

EO 15-5CF-2

ROYAL CANADIAN AIR FORCE



**HANDBOOK WITH PART LIST
FOR MAGNETO TYPE SB9RN-4**

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

26 SEP 52

LIST OF RCAF REVISIONS

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PART 1

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DESCRIPTION, OPERATION AND INSTALLATION

GENERAL DESCRIPTION

1 The SB9RN-4 magneto is a single, base mounted, nine cylinder magneto of clockwise rotation driven at 1-1/8 engine crankshaft speed.

2 The four pole rotating magnet used is made of a high grade magnet steel which enables a stable magnetic field to be maintained, producing adequate energy output for long periods of time. The magnet turns on two ball bearings, one located at the breaker end and the other at the drive end. These bearings are packed with a high temperature grease and do not require lubrication between overhaul periods.

3 A four lobe cam is located on the magnet shaft extension and is secured with a Woodruff key, plain washer, lock washer, and a screw. A step is cut in the cam for timing purposes and the flanks adjacent to the lobes are provided with grooves to serve as a lubricant reservoir for keeping the cam follower felt in a moist condition.

4 The ratio between the large and small distributor gears of the SB9RN-4 magneto is 4:9. Therefore, the distributor finger turns at 9/8 X 4/9 or 1/2 engine crankshaft speed.

5 The contact point assembly is secured in a breaker housing which fits into a recess in the magneto housing. Three holes are provided in the magneto housing for the breaker stop collet which locates the breaker housing. One hole is marked "F" for fixed spark require-

ments, either rotation. Another is marked "L" for anti-clockwise rotation, variable spark, and the remaining one is marked "R" for clockwise rotation, variable spark.

6 The primary and secondary windings of the coil are sealed in a hard rubber case. This protects the coil chiefly from the effects of moisture.

7 The small distributor gear located on the drive shaft extension drives the large distributor gear and distributor finger. The ratio between these two gears is such that the high tension current from the coil is conducted to the distributor block electrodes and thence through the high tension cables to the spark plugs at the correct firing interval of the engine. The high tension current is conducted from the coil through the medium of a carbon brush to the distributor finger segment. High temperature grease is applied to the distributor gears and further lubrication is not necessary except at overhaul periods.

8 The unit can be used on either the right or left hand side of the engine by using the radio shield assembly having the proper outlet for the high tension cables.

ELECTRICAL OPERATION

9 The poles of the rotating magnet are arranged in alternate polarity (see Electrical Diagram) so that the flux can pass from a north pole through the coil core and back to a south pole. As the magnet is turned, the polarity continually changes thereby producing

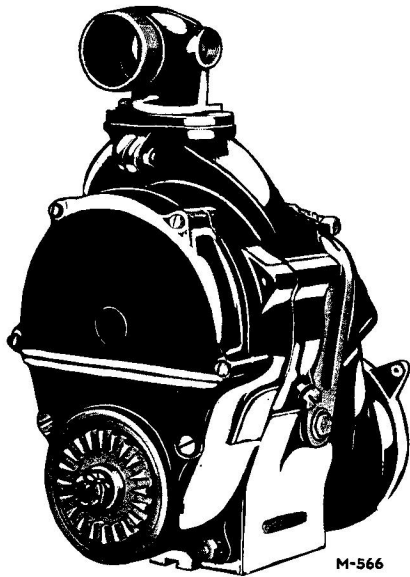


Fig. 1-1 Magneto Type SB9RN-4

flux reversals in the coil core. The number of flux reversals during one complete revolution of the magnet is equal to the number of poles on the magnet.

10 The flux reversals induce current in the primary winding when the contact points close. The flow of current in the primary winding stores energy which is released later by the opening of the contact points thereby producing high voltage in the secondary winding.

11 One end of the primary winding is connected to ground. The other end is connected to the insulated contact point. When the contact points are closed, the primary current passes to ground. The condenser is connected across the contact points.

12 The ground terminal on the magneto is electrically connected to the insulated contact point. A wire is connected between the ground terminal and the switch. When the switch is in the "OFF" position, this wire provides a direct path to ground for the primary current. This prevents the production of high voltage in the secondary winding.

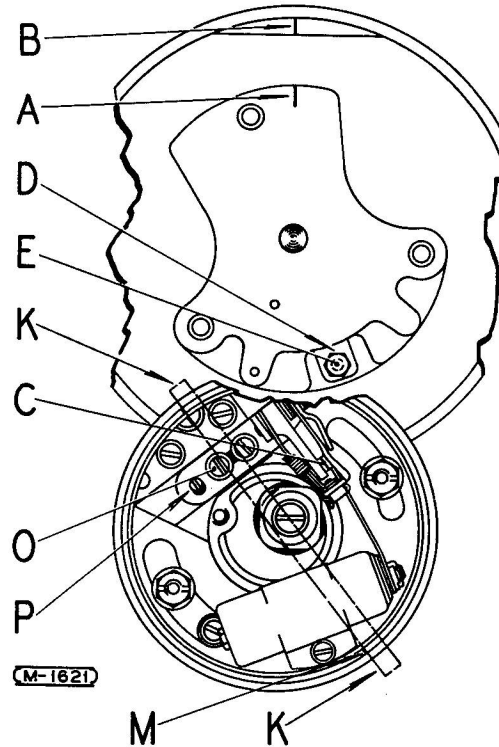


Fig. 1-2 No. 1 Firing Position of Magneto

13 One end of the secondary winding is also grounded to the magneto. The other end terminates at the high tension insert on the coil. High tension current in the secondary winding is then conducted to the central insert of the distributor finger by means of a carbon brush. From here it is conducted to the high tension electrode on the distributor finger and across a small air gap to the electrodes of the distributor block. High tension cables then carry it to the spark plugs where the discharge or spark occurs for ignition purposes.

14 The booster electrode is located so that it trails the high tension electrode on the distributor finger to give a retarded spark for starting the engine.

INSTALLATION

15 Before installing a magneto to an engine, make sure that it has been properly checked and inspected.

TIMING TO THE ENGINE

16 Turn the engine crankshaft in the direction of normal rotation to the full-advance firing position for No. 1 cylinder as specified in the engine manufacturer's instructions.

17 Remove the coil cover, breaker cover and distributor block. Place the breaker in its full advance position. Turn the magneto drive shaft until the timing mark (A) (see figure 1-2) on the distributor finger is approximately aligned with the timing mark (B) on the inside of the front end plate when a straight edge (K) placed on the step cut in the cam coincides with the timing marks (M) on the rim of the breaker housing. At this position, the high tension electrode (D) on the distributor finger will be opposite the distributor block electrode (E) for firing the No. 1 cylinder. Install the magneto to the engine in the foregoing relation but do not tighten the cap screws or nuts to the extent that further adjustment cannot be made.

18 When the exact timing is to be made, all adjustments must be made at the drive end and NOT BY ALTERING THE ADJUSTMENT OF THE CONTACT POINTS.

19 Install the magneto on its mounting pad in this relation, but do not engage the mounting screws until the final accurate timing adjustment has been made.

NOTE

When timing the magneto to the engine, all adjustments must be made at the drive end and not by altering the adjustment of the contact points.

20 Complete the final timing adjustment by rotating the flexible member of the drive coupling until the magneto will engage at the exact No. 1 firing position at which time the straight edge (K) placed on the step of the cam coincides with the timing marks (M) on the rim of the breaker housing (see figure 1-2). It may be found that timing mark (A) on the distributor finger is not exactly opposite the timing mark (B) on the inside of the front end plate after making the final adjustment by having the straight edge (K) on the cam coinciding with the timing marks (M). However, any slight variance of the distributor finger timing mark (A) will not affect the operation of the magneto as this is merely used to locate the approximate firing position of the magneto for No. 1 cylinder.

21 For synchronized spark requirements, the breaker contacts of both magnetos must

open simultaneously. Use the No. 11-851 timing light or equivalent to determine the opening of the contacts. The use of shim stock or cellophane feeler strips invariably introduces a possibility of fouling the points, since oil or dirt are nearly always present on such feeler strips. When the synchronization has been made, secure the magneto firmly by tightening all cap screws or lock nuts.

22 For staggered spark requirements, one magneto will fire later than the other. Install and time one magneto in the same manner as explained for synchronized sparks. Then turn the engine crankshaft until the piston of No. 1 cylinder is in the correct position for the staggered spark requirements and install the other magneto in the same manner followed for the first magneto.

WIRING

23 Connect the ground wire from the magneto switch to the ground terminal of the magneto.

24 Remove the cable piercing screws from the distributor blocks to avoid any possibility of the high tension cables not being fully seated in the base of the cable holes.

25 Insert the spark plug cable for No. 1 cylinder into the distributor block cable hole marked No. 1 and then secure it with the cable piercing screw. Insure that the piercing screw is tight. Insert the spark plug cable for the next cylinder to fire into the distributor cable hole marked No. 2, etc. The numerals on the distributor block denote the serial firing order of the magneto and must not be construed as the engine firing sequence. It is recommended that the part of the cable which is inserted in the distributor block cable holes be treated with powdered talc to prevent its fusing to the walls of the distributor block cable holes. If a high tension booster is used insert the cable from the booster source into the distributor block cable hole marked "B", and secure it with a cable piercing screw. A lock washer is not required beneath the head of this piercing screw. In the magneto not used for booster starting, insure that a lock washer is used with cable piercing screw in the distributor block cable hole marked "B". If a low-tension (induction vibrator) type booster is used, the booster will be connected through a suitable junction box into the magneto switch wire.

26 Before installing the radio shields, it is recommended that the connections be checked for any short or open circuit and to ascertain whether or not the cables lead to the proper cylinders from the magneto. Either a buzzer or light system or a booster magneto can be used. When using a buzzer or light system, touch the distributor block electrode with one point and the spark plug end of the cable for the proper cylinder with the other. The circuit is complete when the buzzer gives a signal or the lamp lights. If the circuit is not complete, check for a possible open circuit or wrong connection of the cable. To check for a short cir-

cuit due to faulty insulation of the cable, a booster magneto is used. The high tension terminal of the booster magneto is connected to the distributor block electrode. The spark plug end of the cable is held about 1/4" from a grounded object. If no spark occurs, check the cable for faulty insulation.

27 Install the radio shields to the distributor blocks. Allow enough slack in the cables to prevent extreme sharp bends. Install the radio shields, distributor blocks, and main covers on the magnetos.

PART 2

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MAINTENANCE, DISASSEMBLY AND INSPECTION

MAINTENANCE

1 This magneto does not require any lubrication between overhaul periods. The only inspection that need be performed between overhaul periods is to see that all screws and connections are tight and that the magneto is securely mounted.

DISASSEMBLY AND INSPECTION

2 Disengage the coil cover strap clamping screw after removing the safety pin, and remove cover.

DISTRIBUTOR BLOCK

3 Remove the two screws which secure the radio shield assembly to the front end plate and lift the assembly from the magneto by applying pressure towards the coil on the top and bottom parts of the assembly and then lifting upwards. Loosen the two screws near the base of the radio shields which secure the distributor block. Remove the clamping screws which hold the shield halves together and then disengage the shield halves.

4 Clean the electrode surfaces in the distributor block with a piece of fine emery cloth. If the electrodes are worn badly, replace with new ones. Socket wrench No. 11-989 is used for the electrodes. Also, the No. 11-1413 tap is used for cleaning the tapped holes for the electrodes in the distributor block. Tap No. 11-1307 is used for the tapped holes for the cable piercing screws. Place distributor block in the radio shield assembly and check the

height of each electrode with the No. 11-1322 gauge. (See figure 2-1). It may be found necessary to remove some material from the new electrodes if installed. If so, place the distributor block in the No. 11-1206 adaptor. Now you can mount the adaptor in a lathe to machine the electrodes with a suitable cutting tool.

5 Examine the cable holes and remove any foreign particles which may be in them. Examine all parts of the distributor block to make sure it is not cracked.

6 Remove the contact button and carbon brush assembly from the distributor block. This is done by prying upward on the head of the contact button with a screwdriver, having first padded the part of the screwdriver which rests against the surface of the block. Inspect the carbon brush, the fiber sleeve and both springs for wear, breakage, or warping. Replace any parts which are worn or broken. Reassemble parts into the distributor block and check for free action of the carbon brush and contact button. Both parts must return firmly (no play in the assembly) to the fully extended position when compressed with the hand and then release. Should the parts bind, check for burrs or ridges which may be interfering with their action. If the parts are loose when in free position, new springs should be installed.



Fig. 2-1 Checking Height of Distributor Block Electrodes

CONTACT BREAKER

7 Remove the breaker cover after taking out the safety pin and releasing the knurled head fastening screw. The advance lever can be taken off by releasing its clamp screw.

8 Remove the breaker hold down spring. The earlier type magnetos employ a hold down spring of different design which does not require a wrench for its removal. It consists of a coil spring and a bayonet lock and is removed by compressing the spring and turning it through a 90 degree angle. Remove the complete breaker and housing assembly. In the magnetos prepared for fixed spark requirements, the two securing screws which hold the breaker housing to the magneto housing must be removed in addition to the two hold down springs.

9 Remove the primary condenser and the breaker contact assembly from the breaker housing. Disengage the primary connector from the condenser. Lift out the adjusting eccentric from its recess under the breaker contact assembly. For electrical test of the condenser see Section entitled "Magneto Test Procedure".

10 Wash the entire contact assembly in Naptha Aliphatic 33C653 Specification TT-M-95

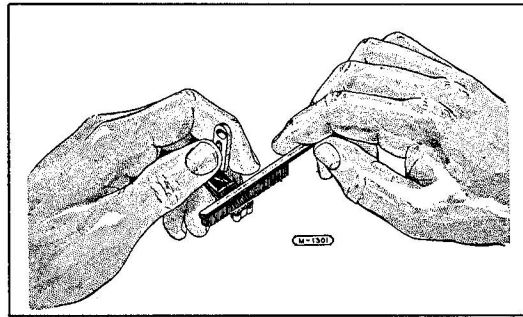


Fig. 2-2 Scrubbing Cam Follower with Brush

to remove all oil. Use a small brush to work around the points and to scrub the felt of the cam follower lightly in order that any particles of dirt or grit will be removed. (See figure 2-2).

11 Blow the assembly dry with a compressed air jet which should be directed over all parts of the assembly, particularly the follower felt and the point surfaces, which latter should be held apart so that the air can evaporate all traces of the solvent and remove any dirt which may have lodged between them.

12 If the above cleaning has been properly done, the felt strip on the cam follower should come out nearly white when dry. If the follower does not appear thoroughly clean, repeat the washing, working the solvent thoroughly into the felt with the fingers. Be sure the solvent is all removed from the felt by blowing with compressed air.

13 After cleaning the cam follower felt, inspect it to see that it is in good condition and securely fastened to the follower spring. Make sure none of the threads which bind the tail of the felt strip are broken. Use a new follower if the felt is loose or torn or if there are any broken threads.

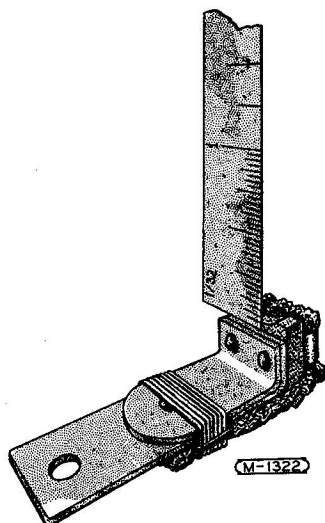


Fig. 2-3 Measuring Wear at Top of Cam Follower

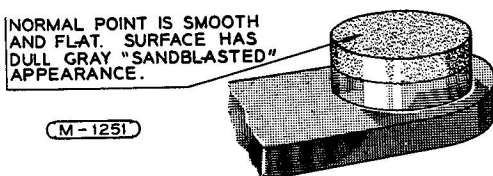


Fig. 2-4 Normal Contact Point

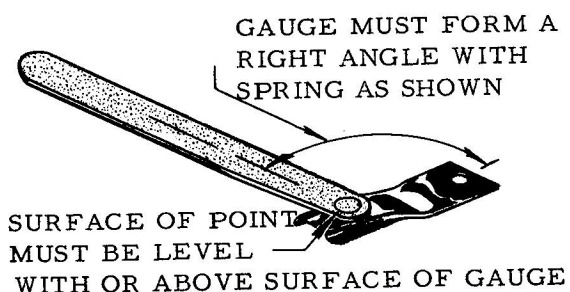


Fig. 2-5 Application of No. 11-1871 Gauge

14 Check fiber block of the follower for excessive wear at the point where it lifts against the main-spring. After long periods of operation there will be a certain amount of normal wear at this point, causing a small depression to be worn in the top of the fiber block. If the bottom of this depression is less than $1/32$ -inch from the top of the spring to which the fiber is riveted, the fiber is worn beyond safe limits and should be replaced. (See figure 2-3).

15 Check the bottom of the follower block for

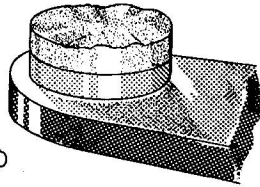
excessive wear or a "battered" condition. The surface which rides the cam should be smooth and hard. If there is any evidence of splitting or cracking of the fiber, the follower should be replaced.

16 Check the follower for loose rivets which secure the fiber block to the springs. This may be done by applying a light twisting force to the block while holding the spring. If there is any looseness or movement of the block or the rivets with respect to the spring the follower should be replaced

17 Check the contact point surfaces. Figure 2-4 shows how the average contact point will look when the surfaces are separated for inspection after the assembly has been removed from the magneto. The contact surfaces have a dull gray, sandblasted appearance (almost rough) over the area where electrical contact is made. This gray frosted surface means that the points are worn in and mated to each other thereby providing the best possible electrical contact, and the highest efficiency of performance. Points in this condition should not be disassembled, nor should the assembly securing screw be loosened or tampered with, since this would change the relation of the points and destroy the perfectly mated fit of their surfaces.

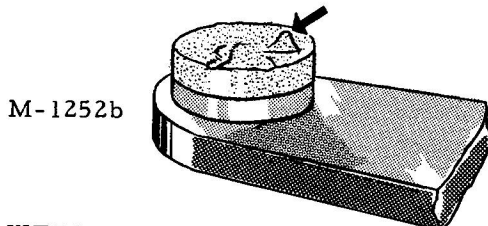
18 Minor irregularity or roughness of the point surfaces is not harmful. Neither are small pits or mounds, if not too pronounced. It is sometimes difficult to judge whether a point is pitted deeply enough to require dressing, because in the final analysis this depends on how much of the original platinum pad is left on the point surface. The danger arises from the possibility of the pit becoming deep enough to penetrate through the platinum pad, which may be thin due to long service or previous dressing operations.

19 To assist mechanics in judging the thickness of the platinum pad, the No. 11-1871 gauge has been provided. The point is checked by applying the gauge in the manner shown in Figure 2-5. A point is satisfactory if its contact surface is level with or extends above the surface of the gauge. If any part of the point surface is below the gauge surface, the platinum is too thin for safe use and a new point assembly should be installed. Points which pass the gauge check are considered satisfactory for operation through one overhaul.



MINOR IRREGULARITIES - SMOOTH ROLLING HILLS AND DALES WITHOUT ANY DEEP PITS OR HIGH PEAKS. THIS IS A NORMAL CONDITION OF POINT WEAR.

Fig. 2-6 Point with Minor Irregularities



WELL DEFINED MOUND EXTENDING NOTICEABLY ABOVE SURROUNDING SURFACE. THE MATING POINT HAS A PIT OR HOLE CORRESPONDING TO THE MOUND SEEN HERE. THESE POINTS NEED DRESSING.

Fig. 2-7 Point with Well-Defined Mounds

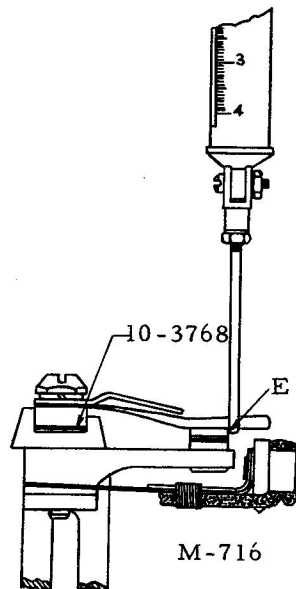


Fig. 2-8 Checking Breaker
Main Spring Tension

However the gauge cannot reveal precisely the extent to which pits may have decreased the pad thickness.

20 In the absence of qualified experience in this matter, it is safest to redress the points if there are any well-defined mounds on either surface. Figure 2-6 and 2-7 will help the reader to understand the difference between "minor irregularities" and "well-defined mounds" as covered in the above discussion.

21 Check the main-spring tension with gauge No. 11-2731. When making this check make sure that the hook of the gauge is applied under the main-spring adjacent to the contact point (E) as shown (figure 2-8). If the tension of a main-spring that has been operated is 15 oz. or more, it is satisfactory for further service. If the tension is low, disassembly of the points will be necessary to correct it. If disassembled, the points must be redressed because it will be impossible to reassemble them in their original relation.

22 Contact points should be dressed with the No. 11-1248 contact point dressing kit in accordance with instructions furnished with this kit.

23 When dressing a set of points which have been rejected due to pits and mounds, do not try to completely remove the pit. File the point only enough to smooth and flatten out all the surface around the pit. This will usually leave plenty of contact area around the hole as shown in Figure 2-9 and the assembly will perform in the same manner as a perfect point. It is obvious that if the pit were deep, most of the platinum pad might be removed if an attempt were made to entirely eliminate the pit by filing.

24 When dressing the mounded point, the mound must be entirely filed off. The surface of this point should be perfectly smooth and flat to provide the largest possible contact area against the other point which now will have a slightly decreased area due to the remaining pit.

25 It is not necessary to obtain a mirror finish on the contact surfaces when completing the dressing operation. Only a few strokes of the stone are required to remove any ridges or burrs left by the file. The most important factor is to have the points flat so that they will

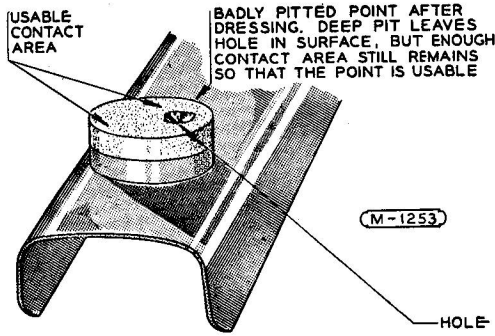


Fig. 2-9 Pitted Point After Dressing

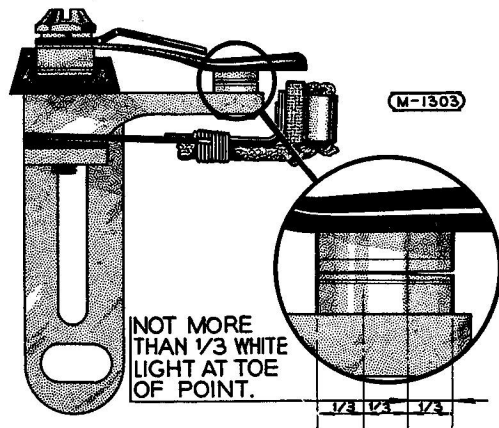


Fig. 2-10 Checking Contact Point Area

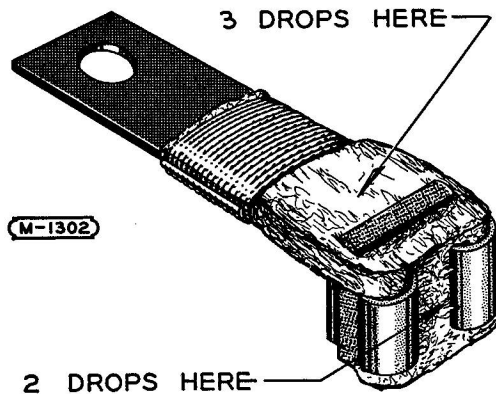


Fig. 2-11 Overhaul Lubrication of Cam Follower

provide satisfactory contact area when assembled.

26 After dressing the points, check thickness of the point itself with the No. 11-1871 gauge as previously explained.

27 If the points were disassembled in order to correct low spring tension, it is recommended that the correction be made by installing a new main-spring. By the exercise of proper care and judgment many operators are making this correction by bending the spring slightly. If this is done, it is advisable to bend the spring with the fingers, in order to avoid concentrated stresses which might weaken the spring if it were bent sharply with pliers. Usually it only requires a very slight bending to correct the tension so that it is within required limits.

CAUTION

Should it be found that the spring was bent too much, as evidenced by excessive tension when checked after assembly, do not attempt to correct the tension further by bending the spring a second time. Discard the spring and use a new one.

28 Use the No. 11-1275 assembly tool when assembling the component parts of breaker. In doing this the operator should strive to obtain full contact area between the point surfaces. In a practical sense however, full contact area is often difficult to obtain since it requires both perfect squareness and perfect flatness of the points. A workable standard is about $\frac{2}{3}$ of full contact area, provided the contact is on the side away from the cam follower block. Contact area can be checked by holding the assembled breaker toward the light and observing whether the light can be seen between the point surfaces as shown in Figure 2-10. At final assembly, the securing screw which holds the breaker parts together should be tightened to a torque value of 18-20 inch-pounds, using No. 11-1681 tension wrench.

29 After thoroughly cleaning and inspecting the assembly it should be relubricated by applying three drops of S. A. E. No. 60 oil 3-GP-115 to the bottom felt of the cam follower and two drops of the same oil to the upper part of the felt. (See figure 2-11). The assembly should

then be allowed to remain undisturbed for at least fifteen minutes before operating it in a magneto. This interval of time will allow the oil to penetrate the felt and minimize any tendency for the oil to be thrown off during operation.

30 Remove the coil screws and clamps which secure the coil to the pole shoes of the magneto housing and remove coil. The primary contact plate can be removed, if necessary, by bending back the ear locks and taking out the securing screws. The ground spring is riveted to the contact plate.

31 Examine the rubber housing for excessive cracks. Make sure all screws are tight. Inspect the primary contact plate for excessive grooves caused by the primary brush.

32 For electrical test, see Part 3, Para. 30, "Magneto Test Procedure".

FRONT END PLATE

33 Remove the breaker cam. If it sticks use puller No. 11-1060. Take out the four screws which secure the front end plate to the magneto housing. Place drift No. 11-1240 over the cam extension of the magnet shaft and tap drift with a mallet until the magnet and front end plate are separated from the housing.

34 Remove the insulating plate from the

front end plate. Remove drive shaft nut, drive coupling, oil seal lockring, oil seal and small distributor gear. Use box wrench No. 11-1228 to hold drive coupling. If gear sticks use puller No. 11-1257. Support the front end plate on the No. 11-1201 sleeve and press out the magnet, using No. 11-1202 drift over the drive end of the shaft to protect the threads. Remove the breaker end ball bearing from the magnet with puller No. 11-1357.

35 Remove the distributor finger from its flange. Take off the distributor gear cover from front end plate. Remove carbon brush from distributor axle and take off the hexagon screw which secures the axle. Use gear holder No. 11-1309 to hold gear when removing screw. Tap out the axle with No. 11-1200 drift. Remove Woodruff key. Remove distributor axle bearing and drive shaft bearing retainers. Drive out the distributor and drive shaft ball bearings, using drifts No. 11-1204 and 11-1241 respectively.

36 Inspect the distributor finger and insulating plate for cracks. Clean the high tension electrode on the distributor finger and remove the pits. If the high tension electrode is burned or worn excessively, replace. Examine the gears for burrs or excessive wear of the teeth. Inspect the ball bearings for roughness or excessive wear. If satisfactory repack ball bearings with grease high melting point 3-GP-690.

PART 3

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REASSEMBLY AND TEST

REASSEMBLY

1 Before reassembling the magneto, make sure that all parts are clean and free from chips or foreign particles.

FRONT END PLATE

2 Replace the felt washer in the groove of the front end plate directly in back of the distributor gear axle ball bearing. Saturate this felt washer with S. A. E. No. 60 oil 3-GP-115.

3 Press the drive shaft ball bearing and the distributor gear axle ball bearing into their recesses in the front end plate using an arbor press and pressing tools No. 11-1382 and No. 11-1243, respectively. Secure these bearings with their respective retainers.

4 Insert the distributor gear axle through its ball bearing. Make sure the felt washer is not loosened or rolled over while inserting the axle. Place Woodruff key in position and then install the large distributor gear on its axle. Use a new four ear lock washer and secure the axle to the gear with the hexagon head screw. Tighten this screw securely. Tap the prebent ear of the four ear lock washer firmly against the sides of the hole into which it is

seated. Lock by bending up one of the ears which will fit against a flat side of the screw. Insert the carbon brush into the hole provided for it in the center of the hexagon head screw.

5 Secure the distributor finger to the axle with its three screws and lock washers.

6 Check the height of the high tension electrode of the distributor finger with gauge No. 11-1230. If the electrode hits the "GO" side of the gauge, remove the necessary amount of material from the electrode with a file. If the electrode does not hit the "NO-GO" step, replace it with a new one. Check new electrode after installing.

7 Secure the insulating plate to the front end plate with its two screws and lock washers.

ROTATING MAGNET

8 Install breaker end ball bearing. This is done by placing the drive shaft end of the magnet in the No. 11-1350 sleeve. Then using an arbor press, press the breaker end ball bearing onto its shaft with the No. 11-1205 mounting tool. The shielded side of the bearing must face inward toward the magnet.

9 Place the Woodruff key in position and secure cam with its screw, plain washer, and lock washer.

10 Recharge the magnet with the No. 11-1301 (110 Volt D C) or No. 11-1302 (36 Volt D C) magnet charger.

11 Saturate the large felt washer with grease high melting point 3-GP-690 and place it in the bearing recess of the magneto housing.

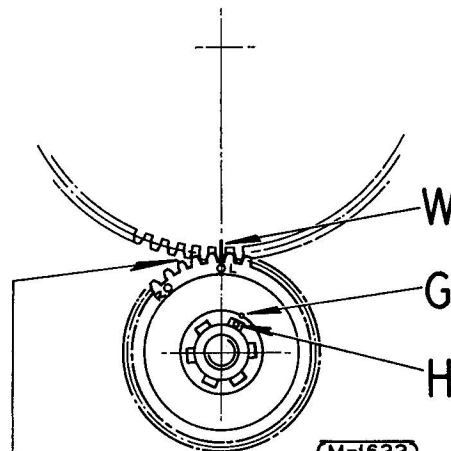
12 Engage the front end plate with the rotating magnet. This is done by placing the breaker end of the rotating magnet in the No. 11-1203 sleeve. Then place the front end plate over the drive shaft end of the rotating magnet. Using an arbor press, press the front end plate into position with the No. 11-1242 pressing tool.

13 Apply a light coating of S. A. E. 60 oil 3-GP-115 on the pole pieces of the rotating magnet. Make sure the rotating magnet is clean and free from chips or foreign particles. Then engage the front end plate and magnet assembly with the magneto housing. This is done by inserting the rotating magnet as far as possible in the magneto housing. Then place the No. 11-1408 adaptor on the base plate of the arbor press. Place the breaker end of the magneto housing on the No. 11-1408 adaptor and press the front end plate and magnet assembly into position with the No. 11-1242 pressing tool.

14 The large distributor gear should run true within .010" full indicator reading as measured with the No. 11-1221 indicator point against the face of the gear just below the tooth section. If the gear does not run true within .010" full indicator reading check the hub seat and also the distributor gear axle for a possible bent shank.

15 Observe for possible binding of the rotating magnet and examine pole pieces closely for small chips that might have adhered to the magnet or housing.

16 Check the clearance between the pole pieces of the magnet and the pole shoe surfaces with a feeler gauge. The clearance between any magnet pole piece and the pole shoe surface must not be less than .0015".



RELATION OF TIMING MARKS WHEN INSTALLING SMALL DISTRIBUTOR GEAR:
 "G" & "H" COINCIDE FOR EITHER ROTATION.
 "W" & "L" FOR ANTI-CLOCKWISE ROTATION.
 "W" & "R" FOR CLOCKWISE ROTATION.

Fig. 3-1 Relation of Timing Marks When Installing Small Distributor Gear

17 Test the eccentricity of the cam lobes with Scintilla indicator No. 11-1221. They must not vary more than .002" full indicator reading. It is permissible to tap the cam lightly to meet the eccentricity requirements. Use a fibre block when tapping the cam.

18 Install the small distributor gear. The timing mark on the drive shaft spline must index with the timing mark on the hub of the small gear over one of its splines. (See figure 3-1). Also, there are two timing marks adjacent to the teeth of the small gear. One is marked "R" for clockwise rotation and the other is marked "L" for anti-clockwise rotation. Index the tooth marked "R" with the timing mark on the tooth of the large distributor gear. (See figure 3-1).

19 Place 1/2 oz. of grease high melting point 3-GP-690 evenly on the teeth of the large distributor gear. Place the mounting flange in position and insert and tighten the four screws which hold flange and front end plate to the magneto housing. Also, secure the mounting flange to the front end plate with its six screws and lock washers.

20 Make sure that the washer in the oil seal assembly is in good condition. Make replacement if necessary. Install the gasket, which must be located directly in back of the oil seal

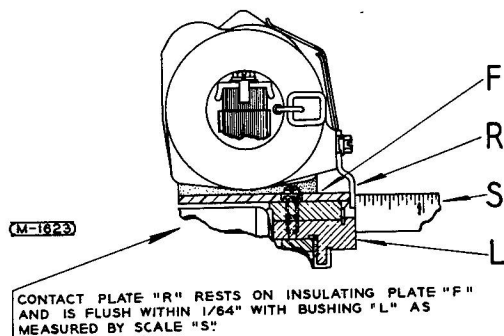


Fig. 3-2 Relation of Primary Contact Plate

assembly. Using assembly tool No. 11-1439, secure the oil seal assembly with its lock ring.

COIL

21 Apply a light coating of S. A. E. No. 60 oil 3-GP-115 or its equivalent on the pole shoe extensions. Secure the insulating plate between the pole shoe extensions and place the felt pad in position. Secure coil to pole shoe extensions with its two screws, clamps and ear lock washers.

22 The primary contact plate should be flush within $1/64$ " with the cast-in bushing of the magneto housing. (See figure 3-2). This contact plate should not touch the magneto housing at any place.

CONTACT BREAKER

23 Engage the condenser terminal with the laminated connector, one end of which is fastened to the contact point assembly. Do not tighten the condenser terminal nut too securely. Place the contact point and condenser assembly in position in the breaker housing. Hold the contact point assembly firmly in its recess with one hand and then turn the condenser slightly to a position where its bracket will squarely rest against the smooth surface on the breaker housing. Observe the laminated connector to make sure it is not buckled, to avoid any possibility of its touching any part of the breaker housing. Remove the contact point and condenser assembly and then tighten the condenser terminal nut securely.

24 Place the eccentric screw in its recess provided in the breaker housing. Reinstall the contact pointer and condenser assembly. Secure the contact point assembly in position with its two screws, plain washers, and lock washers. Secure the condenser to the breaker

housing with its securing screw and palnut. In some magnetos, the condenser may be secured with just a screw and lock washer. If such is the case, the palnut, which requires a longer securing screw, should be incorporated during reassembly. After the contact point and condenser assembly is secured, again observe the laminated connector to make sure it is not buckled or touching any part of the breaker housing. Give particular attention to this laminated connector because if it is incorrectly installed, thereby allowing it to touch the breaker housing or the hold down springs, the primary current would be short-circuited.

25 Secure the breaker stop collet with its screw and two lock washers in the hole marked "F" for fixed spark requirements, either rotation, "R" for variable spark clockwise rotation, or "L" for variable spark anti-clockwise rotation. Install contact breaker assembly in the housing and secure it with the two breaker hold down springs. Make sure all the five leaves of the primary brush make good contact with the primary contact plate of the coil. If the magneto is prepared for fixed spark requirements, the breaker stop collet must engage the bushing provided for it in the breaker housing. For variable spark requirements, the breaker stop collet projects through the elongated slot of the breaker housing.

NOTE

Scintilla pivotless type contact breakers as used in these series magnetos must always be adjusted so that the contacts open at the proper position of the breaker cam in relation to the timing marks in the rim of the breaker housing and not for any fixed clearance between the contacts.

26 Place a straight edge K (see figure 1-2) on the step cut in the cam and rotate the drive shaft until the straight edge coincides with the timing marks M cut in the rim of the breaker housing. Place breaker housing in full advance position. At this point the contact points C should be adjusted so that they just begin to open. To make this adjustment, loosen the two screws O and adjust the eccentric P so that the contact points just begin to open. Use No. 11-851 timing light or equivalent to determine

the position where the contacts open. The use of feeler strips for this purpose when adjusting the contact points may introduce an error of several degrees in the internal timing of the magneto. Tighten the securing screws O and recheck the adjustment.

27 Turn the drive shaft until the timing marks A and B coincide and place the gauge No. 11-1231 on top of the magneto housing adjacent to the inside of the front end plate. Insure that the gauge is centered between the recessed edges of the front end plate. It is desired that the high tension electrode cover at least 50% of the electrode of the gauge when the contact points just begin to open at the time the straight edge K coincides with the timing marks M (see figure 1-2). If variable spark is used, remove the straight edge and move the breaker to the full retard position. Move the drive shaft of the magneto slightly until the contact points just begin to open. At this position, the high tension electrode of the distributor finger should be edge to edge to the electrode of the gauge or have partial coverage. Secure breaker cover in position.

DISTRIBUTOR BLOCK, RADIO SHIELDS, AND MAIN COVER

28 Assemble the radio shield halves to the distributor block and secure them with their fastening screws. Install the distributor block and radio shield to the magneto and fasten plate with its two securing screws.

29 Secure the coil cover in position and tighten the cover straps with their clamping screw. Install the ground terminal assembly into the main cover.

30 Install the magneto drive member and secure it with the retainer, lock washer, castellated nut and cotter pin.

MAGNETO TEST PROCEDURE

31 Mount the magneto on Scintilla test stand No. 11-700 or equivalent. Use the No. 11-751 drive assembly for mounting the magneto.

32 Connect the high tension cables to the 7 mm. three point spark rack, Run magneto for two or three minutes. Make sure that the rotating magnet is not rubbing against the pole shoes of the housing. If so, this can be detected by the occurrence of a decided knock and must be eliminated by scraping out the inside of the housing.

33 Check the coming-in speed. The magneto should spark consistently at 180 R. P. M. full advance and 280 R. P. M. full retard.

34 Increase the speed to 3000 R. P. M. Observe the spark closely. If missing occurs, it may be caused by:

- (a) Improper breaker adjustment.
- (b) Dirty contact points.
- (c) Faulty or broken connections.
- (d) Defective coil.
- (e) Defective condenser (if contacts are excessively).

35 Check the ground connection. No spark should occur at the spark rack if the magneto is short circuited through the ground wire terminal screw.

36 If a high tension booster is used connect the cable from the source of booster current to the booster connection in the magneto. Run the magneto at 150 R. P. M. and observe the booster spark at the spark rack. The booster spark always trails the secondary spark.

ROTATING MAGNET

37 The magnetic strength of a rotating magnet is checked by measuring the primary current output.

38 Operate magneto for about five minutes at 3500 R. P. M. During this run, short circuit the primary current several times. Then operate magneto at 400 R. P. M. (This speed must not vary more than 10 R. P. M.) Hold contact points open by inserting a piece of insulating material between them.

39 Connect ammeter No. 11-1538 in parallel or across the open contact points. The ammeter should not read below 1.7 amperes. If reading is below 1.7 amperes, the rotating magnet must be recharged in magnet charger No. 11-1301 (110 Volt D C) or No. 11-1302 (36 Volt D C). After recharging magnet repeat ammeter test. If reading is still below, repeat ammeter test. If reading is still below, repeat test with a new coil before rejecting the magnet.

COIL

40 Check the continuity of the coil secondary with No. 11-2602, or equivalent, ohmmeter. The actual resistance is not important as long as proper continuity is indicated. If secondary shows an open aircuit, reject coil.

41 The final test of a coil must be made an actual running test of the magneto on the test bench. Also, as heat from the engine affects the insulation materials of the coil, the final test should be made at an elevated temperature. This is done by directing a reflector type heater on the magneto while it is being run on the test bench. When the temperature of the coil has reached approximately 165°, the spark gaps should be increased by means of the adjustable panel from 7 mm. to 9 mm. At 2000 R. P. M. the coil must spark consist-

ently at this temperature and spark gap. Increase the gaps to 10 mm. If consistent sparking occurred with the 9 mm. gap, intermittent missing with the 10 mm. gap will not be sufficient cause to reject the coil.

42 It may be found that the coil produces consistent sparking at room temperature with 7 mm. gaps, however, if the coil does not spark consistently at the elevated temperature with 9 mm. gaps, it should not be used for further service.

PRIMARY CONDENSERS

43 The condenser should be tested before it is installed on the magneto. Use the No. 11-1767 Primary Condenser Tester, in accordance with the instructions furnished with this tool.

NUMERICAL TOOL LIST

TOOL NO.	DESCRIPTION	APPLICATION
11-700	Test Stand	For running test of magneto.
11-751	Drive Assembly	For mounting magneto on test stand.
11-851	Timing Light	To determine position where point opens.
11-989	Socket Wrench	For distributor block electrodes.
11-1060	Puller	To remove breaker cam;
11-1200	Drift	To remove distributor axle.
11-1201	Sleeve	To support front end plate in arbor press.
11-1202	Drift	To protect drive shaft threads in arbor press.
11-1203	Sleeve	To support magnet in arbor press.
11-1204	Drift	To remove distributor bearing.
11-1205	Pressing Tool	To install rear bearing on magnet.
11-1206	Adaptor	To hold distributor block when machining electrodes.
11-1221	Indicator	To check gear and cam eccentricity.
11-1228	Box Wrench	To hold drive coupling.
11-1230	Gauge	To check height of distributor finger electrode.
11-1231	Gauge	To check electrode coverage.
11-1240	Drift	To remove magnet for housing.
11-1241	Drift	To remove drive shaft bearing.
11-1242	Pressing Tool	To install front end plate to magnet.
11-1243	Pressing Tool	To install distributor axle.
11-1248	Contact Point Dressing Kit	For redressing contact points.
11-1257	Puller	To remove small distributor gear.
11-1275	Assembly Tool	To assemble parts of breaker assembly.
* 11-1301	Magnet Charger	To magnetize rotating magnet.
* 11-1302	Magnet Charger	To magnetize rotating magnet.
11-1307	Tap	For cleaning cable piercing screw holes.
11-1309	Gear Holder	To hold distributor gear when removing its securing screw.
11-1322	Gauge	To check height of distributor block electrodes.
11-1350	Sleeve	To support magnet in arbor press.
11-1357	Puller	To remove breaker end bearing.
11-1382	Pressing Tool	To install drive shaft bearing.
11-1408	Adaptor	To support housing in arbor press.

NUMERICAL TOOL LIST (CONT'D)

TOOL NO.	DESCRIPTION	APPLICATION
11-1413	Tap	To clean distributor electrode holes.
11-1439	Assembly Tool	To compress oil seal for installation of lock ring.
11-1538	Ammeter	To check primary current.
11-1681	Tension Wrench	For tightening breaker assembly screw.
11-1767	Condenser Tester	To test condenser
11-1871	Gauge	To check thickness of platinum on contact points.
11-2602	Ohmmeter	To check continuity of coil secondary.
11-2731	Gauge	To check breaker main spring tension.

* The No. 11-1301 charger operates on 110 volts Direct Current. The No. 11-1302 charger operates on 36 volts Direct Current. Order charger to suit voltage source available.

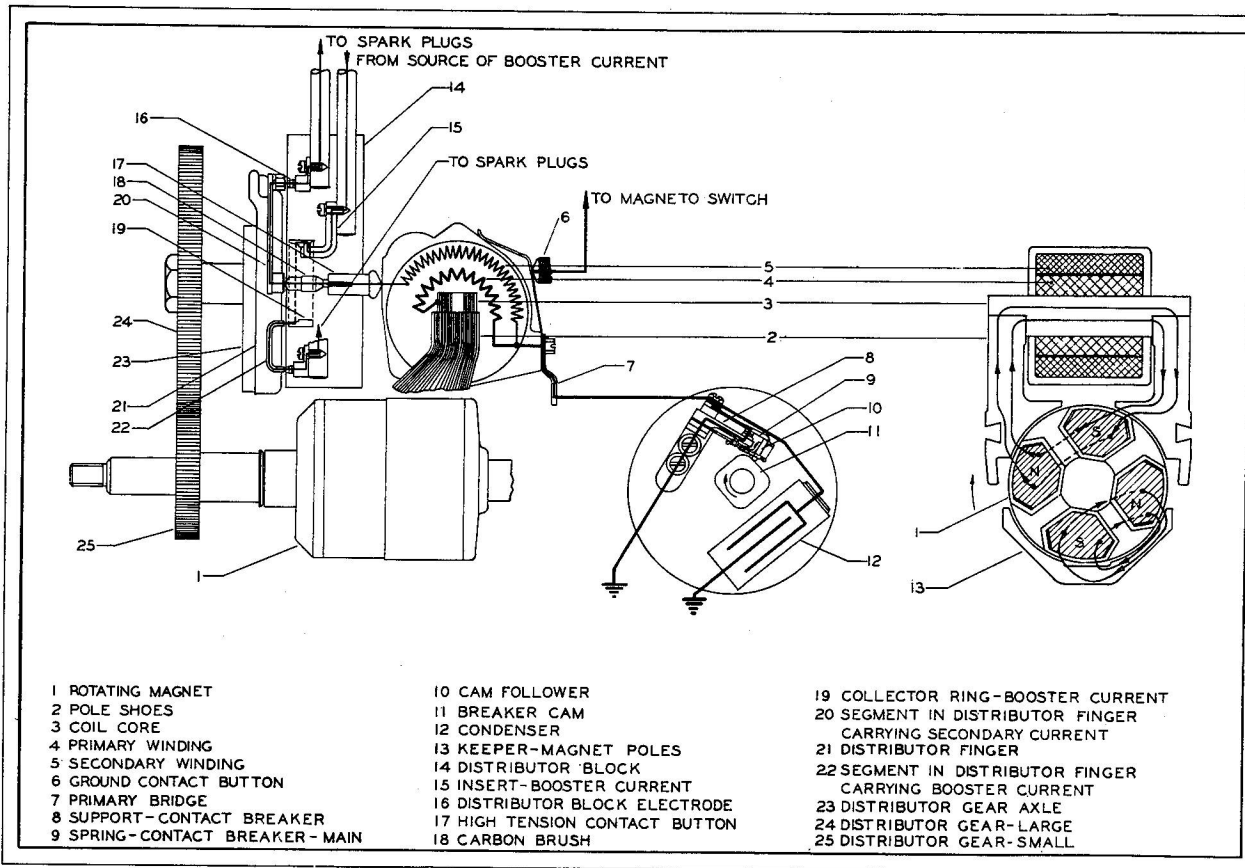


Fig. 3-3 Schematic Diagram of Electric and Magnetic Circuits

PART 4

GROUP ASSEMBLY PART LIST

BENDIX SCINTILLA MAGNETO
TYPE SB9RN-4

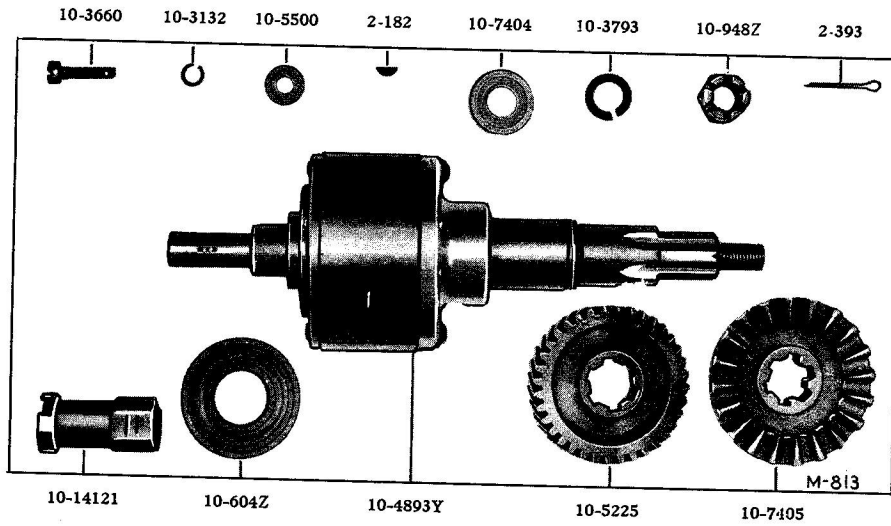


Fig. 4-1 Rotating Magnet

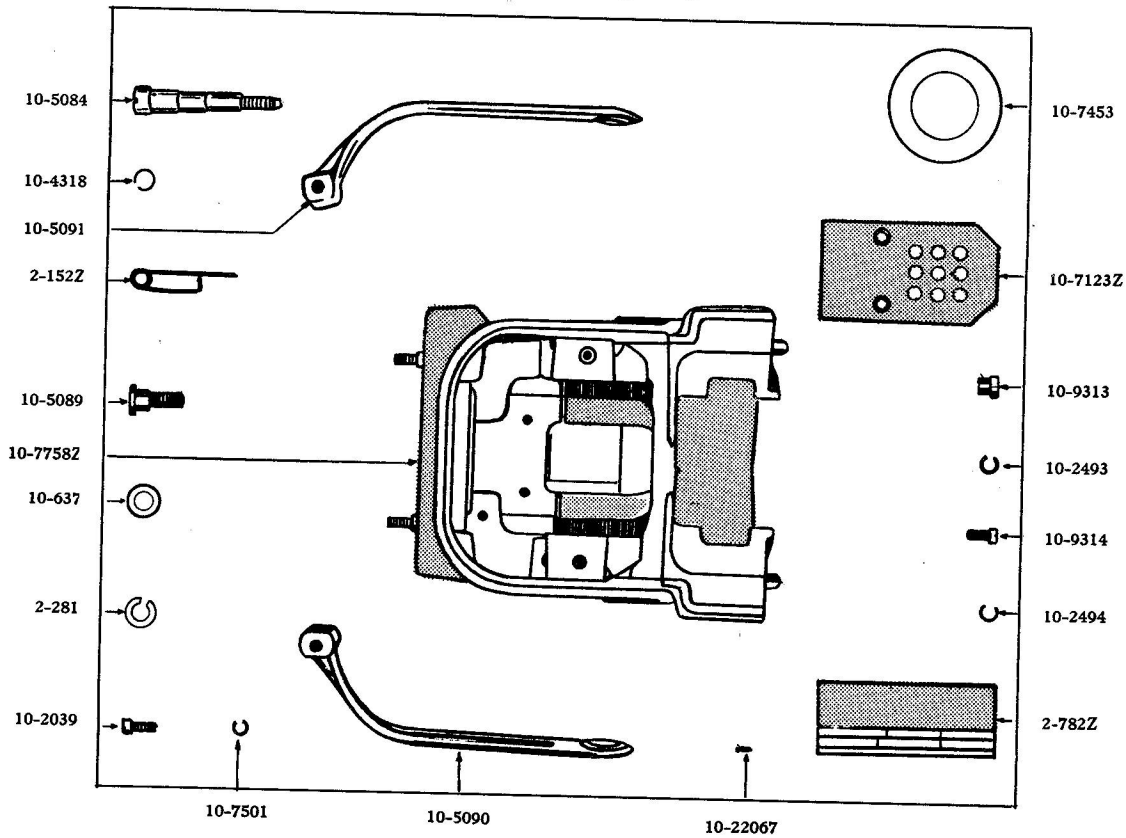


Fig. 4-2 Magneto Housing

FIGURE and INDEX NUMBER	GROUP BENDIX-SCINTILLA							Units Per Ass'y	Usage on Code
	MAJOR ASSEMBLY TYPE SB9RN-4								
	PART NUMBER	1	2	3	4	5	6 7		
4-1									Rotating Magnet
	2-182							1	Key-Woodruff (Cam)
	2-393							1	Pin-Cotter (Drive Shaft Nut) (Cotter Pin Hole .086" dia.)
	* 10-18918							1	Pin-Cotter (Drive Shaft Nut) (Cotter Pin Hole .094" dia.)
	10-604Z							1	Bearing-Ball (Magnet, Breaker End)
	10-948Z							1	Nut-Drive Shaft
	10-3132							1	Washer-Lock (Cam Screw)
	10-3660							1	Screw-Cam Fastening
	10-3793							1	Washer-Lock (Drive Shaft Nut)
	10-4893Y							1	Magnet-Rotating
	10-5225							1	Gear-Distributor-Small
	10-5500							1	Washer-Recessed, Chamfered (Cam Screw)
	10-7404							1	Retainer-Drive Member
	10-7405							1	Drive Member-Magneto
	10-14121							1	Cam-Breaker-Clw.
									* Not illustrated.
4-2									Magneto Housing
	2-152Z							1	Pin-Safety (Strap Clamping Screw)
	* 2-274								Strip-Felt (Specify Length)
	2-281							2	Washer-Lock (Strap Fastening Screw)
	2-782Z							1	Plate-Magneto Identification
	10-637							2	Washer-Plain (Strap Fastening Screw)
	10-2039							2	Screw-Insulating Plate Fastening
	10-2493							1	Washer-Lock (Collet)
	10-2494							1	Washer-Lock (Collet Screw)
	10-4318							1	Ring-Lock (Strap Clamping Screw)
	10-5084							1	Screw-Strap Clamping
	10-5089							2	Screw-Strap Fastening
	10-5090							1	Strap-Cover (Non-Threaded)
	10-5091							1	Strap-Cover (Threaded)
	10-7123Z							1	Plate-Insulating
	10-7453							1	Washer-Felt (Breaker End Bearing Grease Retaining)
	10-7501							2	Washer-Lock (Insulating Plate Screw)
	10-7758Z							1	Housing-Magneto
	10-9313							1	Collet-Breaker Stop
	10-9314							1	Screw-Collet Fastening
	10-22067							2	Drive Screw (Identification Plate)
									* Not illustrated.

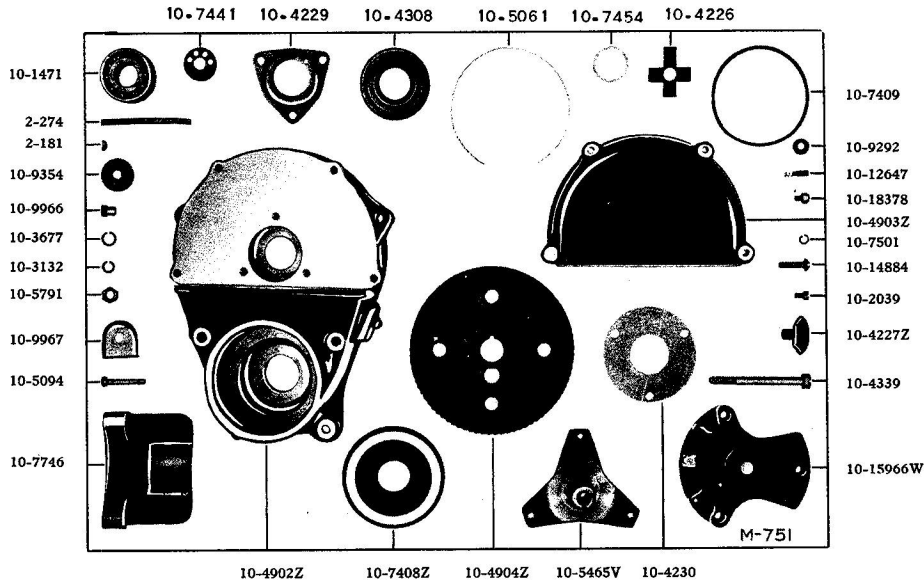


Fig. 4-3 Front End Plate

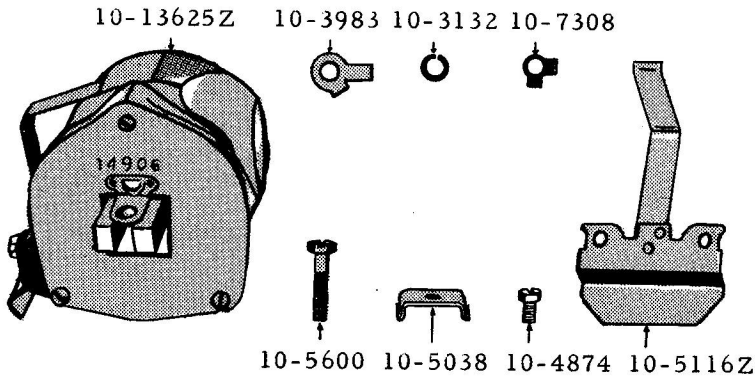


Fig. 4-4 Magneto Coil

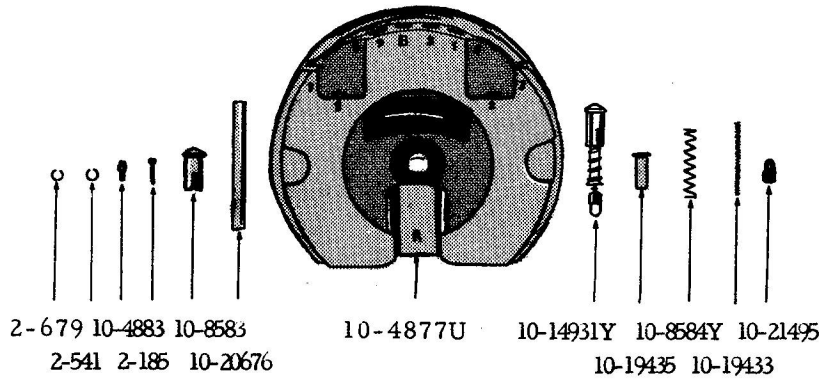


Fig. 4-5 Distributor Block

FIGURE and INDEX NUMBER	GROUP BENDIX-SCINTILLA							Units Per Ass'y	Usage on Code
	MAJOR ASSEMBLY TYPE SB9RN-4								
	PART NUMBER	1	2	3	4	5	6 7		
4-3								Front End Plate	
								Special For Magnetos Having Ventilated Front End Plate	
		10-3132						Washer-Lock (Ventilator Screw)	2
		10-7441						Retainer-Ventilator Screen	2
		10-9292						Washer-Ventilator Shield	2
		10-9354						Screen-Ventilator	2
		10-9966						Spacer-Ventilator Shield	2
		10-9967						Shield-Ventilator	2
		10-14884						Screw-Ventilator Fastening	2
								Common To All Magnetos	
		2-181						Key-Woodruff (Large Gear)	1
		2-274						Strip-Felt (Specify Length)	
		10-1471						Bearing-Ball (Large Gear Axle)	1
		10-2039						Screw-Fastening	11
								(3, Drive End Bearing Retainer)	
								(3, Axle Bearing Retainer)	
								(3, Finger)	
								(2, Insulating Plate)	
		10-3677						Washer-Lock	4
								(2, End Plate Screw)	
								(2, End Plate Mounting Stud)	
		10-4226						Lock-4 Ear (Large Gear Screw)	1
								(Used in magnetos on and after Serial No. 9450. Magnetos up to and including serial No. 9449, clip off pre-bent ear to make all four ears equal in length)	
		10-4227Z						Screw-Large Gear Fastening	1
		10-4229						Retainer (Large Gear Axle Bearing)	1
		10-4230						Retainer (Drive End Bearing)	1
		10-4308						Bearing-Ball (Magnet, Drive End)	1
		10-4339						Screw-End Plate Fastening	2
		10-4902Z						Plate-Front End	1
		10-4903Z						Cover-Large Gear	1
		10-4904Z						Gear-Distributor-Large	1
								(See 10-4226 before ordering)	
		10-5061						Ring-Lock (Oil Seal Assembly Retaining)	1
	10-5094						Screw-Large Gear Cover Fastening	4	
	10-5465V						Axle-Large Gear	1	
	10-5791						Nut (End Plate Mounting Stud)	4	
	10-7408Z						Oil Seal Assembly-Drive Shaft	1	
	10-7409						Gasket (Oil Seal Assembly)	1	
	10-7454						Washer-Felt (Axle Bearing Grease Retaining)		
	10-7501						Washer-Lock	16	
							(4, Large Gear Cover Screw)		
							(3, Drive End Bearing Retainer Screw)		

FIGURE and INDEX NUMBER	GROUP BENDIX-SCINTILLA							Units Per Ass'y	Usage on Code
	MAJOR ASSEMBLY TYPE SB9RN-4								
	PART NUMBER	1	2	3	4	5	6 7		
4-3								Front End Plate (Cont'd)	
	10-7501							Washer-Lock (Cont'd) (3, Axle Bearing Retainer Screw) (3, Finger Screw) (2, Insulating Plate Screw) (1, Distributor Finger Electrode)	16
	10-7746							Plate-Insulating	1
	10-12647							Carbon Brush (Large Gear Screw)	1
	10-15966W							Finger-Distributor-Clw.	1
	10-18378							Electrode-Distributor Finger	1
4-4								Magneto Coil	
	10-3132							Washer-Lock (Coil Core Screw)	2
	10-3983							Washer-2 Ear Lock (Coil Core Screw)	2
	10-4874							Screw-Bridge Fastening	2
	10-5038							Clamp-Coil Core	2
	10-5116Z							Bridge-Primary	1
	10-5600							Screw-Coil Core Fastening	2
	10-7308							Washer-2 Ear Lock (Bridge Screw)	2
	10-13625Z							Coil-Complete	1
4-5								Distributor Block	
	2-185							Screw-Cable Piercing	10
	2-541							Washer-Lock (Distributor Block Electrode)	9
	2-679							Washer-Lock (Booster Cable Piercing Screw)	1
	10-4877U							Block Assembly-Distributor-Clw.	1
	10-4883							Electrode-Distributor Block	9
	10-8583							Contact Button-Distributor Block High Tension	1
	10-8584Y							Spring-Contact Button	1
	10-14931Y							Contact Button and Carbon Brush Assembly- Distributor Block	1
	10-19433							Spring-Carbon Brush	1
	10-19435							Sleeve-Contact Button Spring	1
	10-20676							Retainer (Booster Cable Piercing Screw)	1
	10-21495							Carbon Brush-Distributor Block	1

FIGURE and INDEX NUMBER	GROUP BENDIX-SCINTILLA							Units Per Ass'y	Usage on Code
	MAJOR ASSEMBLY TYPE SB9RN-4								
	PART NUMBER	1	2	3	4	5	6 7		
4-6								Coil Cover	
	* 10-1196							Pin (Ground Terminal Screw Bushing)	1
	10-2619							Contact Button (Ground Terminal Screw)	1
	10-3383							Terminal Screw-Ground	1
	10-5199							Nut-Slotted (Ground Terminal Screw)	1
	10-5200							Lock (Ground Terminal Screw Nut)	1
	10-5531Y							Cover-Coil	1
	* 10-26198							Washer-Plain (Ground Terminal)	1
	* 10-26199							Sleeve-Insulating (Ground Terminal)	1
	* 10-32389							Bushing-Ground Terminal Screw	1
							* Not illustrated.		
4-7								Breaker Assembly	
	2-152Z							Pin-Safety (Cover Screw)	1
	2-171Z							Washer-Plain (Contact Assembly Fastening Screw)	2
	2-194							Washer-Lock (Contact Assembly Fastening Screw)	2
	2-995							Washer-3 Ear Lock (Hold Down Spring, Fixed Spark)	2
	10-528Z							Screw-Contact Assembly Fastening	2
	10-532Z							Screw-Eccentric (Contact Assembly Adjusting)	1
	10-2039							Screw-Condenser Fastening	1
	10-2250							Screw-Advance Lever Clamping (Variable Spark)	1
	10-2497							Screw-Adjusting Plate Fastening	2
	10-3039							Spring-Cover Screw	1
	10-3132							Washer-Lock (Advance Lever Screw, Variable Spark)	1
	10-3300							Lever-Breaker Advance and Retard (Variable Spark)	1
	10-4764							Housing-Breaker	1
	10-4909							Plate-Adjusting (Contact Assembly)	1
	10-4947W							Cover-Breaker-Variable Spark-Ventilated (For Non-ventilated Magneto Housing)	1
	* 10-13884							Cover-Breaker-Variable Spark-Non-Ventilated (For Ventilated Magneto Housing)	1
	* 10-4949W							Cover-Breaker-Fixed Spark-Ventilated (For Non-ventilated Magneto Housing)	1
	* 10-13882							Cover-Breaker-Fixed Spark-Non-Ventilated (For Ventilated Magneto Housing)	1
	10-4951Z							Screw-Cover Fastening	1
10-5071							Rivet-Cover Screw Spring Fastening	1	
10-5442V							Contact Assembly	1	

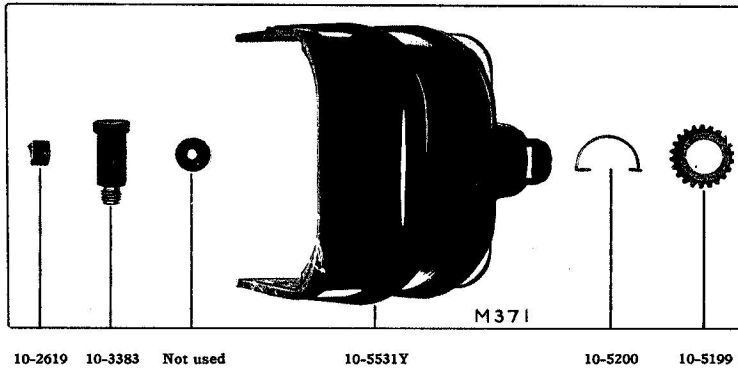


Fig. 4-6 Coil Cover

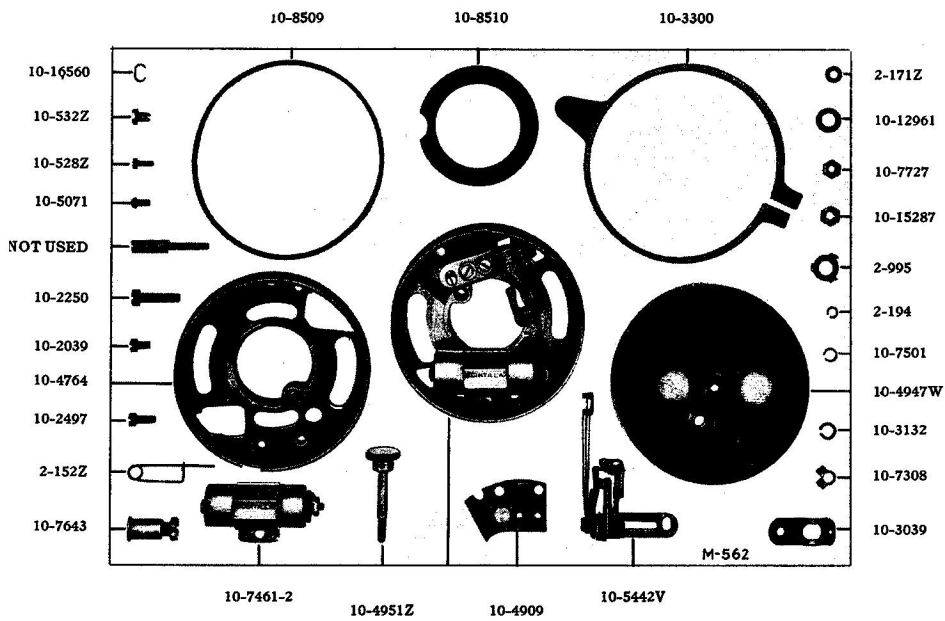


Fig. 4-7 Breaker Assembly

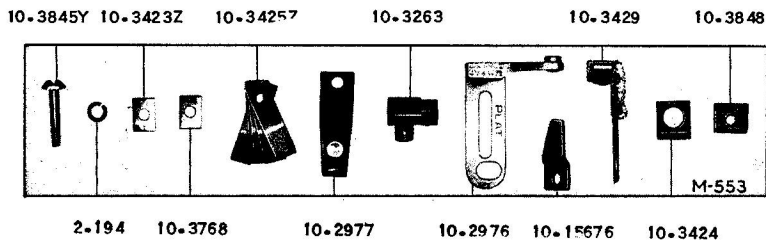


Fig. 4-8 Detail Parts of Contact Assembly No. 10-5442V

FIGURE and INDEX NUMBER	GROUP BENDIX-SCINTILLA							Units Per Ass'y	Usage on Code			
	MAJOR ASSEMBLY TYPE SB9RN-4											
	PART NUMBER	1	2	3	4	5	6			7	NOMENCLATURE	
4-7									Breaker Assembly (Cont'd)			
	10-7308								Washer-2 Ear Lock (Condenser Terminal)	1		
	10-7461-2								Condenser	1		
	10-7501								Washer-Lock (1 Condenser Screw) (2, Adjusting Plate Screw)	3		
	10-7643								Spring-Hold Down (Breaker Assembly)	2		
	10-7727								Nut (Condenser Terminal)	1		
	10-8509								Gasket-Breaker Cover (1, Variable Spark) (2, Fixed Spark)			
	10-8510								Gasket-Breaker Housing	1		
	10-12961								Washer-Plain (Hold Down Spring, Fixed Spark)	2		
	10-15287								Palnut (Condenser Screw)	1		
	10-16560								Ring-Lock (Cover Screw)	1		
									* Not illustrated.			
	4-8									Detail Parts of Contact Assembly No. 10-5442V		
		2-194								Washer-Lock (Assembly Screw)	1	
10-2976									Support-Contact Assembly (Includes Platinum Contact)	1		
10-2977									Spring-Main (Includes Platinum Contact)	1		
10-3263									Bushing-Insulating	1		
10-3423Z									Plate-Main Spring	1		
10-3424									Plate-Insulating (Assembly Screw Nut)	1		
10-3425Z									Brush Assembly-Primary	1		
10-3429									Follower-Cam	1		
10-3768-1									Washer-Shim-.008" thick			
10-3768-2									Washer-Shim-.004" thick (Main Spring Adjusting)			
10-3845Y									Screw-Assembly Fastening	1		
10-3846									Nut (Assembly Screw)	1		
* 10-5441Z									Connector-Condenser to Breaker	1		
10-15676								Stop-Main Spring	1			
								* Not illustrated.				

