June 19, 1934. H. FORD 1,963,657

IGNITION DISTRIBUTOR AND METHOD OF TIMING SAME

Filed April 1, 1933 2 Sheets-Sheet 1

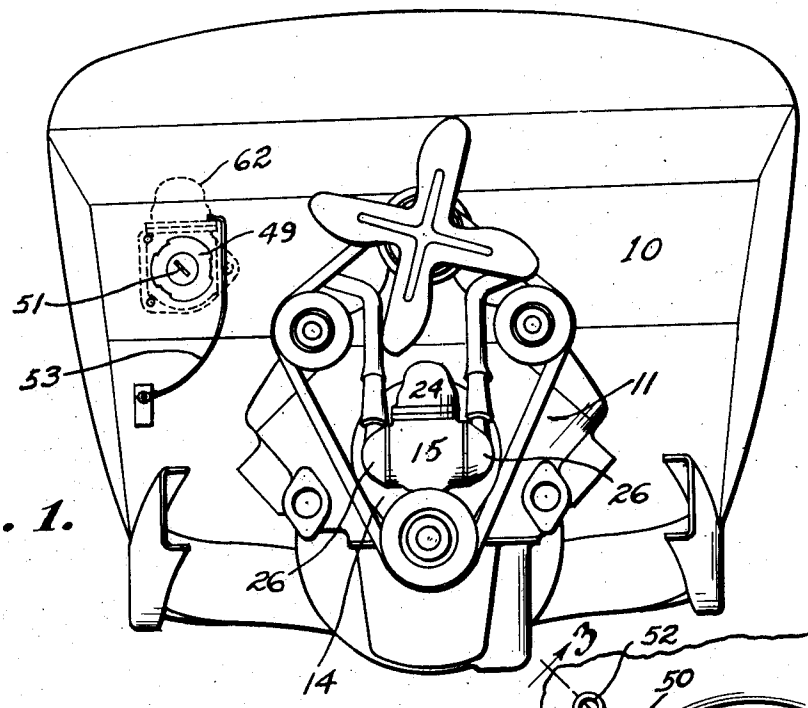


Fig. 1.

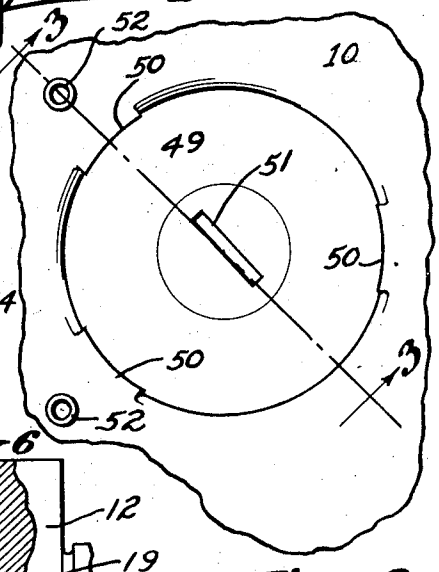


Fig. 2.

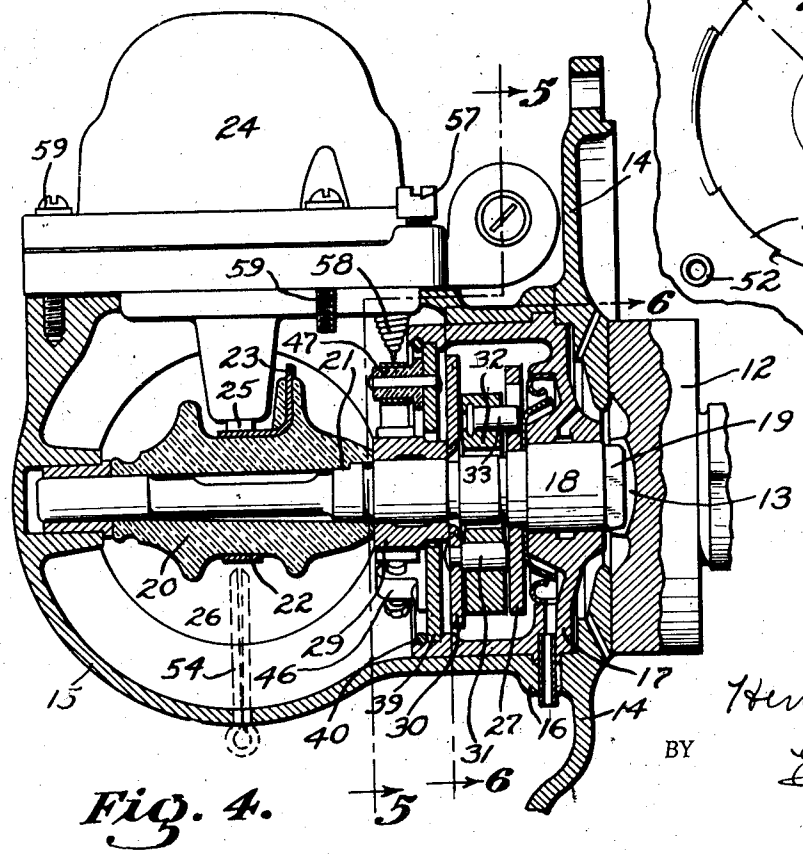


Fig. 4.

INVENTOR.
Henry Ford
BY
Edward Davis
ATTORNEY.

June 19, 1934. H. FORD 1,963,657

IGNITION DISTRIBUTOR AND METHOD OF TIMING SAME

Filed April 1, 1933 2 Sheets-Sheet 2

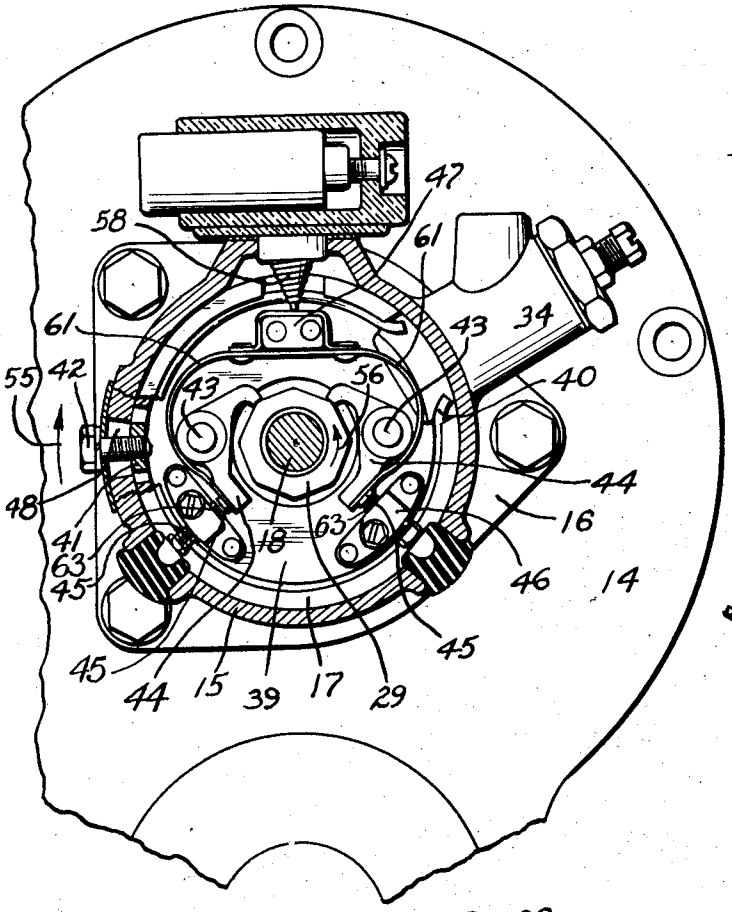


Fig. 5.

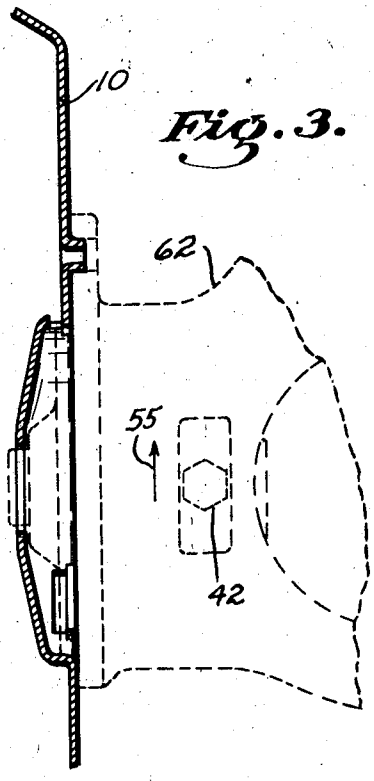


Fig. 3.

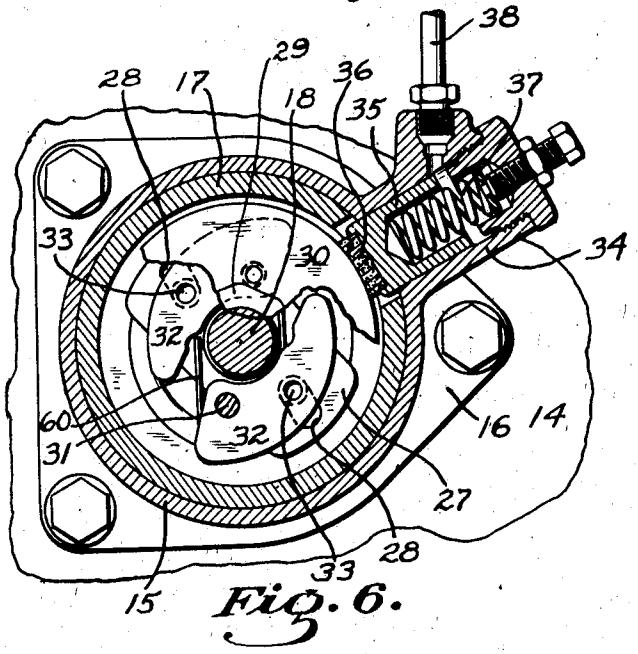


Fig. 6.

INVENTOR.
Henry Ford
BY
ATTORNEY.

Patented June 19, 1934

1,963,657

UNITED STATES PATENT OFFICE

1,963,657

IGNITION DISTRIBUTOR AND METHOD OF TIMING SAME

Henry Ford, Dearborn, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

Application April 1, 1933, Serial No. 663,908

14 Claims. (Cl. 123—148)

The object of my invention is to provide an ignition distributor especially adapted for use in connection with internal combustion engines, which distributor will be of simple, durable and inexpensive construction.

More specifically, my invention comprises a novel distributor which is adapted to be conveniently correctly timed, that is, adjusted to fire each successive spark plug at its correct instant. My method and means for timing the distributor forms a very important part of this invention.

A further object of my invention is to provide a distributor for internal combustion engines which is capable of being installed on the engine in only one predetermined relation to the rotating parts of the engine. To obtain the full utility of this distributor it is required that a distributor driving connection be machined on the engine cam shaft in an exact predetermined relationship to the several cams thereon so that whenever the distributor is secured to the engine the distributor shaft will be angularly fixed in relation to the cam shaft. Inasmuch as my distributor is provided with an automatic spark advancing mechanism in combination with a vacuum operated braking device, it will readily be seen that commercial inaccuracies in the manufacture of these several parts may alter the desired predetermined fixed relationship of the distributor to a considerable extent.

It should be kept in mind that the most desirable condition is to provide a non-adjustable distributor, each part of which is machined to exact dimensions so that such distributor need not be adjusted but need only be assembled on the associated engine. Such a distributor is very expensive to manufacture as the commercial manufacturing limits or permissible manufacturing variations would invariably result in the production of distributors varying by as much as four or five degrees in the timing.

The relatively large variation of such distributors is due to the fact that each of the many parts comprising the centrifugal advance mechanism and distributor parts, although machined to quite close limits, may be assembled in certain combinations to produce distributors wherein the timing will be one or two degrees either ahead of or behind the theoretical position. For example, if a group of parts, the dimensions of each of which are close to one side of the manufacturing limits, are assembled into a unit the timing of the unit will be several degrees different than a distributor formed from parts each of which are close to the other side of the manufacturing limits. As distributors must be commercially assembled from a group of parts chosen at random, the individual part accuracy necessary to form every combination into a unit within the desirable accuracy would be prohibitive from a manufacturing standpoint. For this reason an adjustment capable of covering a range of from five to ten degrees is desirable. However, the adjustment provided for my distributor should not be confused with the ordinary adjustment provided on former distributors inasmuch as all distributors heretofore known to the applicant required a high degree of skill and elaborate mechanism to accurately adjust, while the applicant's distributor may be adjusted in perfect timed relation with the engine by even the most inexperienced mechanic without any knowledge whatsoever of the operation of the distributor itself.

Heretofore, the distributors on all engines known to the applicant were timed by either guess work or the cut-and-try method or by the use of comparatively complicated apparatus which required a high degree of skill to operate. Even with the aid of such apparatus certain inaccuracies could not be compensated for so that the timing of all distributors was very uncertain at the best. The difficulties of correctly timing a distributor of the conventional type may be better understood when it is recalled that to correctly time a distributor the contact point operating cam must open the points at the exact instant a piston reaches a predetermined position in the engine. While the predetermined position of the piston in the engine may be accurately learned, by markings on the engine flywheel, still the exact point at which the cam opens the breaker point is extremely hard to ascertain, inasmuch as the distributor cam is comparatively small in size the effect of a movement of a few degrees around its own axis can not readily be detected.

Further, in all internal combustion engines known to the applicant, the distributor is driven through gear trains and other driving connections, each of which drives are subject to considerable rotary play or what is better known as back-lash. For example, most distributors are driven by means of a spiral gear machined in the engine cam shaft, which gear drives a second spiral gear at right angles thereto, this second gear having a tongue connection to drive an auxiliary shaft and which auxiliary shaft drives the distributor through still another tongue and slot connection. The engine cam shaft is subject to

a definite amount of end play as is the auxiliary shaft, the result being back-lash identical to the back-lash resulting from the tongue and groove driving connections. In most distributors this back-lash will amount to between five and ten degrees of movement even when the engine is new and, of course, after the engine has run a considerable period the driving connections wear and increase the total amount of back-lash. This feature has been mentioned because the conventional distributor is adjusted by rotating the distributor cam upon its driving shaft and locking same in its adjusted position. The usual procedure is to rotate the engine flywheel to a position corresponding to the firing position of one of the cylinders and then rotate the distributor cam until the contact points just start to open. Due to the presence of back-lash, it is impossible to rotate the cam in its normal direction and still take up the back-lash in the drive. Consequently, to insure that the back-lash is eliminated the cam must be rotated oppositely to its normal direction and the point at which the contacts close taken to be the correct point for locking the cam on the distributor shaft. This assumption is seldom correct.

The foregoing has been mentioned to illustrate the purpose of this invention and to show the utility in providing an accurate timing means which is within reach of every car owner and which may be included with every automobile at a negligible extra cost, by which the driver of the vehicle or inexperienced mechanic may with a few simple instructions accurately adjust the vehicle's distributor. The utility of this device is especially important in connection with the present type of automobile now manufactured, as such cars are not usually provided with a manual spark advance of any description. With the old-style distributor a manual spark advance lever was usually provided so that a mechanic could ascertain if his distributor was timed within a few degrees of accuracy. For example, if upon adjusting the distributor the spark was too far advanced the engine would knock when the spark lever was fully advanced, while if the spark was too far retarded the engine would slow down and stop upon fully retarding the spark lever. However, with the elimination of the manual spark adjustment the driver now has no such simple means of ascertaining whether or not the distributor is timed correctly. Consequently, the loss of power and prematurely burned-out valves resulting from an ignition which is too slow and the excessive loads resulting from ignition too far advanced are defects which it is believed my improved distributor will eliminate.

While the means shown for timing my improved distributor is especially adapted for use with the distributor described, it should be kept in mind that it may be advantageously used with other distributors for producing a perfectly timed engine, after such other distributors have been roughly timed by the conventionel method. However, even with the conventional distributor it is necessary that the driving connection for the distributor be located in an exact predetermined angular relationship with the engine cam shaft, inasmuch as my method of timing depends upon a predetermined relationship being established between the cams on the cam shaft and the distributor driving connection.

With these and other objects in view, my invention consists in the arrangement, construction and combination of the various parts of my improved device, as described in the specification, claimed in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 shows a plan view of the front end of an automobile chassis, the vehicle dash having a timing plate formed integrally therewith, whereby my distributor may be accurately timed.

Figure 2 shows a larger view of the timing plate, shown in Figure 1.

Figure 3 shows a sectional view, taken on the line 3—3 of Figure 2.

Figure 4 shows a vertical, central, sectional view through my improved distributor when mounted in its position on the vehicle engine.

Figure 5 shows a sectional view, taken on the line 5—5 of Figure 4, and

Figure 6 shows a sectional view taken on the line 6—6 of Figure 4.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate generally a vehicle dash which is preferably stamped from sheet metal and which extends in a substantial vertical direction directly in the rear of the vehicle engine. A vehicle engine is shown at 11, this engine being of the 8 cylinder V-type in which a cam shaft 12 is rotatably mounted between the two rows of engine cylinders. The forward end of the cam shaft is provided with a driving slot 13 which is considerably offset from the diametrical position and which slot is machined in a predetermined relationship to the several cams of the cam shaft. It is very essential with this device that the angular position of the slot 13 be maintained in a predetermined relationship with the cams on the cam shaft. A cover plate 14 is secured over the forward end of the cam shaft, this cover plate having an opening therein aligned with the forward end of the cam shaft whereby a distributor shaft may extend therethrough and be driven directly by the slot 13 in the cam shaft.

My improved distributor comprises a metallic housing 15 having a flange 16 formed on one end thereof, which flange is adapted to be secured to the cover plate 14 by three unequally spaced cap screws in position directly over the front end of the engine cam shaft. This housing 15 is provided with a cylindrical shaped opening in its flanged side in which opening a cylindrical cup member 17 is fixed. A distributor rotor shaft 18 is rotatably mounted in a pair of spaced bearings, one of these bearings being formed in the housing 15 and the other bearing being formed by the center portion of the cup member 17. The shaft 18 is provided with a tongue 19 machined thereon, this tongue being diametrically offset an amount corresponding to the amount which the slot 13 is diametrically offset from the cam shaft. Thus, the shaft 18 may be assembled to the cam shaft in only one angular position.

I have provided a distributor rotor 20 which is fitted upon the shaft 18 adjacent to its forward bearing, which rotor is molded from a dielectric material and which is adapted to be installed upon the shaft in only one angular position relative thereto, due to a flat 21 being machined upon the shaft which flat coacts with a correspondingly shaped bore in the rotor to thereby form a drive for the rotor and locate it upon the shaft. This rotor is provided with a conductor ring 22 from which a pair of arms 23 extend radially, only one of which is shown, and which arms are molded integrally with the rotor 20. This ring and the arms conduct the high voltage current from a

spark coil, about to be described, to the several terminals in the distributor whereby the high voltage current is conducted to the several spark plugs of the engine.

The spark coil associated with this device is given the reference numeral 24 and is secured over an opening which is formed in the upper portion of the housing 15. This coil is provided with a high tension terminal 25 thereon which extends down into the housing 15 and resiliently bears against the ring 22. The spark coil 24 is provided with a low tension terminal 57 whereby low voltage current may be conducted to the coil. The terminal 57 is connected to one end of the primary winding of the coil while the other end of this winding is conducted to a spring terminal 58 which projects down into the housing 15 from the spark coil, this spring terminal being adapted to thus automatically form a connection with the distributor contact points when the spark coil is assembled in position on the distributor housing. Suitable screws 59 secure the spark coil in place upon the distributor.

A pair of terminal heads 26 are disposed over diametrically opposite openings in the side of the housing 15, which heads secure in place the several terminals associated with the high tension system of the distributor. Inasmuch as the high voltage portion of the distributor forms no part of the invention herein claimed, the exact details or the construction employed will not be further described.

Referring now to the contact point operating mechanism employed, it will be seen that I have provided a rectangular shaped driving plate 27 which is fixedly secured to the shaft 18 just within the cup member 17. This driving plate is provided with a pair of radially extending slots 28 therein, which slots coact with suitable pins, about to be described, to drive a centrifugal advance mechanism. The contact point operating cam used in this distributor has been given the reference numeral 29 and is rotatably mounted on the shaft 18 just rearwardly from the rotor 20. This cam 29 is fixedly secured to a plate 30, from which plate a pair of diametrically opposed pins 31 extend rearwardly. These pins form the respective pivots for a pair of centrifugally operated weights 32, each of these weights having a pin 33 fixedly secured in its free end, which pins 33 extend into the adjacent slots 28 in the driving plate 27. A pair of flat springs 60 are secured to the weights 32, which springs yieldably urge the weights 32 to their innermost positions.

The operation of the centrifugal device is quite conventional in that when the driving plate 27 is rotated by the shaft 18 the weights 32 are driven through the slots 28 and pins 33 and centrifugal force upon the weights tends to pivot them around their respective pivots 31. Inasmuch as the slots 28 extend spirally from the pivot pins 31 the radial movement of the weights 32, due to centrifugal force, causes the plate 30 to rotatively advance relative to the shaft and the driving plate 27. This advance, of course, causes an advancement of the position of the cam 29 relative to the distributor shaft. A total advance of about 10 degrees is provided in this distributor.

It will be seen from Figure 6 that a cylinder 34 is formed integrally with the housing 15 in which cylinder a plunger 35 is reciprocally mounted, this plunger having a friction pad 36 secured thereon which is adapted to coact with the periphery of the plate 30. A spring 37 is adjustably mounted within the cylinder 34 and resiliently urges the friction pad into engagement with the rim of the plate 30 to thereby frictionally retard the rotation of the plate. The resistance offered by the pad 36 requires that a higher speed be maintained by the centrifugal weights to keep the distributor in its advanced position against the friction of this pad.

A tubular vacuum line 38 extends from the intake manifold of the engine and connects with the cylinder 34 just above the plunger 35 so that when the engine is normally operating the vacuum in the intake manifold is sufficient to draw the plunger away from the plate 30 to thereby allow the distributor to advance when its speed is sufficient to move the weights 32 radially against only the action of the springs 60. However, when the engine is being started or when the carburetor throttle is suddenly opened, in either of which cases a lower vacuum in the intake manifold results, the frictional resistance of the pad 36 is applied to thereby maintain the cam in its retarded position until a considerably higher rotating speed is attained.

As has been mentioned, the distributor shown is adapted to operate an 8 cylinder, four cycle engine and consequently the distributor cam 29 is provided with 8 cam lobes thereon, which cam lobes actuate two pairs of contact points, one of the pairs of points being adapted to close the primary circuit of the coil and the other pair to open the circuit to thereby cause a high voltage current to be induced in the secondary winding of the coil upon each reciprocation of said pairs of contact points. The time interval between the opening of the last mentioned pair of points and the closing of the first mentioned pair is very short to thereby allow high speed operation of the coil. These two pairs of contact points are mounted upon a plate 39 which is secured in the cup member 17 by means of a snap ring 40. As will be noted in Figure 5, an ear 41 extends rearwardly from the plate 39, which ear projects into a slot of considerable width in the cup member 17. A screw 42 projects through an elongated slot 48 in the housing 15 and is threaded into the ear 41. Consequently, upon loosening the screw 42 the screw and ear and plate 39 may be rotated the length of the slot 48 and upon tightening the screw at any position along its path the plate 39 will be locked to the housing 15. It is upon the plate 39 that the contact points are mounted so that rotation of this plate around the operating cam will cause an advancement or retardation of the spark timing. The contact point operating means comprise a pair of breaker arms 44 which are rotatably mounted upon a pair of pins 43 which are fixed in and extend forwardly from the plate 39. One end of each breaker arm is adapted to coact with the lobes on the cam 29 while in the other end of each arm one of the two pairs of contact points 45 are mounted. Coacting points 63 are adjustably mounted in a pair of brackets 46. A dielectric block 47 is secured to the plate 39 around which a combined spring and electrical conductor 61 is secured, this conductor electrically connecting the contact points 45 together. The spring terminal 58 from the spark coil is adapted to bear directly against the intermediate portion of the conductor 61 whereby the primary winding of the coil may be grounded through either of the contact points 45 to thereby complete the primary circuit of the spark coil.

From the foregoing, it will be seen that rotation of the cam 29 will cause the contact points 45 to successively open and close thereby successively

completing and opening the primary circuit of the spark coil. Further, rotation of the plate 39 around the cam 29 by means of the screw 42 will adjust the timing of the distributor. However, only sufficient rotation of the plate is permitted to adjust the distributor to compensate for manufacturing inaccuracies. These inaccuracies invariably result because it is required that the driving plate 27 be assembled to the shaft 18 with the driving slots 28 located in a predetermined position relative to the tongue 19. Further, the cam 29 must be assembled to the cam plate 30 with the driving pins in a predetermined relation to the cam lobes.

With this distributor it is only necessary that sufficient accuracy be maintained to insure that the cam 29 be assembled within three or four degrees from its theoretically correct position. However, sufficient accuracy must be maintained to insure that the distributor rotor conducts the current to the correct spark plug, as no adjustment is provided for altering the angle of the rotor.

A very important feature of this distributor is that the rotor 20 is fixedly secured to the shaft 18 while the cam 29 is rotatably mounted upon this shaft. Considerable friction develops between the terminal 25 and the rotor which causes a drag upon the shaft 18; however, this shaft is positively driven by the cam shaft so that the drag cannot affect the advance movement of the cam 29. It will be appreciated that a centrifugally operated cam advancing mechanism is necessarily quite a sensitive piece of apparatus, as it must advance at a definite speed of the weights and be retarded a definite amount by the action of the pad 36. If the rotor 20 was required to be driven by the cam 29, as is believed required in all other distributors, then the friction of the terminal would alter the control effected by the centrifugally operated weights and vacuum operated brake. This novel arrangement is therefore believed to comprise a patentable improvement.

It will be noted in Figure 1 that I have shown the distributor in position mounted upon the forward end of the engine and have also shown a distributor, by dotted lines 62, as being mounted upon the dash 10. The position shown by the dotted lines 62 is the position in which the distributor is placed to correctly time same for the engine. The novel feature of this method of timing is that the distributor is timed before it is placed upon the engine and not after it has been secured in place, as is believed universal with other types of distributors. The dash 10 is provided with a depression 49 which may be either drawn directly therein or provided in a plate or bracket which is later fastened to the dash. This depression has three tongues 50 extending therefrom which serve to accurately align or pilot the cup member 17 of the distributor within the depression. A slot 51 is provided in the bottom of the depression 49 and a pair of lugs 52 are stamped outwardly from the metal of the dash, the slot 51 serving to locate the tongue 19 of the distributor shaft while the lugs 52 serve to locate two of the bolt retaining holes on the distributor flange 16. This slot 51 is positioned in exactly the same position relative to the lugs 52 as is assumed by the driving slot 13 in the cam shaft relative to the flange retaining bolts when one of the pistons of the engine is in position to fire with a retarded spark.

To accurately time the device, the distributor and coil are placed over the depression 49 with the distributor flange 16 piloted by the lugs 52 and with the tongue 19 extending into the slot 51. A cotter pin 54 is inserted through an opening in the bottom of the housing 15, this cotter pin extending up to position spaced $\frac{1}{16}$ or $\frac{1}{8}$ of an inch from the ring 22. A flexible conductor 53 is then connected to the terminal 57 whereby current is conducted to the spark coil. The screw 42 is then loosened and moved bodily to its extreme retarded position. Then it is gradually tapped in the opposite direction, or that shown by arrow 55, and at some point along its path of movement a spark will flash across the gap between the end of the cotter pin 54 and the ring 22, which spark will be both visible and audible. When this spark occurs the screw 42 is tightened and the ignition system is then exactly in its correctly timed position. It may be well to mention that the normal rotation of the cam shaft drives the cam 29 in the direction shown by arrow 56 which is counter to the movement of the adjusting screw to adjust the distributor. Thus, the movement of the screw 42 takes up all the play between the various driving members and is exactly similar to an equivalent movement of the cam 29 in the direction of the arrow 56.

After the distributor has been timed it is secured in position on the front end of the engine and the cotter pin 54 removed. The device is now ready for operation.

Should the operator decide to replace or readjust the contact points of the device, he simply removes the distributor from the engine, then repairs or replaces the contact points, then retimes the distributor by means of the timing plate and then secures the distributor in position on the engine, with the complete assurance that it is exactly timed.

It may be desirable to equip cars with a portable timing plate instead of the device shown, which provision is believed to fall within the scope of this invention.

Among the many advantages arising from the use of my improved device, it may be well to repeat that even the most inexperienced mechanic can with only a few simple instructions time this distributor within a degree of accuracy heretofore obtainable by only skilled mechanics and with the use of costly and elaborate testing equipment.

Further, the method disclosed herein may be used to advantage in timing other types of distributors, the only essential requirement being the provision of a driving connection machined in a predetermined angular position.

Further, it may not be deemed absolutely necessary to provide a spark gap in the circuit, as the spark at the contact points or even the opening thereof may be sufficient in some instances to inform the operator that the adjusted point has been reached.

Some changes may be made in the arrangement, construction, and combination of the various parts of my improved device without departing from the spirit of my invention, and it is my intention to cover by my claims, such changes as may be reasonably included within the scope thereof.

I claim as my invention:

1. The method of timing an ignition system which consists of a distributor and an engine having a distributor driving connection thereon angularly disposed in a predetermined position relative to the rotating parts of said engine, said

distributor having adjusting means for operably changing the angular relationship between the distributor shaft and the time of opening of the distributor contact points, comprising, securing the distributor shaft and distributor housing in fixed angular positions identical to the respective positions of said shaft and housing at the instant when one of the engine spark plugs is being fired, and then changing the angular relationship between the distributor contact points and the distributor shaft until the distributor contact points just start to open.

2. The method of timing an ignition system which consists of a distributor and an engine having a distributor driving connection thereon angularly disposed in a predetermined position relative to the rotating parts of the engine, said distributor having adjusting means for operably changing the angular relationship between the distributor shaft and the time of opening of the distributor contact points, comprising, securing the distributor shaft and distributor housing in fixed angular positions identical to the respective positions of said shaft and housing at the instant when one of the engine spark plugs is being fired, then conducting current through said contact points and then changing the angular relationship between the contact points and distributor shaft until a spark is seen between the contact points.

3. The method of timing an ignition system which consists of an ignition coil and distributor and an engine having a distributor driving connection therein angularly disposed in a predetermined position relative to the rotating parts of said engine, said ignition coil having a visual spark gap in its secondary circuit and said distributor having adjusting means for changing the angular relationship between the distributor shaft and the time of opening of the distributor contact points, comprising, first securing the distributor shaft and housing in fixed angular postions identical to the positions of said shaft and housing when one of the engine spark plugs is being fired, then conducting current in series through said coil and through the distributor contact point, and then changing the angular relationship between the distributor contact points and the distributor shaft until a spark jumps across said spark gap.

4. The method of timing an ignition system which consists of an ignition coil and a distributor and an engine having a distributor driving connection therein angularly disposed in a predetermined position relative to the rotating parts of said engine, said ignition coil having a visual spark gap in its secondary circuit and said distributor having adjusting means for swinging its contact points around the distributor cam, comprising, securing the distributor shaft and housing in an auxiliary timing plate in fixed angular positions identical to the positions of said shaft and housing when one of the engine spark plugs is being fired, then conducting current in series through said coil and distributor contact points, and then swinging said contact points around said cam until a spark jumps across said spark gap, and then securing said contact points in their adjusted position in the housing, and then installing said distributor upon said engine so as to be driven by said driving connection.

5. A distributor and means for timing same, which distributor is adapted for use with an internal combustion engine having a distributor driving connection therein which is angularly disposed in a predetermined position relative to the rotating parts of said engine, comprising, a distributor housing, means for securing said housing to the engine in a predetermined position, a distributor cam driven by said driving connection, a pair of contact points operated by said cam, adjusting means for changing the angular relationship between the distributor shaft and the time of opening of the distributor contact points, and means for securing the distributor shaft and housing in fixed angular positions identical to the respective positions of said shaft and housing when one of the engine spark plugs is being fired in order that said adjustment may be operated to position where said contact points just open for the purpose described.

6. A distributor, as claimed in claim 5, wherein an ignition coil is connected in series with said contact points which upon being electrically energized causes a visual spark to be produced at the instant the contact points are opened.

7. A distributor, as claimed in claim 5, wherein an ignition coil is connected in series with said contact points, which coil is provided with a spark gap in its secondary circuit, so that when said coil is electrically energized a spark will jump across said gap at the instant the contact points are opened.

8. A device, as claimed in claim 5, wherein the means for securing the distributor shaft and housing in fixed angular positions comprise a timing plate which has locators thereon which coact with both the distributor body and distributor shaft so as to retain these elements in their predetermined angular positions.

9. A distributor and means for timing same, said distributor being especially adapted for use on an internal combustion engine having a distributor driving connection therein which is angularly disposed in a predetermined position relative to the cam shaft of said engine, comprising, a distributor housing, means for securing said housing to the engine in a predetermined angular position, a distributor shaft rotatably mounted in said housing and driven by said driving connection, a contact point plate rotatably mounted in said distributor housing, a pair of contact points disposed upon said plate and adjustable around said shaft by rotating said plate, a contact point operating cam secured on said shaft, an ignition coil, a spark gap in the secondary circuit of said coil, a timing plate having locators thereon for securing both said distributor shaft and said housing in fixed angular positions identical to the positions of said shaft and housing while at the instant one of the engine spark plugs is being fired, and a conductor for conducting current in series through said ignition coil and contact points, for the purpose described.

10. A device, as claimed in claim 9, wherein said timing plate is formed permanently with the dash of an automotive vehicle in which said engine is associated.

11. A distributor especially adapted to be readily timed comprising, a housing, a high voltage rotor disposed in said housing, means for conducting high voltage current to said rotor, and a metallic member extending from said housing to position spaced a short distance from said rotor to thus form a spark pap between said member and said rotor.

12. A distributor, as claimed in claim 11, wherein said metallic member is detachably secured in said housing.

13. A distributor, as claimed in claim 11, where-

in the distributor housing is provided with an opening in which a cotter pin is detachably received, said cotter pin comprising said metallic member.

14. A distributor and means for timing same especially adapted to be used on an internal combustion engine having a diametrically offset slot machined in one end of the cam shaft of said engine, which slot is angularly disposed in a predetermined position relative to the cams on said cam shaft comprising, a distributor housing adapted to be secured over the slotted end of said cam shaft in a predetermined angular position, a distributor shaft rotatably mounted in said housing having a diametrically offset tongue formed thereon which is driven by the slot in said cam shaft, a distributor cam driven in a substantially predetermined relationship by said distributor shaft, said cam being adapted to actuate contact points in said distributor, means for adjusting the distributor contact points around said cam, means for securing the distributor shaft and housing in fixed angular positions identical to the positions of said shaft and housing when one of the engine spark plugs is being fired, and means for conducting current through said contact points for the purpose described.

HENRY FORD.