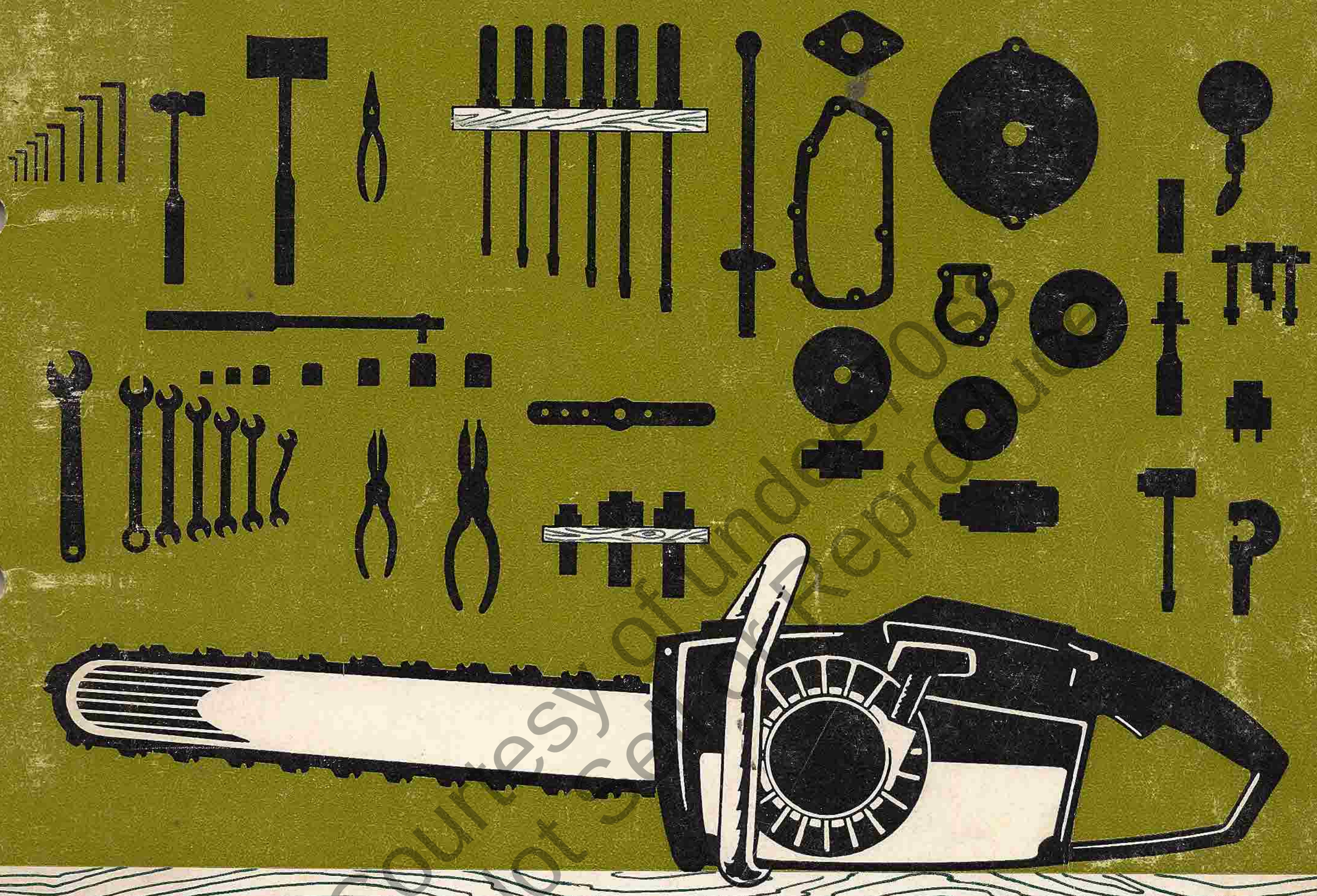
2nd EDITION



HOMELITE®

CHAIN SAW SHOP

SERVICE MANUAL

Form 1—Homelite Div. Chain Saw

HOMELITE® CHAIN SAW SHOP SERVICE MANUAL

(SECOND EDITION)

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HOMELITE

A textron DIVISION

PORT CHESTER, N.Y. U.S.A.

FUNDAMENTALS SECTION

ENGINE FUNDAMENTALS

OPERATING PRINCIPLES

The power source for the chain saw does not differ basically from that used to power automobiles, farm or garden tractors, lawn mowers, or many other items of power equipment in use today. All are technically known as "Internal Combustion, Reciprocating Engines."

The source of power is heat formed by the burning of a combustible mixture of petroleum products and air. In a reciprocating engine, this burning takes place in a closed cylinder containing a piston. Expansion resulting from the heat of combustion applies pressure on the piston to turn a shaft by means of a crank and connecting rod.

The fuel mixture may be ignited by means of an electric spark (Otto Cycle Engine) or by the heat of compression (Diesel Cycle). The complete series of events which must take place in order for the engine to run may occur in one revolution of the crankshaft (referred to as Two-Stroke Cycle), or in two revolutions of the crankshaft (Four-Stroke Cycle).

As the two-stroke cycle spark ignition engine is universally used as the power source for chain saws, this will be the only type engine discussed in this section.

OTTO CYCLE. In a spark ignited engine, a series of five events are required in order to provide power. This series of events is called the **Cycle** (or Work Cycle) and is repeated in each cylinder as long as work is done. The series of events which comprise the work cycle are as follows:

1. The mixture of fuel and air is pushed or drawn into the cylinder, by reducing cylinder pressure to less than the outside pressure, or by applying an initial, higher pressure to the fuel charge.

2. The mixture is compressed, or reduced in volume.

3. The mixture is ignited by a timed electric spark.

4. The burning fuel-air mixture expands, forcing the piston down, thus converting the generated chemical energy into mechanical power.

5. The burned gases are exhausted from the cylinder so that a new cycle can begin.

The series of events comprising the work cycle are commonly referred to as INTAKE, COMPRESSION, IGNITION, EXPANSION (POWER), and EXHAUST.

TWO-STROKE CYCLE. In a two-stroke cycle engine, the five events of intake, compression, ignition, power and exhaust must take place in two strokes of the piston; or one revolution of the crankshaft. Thus, a compressed fuel charge is fired each time the piston reaches the top of the cylinder, and each downward stroke is a power stroke. In order to accomplish this, the initial pressure of the incoming fuel-air mixture must be raised to a point somewhat higher than the lowest pressure existing in the cylinder, or a fresh charge of fuel could not be admitted and the engine would not run. This elevation of pressure requires the use of an air pump, or compressor, of approximately the same volume as the cylinder itself. Coincidentally, such an air pump is available with a minimum of additional parts, cost, or friction losses by utilizing the opposite side of the piston and cylinder as the pump. Such engines are called "Crankcase Scavenged," and are universally used in the chain saw industry.

Fig. CS1 shows a schematic view of the crankcase scavenged, reed valve type, two-stroke cycle engine commonly used. The general sequence of events required for operation is as follows: As the piston moves outward from the crankshaft as shown in view "B", the volume of the closed crankcase is enlarged and the pressure lowered, causing air to be drawn through the carburetor (C), where it is mixed with fuel. This mixture is then drawn through the reed valve (R) and into the crankcase. At the same time, a previous charge of fuel is being compressed between head of piston and closed end of cylinder as shown by the darkened area. As the piston approaches top center, a timed spark ignites the compressed fuel charge and the resultant expansion moves the piston downward on the power stroke. The reed valve (R) closes, and downward movement of piston compresses the next fuel charge in the crankcase as shown in view "A". When the piston nears the bottom of its stroke, the crown of piston uncovers the exhaust port (EX) in cylinder wall, allowing the combustion products and remaining pressure to escape as shown by the wavy arrow. Further downward movement of piston opens the transfer port (TP) leading from the crankcase to cylinder; and the then higher crankcase pressure forces the compressed fuel-air mixture through transfer port into the cylinder. The baffle which is built into crown of piston deflects the incoming charge upward, and most of the remaining exhaust gases are driven from the combustion chamber by this fresh charge. Two-stroke cycle, crankcase scavenged engines are sometimes produced with a fuel induction system other than the inlet reed valve. The two induction systems used in chain saw engines in addition to the reed valve are the three-port system illustrated in Fig. CS2 and the rotary valve system illustrated in Fig. CS3.

In the crankcase scavenged engine, most of the friction parts requiring lubrication are located in the fuel intake system. Lubrication is accomplished by mixing the required amount of oil with the fuel, so that a small amount of oil in the form of a fine mist is drawn into the crankcase with each fuel charge. It should be pointed out that the new oil brought into the crankcase can do little more than supplement the losses, therefore it is necessary that the friction parts be well lubricated at the time the engine is started. The use of too much oil in the fuel mixture results in plug fouling, excessive carbon, and poor performance, as well as being wasteful.

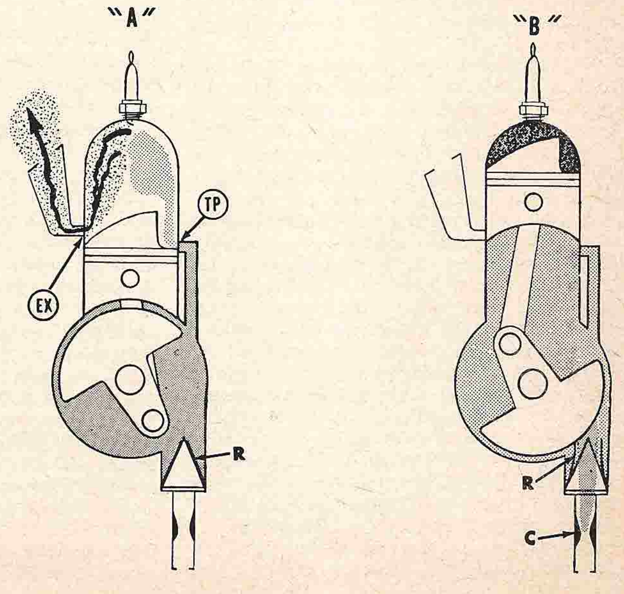


Fig. CS1 — Schematic view of two-stroke cycle, crankcase scavenged engine used in most chain saws. The series of events comprising the Otto cycle takes place in one revolution of the crankshaft by using the crankcase as a scavenging pump.

C. Carburetor
R. Reed valve
TP. Transfer port
EX. Exhaust port

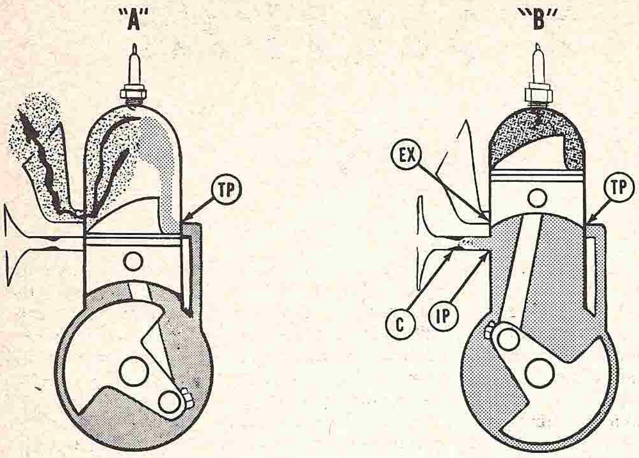


Fig. CS2 — Two cycle, three port engine. Principles are similar to reed valve or rotary valve types except that a third, intake port is located in cylinder wall and opened and closed by the piston skirt.

C. Carburetor
EX. Exhaust port
IP. Intake port
TP. Transfer port

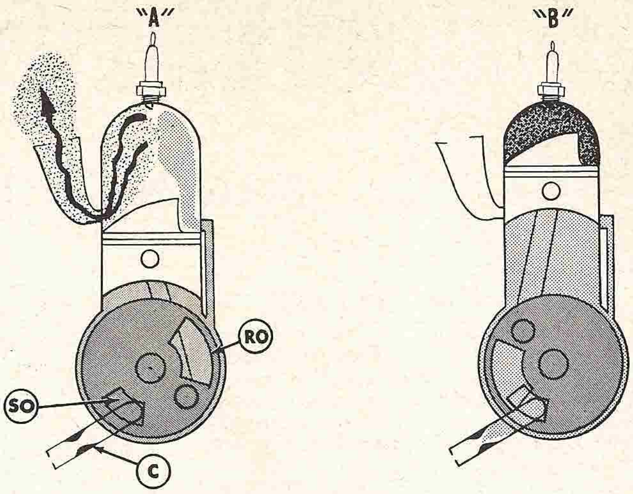


Fig. CS3 — Two cycle, rotary valve engine. The incoming fuel charge is controlled by a rotary valve attached to the crankshaft. The opening in valve (RO) and crankcase (SO) align at the proper time to admit a fresh charge, then close to allow initial crankcase compression.

C. Carburetor
RO. Opening in rotating member
SO. Opening in crankcase wall

CARBURETION

The function of the carburetor is to atomize the fuel and mix it with the air flowing through the carburetor and into the engine. The carburetor must also meter the fuel so that the proper fuel-air ratio for different engine operating conditions is provided. Normal fuel-air ratios are approximately as follows:

	Fuel	Air
For starting in cold weather	1 lb.	7 lbs.
For idling	1 lb.	11 lbs.
For full load at open throttle	1 lb.	13 lbs.

Carburetor design is based on the venturi principle which is that a gas or liquid flowing through a necked-down section (venturi) in a passage undergoes an increase in speed and a decrease in pressure as compared to its speed and pressure in the full sized sections of the passage. This principle is illustrated in Fig. CS5. Due to the low pressure at the venturi, fuel is drawn out through the fuel jet and is atomized by the stream of air flowing through the venturi.

A simple carburetor design is illustrated in Fig. CS6 where flow of fuel into the carburetor is controlled by a float valve. With the float type carburetor, the carburetor must be kept in a nearly upright position for the float valve to function. Early chain saws using this type of carburetor had a provision for tilting the bar and chain independently of the engine.

Later development of a floatless carburetor that would function in any position allowed a more simple and lighter design of chain saws. In this carburetor, the flow of fuel into the carburetor is controlled by linking the inlet valve to a spring-loaded diaphragm. The spring pressure is counteracted by suction through the fuel jets at the venturi of the carburetor.

To provide fuel at the carburetor with the engine in an inverted position, a fuel pump is usually incorporated within the diaphragm type carburetor. As the crankcase of 2-cycle engines is subjected to alternate surges of pressure and vacuum at each stroke of the piston, a diaphragm vented to the crankcase will pulsate at each turn of the engine crankshaft. Thus, the pulsating diaphragm can be used as a fuel pump. See Fig. CS7.

A cross-sectional schematic view of one diaphragm type carburetor with an integral fuel pump is shown in Fig. CS8. The top of the pump diaphragm is vented to the engine crankcase through the channel (8). As the diaphragm pulsates, fuel is drawn into the carburetor through the inlet (1), screen (28) and pump inlet valve (3A). The fuel is then pumped through the outlet valve (3B) into the supply channel (17). Engine suction through the main jet (15) and idle jets (10) is transmitted to the top of the carburetor diaphragm (25) and atmospheric pressure through the vent (23) pushes upward on the diaphragm (25) overcoming spring (20) pressure and unseating the inlet needle (18) allowing fuel to flow into the diaphragm chamber (6).

When starting an engine, closing the choke disc (16) increases the vacuum in the carburetor throat so that the carburetor will function at the low cranking RPM.

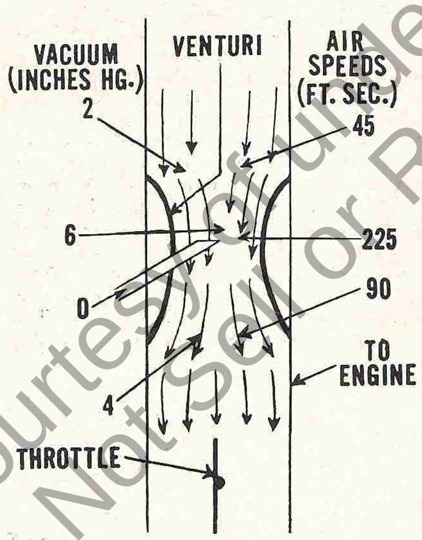


Fig. CS5 — Schematic view of venturi principle. Right hand figures show how air speed is increased by the restriction (venturi) while left hand figures show the accompanying drop in air pressure.

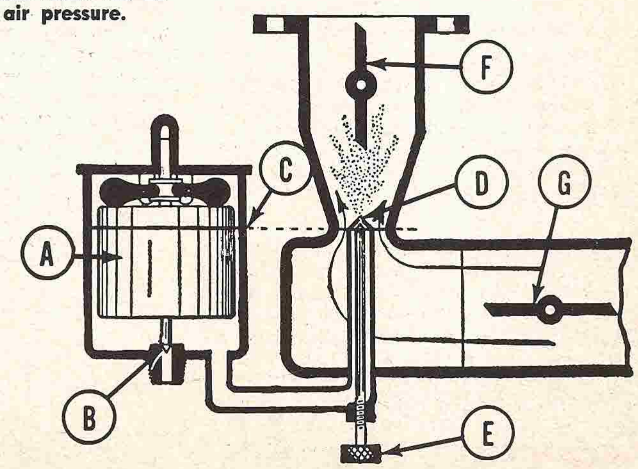


Fig. CS6 — Schematic view of simple float-type carburetor. The buoyancy of float (A) closes the fuel inlet valve (B) to maintain the fuel at a constant level (C). The pressure drop in the venturi causes fuel to flow out nozzle (D) which protrudes just above the fuel level. Maximum fuel flow is controlled by mixture valve (E). Throttle valve is at (F) and choke valve at (G).

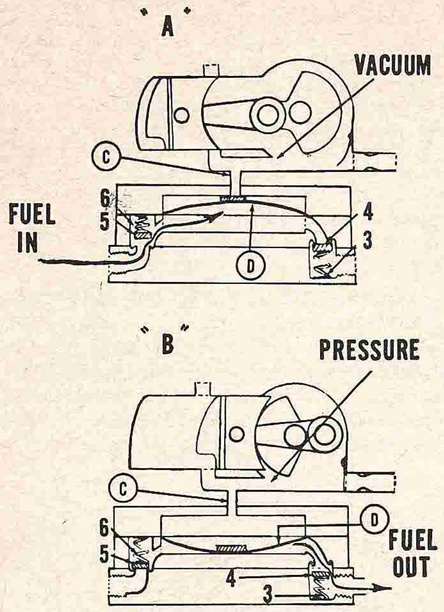


Fig. C57 — Schematic view of a typical, crankcase operated, diaphragm type fuel pump. Pressure and vacuum pulsations from crankcase pass through connection (C) to rear of diaphragm (D) which induces a pumping action on fuel line as shown.

3. Valve spring
4. Outlet check valve
5. Inlet check valve
6. Valve spring

Fig. CS8 — Cross-sectional schematic view of Tillotson series HL diaphragm carburetor.

1. Fuel inlet
2. Pump body
3. Pump diaphragm
3. Pump valves
4. Gasket
5. Gasket
6. Metering chamber
7. Idle needle
8. Impulse channel
9. Idle fuel orifice
10. Idle ports
11. Throttle shutter
12. Main fuel orifice
13. Body
14. Venturi
15. Main fuel port
16. Choke shutter
17. Inlet channel
18. Inlet valve
19. Main needle
20. Spring
21. Diaphragm lever
22. Fulcrum pin
23. Vent hole
24. Cover
25. Diaphragm
26. Atmospheric chamber
27. Gasket
28. Screen
29. Screw
30. Fuel chamber
31. Pulse chamber
32. Strainer cover

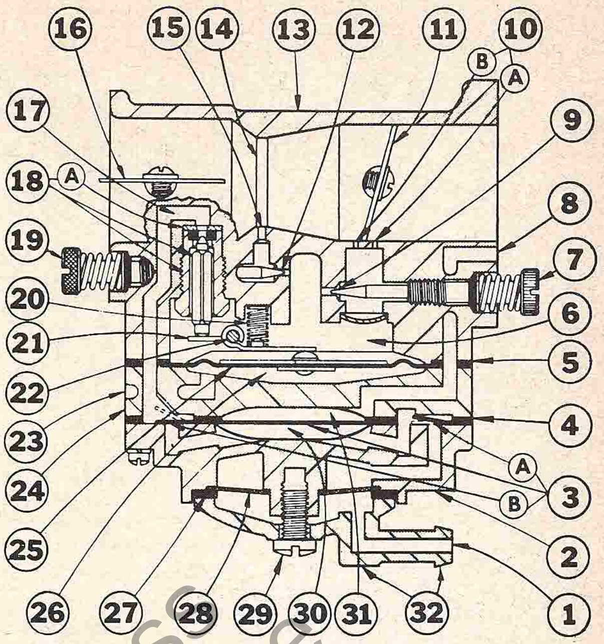
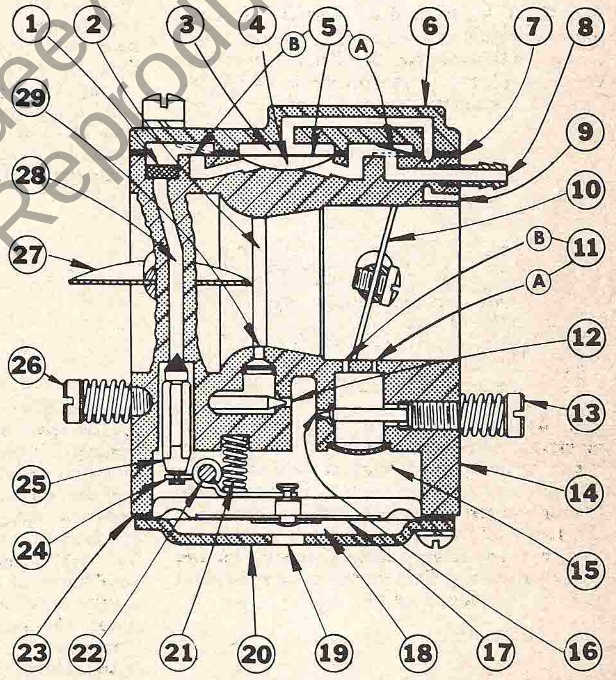


Fig. CS9 — Cross-sectional view of typical Series HS Tillotson diaphragm type carburetor.

1. Filter screen
2. Venturi
3. Pulse chamber
4. Fuel chamber
5. Pump diaphragm
5A. Inlet valve
5B. Outlet valve
6. Pump body
7. Gasket
8. Inlet fitting
9. Impulse channel
10. Throttle plate
11. Primary (A) and secondary (B) idle ports
12. Main fuel orifice
13. Idle fuel needle
14. Carburetor body
15. Metering chamber
16. Idle fuel orifice
17. Metering diaphragm
18. Atmospheric chamber
19. Vent hole
20. Diaphragm cover
21. Spring
22. Fulcrum pin
23. Gasket
24. Diaphragm lever
25. Inlet valve
26. Main fuel needle
27. Choke disc
28. Inlet channel
29. Main fuel port



When the engine is idling, the throttle disc is almost completely closed and there is not enough air passing through the venturi (14) to create any vacuum on the main jet (15). A vacuum is created at the primary idle jet (10A), however, and the fuel necessary for running the engine is drawn through that jet.

As the throttle disc is opened, enough vacuum is created on the secondary idle jet port (10B) so that fuel is drawn through that port also. At a certain point, the throttle disc is open far enough so that the velocity of air passing through the venturi is sufficient to lower the pressure at the main fuel discharge port (15) so that fuel will flow through this port also. Opening the throttle disc farther results in higher air velocities and lower venturi pressures that increase the flow of fuel out of the discharge ports.

Any vacuum created at the idle discharge ports (10) or the main fuel discharge port (15) is transferred through the metering chamber (6) to the diaphragm (25). Air pressure entering through the atmospheric vent hole (23) pushes against the diaphragm because of the vacuum and overcomes pressure applied by the spring (20) through the control lever (21). This releases the inlet needle valve (18) and allows fuel to enter the metering chamber in a direct relationship to the vacuum created at the fuel discharge ports. The higher the vacuum, the greater the movement of the diaphragm and the larger the opening of the needle valve. Thus, fuel is metered into the carburetor to meet the needs of the engine.

CONVENTIONAL FLYWHEEL MAGNETO IGNITION SYSTEM

The fundamental principles of the flywheel magneto ignition system in general use on chain saw engines are presented in this section. As the study of magnetism and electricity is an entire scientific field, it is beyond the scope of this manual to fully explore these subjects. However, the information contained in this section should impart a working knowledge of the flywheel type magneto which will be useful when servicing chain saw ignition systems.

BASIC PRINCIPLES. Although the design of different flywheel magnetos varies, all flywheel magnetos operate on the same basic principles of electro-magnetic induction of electricity and formation of magnetic fields by electrical current.

The principle of electro-magnetic induction of electricity is as follows: When a wire (conductor) is moved through a magnetic field so as to cut across lines of magnetic force (flux), a potential voltage (electro-motive force or emf) is induced in the wire. If the wire is a part of a completed electrical circuit, current will flow through the circuit as illustrated in Fig. CS10. It should be noted that the movement is relative; that is, if the lines of force of a moving magnetic field cut across a wire, this will also induce an emf in the wire. The direction of the induced current when the wire is a part of a circuit is related to both the direction of magnetic force and the direction of movement of the wire through the magnetic field. The voltage of the induced current is related to the strength of the magnetic field and to the speed at which the wire moves through the lines of magnetic force. Also, if a length of wire is wound into a coil and a section of the coil is moved through a magnetic field so

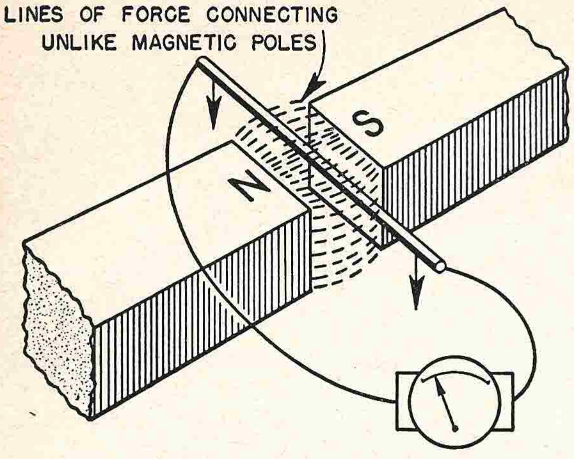


Fig. CS10 — When a wire (conductor) is moved through a magnetic field across lines of magnetic force, an electro-motive force is induced into the wire. If the wire is a part of an electrical circuit, current will flow in the circuit as shown.

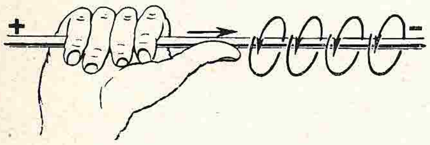


Fig. CS11 — A field of magnetic force is always present around a wire through which current is flowing. The direction of magnetic force is related to the direction of electrical current as shown.

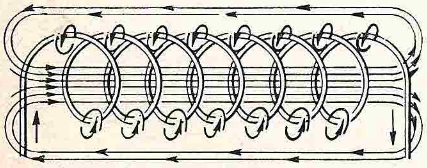


Fig. CS12 — When a wire carrying an electrical current is wound in the shape of a coil or helix, the magnetic field surrounding loops of the wire tend to converge into a single electro-magnetic field as shown. If the loops of the coil are wound closely together, there is very little tendency for the eltctro-magnetic field to surround individual loops of the coil.

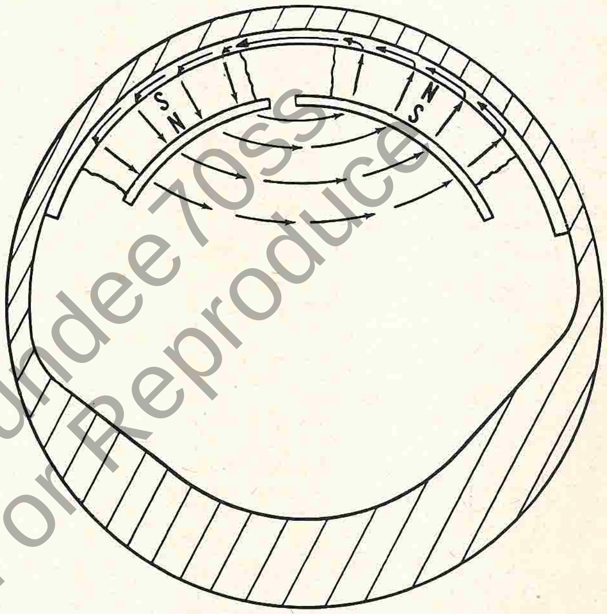


Fig. CS13 — Cut-away view of typical engine flywheel used with flywheel magneto type ignition system. The permanent magnets are usually cast into the flywheel. For flywheel magnetos having the ignition coil and core mounted to outside of flywheel, magnets would be flush with outer diameter of flywheel.

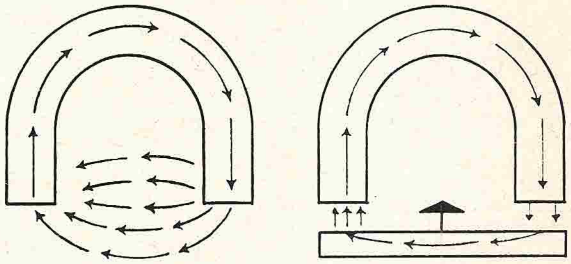


Fig. CS14—Drawing showing function of the magneto armature core. At left, lines of force of permanent magnet are dispersed in the air between the two poles of the magnet. When a soft iron bar, which is an excellent conductor of magnetism, is moved close to the magnetic poles, the magnetic field is attracted by and becomes concentrated in the bar.

that it cuts across lines of magnetic force, the voltage of the induced current is multiplied by the number of turns of wire in the coil.

The second basic principle involved is that when an electrical current is flowing in a wire, a magnetic field is present around the wire as illustrated in Fig. CS11. The direction of force of the magnetic field is related to the direction of current in the wire and the strength of the magnetic field is related to the rate of flow of the electrical current. If the wire is wound in a coil, the magnetic forces around the wire converge to form a stronger single magnetic field as shown in Fig. CS12. If the wire is coiled closely, there is little tendency for the magnetic forces to surround individual loops of the coil.

When there is a change in the current flowing in a wire, there is a corresponding change in the magnetic field surrounding the wire. If the current ceases to flow, the magnetic field will "collapse." Thus, it can be seen from the illustration in Fig. CS12 that if current in the coiled wire would cease, the collapsing magnetic field would cut across adjacent loops of the coil and the resulting induced current would counteract any change in flow of current through the coil.

CONVENTIONAL FLYWHEEL MAGNETO PARTS. To understand how the flywheel type magneto produces the ignition spark, it is necessary to identify each part of the magneto. The various component parts of the conventional type flywheel magneto are discussed in the following paragraphs.

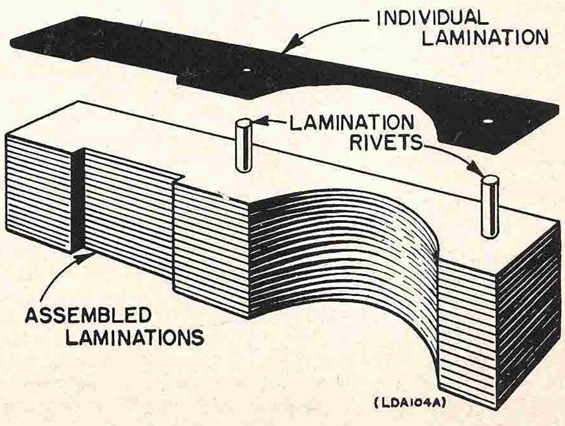


Fig. CS15—To prevent stray electrical currents (eddy currents) from building up within the armature core and creating opposing magnetic fields that would decrease the efficiency of the magneto, the armature core is constructed of thin plates (laminations) that are insulated from each other. (Oxide on surfaces of laminations usually provides sufficient insulation, although laminations in some magnetos are painted or varnished.)

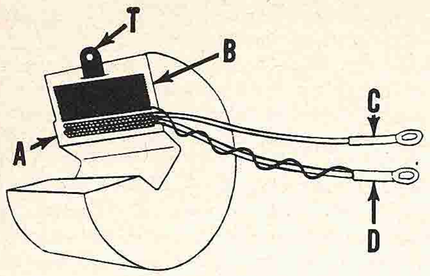


Fig. CS16—Cross-sectional view of a typical high tension coil. Primary windings (A) consist of 100-200 turns of copper wire. Secondary windings consist of about 10,000 turns of very fine wire. Lead (C) is to insulated terminal of breaker points. Lead (D) is to ground. Spark plug (high tension wire) attaches to terminal (T).

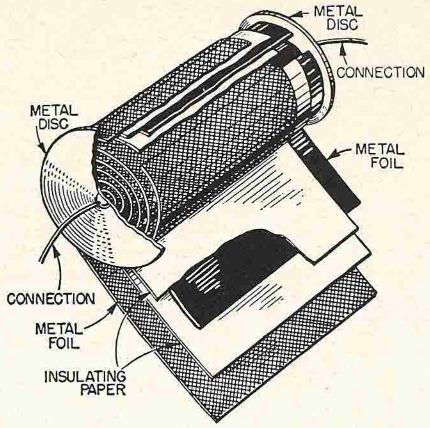


Fig. CS18 — View showing construction of typical condensor. One connection is usually made to the metal housing of the condensor and is grounded to the magneto base plate through the condensor mounting strap (3—Fig. CS17).

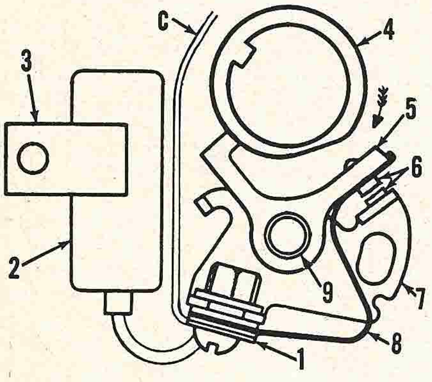


Fig. CS17 — Typical flywheel magneto breaker point unit. Cam (4) is driven by engine crankshaft. Breaker arm spring (8) connects insulated contact point on breaker arm (5) to terminal (1).

C. Lead to primary coil
1. Insulated terminal
2. Condensor
3. Condensor ground (mounting) strap
4. Breaker cam
5. Breaker arm
6. Contact points
7. Breaker base
8. Spring
9. Pivot pin

FLYWHEEL MAGNETS. Permanent magnets are either attached to the flywheel as shown in Fig. CS13 or imbedded into the flywheel casting. Some magnetos use a single ring shaped flywheel magnet; others use two separate magnets as shown in Fig. CS13.

Alnico, a steel alloy containing aluminum, nickel and cobalt, is used for the flywheel magnet or magnets as Alnico retains strong magnetic properties for very long periods of time.

ARMATURE CORE (LAMINATIONS). As shown in Fig. CS14, a field of magnetic force surrounds the poles of a permanent magnet at all times. If a soft iron bar is moved close to the magnet, the magnetic field will become concentrated in the bar because soft iron is a very good conductor of magnetic flux. Thus, the armature core is used in the flywheel type magneto to concentrate the field strength of the flywheel magnets.

In the operation of the magneto, electrical currents can be induced into the armature core. To prevent these stray currents (eddy currents) from building up in the armature core and creating magnetic forces which would decrease the efficiency of the magneto, the armature core is built up of thin plates (laminations) as shown in Fig. CS15. Thus, the armature core is sometimes called laminations.

HIGH TENSION COIL. Refer to Fig. CS16 for construction of typical high tension coil. The coil assembly consists of a primary coil (A) of about 100-200 turns of wire and a secondary coil (B) of about 10,000 turns of very fine wire. The wire is insulated, usually with a fine coating of enamel, and a paper insulating strip is placed between each layer of wire. The entire coil assembly is then impregnated with an insulating compound and covered with varnished cloth tape or plastic. Refer to wiring diagram in Fig CS19 for hook-up of coil leads.

BREAKER (CONTACT) POINTS. Refer to the magneto wiring diagram in Fig. CS19. The breaker points are installed between the lead from the primary coil windings and the magneto ground. The breaker points are opened and closed by a cam which is usually located on the engine crankshaft as shown in Fig. CS17.

CONDENSOR. Refer to Fig. CS18 for construction of a typical condensor. Usually, the lead from one end of the condensor is connected to the metal covering and is thereby grounded through mounting the condensor. The condensor is connected in parallel with the breaker points as shown in Fig. CS19.

The basic function of the condensor is to absorb the flow of current in the primary ignition circuit to prevent the current from arcing across the opening breaker points.

HOW IGNITION SPARK IS PRODUCED. The following explanation of how the ignition spark is produced is based upon the previous paragraphs in this section. By knowing the basic principles of electromagnetic induction and electro-magnetic fields, and by being able to identify the component parts of the magneto, magneto operation can be more easily understood.

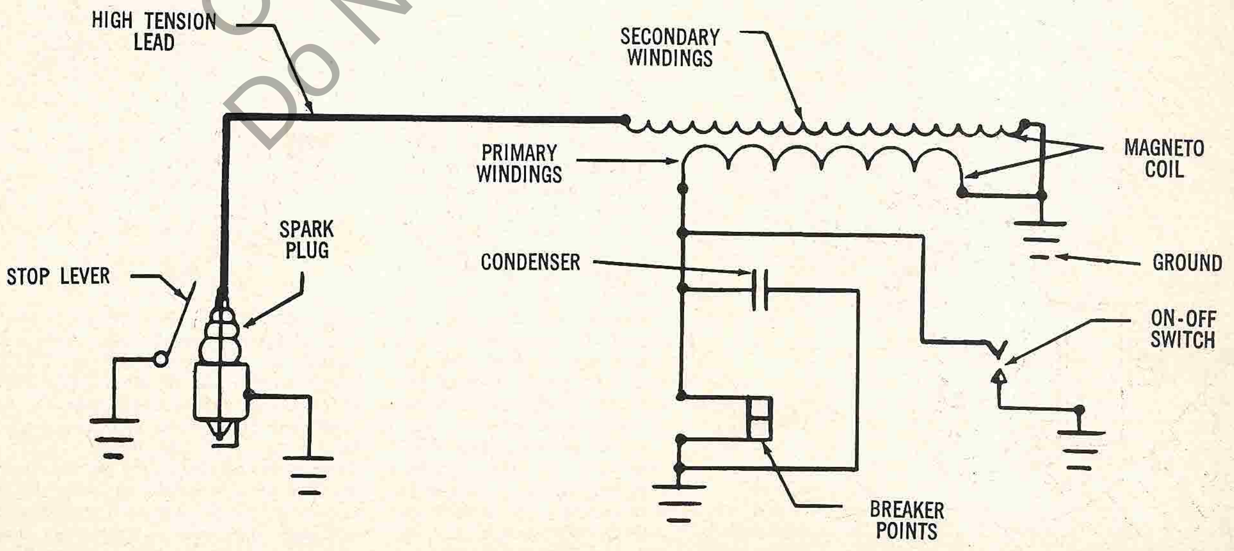


Fig. CS19—Typical wiring diagram for flywheel type magneto. An on-off switch to stop the engine may be attached to the magneto primary circuit to ground out the system, or a stop lever may be used to ground out the center electrode of the spark plug.

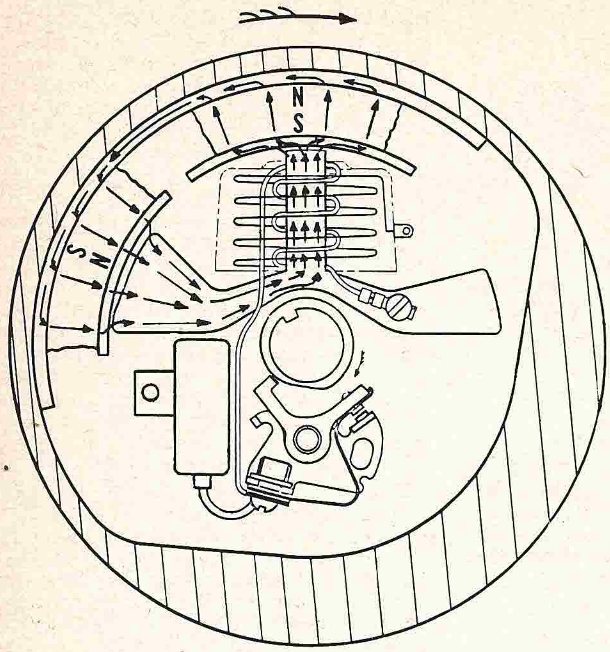


Fig. CS20—View showing flywheel turned to a position so that lines of force of the permanent magnets are concentrated in the left and center core legs and are interlocking the coil windings.

In Fig. CS13, a cross-sectional view of a typical engine flywheel (magneto rotor) is shown. The arrows indicate lines of force (flux) of the permanent magnets carried by the flywheel. As indicated by the arrows, direction of force of the magnetic field is from the north pole (N) of the left magnet to the south pole (S) of the right magnet.

Figs. CS20, CS21, CS22 and CS23 illustrate the operational cycle of the flywheel type magneto. In Fig. CS20, the flywheel magnets have moved to a position over the left and center legs of the armature (ignition coil) core. As the magnets moved into this position, their magnetic field was attracted by the armature core as illustrated in Fig. CS14 and a potential voltage (emf) was induced in the coil windings. However, this emf was not sufficient to cause current to flow across the spark plug electrode gap in the high tension circuit and the points were open in the primary circuit.

In Fig. CS21, the flywheel magnets have moved to a new position to where their magnetic field is being attracted by the center and right legs of the armature core, and is being withdrawn from the left and center legs. As indicated by the heavy black arrows, the lines of force are cutting up through the section of coil windings between the left and center legs of the armature and are cutting down through the coil windings section between the center and right legs. If the right hand rule, as explained in a previous paragraph, is applied to the lines of force cutting through the coil

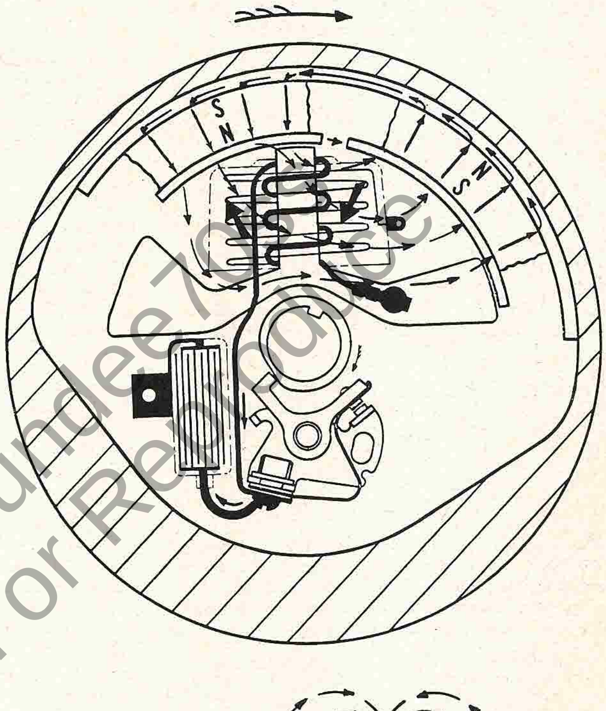


Fig. CS22—The flywheel magnets have now turned slightly past the position shown in Fig. CS21 and the rate of movement of lines of magnetic force cutting through the coil windings is at the maximum. At this instant, the breaker points are opened by the cam and flow of current in the primary circuit is being absorbed by the condenser, bringing the flow of current to a quick, controlled stop. Refer now to Fig. CS23.

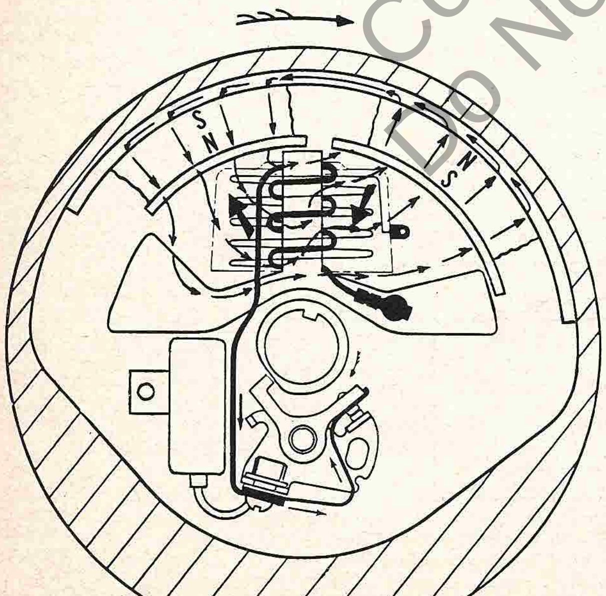


Fig. CS21—View showing flywheel turned to a position so that lines of force of the permanent magnets are being withdrawn from the left and center core legs and are being attracted by the center and right core legs. While this event is happening, the lines of force are cutting up through the coil windings section between the left and center legs and are cutting down through the section between the right and center legs as indicated by the heavy black arrows. As the breaker points are now closed by the cam, a current is induced in the primary ignition circuit as the lines of force cut through the coil windings.

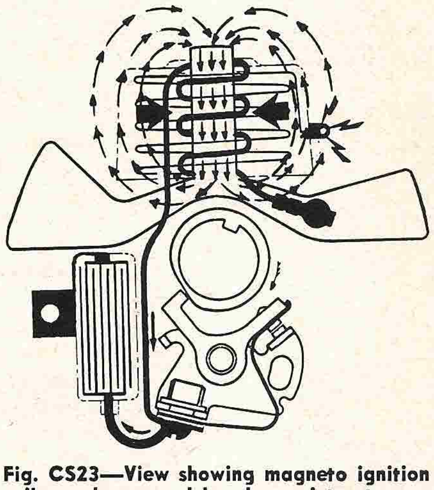


Fig. CS23—View showing magneto ignition coil, condenser and breaker points at same instant as illustrated in Fig. CS22; however, arrows shown above illustrate lines of force of the electro-magnetic field established by current in primary coil windings rather than the lines of force of the permanent magnets. As the current in the primary circuit ceases to flow, the electro-magnetic field collapses rapidly, cutting the coil windings as indicated by heavy arrows and inducing a very high voltage in the secondary coil winding resulting in the ignition spark.

sections, it is seen that the resulting emf induced in the primary circuit will cause a current to flow through the primary coil windings and the breaker points which have now been closed by action of the cam.

At the instant the movement of the lines of force cutting through the coil winding sections is at the maximum rate, the maximum flow of current is obtained in the primary circuit. At this time, the cam opens the breaker points interrupting the primary circuit and, for an instant, the flow of current is absorbed by the condenser as illustrated in Fig. CS22. An emf is also induced in the secondary coil windings, but the voltage is not sufficient to cause current to flow across the spark plug gap.

The flow of current in the primary windings created a strong electromagnetic field surrounding the coil windings and up through the center leg of the armature core as shown in Fig CS23. As the breaker points were opened by the cam, interrupting the primary circuit, this magnetic field starts to collapse cutting the coil windings as indicated by the heavy black arrows. The emf induced in the primary circuit would be sufficient to cause a flow of current across the opening breaker points were it not for the condenser absorbing the flow of current and bringing it to a controlled stop. This allows the electromagnetic field to collapse at such a rapid rate to induce a very high voltage in the coil high tension or secondary windings. This voltage, in the order of 15,000 to 25,000 volts, is sufficient to break down the resistance of the air gap between the spark plug electrodes and a current will flow across the gap. This creates the ignition spark which ignites the compressed fuel-air mixture in the engine cylinder.

SOLID STATE (BREAKERLESS) MAGNETO IGNITION SYSTEM

The solid state (breakerless) magneto ignition system operates somewhat on the same basic principles as the conventional type flywheel magneto previously described. The main difference is that the breaker contact points are replaced by a solid state electronic Gate Controlled Switch (GCS) which has no moving parts. Since, in a conventional system, the breaker points are closed over a longer period of crankshaft rotation than is the "GCS", a diode has been added to the circuit to provide the same characteristics as closed breaker points.

BASIC OPERATING PRINCIPLES. The same basic principles for electro-magnetic induction of electricity and formation of magnetic fields by electrical current as outlined for the conventional flywheel type magneto also apply to the solid state magneto. Thus, the principles of the different components (diode and GCS) will complete the operating principles of the solid state magneto.

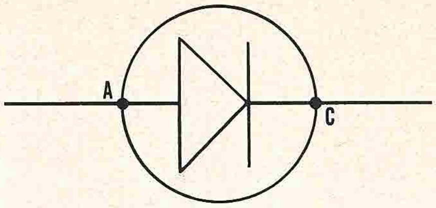


Fig. CS24—In a diagram of an electrical circuit, the diode is represented by the symbol shown above. The diode will allow current to flow in one direction only (from annode "A" to cathode "C" terminal of diode).

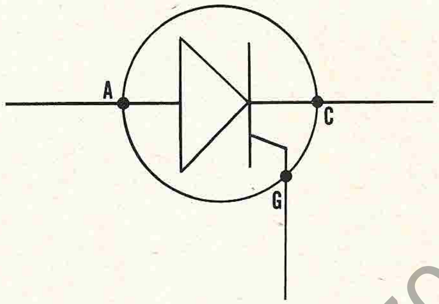


Fig. CS24A—The symbol used for a Gate Controlled Switch (GCS) in an electrical diagram is shown above. The GCS will allow current to flow from annode (A) terminal to cathode (C) terminal when "turned on" by a positive electrical charge at gate (G) terminal. A negative electrical charge at gate (G) terminal will turn off the GCS.

DIODE OPERATING PRINCIPLES. The diode is represented in wiring diagrams by the symbol as shown in Fig. CS24. Although the principle of diode operation is beyond the scope of this manual, it is sufficient to say that it is an electronic device that will permit passage of electrcal current in one direction only. In electrical schematic diagrams, the arrow part of the symbol illustrates the direction which current can flow through the diode.

GATE CONTROLLED SWITCH (GCS). The symbol shown in Fig. CS24A is used to represent the gate controlled switch (GCS) in wiring diagrams. As with the diode, discussion of the GCS is beyond the scope of this manual. However, its action in an electrical circuit is as follows:

The GCS acts as a switch to permit passage of electrical current in the direction indicated by the arrow portion of the symbol (Fig. CS24A) when in "ON" state and will not permit electric current to flow when in "OFF" state. The GCS can be turned "ON" by a positive surge of electricity at the gate (G) terminal and will remain 'ON" as long as current remains positive at the gate terminal or as long as current is flowing through the GCS from annode (A) terminal to cathode (C) terminal. The GCS can be turned "OFF" with a negative surge of electricity at the gate (G) terminal or will go to "OFF" state if current stops flowing through the switch from annode (A) to cathode (C).

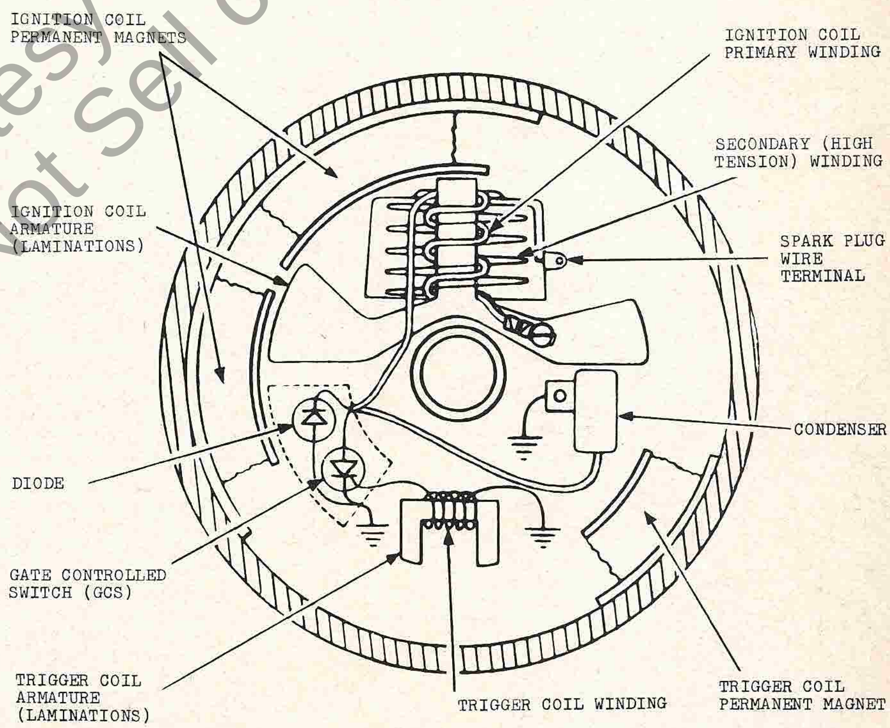


Fig. CS24B — Schematic diagram of solid state (breakerless) flywheel magneto. The diagram is drawn to follow the schematic drawings of a conventional type magneto as shown in Figs. CS20, CS21, CS22 and CS23. Refer to Figs. CS24 and CS24A for diode and Gate Controlled Switch (GCS) symbols. Refer to Figs. CS24C, CS24D and CS24E for schematic views of magneto operating cycle.

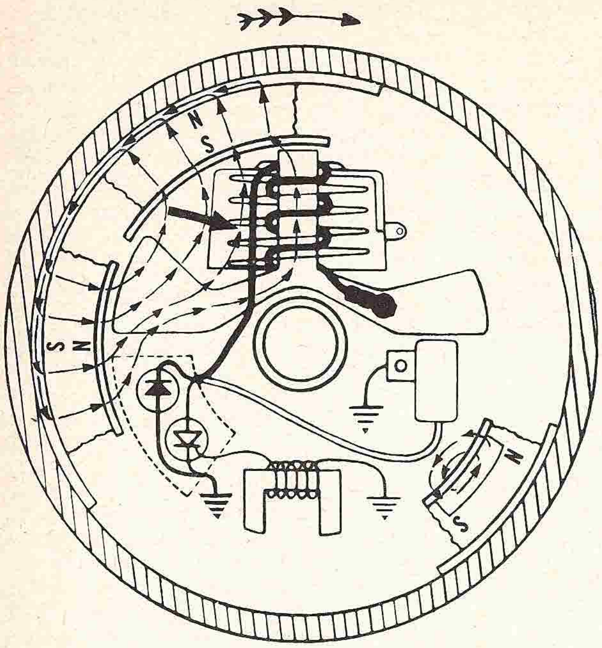


Fig. CS24C — View showing rotor of solid state magneto at instant in rotation where lines of force of ignition coil magnets are being drawn into left and center legs of magneto armature. The diode (see Fig. CS24) acts as a closed set of breaker points in completing the primary ignition circuit at this time, thus preventing an unwanted (maverick) spark which could occur at this time. Refer next to Fig. CS24D.

HOW IGNITION SPARK IS PRODUCED. The basic components and wiring diagram for the solid state (breakerless) magneto are shown schematically in Fig. CS24C, the magneto rotor (flywheel) is turning and the ignition coil magnets have just moved into position so that their lines of force are cutting the ignition coil windings and producing a negative surge of current in the primary windings. The diode (see Fig. CS-24B) allows current to flow as indicated by arrow and action is same as conventional magneto with breaker contact points closed.

In Fig. CS24D, the magneto rotor continues to turn and the ignition coil magnets are in the position to cause their lines of force to cut the coil windings on both sides of the center leg of armature as indicated by the arrows. At the same time, the trigger coil magnet has moved into position to allow its lines of force to cut the trigger coil windings inducing a current which is positive at the GCS gate (G) terminal (see Fig. CS24A) turning the GCS to 'ON" state. Thus, the electrical current induced into the ignition coil primary coil windings can flow through the "ON" GCS as though in a conventional magneto with breaker points closed.

In Fig. CS24E, the magneto rotor has turned to a position so that the lines of force of the ignition coil permanent magnets are cutting the ignition coil windings at the maximum rate, thus the current in the primary wndings is at its peak value. The trigger coil magnet is so located on the magneto rotor that at the time the ignition

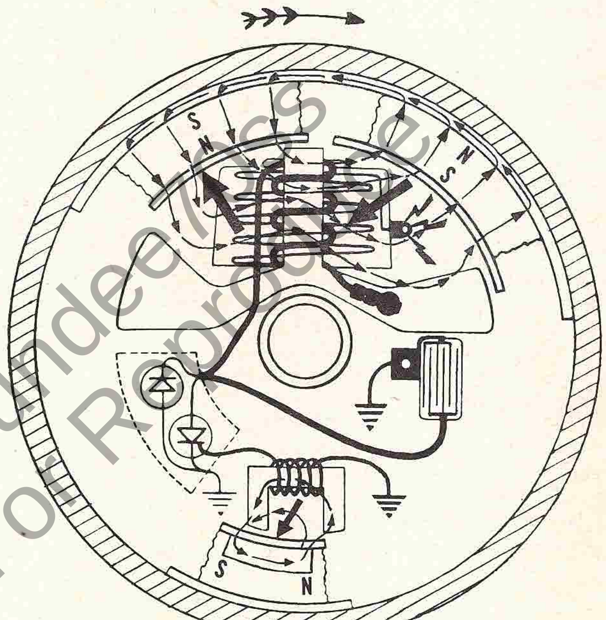


Fig. CS24E—Refer first to Figs. CS24C and CS24D. The ignition coil magnets have now moved to a position so that their lines of force are cutting the ignition coil windings at a maximum rate. At this same instant, movement of the trigger coil magnets is pulling lines of force away from the trigger coil armature thus creating a negative charge in the coil lead to the GCS gate terminal. This "turns off" the GCS and interrupts the primary ignition circuit just as would breaker points opening in a conventional magneto. As the primary current is interrupted at its peak, the current is brought to a quick stop by the condenser and a very high voltage is induced in the ignition coils. Refer to Fig. CS23 regarding the collapsing electro-magnetic field surrounding the ignition coil.

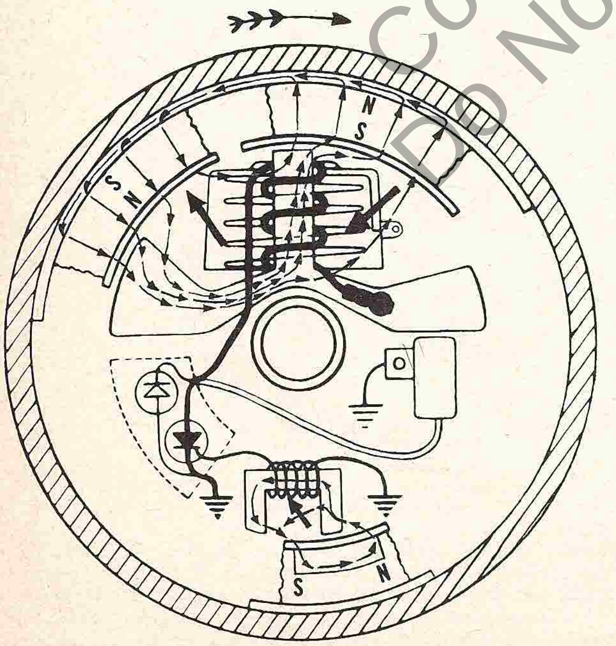


Fig. CS24D — Refer to Fig. CS24C. Magneto rotor has now turned into position so that lines of force of ignition coil magnets are pulling out of armature left leg and are being pulled into the right leg. Thus, lines of magnetic force are cutting ignition coil windings on both sides of center leg inducing a strong voltage. The trigger coil magnets have also moved to a position where lines of magnetic force are being pulled into the trigger coil armature creating a positive charge in the lead to the Gate Controlled Switch (GCS), thus "turning on" the switch for passage of current in the ignition primary circuit. Refer now to Fig. CS24E.

coil magnets are at the position to produce the highest rate of flux movement through the ignition coil, the lines of flux of the trigger coil magnet are cutting through the trigger coil windings in the direction to produce a negative charge of electricity at the GCS gate (G) termnal. This negative charge of electricity turns the GCS to "OFF" state, thus acting the same as the breaker contact points opening at peak ignition coil primary winding current. The condenser absorbs the primary current bringing it to a quick controlled stop causing the electromagnetic field surrounding the ignition coil to quickly collapse creating an ignition spark as illustrated in Fig. CS23 for the conventional type flywheel magneto.

THE SPARK PLUG. In any spark ignition engine, the spark plug (See Fig. CS25) provides the means for igniting the compressed fuel-air mixture in the cylinder. Before an electric charge can move across an air gap, the intervening air must be charged with electricity, or ionized. If the spark plug is properly gapped and the system is not shorted, not more than 7,000 volts may be required to initiate a spark. Higher voltage is required as the spark plug warms up, or if compression pressures or the distance of the air gap is increased. Compression pressures are highest at full throttle and relatively slow engine speeds, therefore, high voltage requirements or a lack of available secondary voltage most often shows up as a miss during maximum acceleration from a slow engine speed. There are many different types and sizes of spark plugs which are designed for a number of specific requirements.

THREAD SIZE. The threaded, shell portion of the spark plug and the attaching hole in the cylinder are manufactured to meet certain industry established standards. The diameter is referred to as "Thread Size." Those commonly used are: 10 mm, 14 mm, 18 mm, ⅞ inch and ½ inch pipe. The 14 mm plug is almost universal for chain saw engine use.

REACH. The length of thread, and the thread depth in cylinder head or wall are also standardized throughout the industry. This dimension is measured from gasket seat of head to cylinder end of thread. See Fig. CS26. Four different reach plugs commonly used are: ⅜-inch, $\frac{7}{16}$-inch, ½-inch and ¾-inch. The first two mentioned are the ones commonly used in chain saw engines.

HEAT RANGE. During engine operation, part of the heat generated during combustion is transferred to the spark plug, and from the plug to the cylinder through the shell threads and gasket. The operating temperature of the spark plug plays an important part in engine operation. If too much heat is retained by the plug, the fuel-air mixture may be ignited by contact with the heated surface before the ignition spark occurs. If not enough heat is retained, partially burned combustion products (soot, carbon and oil) may build up on the plug tip resulting in "fouling" or shorting out of the plug. If this happens, the secondary current is dissipated uselessly as it is generated instead of bridging the plug gap as a useful spark, and the engine will misfire.

The operating temperature of the plug tip can be controlled, within limits, by altering the length of the path the heat must follow to reach the threads and gasket of the plug. Thus, a plug with a short, stubby insulator around the center electrode will run cooler

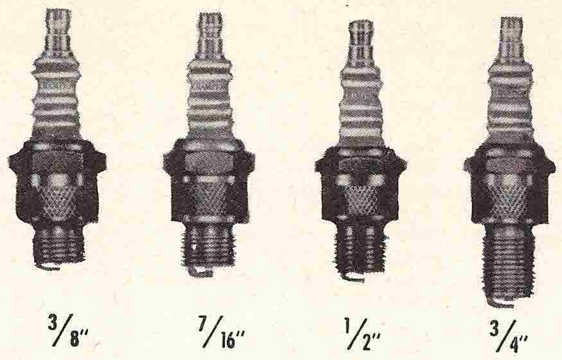


Fig. CS26 — Various "reaches" of plugs available. Chain saw engines normally use a ⅜-inch reach spark plug. A ⅜-inch reach plug measures ⅜-inch from firing end of shell to gasket surface of shell.

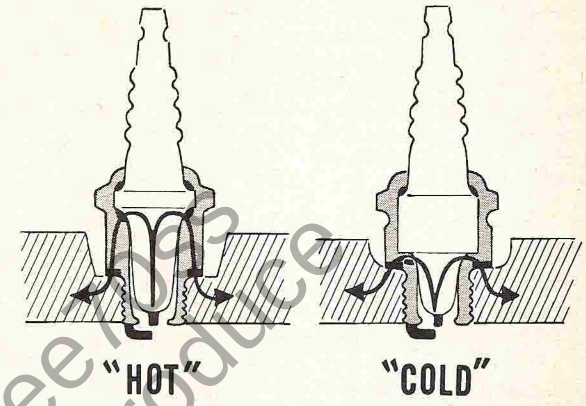


Fig. CS27 — Spark plug tip temperature is controlled by the length of the path heat must travel to reach the cooling surface of the engine cylinder head.

Fig. CS28—The two-cycle spark plug shown at left is almost exclusively used in chain saw engines.

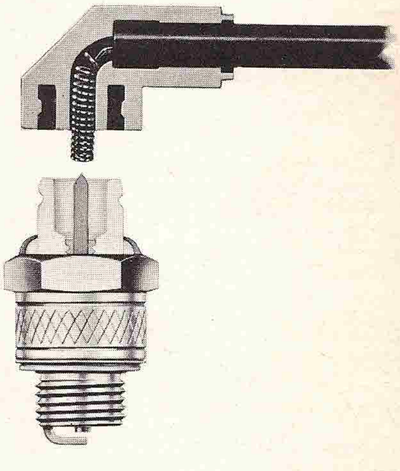


Fig. CS29 — Cut-away view of special "shorty" type spark plug and terminal available for chain saw engines. Refer to Fig. CS29A for a second type special plug.

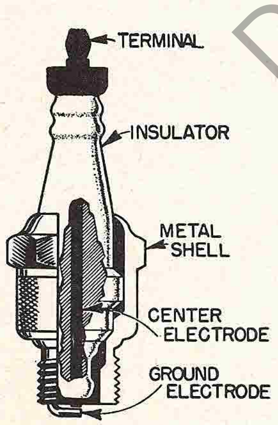


Fig. CS25 — Cross sectional view of spark plug showing construction and nomenclature.

than one with a long, slim insulator. Refer to Fig. CS27. Most plugs in the more popular sizes are available in a number of heat ranges which are interchangeable within the group. The proper heat range is determined by engine design and the type of service. Refer to SPARK PLUG SERVICING, in SERVICE FUNDAMENTALS section, for additional information on spark plug selection.

SPECIAL TYPES. Sometimes, engine design features or operating conditions call for special plug types designed for a particular purpose. Of special interest when dealing with chain saw engines are the two-cycle spark plug shown in Fig. CS28, the "shorty" type plug shown in Fig. CS29, and the "bantam" type plug shown in Fig. CS29A. In the two-cycle spark plug, the ground electrode is shortened so that its end aligns with center of insulated electrode rather than completely overlapping as with the conventional plug. This feature reduces the possibility of the gap bridging over by carbon formations.

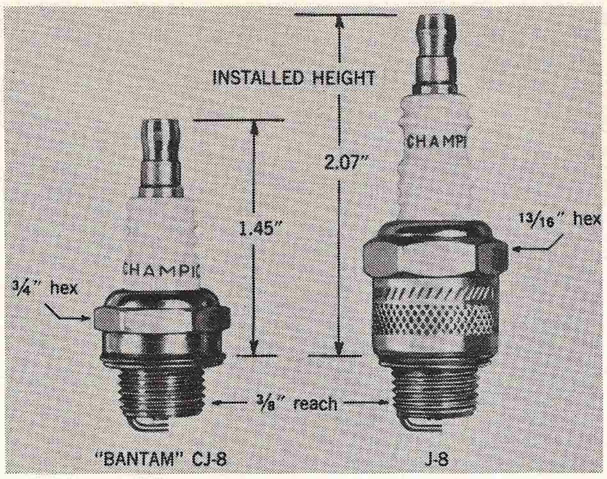


Fig. CS29A — View showing special "bantam" type spark plug as compared with regular type spark plug of same heat range. Refer also to Fig. CS29 for view of special "shorty" type plug.

SERVICE FUNDAMENTALS

IGNITION SYSTEM

In servicing a chain saw ignition system, the mechanic is concerned with trouble shooting, service adjustments and testing magneto components. The following paragraphs outline the basic steps in servicing a flywheel type magneto. Refer to the appropriate chain saw engine section for adjustment and test specifications for a particular engine.

TROUBLE SHOOTING

If the chain saw engine will not start and malfunction of the ignition system is suspected, make the following checks to find cause of trouble.

Check to be sure that the ignition switch (if chain saw is so equipped) is in the "On" or "Run" position and that the insulation on the wire leading to the ignition switch is in good condition. The switch can be checked with the timing and test light as shown in Fig. CS30. Disconnect the lead from the switch and attach one clip of the test light to the switch terminal and the other clip to the chain saw frame or engine. The light should go on when the switch is in the "Off" or "Stop" position, and should go off when the switch is in the "On" or "Run" position.

Inspect the high tension (spark plug) wire for worn spots in the insulation or breaks in the wire. Frayed or worn insulation can be repaired temporarily with plastic electrician's tape.

If no defects are noted in the ignition switch or ignition wires, remove and inspect the spark plug as outlined in the SPARK PLUG SERVICING section. If the spark plug is fouled or is in questionable condition, connect a spark plug of known quality to the high tension wire, ground the base of the spark plug to engine and turn engine rapidly with the starter. If the spark across the electrode gap of the spark plug is a bright blue, the magneto can be considered in satisfactory condition. NOTE: Some engine manufacturers specify a certain type spark plug and a specific test gap. Refer to appropriate engine service section; if no specific spark plug type or electrode gap is recommended for test pur-

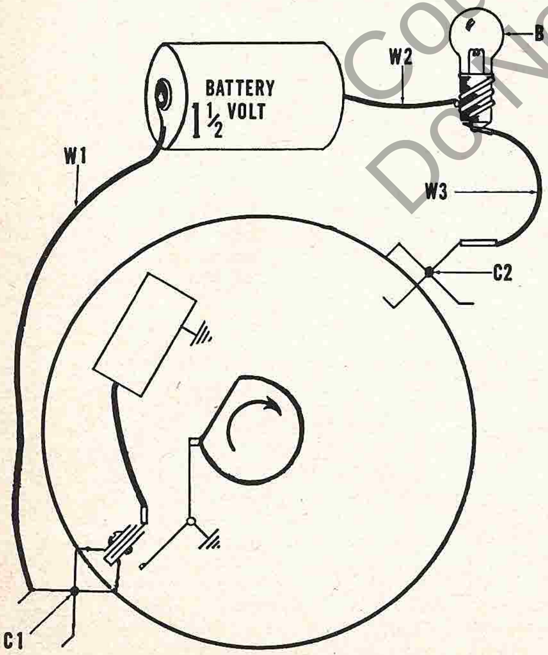


Fig. CS30 — A timing light such as the one shown is a valuable aid in trouble shooting, checking timing and, on some engines, adjusting breaker point gap. The light can be made from a flashlight battery, bulb (B), wire clamps (WC) and short sections of insulated wire.

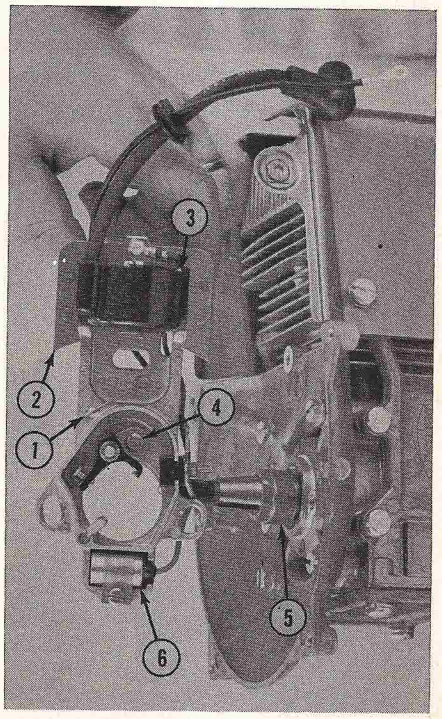


Fig. CS31 — On some chain saw engines, the magneto stator plate mounting holes are slotted as shown so that ignition timing can be adjusted by relocating position of stator plate.

1. Stator plate
2. Armature core
3. Ignition coil
4. Breaker point base
5. Breaker cam
6. Condensor

poses, use spark plug type and electrode gap recommended for engine make and model. If the spark across the gap of the test plug is weak or orange colored, or no spark occurs as engine is cranked, magneto should be serviced as outlined in the following paragraphs.

MAGNETO ADJUSTMENTS

BREAKER CONTACT POINTS. Adjustment of the breaker contact points affects both ignition timing and magneto edge gap. Therefore, the breaker contact point gap should be carefully adjusted according to engine manufacturer's specifications. Before adjusting the breaker contact gap, inspect contact points and renew if condition of contact surfaces is questionable. It is sometimes desirable to check the condition of points as follows: Disconnect the condensor and primary coil leads from the breaker point terminal. Attach one clip of a test light (See Fig. CS30) to the breaker point terminal and the other clip of the test light to magneto ground. The light should be out when contact points are open and should go on when the engine is turned to close the breaker contact points. If the light stays on when points are open, insulation of breaker contact arm or condensor is defective. If light does not go on when points are closed, contact surfaces are dirty, oily or are burned.

Adjust breaker point gap as follows unless manufacturer specifies adjusting breaker gap to obtain correct ignition timing. First, turn engine so that points are closed to be sure that the contact surfaces are in alignment and seat squarely. Then, turn engine so that breaker point opening is maximum and adjust breaker gap to manufacturer's specification. A wire type feeler gage is recommended for checking and adjusting the breaker contact gap. Be sure to recheck gap after tightening breaker point base retaining screws.

IGNITION TIMING. On some engines, ignition timing is non-adjustable and a certain breaker point gap is specified. On other engines, timing is adjustable by changing the position of the magneto stator plate (See Fig. CS31) with a specified breaker point gap or by simply varying the breaker point gap to obtain correct timing. Ignition timing is usually specified either in degrees of engine (crankshaft) rotation or in piston travel before the piston reaches top dead center position. In some instances, a specification is given for ignition timing even though the timing may be non-adjustable; if a check reveals timing is incorrect on these engines, it is an indication of incorrect breaker point adjustment or excessive wear of breaker cam. Also, on some engines, it may indicate that a wrong breaker cam has been installed or that the cam has been installed in a reversed position on engine crankshaft.

Some engines may have a timing mark or flywheel locating pin to locate the flywheel at proper position for the ignition spark to occur (breaker points begin to open). If not, it will be necessary to measure piston travel as illustrated in Fig. CS32 or install a degree indicating device on the engine crankshaft.

A timing light as shown in Fig. CS30 is a valuable aid in checking or adjusting engine timing. After disconnecting the ignition coil lead from the breaker point terminal, connect the leads of the timing light

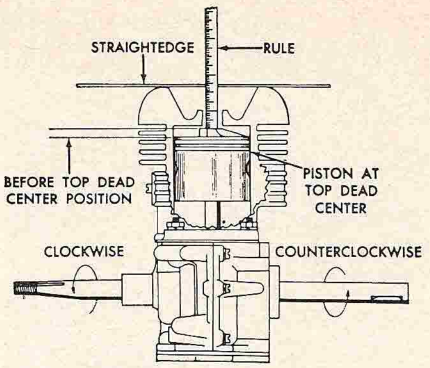


Fig. CS32 — Where timing is specified as measurement of piston travel, measurement can be made as illustrated. Use of a dial indicator instead of ruler will give more exact measurement. Some manufacturers provide a timing gage that can be screwed into spark plug hole or a gage that can be attached to crankshaft.

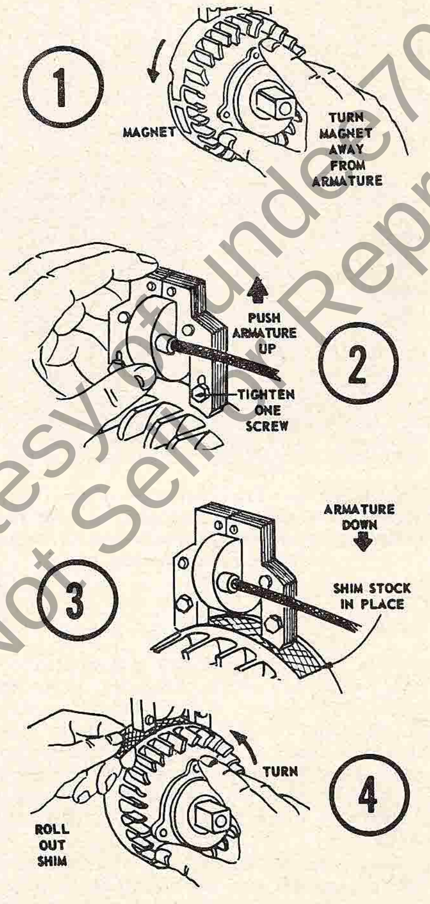


Fig. CS33 — Views showing adjustment of armature air gap when armature is located outside flywheel. Refer to Fig. CS34 for engines having armature located inside (under) flywheel.

as shown. If timing is adjustable by moving the magneto stator plate, be sure that the breaker point gap is adjusted as specified. Then, to check timing, slowly turn engine in normal direction of rotation past the point at which ignition spark should occur. The timing light should be on, then go out (breaker points open) just as the correct timing location is passed. If not, turn engine to proper timing location and adjust timing by relocating the magneto stator plate or varying the breaker contact gap as specified by engine manufacturer. Loosen the screws retaining the stator plate or breaker points and adjust position of stator plate or points so that points are closed (timing light is on). Then, slowly move adjustment until timing light goes out (points open) and tighten the retaining screws. Recheck timing to be sure adjustment is correct.

ARMATURE AIR GAP. To fully concentrate the magnetic field of the flywheel magnets within the armature core, it is necessary that the flywheel magnets pass as closely to the armature core as possible without danger of metal to metal contact. The clearance between the flywheel magnets and the legs of the armature core is called the armature air gap.

On magnetos where the armature and high tension coil are located outside of the flywheel rim, adjustment of the armature air gap is made as follows: Turn the engine so that the flywheel magnets are located directly under the legs of the armature core and check the clearance between the armature core and flywheel magnets. If the measured clearance is not within manufacturers specifications, loosen the armature core mounting screws and place shims of thickness equal to minimum air gap specification between the magnets and armature core (Fig. CS33). The magnets will pull the armature core against the shim stocks. Tighten the armature core mounting screws, remove the shim stock and turn the engine through several revolutions to be sure the flywheel does not contact the armature core.

Where the armature core is located under or behind the flywheel, the following methods may be used to check and adjust armature air gap: On some engines, slots or openings are provided in the flywheel through which the armature air gap can be checked. Some engine manufacturers provide a cut-away flywheel that can be installed temporarily for checking the armature air gap. A test flywheel can be made out of a discarded flywheel (See Fig. CS34), or out of a new flywheel if service volume on a particular engine warrants such ex-

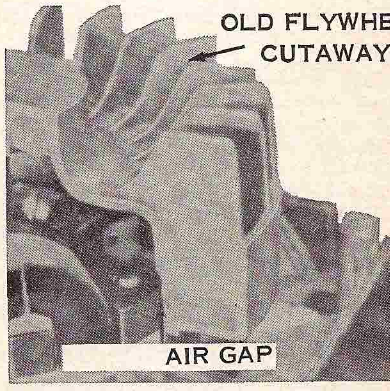


Fig. CS34 — Where armature core and ignition coil are located inside of flywheel, an old discarded flywheel can be cut away as shown to provide air gap adjustment fixture.

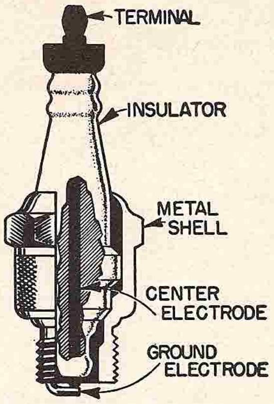


Fig. CS38 — Cross sectional view of spark plug showing construction and nomenclature.

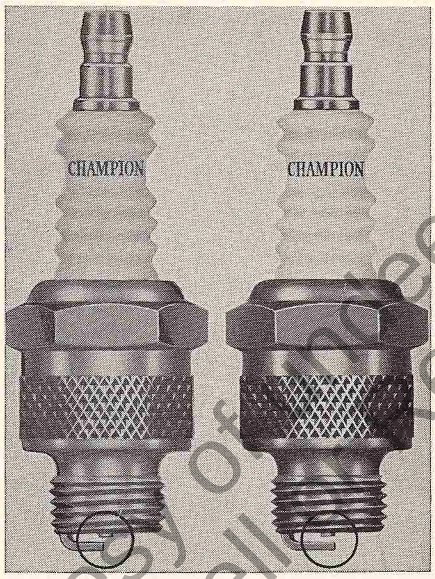


Fig. CS39 — The two-cycle plug (left) differs from conventional plug in that the grounded electrode is shortened to minimize carbon fouling.

penditure. Another method of checking the armature air gap is to remove the flywheel and place a layer of plastic tape equal to the minimum specified air gap over the legs of the armature core. Reinstall flywheel and turn engine through several revolutions and remove flywheel; no evidence of contact between the flywheel magnets and plastic tape should be noticed. Then cover the legs of the armature core with a layer of tape of thickness equal to the maximum specified air gap; then, reinstall flywheel and turn engine through several revolutions. Indication of the flywheel magnets contacting the plastic tape should be noticed after the flywheel is again removed. If the magnets contact the first thin layer of tape applied to the armature core legs, or if they do not contact the second thicker layer of tape, armature air gap is not within specifications and should be adjusted. NOTE: Before loosening armature core mounting screws, scribe a mark on mounting plate against edge of armature core so that adjustment of air gap can be gaged.

In some instances, it may be necessary to slightly enlarge the armature core mounting holes before proper air gap adjustment can be made.

MAGNETO EDGE GAP. The point of maximum acceleration of the movement of the flywheel magnetic field through the high tension coil (and therefore, the point of maximum current induced in the primary coil windings) occurs when the trailing edge of the flywheel magnet is slightly past the left hand leg of the armature core as shown in Fig. CS21. The exact point of maximum primary current is determined by using electrical measuring devices, the distance between the trailing edge of the flywheel magnet and the leg of the armature core at this point is measured and becomes a service specification. This distance, which is stated either in thousandths of an inch or in degrees of flywheel rotation, is called the Edge Gap or "E" Gap.

For maximum strength of the ignition spark, the breaker points should just start to open when the flywheel magnets are at the specified edge gap position. Usually, edge gap is non-adjustable and will be maintained at the proper dimension if the contact breaker points are adjusted to the recommended gap and the correct breaker cam is installed. However, magneto edge gap can change (and spark intensity thereby reduced) due to the following:

a. Flywheel drive key sheared
b. Flywheel drive key worn (loose)
c. Keyway in flywheel or crankshaft worn (oversized)
d. Loose flywheel retaining nut which can also cause any above listed difficulty
e. Excessive wear on breaker cam
f. Breaker cam loose on crankshaft
g. Excessive wear on breaker point rubbing block so that points cannot be properly adjusted.

SPARK PLUG SERVICING

ELECTRODE GAP. The spark plug electrode gap (Refer to Fig. CS38) should be adjusted by bending the ground electrode. The recommended gap is listed in the SPARK PLUG paragraph in MAINTENANCE section for the individual motor.

CLEANING AND ELECTRODE CONDITIONING. Spark plugs are most usually cleaned by abrasive action commonly referred to as "sand blasting." Actually, ordinary sand is not used, but a special abrasive which is nonconductive to electricity even when melted, thus the abrasive cannot short out the plug current. Extreme care should be used in cleaning the plugs after sand blasting, however, as any particles of abrasive left on the plug may cause damage to piston rings, piston or cylinder walls.

After plug is cleaned by abrasive, and before gap is set, the electrode surfaces between the grounded and insulated electrodes should be cleaned and returned as nearly as possible to original shape by filing with a point file. Failure to properly dress the points can result in high secondary voltage requirements, and misfire of the plugs.

PLUG APPEARANCE DIAGNOSIS. The appearance of a spark plug will be altered by use, and an examination of the plug tip can contribute useful information which may assist in obtaining better spark plug life. It must be remembered that the contributing factors differ in two-cycle and four-cycle engine operation and, although

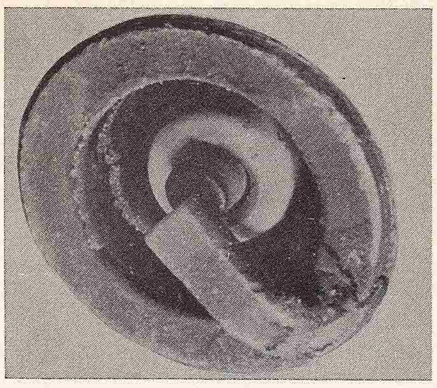


Fig. CS40 — Two cycle engine plug of correct heat range. Insulators light tan to gray with few deposits. Electrodes not burned.

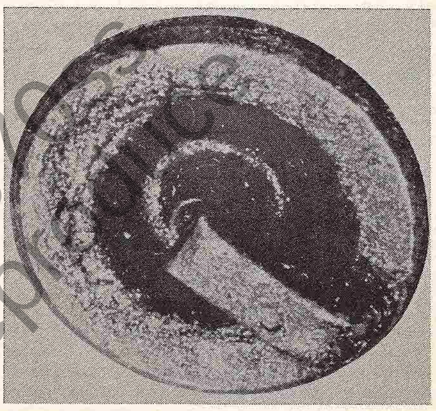


Fig. CS41 — Damp or wet black carbon coating over entire firing end of plug. Could be caused by rich carburetor mixture, too much oil in fuel, or low ignition voltage. Could also be caused by incorrect heat range (too cold) for operating conditions. Correct the defects or install a hotter plug.

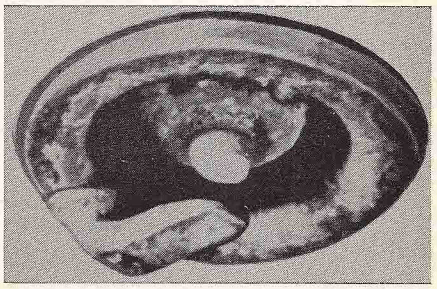


Fig. CS42 — Electrodes badly eroded, deposits white or light gray and gritty, insulator has "blistered" appearance. Could be caused by lean carburetor mixture, fast timing, overloading, or air intake screen and engine cooling fins blocked with sawdust or other debris. Could also be caused by incorrect heat range (too hot) for operating conditions. Check timing, carburetor adjustment, cooling system. If timing, carburetor adjustment, cooling system and engine speed are correct, install a colder plug.

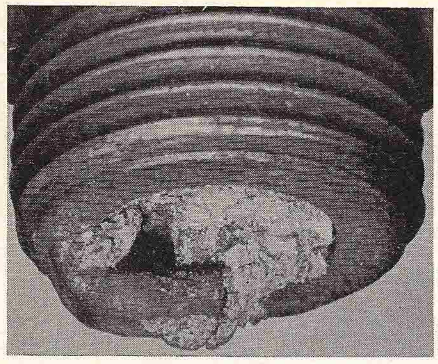


Fig. CS43 — Gray, metallic aluminum deposits on plug. (Seldom encountered). Piston damage due to pre-ignition. Overhaul motor and determine cause of pre-ignition.

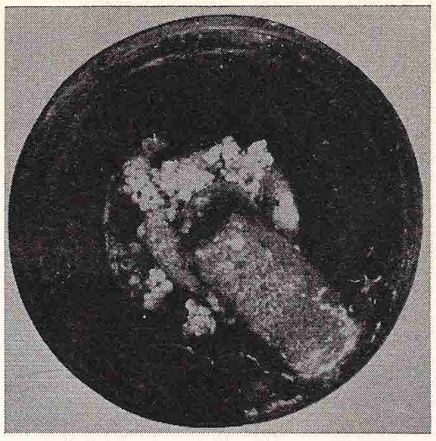


Fig. CS44 — Core bridging from center electrode to shell. Fused deposits sometimes have the appearance of tiny beads or glasslike bubbles. Caused by excessive combustion chamber deposits which in turn could be the result of; excessive carbon from prolonged usage; use of improper oil or incorrect fuel-oil ratio.

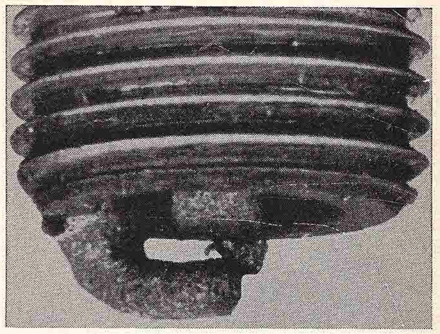


Fig. CS45 — Gap bridging. Usually results from the same causes outlined in Fig. CS44.

the appearance of two spark plugs may be similar, the corrective measures may depend on whether the engine is of two-cycle or four-cycle design. Fig. CS40 to Fig. CS45 are provided by Champion Spark Plug Company to illustrate typical observed conditions in Two-Cycle engines. Listed also are the probable causes and suggested corrective measures.

CARBURETOR SERVICING

The bulk of carburetor service consists of cleaning, inspection and adjustment. After considerable service it may become necessary to overhaul the carburetor and renew worn parts to restore original operating efficiency. Although carburetor condition affects engine operating economy and power, ignition and engine compression must also be considered to determine and correct causes of poor performance.

Before dismantling carburetor for cleaning or overhaul, clean all external surfaces and remove accumulated dirt and grease. Dismantle carburetor and note any discrepancies to assure correction during overhaul. Thoroughly clean all parts and inspect for damage or wear. Wash jets and passages and blow clear with clean, dry compressed air. Do not use a drill or wire to clean jets as the possible enlargement of calibrated holes will disturb operating balance. The measurement of jets to determine the extent of wear is difficult and new parts are usually installed to assure satisfactory results.

Carburetor manufacturers provide for many of their models an assortment of gaskets and other parts usually needed to do a correct job of cleaning and overhaul. These assortments are usually catalogued as Gasket Kits and Overhaul Kits respectively.

Check the fit of throttle and choke valve shafts. Excessive clearance will cause improper valve plate seating and will permit dust or grit to be drawn into the engine. Air leaks at throttle shaft bores due to wear will upset carburetor calibration and contribute to uneven engine operation. Rebush valve shaft holes where necessary and renew dust seals. If rebushing is not possible,

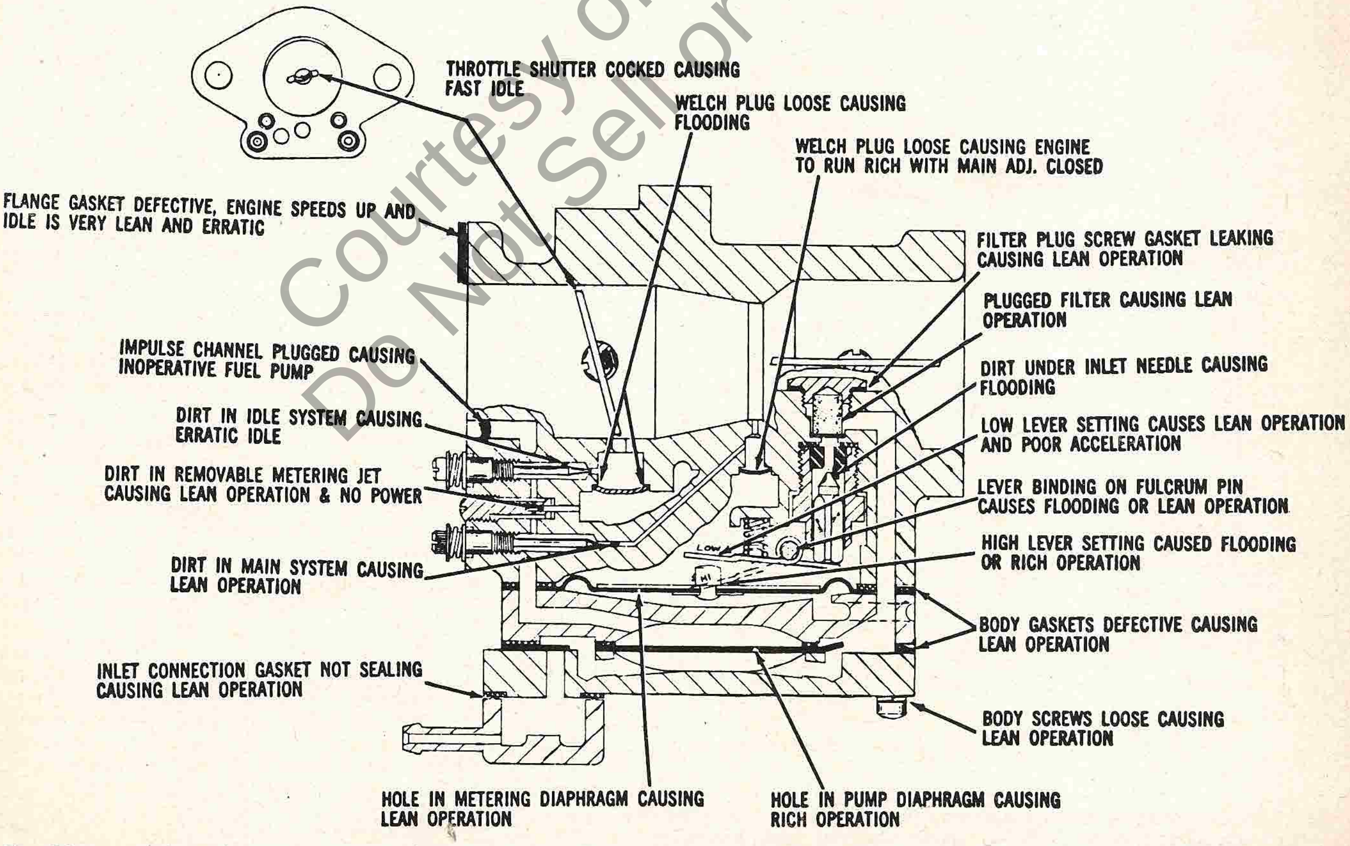


Fig. CS46 — Schematic cross-sectional view of a Brown diaphragm type carburetor showing several possible causes of fuel system malfunction. Refer to chain saw engine service sections for adjustment information on carburetors.

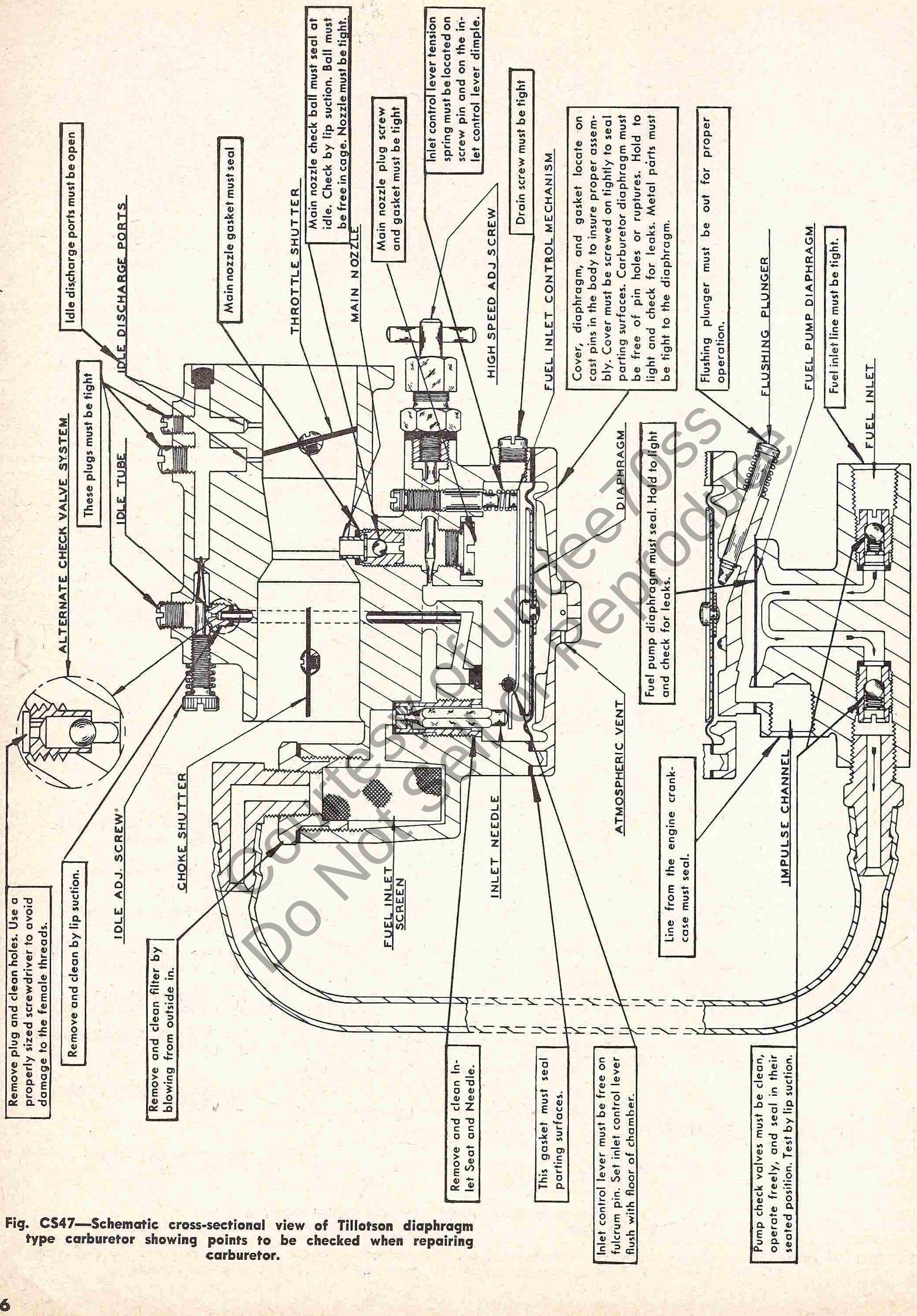


Fig. CS47—Schematic cross-sectional view of Tillotson diaphragm type carburetor showing points to be checked when repairing carburetor.

renew the body part supporting the shaft. Inspect throttle and choke valve plates for proper installation and condition.

Power or idle adjustment needles must not be worn or grooved. Check condition of needle seal packing or "O" ring and renew packing or "O" ring if necessary.

Reinstall or renew jets, using correct size listed for specific model. Adjust power and idle settings as described for specific carburetors in engine service section of manual.

It is important that the carburetor bore at the idle discharge ports and in the vicinity of the throttle valve be free of deposits. A partially restricted idle port will produce a "flat spot" between idle and mid-range rpm. This is because the restriction makes it necessary to open the throttle wider than the designed opening to obtain proper idle speed. Opening the throttle wider than the design specified amount will uncover more of the port than was intended in the calibration of the carburetor. As a result an insufficient amount of the port will be available as a reserve to cover the transition period (idle to the mid-range rpm) when the high speed system begins to function.

Refer to Figs. CS46 and CS47 for service hints on two different diaphragm type carburetors.

DISASSEMBLY AND ASSEMBLY

Special techniques must be developed in chain saw repair because of the aluminum alloy or magnesium alloy construction. Soft threads in aluminum or magnesium castings are often damaged by carelessness in overtightening fasteners or in attempting to loosen or remove seized fasteners. Manufacturer's recommended torque values for tightening screw fasteners should be followed closely.

A given amount of heat applied to aluminum or magnesium will cause it to expand a greater amount than will steel under similar conditions. Because of the different expansion characteristics, heat is usually recommended for easy installation of bearings, pins, etc., in aluminum or magnesium castings. Sometimes, heat can be used to free parts that are seized or where an interference fit is used. Heat, therefore, becomes a service tool and the application of heat one of the required service techniques. An open flame is not usually advised because it destroys the paint and other protective coatings and because a uniform and controlled temperature with open flame is difficult to obtain. Methods commonly used are heating in oil or water, with a heat lamp or in an oven or kiln. The use of water or oil gives a fairly accurate temperature control but is somewhat limited as to the size and type of part that can be handled. Thermal crayons are available which can be used to determine the temperature of a heated part. These crayons melt when the part reaches a specified temperature, and a number of crayons for different temperatures are available. Temperature indicating crayons are usually available at welding equipment supply houses.

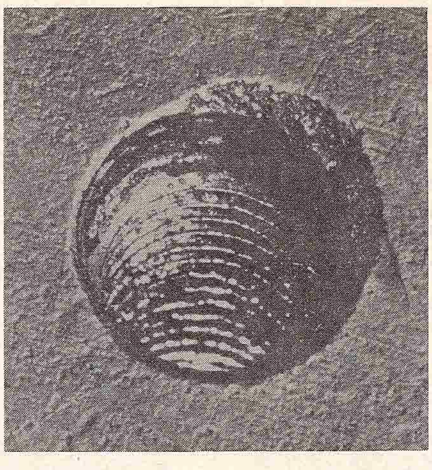


Fig. CS50 — Damaged threads in aluminum casting before repair. (Series provided by Heli-Coil Corp., Danbury, Connecticut).

Fig. CS51 — Drill out the old threads or broken stud, using drill size recommended in instruction sheet which comes with kit. Drill all the way through an open hole or all the way to bottom of a blind hole, making sure hole is straight and that centerline is not moved in drilling process.

The crankcase and combustion chambers of a two-cycle engine must be sealed against pressure and vacuum. To assure a perfect seal, nicks, scratches and warpage are to be avoided. Slight imperfections can be removed by using a fine-grit sandpaper. Flat surfaces can be lapped by using a surface plate or a smooth piece of plate glass, and a sheet of 120-grit sandpaper or lapping compound. Use a figure-eight motion with minimum pressure, and remove only enough metal to eliminate the imperfection. Bearing clearances, if any, must not be lessened by removing metal from the joint.

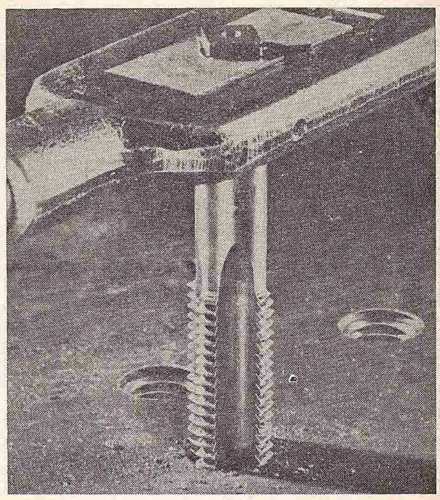


Fig. CS52 — Special drill taps are provided which are the correct size for OUTSIDE of the insert. A standard size tap cannot be substituted.

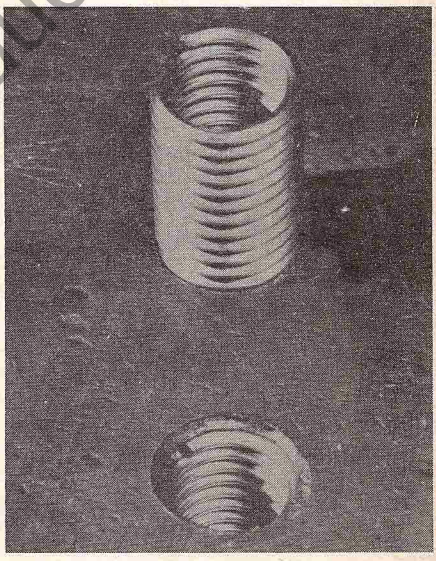


Fig. CS53 — Shown is the insert and a completed repair. Special tools are provided in kit for installation, together with the necessary instructions. Thread repair inserts are available for repairing damaged spark plug ports as well as for standard thread sizes.

Use only the specified gaskets when reassembling, and use an approved gasket cement or sealing compound unless the contrary is stated. Seal all exposed threads and repaint or retouch with an approved paint.

Damaged threads in castings can be renewed by use of thread repair kits which are recommended by a number of chain saw and chain saw engine manufacturers. Use of thread repair kits is not difficult, but instructions must be carefully followed. Refer to Figs. CS50 to CS53 which illustrate the use of Heli-Coil thread repair kits that are manufactured by the Heli-Coil Corporation, Danbury, Connecticut.

SAW CHAIN MAINTENANCE

This section on saw chain maintenance has been prepared to give information that will enable the small engine mechanic to service the cutting chain as well as the engine of the chain saw. Information for trouble-shooting saw chain problems is also given in this section.

SAW CHAIN TYPES. Saw chains now in popular use can be classified into three types as:

1. Chipper Tooth Chain or "curved L router."
2. Chisel Tooth Chain or "square L router."
3. Scratcher Chain or "crosscut."

Refer to Fig. 1 for illustrations of the cutting links from each type chain. The chipper tooth, or curved L router chain is the most widely used and is regarded as the easiest chain to sharpen. The chisel tooth, or square L router, and the scratcher, or cross-cut chains have gained acceptance by professional woodsmen because of their greater sawing speed, etc., but are somewhat more difficult to sharpen.

SAW CHAIN NOMENCLATURE. To identify parts of a saw chain and saw chain link, refer to Fig. 2 for chipper and chisel tooth type chains, and to Fig. 3 for scratcher type chain. Chains may be made up as an "endless chain," or may have a master link that can be unhooked to allow removal of the chain without removal of certain parts of the saw. Endless chain is generally preferred.

LUBRICATION. New chains are coated with a rust preventive which is sometimes mistaken for a lubricant. Soak a new chain for several hours, preferably overnight, in a pan of oil before it is placed into use. Oil the groove in the guide bar before installing the chain. While sawing, pump the chain oiler often. Stop the saw at intervals and pump the oiler as the chain is drawn around the bar. For maximum chain life, remove the chain after each day's use, sharpen and clean the chain and soak it overnight in a pan of oil. (Clean the chain with a stiff bristle brush. Do not use a wire brush).

CHAIN ADJUSTMENT. If manufacturer's instructions are not available, make chain adjustments (See Fig. 4) according to following procedure. Check and adjust tension when the bar and chain are cold. Loosen the stud nuts (A) slightly. Hold the tip end of the bar up. Run the chain tightener screw (B) up tight, then back off the tightener screw ⅛-turn. Tighten the stud nuts. Operate chain oiler plunger three or four times. Pull chain around the bar by hand; if the chain moves freely and all drive links are up in the bar, adjustment is correct.

While sawing, stop the saw occasionally and check the chain adjustment. If the chain appears to be too loose, allow it to cool. Expansion due to heat from sawing can cause the chain to appear loose. If the chain is still too loose after it cools, adjust as in preceding paragraph.

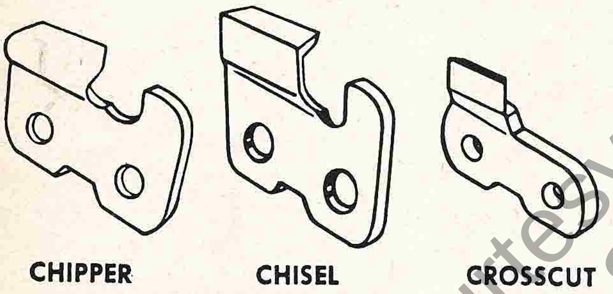


Fig. 1—Cutting links from each of the three types of saw chains.

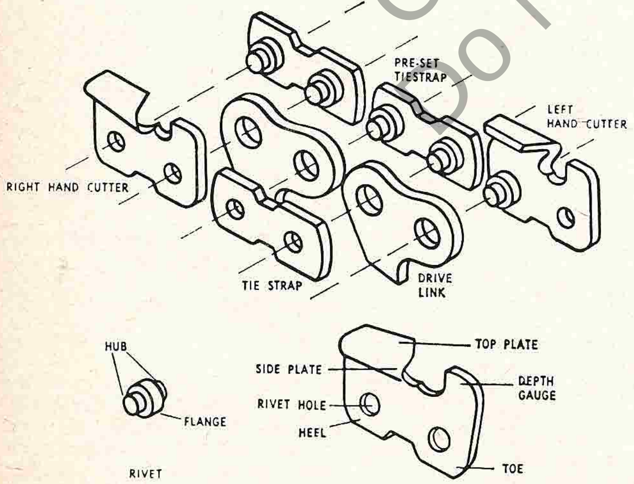


Fig. 2—Nomenclature of chipper tooth and chisel tooth saw chains. Chipper tooth is shown; chisel tooth is similar except for cutter design.

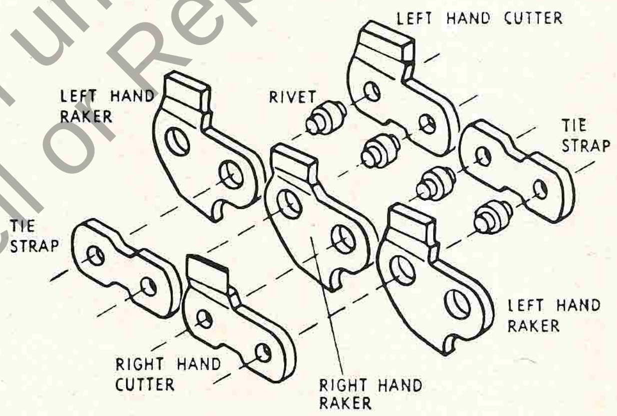


Fig. 3—Nomenclature of scratcher type chain.

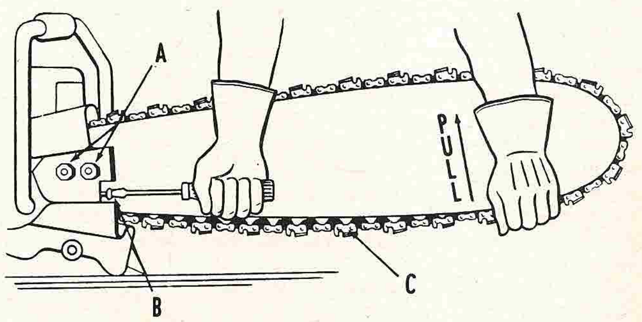


Fig. 4—Adjusting chain tension. Have bolts at A finger tight; adjust tension, B, while holding up outer end of bar. All slack must be out of the chain.

NEW CHAIN BREAK-IN PROCEDURE. Oil and adjust the chain according to previous paragraphs. Run the saw at just above clutch engagement speed for one to two minutes. Stop the saw and check the chain adjustment; readjust if necessary. Make only light cuts and observe the chain adjustment carefully for at least the first half hour of use. Never make heavy cuts with a new chain. New chains are subject to an initial stretch which could cause serious damage to chain and bar if proper break-in procedures are not followed.

SAW CHAIN SHARPENING. Most chain saw operating complaints are caused by improper sharpening. One of the most important maintenance operations for trouble-free sawing is properly filing the saw chain. For best results, the chain should be removed from the saw and placed in a filing vise for sharpening. (See Fig. 5.) If a vise is not available, the chain can be sharpened on the guide bar.

The following practices (See Fig. 6) should be adopted for good results:

A. Have filing vise or guide bar about waist high.
B. Have well lighted work area.
C. Stand erect, not bent over the chain.
D. Push the file with shoulder of arm holding file; guide file with other hand.
E. Follow correct filing angles.

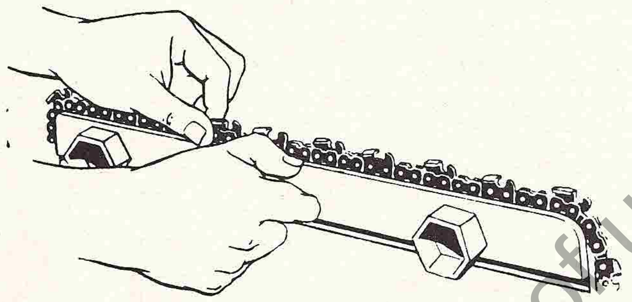


Fig. 5—Typical filing vise for saw chain.

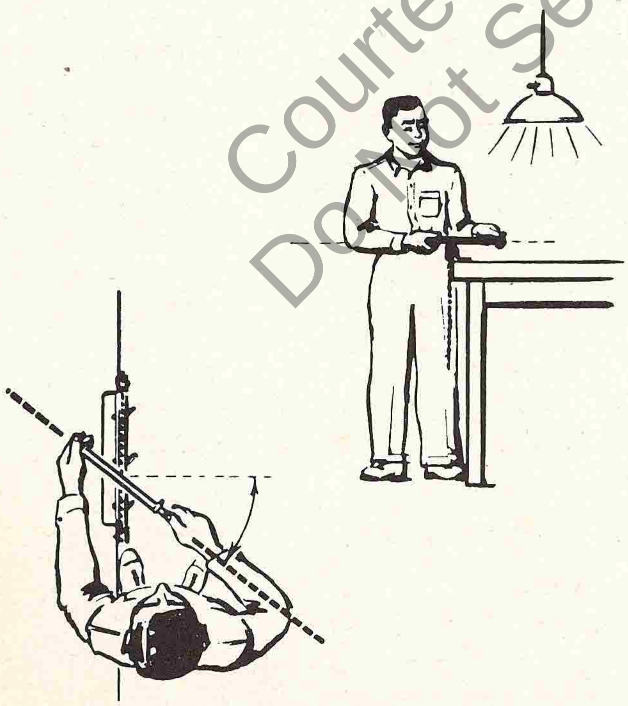


Fig. 6—Have well lighted work area. Stand erect. Swing arms from shoulder to keep file in proper position.

FILING CHIPPER TOOTH CHAIN. A full round file (not a rat-tail) is used to sharpen chipper (curved L router) chain. Different size and design chain will require different file sizes. If manufacturer's recommendations are not available, refer to the following chart.

SUGGESTED FILE SIZES FOR CHIPPER CHAIN

Chain Pitch	*Round File Size
3/8"	3/16"
.404", 7/16"	7/32"
7/16", 1/2"	1/4"
9/16", 5/8"	9/32"
3/4"	5/16"

*See Fig. 7. When cutter is about half worn away on some chains, the recommended size file will cut into the top of the drive links. At this point, use next size smaller file.

For average sawing, maintain the filing angles shown in Fig. 8 by holding the file in the position shown in Fig. 9. Do not allow the file to drag on the backstroke and rotate the file occasionally to increase file life. Approximately 1/10 of the file diameter ("F", Fig. 9) should be above the cutting edge of the cutter. If the distance "F" is less than this, the cutting edge will be too blunt; if distance "F" is greater, a rapidly wearing feather edge will result. For convenience, file alternate (either all right hand or left hand) cutters; then reverse the chain in the vise or turn the saw around and

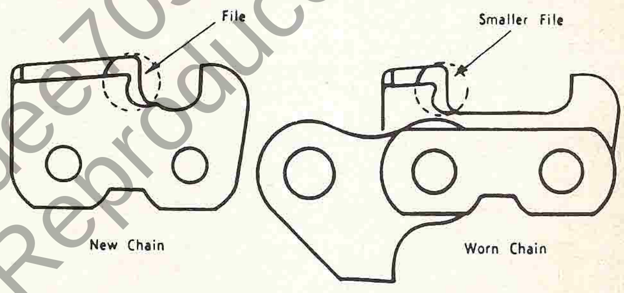


Fig. 7—Use next size smaller file on worn chains.

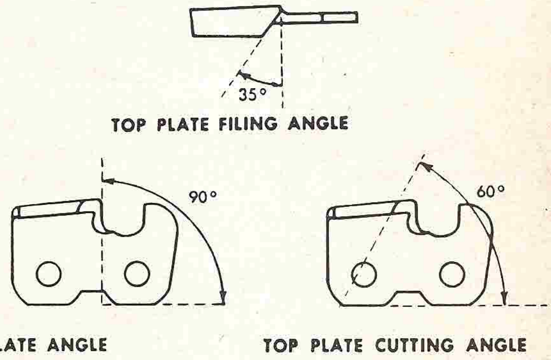


Fig. 8—Filing angles for chipper chain in average use.

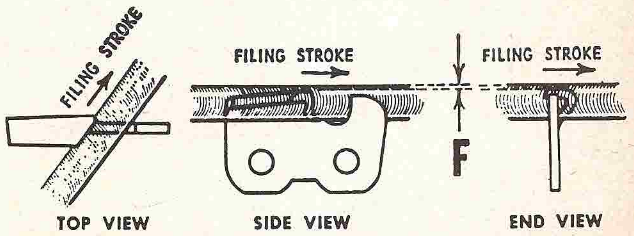


Fig. 9—File position for chipper chain. One-tenth to 1/5 of file diameter (F) should be above cutting edge.

file the remaining cutters. All cutters must be filed alike and the same amount to keep the cutting edges at the same height. Check this by laying a file or straight edge across the tops of the cutters. See Fig. 10. Continue filing high cutters in normal manner until all cutters are same height.

After filing the cutting edges, check the depth gauges, or riders as they are sometimes called, for correct distance below the cutting edges. (Distance "D", Fig. 11.) Depth gauges are generally checked with a jointer that is pre-set for the desired distance as the one shown in Fig. 11, or a jointer with an adjustable setting as the one shown in Fig. 12. Normal depth gauge distances below the cutting edges of the chain are given in the following table. Manufacturer's specific recommendations should be followed if available.

AVERAGE DEPTH GAUGE SETTINGS FOR CHIPPER CHAIN

Chain Pitch	Depth Gauge Distance Below Cutting Edge
$\frac{3}{8}$"	.020"
$\frac{7}{16}$-$\frac{1}{2}$"	.030"
$\frac{9}{16}$-$\frac{5}{8}$"	.040"
$\frac{3}{4}$"	.045"

Place jointer with desired depth gauge setting over chain with depth gauge exposed through the notch in the jointer. File depth gauge down to level of jointer. Be careful not to file on jointer. After all depth gauges have been filed or checked, round off the leading corner of each depth gauge with a file as shown in the insert in Fig. 12. Be careful not to file into the drive link or burr the cutting edges while rounding the depth gauges. Also, be careful not to file too much off of the leading corner. The width of the flat top on the depth gauge should remain at least 1½ times the thickness of the depth gauge material.

The normal top plate filing angle of 35° and the depth gauge distances for different pitch chain have been determined to be the most satisfactory for general sawing. However, the woodsman may, through trial and error, find the most suitable depth gauge distance for a particular condition. No specific figures can be given due to the variety of sawing conditions, but the following information can be used as a guide.

A. On larger horsepower saws and saws with slow chain speeds, the depth gauge distance may be increased which will allow the cutter to take a larger chip. The depth gauge distance should be decreased on small saws and direct drive saws.

B. When cutting continually in soft woods, the depth gauge distance can be increased somewhat.

C. When cutting hard woods, frozen or resin timber, the depth gauge distance should be decreased.

When sharpening the cutting edges on the saw chain, the drive tangs should also be sharpened to keep the guide groove clean, and any burrs on the sides of the drive tangs should be removed. See Fig. 13.

FILING CHISEL TOOTH CHAIN. A double bevel file is used to sharpen chisel tooth, or square L router chain. Recommended files are Nicholson No. 565D, Heller No. 3849 or Oberg No. 149. Use a round file to clean out gullet before filing the cutting edges.

For average sawing, maintain the filing angles shown in Fig. 14 by holding the file in the position as shown in Fig. 15. Do not allow the file to drag on the backstroke. Gradually increase the top plate filing angle from 15° to 20° as the cutting edge is worn back. Set the depth gauge distance below the cutting edge according to the following chart for average sawing.

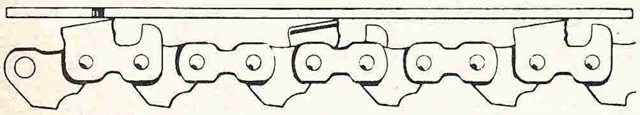


Fig. 10.—Check tooth height with flat file or straight edge. Continue filing high teeth in normal manner until all teeth are of same height.

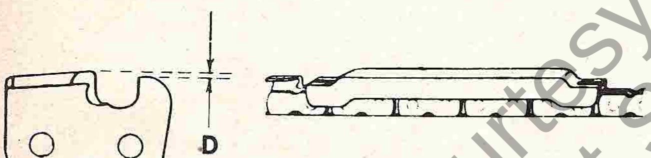


Fig. 11—Depth gauge distance (D) determines the size of chip that the tooth takes. At right, a pre-set type depth gauge jointer.

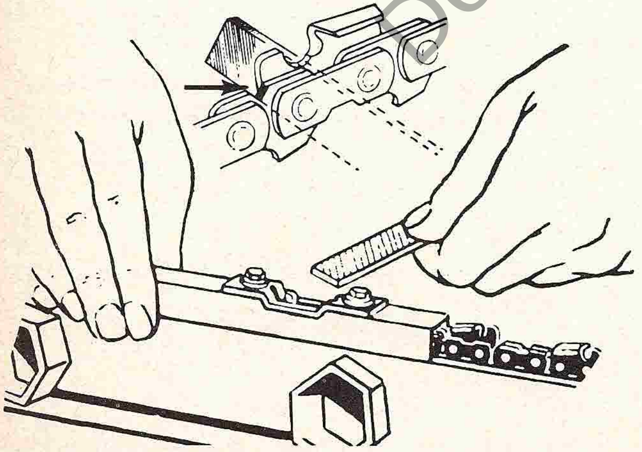


Fig. 12—Filing depth gauge with adjustable type jointer. Insert shows rounding off leading corner of depth gauge. Do not file into drive link as shown at arrow.

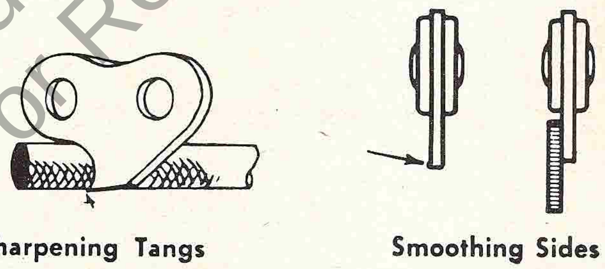


Fig. 13—Sharpen tangs of drive links to keep guide groove clean. Smooth burrs from side of tang with flat file.

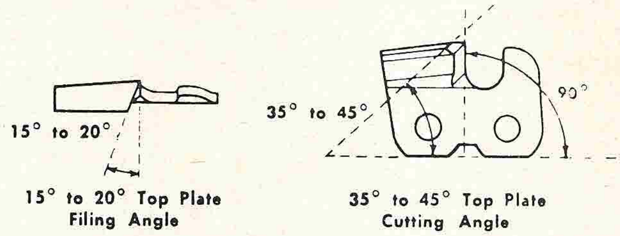


Fig. 14—Filing angles for chisel tooth chain.

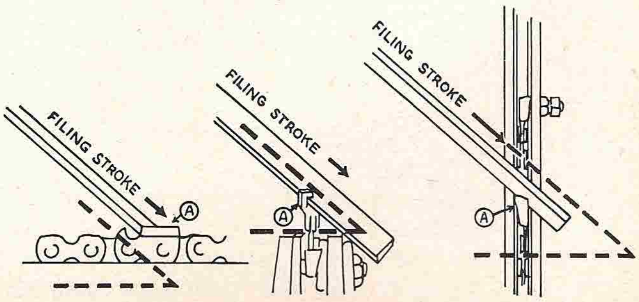


Fig. 15—File positions for chisel tooth chain.

DEPTH GAUGE SETTINGS FOR CHISEL CHAIN

Chain Pitch	Depth Gauge Distance Below Cutting Edge
½"	.030"
$\frac{9}{16}$"	.040"
⅝-¾"	.045"

File depth gauges as explained in chipper tooth chain filing instructions. Depth gauge distance may be varied to suit different conditions as with chipper chain.

FILING SCRATCHER TOOTH CHAIN. Use a flat file of appropriate size to file scratcher tooth, or cross-cut type chain. File cutters as shown in Fig. 16 and file rakers as shown in Fig. 17. Check tooth height with a straight edge while filing and file high cutters or rakers in the normal manner to maintain a straight tooth line and profile as shown in Fig. 18. Sharpen tangs and smooth sides of drive links as shown in Fig. 13 for chipper chain.

REPAIRING SAW CHAIN. Individual drive links, cutters, rakers or tie straps can be replaced in a saw chain. Rivets are removed with a chain breaker as shown in Fig. 19. Be sure new parts are of same design and pitch as the removed part. The holes on outside links are countersunk on one side only, and this side should always face outward as shown in the "right" view in Fig. 20. File bottoms of new tie straps or cutters to match worn parts of the chain as shown in Fig. 21. Peen rivets with ball end of ball-peen hammer. Use light blows to peen the rivet; do not crush or flatten it which would result in a cracked rivet or tight joint.

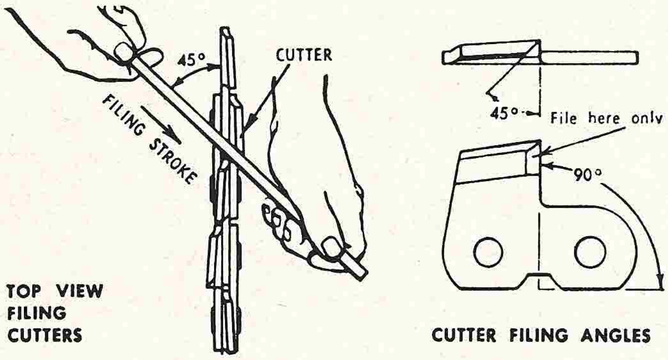


Fig. 16—Filing cutters of scratcher type chain.

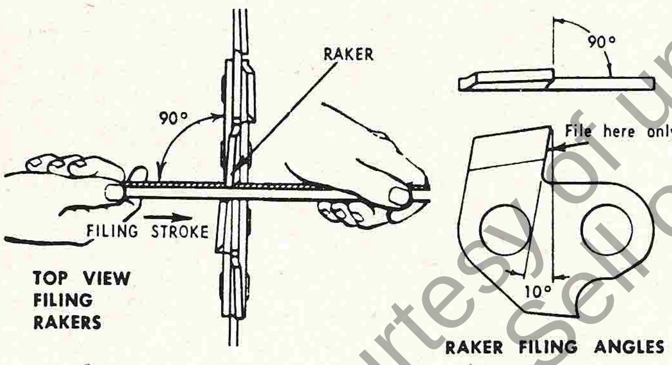


Fig. 17—Filing rakers of scratcher type chain.

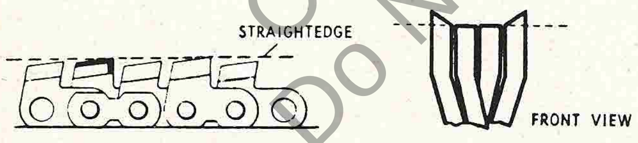


Fig. 18 — Checking height of cutters and tooth profile of scratcher type chain.

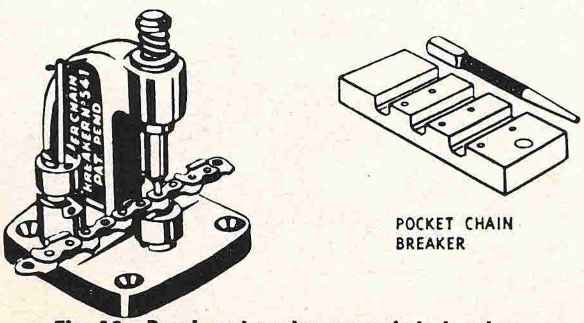


Fig. 19—Bench and pocket type chain breakers.

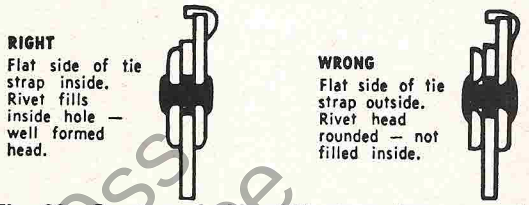


Fig. 20—Countersunk side of tie straps face outward.

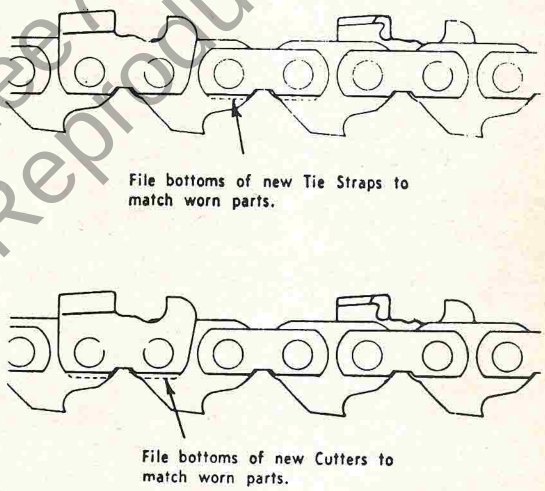


Fig. 21—File bottoms of new parts to match worn parts when installing repair links.

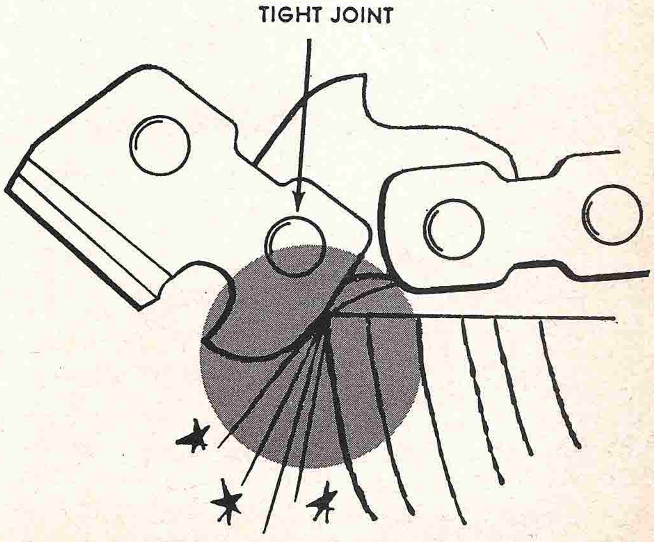


Fig. 22—Tight joints will cause chain damage.

Check the remainder of the chain for tight joints which will not straighten and would cause chain damage as shown in Fig. 22. Remove wood fiber from joints with a knife point or similar tool. Remove burrs by placing chain on support and driving flat with a hollow punch or pipe. See Fig. 23.

GUIDE BAR REPAIRS. If guide rails of bar are spread, they may be closed as shown in Fig. 24. Lay the bar on a flat piece of heavy iron or on a large smooth anvil. Insert a shim of steel, about six inches long and .004" thicker than the drive tangs of the chain, into the guide rail groove. Close the guide rails down on the shim with a heavy hammer; then drive the shim to a new spot and repeat until guide rails are closed all around the bar.

Guide rails are sometimes split from the bar being pinched while the saw is hung up in a cut. Splits of two inches long or less can be repaired by using ordinary welding methods on bars with non-hardened rails. Repairing splits on bars with hardened rails requires special equipment for re-hardening the rails.

Small kinks or bends in guide bars can be removed by laying the bar on a large true anvil or other similar work surface and using light hammer blows to bring the bar back into shape. Technique is very similar to straightening other flat metal pieces.

Use a file to funnel the entrance to the guide rail groove of the bar as shown in the "right" view in Fig. 25. If the guide rails are as in the "wrong" view in this illustration, damage to the chain can occur as the chain enters the groove.

Check the fit of the chain to the guide bar as shown in Fig. 26. If the tangs of the drive links touch the bottom of the guide rail groove, poor cutting and damage to the chain will result. The side links of the chain should ride on the rails and the tangs should clear the bottom of the guide groove. When replacing a chain or a guide bar, the length of the tang and the guide bar groove depth should be checked as in Fig. 27.

If the guide rails are worn or rough, they can be ground smooth and the groove deepened on a special bar grinding machine.

DRIVE SPROCKET REPLACEMENT. When sharpening or repairing chain and guide bar, inspect the chain drive sprocket for wear. See Fig. 28. When the tips of

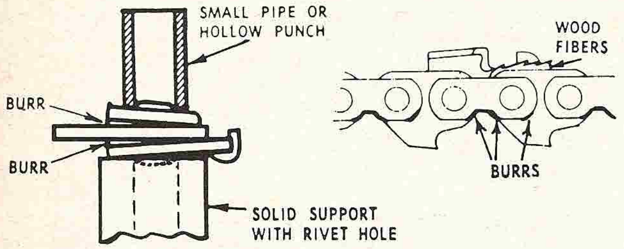


Fig. 23—Relieve tight joints by removing burrs and wood fibers.

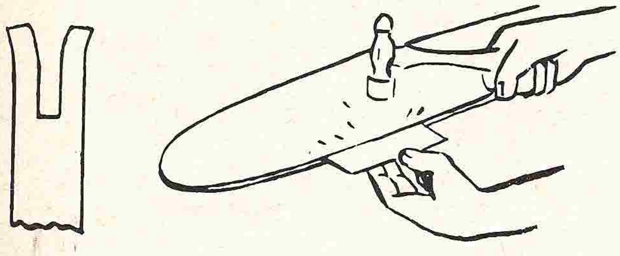


Fig. 24—Closing spread guide rails. Use steel shim .004" thicker than drive link tangs.

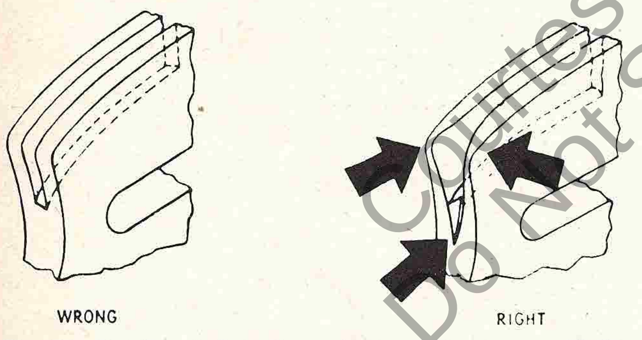


Fig. 25—Cut funnel shaped opening to guide groove with file.

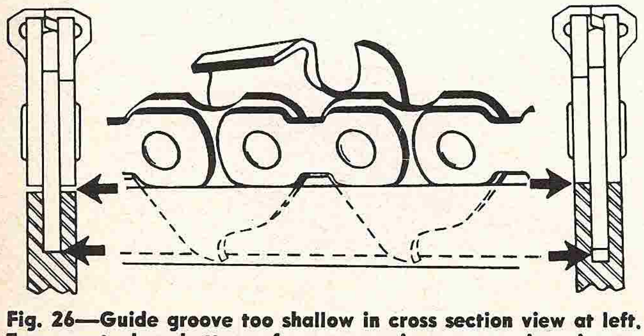


Fig. 26—Guide groove too shallow in cross section view at left. Tang must clear bottom of groove as in cross section view at right.

If Chain Pitch "A" Is:	And Length of Drive Link Tang "B" Is:	Bar Groove Depth "C" Should Be At Least:
7/16"	7/32"	1/4"
1/2"	17/64"	21/64"
9/16"	9/32"	11/32"
3/4"	3/8"	7/16"

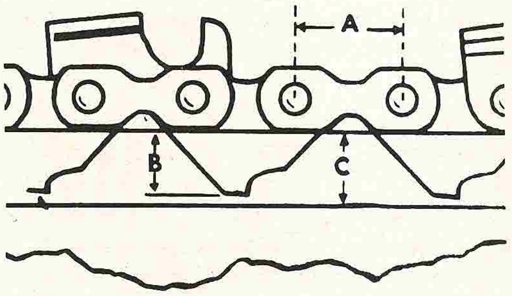


Fig. 27—Proper groove depth for different chains.

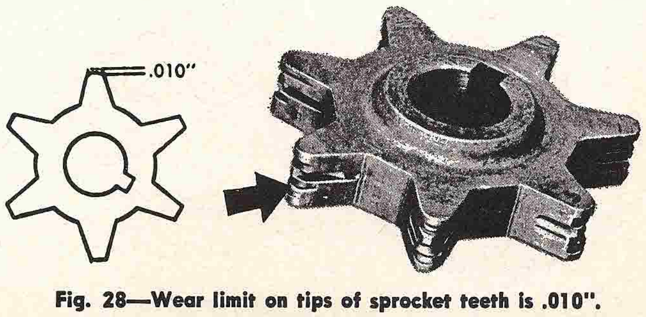


Fig. 28—Wear limit on tips of sprocket teeth is .010".

the sprocket teeth are worn excessively, the sprocket becomes out of pitch with the chain and this will cause chain chatter and breakage. Replace the sprocket if the tips of teeth are worn .010" or more. Always install a new sprocket whenever installing a new chain. Care should be taken that the sprocket is of the correct size and pitch for the chain and the bar. See Fig. 29.

CHAIN WEAR AND BREAKAGE PROBLEMS. If chain wear or breakage is encountered, compare a section of the chain with Figs. 32 through 34 for cause.

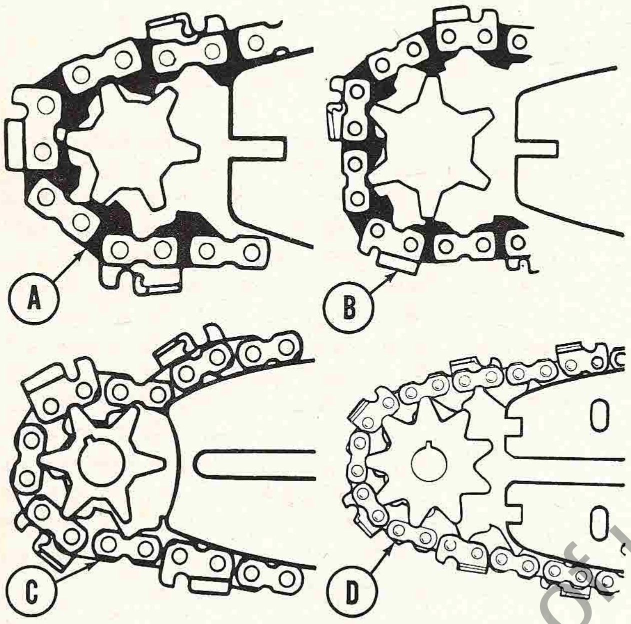


Fig. 29—A. Pitch of sprocket too small for chain. B. Pitch of sprocket too great for chain. C. Pitch of sprocket and chain match, but sprocket is too small for guide bar. D. Correct match of sprocket and chain pitch and of sprocket and bar size.

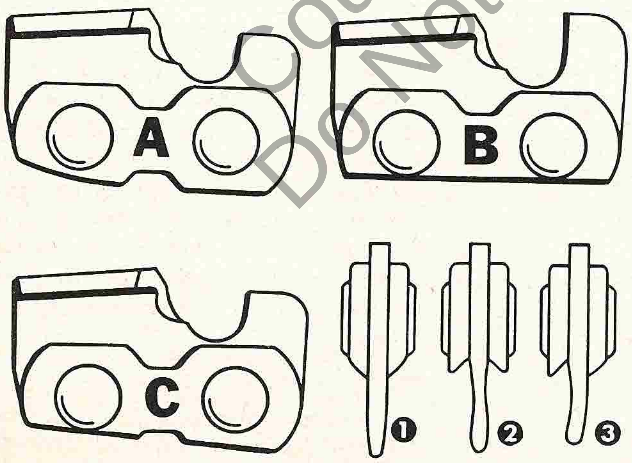


Fig. 30—A. Bottoms of cutters or side links worn due to too much back slope on chisels, very blunt cutting edge, or depth gauge too low. B. Wear caused from heavy pressure on bar generally as result of trying to saw with dull cutters or too high depth gauge setting. C. Wear due to low depth gauges, too much back slope on chisels and tight chain. 1, 2, & 3. Bent or unevenly worn drive tangs caused by uneven filing of cutters which allows chain to wobble or wander.

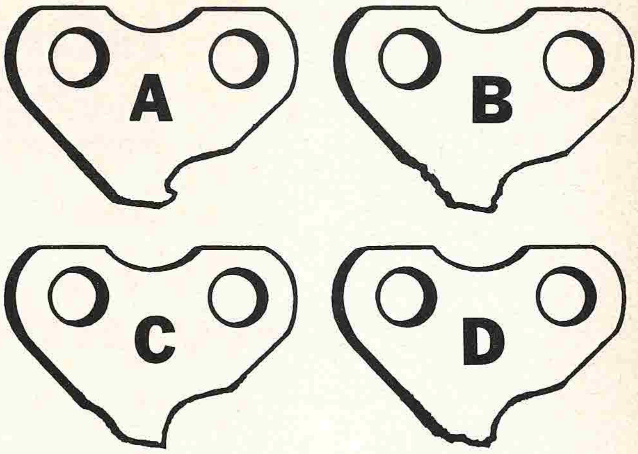


Fig. 32—A. Drive link tang point turned up from striking bottom of improperly fit sprocket. B. Front and back of tang battered by improperly fit sprocket or loose chain. C. Back of tang rounded or peened by undersize or worn sprocket. D. Tang battered or broken by wrong size sprocket.

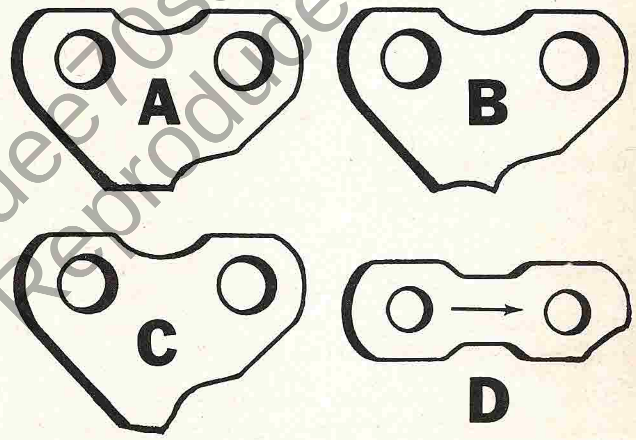


Fig. 33—A. Tang worn flat from dragging on bottom of shallow guide bar groove. B. Tang curved on bottom from shallow groove at nose of guide bar. C. Point of tang worn or battered by square corner at groove entry. See Fig. 25. D. Front of side links battered by tang catching on too large a bar entry; see (C—Fig. 29).

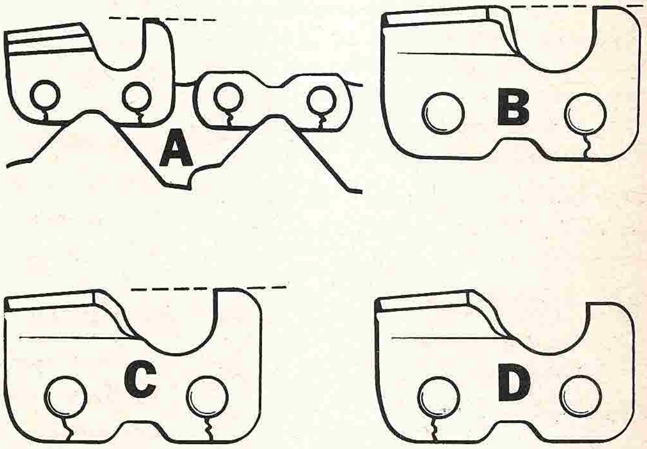


Fig. 34—A. Cracks under all rivet holes due to tight chain with dull cutters and/or high depth gauges. B. Crack under front rivet of cutter and side link caused by high depth gauge. C. Crack under front and rear rivets caused by high depth gauge and dull cutter. D. Crack under rear rivet of cutter and side link caused by dull cutter.

HOMELITE

A textron DIVISION

PORT CHESTER, N.Y. U.S.A.

IGNITION SYSTEM SPECIFICATIONS

HOMELITE-CHAMPION SPARK PLUG CROSS-REFERENCE

"Shorty" Type Plugs:

Champion Model No.	Homelite Part No.
TJ-6J	59654-S
TJ-8J	58917-S
UTJ-11P (Platinum tip)	59558-S
"Bantam" Type Plugs	
CJ-6	63547-S
CJ-8	63710-S
Regular 2-Cycle Type Plugs:	
J-6J	40190-S
HO-3 (Platinum tip)	72858-2S
HO-8A (Platinum tip)	71530-S

NOTE: "Bantam" type spark plugs may be used instead of "Shorty" type plugs by installing a new terminal (Homelite part No. A-33055) on spark plug wire.

IGNITION COIL TEST DATA

Test data for use with Merc-O-Tronic and Graham coil testers to check Homelite chain saw ignition coils is given by chain saw model number, coil manufacturer's coil model number and Homelite part number. Note: Use test procedure specified by coil tester manufacturer.

For Chain Saw Models: 5-30 and 5-30NA; equipped with Wico coil No. X7536, Homelite part No. 72397.

MERC-O-TRONIC TEST DATA:

Operating amperage 1.90
Secondary resistance 38-58

GRAHAM TEST DATA:

Maximum secondary 8,000
Maximum primary 1.2
Coil index 60
Minimum coil test 17
Maximum gap index 70

For Chain Saw Model: 17, 17A, 5-20 and EZ; equipped with Wico coil No. X9533, Homelite part No. 55403.

MERC-O-TRONIC TEST DATA:

Operating amperage 2.20
Secondary resistance 30-50

GRAHAM TEST DATA:

Maximum secondary 5,000
Maximum primary 0.9
Coil index 60
Minimum coil test 20
Maximum gap index 70

For Chain Saw Models: XL-12; equipped with Wico coil No. X14171D, Homelite part No. 58874. **XL-101, XL-102 and XL-103;** equipped with Wico coil No. X16825C, Homelite part No. 64091. **XL-104;** equipped with Wico coil No. X17108, Homelite part No. 64435. **XL-700 and XL-800;** equipped with Wico coil No. X16343C, Homelite part No. 63625. **XL-850;** equipped with Wico coil No. X16669, Homelite part No. 63998.

MERC-O-TRONIC TEST DATA:

Operating amperage 1.30
Primary resistance 0.6-0.7
Secondary resistance 50-60

GRAHAM TEST DATA:

Maximum secondary 10,000
Maximum primary 1.7
Coil index 65
Minimum coil test:
Model XL-850 20
All other models 27
Maximum gap index 65

For Chain Saw Models: 4-20, 4-20 mod., 5-20L, 6-22, 7-19, 7-21, 700D & G, 770D, -G & GS, 707G, 9-23, 9-26, 900D & G, 909D & G, 990D & G, 500, 500 mod., 600D, 600D mod., 600D1, 600D1 mod., 660D, 5-63, 6-63, 7-63, EZ-6, BUZ, BUZ mod., Wiz, Wiz A, Wiz B, Super Wiz, Super Wiz A, Super Wiz B, Zip, Zip A, Zip B, Zip 5, Zip 5E, Zip 5EX, Zip 6, Zip 6 mod.; use Phelon coil No. FG 3082, Homelite part No. 55986. Note: A later ignition coil (Phelon coil No. FG3082B, Homelite part No. 55986B) is now used as service replacement for this coil. Refer to next section (Model 775D, etc.) for test data if chain saw is so equipped.

MERC-O-TRONIC TEST DATA:

Operating amperage 2.8
Secondary continuity 70

GRAHAM TEST DATA:

Maximum secondary 10,000
Maximum primary 2.0
Coil index 75
Minimum coil test 15
Maximum gap index 70

For Chain Saw Models: 775D, -G, -G2 & GA2, 995D, -G & -G1, Wiz 55, Super Wiz 66, Super 77, all "C" Series and all "XP" Series; use Phelon coil No. FG3082B, Homelite part No. 55986B. Note: This coil may also be installed on all models listed in preceding section. (Homelite part No. 55986B is used as service replacement for saws originally equipped with Homelite part No. 55986.)

MERC-O-TRONIC TEST DATA:

Operating amperage 1.8
Secondary continuity 70

GRAHAM TEST DATA:

Maximum secondary 11,000
Maximum primary 2.5
Coil index 75
Minimum coil test 26
Maximum gap index 70

HOMELITE

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PORT CHESTER, N.Y. U.S.A.

Model	Bore	Stroke	Disp.	Drive
17, 17L	2	1⅜	4.32	2-Gear
26LCS, 26LCSA	2 3/8	1½	6.63	Belt
4-20	2	1⅜	4.32	2-Gear
5-20, 5-20L	2 1/16	1½	5.01	2-Gear
5-30, 5-30N	2 7/16	1½	6.97	Belt
6-22	2 1/16	1½	5.01	2-Gear
7-19, 7-19C	2 1/16	1½	5.01	Direct
7-21, 7-21C	2 1/16	1½	5.01	2-Gear
7-29, 8-29	2 1/2	1⅝	7.88	Belt
EZ, EZ-6	2 1/16	1½	5.01	Direct
9-23	2 3/16	1⅝	6.11	Direct
9-26	2 3/16	1⅝	6.11	3-Gear
WIZ, WIZ55	2	1⅜	4.32	2-Gear
ZIP BUZ & Super WIZ, Super WIZ66	2	1½	4.71	2-Gear
Super 77	2 3/16	1 35/64	5.8	2-Gear
ZIP-5	2 1/16	1½	5.01	Direct

Model	Bore	Stroke	Disp.	Drive
ZIP-6	2 3/16	1½	4.71	Direct
500	2	1½	5.64	Direct
600-D	2 1/16	1½	5.01	Direct
600-D1 & 660-D	2 1/16	1½	5.01	Direct
700-D	2 3/16	1½	5.64	Direct
770-G	2 3/16	1½	5.64	2-Gear
707-D & 770-D	2 3/16	1 35/64	5.8	Direct
707-G & 770-G	2 3/16	1 35/64	5.8	2-Gear
770-GS	2 3/16	1 35/64	5.8	2-Gear, 2-Speed
775-D	2 3/16	1 35/64	5.8	Direct
775-G	2 3/16	1 35/64	5.8	2-Gear
900-D, 909-D & 990-D	2 5/16	1⅝	6.83	Direct
900-G, 909-G & 990-G	2 5/16	1⅝	6.83	3-Gear
995-D	2 5/16	1⅝	6.83	Direct
995-G	2 5/16	1⅝	6.83	3-Gear

The following service information applies only to those Homelite models listed on this page. For service information on other Homelite Chain Saws, refer to other sections.

All of these chain saw engines are of the two stroke cycle type. Belt drive models have a disc type rotary inlet valve; a reed type inlet valve is used on the other models. In all models, the cylinder is detachable from the crankcase.

On all models the main bearing at the non-magneto end of crankshaft is an annular ball type. On all models except 26LCS, 26LCSA, 5-30 and early 5-30N, the main bearing at magneto end of crankshaft is of the needle roller type. The main bearing at magneto end of crankshaft on models 26LCS, 26LCSA, 5-30 and early 5-30N is a non-renewable bronze bushing.

Belt drive models are fitted with rotary type inlet valve and use a centrifugal (flyweight) type governor acting directly on and integral with the rotary valve. All other models are fitted with reed type inlet valve. Governed models with reed type inlet valve use an air vane type governor actuated by the stream of air provided by the flywheel fins. Centrifugal type governors are not externally adjustable.

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion as indicated in table below. Electrode gap is 0.025 inch. The Champion HO series plugs have platinum-tipped electrodes. Model J6J plugs may be substituted for HO8A, and J63R for HO3; but will be more susceptible to electrode erosion.

17, 4-20, 5-20, 6-22, 7-19, 7-21, EZ, ZIP, WIZ, BUZ, 500, 600, 700, 660, 707, 770, 775 & Super 77..........HO8A

26, 5-30, 5-30N, 7-29, 8-29, 9-23, 9-26, 900, 909, 990 & 995...............HO3

If saw is being used in extremly high temperature or for heavy duty application, use HO3 plug in place of HO8A. In extremely cold weather, a Champion UJ-12 plug may be used to avoid cold fouling and improve starting.

FUEL SYSTEM AND CARBURETOR. The model 26LCS saw is equipped with a Tillotson MD-56-A float type carburetor. Series H, HL or HP Tillotson and series CP or CS Brown diaphragm type carburetors are used on all other models. Two methods of fuel feed are used with diaphragm type carburetors. One method is to pressurize the fuel supply tank by connecting it to the interior of the engine crankcase. Other method used incorporates a diaphragm type fuel pump built into the bottom section of diaphragm type carburetors. With both methods, the pressure pulsations peculiar to the crankcase of a two cycle engine are utilized. With pump feed, the fuel supply tank must be vented to the atmosphere whereas the pressurized tank system demands a sealed type fuel supply tank.

On systems using gravity or pump feed the fuel tank relief valve should be checked periodically for restrictions due to dirt or

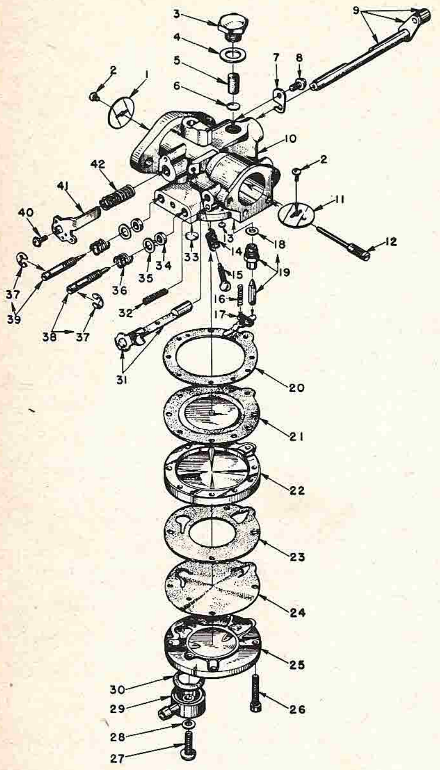


Fig. HL1—Exploded view of typical Brown CP series carburetor used on some models.

1. Throttle disc
3. Plug
5. Filter
6. Screen
7. Retainer
9. Throttle shaft
10. Carburetor body
11. Choke disc
12. Pin for lever (17)
13. Plug
14. Spring
15. Idle speed screw
16. Spring
17. Diaphragm lever
18. Sealing washer
19. Fuel inlet valve
20. Gasket
21. Fuel diaphragm
22. Diaphragm cover
23. Gasket
24. Pump diaphragm
25. Pump body
29. Fuel inlet
30. Gasket
31. Choke shaft
32. Spring
33. Plug
34. Packing
35. Washer
36. Spring
37. Retainer
38. Main fuel needle
39. Idle fuel needle
41. Throttle stop arm
42. Spring

swelling of fabric materials. Be sure when repainting a fuel tank that overspray does not enter cap vent to form a restriction when the paint hardens.

The engine will lose power due to lean mixture if the fuel filter felt element (located in fuel tank) is restricted with dirt. A restricted filter felt element should be renewed rather than cleaned. Filter can be fished out of tank with a piece of hooked wire. Felt element can be removed from strainer body after extracting the retaining nail located under the front rubber bumper. End of new felt should extend 1/16" beyond end of strainer. The connecting flexible tube must be free of kinks and cracks. Refer to Fig. HL4.

On installations without fuel pumps where pressure is maintained in the fuel tank by connecting it to the engine crankcase, make sure that the connecting pipe and passages are open and the connections and filler cap are tight. Make sure also that the check valve at fuel tank on such systems is in working order.

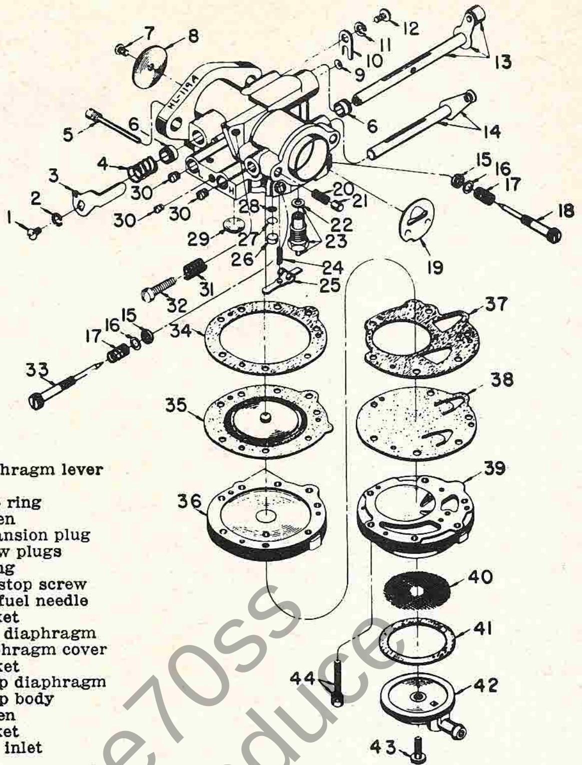


Fig. HL2—Exploded view of typical Tillotson HL series carburetor used on many models of Homelite chain saws. Main and idle fuel needles may be located on front of carburetor as shown or on some models may be located in place of plugs (30) in side of carburetor. Idle fuel needle will always be to left, main fuel needle to right. Screen (28) is not used on all models. Refer also to Fig. HL2A.

3. Throttle stop arm
4. Spring
5. Diaphragm lever pin
6. Bushing
8. Throttle disc
9. Expansion plug
10. Retainer
13. Throttle shaft
14. Choke shaft
15. Packing
16. Washer
17. Spring
18. Main fuel needle
19. Choke disc
20. Spring
21. Choke detent
22. Sealing washer
23. Fuel inlet valve
24. Lever spring
25. Diaphragm lever
26. Plug
27. Snap ring
28. Screen
29. Expansion plug
30. Screw plugs
31. Spring
32. Idle stop screw
33. Idle fuel needle
34. Gasket
35. Fuel diaphragm
36. Diaphragm cover
37. Gasket
38. Pump diaphragm
39. Pump body
40. Screen
41. Gasket
42. Fuel inlet

The dry side of the fuel diaphragm in all diaphragm type carburetors must be vented to allow diaphragm action. In most Tillotson carburetors, a vent hole to atmospheric pressure is provided in the diaphragm cover (36—Fig. HL2). However, in some late production carburetors, the fuel diaphragm is vented internally to the carburetor throat via a passage in the diaphragm cover and carburetor body. To service internally vented carburetors, a fuel diaphragm and gasket with a vent hole as shown in view "A", Fig. HL2A, must be used.

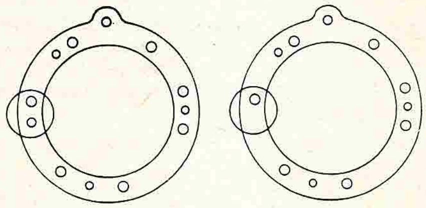
On all carburetors, clockwise rotation of both high speed and idle mixture adjustment needles leans the mixture. Refer to HL5, HL6 or HL7.

On engines equipped with Tillotson MD carburetors, normal idle mixture needle and main adjustment needle settings are 1 to 1½ turns open. Float setting with fuel bowl assembly held in upside-down position should be $\frac{1}{32}$-inch from the then lowest point of float at free end, to rim of fuel bowl.

On engines equipped with Brown or Tillotson diaphragm type carburetors, refer to following chart for normal needle settings. NOTE: Neither Tillotson HL or Brown CS carburetors contain an idle check valve and seat.

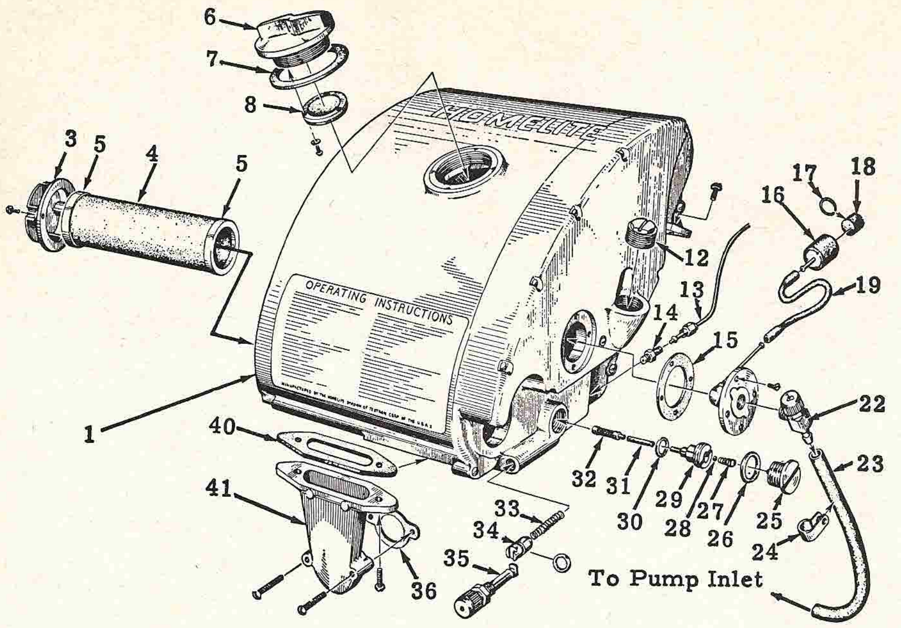
Carburetor Model No.	Normal Setting (Turns open) Idle needle	Main needle
1-CS, HP-19B, HL-1A & HL-4A	¾-1	1-1¼
H-2A & HL-62AX	¾-1	¾-1
HP-15B	¾-1	½-¾
HP-6B & H-6A	½-¾	¾-1
All CP, 5-CS, HP-1B and series HL up to HL-104A	½-¾	½-¾
HL-117C	⅝-⅞	⅝-⅞
HL-181A	⅞-1⅛	⅞-1⅛

Make final adjustments with engine warmed up and running. With engine running at idling speed rotate idle mixture adjustment needle until smoothest and fastest speed is obtained at leanest setting. Now gun the engine (open the throttle half way); if engine falters in accelerating, enrichen the mixture slightly by turning needle a slight amount in counter-clockwise direction. (Exception: Brown CP carburetors utilize main needle for acceleration instead of idle needle.) Now open the throttle wide and place a load on the engine (by stalling the chain in the cut) then set the high speed needle to a point where engine runs at highest obtainable speed without excessive smoke at the exhaust. If necessary, readjust idle speed stop screw to produce desired idling speed.



"A" "B"

Fig. HL2A — Tillotson carburetors with internal fuel diaphragm venting must be serviced with fuel diaphragm and gasket with extra hole as shown in view "A" above; carburetors with external vent may be serviced with diaphragm and gasket shown in either view "A" or view "B". Refer to exploded view in Fig. HL2 for gasket (34) and fuel diaphragm (35).



1. Tank
3. Air filter cap
4. Air filter
5. Gasket
6. Fuel cap
7. Gasket
8. Relief valve
12. Oil filler cap
13. Oil line
14. Check valve
15. Gasket
16. Strainer body
17. Snap ring
18. Felt
19. Pick-up line
22. Shut-off
23. Fuel line
24. Clip
25. Cap
26. Gasket
27. Ball spring
28. Ball check
29. Ball seat
30. Gasket
31. Sleeve
32. Oil pick-up
33. Plunger spring
34. Plunger tube
35. Plunger button
36. Gasket
40. Gasket
41. Filter adaptor

Fig. HL3 — View showing model 6-22 fuel tank and oil reservoir assembly and related parts. Some other models of this series are similar. Air filter element (4) is inserted as indicated by arrow. Refer to Fig. HL4 for method of removing fuel pick-up and filter for service.

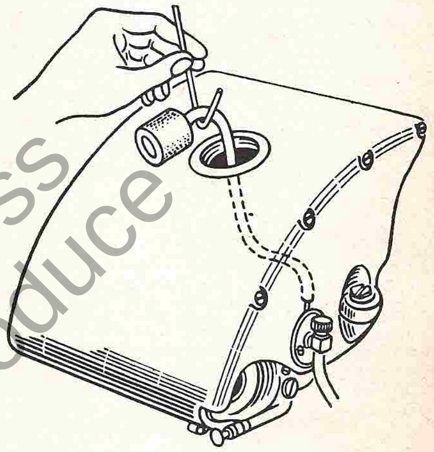


Fig. HL4—Method of extracting filter from inside of tank using a hooked wire.

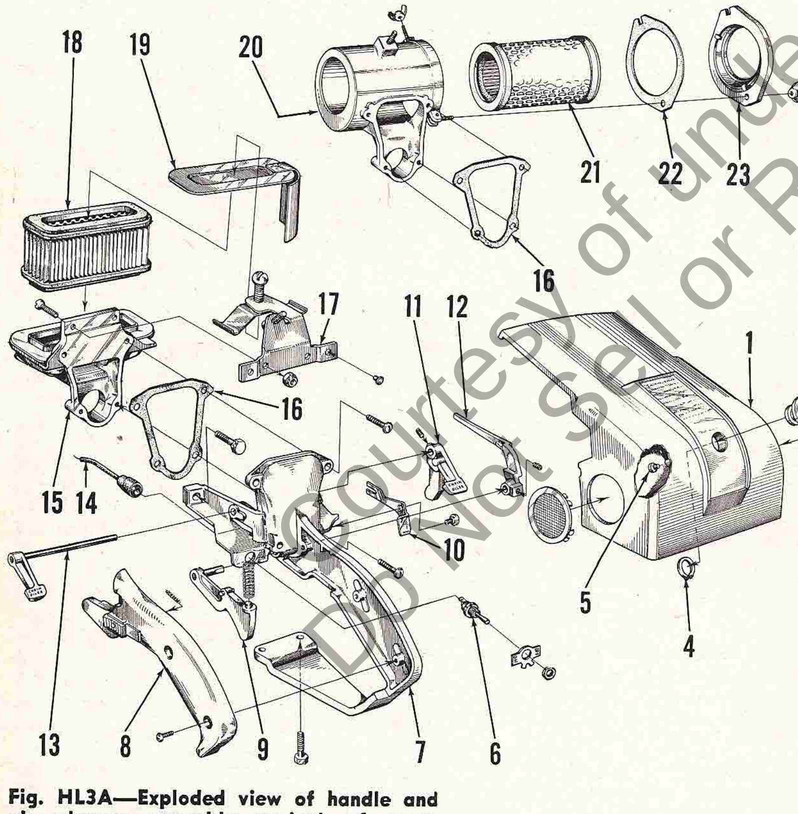


Fig. HL3A—Exploded view of handle and air cleaner assembly typical of many models. Alternate air filter holders (15 and 20) and filter elements (18 and 21) are shown.

1. Shroud
2. Mounting nut
3. Plug
4. Snap ring
5. Rubber bumper
6. Switch
7. Throttle handle
8. Grip cover
9. Throttle trigger
10. Choke lever
11. Oiler lever
12. Throttle arm
13. Oiler shaft
14. Switch lead
15. Filter holder
16. Gasket
17. Bracket
18. Filter element
19. Filter cap
20. Filter holder
21. Filter element
22. Gasket
23. Filter cap

1. Cover
2. Element
3. Fuel cap
4. Relief valve
5. Gasket
6. Fuel tank
7. Oil line
8. Fitting
9. Oil pick-up
10. Gasket
11. Check ball
12. Plug and gasket
13. Spring
14. Check ball seat
15. Flexible tube
16. Gaskets
17. "O" ring
18. Oil pump plunger
19. Spring
20. Elbow
21. Fitting
22. Flexible tube

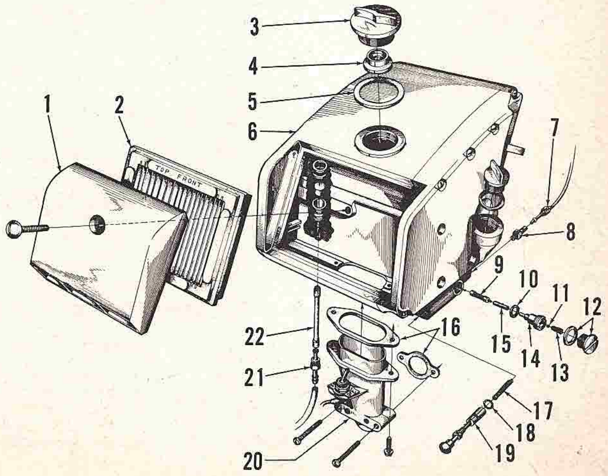
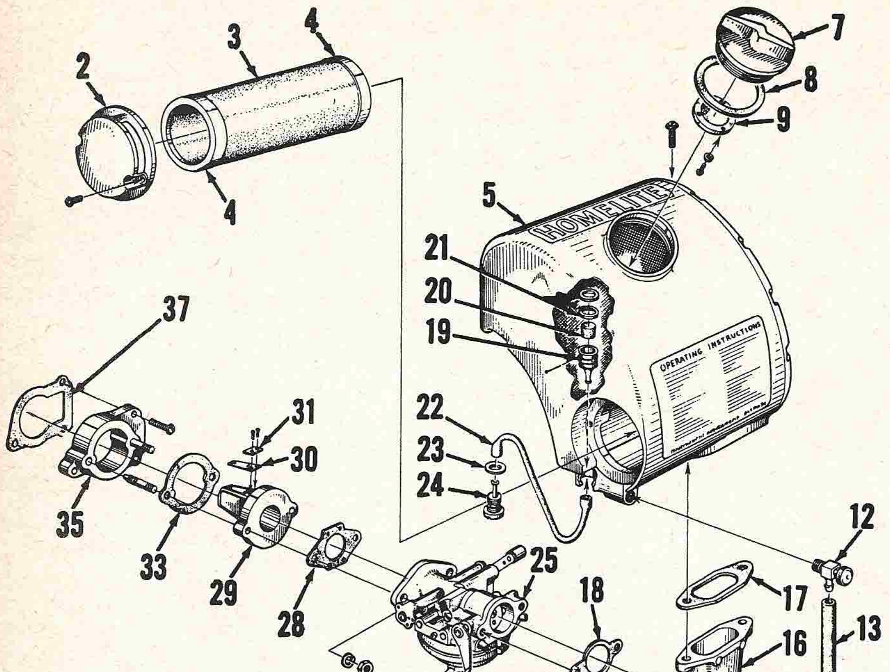
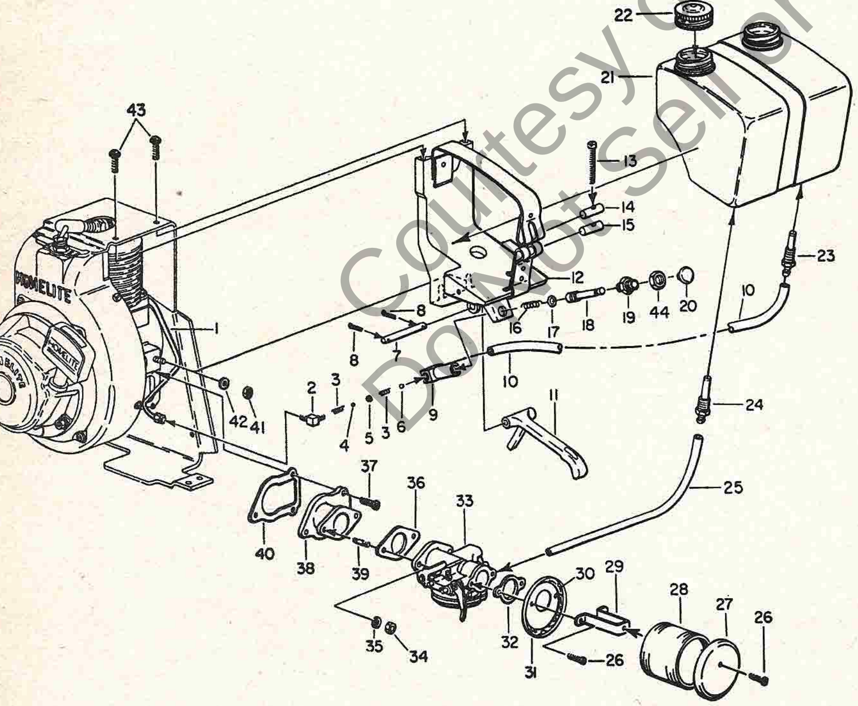


Fig. HL4A — Exploded view showing model 707-G fuel tank and oil reservoir. Air cleaner element (2) is retained to air box portion of fuel tank by cover (1), and carburetor is attached to elbow (20). Other models in series are similar; direct drive models have separate oil reservoir. Tank is cut-away to show fuel pickup assembly.



2. Filter cap
3. Air filter
5. Fuel tank
7. Fuel cap
9. Relief valve
12. Shut-off
13. Fuel line
16. Air adaptor
18. Gasket
19. Strainer
20. Felt
21. Bumper
22. Sleeve
24. Outlet fitting
25. Carburetor
29. Reed valve
30. Reed
31. Reed plate
35. Spacer

Fig. HL4B — Exploded view of fuel tank system on Homelite model 7-19.



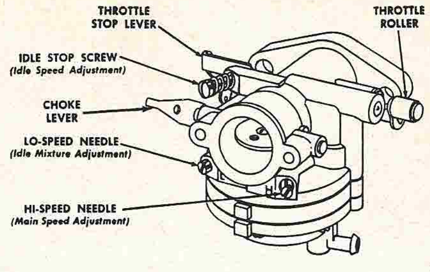


Fig. HL5—View showing location of adjustment points on some Tillotson carburetors. Refer also to Figs. HL6 and HL7.

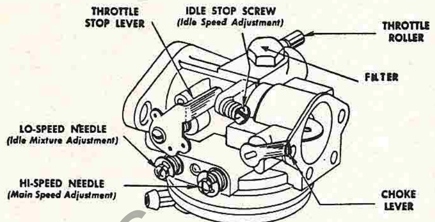


Fig. HL6—View showing location of adjustment points on Brown carburetors used on some engines. Refer also to Figs. HL5 and HL7.

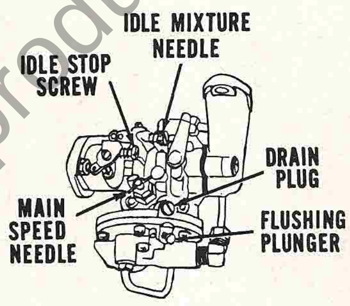


Fig. HL7—View showing location of adjustment points on some Tillotson carburetors.

Fig. HL4C—Exploded view of fuel system and oiler used on economy models.

1. Oil line assembly
2. Elbow
3. Check valve spring
4. Check valve ball
5. Spacer
6. Valve ball
9. Pump body
10. Oil line
11. Throttle trigger
12. Tank bracket & strap
16. Piston spring
17. "O" ring
18. Pump piston
20. Oiler button
21. Fuel and oil tank
23. Screen, oil outlet
24. Screen, fuel outlet
25. Fuel line
27. Air filter cover
28. Air filter element
29. Bracket, Air filter
30. Gasket
31. Air filter cover
32. Gasket
33. Carburetor
36. Gasket
38. Reed valve adapter
40. Gasket

GOVERNOR. Belt drive models have centrifugal type governors which are an integral part of the rotary inlet valve in the engine crankcase as shown in Fig. HL23. The plate (39), with openings registered with the manifold opening, is pinned to the engine crankcase. The size of the inlet opening in the valve plate (37) is controlled by the combination shutter and governor weight (W) which when the engine is stationary, is held in the open position by spring (S). When engine speed exceeds the designed limit, centrifugal force acting on the weight overcomes the opposing spring pressure and partially covers the manifold opening and thus throttles the engine. As the throttled engine slows down, centrifugal force diminishes and the spring again uncovers the opening to restore engine speed.

Direct drive and gear drive chain saws are equipped with reed type inlet valves and, except on non-governored models, have an air vane type governor. The air vane is mounted on the engine back plate and is located in the air stream created by the finned flywheel. A typical exploded view is shown in Fig. HL10 or HL11.

Engine speed variation is obtained by varying the tension of the governor spring by rotating the adjusting screw located under a sheet metal plug in the engine cowling.

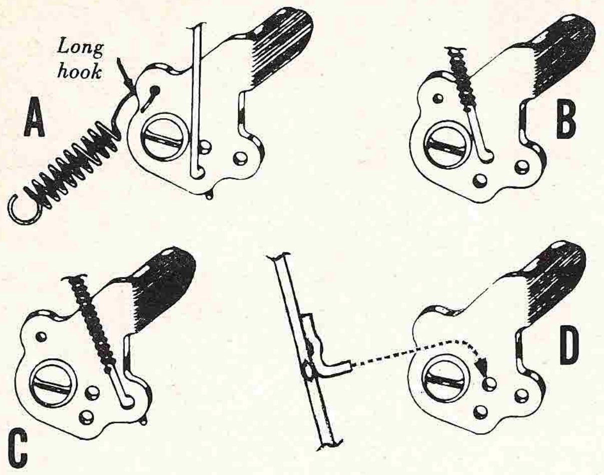


Fig. HL9 — Views showing how governor rod and spring are connected to carburetor throttle shaft on different models. Hook governor rod as in view "A" on all direct drive models. View "B" refers to all 2-gear transmission models except 17, 5-20, Super Wiz 66 and Super 77. View "C" shows hook-up for models 17 and 5-20 and view "D" shows governor rod installation for models Super Wiz 66 and Super 77.

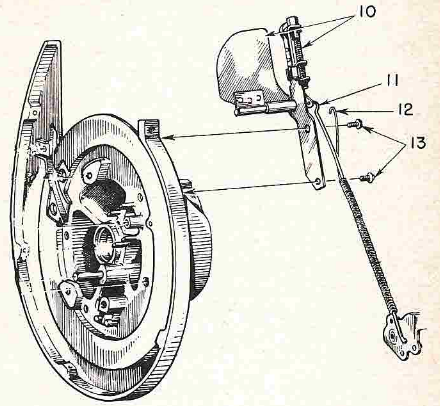


Fig. HL11A — View showing air vane governor and magneto back plate typical of model Wiz and other models in the 700 series.

10. Governor assembly
11. Governor rod
12. Governor spring

1. Flywheel (rotor)
2. Retainer
3. Breaker box cover
4. Gasket
5. Breaker assembly
6. Condenser
7. Armature and breaker box assy.
8. Ignition coil
9. Spark plug wire
10. Clamp
12. Gasket
13. Crankshaft seal
14. Needle bearing

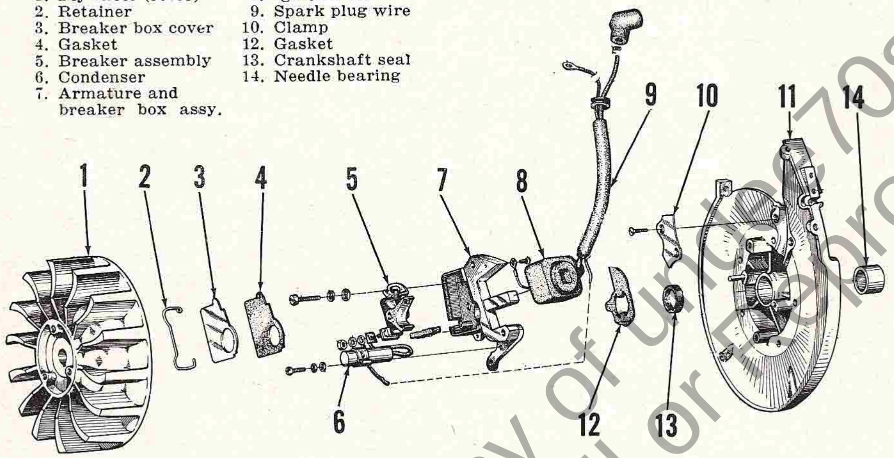


Fig. HL10 — Exploded view of magneto assembly typical of all models in this series. Some models may have two crankshaft seals (13).

IGNITION & TIMING. Breaker point contact gap on belt drive models should be 0.020. Gap on other models should be 0.015.

Ignition timing is fixed and non-adjustable. On all models except 26LCS, 26LCSA, 5-30N, 7-29 and 8-29 the breaker cam is integral with the crankshaft. On the models equipped with a detachable breaker cam, the cam must be installed with arrow facing out.

A quick check can be made for magneto output by disconnecting the spark plug wire and, while holding the wire ¼-inch away from the engine casting, cranking the engine with the starting switch on. A bright blue spark should jump the ¼-inch air gap at cranking speed. (A screw or bolt can be inserted in covered insulated spark plug wires so that the ¼-inch gap can be obtained.)

Condensor capacity on Model 17 using Phelon magneto is 0.16-0.18 mfd.; condensor capacity on all other models is 0.18-0.22 mfd. On models with Wico magneto, condensor capacity should test 0.16-0.20 mfd.

NOTE: Parts are available to install a governor on Super WIZ models prior to Serial No. 1309088; Super WIZ models of this serial number and up are equipped with governors.

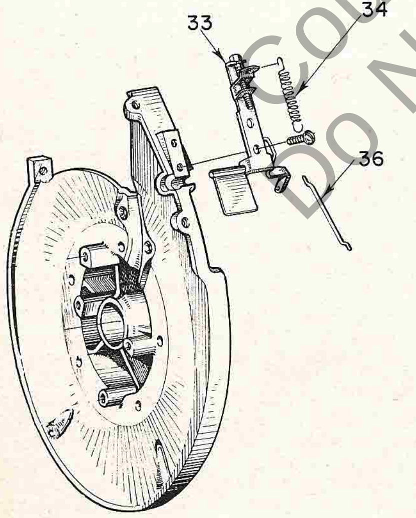


Fig. HL11 — View showing air vane governor and magneto back plate typical of models 9-23, and other models in the 900 series.

33. Governor assembly
34. Governor spring
36. Governor rod

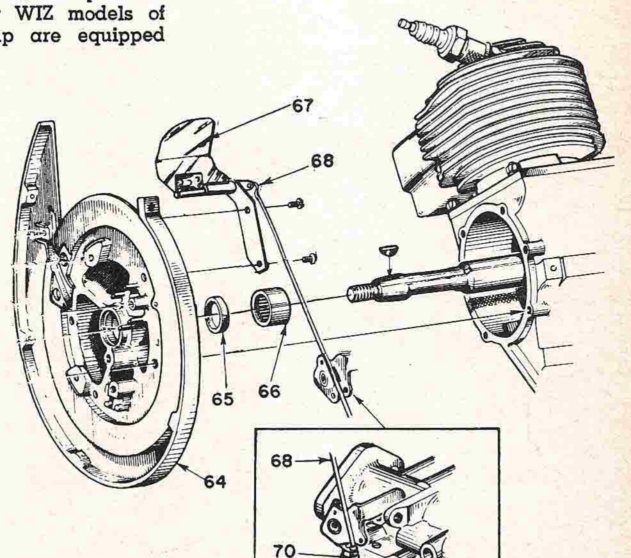


Fig. HL11B — View showing governor assembly used on models Super Wiz 66 and Super 77.

64. Magneto back plate
65. Crankshaft seal
66. Needle bearing
67. Governor assembly
68. Governor rod
70. Governor spring
71. Bracket

LUBRICATION. Engine is lubricated by oil mixed with fuel. Mix thoroughly in a separate container ½-pint of Homelite motor oil or good grade SAE 30 motor oil with each gallon of regular gasoline (16:1 mixture).

The clutch drum and sprocket assembly on direct drive models should be removed and the needle roller bearing cleaned and lubricated occasionally.

Homelite Gear Oil Part No. 55291-B or SAE-90 gear lubricant is recommended for use in gear cases. Maintain oil level at arrow on inspection window in gear case cover with saw setting on level surface. Do not overfill.

Chain oiler tank should be filled with Homelite Bar and Chain oil, or a light oil (up to SAE 30 motor oil). In temperatures below 0° F., dilute the oil with one part kerosene to four parts of oil. Economy model saws with stamped metal oiler tanks have a stationary oil pickup. Oiler will not work on these saws in inverted position and tank must be reasonably full if sawing in an angled position.

REPAIRS

CLEANING CARBON. Carbon deposits should be cleaned from the exhaust ports and muffler at regular intervals. When scraping carbon be careful not to damage the edges of the exhaust ports.

CONNECTING ROD. Rod and piston assembly unit can be removed from all engines after removing the cylinder assembly (Fig. HL12). Be careful to avoid loss of individual needle rollers in crankcase. If piston is removed from the rod at this time be sure to support (buck up) piston when bumping piston pin out of piston.

If the surfaces of rod and cap which form the outer race for the needle rollers are rough, scored or worn, reject the connecting rod.

If the Formica thrust washers are severly grooved or are not completely bonded to the rod reject the rod.

If any one needle roller is worn or if rollers can be separated more than the width of one needle, reject the bearing. This applies also to the needle roller caged bearing assembly or assemblies mounted in the upper end of the connecting rod. Homelite recommends the renewal of the crankpin (lower) connecting rod bearing at each overhaul.

Either 27 or 31 needle rollers are used for the crankpin bearing. The nominal crankpin diameter for engines using 27 rollers is 0.594 and for engines using 31 rollers is 0.694.

Torque specifications for the connecting rod cap retaining screws is 55-60 inch-pounds for rods using No. 8-32 Allen screws and 70-80 inch-pounds for rods using No. 10-32 Allen screws. (No. 8-32 screws have ⅛-inch or 9/64-inch sockets heads and No. 10-32 screws have 5/32-inch socket heads.)

Refer to PISTONS for correct reassembly of rod to piston. When reassembling rod to crankshaft always install new Allen head retaining screws. CAUTION: New, short tapered head Allen screws are now being used on the connecting rods of certain model Homelite saw engines. Refer to Fig. HL13 for "new" and "old" types. Use only "new" type screws on connecting rod where this

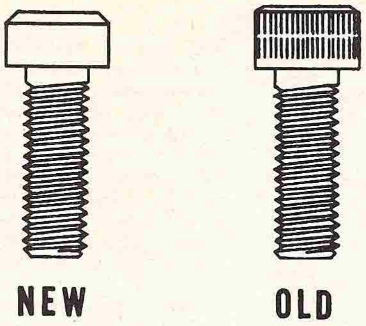


Fig. HL13—"New" and "Old" style connecting rod cap retaining screws. Screws are interchangeable except where "New" style is original equipment. On those models, "New" style must be used.

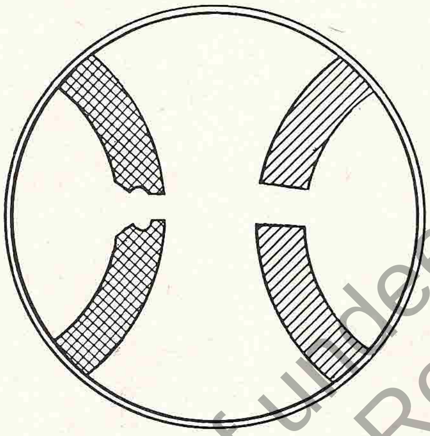


Fig. HL14—View of ring ends. Type on left is used on models 7-29 and 8-29. Refer to text.

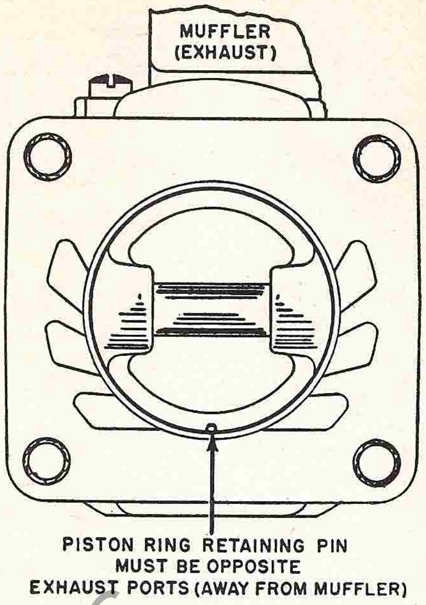


Fig. HL15—Drawing showing proper position of piston in cylinder.

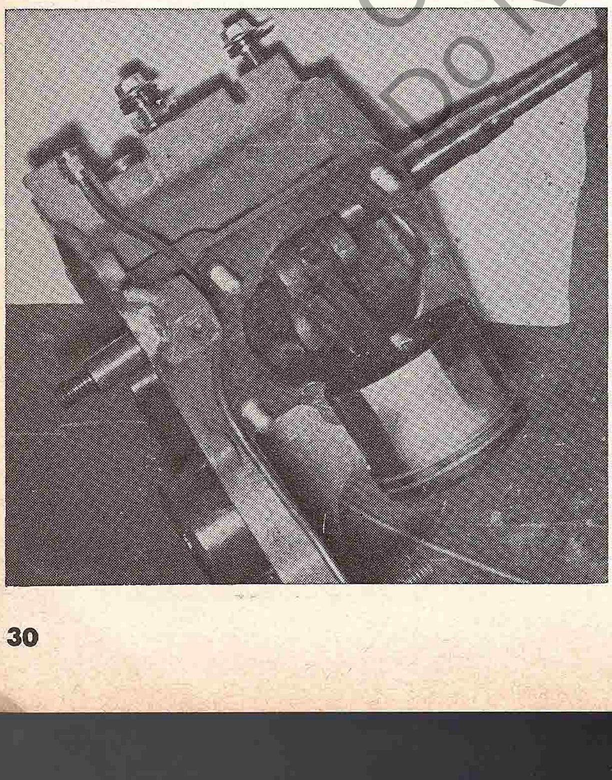


Fig. HL12 — On all models the connecting rod retaining screws are accessible from above.

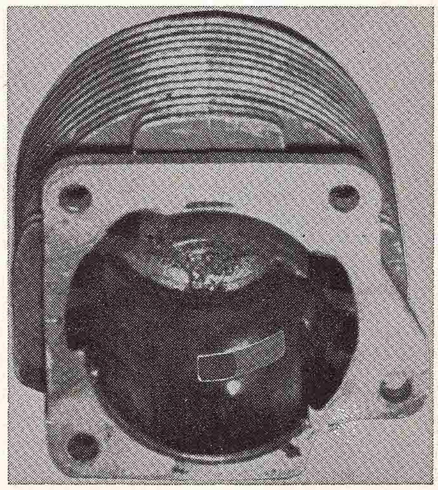
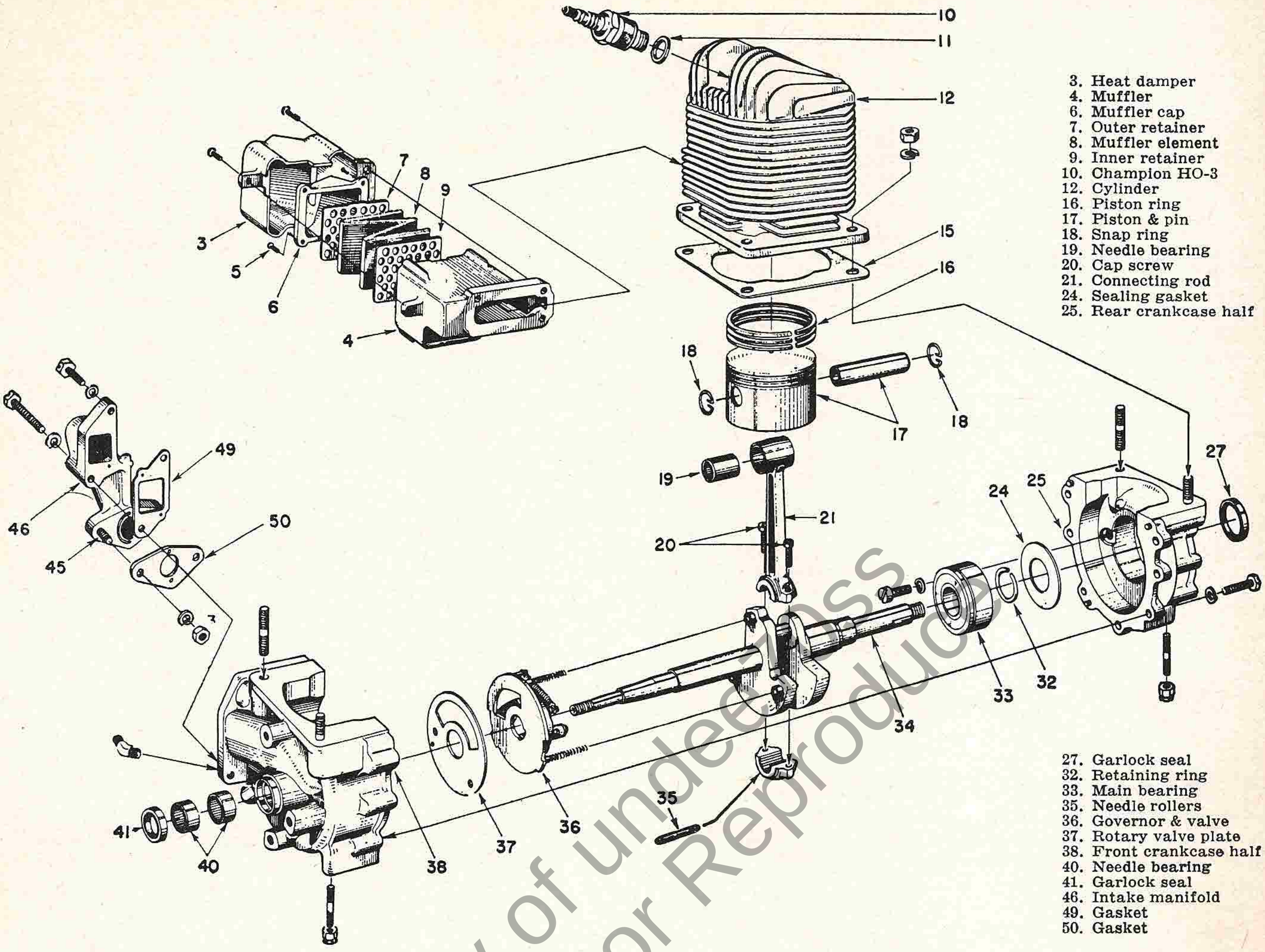


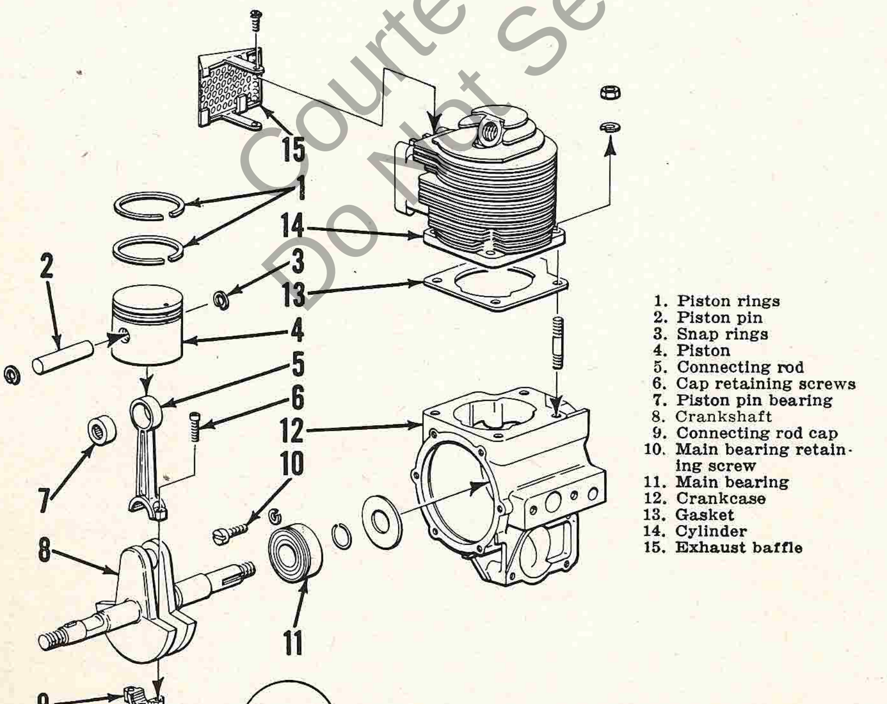
Fig. HL16—View of chrome plated cylinder wall. The light colored areas at top and bottom of port indicate points where chrome has worn away to expose the softer aluminum base metal.



3. Heat damper
4. Muffler
6. Muffler cap
7. Outer retainer
8. Muffler element
9. Inner retainer
10. Champion HO-3
12. Cylinder
16. Piston ring
17. Piston & pin
18. Snap ring
19. Needle bearing
20. Cap screw
21. Connecting rod
24. Sealing gasket
25. Rear crankcase half

27. Garlock seal
32. Retaining ring
33. Main bearing
35. Needle rollers
36. Governor & valve
37. Rotary valve plate
38. Front crankcase half
40. Needle bearing
41. Garlock seal
46. Intake manifold
49. Gasket
50. Gasket

Fig. HL17 — Exploded view of Homelite model 8-29 engine and associated parts. Rotary valve and centrifugal governor (36) is also used on models 5-30, 5-30N, 26LCS, 26LCSA and 7-29.



1. Piston rings
2. Piston pin
3. Snap rings
4. Piston
5. Connecting rod
6. Cap retaining screws
7. Piston pin bearing
8. Crankshaft
9. Connecting rod cap
10. Main bearing retaining screw
11. Main bearing
12. Crankcase
13. Gasket
14. Cylinder
15. Exhaust baffle

Fig. HL18 — Exploded view of engine assembly typical of models with one-piece crankcase and separate bar mounting plate.

type was used as original installation. "Old" type screws may be replaced with either the "new" or "old" type of screw.

PISTON RINGS, PISTONS AND PINS. On all models the piston assembly is accessible after removing the cylinder assembly from crankcase. Always support the piston when removing or installing the piston pin. All models are equipped with an aluminum alloy piston carrying two or three pinned rings as follows:

Engine	No. of Rings	Ring Width	End Gap
7-29, 8-29	3	.057	.008-.018
26LCS, 26LCSA, 5-30, 5-30N	3	.037	.070-.075
Other models	2	.037	.070-.080

End gap (shown at left in Fig. HL14) for 7-29 and 8-29 is measured at flat extreme ends of rings. These rings have a radius cut in their ends enabling them to surround the locating pins in the piston grooves whereas on other models the rings butt against the locating pins. Rings should be rejected when end gap exceeds 0.100 on all except 7-29 and 8-29 on which reject value is 0.018 inch. Minimum ring side clearance is 0.0025: maximum side clearance is 0.004. Oversize piston rings are not available.

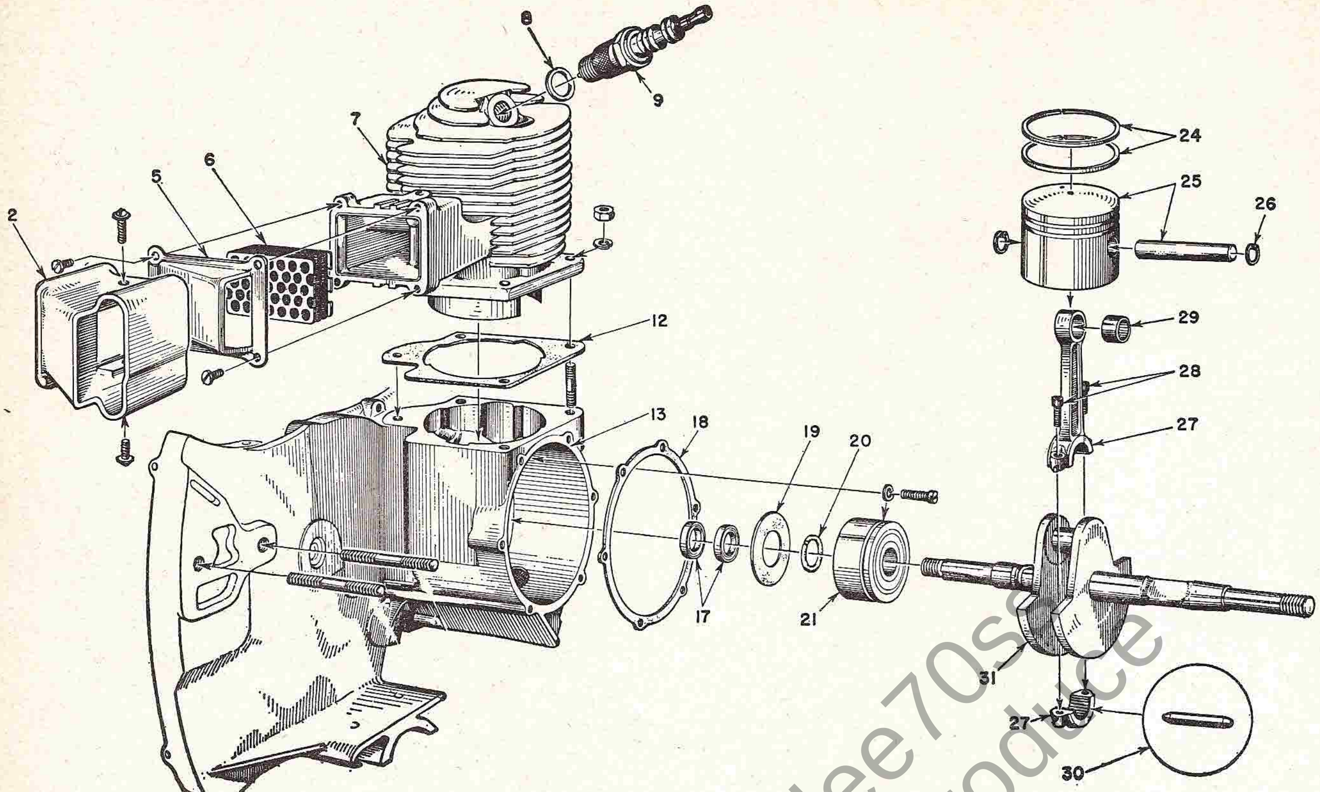
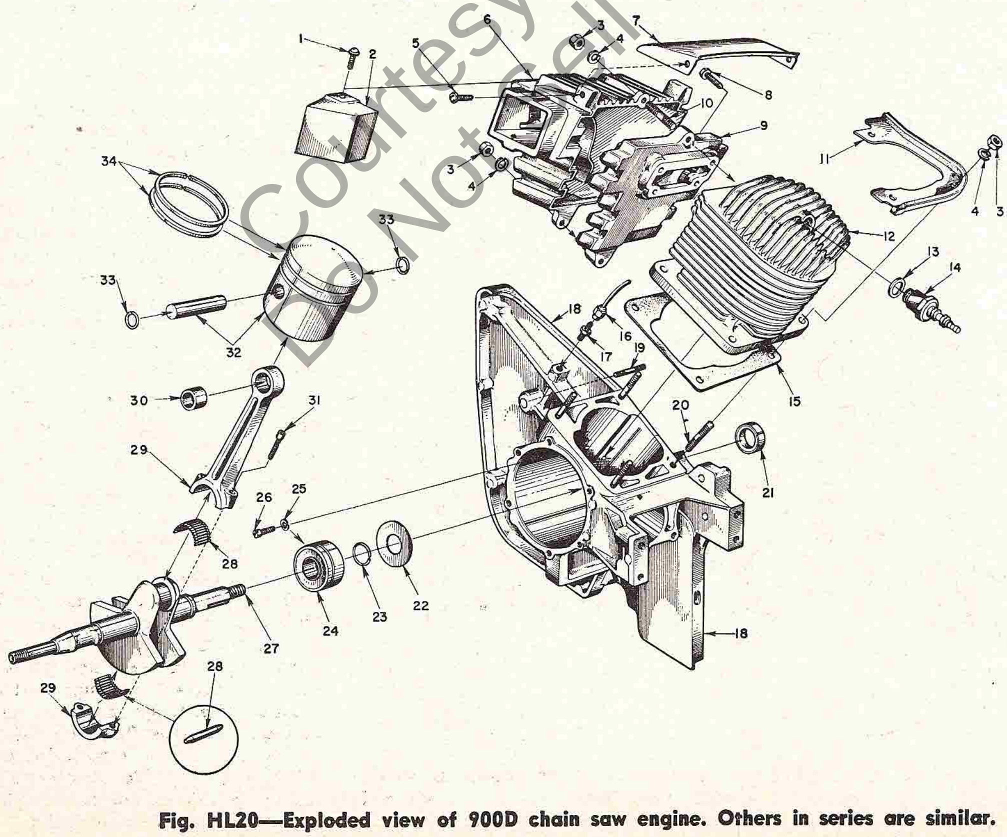


Fig. HL19—Exploded view of model 6-22 engine, typical of models using one piece crankcase with integral mounting plate.

2. Damper
5. Exhaust cap
6. Muffler element
7. Cylinder
9. Champion HO-8A
13. Crankcase
17. Garlock seal
19. Gasket
20. Retaining ring
21. Main bearing
24. Piston ring
25. Piston & pin
26. Retaining ring
27. Connecting rod
28. Cap screw
29. Needle bearing
30. Needle rollers
31. Crankshaft



2. Muffler cap
6. Muffler body
7. Muffler shield
9. Muffler adapter
11. Sawdust shield
12. Cylinder
14. Spark plug
15. Gasket
16. Chain oil line
18. Crankcase
21. Garlock seal
22. Gasket
23. Snap ring
24. Main bearing
26. Main bearing retaining screw
27. Crankshaft
28. Needle rollers (31)
29. Connecting rod
30. Piston pin bearing
32. Piston and pin
33. Snap ring
34. Piston rings

Fig. HL20—Exploded view of 900D chain saw engine. Others in series are similar.

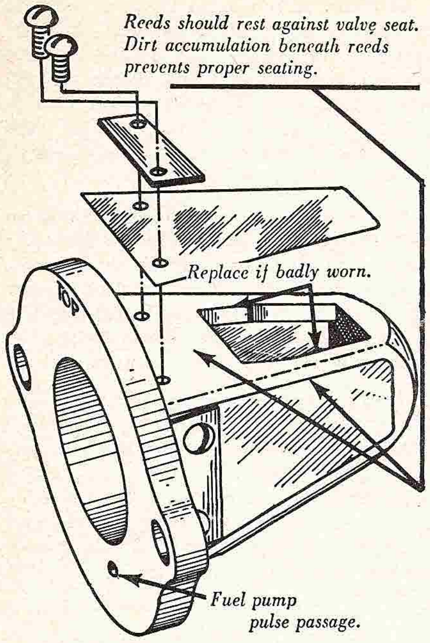


Fig. HL21—Pyramid type reed valve. If reed seating surfaces of adapter castings are worn reject the casting.

On all models reject the pin and the piston if there is any visible up and down play of pin in the piston bosses. Neither the piston or the piston pin are available separately.

Install new needle roller bearing assemblies to upper end of connecting rod if any of the rollers have slight flat spots, are pitted, or if rollers can be separated more than the thickness of one roller.

Inspect piston for cracks and for holes in dome of same and reject if any are found. Slight scoring of piston walls is permissible but if rough surfaces are accompanied by a deposit of aluminum on cylinder walls reject the piston. Refer to CYLINDER for methods of removing such deposits from the cylinder walls.

If piston ring locating pins in piston grooves are worn to half their normal thickness reject the piston. Also, reject piston if side clearance of new ring exceeds 0.004.

When piston and rings unit is assembled to connecting rod the side of the piston which has the piston ring locating pins should be on the intake (away from exhaust side) side of the cylinder (Fig. HL15). Always use new piston pin retaining snap rings when reassembling piston to connecting rod. All wearing parts of the engine are supplied as replacements in standard size only.

CYLINDER. Most cylinder bores are chrome plated. This plating is light grey in color and does not have the appearance of ordinary polished chrome. Because the coating is honed after plating it looks much like the base metal of the aluminum cylinder. If the plating has been

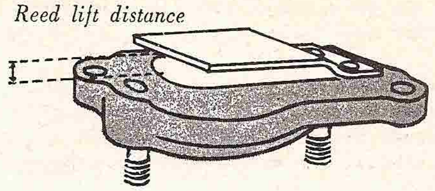


Fig. HL22—Single type reed valve. Reed lift distance should be 0.160 for model 17; 0.180 for 5-20 and EZ, .085 for ZIP, .190 for WIZ, and .060 for BUZ and 500 models.

penetrated by scoring or other causes, the soft aluminum underneath will appear as a much brighter area than the unpenetrated chrome surface. These bright areas usually (but not always) are located at the edges of the cylinder ports. If further checking, as mentioned below, shows that the chrome has been penetrated, the cylinder should be rejected.

In some instances particles of metal from the unplated piston are torn loose and deposited on top of the cylinder plating. This condition is usually indicated by a rough flaky appearance of the bore and can be removed by using a rubber impregnated grinding wheel on a ¼-inch electric drill. If a screwdriver can be run over the cleaned surface without leaving marks thereon, the chrome is intact and the cylinder is fit for further service. If the screwdriver scratches the surface, reject the cylinder.

The cylinder bores on some Homelite models have a transplant coating of steel instead of the bore being chrome plated. To prevent rusting, new service cylinders of this type are coated with a rust-preventive oil. This oil must be washed off with solvent prior to installing the cylinder in an engine; otherwise, dust or grit which may have settled in the oil could cause serious damage.

Models 909D and 909G chain saws above serial No. 1204549 use $\frac{5}{16}$-inch studs to attach cylinder to crankcase. Old service cylinders for use with ¼-inch studs can be used on the newer engines by reaming the four mounting holes to $\frac{11}{32}$-inch. New service cylinders can be used with the older crankcase assemblies by using four bushings, Part No. 56168, to adapt the cylinder to the ¼" crankcase studs.

Reject cylinder if cracked, if more than three critical cooling fins are broken off, or if lining is worn through into base metal.

When installing both a new piston and a new cylinder, clean and oil both parts and place the piston in the cylinder without rings or connecting rod. The piston should fall freely when the cylinder is turned up. If not, select a new piston or a new cylinder that will give this desired fit.

CRANKSHAFT, BEARINGS AND SEALS. The pto end main bearing on all models is a ball bearing. A non-renewable bushing is used for the magneto end main bearing on models 26 and 5-30 only. On all other models, needle roller bearings are used for the magneto end main bearing.

If shaft has damaged threads or enlarged keyways or if "run out" exceeds 0.003, reject the shaft. Journals for the connecting rod and roller type main bearing must be free of pits, galling or heavy score marks. If they are "out of round" or worn more than 0.001 reject the shaft.

If any needle roller shows wear or any visible flat spot or if rollers can be separated more than the width (or diameter) of one roller, reject all of the rollers. If annular ball bearing at opposite end of crankshaft feels "lumpy" when rotated, or has perceptible wear between inner and outer races reject the ball bearing. On 26 and 5-30 models, the main bushing should not have a diametral clearance of more than 0.004. If the bushing is badly scored or worn, renew the front half crankcase.

Suitable pullers, pushers and mandrels (available from the Homelite Company and/or Burco-Chain Saw Specialties, Schenectady, New York) should be used in removing and installing main and connecting rod bearings.

Crankshaft seals must be maintained in first class condition because crankcase compression leakage through seals causes a loss of power.

NOTE: Late model production models 770-D, 770-G, 990-D, 990-G, WIZ-B and Super WIZ have a threaded crankshaft and the clutch rotor screws on and off instead of being retained by keys. Service crankshafts for early production models listed may also be threaded in which case it will be necessary to renew the clutch spider also. The direct drive models and all 990 series have left hand threads; all gear drive models except 990 series have right hand threads.

CRANKCASE. Be sure that all passages through the crankcase are clean. This is especially true of the idle passage line (in the front half crankcase) which enters the crankcase via the intake valve register. This passage is sometimes restricted by carbon deposits which can be cleaned with a piece of wire. The same holds true of the passage for the fuel tank pressure line (on models with pressurized fuel tank) or the actuator line on pump equipped engines.

If main bearing bores have a lapped appearance the bearing has been turning in the crankcase in which instance the bearing and/or the crankcase should be rejected. The mating surfaces of two-piece crankcase must be free of all nicks and burrs as neither sealing compound nor gaskets are used at this joint.

Always use new bearing seals when reassembling engine. Protecting sleeves placed on the crankshaft will prevent damaging the seals during installation.

REED VALVE. The reed valve should be inspected whenever the carburetor is removed. Some engines are equipped with a pyramid type reed valve as shown in Fig. HL21. A single reed type valve, shown in Fig. HL22, is used on models 17, 17L, 5-20, 5-20L, EZ, ZIP, ZIP-5, WIZ, BUZ and 500.

Single reed type valve assembly should be rejected if reed has loosened, screw holes are elongated or if any working part is worn or damaged. Reed lift should be as shown in Fig. HL22.

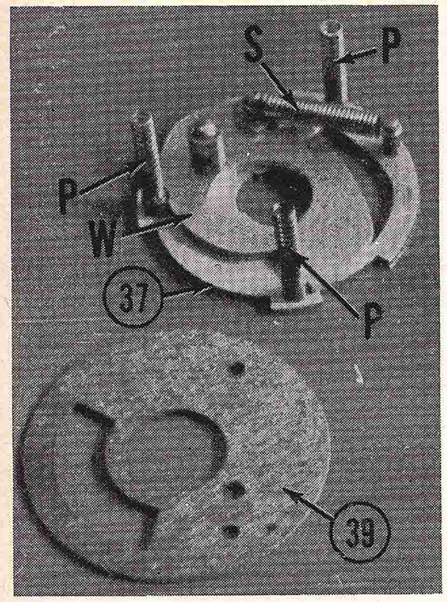


Fig. HL23 — Speed governor and rotary inlet valve used on some models. Refer also to Fig. HL17.

P. Sealing spring
S. Governor spring
W. Shutter
37. Valve plate
39. Wear plate

On the pyramid type valves individual reeds may be renewed.

ROTARY VALVE. The combination rotary type inlet valve and governor (Fig. HL23) should be rejected if any of the following conditions are encountered during inspection:

If the sealing faces of valve are scored or worn enough to produce a ridge; if spring posts are loose or extend to valve seating surface; if the governor pivot point has started to wear through the surface of the valve.

Slight scoring of valve may be corrected by lapping on a lapping plate using very fine abrasive. Lapping motion should be in the pattern of a figure 8 to obtain best results. Slight scoring of the Formica wear plate is permissible. The Homelite Company recommends soaking a new wear plate in engine oil for 24 hours prior to installation.

CLUTCH. A shoe type clutch is used on all models. On direct drive and belt drive models, a dry type clutch is used with the shoes constructed of Oilite bronze. A wet type clutch is used on 2-gear and 3-gear transmission drive models and 1/16-inch Raybestos linings are bonded to the Oilite bronze clutch shoes.

If clutch slips with engine running at high speed under load, check for excessive wear of clutch shoes or clutch shoe linings. If the clutch will not disengage (chain continues to turn) with engine running at idle speed, check for broken, weak, distorted or improperly installed clutch springs.

Needle roller bearing in clutch drum on direct drive models should be renewed if rollers can be separated the width of one roller and clutch drum is otherwise serviceable. Press on lettered end of bearing cage only when removing old bearing and pressing new bearing into place. Oil the needle bearing before reinstalling drum.

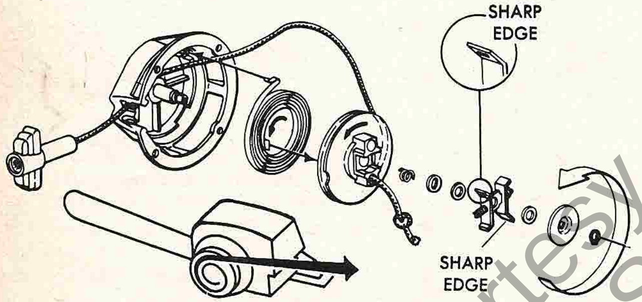


Fig. HL24—Proper assembly of Fairbanks-Morse recoil starter for clockwise pull. Used on some models.

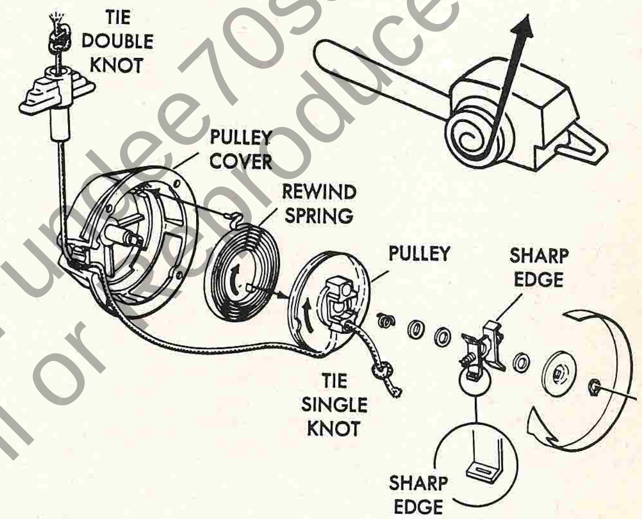


Fig. HL24B—Proper assembly of Fairbanks-Morse recoil starter for counter-clockwise pull. Used on some models.

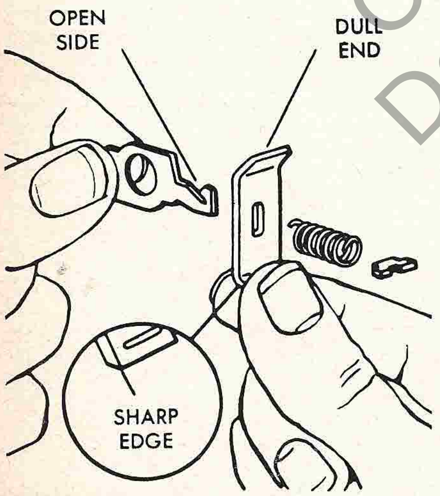


Fig. HL24A — Fairbanks-Morse starter clutch is available as assembly only; however, if unit is disassembled for some reason, it must be reassembled as shown.

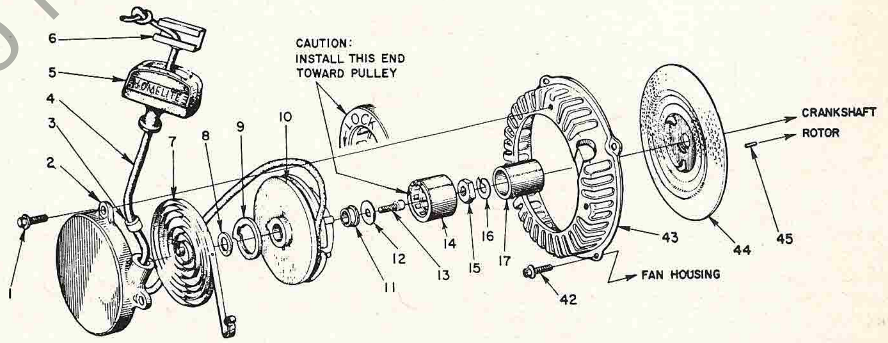


Fig. HL25 — Exploded view of over-running clutch type starter used on models 995-D and 995-G. Refer to Fig. HL25A for exploded view of ball type starter used on earlier models of this series.

2. Cover
3. Bushing
4. Starter rope
7. Rewind spring
8. Thrust washer
9. Rewind lock
10. Starter pulley
11. Bushing
12. Thrust washer
13. Socket head screw
14. Over-running bearing
15. Nut
16. Lock washer
17. Inner race
43. Mounting ring
44. Rotary screen

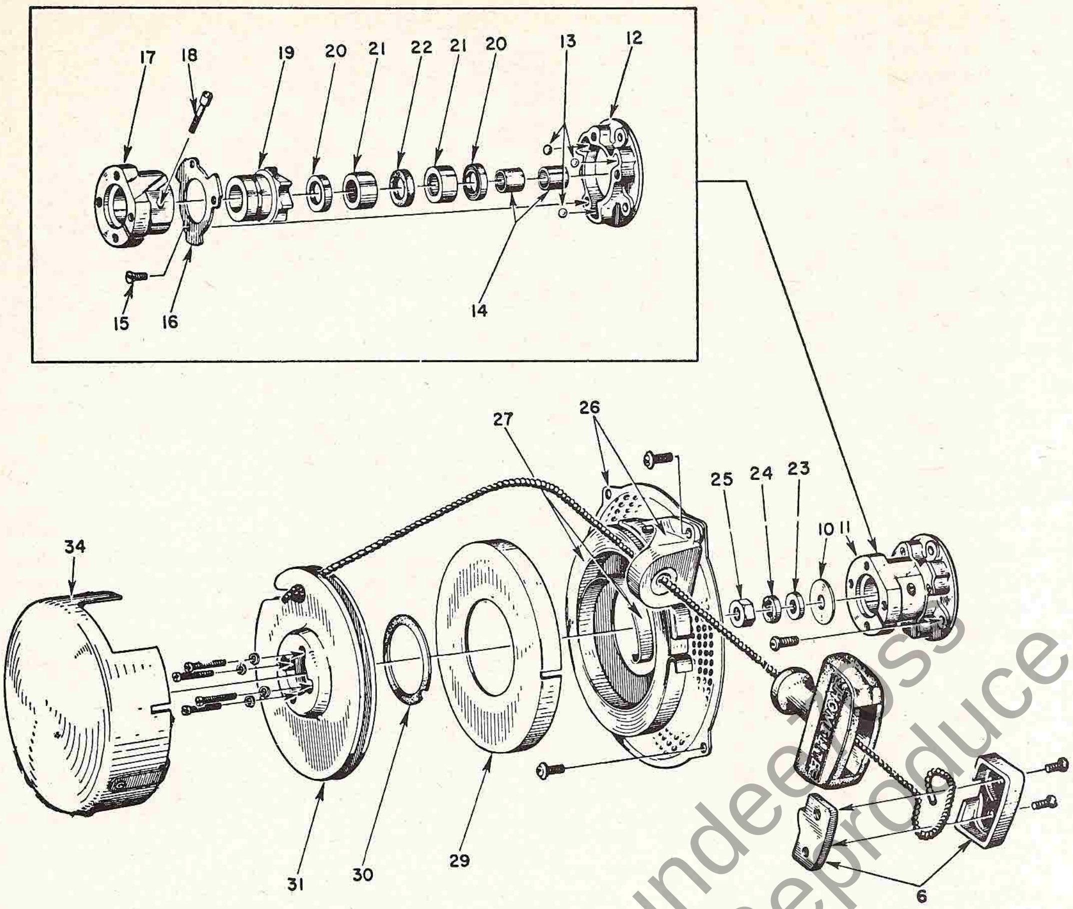


Fig. HL25A—Ball type recoil starter components typical installation.

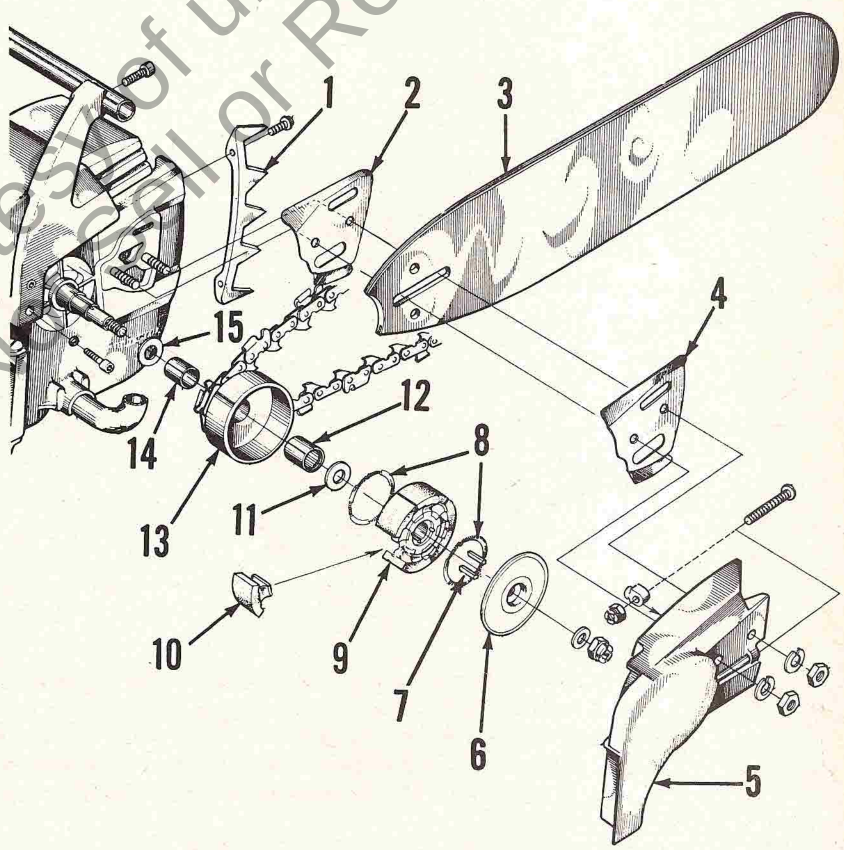
10. Thrust washer
11. Ball drive
12. Drive plate
13. Ball (3 used)
14. Sleeve
16. Ball retainer
17. Drive hub
19. Drive ratchet
20. Seal
21. Needle bearing
22. Felt washer
23. Aluminum washer
24. Lock washer
26. Air screen
27. Recoil spring
29. Spring cover
30. Plastic shim
31. Pulley
34. Pulley cover

Clutch drum (4—Fig. HL27) in belt drive models contain two sealed bearings (3 and 7) and a bearing spacer (6). Bearings do not require lubrication. NOTE: **Do not** wash bearings in solvent. When renewing bearings, drive bearing (3) out by inserting drive punch in slot of spacer (6); then, remove spacer and drive bearing (7) out. Drive new bearing (3) in flush with clutch drum, insert spacer (6) and drive new bearing (7) in flush with belt sprocket.

Clutch drums in 2-gear and 3-gear transmission models have renewable bronze bushings.

When assembling the clutch, be sure the end loops of the springs are closed and are located at the center of a clutch shoe. If installing a new clutch drum, wash off the protective coating with petroleum solvent.

NOTE: Late model production models 770-D, 770-G, 990-D, 990-G, WIZ-B and Super WIZ have a threaded crankshaft and the clutch rotor screws on and off instead of being retained by keys. Service crankshafts for early production models listed may also be threaded in which case it will be necessary to renew the clutch spider also. The direct drive models and all 990 series have left hand threads; all gear drive models except 990 series have right hand threads.



1. Bumper spike
2. Guide plate
3. Guide bar
4. Guide plate
5. Chain guard
6. Clutch cover
7. Clutch keys
8. Clutch springs
9. Clutch rotor
10. Clutch shoes (3 or 6)
11. Thrust washer
12. Needle bearing
13. Clutch drum
14. Sleeve
15. Washer

Fig. HL26 — Exploded view of components of typical direct drive clutch assembly. On some models, position of clutch drum (13) and sprocket (9) is reversed placing chain drive sprocket to outside. Clutch rotor spider (9) on some late production models is threaded onto crankshaft instead of being retained by keys (7). Refer to note following CLUTCH paragraph.

TRANSMISSIONS. The belt drive transmission (See Fig. HL27) is of the dry type using sealed bearings that do not require lubrication. NOTE: **Do not** wash the sealed bearings in solvent of any kind. Renew drive belt if lugs are worn, if belt shows signs of breaking, or if belt tension is loose enough that belt can be pushed against wall of drive case with thumb pressure. If belt and/or clutch drum are to be reused, service can be improved by soaking belt and **sprocket part** of clutch drum **only** in Homelite DC-200 silicone compound.

Refer to Figs. HL28 and HL29 for exploded views of typical 2-gear and 3-gear transmissions. Exploded view of Model 770-GS "Stick Shift" dual ratio transmission is shown in Fig. HL28A. Disassembly procedure is evident from inspection of unit and reference to appropriate exploded view. Check gears for excessive backlash; wear of bronze bushing in clutch drum can cause excessive backlash. Be sure that gasket surfaces of gear case and cover are clean and free of burrs. Use new gasket when reassembling transmission. Fill gearcase to proper level with Homelite SAE 90 gear oil.

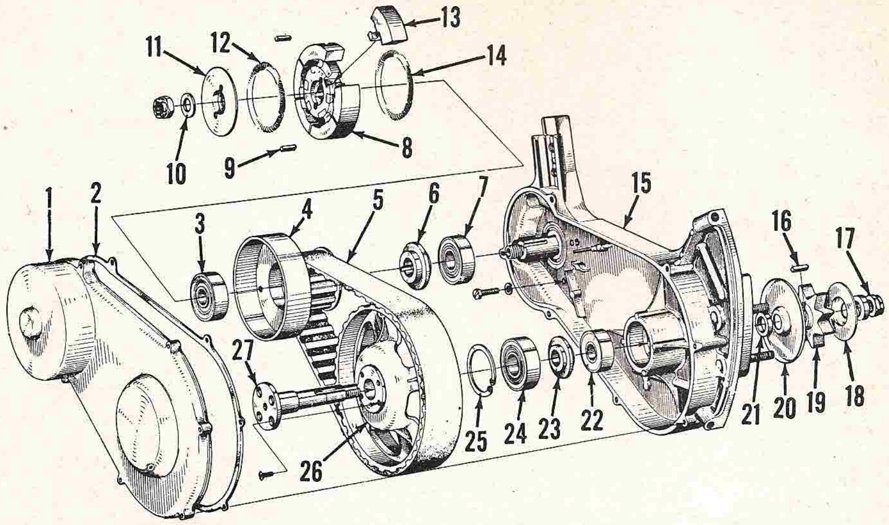


Fig. HL27 — Exploded view of typical belt drive transmission. Belt drive transmission does not require lubrication. Gasket (2) is required to keep sawdust out of transmission. All bearings are pre-lubricated and sealed.

1. Cover
2. Gasket
3. Sealed bearing
4. Clutch drum
5. Drive belt
6. Spacer
7. Sealed bearing
8. Clutch rotor
9. Rotor keys
10. Washer
11. Clutch cover
12. Clutch spring
13. Clutch shoes
14. Clutch spring
15. Transmission case
16. Sprocket key
17. Spacer
18. Washer
19. Chain sprocket
20. Washer
21. Spacer
22. Sealed bearing
23. Spacer
24. Sealed bearing
25. Snap ring
26. Driven sprocket
27. Shaft

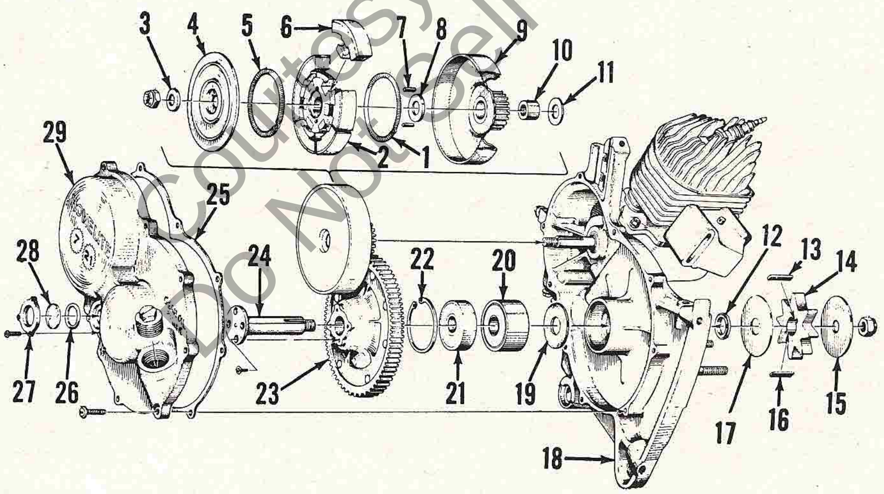


Fig. HL28 — Exploded view of model 7-21 two-gear transmission. Other model two-gear transmissions are similar. On some models, only one bearing is used on sprocket shaft (24) instead of the two shown (20 and 21). Clutch rotor (spider) (2) on late production 770-G, WIZ and Super WIZ models is threaded to crankshaft instead of being retained by keys (7). Refer to note following CLUTCH paragraph.

1. Clutch spring
2. Clutch rotor
3. Washer
4. Clutch cover
5. Clutch spring
6. Clutch shoes
7. Clutch rotor keys
8. Thrust washer
9. Clutch drum
10. Bushing
11. Washer
12. Spacer
13. Sprocket key
14. Chain sprocket
15. Washer
16. Sprocket key
17. Washer
18. Gear case
19. Formica seal
20. Bearing
21. Bearing
22. Snap ring
23. Driven gear
24. Shaft
25. Gasket
26. Seal
27. Window retainer
28. Plastic window
29. Gear case cover

3. Clutch cover
4. Clutch springs
5. Clutch rotor
6. Clutch shoes
7. Rotor keys
8. Thrust washer
9. Bushings
10. Spacer
11. Drum & gear assy.
12. "O" ring
13. Spring
14. Brake shaft
15. Detent plunger
16. Plunger knob
17. Shift lever
18. Formica washer
19. "O" ring
20. Snap ring
22. Shift plate
23. Engine crankshaft
24. Gear case
26. Sprocket washer
27. Chain sprocket
28. Sprocket key
29. Sprocket washer
30. Spacer
32. Formica seal
33. Ball bearing
34. Snap ring
35. Spacer
36. Gasket
37. Gear case spacer
38. Brake shoe
39. Shifter fork
41. Shifter yoke
42. Driven gears
43. Sprocket shaft
44. Inner race
45. Cover
46. Needle bearing
47. Needle bearing
48. "O" ring
49. Plastic window
52. Oil filler cap

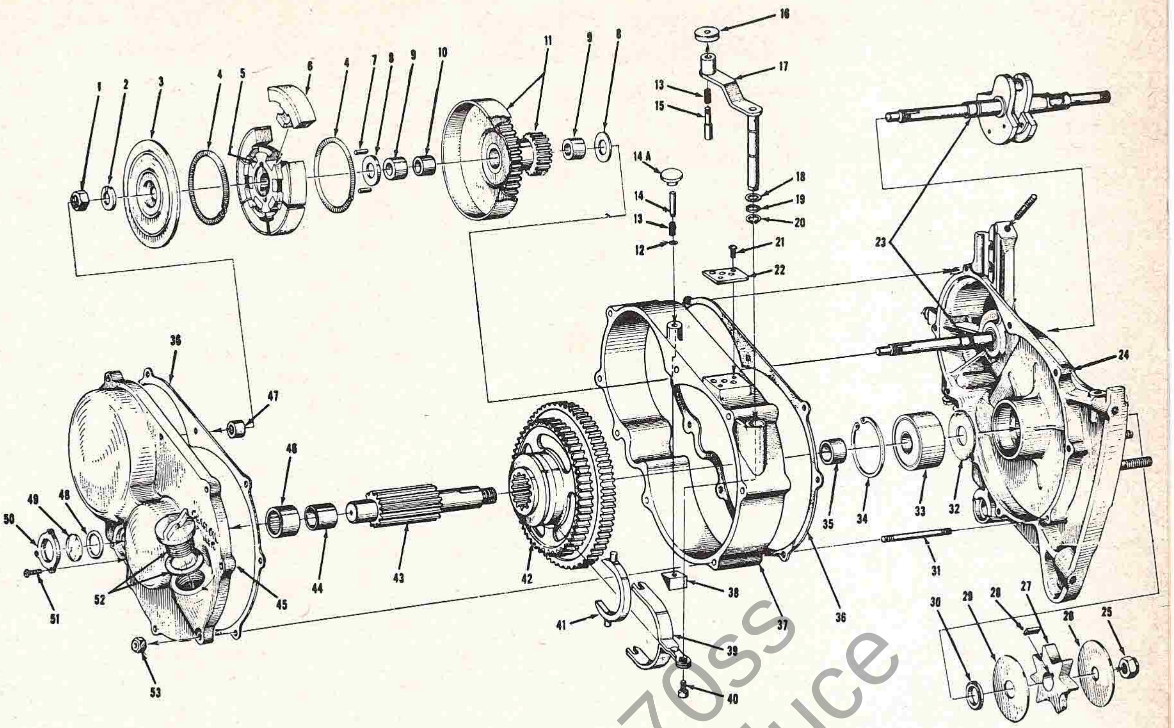
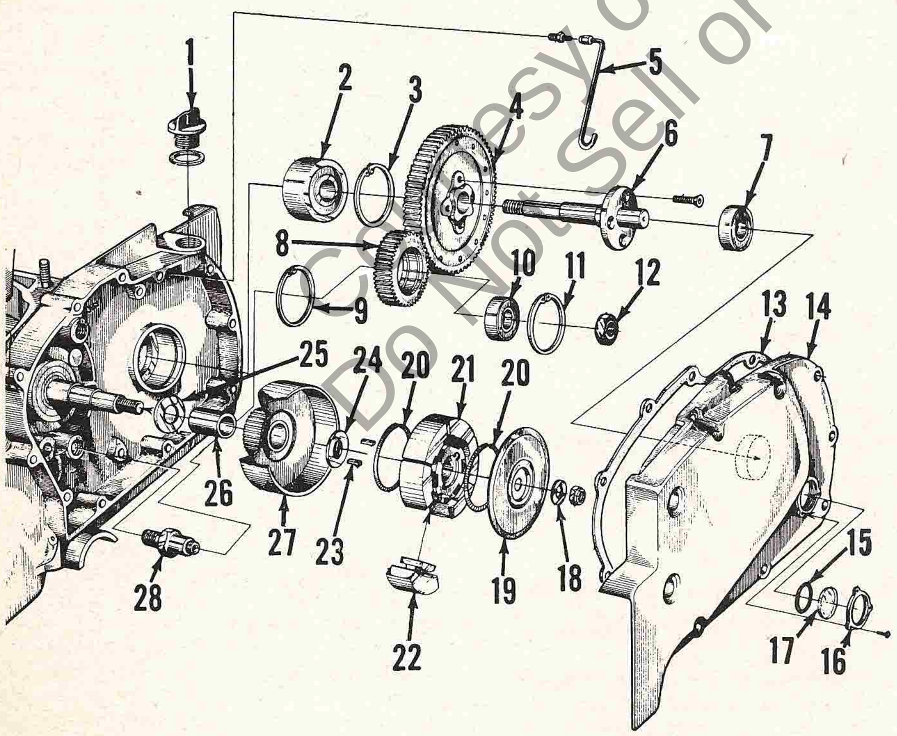


Fig. HL28A — Exploded view of the dual range transmission used on model 770-GS chain saw. With engine idling, depress brake button (14A) to stop gears from rotating; then, shift gears with lever (17). Gear shift detent (15) has neutral position so that engine can be started without turning chain.



1. Oil filler cap
2. Ball bearing
3. Snap ring
4. Driven gear
5. Vent line
6. Sprocket shaft
7. Ball bearing
8. Idler gear
9. Snap ring
10. Ball bearing
11. Snap ring
12. Nut
13. Gasket
14. Cover
15. "O" ring
16. Retainer
17. Window
18. Washer
19. Clutch cover
20. Clutch springs
21. Clutch rotor
22. Clutch shoes
23. Clutch rotor keys
24. Thrust washer
25. Washer
26. Bushing
27. Drum & gear assy.
28. Idler shaft

Fig. HL29 — Exploded view of typical three-gear transmission. Idler gear (8) on some models is an integral gear-bearing-carrier unit. Clutch rotor (spider) (21) is threaded on crankshaft on late production model 990-G saws instead of being retained by keys (23). Refer to note following CLUTCH paragraph.

HOMELITE

A textron DIVISION

PORT CHESTER, N.Y. U.S.A.

MODEL	Bore	Stroke	Disp.	Drive	Reed Type
XL-12	1 3/4	1⅜	3.3	Direct	Flat
XL-15	1 3/4	1⅜	3.3	Gear	Flat
Super XL-12	1 13/16	1⅜	3.55	Direct	Flat
XLAO	1 13/16	1⅜	3.55	Direct	Pyramid
Super XL	1 13/16	1⅜	3.55	Direct	Pyramid
XLAO-G	1 13/16	1⅜	3.55	Gear	Pyramid
Super XL-15	1 13/16	1⅜	3.55	Gear	Pyramid
XL-500 Auto	2.0	$1\frac{7}{16}$	4.50	Direct	Pyramid

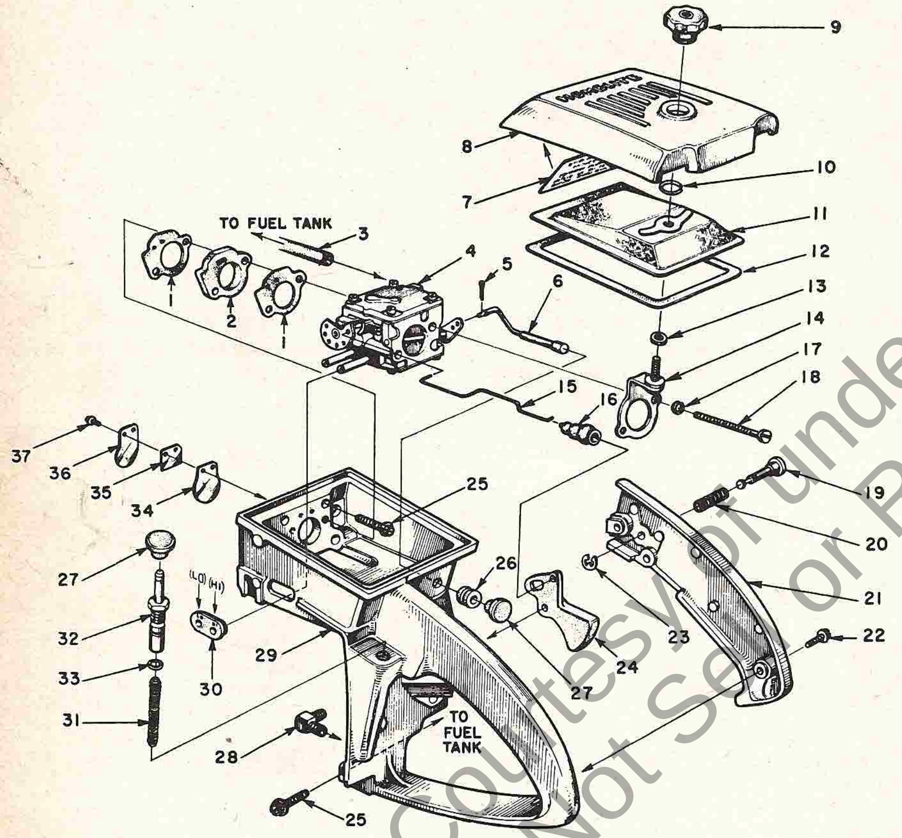


Fig. HL30 — Exploded view of air box (throttle handle) and related parts on models with flat reed intake valve (34). Refer to Fig. HL30A for models equipped with pyramid reed valve.

1. Gasket
2. Insulator
3. Fuel line
4. Carburetor
5. Cotter pin
6. Choke rod
8. Filter cover
9. Nut
10. Snap ring
11. Filter element
12. Gasket
13. Gasket
14. Bracket
15. Throttle rod
16. Boot
19. Throttle lock pin
20. Spring
23. Snap ring
24. Throttle trigger
26. Grommet
27. Choke button
28. Check valve
29. Air box
30. Grommet
31. Spring
32. Pump plunger
33. "O" ring
34. Reed valve
35. Reed back-up
36. Reed stop

MAINTENANCE

SPARK PLUG. For normal service, a Champion TJ-6J spark plug is used on models XLA0, Super XL, XLA0-G and Super XL-15. On all other models, a Champion TJ-8J spark plug is used. For severe service or maximum spark plug life, a Champion UTJ-11P (platinum tip) spark plug is recommended for use on all models. Set electrode gap to 0.025.

CARBURETOR. Refer to Fig. HL31 for exploded view of typical Tillotson Series HS diaphragm type carburetor with integral fuel pump that is used on Model XL chain saws. Models HS-1A, HS-4A, HS-4B, HS-5A, HS-5B and HS-5C have been used in production. A model HS-4C can be used as a service replacement for the above carburetors. Late production XL-500 models use an HS-4D carburetor having a different throttle shaft (24-Fig. HL31).

Late type inlet valve and valve lever are notched (See Fig. HL-31A), whereas ends of early type valve and lever were plain. The valves and levers are interchangeable; however, they must be installed in sets.

NOTE: If air filter cover gasket (12—Fig. HL30) becomes damaged when removed to service carburetor or air filter element, install new gasket as follows: Carefully remove old gasket from air box and be sure that surface is free of all saw dust, oil, etc. Apply "3M" cement to new gasket and carefully place gasket, adhesive side down, on lip around carburetor chamber.

For initial adjustment of carburetor, back idle speed adjustment screw out until it clears throttle stop; then, turn screw back in until it contacts stop plus ¾ additional turn. Open idle fuel needle and main fuel needle one full turn each.

Make final adjustments with engine warm and running. Adjust idle fuel needle so that engine idles smoothly; then, adjust idle stop screw so that engine idles at just below clutch engagement speed (approximately 2600 RPM). Check engine for proper acceleration and open idle fuel needle slightly if necessary for proper acceleration. Adjust main fuel needle only while cutting under load so that engine runs at highest speed obtainable without excessive smoke. NOTE: Idle and high speed fuel adjustments are interdependent; resetting one adjustment usually requires that the other fuel mixture needle be readjusted also.

MAGNETO. A Wico or Phelon flywheel type magneto with external armature and ignition coil is used. Units equipped with Phelon magneto will have a letter "P" stamped after the serial number. The Wico and Phelon magnetos are similarily constructed, so care should be taken to properly identify magneto before ordering service parts. Breaker points and condenser are located behind flywheel.

Armature core and stator plate are riveted together and are serviced only as a unit. Stator plate fits firmly on shoulder of crankcase; hence, armature air gap is non-adjustable.

Late production Wico magneto stator plates are built to retain a felt seal (43—Fig. HL34); the seal cannot be used with early production Wico stator plates. All Phelon stator plates are built to retain the felt seal (43).

Magneto stator plate has slotted mounting holes, and should be rotated as far clockwise as possible before tightening mounting screws to obtain correct ignition timing of 30 degrees BTDC. Set breaker point gap to 0.015. Condensor capacity should test 0.16-0.20 mfd. CAUTION: Be careful when installing breaker points not to bend tension spring any more than necessary; if spring is bent excessively, spring tension may be reduced causing improper breaker point operation. Late Wico units have a retaining clip (35—Fig. HL34) and flat washer to secure breaker arm on pivot post.

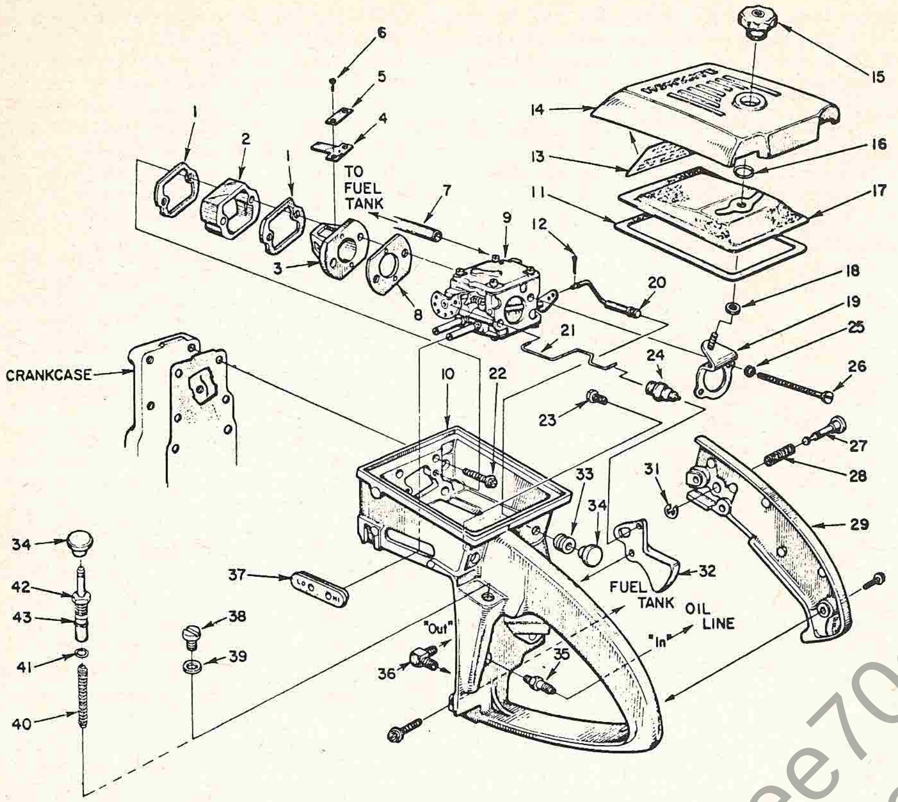


Fig. HL30A — Exploded view of air box and throttle handle assembly for models equipped with pyramid reed type intake valve. Idle speed adjusting screw (23) is located in air box instead of on carburetor body; remove idle speed adjusting screw (4—Fig. HL31) and spring from new service carburetor before installing carburetor on these models.

1. Gaskets
2. Spacer
3. Reed seat
4. Valve reeds (4)
5. Retaining plates
7. Fuel line
8. Gasket
9. Carburetor
10. Air box
11. Gasket
14. Cover
17. Filter
18. Gasket
19. Bracket
20. Choke rod
21. Throttle rod
23. Idle speed screw
24. Boot
27. Throttle lock pin
28. Spring
29. Handle cover
31. Snap ring
32. Throttle trigger
33. Grommet
35. "In" check valve
36. "Out" check valve
37. Grommet
38. Plug (AO models)
39. Gasket
40. Spring (manual oiler)
41. "O" ring
42. Manual pump plunger
43. "O" ring

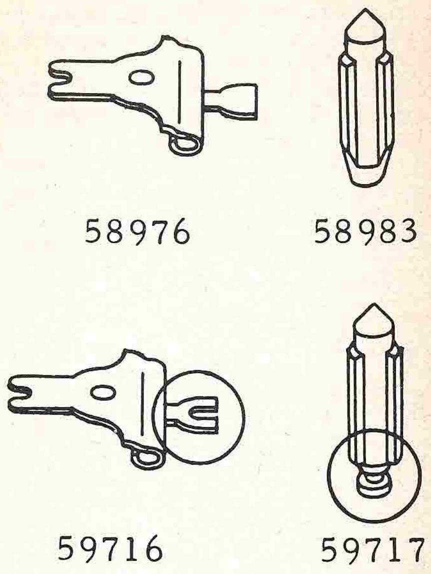


Fig. HL31A — Late type fuel inlet valve (59717) and lever (59716) are notched for better valve control and are interchangeable as a set with early valve (58983) and lever (58976) shown at top.

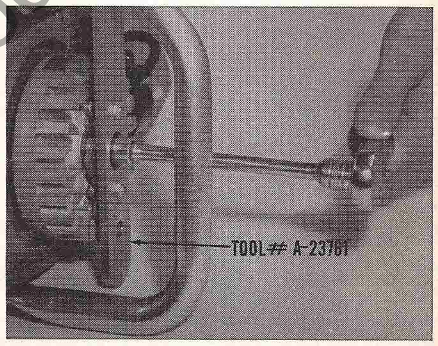


Fig. HL32 — Using Homelite tool No. A-23761 to hold flywheel from turning while removing flywheel retaining nut.

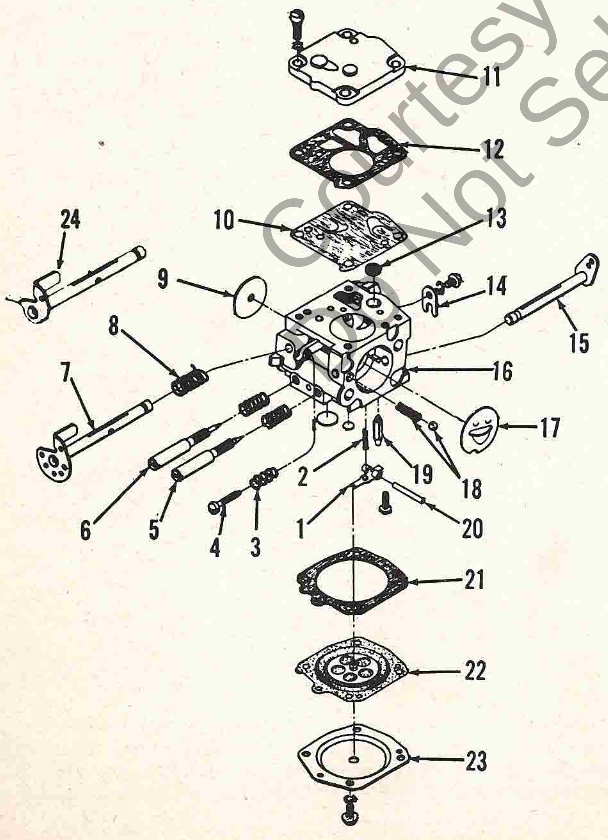


Fig. HL31 — Exploded view of typical Tillotson Series HS diaphragm type carburetor used on XL models. Idle speed stop screw (4) is not used on some models; refer to (23—Fig. HL30A).

1. Diaphragm lever
2. Spring
3. Spring
4. Idle speed stop screw
5. High speed fuel needle
6. Idle fuel needle
7. Throttle shaft (early)
8. Spring
9. Throttle disc
10. Pump diaphragm
11. Pump cover
12. Gasket
13. Fuel screen
14. Shaft retainer
15. Choke shaft
16. Carburetor body
17. Choke disc
18. Choke detent & spring
19. Inlet valve
20. Lever pin
21. Gasket
22. Fuel diaphragm
23. Cover
24. Throttle shaft (late)

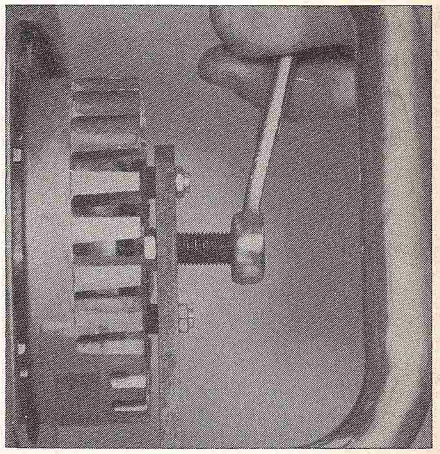


Fig. HL33 — Using Homelite tool No. A-23761 to pull flywheel. Tool is attached to starter pawl studs using rotating screen retaining nuts.

LUBRICATION. Engine is lubricated by oil mixed with fuel. Thoroughly mix oil and gasoline in separate container. Mix ½-pint of Homelite motor oil or good grade SAE 30 motor oil in each gallon of regular gasoline. (16:1 mixture).

Fill chain oiler reservoir with Homelite Bar and Chain oil or a light weight oil (no heavier than SAE 30). In cold weather, chain oil can be diluted with gerosene to allow easier flow of oil through pump and lines. On early models, oil filler cap (48—Fig. HL35) is located on fuel tank cover (17); late models have oil reservoir in drive case (55—Fig. HL40A) oil filler cap is (53).

On early models, the clutch drum and sprocket assembly should be removed and a few drops of oil placed on the Oilite bushing occasionally. Late models (and converted early models) have needle bearing instead of Oilite bushing.

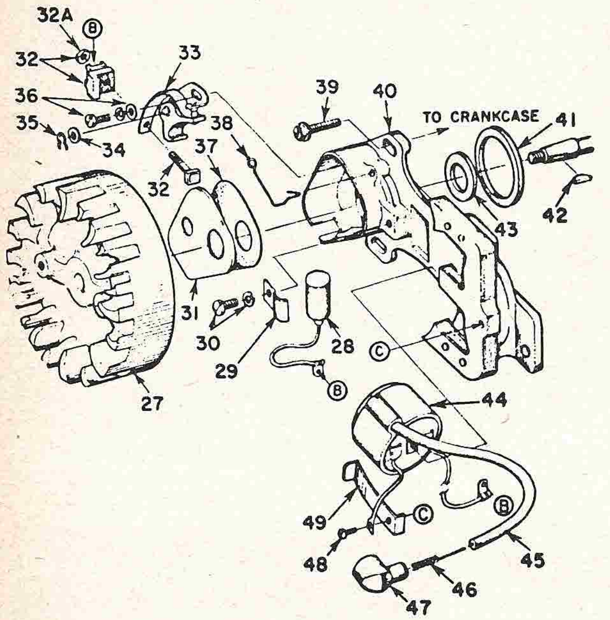


Fig. HL34 — Exploded view of Wico magneto used on some models. Phelon magneto used on other models is of similar construction. Felt seal (43) cannot be used on early Wico magnetos. Connect condenser and ignition coil low tension leads as indicated by letters "B" and "C".

27. Magneto rotor (flywheel)
28. Condenser
31. Breaker box cover
32. Terminal block
33. Point set
34. Washer
35. Clip
37. Gasket
38. Cover spring
40. Armature core & stator plate
41. Gasket
42. Woodruff key
43. Felt seal
44. Ignition coil
45. High tension lead
47. Spark plug boot
49. Coil clip

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and scrape free of carbon. With muffler removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with a wooden scraper. Be careful not to damage chamfered edges of exhaust ports or to scratch piston. Do not run engine with muffler removed.

NOTE: On early models with one-piece muffler (37—Fig. HL35), a "Quiet" muffler kit (Homelite part No. A-59052) is available. Before installing the new muffler, cut ⅞-inch off of high tension lead (spark plug wire), press it back in place and crimp lead clamp to hold lead away from muffler.

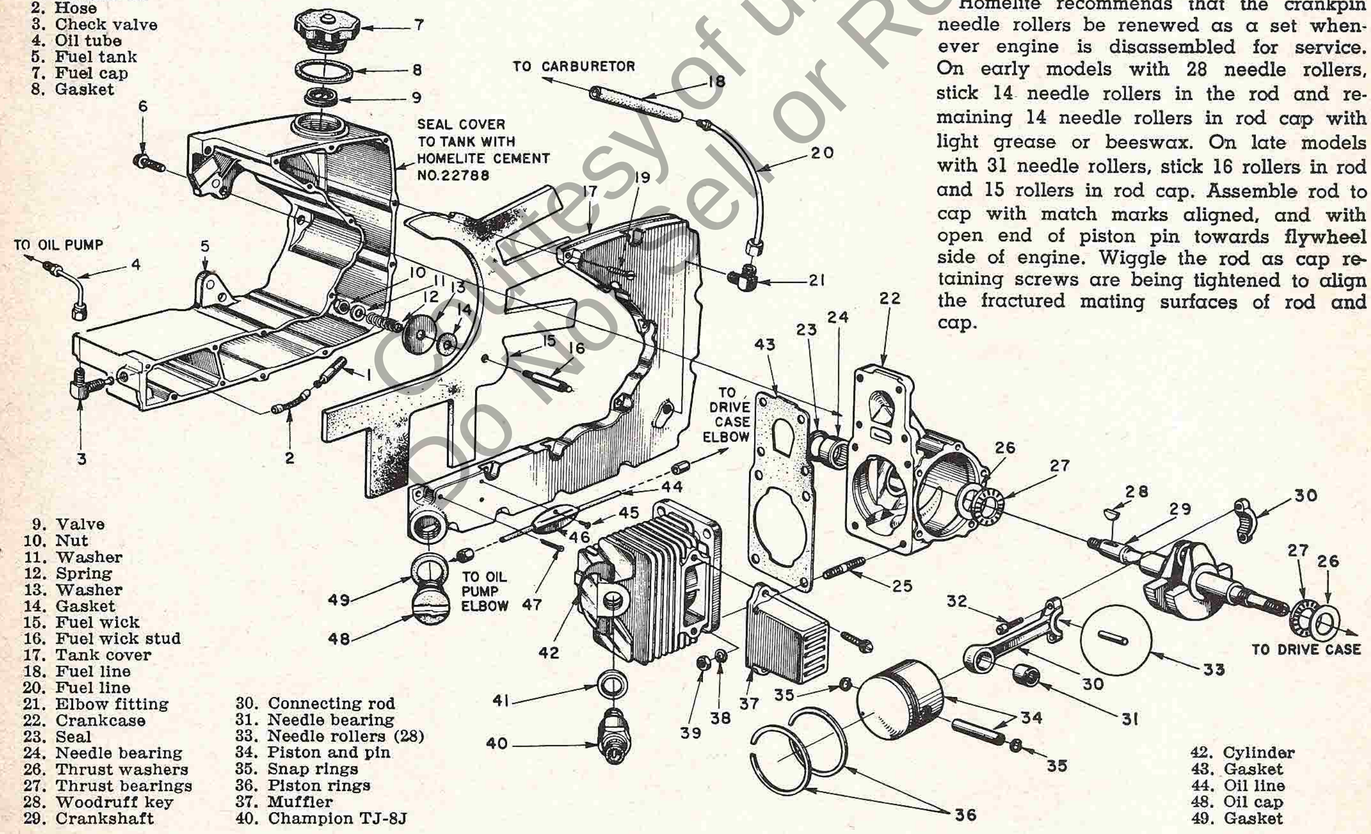
REPAIRS

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Refer to Fig. HL37. Be careful to remove all of the loose needle rollers when detaching rod from crankpin. Early models have 28 loose needle rollers; starting with serial No. 207-1277, 31 loose needle rollers are used.

Note: A different crankshaft and connecting rod are used on late models with 31 needle rollers.

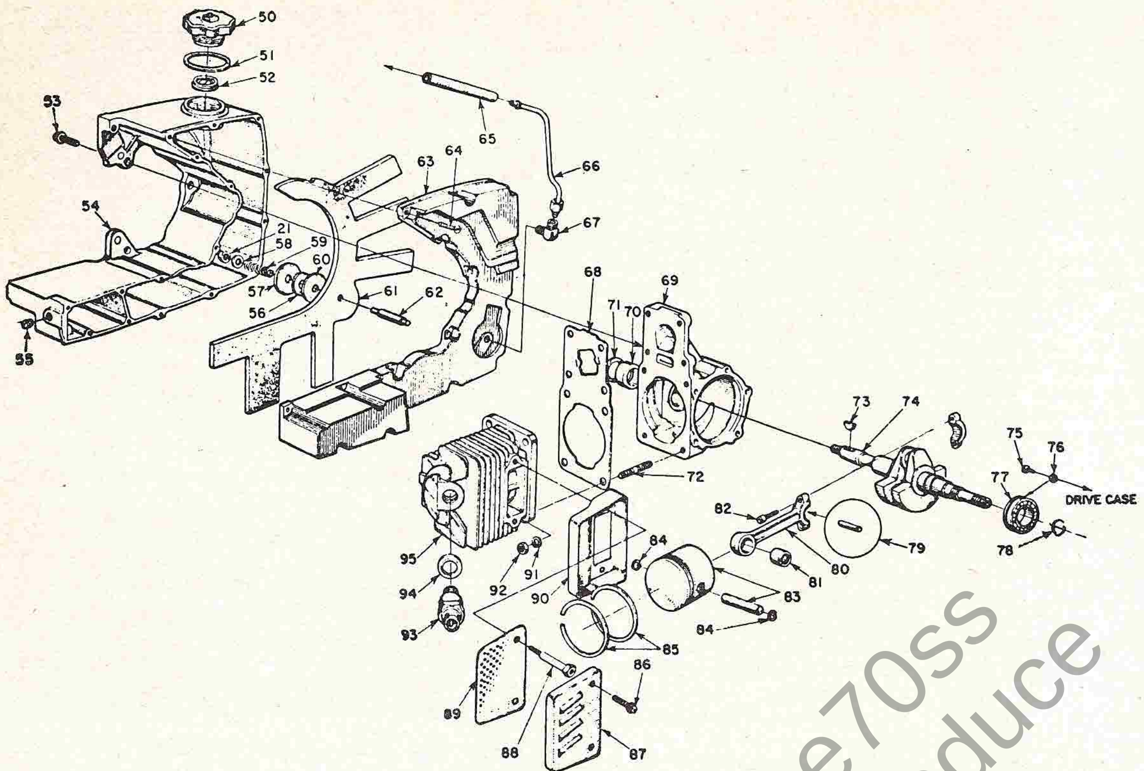
Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23756. Press on lettered end of bearing cage only.

Homelite recommends that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. On early models with 28 needle rollers, stick 14 needle rollers in the rod and remaining 14 needle rollers in rod cap with light grease or beeswax. On late models with 31 needle rollers, stick 16 rollers in rod and 15 rollers in rod cap. Assemble rod to cap with match marks aligned, and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap retaining screws are being tightened to align the fractured mating surfaces of rod and cap.



1. Oil pick-up
2. Hose
3. Check valve
4. Oil tube
5. Fuel tank
7. Fuel cap
8. Gasket
9. Valve
10. Nut
11. Washer
12. Spring
13. Washer
14. Gasket
15. Fuel wick
16. Fuel wick stud
17. Tank cover
18. Fuel line
20. Fuel line
21. Elbow fitting
22. Crankcase
23. Seal
24. Needle bearing
26. Thrust washers
27. Thrust bearings
28. Woodruff key
29. Crankshaft
30. Connecting rod
31. Needle bearing
33. Needle rollers (28)
34. Piston and pin
35. Snap rings
36. Piston rings
37. Muffler
40. Champion TJ-8J
42. Cylinder
43. Gasket
44. Oil line
48. Oil cap
49. Gasket

Fig. HL35 — Exploded view of early powerhead and fuel tank assemblies. Chain oil pick-up (1) and hose (2) can be removed by unscrewing check valve (3). If fuel tank is disassembled, Homelite cement, Part No. 22788, must be used to reassemble and 24 hours allowed for drying before pouring fuel into tank. Refer to Fig. HL35A for exploded view of late powerhead and fuel tank assemblies. Refer also to Fig. HL35C. Early models have 28 loose needle rollers (33) at crankpin end of rod; after Serial No. 2071277, 31 needle are used.



50. Fuel tank cap
54. Fuel tank
55. Pipe plug
56. Gasket
57. Washer
58. Flat washer
59. Spring
60. Felt washer
61. Pick-up wick
62. Stud
63. Fuel tank cover
65. Flexible line
66. Formed line
67. Elbow
68. Gasket
69. Crankcase
70. Needle bearing
71. Seal
73. Woodruff key
74. Crankshaft
75. Retaining screws (12)
76. Lock washers
77. Ball bearing
78. Snap ring
79. Needle rollers
80. Connecting rod
81. Needle bearing
82. Socket head screws
83. Piston & pin
84. Snap rings
85. Piston rings
87. Muffler cap
89. Baffle
90. Muffler body
93. Spark plug
95. Cylinder

Fig. HL35A — Exploded view of late powerhead and fuel tank assemblies. Refer also to Fig. HL35B for view showing disassembly procedure for this type engine. Refer to Fig. HL40A for drive case. Early models have 28 loose needle rollers (79) at crankpin end of rod; after serial No. 2071277, 31 needle rollers are used.

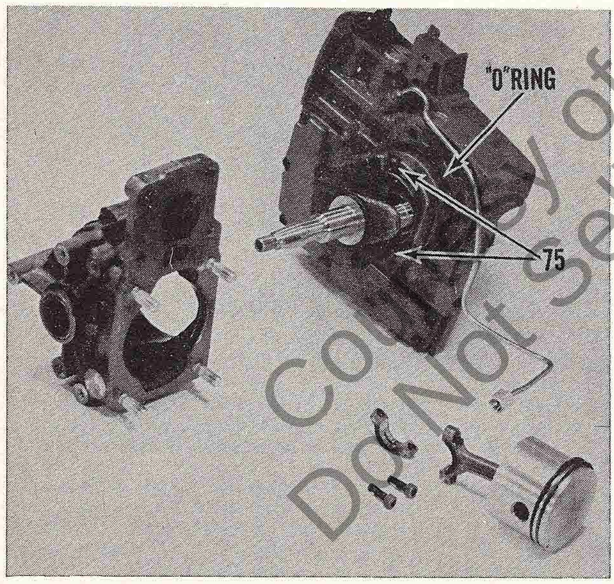


Fig. HL35B—View showing crankcase removed from drive case and crankshaft on models equipped with ball bearing at drive end of crankshaft. To remove crankshaft from drive case, bearing retaining screws (75) must first be removed.

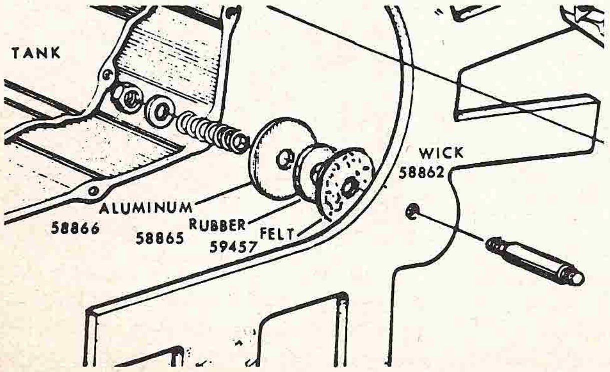


Fig. HL35C—View showing proper assembly of wick, felt washer, rubber washer and aluminum washer on pickup stud.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.0035.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and pin are available in a matched set, and are not available separately.

Piston pin on all early XL saws is retained in piston by snap rings. All late XL models and the XL-500 Automatic model have the piston pin retained in piston by a Spirol pin through the pin boss on exhaust side of piston and by a snap ring on opposite end. Disassemble piston and rod on all early XL models by removing snap rings and tapping pin out with a 3/16-inch rod as shown in Fig. HL39. Disassemble piston and rod on all late XL models and the model XL-500 Automatic by removing the snap ring and tapping pin out with the pin removing tool (Homelite No. A-23949) shown in Fig. HL39A.

When reassembling piston to connecting rod, be sure open end of piston pin is toward side of piston having piston ring retaining pin (closed end next to Spirol pin on late XL models and model XL-500 Automatic). Install piston pin snap ring with sharp side out. Rotate each snap ring to be sure it is secure in retaining groove, then turn gap in snap ring toward closed end of piston.

CRANKSHAFT. On early models, the crankshaft is supported in two caged needle roller bearings and crankshaft end play is controlled by a roller bearing and hardened steel thrust washer at each end of the shaft. Refer to Fig. HL36. On late models, flywheel end of crankshaft is supported in a needle bearing in crankcase and drive

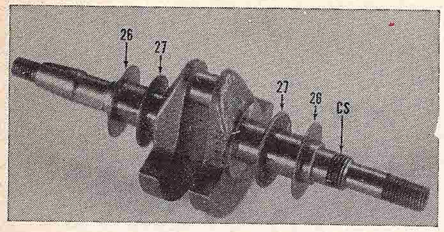


Fig. HL36—Be sure that the hardened steel thrust washers (26) are placed to outside of thrust bearings (27) when installing crankshaft on early models having two needle roller main bearings. Late models with ball bearing in drive case do not use thrust washers or thrust bearings. Threads (CS) for clutch sprocket must be covered with protector sleeve during reassembly as shown in Fig. HL38.

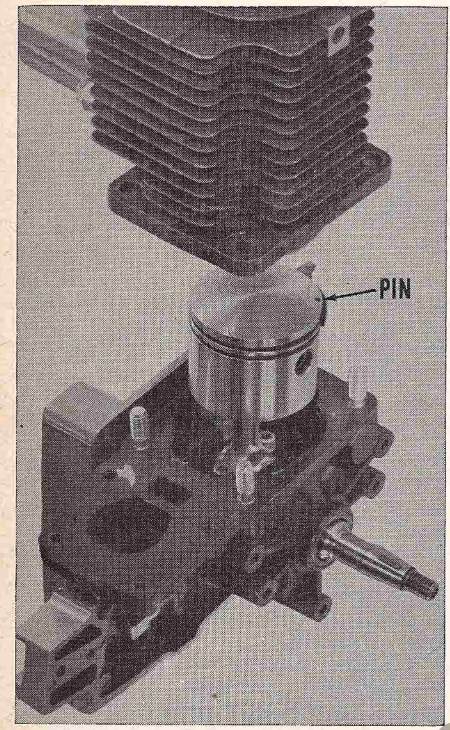


Fig. HL37—Piston and connecting rod assembly can be removed from crankpin after removing cylinder from crankcase. Note piston ring retaining pin.

end is supported in a ball bearing located in drive case; end play is controlled by the ball bearing.

Maximum allowable crankshaft end play on early models with thrust bearings (Fig. HL36) is 0.0202; renew thrust bearings if end play is excessive. Normal end play is approximately 0.010.

Renew the crankshaft if any of the main bearing, crankpin bearing or thrust bearing surfaces or sealing surfaces are scored, burned or excessively worn. On late models, renew the drivecase ball bearing if excessively loose or rough (lumpy). Also, reject crankshaft if flywheel keyway is beat out or if threads are badly damaged. Note: A different crankshaft and connecting rod are used depending on number of loose needle rollers used at crankpin bearing; refer to CONNECTING ROD paragraph.

CYLINDER. The cylinder bore is chrome plated. Renew the cylinder if chrome plating is worn away exposing the softer base metal.

CRANKCASE, DRIVE CASE AND SEALS (EARLY MODELS). The needle roller main bearings and crankshaft seals in crankcase and drive case can be renewed using Homelite tools No. 23757 and 23758. Press bearings and seals from crankcase or drive case with large stepped end of tool No. 23757, pressing towards outside of either case.

To install new needle bearings, use the shouldered short end of tool No. 23757 and press bearings into bores from inner side of either case. Press on lettered end of bearing cage only.

To install new seals, first lubricate the seal and place seal on long end of tool No. 23758 so that lip of seal will be towards needle bearing as it is pressed into place.

To install crankshaft, lubricate thrust bearings (27—Fig. HL36) and place on shaft as shown. Place a hardened steel thrust washer to the outside of each thrust bearing. Insert crankshaft into crankcase being careful not to damage seal in crankcase. Place a seal protector sleeve (See Fig. HL38) on crankshaft and large "O" ring on shoulder of drive case. Lubricate seal protector sleeve, seal and needle bearing and assemble drive case to crankshaft and crankcase. Use **NEW** drive case retaining screws. Clean the screw threads and apply Loctite to threads before installing screws. CAUTION: Be sure the screws are 9/16-inch long, and not ½ or ⅝-inch screws; the screw length is critical. Tighten the screws alternately and remove seal protector sleeve from crankshaft.

CRANKCASE, DRIVE CASE AND SEALS (LATE MODELS). Refer to Figs. HL35A and HL35B. To remove the crankshaft or drive case, disassemble engine as follows: Remove cylinder from crankcase as shown in Fig. HL37 and remove piston and connecting rod unit from crankshaft. Remove crankcase from drive case and crankshaft as shown in Fig. HL35B, remove the two main bearing retaining screws (75) and washers, then press crankshaft and main bearing from drive case. If the ball type main bearing is to be renewed, remove snap ring (78—Fig. HL35A) and press shaft from bearing. Remove oil seal (58—Fig. HL40A) from drive case.

Needle roller bearing and seal in crankcase can be renewed as outlined for early models in preceding paragraph. Install new seal in drive case with lip to inside and reassemble engine by reversing disassembly procedure. Recommended special service tools for ball bearing equipped models are as follows:

Homelite Tool No.	Description
23800	Seal assembly tool
A-23858	Crankcase to drive case assembly tool
23843	Drive case assembly tool
23844	Crankcase assembly tool
23845	Drive case assembly plug
23846	Crankshaft installation anvil
23136	Jackscrew
22820-1	Bearing collar
A-23850	Crankshaft installation sleeve

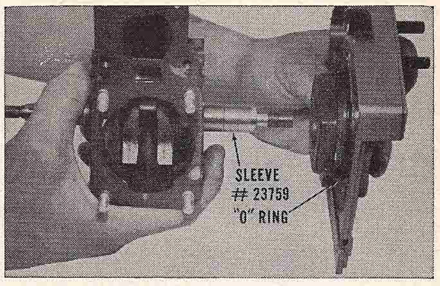


Fig. HL38 — Installing drive case on crankcase and crankshaft assembly on early model with two needle roller main bearings. Refer to Fig. HL35B for late models with ball bearing in drive case. Protector sleeve (Homelite tool No. 23759) is used to prevent damage to seal in drive case.

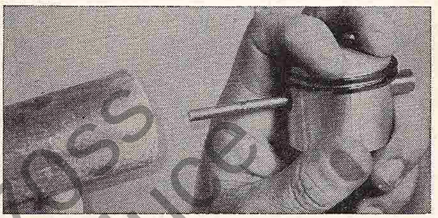


Fig. HL39 — After removing snap rings, the piston pin can be tapped out using a 3/16-inch rod as shown.

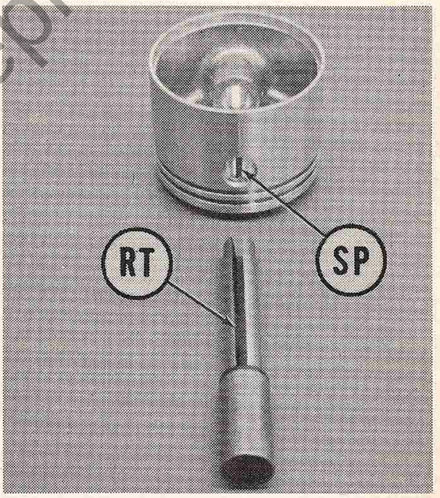


Fig. HL39A—View of model XL-500 Automatic piston and piston pin removing tool (Homelite No. 23949). Note slot in removing tool (RT) which fits over spirol pin (SP).

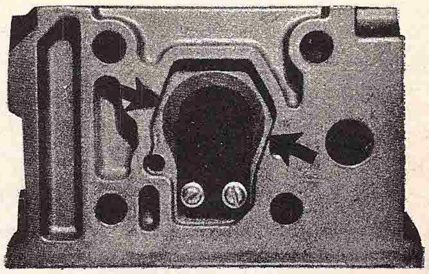
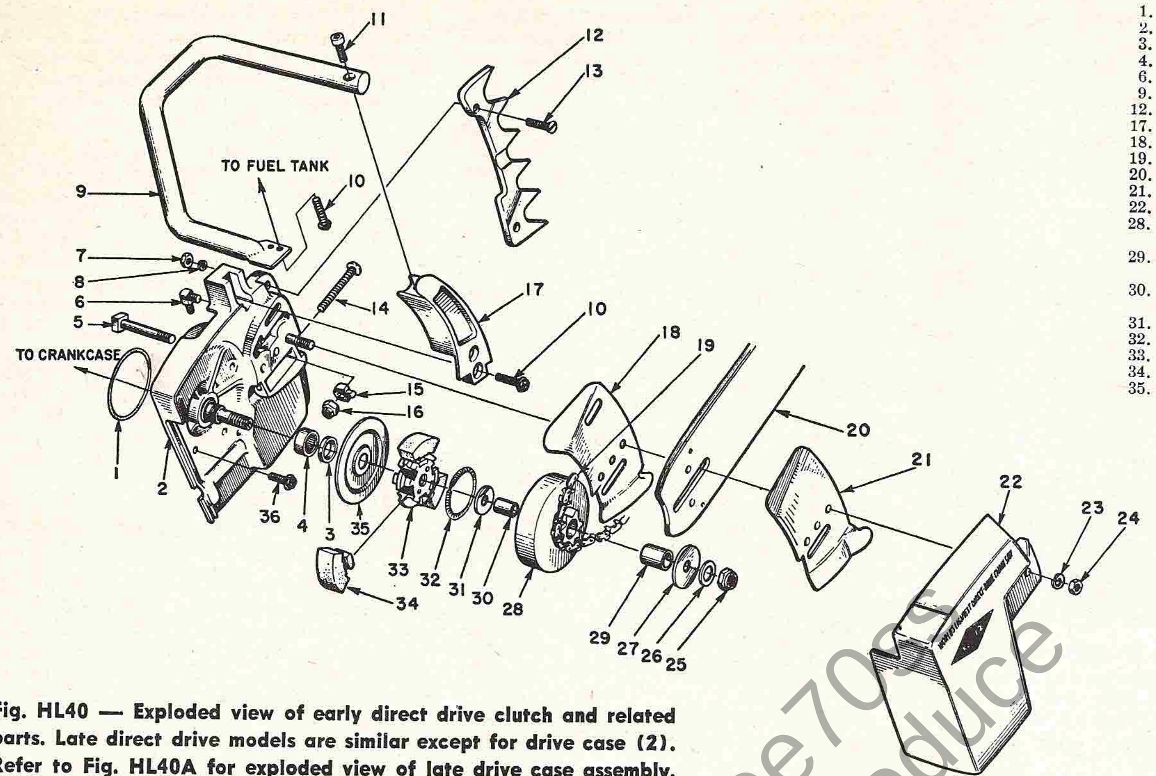


Fig. HL39B — When installing reed valve on air box (models with flat reed intake valve only), be sure reed is centered between the two points indicated by arrows.



1. "O" ring
2. Drive case
3. Crankshaft seal
4. Needle bearing
6. Oil line elbow
9. Handle bar
12. Bumper spike
17. Handle bracket
18. Guide bar plate
19. Cutting chain
20. Guide bar
21. Guide bar plate
22. Cover
28. Clutch drum & sprocket assy.
29. Bushing or needle bearing
30. Sleeve or inner race
31. Thrust washer
32. Clutch spring
33. Clutch rotor
34. Clutch shoes (3)
35. Clutch cover

Fig. HL40 — Exploded view of early direct drive clutch and related parts. Late direct drive models are similar except for drive case (2). Refer to Fig. HL40A for exploded view of late drive case assembly.

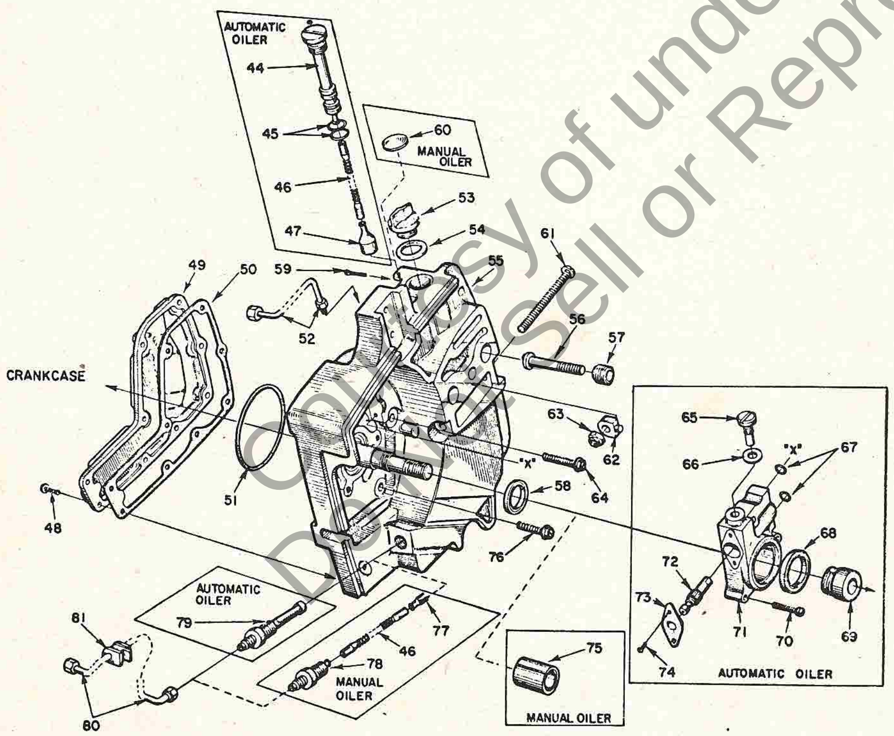


Fig. HL40A — Exploded view of late drive case assembly used on models having ball bearing main at drive end of crankshaft. Parts shown in "boxes" indicate differences between automatic chain oiler ("AO" models) and model with manual oiler pump. Refer to Fig. HL40B for schematic view showing operation of oiler pump.

44. Oil tube
45. "O" rings
46. Oil line
47. Oil filter
49. Oil tank cover
50. Gasket
51. "O" ring
52. Oil line
53. Oil filler cap
54. Gasket
55. Drive case
57. Threaded insert
58. Crankshaft seal
60. Expansion plug
62. Bar adjusting pin
65. Cam screw
66. Gasket
67. "O" ring
68. Felt seal
69. Worm gear
71. Oil pump housing
72. Plunger & gear
73. Flanged bearing
75. Spacer
77. Oil filter
78. Connector
79. Filter & connector
80. Oil line
81. Grommet

FLAT REED VALVE. The reed valve is attached to the carburetor air box as shown in Fig. HL30, and is accessible after removing air box from crankcase.

Check the reed seating surface on air box to be sure it is free of nicks, chips or burrs. Renew valve reed if rusted, pitted or cracked, or if it does not seat flatly against its seat.

The reed stop is curved so that measurement of reed lift distance is not practical. However, be sure that reed is centered over opening in air box and reed stop is aligned

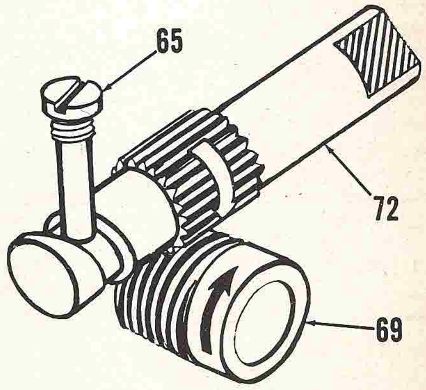


Fig. HL40B — Schematic view showing automatic oil pump operation. Worm gear (69) driven by crankshaft turns plunger and gear (72) at 1/20 engine speed. As plunger turns, cam on end of plunger which engages cam screw (65) causes the plunger to go back and forth. Flat on other end of plunger acts as inlet and outlet valve as it uncovers intake on suction stroke and outlet on pressure stroke.

with reed as shown in Fig. HL39B. Clean the screw threads and apply Loctite to threads before installing screws.

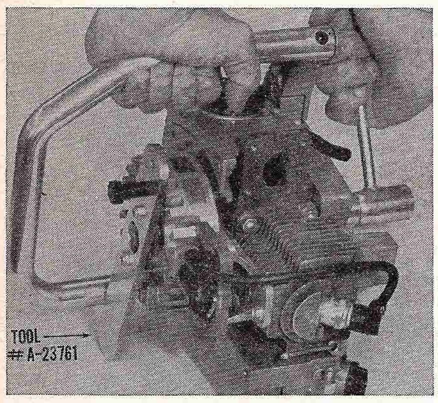


Fig. HL41 — Using Homelite tool No. A-23761 to keep crankshaft from turning while removing clutch retaining nut and clutch rotor. Homelite tool No. A-23696 is used to remove or install clutch rotor.

NOTE: If air box has been removed to service reed valve, inspect gasket (43—Fig. HL35) between air box and crankcase. If gasket is damaged and cylinder is not being removed for other purposes, it is suggested that the exposed part of the old gasket be carefully removed and the new gasket be cut to fit between the air box and crankcase. Also, refer to note in CARBURETOR paragraph in MAINTENANCE section.

PYRAMID REED VALVE. Models as indicated in model listing are equipped with pyramid type reed intake valve assembly (3, 4, 5 & 6—Fig. HL30A). The pyramid reed assembly can be removed by unbolting and removing the carburetor from air box.

Renew reeds if cracked or warped. Renew seat if worn. Be sure the reeds are centered over opening in seat and apply Loctite to reed retaining screws to keep them from working loose. Renew the spacer gaskets (1) and carburetor gasket (8) when reinstalling pyramid reed valve assembly and carburetor.

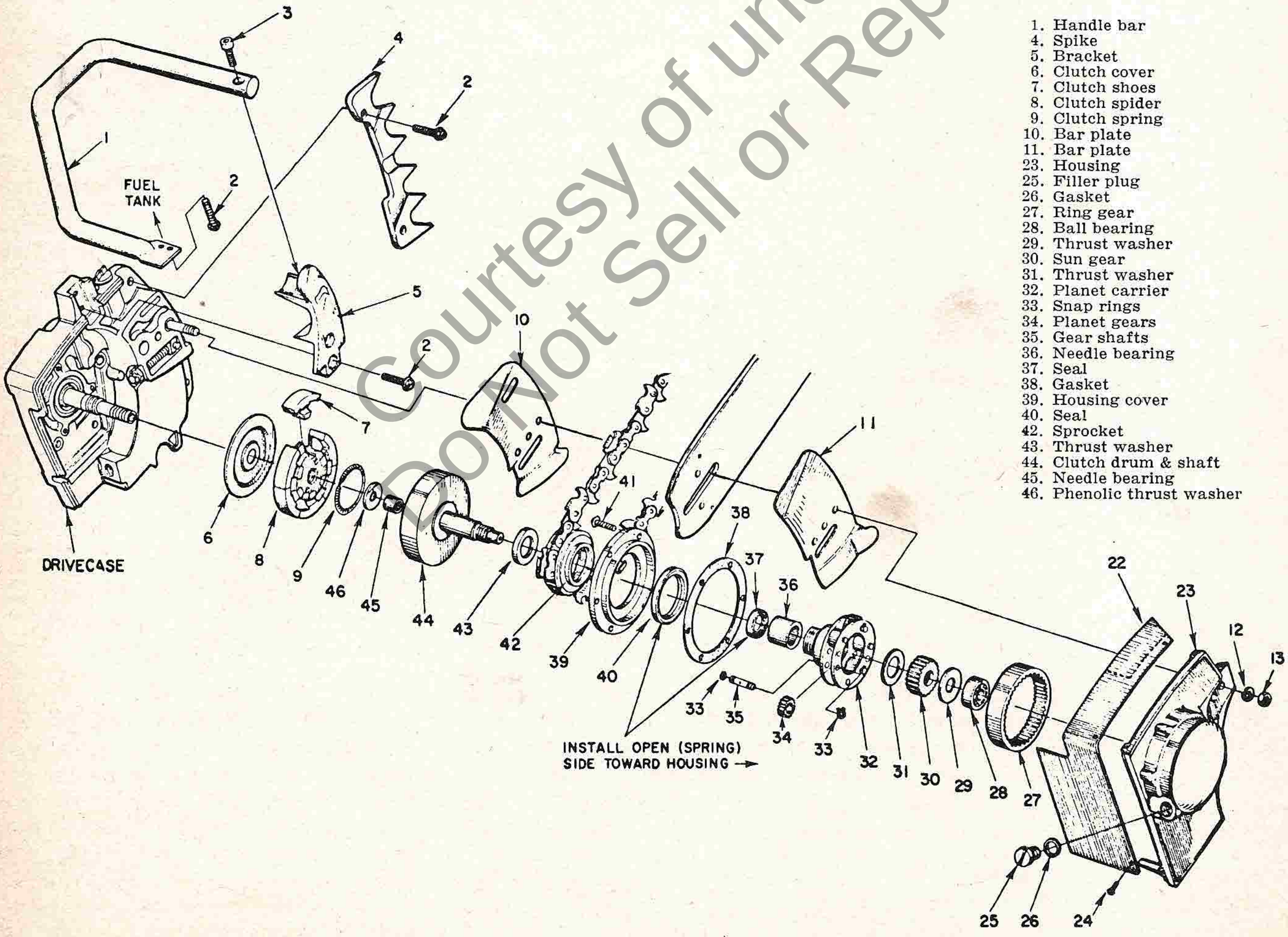
CLUTCH. Refer to Fig. HL40 for exploded view of the shoe type clutch. The clutch rotor (spider) is threaded to the crankshaft and can be removed as shown in Fig. HL41.

If clutch slips with engine running at high speed under load, check for excessive wear of clutch shoes. If the clutch will not disengage (chain continues to turn) with engine running at idle speed, check for broken, weak, distorted or improperly installed clutch springs.

The Oilite bushing (29—Fig. HL40) in the clutch drum (28) of early models can be renewed if the drum and chain sprocket are otherwise serviceable. Long end of Homelite tool No. 23760 can be used to remove old bushing; place new bushing on short end of tool and carefully press bushing into place. Renew bushing sleeve (30) on crankshaft if worn or scored. Late clutch drums are equipped with needle bearing instead of bushing and can be installed on early models by installing needle bearing inner race in place of bushing sleeve (30). To install new needle bearing in clutch drums so equipped, use Homelite tool No. 23760.

TRANSMISSION. Gear drive models are equipped with a planetary gear drive as shown in exploded view in Fig. HL41A.

To disassemble gear drive unit, drain oil from housing and remove screws (41); then, pull unit from housing (23). Hold drum (44) from turning by hand or in a three-jaw chuck and turn sun gear (30) in a clockwise direction with Homelite tool No. A-23696 or suitable spanner wrench. Insert two ¼ x 2 inch dowel pins in carrier (32), hold chain



1. Handle bar
4. Spike
5. Bracket
6. Clutch cover
7. Clutch shoes
8. Clutch spider
9. Clutch spring
10. Bar plate
11. Bar plate
23. Housing
25. Filler plug
26. Gasket
27. Ring gear
28. Ball bearing
29. Thrust washer
30. Sun gear
31. Thrust washer
32. Planet carrier
33. Snap rings
34. Planet gears
35. Gear shafts
36. Needle bearing
37. Seal
38. Gasket
39. Housing cover
40. Seal
42. Sprocket
43. Thrust washer
44. Clutch drum & shaft
45. Needle bearing
46. Phenolic thrust washer

Fig. HL41A — Exploded view of planetary transmission used on gear drive models. Refer to Fig. HL40A for exploded view of drive case.

sprocket from turning (use of Homelite sprocket locking fixture No. A-23713 for 0.404 pitch sprockets or A 23792 for ⅜-inch pitch sprockets is suggested) and turn planet carrier in a counter-clockwise direction with pry-bar against the dowel pins.

Planet gears (34) and shafts (35) can be removed from carrier (32) after removing snap rings (33).

Needle bearing (45) can be removed from blind hole in clutch drum (44) with Snap-On puller A-78 or equivalent tool. Press on lettered end of bearing cage with Homelite tool No. 23726-A or other suitable bearing tool to install new bearing in drum. Needle bearing (36) and seal (37) in planet gear (32) can be pressed from gear with Homelite tool No. 23725-A; press new bearing in from threaded side of gear with short end of tool No. 23725-A and press new seal in with lip towards needle bearing with Homelite tool No. 23726-A.

To remove ball bearing (28) and ring gear (27) from housing (23), heat finned area of housing until bearing can be removed by tapping housing against bench. Then, heat housing until ring gear can be removed. Always be sure to remove bearing first and install last with as little heat as possible.

Reassemble by reversing disassembly sequence. Refill gear housing with SAE 90 gear oil.

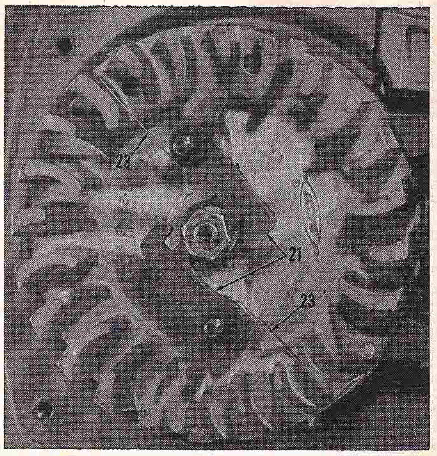


Fig. HL43 — When installing starter pawls (21), be sure that pawl return springs (23) are located in flywheel vanes so that they are parallel to the pawls as shown.

1. Ground wire
2. Ignition switch
6. Blower (fan) housing
7. Bushing
8. Starter rope
9. Hand grip
10. Insert
11. Rewind spring
12. Rope pulley
13. Starter cup
14. Washer
15. Socket head screw
16. Flywheel nut
17. Lock washer
18. Flat washer
20. Pawl studs
21. Pawls
22. Washers
23. Pawl springs
24. Rotating screen
25. Flywheel

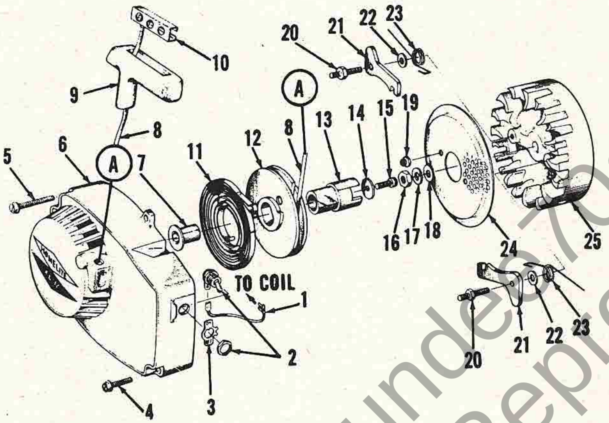


Fig. HL42 — Exploded view of early rewind starter components and related parts. Starter unit is mounted on shaft (starter post) which is an integral part of the blower housing. Refer to Fig. HL42A for late starter assembly.

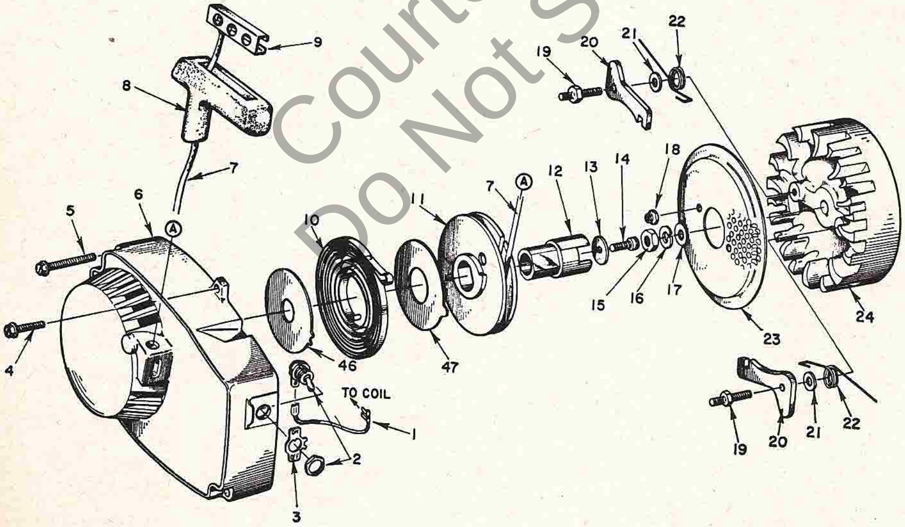


Fig. HL42A — Exploded view of late rewind starter and related parts. Plastic shields (46 and 47) keep sawdust out of rewind spring (10) and dampen noise.

1. Ground wire	11. Rope pulley	16. Lock washer	21. Washers
2. Ignition switch	12. Starter cup	17. Flat washer	22. Pawl springs
6. Blower (fan) housing	13. Washer	18. Lock nut	23. Rotating screen
7. Starter rope	14. Socket head screw	19. Pawl studs	24. Flywheel
10. Rewind spring	15. Flywheel nut	20. Pawls	

REWIND STARTER (EARLY). To disassemble starter, refer to exploded view in Fig. HL42 and proceed as follows: Pull starter rope out fully, hold pulley (12), and pry rope knot from pulley. Let pulley rewind slowly. Hold pulley while removing screw (15), washer (14) and starter cup (13). Turn pulley counter-clockwise until disengaged from spring, then carefully lift pulley off of starter post. Remove the bushing (7), if so equipped, and turn open side of housing down and rap housing sharply against top of work bench to remove spring. CAUTION: Be careful not to dislodge spring when removing pulley and bushing as the rapidly uncoiling spring could cause injury.

Install new spring with loop in outer end over pin in blower housing and be sure spring is coiled in direction shown in Fig. HL42. Install bushing (7), if so equipped, and pulley (12), turning pulley clockwise until it engages spring. Install starter cup (13) and secure with washer and screw. Insert new rope through handle and hole in blower housing. Knot both ends of the rope and harden the knots with heat or cement. Turn pulley clockwise eight turns and slide knot in rope into slot and keyhole in pulley. Let starter pulley rewind slowly. Note: If not equipped with separate starter post bushing (7), late production plastic spring shields (46 & 47—Fig. HL42A) may be installed. Refer to following paragraph on late type starter.

Refer to Fig. HL43 for starter pawl and pawl spring installation. Pull starter rope slowly when installing blower housing so that starter cup will engage pawls.

REWIND STARTER (LATE). Exploded view of late production starter is shown in Fig. HL42A. Service on the late type starter is similar to that outlined for early production starter in preceding paragraph except that plastic shields (46 and 47) are installed at each side of spring (10).

HOMELITE
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MODELS	Bore	Stroke	Displacement	Drive Type
C-5, C-51	2	1 1/2	4.7	Direct
C-7, C-71	2	1 9/16	4.91	Direct
C-9, C-91	2 1/16	1 9/16	5.22	Direct
C-51G	2	1 1/2	4.7	Gear
C-71G	2	1 9/16	4.91	Gear
C-91G	2 1/16	1 9/16	5.22	Gear
XP-1000	2 3/16	1 5/8	6.11	Direct
XP-1020	2 3/16	1 5/8	6.11	Direct
XP-1020 Automatic	2 3/16	1 5/8	6.11	Direct
XP-1100	2 3/16	1 5/8	6.11	Gear
XP-1130	2 3/16	1 5/8	6.11	Gear

Homelite C Series direct drive chain saws are convertible to planetary gear drive in the field to suit the needs of the operator. Models C-51G, C-71G and C-91G are same as Models C-51, C-71 and C-91 except they are equipped with planetary gear drive. Models XP-1100 and XP-1130 are equipped with a spur gear drive unit. Models C-5, C-7 and C-9 are equipped with a Fairbanks-Morse starter; C-51, C-71, C-91, XP-1000, XP-1100 and early XP-1020 and XP-1130 models are equipped with an overrunning bearing starter. All late XP models (after serial No. 2359238) have a ratchet type starter.

MAINTENANCE

SPARK PLUG. Recommended spark plug for normal use on models C-5, C-7, C-51, C-71, C-51G and C-71G is a Champion J-6J or equivalent. On models C-9, C-91, C-91G, XP-1000 and XP-1100, use a Champion HO-8A spark plug. Models XP-1020, XP-1020 automatic and XP-1130 are equipped with a Champion CJ-6 (Bantam) spark plug. For all models in extremely cold weather (below 0° F.), a Champion UJ-12 spark plug can be used to prevent cold fouling. Set electrode gap to 0.025.

CARBURETOR: (Except Models XP-1020, XP-1020 Automatic and XP-1130). Early model C-5 saws were equipped with a Tillotson HL-141A carburetor. Late production C-5 saws and all other C models are equipped with a Tillotson HL-141B carburetor. The XP-1000 and XP-1100 models are equipped with a Tillotson HL-197A or HL-197B carburetor. Refer to Fig. HL51 for exploded view of carburetor. NOTE: If air filter cover gasket (5—Fig. HL51B or HL51C) is damaged when cover is removed to service carburetor or air filter element, install new gasket as follows: Carefully remove old gasket from air box and be sure that surface is free of all saw dust, oil, etc. Apply "3M" cement to new gasket, and carefully place gasket adhesive side down, on lip around carburetor chamber. Note: Latest air filter element has integral gasket: Remove old gasket from air box when installing late type element.

NOTE: Service carburetor will have idle speed adjusting screw (29—Fig. HL51) installed in carburetor body. When installing new service carburetor on models having idle speed adjusting screw installed in air box, remove the screw and spring from air box and plug the hole with a special screw (Homelite part No. 71505). Note: Installation of internal adjusting screw (29) and spring (30) in existing carburetor is also recommended.

When servicing carburetor, note that the main fuel adjustment needle is identified by a groove cut in the shank of the needle.

For initial carburetor adjustment, open both the idle and main fuel adjustment needles ½ to ¾-turn each. Back idle speed stop screw out away from stop on throttle shaft arm; then, turn screw back in until it contacts stop plus ¾-turn additional.

With engine warm and running, set idle fuel adjustment needle so that engine idles smoothly. Set the idle speed stop screw so that engine idles just below clutch engagement speed. Check engine for proper acceleration and open idle fuel adjustment needle slightly as needed for good accleration. Adjust main fuel needle with engine loaded by cutting wood so that engine will run at highest speed obtainable without excessive smoke.

CARBURETOR (MODELS XP-1020, XP-1020 AUTOMATIC AND XP-1130. Refer to Fig. HL51A for exploded view of Tillotson model HL-222A diaphragm carburetor with accelerator pump that is used on models XP-1020, XP-1020 Automatic and XP-1130. No idle speed stop screw is used with this carburetor as idle air is adjusted by screw

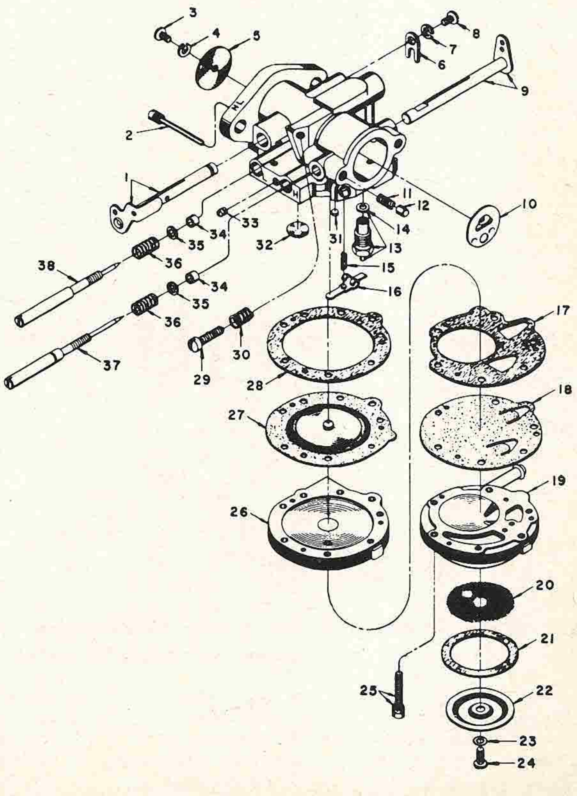


Fig. HL51 — Exploded view of a typical Tillotson Series HL carburetor used on all models except XP-1020, XP-1020 automatic and XP-1130; refer to Fig. HL51A for carburetor used on these models.

1. Throttle shaft
2. Diaphragm lever pin
5. Throttle disc
6. Retainer
9. Choke shaft
10. Choke disc
11. Spring
12. Choke detent
13. Fuel inlet valve
14. Sealing washer
15. Spring
16. Diaphragm lever
17. Gasket
18. Pump diaphragm
19. Pump body
20. Fuel screen
21. Gasket
22. Cover
26. Diaphragm cover
27. Fuel diaphragm
28. Gasket
29. Idle speed stop screw
30. Spring
31. Plug
32. Plug
33. Screw plug
34. Packing
35. Packing washer
36. Spring
37. Main fuel needle
38. Idle fuel needle

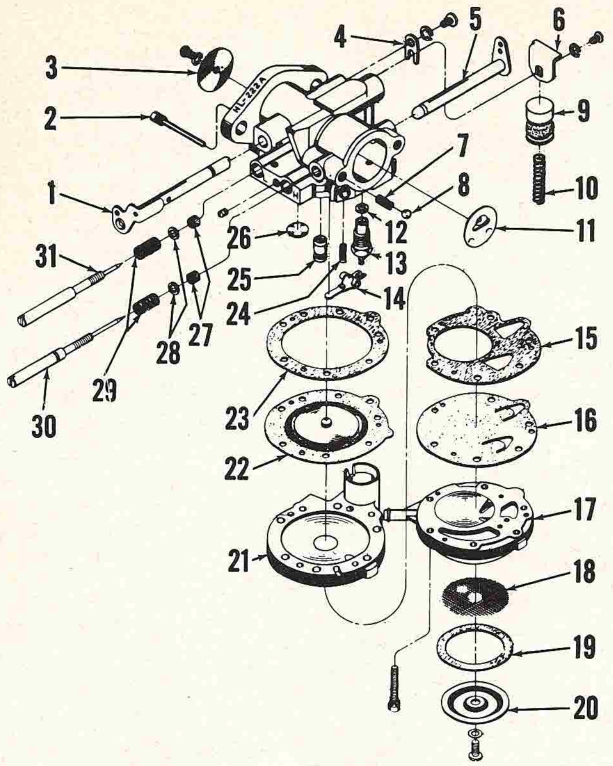


Fig. HL51A — Exploded view of Tillotson model HL-222A diaphragm carburetor with accelerator pump that is used on models XP-1020, XP-1020 Automatic and XP-1130. No idle speed stop screw is used as idle air is adjusted by screw (5—Fig. HL51D) in intake manifold.

1. Throttle shaft
2. Diaphragm lever pin
3. Throttle disc
4. Retainer
5. Choke shaft
6. Accelerator cam
7. Detent spring
8. Choke detent ball
9. Accelerator piston
10. Piston return spring
11. Choke disc
12. Sealing washer
13. Fuel inlet valve & seat
14. Diaphragm lever
15. Gasket
16. Pump diaphragm
17. Pump body
18. Fuel screen
19. Gasket
20. Cover
21. Diaphragm cover
22. Fuel diaphragm
23. Gasket
24. Lever spring
25. Check-valve
26. Expansion plug
27. Packing
28. Washers
29. Springs
30. Main fuel needle
31. Idle fuel needle

(5—Fig. HL51D) in intake manifold (elbow). The idle air screw (5) has left hand thread and is opened by turning it clockwise.

For initial carburetor adjustment, turn the fuel mixture adjustment needles clockwise and the air screw counter-clockwise until just seated, then open both fuel mixture needles one turn (counter-clockwise) and the air screw ⅜-turn (clockwise).

Make final adjustment with engine running and at operating temperature. Adjust the idle fuel (LO) needle to obtain fastest engine slow idle speed. Then, turn the idle air screw in (counter-clockwise) to decrease idle speed or out (clockwise) to increase idle speed to obtain an idle speed of 2500-2600 RPM. Readjust idle fuel (LO) needle if necessary.

NOTE: The clutch should engage only when engine speed exceeds 2600 RPM. If chain rotates when idle speed is below 2600 RPM, the clutch should be serviced.

Adjust the main fuel (HI) needle while cutting wood to obtain highest engine speed without excessive smoke. A slightly rich mixture insures against overheating of engine and provides better engine lubrication.

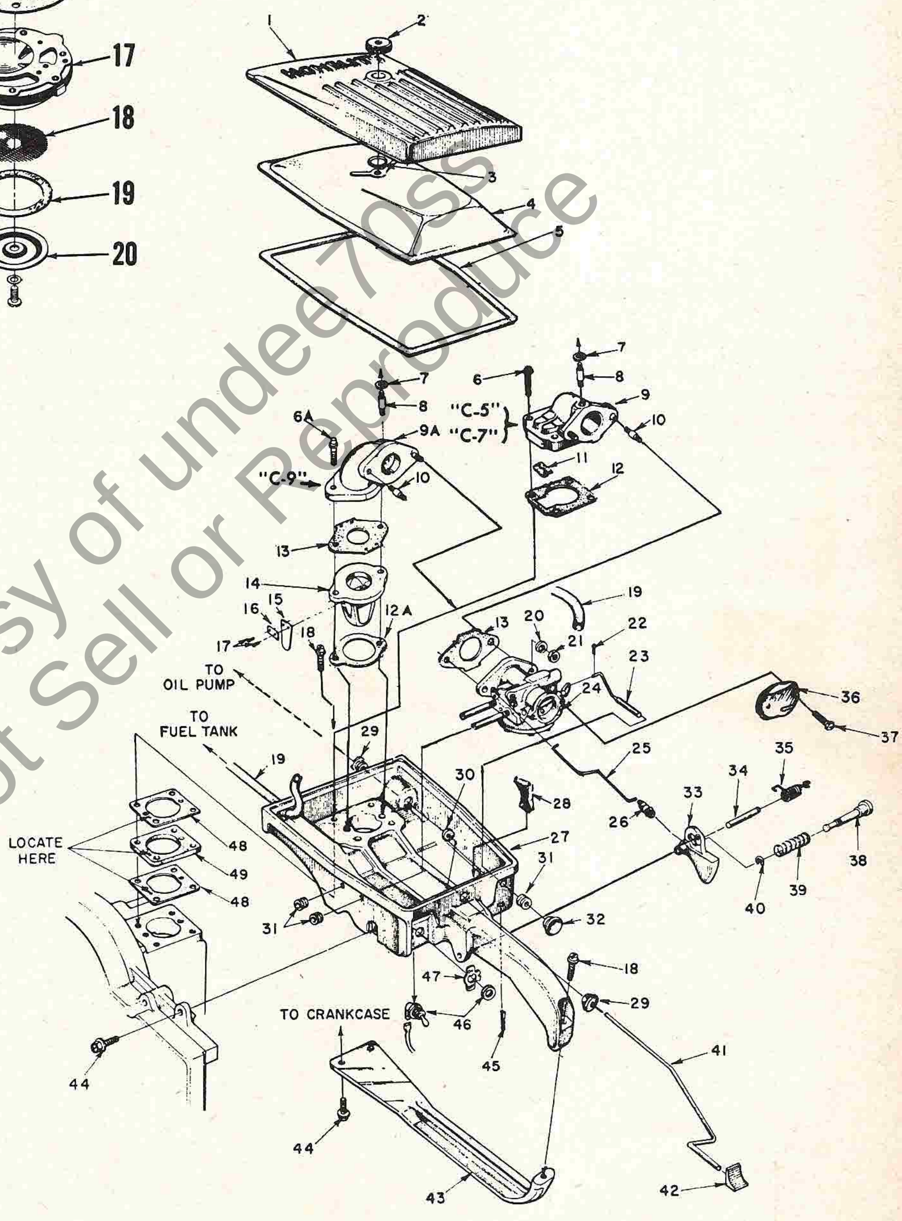


Fig. HL51B Exploded view of C-Series air box assembly (throttle handle) and related parts. Models C-5, C-51 and C-71 have integral elbow (9) and reed valve unit. Models C-9 and C-91 are equipped with pyramid type reed valve assembly (14, 15, 16 & 17). Air deflector (36) is used on late production Models C-7 and C-9 and can be installed on earlier production C-7 and C-9 units if clearance in air box is adequate and by installing new oil pump rod (41). Nylon pump rod bushing (29) and stop (28) fit only late production air box (throttle handle). Filler block (11) is used with C-51, C-71 and late production C-5 and C-7 elbow and reed valve assembly (9) only. Some models may have external idle speed adjusting screw (refer to 29—Fig. HL51C).

1. Air filter cover
4. Filter element
5. Gasket
9. Elbow & Valve assy.
9A. Elbow
11. Filler block
12. Gasket (C-5 & C-7)
12A. Gasket (C-9)
13. Gasket
14. Reed seat (C-9)
15. Valve reeds (4)
16. Reed plates (4)
17. Screws (8)
19. Fuel line
23. Choke rod
24. Carburetor
25. Throttle rod
26. Grommet
27. Air box (throttle handle)
28. Stop
29. Nylon bushing
30. Felt washer
31. Grommets
32. Choke button
33. Throttle trigger
35. Throttle spring
36. Air deflector
38. Throttle detent
39. Spring
41. Pump rod
46. Ignition switch
48. Gaskets
49. Spacer

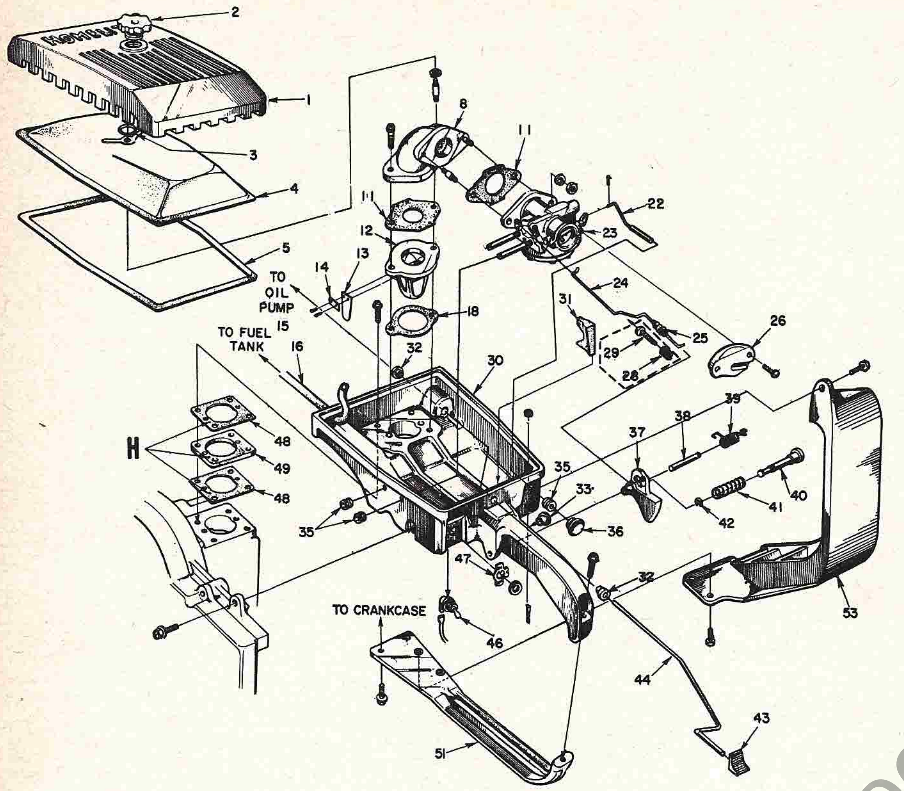


Fig. HL51C—Exploded view of air box assembly for models XP-1000 and XP-1100. External idle speed adjustment screw (29) and spring (28) should be removed on models so equipped, the hole in air box be plugged and an idle speed screw (29—Fig. HL51) and spring (30) be installed on carburetor; refer to text. Align holes (H) in gaskets (48) and spacer (49) with holes in air box and crankcase.

1. Cover
2. Knob
3. Retainer
4. Filter
5. Gasket
8. Elbow
11. Gaskets
12. Reed valve seat
13. Reed valves
14. Retainer
16. Fuel tube
18. Gasket
22. Choke rod
23. Carburetor
24. Throttle rod
25. Grommet
26. Air deflector
28. Spring
29. Idle speed screw
30. Air box
31. Stop
32. Grommet
33. Bushing
35. Grommets
36. Choke button
37. Throttle trigger
38. Pivot pin
39. Return spring
40. Lock pin
41. Spring
42. Snap ring
43. Oiler button
44. Oiler rod
46. Ignition switch
47. On-off plate
48. Gaskets
49. Spacer
51. Brace
53. Muffler shield (XP-1100)

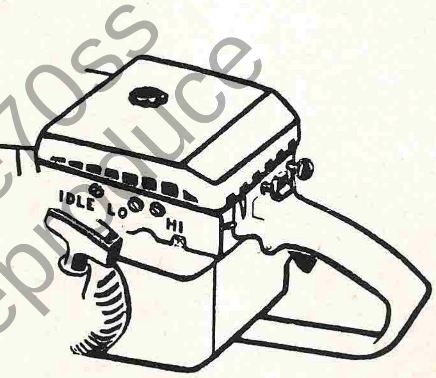


Fig. HL51E—View showing carburetor adjustment points for models XP-1020, XP-1020 Automatic and XP-1130. Refer to exploded view in Fig. HL51D for view showing idle adjusting screw (5), spring (6) and intake manifold (9).

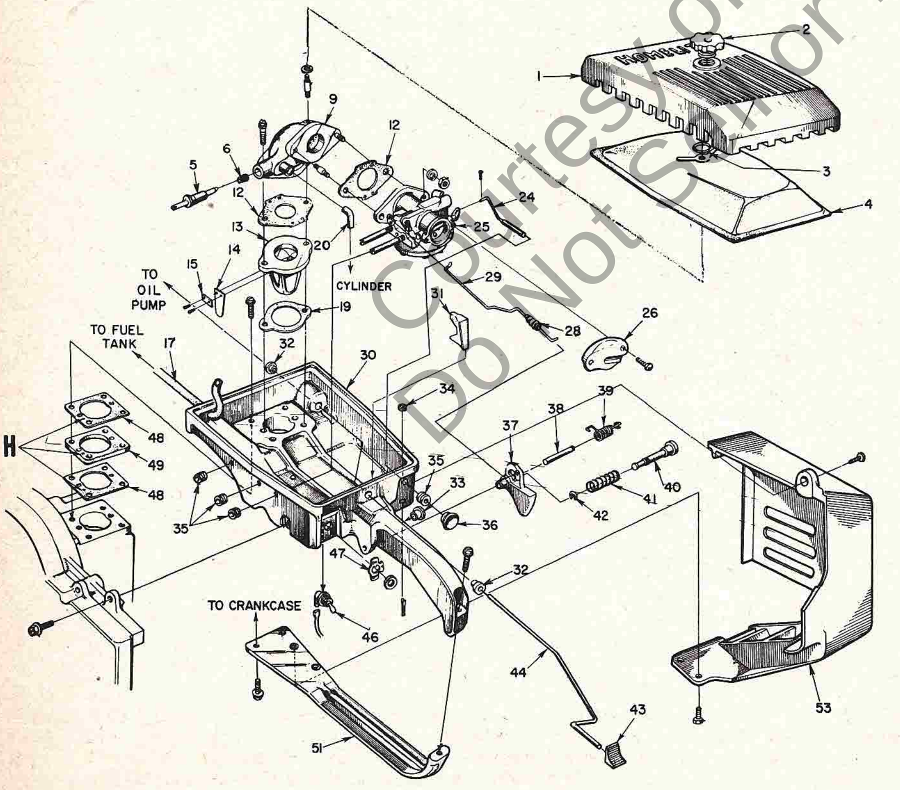


Fig. HL51D—Exploded view of air box assembly for models XP-1020, XP-1020 Automatic and XP-1130. Note idle air (speed) adjusting screw (5) in elbow (intake manifold) (9). Tube (20) is connected between intake manifold and cylinder transfer port. Align holes (H) in gaskets (48) and spacer (49) with holes in air box and crankcase as shown. Air filter element (4) has integral air box sealing gasket.

- H. Holes
1. Cover
2. Cover knob
3. Retainer
4. Air filter
5. Idle air screw
6. Spring
9. Intake manifold
12. Gaskets
13. Reed valve seat
14. Reed valves
15. Retainers
19. Gasket
20. Idle air tube
24. Choke rod
25. Carburetor
26. Air deflector
28. Grommet
29. Throttle rod
30. Air box
31. Stop
32. Grommet
33. Bushing
34. Felt
35. Grommets
36. Choke button
37. Throttle trigger
38. Pivot pin
39. Return spring
40. Lock pin
41. Spring
42. Snap ring
43. Oiler button
44. Oiler rod
46. Ignition switch
47. On-off plate
48. Gaskets
49. Spacer
51. Brace
53. Muffler shield

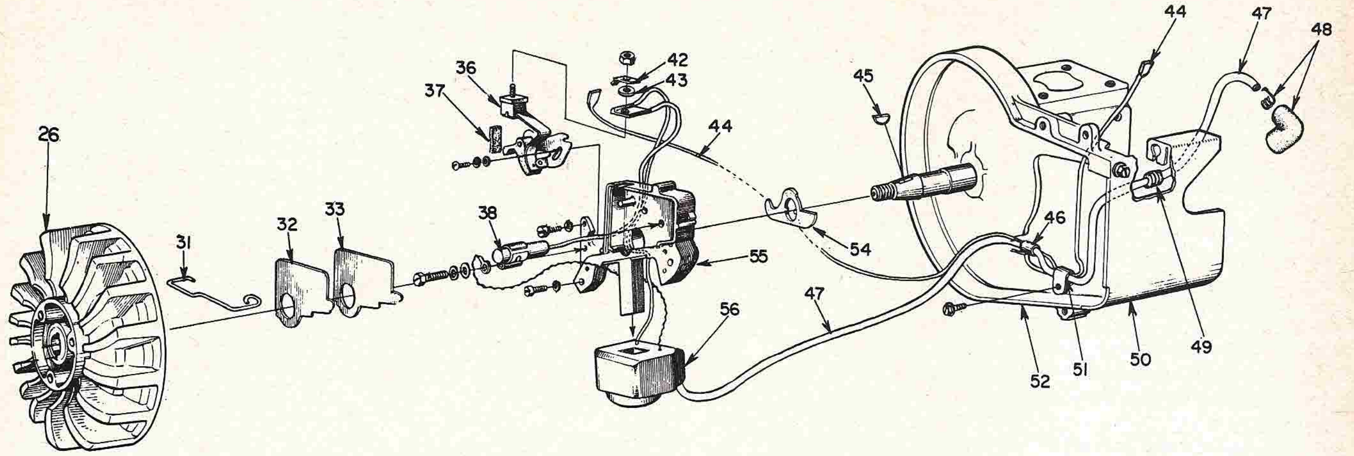


Fig. HL52—Exploded view of typical Phelon magneto used on C-Series chain saws. Rotor (flywheel) will differ in design according to type of starter used; refer to REWIND STARTER paragraph in repair section.

26. Rotor
31. Retainer
32. Breaker box cover
33. Gasket
36. Breaker points
37. Cam wiper
38. Condenser
42. Ground tab
43. Terminal washer
44. Switch lead
45. Rotor key
46. Sleeve
47. Spark plug wire
48. Terminal
49. Grommet
50. Cylinder shield
51. Clamp
52. Crankcase
54. Seal
55. Breaker box & core
56. Ignition coil

MAGNETO AND TIMING. All saws are equipped with a Phelon flywheel type magneto. Refer to Fig. HL52 for exploded view of magneto.

Timing is correct when stator plate (breaker box) is turned as far clockwise as possible before tightening mounting screws and breaker point gap is adjusted to specified value.

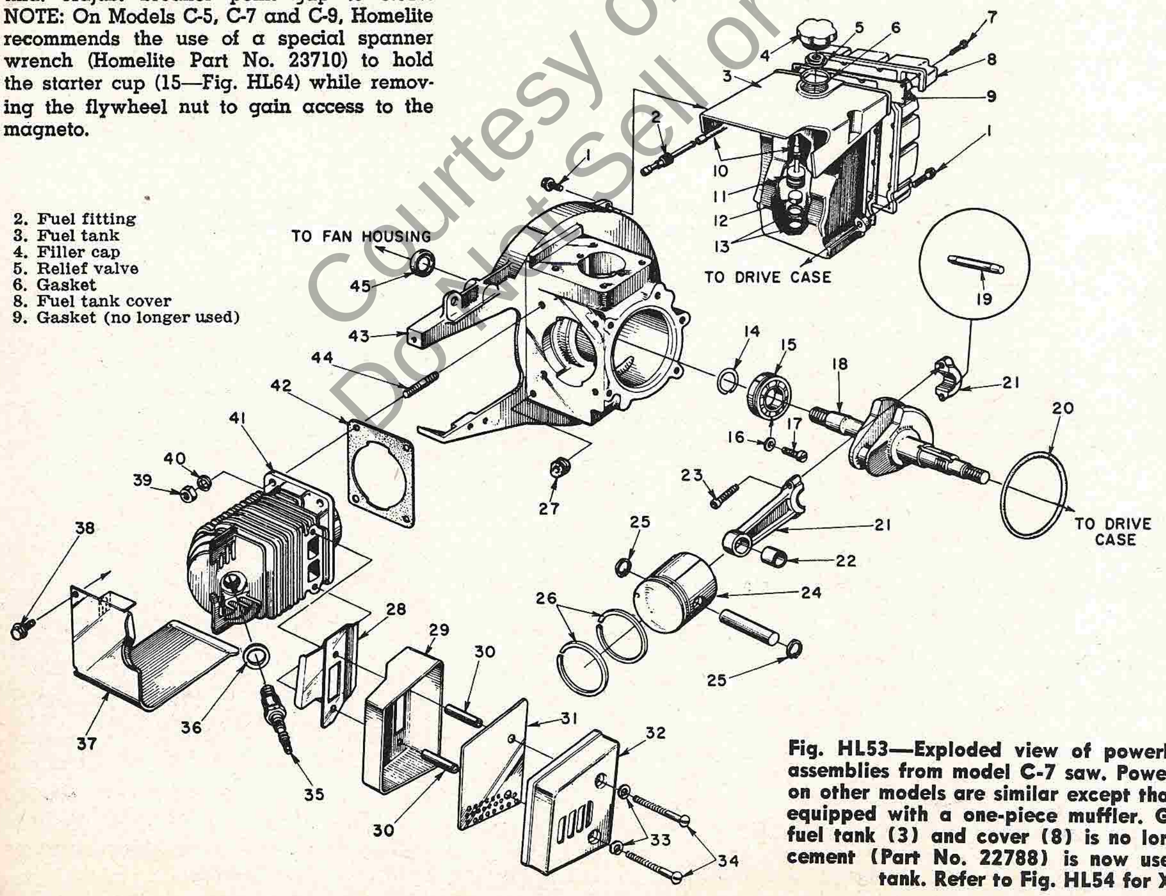
Condensor capacity should be 0.18-0.22 mfd. Adjust breaker point gap to 0.015. NOTE: On Models C-5, C-7 and C-9, Homelite recommends the use of a special spanner wrench (Homelite Part No. 23710) to hold the starter cup (15—Fig. HL64) while removing the flywheel nut to gain access to the magneto.

LUBRICATION. Engine is lubricated by mixing oil with fuel. Mix thoroughly in a separate container ½-pint of Homelite motor oil or good grade SAE 30 motor oil with each gallon of regular gasoline (16:1 mixture).

Fill chain oil reservoir with Homelite Bar and Chain oil or a light oil (up to SAE 30 motor oil).

The planetary drive assembly or the clutch drum and sprocket assembly should be removed and the needle bearing in the clutch drum lubricated occasionally.

Check oil level in gear drive after each day of use. With saw setting on level surface, oil should be level with filler cap opening. Drain and flush gearcase with kerosene after each 100 hours of use. Refill with Homelite SAE 90 gear oil.



2. Fuel fitting
3. Fuel tank
4. Filler cap
5. Relief valve
6. Gasket
8. Fuel tank cover
9. Gasket (no longer used)

10. Flexible hose
11. Fuel pick-up
12. Fuel filter
13. Bumpers
14. Snap ring
15. Ball bearing
16. Lock washers (2)
17. Screws (2)
18. Crankshaft
19. Needle rollers (27)
20. "O" ring
21. Connecting rod
22. Needle bearing
24. Piston & pin assy.
25. Snap rings (2)
26. Piston rings
27. Grommet (Sleeve now used)
28. Air deflector
29. Muffler body
31. Baffle
32. Muffler cap
35. Spark plug
41. Cylinder
42. Gasket
43. Crankcase
45. Seal

Fig. HL53—Exploded view of powerhead and fuel tank assemblies from model C-7 saw. Powerhead and fuel tank on other models are similar except that C-5 and C-51 are equipped with a one-piece muffler. Gasket (9) between fuel tank (3) and cover (8) is no longer used; Homelite cement (Part No. 22788) is now used to seal cover to tank. Refer to Fig. HL54 for XP models.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and scrape free of carbon. With muffler removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with a wooden scraper. Be careful not to damage edges of the exhaust ports or to scratch piston. **Do not** run engine with muffler removed.

REPAIRS

CONNECTING ROD. Connecting rod and piston assembly can be removed from crankpin after removing cylinder from crankcase. Be careful to remove all the loose needle rollers from crankcase.

The C model saws are equipped with 27 rollers whereas the XP models have 31 rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. Latest connecting rods are 1/16-inch wider than early rods (at piston pin end). The caged needle roller piston pin bearing can be renewed by pressing old bearing out of rod and pressing new bearing in. On C series saws use Homelite special tool No. 23234 or equivalent to install early type needle bearing in early type rod, or Homelite tool A-23951 to install late type needle bearing. Press on lettered end of bearing cage only. On XP models, use Homelite tool 23874 to install needle bearing.

Renew the crankpin needle rollers as a set if any roller has flat spots, or is scored or worn. New needle rollers are serviced in a strip; wrap the strip around crankpin. If reusing needle rollers, use beeswax or light grease to stick rollers to rod and cap. Install piston and rod assembly with ring retaining pin in piston away from exhaust port side of cylinder. Be sure that match marks on rod and cap are aligned and secure rod to cap with new socket head screws.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.004.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and piston pin are available as a matched set only.

Piston pin is retained in piston by snap rings on C-Series and models XP-1000 and XP-1100. On models XP-1020, XP-1020 Automatic and XP-1130, pin is retained by a Spirol pin and one snap ring. Disassemble piston and rod assembly by removing snap ring or rings and pushing pin out using Homelite tool No. A-23950.

NOTE: On late production pistons, pin is retained by a plain square end snap ring at exhaust side and by a Waldes Truarc snap ring at intake side. The Waldes Truarc snap ring has a hole in each end so the ring can be removed using special Waldes pliers; no attempt should be made to remove the plain square end snap ring. To remove the piston pin, remove the Waldes Truarc snap ring, then insert a $\frac{3}{16}$-inch dia. rod through the plain snap ring and drive pin from piston.

When reassembling piston to connecting rod, install new snap ring or rings with sharp side of ring out. Rotate each snap ring to be sure it is secure in retaining groove; then, turn gap in snap ring towards closed end of piston.

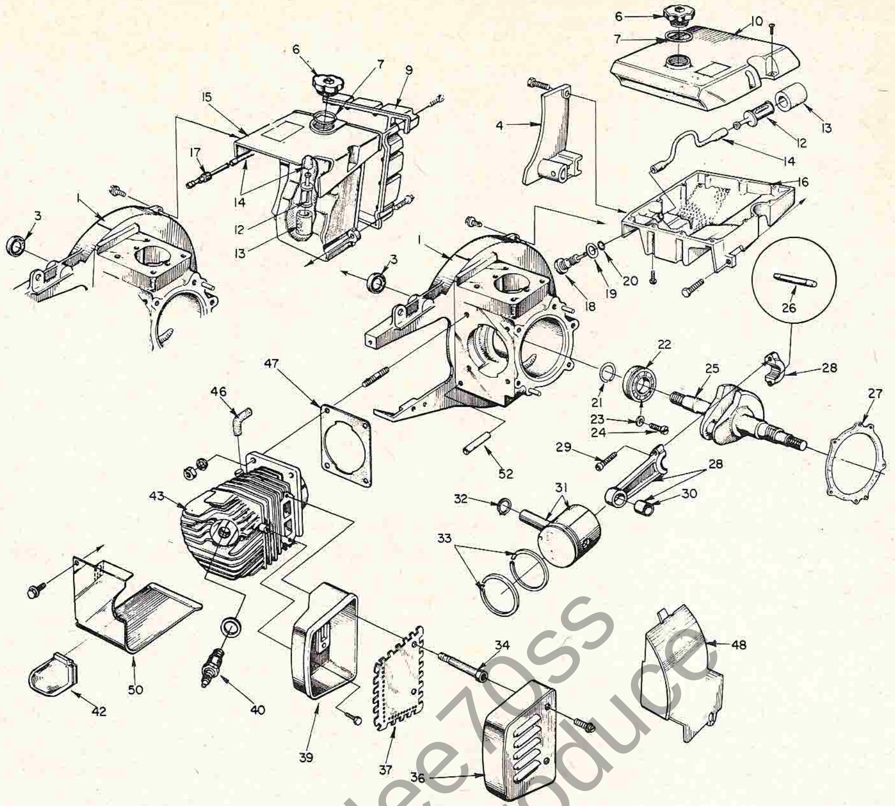


Fig. HL54—Exploded view showing model XP-1020 and model XP-1130 engine assembly. Model XP-1020 Automatic, model XP-1000 and model XP-1100 are similar. View shows fuel tank construction for both the direct and gear drive models. Piston pin is retained by two snap rings in models XP-1000 and XP-1100 whereas pin is retained in piston in models XP-1020, XP-1020 Automatic and XP-1130 by Spirol pin and snap ring. Refer to Fig. 54A.

1. Crankcase	16. Fuel tank	26. Needle rollers (31)	39. Muffler body
3. Crankshaft seal	17. Fitting	27. Gasket	40. Spark plug
4. Handle brace	18. Fitting	28. Connecting rod	42. Spark plug cap
6. Filler cap	19. Gasket	29. Screws	43. Cylinder
7. "O" ring	20. "O" ring	30. Needle bearing	46. Idle tube (see 20—Fig. HL51D)
9. Tank cover	21. Snap ring	31. Piston & pin	47. Gasket
10. Tank cover	22. Ball bearing	32. Snap ring	48. Heat exchanger (optional)
12. Fuel pickup	23. Lock washers (2)	33. Piston rings	50. Cylinder shield
13. Filter	24. Screws (2)	34. Muffler studs	
14. Flex hose	25. Crankshaft	36. Muffler cap	
15. Fuel tank		37. Baffle	

CRANKSHAFT, MAIN BEARINGS AND SEALS. The crankshaft is supported in a caged needle roller bearing at drivecase end of shaft and a ball bearing at flywheel end. End play of the crankshaft is controlled by the ball bearing which is retained on the crankshaft by a snap ring (14—Fig. HL53, or 21—Fig. HL54) and in the crankcase by two screws (17—Fig. HL53 or 24—Fig. HL54) and lock washers.

To remove crankshaft, remove the two bearing retaining screws and lock washers and press crankshaft and bearing (15—Fig. HL53 or 22—Fig. HL54) from crankcase. If bearing is rough or excessively worn, remove snap ring and press crankshaft from bearing. Renew the crankshaft seal (45—Fig. HL53 or 3—Fig. HL54) if worn or damaged. Renew crankshaft if needle bearing surface at drive case end or crankpin bearing surface is burned, scored or excessively worn. Also, inspect keyways and threads for damage.

Install new seal with lip to inside of crankcase. Press bearing onto crankshaft and secure with snap ring. Apply heat to

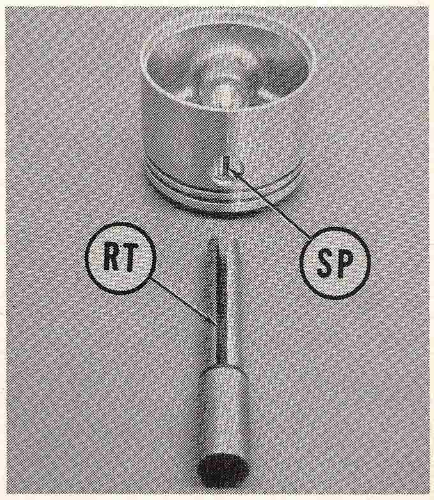


Fig. HL54A—Slot in piston pin removal tool (RT) allows tool to enter pin bore with Spirol pin (SP) to push piston pin from piston.

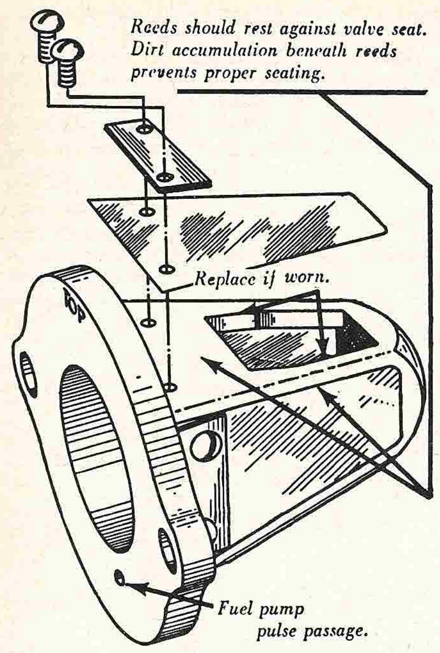


Fig. HL55—Pyramid type reed valves are used on all models except C-5, C-7, C-51 and C-71. Refer to Fig. HL55A on Models C-9 and C-91.

bearing seat in crankcase, taking care not to damage seal, until the crankshaft with main bearing can be **pushed** into the crankcase. Do not press bearing into crankcase. Install **new** bearing retaining screws and lockwashers.

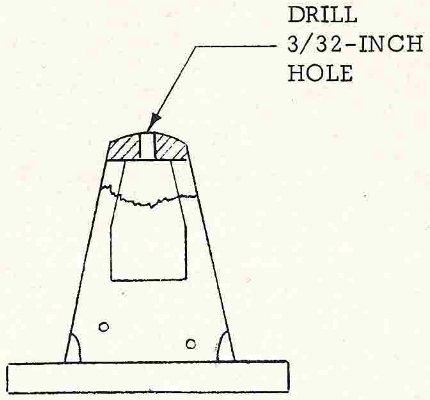


Fig. HL55A — Modify C-9 and early C-91 pyramid reed seat by drilling hole as shown to improve carburetion. Late C-91 pyramid seat has hole as shown. CAUTION: Modification does not apply to other Homelite models.

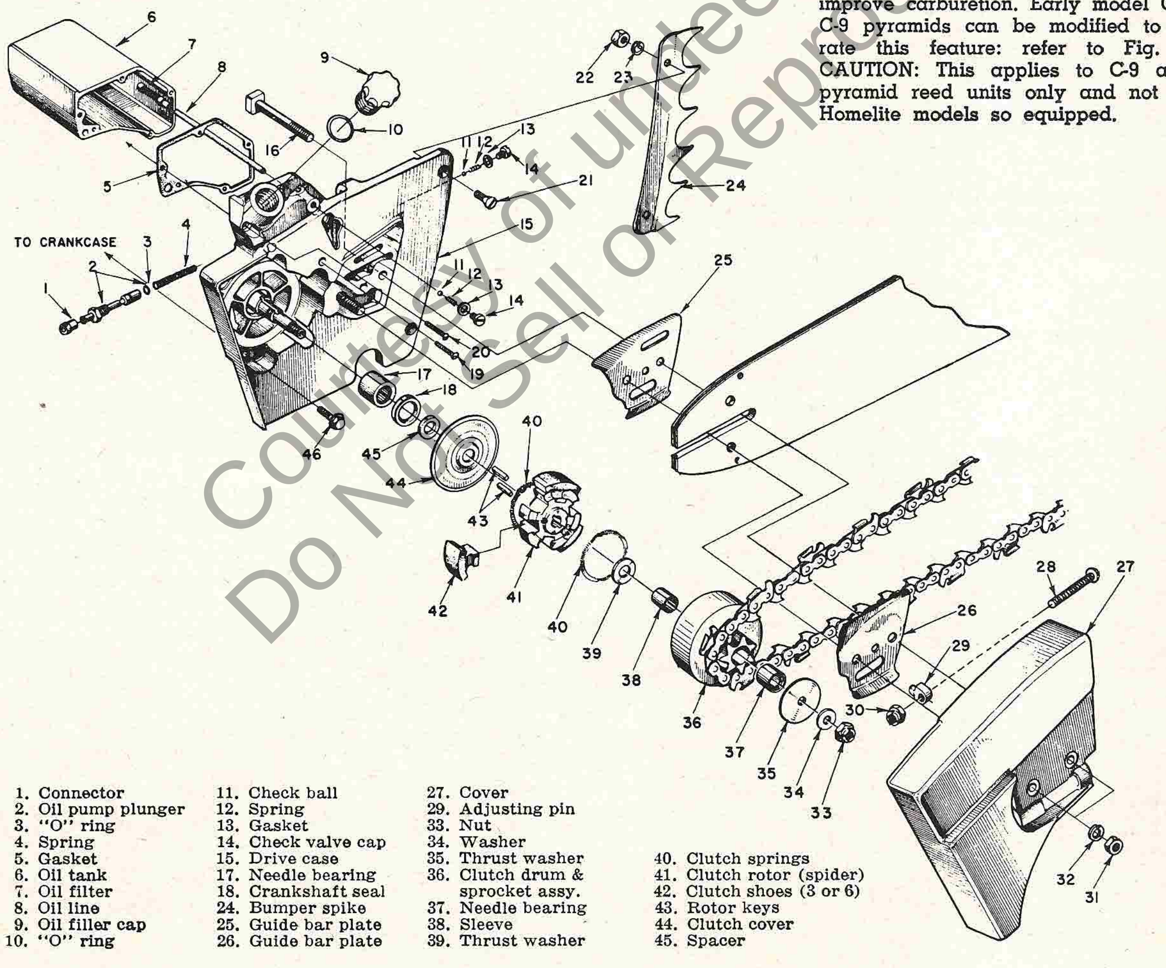
Renew needle bearing in drive case, if necessary, by removing seal (18—Fig. HL56 or 4—Fig. HL58) and pressing bearing from casting. Press new bearing into case and install new seal with lip on inside. Place large "O" ring, or gasket on the drive case, place seal protector (or tape) over keyways, threads and shoulder; and install drive case on crankshaft and crankcase. Tighten the retaining screws alternately.

REED VALVE. The reed inlet valve on Models C-5, C-7, C-51 and C-71 is attached to the carburetor adapter elbow (9—Fig. HL51B) and is serviced as a complete assembly only. A pyramid type reed valve (14, 15, 16 and 17) assembly is used on all other models. Refer to Fig. HL55 for service information on the pyramid reed valve assembly. When installing new reeds on pyramid seat, thoroughly clean all threads and apply Loctite to threads on screws before installing. Be sure reeds are centered on seats before tightening screws.

Be sure that pulse passage holes in gaskets (48) and spacer (49) are located as shown in Figs. HL51B, HL51C and HL51D.

Reed lift distance on models C-5, C-7, C-51 and C-71 should be 0.172-0.177. The pyramid structure reeds on other models have no reed stops.

NOTE: Late model C-91 pyramid seats have a hole drilled at tip of pyramid to improve carburetion. Early model C-91 and C-9 pyramids can be modified to incorporate this feature: refer to Fig. HL55A. CAUTION: This applies to C-9 and C-91 pyramid reed units only and not to other Homelite models so equipped.



1. Connector
2. Oil pump plunger
3. "O" ring
4. Spring
5. Gasket
6. Oil tank
7. Oil filter
8. Oil line
9. Oil filler cap
10. "O" ring
11. Check ball
12. Spring
13. Gasket
14. Check valve cap
15. Drive case
17. Needle bearing
18. Crankshaft seal
24. Bumper spike
25. Guide bar plate
26. Guide bar plate
27. Cover
29. Adjusting pin
33. Nut
34. Washer
35. Thrust washer
36. Clutch drum & sprocket assy.
37. Needle bearing
38. Sleeve
39. Thrust washer
40. Clutch springs
41. Clutch rotor (spider)
42. Clutch shoes (3 or 6)
43. Rotor keys
44. Clutch cover
45. Spacer

Fig. HL56 — Exploded view of direct drive clutch of Model C-5 and related parts. Same clutch rotor (spider) and shoe assembly 40, 41 & 42) are used with planetary gear drive shown in Fig. HL57. Rotor is threaded to crankshaft on C-7, C-9 and late production C-5 saws; keys (43) are not used on models with threaded spider. Spacer (45) is used on early production C-5 saws only. Six clutch shoes (42) are used on C-9, C-91 and late production model C-7; three shoes are used on C-5, C-51 and early production C-7. Six clutch shoes are required on all models with planetary gear drive.

CLUTCH. All models are equipped with a dry shoe type clutch. Models C-5 and C-51 and early production model C-7 use three clutch shoes; all other models use six clutch shoes.

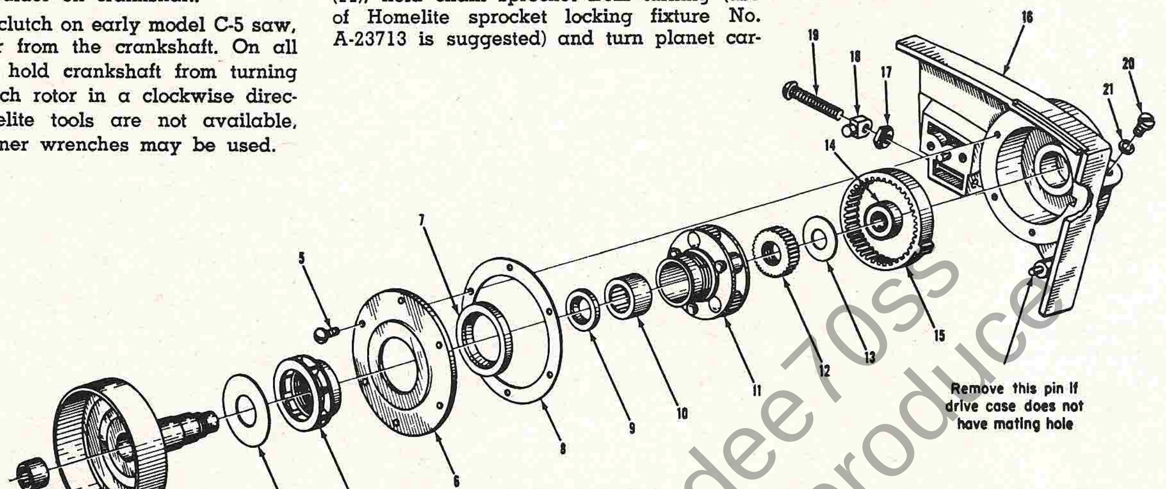
The clutch rotor (spider) on early production C-5 saws is keyed to the crankshaft, and has a spacer between the rotor and shoulder on crankshaft. Service rotor will be threaded; discard the keys but retain spacer when installing new type threaded rotor. Late production model C-5 saws and all other saws will have threaded rotor, but are not fitted with a spacer between rotor and shoulder on crankshaft.

To remove clutch on early model C-5 saw, pull the rotor from the crankshaft. On all other models hold crankshaft from turning and turn clutch rotor in a clockwise direction. If Homelite tools are not available, suitable spanner wrenches may be used.

TRANSMISSION (C SERIES). A planetary gear transmission is used on models C-52G, C-71G and C-91G and a planetary drive kit is available to convert C Series direct drive saws to gear drive. Refer to exploded view in Fig. HL57.

To disassemble gear drive unit, drain oil from housing and remove screws (5); then, pull unit from housing (16). Hold drum (2) from turning by hand or in a three-jaw chuck and turn sun gear (12) in a clockwise direction with Homelite tool No. A-23696 or suitable spanner wrench. Insert **two ¼ x 2 inch dowel pins in carrier** (11), hold chain sprocket from turning (use of Homelite sprocket locking fixture No. A-23713 is suggested) and turn planet carrier in a counter-clockwise direction with pry-bar against the dowel pins.

Needle bearing (1) can be removed from blind hole in clutch drum (2) with Snap-On puller A-78 or equivalent tool. Press on lettered end of bearing cage with Homelite tool No. 23726-A or other suitable bearing tool to install new bearing in drum. Needle bearing (10) and seal (9) in planet gear (11) can be pressed from gear with Homelite tool No. 23725-A; press new bearing in from threaded side of gear with short end of tool No. 23725-A and press new seal in with lip towards needle bearing with Homelite tool No. 23726-A.



1. Needle bearing
2. Clutch drum
3. Thrust washer
4. Chain sprocket
5. Housing cover screws
6. Housing cover
7. Garlock seal
8. Gasket
9. Planet carrier seal
10. Needle bearing
11. Planet carrier & gears
12. Sun gear
13. Thrust washer
14. Ball bearing
15. Ring gear
16. Gear housing
17. Lock nut
18. Adjusting pin
19. Adjusting screw
20. Oil filler cap
21. Gasket

Fig. HL57 — Exploded view of planetary drive unit that is used on C Series saws. When planetary drive is installed, a formica thrust washer should be installed between drum (2) and clutch rotor instead of steel thrust washer (39—Fig. HL56).

3. Gear housing
4. Oil seal
5. Needle bearing
6. Bushing
7. Oil filter (auto)
8. Oil line
9. Oil filter (manual)
11. Flange bearing
13. Plunger and gear
14. "O" ring
15. Ball bearing
16. Filler cap
17. Gasket
21. Cam screw
22. Gasket
23. Spacer
24. Oil pump housing
25. Worm gear
27. Sprocket shaft
28. Idler gear post
30. Snap ring
31. Idler gear
32. Ball bearing
33. Nut
34. Retaining ring
67. Housing cover
68. Pipe plug
69. Nut
70. Washer
71. Clutch cover
72. Clutch spring
73. Clutch spider
74. Clutch shoe
75. Thrust washer
76. Clutch drum
77. Sleeve bearing

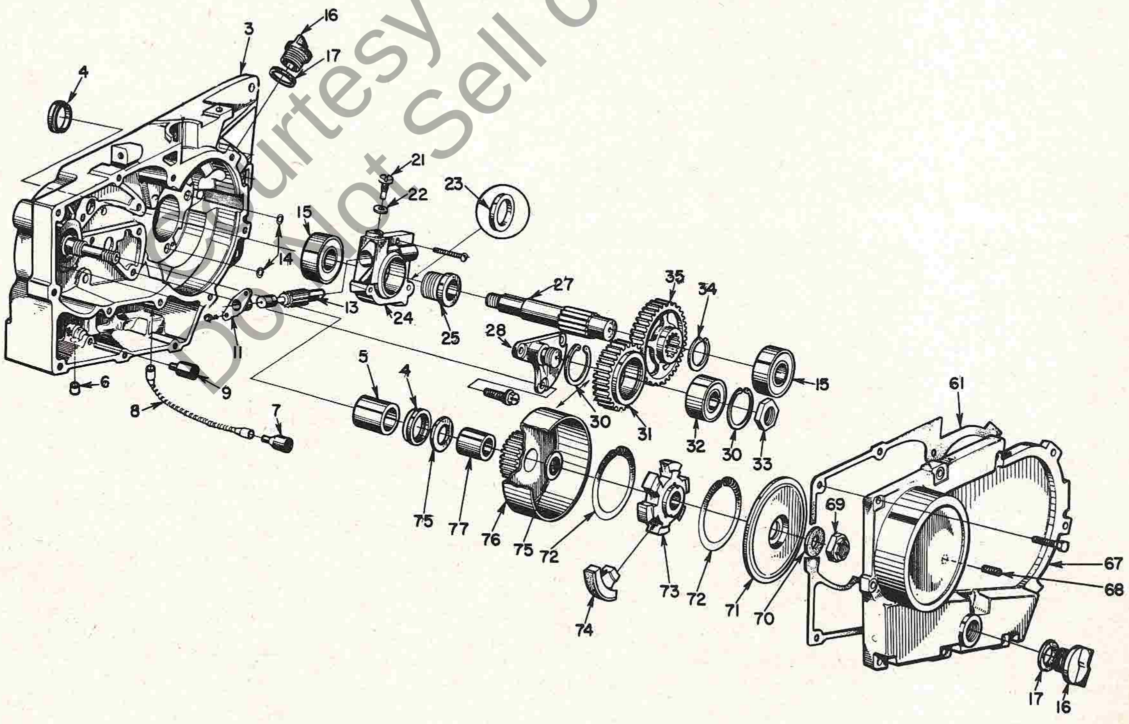


Fig. HL58—Exploded view of gear case assembly used on models XP-1100 and XP-1130. Refer to Fig. HL58A for view showing opposite side of gear case and chain drive sprocket. A ⅛-inch thick spacer (23) is used with XP-1100 models having a 11/16-inch wide worm gear (25); do not use spacer if a 13/16-inch wide worm gear is used. Ratios of 2:1 and 3:1 can be obtained by changing gear 35 and repositioning idler gear assembly to accomodate the different gear diameter. The 2:1 ratio gear has 42 teeth and the 3:1 ratio gear has 64 teeth.

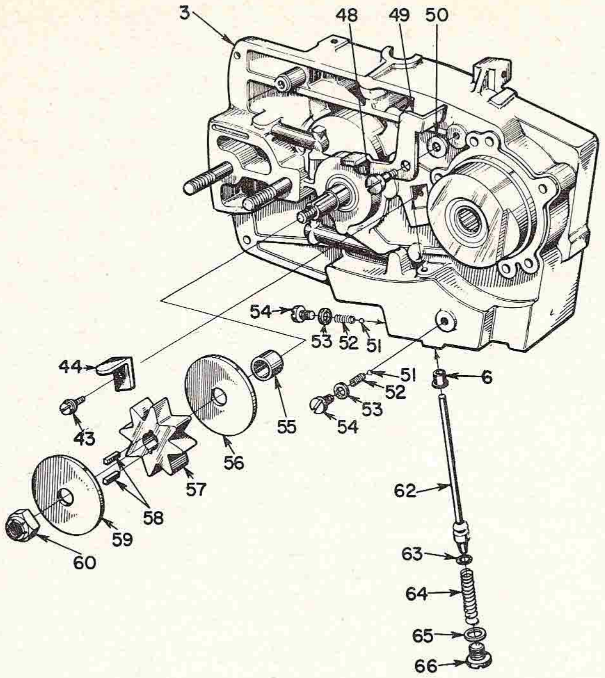


Fig. HL58A—View showing chain drive sprocket and manual oiler pump components removed from model XP-1100 and XP-1130 gear case. Refer to Fig. HL58 for exploded view of gear case assembly.

3. Gear case
6. Bushing
35. Driven gear
44. Bracket
49. Bellcrank
50. Thrust washer
51. Check ball
52. Spring
53. Gasket
54. Cap
55. Spacer
56. Washer, inner
57. Sprocket
58. Keys
59. Washer, outer
60. Nut
61. Gasket
62. Plunger
63. "O" ring
64. Spring
65. Washer
66. Cap

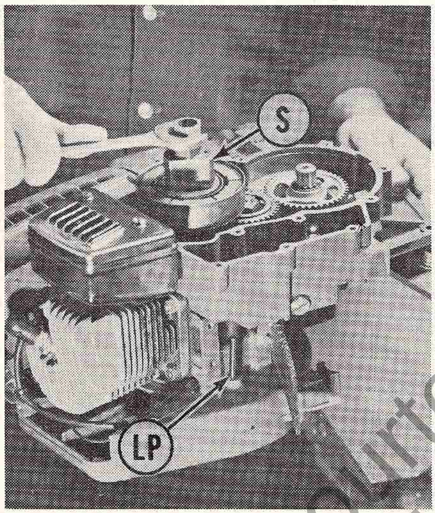


Fig. HL59—When removing clutch spider, use lock pin (LP) inserted as shown and turn clutch spider clockwise using a spanner wrench (S). Homelite number for spanner is A-23969.

To remove ball bearing (14) and ring gear (15) from housing (16), heat finned area of housing until bearing can be removed by tapping housing against bench. Then, heat housing until ring gear can be removed. Always be sure to remove bearing first and install last with as little heat as possible.

Reassemble by reversing disassembly sequence. Refill gear housing with SAE 90 gear oil.

TRANSMISSION (XP SERIES). Model XP-1100 and XP-1130 saws are equipped with a gear transmission as shown in Fig. HL58. Except for renewal of the crankshaft needle bearing, transmission can be serviced after cover (67) is removed.

NOTE: Effective with model XP-1130 serial No. 2188219, gear case is vented through drilled sprocket shaft instead of through hole in gear case. Also, the chain oiler reservoir is vented through the filler cap instead of through hole in reservoir. When installing the late type gear case (Homelite part No. A63398-B) in model XP-1100 or in model XP-1130 prior to serial No. 2188219, a new drilled sprocket shaft (part No. 59277-A) and vented chain oiler filler cap (part No. A63717) must also be installed. When installing drilled sprocket shaft in early type vented gear case, it is recommended that the transmission vent hole in gear case be plugged.

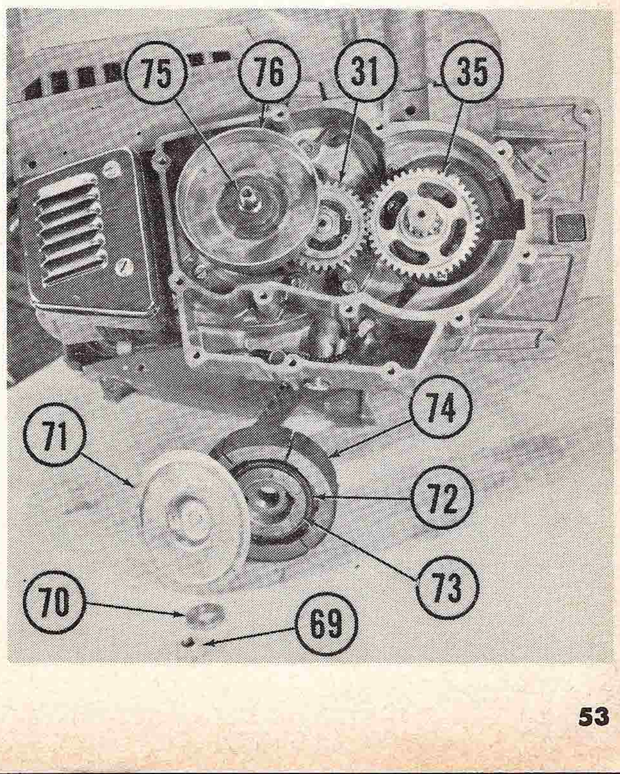


Fig. HL60—View of XP-1100 transmission with cover off and clutch assembly removed.

31. Idler gear
35. Sprocket gear
69. Nut
70. Washer
71. Clutch cover
72. Clutch spring
73. Clutch
74. Clutch shoe
75. Thrust washer
76. Clutch drum

To service transmission, drain oil from chain oil tank and transmission case, then remove handlebar and cover (67). Tap cover lightly, if necessary, to loosen cover. Install a ¼-inch lock pin through hole in bottom of blower housing to hold flywheel, then use a spanner wrench (Homelite A-23969) and turn clutch clockwise to remove it from crankshaft. See Fig. HL59 and HL60. Thrust bearing (75) and clutch drum (76) can now be removed. Drum sleeve bearing (77—Fig. HL58) can be removed if necessary. Turn nut (33) clockwise to remove and lift idler gear assembly (31) off idler post (28). Bearing (32) can be removed from idler gear after removing snap rings (30). Remove retaining ring (34) and pull sprocket gear (35) from sprocket shaft (27). See Fig. HL61.

NOTE: Sprocket shaft gear can be removed without removing idler gear should it be necessary for service only on the sprocket gear, sprocket shaft and bearings or the automatic chain oiler pump (OP) which is located behind the sprocket gear.

To remove the sprocket shaft, unbolt and remove the oil pump housing and discard the two "O" rings (14—Fig. HL58). Hold sprocket (57—Fig. HL 58A) from turning and remove nut (60), outer washer (59), sprocket and keys and inner washer (56), then push sprocket shaft from gearcase. Spacer (23—Fig. HL58) and worm gear (25) can now be removed from shaft.

NOTE: Spacer (23) is used with a short (11/16-inch long) worm gear (25) which was used in some saws. Do not use spacer in the saws which have a 13/16-inch long worm gear. For information on chain oiler pump, refer to Automatic Chain Oiler section.

If sprocket shaft outer (pilot) bearing requires renewal, heat cover (67) until bearing will drop out. To remove sprocket shaft inner bearing, remove oil seal and press bearing out toward clutch side of gearcase

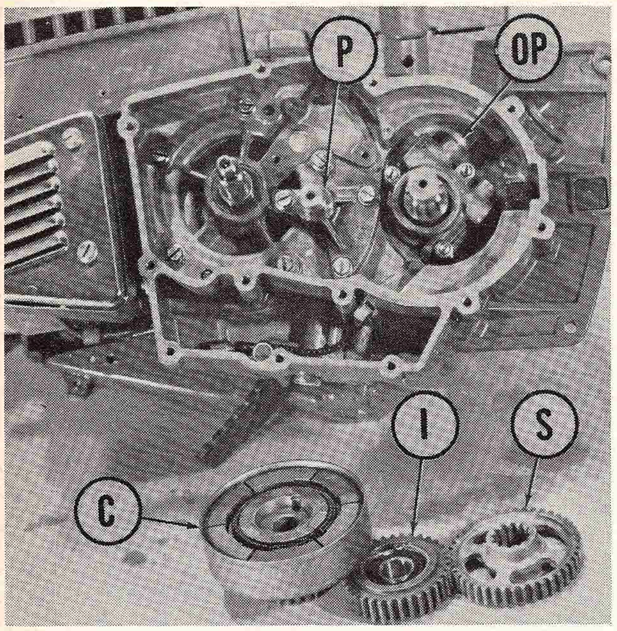


Fig. HL61—View of gearcase with clutch, idler gear and sprocket gear removed.

C. Clutch assembly
I. Idler gear assy.
P. Idler gear post
S. Sprocket gear
OP. Oil pump (chain)

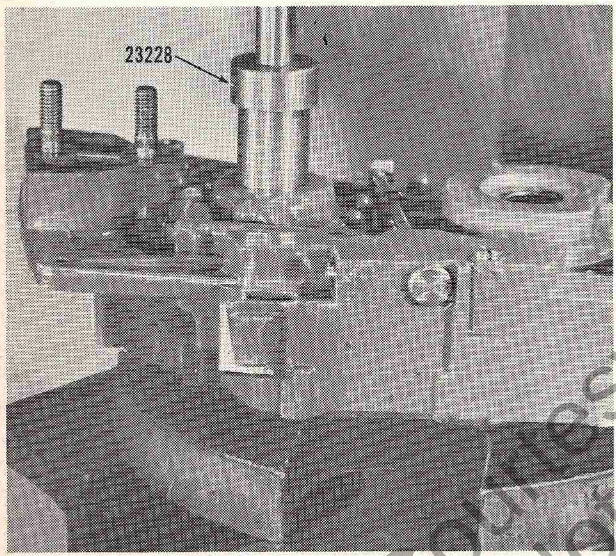


Fig. HL62—When removing sprocket shaft inner bearing, use Homelite tool 23228, or equivalent as shown.

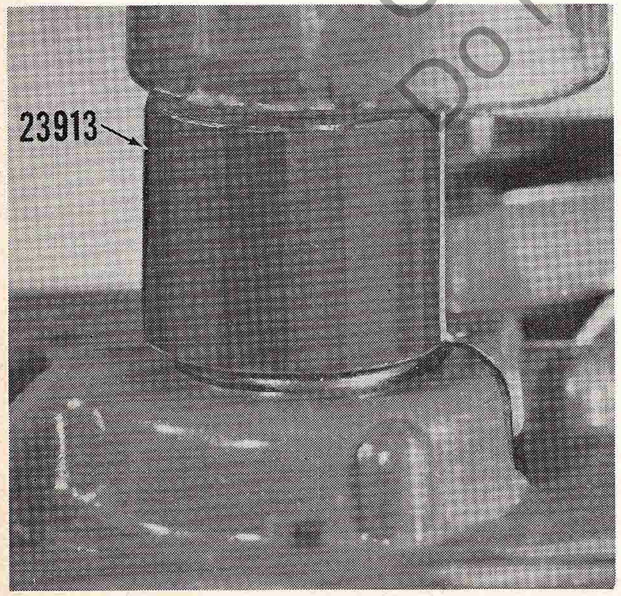


Fig. HL63 — When installing sprocket shaft seal, use Homelite tool 23913, or equivalent, as shown. This tool can also be used to install sprocket shaft outer (pilot) bearing in cover.

using Homelite tool No. 23228, or equivalent, as shown in Fig. HL62.

If crankshaft needle (main) bearing (5—Fig. HL58) is to be renewed, remove gearcase and using Homelite tool No. 23931-3, press bearing out toward clutch side. When reinstalling bearing, install from engine side of gearcase and press only on lettered end of bearing. Use protector sleeve, Homelite No. 23963, over crankshaft when installing gearcase to engine.

Reassemble by reversing disassembly procedure. Use new oil seals and install with open side next to bearing. Use new "O" rings between gearcase and oil pump housing. Use Loctite on idler gearing retaining nut and tighten nut to 200 in.-lbs. torque. Tighten clutch spider and nut (69) to a minimum of 300 in.-lbs. torque and sprocket nut to 250 in.-lbs. torque.

REWIND STARTER. A Fairbanks-Morse rewind starter is used on models C-5, C-7 and C-9. Install friction shoes on brake lever as shown in Fig. HL64A if unit was disassembled. The friction shoe and lever unit is available for service as a complete assembly only. Refer to Fig. HL64 for complete starter exploded view.

Models C-51, C-71, C-91, XP-1000 and XP-1100 and early models XP-1020 and XP-1130 are equipped with an overrunning bearing type starter as shown in the exploded view in Fig. HL65- Be sure to note that bearing (14) must be installed with end lettered "LOCK" towards rope pulley (10).

Late model XP-1020 and XP-1130 saws (after serial No. 2359237) and model XP-1020 Automatic saws are equipped with a ratchet type starter as shown in Fig. HL66.

AUTOMATIC CHAIN OILER KIT. Refer to Fig. HL67 for exploded view of automatic oiler kit that can be installed on direct drive Series C and models XP-1000 and XP-1020 saws. If early C-5, C-7 or C-9 drive case does not have an "L" shaped oiler passage with a screw plug in the channel, a new type drive case must be installed to install the oiler kit. The manual chain oiler system is not affected by installation of the automatic oiler kit and can be used to supply extra chain lubricating oil in special cutting situations.

The drive pin (7) must extend 25/64 to 13/32-inch, and must engage the drive slot in clutch drum (1). Under normal conditions, use Homelite Bar and Chain oil or SAE 30 motor oil in reservoir. In cold weather, dilute oil with kerosene as necessary to keep it flowing through pump. Oil filter (24) can be cleaned after removing cover (26).

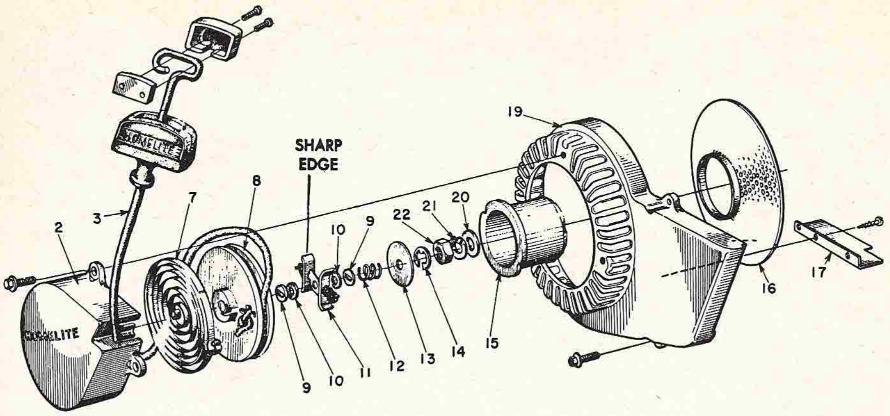


Fig. HL64—Exploded view of C Series Fairbanks-Morse starter. Friction shoe (11) components are not available separately; however, if unit has been disassembled, refer to Fig. HL64A for reassembly. Baffle (17) is integral with housing on late production units.

2. Starter housing
3. Starter rope
7. Rewind spring
8. Starter pulley
9. Brake washer
10. Fiber washer
11. Friction shoe
12. Spring
13. Washer
14. Snap ring
15. Starter cup
16. Rotating-screen
17. Baffle
19. Fan housing
20. Flat washer
21. Lock washer
22. Flywheel nut

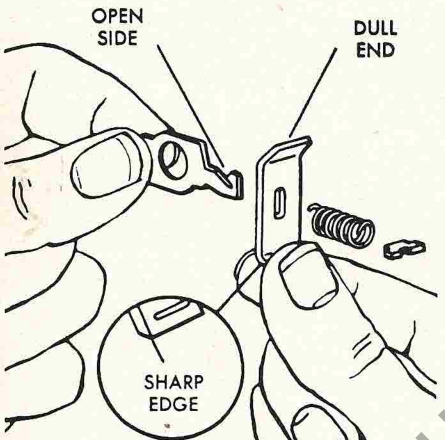


Fig. HL64A—Fairbanks-Morse friction shoe unit is serviced as complete assembly only. However, if unit has been disassembled, it must be reassembled as shown. Refer to Fig. HL64 for complete view of Fairbanks-Morse starter.

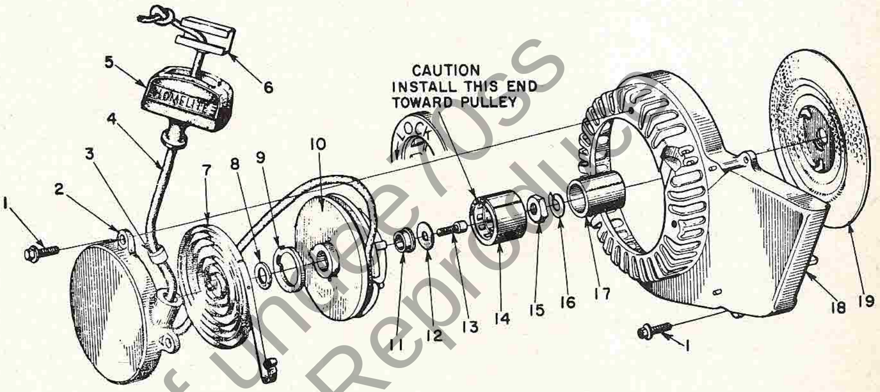
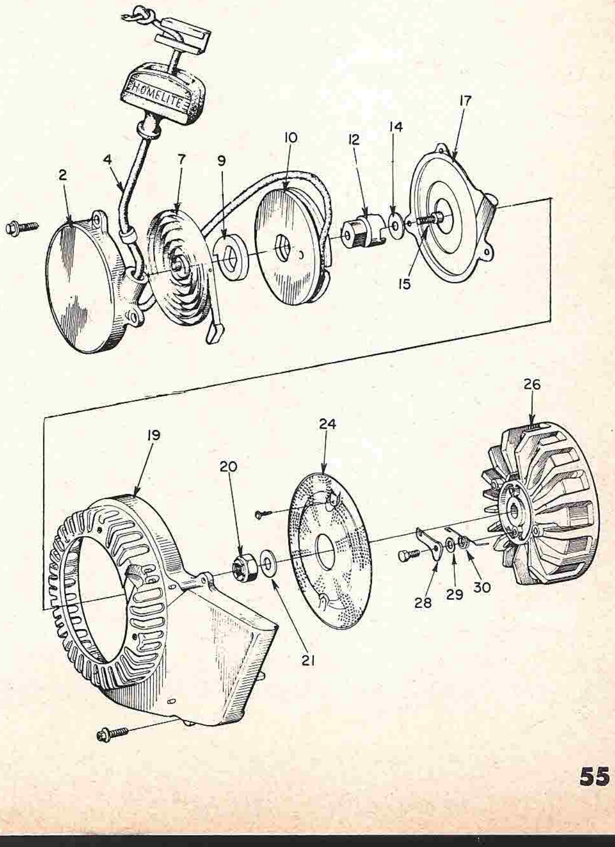


Fig. HL65—Exploded view of overrunning bearing starter used on models C-51, C-71, C-91, XP-1000 and XP-1100 and early models XP-1020 and XP-1130. Refer to Fig. HL64 for Fairbanks-Morse starter used on models C5, C-7 and C-9 and to Fig. HL66 for ratchet starter used on model XP-1020 automatic and late model XP-1020 and XP-1130 saws.

2. Starter cover
3. Rope bushing
4. Starter rope
7. Rewind spring
8. Thrust washer
9. Rewind spring lock
10. Starter pulley
11. Pulley bushing
12. Thrust washer
13. Socket head screw
14. Overrunning bearing
15. Flywheel nut
16. Lock washer
17. Inner race for (14)
18. Blower housing
19. Rotary screen

Fig. HL66 — Exploded view of ratchet type starter used on model XP-1020 Automatic and late models XP-1020 and XP-1130.

2. Starter housing
4. Starter rope
7. Rewind spring
9. Rewind spring lock
10. Starter pulley
12. Starter cup
14. Washer
15. Socket head screw
17. Sawdust shield
19. Fan housing
20. Flywheel nut
21. Washer
24. Rotating screen
26. Flywheel
28. Pawls
29. Washer
30. Pawl springs



AUTOMATIC CHAIN OILER. Models XP-1100 and XP-1130 gear drive saws are equipped with an automatic chain oiler system and pump for this system is located inside the gear case; refer to Fig. HL61. Model XP-1020 Automatic chain oiler pump is mounted on crankcase cover behind the chain sprocket and clutch assembly; refer to exploded view in Fig. HL68.

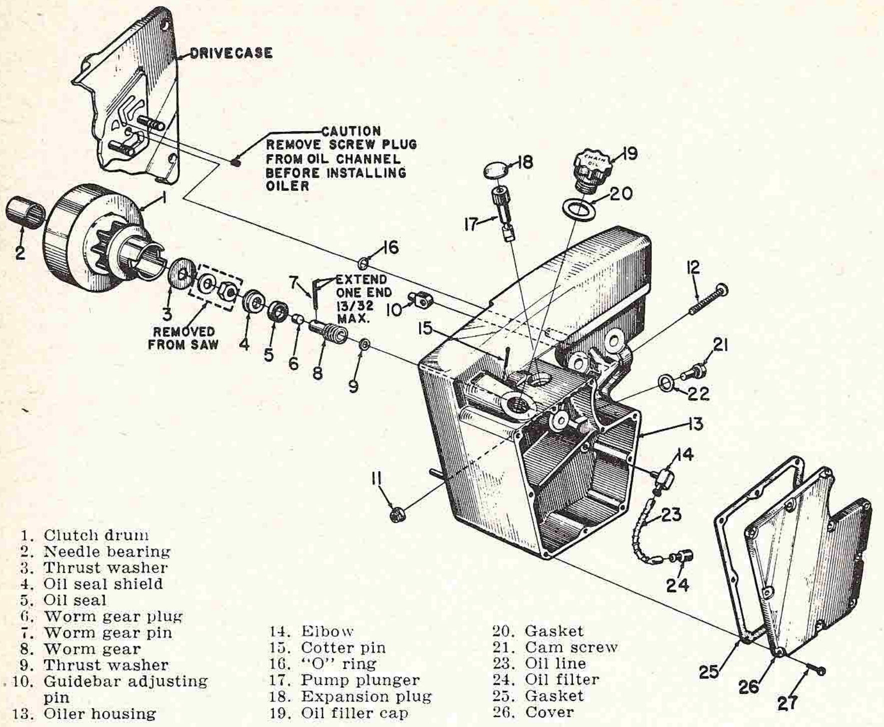
To service pump on gear drive models, drain chain oil tank and transmission case, then remove cover (67—Fig. HL58). Remove retaining ring (34) and pull gear (35) from sprocket shaft (27). Unbolt and remove pump body (24) from gearcase. Discard "O" rings (14) and use new during installation. Pump plunger (13) can be removed from body after removing the flanged bearing (11).

If necessary to remove worm (25), remove chain sprocket and spacer (55), push shaft from gearcase and remove spacer (23) and worm (25) from shaft.

NOTE: Spacer (23) is used only with a short (11/16-inch long) worm which was used in some saws. If saw is equipped with a long (13/16-inch long) worm, the spacer is not used.

To service pump on direct drive model XP-1020 Automatic, first remove the clutch assembly, clutch drum and sprocket and the drive worm (31—Fig. HL68). The pump can then be removed from crankcase cover (11).

Clean and inspect all parts and renew parts as necessary. Reassemble by reversing the disassembly procedure.



1. Clutch drum
2. Needle bearing
3. Thrust washer
4. Oil seal shield
5. Oil seal
6. Worm gear plug
7. Worm gear pin
8. Worm gear
9. Thrust washer
10. Guidebar adjusting pin
13. Oiler housing
14. Elbow
15. Cotter pin
16. "O" ring
17. Pump plunger
18. Expansion plug
19. Oil filler cap
20. Gasket
21. Cam screw
23. Oil line
24. Oil filter
25. Gasket
26. Cover

Fig. HL67—Exploded view of automatic chain oil kit available for Series C chain saws. If drive case does not have "L" shaped oiler passage as shown with a screw plug in the channel, a new drive case must be installed.

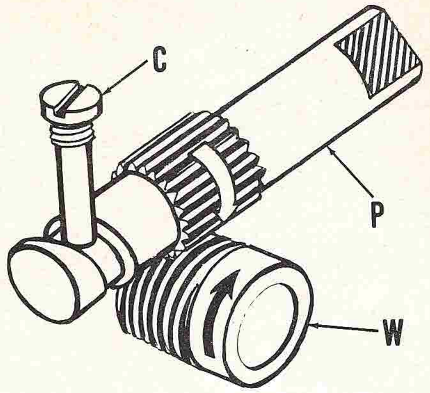
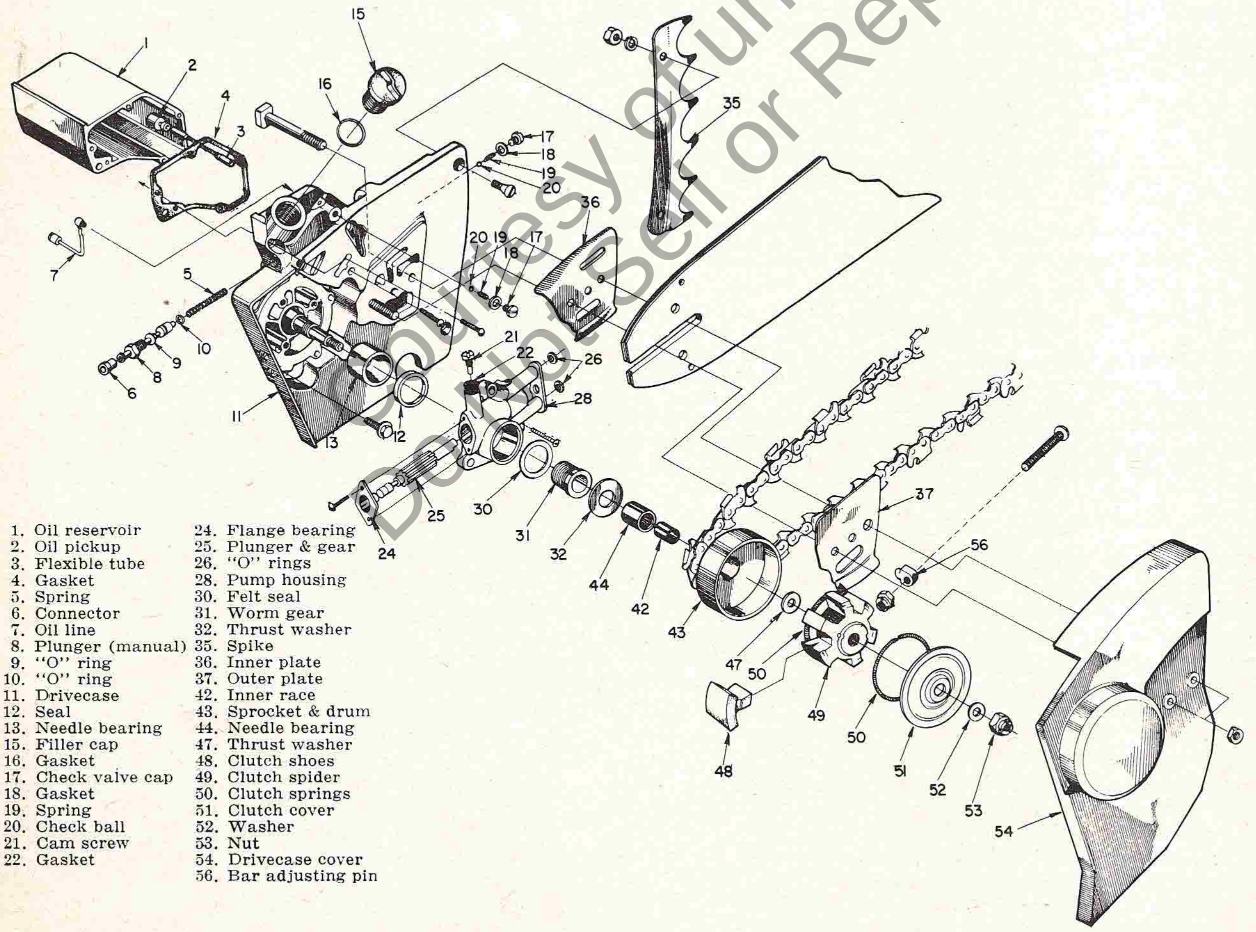


Fig. HL67A—View showing operation of automatic chain oiler pump. Worm (W) mounted on crankshaft or sprocket shaft turns the plunger (P). As the plunger turns, it is moved back and forth by the cam groove cut in plunger riding on the cam screw (C). Flats on piston end of plunger act as inlet and outlet valve as the plunger turns past inlet and outlet ports.



1. Oil reservoir
2. Oil pickup
3. Flexible tube
4. Gasket
5. Spring
6. Connector
7. Oil line
8. Plunger (manual)
9. "O" ring
10. "O" ring
11. Drivecase
12. Seal
13. Needle bearing
15. Filler cap
16. Gasket
17. Check valve cap
18. Gasket
19. Spring
20. Check ball
21. Cam screw
22. Gasket
24. Flange bearing
25. Plunger & gear
26. "O" rings
28. Pump housing
30. Felt seal
31. Worm gear
32. Thrust washer
35. Spike
36. Inner plate
37. Outer plate
42. Inner race
43. Sprocket & drum
44. Needle bearing
47. Thrust washer
48. Clutch shoes
49. Clutch spider
50. Clutch springs
51. Clutch cover
52. Washer
53. Nut
54. Drivecase cover
56. Bar adjusting pin

Fig. HL68—Exploded view of model XP-1020 Automatic chain oiler pump and related parts. Refer to Fig. HL67A for view showing pump operation.

HOMELITE

A textron DIVISION

PORT CHESTER, N.Y. U.S.A.

Model	Bore	Stroke	Displacement	Drive Type
XL-700	2	1 1/2	4.7	Direct
XL-800	2 1/16	1 1/2	5.0	Direct
XL-850	2 1/16	1 1/2	5.0	Direct

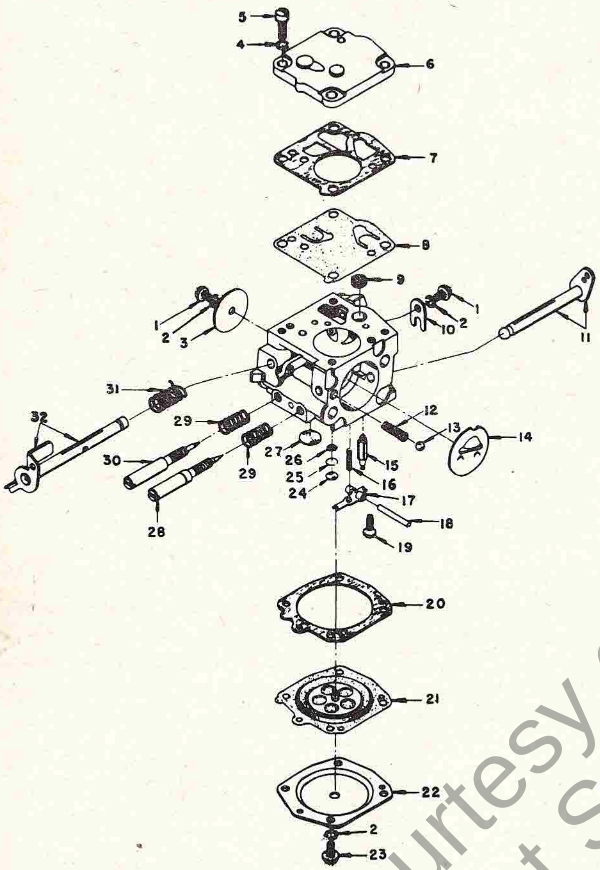


Fig. HL75 — Exploded view of Tillotson series HL carburetor used on models XL-700, XL-800 and XL-850. Refer also to Figs. HL76 through HL80.

3. Throttle disc
6. Diaphragm cover
7. Gasket
8. Pump diaphragm
9. Filter screen
10. Retainer
11. Choke shaft
12. Detent spring
13. Choke detent ball
14. Choke disc
15. Inlet valve
16. Lever spring
17. Diaphragm lever
18. Pivot pin
19. Pin retaining screw
20. Gasket
21. Metering diaphragm
22. Diaphragm cover
24. Expansion plug
25. Retaining ring
26. Channel screen
27. Expansion plug
28. Main fuel needle
29. Springs
30. Main fuel needle
31. Throttle return spring
32. Throttle shaft

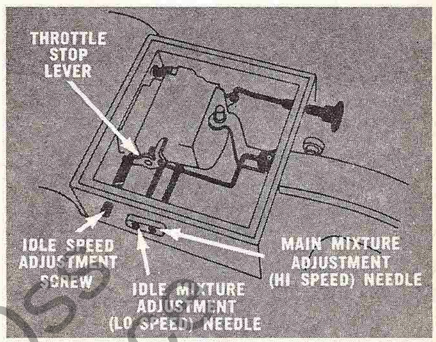


Fig. HL76—Drawing showing locations of fuel mixture adjustment needles, idle speed needle and throttle stop lever.

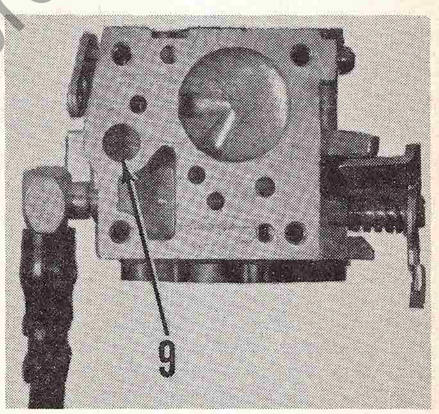


Fig. HL77—Be sure to clean or renew screen (9) when servicing carburetor.

MAINTENANCE

SPARK PLUG. A Champion model CJ-6 spark plug is used for all models. For heavy duty operation, a Champion HO-8A platinum tip spark plug can be used, though it will be necessary to pull the plug wire further out of the retaining clip in air box. Set electrode gap to 0.025 on all models.

CARBURETOR. A Tillotson series HS-26A diaphragm type carburetor with integral fuel pump is used on all models. Refer to Fig. HL75 for exploded view.

For initial adjustment, back idle speed adjustment screw (see Fig. HL76) out until it clears throttle stop, then turn screw in until it contacts stop plus ¾-turn additional. Open idle mixture adjustment (LO) Speed) needle and main mixture adjustment (HI Speed) needle one full turn each.

Make final adjustments with engine warm and running. Adjust idle mixture needle so that engine idles smoothly; then, adjust idle speed screw so that engine idles at just below clutch engagement speed (approximately 2600 RPM). Readjust idle mixture if necessary.

To set main mixture adjustment needle, jam chain in a cut so that clutch slips, turn main mixture needle in until engine falters, then back needle out (about ¼-turn clockwise) until engine carries a full clutch-slipping load. With main mixture needle so adjusted, check engine acceleration. If engine will not accelerate smoothly, open main mixture needle a small amount at a time until engine will accelerate smoothly.

When servicing carburetor, refer to Figs. HL77 through HL79 as well as to exploded view in Fig. HL75. Slide screen (9—Fig. HL77) from bore to clean or renew. If passages are choked, plugs (24 and 27—Fig. HL78) may be removed for cleaning pur-

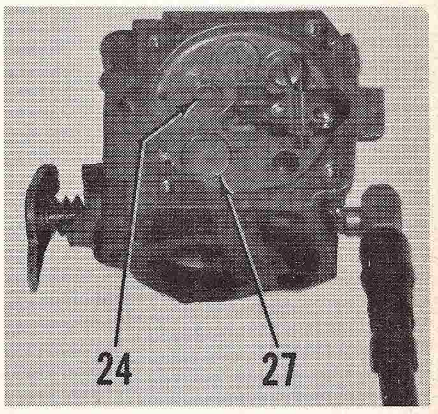


Fig. HL78—View of carburetor showing location of expansion plugs (24 and 27). Channel screen (26—Fig. HL75) is located under plug (24).

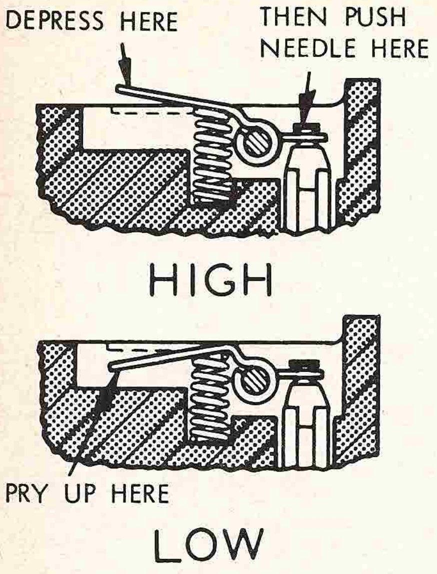


Fig. HL79—Drawing showing proper adjustment procedure for metering diaphragm lever.

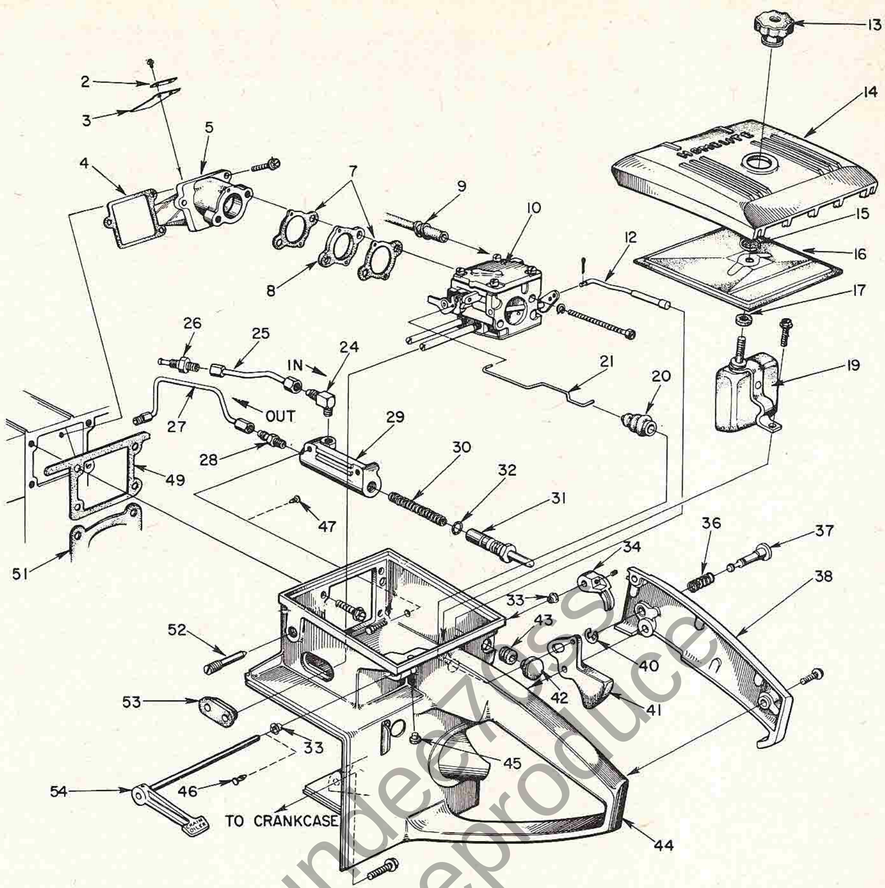


Fig. HL80—Exploded view of air box and handle assembly for early model XL-700. Model XL-800 is not equipped with manual oiler pump (items 24 through 31) and operating lever (34 and 54) although late model XL-800 has provisions for installing same. Model XL-850 and late models XL-700 and XL-800 have "Delrin" pyramid reed seat which does not use reed retaining plates (2) and screws.

2. Retaining plates
3. Inlet valve reeds
4. Gasket
5. Elbow & reed seat
7. Gaskets
8. Spacer
9. Fuel tube
10. Carburetor assy.
12. Choke rod
13. Cover nut
14. Air filter cover
15. Retaining ring
16. Filter element
17. Gasket
19. Air deflector
20. Boot
21. Throttle rod
24. Check valve
25. Oil line
26. Connector
27. Oil line
28. Check valve
29. Pump body
30. Plunger spring
31. Pump plunger
32. "O" ring
33. Bushing
34. Oiler lever
36. Lock spring
37. Throttle lock pin
38. Handle cover
40. Snap ring
41. Throttle trigger
42. Choke button
43. Grommet
44. Throttle handle
45. Rubber bumper
46. Plug (XL-800)
47. Plug (XL-800)
49. Gasket
51. Cylinder gasket
52. Idle speed screw
53. Grommet
54. Oil lever & shaft

poses. Drill a ⅛-inch hole through large plug (27) and a 1/16-inch hole through small (nozzle) plug, then pry plugs from bores. Note: Carefully drill the holes so as not to damage carburetor body; drill should be controlled so that it will just break through the plug. Install new Welch plugs after cleaning carburetor. Refer to Fig. HL79 and bend diaphragm lever as shown, if necessary, so that lever is flush with floor of diaphragm chamber as shown by dotted line.

MAGNETO. Models XL-700 and XL-800 are equipped with a conventional Wico flywheel type magneto. The model XL-850 is equipped with a Wico solid state breakerless flywheel type magneto. Refer to the following appropriate paragraph:

MODELS XL-700 AND XL-800. Refer to exploded view of magneto in Fig. HL81. Breaker points and condenser are accessible after removing starter housing, flywheel and breaker box cover plate. Use Homelite rotor puller No. A-23960 or equivalent to remove flywheel (magneto rotor).

Breaker point gap is 0.015. Ignition timing is fixed and non-adjustable at 30 degrees BTDC. Armature to flywheel air gap should be 0.005-0.007. To adjust air gap, place a plastic shim (Homelite part No. 23987) between flywheel magnets and armature, tighten armature retaining screws and remove the shim. Refer to the following condenser and ignition coil test specification:

MODEL XL-850. The model XL-850 is equipped with a Wico breakerless solid state magneto; refer to exploded view of magneto in Fig. HL82 and to assembled view in Fig. HL83. Note: Refer to FUNDAMENTALS section for solid state magneto operation.

To check the solid state magneto, disconnect spark plug wire, turn ignition switch on and crank engine while holding terminal about ¼-inch away from ground (engine casting) and check for spark as with conventional magneto. If no spark occurs, refer to the following inspection and test procedure:

Visually inspect rotor (flywheel) for damage. Check for broken or frayed wires and make sure the terminal (42—Fig. HL83) is not shorted out to magneto ignition coil armature.

To test the ignition coil, disconnect the wires at terminal (42) and test coil according to tester procedure. Specifications for testing with either Graham Model 51 or Merc-O-Tronic tester are as follows:

Graham Model 51:

Maximum secondary	10,000
Maximum primary	1.7
Coil index	65
Minimum coil test	20
Maximum gap index	65

Merc-O-Tronic

Operating amperage	1.3
Primary resistance:	
Minimum	0.6
Maximum	0.7
Secondary continuity:	
Minimum	50
Maximum	60

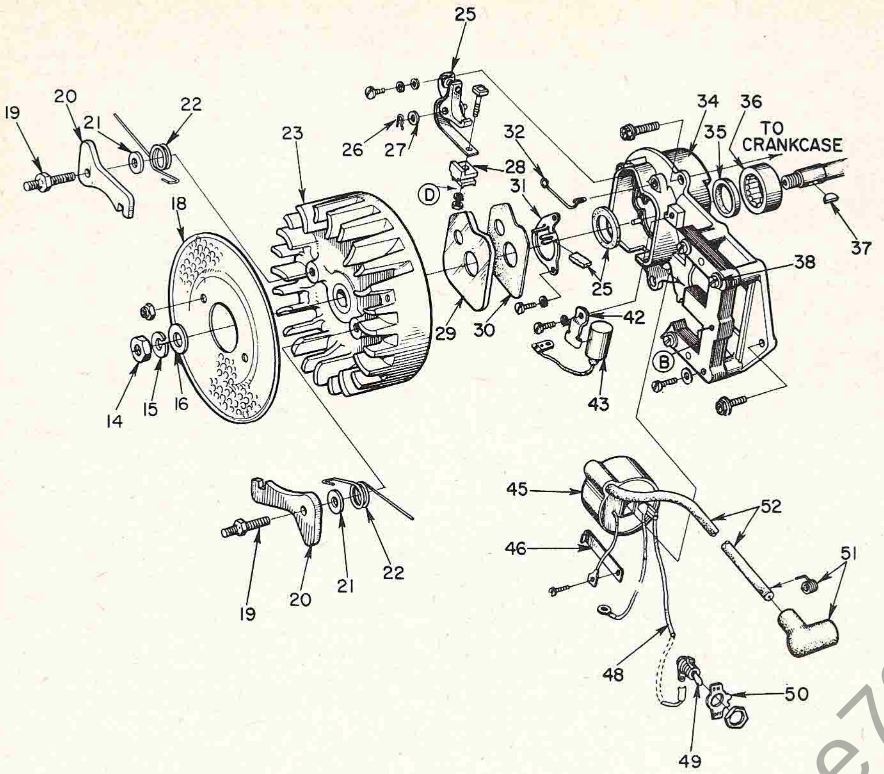


Fig. HL81—Exploded view of conventional flywheel type magneto used on models XL-700 and XL-800. Refer to Fig. HL82 for solid state magneto used on model XL-850. Coil clip retaining screw location is shown by letter "B". Condenser lead and ignition coil primary lead are attached to terminal block (28) at "D".

14. Flywheel nut
15. Lock washer
16. Flat washer
18. Air screen
19. Pawl studs
20. Starter pawls
21. Flat washers
22. Pawl springs
23. Rotor (flywheel)
25. Breaker point set
26. Clip
27. Washer
28. Terminal block
29. Breaker box cover
30. Gasket
31. Felt retainer
32. Cover spring clip
34. Back plate
35. Crankshaft seal
36. Roller bearing
37. Rotor key
38. Coil core (armature)
42. Clamp
43. Condenser
45. Ignition coil
46. Coil retaining clip
48. Ground lead
49. Ignition switch
50. "ON-OFF" plate
51. Spark plug terminal
52. Spark-plug wire

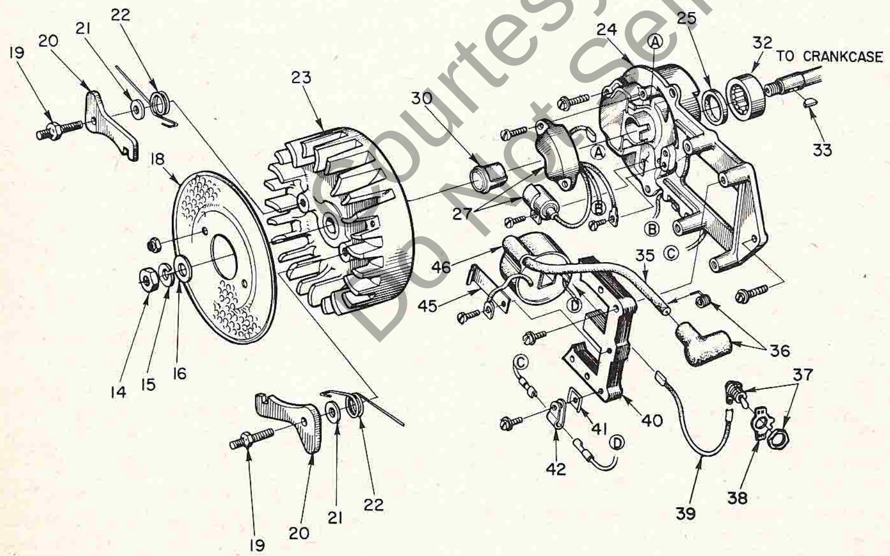


Fig. HL82—Exploded view of solid state (breakerless) type flywheel magneto used on model XL-850. Refer also to Figs. HL83, HL84 and HL85. Refer to Fig. HL81 for conventional type magneto used on models XL-700 and XL-800.

14. Flywheel nut
15. Lock washer
16. Flat washer
18. Air screen
19. Pawl studs
20. Starter pawls
21. Flat washers
22. Pawl springs
23. Rotor (flywheel)
24. Back plate & trigger coil assembly
25. Crankshaft seal
27. Condenser & switch
30. Dust cap
32. Roller bearing
33. Rotor key
35. Spark plug wire
36. Spark plug terminal
37. Ignition switch
38. "ON-OFF" plate
39. Ground lead
40. Coil core (armature)
41. "D" washer
42. Nylon clamp
45. Coil clip
46. Ignition coil

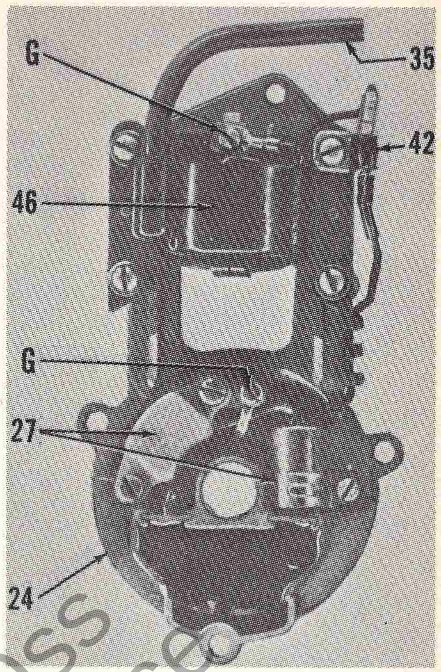


Fig. HL83—Assembled view of the solid state (breakerless) model XL-850 magneto. Refer to Fig. HL82 for exploded view and legend. "G" indicates ground terminals.

Renew the ignition coil if found faulty and again check for spark. If no spark then occurs or if ignition coil checked OK, proceed as follows:

Remove the flywheel and again check for broken or frayed wires. If no defect is noted, remove the screw attaching condenser to magneto back plate and be sure condenser is not touching back plate or other ground. Push a pin through the condenser lead and using condenser tester, check for short, series resistance and capacity; condenser capacity should be 0.16-0.20 mfd. If condenser is faulty, renew the switch box and condenser assembly. If condenser tested OK, proceed as follows:

Disconnect coil primary at terminal (42—Fig. 83) and disconnect switch box ground lead (see Fig. HL85). Remove the screw attaching condenser to back plate and be sure condenser is insulated from any ground. Be sure the switch box ground lead and ignition coil lead are not touching anything and connect leads of an ohmmeter to the two leads. Meter should read either between 1 megohm and infinity or between 5 and 25 ohms; with ohmmeter leads reversed, reading should be opposite that of preceding test. That is, if first reading obtained was 5-25 ohms, second reading should be 1 megohm to infinity. If ohmmeter readings are not as specified, renew the switch box and condenser assembly. If switch box tested OK, test trigger coil as follows:

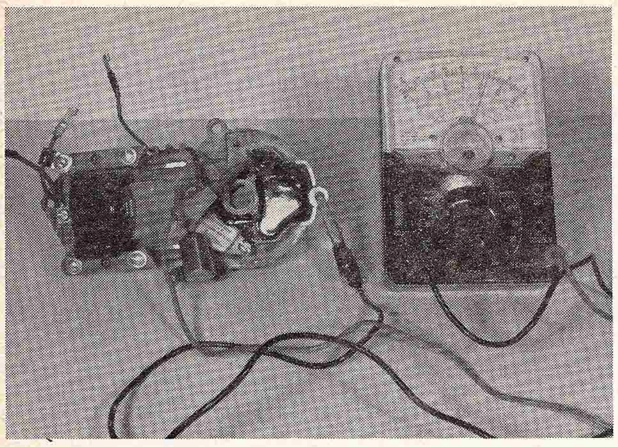


Fig. HL84—View showing ohmmeter connected to ground (back plate) and unused terminal of trigger coil; refer to test procedure in text and also to Fig. HL85.

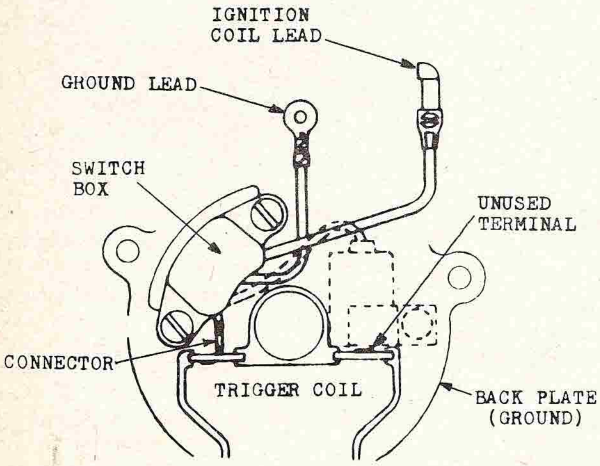


Fig. HL85 — Drawing showing points for ohmmeter test lead connections for checking solid state magneto trigger coil, condenser and switch box. Refer to text for procedure and specifications.

Connect one ohmmeter lead to connector between switch box and trigger coil and other ohmmeter lead to back plate (ground). Reading should be either between 0 to 85 ohms or between 85 and 150 ohms. Reverse the leads; second reading on ohmmeter should be opposite first reading. That is, if first reading was in specified range of 0-85 ohms, second readng should be with range of 85-150 ohms. Then, connect the ohmmeter leads to unused terminal of trigger coil and to magneto back plate; refer to both Fig. HL85 and Fig. HL84. Ohmmeter reading should then be 20 to 26 ohms. If trigger coil does not test within specifications, renew the magneto back plate and trigger coil assembly.

When reassembling magneto, check back plate and remove any sharp edges, especially where wires may contact the back plate. Be sure the "D" washer (41—Fig. HL82) securing the plastic clamp (42) is correctly positioned. Be sure all leads are in place as shown in Fig. HL83 and with terminal connection (42) parallel with armature core. Be sure the back plate is clean and check all screws for tightness. If there is any doubt about the strength of the rotor (flywheel) magnets, install a new flywheel; be sure to remove "keeper" plates from new flywheel before installing it.

LUBRICATION. Engine is lubricated by oil mixed with fuel. Thoroughly mix oil and gasoline in separate container. Mix ½-pint of Homelite motor oil, or a good grade non-detergent SAE 30 motor oil, in each gallon of regular gasoline.

Fill chain oiler reservoir with Homelite Bar and Chain oil or a light oil (no heavier than SAE 30). In cold weather, chain oil can be diluted with kerosene to allow easier flow of oil through pump and lines.

The clutch drum and sprocket should be removed and the needle roller bearing and inner race be cleaned and greased occasionally.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler cover and baffle plate and scrape muffler free of carbon. With muffler cover removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with wooden scraper. Be careful not to damage the edges of exhaust ports or to scratch piston. Do not attempt to run engine with muffler baffle plate or cover removed.

REPAIRS

RECOMMENDED SPECIAL SERVICE TOOLS. Homelite service tools available for servicing XL-700, XL-800 and XL-850 chain saws are as follows: Note: An asterisk (*) after tool number indicates the tool is for servicing models XL-700 only; symbol (#) indicates tool is for servicing models XL-800 and XL-850 only and tools without either asterisk or symbol are for servicing all models.

HOMELITE

Tool No.	Description
23955	Con. rod bearing tool
A-23137*	Main bearing & crankshaft jackscrew
A-23965#	Main bearing & crankshaft jackscrew
23136*	Jackscrew body
23136-1#	Jackscrew body
22820-3*	Bearing collar
22820-4#	Bearing collar
23759*	Crankshaft seal protector
23971#	Crankshaft seal protector
23972	Crankshaft seal installer sleeve
23957	Crankshaft seal installer plug
A-23696	Clutch spider remover (early type clutch)
A-23934	Clutch spanner wrench (late clutch)
A-23841	Guide bar stud remover
A-23960	Rotor (flywheel) remover
23819	Sprocket needle bearing plug
23420#	Sprocket bearing installer
23956	Backplate bearing & seal installer
A-23962	Back plate bearing remover
23846-2	Back plate bearing anvil
A-23951	Piston pin removal tool

CYLINDER. The cylinder bore is chrome plated. Renew cylinder if chrome plating is worn away exposing the softer base metal.

To remove cylinder, first remove the blower (fan) housing, carburetor and air box (handle) assemblies and remove the screw retaining magneto back plate to flywheel side of cylinder. The cylinder can then be unbolted from crankcase and removed from the piston.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.0035.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and pin are available as a matched set and are not available separately.

Piston pin is retained in piston by a Spirol pin through the pin boss on exhaust side and by a snap ring on opposite end. Disassemble piston and rod by removing the snap ring and pushing pin out with the pin removing tool (Homelite tool No. A-23951) shown in Fig. HL86A.

When reassembling piston to connecting rod, be sure closed end of pin is next to Spirol pin in piston. Install piston pin retaining snap ring with sharp side out. Rotate snap ring to be sure it is secure in

37. Rotor (flywheel) key
54. Piston & pin
55. Snap ring
56. Piston rings
57. Connecting rod
58. Needle bearing
59. Needle rollers
60. Crankshaft
61. Ball bearing
62. Bearing retaining screws
63. Lock washers
64. Snap ring
65. Back plate gasket
66. Oil filler cap
67. Gasket
68. Fuel filler cap
69. Gasket
70. Relief valve
71. Fuel pickup
72. Filter element
73. Flexible line
74. Crankcase & tank assy.
75. Gasket
76. Cap plug
77. Crankshaft seal
78. Pipe plug
81. Elbow fitting
82. Fuel line
83. Guide bar studs
84. Stud retainers (threaded inserts)
85. Gasket
86. Cam screw
87. Gasket
88. Automatic oiler pump housing
89. Felt seal
90. Worm gear
92. Pump plunger gear
97. Chain oil filter
98. Oil line
99. Connector
100. Oil tube
101. "O" ring
102. Gasket
103. Oil pick-up line
104. Oil filter
105. Washer
106. Cap
107. Gasket (same as 49—Fig. HL80)
108. Gasket (same as 51—Fig. HL80)
111. Cylinder
112. Spark plug
115. Muffler body
117. Baffle
118. Muffler cap
119. Shoulder screws

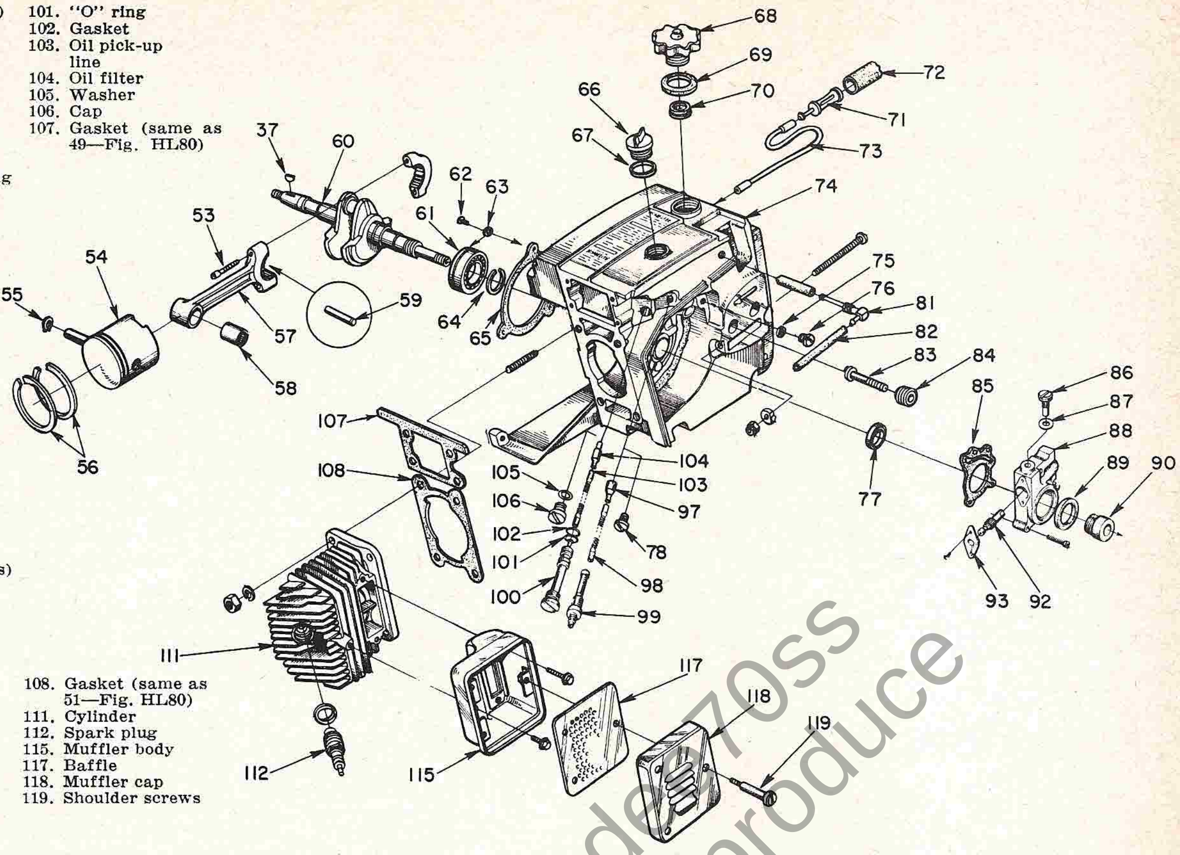


Fig. HL86—Exploded view of engine assembly. Model XL-700 does not have the automatic chain oiler pump assembly (items 85 through 93). Note that to remove the guide bar studs (83), the stud retainers (84) must be unscrewed from crankcase and tank assembly (74); do not attempt to unscrew the studs.

retaining groove, then turn gap toward closed end of piston.

NOTE: On late production pistons, pin is retained by a plain square end snap ring at exhaust side and by a Waldes Truarc snap ring at intake side. The Waldes Truarc snap ring has a hole in each end so the ring can be removed using special Waldes pliers; no attempt should be made to remove the plain square end snap ring. To remove the piston pin, remove the Waldes Truarc snap ring, then insert a $\frac{3}{16}$-inch dia. rod through the plain snap ring and drive pin from piston.

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Be careful to remove all of the 28 loose needle rollers when detaching rod from crankpin.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23955. Press on lettered end of bearing cage only.

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. Stick 14 needle rollers in rod and the remaining 14 needle rollers in rod cap with light grease or beeswax. Assemble rod to cap with match marks aligned and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap retaining screws are being tightened to align the fractured surfaces of rod and cap.

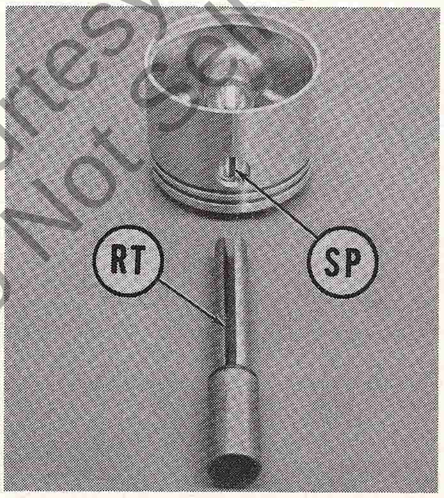


Fig. HL86A—Slot in piston pin removal tool (RT) aligns with Spirol pin (SP) in piston to allow tool to push pin from piston and rod assembly.

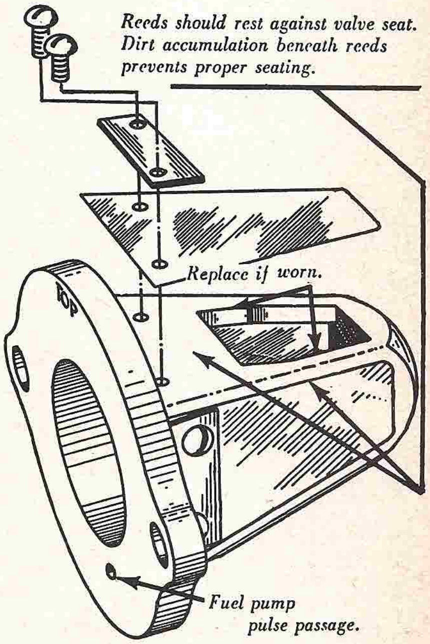


Fig. HL86B—View showing typical pyramid reed installation; pyramid reed seat is part of intake elbow on models in this section. Late models have "Delrin" plastic seat and do not use retainer plate and screws shown.

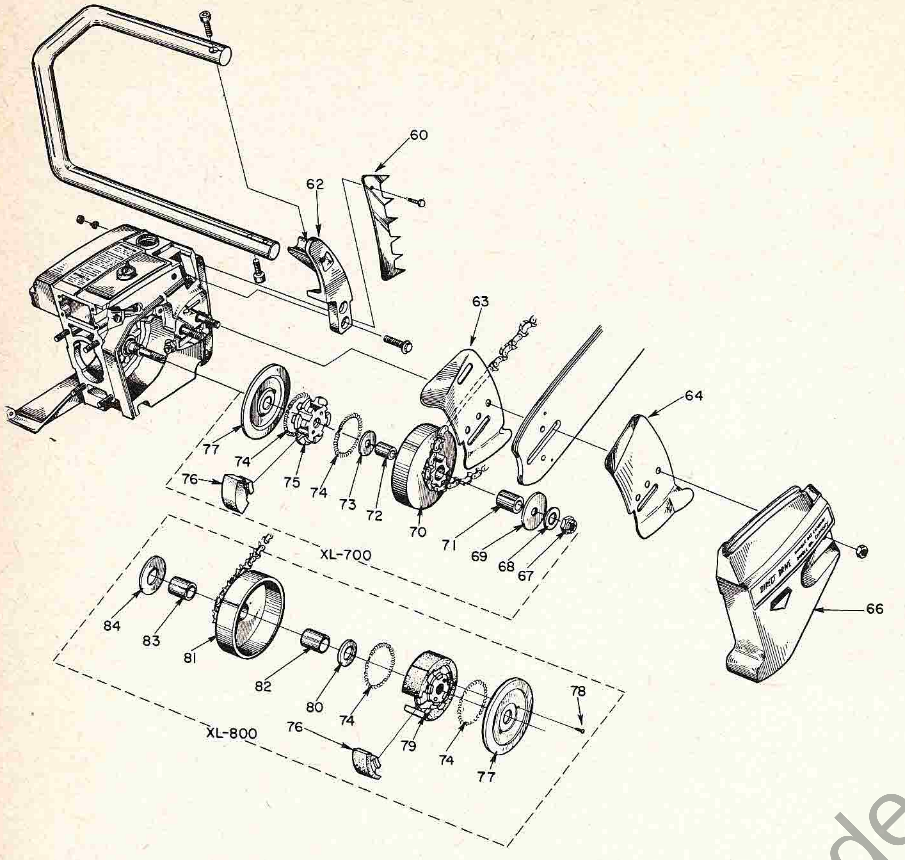


Fig. HL87—Exploded view of early type clutch assemblies for models XL-700 and XL-800. Late type clutch installation is similar except that plate, springs and shoes as shown in Fig. HL88 are used.

60. Spike
62. Bracket
63. Inner plate
64. Outer plate
66. Cover
67. Self-locking nut
68. Flat washer
69. Large flat washer
70. Clutch drum & sprocket
71. Needle bearing
72. Bearing inner race
73. Flat washer
74. Clutch springs (2)
75. Clutch spider (XL-700)
76. Clutch shoes (6)
77. Plate
78. Screws (3)
79. Spider (XL-800)
80. Flat washer
81. Clutch drum & sprocket
82. Needle bearing
83. Inner race
84. Flat washer

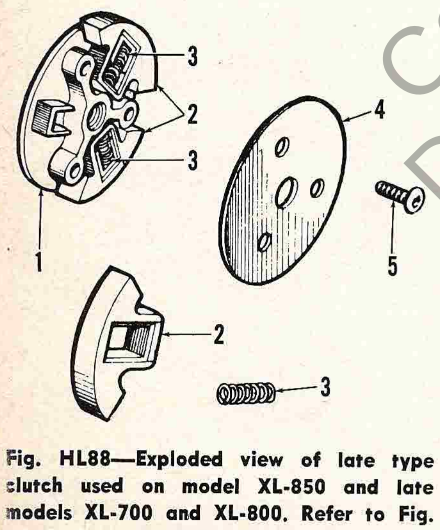


Fig. HL88—Exploded view of late type clutch used on model XL-850 and late models XL-700 and XL-800. Refer to Fig. HL87 for exploded view showing early model XL-700 and XL-800 clutch.

1. Clutch plate
2. Shoes
3. Springs
4. Cover
5. Screws (not used on model XL-700)

CRANKSHAFT. Flywheel end of crankshaft is supported in a roller bearing in magneto back plate and drive end is supported in a ball bearing located in crankcase. End play is controlled by the ball bearing.

Renew the crankshaft if the flywheel end main bearing or crankpin bearing surface or sealing surfaces are scored, burned or excessively worn. Renew the ball bearing if excessively loose or rough. Also, reject crankshaft if flywheel keyway is beat out or if threads are badly damaged.

CRANKCASE, MAGNETO BACK PLATE AND SEALS. To remove the magneto back plate, first remove the blower (fan) housing, flywheel and (except on model XL-850) breaker point assemblies. Loosen the cylinder retaining stud nuts on flywheel side of engine to reduce clamping effect on back plate boss, then unbolt and remove the back plate assembly from crankcase.

To remove crankshaft from crankcase, first remove the cylinder, connecting rod and piston assembly and the magneto backplate as previously outlined. Remove the drive clutch assembly and (except on model XL-700) the automatic chain oiler drive worm and pump from drive end of crankcase and shaft. Then, remove the two ball bearing retaining screws (62—Fig. HL86) from inside of crankcase and remove the crankshaft and ball bearing assembly from crankcase. Remove snap ring (64) and press crankshaft from bearing if necessary.

REED VALVES. All models are equipped with pyramid reed valves. On early models XL-700 and XL-800, the four reeds are retained to the metal pyramid seat by retaining plates and screws as shown in Fig. HL86B; inspect the seat and reeds as noted.

On model XL-850 and late models XL-700 and XL-800, the pyramid seat is of "Delrin" plastic and the reeds are located by pins moulded in the seat. The reeds are held in place by a moulded retainer that also serves as a gasket between reed seat and crankcase. Reeds for the previous diecast metal seat are 0.005 thick whereas reeds for the late type 'Delrin" seat are 0.004 thick.

When installing latest type intake elbow and 'Delrin" seat assembly, it is important that the special shoulder type retaining screws be installed.

CLUTCH. Early models XL-700 and XL-800 were equipped with a six-shoe clutch as shown in the exploded views in Fig. HL87. Model XL-850 and late models XL-700 and XL-800 are equipped with a three-shoe clutch as shown in Fig. HL88.

To remove either the early or late type clutch, proceed as follows: On models XL-800 and XL-850, first remove the screws retaining clutch cover (77—Fig. HL87 or 4—Fig. HL88) to clutch spider and remove the plate. Unscrew the clutch spider from crankshaft using a spanner wrench (Homelite tool No. A-23696 for early type or No. A-23934 for late type clutch). The clutch drum, bearing and inner race can then be removed from crankshaft.

On model XL-700, remove nut from drive end of crankshaft and slide clutch drum and inner race from shaft. Then, using spanner wrench (Homelite tool No. A-23696 for early type or No. A-23934 for late type clutch), unscrew spider from crankshaft.

To disassemble early type clutch, remove the two clutch springs (74—Fig. HL87), then remove the shoes from spider. On late type clutches, pry shoes from clutch plate (1—Fig. HL88) with a screwdriver; place shop towel over clutch assembly to keep springs (3) from flying out as shoe is removed.

When reassembling early type clutch, be sure the identifying marks on the shoes are all to same side of the assembly. To reassemble late type clutch, place shoe over retainers on clutch plate, then pry the springs into place using a small screwdriver.

CHAIN OILER. Model XL-700 is equipped with a manual chain oiler pump. Model XL-850 is equipped with both a manual pump and an automatic chain oiler pump. Model XL-800 is equipped with an automatic chain oiler pump only; however, starting with serial No. 2201258, the crankcase and oil reservoir are drilled and

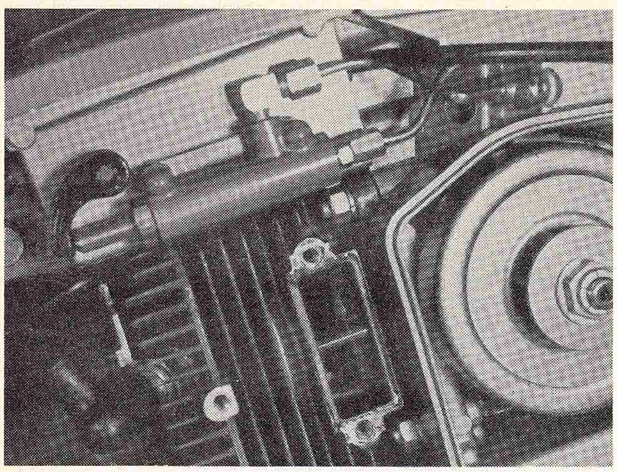


Fig. HL89—View showing manual chain oiler pump installed on model XL-700. Refer to Fig. HL80 for exploded view.

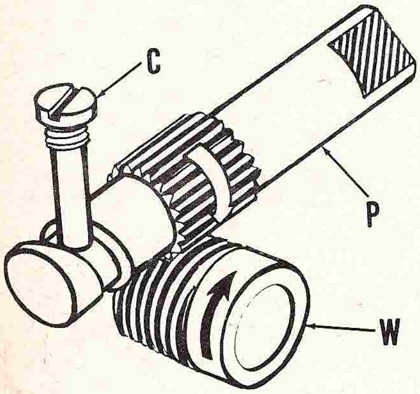


Fig. HL90—Schematic diagram of automatic chain oiler pump operation. Worm gear (W) on crankshaft drives (rotates) pump plunger (P). Cam cut in plunger rides against cam screw (C) causing plunger to move back and forth as it rotates. Flat on plunger acts as a valve as it opens intake port on downward stroke and outlet port on upward stroke.

tapped so that a manual chain oiler pump can be installed if so desired.

The manual oiler pump is installed as shown in Fig. HL89; refer to Fig. HL80 for expoded view of the pump assembly. Usually, service of the manual pump consists of renewing the plunger "O" ring (32).

To service the automatic chain oiler pump, the clutch drum and spider must first be removed from the crankshaft as outlined in a preceding paragraph. Refer to Fig. HL90 for operational diagram of pump and to Fig. HL86 for exploded view of pump assembly.

REWIND STARTER. Refer to Fig. HL91 for exploded view of the ratchet type rewind starter used on all models. To disassemble starter after removing the housing (2) and starter assembly from saw, proceed as follows:

On early models with slotted rope pulley (10), pull starter rope fully out, hold pulley from turning and pry knot end of rope from pulley. Allow pulley to rewind slowly.

On later models without slot in rope pulley, pull ropt outward a short distance, hold rope and pry rope retainer from starter handle and untie knot in outer end of rope. Allow pulley to rewind slowly.

Then, on all models, remove the socket head screw (13) and remove bushing (11) and rope pulley. CAUTION: Be careful not to dislodge spring (8) while removing bushing and pulley as the rapidly uncoiling spring could cause injury. Rope bushing (3) in housing should be renewed if worn.

When reassembling starter, lubricate starter post lightly and install spring dry (without lubrication).

Reassemble starter using exploded view in Fig. HL91 as a guide. Pre-wind spring about 2-4 turns.

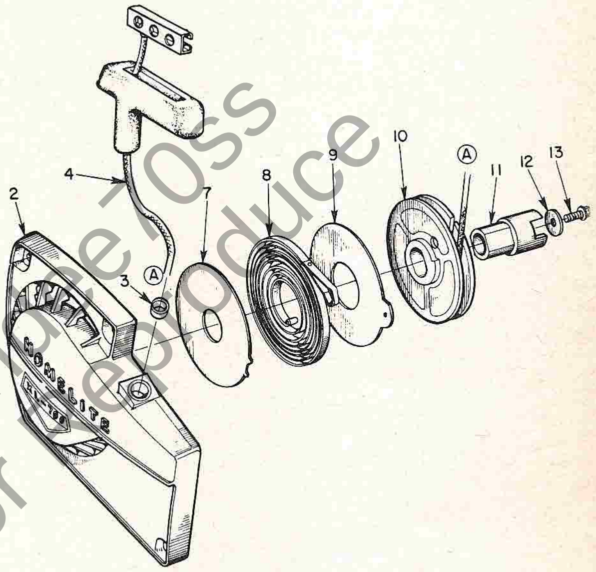


Fig. HL91 — Exploded view of ratchet type starter used on all models.

2. Starter housing
3. Rope guide
4. Starter rope
7. Plastic disc
8. Rewind spring
9. Plastic disc
10. Rope pulley
11. Starter cup
12. Flat washer
13. Screw

NOTES

HOMELITE
A textron DIVISION
PORT CHESTER, N.Y. U.S.A.

MODEL	Bore	Stroke	Displ.	Drive
XL-101	1¾	1⅜	3.3	Direct
XL-102	$1\frac{13}{16}$	1⅜	3.5	Direct
XL-103	$1\frac{13}{16}$	1⅜	3.5	Direct
XL-104	$1\frac{13}{16}$	1⅜	3.5	Direct

Basic design of all models in this section is similar. Models XL-102, XL-103 and XL-104 have a compression release for easier starting. Models XL-101 and XL-102 have manual chain oilers; Models XL-103 and XL-104 have automatic oiler with manual override. Model XL-104 is equipped with solid state breakerless ignition system, whereas other models have conventional flywheel magneto ignition systems.

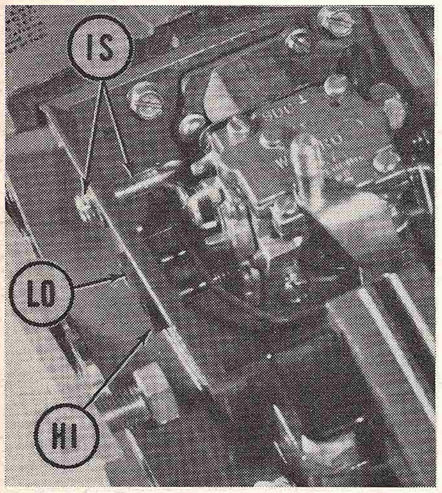


Fig. HL100—View with air filter cover and filter element removed showing carburetor and adjustment points.

HI. High speed needle
IS. Idle speed screw
LO. Idle fuel needle.

MAINTENANCE

SPARK PLUG. A Champion CJ-6 "bantam" spark plug is used in all models. Set electrode gap to 0.025. Tighten plug to torque of 250 inch-pounds.

CARBURETOR. A Walbro model SDC-1 carburetor is used on all models. The diaphragm type carburetor also incorporates a diaphragm type fuel pump and a diaphragm type accelerator pump. Fig. HL100 shows carburetor adjustment points; refer to Figs. HL101 and HL102 for exploded views of carburetor.

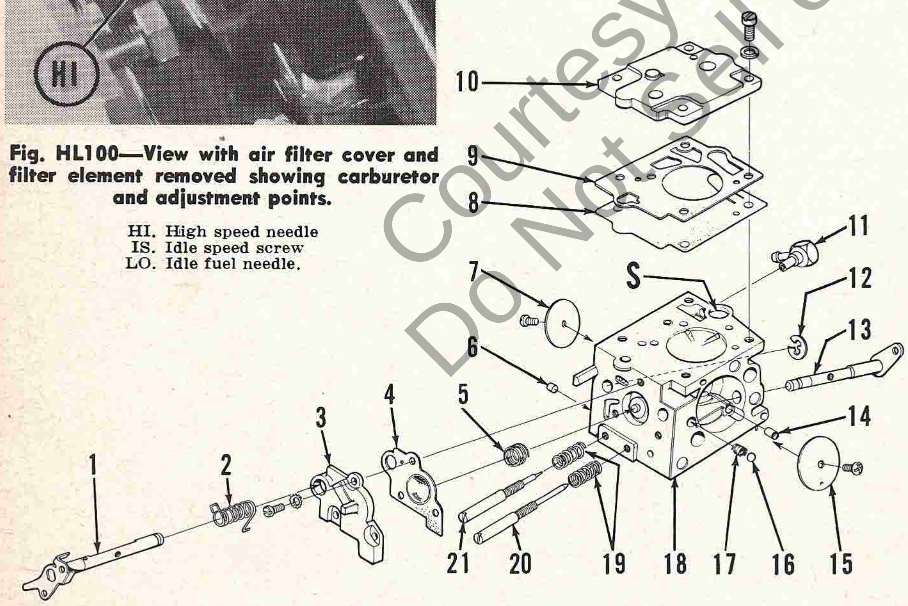


Fig. HL101—Exploded view of Walbro SDC-1 carburetor assembly except for metering diaphragm, lever and inlet valve assembly; refer to Fig. HL102 for exploded view of these parts. Note that throttle shaft (1) extends through accelerator diaphragm (4) and cover (3).

1. Throttle shaft
2. Return spring
3. Pump cover
4. Accelerator diaphragm
5. Spring
6. Limiting plug
7. Throttle valve (disc)
8. Fuel pump diaphragm
9. Gasket
10. Pump cover
11. Elbow fitting
12. "E" ring
13. Choke shaft
14. Idle air jet
15. Choke valve (disc)
16. Detent ball
17. Detent spring
18. Carburetor body
19. Springs
20. High speed needle
21. Idle fuel needle

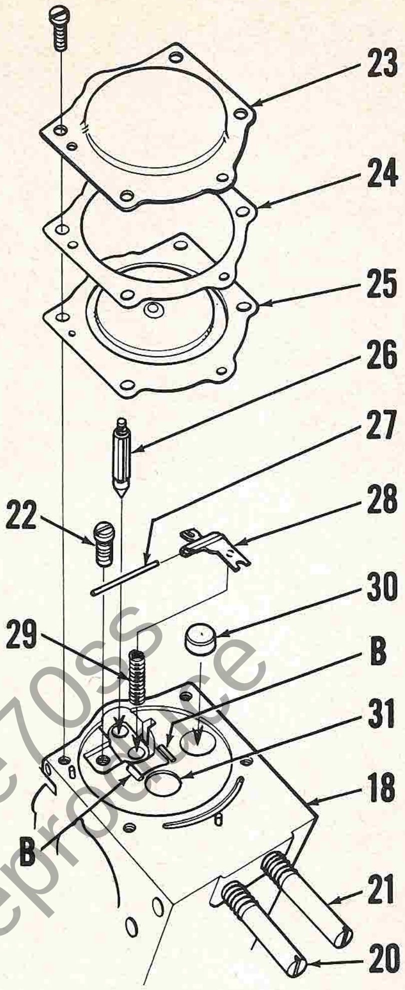


Fig. HL102—Bottom view of carburetor showing exploded view of metering diaphragm, lever and inlet valve assembly. Refer to Fig. HL101 for exploded view of other carburetor parts.

18. Carburetor body
20. High speed needle
21. Idle fuel needle
22. Lever pin screw
23. Diaphragm cover
24. Gasket
25. Diaphragm
26. Inlet valve
27. Lever pin
28. Inlet lever
29. Metering spring
30. Idle passage plug
31. Main channel plug

For initial adjustment of carburetor, refer to Fig. HL100 and proceed as follows: Back out the idle speed screw (IS) until it clears throttle shaft arm and gently close both fuel mixure needles (LO and HI). Open idle fuel needle (LO) about ¾ to 1 turn and open main fuel needle (HI) 1 to 1¼ turns. Turn idle speed screw (IS) in slowly until it contacts throttle shaft arm, then continue turning screw in 1½ turns. Note: Flip throttle trigger when turning idle speed screw in; a sharp click will be heard when screw is in far enough to contact throttle shaft arm.

Make final carburetor adjustment with engine warm and running. Adjust idle speed screw so that engine is idling at just below clutch engagement speed; do not try to make engine idle any slower than this. Adjust idle fuel needle for best engine idle performance, keeping the mixture rich as possible (turn needle out to richen mixture). If necessary, readjust idle speed screw. Adjust main fuel needle while engine is under

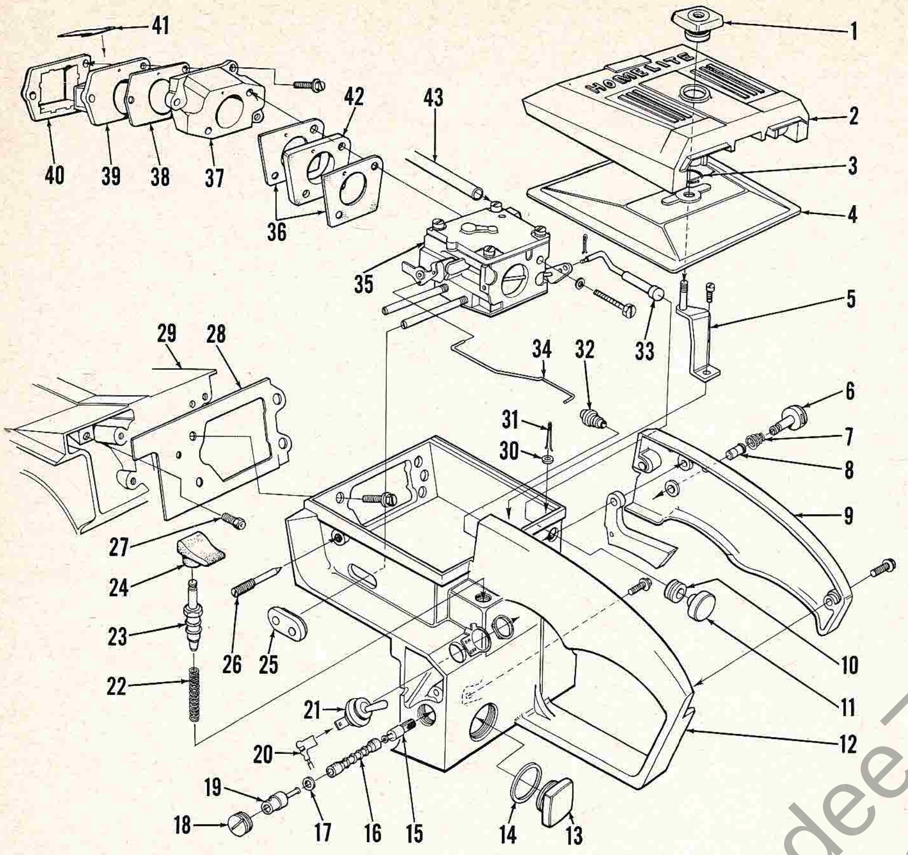


Fig. HL103—Exploded view of throttle handle, air box chain oiler tank assembly and related parts. When cementing new gasket (28) to crankcase (29), insert reed valve retainer (40) in crankcase opening to align gasket. Fuel tank is vented to carburetor chamber in air box through vent valve (27).

1. Knob
2. Air filter cover
3. Snap ring
4. Filter element
5. Bracket
6. Throttle lock
7. Spring
8. Bushing
9. Handle cover
10. Grommet
11. Choke knob
12. Throttle handle
13. Oil tank cap
14. Gasket
15. Oil filter
16. Flexible tube
17. Gasket
18. Plug
19. Check valve
20. Ground lead
21. Ignition switch
22. Spring
23. Pump plunger
24. Oil pump button
25. Grommet
26. Idle speed stop screw
27. Fuel tank vent
28. Gasket
29. Crankcase
30. Felt washer
31. Cotter pin
32. Boot
33. Choke rod
34. Throttle rod
35. Carburetor
36. Gaskets
37. Adapter
38. Gasket
39. Reed valve seat
40. Reed retainer
41. Valve reeds
42. Heat insulator
43. Fuel tube

load cutting wood so that engine runs at highest speed without excessive smoke.

The carburetor can be unbolted and removed from adapter (37—Fig. HL103) after removing air filter cover, filter and cover retaining bracket (5). Pry fuel line from inlet fitting and disconnect choke rod. Tilt carburetor and pull adjustng screws from grommet in air box, unhook throttle rod from throttle lever and remove the carburetor. Remove the heat insulator (spacer) (42) and gaskets (36).

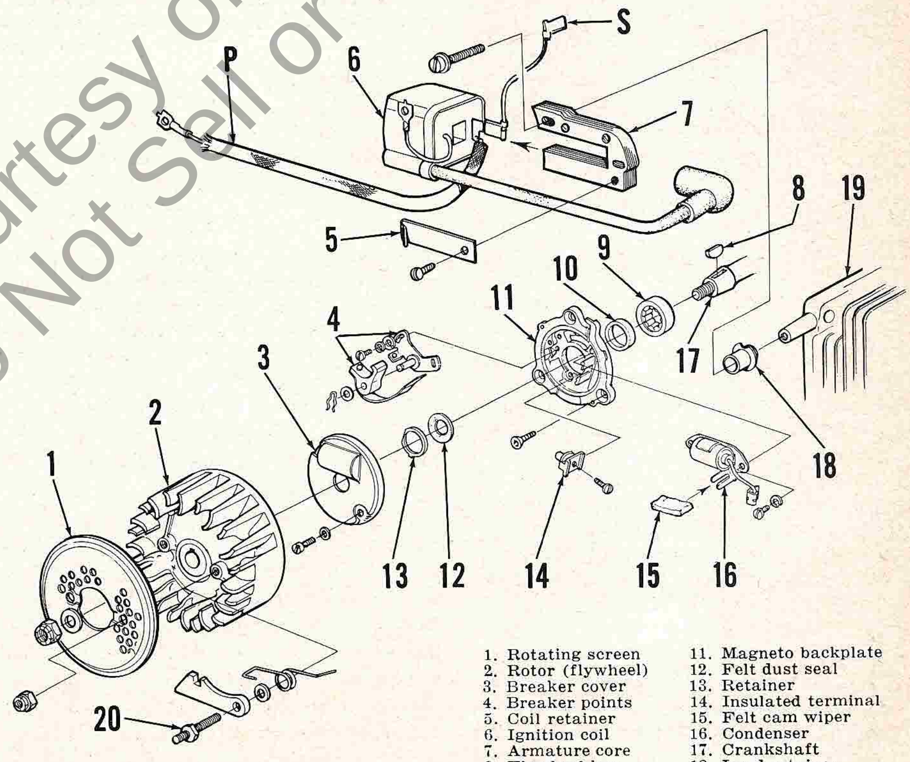
Refer to exploded views in Figs. HL101 and HL102 for disassembly and reassembly guide. To renew accelerator pump diaphragm (4) and/or spring (5) it is first necessary to remove throttle disc and the "E" ring (12) from throttle shaft and remove shaft from carburetor. After reassembly of inlet valve (26) and diaphragm lever (28), lever should be flush with bosses (B) at each side of lever.

When reinstalling carburetor, stick the two gaskets to spacer and stick the spacer and gasket assembly to carburetor with tacky grease to aid in reinstalling unit to adapter. Tighten the retaining screws evenly and to a minimum torque of 50 inch-pounds.

MAGNETO (Except XL-104). Refer to Fig. HL104 for exploded view of the conventional flywheel type Wico magneto used on mdels XL-101, XL-102 and XL-103.

Breaker points and condenser are accessible after removing the fan housing and starter assembly, flywheel and breaker cover. A pry slot is provided to facilitate breaker point gap adjustment using screwdriver as shown in Fig. HL105. Adjust breaker point gap to 0.015 if not renewing points. Homelite recommends adjusting breaker point gap with new points to 0.016, or adjust to 0.0165 if both points and crankshaft are new. Condenser capacity should test 0.16-0.20 mfd. Note that the breaker point and condenser retain the felt dust seal (12—Fig. HL104) and washer (13).

Adjust armature to flywheel (magneto rotor) air gap to 0.004-0.008. Use of a plastic shim cut from 0.0125 plastic shim stock (color code black) will provide an air gap of approximately 0.006. Refer to Fig. HL106.



P. Primary lead
S. Switch (ground) lead

1. Rotating screen
2. Rotor (flywheel)
3. Breaker cover
4. Breaker points
5. Coil retainer
6. Ignition coil
7. Armature core
8. Flywheel key
9. Roller bearing
10. Crankshaft seal
11. Magneto backplate
12. Felt dust seal
13. Retainer
14. Insulated terminal
15. Felt cam wiper
16. Condenser
17. Crankshaft
18. Lead retainer
19. Cylinder

Fig. HL104—Exploded view of conventional flywheel magneto used on models XL-101, XL-102 and XL-103. Felt dust seal retainer (13) is held in place by condenser bracket and breaker point base. Refer also to Figs. HL105 and HL106.

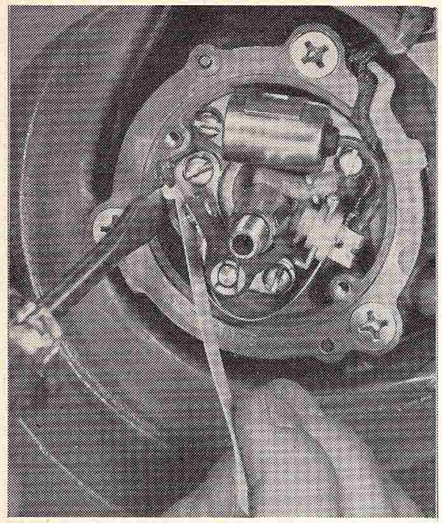


Fig. HL105—View showing magneto backplate, condenser and breaker point assembly. A pry slot is provided to facilitate breaker point adjustment.

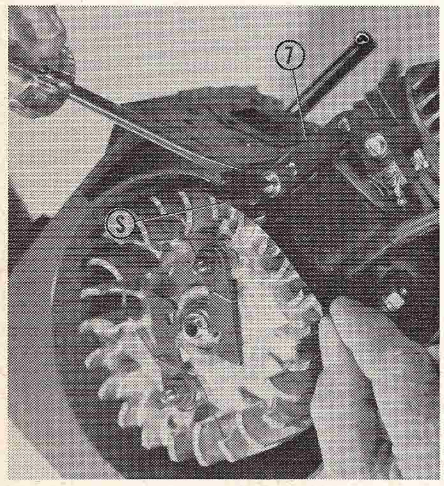


Fig. HL106—Adjusting air gap between flywheel and armature (7) using plastic shim (S). Air gap should be 0.004-0.008.

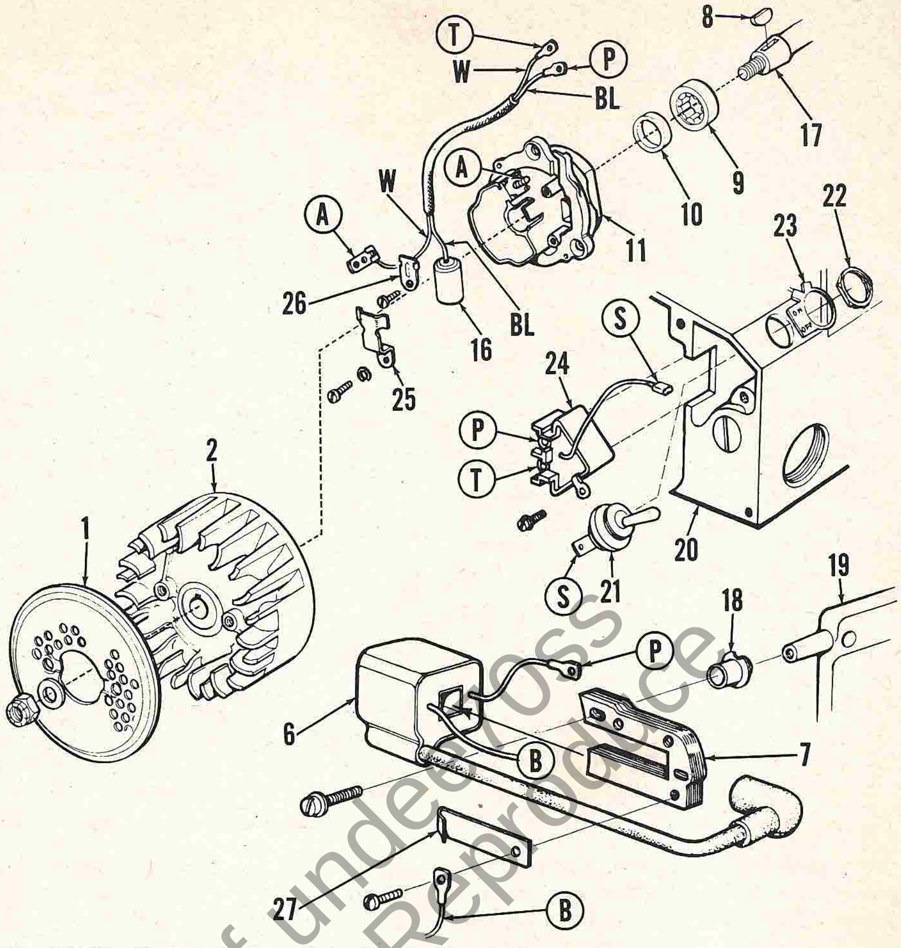


Fig. HL107—Exploded view of the breakerless solid state Wico magneto used on model XL-104. Wiring connections are identified by circled letter; thus, connect wire clip (A) to connection (A) on trigger coil, etc. White wire (W) connects trigger coil to terminal (T) on trigger switch (24).

A. Trigger coil connection
B. Coil ground lead
BL. Black (condenser) lead
P. Trigger switch connection
S. Switch connection
T. Trigger switch connection
W. White lead
1. Rotating screen
2. Magneto rotor (flywheel)
6. Ignition coil
7. Armature
8. Flywheel key
9. Roller main bearing
10. Crankshaft seal
11. Magneto backplate (trigger coil)
16. Condenser
17. Crankshaft
18. Condenser lead retainer
19. Cylinder
20. Throttle handle
21. Ignition switch
22. Nut
23. "ON-OFF" plate
24. Trigger switch
25. Condenser clamp
26. Lead retainer
27. Coil retainer

MAGNETO (Model XL-104). Refer to Fig. HL107 for exploded view of the solid state breakerless Wico flywheel magneto used on the model XL-104 engine.

To check the magneto, connect a test spark plug to high tension lead, turn ignition switch on and crank engine. If there is no spark, remove fan housing and inspect flywheel and wiring for physical damage. If no defects are noted, disconnect coil primary lead at switch box and check coil with Graham or Merc-O-Tronic tester according to tester manufacturer's procedure. Test specifications for each tester are given in Homelite IGNITION SYSTEM SPECIFICATIONS on page 24.

If coil tests OK, disconnect the condenser (black) lead from switch box and test condenser by attaching one tester lead to black lead and other tester lead to engine ground. Check the condenser for short, series resistance and capacity; condenser capacity should test 0.13-0.15 mfd.

To check trigger coil, disconnect trigger coil (white) lead from switch box and connect one lead of ohmmeter to the trigger coil lead and other ohmmeter lead to engine ground. The ohmmeter reading should be either between 25 to 80 ohms or between 80 to 110 ohms. Reverse the ohmmeter leads; the reading should then be alternate to the first ohmmeter reading. Thus, if the first reading was between 20 to 80 ohms, the second reading should be between 80 to 110 ohms, or vice versa.

To check trigger switch, disconnect all wires from the switch. Then, connect one lead of ohmmeter to switch box "P" terminal (see Fig. HL107) and other ohmmeter lead to switch box ground terminal (retaining strap screw eye). Ohmmeter reading should be either between 5 to 25 ohms or between 1 megohm to infinity. Reverse the ohmmeter leads and alternate reading should be obtained. Thus, if first reading was between 5 to 25 ohms, second reading should be between 1 megohm to infinity, or vice versa.

Renew any component not checking within specified test values and reconnect wiring according to connection code shown in Fig. HL107. Note: Although not necessary to remove flywheel to check or test magneto components, the flywheel must be removed to renew trigger coil and/or condenser. Adjust armature air gap as outlined in preceding paragraph for conventional magneto used on other models.

LUBRICATION. Engine is lubricated by oil mixed with the fuel. Mix ½-pint of Homelite oil or SAE 30 non-detergent motor oil with each gallon of regular gasoline; mix fuel and oil in a separate container.

Fill chain oiler reservoir with Homelite Bar and Chain oil or with light motor oil (not over SAE 30). In cold weather, thin oil with kerosene until it flows freely.

The clutch needle roller bearing should be cleaned and relubricated after each 100 hours of operation. A high temperature grease such as Aero Shell #L-14, Aero Shell #5, Texaco Unitemp #500 or Humble (Esso) Nebula EP1 should be used.

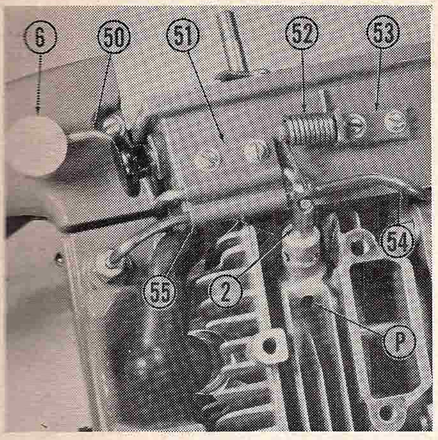


Fig. HL108—View with muffler assembly removed to show compression relief mechanism. Depressing throttle lock button (6) actuates lever (50) lifting compression relief plunger (2). Engine compression will then force relief valve (steel ball) from seat relieving compression through port (P).

P. Compression relief port
2. Relief valve plunger
6. Throttle lock button
50. Release lever
51. Lever bracket
52. Valve spring
53. Spring bracket
54. Chain oiler tube
55. Tube clamp

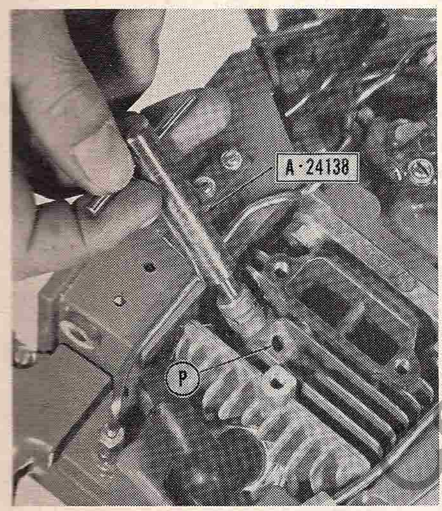


Fig. HL109 — Cleaning compression relief valve seat using Homelite tool No. A-24138. Hold the engine with relief port (P) down so that carbon scraped from seat will fall out.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and scrape free of carbon. With muffler removed, turn engine so that piston is a top dead center and carefully remove carbon from exhaust ports with a wooden scraper. Be careful not to damage chamfered edges of exhaust ports or to scratch piston. Do not run engine with muffler removed.

CLEAN COMPRESSION RELIEF VALVE. While muffler is removed to clean carbon from the muffler and exhaust ports, proceed as follows to clean the compression relief valve on Models XL-102, XL-103 and XL-104:

Remove the two bolts retaining compression relief lever bracket (51—Fig. HL108) and oil tube clamp (55) to air box and remove the compression relief lever (50) and throttle lock (6). Using pliers, carefully lift end of spring (52) from notch in end of valve plunger (2) and ease spring down against oil tube. CAUTION: Do not allow spring to snap against the oil tube as this will dent the tube causing a restriction. Remove the valve plunger, then turn saw over and allow the valve (steel ball) to drop out.

Turn crankshaft so that piston is at bottom dead center, position engine with valve bore down so that scrapings will fall out and clean the valve seat using Homelite tool No. A-24138 as shown in Fig. HL109.

Reinstall valve ball and plunger and lift spring back into notch in plunger. Reinstall actuating lever and throttle lock as a unit, then reinstall oil tube and lever clamps.

REPAIRS

TIGHTENING TORQUES. Suggested minimum tightening torque values (in inch-pounds) are as follows:

Air box to cylinder	80
Automatic oiler to crankcase	40
Carburetor spacer to crankcase	40
Carburetor to spacer	50
Clutch rotor to crankshaft	180
Connecting rod screws	55
Cylinder to crankcase	100
Flywheel nut	150
Spark plug	250

RECOMMENDED SERVICE TOOLS. Tools available from Homelite for servicing Models XL-101, XL-102, XL-103 and XL-104 are as follows:

HOMELITE

Tool No.	Description
23756	Connecting rod bearing tool
A-24051	Main bearing (drive end) & crankshaft jackscrew; also requires:
23136-1	Sleeve
22820-5	Collar
24076	Seal protector
24006-1	Alignment plate
23972	Crankshaft seal installer (drive end w/crankshaft installed)
24054	Crankshaft seal installer (drive end w/crankshaft removed)
A-24057	Main bearing remover (backplate end)
23846-2	Anvil (for use w/A-24057)
24055	Main bearing installer (backplate end); seal remover & installer (backplate)
23759	Seal protector (backplate)
A-23949	Piston pin remover
A-23960	Rotor (flywheel) holder & remover
A-24060	Clutch spanner wrench
A-24138	Compression relief valve seat reamer

CONNECTING ROD. Connecting rod and piston assembly can be removed from crankshaft after removing cylinder. Be careful to remove all of the 31 loose needle rollers when detaching rod from crankshaft.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The needle roller piston pin bearing can be renewed by pressing old bearing out and new bearing in using Homelite tool No. 23756. Note: If substitute bearing installation tool is used, be sure bearing cage extends equal distance from each side of connecting rod. Press on lettered end of bearing cage only.

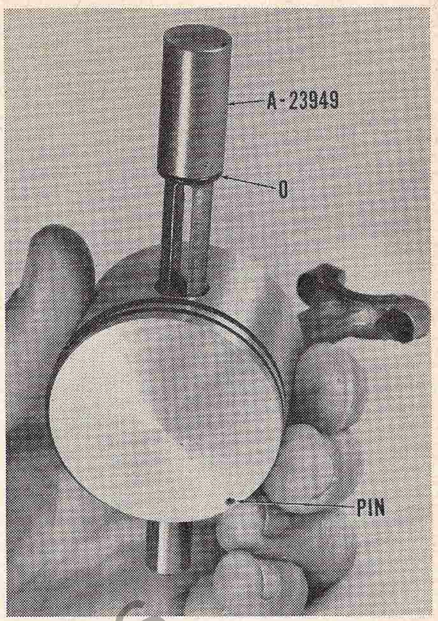


Fig. HL110—Homelite tool No. A-23949 is used to push piston pin from connecting rod and piston. Note "O" ring (O) which protects piston from damage by tool. Note piston ring retaining pin.

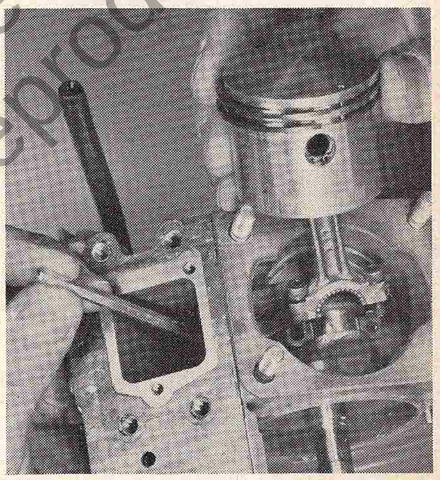


Fig. HL111—View showing reassembly of connecting rod to crankpin. Note that needle rollers are stuck to rod and cap with grease. Rod cap is held in position with Allen wrench. Be sure that match marks on rod and cap are aligned, and that intake side of piston is towards flywheel end of crankshaft as shown.

Renew the crankpin needle rollers as a set if any roller has flat spots or is scored or worn. If reusing needle rollers, use grease to stick 16 rollers in rod cap and 15 rollers in connecting rod; refer to Fig. HL111 for assembly of rod and piston unit to crankshaft. New needle rollers are supplied in a strip of 31 rollers; wrap the

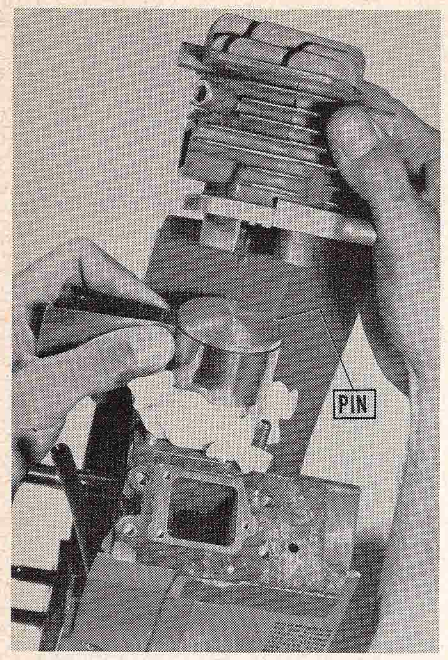


Fig. HL112—View showing cylinder being installed over piston. Piston is held upright by rags stuffed around rod. Make final check to be sure piston ring pin is towards intake side of cylinder as shown.

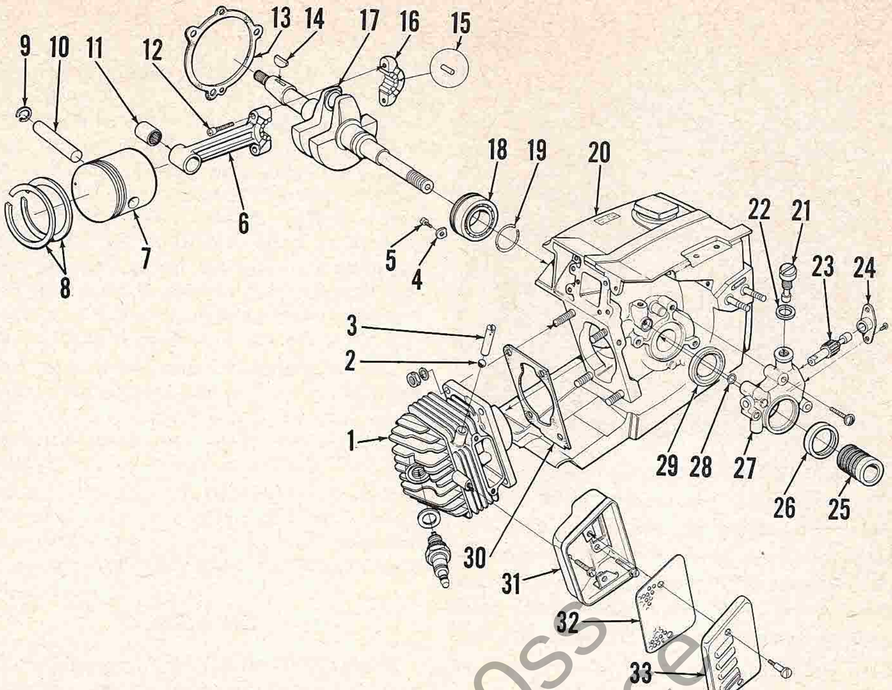
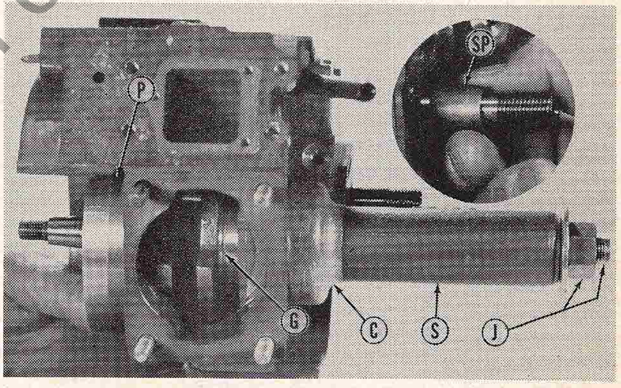


Fig. HL113—Exploded view of Model XL-103 engine assembly; other models are similar except that Model XL-101 does not have compression relief valve (items 2 and 3) in cylinder head and Models XL-101 and XL-102 do not have the automatic chain oiler pump (items 21 through 28). Refer to Fig. HL104 or to Fig. HL107 for flywheel end main bearing which is supported in magneto backplate.

1. Cylinder
2. Relief valve
3. Valve plunger
4. Special washers (2)
5. Retaining screws (2)
6. Connecting rod
7. Piston
8. Rings
9. Snap ring
10. Piston pin
11. Needle bearing
12. Rod cap screws
13. Backplate gasket
14. Flywheel key
15. Needle rollers
16. Rod cap
17. Crankshaft
18. Ball bearing
19. Snap ring
20. Crankcase & fuel tank assy.
21. Cam screw
22. Gasket
23. Pump plunger & gear
24. Flange bearing
25. Worm gear
26. Felt seal
27. Pump body
28. "O" ring
29. Crankshaft seal
30. Gasket
31. Muffler body
32. Baffle
33. Muffler cover

Fig. HL114 — Alignment plate (P) fits onto magneto backplate dowel pins to guide crankshaft as it is being pulled into position with collar (C), sleeve (S) and jackscrew (J). Note that groove (G) in main bearing outer race is next to crankpin throw. Inset shows seal protector (SP) being removed after crankshaft is in position.



waxed strip around crankpin; then assemble rod and piston unit to crankshaft as in Fig. HL111. Be sure that match marks on rod and cap are aligned and secure rod to cap with new socket head screws.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn. If ring side clearance in top ring groove exceeds 0.004 when measured with new ring, piston is excessively worn.

Recommended piston ring end gap is 0.070-0.080; maxmum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and pin are not available separately.

Early type pin is retained in piston by a snap ring at intake side of piston and by a Spirol pin at exhaust side. Closed end of piston pin must be towards Spirol pin. To remove piston from connecting rod, remove the snap ring and push pin out using Homelite tool No. A-23949 as shown in Fig. HL110.

When reassembling piston to connecting rod, push piston pin in with a $\frac{3}{16}$-inch diameter rod inserted in open end of pin. Install snap ring at open end of pin with sharp edge of ring out. Rotate snap ring to be sure it is seated in groove, then turn snap ring gap towards closed end of piston.

NOTE: On late production pistons, pin is retained by a plain square end snap ring at exhaust side and by a Waldes Truarc snap ring at intake side. The Waldes Truarc snap ring has a hole in each end so the ring can be removed using special Waldes pliers; no attempt should be made to remove the plain square end snap ring. To remove the piston pin, remove the Waldes Truarc snap ring, then insert a $\frac{3}{16}$-inch dia. rod through the plain snap ring and drive pin from piston.

CYLINDER. The cylinder can be unbolted and removed from crankcase and piston after removing fan housing and starter assembly and the throttle handle, air box and chain oil tank assembly. Be careful not to let piston hit against crankcase as cylinder is removed.

The cylinder bore is chrome plated. Renew cylinder if chrome plating has worn away exposing the softer base metal. Except on Model XL-101, refer also to COMPRESSION RELEASE paragraph.

CRANKSHAFT, BEARINGS AND SEALS. Crankshaft is supported at drive end by a ball bearing in crankcase and at flywheel end by a roller bearing in magneto back plate. Crankshaft end play is controlled by the ball bearing which is retained on crankshaft by a snap ring and in crankcase by two screws and special washers.

To remove crankshaft, first remove the clutch assembly, automatic chain oiler pump on models so equipped, the fan housing and starter assembly, the throttle handle, air box and chain oiler tank assembly, cylinder, and the connecting rod and piston. Remove the three screws retaining magneto backplate to crankcase and carefully pry backplate from crankcase and the two locating dowel pins. Working through magneto back-

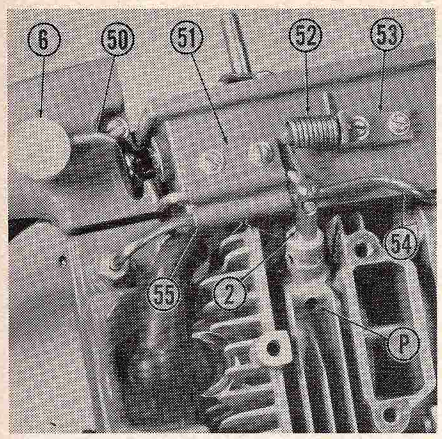


Fig. HL115—View showing compression relief mechanism; all models except XL-101 are so equipped.

P. Relief port
2. Valve plunger
6. Throttle trigger
50. Valve lever
51. Lever bracket
52. Valve spring
53. Spring bracket
54. Oiler tube
55. Tube clamp

plate opening, remove the two screws and special washers retaining ball bearing in crankcase, then press crankshaft and bearing assembly from crankcase.

An expandable type bearing remover (Homelite tool No. A-24507) is available for removing roller bearing from backplate. Insert tool through bearing from inner side of backplate taking care to push tool through bearing only far enough that collets will engage outer side of rollers. Tighten the expander screw of tool, then place backplate on suitable support such as Homelite tool No. 23846-2 and drive bearing from backplate. Remove old crankshaft seal, lubricate new seal and install with lip to inner side of backplate; large stepped end of Homelite tool No. 24055 may be used to install seal. **Lubricate** outer race of new bearing and bore in backplate, then place bearing on small stepped end of Homelite tool No. 24055 or use other suitable tool and press bearing into backplate. CAUTION: Due to tight press fit, installing bearing dry may cause distortion and early bearing failure.

If necessary, remove the retaining snap ring and press crankshaft from ball bearing. New bearing can be installed on crankshaft with bearing collar (Homelite tool No. 22820-5) and sleeve (23136-1) using jackscrew (A-24051) threaded onto clutch end of crankshaft. **Be sure** to **lubricate** bearing and shaft before pushing bearing onto shaft. If special tools are not available, support crankshaft under crankpin throw and use suitable sleeve to press bearing into place. Note: Press against bearing inner race only. Be sure snap ring groove in outer race is towards crankpin (see G—Fig. HL114). Install snap ring on crankshaft with sharp edge away from bearing.

Drive old seal out towards inside of crankcase using long end of Homelite tool No. 24054 or other suitable driver. Install new seal in crankcase using short end of tool No. 24054; if using substitute seal installation tool, outer face of seal should be

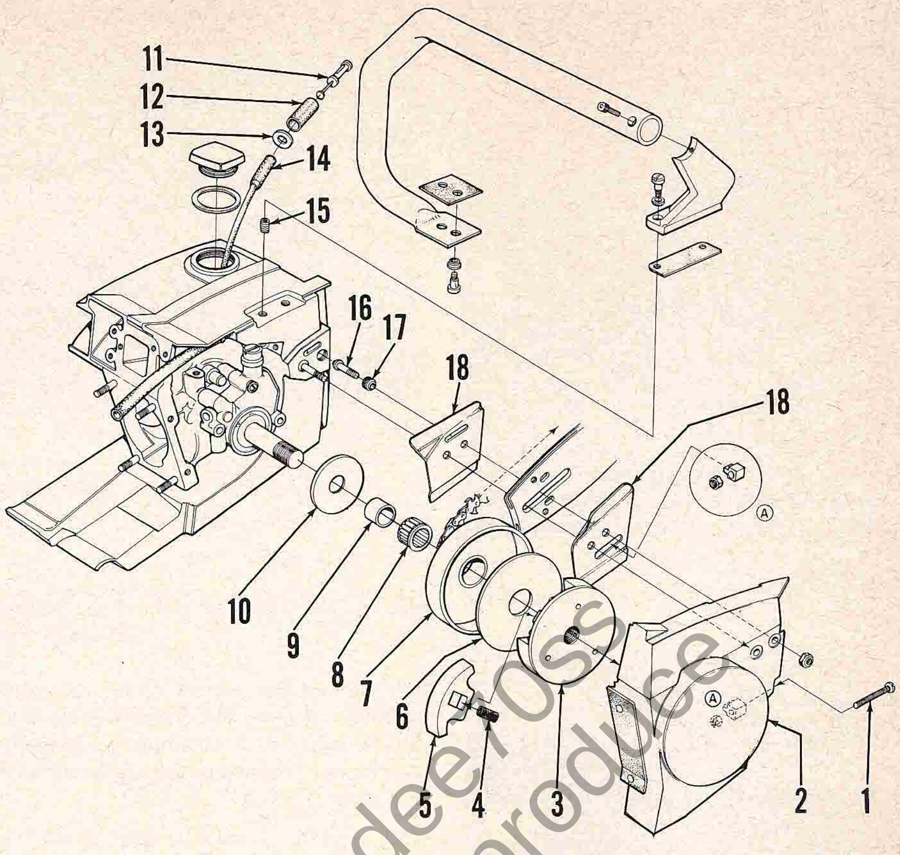


Fig. HL116—Exploded view showing clutch cover and chain tension adjustment, clutch and fuel tank (engine crankcase and fuel tank assembly). Clutch plate (3) is threaded to crankshaft (L.H. threads).

1. Adjusting screw
2. Clutch cover
3. Clutch plate
4. Springs
5. Shoes
6. Large washer
7. Clutch drum & sprocket
8. Needle bearing
9. Bearing race
10. Small washer
11. Fuel pickup
12. Filter
13. Washer
14. Flexible tube
15. Thread insert
16. Bar studs
17. Stud retainers
18. Guide plates

$\frac{1}{16}$-inch below flush with crankcase. Note: Be sure lip of seal is towards inside of crankcase. If desired, new seal can be installed after installing crankshaft and bearing assembly; Homelite tool No. 23972 can be used to install seal with crankshaft installed.

Refer to Fig. HL114 for recommended crankshaft installation procedure. **Be sure** to **lubricate** both bearing and bore in crankcase before installing crankshaft and bearing assembly. Due to tight press fit, installing bearing dry may cause distortion and early bearing failure. Alignment plate (P) (Homelite tool No. 24006-1) fits onto magneto backplate dowels to guide shaft and bearing as the bearing is being pressed into crankcase. Insert shows removing seal protector (SP) (Homelite tool No. 24076) after crankshaft is installed. Note position of retaining groove (G) in bearing outer race. Use two **new** screws and special washers to secure bearing in crankcase.

COMPRESSION RELIEF. Except for model XL-101, all models are equipped with compression relief; refer to Fig. HL115. When the throttle lock (6) is pushed in, lever (50) lifts plunger (2) against spring (52) pressure. When engine is cranked, compression forces steel ball (not shown) from its seat and compression is partly relieved through port (P). Squeezing throttle trigger after engine starts releases throttle lock allowing spring to snap plunger against steel ball closing the compression relief port.

Service of the compression relief valve usually consists of cleaning the valve seat as the port may gradually fill with carbon while the engine is running with compression relief valve open. Refer to MAINTENANCE paragraph for seat cleaning procedure.

When overhauling engine, the cylinder should be inspected for any damage to the compression relief valve port and valve seat that cannot be remedied by cleaning with Homelite tool No. A24138 as shown in Fig. HL109.

PYRAMID REED VALVE. All models are equipped with a "Delrin" plastic pyramid valve seat and stainless steel valve reeds. Pyramid seat, reeds and retainer can be removed after removing carburetor and adapter elbow. The reeds fit on pins molded into the pyramid seat and can be lifted

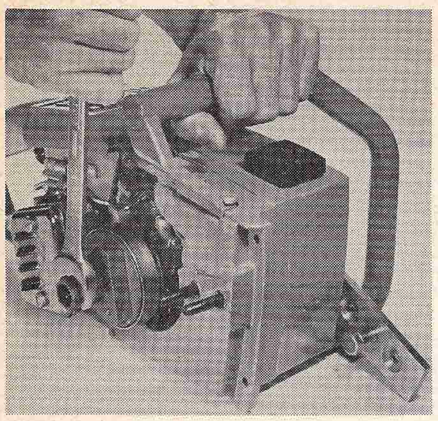
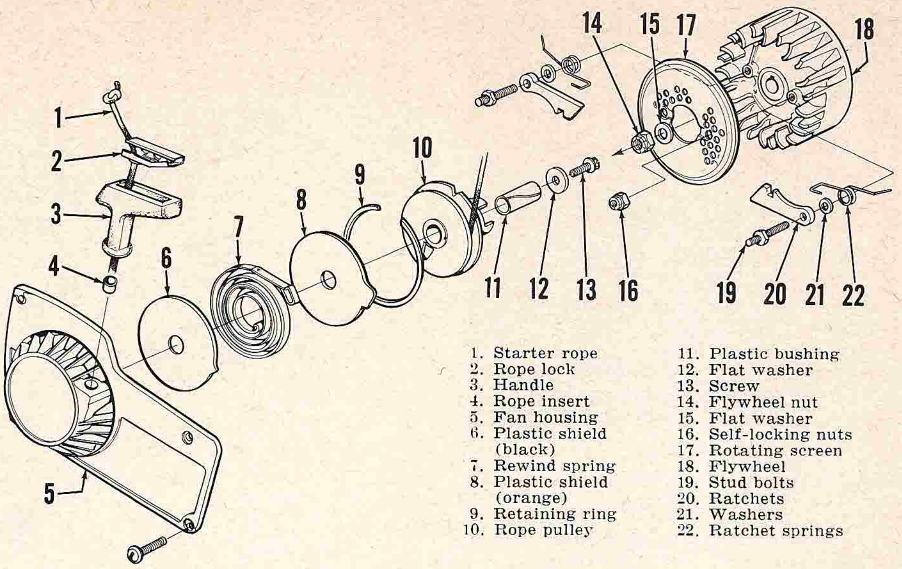


Fig. HL117—Turn clutch rotor clockwise to unscrew from crankshaft (L.H. threads). Spanner wrench is Homelite tool No. A24-060; flywheel (rotor) holder is Homelite tool No. A23960.



1. Starter rope
2. Rope lock
3. Handle
4. Rope insert
5. Fan housing
6. Plastic shield (black)
7. Rewind spring
8. Plastic shield (orange)
9. Retaining ring
10. Rope pulley
11. Plastic bushing
12. Flat washer
13. Screw
14. Flywheel nut
15. Flat washer
16. Self-locking nuts
17. Rotating screen
18. Flywheel
19. Stud bolts
20. Ratchets
21. Washers
22. Ratchet springs

Fig. HL120—Exploded view of the ratchet type rewind starter used on all models. Refer also to Figs. HL121 and 122.

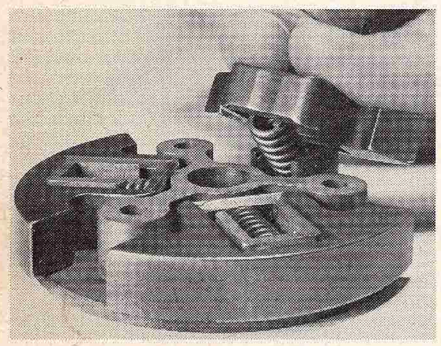


Fig. HL118—To install clutch shoes, hook shoe and spring on clutch plate as shown, then push shoe down into place.

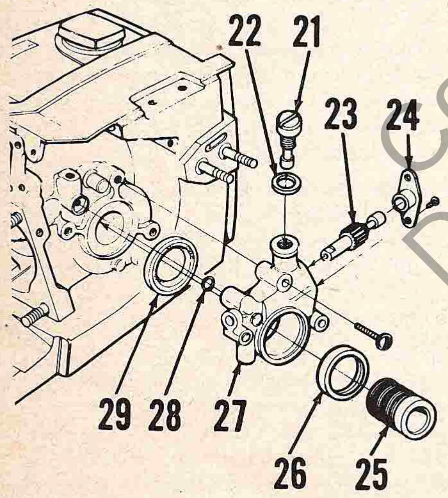


Fig. HL119—Exploded view of automatic chain oiler pump assembly used on models XL-103 and XL-104. Worm gear (25) is driven by engine crankshaft.

21. Cam screw
22. Gasket
23. Plunger & gear
24. Flange bearing
25. Worm gear
26. Felt seal
27. Pump body
28. "O" ring
29. Crankshaft seal

from the seat after removing seat and valve assembly. Inspect the pyramid seat and reed retainer for distortion and/or deterioration. Inspect reeds for cracks or being bent or broken.

To reinstall, proceed as follows: Fit the reed retainer carefully into crankcase. Stick the reeds to the pyramid seat with light oil, then push the seat and reed assembly into the retainer. Homelite recommends that the reed valve assembly and reed retainer always be installed separately. Install carburetor adapter with new gasket using the three special shouldered screws.

CLUTCH. Refer to Fig. HL116 for exploded view of shoe type clutch used on all models. The clutch rotor (plate) (3) is threaded to the crankshaft and can be removed as shown in Fig. HL117; note that L.H. threads are used.

The needle roller bearing (8—Fig. HL 116) should be removed, cleaned and lubricated after each 100 hours of operation. A high temperature grease such as Aero Shell #L-14, Aero Shell #5, Texaco Unitemp #500 or Humble (Esso) Nebula EP1 should be used.

If clutch slips with engine running at high speed under load, check the clutch shoes for excessive wear. If chain continues to turn with engine running at idle speed (below normal clutch engagement speed of 3000 RPM), check for broken, weak, distorted or improperly installed clutch springs.

To disassemble clutch plate and shoe assembly, pry shoes from plate with screwdriver. To install clutch shoes and springs, refer to Fig. HL118. When installing clutch plate and shoe assembly on crankshaft, tighten to a minimum torque of 180 inch-pounds.

AUTOMATIC CHAIN OILER PUMP. All models except model XL-101 are equipped with an automatic chain oiler pump which is located behind the clutch and chain sprocket. Refer to exploded view in Fig. HL119. Pump body (27) is attached to crankcase and worm gear (25) is driven by crankshaft.

To service pump, unscrew the clutch plate assembly as shown in Fig. HL117 and remove clutch drum and bearing. The automatic chain oiler pump can then be removed from engine crankcase after disconnecting the oil lines.

Worm gear (25—Fig. HL119) can be removed from pump body. To remove pump plunger (23), first remove flange bearing (24) and cam screw (21). Pry felt dust seal (26) from pump body and install new seal using suitable driver. Install new gasket (22) on cam screw and use new "O" ring (28) when reassembling and reinstalling pump. Tighten pump retaining screws evenly to a minimum torque of 40 inch pounds.

REWIND STARTER. For exploded view of starter, refer to Fig. HL120. To disassemble starter, refer to Fig. HL121 and proceed as follows: If starter spring remains under tension, pull the starter rope out about two turns of pulley, hold pulley from turning and pull loop of rope out past notch in pulley. Allow the starter spring to completely unwind, then remove screw (13) and disassemble unit. Be careful when removing spring; a rapidly uncoiling starter spring could cause serious injury.

Refer to exploded view in Fig. HL120 and to Fig. HL122 for reassembly guide. It is recommended that the spring be reinstalled dry (without oil or grease) and the starter post and plastic sleeve be lubricated with light oil only. Install black plastic spring shield, spring (as shown in Fig. HL122) and the orange plastic shield on top of spring. If inner loop of spring is not then visible through hole in orange plastic shield, bend inner loop in towards starter post. Install retaining ring (9—Fig. HL120).

If necessary to install new rope, insert end through pulley and tie knot as shown at (K—Fig. HL121). Heat end of rope to secure knot, then insert other end through rope guide in fan housing and secure in handle. Wind cord all the way onto pulley, then fit pulley and plastic sleeve onto starter post. Pull rope out far enough to be sure pulley engages spring, then allow spring to rewind. Install pulley retaining washer and screw and tighten screw to minimum torque of 50 inch-pounds. Pull cord out about two feet so that notch in pulley is at rope insert in housing and hold pulley from turning (Fig. HL121). Pull up a loop of rope between notch and fan housing, then holding loop, turn pulley and rope three turns clockwise (winding spring). Pull out the rope so that it runs straight from pulley through insert in fan housing, then allow pulley to rewind slowly.

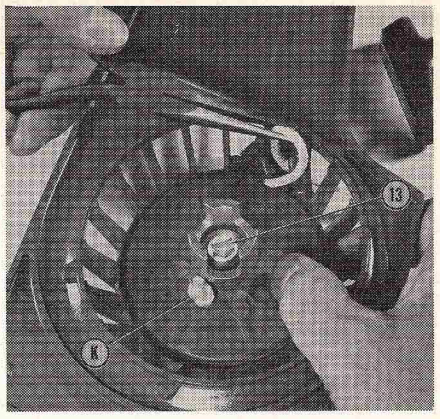


Fig. HL121—Pulling loop of starter rope past notch in rope pulley. Rope is retained by knot (K). Rope pulley retaining screw is (13).

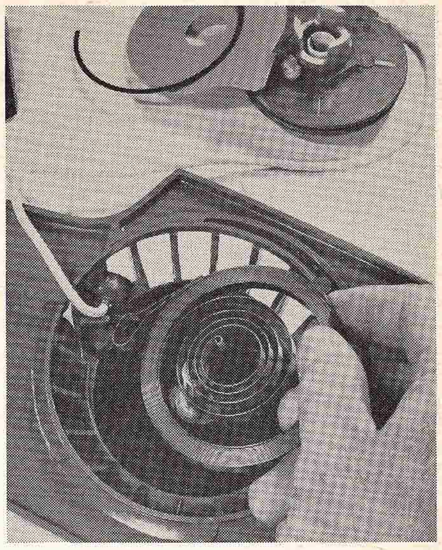


Fig. HL122—Installing rewind spring. Outer (black plastic) spring shield is already installed.

NOTES

HOMELITE AUTHORIZED FACTORY BRANCHES

(Arranged in alphabetical order by states)

When communicating with any of the establishments listed below, insert the name "Homelite" before the listed address, except those in Canada and Europe.

3000 W. Valley Blvd.
Alhambra, California 91803

211 M. Street
Fresno, California 93721

2234 Auburn Blvd.
Sacramento, California 95821

727 Airport Blvd.
So. San Francisco, California 94080

1575 Carr Street
Denver, Colo. 80215

164 E. Service Road
Hartford, Connecticut 06101

6965 Phillips Hwy. (U. S. No. 1 South)
Jacksonville, Florida 32216

198—14th Street, N.W.
Atlanta, Georgia 30318

3820 W. North Avenue
Stone Park, Illinois 60161

1818 W. 16th Street
Indianapolis, Indiana 46207

3209 Old Minden Rd.
Bossier City, Louisiana 71010

Park Street
Orono, Maine 04473

144 Western Avenue
Allston, Massachusetts 02134

30425 Stephenson Highway
Madison Heights, Michigan 48071

1547 Godfrey Ave., S.W.
Grand Rapids, Michigan 49509

814 North Prior Avenue
St. Paul, Minnesota 55104

4115 Pennsylvania
Kansas City, Missouri 64111

5733 Manchester Avenue
St. Louis, Missouri 63110

1433 So. 13th Street
Omaha, Nebraska 68103

1006 St. George Avenue
Avenel, New Jersey 07001

39 River Road
North Arlington, New Jersey 07032

1650 William Street
Buffalo, New York 14206

658 New Loudon Road
Latham, New York 12110

Rte. 1, Boston Post Road
Port Chester, New York 10573

2518 Erie Boulevard, East
Syracuse, New York 13224

2640 Freedom Drive
Charlotte, North Carolina 28208

7806 Anthony Wayne Avenue
Cincinnati, Ohio 45216

15728 Industrial Parkway
Cleveland, Ohio 44135

2714 Nebraska Avenue
Toledo, Ohio 43607

1212 S.E. Powell Blvd.
Portland, Oregon 97242

126 Frankstown Ave.
Altoona, Pennsylvania 16602

176 Lincoln Highway
Malvern, Pennsylvania 19355

5025 Longshore Avenue
Philadelphia, Pennsylvania 19135

4260 Ohio River Blvd.
Pittsburgh, Pennsylvania 15202

1324 No. Hollywood
Memphis, Tennessee 38108

1225 No. Industrial Blvd.
Dallas, Texas 75207

113 North Highway 91
North Salt Lake, Utah 84054

4605 Wheeler Ave.
Alexandria, Virginia 22304

1911—22nd Avenue, So.
Seattle, Washington 98144

E. 3927 Trent Avenue
Spokane, Washington 99202

5128 MacCorkle Ave., S.E.
Charleston, West Virginia 25304

9010 W. Schlinger Ave.
W. Allis, Wisconsin 53214

CANADA

Terry Industries,
A Div. of Textron Canada Ltd.
180 Labrosse Avenue
Pointe Claire, Quebec

Terry Industries,
A Div. of Textron Canada Ltd.
37 Densley Avenue
Toronto 15, Ontario

Terry Industries,
A Div. of Textron Canada Ltd.
12—5th Street
P.O. Box 801
Moncton, New Brunswick

Distributors for Terry Industries are:

Broadway Equipment, Ltd.
98 Broadway
Corner Brook, Newfoundland

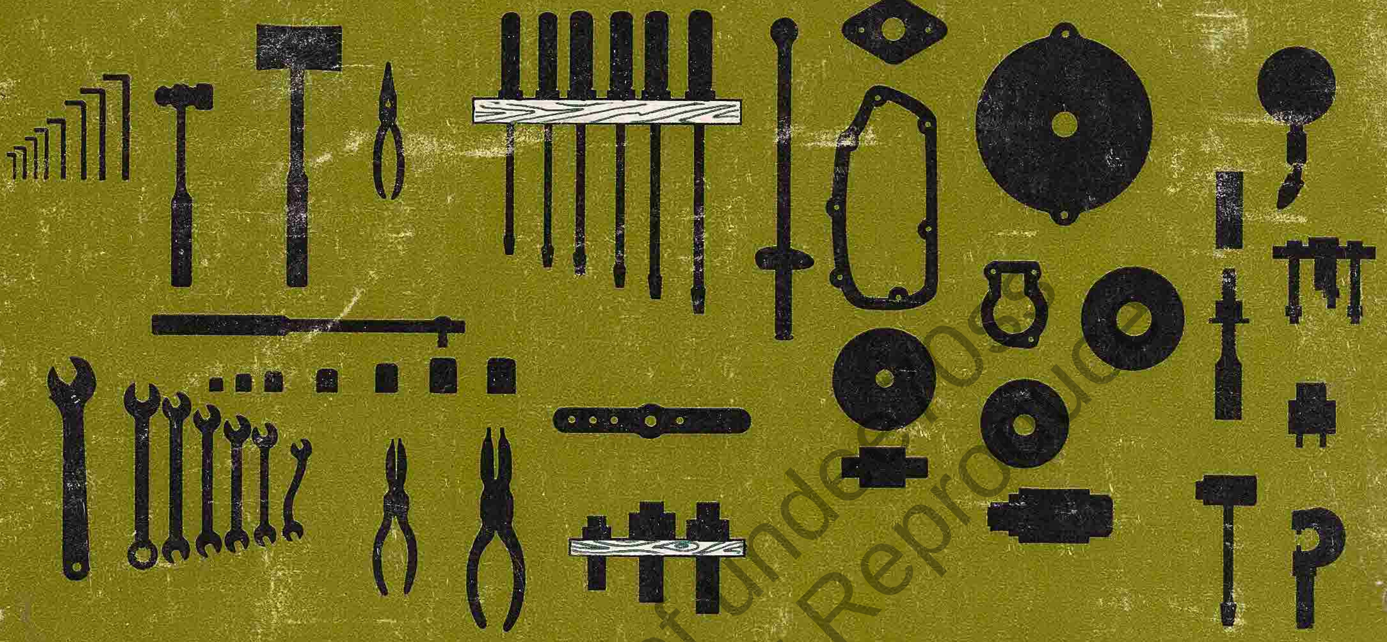
Borton's Sales &
Saw Service (1967) Ltd.
175 Stadacona Street
Winnipeg, Manitoba

Specialty Products & Equipment
Division of Velma Holdings Ltd.
14650—118th Avenue
Edmonton, Alberta

Challenger Equipment Ltd.
14 Powell Street
Vancouver, British Columbia

EUROPE

Homelite, A Div. of Textron Inc.
Biesbosch 74A
Amstelveen, Holland



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