Sept. 30, 1958 J. P. BEAUCLAIR 2,854,534

DISTRIBUTOR FOR IGNITION SYSTEM

Filed Nov. 23, 1956

Fig. 1

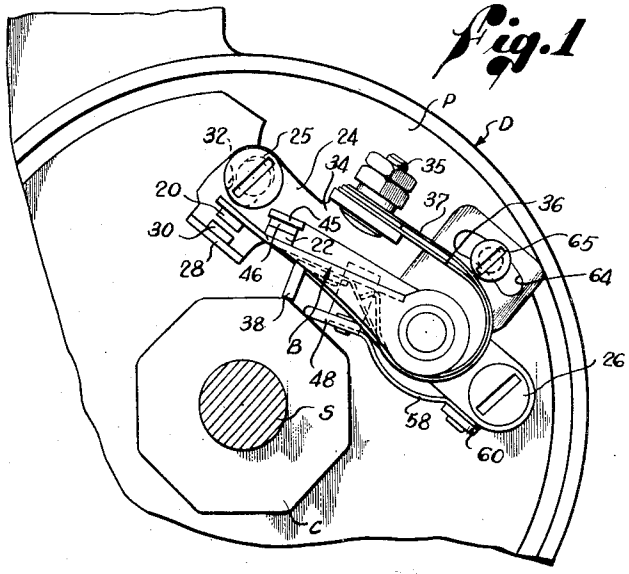


Fig. 2

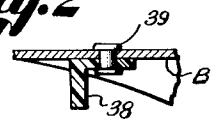


Fig. 3

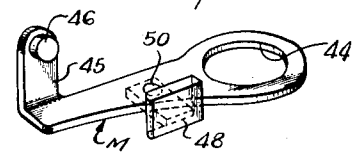


Fig. 4

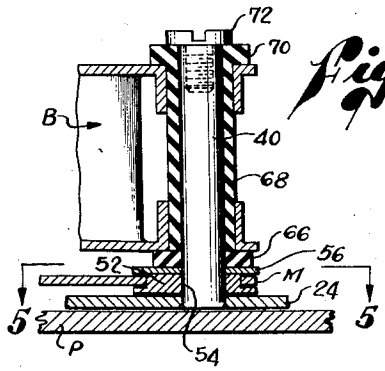


Fig. 5

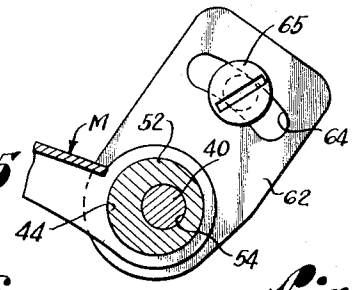


Fig. 6

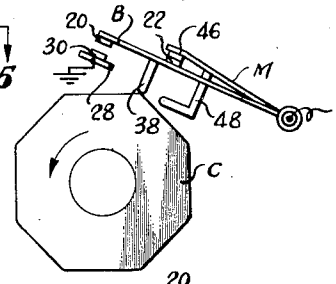


Fig. 7

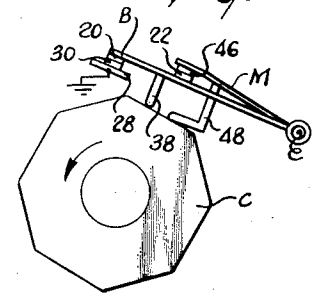


Fig. 8

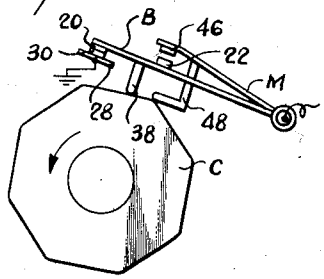


Fig. 9

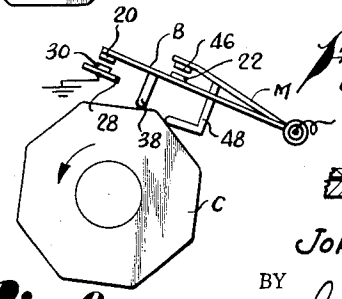
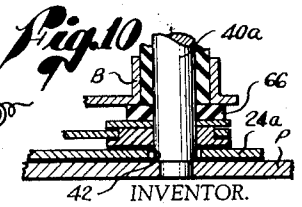


Fig. 10



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2,854,534

DISTRIBUTOR FOR IGNITION SYSTEM

John P. Beauclair, Inglewood, Calif.

Application November 23, 1956, Serial No. 623,836

20 Claims. (Cl. 200—30)

This invention relates to a distributor for the ignition system of an internal combustion engine, which distributor incorporates two oscillatory circuit-controlling members actuated by the usual polygonal timing cam to carry out the required ignition cycle. The present invention is an improvement on the distributor described in my prior Patent No. 2,711,451, issued June 21, 1955, which prior disclosure is hereby incorporated into the present disclosure by reference.

The purpose of providing two cam-actuated oscillatory members instead of the usual single breaker arm is to increase the relative duration of the closed circuit periods in the cycle during which current flows into the ignition coil. Because of the high initial impedance of the coil, the current flow is initially low when the coil circuit is closed but the current rises progressively at a rapidly increasing rate. Consequently, even a small increase in the relative duration of the closed circuit periods in the ignition cycle greatly increases the efficiency of the ignition circuit. Such an increase in the closed circuit periods is especially important at high engine speeds when the whole ignition cycle is drastically shortened.

In a typical dual arm distributor of the type to which the present invention pertains, the cam-actuated breaker arm which is energized by the ignition circuit carries an energized breaker point for cooperation with a fixed grounded breaker point, and a second pair of points, including a second energized point and a second grounded point, is in parallel with the first pair under the control of a second oscillatory arm. The two pairs of points open and close intermittently with the closed periods of the two pairs of points overlapping to extend the intervals during which the ignition circuit is closed by one pair or the other, there being only a relatively short remaining interval in the cycle during which both pairs of points are open. Since the second pair of points close the circuit, these points may be aptly termed maker points and the second arm may be termed a maker arm.

It is a broad object of the present invention to utilize this same principle of overlapping closed periods of two pairs of points by means of a novel dual arm system that functions in a positive manner with high efficiency and affords close, accurate, adjustable control over the timing and duration of the alternate open and closed circuit periods.

A more specific important object of the invention is to increase the rapidity of the circuit-closing operation of the system by moving the two cooperating maker points simultaneously towards each other from their open positions.

A further specific object of the invention is to provide adjustable means for varying the timing of the operation of the maker arm relative to the operation of the breaker arm. In this regard, a feature of the invention is the concept of employing an adjustable eccentric bearing to mount the maker arm on the same pivot pin as the breaker arm. Rotational adjustment of the eccentric bearing shifts the axis of oscillation of the maker arm relative to the timing cam, and thus varies the timing of the actuation of the maker arm by the timing cam.

These objects are attained by mounting the energized maker point on the usual breaker arm and by mounting a second grounded maker point on a maker arm that is controlled part of the time by the breaker arm and part of the time by actuating contact with the timing cam.

The maker arm is spring pressed to urge its grounded maker point towards the energized maker point on the breaker arm, and, throughout most of the cycle, the maker arm is controlled by the breaker arm, the maker arm following the movements of the breaker arm with the two maker points pressed together. Just before the breaker arm moves outward to separate the breaker points, the timing cam acts on the maker arm to move it outward from the breaker arm for separation of the maker points. Then, after the breaker points separate and while the breaker arm is swinging outward, the timing cam permits the maker arm to swing inward to close the pair of maker points, the two maker points closing by moving simultaneously towards each other.

While the invention may be incorporated in a distributor as produced at the factory, an important feature of the invention is that it may be embodied in an adapter unit to convert a conventional single arm distributor to dual arm operation. An important feature of the invention is that it is designed to be installed in any conventional distributor to replace the single contact circuit breaker unit without the use of the usual adapter plate or other extra attachment, and thus converts the distributor to dual contact operation. Such a unit is described below, by way of example, and will provide adequate guidance for those skilled in the art who may have occasion to embody the same principles in various specific types of distributor mechanisms.

The various features and advantages of the invention may be understood from the following detailed description considered with the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

Fig. 1 is a fragmentary plan view of a selected embodiment of the invention as installed in a conventional distributor for conversion of the distributor from single arm operation to dual arm operation;

Fig. 2 is a fragmentary sectional view showing the usual conventional rubbing block attached to the breaker arm;

Fig. 3 is a perspective view on an enlarged scale of the maker arm;

Fig. 4 is an enlarged fragmentary section showing how the breaker arm and the maker arm are mounted on the same pivot pin;

Fig. 5 is an enlarged section taken as indicated by the line 5—5 of Fig. 4, showing the structure for adjusting the axis of oscillation of the maker arm;

Figs. 6 to 9 are diagrammatic views showing the positions of the breaker and maker arms at different points in the ignition cycle; and

Fig. 10 is a fragmentary sectional view, similar to Fig. 4, illustrating a modified practice of the invention.

Fig. 1 shows, by way of example, how the invention embodied as an adapter unit may be applied to a conventional single arm distributor for conversion of the distributor to dual arm operation. The distributor D has the usual support plate P and the usual polygonal timing cam C mounted on a shaft S. The dual arm point assembly of the present invention provides a substitute or replacement breaker arm B to replace the original breaker arm of the distributor, the replacement breaker arm having the usual energized breaker point **20**. The breaker point **20** is on the side of the replacement breaker arm B that is nearest the timing cam C and the breaker arm is further provided with a maker

point 22 that is on its opposite side away from the timing cam.

In this particular embodiment of the invention, all of the parts of the adapter are supported on an adapter base plate 24 that is mounted on the distributor support plate P by two hold-down screws 25 and 26. The base plate 24 has an upstanding ear 28 which carries a grounded breaker point 30 to replace the usual fixed grounded breaker point that cooperates with the breaker point 20. The base plate 24 is adjustably mounted on the distributor plate P to permit adjustment of the position of the fixed breaker point 30, and, for this purpose, the base plate is formed with a slot 32 for adjustable engagement by the hold-down screw 25. Thus, adjustment of the base plate 24 relative to the hold-down screw 25 varies the timing of the closing of the pair of breaker points 20 and 30.

The base plate 24 of the adapter has a second upstanding ear 34 on which is mounted an insulated terminal screw 35 to replace the original terminal screw of the distributor, this terminal screw being adapted for connection with the ignition circuit in the usual manner. A leaf spring 36 anchored to the terminal screw 35 curves around the base end of the breaker arm B and is connected thereto in a well known manner to urge the breaker arm continuously counterclockwise for cooperation with the timing cam C. If desired, a thin, flexible copper strip 37 is provided adjacent the leaf spring 36 to electrically connect the terminal screw 35 with the breaker arm B to minimize the resistance to current flow. The breaker arm B is insulated from the rest of the structure and the whole breaker arm is energized continuously by the ignition circuit, the breaker point 20 and the maker point 22 being energized with the breaker arm. As indicated in Fig. 2, the breaker arm B is provided with an angular rubbing block 38 of insulating material for contact with the timing cam C, the rubbing block being attached to the breaker arm by a rivet 39.

In this particular practice of the invention, the breaker arm B is mounted in an insulated manner on a spindle or pivot pin 40, and this pivot pin is rigidly mounted on the adapter base plate 24, as indicated in Fig. 4. Thus, the pivot pin 40 is a replacement for the original pivot pin on which the original breaker arm is mounted. It is to be noted, however, that in some practices of the invention the adapter may utilize the original pivot point. For example, Fig. 10 shows a somewhat different arrangement in which the adapter base plate 24*a* is formed with an aperture 42 to clear a pivot pin 40*a* which is the original pivot pin of the distributor, the replacement breaker arm B being mounted on this pivot pin.

The present assembly or adapter further includes a maker arm M which may be of the construction shown in Fig. 3. One end of the maker arm M has a relatively large pivot aperture 44, and the other end is formed with an upstanding ear 45 on which is mounted a second maker point 46 to cooperate with the previously mentioned energized maker point 22. The maker arm M is grounded by contact with the adapter base plate 24, and thus grounds the second maker point 46. For cooperation with the timing cam C, the maker arm M is provided with an angular rubbing block 48, the rubbing block being attached to the underside of the maker arm by a rivet 50.

The maker arm M is journaled by its pivot aperture 44 on a special bearing collar 52 and the bearing collar is mounted eccentrically on the pivot pin 40. For this purpose, as shown in Figs. 4 and 5, the bearing collar 52 has an off-center bore 54 to receive the pivot pin 40. The maker arm M is confined between a lower radial flange of the bearing collar 52 and a washer 56 that lies against the upper face of the bearing collar.

Suitable spring means is provided to urge the maker arm M continuously counterclockwise towards the breaker arm B and the timing cam C. For this purpose, a leaf spring 58 may be anchored by one end to an upstanding ear 60 of the adapter base plate and attached at its other end to the maker arm M. Preferably, the rotational force transmitted to the maker arm M by the leaf spring 58 is somewhat greater than the rotational force transmitted to the breaker arm B by the leaf spring 36.

It is apparent that the pivot axis or axis of oscillation of the marker arm M shifts relative to the timing cam C when the bearing collar 52 is rotated on the pivot pin 40. In the present construction, the lower flange 55 of the bearing collar 52 is extended to form a radial wing 62 that lies flat against the adapter base plate 24. The wing 62 has an arcuate slot 64 that is concentric to the off-center bore 54. An adjustment screw 65 extends through the slot 64 and is threaded into the adapter base plate 24. Thus, the screw 65 may be loosened to permit rotational adjustment of the bearing collar 52 to shift the axis of oscillation of the maker arm M relative to the timing cam C for changing the timing of the actuation of the maker arm.

As shown in Fig. 4, the breaker arm B is mounted on the pivot pin 40 in an insulated manner by a washer 66 and a sleeve 68, both of which are made of suitable insulating material. The washer 66 rests on the previously mentioned metal washer 56 and the sleeve 68, in turn, rests on the insulated washer 66. The sleeve 68 is formed with a radial flange 70 at its upper end to retain the breaker arm B, and a screw 72 is mounted in the end of the pivot pin 40 to secure the sleeve.

Operation

The manner in which the point assembly operates for the purpose of the invention may be readily understood from the foregoing description. It is apparent that, since the insulated breaker arm B is continuously energized, current flows through the ignition coil of the ignition system whenever either the two breaker points 20 and 30 are closed or the two maker points 22 and 46 are closed. Since the maker points 22 and 46 close in advance of the closing of the breaker points 20 and 30, the addition of the maker points under control of the maker arm M reduces the duration of the interval during which the circuit through the ignition coil is open. The complete operating cycle may be understood by referring to Figs. 6 to 9.

At the stage in the firing cycle shown in Fig. 6, the rubbing block 38 of the breaker arm B has just reached the peak of a lobe of the cam C, and, in the approach to the peak, the breaker arm has closed the two maker points 22 and 46 to close the circuit through the ignition coil. In closing the two maker points 22 and 46, the breaker arm B acts on the maker arm M in opposition to the maker arm spring and thereby shifts the maker arm rubbing block 48 out of contact with the cam C. Thus, during this portion of the ignition cycle, the breaker arm B takes control of the maker arm M away from the timing cam. As may be seen in Fig. 6, with the breaker arm rubbing block 38 at the peak of the cam lobe, the breaker arm B holds the breaker points 20 spaced away from the cooperating fixed breaker point 30.

As the cam C rotates counterclockwise from the position shown in Fig. 6 to the position shown in Fig. 7, the breaker arm rubbing block 38 rides down the rear shoulder of the cam lobe, and thereby permits the breaker arm B to swing towards the cam. Thus, as the breaker arm rubbing block 38 approaches the next minimum low point between successive cam lobes, the breaker point 20 is moved into contact with the cooperating fixed breaker point 30. It is apparent that the circuit through the ignition coil remains closed throughout the period represented by Figs. 6 and 7, the current being initially carried solely by the pair of maker points 22 and 46 and being subsequently carried by both the pair of maker points and the pair of breaker points.

The continued counterclockwise rotation of the timing

cam, indicated by Fig. 8, brings the breaker arm rubbing block **38** to the minimum low point between the cam lobes to continue to hold the two breaker points **20** and **30** closed. As the breaker arm rubbing block **38** approaches the minimum low point, however, the maker arm rubbing block **48** starts up the forward shoulder of the next cam lobe and control of the maker arm is transferred from the breaker arm back to the timing cam with consequent opening of the maker points **22** and **46**. Current continues to flow through the ignition coil since the breaker points **20** and **30** continue to be closed.

As the timing cam rotates counterclockwise from the position shown in Fig. 8 to the position shown in Fig. 9, initially both of the rubbing blocks climb the forward shoulder of the next succeeding cam lobe. As a result, both the breaker arm B and the maker arm M swing outward with respect to the cam, with the maker arm staying in advance of the breaker arm to keep the two maker points **22** and **46** open. At the same time, the outward movement of the breaker arm B separates the two breaker points **20** and **30**. For the first time in the cycle, both pairs of points are open to open the circuit through the ignition coil.

In Fig. 9, the two rubbing blocks **48** and **74** straddle the peak of a cam lobe. It is important to note, however, that the maker arm rubbing block **48** at this point is moving down the rear slope of the lobe while the breaker arm rubbing block **38** is moving up the forward slope of the same lobe. Thus the grounded maker contact **46** carried by the maker arm B is momentarily moving inward towards the cooperating energized maker point **22**, and, at the same time, the energized maker point **22** is moving outward towards the inwardly moving maker points **46**. In effect, the two maker points **22** and **46** are closing at approximately twice the speed that would be possible by means of a single cam-controlled arm.

As the timing cam continues to rotate from the position shown in Fig. 9 to the first described position shown in Fig. 6, the closing movement of the maker points **22** and **46** is completed to restore current flow through the ignition coil and control of the maker arm M is again transferred from the timing cam to the breaker arm B. The pair of breaker points **20** and **30** remain open since the breaker arm continues to move outward with respect to the timing cam as the breaker arm rubbing block **38** approaches the peak of the lobe.

An important advantage of the invention is that both of the two arms B and M are mounted on the same side of the timing cam C to be actuated in close sequence by the same cam lobe in each firing cycle. If the two arms were spaced apart circumferentially to such extent as to be operated by different cam lobes in the same firing cycle, any play that might develop in the rotation of the cam shaft S would disturb the relative timing of the operation of the two pairs of points. The placing of both of the arms on the same side of the cam results in accurate timing even when the shaft S rotates erratically. Thus, the described dual arm point assembly is no more sensitive to cam wear or shaft play than a conventional single arm arrangement.

It is also to be noted that the described arrangement of both of the arms on the same side of the timing cam simplifies the problem of correctly setting the points and makes it possible to set the points by means of a feeler gauge. It is a simple matter to loosen the hold-down screw **32** for adjustment of the base plate **24** to shift the stationary breaker point **30** to determine the point in the ignition cycle at which current flow through the ignition coil is cut off and it is likewise a simple matter to loosen the adjustment screw **65** for rotation of the bearing collar **52** to determine the moment at which the maker points **22** and **46** close in the firing cycle.

The construction of the point assembly is simplified by virtue of the fact that both of the two arms are mounted on the same pivot pin **40**. Further simplicity resides in the fact that the maker arm M is grounded, both the energized breaker point **20** and the energized maker point **22** being on the insulated energized breaker arm B. By virtue of these features, the invention may be manufactured as an adapter at relatively low cost and may be readily applied as a simple replacement unit to any conventional single contact distributor.

The invention is especially advantageous for operation at high speeds. In the operation of a conventional single arm point assembly, the higher the speed, the greater the tendency of the ignition coil circuit to remain open because of the inertia of the breaker arm. Thus, the higher the speed, the shorter the relative duration of the closed circuit stage of the firing cycle. On the other hand, in the operation of the described point assembly, the inertia effect on the breaker arm tends to hold it at its outer position against the maker arm to keep the ignition coil circuit closed. Thus, the higher the engine speed, the longer the relative duration of the closed circuit stage of the cycle.

It is also to be noted with reference to high speeds that only relatively low inertia forces are involved. The breaker arm B has no greater inertia than the usual single breaker arm and the maker arm M has substantially less inertia than the usual single breaker arm. In this regard, a further feature of the invention resides in the use of the two springs **36** and **58** that continuously act on the breaker arm and maker arm respectively. Since the maker arm spring **58** is relatively strong, being preferably stronger than the breaker arm spring **36**, and since the mass of the breaker arm M is relatively low, inertia effects in the operation of the maker arm are minimized. It is also important to note that, as the breaker arm B moves outward to the position that it tends to maintain by inertia at high speed operation, the outward movement of the breaker ram is opposed by the maker arm spring as well as the breaker arm spring. Thus, the two springs cooperate to minimize inertia effects with respect to the breaker arm B.

My description in specific detail of the selected embodiment of the invention will suggest various changes, substitutions and other departures from my disclosure within the spirit and scope of the appended claims.

I claim as my invention:

1. In a distributor point system including a pair of cooperating breaker points for closing an ignition circuit, wherein one point is fixed and the other point is mounted on a breaker arm adapted to be oscillated by a timing cam adjacent one side of the breaker arm, the improvement for increasing the relative duration of the closed circuit period of the operating cycle, comprising: a pair of cooperating maker points in said circuit in parallel with said pair of breaker points, one of said maker points being mounted on the other side of said breaker arm; and movable means carrying the other of said maker points and positioned adjacent the other side of the breaker arm, said movable means being spring-biased to press towards said breaker arm to close said pair of maker points and to place the movable means under the control of the breaker arm during part of the operating cycle, said movable means having a portion positioned for contact with said cam to transfer control of the movable means directly to the cam during another part of the operating cycle for actuation of the movable means by the cam to open said pair of maker points before said breaker arm opens said breaker points, and to permit the spring-biased movable means to close said maker points after the breaker arm opens said breaker points.

2. The improvement as set forth in claim 1, in which said movable means is positioned relative to the cam and relative to said breaker arm to move towards the breaker arm as the breaker arm moves towards the

movable means, thereby to cause rapid closing of the maker points.

3. The improvement as set forth in claim 2, in which said breaker arm and said movable member each has a corresponding rubbing portion in contact with said cam, said rubbing portions being positioned relative to each other to straddle a lobe of the cam at one rotary position of the cam, whereby the rubbing portion of the breaker arm rides up the forward slope of the lobe while the rubbing portion of the movable member simultaneously rides down the rear slope of the same lobe to cause both of the maker points to move simultaneously towards each other to close the ignition circuit.

4. The improvement set forth in claim 1, which includes means to adjust said movable member relative to the cam to vary the timing of the operation of the pair of maker points.

5. The improvement as set forth in claim 4, in which said movable member is a second pivotally mounted arm and said adjustment means shifts the pivot axis of said second arm.

6. The improvement as set forth in claim 5, in which said breaker arm is mounted on a fixed spindle and said second arm is journaled on a bearing member that is eccentrically mounted on said spindle, whereby rotary adjustment of the eccentric bearing member relative to the spindle shifts the axis of the bearing member relative to said cam.

7. In a distributor point system wherein a breaker arm mounted on a pivot and actuated from one side by a timing cam carries a breaker point on its same side for cooperation with a fixed grounded breaker point to control an ignition circuit, the improvement for increasing the relative duration of the closed-circuit period of the ignition cycle, comprising: a maker arm adjacent the other side of said breaker arm; a pair of maker points in said circuit in parallel with said pair of breaker points, one of said maker points being mounted on the other side of said breaker arm and the other maker point being mounted on said maker arm; and spring means urging said maker arm towards said breaker arm to close said maker points and thereby make the maker arm directly responsive to the breaker arm for a portion of the operating cycle, said maker arm being directly responsive to said cam during an alternate portion of the operating cycle to move away from said breaker arm to open said maker points just before said breaker arm opens said breaker points and to keep the maker points open until just after the breaker points open.

8. The improvement as set forth in claim 7, which includes a pivot means for said maker arm and means to shift said pivot means relative to said cam to vary the timing of the opening and closing of the pair of maker points.

9. The improvement as set forth in claim 8, in which said pivot means comprises: a bearing mounted for rotational adjustment on an adjustment axis located eccentrically of the bearing; and means to fix the bearing at selected positions of rotation relative to said adjustment axis.

10. The improvement as set forth in claim 9, in which said bearing has a radial extension with a slot therein, and which includes a screw in said slot for releasable engagement with said extension to releasably secure said bearing.

11. The improvement as set forth in claim 9, in which said adjustment axis is the pivot axis of said breaker arm.

12. A point assembly for use in a distributor wherein a breaker arm energized by an ignition circuit and oscillated about a pivot by a timer cam carries an energized breaker point for cyclic contact with a fixed grounded breaker point, said point assembly including: a base for mounting on said distributor to be grounded thereby; a substitute breaker arm to replace the breaker arm of the distributor; a breaker point on one side of said breaker arm for energization by the circuit and cooperation with said fixed breaker point; a first maker point on the other side of said breaker arm for energization by the circuit; a second maker point for contact with said first maker point to close the circuit; and a spring-pressed maker arm carrying said second maker point to close the two maker points and thereby make the maker arm directly responsive to the breaker arm for a portion of the operating cycle, a part of said maker arm being positioned for contact with said cam during an alternate portion of the operating cycle for direct actuation of the maker arm by the cam to open the two maker points for a time period beginning before said breaker points open and ending before said breaker points close.

13. A point assembly as set forth in claim 12, which includes a pivotal bearing for said maker arm, said bearing being mounted for rotation about an adjustment axis positioned eccentrically thereof; and which includes means to releasably hold said bearing at selected positions of rotation relative to said axis.

14. A point assembly as set forth in claim 12, which includes a pivot bearing for said maker arm, said bearing having an aperture positioned eccentrically therein to permit the bearing to be mounted eccentrically on the same pivot pin as said breaker arm.

15. A point assembly as set forth in claim 14, in which said bearing has an integral wing with an adjustment slot therein; and in which screw means on said base extends through said slot for releasable engagement with the wing.

16. A point assembly as set forth in claim 12, in which said base carries a fixed breaker point grounded thereby, and in which said base is adjustable relative to the distributor to vary the position of the fixed breaker point relative to the breaker arm.

17. A point assembly as set forth in claim 12, which includes: a pivot pin on said base for pivotally mounting said substitute breaker arm; and in which said maker arm is mounted on said pivot pin by an adjustable eccentric means.

18. A point assembly as set forth in claim 17, which includes a bearing for said maker arm, said bearing being substantially larger in diameter than said pivot pin and being mounted eccentrically rotatably thereon.

19. A point assembly as set forth in claim 18, which includes means to releasably hold said bearing at various rotary positions relative to said pivot pin.

20. In a distributor for an ignition system of an internal combustion engine, the combination of: a timer cam, a first spring-pressed arm and a second spring-pressed arm for actuation independently by said cam for oscillatory movement inward and outward relative to the cam; a grounded breaker point; an energized breaker point positioned on the cam side of said first arm for intermittent contact with said grounded breaker point; an energized maker point on the side of said first arm away from the cam; and a grounded maker point on said second arm for intermittent spring-pressed contact with said energized maker point, said second arm being positioned relative to said first arm and relative to said cam for outward movement to carry the grounded maker point away from the energized maker point just before the outward movement of the first arm carries the energized breaker point away from the grounded breaker point and for inward movement during the outward movement of the first arm to restore the contact of the grounded maker point with the energized maker point before the first arm restores the contact of the energized breaker point with the grounded breaker point.

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