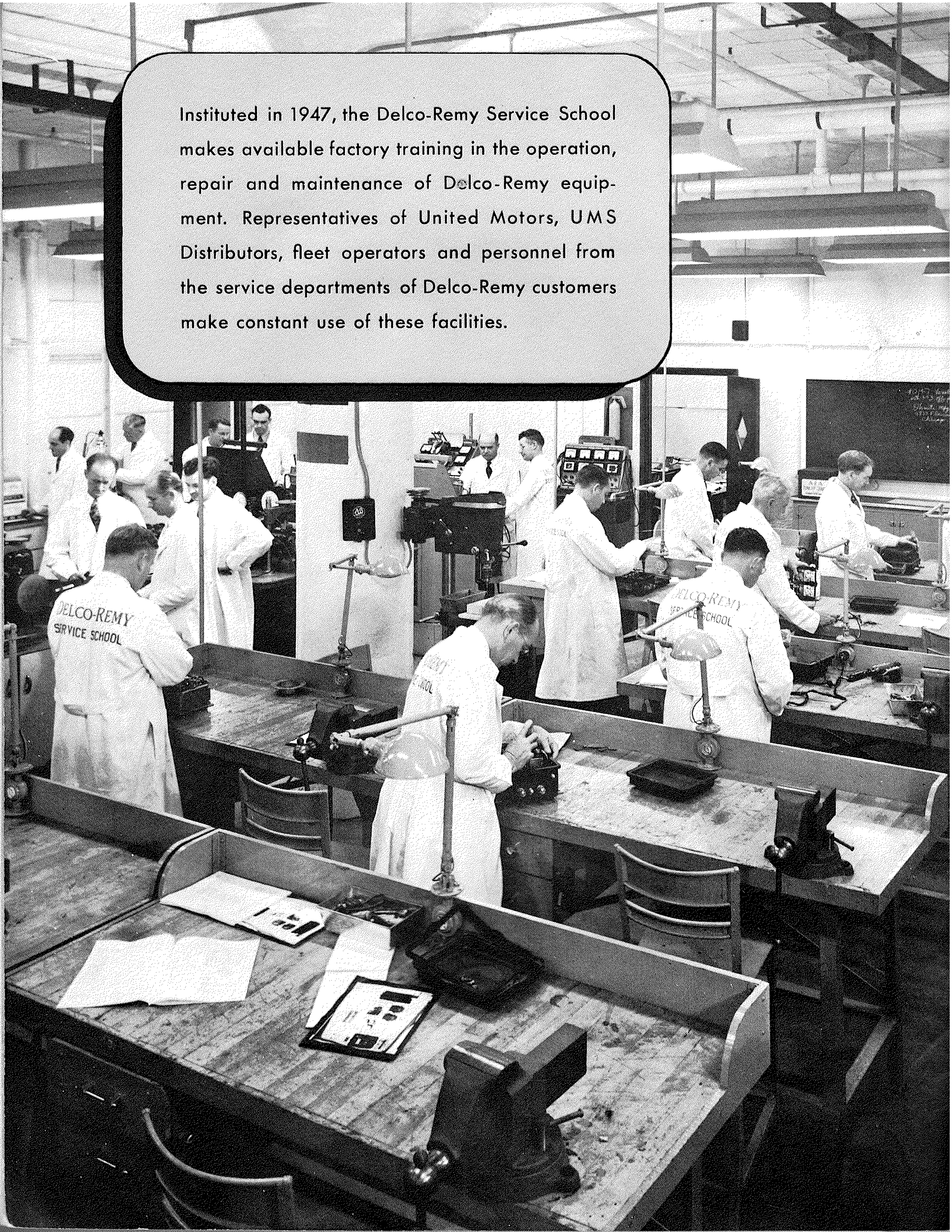
Better Ignition

WHEREVER WHEELS TURN OR PROPELLERS SPIN
Delco Remy

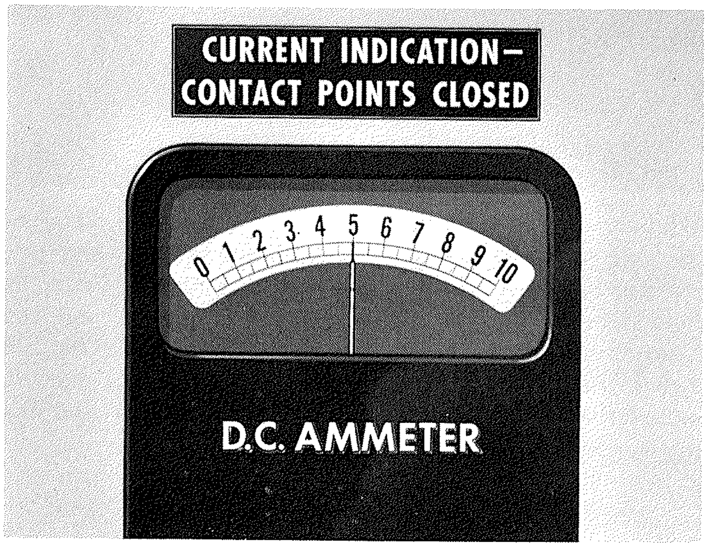
DELCO-REMY DIVISION, GENERAL MOTORS CORPORATION · ANDERSON, INDIANA

Instituted in 1947, the Delco-Remy Service School makes available factory training in the operation, repair and maintenance of Delco-Remy equipment. Representatives of United Motors, UMS Distributors, fleet operators and personnel from the service departments of Delco-Remy customers make constant use of these facilities.

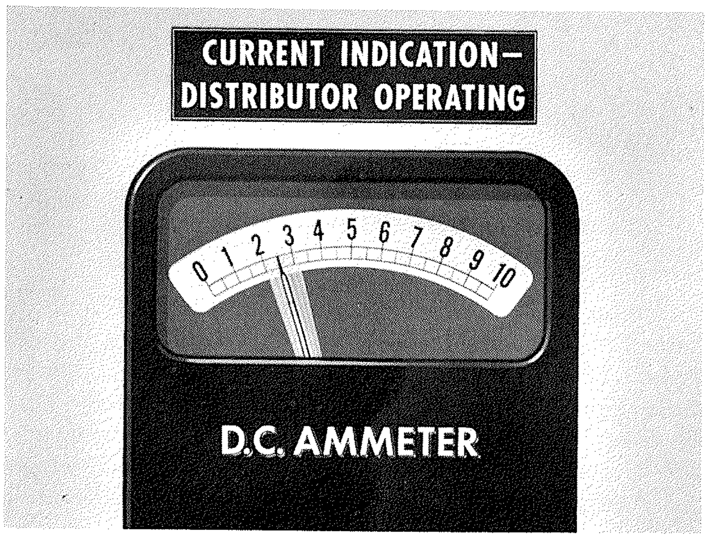


Better Ignition by DELCO-REMY

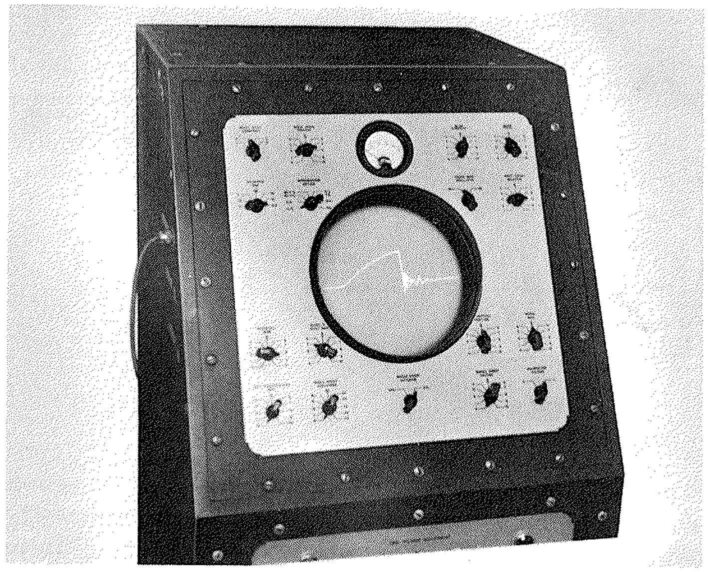
"Better Ignition" attempts to explain how ignition occurs and what actually goes on in the ignition circuits. It is an effort to clear up points about ignition which have not been clearly understood. The ignition system always has been mysterious to automotive electricians, just as all things are mysterious when they cannot be seen. When we can look and see things happen much of the mystery disappears. At least the results are visible. We



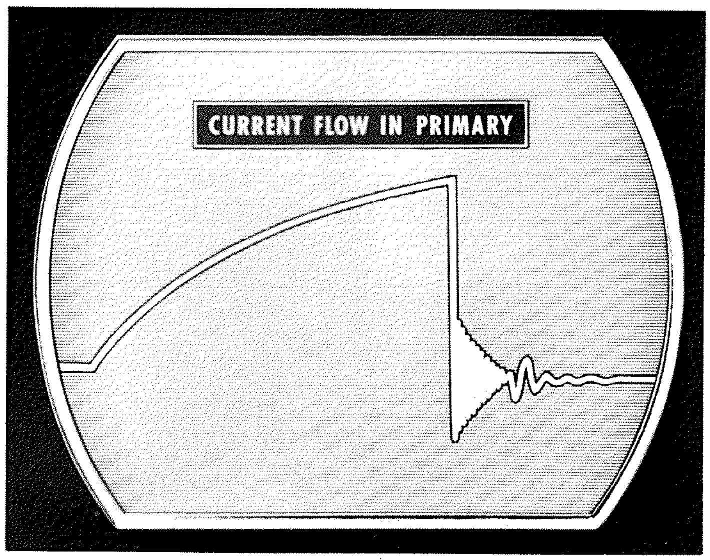
can't see current flow through a wire but we do have ammeters which register the amount of current flow on a graduated scale, which can be seen and read. In an ignition circuit, voltage and current changes occur so rapidly that normal meters cannot follow these changes



fast enough to give a clear picture. We need considerable help to unravel the apparently invisible actions which take place in creating a high tension spark. An oscilloscope is an instrument which can follow such electrical impulses and show a light-beam picture of what happens in an electrical circuit, in great detail. It is much like a high-speed camera in that the faster the

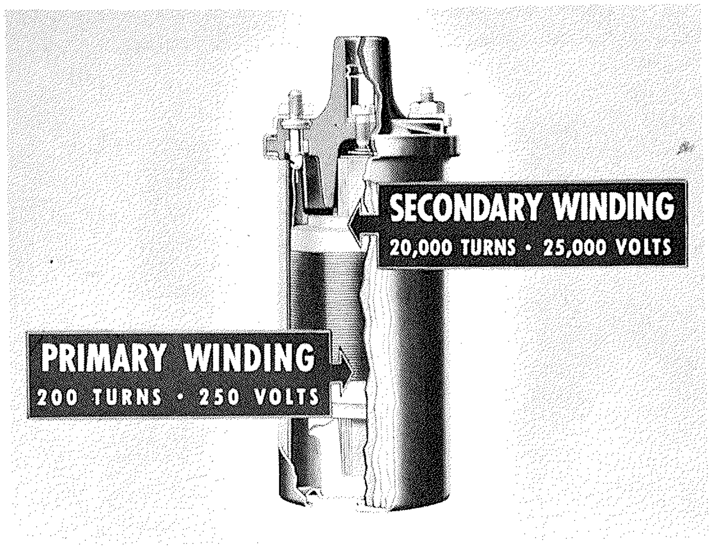


pictures are taken in a given period of time, the slower the action becomes when shown on a screen. Movements thus can be seen which ordinarily would be invisible because of speed. With the oscilloscope the time base

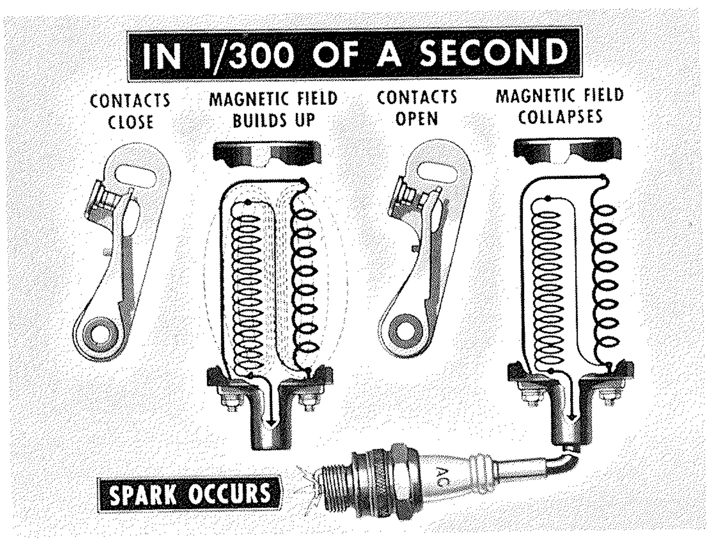


is very flexible enabling us to get pictures so detailed that we can see voltage and current waves which oscillate at the unbelievable speed of 150 million cycles per second. A special type of oscilloscope which has brought about this remarkable aid to the human eye was developed by Delco-Remy. It is no longer necessary to guess about things which happen when ignition contact points open, they now can be pictured on a screen much like the viewing screen in a television set.

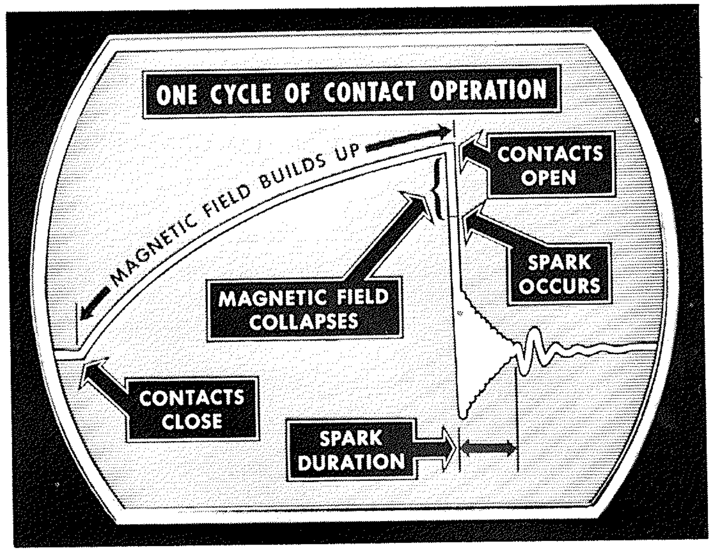
A typical ignition system consists of a primary and a secondary circuit magnetically linked together by the construction of the ignition coil. The battery or generator supplies current to the primary circuit which builds up a magnetic energy field around the coil. The quick col-



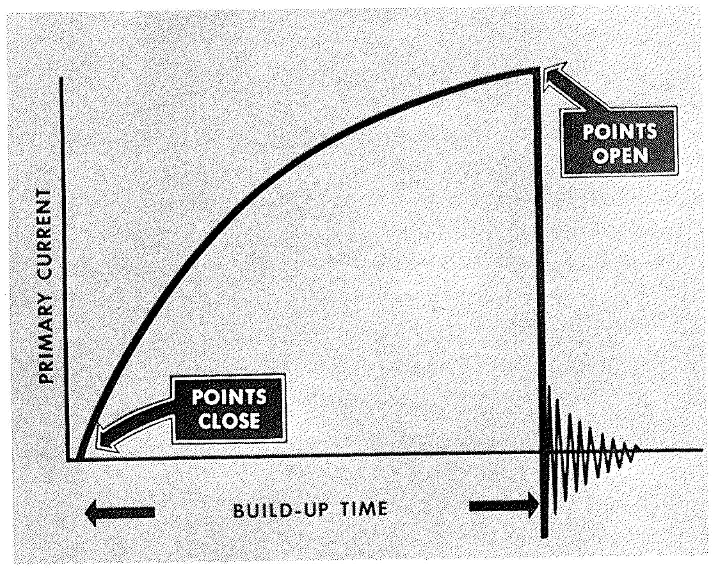
lapse of the magnetic field induces a voltage in both windings, proportionate to the number of turns. The secondary winding has the greatest number of turns and the high voltage produced in this circuit is used to deliver a spark to fire the gas mixture in an engine cylinder. For every high voltage surge, the ignition system uses the 6 volts from the battery and steps it up to the 4,000 to 18,000 volts required to fire the spark plug. On an 8 cylinder car, 12,000 of these sparks, or high voltage surges, are produced for every car mile. At 90 miles per hour, the ignition system is delivering 300 of these high voltage surges every second. In one three-



hundredth of a second the distributor contact points close, the magnetic field of the coil builds up, the points open, the magnetic field collapses and the high voltage surge is delivered to a spark plug. That is truly high-speed operation. These facts can be proved by figures but this does not help in understanding how so many things can happen in such a short interval of time. Pictures taken at ultra-high speed by the oscillograph (an oscilloscope equipped for taking pictures), like those from a high-speed camera, stretch out the action and give us time to take a good look at what goes on.

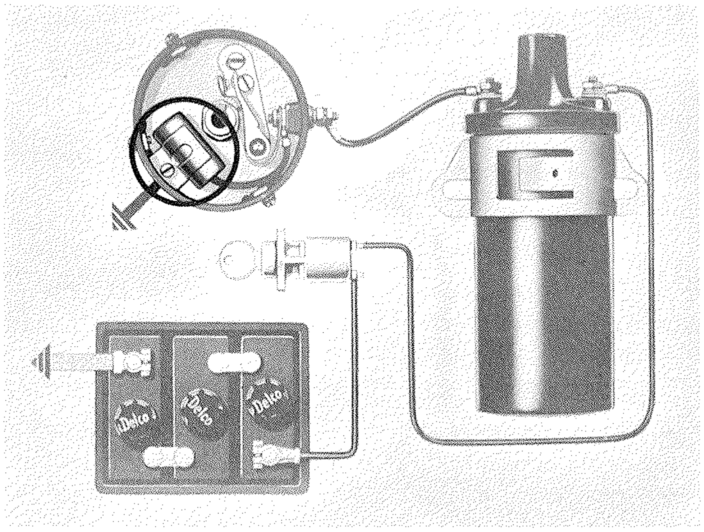


When the ignition switch is turned on and the distributor contact points close, current flows through the primary winding of the ignition coil, creating a magnetic field around the coil. The current, however, and the magnetic field do not increase to their peak, or full value, instantly. It takes a small fraction of a second, called the build-up time, for the current flow and the

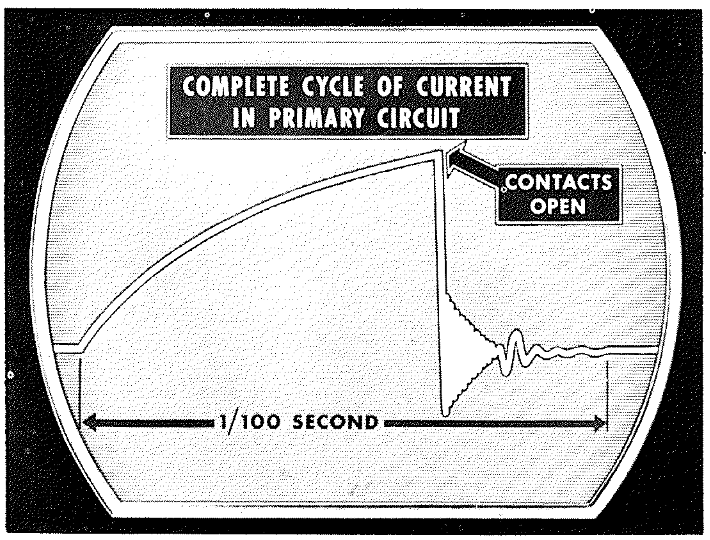


magnetic field to reach their maximum. The value attained is determined either by the resistance of the coil winding or by the length of time the contact points remain closed. Normally the current does not have time to reach the maximum determined by the resistance of the winding, because the contact points remain closed for such a short period of time. This is one condition ignition engineers must consider in designing ignition equipment. Coil characteristics must be balanced with build-up time, so that at top speed, when the contact points remain closed the minimum time, the ignition coil still will build up sufficiently for good ignition.

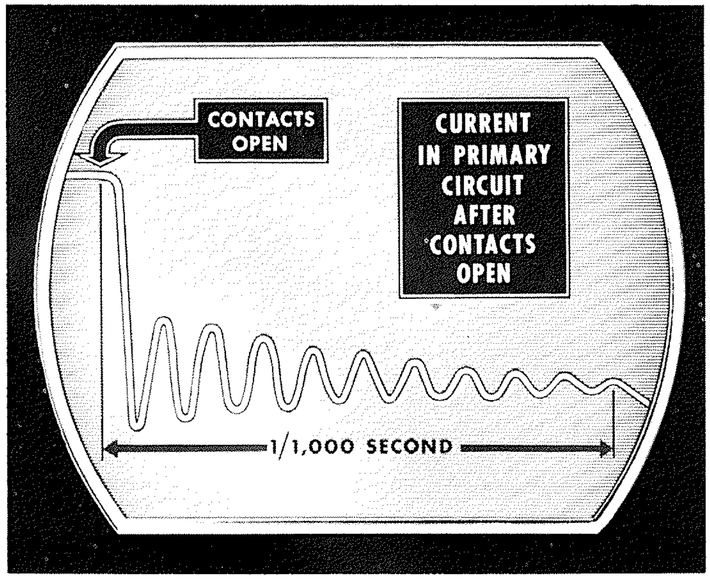
When the distributor contact points begin to open the current flowing in the primary circuit tends to continue its flow, a natural occurrence in all windings and especially those with iron cores. Without an ignition condenser the voltage causing this current flow would establish an arc across the contact points as they separated and the energy in the ignition coil (stored momentarily in the form of a magnetic field) would be consumed in this arc.



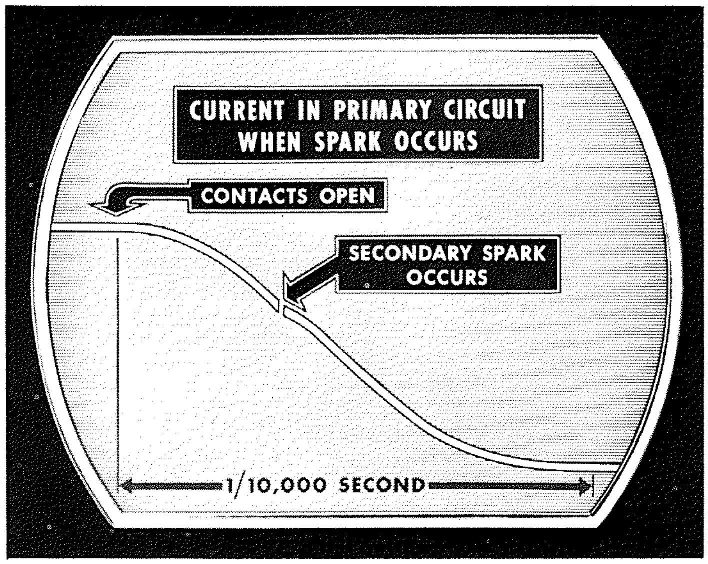
Not only would this cause burning of the contact points, but normal ignition performance would be impossible. The condenser prevents an arc from forming because it momentarily provides a place for the current to flow, thus bringing the flow of current to a quick, controlled stop. Therefore, the magnetic field, produced and sustained by the current flow, quickly collapses. It is this quick collapse of the magnetic field which induces high voltage in both the primary and secondary windings of the ignition coil. The voltage induced in the primary may be as high as 250 volts and, consequently, the secondary voltage may go as high as 25,000 volts.



One cycle of contact points closing and opening at 30 miles per hour would take place in one one-hundredth of a second and our picture of the current flow during this interval is clearly indicated. But things are happening that we cannot see, so a high-speed camera used

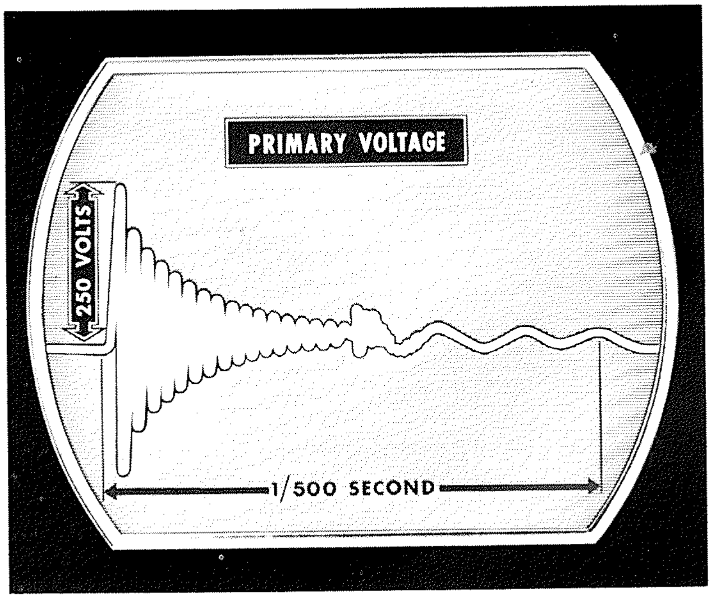


on the right-hand portion of this curve where the points open, taking pictures 10 times faster, shows more detail. It will indicate the condenser action after the contact points open. The sharp current drop at the left, pictured

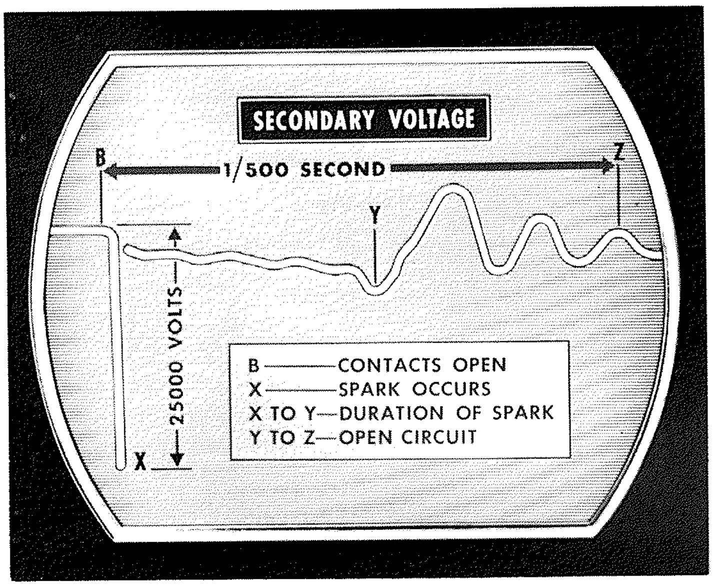


alone with a still faster camera, operating at one ten-thousandth of a second, shows a break in the line when the current has reduced only about one-third. This indicates when a spark occurred in the secondary and refutes the old belief that the high voltage spark took place when the condenser discharged back through the primary.

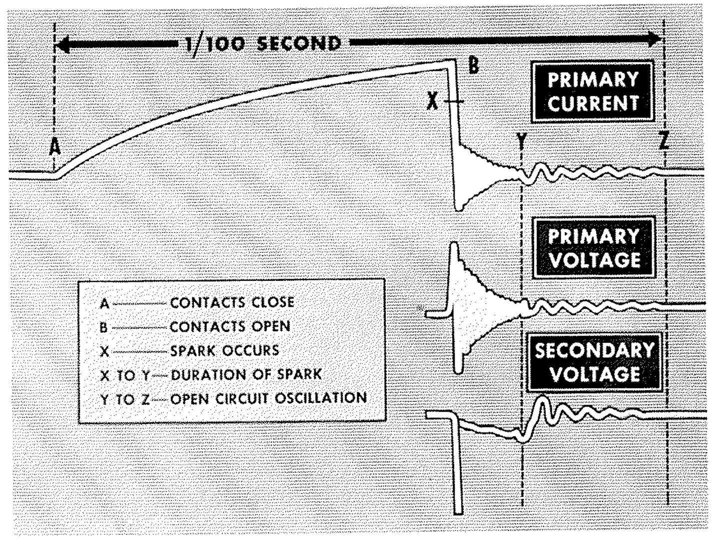
All we have shown and talked about has been the current in the primary circuit, speeding up each picture in order to show more detail. Since the primary and secondary are linked together magnetically, other things are occurring at the same time. With the collapse of the magnetic field around the coil, the primary voltage, which may reach 250 volts, oscillates at a high frequency for the duration of the spark and then matches the open circuit oscillation of the current curve when

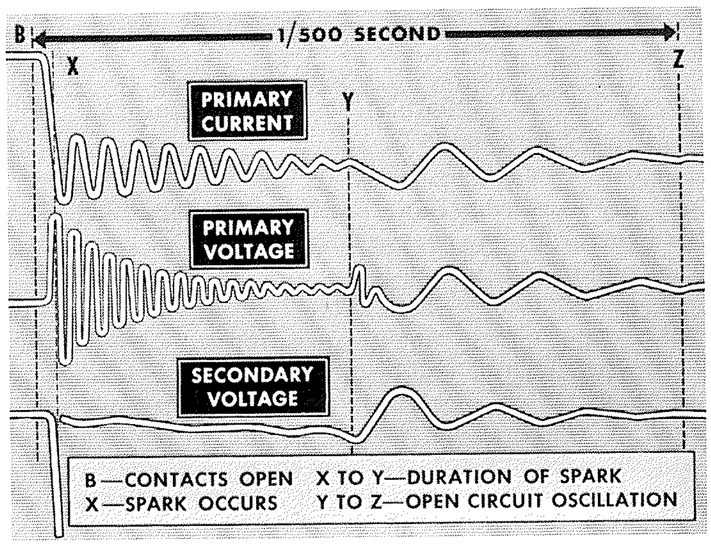


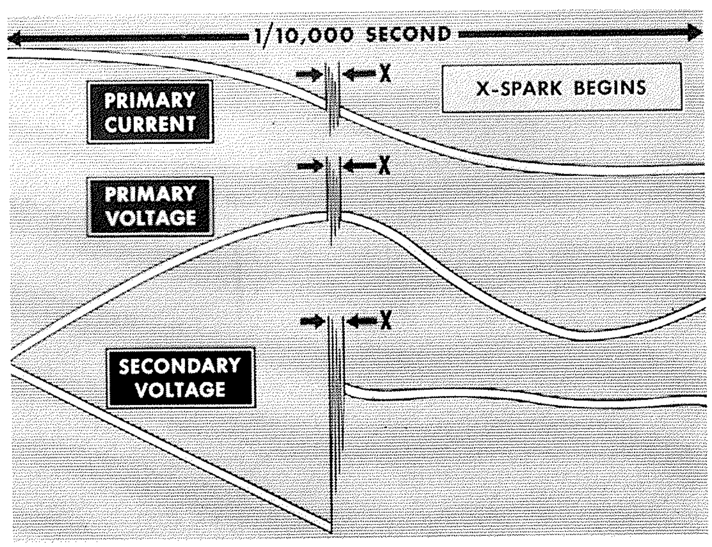
the spark goes out. At the same instant the secondary voltage may reach 25,000 volts. When a spark is established, which may be at some lower value, the secondary voltage drops back to a few thousand volts for a short interval of time.

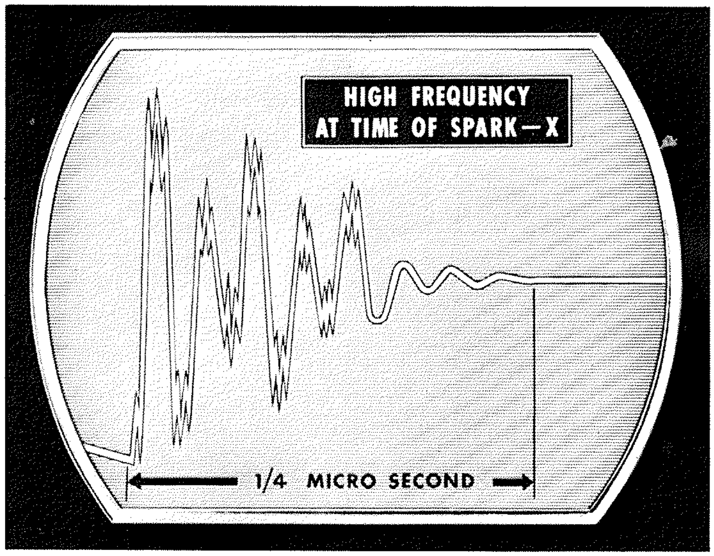


It will be noted that the voltage is shown below the zero line which means that the secondary voltage used for ignition should be negative with respect to ground at the time of ignition. Negative voltage at the center electrode results in a lower and more consistent sparking voltage than that obtained when the center electrode is positive. Since the pictures of primary current, primary voltage and secondary voltage show events happening at the same time, a direct comparison can be made with one one-hundredth of a second as a time base. When the picture speed is increased five times with one five-hundredth of a second as a time base, the shape of the current and voltage waves is brought out clearly. Only when the left-hand portion of these curves is photographed at one ten-thousandth of a second have we slowed the movement down to a point where we can see a break in each of the curves. This break indicates the time the spark is established and is accompanied by a high-frequency wave which can be followed only by an exceedingly high-speed camera. To see this frequency, which occurs in the secondary when the spark first is

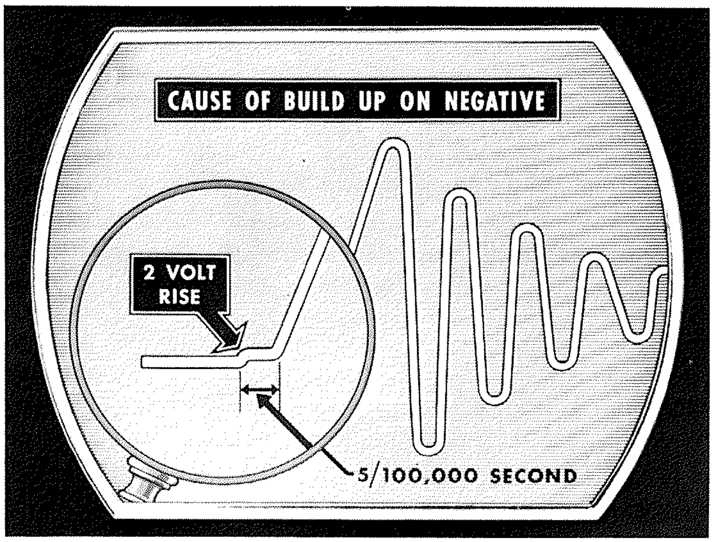




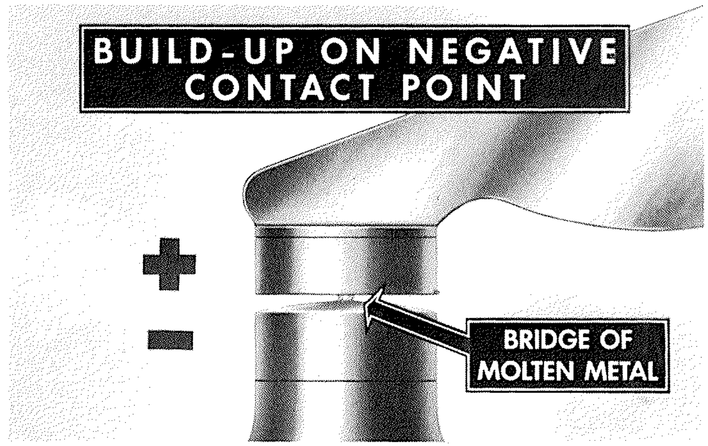


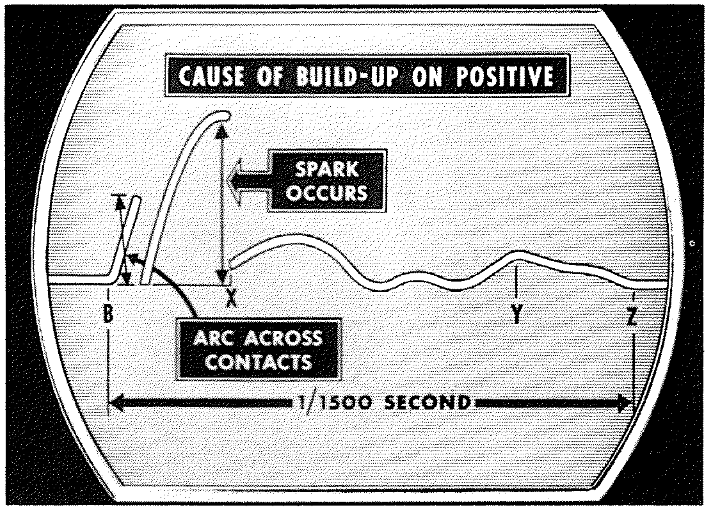


established, our camera is cranked up to its highest speed to follow this wave. This picture shows only what is happening during the break in the former curves. It oscillates at the rate of 30,000,000 cycles or more per second and lasts for only one-quarter of a millionth of a second. That is a very short interval of time but it is this frequency which causes radio and television interference.

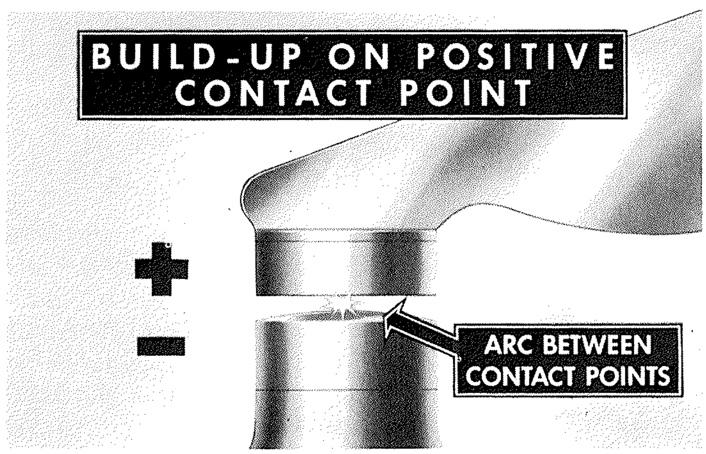


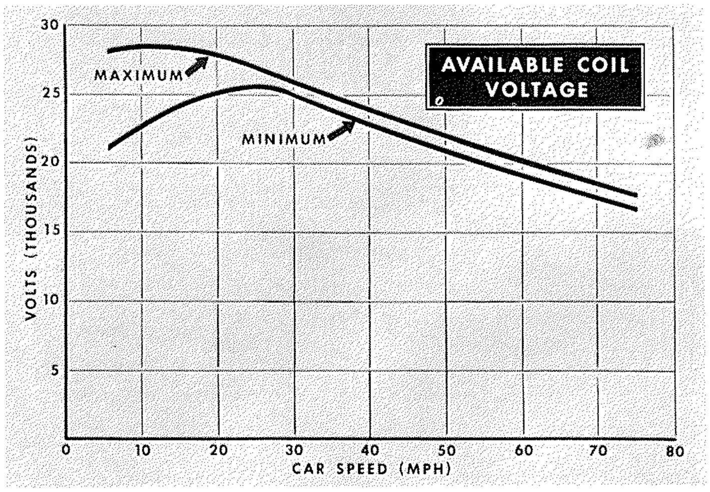
Other pictures at extremely high camera speeds bring out further interesting details which affect ignition performance. The primary voltage curve shows a rise of 2 volts just before complete separation of the points. A bridge of molten metal, consisting of a few molecules in volume, is between the points at the time of this rise in voltage. This "burn," as it may be called, causes build-up of material on the negative point. This condition exists every time the contacts separate. Sometimes the voltage builds up so fast in the primary, due to coil design or circuit capacity, that it jumps across the gap of the separating points, causing an arc which dissipates some of the energy. The voltage build-up starts over again but does not reach as high a value as it would have if the arc had not occurred. These arcs cause a temperature high enough to vaporize the metal, which then builds up on the positive contact point. Some of these arcs are desirable to balance transfer of material on the negative contact point which occurs in every break.

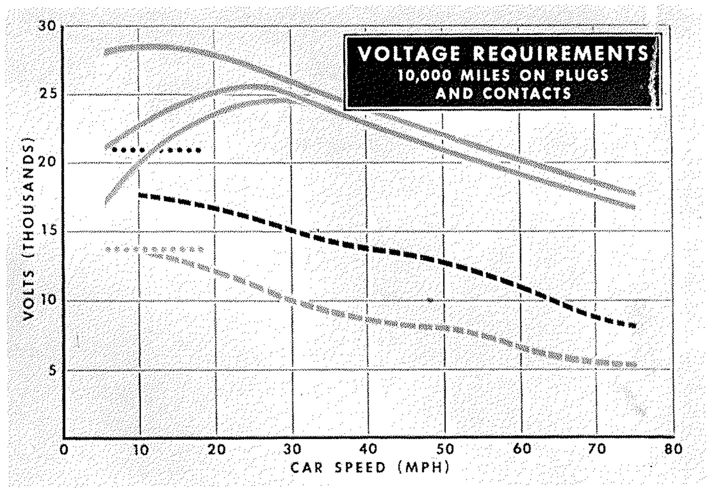




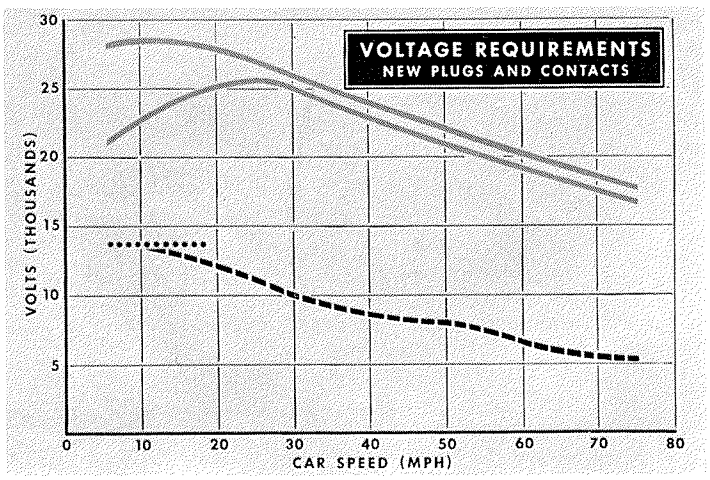
The graphs which have been shown are reproductions of fundamental occurrences in an ignition circuit while in operation. It is hoped that the principles brought out will remove much of the mystery which has surrounded ignition since its first application on automotive engines. These principles should form a background for a better understanding of ignition equipment and its functions, enabling us to obtain better ignition performance.



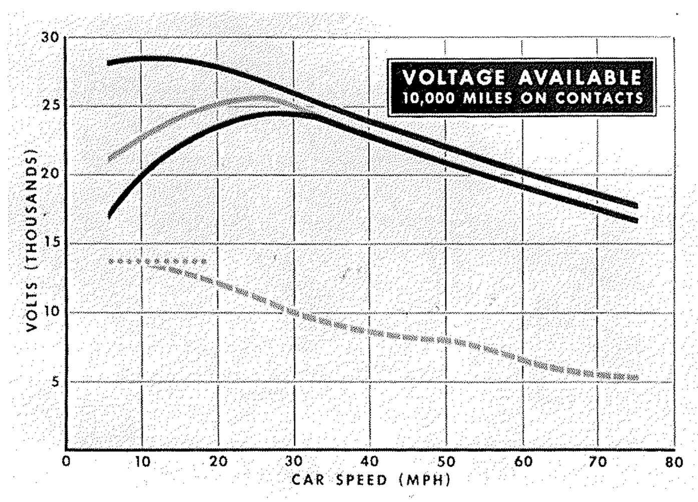




Variations in the voltage required to fire a spark plug are due to engine compression, engine speed, mixture ratios, spark plug temperatures, width and shape of spark gap and many other factors. The voltage available from an ignition coil varies with speed but a wide range be-



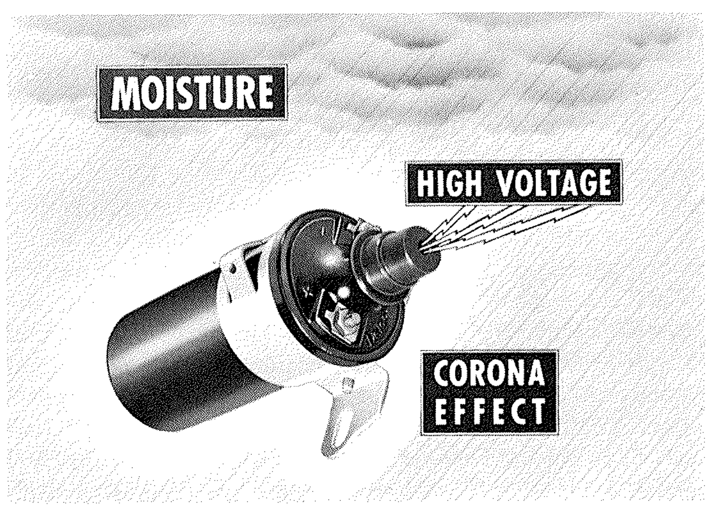
tween maximum and minimum voltages is noticed at lower speeds. Whenever an arc occurs at the contact points, a lower secondary voltage is the result. It is necessary that the voltage requirements to fire the plugs never exceed the minimum voltage available, otherwise missing

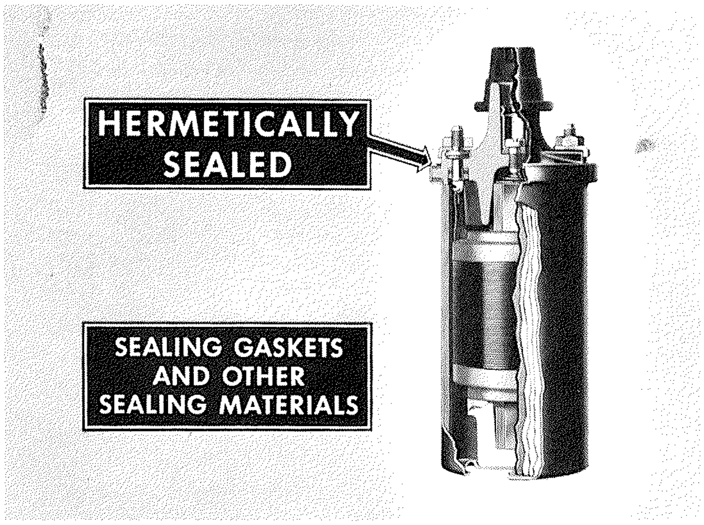


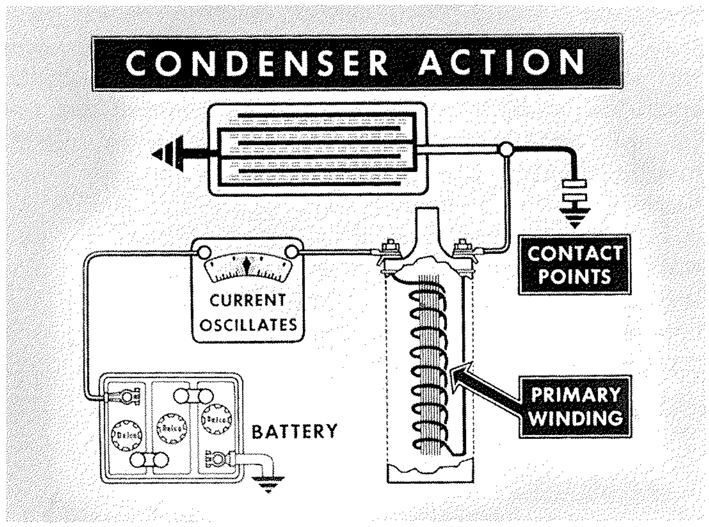
will take place. New points give the highest available voltage and new plugs have the lowest requirements. After approximately 10,000 miles of service, the presence of some oxide on the contact points will lower the minimum voltage available at low speeds. During the same period, the spark plug gaps may increase as much as .015 and the electrode usually becomes rounded instead of having sharp corners. These conditions increase voltage requirements and cut down on the amount of available reserve. Cleaning and adjusting contacts, filing off the rounded end of the spark plug electrode and readjusting the gap will again lower the requirement.

The voltage which can be obtained, beyond what actually is required to fire the plugs, represents the electrical reserve built into the ignition system. Installation of coils close to the distributor, keeping spark plug leads as short as possible and connecting coil terminals properly to assure negative high tension are other means of conserving electrical reserve.

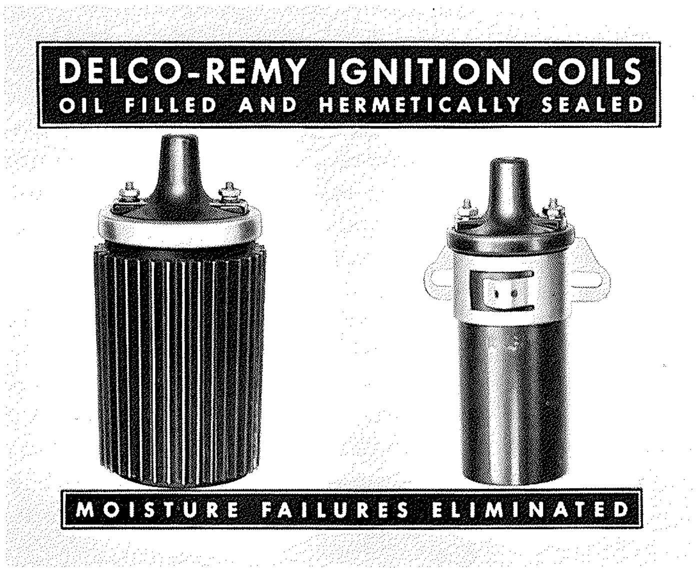
In addition to electrical performance requirements, the ignition coil must be built to withstand moisture, the heat developed in the windings, and also the corona effects and stresses resulting from the high induced voltages. Consequently, late Delco-Remy ignition coils are





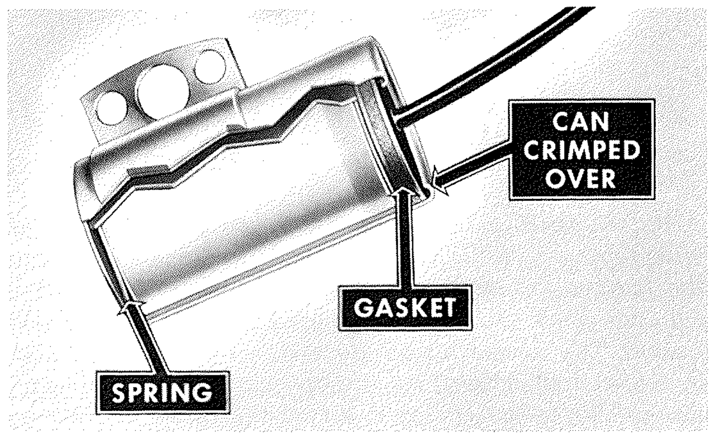


oil-filled. The oil permits more rapid heat dissipation, provides greater insulation strength and reduces the possibility of insulation failures. The coil is hermetically sealed against the entrance of moisture, by the use of special sealing gaskets and other sealing materials. This prevents the coil from "breathing" (drawing in moisture during the cooling off period) which might ultimately cause the coil to fail.

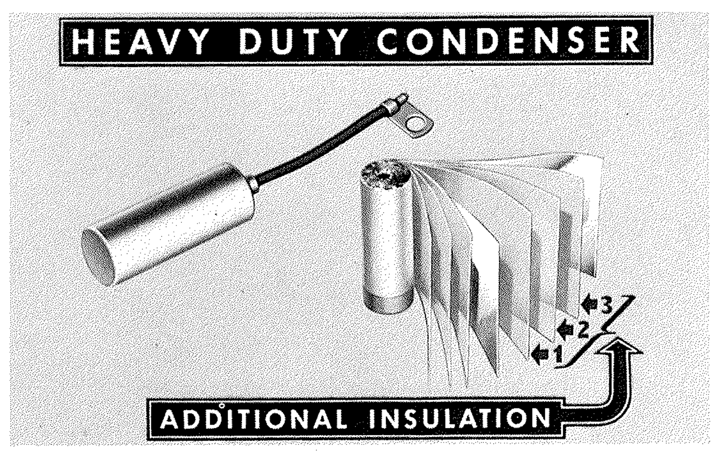


Oil filling and hermetic sealing of ignition coils have removed the greatest single cause of coil failures—moisture. At first, heavy-duty coils were made in this way only for truck, motor coach and marine applications where long and trouble-free service is so important. Today, these same features are available in all Delco-Remy ignition coils.

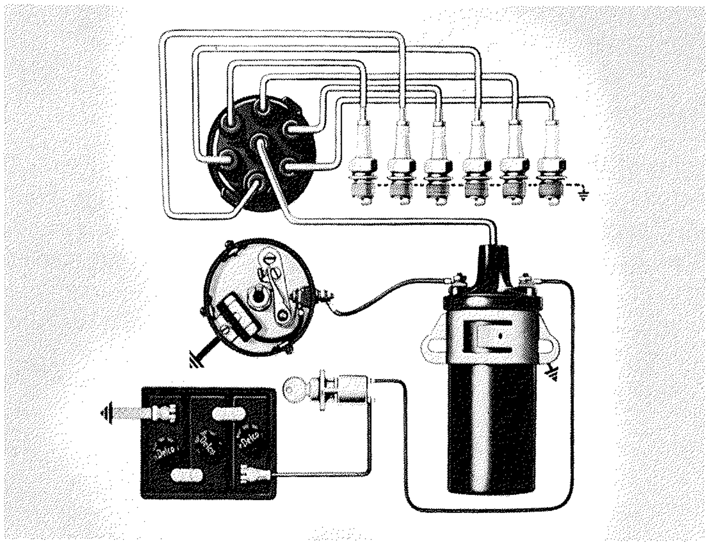
No ignition system would function without a condenser. It reduces the arc at the contacts, as the points first separate, by providing a place where current can be stored until the points are completely separated. Condenser action requires a high-quality insulation between the two foil sheets. The difference in voltage on the two sides of this dielectric creates the oscillating action which brings the voltage and current to a controlled stop. Delco-Remy ignition condensers all are hermetically sealed. The condenser can is crimped down against the outer gasket in the assembly process. This compresses the heavy spring at the bottom of the can with a 40-pound



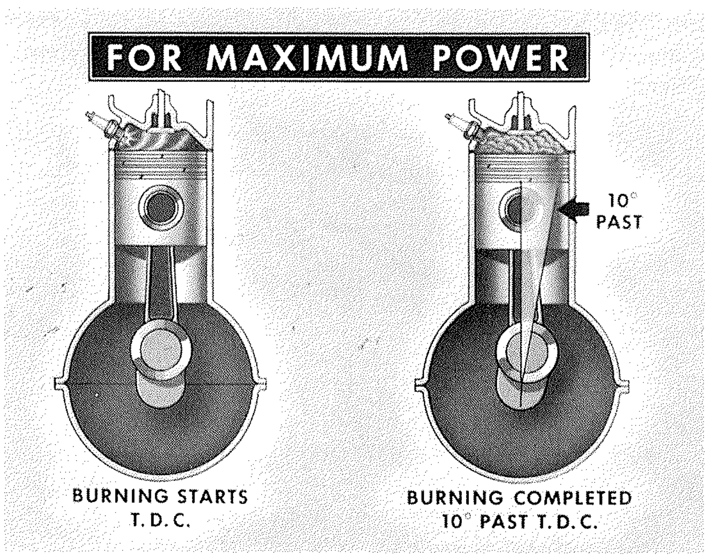
tension to guarantee an effective seal at the inner and outer gasket surfaces. This pressure also provides solid, permanent contact at both ends of the condenser winding, over the full area of the winding. This feature minimizes the possibility of high series resistance in the condenser assembly.

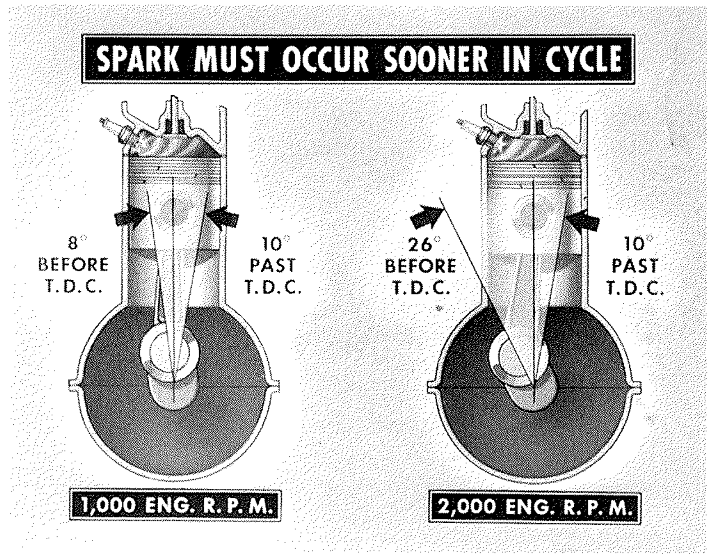


Heavy-duty 6- and 12-volt condensers require more electrical insulation between the foil sheets, and to maintain the same capacity, a longer can is required. With the exclusion of all moisture, heavy heat insulation is not required since heat *plus moisture* was the cause of premature failures. The production check on these condensers consists of heating them in an oven to 180° F., submerging them in water until cool and then drying and testing them. All heavy-duty condensers must show not less than 4,200 megohms of resistance on this test. A breakdown failure of this condenser never has been reported.



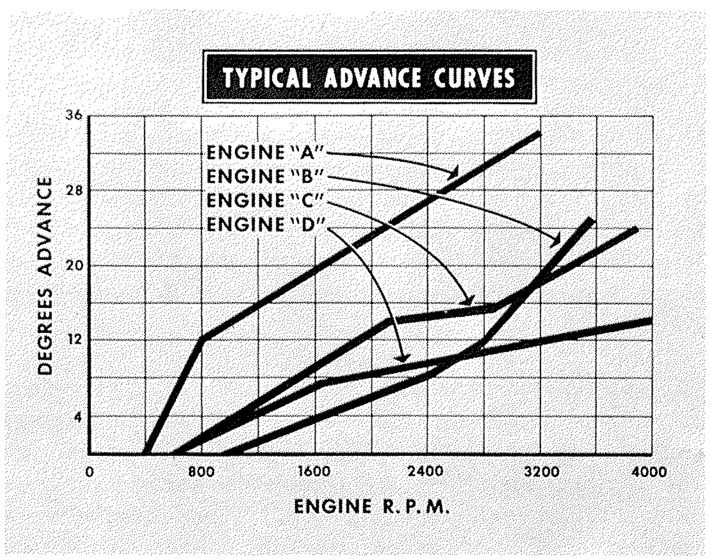
After the ignition coil produces the high voltage surge, with the help of the condenser, the ignition system has the further job of distributing the surge to the correct cylinder spark plug and this must be done at the correct instant. The correct instant depends on engine speed and, in many applications, on intake manifold vacuum conditions. When the engine is idling, the spark is timed to reach the cylinder spark plug just before the piston reaches top dead center. The burning time of the gas mixture in an automotive engine is approximately .003





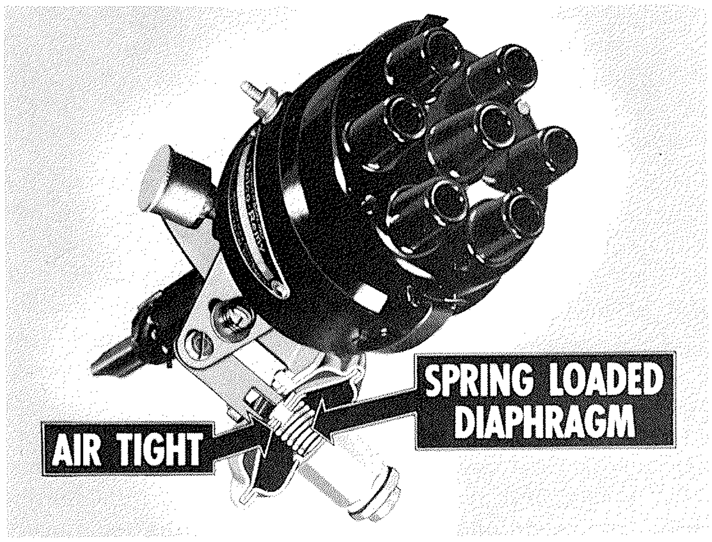
of a second. To obtain full power from the explosion, the burning must take place before the piston travels 10° to 20° past top dead center. At 1,000 engine r.p.m. the crankshaft would travel through 18° in .003 of a second, at 2,000 r.p.m. it would travel through 36°. It is easy to see that since the completed burning point is fixed, we must get the spark into the cylinder earlier in the cycle in order to deliver full power, when engine speed increases. To obtain this spark advance based on engine speed, Delco-Remy distributors have a centrifugal advance mechanism which consists of two weights which throw out against spring tension to advance the breaker cam as engine speed increases. The timing consequently varies from no advance at idle, to full advance at high engine speed, when the weights reach the outer limit of their travel.

The centrifugally controlled advance for a particular engine is determined by operating that engine at wide-open throttle on a dynamometer and varying the spark advance at each engine speed until a range of advance is found which gives maximum power.

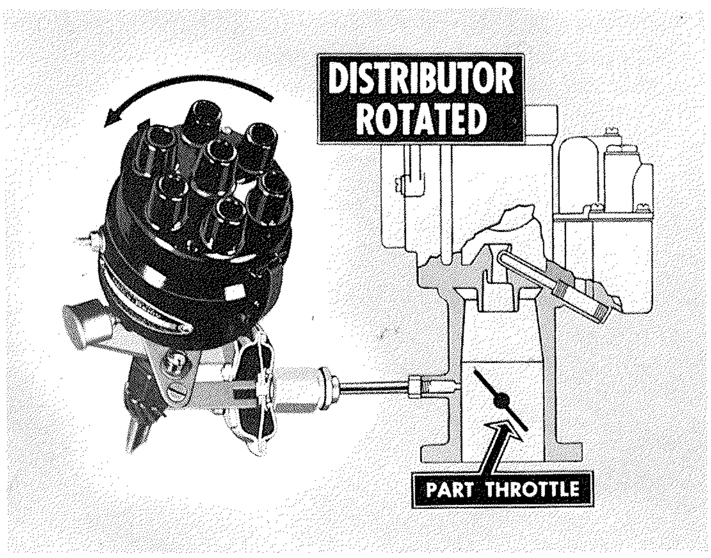


Centrifugal advance weights, automatic cam contours and weight springs are then selected to provide an advance curve which will fall in the full power range. A few typical centrifugal advance curves illustrate the variations in spark advance required on various engines.

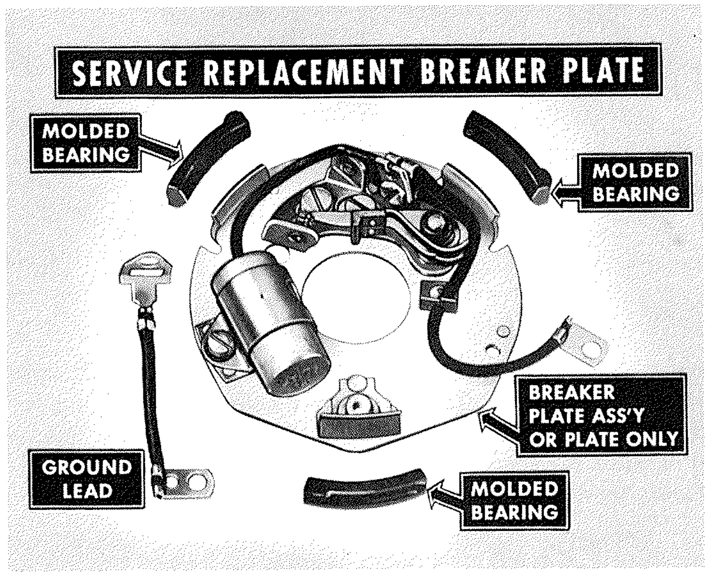
Under part throttle operation there is a high vacuum in the intake manifold. Accordingly, the charge taken into the cylinder is not so highly compressed and burns at a slower rate. With this condition an additional spark advance will increase fuel economy.



Therefore, on many applications where part throttle operation predominates, a vacuum advance mechanism is used to secure this additional spark advance and increased economy. The vacuum advance mechanism consists of a spring loaded diaphragm connected through linkage to the distributor. The spring loaded side of the diaphragm is airtight and is connected through a vacuum passage to an opening in the carburetor. This opening is on the atmospheric side of the throttle valve when the throttle is in the idling position and consequently there is no vacuum advance.

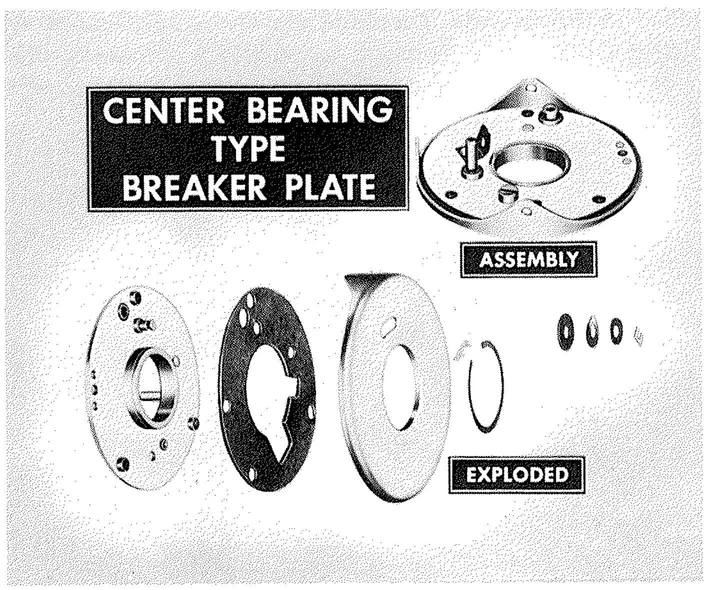


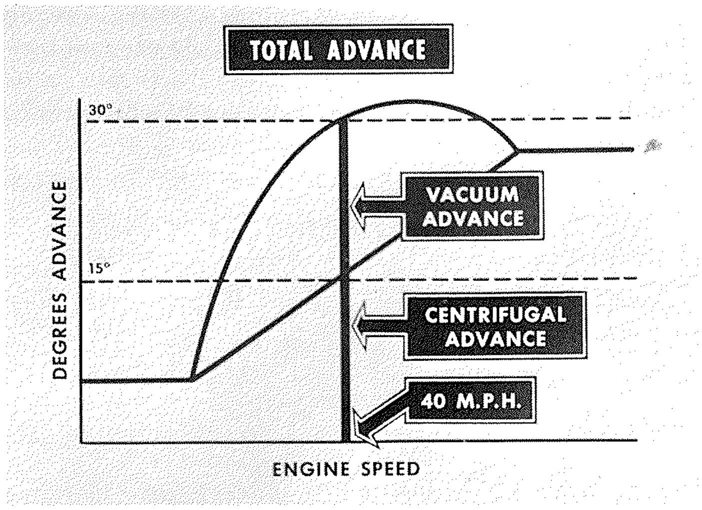
When the throttle is opened, it swings past the opening of the vacuum passage. The intake manifold vacuum then moves the diaphragm and rotates the distributor in its mounting. This produces a spark advance based on intake manifold vacuum.



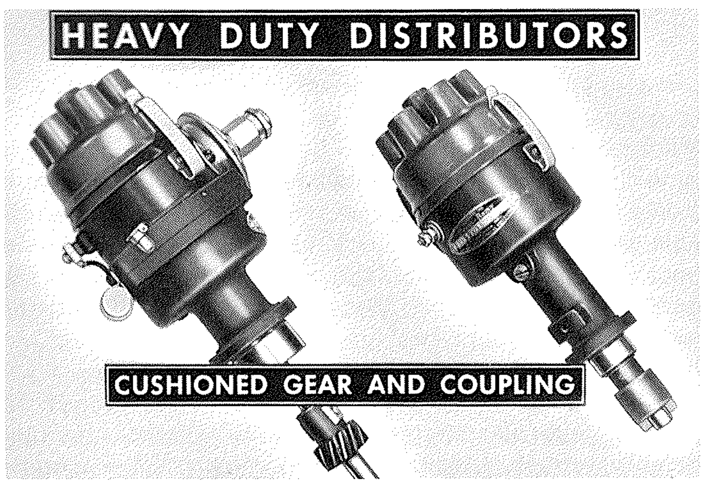
Many applications employing vacuum advance rotate the breaker plate only, instead of rotating the entire distributor in its mounting. The breaker plate on one such unit is supported on three ball bearings so it can rotate freely. A Delco-Remy service replacement plate is available for this type distributor which uses three molded bearing blocks on which the movable plate glides. On another type distributor, the movable breaker plate turns on a central bronze bearing and is supported by three molded buttons at the outer diameter.

At any particular engine speed there will be a certain definite centrifugal advance, plus a possible additional advance, resulting from vacuum conditions in the intake manifold. For example, at forty miles an hour, the cen-

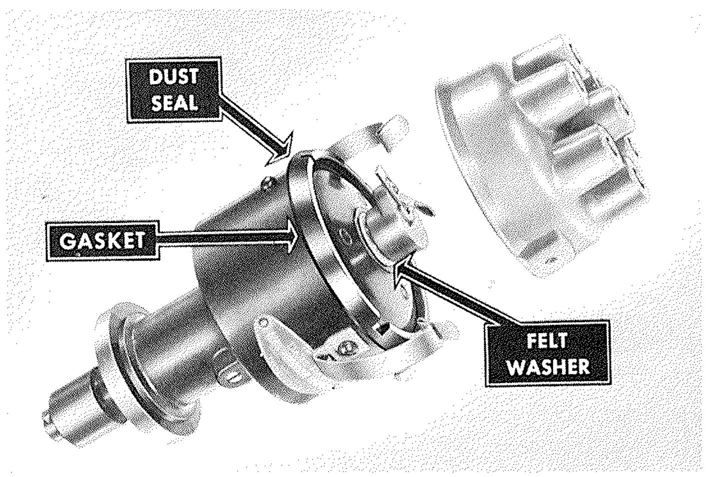


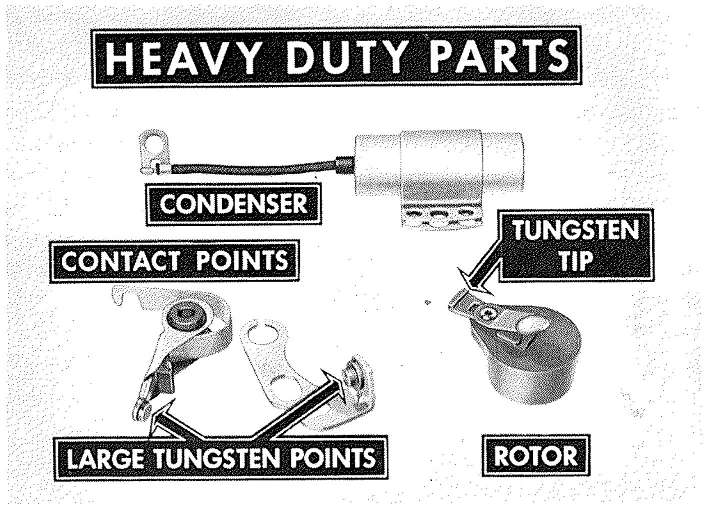


trifugal advance on this particular application will provide 15° advance. The vacuum mechanism will supply up to 15° additional advance, under part throttle operation. However, with wide-open throttle, this vacuum advance would not be obtained.



Heavy-duty distributors, as well as some passenger car types, have taken on a new appearance with many added improvements. Torsional vibration, aggravated by higher compression engines, made shock-absorbing distributor drives a necessity. Both gear and coupling drives

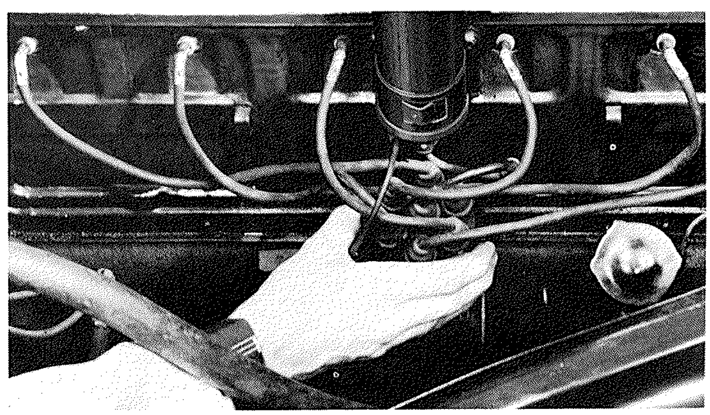




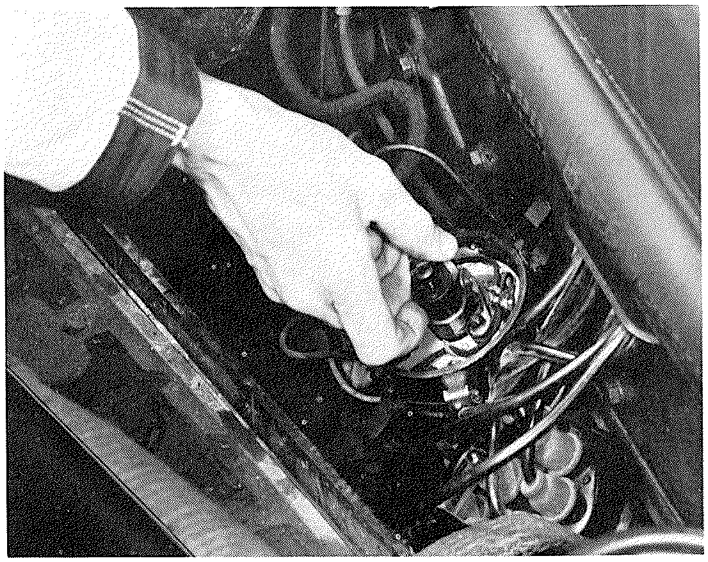
are now built with synthetic rubber shock members to absorb torsional vibration and prevent damage to distributors. The shaft bearing is a full length, porous bushing with an oil reservoir between the bushing and the casting, making possible long periods of service without attention. The breaker compartment is sealed to keep out dust which would cause cam and rubbing block wear. A cam lubricator impregnated with a non-bleeding grease also lengthens the life of cams and rubbing blocks. Special molding materials used in caps and rotors prevent arcing and tracking caused by moisture. Heavy-duty condensers and contact points, and tungsten tipped rotors give added service for income-producing operations.

While an explanation of the functions of various units of the ignition system has been complicated, the units themselves are comparatively simple and can be checked with standard types of test equipment. Periodic inspection is essential to obtain peak performance on present-day cars and the ignition certainly should not be overlooked. A complete checkup should include the following steps.

First, determine the condition of the battery and the battery cables, because if they are not capable of delivering current at sufficient voltage to the ignition system, proper ignition performance will not be obtained.

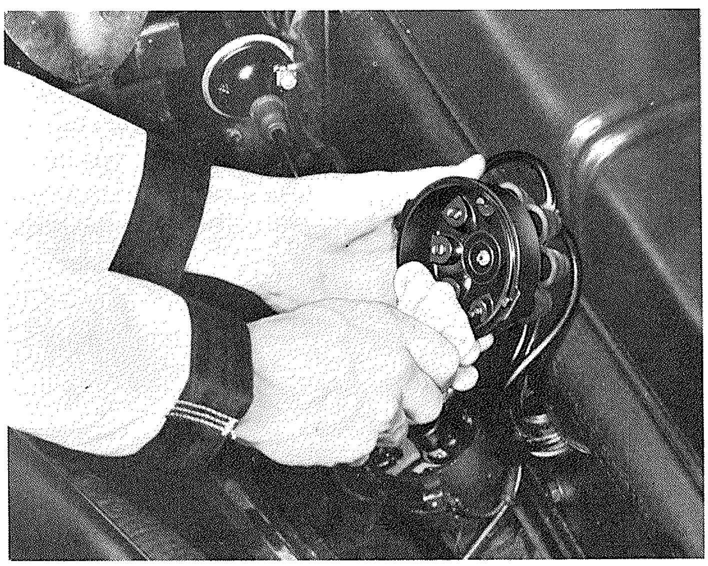


To check the vacuum advance unit on the type application which rotates the distributor, turn the distributor in a direction opposite to the normal rotation of the breaker cam. The distributor should turn freely and the vacuum advance spring should return it to its original position when released. On the type where the breaker plate is supported on bearings for vacuum advance, rotate the breaker plate to check the vacuum advance mechanism.

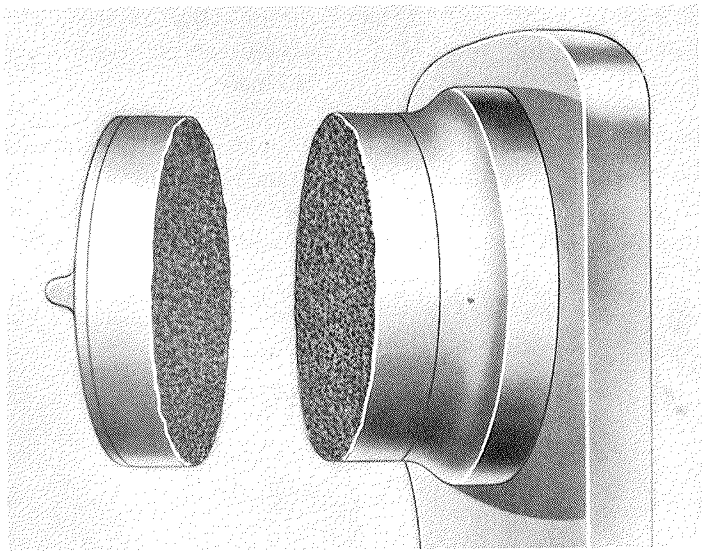


The centrifugal advance can be checked by turning the breaker cam in the direction of its normal rotation. It should rotate freely and the advance springs should return it, without sticking, to its original position when released.

These checks give a quick indication of whether or not the advance mechanisms are operating. Special testing instruments are required to check them accurately.



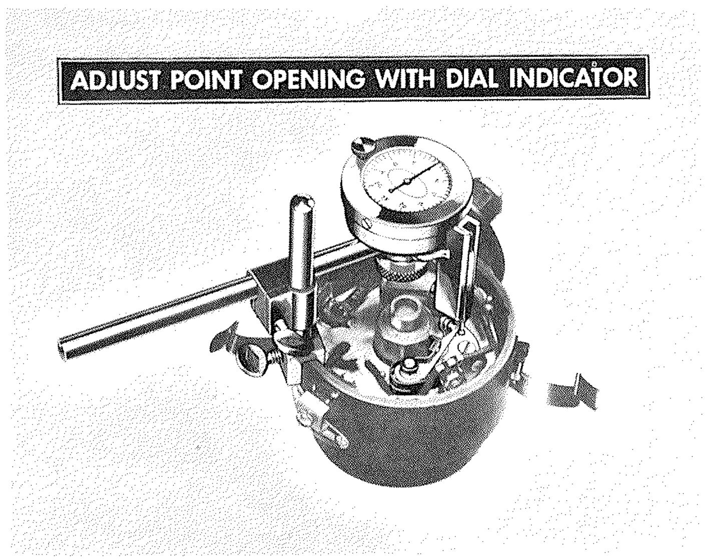
Wipe out the cap with a soft cloth and inspect both cap and rotor for chips, cracks and carbonized paths which would allow high-tension leakage to ground.



If the contact points are burned or pitted they should be replaced or dressed with a clean fine-cut contact file or stone. Blow out all dust. Be sure no loose particles remain on the point surfaces after completing the dressing operation. Never use emery cloth or sandpaper to clean the points, since particles of these materials may embed in the contact surfaces and cause the points to burn.

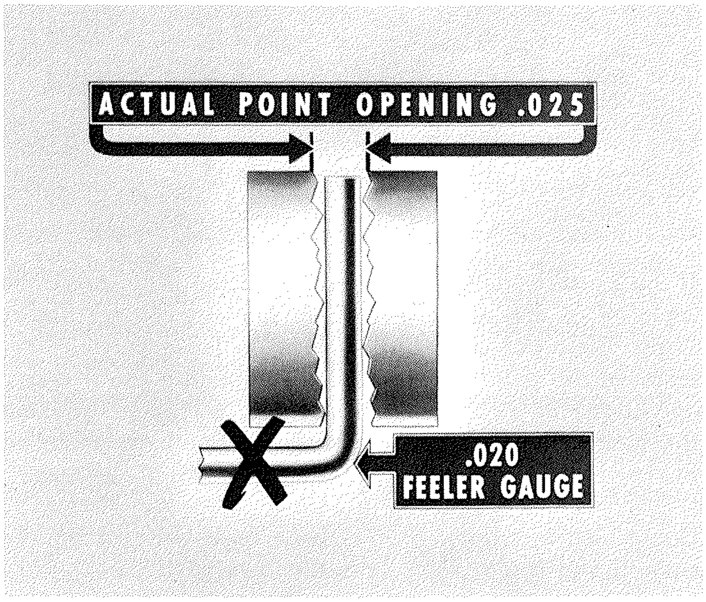
Contact surfaces which have been used will not appear smooth and bright. This does not necessarily mean they are not operating satisfactorily. Often they may be making contact over an even greater area than could be obtained with new points.

If the points need cleaning or replacement take the distributor off the engine, since this job can be done more easily on the bench. Notice the relative position of the rotor and the distributor with relation to the engine before removing the distributor. It will then be easy to reinstall the distributor in the same approximate position and only a small adjustment will be necessary to complete the timing.



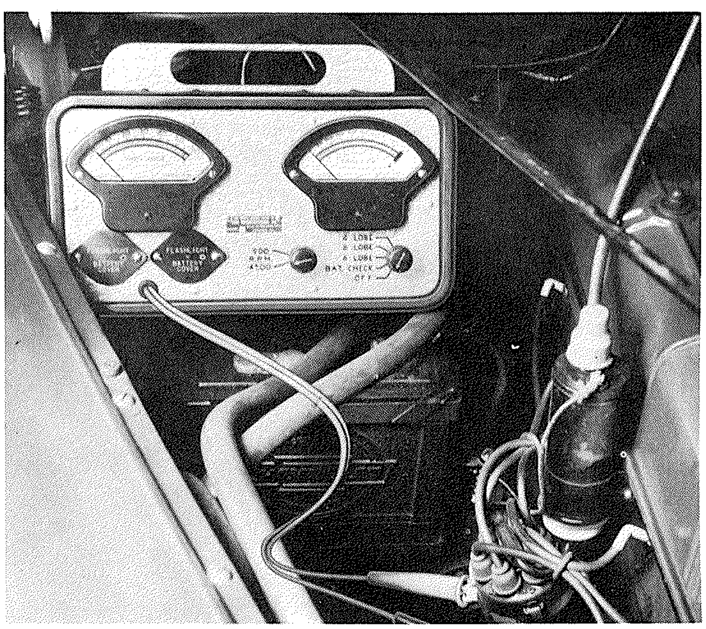
A timing light may be used to time the engine. The instructions of the engine manufacturer should always be followed when setting the timing.

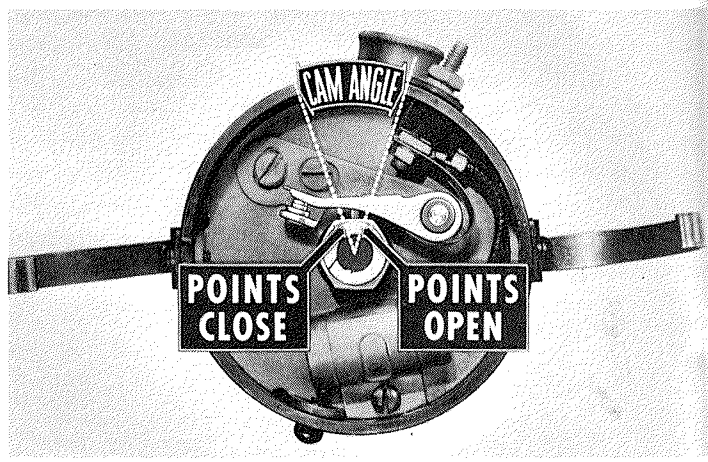
The contact point opening can be checked and adjusted on most cars, without removing the distributor, by use of a dial indicator. The dial indicator measures the movement of the movable contact point in thousandths of an inch.



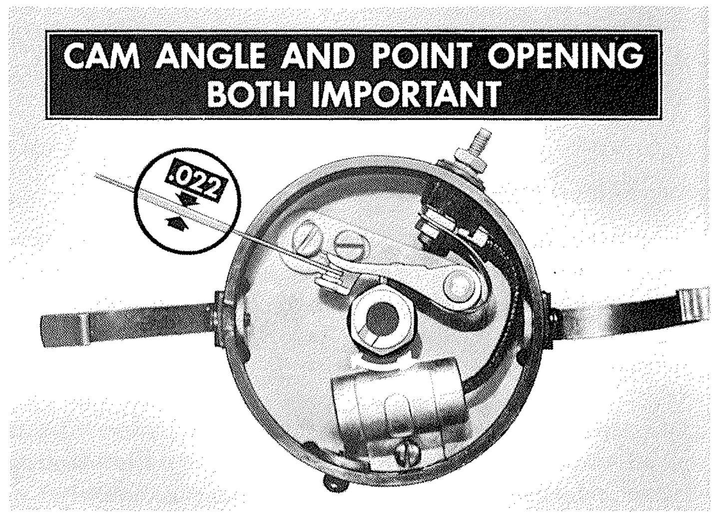
The point opening of used points cannot be checked correctly with a feeler gauge, since a feeler gauge measures from high point to high point on the contact surfaces and not the true point opening.

A cam or contact angle meter also may be used under normal conditions to check the cam angle on the car. There are several makes of contact angle meters. Any reliable instrument may be used.

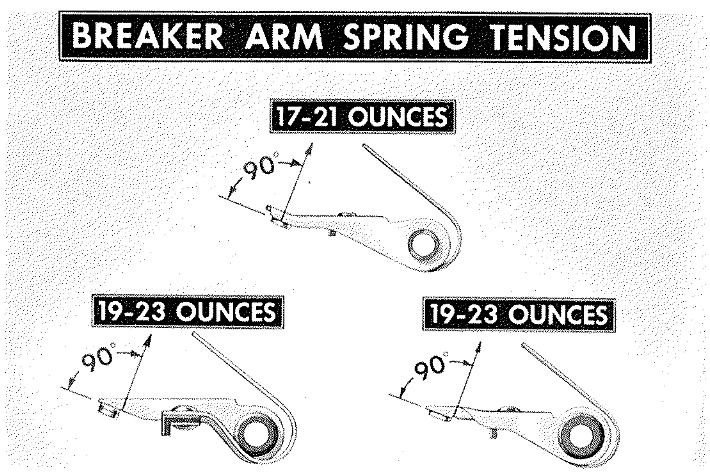




The cam angle, sometimes referred to as dwell angle, is the number of degrees the cam rotates from the time the contact points close until they open again. The contact angle increases as the point opening is decreased, and is reduced as the point opening is increased.



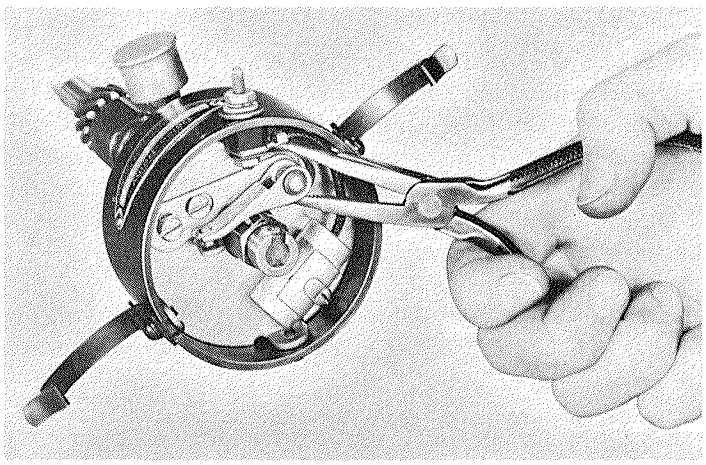
Point opening and cam angle are both requirements for good ignition. The maximum cam angle is required only for top engine speeds but a reasonable point opening is required for all speeds. Be sure the contacts always separate according to specifications even when a cam angle meter is used as a check.



To adjust the point opening, loosen the locking screw and turn the eccentric screw. Tighten the lock screw after adjustment.

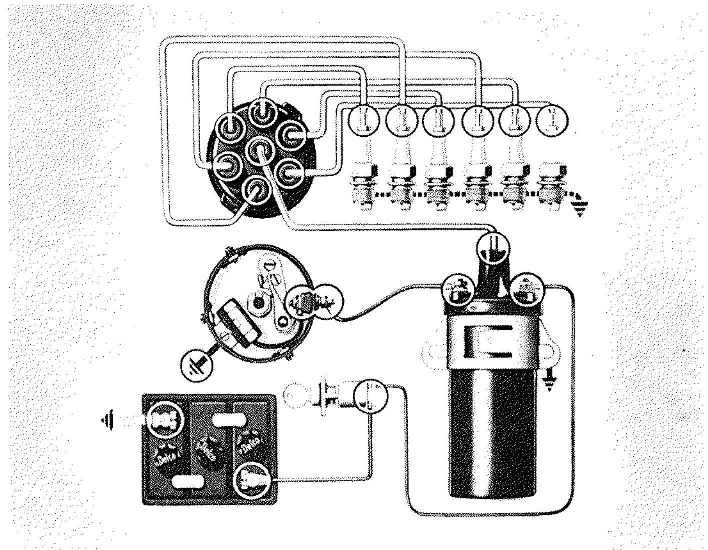
The contact point pressure should be measured with a spring gauge. The spring tension must give the correct point pressure for each type of breaker lever arm. Weak tension will cause the points to flutter and bounce at high speed and this results in a high-speed miss. Too much spring tension will cause excessive wear of the cam and rubbing block.

The point pressure of all breaker lever arms should be 17-21 ounces measured from the center line of the point. When the reading must be taken back of the point, an allowance is made by using a limit of 19-23 ounces. The actual contact pressure will be the same. On all types of levers, the pull should be exerted at 90° with the point surface and the scale should be read just as the points separate.

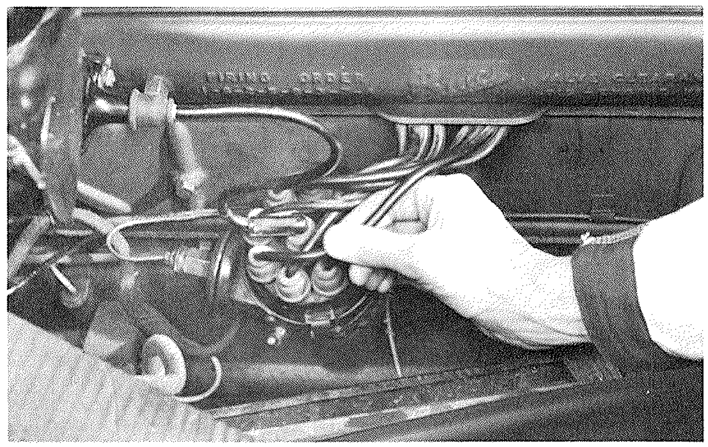


The contact point pressure can be adjusted by bending the breaker lever spring. Bending the spring as shown decreases the contact point pressure. To increase the point pressure, the breaker lever arm must be removed from the distributor and the spring bent away from the arm by hand. Avoid excessive distortion of the spring, since only a small change in spring tension normally is required. New breaker lever springs usually are stronger than required in operation; therefore, always check the contact pressure of new contacts after they have been installed.

Always check point pressure of new contacts when installed



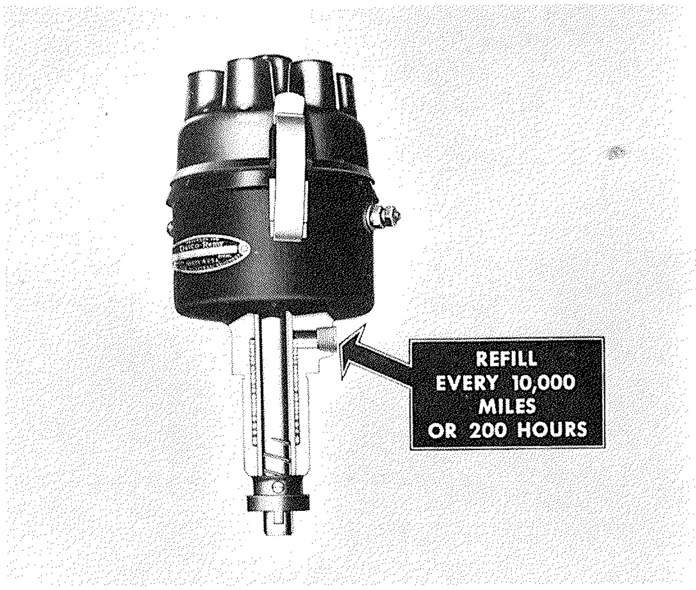
Carefully inspect all low and high tension connections in the ignition circuit. It must be remembered that a bad connection causes resistance which will impair ignition performance—possibly to a point where engine operation is seriously affected.

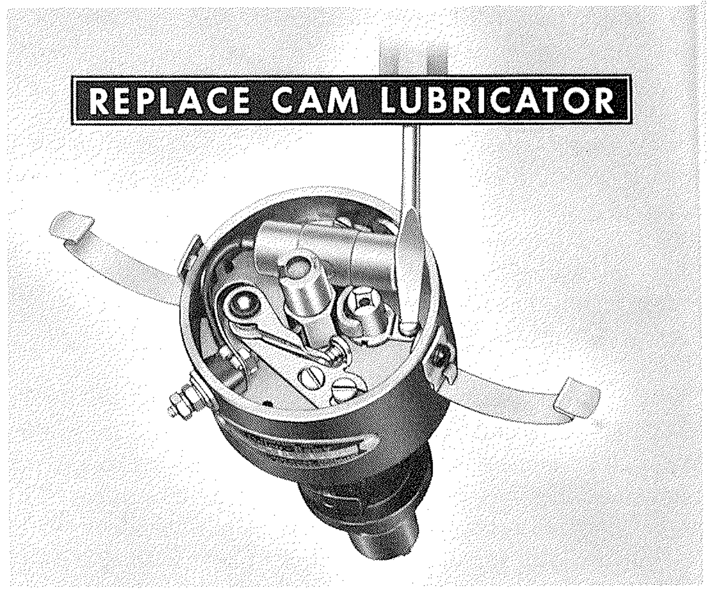


Examine the high tension as well as the low tension wiring for brittle or cracked insulation and broken strands. Replace the wiring if necessary. Defective insulation on the high tension wiring may cause missing or cross firing of the cylinders.

LUBRICATE DISTRIBUTORS EVERY 5,000 MILES

- SHAFT
- ADVANCE MECHANISM
- BREAKER CAM
- BREAKER PLATE ASSEMBLY
- BREAKER LEVER PIVOT
- HINGE CAP OILERS

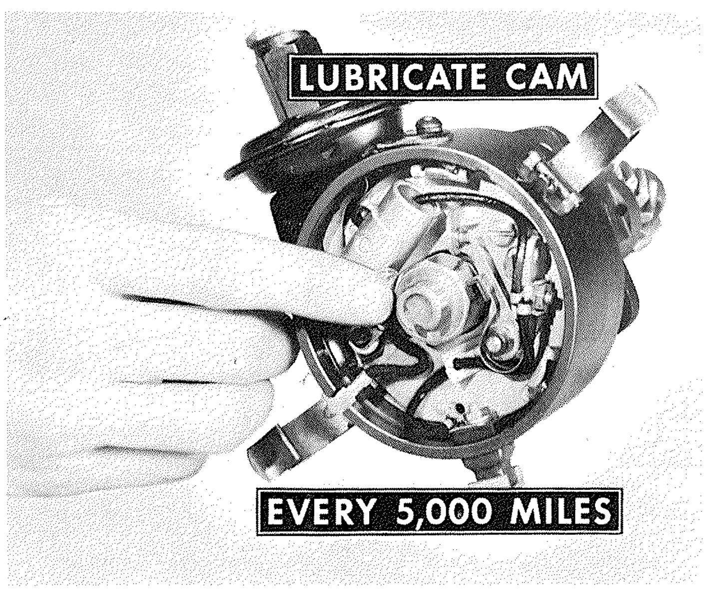




The distributor requires lubrication of the shaft, advance mechanism, breaker cam, breaker plate assembly and breaker lever pivot. Hinge cap oilers should have 8 to 10 drops of light engine oil (10 W) every 5,000 miles. Grease cups should be turned down until tight every 5,000 miles and refilled with No. 2½ grease. High pressure grease fittings should be supplied with grease every 5,000 miles. Use Delco-Remy Cam and Ball Bearing Lubricant on distributors equipped with ball bearings.

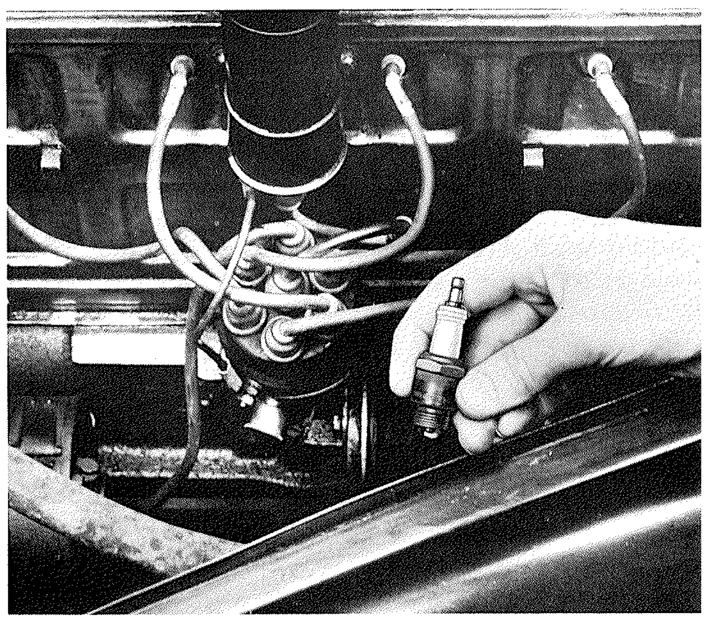
Distributors with built-in lubrication are assembled with a supply of oil in the reservoir. Under normal operating conditions the reservoir should be refilled every 10,000 miles or 200 hours of operation. To refill the reservoir, remove the oil plug and add Grade 20 W oil. When replacing the plug, seal with a compound that will hold against oil.

A trace of Delco-Remy Cam and Ball Bearing Lubricant should be placed on the breaker cam every 5,000 miles.

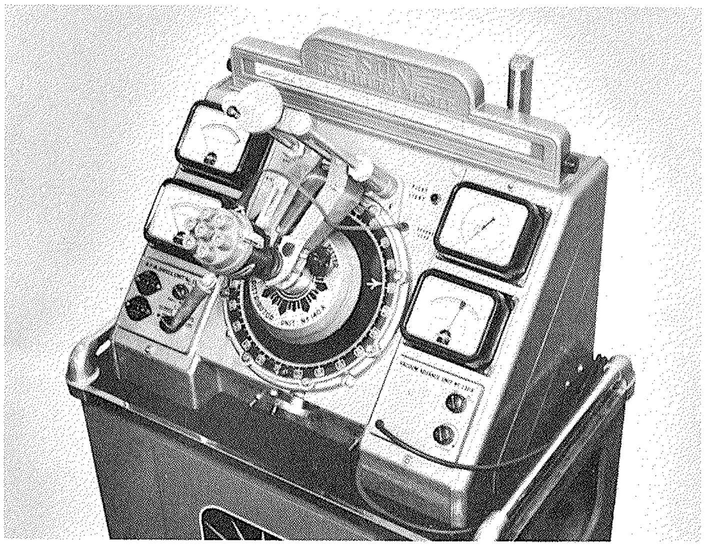


If the lubricator felt becomes hard and stiff, install a new cam lubricator. Never put oil on the cam lubricator. Every 5,000 miles put 1 to 2 drops of light engine oil (10 W) on the breaker lever pivot and 3 to 4 drops on the felt wick under the rotor. On bearing-supported breaker plates, place a small amount of Delco-Remy Cam and Ball Bearing Lubricant on each ball or molded bearing every 5,000 miles; on center-bearing breaker plates, add 3 to 4 drops of light engine oil (10 W) to the felt wick between the plates every 5,000 miles.

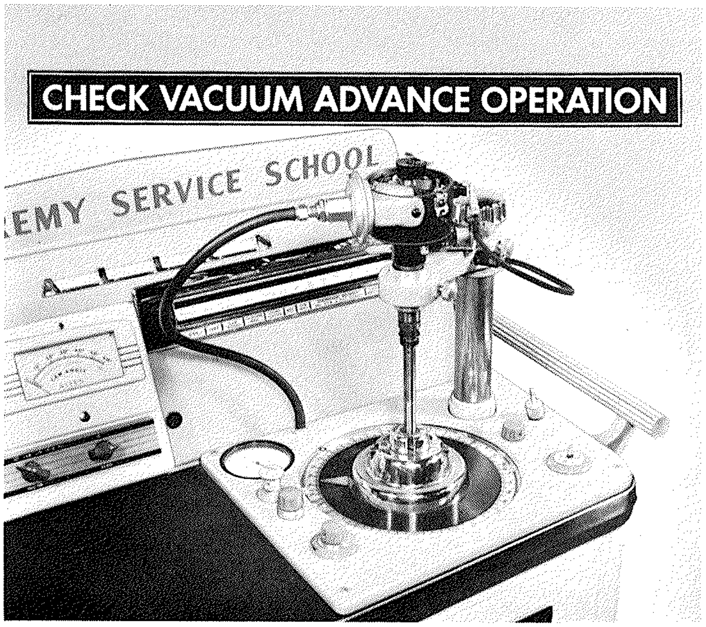
Avoid excessive lubrication. If too much oil is used, the excess is apt to get on the contact points and cause them to burn.



The spark plugs should be checked, cleaned, adjusted or replaced as necessary. Be sure the proper spark plugs for the application and type of operation are being used. Removing the rounded end on the center electrode will assure the lowest voltage requirement to fire the plug.

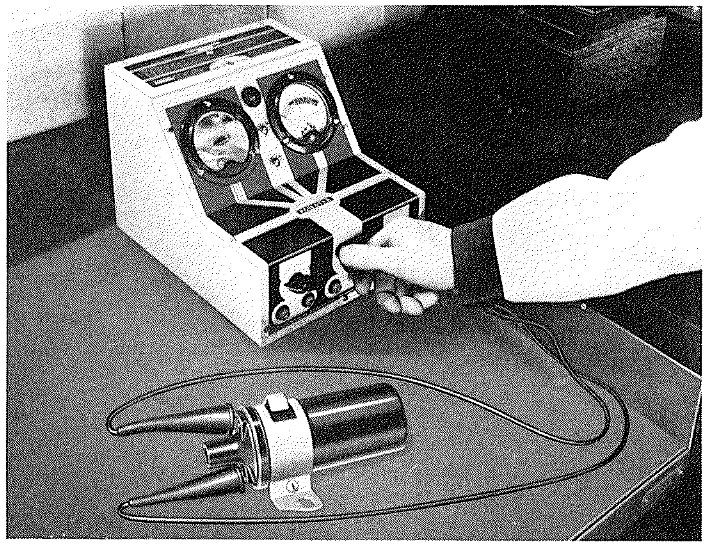


When the distributor is removed from the engine, the operation of the centrifugal advance mechanism can be studied throughout the full distributor speed range on a synchroscope. In addition to spark advance, the synchroscope also will check contact angle and will detect excessive distributor shaft eccentricity.

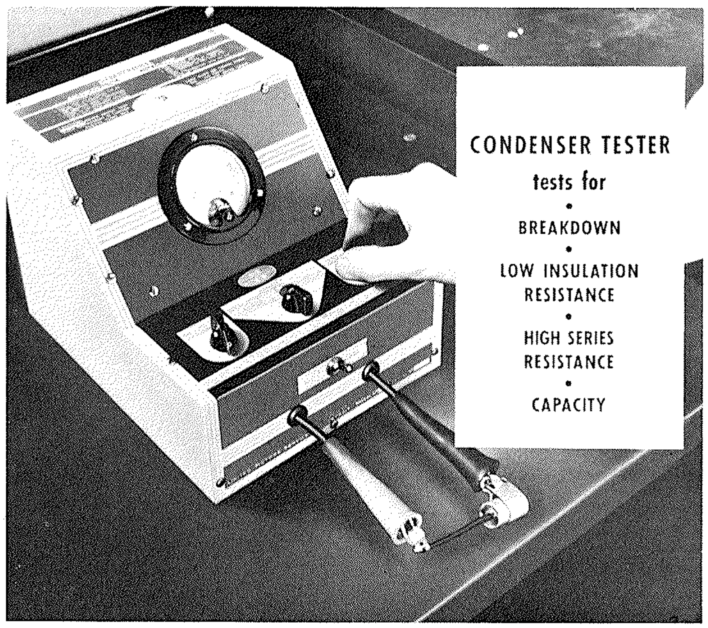


With a vacuum attachment, the synchroscope will check operation of the distributor vacuum advance mechanism. If the vacuum unit is found to be inoperative, it should be replaced, since, as a rule, it is not economical to attempt repair of this unit. There are several reliable makes of synchroscopes, or distributor testers, which will check distributor centrifugal and vacuum advance satisfactorily.

The ignition coil should be tested on a reliable coil testing instrument capable of detecting as few as ten shorted turns in the coil secondary and one shorted turn in the primary. It also should detect open circuits, insulation breakdown and excessive magnetic losses. These all are



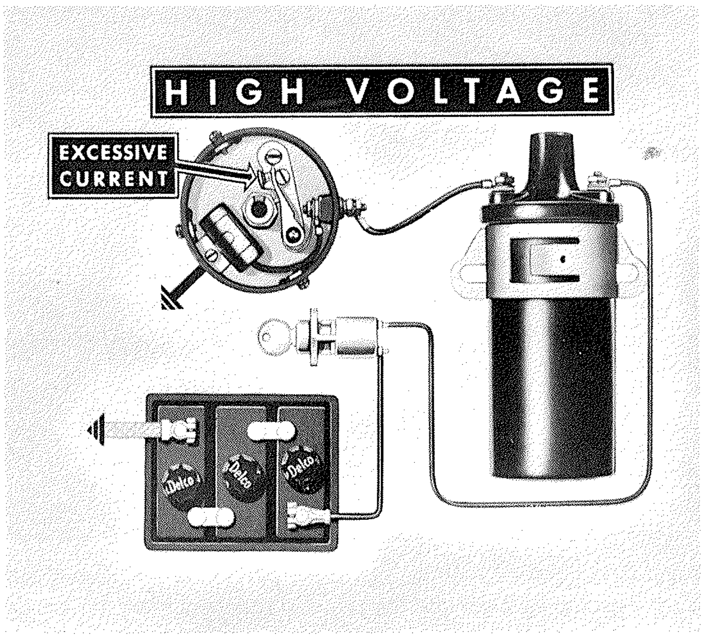
conditions which affect ignition performance. The coil may be checked on the bench, or the test may be made without removing the coil from the car.

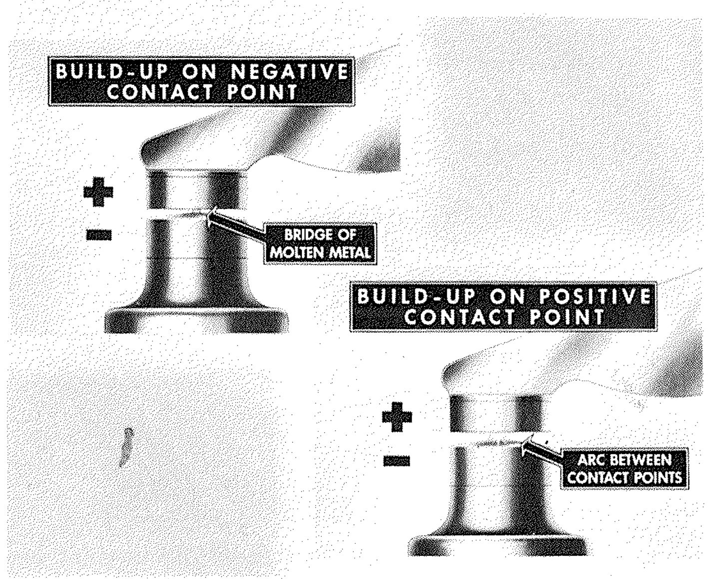


The ignition condenser may be checked on a reliable instrument which checks for breakdown, low insulation resistance, high series resistance and capacity—all conditions which affect ignition performance.

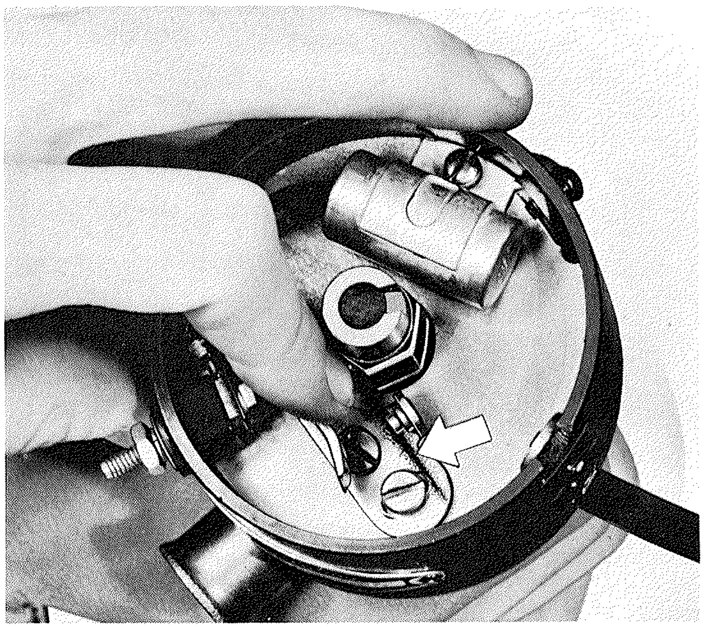
These testing instruments give meter indications of the actual condition of the coil, condenser and distributor, under testing procedures similar to those used in the Delco-Remy laboratories.

There are many causes of poor ignition performance which can be found without any testing instruments, such as defective wiring, plugs, distributor cap, or contact points. Most of these are due to normal wear, but at times some special condition in the application, the engine, or type of operation will cause more rapid wear of one part.





Burned contact points, for example, may be produced by any of several conditions. Excessive current during cold weather operation, or high voltage from an improper regulator adjustment will cause this condition. Oil or crankcase vapors may be getting into the distributor and depositing on the contact surfaces. This



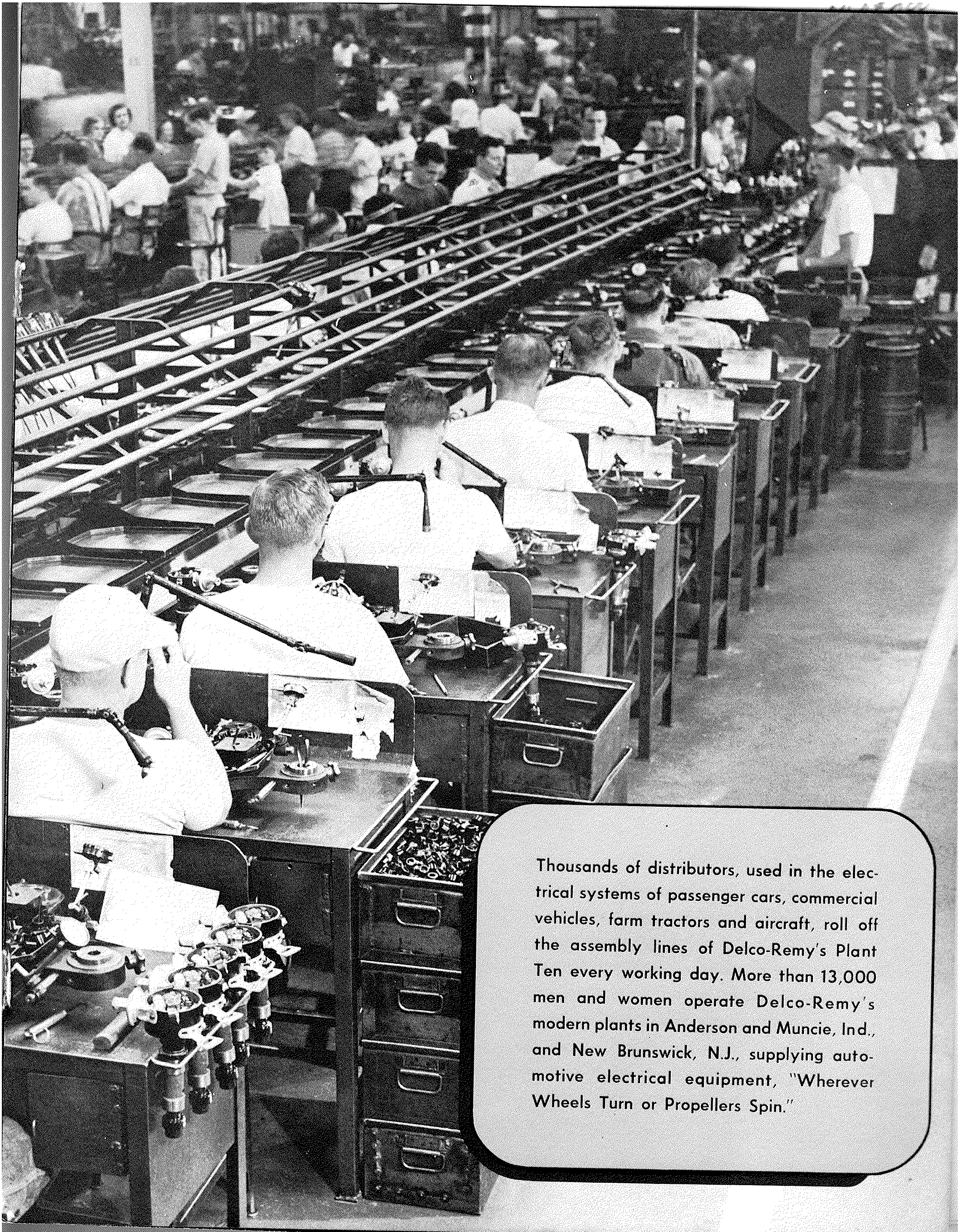
causes arcing and rapid burning of the points. A glance at the breaker plate and point support will disclose instantly whether the trouble is caused by oil, for oil produces black areas on the contact points or a smudgy line under the contact points. Clogged engine breather pipes or piston blow-by create crankcase pressure which may force oil up into the distributor. Breather pipes and vents should be checked.

The manner in which contact points transfer metal from one point to another was discussed earlier. As engine compressions are increased, fewer engineering corrections of this condition are possible.

It is characteristic of city service, 12-volt bus ignition systems to show a build-up on the positive contact point. For this type of operation a high ratio coil, designed for the purpose, causes less build-up on the positive point, assuring longer contact point life.

Passenger car 6-volt ignition systems tend to show a build-up on the negative contact point, but since high ratio coils already are used and are required to fire the present engines, a coil change is of no benefit.

The application of improved operating units and parts together with more complete knowledge of what takes place in the ignition system has made it possible for Delco-Remy to supply "Better Ignition."



Thousands of distributors, used in the electrical systems of passenger cars, commercial vehicles, farm tractors and aircraft, roll off the assembly lines of Delco-Remy's Plant Ten every working day. More than 13,000 men and women operate Delco-Remy's modern plants in Anderson and Muncie, Ind., and New Brunswick, N.J., supplying automotive electrical equipment, "Wherever Wheels Turn or Propellers Spin."

DELCO-REMY

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PASSENGER CARS • COMMERCIAL CARS

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TRACTORS • TRUCKS

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