# MAINTENANCE MANUAL AND OVERHAUL INSTRUCTIONS

PRECISION BUILT
CLINTON
ENGINE
CLINTON
MACHINE CO.
MAQUOKETA
IOWA
U.S.A.

**THE CLINTON MACHINE COMPANY**

**Service Division**

**MAQUOKETA, IOWA., U. S. A.**

# MANUAL OF MAINTENANCE AND OVERHAUL INSTRUCTIONS

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### WARRANTY

The Clinton Machine Company of Clinton, Michigan, U.S.A., warrants each new engine manufactured by us against defects in material and workmanship under normal use and service, our obligation under this warranty being limited to make good at our factory, or authorized service stations, any part or parts thereof, which shall within ninety days after delivery of such engine to the original purchaser be returned to us, or authorized service station, with transportation charges prepaid, and which our examination shall disclose to our own satisfaction to have been thus effective; 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 station, to assume for us any other liability in connection with the sale of our engine.

This warranty shall not apply to any engine which shall have been repaired or altered outside of our own factory or authorized service station, in any way so as, in our judgment, to effect its stability or reliability, nor which has been subject to misuse, negligence, or accident, nor to any engine made by us which does not have a governor, or, shall have been operated at a speed, or loaded beyond the factory rated load 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 its product without imposing any obligation upon itself to install the same upon its product theretofore manufactured.

**THE CLINTON MACHINE COMPANY**
**Service Division . . . Maquoketa, Iowa**

# INTRODUCTION

This Manual of Maintenance and Overhaul Instructions is designed to furnish Clinton dealers and service stations with factory-approved instructions, specifications, and general data for properly repairing and overhauling Clinton engines, and should be preserved for ready reference at all times. It would be almost impossible to furnish an instruction book with step-by-step procedures for disassembling, re-assembling, and completely rebuilding all types of engines built by the Clinton Machine Company. Such a book would be beyond the bounds of practicability. However, in this manual an attempt has been made to supplement the knowledge of service station engine mechanics by providing them with typical engine variations, correct tolerances, and detailed instructions for reboring cylinders, replacing piston rings, replacing crankshaft bearings, and other important operations.

All Clinton products have been skillfully engineered, precision built, and carefully inspected by men who are devoting their lives to the production of fine engines. It is the intention of the factory to build the finest engines of this type that money can buy, and for this reason the Company is desirous of assuring its customers of a convenient source for expert repair service. Because of the many Clinton engines now in service, Clinton dealers and service shops are provided with the opportunity of building up an attractive and profitable service business. This can be accomplished if the following conditions are strictly adhered to: (1) use of genuine factory-approved parts, (2) use of proper equipment and tools, (3) expert service on the part of the operator, and (4) advice to the owner on proper use of his engine.

There are six distinct series of engines, rated from 1 hp to 3 hp, and there are two separate models in each series. In addition, each individual engine can be equipped with one or more of certain special accessories used for adapting the engine to specific applications. Some of these accessories are: reduction gear attachments, special length crankshafts, a kick starter, and special control cables. A few of these accessories must be built into the engine at the factory, but most of them can be installed on engines already in use. These features provide wide-awake dealers with an additional source of revenue because new-engine users frequently find it necessary to adapt an engine from one specific function to another.

Clinton engineers are constantly endeavoring to improve their products, and when new designs are created, they are incorporated in production at once instead of waiting for specific yearly model changes. For this reason, many later parts can be used to service engines already in the field, and the factory suggests that the dealers stock latest equipment to replace superseded equipment when reordering parts. If dealers keep a constant check of their stocks of parts, the volume of parts can be maintained at a minimum provided latest parts are ordered. The factory has endeavored to keep the dealers supplied with all changes by revising parts catalog pages.

It is the policy of the factory to keep the dealers constantly supplied periodically with service bulletins indicating the addition of new engines plus changes in equipment already in the field. These service bulletins should be filed for ready reference at all times.



*Printed in the United States of America*

DIVISION A

# ENGINE FEATURES AND IDENTIFICATION

## ENGINE FEATURES

Each Clinton engine is a four-cycle, single-cylinder, internal combustion type, designed to operate on regular gasoline. (Some special models are designed for kerosene or No. 1 fuel oil and may be identified by the letter "L" preceding the Model No.) Because the engines have been designed by some of the most skilled engineers, and because they have been carefully built in a modern factory—they contain many features not found in other small engines at any price. A few of the features built into these engines are stated in subsequent paragraphs.

1. Each engine is of the "L" head type with a Ricardo-type combustion chamber which is without equal for power and efficiency. This is the same type of cylinder head and combustion chamber employed in many of the world's finest automobiles.

2. The cylinder block is a fine-grained, gray iron casting with numerous cooling fins cast integrally with the block. The cylinder head is an aluminum alloy casting with cooling fins arranged for maximum cooling. All cylinder blocks are produced in the Clinton factory, which has been equipped with the latest temperature controls for producing fine-quality castings.

3. Mounted on the face of the cylinder block at the flywheel end of the crankshaft is a heavy-duty, die-cast, bearing plate which supports the flywheel-end main bearing and magneto.

4. The crankshaft is a heat-treated steel forging having large, highly-polished bearing journals and integral counterweights. A special aluminum alloy is used to forge the "I" beam type connecting rod, and the same alloy is used for the piston.

5. Both cams and cam gear are machined on an integral, gray iron casting with a bore through the center which rides on a polished steel shaft anchored at both sides of the engine block. Series 300 engines have a separate gear for each cam.

6. Splash type lubrication is employed for adequate lubrication of all moving parts. Some vertical shaft engines have an oil impeller to provide oil circulation.

7. The piston is equipped with three rings—two compression rings and one oil control ring—in order to guarantee a perfect cylinder seal with minimum oil consumption.

8. Cooling is accomplished by an air blast forcefully created by rotation of the finned flywheel. This air blast is directed over the finned cylinder block and cylinder head by an efficiently contoured blower housing. The new Phelon magneto supplies ignition for all Clinton engines. This magneto features a pivot type breaker assembly which, as a special protection against dust, is enclosed in a plastic cover. Many older engines which were equipped with Scintilla magnetos are in the field.

9. Carburetion in all Clinton engines incorporates equipment of the latest design. Some engines are equipped with Carter standard-float type carburetors, and other engines are equipped with a suction-type carburetor. Many engines still in use were equipped with Tillotson and Zenith carburetors.

10. Vis-O-Bath air filters are used as standard equipment on all Clinton engines. This type of filter is exceptionally efficient in removing dust particles from the air which is taken into the carburetor. This feature lengthens engine life materially. Some engines in use are equipped with different types of air filters, many of which can be replaced with the Vis-O-Bath type.

11. Clinton 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. Extra strong, no-jam type kick starter, 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. A revolving screen attached to the fly-wheel, covering the air intake opening. This screen prevents foreign material from becoming lodged in the cooling passages.

## IDENTIFICATION

When a Clinton engine is received at a dealer service station for repairs, it should be identified as to type, size, application and year made. Much of this information can be obtained from the name plate, and if possible to talk to the owner directly, he can supply information regarding its use. The accumulation of foreign material on an engine provides one of the most accurate methods of determining what the engine has been used for. The accompanying illustrations show the major types of engines and illustrate their principal characteristics, such as types of carburetors, air filters, and other equipment.

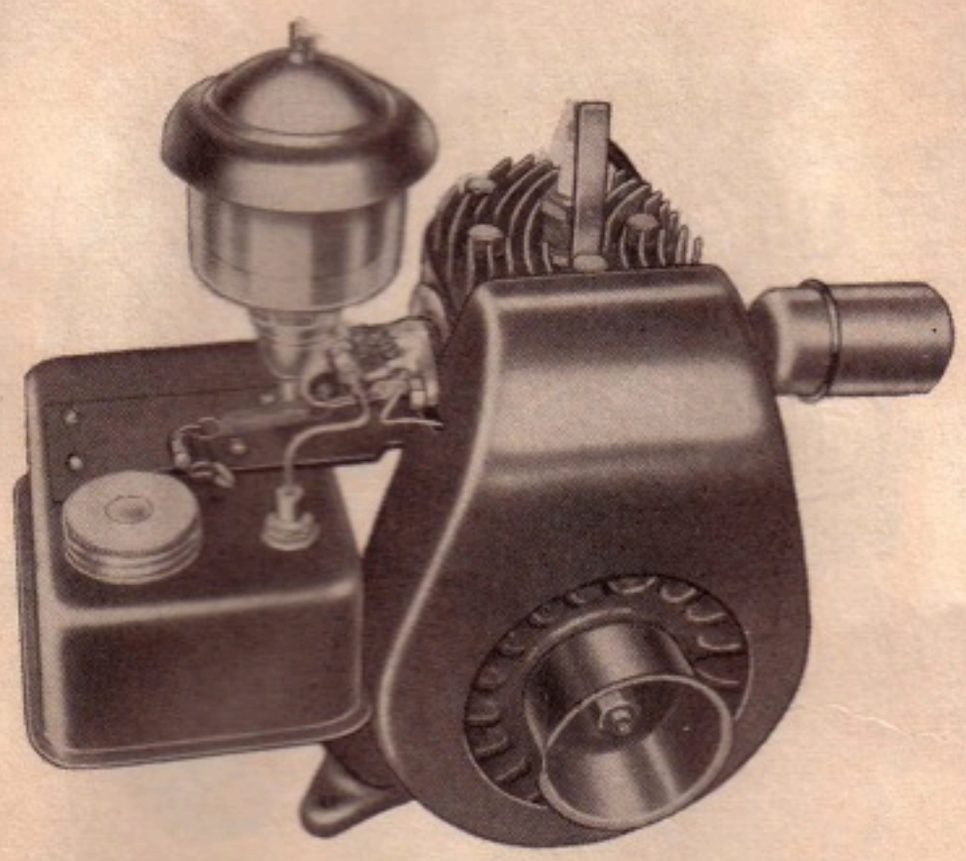

Figure A-1. Series 300 Engine Equipped With Bracket Mounted Fuel Tank, Early Model Suction-Type Carburetor, Downdraft Vis-O-Bath Air Filter, and Air Vane Governor

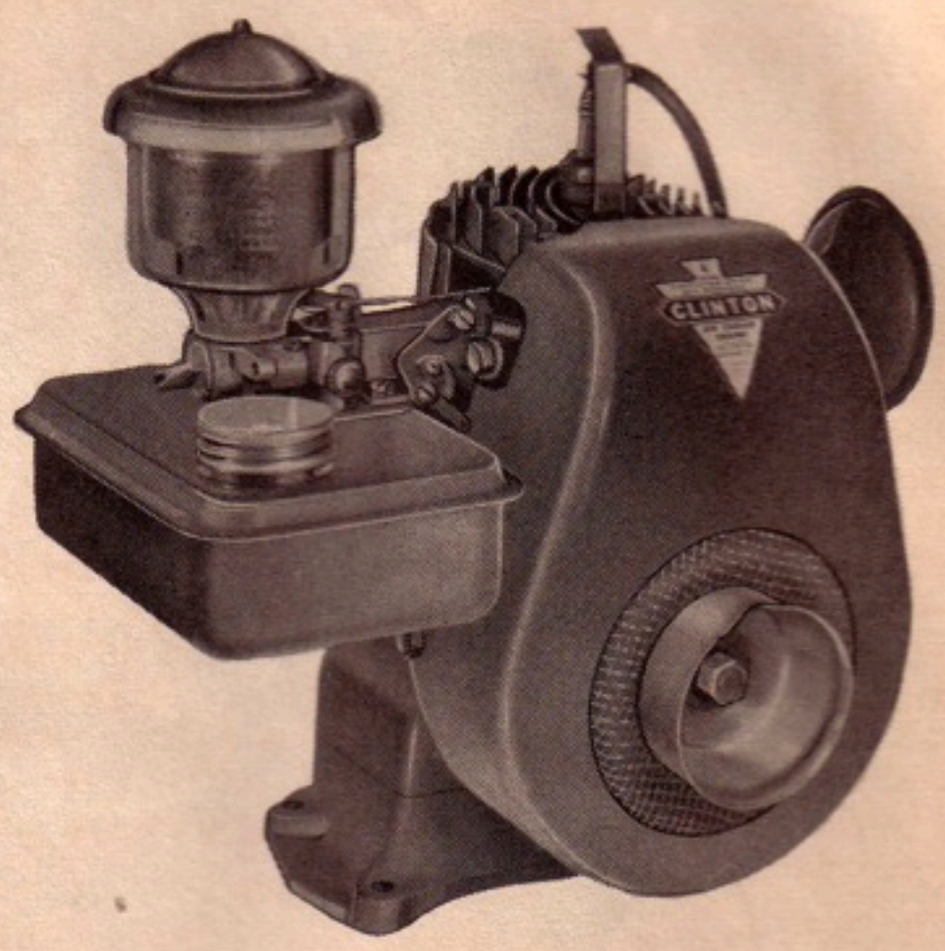


Figure A-2. Series 300-350 Engine Equipped with Late Model Suction-Type Carburetor Mounted Directly on Fuel Tank, Vis-O-Bath Downdraft Air Filter, and Air Vane Governor

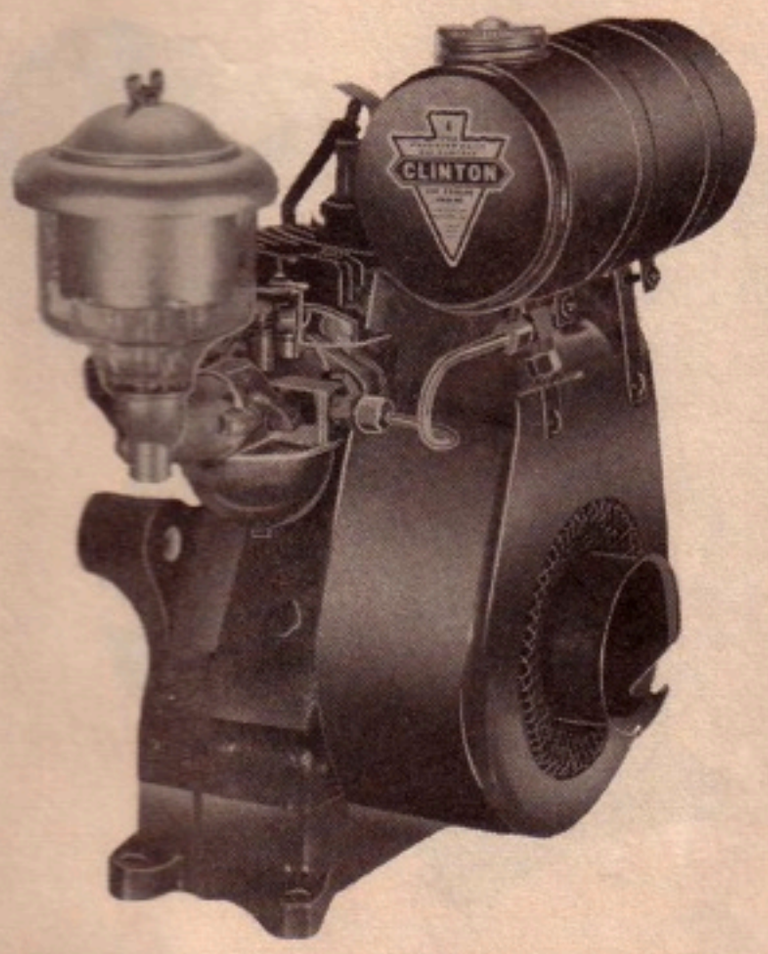


Figure A-3. Series A-300 Engine Equipped With Carter Carburetor, One Quart Fuel Tank and Air Vane Governor

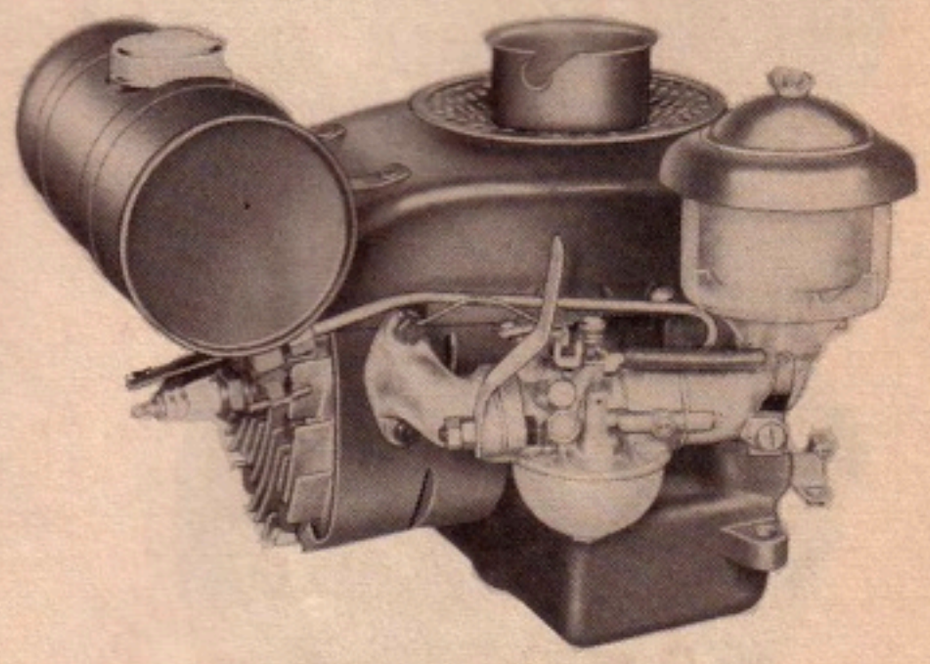

Figure A-4. Series VS-300 Engine Equipped With Carter Carburetor, Vis-O-Bath Downdraft Air Filter, and Air Vane Governor

# CLINTON Engines

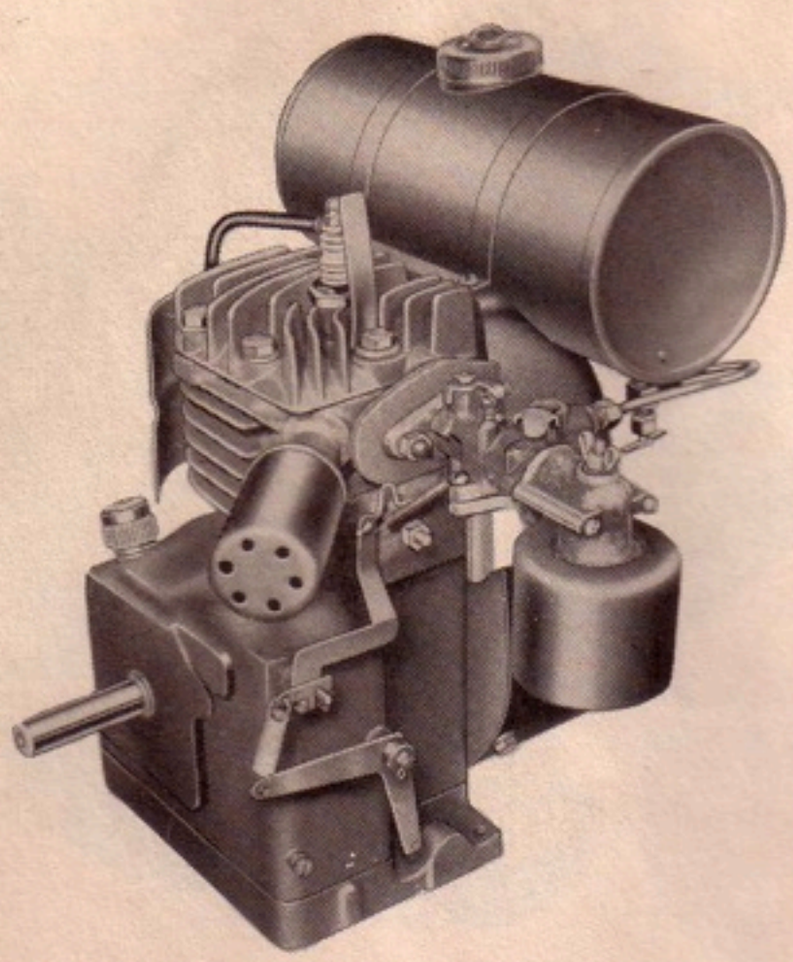

Figure A-5. Series 500 Engine Equipped With Zenith Carburetor, Large Fuel Tank, Fuel Shut-Off Valve at Tank, Flyball Governor, and Ribbon-Type Air Filter

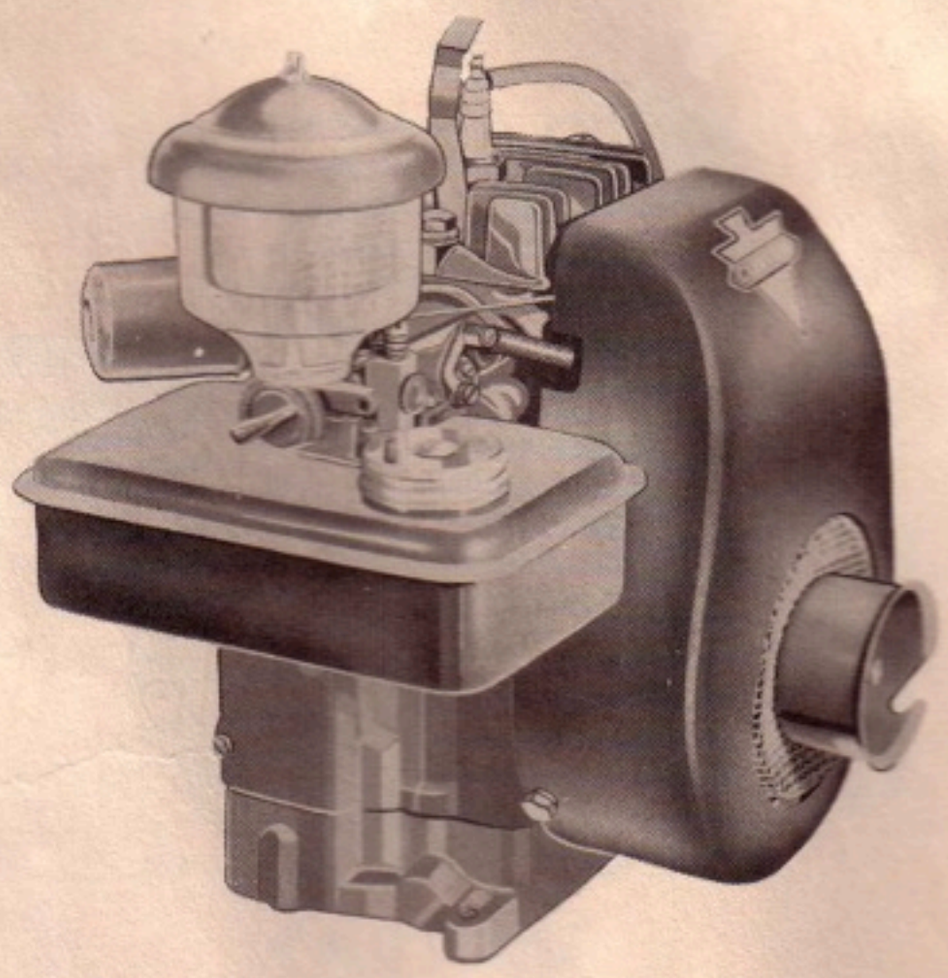

Figure A-6. Series 650 Engine Equipped With Suction Carburetor, One Quart Fuel Tank, Vis-O-Bath Air Filter, and Air Vane Governor

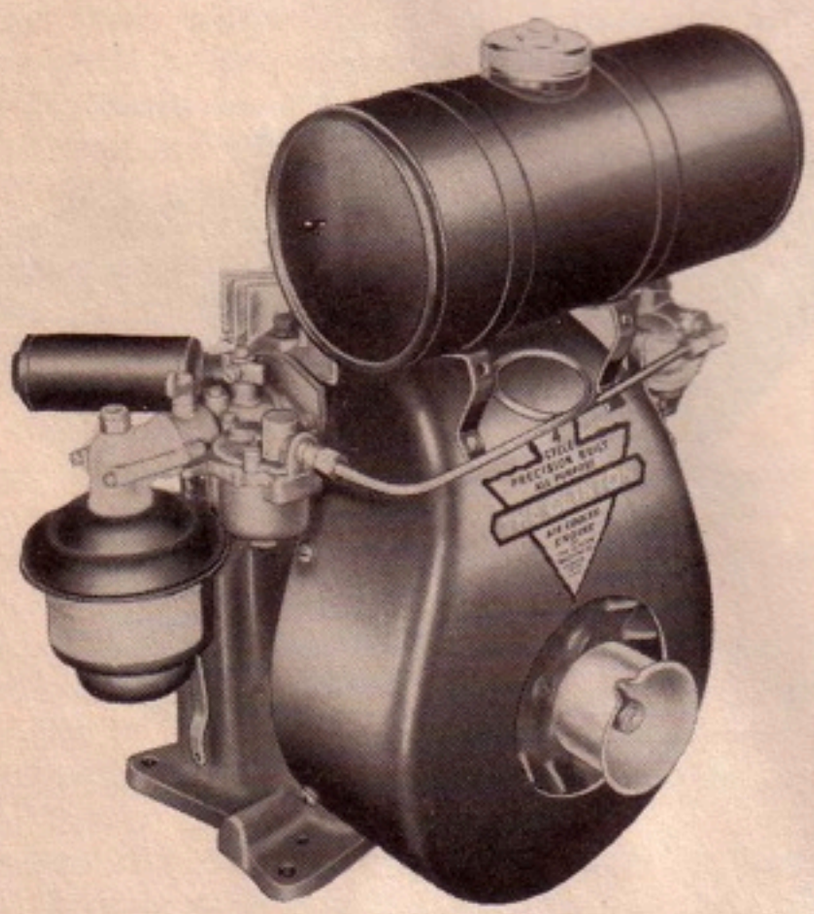

Figure A-7. Series 700 Engine Equipped With Tillotson Carburetor, Updraft Metal Oil Bath Air Filter, and Fuel Filter Mounted on Tank

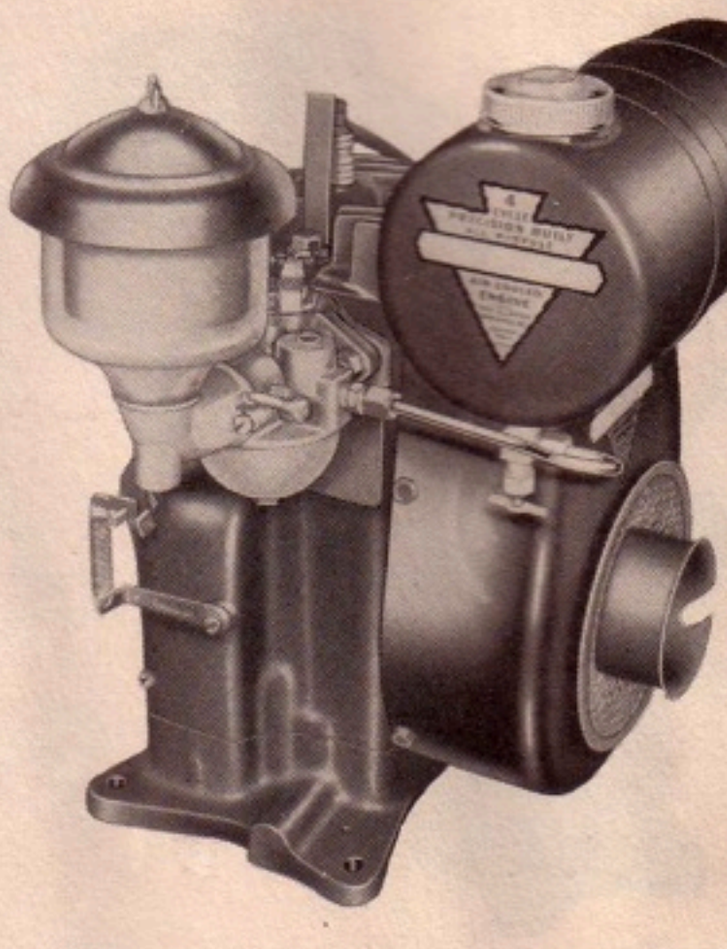

Figure A-8. Series B-700 Engine Equipped With Carter Carburetor, Vis-O-Bath Downdraft Air Filter, and Flyball Governor

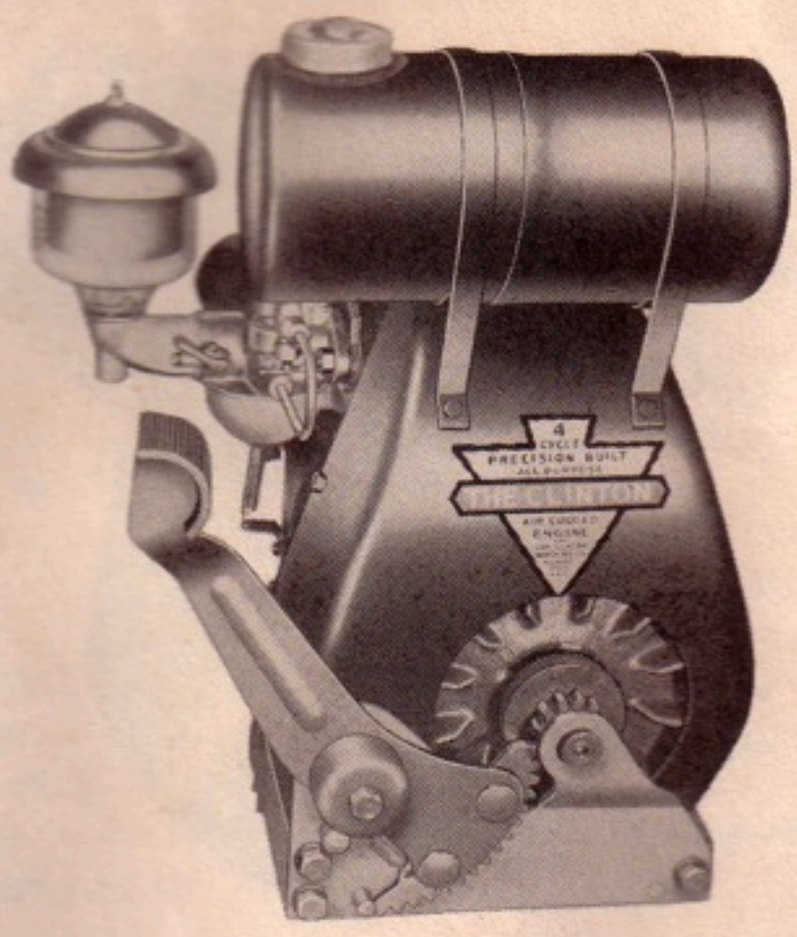

Figure A-9. Series B-700 Engine Equipped With Late Model Kick Starter, Carter Carburetor, Vis-O-Bath Downdraft Air Filter, and Flyball Governor

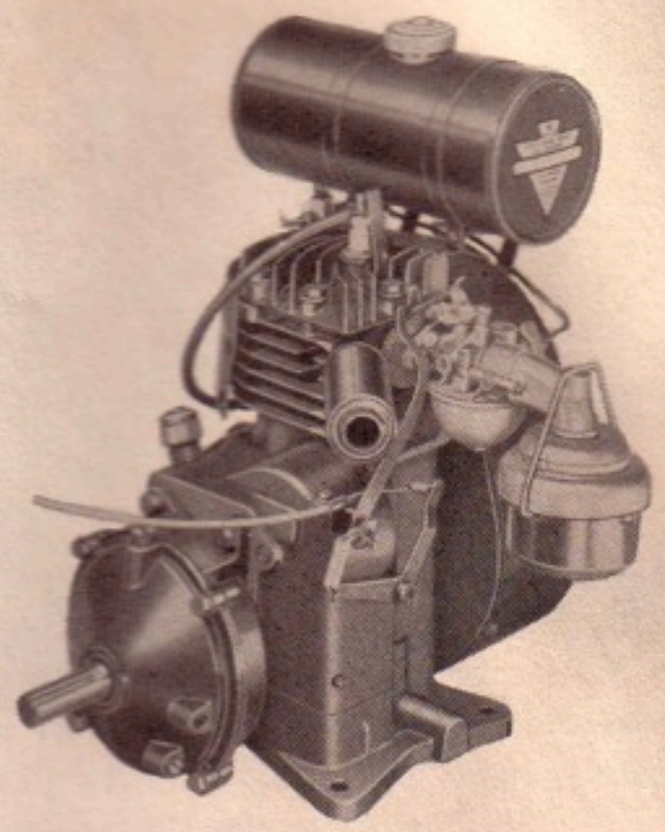

Figure A-10. Series 700 Engine Equipped With Carter Carburetor, Updraft Air Cleaner, Flyball Governor and Gear Reducer

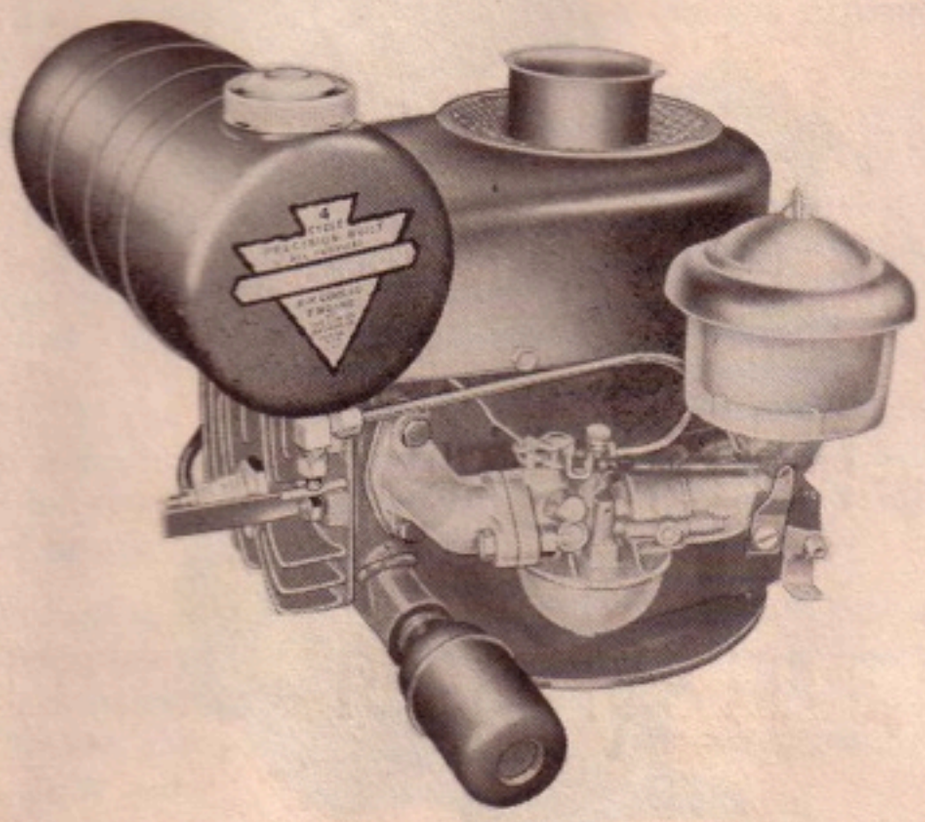

Figure A-11. Series VS-700 Engine Equipped With Carter Carburetor, Vis-O-Bath Downdraft Air Filter, and Air Vane Governor

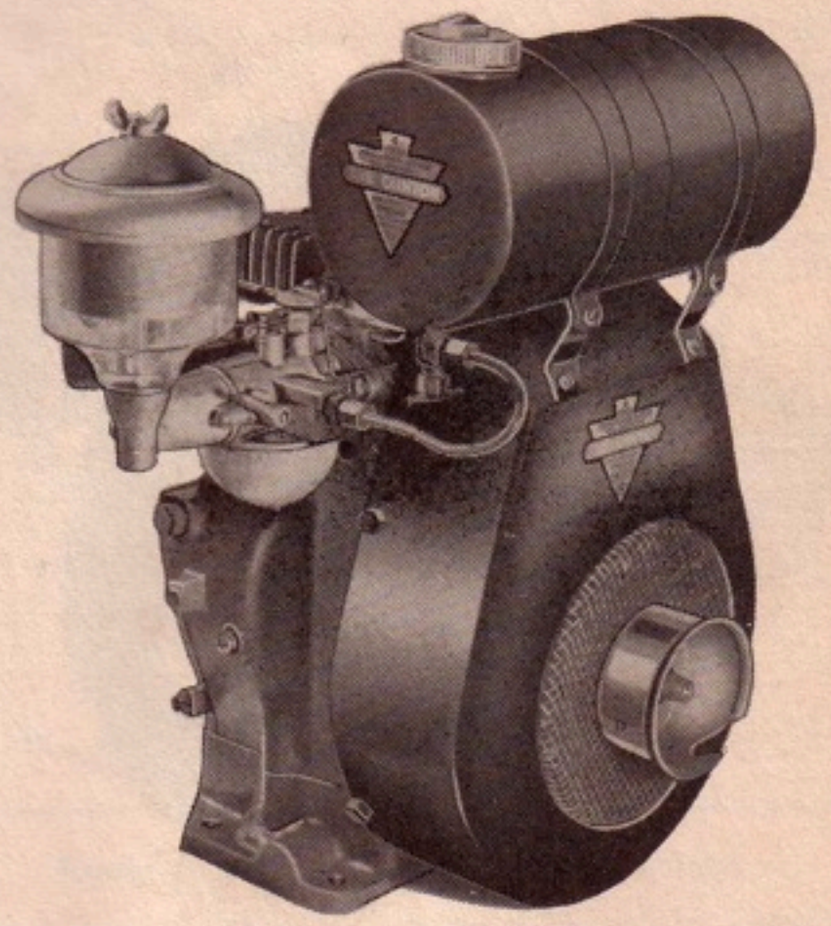

Figure A-12. Series 800 Engine Equipped With Carter Carburetor, Two Quart Round Fuel Tank, Vis-O-Bath Air Filter, and Air Vane Governor

# CLINTON Engines

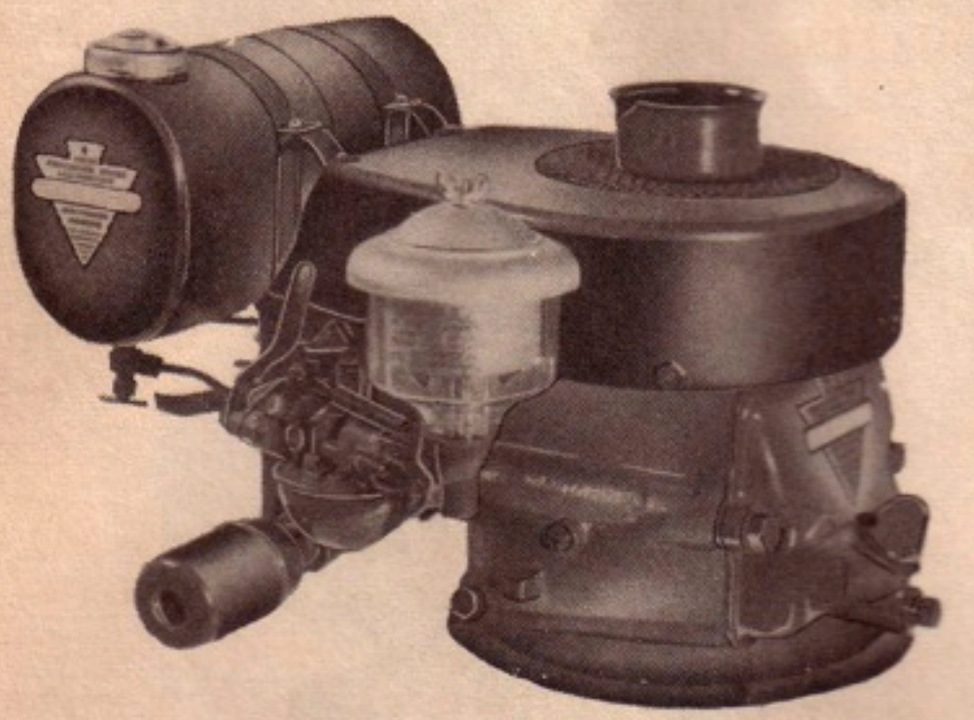

Figure A-13. Series VS-800 Engine Equipped With Carter Carburetor, Three Quart Oval Fuel Tank, Vis-O-Bath Air Filter, and Air Vane Governor

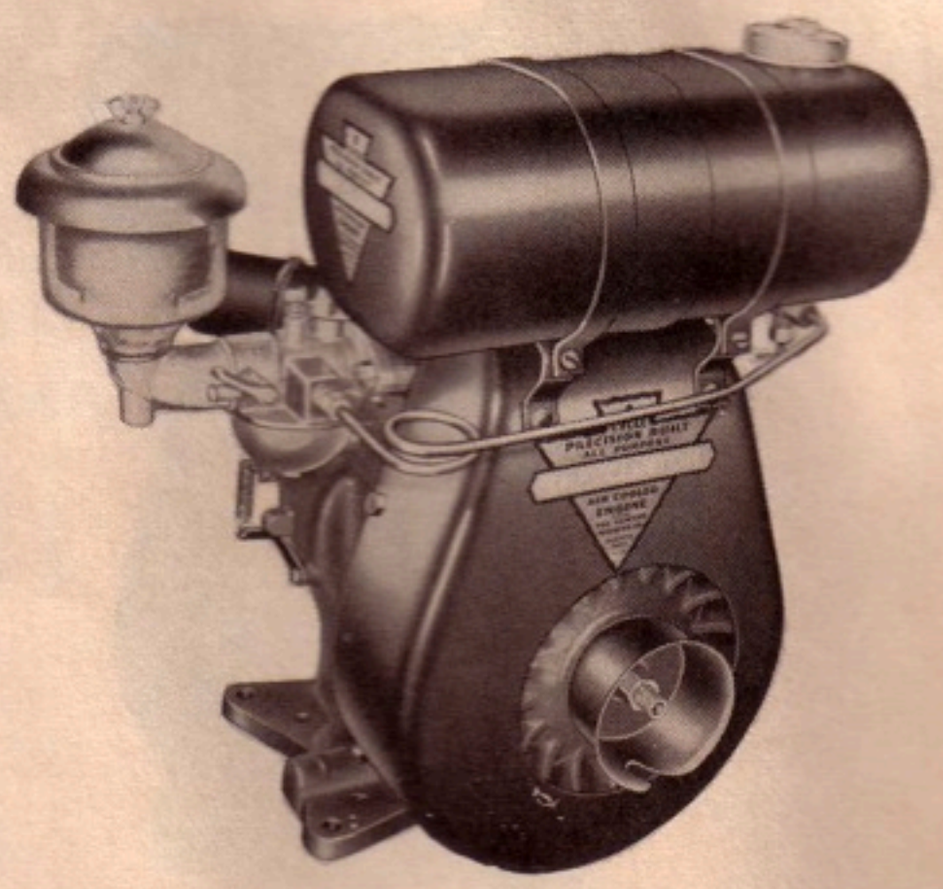

Figure A-14. Series C-1100 Engine Equipped With Oval Fuel Tank Mounted at Top, Carter Carburetor, Vis-O-Bath Downdraft Air Filter, and Flyball Governor

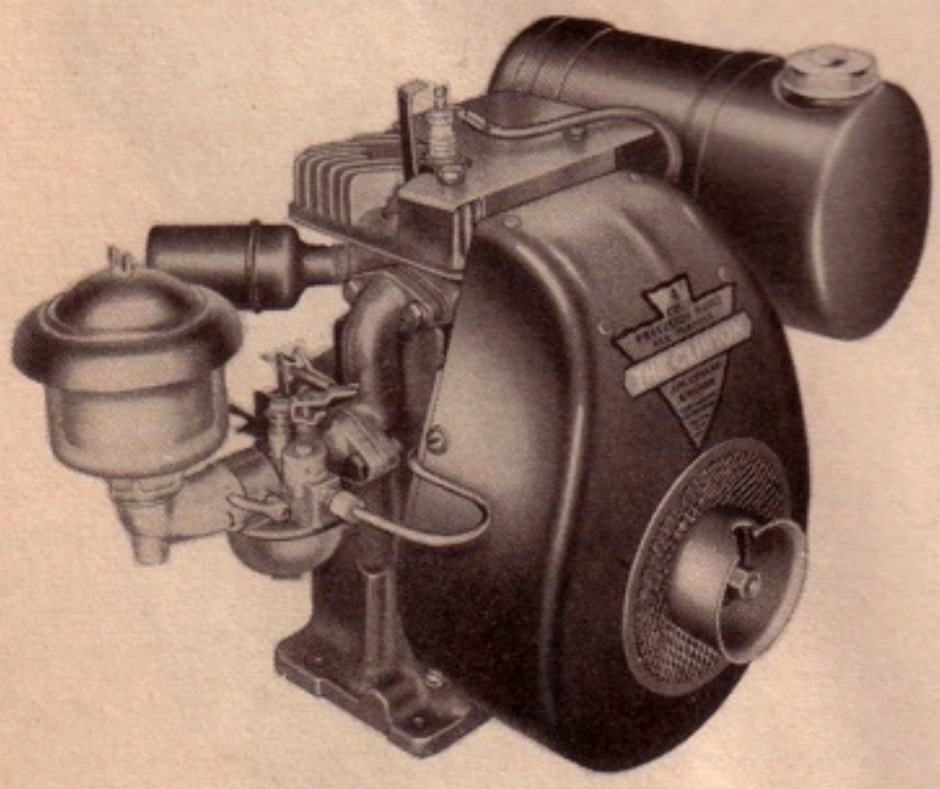

Figure A-15. Series C-1100 Engine Equipped With Side Mounted Oval Fuel Tank, Carter Carburetor, Vis-O-Bath Downdraft Filter, and Flyball Governor

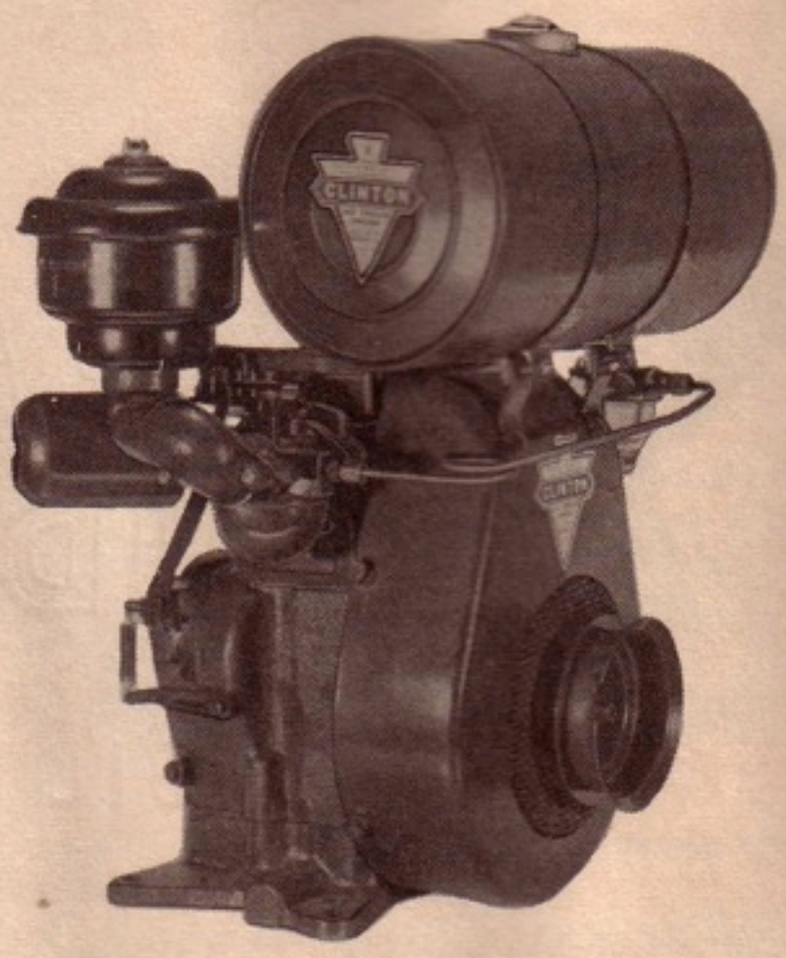

Figure A-16. Series D-1100 Engine Equipped With Carter Carburetor, Five Quart Fuel Tank, Large Oil-Bath Air Filter, Heavy Duty Ball Bearings on Crankshaft, and Flyball Governor

**BASIC MODELS:**

| *Engine Series* | *Production Originated* | *Special Variations* |
|---|---|---|
| 300 | 9- 1-49 | ¾-1.1HP w/suction carb. |
| A300 | 9- 1-49 | ¾-1.3HP w/Carter carb. |
| VS-300 | 3- 1-50 | ¾-1.3HP VS w/Carter carb. |
| 500 | 9- 1-48 | 1¼HP w/Phelon Magneto |
| to | 5- 1-49 | |
| 650 | 10- 1-50 | 1.6HP w/Phelon Magneto |
| 700-A | 3-11-46 | 1½-2HP w/Scintilla Mag. |
| to | 5- 1-49 | |
| B-700 | 5- 1-49 | 1½-2HP w/Phelon Magneto |
| VS-700 | 5- 1-49 | 1½-2HP VS w/Carter Carb. |
| 800 | 1-15-52 | 2½HP w/Phelon Magneto |
| VS-800 | 1-15-52 | 2½HP w/Phelon Magneto |
| B-1100 | 1947 | 2½-3HP w/Scintilla Mag. |
| to | 11- 1-49 | |
| C-1100 | 11- 1-49 | 2½-3HP w/Phelon Magneto |
| D-1100 | 1-15-52 | 3HP w/Phelon Magneto |

MANY OF THE OLDER ENGINES CAN BE IMPROVED BY THE INSTALLATION OF LATER EQUIPMENT, AS A LATE MODEL CARBURETOR HAS THE SAME SIZE MOUNTING FLANGE AS AN EARLIER UNIT. SHOULD THE CARBURETOR NEED TO BE REPLACED, IT IS ADVISABLE TO INSTALL A CARBURETOR USED ON CURRENT PRODUCTION. THIS IS ALSO TRUE OF AIR FILTERS, CONTROLS, AND CERTAIN PARTS WHICH SOME ENGINES ARE EQUIPPED WITH AT THE FACTORY, BUT WHICH MAY BE USED AS ACCESSORIES ON ENGINES NOT SO EQUIPPED.

When installing new units and parts on an old engine, consideration must be given to the position in which the engine is to be mounted on the equipment it operates in order to prevent interference with any other portion of the equipment. When ordering parts, always refer to the parts catalog.



DIVISION B

# OPERATION AND GENERAL MAINTENANCE

## OPERATING INSTRUCTIONS

PREPARATION FOR STARTING. The following steps should be taken prior to starting a new engine.

(1) Fill the crankcase with oil to the correct level. If the engine has a horizontal crankshaft, add oil until the level is up to the "FULL" mark on the dipstick. (See figure B-1.)

WHEN MEASURING THE OIL LEVEL, BE SURE TO ROTATE THE FILLER PLUG ALL THE WAY IN (Clockwise), OTHERWISE THE READING ON THE DIPSTICK WILL NOT BE ACCURATE. MAKE SURE THE ENGINE IS IN A LEVEL POSITION WHEN CHECKING THE OIL.

(2) If the engine has a vertical crankshaft, the oil level is determined by looking into the filler plug hole. The oil level should be maintained at the mark indicated on the face of the end housing.

(3) Always use a premium-grade engine oil. At temperatures above freezing (32°F), use SAE No. 30 oil. At temperatures below freezing, use SAE No. 20 oil. When the temperature drops below zero, use SAE No. 10W oil.

(4) If the engine is equipped with a reduction gear unit, check the oil in the unit by removing the oil level plug in the gear case. (See figure B-2.) The correct oil level for the different gear reductions is indicated on the housing. If the oil is not up to correct level, remove the vented filler plug at the top of the housing and add engine oil, SAE No. 30, through the vented filler plug hole until the oil begins to run out of the oil level plug opening. Replace both plugs. Do not overfill the reduction gear unit, as this will cause overheating of the unit and result in loss of power.

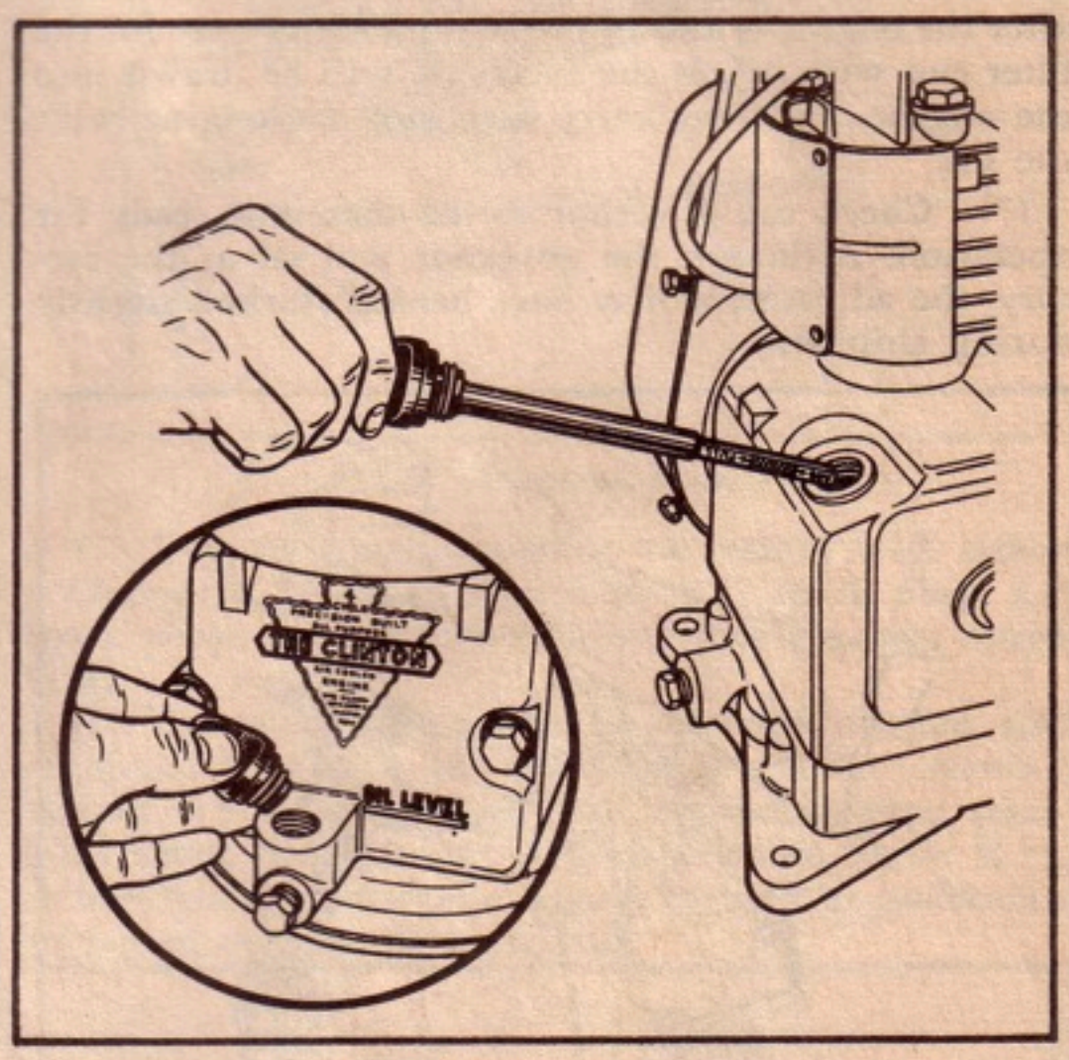


Figure B-1. Checking Oil in Crankcase

MAKE CERTAIN THE HOLE IN THE VENTED FILLER PLUG IS NOT OBSTRUCTED.

(5) Fill the fuel tank with any regular-grade, commercial gasoline. Open the fuel shut-off valve located under the fuel filter. (This does not apply to engines equipped with a suction-type carburetor, as they are not equipped with a shut-off valve.)

(6) The oil level is indicated by a line on the bowl of the Vis-O-Bath filter. Use SAE 50 oil or SAE 30 when heavier oil is not available. When the engine is

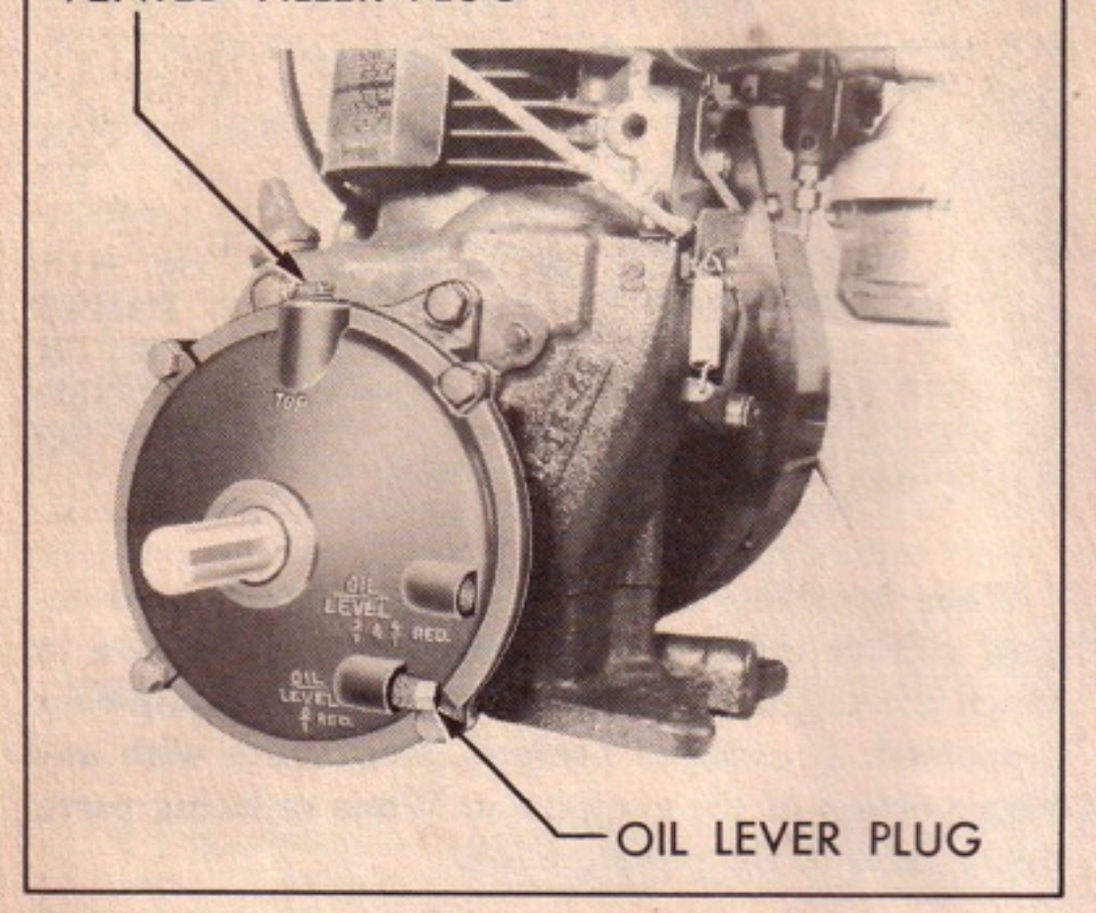


Figure B-2. Checking Oil Level in Reduction Gear Unit

operating, 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 over fill the filter cup with oil, as the excess oil will be drawn into the engine, and may carry dirt into the engine with the oil.

(7) Check the governor to see that it is ready for operation. Although the governor was set at the factory, the adjustment may have been disturbed slightly during shipment.

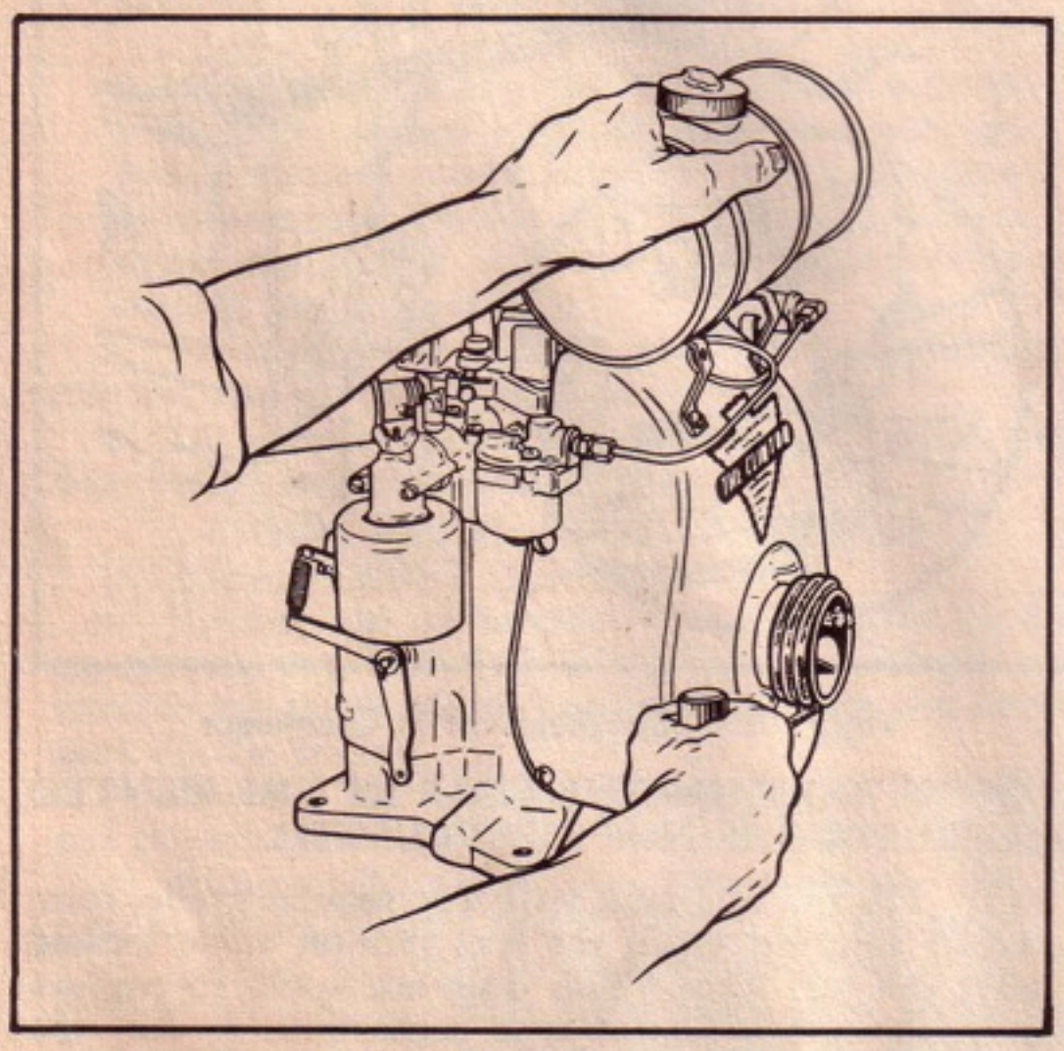

Figure B-3. Rope Starting

STARTING. The following instructions for choking the engine should be regarded only as approximate, because more or less choking than specified may be required, depending upon atmospheric conditions, fuel used, and condition of the engine. After starting the engine a few times, the operator will become acquainted with the best choking procedure for his particular engine.

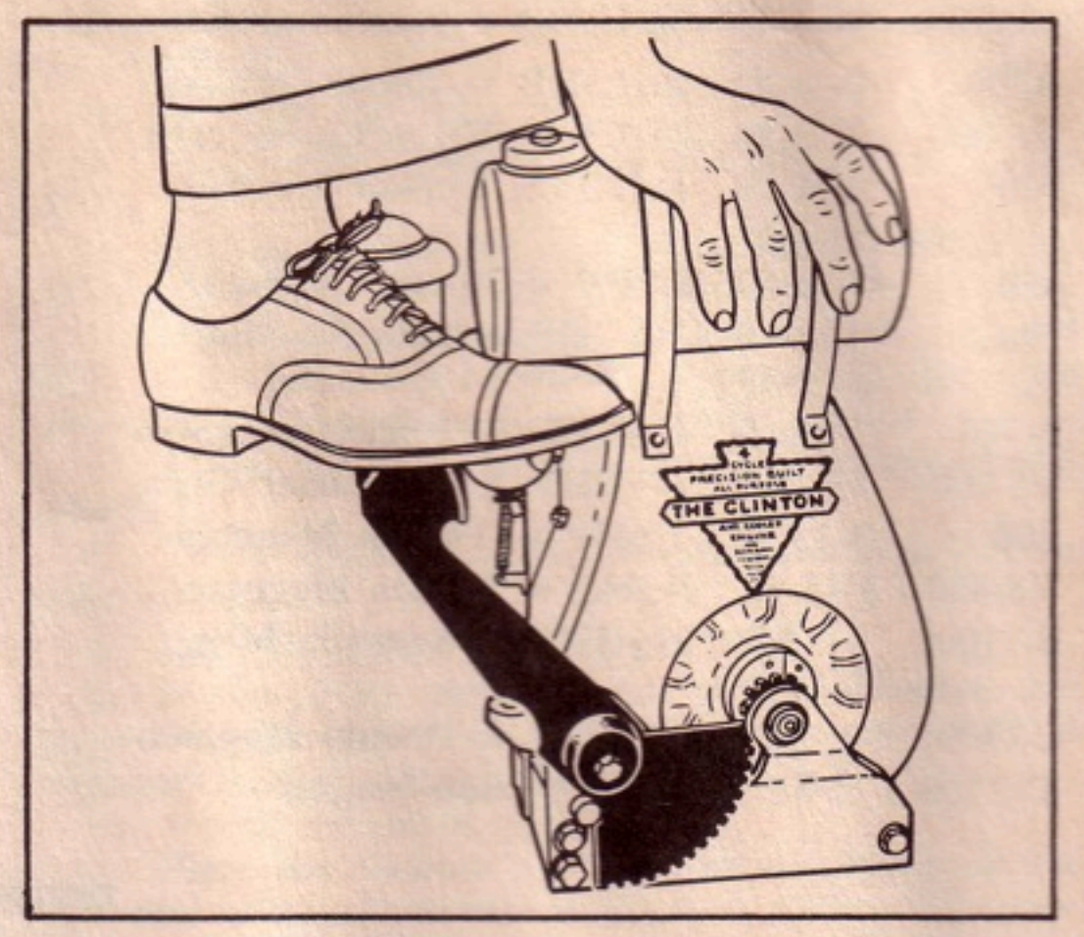


Figure B-4. Kick Starting

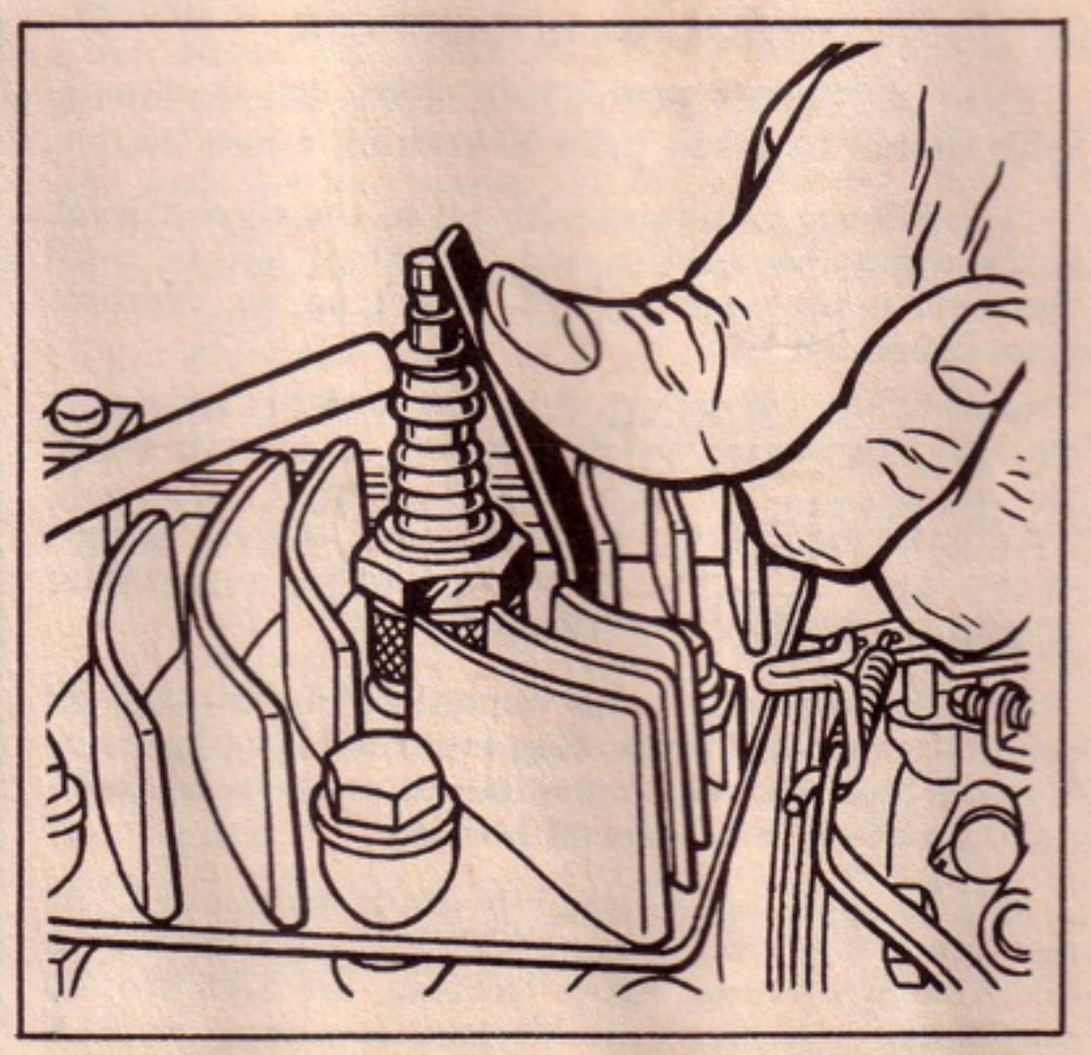

Figure B-5. Stopping the Engine

## CAUTION

When cranking an engine with a rope starter, give the rope a quick but steady pull in order to prevent any possibility of fouling the rope on the engine in case of a kickback. (See figure B-3.) 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. This method will eliminate any personal injury that might result from kickback. (See figure B-4.)

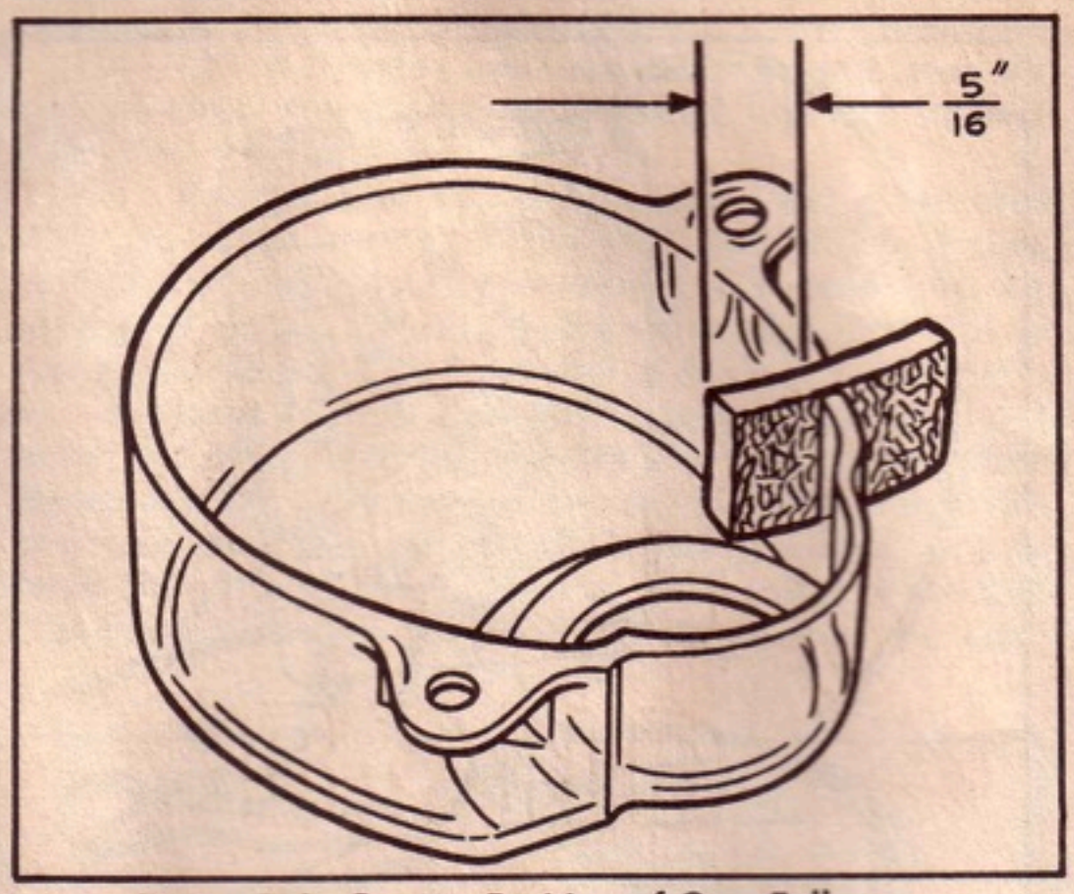


Figure B-6. Correct Position of Cam Follower Lubrication Felt in Dust Cover

(1) Close the choke by rotating the choke lever to the position marked "CLOSED," and while holding the lever in this position, crank the engine through two to four revolutions of the crankshaft.

(2) Should the engine fail to start after this operation, open the choke half way and repeat the cranking operation. As soon as the engine has started, move the choke back to the full open position, as rapidly as the engine will permit without stalling.

DO NOT USE THE CHOKE WHEN STARTING A HOT ENGINE.

(3) When starting an engine which is partially warm, crank it with the choke partially open. If the engine fails to start after two cranking cycles, close the choke approximately half way and repeat the cranking process.

STOPPING. The engine can be stopped by pressing the shorting clip firmly against the top of the spark plug. Hold the shorting clip in this position until the engine comes to a complete stop. If the shorting clip is released while the engine is still rotating, it will start again. (See figure B-5.)

## MAINTENANCE AND ADJUSTMENTS

*Lubrication*

(1) Drain the oil and refill with new oil after 20 hours of normal engine operation. If the engine is operating under dusty conditions, the oil should be drained and refilled after 10 hours of operation, or when the oil 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, as a substitute), and position it in accordance with Figure B-6.

## IGNITION SYSTEM — PHELON MAGNETO

All current Clinton engines are equipped with Phelon magnetos but many which were equipped with Scintilla magnetos are in service. A feature of the Phelon-type magneto is an exceptionally efficient ignition coil which is mounted on a soft iron core located within the flywheel flange. A permanently-charged magnet is mounted within, and rotates with, the flywheel. (See figure B-9) 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. A pivot-type breaker plate assembly is employed, and is specially protected against dust by a plastic or metal cover.

## IGNITION SERVICING

### SPARK PLUGS

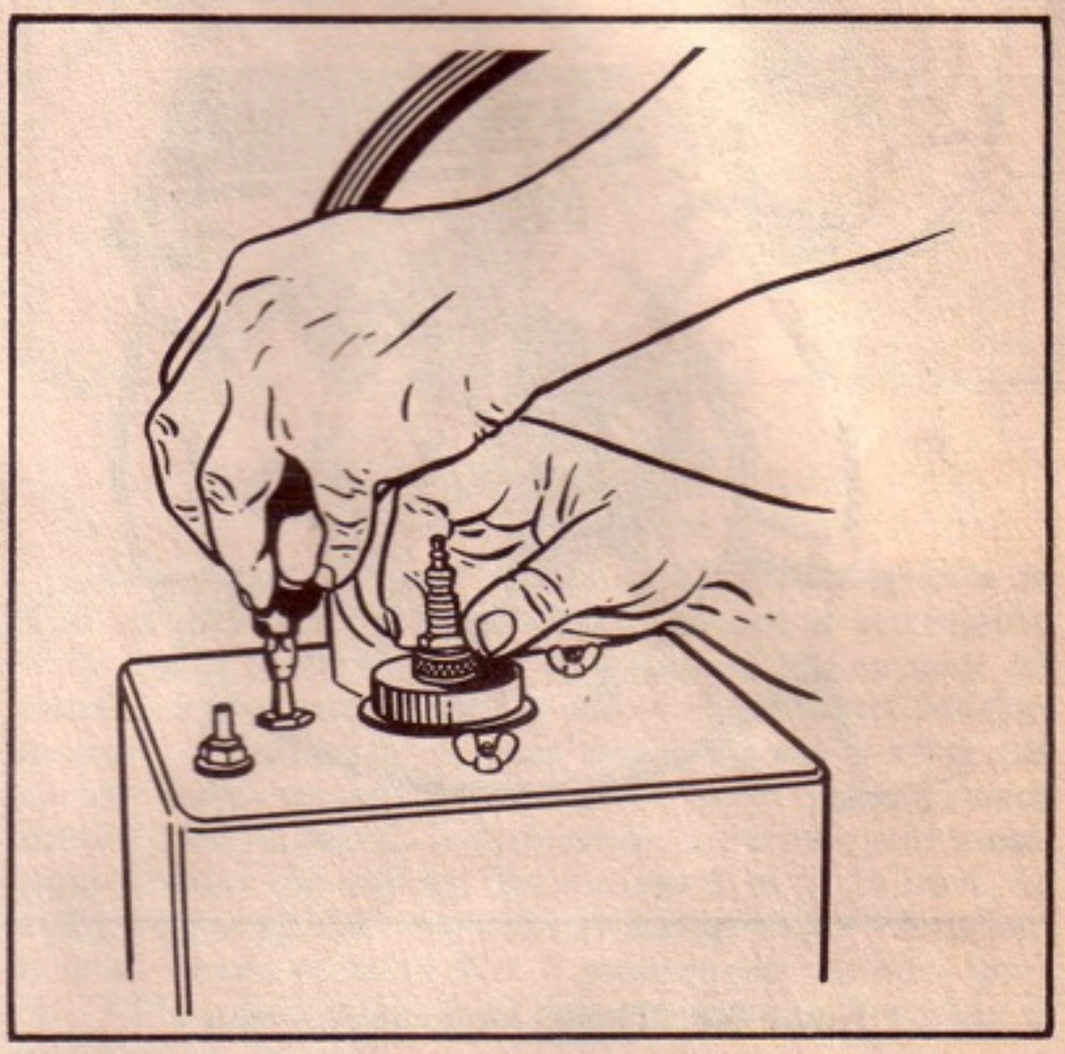

Figure B-7 Cleaning Spark Plug

(1) Engines are equipped at the factory with either a Champion J-8 or an Auto-Lite AN7 spark plug. All spark plugs are regulation 14-mm medium heat range type.

(2) The spark plug should be removed, cleaned, and regapped after each 100 hours of operation. Cleaning should be accomplished with an automotive-type, sand-blast spark plug cleaner if possible. (See figure B-7). A new spark plug should always be used in preference to a plug that has been cleaned.

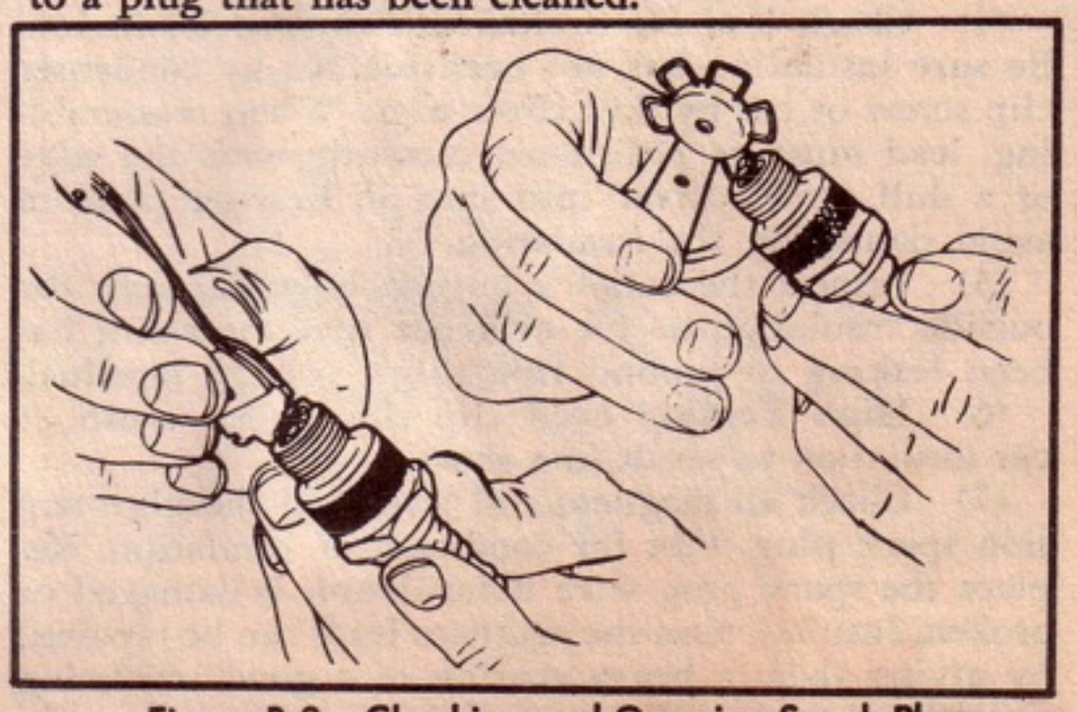

Figure B-8 Checking and Gapping Spark Plug

(3) Regap the spark plug to .025 inch by bending the ground electrode. Do not attempt to bend the center electrode. (See figure B-8).
SINCE THE CYLINDER HEAD IS MADE OF ALUMINUM, SPARK PLUG THREADS SHOULD BE PROTECTED BY COATING THE THREADS SPARINGLY WITH GRAPHITE LUBRICANT OR A SPECIAL ANTISEIZE COMPOUND.

(4) When tightening the spark plug; use just enough pressure to flatten the spark plug gasket.

## CHECKING PHELON MAGNETO

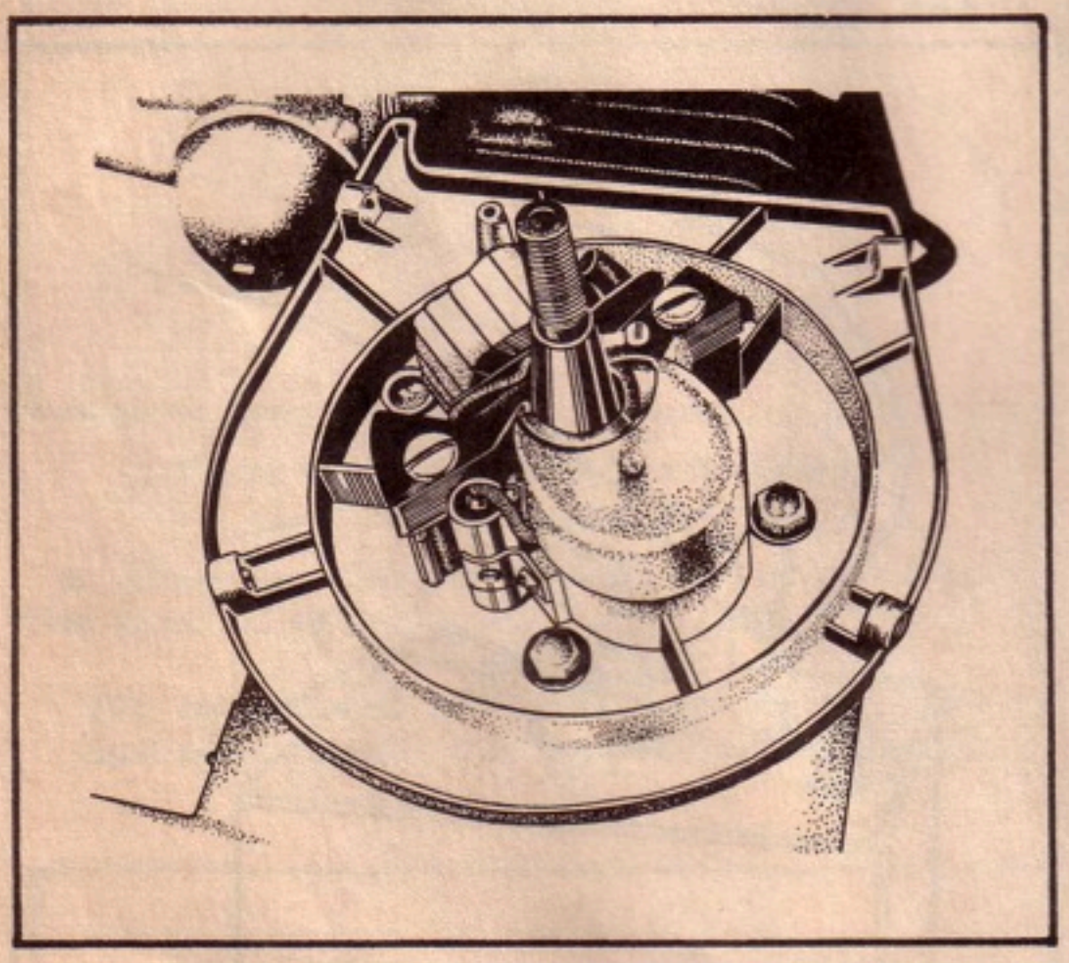

Figure B-9 Phelon Magneto Assembly

(1) Breaker cam should be replaced if rough or showing signs of wear. Check for looseness that may allow cam to rub against dust cover causing Breaker Points to foul from metal dust. (See Fig. B-9)

(2.) Hold down screws are to be tightened whenever the magneto is serviced. Be sure screws are 1" long whenever coil lamination is replaced or removed. Screw part No. 5406.

(3) Condenser capacity—.11 to .13 mfd. Replace if not within this range, test for breakdown and series resistance, and replace if defective.

(4) Check lead for broken or damaged insulation. Be sure insulation has not been pierced by condenser clip screw or cut by dust cover edge. When reassembling, lead must be positioned carefully with the edge of a dull screw driver into slots in bearing plate to avoid damaging the insulation.

(5) Inspect the coil for burned holes through the outside insulation or for evidence that the spark has been leaking to ground from high voltage terminal.

(6) High Tension Lead clip should not crush or cut insulation to result in a short.

(7) Check all magneto coil leads and the high-tension spark plug wire for condition of insulation. Replace the spark plug wire if insulation is damaged or broken. Insulation on the magneto leads can be repaired by giving them a heavy coating of a good insulating varnish, provided the insulation is not too severely

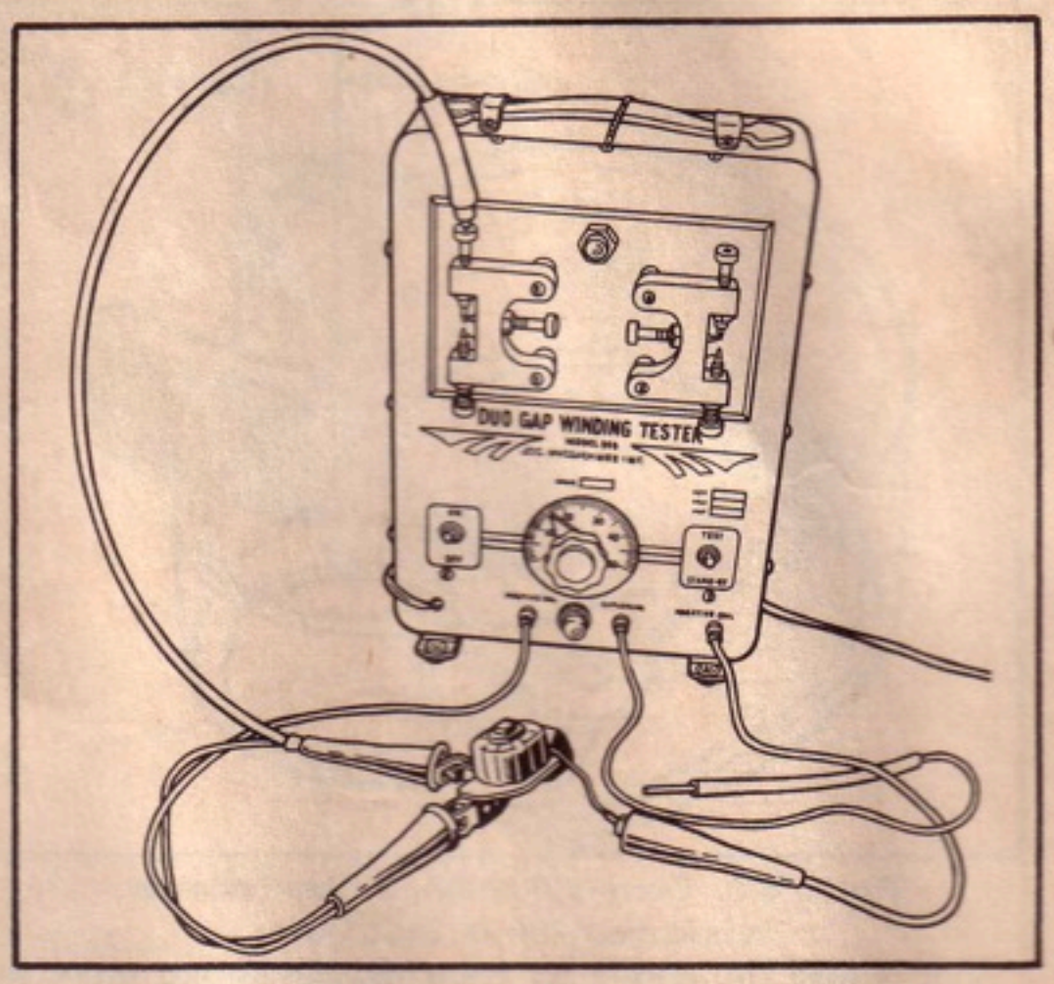


Figure B-10. Testing Magnet Coil

damaged, which would require replacement of the coil.

(8) To test the coil, connect the coil leads to an approved coil tester like the one shown in figure B-10, which is recommended by the manufacturer. When in good condition, the coil will produce a spark across the gap at the recommended dial setting. Refer to specification chart that is supplied by the manufacturer of the testing apparatus and use appropriate settings for desired tests. If the coil fails to produce a continuous spark at this setting, it is an indication that it is defective and must be replaced.

(9) Test the outer insulation of the coil for high-tension leaks by using the single prod as shown in figure B-11.

(10) If a weak spot is present in the outer coil insulation, a spark will jump from the coil to the prod when the prod is moved slowly around the coil at a

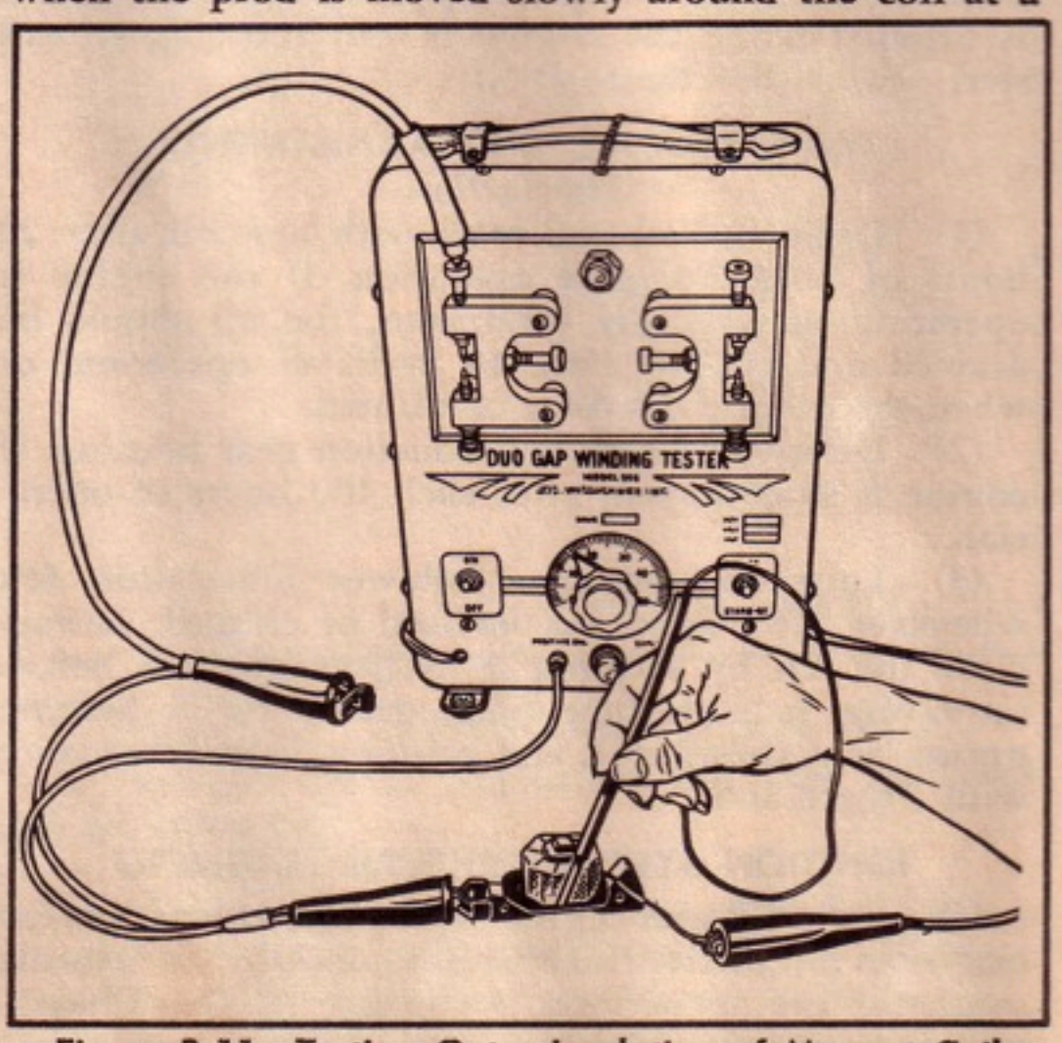


Figure B-11. Testing Outer Insulation of Magnet Coil

distance of approximately ⅛ inch from the insulation.

(11) Check Primary and Secondary ground leads for a good clean connection to terminal lug and inspect lug screw for tightness.

(12) 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" 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" 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.

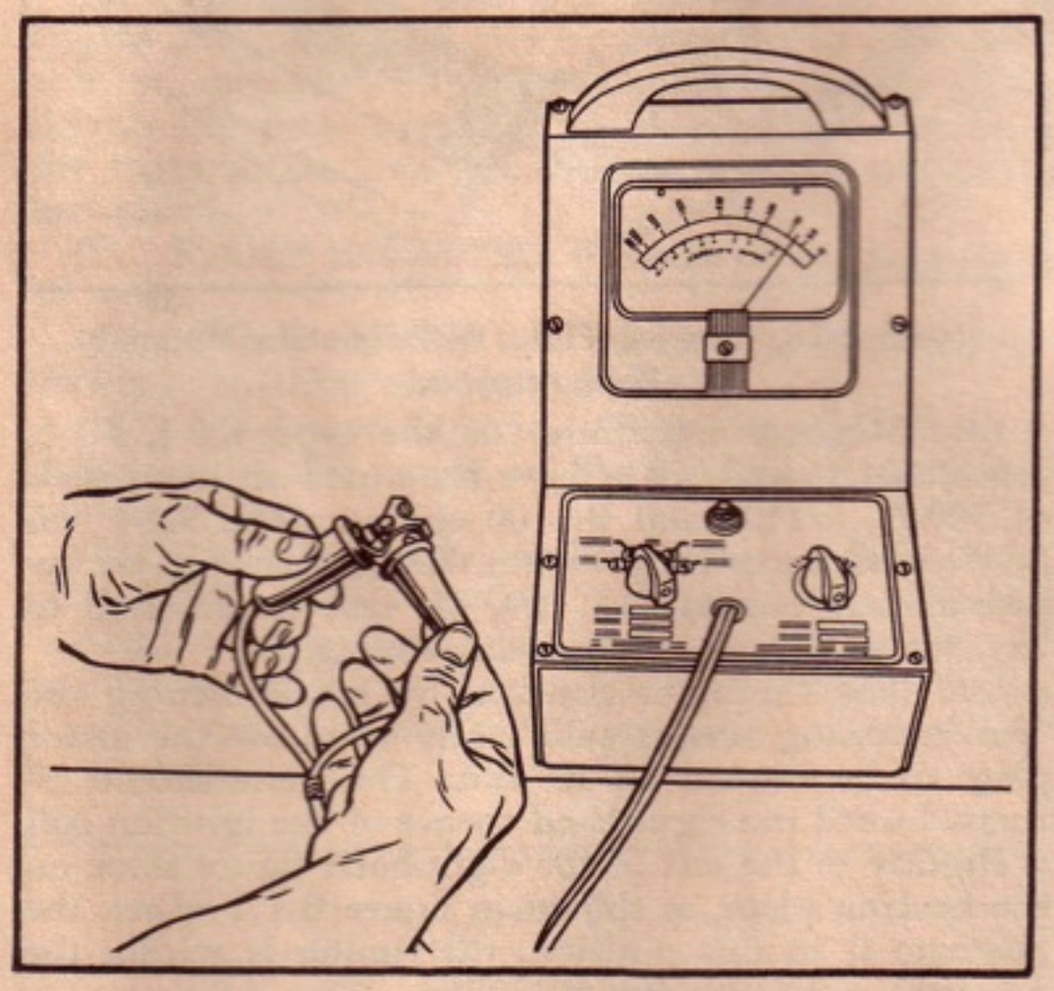

Figure B-12. Testing Resistance Across Breaker Points

(13) If the breaker points are badly burned, it is better to install a new set than to attempt any form of repair. Points just slightly oxidized or pitted can be salvaged by honing the surface with a flat Carborundum hone. Be sure to hold the point assemblies solidly in order to produce a flat surface.

(14) Clean breaker contact surfaces with a piece of lintless, seam-binding tape saturated with carbon tetrachloride (not fire extinguisher fluid) or fireproof Energine. Pull the wet tape back and forth between the points several times and separate the points before removing the tape.

(15) If breaker points have been resurfaced, it is advisable to assemble the breaker points outside of the engine and test the resistance between the two points with the condenser tester, as shown in figure B-12.

(16) When testing, allow the breaker points to be held together by normal spring tension. Resistance across the points should be negligible. If there is noticeable resistance across points when clean, replace them.

(17) Before adjusting the breaker point gap, rotate the flywheel until the rubbing block is on the high portion of the cam in order to open the gap to the widest position. Adjust the points on Scintilla magnetos to .018 inch, in accordance with figure B-18.

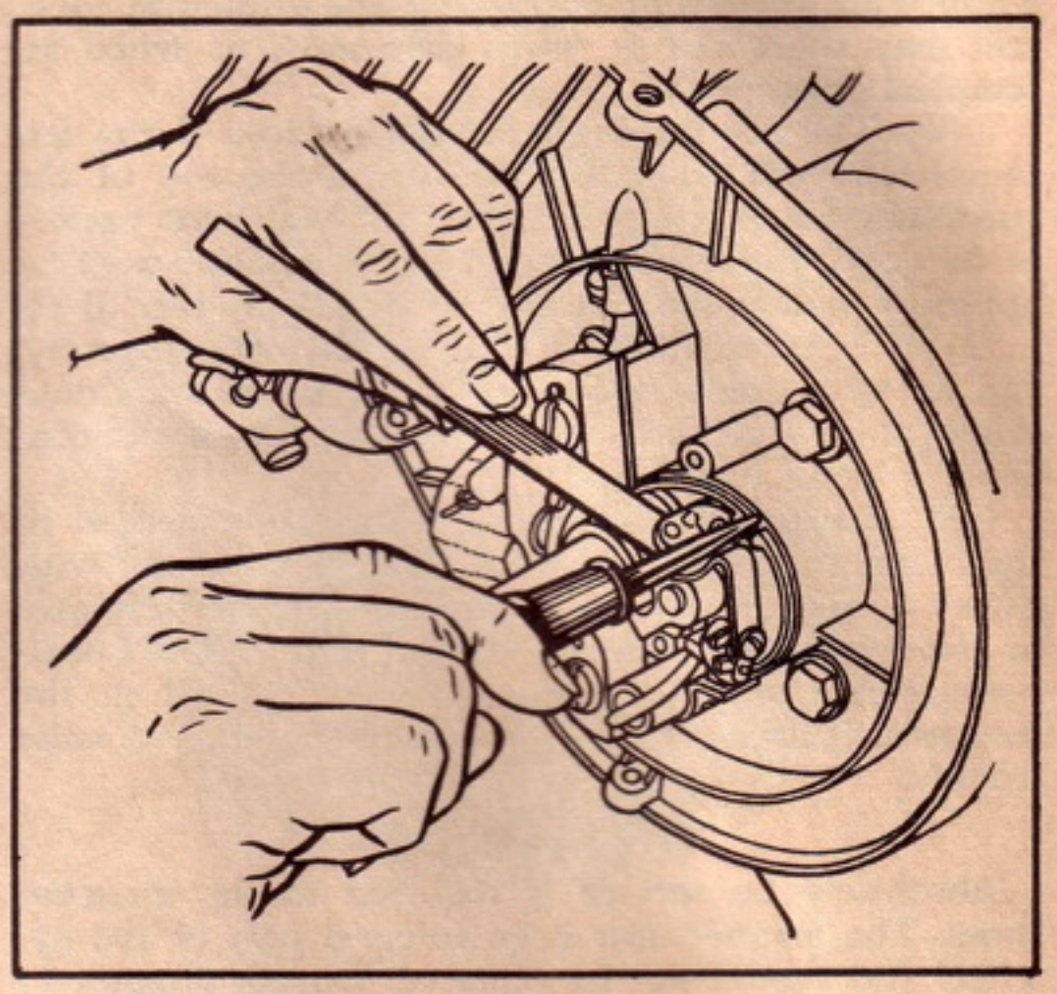

Figure B-13. Adjusting Breaker Points on Phelon Magneto

(18) Adjust breaker points of Phelon magnetos to .018 inch by shifting the breaker bracket in accordance with figure B-13. In either case, loosen the contact retaining screw just enough to allow the breaker bracket to shift. Tighten the contact retaining screw after the correct measurement is obtained. A new measurement should then be taken, as tightening the screw will sometimes change the gap several thousandths of an inch. As a precaution against the points closing under vibration, it is advisable to use a No. 8 shakeproof washer—part No. 5481—under the hold down screw (if a washer is not already in use).

(19) Breaker point terminal screw should make a clean, tight connection with terminal lug of condenser and coil lead. Be careful not to allow the screw to tighten on insulation of leads. The tension spring has

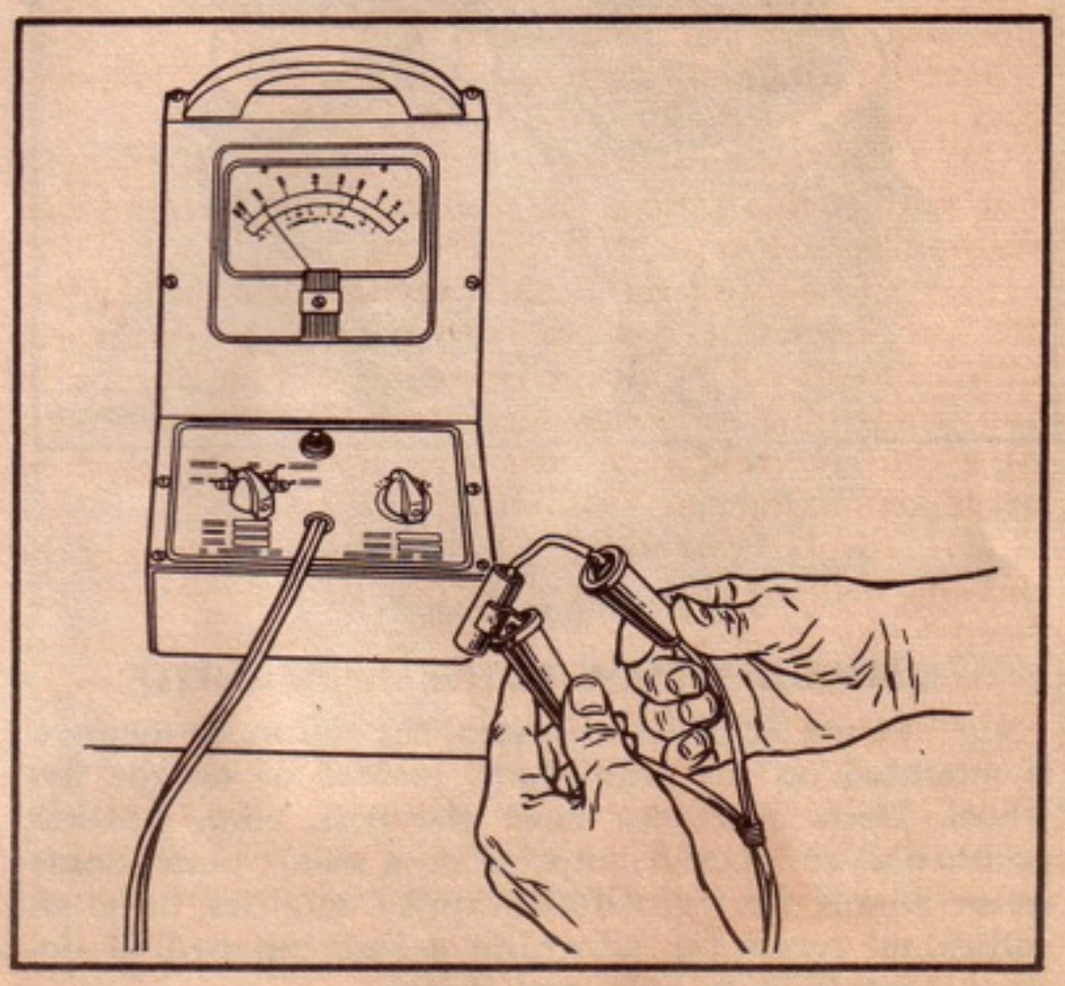

Figure B-14. Testing Condenser

a minimum amount of clearance to the metal dust cover and may short circuit when deformed, or when assembled improperly.

(20) The condenser should be replaced if the terminal lead and insulating washer in the end of the condenser are in bad condition. If these parts appear to be good, test the condenser in accordance with an approved condenser tester, as shown in figure B-14.

(21) Test the condenser for breakdown, capacity, and series resistance, any of which, if defective, would render the condenser useless. The capacity of the condenser should be .11 to .13 mfd.

(22) Lubrication—The only lubrication needed in the magneto is the cam wick. This is saturated with grease at the factory. If it becomes dry, the felt may be removed and new grease worked into it. (Use Lubriplate grease or equivalent.) Avoid using oil in the magneto. It may get into the breaker points and cause trouble.

*Flywheel Magnet*

Absolutely no service is required to the magneto shoes. The magnet unit is an integral part of the flywheel and should not be replaced. Do not attempt to recharge the flywheel. The magnetic "strength" may be checked by comparing the questionable magnets to a new flywheel assembly, using a magneto-meter. (See figure B-15.) The flywheel has a life time charge guarantee. Any flywheel loosing its charge may be returned to the factory for free charging.

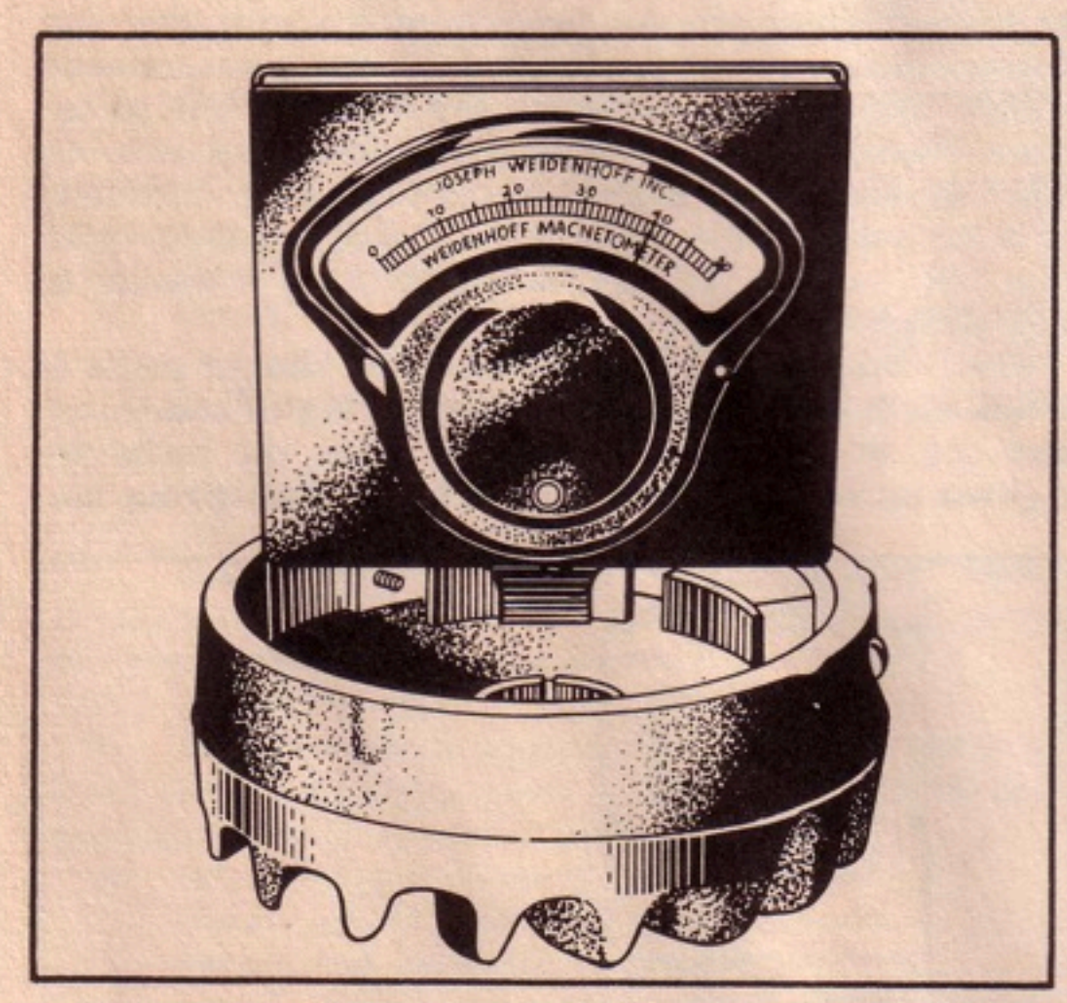


Figure B-15. Testing Magnet Strength With "Magnetometer"

## IGNITION SYSTEM—SCINTILLA MAGNETO

(1) In the Scintilla 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 B-16 and B-19.)

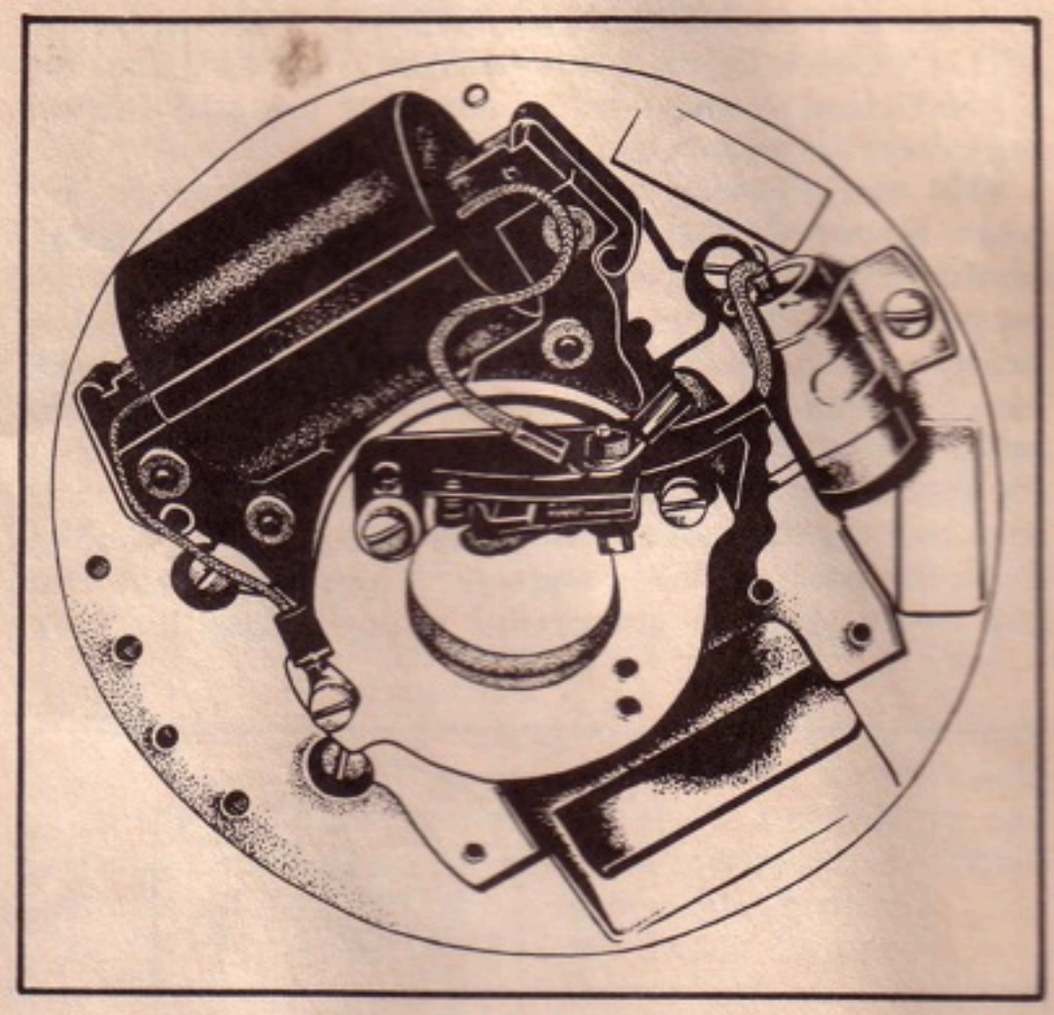

Figure B-16. Bearing Plate With Scintilla Magneto Parts Attached

(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.

(3) The timing is adjusted by first loosening the four retaining screws sufficiently to allow the stator plate to be rotated on its axis. 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, as shown in figure B-17. When the magneto is in this 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

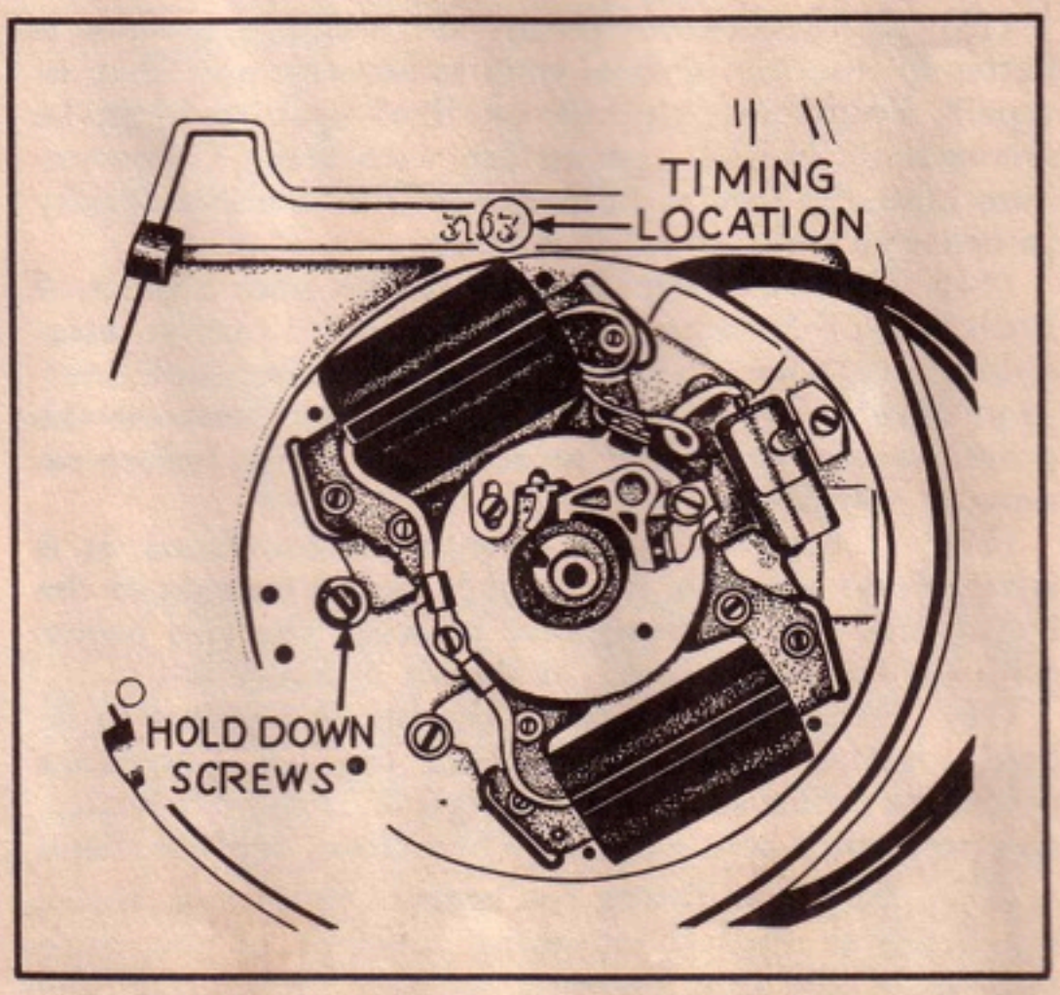


Figure B-17. Timing Location for Scintilla Magneto

the bearing plate are in position and secure.

(5) The breaker points are then adjusted to a desired gap of .018 inch 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 point gap should be .018-.020.

(6) As a final check to be used in deciding whether or not the magneto is properly timed is to 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, this being equivalent to the piston being ⅛ of an 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.

(9) Replace breaker cam if rough or showing signs of wear.

(10) Check all leads and terminal connections for broken insulation or looseness.

(11) Condenser Capacity .18 to .20 mfd. Replace, if not within this range, test for breakdown and series resistance also.

(12) Breaker points used on original equipment have a flat tension spring. Replacement points are available with a pivot type design rubbing block and contact assembly for improved performance. Points that are pitted, burned or having poor contact should be replaced.

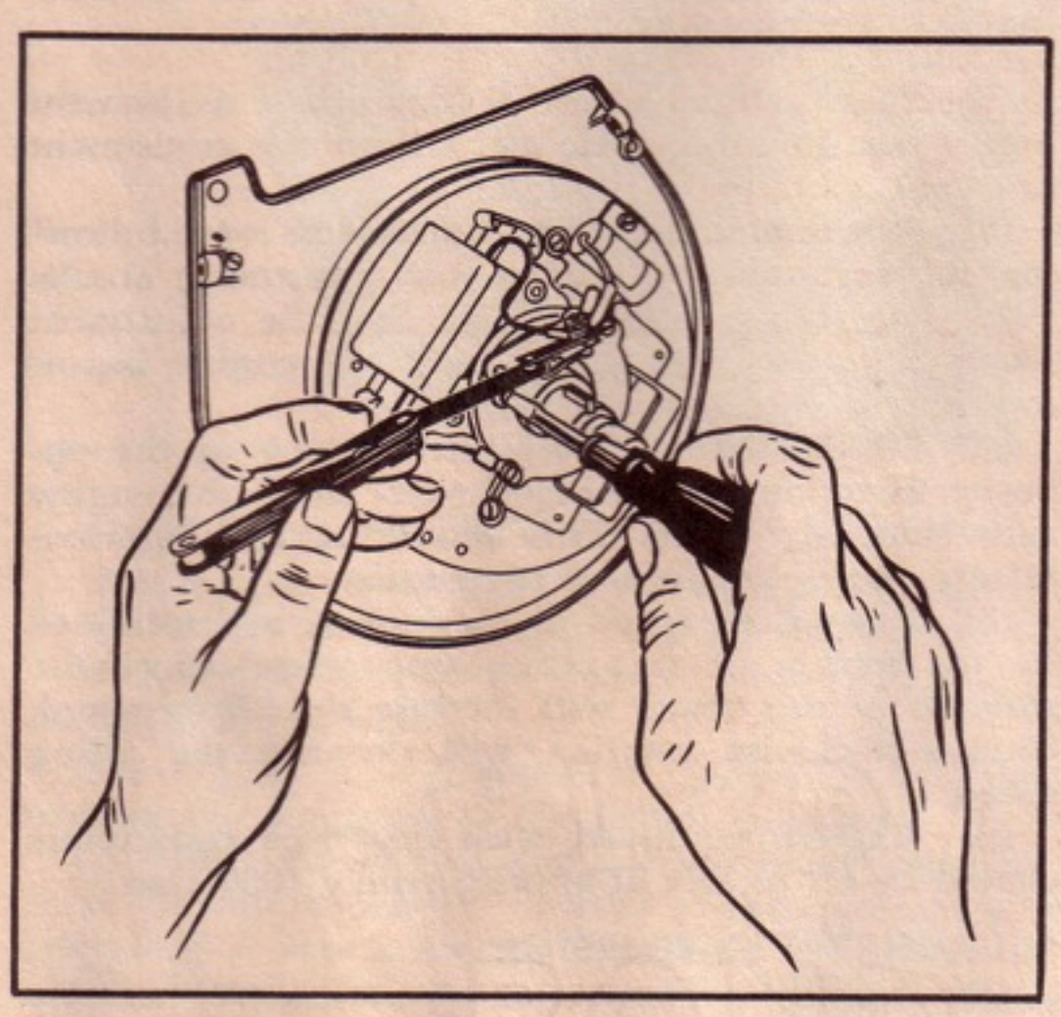

Figure B-18. Adjusting Breaker Points on Scintilla Magneto

(13) A lighting coil is standard equipment on the K1-4 and K1-12 magneto. This coil has connections for one No. 87 bulb—15 candle power—for the head lamp and one No. 63 bulb—3 candle power—for the tail lamp.

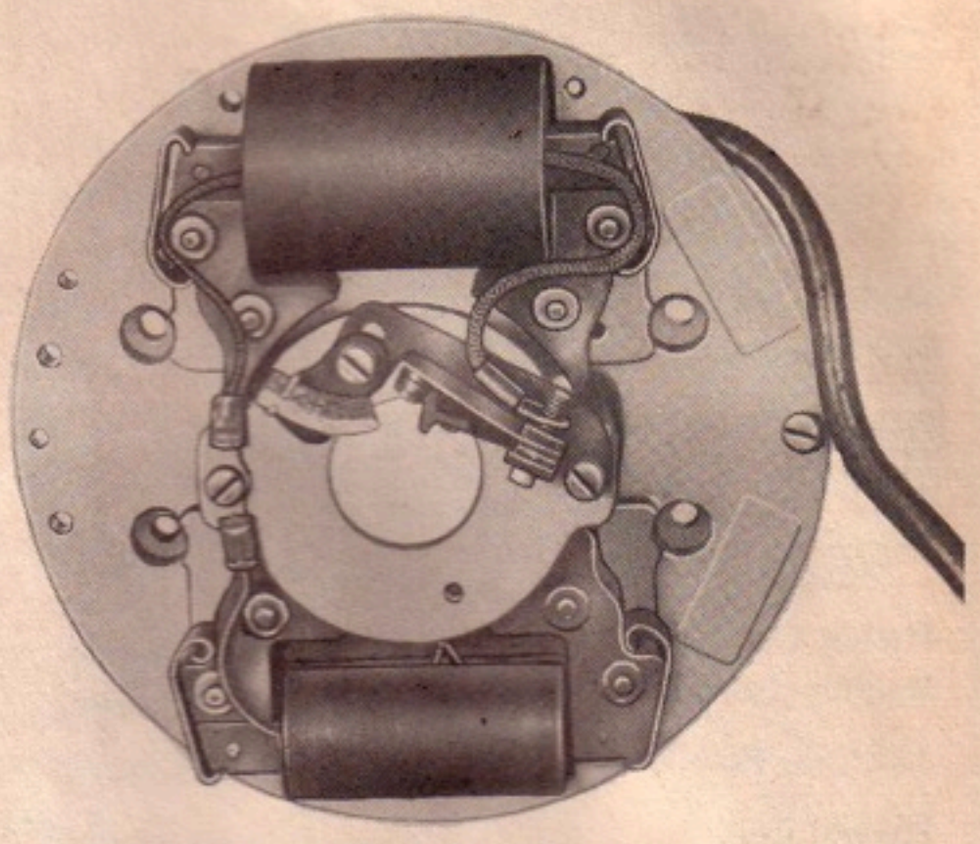

Figure B-19. Scintilla-Equipped Bearing Plate With Lighting Coil Attached

(14) 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. 3183A—is available. Thereafter a dust cover was used on original equipment and these magnetos may be more completely dust-proofed by installing a felt dust seal between the flywheel and dust cover. The dust kit No. 4051A 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.

(15) The coil is tested in the same manner as given above for the Phelon magneto.

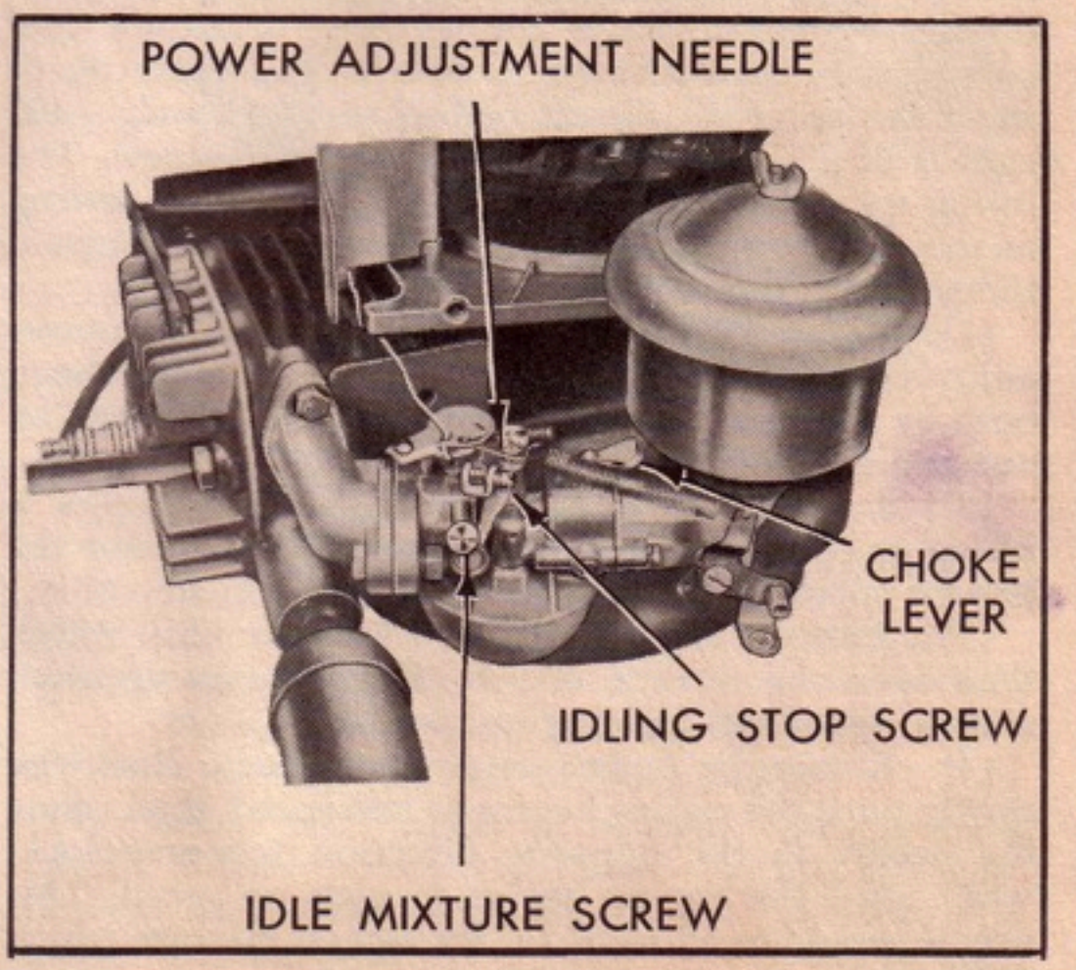


Figure B-20. Standard Float-Type (Carter) Carburetor

# CLINTON Engines

## 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 | .11 to .13 mfd. |
| Scintilla | .18 to .20 mfd. |

### CARBURETOR ADJUSTMENTS

When adjusting the carburetor, the engine should respond to a slight movement of the adjusting needle(s). If the needle(s) can be rotated considerably without producing any noticeable effect on engine operation, it is an indication that the carburetor must be removed and cleaned. Refer to Division D.

### STANDARD FLOAT-TYPE CARBURETOR

(See Fig. B-20.) Separate manual adjustments are provided for regulating the idling mixture, idling speed and power mixture. The character of the mixture above 1400 rpm is determined by the power adjustment needle, which regulates the amount of liquid fuel passing through the main jet orifice. The character of the mixture at all speeds below approximately 1400 rpm is determined by the idle adjustment screw. The idling speed of the engine is determined by the setting of the idle stop screw, which acts as a stop to prevent the throttle from closing completely.

(1) Rotate the idle adjustment screw and the power adjustment needle all the way in (clockwise), then open both by rotating them in a counter-clockwise direction one and one-half turns.

(2) Set the idle stop screw so that the engine is idling at approximately 1000 rpm. (This is about the slowest speed at which the engine will run smoothly.)

(3) Start the engine and allow it to run until warm, then open the throttle one-third to produce approximately two-thirds full engine speed.

(4) Rotate the power adjustment needle clockwise slowly until the engine begins to lose speed, then rotate the needle in the opposite direction (counter-clockwise) until the engine begins to pick up speed. This needle should be adjusted for the leanest mixture which will allow responsive acceleration and steady governor operation.

IF THE ENGINE MISSES AND BACKFIRES, THE POWER MIXTURE IS TOO LEAN AND THE POWER MIXTURE NEEDLE MUST BE ROTATED COUNTER-CLOCKWISE TO CORRECT THE CONDITION. IF THE ENGINE LOADS (heavy exhaust) AND IS SLUGGISH, THE MIXTURE IS TOO RICH AND THE NEEDLE MUST BE ROTATED CLOCKWISE TO CORRECT THE CONDITION.

(5) Make a final check of the power adjustment needle setting under load, and correct the adjustment as required.

(6) Idle mixture adjustment should be made following the adjustment of the power adjustment needle. With the engine idling, rotate the idle adjustment screw in (clockwise) slowly until the engine begins to misfire or lose speed.

(7) Rotate the idle adjustment screw in the opposite direction (counter-clockwise) until the engine runs smoothly again. This should require approximately one-eighth turn of the needle.

(8) The idling speed of the engine is determined by the setting of the idling stop screw. Clockwise rotation of this screw will increase the idling speed, counter-clockwise rotation will decrease the idling speed.

(9) Engines equipped with float-type carburetors should be set to idle at approximately 1000 rpm.

### SUCTION-TYPE CARBURETOR

(See Fig. B-21.) The suction-type carburetor has only two adjustments, a mixture adjusting screw and an idle stop screw.

(1) The engine should be allowed to run a few minutes for warm-up and then the final mixture setting may be made. If the engine is firing irregularly and runs rough, the mixture is too rich. When the engine runs smoothly, but will not accelerate without hesitation or stalling upon opening the throttle, then the

mixture is too lean. A setting between these two mixtures is one that is correct for average performance.

(2) Then set the idle stop screw so that the idling speed of engines equipped with suction-type carburetors is approximately 1500 rpm.

(3) After setting the idle stop screw, it may be necessary to readjust the mixture adjusting screw slightly.

### GOVERNOR ADJUSTMENTS

The function of a governor is to keep the engine running at constant speed when operating under a variable load, and to prevent the engine from ever exceeding its predetermined maximum speed. All Clinton engines are equipped with one or the other of two types of governors: A flyball (centrifugal) type governor or an air vane (pneumatic) type governor.

## CAUTION

**The engine can be forced to speed at several thousand rotations per minute higher than the factory recommended speed of 3600 rpm. Therefore it is important that the governor be adjusted so that the maximum rpm is below 3600. High speed may cause severe damage to the engine.**

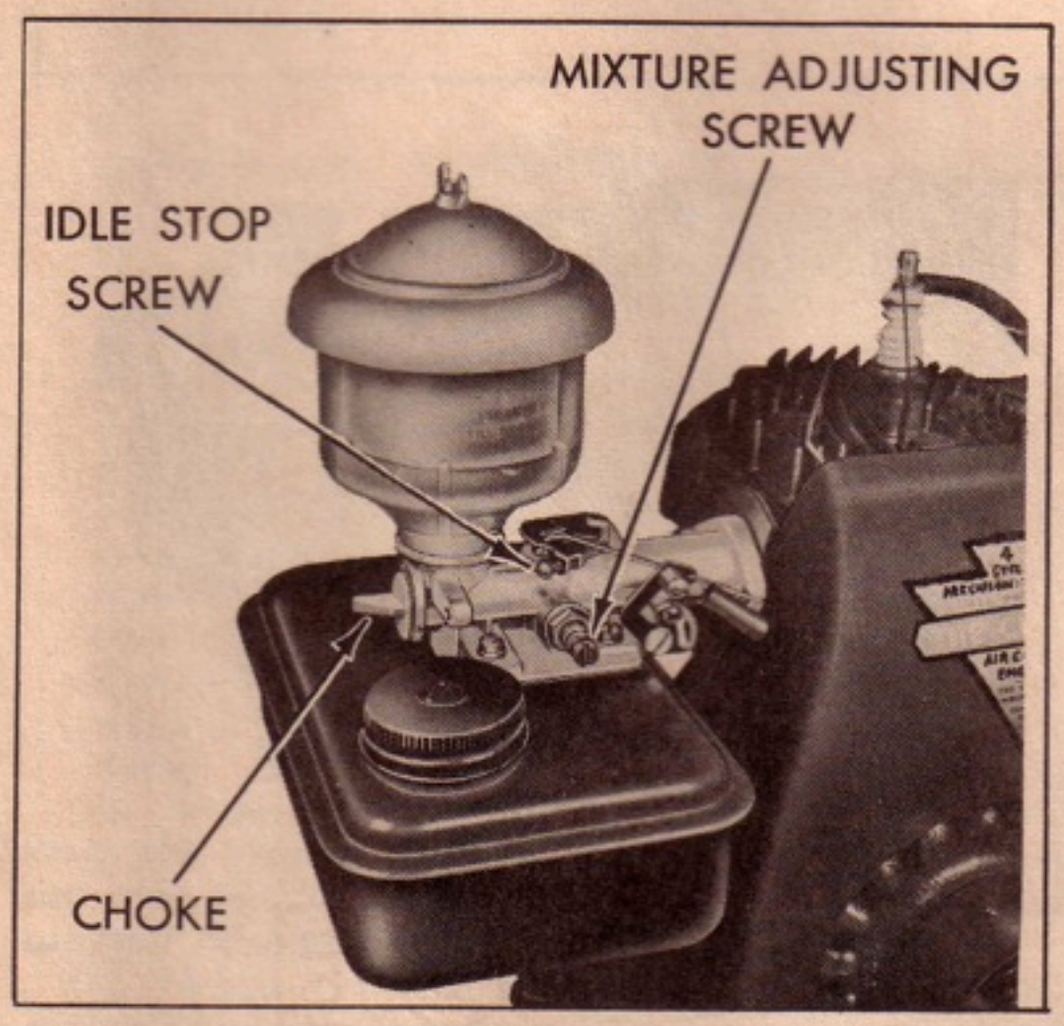


Figure B-21. Late Model Suction-Type Carburetor

### FLYBALL GOVERNOR

(See Fig. B-22.) A practical illustration can best explain the operation of the flyball governor.

(1) Start the engine and set the speed adjusting lever (or remote control throttle) so that 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. This lateral movement of the yoke activates the governor shaft assembly, the action of which is transmitted through connecting linkage to the throttle, which is thereby opened. Movement of the governor shaft and the amount by which the throttle is opened will be proportional to the loss of engine speed. Therefore, the throttle will open just enough to restore the lost speed.

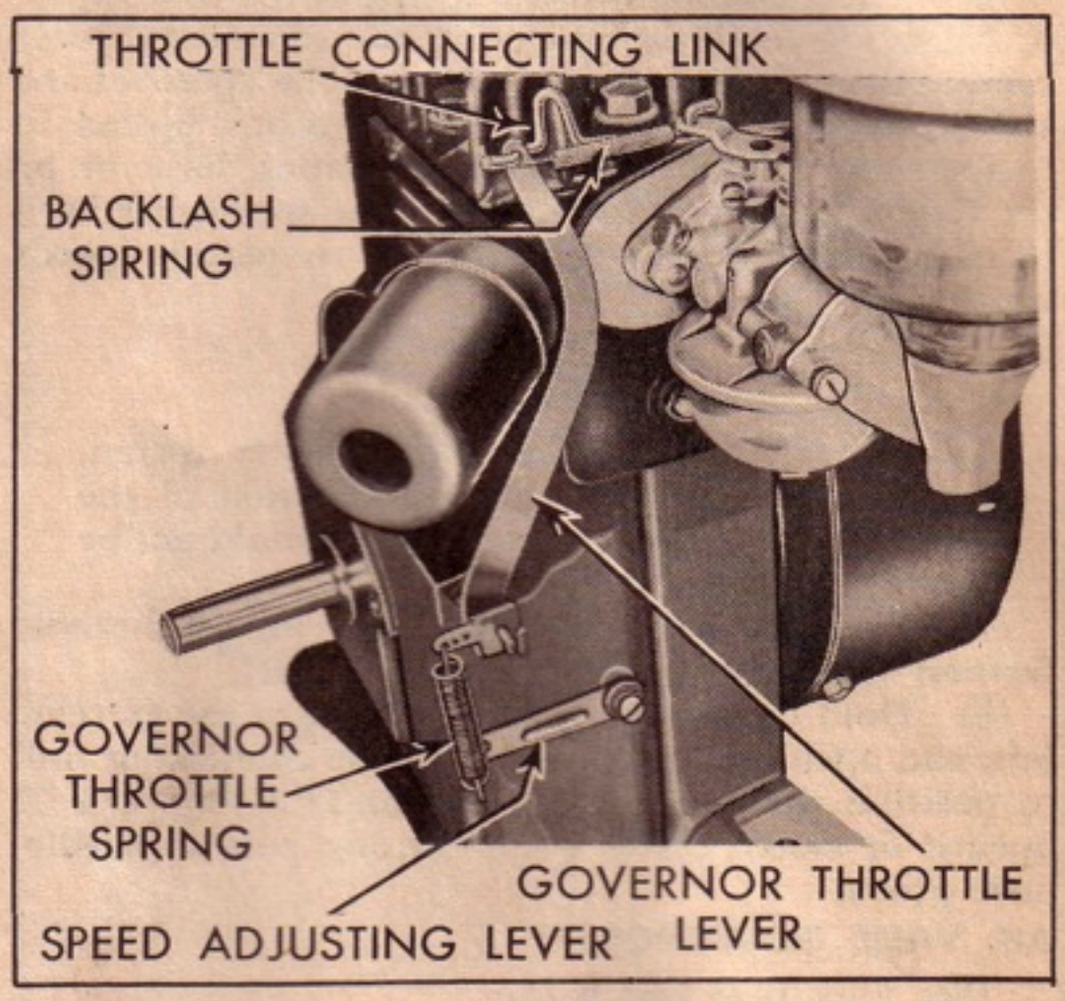


Figure B-22. Typical Flyball Governor Linkage

(4) Remove the load from the engine drive shaft. The governor will reverse the operation to prevent the engine from running away.

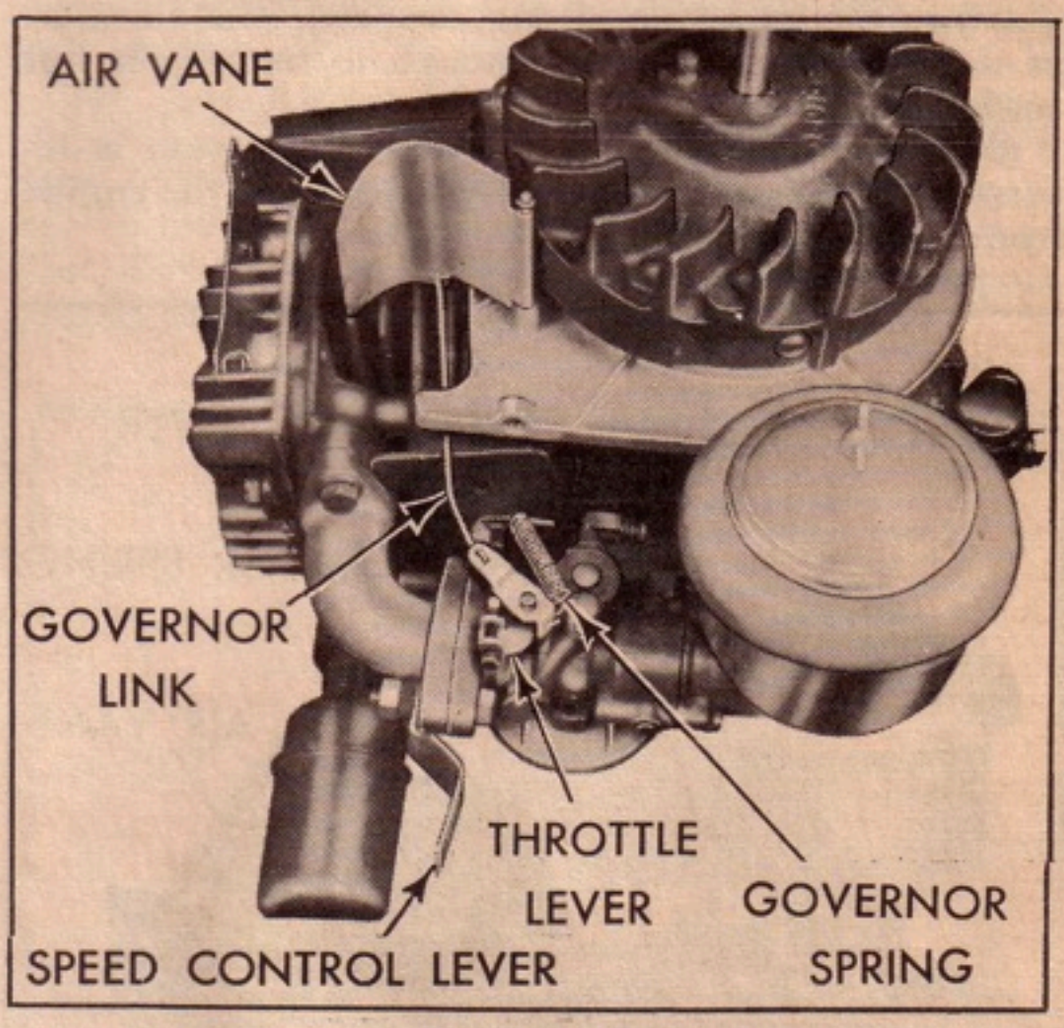


Figure B-23. Typical Air Vane Governor Linkage on Vertical Shaft Engine

(5) 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.

(6) The governor throttle spring is the controlling or balancing force 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 level. The spring has been carefully selected and is calibrated to permit speeds up to 3600 rpm.

## CAUTION

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.

(7) Place the governor throttle spring in the hole farthest from the governor throttle shaft.

(8) 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.

### AIR VANE GOVERNORS

(See Figs. B-23 and B-24.)

(1) The air vane governor depends for its operation upon the air blast created by the finned flywheel. The air vane is located inside the blower housing and is linked directly to the throttle lever of the carburetor. The governor air vane 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.

(2) When a load is applied to the engine drive shaft, the flywheel begins to slow down. This causes a reduced air blast and the governor spring will move the linkage (and the air vane) by the amount proportional to the reduction of engine speed. 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.

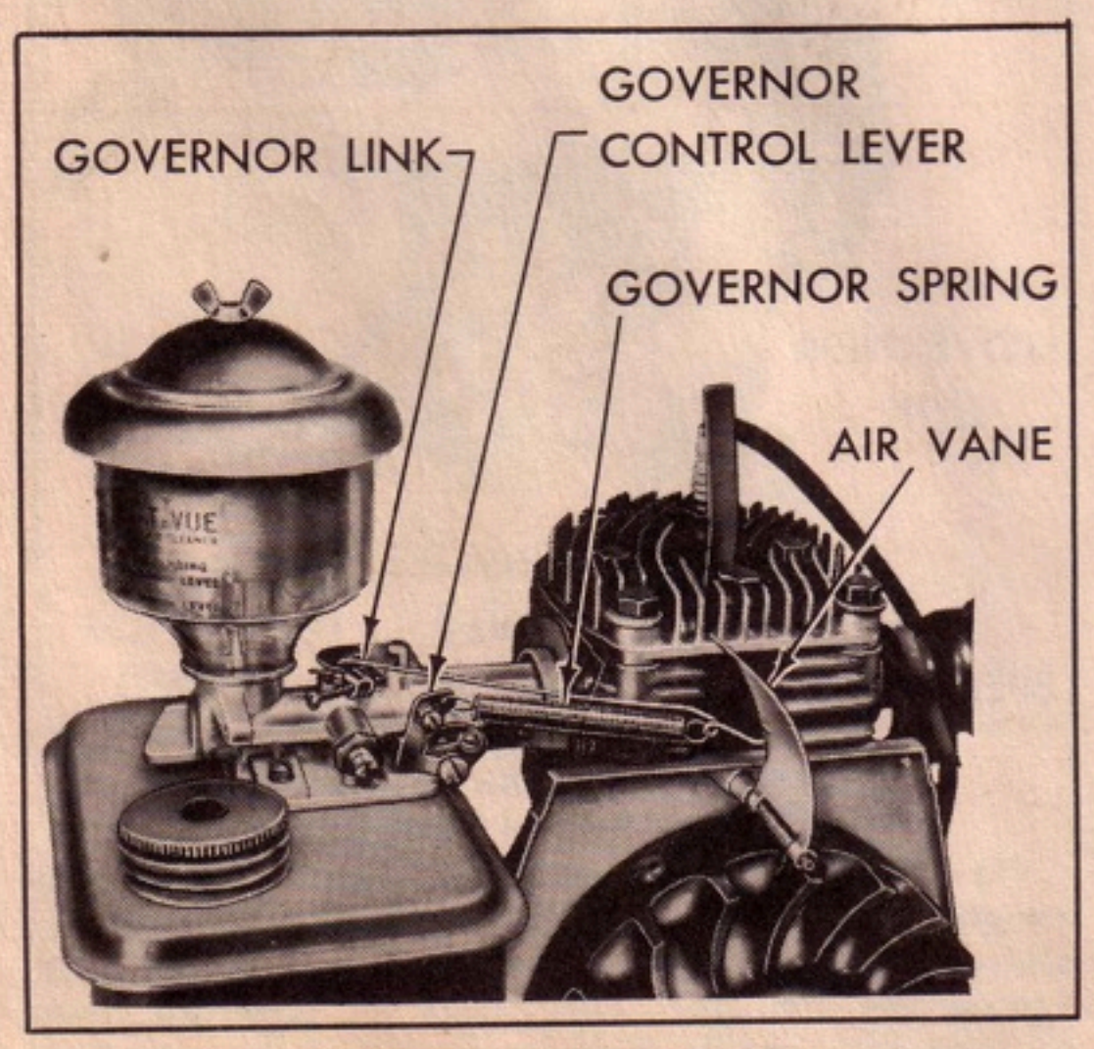


Figure B-24. Typical Air Vane Governor Linkage on Horizontal Shaft Engine

(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. Figure B-23 shows a typical spring used on a vertical shaft-type engine, and figure B-24 shows a typical hookup used on a horizontal shaft engine equipped with a suction-type carburetor.

## CAUTION

Do not substitute a heavier or lighter spring, as 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.

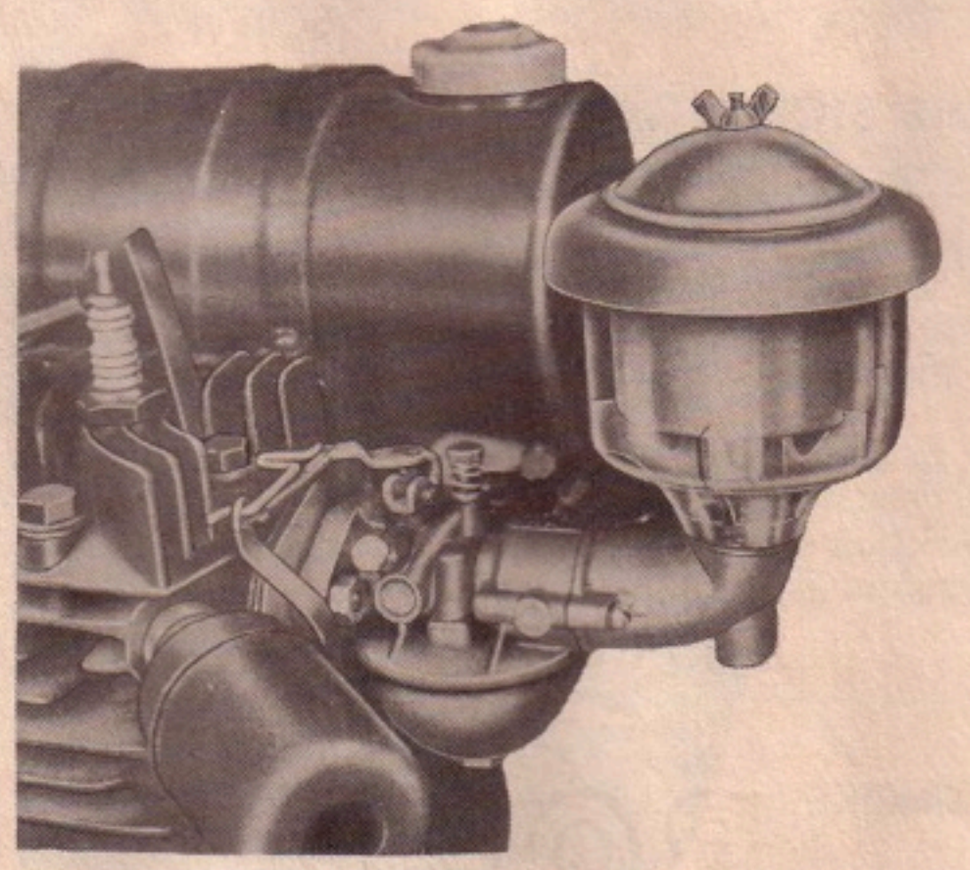

Figure B-25. Typical Vis-O-Bath Downdraft Air Filter Installation

WHEN REPLACING THE BLOWER HOUSING, MAKE CERTAIN 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.

### AIR FILTER

(See Figs. B-25 and B-26.)

(1) It is impossible to designate definite periods for cleaning an air filter because it should be cleaned when it becomes dirty, and these periods will vary depending upon the cleanliness of the surrounding atmosphere.

(2) The Vis-O-Bath air filter which is used on late-production engines allows the operator to determine when the filter needs servicing by simply observing the level and color of the oil in the filter cup.

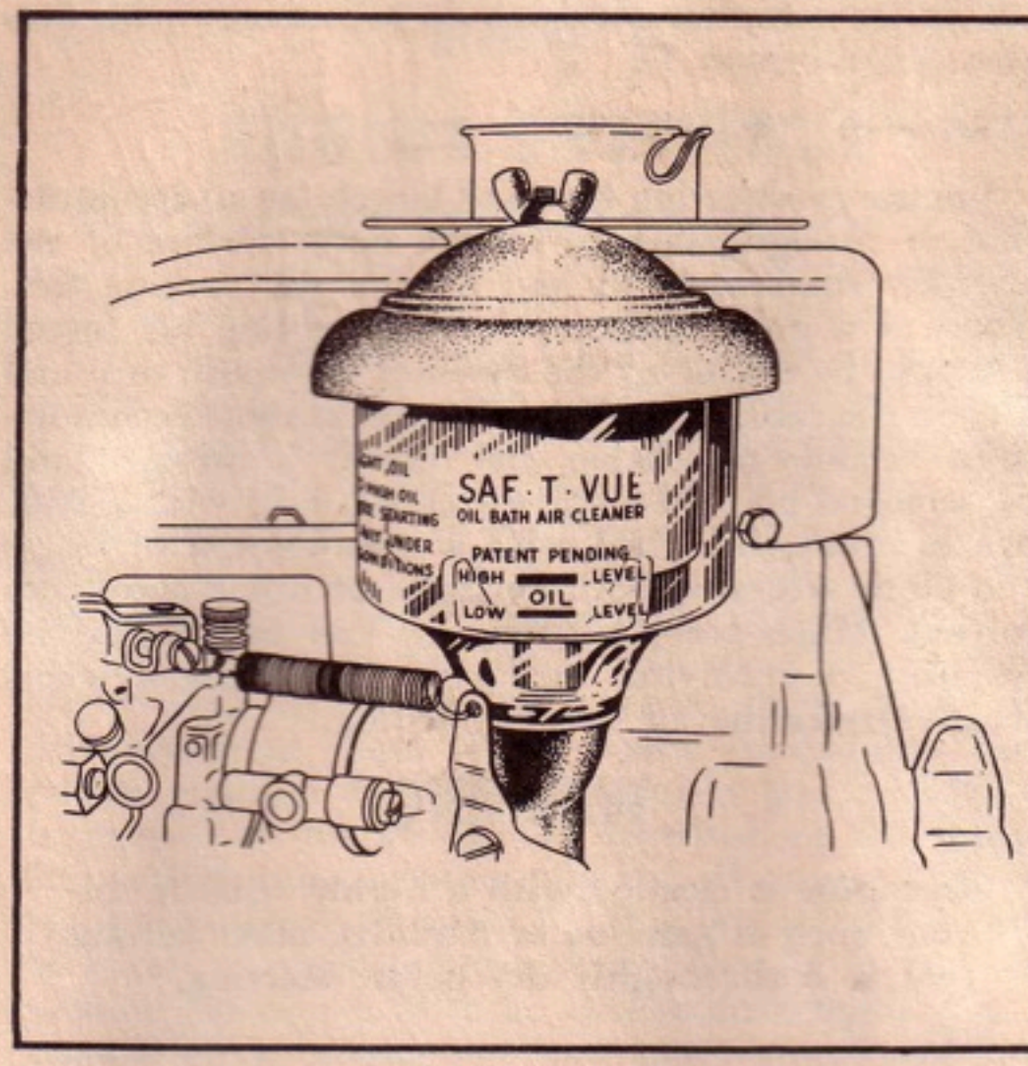


Figure B-26. Vis-O-Bath Air Filter Showing High and Low Level Markings

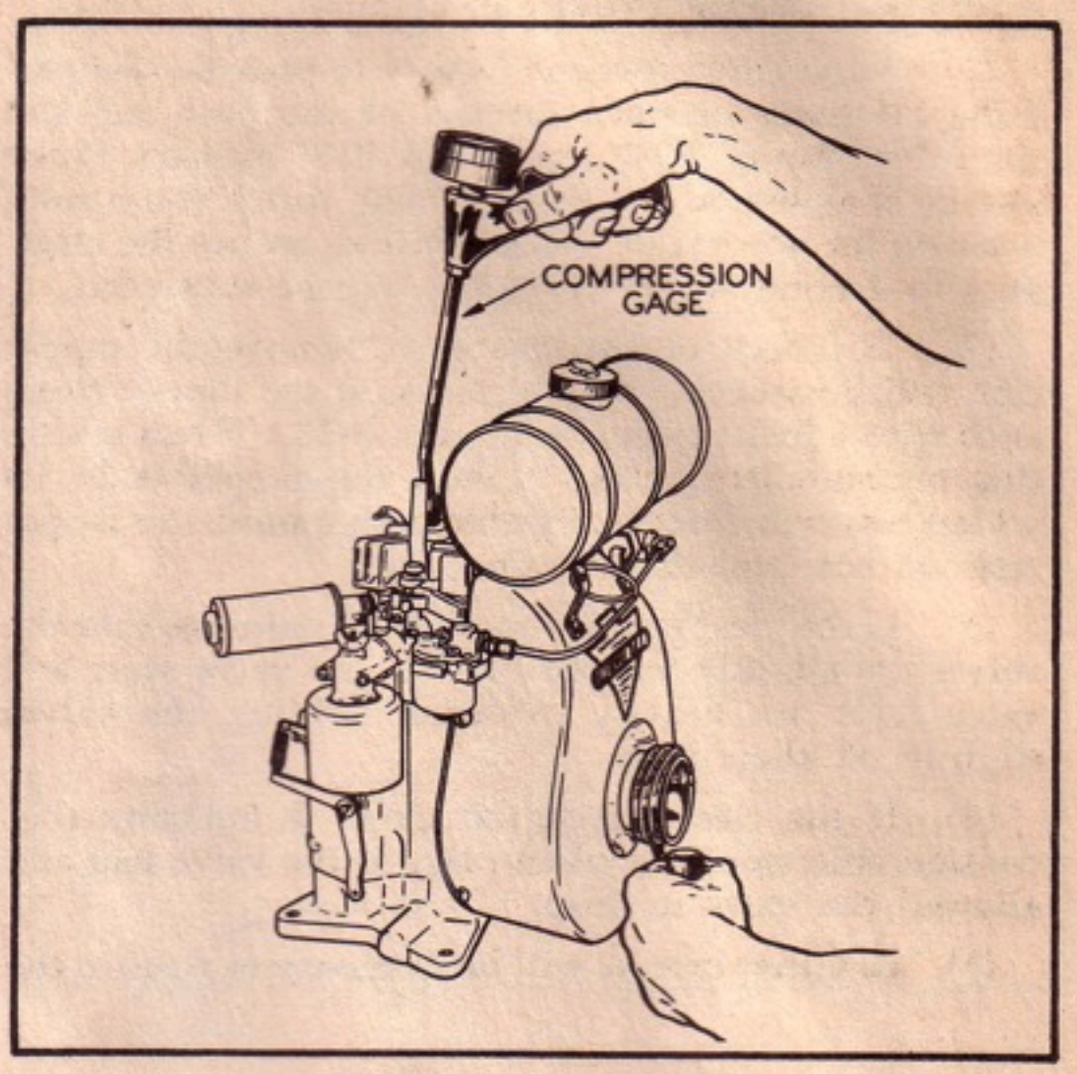


Figure B-27. Testing Compression

## CAUTION

From the standpoint of engine life, the air filter is one of the most important parts of the power plant. An engine operated under dusty conditions would wear out in a few hours if it were not provided with an efficient air filter. For this reason, the air filter should be checked at least once each day and cleaned whenever necessary. Even when operating under the cleanest conditions, it should be cleaned at least once each week.

(3) When cleaning mesh and ribbon type air filters, wash the element thoroughly in clean gasoline and dry with compressed air. Coat the surface lightly with oil, and reinstall the filter on the engine.

(4) When cleaning late-type oil bath air filters, remove the filter from the engine and empty the dirty oil from the filter cup. Wash all parts in clean gasoline, kerosene, or other petroleum solvents. Dry the parts with compressed air. Fill the lower cup with clean engine oil up to the high-level mark embossed on the side. (See figure B-26.) Use SAE No. 50 oil in warm weather and SAE No. 30 in cold weather. Reassemble the filter unit and install it on the engine.

### VALVES

The valves are constructed of special material selected for long life and trouble-free service, and will give little trouble provided the engine is operated under normal conditions. Both intake and exhaust valves have 45-degree seats, and the exhaust valve is made of extra hard, heat-resistant steel to insure long life. If valves are removed, extreme care must be exercised to replace the intake and exhaust valves correctly in their respective positions.

### COMPRESSION TEST

(See Figure B-27.)

(1) Remove the spark plug and insert the rubber-tipped end of the compression gage in the spark plug hole so that there will be no leakage around the tip.

(2) If the engine is equipped for rope starting, wind the full length of the rope around the starter pulley and give a sharp, quick pull. (See figure B-27.)

(3) If the engine is equipped with a kick starter, check compression by holding the gage in the spark plug hole and operating the kick starter through one full stroke.

(4) Compression in either case should build up to approximately 75 pounds on the gage. If pressure is low, it indicates that compression is leaking out of the cylinder, due to valve leakage, or leaking around the piston rings or cylinder head gasket. If compression is low, the engine should be overhauled.

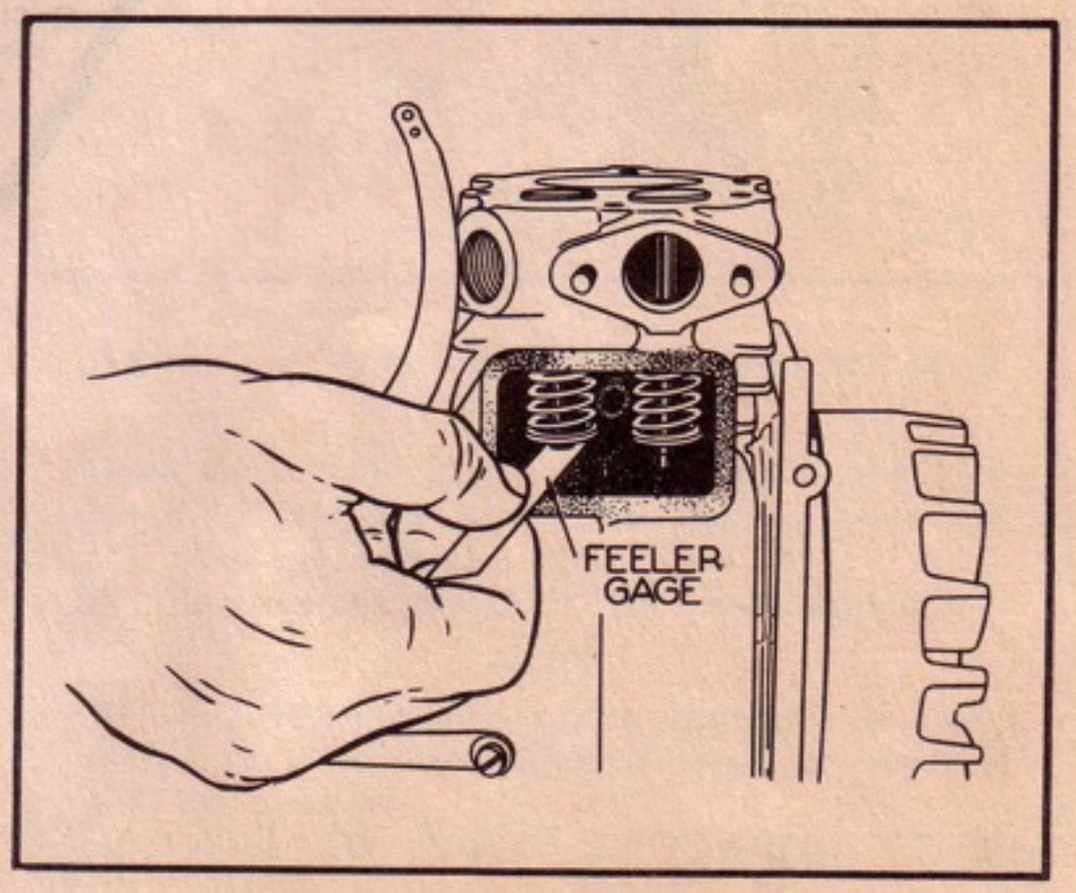


Figure B-28. Measuring Tappet Clearance With Feeler Gage

## CHECKING VALVE CLEARANCES

(1) 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.

(2) To check tappet clearance, remove the tappet case and breather cover and measure the tappet clearance with a feeler gage. (See figure B-28.) 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.

(3) If the clearance is too wide, it indicates that the valves are slightly warped or that the valve seats and valve faces are heavily oxidized, holding the valves slightly off their seats.

(4) If the clearance is too close, it indicates that considerable wear has taken place at the valve seat and allowed the valve to drop.

(5) In either case, it will be necessary to remove the valves for complete servicing in accordance with Section VI, Division D.

## CLEANING THE ENGINE

Engine overheating is caused largely by an accumulation of foreign material on the outer surface of the engine, particularly in and around the cooling fins. There is a great tendency for the cooling air forced through the engine by the flywheel to deposit dust and dirt on the cooling surfaces. As soon as these accumulations become noticeable, the blower housing should be removed and the engine cleaned, first with a stiff-bristle brush, and then with a combination of brush and cloth saturated with kerosene or other petroleum solvent. Much trouble from dirt can be avoided by installing a revolving intake screen on the flywheel which covers the air intake opening.

### WARNING

If engine is cleaned with a highly volatile solvent, such as gasoline or naphtha, make certain that it is thoroughly dry before starting.

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DIVISION C

# ENGINE OVERHAUL

PRELIMINARY INSTRUCTIONS. The Clinton engine is a precision-built unit and must be treated as such when performing any type of overhaul service. Valve seats, bearings and cylinder walls must all be treated in accordance with instructions in this section. The cylinder bore, if rebored, must be finished to as high a polish as can be obtained with high-grade honing equipment, and clearances must be maintained within the limits specified. Conventioned automotive tolerances with which the service operator may be familiar should not be rigidly adhered to because these engines are air-cooled and operate under conditions different from those under which comparable automobile engines function. The tools and equipment illustrated in this section are approved by the factory for overhauling Clinton engines. If other types of equipment are substituted for this use, attention must be given to obtaining the desired results in order to provide the owner with an overhauled engine that is capable of delivering the same performance and long life that he would normally expect from a new engine. (Refer to the appendix for a list of approved tools and tolerances.)

DISASSEMBLY OF ENGINE. Because of the many types of Clinton engines, no attempt has been made to provide a step-by-step procedure for removal of the different parts, as the removal of most units will be obvious. However, the general disassembly routine contained in the following steps should be adhered to in order to simplify the disassembly as much as possible.

1. Close the shut-off valve on engines equipped with float-type carburetors and remove the fuel line.
2. Remove the carburetor and air filter as a unit. (Fuel tank will be removed with carburetor on engines equipped with suction-type carburetors.)
3. Disconnect the spark plug wire.
4. Remove the starter pulley and revolving screen, if so equipped.
5. Remove the blower housing and fuel tank.
6. If engine is equipped with an air vane governor, remove governor vane and link. If equipped with a flyball governor, remove governor lever.
7. Remove the flywheel. (See figure C-1.)
8. Remove cylinder head and parts attached thereto.
9. Drain oil from the engine.
10. Turn engine upside down and remove the base.
11. Remove connecting rod and piston assembly. (See figure C-2, for method of releasing connecting rod bolt locks.)
12. Remove flywheel key and dust cover.
13. Slide the breaker cam off the crankshaft. (Some engines use a rotating magnet which must be removed first.)
14. Remove bearing plate. (On 300 series engines, the bearing plate contains the valve tappets, cam and gear.)
15. Remove the crankshaft.
16. Remove the tappet case and breather cover, tappet case stud, and crankcase breather. (Series 300 engines have two tappet case covers.)
17. Remove the valves and valve springs.

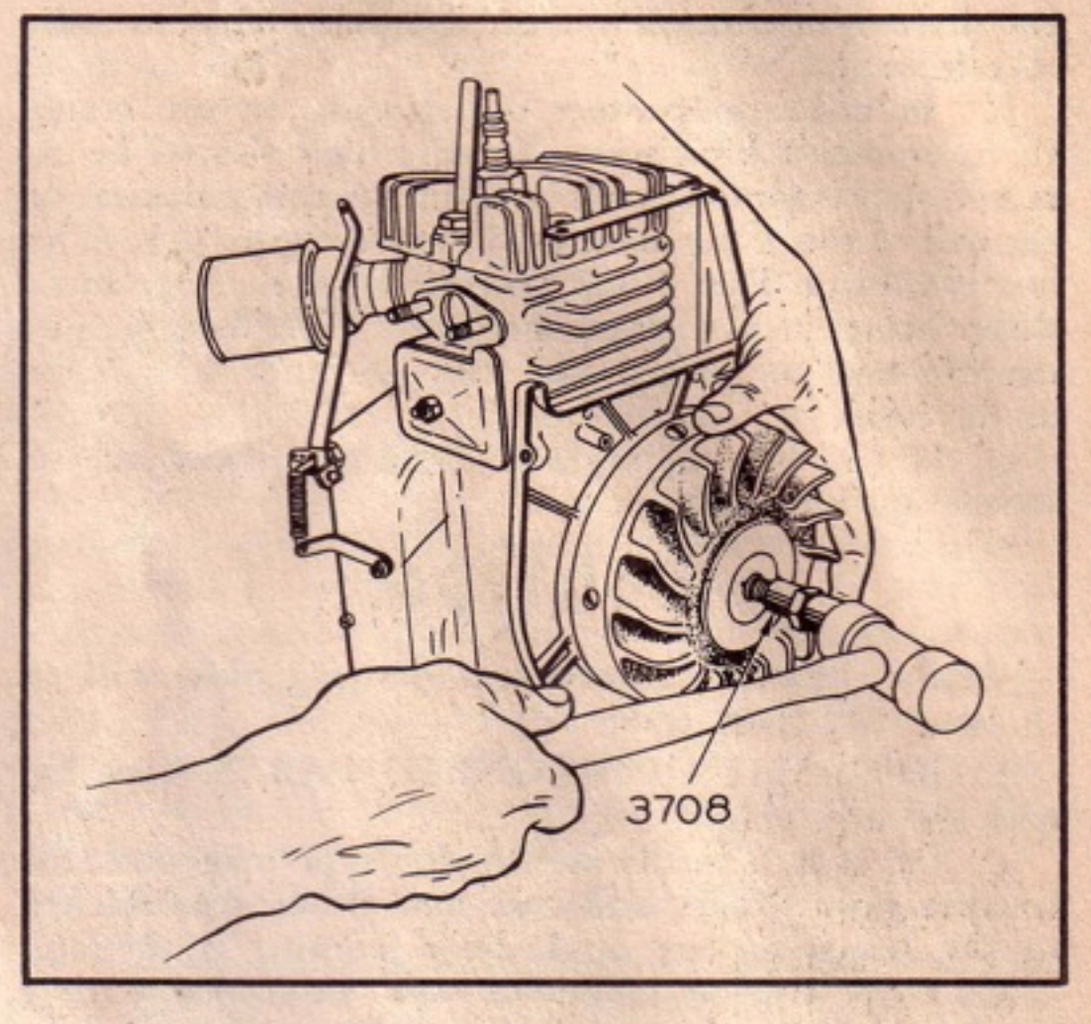


Figure C-1. Removing Flywheel

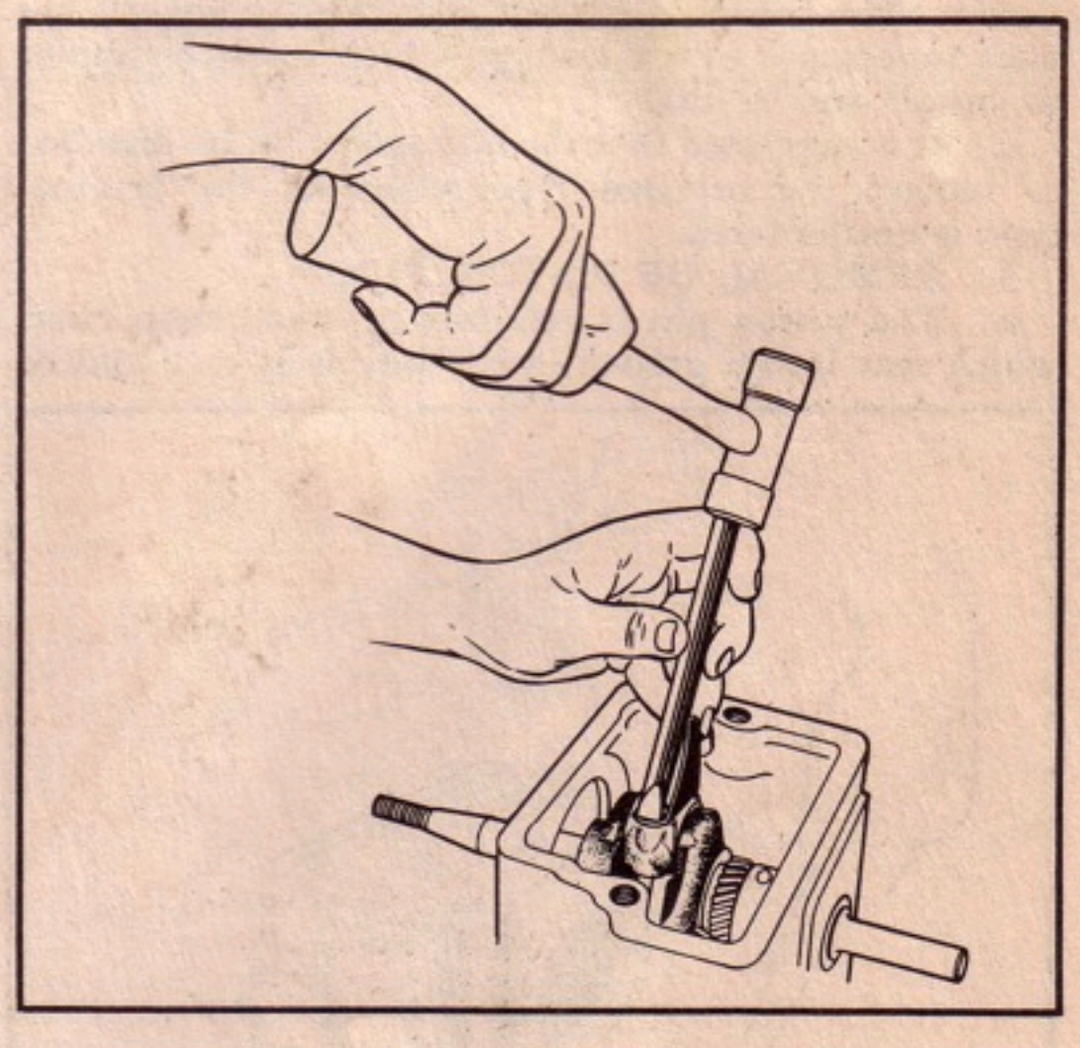

Figure C-2. Removing Connecting Rod Bolt Locks

**NOTE**

Some early model engines are equipped with pin retainers, but late production engines have flat "C" washer retainers.

18. Remove the camshaft and valve tappets.

**NOTE**

When following this order, removal of associated parts due to different types of engines will be obvious.

REMOVAL OF PARTS REQUIRING SPECIAL OPERATIONS.

1. REMOVAL OF FLYWHEEL. (See figure C-1.)

a. The flywheel is mounted on the tapered portion

of the crankshaft and in some instances will stick to the shaft tight enough to require a sharp blow in order to release it.

b. In order to protect the threads on the crankshaft, install a kick starter nut (which should be retained in the serviceman's tool kit for this purpose) on the end of the crankshaft, as shown in figure C-1. (This nut is Clinton Part No. 3708.) Strike the starter nut a sharp blow with a plastic hammer. This should cause the flywheel to jump away from the tapered portion of the shaft.

c. If the first blow fails to loosen the flywheel, repeat until it is loose.

## CAUTION

Strike the nut squarely, as a glancing blow will bend the shaft end.

2. REMOVAL OF MAGNETO PARTS. (See figures B-9 and B-16.)

a. On both Scintilla and Phelon type magnetos, the breaker points, coil, and core assemblies are attached to the bearing plate, and their removal is obvious.

b. Early Phelon magnetos were equipped with a breaker point set having numerous insulating washers and attaching screws, which made it necessary to use extreme care in assembling the parts to provide insulation for the movable contact arm. This point set has been superseded by a later type which is much simpler to install and adjust.

c. It is suggested that the later point set be installed to replace the original type whenever the original type is encountered.

3. REMOVAL OF PISTON PIN.

a. The piston pin is retained by small snap rings which seat into a groove in the piston at each end of

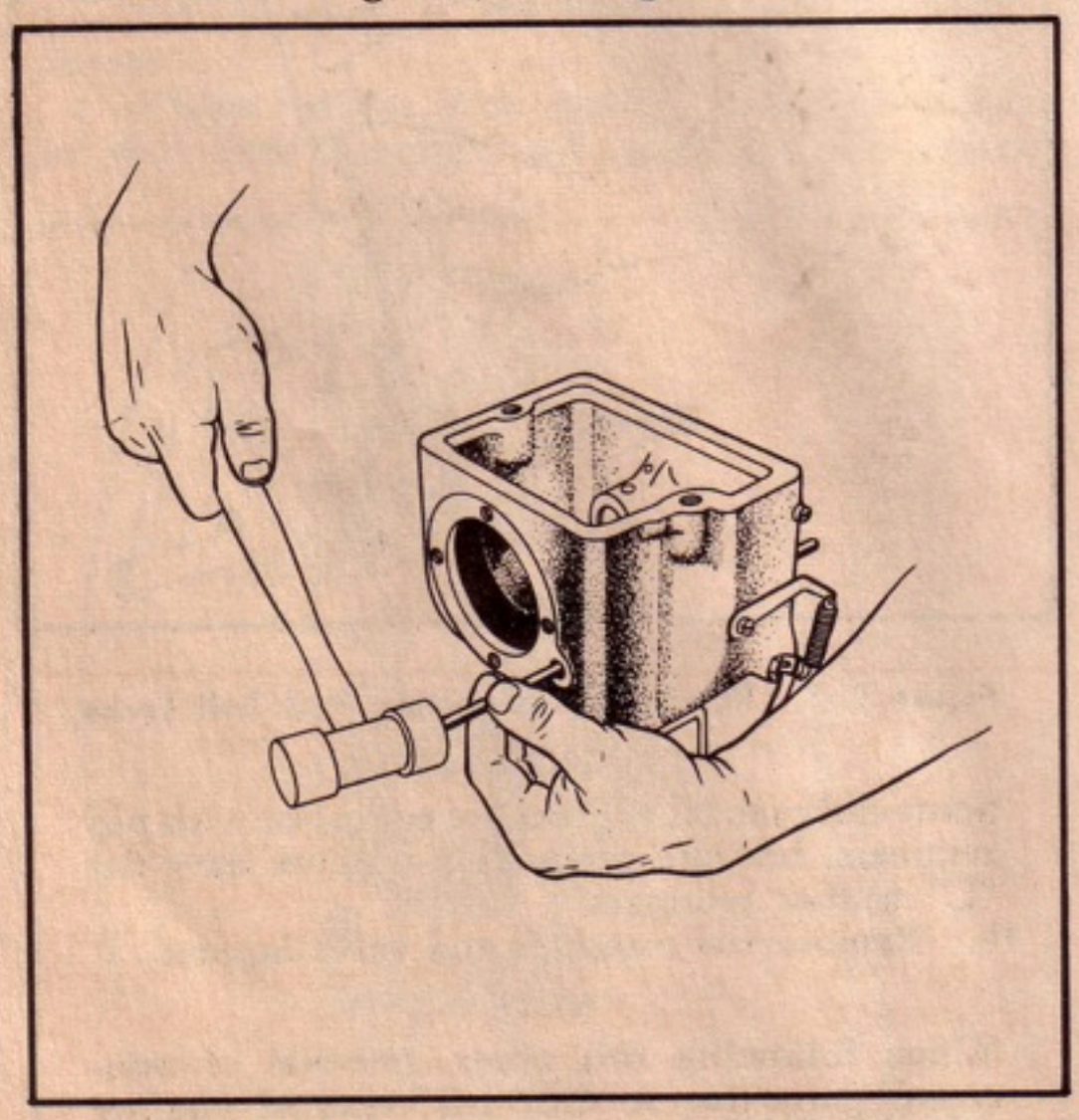

Figure C-3. Removing Camshaft Axle

the piston pin. These rings are easily removed with small, needle-nose pliers.

b. Remove both snap rings and use a wood dowel to tap the piston pin out of the piston. Be sure to hold the piston in one hand while tapping it out with the other hand to avoid marring the piston in any way.

### NOTE

If the piston is to be reused, it is advisable to mark the piston in respect to the connecting rod so that they can be reassembled in the same relationship as when removed.

4. REMOVAL OF PISTON RINGS.

a. If the piston rings are to be replaced (which would normally be true at overhaul), they can be broken and removed, provided care is exercised to prevent scarring the piston lands.

b. If the rings are to be reused, use feeler gages as skids to slide the rings over the piston lands.

### NOTE

Unless the piston is removed for some specific condition, the rings should always be replaced each time the engine is disassembled.

5. REMOVAL OF CAMSHAFT AXLE (See figure C-3.)

a. All cylinder blocks are bored for the camshaft axle with additional clearance given on the power take-off side of the block to permit easy installation and removal of the axle. Therefore, when removing the camshaft axle, always drive it out from the bearing plate side of the cylinder block.

b. In this way, as soon as the axle is free of the bearing plate side of the block it will slide out of the opposite side with ease. (See figure C-3.)

### NOTE

On 300 series engine, the cam-axle pins should not be removed except to install new pins. Refer to page 33 for rebuilding instructions.

6. REMOVAL OF VALVES.

a. It is not necessary to use a special valve lifter in order to remove the valve "C" washers.

b. Use a screwdriver to compress the valve spring, and lift out the "C" washer with the fingers or by using needle-nose pliers.

c. Removal of 'C" washers will be facilitated if the tappet case stud is removed.

## CLEANING ENGINE PARTS

1. Wash all parts of the engine except carburetor (carburetor is overhauled separately) and magneto parts in a regular commercial cleaning solvent capable of removing gum and lacquer formations as well as other types of foreign material.

### NOTE

Solvents which would remove paint from the parts should be avoided unless the parts are to be repainted before reassembling. In most cases, repainting is advisable for the sake of appearance.

2. If such cleaning solvent is not available, denatured alcohol will usually suffice to remove all foreign material, provided the parts are allowed to soak for several minutes before removing them from the solvent.

3. Cleaning can be facilitated by brushing the parts with a small brush while holding them immersed in the cleaning solvent.

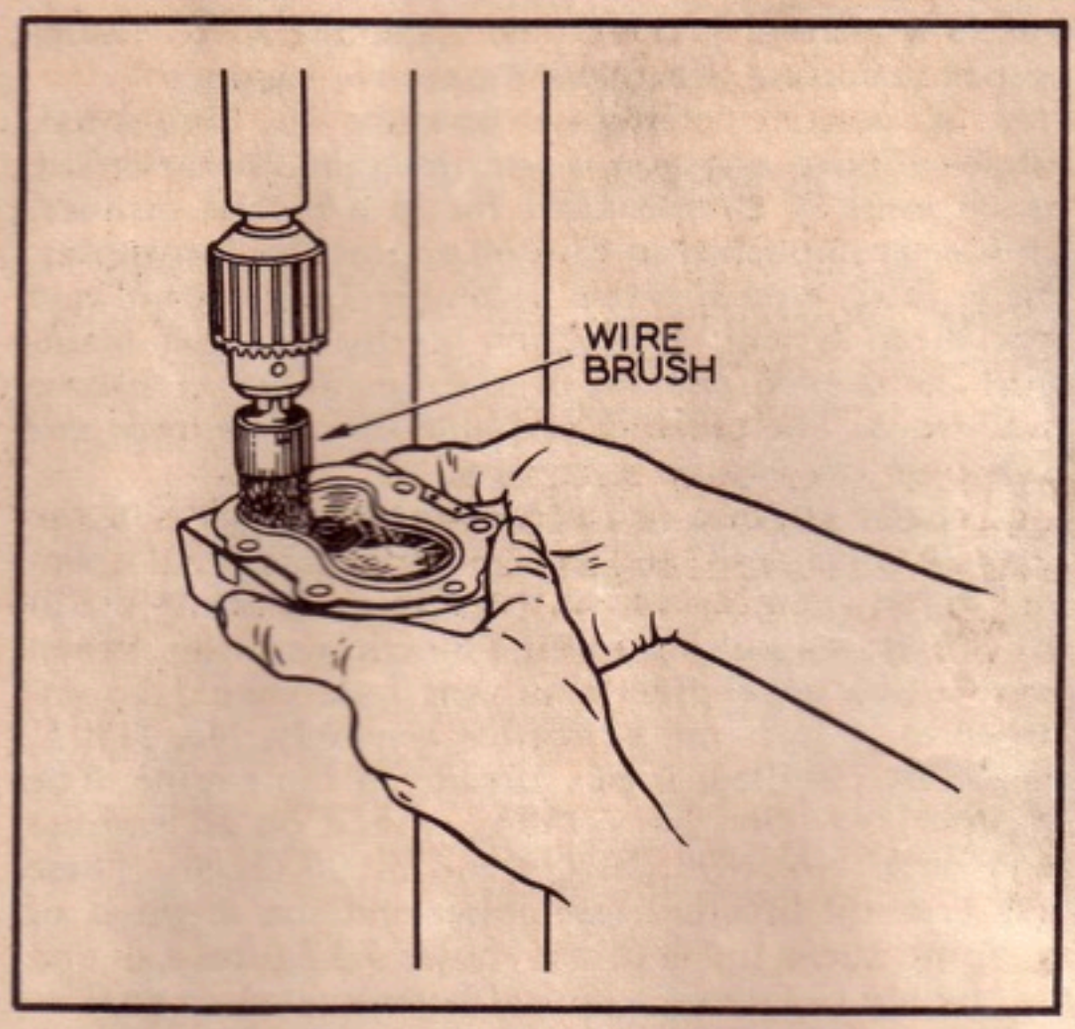


Figure C-4. Removing Carbon From Cylinder Head

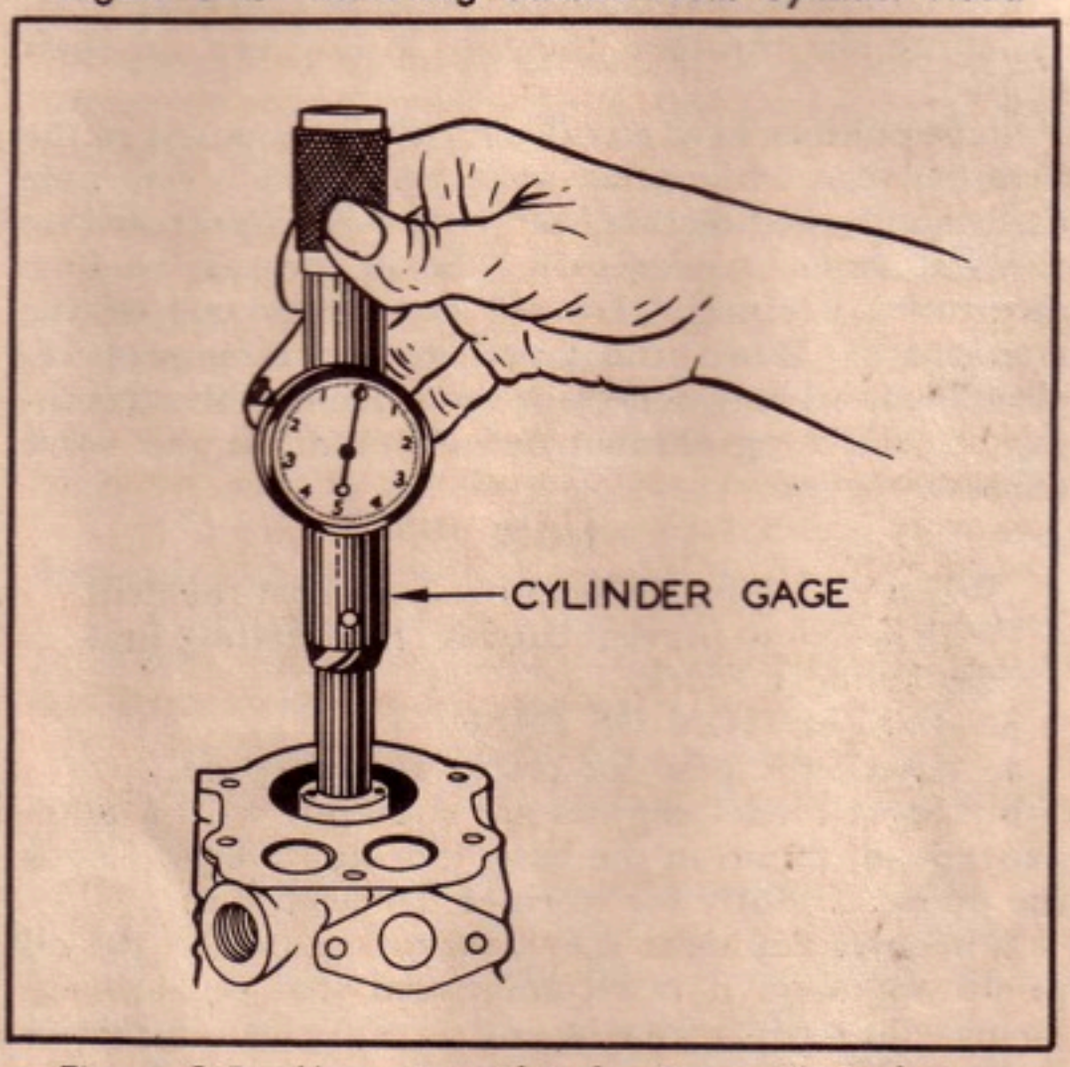


Figure C-5. Measuring Clyinder Bore with Dial Gage

4. Before inserting the cylinder head and piston into the cleaning solvent, scrape all carbon from the top of the piston with a putty knife or wire brush, and remove the carbon from the piston ring grooves with a special carbon scraper or by using the square end of a broken piston ring. Remove all carbon from the cylinder head with a wire brush. (See figure C-4.)

## INSPECTION OF PARTS

After the engine has been disassembled and all parts thoroughly cleaned, each part must be inspected carefully to determine if it is capable of being reused or if it will have to be replaced.

1. INSPECTION OF CRANKSHAFT.

a. Check the bearing journals on the crankshaft for score marks, and for aluminum or other metallic pick-up.

b. If the crankshaft is smooth but shows slight evidence of pick-up, this material can be removed by polishing the journal with crocus cloth soaked in oil until all traces of pick-up have been eliminated.

c. Measure the crankshaft journals for out-of-round condition with an accurate micrometer. The main bearing journals must not be more than .001 inch out-of-round, and the connecting rod journal must not be more than .0005 inch out-of-round. Due to the simplicity of the engine and low cost of parts, it is not advisable to attempt regrinding the crankshaft, as undersize bearings are not available.

d. Check condition of the tapered portion of the crankshaft, keyway, and threads. Battered threads can be restored in most cases by running a die over the battered portion. If the taper is rusty, it is an indication that the engine has been operating with a loose flywheel. Clean the rust off the shaft with crocus cloth and check for evidence of wear. If the taper or keyway is badly worn, the flywheel will not remain tight on the shaft and the shaft must be replaced.

2. INSPECTION OF CYLINDER BLOCK.

a. Using a dial gage, measure the cylinder bore for wear. (See figure C-5.) If the cylinder block is tapered and out-of-round more than .006 inch, the cylinder should be rebored and an oversize piston installed. Refer to paragraph VI, 1, for reboring instructions.

b. Inspect valve seats for extreme wear. The seats

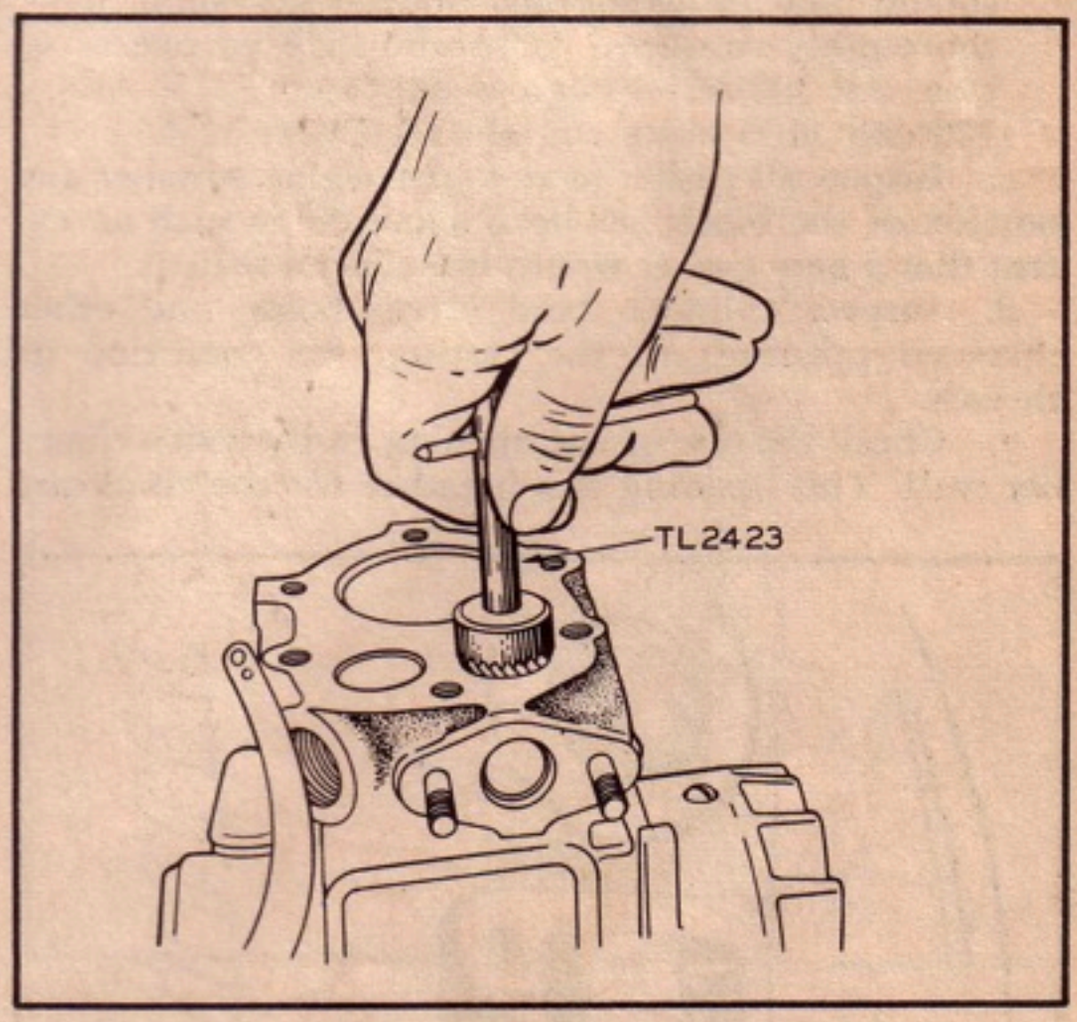


Figure C-6. Reconditioning Valve Seat

should be approximately 1/32 inch in width, and under no condition should they be more than 1/16 inch in width. In many cases, badly worn seats can be restored by reconditioning with an approved valve seat cutter. (See figure C-6.) If the seat width exceeds 1/16 inch after using the 45-degree seat cutter, it can be reduced by using a 15-degree cutter 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.

**NOTE**

Properly-equipped shops can sometimes save an

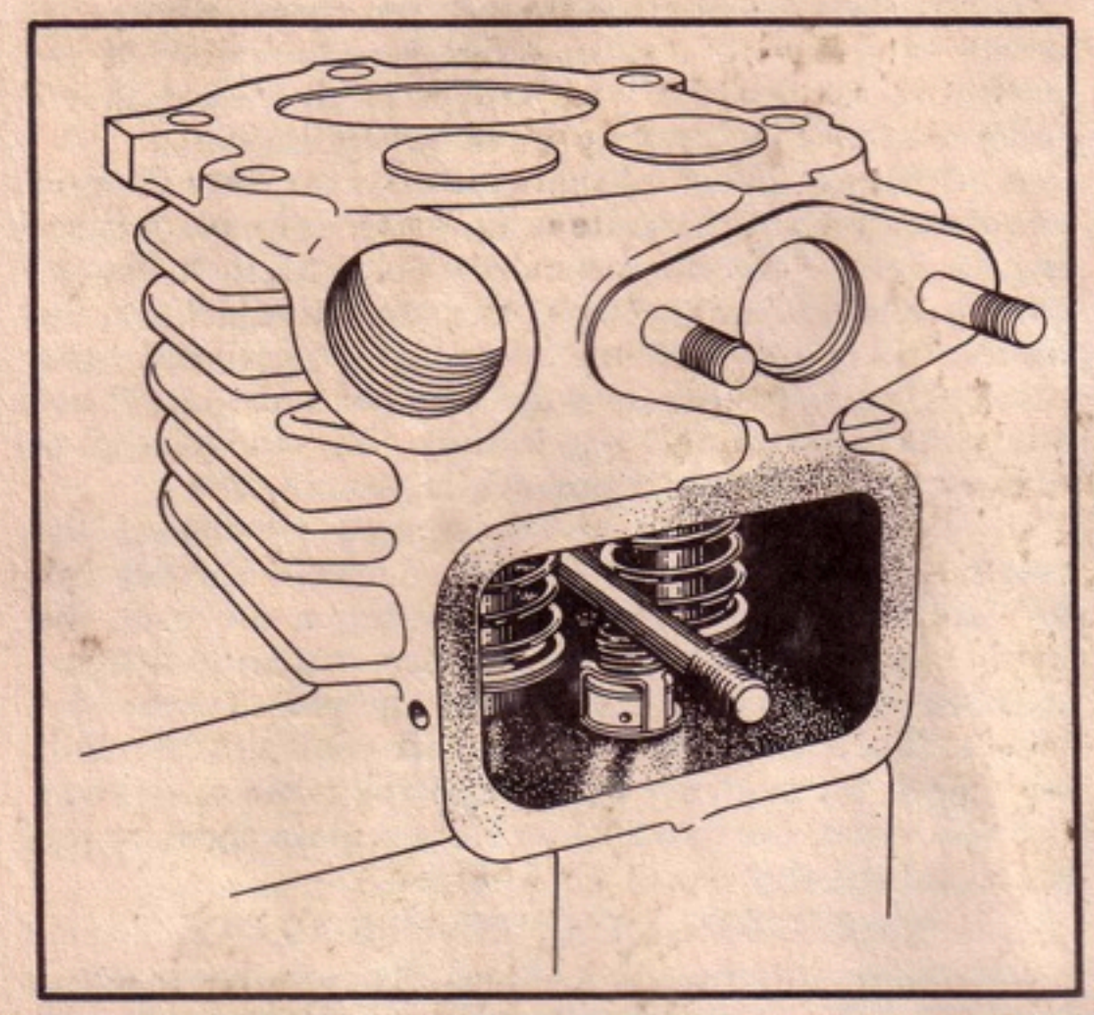

Figure C-7. Oil Breather Assembly in Typical Horizontal Shaft Engine

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. All 300 series engines use insert 7275. All 700 and 1100 series engines use insert 3156.

c. 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 effect a seal.

d. Inspect cylinder head screw holes, and other threaded openings in the casting, for condition of threads.

e. Check the size of the opening in the valve chamber wall. This opening is a breather for the crankcase and it is necessary that it be unhampered to insure proper crankcase breathing on certain engines.

f. A positive crankcase pressure in high-speed, single-cylinder engines is an inherent characteristic which must be compensated for in a special manner. This is accomplished in Clinton engines by incorporating a valve type breather assembly in the crankcase ventilation system. The action of this breather maintains the desired amount of vacuum in the crankcase at all times. The breather assembly should be inspected each time the engine is serviced.

g. Early engines had a 3/16-inch vent hole in the valve chamber wall, and in some cases this small opening would cause excessive pressure to be built up in the crankcase resulting in high oil consumption. When overhauling an engine, this vent hole should be enlarged to ⅜ inch and a breather assembly, No. 7150A, should be installed, if not already in the engine. The breather assembly, No. 7150A, is used on all engines after serial No. 1895 (B-700) and 21090 (1100). These new type oil breather assemblies and the methods of retaining them in place are shown in figures C-7 and C-8. Figure C-7 shows a typical horizontal shaft engine, and figure C-8 shows installation on series 300 engines.

Special assembly precautions must be observed when installing the breather assembly in any vertical shaft engine.

Some engines have an oil return tube attached to the breather seat, while other series only have a vent hole drilled into the breather seat. It is very important that the vent hole or oil return tube in the seat be in a downward position. (Toward the pulley end of the crankshaft.) When the breather seat is improperly assembled, oil may collect in the valve chamber resulting in oil being thrown out the vent in the valve chamber cover.

**NOTE**

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

3. INSPECTION OF BASE.

a. Check the base for cracks and warpage.

b. Some model engines are equipped with a plunger-type oil pump in the base. (See figure C-9.) Check the pump carefully for worn or damaged parts.

Whenever any wear is evident to any part of the oil pump assembly, it is recommended that replacement be made in accordance with instruction given in Service Bulletin No. 52.

4. INSPECTION OF CONNECTING ROD.

a. Check the connecting rod bearing for score marks and evidence of wear.

b. The bearing can be checked most effectively by measuring the crank pin diameter and comparing this with the inside diameter of the connecting rod bearing (with the connecting rod cap bolts pulled up tight). Clearance should be between .001 and .0025 inch.

c. In most instances, wear in the connecting rod bearing which would exceed these limits will be characterized by score marks or a rough bearing surface, either of which would necessitate replacement of the connecting rod.

d. New connecting rod bearings are bored to correct size, and will effect a proper fit on the connecting rod journal, provided the journal is not undersize more than .001 inch.

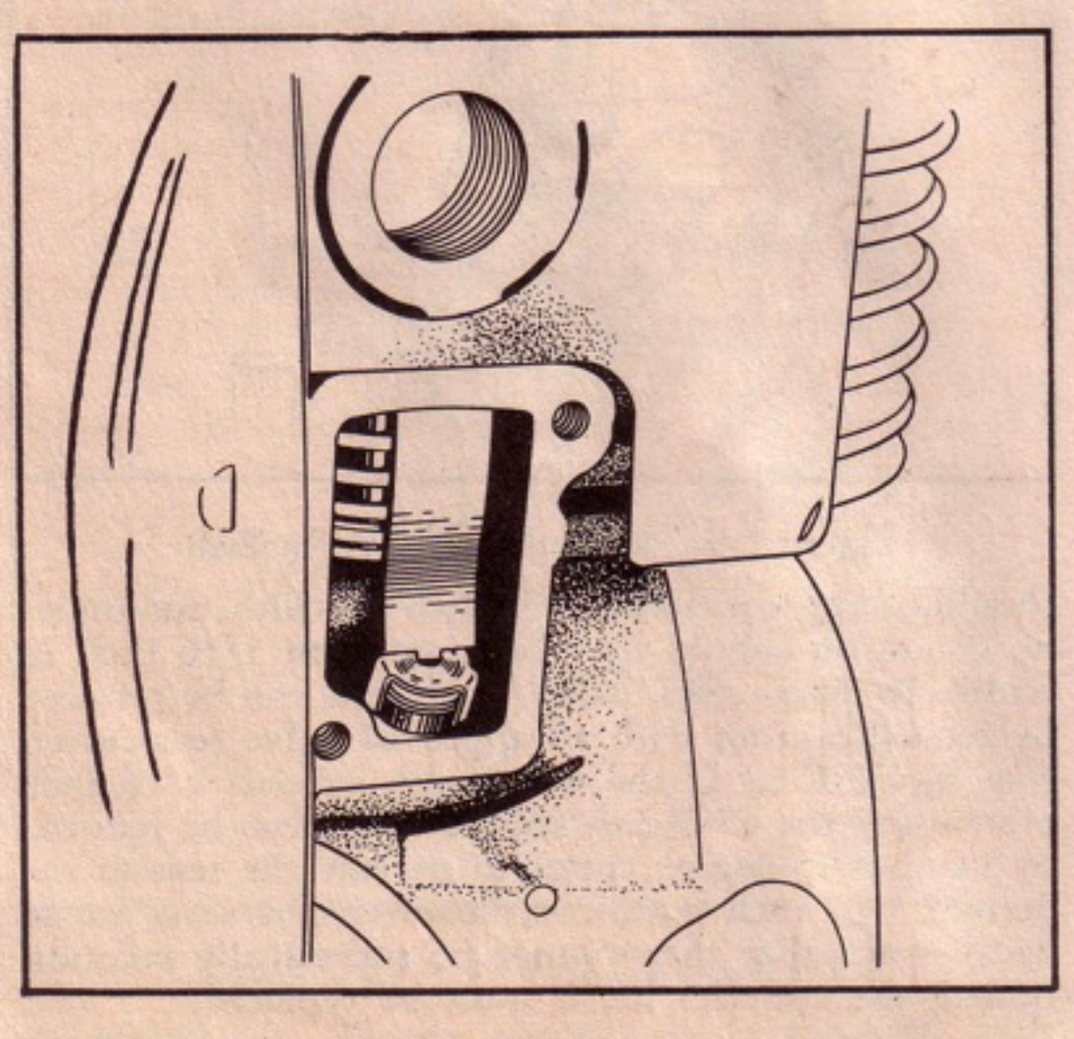

Figure C-8. Oil Breather Assembly in Series 300 Engine

5. INSPECTION OF VALVE SPRINGS.

a. The most effective method of testing valve springs is to compare them with new springs. This can be done on a valve spring tester, but if such a tester is not available, check the used valve spring against the new spring for correct length. If the spring has weakened, it will be shorter than the new spring and in most instances will not stand up straight but will lean to one side when standing on end.

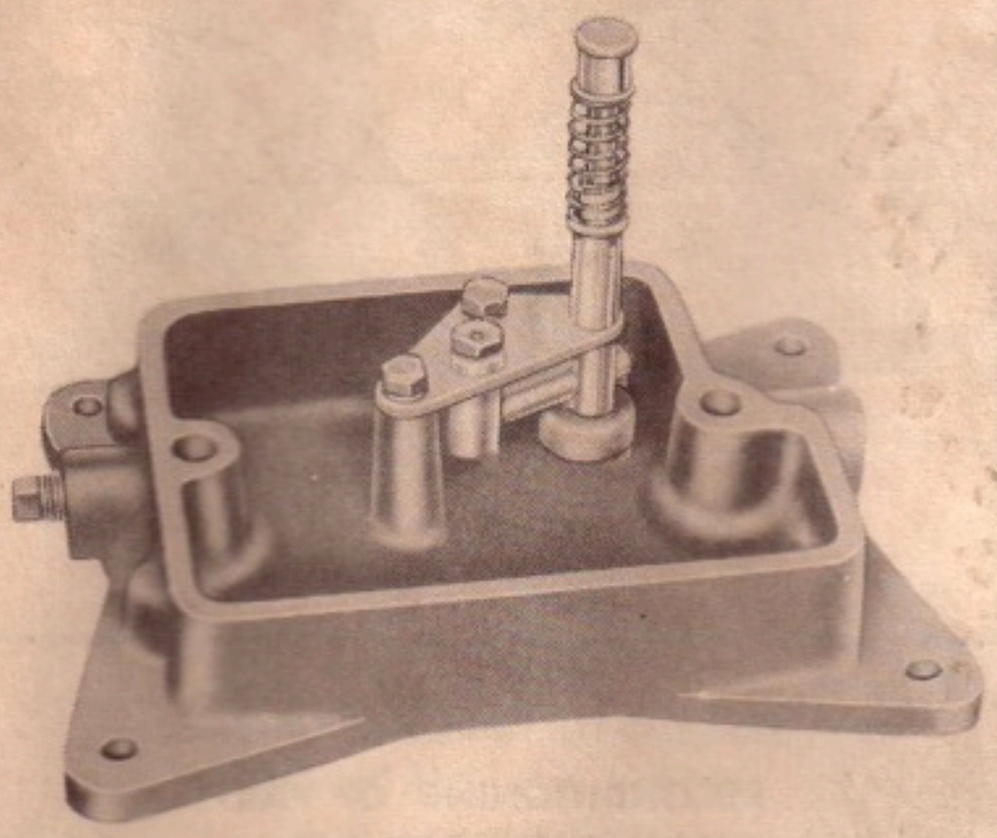

Figure C-9. Oil Pump Mounted in Base

b. If there is any question concerning the condition of valve springs, they should be replaced to insure proper valve action.

6. INSPECTION OF FLYWHEEL.

a. Check the flywheel for broken fins and loose magnets. If magnets are loose, tighten them securely and stake the screw heads in position. Test strength of magnets with the "magnetometer," as shown in figure C-10.

b. Pay particular attention to the tapered bore of the flywheel for evidence of rust and wear. Either of these conditions indicates that the flywheel has been loose on the crankshaft.

c. Clean the bore carefully with crocus cloth before reinstalling the flywheel on the engine.

7. INSPECTION OF BEARING PLATE.

a. Check the bearing plate for warpage and condition of the bearing surface.

b. Measure the crankshaft journal diameter and the bearing diameter in order to determine the amount of wear. If clearance exceeds .005 inch, the bearing must be replaced. The correct clearance can be ascertained with reasonable accuracy by feeling a new crankshaft in a new bearing and comparing the amount of looseness with the parts being checked. Refer to paragraph VI, 2, for replacement instructions.

c. 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.

d. Inspect the threads in all screw holes in the bearing plate. If a considerable number of screw holes have damaged threads, it is advisable to replace the bearing plate. However, in some instances the bearing plate can be salvaged by tapping out the damaged screw holes for the next size larger screw, provided the bearing plate is in good condition otherwise.

8. INSPECTION OF BLOWER HOUSING.

a. Check the blower housing for dents. The housing has a carefully-shaped contour in order to allow the correct circulation of air over the engine. Dents in the blower housing will interfere with cooling and should be removed when the engine is overhauled.

b. Remove dents with a plastic hammer, using a wood block for back-up purposes.

9. INSPECTION OF CAMSHAFT.

a. Check the teeth on the camshaft gear(s) for damage, and inspect each cam for wear and score marks. Existence of any of these conditions will necessitate replacement of the camshaft.

b. Check the camshaft axle for wear and replace it if damaged.

When inspecting the 300 series cam gears, all teeth must be checked carefully as any wear that may be present will only appear on a few teeth and the balance of the gears may be in good condition. If either gear indicates wear, both cam gears and crankshaft should be replaced.

c. On engines equipped with a flyball governor, check the governor weights for wear and other obvious damage. All governor parts must be free.

10. INSPECTION OF MUFFLER.

a. Check the muffler for restriction due to an accumulation of carbon on the inside.

b. If carbon is apparent, the muffler should be soaked in an effective commercial cleaning solvent until the restriction is sufficiently dissolved to permit the carbon to be blown out with a stream of compressed air.

11. INSPECTION OF CYLINDER HEAD.

a. Scrape the old gasket from the cylinder head, and lay the head right side up on a face plate and check to see if the gasket surface of the cylinder head makes full contact with the plate.

b. If the cylinder head is severely warped, it must be replaced, but slight warpage can be eliminated by resurfacing the head in accordance with paragraph 9, page 30.

c. Make certain that no cooling fins have been broken off of the head.

12. INSPECTION OF CARBURETOR.

Disassemble the carburetor and repair it in accordance with Section VI, Division D.

13. INSPECTION OF FUEL TANK AND LINES.

a. Check the fuel tank for leaks, and for rust on the inner surface of the tank. A severely rusted tank should be replaced. However, small leaks can be repaired successfully by resoldering or welding. It is suggested that the tank be filled with water and allowed to stand for several hours before draining the water and attempting to solder the damaged portion.

**WARNING**

Never attempt to solder a tank with the cap in place.

b. Remove the tank strainer and clean it.

c. On engines equipped with Carter carburetors, remove the shut-off valve assembly from the fuel tank and clean the small screen inside the shut-off valve. Replace if the screen is damaged.

d. Check all fuel lines for kinks, cracks, and weak flares. Replace all damaged lines, as well as those showing signs of weakness which would cause premature failure.

14. INSPECTION OF SPARK PLUG.

a. Check the spark plug for blistered or broken porcelain, and excessive wear on the electrodes. Either of these conditions will necessitate replacement of the plug.

b. If plug is in good condition, clean and regap it in accordance with Section VI, Division B.

15. INSPECTION OF AIR FILTER.

Inspect all parts of the air filter and service it in accordance with Section VI, Division B.

16. INSPECTION OF MAGNETO PARTS.

a. Check the breaker points, condenser, and magnet coil in accordance with Section VI, Division B.

b. Check the plastic dust cover for cracks and warpage. If this cover does not fit closely around the rib of the bearing plate casting, install a new dust cover.

Some engines may have metal dust covers. Make sure the cover does not contact the breaker cam or the breaker point. Either condition will cause ignition failures.

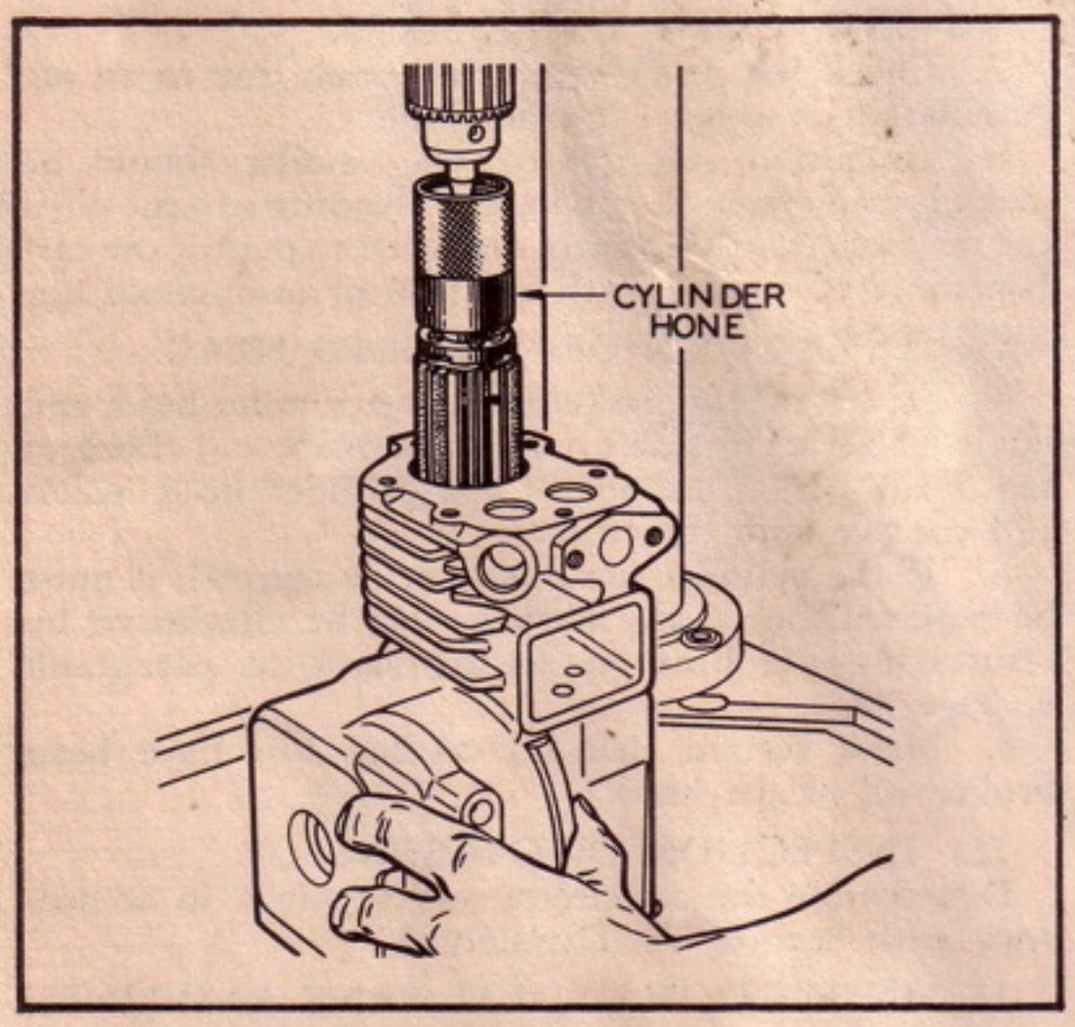


Figure C-10. Honing Engine Cylinder

17. INSPECTION OF BREATHER ASSEMBLY.

a. Check the breather assembly for blocked ports and worn valve seat.

b. Replace the unit if damaged.

18. INSPECTION OF PISTON.

a. Check the piston for score marks, worn ring lands, and worn piston pin bores. If any of these conditions are excessive, replace the piston.

b. Measure the ring grooves in the piston by inserting a new piston ring and checking the clearance between the edge of the ring and the piston land. This clearance should not exceed .002 inch.

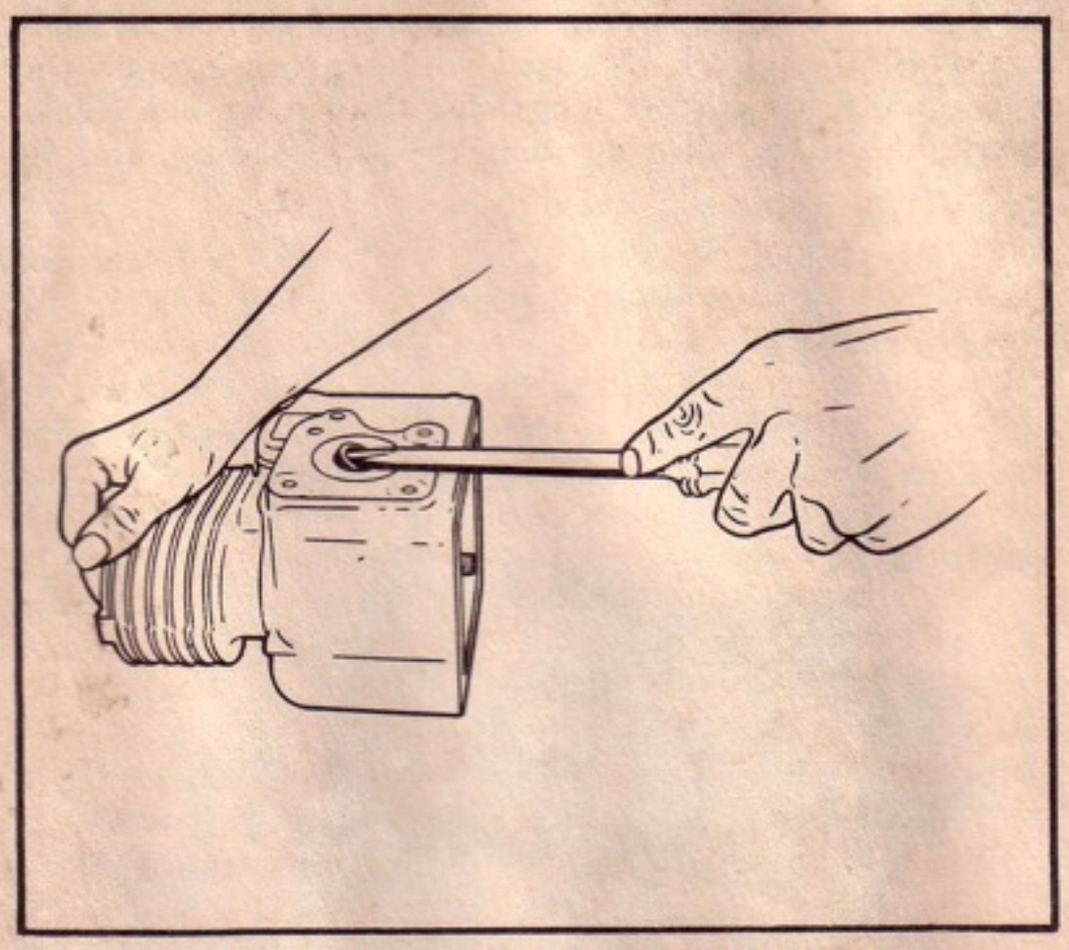

Figure C-11. Removing Oil Seal

## RECONDITIONING OF PARTS

1. REBORING CYLINDER. Pistons and piston rings are available from the Clinton Machine Company in regular oversizes of .005 inch, .010 inch, and .020 inch; and special oversizes of .030 inch and .040 inch. Measure the cylinder wear with a dial gage as shown in figure C-5 to determine the amount of cylinder wear, and rebore the cylinder to the nearest available oversize which will permit cleaning up cylinder wear completely. Any standard commercial cylinder hone can be used for reboring the cylinder, provided it is used with care and common sense. Nominal operating clearances are allowed on oversize pistons and oversize piston rings. Therefore, when reconditioning the cylinders, 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 followed, a long wearing cylinder will be obtained.

a. Clean the table of a conventional drill press thoroughly so that the cylinder block can be rested on the table without rocking.

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 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 C-10.)

e. Lower the hone to the point where the lower ends of the stones are in contact with the lowest point of the cylinder, 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 the hone up and down at the rate of approxi-

mately 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 to 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 a large amount of metal, they should be cleaned by brushing them with a wire brush each time the hone is removed.

h. When the bore has straightened out, continue honing with long strokes carrying the hone through both ends of the cylinder approximately one inch. Continue to hone in this manner until the cylinder is within .002 inch of the desired finished size.

i. Remove the cylinder hone and replace the coarse stones with burnished stones and hone in accordance with preceding instructions until the bore is within approximately .0005 inch of desired size.

**NOTE**

The cylinder should be checked with the dial gage as the honing operation progresses to avoid removing too much metal.

j. Remove the hone and install finishing stones to polish the cylinder for final finishing.

k. Insert the hone with the finishing stones and remove the final .0005 inch of metal by the polishing process. These stones will cut very slowly and one or two checks for size during these operations 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, as this has been discovered to be the most efficient method of removing cuttings which may have been embedded in the surface of the cylinder wall. It is advisable to scrub the cylinder wall thoroughly, using a coarsely woven cloth and soapy water.

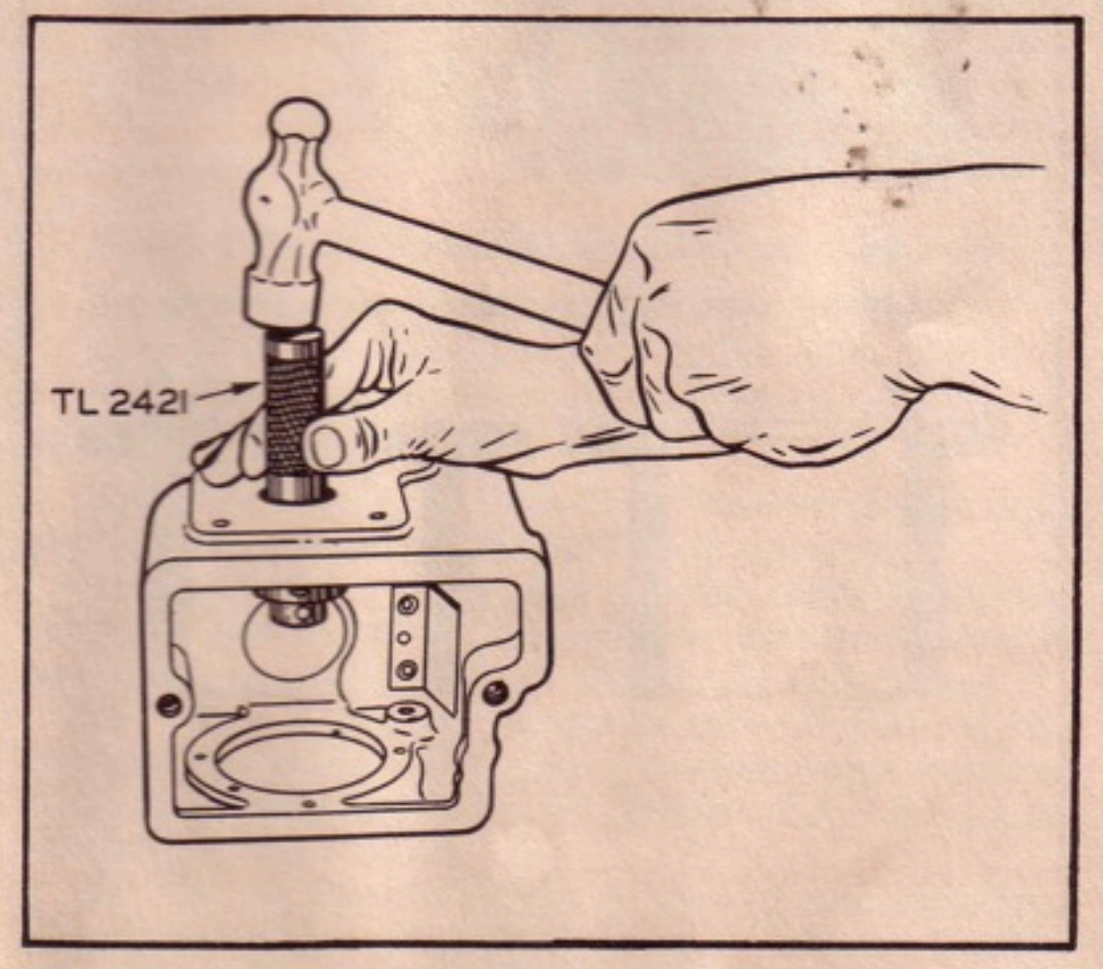


Figure C-12. Driving Crankshaft Bearing Out of Cylinder Block

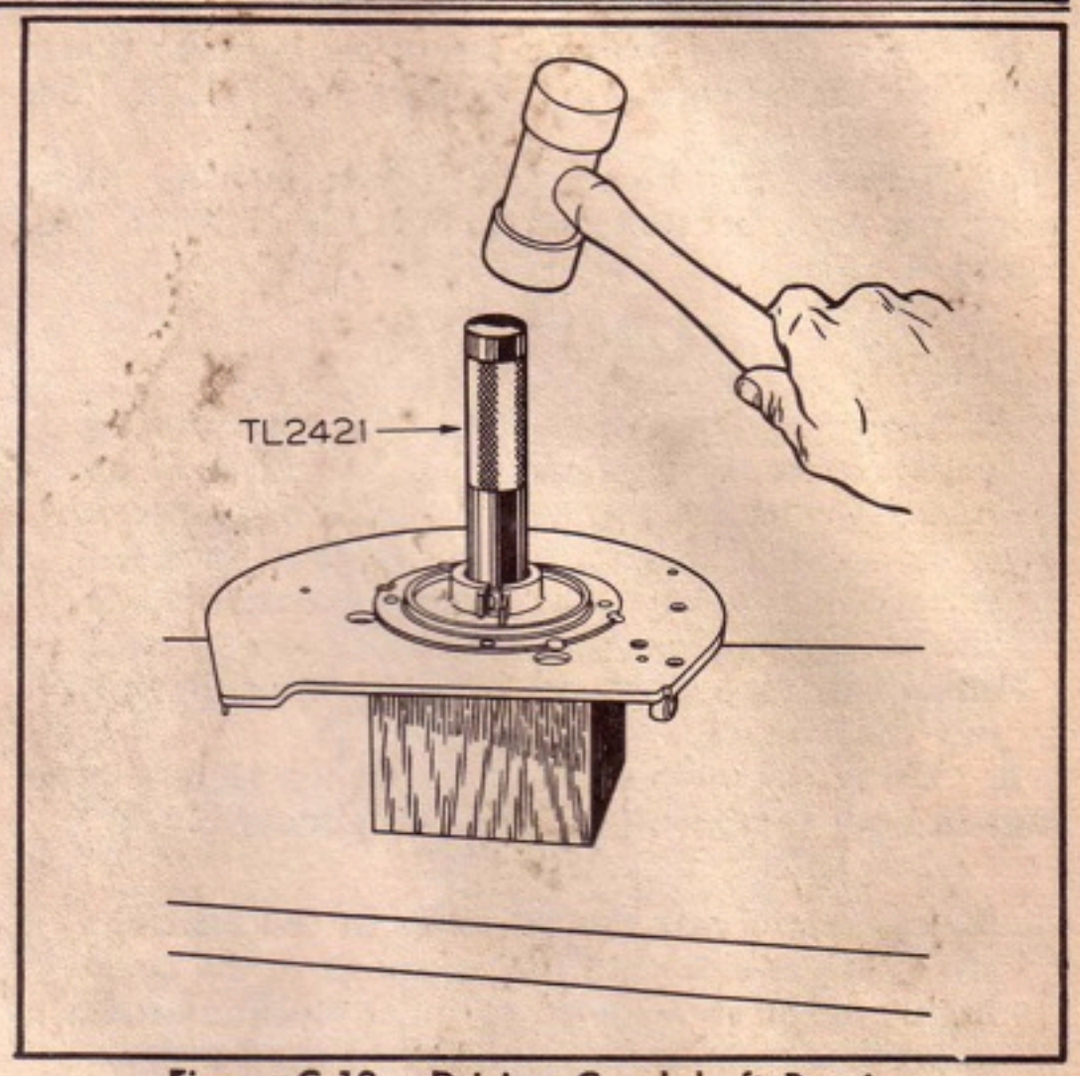


Figure C-13. Driving Crankshaft Bearing Out of Bearing Plate

m. After washing with the soap and water solution, wash the cylinder block with a good commercial solvent or ordinary gasoline.

n. Coat the cylinder wall with oil to prevent rust.

**NOTE**

The cylinder is now ready for installation of the new oversize piston and rings.

2. INSTALLING NEW CRANKSHAFT BEARINGS.

a. Remove the oil seals in the cylinder block and bearing plate. (See figure C-11.) These seals can be removed by prying them out of their recesses with a screwdriver. No special care is required, as these parts are to be replaced.

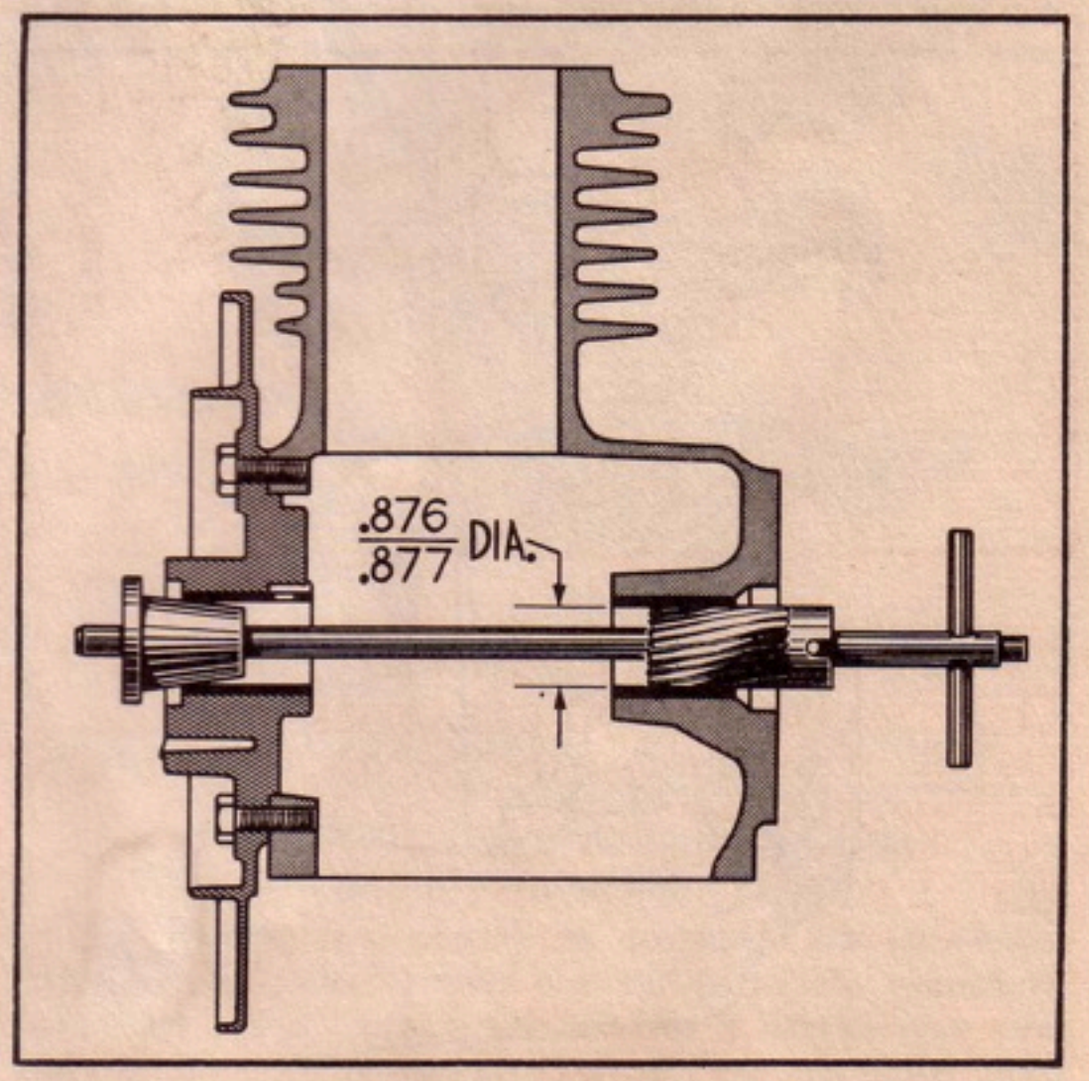


Figure C-14. Align-Reaming Main Bearings

b. Drive the old bearings out of the cylinder block, using the main bearing driver, Part No. TL2421. (See figure C-12.)

c. Remove the bearing from the bearing plate, using the main bearing driver, Part No. TL2421. (See figure C-13.)

**CAUTION**

When removing the bearing from the bearing plate, make certain the plate is blocked up squarely with the face of the plate with a block of hard wood or a piece of steel having a flat surface and a hole in the center to accommodate the bearing. An old cylinder block can be used effectively for supporting the plate when driving out the bearing.

d. Using the main bearing driver, install new bearings in both the bearing plate and cylinder block.

**NOTE**

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 in order to provide proper oil circulation to the bearings. Figures C-12 and C-13 show the approximate location of these holes.

e. Install the bearing plate on the cylinder block and tighten all four attaching bolts securely.

f. Insert the main bearing reamer in the bearing bore and slide the alignment sleeve on the end of the reamer shaft in the opposite bearing from the one being removed. (See figure C-14.)

g. Rotate the reamer continuously until it passes through the bearing. Remove the reamer and insert it in the opposite direction and ream the opposite bearing.

h. Remove the bearing plate from the cylinder block and insert the crankshaft journals through their respective bearings to determine if the proper fit has been obtained. 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 if the crankshaft binds in its bearings. A warped bearing plate will sometimes cause binding. If this condition exists, the bearing plate must be replaced.

3. RECONDITIONING VALVES.

a. REAMING VALVE GUIDES. Insert a new valve stem in a new cylinder block and acquire the feel of the proper valve stem clearance. Compare this clearance with the valves in the reconditioned block to determine whether or not it will be necessary to install valves having oversize stems. If this clearance is excessive, it is always advisable to install valves having oversize stems in order to insure long valve life. The valve guides in the cylinder block should be reamed in accordance with the following instructions:

(1) Clean the table of a drill press so that the bottom surface of the cylinder block will lie flat against the metal table.

(2) Install the valve guide reamer (use a standard 9/32 reamer) in the chuck of the drill press. (See figure C-15.) 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.

(3) Ream the other valve guide in the same manner.

(4) Coat the valve guides with oil to prevent rusting.

4. RECONDITIONING VALVE SEATS.

a. Insert the pilot of the valve seat cutter, Part No. TL2423, in one of the valve guides and take a light cut by rotating the cutter approximately one-half revolution. (See figure C-6.) Apply pressure to the cutter in a direct line with the valve guide in order to prevent forcing the cutter against either side of the seat.

b. Remove the valve seat cutter and check to see if 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 pre-

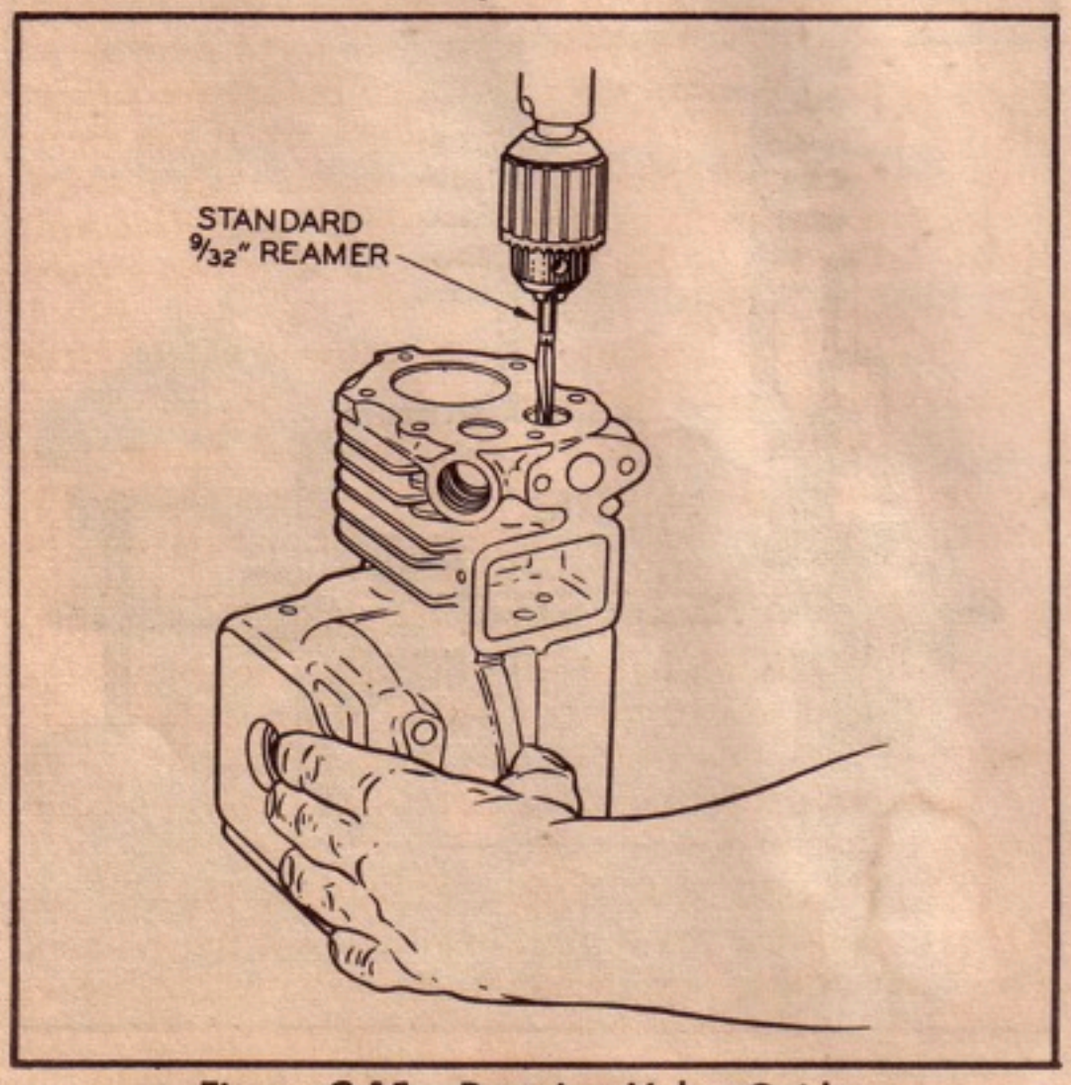


Figure C-15. Reaming Valve Guides

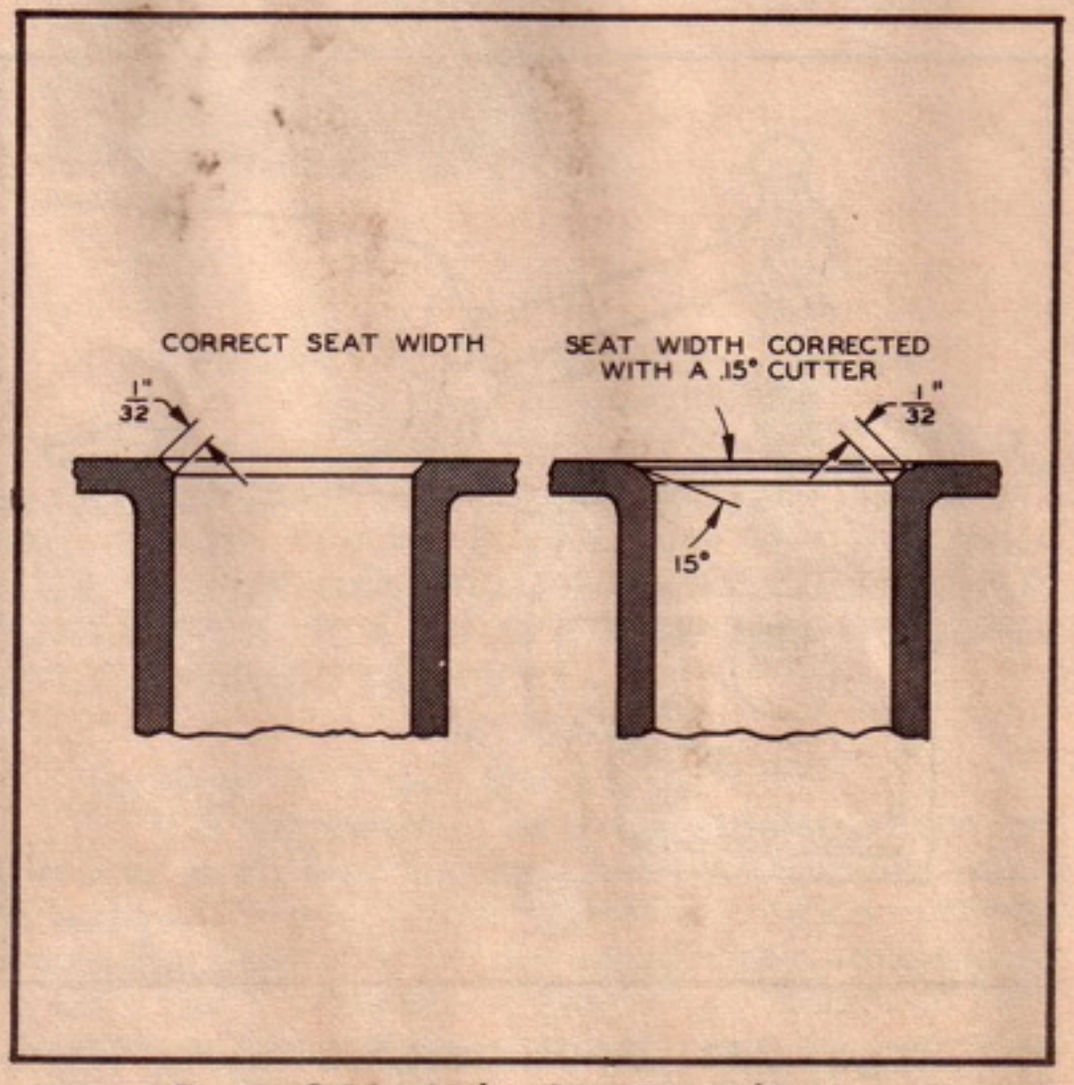


Figure C-16. Valve Seat Reconditioning

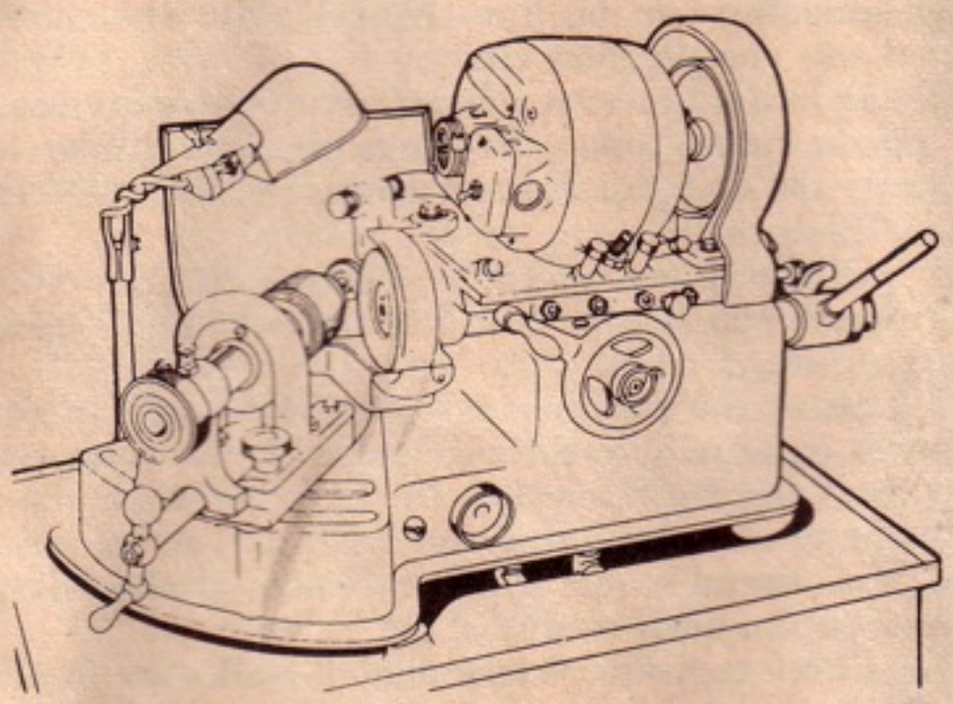

Figure C-17. Reconditioning Valve Faces

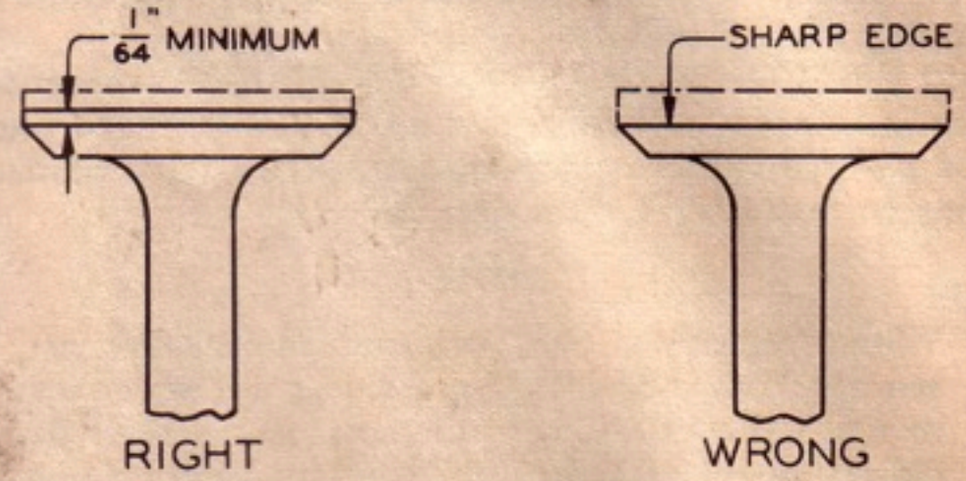


Figure C-18. Correct and Incorrect Valve Faces

ceding instructions. (See figure C-16.)

c. Continue this operation until a true valve seat has been formed.

d. Recondition the other valve seat in the same manner.

e. Measure the width of each valve seat, which should be approximately 1/32 inch. If the valve seats are more than 1/32 inch in width, use a 15-degree seat cutter in the same manner as the 45-degree seat cutter to narrow the seat to within limits, which should average between 1/32 and 1/16 inch. (See figure C-16.)

5. RECONDITIONING VALVE FACES.

a. If the original valves are in good condition and can be reused after they have been refaced, chuck one of the valves in a typical valve refacing machine and grind the face at a 45-degree angle until the entire face has been cleaned up. (See figure C-17.)

b. Recondition the other valve in the same manner.

**NOTE**

If sufficient metal must be removed in reconditioning the valve faces to produce a thin edge at the top of the valve face, the valve must be replaced. These edges should be at least 1/64 inch in width. (See figure C-18.)

6. LAPPING VALVES.

a. Coat the face of the 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.

b. Use a vacuum cup to grip the top of the valve, and rotate the valve back and forth with an oscillating motion, raising the valve slightly after each eight or ten strokes to keep the compound equalized on the surface of the valve and the seat. 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.

c. After both valves have been lapped in this manner, wash the valve seats and cylinder block thoroughly with solvent to remove all traces of the valve lapping compound. Dry the parts with compressed air.

7. ADJUSTING VALVE TAPPET CLEARANCE.

a. Install the valve tappets and camshaft in the cylinder block, and rotate the cam so that the intake valve tappet is resting on the heel of the cam.

b. 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. This clearance must be .008 inch. (See figure B-28.)

c. After reconditioning valves or installing new valves, this clearance will be less than .008 inch and the end of the valve stem must be ground off until this clearance is obtained. Use the 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.

d. Rotate the camshaft back and forth and see if 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, it indicates a worn cam which necessitates replacement of the camshaft. This variation must never exceed .002 inch.

e. Adjust the clearance for the exhaust valve in the same manner to .012 inch.

8. FITTING PISTON PINS. Oversize piston pins are not supplied as spare parts. Experience in the field has shown that very little wear occurs on the piston pins, and by the time sufficient wear on the pin, pin bosses in the piston, and the connecting rod little end is great enough to be objectionable, the connecting rod will need to be replaced due to wear at the crankshaft end. For this reason, new piston pins should always be installed when new connecting rods and pistons are installed.

9. RESURFACING THE CYLINDER HEAD. Before reassembling the engine, always check the cylinder head for warpage and distortion by placing the gasket surface against a face plate and checking to see if the gasket surface contacts the face plate throughout. If the head shows signs of slight distortion, the gasket

surface can be repaired in accordance with subsequent instructions.

a. Lay a piece of fine emery cloth, abrasive side up, on the face plate and move the cylinder head across the surface of the mery cloth in a "figure 8" manner. (See figure C-19).

b. Check often to determine when all portions of the face have been cleaned up.

10. RECONDITIONING MAGNETO. Magneto reconditioning will consist of replacing damaged parts and adjusting these parts in accordance with instructions in Section VI, Division B.

**NOTE**

When removing the coil and lamination assembly from the bearing plate, it is not necessary to mark the location, as the attaching screws fit closely in the attaching holes of the laminations and when reinstalled they will automatically be positioned to produce the proper core gap between the ends of the lamination assembly and the magnets in the flywheel.

## REASSEMBLY OF ENGINE

Because of the many variations and types of Clinton engines, complete step-by-step reassembly instructions for each individual engine would be too lengthy to serve a practical purpose for the engine repairman. However, the subsequent general routine should be followed as closely as possible when reassembling an engine. Operations which require application of special tools or unusual treatment will be handled under individual headings following the general reassembly routine. Always refer to the appropriate headings for specific instructions on these highly important operations.

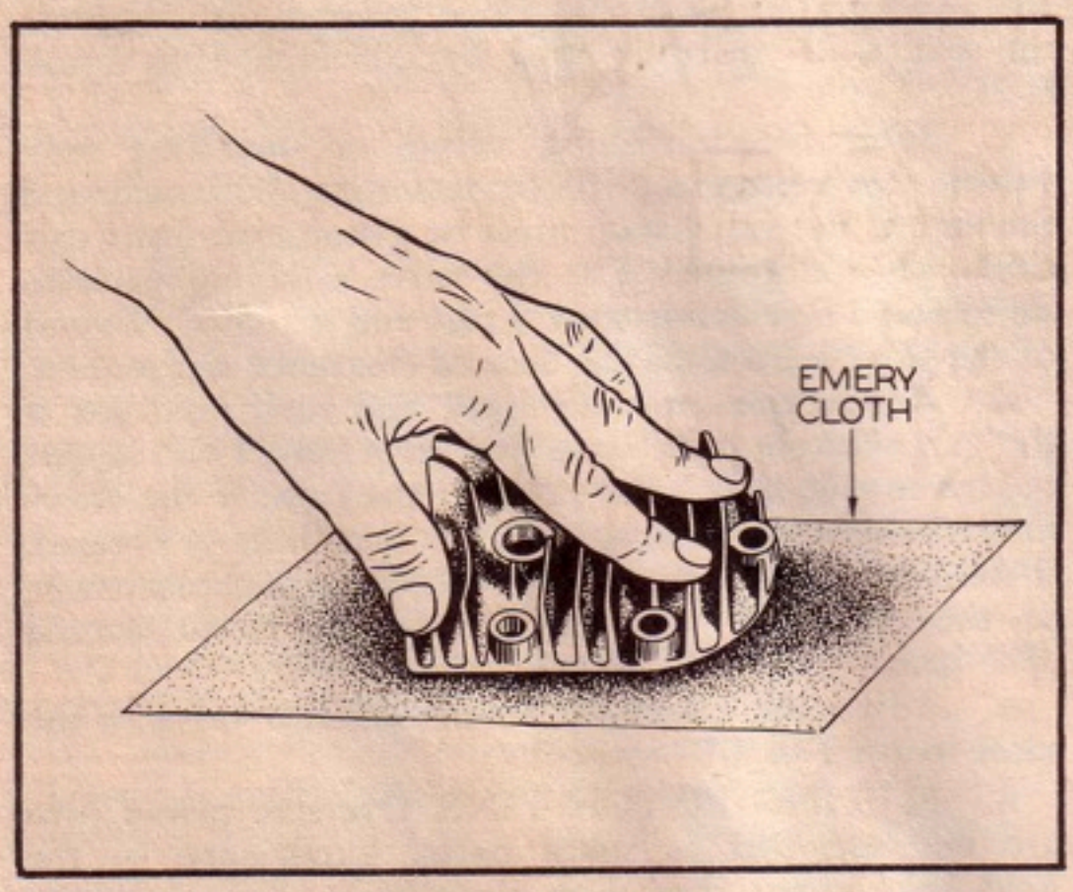


Figure C-19. Resurfacing Cylinder Head

1. Install all magneto parts on the bearing plate.

2. Assemble the piston to the connecting rod and anchor the piston pin with the small snap rings. Make certain the snap rings are fully engaged in the grooves in the piston pin bosses.

3. Install the piston rings in their proper grooves in the piston. The oil ring, which is wider than the other two, is always installed in the lower position in most engines. The second compression ring is a scraper ring and must not be interchanged with the conventional top compression ring.

4. If in doubt about the correct oversize dimension of piston rings, insert the rings in the cylinder and measure the end gap. Correct gap is between .007 inch and .012 inch.

5. Oil the piston pin generously with SAE No. 10 engine oil, and place a few drops of oil in each piston ring groove.

6. Move the piston rings back and forth in their grooves to distribute the oil, and rock the connecting rod back and forth several times to distribute the oil into the upper connecting rod bearing. Lay the piston and rod assembly on a clean bench, preferably on waxed paper, until ready for use.

7. Check to make certain that all baffles are in place in the cylinder block, if these baffles were removed during disassembly.

8. Insert the two tappets in the cylinder block and install the camshaft.

9. Drive the camshaft pin into the engine block from the power take-off side and make certain that it extends through the bearing plate side approximately

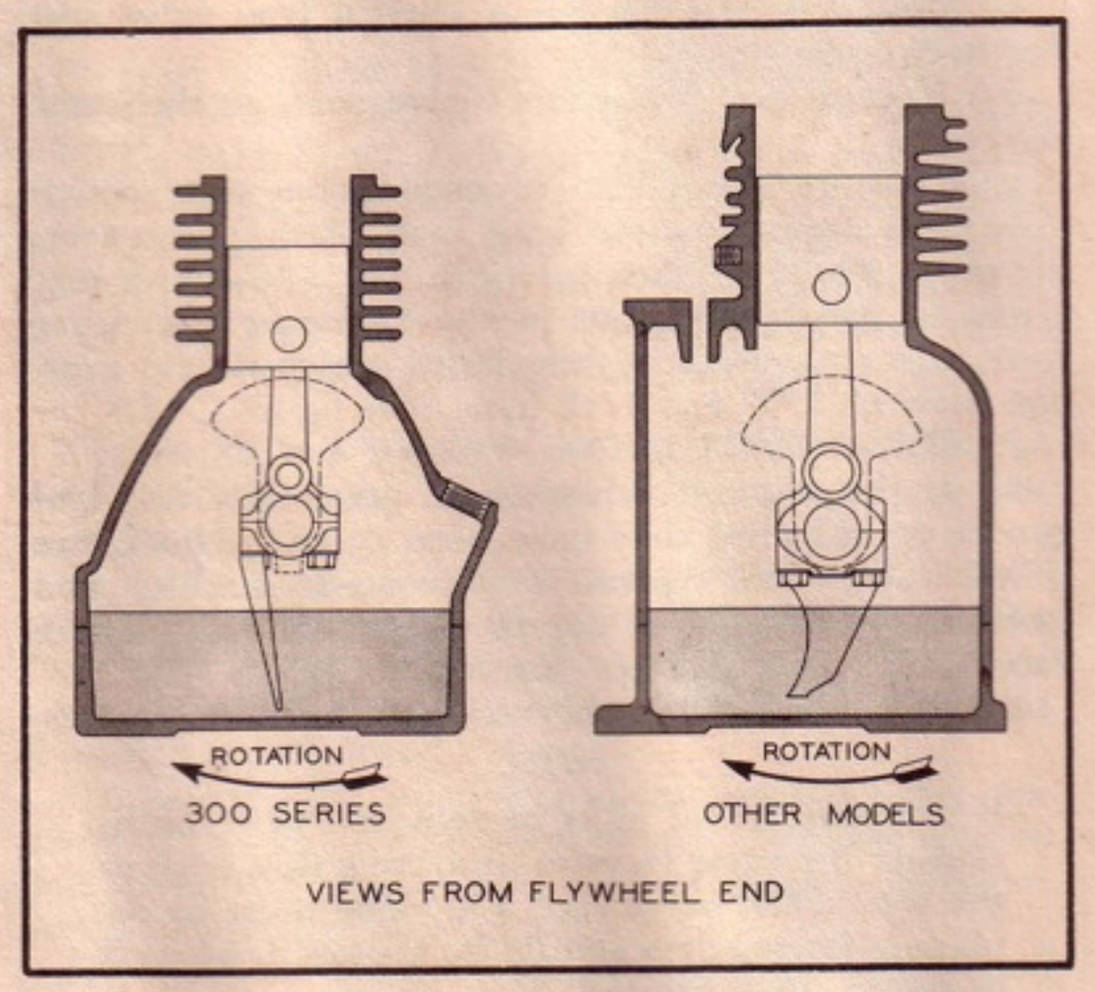


Figure C-20. Correct Position of Splash Fingers

3/16 inch. This will provide room for installation of the camshaft plug which should be driven into the block with a plastic hammer.

10. Install valves, valve springs, and "C" washers. (Some early model engines are equipped with pins instead of "C" washers.)

11. Check valve clearances to make certain they are accurately set at .008 inch intake, and .012 inch exhaust.

12. Coat the crankshaft journals with oil, and insert the crankshaft into the cylinder block using the proper thrust washers.

13. Install the bearing plate.

14. Remove the bearing cap from the connecting rod.

15. Install the piston and connecting rod assembly.

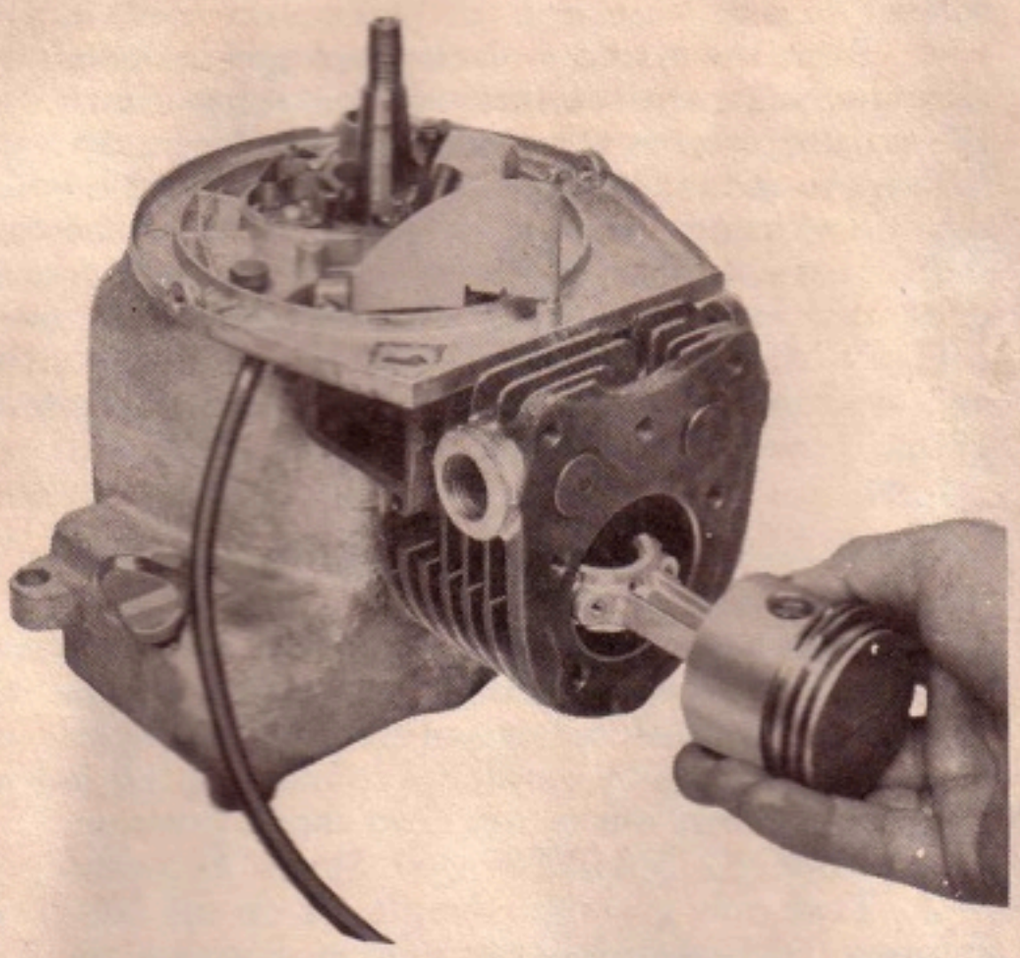

Figure C-21. Piston and Rod—The connecting rod MUST be installed with the oil hole in the rod towards the bearing plate

**NOTE**

Most connecting rods have an oil hole drilled to the top portion of the bearing emerging at one side of the I-beam rib. This opening should face the bearing plate side on all vertical shaft engines. It is immaterial on horizontal shaft engines. The relationship between the connecting rod and cap is indicated by a small protrusion on each part. These parts must be mated during reassembly.

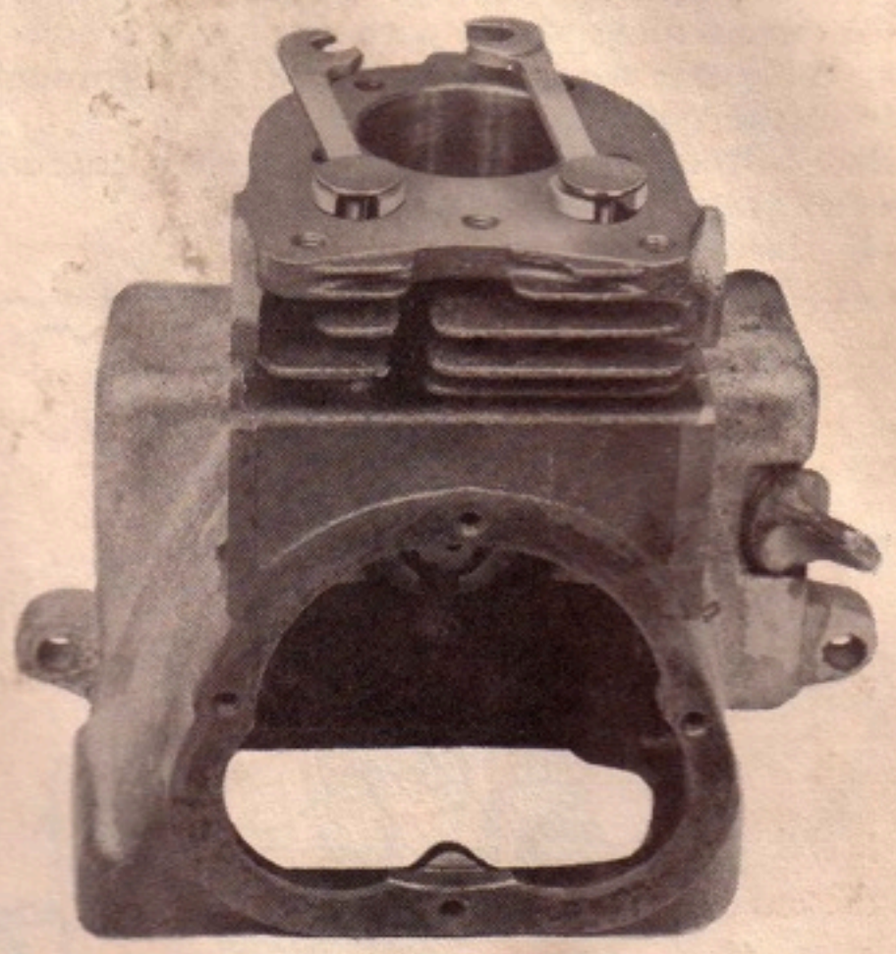

Figure C-23. Holding Valve Out of Position—300 Series—Prepare the valves in a raised position as shown to simplify the assembly of the bearing plate and crankshaft assembly

16. When installing the piston and connecting rod assembly, use piston ring compressor, Part No. TL2286 or TL2287.

17. Coat the connecting rod bearing cap with oil, and install the cap (with protrusions matched). The oil splash finger is attached to these screws in all horizontal shaft engines. Refer to figure C-20 for the proper position of the oil splash finger.

18. After tightening connecting rod bolts, bend the bolt locks up against one side of the bolt heads, as shown in figure C-25.

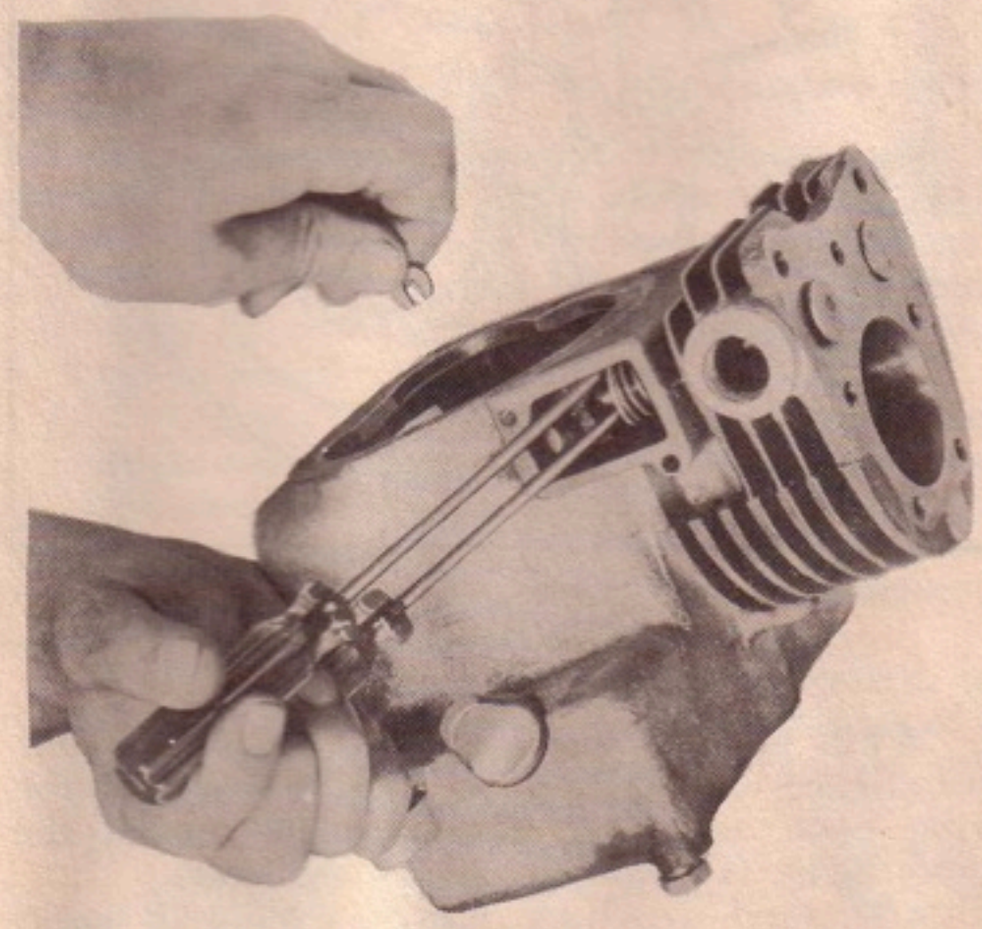

Figure C-22. Valve Spring Assembly — 300 Series — After installing the valve, valve spring, and valve spring seat, the "keeper" (No. 3291) is easily assembled when the valve spring is held compressed in the manner shown

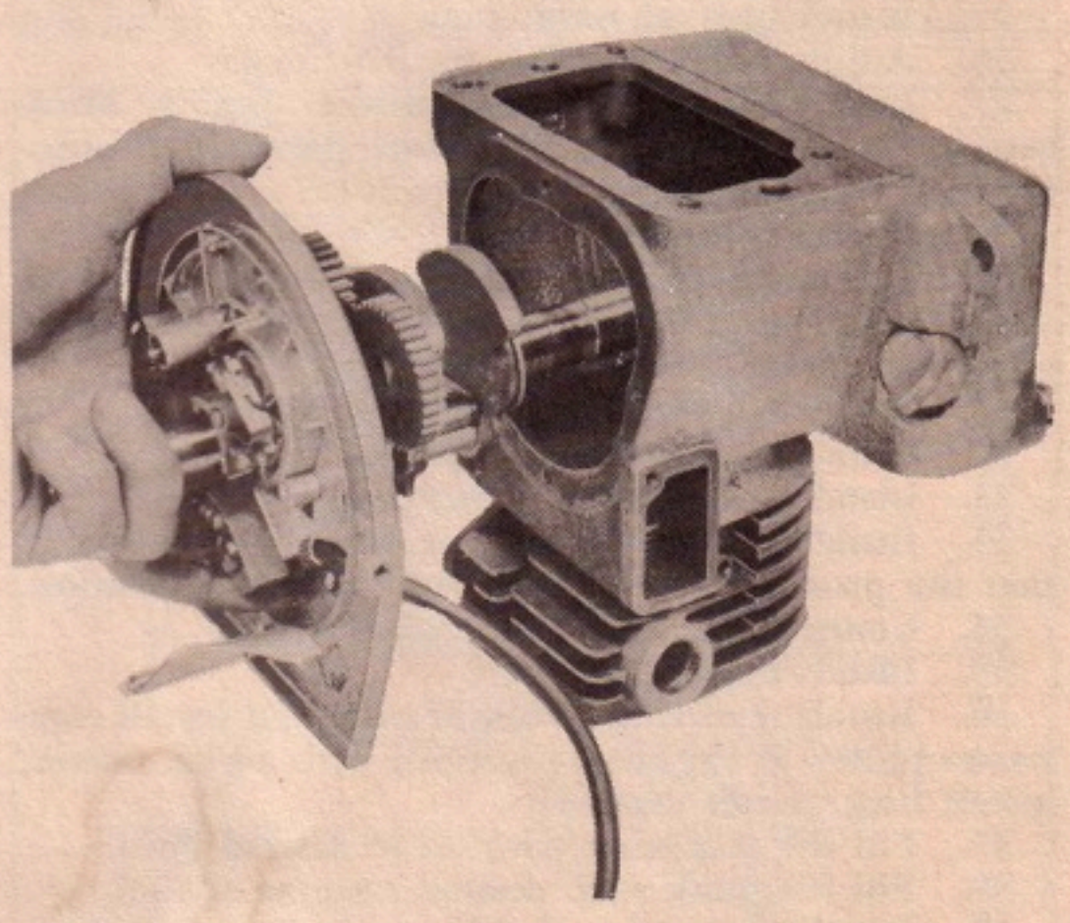

Figure C-24. Crankshaft and Magneto Assembly—With cylinder block in inverted position, assemble crankshaft and magneto assembly into position

19. On engines equipped with a flyball governor, make certain all governor parts are in the correct position, and insert the governor control shaft through the hole in the cylinder block.

20. Install the base on horizontal shaft engines and the end cover on vertical shaft engines.

21. Install both crankshaft oil seals.

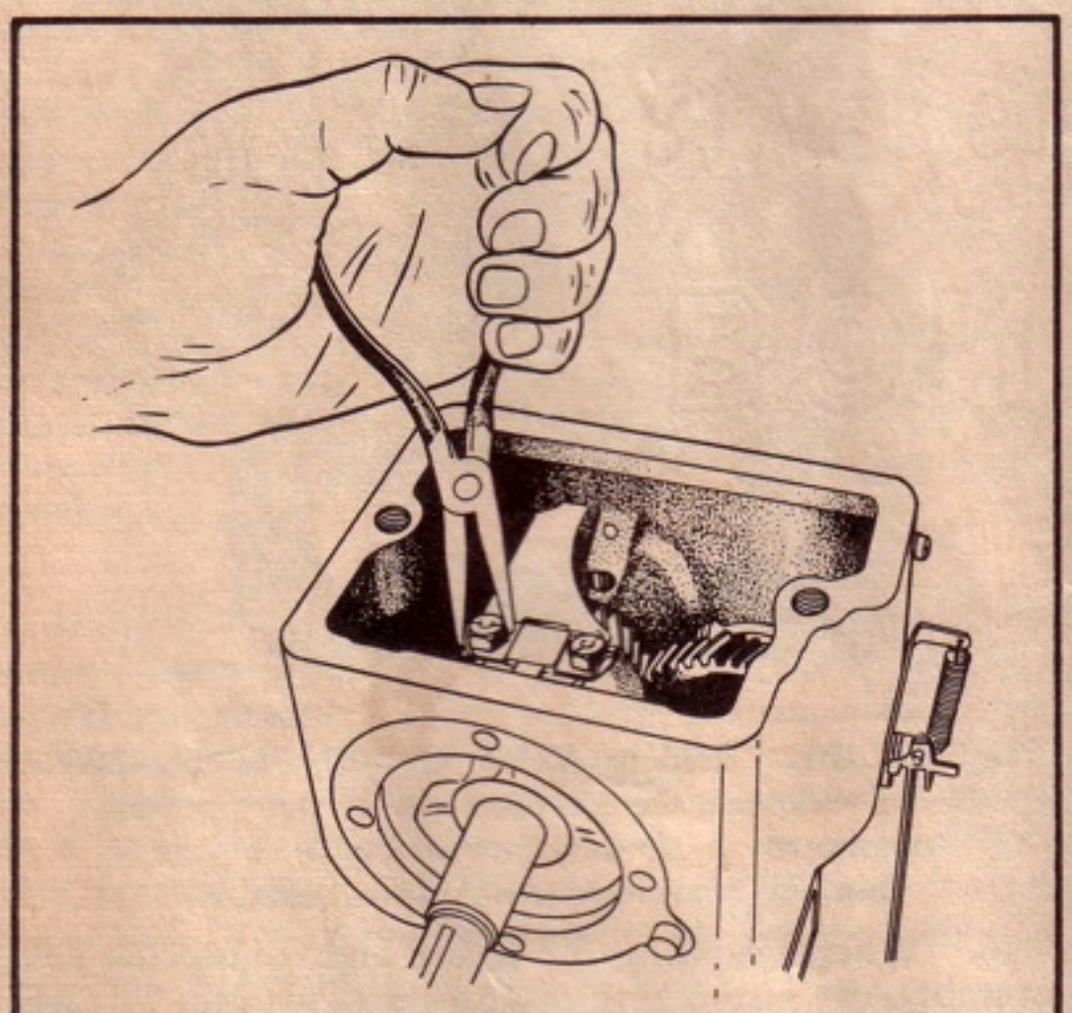

Figure C-25. Locking Connecting Rod Bolts

22. On vertical shaft engines, check the needle bearing in the bearing housing. If replacement is necessary, refer to page 33, par. 4. Install the bearing housing on the engine.

23. Install the breather assembly.

24. Install the cylinder head and tighten cylinder head bolts in accordance with page 34, par. 6. Make certain that all parts are connected to the correct cylinder head bolt.

25. Install breaker point cam.

26. Adjust breaker points to .018 inch.

27. Install dust cover over breaker points. Make certain the felt pad is saturated with grease, and properly positioned as shown in figure B-6.

28. Install flywheel.

29. If the engine is equipped with an air vane governor, install governor parts. If equipped with flyball governor, install governor throttle lever.

30. Install blower housing and fuel tank.

31. Install tappet case and breather cover.

32. Install and connect spark plug.

33. Install carburetor and air filter. Make certain that the proper control levers are in correct position.

34. Connect fuel line.

35. Install muffler.

36. Install revolving screen, if used, and install rope starter pulley. If engine is equipped with a kick starter, install kick starter assembly.

37. Fill the crankcase with oil to desired level.

38. Fill fuel tank with desired amount of fuel.

39. Install the gear reduction unit if engine is so equipped.

**NOTE**

Engine is ready to be started.

## SPECIAL ASSEMBLY OPERATIONS

1. TIMING VALVES — All Engines Except 300 Series.

a. Place the cylinder block in an upside-down position and rotate the camshaft to the one position where the exhaust valve is about to close and the intake valve is about to open. This free, or neutral, position is where the valve springs have no tendency to rotate the camshaft. It is also the position the camshaft will assume if rotated very slightly in either direction by hand.

b. With the connecting rod crank journal in the approximate top dead center position, mesh the timing gears by moving the crankshaft into position.

**NOTE**

Make certain the desired thrust washers are in place on the crankshaft.

c. When properly engaged, with the crankshaft fully in place, the connecting rod bearing journal will be in the top dead center position. If improperly engaged as much as one tooth, the connecting rod journal will be obviously out of top dead center position.

2. TIMING VALVES—300 Series Engines.

a. Two cam gears are employed on all 300 series engines. To time this series engine, 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 a "dash."

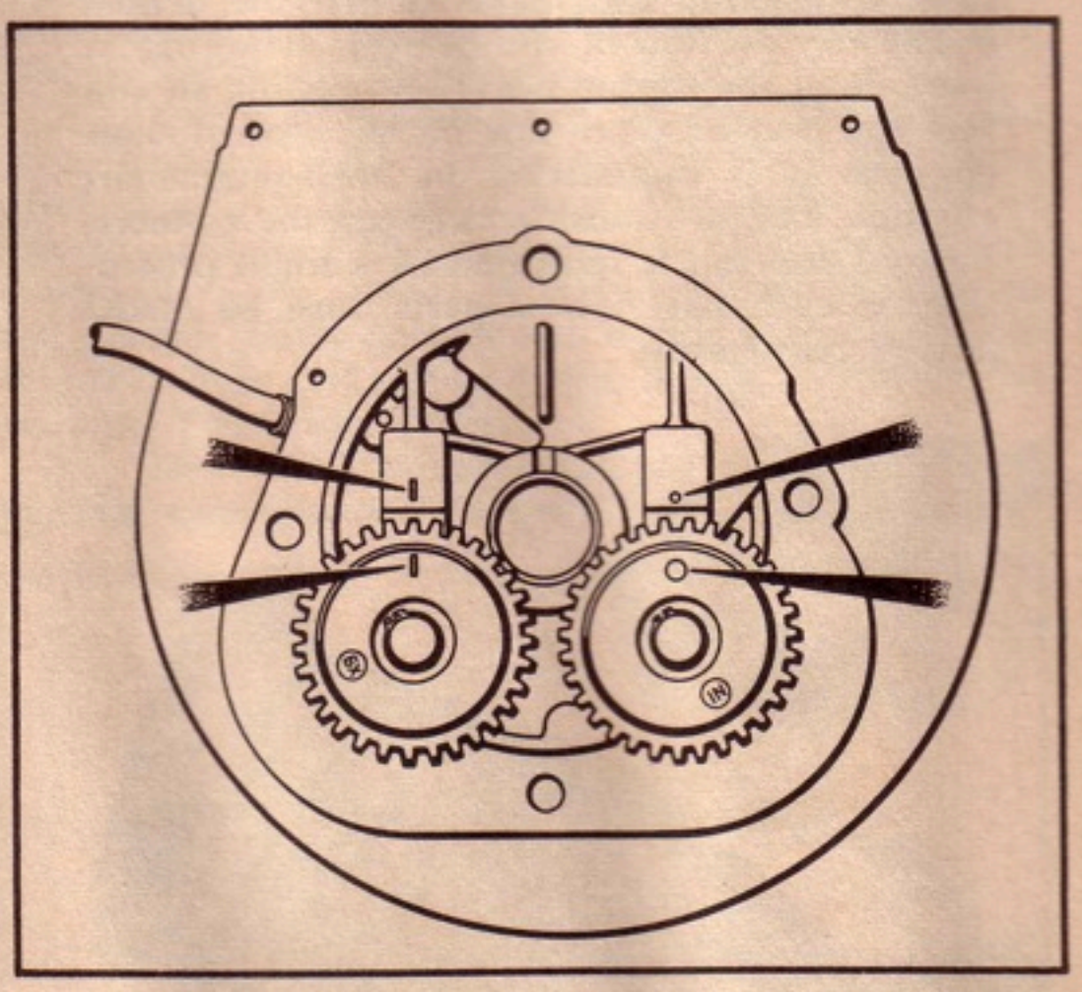

Figure C-26. Valve Timing Marks in Series 300 Engines

b. While holding both gears with their respective marks aligned with their corresponding marks on the bearing plate, move the bearing plate toward the cylinder block far enough to mesh the gears.

c. After meshing, check to make certain all marks are in alignment. (See figure C-26.)

d. The only time that replacement of the cam pins is necessary is when the pin has 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 to give the correct cam gear end

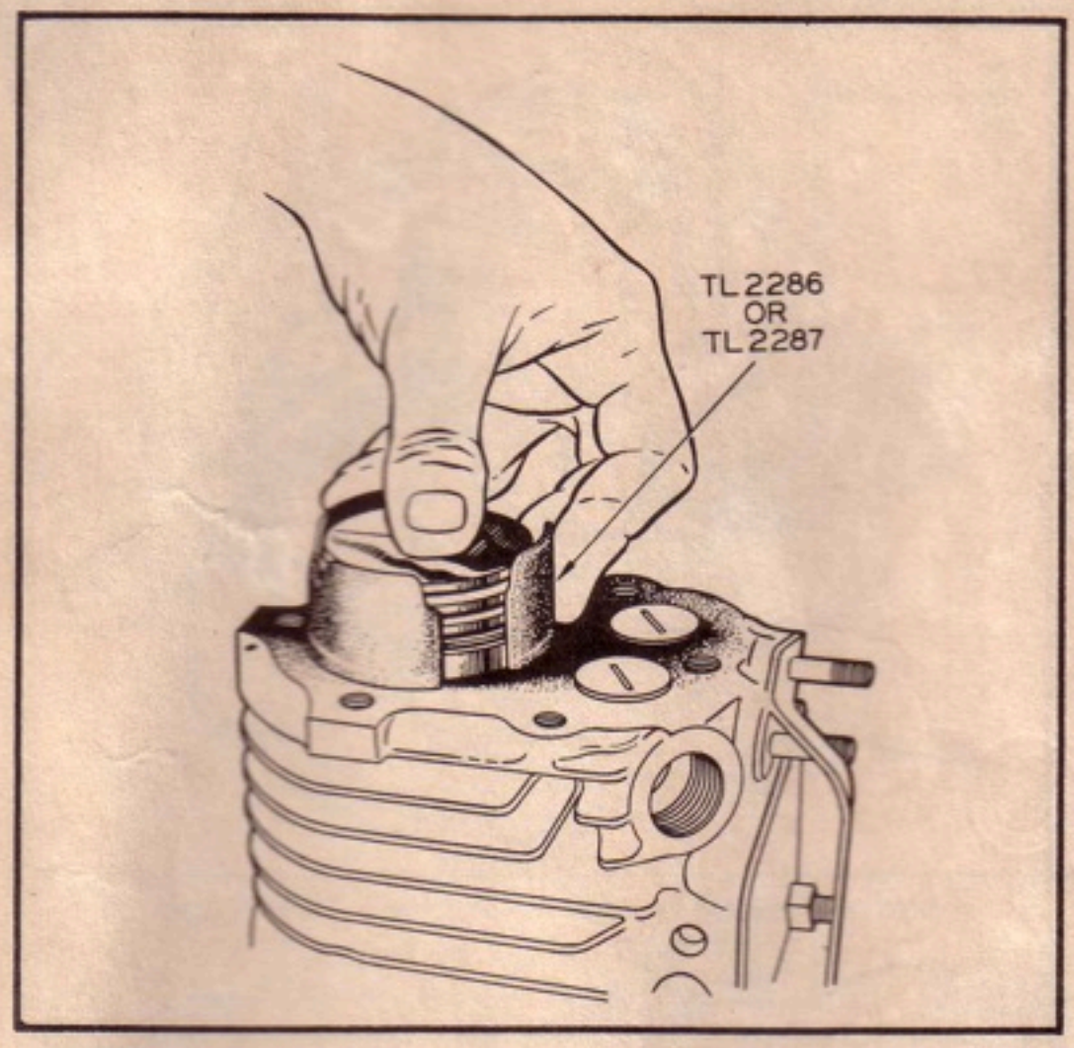


Figure C-27. Inserting Piston in Cylinder

play. Such a repair is not permanent, and the cam axle pin should be removed completely from the bearing plate and a replacement cam pin sintalled. Cam pins may be ordered under part number 7225-2.

a. Coat the piston with oil.

b. Slide the piston ring compressor over the piston skirt and start the piston skirt in the cylinder.

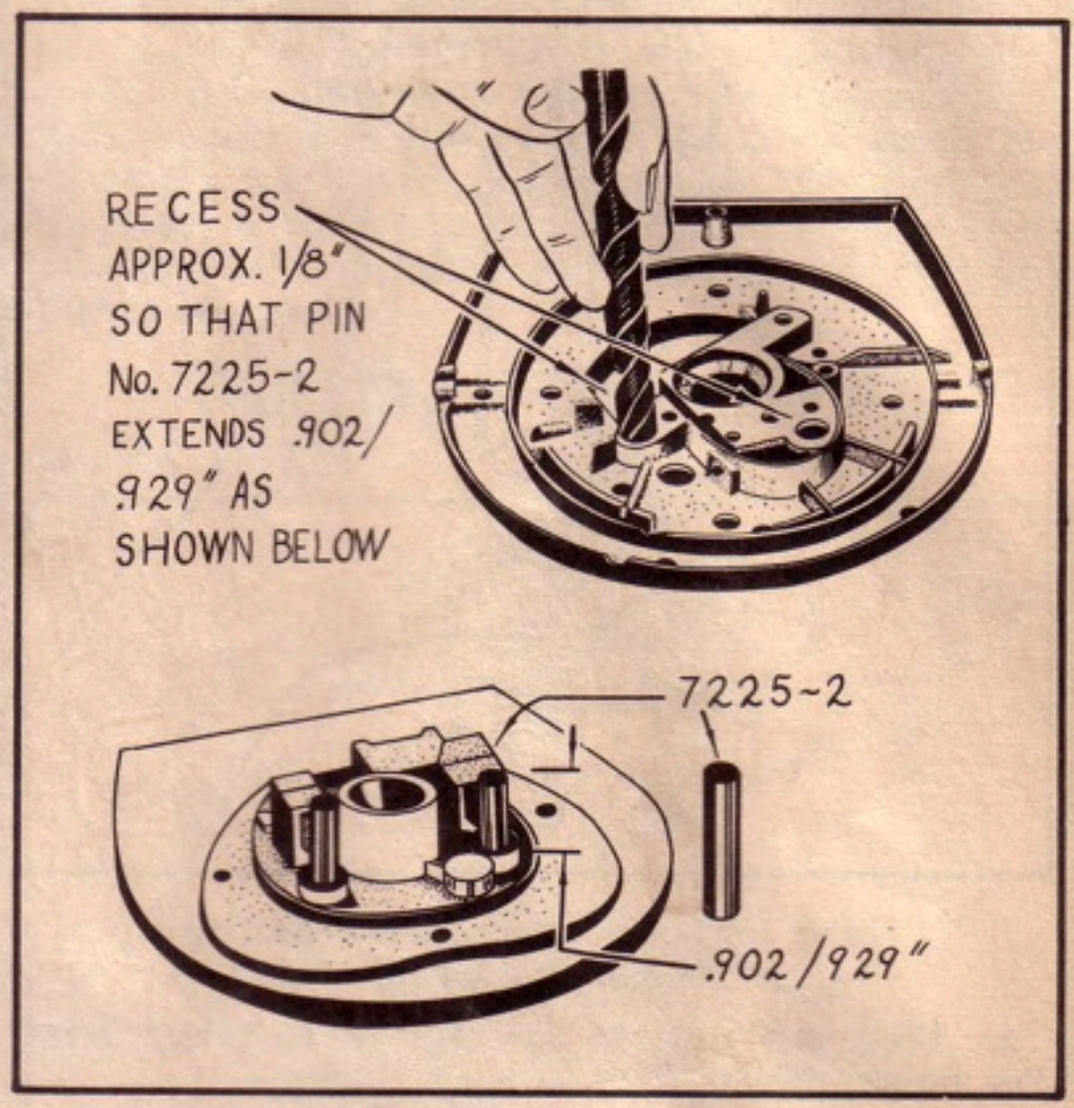


Fig. C-29. Replacing Cam Axle Pins

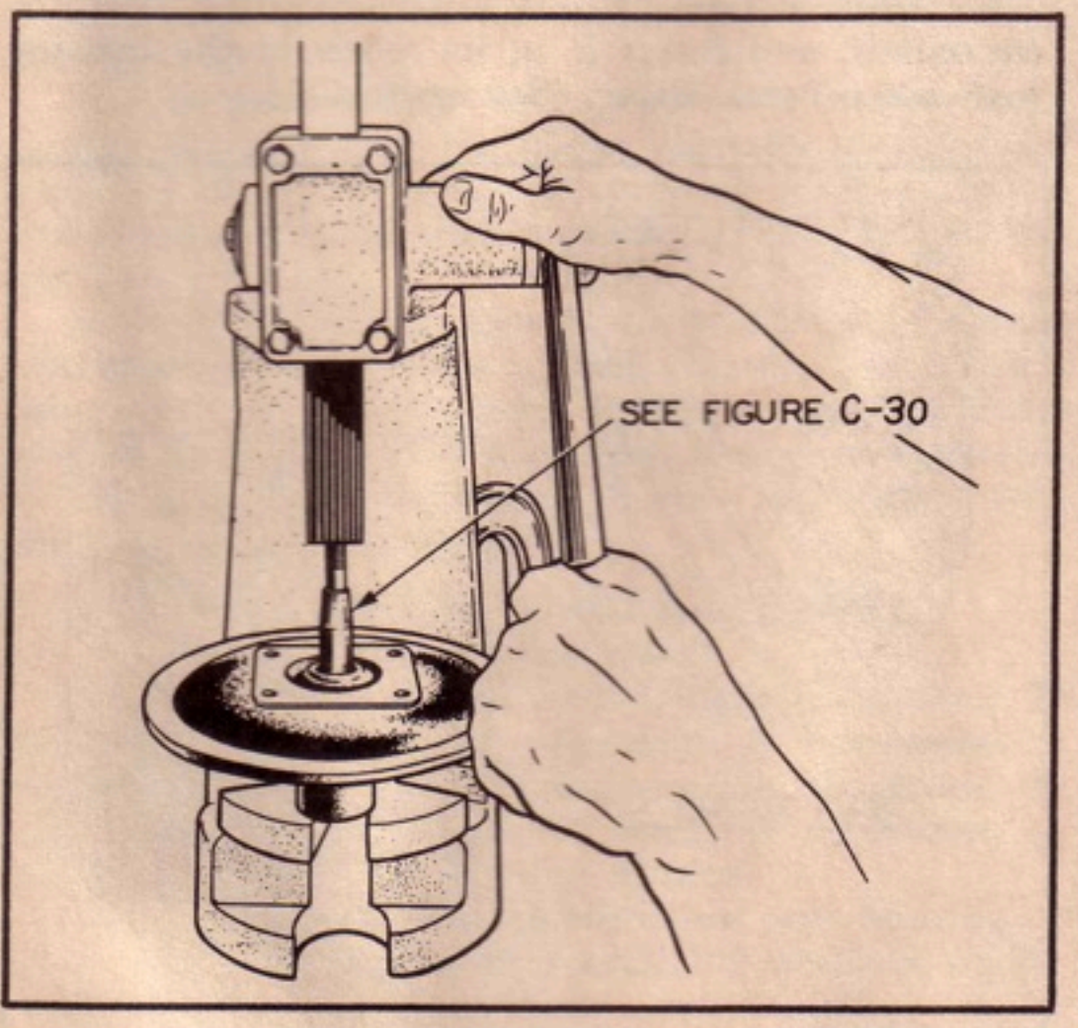


Figure C-28. Removing Needle Bearing From Bearing Housing

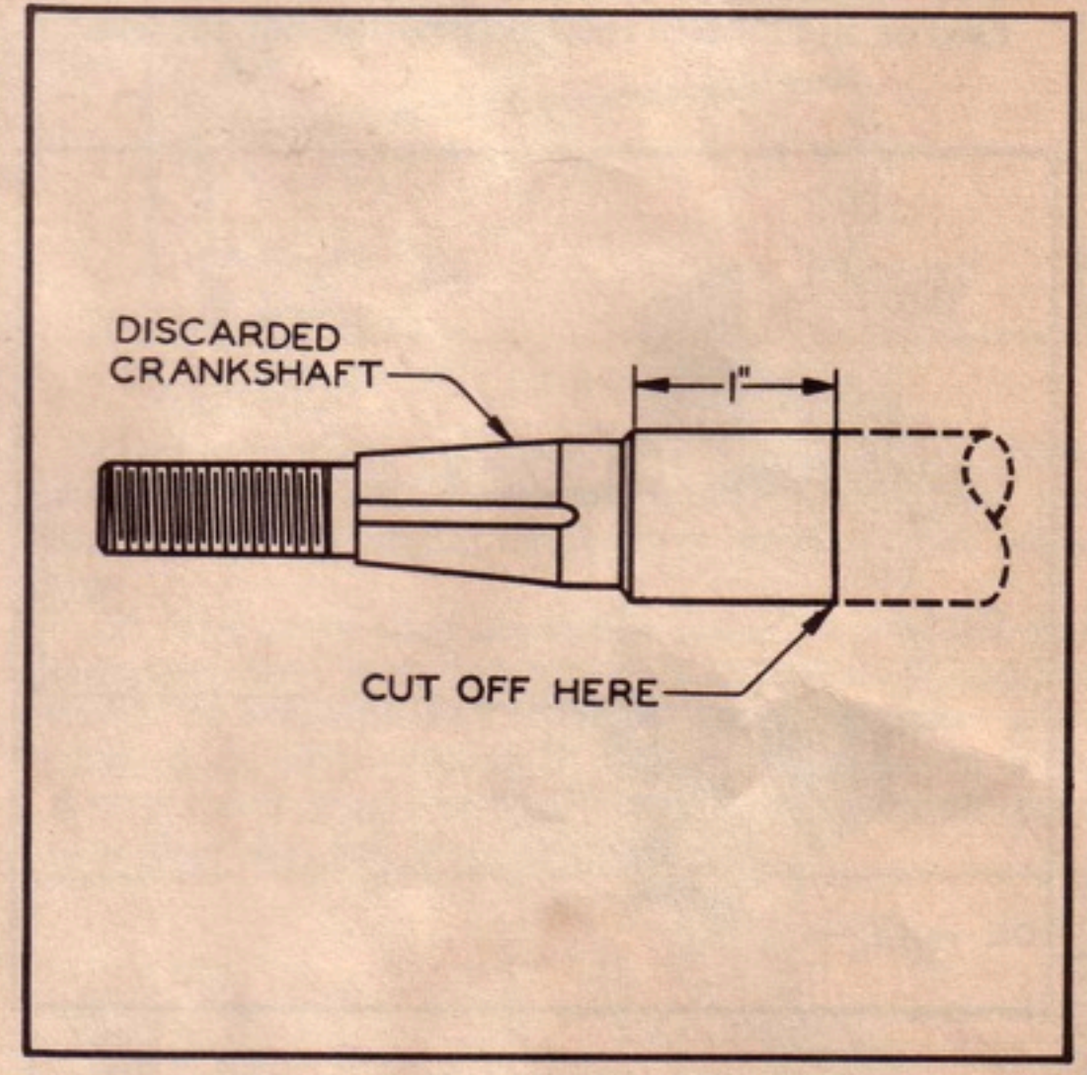


Figure C-30. Bearing-Removing Tool Constructed From Discarded Crankshaft

When installing the new cam axle pins, it is necessary to first provide clearance for the cap of the cam axle pin by cutting a small recess into the bearing plate. This recess should be cut to a depth of approximately ⅛ with a ½ drill and the cam axle pins can then be thrust into the plate so that the extension is .902/.929 inches.

3. INSERTING PISTON IN CYLINDER. (See figure C-27.)

c. Press the piston firmly and carefully into the cylinder. Make certain the rings are not damaged.

d. Remove the ring compressor and push the piston down until the connecting rod bearing contacts the crankshaft journal.

4. INSTALLATION OF NEEDLE BEARINGS. (See figures C-28 and C-31.) Needle bearings are used on many vertical shaft engines, and need not be removed unless replacement is required.

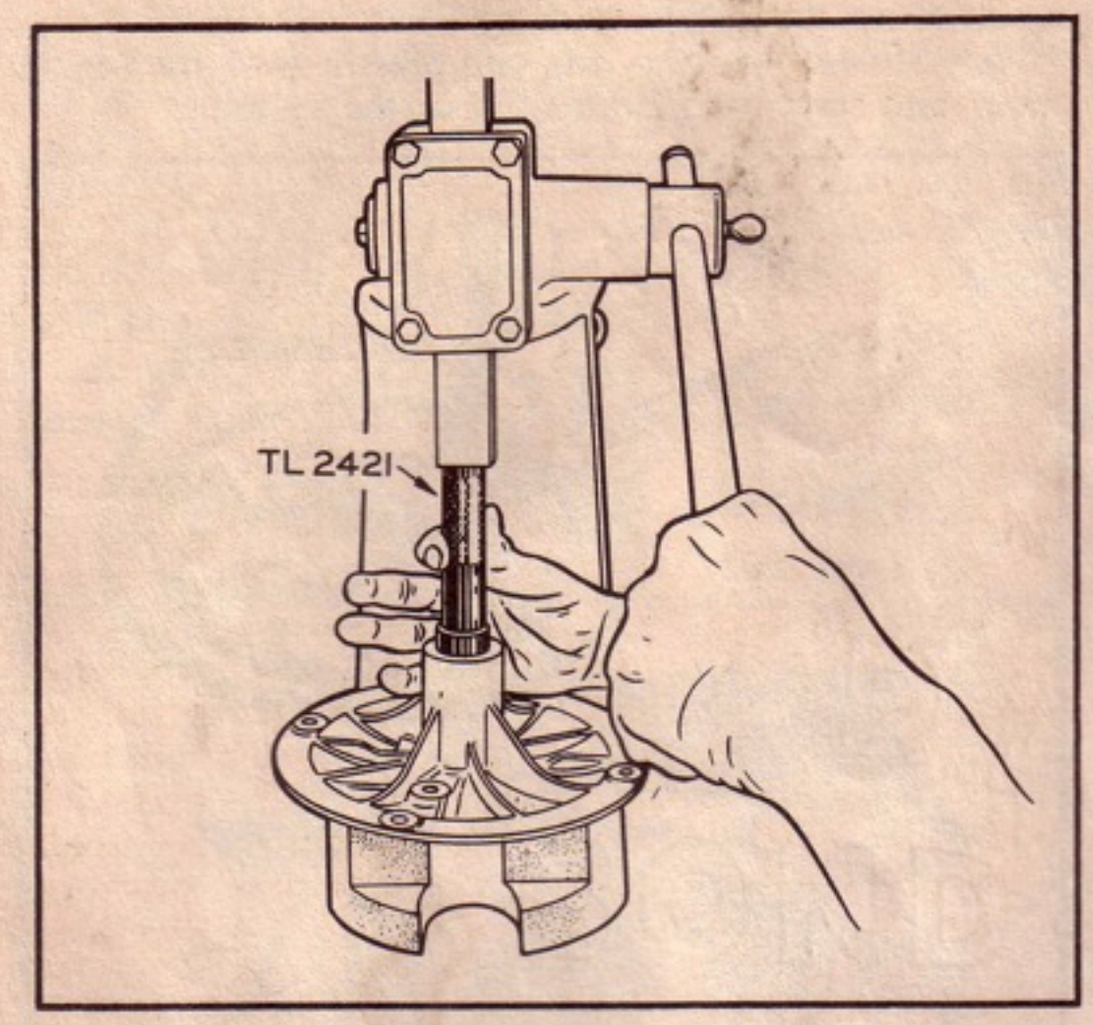


Figure C-31. Installing Needle Bearing in Bearing Housing

a. Press out the old bearings in an arbor press. (See figure C-28.)

**NOTE**

The tapered end of an old crankshaft can be used as an effective tool for pressing out the old bearing. (See figure C-30.)

b. Clean all parts and press the needle bearing into the bearing housing with the main bearing driver, Part No. TL-2421. (See figure C-31.)

## CAUTION

Make certain the bearing housing is properly supported to prevent distorting it.

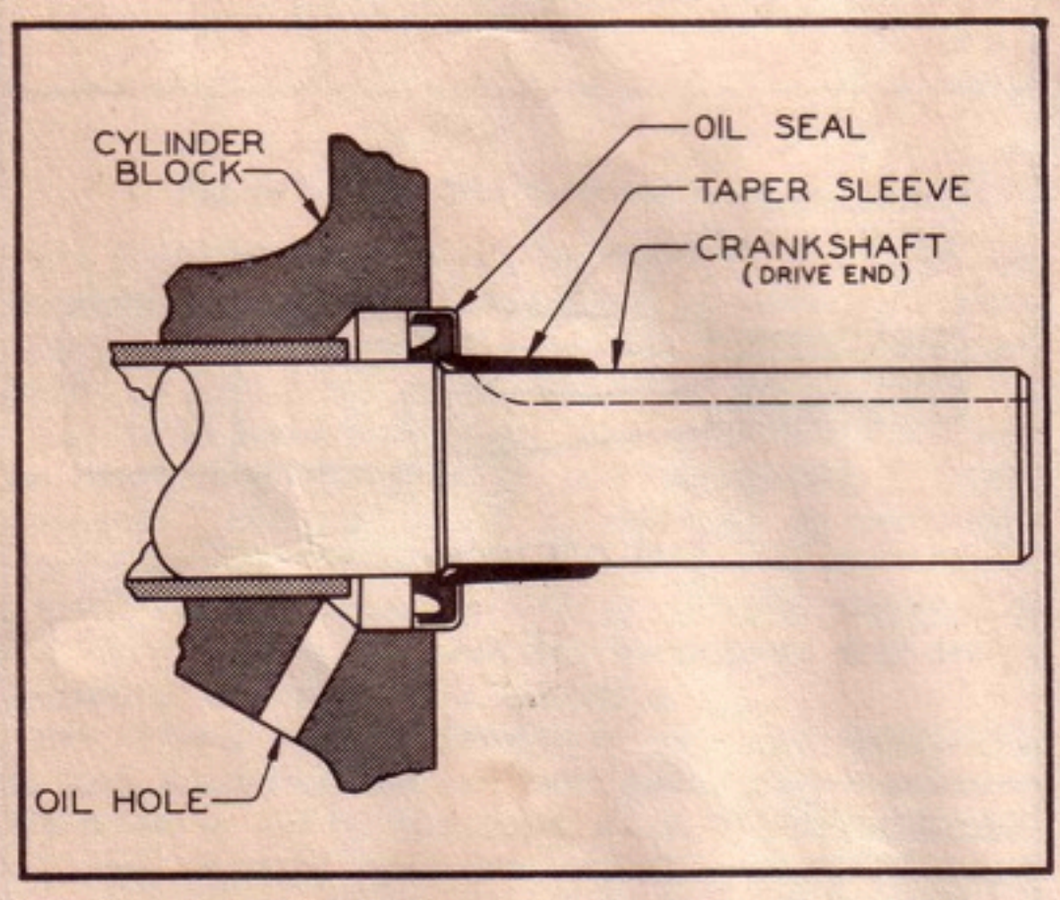


Figure C-32. Use of Tapered Sleeve for Installation of Oil Seal

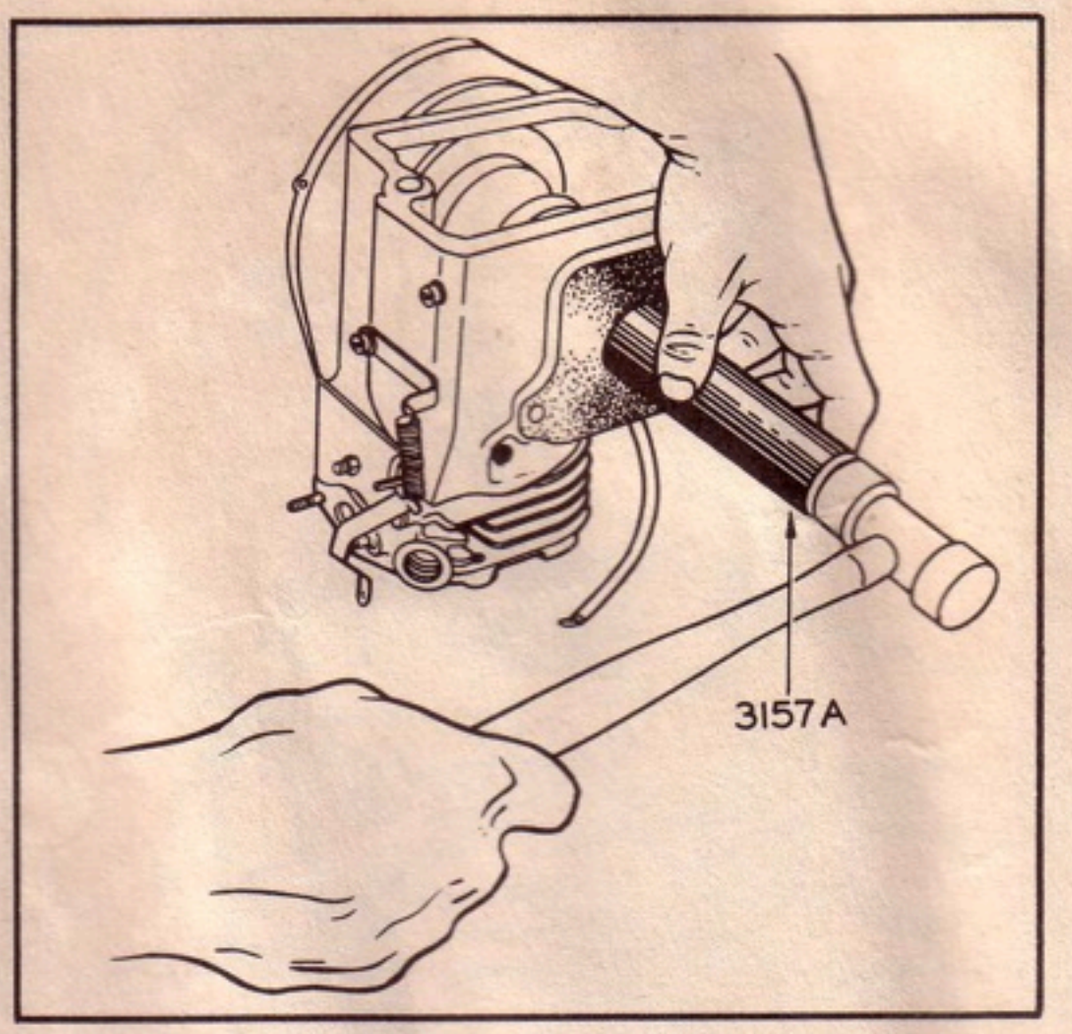


Figure C-33. Installing Oil Seal

5. INSTALLATION OF OIL SEALS.

a. Select the proper insert used with the oil seal driver, Part No. 3157-A, and slide the insert over the crankshaft to protect the oil seal as it moves into position. (See figure C-32.)

b. Place the proper oil seal in position over the crankshaft, and insert it in its recess in the housing with the oil seal driver. (See figure C-33.)

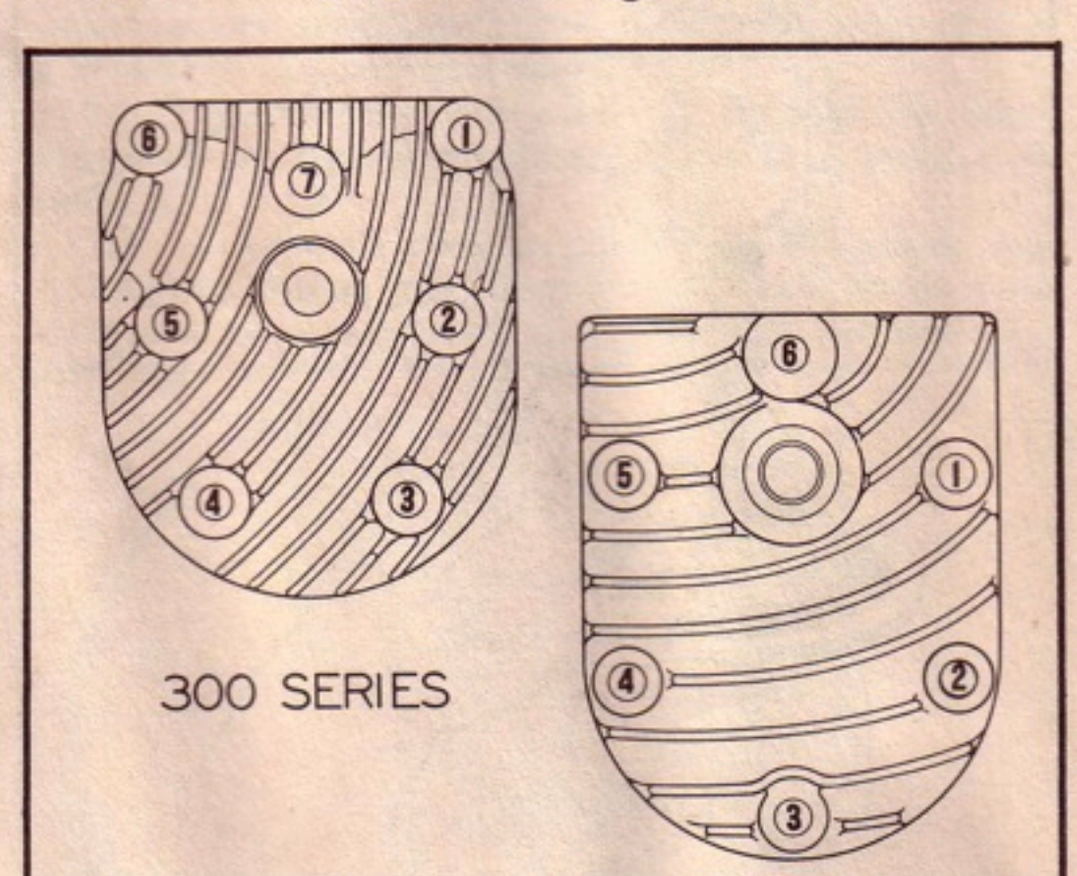


Figure C-34. Clyinder Head Tightening Order

c. Remove the oil seal driver and slide the insert off the crankshaft.

**NOTE**

It is always easier to install the oil seal in the cylinder block after installation of the crankshaft, as the crankshaft serves as a guide.

6. TIGHTENING CYLINDER HEAD BOLTS.

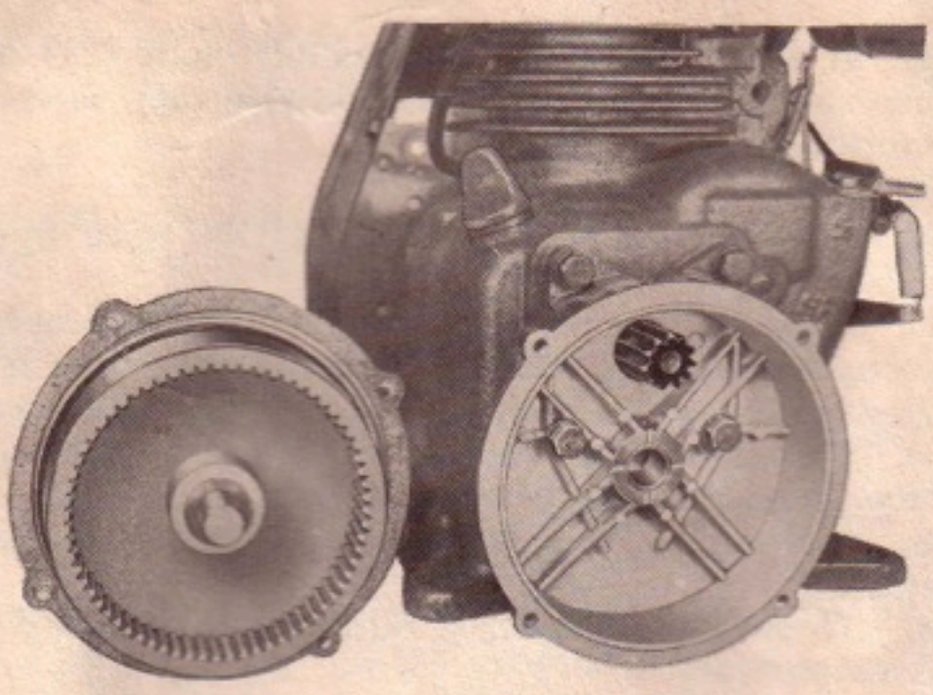

Figure C-35. Components of the Reduction Gear Drive Unit

**NOTE**

Always use a torque indicating wrench if possible.

a. Tighten all cylinder head bolts lightly, then pull each bolt down a little at a time in accordance with the order shown in figure C-34.

b. Continue the tightening process until each bolt has been pulled down to a tension of approximately 100 inch pounds.

c. After the engine has been operated for a few hours, retighten cylinder head bolts in accordance with this same routine.

7. REPAIRING REDUCTION GEARING. The reduction gear assembly seldom gives trouble if kept properly oiled, and is not permitted to operate with loose attaching bolts. Figure C-35 shows the principal parts of a typical gear reduction unit. Repairs will consist of replacing damaged parts. It will be necessary to replace the housing when new bearings are required. Replacement housings will contain new bearings finished to the correct size. Bearings are available separately. However, special tools are required for installation and fitting. The small cost of a new housing makes it more practical to replace it rather than attempt repairs. The end play in the reduction gear must be at least .005 inch.

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DIVISION D

# CARBURETOR OVERHAUL

## PRELIMINARY INSTRUCTIONS

Several makes and models of carburetors have been used on Clinton engines, and to provide detailed instructions for each and every model would require too much material to be of practical value. However, each particular type of carburetor has been exploded and instructions given for its overhaul. If a particular carburetor is unlike any unit illustrated in this section, select the one nearest like the one to be overhauled and use the instructions given. Differences will be obvious. It must be remembered that the carburetor is an essential component of the engine and must be treated as a precision-built unit. All carburetor jets are sized at the factory to within a tolerance of .00025 inch, which is approximately 1/12 the thickness of a human hair.

## CAUTION

Do not insert any metal object through a jet or metered orifice, as this would upset the calibration of the carburetor.

## CLEANING INSTRUCTIONS

1. Wash all parts of the disassembled carburetor in a solvent capable of removing gum, varnish, and all other foreign material. A good commercial carburetor cleaner is perhaps the fastest and most efficient cleaning solvent. If this is not available, a thorough job of cleaning can be accomplished by using lacquer thinner or denatured alcohol. Be sure to allow the parts to soak in the solvent for a few minutes.

2. Using a small paint brush, brush the parts while holding them in the solvent until perfectly clean.

## CAUTION

Some solvents are hard on the hands and will do a thorough job of cleaning without brushing. Read instructions regarding the particular type of solvent used. Do not boil the parts in alkaline solutions, as this will destroy the protective coating on the parts.

3. Rinse the parts in clean gasoline or dry cleaning solvent, and dry them with compressed air.

4. Do not allow parts to become contaminated with dust before assembling carburetor.

## ZENITH MODEL 10390 CARBURETOR

1. DISASSEMBLY. (See figure D-1).

a. Remove the carburetor from the engine by disconnecting the fuel line and governor linkage, and unscrewing the bowl cover extension from the intake port on the engine.

b. Remove the bowl cover assembly (3) by taking out the attaching screws (1) and lockwashers (2).

c. Remove the needle and seat assembly (5). Be sure to use an accurate fitting wrench on this part.

d. Inspect the throttle bore in the bowl cover assembly (3), and if rather dirty remove the screw (6), lockwasher (7), and throttle valve (8). Withdraw the throttle shaft (9).

e. Remove the gasket (12) and float (13).

f. Loosen the locknut (16) and remove the adjusting needle (15).

g. If the choke valve (20), choke shaft (21) and choke spring (22) are in good condition they need not be removed.

h. Remove the drain plug (23).

2. CLEANING AND INSPECTION. (See figure D-1.)

a. Inspect all parts for wear and damage and replace defective parts. Pay particular attention to the float (13), needle and seat assembly (5), and adjusting needle (15). If the adjusting needle has a groove in the taper where it contacts the seat in the body, replace it.

b. Clean the carburetor in accordance with paragraph II.

c. There are no internal adjustments required in this carburetor.

3. REASSEMBLY (See figure D-1.)

a. If the choke assembly was removed, install the parts in the body (14). Be sure the choke spring (22) is engaged so that it holds the choke open.

b. Install the drain plug (23).

c. Place the locknut (16) on the adjusting needle (15) and install the needle in the body (14) with a new gasket (17). Run the needle in until it touches the seat (do not force), then back it out approximately one and one-half turns.

d. Install the needle and seat assembly (5) in the bowl cover assembly (3), using a new gasket (4).

e. Install the throttle shaft (9) and throttle valve (8) with the lockwasher (7) and screw (6). Hold the throttle valve centered while tightening the screw (6), then operate the throttle to see that no binding occurs.

f. Drop the float (13) in the body (14).

g. Place the gasket (12) over the bowl and attach the bowl cover assembly (3) to the body assembly (14) with screws (1) and lockwashers (2). Tighten screws firmly.

h. Tighten the locknut (16) temporarily to prevent leakage.

i. Install the carburetor on the engine.

4. ADJUSTING. (See figure D-1.) This carburetor has only two adjustments: the idle adjusting screw (11) and the mixture adjusting needle (15). Set the screw (11) so the engine will not run slower than 1000 rpm and rotate the needle (15) until the engine operates smoothly and accelerates without hesitation. After adjusting the mixture, reset the screw (11) to idle the engine between 1000 and 1400 rpm.

### NOTE

The engine must be warm before attempting an adjustment.

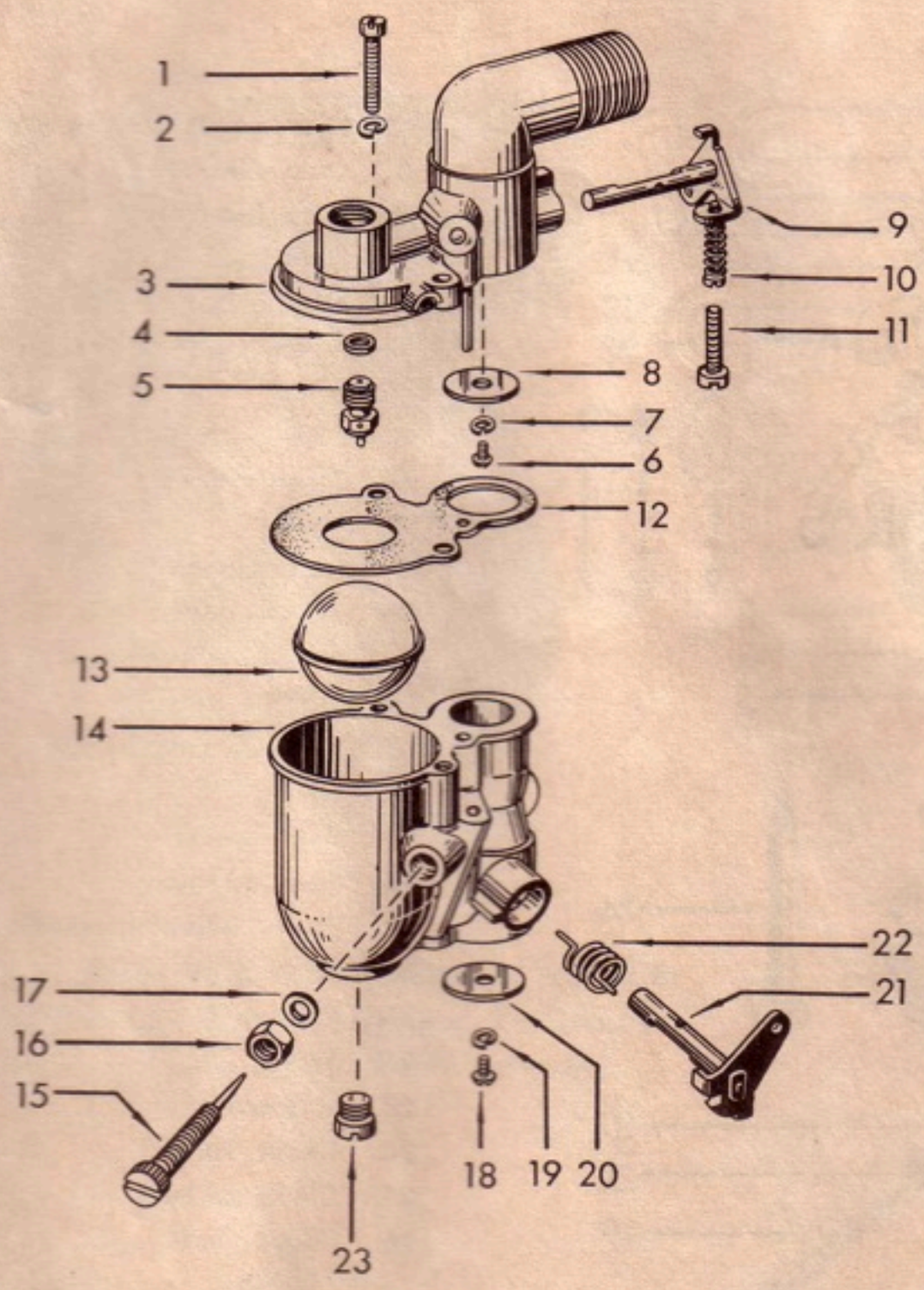
## ZENITH MODELS 10658 AND 10665 CARBURETORS

1. DISASSEMBLY. (See figure D-2.)

a. Remove the carburetor from the engine by disconnecting the fuel line, removing the two flange nuts and disconnecting governor linkage.

b. Remove the three screws (1) and lockwashers (2), and separate the body assembly (3) from the bowl assembly (18).

c. Remove the gasket (17) and drop out the float (4).




1. Bowl attaching screw
2. Lockwasher
3. Bowl cover assembly
4. Needle seat gasket
5. Needle and seat assembly
6. Throttle valve screw
7. Lockwasher
8. Throttle valve
9. Throttle shaft
10. Spring
11. Idle adjusting screw
12. Bowl cover gasket
13. Float
14. Body assembly
15. Adjusting needle
16. Locknut
17. Gasket
18. Choke valve screw
19. Lockwasher
20. Choke valve
21. Choke shaft
22. Choke spring
23. Bowl drain plug

Figure D-1. Zenith, Model 10390 Carburetor

d. Remove the needle and seat assembly (5) and gasket (6).

e. Remove the screw (7), lockwasher (8) and throttle valve (9).

f. Remove the nut (10), lockwasher (11) and throttle lever (12). Withdraw throttle shaft (14).

g. Remove the idle adjusting needle (15) and spring (16).

h. Loosen the packing nut (20) and remove the power adjusting needle (19). Using a piece of fine wire, lift out the packing (21).

i. If removal of the choke is required, take out the screw (22), lockwasher (23), choke valve (24), choke spring (25) and choke shaft (26).

2. CLEANING AND INSPECTION. (See figure D-2.)

a. Clean the carburetor in accordance with paragraph II.

b. Inspect all parts for wear or damage. Pay particular attention to the needle and seat assembly (5), power adjusting needle (19) and idle adjusting needle (15). If the adjusting needles have grooves on their tapered seats, replace them.

c. Shake the float to make sure it is not loaded with fuel.

3. REASSEMBLY. (See figure D-2.)

a. Install the choke shaft (26) and spring (25) in the body assembly (3) if these parts were removed during disassembly. Slide the choke valve (24) into position and secure it with the lockwasher (23) and screw (22). Hold the choke in a closed position and tighten the screw (22). Make certain the spring (25) is hooked up so the choke will be held in the open position when the choke lever is released.

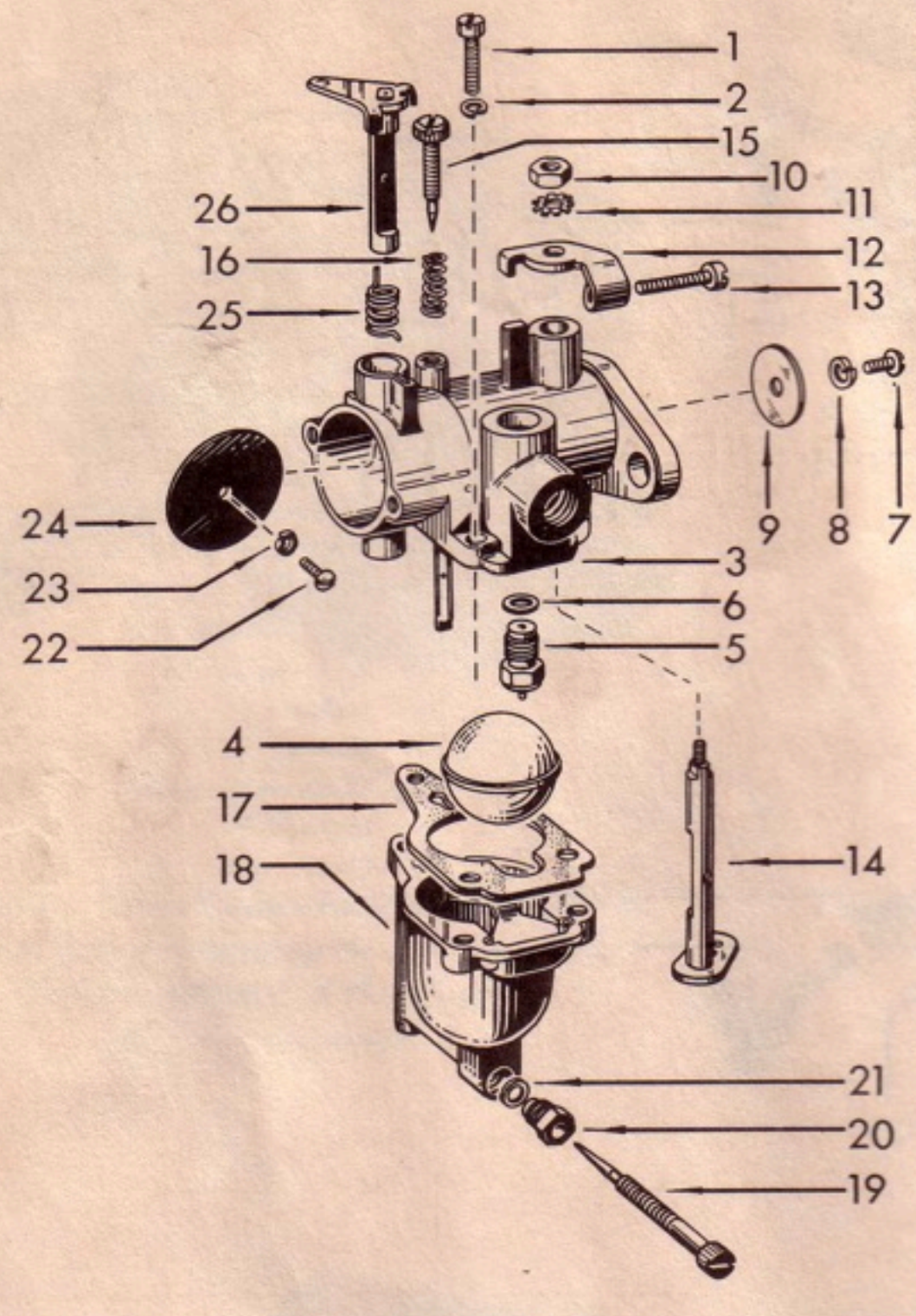
b. Install the idle adjusting screw (13) and spring (16) in the body (3). Rotate the screw (13) until it touches the seat (do not force), and back it out approximately one turn.

c. Insert the throttle shaft (14) in the body (3) and install the throttle lever (12), lockwasher (11) and nut (10).

d. Install the throttle valve (9) with the lockwasher (8) and screw (7). Hold the throttle valve in the closed position and tighten the screw (7). Operate the throttle to make certain no binding occurs.

e. Install the needle and seat assembly (5) with a new gasket (6). Tighten the seat with a close fitting wrench to prevent distortion.

f. Insert a new packing washer (21) into the bowl assembly (18) and start the packing nut (20).




1. Bowl cover attaching screw
2. Lockwasher
3. Body assembly
4. Float
5. Needle and seat assembly
6. Needle seat gasket
7. Screw
8. Lockwasher
9. Throttle valve
10. Nut
11. Lockwasher
12. Throttle lever
13. Idle adjusting screw
14. Throttle shaft
15. Idle adjusting needle
16. Spring
17. Bowl gasket
18. Bowl assembly
19. Power adjusting needle
20. Packing nut
21. Packing
22. Screw
23. Lockwasher
24. Choke valve
25. Choke spring
26. Choke shaft

Figure D-2. Zenith, Models 10658 and 10665 Carburetor

g. Install the power adjusting needle (19) and rotate it until it touches the seat. Back the screw out one and one-half turns.

h. Raise the float lever and drop the float (4) into the bowl assembly (18).

i. Place a new bowl gasket (17) over the bowl assembly (18) and attach the bowl assembly to the body assembly (3) with the three screws (1) and lockwashers (2). Tighten the screws firmly.

j. Tighten the packing nut (20) enough to prevent leakage, and install the carburetor on the engine.

4. ADJUSTING. Refer to adjustment instructions for Carter-carburetor equipped engines, Section II, paragraph II, 3.

### TILLOTSON MODEL ML CARBURETOR

1. DISASSEMBLY. (See figure D-3.)

a. Remove the carburetor from the engine by disconnecting the fuel line, removing the two attaching nuts and disconnecting the governor linkages.

b. Remove the bowl cover (3) by taking out the three attaching screws (1) and lockwashers (2).

c. Remove the bowl cover gasket (9).

d. Press the float pin (4) out by using a long-nosed, slender-point punch.

e. Drop out the float (5) and inlet needle (6).

f. Remove the needle seat (7), using a wide-blade screwdriver to prevent damage to the screw slot.

g. Remove the throttle valve (12) by taking out the screw (10) and lockwasher (11).

h. Remove the screw (13), lockwasher (14), throttle lever (15) and washer (16).

i. Lift out the throttle shaft (17).

j. Spread the slot in the end of the choke shaft (34) and remove the choke spring (33).

k. Remove the choke valve (32) by taking out the screw (30) and lockwasher (31).

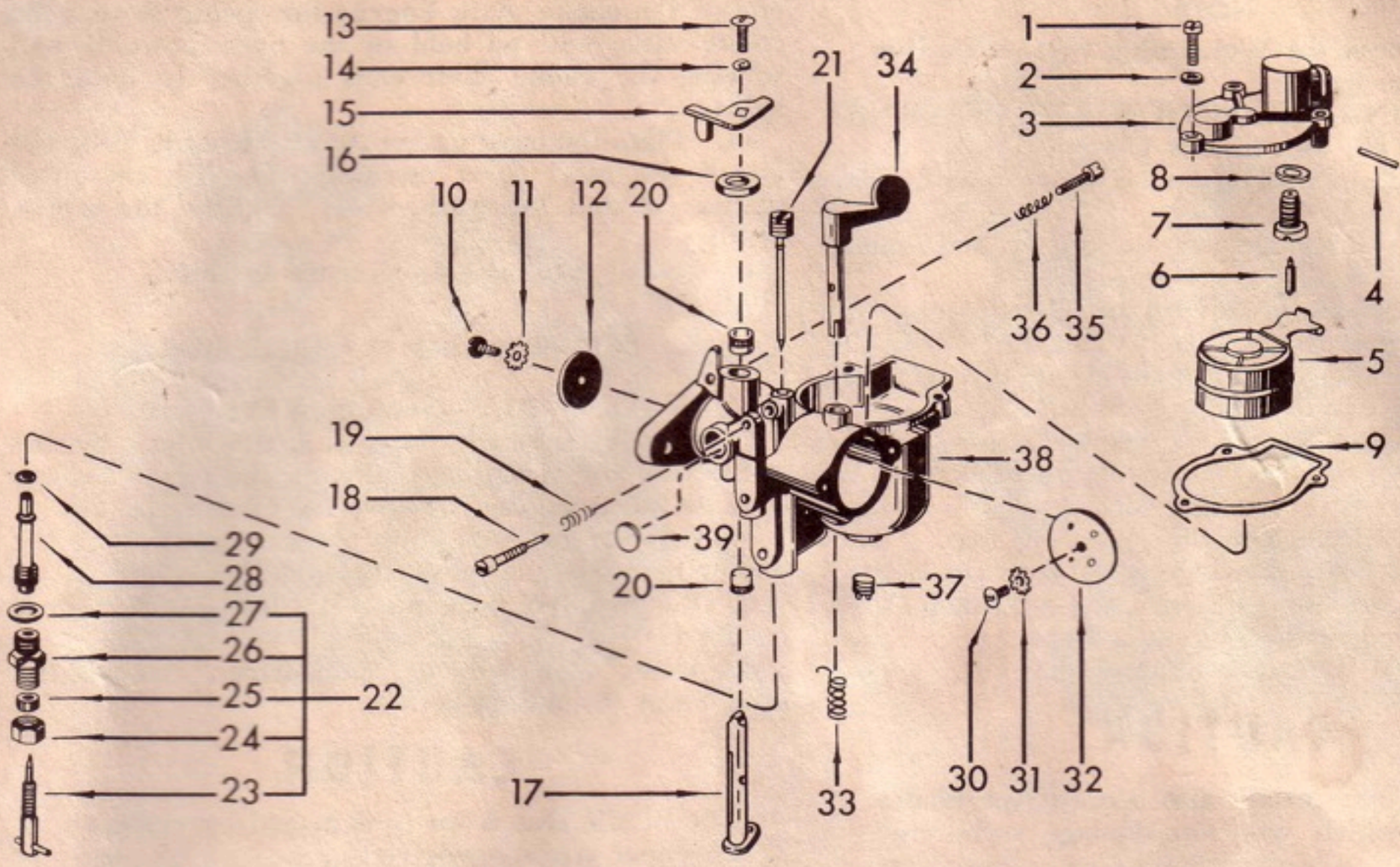
l. Lift out the choke shaft (34).

m. Remove the idle adjusting needle (18) and spring (19).

n. Remove the power adjusting needle assembly (22) and gasket (27).

o. Remove the idle tube (21).

p. Remove the main nozzle (28) and gasket (29).




1. Bowl cover attaching screw
2. Lockwasher
3. Bowl cover
4. Float pin
5. Float
6. Needle
7. Needle seat
8. Needle seat gasket
9. Bowl gasket
10. Screw
11. Lockwasher
12. Throttle valve
13. Screw
14. Lockwasher
15. Throttle lever
16. Washer
17. Throttle Shaft
18. Idle adjusting needle
19. Spring
20. Throttle shaft bushings
21. Idle tube
22. Power adjusting needle assembly
23. Power adjusting needle
24. Packing nut
25. Packing gasket
26. Main adjusting needle gland
27. Gasket
28. Main nozzle
29. Nozzle gasket
30. Screw
31. Lockwasher
32. Choke valve
33. Choke spring
34. Choke shaft
35. Throttle stop screw
36. Spring
37. Drain plug
38. Body assembly
39. Welch plug

Figure D-3. Tillotson Model ML(W-34) Carburetor

q. If disassembly of the power adjusting needle assembly (22) is required, separate the parts in the order shown in figure D-3.

r. Remove the drain plug (37).

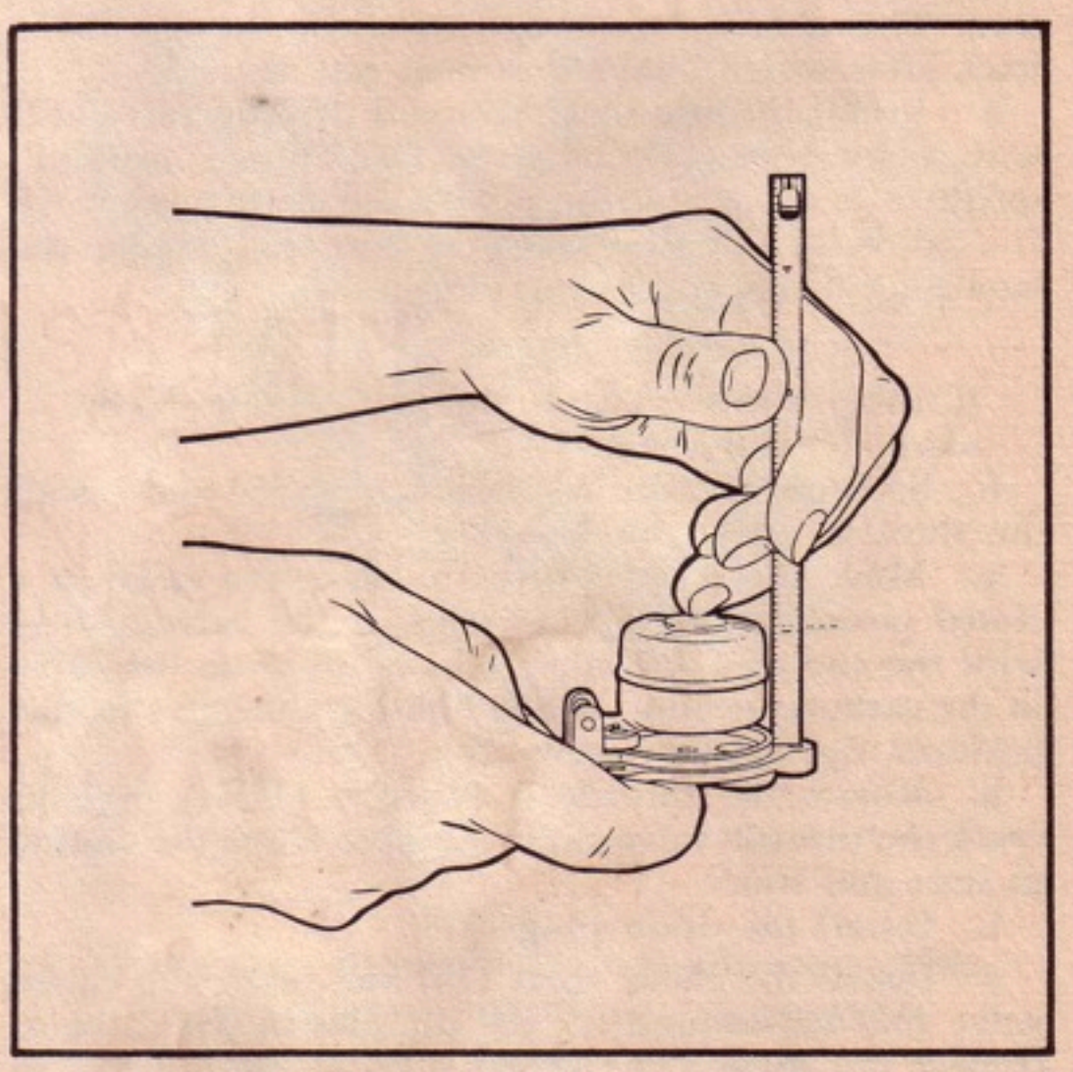


Figure D-4. Gaging Float on Tillotson Carburetor

**NOTE**

Do not remove the Welch plug (39) unless it is loose in the body.

2. CLEANING, INSPECTION, AND INTERNAL ADJUSTMENTS. (See figures D-3 and D-4.)

a. Clean the carburetor in accordance with paragraph II.

b. Inspect all parts for wear or damage, and replace defective parts.

c. Install the needle seat (figure D-3, reference 7) with a new gasket (8), needle (6) and float (5) in the bowl cover (3). Secure the float (5) to the bowl by inserting the float pin (4).

d. Hold the bowl cover (3) upside down and measure from the machined surface (gasket surface) of the bowl cover to the bottom surface of 1-3/32 inch at the location specified in the preceding step.

e. Bend the float tip where it contacts the needle, if necessary, to provide a distance of 1-3/32 inch at the location specified in the preceding step.

3. REASSEMBLY. (See figure D-3.)

**CAUTION**

Be sure to use correct size screwdriver blades and tools which will not damage carburetor parts.

a. Install the main nozzle (28) with a new gasket (29).

b. Install the idle tube (21).

c. Assemble the power adjusting needle assembly (22) and install it in the body (38) with a new gasket (27).

d. Tighten the packing nut (24) until the needle (23) turns with slight resistance. Rotate the needle clockwise until it seats (lightly), and back it out one turn. This should be enough to allow the engine to start, after which final adjustment can be made.

e. Install throttle shaft (17) and throttle valve (12) with lockwasher (11) and screw (10). When installing the throttle valve, position it with the identifying mark "—" directly opposite the idle port and facing the mounting flange end of the carburetor.

**NOTE**

If the throttle shaft bushings (20) are badly worn, replace them.

f. Back out the throttle stop screw (35) and install the throttle valve loosely.

g. Move the throttle lever to place the valve in a closed position, and tap the edge of the valve lightly with the end of a screwdriver blade to settle the valve in the carburetor bore. While holding the valve in this position, tighten the screw (10).

h. Rotate the throttle stop screw (35) enough to crack the throttle valve slightly and to allow the engine to start and run.

i. Install the drain plug (37).

j. Install the choke shaft (34) and insert the choke valve (32) far enough for the dimples in the valve to contact the shaft. (The raised sides of the dimples in the choke valve should face the outside.)

k. Install the idle adjusting needle (18) and spring (19). Rotate the needle in until it touches the seat, and back it out one turn.

l. Insert the choke spring (33) in the slot in the end of the choke shaft. Engage the spring so that the choke valve will be held in the open position, and squeeze the choke shaft ends together to hold the spring.

m. Place the bowl gasket (9) on the body (38), and install the bowl cover assembly (3) with the three screws (1) and lockwashers (2). Tighten the screws firmly.

n. Install the carburetor on the engine.

## CARTER MODEL N CARBURETOR

1. DISASSEMBLY. (See figure D-5.)

a. Remove the carburetor from the engine by disconnecting the fuel line, removing the two attaching nuts, and disengaging the governor linkage.

b. Remove the bowl nut (1) and gasket (2) lift off the bowl (3) and bowl ring gasket (4).

c. Remove the float pin (5), float (6) and float needle (7).

d. Using a wide-blade screwdriver, remove the needle seat (8) and gasket (9).

**CAUTION**

The needle seat is easily damaged by using an improper size screwdriver.

e. Remove the low-speed jet assembly (10) and spring (11).

f. Remove the nozzle (14).

**CAUTION**

Be sure to remove the low-speed jet (10) before taking out the nozzle (14) in order to avoid damaging the lower end of the low-speed jet tube with the screwdriver.

g. Remove the idle mixture screw (12) and spring (13).

h. Remove the throttle valve screws (15), throttle valve (16) and throttle shaft assembly (17).

i. The choke valve can be removed, if necessary, by taking out the two choke valve screws (19) and valve (20), and sliding the choke shaft (21) out of the body assembly (24).

j. The choke shaft ball (22) and spring (23) will fall out when the choke shaft (21) is removed.

2. CLEANING, INSPECTION, AND INTERNAL ADJUSTMENTS. (See figures D-5 and D-6.)

a. Clean all parts in accordance with paragraph II.

b. Inspect all parts for wear or damage. Pay particular attention to the low-speed jet assembly (figure D-5, reference 10), needle (7) and idle mixture screw (12).

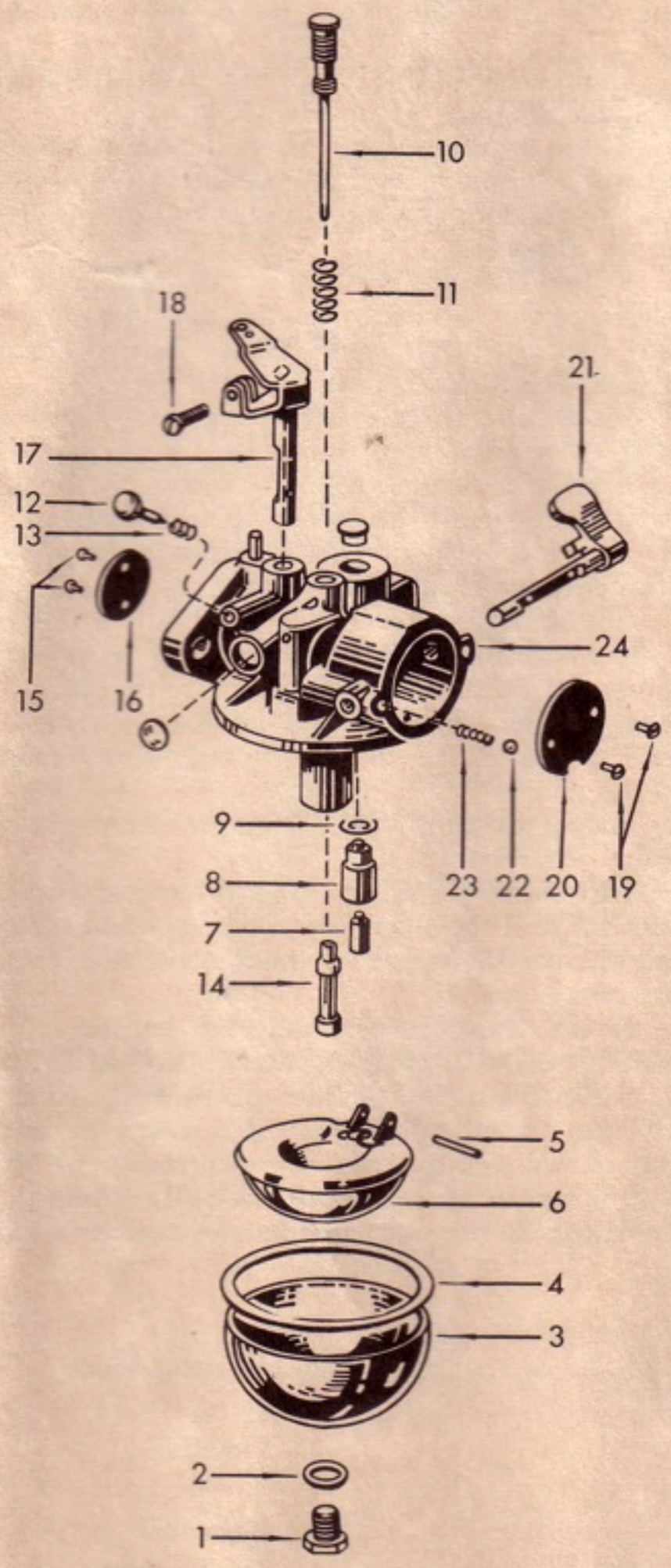
**NOTE**

Always replace needle and seats in matched sets.

c. Install the needle seat (8) with a new gasket (9) in the body assembly (24).

d. Insert the needle (7) and attach the float (6) to the body (24) by inserting the float pin (5).

e. Hold the carburetor body (24) upside down and gage the float as shown in figure D-6. The distance from the upper edge of the float at the free end should be ¼ inch from the edge of the casting. If an adjustment is required, bend the float lip with a small screwdriver.




1. Bowl nut
2. Bowl nut gasket
3. Bowl
4. Bowl ring gasket
5. Float pin
6. Float assembly
7. Needle
8. Needle seat
9. Needle seat gasket
10. Low-speed jet assembly
11. Spring
12. Idle mixture screw
13. Spring
14. Nozzle
15. Throttle valve screws
16. Throttle valve
17. Throttle shaft assembly
18. Throttle stop screw
19. Choke valve screws
20. Choke valve
21. Choke shaft assembly
22. Choke shaft ball
23. Choke shaft spring
24. Body assembly

Figure D-5. Carter Model N Carburetor

## CAUTION

Do not bend the float in any other location.

3. REASSEMBLY. (See figure D-5.)

a. Install throttle shaft (17), throttle valve (16) and throttle valve screws (15). Do not tighten the screws.

b. Rotate the throttle stop screw (18) counter-clockwise to permit the throttle valve to close completely in the bore. The throttle valve (16) must be installed with the trademark "C" toward the idle port when valve is viewed from the carburetor flange opening. Always use new screws (15) when installing the throttle valve.

c. Tighten the screws (15) just enough to permit the throttle valve to slip under the screw heads. Close the throttle valve and tap the edge of the valve lightly wih a small screwdriver to seat it in the carburetor bore. While holding the parts in this position, tighten both screws.

d. Open and close the throttle valve to make certain it does not bind in any position and that it fits the carburetor bore precisely.

e. Rotate the throttle stop screw (18) clockwise to crack the throttle valve enough to permit the engine to start and run.

f. Install the nozzle (14) and tighten it firmly, but not too tight.

g. Install the low-speed jet assembly (10) and spring (11). Rotate the jet until it touches the seat (do not force), and back it out two turns.

h. Install the idle mixture screw (12) and spring (13). Rotate the screw until it seats (lightly), then back it out approximately two turns.

i. Install the bowl ring gasket (4), working it well into the groove in the carburetor body (24).

j. Place the carburetor bowl (3) in position and hold the bowl centered against the bowl gasket. While holding the bowl in this position, install the bowl nut (1) and gasket (2). Tighten the bowl nut firmly.

k. If the choke assembly was disassembled, install the choke shaft spring (23) and ball (22).

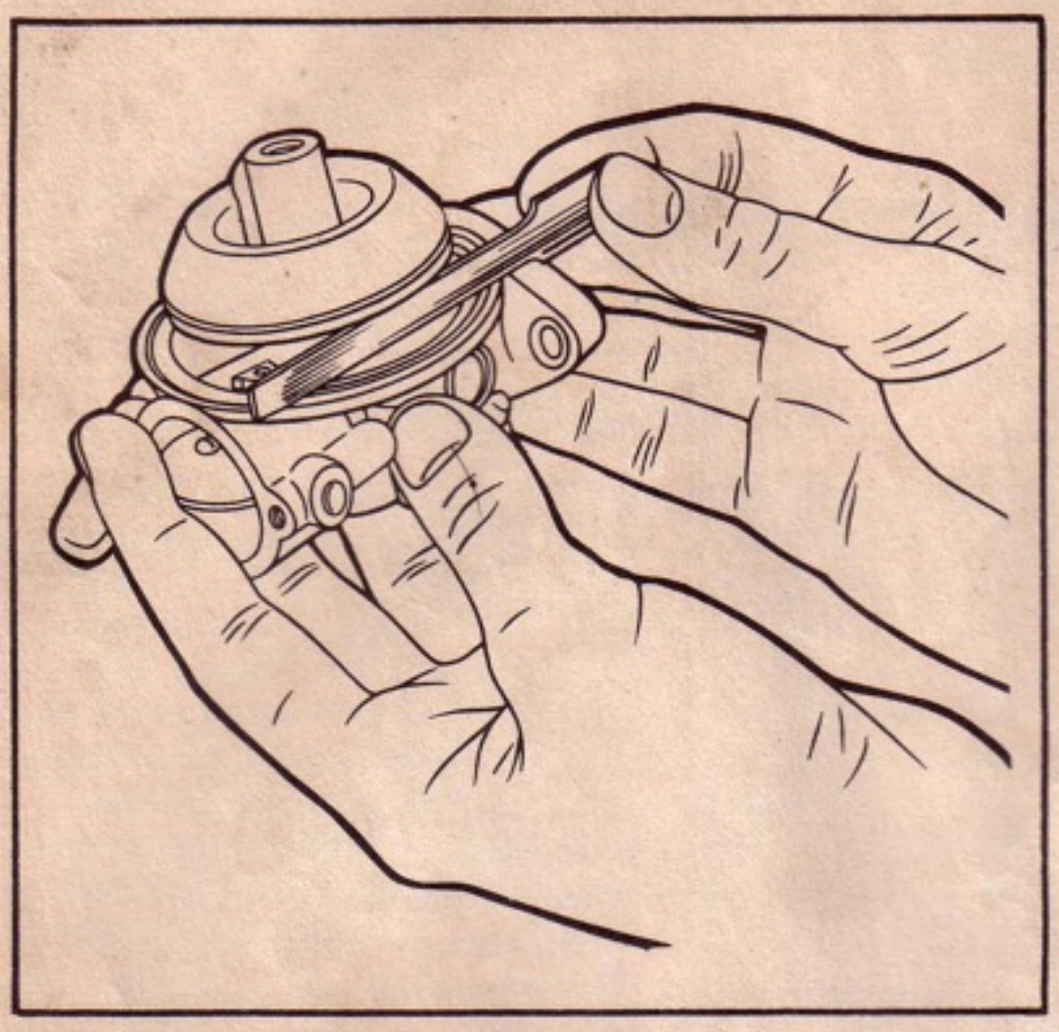


Figure D-6. Gaging Float on Carter Carburetor

l. Press the ball in against the spring with a slender-point punch and insert the choke shaft (21).

m. Install the choke valve (20) with the two screws (19). Seat the choke valve in the bore before tightening the screws.

n. Install the carburetor on the engine.

**SUCTION CARBURETOR MODEL 7100**

1. DISASSEMBLY. (See figure D-7.)

a. Remove the carburetor from the engine.

b. Remove the adjusting needle (1), spring (2) and washer (3).

c. Unscrew and remove the connector (8) and connector gasket (9).

d. Remove the screw (4), lockwasher (5) and throttle valve (6). Withdraw the throttle shaft (7).

e. If removal of the choke is required, pry off the Tinnerman nut (12) carefully, and slide the choke (13) out of the body assembly (14).

f. Removal of the throttle stop screw (10) and spring (11) is not necessary unless the screw is damaged.

2. CLEANING, INSPECTION AND INTERNAL ADJUSTMENTS. (See figure D-7.)

a. Clean all carburetor parts in accordance with paragraph II. Allow the body assembly (14) to remain in the solvent long enough to remove foreign deposits from the passages.

b. Check all parts for wear or damage, and replace defective parts. Make certain the needle point on the end of the adjusting needle is not bent or damaged.

3. REASSEMBLY. (See figure D-7.)

a. Install the throttle stop screw (10) and spring (11), if these parts were removed.

b. Slide the throttle shaft (7) into the body (14), and install the throttle valve (6), lockwasher (5) and screw (4). The flat side of the throttle valve must be positioned next to the idle port.

c. Check the choke (13) in the body (14) for freedom of operation, and relieve binding (if present) 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 (12).

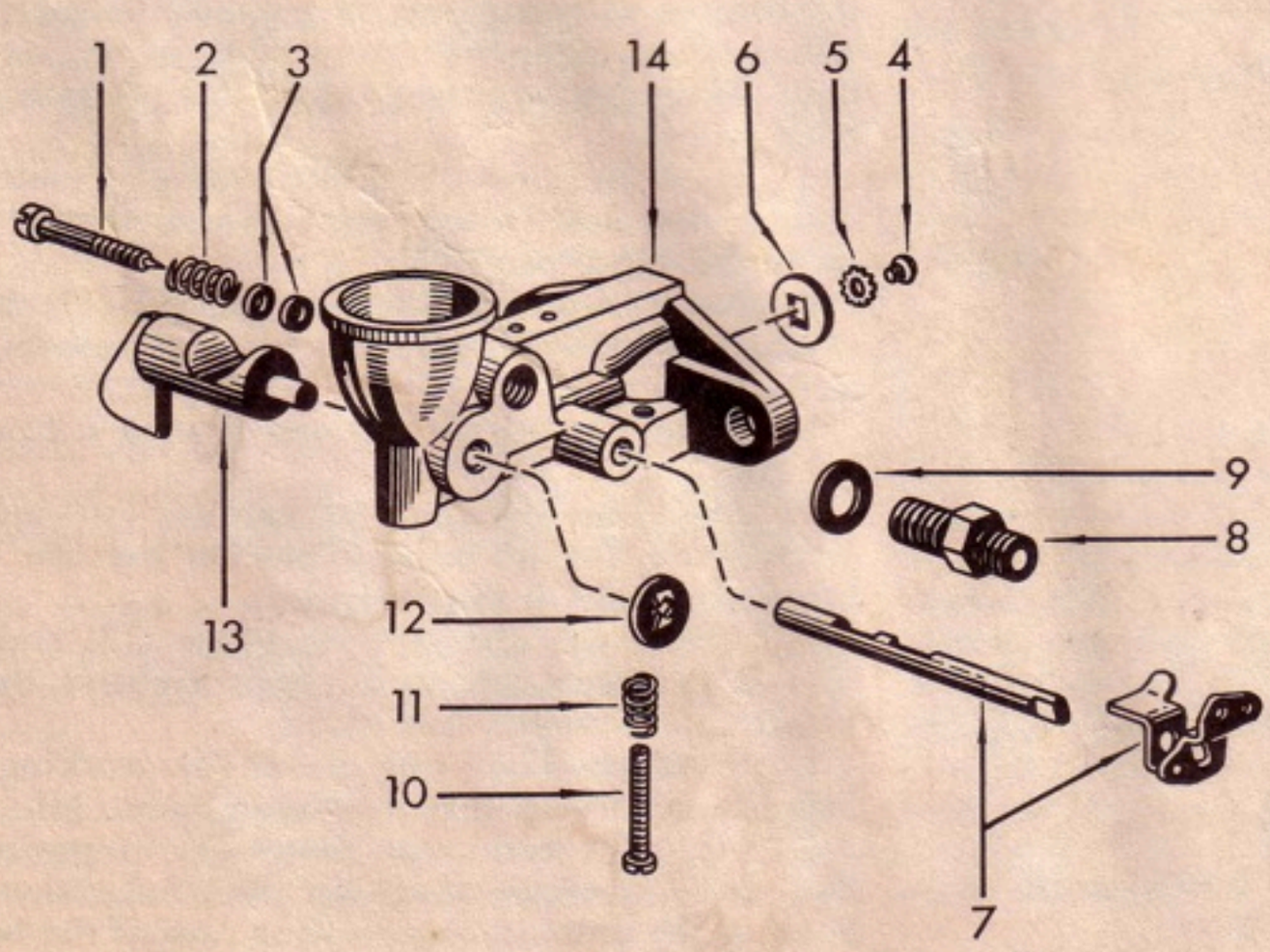
d. Install the connector (8) with a new gasket (9). Tighten securely.

e. Insert a new washer (3) in the recess in the body (14) and install the adjusting needle (1) and spring (2). Rotate the needle in until it touches the seat, then back it out two turns.

f. Install the carburetor on the engine.

**SUCTION CARBURETOR MODELS 7120 AND 7080-1**

1. STARTING — The mixture adjusting screw should be turned open about 3½ turns or until the spring on the mixture screw measures ¼ of an inch. The choke must be turned to the fully closed position for starting. If the engine does not start after several




1. Adjusting needle
2. Spring
3. Washers
4. Screw
5. Lockwasher
6. Throttle valve
7. Throttle shaft
8. Connector
9. Connector gasket
10. Throttle stop screw
11. Spring
12. Tinnerman nut
13. Choke
14. Body assembly

Figure D-7. Suction Carburetor Model 7100

attempts, this is an indication that fuel is not being drawn into the carburetor and the mixture screw should be opened an additional turn or more. After the engine starts, immediately open the choke as rapidly as the engine will permit without stalling.

2. FINAL ADJUSTMENTS—Main adjusting screw—The maximum power out-put is obtained when the main adjusting screw is opened for a top engine speed of between 3600 and 4000 rpm. Higher engine speeds can be obtained on a leaner mixture. However, this is not the correct setting for maximum power. Idle stop screw—The recommended minimum idle for average operations is 1500 rpm. A slightly higher idle speed may be necessary until after the mower and engine have become "broken in."

3. TROUBLE CHART—

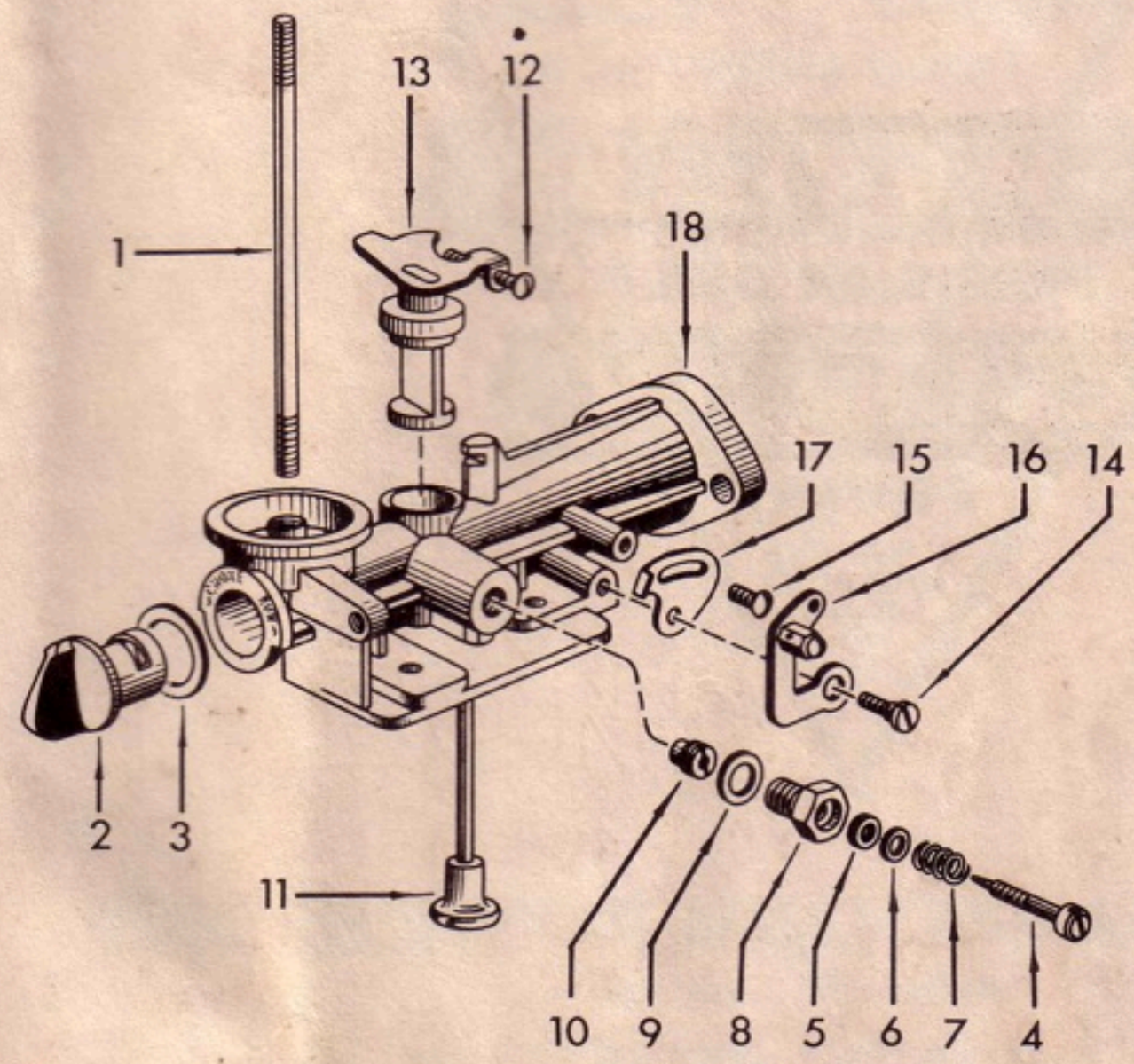
Failure to Start:
a. Adjusting Screw not fully open.
b. Choke not closing properly.
Sensitive Adjustment:
a. Replace adjusting screw.
b. Choke not fully open.
Idles Too Fast:
a. Set stop bracket to extreme right hand position.
b. Linkage binding.
c. Paint on governor spring.
d. Governor spring has too much tension. The spring may be stretched slightly.
No Governor Action:
a. Linkage binding.
b. Throttle valve sticking.
c. No tension on governor spring.
Loose Choke:
a. Tighten air cleaner stud.
b. Replace choke gasket.
Tight Choke:
a. Loosen air cleaner stud.
b. Inspect choke to locate cause.

4. PAINT ON THE MIXING VALVE—Any paint that is on the throttle must be removed by using paint thinner or any other appropriate means so as to clean the throttle and that portion of the mixing valve the throttle contacts. Also, any paint that is on the governor spring causing the coils to stick together must also be removed in a similar manner. Extreme care must be exercised in handling the governor spring so as not to stretch or damage this spring in any way.

5. GOVERNOR LINKAGE—Any looseness or play in the linkage arrangement between the air-vane governor and the throttle should be removed as much as is possible by closing the loops in the ends of the governor link.

6. SURGING—Surging may be caused by an improper fuel mixture which is usually corrected by adjusting the mixture adjustment screw until a good mixture is obtained or by repairing the "V" slot in the needle to eliminate any obstruction to the fuel flow. Also, looseness in the governor linkage contributes to a hunting or surging condition and this looseness should be corrected as mentioned in the paragraph above.

7. DISASSEMBLY. (See figure D-8.)




1. Air cleaner stud
2. Choke
3. Choke gasket
4. Adjusting needle
5. Packing
6. Washer
7. Spring
8. Packing
9. Gasket
10. Metering jet
11. Intake screen
12. Throttle stop screw
13. Throttle valve
14. Shoulder screw
15. Screw
16. Throttle lever
17. Throttle lever stop
18. Body

Figure D-8. Suction Carburetor Model 7120

a. Remove carburetor and gas tank from the engine and separate the carburetor from the gas tank by taking out the two attaching screws.

b. Unscrew and remove the air cleaner stud (1) to free the chock (2). Lift out the choke (2) and gasket (3).

c. Remove the adjusting needle (4). Remove from the needle the packing (5), washer (6) and spring (7).

d. Unscrew and remove the packing nut (8) and gasket (9).

e. Remove the metering jet (10), using a correct size screwdriver blade to avoid damaging the screw slot.

f. Rotate the throttle stop screw (12) in a counter-clockwise direction until the throttle lever can be rotated far enough to permit the throttle valve (13) to be lifted out of the body (18).

g. If necessary to remove the throttle linkage, take out the shoulder screw (14) and regular screw (15) to free the throttle lever (16) and throttle lever stop (17).

8. CLEANING, INSPECTION AND INTERNAL ADJUSTMENTS. (See figure D-8.)

a. Clean the carburetor in accordance with paragraph II.

**NOTE**

The intake screen (11) need not be removed from the body (18) unless it is damaged. Make certain that the screen is thoroughly clean, and use compressed air to clean out the intake passage.

b. Check all carburetor parts for evidence of wear and damage. Replace defective parts.

c. Check both the throttle valve (13) and choke (2) for freedom of movement in the body (18). If binding occurs, relieve the high spots by rubbing them with crocus cloth.

d. Check the idle port and main port, making certain both are free. Do not insert wires through these passages, but clean with compressed air.

9. REASSEMBLY. (See figure D-8.)

a. Install the metering jet (10) in the body (18). Tighten firmly but do not damage the screw slots.

b. Install the packing nut (8) with a new gasket (9).

c. Place the spring (7), plain washer (6) and a new packing (5) on the adjusting needle (4) in the order named, and install the adjusting needle in the packing nut (8). Rotate the needle until it touches the seat, and back it out 3½ turns.

d. Slide the throttle valve (13) in the body (18), and rotate the throttle stop screw (12) enough to secure the throttle valve in the body.

e. Place a new gasket (3) on the choke (2) and insert the choke in the body with the arrow in a vertical position. Install the air cleaner stud (1).

f. Rotate the choke to make certain it operates with slight resistance. The choke should have just enough resistance to remain in either the open or closed position.

g. If the throttle lever (16) was removed, place it in position and secure it with the screw (15).

h. Place the throttle lever (16) over the shoulder screw (14) and tighten the screw in place.