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To facilitate finding the various sections into which this Manual is divided, black marks are printed on the margin of the first right-hand page in each section. By bending the Manual backward, these marks are exposed in line with the sections as listed on the margin of this page. A separate alphabetical index is listed for each section.

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INTRODUCTION

This special instruction manual is one of a series designed to supplement service station experience and to be used as a reference in determining recommended procedures for servicing International Harvester equipment. It is one of the aids for developing students into full-fledged Blue Ribbon servicemen; it is a source of the latest information for skilled servicemen; it is a sales help to the dealer who uses service information to point out the superiority of his merchandise.

Specifically this instruction manual replaces all previous service information on the magnetos used on all McCormick-Deering and International tractors, power units, and stationary engines. The following magnetos are covered: International F-4, F-6, E4A, H-4, and H-1; Wico "H," "AH," "AP," and "EK"; and Splitdorf Dixie and Aero. In addition it explains operating principles of the International F-4, F-6, H-4, and H-1 magnetos.

The manual is divided into 7 sections, each section covering either one particular magneto or a combination of two similar ones. Service information is arranged in the same general order in which the overhaul work is usually done. This arrangement, together with a complete index for each section (page 1), provides a convenient reference for the desired information.

General Servicing Cautions

The magneto workshop should be *clean and orderly*. Service parts should be stored in glass jars or bins. Make the place look workmanlike. Create confidence that you know how to do the work correctly and have the tools to do it with. Have a place for all servicing tools and keep each tool in its place. This is essential for establishing a reputation for quick and efficient service. It is suggested that a magneto test bench be built. (See page 4.)

Clean the outside of a magneto thoroughly before opening it up. Don't send it back to the customer with sand or dirt in every corner and recess. He naturally concludes that you did your work in the same haphazard way. Repaint the magnet and other painted surfaces if paint is in bad condition. Be sure to use the original color, however. Tell him the appearance of the job shows it was done by a carefully trained operator who is competent and skilled in his work.

Make promptness of service a rigid policy. In many cases the tractor from which the repaired magneto has been removed is worth $10.00 or more per day to the owner. It is our duty to protect his interest. If the magneto repair work is delayed for several days until several more come in "to make it worth while" starting repair operations, we have deliberately taken $20.00 from the tractor owner to further our own convenience. Under such conditions it is not likely that we will enjoy his further patronage.

It sometimes happens that after repairs have been made further costly delays to the customer result from failure to pack the magneto promptly and get it in the hands of the transportation agency that is to return it to the customer. Facilities must be provided for accomplishing the return of repaired magnetos promptly if we are to enjoy the highest degree of success.

Inspection of Repaired Magnetos

The responsibility for the thoroughness of the work should be in the hands of one man. We recommend that all service jobs be tagged and signed with the date and initials of the serviceman and the responsible individual who acts as the inspector. This tag should always be returned in case faulty repair work is reported from the field. It should be our policy to request constructive criticism of repair work for the purpose of maintaining the quality at a high level. Sometimes the magneto serviceman can safely be depended upon to act as his own inspector. This is satisfactory to our minds only when he is extremely thorough and meticulous in his work. Usually better success is assured by having a second party of proper training perform the final inspection.

Magneto Servicing Equipment

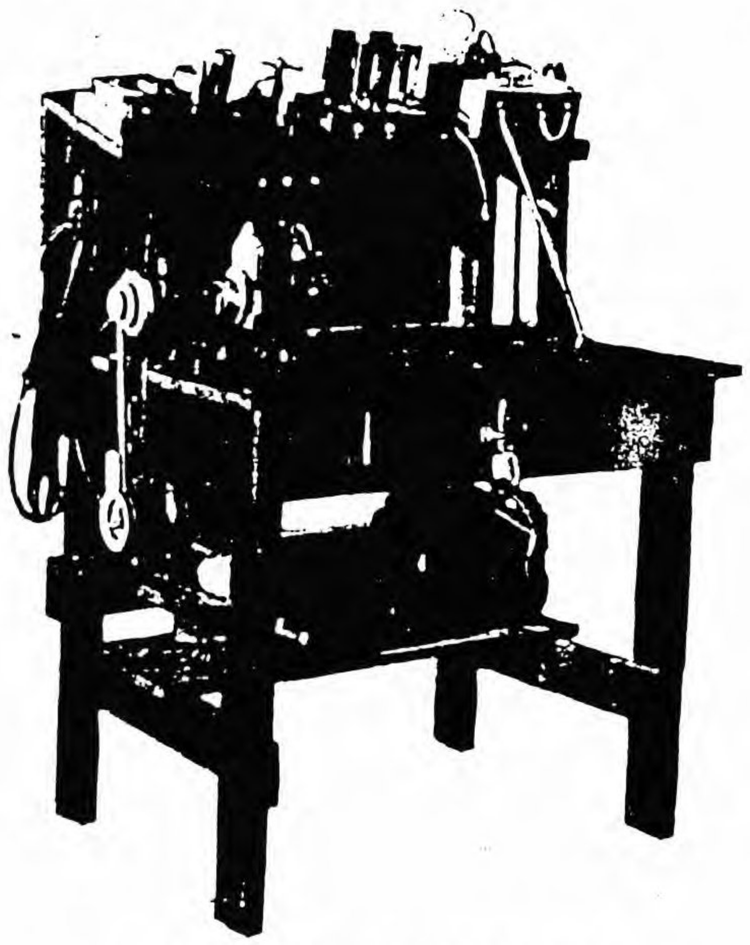
Few service tools are required to service magnetos used on McCormick-Deering and International engines. However, much time and effort can be saved by the use of tools especially designed for testing, charging magnets and removing and replacing parts quickly and efficiently. Service tools can be secured from the nearest Company Branch at a minimum charge to the dealer.

Servicemen find that a test bench, is a ready means of keeping tools in a particular place where they can be found ready for use when needed. This saves much time looking for mislaid tools. Tools are less likely to be lost and the possibility of damaging costly tools is minimized. The neat and orderly appearance of a magneto test bench impresses the customers with the businesslike methods of the dealer, inspires confidence in the serviceman's ability to service magnetos and assists in establishing a reputation for quick and efficient service.

Test bench is made of crating material. All material is 13/16" thick except the four legs and rear motor mounting piece which are 2 by 4" lumber.

The tester, charger, and automatic impulse coupling tool set are permanently fastened to the upper shelf. Shelf is set at about a 12° angle, which makes it handy to use tester and charger, and helps prevent the accumulation of junk.

Test bench is equipped with an electric motor magneto drive, which provides the servicemen with a means of observing the performance of a magneto without



SUGGESTED MAGNETO TEST BENCH.

running it on an engine. The drive consists of a 1/4 H.P. electric motor which drives the magneto through two three-step V-belt pulleys. Electric motor is mounted on a hinged shelf. This construction maintains tension in the belt and facilitates changing V-belt from one pulley step to another for obtaining a different drive speed.

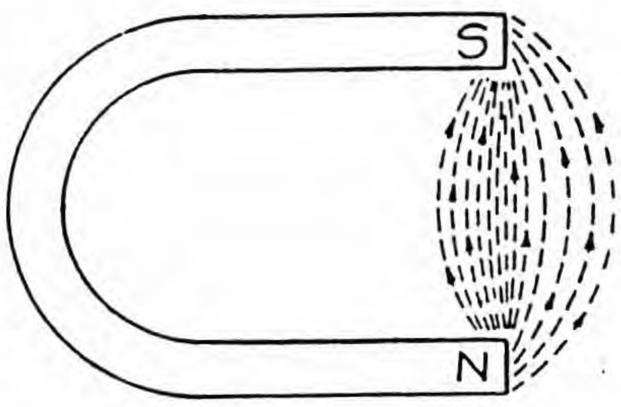
The magneto mounting is a 15-30 magneto bracket (a 10-20 magneto bracket can also be used), attached to an angle iron which is bolted to the table top.

The spark plug mounting is a piece of 1/4 x 1-3/4" strap iron fastened with a couple of angle brackets to the under side of the shelf and grounded to the magneto bracket. Spark plugs have the points spread to about a 3/16" gap.

Name	Number
E4A Automatic Impulse Coupling Tool Kit	SE-783
(Component parts of SE-783):	
Magneto Member Winder	SE-783-1
Drive and Snubber Spring Winder	SE-783-2
Stop Ring Winder	SE-783-3
Handle for SE-783-1, 2, 3	SE-783-4
Stop Ring Block	SE-783-5
Impulse Coupling Service Kit Holder	SE-783-6
Puller for F-4, F-6 and E4A Magneto Rotor or Armature Bearing Race and E4A Collector Ring	SE-839
(Component parts of SE-839):	
Center Screw	SE-839-1
Puller Screw and Handle	SE-839-2
Puller Body	SE-839-3
Armature Bearing Race Adapter	SE-839-4
Electrical Test Set	SE-846
Spool Type Magnetizer	SE-858
Standard Keeper (furnished with magnetizer)	SE-858-3
Charging Bar with Milled Radius	SE-858-4
Charging Bar without Milled Radius	SE-858-5
Impulse Coupling Puller for "F" Type Impulse Coupling	SE-912
Block for pressing out Wico Type "H" Magneto Drive Shaft	SE-914-1
Driver for pressing in Ball Bearings and Oil Seal in Wico Types "H" and "AH" Magnetos	SE-914-2
Magneto Bearing Race Puller	SE-1020
(Component parts of SE-1020):	
Split Sleeve	SA-1020-1
Expander	SE-1020-2
Hexagon Nut	SE-1020-3
Magneto Bearing Race Replacer	SE-1021
Neon Condenser Tester	SE-1064

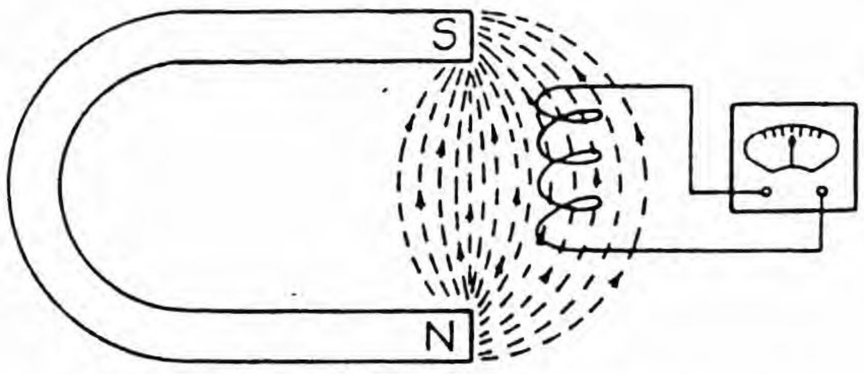
Magneto Fundamentals

Before going into the actual dismantling and servicing of magnetos, it is advisable to have a good understanding of the magnetic and electrical principles involved. By knowing these principles a serviceman is in a position to reason the construction of the various magnetos, will not depend to much on his memory, and oftentimes can figure things out for himself.



ILLUST. 1--INDICATES THE PATH OF MAGNETIC LINES OF FORCE BETWEEN THE POLES OF AN ORDINARY HORSESHOE MAGNET.

Illust. 1 shows a simple horseshoe magnet, found in the average magneto. This magnet will pick up tacks and nails and will affect the pointer in a compass. The attracting action is caused by a magnetic field in the vicinity of the magnet made up of magnetic lines of force which travel from the north pole at one end of the magnet, through the air to the south pole at the other end. It will be noted that the attractive force is greater nearer the magnet and less the farther away you go.



ILLUST. 2--SHOWS A COIL OF WIRE CONNECTED TO A CURRENT METER. COIL IS LOCATED IN MAGNETIC FIELD. MOVEMENT OF COIL IN MAGNETIC FIELD WILL INDICATE A CURRENT THROUGH CURRENT METER.

Illust. 2 shows, in addition to a horseshoe magnet, a coil of wire placed in the magnetic field and connected to a current meter or better known as an ammeter. The ammeter will show a reading if a current passes through the coil. While the coil of wire is stationary in the magnetic field there is no reading on the meter; if the magnet is suddenly jerked away there is a reading on the meter. Now if the magnet is suddenly moved back again there is a reading on the meter, but in the opposite direction. From this it can be concluded that the mere presence of magnetism in the vicinity of a coil produces no current but the change in magnetism does produce a current. The direction of current is determined by the direction of change in magnetism. It will also be noted that if the magnet is moved slowly a very slight reading on the meter results and if moved rapidly a larger reading results. This shows that the speed at which the magnetic field is changed around the coil will directly affect the current induced in the wire.

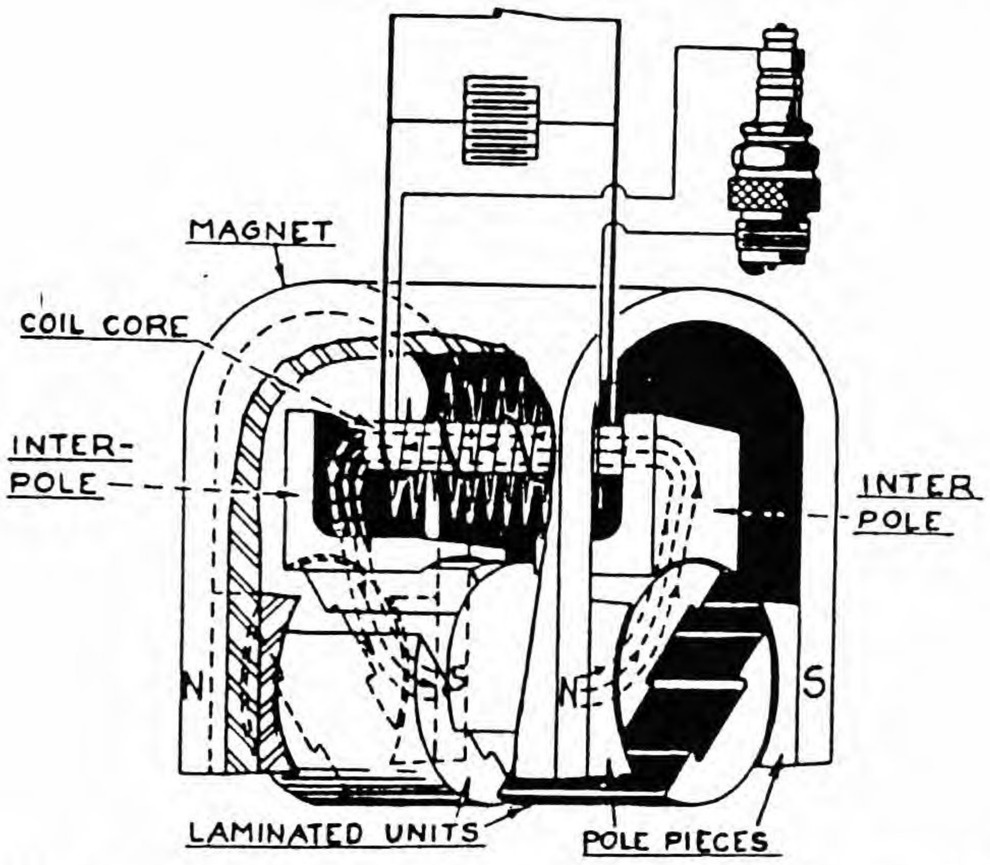
It has been shown that a current will be generated in the coil if placed in a changing magnetic field; however, this current will not have sufficient voltage to jump a gap in an ordinary spark plug. For this reason a transformer coil is used which steps up the low voltage in the primary coil to a high voltage in the secondary coil. The high voltage current produced in the secondary coil will jump an ordinary spark gap. A condenser is used across the breaker points which acts as a shock absorber and helps produce a sudden break in the primary circuit when the points open.

The condenser also helps prevent excessive burning of the breaker points.

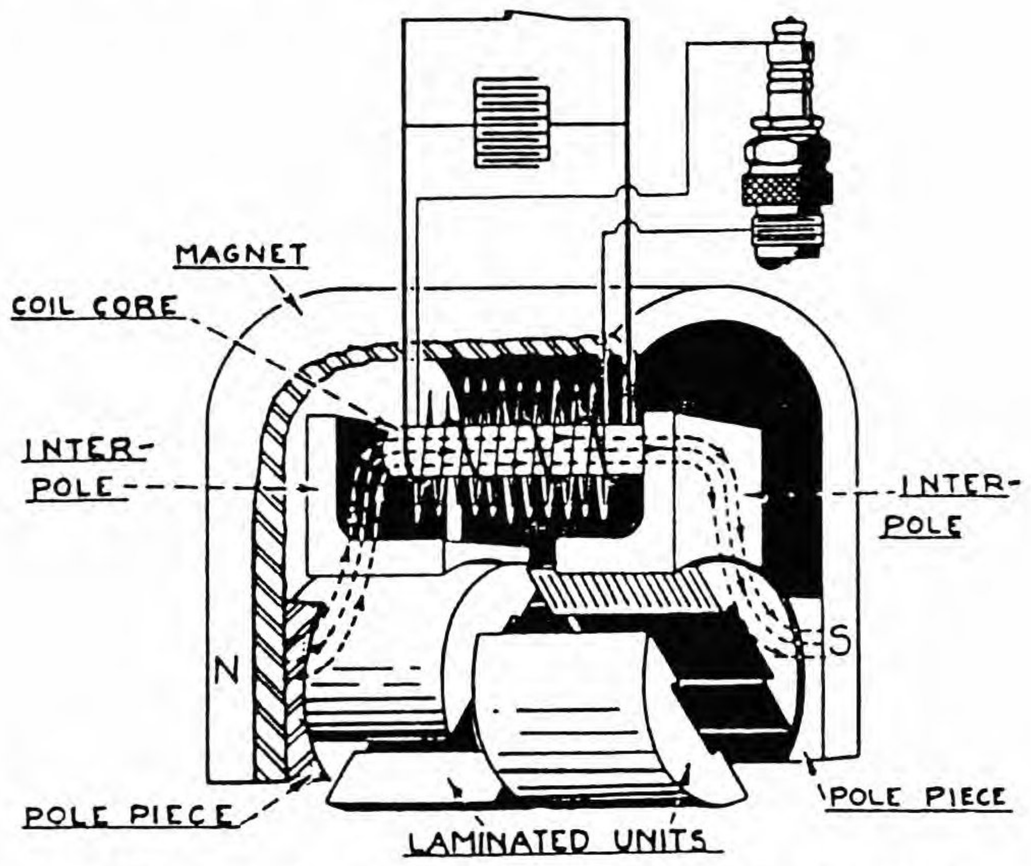
The following section explaining what happens in the F-4 and F-6 magnetos is broken up into two parts. The first part covers the magnetic circuit in the magnetos, and the second covers the electric circuit in the magnetos. Each circuit depends upon the other for successful magneto operation and this relation should be understood after reading the following.

Magnetic Circuit in the International F-4 and F-6 Magnetos

Lines of magnetic force will pass through some substances more readily than through others. When a piece of iron or steel is placed in a magnetic field, the lines of force are bent out of their natural path and pass through the iron. There will be more lines of force passing through the space occupied by the iron than when this space was occupied by air only. This magnetic principle of magnetic lines of force, taking the path of least resistance, is utilized in the F-4 and F-6 magnetos.



ILLUST. 3--SHOWS PATH OF MAGNETIC LINES OF FORCE THROUGH THE F-4 AND F-6 MAGNETOS.



ILLUST. 4--SHOWS PATH OF MAGNETIC LINES OF FORCE THROUGH THE F-4 AND F-6 MAGNETOS WITH ROTOR SET AT 90° FROM THAT SHOWN IN ILLUST. 3.

The magnetic action in the F-4 and F-6 magnetos can best be explained from the diagrammatic views shown in Illusts. 3 and 4. Running over the magneto proper is a permanent horseshoe magnet. This magnet contacts a north pole piece on one side and a south pole piece on the other. (A section of each magnet has been cut out to show more clearly the internal construction of the magneto.) Between these pole pieces turns a rotor with very little clearance for air space. The rotor consists of two pairs of soft steel laminated units. Each pair of units is placed at 90° to the other. Laminated units are mounted in place and magnetically insulated from each other by an aluminum die casting. Through the center of the rotor, also magnetically insulated from the laminated units, is a shaft. (Shaft is not shown in illustrations.)

Directly over each pair of laminated rotor units is a laminated interpole. The two interpoles are connected by a coil core, around which is wound the primary and secondary coils.

From previous explanation it must be remembered that magnetic lines of force will continually flow from the north pole of a magnet to the south pole of a magnet. By means of the soft laminated units in the rotor, the magnetic lines of force are directed from their natural path directly across from pole to pole to a path up through the coil core and down again. The path taken by the magnetic lines of force is shown by the dotted lines and arrows in Illusts. 3 and 4.

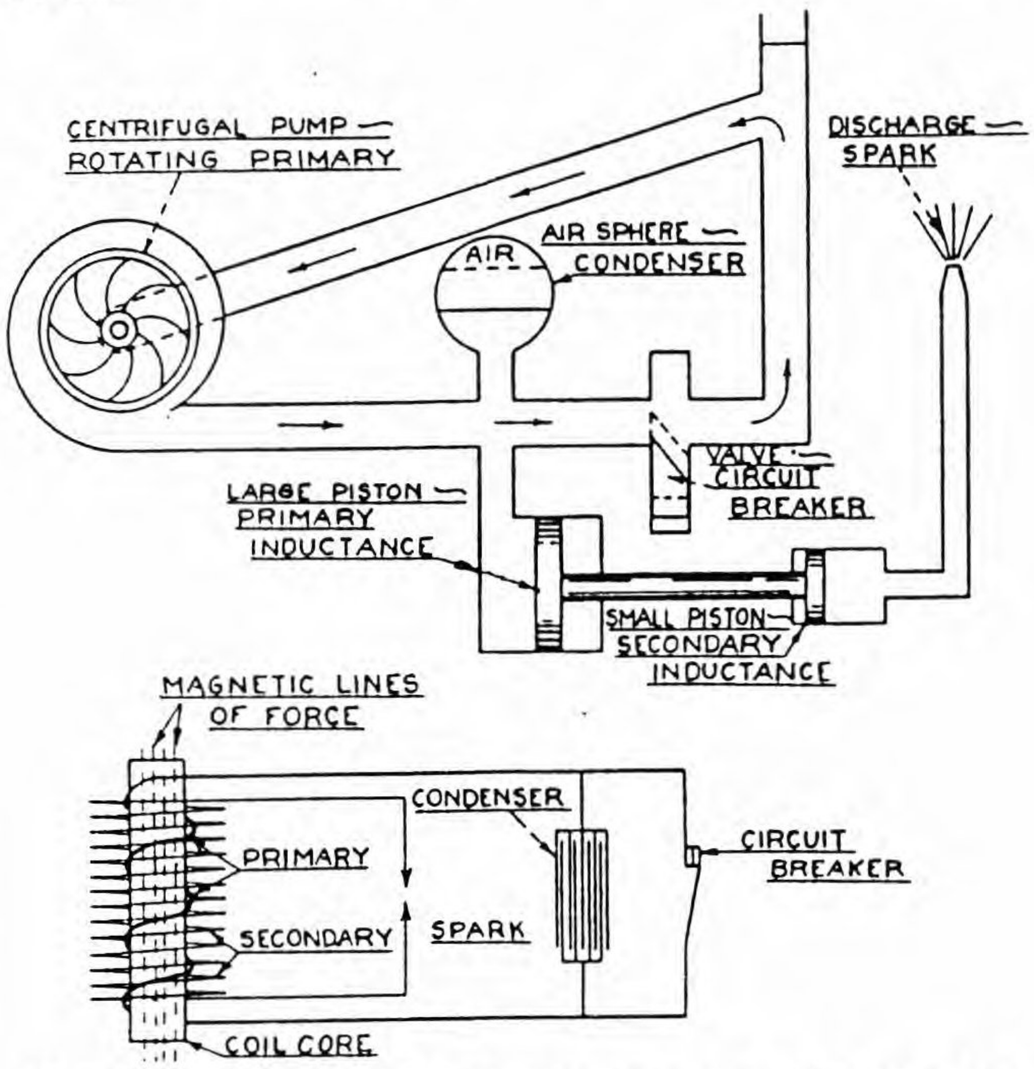
As the rotor turns in a clockwise direction (facing the front end), the number of magnetic lines of force passing through the coil core will be reduced, due to the unbalanced position of the rotor laminated units, with respect to the pole pieces and interpoles. This change in number of magnetic lines of force in the coil core induces a current to flow in the primary circuit which is wound around the core; the amount of current depending upon the speed and quantity of magnetic change.

If the rotor continues to turn, the number of lines of force passing through the coil core will drop to zero and then build up again to maximum but will flow in the opposite direction as shown in Illust. 4. The rotor position in Illust. 4. is 90° from the rotor position in Illust. 3, or 1/4 of a complete turn. From this we can see there will be four complete changes in direction of magnetic lines of force in the coil core and direction of current flow in the primary coil for each revolution of the rotor. In the F-6 magneto both directions of current are utilized, whereas in the F-4 magneto only one direction is used.

Electrical Circuit in the International F-4 and F-6 Magnetos

The basic principle of the magneto coil and condenser can best be explained by comparing the action of a coil and condenser with that of a hydraulic booster system, which can be more readily followed by the average person. Illust. 5 shows a diagrammatical drawing of hydraulic booster system above, and a comparative drawing of the F-4 and F-6 magneto electrical circuit below.

The hydraulic booster circuit consists of a centrifugal pump which circulates water around a closed circuit, as indicated by arrows in Illust. 5. A slide valve is provided in tne circuit to stop the flow of water. Between the pump and slide valve branching off the circiut is an air sphere containing a quantity of entrapped air. The entrapped air will occupy a smaller space as the pressure in the water is raised. Also branching off this same circuit between the pump and valve is a piston and cylinder. This piston operates a smaller piston through a connecting rod. The pressure on the larger piston can be stepped up to a higher pressure on the smaller piston by this hydraulic arrangement.



ILLUST. 5--DIAGRAMMATICAL DRAWING OF A HYDRAULIC BOOSTER SYSTEM AND A COMPARATIVE DRAWING OF THE F-4 AND F-6 MAGNETO ELECTRICAL CIRCUIT.

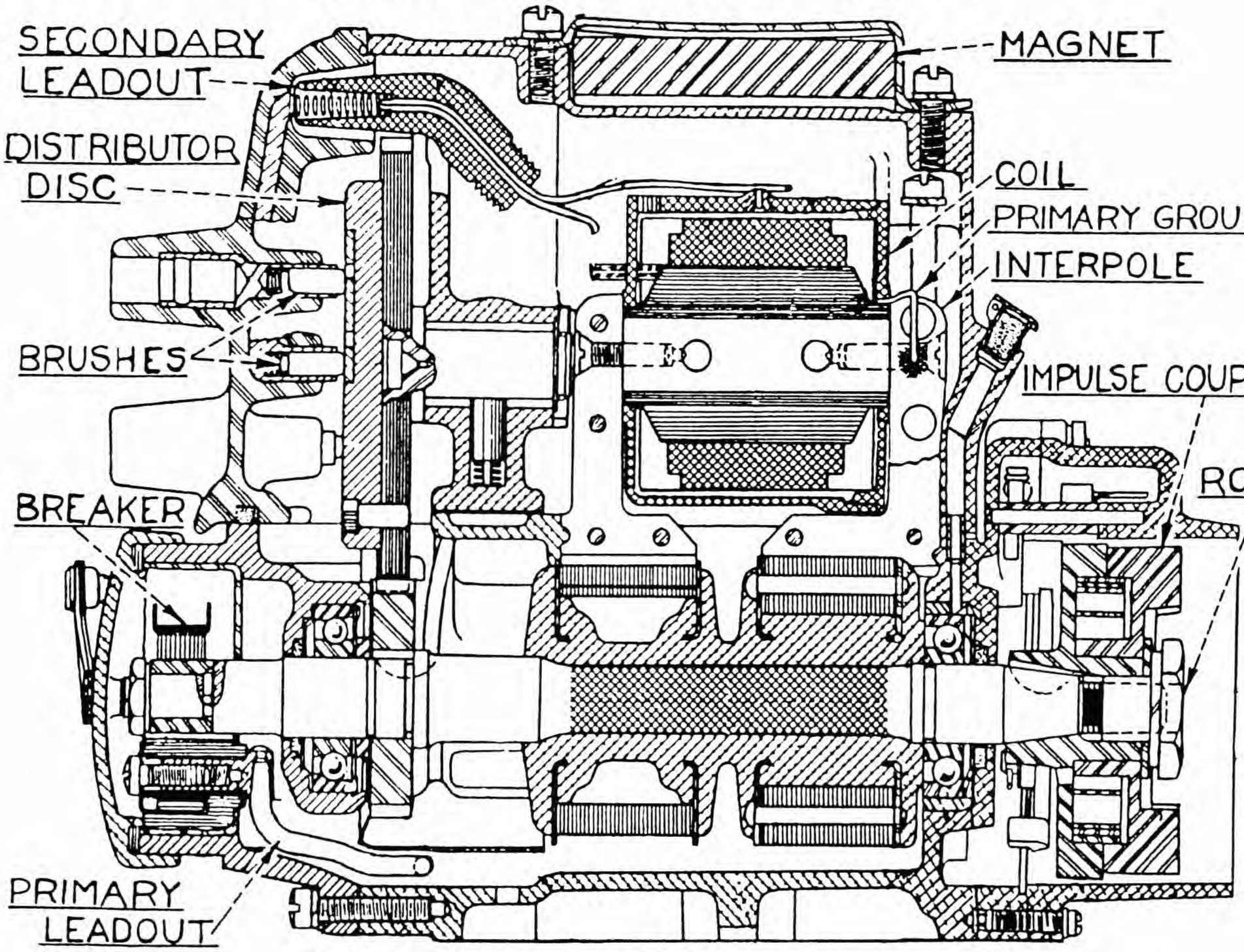
The circulation of water around the system can be compared to the primary circuit in a magneto where changing magnetic lines of force passing through a soft steel coil core, as explained on Pages 5 and 6, induce an electric current to flow through the primary windings. This current passes from the primary out through the circuit breaker and back to the primary.

Suddenly the slide valve in the hydraulic circuit closes, stopping the flow of water. Immediately, the pressure builds up, compressing the trapped air in the air dome and forcing the large and small pistons to the right. The difference in areas of the two pistons steps up the pressure per square inch in the smaller piston chamber sufficiently to force a high pressure discharge at the end of the small pipe.

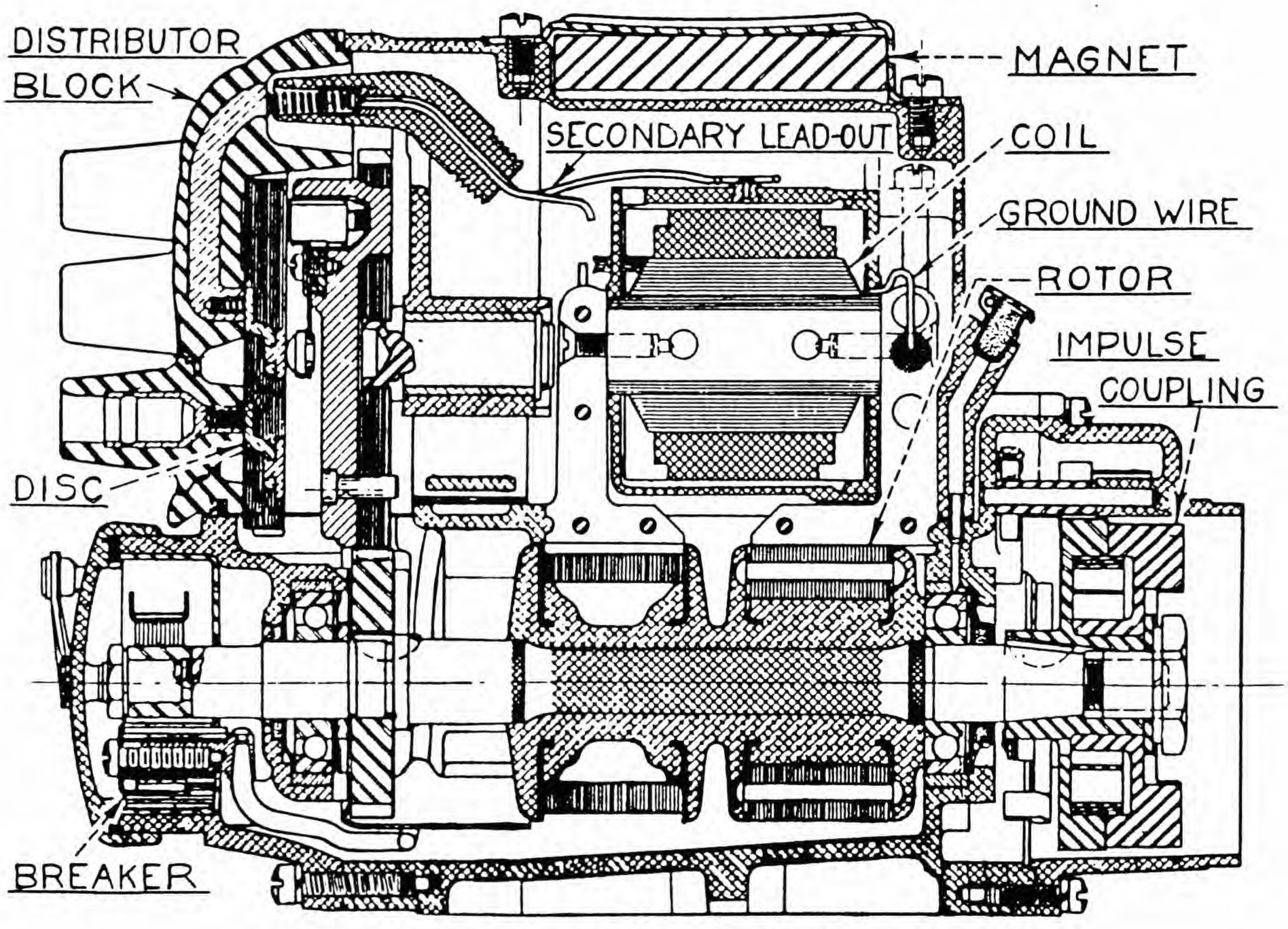
Referring to the magneto, the circuit breaker suddenly opens, stopping the flow of electric current when it is the greatest. By so doing, the electric current rushes into the condenser and charges it with electrical energy. This energy is discharged back through the primary circuit in the opposite direction immediately after the primary circuit is broken, helping to produce a quick collapse of magnetism in the core. This collapse of magnetic field in the coil core induces a high voltage current in the secondary coil which consists of a great number of turns of fine wire. The high voltage current is sufficient to jump a spark gap. A distributor disc is timed to the rotor and delivers the current to the individual spark plug at just the right moment for proper combustion in the engine. It must be remembered that the magnetic and electrical action in a magneto occurs in an infinitesimally short period of time.

It was mentioned before that the condenser also prevented the circuit breaker points from burning. This can be explained by again referring to the hydraulic system. As the slide valve crosses the path of circulating water, there is a tendency for the water to keep flowing and possibly break off the thin edge at the valve point. This is granted to be a very poor valve, but it is a good hydraulic analog of the best electric valve available. The inertia of the water and the action of the pump tends to keep the current flowing past the valve. Injury would probably result to the valve if it were not for the air dome which receives some of the water and allows the pressure to build up gradually, giving the valve a chance to close and the thicker part to cover the opening before the higher pressures are exerted on it. The pressure stored in the air dome will probably further increase the action of the primary piston immediately after the valve is closed.

When the breaker points in the magneto are separated, there is a tendency for the electric current to keep flowing in an arc across the gap formed. The magnetic core, acting inductively on the primary coil, has a tendency to maintain the arc. The condenser counteracts the combined effort by receiving and storing the electrical energy and thus breaking down the arc quickly. The energy stored in the condenser is discharged back through the primary immediately after the circuit points are separated, thus further increasing the inductive action and the strength of the spark.



ILLUST. 6--CROSS SECTIONAL VIEW OF INTERNATIONAL F-4 MAGNETO.



ILLUST. 7--CROSS SECTIONAL VIEW OF INTERNATIONAL F-6 MAGNETO.

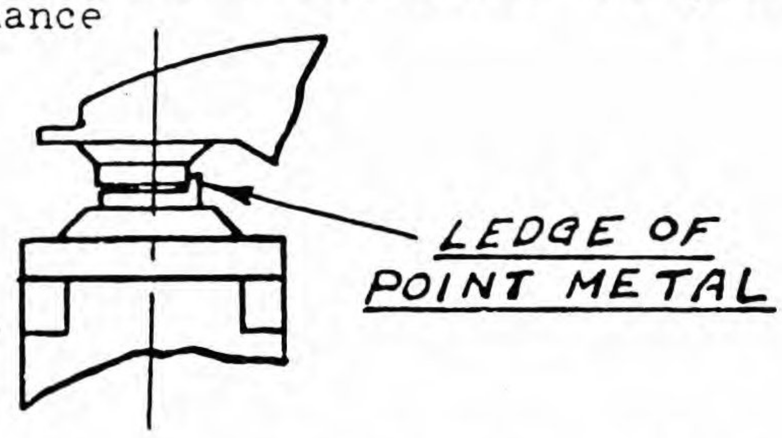
INTERNATIONAL F-4 AND F-6 MAGNETOS

F-4 and F-6 Magnetos—General

The F-4 and F-6 magnetos have been designed so as to make possible the convenient replacement of any part in the field. This section of the Manual, covering the F-4 and F-6 magnetos, is divided into two parts. The first covers the recommended dismantling and testing procedure to follow when attempting to locate the cause of faulty operation in an F-4 or F-6 magneto. The remaining part covers adjusting, testing and general information necessary to properly repair a magneto and restore it to its most efficient operating condition.

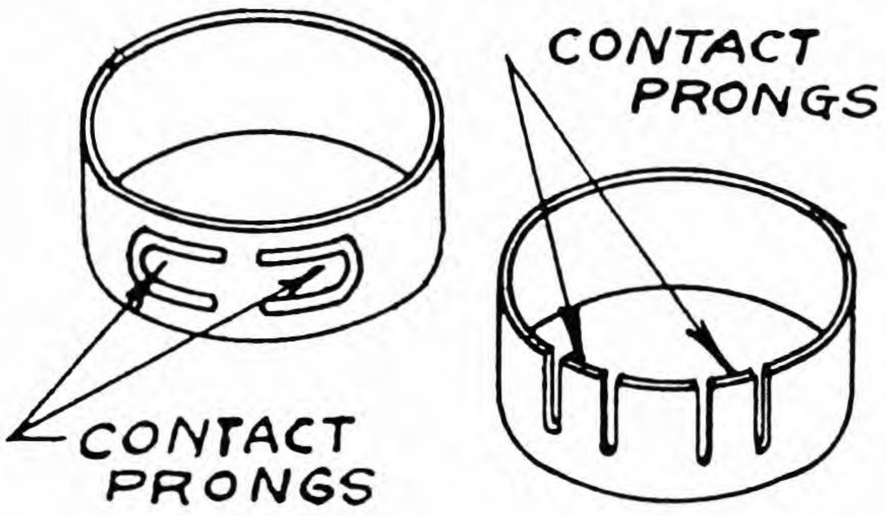
Preliminary Examination of the Circuit Breaker

Remove the breaker housing cover and examine for correct point performance and setting. A ledge of point metal running up to the side of the companion point causes a slow break and poor performance

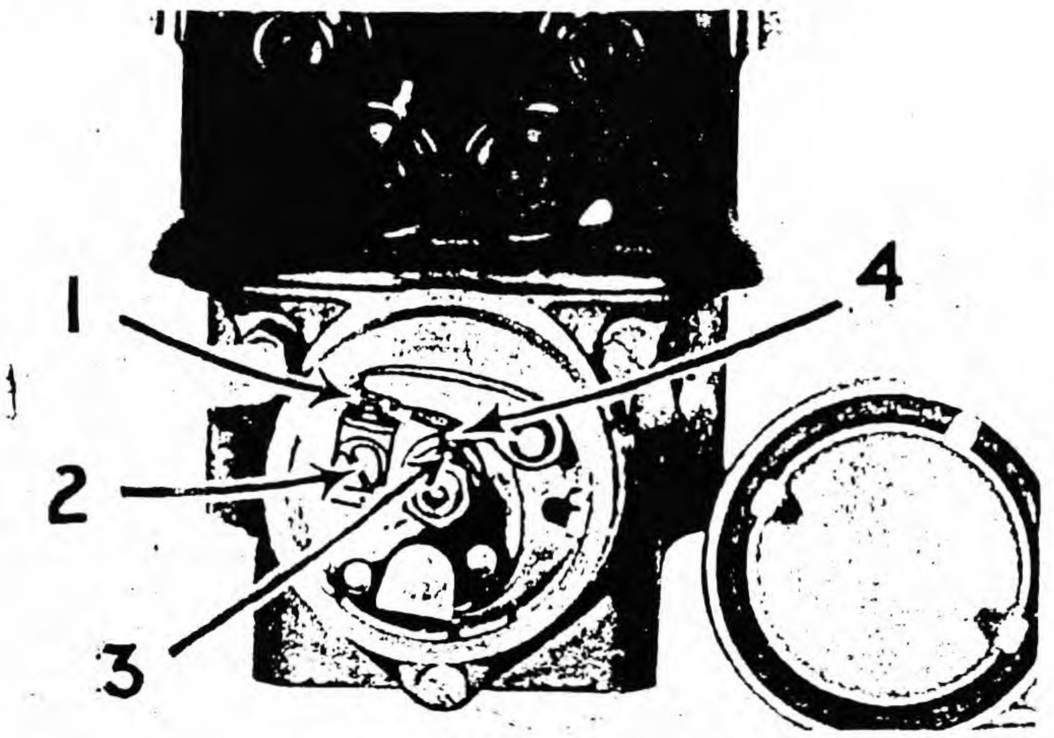


ILLUST. 8--LEDGE OF POINT METAL CAUSES A SLOW BREAK AND POOR PERFORMANCE.

Breaker points on F-4 magneto should be set to .013"; breaker points on F-6 magneto should be set to .020". To adjust point opening, loosen stationary point support screw (2) slightly and use a screw driver as a pry to move stationary point support as necessary. Tighten screw and check adjustment. (Illust. 10).



ILLUST. 9--CONTACT PRONGS SHOULD BE BENT TO MAKE A FIRM ELECTRICAL CIRCUIT.



ILLUST. 10
BREAKER ADJUSTMENT.
1--BREAKER POINT OPENING. 2--STATIONARY (ADJUSTABLE) POINT SUPPORT SCREW. 3--BREAKER CAM. 4--BREAKER ARM RUBBING BLOCK ON HIGH RIDGE OF CAM.

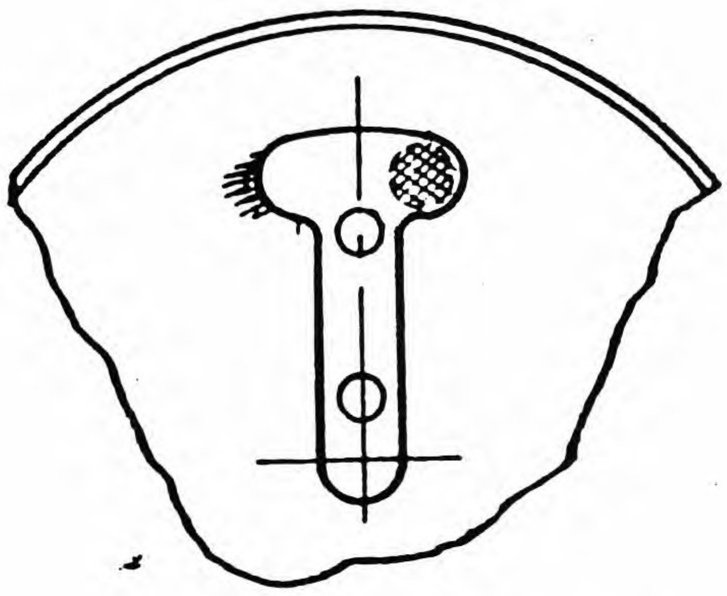
Examine the breaker for excess oil around the outside and at the bottom. Occasionally over-oiling is noted. This may interfere with the proper primary circuit from the cup member to the breaker housing. The contact prongs of the breaker cup (Illust. 9) are supposed to be bent out at the factory so as to make a firm electrical circuit between this cup and the housing in which it fits. The oil interferes with this contact. Likewise a loose fitting cup produces the same effect. BEND THE PRONGS OUT, if need be, and reduce the oil supply.

Examination of the Distributor

Remove the distributor block. Examine the brush track for black carbon, burns, and for the spot on the bronze insert that tells whether the spark has been occurring at the correct place. A magneto spark is a rather long drawn-out discharge. It has a tendency to burn the brush track unless the spark is started soon enough to permit a rather complete discharge before the brush runs off of the insert and onto the distributor disc surface. Distributor disc brush track can be readily cleaned of *black carbon with a soft rubber eraser.* Do not use sandpaper.

All sparks from the F-4 magneto are of one polarity. The spot on the distributor disc insert should be as shown in Illust. 11.

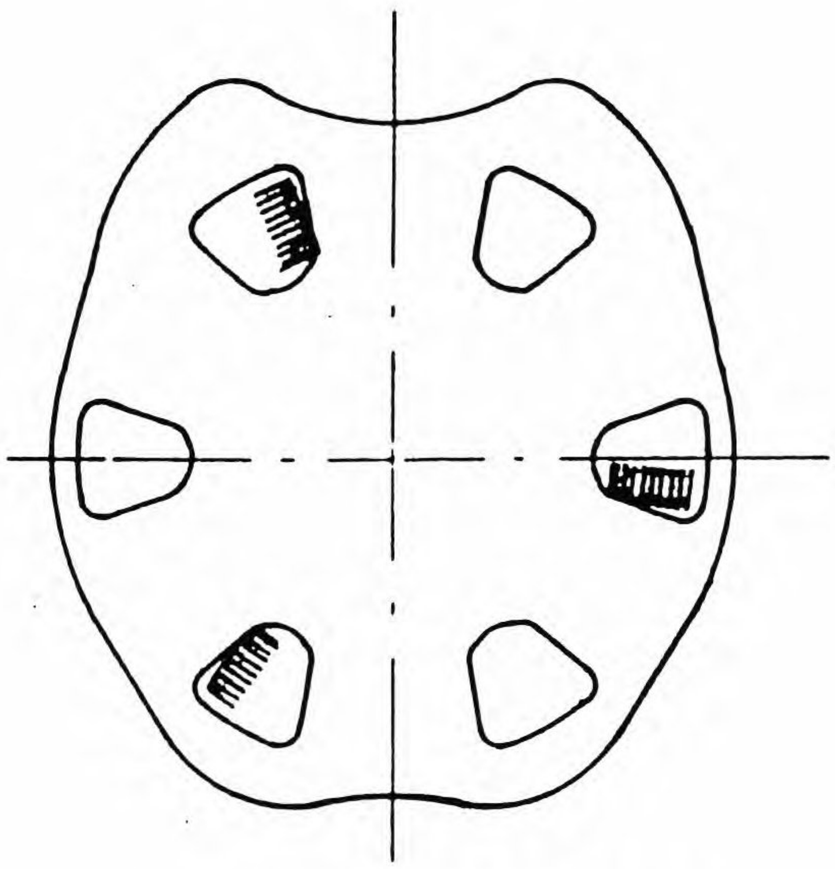
A slight blackening of the disc surface at the trailing edge of the insert is normal. The remainder of the brush track on the F-4 disc should be almost completely free of carbon.



ILLUST. 11--CORRECT TIMING SPOT MARK ON F-4 DISTRIBUTOR DISC.

If the track shows any particular carbon smearing on the F-4 magneto it is advisable to change the brushes. DO NOT USE E4A BRUSHES IN THIS MAGNETO. They will almost always smear and cause "CROSS FIRING." The F-4 brushes have no groove along the side. The latest and most successful F-4 brush (No. 32032-DXA) has a flat spot on the neck which fits into the brush springs.

A late spark spot will cause excess distributor disc burning at trailing edge of insert if operation is continued very long. It results either from incorrect timing of the distributor gears or from running with a retarded spark for long periods of time. The distributor disc will not give its longest service with a late spark.



ILLUST. 12--CORRECT TIMING SPOT MARK ON F-6 DISTRIBUTOR DISC.

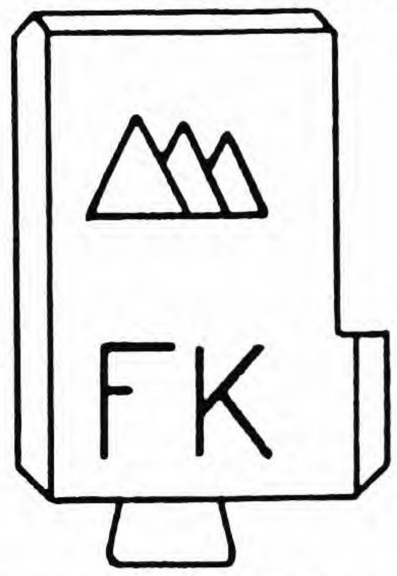
The sparks of the F-6 magneto are of alternate polarity and, therefore, spots each alternate distributor disc insert the same.

Those men who are familiar with direct current arc welding readily realize that the direction of current flow has an important bearing on the heat generated when an arc is created in the circuit.

In the case of the F-6 magneto the spark spots should always come on the leading edge of the inserts as shown in Illust. 12, otherwise the distributor disc will burn as the brush leaves at the other side.

This matter of distributor timing is especially important in view of the increasing number of F-4 and F-6 magnetos that we are building with special short spark range. When these short range magnetos are correctly applied they, as well as the standard 35° units, all have the distributor spark spot in the same place on the distributor disc insert.

The disc should be almost completely free of smeared carbon on the brush track, although it may show considerable scratching. This scratching is especially characteristic of the brush stamped (X) on the side. This does not matter as long as the brush track is clean and the disc wear is not excessive.



ILLUST. 13 SHOWS IDENTIFICATION MARKINGS ON LATEST TYPE NATIONAL CARBON BRUSH USED IN F-6 MAGNETO.

If the disc shows signs of excessive wear, replace the brush with the new National Carbon "FK" brush (Lettered "FK" on side of brush) which runs relatively clean and is less aggressive than the older brush.

The fitting of brushes to magnetos is one of the most delicate and unpredictable operations that the factory has to perform. Occasionally a brush under factory operation will operate cleanly and otherwise satisfactorily and, under different conditions in the field, start smearing. This is almost impossible to avoid in all cases, but should be of infrequent occurrence.

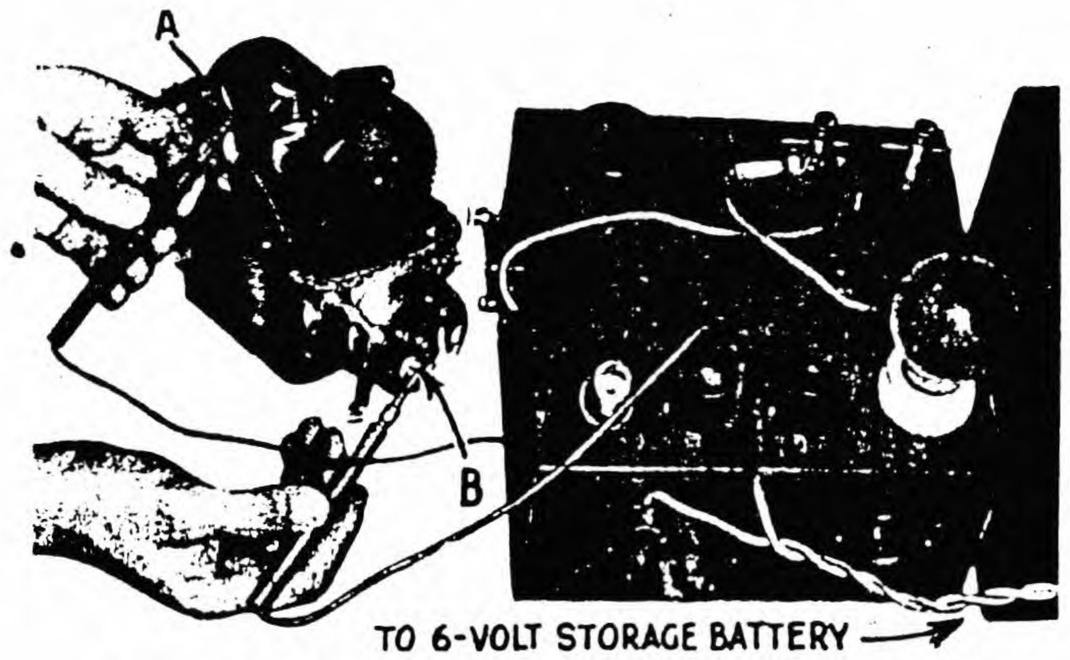
Safety Gap

If the breaker and distributor of the subject magneto are both found to be in good condition, carry the examination further. Leave the distributor block off, advance the spark, disengage the impulse coupling (see page 25), then turn the magneto briskly by hand. A spark should jump regularly across the safety gap. This test cannot be made on the F-6 magneto unless the safety gap is reduced to the same setting as in the F-4 magneto.

Examination for Safety Gap Sparking

We will assume that the spark is still unsatisfactory, intermittent, and weak. The examination must then proceed still further. Remove the magnet and frame cover. Check the condenser; better put in a new one, if it is available, and test the magneto for spark once more. Test condenser as explained on Page 16.

The frame cover may be left off for this test; however, it is necessary to replace magnet on magneto. The spark should jump the safety gap with the breaker in advance position, with the rotor being turned briskly by hand. If performance is now satisfactory, the condenser was at fault. Reset the F-6 magneto safety gap; see Page 16 for correct setting.

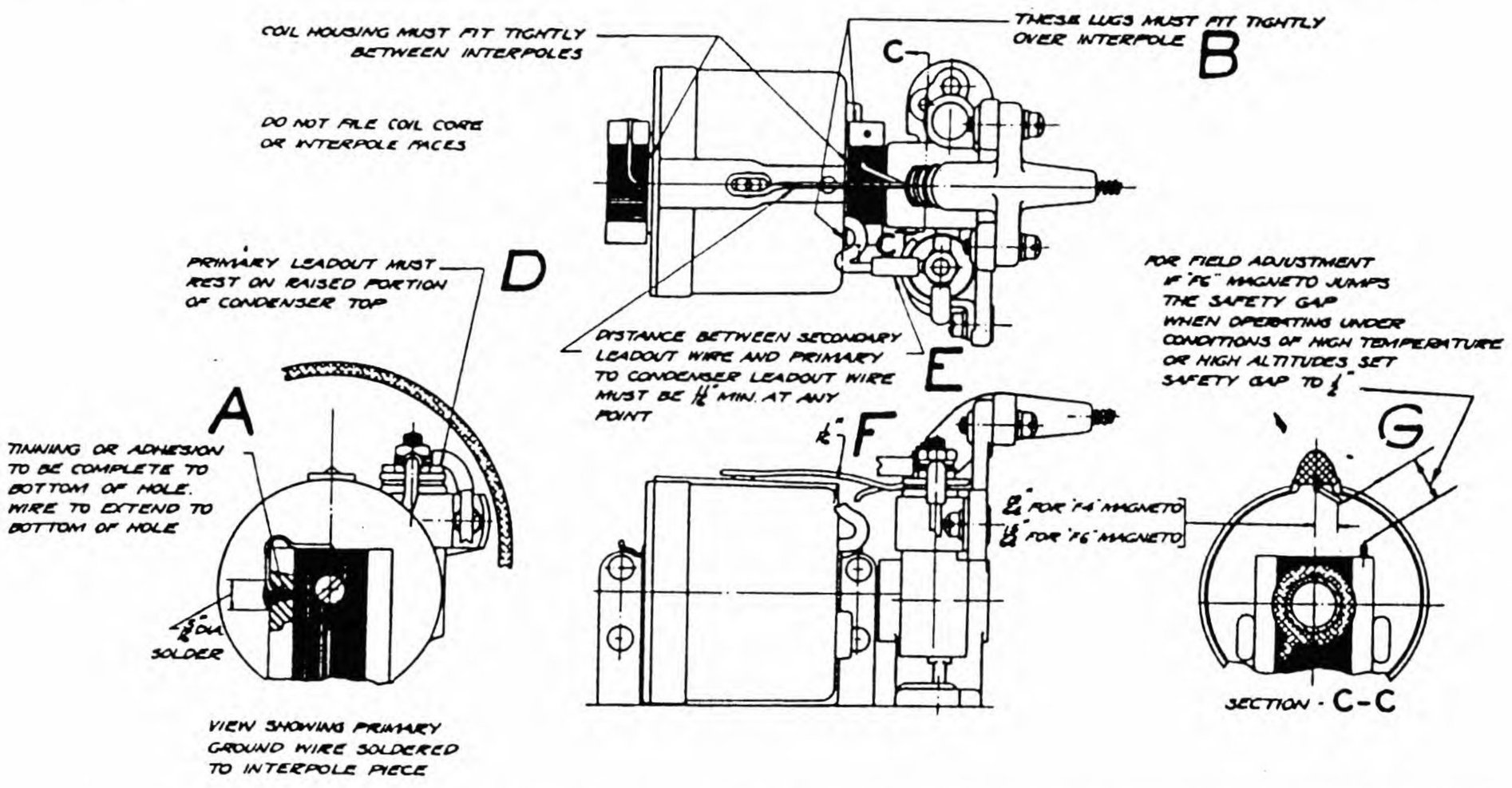


ILLUST. 14--TESTING PRIMARY LEAD-OUT WIRE FOR OPEN CIRCUIT OR FOR GROUNDING.

Assuming that the condenser exchange did not correct faulty operation, it will be in order to check the primary lead-out wire for open circuit and for grounding. This is done by using the 6-volt line on electrical test set as shown in above illustration. Disconnect primary lead-out wire terminal "A" from condenser and turn rotor until breaker points are open. If primary lead-out wire shows a closed circuit from terminal "A" to terminal "B", and an open circuit from either terminal to any grounded surface, then the fault lies either in the magneto winding or its installation.

Examination of the Ground Connection

Examine the ground connection of the winding to the interpole (Illust. 15), Item "A"). This wire should be securely

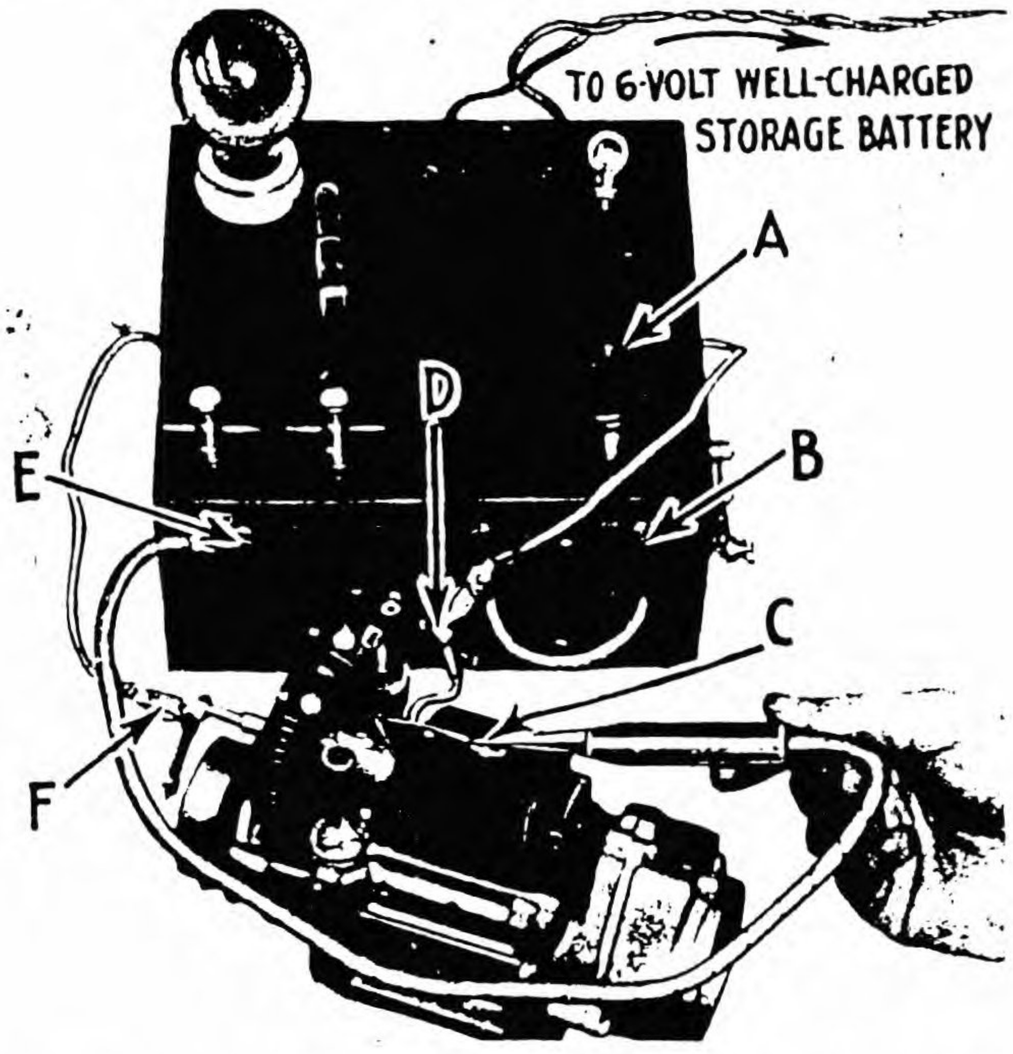


ILLUST. 15--DRAWING OF MAGNETO COIL ASSEMBLED IN PLACE ON F-4 AND F-6 MAGNETOS WITH SERVICING POINTERS FOR INSTALLING COIL PROPERLY. (REFER TO ILLUST. 22, PAGE 14 FOR LATEST CONSTRUCTION OF ITEM A).

soldered into the countersunk hole in the interpole. Laying the ground wire along the interpole and making a surface joint is not secure enough. The solder will crack through in time. See that this is not the case in the subject magneto. See Illust. 93 for new type.

The coil housing should be a *tight press fit* between the interpoles endwise, so that it cannot shift and wear loose from engine vibration. If this happens, the ground connection, or the wire to the condenser, will crack in two. A very slight amount of motion will bring this about. Now see that this fault does not exist in the magneto being examined.

The spark is still unsatisfactory we will assume. It will then be necessary to replace the coil. It must be faulty because everything else has been gradually eliminated as the source of trouble. However, an additional check for faulty coil can be made (as given below) before removing coil from magneto.

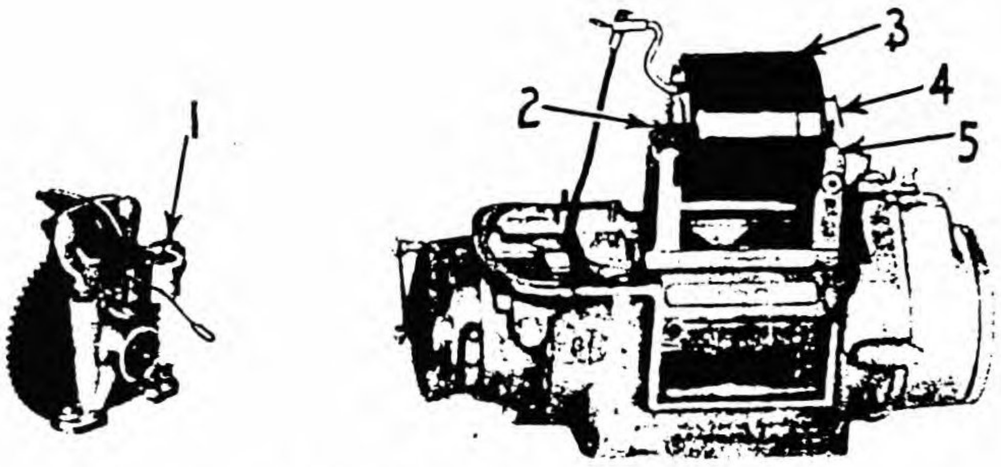


ILLUST. 16--TESTING MAGNETO COIL WHILE IT IS STILL IN PLACE ON THE MAGNETO, USING THE ELECTRICAL TEST SET.

As a final check for faulty coil, the coil may be tested while still on the magneto by connecting the electrical test set as shown. Have vibrator switch "A" in "off" position, and high tension switch connected to "armature terminal" "B." Connect high tension test point lead to "high tension terminal" "E". Turn magneto rotor until breaker points are separated and remove primary wire terminal from condenser post. Snap winding test lead clip "D" on terminal primary wire to condenser and test lead clip "F" on any grounded part of magneto. Hold high tension test point "C" on secondary lead-out wire. Snap on vibrator switch and a strong spark should jump a 5/16" test gap.

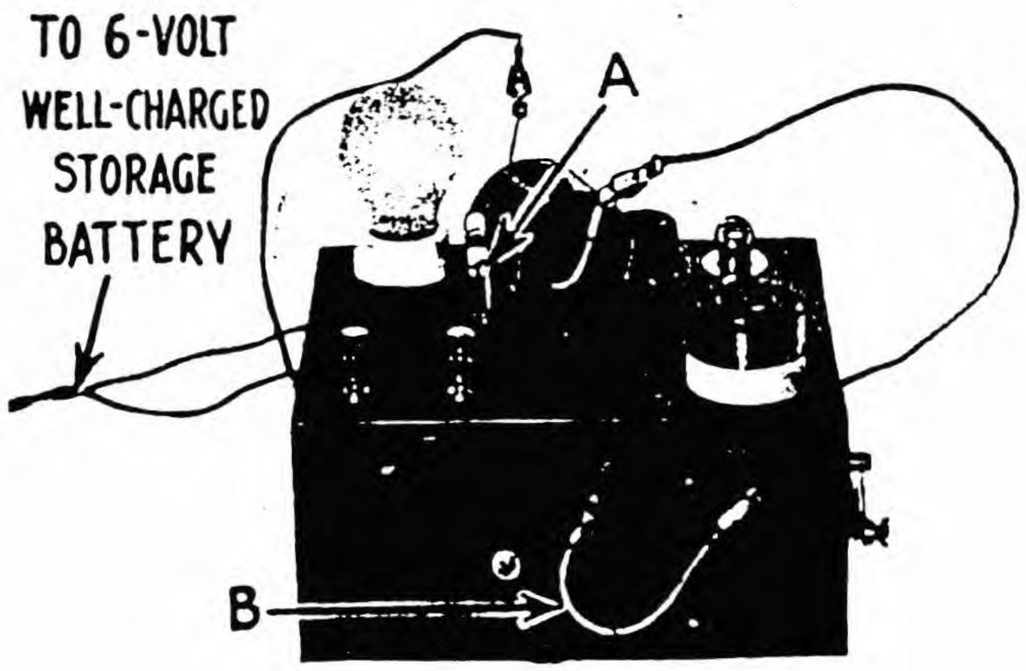
In this case the method of testing the coil while it is still on the magneto is being shown for the information it will give. The coil on the test magneto has already been proven faulty by previous checks. The coil should now be removed from the magneto and replaced with a new one.

Removing Coil From Magneto



ILLUST. 17--COIL REMOVED FROM MAGNETO.
1--DISTRIBUTOR GEAR AND BEARING. 2--COIL CORE SCREW.
3--COIL. 4--COIL GROUND WIRE. 5--INTERPOLE.

Disconnect the condenser. Then remove the distributor gear and bearing. Next, remove the coil core screws. Unsolder the coil ground wire from the interpole. Use a large soldering copper, quite hot so it can be done quickly. Pour out all extra solder from the countersunk hole. Finally force the coil upward slowly with the aid of a screw driver.



ILLUST. 18--TESTING COIL WITH COIL CORE IN PLACE WITH ELECTRICAL TEST SET.

The core should always be in position in the center of the windings when testing the coil on the electrical testing

instrument. If the core is not in place, the transformer set-up of the coil is not complete and no spark will appear at the gap. This test should not be prelonged any more than is necessary to obtain the check. Subjecting the coil to the test conditions for a prolonged period may damage it.

Have vibrator switch "off" and high tension switch "B" connected to "Armature" terminal. Place coil on test box so brass secondary lead-out terminal is firmly against metal of collector ring holder. (See "A", Illust. 18.) Clip winding test leads to primary lead-out wires which extend from each end of coil housing. Snap on vibrator switch. There should be a strong spark across a 5/16" test gap.

Removing Coil Core



ILLUST. 19--REMOVING COIL CORE WITH HARD WOOD OR FIBER PUNCH.

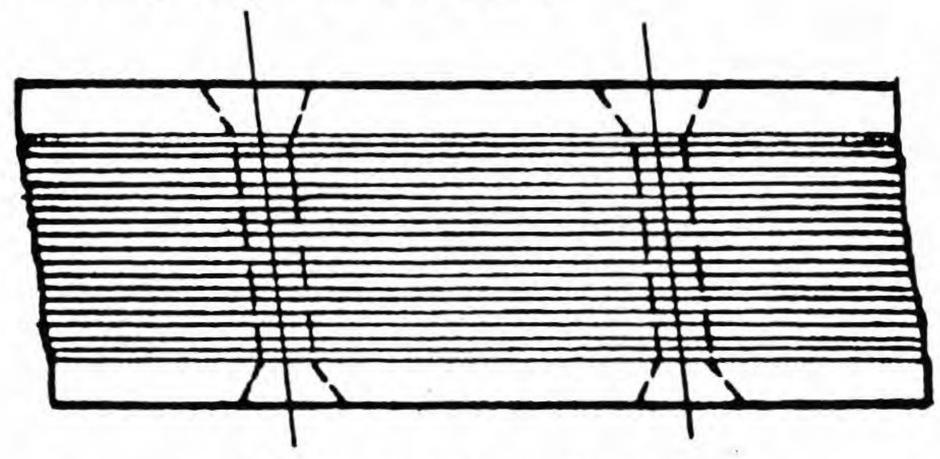
Next, remove the coil core from the defective winding. Hold the coil in the hand, preferably with the coil lid up. By the use of a flat-end hardwood or fiber punch, at least 5/8 to 11/16" in diameter, drive the core downward between the fingers. Be sure to hold coil firmly when driving out core. Bakelite coil case is brittle and will break if dropped.

Never use a metal punch of any kind.

Examination for Coil Core Fit Between Interpoles

The least defect on the joining surfaces between the coil core and interpole will permanently impair the magneto's operation.

This joint must be a clean "sucking" fit, similar to the fit when two Johannsen gauge blocks are put together. They stick just by virtue of their flatness after being properly "wrung" together. No rust, no oil or foreign matter of any kind must be on these surfaces. By all means do not try to correct defects by filing the ends of the coil core. This can only end in failure.



ILLUST. 20--DRAWING SHOWS COIL CORE KNOCKED OUT OF SQUARE.

The coil core is made of laminated electrical sheet steel. It is held together by two rivets. If struck vigorously with a metal tool it will burr and may be knocked out of line as shown in exaggerated form in illustration.

Identifying the F-4 and F-6 Magneto Coils

Select a new coil to replace the defective one. Sometimes it is an advantage to know when the coil was made.

This can be done as follows: The year and month when the coil was made is indicated either on the paper lable or stamped on the side of the coil case. Following the date is the letter A, B, C or D, which indicates the improvements made in their construction, the D coils being the latest construction and are immersed in water for 12 hours at the factory before they are accepted for production. A black asphalt material is used to seal this coil in the housing instead of Halowax. This improves the water resistance of the coil. D coils are called "Tropical Coils."

Assembling the F-4 and F-6 Magneto Coils

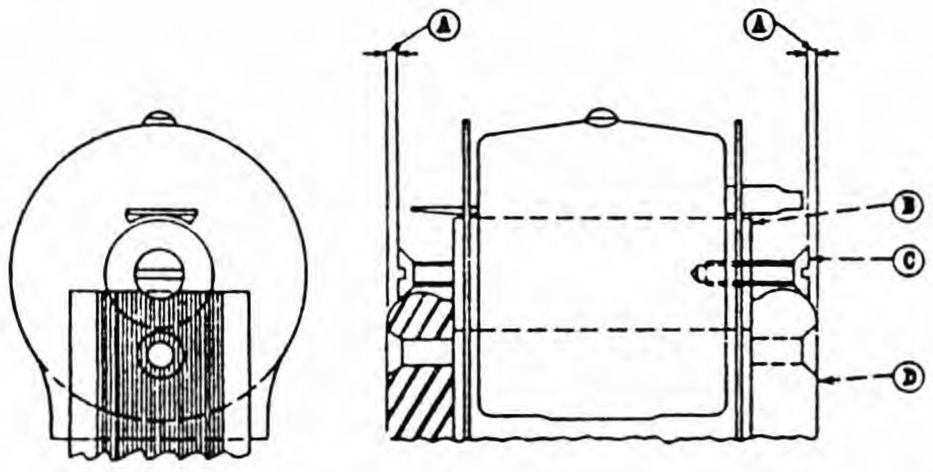
The coil must be a light fit between the interpoles and on the coil core. Otherwise vibration will loosen it and cause failure.

Also, *do not attempt* to file the diameter of the coil core so that it will slip into the winding easily, nor file the ends to make it fit between the interpoles easier. Paint the coil hole generously all around with a thick as-

phalt solution for a 3/8" length at each end before pressing in the core. The core should be a hard pressed fit in the winding and it may have to clear a path by removing a small amount of varnish as it is pressed in; this is permissible and will cause no damage, provided it is started and pressed in straight. Clean the core ends thoroughly of paint. These surfaces must be absolutely clean. The core should be a light press fit between the interpoles. The bakelite housing will normally be a little longer than the coil core and should not be filed.

The guide lugs on the coil housing should fit the interpole so that they bear against it lightly, just enough to keep the winding from moving sideways or turning around on the screws. A check should be made on the length of the coil core screws. They should be bottomed lightly in the core and the winding placed on top of the interpoles with the screws in place. (See Illust. 17.) In this position it can be readily seen whether the screws bottom before they would tighten or not. If the guide lugs are too tight on the interpole, they may be filed until they fit properly. Be careful not to touch the end of the core with the file during this operation.

Test coil core mounting screw length by bottoming screws lightly in coil core and pressing assembly into the position shown.



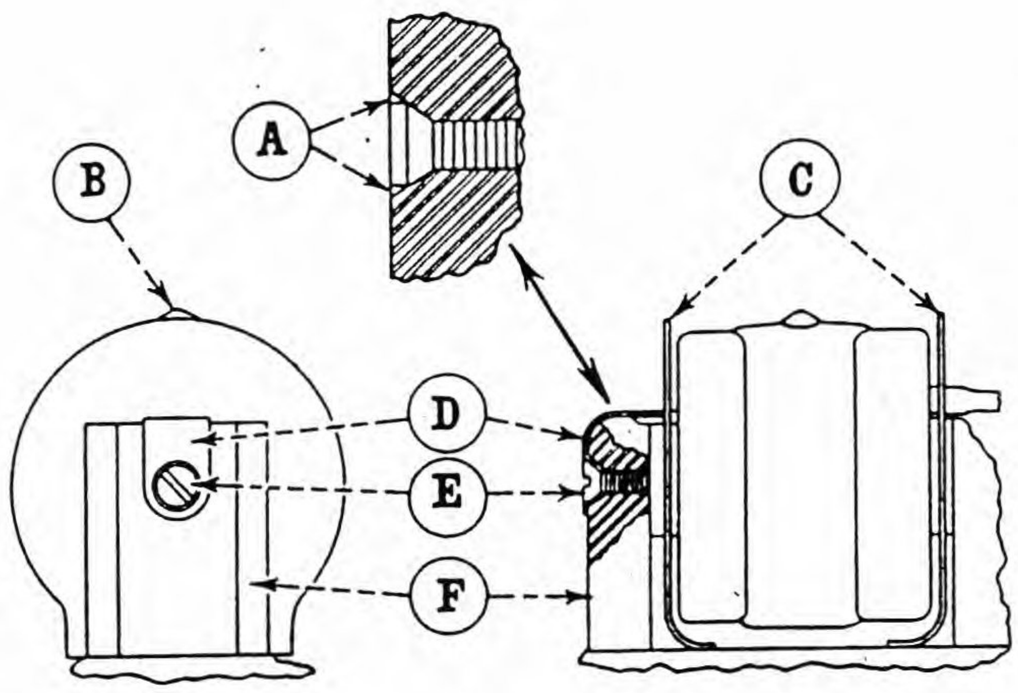
ILLUST. 21--TESTING COIL CORE SCREWS BEFORE ASSEMBLING COIL AND CORE TO MAGNETO. A. 1/32" MINIMUM. B. COIL CORE. C. COIL CORE MOUNTING SCREW. D. POLE PIECE.

If either screw head does not fall back of the face of pole piece by 1/32" minimum shown, it must be removed and enough cut off the end to meet this requirement. This is done so that when coil core is in place, the screws will tighten up in pole piece countersink before screws bottom in coil core.

Caution: Do not file or in any way deface ends of coil core or face of pole pieces as this will impair the magnetic circuit and efficiency of the magneto. The coil core should be a light press fit between the pole pieces.

The Ground Connection

This connection must be bent and inserted into the bottom of the hole as shown on Page 11, Illust. 15, Item "A", to prevent the wire breaking from vibration. Be sure that the countersunk hole and the end of the lead-out wire is clean and that a thorough soldering job is done. Do not use acid; use a resinous flux. A resinous flux will not corrode or eat the metal.



ILLUST. 22--METHOD OF GROUNDING COIL WITH NEW GROUND STRIP A. IF COUNTERSUNK HOLE IN POLE PIECE HAS A SHOULDER, REMOVE IT BEFORE ASSEMBLING COIL GROUNDING STRIP UNDER COIL MOUNTING SCREW, OTHERWISE COIL GROUNDING STRIP WILL NOT MAKE A GOOD CONTACT. B. HIGH TENSION TERMINAL. C. COIL INSULATORS. D. COIL GROUNDING STRIP. E. SCREW. F. COUPLING END OF POLE PIECE.

Remove the old coil from coil core and assemble new coil on core with a coil end insulator at each end. Locate coil and core in magneto so high tension terminal is on a vertical center line as shown.

Assemble coil grounding strip under coil mounting screw in pole piece as shown. Tighten screw firmly. Surface of countersink in pole piece and grounding strip must be clean and bright before assembling.

If there is a shoulder in countersink hole in pole piece, the shoulder must be removed.

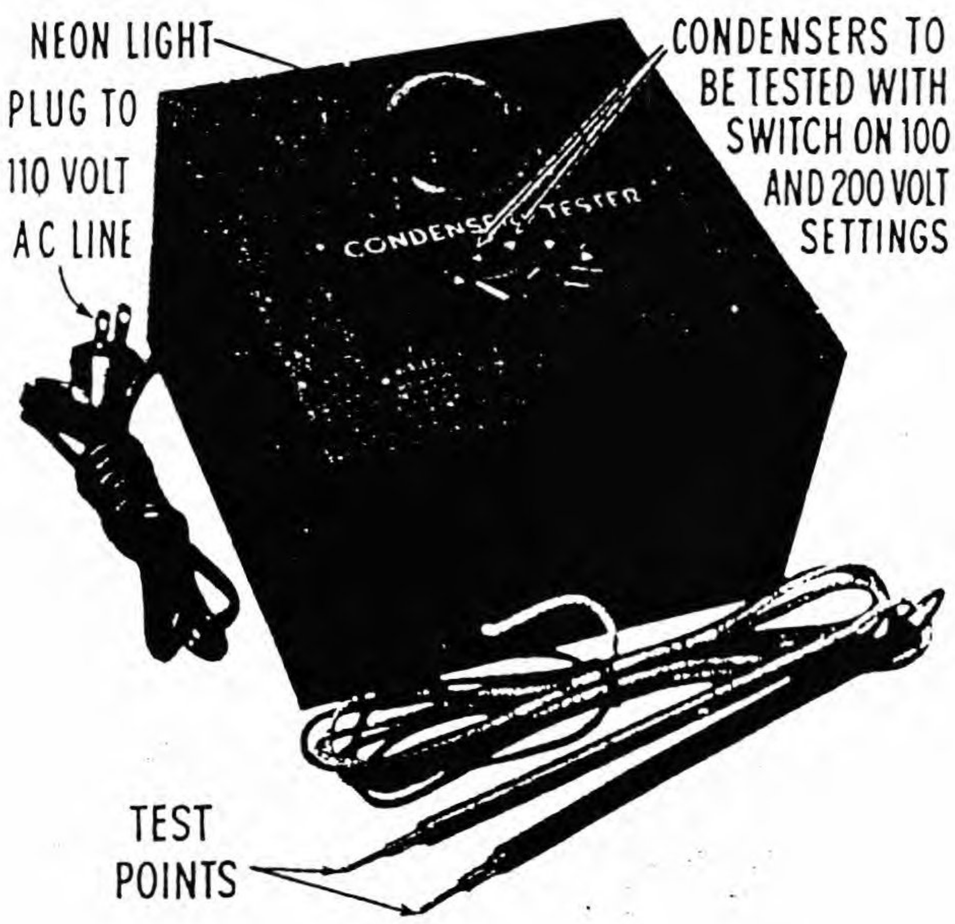
The High Tension Lead-Out

Do not allow this lead-out to touch the bakelite coil housing at any point. Maintain 1/16" between the secondary lead-out and the coil housing. (See Page 11, Illust. 15, Item "F".) This is to prevent a drop of moisture from bridging at this place. If this wire is raised too high the spark will jump upward to the roof of the aluminum cover.

The Condenser

All metal surfaces contacting the condenser should be thoroughly cleaned to insure a good ground. See that condenser is pushed down as far as it will go before tightening the clamp. Refer to Page 11, Illust. 15, Items "E" and "D" for instructions on the proper positioning of the lead wires to condenser terminal screw. It is very important that these wires be positioned as shown in the illustration to prevent "shorting" or "grounding." Condenser as furnished for replacement does not include condenser nut (10-32) which must be obtained separately.

Testing Condenser



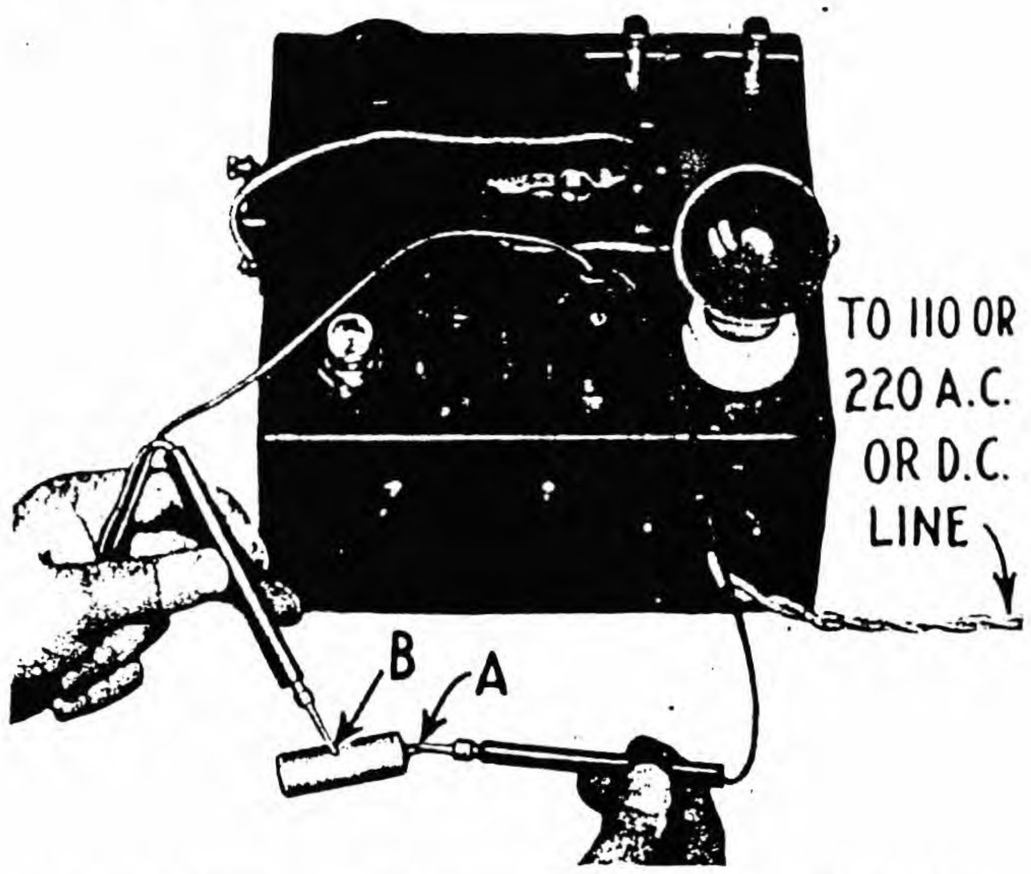
ILLUST. 23--NEON CONDENSER TESTER S.E.-1064.

A sensitive Neon tube type condenser tester is available, which will conclusively show up defects in condenser that cannot be indicated with ordinary test equipment. This Neon condenser tester operates on a 110-volt A.C. current. A special switch on the box allows for testing at four different voltages, ranging from 100 to 600 volts. To determine the exact condition of any condenser, use only the 100 and 200-volt test settings. The use of the 400 and 600-volt test settings will in no way injure the condenser being tested, neither will the readings of the test be as accurate as when using the two lower voltage settings.

Hold one test point on the condenser terminal, the other on the outer metal housing of the condenser. If infrequent flashes occur in the Neon tube with the switch set on the 200-volt position and the tube flashes only for initial charge with the switch set on the 100-volt position, the condenser will pass satisfactorily. If the condenser gives continuous flashes at 200 volts, it should be discarded even though it tests satisfactorily at 100 volts.

This does not apply to the condensers used in the E-4A magnetos. For an E-4A condenser use only the 100 volt test. If satisfactory at this voltage, condenser may be used in the magneto, even though it may flash continuously at the 200 volt test. Good performance is assured when using an E-4A condenser meeting the 100 volt specification.

The Neon condenser tester can be secured by ordering under SE-1064 from any IHC Branch House.



ILLUST. 24--TESTING CONDENSER WITH ELECTRIC TEST SET.

Have a 60-watt, 110-220-volt bulb screwed into the socket inside the test set, and a 15-watt, 110-220-volt bulb screwed into the socket on top of the test set.

Remove the condenser from the magneto and test for short circuit by placing one test point on the terminal screw "A" and the other on the outer metal housing of condenser "B," as shown in illustration. If the condenser is not short circuited, the test lamp will not light.

The test for capacity consists of charging the condenser by holding test points on condenser as shown in illustration and then immediately discharging it by removing test points and placing the side of one of the test points in

contact with the condenser housing and bringing its point close to the terminal screw. A snappy flash should occur. If direct current of 110 or 220 volts is used, this flash will occur every time; if A.C. is used, the test should be repeated a number of times, because in charging with A.C. the contact has to be broken at just the right time, or the charge will be partially removed by the reversal of the charging current.

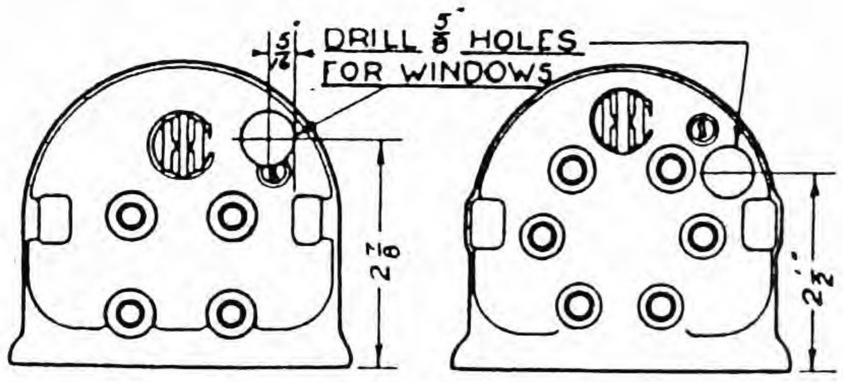
By repeating the charging process several times it is possible to break the circuit at the proper point to have a charge in the condenser. With alternating current only, the best flashes should be considered in judging the condenser's fitness. With direct current all flashes may be considered as they will be of relatively equal intensity.

The Safety Gap

The safety gap acts as a protection to the winding when abnormal sparking conditions are experienced. The regular safety gap setting on the F-4 is 9/32 to 11/32", and on the F-6, 7/16 to 15/32".

The F-4 sparks are of one polarity. If the magnet is on correctly, the short F-4 safety gap is as effective as the longer F-6 gap. It is possible, even when this gap is set at the high point, for the spark to jump this gap, if the conditions are abnormal enough.

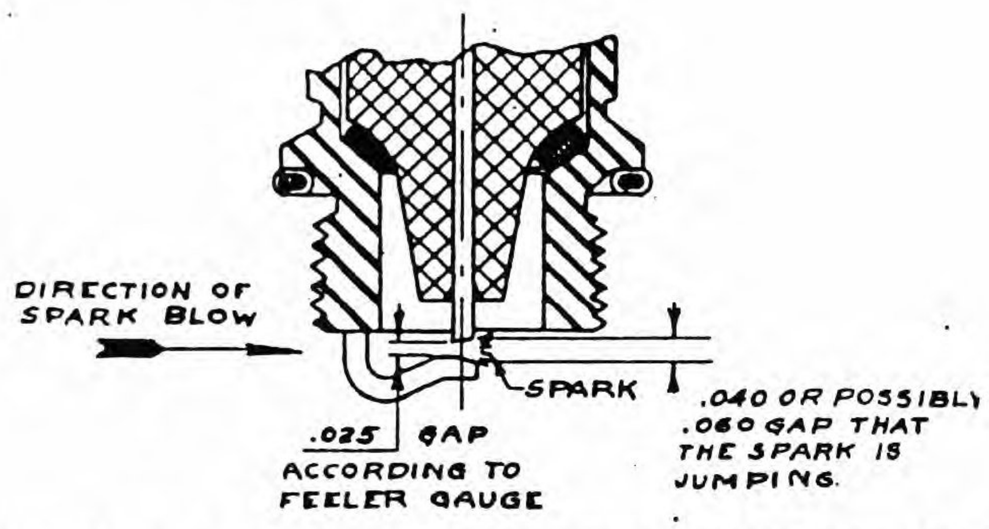
High humidity, extreme high temperature or high altitude, or a combination of all three, may cause internal jumping of the spark. If a magneto starts jumping the safety gap, determine the cause and correct it. These gaps are amply long for almost every condition where internal combustion engines are operated, except high altitudes.



ILLUST. 25--HOLE FOR WINDOW IN F-4 AND F-6 DISTRIBUTOR BLOCK FOR OBSERVING SPARK ACROSS SAFETY GAP.

A spark jumping a safety gap can be readily detected by replacing on the magneto a regular distributor block in which a transparent window has been provided (See Illust. 25). Run the engine for a sufficient time to permit the air in the magneto to attain the normal operating temperature, and observe through the window if spark is jumping safety gap. If it is jumping safety gap, check all spark plug gap settings. It may be necessary to file off the spongy metal at tips of spark plug wires and close gap to .020". If spark still jumps safety gap, with engine running, safety gap may be increased. Cut off and reform the spark plug lead-out closer to the secondary lead. (See Page 11, Illust. 15, Item "G".)

A window, rather than just an opening, must be used; otherwise air conditions in the magneto will change and probably prevent spark jumping. Drill holes in block as shown in illustration; then with a drill slightly larger in diameter, counterbore the same hole. Window can be made of celluloid to fit counterbored hole and then cemented into place with shellac.



ILLUST. 26--SHOWS HOW THE SPARKS WILL JUMP BETWEEN SPARK PLUG ELECTRODE WIRES WHICH ARE BURNED AT AN ANGLE.

Spark plug electrode wires burn off on one side more than the other, because the spark is blown there. This is especially true when the engine is carrying a load. The sparks may never jump the actual gauge gap until the engine is idled at low speed.

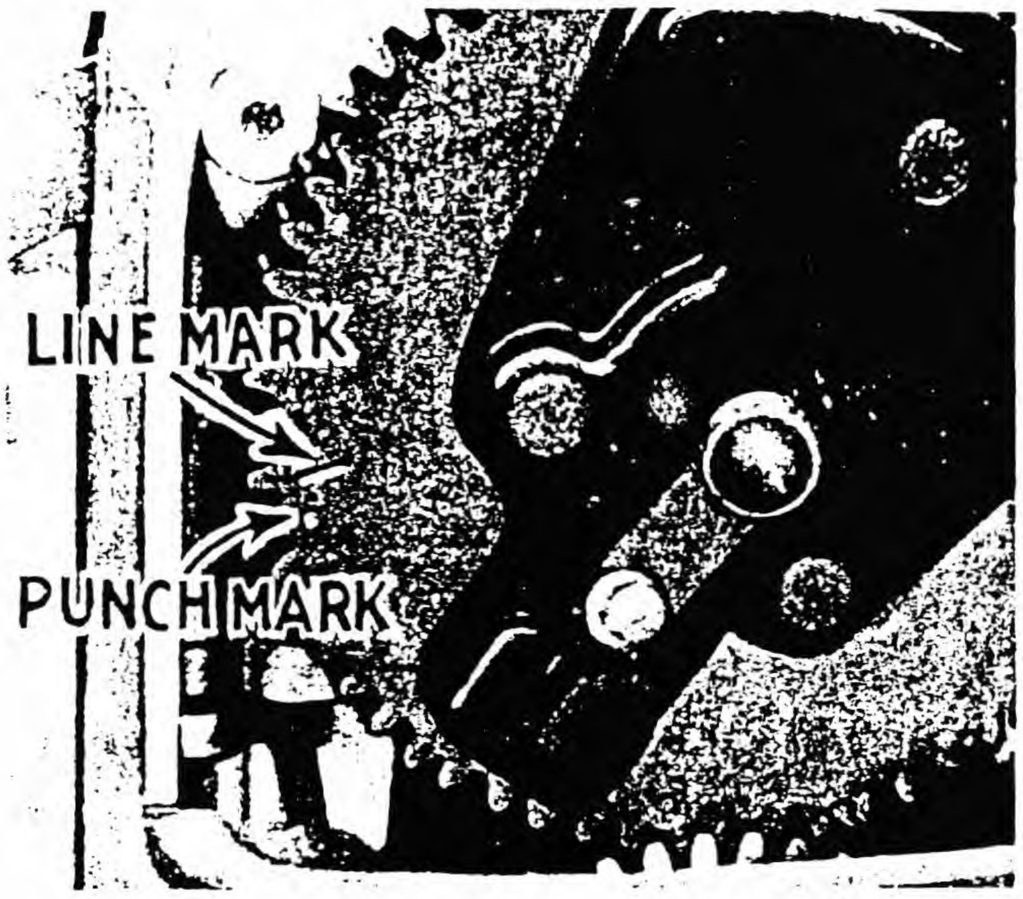
Keep the spark plug gap set close (.025 to .020 inches). In many cases even then the spark is jumping .040 to .060 inches due to turbulance in the combustion chamber (see illustration).

Spark Jumps to Frame Cover

If the spark still jumps to the frame cover after reforming safety gap, three coats of insulating varnish may be applied to the inside of the frame cover, allowing sufficient time for drying between each coat. A spaghetti insulator can be slipped over the high tension lead-out, or it may be coated with insulating varnish with the exception of the contact point. Another method is to

place a thin sheet of bakelite under the roof of the frame cover. We have never as yet seen a case that needed varnish coating as suggested; the information is being given, however, as an extreme emergency measure for very high altitudes, and should not be done unless absolutely necessary.

Timing the Distributor Gears



ILLUST. 27--SHOWS PUNCH MARK USED FOR TIMING 35° SPARK RANGE MAGNETO AND LINE MARK USED FOR TIMING MAGNETO OF REDUCED SPARK RANGE, EXCEPT F-4 MAGNETO USED ON THE 4-CYLINDER DIESEL ENGINE.

The standard F-4 and F-6 magnetos are made to advance the spark 35° measured on the engine crankshaft when timed on dead center with fully retarded spark.

The 4- and 6-cylinder Diesel engines, the PA-100 power unit using gasoline and the 3-5/16 x 4-1/8 6-cylinder harvester thresher engines all have magnetos timed for less than 35° spark advance. The Diesel magnetos have the spark fixed by an external link on the breaker cover.

In the case of the 4-cylinder Diesel, magnetos that run only during the starting period, the distributor gears have not been retimed. It has not been found necessary to retime them, due to the very small amount of running that they do.

Where the magnetos are special and are retimed, care should be exercised to see that they are installed on the engines with the spark limiting mechanism in place.

Use the round punch mark on both the F-4 and F-6 standard magnetos for 35° spark range. Use the line mark for all magnetos of reduced spark range, except the F-4 magneto used on the 4-cylinder Diesel which is timed with the punch mark.

Designating Markings and Special Features of F-4 and F-6 Magnetos

All F-4 Magnetos operate at Crankshaft Speed.

1. **F-4 Magneto, 21447-D—**
   Black magnet; 35° spark range; E4A Type Impulse Coupling. Furnished as parts and used as regular equipment on all earlier 4-cylinder engines. The dot on the distributor gear is used for timing.

2. **F-4 Magneto, 26335-D—**
   Black magnet; 35° spark range; F-4 Type Impulse Coupling. Used as regular equipment on all 4-cylinder engines and tractors using 35° spark range. The dot on the distributor gear is used for timing.

3. **F-4 Magneto, 28855-D—**
   Has "D" stamped on the frame preceding the F-4 serial number. Black magnet. Fitted with external timing link holding the spark range to 15° with E4A Type Impulse Coupling. This magneto is used on all 4-cylinder Diesel engines. The timing on this magneto is made by using the dot.

4. **F-4 Magneto, 36940-DM—**
   Has "W" stamped on the frame preceding the F-4 serial number. Green magnet. 18 to 25° spark range, which must be limited by an external stop, preventing the timing lever from moving more than 18° to 25° from full retarded position. Uses the F Type Impulse Coupling. This magneto will be used on Waukesha 4-cylinder engines for harvester-threshers and on various 4-cylinder engines of other makes used by the Western Austin Company of Aurora, Ill. This magneto is timed by using the line mark on the distributor gear.

All F-6 Magnetos operate at ¾ Crankshaft Speed.

1. **F-6 Magneto, 21448-D—**
   Does not have a letter preceding the serial number. Black magnet; 35° spark range measured on the engine crankshaft. F Type Impulse Coupling. Used as regular equipment on most of our 6-cylinder engines. This is the standard F-6. It is timed by using the dot on the distributor gear. The timing arm moves 26-1/4° to give 35° on the engine crankshaft.

2. **F-6 Magneto, 29826-D—**
Has "H" stamped on the frame preceding the F-6 serial number. Red magnet. Used on PA-100 Power Unit with gasoline carburetor for 17-1/3° advance (measured on the engine crankshaft.) It is also used on 3-5/16 x 4-1/8 6-cylinder harvester-thresher engine. In this case the spark advance limiting mechanism permits a maximum of 18° measured on the engine crankshaft. This magneto is timed by using the line mark on the distributor gear.

3. **F-6 Magneto, 32361-D—**
Has "D" stamped on the frame preceding the serial number. Has white magnet and impulse coupling housing. This magneto is fitted with a timing link that provides 15° spark advance measured on the engine crankshaft. It is timed by using the line mark on the distributor gear. This magneto is used on the large 6-cylinder Diesel engine. It is also fitted with a special main pawl in the impulse coupling and special engaging pawls. These are designed to lower the "throw-out" speed of the coupling and thus insure easier starting.

4. **F-6 High Tension Inductor Type Magneto, 60447-D—**
A new magneto for 6-cylinder engines equipped to burn natural gas. The new magneto is incorporated as a part of the natural gas attachments for the U-21, PA-40, and PA-50 power units and regular equipment on the PA-100 unit natural gas burning engine, displacing the regular magneto 21448-D in all these applications effective with Serial No. 42286, since a magneto generating a higher voltage is required for natural gas burning engines, especially when engine is operated at slow speed.

When operating power units on natural gas and using them for oil field work, the ignition requirements are much greater than are ordinarily necessary, due to the much higher compression ratio used and the dryness of the fuel, or a higher voltage is necessary to jump the spark plug gap.

The outward appearance on this special F-6 magneto is the same as the standard magneto; however, basic changes have been made to secure the desired increased output. This magneto can be identified by the prefix letter "N" in front of the serial number. The breaker points have been set to .013" for greater point life. This setting should be maintained at all times.

The ignition system of natural gas units should be inspected at the end of every 200 hours of continuous operation or approximately once a week or every ten days. At this time the breaker points should be cleaned and filed, and if necessary, reset. If necessary, repack the fiber grease in the pocket of the rubbing block. Make sure the breaker points themselves are free of grease and oil, otherwise excessive arcing and rapid wear of the points will occur.

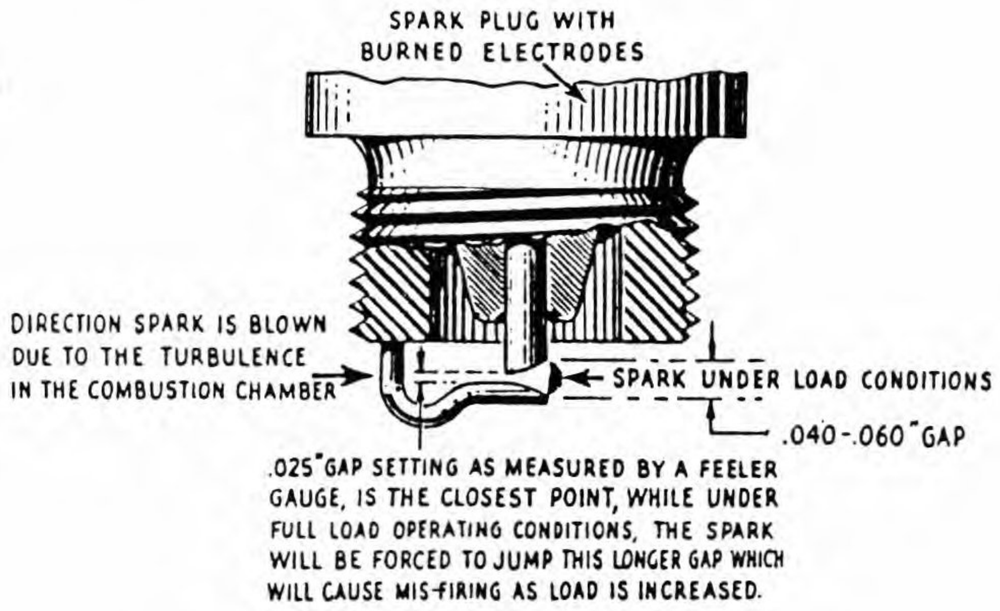
Inspect the distributor disc and, if necessary, clean the excessive tracking with a soft rubber eraser. Do not use sand paper or any abrasive material as this will scratch the disc and cause excessive wear of the brush, which in turn will pile up carbon on the brush path and eventually lead to cross-firing. The use of an ordinary pencil eraser is all that is necessary to thoroughly clean the disc.

The quality of the inspection and the care given the spark plugs is one of the most important items affecting the efficiency of natural gas operation in oil field work. Spark plugs should be inspected at least every 200 hours of operation or approximately every week to ten days.

Due to the dryness of the fuel, the severe operating conditions, and the rapid accumulation of hours, the electrodes of the spark plugs may wear to an abnormal gap in a relatively short period of time. When making an inspection, if the spark plug gap has been burned wide, and the electrodes appear to be spongy on the tip, file off this spongy material and re-set the gap to .013 to .018 inches. This gap should be maintained for increased hours of operation between inspection and also for better engine performance at lower speeds under full load.

In checking the gap of the spark plugs as removed from the engine, do not be mislead by a gap which may appear to be only .025 inches with a feeler gauge whereas under actual operating conditions the spark may have to jump .040 to .060 inches gap (refer to the illustration.) Turbulance in the combustion chamber will blow the spark in the somewhat circular path as shown. As a matter of fact the spark may never jump the actual gauge gap, but will be required to jump a gap twice as large. Therefore, spark plugs should be inspected every 200 hours, for conditions mentioned above, filed, and re-set to our recommended gap

for this type of work, or 0.13 to 0.18 inches.



ILLUST. 28--DIFFERENCE BETWEEN ACTUAL AND MEASURED SPARK GAP.

The use of colder spark plugs than those recommended for standard production will give greater life and better operation when using natural gas. Since no trouble will be experienced with fouling when operating under these conditions, a plug one or two steps colder may be used. (See Service Bulletin S-3145A-1408). This will greatly increase the spark plug life and also result in better engine performance. Do not use a plug so cold that the spark will jump between the center electrode and the shell of the plug, for this will cause the engine to mis-fire.

All parts of the special F-6 magneto are the same as the standard F-6 magneto except for the coil, frame, secondary leadout, rotor and the setting of the breaker points.

Distributor Shaft and Bearing

After the distributor gear is properly meshed with the rotor pinion as mentioned on Page 17, Illust. 27, see that the teeth have a very slight amount of clearance so that no radial pressure is exerted on the distributor shaft bearing. Use shims under the bearing bracket, if necessary, to provide this clearance.

The distributor shaft end play should not be more than .014" or less than .003"; preferably .003". The reason for this is that excess end play at this point allows the distributor disc to travel back and forth, causing more or less uneven brush pressure and creating excessive wear on the disc brush track. This end play may be adjusted by placing special shim washers Number 12588-C which are .004" thick and Number 12589-C which are .008" thick, between the retainer spring and the rear thrust washer.

Effective with F-4 Serial No. 409158 and F-6 Serial No. 34967, the bushing in the distributor bearing is changed to a porous bronze which permits oil to filter through from oil passage. Oil passage is also changed to a short lead over the bushing, eliminating the oil wick and cork.

Primary Lead-Out

The primary lead-out fastening and positioning on the condenser end has been described under "The Condenser" (Page 15). This wire carries the primary current from the winding to the breaker. It is made of carefully insulated stranded copper wire chosen for its long fatigue life when flexed repeatedly. It is long enough so that the circuit breaker may be removed and examined without disconnecting at the breaker end. When the breaker is replaced, this extra length of wire should be tucked under the primary lead-out shield 21331-D in the magneto frame.

Distributor Disc

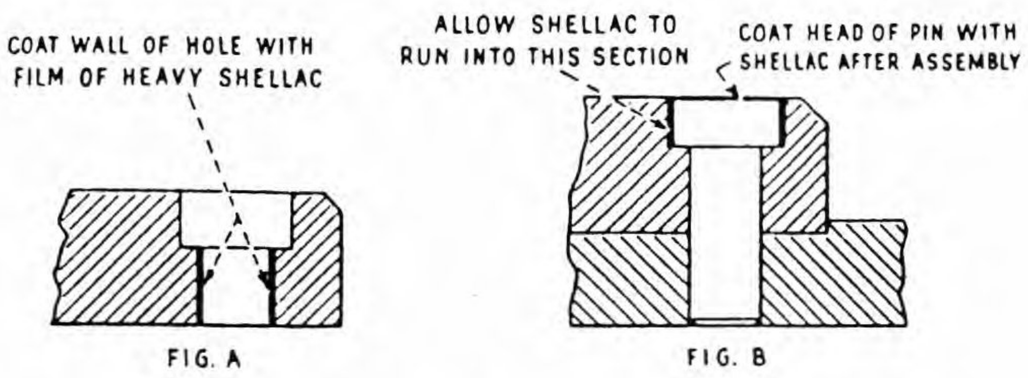
The distributor disc and brushes should be examined periodically and the disc should be kept clean. Disc can be cleaned with a soft rubber eraser which is free of grit and abrasives and will not scratch disc surface. If the disc becomes badly worn it may be replaced on the F-4 by driving out three bakelite pins that hold the disc to the gear, and on the F-6 by removing three bakelite screws that hold the disc to the distributor block. When replacing the bakelite pins or screws the heads should be given a light coat of shellac. This will help prevent them from loosening and seals them against the possibility of changing shape from the effects of moisture. The pins on the F-4 magneto must be a tight fit in the distributor gear and a close push fit in the disc.

When the brushes and the disc are properly related the brush track will wear very slowly; it will be polished and reasonably smooth. If other than this condition exists, check the gaskets for moisture entrance, or dirt entry, and be sure that the proper brushes are used.

If the magneto has been operating with the proper spark advance in relation to the distributor gear setting, a slightly blackened condition ("spark spot") will exist on the insert at the

leading end of the brush contact. If the magneto has been operating with the spark not properly advanced, this blackened spot will be at the center of the insert. The longest life of the distributor disc can only be secured by the proper timing and the exclusion of all water.

When replacing a distributor disc, the distributor disc pin should first be pushed into place in the disc before final assembly to the gear. Check the clearance between the body diameter of the pin and the hole in the disc. If any excessive amount of clearance exists, the disc may eventually come loose after assembly and cause excessive disc and brush wear which may result in faulty performance of the magneto.



ILLUST. 29--INSTALLING NEW DISTRIBUTOR DISC PIN.

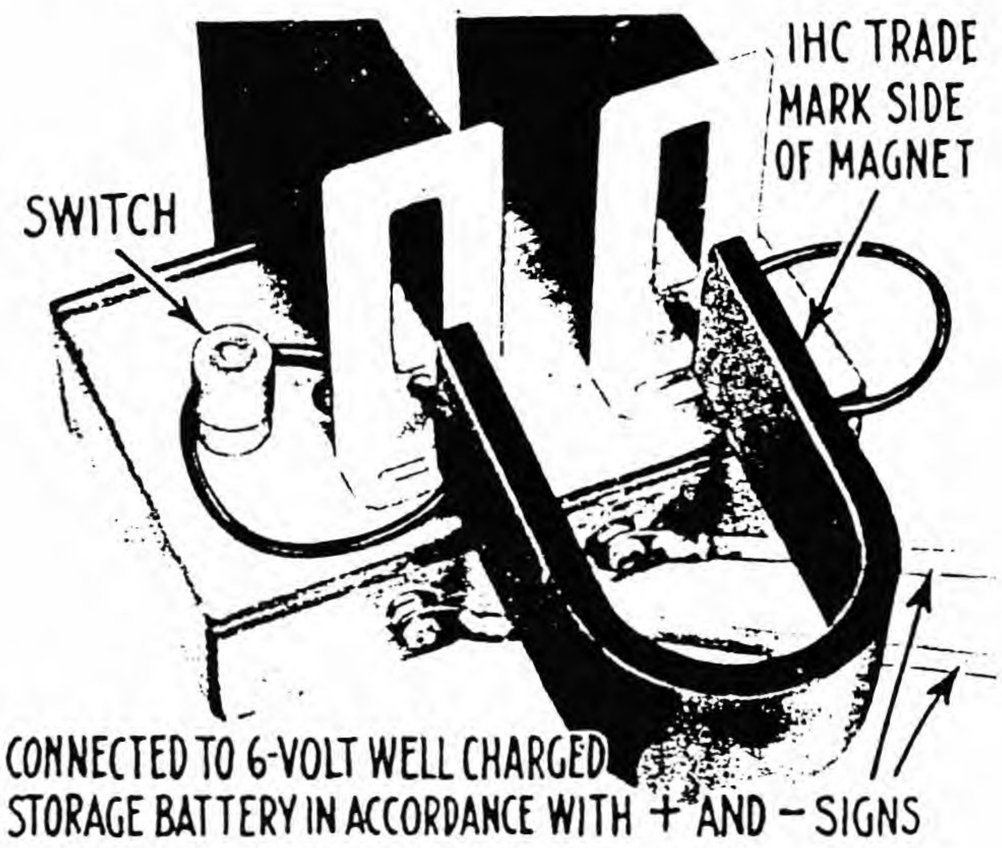
To correct such cases where excessive clearance exists the following procedure should be used. Coat the hole in the disc with a film of heavy shellac as shown in sketch Fig. "A". Allow the shellac to dry thoroughly. Place disc on gear. Coat pin with shellac and drive into place through the disc and into the gear. Be careful not to strike the disc in doing this since the disc may readily be cracked. Then coat the head of the pin with shellac allowing same to run into the space between the head and the counter bore in the disc, (see sketch Fig. "B"). Wipe off excessive shellac from the face of the disc. Be absolutely certain that no shellac remains in the brush path. This procedure if carefully followed will give an assembly which will remain tight indefinitely.

Distributor Brushes

These brushes have to be of the proper material to match the disc they are rubbing against. This material has been worked out for each magneto by test. Be sure that E4A brushes are not used in F-4 magnetos. The E4A brush is grooved lengthwise and the F-4 has no groove. The latest and most successful F-4 brush (No. 32032 DXa) has a flat spot on the neck for holding the brush spring. The latest and most successful F-6 brush is the new National Carbon grade, lettered "FK" on the side. (See Illust. 13.) These brushes run relatively clean and are less aggressive than earlier brushes.

Charging F-4 or F-6 Magnet

Unless a magnet is cracked by rough handling, it usually improves with age, but it loses a little of its magnetism gradually. Always recharge the magnet during an overhaul. It is a good investment.

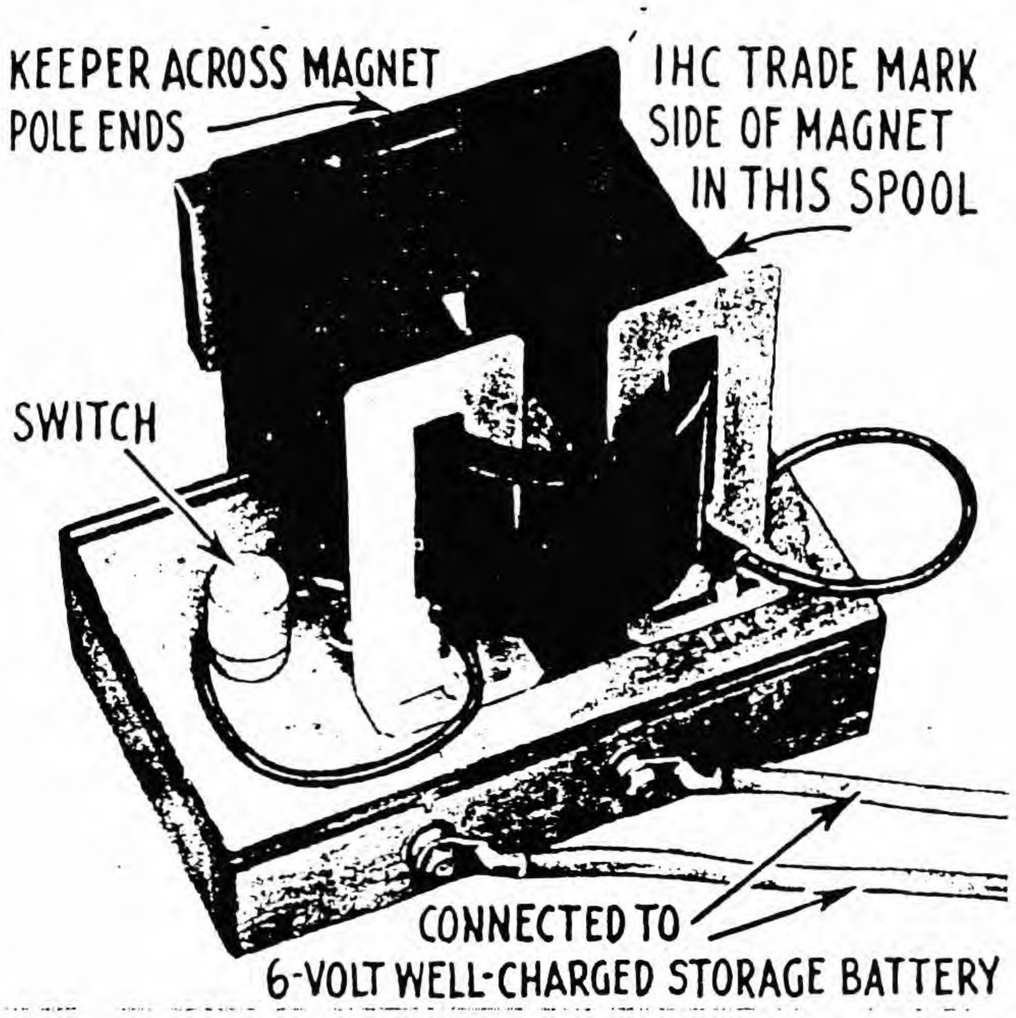


ILLUST. 30--SHOWING PROPER METHOD OF INSERTING F-4 AND F-6 MAGNETO IN SPOOL TYPE CHARGER.

Magnetizer terminals are identified + and - , and must be so connected to a well-charged 6-volt storage battery. The terminals are at the front of the magnetizer, and magnet should be inserted into spools from this end, with IHC trade-mark on right; magnet will be magnetized in accordance with original factory polarity. If magnet has no I H C trade-mark, hold magnet in front of spools and depress switch an instant. (See Illust. 30.) Magnet is being inserted properly if magnetizer tends to pull it into spools.

Push magnet all the way into spools and place keeper over ends. (See Illust. 31.) Compress magnetizer switch once or twice for total of about two seconds. To keep switch depressed longer accomplishes no further good, but discharges battery unnecessarily and heats up magnetizer.

Slide keeper downward off ends of magnet, pull magnet from spools and immediately assemble on magneto. Never slide keeper up on side of magnet, as

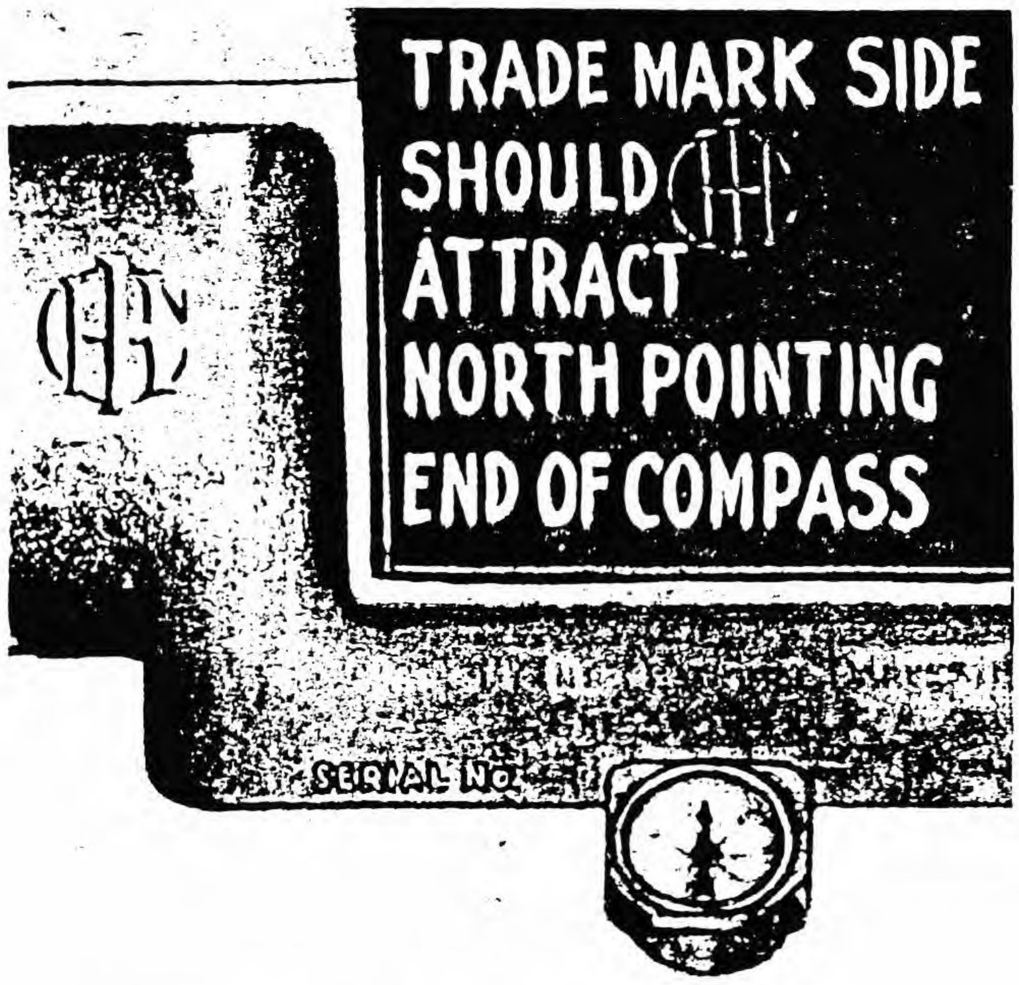


ILLUST. 31--RECHARGING MAGNETO MAGNET ON SPOOL TYPE CHARGER.

this will result in partial demagnetization.

To check for correct polarity, the north seeking pointer of a compass should point to the I H C trade-mark side of the magnet. Place a soft iron keeper across the magnet ends when magnet is removed from the magneto.

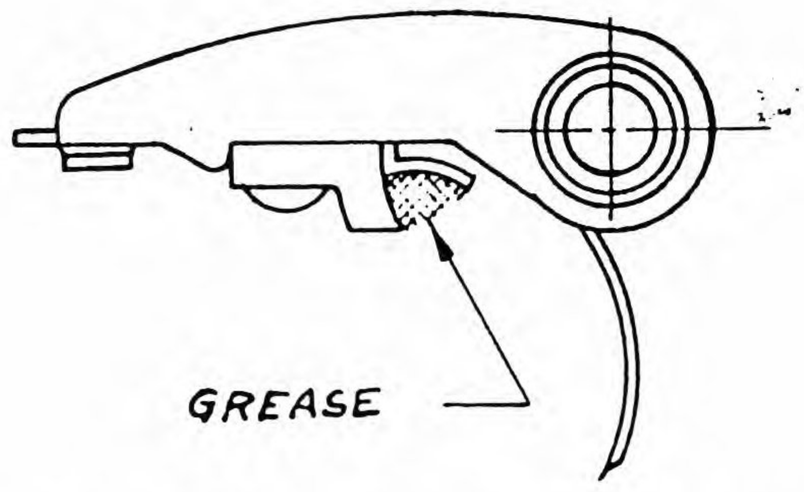
Because all the sparks of the F-4 magneto are of the same polarity it is essential that the magnet be assembled correctly. The trade-marked end of the magnet must be on the same side as the serial number on the magneto frame. This trade-marked end of the magnet should always attract the North pointing end of the compass. (See Illust. 32.) This makes the polarity of the stationary breaker point positive and, with a condenser of the proper capacity, the slight crater or depression caused by the normal spark action between the points will always be on the stationary point. The peak will build up on the movable point. This means that the cheaper of the two points will be the one that will have to be replaced when such replacement is required. The peak may easily be removed from the movable point, which will make it the same as new.



ILLUST. 32--SHOWING PROPER ASSEMBLY OF MAGNET ON F-4 MAGNETO. TRADE-MARK ON SAME SIDE AS SERIAL NUMBER.

The effectiveness of the F-4 safety gap is also dependent on correct magnet polarity, so be sure to make this assembly correctly.

Breaker Points



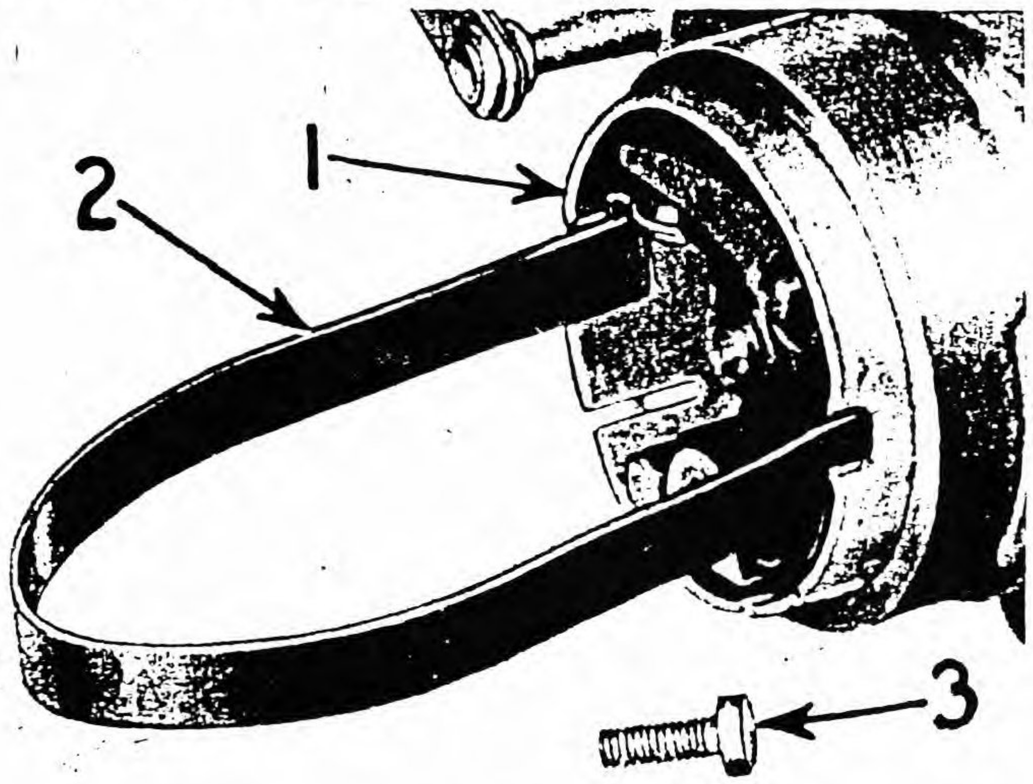
ILLUST. 33--WHERE MAGNETO GREASE SHOULD BE PLACED ON BREAKER ARM TO LUBRICATE RUBBING FIBER.

The breaker point life may be very materially increased by keeping the breaker arm rubbing fiber properly lubricated with the long life grease furnished in a tube with each magneto. Also keep points set to gauge. Wide point settings burn contacts rapidly.

The breaker point setting, that is the distance between the points in their wide-open position, is .013" in the F-4 and .020" in the F-6. This setting should be maintained as close as possible for maximum efficiency and checked periodically. See that the points are reasonably flat. File them a little if uneven point contact is formed. (See Breaker Adjustment, Page 9, Illust. 10.)

Breaker Cup Removal

A simple tool for removing the circuit breaker cup may be made from a discarded flat impulse coupling spring.



ILLUST. 34--HOW TOOL IS USED TO REMOVE BREAKER CUP. 1--BREAKER CUP. 2--SPRING TOOL. 3--PRIMARY LEAD-OUT TERMINAL SCREW.

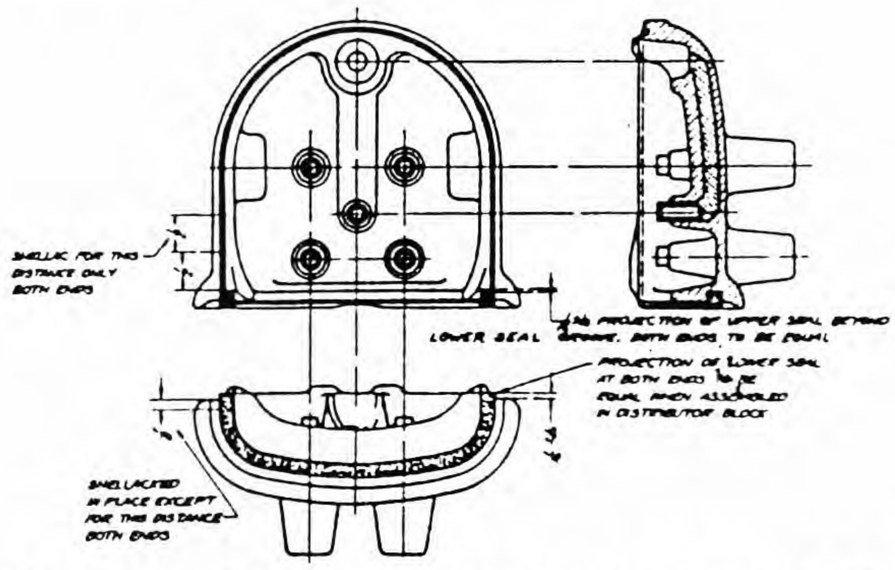
Bend the spring into a "U" shape and turn a short lip at a right angle on both legs of the "U". These two lips should be long enough to hook in back of the bent over lips on the breaker cup slots which are used to move the cup to advance or retard the spark.

To remove the breaker cup, first remove the primary lead-out terminal screw. A light blow on the head of this screw after it has been loosened about two turns will free the lead-out terminal and facilitate the breaker cup removal. The breaker cup must be positioned so that the slot in the rear of the cup registers with the pin which is a stop for the advance and retard action. A light pull on the puller, as shown in Illust. 34, will then remove the breaker cup.

Distributor Block and Gaskets

For satisfactory performance of a magneto, water should not be permitted to find its way to the inside. The F-4 and F-6 magnetos have for some time been fitted with distributor block gaskets of waterproof construction. This is being done in two ways, one by waterproofing the felt, and the other by applying a narrow lamination of artificial rubber in the gasket to prevent seepage from working through.

In wet localities see that these gaskets are used in case ignition troubles



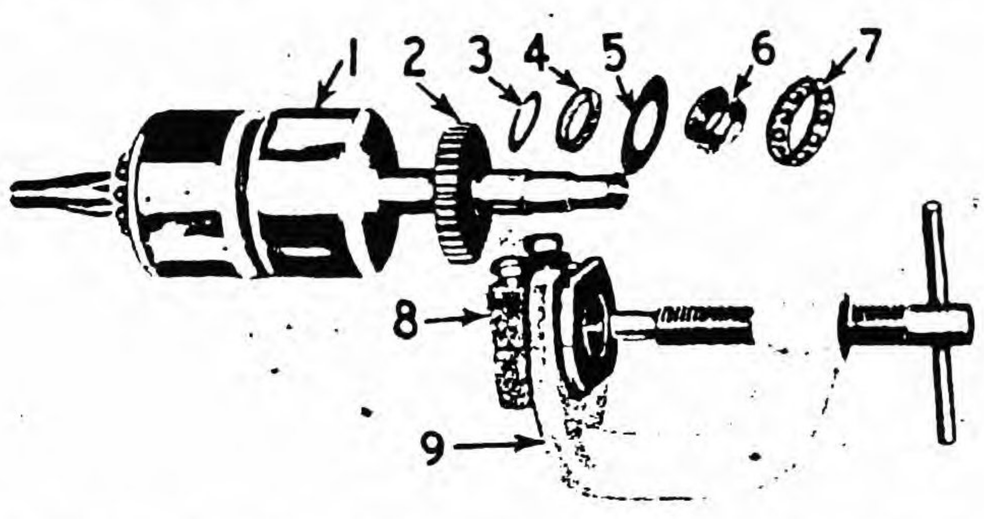
ILLUST. 35--PROPER METHOD OF ASSEMBLING DISTRIBUTOR BLOCK GASKETS.

are experienced. Assemble them as shown in Illust. 35.

Keep the outside of the distributor block clean of mud and water. Some soils produce a mud that is a very good conductor of electricity. With the exterior surfaces of the distributor block coated with such material, the electrical losses may readily reach values that jeopardize ignition, especially when starting is attempted.

Removing F-4 or F-6 Rotor from Magneto Frame

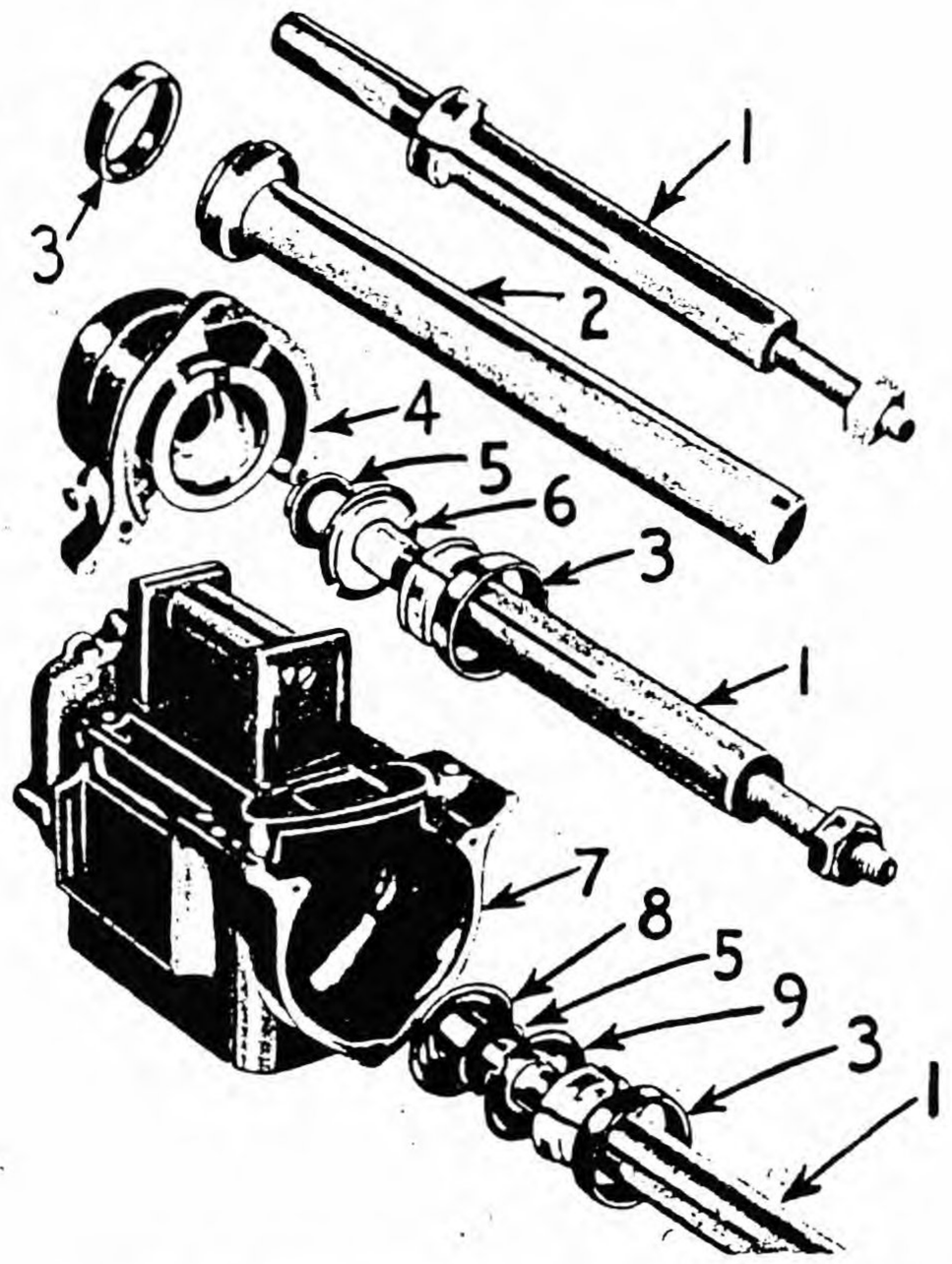
To remove the rotor from either of these magnetos, first remove the impulse coupling. Use puller SE-912 to avoid injury to the rear of the magneto frame. Then take off distributor block, magnet, magneto frame cover, distributor disc, bearing assembly, and breaker housing cover. Remove primary lead-out terminal screw and three breaker housing screws. Breaker housing can then be removed from magneto frame and rotor taken from frame.



ILLUST. 36--EXPLODED VIEW OF ROTOR PARTS WITH INNER RACE PULLER TOOL SE-839. 1--ROTOR. 2--ROTOR PINION. 3-ROTOR SHIMS. 4--ROTOR SHAFT BEARING SPACER. 5--OIL FLINGER. 6--INNER BEARING RACE. 7--BALL BEARINGS AND SEPARATOR ASSEMBLY. 8--BEARING RACE ADAPTER. 9--PULLER.

Inner bearing race can be readily removed from the rotor by using puller and adapter SE-839, shown in above illustration. It is necessary to remove inner bearing race when removing or inserting rotor shims for preloading rotor bearings as explained on following page.

Removing and Replacing Magneto Outer Bearing Race



ILLUST. 37--TOOLS USED FOR REMOVING AND REPLACING MAGNETO OUTER BEARING RACES.
1--MAGNETO BEARING RACE PULLER TOOL SE-1020. 2--MAGNETO BEARING RACE REPLACER TOOL SE-1021. 3--OUTER BEARING RACE. 4--BREAKER HOUSING. 5--FELT. 6--FELT RETAINER, BREAKER HOUSING END. 7--FRAME. 8--FELT RETAINER, OUTER. 9--FELT RETAINER, INNER.

Magneto outer bearing race in both breaker housing and magneto frame can be readily removed with tool SE-1020 as shown in illustration. Loosen expander and insert tool into bearing race in the direction shown. Manipulate split sleeve flange through bearing race and hold it against felt retainer. Now draw up on expander by applying a wrench to flats on threaded end of expander and turning in an anticlockwise direction until a definite pressure is felt. Then tighten hexagon nut, and carefully drive bearing race from place.

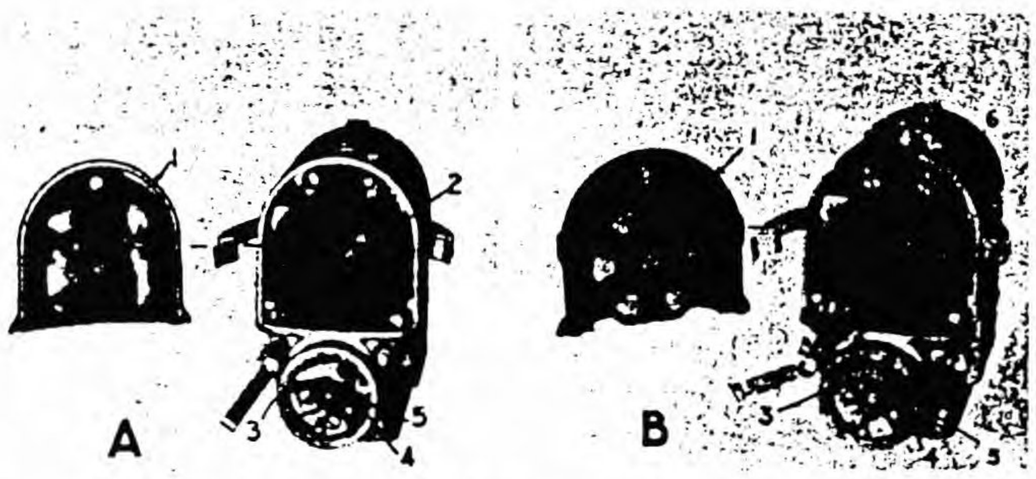
Before replacing outer bearing races make sure felts and retainers are correctly assembled in place. Set bearing race on end of tool SE-1021. A small amount of clean grease will hold race on tool. Carefully line up tool over hole and drive race in place.

Preloading Rotor Bearings

In order to maintain the nigh efficiency of this type of magneto, it is necessary to reduce the air gaps in the magnetic circuit to a minimum. To do this, the rotor clearance is held close. A small amount of end play would allow the rotor to rub, due to the construction of the ball bearings. They are made to take lateral as well as radial load.

To avoid any possibility of the bearings becoming loose, we preload them from .000 to .002" lengthwise. To do this, assemble the rotor with just enough shims to set the end play at nothing, or a point where no perceptible play can be felt and still be free. This is to be tried with the rotor in the frame and the bearing housing in place and all the screws in and tight. The bearings should be free of grease and oil to get an accurate fit. Then remove the bearing housing, bearing inner race and flinger, and add one .002 or .0025" shim. (See Illust. 36.) The washer shims should be between the inner race and the gear on the rotor shaft. After this setup is completed be sure that the shaft does not bind and that the preloading was all done with the last placed shim of .002 or .0025". Too much preloading will ruin the bearing. Some relief to these bearings is provided as soon as the magneto starts to warm up on the engine. The aluminum frame expands more rapidly than the steel rotor shaft and thus relieves the preloading to a large degree.

Timing Magnetos to Engine



ILLUST. 38--(A) TIMING INTERNATIONAL F-4 MAGNETO TO ENGINE. (B) TIMING INTERNATIONAL F-6 MAGNETO TO ENGINE.
1--DISTRIBUTOR BLOCK. 2--DISTRIBUTOR DISC SEGMENT DELIVERING SPARK TO NO. 1 CYLINDER. 3--BREAKER POINTS JUST OPENING. 4--GROUND CONTACT SPRING AGAINST BREAKER STOP. 5--BREAKER STOP. 6--DISTRIBUTOR BRUSH SET FOR DELIVERING SPARK TO NO. 1 CYLINDER.

With the breaker points cleaned and adjusted as outlined on Page 9, replace breaker housing cover, move the lever end up as high as it will go and remove the cover. This places the breaker assembly in full retard position with ground contact against breaker stop. In this position the magneto will deliver no spark.

Secure the magneto in place on the magneto bracket by inserting the magneto base screws loosely in the magneto. Do not use base screws longer than the originals as they will damage magneto.

Place No. 1 piston of engine on firing dead center. Compression stroke can be determined by removing No. 1 spark plug, placing the thumb over the opening and cranking engine until an outward pressure is felt. Then line up "DC" mark on flywheel with mark on flywheel housing.

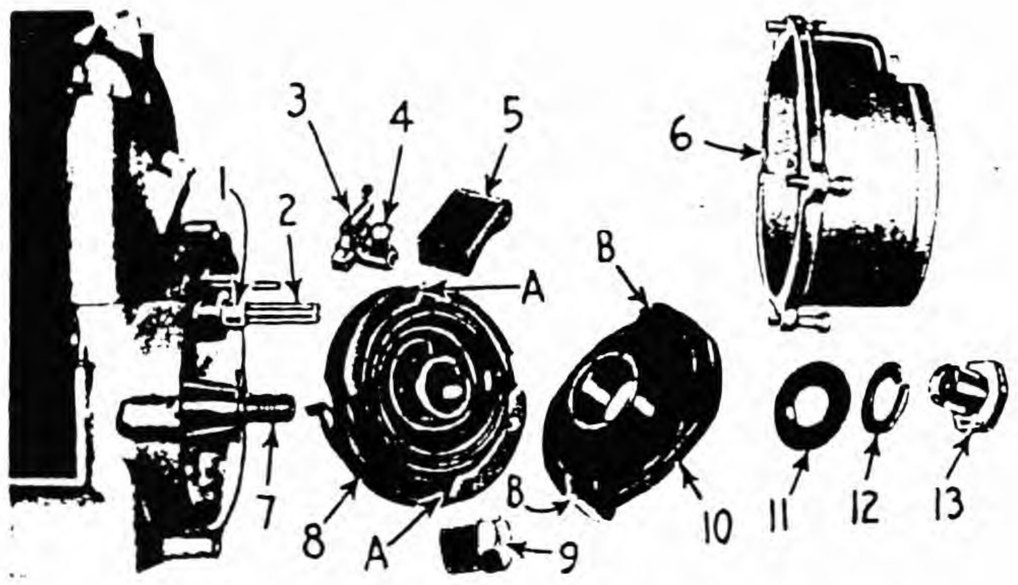
Release the impulse coupling as explained on Page 25. This makes it inoperative. Remove the two coupling cap screws and shims. Take off distributor block. Grasp the magneto half of adjustment coupling and rotate it clockwise (as viewed from the coupling end) until distributor disc on the F-4 magneto or distributor brush on the F-6 magneto are in the position shown above, with the breaker points just starting to open.

The magneto is now correctly timed. Without changing this position, replace the magneto drive coupling cap screws and shims. The coupling is so made that only two holes line up exactly opposite each other; the cap screws must not be forced or the setting will be incorrect.

Tighten magneto down in place on magneto bracket, replace distributor block, breaker housing cover, and spark plug cables.

How the International F-Type Impulse Coupling Works (See Illustrations 39 and 40)

A brief description of how the F-type impulse coupling operates follows: The cam member (10) is locked to the magneto drive shaft on the engine and always rotates steadily at a definite ratio to the engine speed. The magneto member (8), with drive spring and engaging pawls, is keyed to the magneto rotor shaft driving end (7). Cam member and magneto member are connected by a spiral drive spring, shown in magneto member (8), Illust. 39.



ILLUST. 39--EXPLODED VIEW OF F-4 TYPE IMPULSE COUPLING.
1--PAWL SPACER. 2--PAWL PIN. 3--PAWL LATCH SPRING.
4--ENGAGING PAWL LATCH. 5--PAWL. 6--COUPLING COVER.
7--MAGNETO ROTOR SHAFT. 8--MAGNETO PAWLS WITH ENGAGING PAWLS AND DRIVE SPRING. 9--IMPULSE COUPLING PULLER, SE-912.
10--CAM MEMBER. 11--WASHER. 12--LOCK WASHER.
13--COUPLING NUT.

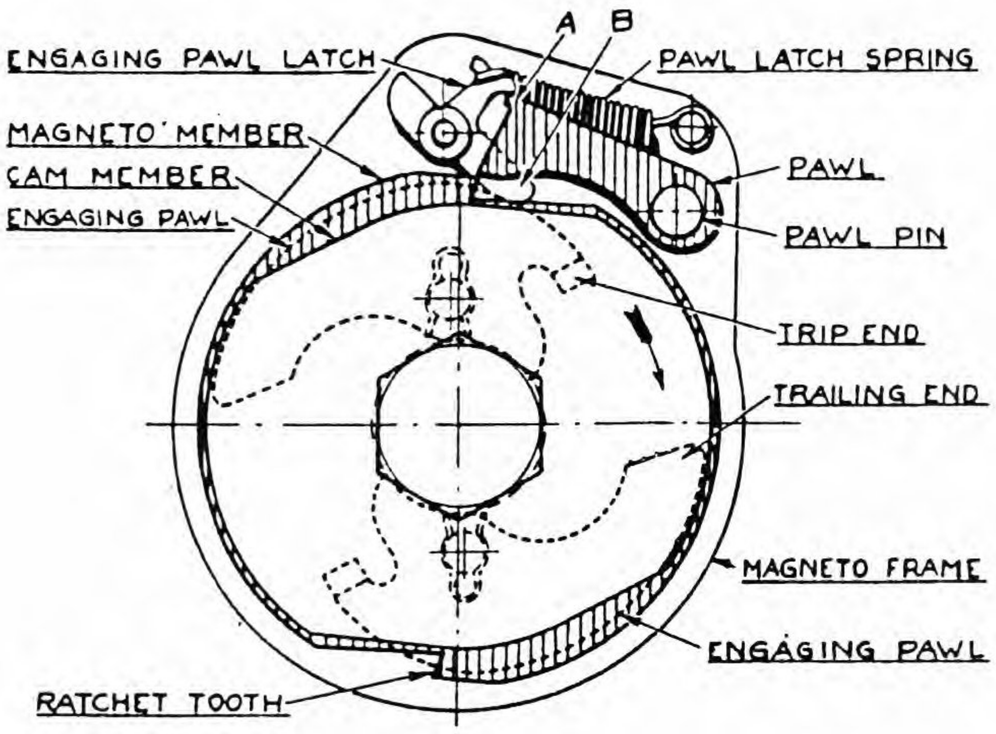
As the cam member and magneto member rotate slowly, a pawl (5), which pivots on a pawl pin (2) mounted to the magneto frame, engages in the upper ratchet slot in magneto member and prevents magneto member from turning. Cam member continues to turn and winds up drive spring for approximately 46° on the F-6 magneto and 64° on the F-4 magneto. Pawl is then tripped from ratchet slot by cam member (10). Spiral drive spring unwinds, hurling magneto member unit and rotor rapidly forward until end of milled slots (A) in magneto member strike lugs (B) on cam member Illust. 39. Complete coupling will then rotate at same speed as a unit until pawl catches on following ratchet slot. There are two equally spaced ratchet slots in the magneto member of the F-4 magneto coupling and four ratchet slots in the F-6 magneto coupling. Tripping of the pawls is timed so as to cause a spark to occur between top dead center position to 8° after dead center, provided magneto is timed correctly to the engine.

Impulse Coupling—General

A magneto is capable of delivering suitable sparks at higher speeds, but for slower speeds and for starting, it is necessary to drive the rotor or armature through an impulse coupling. This impulse coupling permits the production of a strong magneto spark at the slowest cranking speeds. The impulse couplings furnished with the International F-4 and F-6 magnetos are completely automatic and require no adjustment or manual engaging or disengaging An occasional cleaning and generous lubrication with cream separator oil is the secret of satisfactory impulse coupling performance.

The following section of this Manual covers the F-type impulse coupling and the E4A type impulse coupling furnished with either the International F-4 or the F-6 magnetos.

INTERNATIONAL F-TYPE IMPULSE COUPLING



ILLUST. 40--END VIEW DRAWING OF F-4 TYPE IMPULSE COUPLING.

The impulse coupling on the F-4 magneto is designed to automatically throw out at 180 to 280 R.P.M., the F-6 at 130 to 200 R.P.M., and the F-4 Diesel at 60 to 130 R.P.M. As the speed of the impulse coupling increases, the cam member disengages the pawl from the ratchet teeth with greater force. When the throw-out speed is reached the pawl is thrown high enough to catch latch tip under pawl ledge "A", Illust. 40. In this position pawl is supported out of engagement and the coupling rotates as a single unit, turning the magneto rotor at a steady speed with the engine. When the impulse coupling speed is reduced to between 125 to 145 R.P.M. on the F-4 and F-6 magnetos, and between 75 to 90 R.P.M. on the F-4 Diesel magneto, the coupling automatically comes into operation again. As the throw-in speed is reached, the trailing ends of the engaging pawls which are the heavier, drop down on the magneto member hub when passing over the center of rotation. By so doing the trip ends raise to a position where they will strike lower arm of engaging pawl latch "B", Illust. 40, releasing latch from pawl. Pawl then drops into working position and impulse coupling is again in operation.

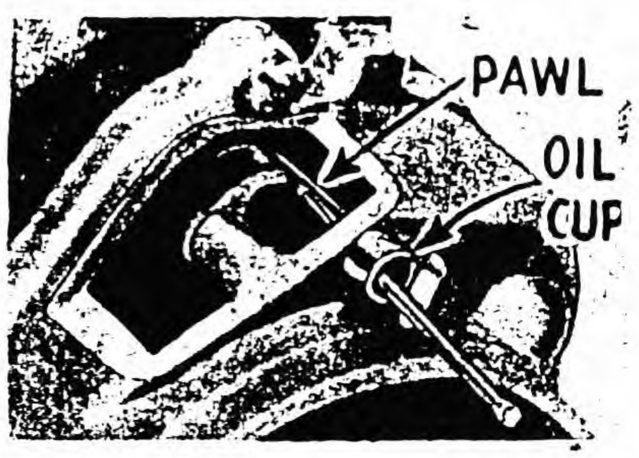
Release F-Type Impulse Coupling for Timing Without Timing Hook

A timing hook has been provided on the earlier types of F-type impulse coupling to free the coupling for timing. By lifting the timing hook, the pawl lifts out of engagement and a pawl latch holds it in that position. Magneto can then be turned freely for timing. To engage the impulse coupling, push the timing hook in and turn the impulse coupling until pawl drops.

Release F-Type Impulse Coupling for Timing Without Timing Hook



ILLUST. 41--SHOWS HOW MAIN PAWL CAN BE LIFTED, DISENGAGING THE IMPULSE COUPLING FOR FREE ROTATION DURING TIMING.



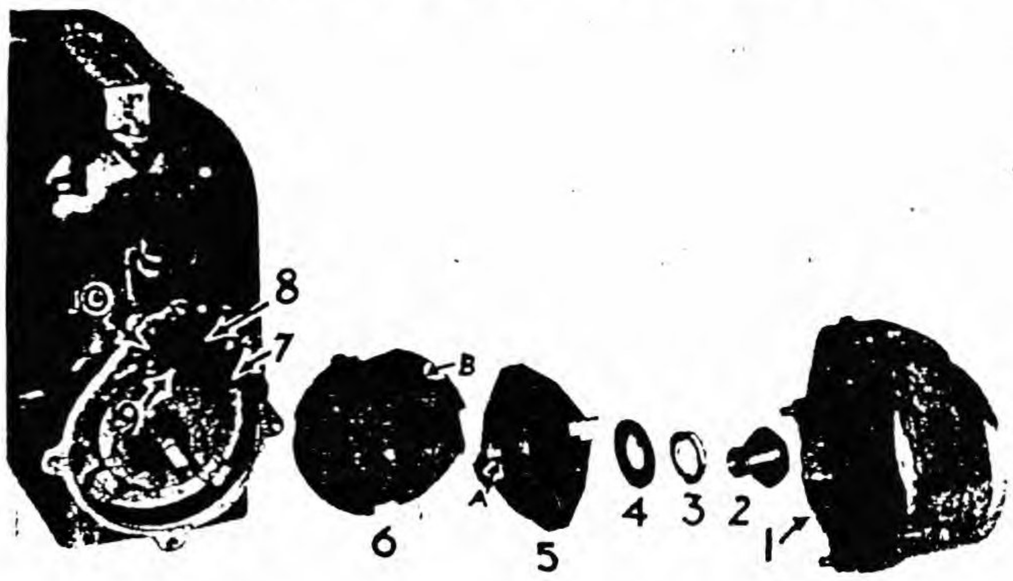
ILLUST. 42--SHOWS HOW LATCH IS TRIPPED, ALLOWING PAWL TO DROP IN OPERATING POSITION.

The timing hook has been removed from the later magnetos and the oil cup position has been changed in the impulse housing to a point where it can be used for a double purpose. First, to furnish an opening for lubricating the impulse coupling and, second, to furnish an opening through which the main pawl may be lifted to allow rotation of the magneto without the impulse action during the timing operation. By manipulating a light finishing nail through the oil cup as shown in Illust. 41 and 42, the pawl may be lifted for free rotation during timing.

By placing the nail in the position shown in Illust. 41 and prying downward on the outer end, the pawl may be lifted and the latch will hold it up. It may be necessary to turn the rotor (or rotate the magneto) to a point just past the trip of the impulse to accomplish the lifting of the pawl. If the pawl is in the low position and the impulse spring is partly wound up, it will be impossible to move it with the nail.

To return the pawl to the operating position, place the nail in the position as shown in Illust. 42 and press down on the outer end of the nail to lift the latch.

Dismantling F-Type Impulse Coupling



ILLUST. 43--F-TYPE IMPULSE COUPLING DISMANTLED FROM THE MAGNETO.

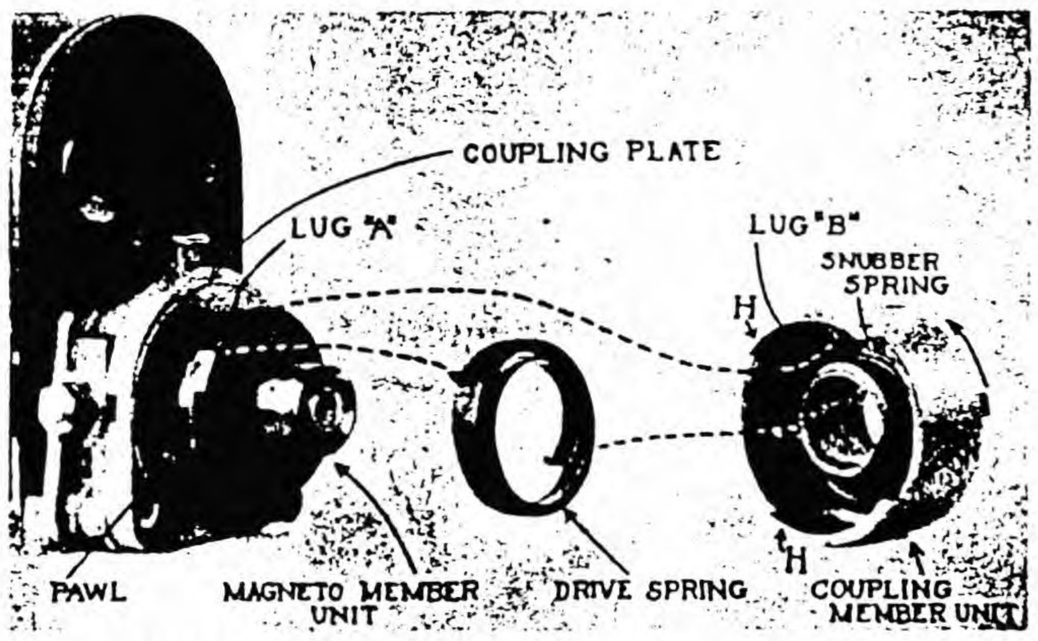
To remove the coupling member (6) start puller SE-912 in the threads (See Illust. 39, Item 9), then lock the member with pawl (7) and screw the puller until considerable effort is required to turn it. If the impulse has been allowed to stand or operate without sufficient oil, coupling member (6) is likely to be rusted and stuck on the shaft. It may be necessary to use two screw drivers, one from each side between the coupling and the magneto frame, and to hit the puller SE-912 a rather hard blow, at the same time exerting pressure on the screw drivers. Care must be used when this condition exists to remove the member without damaging the threads or the magneto frame.

To separate cam member from magneto member, pull outward until lugs clear, let unwind about one-half turn, and then remove. Drive spring can be easily pried out with a screw driver. In replacing spring, first hook it into position at "B", being sure it will wind in the direction shown. Wind the spring into position, using the right hand to push it gradually down and the left hand to hold the wound coils in place.

When assembling the coupling be sure that the hub of magneto member (6) is clean and well oiled, and if the latch spring (8) is rusty, replace it with a new one. Couplings must be oiled generously with cream separator oil at regular intervals. When the weather is extremely cold, kerosene should be used.

The earlier engaging pawls were held on the pawl pin by cotter pins. Be sure that these cotter pins are tight. If they are loose they will soon wear and drop out. Replace these cotter pins if they show any signs of wear. At present snap rings are used to hold these pawls on. They must be tight on the pawl pins when in place, otherwise they will wear and fall off. This causes a general wreckage of the magneto frame.

How the International E4A Impulse Coupling Works

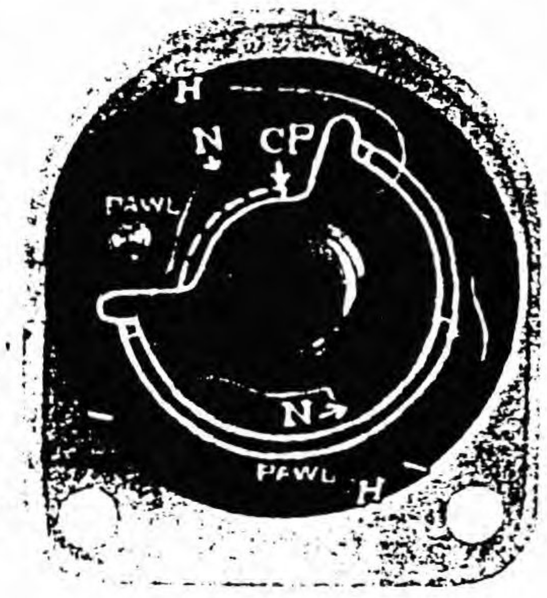


ILLUST. 44--E4A IMPULSE COUPLING PARTIALLY DISMANTLED TO SHOW HOW IT WORKS.

Following is a brief description of how the E4A Impulse Coupling operates: The coupling member unit (Illust. 44) is locked to the magneto drive shaft and always rotates steadily at engine speed. The magneto member unit is keyed to the armature driving end. These two units are connected to the drive spring as indicated in Illust. 44.



ILLUST. 45
PAWL ENGAGED AND ABOUT TO BE TRIPPED BY LUG "H"



ILLUST. 46
CENTRIFUGAL FORCE HOLDS PAWLS OUT OF ENGAGEMENT AT SPEEDS GREATER THAN 100 R.P.M.

Attached to the back of the magneto member unit are two pawls (Illusts. 44, 45, and 46). When the engine is turning at less than 100 R.P.M., gravity causes the uppermost pawl to catch the coupling plate at "CP", Illusts. 45 and 48, in notch "N", Illust. 45. This prevents the magneto member from turning until lug "H" of the steadily rotating coupling member trips the pawl by hitting its tail as shown in Illust. 45.

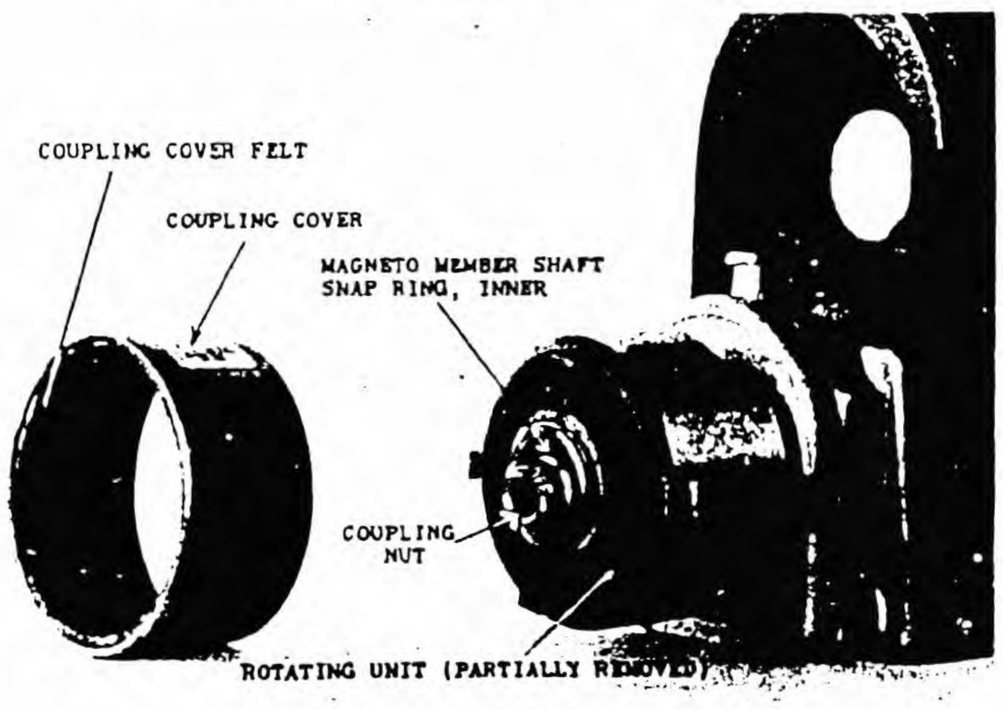
INTERNATIONAL E4A TYPE IMPULSE COUPLING

In the meantime, the drive spring has been wound up almost one-quarter revolution. Therefore, when the pawl is tripped, this spring unwinds, hurling the magneto member unit and rotor rapidly forward. Then, in the next one-half revolution, the second pawl comes to the top, catches, is tripped and the magneto armature is again hurled rapidly forward. Tripping of the pawls is timed so as to cause a spark when engine is on dead center or from dead center to 8° after dead center, provided the magneto is properly timed to the engine.

The snubber spring acts as a cushion against the impact of lugs "A" against lugs "B", Illust. 44, after the magneto member unit and rotor have been hurled forward by the drive spring. Cushioning movement of the snubber spring is limited by lug "L" which fits into groove "G", Illust. 53.

When the engine runs at a speed greater than 160 to 180 R.P.M., the centrifugal effect on the pawls is sufficient to hold them firmly against the inside of the two lugs "H" as in Illust. 46, so that notches "N" fail to catch at "CP". All parts of the coupling then rotate as a single unit.

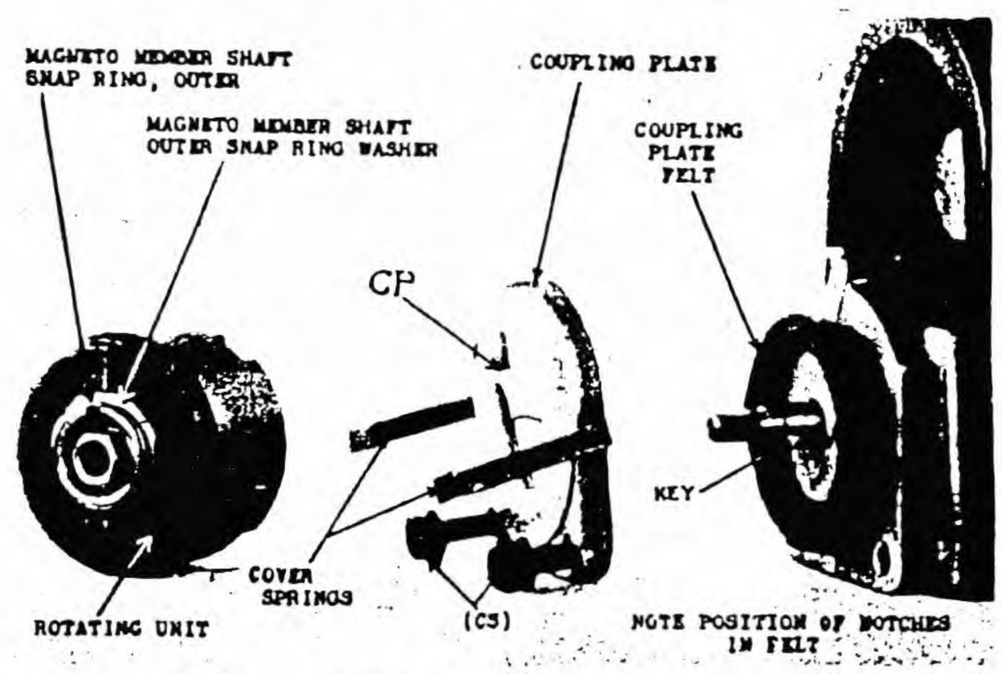
Dismantling E4A Type Coupling



ILLUST. 47--ROTATING UNIT IS PULLED OFF BY UNSCREWING COUPLING UNIT.

1. Release the two cover springs and remove coupling cover Illust. 47. Examine the coupling cover felt. If a new felt is necessary, remove old felt, clean coupling cover of all dirt, oil and grease and shellac new felt in place.

2. Using a 9/16" socket wrench, with a socket having an outside diameter of not more than 25/32", unscrew the coupling nut, Illust. 47, from the rotor driving end. While the nut is being unscrewed, its shoulder will bear against the magneto member shaft snap ring, inner, and will pull off the rotating unit.

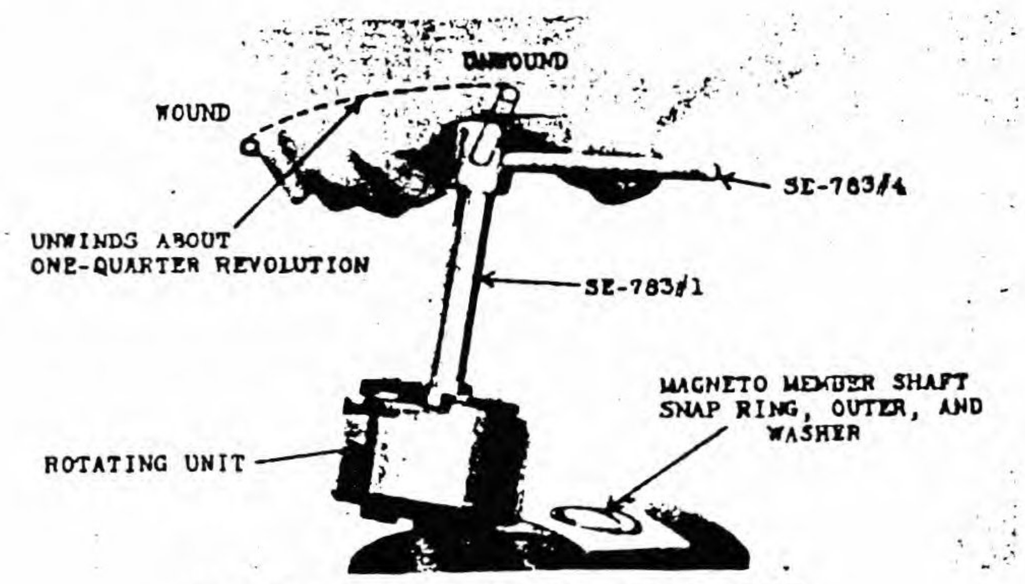


ILLUST. 48--ROTATING UNIT AND COUPLING PLATE REMOVED.

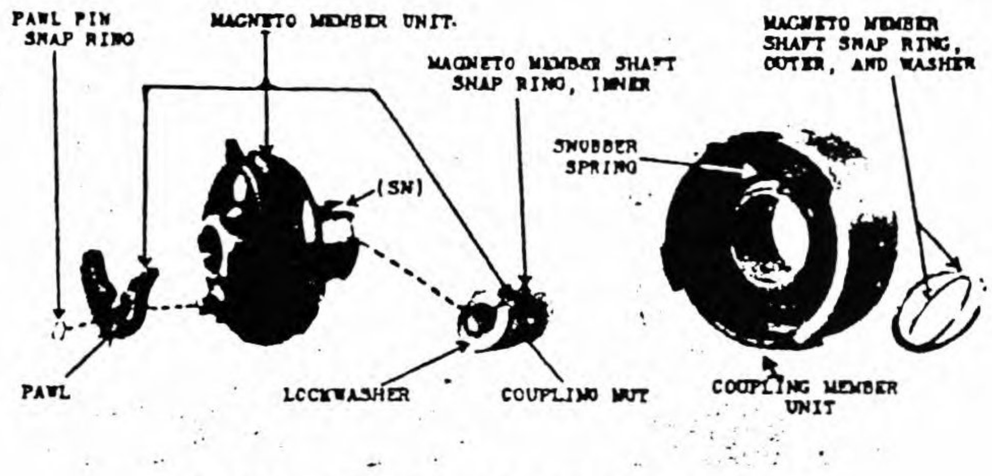
3. Should it be necessary to remove a pawl, this can be done after the pawl pin snap ring has been pried off. (See Illust. 50).

4. To separate the coupling member unit from the magneto member unit (see Illust. 50), first pry off the magneto member shaft snap ring, outer (Illusts. 48 and 49), and remove it and its washer. Place the rotating unit in a vise as shown in Illust. 49, and insert winder SE-783 No. 1. Turn winder clockwise with handle SE-783 No. 4 just enough to release pressure of lugs "A" against lugs "B", Illust. 44, and at same time press upward on the coupling nut as shown in Illust. 49.

When the magneto member has been pushed upward to the height shown, lugs "A" and "B" will clear each other. Carefully permit the drive spring to unwind. In unwinding, the spring will move handle SE-783 No. 4 counterclockwise as indicated in Illust. 49. The magneto member unit and coupling member unit can then be separated.



ILLUST. 49--SEPARATING MAGNETO UNIT FROM COUPLING UNIT.

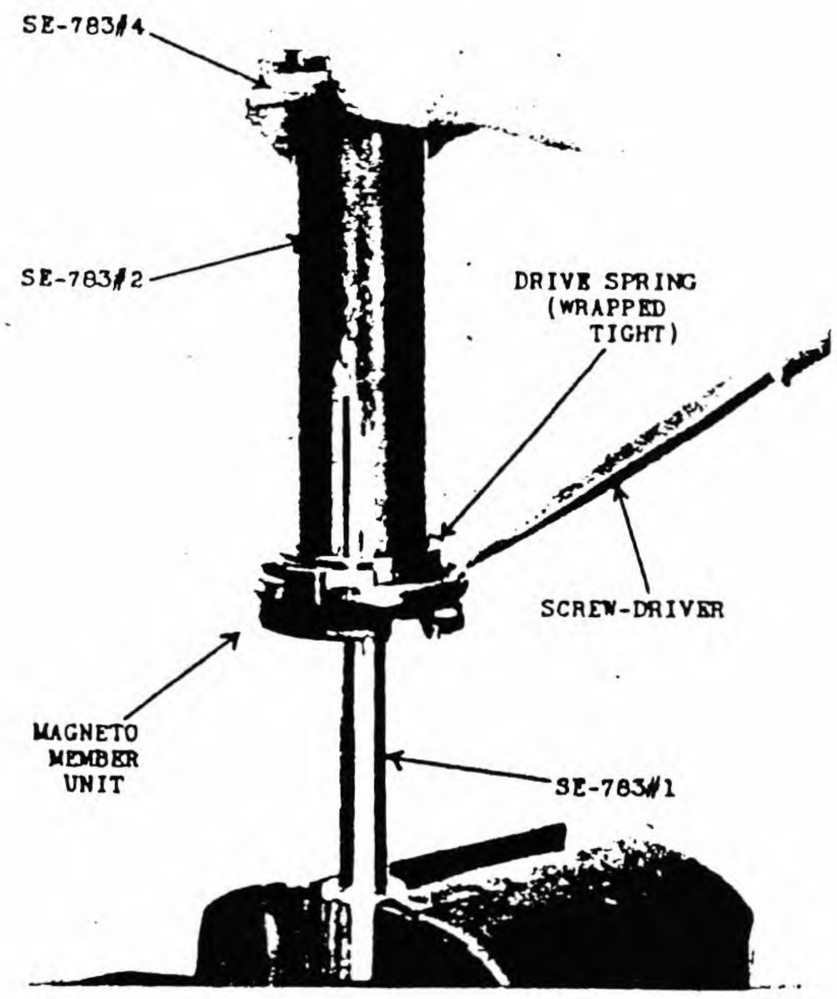


ILLUST. 50--MAGNETO MEMBER UNIT AND COUPLING MEMBER UNIT SEPARATED.

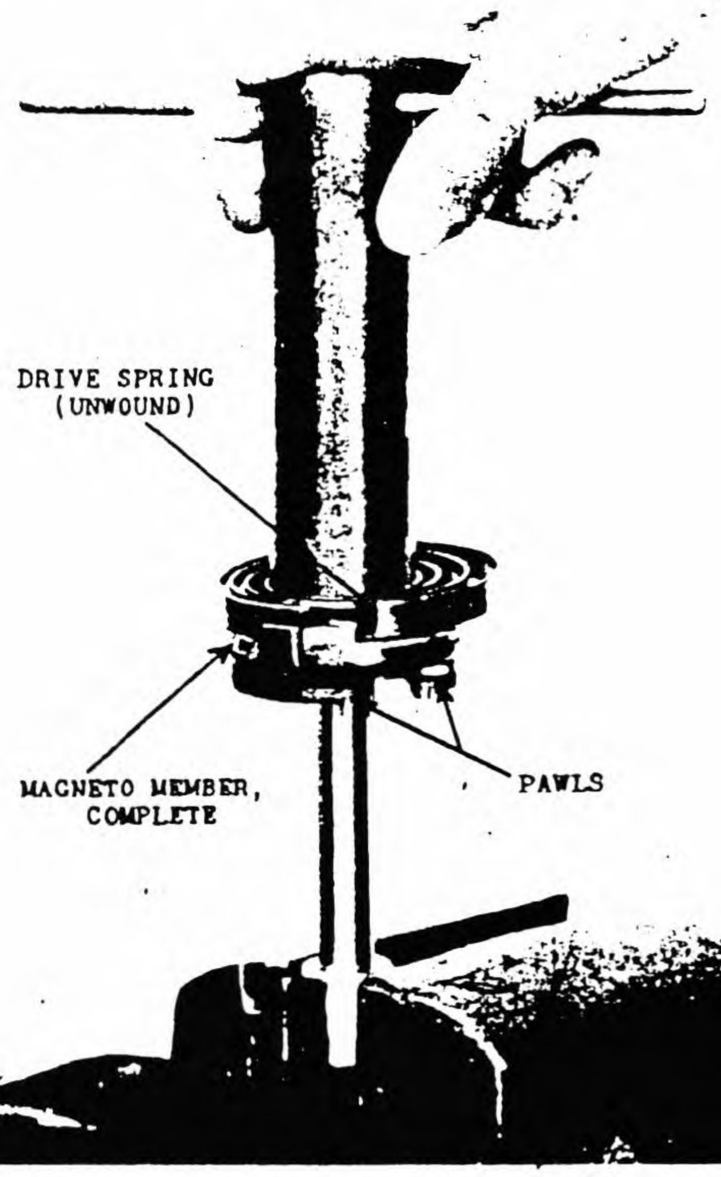
5. To remove the coupling nut, first pry out the magneto shaft snap ring, inner (Illusts. 47 and 50), by inserting a small screw driver in notch "SN". Note there is a special light lockwasher under the nut.

6. When a drive spring is broken, the coupling will fail to impulse and will automatically retard the spark. *To remove a drive spring*, grip winder SE-781 No. 1 in a vise as in Illust. 51. Catch inside hook of drive spring in slot of winder SE-783 No. 2 and by turning the winder clockwise, wrap spring fairly tight around it. Pry up spring with a screw driver applied as shown. Let spring slowly unwind until it assumes the shape and position shown in Illust. 52. It can then be picked up in one's fingers.

7. The coupling member stop ring with the snubber spring (Illust. 53) can be removed by hitting the wide-open end of



ILLUST. 51--REMOVING DRIVE SPRING.



ILLUST. 52--DRIVE SPRING RELEASED.

the coupling member, complete, sharply against a smooth board.

8. A broken snubber ring will make itself evident by a change in the sound of the impulse -- a single thud louder than usual, at each trip of the coupling. It will also advance the time at which the coupling trips.

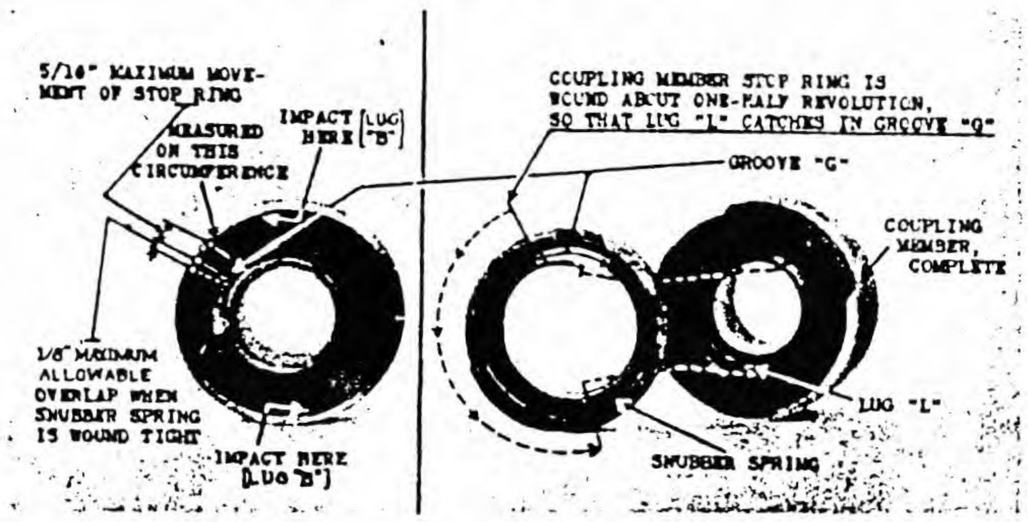
To remove the snubber spring from the coupling member stop ring, clamp the assembly in wood blocks SE-783 No. 5, Illust. 54. Catch the inside hook of the spring in winder SE-783 No. 2 as shown in Illust. 54, and proceed as instructed to remove drive spring, operation 6.

A study of the preceding illustrations and operations will reveal the simplest, safest and most efficient way to clean, inspect or remove any particular part of the coupling. Before reassembling the coupling, thoroughly clean and inspect all parts. In removing drive and snubber springs, care should be taken not to scratch or nick them as this may weaken them so as to result in breakage.

Reassembling the Coupling

Checking Snubber Spring Overlap:

Length of snubber springs will vary slightly, so that frequently the 1/8" maximum allowable overlap, given in Illust. 53, must be adjusted by means of



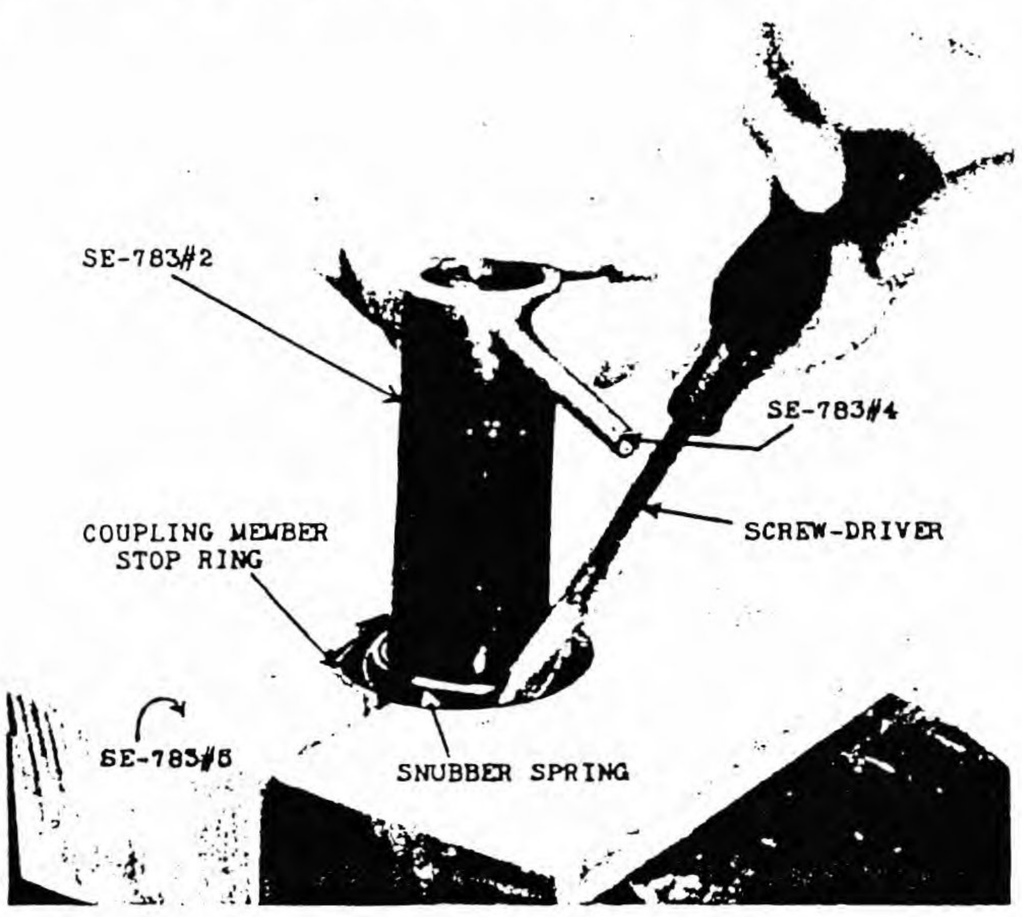
ILLUST. 53--COUPLING MEMBER UNIT. NOTE THAT SNUBBER SPRING IS WOUND THROUGH ABOUT ONE-HALF REVOLUTION.

the snubber spring felt in Illust. 58. Too much overlap will result in excessive coupling oscillation (or vibration) which may cause irregular impulsing at slow speeds. Overlap must be checked as follows:

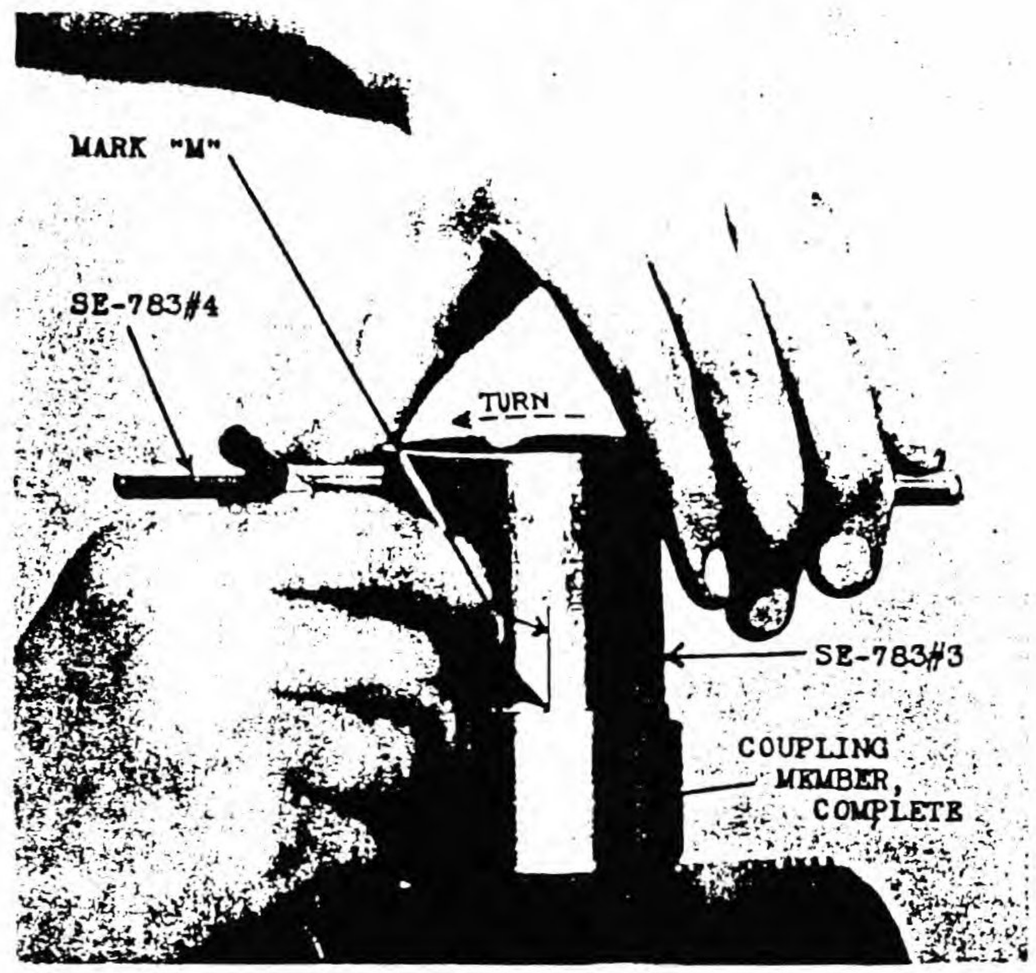
(a) Assemble the coupling member stop ring, without the snubber ring, so that lug "L" fits into groove "G",Illust. 53. Using winder SE-783 No. 3, turn the stop ring counterclockwise as far as it will go. (See Illust. 53). Note that there is a mark "M" (Illust. 57) on SE-783 No. 3. Using a pencil, extend a radial line from this mark cut across the edge of the coupling member. The pencil line must be plainly visible.

(b) Remove coupling ring and assemble the snubber spring into it by reversing operation 8.

(c) Bend a piece of heavy wire or wire solder into a loop as shown in Illust. 56 and place it inside the coupling member. The idea is to keep lug "L" from catching in groove "G", Illust. 53.



ILLUST. 54--REMOVING SNUBBER SPRING FROM COUPLING MEMBER STOP RING.

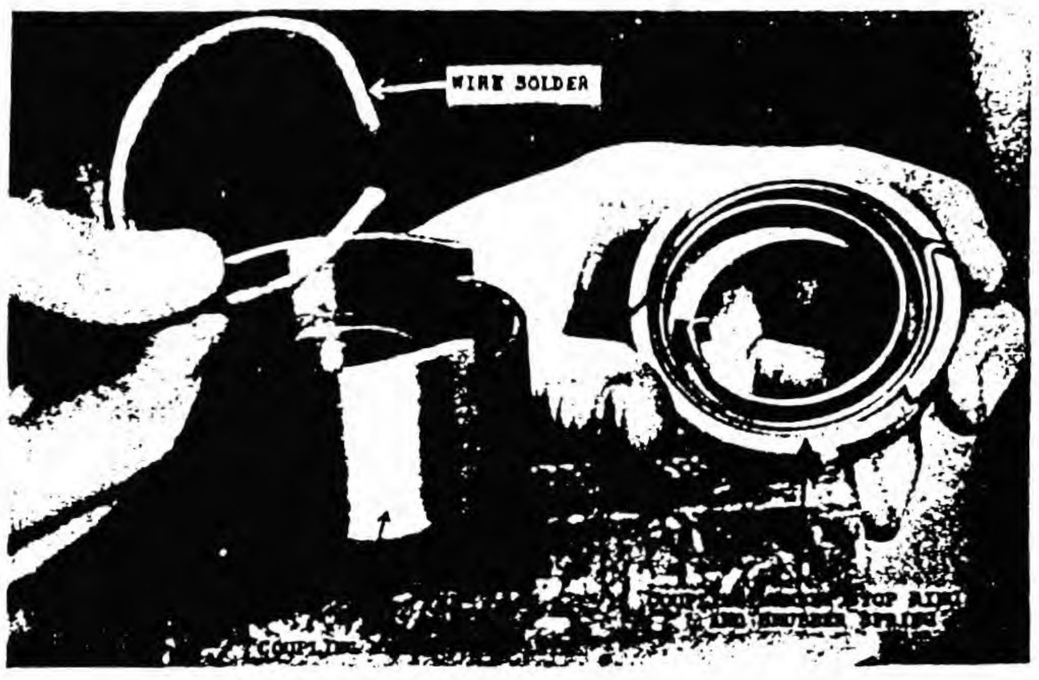


ILLUST. 55--DETERMINING SNUBBER SPRING OVERLAP.

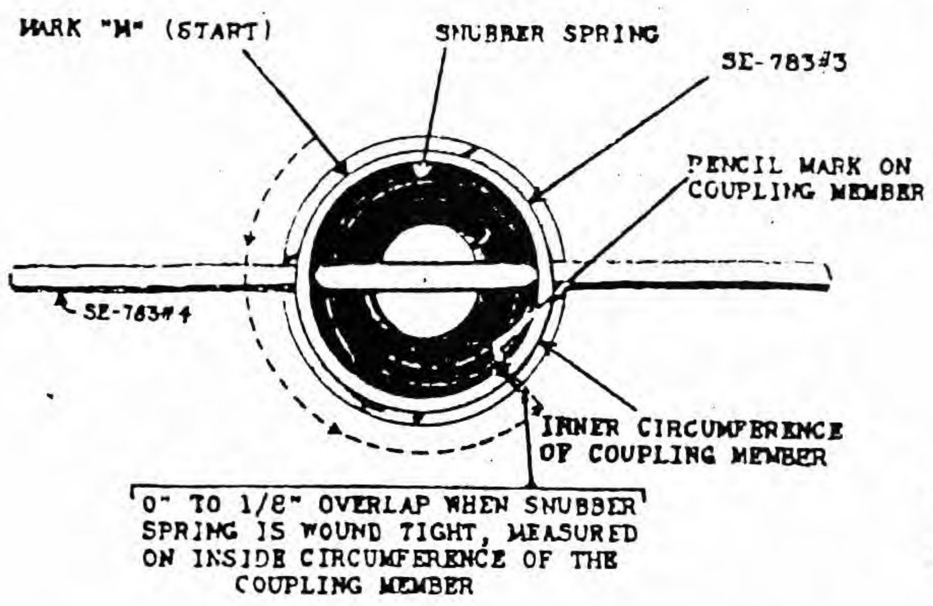
(d) Assemble the coupling stop ring with the snubber spring, into the coupling member. Again using SE-783 No. 3, start with mark "M", turned to the opposite side of the coupling from the pencil mark (Illust. 57), and wind the snubber spring counterclockwise until wrapped tight. Mark "M" on SE-783 No. 3 should then be 0 to 1/8" beyond the pencil line, in the direction that the winder was turned, measured as instructed in Illust. 57. If this measurement is within the specified limits, the snubber spring is of proper length and can be assembled without the use of felt.

When mark "M" fails to turn as far as the pencil mark, the spring is too short for the assembly being tested and must not be used. Assemble another spring and again check overlap.

When mark "M" turns beyond the 1/8" limit, remove snubber spring from coup-



ILLUST. 56--DETERMINING SNUBBER SPRING OVERLAP.



ILLUST. 57--FINAL OPERATION IN DETERMINING SNUBBER SPRING OVERLAP.

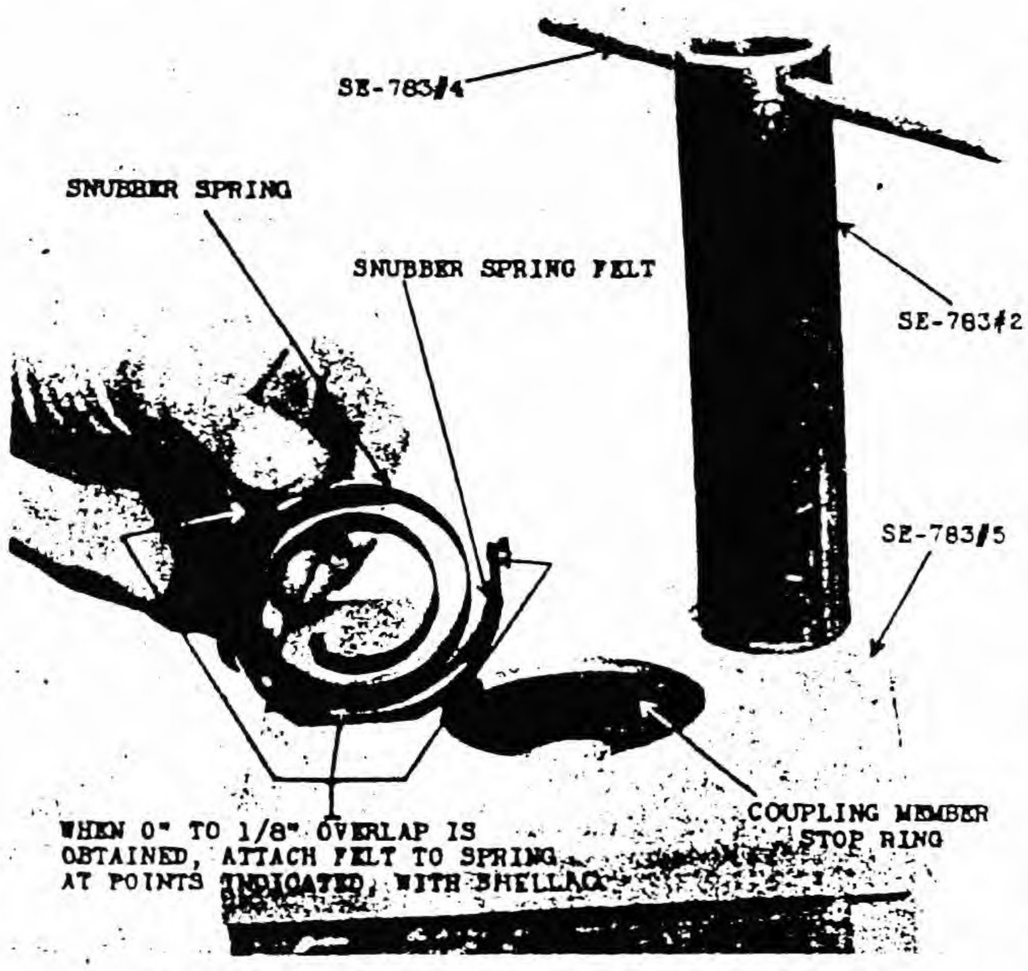
ling member stop ring and insert a strip of felt as shown in Illust. 58. Then repeat operation (D). If mark "M" then fails to turn as far as pencil mark, cut off a little of the felt and remeasure overlap. Repeat this procedure as often as necessary until desired 0 to 1/8" overlap is obtained. Then shellac felt to spring at several places as indicated in Illust. 58.

Winding and testing coupling: In reversing operation 7, remove the wire loop (Illust. 56) from the coupling member. Assemble the coupling member stop ring with the snubber spring (and felt if required), being sure to wind the spring counterclockwise with SE-783 No. 3 until lug "L" catches in groove "G" (Illust. 53). Reverse operations 6 and 5. The outside hooks of both the snubber spring and the drive spring must be all the way down in their retaining slots and the coil of the springs must be pushed down evenly.

In reversing operation 4, be sure to wind the magneto member clockwise as indicated in Illust. 49. This winding must be done with tne magneto member pushed upward as in the illustration.

After reassembling magneto member shaft snap ring, outer, and washer, grip rotating unit in vise as in Illust. 49. Insert winder SE-783 No. 1 and turn magneto member unit clockwise as far as it will go. Release it. The magneto member unit should instantly snap back to its original position, rebounding slightly on account of the snubber spring action. If the performance is satisfactory, reverse operation 3: immerse the rotating unit in cream separator oil, let excess oil drip off, and then reassemble coupling onto magneto.

When the coupling is impulsing normally with the cover off, the line mark on the coupling member unit should lie somewhere between the two timing marks



ILLUST. 58--ASSEMBLING SNUBBER SPRING FELT WHEN SNUBBER SPRING OVERLAP EXCEEDS 1/8".

on the coupling plate at the exact time of tripping. Before reassembling the magneto on the tractor, check this timing to verify the correctness of the coupling assembly. A coupling plate (Illust. 48) that is assembled eccentric with respect to the rotating unit may cause the pawls to catch and fail to trip.

When timing the magneto to the engine, unfasten the coupling cover (Illust. 47) and disengage the coupling by pressing down with one finger on the tail of the pawl that is on top, thus preventing this pawl from catching at "CP", Illusts. 45 and 46.

In regard to proper working and long life of this coupling, too much emphasis cannot be placed on keeping the coupling cover in place except when oiling. Emphasize strongly also that a good grade of cream separator oil or its equivalent must be squirted liberally into the coupling once a week. This forcible lubrication is necessary to insure that the bearing surface between the coupling member unit (Illust. 44) and the magneto member unit receives sufficient oil.

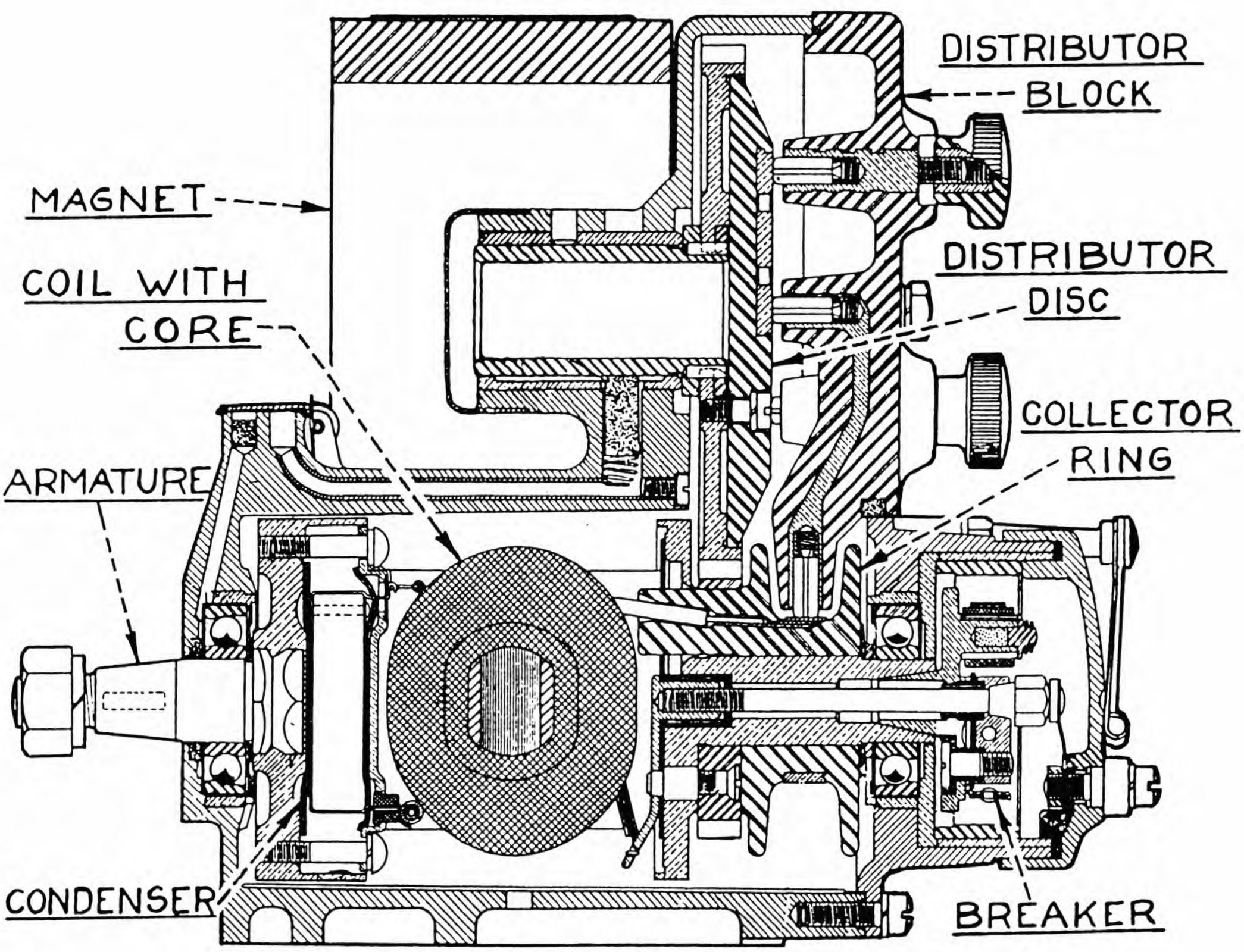
Rust, dirt, gummy lubricant or lack of proper lubrication is always sure to cause sluggish or irregular coupling action. A coupling that is working properly should engage uniformly up to a speed of 100 R.P.M. and should cut out completely at a speed of 180 R.P.M. or less. If the coupling will not engage and disengage at these speeds, clean thoroughly and lubricate with cream separator oil.

INTERNATIONAL E4A MAGNETO

International E4A Magneto—General

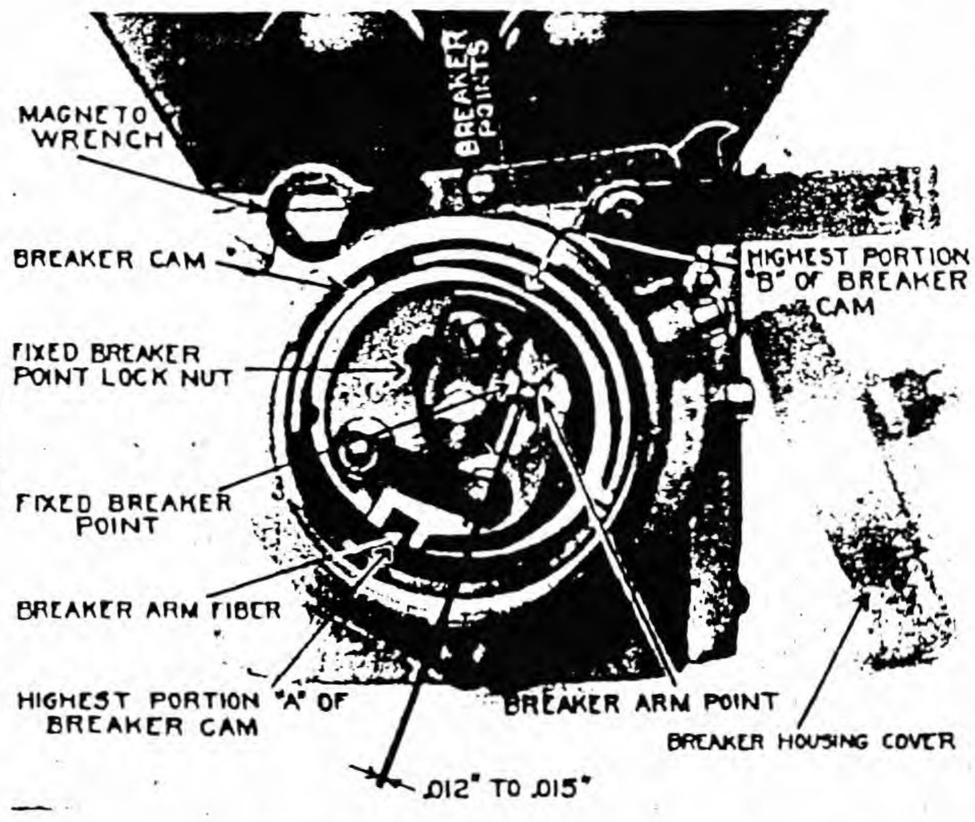
The International E4A magneto is designed for 4-cylinder engines. It is fully enclosed against dirt, dust and moisture. The condenser and coil are located in the armature which rotates between two pole pieces. A conventional horseshoe magnet runs over the magneto and contacts the two pole pieces on either side. Breaker assembly turns with the armature and operates off an internal cam in the magneto frame. The magneto is equipped with a distributor which delivers the spark to the individual spark plugs at just the right moment. It is also equipped with an automatic impulse starter which enables the magneto to furnish to the engine at all speeds an electric current capable of producing a good hot spark. Impulse starter couplings used with the E4A magneto are the International E4A type, the "BX" type, and the "BH" type.

The International F-4 has taken the place of the International E4A magneto. At the present time service parts only are being built for the E4A magneto.



ILLUST. 59--CROSS SECTIONAL DRAWING OF THE INTERNATIONAL E4A MAGNETO

Examination of Breaker Assembly



ILLUST. 60--BREAKER ADJUSTMENT--E4A MAGNETO.

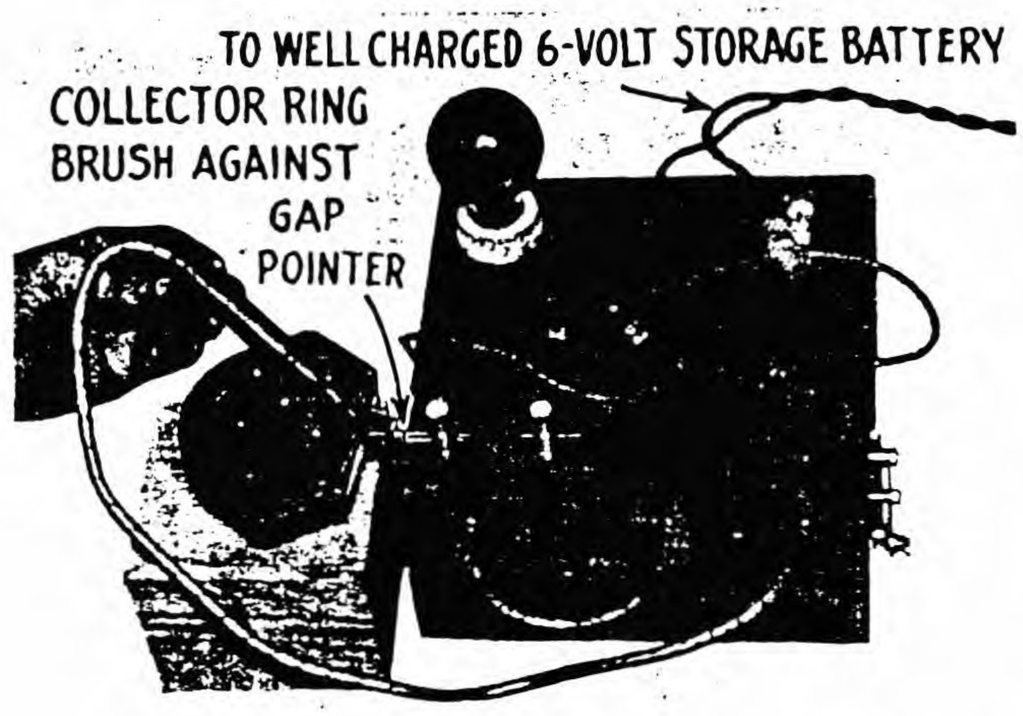
Clean the magneto thoroughly before removing any parts. Remove breaker cover. Inspect short circuiting spring for wear. If the breaker cover no longer short-circuits the magneto when moved to the fully retarded position, it will be necessary to replace the spring. Inspect breaker cover packing and replace if not in good condition.

Breaker point gap should be maintained at .013" at all times. If points are pitted or a ledge of point metal (see Illust. 6) is present, they require dressing; use a sharp magneto point file and dress only to the polishing point. Points should be true to each other to permit perfect contact. Install new breaker points if old ones are badly burned down. Finish by adjusting points to .013" gap clearance, as follows: With rubbing block set on high position of cam, loosen the fixed breaker point lock nut and adjust breaker point to get proper gap setting; then tighten lock nut.

Examination of Distributor

Take off the distributor block after removing two screws and nuts holding it in place. Test the distributor block for cracks, using the high tension circuit in the test set.

Have test set connected as shown in Illust. 61, with collector ring brush against blunt end of gap pointer. Snap on switch and work high tension pointer over surface of distributor block, observing for spark which would indicate a cracked block.



ILLUST. 61--TESTING DISTRIBUTOR BLOCK FOR CRACKS, USING HIGH TENSION CIRCUIT OF TEST SET.

Examine for stuck brushes and make sure they are the E4A brushes (brush is distinguished by groove down one side). If bakelite is burned around the brush holder it usually indicates the brush has been sticking. Stretching the brush spring is not good practice. It is advisible to replace with a new spring and brush. Inspect the felt around the distributor and replace if not in good condition. Good sealing will prolong the life of the brushes, as well as the distributor disc.

Clean the distributor disc with a soft rubber eraser and examine the brush track. The spark spot on the insert should be near the leading edge of the insert. A late spark will cause a spark near the trailing edge of the insert. It results either from incorrect timing of the distributor gears or from running with retarded spark for long periods of time. A worn distributor gear shaft bushing will also result in disc and brush wear. If disc is worn below the edge of the disc insert, it is advisable to replace the disc. This can be done by taking out three screws. Be sure to replace the disc in the same relation to the gear as the one removed from the timing mark or the gear cannot be used in timing the distributor to the armature.

Examination of Ground Brush

Remove the ground brush holder. Clean it and see that the ground brush is free in the holder. Examine the brush track through the ground brush hole in the housing. Track should be clean to make a good contact with brush. Replace the ground brush holder.

Safety Gap

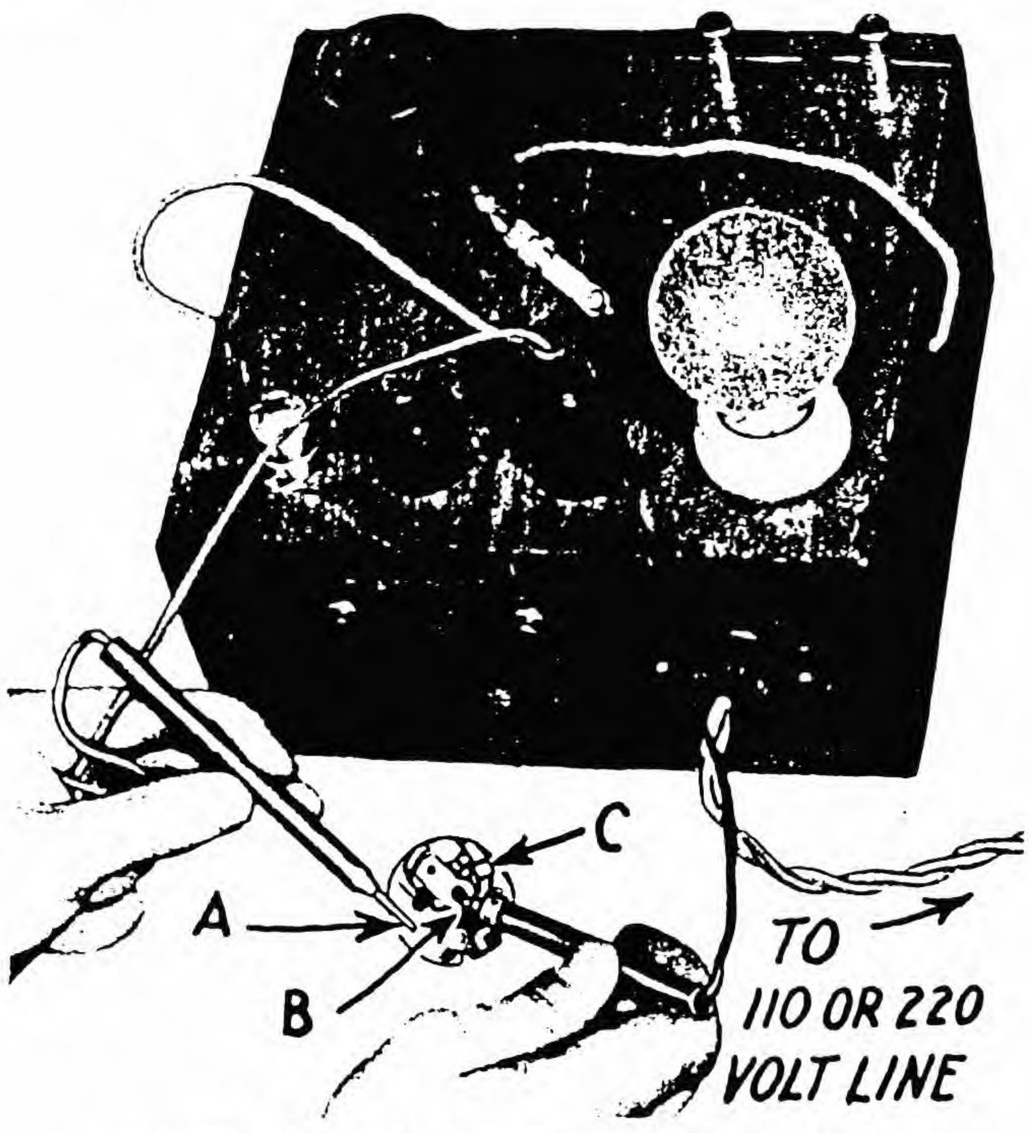
If the breaker and distributor are both found in good condition, carry the examination further. Leave the distributor block off, advance the spark, disengage the magneto starter pawl, then turn the armature briskly by hand. A spark should jump regularly across the safety gap.

Examination for Safety Gap Sparking

We will assume the spark is still unsatisfactory, intermittent and weak. The examination must proceed still further. Take out four screws holding name plate and remove magnet. Recharge magnet as explained under the heading "Magnet" on Page 33. Replace the magnet on the magneto. Magnet can be assembled on magneto either way as the direction of current through the breaker points is reversed with each succeeding break.

Again turn the armature briskly by hand and observe if a spark jumps regularly across the safety gap. If spark does not jump safety gap it will be necessary to remove the magnet; place a soft iron keeper across the poles, and follow the dismantling and testing procedure that follows.

Remove breaker cover and turn out breaker screw which holds breaker in place. Remove breaker assembly. Breaker assembly may be tight on shaft and can be loosened by manipulation of breaker screw in breaker assembly.



ILLUST. 62--TESTING BREAKER ASSEMBLY OF E4A MAGNETO FOR GROUND.

Test breaker assembly for ground as shown in illustration. A dry piece of wood "C" placed between the stationary point support and the breaker arm will hold the points open. Place test point "A" on breaker carrier, and test point "B" on stationary point support as shown. Test lamp should not light when making test.

Magnet

The E4A magneto magnet can be removed after taking out four screws holding name plate and magneto band. Magnet can be charged using the spool type magnetizer SE-858 and following the same procedure as explained on Page 20 for charging the F-4 and F-6 magneto magnets. Original factory polarity of the magnet should be maintained, when recharging magnet on magnetizer. See Illust. 30 for inserting magnet in spools correctly. E4A magnet can be assembled on the magneto either way; the direction of current through the breaker points is reversed with each succeeding break.

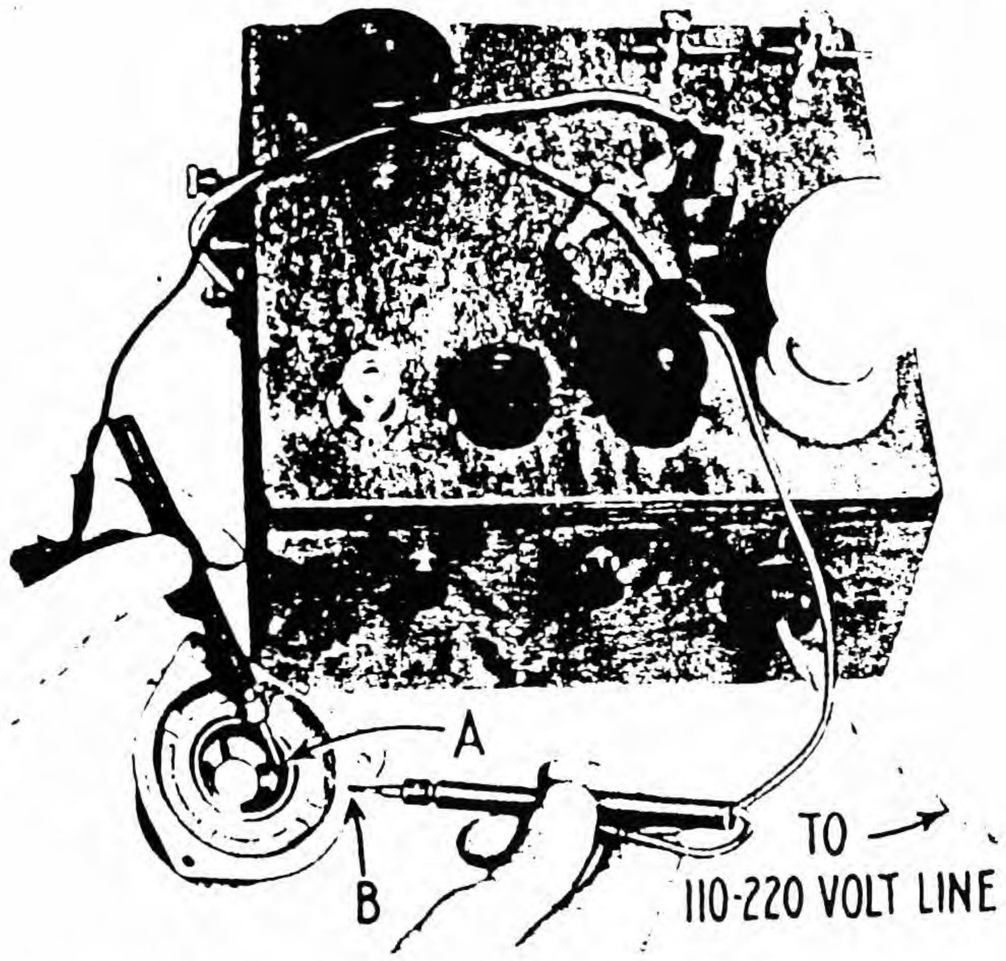
Removing Armature

Remove impulse starter coupling. Screw out safety spark gap screw. Remove ground brush holder and brush. Pry off distributor gear shaft cover and remove distributor gear shaft snap ring and lock washer. Remove magneto end plate and breaker housing, complete. Distributor gear assembly, together with the armature, can then be removed from the magneto frame.

Testing Bearing Race Insulation

Test outer bearing race insulation of both front and rear bearings, using either 6-volt test circuit or 110-220 volt test circuit of electrical test set as shown in Illust. 63. Frequently dust and dirt are a very good conductor of electricity; therefore it is essential that the space around the bearing race be thoroughly cleaned before making test. Hold one test point on outer bearing race and other test point on housing. (See "A" and "B" in illustration.) If test shows shorted condition using 110-220 circuit it is advisable to recheck, using 6-volt circuit. If test shows shorted condition using 6-volt circuit, it is necessary to remove race and install new insulation.

Magneto bearing race puller tool SE-1020 and magneto bearing replacer tool



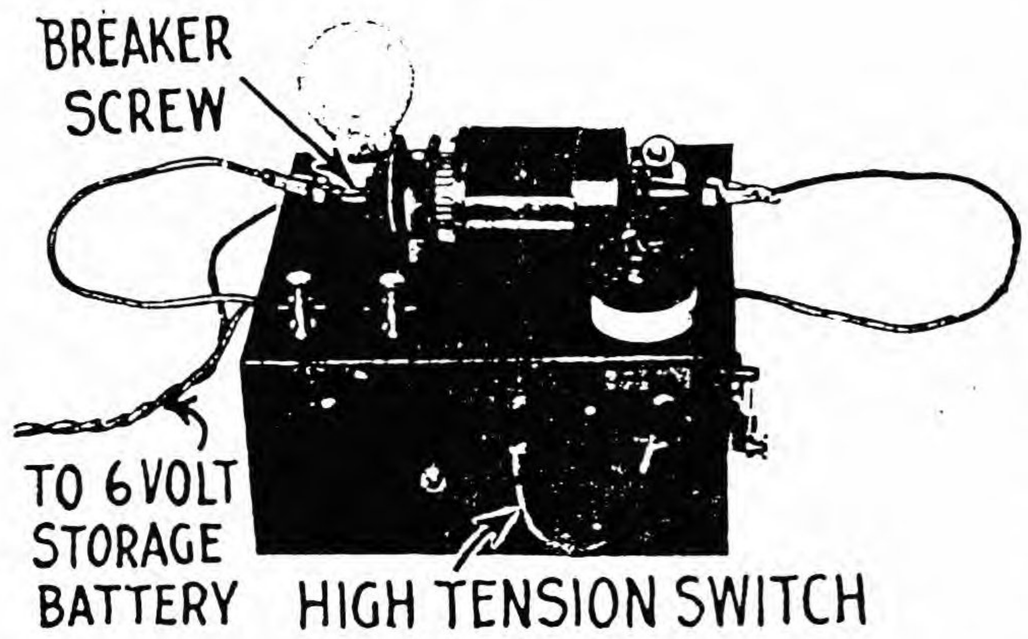
ILLUST. 63--TESTING BEARING INSULATION IN END PLATE AND BREAKER HOUSING OF E4A MAGNETO.

SE-1021 should be used for removing and replacing bearing outer race (see Page 23). Insulation must be of even thickness around bearing race and free of wrinkles. Cut excessive insulation around bearing race after race is assembled in place, and test with electrical test set. A shorted condition will destroy the lubricant in the bearings.

Testing E4A Magneto Coil

Have vibrator switch "off" and high tension switch connected to "armature" terminal. Insert breaker screw into armature so that screw is centrally located, is not bent, or screwed in too tightly. Set armature on test box, pushing its collector ring all the way down into collector ring holder. Clip winding test ends to ends of armature as shown.

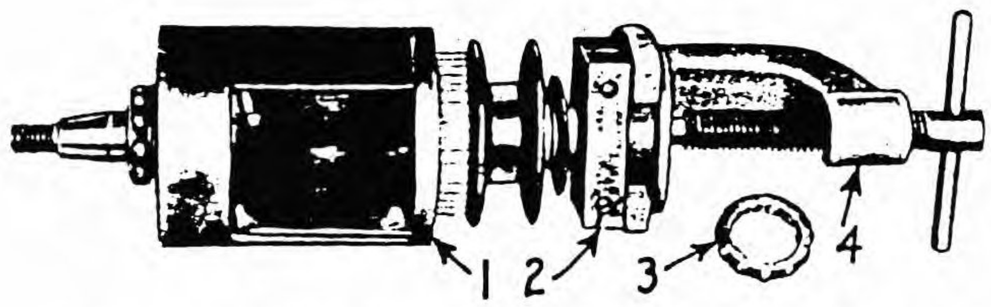
Snap on vibrator switch. Spark should jump 5/16" spark gap continuously, except possibly for occasional skip due to



ILLUST. 64--TESTING E4A ARMATURE WINDINGS USING ELECTRICAL TEST SET.

vibrator. Spark should not jump from armature windings to core. No sparking should occur at collector ring lead-out. If there is sparking here, collector ring should be removed with use of puller SE-839, as shown in Illusts. 65 and 66.

Removing E4A Armature Parts



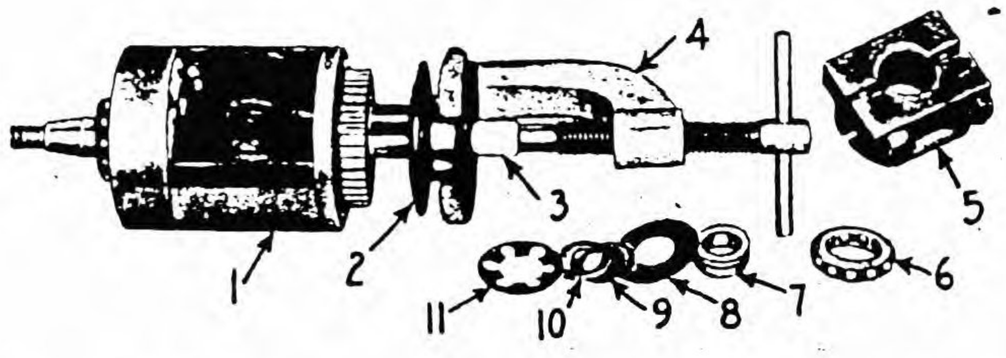
ILLUST. 65--PULLER SE-839 REMOVING BEARING INNER RACE FROM BREAKER END OF E4A MAGNETO ARMATURE.
1--E4A ARMATURE. 2--ARMATURE BEARING RACE ADAPTER SE-834-4.
3--BEARING RETAINER WITH BALLS.
4--BEARING PULLER WITH SCREW

Bearing retainer with balls is readily pried off inner race with screw driver. Inner race is removed as shown in Illust. 65. Collector ring is removed as shown in Illust. 66. Parts are shown in order in which removed.

Assemble new ring and repeat coil test as explained with Illust. 64. A

CAUTION: Armatures with high resistance primary windings tend to reduce current flowing in circuit and to unbalance vibrator operation. As a consequence, they give a somewhat then and sometimes slightly skippy spark across a 5/16" spark gap. The E4A "C" winding, identified by a "CW" on the winding insulation, is of this type.

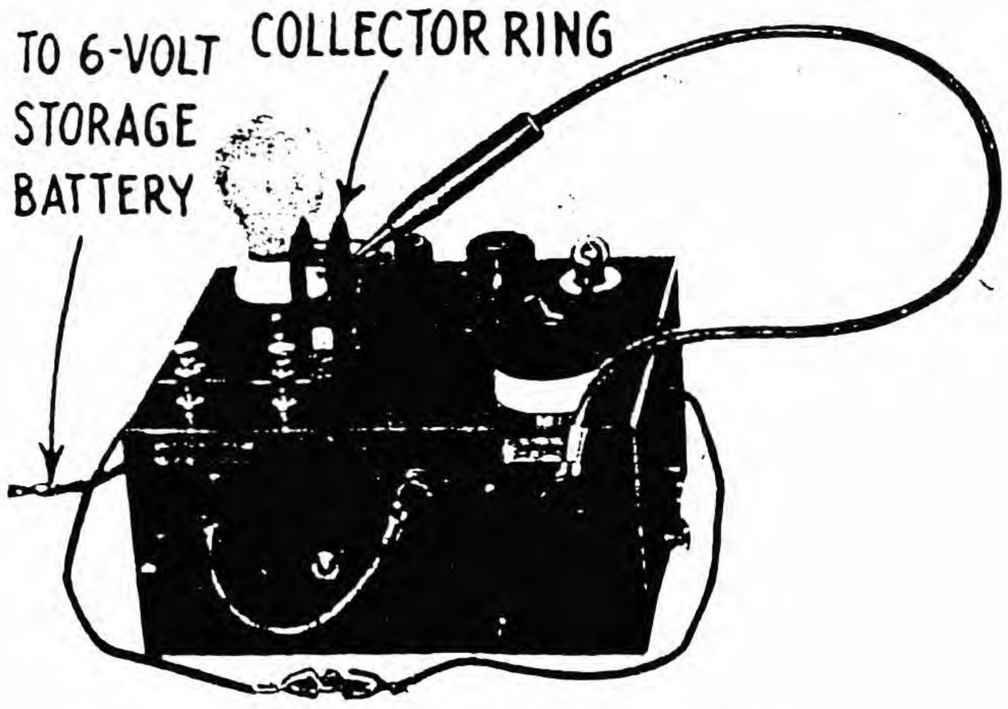
The E4A "C" winding generally gives best spark across test gap with vibrator point adjustment screwed well down. A steadier spark will be had if the armature primary lead-out wire is unsoldered from the condenser terminal. Never condemn a "C" winding on this test because it does not give as intense a spark, as for instance an "A" or "B" winding. When the "C" winding is assembled in a magneto, where it generates its own electrical energy, it develops just as satisfactory a spark as the other windings.



ILLUST. 66--PULLER SE-839 REMOVING E4A MAGNETO COLLECTOR RING. ARMATURE. 1--E4A ARMATURE. 2--COLLECTOR RING. 3--SCREW EXTENSION. 4--BEARING PULLER WITH SCREW. 5--BEARING RACE ADAPTER. 6--BEARING RETAINER WITH BALLS. 7--INNER BEARING RACE. 8--OIL FLINGER. 9--SHIMS. 10--OIL FLINGER SPACER. 11--COLLECTOR RING LOCK WASHER.

strong sulphur-like odor pervades around a defective winding. This odor also exists at the spark gap; therefore, the source must be carefully distinguished.

Testing E4A Collector Ring.

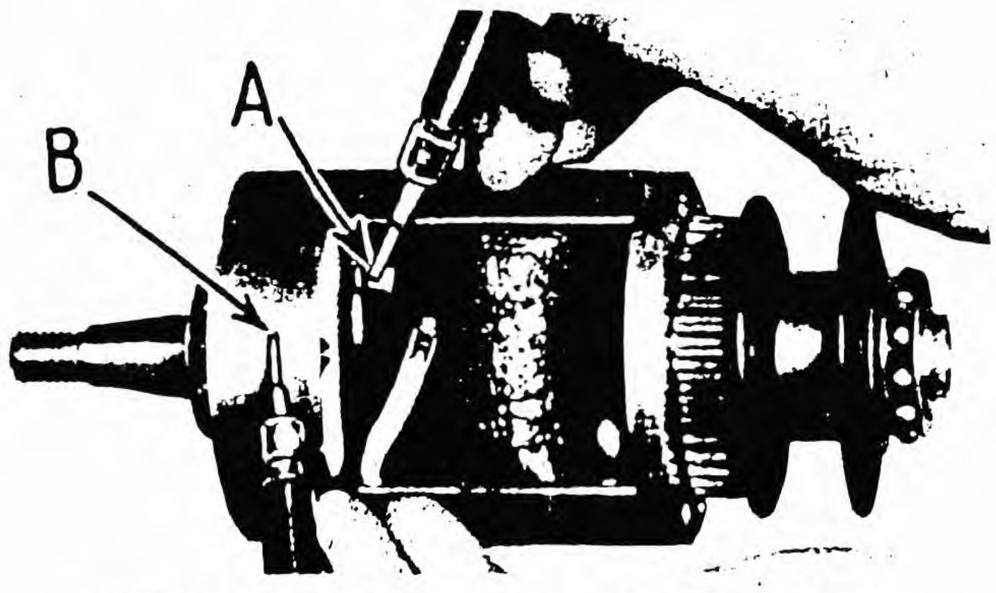


ILLUST. 67--TESTING COLLECTOR RING FOR CRACKS IN INSULATION.

Place collector ring in collector ring holder on test set. Snap switch "on" and move high tension test point over both side faces and in hole of collector ring. Spark should continue to jump gap points and should not jump through insulation.

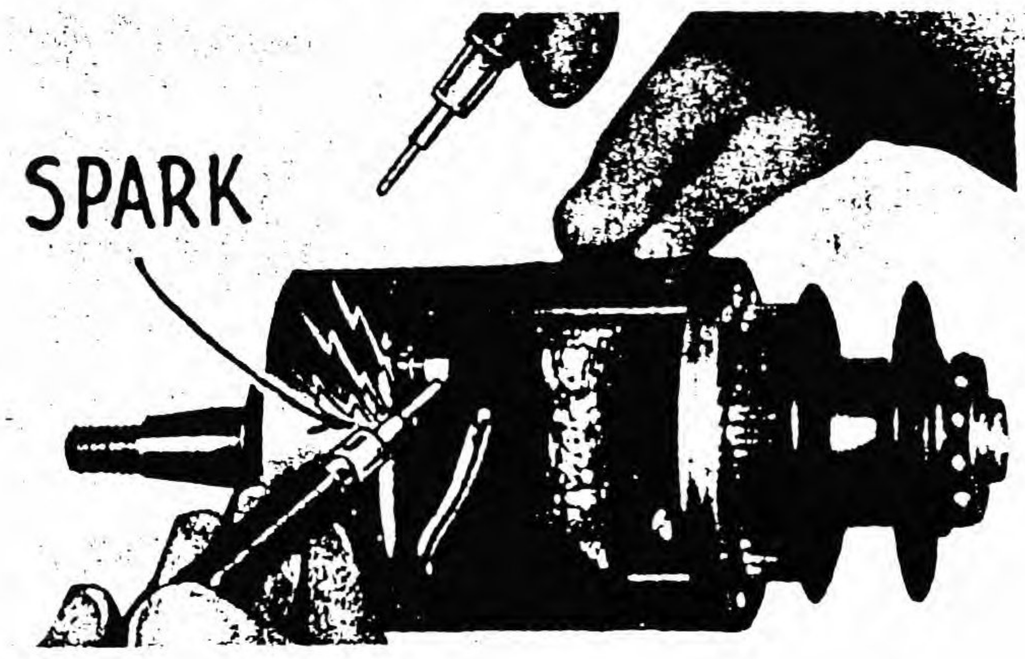
Testing E4A Condenser

Condenser failure on the E4A magneto is rare and testing is usually not required. It is advisable to install a new condenser E4A 608 if there is any doubt as to the successful operation of the old condenser. To test condenser for short circuit and for open circuit it is necessary to unsolder the primary lead-out wire from the insulated condenser terminal. (Place a piece of heat insulating material between soldered connection and coil to protect coil from heat of soldering iron.) Test condenser as shown in Illusts. 68 and 69.



ILLUST. 68--TESTING CONDENSER FOR SHORT CIRCUIT.

Text condenser for short circuit by using only 110-volt test circuit of electric test set. (See Illust. 24.) Hold the test point on insulated condenser terminal "A" and other on grounded face of armature "B". Test lamp should not light. If it does, replace condenser.



ILLUST. 69--DISCHARGING CONDENSER.

Charge condenser as shown in Illust. 68 by holding one test point on insulated condenser "A" and other on grounded face "B". Remove test point to ground face and pivot other test point on condenser terminal to a position where a spark will occur between the side of the test point and a grounded edge as shown in Illust. 69.

With 110 or 220 volts D.C. current a snappy flash should occur every time. With A.C. current a flash may not occur every time; hence the test should be repeated a number of times before condemning condenser. If flash is weak or if no flash occurs after many attempts to charge and discharge condenser, it is necessary to replace it with a new one.

Replacing Condenser

Unsolder both wire connections at condenser terminals. Take out four armature driving end plate screws. Mark

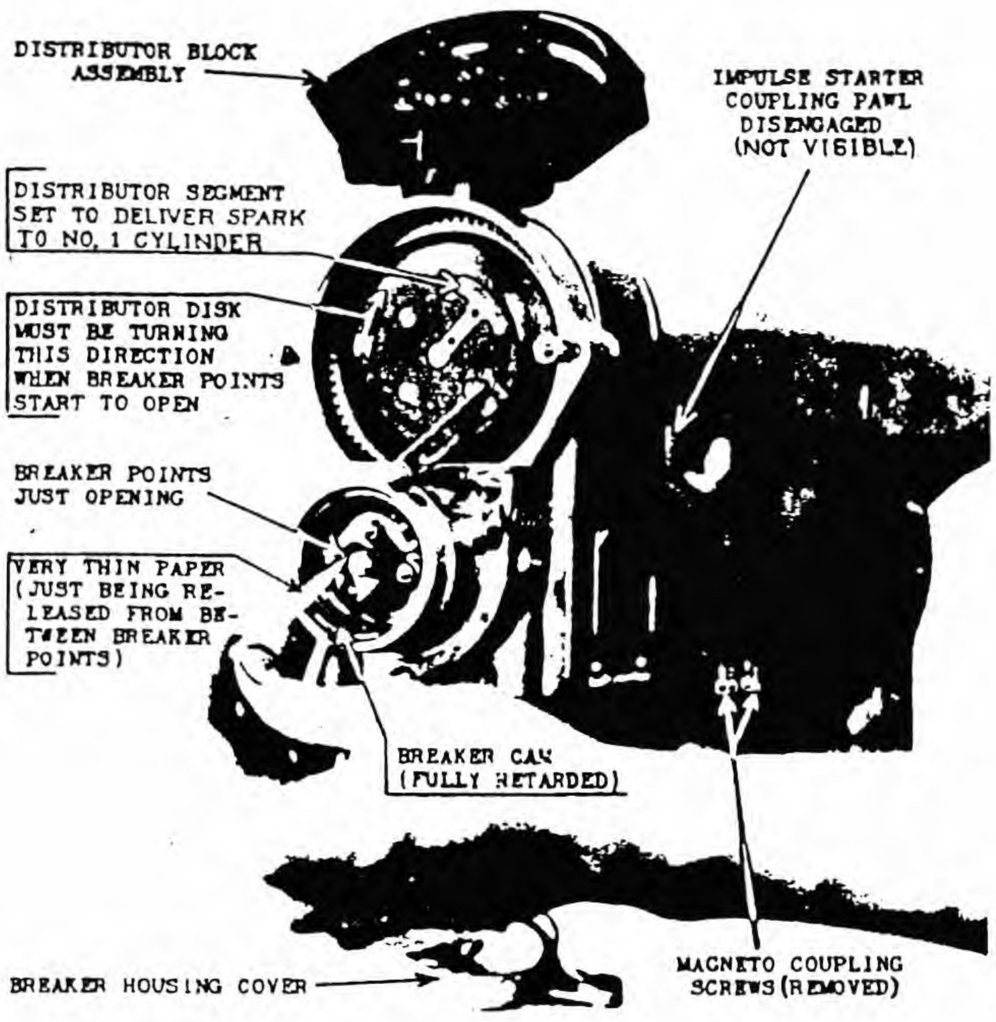
armature driving end plate and center core so they can be reassembled in same relation to each other. Take off armature driving end plate and remove two condenser screws and condenser. Assemble condenser and armature by reversing the foregoing dismantling procedure. Make certain to lock end plate screws with a center punch after screws are drawn up in place and securely solder both wire connections.

Assembling the E4A Armature in Magneto Frame

Magneto armature should be assembled in frame with just enough shims between oil flinger and end plate on driving end of armature to allow no perceptible end play. An accurate test is to assemble the armature in place with the bearings free of grease and oil and the bearing felt removed, then test for end play. Adjustment is made by removing or adding shims.

Distributor is correctly timed when punch-marked tooth in distributor gear lines up with mark on collector ring flange.

Timing Magneto To Engine



ILLUST. 70--TIMING MAGNETO TO ENGINE.

Fully retard spark by raising breaker housing cover. Then remove breaker housing cover by pulling it straight back. Test for .013" point opening. Remove distributor block. Line up magneto assembly on magneto bracket and insert four cap screws. Remove two magneto coupling screws. Crank engine until No. 1 piston is on firing dead center position. Then rotate the impulse starter coupling as shown in illustration (impulse starter coupling pawl must be disengaged), so that distributor disk moves in direction indicated. Stop rotating the instant breaker points start to open and distributor segment is in position shown delivering a spark to No. 1 cylinder. Insert two magneto coupling screws, taking great care not to disturb setting of magneto.

Reassemble distributor block assembly and put on the breaker housing cover. On magnetos equipped with "BX" or "BH" type impulse starter couplings, engage the pawl. Replace the cover on E4A type coupling. Then crank engine slowly, stopping the instant coupling trips. The trip should occur when the engine is on dead center or from dead center to 8° after dead center. If the trip occurs within these limits, the magneto is ready for service. If trip does not occur within these limits, recheck timing; also check impulse starter coupling.

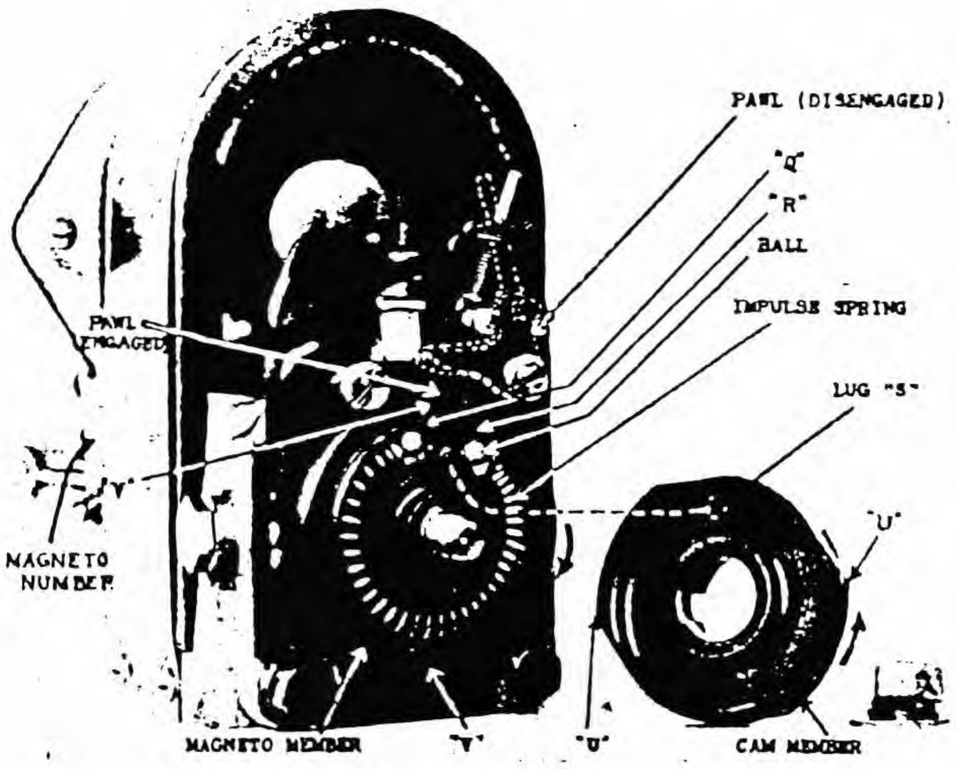
Model "BX" and "BH" Impulse Couplings

International E4A magnetos can be equipped with any one of three types of impulse couplings. The International E4A type covered on pages 26 to 30 of this Manual; the Model "BX" impulse coupling, and the Model "BH" impulse coupling which are both covered in the following pages. The Model "BX" and "BH" impulse couplings serve the same purpose as the International "F" type automatic impulse coupling. It is necessary to manually engage the pawl on the Model "BX" or "BH" impulse coupling if it has been disengaged.

How the Model "BX" and "BH" Impulse Couplings Work

Illustration shows a Model "BX" impulse coupling. The magneto member is keyed to the armature driving end. The cam member is locked to the "magneto and governor shaft" and is always driven steadily at engine speed. Lug "S" fits between the two balls, which are held apart by the knobs "Q" and "R". The pawl, when engaged, catches successively in notches "V" as shown, holding the magneto member and armature from turning until peak "U" of the steadily rotating cam member lifts the pawl out of "V". In the meantime the impulse spring has been compressed by lug "S" through a little more than one-fifth revolution. Therefore, when the pawl is tripped, this

MODEL "BX" AND "BH" IMPULSE COUPLINGS



ILLUST. 71--MODEL "BX" IMPULSE COUPLING PARTIALLY DISMANTLED. THE MODEL "BH" COUPLING IS SIMILAR, THE PRINCIPAL DIFFERENCE BEING THAT ITS MAGNETO MEMBER ASSEMBLY IS MADE UP AS SHOWN IN ILLUST. 75.

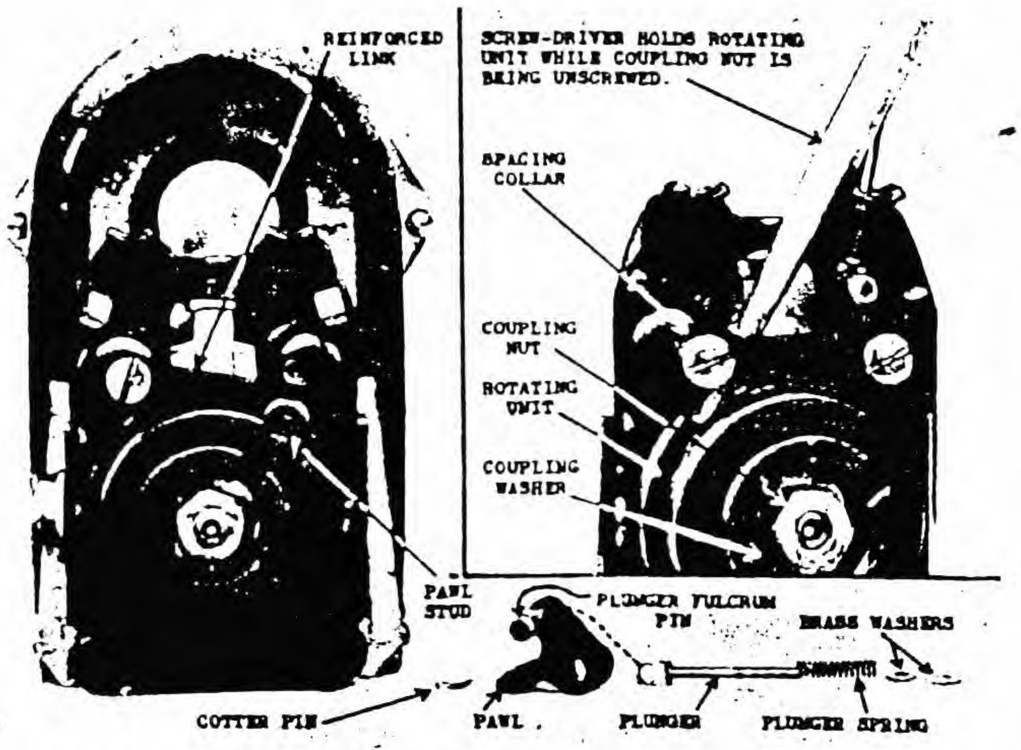
spring expands behind the ball held by knob "Q", hurling the magneto member and armature rapidly forward. There being two notches "V", this action occurs twice during each revolution.

Leverage exerted by the plunger spring holds the pawl in engaged position until the engine's speed exceeds 140 to 240 R.P.M. Then the impact of peak "U" is sufficient to throw the pawl back into disengaged position, where it remains until manually re-engaged.

The Model "BH" coupling operates similar to the Model "BX" except that instead of the balls, it has a cushion-spring (Illust. 75). One end of this spring bears against a lug in the magneto member. The other end makes contact with lug "S", Illust. 71, which fits between the cushion spring and the compression spring, Illust. 75.

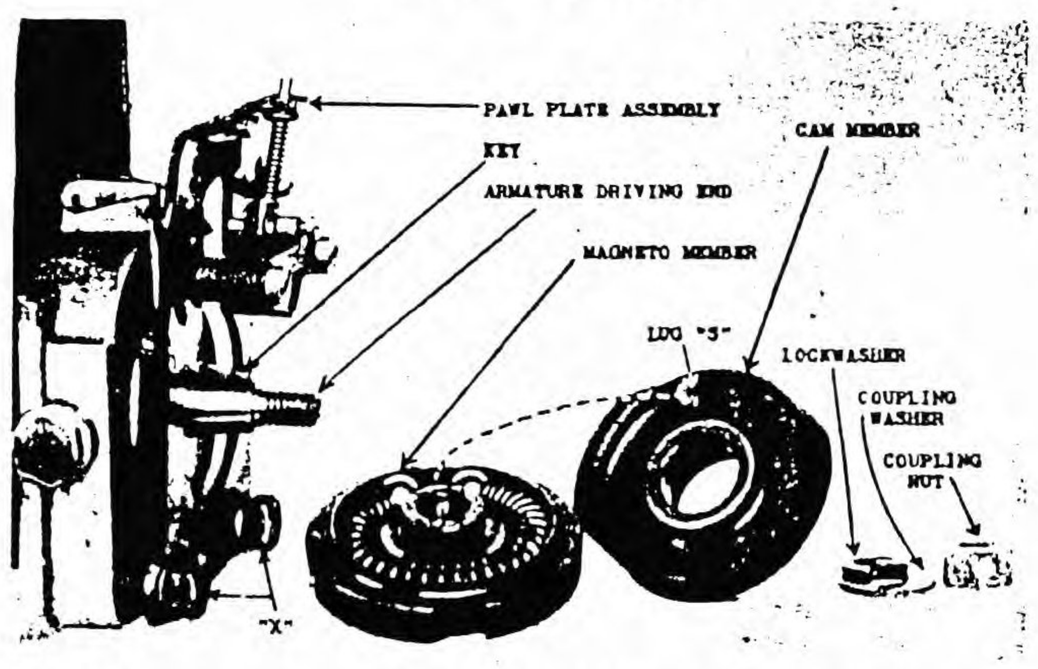
Adjusting Pawl for Throw-Out Speed

The pawl stud (Illust. 72), pawl, plunger, plunger spring, spacing collar and reinforced link, can be removed with the magneto assembly on the tractor. Engine speed at which the pawl will be thrown out of engagement is adjusted by varying the tension of the plunger spring. This is done by means of brass washers. Adding washers raises the throw-out speed; removing washers decreases it. Throw-out speed should be from 140 to 240 R.P.M. Parts should be clean and lubricated with machine oil. Pawl must work freely on its stud, and the plunger and its fulcrum pin must be free.



ILLUST. 72--MODEL "BX" IMPULSE STARTER COUPLING PAWL ASSEMBLY DISMANTLED. INSERT SHOWS ONE WAY OF HOLDING ROTATING UNIT FROM TURNING WHILE UNSCREWING THE COUPLING NUT.

Removing and Dismantling Impulse Starter Coupling

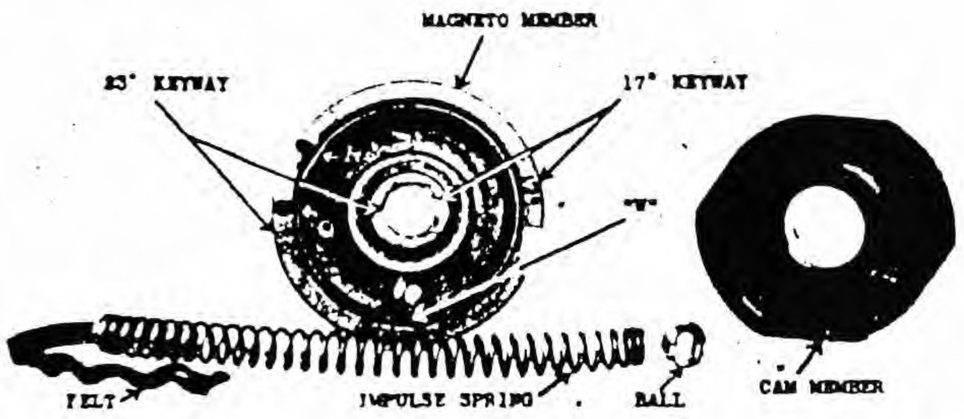


ILLUST. 73--MODEL "BX" IMPULSE STARTER COUPLING PARTS. CONSTRUCTION OF THE MODEL "BH" COUPLING IS SOMEWHAT SIMILAR ALTHOUGH MOST OF ITS PARTS ARE NOT INTERCHANGEABLE WITH MODEL "BX" PARTS.

Hold rotating unit from turning as shown in Illust. 72. Remove coupling nut Illust. 73, lockwasher, coupling washer, and rotating unit. If a screw driver is used to pry off the rotating unit, extreme care must be exercised to avoid crushing the magneto frame. The pawl plate assembly can be removed next by taking out the two cap screws "X", Illust. 73. Pry apart magneto member and cam member, Illust. 73. Impulse spring can be pried out by inserting a screw driver between the spring and one of the balls. Balls can be rolled out only at notch "W", Illust. 74.

Compression spring, Illust. 75, in Model "BH" impulse couplings can be pried out with a screw driver. The cushion spring snaps securely in place and does not as a rule need to be removed. Clean and inspect parts.

Reassembling Rotating Unit



ILLUST. 74--MODEL "BX" IMPULSE STARTER COUPLING ROTATING UNIT DISMANTLED. THE 23° KEYWAY IS USED WHEN MAGNETO IS EQUIPPED WITH 35° BREAKER CAM (SEE ILLUST. 76); THE 17° KEYWAY IS USED WHEN THE MAGNETO IS EQUIPPED WITH 42° BREAKER CAM.

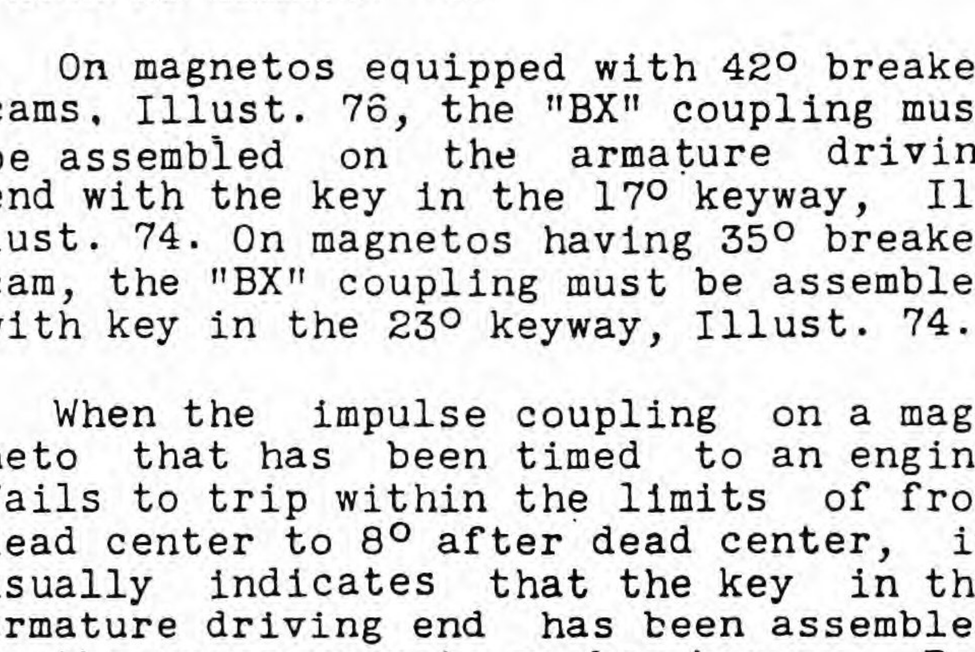
Model "BX" Rotating Unit:

Insert balls at "W", Illust. 74, and roll them into position. Be sure that knobs "Q" and "R" engage balls an ample amount; if balls slip past knobs, magneto will be thrown out of time. Assemble felt into impulse spring, press ends of spring into place against balls, after which middle portion of spring can readily be pressed into position. Pack spring with vaseline, or with a grease that will not become hard and gummy in cold weather. Snap cam member into place, and turn it clockwise on magneto member to test operation of spring.

Model "BH" Rotating Unit:

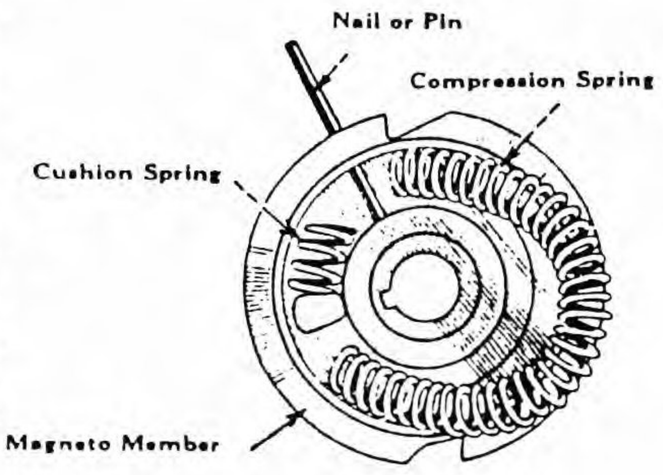
Insert a pin or nail as shown in Illust. 75. Press ends of compression spring into place against lug and nail, respectively, and then press rest of spring into position. If cushion has been removed, see that it is assembled on the same side of the lug as shown in Illust. 75. Pack spring with vaseline, or with a grease that will not become hard and gummy in cold weather. Snap cam member (which is similar to the cam member shown in Illust. 73) into place, with lug "S" between the cushion spring and the nail. Remove nail. Turn cam member clockwise on magneto member to test operation of spring.

The 42° cam was used in all International Type E4A magnetos up to 60401 in magnetos 66001 to 76384, and in magnetos 325000 to 331000. The 35° cam was used in magnetos 60401 to 66001, 76384 to 325000, in magnetos above 330999. International Type E4A magnetos have been equipped with two types of breaker cams, namely, a 35° cam and a 42° cam (Illust. 76). The degrees signify range of spark advance, which is limited by the cam ring stop pin. This pin fits into the 11/16" slot of the 35° cam, and into the 25/32" slot of the 42° cam. In identifying a cam, be sure that the slot measured is on the opposite side of the cam from the grooves, Illust. 76.



ILLUST. 76--E4A MAGNETO 35° AND 42° BREAKER CAM.

ILLUST. 75--MAGNETO MEMBER ASSEMBLY OF MODEL "BH" IMPULSE STARTER COUPLING. THE NAIL OR PIN IS INSERTED WHILE ROTATING UNIT IS BEING ASSEMBLED TO LEAVE SPACE BETWEEN THE COMPRESSION AND CUSHION SPRINGS SO THAT LUG "S" (ILLUST. 73) OF THE CAM MEMBER CAN BE SNAPPED INTO PLACE. NAIL OR PIN IS THEN REMOVED.



Reassembling Impulse Coupling onto Magneto

The Model "BH" coupling is used only on magnetos having 42° breaker cams. The Model "BX" coupling is used with either cam, its magneto member being furnished with two keyways identified as shown in Illust. 74.

On magnetos equipped with 42° breaker cams, Illust. 76, the "BX" coupling must be assembled on the armature driving end with the key in the 17° keyway, Illust. 74. On magnetos having 35° breaker cam, the "BX" coupling must be assembled with key in the 23° keyway, Illust. 74.

When the impulse coupling on a magneto that has been timed to an engine fails to trip within the limits of from dead center to 8° after dead center, it usually indicates that the key in the armature driving end has been assembled in the wrong magneto member keyway. Before removing the magneto assembly, however, recheck the setting of the magneto breaker points and the timing of the magneto to the engine. Check also the pawl assembly, Illusts. 71 and 72, and make sure that the pawl plate is assembled "square" with the magneto frame. If the impulse spring is broken, or if one of the balls slips past knobs "Q" or "R", Illust. 74, magneto cannot be timed correctly. Make sure this does not happen.

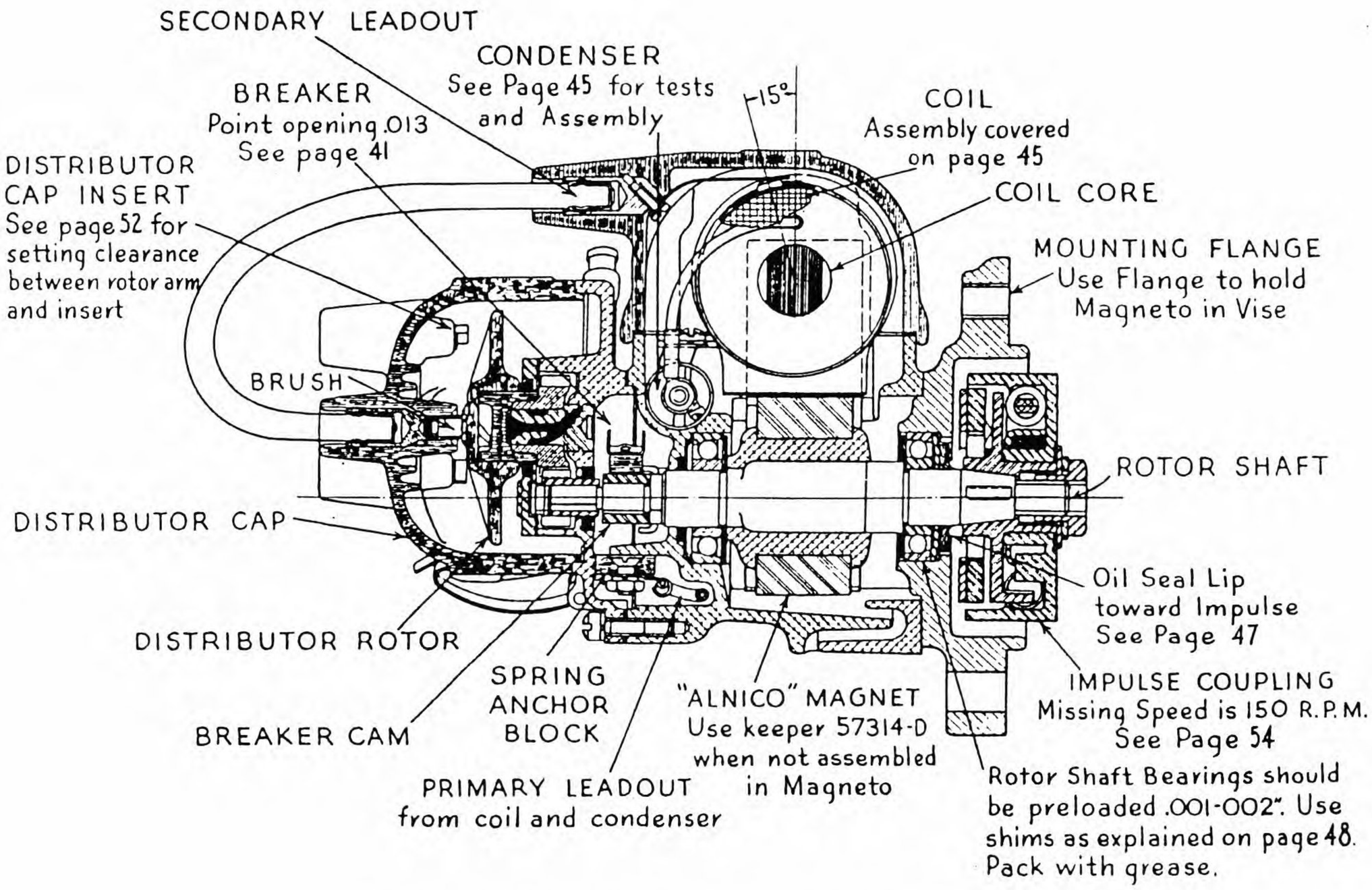
INTERNATIONAL H-4 MAGNETO

International H-4 Magneto—General

The International H-4 magneto features a completely enclosed breaker chamber, a starting impulse coupling and an Alnico rotor magnet that should never require remagnetising. The exterior is extremely clean and all possible dirt-catching points have been eliminated. The flange is mounted to a drive bracket which is connected to the front plate of the engine. All shimming and lining up of various bolt holes when coupling magneto to engine is eliminated. Fine adjustment of timing is accomplished by rotating magneto in slotted holes in flanges of bracket and magneto. The magneto is driven through the impulse coupling which has a 150 R.P.M. missing speed.

Designed for operation with 4-cylinder engines, the entire mechanism is fully enclosed and protected against entrance of dirt, dust and moisture. The condenser and coil are located underneath a plastic cover. The magnet is the rotating type, revolving between ends of pole pieces. Near the end of magnet rotor shaft is the cam which operates breaker mechanism; the breaker mechanism is sealed from coil and distributor compartment. The flat on the extreme end of magnet rotor shaft drives reduction gears which drive distributor arm. The distributor cap fits only one way and the No. 1 leadout is plainly marked.

The International H-4 magneto is designed for use on all new line units, including the A, B, H, M, "4" Series, "6" Series, "9" Series and "14" Series (Diesels included) and No. 62 Harvester Thresher Engine.



ILLUST. 77--CROSS SECTIONAL VIEW OF INTERNATIONAL H-4 MAGNETO.

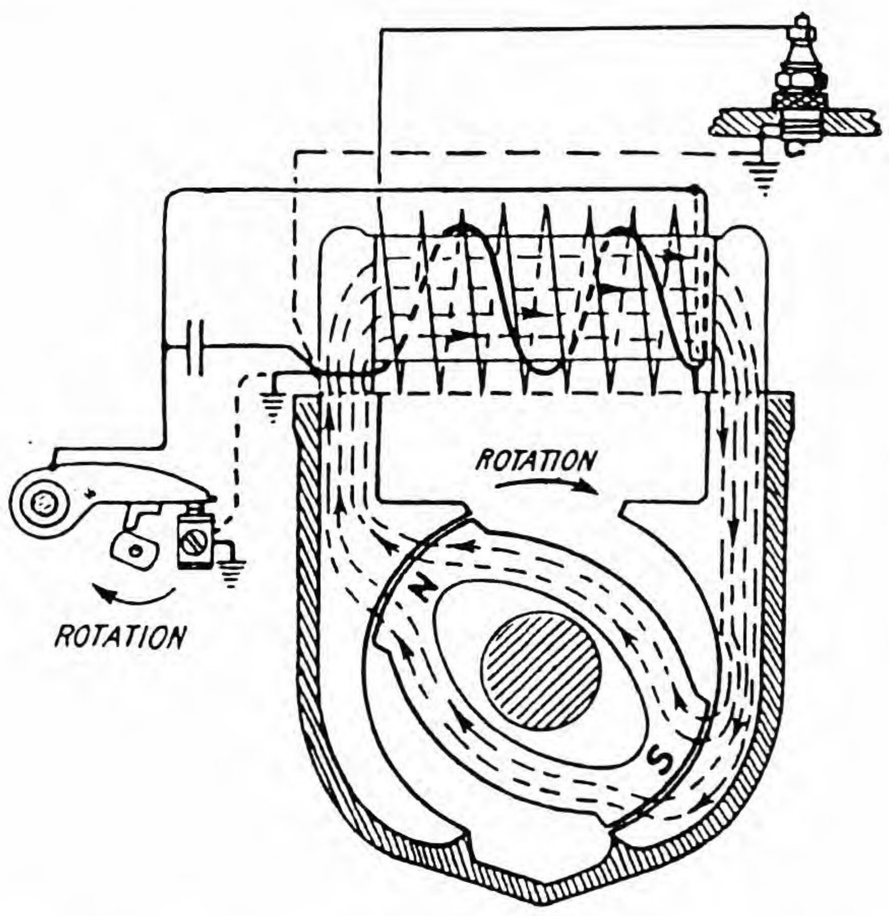
Magnetic Circuit in the International H-4 Magneto

The H–4 magnetic cirucit differs from the F-4 and F-6 magnetic circuit (page 5) in that the magnet is part of the rotor and is the rotating part of the magneto.

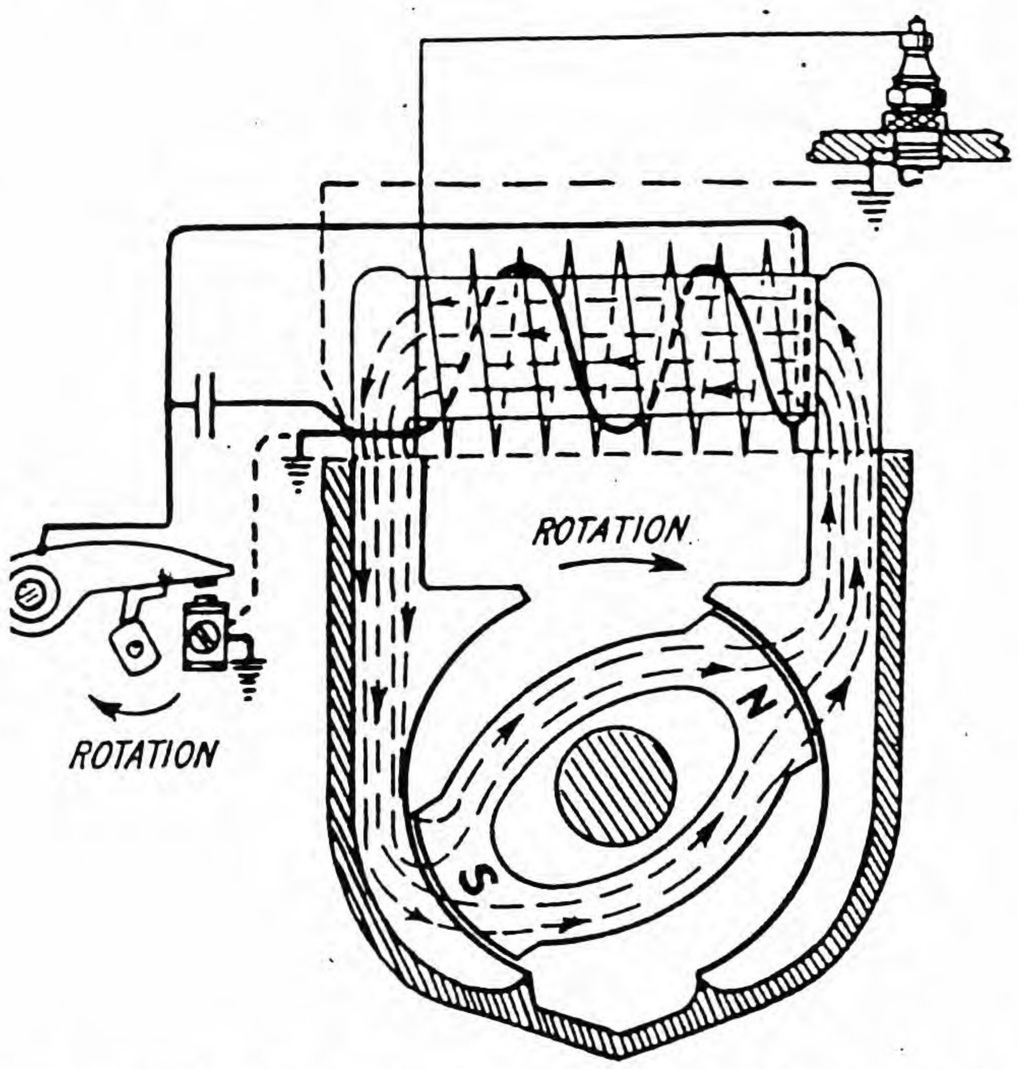


ILLUST. 78--ARROWS INDICATE THE PATH OF MAGNETIC LINES OF FORCE BETWEEN THE POLES OF ROTOR MAGNET.

Illustration 78 shows the H-4 magnet and the natural path taken by the lines of magnetic force; they are identical to those found around a compass needle.



ILLUST. 79--ARROWS INDICATE THE PATH OF MAGNETIC LINES OF FORCE THROUGH POLE PIECES AND THE CORE OF H-4 MAGNETO.



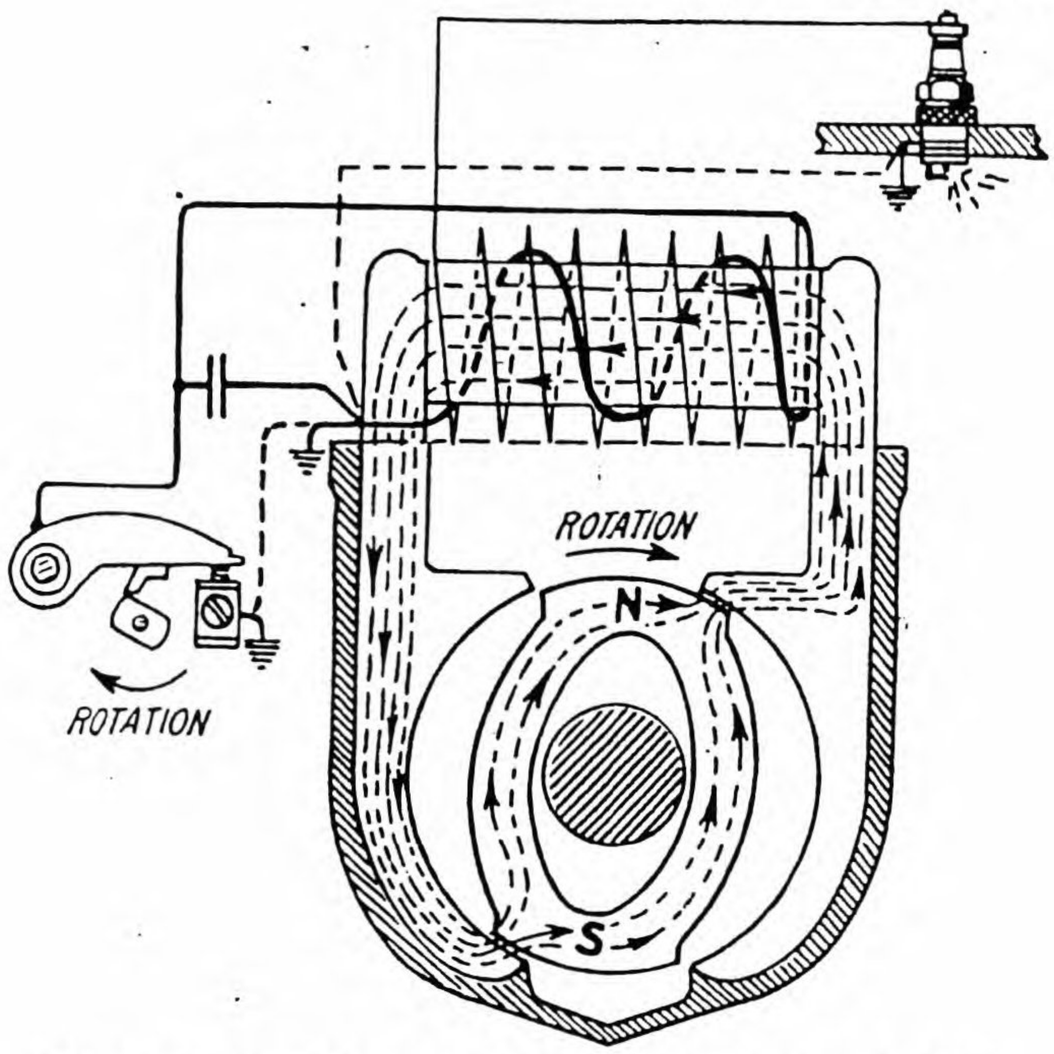
ILLUST. 80--ARROWS INDICATE THE PATH OF MAGNETIC LINES OF FORCE THROUGH POLE PIECES AND COIL CORE OF H-4 MAGNETO WITH ROTOR MAGNET TURNED 90° FROM THE POSITION IN ILLUST. 2. NOTE CHANGE IN DIRECTION OF ARROWS THROUGH COIL CORE.

Illustration 79 shows how the above natural lines of magnetic force have been changed to pass through the laminated pole pieces cast into the magneto frame and then through the laminated coil core. Magnetic lines of force will always pass through such an iron or soft steel path rather than pass from N to S through the air.

When the magnet has rotated clockwise to the position in Illust. 80, the path of magnetic lines of force through the coil core is the same but in the opposite direction. This means that every time the "N" end of the magnet passes from one pole piece to the other pole piece, there is a complete reversal of the direction of the magnetic lines of force.

Illust. 81 shows the position of the magnet when the breaker points start to open and when a spark occurs across the gap of the spark plug, that is when the magnetic center line of magnet is 6 degrees beyond vertical center line.

As magneto rotor moves from the position shown in Illust. 79 to the position in Illust. 80, the magnetic lines of force in the coil core are reversed. With this method of producing the reversal of force clearly understood, refer to pages 6 and 7 for the hydraulic analogy to complete the theory of the H-4 magneto operation.



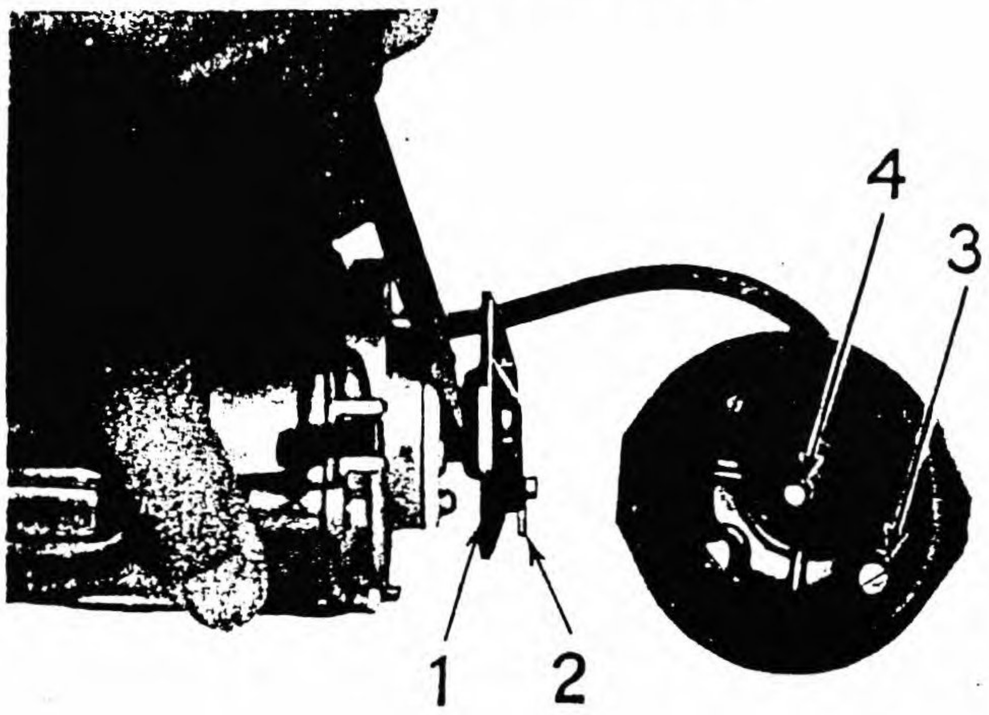
ILLUST. 81--INDICATES POSITION OF ROTOR MAGNET AT TIME SPARK JUMPS THE AIR GAP AT SPARK PLUG; BREAKER POINTS ARE JUST OPENING.

Distributor Cap

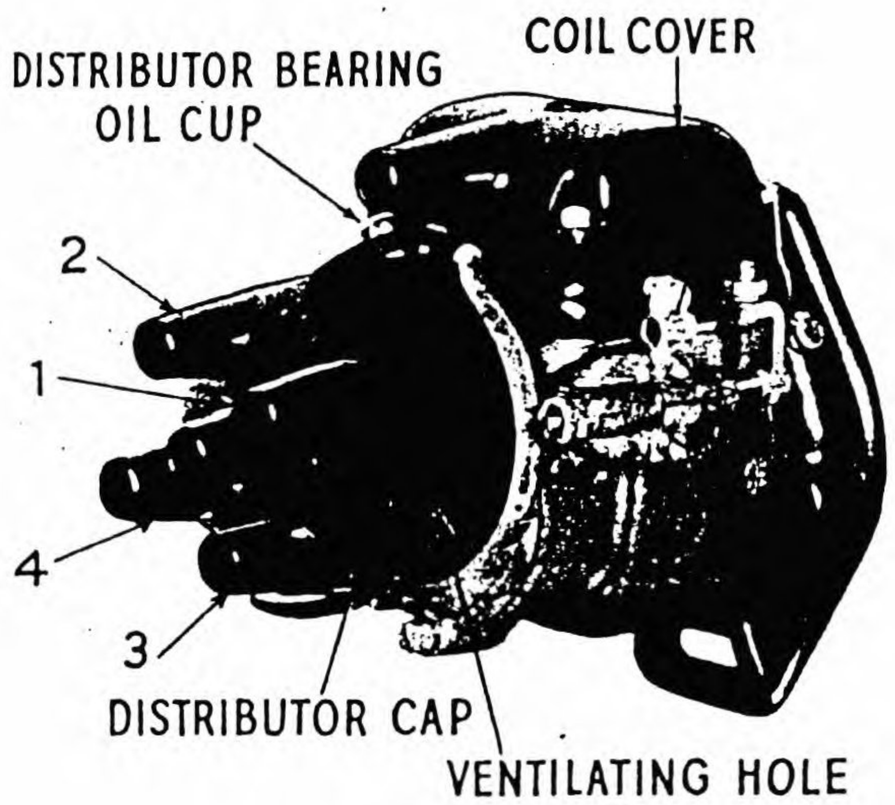
To remove distributor cap push distributor cap springs out of cap recesses and pull off cap. The lead from secondary of coil plugs into central insert socket and the cables to spark plugs fits in outside sockets starting with No. 1 marked on the face of the cap. Firing order on all four cylinder IHC engines and Continental engines used on Harvester Threshers is 1-3-4-2 . See wiring plan for each motor in their respective instruction books.

The carbon brush 4, Illust. 83, in the central socket contacts the monel metal strip (2) of the magneto rotor (1). The brush is attached to a spring; the assembly can be pulled from its socket if replacement is required. All grease should be removed from the monel strip to get a good contact.

The distributor cap should be free of dust or dirt, inside and out, before reassembling to magneto. The two ventilating holes (Item 2, Illust. 82) should be open at all times. For adjustment of the distributor rotor arm with respect to inserts (3), Illust. 83, refer to Page 52 and Illustrations 108 and 109. The cap fits only one way; the ventilating holes are always on the bottom side.



ILLUST. 83--METHOD OF REMOVING DISTRIBUTOR ROTOR FROM ITS SPINDLE. 1--DISTRIBUTOR ROTOR. 2--MONEL DISTRIBUTOR ARM. 3--DISTRIBUTOR CAP INSERTS. 4--SECONDARY CARBON BRUSH.



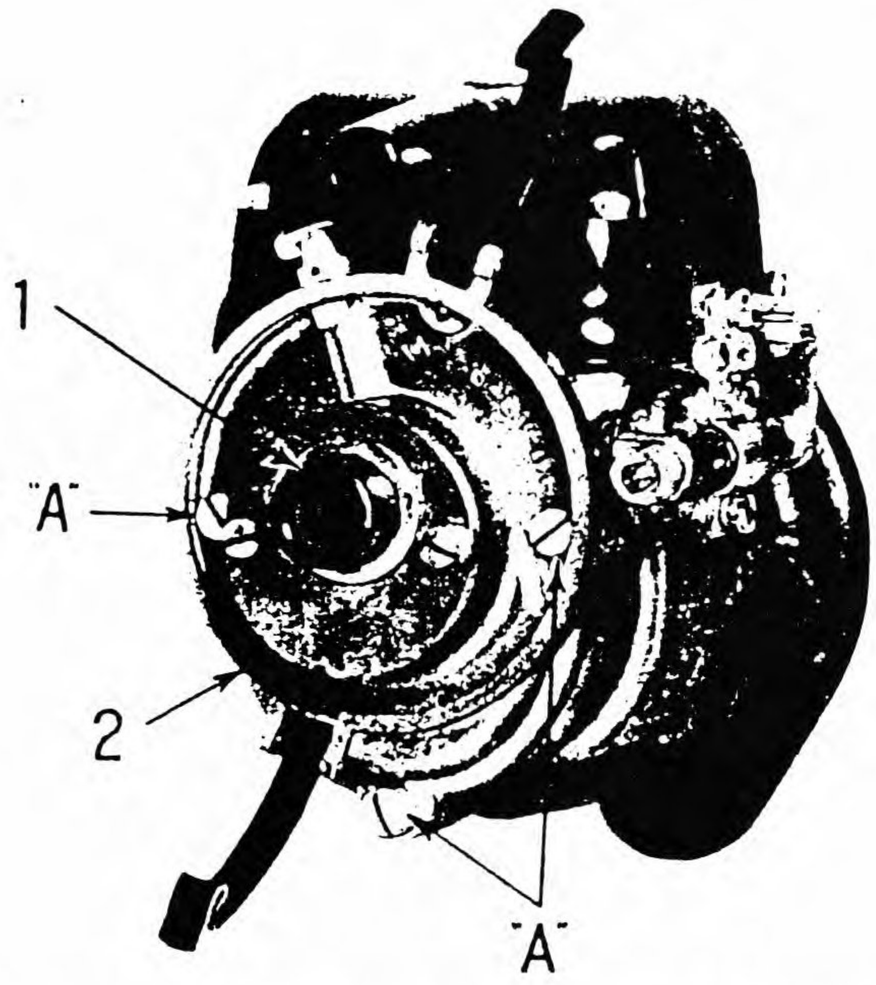
ILLUST. 82--H-4 MAGNETO COMPLETE WITH BODEN WIRE TYPE OF GROUNDING SWITCH.

Breaker Points

The entire breaker mechanism for the H-4 magneto is in its own separate internal compartment, thoroughly sealed against dirt and moisture. This makes it possible to thoroughly grease the mechanism without the usual danger of grit working into the lubrication, causing an abrasive action on the working parts.

Inspection of Breaker Points

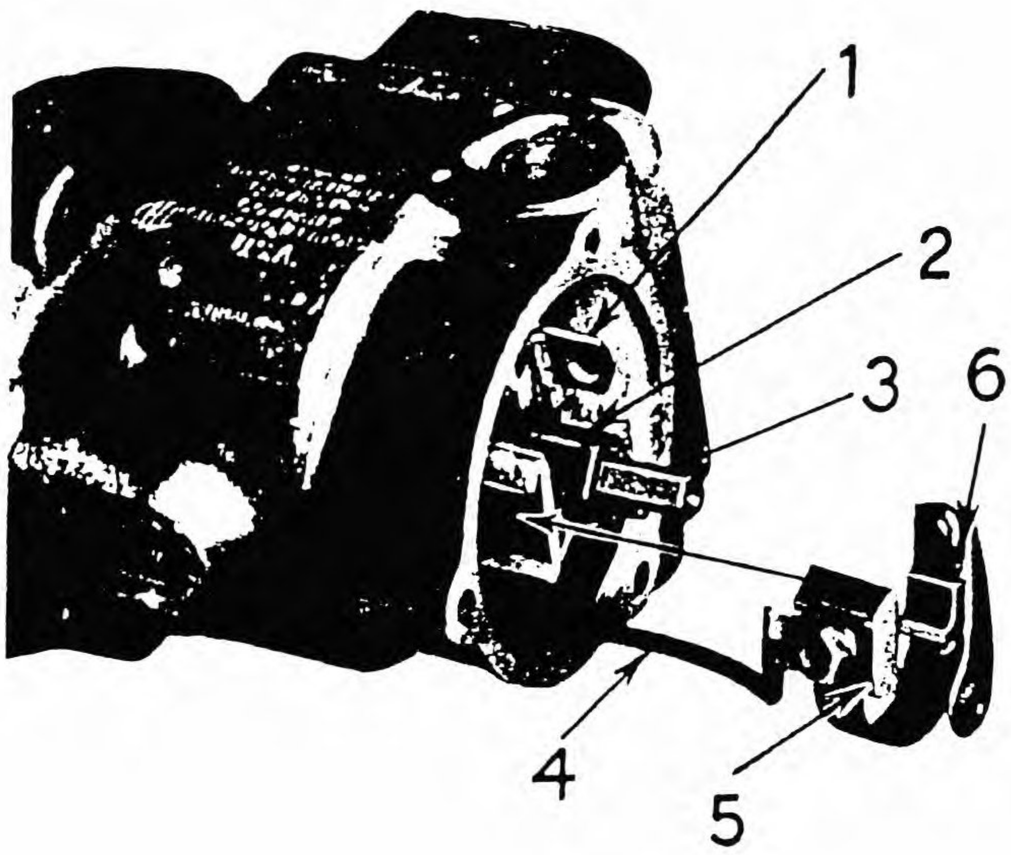
To gain access to the breaker mechanism, remove the distributor cap (Illust. 82), distributor rotor, and distributor body. The distributor rotor fits tight on the spindle and should be removed (Illust. 83) with a screw driver in back of the rotor hub. Bakelite rotor is fragile and should be handled with care. Distrib-



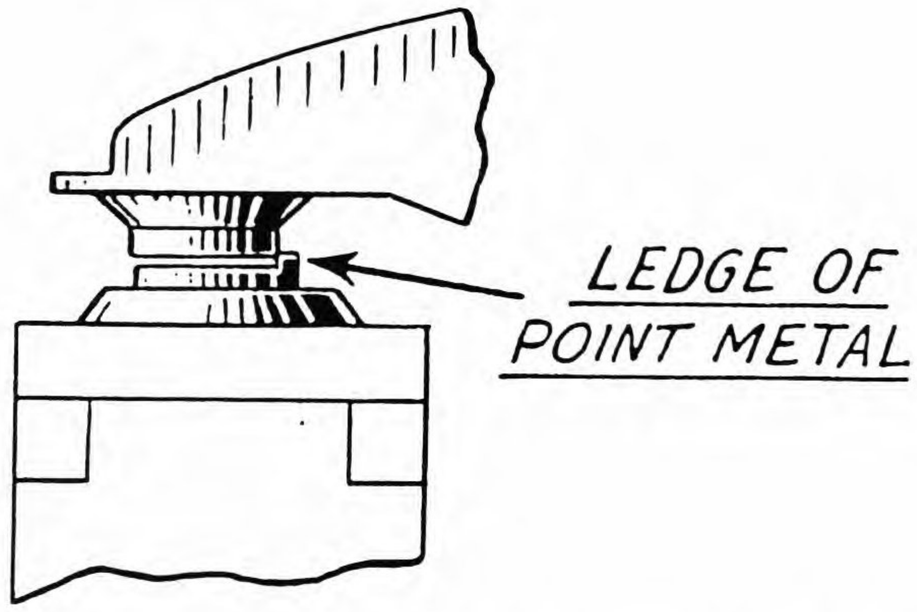
ILLUST. 84--H-4 MAGNETO WITH DISTRIBUTOR CAP AND DISTRIBUTOR ROTOR REMOVED. "A", SCREWS HOLDING DISTRIBUTOR BODY TO MAGNETO FRAME. 1--ROTOR SPINDLE. 2--DISTRIBUTOR BODY.

utor body is removed by loosening the screws "A" (Illust. 84). These screws should not be removed from the distriubtor body (2).

Now the breaker arm assembly (6) and spring anchor block (5), (Illust. 85) can readily be inspected and removed for any reworking required. As shown in Illust.



ILLUST. 85--H-4 MAGNETO WITH BREAKER ARM REMOVED (SEE ILLUST. 88.) 1--STATIONARY POINT. 2--BREAKER CAM, 3--"D" SHAPED END OF ROTOR SHAFT. 4--PRIMARY LEAD-OUT WIRE. 5--SPRING ANCHOR BLOCK. 6--BREAKER ARM ASSEMBLY.



ILLUST. 86--LEDGE OF POINT METAL CAUSES A SLOW BREAK AND POOR PERFORMANCE.

86 a ledge of point metal running up to to the side of the companion point causes a slow break and a weak spark and poor performance. If points are not worn down they may be re-dressed as shown in Illust. 88, but if excessive wear has occured, replace both stationary point and breaker arm.

At this same time examine the inside of the breaker housing for oiliness or grease. If oil has been leaking into the breaker housing the grease being used on the breaker arm in the distributor gear case is too thin. Remember that a dirty or oily breaker chamber means excessive breaker point wear. Keep the breaker chamber clean at all times.

Another possibility is that excessive lubricant is being injected into the distributor gear oil cup, or the felt seal, (Illust. 90) is not functioning properly. The replacement of felt seals is covered on Page 52.

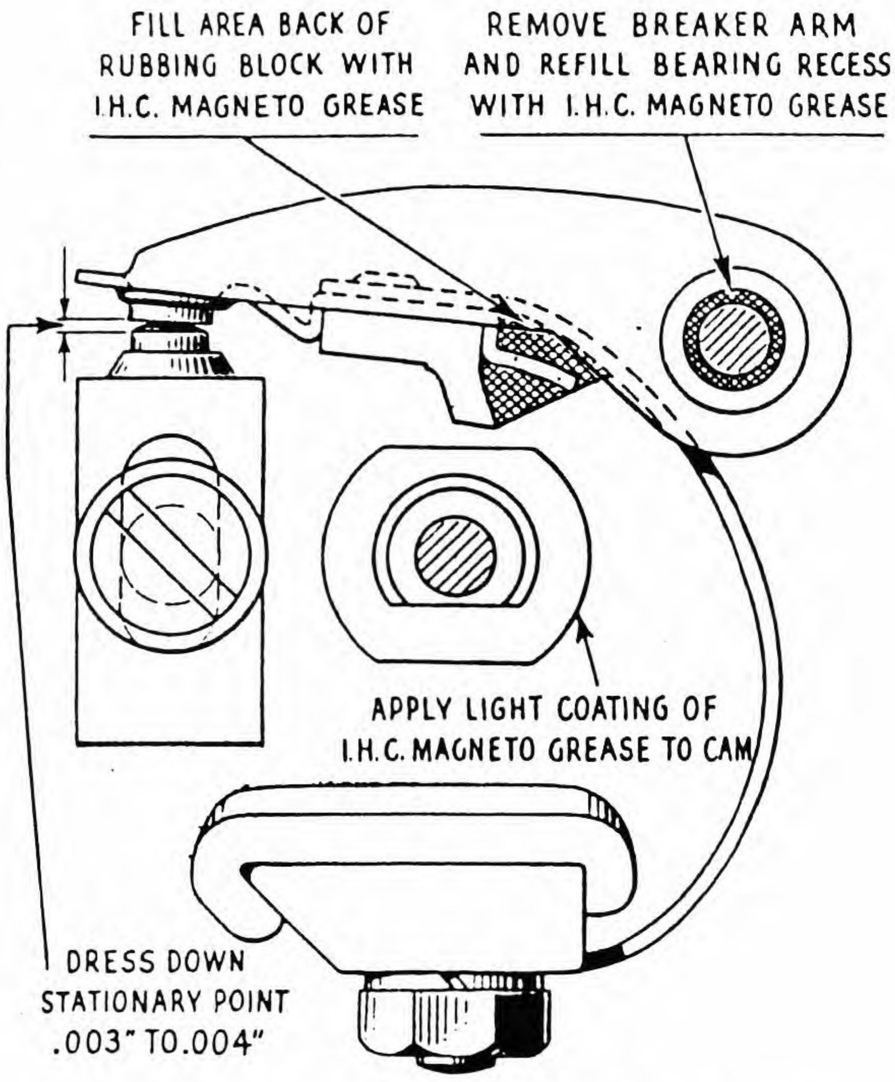
Adjusting Breaker Point

The point opening (1) should be .013" when rubbing block (2), Illust. 89, is on high point of cam (6). A gauge of this thickness is furnished with each tractor or power unit. Remove distributor cap, distributor rotor, (Illust. 83) and distributor body. Turn rotor until rubbing block (2) is on high point of cam (6). Loosen screw (8) in stationary point (7) and tap until gauge will slip snugly in opening. After adjustment be sure to retighten screw. When installing distributor body, be sure the pinion gear hub (5) which has a flat spot (Illust. 90) lines up with flat spot on the rotor shaft (6).

If breaker points are adjusted while magneto is mounted on engine, see section on timing of the magneto before reassembling distributor body.

INTERNATIONAL H-4 MAGNETO

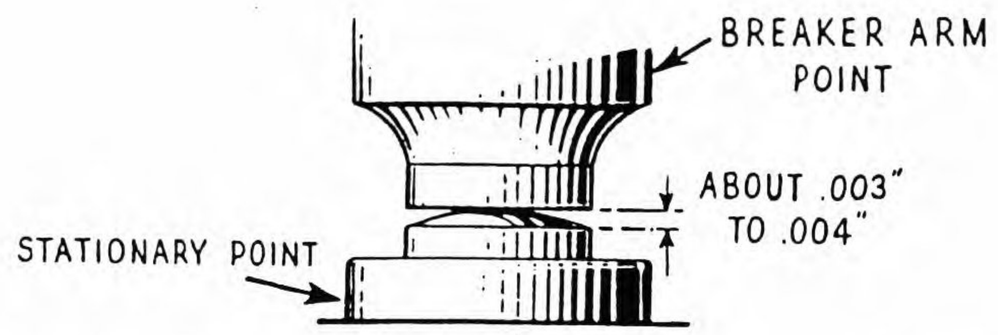
Assembling Breaker Mechanism in Housing: Greasing Instructions



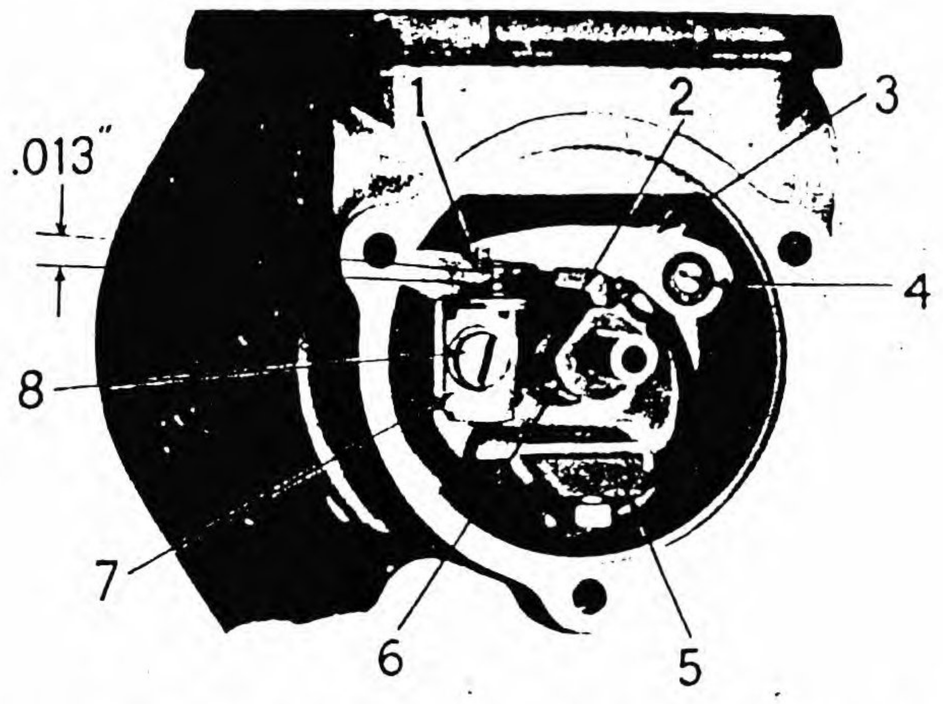
ILLUST. 87--GREASING H-4 BREAKER MECHANISM.

Before reassembling breaker mechanism thoroughly clean all parts to remove all grease and dirt. Fill the area back of the rubbing block as shown in Illust. 87 with I.H.C. magneto grease. Use a small clean screw driver as a spatula for this operation. Next fill the pivot bearing recess (3) with I.H.C. magneto grease. Use only enough grease to fill the recess in the shaft. Apply a light coating of grease to the breaker cam.

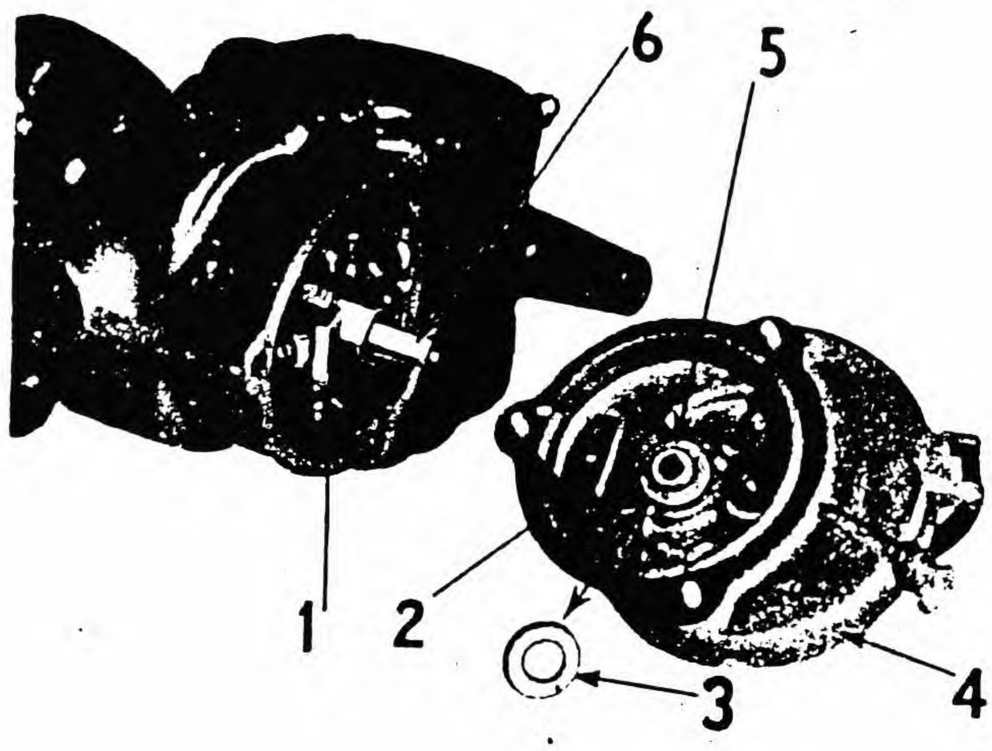
If the fixed breaker point has been removed, re-install it leaving the screw (8) slightly loose until point opening is adjusted. When re-installing the anchor block (5), (Illust. 89) do not push it tight against the housing, but allow it to stick out far enough so that it is pushed into place by the distributor pad (2) on the distributor body (4) (Illust. 90).



ILLUST. 88--CORRECTLY DRESSED BREAKER POINTS. DRESS DOWN OUTSIDE EDGE OF STATIONARY POINT FOR ABOUT .003 to .004" CROWN.



ILLUST. 89--END VIEW OF BREAKER MECHANISM. 1--POINT OPENING. 2--RUBBING BLOCK. 3--BREAKER ASSEMBLY. 4--BREAKER ARM PIVOT RECESS (FILL WITH MAGNETO GREASE). 5--SPRING ANCHOR BLOCK. 6--BREAKER CAM. 7--STATIONARY POINT. 8--ADJUSTING SCREW.



ILLUST. 90--H-4 MAGNETO WITH DISTRIBUTOR BODY REMOVED. 1--SPRING ANCHOR BLOCK. 2--DISTRIBUTOR PAD. 3--DISTRIBUTOR PINION OIL SEAL. 4--DISTRIBUTOR BODY. 5--DISTRIBUTOR PINION HUB. 6--FLAT ON END OF ROTOR SHAFT.

Timing Magneto To Engine

To time magneto to engine:

1. First turn the engine over to top dead center of the compression stroke for cylinder No. 1. This can be determined by removing the spark plug for No. 1 cylinder and cranking engine over until outward flow of air is felt. Then continue turning until flywheel or water pump drive pulley timing indicator lines up with "DC" mark.

On Farmall "A" and "B" Tractors and U-2 power units, timing marks are on flywheel. Timing pointer may be seen through opening in bottom of clutch housing.

On No. 62 Harvester-Thresher engines, line up letters "IGN" with timing pointer for No. 1 compression stroke. Pointer is visible through inspection hole in flywheel housing.

On Farmall "H" and "M", and "4", "6", "9" and "14" series carbureted engines, the timing indicator is on the water pump drive pulley and timing pointer is on crankcase front cover. The "DC" mark will be the first notch in the pulley to come in line as T.D.C. is approached.

On Farmall "MD" and "6" and "9" series Diesel Engines, pull compression release lever to convert engine to gasoline starting, and then turn engine past T.D.C. until "DC" mark on water pump drive pulley is 7/16" to 1" past the timing pointer in crankcase front cover. Later engines have the letter "M" stamped on water pump drive pulley at this position.

On "14" Series Diesel Engines, convert engine for gasoline starting and turn to "DC" mark for No. 1 cylinder on compression stroke.

2. Remove the cable from coil cover to the distributor cap.

3. Remove the distributor cap and turn magneto coupling in direction opposite to its normal rotation until arm on distributor points towards the No. 1 terminal on the distributor cap.

4. Assemble magneto on engine, making sure that impulse coupling lugs engage in slots on magneto drive coupling.

5. Insert magneto mounting bolts loosely in magneto flange, just enough to hold magneto in place.

6. On Farmalls "A", "B", "H" and "M" Harvester-Thresher, U-2, "4" and "6" Series carbureted engines, rotate the top of the magneto toward the crankcase. On "6" Series Diesel Engines and all "9" and "14" Series carbureted and Diesel engines pull the top of the magneto away from the crankcase.

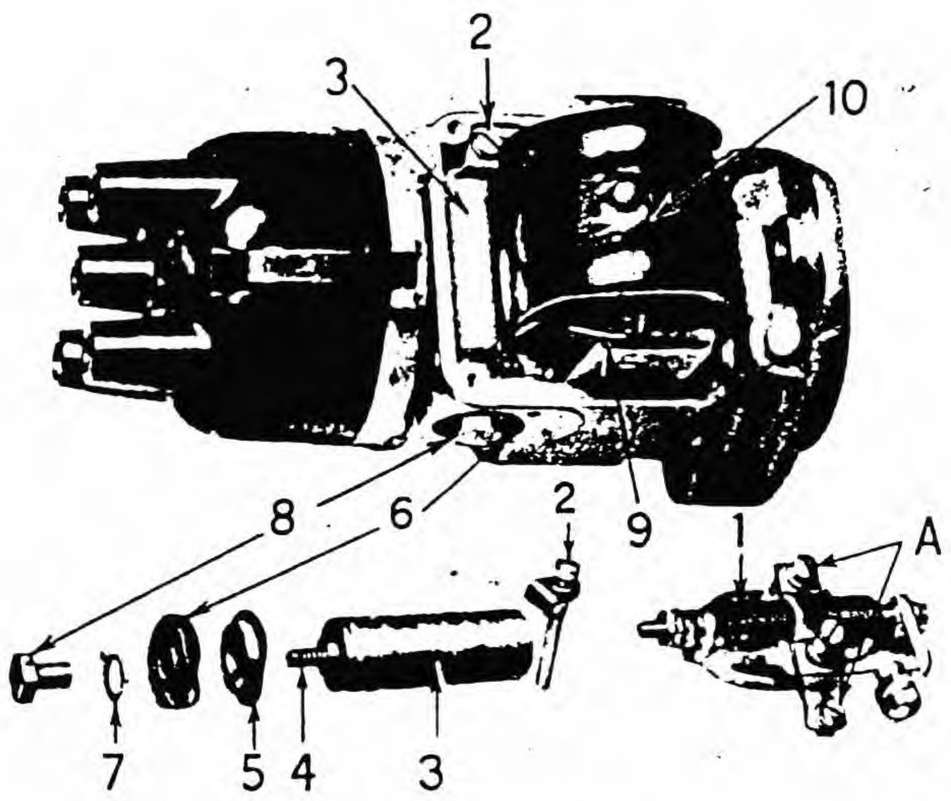
7. Crank the engine one complete revolution or to the next T.D.C. Pull the upper part of the magneto toward the opposite side from that in step No. 6 until impulse coupling just trips.

On "6" and "9" series Diesel engines, it is good policy to start the engine and while the engine is still cold, move the top of the magneto to the point where the R.P.M. is maximum and the exhaust is snappy. A draggy, puffing exhaust indicates the need for additional retard of the magneto for starting purposes.

8. Tighten mounting bolts securely. Attach spark plug cables to engine and magneto. Start by connecting the No. 1 cylinder spark plug to the socket marked "No. 1" on distributor cap. Firing order on all four cylinder engines using the H-4 magnetos is 1-3-4-2. Crank the engine over with the distributor cap removed slightly to check actual position of each wire after "1". Also consult wiring chart in the Instruction Book for the engine being worked on.

9. To check timing, crank engine slowly until impulse coupling trips and compare timing indicator with "DC" mark.

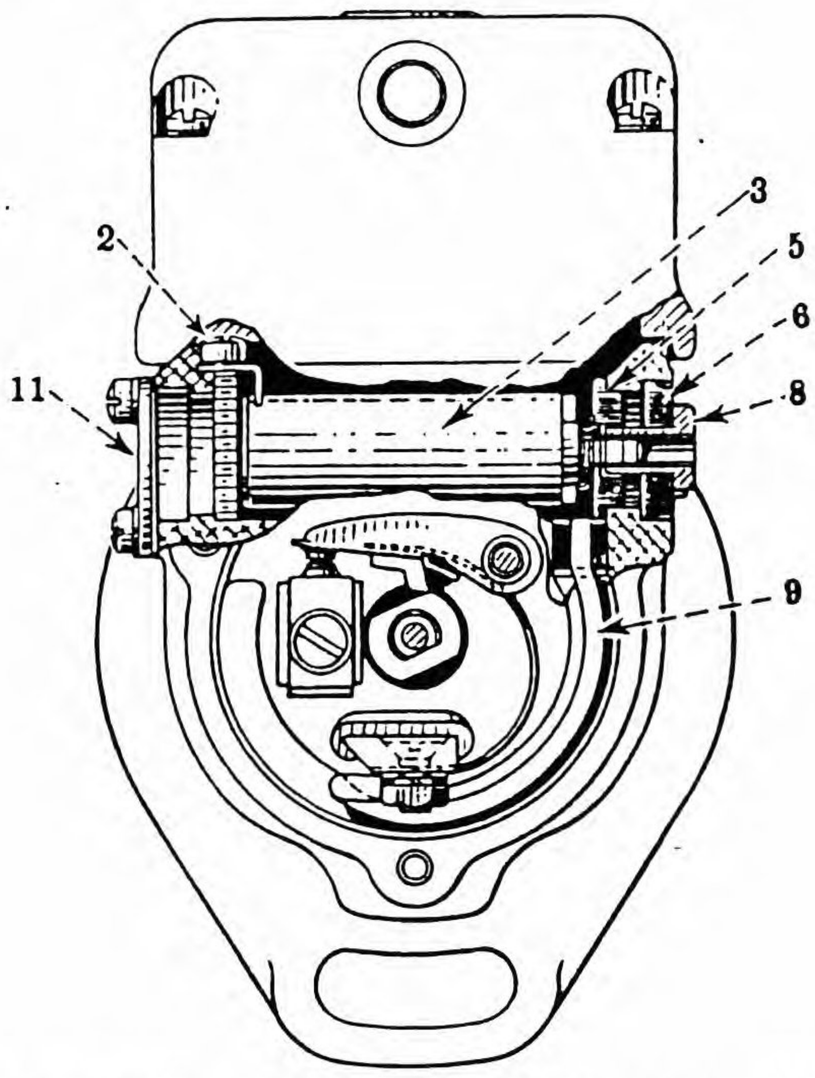
10. If breaker points are examined and distributor gear case is to be replaced, rotor pinion must fit over "D" shaped end of rotor shaft. If rotor has been turned while inspecting points, there is danger of getting engine out of time by 180°. After setting points, turn engine to No.1 T.D.C.compression stroke, attach distributor rotor to its spindle, and then turn distributor rotor key to the No. 1 position on the distributor. Then assemble this unit over the rotor shaft, making sure rotor shaft enters "D" shaped hole in rotor pinion. Remove rotor and tighten the three screws.



ILLUST. 91--H-4 MAGNETO WITH COIL COVER REMOVED SHOWING PARTS MAKING UP THE CONDENSER ASSEMBLY. 1--MAGNETO GROUNDING SWITCH. 2--CONDENSER CLAMP AND SCREW. 3--CONDENSER. 4--CONDENSER TERMINAL. 5--INNER BAKELITE WASHER. 6--OUTER BAKELITE WASHER. 7--CONDENSER TERMINAL LOCK. 8--TERMINAL SCREW. 9--PRIMARY LEAD-OUT WIRE. 10--COIL.

INTERNATIONAL H-4 MAGNETO

The condenser (3) Illust. 91, is located in the body of the magneto. To remove the condenser with the coil in place, first remove the grounding switch (1) by removing the screws (A). Next bend the lock (7) away from the flat on the condenser terminal screw (8). The screw may then be removed with the lock and outer bakelite washer (6). Remove the coil cover and then remove the condenser clamp and screw (2). Then push the condenser back into the frame and remove the inner bakelite washer (5) and the two primary wires (9) from the condenser terminal. (The primary wire from the breaker arm to condenser is not shown, but it is shown in Illust. 97, Item 1). The condenser may now be lifted out by working it forward through the side of the magneto. To assemble the condenser into the magneto just reverse the above procedure.



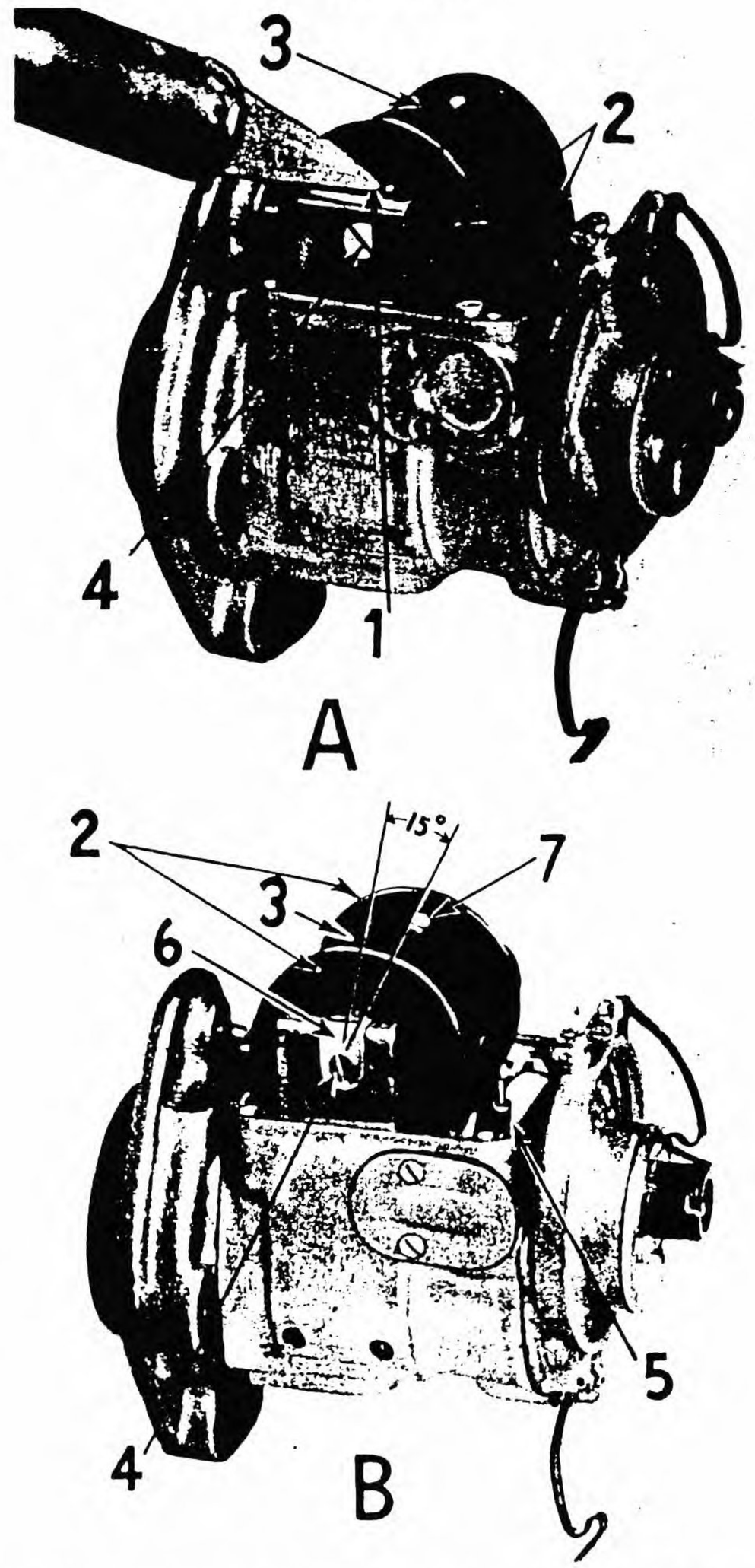
ILLUST. 92--CROSS SECTION VIEW OF H-4 CONDENSER ASSEMBLY SHOWING THE LATEST CONSTRUCTION. 2--CONDENSER CLAMP AND SCREW. 3--CONDENSER. 5--INNER BAKELITE WASHER. 6--OUTER BAKELITE WASHER. 8--TERMINAL SCREW. 9--CONDENSER PRIMARY WIRE. 11--CONDENSER HOLE COVER PLATE.

As shown in Illust. 92, removal and re-assembly of the condenser is simplified in the latest magneto by the substitution of a flat plate held by two screws instead of the expansion plug in the side of the magneto housing. Slide the condenser through this hole and make all other connections as outlined.

When tightening the condenser terminal screw (8) there is a possibility of breaking the bakelite washer (6) or breaking the condenser terminal (4), so do not apply too much pressure to the wrench when tightening screw.

The condenser is the same as used on the latest F-4 Magneto. By that we mean, it has the large diameter thread (No.10-32 threads per inch) on the terminal instead of No. 8-36 threads per inch. The H-4 condenser may be used to replace the old F-4 condenser in F-4 magnetos, by using a No.10 nut (32 threads per inch). The old F-4 condenser will not replace the condenser in the H-4 magnetos. The terminal screw will not fit the threads on the F-4 condenser.

H-4 Coil



ILLUST. 93--COIL MOUNTING IN H-4 MAGNETO. 1--SOLDERED GROUND CONNECTION. 2--COIL INSULATORS. 3--COIL. 4--COIL CORE HOLDING SCREW, COUNTER SUNK. 5--CONDENSER TO BREAKER WIRE. 6--COIL GROUNDING STRIP. 7--SECONDARY LEAD-OUT TERMINAL.

The construction of the coil is very similar to that previously used on the F-4 and F-6 magnetos. To remove the coil, first remove the coil cover by taking off the four screws, (See Illust. 82). Then remove the condenser primary wire (9) Illust. 91, from the condenser terminal by following the same procedure as outlined for removing the condenser on Page 45. The next step is to remove the soldered strip (1) Illust. 93, from the top of the pole piece. This strip is used as a ground wire. When applying the soldering iron be careful not to overheat the strip and loosen the joint inside the coil; also do not hold the soldering iron too close to the coil.

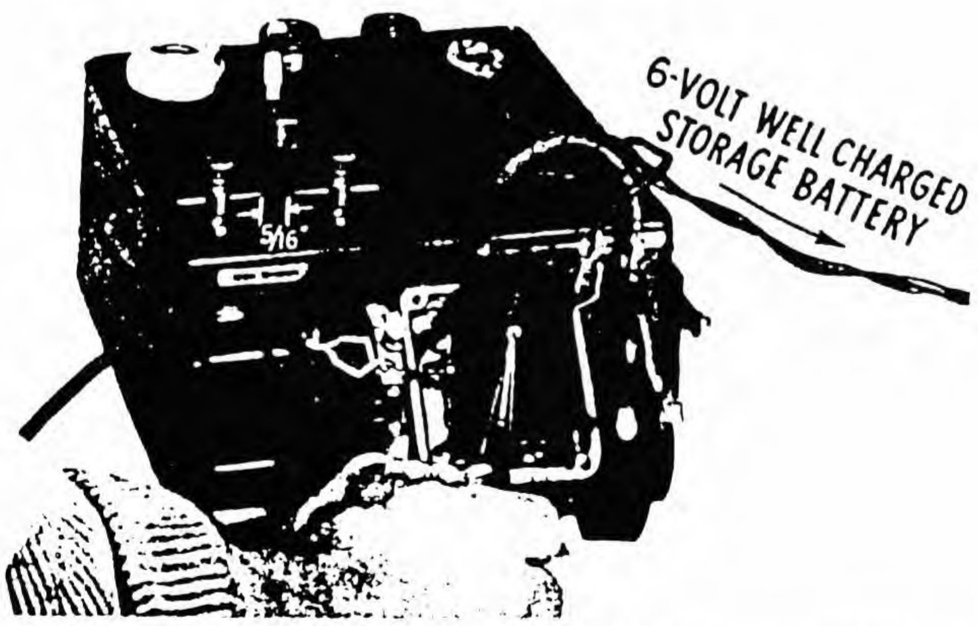
Illust. 93 shows two magnetos with the coil cover removed. Magneto "B", which is of the later construction (71002 and up); shows the coil strip (6) attached under the countersunk screw (4) and requires no soldering iron to remove the coil strip. It is necessary only to remove the screw that holds the coil core. Next remove two screws (4) from each end of the coil core. The coil may then be taken out of the magneto.

Important: Before lifting coil out, turn magnet to the neutral position or so pole of magnet bridges air gap between end of coil pole pieces. The instructions for removing coil core and the examination for coil core fit between inter-poles as outlined on Page 14, applies to the H-4 Magneto.

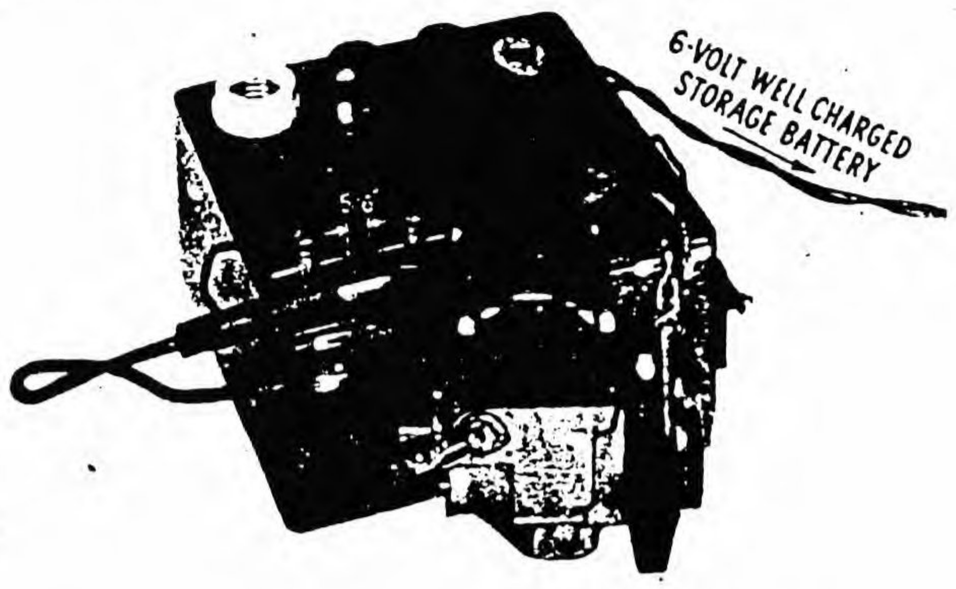
Testing Condenser

To test the condenser, it must be removed from the magneto and then the test made with either the Neon Condenser Tester No. SE-1064, as explained on Page 15 or the Electrical Test Set, SE-846, as explained on Page 15.

Testing H-4 Coil

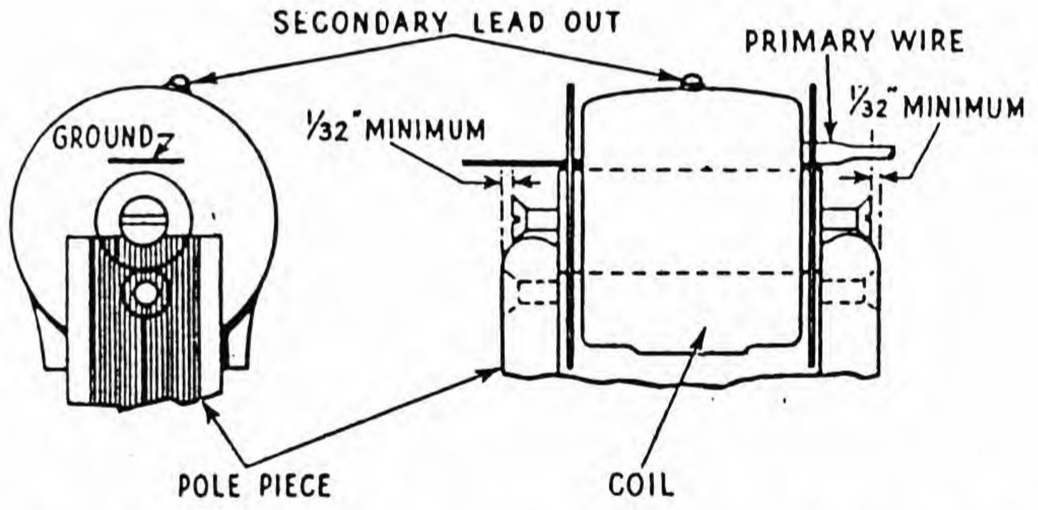


ILLUST. 94--TESTING H-4 COIL WHILE ASSEMBLED TO MAGNETO USING SE-846 WHEN COIL COVER AND CONDENSER ARE REMOVED. FOR METHOD USED REFER TO PAGE 12.



ILLUST. 95--TESTING H-4 COIL WHILE ASSEMBLED TO MAGNETO USING SE-846 WHEN COIL COVER IS IN PLACE AND BREAKER POINTS ARE OPEN. FOR METHOD USED, REFER TO PAGE 12.

When the coil is removed from the magneto it may be tested in the same manner as shown for the F-4 coil on Page 12 (Illust. 18). The coil also may be tested without removing it from the magneto as shown in Illust. 95.



ILLUST. 96--ASSEMBLE COIL CORE MOUNTING SCREWS TO COIL CORE TO MAKE SURE THEY DO NOT BOTTOM IN CORE WHEN ASSEMBLED IN MAGNETO.

Inspect the end insulators (2), (Illust. 93) of the coil. If they are damaged they should be renewed. The end insulators are the same as used on the F-4 and F-6 Magnetos. When replacing the coil, the secondary leadout terminal (7), Illust. 93, should be at an angle of 15° with the center line of the coil. The reason for so positioning the coil terminal is to secure a good contact with the secondary terminal outlet in the coil cover.

Test coil core mounting screw length by bottoming screws lightly in coil core and pressing assembly into position shown (Illust. 96). H-4 mounting screws (4) are 5/8" length.

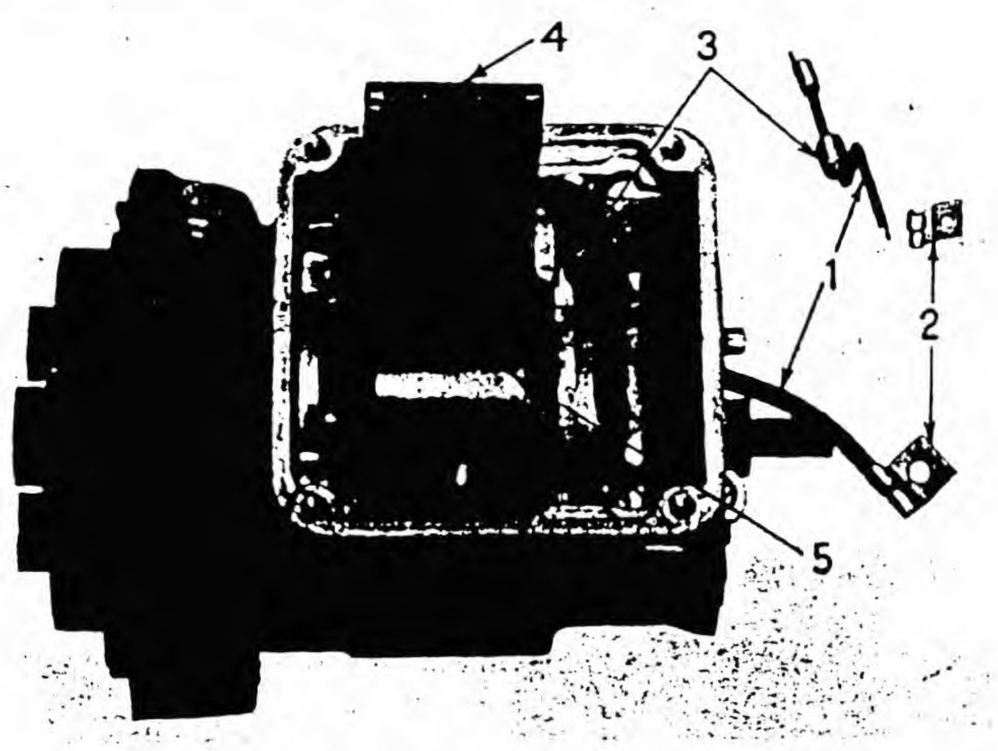
If either screw head does not fall back of the face of pole piece by 1/32"

as shown, it must be removed and enough cut off the threaded end to meet this requirement. When the coil core is in place the screws will then tighten up in the countersunk hole of the pole piece before the screws bottom in the coil core.

CAUTION: Do not file or otherwise deface ends of coil core or face of pole pieces as this will impair the magnetic circuit and efficiency of the magneto. The coil core should be a light press fit between the pole pieces.

Coil Marking

The coils are marked as to the month and year of their manufacture. For instance, a mark, 8-39, means that the coil was built in August 1939.



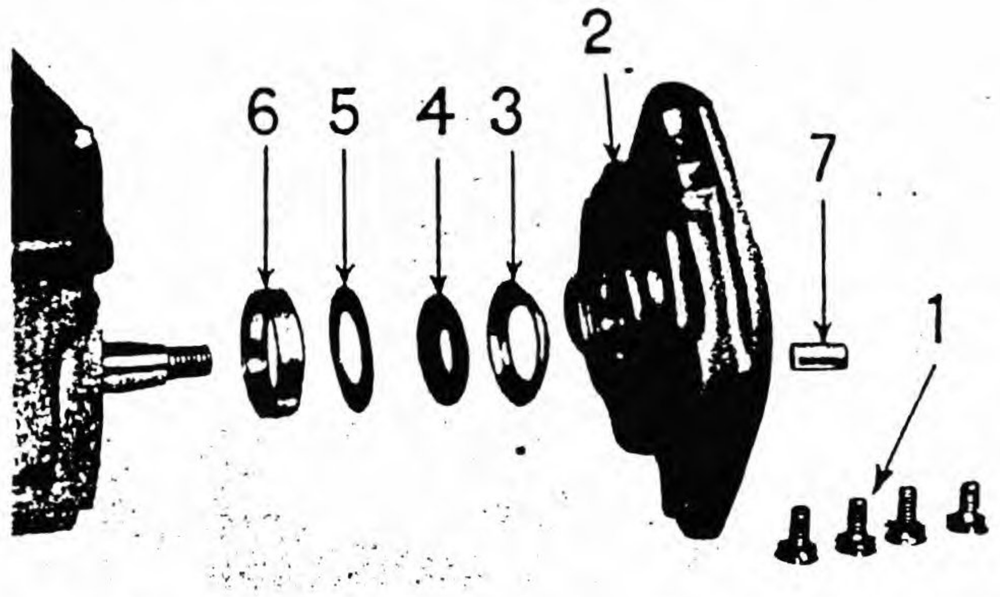
ILLUST. 97--LOCATION AND ASSEMBLY OF PRIMARY WIRE. 1--PRIMARY WIRE. 2--SPRING ANCHOR TERMINAL. 3--RUBBER GROMMET. 4--COIL INTER-POLE. 5--ROTOR MAGNET BRIDGING AIR-GAP.

The primary wire (1) connecting the breaker arm assembly to the condenser terminal, should be a tight fit in rubber grommet (3), and the rubber grommet (3) should be a tight fit in the magneto frame (Illust. 97). The primary wire and the rubber grommet should make an air-tight job in the magneto frame.

To remove the primary wire (1) the spring anchor terminal (2) must first be unsoldered. Then pull the terminal wire out from the top of the magneto. In reassembling the primary wire, reverse the above procedure.

The spring anchor terminal (2) should be assembled to the breaker arm assembly. When assembling the breaker arm to the magneto, do not flatten the terminal and be careful that it does not touch any part of the magneto frame.

Mounting Flange and Oil Seal



ILLUST. 98--H-4 MAGNETO WITH IMPULSE COUPLING REMOVED, SHOWING MOUNTING FLANGE AND ROTOR BEARING PARTS. 1--COUNTER SUNK SCREWS WITH LOCK WASHERS. 2--MOUNTING FLANGE. 3--FORWARD OIL SEAL RETAINER. 4--LEATHER OIL SEAL. 5--INNER OIL SEAL RETAINER. 6--OUTER BEARING RACE.

The mounting flange (2) attaches the magneto to the engine and is held to the magneto frame with four countersunk screws and shakeproof lock washers (1) Illust. 98. The mounting flange contains one of the rotor bearing races (6) and a leather oil seal (4). The purpose of the oil seal is to keep engine lubricating oil out of the magneto.

To remove the mounting flange, first remove the impulse couplings as explained on Page 53. Then, take out the four countersunk cap screws (1). When replacing, attach so impulse coupling oil cup is on top.

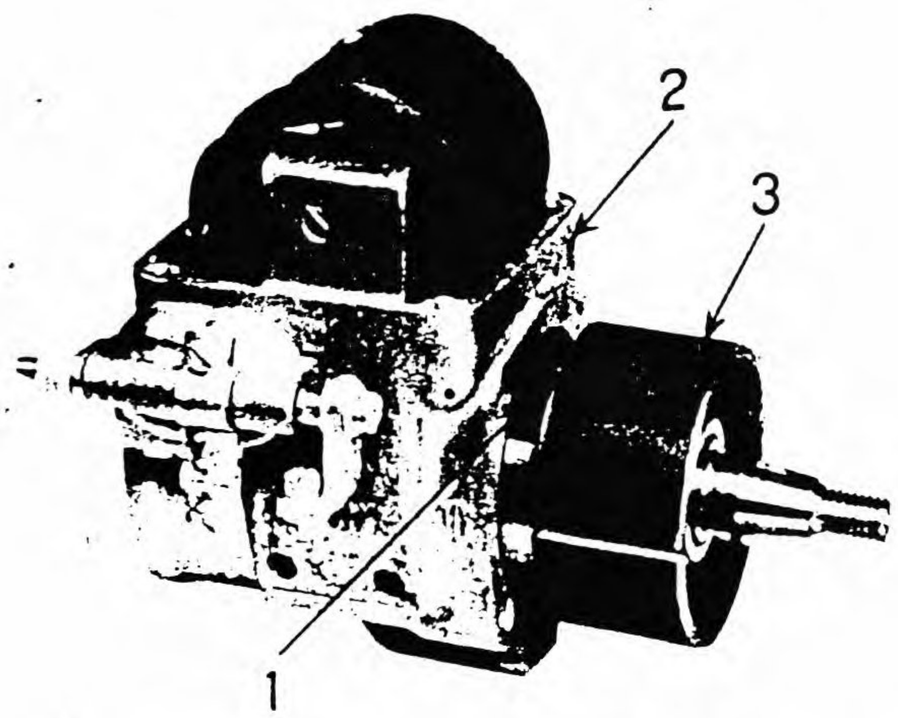
Removing Oil Seal

The rotor shaft leather seal (4) Illust. 98, and the two retaining members, (3) and (5) are held in place by press fit of the rotor ball bearing outer race (6). The rotor bearing races (6) can be removed with Puller SE-1020 as outlined and illustrated on Page 23. Races may be replaced with Tool SE-1020, shown on the same page.

Illustration 98 shows the sequence of assembly of bearing race and oil seal. The internal taper side of the leather oil seal (4) faces the bearing race (6) and the bulged side of the oil seal retainer (5) faces the oil seal (4). Careful centering and proper arrangement of the oil seal produces maximum compression and efficiency.

If a new bearing race has been installed, the recommended procedure is to remove complete rotor and bearings and reassemble all parts as covered under the heading of ROTOR MAGNETS and ROTOR BEARINGS (including checking magneto rotor shaft end play).

Rotor Magnets and Rotor Bearings



ILLUST. 99--REMOVING MAGNETO ROTOR. REMOVE ROTOR (1) FROM MAGNETO FRAME (2). SLIDE KEEPER #57314 D (3) OVER ROTOR POLES BEFORE ROTOR IS COMPLETELY OUT OF FRAME.

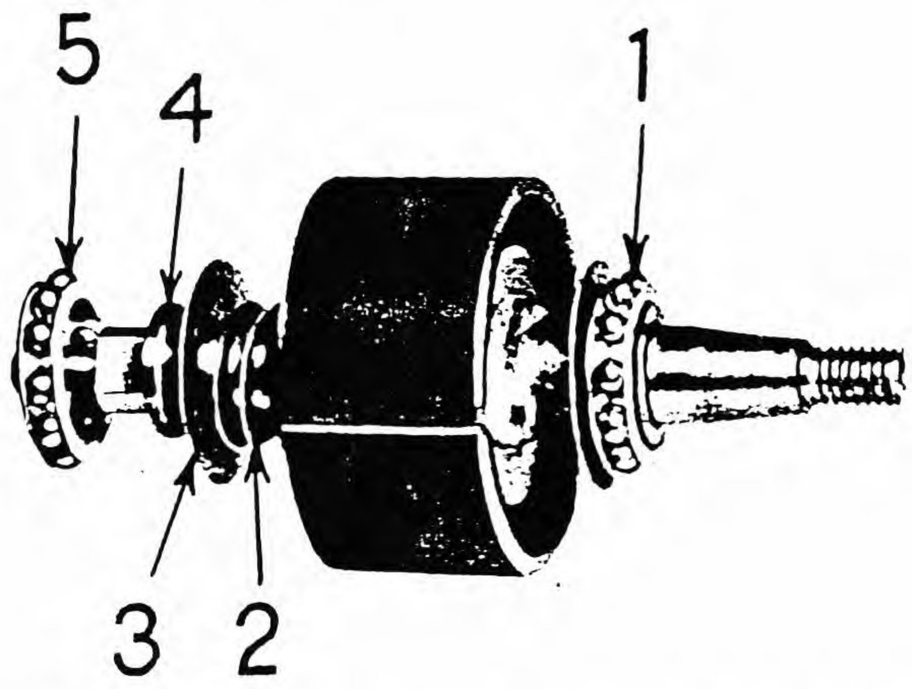
A new feature of the H-4 magneto is the combining of the rotor and the magnet which means that the magnet is the revolving part of the magneto. To remove the rotor and bearings it is necessary to remove the impulse coupling and mounting flange. Then slide the rotor magnet into keeper 57314-D (Illust. 99), as it is being removed from the magneto frame. Always have the rotor in the keeper when it is out of the magneto frame. Use extreme care to see that the rotor does not pick up dirt and metal particles. Keeper 57314-D is available as a service part.

Thoroughly clean rotor assembly and bearing races of the old grease and any grit. Re-greasing of the bearings should not be done until they have been checked for end play.

The bearings when assembled at the factory are preloaded .001 to .002 inches. The rotor should never have any perceptible end play if it is assembled properly. Old bearings and races should be assembled without disturbing shims (3) Illustration 100). Should an end play check, (Illustration 101) reveal that end play is present, no attempt should be made to preload old bearings as this will cause rapid deterioration of the bearings. The recommended procedure when end play exists on old bearings is to replace them.

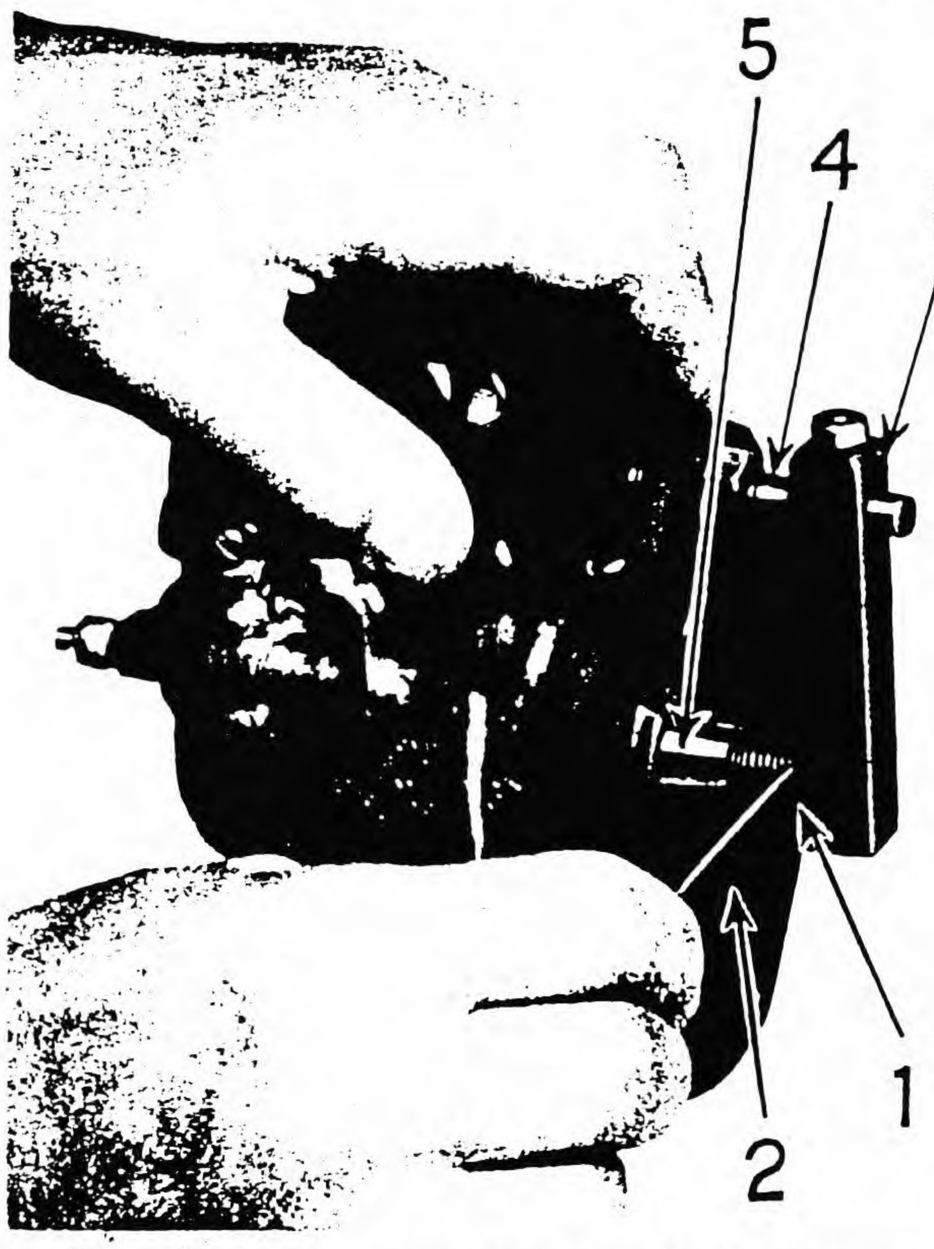
Checking Rotor End Play

Place sufficient shims (2), Illust. 100, in back of the bearing race to allow a small amount of end play in the rotor



ILLUST. 100--H-4 ROTOR MAGNET WITH KEEPER, BEARINGS, AND SHIMS. 1--FORWARD BEARING. 2--ROTOR SHIMS. 3--INNER FELT RETAINER. 4--BEARING INNER RACE 5--BEARING RETAINER WITH BALLS.

shaft after it is completely assembled and the mounting screws are tightened up (end play should be checked with no grease on the bearings). The end play may then be checked with a dial indicator or or by making a device as shown in Illust. 101. Then check the end play between the fixture (3), and the end (1) of the rotor shaft (5) with a feeler gauge (2). Take two readings of the feeler gauge, one with the rotor as far one way as it will go, and the other with the rotor moved as far in the opposite



LLUST. 101--CHECKING ROTOR END PLAY. 1--CHECKING POSITION, 2--FEELER GAUGE. 3--FIXTURE END PIECE. 4--FIXTURE MOUNTING BOLT. 5--ROTOR SHAFT.

direction as it will go. The difference in these two readings, will be the actual end play. Add .001" to the difference between the two readings, which should be the thickness of the additional shims to be added. Remove the mounting flange, slide the rotor into the keeper 57314-D, then add the required number of shims (2), Illust. 100, in the proper location. Grease bearings, reassemble the rotor and the mounting flange and check the rotor for free turning. The preloading of the bearing should not cause binding of the rotor. Be careful not to overfill the bearings with grease; just fill the spaces between the balls of the bearings with I.H.C. magneto grease.

IMPORTANT: Be sure to keep the rotor and bearings clean during this operation. Do not drop the magnet or hit it with any sharp instrument, because it is very brittle and will chip readily.

Extreme care must be exercised to assure that the rotor is free from metal chips before it is assembled into the magneto as chips may jam the rotor. The magnet is highly magnetized and will draw all magnetic metals to it. Using compressed air is one of the best methods to clean the rotor.

Removing and Replacing Bearing Races

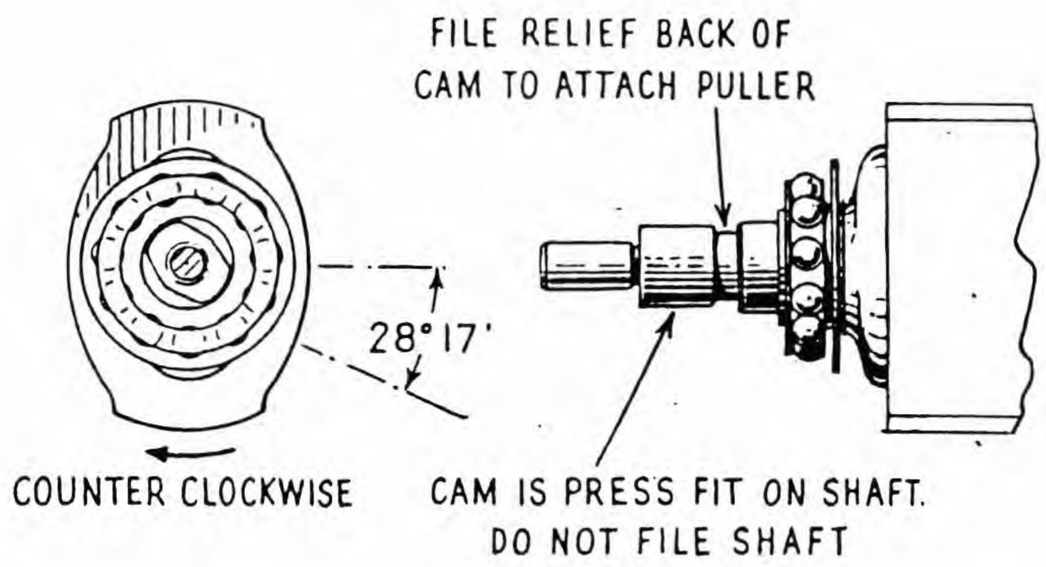
The ball bearings and outer bearing races are similar to those used in the F-4 and F-6 magneto and may be removed and replaced in the same manner, i.e., with tools No. SE-1020 and No. SE-1021 as outlined and illustrated on Pages 22 and 23. The inner race may be removed with tool No. SE-839 as explained on Page 22.

Magneto Magnet

As stated before, the magnet is part of the rotor and is the revolving member of the magneto. The magnet, made of a new alloy known as Alnico (an aluminum, nickel, cobalt and iron alloy), is cast directly into sand moulds. After it is once thoroughly magnetized, this magnetic material should never lose its magnetism if carefully handled.

We cannot stress too emphatically the importance of being careful tc guard against metal chips adhering to the magnet. The use of compressed air is one of the best methods of cleaning the magnet and rotor before assembly into the main frame of the magneto. The clearance of the magnet and the pole pieces of the magneto is so close that any chips adhering to the magnet may cause the rotor to become jammed.

Breaker Arm Cam



ILLUST. 102--POINTS AT WHICH ROTOR MAY BE FILED IN ORDER TO REMOVE CAM.

The breaker arm cam (2) Illust. 85 should last indefinitely if it is properly lubricated. If the cam should become worn, it is so designed that it may be replaced. If the cam is to be replaced, install the new slow rise cam 60094-D as outlined in Service Bulletin S-3738A-1713. This cam has greatly increased radii at contacting surfaces and provides a slower rise cam to overcome vibration of breaker arm at higher speeds, lengthen life of breaker arm and breaker points, and improve grease retention. The cam can be replaced as outlined below.

Remove the rotor from magneto:

1. Place magneto in a vise by holding it in the flange.

2. Remove the impulse coupling:

   a. Insert a nail or pin through the hole in the coupling drive member.

   b. Remove nut by applying a socket wrench to the nut, and an open end wrench to one of the driving lugs.

   e. Pull drive member and impulse coupling complete by using puller tool SE-912.

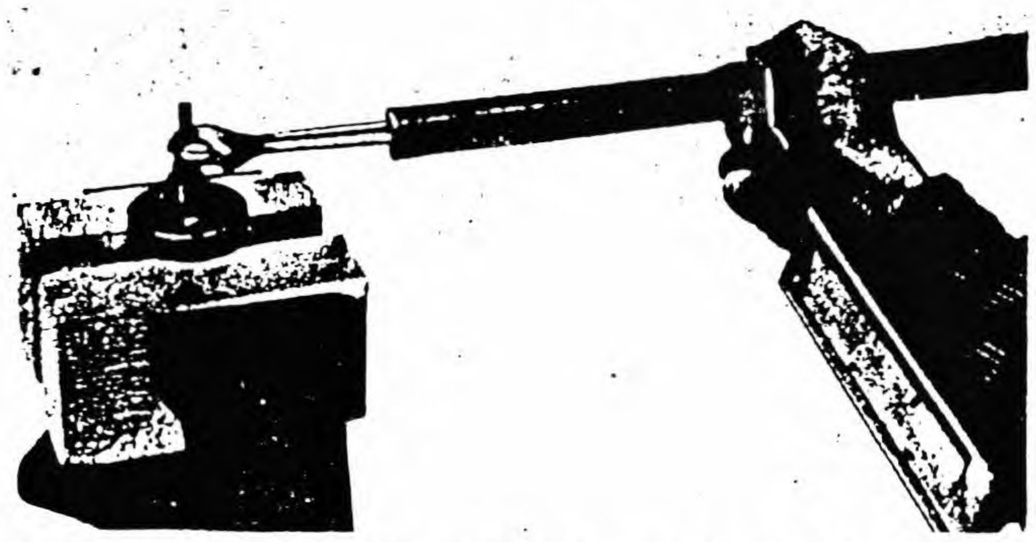
3. Remove key from shaft.

4. Remove mounting flange (4 cap screws).

5. Remove distributor cap and distributor rotor.

6. Remove magneto body (3 capscrews).

7. Withdraw rotor from body and attach keeper 57314-D to magnet of the rotor.



ILLUST. 103--CHECKING TIGHTNESS OF NEW CAM ON ROTOR SHAFT

Remove Old Cam From Rotor:

File an undercut just behind the rotor sufficiently deep to apply a small puller for removal of cam. Hold the rotor (with keeper 57314-D) in a vise, by using wooden blocks (Illust. 103), carved out to fit the assembly. Do not file the shaft diameter where the cam fits since the new cam must be a press fit on the shaft.

Replacement of Cam:

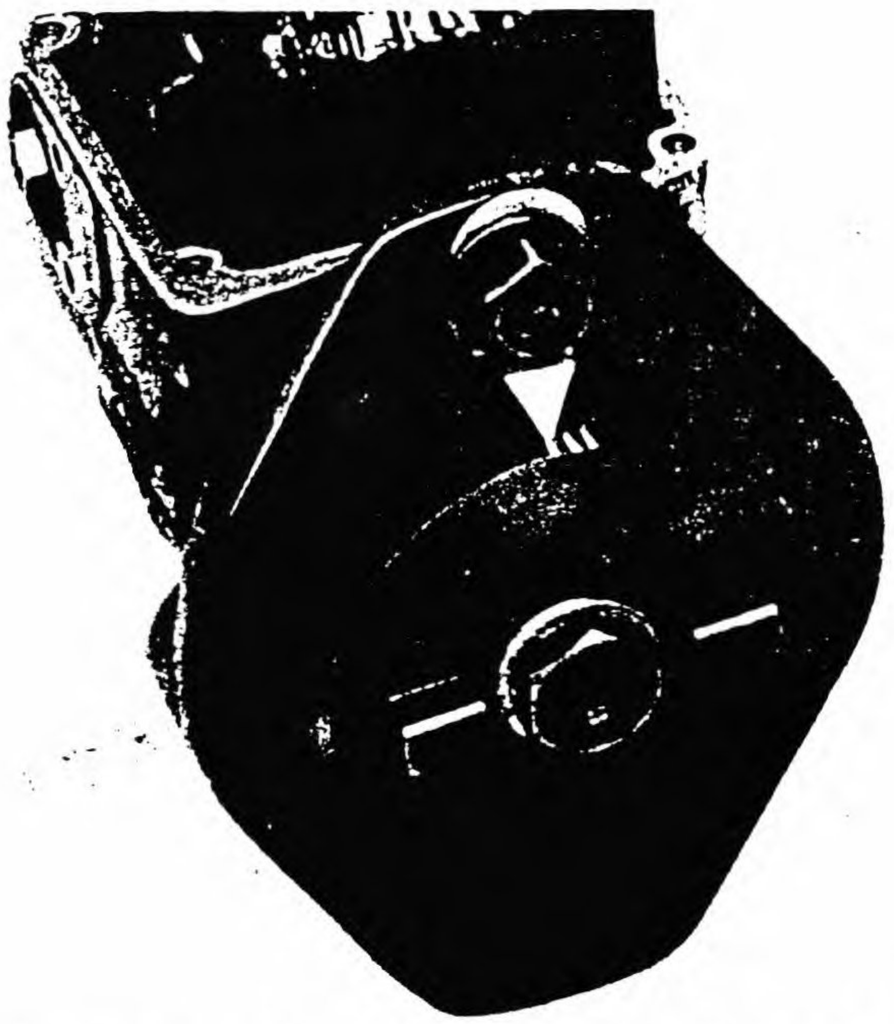
Clockwise Magnetos: "A", "B", "H", "M", "4" and "6" Series carbureted engines.

With key in place on rotor shaft, press new cam 60094-D on the shaft. Reassemble the rotor to the magneto body after it has been cleaned thoroughly and the bearings have been regreased. Then check the timing as listed under that heading.

Counterclockwise Magnetos: "6", "9" and "14" Series Diesel Engine and "9" and "14" Series Carbureted Engines.

Remove the key for cam from shaft, or file the key down to the shaft diameter. Do not file the shaft diameter itself as a new cam must be a press fit at this point. Press fit means the cam, after assembly, must withstand a torque of 11.2 foot pounds without turning on the shaft. This can be checked by holding the rotor in a vise as described above and applying an open end wrench with an extension (Illust. 103). Pull 11.2 lbs. on a spring scale 1 foot from the center of the shaft or 22.4 lbs. at 6" from the center of shaft. If the cam turns with less torque than this amount, it is very likely the cam will turn when magneto is put in use. Be sure it is tight on the shaft.

Press new cam in place with leading flat 28° 17' from transverse center line as shown in Illust. 102. (See cross section of the cam). Try to set the cam at



ILLUST. 104--CHECKING THE TIMING OF THE NEW BREAKER CAM WITH RESPECT TO IMPULSE COUPLING.

the proper angle before pressing it in place. The angle of the cam on the shaft may be changed to the correct value by applying a wrench to the cam and turning it on the shaft. Thoroughly clean the rotor and magnet, grease the bearings, and assemble the rotor to the body of the magneto. Now check the timing or cam position as listed under that heading.

Checking Magneto Timing (Cam Position): (Both clockwise and counterclockwise magnetos).

1. Mount the magneto in a vise, clamping on the flange.

2. Make a pointer out of thin sheet steel and mount as shown in Illust. 104.

3. Remove coil cover from top of magneto.

4. Turn rotor until the points are open all the way on high point of cam, and adjust the opening very accurately to .013 inches.

5. Turn the rotor until the poles of the magnet bridge the gap or opening between the ends of the pole pieces in the magneto body as shown in Illust. 97. The magnetic pull will hold magnet in this position; look between coil and the front of the body to see the pole of the magnet come into position.

6. Make a mark below pointer on the outside diameter of the impulse coupling drive member at the position set in Operation 5.

7. Turn coupling and rotor slowly in the counterclockwise direction (Diesel magnetos "9" and "14" Series carbureted engine magnetos)until the breaker points just open. Now make another mark below the pointer on the drive member. (Turn all the other carbureted engine magnetos in the clockwise direction).

8. Measure the distance between the mark on the drive member. This distance should be .137" or between 1/8 and 3/16".

9. If points do not open within this range (1/8 to 3/16") remove breaker point, place the nail or pin in drive member, and turn cam on the shaft to bring the point of opening within the above range.

10. When checking clockwise magnetos, the second mark will appear to the left of the first mark instead of to the right, and should be within the same range, 1/8 to 3/16". The leading flat of the cam on these magnetos with key in place should be 23° 50' from the horizontal center line.

Be careful that every part of the rotor and bearings are perfectly clean, i.e., remove the old grease from the bearings,replace with new I.H.C. grease, and clean the rotor of any metal chips which may have adhered to it. Be sure to keep the rotor in the keeper 57314-D during these operations.

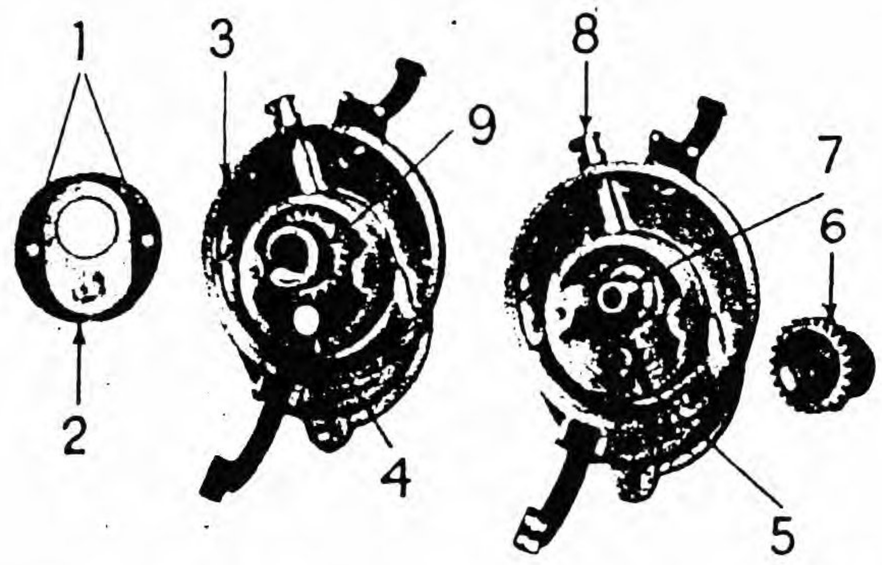
Slow rise cams are used in magnetos with serial numbers 180,001 to 181,000 and from 216,970 up. Clockwise magnetos 180,001 to 181,000 do not have cam key 21342-D.

If cam is to be replaced on magnetos with serial numbers 220,001 to 220,956, remove or file off the cam key 21342-D in rotor shaft and place a new key in hole in opposite side of shaft. Then press new slow rise cam in position and check as outlined above.

Distributor Gears

Distributor gears are contained in a chamber which is part of the distributor body, (Illustration 105). This chamber is partially filled with I.H.C. magneto grease and sealed with felt washers around the hub of the gears. These seals and the consistency of the grease should prevent any possibility of the grease working out of the chamber.

To remove the distributor gear, first disassemble the distributor cap, the distributor rotor (Illustration 83) and the distributor gear chamber cover (2),

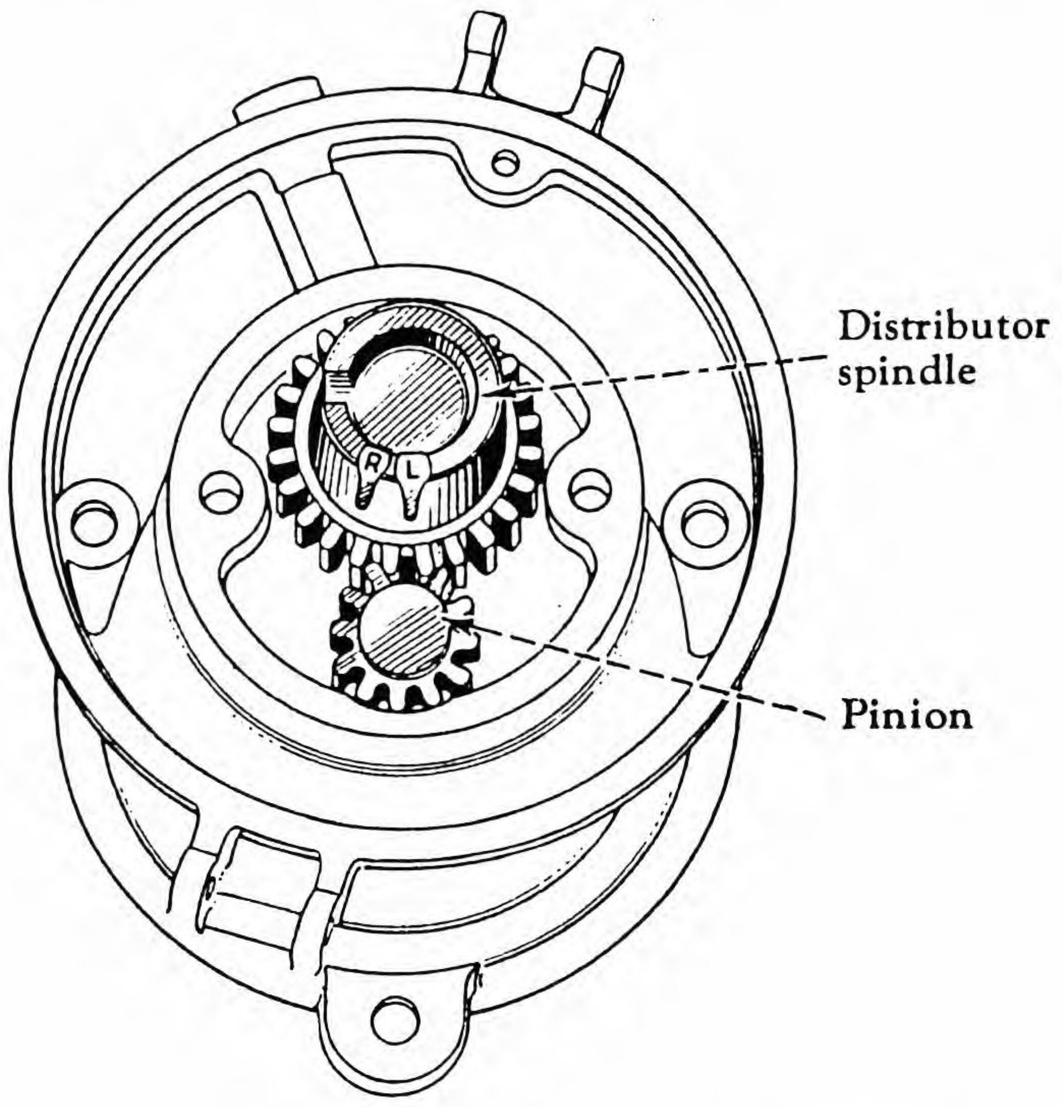


ILLUST. 105--DISTRIBUTOR GEAR ASSEMBLY. 1--CAPSCREWS (2) IN COVER. 2--GEAR CHAMBER COVER. 3--GEAR BODY. 4--BORE FOR DISTRIBUTOR PINION SHAFT. 5--DISTRIBUTOR PINION. 6--DISTRIBUTOR GEAR. 7--DISTRIBUTOR SHAFT. 8--DISTRIBUTOR BEARING OIL CUP. 9--DISTRIBUTOR SPINDLE.

Illustration 105. Now both the distributor gear and the distributor pinion may be removed.

Timing of Distributor Gear

The old distributor gear has two markings: (1) Counterclockwise rotation -- two teeth cut off at an angle, (2) clockwise rotation -- two teeth with ends partially cut away by a circular cutter. When assembling this type distributor gear to the pinion, set the two marked teeth straddle of the one marked tooth on the rotor gear pinion. The old



ILLUST. 106--NEWEST TIMING MARKS ON H-4 DISTRIBUTOR SPINDLE AND PINION. "R" - - - CLOCKWISE MAGNETO, "L" - - - COUNTERCLOCKWISE MAGNETO.

distributor gear removed from the magneto will have but one set of markings on the gear, so there will be no possibility of confusion.

A change has been made on the later type distributor spindle and gear, changing the timing marks. The letters "R" and "L" are formed on the spindle (Illustration 106). The "R" marking on the new distributor spindle is the setting for the clockwise magnet, and the "L" marking on the end of the distributor spindle is a correct lineup for counter-clockwise magnetos. Time the new type distributor spindle by meshing the rotor pinion and the distributor gear so that the marked tooth on the pinion is in line with the correct marking for the type of magneto being timed. The new gear can be used to replace the old.

Before assembling the distributor gear, be sure that the gear and the gear chamber are thoroughly cleaned of old grease and any grit that may be present. The magneto greasing recommendation is that the grease in the distributor gear chamber should be cleaned out and replaced with I.H.C. grease every 2000 hours of operation.

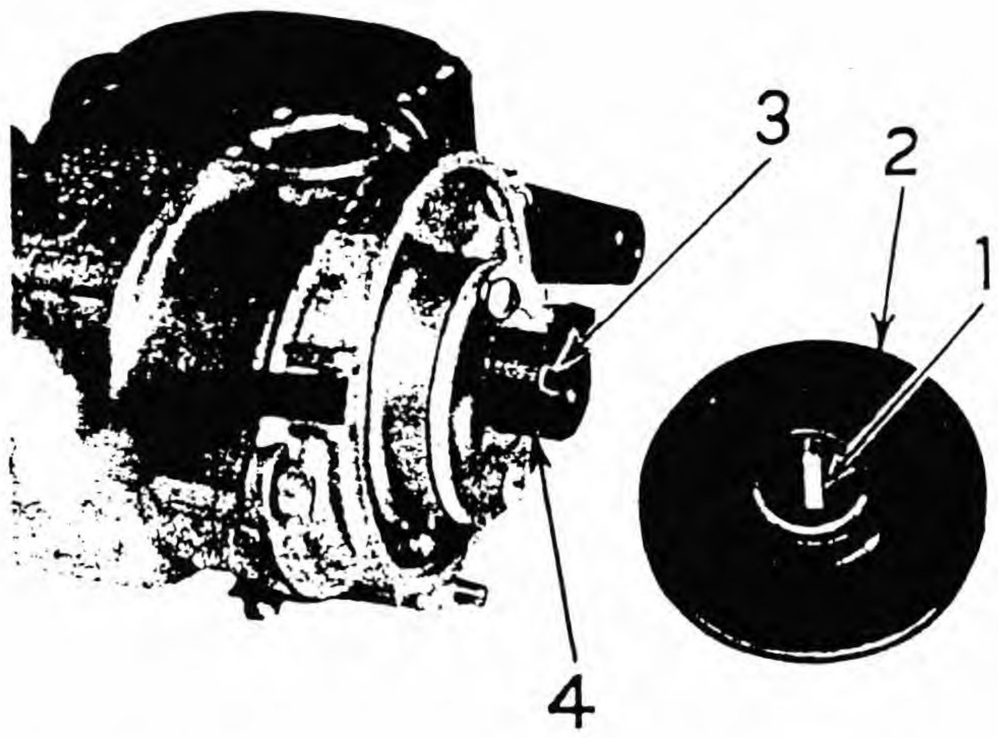
To grease the distributor gear spindle (9), Illustration 105, fill the hole four-fifths full of I.H.C. magneto grease and press the gear on to the shaft (7). Because of entrapped air, the gear may spring back after pressure is removed. To bleed out the entrapped air, turn the magneto by hand with a light inward pressure on the gear hub. This method of greasing will force grease into the oil holes in the shaft (7) and the housing (3) and will prevent fluid oil from entering this chamber. The purpose of adding oil to this chamber is to keep the grease from drying out. The recommended greasing instructions as outlined in the instruction book call for filling the distributor bearing oil cup (8) once every 500 hours of service, using the same grade of oil as used in the engine crankcase. A caution is added, stating: "Do not oil oftener, as excessive oil might work to the breaker points, causing rapid point wear." Tube from oil cup (9) leads directly to hollow shaft (7).

Replacing Felt Oil Seals in Distributor Gear Housing

The felt oil seals in the distributor body (Illust. 90), may be replaced by driving out the old retainer and replaced with a new retainer and felt assembly (2)(Illust. 105). Before replacing the retainer and felt, clean out the hole with a metal cutting tool, such as a bearing scraping tool. Then lock the new retainer in place with a center punch.

Do not soak the new felt seals in oil. After assembly of the seals, coat them on the inside slightly with I.H.C. magneto grease.

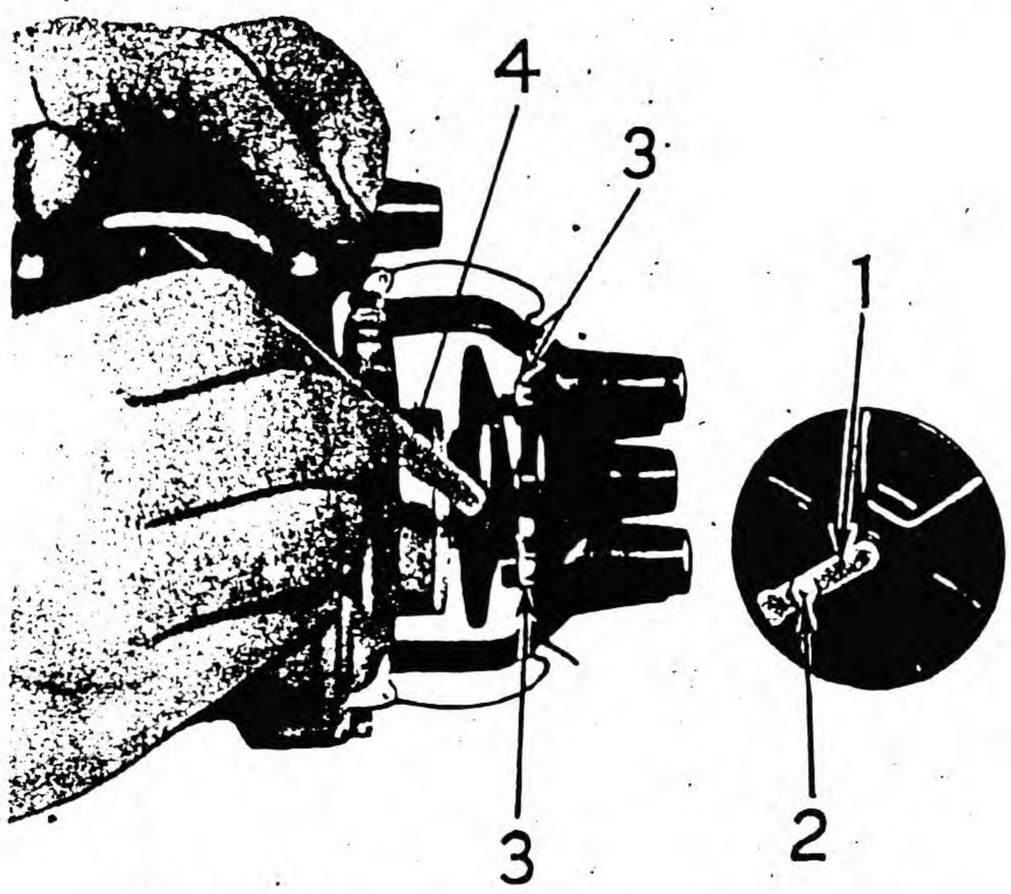
Distributor Rotor



ILLUST. 107--DISTRIBUTOR ROTOR REMOVED SHOWING KEY AND KEYWAY FOR LOCKING IN POSITION. 1--ROTOR KEY. 2--ROTOR. 3--DISTRIBUTOR SPINDLE KEYWAY 4--DISTRIBUTOR SPINDLE.

Distributor Rotor (2), Illustration 107, is exposed after removal of the distributor cap. The distributor rotor should be a pressed fit on the distributor gear hub (4). To remove the rotor apply the end of the screw driver against the hub of the rotor and pry off as shown in Illustration 82. When replacing the rotor, be sure that the key (1), on the inside of the rotor coincides with the slot (3) on the end of the distributor gear spindle. To assist in lining up the key with the slot use the rib which is opposite the Monell arm on the opposite side of the rotor as a guide, the rib being in line with the key. Be sure that the rotor is pressed on as far as it will go because there is a possibility of entrapped air preventing the rotor from being pushed all the way on to the hub of the distributor gear.

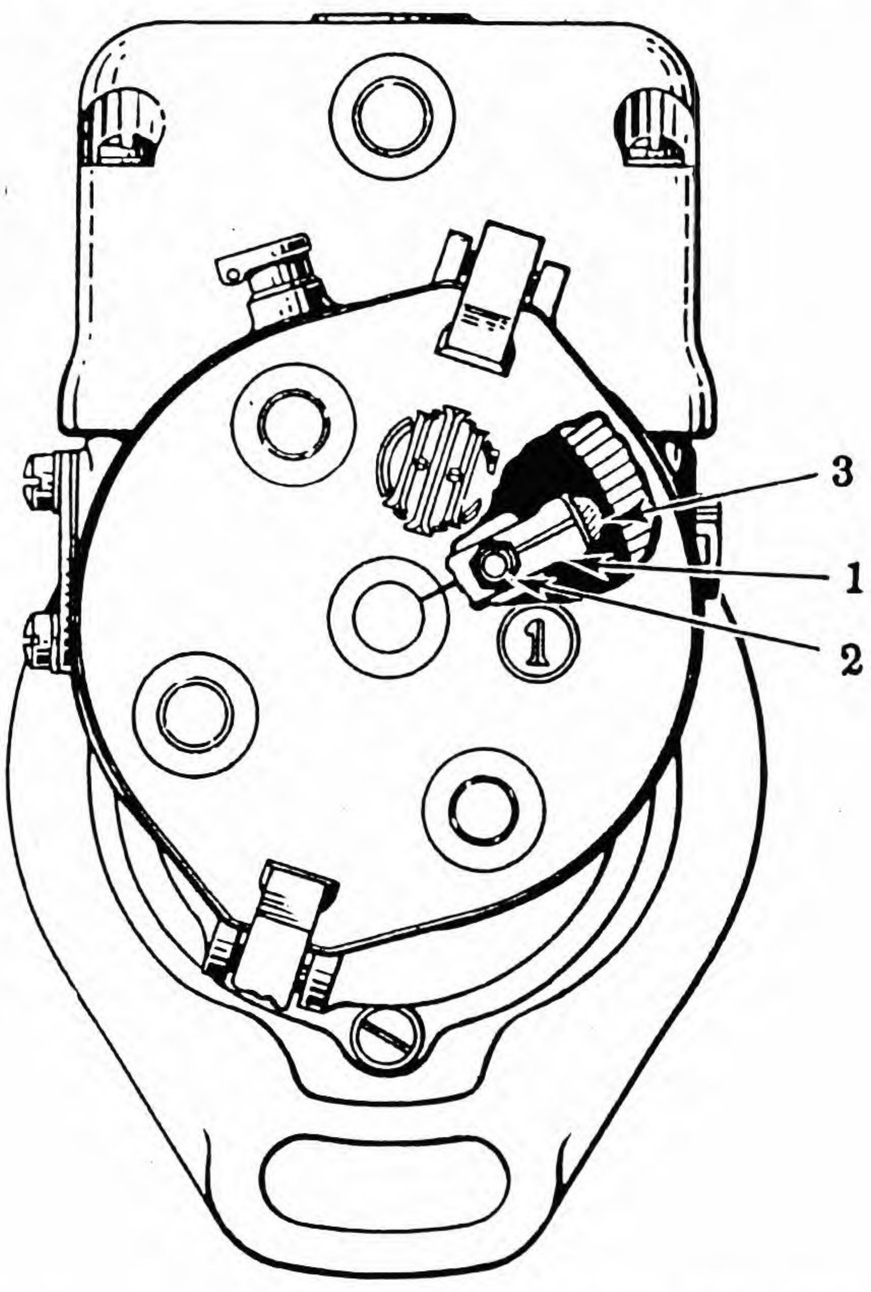
The Monell metal arm (1), Illustration 108, on the distributor rotor is adjustable and renewable. The arm should operate as close to the insert in the distributor cap as possible without rubbing. (Refer to Illust. 108). To correctly adjust the distributor arm, a cap may be taken from parts stock and cut away as shown in Illust. 109. Then by using a feeler gauge the distance be-



ILLUST. 108--CHECKING CLEARANCE BETWEEN DISTRIBUTOR ROTOR METAL ARM AND THE INSERT IN DISTRIBUTOR CAP USING A CUTAWAY CAP. 1--MONEL METAL ARM. 2--ARM NUT. 3--DISTRIBUTOR CAP INSERT 4--FEELER GAUGE.

tween the distributor arm and the insert in the distributor cap can be checked.

Another method is to apply a little prussian blue to the ends of the distributor arm, then place the distributor cap on the magneto. Next turn the magneto rotor over several times by hand. If the limits between the distributor arm and the cap insert are close, a small amount of the bluing will be transferred to the distributor cap insert. A very slight coating should show on the insert without any actual rubbing occurring.



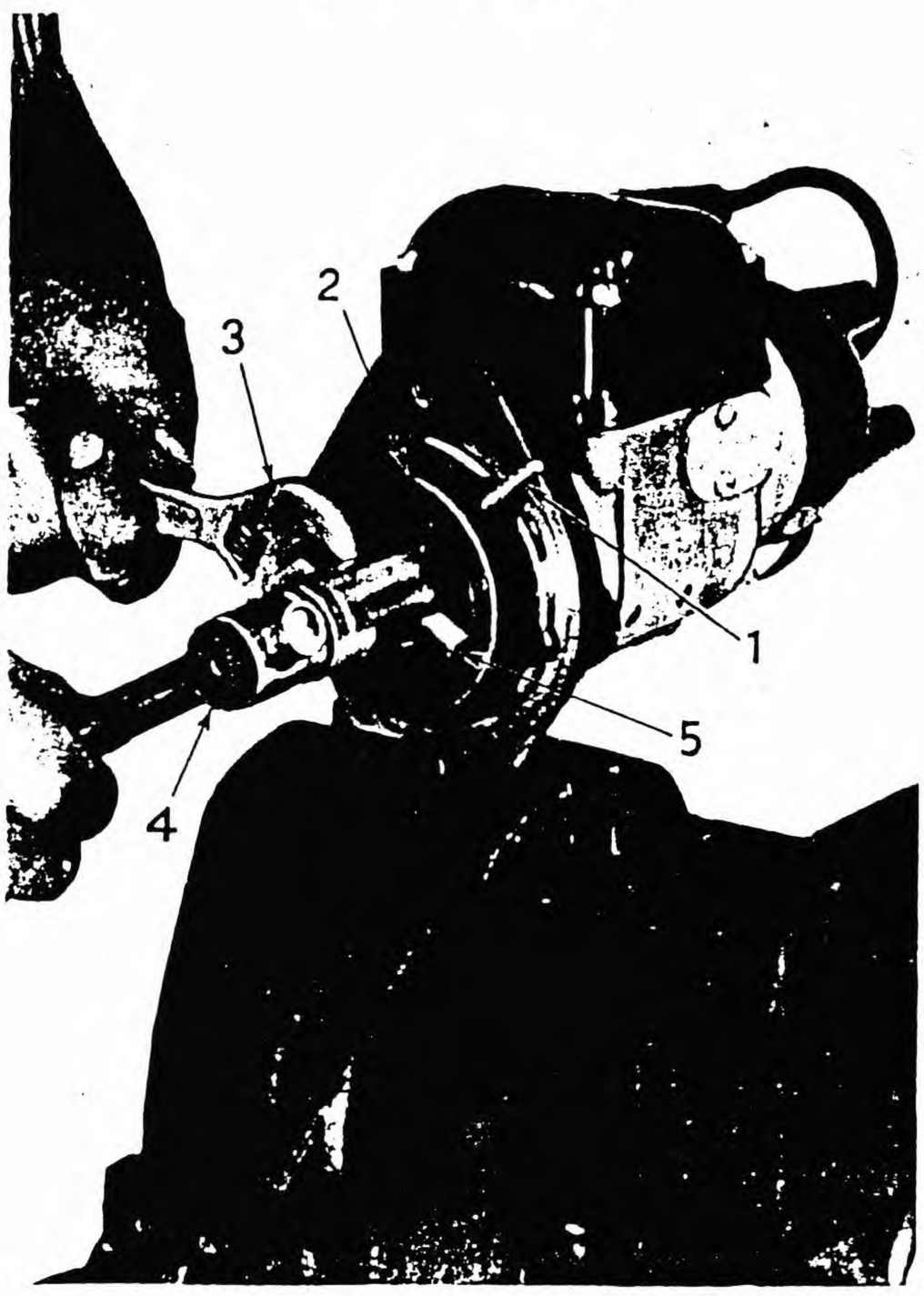
ILLUST. 109--LOOSEN NUT (2) TO ADJUST DISTRIBUTOR ROTOR ARM (1) AS CLOSE TO ALL FOUR DISTRIBUTOR CAP INSERTS (3) AS POSSIBLE WITHOUT ACTUALLY RUBBING.

To adjust the rotor arm, loosen the nut (2) Illustration 82, and move the arm to a point that just clears the distributor cap inserts. Use both methods of checking clearance or the latter only.

The inside of the distributor cap must be kept clean and dry. The two ventilating holes should be kept open at all times.

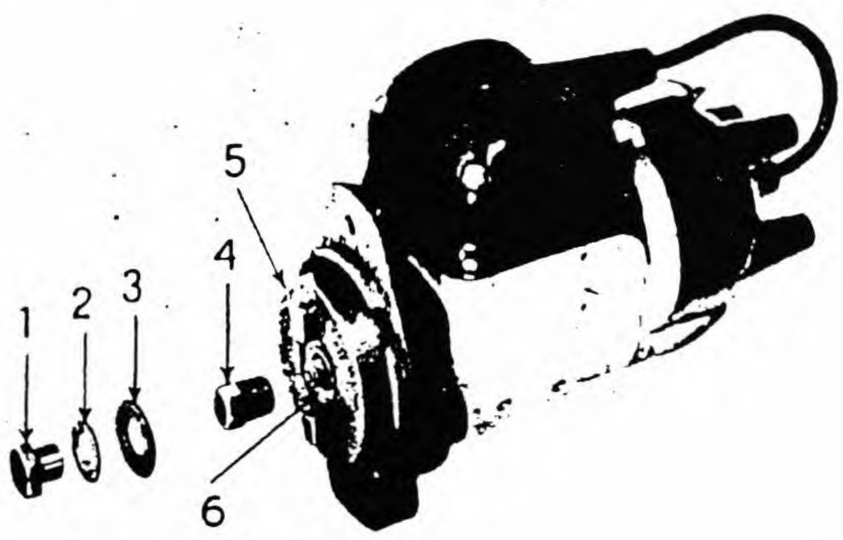
The operator of engine on which the H-4 magneto is used should be cautioned to keep the distributor cap ventilating holes (Illust. 82) open and not to overoil the distributor gears, because there is a possibility of thin lubricant working into the breaker chamber.

Impulse Couplings



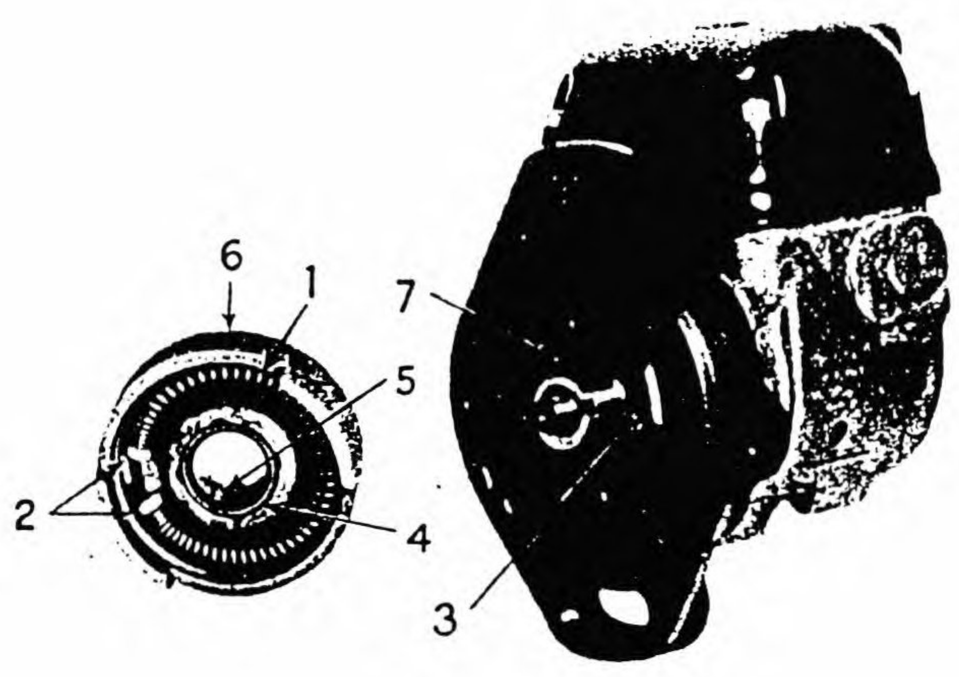
ILLUST. 110--CORRECT METHOD OF REMOVING IMPULSE COUPLING NUT. 1--PIN CONNECTING HOLE IN IMPULSE DRIVING MEMBER AND LUG OF MAGNETO MEMBER. 2--IMPULSE DRIVING MEMBER. 3--ADJUSTABLE WRENCH. 4--SOCKET WRENCH. 5--LUG ON IMPULSE DRIVING MEMBER.

To remove the impulse coupling insert a nail or pin through a hole (1), Illust. 110, in coupling drive member (2), locking the two elements together. Apply a socket wrench to the nut and a wrench to one of the driving lugs (3) to prevent shearing the nail or pin while removing nut. The impulse coupling may now be removed with tool No. SE-912 which screws into a thread provided inside coupling body (6), Illust. 111.

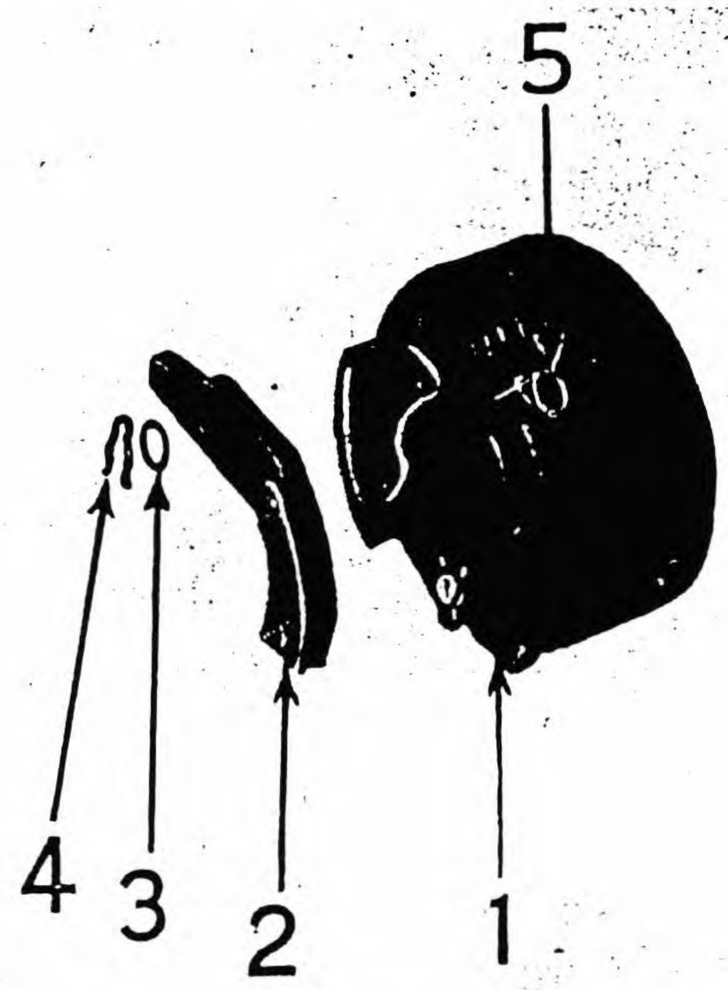


ILLUST. 111--REMOVING IMPULSE COUPLING. 1--IMPULSE NUT. 2--LOCK WASHER. 3--WASHER. 4--SERVICE TOOL SE-912. 5--IMPULSE DRIVE MEMBER. 6--THREAD ON INSIDE OF MAGNETO MEMBER.

The impulse coupling driving member (6) with impulse coupling spring (1) can readily be removed as shown in Illust. 112. The impulse coupling spring (1) should very seldom need to be removed from the driving member, but should it be necessary to remove the spring it can readily be pried out of place. To replace this spring, just compress it sufficiently to fit into the driving member as shown. Before assembling the impulse coupling member (6) with the body (7), soak the wick inside the impulse coupling spring and the felt inside retainer



ILLUST. 112--IMPULSE COUPLING REMOVED. 1--IMPULSE SPRING. 2--IMPULSE SPRING BUTTON. 3--LUG ON MAGNETO MEMBER. 4--FELT RETAINER. 5--DRIVE MEMBER HUB. 6--IMPULSE DRIVE MEMBER. 7--IMPULSE MAGNETO MEMBER.



ILLUST. 113--IMPULSE COUPLING COMPLETE SHOWING REAR SIDE OF MAGNETO MEMBER WITH IMPULSE PAWL REMOVED. 1--IMPULSE PAWL. 2--COUNTERWEIGHT. 3--WASHER 4--RETAINING SNAP RING. 5--IMPULSE PAWL SPRING.

(4) with either light household oil or cream separator oil. Also coat inside hub (5) of the driving member with I.H.C. magneto grease. The lug (3) should be a tight fit between the hardened button (2) on each end of the impulse coupling spring. If the buttons (2) should become worn or grooved renew them.

The first H-4 magnetos were built with an impulse coupling which had a missing speed of approximately 120 R.P.M. These couplings may be identified by their construction in that they did not have the counterweight (2) added to the pawls (1), Illust. 113; these couplings did not have the two small springs (5).

The latest coupling is the type shown in Illust. 113 and has a missing speed of approximately 150 R.P.M. New couplings are used on magneto Serial No. H4-7635 and up. The new coupling has weighted pawls (1) and stainless steel coil springs (5). To secure good impulse coupling performance, it is necessary that the springs be in good condition and they should be replaced if worn or broken.

Explanation of H-4 Magneto Markings (Chart - page 55)

Serial Number

The serial number on the magneto frame will identify the magneto and give all necessary information about it by referring to the magneto chart. NOTE: A few of the first production 49094-D magnetos were issued with "XDH4-000000" on the ser-

INTERNATIONAL H-4 MAGNETO

Magneto Markings					
Unit	Serial	Spark Range and Rotation	Impulse Coupling		Distributor Spindle Timing Mark (See Page 51)
			Magneto Member	Drive Member	
A, B, U-2, H, W-4, I-4, O-4, U-4, IU-4, M, W-6, I-6, O-6, U-6, IU-6, T-6	H4-000,000	35° C.W.*	...	...	R
W-9, I-9, U-9, IU-9, T-9, W-14, T-14	H4-000,000-L	35° C.C.W.*	L7	L	L
MD, WD-6, ID-6, UD-6, IUD-6, TD-6, WD-9, ID-9, UD-9, IUD-9, TD-9, TD-14, UD-14	H4-000,000-D	15° C.C.W.	L3	L	L
60 H.T. 61 H.T. 62 H.T.	H4-000,000-X	10° C.W.	R2	XR	R

* C.W. = Clockwise Rotation. C.C.W. = Counterclockwise Rotation.

ial number pad in place of "H4-000000-D" as shown on the chart. Also a few of the first production 53176-DA magnetos were issued with "XH4-000000" on the serial number pad in place of "H4-000000L" as shown on the chart.

Distributor Spindle

The timing marks on the distributor gear spindle of the first magnetos were made by beveling one pinion tooth and cutting two of the distributor spindle gear teeth. The later type distributor spindle has the letters "R" and "L" molded into the end of the bakelite spindle which fits into the distributor rotor. The "R" marking is for timing clockwise rotation magnetos and the "L" mark is for timing of counterclockwise rotation magnetos. For more detailed information refer to section on timing distributor gears.

Impulse Coupling Members

The impulse coupling drive member and body will be marked with the letters "R" and "L" stamped on the parts. The letter "R" designated part is for clockwise magneto rotation and the "L" marking designates the part for the counterclockwise magneto.

Standard clockwise impulse coupling drive members will not be marked, but all special drive members which have the lugs at other than 35° below the horizontal center line of the magneto at the impulse coupling trip, will be marked by an "R" proceeded by another letter (this other letter being the one found at the end of the serial number on the frame). Thus the impulse coupling drive member for a magneto with "H-4000000-X" would be an XR impulse coupling part.

Standard counterclockwise impulse coupling drive members will be marked an "L". Special counterclockwise impulse coupling drive members will have another identifying letter preceding the letter "L" as has been explained.

In addition to the letters "L" and "R" a numeral follows the letter. This numeral back of the letters "L" and "R" will indicate the spark advance the impulse coupling member is designed to give. EXAMPLE: The spark advance is found by multiplying this numeral by 5: for instance, L-3 would be a magneto impulse coupling member for counterclockwise rotation, 5x3 or 15 degrees spark advance. All magneto impulse coupling members will be marked except the 35° clockwise part which will have no marking.

Changing Magneto Direction

In an emergency, a counterclockwise rotation magneto can be changed to clockwise and vice versa. Only four items have to be changed. These are: 1. Impulse coupling rotating unit complete; 2. Mounting flange assembly complete; 3. Rotor (or changing cam on end of rotor shaft); 4. Distributor gears (Reset only). Consult the chart above to obtain the proper impulse coupling for the respective engine. Lift out distributor spindle and match other letter ("R" or "L") with the chamfered tooth of the driver pinion.

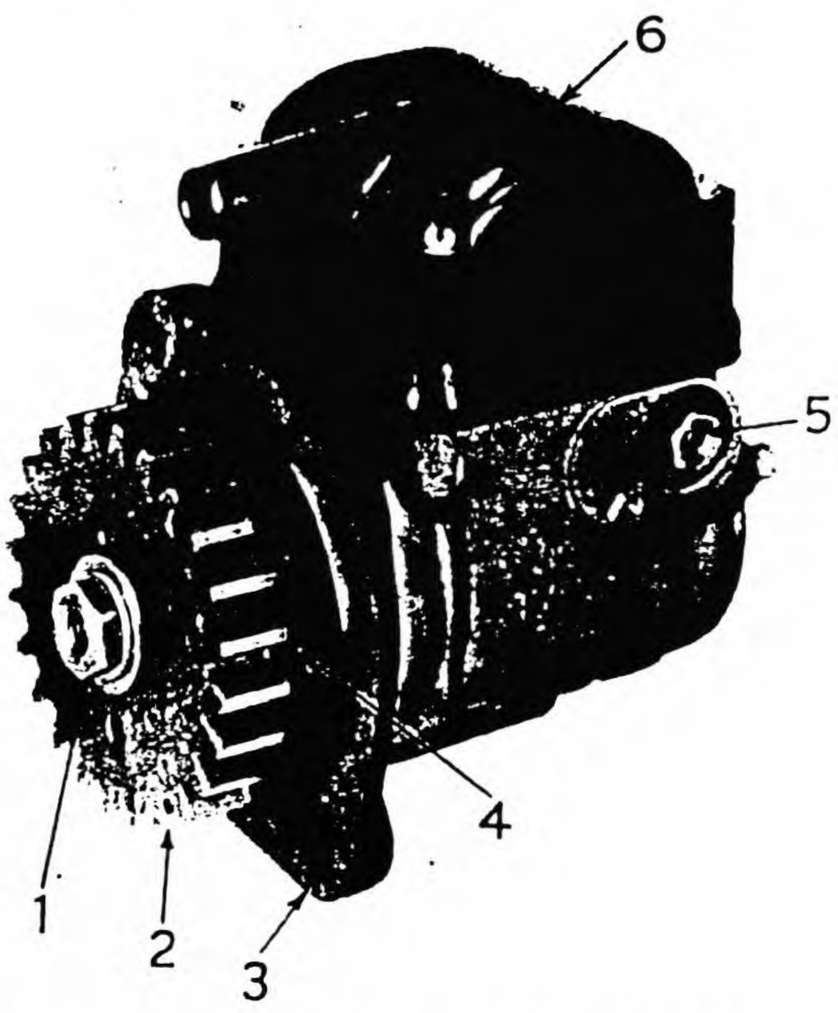
International H-1 Magneto—General

The Model H-1 magneto is standard on all McCormick-Deering type "LA" single cylinder engines after serial numbers LAA-64086 (1½ to 2½ h.p.) and LAB-21120 (3 to 5 h.p.). It also replaces Wico Type "AH" and Splitdorf Type "RM" Edison magnetos on all Type "LA" engines without any change in engine design. It is standard on the new series "LB" engines - both hopper and radiator cooled.

The Model H-1 magneto has basically the same construction as the new H-4 model with several necessary differences for adapting it to single cylinder engine operation. The cam for breaker points has but one lobe. The distributor is eliminated and the impulse coupling drive member is replaced with a gear having clockspring type of impulse within the gear. The drive gear is marked 19° for the standard 19° of spark advance, clockwise rotation.

The magnetic circuit and operation is identical to that of the H-4.

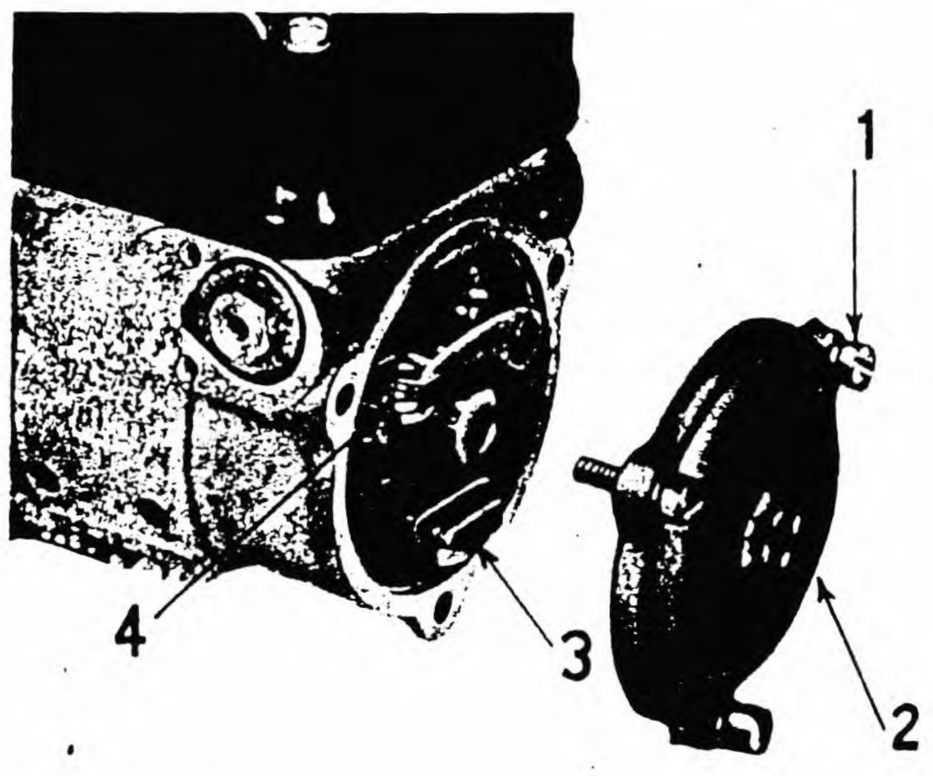
Serial numbers on the magneto body are prefixed with "H1" for all LA and LB engines and also carry the suffix "A" after the serial number on the magnetos for the 3 to 5 h.p. engines, indicating the different gear. With the exception of the drive gears and mounting flange both engines have identical magnetos.



ILLUST. 114--TYPE H-1 MAGNETO COMPLETE--DRIVE END. 1--IMPULSE NUT. 2--DRIVE GEAR (MARKED TOOTH). 3--MOUNTING FLANGE WITH GASKET. 4--IMPULSE PAWL. 5--TERMINAL SCREW FOR GROUND SWITCH. 6--COIL COVER.

Breaker Points

Like the H-4, the breaker points of the H-1 magneto are completely enclosed in a compartment at the rear of the magneto. To gain access to the breaker points take out three screws (1) (Illust. 115) in rear cover (2) of magneto and remove the cover (2) and gasket. Servicing of the points is the same as outlined for the H-4, and should be adjusted to .013" when breaker is on high point of the cam.



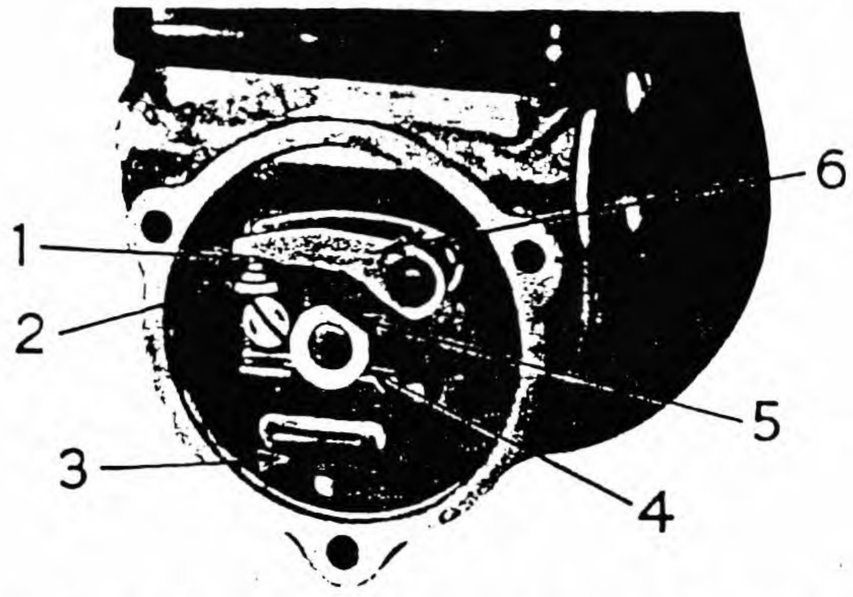
ILLUST. 115--TYPE H-1 MAGNETO WITH BREAKER-POINT COVER REMOVED. 1--SCREWS. 2--BREAKER POINT COVER. 3--SPRING ANCHOR BLOCK. 4--BREAKER POINTS.

Points open once for every revolution of the magneto or magneto runs at half engine speed.

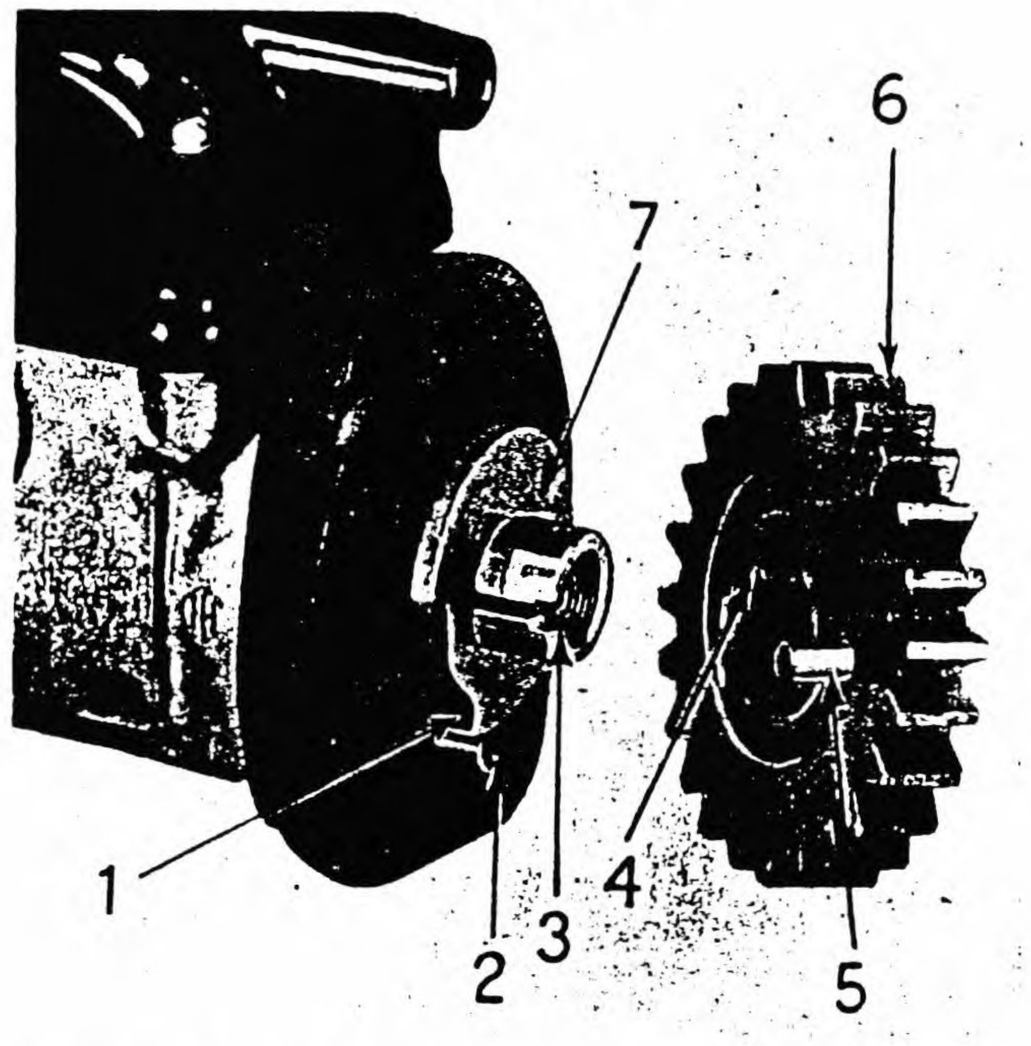
If points are replaced, pull out the spring anchor block (3) a little way and allow the cover (2) to push it in when reassembling.

Greasing Breaker Mechanism

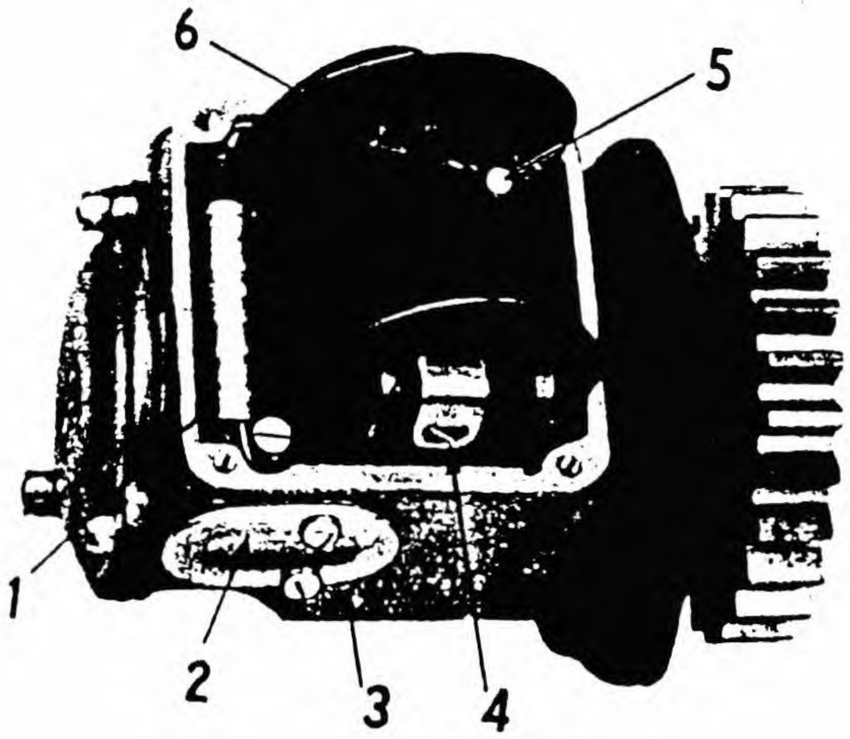
Before reassembling breaker mechanism, thoroughly clean all parts to remove grease and dirt. With I.H.C. magneto grease, fill the area back of the rubbing block as shown in Illust. 87 for the H-4 magneto. Use only enough grease to fill the area.



ILLUST. 116--BREAKER MECHANISM OF TYPE H-1 MAGNETO. 1--GAUGING POINT OPENING. 2--STATIONARY POINT. 3--SPRING ANCHOR BLOCK. 4--BREAKER CAM. 5--RUBBING BLOCK (NOTE GREASE). 6--MOVABLE BREAKER POINT.



ILLUST. 118--TYPE H-1 MAGNETO WITH DRIVE GEAR REMOVED. 1--SLOT IN MAGNETO MEMBER. 2--IMPULSE STOP PIN. 3--SPRING SLOT IN MAGNETO MEMBER. 4--INNER END OF IMPULSE SPRING. 5--DRIVE PIN IN MAGNETO DRIVE GEAR. 6--MAGNETO DRIVE GEAR. 7--MAGNETO MEMBER.



ILLUST. 117--TYPE H-1 MAGNETO WITH COIL COVER REMOVED. 1--CONDENSER. 2--CONDENSER CLAMP SCREW. 3--SIDE COVER PLATE. 4--COIL MOUNTING SCREW. 5--COIL SECONDARY LEAD-OUT. 6--COIL.

Condenser

The condenser (1) (Illust. 117), is the same as used in the H-4 and can be removed and tested by the same methods as already outlined. All H-1 magnetos have the removable plate (3) on the side opposite from the ground wire terminal connection. Remove terminal screw and outer bakelite washer; take off condenser clamp screw (2) and cover (3). Condenser can now be freed of primary wires. Slide through opening on cover side.

The testing of this condenser is the same as for the H-4 (page 46).

Coil

Coil (6) is the same type as used in the H-4 and may be serviced the same way. Coil cover has high tension lead-out (5) pointing toward the flange mounting and therefore secondary lead-out on coil must be inclined at 15° toward the flange, or opposite in direction to that of the H-4. All H-1 coils have the new construction (4) and do not require any soldering for installing a coil. The condenser terminal is on the opposite side of the magneto compared to the H-4 so the coil must be turned so that the primary wire will reach the terminal.

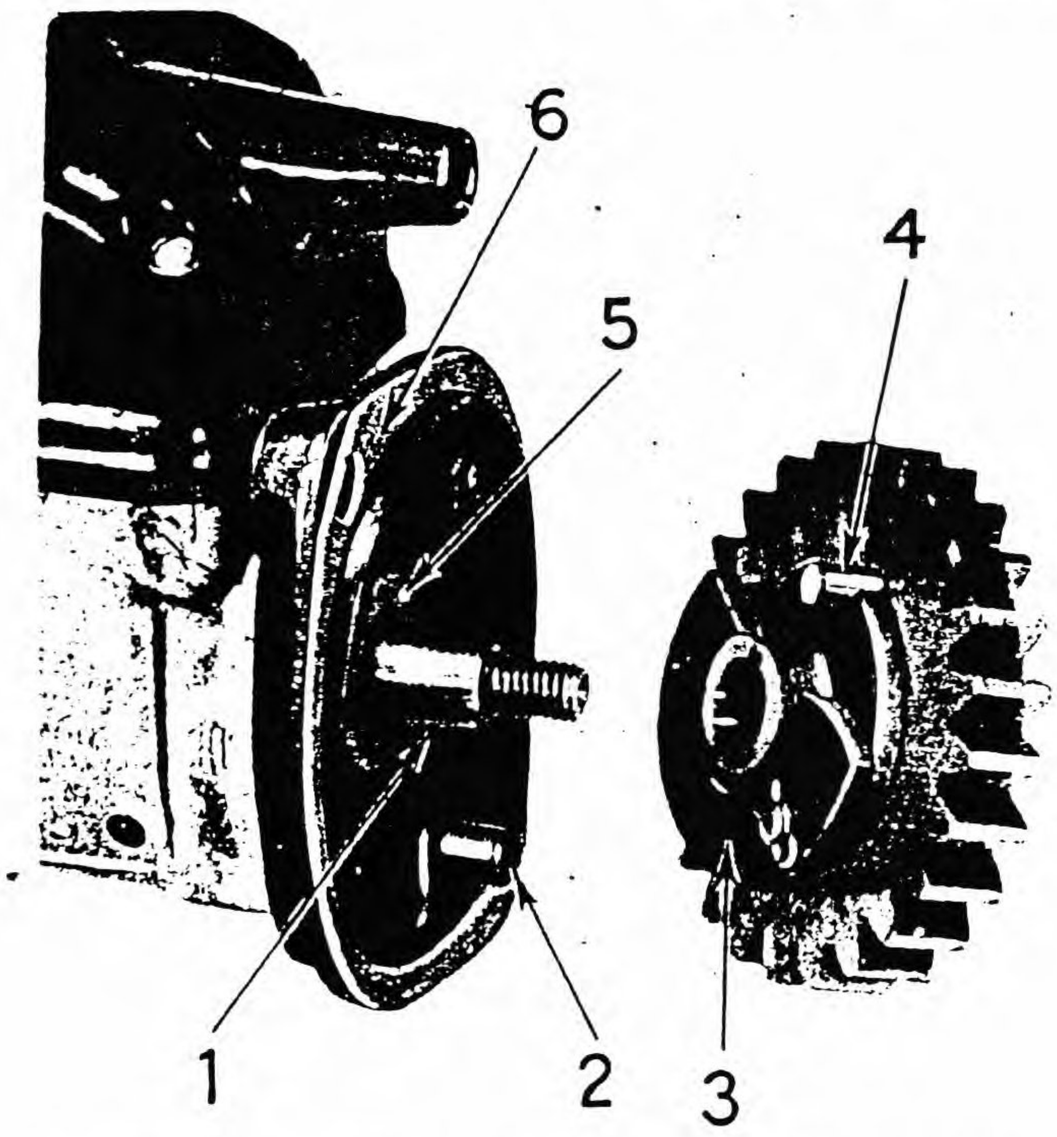
The coil can be tested in or out of the magneto frame as outlined on page 46. Have the poles of the magnet in vertical position when coil is out of magneto, and/or place a piece of metal across the tops of the interpoles in place of the coil core. Test coil core mounting screw length before assembling coil.

Primary wire from condenser to breaker points has rubber grommet same as that of the H-4. Refer to page 47 for details.

Impulse Coupling-

The impulse coupling and drive gear can be removed after taking off the nut on the front end of the shaft. Place an "L" shaped rod between impulse pawl (3) (Illust. 119) and the impulse coupling stop pin (2) to keep shaft from turning. Pull out gear far enough to allow pin (5), Illust. 118, in gear (6) to clear lug (1) on magneto member (7). Then allow spring to unwind. Gear can now be slipped off.

To pull the magneto member use a 1/4"



ILLUST. 119--TYPE H-1 MAGNETO WITH IMPULSE COUPLING REMOVED. 1--KEY AND ROTOR SHAFT. 2--IMPULSE STOP PIN 3--IMPULSE PAWL. 4--IMPULSE DRIVE PIN. 5--MOUNTING FLANGE OIL SEAL. 6--GASKET.

or 5/16" ball bearing inside service tool SE-912 and assemble puller to the magneto member (7). Turn puller in to draw magneto member off shaft.

Mounting flange can now be removed in order to remove rotor shaft.

When replacing impulse coupling, engage inner end of spring (4) in slot (3) in magneto member, hold peg (5) on gear out from magneto member (7), wind up spring until peg (5) drops down into space provided (1), and then slide the assembly on rotor shaft. Key (1), Illust. 119, locates magneto member on rotor shaft.

Make sure that all parts of the impulse coupling are clean. See that there is a little grease between the turns of the impulse coupling spring. Spring can be removed from drive gear by working it out of the cup with a screw driver.

To replace spring in drive gear, place magneto member (7) on magneto rotor shaft, assemble inner end (4) of spring in slot (3) in magneto member (7), and then snug up the coupling nut (1) Illust. 114. Spring should coil in a clockwise direction from the center toward the outer end. Stand magneto on wood bench with coupling end up. Place a nut about 1/4" thick over impulse stop pin (2) and turn magneto member (7) until impulse pawl (3), Illust. 119, strikes nut over pin (2).

Engage outer end of spring in notch in drive member (6) adjacent to drive lug (5). With gear in palm of the left hand, hold spring in notch with the forefinger, grip drive gear (6) with the other fingers, center the bore of drive gear down over impulse nut, and then turn magneto to tighten spring with the right hand. Lift up gear to prevent lug (5) from dropping into space (1), continue turning for one revolution and press down on gear when space (1) is again reached. Spring can be pushed all the way on by turning peg (5) to the limit of space (1). Remove nut and attach the special washer and lockwasher under the impulse nut. The nut over the impulse stop pin can be slipped off after tightening impulse nut.

Illust. 119 shows the impulse coupling complete as well as the oil seal (5) in the flange. Pin (4) keeps spring from unwinding and also limits angular deplacement of coupling with respect to the rotor. Impulse pawl (3) is held on by a spring clip. Flange gasket (6) seals oil in crankcase.

Mounting Flange and Oil Seal

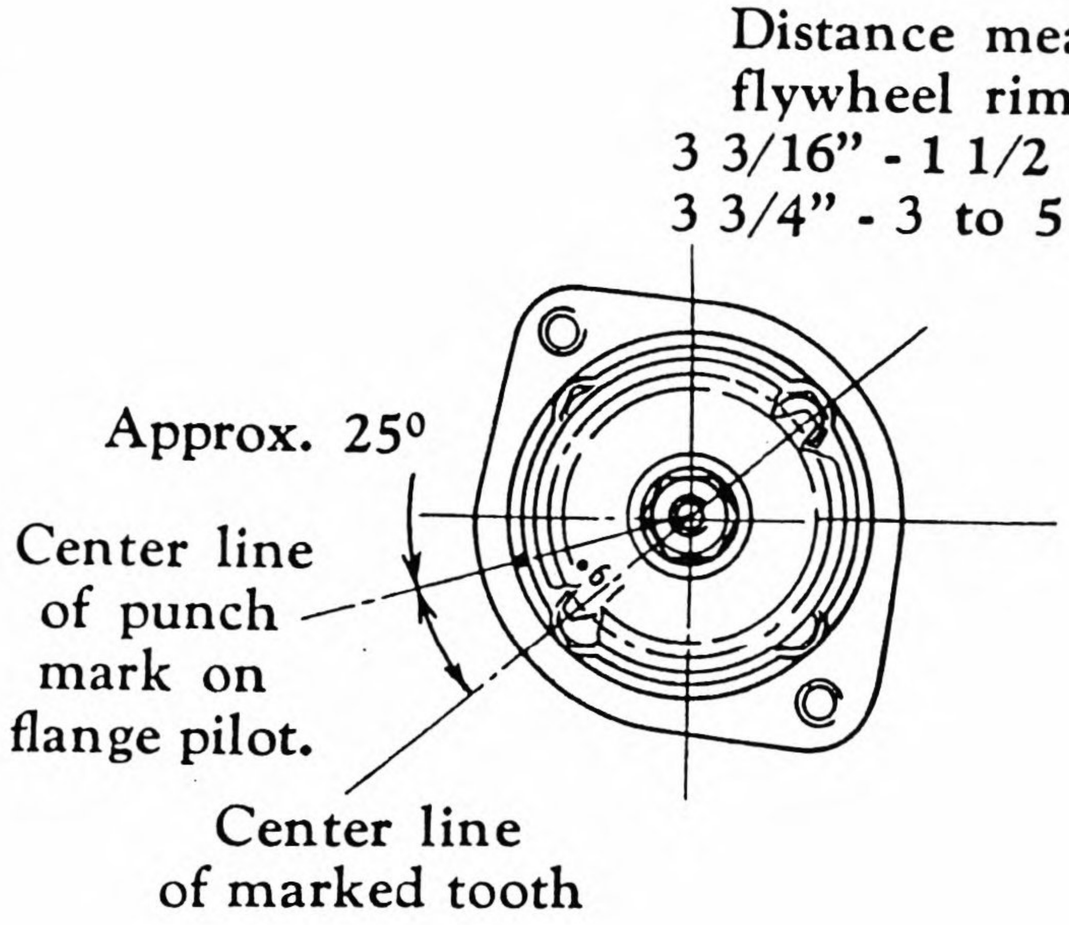
Mounting flange is somewhat different from the H-4 but the oil seal and retainers are the same part numbers as those used in all H-4 magnetos. Refer to page 47 for oil seal replacement procedure. Attach flange (6) as pictured in Illust. 119, with impulse stop pin (2) at the bottom.

Rotor Bearings

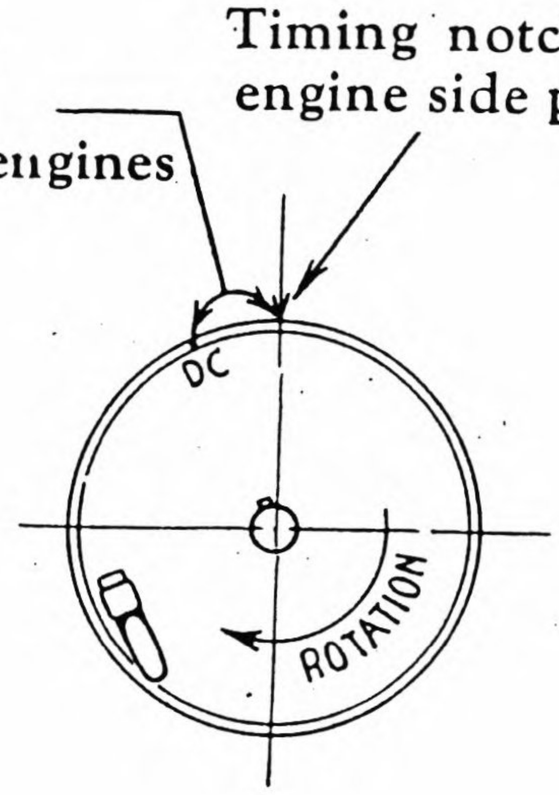
The rotor magnet is similar to that used in the H-4; the magneto is shorter and the distributor system is eliminated. Bearings are the pre-loaded type at time of installation. Method of replacement is covered on page 48. Use keeper 57314-D when magnet is not assembled in magneto.

Thoroughly clean bearings and magnet before replacing them as particles are liable to jam between the magnet and the pole pieces of the core where the clearance is very small. Use compressed air as a final cleaning of the rotor.

Bearing races can be replaced the same as those in the H-4 by the methods outlined on page 49 and as demonstrated on page 23.



ILLUST. 120 (a)--VIEW OF MAGNETO WHEN ROTOR IS HELD IN STABLE POSITION BY MAGNETIC FIELD.



ILLUST. 120 (b)--VIEW OF ENGINE FLYWHEEL IN POSITION FOR ASSEMBLY OF MAGNETO WITH ROTOR IN STABLE POSITION.

Breaker Cam

Breaker cam is located on rotor shaft with a key like that used on H-4 clockwise magnetos. If replacement is necessary it can be removed as outlined on page 49. Cam is extremely hard and should never require replacement.

Timing Magneto To Engine

Magneto may be timed to the engine by placing "DC" on flywheel in line with the timing notch on side plate of the engine and inserting magneto into place with marked tooth of magneto gear held in line with punch mark on the magneto flange. (Marked tooth is stamped 19°).

Refer to Illust. 120-A and 120-B for an easier method of timing the magneto to the engine. Place the flywheel in the position shown in Illust. 120-B with the "DC" mark 3-3/16" behind the timing notch on engine side plate (3-3/4" for 3 to 5 h.p. engine). Turn magneto gear marked tooth (19°) to the stable position shown in Illust. 120-A and insert magneto in its mounting hole so gears mesh. Then tighten the magneto screws lightly so magneto can be rocked.

Magneto can be tipped forward and backward to make the impulse coupling trip exactly on the "DC" timing mark.

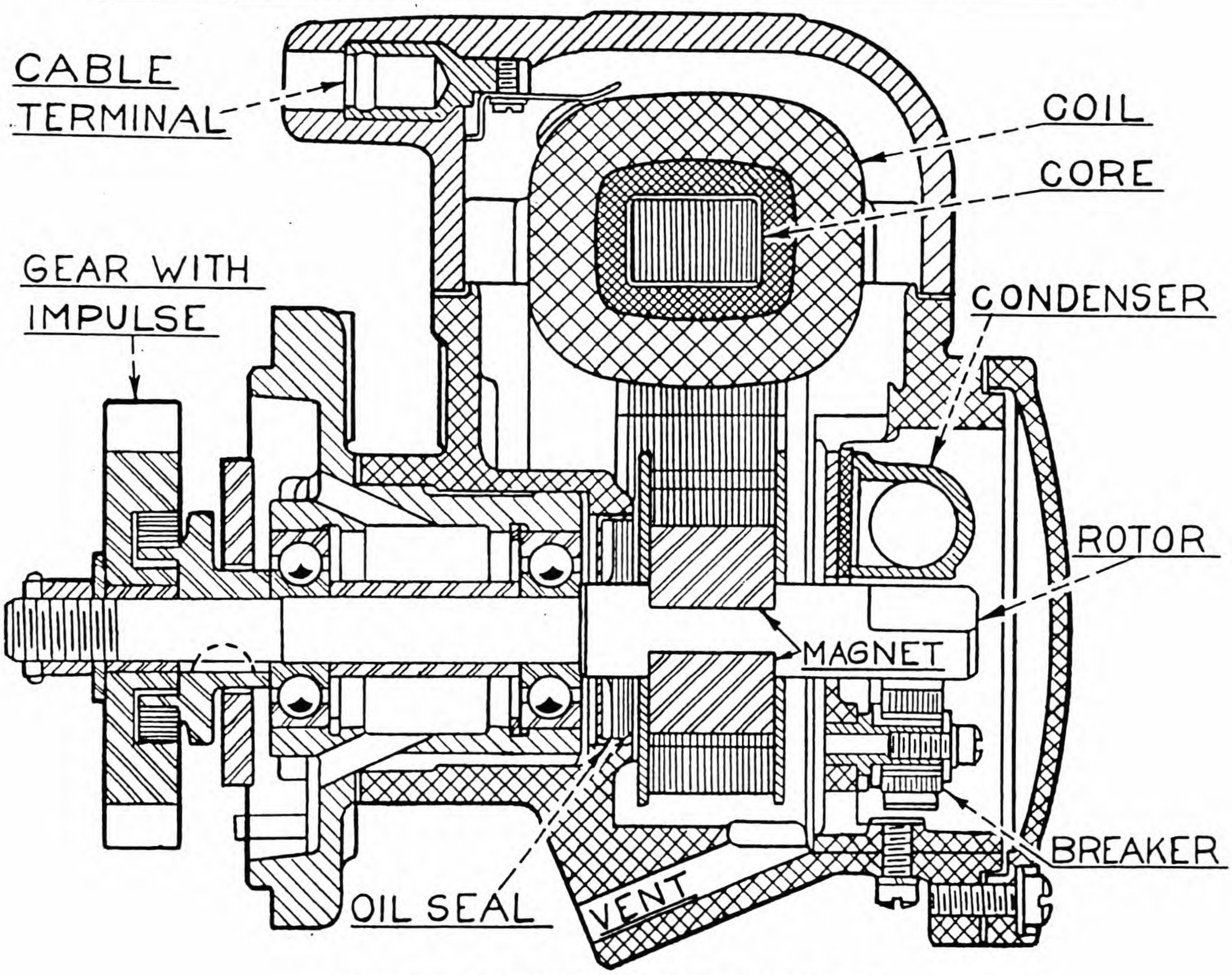
When checking the magneto for the point of tripping of the impulse coupling, disconnect high tension wire, take a firm grip on the flywheel handle, and move flywheel slowly and surely to determine the exact point of tripping. Never allow the magneto impulse coupling to trip before the "DC" mark.

Wico Type "H" and "AH" Magnetos—General

The type "H" Wico magneto was standard equipment on all McCormick-Deering type "LA" engines before serial number LAA-28503 (1-1/2 to 2-1/2 H.P. engine) and LAB-4413 (3 to 5 H.P. engine). All later "LA" engines are equipped with the type "AH" Wico magneto. The same operating principle is incorporated in both these magnetos, the only difference being in the general design which provides a more moisture and dustproof unit in the type "AH" magneto.

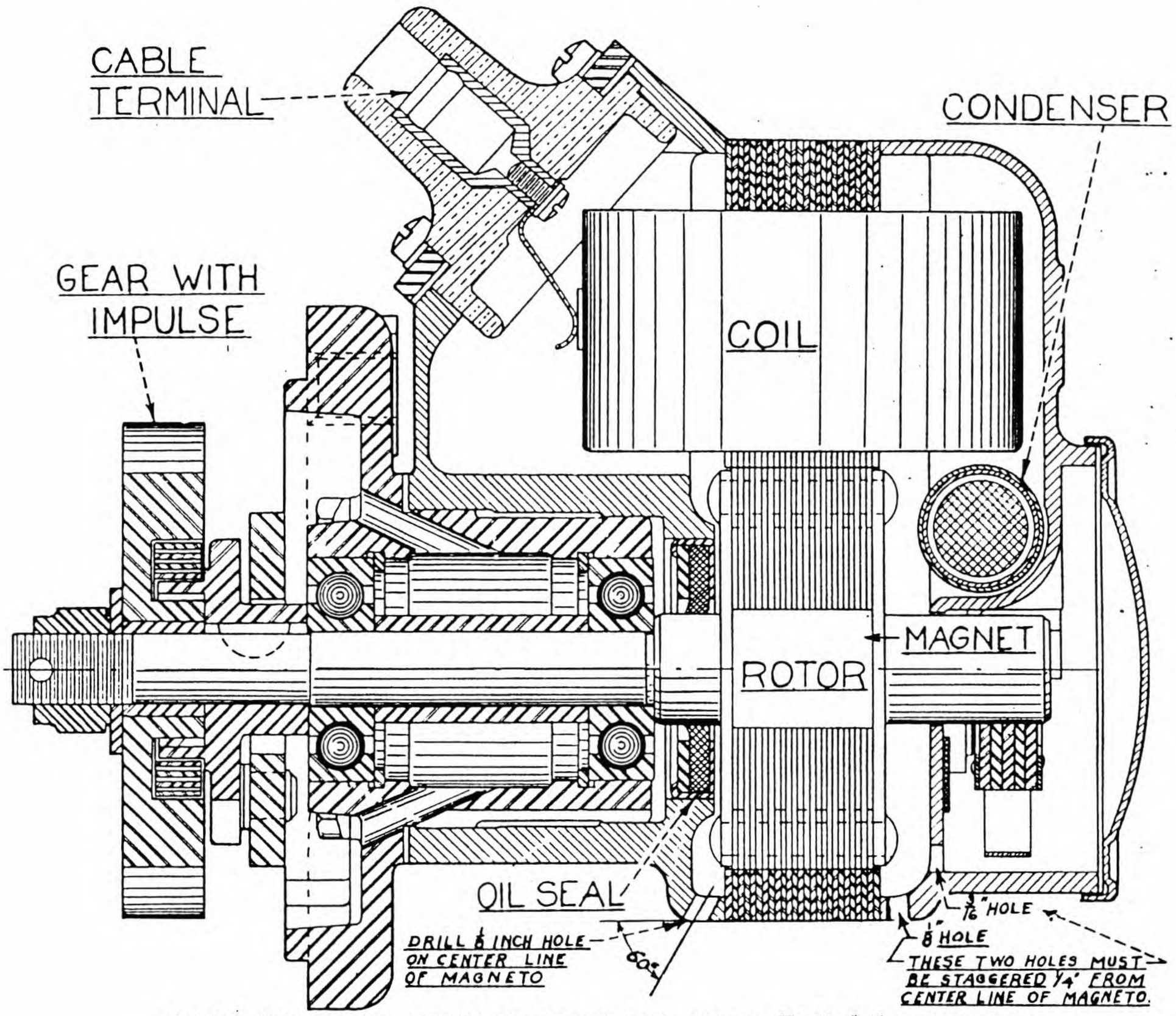
The Wico type "H" and "AH" magnetos have a rotating magnet, fixed coil, adjustable breaker point and rotating cam. They are designed for flange mounting only. The drive shaft unit (consisting of drive shaft, magnet, and cam) is mounted on ball bearings. Bearings are lubricated from the crankcase of the engine. The impulse is incorporated into the drive gear.

There are two specifications of the type "H" and "AH" magnetos, the chief difference being in the size of the pilot boss and the impulse gear. Magnetos used on the 1-1/2 to 2-1/2 H.P. "LA" engines have a pilot boss of 3-1/8" diameter, and an impulse gear of 2-5/8" diameter. Magnetos used on the 3 to 5 H.P. "LA" engines have a pilot boss of 3-3/8" diameter, and an impulse gear of 3-3/4" diameter.



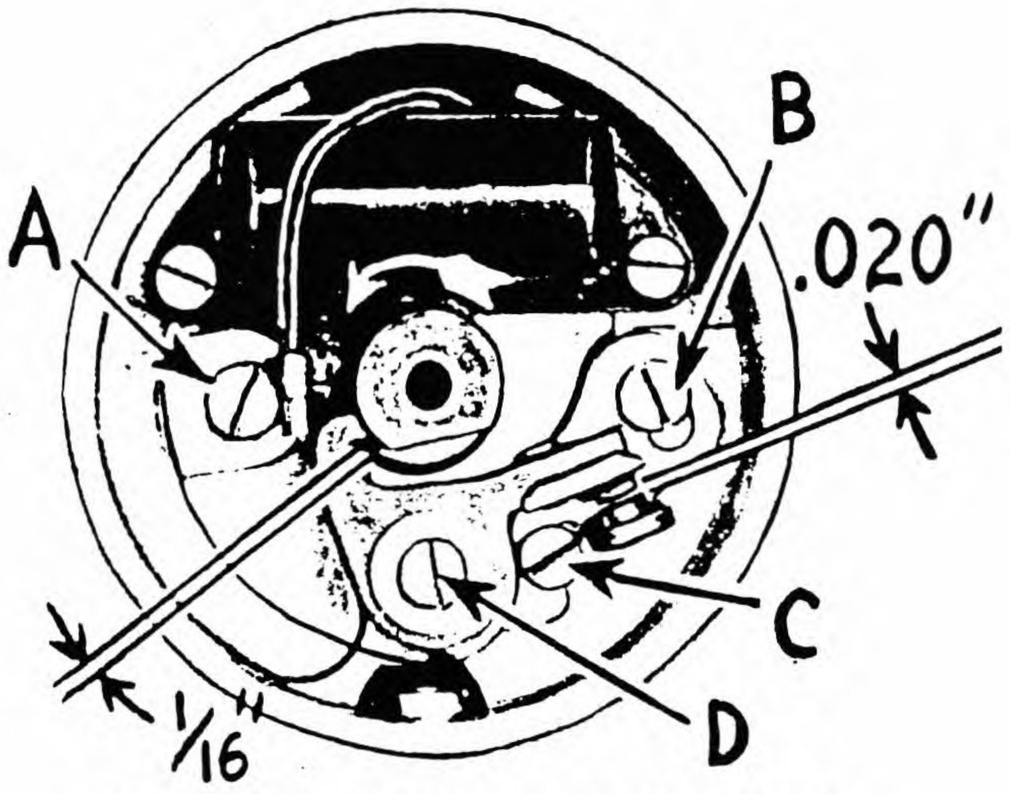
ILLUST. 121--CROSS SECTIONAL DRAWING OF WICO TYPE "AH" MAGNETO WITH NAMES OF MORE IMPORTANT PARTS.

WICO TYPE "H" AND "AH" MAGNETOS



CROSS-SECTIONAL VEIW OF COMPLETE WICO TYPE "H" MAGNETO SHOWING LOCATION OF DRILLED DRAIN HOLES.

ILLUST. 122--CROSS SECTIONAL DRAWING OF WICO TYPE "H" MAGNETO WITH NAMES OF MORE IMPORTANT PARTS. ALSO SHOWS LOCATION OF DRILLED DRAIN HOLES FOR MAGNETOS AFTER NO. 22325 USED ON 1-1/2 TO 2-1/2 H.P. "LA" ENGINES AND AFTER NO. 8800 USED ON 3 TO 5 H.P. "LA" ENGINES.



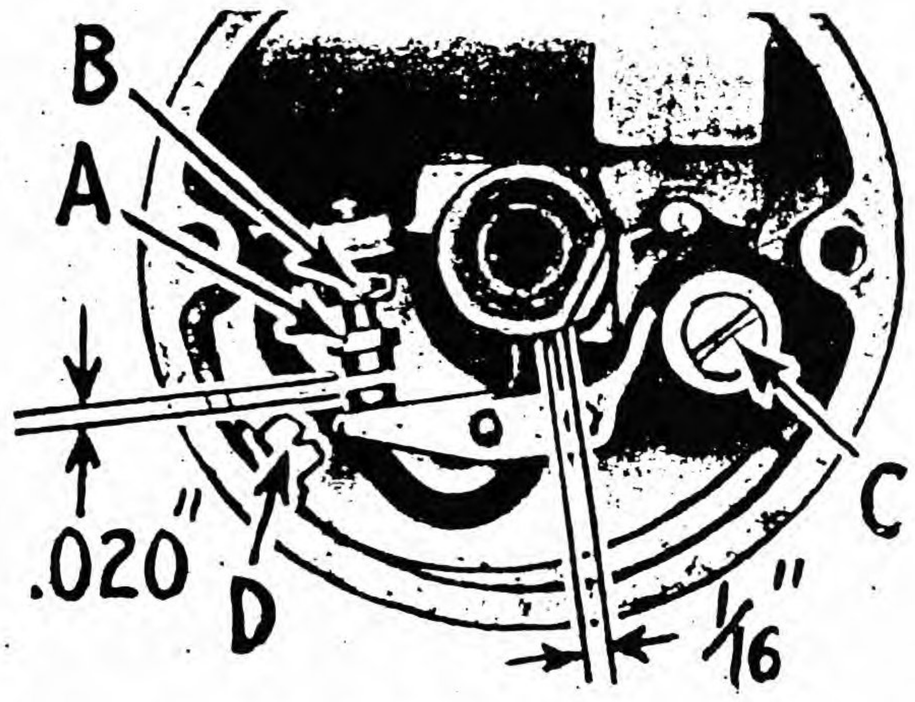
ILLUST. 123--WICO TYPE "AH" BREAKER ASSEMBLY.

Adjusting Wico Type "AH" Magneto Breaker Points

If points require dressing, use a sharp magneto file and dress only to the polishing point.

Stationary point is mounted on a steel plate, the movement of which is controlled by a slotted head eccentric "C" and a slotted-head locking screw "B". The locking screw has the larger head. Loosen screw "B", then turn the slotted-head eccentric "C" until the correct breaker opening of .020" has been obtained with rubbing fiber set at 1/16" past flat of cam. Tighten the locking screw. Test the opening again to be sure it has not changed.

Adjusting Wico Type "H" Magneto Breaker Points



ILLUST. 124--WICO TYPE "H" BREAKER ASSEMBLY.

Turn drive shaft unit until breaker arm rubbing block rests 1/16" past flat of cam. Loosen lock nut "B" which holds adjustable breaker point and turn point "A" until breaker opening of .020" has been obtained. Tighten lock nut. Test opening again to be sure it has not changed.

Breaker Point Renewal

It is recommended that if one point needs replacing, both points should be installed to insure best results.

Type "AH" Magneto: (See Illust. 123)
Removal of pivot screw "D" and breaker lead terminal screw "A" will permit withdrawal of the movable breaker point from breaker housing. Take out locking screw "B" and remove fixed contact plate. Care should be taken when assembling new breaker arm so that both washers and steel bushing are in place.

In replacing the screw for the spring clip, it will be found helpful to wedge this clip into place with a screw driver while the screw is being started.

Type "H" Magneto: (See Illust. 124)
Remove adjustable point "A", then remove screw "C". Shift the arm far enough off its pivot so that a small screw driver can be placed in back of arm. Remove screw "D" and breaker arm and spring can be taken out. If breaker arm and spring are to be used again, care should be exercised to see that the breaker arm spring is not distorted.

To replace new breaker arm, place spring in position inside breaker housing. Insert and start screw "D", then place arm over pivot part way and tighten screw "D". Push arm into place on pivot. Insert and tighten breaker arm retainer screw "C". Screw in adjustable point "A" and adjust for proper gap setting.

Condenser Renewal

Type "AH" Magneto:
To remove condenser, it is only necessary to remove breaker cover to take out the screw holding the coil connection wire and the two screws located at either end of the condenser. Condenser may be tested with SE-846 Electrical Test Set for both short circuit and open circuit as explained on Page 15. Condenser can be easily replaced.

Type "H" Magneto:
Remove main housing (breaker end) by taking out four nuts and working the housing gently off the studs. Housing should not be removed by force as the high tension coil is connected to it by a wire and care must be taken not to break this connection. Remove the nut and lock washer on the outside of the housing which holds one end of the condenser to the housing; then loosen the nut on the other end of the condenser. The condenser and primary lead wire will lift out easily, since the condenser bracket is slotted.

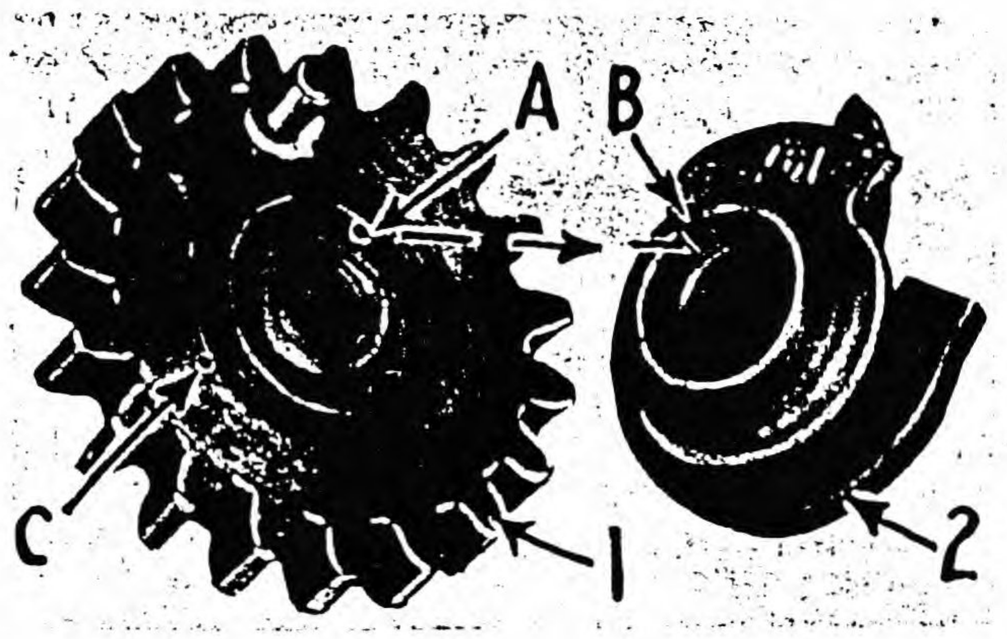
Condenser may then be tested with SE-846 Electrical Test Set for both short circuit and for open circuit as explained on Page 15. Reverse above procedure for replacing condenser.

Wico Type "H" and "AH" Magneto Impulse Coupling

To remove the impulse coupling from the magneto, remove the cotter pin and nut on end of the shaft. In order to hold the shaft while the nut is being loosened, insert a screw driver between the impulse stop and end of the impulse pawl or driven flange. Do not try to hold the gear.

After the nut is removed, the gear and its bushing can be taken off the shaft, making sure that the impulse spring contained in the gear is removed with it. It will be necessary to work the inner eye "A" out of its groove "B" in the driven flange with a screw driver as the gear is removed, in order that the spring will not unwind itself. The impulse spring can be removed from the

WICO TYPE "H" AND "AH" MAGNETOS

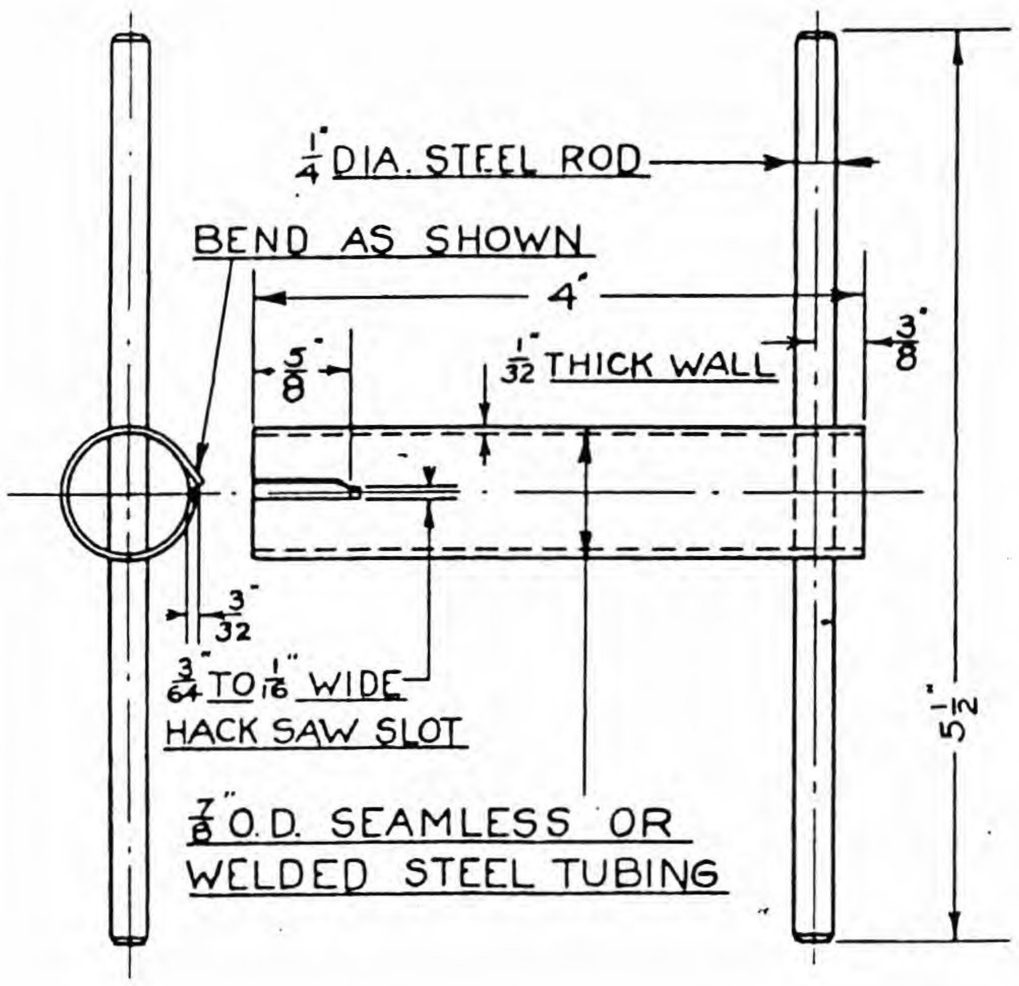


ILLUST. 125--IMPULSE GEAR AND IMPULSE DRIVE. FLANGE SEPARATED. 1--IMPULSE GEAR WITH GEAR BUSHING AND DRIVE SPRING. 2--IMPULSE DRIVE FLANGE WITH PAWL.

gear by inserting a blunt pin through the hole in the gear that anchors the outer end of the spring, forcing the spring out of the hole "C". The spring has considerable precompression in the gear and will unwind when removed, so caution should be exercised to prevent injury to the hands.

The driven flange is keyed to the drive shaft of the magneto and can be pried off by placing a screw driver behind it on each side. Do not damage the pilot boss that guides the magneto into the engine housing. If the impulse spring is not to be replaced, remove driven flange, impulse spring and gear as a complete unit..

Installing Impulse Spring in Impulse Gear



ILLUST. 126--SUGGESTED TOOL FOR INSTALLING IMPULSE DRIVE SPRING FOR "H" AND "AH" MAGNETOS.

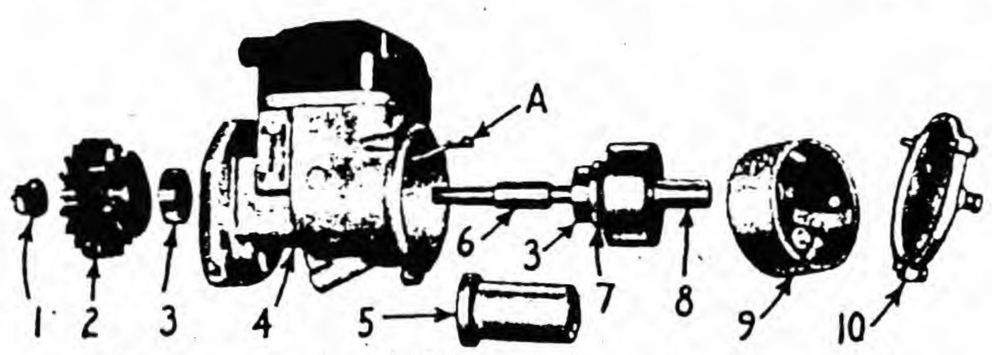
To facilitate installing an impulse spring which is removed from the casing or gear recess it is advisable to use a tool as suggested in Illust. 126). This tool can be easily made from a piece of 7/8" O.D. seamless or welded steel tubing approximately 4" long; a 1/4" diameter steel rod is used for a handle. Clamp the impulse gear upright in a vise with the vise jaws against the flat sides of the gear. Catch the inner eye of spring in slot of tool. Place spring over recess in gear, so that outer eye of spring is caught in notch provided in gear recess. Bear down on the spring and turn tool in clockwise direction until spring is wound up sufficiently to slip into recess of gear. Remove tool.

Replacement impulse springs are enclosed in a casing to facilitate their installation. To insert a new spring, lay the wound spring, which is in the casing, over the recess in the gear, so that the outer eye of the spring is over the notch in gear provided for it. Use a piece of brass or hard wood to drive the eye into its notch in the gear, and at the same time work the rest of the spring into the gear by inserting the blunt pin through holes in the casing provided for this purpose. The spring will then drop into its recess. At the same time, the casing which holds the wound spring will come off.

To replace the gear on the magneto drive flange pull the inner eye of the spring ("A", Illust. 125) out just enough so that it can be started into the notch in the driven flange ("B", Illust. 125). Turn the flange until the impulse pawl engages the impulse stop, then turn the gear clockwise for a clockwise magneto until the impulse trip pin in the gear passes by the engaging surface on the flange. Then press the gear into place and insert the bushing.

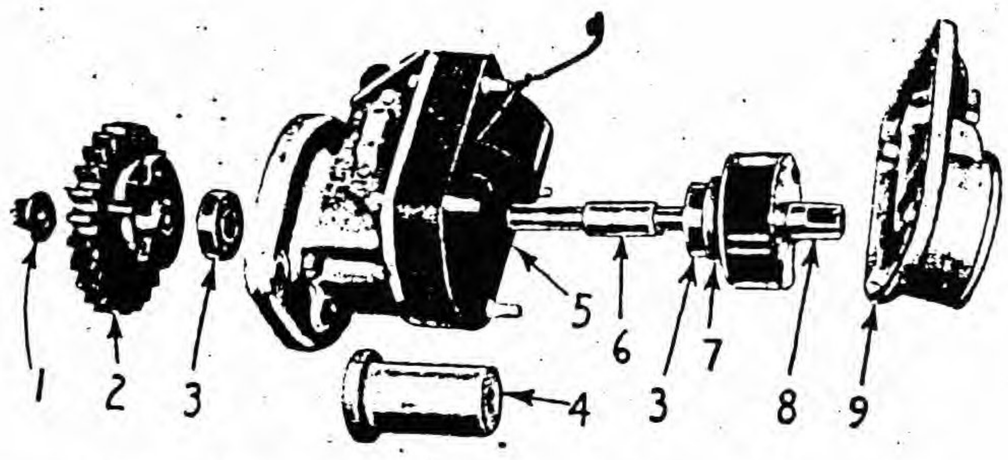
Removing Rotor Unit

To remove the rotor unit from the "AH" type magneto, it is necessary to remove breaker box cover, the screw holding the



ILLUST. 127--ROTOR REMOVED FROM TYPE "AH" MAGNETO. 1--IMPULSE GEAR NUT AND WASHER. 2--IMPULSE ASSEMBLY. 3--BALL BEARING. 4--MAIN HOUSING. 5--DRIVER TOOL SE-9147. 6--BALL BEARING SPACER. 7--OIL SEAL. 8--ROTOR. 9--BREAKER BOX. 10--BREAKER BOX COVER.

coil connection wire "A", to the condenser and the screw at the bottom of the magneto which holds the breaker box in the housing. The breaker box with the condenser and contacts attached can then be pulled out. Next remove the gear and coupling as given under Illust. 125. With these parts removed the rotor unit can be pressed out. Press out rotor with a press if available.



ILLUST. 128--ROTOR REMOVED FROM TYPE "H" MAGNETO. 1--IMPULSE GEAR NUT AND WASHER. 2--IMPULSE ASSEMBLY. 3--BALL BEARING. 4--DRIVER TOOL SE-9142. 5--COIL, CORE AND MAIN HOUSING (IMPULSE END). 6--BALL BEARING SPACER. 7--OIL SEAL. 8--ROTOR. 9--MAIN HOUSING, BREAKER END.

To remove the drive shaft unit from the "H" type magneto, remove main housing (breaker end) as given under "Condenser Renewal"; next remove gear and coupling as given under "Impulse Coupling." With these parts removed, the drive shaft unit can be pressed out. Press out drive shaft with a press if available, using block SE-9141 for blocking against the core plates.

Both ball bearings should remain in the housing. Occasionally, however, the inside one and the oil seal come out with the rotor, as shown in illustration. If this happens, the block SE-9141 with two rectangular pieces of rolled steel laid across it to catch under the bearing can be used in the press to remove it. Test bearing with fingers to determine if it has been injured. If bearing is free from catches, replace it, according to instructions given under the following heading. If new bearing is required, follow same instructions.

If inner bearing remains in the housing, inspect carefully to see whether or not it has moved from its seat. If bearing has been disturbed, remove it and the oil seal by striking against it with a brass punch rod. Check bearing for injury. If bearing is injured, replace with new one.

It is necessary to remove the inner bearing if it is disturbed from its seat in pushing out the shaft, because just pressing in a new drive shaft will not reseat this bearing satisfactorily. The leather of the oil seal is apt to catch under the shoulder of the rotor shaft, wedging between it and the inner race of the bearing, thereby cocking the shaft.

Replacing Ball Bearings, Oil Seal, and Rotor in "H" and "AH" Magnetos

Clean bearings thoroughly before replacing and test for injury. Outside bearing can be pressed in place with driver SE-9142 (see Illust. 128), using small end against bearing. Then place ball bearing spacer in cavity of housing. Place block SE-9141 or ordinary "V" block with bottom side up on plate of arbor press. Place magneto flange down on block, hooking impulse stop over edge to render a flush seat. Press bearing into housing, using driver SE-9142 with small end against outer race. Press oil seal into place with plain side of brass facing, breaker end of magneto, using large end of driver SE-9142 against oil seal until it is flush with hub. Place a few drops of heavy lubricating oil on seal.

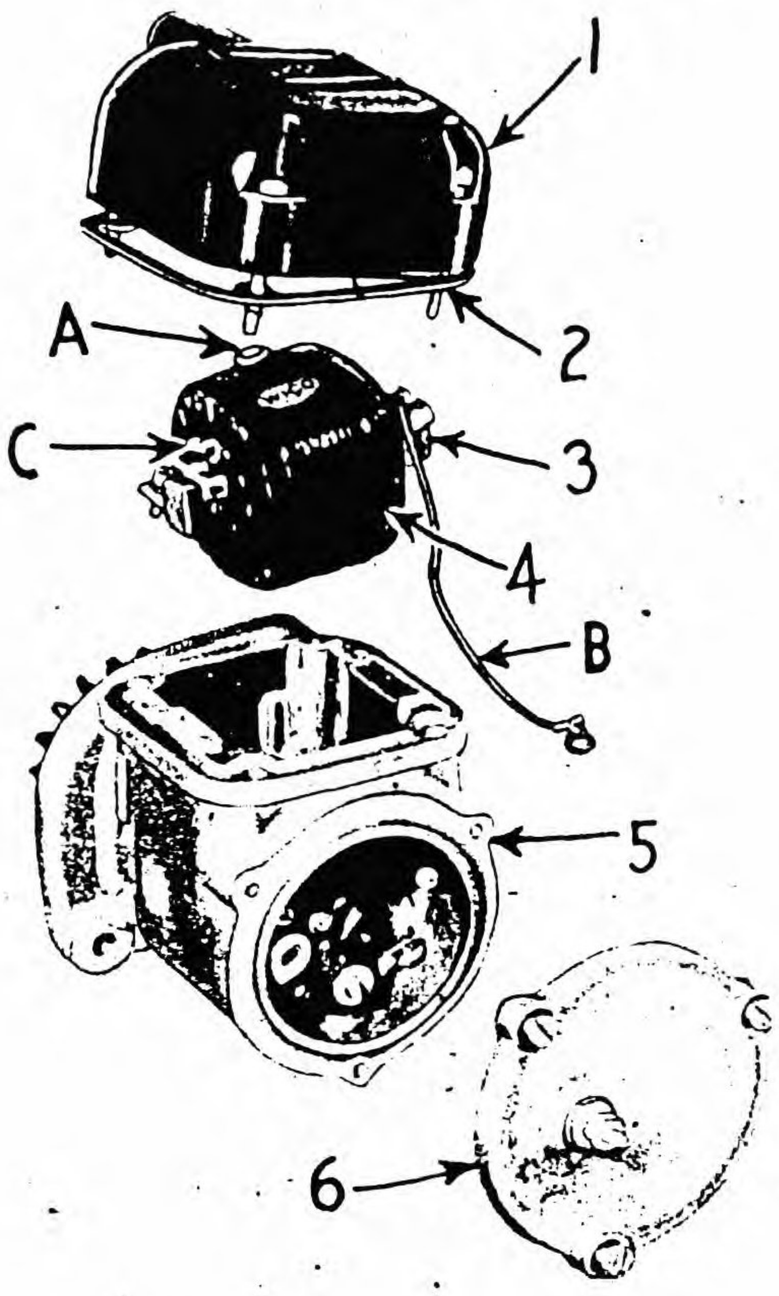
Place rotor unit in magneto, threading spacer, between bearing onto shaft. Holding magneto flange down to bottom plate of arbor press and with driver SE-9142 over shaft with small end against outer bearing, bring press down on cam end of drive shaft until it bottoms.

Replace all parts removed. Recharge magnet, adjust breaker points. Test impulse to see that drive gear is free.

Coil Group

Removing Type "AH" Magneto Coil:

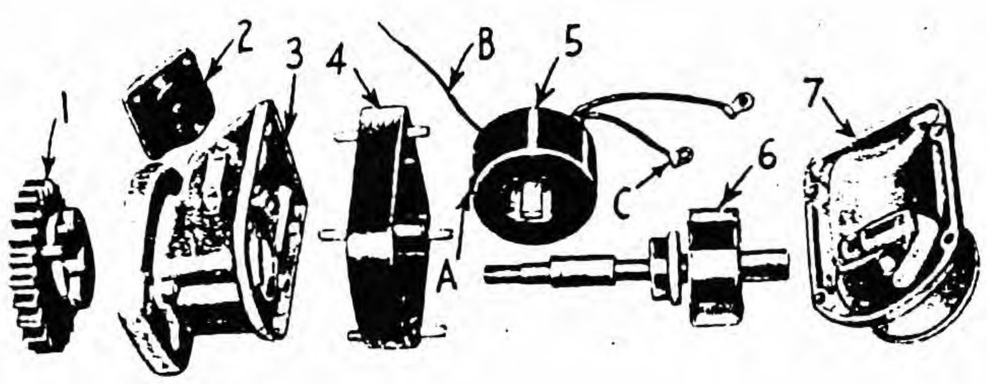
With the breaker box cover off, remove the screw holding the coil connection wire on the breaker box. Unscrew the four screws holding the bakelite cover of the magneto down and take his cover off. The coil will then be exposed where it is held down by two clamps over the coil core. Remove these two screws and the clamps. Take hold of the coil and coil core assembly, exerting just enough force to lift it off if there were no magnetism gripping it to the magneto. Turn over the magneto shaft slowly in a counterclockwise direction when looking at the drive gear, or if the magneto is on the engine turn the engine over slowly in the direction opposite to its ordinary rotation, until the magnetism no longer grips the coil core and the coil and core come free from the magneto. Do not turn the mag-



ILLUST. 129--TYPE "AH" MAGNETO COIL REMOVED.
1--COIL COVER. 2--COVER GASKET. 3--COIL CORE. 4--COIL.
5--MAGNETO HOUSING WITH ROTOR BREAKER ASSEMBLY, CONDENSER, AND IMPULSE. 6--BREAKER BOX COVER.

neto shaft again while the coil core is off. To do this will necessitate recharging the magnet in order to prevent its full intensity of spark from being impaired.

Removing Type "H" Magneto Coil:



ILLUST. 130--COIL REMOVED ON WICO TYPE "H" MAGNETO. (IT IS NOT NECESSARY TO TAKE OFF IMPULSE GEAR AND ROTOR AS SHOWN TO REMOVE COIL.) 1--IMPULSE STARTER ASSEMBLY.
2--TERMINAL. 3--MAIN HOUSING (IMPULSE END). 4--CORE.
5--COIL. 6--ROTOR. 7--MAIN HOUSING (BREAKER END).

Remove main housing (breaker end) as outlined under "Condenser Renewal"; take out four nuts holding laminated core to main housing (impulse end). Disconnect two wires from coil to the main housing (impulse end). Line up notch in rotor over primary ground wire screw in main housing (impulse end) and remove screw which frees one wire to main housing. Other wire connects coil to stop button. Inspect serial number on cover of magneto. All (1-1/2 to 2-1/2 engine) magnetos above serial number 6000 and all (3 to 5 engine) magnetos above serial number 15000 have a slotted terminal on the lead-out wire connecting the stop button. This makes it possible, after having removed the spark plug cable terminal block, to reach in the opening and by using a 30-degree offset and a straight wrench, loosen the terminal unit and pull out terminal without removing screw. On all magnetos with previous serial numbers, it is necessary to push back the extra yellow insulation near the coil and unsolder the stop connection. Then the whole unit, consisting of laminated core and coil, can be lifted off. Caution should be exercised to see that the laminations are neither separated nor turned over, otherwise, when reassembling, the proper alignment will be lost, because the core is doweled and reamed, when originally assembled, to secure proper fit.

Testing Coil, Types "H" and "AH"

Coil may be tested with SE-846 electrical test set similar to the test outlined on Page 12 (Illust. 18), covering testing the F-4 and F-6 magneto. Place coil with core in place on test box so secondary lead-out terminal ("A", Illusts 129 and 130) is firmly against metal of collector ring holder. Clip winding test leads to primary lead-out wires ("B" and "C" in Illusts. 129 and 130) which extend from each side of the "AH" coil and the same side of the "H" coil. Snap on vibrator switch. There should be a strong spark across a 5/16" test gap. If coil will not pass test, replace with new coil.

Replacing Coil, Types "H" and "AH"

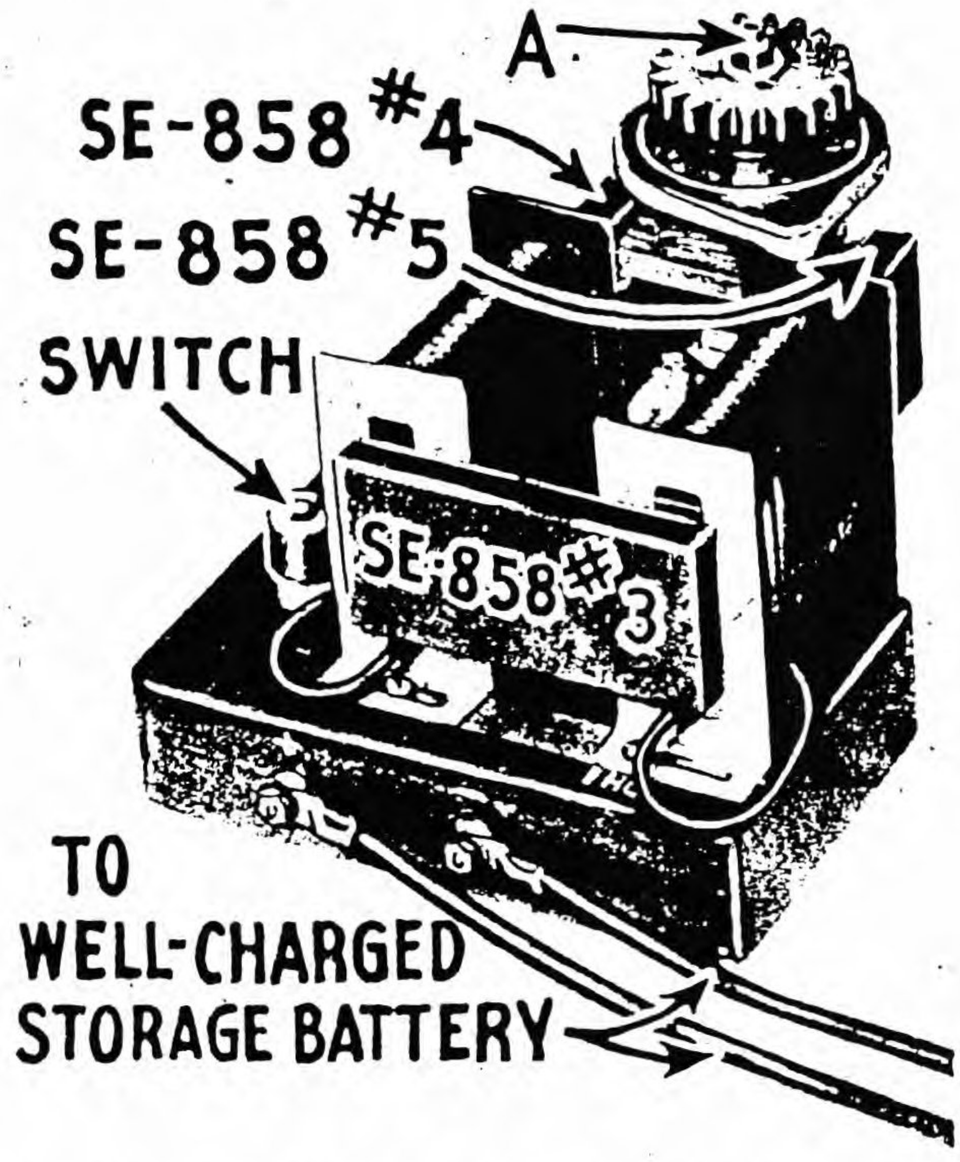
Coil can be readily removed from the core. When placing new coil on core, use care to avoid damage to insulation; see that wedge or wedges for holding the coil are securely in place; have contact button of coil toward impulse end of magneto and connect primary lead-out wires by reversing procedure given for removing coil. It is advisable to recharge type "AH" magneto before replacing the magneto coil.

Drain Holes for Type "H" Magnetos

All Wico Type "H" magnetos after No. 22325 used on the 1-1/2 to 2-1/2 H.P. "LA" engine and after No. 8800 used on the 3 to 5 H.P. "LA" engine have been drilled in the bottom to drain out any moisture that may enter it either by seepage or condensation. All earlier "H" type magnetos should be drilled as shown in Illust. 122 whenever servicing whether it is for moisture or something else.

Two 1/8" holes are drilled in the bottom portion of the magneto, one on each side of the laminations and one 3/16" hole is drilled in the breaker housing.

Recharging the Wico Type "AH" Magneto



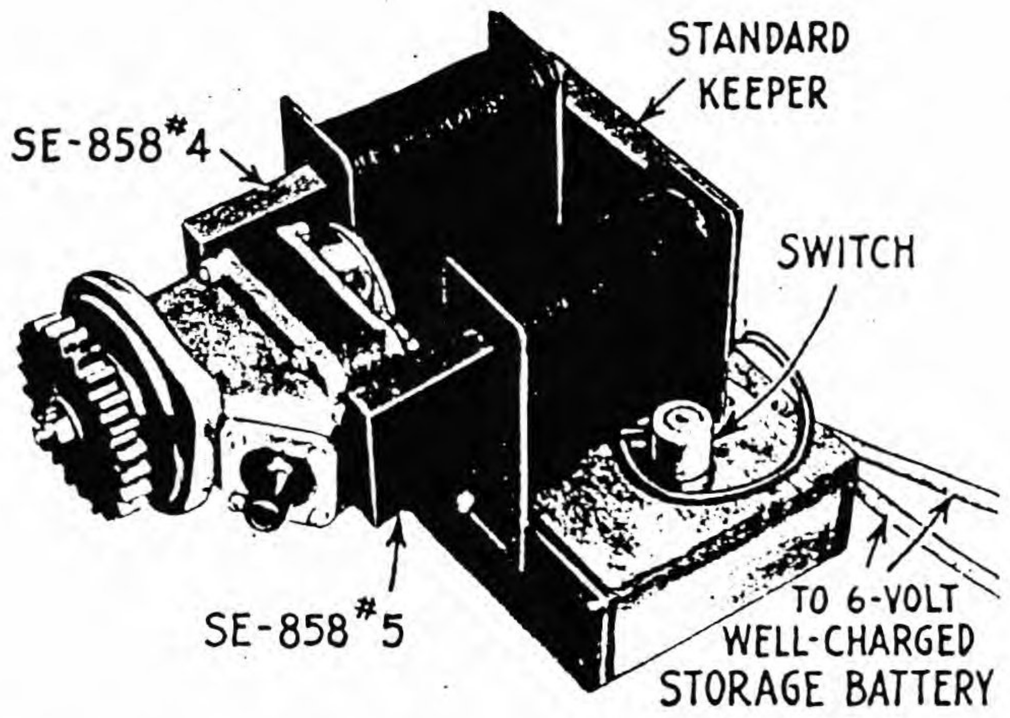
ILLUST. 131--SHOWS WICO TYPE "AH" MAGNETO IN POSITION TO BE RECHARGED ON SE-858 SPOOL TYPE MAGNETIZER.

Wico Type "AH" magnetos should never be recharged unless it is definitely proven that the rotor magnet has lost its magnetism.

Connect charger to a well-charged storage battery having the terminals marked (+ and —) of the magnetizer and storage battery corresponding. Place charging bars SE-858-4 and SE-858-5 in spools with finished sides facing in, towards each other. and curved end of bar SE-858-4 in spool. Remove the coil cover, breaker cover, and coil with core from magneto, as outlined under Illust. 129. Hold the magneto in its normal operating position, turn the drive gear clockwise until the trip arm strikes against the impulse stop; then turn the gear back until the hole for the cotter pin "A" in the end of the shaft is vertical (roller magnet lamination should be centralized between pole pieces).

Place the magneto between the charging bars with the drive gear facing up as shown in the illustration, and place a standard keeper bar, SE-858-3, bridged across ends of bars in spool. Depress the switch for one or two seconds, then release switch; turn the rotor 90° so that the pole pieces bridge rotor lamination. Remove magneto and assemble parts removed.

Recharging the Wico Type "H" Magneto



ILLUST. 132--SHOWING TYPE "H" MAGNETO IN POSITION TO BE RECHARGED WITH SE-858 SPOOL TYPE MAGNETIZER.

Spool type magnetizer SE-858 can be used to charge type "H" magneto. Slight alterations are necessary when using earlier made magnetizers. It is necessary to spread the spools 1/4" farther apart. To do this, proceed as follows: Remove two screws holding spool near the switch. Then drill 2-3/16" holes in the base, measuring 1/4" out from the holes from which the screws were removed. Reassemble the spool with the screws in the newly drilled holes. Connect charger to well-charged storage battery, making sure the terminal marks (+ and —) of the magnetizer and storage battery correspond. Place the bar SE-858 No. 5 in the spool nearest the switch and the bar SE-858 No. 4 in the other spool. With this set-up the magnetizer is ready for use. Have standard keeper ready to place across charging bars.

WICO TYPE "EK" MAGNETO

To recharge magneto, hold magneto in upright position, turn drive gear until impulse trip arm contacts impulse stop; then turn gear back until cotter pinhole in end of shaft for impulse gear nut is in horizontal position. Curved end of magnet is a south pole. Magnets are now in correct position for charging. Make sure not to change this position and place complete magneto between charging bars as shown in Illust. 132. Be sure to complete the circuit by placing a keeper across the charging bars while closing the switch. Switch need only be closed a few seconds.

Timing Wico Type "H" and "AH" Magnetos to "LA" Engine

Align the "DC" mark on flywheel with the timing notch on side plate when engine is on the compression stroke. The compression stroke may be determined by placing the finger over the spark plug hole and cranking engine in a clockwise direction. When air blows past finger, the engine is on compression stroke.

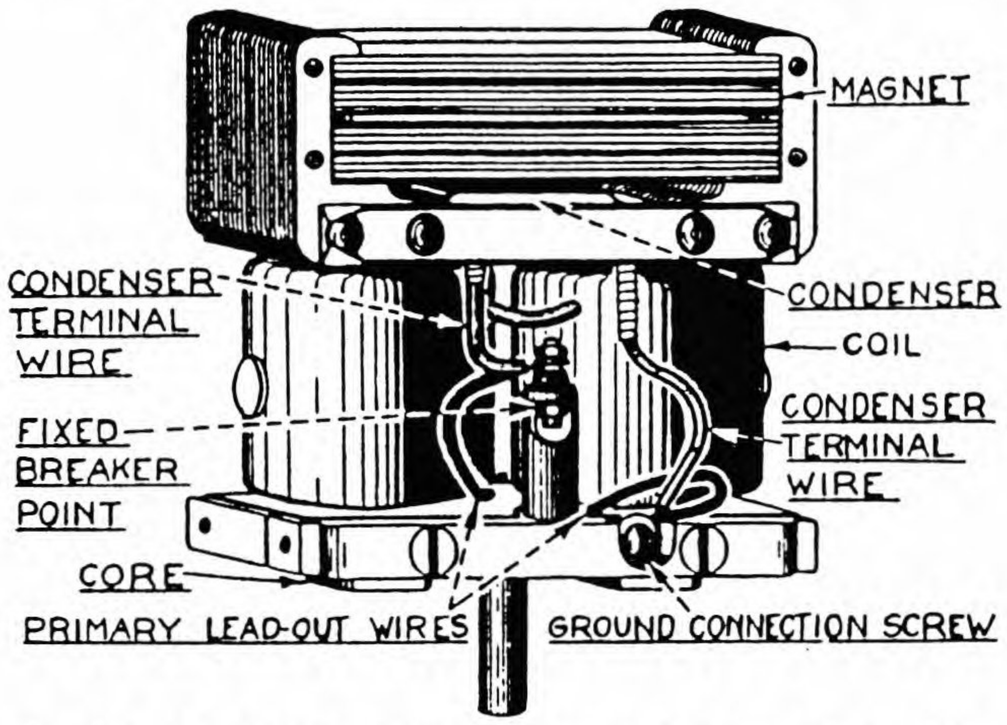
Align the marked tooth on magneto gear with mark on magneto flange, and, without disturbing this setting, insert magneto into its mounting hole so magneto gear meshes with cam gear. Then tighten the magneto screws lightly so magneto can be rocked. Impulse coupling can be made to trip exactly at the time the "DC" mark on flywheel is in line with timing notch on side plate by tipping the magneto forward and backward. Then tighten the magneto screws.

Wico Type "EK" Magneto—General

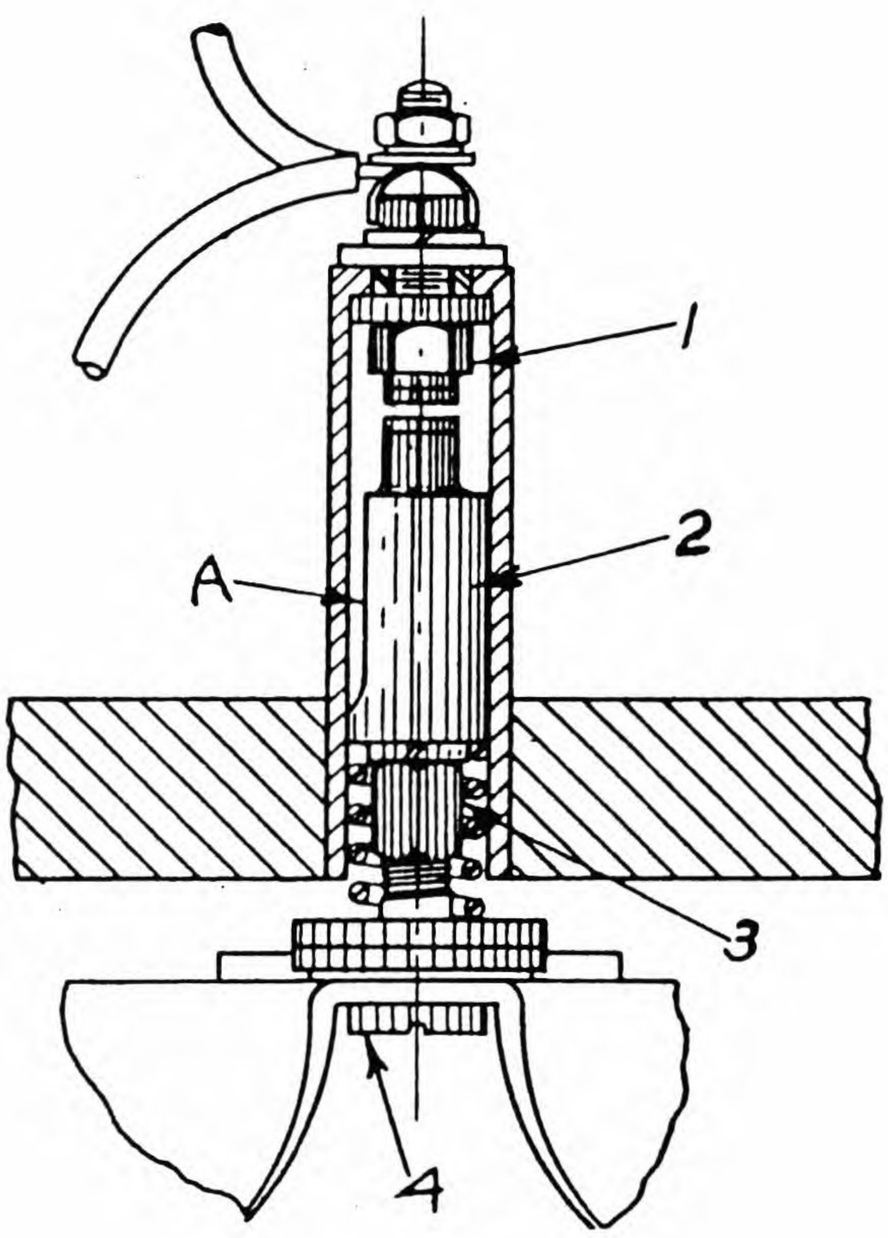
Wico type "EK" high tension magnetos are used on the 1-1/2, 3, 6 and 10 H.P. McCormick-Deering stationary engines. These magnetos should require very little service and will give thousands of hours of trouble-free performance if working parts are kept clean and well oiled as outlined in the Instruction Book.

Breaker Points

The two side covers of the magneto are held in place by a cover band which is fastened by four screws. Removal of these screws allows band and covers to be taken off. Breaker point contacts should just be open when the armature is about 3/32" away from cores. To adjust contacts, withdraw the moving parts and loosen locknut (3), Illust. 134, on stem of breaker point. Replace the moving parts and insert two 3/32" thick metal strips between armature and face of



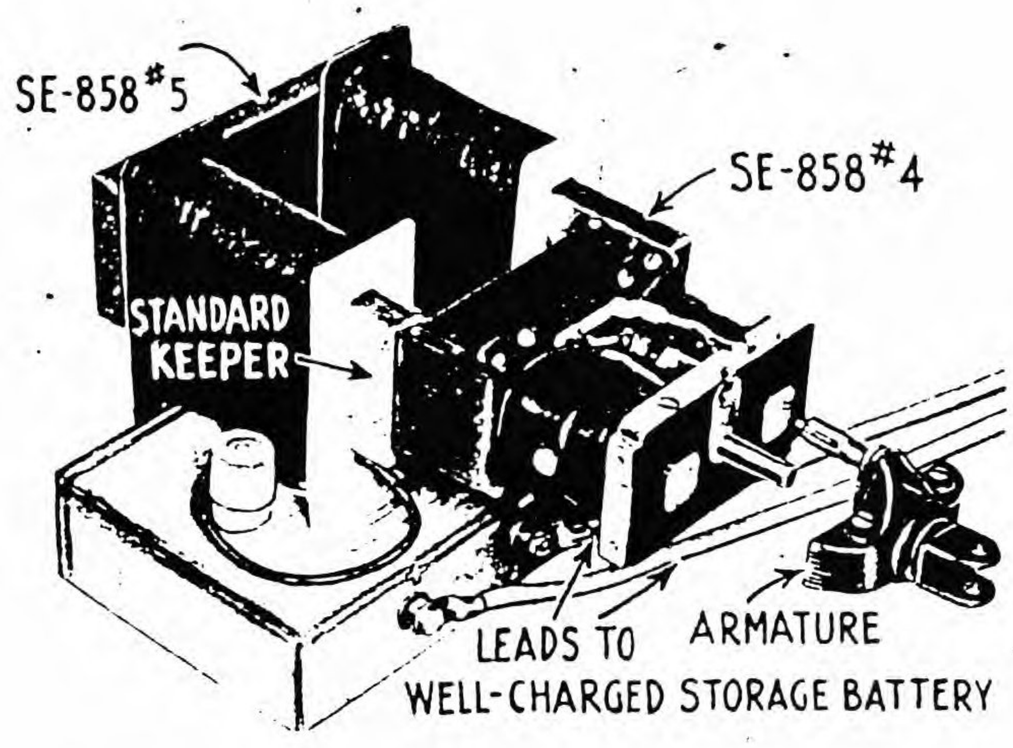
ILLUST. 133--WICO TYPE "EK" MAGNETO WITH COVERS OFF AND MOVING PARTS REMOVED. NAMES OF THE MORE IMPORTANT PARTS ARE SHOWN.



ILLUST. 134--WICO "EK" BREAKER POINT DETAILS.

cores. Hold the contact (2) from turning by inserting a key in slot (A) in its side. Turn screw (4) until contact (2) just fails to touch contact (1). Then remove the armature from the magneto and draw up nut (3) against lockwasher and contact, taking care screw does not turn in contact while doing this. Replace armature and check adjustment. Be sure to remove metal strips when breaker points are properly adjusted.

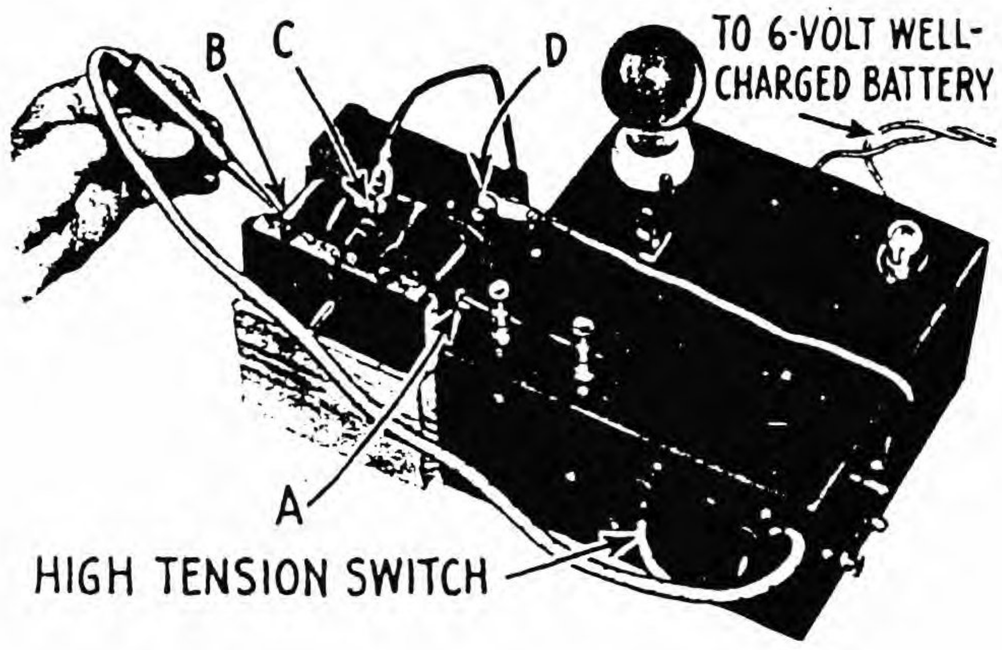
Charging Wico Type "EK" Magneto-



ILLUST. 135--WICO "EK" MAGNETO BEING RECHARGED WITH SE-858 SPOOL TYPE MAGNETIZER.

Wico "EK" magneto can be recharged on a spool type magnetizer (SE-858) as shown in Illust. 135. On earlier spool magnetizers it is necessary to spread the spools 1/4" farther apart as was necessary when recharging the Wico "H" type magneto. (See Page 66.) It is necessary to have two charging bars (SE-858 No. 4 and SE-858 No. 5) and the standard keeper to properly recharge the Wico "EK" magneto on the spool type magnetizer. Connect magnetizer to a well charged storage battery, making sure the terminal marks (+ and —) of the magnetizer and storage battery correspond. Remove the cover band and two side covers from the magneto. Then place the magneto in the position to the charging bars as shown in Illust. 135. Remove the armature from the core, and place bar SE-858 No. 5 across opposite end of the charging bars, to complete the magnetic circuit. Close the electric circuit by forcing down on the switch, for only a few seconds. Before removing the magneto from the charger replace the armature. If this is not done, the magnets will lose part of their magnetism. If the armature is left in place while charging with this type of magnetizer, the magnets do not become completely saturated. When magnets are fully charged, it will take from 65 to 70 lbs. pull to remove the armature.

Testing Magneto Coil



ILLUST. 136--TESTING MAGNETO COIL ON ELECTRICAL TEST SET SE-846.

Have vibrator switch "off" and high tension switch connected to armature terminal (see illust.). Place magneto, with covers and armature removed, next to electrical test set box with coil secondary lead-out button "A" firmly against back end of gap pointer. Clip one winding test lead on breaker point nut "C" and other test lead to frame of magneto "D". Have high tension test point lead connected to "armature" terminal and hold test point end firmly against coil secondary lead-out button "B". Snap on vibrator switch. A good spark should jump a 3/16" test gap. It is necessary to recharge the magneto after testing the coil with an electrical test set. Testing the coil will break down the magnetic lines of force in the magnet.

Testing Condenser

Remove ground connection screw which releases condenser terminal wire. (See Illust. 133 for identification of parts.) Condenser can then be tested for short and open circuit using condenser terminal wire and fixed breaker point screw for lead-outs. Use 110 or 220-volt circuit of electrical test set SE-846 as explained on Page 15, or Neon condenser test set SE-1065 shown on Page 15.

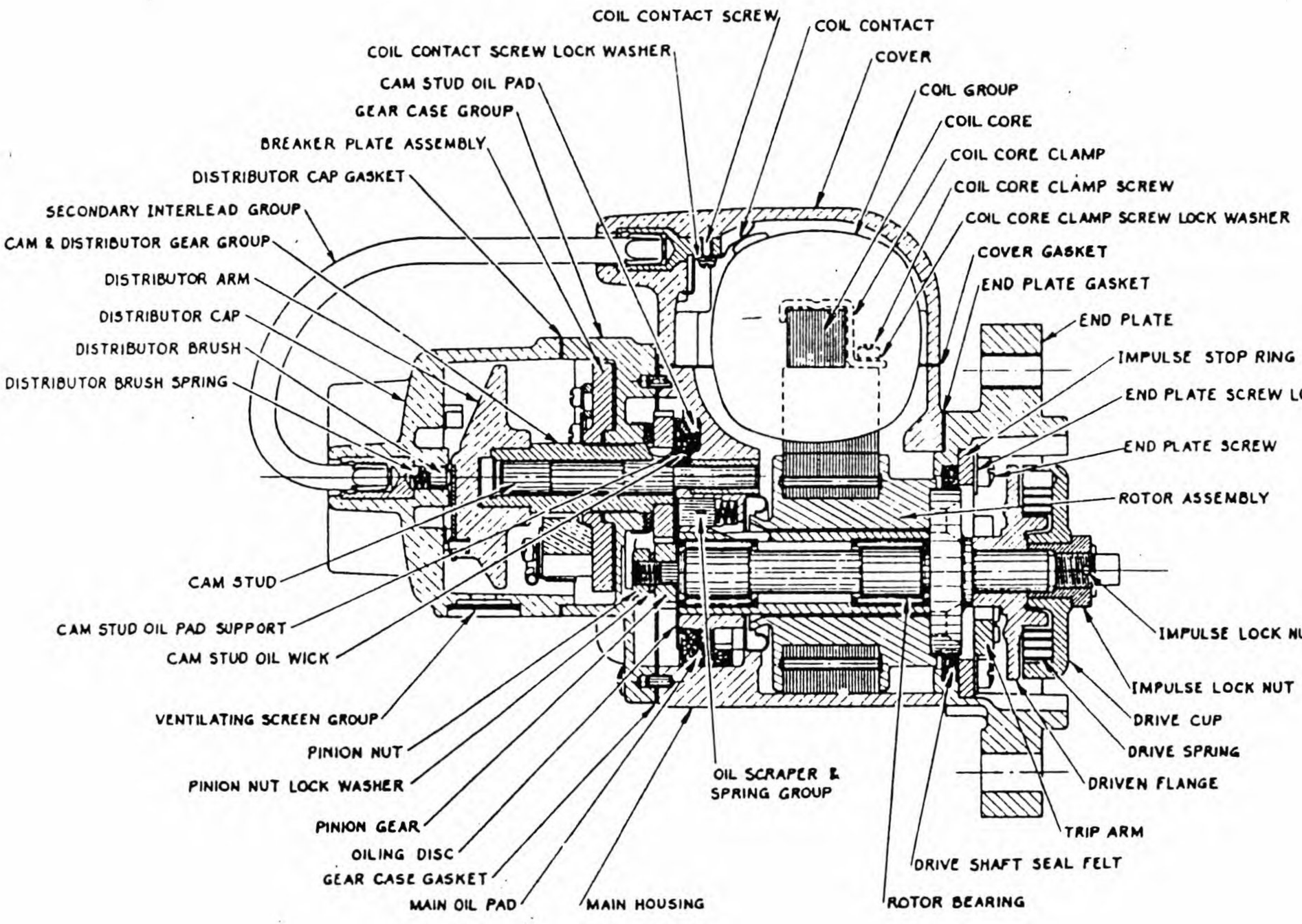
WICO TYPE "AP" MAGNETO

Wico Type "AP" Magneto—General

The type "AP" Wico magneto, clockwise rotation was standard equipment on all No. 60 and No. 61 Harvester Thresher Engines up to serial number 10820. All later engines of this type (Continental Y-69) are equipped with the 10° spark advance International type H-4 magneto. The operating principle and electrical circuit is much the same as the H-4. Impulse coupling is of the clock-spring type.

The Wico type "AP" magnetos have a rotating magnet, fixed coil, adjustable breaker points, and a rotating cam. They are designed for flange mounting only. The drive shaft unit (drive shaft, magnet and pinion gear) rotates in needle bearings, one in either end of a hollow stud which is permanently attached to main housing of the magneto. Bearings and moving parts are lubricated from an oil reservoir in the base of housing, using an oiling disc and wicks to circulate the oil. Fill reservoir every 200 hours with S.A.E. 20 oil.

To time magneto to the engine, first remove distributor cap. Rotate magneto shaft in a counterclockwise direction (looking at impulse coupling) until the pointer on the distributor arm is under terminal on distributor cap mark "1". Continue rotation until points are closed. Then reverse the direction of rotation of magneto shaft (turn in clockwise direction) and turn until points just begin to open. Next, crank the engine until the marking "IGN" on flywheel is in line with pointer of inspection hole in flywheel housing. Then very carefully assemble magneto to engine without turning magneto shaft.



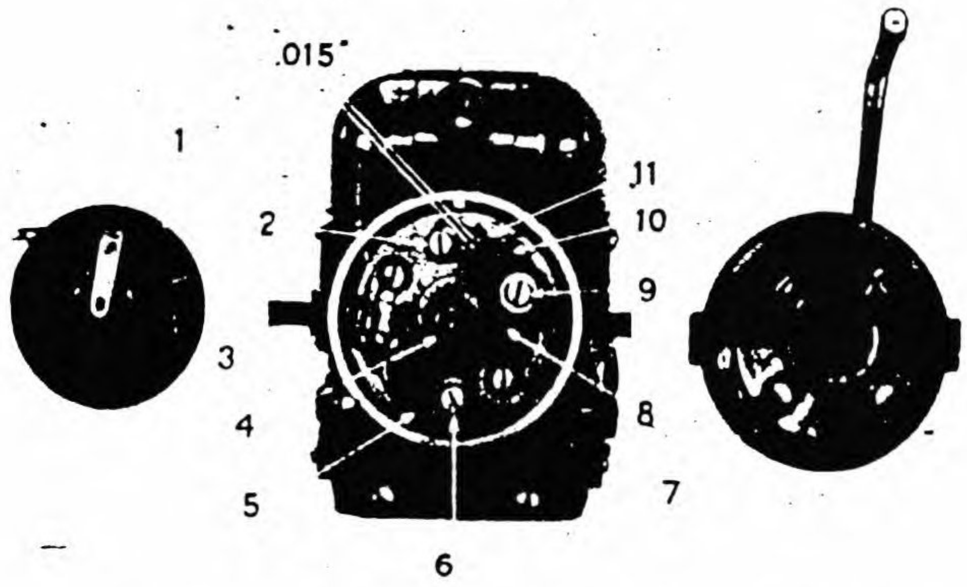
ILLUST. 137--CROSS SECTIONAL VIEW OF WICO "AP" MAGNETO.

Distributor

To remove distributor, wedge distributor clips out with a screw driver and pull off cap with its gasket.

The distributor brush and its spring are integral; both can be removed together by directly pulling out the carbon brush.

Clean ventilating screen in distributor cap and remove any dirt from interior of the cap. Slot in the distributor cap engages key inside gear housing so that the cap fits only one way.



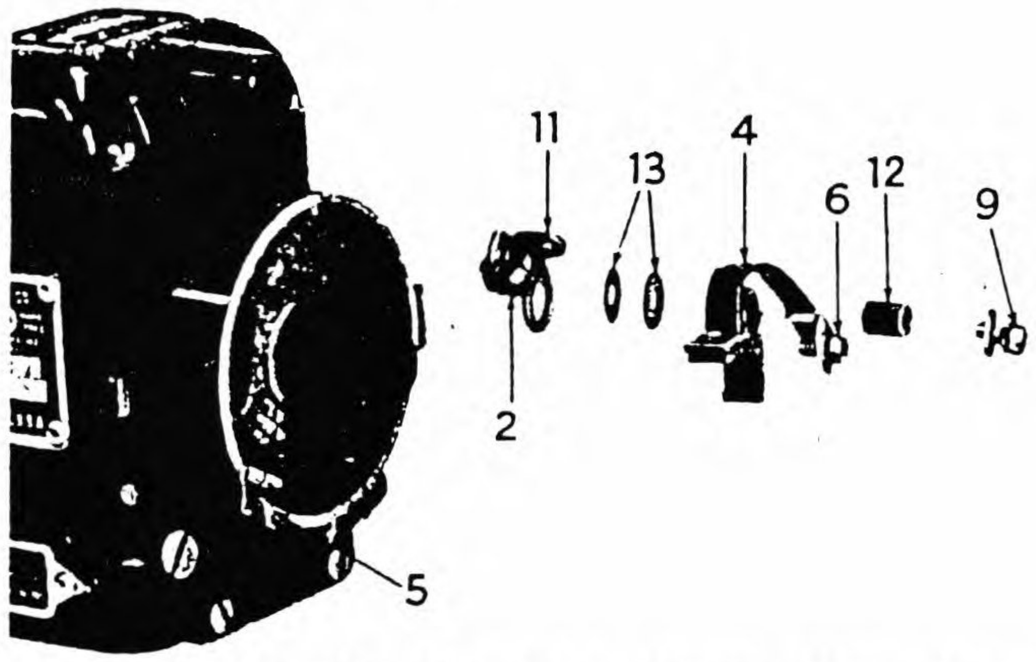
ILLUST. 138--WICO "AP" MAGNETO WITH DISTRIBUTOR CAP AND ROTOR REMOVED. 1--DISTRIBUTOR ARM. 2--BREAKER POINT LOCK SCREW. 3--DISTRIBUTOR CLIP. 4--BREAKER CAM. 5--PRIMARY LEAD-OUT TERMINAL. 6--BREAKER ARM SPRING TERMINAL SCREW. 7--DISTRIBUTOR CAP WITH HIGH TENSION CABLE. 8--BREAKER ARM. 9--BREAKER ARM PIVOT AND RETAINING SCREW. 10--ECCENTRIC ADJUSTMENT SCREW. 11--STATIONARY BREAKER POINT.

Breaker Points

To get at the breaker points, the distributor cap (7) and distributor arm) (1) must be removed. This is accomplished by wedging the distributor clips (3) out with a screw driver, and pulling off cap (7) with its gasket.

Breaker point opening should be adjusted to .015 in. when breaker arm (8), (Illust. 138) is on the high point of one of the cams (4). Adjustment is made by loosening screw (2) and turning the screw head eccentric (10). It is located half way between the pivot (9) and the contact on the fixed contact plate (11). After adjusting points, be sure the fixed contact plate screw (2) is tightly locked.

On replacing the distributor arm (1), care should be taken to locate the key molded in the hole in distributor arm into the slot cut in the end of the cam (4). Key must be located properly to have arm go on all the way.



ILLUST. 139--WICO "AP" MAGNETO WITH BREAKER ASSEMBLY REMOVED. 2--LOCK SCREW. 5--PRIMARY LEAD OUT TERMINAL. 6--BREAKER ARM SPRING TERMINAL SCREW. 8--BREAKER ARM WITH SPRING. 9--BREAKER ARM PIVOT SCREW. 11--STATIONARY BREAKER POINT. 12--BREAKER ARM SPACER. 13--BREAKER ARM SPACING WASHERS.

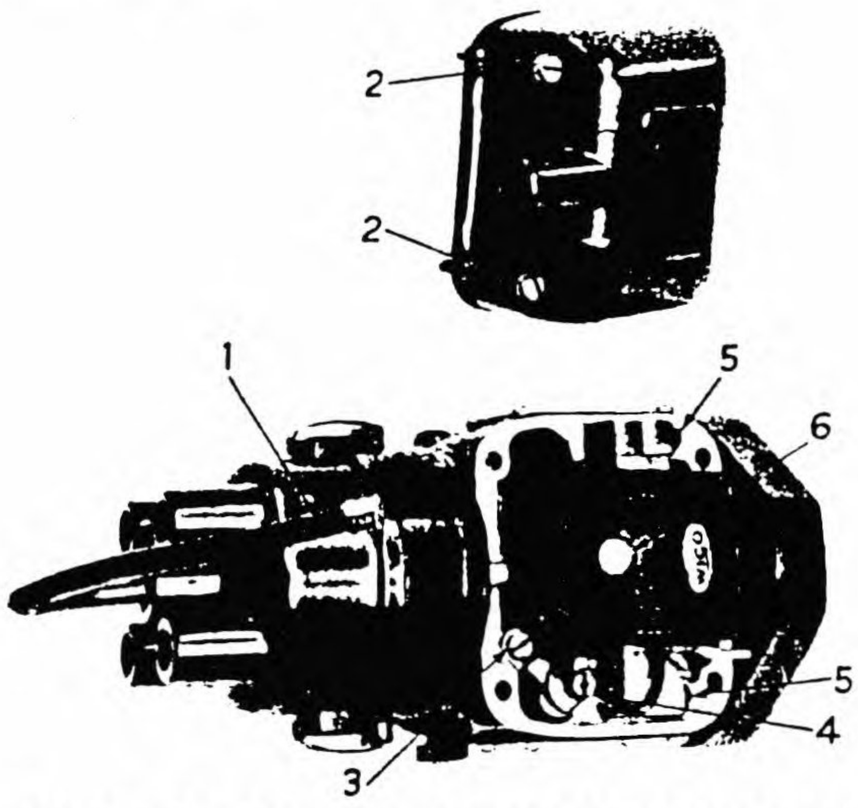
Breaker Arm Removal

The breaker arm (4) is integral with the spring and spring terminal. To remove it, take off the breaker clamp screw (9), lock washer and clamp washer and the breaker arm spring terminal screw (6). Then the assembly can be pulled off the breaker arm pivot.

If new points are required, it is recommended that both the fixed (11) and moving points (4) be replaced at the same time. Stationary point is removed by taking out screw (2).

When reassembling breaker arm, be sure the steel breaker arm spacers (13) are in place.

If the points are rough or pitted, they should be polished with a sharp breaker point file. This can best be done when the points are removed from the magneto.



ILLUST. 140--WICO "AP" MAGNETO WITH COIL COVER REMOVED. 1--SECONDARY INTERLEAD. 2--COIL COVER SCREWS. 3--CONDENSER BRACKET SCREW. 4--CONDENSER NUT. 5--COIL CORE BRACKET SCREW. 6--SECONDARY CONTACT.

Removal of Magneto Cover

Pull out secondary interlead (1) from cover terminal (Illust.140). Loosen four cap screws (2) holding cover to main housing and remove cover. Screws are prevented from being separated from the cover by snap rings. The gasket should be removed with the cover.

Coil Contact inside magneto cover can be removed for bending to make better contact with coil lead out (6). (See cross sectional view).

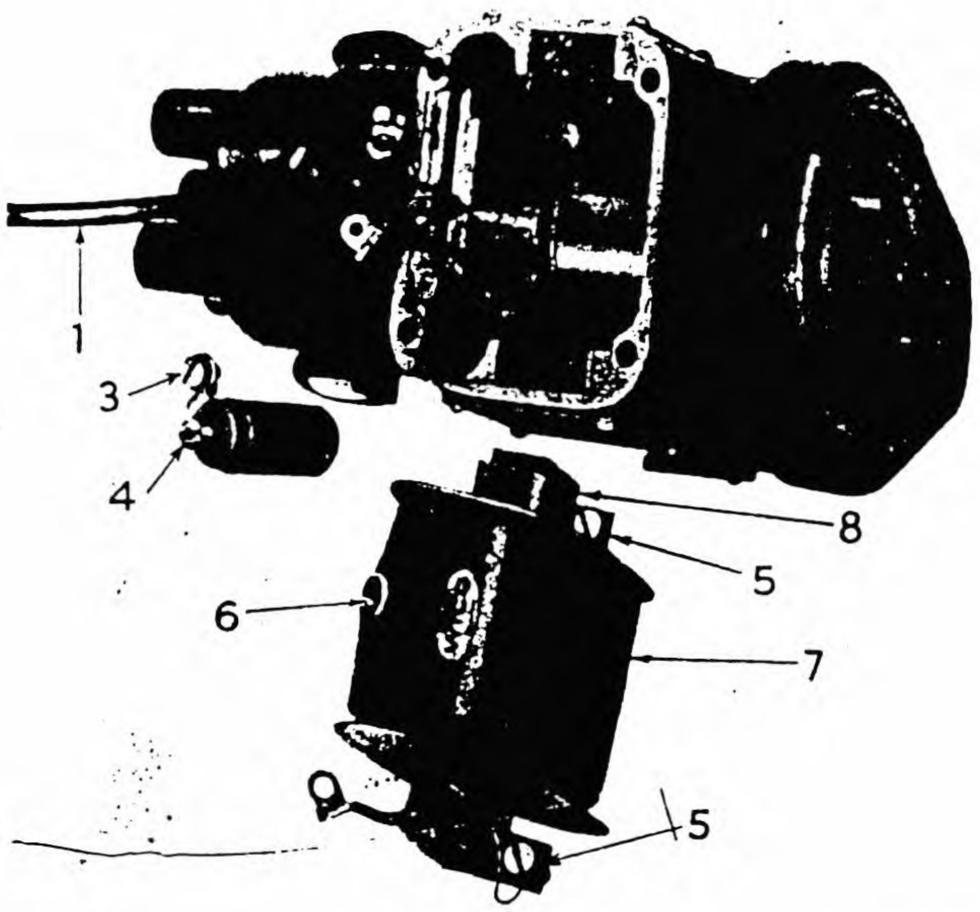
Condenser

To remove condenser, first remove magneto cover. Disconnect leads to condenser support (2) by taking off slotted nut (4). Remove screw (3) which holds condenser support to the housing and lift out the condenser assembly. Condenser may be tested as described on Page 15.

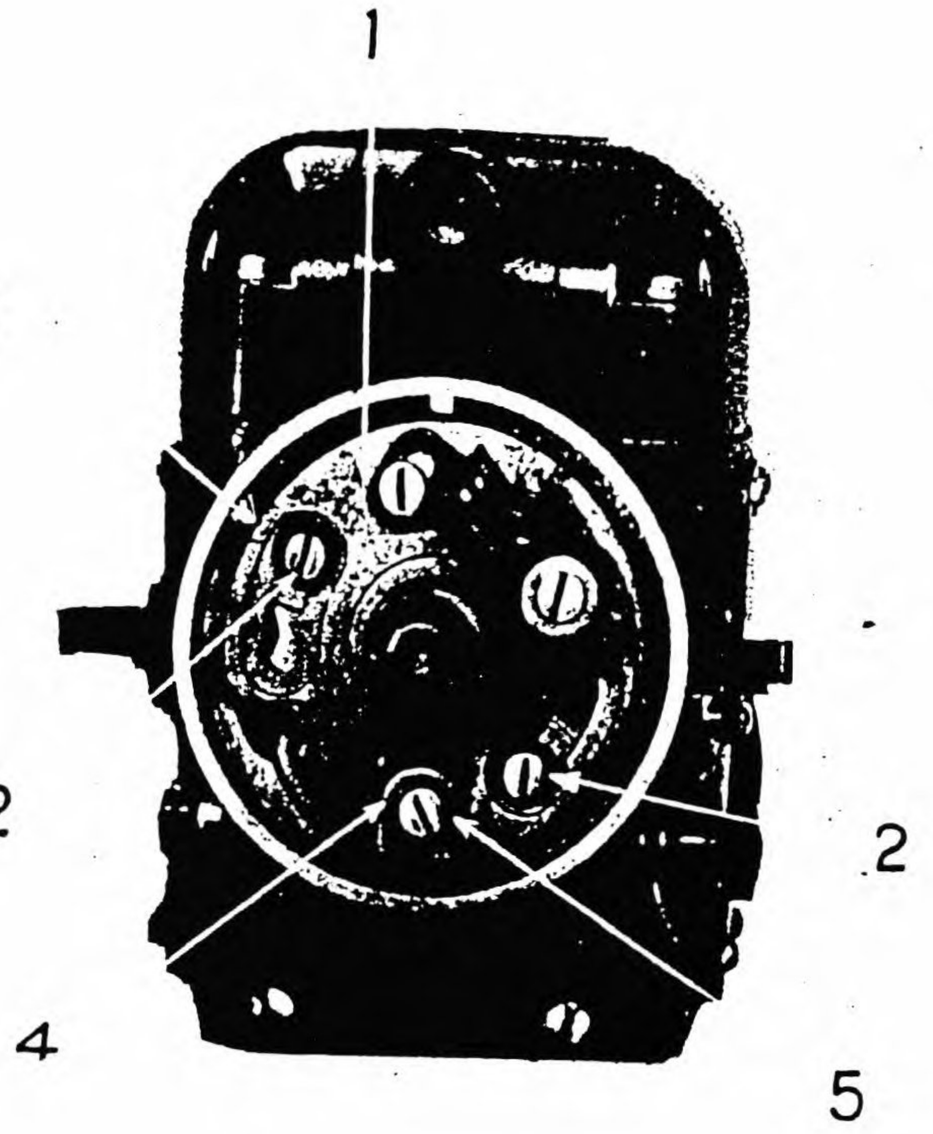
The condenser clip grounds the condenser; if clip has been removed be sure it makes a good contact with the magneto housing when replaced. Also be sure that the nut (4) on top of the condenser securely holds the terminals of all covered wires.

Coil and Coil Core

Remove the magneto cover, then unscrew the small nut holding primary lead to condenser support (4). Remove two screws (5) holding core clamps. Turn rotor until magnetism no longer grips coil core to main housing. Pull coil, coil gasket, and coil core free. Do not turn the rotor while the coil core is off. This would lose the "keeper" of the magnets, placing the magnets on "open circuit." The magnetic lines of force would then pass through the air, diminishing the strength of the magnet.



ILLUST. 141--WICO "AP" MAGNETO WITH COIL AND CONDENSER REMOVED. 1--SECONDARY INTERLEAD. 3--CONDENSER BRACKET SCREW. 4--CONDENSER NUT. 5--COIL CORE BRACKET SCREW. 6--SECONDARY CONTACT. 7--COIL. 8--COIL CORE.



ILLUST. 142--WICO "AP" MAGNETO WITH DISTRIBUTOR CAP AND ROTOR REMOVED. TAKE OUT SCREWS (2) AND (5) TO REMOVE BREAKER PLATE. 1--BREAKER PLATE. 2--BREAKER PLATE HOLDING SCREWS. 3--TIMING POINTER. 4--PRIMARY LEAD OUT TERMINAL. 5--BREAKER ARM SPRING TERMINAL SCREW.

The coil (7) is held on the core (8) by the wedge. If the coil is to be replaced, it will be necessary to press with considerable force to remove the coil from the core.

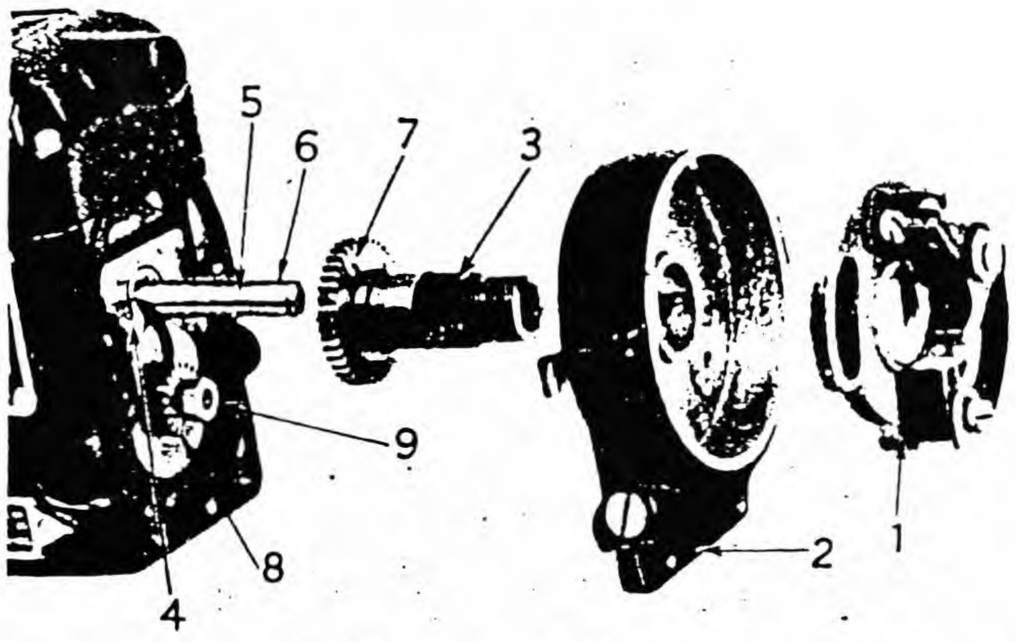
Avoid possible damage to the windings while handling the coil.

In replacing coil (7) and coil core (8) be sure the ground surface of the core is against the housing and that the primary leads are properly located. Refer to Illust. 141. Contact (6) is near distributor; there are two wires from coil grounded under bracket (5).

Testing Coil

The coil may be tested with the Electrical Test Set SE-846, similar to the method shown on pages 12 and 13.

Breaker Plate



ILLUST. 143--WICO "AP" MAGNETO WITH GEAR HOUSING REMOVED. 1--BREAKER PLATE ASSEMBLY. 2--GEAR HOUSING. 3--CAM AND GEAR. 4--PRIMARY WIRE FROM CONDENSER. 5--CAM STUD. 6--CAM STUD OIL WICK. 7--"C.W." TIMING MARK. 8--PINION GEAR. 9--PINION GEAR NUT.

When the distributor cap and distributor arm are removed, the breaker plate assembly (1) can be pulled off the gear case bushing after removal of the two breaker plate screws (2). The primary lead (4) should be disconnected from the breaker spring terminal screw (5).

Illust. 4-A shows a timing pointer (3). When removing breaker plate, mark the plate adjacent to this pointer as an aid to reassembling to the same relative position. The lots in breaker plate (1) allow for change of spark advance other than that provided by the shifting of magneto at the slots in mounting flange.

With breaker place removed, thoroughly saturate cam oil pad (10), Illust. 143, in primary terminal block with Wico cam lubricant. Remove pad, squeeze, and work lubricant into pad to saturate it. When reassembling be sure pad touches cam.

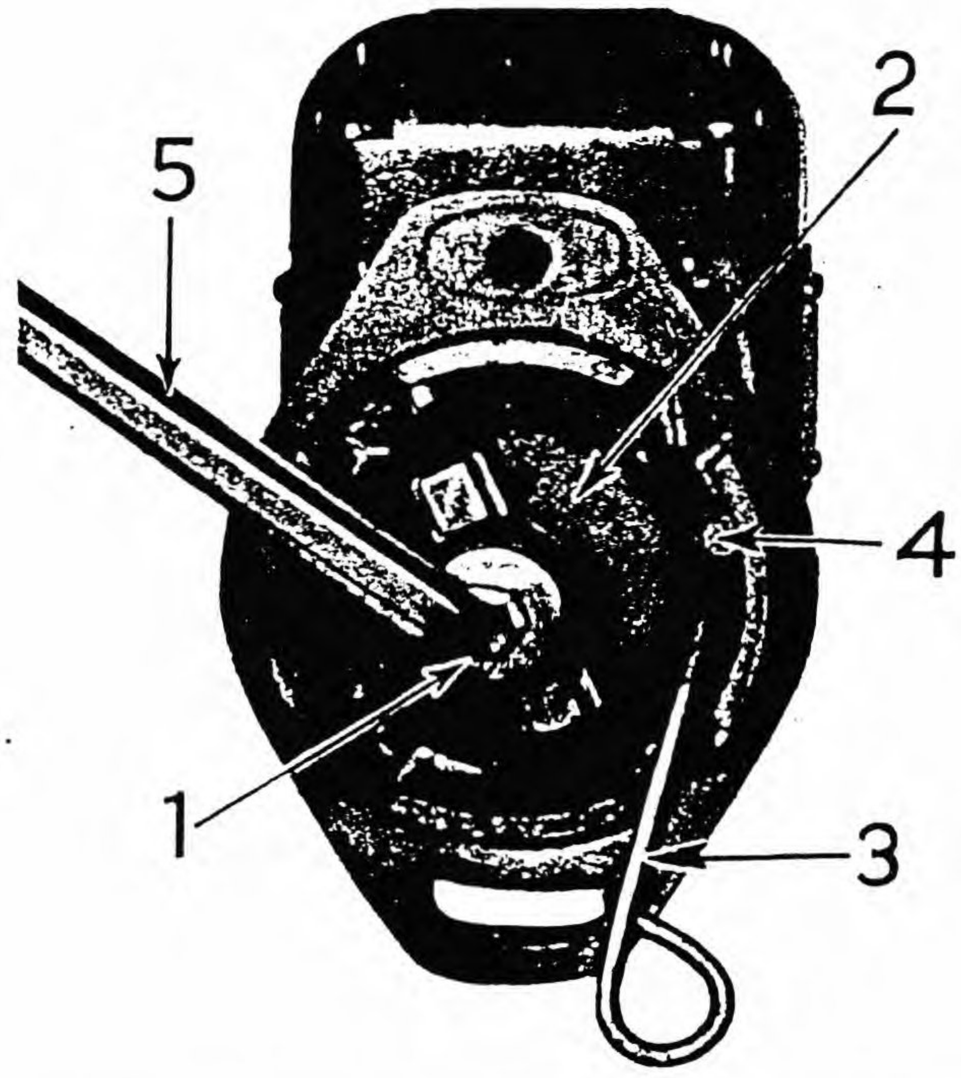
Gear Housing

After the breaker plate assembly (1) (Illust. 143) is removed, the four screws holding the gear housing (2) can be taken out and the housing pulled off the cam (3). The breaker lead terminal must be threaded back through the slot in the gear housing (2) provided for this purpose.

Pinion Gear

With the gear housing (2) and the cam (3) off, remove the nut (9) over the pinion gear (8), holding the lugs on the impulse cup to keep the rotor shaft from turning. The key in the rotor shaft locates the gear. The oiling disc, beneath pinion gear, bears against lower oiling pad and upper oil scraper. The oil scraper is fiber and is attached to a spring. The assembly can be pulled out of the opening when cleaning magneto body and pushed back in place when re-assembling.

Impulse Coupling



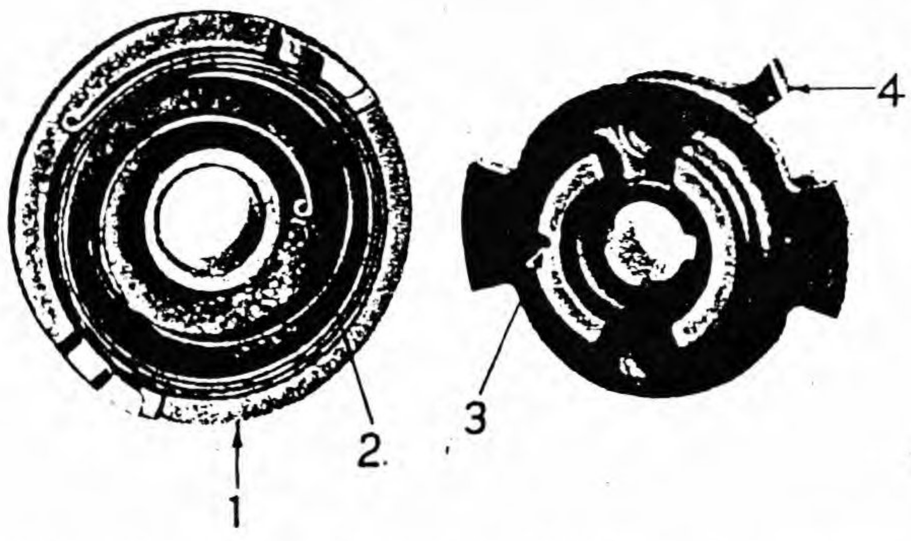
ILLUST. 144--REMOVING IMPULSE COUPLING NUT ON WICO "AP" MAGNETO. 1--IMPULSE NUT. 2--IMPULSE COUPLING DRIVE MEMBER. 3--ROD WITH L-SHAPED END. 4--IMPULSE STOP. 5--SOCKET WRENCH.

To remove impulse coupling (2), Illust. 144, unscrew impulse nut (1). Insert a rod (3) bent in "L" shape to lock the magneto member when turning off the nut with a socket wrench (5). With the rod (3) inserted under the impulse drive member (2) against the impulse stop (4), the nut (1) can be turned off. To remove the cup, with its spring, first turn it to the right until the trip arm latches against the impulse stop. Continue to turn the cup until the projection of the cup clears the projection on the driven flange. Without the friction of these parts against each other, the cup can be pulled out far enough that it may be released, unwinding the spring. Pull the cup off the shaft.

Pull the driven flange off the shaft. If the flange sticks on the shaft, insert two screw drivers 180 degrees apart and gently pry it off, being careful not to damage the end plate casting.

To remove impulse spring, work it out of the cup with a screw driver.

Replacing Impulse Coupling



ILLUST. 145--WICO "AP" IMPULSE COUPLING. 1--IMPULSE DRIVE MEMBER. 2--INNER END OF IMPULSE SPRING. 3--GROOVE FOR INNER END OF SPRING. 4--IMPULSE TRIP ARM.

Check to see that there is some grease between turns of the impulse coupling spring. Pull the inner eye of the spring out of the cup about 1/4 in. Hold the cup in the left hand, the driven flange in the right, and insert the inner eye of the spring into the slot provided for it in the driven flange. Press the two members together. Wind the flange 1/2 revolution against the spring. Then withdraw the flange so that its projections clear those of the cup. Press it in again with the projection ahead of those of the cup. This will provide the proper spring tension. Press the entire unit on to the shaft, making sure that the Woodruff Key for the driven flange is in place.

Coat the bearing surface of the impulse lock but with a thin film of grease. Screw the nut into place, making sure that the nut is tight before the cotter pin is inserted.

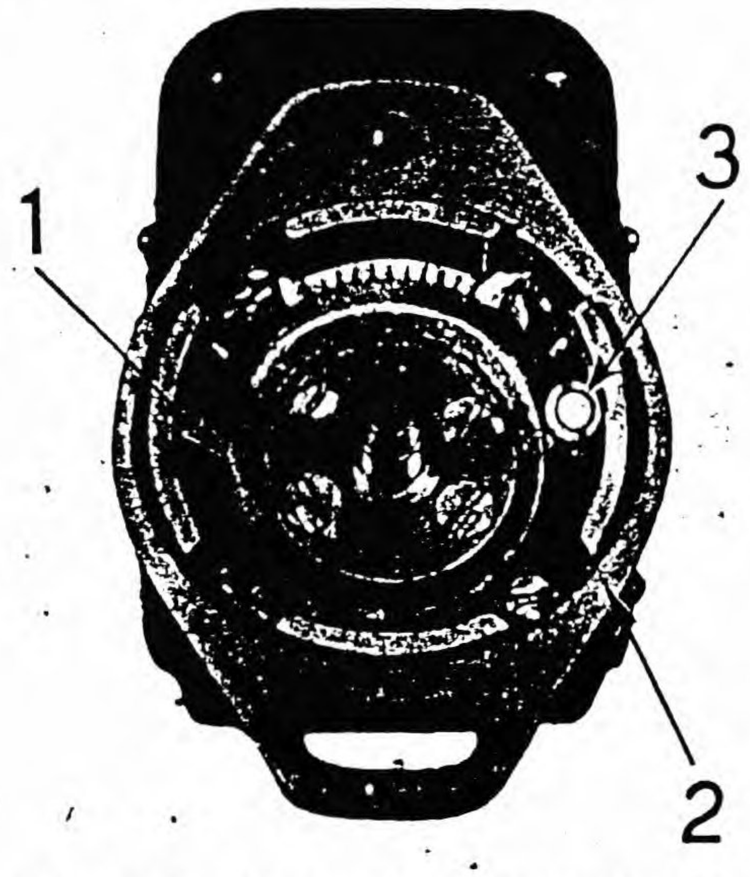
Inserting New Impulse Spring

Place spring over the cup so that the outer eye is over the slot provided in inner periphery of the cup (1). Insert the outer eye in the slot as far as possible. Catching the inner eye with a pair of small nosed pliers, wind up the spring until it will drop into the recess of the cup.

Exercise care so as not to distort or scratch the spring with the pliers. Spring should coil in a clockwise direction as shown in the illustration.

End Plate

To take off the end plate,the impulse coupling must be removed. Referring to Illust. 146, mark the impulse stop ring (1) opposite the graduation on upper



ILLUST. 146--FRONT VIEW OF WICO "AP" WITH IMPULSE COUPLING REMOVED. 1--IMPULSE STOP RING. 2--END PLATE. 3--IMPULSE STOP.

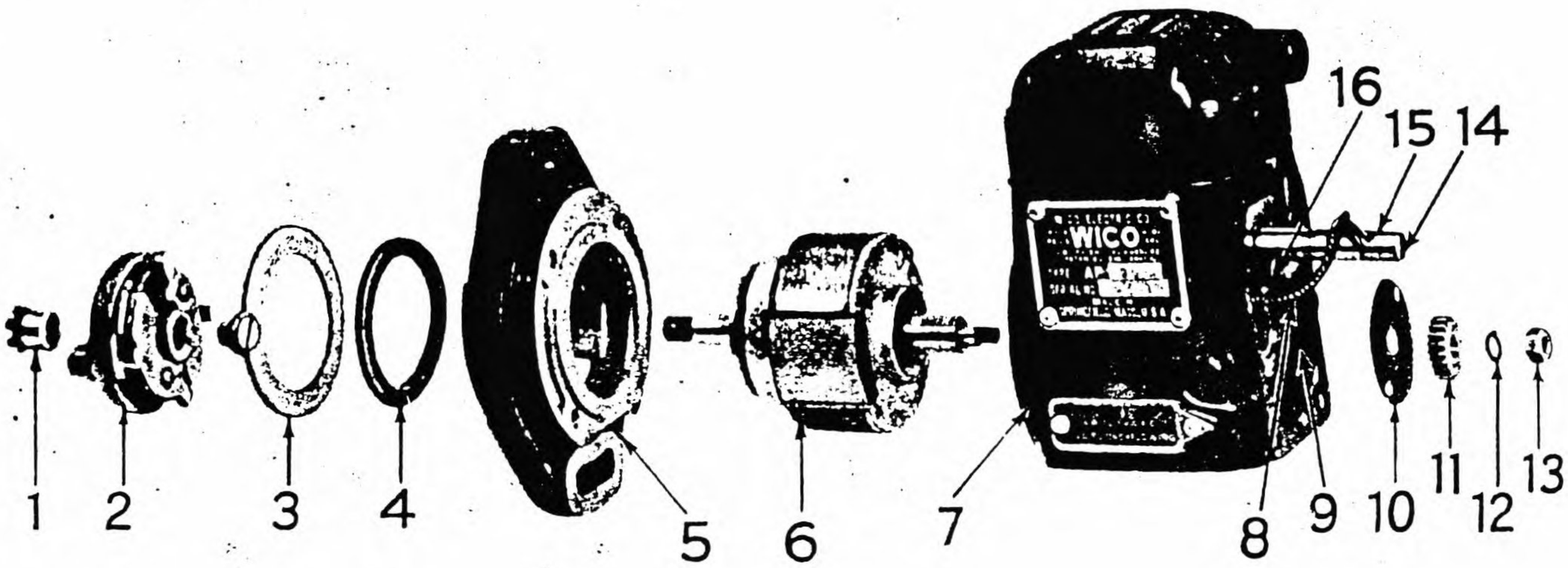
side of the end plate (2) so that the stop ring may be replaced in the same position. Movement of the stop ring changes position of the impulse coupling tripping. This in turn will change the timing of the magneto with regard to the angle between advanced spark and impulse coupling trip. Each division is 5 degrees. Advancing the ring to the right advances point of release of impulse. Since the magneto is timed by the impulse coupling trip, any change in the stop ring position may result in an incorrectly timed spark for the desired engine performance at full advance.

Take out the four fillister head screws. This frees the impulse stud in drive shaft seal felt. In replacing the end plate be sure that the drive shaft is in its correct position (Illust. 147).

Cam and Distributor Gear Group

After removal of the gear housing (2) it is possible to pull off the cam and distributor gear group (3), exposing the cam stud (5) and the oil wick (6).

The distributor gear has marks (7) "CW" and "CCW" for correct timing of gears. In reassembling the cam and distributor gear group, care should be taken to match up the proper marks on the gear with the marked tooth on the pinion. For No. 60 and No. 61 Harvester-Thresher engines, the rotation is clockwise. Therefore, line up the letters "CW" with the scratch mark on the drive pinion (8).



ILLUST. 147--WICO "AP" MAGNETO--EXPLODED VIEW. 1--IMPULSE LOCK NUT. 2--IMPULSE COUPLING COMPLETE. 3--IMPULSE STOP GROUP. 4--DRIVE SHAFT SEAL FELT. 5--END PLATE. 6--ROTOR MAGNETS WITH SHAFT. 7--MAIN HOUSING ASSEMBLY. 8--PRIMARY LEAD OUT WIRE. 9--MAIN OIL PAD. 10--OILING DISC. 11--PINION GEAR. 12--PINION NUT LOCK WASHER. 13--PINION NUT. 14--CAM STUD. 15--CAM STUD OIL WICK. 16--CAM STUD OIL PAD.

Rotor

The rotor can be removed, by taking off breaker assembly, gear housing, pinion gear, impulse coupling, stop ring, and end plate. Place a keeper on the magnet similar to 57314-D used on H-4 magnetos. Thoroughly clean magnet and use compressed air to blow off any particles before replacing. Magnets should never require recharging unless dropped or discharged through carelessness.

Rotor Bearings

(Refer to cross-section illustration)

The rotor needle bearings are removed by inserting a blunt brass drift through the hollow stud and against the bearing race. Tap the bearings at various points around the race to avoid injury to the seat.

If the bearing is injured during removal, use a new bearing in its place.

When the new bearings are installed, allow the oil already on them to remain.

Cam Stud

To remove the cam stud (14) support the housing on its gear housing face. The stud may then be pressed out of the casting with a soft metal drift, thus freeing the cam stud oil pad and support, and the cam stud oil wick (15). The cam stud should be square with the surface of the magneto body. Pilot the cam stud before replacing; extreme care must be used to prevent bending of shaft. Oil pad, oil pad support and oil wick must be in place before assembling. Oil wick is on top side of shaft.

Stop Button

The top of the stop button is removed by wedging underneath it with a screw driver. To unscrew the stop button nut, wedge a screw driver between the nut and the cup, then use the screw driver as a wrench.

The fiber washer is on the inside of the magneto body. Two fiber washers fit in bore of the body and one washer fits in the counter-bore on outside. A metal washer under a special nut and lock washer holds all insulators together. The stop button nut compresses a spring within an inverted cup. When the button pushes the cup against the magneto body, the magneto is shorted and the engine stops.

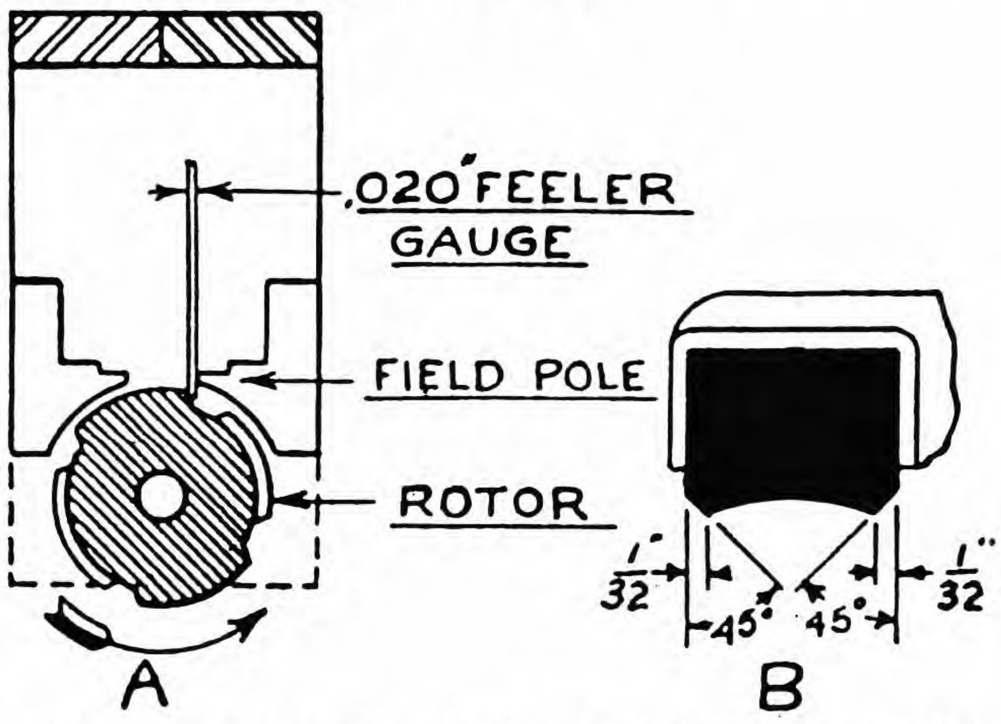
SPLITDORF (DIXIE AND AERO) MAGNETOS

Splitdorf (Dixie and Aero) Magnetos—General

The Dixie and Aero magnetos are high tension magnetos of the inductor type. They develop two sparks per revolution, turn at engine speed in a right-hand rotation and are fully enclosed against dirt, dust and moisture. Clean the outside of the magneto thoroughly before removing any parts and refer to the following section covering servicing operations.

Breaker Points

Remove breaker cover. See that breaker points are clean, then turn the rotor shaft in an anti-clockwise direction until the fiber block on the breaker bar is at the highest point of the cam. Check opening between points with a .020" thickness gauge.



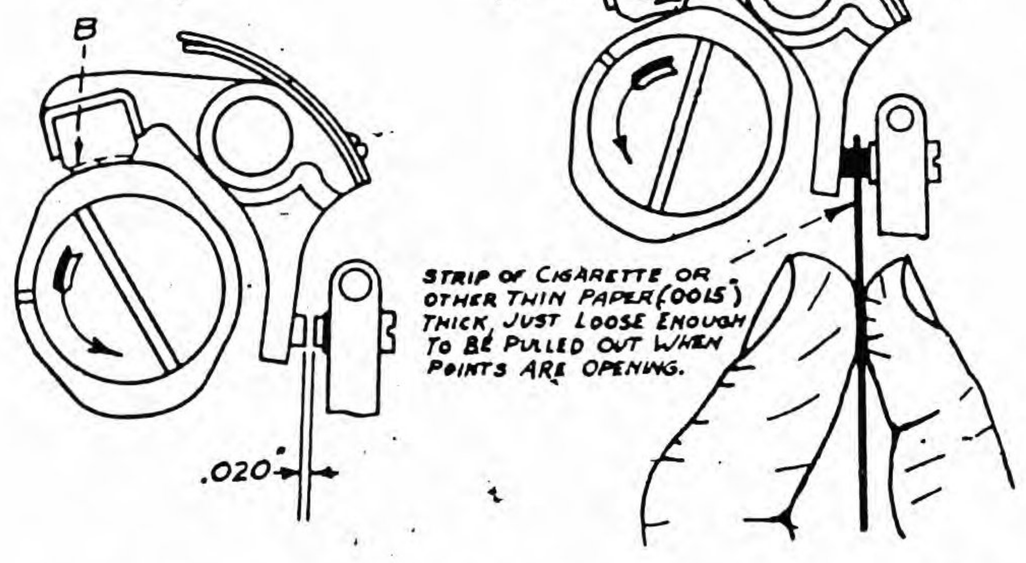
ILLUST. 148 (A)--SHOWS .020" FEELER GAUGE PLACED BETWEEN THE LEAVING EDGE OF THE ROTOR AND FIELD POLE. BREAKER POINTS SHOULD JUST BEGIN TO OPEN. (B) DIMENSIONS OF A NEW FIBER RUBBING BLOCK.

Loosen lock screw and adjust contact point until gauge just passes between points without forcing them apart.

In order that the Dixie or Aero magneto delivers a good spark, it is essential that the breaker point opening takes place in correct relation to the rotor. This relation may be checked as follows:

Remove the impulse coupling (see Page 37); take off magneto top cover and side plates. Remove magnets and place a keeper across their poles. Next take off the condenser and coil. Place a .020" feeler gauge between the leaving edge of the rotor and field pole. (See Illust. 148-A.) The breaker points should just commence to open with the rotor in this position.

Use a very thin strip of paper as a feeler. (See Illust. 149).



ILLUST. 149--SHOWING WHERE RUBBING BLOCK MAY BE GROUND TO GET PROPER RELATION BETWEEN BREAKER POINTS AND ROTOR.

Ordinarily all magnetos will check to the correct timing. However, if one is found to be off a little, correction can be made as follows:

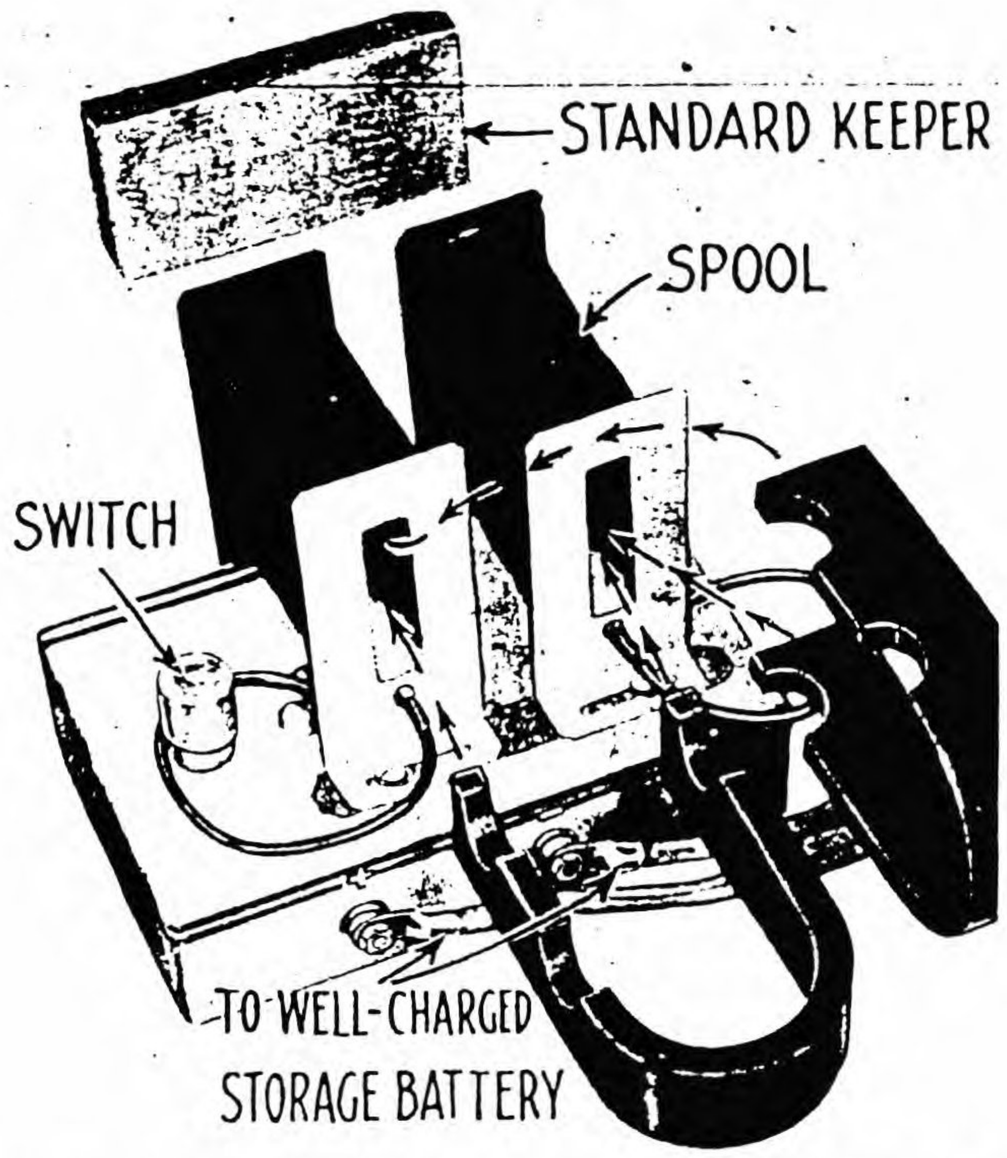
If, after setting them to open .020", the points separate while the leaving edge of the rotor wing is yet under the pole structure, bevel the fiber rubbing block more at "A", Illust. 149. This bevel should be 45° with the sides of the fiber block. Correct bevel of new fiber block is shown in Illust. 148 (B). If it is found that breaker points open too late with.020" gauge in place, fiber block may be ground away slightly as shown at "B", Illust. 149. Only a very weak spark will be produced if this relation of breaker point to rotor is not maintained.

Inspecting Distributor Block, Disc and Brushes

Remove distributor block; notice that top screw is shorter than other two. Clean inside of distributor block and test with high tension circuit of electrical test set SE-846 for cracks (See Page 32, Illust. 61.) Inspect carbon brushes; they should be free in their sockets. Remove distributor disc and test it for cracks, also using high tension circuit of electrical test set. Its brush must work freely. Clean distributor disc of carbon brush smear with soft rubber eraser.

Examine distributor disc drive pin hole in back face of disc. If this hole is worn oblong, the spark spot on distributor disc segment will be late and may cause burning into the bakelite brush track. If this condition is present, replace with a new distributor disc.

Recharging Magnets



ILLUST. 150--SHOWS HOW SPLITDORF (DIXIE AND AERO) MAGNETS SHOULD BE INSERTED INTO SPOOLS OF SPOOL TYPE MAGNETIZER FOR CHARGING.

To remove magnets, take off impulse coupling, magneto cover assembly and both side plates. Magnets can then be pulled apart and removed from the magneto. Keep magnets together in the same relative position as assembled on magneto and place a soft steel keeper across the poles. Magnets should be remagnetized if possible before replacing on the magneto.

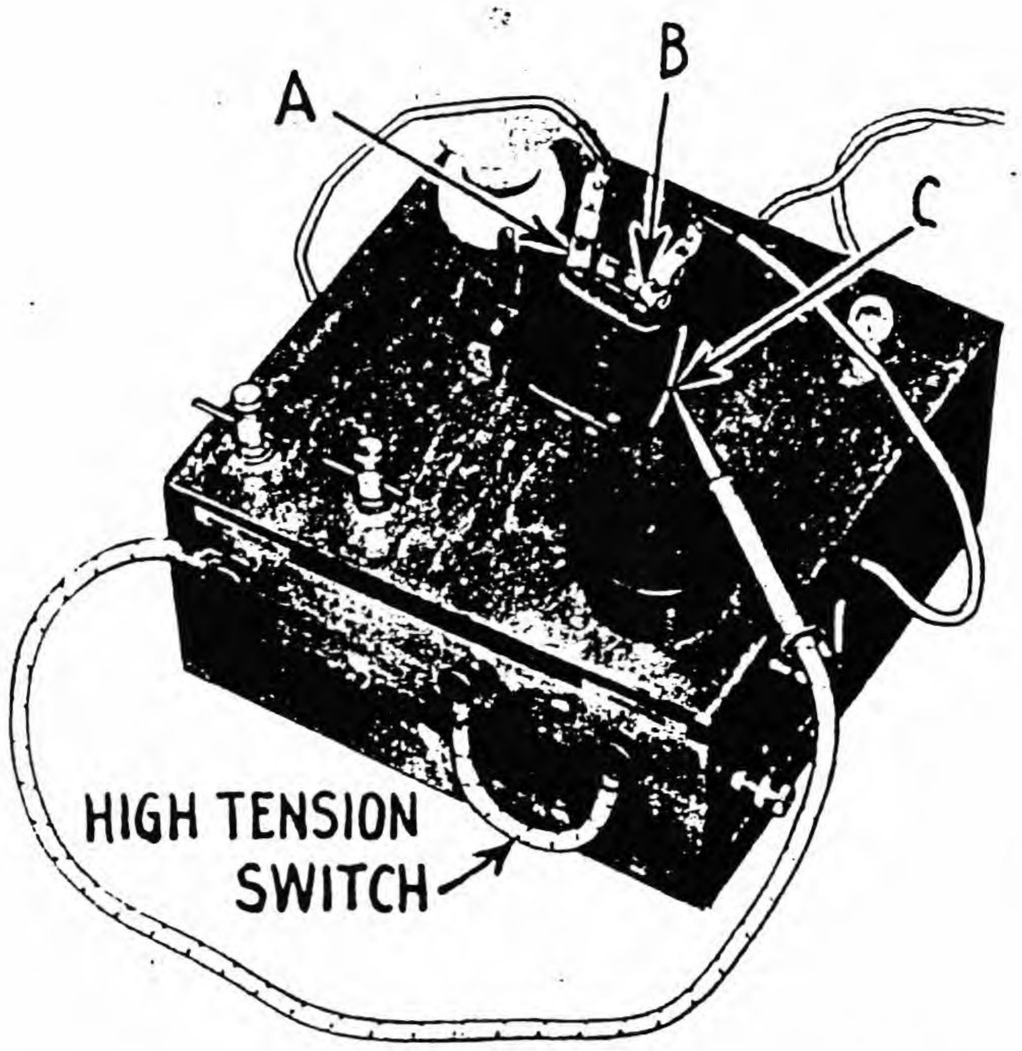
Magnets can be magnetized in the spool type magnetizer SE-858 as shown in Illust. 150. Connect magnetizer to a well-charged storage battery, making sure terminals marked (+ and —) of the magnetizer and storage battery correspond.

Charge one magnet on magnetizer at a time. Facing front side of magnetizer (terminal side) insert magnet in spools so that the leg with two half holes is in spool nearest the switch. Place standard keeper across pole ends. Close switch permitting current to flow for a few seconds. Open switch, slide keeper down off ends of magnet poles and remove magnet. Place keeper across poles until ready to assemble magnet on magneto. When replacing magnets the pole that will attract the north seeking pole of a compass should be nearest the impulse coupling end of the magneto.

Testing Condenser on Test Set

With magnets removed, take out screw fastening condenser to primary and condenser ground screw. Remove condenser. Test condenser for short and open circuit with 110 or 220 circuit of electrical test set SE-846. (See Page 15). If breaker points have been pitting excessively and condenser is found in good condition, install a smaller capacity condenser (No. 33477-D). This will help eliminate excessive pitting of the breaker points but cannot be accepted as a cure-all for excessive point pitting.

Testing Coil on Test Set



ILLUST. 151--TESTING DIXIE OR AERO MAGNETO COIL ON ELECTRICAL TEST SET SE-846.

After condenser is removed, take out two screws holding coil core to pole structure and screw to ground strip. Remove coil and test as shown in Illust. 151. Have high tension switch connected to armature terminal clip one winding test lead on primary lead-out screw "B", and other test lead on ground screw "A". Have high tension test point lead connected to "high tension" terminal and

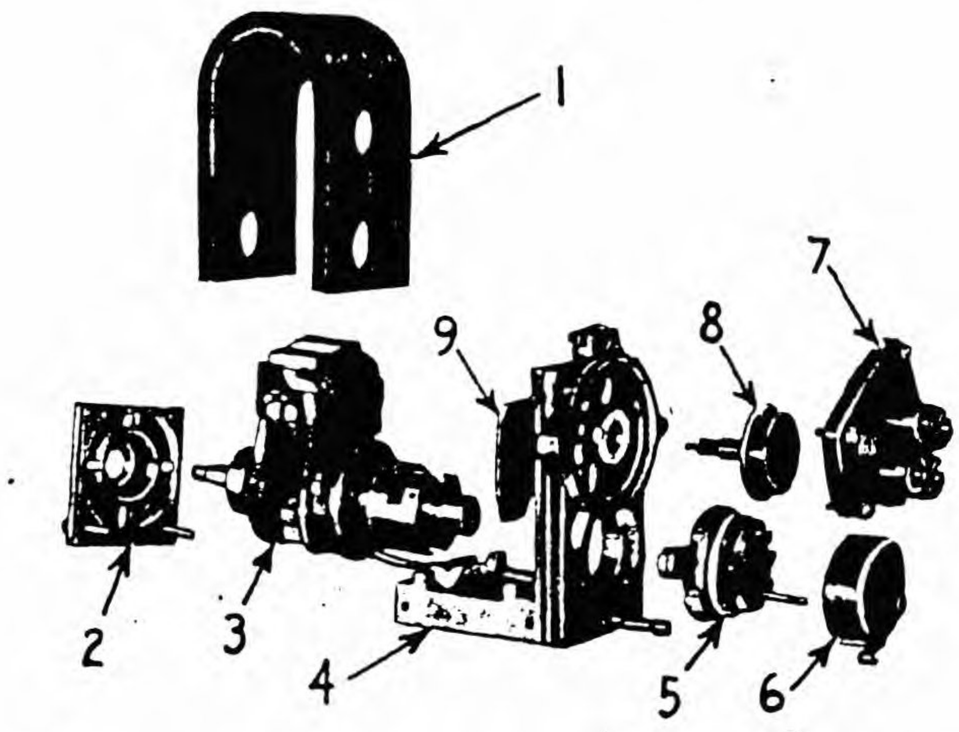
hold test point firmly against secondary lead-out segment "C". Snap on switch and spark should jump a 5/16" test gap.

Inspect insulation around secondary lead-out segment for cracks and make sure core is tight in coil.

Removing Breaker Base

Remove primary lead wire screw and straighten wire so it will pass through opening in breaker base. Be very careful wire does not break when it is bent. Remove four screws holding breaker base to front frame and work breaker base from place. See Illust. 152 for identification of part.

Safety Gap Protector



ILLUST. 152--DISMANTLED VIEW OF THE SPLITDORF (DIXIE) MAGNETO. 1--MAGNETO. 2--BACK PLATE. 3--ROTOR ASSEMBLY WITH COIL AND CONDENSER. 4--MAIN FRAME. 5--BREAKER BASE ASSEMBLY. 6--BREAKER COVER ASSEMBLY. 7--DISTRIBUTOR BLOCK. 8--DISTRIBUTOR DISC. 9--SAFETY GAP PROTECTOR.

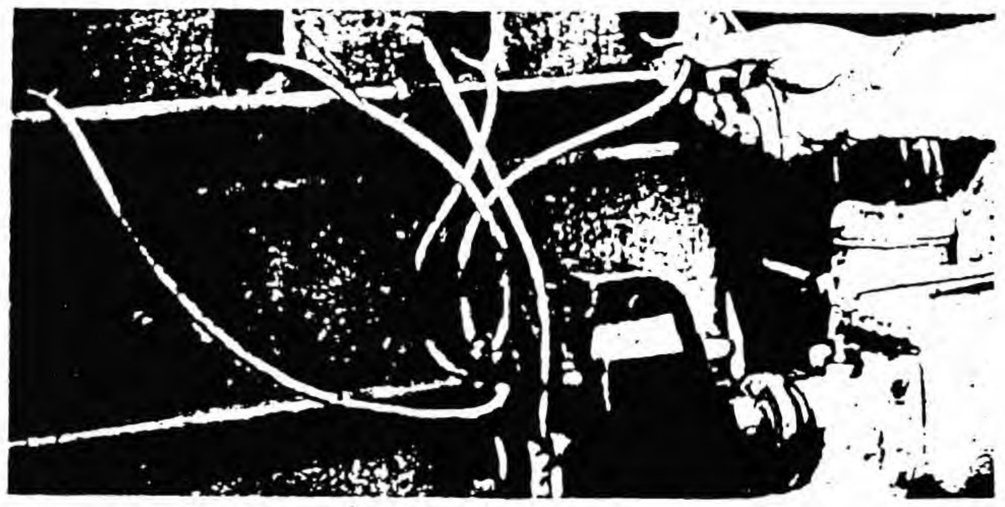
Remove safety gap protector and examine for possible leaks, using high tension circuit of electrical test set. A suggested method of testing protector is to lay it on a flat piece of sheet steel or copper screening, which is grounded by a wire connected to the gap test point post nearest to the corner of the test set. Have both primary lead-out clips together, high tension switch connected to "high tension terminal" and high tension test point wire connected to "armature" terminal. Snap on switch and move high tension test point over safety gap protector. Sparks should continue to jump test gap and should not go through mica sheets. Bakelite ring in center of protector should not be loose in mica sheets. The use of a piece of sheet steel or copper screening will also work very well when testing the distributor disc and distributor block for cracks.

Removing Rotor Assembly

Take out screws holding back plate and remove back plate. Examine bearing retainer for looseness in back plate. If retainer is loose it will be necessary to install a new back plate. Examine felt seal around back plate.

Remove rotor assembly and examine ball bearings and front bearing retainer in front of frame. If bearing retainer is loose in frame it will be necessary to install a new frame. Examine primary lead-out wire and wire tube for damage.

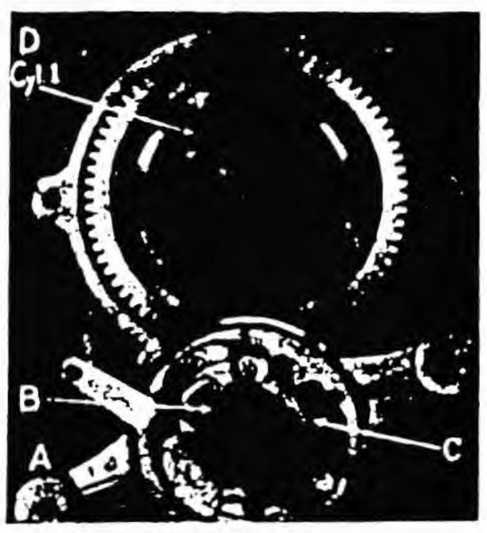
Timing Magneto to Engine



ILLUST. 153--WIRING PLAN OF THE (DIXIE OR AERO) MAGNETOS. THE MAN'S FINGERS ARE ON NO. 1 SPARK PLUG CABLE.

Remove distributor block and breaker cover. Check breaker point opening as outlined under heading "Breaker Points." Crank engine until No. 1 piston (piston next to starting crank) is an upper dead center on the compression stroke. Compression stroke can be determined by removing No.1 spark plug and placing thumb over the opening and cranking the engine until an outward pressure is felt. Continue cranking until "DC" mark on flywheel lines up with mark on flywheel housing. Fully retard the spark by turning breaker base in a counterclockwise direction as far as it will go. Rotate magneto rotor clockwise (as viewed from the coupling end), until distributor segment is in a position shown in Illust. 154, delivering spark to No. 1 spark plug, and breaker points are just opening.

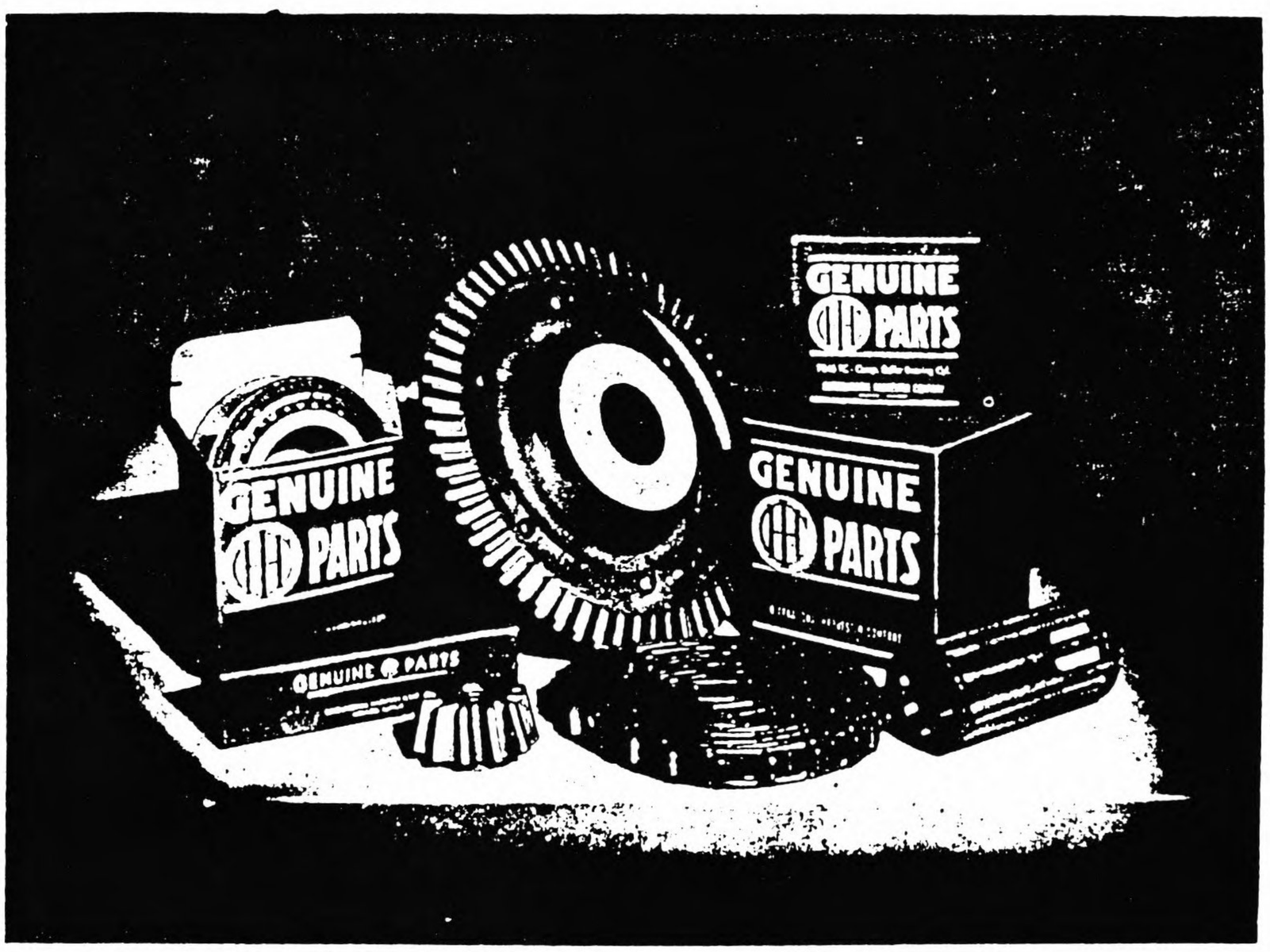
Magneto is now correctly timed to the engine. Without changing setting, insert magneto base screws and coupling screws.



ILLUST. 154--BREAKER BASE "A" IN FULLY RETARDED POSITION. DISTRIBUTOR SEGMENT "D" SET TO DELIVER SPARK TO NO. 1 CYLINDER AND BREAKER POINTS "C" JUST OPENING.

MEMORANDUM

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STOCK AND SELL ONLY GENUINE IH PARTS

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Protect your own reputation for quality parts and service by protecting your customer—stock and sell only Genuine IHC Parts.