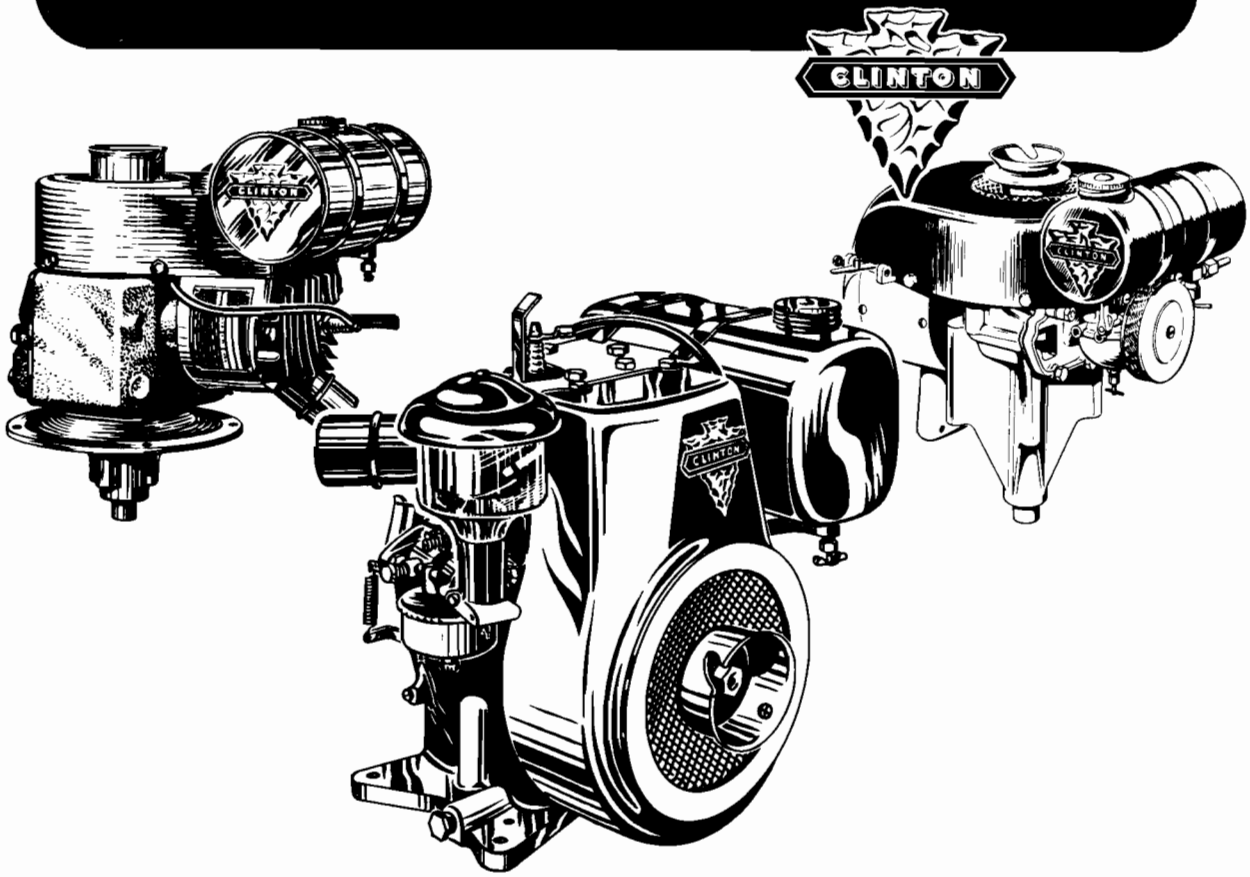
MAINTENANCE MANUAL and OVERHAUL INSTRUCTIONS



★ CLINTON ★

2 & 4 CYCLE ENGINES

CLINTON ENGINES

2 & 4 CYCLE MAINTENANCE

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INTRODUCTION

This Maintenance and Overhaul Instruction Manual is designed to provide Clinton dealers and Authorized Clinton Service Stations with factory-approved methods.

There are now over two-and-one-half million Clinton Engines in use, many of which have special variations to make them suitable for specific applications. It would be impossible to compile a manual of this type with step-by-step procedures for disassembly and reassembly of all the two and four cycle engines Clinton Machine Company builds. It is possible, however, to list typical variations, correct tolerances and other important servicing data.

Periodic Service Bulletins, issued by the Service Department, contain the latest information on procedures and equipment. These should be filed for reference and used in conjunction with this Manual. Factory School Courses are offered to provide mechanics with the teardown and rebuild information they want to have about the engines they service.

Clinton Machine Company knows that expert service plays a vital part in the small gasoline engine business. By providing this service efficiently and effectively, dealers and Service Stations will bring increased profit and new customers to their own enterprises.

Material contained in this manual incorporates instructions appearing in Service Bulletins 43, 52, 56 and 61 .

GENERAL INFORMATION

Every Clinton Engine can be equipped with at least one and possibly more accessories to adapt it for a specific use. Service Stations and dealers should familiarize themselves with accessory items such as reduction gear attachments, special length crankshafts, special control cables. Several of these accessory items must be built in at the factory, but others offer a profitable source of business to dealers, when customers wish to convert their engines to another use or bring earlier models up to date.

Some of the quality features of Clinton two and four cycle engines are listed below. All Clinton Engines are one cylinder, internal combustion types.

1. **Cylinder Head**—Clinton four cycle engines are "L" head type with a Ricardo-type combustion chamber. Blocks are made from fine grained gray-iron castings under strict metalurgical controls at the Factory. Two cycle engines have the cylinder block, cylinder head and crankcase cast in one piece aluminum alloy. This difference should be kept in mind when reading instructions in this manual.
2. **Carburetor**—Float type carburetors, including the Clinton Carburetor with the built in float lever, are standard on all late model Clinton Engines. Some early engines in the field have suction type carburetors.
3. **Magneto** — Nationally-advertised magnetos of special design are standard on all late models. Long life, double protection and easy accessibility are features of this Magneto.
4. **Governors**—One of two types of governor is used. The automatic, centrifugal flyball type is standard on most Clinton four cycle engines, while the adjustable air vane type is standard on all two cycle and some four cycle models
5. **Lubrication**—Splash type lubrication is standard on all four cycle engines except the VS-300 which employs the centrifugal sump type. Horizontal engines have an automotive type dip stick for increased safety. Some early four cycle engines have an oil pump in the base, and these can be converted when they show signs of wear. Two cycle engines are lubricated solely by mixing the proper amount of oil with the gasoline.
6. **Air Filters**—Visible, oil bath downdraft air cleaners are used on all late model four cycle engines. Aluminum mesh type air filters are used on two cycle engines.
7. **Flywheel**—Efficient and dependable. Essentially simple design means maximum protection and ready accessibility.
8. **Bearings**—Bearings surfaces range from 25% to 40% greater than is ordinarily standard on similar sized engines.
9. **Crankshaft**—One piece, Arma Steel castings for long life. Both main crankshaft journals and the connecting rod journal are Toco hardened; hard enough to stay round under continuous full load service.
10. **Cooling**—Accomplished by an air blast, forcefully created by the finned flywheel and directed over the finned cylinder head by an effectively contoured blower housing.
11. Both cams and gears are machined on an integral, gray iron casting with a bore through the center. The bore rides on polished steel shaft anchored at both sides of the engine block. Series 300 engines have a separate gear for each cam.
12. Clinton four cycle engines are available with the following variations:
    a. Speed reductions—2:1, 4:1 or 6:1 with a choice of four positions for the power take-off.
    b. Remote control throttle cables.
    c. Bases with a variety of mounting holes.
    d. Special crankshaft extensions.
    e. Recoil starters, instead of the conventional rope starter pulley.
    f. Ball thrust bearings for the power take-off end of the crankshaft. These thrust bearings are designed to carry unusually applied thrusts.
    g. Auxiliary power take-off units—15:1 to 30:1, clockwise or counter-clockwise.

CLINTON ENGINES

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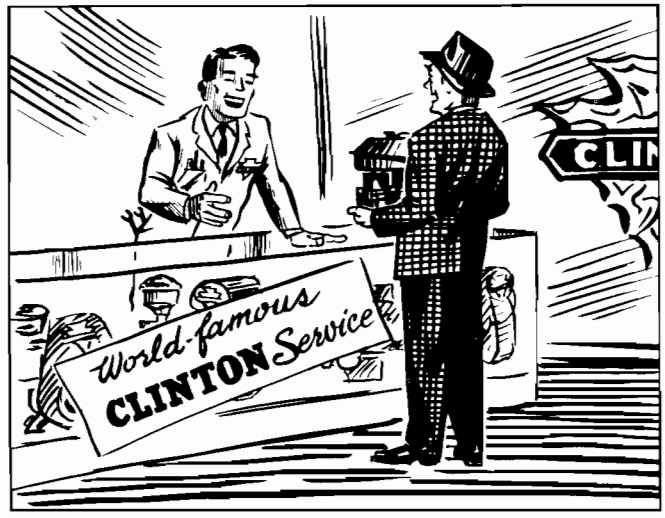
THE FREE ENGINE CHECK-UP

In almost all Clinton's advertising, reference is made to the "Free Engine Check-Up"—a sales feature which has brought Clinton and you many new customers and friends. Ninety per cent of all service needs can be spotted during the three simple 'Check-Up' operations: Compression, Carburetor and Ignition. They take you very little time to complete, but they make the customer realize just what Clinton Service means. For your benefit we review them here.



TO TEST COMPRESSION

1. Turn the starter pulley with a rope or with your hand. If there is not resistance something is wrong in the compression system.
2. Use a compression gage and check compression for 80 lbs.

TO CHECK THE IGNITION

1. Disconnect the high tension head and hold it ¼" or less from the block. Crank the engine and watch the spark jump. This will give you an indication of any trouble in the magneto.
2. Take out the spark plug; examine the points.

TO CHECK THE CARBURETOR

1. Remove the bowl and check:
   a. The float
   b. The flow of fuel into the carburetor
   c. Look at the jets
   d. Look for gum accumulation

WARRANTY

The Clinton Machine Company, Maquoketa, Iowa, U.S.A., warrants each new engine it manufactures against defects in material and workmanship under normal use and service. Our obligation under this warranty is limited to make good at our factory or authorized service station, any part or parts thereof which shall, within ninety days after delivery of such engine to the original purchaser, be returned to us or our factory authorized service station, with transportation charges prepaid, and with our examination shall disclose to our own satisfaction to have been thus defective; this warranty being expressed in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume, nor authorize service stations to assume for us any other liabilities in connection with the sale of our engine.

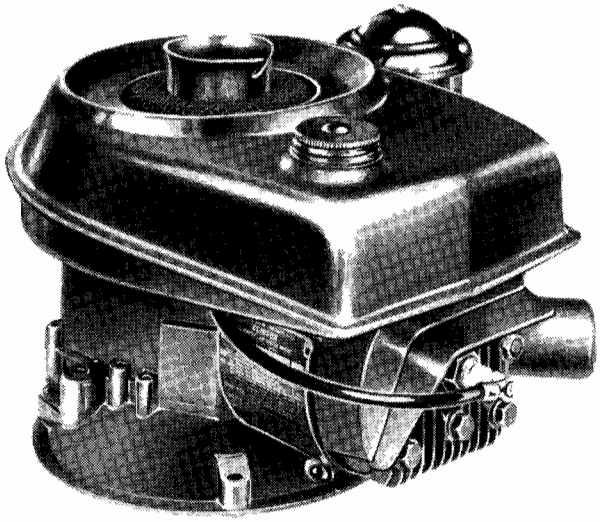
This warranty shall not apply if any engine which shall have been repaired or altered outside of our own factory or our factory authorized service station in any way so as in our judgement to affect the stability or liability, nor which has been subjected to misuse, negligence, or accident, nor any engine made by us which does not have a governor, or shall have been operated at a speed or load beyond the factory specified capacity. Carburetors, magnetos, and other trade accessories are guaranteed separately by their respective manufacturers.

The Clinton Machine Company reserves the right to make changes in design, and changes or improvements upon this product without imposing any obligation upon itself to install the same upon its products previously manufactured.

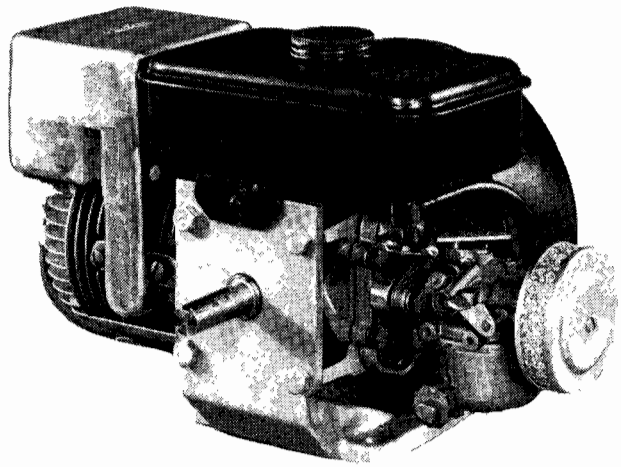
CLINTON MACHINE COMPANY

SERVICE DIVISION — MAQUOKETA, IOWA

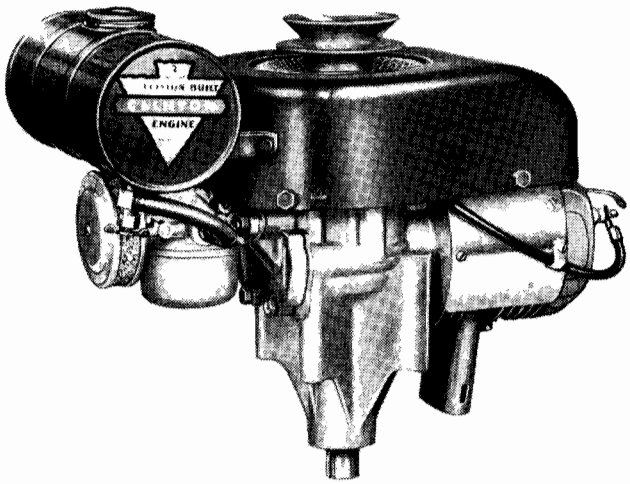
PICTORIAL REVIEW OF CLINTON ENGINES



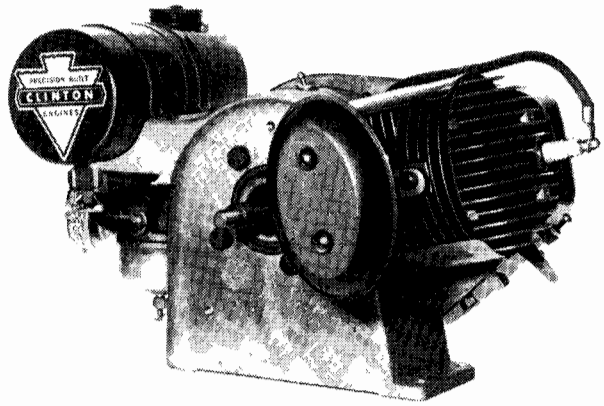
VS-100
Lightweight, vertical shaft, 4-cycle 1½ quart fuel tank integral with the housing, float carburetor, air vane governor, visible oil bath air filter. (See special overhaul and maintenance instructions — VS-100 and VS-2100 engines.)



200
Horizontal shaft, 2-cycle square fuel tank, float carburetor, air vane governor and metallic mesh air filter.



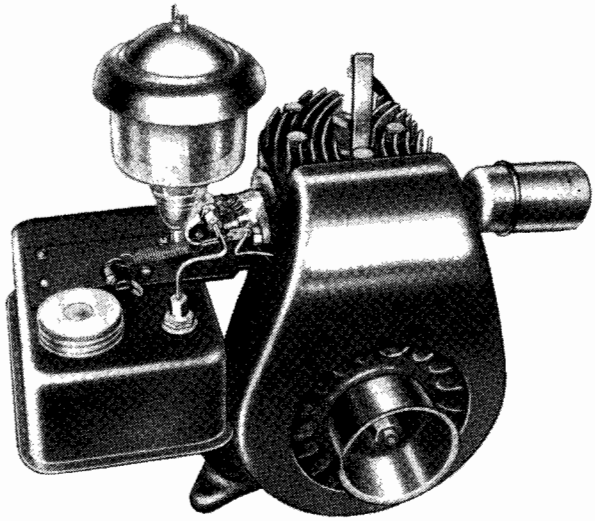
VS-200
Vertical shaft, 2-cycle, 1 quart round fuel tank, float carburetor, air vane governor, metallic mesh air filter.



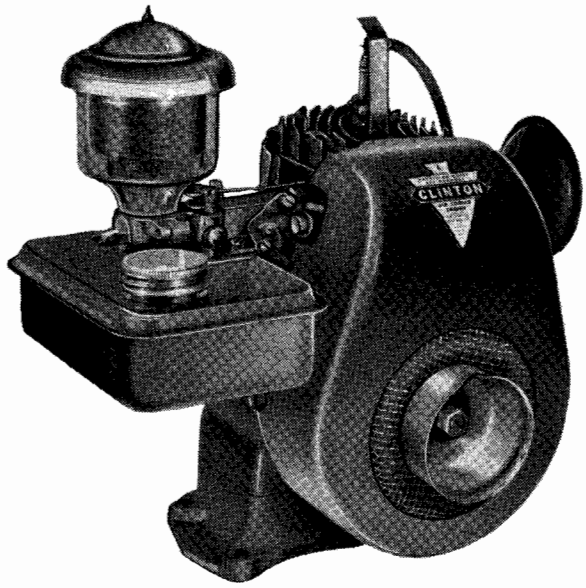
290
Horizontal shaft, 2-cycle, round 1 qt. fuel tank, float carburetor, air vane governor, metallic mesh air filter.

CLINTON ENGINES

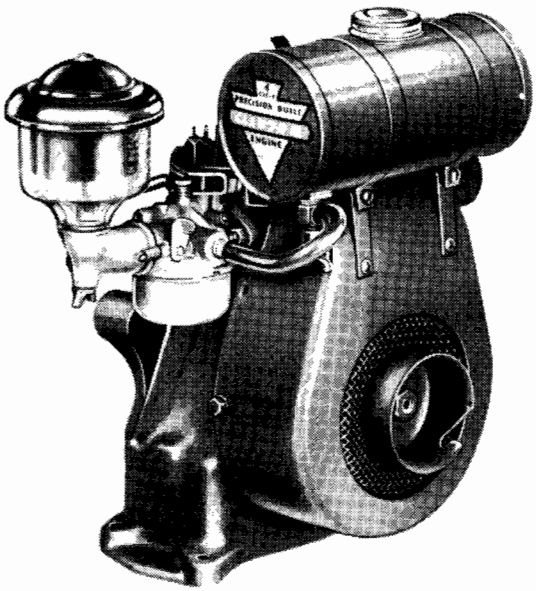
2 & 4 CYCLE MAINTENANCE



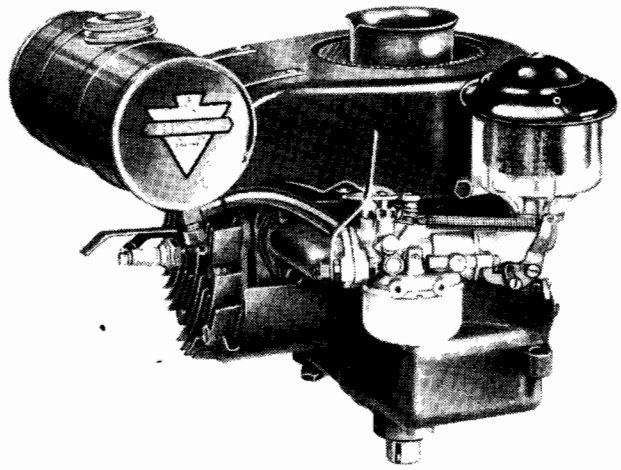
300
Horizontal shaft, 4-cycle, squared fuel tank, suction type carburetor, air vane governor, visible oil bath air filter.



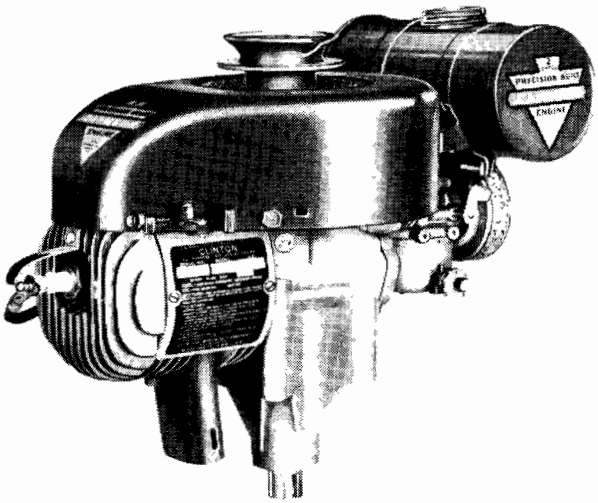
300-350
Horizontal shaft, 4-cycle, squared fuel tank, suction type carburetor, air vane governor, visible oil bath air filter.



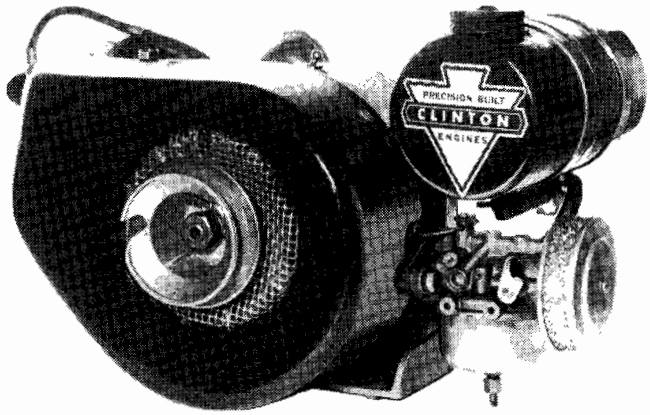
A-300
Horizontal shaft, 4-cycle, round 1 qt. fuel tank, float-carburetor, air vane governor, visible oil bath air filter.



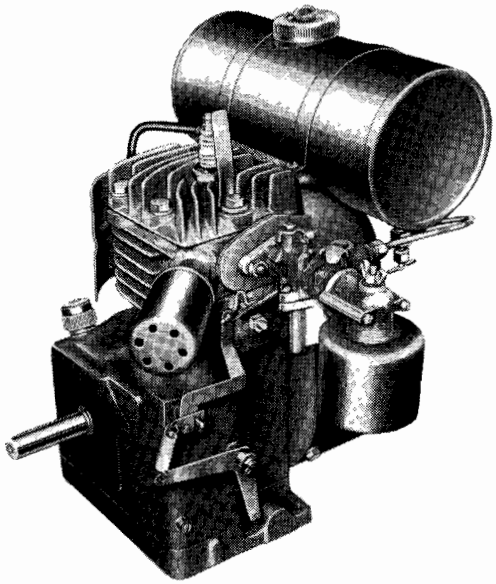
VS-300
Vertical shaft, 4-cycle, round 1 qt. fuel tank, float carburetor, air vane governor, visible oil bath air filter.



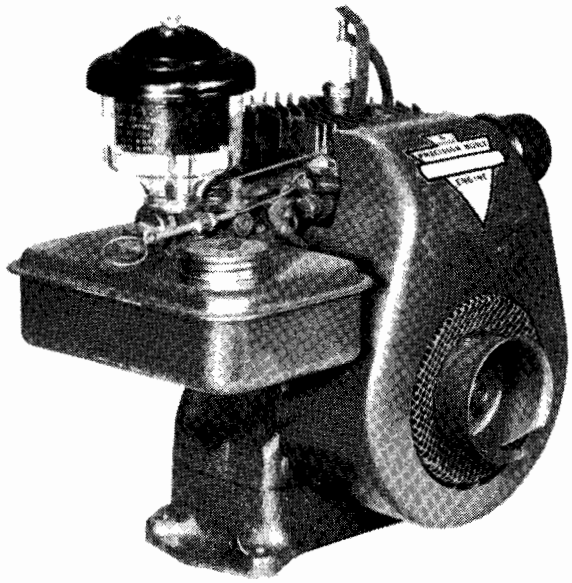
VS-400
Horizontal shaft, 2-cycle, round 1 qt. fuel tank, float carburetor, air vane governor, metallic mesh type air filter.



490
Horizontal shaft, 2-cycle, round 1 qt. fuel tank, float carburetor, air vane governor, metallic mesh air filter.



500
Horizontal shaft, 4-cycle, round fuel tank, Zenith Carburetor, flyball governor, ribbon-type air filter.



650
Horizontal shaft, 4-cycle, squared 1 qt. fuel tank, suction carburetor, air vane governor, visible oil bath air filter.

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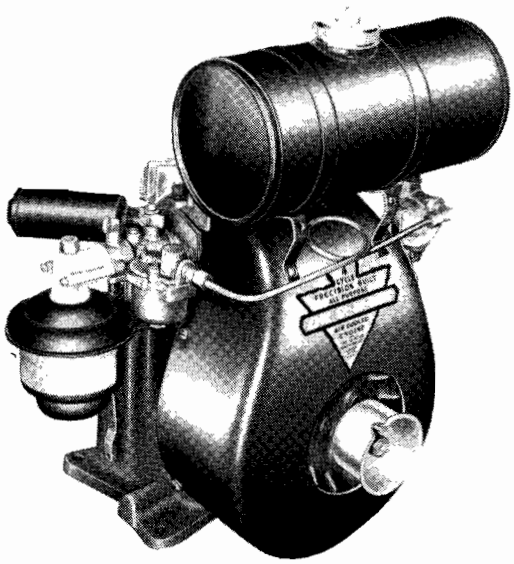
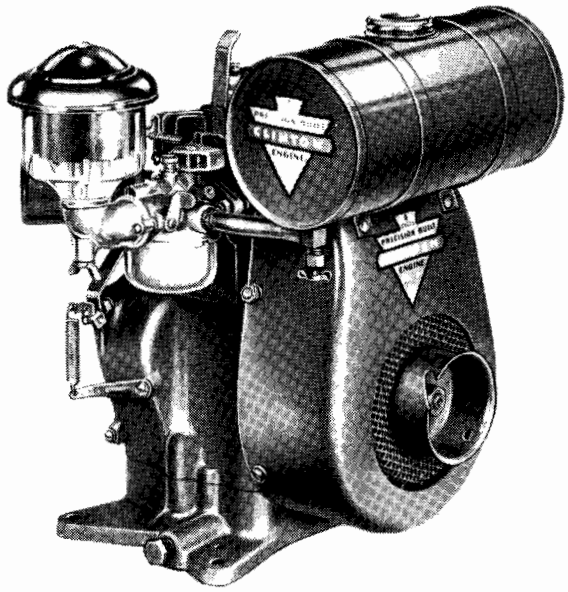
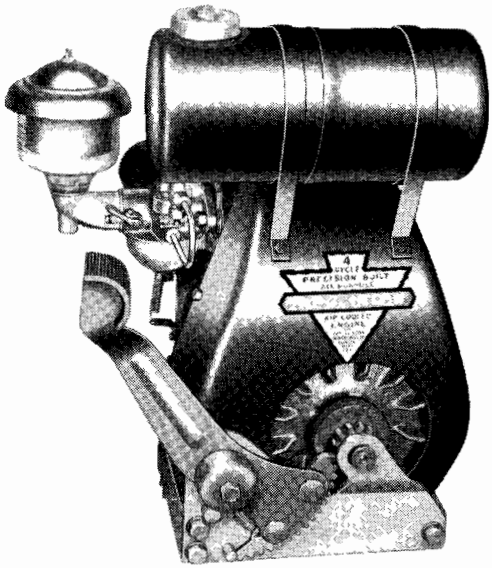
2 & 4 CYCLE MAINTENANCE



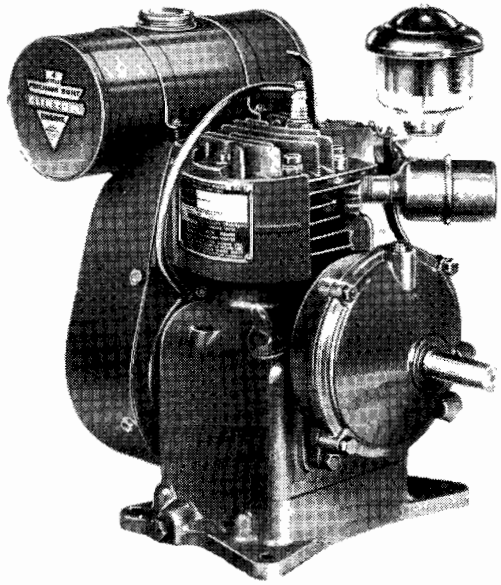
700
Horizontal shaft, 4-cycle, round fuel tank, Tillotson carburetor, fuel filter mounted on tank, updraft metal oil bath air filter.



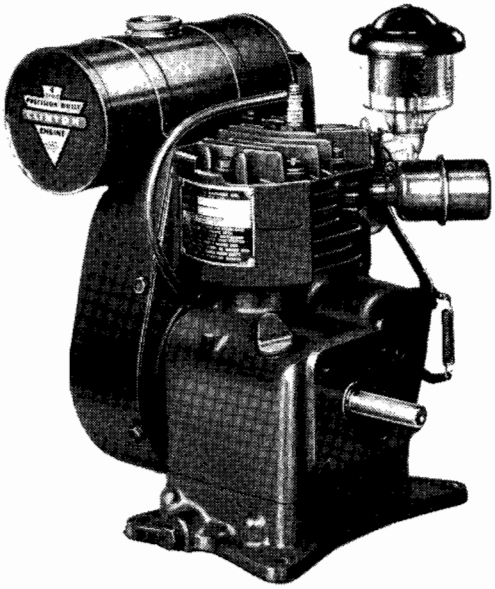
B-700
Horizontal shaft, 4-cycle, round 2 qt. fuel tank, float carburetor, flyball governor, visible oil bath air filter.



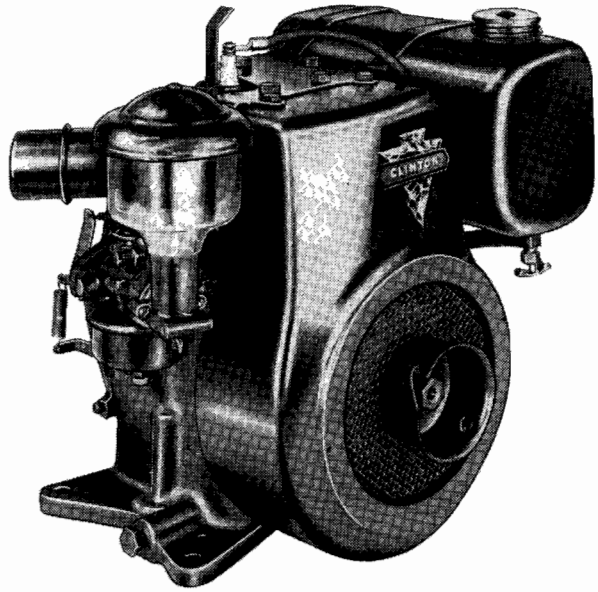
B-700
Horizontal shaft, 4-cycle, round 2 qt. fuel tank, float carburetor, flyball governor, visible oil bath air cleaner and kick starter.



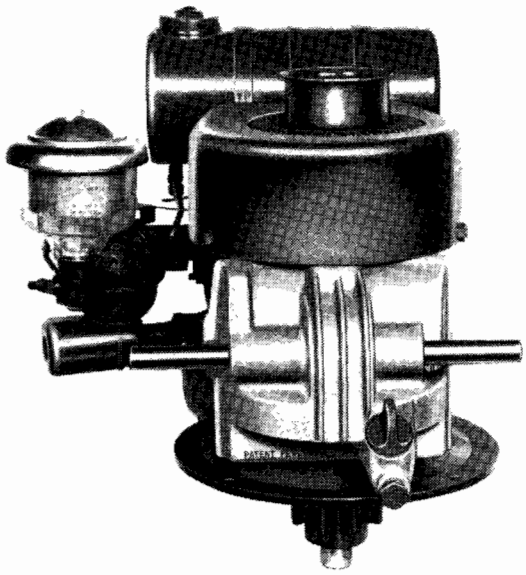
B-760
Horizontal shaft, 4-cycle, round 2 qt. fuel tank, float carburetor, flyball governor, visible oil bath air filter.



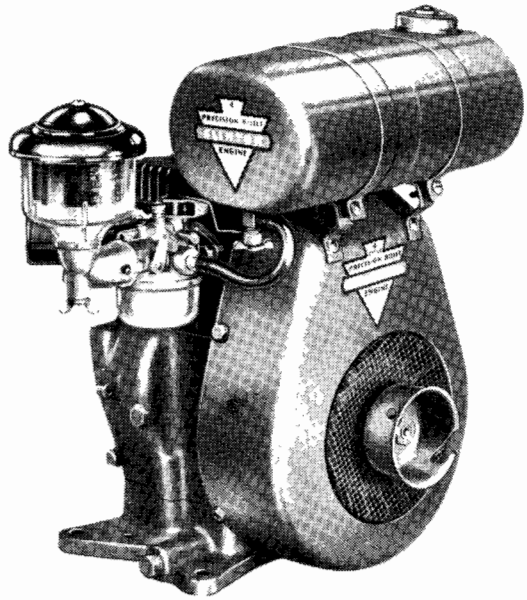
B-790
Horizontal shaft, 4-cycle, round 2 qt. tank, float carburetor, flyball governor, visible oil bath air filter.



C-700
Horizontal shaft, 4-cycle, rectangular 2 qt. fuel tank with gasoline strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter.



VS-700
Vertical shaft, 4-cycle, round 2 qt. fuel tank, float carburetor, air vane governor, visible oil bath air filter with an auxiliary power take-off.



800
Horizontal shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, visible oil bath air filter.

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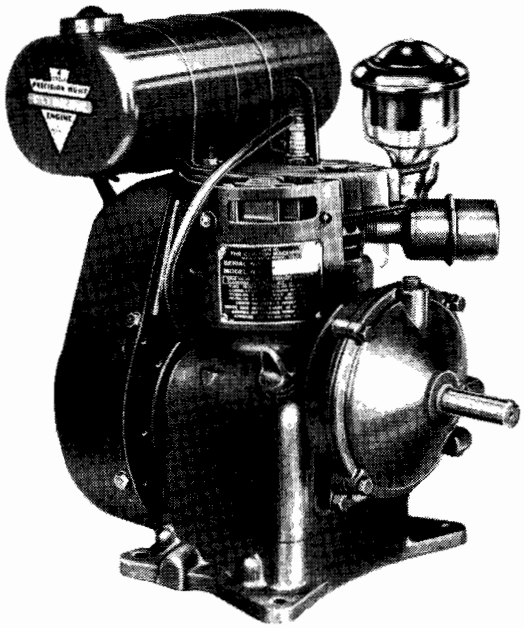
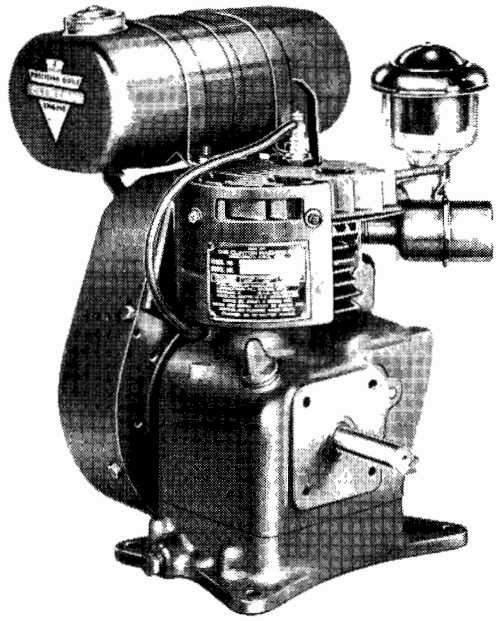
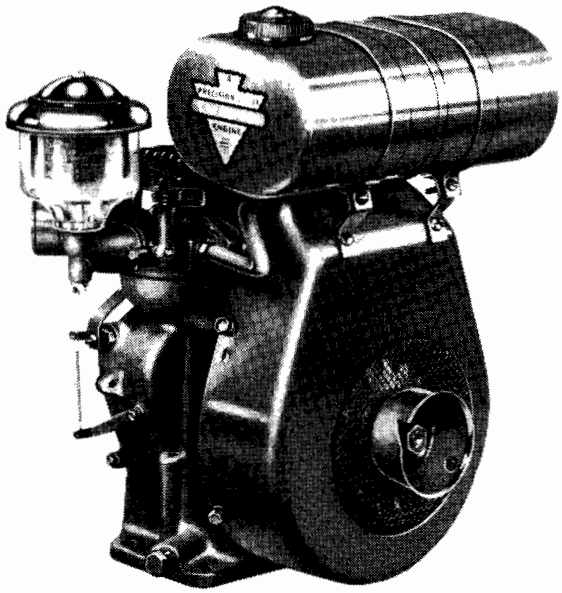
2 & 4 CYCLE MAINTENANCE



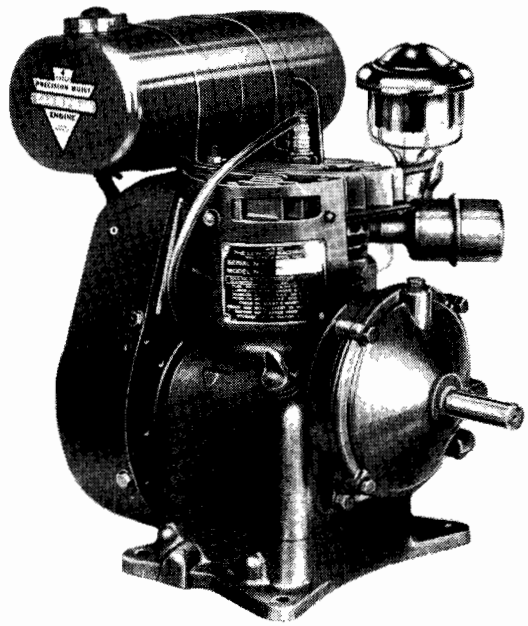
860
Horizontal shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, visible oil bath air filter.



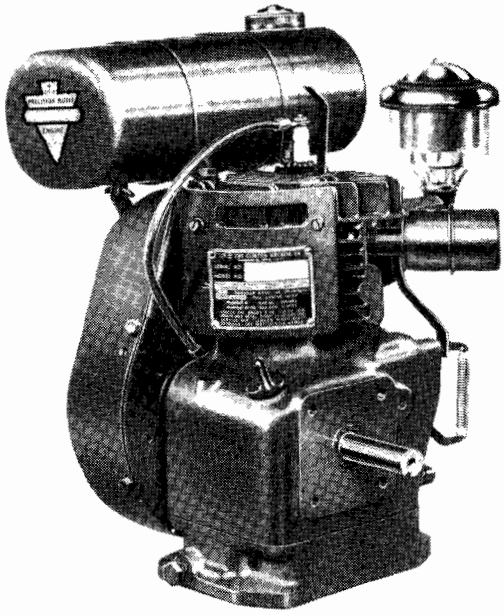
890
Horizontal shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, visible oil bath air filter.



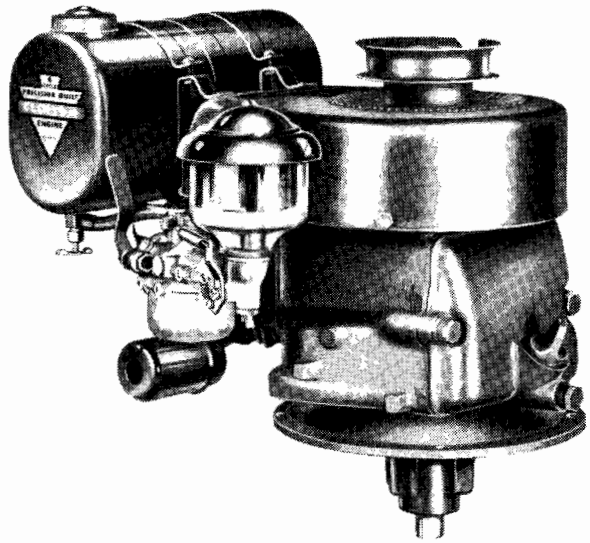
A-800
Horizontal shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter.



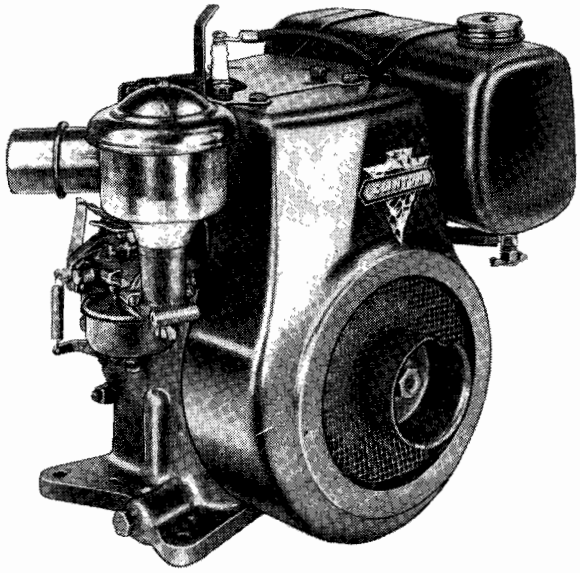
A-860
Horizontal shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, visible oil bath air filter.



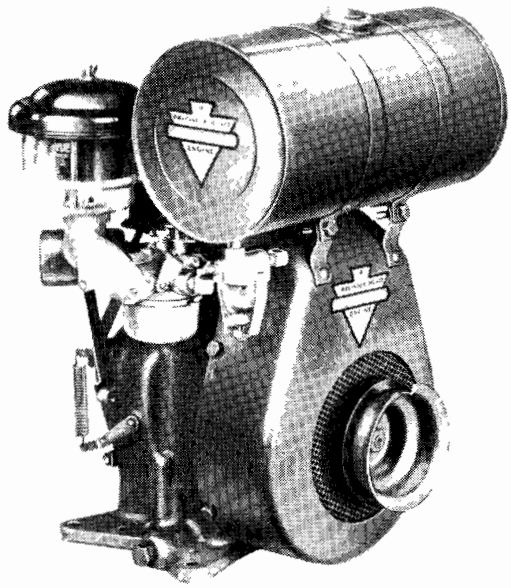
A-890
Horizontal shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, visible oil bath air filter.



VS-800
Vertical shaft, 4-cycle, oval 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, visible oil bath air filter.



900
Horizontal shaft, 4-cycle rectangular 3 qt. fuel tank with fuel strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter.



D-1100
Horizontal shaft, 4-cycle, round 5 qt. fuel tank with visible fuel strainer and and shut-off, float carburetor, flyball governor, visible oil bath air filter.

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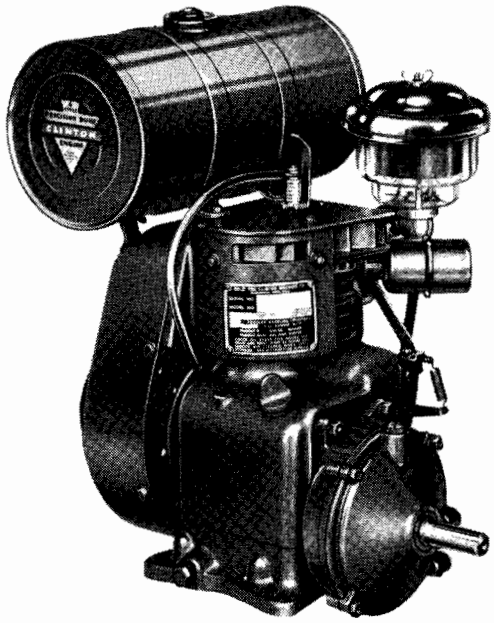
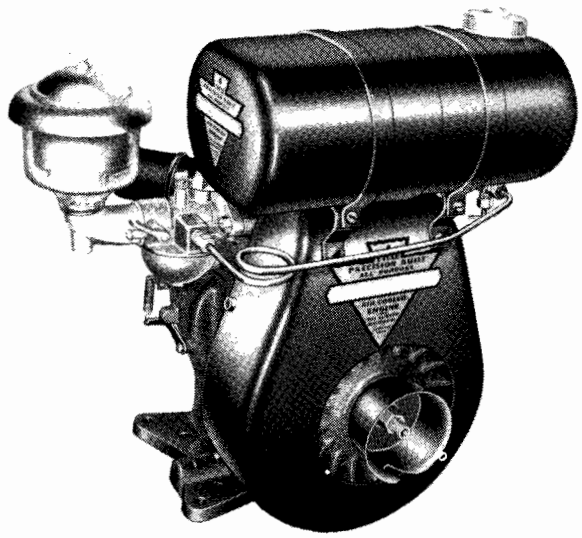
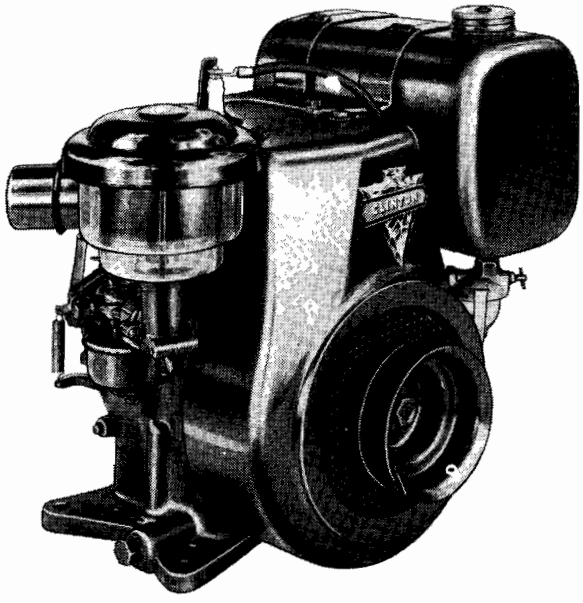
2 & 4 CYCLE MAINTENANCE



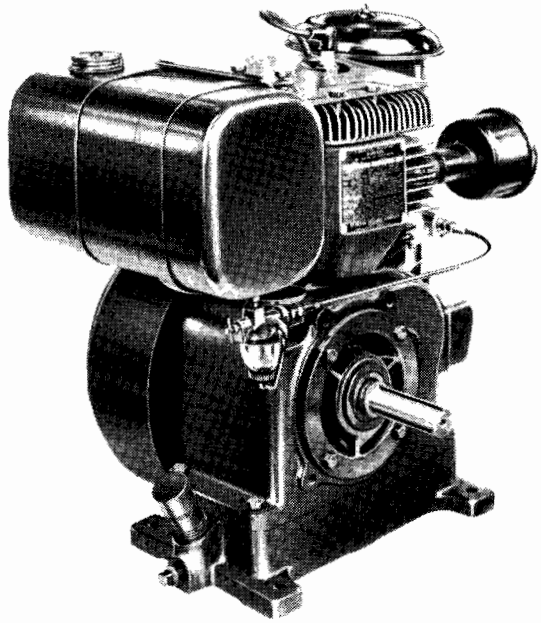
D-1160
Horizontal shaft, 4-cycle, round 5 qt. fuel tank with visible fuel strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter.



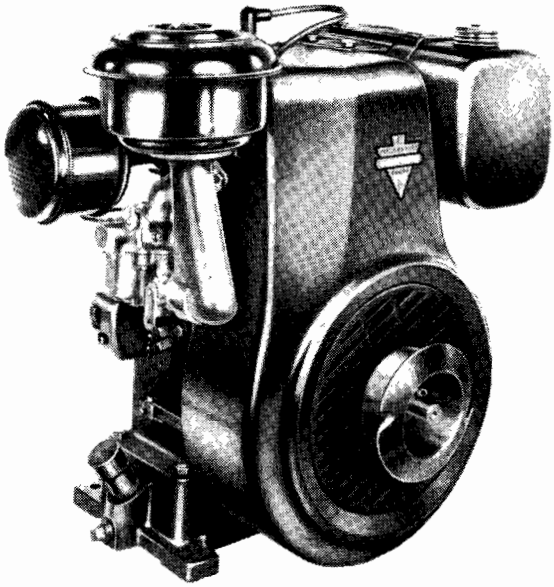
C-1100
Horizontal shaft, 4-cycle, oval 5 qt. fuel tank with visible fuel strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter.



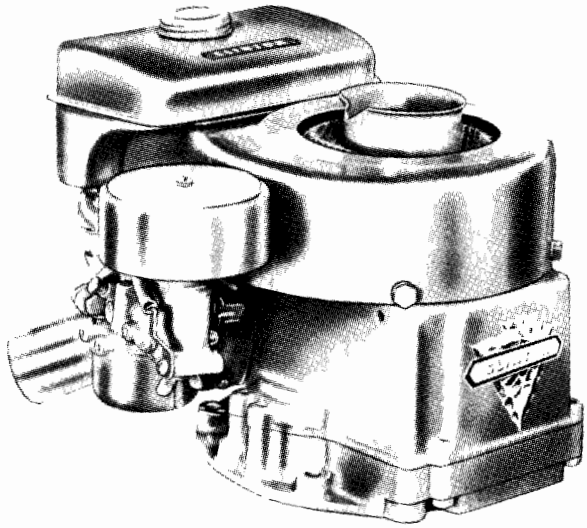
1200
Horizontal shaft, 4-cycle, rectangular 5 qt. fuel tank with visible fuel strainer shut-off, float carburetor, flyball governor, visible oil bath air filter.



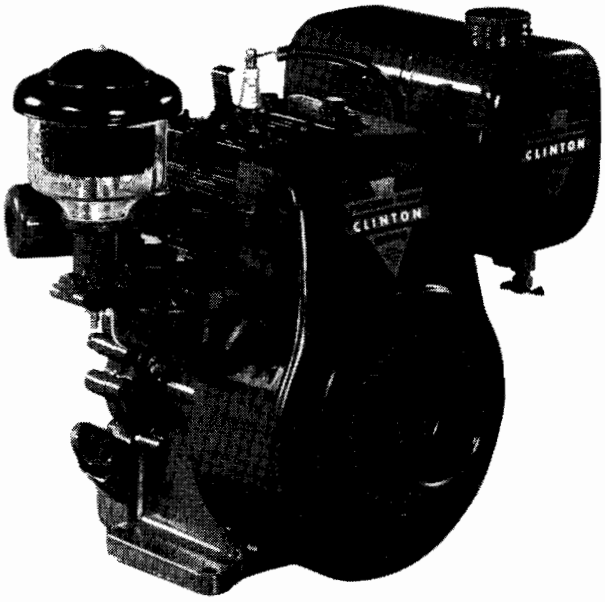
1600
Horizontal shaft, 4-cycle, rectangular 6 qt. fuel tank with visible fuel strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter. (See owner's guide to operation and maintenance Clinton 1600 and 2500 engines.)



2500
Horizontal shaft, 4-cycle, rectangular 6 qt. fuel tank with visible fuel strainer and shut-off, float carburetor, flyball governor, visible oil bath air filter.



VS-2100
Lightweight, vertical shaft, 4-cycle, saddle-type 1 qt. fuel tank with fuel strainer and shut-off, float carburetor, air vane governor, element type air cleaner. (See special overhaul and maintenance instructions VS-100 and 2100 engines.)



2100
Lightweight, horizontal shaft, 4-cycle, rectangular fuel tank with fuel strainer and shut-off, float-type carburetor, air vane governor and visible oil bath air cleaner. (See Special Overhaul & Maintenance Manual for Clinton Lightweight Engines.)

CLINTON ENGINES

2 & 4 CYCLE MAINTENANCE

PRINCIPLE OF OPERATION

TWO CYCLE ENGINE

In a two cycle engine, intake, compression, power and exhaust are completed in two strokes of the piston. A power stroke results with every complete revolution of the crankshaft. On the upward stroke of the piston a partial vacuum is created in the crankcase. (See Figure No. 1.)

First, the vacuum and outside air pressure cause the reed valve between the crankcase and the carburetor to open. The air-fuel mixture from the carburetor flows into the engine crankcase. Then, the downward movement of the piston compresses the fuel charge in the crankcase. Near the bottom of its stroke the piston uncovers the intake by-pass port, which connects the combustion chamber and the crankcase.

As the piston moves upward on its stroke, it passes the intake port, closing the port opening. Its continued upward movement causes the fuel mixture in the cylinder to be compressed. At the same time a new fuel charge is drawn into the crankcase. As the piston nears the top of the compression stroke, the fuel mixture in the combustion chamber is ignited by the spark. The burning and expansion of gases forces the piston down on its power stroke. Power is not delivered for the full length of the stroke. Some time is required to rid the cylinder of burned gases, so that it may receive a fresh fuel charge from the crankcase.

As the piston nears the bottom of its stroke, it uncovers the exhaust port opening slightly ahead of the intake port. This permits taking advantage of the pressure of the exhaust gases in the cylinder, which are still comparatively high, and allows them to start escaping. Further downward travel of the piston uncovers the intake by-pass port. The incoming charge assists in forcing the exhaust gases out of the cylinder, to complete the cycle.

The chief attributes of the two cycle engine are its lightweight, low cost and powerful but simple operation. With only three basic moving parts (crankshaft, piston and rod) maintenance costs are at a minimum while efficiency is at a maximum.

THE FOUR CYCLE ENGINE

For an equivalent horsepower rating, the four cycle engine is a larger, heavier engine than the two cycle. Since power is delivered to the piston only on every other revolution of the crankshaft (instead of with every revolution as in the two cycle), a larger cubic piston displacement is required, so that a greater amount of gas can be fired at each ignition period. Only one action is performed with each upstroke or downstroke of the piston. Starting with the piston at the top of the cyclinder, let us see what goes on in the engine as the crankshaft is turned. (See Figure No. 2.)

The piston descends, opening the intake valve. Withdrawal of the piston creates a partial vacuum in the cylinder. Outside air pressure forces a mixture of vaporized gasoline and air into the cylinder.

As the crankshaft turns over, the piston rises compressing the gas in the cylinder. The intake valve closes as the piston reaches the bottom of its stroke. As the piston arrives at the top of the cylinder, the gas is fully compressed. The timing mechanism actuates the ignition system, which causes the spark plug to spark, igniting the gas in the cylinder.

The piston is driven downward with great force, delivering power on the power stroke to the crankshaft.

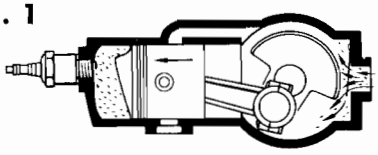
As the piston rises again, the exhaust valve opens and the burned gases are forced out through the exhaust. The exhaust valve closes as the piston reaches the top of its stroke. The intake valve opens as the piston starts down, and the cycle repeats itself.

The four stroke cycle of the four cycle engine is, therefore, as follows: (1) intake stroke, (2) compression stroke, (3) power stroke, and (4) exhaust stroke.

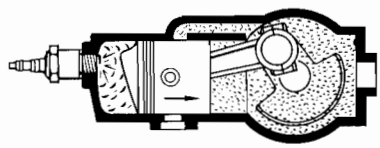
There is a single, clearly defined action for each upstroke and downstroke of the piston.

The four cycle engine is a cooler running engine than the two cycle, owing to the longer period between consecutive firing stages.

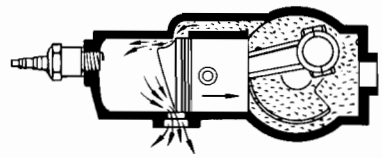
Fig. 1



Compression Stroke

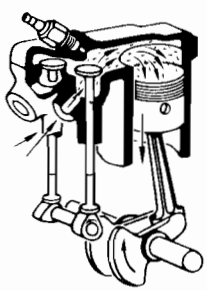


Power Stroke

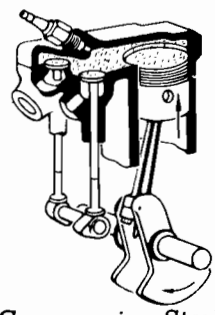


Exhaust Stroke

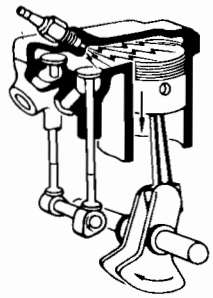
Fig. 2



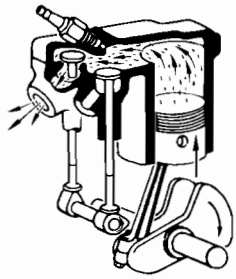
1. Intake Stroke



2. Compression Stroke



3. Power Stroke



4. Exhaust Stroke

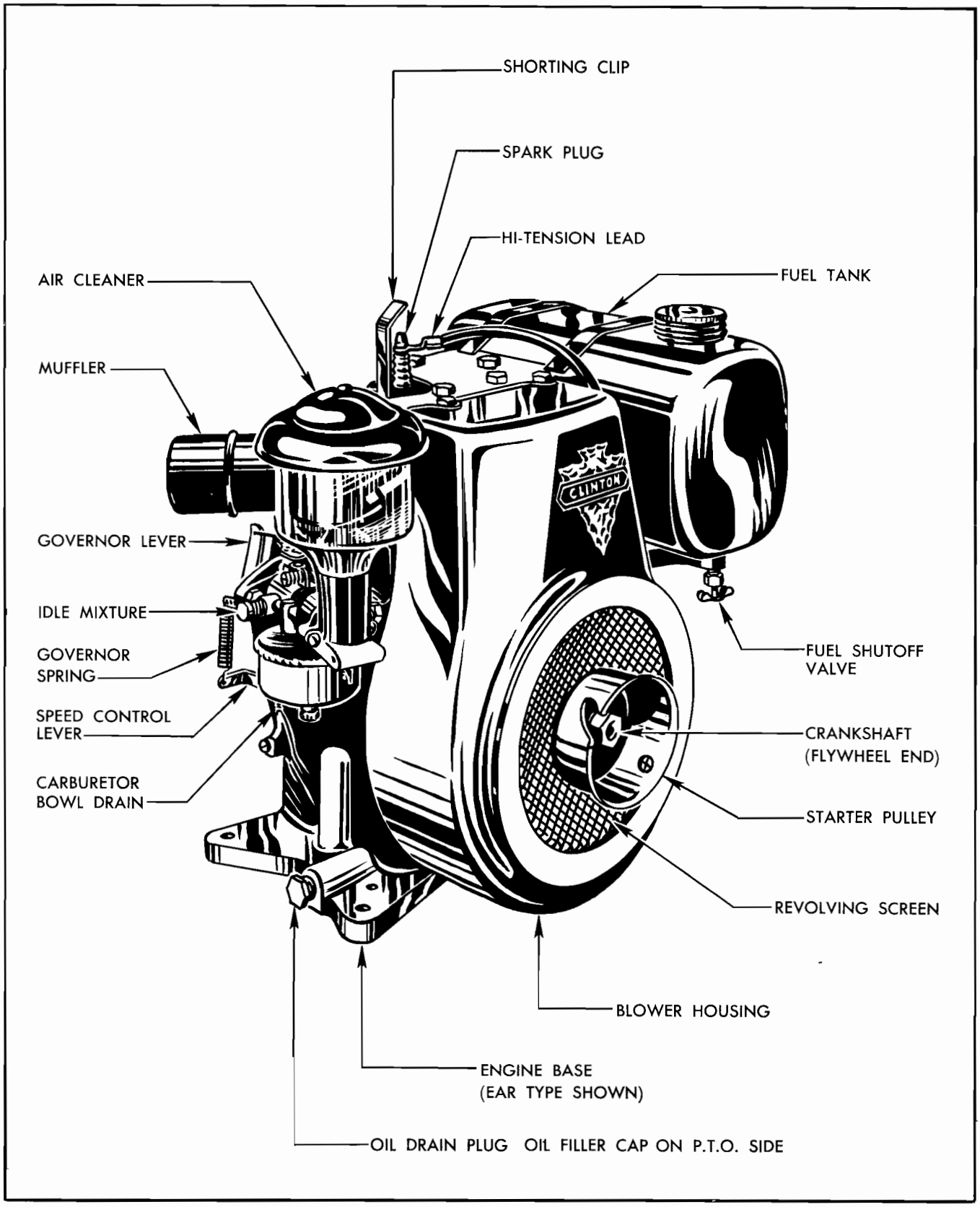


Figure No. 3—General View of Clinton Four Cycle Engine

CLINTON ENGINES
2 & 4 CYCLE MAINTENANCE

FUEL PREPARATION & LUBRICATION

FOUR CYCLE ENGINES

Only by using the correct fuels can maximum service be obtained from the engine.

1. Always use premium grade engine oil like Mobilgas.
   a. At temperatures above freezing (32°) use SAE No. 30.
   b. At temperatures below freezing use SAE No. 20W.
   c. If temperature drops below zero, use SAE No. 10W.
2. Fill the crankcase on horizontal crankshaft engines until the oil level is up to the 'full' mark on the dipstick. (See Figure No. 4.)
3. The oil level in vertical shaft engines should be up to the threads in the filler plug hole. (See Figure No. 4.)
4. If the engine is equipped with a reduction gear unit, the correct oil level for the gear reduction is indicated on the face of the gear housing. (See Figure No. 5.) To fill the unit:
   a. Remove the vented filler plug at the top of the housing and add SAE No. 30 through the hole until oil begins to run out of the oil level opening **marked for the particular gear reduction.**
   b. Replace both plugs. Do not overfill the reduction gear unit, since this will cause overheating of the unit and result in loss of power.
5. Fill the fuel tank with any regular grade commercial gasoline. Open the fuel shut-off valve located under the fuel tank. (This does not apply to engines having a suction type carburetor, since they do not have shut-off valves.)
6. Fill the visible oil bath filter with SAE No. 50 up to the level mark on bowl. (See Figure No. 6.) Some oil is drawn into the filter element of the air cleaner, and will drain back into the filter cup after the engine is allowed to stand. Do not overfill the filter cup with oil, or the excess will be drawn into the engine and may carry dirt with it.

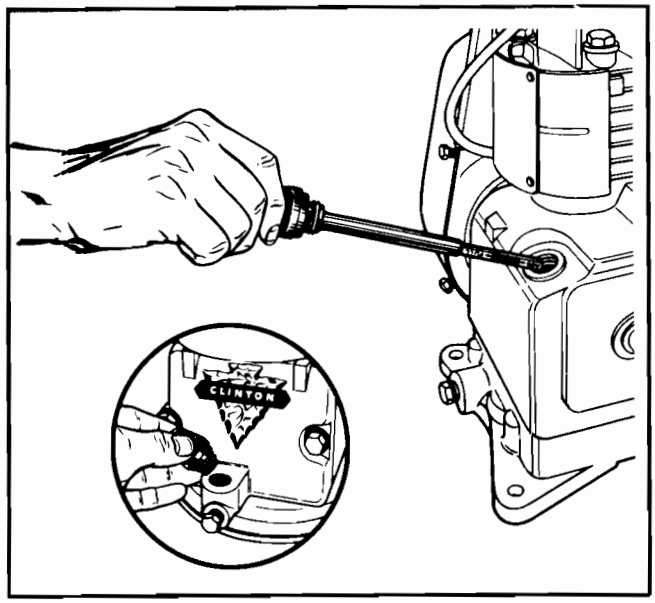


Figure No. 4—Checking Oil Level in Base

7. Check the governor adjustment and be certain it is ready for operation. Although the governor is set at the factory, the adjustment may be altered slightly during shipment.

CHOKING

Choking instructions are approximate. When the operator has started his engine a few times he will become familiar with the most satisfactory choking procedures for his particular model.

CRANKING

When cranking the engine with a rope starter (See Figure No. 9.) be sure to give the rope a sharp but steady pull

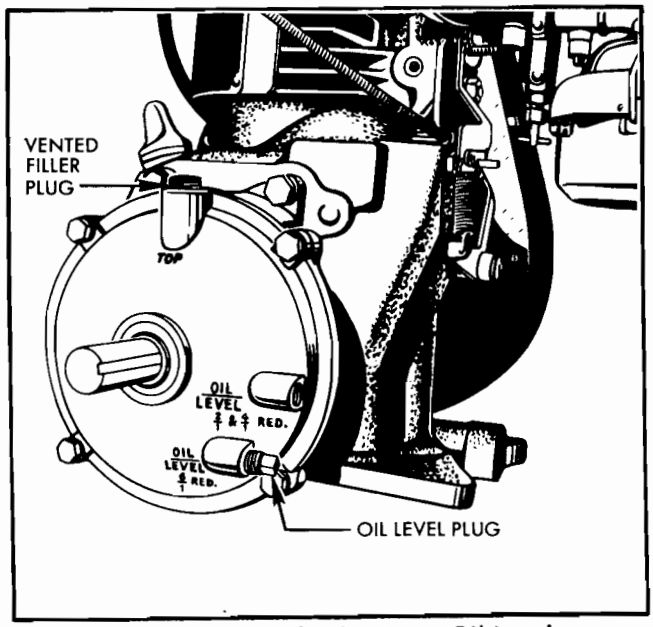


Figure No. 5—Reduction Gear Oil Levels

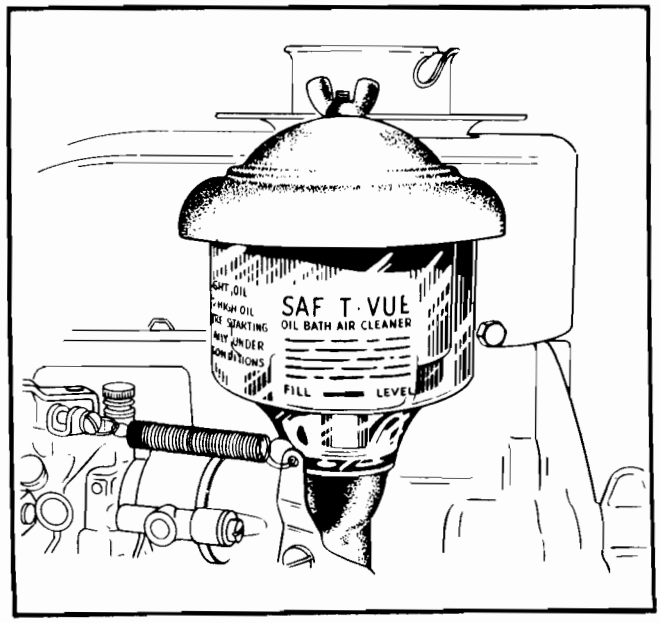


Figure No. 6—Air Cleaner Oil Levels

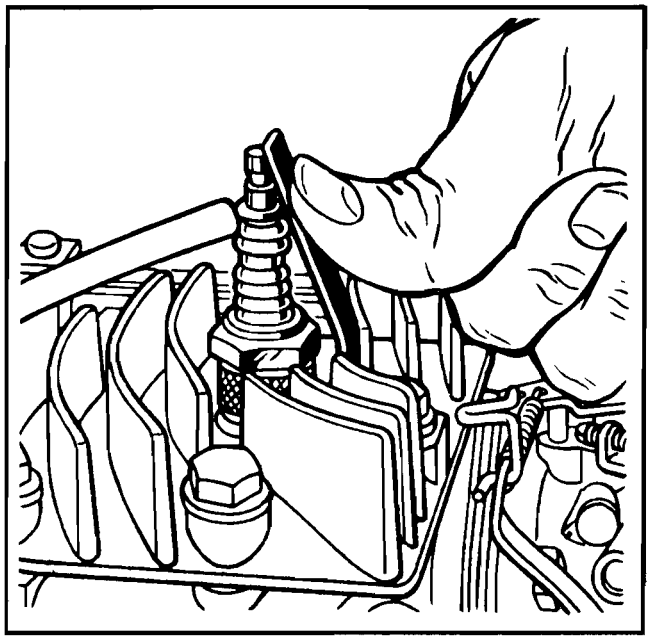


Figure No. 7—Shorting Procedure

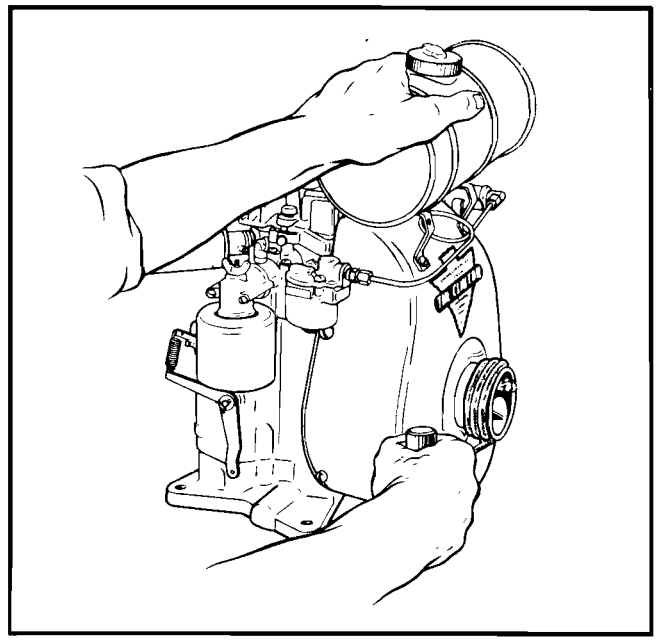


Figure No. 9—Rope Starting

in order to prevent its fouling on the engine in case of kickback. With an automatic rewind starter (See Figure No. 8), always release the handle slowly. Do not allow it to snap back into the socket. When starting an engine equipped with a kick starter place the foot lightly on the pedal and push down slowly until all the slack has been taken up, then press down quickly, but firmly to avoid danger of personal injury caused by kickback.

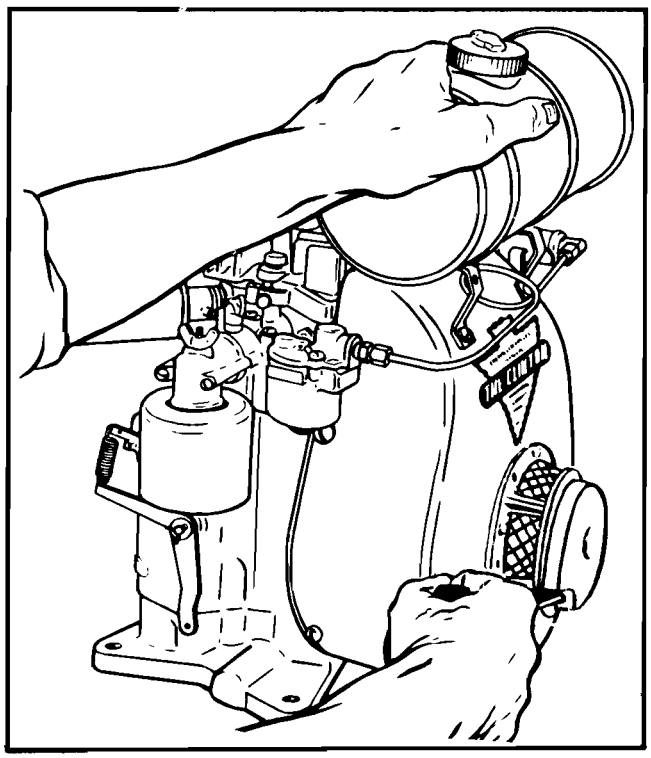


Figure No. 8—Recoil Starting

TO START THE ENGINE

1. With the choke in a closed position, crank the engine through two revolutions of the crankshaft.
2. Should the engine fail to start, open the choke half way and repeat the cranking operation.
3. Never choke a hot engine, but when starting an engine that is partially warm, crank it with the choke slightly open. If it does not start after two cranking cycles, close the choke approximately half way and repeat the cranking process.

TO STOP THE ENGINE

1. On most models the engine can be stopped by firmly pressing the shorting clip against the top of the spark plug. There is no danger of the operator's being shocked if he keeps the clip firmly in place. (See Figure No. 7.)
2. Some models are equipped with an ignition switch, in which case the switch should be moved to the "off" position.

TWO CYCLE ENGINES

Correct fuel preparation is one of the most important points in the correct operation of the two cycle engine. Do not pour unmixed gasoline or oil into the fuel tank.

TYPE OF OIL

Use SAE No. 30 motor oil (non-detergent), such as Mobiloil or a comparable straight mineral oil. A detergent oil or one containing additives, is not advised.

TYPE OF GASOLINE

A good grade of regular gasoline, available at any local filling station, is recommended for use in the 2 cycle engine. High octane or leaded fuels offer no advantages and are not recommended.

MIXING RATIO OF OIL TO GASOLINE

For the first five hours of operation in a new two cycle engine, thoroughly mix ¾ pint of oil with each gallon of gasoline. Strain the mixture into the tank to remove all dirt

CLINTON ENGINES

2 & 4 CYCLE MAINTENANCE

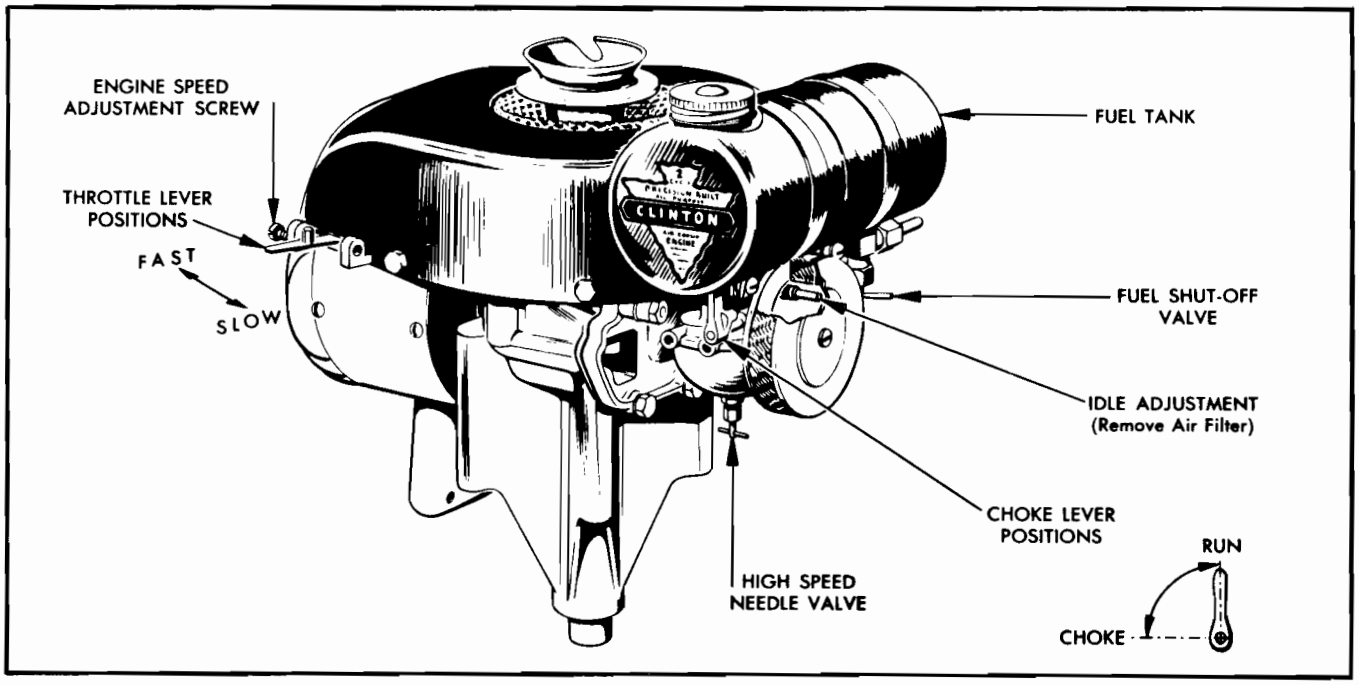


Figure No. 10—General View of Clinton Two Cycle Engine

and water. The rich oil mixture may cause idling difficulty, but it is necessary to properly wear-in the various parts of the engine. After this break-in period, mix ½ pint of oil to each gallon of gasoline.

TO START THE ENGINE

1. Fill the fuel tank with the mixture listed in Fuel Preparation instructions on page 17.
2. Open the fuel tank petcock.
3. Open the high speed adjustment screw so that dot on dial lines up with mark on bowl.
4. Push choke lever into "choke" position. (See Figure No. 10.)
5. Pull sharply on the automatic rewind or rope starter.
6. After two or three pulls the engine should start. Then return "choke" lever to run position.
7. Allow the engine to run a few minutes at one half throttle to establish uniform temperature and pressure.
8. Set the speed adjustment screw to position the throttle control lever for desired operating speed. The governor will then maintain a constant speed to automatically compensate for any loads applied to your engine. The screw may be reset for lighter or heavier work.
9. To stop the engine press the shorting clip firmly against the spark plug, or if the engine is equipped with an ignition switch move it to the "off" position.

MAINTENANCE AND ADJUSTMENTS

LUBRICATION

1. Drain the oil and refill with new oil after 20 hours of normal four cycle engine operation. If the engine is operating under dusty conditions, the oil should be drained and refilled after 10 hours of operation, or when it appears dirty or diluted.
2. Drain the oil in the reduction gear housing, if engine is so equipped, after each 100 hours of operation.
3. Lubricate the cam follower lubrication felt whenever the magneto is serviced or cleaned. Always clean the felt by washing it in clean gasoline before saturating it with lubri-plate grease (or a bearing grease) and position it in accordance with Figure No. 20.

IGNITION SYSTEM

Late model Clinton Engines are equipped with Phelon Magnetos though many earlier models still in service have Scintilla magnetos.

A feature of the Phelon magneto is the exceptionally efficient ignition coil which is mounted on a soft iron core located within the flywheel flange on four cycle engines (See Figure No. 14). A permanenrly charged magnet is mounted in, and rotates with, the flywheel. (On two cycle engines the magnet is contained in the laminations on the bearing plate—See Figure No. 13). When the permanent magnet passes over the coil, and the breaker points separate, a high voltage current is induced in the secondary winding of the coil. This current produces a spark across the spark plug electrodes for igniting the charge in the combustion chamber. On late models a plunger-type breaker assembly is employed with a breaker points cover which can be used as a gage in setting the points. The entire assembly is protected from dust by a plastic or metal cover.

IGNITION SERVICING

1. Four cycle engines are equipped at the factory with Champion J8 spark plugs and two cycle engines with Champion H11 spark plugs.

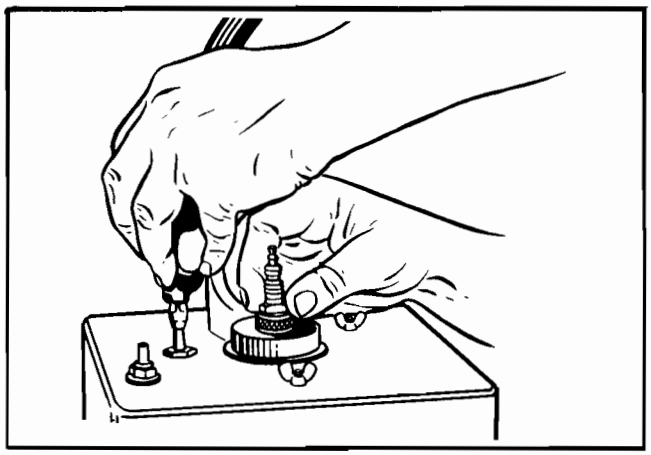


Figure No. 11—Cleaning the Spark Plug

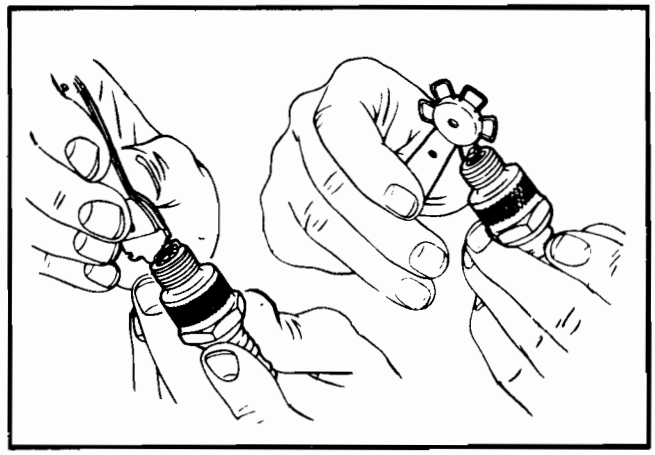


Figure No. 12—Gapping the Spark Plug

2. The spark plug should be removed, cleaned (See Figure No. 11) and regapped (See Figure No. 12) after every 100 hours of operation. Cleaning should be accomplished with an automotive-type, sand blast spark plug cleaner. A new spark plug should be used in preference to one which has been cleaned.
3. Regap the spark plug to .025 inch by bending the ground electrode. Do not attempt to bend the center electrode.
4. Since the cylinder heads on four cycle engines and the integral heads on two cycle engines are made of aluminum, spark plug threads should be protected by coating the threads sparingly with graphite lubricant or a special anti-seize compound.
5. When tightening the spark plug, use just enough pressure to flatten the spark plug gasket.

PHELON MAGNETO ASSEMBLY

The magneto assembly should be inspected after every 100 hours of operation. If the engine refuses to start or is hard to start after gas supply, carburetion, spark plug and other features have been checked, inspect the magneto. (See Figure No. 14.)

1. Remove the spark plug wire, hold it 1/8 inch away from the sharp part of the engine block. A spark should jump this gap when the engine is cranked over in the usual way.
2. While the engine is running, hold the lead wire 1/16 inch away from the spark plug terminal. The spark should jump this extra gap. (CAUTION: Do not hold the wire farther away from the plug, and only make this test briefly, since it puts a strain on the coil and might break down a perfectly good coil if overdone.)
3. Remove and inspect the spark plug for fouling and for proper gap. A badly fouled plug will not even fire across the electrodes when seated on the cylinder block and not under compression. A plug can be fouled badly enough so that it will not fire under compression in the engine, but not badly enough to prevent it from firing in the air. It is best to replace a fouled plug with a new plug—cleaning an old plug usually does not last long.

MAGNETO INSPECTION

1. Unscrew the nut which holds the flywheel on the shaft about one turn. The flywheel will stick to the shaft.
2. To loosen it, install TL-916, the Knockout Flywheel Puller, on the crankshaft. Strike the tool firmly with a

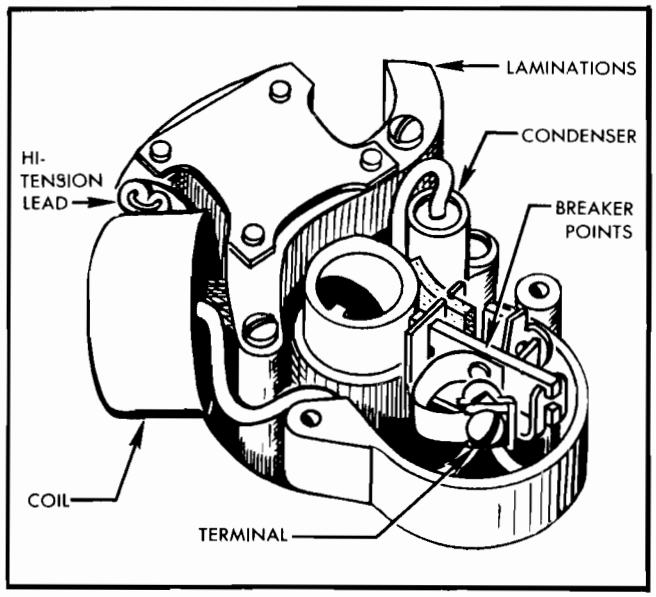


Figure No. 13—Two Cycle Magneto Assembly

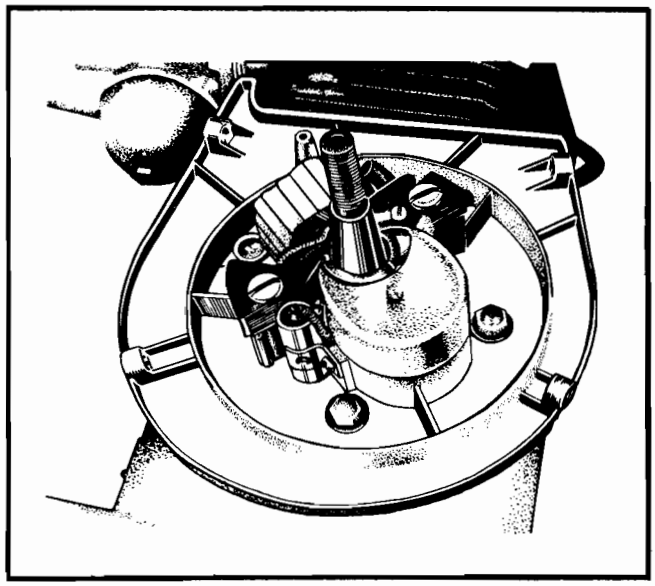


Figure No. 14—Four Cycle Magneto Assembly

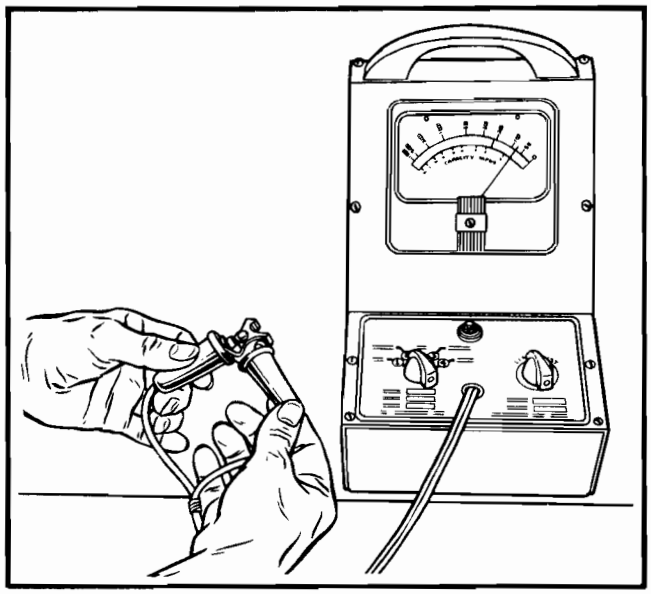


Figure No. 15—Testing Breaker Points—Phelon

plastic hammer (See Figure No. 40). The rapping will break the flywheel loose from its tapered fit on the shaft without damaging the threads.

3. Remove the nut and flywheel from the shaft, after using TL-916.
4. Check the lead wire to see whether the spark plug is leaking through the insulation at some point.
5. Check the breaker points (See Figure No. 15). Be sure they are set to the proper gap. (.020) by using a feeler gage. (See Figure No. 16.)
6. When checking the points make certain that the breaker rubbing surface is on the highest part of the cam. This is the part of the cam which comes right after the points have opened.
7. Be sure the points are clean by lightly rubbing a piece of white, unprinted cardboard, moistened with cleaning fluid or laquer thinner, between them. Avoid using anything that might contaminate or leave lint on the points.

   CAUTION: Before removing the magneto from the engine, note the position of the breaker cam. It must be replaced in its original position with the recessed end of the fixed key toward the oil seal. On some models a dust cover seats in the space between the flush side of the fixed key and the flywheel key.
8. If the points are pitted replace them and, it is generally best to replace the condenser also, since a defective condenser is often the cause of badly pitted points.
9. If replacement parts are not available the original ones can be stoned if you are careful to keep the surfaces flat and parallel. Remove the points and rub each one separately against the stone. Do not use a file, since particles of iron might contaminate the points. Never use a plated gauge in checking the point gap, since the plating may come off.

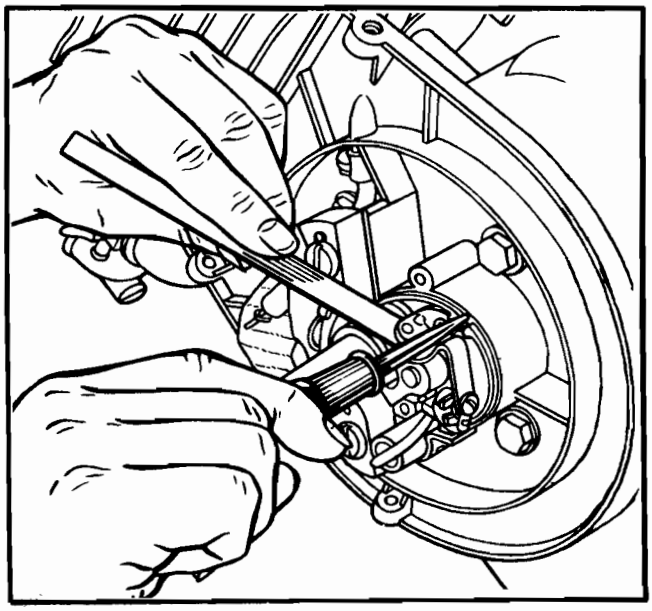


Figure No 16—Gapping Breaker Points—Phelon

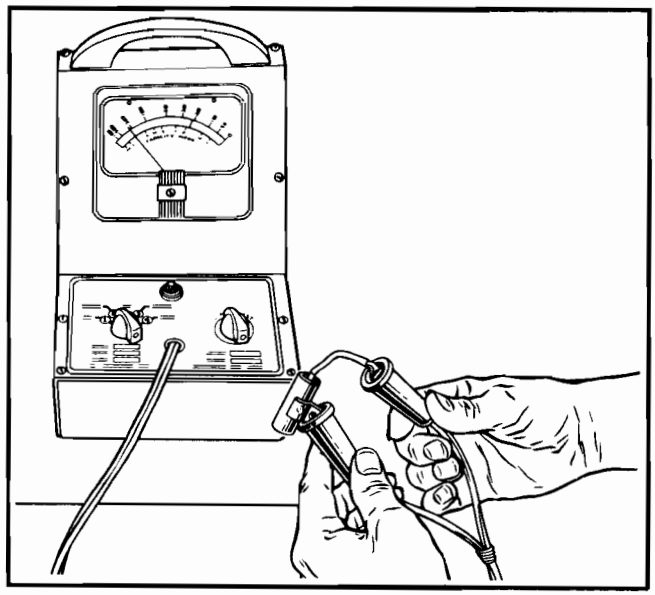


Figure No. 17—Testing Condenser—Phelon

10. Use a condenser tester (See Figure No. 17). The condenser has a capacity of .13 to .15 mfd. Do not substitute another of different capacity.
11. Inspect the coil for burned holes through the outside insulation, or for evidence that the spark has been leaking to the ground from the terminal where the spark plug lead is connected. (See Figure No. 19.)
12. Check the coil on a coil tester (See Figure No. 18) in accordance with specifications given by the manufacturer. (See Test Data Chart—Page 23.)

TO REPLACE THE COIL

1. Remove the primary connection, coil to breaker connection and spark plug wire.
2. Remove the core screws freeing the coil and core assembly.
3. Bend down the clip holding the coil down on the core, being careful not to break off this clip.
4. Place the coil across the open jaws of a vise with the bottom of the coil resting on the tops of the vise jaws.

Tap the center leg of the core gently with a wooden stick until the coil comes off with the coil shield.

5. Thread the primary leads of the new coil through the slot in the coil shield.
6. In replacing the coil on the core, great care must be taken not to bend the core which, being laminated, is quite easily distorted. The core must be supported under the center leg while the new coil is being pressed on. The best way to do this is to place a ⅜ inch diameter bar on the work bench to support the inner leg of the coil core. Place the coil core so that the center leg is supported by the ⅜ inch bar. Then the new coil can be pressed in place being careful not to catch the primary leads under it. Then rebend the coil clip firmly, but do not pound it down into the coil.
7. In replacing the high tension lead treat the terminal on the coil gently so it will not pull loose from the coil. Make sure that loose strands of the lead wire are not sticking out to make a short path for the spark to jump to ground.

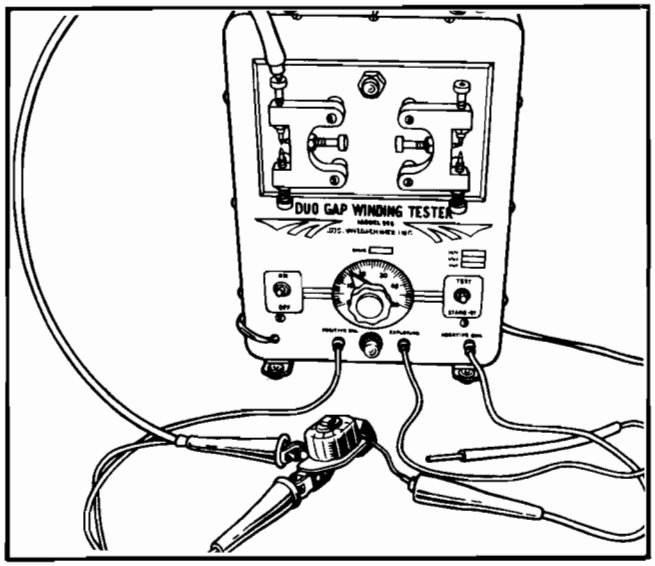


Figure No. 18—Testing Magneto Coil

MAGNETO LUBRICATION

1. The only lubrication needed in the magneto is in the cam wick. (See Figure No. 20.) This is saturated with grease at the factory. If it becomes dry the felt may be removed and new grease worked into it. Avoid using oil in the magneto.
2. Oil will cause trouble if it gets into the breaker points. Necessary lubrication is done at the factory.

FLYWHEEL MAGNETO

1. No servicing is necessary to the magneto unit in the flywheel on four cycle engines. It is an integral part of the flywheel, assembled permanently, and it should never be removed. (In two cycle engines the magnet is in the laminations on the bearing plate.)
2. The magnet unit never needs recharging since its magnetism lasts forever. Any attempt to recharge this unit will result only in discharging it. Any magnet unit loosing its charge should be returned to the factory for free charging.
3. Compare a questionable magnet to a new assembly using a magneto-meter. (See Figure No. 21.)

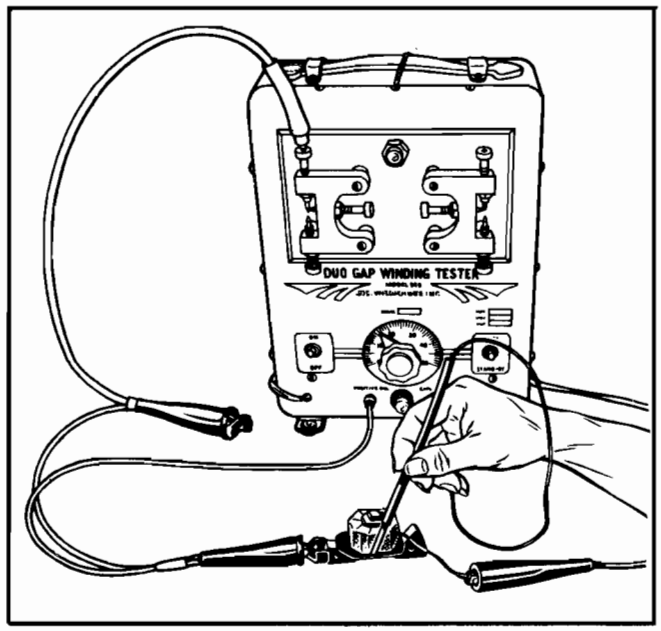


Figure No. 19—Testing Outside Insulation

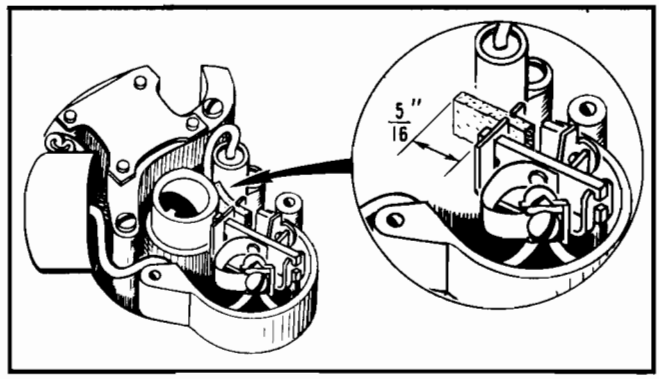


Figure No. 20—Correct Position of Cam Wick

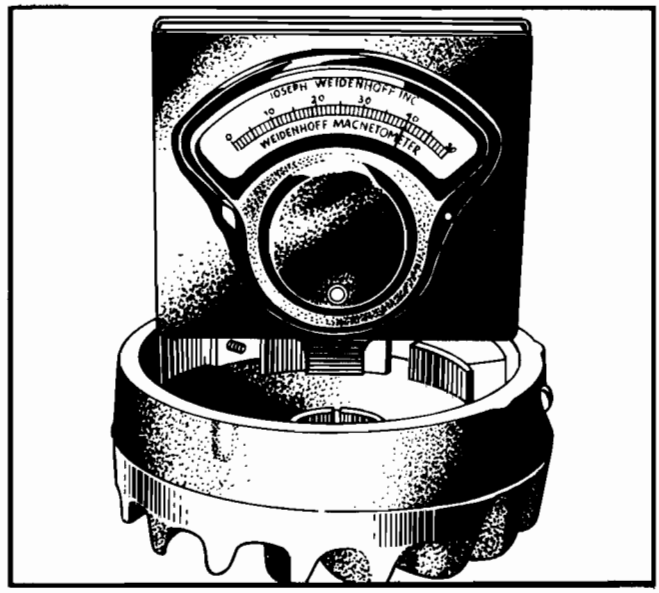


Figure No. 21—Testing Flywheel Magneto

CLINTON ENGINES

2 & 4 CYCLE MAINTENANCE

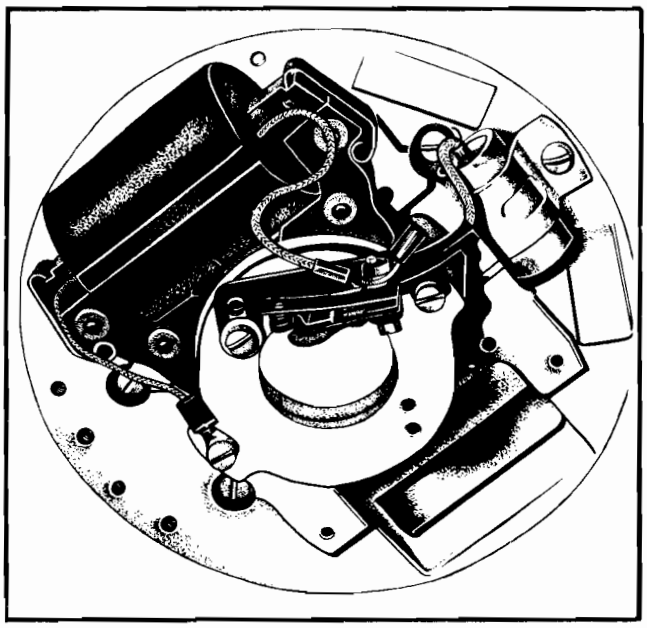


Figure No. 22—General View Scintilla Magneto

SCINTILLA MAGNETO

1. In this magneto the stator, or magnet is mounted on the crankshaft instead of on the flywheel. Both magnetos have the coil, core, breaker points and condenser mounted on a stator plate. Some stator plates for Scintilla-equipped engines have an additional recess for attaching a lighting coil, if desired. (See Figures No. 22 and 23.)
2. Magneto assemblies of the type K1-4, K1-5, K1-12, K1-16 and K1-19 have been used on the models of 700-A, A-1100 and B-1100 engines. The K1-4 and K1-5, used exclusively on the 700-A series up to approximately engine No. 199,736, may be adjusted to advance or retard the ignition timing.

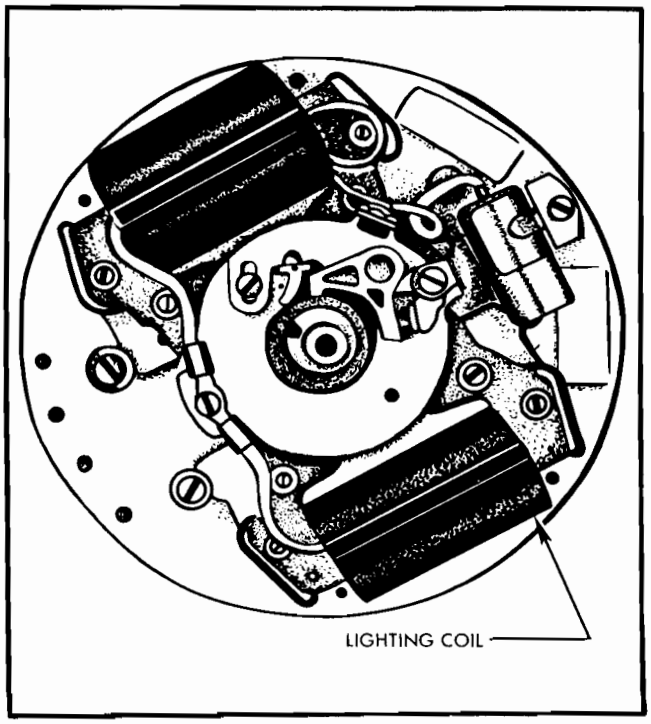


Figure No. 23—Scintilla Lighting Coil in Place

TIMING ADJUSTMENT

1. Loosen the four retaining screws to allow the stator plate to be rotated on its axis.
2. The plate should be rotated until the right-hand corner of the ignition coil is slightly to the left of the right-hand figure three on the bearing plate. (See Figure No. 24.)
3. When the magneto is in position, the timing is within the practical operating limits.
4. The hold down screws should next be tightened, making sure that the clamps engaging the groove of the bearing plate are in position and secure.
5. The breaker points are then adjusted to a desired gap of (.018 inch) (See Figure No. 25) when the crankshaft has been rotated until the cam follower is on the high point of the cam and the contacts are fully open. The measured breaker gap should be .018-.020.
6. As a final check to be used in deciding whether the magneto is properly timed, remove the cylinder head and observe the position of the piston at the time the breaker points open. The spark should occur at between 18 and 20 degrees before top dead center which is equivalent to the piston's being ⅛ inch below the top of the cylinder block face.
7. The K1-12, K1-16 and K1-18 magnetos do not have provision for ignition timing adjustment. Breaker points should be set for a gap of .018 to .020 inch.
8. The magnet-rotor is a light press fit onto the engine crankshaft. Remove by applying an even pressure on opposite sides of the rotor with two screw drivers. Extreme care must be exercised in removing the rotor as the hub is a die-cast material and easily broken.

INSPECTION OF PARTS

1. Replace breaker cam if rough or showing signs of wear.
2. Check all leads and terminal connections for broken insulation or looseness.
3. Condenser capacity is .18 to .20 mfd. It must be replaced if it is not within this range. Test for breakdown and series resistance also.

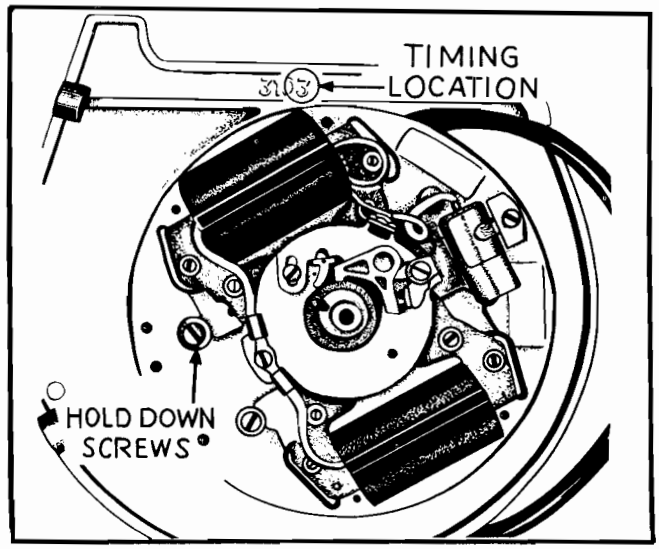


Figure No. 24—Timing Location for Scintilla Magneto

4. Points that are pitted, burned or having poor contact should be replaced. Breaker points used on early models have a flat tension spring. Replacement points are available with a pivot type design rubbing block and contact assembly for improved performance.
5. A lighting coil is standard equipment on the K1-4 and K1-12 magneto. This coil has connections for one No. 87 bulb—3 candle power—for the tail lamp.
6. Engines up to serial No. 50,000 were not originally equipped with a dust cover over the magneto assembly. For these engines a dust proofing kit Part No. 3183-A, is available. Later a dust cover was used on original equipment. These magnetos may be more completely dust-proofed by installing a felt dust seal between the flywheel and dust cover. The dust kit No. 4051-A is available for this purpose. When installing the felt washer, cement the washer to the flywheel. When assembled, the washer should make a light pressure rubbing contact against the dust cover. Be certain that all other openings in the dust cover or magneto plate are sealed. For this purpose a gasket cement may be used.
7. The coil is tested in the same manner as the Phelon Magneto coil.

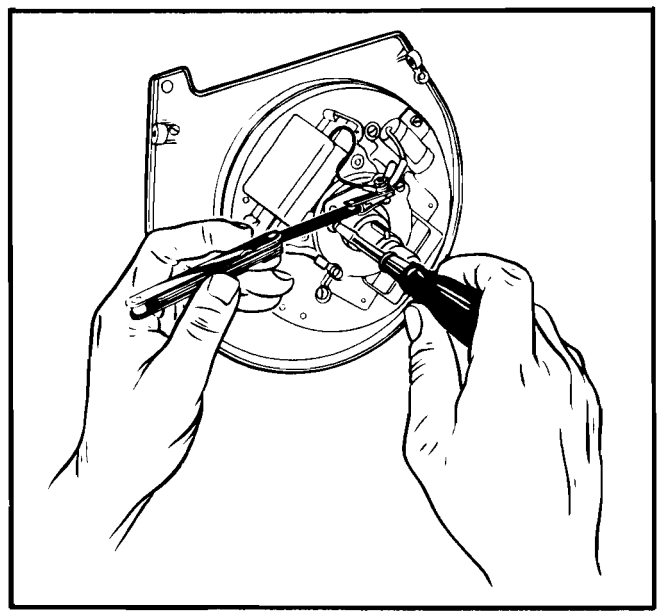


Figure No. 25—Gapping Breaker Points——Scintilla

MAGNETO TEST DATA

COIL WEIDENHOFF—MODEL 358—COIL TESTER	Gap	Index Setting Coil on Core only	Index Setting Coil Mounted on Plate	Results
Phelon Coil	5 MM	17	19	Steady Spark
Scintilla Coil	5 MM	12	14	Steady Spark

ALLEN—No. 309—COIL TESTER	Test Setting Coil on Core only	Test Setting Coil Mounted on Plate	Meter Reading	Continuity
Phelon Coil	40		30	
Scintilla Coil	28-1-B	41-1-B	60-80	46-56

JACK & HEINTZ OR EISEMANN TESTERS

Phelon Coil ..... 5 MM Gap, Condenser switch on—Maximum Ammeter Reading 1.8
Scintilla Coil 1.70

CONDENSERS

Phelon ..... .13 to .15 mfd.
Scintilla ..... .18 to .20 mfd.

CLINTON ENGINES
2 & 4 CYCLE MAINTENANCE

CARBURETOR ADJUSTMENTS

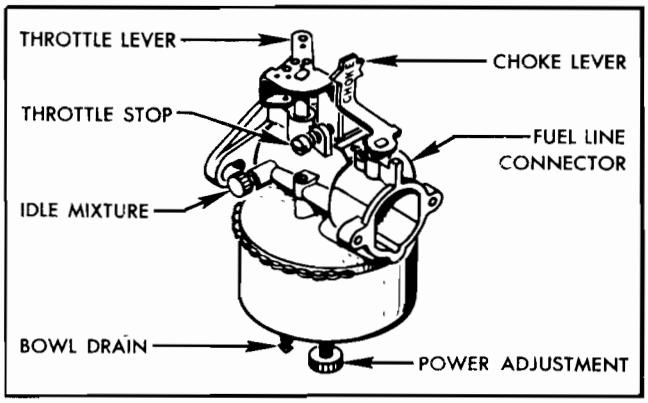


Figure No. 26—General View—Clinton Carburetor

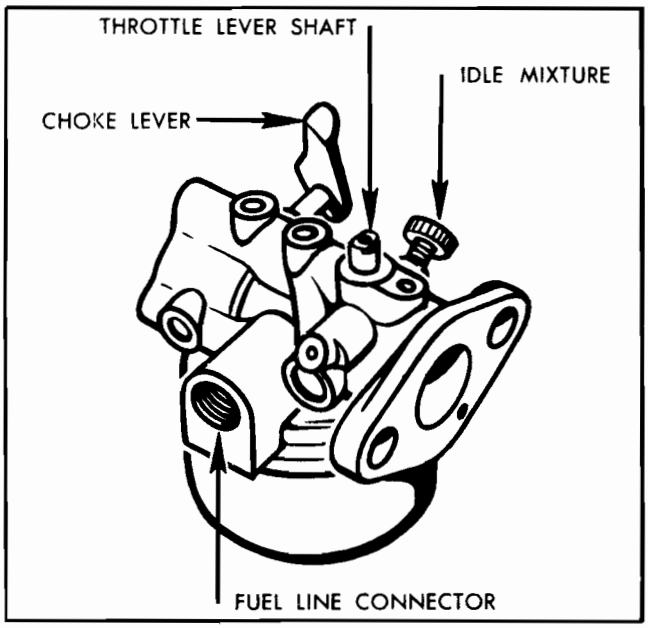


Figure No. 27—General View—Carter Carburetor

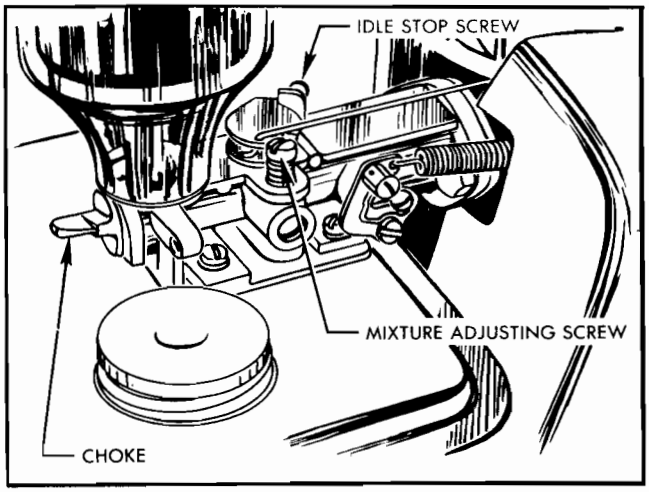


Figure No .28—General View—Suction Carburetor

CLINTON FLOAT TYPE CARBURETORS

Notice that the correct "lean" and "rich" positions are marked on the edge of the carburetor body where it fits over the bowl. (See Figure No. 26.)

1. Start the engine and allow it to warm up.
2. From a closed position turn the power needle approximately ¾ turn counter-clockwise or open.
3. Allow a few seconds for the engine to adjust before turning the needle again.
4. The average setting for the power range adjustment is about ¾ turn off the seat.
5. Turning the needle clockwise gives a leaner mixture.
6. After the power range adjustment has been made, set the engine to a fast idle.
7. Rotate the idle needle about one turn out from the closed position.
8. Allow a few seconds for the engine to react before making any further adjustment.
9. Proper setting is between ½ and 1 full turn open.
10. Turning the needle clockwise gives a leaner idle mixture.

CARTER FLOAT TYPE CARBURETOR

To regulate the high speed mixture, idle mixture and idling speed of the engine, separate manual adjustments are necessary.

The engine should respond to slight movements of the adjustment needles (See Figure No. 27). If it does not, remove and clean the carburetor in accordance with the instructions in the Carburetor Overhaul section of this Manual.

1. Close the idle adjustment screw and the high speed mixture needle by turning them clockwise. From this closed position turn each screw one-and-one-half (1½) turns counter-clockwise.
2. Set the idle stop screw so that the engine idles at 1000 RPM, approximately the slowest speed at which the engine will run smoothly.
3. Start the engine and allow it to warm up, then open the throttle approximately ⅓ to achieve about ⅔ full engine speed.
4. If the engine misses or backfires the mixture is too lean. To correct, turn the high speed mixture needle counter-clockwise until the engine runs smoothly.
5. If the engine is sluggish and has heavy exhaust, the mixture is too rich. To correct this, turn the high speed mixture needle valve clockwise until the engine runs smoothly.
6. The richest mixture between these two points will allow responsive acceleration and steady governor operation.
7. Make final check of the high speed mixture while the engine is under load, and correct the adjustment if it is necessary.

IDLE MIXTURE ADJUSTMENT

1. Following the power range adjustment, set the engine to a fast idle. Turn the idle adjustment needle clockwise until the engine starts missing or losing speed. (On two cycle engines, equipped with Carter Carburetors, the idle adjustment needle is located under the air cleaner cover on the upper portion of the carburetor.)
2. Turn the needle counter-clockwise until the engine runs smoothly again. This should require about ⅛ turn.
3. For proper idling speed, turn the idle set screw clockwise to increase idling speed and counter-clockwise to decrease

idling speed. Engines equipped with float-type carburetors should idle at approximately 1000 RPM.

SUCTION TYPE CARBURETORS

Suction type carburetors are equipped with only two adjustments—a mixture adjusting screw and an idling stop screw. (See Figure No. 28.)

1. Allow the engine to warm up and then the final mixture setting may be made.
2. Turn the mixture adjusting screw to a point where the engine will accelerate from idling speed without hesitation.
3. Set idle stop screw so that idle speed is approximately 1700 RPM.
4. Loosen both governor lever and lever stop screw. Adjust governor lever stop so that tension governor spring will maintain an idle speed of 1800 to 2000 RPM. Idle stop set screw should not contact the throttle stop at the governor controlled idle speed.
5. The throttle control cable must be properly attached to the governor lever to obtain regulation of the engine speed. Remove any excessive control wire length at the governor lever or at the control handle on the equipment.
6. After final adjustments have been made, recheck to see that linkage operates freely without binding.

GOVERNORS

The functions of a governor are to keep the engine running at constant speed when operating under a variable load, and to prevent the engine from ever exceeding its pre-determined maximum speed.

Engines can be forced to speeds at several thousand rotations per minute more than the factory recommended speed of 3600 RPM. Since high speed may cause severe damage to the engine, it is important that the governor be adjusted to a speed *below* the 3600 RPM maximum.

Clinton Engines are equipped with one of two types of governor . . . The flyball (centrifugal) type or the adjustable air vane (pneumatic) type. (For a specific breakdown on engine models and their governor types, see the Specification and Tolerance Chart on page 49.)

FLYBALL GOVERNORS

To best illustrate the operation of the flyball governor, (See Figure No. 29) a practical example is necessary.

1. Start the engine and set the speed adjusting lever (or remote control throttle) to a point where the engine is operating at approximately two-thirds full power.
2. Place a load on the power take-off shaft of the engine. The engine will appear to slow down momentarily, but will quickly regain its former speed because of the governor action.
3. As the engine begins to slow down, the three sets of centrifugal governor weights which are mounted on pivot pins on the side of the camshaft gear will allow the governor yoke to move toward the cam gear.
4. This lateral movement of the yoke activates the governor shaft assembly which transmits the action through connecting linkage to open the throttle. Movement of the governor shaft and the amount the throttle is opened will be proportionate to the loss of engine speed. The throttle will open just enough to restore lost speed.
5. When the load is removed from the engine drive shaft, the governor will reverse the operation to prevent the engine's running away.
6. When the engine is stopped, the governor weights fall dead toward the center of the camshaft, allowing the governor yoke to move all the way over against the cam gear. This causes the governor shaft to open the throttle wide by means of the governor spring and connecting linkage.
7. The governor throttle spring is the control or balance acting against the centrifugal force produced by the governor weights. The speed of the engine depends upon the initial tension applied to this spring, either by the speed adjusting lever or by the remote control throttle lever. The spring has been carefully selected and is calibrated to permit speeds up to 3600 RPM. Do not substitute a heavier or lighter spring, as this would seriously affect operation of the governor. Maximum engine speed should not be above 3600 RPM.
8. Place the governor throttle spring in the hole farthest from the governor throttle shaft. (See Figure No. 31.)
9. Hold the governor throttle arm to the extreme left, and open or close the loop in the connecting link to position the throttle wide open. This loop can be opened or closed easily with a strong pair of needle nose pliers. **Caution:** Never remove the governor spring from the throttle lever without marking the proper hole. Failure to replace the spring properly can cause serious damage. (See Figure No. 31.)

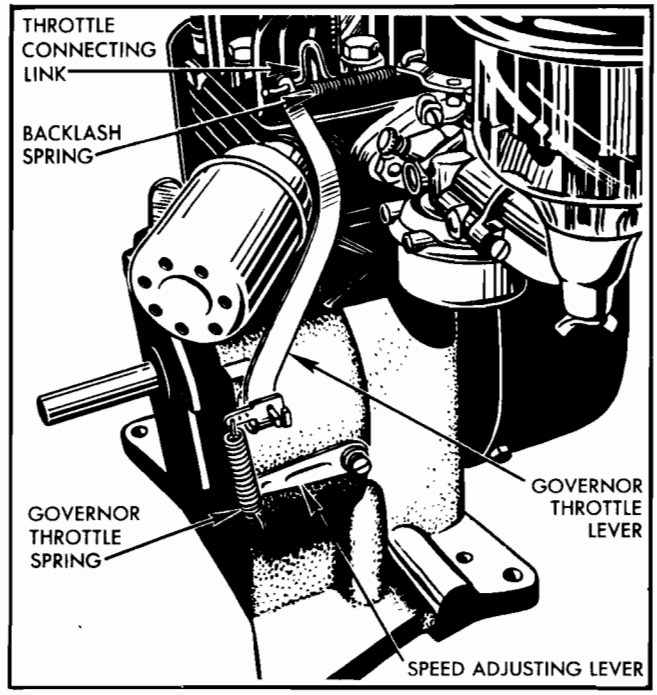


Figure No. 29—Flyball Governor Linkage

AIR VANE GOVERNOR

1. The air blast created by the finned flywheel operates the air vane governor. The air vane is located inside the blower housing and linked directly to the throttle lever. The air vane governor is positioned in respect to the air blast by a light coil spring attached to the throttle lever or, in some instances to the governor link. (See Figure No. 30.)
2. When a load is applied to an engine drive shaft, the flywheel begins to slow down, causing a reduced air blast.

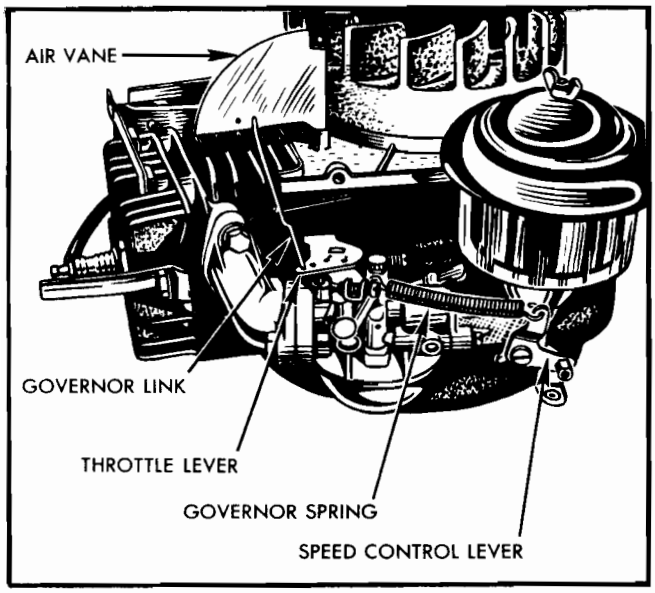
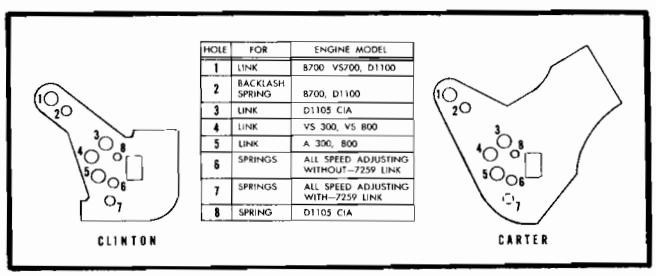


Figure No. 30—Air Vane Governor Linkage

The governor spring will move the linkage (and the air vane) in proportion to the engine speed reduction. The air vane, in turn opens the throttle enough to restore the lost engine speed.

3. When the load is removed, this action is reversed and the governor operates to prevent the engine from running away.
4. The governor spring is the balancing force of the governor. The engine can be set to run at any desired speed within the operating range by adjusting the initial tension of the governor spring.
   NOTE: Do not substitute a heavier or lighter spring, since this would seriously affect governor action. Maximum engine speed should not be above 3600 RPM.
5. Rotate the throttle lever as far as possible in both directions to make certain that the governor linkage does not bind in any position within the range.
6. Move the throttle to the closed position by hand and release it. The throttle should return to the wide-open position. If it fails to do this, check for binding in the governor linkage, or for insufficient tension of the governor spring.
   Caution: When replacing the blower housing, make sure that no part of the housing binds against the governor linkage. If the housing is dented, hammer the dents out to restore the housing to its original shape. Never remove the governor spring from the throttle lever without marking the correct hole with crayon or pencil. Failure to replace the spring properly can cause serious damage. (See Figure No. 31.)



HOLE	FOR	ENGINE MODEL
1	LINK	8700 VS700, D1100
2	BACKLASH SPRING	8700, D1100
3	LINK	D1105 CIA
4	LINK	VS 300, VS 800
5	LINK	A 300, 800
6	SPRINGS	ALL SPEED ADJUSTING WITHOUT—7259 LINK
7	SPRINGS	ALL SPEED ADJUSTING WITH—7259 LINK
8	SPRING	D1105 CIA

Figure No. 31—Throttle Lever Positioning Guide

RECOIL STARTERS

REPLACEMENT OF ROPE PULLEY WITH ARMSTRONG RECOIL STARTER

1. Remove existing starter pulley from crankshaft.
2. Secure the new aluminum die-cast starter pulley to the shaft with a washer and hexagonal nut. (If starter pulley is equipped with rotor pin, be sure pin engages keyway.)
3. Put the Armstrong recoil starter unit into place against the blower housing, making certain that the centering pin on the starter unit engages the center hole in the crankshaft. (If centering pin does not extend far enough to engage the hole in the crankshaft, use a pair of pliers to pull the pin out to the required length.) With the starter unit centered, scribe four holes against the blower housing surface.
4. Remove the starter unit and the blower housing. Drill or punch out the four circles scribed on the blower housing.
5. Use Tinnerman nuts to tighten the four mounting screws in the holes. Screw heads should be on the engine side of the blower housing. Place the recoil starter unit over the mounting screws, checking to make sure that the centering pin engages the center hole in the crankshaft. If you fail to center the unit properly serious damages will result.
6. Remount blower housing on engine and securely fasten the starter unit by tightening hex nuts.

REPLACEMENT OF SCHNACKE RECOIL STARTER WITH ARMSTRONG, USING FOUR MOUNTING STUDS

1. Remove existing starter, starter pulley, lockwasher and nut.
2. Secure the new aluminum die-cast starter pulley with a washer and a hexagonal nut. When starter pulley is equipped with pin, be sure pin engages keyway.
3. Put the Armstrong Recoil Starter unit into place against the blower housing, making certain that the centering pin engages the center hole in the crankshaft. (If centering pin does not extend far enough to engage the hole in the crankshaft, use a pair of pliers to pull the pin out to the required length.) Press the starter into position and place four lockwashers on the studs.
4. Continue to hold the starter in this position with one hand, and securely fasten it with the other by tightening the hexagonal nuts.

REPLACEMENT OF SCHNACKE WITH ARMSTRONG, USING MACHINE SCREWS

1. Remove existing starter, starter pulley, lockwasher and hex nut from engine.
2. Secure the Armstrong starter pulley to the shaft with a washer and hexagonal nut. (If starter pulley is equipped with rotor pin, be sure the pin engages the keyway.)
3. Place the starter on the blower housing so that the centering pin engages the center hole of the crankshaft. (If centering pin does not extend far enough to engage the hole in the crankshaft, use a pair of pliers to pull the pin out to the required length.) Press the starter into position and place four lockwashers on four machine screws.
4. Continue to hold the starter in this position with one hand and securely fasten the starter with the other hand by tightening machine screws.

REPLACEMENT OF ROPE PULLEY WITH SCHNACKE RECOIL STARTER

1. Remove the existing starter pulley from the engine.
2. Assemble the new starter pulley on the crankshaft with a hexagonal nut and washer.
3. Position Schnacke recoil starter unit against the blower housing with one hand. With the other, pull the starter handle to bring the unit into alignment. (On older Schnackes, pull starter handle to unwind cable until the clutch assembly engages the driven nut. The clutch assembly should be separated approximately ⅛ inch or less when the starter cable is retracted causing the clutch assembly to separate from the driven serrated nut. Use extra shim washers to obtain correct separation. Replacement of this unit with the newer type is recommended.)
4. Be sure the recoil starter unit is centered against the blower housing.
5. Holding the starter in correct position with one hand, scribe four, ¼ inch holes.
6. Remove the blower housing and drill or punch out the mounting holes.
7. Assemble the recoil starter to blower housing using mounting screws. Screw heads should be on the engine side of the blower housing with nuts and lockwashers assembled from the recoil starter side.
8. Assemble the blower housing and the starter unit on the engine, replacing blower housing screws and cylinder head cap screws.

TO REPLACE OTHER RECOIL STARTERS WITH THE SCHNACKE:

Follow the instructions given for replacement of recoil starrers with Armstrong units. However, instead of engaging the centering pin in the crankshaft hole, pull the handle of the Schnacke to bring it into proper alignment on the studs or mounting screws.

FOR 350 SERIES ENGINES ONLY

A blower housing brace, part number 7164 and two rivets, part number 3619, are also used when mounting the recoil starter assembly on a 350 series engine. This brace must be attached to the blower housing and anchored by the two cylinder head screws. This is the same brace that is used on A-300 and VS-300 series engines. All other engines are equipped at the factory with this brace.

FIELD FIX FOR THE SCHNACKE RECOIL STARTER

Recoil starters that fail to retract cable when the handle has been pulled out can be given a quick field fix in the following way. Loosen the four attaching screws by using a screw driver. It is then possible to center the unit and eliminate the bind caused by mis-alignment. The spring is then permitted to recoil the cable and solve the difficulty.

COMPRESSION

FOUR CYCLE ENGINES

Special material, selected for long life and trouble-free service, is used in the construction of Clinton four cycle Engine valves. Both intake and exhaust valves have 45 degree seats, and the exhaust valve is made of extra-hard, heat resistant steel for heavy duty wear. If valves are removed, extreme care must be taken to replace intake and exhaust valves correctly in their respective positions.

TO TEST COMPRESSION:

1. Remove spark plug.
2. Insert the rubber-tipped end of the compression gauge in the spark plug hole snugly. (See Figure No. 32.)
3. If the engine is equipped with a rope starter, wind the full length of the rope around the starter pulley and give a sharp, quick pull.
4. If the engine is equipped with an automatic rewind starter, pull the handle firmly to turn the engine.
5. If the engine has a kick starter, check compression by holding the gauge in the spark plug hole and operating the starter through one full stroke.
6. Compression in any case should build up to approximately 80 pounds on the gauge. If pressure is low, it indicates that compression is leaking out of the cylinder as a result of valve leakage or leakage around the piston rings or cylinder head gasket. If compression is low the engine should be overhauled.

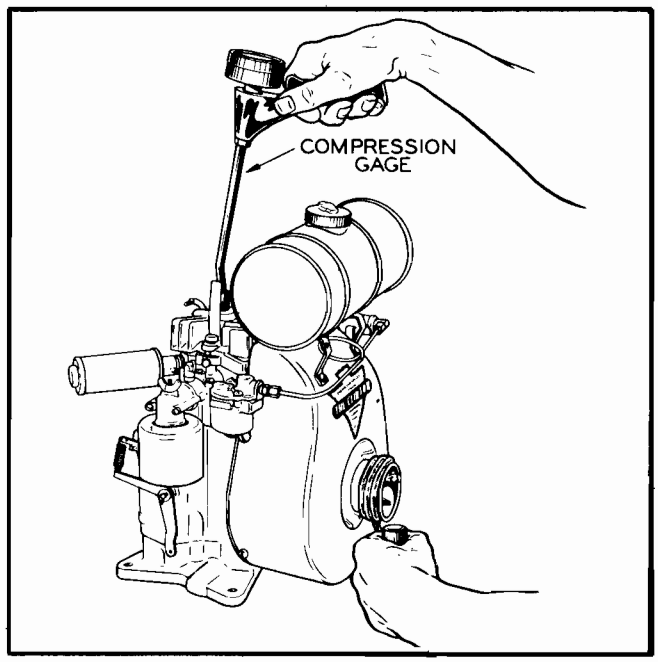


Figure No. 32—Testing Compression

CHECKING VALVE CLEARANCES

Valves are set at the factory to provide an operating clearance between the end of the push rod and the valve stem of .008" intake and .012" exhaust. If the engine is operated under extremely dusty conditions, wear on the valve seats will sometimes reduce the clearance to a point where valve life will be shortened. See page 48.

1. To check tappet clearance, remove the tappet case and breather cover and measure the tappet clearance with a feeler gauge. (See Figure No. 33.) When taking this measurement, make certain the tappet is at its widest position by rotating the engine until the tappet rests on the heel of the cam.
2. If the clearance is too wide, it indicates that the valves

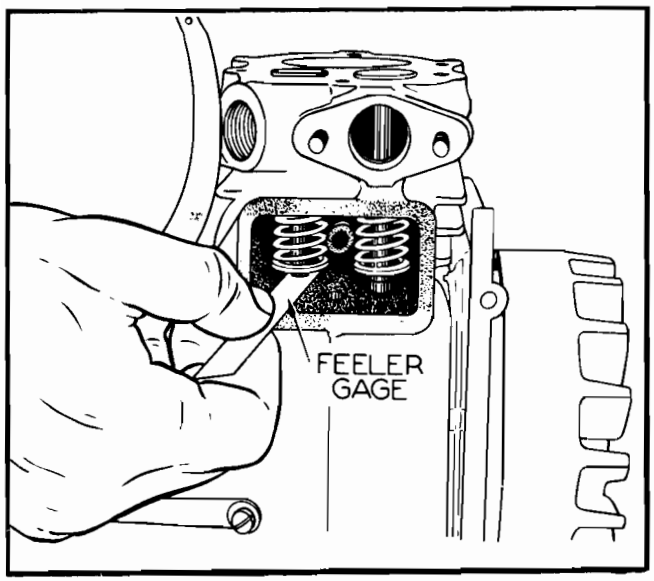


Figure No. 33—Checking Valve Tappet Clearance

are slightly warped or that the valve seats and valve faces are heavily oxidized, holding the valves slightly off their seats.

3. If the clearance is too close, it indicates that considerable wear has taken place at the valve seat and allowed the valve to drop.
4. In either case, it will be necessary to remove the valves for complete servicing.

TWO CYCLE ENGINES

1. **The Exhaust Valve Ports** require a minimum of service. An occasional cleaning to remove carbon deposits is all that is necessary.
   a. Remove muffler assembly from engine to expose exhaust valve ports. (See Figure No. 34.)
   b. Clean with a suitable instrument capable of scraping and removing the carbon deposits within these ports.
   c. The engine should be turned over by hand until the piston moves below the port openings to allow greater access for the cleaning of these ports.
   d. Use extreme care to avoid damaging or scoring the top of the piston when cleaning these ports.

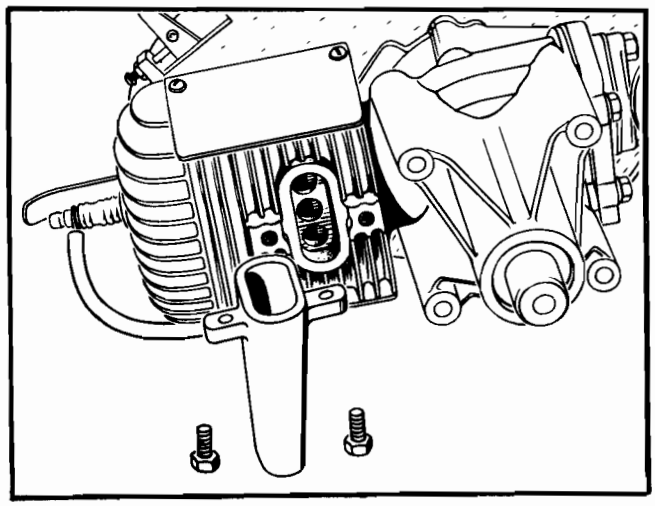


Figure No. 34—2-Cycle Exhaust Ports

2. **The Intake Valve Ports** should be cleaned in the same manner as the exhaust valve ports.
   a. Remove the bearing plate assembly which will expose the intake valve ports.
   d. Clean with a suitable instrument.
3. **The Reed Valves** are among the most important parts of the two cycle engine. If they are not set and working properly, the following trouble signs may develop: (See Figure No. 35)
   a. Difficulty in starting the engine.
   b. Lack of sufficient fuel in the combustion chamber.
   c. Lack of compression, poor carburetion and low efficiency in the general operation of the engine.
   d. A whistling sound, heard when starting the engine.

Note: When reed valves are found to be distorted or bent out of shape, causing leakage, it is recommended that they be replaced. It is not recommended that you rebend or invert them in repairing and servicing this assembly.

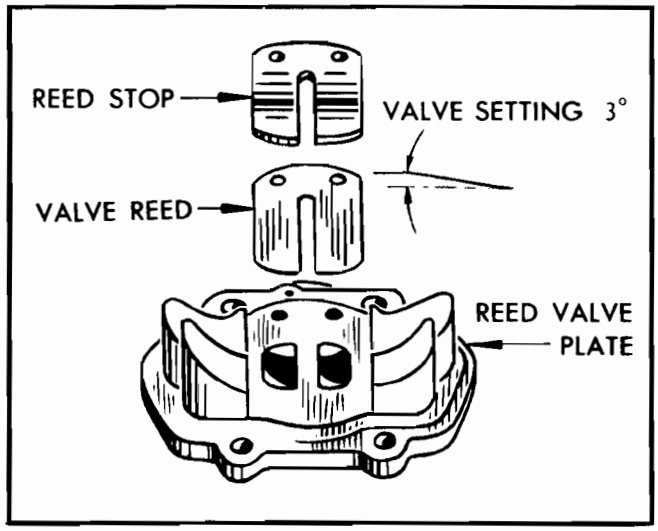


Figure No. 35—2-Cycle Reed Valve Assembly

4. **To Inspect the Reed Valves:**
   a. Remove the entire carburetor and induction manifold assembly.
   b. Remove the pressure line, the induction bracket mounting screws and the entire assembly.
   c. Remove the reed valve mounting screw lock wire, screws, reed valve stop and reed valve. Examine the reed valves for cracks, fractures and proper seating over the induction bracket ports.
   d. When replacing the reed valve, be sure it is installed properly. (The slight bend in the reed should be placed over the ports with the bend up.)
   e. Place the reed stop over the reed and secure with screws and lock wire. The reed valve should now seat firmly over the ports and make positive contact all around the edges. Clearance between the tips of the reed valve stop and the reed valve should be 9/32 of an inch, measured from the under side of the reed valve stop.

TO TEST COMPRESSION:

1. Remove the spark plug and insert compression gage into the spark plug hole.
2. Spin the engine with the starter, and compression should register 60 to 70 pounds.

AIR FILTERS

From the standpoint of engine life, the air filter is one of the most important parts of the power plant. Were it not for the air filter, an engine operating in dusty conditions would wear out in a few hours.

It is almost impossible to determine exactly how often an air filter should be cleaned, since the atmospheric conditions under which it operates will vary. However, the air filter should be checked at least once every day and cleaned once a week even under ideal conditions. If the engine is operating in dusty air, cleaning will be necessary more often.

VISIBLE OIL BATH AIR FILTERS

This type of air filter is standard on all late model Clinton Engines. The level and color of the oil indicate how often cleaning is necessary. To clean this type of filter:

1. Remove the filter from the engine and empty the dirty oil from the filter cup.
2. Wash all parts in clean gasoline, kerosene or other petroleum solvents. Dry the parts with compressed air.
3. Fill the lower cup with clean engine oil up to the 'fill level' mark. (On older models fill to the 'high level' mark.)
4. Use SAE No. 50 oil to fill the unit.
5. Reassemble the filter unit and install it on the engine.

Clinton Breather Tube. In some localities where Clinton Engines are operated under extreme dusty conditions, dirt and dust is taken into the engine through the valve chamber cover. To avoid this, a method has been developed to filter all air taken in through the valve chamber cover through the oil bath air cleaner. Replacement of the valve chamber cover and the air horn is necessary, so that the new system can be installed. The new valve chamber cover and air horn are fitted with connectors and joined with a piece of Flexible hose. Parts required to make this adjustment on specific engines are listed and illustrated in Figures No. 36, 37, 38.

Note: To properly position the elbow fittings it is necessary to tighten the fittings. They should never be loosened for positioning purposes.

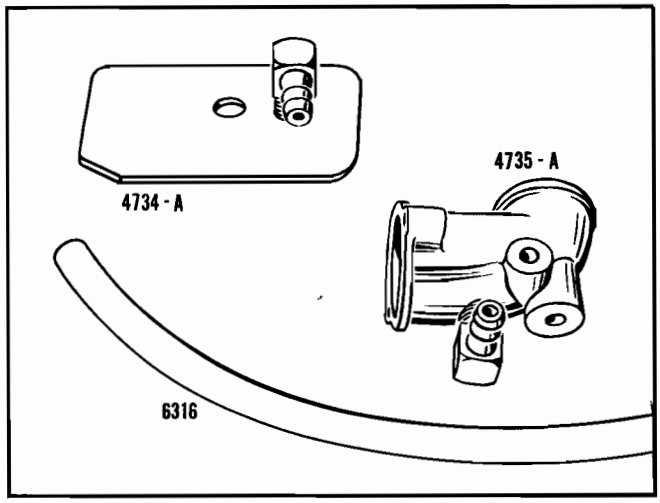


Figure No. 36—Breather Tube Parts—VS-700

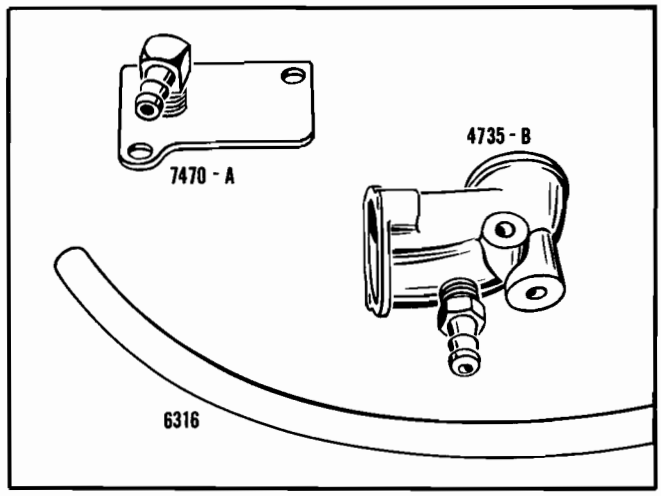


Figure No. 37—Breather Tube Parts—VS-300

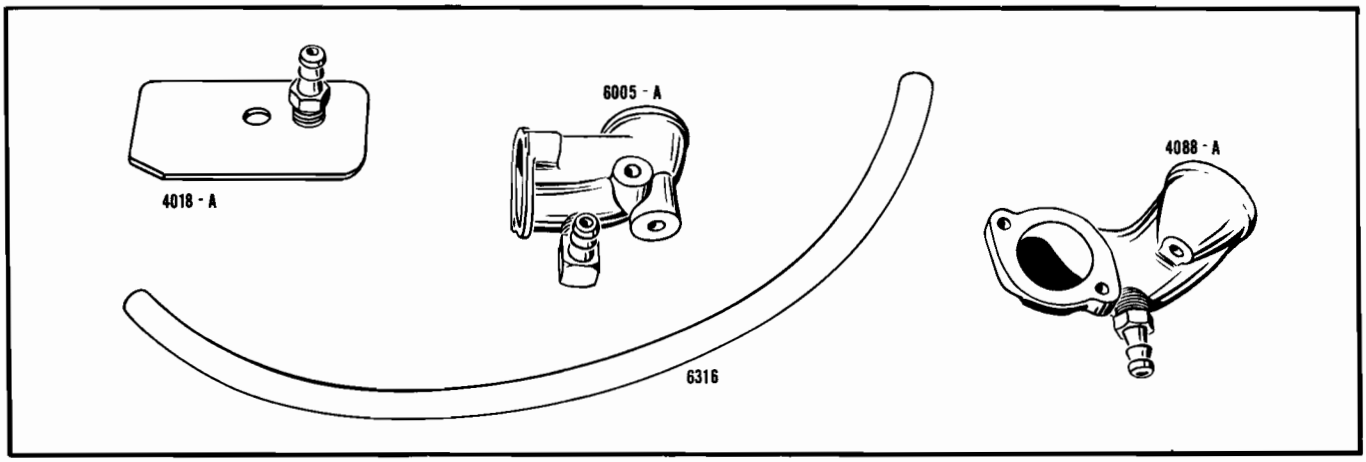


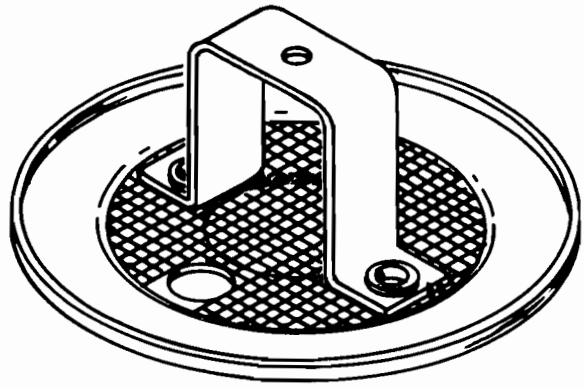
Figure No. 38—Breather Tube Parts—B-700, A-800 & D-1100

METALLIC MESH TYPE AIR FILTERS

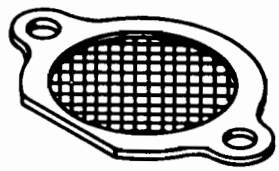
This type of filter (See Figure No. 10) is standard on Clinton two cycle engines. It should be checked daily when the engine is in operation to be sure that it does not become clogged with dust particles. Use a stiff brush to clean the filter and periodically rinse it in pure gasoline, then dip it in oil before reinstalling it on the engine.

The Intake Screen. Early production of Clinton two cycle engines did not incorporate an intake screen, and it was soon found that foreign matter was being taken into the combustion chamber causing excessive damage. A screen and gasket assembly (Part No. 2075A) (See Figure No. 39) is now available for installation between the air cleaner bracket (Part No. 2000-A, See Figure No. 39) and the carburetor on engines which do not have this protective unit as part of the air cleaner bracket assembly.

Note: When Clinton two cycle engines are brought in for service, check to see whether they are equipped with this assembly. If not, one should be installed in the interests of prolonging engine life and service.



Part No. 2000A



Part No. 2075A

Figure No. 39—2-Cycle Intake Screen Elements

ENGINE OVERHAUL PROCEDURES

SEE GENERAL DISASSEMBLY PROCEDURE CHART ON PAGE 45

Clinton Engines are precision built units, incorporating fine engineering design with superior materials, and should be treated as such when undergoing overhaul and service.

Conventional automotive tolerances with which many service operators are familiar cannot be applied haphazardly to Clinton Engines, since they are air cooled and operate under different conditions than automobile engines.

Valve seats, bearings and cylinder walls must all be treated in accordance with instructions in this manual. The cylinder bore, if rebored, must be polished with high grade honing equipment and clearances must be maintained within the limits specified.

Tools and equipment illustrated in this section are approved by the Factory for overhauling Clinton Engines. If other equipment is used, the service operator must make certain that the overhauled engine is capable of delivering the same performance and long life found in a new engine.

REMOVAL OF PARTS

FLYWHEEL

In some instances the flywheel, mounted on the tapered end of the shaft, will require a sharp blow in order to release it.

1. To protect the threads on the crankshaft from being damaged install TL-916, knockout Flywheel Puller, on the end of the crankshaft and strike it a sharp blow with a plastic hammer (See Figure No. 40). The flywheel should jump away from the tapered portion of the shaft. Repeat if necessary.
2. Strike tool squarely. A glancing blow may bend shaft end.

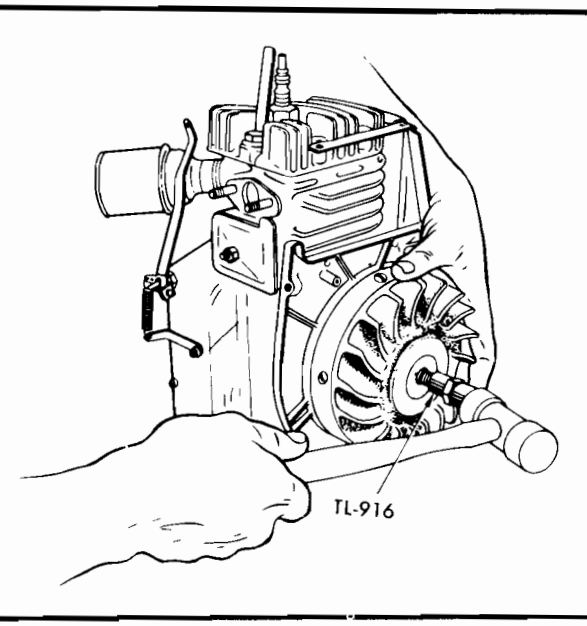


Figure No. 40—Removing the Flywheel

MAGNETO

On both Phelon and Scintilla magnetos the breaker points are attached to the bearing plate.

1. Early Phelon magnetos were equipped with a breaker point set having numerous insulating washers and attaching screws. Extreme care in assembling these parts was necessary to provide insulation for the movable contact arm.
2. The later type is much simpler to install and adjust.
3. The two and four cycle magnetos on all late models have three interchangeable parts:
   a. Coil (with different laminations).
   b. Breaker points cam.
   c. Condenser (same capacity but different lead and hold down clips).
4. **Bearing Plates**—Four Cycle Engines
   Bolt holes on new blocks are deeper and have a roll thread. Be sure to use old bolts with old blocks and new bolts with new blocks.
5. **Bearing Plates**—Two Cycle Engines
   Three types of bearing plates have been made since the two cycle engine production started: the first had a bronze main bearing; the next was the same bearing plate milled out to accommodate a needle bearing which cuts down friction, and the present bearing plate has a needle bearing and is thicker throughout with longer lugs to prevent stripping out. Do not attempt to replace the old bronze bearing plate with the needle type without changing the crankshaft.
6. **Removal of Piston Pin**
   a. Be sure to hold piston in one hand while tapping the pin out with the other to avoid causing an out-of-round condition.
   b. If the piston is to be reused, mark it in respect to the connecting rod, so they can be reassembled in their previous relationship. (See Figure No. 41.)
7. **Removal of Piston Rings**
   a. Piston rings should be replaced whenever the engine is overhauled. Break and remove them with care, however, to prevent scaring piston lands.
   b. Rings must always be replaced when the engine is disassembled because they have worn in a way that conforms to the irregularities of the cylinder wall. New rings will adjust themselves to the cylinder wall irregularities when the engine is reassembled, while the old rings would never find similar rough spots and engine efficiency would be impaired.
8. **Removal of Camshaft Axle**
   a. When removing the camshaft axle always drive it out from the bearing plate side of the block where additional clearance has been allowed. (See Figure No. 42.)
   b. If the camshaft axle pins are damaged, it is better and more efficient to replace the entire bearing plate.
9. **Removal of Valves**—Four Cycle Engines
   a. Remove the tappet case stud first to facilitate "C" washer removal.
   b. Use TL-925, Valve Spring Compressor, and lift out the "C" washer with the fingers, or with needle nose pliers shaped on the end to fit the "C" washer.

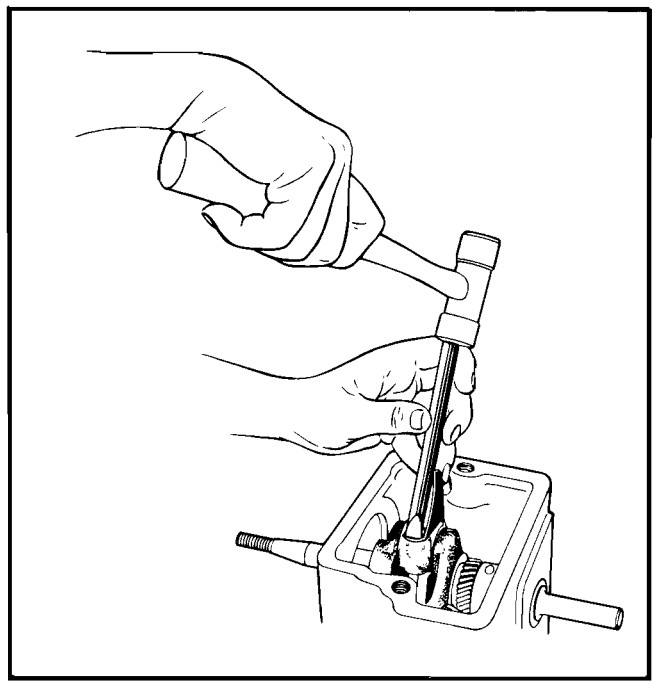


Figure No. 41—Removing Connecting Rod Bolt Locks

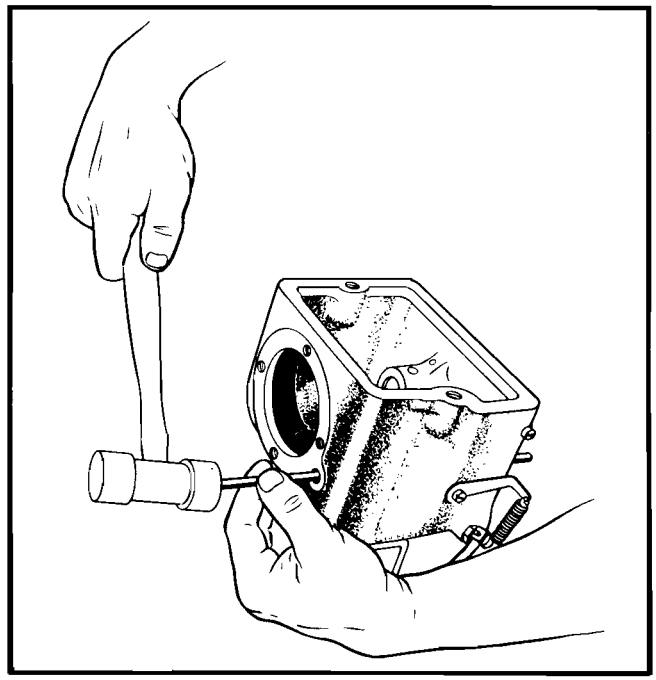


Figure No. 42—Removing Camshaft Axle

CLEANING ENGINE PARTS

Wash all engine parts (except the carburetor and the magneto) in a regular commercial cleaning solvent capable of removing all lacquer, gum and foreign material.

1. Avoid solvents which will remove paint from parts unless they are to be repainted. (Repainting is advisable for appearance sake).
2. If a suitable solvent is unavailable, denatured alcohol will suffice, providing parts are allowed to soak several minutes.
3. Clean parts with a firm brush while holding them submerged in the solvent.
4. Remove all carbon from the cylinder head (See Figure No. 43) and piston with a putty knife or a wire brush before submerging in solvent. Use a special scraper or the square end of a broken piston ring to remove carbon deposits from piston ring grooves.

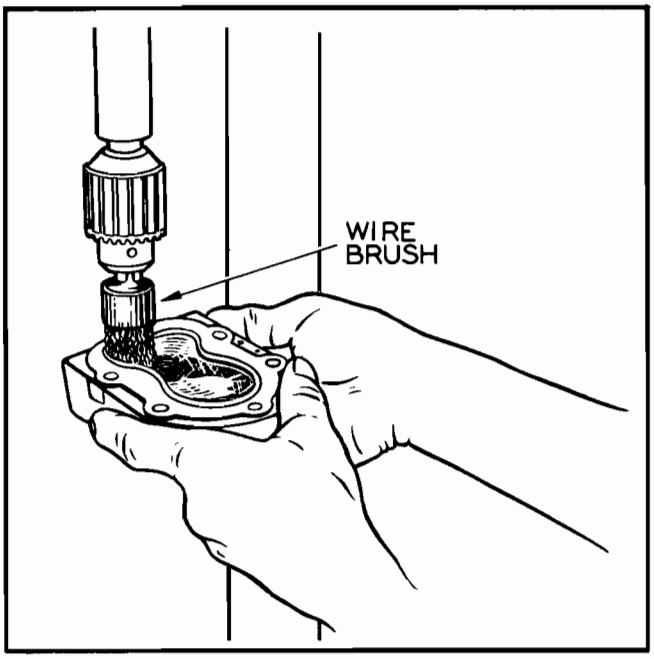


Figure No. 43—Cleaning the Cylinder Head

Once the engine has been disassembled and all parts thoroughly cleaned, each part should be inspected carefully for signs of wear and improper tolerance or alignment. Some parts will have to be replaced, while others will be satisfactory for reuse.

INSPECTION OF CRANKSHAFT

1. Check bearing journals on crankshaft for signs of score marks and for aluminum or other metallic pick-up. If the crankshaft is smooth, but shows slight evidence of pick-up, remove by polishing the journal with crocus cloth soaked in oil until all traces of pick-up have been eliminated.
2. Measure the crankshaft journals for out-of-round condition with an accurate micrometer. Main bearing journals must not be more than .001 inch out-of-round. Connecting rod journals must not be more than .0005 inch out-of-round. Do not attempt to regrind the crankshaft, since undersize bearings are not available.
3. Check condition of tapered portion of crankshaft, keyway and threads. Restore battered threads in some cases by running a die over the damaged portion. Rusty taper indicates engine has been running with a loose flywheel. Clean the rust off the shaft with crocus cloth and check for evidence of wear. Replace shaft if taper or keyway is badly worn, since flywheel will not remain tight.

INSPECTION OF CYLINDER BLOCK

1. Using a dial gage, measure the cylinder bore for wear. (See Figure No. 44.) If the cylinder block is tapered and out-of-round more than .006 inch, the cylinder should be rebored and an oversize piston installed.
2. **Valves**—Four Cycle Engines
   a. Inspect valve seats for extreme wear. The seats should be approximately 1/32 inch in width and under no circumstances more than 1/16 in width. In many cases badly worn seats can be restored by reconditioning with Valve Seat Cutter. TL-913. (See Figure No. 46.) If the seat width exceeds 1/16 after using this 45° cutter, it can be reduced by using a 15° seat undercutter, TL-919, to narrow the seat to the desired 1/32 inch width. If, however, the seats are so badly worn that they cannot be successfully reconditioned, the cylinder block must be replaced.
   b. Well equipped shops can sometimes save an engine block by counterboring the valve ports and installing valve seat inserts. This, however, should not be attempted unless the shop is thoroughly equipped to handle such an operation.
3. **Valves (Reed)**—Two Cycle Engines
   a. If reeds are chipped or cracked they must be replaced, (See Figure No. 35) with a new assembly.
   b. Make sure the new reeds have no burrs and lie completely flat.
   c. Make sure the reed contact surface is not scored or scratched and that the dirt groove is clean.
   d. Reed support should be adjusted so that reeds are allowed to open approximately 3/16 inch at the tip.
4. Inspect all gasket faces to determine whether any portion of the block has been damaged to such an extent that a new gasket would not provide a seal.
5. Inspect cylinder head screw holes and other threaded openings in the casting.
6. **Breather Assembly**—Four Cycle Engines
   a. Positive crankcase pressure is a characteristic of high speed, single cylinder, four cycle engines. Clinton Engines incorporate a valve-type breather assembly (See Figures No. 45, 47) in the crankcase ventilation system to compensate for this pressure. Breather action maintains the proper amount of vacuum in the crankcase at all times. This assembly should be inspected each time the engine is serviced. (See Breather Tube, Page 29.)
   b. Check the size of the opening in the valve chamber wall. It is necessary that it be unhampered to assure proper crankcase breathing on certain engines.
   c. A 3/16 vent hole, found on some early engines, may cause excessive crankcase pressure and high oil con-

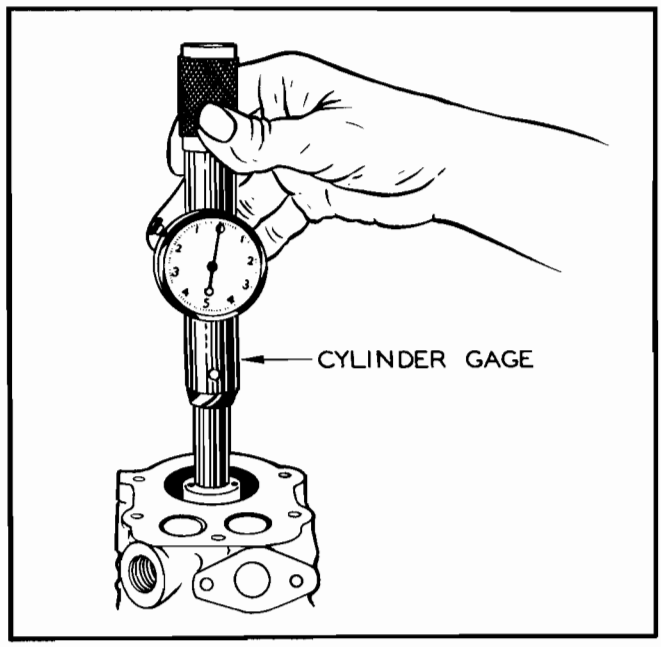


Figure No. 44—Measuring Cylinder Bore for Wear

sumption. When overhauling the engine, enlarge the hole to 3/8 inch and install the breather assembly if the engine is not so equipped.

d. Special precautions are necessary when installing this breather assembly in a vertical shaft engine. Be sure that the oil return tube or the vent hole drilled into the breather seat (See Figure No. 47) (whichever the engine has) is in a downward position or the oil may collect in the valve chamber and be thrown out of the vent in the valve chamber cover.

e. When enlarging the breather hole, coat the drill with grease to prevent cuttings from falling into the cylinder block.

INSPECTION OF BASE

1. Check the base for cracks or warpage.
2. Some four cycle engine models are equipped with a plunger-type oil pump in the base. (See Figure No. 59.) Check this pump carefully for worn or damaged parts, and if wear is evident to any part of the oil pump assembly, it is recommended that replacement be made in accordance with instructions on page 38.
3. Two cycle engines, because of their distinct method of lubrication are never equipped with an oil pump in the base.

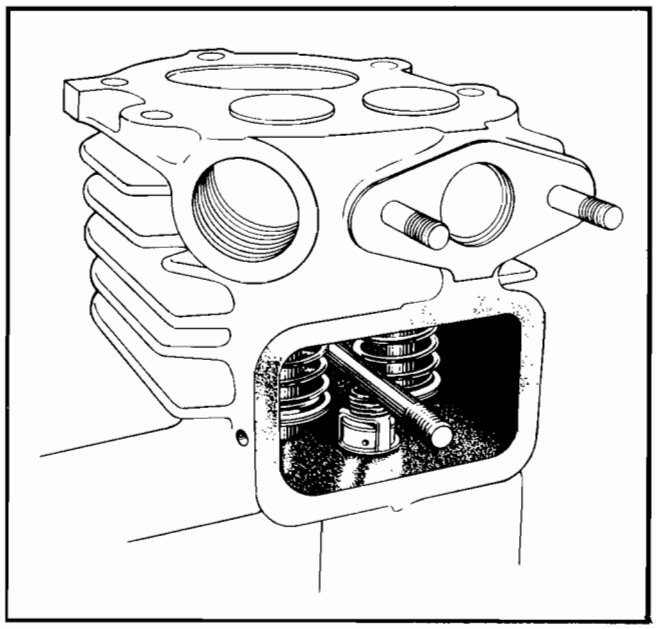


Figure No. 45—Breather Assembly—Horizontal Shaft

INSPECTION OF CONNECTING ROD

1. Check for evidence of score marks or wear.
2. Measure the crank pin diameter and compare this with the inside diameter of the connecting rod bearing (with connecting rod cap bolts pulled up tight). Clearance should be between .001 and .0025 inch.
3. Wear in the connecting rod which exceeds these limits will be characterized by score marks or a roughness. Either makes replacement of the connecting rod necessary.
4. New connecting rod bearings are bored to correct size, and will fit properly on a connecting rod journal which is not undersize by more than .001 inch.

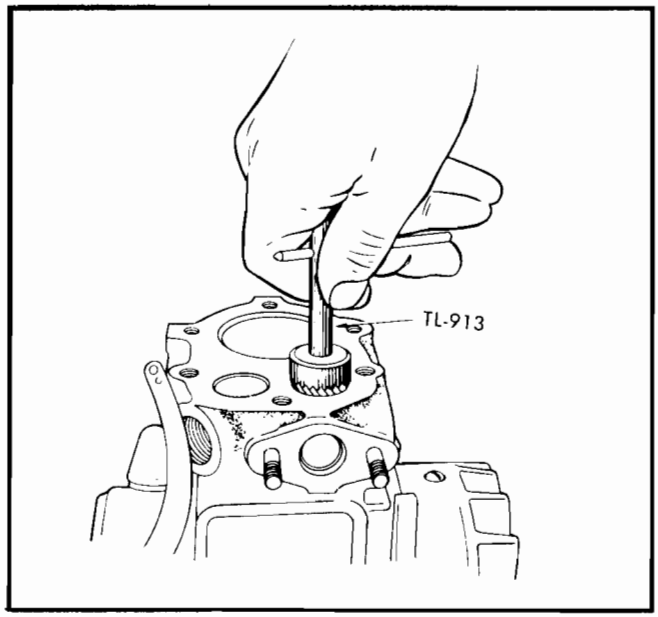


Figure No. 46—Reconditioning Valve Seat

INSPECTION OF VALVE SPRINGS
Four Cycle Engines

1. The most effective method of testing valve springs is to compare them with new springs. This can be done on a valve spring tester if one is available, or by comparing the length of the new springs against the old. If the old spring has weakened it will be shorter than the new spring, and it will usually lean to one side when standing on end.
2. If there is any question concerning the condition of valve springs, they should be replaced.

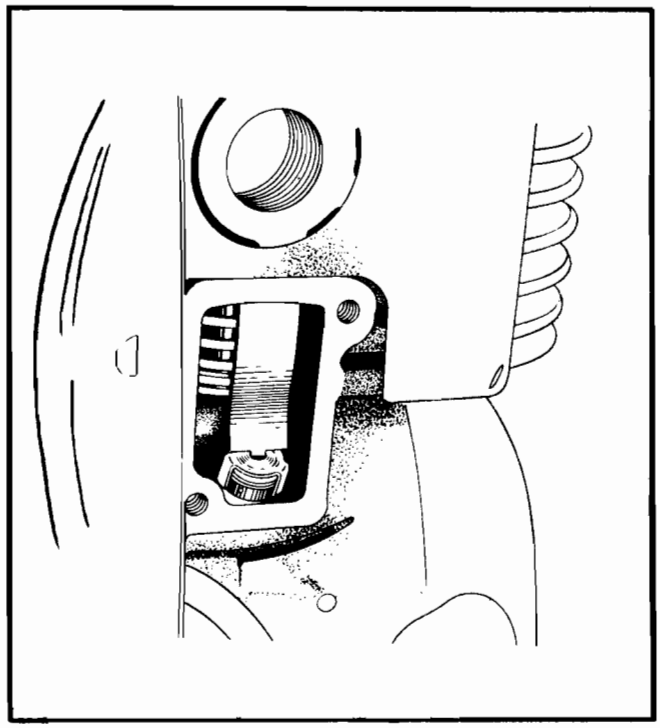


Figure No. 47—Breather Assembly—300 Series Engines

CLINTON ENGINES

2 & 4 CYCLE MAINTENANCE

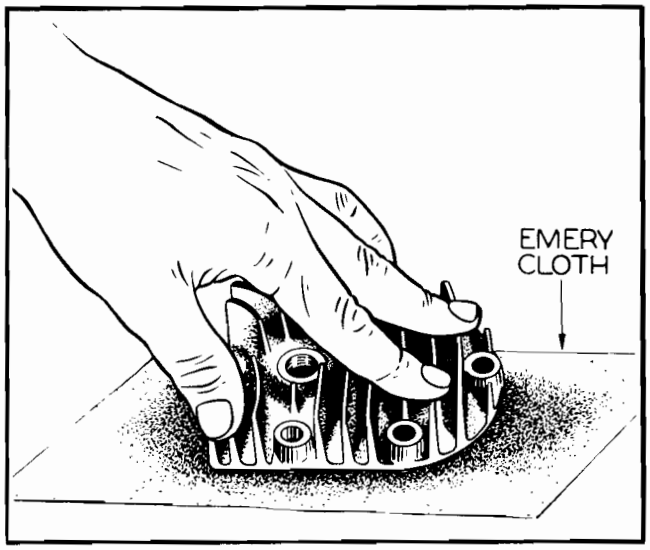


Figure No. 48—Resurfacing the Cylinder Head

INSPECTION OF CYLINDER HEAD

Four Cycle Engines

1. Remove old gasket from cylinder head and lay head right side up on face plate. Check to see if the gasket surface of cylinder head makes full contact with the plate.
2. If the cylinder head is severely warped, replace it. Slight warpage can be eliminated by resurfacing the head. (See Figure No. 48.)
3. Make certain that no cooling fins have been broken off of the head.

INSPECTION OF CARBURETOR

Disassemble and service in accordance with instructions in the carburetor section of this manual.

INSPECTION OF FUEL TANK AND FUEL LINES

1. Check fuel tank for leaks and for rust on inner surface. Replace severely rusted tank, but slight leaks can be repaired by soldering or welding. Fill tank with water and allow it to stand several hours. Then, empty the tank and make repairs.
2. Never attempt to solder a tank with the cap in place.
3. Remove the tank strainer and clean it.
4. On engines equipped with Carter carburetors: Remove shut-off valve assembly and clean small screen inside the valve. If screen is damaged, replace it.
5. Check all fuel lines for kinks, cracks and weakness. Replace all damaged lines as well as those showing signs of wear which might cause premature failure.

INSPECTION OF SPARK PLUGS

1. If the spark plug shows excessive wear on electrodes or blistered or broken porcelain, replace it.
2. If plug is in good condition, clean and regap it.

INSPECTION OF AIR FILTER

1. Inspect the air filter and service it according to instruction in the Maintenance Section.
2. Visible oil bath filters are standard on four cycle engines while automotive aluminum mesh filters are standard on two cycle engines.

INSPECTION OF MAGNETO PARTS

1. Check the breaker points, condenser and magnet coil.
2. Check plastic dust cover for cracks and warpage. If cover is not snug around the rib of bearing plate casting, install a new dust cover. Some engines may have metal dust covers, in which case make sure the cover does not contact the breaker cam or the breaker point and cause ignition failure.

INSPECTION OF FLYWHEEL

1. Check the flywheel for broken fins and loose magnets. If magnets are loose, tighten securely and stake the screw heads in position. Test strength of magnets with magnetometer.
2. Check carefully for rust or wear on the tapered bore of the flywheel. These conditions indicate that the flywheel has been loose on the crankshaft.
3. Clean the bore carefully with crocus cloth before reinstalling the flywheel on the engine.

INSPECTION OF BEARING PLATE

1. Check the bearing plate for warpage and surface condition.
2. Measure the crankshaft journal diameter and the bearing diameter to determine the amount of wear. If clearance exceeds .005 inch, the bearing must be replaced. Put a new crankshaft in a new bearing and compare the amount of looseness with the parts being checked.
3. Remove the oil seal from the bearing plate by prying it out with a screwdriver. This oil seal must be replaced whenever an engine is overhauled.
4. Inspect the threads in all screw holes in the bearing plate. If a considerable number of screw holes have damaged threads, replace the bearing plate. In some cases where the bearing plate is in generally good condition, it can be salvaged by tapping out the damaged screw holes for the next size larger screw.

INSPECTION OF BLOWER HOUSING

1. Check the blower housing for dents. The housing is designed for correct circulation of air over the engine. Any dents that might interfere with cooling should be removed when the engine is overhauled.
2. Remove dents with a plastic hammer, using a wood block for back-up purposes.

INSPECTION OF CAMSHAFT

1. Inspect camshaft gear(s) for damage and each cam for wear and score marks. Replace camshaft if any of these signs are evident.
2. Check camshaft axle for wear and replace it if it is damaged.
3. When inspecting the 300 series cam gears, all teeth must be checked carefully. Wear may appear only on a few of the teeth, but if wear is indicated both the camshaft and cam gears must be replaced.
4. On engines equipped with a flyball governor, check to make sure all governor parts are free.

INSPECTION OF MUFFLER

1. Check the muffler for restriction due to an accumulation of carbon on the inside.
2. To remove carbon deposits, soak the muffler in a commercial cleaning solvent until the obstruction is partially dissolved. Blow out remainder with compressed air.

INSPECTION OF PISTONS

1. Replace piston if it shows signs of score marks, worn ring lands and worn piston pin bores.
2. Measure ring grooves by inserting new piston ring and checking clearance between edge of ring and the piston land, which should not exceed .002 inch.

RECONDITIONING PARTS

REBORING CYLINDER

Pistons and piston rings are available in regular oversizes (.005 inch, .010 inch and .020 inch) and special oversizes (.030 inch and .040 inch).

1. Measure the cylinder wear with a dial gage (See Figure No. 44) and rebore cylinder to the nearest available oversize to permit clearing up wear completely.
2. Any standard cylinder hone can be used for reboring providing extreme care is used.
3. Nominal operating clearances are allowed on oversize piston and oversize piston rings. When reconditioning bore the cylinder to the exact indicated oversize. For example, when fitting .010 inch oversize pistons, bore the cylinder to exactly .010 inch oversize and the piston can be installed without further measurement. If the following procedure is used, a long wearing cylinder will be obtained.
   a. Clean the table of a conventional drill press to permit the cylinder block to rest on the table without rocking. **(Due to the two cycle engine integral head, reboring must be accomplished from the crankcase side.)**
   b. Mount the cylinder hone in the chuck of the drill press, and set the speed of the spindle to rotate at approximately 600 RPM.
   c. Place the cylinder block or integral head on the drill press table and center it under the spindle.
   d. Install a set of coarse stones in the cylinder hone, and insert the hone in the cylinder. (See Figure No. 49.)
   e. Lower the hone to the point where the lower ends of the stones are in contact with the lowest point of the cylinder wall, and rotate the adjusting nut until the stones touch the cylinder wall. Continue to rotate the adjusting nut to permit removal of approximately one half the estimated amount of metal required for the desired oversize.
   f. Begin honing at the bottom of the cylinder and move hone up and down at the rate of about 50 strokes per minute to avoid cutting ridges in the cylinder wall and to keep the hones straight. About every fourth or fifth stroke, move the hone far enough so that the ends of the stones will extend about one inch beyond the extremities of the cylinder bore. The bore should be checked after every 30 or 40 strokes for size and straightness in order to make certain that the cutting process is progressing correctly.
   g. If the stones and felt buffers of the hone are collecting large amounts of metal use a wire brush to clean them each time the hone is removed.
   h. When the bore has been straightened out, continue honing with long strokes carrying the hone through both ends of the cylinder approximately one inch on four cycle engines. Continue to hone in this manner until the cylinder is within .002 inch of the desired finished size. NOTE: Check the cylinder with the dial gauge as the honing progresses to prevent removing too much metal.
   i. Remove the cylinder hone and replace the coarse stones with burnishing stones and hone in accordance with preceding instructions until the bore is within approximately .0005 inch of desired size.
   j. Remove the hone and install finishing stones to polish the cylinder for final finishing.

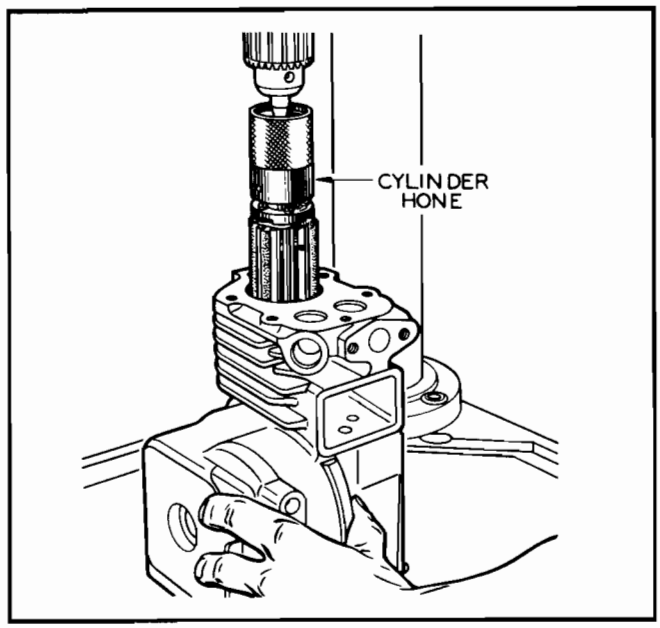


Figure No. 49—Honing the Cylinder

   k. Insert the hone with the finishing stones and remove the final .0005 inch of metal by polishing. These stones will cut very slowly and one or two checks for size should enable the operator to finish the cylinder to correct size within approximately .00025 inch.
   l. After honing has been completed and the cylinder wall appears to have a high polish, wash the cylinder block thoroughly with a soap and water solution—the most efficient way to remove cuttings which may have lodged in the cylinder wall surface.
   m. Now wash the cylinder wall with a good commercial solvent or ordinary gasoline.
   n. Coat the cylinder wall with oil to prevent rust.
   o. The cylinder is now ready for installation of the new oversize piston and rings.

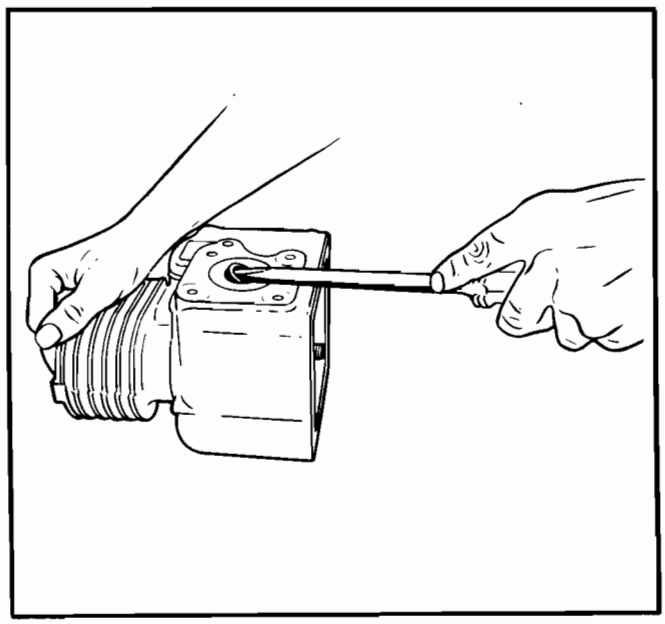


Figure No. 50—Removing Oil Seals

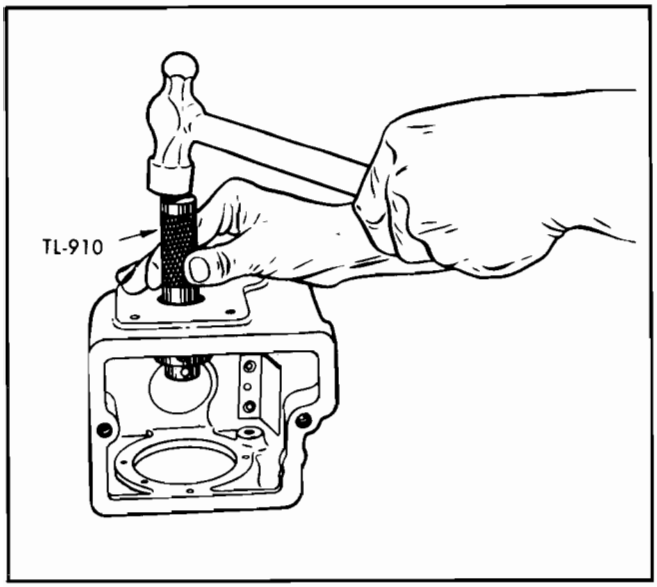


Figure No. 51—Driving Bearing from Block

INSTALLING NEW CRANKSHAFT BEARINGS

1. Remove the oil seals in the cylinder block and bearing plate by prying them out of their recesses with a screwdriver. (See Figure No. 50.) No special care is required, as these parts are to be replaced.
2. Drive the old bearings out of the cylinder block, using the main bearing driver(s)—TL-910 (Four Cycle Engines), TL-924 (Two Cycle Engines). (See Figure No. 51.)
3. Remove the bearing from the bearing plate, using the main bearing driver(s) (See Figure No. 52). **Caution:** When removing the bearing from the bearing plate, make certain the plate is blocked up squarely with the face of the plate on a block of hard wood or a piece of steel which has a flat surface and hole in the center to accommodate the bearing.
4. Using the main bearing driver(s) install new bearings in both the bearing plate and cylinder block. Make certain that the oil holes in the bearings are in alignment with the openings in the bearing plate and those in the cylinder block to provide proper oil circulation to the bearings. (See Figures No. 45, 47 for General view.)
5. Install the bearing plate on the cylinder block and tighten all four attaching bolts securely.
6. Insert the main bearing reamer, TL-912, in the bearing bore and slide the alignment sleeve on the end of the reamer shaft in the opposite bearing from the one being reamed. (See Figure No. 53.)
7. Rotate the reamer continuously until it passes through the bearing. Remove the reamer and insert it in the opposite direction. Ream the opposite bearing.

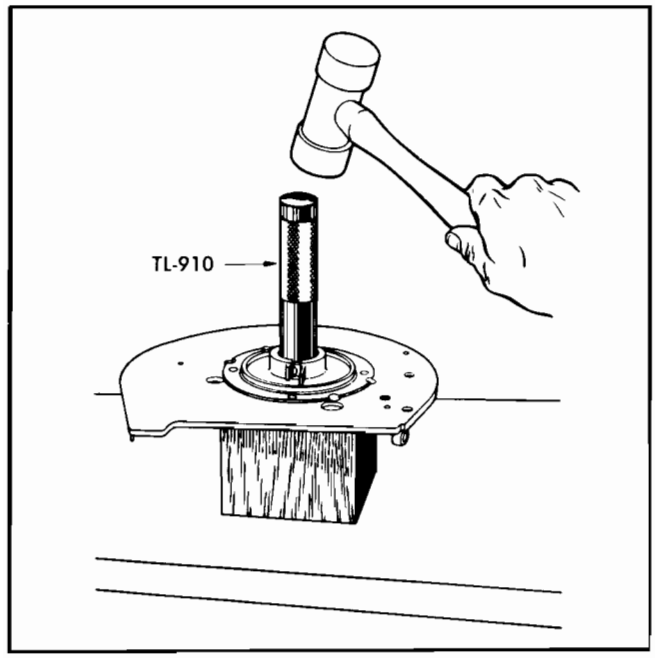


Figure No. 52—Driving Bearing from Bearing Plate

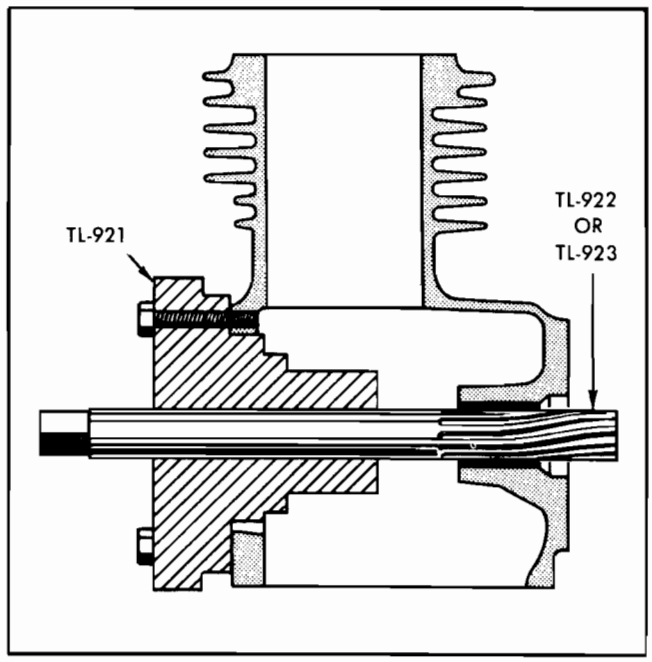


Figure No. 53—Reaming Main Bearings

8. Remove the bearing plate from the cylinder block and insert the crankshaft journals through their respective bearings to see whether they fit properly. Always coat the bearings with oil before inserting the crankshaft. It is also advisable to insert the crankshaft in the cylinder block and install the bearing plate to determine whether the crankshaft binds in its bearings. A warped bearing plate will sometimes cause binding. If this condition exists, the bearing plate must be replaced.

REAMING VALVE GUIDES

1. Insert a new valve stem in a new cylinder block to acquire the feel of proper valve stem clearance. Compare this clearence with the valves in the reconditioned four cycle engine block. It will be necessary to install valves having oversize stems if this clearance is excessive.
2. Procedure:
   a. Clean the table of a drill press so the bottom surface of the cylinder block will lie flat against the metal table.

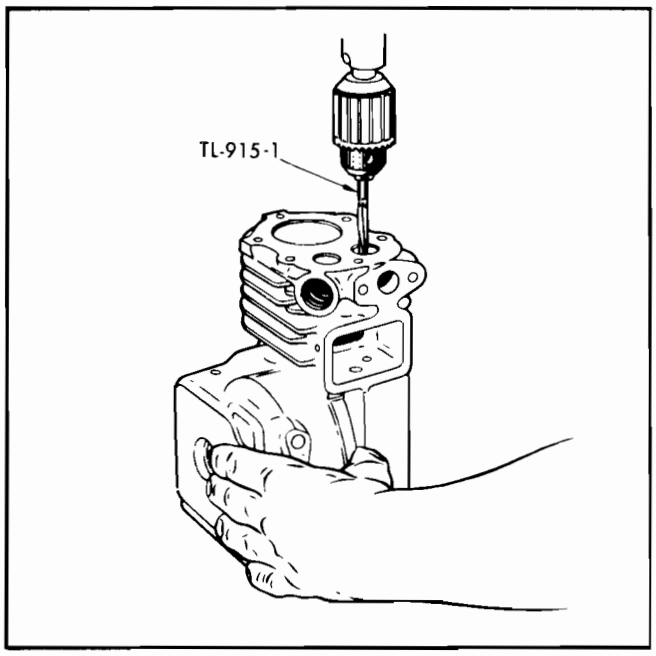


Figure No. 54—Reaming Valve Guides

b. Install the valve guide reamer TL-915-1, 9/32 reamer, in the chuck of the drill press. (See Figure No. 54.) Operate the spindle at approximately 600 RPM, and feed the reamer slowly and carefully through the valve guide. Make only one pass through the guide with the reamer.
c. Ream the other valve guide in the same manner.
d. Coat the valve guides with oil to prevent rusting.

RECONDITIONING VALVE SEATS

1. Insert the pilot of the valve seat cutter, Part No. TL-913, in one of the four cycle engine valve guides and take a light cut by rotating the cutter approximately one-half revolution. Apply pressure to the cutter in a direct line with the valve guide to prevent forcing the cutter against either side of the seat.
2. Remove the valve seat cutter and check to see whether the valve seat has been cleaned up completely. If the cutter has not produced a seat at least 1/32 inch wide at all points, take another cut in accordance with previous instructions. (See Figure No. 55.)
3. Continue this operation until a true valve seat has been formed, and recondition other valve seat in the same manner.
4. Width of each valve seat should be approximately 1/32 inch. (See Figure No. 55.) If they are larger, use a 15° seat undercutter, TL-919, in the same manner as the 45° seat cutter, TL-913 to narrow the seat within limits between 1/32 and 1/16

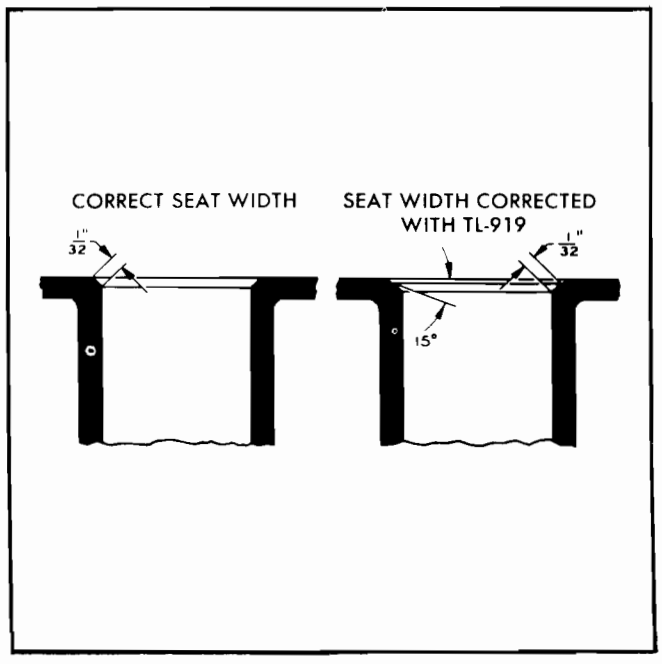


Figure No. 55—Valve Seat Reconditioning

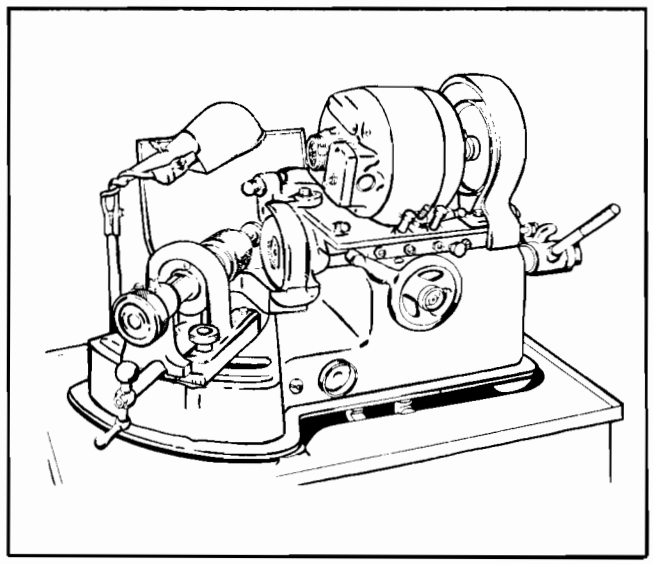


Figure No. 56—Reconditioning Valve Faces

RECONDITIONING VALVE FACES

1. If the original valves in the four cycle engine are in good condition and can be reused, chuck one of the valves in a typical valve refacing machine (See Figure No. 56) and grind the face at 45° angle until the entire face has been cleaned up.
2. Recondition the other valve in the same manner.
3. Edge at top of valve face must be 1/64 inch in width. If reconditioning has left a thinner edge, the valve must be replaced. See Figure No. 57.

LAPPING VALVES

1. Coat the face of the four cycle engine valve sparingly with a fine grade of valve grinding compound, and lap the valve into its seat just enough to insure a gas-tight seal.
2. Using a Valve Grinding Lap-In Cup, TL-928, to grip the top of the valve, rotate the valve back and forth raising it slightly after every eight or ten strokes to keep the compound equalized on the surface. As the lapping process continues, the compound will break down and produce a dull finish on both the valve and the seat which will insure a perfect seal and long valve life.
3. After lapping both valves in this manner, wash the seats and cylinder block thoroughly with solvent to remove all traces of the compound. Dry with compressed air.

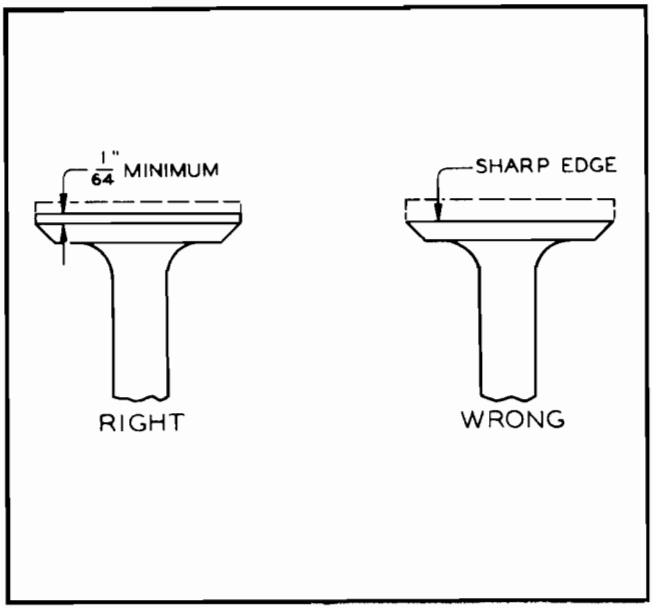


Figure No. 57—Correct and Incorrect Valve Faces

ADJUSTING VALVE TAPPET CLEARANCE

1. Install the four cycle engine valve tappets in the cylinder block and rotate the cam until the intake valve tappet is resting on the heel of the cam.
2. Insert the intake valve in position and measure the clearance between the end of the valve stem and the valve tappet with the valve pressed tight against the seat. The clearance must be .008 inch. (See Figure No. 33.)
3. After reconditioning valves or installing new valves this clearance will be less than .008 inch. Use a valve refacing machine set to grind a perfectly square face and grind off the end of the valve stem until the desired clearance is obtained.
4. Rotate the camshaft back and forth to see whether the gap changes more than .001 inch before the tappet begins to ride up on the slope of the cam. If the clearance changes considerably as the camshaft is rotated the cam is worn and the camshaft must be replaced. This variation must never exceed .002 inch.
5. Adjust the clearance for the exhaust valve in the same manner to .010 inch.

FITTING PISTON PINS

1. Oversize piston pins are not supplied as spare parts, since they experience very little wear until the connecting rod itself is due to be replaced.
2. For this reason, new piston pins should always be installed when new connecting rods and pistons are installed.

RESURFACING THE CYLINDER HEAD

1. Check for signs of cylinder warpage or distortion by placing gasket surface against a face plate. If the four cycle head shows signs of slight distortion repair the gasket face.
2. Lay a piece of fine emery cloth, abrasive side up, on the face plate and move the cylinder head across the surface of the emery cloth in a "figure eight" pattern. Continue this until all portions of the face have been cleaned up. (See Figure No. 48.)

RECONDITIONING THE MAGNETO

1. Replace damaged parts and make adjustments as stated in the adjustment section of this manual.
2. When removing the coil and lamination assembly from the bearing plate it is not necessary to mark location.

PROTECTING LOWER OIL SEAL ON VERTICAL SHAFT ENGINES

When rotary lawn mowers are used to cut growth other than normal grass, lower oil seals in the vertical shaft engines are subject to damage. Normal cutting does not produce clippings of a sort that will wrap around the crankshaft and damage the seal. An accessory Dirt Excluder Kit, Part No. 7443-A, should be installed on mowers used for cutting weeds, hay or similar types of growth.

Use the following procedure:

1. Remove the blade and clutch assembly from the crankshaft.
2. Inspect oil seal for evidence of damage and leakage. Replace it if it is defective.
3. Drive the oil seal into the housing with TL-908, Oil Seal Driver, until it is recessed about 3/32 or until it bottoms in the housing. (See Figure No. 58.) The seal should be recessed in order to properly shield the felt washer after assembly.
4. Assemble the felt onto the crankshaft and then the steel washer. Position the felt and washer tightly against the lower bearing housing. Slip the retainer ring over the crankshaft and slide the ring up against the steel washer to give a slight crush of the felt washer.
5. Reposition the clutch and tighten the assembly.

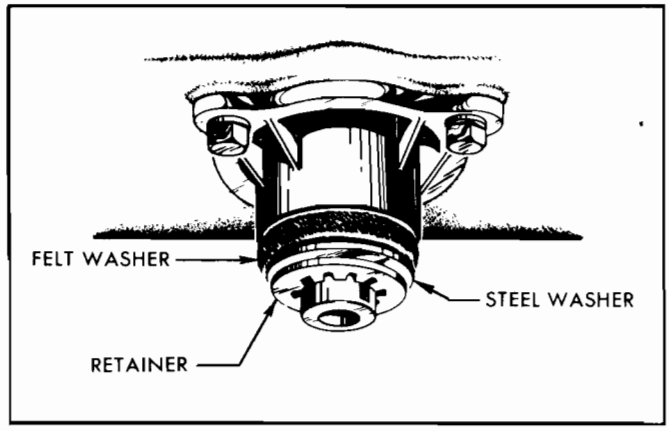


Figure No. 58—Dirt Excluder Assembly

CONVERTING OIL PUMP IN BASE

The first production of the 700A Series Engines had a plunger-type oil pump in the base. (See Figure No. 59.) It was later found that the splash type lubrication system was more positive and required less service. When these engines come in for service it is recommended that the system be replaced as follows:

1. Remove the hold down bolts securing the oil pump assembly to the base.
2. Remove the center boss from the base with a cutting torch, large drill or metal saw, notching boss on three sides and removing with sharp hammer blow. (See Figure No. 59.)
3. File or chisel all high portions that may remain after boss has been removed. There should be a clearance of 1/8" between boss and oil distributor at its nearest clearance point.

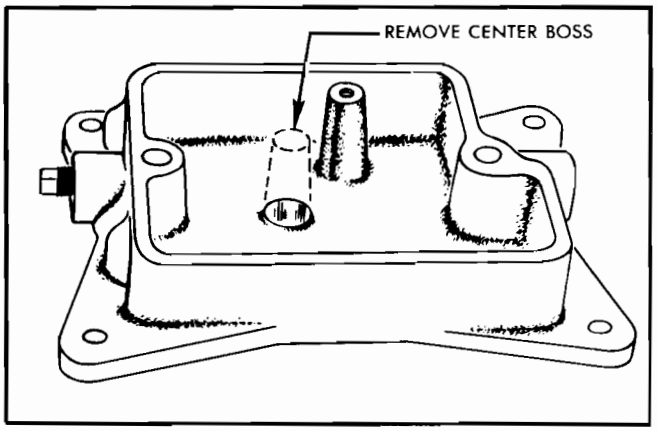


Figure No. 59—Base Oil Pump Conversion

4. Due to the increased amount of oil that will be distributed with the addition of the splash finger, a new baffle must be installed. Use chisel to remove hold down rivet, and with a .144 drill clean the rivet hole. Then assemble baffle plate No. 3559, and hold it in place by using a new rivet No. 3569.
5. The oil distributor is installed on the connecting rod as shown in Figure No. 60. It should be noted that the oil distributor leads into the oil and that the distributor should rest against flat portion on connecting rod cap.
6. Parts required to make the conversion are as follows: 4007-oil distributor; 3559-baffle plate and 3569 rivet.

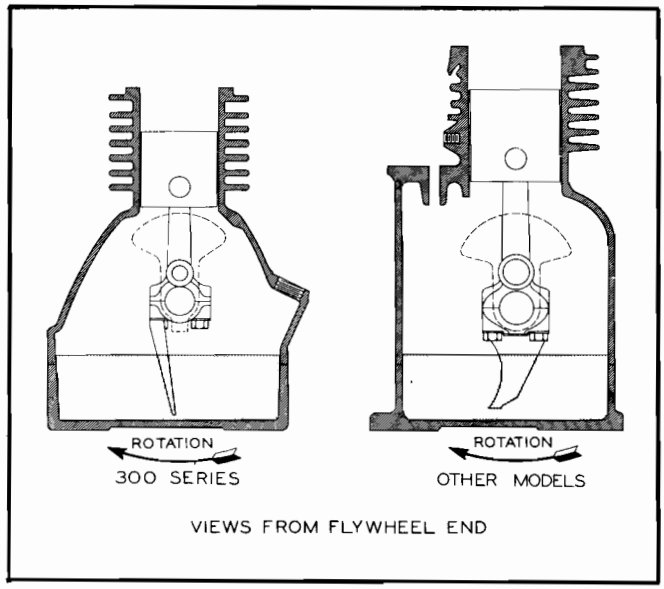


Figure No. 60—Correct Position of Splash Fingers

SPECIAL ASSEMBLY OPERATIONS

SEE GENERAL ASSEMBLY PROCEDURE CHART ON PAGE 46

TIMING VALVES

FOUR CYCLE ENGINES

1. With the cylinder block upside down, rotate the camshaft until the exhaust valve is about to close and the intake valve is about to open. (In this position the valve springs have no tendency to rotate the camshaft.)

   Note: Desired number of thrust washers should be in place on the crankshaft.

2. With the connecting rod crank journal in approximately top dead center position, mesh the timing gears by moving the crankshaft into position. If every tooth is not properly engaged, the connecting rod journal obviously will be out of top dead center position.

300 SERIES ENGINES

1. All 300 Series Engines have two cam gears. Position the connecting rod crankshaft journal in the top dead center position and align both gears in accordance with their marks. (The intake gear has a 'dot' and the exhaust gear has a 'dash').
2. Align the gear marks with the corresponding marks on the bearing plate, and hold them in position, while moving the bearing plate toward the cylinder block until the gears mesh.
3. After meshing gears, check to see that the marks are still aligned. (See Figure No. 61.)
4. If the cam pins have pulled through the bearing plate allowing excessive end play of the cam and gear, do not attempt to drive the cam axle pin back into position. Such a repair is temporary. Replace the entire bearing plate.

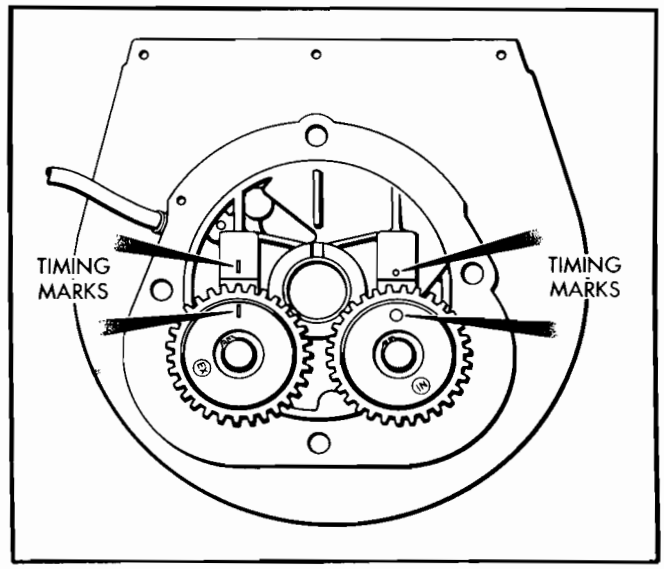


Figure No. 61—Valve Timing Marks—Series 300

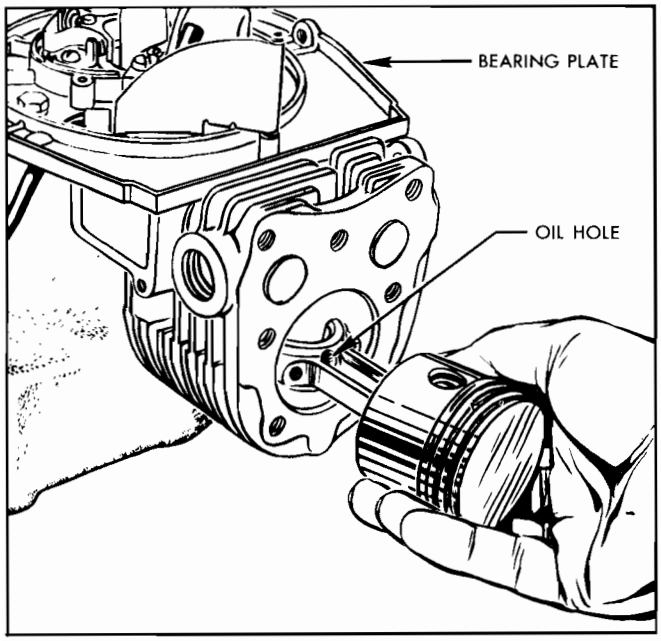


Figure No. 62—Correctly Inserting Piston and Rod with Oil Hole Toward the Bearing Plate

INSERTING THE PISTON IN CYLINDER

1. Coat the piston with oil.
2. Slide the ring compressor, TL-929, over the piston skirt and start the piston skirt in the cylinder. (See Figure No. 63.)
3. Press the piston firmly but carefully into the cylinder being careful not to damage the new rings.
4. Remove TL-929, ring compressor, and push the piston down until the connecting rod bearing contacts the crankshaft journal. (See Figure No. 62.)

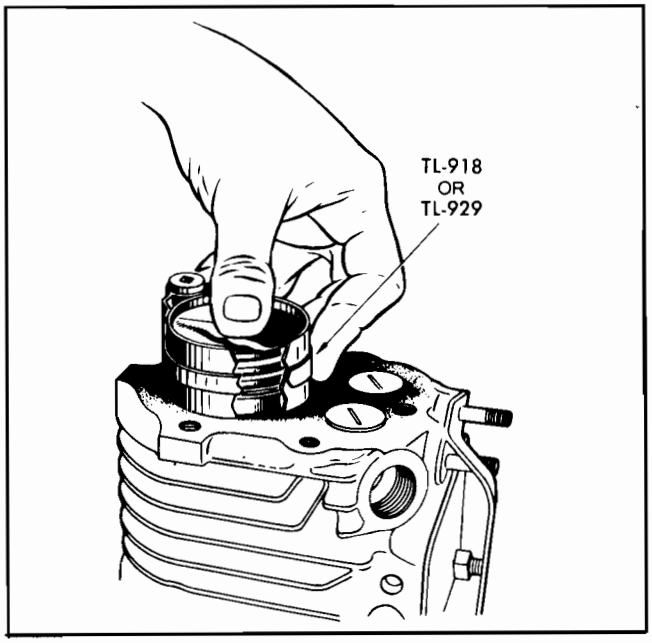


Figure No. 63—Inserting Piston in Cylinder using Ring Compressor

INSTALLATION OF NEEDLE BEARINGS

1. Needle bearings are used in many vertical shaft engines, but they need not be removed unless they require replacement.
2. Remove the needle bearings from the bearing housing using an arbor press.
   Note: The tapered end of an old crankshaft is an effective tool for pressing out old bearings.
3. Clean all parts thoroughly and press the needle bearing into the bearing housing with TL-910, the main bearing driver. (See Figure No. 64.)

INSTALLATION OF OIL SEALS

1. Slide the oil seal loader over the crankshaft to protect the oil seal as it is moved into position by the oil seal driver Part No. TL-908 or TL-909. (See Figure No. 65.)
2. Place the proper oil seal in position on the crankshaft and insert it in its recess in the housing with the oil seal driver.
3. Remove the oil seal driver and slide the loader off the crankshaft.
   Note: It is easier to install the oil seal if the crankshaft has been inserted first.

TIGHTENING THE CYLINDER HEAD BOLTS

1. Use a torque indicating wrench and consult the Torque Chart on Page 47.
2. Tighten all cylinder head bolts lightly and pull each bolt down a little at a time in accordance with the order shown (See Figure No. 67).
3. After the engine has been operated a few hours, bolts should be tightened down again in the same manner.

REDUCTION GEAR

1. With proper lubrication and correctly tightened bolts, the reduction gear unit should give no trouble.
2. Damaged parts must, of course, be replaced, and the housing itself must be replaced when new bearings are required. Replacement housings contain new bearings finished to the correct size.
3. The end play in the reduction gear must be at least .005.

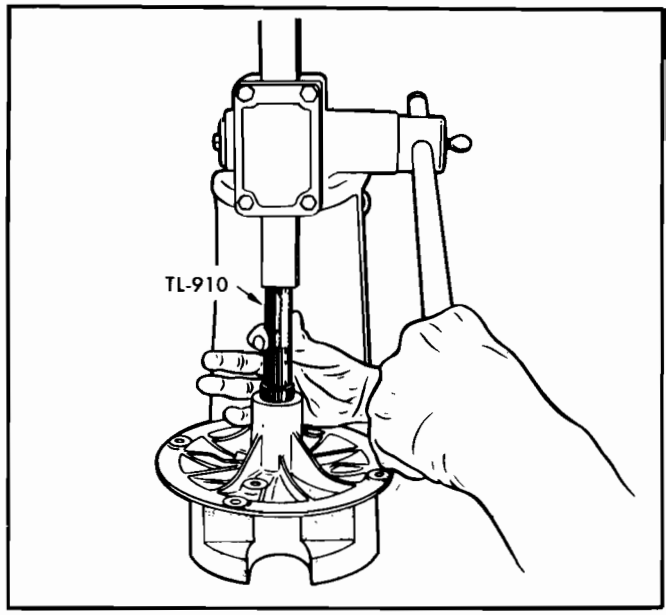


Figure No. 64—Install Needle Bearings in Bearing Housing

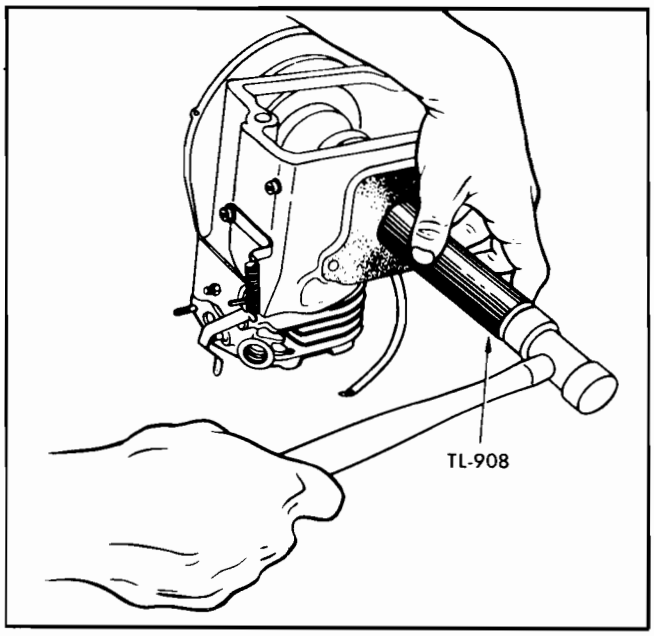


Figure No. 65—Installing Oil Seal

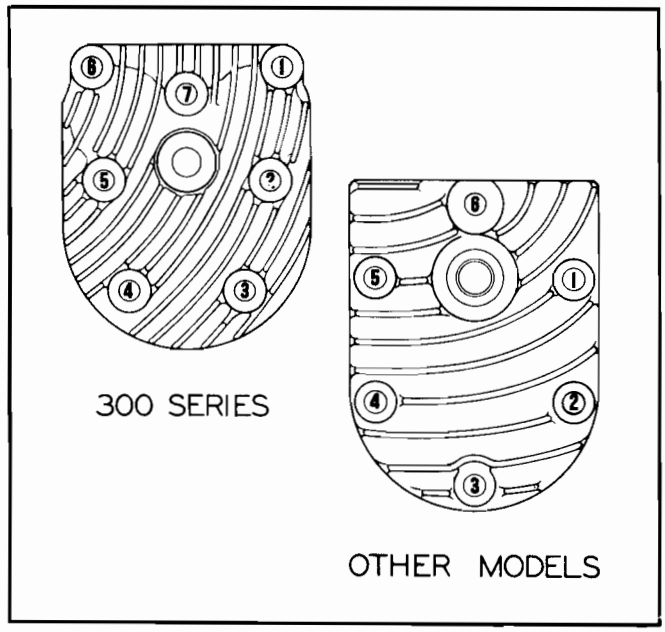


Figure No. 67—Cylinder Head Tightening Order

ASSEMBLY SUGGESTIONS

Three time saving assembly procedures are shown in Figures No. 66, 68 and 69. Figure No. 66, below, shows method for compressing valve, valve spring and valve spring seat with TL-925 to simplify 'keeper' installation. Figure No. 68 suggests a method for holding valves out of position while inserting the crankshaft and bearing plate assembly on 300 Series Engines, and Figure No. 69 shows inverted position of cylinder block to facilitate crankshaft and Magneto Assembly installation.

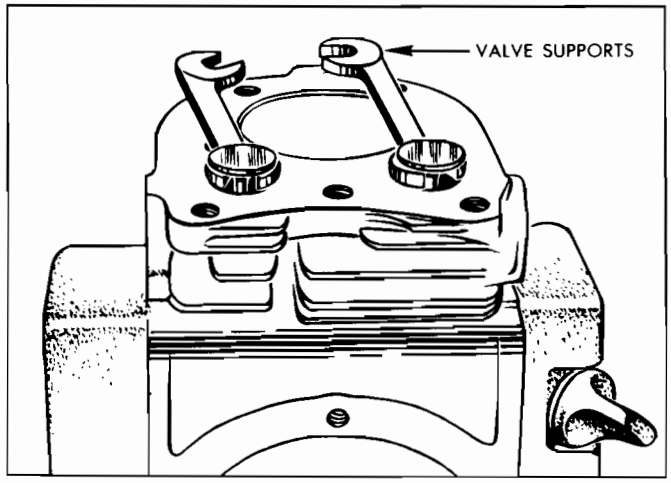


Figure No. 68—Holding Valve Out of Position

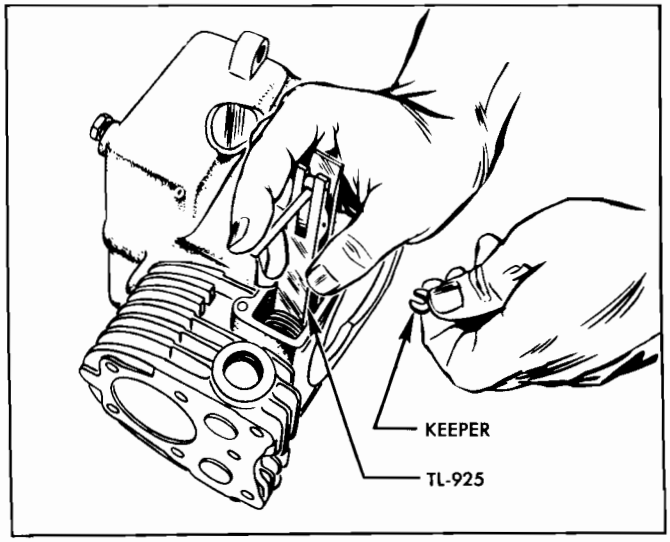


Figure No. 66—Compressing Valve Spring for Keeper Installation

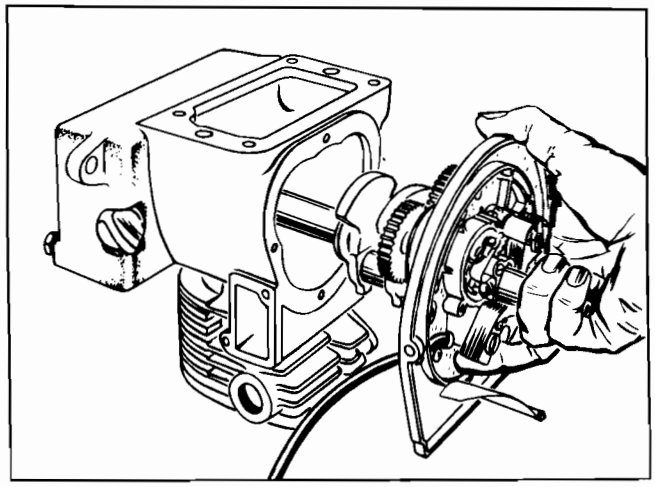


Figure No. 69—Installing Crankshaft and Magneto Assembly

CLINTON ENGINES

2 & 4 CYCLE MAINTENANCE

CARBURETOR OVERHAUL

GENERAL INSTRUCTIONS

Proper carburetor operation and maintenance is very necessary to the overall efficiency of the engine. In this section instructions are given for both float and suction type carburetors. Some early engines were equipped with Tillotson or Zenith float type carburetors and though specific instructions are not included for these models, service operators can use the general instructions given for Carter and Clinton float types if necessary. Exploded views and parts lists for all carburetors appear in Section III, Division A of the Master Parts & Service Manual.

CLEANING INSTRUCTIONS

Apply the following to all disassembled carburetors unless contrary instructions are given.

1. Wash all parts in a solvent capable of removing gum, varnish and other foreign material. Use commercial carburetor cleaner, lacquer thinner or denatured alcohol, and allow the parts to soak in solvent before cleaning.
2. Brush parts while holding them in solvent. Read the instructions on your solvent carefully. Some are strong enough to do the cleaning without brushing. **Note:** Never boil parts in alkaline solution since this will destroy the protective coating.
3. Rinse the parts in clean gasoline or a dry cleaning solvent, then dry them with compressed air.
4. Do not allow parts to become contaminated with dust before reassembling carburetor.

SUCTION CARBURETOR MODEL 7100

Disassembly

1. Remove the carburetor from the engine.
2. Remove the adjusting needle, spring and washer.
3. Unscrew and remove the connector and connector gasket.
4. Remove the screw, lockwasher and throttle valve. Withdraw the throttle shaft.
5. If removal of the choke is required, pry off the Tinnerman nut carefully and slide the choke out of the body assembly.
6. Removal of the throttle stop screw and spring is not necessary unless the screw is damaged.

Cleaning and Inspection

1. Clean according to instructions.
2. Make certain the needle point on the end of the adjusting needle is not bent or damaged.

Assembly

1. Install the throttle stop screw and spring if these parts were removed.
2. Slide the throttle shaft into the body and install the throttle valve, lockwasher and screw. The flat side of the throttle valve must be positioned next to the idle port.
3. Check the choke in the body for freedom of operation and relieve binding by rubbing the surface of the choke with crocus cloth. Binding points will be noted by bright spots on the choke When choke is free, install the Tinnerman nut.
4. Install the connector with a new gasket. Tighten securely.
5. Insert a new washer in the recess in the body, then install the adjusting needle and spring. Rotate the needle in until it touches the seat, then back it out two turns.
6. Install the carburetor on the engine.

SUCTION CARBURETORS MODEL 7120 AND 7080-1

1. Remove the carburetor and gas tank from the engine and separate the two by removing the two attaching screws.
2. Unscrew and remove the air cleaner stud to free the choke, then remove choke and gasket.
3. Remove the adjusting needle and take the packing, washer and spring from it.
4. Unscrew and remove the packing nut and gasket.
5. Using the correct size screwdriver blade to avoid damaging the screw slot, remove the metering jet.
6. Turn the throttle stop screw counter-clockwise until the throttle lever can be turned far enough to permit lifting the throttle valve out of the body.
7. If throttle linkage must be removed take out the shoulder and regular screws to free the throttle lever and the throttle lever stop.

Inspection and Internal Adjustments

1. Clean in accordance with instructions.
2. The intake screen need not be removed unless it is damaged, but make certain it is cleaned. Use compressed air to clean out the intake passage.
3. Check all parts for wear and damage and replace all defective parts.
4. Throttle valve and choke must have freedom of movement. If binding occurs, rub high spots with crocus cloth.
5. Idle port and main port must both be free. Clean with compressed air. Do not insert wire through passages.

Assembly

1. Install metering jet in body. Tighten firmly but do not damage screw slots.
2. Install packing nut with a new gasket.
3. Place spring, plain washer and new packing (in that order) on the adjusting needle, then install it in the packing nut. Turn needle until it touches seat, then back out 3½ turns.
4. Slide throttle valve in the body, rotating the throttle stop screw enough to secure the valve.
5. Place a new gasket on the choke and insert the choke in the body with the arrow in a vertical position. Install air cleaner stud.
6. Rotate the choke, making certain it operates with enough resistance to remain in either the open or closed position.
7. If the throttle lever was removed, place it in position and secure it with the screw.
8. Place the throttle lever over the shoulder screw and tighten the screw in place.

CARTER FLOAT-TYPE CARBURETORS

Carter float-type carburetors are standard on many current model Clinton two and four cycle engines. Various applications make it necessary to relocate certain parts, alter Venturi sizes and use different shaped bowls and floats. For example, the main adjustment needle will sometimes be located on top of the carburetor, sometimes on the side or bottom of the bowl and ocasionally it will be combined with the low speed jet assembly. The service operator will notice these obvious variations and proceed accordingly when overhauling Carter Carburetors. The following instructions provide a general method of approach.

1. Remove the carburetor from the engine.
2. Remove bowl nut, gasket and bowl.
3. Remove float pin, float, needle and needle seat. Check float for dents, leaks and wear on float lip or in float pin holes.
4. Remove bowl ring gasket.
5. Remove low speed jet and high speed adjustment needle assembly and spring.
6. Remove idle adjustment screw and spring.
7. Remove nozzle.
8. Now remove throttle valve screw, valve, and the shaft and lever assembly.
9. Do not remove choke valve and shaft unless replacement of these parts is necessary. Be sure to use a new ball and spring when replacing choke shaft and lever assembly.

   CAUTION: Hold a screw driver handle or a small piece of wood over threaded hole in air horn (side opposite choke lever) to prevent the ball from flying out when shaft is removed.

Cleaning

1. Clean all parts in a carburetor solvent, making sure all carbon accumulation is removed from bore, especially where throttle valve seats in casting.
2. Blow out all passages with compressed air.
3. Replace all worn or damaged parts, and always use new gaskets.

Assembly

1. Install throttle shaft and valve. Valve must be installed with the trademark "C" on side toward idle port when viewing from flange side. Always use new screws. With valve screws loose and throttle lever set screw backed out, seat valve by tapping lightly with a small screw driver. Hold in place while tightening screws.
2. Install nozzle making sure it seats in casting.
3. Install needle seat, needle, float and float pin.
4. Set float level. With carburetor casting inverted, and float resting lightly against needle in its seat, there should be 14/64 inch clearance between machine surface of casting and free end of float (side opposite needle seat). Adjust by bending lip of float with small screw driver.
5. Install bowl ring gasket, bowl, bowl nut gasket and bowl nut. Tighten securely after making sure bowl is centered in gasket.
6. Install low speed jet and high speed needle assembly. Turn in until it seats in nozzle lightly, then back out two turns.
7. Install idle adjusting screw, finger tight. Back out approximately 1½ turns.

   Caution: Do not use pliers or screw driver as it may damage idle screw.

Adjustments

Refer to adjustment instructions on page 24.

CLINTON FLOAT TYPE CARBURETORS

Disassembly

1. Remove carburetor from engine.
2. Unscrew and remove power adjusting needle assembly. This will allow bowl to come free. **Caution:** Needle assembly has two gaskets, one outside bowl and one inside.
3. Remove float hinge pin, which frees float. Inspect float carefully for dents, leaks and wear on lip in pin holes.
4. Triangular float valve needle will drop out. Unscrew brass needle valve seat.
5. Remove bowl gasket from recess in casting.
6. Unscrew nozzle and remove.
7. Unscrew idle needle (with spring) and remove.
8. Remove throttle valve screws. Valve will drop clear. Slide shaft and lever out sidewise.
9. Remove choke valve screws. Valve will drop clear. Slide shaft and lever out sidewise. Pull choke friction spring free with pliers.
10. Check throttle adjusting screw for damage and for weak or broken spring.
11. Clean all parts in solvent, making sure that all accumulated carbon is removed—especially from the bore and and from where the throttle valve seats in the casting. Blow out thoroughly with compressed air.
12. Always replace all worn or damaged parts, and always replace all gaskets and screws with new ones.

Assembly

1. Install throttle shaft and lever.
2. Install throttle valve with two screws. **Caution:** Valve must be installed with trade-mark 'W' showing and to the left.
3. Install new choke friction spring by pressing carefully into seat with pliers.
4. Install choke lever and shaft.
5. Install choke valve with two screws. **Caution:** Valve must be installed with trade-mark 'W' showing (away from bowl), notch pointing toward idle adjustment screw.
6. Install throttle adjusting screw, with spring.
7. Install idle adjustment screw and spring. Turn finger tight, then back off ¼ turn.
8. Install nozzle.
9. Install matched assembly of float valve, valve seat and gasket.
10. Install bowl gasket.
11. Install float assembly in position, and insert float hinge pin. With casting upside down, and the free weight of the float resting on the seated valve needle, the distance between the bottom of the casting and the free end of the float (opposite the needle valve) should be ⅛ inch, plus, or minus 1/64 inch. Adjust as required by carefully bending the "lip", which rests against the needle, with a small screw driver.
12. Insert power adjustment needle assembly in hole in bowl bottom. Be sure to place one gasket between assembly and bowl, and one inside the bowl.
13. Install bowl and Power Needle assembly by screwing assembly down until snug. To protect the power adjustment needle during this operation, back it off 6 or 8 turns. Next, tighten larger hex nut, making sure that bowl is centered. Then turn adjustment needle (knurled head) until it seats finger tight; and back off one turn. Make certain that packing nut is tight.

APPENDIX

The steps appearing on the following charts should be used by mechanics as nominal guides when overhauling Clinton two and four cycle engines. Engine variations and adaptations will, of course, change the order of the steps in some cases, but these differences will be apparent to the mechanic as he proceeds with the disassembly and assembly.

These charts are not complete within themselves. Mechanics should consult the other sections of this manual which deal with Removal, Inspection, Overhaul Procedures and Special Assembly Operations, as well. Mechanics will also want to jot down their own reminders and in this way build another helpful Clinton "Service Tool."

CLINTON ENGINE PRODUCTION RECORD
ARRANGED BY DATE IN ORDER OF PRODUCTION

MODEL	HP	FIRST PRODUCED	PRODUCTION DISCONTINUED	TYPE OF MAGNETO	TYPE OF CARBURETOR	KIND OF GOVERNOR	REPLACED WITH MODEL
700-A	2	1946	Yes	Bendix Scintilla	Tillotson Zenith	Flyball Mech.	B-700
A & B-1100	3	1947	Yes	Bendix Scintilla	Tillotson Zenith	Flyball Mech.	D-1100
500	1½	1948	Yes	Phelon	Carter	Flyball Mech.	B-700
B-700	2	1949	Yes	Phelon	Carter	Flyball Mech.	C-700
C-1100	3	1949	Yes	Phelon	Carter	Flyball Mech.	D-1100
VS-700	2	1949	No	Phelon	Carter	Air Vane	—
A-300	1.6	1949	No	Phelon	Carter	Air Vane	—
VS-300	1.6	1949	No	Phelon	Carter	Air Vane	—
650	1½	1950	Yes	Phelon	Clinton Built Suction Type	Air Vane	B-700
VS-750	1¾	1950	Yes	Phelon	Clinton Built Suction Type	Air Vane	VS-700
350	1	1950	Yes	Phelon	Clinton Built Suction Type	Air Vane	A-300
D-1100	3	1951	Yes	Phelon	Float	Flyball Mech.	1200
800	2½	1951	Yes	Phelon	Carter	Air Vane	900
VS-800	2½	1951	No	Phelon	Carter	Air Vane	—
VS-200	1.6	1952	No	Phelon	Carter	Air Vane	—
VS-400	2.6	1953	No	Phelon	Carter	Air Vane	—
1600	6.3	1953	No	Phelon	Float Type	Flyball Mech.	—
2500	9	1953	No	Phelon	Float Type	Flyball Mech.	—
VS-100	2.5	1954	No	Phelon	Clinton or Carter	Air Vane	—
VS-2100	1.7	1954	No	Phelon	Clinton or Carter	Air Vane	—
C-700	2	1954	No	Phelon	Clinton or Carter	Flyball Mech.	—
900	2.5	1954	No	Phelon	Clinton or Carter	Flyball Mech.	—
1200	3.6	1954	No	Phelon	Clinton or Carter	Flyball Mech.	—

DISASSEMBLY PROCEDURE

VS-200	A-300	VS-300	VS-400	B-700	C-700	VS-700	A-800	VS-800	900	D-1100	1200	REMOVE AND INSPECT	REMARKS	REFERENCE
X	X	X	X	X	X	X	X	X	X	X	X	**1. Drain oil and gasoline from engine** Use TL-917 Repair Stand for Two Cycle Engines.	Close fuel shut-off valve.	
X	X	X	X	X	X	X	X	X	X	X	X	**2. Muffler**		Page 34
X	X	X	X	X	X	X	X	X	X	X	X	**3. Fuel Line and Connections**	Hi-Tension lead and spark plug removed from A-300 here.	Page 34
X	X	X	X	X	X	X	X	X	X	X	X	**4. Air Cleaner**	Air Cleaner Bracket also on VS-200 and VS-400 Engines.	Pages 29, 30
X	X	X	X	X	X	X	X	X	X	X	X	**5. Blower Housing & Tank Ass'y**	Lift front end of housing and move toward carburetor on two cycle engines.	Page 34
X	X	X	X	X	X	X	X	X	X	X	X	**6. Carburetor Linkage and Carburetor**	Remove Flyball Governor Link (if any) at this time.	Pages 24, 42, 43
	X	X				X		X				**7. Air Vane Linkage and Air Vane**	Mark proper hole on throttle arm for correct replacement.	Pages 25, 26
X	X	X	X	X	X	X	X	X	X	X	X	**8. Starter Pulley Nut, Washers, Starter Pulley & Revolving Screen** (Use Socket Wrench)	Use old fan belt or V-belt to brace flywheel and remove nut.	Pages 18, 26, 27
X	X	X	X	X	X	X	X	X	X	X	X	**9. Spark Plug**		Pages 19, 34
										X	X	**10. Cylinder Head Shield**		
	X	X		X	X	X	X	X	X	X	X	**11. Cylinder Head**	Name Plate comes off here.	Pages 32, 34
X	X	X	X	X	X	X	X	X	X	X	X	**12. Air Deflector Shields**		
	X	X		X	X	X	X	X	X	X	X	**13. Valve Chamber Covers**	Remove valve chamber cover on carburetor side. Cover & Shield Ass'y from muffler side.	Page 20
	X	X		X	X	X		X	X	X	X	**14. Breather Assembly**	Note correct installation; remove from exhaust side.	Page 20
X	X	X	X	X	X	X	X	X	X	X	X	**15. Flywheel, Flywheel Key & Breaker Points Cover** (Use TL-916 Knock-out Tool)	Rap knock-out tool lightly with hammer; flywheel will break loose.	Pages 21, 30, 34
X	X	X	X	X	X	X	X	X	X	X	X	**16. Points Breaker Cam**	Note position of fixed key with recessed end toward oil seal.	Page 20
X	X	X	X	X	X	X	X	X	X	X	X	**17. Bearing Plate**	Check for warpage; replace if damaged.	Pages 31, 34, 36
	X	X		X	X	X	X	X	X	X	X	**18. Valve Keeper, Valve Springs, Valves** (Use TL-925 Spring Compressor)	Lift out "C" washer or keepers with needle nose pliers.	Page 33
	X	X										**19. Valve Tappets**		
	X			X	X				X	X	X	**20. Base**		
		X				X		X				**21. Crankcase Cover**		
X			X									**22. Reed Plate Ass'y**		Page 28
		X				X		X				**23. P. T-O Housing**		
		X										**24. Oil Impeller, Oil Impeller Needle**	Remove drive pin with needle nose pliers.	Page 39
X	X	X	X	X	X	X	X	X	X	X	X	**25. Connecting Rod Cap**		Page 31
	X				X				X		X	**26. Oil Distributor**	Note position and replace exactly.	
X	X	X	X	X	X	X	X	X	X	X	X	**27. Crankshaft**		Page 32
X		X	X			X		X				**28. Thrust Washers**		
X	X	X	X	X	X	X	X	X	X	X	X	**29. Piston & Rod Ass'y**	Break rings with care to avoid scaring lands.	Pages 34, 40, 41
				X	X	X		X	X	X	X	**30. Cam Axle and Camshaft**	Always drive cam axle from bearing plate side where more clearance has been allowed.	Page 31
		X				X		X				**31. Oil Distributor**		
				X	X				X	X	X	**32. Governor Assembly**	Mark proper hole on throttle arm for correct replacement.	Page 26
					X	X		X	X	X		**33. Valve Tappets**		

ASSEMBLY PROCEDURE

VS-200	A-300	VS-300	VS-400	B-700	C-700	VS-700	A-800	VS-800	900	D-1100	1200	INSTALL AND ADJUST	REMARKS	REFERENCE
				X	X	X	X	X	X	X	X	**1. Install Valve Tappets**		Page 38
				X	X		X		X	X	X	**2. Governor Assembly**	Attach throttle arm to prevent shaft from dropping back into block.	Page 25, 26
		X				X		X				**3. Oil Distributor (cam gear)**		
				X	X	X	X	X	X	X	X	**4. Camshaft & New Cam Axle & Plug**	Drive new cam axle through camshaft from gear side 1/8" past the face of the block.	Page 34
X			X									**5. Piston & Rod Assembly** Use TL-926 Ring Compressor	Always use new piston rings.	Pages 34, 40-41,
X		X	X			X		X				**6. Thrust Washers**		
				X	X	X	X	X	X	X	X	**7. Valves, Valve Springs, Valve Keepers** Recondition the Valve Seats with TL-915-1, 9/32 Reamer; TL-919, 15° Undercutter. Use TL-925, Valve Spring Compressor	See Service Clearance Chart.	Page 38
				X	X	X	X	X	X	X	X	**8. Install Crankshaft**		Page 41
	X	X										**9. Crankshaft to Bearing Plate, Bearing Plate to Block**	End play taken between crankshaft and block.	
	X	X		X	X	X	X	X	X	X	X	**10. Piston & Rod Assembly** Use TL-926, Ring Compressor	Oil hole in connecting rod must be turned toward bearing plate while this installation is made.	Pages 34, 40, 41
	X	X		X	X	X	X	X	X	X	X	**11. Connecting Rod Cap**	Tighten rod bolts to 65-75 inch pounds. Line up mark on rod cap with connecting rod.	Pages 31, 40
	X			X	X				X	X	X	**12. Oil Distributor**		Page 39
		X										**13. Oil Impeller Needle and Oil Impeller**	Insert drive pin in P.T-O side of crankshaft with needle nose pliers.	Page 39
		X				X		X				**14. Power Take-off Housing**	Use new rubber seal. (See Torque Chart.)	
X			X									**15. Reed Plate Assembly**	Rotate crankshaft to be sure rod cap does not touch reed stop plate. (See Torque Chart.)	Page 28
		X				X		X				**16. Crankcase Cover**	(See Torque Chart.)	
	X			X	X		X		X	X	X	**17. Base**	(See Torque Chart.)	Page 33
	X X	X X										**18. Valve Tappets** **Valves, Valve Springs, Valve Keepers**		Page 33 Page 38
X			X	X	X	X				X	X	**19. Bearing Plate** (See Torque Chart.)		
X	X	X	X	X	X	X	X	X	X	X	X	**20. Points Breaker Cam**	Points gap: .018-.020; be sure cam follower felt is properly lubricated; install cam with recessed end of fixed key toward the oil seal.	Page 20
X	X	X	X	X	X	X	X	X	X	X	X	**21. Breaker Points Cover and Flywheel Key**	Check laminations for magnetism and be sure they are free of pick-up.	Page 34
X	X	X	X	X	X	X	X	X	X	X	X	**22. Flywheel**	Check spark. (See Torque Chart.)	Page 34
	X	X		X	X	X	X	X	X	X	X	**23. Breather Assembly**	Use new gasket. Install from muffler side.	Page 33
	X	X		X	X	X	X	X	X	X	X	**24. Valve Chamber Covers**	Valve chamber cover from carburetor side; Cover & Shield Ass'y from exhaust side.	Page 33
X	X	X	X	X	X	X	X	X	X	X	X	**25. Air Deflector Shields**		
	X	X		X	X	X	X	X	X	X	X	**26. Cylinder Head**	(See Torque Chart.)	Pages 32, 34, 40, 41
										X	X	**27. Cylinder Head Shield**		
X	X	X	X	X	X	X	X	X	X	X	X	**28. Spark Plug**	(See Torque Chart.)	Pages 18, 34
X	X	X	X	X	X	X	X	X	X	X	X	**29. Revolving Screen, Washers, Starter Pulley and Nut**	Hold flywheel with V-belt.	

ASSEMBLY PROCEDURE

VS-200	A-300	VS-300	VS-400	B-700	C-700	VS-700	A-800	VS-800	900	D-1100	1200	INSTALL AND ADJUST	REMARKS	REFERENCE
X	X	X	X	X	X	X	X	X	X	X	X	**30. Carburetor Linkage & Carburetor**	(See Torque Chart.) Attach governor link before tightening carburetor to block.	Pages 24, 42, 43
X		X	X			X		X				**31. Air Vane Linkage & Air Vane**	Be sure there is no bind on the linkage.	Pages 25, 26
X	X	X	X	X	X	X	X	X	X	X	X	**32. Blower Housing & Tank Assembly**	Hammer out any dents in blower housing. (See Torque Chart.)	
X	X	X	X	X	X	X	X	X	X	X	X	**33. Fuel Line and Connections**		
X	X	X	X	X	X	X	X	X	X	X	X	**34. Air Cleaner**	On two cycle engines, use the bracket with the screen that fits over air cleaner opening and use shake-proof washers.	Pages 29, 30
X	X	X	X	X	X	X	X	X	X	X	X	**35. Muffler**	Should be free of carbon. (See Torque Chart.)	Page 34
	X	X		X	X	X	X	X	X	X	X	**36. Fill Crankcase with Oil**		Pages 16, 17
	X	X		X	X	X	X	X	X	X	X	**37. Fill Oil Bath Air Cleaner**	SAE #50.	Page 16
X	X	X	X	X	X	X	X	X	X	X	X	**38. Start Engine**		Pages 16, 17
	X	X		X	X	X	X	X	X	X	X	**39. Re-tighten Cylinder Head Studs**		Page 41
X	X	X	X	X	X	X	X	X	X	X	X	**40. Adjust Carburetor**		Page 24
X	X	X	X	X	X	X	X	X	X	X	X	**41. Adjust and set governor**		Pages 25, 26

TORQUE DATA FOR SERVICING CLINTON ENGINES

	VS-200	A-300	VS-300	VS-400	C-700	VS-700	VS-800	900	1200
Head Bolts	... ...	125 150" lb.	125 150" lb.	... ...	125 150" lb.	125 150" lb.	125 150" lb.	125 150" lb.	125 150" lb.
Connecting Rod	50 55" lb.	65 75" lb.	65 75" lb.	50 55" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.
Bearing Plates	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.	65 75" lb.
End Cover	... ...	... ...	80 90" lb.	... ...	... ...	80 90" lb.	80 90" lb.	... ...	... ...
Base Bolts	... ...	80 100" lb.	... ...	... ...	80 100" lb.	... ...	... ...	80 100" lb.	80 100" lb.
Flywheel	150 175" lb.	150 175" lb.	150 175" lb.	150 175" lb.	150 175" lb.	150 175" lb.	150 175" lb.	150 175" lb.	150 175" lb.
Spark Plug	250 275" lb.	250 275" lb.	250 275" lb.	250 275" lb.	250 275" lb.	250 275" lb.	250 275" lb.	250 275" lb.	250 275" lb.
Blower Housing	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.
Reed Plate	65 75" lb.	... ...	... ...	65 75" lb.	... ...	... ...	... ...	... ...	... ...
Carburetor Mounting	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.	60 70" lb.
Power Take-Off Hsg.	... ...	... ...	80 100" lb.	... ...	... ...	80 100" lb.	80 100" lb.	... ...	... ...
Muffler	20 25" lb.	... ...	... ...	20 25" lb.	... ...	... ...	... ...	... ...	... ...

SERVICE CLEARANCES FOR CLINTON ENGINES

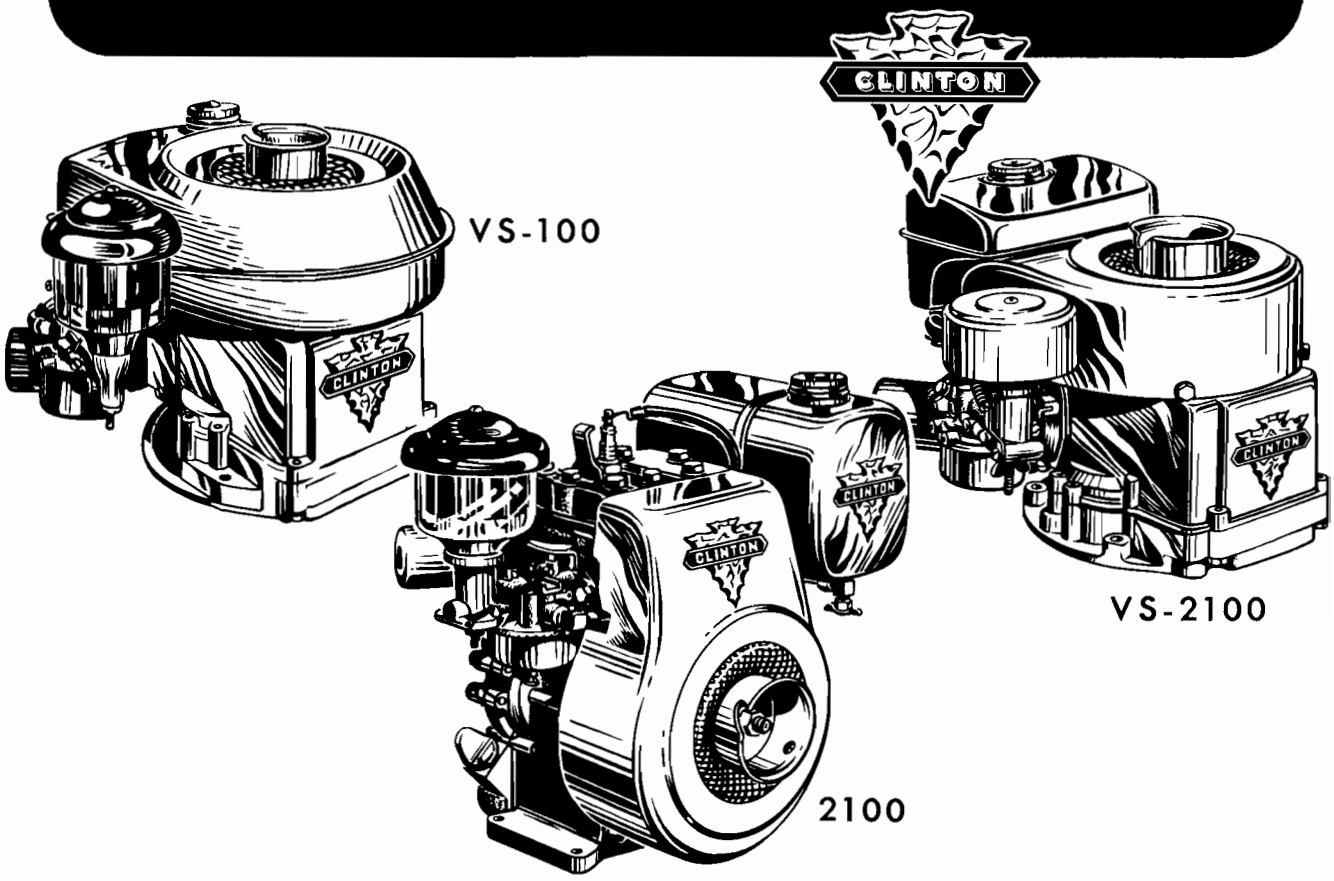
	VS-200	VS-300	A-300	VS-400	C-700	VS-700	VS-800	900	1200
Crankshaft Endplay	.004 .012	.004 .012	.004 .012	.004 .012	.004 .012	.004 .012	.004 .012	.004 .012	.003 .029
Bearing Clearance	.001 .002	.001 .002	.001 .002	.001 .002	.001 .002	.001 .002	.001 .002	.001 .002	. . . . . .
Valve Clearance (Cold Set) In	. . .	.006	.006	. . .	.010	.010	.010	.010	.010
Valve Clearance (Cold Set) Ex	. . .	.008	.008	. . .	.010	.010	.010	.010	.010
Valve Set Angle	. . .	45°	45°	. . .	45°	45°	45°	45°	45°
Valve Set Width	. . . . . .	.030 .045	.030 .045	. . . . . .	.030 .045	.030 .045	.030 .045	.030 .045	.030 .045
Ring End Gap	.007 .017	.007 .017	.007 .017	.007 .017	.007 .017	.007 .017	.007 .017	.007 .017	.007 .017
Top Land Clearance	.0045 .0065	. . . . . .	. . . . . .	.0045 .0065	.0075 .0095	.0075 .0095	.0085 .0105	.0085 .011	.009 .011
Skirt Clearance	.0045 .0065	.0045 .0065	.0045 .0065	.0045 .0065	.0045 .0065	.0045 .0065	.0055 .0075	.0055 .0075	.006 .008
Points Setting	.018 .020	.018 .020	.018 .020	.018 .020	.018 .020	.018 .020	.018 .020	.018 .020	.018 .020
Spark Plug Gap	.025	.025	.025	.025	.025	.025	.025	.025	.025
Air Gap	.007 .014	.007 .014	.007 .014	.007 .014	.007 .014	.007 .014	.007 .014	.007 .014	.007 .014

TOLERANCES AND SPECIFICATIONS FOR SERVICING CLINTON ENGINES

	VS-100 4 Cycle	VS-200 2 Cycle	A-300 4 Cycle	VS-300 4 Cycle	VS-400 2 Cycle	C-700 4 Cycle	VS-700 4 Cycle	VS-800 4 Cycle	900 4 Cycle	1200 4 Cycle	VS-2100 4 Cycle
Piston Displace.	7.2	4.49	4.71	4.72	5.76	5.89	5.89	8.3	8.3	9.0	7.2
Piston Diameter	2.3695 2.3685	1.8705 1.8695	1.995 1.993	1.995 1.993	2.120 2.1195	1.994 1.995	1.995 1.993	2.36	2.367 2.368	2.4630 2.4620	2.3695 2.3685
No. of Comp. Rings	2	2	2	2	2	2	2	2	2	2	2
No. of Oil Rings	1	0	1	1	0	1	1	1	1	1	1
Width Comp. Rings Groove	.096 .098	.097 .095	.097 .095	.097 .095	.097 .095	.096 .098	.097 .095	.098 .096	.096 .098	.096 .098	.096 .098
Width of Oil Rings Groove	.1890 .1825	——	.129 .127	.129 .127	——	.1890 .1875	.129 .127	.129 .127	.187 .189	.189 .189	.1890 .1875
Spark Plug Size	H-10	H-11	J-8	J-8	H-11	J-8	J-8	J-8	J-8	J-8	H-10
Head	L	Integral	L	L	Integral	L	L	L	L	L	L
Rated H.P.	1.4 2.5	1.6	.7 to 1.6	.7 to 1.6	2.5	1.4 2.0	½ to 2	2 to 2½	1.9 2.5	2.8 3.6	1.1 1.7
R.P.M.	2200 to 3600	3600	2000 to 3600	2000 to 3600	3600	2400 to 3600	2000 to 3600	2000 to 3600	2600 to 3600	2600 to 3600	2200 to 3600
Comp. Pressure at Cranking Speed	75 90	65	75 95	75 95	65	75 90	75 95	75 95	75 90	75 90	75 90
Make of Magneto	Phelon	Phelon	Phelon	Phelon	Phelon	Phelon	Phelon	Phelon	Phelon	Phelon	Phelon
Make of Carburetor	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter
Type of Air Cleaner	Down Draft	Aluminum Mesh	Down Draft	Down Draft	Aluminum Mesh	Down Draft	Down Draft	Down Draft	Down Draft	Down Draft	Aluminum Mesh
Lubrication	Oil Pump	Mixed with Fuel	Distrib.	Impeller	Mixed with Fuel	Distrib.	Distrib.	Distrib.	Distrib.	Distrib.	Oil Pump
Starting Method	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope
Length & Width Height	12½x12 13	15 x8 12⅜	14⅝x11⅛ 13¾	13¼x12½ 12¼	15 x8 12⅜	15⅛x8 13	15x13 10⅜	16⅞x13 11	15⅛x8 13⅝	17½x10 13	12½x12 13
Type of Bearing	Bronze & Aluminum	Needle & Sleeve	Sleeve	Needle & Sleeve	Needle & Sleeve	St. Backed Babbit	Needle & Sleeve	Needle & Sleeve	Steel Backed Babbit	Ball	Bronze & Aluminum
Shipping Weight	21 lb.	14 lb.	28 lb.	29 lb.	15¾ lb.	40 lb.	36 lb.	45 lb.	43 lb.	43 lb.	21 lb.
Wrist Pin Dia.	.5624 .5626	.429	.5000	.5000	.5000	.4990 .5001	.5000	.5625	.5624 .5626	.5624 .5626	.5624 .5626
Conn. Rod Dia.	.8145 to .8140	.782 to .7827	.7515 to .752	.7515 to .752	.782 to .7827	.877 to .878	.877 to .878	.877 to .878	.877 to .878	.877 to .878	.8145 to .8140
Fuel Recommended	Reg. Gas SAE30	Reg. Gas mix. SAE30	Reg. Gas SAE30	Reg. Gas SAE30	Reg. Gas mix. SAE30	Reg. Gas SAE30	Reg. Gas SAE 30	Reg. Gas SAE30	Reg. Gas SAE30	Reg. Gas SAE30	Reg. Gas SAE30
Governor, Type	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Flyball	Pneumatic Air Vane	Pneumatic Air Vane	Flyball	Flyball	Pneumatic Air Vane
Cooling Method	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air

SERVICE INDEX

SUPPLEMENT for Lightweight Engine Overhaul and Maintenance



CLINTON

★ LIGHTWEIGHT ★

4 CYCLE ENGINES

CLINTON ENGINES
LIGHTWEIGHT MAINTENANCE

TABLE OF CONTENTS

MAINTENANCE AND ADJUSTMENTS

ENGINE OVERHAUL PROCEDURES

INTRODUCTION

In answer to the growing demand for power units light in weight and high in quality, Clinton offers its new Lightweight Engine Series.

The die-cast characteristics of these models make special service and overhaul procedures necessary. For this reason specific details about the new models are contained in this section. Whenever possible, the reader is referred to the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines*. Only the points of difference are covered in this special section.

As more and more Lightweights reach the field, Clinton Dealers and Authorized Service Stations will find them another profitable addition to the Clinton Line. Information about Clinton Lightweights has also been incorporated in the Maquoketa Factory School curriculum for the benefit of those taking advantage of this "better service" program.

GENERAL INFORMATION

Cylinder—Die-cast cylinder block and crankcase with large amount of cooling area. A close grained, cast-iron liner is die case in block.

Cylinder Head—Aluminum, L-head type, removable; extra deep cooling fins.

Carburetor—Full float-feed type.

Lubrication—Positive, gear actuated oil pump.

Air Filter—Oil bath or aluminum mesh type.

Flywheel—Lightweight; curved Sorroco fins for better cooling.

Crankshaft—Arma steel, induction heat treated.

Cooling—Accomplished by an air blast, forcibly created by the finned flywheel and directed over the finned cylinder head by an effectively contoured blower housing.

Bearings—Bronze and aluminum bearings are standard.

Piston—Aluminum alloy, Clinton-Engineered for efficient combustion; additional skirt clearance. Two compression and one oil control ring; treated surface.

Connecting Rod—I-Beam construction, aluminum alloy with extra large bearings.

Magneto—Quick-starting efficiency; easy servicing.

Governor—Adjustable air vane type.

WARRANTY

The Clinton Machine Company, Maquoketa, Iowa, U.S.A., warrants each new engine it manufactures against defects in material and workmanship under normal use and service. Our obligation under this warranty is limited to make good at our factory or authorized service station, any part or parts thereof which shall, within ninety days after delivery of such engine to the original purchaser, be returned to us or our factory authorized service station, with transportation charges prepaid, and with our examination shall disclose to our own satisfaction to have been thus defective; this warranty being expressed in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume, nor authorize service stations to assume for us any other liabilities in connection with the sale of our engine.

This warranty shall not apply if any engine which shall have been repaired or altered outside of our own factory or our factory authorized service station in any way so as in our judgement to affect the stability or liability, nor which has been subjected to misuse, negligence, or accident, nor any engine made by us which does not have a governor, or shall have been operated at a speed or load beyond the factory specified capacity. Carburetors, magnetos, and other trade accessories are guaranteed separately by their respective manufacturers.

The Clinton Machine Company reserves the right to make changes in design, and changes or improvements upon this product without imposing any obligation upon itself to install the same upon its products previously manufactured.

CLINTON MACHINE COMPANY

SERVICE DIVISION — MAQUOKETA, IOWA

CLINTON ENGINES

LIGHTWEIGHT MAINTENANCE

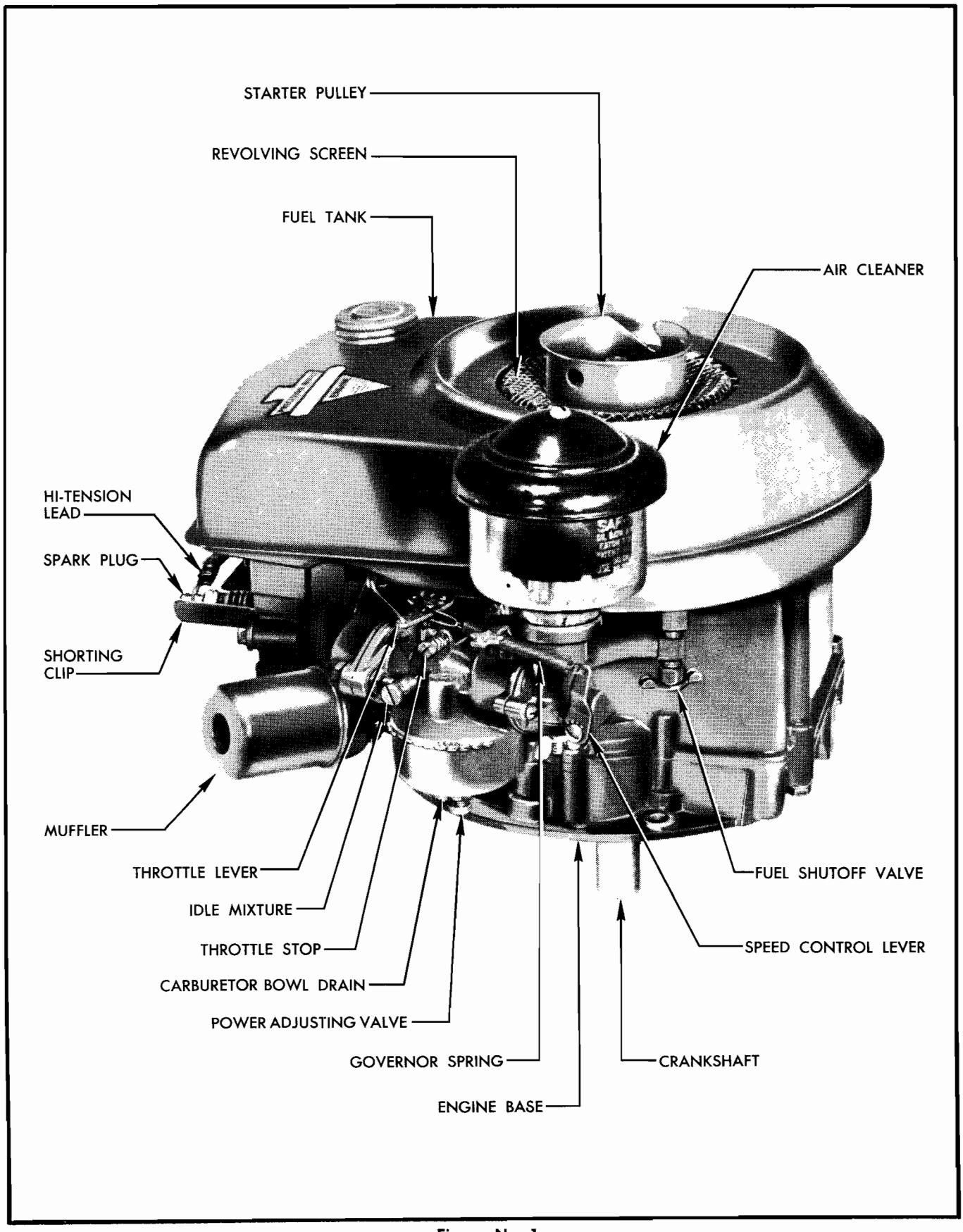


Figure No. 1

DESIGN CHARACTERISTICS

Mechanics will note that the VS-100 (See Figure No. 1) has a circular fuel tank integrated with the blower housing, while the VS-2100 features a saddle-type tank. Both conform to the modern contours of the unit.

The crankcase cover and mounting flange—standard features on most Clinton Vertical Shaft Engines—are supplanted by a base which incorporates a bearing flange. The oil filler plug and dipstick are housed in this base, and the oil drain plug protrudes from beneath it.

Internally, the lightweight models feature a magneto assembly like those used on Clinton Two Cycle Engines. Magnetism is contained in the laminations rather than in the flywheel. The magneto assembly itself mounts directly upon the block without benefit of bearing or stator plates. Weight requirements dictated this design feature.

Lubrication is accomplished by a gear-actuated oil pump assembly, which consists of three parts: (1) A brass oil line, (2) a pump body incorporating the two activating gears, and (3) the oil strainer which mounts on the end of the pump and is secured when the base is in position.

In other respects, the lightweight models resemble other Clinton Four Cycle Engines. The die-cast construction, however, necessitates more careful handling since the block can be ruined by failure to observe proper torques in servicing.

FUEL AND LUBRICATION

Fuel requirements in Lightweight models are the same as those in other Clinton Four Cycle Engines.

Type of Gasoline

A good grade of regular gasoline, like Mobilgas, is recommended.

Type of Oil

A high quality engine oil (non-detergent) like Mobiloil. Use SAE 30 in summer, and SAE 20W in winter.

Proper Oil Levels

1. Oil should be poured into the filler plug opening until it remains at the top of the slot. Always be sure that the engine is resting on a flat surface while filling the base.
2. If the engine is equipped with a dipstick, the proper oil level is up to the 'full' mark. Oil should be kept well-above the 'add' mark on the dipstick.
3. The oil bath air cleaner should be filled with SAE 50 up to the 'oil level' mark embossed on the face of the filter cup. (Aluminum mesh type air filters should be rinsed in pure gasoline and saturated with oil, at least once a day and oftener under extremely dusty operating conditions.)

TO START THE ENGINE

1. If the engine is equipped with an ignition switch, move it to the 'on' position.
2. Open the fuel shut-off valve on the bottom of the fuel tank.
3. With the choke in a closed position, crank the engine through two revolutions of the crankshaft.
4. Open the choke wide and with two sharp pulls on the rope or recoil starter the engine should start. See Figures No. 2 and 3.
5. If the engine fails to start, move the choke back to the half way open position and repeat the cranking cycle. Move the choke to the open position as soon as the engine permits.
6. Never choke a hot engine, but when an engine is partially warm, crank it with the choke slightly open. If it does not start after two cranking cycles, close the choke about half way and crank again.

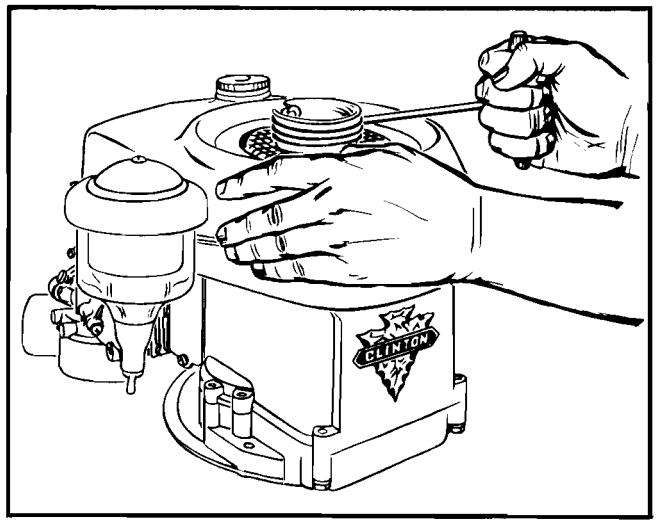


Figure No. 2

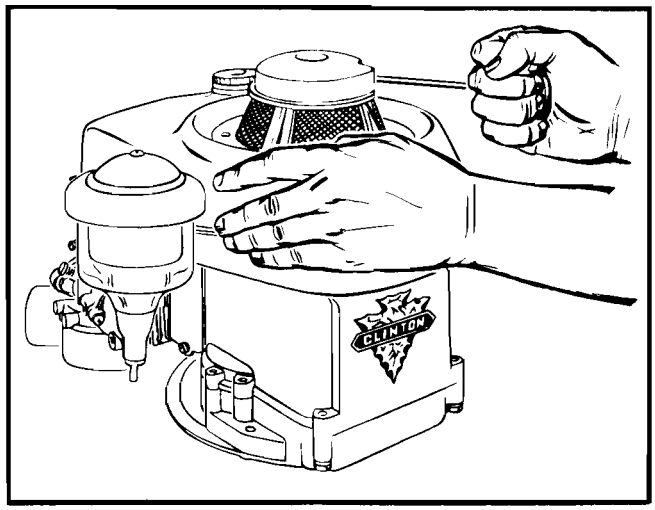


Figure No. 3

MAINTENANCE AND ADJUSTMENTS

LUBRICATION

1. Oil level in the base should be checked every (5) hours of operation, and oil should be drained from the base after every twenty-five hours of operation, or oftener if the engine is operating under dusty conditions. Point out the importance of proper maintenance to your Clinton Customers.
2. If the engine is equipped with a reduction unit, oil level should be checked daily and oil added as needed.
3. The oil bath air cleaner or aluminum mesh type air cleaner should be cleaned daily or every two hours under dusty conditions. (See Pages 29 and 30, *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines.*)

SPARK PLUG

1. Clinton Four Cycle Lightweight Engines are equipped at the factory with 14 mm, medium heat range spark plugs (H-10).
2. After every 100 hours of operation the spark plug should be cleaned and regapped (or replaced if fouled or badly burned). Cleaning should be accomplished with an automotive type sand blast spark plug cleaner.
3. Regap the plug to .025 inch by bending the ground electrode. Do not attempt to bend the center electrode. Coat the threads sparingly with graphite lubricant or special anti-seize compound to protect them when they are reinstalled on the aluminum head.
4. Torque the spark plug 250 to 275 inch pounds. (See *Maintenance Manual and Overhaul Instructions* Pages 18 and 19 for Cleaning and Gapping illustrations.)

PHELON MAGNETO ASSEMBLY

The magneto assembly should be inspected after every 100 hours of operation, and owners have been advised to bring the engines to Authorized Service Stations for this check-up.

TO TEST FOR SPARK

1. Remove the spark plug wire, hold it ⅛ inch away from the sharp part of the engine block. A spark should jump this gap when the engine is cranked over in the usual way.
2. While the engine is running, hold the lead wire 1/16 inch away from the spark plug terminal. The spark should jump this extra gap. *Caution:* Do not hold the wire farther away from the plug and only make the test briefly, since it puts a strain on the coil and might break it down if overdone.
3. Remove and inspect the spark plug for fouling and for proper gap. A badly fouled plug will not fire across the electrodes when seated on the cylinder block and not under compression. A plug can be fouled badly enough so that it will not fire under compression in the engine, but not enough to prevent its firing in the air. It is best to replace a fouled plug with a new one. Cleaning an old plug usually does not last long.

MAGNETO INSPECTION

1. To obtain access to the magneto it is necessary to remove the flywheel from the engine. To do this, loosen the flywheel nut about one turn, and install TL-916 (Knockout Flywheel Puller) on the end of the crankshaft. Strike the tool firmly with a plastic hammer, and the flywheel will break loose from the tapered end of the shaft.
2. Remove the flywheel from the crankshaft and look carefully at the magneto assembly. As previously mentioned, the assembly mounts directly to the block, with the laminations containing the magnetism instead of a flywheel magnet as is common on most four cycle engines.
3. Note the order of parts over the magneto assembly. (See Figure No. 4.) (1) dust cover over the crankshaft, (2) a Neoprene gasket (3) breaker points cover, and (4) condenser lead. It is important that these parts be reassembled exactly as they are, with the dust cover going on last.
4. Check the lead wire to see whether the spark plug is leaking through the insulation at some point.
5. Check the breaker points (See Figure No. 4). Be sure they are set to the proper gap. .018 by using a feeler gage.
6. Be sure the breaker rubbing surface is on the highest part

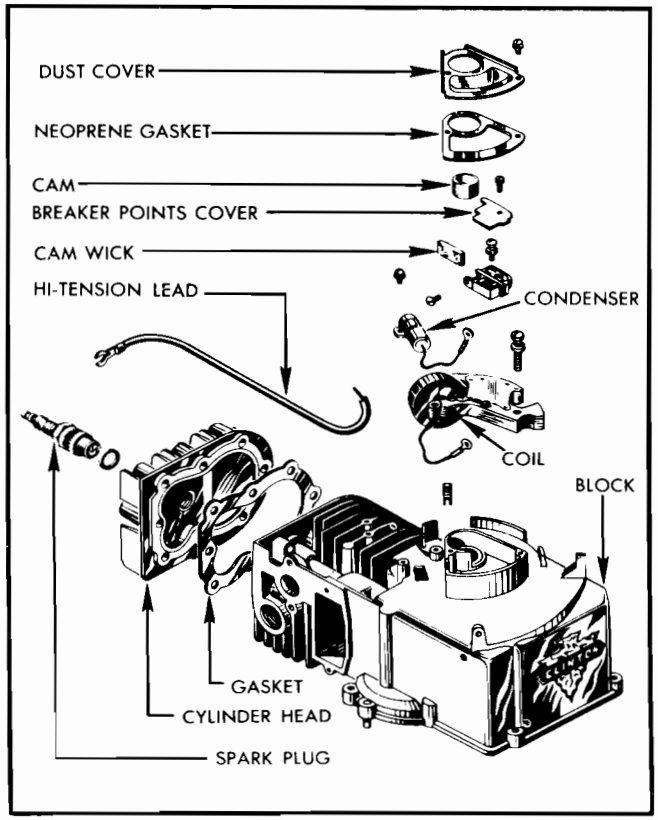


Figure No. 4

of the cam. This is the part of the cam that comes right after the points have opened.

7. Be sure the points are clean by lightly rubbing a piece of white, unprinted cardboard, moistened with cleaning fluid or lacquer thinner between them. Avoid using anything that might contaminate or leave lint on the points.
8. If the points are pitted, replace them. It is generally advisable to replace the condenser also since badly pitted points are usually the result of a defective condenser.
9. Test the condenser on a condenser tester (See Pages 20, 21 and 23, *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines* for instructions and illustrations for checking the condenser and coil and replacing the coil.)
10. The only lubrication needed in the magneto is for the cam wick, which should be saturated with grease if it has dried out since serviced at the factory. Note the correct position of the cam wick as shown in Figure No. 4.

CARBURETOR ADJUSTMENTS AND SERVICING

Complete instructions and illustrations for Clinton and Carter Float-Type carburetors appear on Page 24 of the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines.* Please refer to that page to find the proper adjustment for the Lightweight Engine carburetor.

Carburetor disassembly, cleaning and assembly instructions are contained on Pages 42 and 43 of the Maintenance Manual.

AIR VANE GOVERNOR ADJUSTMENTS

Consult pages 25 and 26 of the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines* for complete details and an illustration of the Air Vane Governor.

RECOIL STARTERS

Instructions for installing or replacing recoil starters (both Schnacke and Armstrong types) appear on Pages 26 and 27 of the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines.* Exploded views and parts lists for both starters appear in Section III of the Master Parts & Service Manual.

ENGINE OVERHAUL PROCEDURES

REMOVAL OF PARTS

Follow the steps listed in the Disassembly Chart on Page 10. Special attention should be paid to the parts that follow:

CAMSHAFT

The shaft is driven out from the base side of the engine instead of from the bearing plate side as on most four cycle engines. There is no bearing plate on the Lightweight Engines.

PISTON RINGS

New piston rings must be used whenever the engine is overhauled. Break and remove them with care, however, to avoid scoring piston lands. Old rings conform to the irregularities in the cylinder wall and they cannot be replaced in exactly the same position. It is, therefore, advisable that new rings be used whenever the piston is removed from the cylinder.

Note the louvred slots inside the piston dome which open to the oil ring slot. This design permits (a) better lubrication of the wrist pin, (b) better cooling of the piston, and (c) prevention of oil pumping.

If the piston is to be reused, be sure to mark it in relation to the connecting rod so that the two can be reassembled in their previous relationship.

CAM GEAR AND OIL PUMP ASSEMBLY

The oil pump assembly consists of an oil pump body (which incorporates the two activating gears) and the oil pump tube. To remove the assembly, it is necessary to rotate the pump until the pin on the cam gear lines up with the grooves in the pump. The assembly is easily removed at this point. (See Figure No. 5.)

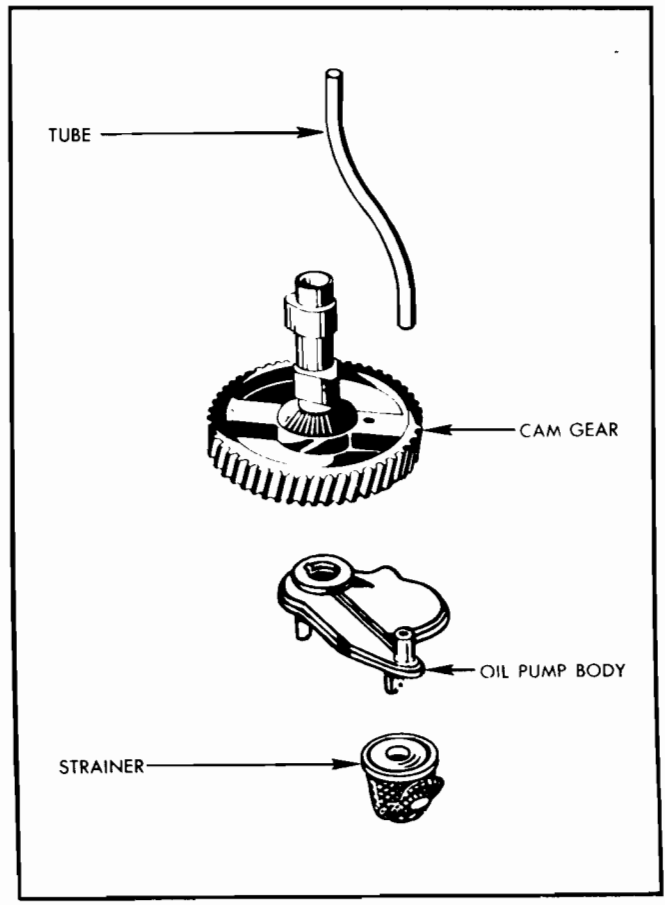


Figure No. 5

VALVES

The Lightweight engines incorporate the 'C' type of keeper common to most Clinton Four Cycle Engines. It is easier to remove the tappet case stud first to facilitate keeper removal. Use TL-925, Valve Spring Compressor, and lift out the 'C' washer with the fingers or with needle nose pliers shaped on the end to fit the washers.

CLEANING ENGINE PARTS

Wash all parts (except the carburetor and magneto) in a regular commercial cleaning solvent capable of removing all lacquer, gum and foreign material. Avoid solvents which will remove paint from parts unless they are to be repainted. (This is advisable for appearance sake.) Clean parts with a firm brush while holding them submerged in the solvent.

INSPECTION OF ENGINE PARTS

When all parts have been cleaned they should be inspected for signs of wear, damage, improper tolerance, etc. General inspection instructions appear on Pages 32, 33 and 34 of the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines.* These instructions are applicable to the Lightweight Engines with very few exceptions. The mechanic will notice instructions which do not apply to the Lightweight Engines immediately.

RECONDITIONING PARTS

The step-by-step procedure for reboring the cylinder appears on page 35 of the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines.* Since the block is die-cast, however, extra care must be taken during this procedure.

After the cylinder has been rebored, special instructions are necessary for the crankshaft bearing and oil pump assembly.

CRANKSHAFT BEARING

1. Drive the old bearing out of the block, using TL-910, Main Bearing Driver.
2. Use TL-910 to install new bearings in the block. Make certain that the oil holes in the bearing are lined up with those in the block.
3. Insert the reamer (TL-911) into the bearing bore from the top of the block.
4. Rotate the reamer continuously until it passes through the bearing.
5. Insert the crankshaft journal through the bearing to see whether it fits properly. (Bearing should be coated with oil before inserting the crankshaft.) Check for binding.
6. There is no lower or power-take-off bearing on the Lightweight Engines at the present time. If a new lower bearing surface is needed the entire bearing flange or 'base plate' must be replaced.

OIL PUMP ASSEMBLY

1. The gear actuated oil pump is considered the most efficient type for this application. Wear should be slight since the pump is a positive, rotary-type running in oil.
2. Should it become necessary to repair the oil pump, the entire pump body must be replaced. It is impossible to install new gears in old cases, since the unit, as assembled at the factory, is the only guarantee of complete efficiency.
3. The brass oil line is, of course, replaceable, and should be carefully inspected by mechanics when the engine is brought in for service.

RECONDITIONING OTHER PARTS

Follow the instructions listed on Page 36, 37 and 38 of the *Maintenance Manual and Overhaul Instructions for Clinton Two and Four Cycle Engines.* Procedures and illustrations on these pages can be applied to Clinton Lightweight Engines.

SPECIAL ASSEMBLY OPERATIONS

Follow the steps appearing in the Assembly Chart on Page 10. Special assembly steps follow: CAUTION: Consult the Torque Chart on Page 9 before tightening any screws. Failure to observe proper torque procedure will damage the engine beyond repair.

CAM GEAR AND OIL PUMP ASSEMBLY

1. The brass oil line must be properly lined up with the oil pump. One end fits into the hole in upper right hand corner of the crankcase, while the other fits over the oil pump. (See Figure No. 5.)
2. If the oil line is not correctly lined up before the cam gear is installed, improper oil circulation will result and the engine will burn up in a matter of minutes.
3. When the brass oil line is in place, install the cam gear by lining up the gear pin with the grooves on the oil pump.

MAGNETO

1. Install the coil and lamination assembly to the block, and position the condenser.
2. Attach the condenser lead and the coil lead to the breaker point terminal.
3. Install the breaker points assembly and turn the crankshaft until the plunger is on the highest part of the cam. (Set gap to .018-020.)
4. Install breaker points cover and dust cover using new gasket.

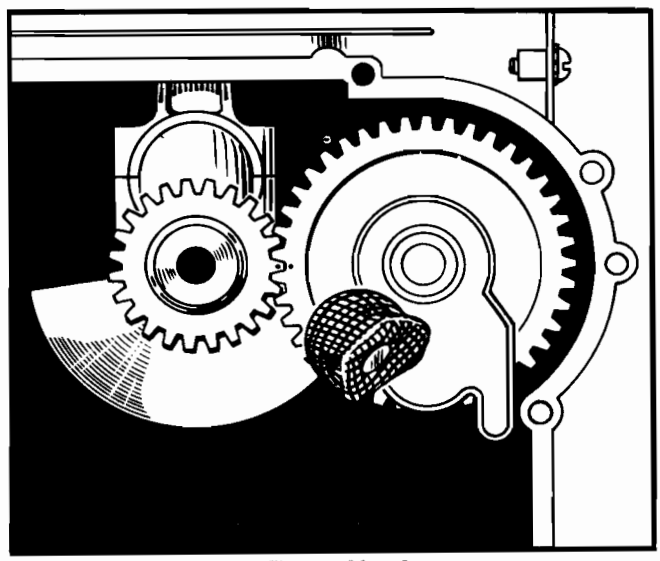


Figure No. 6

TIMING

1. Punch marks on the cam gear and crankshaft pinion indicate mating teeth for proper timing.
2. Mesh the two gears for proper timing. (See Figure No. 6.)

PISTON AND ROD ASSEMBLY

1. Be sure the oil hole in the connecting rod is toward the flywheel.
2. Be sure the mark on the connecting rod cap lines up with the mark on the connecting rod and use new rod locks.

BASE

1. The base is installed over the positioning studs on either side of the block.
2. The cam axle must line up with the boss on the base, and the locating pins on the block slip into the matching bosses. See Figure No. 7.
3. Use a new gasket.
4. Tighten the drain plug on the bottom of the base, and replace the filler plug cap.

Note: Other parts not mentioned in this section conform to the customary assembly procedures for Clinton Four Cycle Engines. Refer to the Torque Chart and the Service Clearance Chart that follow for specific adjustment operations.

CHECKING VALVE CLEARANCES

Valves are set at the factory to provide an operating clearance between the end of the push rod and the valve stem of .010 inch for both intake and exhaust. Clinton Lightweight Engines feature special hardened valve seat inserts.

1. Remove the tappet case and breather cover and measure the tappet clearance with a feeler gage. Take this measurement when the tappet is at its widest position by rotating the engine until the tappet rests on the heel of the cam.

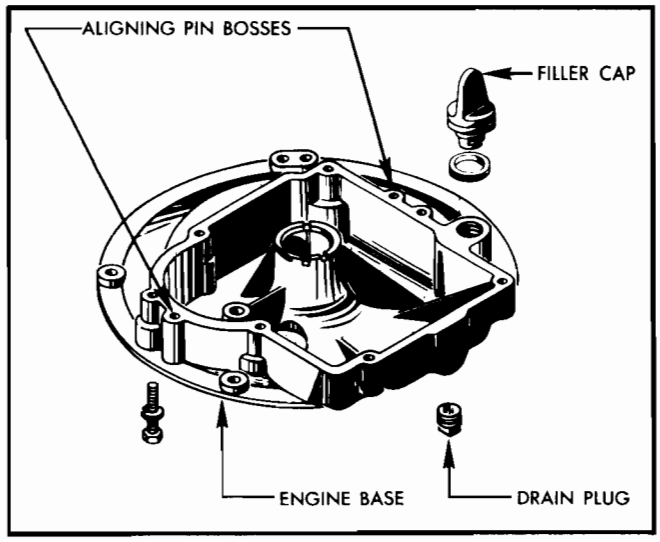


Figure No. 7

TO TEST COMPRESSION

1. Remove spark plug.
2. Insert the rubber tipped end of the compression gage in the spark plug hole snugly.
3. If the engine is equipped with a rope starter wind the full length of the rope around the starter pulley and give it a sharp, quick pull.
4. If the engine is equipped with an automatic recoil starter, pull the handle firmly to turn the engine.
5. Compression in any case should build up to approximately 75 to 90 pounds. If pressure is low, it indicates that compression is leaking out of the cylinder as a result of valve leakage, leakage around the piston rings or cylinder head gasket.

TORQUE DATA

	VS-100	VS-2100
Head Bolts	110 125" lb.	110 125" lb.
Connecting Rod	65 75" lb.	65 75" lb.
Bearing Plates	65 75" lb.	65 75" lb.
Base Bolts	65 75" lb.	65 75" lb.
Flywheel	150 175" lb.	150 175" lb.
Spark Plug	250 275" lb.	250 275" lb.
Blower Housing	60 70" lb.	60 70" lb.
Carburetor Mounting	65 75" lb.	65 75" lb.

CLINTON ENGINES

LIGHTWEIGHT MAINTENANCE

DISASSEMBLY PROCEDURE

STEP	REMOVE AND INSPECT
1.	Drain oil and gasoline from engine
2.	Muffler
3.	Fuel Line and Connections
4.	Air Cleaner
5.	Blower Housing & Tank Ass'y
6.	Carburetor Linkage and Carburetor
7.	Air Vane Linkage and Air Vane
8.	Cylinder Head Shield & Cylinder Head
9.	Base
10.	Oil Distributor (cam gear)
11.	Cam Axle and Camshaft
12.	Valve Tappets
13.	Piston & Rod Ass'y
14.	Air Deflector Shields
15.	Starter Pulley Nut, Washers, Starter Pulley & Revolving Screen (Use Socket Wrench)
16.	Flywheel, Flywheel Key
17.	Breaker Points Cover (Use TL-916 Knock-out Tool)
18.	Points Breaker Cam
19.	Crankshaft
20.	Valve Chamber Covers
21.	Breather Assembly
22.	Valve Keeper, Valve Springs, Valves

ASSEMBLY PROCEDURE

STEP	INSTALL AND ADJUST
1.	Install Crankshaft
2.	Piston & Rod Assembly
3.	Connecting Rod Cap
4.	Points Breaker Cam
5.	Breaker Points Cover and Flywheel Key
6.	Flywheel
7.	Starter Pulley and Starter Pulley Nut
8.	Install Valve Tappets
9.	Cam Axle
10.	Oil Distributor (cam gear)
11.	Air Deflector Shields
12.	Base
13.	Valves, Valve Springs, Valve Keepers
14.	Breather Assembly
15.	Valve Chamber Covers
16.	Air Vane Linkage & Air Vane
17.	Muffler
18.	Carburetor Linkage & Carburetor
19.	Cylinder Head & Cylinder Head Shield
20.	Blower Housing & Tank Assembly
21.	Air Cleaner
22.	Fuel Line and Connections

TOLERANCES AND SPECIFICATIONS

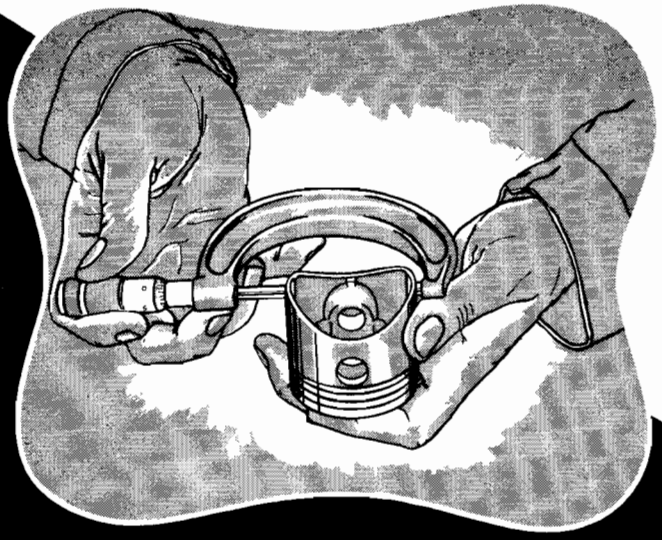
	VS-100 4 Cycle	VS-2100 4 Cycle
Piston Displace.	7.2	7.2
Piston Diameter	2.3695 2.3685	2.3695 2.3685
No. of Comp. Rings	2	2
No. of Oil Rings	1	1
Width Comp. Rings Groove	.096 .098	.096 .098
Width of Oil Rings Groove	.1890 .1825	.1890 .1875
Spark Plug Size	H-10	H-10
Head	L	L
Rated H.P.	1.4 2.5	1.1 1.7
R.P.M.	2200 to 3600	2200 to 3600
Comp. Pressure at Cranking Speed	75 90	75 90
Make of Magneto	Phelon	Phelon
Make of Carburetor	Clinton or Carter	Clinton or Carter
Type of Air Cleaner	Down Draft	Aluminum Mesh
Lubrication	Oil Pump	Oil Pump
Starting Method	Recoil or Rope	Recoil or Rope
Length & Width Height	12½x12$\frac{13}{32}$ 13$\frac{9}{32}$	12½x12$\frac{13}{32}$ 13$\frac{9}{32}$
Type of Bearing	Bronze & Aluminum	Bronze & Aluminum
Shipping Weight	21 lb.	21 lb.
Wrist Pin Dia.	.5624 .5626	.5624 .5626
Conn. Rod Dia.	.8145 to .8140	.8145 to .8140
Fuel Recommended	Reg. Gas SAE30	Reg. Gas SAE30
Governor, Type	Pneumatic Air Vane	Pneumatic Air Vane
Cooling Method	Air	Air

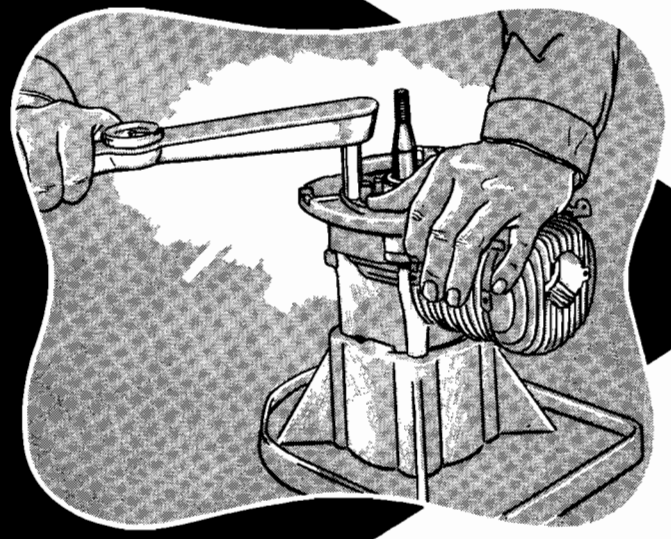
SERVICE CLEARANCES

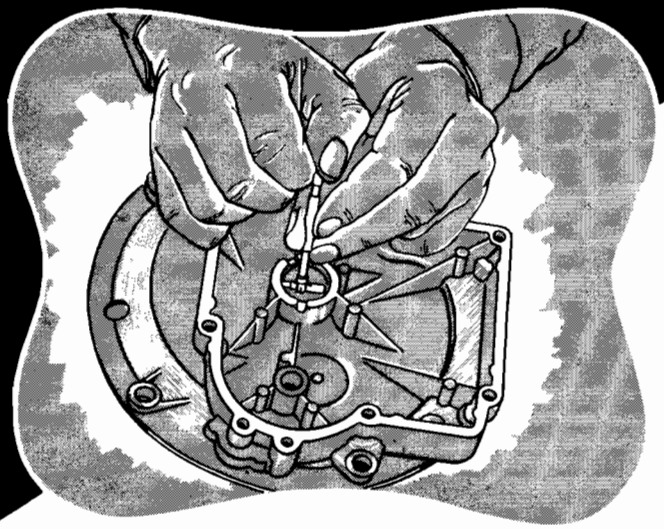
	VS-100	VS-2100
Crankshaft Endplay	.004 .012	.004 .012
Bearing Clearance	.001 .002	.001 .002
Valve Clearance In	.010	.010
(Cold Set) Ex	.010	.010
Valve Set Angle	45°	45°
Valve Set Width	.030 .045	.030 .045
Ring End Gap	.007 .017	.007 .017
Top Land Clearance	.0085 .0105	.0085 .0105
Skirt Clearance	.0055 .0075	.0055 .0075
Points Setting	.018 .020	.018 .020
Spark Plug Gap	.025	.025
Air Gap	.007 .014	.007 .014

SECTION VI

SERVICE CLEARANCES, SPECIFICATIONS
AND TORQUE DATA
REVISED AUGUST, 1957
SUPERSEDES JULY, 1955







SERVICE CLEARANCES

SPECIFICATIONS

TORQUE DATA

PRINTED IN U.S.A.

CLINTON MACHINE CO., Maquoketa, Iowa

CLINTON ENGINES

TABLE OF CONTENTS

INTRODUCTION

This division is intended to be used as a reference to necessary Tolerances and Specifications, Service Clearances, and Torque Data to be used in servicing Clinton engines.

The models are listed by basic type, these being: Gem, Panther, Long Life, and Red Horse as shown in the Table of Contents.

On each, under Service Clearances, there are shown three (3) figures; the minimum clearance, the maximum clearance and rework. The REWORK figure is the point at which the part or parts must either be rebuilt or replaced to receive proper operation from the engine. When rework is necessary, the final clearance should be between the minimum and maximum and favoring the minimum for longest operation and best performance. If there is no rework figure shown, the clearance must be between the minimum and maximum.

NOTE: For Torque Data and Service Clearances on the engines not listed use comparative models shown below:

ENGINE	REFER TO:
300	A-300
350	A-300
500	C-700
650	C-700
700A	C-700
B-700	C-700
VS-750	VS-700
800	A-800
A & B-1100	1200
C-1100	1200
D-1100	1200

TOLERANCES AND SPECIFICATIONS

"GEM"

	100	VS-100	2100	A-2100	VS-2100	3100	VS-3100 AVS-3100
Piston Displacement (Cu. Inches)	7.2	7.2	7.2	7.2	7.2	8.3	8.3
Piston Diameter—Skirt (Thrust Side)	2.370 2.369	2.370 2.369	2.370 2.369	2.370 2.369	2.370 2.369	2.370 2.369	2.370 2.369
No. of Compression Rings	2	2	2	2	2	2	2
No. of Oil Rings	1	1	1	1	1	1	1
Width Oil Ring Groove	.1875 .1890	.1875 .1890	.1875 .1890	.1875 .1890	.1875 .1890	.1875 .1890	.1875 .1890
Width Compression Ring Groove	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098
Spark Plug	H-10	H-10	H-10	H-10	H-10	H-10	H-10
Head	L	L	L	L	L	L	L
Rated H.P.	1.45 2.5	1.45 2.5	1.1 1.75	1.2 2.0	1.2 2.0	2.42 3.0	2.42 3.0
R. P. M.	2200 to 3600	2200 to 3600	2200 to 3600	2200 to 3600	2200 to 3600	2600 to 3600	2600 to 3600
Compression Pressure at Cranking Speed (lbs.)	80	80	80	80	80	80	80
Make of Magneto	Clinton or Phelon	Clinton or Phelon	Phelon	Clinton or Phelon	Clinton or Phelon	Clinton	Clinton
Make of Carburetor	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton	Clinton or Carter
Clinton Carburetor Float Setting	Up to 14023: .110 to .130 — 14023 and Above: .150 to .170						
Type of Air Cleaner	Oil Bath or Dry Type	Oil Bath or Dry Type	Oil Bath or Dry Type	Dry Type	Aluminum Mesh	Dry Type	Dry Type
Lubrication	Splash	Oil Pump	Splash	Splash	Oil Pump	Splash	Oil Pump
Starting Method	Recoil or Rope	Recoil, Electric or Rope	Recoil or Rope	Recoil or Rope	Recoil, Electric or Rope	Recoil or Rope	Recoil, Electric or Rope
Length Width Height	15⅛ 11⅝ 13¼	13⅝ 13¾ 8⅝	15 5/16 10 21/32 13¼	12 11⅝ 13¼	12⅝ 11 13/16 9⅜	15⅛ 11⅝ 13¼	13⅝ 13¾ 8⅝
Type of Bearing	Bronze	Bronze & Alum.	Bronze	Bronze	Bronze & Alum.	Bronze	Bronze & Alum.
Shipping Weight	19 lb.	19 lb.	19 lb.	19 lb.	19 lb.	19 lb.	19 lb.
Wrist Pin Diameter	.5624 .5626	.5624 .5626	.5624 .5626	.5624 .5626	.5624 .5626	.5624 .5626	.5624 .5626
Connecting Rod Diameter (Bearing Surface)	.8145 to .8140	.8145 to .8140	.8145 to .8140	.8145 to .8140	.8145 to .8140	.8770 to .8765	.8770 to .8765
Fuel and Oil* Recommended	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30
Governor Type	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane
Cooling Method	Air	Air	Air	Air	Air	Air	Air

*Either Detergent or Non-Detergent Acceptable.
CAUTION! Do Not Mix. Do Not Change from One to the Other.

Vertical Shaft Engine Height Is Measured from Base Mounting.

CLINTON ENGINES

SERVICE CLEARANCES

"GEM"

		100	VS-100	2100 A-2100	VS-2100	3100	VS-3100 AVS-3100
Crankshaft End Play	Min.	.012	.012	.012	.012	.012	.012
	Max.	.018	.018	.018	.018	.018	.018
	Rework	.025	.025	.025	.025	.025	.025
Bearing Clearance	Min.	.0018	.0018	.0018	.0018	.0018	.0018
	Max.	.0035	.0035	.0035	.0035	.0035	.0035
	Rework	.005	.005	.005	.005	.005	.005
Connecting Rod to Crankshaft	Min.	.0015	.0015	.0015	.0015	.0015	.0015
	Max.	.0026	.0026	.0026	.0026	.0026	.0026
	Rework	.0045	.0045	.0045	.0045	.0045	.0045
Valve Clearance—Intake	Min.	.009	.009	.009	.009	.009	.009
	Max.	.012	.012	.012	.012	.012	.012
	Rework	+.000 —.002	+.000 —.002	+.000 —.002	+.000 —.002	+.000 —.002	+.000 —.002
Valve Clearance—Exhaust	Min.	.009	.009	.009	.009	.009	.009
	Max.	.012	.012	.012	.012	.012	.012
	Rework	+.000 —.002	+.000 —.002	+.000 —.002	+.000 —.002	+.000 —.002	+.000 —.002
Valve Seat Width	Min.	.030	.030	.030	.030	.030	.030
	Max.	.045	.045	.045	.045	.045	.045
	Rework	.060	.060	.060	.060	.060	.060
Valve Stem to Valve Guide	Min.	.0015	.0015	.0015	.0015	.0015	.0015
	Max.	.0045	.0045	.0045	.0045	.0045	.0045
	Rework	.007	.007	.007	.007	.007	.007
Valve Seat Angle		43½-44½	43½-44½	43½-44½	43½-44½	43½-44½	43½-44½
Top Land Clearance	Min.	.0068	.0068	.0068	.0068	.0068	.0068
	Max.	.010	.010	.010	.010	.010	.010
	Rework	.012	.012	.012	.012	.012	.012
Skirt Clearance	Min.	.0045	.0045	.0045	.0045	.0045	.0045
	Max.	.0065	.0065	.0065	.0065	.0065	.0065
	Rework	.0085	.0085	.0085	.0085	.0085	.0085
Ring End Gap	Min.	.007	.007	.007	.007	.007	.007
	Max.	.017	.017	.017	.017	.017	.017
	Rework	.025	.025	.025	.025	.025	.025
Ring to Ring Groove	Min.	.0025	.0025	.0025	.0025	.0025	.0025
	Max.	.005	.005	.005	.005	.005	.005
	Rework	.0065	.0065	.0065	.0065	.0065	.0065
Points Setting	Min.	.018	.018	.018	.018	.018	.018
	Max.	.021	.021	.021	.021	.021	.021
Spark Plug Gap	Min.	.025	.025	.025	.025	.025	.025
	Max.	.028	.028	.028	.028	.028	.028
Air Gap	Min.	.007	.007	.007	.007	.007	.007
	Max.	.017	.017	.017	.017	.017	.017
Phelon Edge Gap	Min.	.156	.156	.156	.156	---	---
	Max.	.281	.281	.281	.281	---	---
Clinton Edge Gap	Min.	.094	.094	.094	.094	.094	.094
	Max.	.219	.219	.219	.219	.219	.219
Ignition Timing		21° BTC	21° BTC	21° BTC	21° BTC	21° BTC	21° BTC
Rod Journal (Out of Round)	Max.	.001	.001	.001	.001	.001	.001
	Rework	.0015	.0015	.0015	.0015	.0015	.0015
Connecting Rod to Wrist Pin	Min.	.0004	.0004	.0004	.0004	.0004	.0004
	Max.	.0011	.0011	.0011	.0011	.0011	.0011
	Rework	.002	.002	.002	.002	.002	.002
Cam Axle to Camshaft	Min.	.001	.001	.001	.001	.001	.001
	Max.	.003	.003	.003	.003	.003	.003
	Rework	.005	.005	.005	.005	.005	.005
Cam Axle to Base and Block	Rework	.006	.006	.006	.006	.006	.006

TORQUE DATA

"GEM"

		100	VS-100	2100	A-2100	VS-2100	3100	VS-3100 AVS-3100
Bearing Plate	Min.	75	75	75	75	75	75	75
P.T.O.	Max.	85" lb	85" lb	85" lb	85" lb	85" lb	85" lb	85" lb
Blower Housing	Min.	60	60	60	60	60	60	60
	Max.	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb
Carburetor to	Min.		35			35		35
Manifold	Max.		50" lb			50" lb		50" lb
Carburetor or	Min.	60	60	60	60	60	60	60
Manifold to Block	Max.	65" lb	65" lb	65" lb	65" lb	65" lb	65" lb	65" lb
Connecting Rod	Min.	70	70	70	70	70	70	70
	Max.	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb
Head Bolts	Min.	125	125	125	125	125	125	125
	Max.	150" lb	150" lb	150" lb	150" lb	150" lb	150" lb	150" lb
Flywheel—Cast	Min.	175			175		175	
Iron	Max.	200" lb			200" lb		200" lb	
Flywheel—Zinc	Min.	300	300	300	300	300	300	300
	Max.	350" lb	350" lb	350" lb	350" lb	350" lb	350" lb	350" lb
Spark Plug	Min.	250	250	250	250	250	250	250
	Max.	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb
Speed Reducer	Min.	110		110	110		110	
Mounting	Max.	150" lb		150" lb	150" lb		150" lb	

NOTE: All measurements given in INCH POUNDS

NOTE: Graphite should be used on threads of screws being replaced in diecast parts.

CLINTON ENGINES

TOLERANCES AND SPECIFICATIONS

"PANTHER"

	200	A-200	AVS-200	VS-200	A-400	AVS-400	BVS-400	VS-400
Piston Displacement	4.5	4.5	4.5	4.5	5.76	5.76	5.76	5.76
Piston Diameter Skirt (Thrust Side)	1.8705 1.8695	1.8705 1.8695	1.8705 1.8695	1.8705 1.8695	2.120 2.119	2.120 2.119	2.120 2.119	2.120 2.119
No. of Compression Rings	2	2	2	2	2	2	2	2
Width Compression Ring Groove	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098
Spark Plug	H-11 or H-11-J	H-11 or H-11-J	H-11 or H-11-J	H-11 or H-11-J	H-11 or H-11-J	H-11 or H-11-J	H-11 or H-11-J	H-11 or H-11-J
Head	Integral	Integral	Integral	Integral	Integral	Integral	Integral	Integral
Rated H.P.	1.5 1.75	1.6 2.0	1.6 2.0	1.6 2.0	1.9 2.5	1.9 2.5	1.9 2.5	1.9 2.5
R. P. M.	2800 3600	2800 3800	2800 3800	2800 3800	2800 3800	2800 3800	2800 3800	2800 3800
Compression Pressure at Cranking Speed (lbs.) Min.	60	60	60	60	60	60	60	60
Make of Magneto	Phelon	Clinton	Clinton	Phelon or Clinton	Clinton	Clinton	Clinton	Phelon or Clinton
Make of Carburetor	Carter or Clinton	Clinton	Clinton	Carter or Clinton	Clinton	Clinton	Clinton	Carter or Clinton
Clinton Carburetor Float Setting	Up to 14023: .110 to .130 — 14023 and Above: .150 to .170							
Type of Air Cleaner	Metallic Mesh	Metallic Mesh	Metallic Mesh	Metallic Mesh	Metallic Mesh	Metallic Mesh	Metallic Mesh	Metallic Mesh
Lubrication	Mixed with Fuel	Mixed with Fuel	Mixed with Fuel	Mixed with Fuel	Mixed with Fuel	Mixed with Fuel	Mixed with Fuel	Mixed with Fuel
Starting Method	Rope or Recoil	Rope or Recoil	Recoil, Electric or Rope	Recoil, Electric or Rope	Rope or Recoil	Recoil, Electric or Rope	Rope or Recoil	Recoil, or Rope Electric
Length Width Height	15 5/16 10 21/64 8 11/16	13 7/8 10 3/4 9 3/4	16 9/16 9 8 5/8	16 13/32 8 1/2 9 23/32	13 7/8 10 3/4 9 3/4	16 3/4 9 8 5/8	17 1/2 8 1/2 8 5/8	16 13/32 8 1/2 9 23/32
Type of Bearing	Needle & Bronze	Bronze	Bronze	Bronze	Bronze	Bronze	Bronze	Bronze
Shipping Weight	18 lbs.	18 lbs.	15 3/4 lbs.	15 3/4 lbs.	18 lbs.	15 3/4 lbs.	15 3/4 lbs.	15 3/4 lbs.
Wrist Pin Diameter	.4295	.4295	.4295	.4295	.5000	.5000	.5000	.5000
Connecting Rod Diameter	.782 .7827	.782 .7827	.782 .7827	.782 .7827	.782 .7827	.782 .7827	.782 .7827	.782 .7827
Fuel and Oil Recommended	Reg. Gas *SAE 30	Reg. Gas *SAE 30	Reg. Gas *SAE 30	Reg. Gas *SAE 30	Reg. Gas *SAE 30	Reg. Gas *SAE 30	Reg. Gas *SAE 30	Reg. Gas *SAE 30
Governor Type	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane	Pneumatic Air Vane
Cooling Method	Air	Air	Air	Air	Air	Air	Air	Air

*Non-Detergent Oil

Vertical Shaft Engine Height Is Measured from Base Mounting.

SERVICE CLEARANCES

"PANTHER"

		200	A-200	AVS-200	VS-200	A-400	AVS-400	BVS-400	VS-400
Crankshaft Endplay	Min.	.003	.003	.003	.003	.003	.003	.003	.003
	Max.	.020	.020	.020	.020	.020	.020	.020	.020
	Rework	.025	.025	.025	.025	.025	.025	.025	.025
Bearing Clearance	Min.	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018
	Max.	.0035	.0035	.0035	.0035	.0035	.0035	.0035	.0035
	Rework	.0055	.0055	.0055	.0055	.0055	.0055	.0055	.0055
Connecting Rod To Crankshaft	Min.	.0026	.0026	.0026	.0026	.0026	.0026	.0026	.0026
	Max.	.0039	.0039	.0039	.0039	.0039	.0039	.0039	.0039
	Rework	.006	.006	.006	.006	.006	.006	.006	.006
Rod Journal (Out of Round)	Max.	.001	.001	.001	.001	.001	.001	.001	.001
	Rework	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015
Wrist Pin to Connecting Rod	Min.	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004
	Max.	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011
	Rework	.002	.002	.002	.002	.002	.002	.002	.002
Top Land and Skirt Clearance	Min.	.0045	.0045	.0045	.0045	.005	.005	.005	.005
	Max.	.0065	.0065	.0065	.0065	.007	.007	.007	.007
	Rework	.008	.008	.008	.008	.0085	.0085	.0085	.0085
Ring End Gap	Min.	.005	.005	.005	.005	.007	.007	.007	.007
	Max.	.013	.013	.013	.013	.017	.017	.017	.017
	Rework	.020	.020	.020	.020	.025	.025	.025	.025
Ring to Ring Groove	Min.	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015
	Max.	.004	.004	.004	.004	.004	.004	.004	.004
	Rework	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065
Breaker Points Setting	Min.	.018	.018	.018	.018	.018	.018	.018	.018
	Max.	.021	.021	.021	.021	.021	.021	.021	.021
Spark Plug Gap	Min.	.028	.028	.028	.028	.028	.028	.028	.028
	Max.	.033	.033	.033	.033	.033	.033	.033	.033
Air Gap	Min.	.007	.007	.007	.007	.007	.007	.007	.007
	Max.	.017	.017	.017	.017	.017	.017	.017	.017
Clinton Edge Gap	Min.		.094	.094	.094	.094	.094	.094	.094
	Max.		.219	.219	.219	.219	.219	.219	.219
Phelon Edge Gap	Min.	.156			.156				.156
	Max.	.281			.281				.281
Ignition Timing		27° BTC	27° BTC	27° BTC	27° BTC	27° BTC	27° BTC	27° BTC	27° BTC

CLINTON ENGINES

TORQUE DATA

"PANTHER"

		200	A-200	AVS-200	VS-200	A-400	AVS-400	BVS-400	VS-400
Bearing Plate	Min. Max.	75 to 95" lb.	75 to 95" lb.	75 to 95" lb.	75 to 95" lb.	75 to 95" lb.	75 to 95" lb.	75 to 95" lb.	75 to 95" lb.
Blower Housing	Min. Max.	65 to 70" lb.	65 to 70" lb.	65 to 70" lb.	65 to 70" lb.	65 to 70" lb.	65 to 70" lb.	65 to 70" lb.	65 to 70" lb.
Bracket Engine Base	Min. Max.	125 to 150" lb.	125 to 150" lb.	125 to 150" lb.	125 to 150" lb.	125 to 150" lb.	125 to 150" lb.	125 to 150" lb.	125 to 150" lb.
Carburetor Mounting	Min. Max.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.
Connecting Rod	Min. Max.	35 to 45" lb.	35 to 45" lb.	35 to 45" lb.	35 to 45" lb.	35 to 45" lb.	35 to 45" lb.	35 to 45" lb.	35 to 45" lb.
Flywheel—Cast Iron	Min. Max.		175 to 200" lb.			175 to 200" lb.			
Flywheel—Zinc	Min. Max.	300 to 350" lb.	300 to 350" lb.	300 to 350" lb.	300 to 350" lb.	300 to 350" lb.	300 to 350" lb.	300 to 350" lb.	300 to 350" lb.
Muffler (To Block)	Min. Max.	40 to 60" lb.	40 to 60" lb.	40 to 60" lb.	40 to 60" lb.	40 to 60" lb.	40 to 60" lb.	40 to 60" lb.	40 to 60" lb.
Reed Plate	Min. Max.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.	60 to 65" lb.
Spark Plug	Min. Max.	250 to 275" lb.	250 to 275" lb.	250 to 275" lb.	250 to 275" lb.	250 to 275" lb.	250 to 275" lb.	250 to 275" lb.	250 to 275" lb.

NOTE: All measurements given in INCH POUNDS

NOTE: Graphite should be used on threads of screws being replaced in diecast parts.

TOLERANCES AND SPECIFICATIONS

"LONG LIFE"

	A-300	VS-300	C-700	D-700	VS-700	A-800	VS-800	900	VS-900	VS-1000 AVS-1000	VS-1100 AVS-1100	1200	A-1200	VS-1200
Piston Displacement	4.72	4.72	5.89	6.65	5.89	8.3	8.3	8.3	8.3	8.3	9.5	†9.0	10.2	10.2
Piston Skirt Diameter	1.9945 1.9935	1.9945 1.9935	1.9945 1.9935	2.120 2.119	1.9945 1.9935	2.369 2.370	2.369 2.370	2.369 2.370	2.369 2.370	2.369 2.370	2.369 2.370	2.463 2.462	2.463 2.462	2.463 2.462
No. of Comp. Rings	2	2	2	2	2	2	2	2	2	2	2	2	2	2
No. of Oil Rings	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Width Comp. Ring Groove	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098	.096 .098
Width of Oil Ring Groove	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189	.1875 .189
Spark Plug	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8	J-8
Head	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Rated H.P.	.7 to 1.6	.7 to 1.6	1.4 2.0	1.4 2.0	1.4 2.0	2.35 3.0	2.35 3.0	2.42 3.0	2.2 to 2.75	1.9 to 3.0	2.3 to 3.5	2.8 3.6	3.4 4.0	2.7 4.0
R. P. M.	2000 to 3600	2000 to 3600	2400 to 3600	2400 to 3600	2400 to 3600	2600 to 3600	2600 to 3600	2600 to 3600	2600 to 3600	2200 to 3600	2200 to 3600	2600 to 3600	2800 to 3600	2200 to 3600
Comp. Pressure at Cranking Speed (Min.)	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Make of Magneto	Phelon	Phelon	Phelon	Clinton Phelon	Phelon	Phelon	Phelon	Clinton Phelon	Clinton	Clinton	Clinton	Clinton Phelon	Clinton	Clinton
Make of Carburetor	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton or Carter	Clinton	Clinton	Clinton	Clinton or Carter	Clinton	Clinton
Clinton Carb. Float Setting	Up to 14023: .110 to .130 — 14023 and Above: .150 to .170													
Type Air Cleaner	Oil Bath	Oil Bath	Oil Bath	Oil Bath or Dry Type	Oil Bath	Oil Bath	Oil Bath	Oil Bath or Dry Type	Dry Type	Dry Type	Dry Type	Oil Bath or Dry Type	Dry Type	Dry Type
Lubrication	Distrib.	Im-peller	Dist.	Dist.	Dist.	Dist.	Dist.	Dist.	Oil Pump	Oil Pump	Oil Pump	Dist.	Dist.	Oil Pump
Starting Method	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil or Rope	Recoil, Electric or Rope	Recoil, Electric or Rope	Recoil or Rope	Recoil, Electric or Rope	Recoil, Electric or Rope	Recoil or Rope
Length Width Height	14 5/8 11 1/8 13 3/4	13 1/4 12 1/2 12 1/4	15 1/8 8 15/16 13 3/16	15 1/8 8 15/16 13 3/16	15 13 10 3/8	15 1/8 8 1/2 13 1/2	16 7/8 13 11 5/16	15 1/2 8 15/16 13 5/8	14 17/32 13 3/8 10 1/32	14 11/16 13 15/16 10	14 11/16 13 15/16 10	17 1/2 10 13/16 13 11/16	16 1/2 11 15/16 14 5/8	14 7/8 15 5/8 10 1/8
Type of Bearing	Sleeve	Needle and Sleeve	Steel Backed Babbit	Steel Backed Babbit	Needle and Sleeve	Sleeve	Needle and Sleeve	Steel Backed Babbit	Bronze Alum.	Bronze Alum.	Bronze Alum.	Ball	Ball	Bronze and Alum.
Shipping Wt.	28 lb.	29 lb.	40 lb.	40 lb.	36 lb.	43 lb.	45 lb.	43 lb.	28 lb.	28 lb.	28 lb.	45 lb.	43 3/4 lb.	33 lb.
Wrist Pin Dia.	.5000	.5000	.5000	.562	.5000	.562	.562	.562	.562	.562	.562	.562	.562	.562
Connnecting Rod Dia.	.7515 to .752	.7515 to .752	.877 to .878	.877 to .8775	.877 to .878	.877 to .878	.877 to .878	.877 to .8775	.877 to .8775	.877 to .8775	.914 to .9145	*.877 to .8775	.914 to .9145	.914 to .9145
Fuel and Oil** Recommended	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30
Governor Type	Pneu-matic Air Vane	Pneu-matic Air Vane	Fly-ball	Fly-ball	Pneu-matic Air Vane	Fly-ball	Pneu-matic Air Vane	Fly-ball	Pneu-matic Air Vane	Pneu-matic Air Vane	Pneu-matic Air Vane	Fly-ball	Fly-ball	Pneu-matic Air Vane
Cooling Method	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air	Air

*Connecting Rod Diameter 1200-2000—9.14 to .9145.
†Displacement on 1200-2000 is 10.2 cu. in.
**Either a Detergent or Non-Detergent Oil is Acceptable.
CAUTION! Do Not Mix. Do Not Change from One to the Other.
Vertical Shaft Engine Height is Measured from Base Mounting.

CLINTON ENGINES

SERVICE CLEARANCES

"LONG LIFE"

		A-300	VS-300	C-700	D-700	VS-700	A-800	VS-800	900	VS-900	VS-1000 AVS-1000	VS-1100 AVS-1100	1200	A-1200	VS-1200
Crankshaft Endplay	Min.	.004	.004	.012	.012	.004	.004	.004	.012	.012	.012	.012	.012	.012	.012
	Max.	.012	.012	.018	.018	.012	.012	.012	.018	.018	.018	.018	.018	.018	.018
	Rework	.020	.020	.025	.025	.020	.020	.020	.025	.025	.025	.025	.025	.025	.025
Bearing Clearance	Min.	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	Ball	Ball	.0018
	Max.	.0035	.0035	.0035	.0035	.0035	.0035	.0035	.0035	.0035	.0035	.0035	---	---	.0035
	Rework	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	---	---	.005
Connecting Rod to Crankshaft	Min.	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018	.0018
	Max.	.0035	.0035	.004	.003	.004	.004	.004	.003	.003	.003	.003	.003	.003	.003
	Rework	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005
Rod Journal (Out of Round)	Max.	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001
	Rework	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015
Camshaft End Play	Min.	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
	Max.	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010
	Rework	.015	.015	.015	.015	.015	.015	.015	.015	.015	.015	.015	.015	.015	.015
Camshaft to Cam Axle	Min.	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001
	Max.	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
	Rework	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005
Connecting Rod to Wrist Pin	Min.	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004
	Max.	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011	.0011
	Rework	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
Valve Clearance—Intake	Min.	.006	.006	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009
	Max.	.008	.008	.011	.012	.011	.011	.011	.012	.012	.012	.012	.012	.012	.012
	Rework	---	---	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002
Valve Clearance—Exhaust	Min.	.007	.007	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009
	Max.	.009	.009	.011	.012	.011	.011	.011	.012	.012	.012	.012	.012	.012	.012
	Rework	---	---	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002	± .002
Valve Seat Width	Min.	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030
	Max.	.045	.045	.045	.045	.045	.045	.045	.045	.045	.045	.045	.045	.045	.045
	Rework	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060
Valve Stem to Valve Guide	Min.	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015
	Max.	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045	.0045
	Rework	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
Valve Seat Angle	Min.	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°	43½°
	Max.	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°	44½°
Piston Skirt Clearance (Thrust Side)	Min.	.0045	.0045	.0045	.005	.0045	.0055	.0055	.005	.005	.005	.005	.0055	.005	.0055
	Max.	.0065	.0065	.0065	.007	.0065	.0075	.0075	.007	.007	.007	.007	.0075	.007	.0075
	Rework	.0085	.0085	.0085	.0085	.0085	.009	.009	.0085	.0085	.0085	.0085	.009	.009	.009
Piston Top Land Clearance	Min.	----	----	.0075	.0072	.0075	.0073	.0073	.0073	.0073	.0073	.0073	.0084	.0075	.0084
	Max.	----	----	.0095	.0103	.0095	.0104	.0104	.0104	.0104	.0104	.0104	.0115	.0105	.0115
	Rework	----	----	.0115	.012	.0115	.012	.012	.012	.012	.012	.012	.013	.012	.013
Ring End Gap	Min.	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
	Max.	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017
	Rework	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025
Ring to Ring Groove	Min.	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025	.0025
	Max.	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005
	Rework	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065	.0065
Breaker Points Setting	Min.	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018
	Max.	.021	.021	.021	.021	.021	.021	.021	.021	.021	.021	.021	.021	.021	.021
Spark Plug Gap	Min.	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025
	Max.	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028	.028
Air Gap	Min.	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
	Max.	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017	.017
Edge Gap (Clinton)	Min.	---	---	---	.094	---	---	---	.094	.094	.094	.094	.094	.094	.094
	Max.	---	---	---	.219	---	---	---	.219	.219	.219	.219	.219	.219	.219
Ignition Timing B.T.C.		21°	21°	21°	21°	21°	21°	21°	21°	21°	21°	21°	21°	21°	21°

CLINTON ENGINES

TORQUE DATA

"LONG LIFE"

		A-300	VS-300	C-700	D-700	VS-700	A-800	VS-800	900	VS-900	VS-1000 AVS-1000	VS-1100 AVS-1100	1200	A-1200	VS-1200
Base Bolts	Min.	150		150	150		150		150				150	150	
	Max.	160" lb		160" lb	160" lb		160" lb		160" lb				160" lb	160" lb	
Bearing Plates	Min.	90	90	90	90	90	90	90	90	90	90	90	90	90	90
	Max.	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb	110" lb
Blower Housing	Min.	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	Max.	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb
Carburetor or Manifold to Block	Min.	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	Max.	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb	70" lb
Carburetor to Manifold	Min.		35	35		35		35		35	35	35			35
	Max.		50" lb	50" lb		50" lb		50" lb		50" lb	50" lb	50" lb			50" lb
Connecting Rod	Min.	70	70	70	70	70	70	70	70	70	70	70	70	70	70
	Max.	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb	80" lb
End Cover or Gear Box	Min.		90			90		90		90	90	90			90
	Max.		110" lb			110" lb		110" lb		110" lb	110" lb	110" lb			110" lb
Flywheel	Min.	175	175	175	175	175	175	175	175	175	175	175	175	175	175
	Max.	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb	200" lb
Head Bolts	Min.	200	200	200	200	200	200	200	200	200	200	200	200	200	200
	Max.	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb	220" lb
Power Take-Off Housing or Adapter Flange	Min.		80			80		80		120	120	120			120
	Max.		100" lb			100" lb		100" lb		150" lb	150" lb	150" lb			150" lb
Spark Plug*	Min.	250	250	250	250	250	250	250	250	250	250	250	250	250	250
	Max.	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb	275" lb
Speed Reducer Mounting	Min.	110		110	110		110		110				110	110	
	Max.	150" lb		150" lb	150" lb		150" lb		150" lb				150" lb	150" lb	

NOTE: All measurements given in INCH POUNDS

*Use Graphite on Threads When Replacing Spark Plug.

CLINTON ENGINES

TOLERANCES AND SPECIFICATIONS

"RED HORSE"

	1600	2500	A-2500
Piston Displacement (Cubic Inches)	16.3	25	25
Piston Diameter—Skirt (Thrust Side)	2.8055 2.8045	3.1185 3.1175	3.1195 3.1185
Number of Compression Rings	2	2	2
Number of Oil Rings	1	1	1
Width Compression Ring Groove	.098 .096	.098 .096	.098 .096
Width of Oil Ring Groove	.1875 .189	.1875 .189	.1875 .189
Spark Plug	H-10	H-10	H-10
Head	L	L	L
Rated H.P.	2.9 6.3	4.6 9.0	4.75 10.3
R. P. M.	1600 to 3200	1600 to 3200	1600 to 3600
Compression Pressure at Cranking Speed (lbs.) Min.	90	90	90
Make of Magneto	Phelon	Phelon	Phelon
Make of Carburetor	Carter or Zenith	Carter or Zenith	Carter or Zenith
Type of Air Cleaner	Oil Bath	Oil Bath	Oil Bath
Lubrication	Distrib.	Distrib.	Distrib.
Starting Method	Crank, Electric or Rope	Crank, Electric or Rope	Crank, Electric or Rope
Length Width Height	19⅝ 14¼ 18 7/32	19 15/16 15 27/32 19 15/16	19 15/16 15 27/32 19 15/16
Type of Bearing	Ball	Ball	Ball
Shipping Weight	76 lb.	104 lb.	104 lb.
Wrist Pin Diameter	.672	.734	.734
Connecting Rod Diameter	1.1265 to 1.1273	1.2515 to 1.2523	1.2515 to 1.2523
Fuel and Oil* Recommended	Reg. Gas SAE 30	Reg. Gas SAE 30	Reg. Gas SAE 30
Governor Type	Flyball	Flyball	Flyball
Cooling Method	Air	Air	Air

*Either Detergent or Non-Detergent Acceptable.

CAUTION! Do Not Mix. Do Not Change from One to the Other.

SERVICE CLEARANCES

"RED HORSE"

		1600	2500	A-2500
Crankshaft End Play	Min.	.003	.003	.003
	Max.	.029	.029	.029
	Rework	.035	.035	.035
Bearing Clearance		Ball	Ball	Ball
Connecting Rod to Crankshaft	Min.	.0015	.0015	.0015
	Max.	.003	.003	.003
	Rework	.0045	.0045	.0045
Rod Journal (Out of Round)	Max.	.001	.001	.001
	Rework	.0015	.0015	.0015
Camshaft End Play	Min.	.003	.003	.003
	Max.	.010	.010	.010
	Rework	.015	.015	.015
Camshaft to Cam Axle	Min.	.0015	.0015	.0015
	Max.	.0035	.0035	.0035
	Rework	.0055	.0055	.0055
Connecting Rod to Wrist Pin	Min.	.0004	.0004	.0004
	Max.	.0011	.0011	.0011
	Rework	.002	.002	.002
Valve Clearance—Intake	Min.	.010	.010	.010
	Max.	.012	.012	.012
	Rework	±.002	±.002	±.002
Valve Clearance—Exhaust	Min.	.010	.010	.010
	Max.	.012	.012	.012
	Rework	±.002	±.002	±.002
Valve Seat Width	Min.	.030	.030	.030
	Max.	.045	.045	.045
	Rework	.060	.060	.060
Valve Stem to Valve Guide	Min.	.002	.002	.002
	Max.	.004	.004	.004
	Rework	.006	.006	.006
Valve Seat Angle		43½° to 44½°	43½° to 44½°	43½° to 44½°
Piston Skirt Clearance (Thrust Side)	Min.	.007	.0065	.005
	Max.	.009	.0085	.007
	Rework	.010	.010	.0085
Piston Top Land Clearance	Min.	.0098	.0095	.008
	Max.	.0132	.0131	.0116
	Rework	.014	.014	.013
Ring End Gap	Min.	.007	.010	.010
	Max.	.017	.020	.020
	Rework	.025	.028	.028
Ring to Ring Groove	Min.	.0025	.0025	.0025
	Max.	.005	.005	.005
	Rework	.0065	.0065	.0065
Breaker Points Setting	Min.	.028	.028	.028
	Max.	.030	.030	.030
Spark Plug Gap	Min.	.025	.025	.025
	Max.	.028	.028	.028
Air Gap	Min.	.012	.012	.012
	Max.	.020	.020	.020
Ignition Timing	Retarded	1° to 3° BTC	1° to 3° BTC	1° to 3° BTC
	Advanced	19° to 21° BTC	19° to 21° BTC	19° to 21° BTC

CLINTON ENGINES

TORQUE DATA

"RED HORSE"

	1600	2500	A-2500
Back Plate to Block	80" lb.	80" lb.	80" lb.
Base Bolts	150" lb.	150" lb.	150" lb.
Bearing Plate P.T.O.	160 180" lb.	160 180" lb.	160 180" lb.
Blower Housing	65 70" lb.	65 70" lb.	65 70" lb.
Carburetor to Manifold	60 65" lb.	60 65" lb.	60 65" lb.
Manifold to Block	60 65" lb.	60 65" lb.	60 65" lb.
Connecting Rod	130 140" lb.	130 140" lb.	130 140" lb.
Flywheel	100 Ft. lb. 120 Ft. lb.	100 Ft. lb. 120 Ft. lb.	100 Ft. lb. 120 Ft. lb.
Head Bolts	200 220" lb.	200 220" lb.	200 220" lb.
Stator Plate	80 100" lb.	80 100" lb.	80 100" lb.
Spark Plug*	250 275" lb.	250 275" lb.	250 275" lb.
Speed Reducer Mounting	110 150" lb.	110 150" lb.	100 150" lb.

NOTE: All Torque **EXCEPT** Flywheel is Shown in Inch Pounds. Flywheel is Given in Foot Pounds.

*Use Graphite on Threads When Replacing Spark Plug.