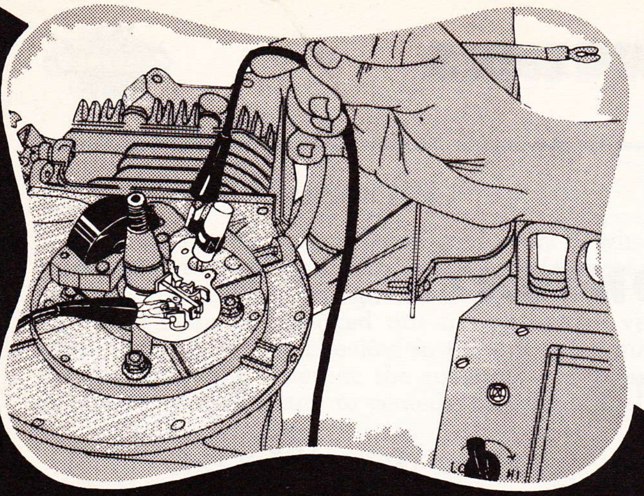
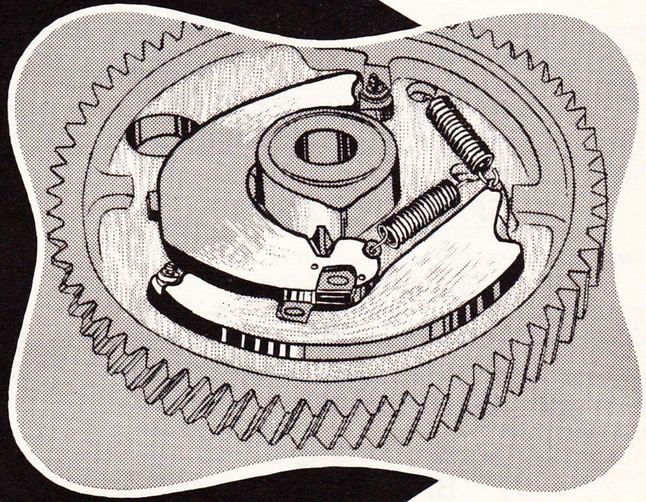
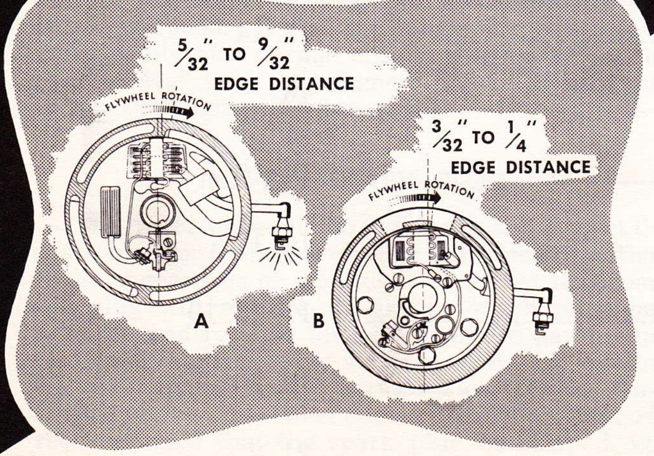
SECTION VI
DIVISION D
SERVICE MANUAL
ISSUED FEB., 1960







MAGNETOS

PRINTED IN U.S.A.

CLINTON ENGINES CORPORATION, Maquoketa, Iowa

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MAGNETO

MAGNETOS

Clinton Engines are all equipped with flywheel-type magnetos and periodically a magneto requires service. An engine brought in for "hard start" or "no start" can be checked out magneto-wise very simply and should be checked in the following manner to determine whether the magneto parts must be inspected and tested to remedy the condition.

CHECK MAGNETO OUTPUT

To check magneto output, it is recommended that an 18 mm spark plug (Fig. 1) be used and that the

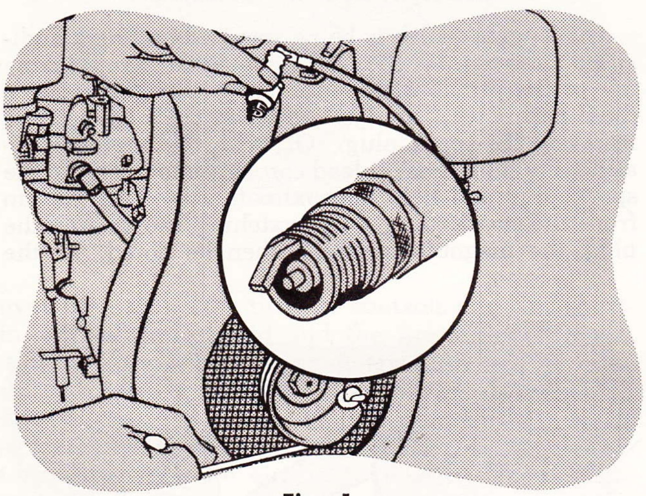

Fig. 1

ground electrode of the spark plug be bent away from the center electrode up to 3/16" (.187) and at least 5/32" (.156). Using a fixed gap in the range of .156 to .187 (that is, 5/32" to 3/16") the high tension lead can be removed from the engine and fastened to this gapped plug. Then hold the hex or threaded portion of the spark plug (Fig. 1) against the engine head or block and crank the engine in a normal manner with rope or recoil at a normal cranking speed. If the fire jumps the gap readily and steadily at a normal cranking speed across the 5/32" to 3/16" gap, the magneto output is adequate to fire the engine under compression.

INSPECT SPARK PLUG

The next step would be to remove and inspect the spark plug for fouling, wide gap, or burned condition. If the appearance of the plug is such that it appears the plug will operate, check the spark plug gap, (Fig. 2), and reset to the recommended gap for the particular engine being serviced (refer to Section VI, Maintenance, under Service Clearances). On a single cylinder air-cooled engine it is not particularly recommended that the spark plug be cleaned, but when questioned, should be replaced. However, if the equipment is available, it is satisfactory to clean and regap the plugs.

The color of a spark plug can indicate many things. For instance:

1. A dry brown color usually indicates a normal engine running in the proper heat range and with the proper fuel mixture.
2. A greyish-white porcelain and electrode can indicate several misapplications:
   a. Plug running too "hot."
   b. Fuel mixture is too lean (leaking gasket or wrong carburetor adjustment).
   c. Wrong fuel (stove gasoline, premium grade gasoline).
   d. Cooling fins blocked or broken (thus raising engine temperature).
   e. Heavy, constant load (in this case one number colder plug may remedy the trouble).

NOTE: Constant operation with a very "hot" spark plug can cause a short due to a fine metal particle formed between center electrode and ground electrode.

3. A dark "sooty" plug can indicate the following:
   a. Carburetor adjustment too "rich" (not enough air to fuel).
   b. Engine using oil (needs rings).
   c. Too much oil in fuel mixture (two-cycle engine).
   d. Cold spark plug (in this case one number hotter plug may remedy the trouble).

NOTE: Operation of a plug that is "too cold" will cause carbon deposits to accumulate on electrode and porcelain in a very short time and short plug out and cause "no start."

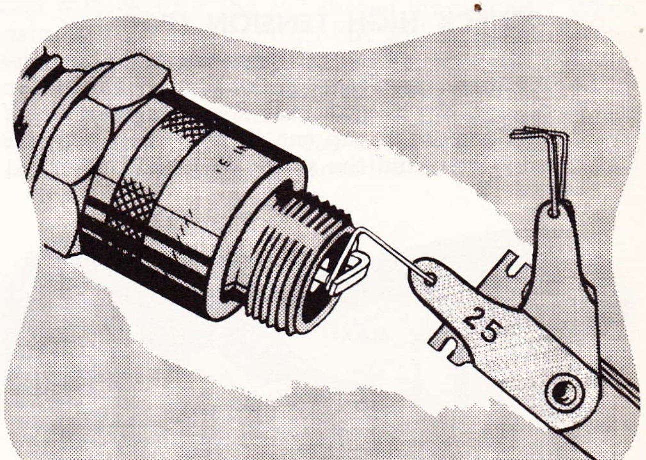

Fig. 2

CHECK COMPRESSION

After the spark plug has been reconditioned and re-gapped and prior to replacement, use a compression gauge (Fig. 3) to check the compression on the engine because low compression can result in a no start. Refer to Section VI, Tolerances for the Recommended Compression on an Engine. Crank the engine over by rope or recoil at cranking speed to check compression. When an engine passes the compression check, and also the firing check across the gapped plug and is still a "hard start" or "no

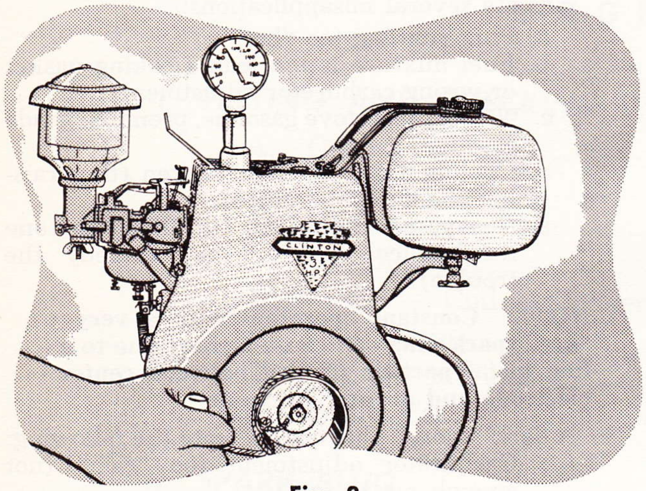

Fig. 3

start", the problem could be the spark plug and it should be replaced if questionable. Plugs that have had a long period of operation must either be replaced or cleaned with an abrasive spark plug cleaner and the ground and center electrode reconditioned comparable to a new plug, and at that time regapped. Old plugs require a higher magneto output, not only due to the gap widening, but also due to the carbon formation and/or possible oxidation of the metal due to heat conditions.

CHECK HIGH TENSION LEAD

After magneto output, compression, and plug condition have been checked and the plug re-gapped or replaced (and the engine still does not start or is "hard start") a small gap can be used between the high tension lead and the spark plug (Fig. 4) to be

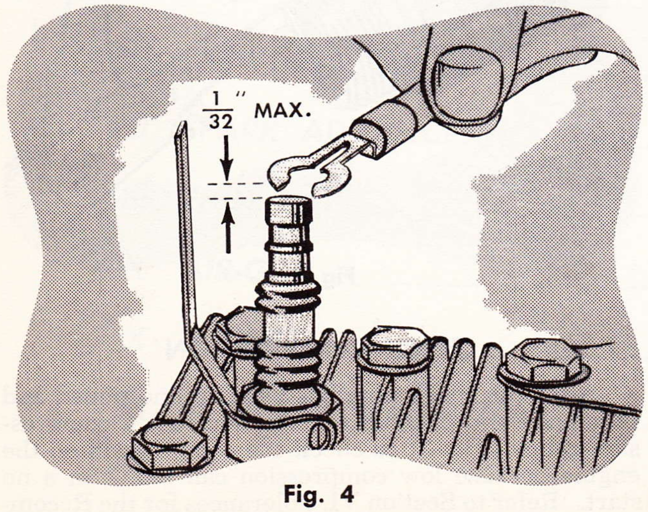

Fig. 4

sure that the engine is firing to the plug under compression at cranking speeds. The gap between the high tension lead and the spark plug should not be over $\frac{1}{32}$" and preferably closer to $\frac{1}{64}$". This fire under compression can be checked by a fixed gap tester that has this spacing set on it. If the engine will fire this gap through the plug and the outside portion of the plug is clean and the plug internally has been cleaned (or, when in question, has been replaced) the problem then could be in air and fuel supply, in other words — carburetion. (Refer to Sec. VI, Div. E). **NOTE: Refer to Section VI Tolerances and Specifications to Determine the Proper Spark Plug for the Engine Being Serviced.**

HIGH SPEED MISSFIRING

An engine which is being serviced having a high-speed miss can be checked for magneto troubles by use of the previously mentioned gap tester; using a fixed gap of $\frac{1}{64}$" to $\frac{1}{32}$" between the high tension lead and the spark plug. Or, with the engine operating, the high tension lead can be removed from the spark plug and held approximately $\frac{1}{32}$" maximum from the spark plug. By watching the fire to the plug, the magneto miss can then be noted. If the

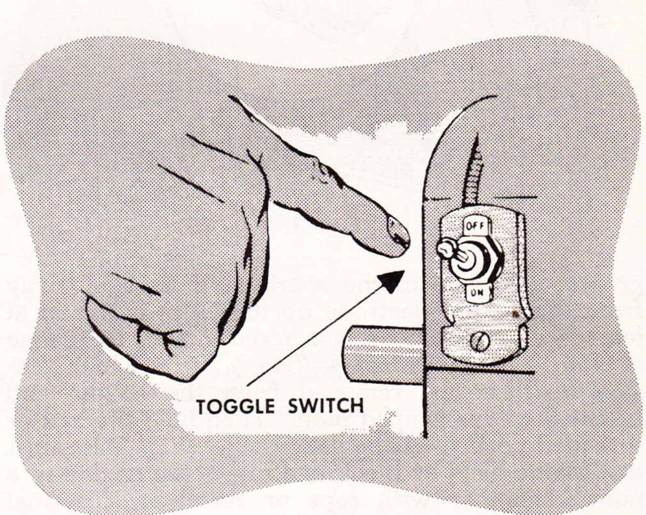

Fig. 5

engine is missing as far as the engine sound is concerned (while the magneto is firing steadily to the spark plug) the miss is then due to some other malfunction, such as valves or carburetion. (Refer to Sec. VI, Div. B and Sec. VI, Div. E).

When it is determined by checking the fire over a wide gap at cranking speed or by checking over a narrow gap with an engine running, that the magneto is not functioning properly, it will be necessary to disassemble the engine to expose the magneto, so that the various magneto parts may be inspected.

CHECK POSSIBLE GROUNDING

Prior to disassembly, think of the shorting device, such as the toggle switch (Fig. 5) which may have failed and be actually grounding out the primary in the magneto. Unfasten this switch and crank the engine and check fire with it unfastened. Also many of the vertical shaft engines are equipped with a shorting device on the throttle control low-speed end (Fig. 6). The cover should be removed from

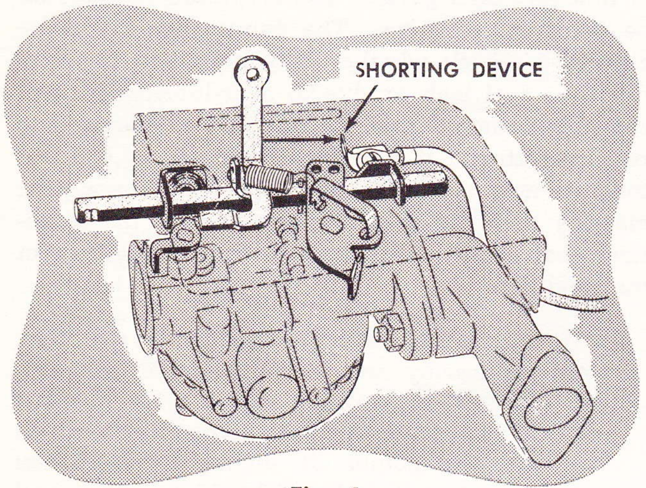

Fig. 6

over the carburetor throttle controls and this shorting device unfastened and the fire checked again. After the ground switch or shorting device (there are several types) and the external part of the high tension lead have been checked, and have proven satisfactory, it may then be necessary to remove external parts of the engine to inspect the magneto assembly.

One of the most important things during magneto service, is to use care in disassembly and to check the positioning of the parts. For example: The high tension lead, through vibration, may have worn and is grounded to a cylinder fin, or the hold-down clamp on a high tension lead may have worn through or cut through causing a grounded-out condition of the high tension lead or a part-time grounded condition.

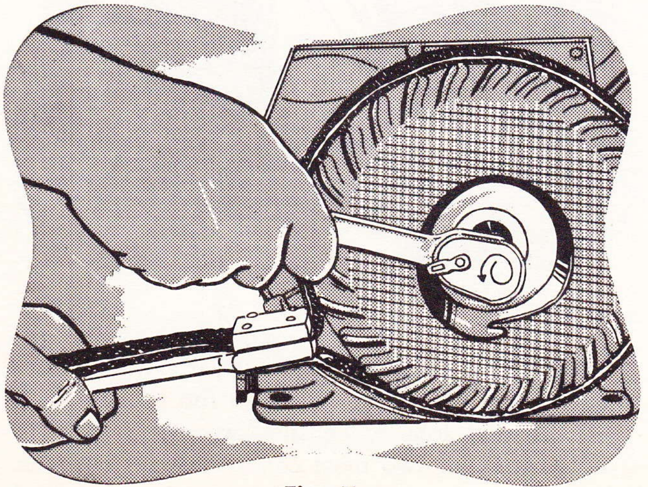

Fig. 7

DISASSEMBLE ENGINE

To inspect the magneto assembly, remove the blower housing to expose the flywheel. To remove the flywheel, use holder #TL-938 to hold the fly-

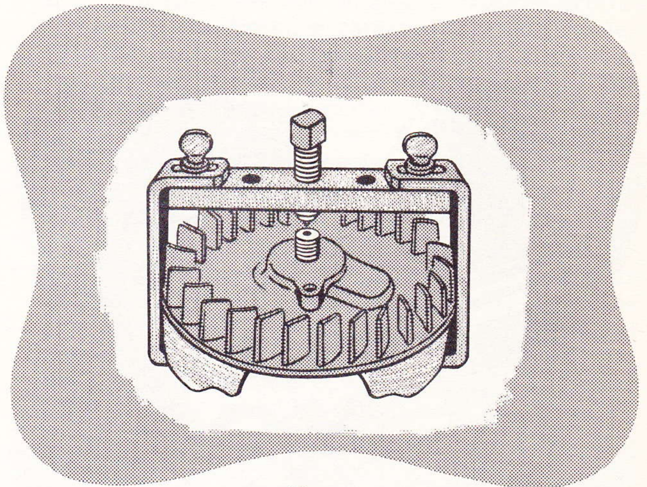

Fig. 8

wheel and remove the flywheel nut in a counterclockwise direction (See Fig. 7). After the flywheel nut is removed, remove starter cup, recoil cup and/or screen, depending upon the assembly. Then use the flywheel puller #TL-969 (Fig. 8) to loosen flywheel. To use this flywheel puller, tighten the center screw down about 100-inch-pounds or more and then rap the end of the screw with a steel hammer to impact the flywheel loose. The flywheel may be loosened as well with #TL-916 for the 7⁄16″ thread crankshaft and #TL-968 for the ½″ thread crankshaft. When using the impact nut, turn nut within ⅛″ of the flywheel and then strike with a steel hammer. It will aid in flywheel removal, if the flywheel is gripped by the fingers and the weight of the engine is partially supported in this way when the nut is struck (Fig. 9). It is not recommended that screw drivers

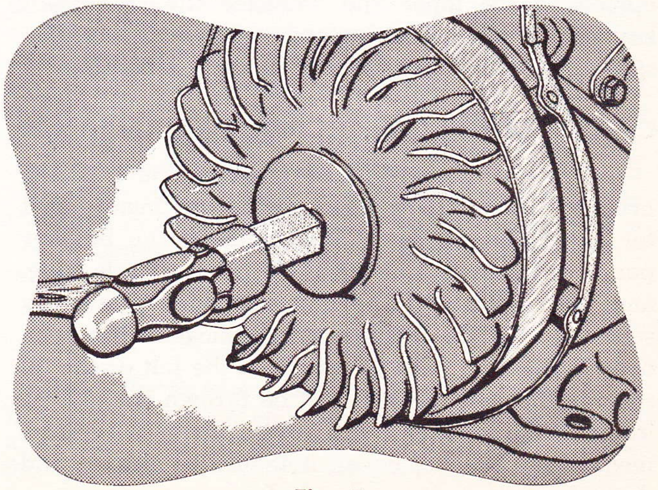

Fig. 9

be used to pry against the flywheel, as the bearing plate or other parts of the engine may be damaged. The puller #TL-969 will fit the Clinton Engines produced to date, through the 4½ h.p. model. The Red Horse Series Engines require usage of the #TL-931

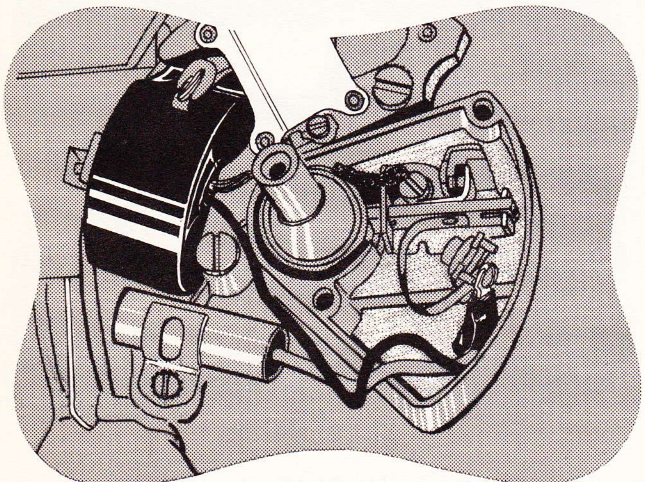

Fig. 10

impact nut and in the case of this engine, pulling on the flywheel may be beneficial, provided the tool is used against the head of a cap screw pulling outward against the flywheel and then letting the impact nut do the work.

NOTE: USE CARE IN REMOVAL OF FLYWHEEL NUT TO BE CERTAIN THAT IT WAS TIGHT. ITS TIGHTNESS IS TO BE CONSIDERED WHEN SERVICING THE ENGINE.

If the flywheel nut has been loose (which means the flywheel has lost torque) the flywheel may have moved on the taper and damaged the crankshaft keyway, flywheel keyway, and/or flywheel key. Inspection of these parts will be discussed later.

CHECK POINTS, COIL, CONDENSER AND CAM

After the flywheel is removed, remove the breaker points cover and inspect the inside of it for excess lubrication. The inside of the breaker points cover will indicate if an oil seal is leaking, and will indicate if the unit has been previously serviced or if the felt for cam lubrication has been over lubricated. The grease from the felt or the oil moving through the seal will be thrown against the inside of the breaker points cover. Prior to replacement of the breaker cover, it should be cleaned and dried for future diagnosis.

After removal of the breaker cover and visual inspection in the area of the points, wiring, etc., (Fig. 10) the coil and condenser should then be checked out. If the engine had previously been serviced and has been operated only a short period of time and then gave a "no fire", more care should be taken in this area. The points should first be cleaned to check whether they have become dirty due to a seal leak or due to over-lubrication, and the points should then be checked to see if they require setting. If they have been set at .020 and they are now over or under that setting (by a great margin) then the following are some of the conditions that could cause this and that would correct the condition:

1. Points that check out much wider than they were supposedly set, or should have been set, usually indicate that the points were checked and then the point screw tightened down which "walked" the points off their setting. When points are installed; they should be clean and dry and the bearing plate or block to which they are mounted should also be clean and dry, to minimize the slippage or moving. The proper assembly of screws and washers will also minimize this. However, after a point screw is tightened, the points should be rechecked for proper setting.

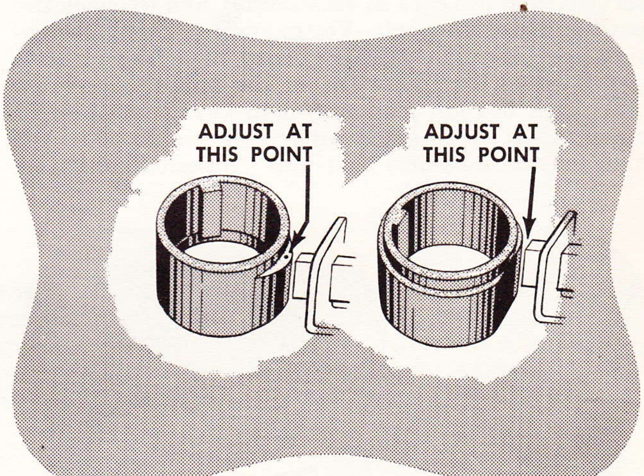

Fig. 11

2. If the point setting is off, it can also indicate that the point was not in the proper place on the cam lobe when they were set. Fig. 11 illustrates the two most common types of cams, which have been used on engines other than Red

Horse series, and at which point on the cam the point adjustment should be made. Refer to Section VI, Service Clearances for Point Setting of the Respective Engine. Fig. 12 illustrates breaker points and common terminology.

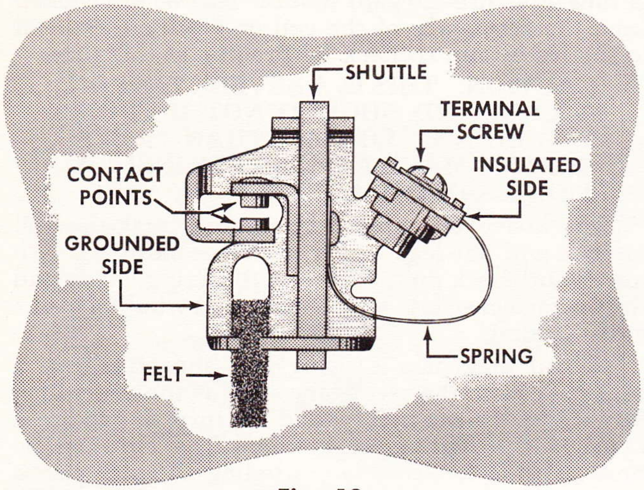

Fig. 12

3. When points have been properly adjusted and the engine comes back in a short period of time due to "no fire" and upon careful inspection the points setting shows the points have a much closer gap than previously, a number of things may have caused this:

4. One of the possibilities is the installation of new points to an old breaker cam and that the breaker cam is rough and is grinding off the shuttle or rocker arm which gives a lower or closer point setting in a very short period of operation. In this case the breaker cam should be replaced.

5. When the main bearing on the magneto side of the engine is worn or the crankshaft is worn, the point setting can vary — depending on whether the crankshaft is pulled toward the rocker arm and shuttle or pushed away from it. This would give a variable setting, and could give "no start", "hard start", etc.

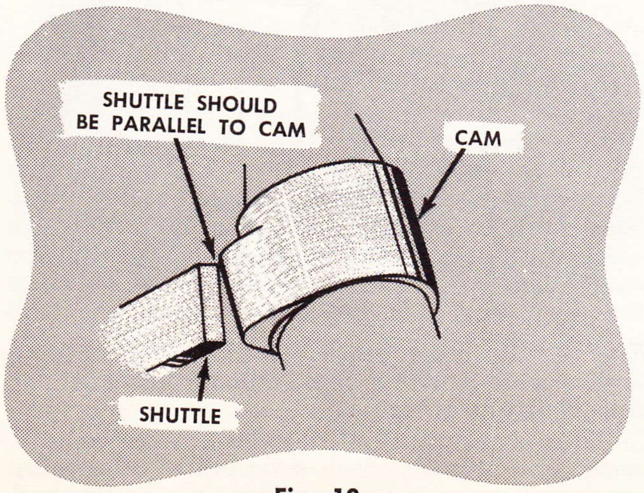

Fig. 13

6. Another possibility of point setting changing would be that as the points were installed, the rocker arm or shuttle arm to cam lobe was not true. In this case the shuttle or rocker arm is contacting the breaker cam on only one corner (Fig. 13) and (as the rocker arm or shuttle arm wear to the curvature of the breaker cam) the clearance is reduced rapidly. Always check the relationship of breaker cam to shuttle or rocker arm when installing points.

In some cases, it has been known that points will come back to the shop having lost .010 of their original setting due to the improper alignment of shuttle or rocker arm to breaker cam, and in this period of time they have worn to the curvature and to a full contact of the cam. If they were reset at this time, they would then hold a setting. **Check this relationship each time the points are adjusted or replaced.**

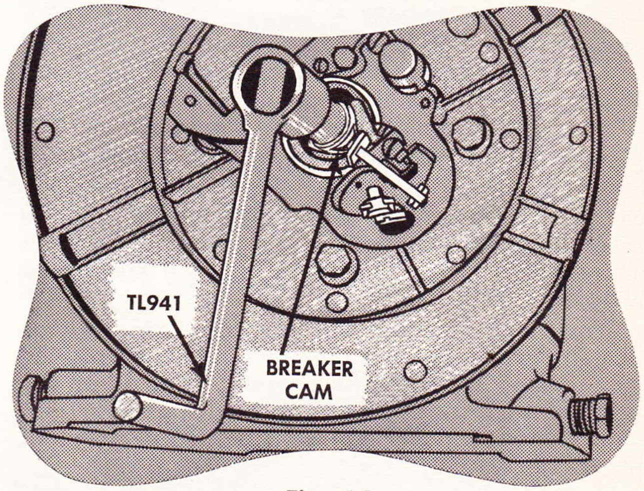

Fig. 14

The previous comments would be considered during normal magneto service, but points are not usually cleaned or rechecked for setting except as an engine is disassembled and it is known that the engine has been serviced only a few operating hours prior to this time. In this case the engine would be carefully watched for flywheel torque, seal leaks, over lubrication, improper alignment of points, and proper setting of points, point cleanliness, etc. On standard magneto service, it is not necessary and is not recommended that the magneto be taken apart piece by piece.

COIL TESTING

After the flywheel and breaker point cover have been removed, the coil can be checked readily on most testers by turning the crankshaft with a #TL-941 crank (Fig. 14) and moving the points to an open position. (i.e. holding them open by use of the breaker cam.) One lead of the tester can be hooked up to the insulated side of the points or hooked to the points screw, and the other lead of the tester to the ground side or to the bearing plate to complete the circuit through the primary (Figs. 15 and 16). The points held open by the breaker cam will open the primary circuit. Or the points could be held open by use of paper between the contacts to open

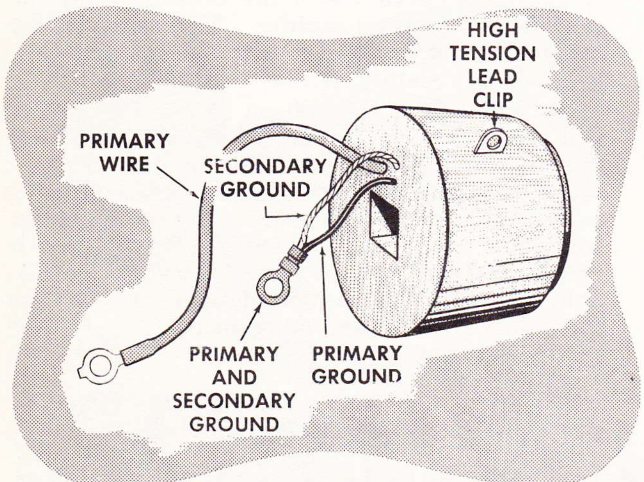

Fig. 15

the primary circuit. Most coil testers check over a 5 mm gap on the secondary output so that another lead should be brought to the high tension and the tests followed as recommended by the manufacturers of the tester. (Fig. 15 illustrates a coil and terminology).

Now, make the coil test (i.e., the firing test on the coil) to see whether the secondary is furnishing the required output (which would be to jump the recommended tester gap for the particular coil) with the tester set as specified by the manufacturer of the tester (Fig. 16).

If the coil does not pass the firing test when hooked to the high tension lead, then unfasten the high tension lead from the coil and retest by fastening the tester lead to the secondary clip.

If the coil now passes the test, it would indicate that the high tension lead was possibly grounded out through the insulation. Check the possibilities; such as, paint grounding lead out, or in some cases the use of the wrong flux on soldering the end of the high tension lead wires to hold them together may have left a residue on the insulation. This would give a path for the electricity to move from the high tension lead to the bearing plate and ground out in this manner. Also, the lead wire may be broken internally, or the spark plug connector may not be in contact with wire of high tension lead.

By leaving the high tension lead fastened, it is possible to make a probe on the high tension lead to find where it is leaking or where it could leak when the engine is reassembled. The firing test is the normal test on a coil and does point out whether the coil will function but also can point out whether the high tension lead between the coil and the spark plug is grounding out. Both the coil and high tension leads can be probed with an external probe for broken insulation to determine whether the break is superficial or whether it goes down into the wire. Many testers recommend (after checking the ability of the coil to fire the gap) that the lead be unfastened from the secondary of the coil or high tension lead to the tester and recheck by probing at this time.

CAUTION: THIS IS A SEVERE TEST ON A COIL AND SHOULD NOT BE CONTINUED ANY LONGER THAN NECESSARY TO MAKE A COMPLETE INSULATION LEAKAGE CHECK.

The above test almost guarantees that the coil or lead will not leak under service conditions. An important check on a coil after the firing check and the leakage check, is a secondary coil winding continuity reading.

A coil may pass a firing test and still have a broken wire in the secondary such as the clip which fastens to the secondary and in turn to which is fastened the high tension lead. The clip can be broken from the secondary winding and still pass a firing test. It could cause intermittent fire resulting in surging of an engine due to this broken wire and also due to other magneto problems. The secondary continuity check will pick up this broken wire readily and is a check that should be used on a coil. Most coil testers will make this check.

An additional test on the coil would be a primary reading to determine the condition of the primary. Normally, if the primary is bad, the coil would not have passed the firing test. It may not test satisfactorily due to a broken wire, due to grounding out underneath a screw, broken insulation, or other

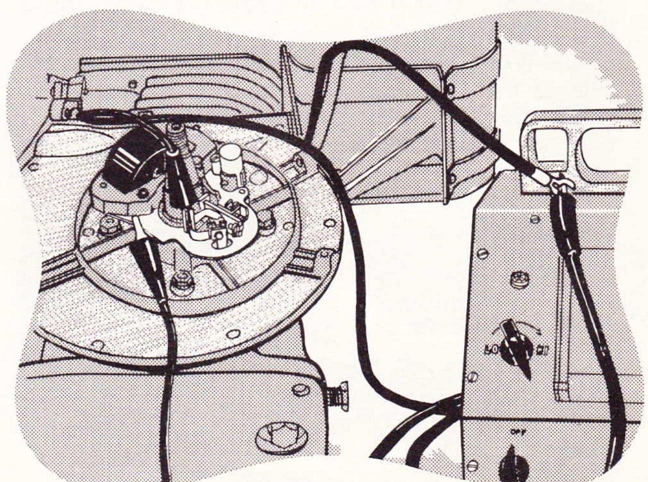

Fig. 16

damage. Move the primary lead wire while testing to determine if wire is broken under insulation, or if insulation is broken.

When a coil passes a firing check, leakage check, secondary continuity check, and a primary continuity check, and passes these tests with only the flywheel and breaker cover removed with the points held open by the breaker cam, there is very little chance that the coil will not function properly.

Heat may sometimes have an effect on the coil, but this will show up on magneto output when the engine is warm and when it will not fire a gap as previously stated.

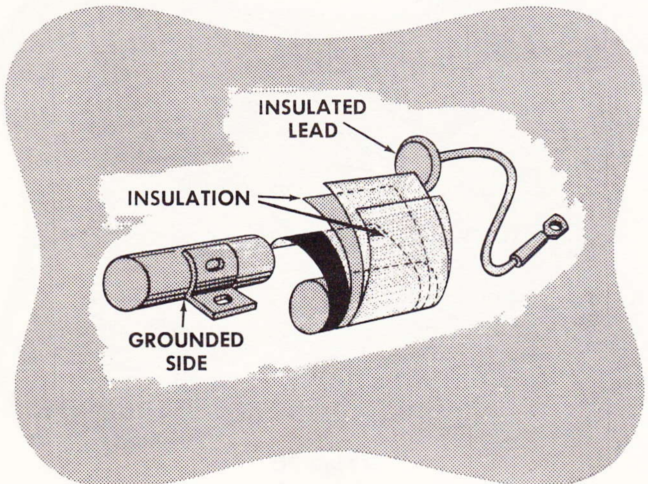

Fig. 17

CAUTION: IN SERVICING A MAGNETO, PERFORM THE COIL AND CONDENSER TEST AS THE ENGINE IS DISASSEMBLED.

Under certain storage conditions there may be a lot of moisture over the coil, and under certain storage conditions, coil insulation may soften so for proper diagnosis of the magneto, it should be tested as engine is disassembled to determine which was the failing part, if any.

CAUTION: USE THE MAGNETO TESTER MANUFACTURER'S RECOMMENDATIONS ON COIL TESTS AND USAGE OF TESTERS.

If many coils are testing bad, take three new coils from stock and check out to be sure that the tester is functioning properly and that recommendations are correct. The new specifications are made up for the tester by checking three to five new coils and then allowing a little (approximately 20%) more on input, so that the coil will have a useful life. It will aid in minimizing problems with testers if a good coil on a lamination is set aside for checking out the tester whenever a series of bad tests occur. However, checking out three new coils from stock will give an idea of the severity of the test being applied to coils that have been in operation.

(Fig. 17 illustrates a condenser and terminology.) The condenser should be checked for capacity, and leakage, while servicing a magneto (Fig. 18), and also for series resistance (if tester is so equipped). The capacity on the present Clinton condensers is as follows:

P2053	**CAPACITY .13 to .19 M.F.D.**
C3416	**CAPACITY .15 to .19 M.F.D.**
P5549	**CAPACITY .22 to .27 M.F.D.**
P5589-A	**CAPACITY .15 to .19 M.F.D.**
P5599-A	**CAPACITY .15 to .19 M.F.D.**
P7219	**CAPACITY .13 to .19 M.F.D.**
P5758	**CAPACITY .24 to .27 M.F.D.**

An important check on a condenser and one of the harder tests to perform accurately is the leakage test which checks the quality of the insulation between the condenser foils or plates. On the previously mentioned condensers, two megohm leakage is allowable on a leakage test.

To learn more about a tester and the results of leakage; save several older condensers and then test a group of them. The ones where the insulation is definitely broken down, will show bad leakage or a short. Lay aside the condensers that check out good on the tester. Warm these condensers 25 to 50 degrees above room temperature, (not over 125 degrees total temperature reading) then retest them. You will then find that in some cases a condenser will give trouble on an engine at operating temperatures (also when engine is still warm engine will not start). However, engine will restart after cooling and this can be due to the expansion of the individual components of the condenser giving a different leakage check when warm than when cold. A good condenser should show no particular change on the tester reading whether it is checked at 72 degrees and passes the check and then rechecked at 100 degrees. If there is a great change in the dial reading, the condenser is not suitable for reuse. If the condenser is heated, it should be warmed slowly as matches, torches, and that type of a heating device can damage the condenser or ruin it entirely.

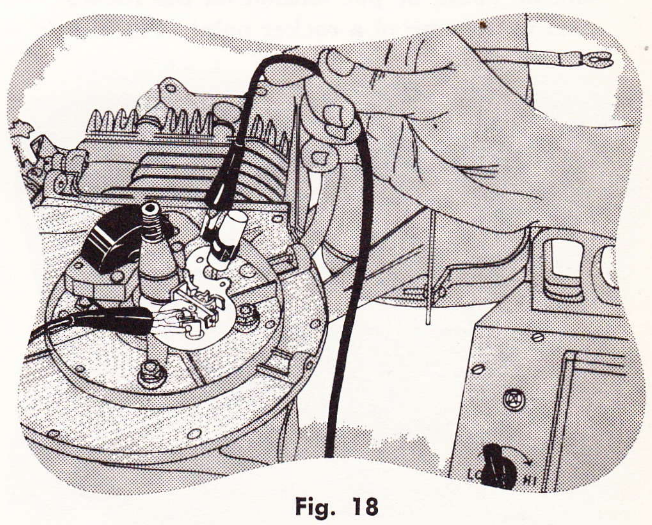

Fig. 18

Condensers can be loaded on certain testers and will be loaded when removed from the tester. By grounding out the condenser to its case, an indication of its leakage can be determined. A good condenser will snap and show a blue fire. If the kick back to the case is not audible, recheck condenser carefully or warm condenser and recheck. **Do not warm above 125 degrees, total overall temperature.**

Some condenser testers have a series resistance test and this test should be used as it can pick out a bad lead, or a bad connection of lead to the foil, and while making a series resistance test move the lead to see what effect it has on the test. If possible, make the series resistance test before the leakage test.

TESTING AND ADJUSTING POINTS

The next test that can be made by some testers is to check the ability of the points to conduct electricity or high resistance primary test. Follow tester manufacturers recommendations on making the test. Hook one of the leads to the point terminal screw and the other lead to the lamination, stator or ground screw, then turn the crankshaft so that the breaker cam opens and closes the points. The points should have approximately the same contact as if the two leads of the tester were clamped together. As the points open, the reading will be the primary of the coil. This check will show up dirty points and also points that have a weak spring tension.

NOTE: The spring tension may be adequate, but as the point terminal screw is screwed in, it may twist the spring in the case of a shuttle point, or put tension on the rocker arm in the case of a rocker point (Fig. 19).

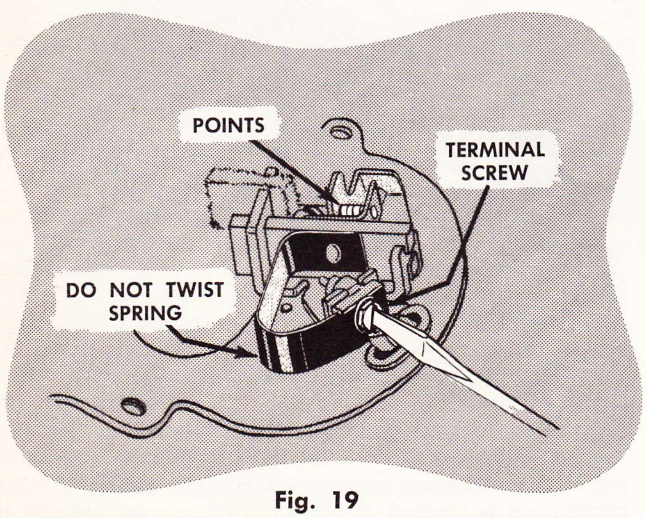

Fig. 19

Prior to making a point test of the above type, set tester according to manufacturers recommendation. In making this test on new points or used points it will be necessary to clean the points in most cases (if points are to pass test) by use of carbon tetrachloride (readily available at drug stores) or some other similar type cleaner (Fig. 20). When the points are cleaned with a cleaner use a lint-free white material to soak in the cleaner and then pull it through the points. After cleaning with a cleaner,

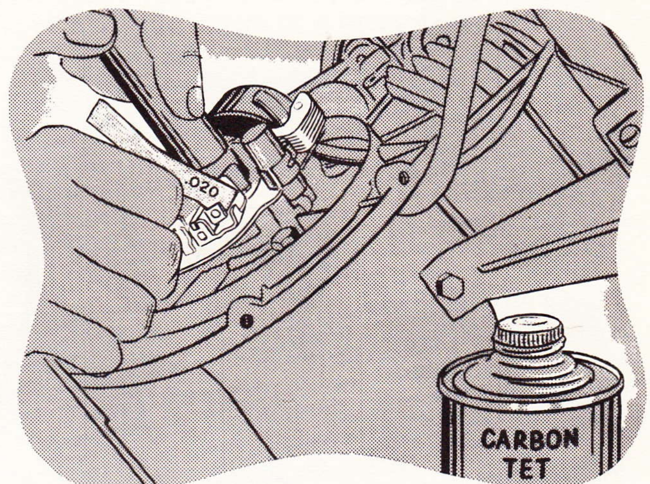

Fig. 20

use dry lint-free material to dry the points and then conduct tests. New points (or points of engines that have stood for a period of time) should be cleaned and the fact they have not been cleaned may be the only reason for the no start.

BREAKER POINTS

Equipment is available for checking point spring tension. The point spring tension should check out at least 14 ounces at opening. Shuttle type breaker assemblies should have a slight amount of grease on both sides of the shuttle in the forward and the rear slots, and the rocker type breaker assemblies should have a slight amount of lubricant around the pivot post. The approved lubricant for this is Aero lubri-plate or equivalent. **CAUTION: Wipe off excess lubricant when lubricating the points, as engine operation can cause this grease to move into the contact.** The points have a felt which may be lubricated with the same lubricant by working it into the felt, but if a felt is over lubricated or if the felt is oiled, this excess lubricant will coat the points and probably give a "no start" or "hard start" after the first operation of the unit if dirt is mixed with the lubricant.

POINT CONTACTS

In servicing a magneto, the point contacts should be inspected. First, to see that they are tight to the respective support, and also inspect the contact for pitting and burning. A new, clean point will have a chrome or silver appearance and, as the points wear in, this bright color will change to a gray which is normal and shows proper operation. A new point installed should have at least 70% or more contact alignment (Fig. 21). New points will wear in, and

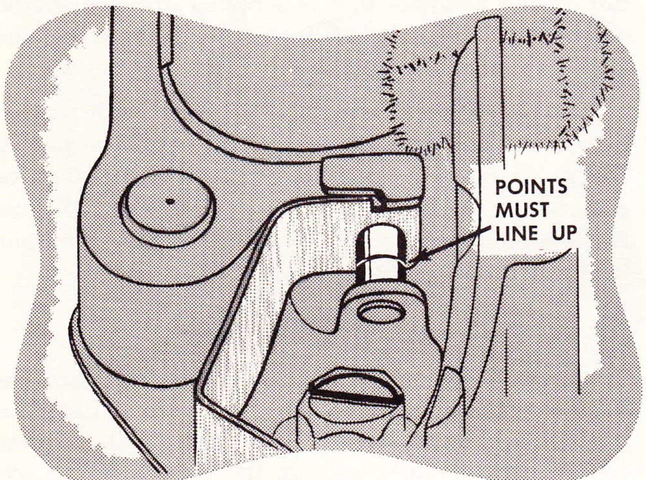

Fig. 21

the actual contact area will be detected during operation by the change from the bright silver color to the gray when the point is operating cleanly and with a good coil and condenser. As new points wear in, the contact area increases.

NOTE: Remember that improper shuttle or rocker arm alignment to breaker cam will give a "no fire" or "poor fire" after a short period of operation, even after a new point assembly is installed. When this occurs, the point can be reset to the recommended setting and cleaned. The fault was not with the point contact. It was, in this case, misalignment to breaker cam.

Fig. 22 illustrates points that have pitted, and they may pit on the opposite side as well. It is not recommended that points be filed or dressed as the abrasive used in the points will give a series of scratches across the point and will make it difficult for the point to have much of any contact area. Also due to the pit, a lot of filing or stoning would have to be done to make the points come back to their original potential surface area. The points have a tungsten tip and the filing away of the pit can remove the tungsten; which will give the point a chance for oxidation in operation and will not be satisfactory. The only dressing down of points that is recommended would be a point under good operating conditions which has operated for a long period of time and may have high spot due to mis-alignment. This high spot should be removed if the points are to be reused. If these high spots are dressed off, the actual point contact area should not be filed or stoned.

When point contacts are in good condition, reset, and then clean. If the condenser then checks out on a tester, the parts may be reused. The points should be checked by the tester, if they have been used, or spring tension checked to insure proper contact. It is common practice, whenever points are replaced, to replace the condenser as well and this is accepted and is generally recommended by the trade. Also when a magneto is being serviced that has had many hours of operation, it would be common to replace both the points and the condenser. The cost of properly servicing the unit will not be increased much by the replacement with new parts, and will do away with the filing or stoning points and all the other things that may or may not aid the unit. Filing or stoning points is recommended only to remove the metal caused by the mis-alignment of a point and could also be done in emergency cases.

Points should be checked for parallelism. Points can be affected as far as being parallel at the contacts by tightening the screw down at the condenser and coil lead junction. This can put a side twist on the spring causing the points to contact only on one corner. The same thing can affect a rocker point. As the screw is tightened at the terminal on a rocker point it can throw the points out of parallel. It is

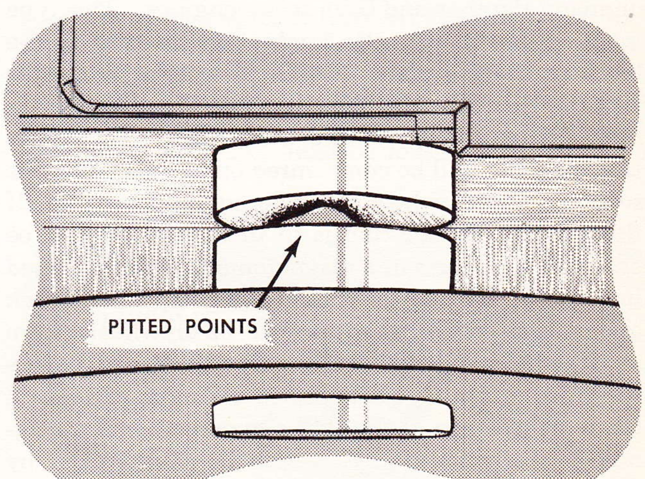

Fig. 22

recommended that after points have been set and cleaned that the engine be turned over with a #TL-941 crank several times while watching the point action to see that the point is opening and closing freely. In the case of the shuttle points (when a point is reset) the shuttle may have worn enough that the shuttle hangs in the rear support, (the support furthest from the cam) and will not actually close. The point check by use of a tester would also show this up. **CAUTION: After a point hold-down screw is tightened, recheck the point setting.**

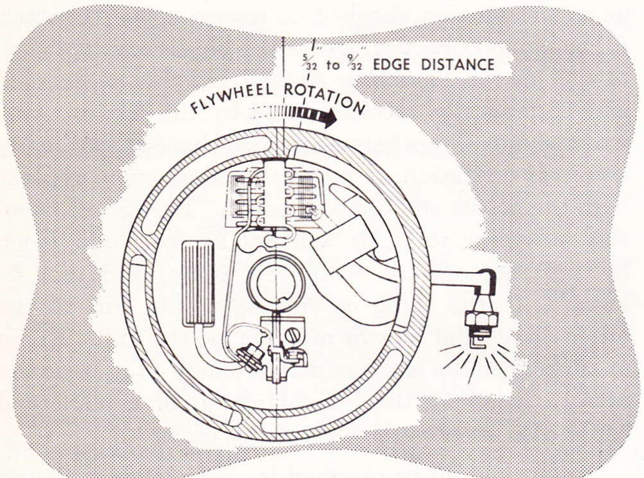

Fig. 23

FLYWHEELS

Clinton Engines are flywheel magneto equipped only and the flywheel may be checked as well. Most of the Clinton Engines have the magnetic lamination in the flywheel with the exception of the one common type of magneto (shown in Fig. 23) which was used on many Panther and Gem series engines. This type magneto has a magnetic lamination screwed to the block or bearing plate. Another variation from this was the Scintilla Magneto that had a rotating magnetic stator applied to the crankshaft. This Scintilla magneto will be commented on at the end of this section. The flywheel magneto equipped engine (if the magnetic lamination is in the flywheel) can be checked by the use of a magnetometer (as illustrated in Fig. 24). This tester is used as a comparison check and (after checking a number of flywheels from stock) the standards for the flywheels can be determined. If a flywheel drops off more than 10% from the average, it should be questioned (if a magneto problem exists). This can be checked out by installation of a flywheel from stock.

The actual magnet never needs recharging as the alloy in the magnet has been developed to maintain a permanent charge. This charge will remain permanent unless someone reverses the polarity using a charger with poles reversed and also the flywheel or magnet charge may actually be reduced.

Other possible ways of reducing magnetic charge is lightning, possible hooking up of electrical system to the shorting switch, trying to raise the magnet charge with a charger operated by someone that does not understand polarity or who has not the necessary equipment to have previously checked the charge and polarity of the flywheel. The magnetic lamination in the flywheel that is screwed in place should not be removed as it will (or can) affect air gap and edge gap on the magneto.

If a service man checks a flywheel with a magnetometer and the magnet in it shows a partial charge or no charge, it is recommended that it be returned to the factory for recharging. (Fig. 23 illustrates a magneto that has a non-magnetic lamination in the flywheel.)

MAGNETO COILS

After the general condition of the magneto has been checked by use of testers, the worn or defective parts should be replaced. To replace a coil, unfasten the primary connection from the point terminal, remove the coil and lamination as an assembly, unfasten the coil ground screw, bend the clip holding the coil in place 90 degrees away from the coil and tap the core gently to remove the coil from the core. If the coil did not pass the test, it can be supported on the jaws of a vise (taking care not to damage the core) and replace a new coil on the core. First check to see that the coil is in the right position in relation to the core for the ground wires and the

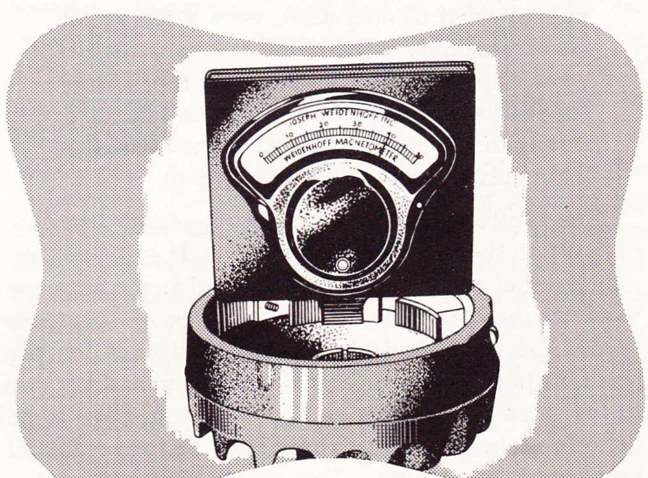

Fig. 24

primary lead to the points; then assemble the two together by hand pressure but do not, under any circumstances, drive them together. After they have been replaced, bend the clip back onto the coil to guarantee that the coil remains in position.

Present production magnetos have the clip loose and this can readily be replaced by a new clip (Part No. P5734). When replacing the high tension lead to a new coil or replacing a high tension lead on a

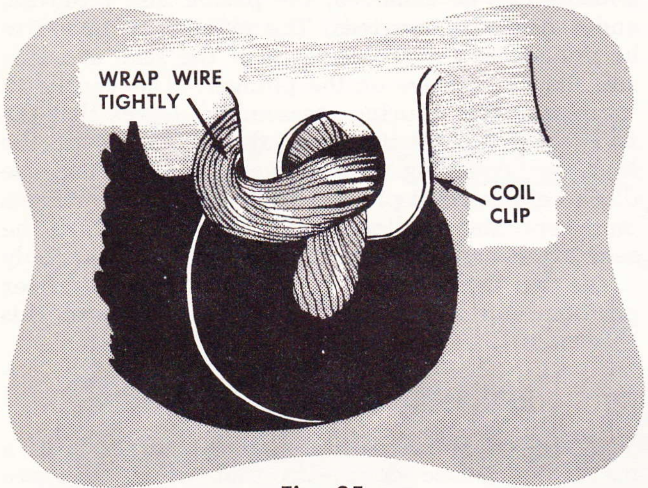

Fig. 25

coil being serviced, wrap it tightly around the coil clip as illustrated in Fig. 25, but **under no circumstances should it be soldered to this clip.** However, if it is hanging loosely to the clip on the coil, it can give a surge in the engine due to the vibration of the high tension lead to the clip. If a high tension lead is being reused, see that all of the wires are tightly twisted together prior to attempting to insert them through this clip. The end of the high tension lead can be heated by use of a torch or soldering iron, and the strands twisted together so the existing solder on the lead will hold the strands together for insertion through and winding around this clip. **Do not add solder** to the ends of these high tension leads as the wrong type of solder can give a residue on the outside of the insulation that can give the electricity a path to "short out" to the bearing plate or block. Use care in this connection, as a broken wire or loose strand of wire can also give the electricity a path to

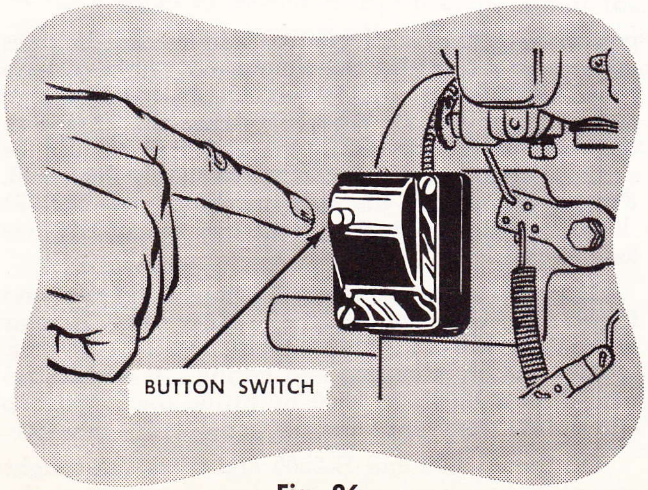

Fig. 26

follow to the flywheel or to the bearing plate, stator plate, etc. Passing the tester probe over this connection will indicate if there is a broken wire which is not readily visible. It is recommended that the

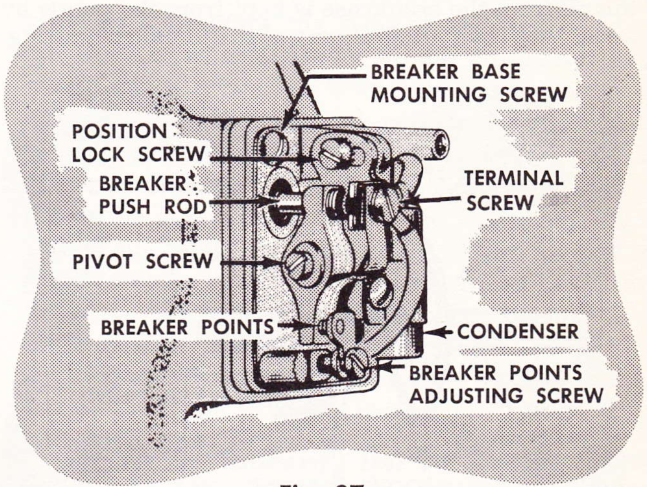

Fig. 27

original lamination be reused rather than replacing coil and lamination both. This is true especially on the magneto shown in Fig. 23.

RED HORSE ENGINES

On the Red Horse series engines the points and condenser are mounted on the outside of the block and are protected by a cover which has a button in it for stopping the engine (Fig. 26). By pressing on the button, it grounds out the primary of the magneto. This engine is operated (as far as the points are concerned) by a plunger from the breaker cam which sets inside on the cam shaft. To set these points, the engine must be turned over by hand until the points are opened to the widest gap and then points are adjusted. On the 1600 and 2500 and A-2500, the lock screw (Fig. 27) must be loosened (prior to ad-

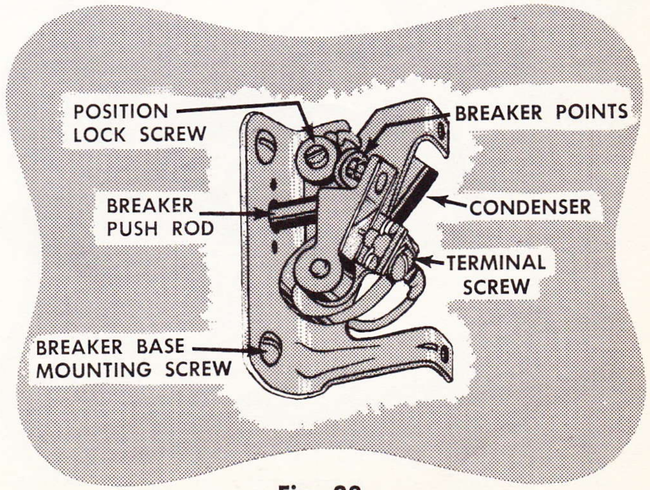

Fig. 28

justment) and, after the points are adjusted, they can be locked in place. On the A-1600, B-2500 and 2790 (Fig. 28) the points are adjusted by using screwdriver in slot. On the 1600 and 2500 and A-2500, the plunger operates through the breaker housing and the oil from the crankcase is kept from the points by a seal that is an integral part of this breaker housing.

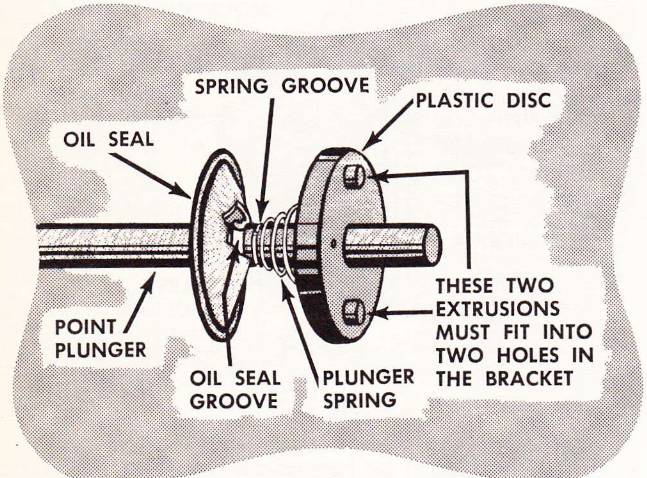

Fig. 29

Oil from seal leaks may reach the points due to failure of the seal or leaks may be caused by damage of the gasket between housing and block. Check and replace the gasket between the breaker housing and block if oil leakage occurs at this point.

If the seal leak is on the point plunger, the plunger may be removed. First, remove breaker housing from block, then pull the plunger from the housing. If the leak is between the plunger and the seal, a small amount of gasket sealer may be put in the groove and then reinserted to seal this off. If the seal itself has failed, it will be necessary to replace the breaker housing.

CAUTION: Fasten primary lead wire and condenser lead wire to points at a 90° angle to point spring so that point spring tension is not reduced by primary lead wire pressure on spring.

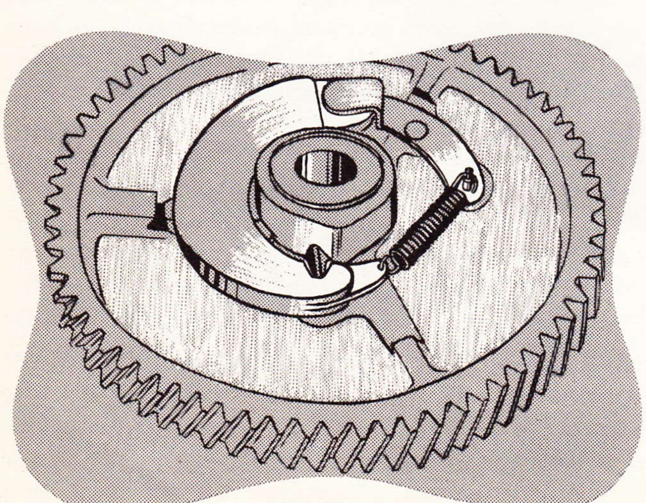

Fig. 30

In the case of the A-1600, B-2500 and 2790, the housing can be removed, the plastic disc removed, and a new seal inserted. The plunger will have to be pulled out for replacement of the seal, and this seal fits in a groove on the plunger. Use care with the plastic disc (during reassembly) to see that the two extrusions on it fit into the two holes on the bracket. A spring goes between the seal and the disc to aid in point plunger return. This spring sets on a separate, smaller groove from that which the seal sets in, and should be checked during reassembly to see that the seal, spring, and disc all are in proper position and alignment. (Fig. 29 illustrates this assembly.)

RED HORSE SPARK ADVANCE

The Red Horse series engines operate with a magneto advance device so that when they are started or at cranking speeds they are firing at ap-

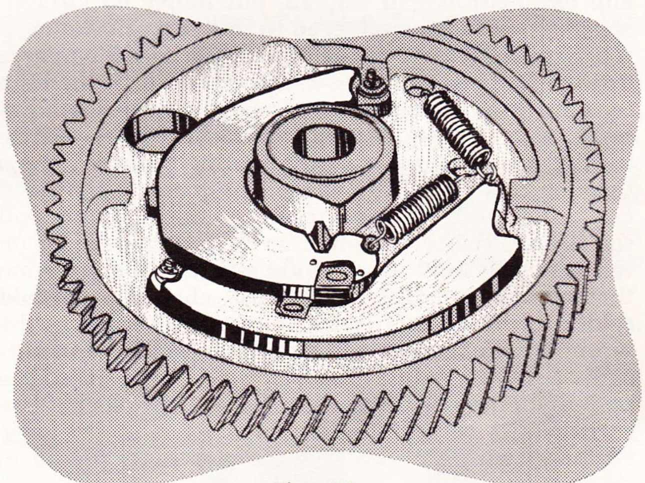

Fig. 31

proximately top dead center, and as the engines operate on a fast idle, the weight moves out (due to centrifugal force) and moves the breaker cam to secure an advance. When servicing the engine in the area of the camshaft, the camshaft should be removed and this spark advance assembly inspected. Fig. 30 illustrates the original type and Fig. 31 illustrates the current production spark advance assembly.

Inspect for wear between the weight and cam, and if any wear is shown, replace breaker cam. If wear is shown between the shift weight, and the cam gear, replace the shift weight and spring. It can be replaced on a 1600 and 2500 by lifting the metal clip and sliding weight out and replacing with a new one.

On the A-1600 and B-2500 and 2790, the weight assembly has been changed, but it performs the same function. That is, a retarded magneto fire at cranking speeds and advancing as the engine r.p.m. increases.

The Red Horse series engines can be started readily by cranking, if they are pulled against the

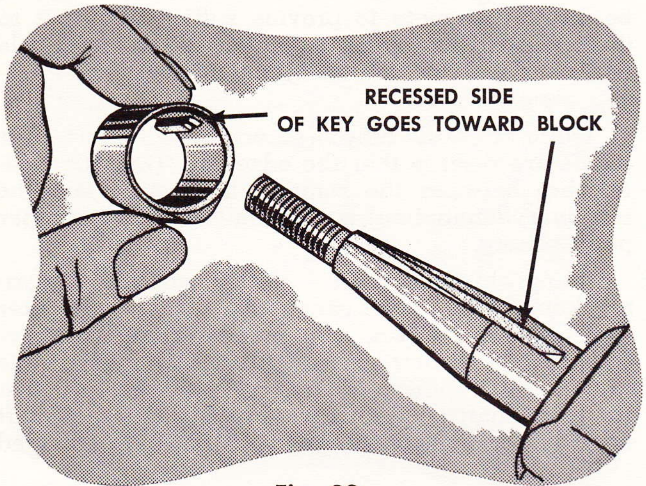

Fig. 32

compression and then the crankshaft rotated in the reverse direction for approximately one turn, then pulled through. This gives the person starting the engine the advantage of the flywheel and crankshaft weight and the engine goes through compression without any particular difference in cranking resistance. If this engine is cranked in this way, it will crank as easily as a much smaller engine, and is one of the easiest starting engines.

The specifications on coils and condensers are quite different for Red Horse series engines than for smaller engines. Check specifications before testing. On other than Red Horse series, prior to reassembly of the breaker cover and the flywheel, be certain that the breaker cam is on properly and the recessed side of the breaker integral key is towards the engine crankcase (refer to Fig. 32).

As the breaker cam is being installed on the crankshaft, check the breaker cam for cracks and key wear. See that it is not worn as far as the key of the breaker cam to the crank keyway. If a worn condition is present; replace with a new breaker cam. For magneto replacement parts, refer to Engine Service Manual, Section II, for the respective parts.

Identification of the various breaker cams is shown in Section IV, Div. E. If the breaker cam is rough or lobe shows wear, replace. Inspect the flywheel key for partial shearing and inspect the crankshaft keyway and the flywheel keyway for possible damage due to loose flywheel (refer to Fig. 33). Inspect, also, as to possible damage from impact, such as might be found on a vertical shaft engine used on a direct hook-up rotary. The flywheel key should be replaced if it shows any signs of shearing. Inspect for worn flywheel keyway or the crankshaft keyway also. If metal has been pounded out on these keyways the flywheel will not go down in place properly on taper even though properly torqued. In the case of a loose flywheel, each side of the keyway should be de-burred with a stone so that the burr, turned up by flywheel pounding on the key, is removed from crankshaft. This burr affects the ability to torque the flywheel. The flywheel should have the same care taken, as a burr turned out of the keyway on the flywheel will affect its ability to hold torque when the engine is reassembled.

The tapers on both the flywheel and crankshaft should be dry upon reassembly. You were cautioned, while disassembling the engine to inspect this general area for possible seal leaks, and the bearing condition should be considered as well; by moving the crankshaft toward and away from the point shuttle or rocker arm. If the seal in the magneto side is questioned, it should be replaced. If the bearings are worn excessively, they will have to be replaced to maintain an even point setting and also to keep a new oil seal from leaking.

After the flywheel is replaced (and other parts are being reassembled) care should be taken when

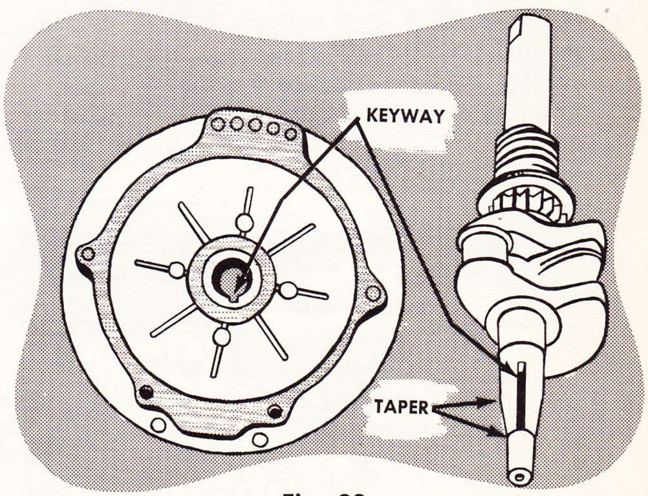

Fig. 33

installing the starter cup. Many of the starter cups have a means of positive engagement to the flywheel such as a steel roll pin in the keyway, metal pressed out to engage with ribs on the flywheel, or drillings on the flywheel into which the starter cup is to recess.

(Fig. 34 illustrates this.) If the starter cup is not properly reassembled to the flywheel, the torque applied to the flywheel nut will actually force the part out of line and, over a period of operation, the unit will lose flywheel torque due to improper assembly.

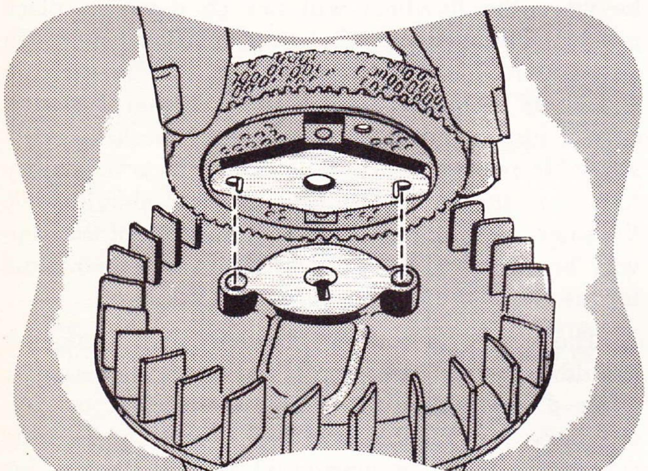

Fig. 34

As the starter cup is replaced, a lockwasher and a flywheel nut are used, which should be torqued, according to the specifications listed in Section VI, Torque Data. As the unit is reassembled, the magneto output can be checked (Fig. 1) as soon as the starter cup is applied and the flywheel nut tightened to be sure that the magneto malfunction has been corrected. With the spark plug out of the engine, and the flywheel tight, it can be spun by hand and fire checked over a fixed gap.

CAUTION: Watch the air vane governor-equipped engines as the flywheel is being spun, so that fingers are not cut on vane.

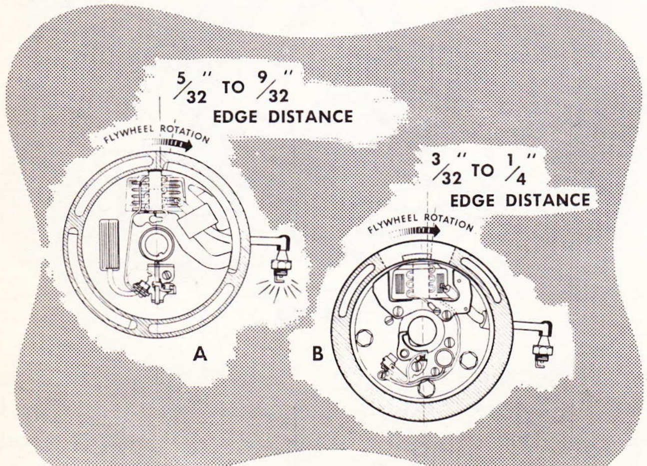

Fig. 35

MAGNETO EDGE-GAP

Fig. 35 (A and B) illustrates magneto edge-gap. Normally, this distance need not be checked as it is pre-set and will not give problems unless a worn or damaged part is in the magneto assembly. Of course, the magneto edge-gap is affected by point setting, and as the points are set too wide, the edge-gap (illustrated in Fig. 35) becomes much less than it should be for the magneto to provide sufficient output to fire under compression. As points wear on the shuttle or rocker arm, the points become too close and edge-gap becomes wider.

Quite often the reason an engine will start after points are reset is that the edge-gap, (i.e., the relationship between the rotating lamination and the stationary lamination) is re-established due to proper point setting.

Many things can throw edge-gap off; a worn breaker cam, a breaker cam with a worn key, breaker cam on upside down, split breaker cam, worn flywheel or crankshaft keyway, twisted crankshaft due to impact that affects or causes the flywheel to twist the crankshaft on the magneto side, wide crankshaft keyways, wide flywheel keyways, partially sheared key, no torque on flywheel, wide point settings, wrong points, wrong breaker cam, points not down in proper position, etc.

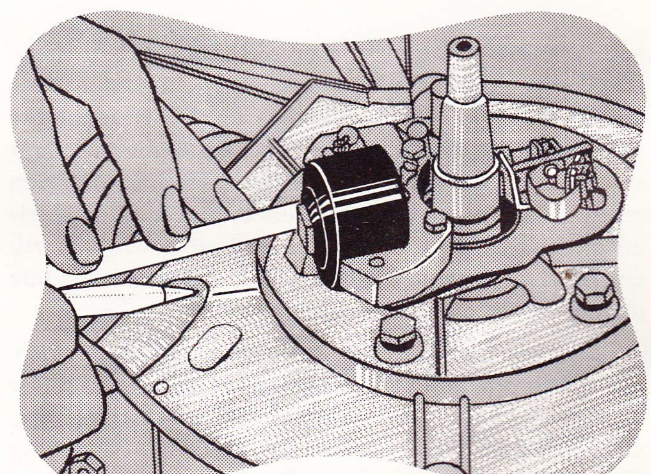

Fig. 36

In the case of a magneto that has been carefully checked as to coil, condenser, points, point setting and cleanliness, flywheel magnet, or magnet charge (whether flywheel or stationary) and if a problem still occurs in the engine, the edge-gap can be checked readily. In the case of a "no fire" or a "weak fire," and it is questioned that the relationship between the flywheel and the stationary lamination is correct, the relationship can be checked by marking the position of the lamination on the bearing plate or block (reference, Fig. 36). Then mark the position of the rotating lamination on the outside of the flywheel.

CAUTION: First show the direction of rotation of the flywheel with a small arrow as when the flywheel is turned over to mark out the trailing edge of the lamination it will appear correct, but will be backwards, and it will possibly be marked wrong.

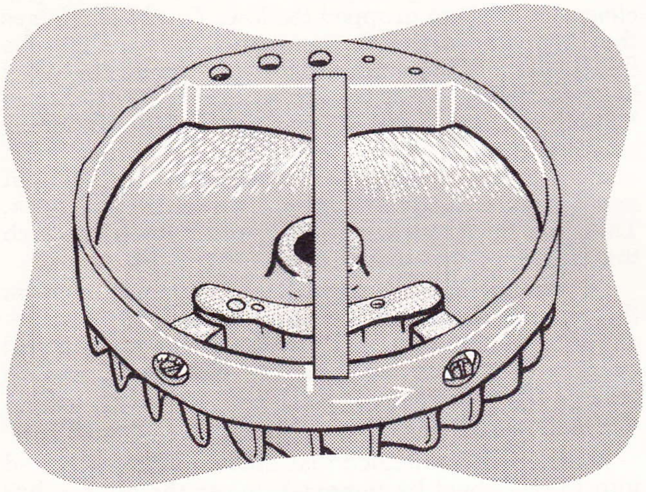

Fig. 37

Fig. 35 (A and B) shows the marking for edge-gap of the two variations in magnetos commonly used. In the case of Fig. 35(A) the trailing edge of the one lamination is marked to the outside of the flywheel for reference, and in the case of Fig. 35(B) the trailing edge of what appears to be the first lamination is marked out. Check the difference between reference lines on these two figures for the edge-gap. The relationship between the trailing edge of the forward lamination on either flywheel is in reference to the closest side of the core through the coil, and it should be marked from here or the reference mark put on the bearing plate or block at this point.

CAUTION: As the lines are drawn further and further outward, they are further apart so try to bring them out straight.

After the relationship has been marked between the core through the coil by the mark on the bearing plate and the lamination of the flywheel by the mark on the outside of the flywheel (Fig. 37), the points should be set according to the service clearance in Section VI. Then the crankshaft should be rotated in the direction of normal engine operation until the points just break or are open .001 of an inch with the original .020 point setting. The time at which the points break is where edge-gap is measured and this can be checked by using a magneto tester (which will indicate when the points first open) or by using something that is .001 of an inch thick, between the points to determine when it loosens.

After the crankshaft has been rotated so the points (that are pre-set at the proper setting) (for example .020) open .001, the flywheel key should be put into the crankshaft keyway and the flywheel carefully set down on the crankshaft taper and tapped lightly into place using caution not to move the crankshaft. Then by measuring the distance between the two lines, the edge-gap of the magneto can be determined (Fig. 38).

Section VI, Service Clearances, lists the edge distance on the magnetos in common usage. When the edge distance is off a great distance, it has either been marked wrong or else there is a wrong or damaged part in use on the engine.

Another way to check edge distance on an engine (which is being used by many service people) is to check fire at .020 (if that is the recommended point setting) and then move the point setting to .014 and recheck fire, then to .026 to recheck fire. In this way, they can determine at which point setting they secure the best magneto output, but it is recommended (when edge-gap is a problem) that it be marked out carefully and the defective, worn, or wrong part be replaced.

In the case the engine has suffered impact, it may be the crankshaft. In the case of engines running

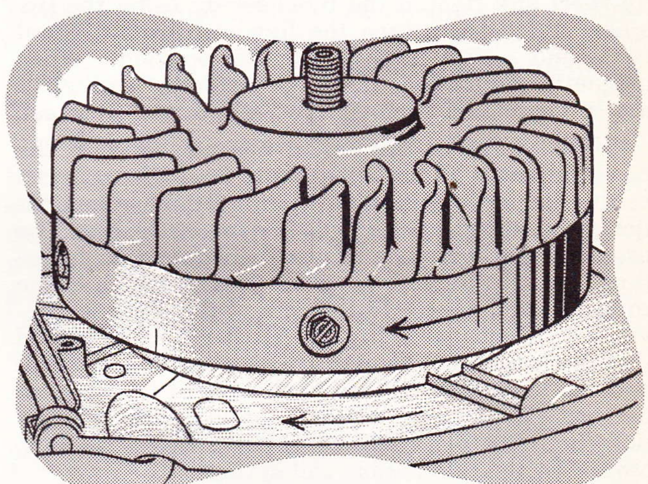

Fig. 38

with loose flywheels, it may be the flywheel, flywheel key, and possibly the crankshaft. The first thing to check on an engine with edge-gap off, would be the breaker cam. Replace it if necessary.

AIR GAP

Another thing that may affect the magneto's operation is improper air-gap. This is the distance between the stationary lamination and the rotating lamination. Again, the proper clearance is listed under Service Clearances, Sec. VI.

Checking the air-gap can be done by using plastic tape over the laminations. In other words, use one layer of plastic tape, checking it for its thickness (Fig. 39), applying it to the laminations carefully, then replace the flywheel to the crankshaft (using

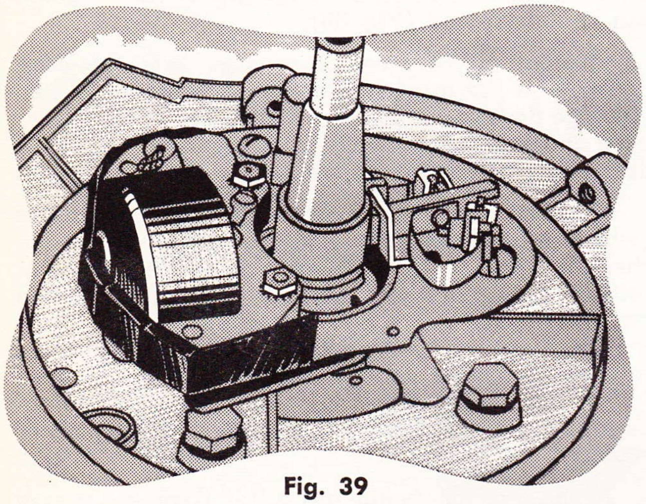

Fig. 39

care to have the magnetic lamination to the stationary lamination separated by ½ turn), replace the flywheel and tighten the flywheel by using the flywheel nut. Then, turn the flywheel around about twice and return it to its original position. When magnetic lamination and non-magnetic lamination are ½ turn apart, remove flywheel nut and flywheel.

If the rotating lamination has cut through the tape, there is too little air-gap and the high spots can be dressed down with a file if the stationary lamination is non-magnetic. If this is done, care should be used because there is a requirement that each of the three legs of the lamination be equal distance to the rotating lamination. In the case of the older or previous style magneto (Fig. 35-A), it is recommended that the lamination be oversized by use of a 7/32 drill and the lamination moved back toward the breaker housing. Prior to the drilling operation, the lamination should be placed and held in a vise for drilling, otherwise the lamination will spread.

All metal chips should be removed from lamination as well. Prior to replacement to the block, the housing should be filed at the point closest to the crankcase because this die casting has a slope to it and it may appear that there is room to move the lamination towards the housing, but actually it is hitting on the lower corner of the housing where not visible (refer to Fig. 40). In most cases, if care is used, the lamination may be dressed down.

In case the magneto is not operating properly and one strip of tape does not touch the flywheel, then apply another strip, replace the flywheel (keep the magnetic lamination, and non-magnetic lamination separated by 180 degree rotation), tighten the flywheel nut, and rotate the flywheel again. It should contact or show contact by rubbing on the two thicknesses of tape as generally the tape when checked out will run .008 to .009 or larger per layer.

In case there is too much air-gap, the lamination holes (illustrated in Fig. 35-A) could be oversized, as previously commented upon, and moved towards the flywheel. This would be the only practical method of closing up the air-gap. As it moved outward it would be necessary to check to see that the air-gap clearance was not dropped too low. On those engines that have the magnetic lamination screwed to the flywheel and (upon checking it) it is found that they have too much air-gap, it is possible to put a shim behind this flywheel by cutting a shim the same length and the same width and slotting in from each end. Loosen the screws, place shim in back of lamination and tighten screws down and recheck. The shim thickness would be based upon how much the clearance or air-gap is.

It is important (working with a magneto) to check the general relationship of the lamination. If someone hits a lamination and distorts it, the air-gap will be greater on one leg than the other, and will be greater from one side of the leg to the other, reducing magneto output.

It is not recommended that the lamination screwed into the flywheel be removed unless the air-gap has been checked prior to removal. If the lamination has been removed from the flywheel, it will be necessary to recheck the air-gap to determine what it is. The lamination first is put into the flywheel and then the radius inside of the flywheel is machined. Any switching of lamination from one flywheel to another will throw off the air-gap and is not recommended.

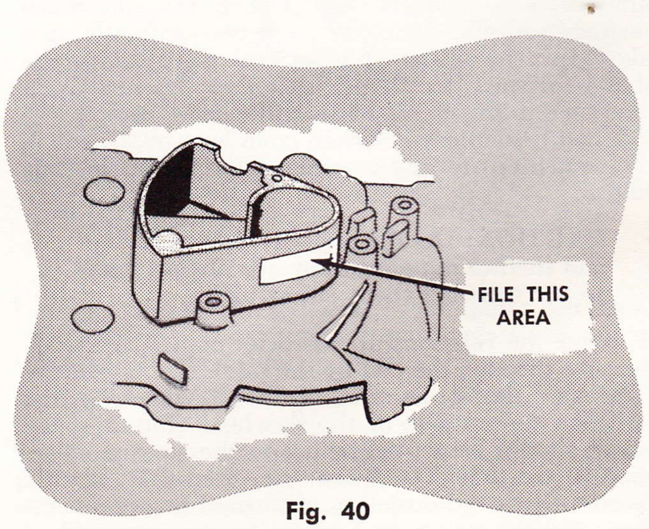

Fig. 40

Check Service Clearances, Section VI, for minimum and maximum air-gap.

The closer the lamination rotates without rubbing, the better the magneto output is. However, some distance must be allowed between the rotating and stationary laminations for possible bearing wear.

CAUTION: Check, visually, the straightness of the magnetic laminations, the non-magnetic laminations, and the relationship between the two. If damage has resulted from careless performance of service work on a magneto, replace the parts that appear

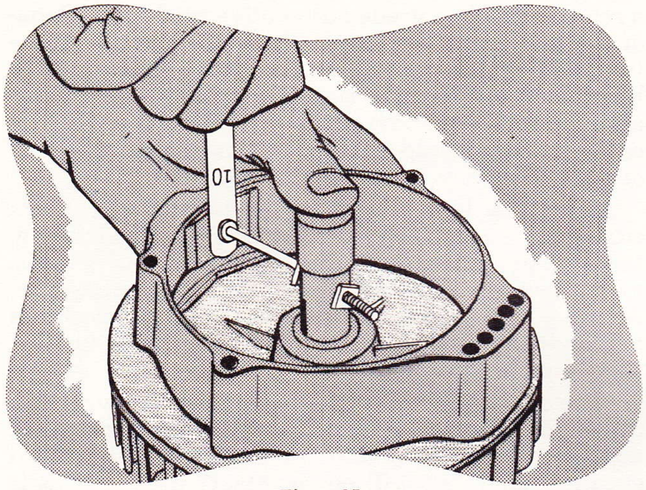

Fig. 41

to be damaged. If parts have been carried by the flywheel and have damaged the stationary lamination, replace lamination and any other damaged parts. When there has been physical damage in a flywheel area, care should be taken upon reassembly, not only to replace the parts, but to carefully check fire on reassembly and, if the magneto output is questionable, to then recheck the air-gap and possibly the edge-gap on this magneto.

At one time, an open flywheel was sent to authorized service accounts for checking air-gap. Since this flywheel was sent out, the magneto has been changed but this same flywheel can be used if the difference in radius is checked (Fig. 41) between flywheels. In this way air-gap can be determined.

TIMING

From time to time, it may seem necessary to check the magneto timing to the piston. This can be done accurately if the top dead center of the piston travel is located. It is not easy to find exact top dead center. If a dial indicator is available (as the piston goes over top dead center) note that there is a definite spot where the piston seems stationary even though the flywheel moves. Top dead center can be found quite accurately by moving the flywheel back and forth—thus moving the piston over top dead center. With the dial indicator, it will show at which point the piston apparently stops. If a reference mark is put on the bearing plate or block in line with a mark on the flywheel as the piston **starts** to move as flywheel is turned counterclockwise and if the bearing plate and block are marked again as the piston **starts** to move, as the flywheel is turned clockwise, then half the difference between the two marks illustrated on Fig. 42 would be an exact top dead center of the crankshaft.

When exact top dead center is found, the flywheel should be removed (on all engines except the Red Horse). The points should then be set as recommended in Section VI, Service Clearance. The crankshaft then rotates in the direction of engine rotation until the points break .001 of an inch (which can be checked the same as edge-gap is checked). The flywheel key and flywheel then should be carefully replaced, and the difference between where the reference mark was placed on the flywheel and the center mark was placed on the bearing plate or block would be the magneto timing position.

The number of degrees before top dead center can be figured by counting the number of flywheel fins and dividing them into 360 degrees. For instance: if there are 20 flywheel fins and that is divided into 360 degrees, the distance between each fin will be 18 degrees. And if the mark on the bearing plate or block is approximately one flywheel fin from the mark on the flywheel, the magneto timing to piston would then be approximately 18 degrees.

If it is more or less than this, the distance between two fins can be marked out into three degrees, six degrees, or whatever is desired by measuring the distance and dividing the distance into three parts which would give six degrees, six parts which would give three degrees, etc. With a different flywheel having a different number of fins the original division

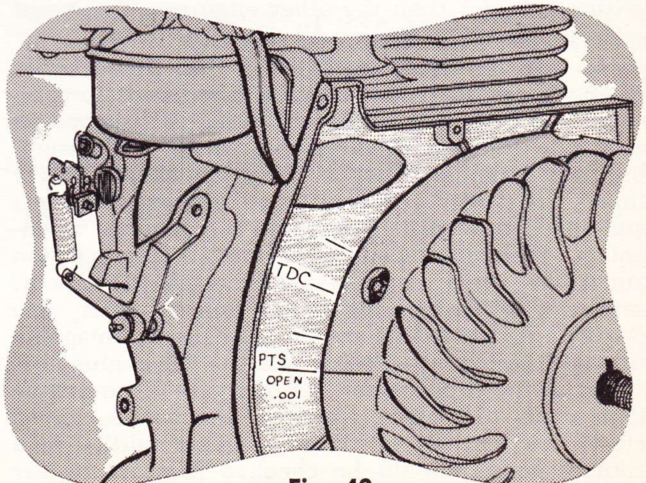

Fig. 42

into 360 degrees will vary, but this gives a method of checking magneto timing accurately as to piston travel. Section VI, Service Clearances, gives the timing of the magneto to the piston.

In the case of the Red Horse series engines with the spark advance, when these engines are checked

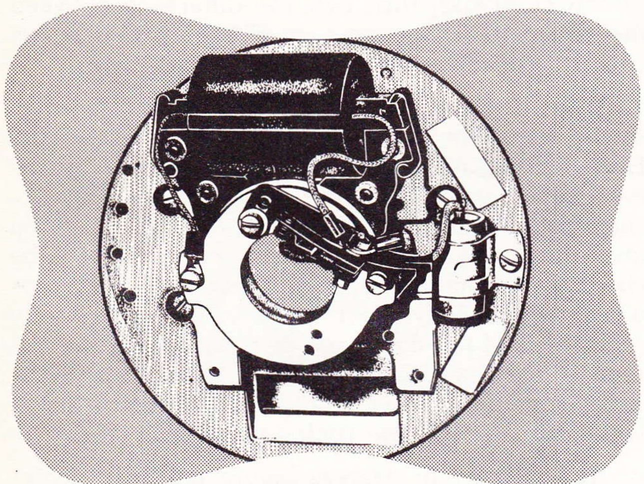

Fig. 43

in a stopped position for magneto timing, they should be firing at approximately top dead center or perhaps not more than 3 degrees before top dead center. If it checks out this way, when the engine is started, it will then advance into a 19 to 20 degree advance of the magneto to the piston.

If the Red Horse series engine checks out on a definite advance such as 12, 15, or 18 degrees before top dead center with the engine in a stopped position, the advanced mechanism may be stuck, the alignment extrusion between the centrifugal weight and the breaker cam damaged or broken off, and more possibly the crankshaft is out of time one tooth to the camshaft, which would throw the engine timing off. Of course, the point setting should have been checked prior to checking the magneto timing to piston. In the case of the Red Horse series engine, the point setting is wider than the other engines. This point setting is given in Section VI, Service Clearances.

In case it is suspected that a Red Horse series engine is one tooth out of time, crankshaft to camshaft, mark the two crankshaft teeth, i.e., the one on each side of the marked cam gear prior to disassembly to determine that it was (or was not) properly timed. If it was properly timed, remove camshaft and check the breaker cam and the advance mechanism. Point setting affects magneto timing to piston and as the points are gapped wider, each .001 of point setting will advance the timing approximately one degree. As the points are set too close the magneto timing to piston is retarded. That is, the engine fires closer to top dead center. In the case of an engine that wants to kick at cranking, the points can be closed .003 or .004 to minimize this condition. Of course, points should be checked first for proper setting as they may be too wide.

The characteristics of an engine on an advanced ignition timing is that the engine accellerates very roughly and under load, the fuel will detonate (uncontrolled combustion) which eventually will ruin the engine. That is, damage the head gasket, piston, rod and possibly other parts. Detonation on an engine is not always the magneto timing to piston, it can also be the fuel used. Clinton engines require regular gasoline, either leaded or non-leaded, but of a regular gasoline grade automotive type fuel. Some of the low grade gasolines, which are actually stove fuel, detonate in an engine and the detonation may be blamed on magneto timing to piston when, actually, the fuel is too low-grade for the engine. In this case, the fuel would have to be changed to the type of fuel necessary to stop this detonation.

As previously mentioned, point setting also affects edge-gap. For each .001 the points are gapped wrong, the edge-gap changes almost 1/32 of an inch. That is, as the points are set too close, the edge-gap is wide. As the points are set too wide, the edge-gap becomes narrower by approximately 1/32 of an inch to each .001 of point setting.

The characteristics of edge-gap too narrow, is that the engine just will not start. The characteristics of edge-gap too wide, is that the engine may be "hard starting" cold, but will be "no start" warm. This is characteristic of a leaky condenser, also, where the heat warms it and shorts it out.

SCINTILLA MAGNETOS

Fig. 43 illustrates the Scintilla Magneto and Fig. 44 illustrates the Scintilla Magneto with the lighting

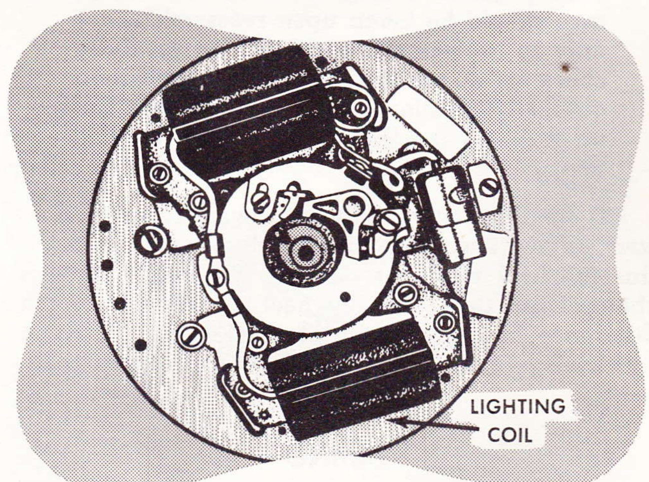

Fig. 44

coil. The Scintilla Magneto has the magnetic lamination as a rotor which slides on the crankshaft and is held to the crankshaft with the key. This magneto has been generally trouble-free, and it was used on the first production engine, that is, the 700-A and A and B-1100.

When inspecting this engine, check the key (that goes into the crankshaft that holds the rotor) for wear of the key, crankshaft, or the rotor and replace what is necessary to minimize any movement in this area. Check the key for shearing or partial shearing. Also, check the stator for damage and positioning. Fig. 45 illustrates the Scintilla Magneto used on the first 700-A's below serial number 199,736, which can be advanced or retarded, as far as magneto timing to piston.

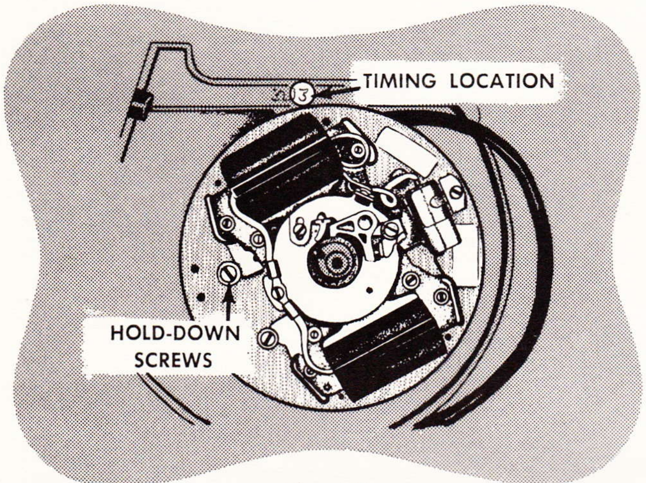

Fig. 45

When this unit has been disassembled, the stator should be rotated and lined up so that the right hand corner of the magneto coil lines up with the right hand figure 3 on the bearing plate. It should line up or be just slightly to the left of this right hand number. When this is lined up, lock the screws down to hold the stator. The magnet rotor should be tight to the engine crankshaft, that is, snug, and in removal, use care not to break this, as it is die-cast. When it is disassembled, check it to be sure that it is not cracked. If it is, replace with new, but check for fit of the new rotor to the crankshaft and use care in pressing it on, as it may be damaged during installation.

It may be necessary to polish the crankshaft for easy installation. Condenser capacity on the Scintilla Magneto is .15 to .19 M.F.D. The lighting coil is standard equipment on certain Scintilla Magnetos. This coil has connections for one number 87 bulb, three candle power for a tail lamp.

The coil is tested in the same manner as the other coils. Specifications are current in the magneto tester manufacturer's book for these magnetos. The same care should be exercised in working with breaker cams as commented on before, and special care should be used to check the slot for wear and replace if wear is apparent, as this will affect the performance of the magneto.

Use a gap of $5/32''$ to $3/16''$ for checking the magneto output to ground. That is, by using a fixed-gap tester. In checking for a high speed miss (in the magneto or other part of the engine) use a gap not over $1/32''$ between the high tension lead and the spark plug with the engine operating. High speed misses on a magneto can be due to low spring tension, point spring twisted due to improper tightening of screw at contact terminal, burrs on the shuttle, lack of lubricant on shuttle or rocker arm, seal leaks, partially grounded wires, etc., as discussed previously.

Breaker points that do not last in the contact area (that is, are burned or pitted) can be due to faulty breaker point action such as weak tension, burrs on shuttles, lack of lubrication; also, due to seal leakage or excessive lubrication on the shuttle, felt, or rocker arm causing flash-over on the contacts. A leaky condenser will affect points.

The possibility of condenser way under capacity or way over capacity should be considered; and also, condensers that are not grounded properly (loose or poor ground); condensers not tight to ground or are not tight at the terminal point.

CAUTION: When installing points, tighten screw at point terminal and carefully watch point spring to see that tightening does not affect the positioning of the point spring, shuttle, or rocker arm, that is, that it does not put a side twist on spring, shuttle or rocker arm.

In reassembly, be careful that the stator is not screwed down on top of the coil primary lead. Be certain the condenser is grounded tightly, set points carefully, and recheck setting after point screw is tightened. Clean with cleaner such as carbon tetrachloride. *If carbon tetrachloride is used, keep the lid on the container when it is not being used. Recap at once, after use.*

SERVICE NOTES