the engine without a blade. Kick back can occur and cause serious damage to the engine. See Service Letter, Section B, Page 33.

Q. DISASSEMBLY.

- (1) Remove handle (Figure 1-12). Relieve spring tension by allowing starter spring cover to slide slowly through fingers as rope end slips past rope clip. See Figures 1-12 and 1-13. Complete removal of the starter is not always necessary if it is easily accessible. It may be necessary to remove the shrouding provided by the mower manufacturer. See Figure 1-12.
- (2) Remove the starter spring cover by loosening the two (2) small screws. Figure 1-13. This exposes the rewind spring which can easily be replaced at this point if necessary. **CAUTION: ALWAYS REMOVE SPRING TENSION BEFORE REMOVING COVER.**
- (3) A temporary spring retainer makes easy spring replacement. After removing old spring, reinsert replacement spring in the same relative position. Lay spring and retainer over pulley spring receptacle and push spring out of the retainer into position. Discard the retainer.
- (4) To further disassemble starter, remove the center hub screw and spring hub. This will allow the pulley and gear to be removed as an assembly. See Figure 1-14. **NOTE: TO TROUBLE SHOOT COMPLAINT** - Check hub screw to see that it is tight. Looseness causes the spring to unwind, preventing rope retraction.

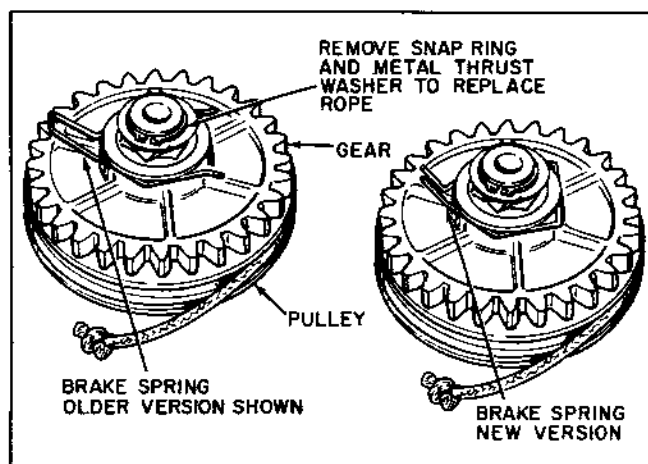


Figure 1-15

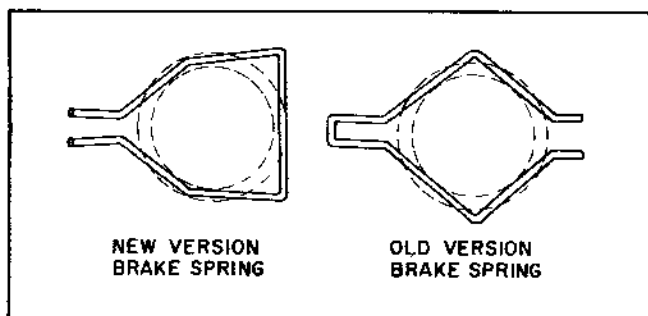


Figure 1-16

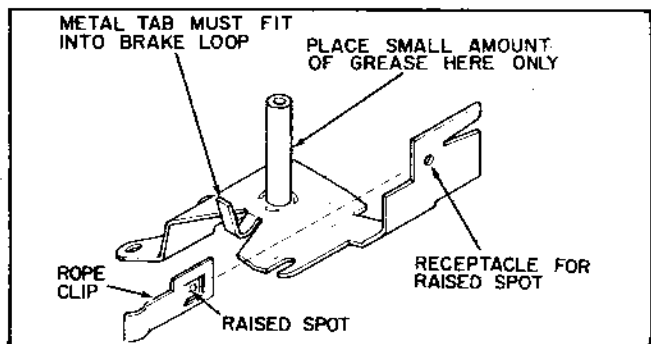


Figure 1-17

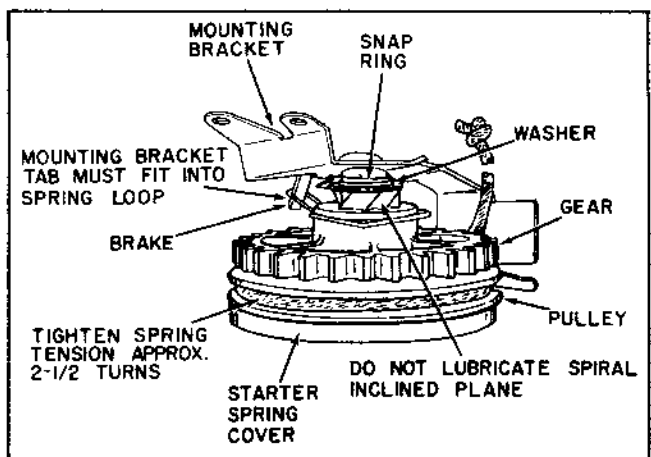


Figure 1-18

R. THE BRAKE SPRING - should be removed and replaced if it does not cause immediate gear mesh with the flywheel teeth on the initial pull of the starter rope. Check spring for operative condition, it must cling snugly into groove receptacle provided in the gear. Figure 1-15. The GEAR and PULLEY is disassembled by removing the snap ring on the brake and gear side of the pulley. Note location of steel washer. Figure 1-15 and 1-18. The gear can now be replaced and the rope end is easily accessible at this point.

S. ROPE REMOVAL - Remove knotted end from pulley receptacle and cut off knot. This will allow the rope to be removed. Remove handle as outlined in appropriate paragraph and figure 1-12.

Reinstall new rope into pulley. Insert end opposite small metal retainer and tie knot. Feed knot into recessed receptacle in pulley and reassemble starter.

T. REASSEMBLY.

- (1) Reassemble starter in the reverse procedure for disassembly. Points to note are: Rope length and diameter must be equal to that which was factory installed, 5/32 diameter, length to be measured.
- (2) Rope clip must fit tightly onto mounting bracket. Small raised spot must fit into hole provided in bracket. Figure 1-14 and 1-17.
- (3) Lubricate with light grease at only two points, the center shaft and the edges of the rewind spring. See Figure 1-14 and 1-17.
- (4) Do not lubricate the exposed spiral inclined plane or brake spring groove as dirt will cling to these points and cause premature wear. Figure 1-18. Insert mounting bracket tab into loop of brake spring or starter gear will not engage. Figure 1-17 and 1-18.
- (5) Tighten hub screw securely or slippage will result in that the spring cannot return the rope into pulley. See Figure 1-14.

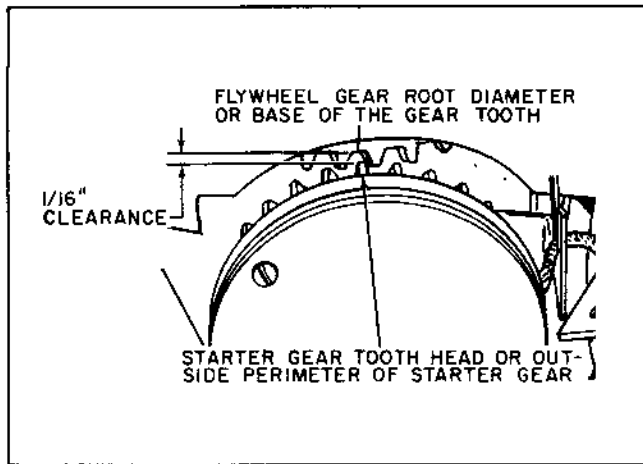


Figure 1-19

U. SIDE STARTER MOUNTING - When mounting starter, adjust STARTER gear tooth head so that it is located no closer than 1/16" from the base of the FLYWHEEL gear tooth. The mounting brackets mounting holes are elongated to allow for this adjustment. See Figure 1-18 and 1-19.

V. IMPORTANT - The gear tooth distance must be carefully adjusted. Adjustment too close can cause the gear to bind and "Hang Up" on flywheel after the engine starts, thus spinning the starter into total destruction. Remove the spark plug wire and then test starter for binding so the engine can't destroy the starter.

CAUTION: Do not attempt to start engine without the blade mounted or a similar substitute. Damage can occur to starter gear and possibly injury to the operator.

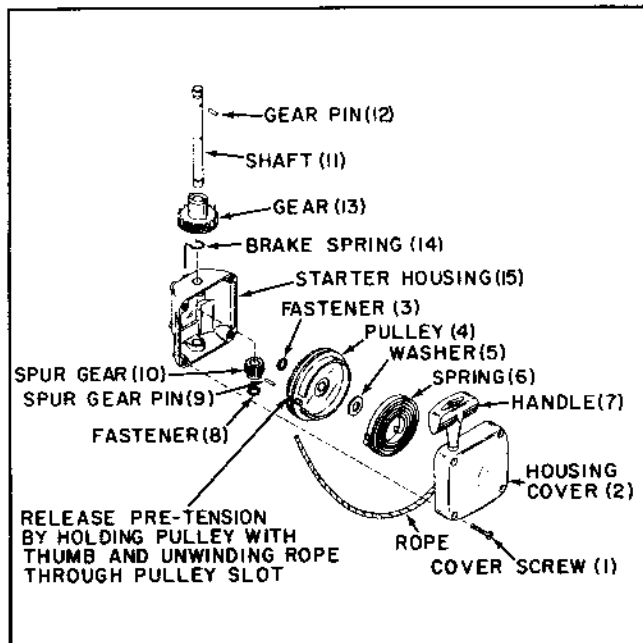


Figure 1-20. Side Mount Starter

W. SIDE MOUNT STARTER - Be sure tension is relieved from spring before disassembly.

NOTE

DISASSEMBLY - Follow numbering on illustration. ASSEMBLY - Follow reverse numbering on illustration.

X. REWIND STARTER - Dog Type Sno-Proof (No. 590473).

Note position of starter on engine before removal and replace in same position.

NOTE

FOR DISASSEMBLY - Follow numbering on Figure 1-21. FOR ASSEMBLY - Follow reverse numbering on Figure 1-21. (*†) Numbers are elaborated upon in text.

Y. DISASSEMBLY.

- (1*) Release spring tension before disassembly. Hold pulley with thumb firmly after removing handle and pull rope out of pulley. Ease tension to slowly unwind spring.
- (11*) Remove spring and keeper as an assembly. Be careful not to yank spring.

Z. ASSEMBLY.

- (11†) Install spring and keeper as an assembly. Be careful not to yank spring. Replace in correct position.
- (9†) Install dog spring and dog (8†) in pulley insuring spring is positioned to hold dog against hub of pulley. Secure dog retainer (7†) with retainer screw (6†) to pulley. Torque to 5 to 6 inch lbs.
- (5†) Install brake spring, dog cam (4†) (dish down) and secure to housing with retainer screw (3†). Torque to 65 to 75 inch lbs.
- (1†) Wind pulley about 6 times and hold. Install rope through eyes and attach handle. Ease tension to let spring wind up rope.
- (2†) If centering pin is used, be sure to align with crankshaft.

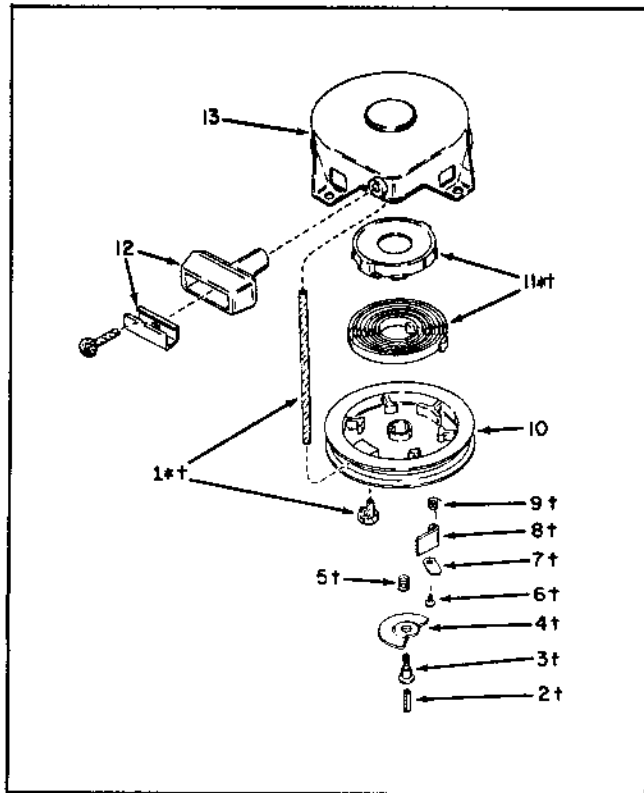


Figure 1-21

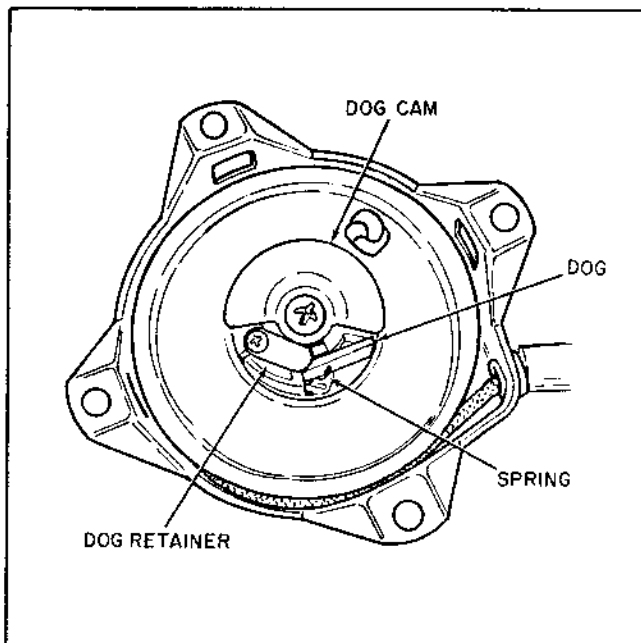


Figure 1-22

SECTION 2. WIND-UP STARTERS

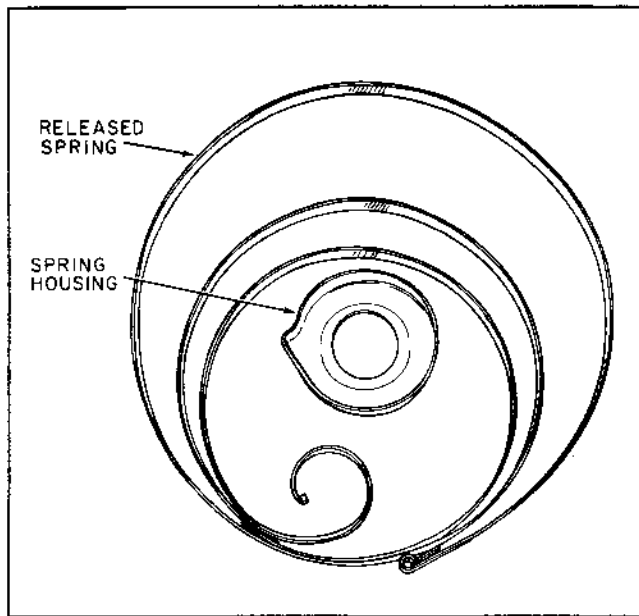


Figure 2-1

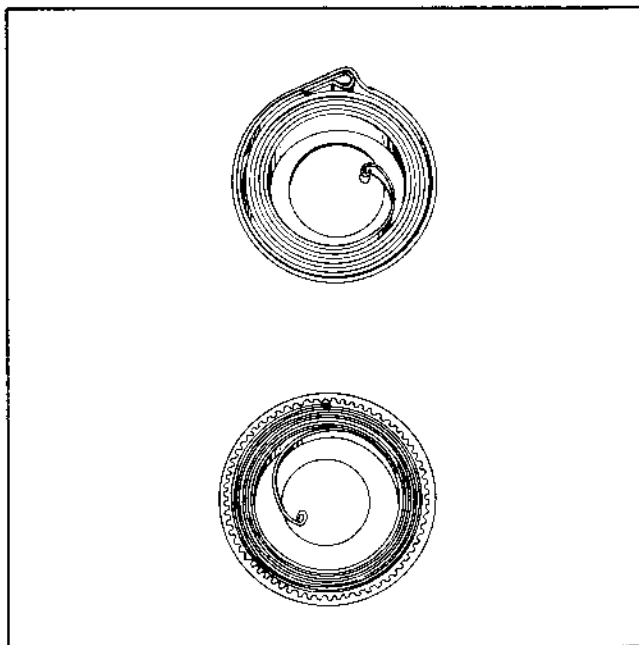


Figure 2-2

A. OPERATION. Wind-up starters are referred to as: self-starters, impulse starters, speedy starters, ratchet starters, or by various other names. The wind-up starters use a ratchet and pawl (dog) mechanism to wind-up and hold the latent force of a powerful spring. Upon release, the unwinding spring overcomes inertia, compression and friction to start the engine. The ratchet is rotated directly or through gearing by a wind up handle and release is possible through a number of ways as shown in the preceding pages.

All wind-up starter springs must be handled with extreme caution to prevent destructive or injurious release from the spring retainer. Although care is often exercised during removal and replacement, it should be understood that discarded springs or stored springs can be accidentally snagged and unsprung by anyone, anytime. For this reason, it is a good idea to have a definite desensitizing procedure for discarded springs and a positive procedure for stored or shelved spring and retainer assemblies.

Use strong wire to secure the spring in retainer so that accidental dropping or snagging won't release the spring.

For discarded assemblies, if safely possible, the best solution is to uncoil the spring from the retainer using all precautions to prevent injury. Using a blow torch to heat the spring red hot at several areas around the retainer will desensitize its spring action considerably.

B. WIND-UP STARTERS.

- (1) (Winter Operation). If unit has been stored in temperatures less than 25°F. for any length of time between starts, the following starting procedure may be necessary.
- (2) Disengage all parasitic loads such as clutches and belts.
- (3) If starter fails to turn over engine fast enough to start, only remedy is to move unit to area where temperature is at least 25°F.
- (4) If spring tension has failed to turn over engine, re-engage starter and wind handle one cog to prevent spring tension from releasing accidentally.

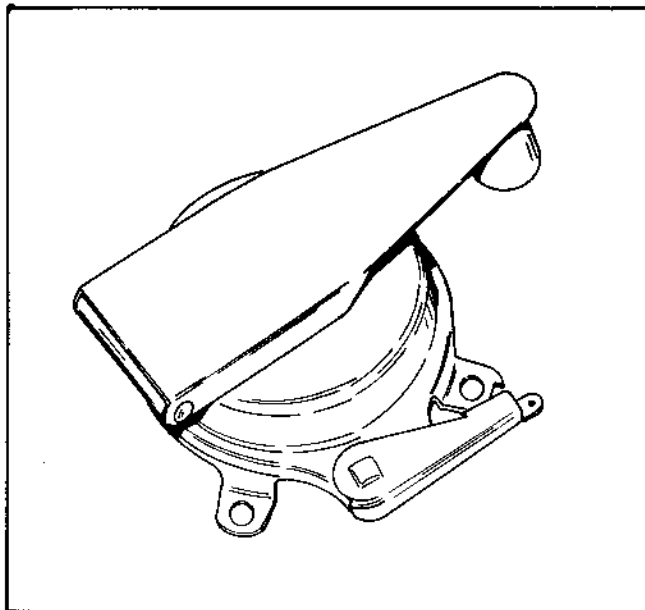


Figure 2-3. Sure Start Starter

C. SURE START STARTER.

- (1) Wind the starter a few cogs, then move release lever to remove any spring tension.

CAUTION

Do not hold starter so that the engaging mechanism (Parts 1-9 of Figure 2-4) are in the palm of the hand.

NOTE

DISASSEMBLY - Follow numbering on illustration. (*) Number indicates text elaboration at that point.

ASSEMBLY - Follow reverse numbering (EXCEPT - Maintain sequence 9, 10, 12, 11) on illustration. (†) Number indicates text elaboration at that point.

(2) DISASSEMBLY

- (3*) Do not stretch spring excessively when removing retainer.

- (9*-10*) Turn the spring housing, while pressing on the hub to force hub and housing out.

The spring (9b) is replaceable. Grasp the spring inner end with pliers and pull out.

This is the ONLY wind-up starter spring that may be removed from the keeper.

- (16*) File off the four peened over sides to remove release lever (17).

NOTE

Examine the brake spring (6). If worn or loose it is important to replace with a new spring. Also determine on reassembly that centering pin (1) is centered into the crankshaft hole.

(3) ASSEMBLY

- (16†) Peen corners over edge of new lever with a 1/4" flat face punch.

- (9†) If spring was removed, replace. See paragraph D, next page 3-2-3.

Be sure spacer washer (9c†) is aligned between the spring windings.

- (1†) Press pin into handle axle, when assembled, 1/3 of length so that it will align with hole in end of crankshaft.

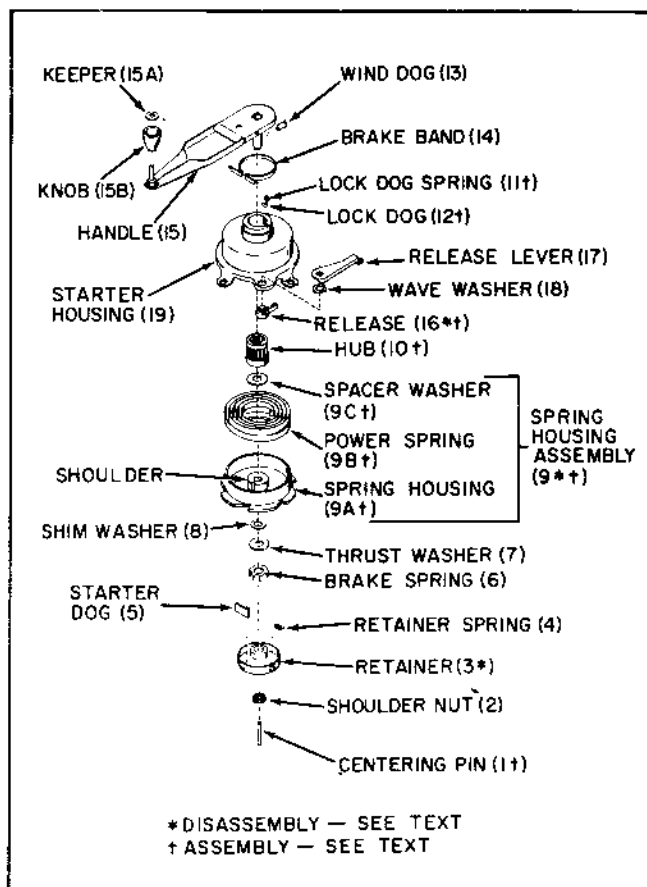


Figure 2-4. Assembly-Disassembly

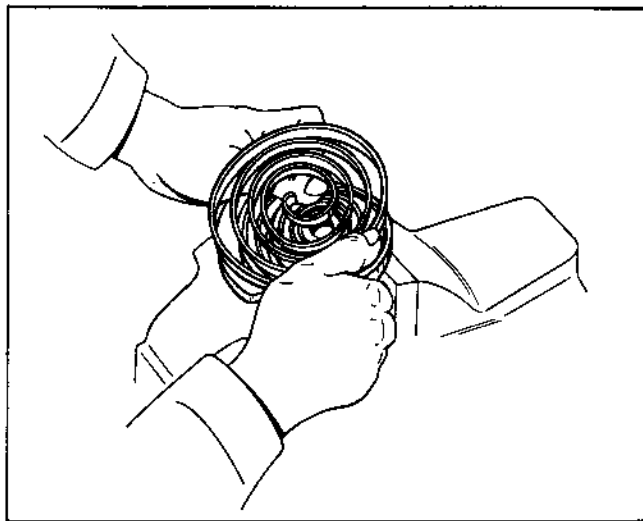


Figure 2-5. Anchor Spring Lower End

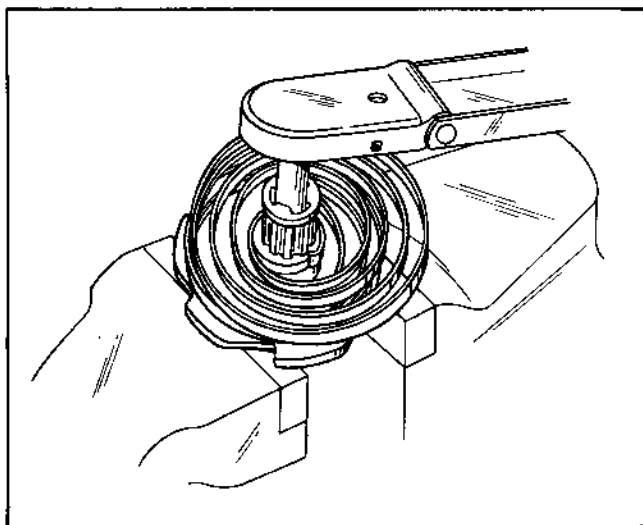


Figure 2-6. Engage Spring Upper End

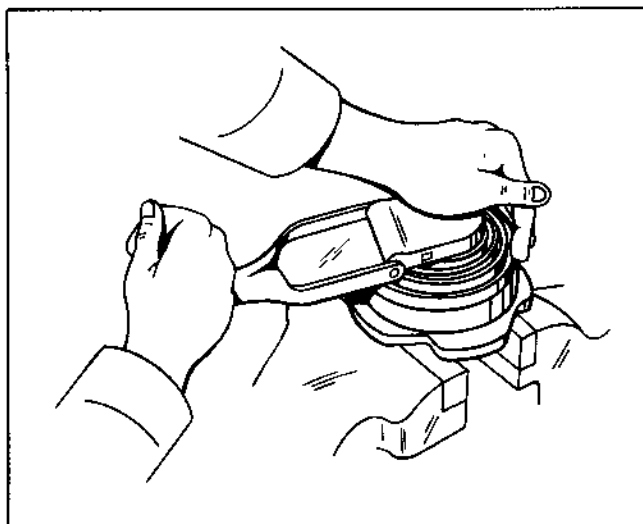


Figure 2-7. Press Firmly While Turning

D. POWER SPRING REPLACEMENT.

- (1) Install the spring housing (9a) in a vise.
- (2) Anchor the spring lower end in the notch. Engage the hub notch to the other end.

- (3) Insert the crank handle shaft through the center holes.

- (4) With the palm of one hand, press firmly at the handle shaft to keep the hub (10) in contact with the housing shoulder

- (5) Turn the hub with the handle to wind spring into the housing. Use the fingers to work the spring over the housing edge.

- (6) When all the spring is in the housing, press the spring so that it remains compressed in place while carefully allowing the handle and hub to unwind.

- (7) Be sure the spacer washer is inserted between the spring windings.

SECTION 3. KICK STARTER

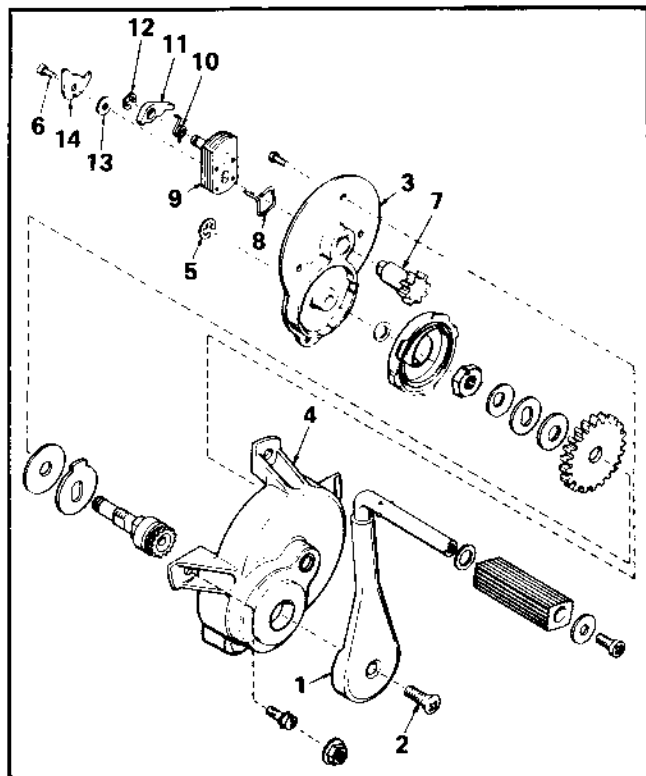


Figure 3-1

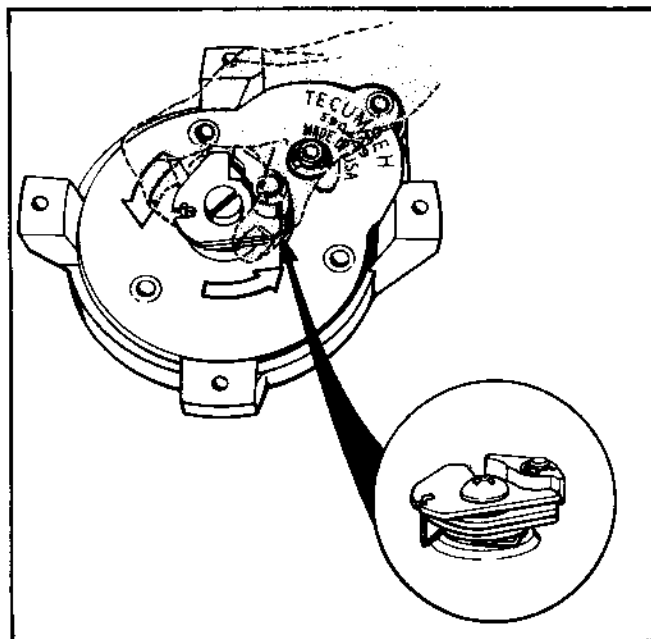


Figure 3-2

KICK STARTER -- PART NO. 590489

Designed and built by Tecumseh for 2.5 thru 5 h.p. Tecumseh mini-bike engine. The kick starter has a built-in clutch to protect the operator and engine from engine kick-back. Identification of the kick starter can be easily accomplished and is shown in Figure 3-2. The mini-bike warranty applies to this accessory.

DISASSEMBLY:

1. Remove crank arm assembly No. 1, Figure 3-1 by removing screw No. 2, Figure 3-1. If necessary, mark arm and starter for proper reinstallation when repairs have been completed.
2. Remove 4 screws holding cover assembly No. 3, Figure 3-1, to starter housing No. 4. Hold dog plate and pin assembly (incl. dog and dog cam), Figure 3-2, in a manner that when cover is removed from housing, spring tension will not be released. Remove cover from housing. When cover has cleared housing gradually release spring tension by allowing dog plate and pin, dog and cam to unwind opposite arrow direction. See Figure 3-2.
3. Remove retainer ring No. 5, Figure 3-1. Remove shaft, clutch plate and liner, gear and hex nut No. 1, Figure 3-3, as an assembly. Remove thrust washer and spring and keeper.
4. Remove center screw No. 6, Figure 3-1, to gain access to individual parts assembled to dog plate and pin and shaft. Note location of dog and dog return spring and brake location on plate and on dog cam, Figure 3-2.
5. Remove hex nut (LEFT HAND THREAD) No. 1A, Figure 3-3, from shaft for servicing gear, clutch liner or clutch plate.
6. Examine parts for wear and damage. Replace as necessary.

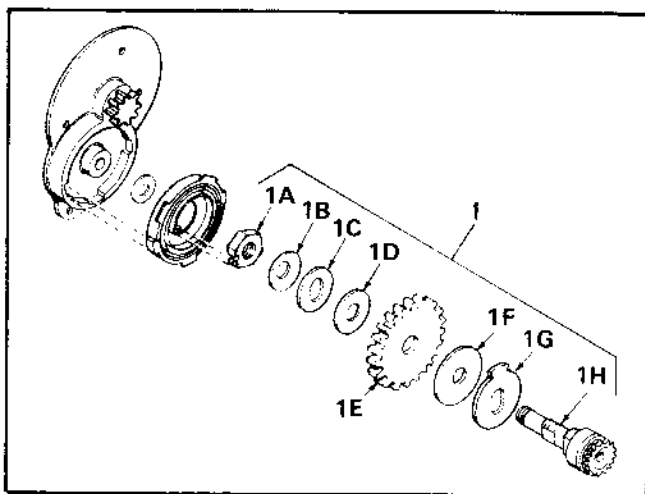


Figure 3-3

REASSEMBLY:

1. Install clutch plate, No. 1G, clutch liner, No. 1F, gear, No. 1E, (flat side toward liner) thin flat washer, No. 1D, thick flat washer, No. 1C Belleville washer, No. 1B, (crown toward hex nut) and hex nut (flat side against Belleville washer) in that order on shaft No. 1H, Fig. 3-3. Torque nut to 40 ft. lbs. maximum. If not properly torqued damage to starter may occur. It is normal under certain conditions that some starter clutch slippage may be encountered on the 5 h.p. engine. Install spring and keeper assembly on hex nut with spring end in nut notch. Place thrust washer on shaft and install spring and keeper and gear assembly in cover. See Fig. 3-3. Note: Locators on keeper to fit in cover. Install clip on shaft opposite spring side of cover.
2. Install shaft No. 7, Fig. 3-1, through cover. Install brake spring No. 8, Fig. 3-1 and 3-2, on cover. Install dog plate No. 9, dog spring No. 10, dog No. 11, clip No. 12, washer No. 13, dog cam No. 14 and center screw on shaft No. 6, Figs. 3-1 and 3-2. Torque screw to 60 in. lbs.
3. Holding cover with gear assemblies installed, wind dog plate assembly as shown by arrow in Fig. 3-2, approximately 2 to 3 turns. With spring tension applied hold the dog plate assembly and guide the plate assembly into location in the housing. Be sure cog on clutch plate is positioned in housing to allow free travel.
4. Install 4 screws to hold cover to housing.
5. Install starter on blower housing.
6. Install crank arm assembly. Torque screw to 120 to 140 in. lbs. NOTE: Be sure starter or crank arm does not interfere with vehicle.

SECTION 4. ALTERNATORS

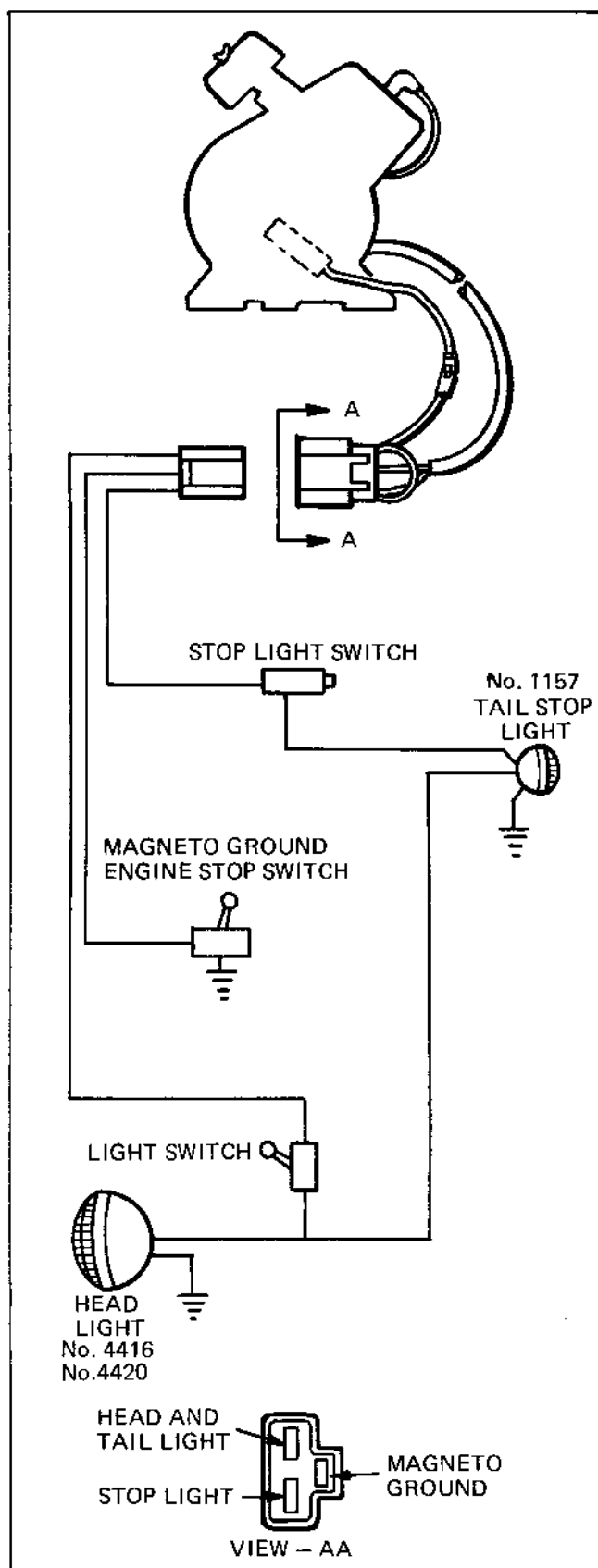


Figure 4-1

ALTERNATORS

- A. Operation....In order to generate current to supply accessories such as brake and running lights on a mini-bike or recreational vehicles, an engine is equipped with a set of charging coils.
- B. Ignition Coil...The ignition coil generates current but is used exclusively to fire the spark plug. Do not confuse the function of this coil with the accessory charging coils.
- C. Charging Coils....The charging coils provide a constant flow of current through the regulator to power the head, tail and brake lights, and an electric horn where installed.

See Figure 4-1

NOTE: At an idle speed (2600 RPM) a slight dimming of the lights will be noticed. This is normal and should not be considered faulty.

D. Testing

(1) Initial Tests

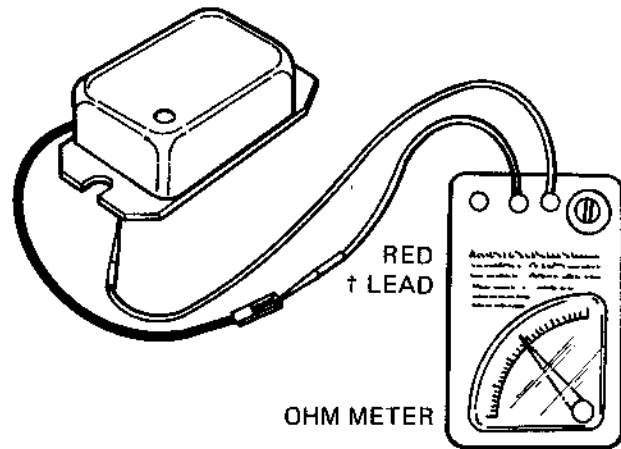
- a. Isolate the problem...If difficulty is encountered in engine operation and is traced to the electrical system, the next step is to pinpoint the problem area. It is assumed that, wherever possible, the electrical tests will be made with a minimum of disassembly. Also, perform any electrical test, whenever possible, without the engine in operation.

Before going into extensive checks, be sure to examine the more basic causes first, such as:

1. Make sure bulbs are good and the right ones are being used.
2. Corroded terminals.
3. Cracked wire insulation.
4. Broken wires.
5. Broken wires covered by insulation.
6. A wire grounding out the system.
7. Loose connections.
8. Make sure regulator has good ground.

(MOUNTED ON BLOWER HOUSING OR COVER PLATE)

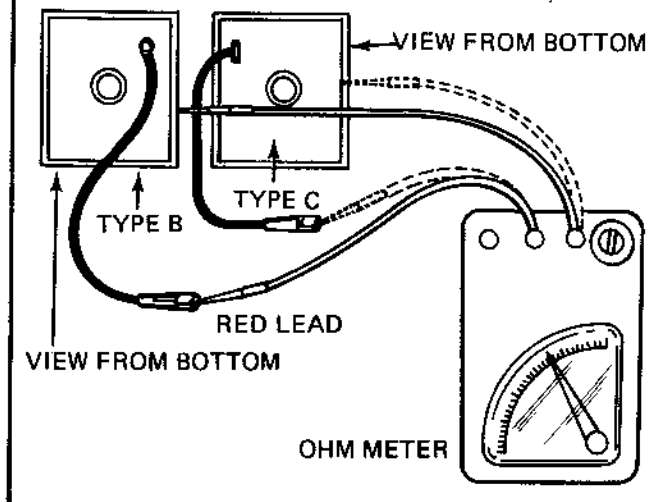
TYPE A



OHM METER

Figure 4-2

(MOUNTED ON BLOWER HOUSING)



OHM METER

Figure 4-3

b. Switch Check...Once the basic causes are checked out and the problem still occurs, continuity checks can be made to determine if there is a faulty component. If a switch is suspected, it can be checked either in or out of the circuit.

c. Alternator and Regulator Check...If the light bulbs continually burn out be sure correct bulbs are being used.

d. Test

Attach ohmmeter per Figure 4-2 or 4-3 depending on type used. Test may be made with regulator on the engine.

Type A	Type B	Type C
100 to 200 Ohms	Over 50,000 Ohms	100 to 200 Ohms

If regulator checks okay, use a correctly rated and numbered bulb, place it in the circuit, and with engine running, a constant lighting of the bulb should take place. If not, check continuity of leads back to alternator. If bulb lights, check bulb socket on unit for loose connections or broken wires at lamp fixture. Check generating coils for shorted or open circuits. Replace generating coils where applicable.

CAUTION: DO NOT RUN ENGINE WITH REGULATOR DISCONNECTED.

PART IV. IGNITION

SECTION 1. IGNITION COMPONENTS AND OPERATION

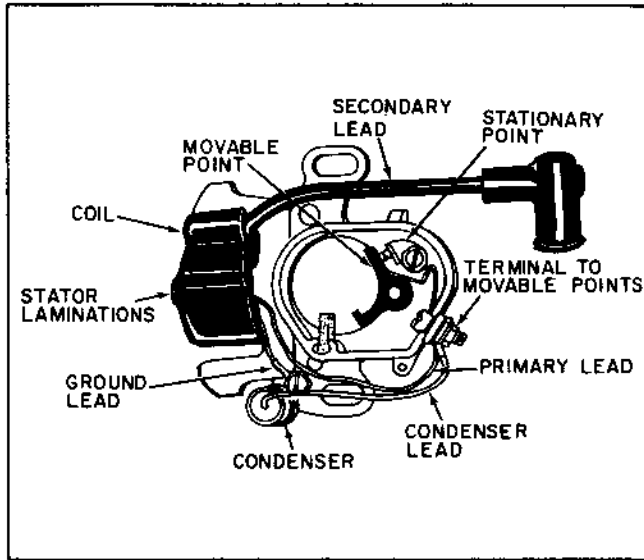


Figure 1-1

A. MAGNETO IGNITION. Tecumseh's magneto ignition consists of a stator assembly mounted to the engine and a magnet cast into the rotating flywheel.

B. STATOR ASSEMBLY. The stator assembly consists of stator plate, laminations, ignition coil, contact points and condenser.

Stator laminations merely assist in concentrating the magnetic lines of force for the primary circuit.

C. CONTACT POINTS. Contact points consist of an insulated movable point that connects to the coil primary lead and a stationary point that is grounded to the stator body and provides the return path for the primary circuit.

D. CONDENSER. The condenser acts as an electrical shock absorber to prevent arcing between the contact points as they open. Arcing would lower voltage output at the spark plug as well as burn and pit contact points, shortening point life.

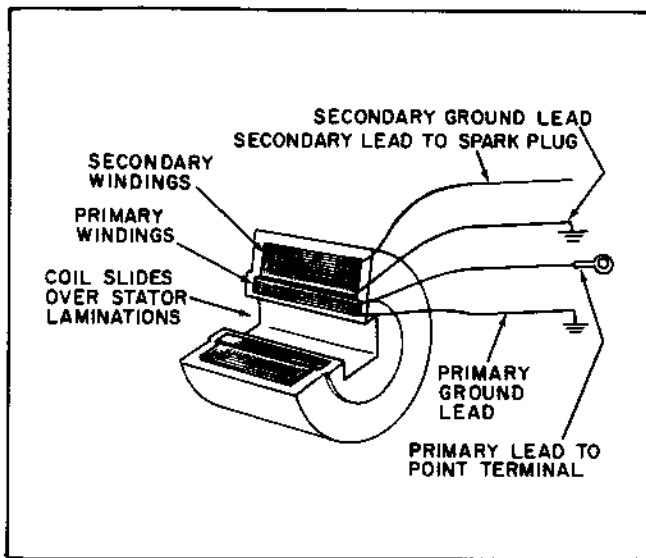


Figure 1-2

E. THE IGNITION COIL. The coil consists of two coil windings that are hermetically sealed within a plastic like casing.

- (1) The primary winding consists of a few turns (about 150) of a comparatively heavy gauge wire wrapped around the center receptacle hole for the stator laminations. One lead is connected to the insulated movable contact point terminal and the other lead is grounded to the stator body.

The primary circuit is the low voltage (300-400 volts) circuit that is used as a transformer to increase the voltage in the secondary or high voltage circuit (10-20 thousand volts).

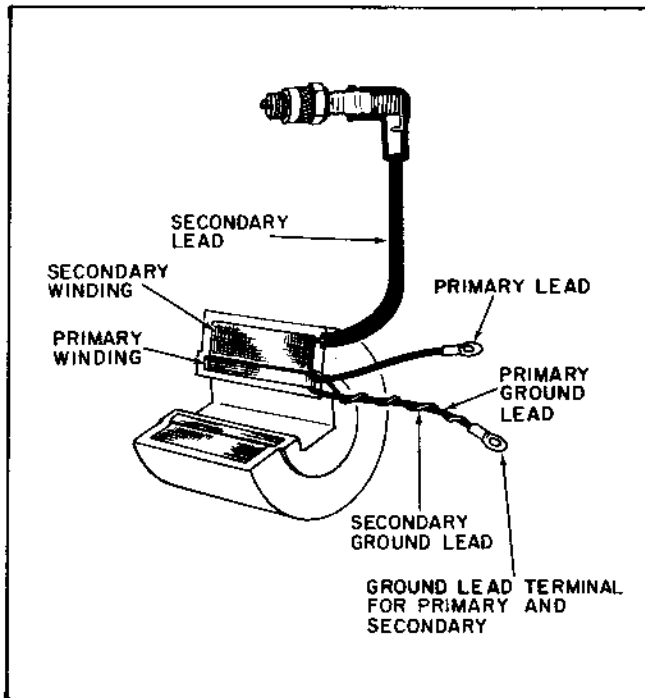


Figure 1-3

- (2) The secondary winding is of extremely fine wire with many turns (about 10,000) wrapped over the primary windings. One lead connects to the spark plug and the other is grounded to the stator body.

The ground (also known as the common) provides the return path to complete each circuit.

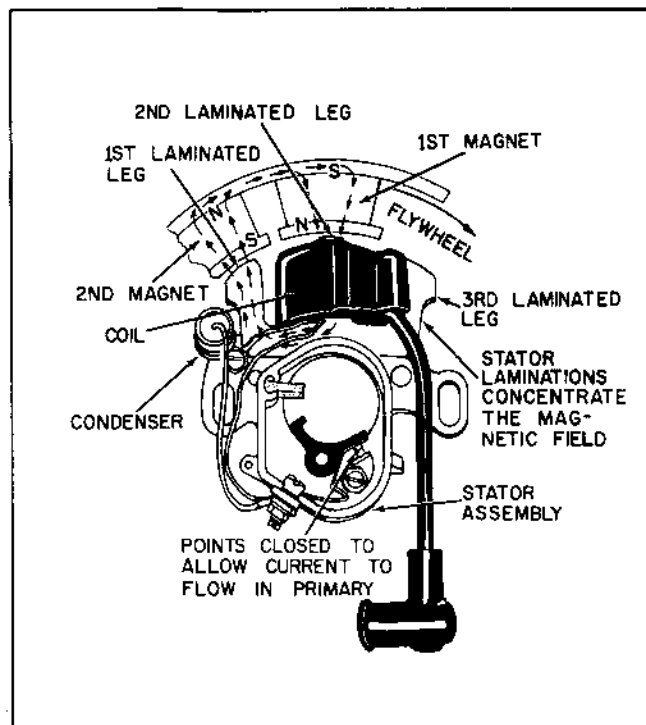


Figure 1-4

F. HOW A TECUMSEH MAGNETO IGNITION WORKS.

- (1) Bar magnets in the flywheel revolve around the magneto laminated legs. As the North Pole of the 1st magnet passes over the center leg a magnetic force field is set up down through the first leg since the South Pole of the 2nd magnet is directly above the 1st leg. The circuit is completed in the iron flywheel rim. As the field passes from the top to bottom of the center leg it cuts the windings in the coil. With the points closed (completed circuit) the coil generates a small amount of charge.

4

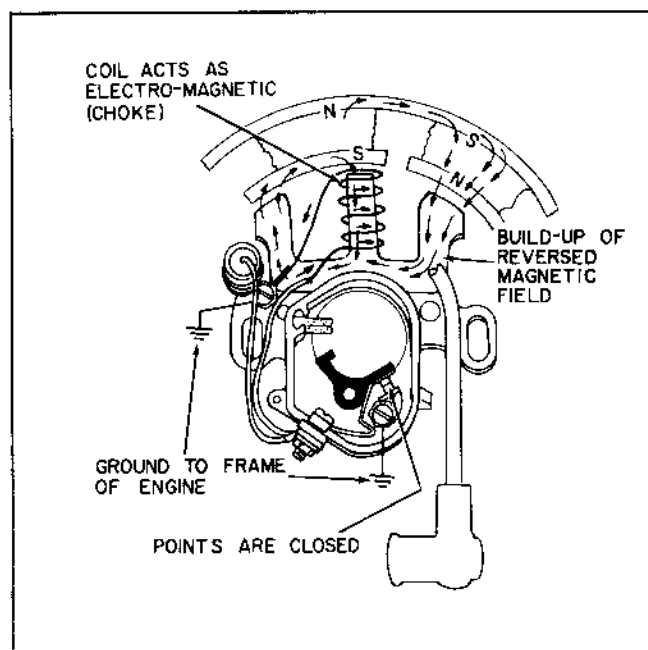


Figure 1-5

- (2) As the flywheel continues to rotate, the 1st magnet now appears over the 3rd leg and the 2nd magnet comes directly over the center leg. Now the magnetic field passes from the top of the 3rd leg down and attempts to go up the center leg. However, in step one the coil had become an electro-magnet and opposes any change in magnetic flow.

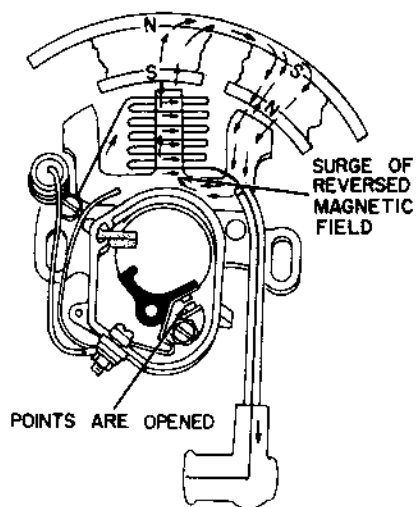


Figure 1-6

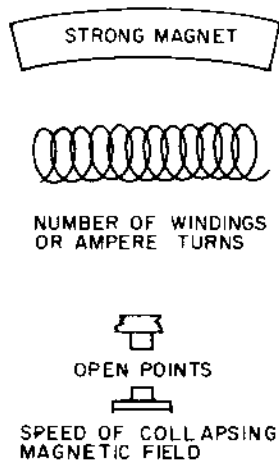


Figure 1-7

- (3) At the precise instant the magnetic field reversal build-up is at its peak, the points are opened. This breaks the circuit and the coil no longer acts as an electromagnet causing a tremendous surge of reversed magnetic field. This sudden reversal of magnetic field generates an enormous voltage in the secondary coil. It travels to ground by arcing the air gap in the spark plug.

- (4) The points then re-close to repeat the cycle sequence. High secondary voltage depends on the amount of conductor turns in the primary and secondary windings, the strength of the magnetic field within the magnet and primary circuit and the speed at which the collapsing magnetic lines of force are cut by the secondary windings.

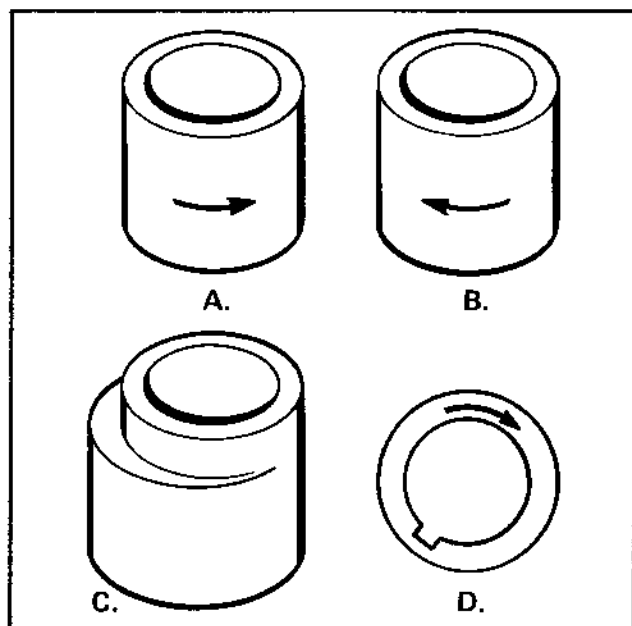


Figure 1-8

G. CAM POSITIONING

Four basic variations of cams used in two-cycle engine applications are shown in Figure 1-8. Use only the cam specified for the engine. Cams which show an arrowhead on the side are placed on the crankshaft with the arrow on the lower half (towards P.T.O. end of crankshaft). Figure 1-8 A and B. An offset cam has the step end facing the magneto end of the crankshaft (C) and the type shown in (D) has the arrow facing up toward the magneto end of the crankshaft. The arrowhead points in the crankshaft rotation.

SECTION 2. IGNITION SERVICE

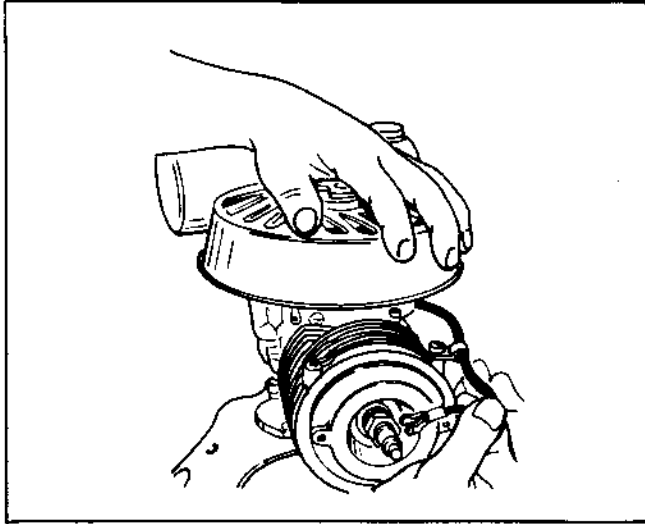


Figure 2-1. Checking for Spark

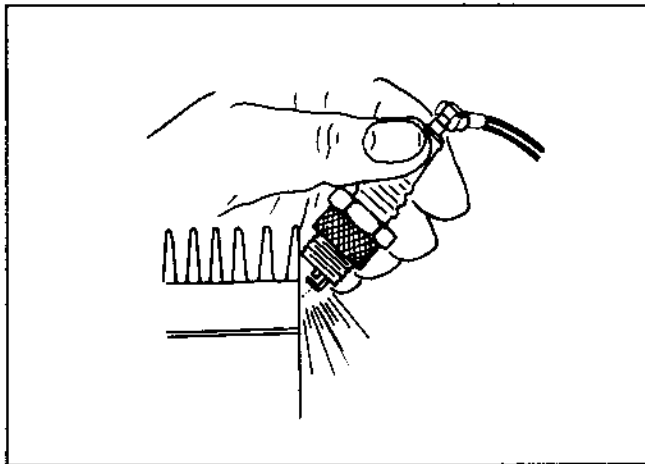


Figure 2-2. Checking Spark Plug

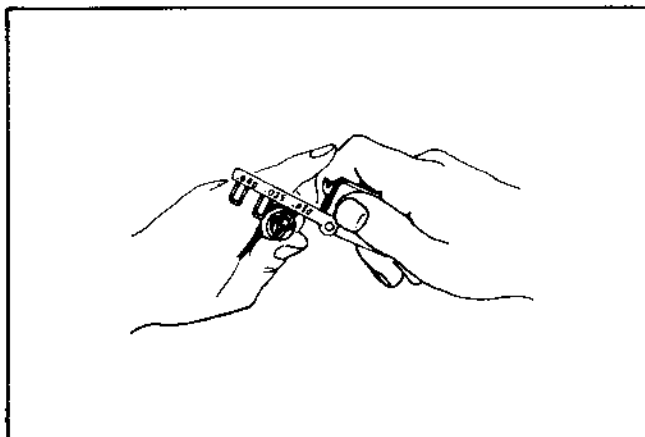


Figure 2-3. Checking Spark Plug Gap
With Wire Feeler Gauge

A. CHECKING OPERATION OF IGNITION SYSTEM.

CAUTION: Do not attempt to crank engine with the primary wire of the transformer disconnected. Also do not allow the primary wire of the transformer to be grounded or arc. A broken wire causing an open circuit to or in the transformer can also cause permanent damage. If in doubt as to condition of transformer or solid state stator follow instructions for electrical component tests as given for test equipment designed for such tests.

- (1) Grasp high tension cable by insulation and hold terminal end about 1/8 inch from metal body of spark plug (Fig. 2-1).
- (2) Crank engine. If bright hot spark jumps gap, magneto is operating correctly.
- (3) Remove spark plug and reconnect high tension lead.
- (4) Ground plug and crank engine. If hot spark jumps the spark gap, the ignition system is operating satisfactorily.

B. SPARK PLUG SERVICE. Spark plugs should be removed, cleaned, and adjusted periodically. Check point gap with wire feeler gauge and adjust gap. Replace if points are pitted and burned or the porcelain is cracked. Refer to master parts manual for correct replacement number. Be sure cleaned plugs are free of all foreign material.

C. CONDITIONS CAUSING FREQUENT SPARK PLUG FOULING. If spark plugs foul, frequently, check for the following conditions:

- (1) Carburetor setting too rich.
- (2) Partially closed choke valve.
- (3) Poor grade of gasoline.
- (4) Clogged exhaust system.
- (5) Incorrect spark plug.
- (6) Too much oil in 2-cycle engine fuel mixture.

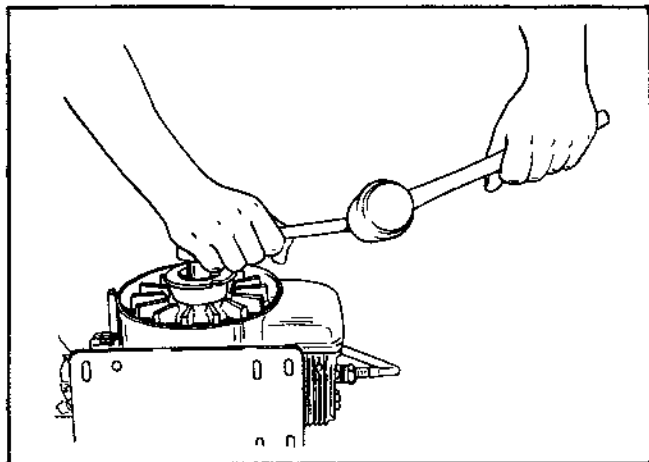


Figure 2-4. Removing the Flywheel Nut From Two-Cycle Engines

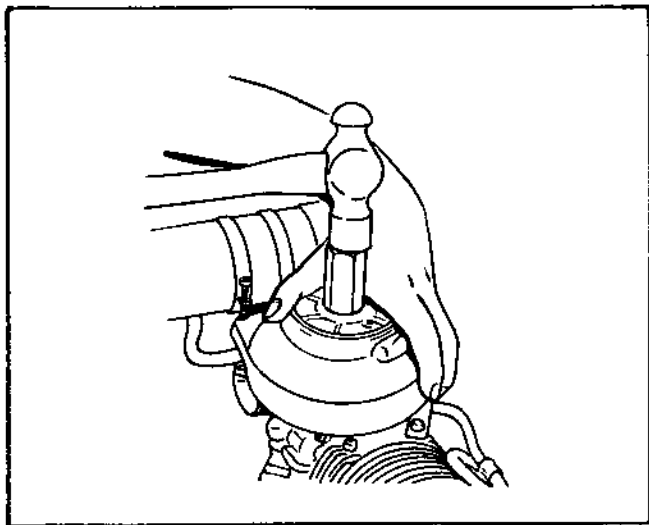


Figure 2-5. Removing the Flywheel Using a Knockoff Tool

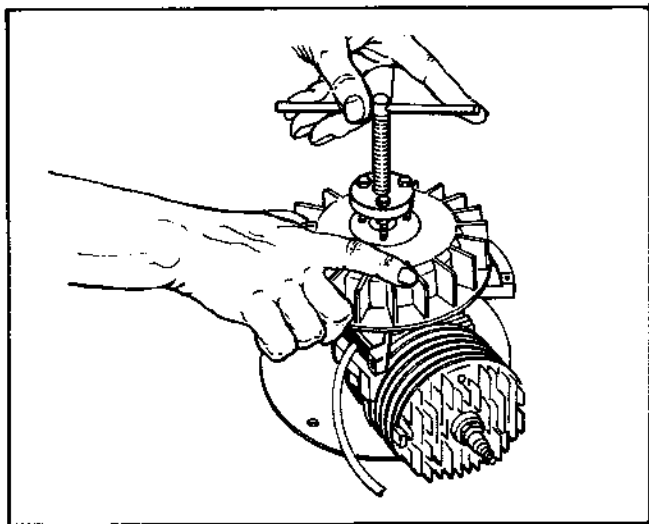


Figure 2-6

D. FLYWHEEL REMOVAL.

(1) Use of Wrench

NOTE

Direction or rotation of 2-cycle engines is determined by viewing the engine from magneto end.

Remove screws, engine shroud, and rewind starter. Place a box end wrench on flywheel nut and rap sharply with a soft hammer. This will loosen the flywheel nut. Engines rotate in both directions depending on application. Determine whether flywheel nut has right-hand or left-hand thread before impacting loose. The use of a flywheel tool can be helpful.

Caution: Do not use knock-off tool to remove flywheel from types 670, 660 and 1500 ball bearing models. A knock-off tool requires pounding which could cause the crankshaft to be moved out of place. If a knock-off tool was accidentally used to remove flywheel an equal blow on the P.T.O. end must be made for reseating and correct clearances. See Part V Sec. 2, Page 5-2-2.

(2) Use of Knock Off Tools

Remove flywheel, nut, and starter cup. Turn correct knockoff tools onto crankshaft, to within 1/16 inch of flywheel. Hold flywheel firmly and rap top of puller sharply with a hammer to jar flywheel loose. Remove puller and flywheel.

(3) Flywheel Puller

On flywheels that have cored holes use flywheel puller #670215. A set of 3 self-tapping screws are included with the puller.

If the flywheel is still difficult to remove from the crankshaft because of rust, etc. the use of a torch can be helpful.

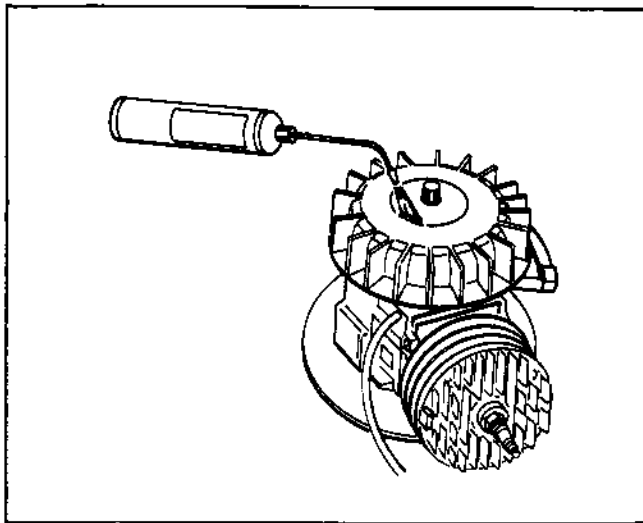


Figure 2-7

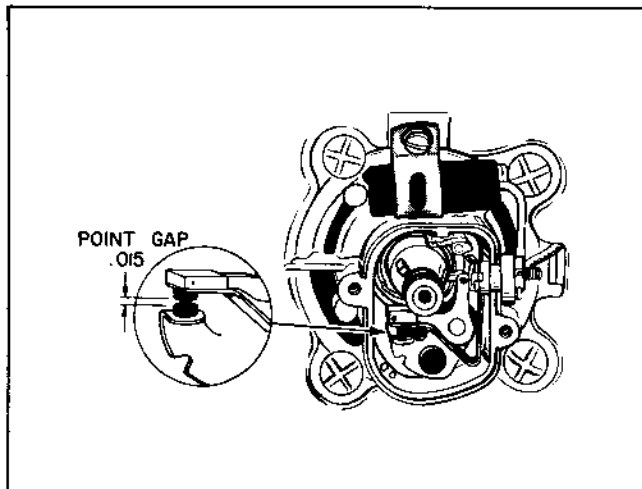


Figure 2-8. Fixed Timed Unit

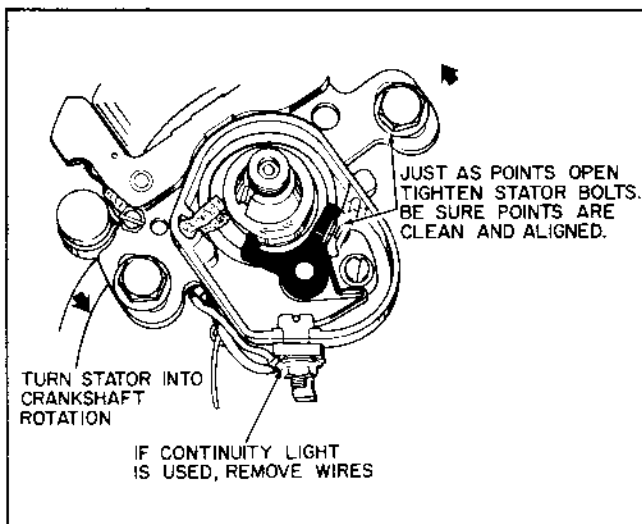


Figure 2-9. Adjustable Timed Unit

- (4) Flywheel removal using heat with a butane torch, heat the area immediately outside of the crankshaft. The aluminum alloy in the flywheel should expand enough to break the seal away from the steel crankshaft.

E. REPLACING MAGNETO BREAKER POINTS. If frequent breaker point replacement is necessary, it may be the fault of condenser. Check condenser on a tester, and if substandard, replace. Replace breaker points as follows:

- (1) Remove nuts that hold electrical leads to the screw on the movable breaker point spring. Remove the movable breaker point from stud.
- (2) Remove the screw and stationary breaker point. Put a new stationary breaker point on breaker plate; install the screw, but do not tighten.
- (3) Position a new movable breaker point on the post.
- (4) Adjust breaker point gap at high side of cam and tighten screw. Refer to the table of specifications for correct gap, if not shown on dust cover.
- (5) Check new point contact and remove all grease, finger-prints, and dirt from points.

Fixed Timed Unit

Figure 2-8 shows a 2-cycle fixed timed engine. Follow Step 4 as listed (see above).

Adjustable Timed Unit

Figure 2-9 shows a 2-cycle adjustable timed unit. (Stator can be rotated) After checking points at cam high side (Step 4 above), follow timing procedure as found on page 4-4-1.

Outboard Engine Timing

See pages 4-3-1 through 4-3-9.

F. MAGNETO REMOVAL. If magneto fails to produce a proper spark after adjusting or replacing breaker points, remove and test coil and condenser.

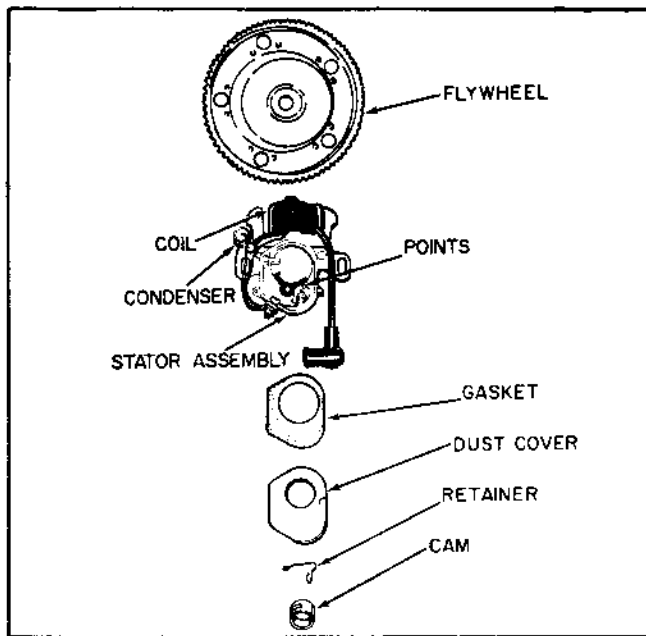


Figure 2-10

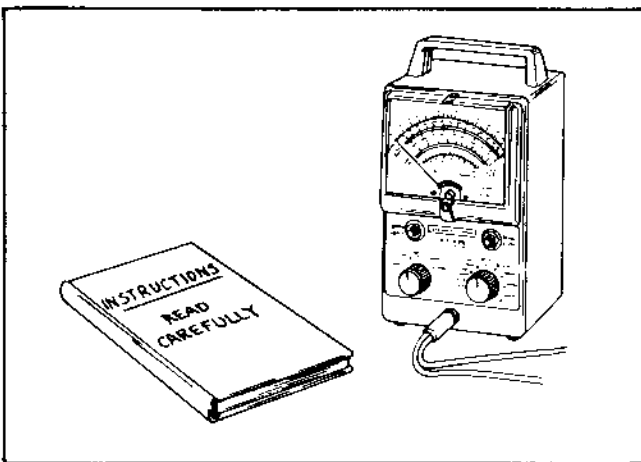


Figure 2-11. Use Instructions Issued with Testing Equipment

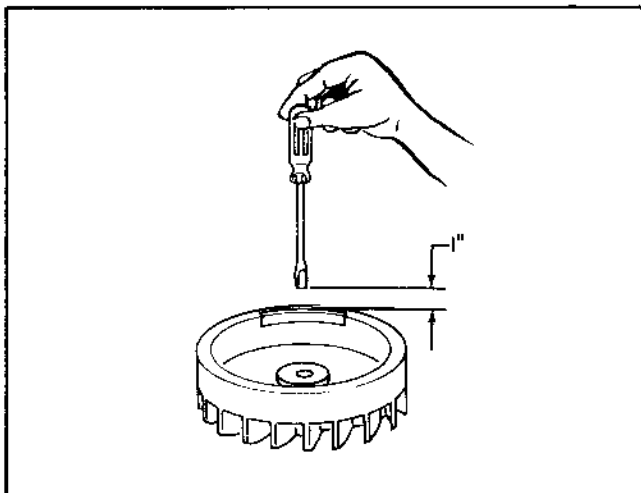


Figure 2-12. Field Test for Magnetic Strength of Flywheel Magnets

G. CHECKING MAGNETO PARTS.

(1) Coil Assembly.

- a. Inspect coil assembly for cracks or insulation, evidence of overheating, or other damage. Make sure electrical leads are intact, especially where they enter the coil.
- b. With coil assembly installed on core assembly, check operation of coil on approved coil tester.

NOTE

Check magneto and parts according to instructions issued with the testing equipment. Due to the diversity of good testing equipment and the constant updating of testing instructions, Tecumseh Products makes no attempt to compile representative readings here.

(2) Condenser Testing.

- a. Inspect condenser for visible damage. Look especially for damaged terminal lead, dents or gouges in can, or broken mounting clip.
- b. Check condenser on a good quality tester. Follow test equipment manufacturer's instructions to check for breakdown capacitance and series resistance.
- c. Replace condenser if condition is in doubt.

- (3) Flywheel Magnets. A rough test to determine strength of magnetic field follows. The Alnico magnets cast into the flywheel rarely lose their magnetic strength. If magnets are suspected faulty, place flywheel upside down on a wooden surface. Hold a screwdriver by the extreme end of handle with point down. Move blade to within one inch of magnets. The magnets should attract screwdriver blade against magnet.

NOTE

Alnico magnets cannot be recharged on a conventional charger. Never store flywheels in nested piles. It may dissipate the magnetic strength of the magnets.

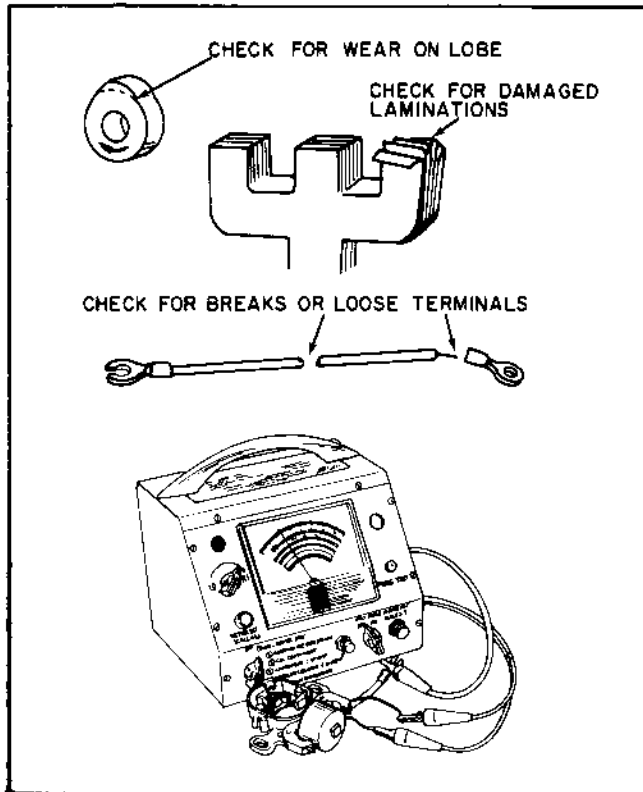


Figure 2-13. Check Parts Carefully

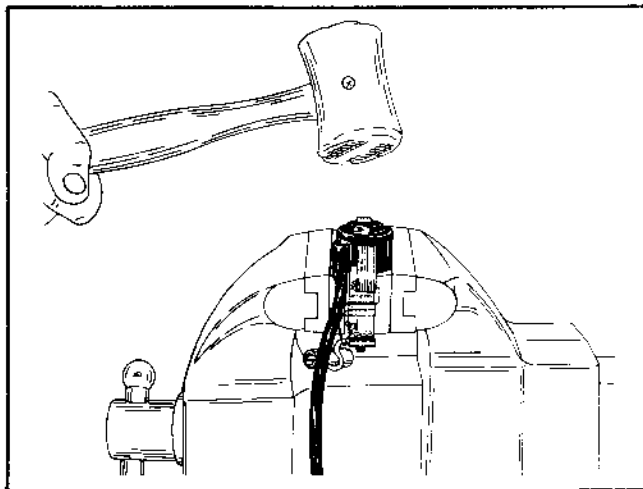


Figure 2-14. Removing Coil

NOTE

Check coils for open circuits, shorts and grounds, then take direct meter readings.

(a) Other Magneto Parts.

1. Replace breaker cam showing excessive wear, scoring or other damage.
2. Replace core assembly showing bent laminations, distortion, or other damage.
3. Replace all electrical leads showing wear, insulation breaks, insecure terminals, or other damage.

H. REASSEMBLY AND INSTALLATION OF MAGNETO.

- (1) If coil was removed, reinstall carefully supporting center of core to prevent distorting the laminations. Bend up holding clip.
- (2) Time the magneto as described in Sections 3, 4, and 5.

I. GLUED ON COIL SERVICE. Some ignition coils are retained with an epoxy glue. If testing indicates replacement, proceed as follows:

- (1) Support the coil in jaws of a vise with the stator loose. With a mallet rap the center coil core leg sharply to break the bond (Fig. 2-14). The coil may also be removed by cutting on two sides with a hack saw.
- (2) Clean the coil core.
- (3) Secure the new coil with an epoxy bonding material available at local parts suppliers and hardware stores. Use a heat lamp to accelerate the curing time of some epoxy.

SECTION 3. OUTBOARD MOTOR TIMING

A. TYPE 634, 635, AND 636 IGNITION TIMING AND CAM ADJUSTMENT.

NOTE

Steps 1 through 4 pertain to reassembly prior to timing.

- (1) Lubricate around curved slots and position base on mounting studs.
- (2) Install washers, then tension springs. Secure with locknuts so that tops of nuts and studs are flush.

NOTE

The base should rotate freely with no binding.

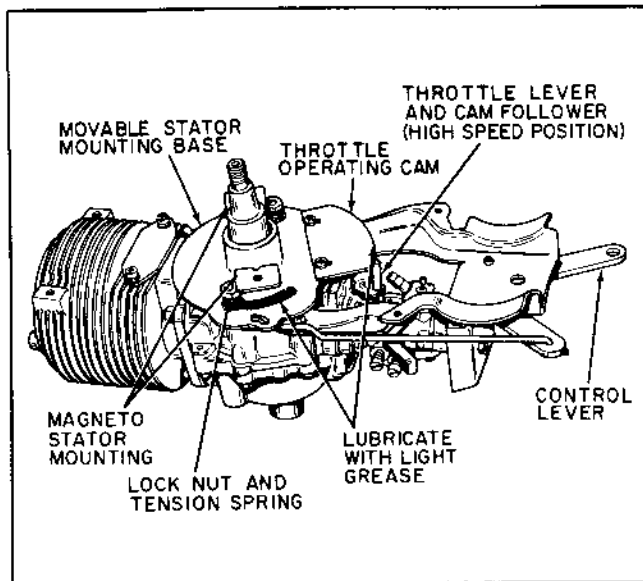


Figure 3-1. Tecumseh Two-Cycle Outboard Motor Power Head

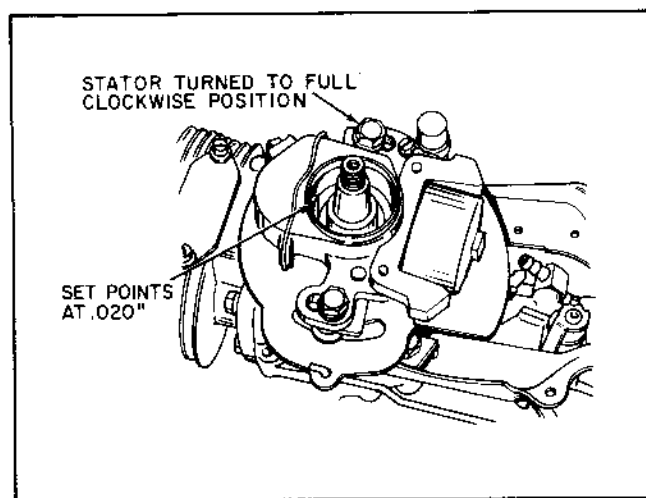


Figure 3-2. Tecumseh Outboard Motor Power Head Ignition Timing

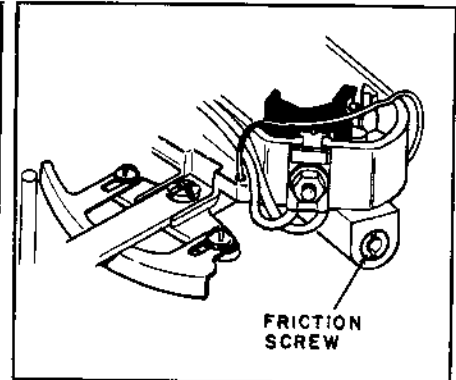
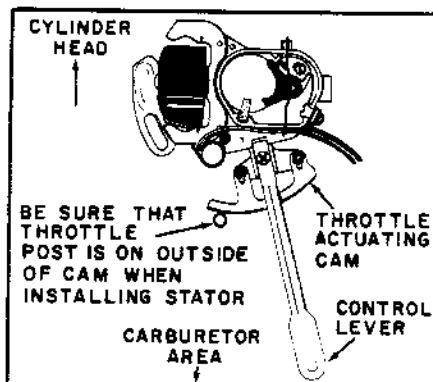
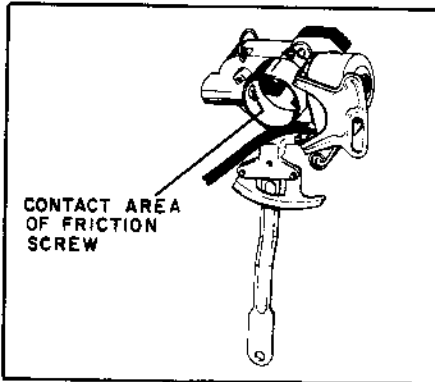
- (3) Snug throttle cam to base with two screws and washer. Don't tighten.
- (4) Move control lever full right. The throttle cam should open the throttle fully. Adjust cam and secure screws. Apply grease to rubbing edge of cam.

NOTE

Be sure that cam doesn't bind with the follower at the high speed position.

- (5) Secure magneto stator to base with slots turned full clockwise.
- (6) Set points to .020" while point breaker rubbing block is on the highest point of the cam lobe.

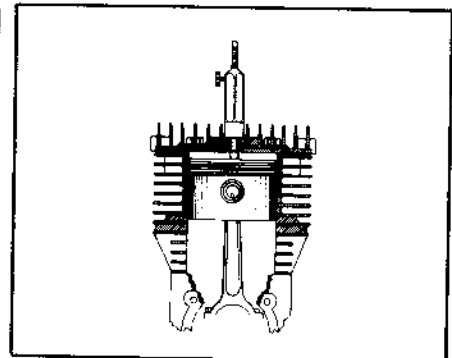
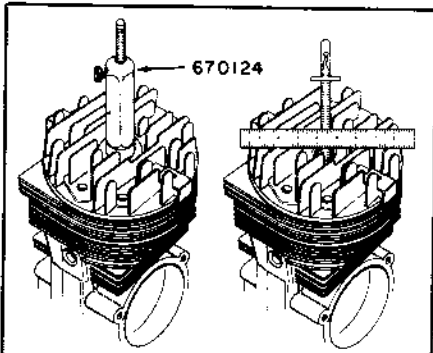
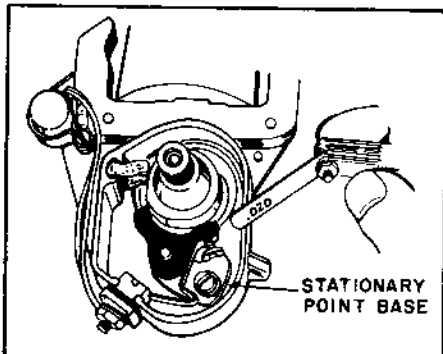
IGNITION TIMING AND THROTTLE CAM ADJUSTMENT FOR ENGINE TYPES — See Page 4-3-10



1. Apply a small amount of E. P. Lithium grease to the contact area of the friction screw. Do not turn the screw into the radius of the stator collar.

2. Install the stator with operating handle pointed in the direction of the carburetor. Be sure the throttle post is NOT INSIDE the area of the throttle actuating cam. Hold the throttle open when installing the stator.

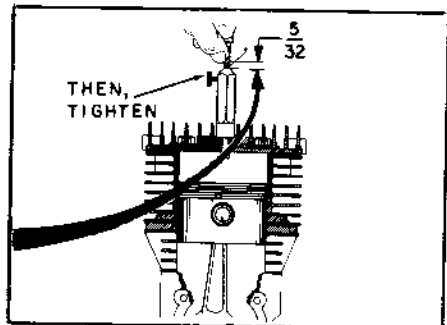
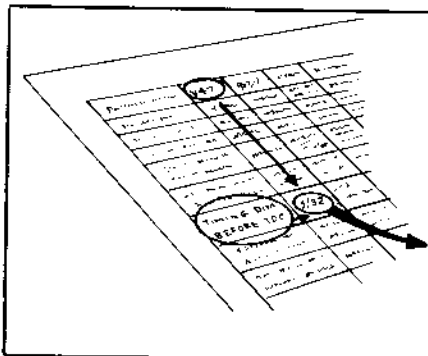
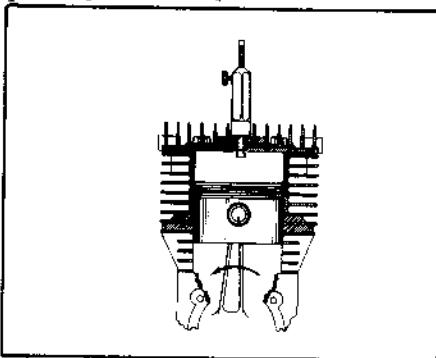
3. Tighten the friction screw to 12-15 in. lbs. torque.



4. Install the points if necessary. Adjust the point stationary base for a .020" point gap on high side of cam, then close points and clean. Use a squarely cut piece of bond paper. If solvent is used, blow the points clean and dry with compressed air.

5. Install the two cycle timing gauge #670124; or use a straight edge and narrow machinists rule; or use a dial indicator Part No. 670241, through the spark plug hole.

6. Find Top Dead Center (TDC) while rotating the crankshaft.



7. If the tool #670124 is used, tighten the set screw to lock the plunger, then back off TDC opposite normal rotation (turn counterclockwise). If the rule and straight edge or dial indicator is used, leave the piston at TDC.

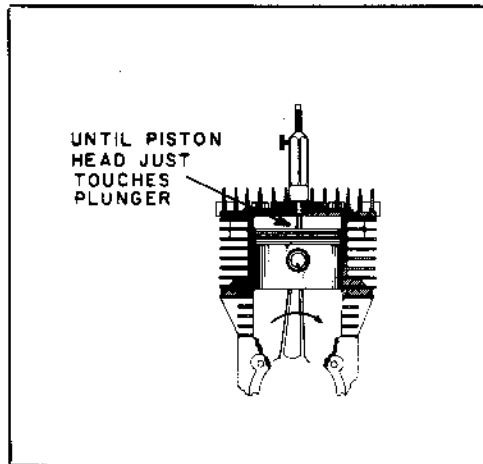
8. Find the correct Before Top Dead Center (BTDC) dimension in the specs.

9. Apply the correct dimension to the engine.

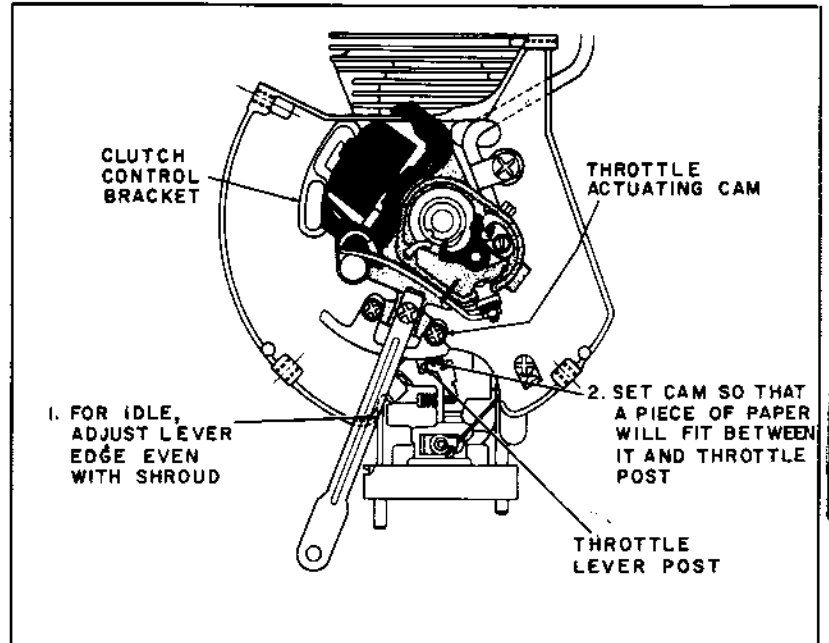
a. If tool #670124 is used, carefully find dimension on the calibrated plunger. Hold that dimension carefully, then loosen the set screw and move the plunger into the barrel. Retighten the set screw. Note: Calibrations on plunger are $\frac{1}{32}$ or .031."

b. If dial indicator Part No. 670241 or straight edge and rule are used, move piston down until correct dimension is registered.

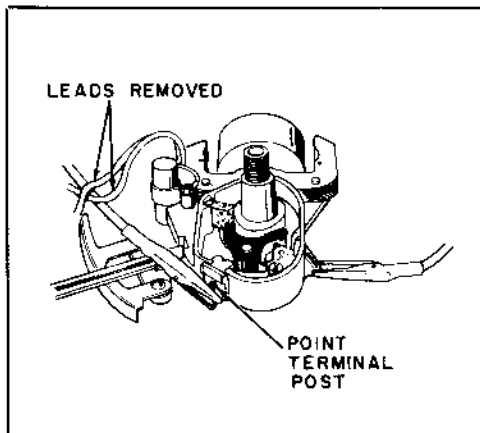
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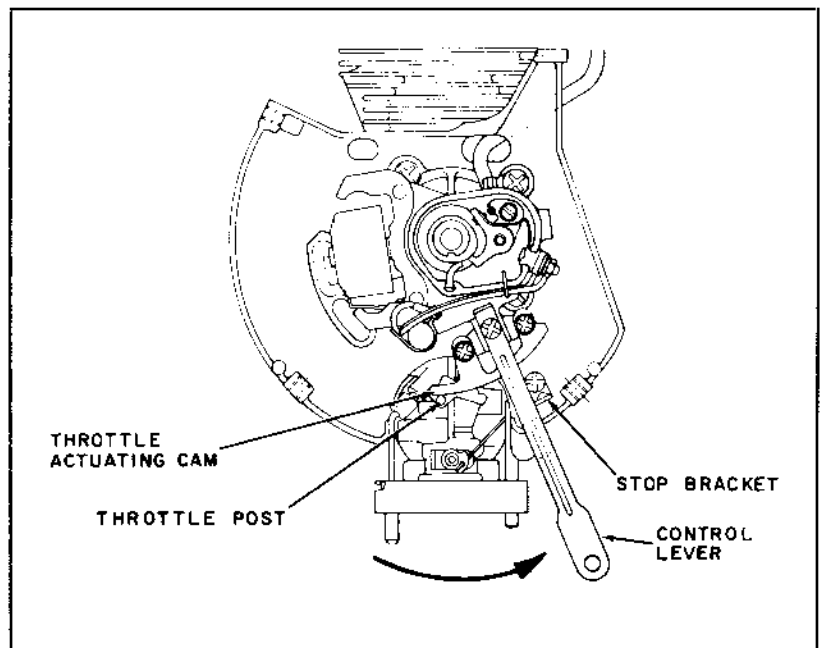
10. When using tool #670124, bring piston up on normal rotation until it contacts plunger.



11. Position the operating lever as shown in the figure, to set the idle location of the throttle cam.



12. Install leads of some continuity reading device on the point terminal and to ground.

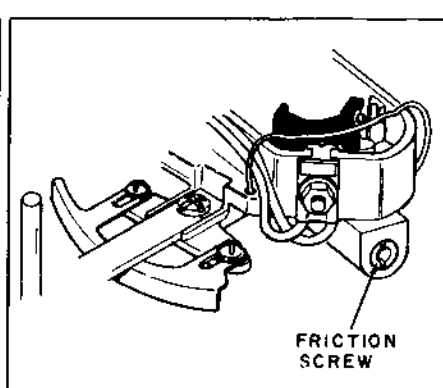
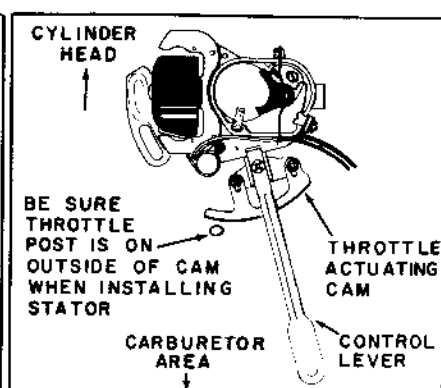
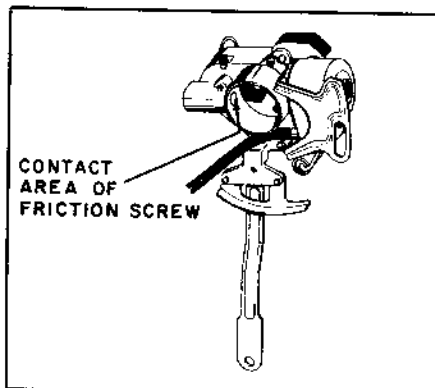


13. Move the stator counterclockwise advancing the timing until the continuity reading breaks and reads zero. Tighten the stop bracket so that the stator won't move any farther counterclockwise.

14. Adjust the throttle cam for full throttle. Recheck to see that the idle position wasn't changed (step 11). Be sure the cam is contacting correctly at both ends of the operating lever travel before tightening cam screw.

Install gasket, cover and retaining clip. Reassemble key and flywheel, starter and other accessories.

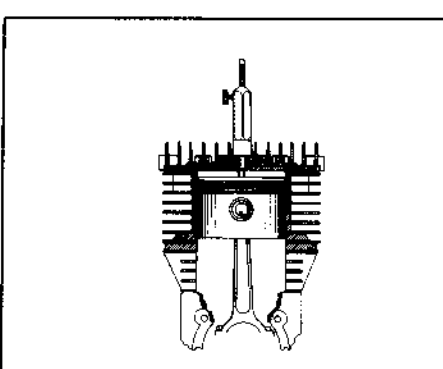
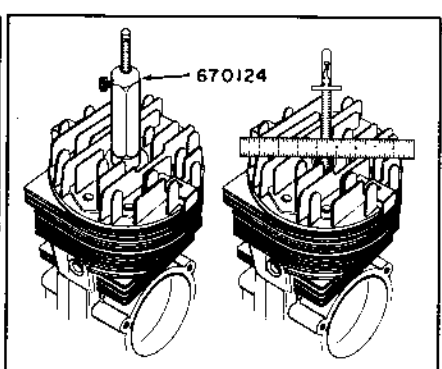
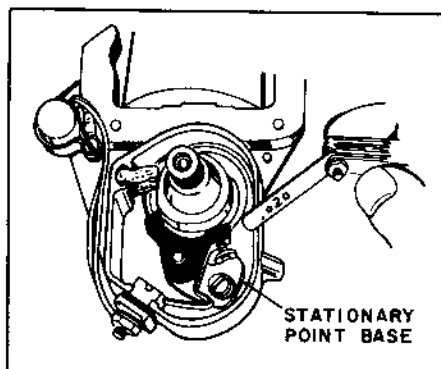
IGNITION TIMING AND THROTTLE CAM ADJUSTMENT FOR ENGINE TYPES — See Page 4-3-10.



1. Apply a small amount of E. P. Lithium grease to the contact area of the friction screw. Do not turn the screw into the radius of the stator collar.

2. Install the stator with operating handle pointed in the direction of the carburetor. Be sure the throttle post is NOT INSIDE the arc of the throttle actuating cam. Hold the throttle open when installing the stator.

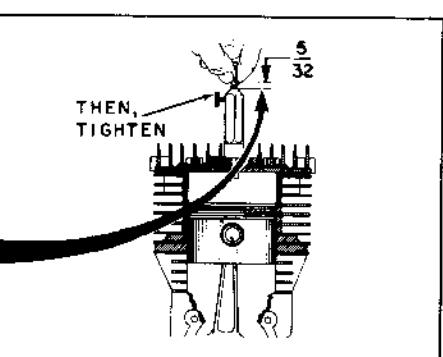
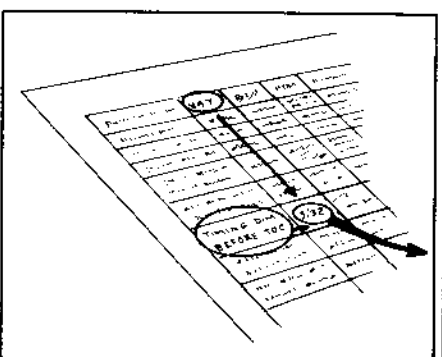
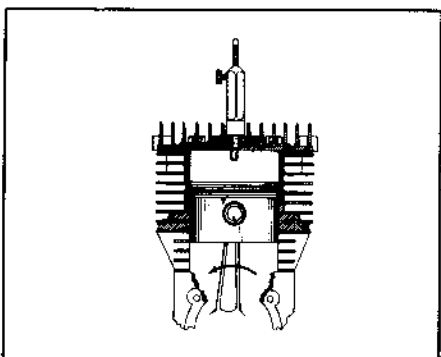
3. Tighten the friction screw to 12-15 in. lbs. torque.



4. Install the points if necessary. Adjust the point stationary base for a .020" point gap on high side of cam, then close points and clean. Use a squarely cut piece of bond paper. If solvent is used, blow the points clean and dry with compressed air.

5. Install the two cycle timing gauge #670124; or use a straight edge and narrow machinist's rule; or use a dial indicator Part No. 670241, through the spark plug hole.

6. Find top dead center (TDC) while rotating the crankshaft.



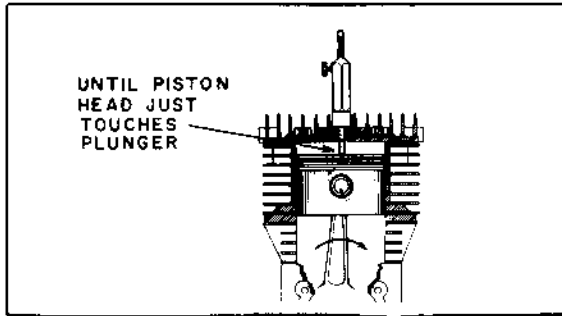
7. If the tool #670124 is used, tighten the set screw to lock the plunger, then back off TDC opposite normal rotation (turn counterclockwise). If the rule and straight edge or dial indicator is used, leave the piston at TDC.

8. Find the correct before top dead center (BTDC) dimension in the specs.

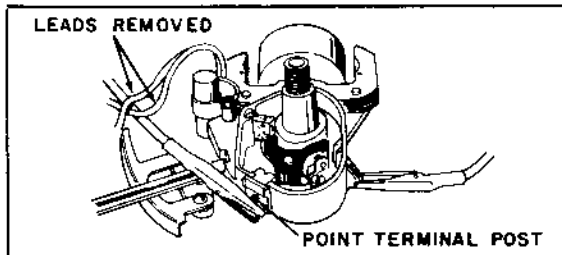
9. Apply the correct dimension to the engine.

a. If tool #670124 is used, carefully find dimension on the calibrated plunger. Hold the dimension carefully, then loosen the set screw and move the plunger into the barrel. Re-tighten the set screw. NOTE: Calibrations on plunger are $\frac{1}{32}$ or .031".

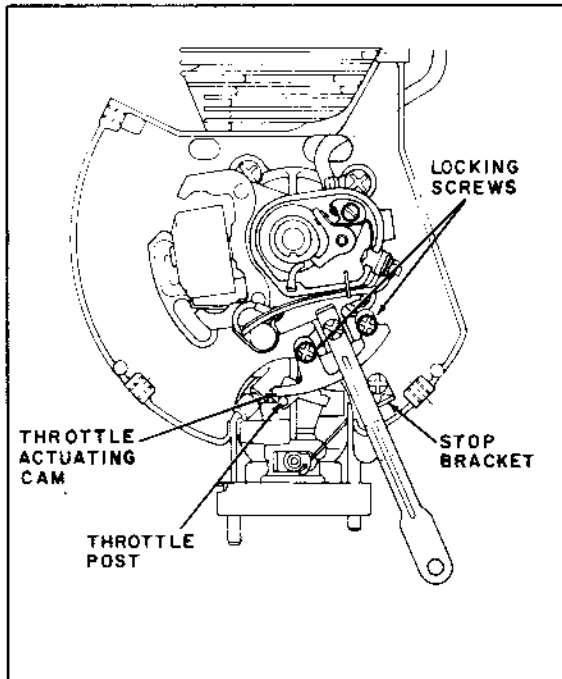
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10. When using tool #670124, bring piston up on normal rotation until it contacts plunger.

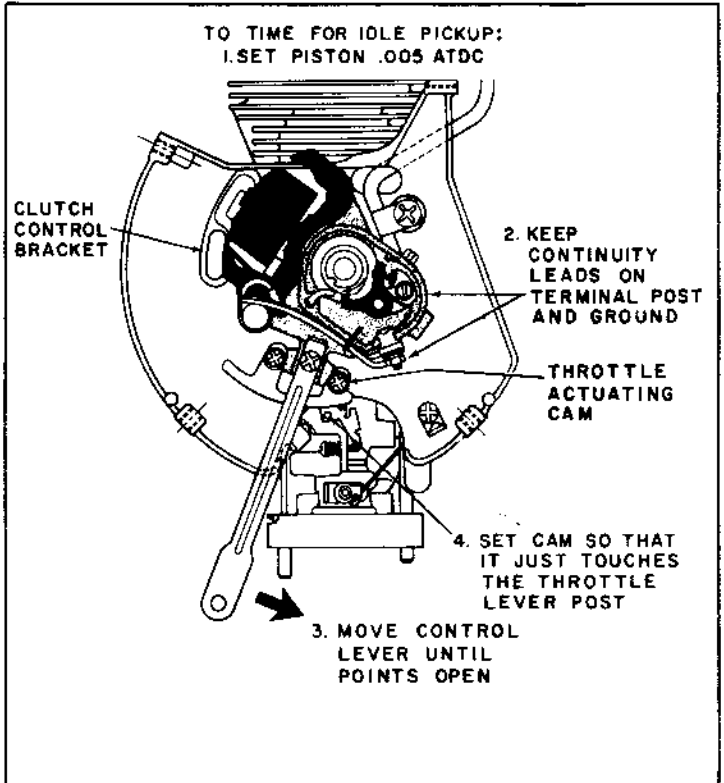


11. Install leads of some continuity reading device on the point terminal and to ground.



12. Move the stator counterclockwise advancing the timing until the continuity reading breaks and reads zero. Tighten the stop bracket so that the stator won't move any farther counterclockwise.

13. Loosen the cam locking screws just enough to allow adjustment of the cam. Move the cam to open the throttle completely WITHOUT causing any binding with the throttle post.



14. To determine the idle speed throttle cam pick up point, proceed as follows:

- A. If a dial indicator Part No. 670241 is used, find the .005" ATDC (after top dead center) piston position, then proceed to step C below.
- B. If a 2-cycle timing gauge is used, set as follows:
 - (1) Turn the gauge into the spark plug threads until it is finger tight, then back out (unthread) the gauge 1/8 to 1/10 of a turn.
 - (2) From that position, find TDC (top dead center), then lock the plunger with the set screw.
 - (3) Advance the crankshaft so that the timing gauge can be tightened finger tight. Do not - loosen the set screw to move the plunger only. Tighten the timing gauge in the spark plug hole.
 - (4) Back up the crankshaft so that the piston just contacts the gauge plunger.
- C. With a continuity indicating device set at the point terminal post and ground, retard the timing (move operating lever clockwise) until the points close and continuity is established. The operating lever should be at full run position to start. Find the point where continuity breaks, then hold the magneto position.
- D. Move the throttle actuating cam (see figure above step 14) right side so that the cam just touches the throttle post without moving it. Tighten the retaining screw slightly to hold that position.
- E. Leave the continuity device attached, but move the operating lever back to the full run position. Usually, the cam left slot may be readjusted. Work carefully.
- F. Recheck idle (using continuity device), then full run position alternately until the operating lever can be moved from one position to the other without having to make some minor adjustment to the cam position.

Install gasket, cover and retaining clip. Reassemble key and flywheel, starter and other accessories.

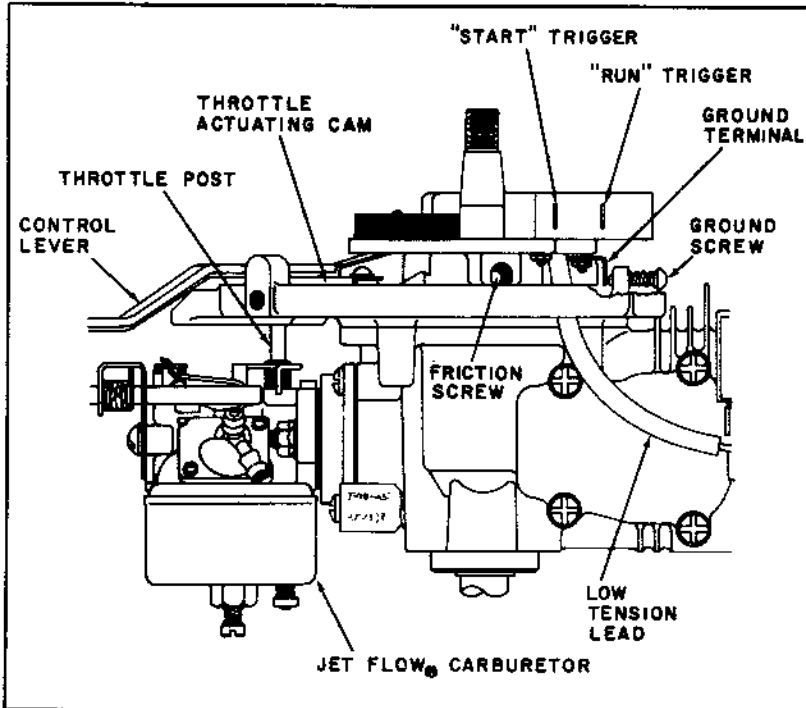


Figure 3-3. Side View of Solid State Equipped Engine

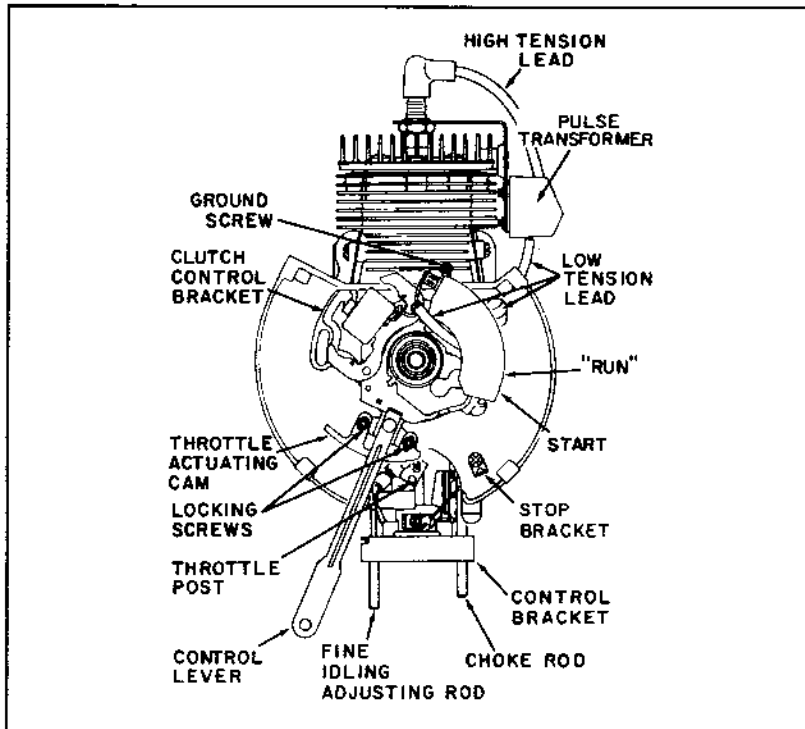


Figure 3-4. Top View of Ignition Unit

OUTBOARD ENGINE TYPE	ENGINE MODEL	PISTON POS. BTDC	PICKUP POS. # ON TOOL
639-	V-750	.095	2
643-	V-600	.085	4

Figure 3-5. BTDC Timing Dimensions

D. SOLID STATE IGNITION - OUTBOARD ENGINE - TIMING AND THROTTLE ADJUSTMENT FOR SOME ENGINE TYPES 639^S and 643^S. See Page 4-3-10.

1. Install the magneto or carburetor as necessary.

NOTE: Later models of listed engine types have only one trigger.

CAUTION: Be sure that the throttle post is not bound behind the throttle actuating cam.

See Steps 1 thru 3 of standard outboard engine timing procedure.

2. The ground screw (ignition cut out) can be turned to contact the ground terminal on the ignition unit, whenever the control lever is close to the control bracket in the retard direction. See Page 4-3-8.

3. Set the BTDC (Before Top Dead Center) piston position according to table in figure 3-5.

NOTE: The key should be in its normal position on the crankshaft keyway.

Do not disturb the piston position once it has been properly set.

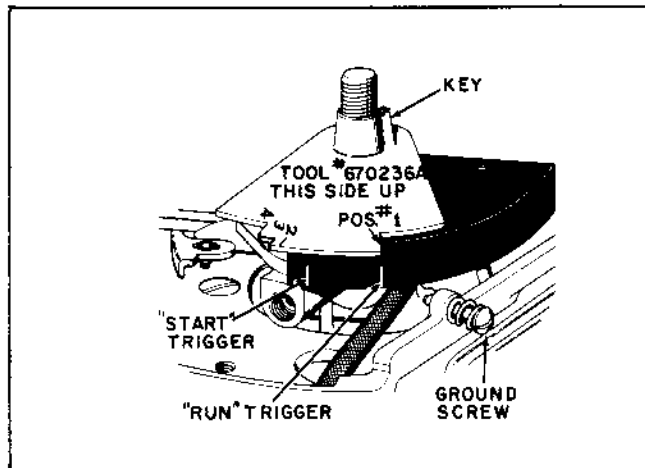


Figure 3-6. High Speed Position

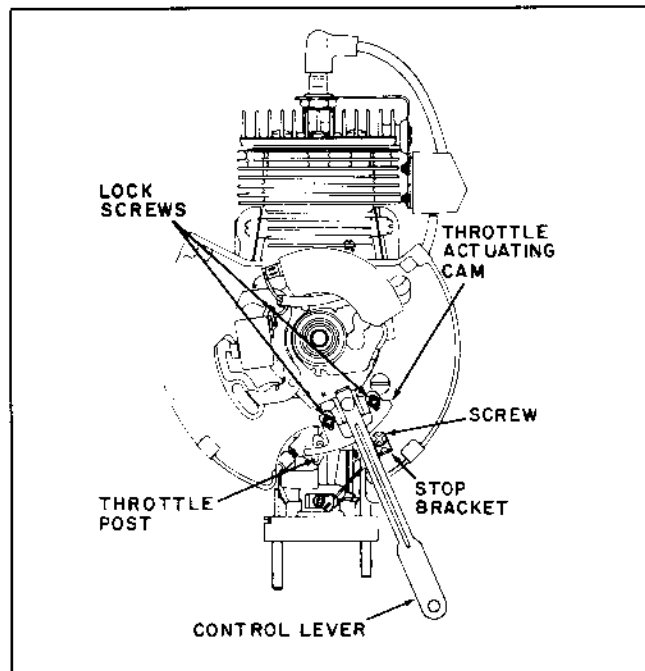


Figure 3-7. High Speed Stop Bracket & Cam Adjustment

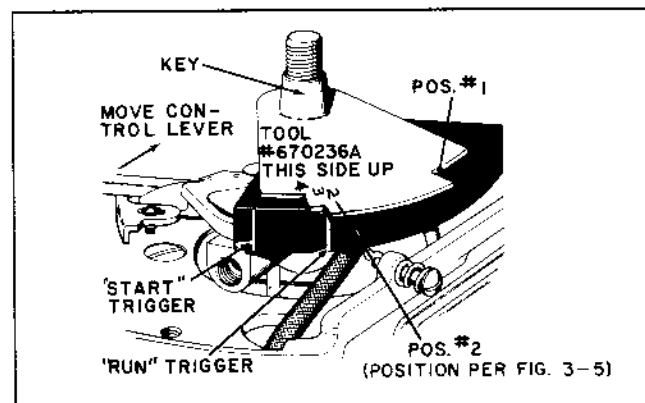


Figure 3-8. Idle (pickup) Position

Install tool 670236A on the crankshaft - Be careful not to distort key register area.

4. Without disturbing the BTDC piston position set in step 3, move the control lever counterclockwise until the RUN trigger aligns with the timing tool (670236A) notch marked #1. Hold this position.

5.(a) Adjust the stop bracket (Fig. 3-7) to prevent the control lever from moving any further counterclockwise. Tighten the stop bracket screw securely.

(b) Loosen the actuating cam lock screw enough to allow adjustment of the cam. Position the end of the cam (contacting the throttle post) so that it opens the throttle completely - However, be sure that the cam doesn't cause a binding with the post.

(c) When properly adjusted, there should be perceptible play in the throttle post (1/16th to 1/8th inch) at open throttle. If this is not present, the cam is probably causing binding at the post and subsequent readjustment and parts replacement may soon follow.

(d) When the correct position is attained, tighten the lock screw on the "high" end to hold the cam in place.

6.(a) Move the control lever to align the "RUN" trigger of the ignition unit with the tool at the proper position pointed out in Fig. 3-5, depending upon engine type. Hold this position. (Fig. 3-8 shows example of type 639).

(b) Adjust the cam to touch the post without moving it. Tighten the lock screw to hold the cam in place.

(c) Recheck to ensure that the high speed point hasn't changed or that binding will not occur. Readjust from high to pickup point as necessary.

(d) When assured that cam position is correct at FULL RUN and IDLE positions, torque the lock screw to 10-15 in.lbs.

(e) Install the remaining magneto parts, shroud and starter and other removed accessories.

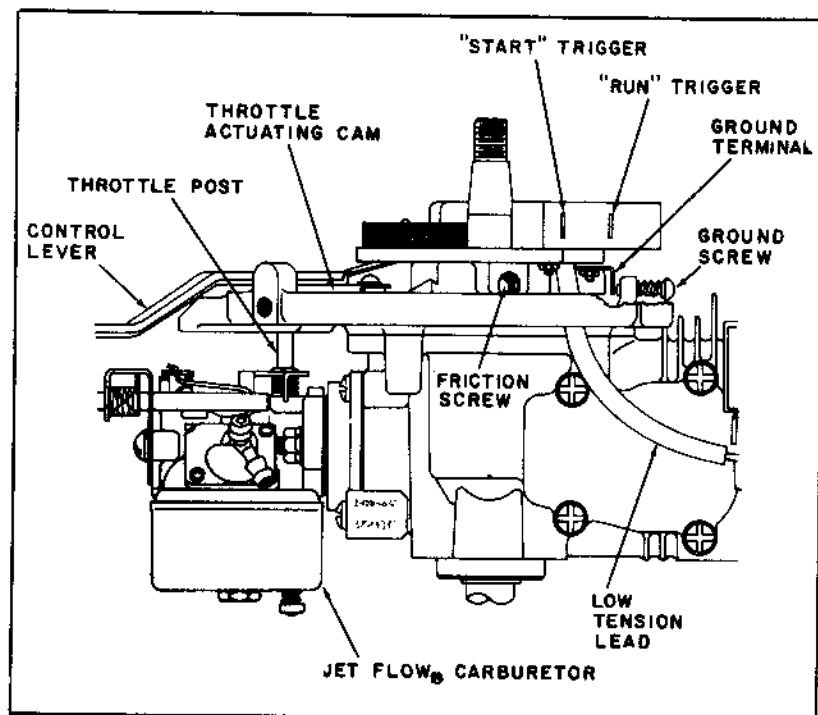


Figure 3-9. Side View of Solid State Equipped Engine

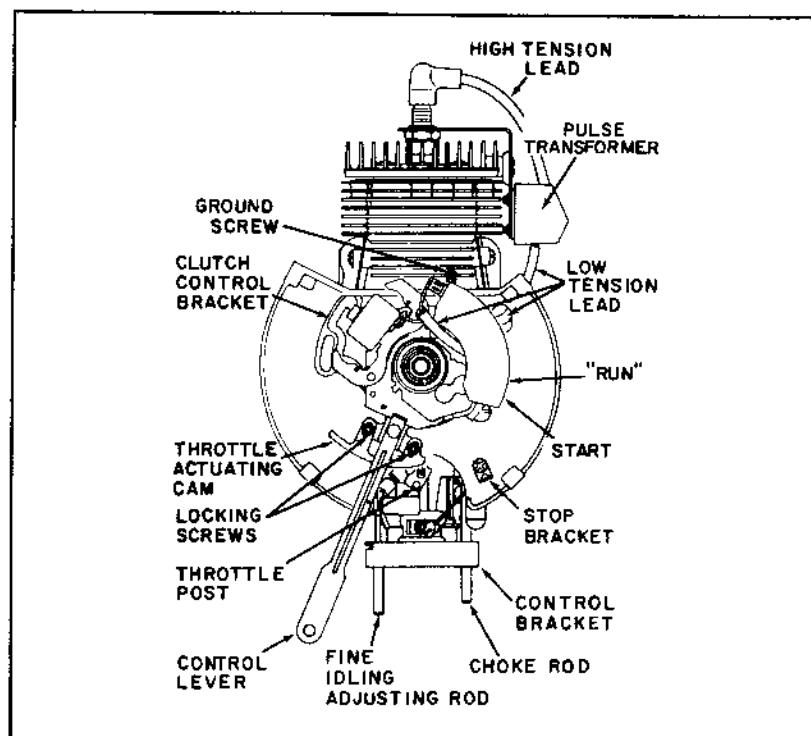


Figure 3-10. Top View of Ignition Unit

E. SOLID STATE IGNITION - OUT-BOARD ENGINE - TIMING AND THROTTLE ADJUSTMENT FOR TYPE 640. See Page 4-3-10.

1. Install the magneto or carburetor as necessary.

CAUTION: Be sure that the throttle post is not bound behind the throttle actuating cam.

See Steps 1 thru 3 of standard outboard engine timing procedure.

NOTE: Later models of engine type 640 have only one trigger.

2. The ground screw (ignition cut out) can be turned to contact the ground terminal on the ignition unit, whenever the control lever is close to the control bracket in the retard direction.

3. Set the BTDC (Before Top Dead Center) piston position to .115".

NOTE: The key should be in its normal position on the crankshaft keyway.

Do not disturb the piston position once it has been properly set.

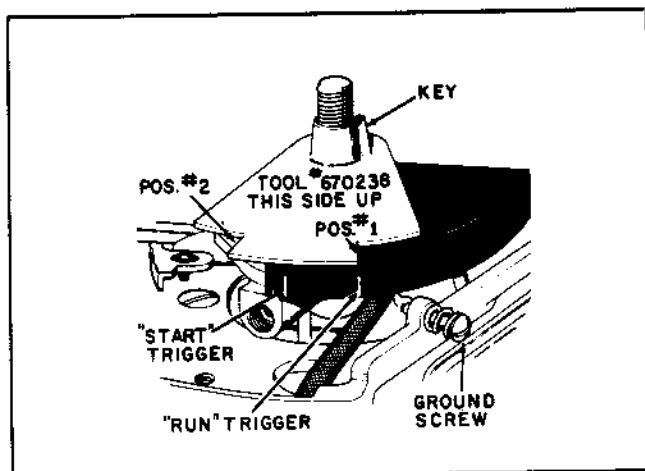


Figure 3-11. High Speed Position

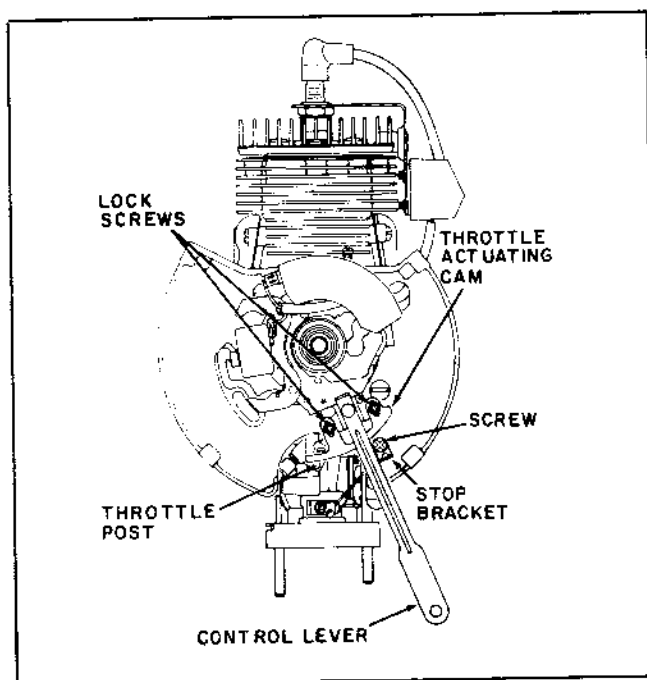


Figure 3-12. High Speed Stop Bracket & Cam Adjustment

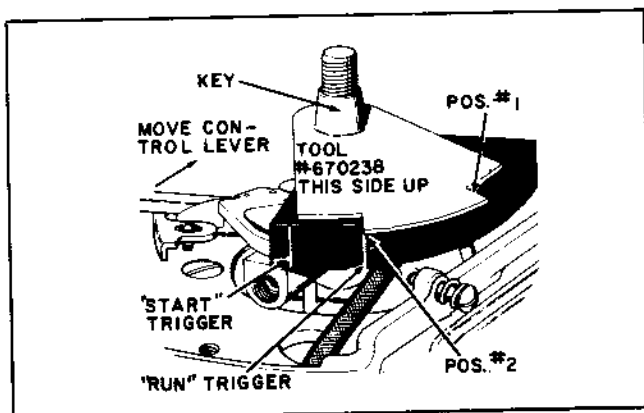


Figure 3-13. Idle (pickup) Position

Install tool 670238 on the crankshaft - Be careful not to distort key register area.

4. Without disturbing the BTDC piston position set in step 3, move the control lever counterclockwise until the RUN trigger aligns with the timing tool (670238) notch marked #1. Hold this position.

- 5.(a) Adjust the stop bracket (Fig. 3-12) to prevent the control lever from moving any further counterclockwise. Tighten the stop bracket screw securely.

- (b) Loosen the actuating cam lock screw enough to allow adjustment of the cam. Position the end of the cam (contacting the throttle post) so that it opens the throttle completely - However, be sure that the cam doesn't cause a binding with the post.

- (c) When properly adjusted, there should be perceptible play in the throttle post (1/16th to 1/8th inch) at open throttle. If this is not present, the cam is probably causing binding at the post and subsequent readjustment and parts replacement may soon follow.

- (d) When the correct position is attained, tighten the lock screw on the "high" end to hold the cam in place.

- 6.(a) Move the control lever to align the "RUN" trigger of the ignition unit with the tool at the proper position pointed out in Fig. 3-13. Hold this position.

- (b) Adjust the cam to touch the post without moving it. Tighten the lock screw to hold the cam in place.

- (c) Recheck to ensure that the high speed point hasn't changed or that binding will not occur. Readjust from high to pickup point as necessary.

- (d) When assured that cam position is correct at FULL RUN and IDLE positions, torque the lock screw to 10-15 in.lbs.

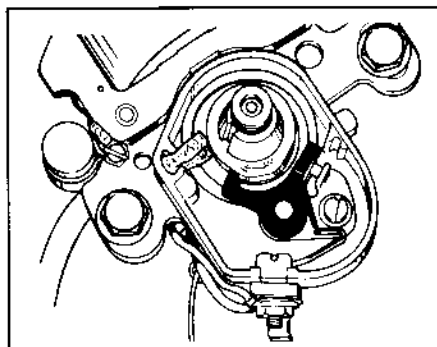
- (e) Install the remaining magneto parts, shroud and starter and other removed accessories.

2-STROKE CYCLE ENGINE

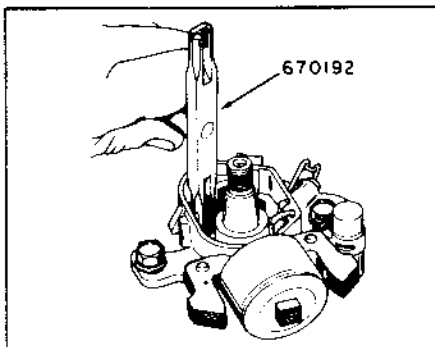
A. TYPE NUMBER CROSS REFERENCE (Timing procedure for all engine types.)

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634	4-3-1	640-02	4-3-8	642	4-3-2	642-23	4-3-4		
635	4-3-1	640-03	4-3-8	642A	4-3-4	642-24	4-3-4		
636	4-3-1	640-03A	4-3-8	642B	4-3-4	642-25	4-3-4		
639	4-3-2	640-04	4-3-8	642-01	4-3-2	642-26	4-3-4		
639A	4-3-4	640-05	4-3-8	642-01A	4-3-2	642-27	4-3-4		
639B	4-3-6	640-05A	4-3-8	642-02	4-3-2	643	4-3-2		
639-02	4-3-2	640-06	4-3-8	642-02A	4-3-2	643A	4-3-4		
639-02A	4-3-2	640-06A	4-3-8	642-02B	4-3-2	643B	4-3-4		
639-02B	4-3-2	640-06B	4-3-8	642-02C	4-3-4	643-01	4-3-2		
639-02C	4-3-6	640-07	4-3-8	642-02D	4-3-4	643-01A	4-3-2		
639-02D	4-3-6	640-07A	4-3-8	642-02E	4-3-4	643-02	4-3-2		
639-03	4-3-2	640-08	4-3-8	642-03	4-3-2	643-03	4-3-2		
639-03A	4-3-4	640-09	4-3-8	642-03A	4-3-2	643-03A	4-3-4		
639-04	4-3-2	640-10	4-3-8	642-03B	4-3-2	643-03B	4-3-4		
639-04A	4-3-4	640-11	4-3-8	642-04	4-3-2	643-04	4-3-4		
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639-07	4-3-6	640-14	4-3-4	642-04C	4-3-4	643-05A	4-3-4		
639-07A	4-3-6	640-14A	4-3-4	642-05	4-3-2	643-05B	4-3-4		
639-07B	4-3-6	640-15	4-3-8	642-05A	4-3-2	643-06	4-3-2		
639-08	4-3-6	640-16	4-3-8	642-05B	4-3-2	643-07	4-3-2		
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639-13	4-3-6			642-07C	4-3-4	643-14	4-3-4		
639-13A	4-3-6			642-08	4-3-4	643-14A	4-3-4		
				642-08A	4-3-4	643-15	4-3-4		
				642-08B	4-3-4	643-15A	4-3-4		
				642-08C	4-3-4	643-16	4-3-4		
				642-09	4-3-2	643-17	4-3-4		
				642-10	4-3-2	643-18	4-3-4		
				642-11	4-3-4	643-19	4-3-4		
				642-13	4-3-4	643-20	4-3-4		
				642-13A	4-3-4	643-20A	4-3-4		
				642-14	4-3-4	643-20B	4-3-4		
				642-14A	4-3-4	643-21	4-3-4		
				642-15	4-3-4	643-22	4-3-4		
				642-16	4-3-4	643-23	4-3-4		
				642-17	4-3-4	643-24	4-3-4		
				642-17A	4-3-4	743-24A	4-3-4		
				642-17B	4-3-4	643-25	4-3-4		
				642-17C	4-3-4	643-26	4-3-4		
				642-18	4-3-4				
				642-18A	4-3-4				
				642-19	4-3-4				
				642-20	4-3-4				
				642-21	4-3-4				
				642-22	4-3-4				

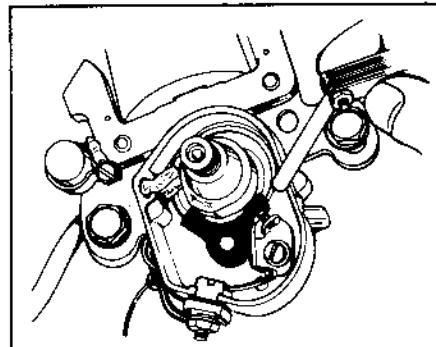
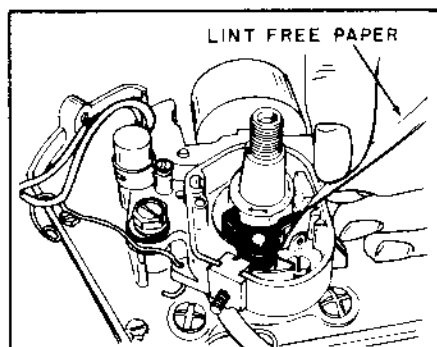
SECTION 4. 2-CYCLE TIMING



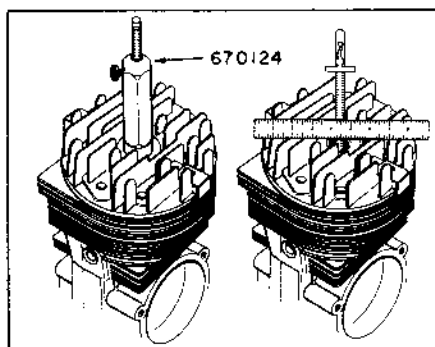
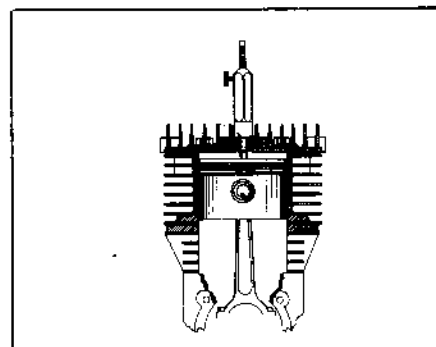
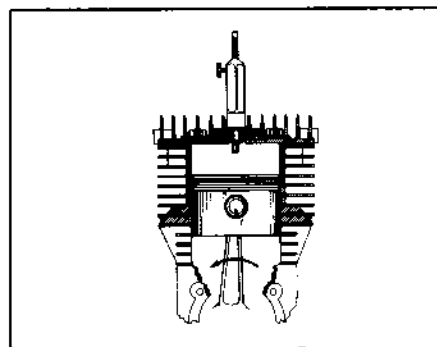
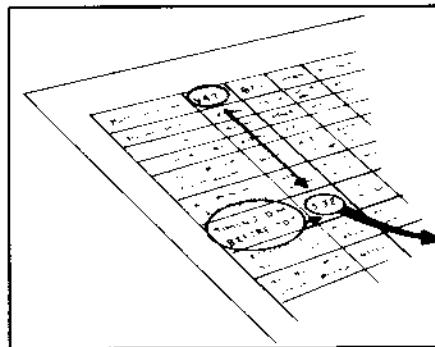
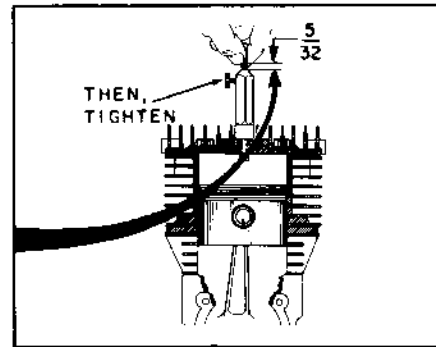
1. INSTALL POINTS



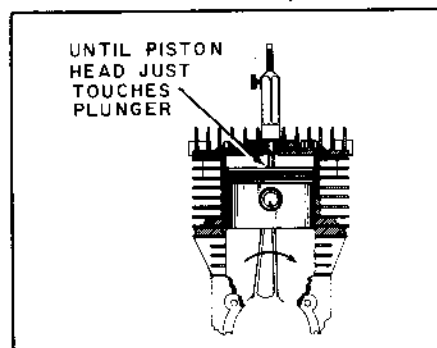
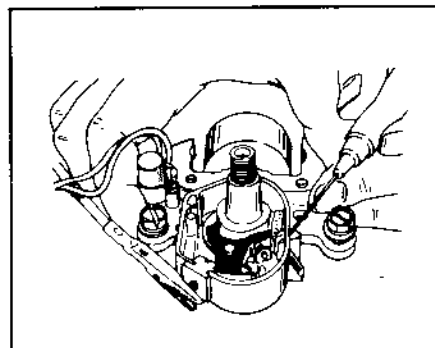
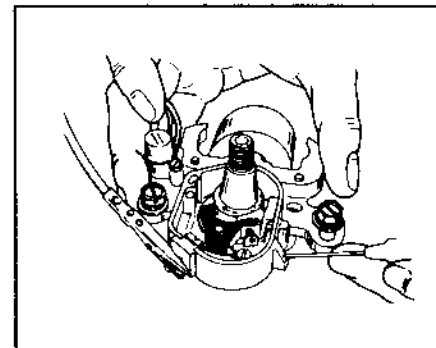
2. ALIGN POINTS

3. GAP POINTS
(SEE SPECS. OR COVER)

4. CLEAN POINTS

5. INSTALL TIMING TOOL,
DIAL INDICATOR, PART
NO. 670241 OR RULE.6. FIND TDC
(TOP DEAD CENTER)7. BACK OFF ROTATION
(OPPOSITE NORMAL RUNNING
ROTATION)8. FIND BTDC TIMING
DIMENSION (SPECS.)

9. APPLY DIMENSION TO TOOL

10. BRING UP ON STROKE
(NORMAL RUNNING ROTATION)11. INSTALL TIMING LIGHT
(OR USE CELLOPHANE)12. ROTATE STATOR UNTIL
POINTS JUST OPEN

Tighten down stator bolts (Specs.), install lead, cover, flywheel, and blower housing.

SECTION 5. SOLID STATE IGNITION

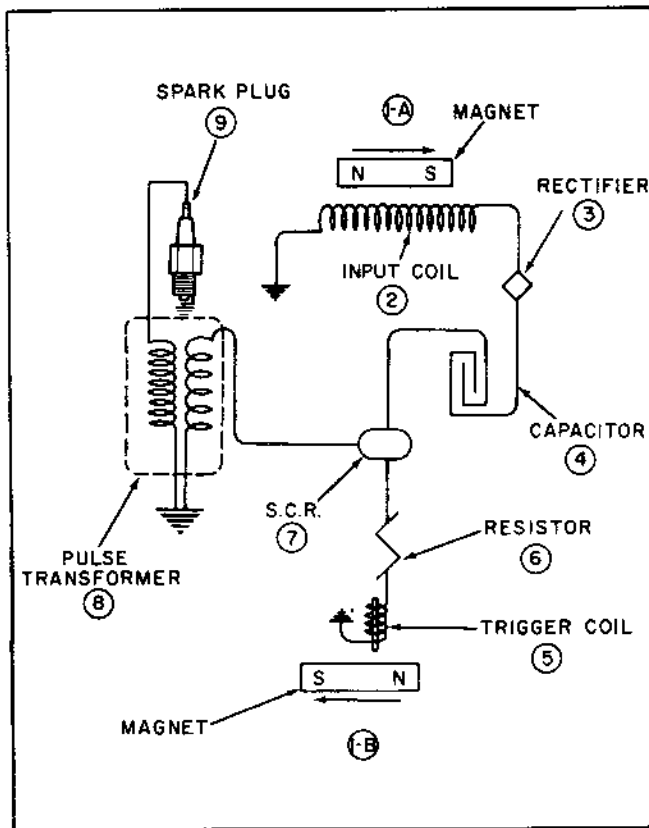


Figure 5-1. Solid State Ignition Schematic

A. GENERAL. The solid state ignition system developed by Tecumseh has no friction-producing (hence, wearing) parts. The only moving part of the system is the flywheel with the charging magnets.

B. OPERATION.

NOTE

Numbers in parentheses refer to figure 5-1.

As the engine's (1-A) flywheel magnet passes the (2) input coil a low voltage A.C. current is induced into that coil. The current passes through a (3) rectifier converting this current to D.C. It then travels to the (4) capacitor where it is stored. The (1-B) flywheel rotates approximately 180° and as it passes the (5) trigger coil it induces a very small electric charge into that coil. The charge passes through the (6) resistor and turns on the (7) silicon controlled rectifier (solid state switch). With the (7) silicon controlled rectifier closed the low voltage stored in the (4) capacitor travels to the (8) pulse transformer. Here the voltage is stepped up instantaneously and it is discharged across the electrodes of the (9) spark plug, firing before top dead center. Some units are equipped with an advance and retard feature. This is accomplished through the use of a second (5) trigger coil and (6) resistor set to turn on the (7) S.C.R., at a lower R.P.M., to fire the spark plug at top dead center.

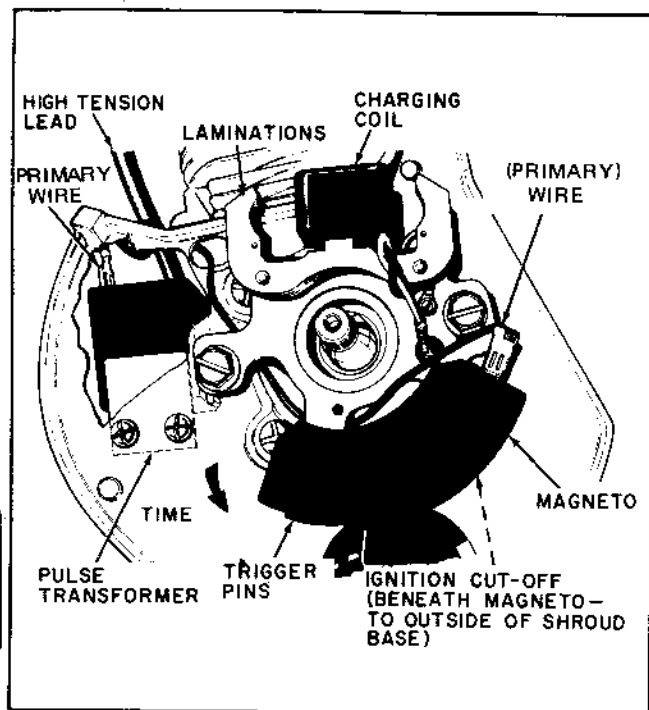


Figure 5-2. Solid State Ignition on 2-Cycle Engine

C. 2-CYCLE SOLID STATE IGNITION SYSTEM.

CAUTION: Do not attempt to crank engine with the primary wire of the transformer disconnected. Also, do not allow the primary wire of the transformer to be grounded or arc. A broken wire causing an open circuit to or in the transformer can also cause permanent damage. See Step 2 below.

1. Preliminary Tests

SPARK TEST

Check for spark using procedure on Page 4-2-1, Paragraph A.

Perform the following visual tests:

HIGH TENSION LEAD . . . Inspect for cracks or indications of arcing. Replace the transformer if questionable lead is found.

LOW TENSION LEADS . . . Check all leads for shorts. Check ignition cut-off lead to see that unit is not grounded out. Repair leads, if possible, or replace.

FLYWHEEL . . . Check magnets for strength. Check key and keyway. Be sure that key locks flywheel to crankshaft.

2. After the above visual checks are made the transformer and solid state stator components can be checked using a Merc-O-Tronic, Graham-Lee or similar tester.
3. When testers are not available . . . If testers are not available use new replacement parts as test for possible failed parts.

Solid State Stator — Replace and test for spark. Time the magneto by turning counter-clockwise as far as it will go. Tighten retaining screws to 5-7 foot pounds.

Pulse Transformer — Before replacing unit, attach leads to a new transformer, ground the unit and test for spark. If a spark occurs now, where previously one didn't, replace the unit with a good one.

PART V. CYLINDER REPAIR

SECTION 1. SPLIT CRANKCASE ENGINE SERVICE

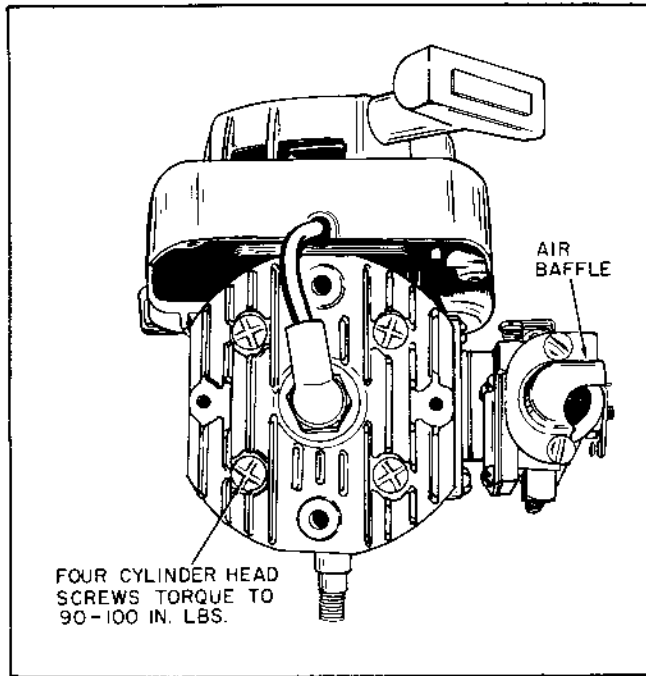


Figure 1-1

A. DISASSEMBLY OF SPLIT CRANKCASE ENGINE. Analyze engine as covered in Part IV, Section 1, then disassemble as necessary.

Remove shroud and fuel tank if present.

Remove flywheel as described in Part IV, Section 2. Inspect flywheel for stator striking, magnet strength, etc. See Part V, Section 8 on trouble shooting and analysis. See also Part IV, Figure 2-12.

Remove the stator and test as explained in Part IV, Section 2, on ignition.

Remove the carburetor and governor linkage. Carefully note exact positions of carburetor wire links and springs or proper carburetion adjustments cannot be properly made. See Part II, Section 5 on governors.

Lift off reed plate and gasket if present and inspect. Refer to Page 5-1-5, for reed service.

Remove spark plug and inspect. Refer to Part IV, Section 2.

Remove muffler. Be sure muffler or ports are not clogged with carbon.

Remove transfer port cover. Check for seal.

Remove cylinder head, if present. Some engine models utilize "LOCTITE" on the screws holding cylinder head to cylinder. Removing screws on engines treated with "LOCTITE" can be a problem. This is true especially with screws having a slotted head for a straight screwdriver blade. The screws can be removed if heat is applied to the head of the screw with a gun type electric soldering iron.

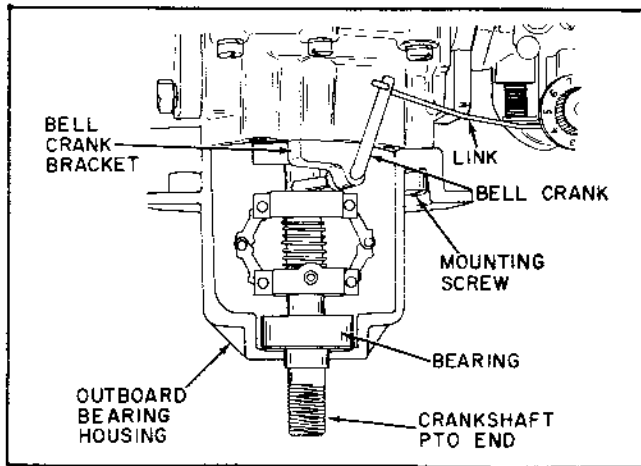


Figure 1-2. Power Take-Off End Mounted Governor

On engines having a governor mounted on the power take off end of crankshaft, remove screws that hold outboard bearing housing (Fig. 1-2) to crankcase; clean the P.T.O. end of the crankshaft and remove outboard bearing housing and bearing. Loosen setscrew that holds governor assembly to crankshaft, slide entire governor assembly from crankshaft. Remove screw that holds governor bell crank bracket to crankcase; remove governor bell crank and bracket.

For P.T.O. mounted governor, see Part II, Section 5, Paragraph B on Governors for proper adjustment.

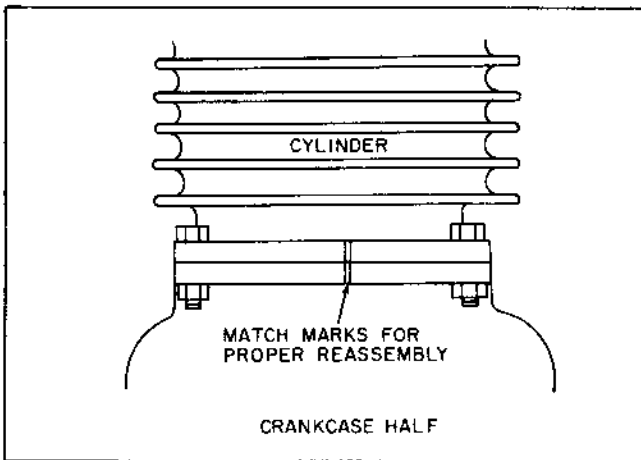


Figure 1-3

Make matching marks on cylinder and crankcase. Remove four nuts and lockwashers that hold cylinder to crankcase, remove cylinder by pulling it straight out from crankcase.

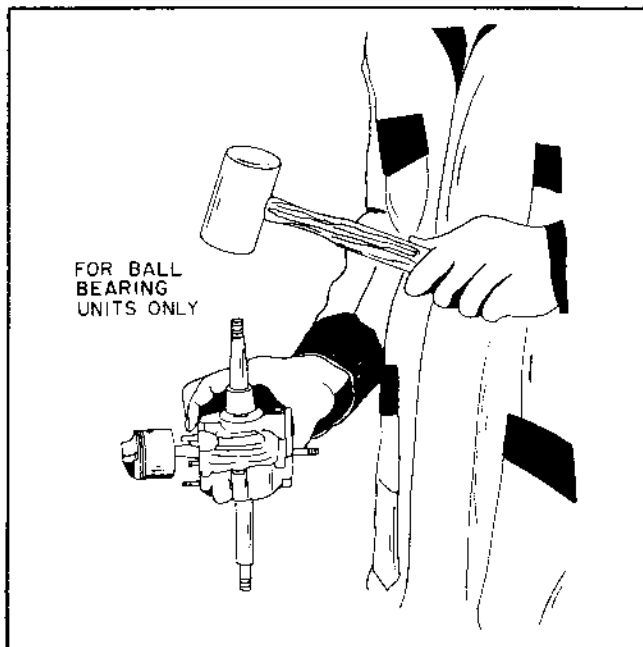


Figure 1-4. Separating Crankcase Halves from the Crankshaft

To separate crankcase halves:

Remove all of screws that hold crankcase halves together. Hold crankshaft vertically. Grasp top half of crankcase and hold firmly. Strike top end of crankshaft firmly with a rawhide mallet (Figure 1-4) while holding assembly over a bench to prevent damage to parts when they fall. The top half of crankcase should separate from remaining assembly.

Invert assembly and repeat procedure to remove other casting half from crankshaft on ball bearing units.

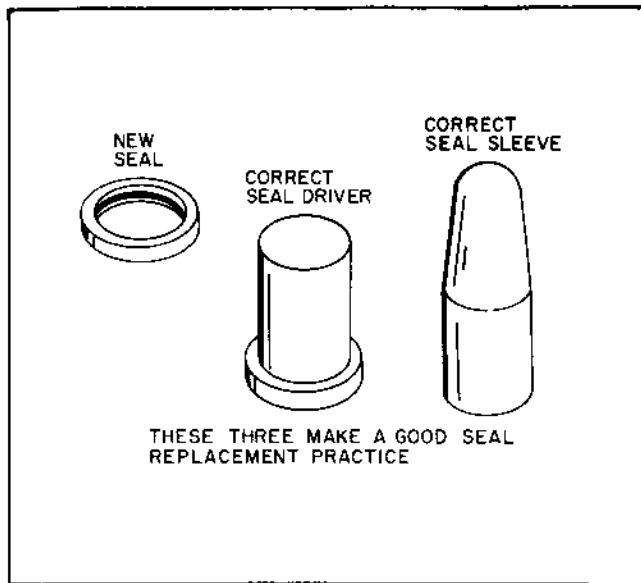


Figure 1-5

Each time crankshaft is removed from crankcase, seals at ends of crankcase should be replaced. To replace seals see Section 3 for procedure.

Use seal protectors where necessary when sliding crankshaft through new seals.

For connecting rod service, see Section 4. For piston and ring service, see Section 7. For crankshaft checks, see Section 5. For main bearing service, see Section 6.

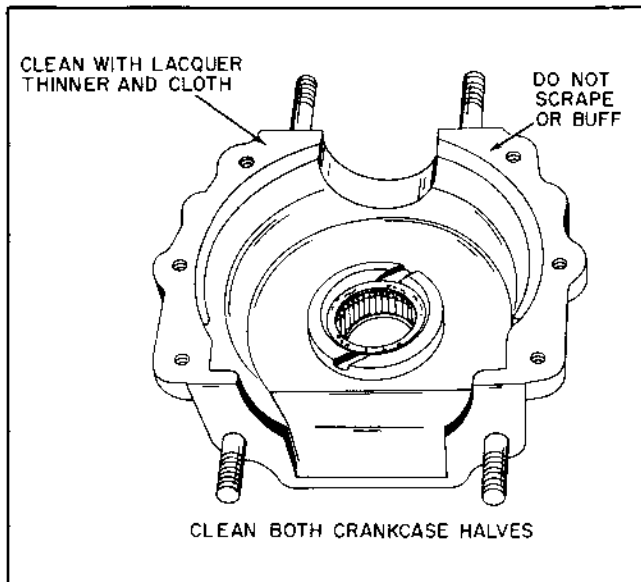


Figure 1-6

The gasket surface where the crankcase halves join must be thoroughly clean before reassembly.

Clean each half with a cloth saturated with a lacquer thinner. Do not buff; do not use a file or an abrasive on these surfaces.

These are matched crankcase halves that cannot be replaced separately. If one half is in need of replacement both halves must be replaced together.

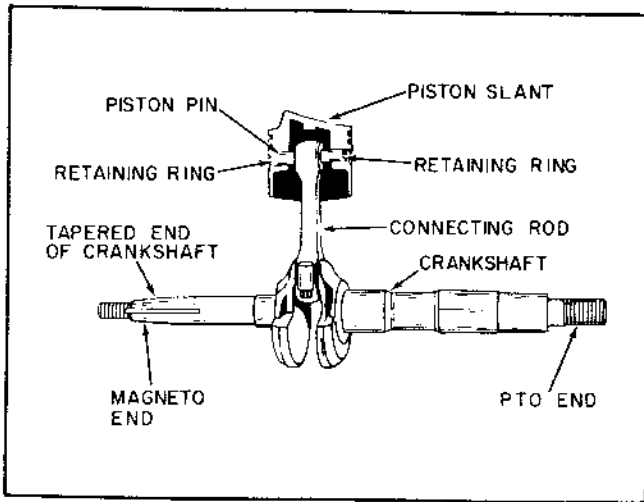


Figure 1-7. Piston, Connecting Rod, and Crankshaft Correctly Assembled

B. REASSEMBLY OF SPLIT CRANKCASE ENGINE.

After servicing the bearings, rings, oil seals, etc. reassemble as follows:

NOTE

Refer to and use the torque tightening table, Part IV.

Domed pistons must be positioned so slope slants toward exhaust or P.T.O. (Power Take-Off) side of crankshaft. See Figure 1-7.

The exhaust gases must slide down the slope and out through the exhaust ports.

Place the P.T.O. half of the crankcase onto the P.T.O. end of the crankshaft. Use seal protectors where necessary.

Apply a thin coating of LIQUID gasket cement to the contact face of one crankcase half. Position one crankcase half on the other. The fit should be such that some pressure is required to bring two halves together. If this is not the case, either the crankcase halves, or the crankshaft, or both must be replaced. Secure halves with the screws provided, tightening screws alternately and evenly to eliminate undue stresses. Before tightening screws, check union of crankcase halves on cylinder mounting side. The halves should be flat and smooth at the union to provide a good mounting face for the cylinder. If necessary, realign before tightening the screws.

The sleeve tool should be placed into crankcase bore from direction opposite crankshaft. Check crankshaft for burrs, nicks, or scratches before inserting it through seal tool. Insert tapered end of crankshaft through the half of crankcase to which the magneto stator is mounted. Remove seal tools after installing crankcase halves.

Stagger ring end gaps on piston and check for correct positioning of domed piston.

Place cylinder gasket on crankcase end.

Place piston into cylinder using chamfer provided on bottom edge of cylinder to compress rings.

Secure cylinder to crankcase assembly.

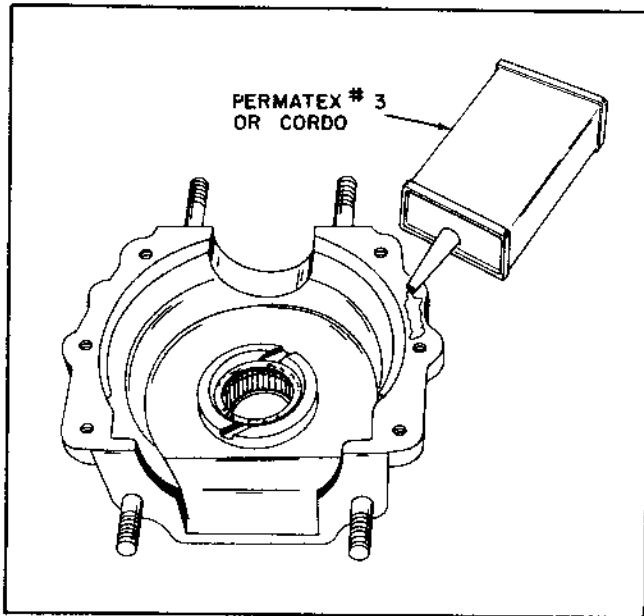


Figure 1-8

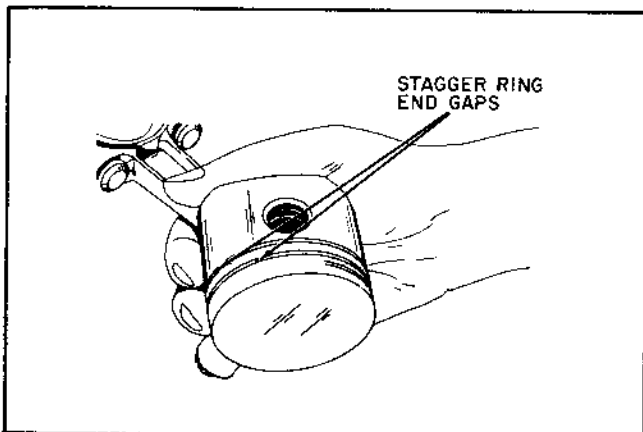


Figure 1-9

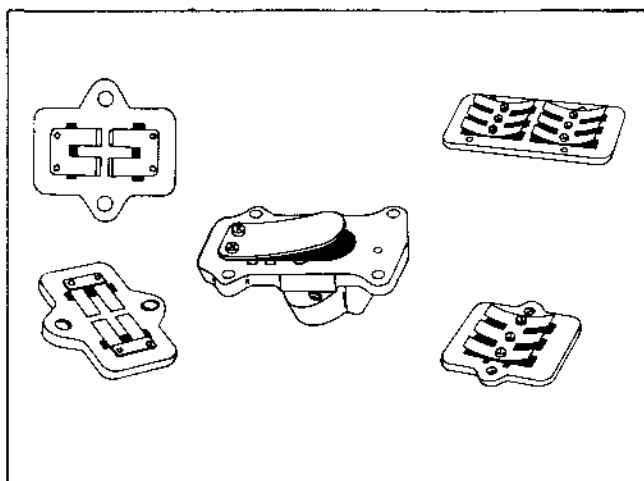


Figure 1-10. Typical Reed Plate Assemblies

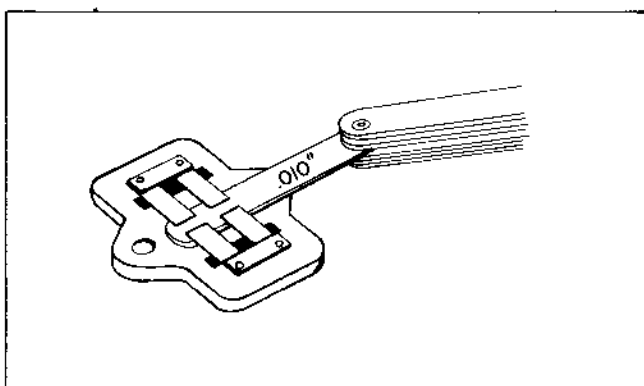


Figure 1-11

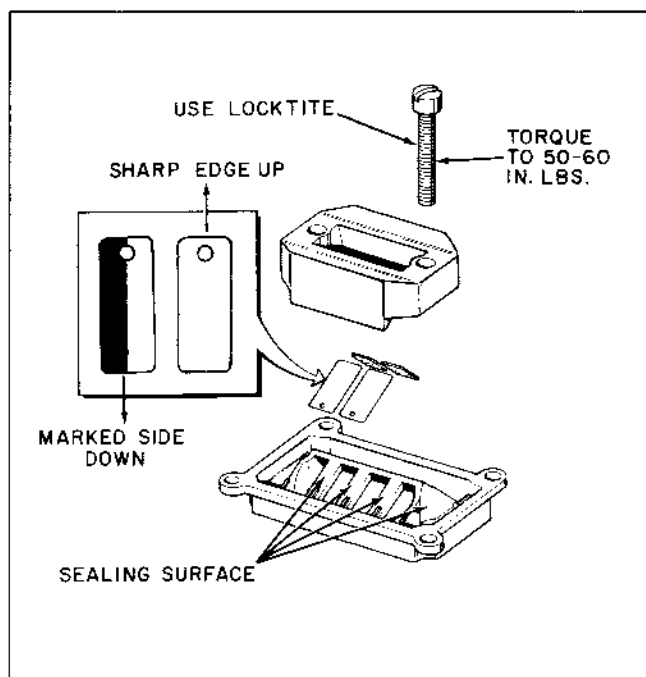


Figure 1-12

C. REED VALVE SERVICE. Clean reeds, stops and adapters of oil, or other foreign matter.

All serviceable reed plates have locating "smudge" marks on the smooth side of the reed as shown in figure 1-12.

The torque requirement on screws securing the reed stop and reeds to the reed plate on the Type 640 engine is 6-9 inch lbs.

Snowblower engines with reeds on the carburetor adapter require 10-15 inch lbs. of torque. Use Loctite on the screws.

Check reeds for seal against the adapter. Reeds should not bend away from plate more than 0.010 inch. Figure 1-11.

When replacing reeds in units where reeds can be removed, be sure the sealing surface of the reed faces the sealing surface of the adapter or body.

The Type 639 engine reed assembly is shown in Figure 1-12.

If the "smudge" marks are gone, feel for a rough edge on the reed. This edge must face away from the sealing surface.

Torque screw to 50-60 in-lbs. Use loctite on screw threads.

SECTION 2. UNIBLOCK ENGINE SERVICE

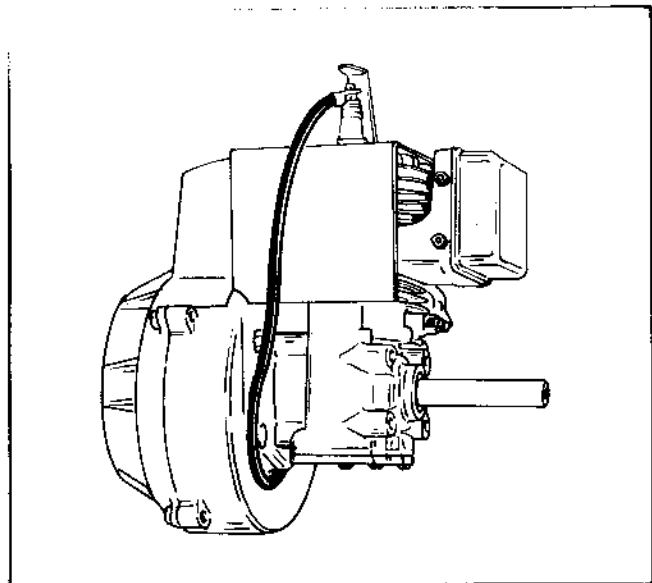


Figure 2-1

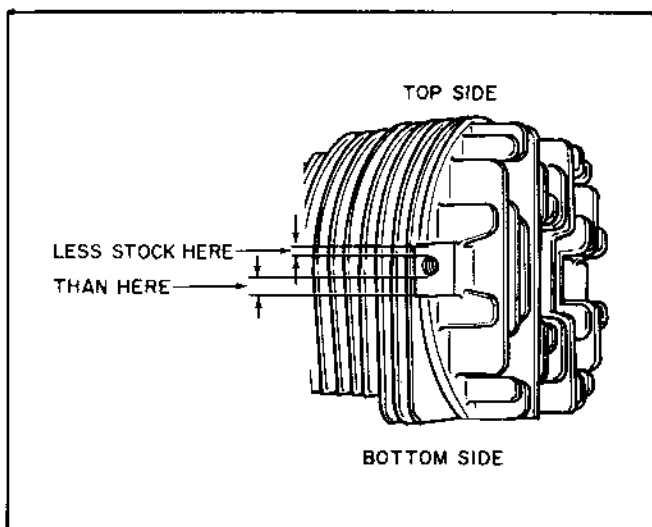


Figure 2-2

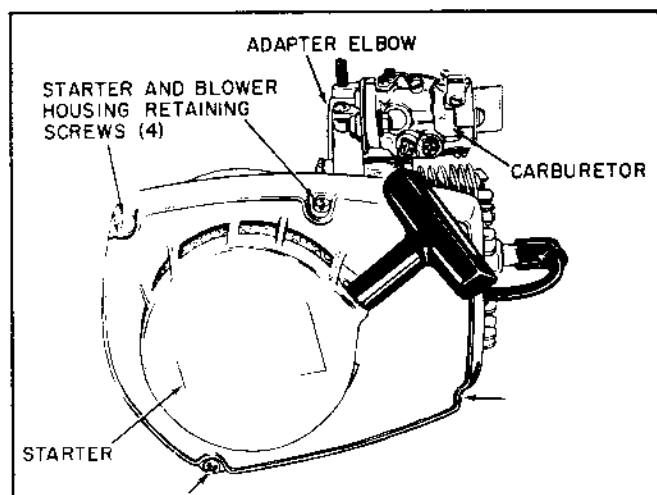


Figure 2-3

A. INTRODUCTION AND IDENTIFICATION. The uniblock (meaning-combined crankcase and cylinder design) engine provides equal or greater horsepower in a more compact unit. Crankcase compression area has been decreased allowing for greater differentials in pressure. This means that the system will pull the oil gasoline-air mixture more efficiently, compress it tighter, and force it into the combustion chamber with more power to purge the exhaust, again, more efficiently. Also uniblock engines use the loop scavenge system, and the 3rd port system, which allows greater R.P.M., hence greater horsepower.

B. OUTBOARD ENGINE HEAD INSTALLATION ON SOME EARLY 1970 MODELS. The cylinder head may fit to the cylinder in a way which appears wrong - but is right.

The head may be like either shown, i.e. two flats around the circumference, or one. Important in any case is that the fuel tank bracket mounting hole must have less stock on the boss toward the top of the engine when correctly assembled.

This is necessary so that the tank bracket positioning slots allow alignment between the tank bracket and boss mounting holes.

C. UNIBLOCK DISASSEMBLY. After completing engine tests for ignition, compression etc., disassemble the engine as follows:

Remove the shroud and fuel tank.

Note the condition of the air vane governor, if present.

Remove the starter cap and flywheel, note the position of the Belleville washer.

Remove the flywheel - See Part IV, Section 2.

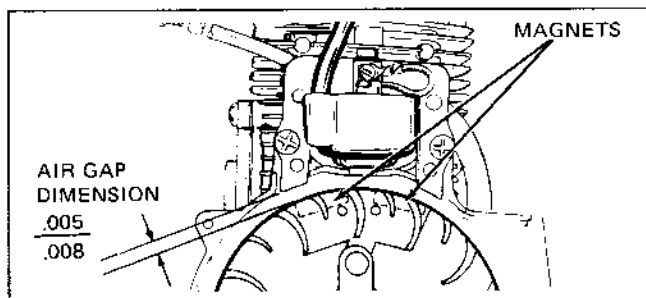


Figure 2-3A

MAGNETO AIR GAP SETTING (Figure 2-3A). Loosen the two screws securing the laminations to the block. Hold the laminations away from the flywheel and insert air gap gauge P/N 670216 in the gap. (Magnetic attraction will hold laminations to flywheel). Use Loctite Grade A on screws. Tighten screws. Torque to 35 to 45 inch pounds. Remove air gap gauge.

SHROUD BASE REMOVAL - Two types of bases are available.

- (1) One piece magneto coil and stator plate.
- (2) Coil separate from stator points.

AIR GAP (Setting for Breaker Point & C.D. Systems)

NOTE: Due to variation between pole shoes, air gap may vary from .005/.015 when flywheel is rotated.

Point gap setting on Breaker Point System: .019/.022

On engines with the ignition coil mounted outside the flywheel, the correct air gap setting between the flywheel magnets and the ends of the laminations is .015". Place two air gap gauges (part number 670216) together and insert between gap. Tighten coil mounting screws to a torque of 20-30 inch pounds. Recheck gap setting to be certain there is proper clearance between magnets and lamination ends.

There is no timing adjustment on external laminations ignition systems.

Both units are secured by four (4) screws as shown in Figure 2-4. A gasket is placed between the shroud base and the cylinder block assembly, Figure 2-5.

On needle bearing models - the shroud base may be lifted off of the engine block.

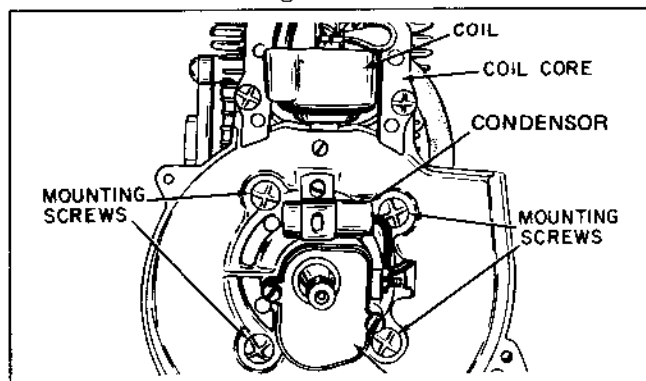


Figure 2-4

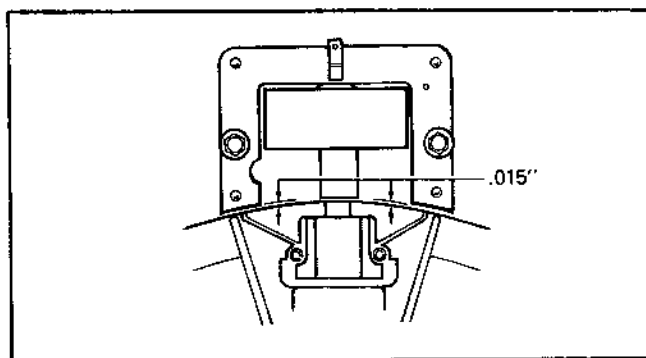


Figure 2-4A

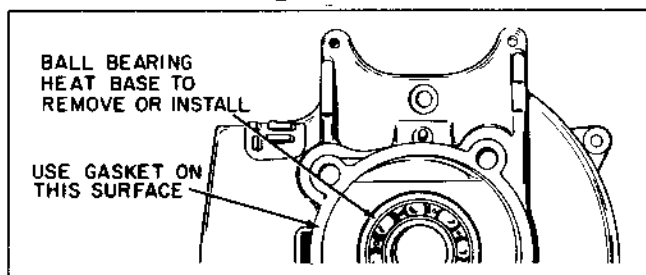


Figure 2-5

If an engine evidences being tight or if when removing the flywheel the use of a knock-out tool dislodges the ball bearing from blower housing base at the magneto end, this could force the lower thrust face of the crankshaft up against the cylinder thrust face. To correct this condition, rap sharply on the P.T.O. end to provide clearance between crankshaft and cylinder thrust face.

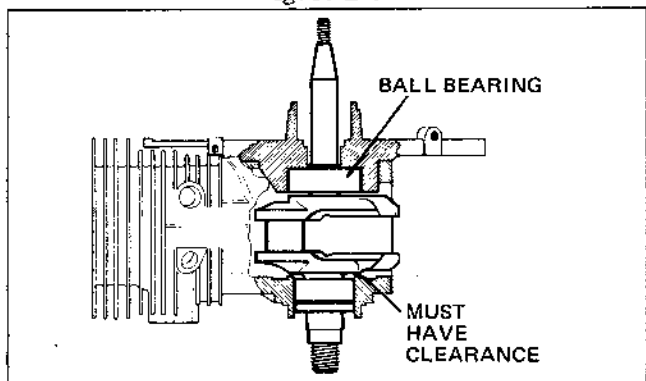


Figure 2-5A

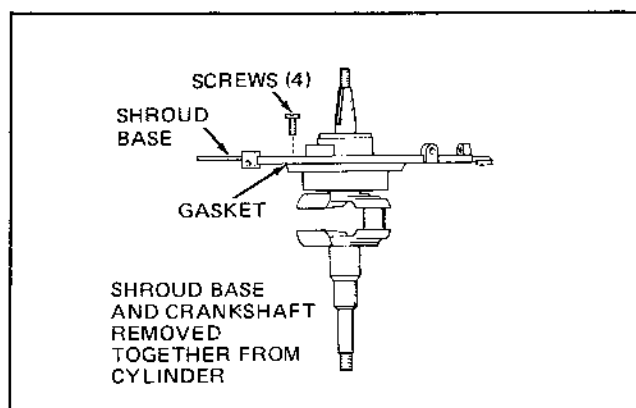


Figure 2-5B

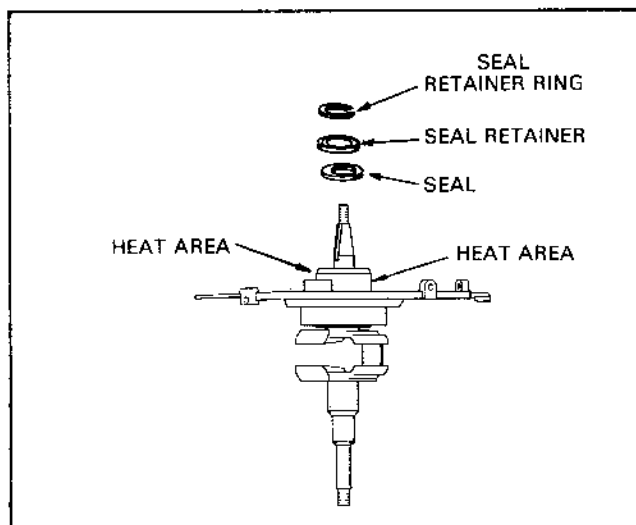


Figure 2-5C

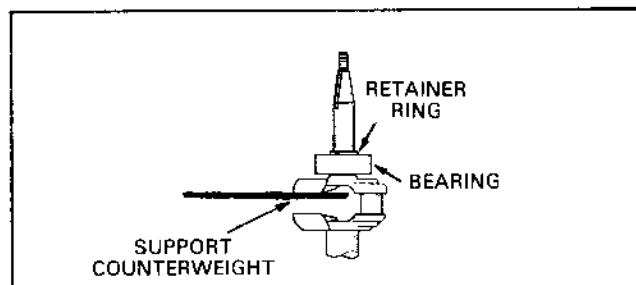


Figure 2-5D

ENGINES EQUIPPED WITH CRANKSHAFT BALL BEARINGS

1. Before removing shroud base with crankshaft, disassemble rod cap from rod and remove the piston from the bore to prevent any interference when shroud base and crankshaft are removed.
2. Remove four (4) shroud base screws and tap shroud base so base and crankshaft can be removed together. Figure 2-5B.
3. To remove bearing with crankshaft from base -

! This symbol points out important safety instructions which if not followed could endanger the personal safety and/or property of yourself and others. Read and follow all instructions.

! Use safety glasses and heat resistant gloves. Using a propane torch, heat area on base around outside area of bearing until there is enough expansion to remove base from bearing on crankshaft. Now remove and discard seal retainer ring, seal retainer and seal.

4. To remove the bearing race, remove the retainer ring on the crankshaft with a snap ring pliers, Figure 2-5D, (positioning bearing race) and with the use of a bearing splitter or arbor press remove the ball bearing.

CAUTION: Support crankshaft's top counterweight to prevent bending. Also, bearing to be pressed on inner race only.

5. To install ball bearing on crankshaft, slide bearing on crankshaft and fit on shaft by tapping using a mallet and tool, part number 670258 or press ball bearing on crankshaft with an arbor press. Install retainer ring.
6. To install crankshaft with ball bearing, heat shroud base to expand bearing seat and drop ball bearing into seat of base shroud. Allow to cool. Install new seal retainer ring, seal retainer, and seal.

5

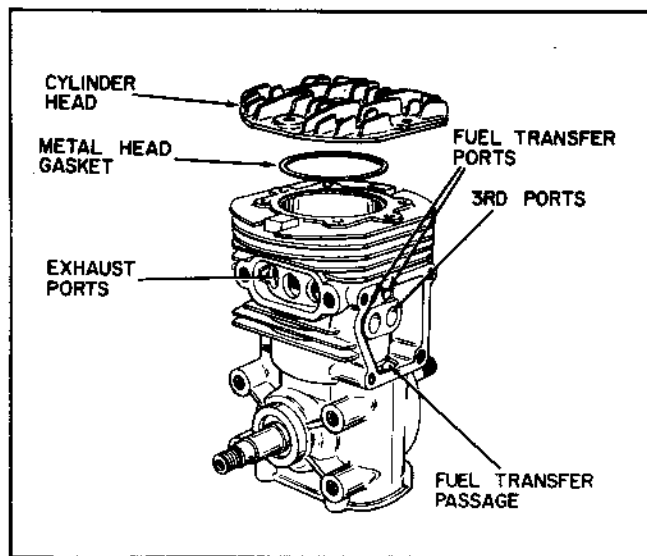


Figure 2-6

Remove Head - Replace head gasket. Save old head gasket for use when replacing piston, then discard.

Remove cylinder block cover plate to gain access to the connecting rod bolts.

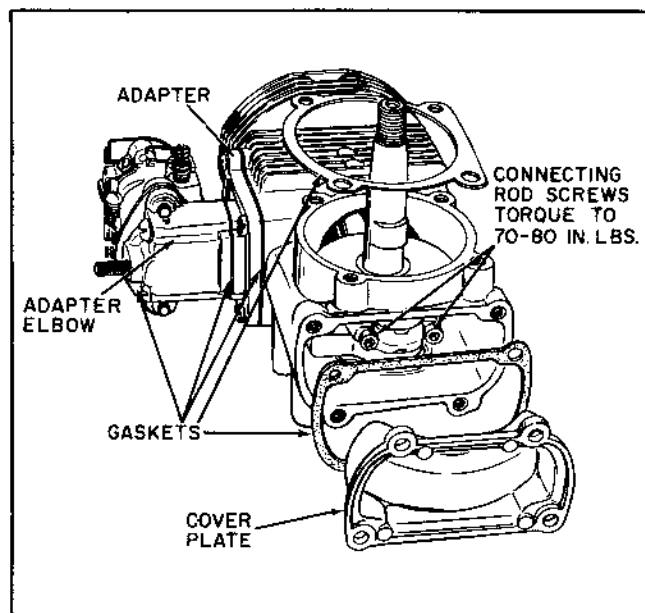


Figure 2-7

Connecting rod - Note location of match marks before disassembly. See Part V, Section 4 for needle bearing replacement.

Remove piston - Remove ridge if necessary. Push piston and connecting rod through top of cylinder. Important: Use a ring compressor to reinstall piston. Be careful not to allow rings to catch on recess for head gasket. Use old head gasket to take up space in recess. Do not force piston into cylinder as damage to rings or piston could occur.

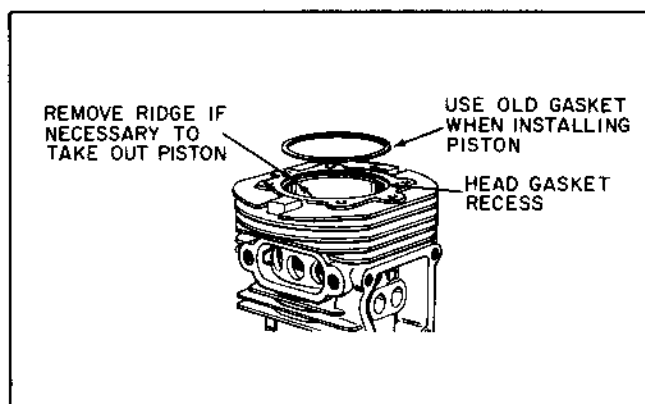


Figure 2-8

Remove crankshaft from the cylinder block assembly.

Sleeve or needle bearing - Use a seal protector and lift crankshaft out of cylinder. Be careful not to lose needles from needle bearing.

Ball bearing - Use a mallet to strike crankshaft on P.T.O. end (Power Take Off) while holding cylinder block in hand.

Ball bearing service - See Part V, Section 6

Connecting rod service - See Part V, Section 4

Piston service - See Part V, Section 7

Reed plate service - See Part V, Section 1

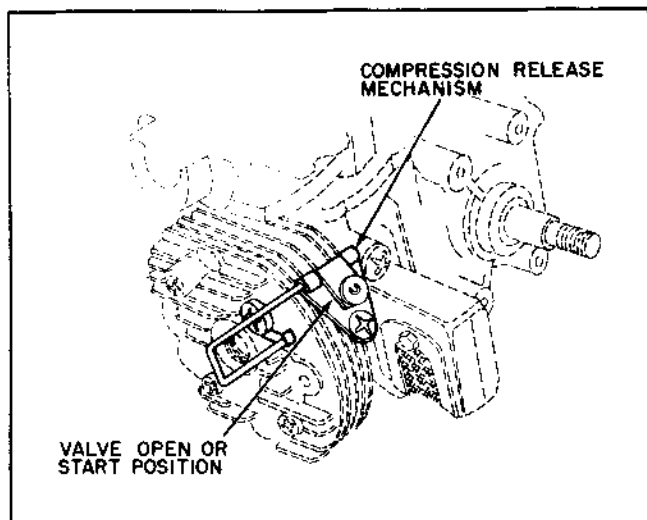


Figure 2-9

D. MANUAL COMPRESSION RELEASE. The compression release mechanism shown in the picture is poised in the open (start) position ready for starting the engine.

Cylinder pressures will leak through the hole provided on the cylinder, easing starting.

CAUTION: Do not run engine with valve open (start position) for prolonged periods; damage to valve and seat could result.

5 TROUBLE SHOOTING

(1) Compression Checks

- a. With release closed (run position) check compression; reading should be above 85 pounds.
- b. Open release mechanism (start position) and again check compression; reading should be 45-60 pounds.

If readings are low, check for compression leaks at rings, head or in release mechanism. Remember - crank engine vigorously several times and record the highest gauge reading.

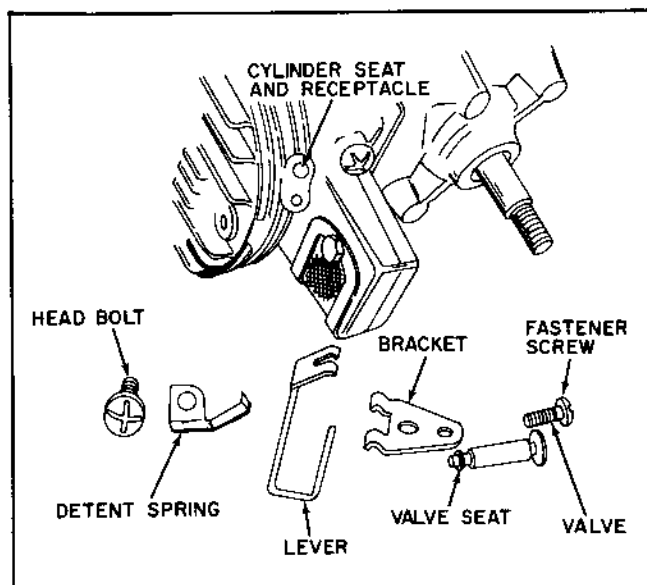


Figure 2-10

REMOVAL AND DISASSEMBLY

- (1) Loosen head bolt and remove detent spring.
- (2) Loosen relief mechanism fastener and lift out of position.
- (3) Inspect valve seating surfaces.
 - a. Valve can be replaced if damaged.
 - b. Cylinder assembly must be replaced if seat is damaged.
- (4) Clean all passages in cylinder.
- (5) Check lever and detent spring for distortion.

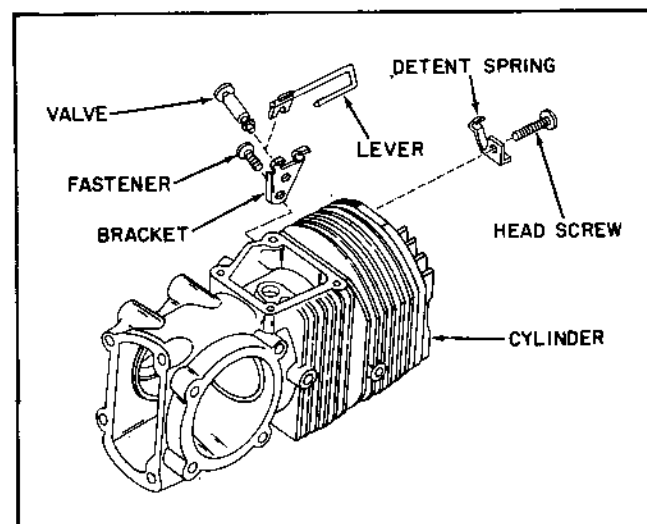


Figure 2-11

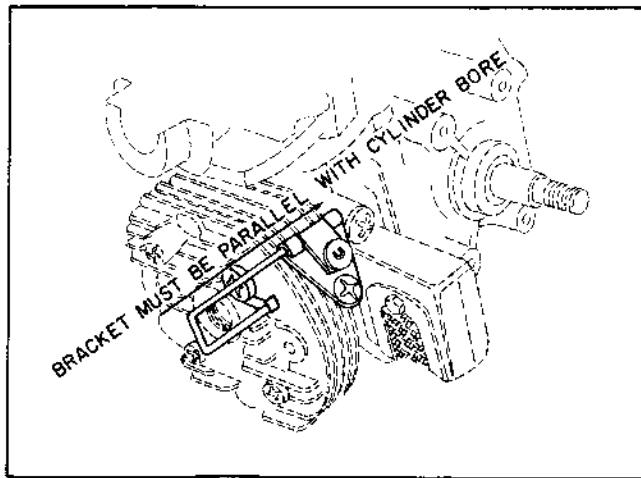


Figure 2-12

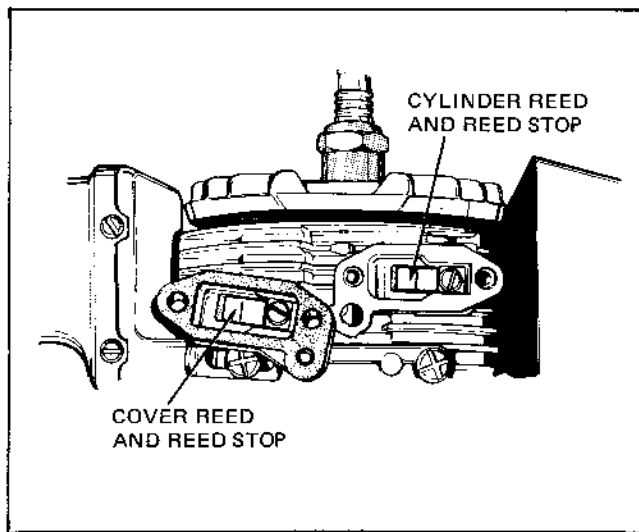


Figure 2-13

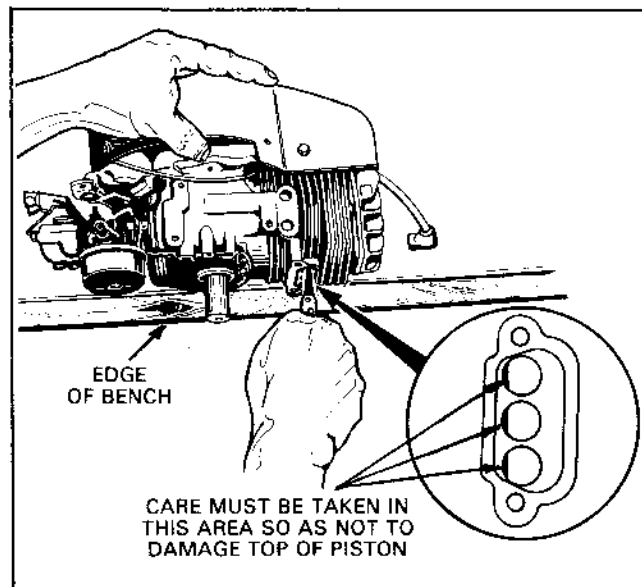


Figure 2-14

REASSEMBLY

Install parts in reverse order leaving both fasteners loose.

Align lever parallel with cylinder and tighten fastener; then secure head bolt and spring.

Lubricate detent spring at point of lever contact and check operation.

E. AUTOMATIC COMPRESSION RELEASE

- (1) Operation — Cranking compression pressures are allowed to bleed passed reeds and into muffler. Once the engine is started, a high pressure build-up between the reeds forces the reeds against their seats stopping compression bleed off and allowing engine to run at full compression.
- (2) Trouble Shooting — Poor running or lack of power may be caused by a leaking reed or cover gasket.
- (3) Reed Replacement — Replace both reeds if either is defective. When installing reeds be sure the colored side of the reed faces its seating surface, if in doubt, feel for a rough edge on the reed. The rough edge must be installed away from the seating surface. Assemble reed stops and tighten self-tapping screws.

Note! Cylinder and cover reed are not the same, the cover reed is thinner, so order and assemble per parts list.

EXHAUST PORT CLEANING (All two-cycle engines)

- (1) Remove muffler, adapter or other parts used, depending on type.
- (2) Remove spark plug.
- (3) Position piston to bottom-dead-center.
- (4) Position engine as shown in Figure 2-14.

CAUTION: Do Not Scratch Metal Surfaces

- (5) Carefully remove carbon with knife or similar tool. **NOTE:** Some plug fouling may occur due to loose carbon particles!

SECTION 3. OIL SEAL SERVICE

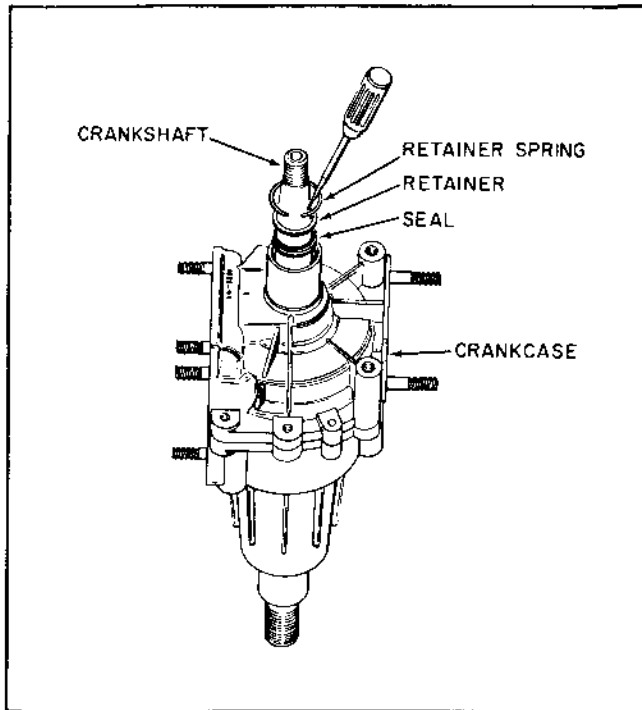


Figure 3-1. Crankshaft Seal Removal

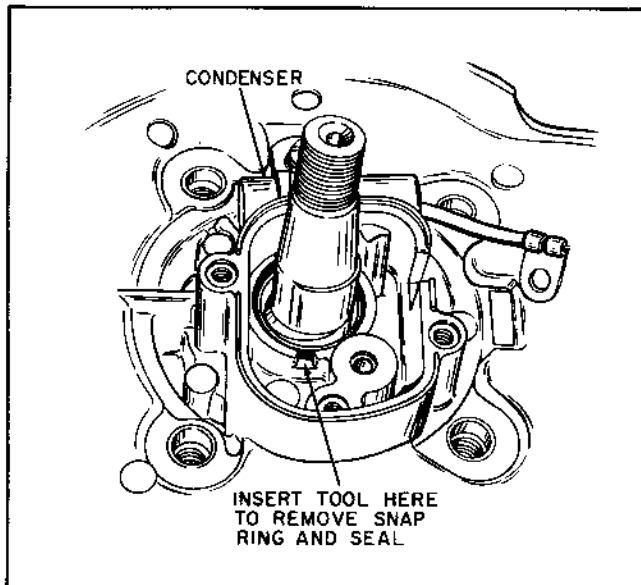


Figure 3-2

A. SEAL REMOVAL. Discard all seals removed from crankcase, since new seals should be installed each time crankshaft is removed. Check condition of seal retainers and retainer springs.

To remove seals, use ice pick, or old carburetor main adjustment needle or screwdriver. Insert tool between retainer spring and crankcase retainer spring groove so that point of tool is near gap in spring. Carefully pry retainer spring out of spring groove, then remove retainer and seal. Seal removal can be done with crankshaft in place, but it is easier with crankshaft removed.

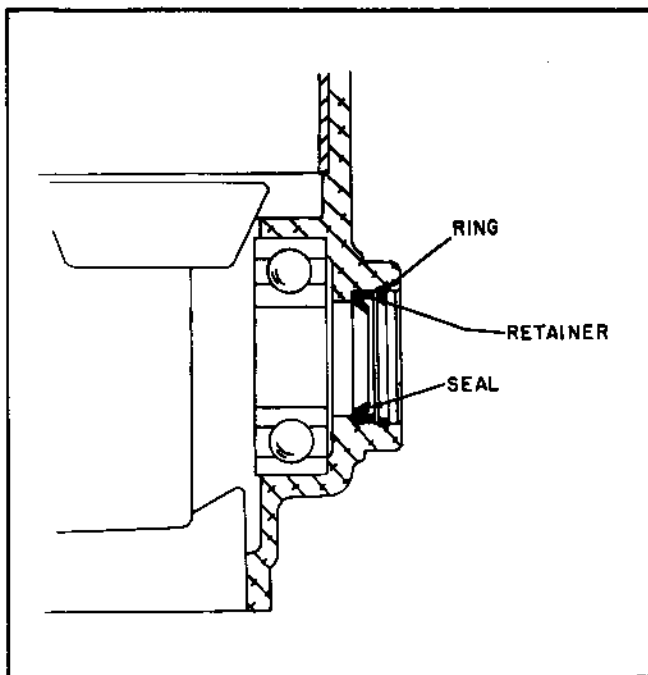
CAUTION

Use care when removing retainer spring from crankcase groove. Excessive pressure could damage crankcase, especially on magneto side which has a thin-walled hub.

Do not scratch or nick crankshaft where seal makes contact.

Newer models of engines have a small recess cast into the seal receptacle. This allows easy access to seal and retainers.

B. SEAL REINSTALLATION. Install seals in bores of crankcase halves. Seals must be inserted into bearing well with channel groove toward internal side of crankcase. Retain seal with retainer. Seat retainer spring into spring groove.



C. OUTBOARD ENGINE OIL SEALS. The power take-off end oil seal on engines used in outboard application, will seal down (outward) from the crankcase.

D. OIL SEAL TOOLS. See Chapter 5 Mechanics Handbook 2-Cycle Engine Tools for appropriate tools for oil seal removal and installation.

Figure 3-3

SECTION 4. CONNECTING ROD SERVICE

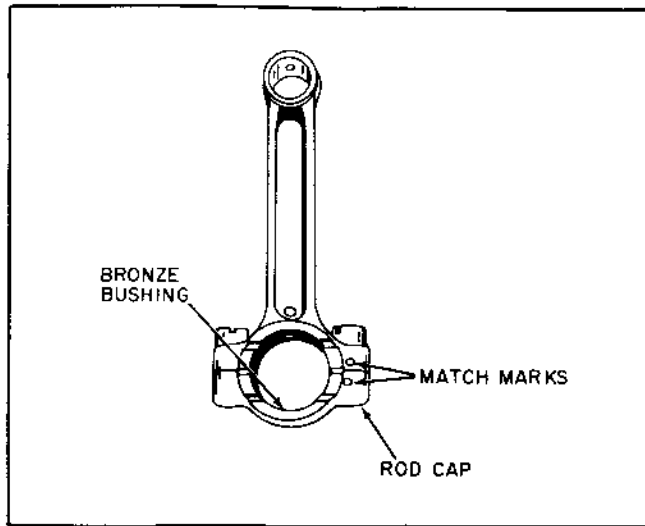


Figure 4-1

A. DISASSEMBLY. For engines that use a solid bronze or aluminum connecting rod, remove two self-locking capscrews holding the connecting rod to crankshaft; remove rod cap.

Note match marks on connecting rod and cap, these marks must be reinstalled in the same relative position to the crankshaft.

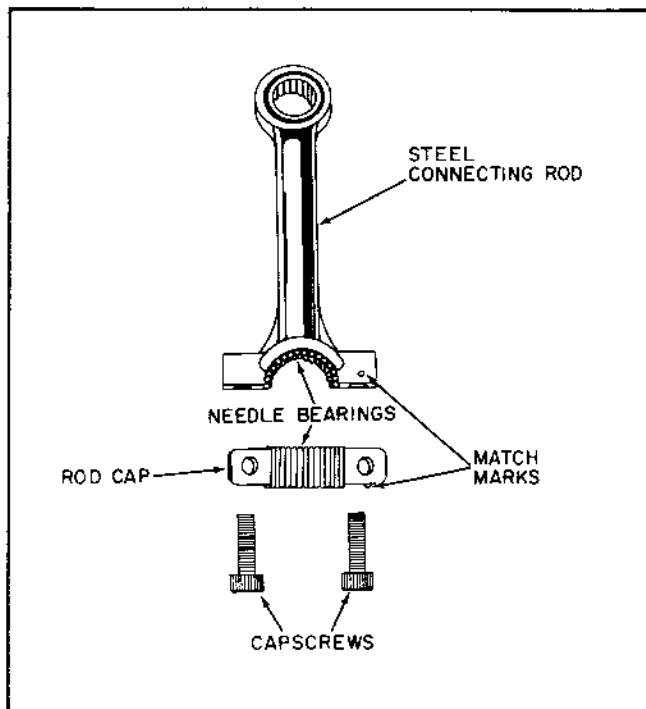
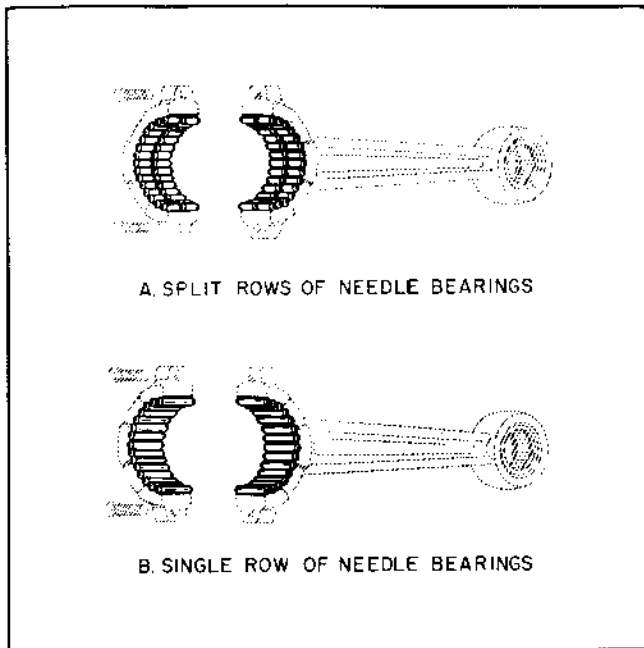


Figure 4-2. Steel Connecting Rod

Engines using steel connecting rods are equipped with needle bearings at both crankshaft and piston pin end. Remove two screws that hold connecting rod and cap to crankshaft, taking care not to lose needle bearings during removal. Needle bearings at the piston pin end of steel rods are caged and can be pressed out as an assembly if damaged.

Check connecting rod for cracks or distortion. Check bearing surfaces for scoring or wear. Bearing diameters should be within the limits indicated in Table of Specifications.



B. TWO BASIC ARRANGEMENTS OF NEEDLES are supplied with the connecting rod crankshaft bearing.

A. Split rows of needles.

B. Single row of needles.

Service needles are supplied with a beeswax coating. The beeswax tends to hold the needles in position.

Figure 4-3. Single and Split Rows of Needle Bearings

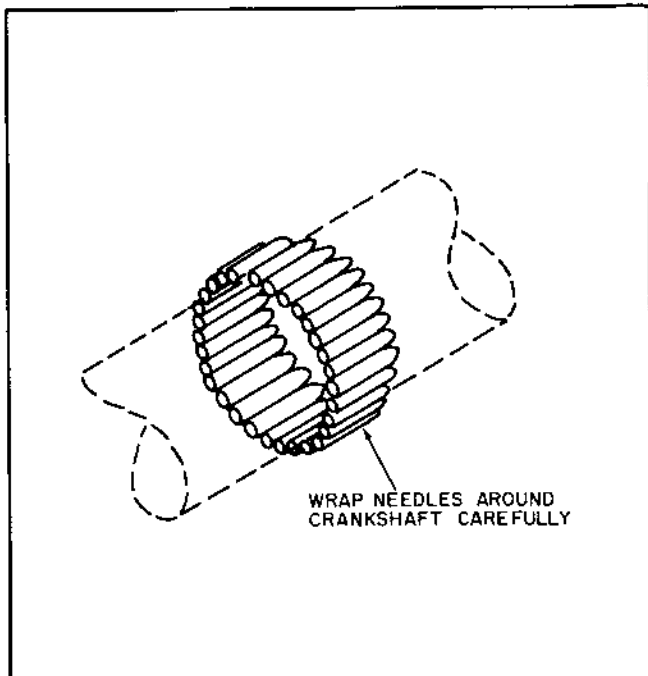


Figure 4-4

C. TO INSTALL SERVICE NEEDLES

- (1) Clean crankshaft journal and connecting rod bearing thoroughly so they are free of oil. Hands must also be free of oil and dirt.
- (2) Place bearings with beeswax onto cool metallic surface so as to stiffen beeswax. Hand temperatures will melt wax, so avoid prolonged handling.
- (3) Remove paper backing on bearings and wrap needles around crankshaft journal. Beeswax will hold needles onto journal.

Needles must be positioned uniformly onto the crank pin.

NOTE

When installing split row of needles, wrap each row of needles around journal and try to seal together with gentle, but firm pressure to keep bearings from unwinding.

- (4) Place connecting rod onto journal, position rod cap and secure with capscrews. Torque to specifications.
- (5) Force solvent (lacquer thinner) into needles just installed to remove all beeswax.
- (6) Force 30W oil into needles for proper lubrication.

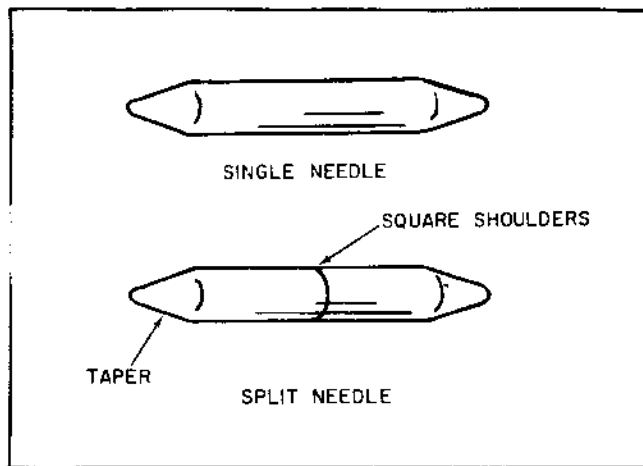


Figure 4-5

The quantity of needles required for a complete set is noted in the parts manual under the appropriate part number.

Split needles are to be installed with blunt ends together and tapered ends toward the outer end of the journal.

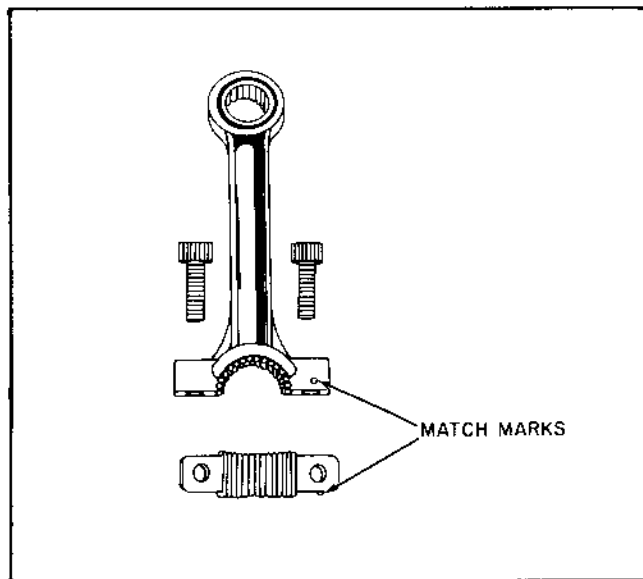


Figure 4-6

D. CONNECTING ROD REINSTALLATION

Reassemble connecting rod on crankshaft and check fit moving parts. Match marks (Fig. 4-6) on connecting rod and cap must be aligned during reassembly. Tighten fasteners alternately to insure even torque distribution. Torque to specifications and check fit between connecting rod and crankshaft journal.

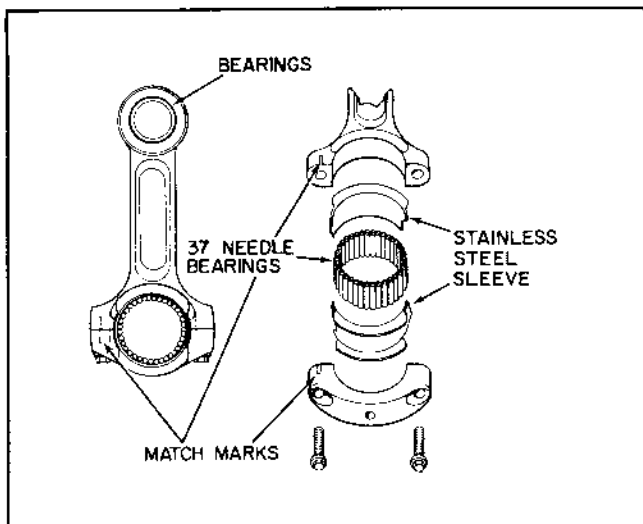


Figure 4-7

E. TYPE 670 CONNECTING ROD REINSTALLATION

A stainless steel insert is fitted into the rod and 37 needle bearings are fitted into the insert. Match marks (Figure 4-7) on connecting rod and cap must be aligned during reassembly. Tighten fasteners alternately to insure even torque distribution. Torque to specifications and check fit between connecting rod and crankshaft journal.

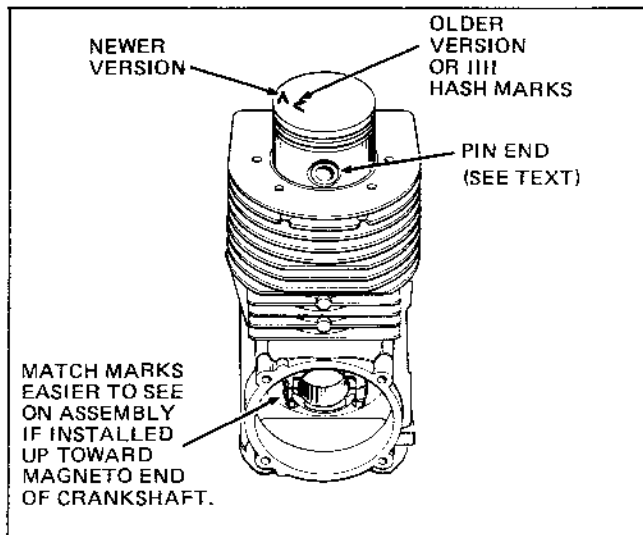


Figure 4-8

F. PISTON INSTALLATION.

- (1) An offset piston is identified by a "V" or hash mark (IIII) stamped into the top of the piston.

The older version piston's arrowhead was 90° from a line of the piston pin bore. The newer version's piston arrowhead points in a line parallel to the piston bore. In the newer version the wrist pin bore's diameter is smaller at the end the arrowhead points.

- (2) Figure 4-8 shows correct installation of piston pin for newer version piston. For older piston version the piston pin may or may not be installed as shown in Figure 4-8.

⚠ Whenever working with a flammable material, safety precautions must be observed. Safety glasses, proper tools, insulated gloves, and a proper stand-by fire extinguisher is mandatory.

(3) PISTON PIN BORE EXPANSION

It is necessary to expand the diameter of the piston pin hole to accept the piston pin. To accomplish this:

- (a) Fill a quart can 3/4 full of SAE No. 30 motor oil.
- (b) Completely submerge the piston in the oil but DO NOT let the piston touch the bottom of the can. Use a heavy wire (8" in length) and bend a hook in each end to suspend the piston in the oil. See Figure 4-9.
- (c) Gradually heat the oil using a hot plate or torch until the oil begins to smoke.
- (d) When the oil smokes, remove the piston from the oil.

(4) PISTON PIN INSTALLATION

⚠ Use safety precautions when working with hot metal surfaces. Safety glasses, proper tools, insulated gloves, and a proper stand-by fire extinguisher is mandatory.

Since it is easier to install the retainer ring and push in the piston pin with a punch when working with a heated piston, use the open end of the pin as a support for a punch. Figure 4-10. Install the remaining retaining ring.

(5) INSTALLING THE PISTON INTO THE CYLINDER.

Allow piston to cool before attempting to insert in cylinder.

Install piston in cylinder bore as shown in Figure 4-8.

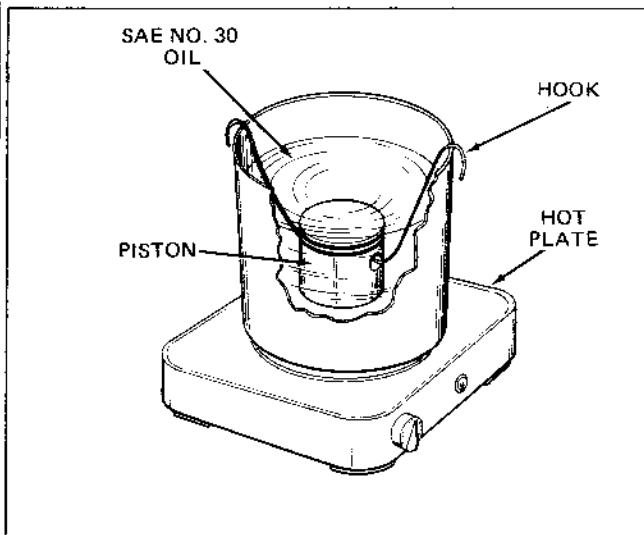


Figure 4-9

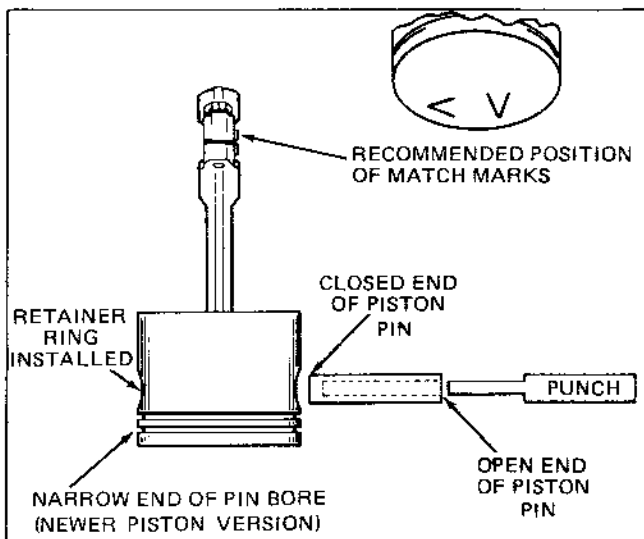


Figure 4-10

SECTION 5. CRANKSHAFT SERVICE

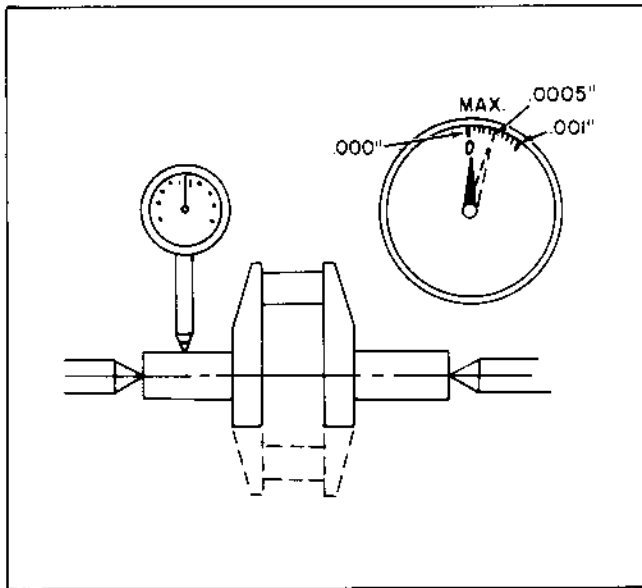


Figure 5-1

Use a micrometer to check bearing journals for out-of-round condition. The main bearing journals should not be more than 0.0005 inch out-of-round. Connecting rod journal should not be more than 0.001 inch out-of-round. Replace a crankshaft that is not within these limits. Do not attempt to regrind the crankshaft, since undersized parts are not available.

Check tapered portion of crankshaft (magneto end) keyways, and threads. Damaged threads may be restored with a thread die. If taper of shaft is rusty, it indicates that engine has been operating with a loose flywheel. Clean rust off taper and check for wear. If taper or keyway is worn, replace crankshaft.

Check all bearing journal diameters. They should be within limits indicated in the Table of Specifications.

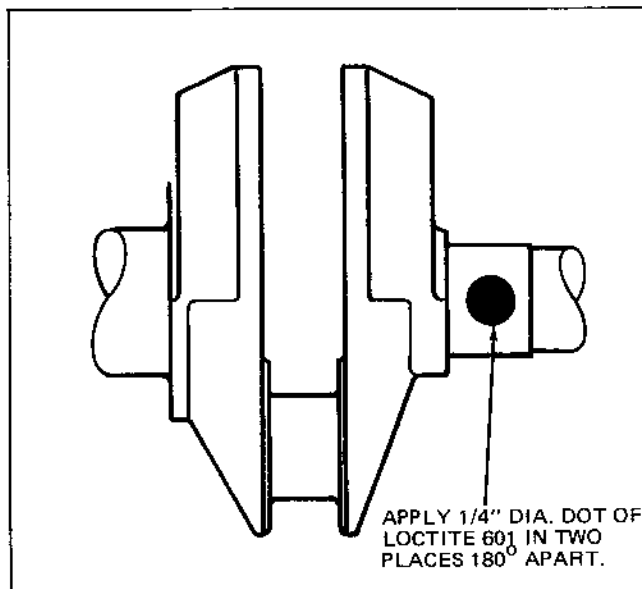


Figure 5-2

Check oil seal contact surfaces for any micro scratches which could cause premature wear to oil seals.

Check crankshaft for bend by placing it between two pivot points (dead centers). Position dial indicator sensor onto crankshaft bearing surface and rotate shaft. A significant variance in indicator readings is indicative of the amount of bend in the crankshaft. General maximum limits are .002 to .004 true indicator reading (T.I.R.).

BALL BEARING MODELS

Prior to crankshaft installation for the 817 and 520 model engines (horizontal) apply a 1/4" diameter dot of Loctite 601 in two places 180° apart to the crankshaft P.T.O. bearing. Press shaft into bearing being careful not to get Loctite on ball bearings. Figure 5-2.

SECTION 6. BEARING SERVICE

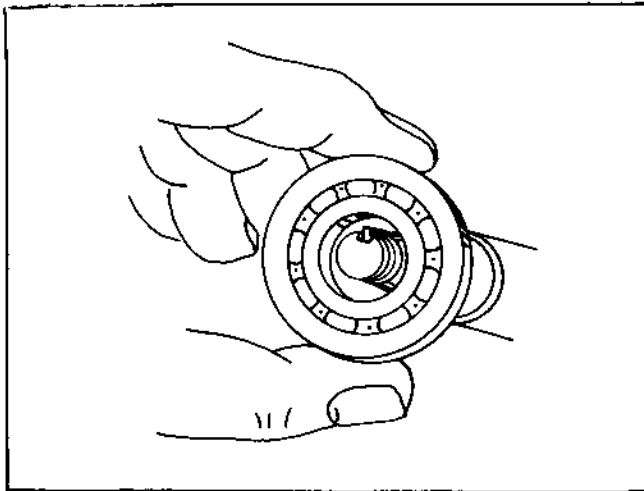


Figure 6-1

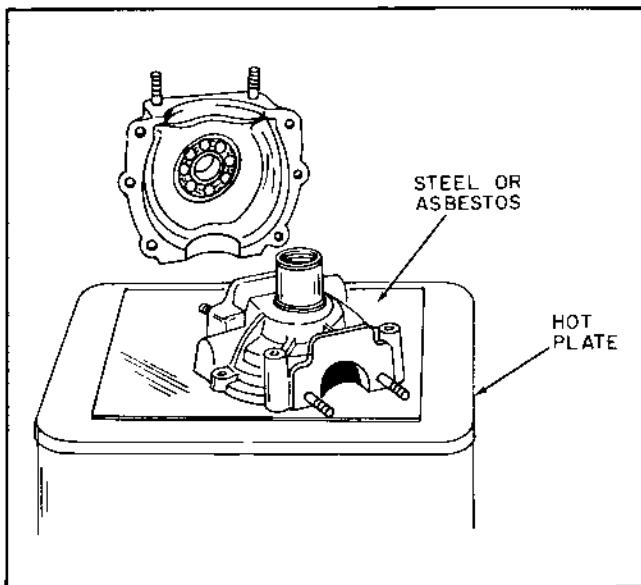


Figure 6-2. Heating Crankcase Halves to Remove Ball Bearings

A. BALL BEARING REPLACEMENT

Do not remove ball bearings from crankcase unless they are worn or noisy.

Check operation of bearings by rotating the bearing cones with fingers to check for roughness, binding, or other signs of unsatisfactory operation. If bearings do not operate smoothly, remove.

To remove ball bearings it is necessary to apply heat to expand the crankcase halves. Remove seals and place crankcase halves face down on a 1/8-inch steel or asbestos plate that has been placed on an electric hot plate (Fig. 6-2). The case halves should be heated to about 400°F. At this temperature, the bearings should drop out. Tap the case lightly to assist in removing the bearings, if necessary.

The replacement bearing is left at room temperature and dropped into the heated crankcase. Make sure bearing is seated to the maximum depth of the cavity.

CAUTION

Do not use an open flame to heat the crankcase halves, and do not heat the crankcase halves to more than 400°F. The uneven heating of an open flame, or excessive temperatures will distort the case.

B. NEEDLE BEARING REPLACEMENT

The bearing needles will fall out of the bearing cage with very little urging. Needles can be reinstalled easily by using an all purpose grease to assist in maintaining the proper needle position.

The bearing cage is removed and replaced in the same manner used to service ball bearings.

Sleeve bearings cannot be replaced. Both crankcase halves must be discarded if a bearing is worn excessively.

SECTION 7. PISTON AND RING SERVICE

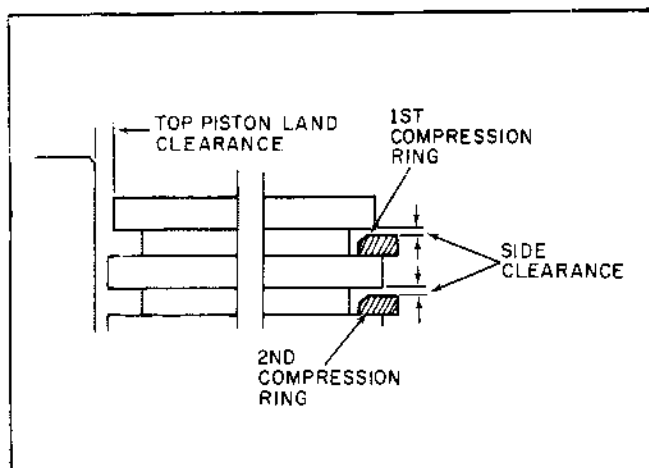


Figure 7-1

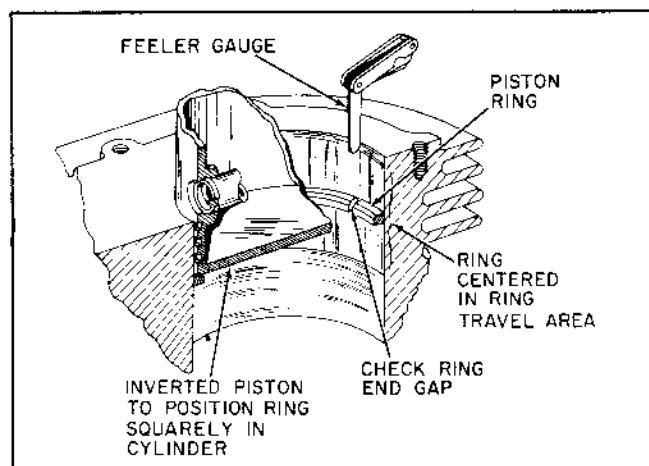


Figure 7-2

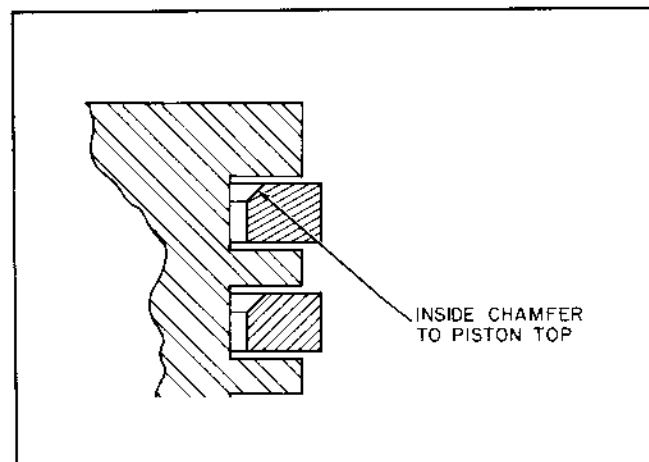


Figure 7-3

A. PISTON CLEARANCE. Make sure all carbon is cleaned from piston and ring grooves. Check piston for scoring or other damage. Check fit of piston in cylinder bore. Move piston from side to side to check clearance. If clearance is no greater than 0.003 and cylinder is not scored or damaged, piston should be serviceable.

Check piston ring side clearance to make sure it is within the limits as listed in the Table of Specifications.

Check piston rings for wear by inserting them into cylinder to about 1/2 inch from top of cylinder. Check at various places to make sure that gap between ends of ring does not exceed the dimensions indicated in the Table of Specifications.

Bore wear can be checked by the same method except use a new ring to measure end gap.

If replacement rings have beveled or chamfered edge, install with bevel up toward top (crown) of the piston. Not all engines use beveled rings. The two piston rings installed on piston are identical.

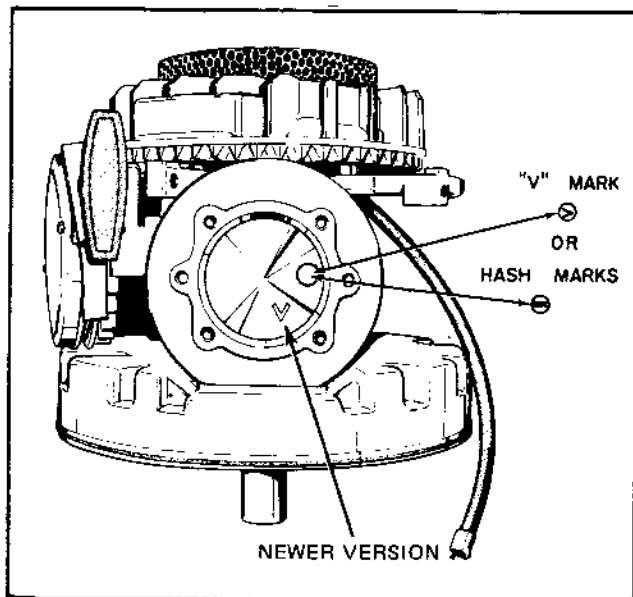


Figure 7-4

B. OFFSET PISTON USED ON THE AV600 AND AV520 SERIES ENGINES. The "V" stamped in the piston head (some models have hash marks) must go to the right as the engine is viewed as in Figure 7-4.

The piston is offset slightly to balance piston movement.

Mispositioning the piston can cause knock which will distract from the overall quietness of the engine.

NOTE

Some AV600 and AV520 models do not have offset pistons - only offset pistons will have "V" or hash marks on piston head.

Some pistons have the "V" marks turned 90° from the original position so that they point in a line parallel to the piston pin bore. See Page 5-4-4.

SECTION 8. TROUBLESHOOTING

2-CYCLE ENGINE TROUBLESHOOTING CHART	
Cause	Remedy
ENGINE FAILS TO START OR STARTS WITH DIFFICULTY	
No fuel in tank	Fill tank with clean, fresh fuel.
Fuel shut-off valve closed	Open valve.
Obstructed fuel line	Clean fuel screen and line. If necessary, remove and clean carburetor.
Tank cap vent obstructed	Open vent in fuel tank cap, or replace cap.
Water in fuel	Drain tank. Clean carburetor and fuel lines. Dry spark plug points. Fill tank with clean, fresh fuel.
Engine over-choked	Close fuel shut-off and pull starter until engine starts. Reopen fuel shut-off for normal fuel flow immediately after engine starts.
Improper carburetor adjustment	Adjust carburetor. (See Part II, Section 2).
Loose or defective magneto wiring	Check magneto wiring for shorts or grounds; repair if necessary.
Faulty magneto	Check timing (Part IV, Section 4), point gap (See Specs.), and, if necessary, overhaul magneto (Part IV, Section 2).
Spark plug fouled	Clean and regap spark plug (Part IV, Section 2).
Spark plug porcelain cracked	Replace spark plug.
Poor compression	Overhaul engine.
ENGINE KNOCKS	
Carbon in combustion chamber	Remove cylinder head or cylinder and clean carbon from head and piston.
Loose or worn connecting rod	Replace connecting rod.
Loose flywheel	Check flywheel key and keyway; replace parts if necessary. Tighten flywheel nut to proper torque (Table of Specifications, Part VI).
Worn cylinder	Replace cylinder.
Improper magneto timing	Time magneto (Part IV, Section 4).

2-STROKE CYCLE ENGINE

2-CYCLE ENGINE TROUBLESHOOTING CHART (Cont.)

Cause	Remedy
ENGINE MISSES UNDER LOAD	
Spark plug fouled	Clean and regap spark plug.
Spark plug porcelain cracked	Replace spark plug.
Improper spark plug gap	Regap spark plug.
Pitted magneto breaker points	Clean and dress breaker points. Replace badly pitted breaker points.
Magneto breaker arm sluggish	Clean and lubricate breaker point arm.
Faulty condenser (except on Tecumseh Magneto)	Check condenser on a tester; replace if defective (see test instrument instructions and specifications).
Improper carburetor adjustment	Adjust carburetor (Part II, Section 2).
Reed fouled or sluggish	Clean or replace reed.
Crankcase seals leak	Replace worn crankcase seals (Part V, Section 3). Some engines have no lower seal. Check bearing surface of bottom half of crankcase.
ENGINE LACKS POWER	
Choke partially closed	Open choke.
Improper carburetor adjustment	Adjust carburetor (Part II, Section 2).
Magneto improperly timed	Time magneto (Part IV, Section 4).
Worn piston or rings	Replace piston or rings (Part V, Section 7).
Air cleaner fouled	Clean air cleaner (Part II, Section 1).
Reed fouled or sluggish	Clean or replace reed.
Improper amount of oil in fuel mixture	Drain tank; fill with correct mixture (See engine decal).
Crankcase seals leaking	Replace worn crankcase seals (Part V, Section 3). Some engines have no lower seal. Check bearing surface of crankshaft.
ENGINE OVERHEATS	
Engine improperly timed	Time engine (Part IV, Section 4).
Carburetor improperly adjusted	Adjust carburetor (Part II, Section 2).

2-STROKE CYCLE ENGINE

2-CYCLE ENGINE TROUBLESHOOTING CHART (Cont.)	
Cause	Remedy
ENGINE OVERHEATS (Cont.)	
Air flow obstructed	Remove any obstructions from air passages in shrouds.
Cooling fins clogged	Clean cooling fins.
Excessive load on engine	Check operation of driven equipment. Reduce excessive load.
Carbon in combustion chamber	Remove cylinder head or cylinder and clean carbon from head and piston.
Improper amount of oil in fuel mixture	Drain tank; fill with correct mixture.
ENGINE SURGES OR RUNS UNEVENLY	
Fuel tank cap vent hole clogged	Open vent hole.
Governor parts sticking or binding	Clean, and if necessary repair governor parts.
Carburetor throttle linkage or throttle shaft and/or butterfly binding or sticking	Clean, lubricate, or adjust linkage and deburr throttle shaft or butterfly.
ENGINE VIBRATES EXCESSIVELY	
Engine not securely mounted	Tighten loose mounting bolts. (See equipment instructions).
Bent crankshaft	Replace crankshaft.
Driven equipment out of balance	Recheck driven equipment.

UNIBLOCK ENGINES FOR USE WITH TABLE OF SPECIFICATIONS PAGES 6-1-3 and 6-1-4.

[illegible]

2-STROKE CYCLE ENGINE

2-CYCLE TABLE OF SPECIFICATIONS FOR ENGINES OF UNIBLOCK DESIGN

	1	2	3	4	5	6	7	8	9A	9B	9C	10A	10B	11	12
NOTE 1: 642-08, 14A, 14B B.T.D.C. = .110" 642-16D, 19A, 20A, 21, 22 B.T.D.C. = .078" NOTE 2: 642-24, 26, 29 B.T.D.C. = .085" 643-24A, 25, 26 B.T.D.C. = .085" NOTE 3: 643-13 B.T.D.C. = .095" NOTE 4: 643-03A, 05A, 13, 14 = .020"															
Bore	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094	2.093 2.094
Stroke	1.250	1.410	1.410	1.410	1.410	1.500	1.500	1.500	1.500	1.500	1.500	1.750	1.750	1.750	1.410
Cu. In. Displacement	4.40	4.80	4.80	4.80	4.80	5.20	5.20	5.20	5.20	5.20	5.20	6.00	6.00	6.00	4.80
Point Gap	.017	.017	.017	.017	.017	.018	.017	.020	.018	.020	.020	.018	.020	.018	.017
Timing B.T.D.C.	.122"	.100"	.135"	.100"	.135"	.100"	.185"	.070"	.110"	.085"	.078"	.090"	.085"	.100"	.135"
Spark Plug Gap	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035
Piston Ring End Gap	.007 .017	.007 .017	.006 .011	.006 .014	.006 .011	.006 .014	.007 .017	.006 .016	.007 .017	.006 .016	.006 .016	.007 .017	.006 .016	.006 .014	.007 .017
Piston Diameter	2.0880 2.0870	2.0880 2.0870	2.0885 2.0875	2.0885 2.0875	2.0885 2.0875	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0883 2.0873	2.0880 2.0870
Piston Ring Groove Width (Top)	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665
Piston Ring Groove Width (Bot.)	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655
Piston Ring Width	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615
Piston Pin Diameter	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997
Connecting Rod Diameter Crank Bearing	—	—	—	.6886 .6879 Dowels	—	—	—	1.0053 1.0023 Liner Dia.	—	1.0053 1.0023 Liner Dia.	1.0053 1.0023 Liner Dia.	—	1.0053 1.0023 Liner Dia.	—	—
Crankshaft Rod Needle Dia.	.0655 .0653	.0655 .0653	.0655 .0653	—	.0655 .0653	—	.0655 .0653	.0781 .0780	—	.0781 .0780	.0781 .0780	—	.0781 .0780	—	.0655 .0653
Crank Pin Journal Diameter	.5618 .5611	.5621 .5614	.5621 .5614	.6865 .6857	.5618 .5611	.6865 .6857	.5618 .5611	.8450 .8442	.6865 .6857	.8450 .8442	.8450 .8442	.6865 .6857	.8450 .8442	.6865 .6857	.5621 .5614
Crankshaft P.T.O. Side Main Brg. Dia.	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.8750 .8745	.6694 .6690	1.0003 .9998	.8750 .8745	1.0003 .9998	1.0003 .9998	.8750 .8745	1.0003 .9998	.8750 .8745	.6695 .6691
Crankshaft Magneto Side Main Brg. Dia.	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.7500 .7495	.6694 .6690	.6695 .6691	.7500 .7495	.7503 .7498	.6695 .6691	.7500 .7495	.7503 .7498	.7500 .7495	.6695 .6691
Crankshaft End Play	None	None	None	None	None	.003 .016	None	None	.003 .016	.003 .016	None	.003 .016	.003 .016	.003 .016	None

2-STROKE CYCLE ENGINE

2-CYCLE TABLE OF SPECIFICATIONS FOR ENGINES OF UNIBLOCK DESIGN

	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Bore	<u>2.375</u> <u>2.376</u>	<u>2.093</u> <u>2.094</u>	<u>2.4375</u> <u>2.4385</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.4375</u> <u>2.4385</u>	<u>2.437</u> <u>2.438</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>	<u>2.093</u> <u>2.094</u>
Stroke	1.680	1.500	1.750	1.500	1.500	1.750	1.410	1.250	1.750	1.750	1.500	1.410	1.410	1.500	1.500
Cu. In. Displacement	7.50	5.20	8.17	5.20	5.20	6.02	4.80	4.40	8.17	8.17	5.20	4.80	4.80	5.20	5.20
Point Gap	.020	.018	.018	.017	.017	.020	.017	.017	.020	.020	.017	.017	.020	.020	.017
Timing B.T.D.C.	.085" .110"	.100" .113"	.088" .113"	.110"	.110"	.070"	.100"	.122"	.118"	.115"	.110"	.135"	Fixed	.062"	.100"
Spark Plug Gap	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035	.035
Piston Ring End Gap	.005 .013	.006 .014	.007 .017	.006 .016	.006 .016	.006 .016	.007 .017	.007 .017	.007 .017	.007 .017	.006 .016	.007 .017	.007 .017	.006 .016	.006 .016
Piston Diameter	2.3695 2.3685	2.0880 2.0870	2.4312 2.4302	2.0885 2.0875	2.0890 2.0880	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.4312 2.4302	2.4312 2.4302	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0880 2.0870	2.0885 2.0875
Piston Ring Groove Width (Top)	.0655 .0665	.0975 .0985	.0655 .0665	.0645 .0655	.0645 .0655	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665	.0655 .0665
Piston Ring Width (Bot.)	.0645 .0655	.0955 .0965	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655	.0645 .0655
Piston Ring Width	.0625 .0615	.0925 .0935	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615	.0625 .0615
Piston Pin Diameter	.4999 .4997	.3750 .3751	.4999 .4997	.3750 .3751	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997	.4999 .4997
Connecting Rod Diameter Crank Bearing	—	—	.7592 .7588 Dowels	—	—	1.0053 1.0023 Liner Dia.	—	—	.7592 .7588 Dowels	.8534 .8504 Liner Dia.	.8534 .8504 Liner Dia.	—	—	.8534 .8504 Liner Dia.	.8919 .8924
Crankshaft Rod Needle Dia.	.0652 .0648	—	.0655 .0653	—	—	.0781 .0780	.0655 .0653	.0655 .0653	.0655 .0653	.0781 .0780	.0781 .0780	.0655 .0653	.0655 .0653	.0781 .0780	.0781 .0780
Crank Pin Journal Diameter	.6266 .6259	.6965 .6857	.6266 .6259	.6868 .6857	.6865 .6857	.8450 .8442	.5621 .5614	.5618 .5611	.6266 .6259	.6927 .6919	.6927 .6919	.5621 .5614	.5621 .5614	.6927 .6919	.6927 .6922
Crankshaft P.T.O. Side Main Brg. Dia.	.8850 .8650	.8750 .8745	.6695 .6691	.6695 .6691	1.0003 .9998	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.6695 .6691	.7503 .7498	.6695 .6691
Crankshaft Magneto Side Main Brg. Dia.	.7503 .7495	.7500 .7495	.7500 .7495	.7500 .7495	.7500 .7495	.6695 .6691 See Note A	.6695 .6691	.6695 .6691	.8750 .8745	.8753 .8748	.7503 .7498	.6695 .6691	.6695 .6691	.6695 .6691	.7503 .7498
Crankshaft End Play	None	.003 .016	None	None	None	None	None	None	None	None	None	None	None	None	.003 .016

A. on Engines
prior to 660-24
.7505
7.98

TWO-CYCLE ENGINE TABLE OF TORQUE LIMITS

Application	Size	Torque
CARBURETOR AND REED PLATES		
Carburetor to crankcase, Carburetor to adapter, or Carburetor adapter to crankcase	1/4 in.-20 hex nuts 1/4 in.-20 x 5/16 hex hd. cap screws	70-75 in. pounds
Carburetor to snow blowers cover	1/4-28 center lock hex nut	30-35 in. pounds
Carburetor outlet fitting	1/8 pipe plug	40 in. pounds
Reed and cover plates 639 type engines	1/4-28 x 1-1/4	50-60 in. pounds with Loctite, type A
Reed to plate 635 type engines	6-32 x 3/8 fil. flex.	12-18 in. pounds
CRANKCASE AND CYLINDER		
Crankcase to crankcase cover	10-24 x 5/8 or 1/2 fil hd Sems	23-30 in. pounds
Crankcase to crankcase cover screws	10-24 x 5/8 or 3/4 fil flex hd	35-40 in. pounds
Mounting cylinder or carburetor to crankcase studs	1/4-20 studs	50 in. pounds
Base to crankcase	5/16-24 nut (650482) to stud (650471)	240-250 in. pounds
Cylinder to crankcase nuts	1/4-20 hex nuts	70-75 in. pounds
In cylinder	Pipe plug (650414)	100-110 in. pounds
Spark plug stop lever and head shroud to head	1/4-20 x 5/8 pan flex hd	50-60 in. pounds
Cylinder head to cylinder	10-24 x 3/4 pan hd mach screw	30-40 in. pounds
Cylinder head to cylinder	10-24 x 3/4 socket hd cap 1/4-20 pan flex head	50-60 in. pounds 80-90 in. pounds
Cylinder head to cylinder (635 type engines)	10-24 x 7/8 pan flex hd	45-50 in. pounds
Cable clip and transfer port cover to cylinder	10-24 x 5/8 in. fil hd Sems	25-30 in. pounds
Cable clip to cylinder Stop lever to cylinder	10-24 x 1/2 fil hd Sems	25-30 in. pounds
Spark plug		18-22 <u>ft pounds</u>

2-STROKE CYCLE ENGINE

TWO-CYCLE ENGINE TABLE OF TORQUE LIMITS (Cont.)

Application	Size	Torque
CRANKCASE AND CYLINDER (Cont.)		
Transfer cover cross port engines	10-24 x 1/2 pan flex hd	25-30 in. pounds
CRANKSHAFT AND CONNECTING RODS		
Aluminum and bronze rods to rod cap	10-24 x 17/32 fil hd screws	40-50 in. pounds
Steel rod to rod cap	10-32 x 9/16 and 5/8 soc hd screws	70-80 in. pounds
Flywheel nut on tapered end of crankshaft: Aluminum hub on iron or steel shaft.	7/16-20 RH or LH hex nut	18-25 <u>ft pounds</u>
Steel hub flywheel on iron shaft	7/16-20 hex nut	18-25 <u>ft pounds</u>
Steel hub flywheel on steel shaft	7/16-20 hex nut	30 <u>ft pounds</u>
GOVERNOR AND BELL CRANK PARTS		
Power take-off end governor lower ring to crankshaft setscrew	10-32 x 3/8 cup pt, soc set screw	30-35 in. pounds
Bell crank bracket to crankcase	10-24 x 3/8 fil hd Sems	20-25 in. pounds
Governor cover to crankcase	1/4-20 x 3/8, 1/2 fil hd Sems	50-60 in. pounds
OUTBOARD BEARING ADAPTERS, ADAPTER RINGS AND ENGINE BASES		
Outboard bearing adapter to crankcase screw	1/4-20 x 3/4 fil hd Sems	75-100 in. pounds
Outboard bearing adapter to crankcase screw	5/16-18 x 7/8 special hd mach screw	105-120 in. pounds
Adapter ring to crankcase	5/16-18 x 7/8 fil hd Sems	105-120 in. pounds
Engine base to crankcase	1/4-20 x 3/4 fil hd mach screw	65-75 in. pounds
Engine base to crankcase	1/4-20 x 1-1/4 hex hd cap screw	70-80 in. pounds
Engine base to crankcase	5/16-18 x 3/4 or 1 hex hd cap screw 5/16-24 nut (650482) to studs (650471)	240-250 in. pounds

2-STROKE CYCLE ENGINE

TWO-CYCLE ENGINE TABLE OF TORQUE LIMITS (Cont.)

Application	Size	Torque
MAGNETOS		
Stators - Solid state and regular	1/4-20 x 7/8 hex hd Sems	5-7 <u>ft pounds</u>
Friction screw on stator plate of F-109F, F-109K, F-1325D, and Bendix K-1504, K-1505, and K-1506 magnetos	Friction screw	30-35 in. pounds
Clamp screw to hold F-2120 magneto assembly to crankcase	8-32 clamp screw	10-15 in. pounds
Pitch screw used on Wico and Bendix dust covers	8-32 pitch screw	20-30 in. pounds
Shorting wire to magneto stator stud nut	6-32 hex nut	10-14 in. pounds
Breaker and condenser mounting screw on all F-2120 and F-2420 magnetos	8-32 breaker screw	20-30 in. pounds
Friction plug on Wico FW-2385, FW-2364 and FW-2260 magnetos	Friction plug	25-30 in. pounds
REWIND STARTERS		
Starter to shroud	1/4-20 x 3/4 pan hd Sems	60-70 in. pounds
Starter to shroud	1/4-20 fil hd Sems	55-65 in. pounds
Starter to shroud	10-24 x 1/2 binding hd Sems	25-30 in. pounds
Starter to shroud and bracket	1/4-20 x 1/2 pan hd Sems	45-55 in. pounds
SHROUD		
Shroud to base	1/4-20 x 5/8 pan hd Sems	60-70 in. pounds
Shroud base to cylinder	1/4-20 x 5/8 flat hd screw	70-80 in. pounds
Shroud to bracket	1/4-20 x 5/8 pan hd Sems	55-65 in. pounds
Shroud to powerhead	1/4-20 x 1-1/2 fil hd Sems	
Shroud base or shroud bracket to powerhead. Shroud to base.	1/4-20 x 5/8, 3/4, and 7/8 in. fil hd Sems	70-75 in. pounds
AH-52 Engines	1/4-20 x 5/8 pan flex hd	50-60 in. pounds
Shroud to crankcase, cover or shroud to cylinder	1/4-20 x 2 fil hd Sems 1/4-20 x 2-1/2 fil hd Sems	50-60 in. pounds

TWO-CYCLE ENGINE TABLE OF TORQUE LIMITS (Cont.)

Application	Size	Torque
SHROUD (Cont.)		
Shroud to mounting bracket	1/4-20 x 3/8 pan hd Sems	45-55 in. pounds
Shroud to tank bracket	#8 x 3/8 type I Phillips pan hd spinlock tapping screw	20-25 in. pounds
Shroud to crankcase cover	1/4-20 x 1 socket hd cap screw	150-160 in. pounds
Cut-Off switch	15/32-32 nut	25-30 in. pounds
FUEL TANK BRACKET AND ASSOCIATED PARTS		
Bracket supports or brackets to crankcase	1/4-20 x 1/2 hex hd Sems	50-60 in. pounds
Tank to shroud	1/4-28 x 5/8 oval hd Sems	85-90 in. pounds
Tank to bracket	10-24 x 1-3/8 fil hd Sems 10-24 x 1-1/2 fil hd Sems	10-15 in. pounds
Straps to shroud	10-24 x 1/2 pan hd Sems	30-40 in. pounds
Straps to bracket nuts	10-32 hugnuts	12 in. pounds min.
Straps to bracket nuts (Aluminum casting)	10-23 hex nuts	8-10 in. pounds
Tank to bracket screws	10-24 x 1-3/8 fil hd Sems	7-10 in. pounds
PANEL CONTROLS		
Shroud bracket to panel control	10-24 x 1/2 pan hd Sems	30-35 in. pounds
Control knob setscrew	10-32 x 1/2 soc hd cup point setscrew	30-35 in. pounds
MUFFLER ASSEMBLY		
Hold together muffler assembly screws	1/4-20 x 1-1/4 flt hd mach	70-75 in. pounds
Above deck Hush-Tone muffler screws	1/4-20 x 5/8, 1-1/4, 1-3/8 flt hd mach	35-40 in. pounds
Donut muffler	1/4-20 x 2-3/8, 2-3/4, 3-1/8 flt hd mach	20-30 in. pounds
Two piece stack type muffler assembly (stamped steel)	1/4-20 x 2 fil hd Sems	40-50 in. pounds
Two piece stack type muffler assembly (cast aluminum)	1/4-20 x 1-3/4 fil hd Sems	70-75 in. pounds

2-STROKE CYCLE ENGINE

TWO-CYCLE ENGINE TABLE OF TORQUE LIMITS (Cont.)

Application	Size	Torque
MUFFLER ASSEMBLY (Cont.)		
Stamped steel box muffler (New) to cylinder	1/4-20 x 5/8	80-90 in. pounds
Integral muffler and base	1/4-20 x 3/4 fil hd Sems	70-80 in. pounds
Straight one piece muffler to cylinder	5/16-18 x 7/8 fil hd Sems 5/16-18 x 1-1/8 fil hd Sems	105-115 in. pounds
GENERAL, CAP SCREWS		
"	4-40	6-8 in. pounds
"	6-32	10-15 in. pounds
"	8-32	20-30 in. pounds
"	10-24	30-40 in. pounds
"	10-32	35-40 in. pounds
"	1/4-20 fil hex hd	50-60 in. pounds
"	1/4-20 flex hd	70-80 in. pounds
"	1/4-28	70-75 in. pounds
"	5/16-18	105-115 in. pounds
GENERAL, NUTS		
"	8-32	20-25 in. pounds
"	1/4-20, 1/4-28	70-75 in. pounds

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