Dec. 25, 1928. 1,696,340

E. A. BOHLMAN

DISTRIBUTOR

Filed July 11, 1924 2 Sheets-Sheet 1

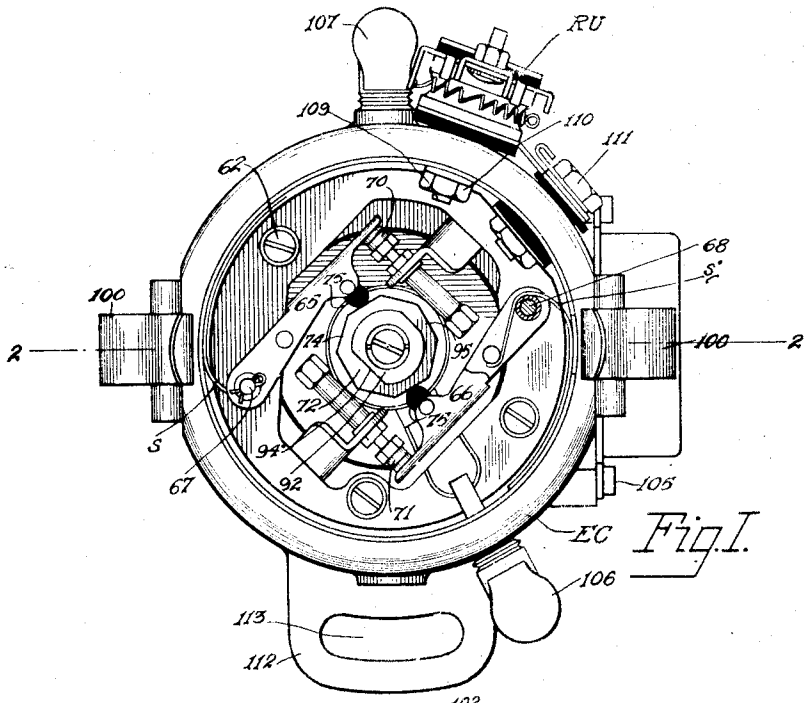

Fig. 1.

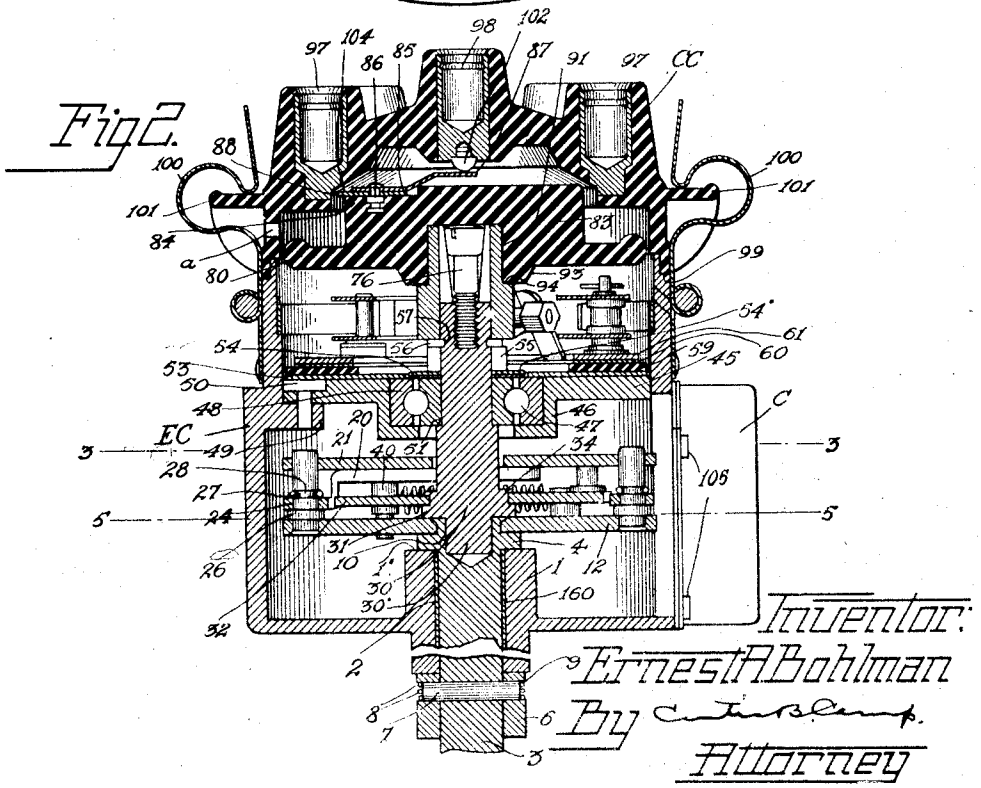

Fig. 2.

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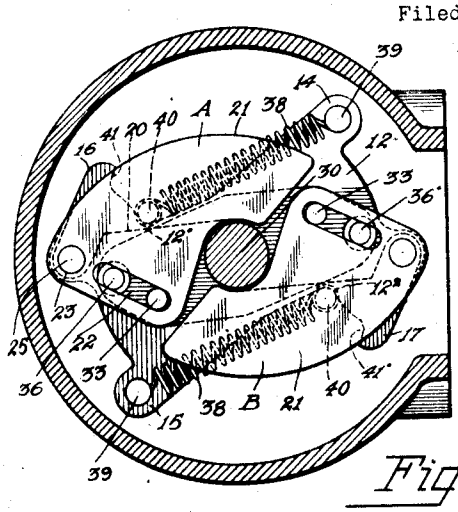

Fig. 3.

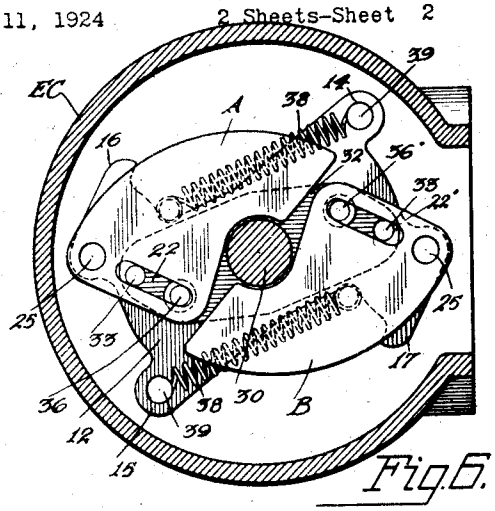

Fig. 6.

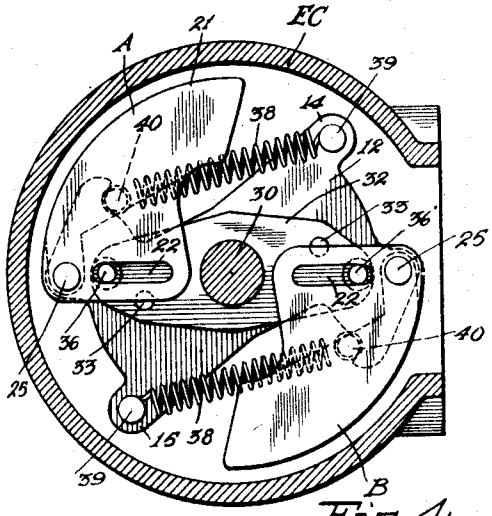

Fig. 4.

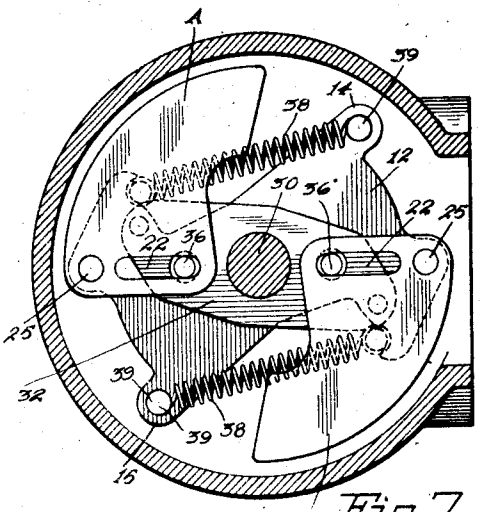

Fig. 7

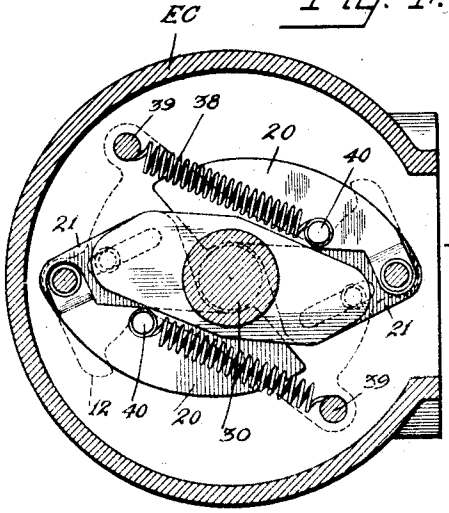

Fig. 5.

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Patented Dec. 25, 1928. 1,696,340

UNITED STATES PATENT OFFICE.

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DISTRIBUTOR.

Application filed July 11, 1924. Serial No. 725,337.

My invention relates to improvements in current controllers commonly called ignition distributors for the electric ignition of internal combustion engines, and is particularly intended for use in engines which are subject to various and sudden changes of speed, such as automobile engines and the like.

One of the objects of my invention is the provision of an ignition distributor which is provided with a simple, durable and dependable automatic spark advance control mechanism, and which ignition distributor may be considered as universal in scope as the same is designed so that it is adaptable for use with different makes of internal combustion engines which utilizes an automatic spark advance mechanism.

Another feature of my invention is the provision of an automatic spark advance control mechanism which is provided with adjustable means for adjustably controlling the angle or degree of advancement of the auxiliary rotatable shaft which is operatively associated with the ignition controlling contact means of the distributor of my invention, that is, I have provided the automatic spark advance control mechanism of my distributor with adjustable means whereby I am able to regulate the degree of advancement of the sparking mechanism of my distributor so that my distributor may be utilized on different makes of internal combustion engines.

Another feature of my invention is the construction and arragement of the weighted members of my automatic spark advance control mechanism which enables me to greatly reduce the size and weight of the said weighted members without interfering with the efficiency of my said mechanism. Prior to my invention the weighted members, of the different types of automatic spark advance control mechanism, were very large and particularly thick which made them sometimes objectionable.

Still another feature of my invention is the provision of simple stop means for limiting the degree of movement of the weighted members of the automatic spark advance control mechanism of my distributor.

The above features, as well as others, will be more specifically pointed out in the ensuing specification, and for a clearer understanding of the same reference may be had to the accompanying drawings in which like reference characters in the several views denote like parts.

Referring to the drawings:

Fig. 1 is a top plan view of the distributor of my invention with the top or cover thereof removed;

Fig. 2 is a sectional view in elevation of the distributor of my invention along the line 2—2 of Fig. 1;

Fig. 3 is a view along the line 3—3 of Fig. 2 showing the automatic spark advance control mechanism of my invention in its normal inert position, and also showing the adjustable pins, for adjustably controlling the degree of advancement of the sparking control mechanism of my distributor, in one of their adjustably operable positions;

Fig. 4 is a view similar to Fig. 3 but showing the automatic spark advance control mechanism in its fully operated position;

Fig. 5 is a bottom view of the automatic spark advance control mechanism of my invention along the line 5—5 of Fig. 2 and, showing the supporting plate, which supports the weighted members of said mechanism, in dotted lines;

Fig. 6 is a view similar to Fig. 3 but showing the manually adjustable control pins in a different adjustably operable position;

Fig. 7 is a view similar to Fig. 6 but showing the automatic spark advance control mechanism in its fully operated position.

Referring now in detail to my invention as illustrated in the drawings, the distributor of my invention comprises an enclosing cup shaped casing EC which is provided with an integrally formed hub or sleeve 1 having a central opening 2 extending therethrough. The central opening 2 is adapted to receive a cylindrical rotatable driving shaft 3, which has a circumferential collar 4 integrally formed therewith and adapted to engage and rest upon the internal end 1′ of the sleeve 1, the said sleeve 1 serving as a bearing for the rotatable shaft 3 and, as is apparent, the collar 4 of the shaft 3 bearing upon the end 1′ of the sleeve 1 will prevent downward movement of said shaft 3. A cylindrical member 6 is provided and is adapted to fit over the end of the shaft 3 and is retained thereon against

displacement and rotation relative to said shaft 3 by means of a plug 7 which engages suitably aligned openings in the shaft 3 and the said member 6, and to prevent the removal of said plug 7 I provide a flexible coil 8 which engages a suitable circumferential groove 9 formed in the member 6 and in alignment with the openings engaged by the plug 7 whereby said plug 7 lies in a plane within said coil 8. The member 6 is adapted to prevent upward movement of the shaft 3 and is also adapted to fit into a suitable opening in a shaft of the engine with which my distributor may be used, the connection of the member 6 with the engine shaft being such that rotary movement will be imparted to the shaft 3 by the engine when the engine is running.

The end of the shaft 3, having the circumferential collar 4, is provided with an opening 10, the purpose of which will be pointed out later. A plate 12 is provided which has a suitable centrally located opening adapted to permit the said plate 12 to fit over the end of the shaft 3, whereby said plate 12 will engage the circumferential collar 4 of the shaft 3 and the end of said shaft 3 is then staked over to prevent the removal of the plate 12, and the engagement of the end of the shaft 3 in the opening in the plate 12 is such as will prevent rotary movement of said plate 12 relative to said shaft 3. The plate 12 carries the control mechanism that operates to automatically advance the spark as the speed of the driving shaft increases. The plate 12 is provided with integrally formed ears 14 and 15 each of which is provided with a suitable opening. Wing members 16 and 17 are also provided and integrally formed with the plate 12, each of said wing members being provided with a suitable opening.

The weighted members A and B of my automatic spark advance control mechanism are identical in construction and assemblage and are secured and supported on the plate 12 in the same identical manner so that a description of one will suffice for a clear understanding of the other of said weighted members, the said weighted members being pivotally supported diagonally opposite each other on the plate 12.

The weighted member A comprises a pair of angularly shaped members 20 and 21 of suitable metal and, which are suitably secured together so that the contour of the curved edges of said members coincide, and, also so that the free ends of said members will coincide. A slot 22 is provided in the enlarged end of the member 21 and also an opening 23 for purposes to be pointed out later. One end of the member 20 is L-shaped and is provided with an opening 24 which is in alignment with the opening 23 in the member 21. The weighted member A is pivotally supported on the supporting member 12 by means of a pivot pin 25 which has its one end engaging the orifice in the wing member 16 and is suitably secured therein and to the said supporting plate 12 so that the collar 26, integrally formed with the pin 25, engages the upper face of the plate 12, while the other end of the pivot pin 25 extends through the aligned openings in the L-shaped end of the member 20 and the member 21, the said L-shaped end of the member 20 engaging and resting upon the upper face of the collar 26 of said pivot pin 25. To prevent the removal of the weighted member A from its pivot pin 25, a split spring member 27 is provided, which is adapted to rest in a circumferential groove 28, formed in the pin 25, so that said split spring member 27 engages the upper face of the L-shaped end of the member 20 which will prevent the displacement of the said weighted member and at the same time allow rotary movement of the said weighted member on the pivot pin 25. The L-shaped end of the member 20 engaging the pivot pin 25 and the collar 26, the weighted member A is separated from the supporting plate 12 for purposes to be subsequently pointed out.

An auxiliary shaft 30 is provided which has its one end 30′ reduced to a size so that it will fit into the opening 10 provided in the end of the shaft 3 and also bring the flange 31, formed integrally with the auxiliary shaft 30, into engagement with the end of the driving shaft 3 and a portion of the top face of the plate 12, said plate 12 and end of the shaft 3 forming a bearing for the auxiliary shaft 30. The opening 10 in shaft 3 is such as to permit movement of the auxiliary shaft 30 relative to said shaft 3. A plate 32, having a pair of openings 33 provided in each of its ends, is provided and has a central opening of a size to permit it to be slipped on over the end of the auxiliary shaft 30 and brought into engagement thereon with the flange 31, and a portion 34 of the shaft 30 is then staked over to secure the plate 32 in position on said shaft 30 against displacement and rotary movement relative to said shaft 30.

The plate 32 is positioned between the supporting plate 12 and the weighted members A and B. A pin 36 is secured in one opening of one pair of the openings 33, while a pin 36′ is secured in the corresponding opening in the other pair of openings 33 in the other end of the plate 32. The pins 36 and 36′ are adapted to engage and protrude through the oblong slots 22 in the weighted members A and B respectively, the said pins 36 and 36′ being of a size to permit their moving within the said slots 22. The portions of the members 20 and 21 of the weighted members A and B opposite the auxiliary shaft 30 are shaped so

as to conform to the contour of said auxiliary shaft 30 so that the said weighted members A and B may assume the position as shown in Fig. 3 of the drawings. To maintain the weighted members A and B in their normal inert position and to restore said members to their normal position, a pair of helical springs 38 are provided which have their one end engaging grooves in the free ends of a pair of pins 39 secured in the openings in the ears 14 and 15 of the supporting plate 12, and their other end engaging circumferential grooves in a pair of pins 40 secured in suitable openings in the weighted members A and B. The pins 40 extend downwardly and one of said pins is adapted to engage the face 12′ of the plate 12 and the inner face 41 of the wing member 16 and the other of said pins 40 adapted to engage the face 12^2 of plate 12 and the face 41′ of the wing member 17 of the said plate 12 thereby serving also as stop pins for limiting the degree of rotary movement of the weighted members A and B, the said pins 40 engaging the faces 12′ and 12^2 of the plate 12 also will prevent the weighted members A and B from engaging the auxiliary shaft 30. The plate 32 being secured to the auxiliary shaft 30 and also being disposed between the plate 12 and the weighted members A and B, and the pins 36 engaging the slots 22 in said members A and B it will be obvious that the auxiliary shaft 30 cannot move in a longitudinal direction to disengage the rotatable shaft 3, and consequently the assemblage of the various parts as just described above will be maintained. The ears 14 and 15 of the plate 12, in which the pins 39 are secured, are so positioned relative to the pins 40 secured in the weighted members A and B, that the helical springs 38 exert a pull upon the pins 40 at such an angle that the weighted members A and B tend to assume their normal position as shown in Figs. 3, 5 and 6.

A plate 45 is provided which has an integrally formed cup 46 in which is secured and supported any suitable standard type ball bearings 47 and ball bearing races 48, said plate 45 being supported in the casing EC on ears 49 integrally formed with the casing EC and is held on said ears 49 by suitable screws 50 which pass through suitable openings in the plate 45 and have screw-threaded engagement with suitably tapped orifices in the ears 49. The heads of said screws 50 are sunk into the plate 45 so that their top surface is flush with the top surface of said plate 45. One of the ball bearing races 48 is secured to the reduced end of the shaft 30 by a drive fit and rests upon the circumferential shoulder 51 of said shaft 30. A plate 53 rests upon the plate 45 and a washer 54 fits around the shaft 30 and rests upon one of the races 48, said plate 53 and washer 54 serve as separating means and also to prevent foreign matter from getting between the ball bearing races 48. A felt washer 54′ is provided which rests immediately below the washer 54 and is for the usual oiling and sealing purposes. A collar 55 fits over the shaft 30 and engages the washer 54, and a split ring 56 is provided which engages a circumferential groove 57 formed in the shaft 30 to prevent longitudinal movement of the different parts on the reduced portion of the shaft 30.

An insulation plate 59, a metal ring 60 and a metal conducting plate 61 are provided which are secured on the plate 45 by suitable screws 62, said ring 60 and plate 61 being insulated from the plate 53 and said plate 45 by the insulation plate 59, and suitable insulation bushings insulate the screws 62 from the ring 60 and plate 61. A pair of interrupter contacts 65 and 66 are pivotally supported by suitable pivot pins 67 and 68 respectively, which pins are suitably secured in openings in the ring 60 and plates 59 and 61 but suitably insulated therefrom and also do not have contactual engagement with the plates 45 and 53. Adjustable contacts 70 and 71 are provided which are secured to and supported on a pair of angular members 73 and 73′, respectively, which are formed integrally with the conducting plate 61, said contacts 70 and 71 adapted to make contactual engagement with the interrupter contacts 65 and 66 respectively. The interrupter contacts 65 and 66 are spring pressed into engagement with contacts 70 and 71 respectively by spring members *s* and *s′*. A cam member 72, having a central opening, is provided and is adapted to fit over the end of the shaft 30 and rest upon the split ring 56, so that the octonary peripheral edge 74 of the cam 72 rests between and is adapted to engage the insulation buffers 75 secured to the interrupter contacts 65 and 66. The end of the shaft 30 is split and a screw 76 has screw threaded engagement with said split end and is of such a size and shape that when screwed into the said split end, said split end will spread and engage the inner wall of the cam 72 to thereby prevent the removal of said cam 72 and to also prevent rotary movement of said cam 72 relative to the shaft 30.

The rotor element R of my distributor comprises a circularly shaped disk 80 of suitable non-conducting material. A block 83 is formed integrally with the disk 80 and has its one end 84 cut down to form a step 85. Moulded in the block 83 is a stud 86 which has one of its ends protruding above the step 85 and a contact spring 87 and a conducting member 88, having suitable

orifices, are provided and adapted to fit over said protruding end and rest upon the step 85 and are secured thereon by the stud 86, which has its end, extending through the openings in the conducting member 88 and contact spring 87, upset. Suitable means are provided for preventing rotary movement of said member 88 and spring 87 relative to the member 80. The conducting member 88 has direct contactual engagement with the contact spring 87 and extends slightly beyond the end 84 of the block 83 for purposes to be pointed out later. A central opening 91 is provided in the disk 80 and extends partially into the block 83, and is of a size and shape to fit loosely over the reduced end 92 of the cam 72 so that the collar 93 formed integrally with the disk 80 rests upon the circumferential shoulder 94 and the end of the opening 91 rests upon the end of the said reduced end 92, and to prevent rotary movement of said disk 80 on the cam 72 said cam 72 is provided with a pair of flat surfaces 94′ and 95 adapted to engage similar flat surfaces formed in the wall of the central opening 91.

Air holes *a* are provided in the casing EC for permitting air currents to pass into and out of the interior of my distributor.

A cover cap or distributor head CC is provided for my distributor which has a plurality of suitable terminals 97 suitably secured therein and adapted to receive external conductors which have connection with the spark plugs of the engine with which my distributor is used, their being a terminal 97 for each spark plug. The distributor is also provided with a suitable terminal 98 for receiving an external conductor extending from a source of current, or from a coil, said cover cap or distributor head CC adapted to fit over the open end of the casing EC and rest upon a circumferential shoulder 99 formed in the casing EC. To secure the head CC on the casing EC against displacement a pair of spring members 100 are provided and pivotally supported by suitable means on the side of the casing EC which members 100 are adapted to engage a pair of ears 101 formed integrally with the cover cap CC, and means are also provided for positioning the cap relative to the casing EC. When the distributor head CC is in position on the casing EC, as shown in Fig. 2, the free end of the contact spring 87 will engage the contact member 102 secured in the terminal 98 and the extending end 104 of the conducting member 98 will be opposite the inserted end of the terminal 97 but slightly separated therefrom by a small air gap. The contact spring 87 due to its spring tension will tend to hold the rotor element down on the cam 72. A condenser C is provided and secured on a flat portion of the casing EC by suitable screws 105 and serves for the well known purposes.

Oil cups 106 and 107 are provided and have screw-threaded engagement with suitably tapped orifices in the casing EC for conducting oil to the distributor shafts. The oil cup 107 feeds into the bearing sleeve 160 pressed into the sleeve 1. A resistance unit RU is provided for the well known purposes and is secured to the casing EC by a bolt 109 and nut 110, said resistance unit RU being conductively connected with the interrupter contacts 65 and 66 through a terminal screw 111 which has conductive connection with the plate 61 which is conductively connected with the interruper contacts 65 and 66.

For manually adjusting my distributor, lever mechanism is connected to the casing to oscillate the same. To limit the manual adjustment of the casing the same is provided with an integrally formed bracket 112 which has a slot 118.

Having described the construction of the distributor of my invention, I will now give a brief description of its operation.

When the engine with which my distributor is operatively associated is running or operating rotary motion will be imparted to the driving shaft 3 and member 6 whereupon said shaft 3 will rotate in and on the bearing sleeve 1 of the casing EC. The plate 12 being secured to the shaft 3 against rotary movement will also rotate with the shaft 3 and, the auxiliary shaft 30 being operatively and rotatably associated with the driving shaft 3 and, the weighted members A and B being pivotally supported on the plate 12 and operatively connected to the plate 32 secured to the auxiliary shaft 3, it will be at once apparent that the said auxiliary shaft 30 together with the parts supported thereon will rotate simultaneously with the shaft 3, so that the corners of the cam 72 will rotate into engagement with the buffers 75 to operate the interrupter contacts 65 and 66 to cause the same to disengage and engage the stationary contacts 70 and 71 respectively thereby interrupting the ignition circuit. The auxiliary shaft 30 will rotate in synchronism with the shaft 3 until a certain rate of speed of rotation is reached which speed will cause the weighted members A and B, pivotally supported on the plate 12 and also positioned diagonally thereon, to move outwardly and away from the auxiliary shaft 30 by centrifugal force and overcome the spring tension of the helical springs 38, and the pins 36 and 36′ secured in the openings 33 in the plate 32 and engaging the slots 22, provided in the members 21 of the weighted members A and B, the said pins 36 and 36′ will move through the said slots 22 when said weighted members A and B move outwardly and, due to

the position of the said slots and said pins 36 and 36′ and the members A and B being pivotally supported on the plate 12 and positioned diagonally opposite each other, the plate 32 will be rotated which in turn will rotate the auxiliary shaft 30 in an advanced or clockwise direction relative to the driving shaft 3, whereby the cam 72 secured on the shaft 30 will also rotate with the shaft 30 to an advanced position so that the corners of said cam will make an earlier engagement with the buffers 75 of the interrupter contacts 65 and 66 thereby advancing the spark as will be obvious to and understood by those skilled in the art. It will be obvious that the weighted members A and B can not move outwardly without moving the plate 32 and auxiliary shaft 30 in a rotatably advanced position relative to the shaft 3, due to the fact that the pins 36 and 36′ engage the slots 22 and, the weighted members A and B moving outwardly and away from each other at their free ends a pull will be exerted upon the plate 32 in the same rotatable direction to cause the same to move rotatably on the shaft 3. The weighted members A and B will move out to their maximum extent, which movement is measured by the distance between the face 12′ and the inner face 41 of the wing member 16 for the member A and by the distance between the face 12^2 and face 41′ of the wing member 17 of the plate 12 for the member B, the pins 40 secured to the members A and B are adapted to move between these faces respectively and to engage the same to limit the movement of said members A and B, to advance the spark a predetermined maximum amount when the speed of rotation has reached a certain rate of speed. When the speed of rotation has reached a certain rate of speed, and as the rate of speed decreases and drops below that necessary to maintain the weighted members A and B in their maximum operated position by centrifugal force the springs 38 will, through the medium of the pins 36 and 36′ secured to the plate 32 and the slots 22 in the members A and B move the plate 32 and shaft 30 in a counter clockwise direction relative to the driving shaft 3 thereby retarding the spark as will be clearly understood by those familiar with the art. From the above it will be seen that the driving shaft 3 serves as a bearing for the auxiliary shaft 30 as well as for supporting the same. When the shaft 30 is rotating the free end of the contact spring 87 rotates under the contact 102 secured to the terminal 98 and the conducting member 88 rotates with the rotor disk 80 whereby the free end 104 of the conducting member 88 is brought opposite the inserted ends of the terminals 97 and will establish a sparking circuit with the particular terminal 97 whose inserted end is opposite the free end of the conducting member 88.

Referring now to Figures 6 and 7, these figures show the pins 36 and 36′ secured in the other openings of the pair of openings 33 in the plate 32 and engaging the slots 22 of the members 21 of the weighted members at a different point from that shown and described in Figures 3, 4 and 5. When the pins 36 and 36′ are engaging the openings 33 in the plate 32 as illustrated in Figs. 6 and 7, the auxiliary shaft 30 will be rotatably advanced to a much greater extent than when the said pins are positioned in the opening 33 as shown in Figs. 3, 4 and 5 as the openings 33 in the plate 32 in which the pins 36 and 36′ are inserted as illustrated in Figs. 6 and 7 are positioned at a greater angle with relation to axis of the auxiliary shaft 30 than the openings 33 in the plate 32 in which the pins 36 and 36′ are located in Figs. 3, 4 and 5, so that as the weighted members are moved outward about their pivoted points 25 the plate member 32 is moved through a greater arc consequently rotatably advancing the auxiliary shaft 30 as will at once be apparent from inspection of the drawings. The pins 36 and 36′ are such as will permit the same to be readily secured in the desired openings 33 in the plate 32. While I have only shown a pair of openings 33 in each end of the plate 32 it is to be understood that other openings similar to openings 33 may be provided in said plate 32 to receive the pins 36 and 36′ whereby a different adjustment of the auxiliary shaft 30 may be obtained relative to the shaft 3. The operation of the automatic spark advance control mechanism as shown in Figs. 6 and 7 is the same as that described above in connection with the other figures of the drawings.

Thus it will be seen that by having a number of openings 33 adaptable for receiving the pins 36 and 36′ I am able to obtain practically any degree of rotatable advancement of the shaft 30 relative to the shaft 3 which obviously renders my distributor universal in scope as it may be utilized on practically any make of internal combustion engine requiring a distributor of the automatic spark advance type.

While I have described a preferred embodiment of my invention it is to be understood that I do not wish to be limited to the exact structure, as shown and described, but that I intend to cover all changes and modifications which may come within the scope and spirit of the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A device of the character described including a driving shaft, a control member secured thereto, an auxiliary shaft having

a split end adapted to be rotatable therewith and to be moved angularly with respect to said driving shaft, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam member to said shaft, centrifugally controlled means for connecting said auxiliary shaft to said driving shaft and for angularly moving said auxiliary shaft, means formed integrally with said control member for limiting the movement of said centrifugally controlled means, and adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said centrifugally controlled means.

2. A device of the character described including a driving shaft, a control member secured thereto, an auxiliary shaft having a split end adapted to be rotated with said driving shaft and to be moved angularly with respect to said driving shaft, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam member against movement relative to said shaft, centrifugally controlled means for connecting said auxiliary shaft to said driving shaft and for angularly adjusting said auxiliary shaft, means formed integrally with said control member for limiting the movement of said centrifugally controlled means, and means whereby said auxiliary shaft may be moved various amounts in response to movements of said centrifugal means from its normal to its fully operated position.

3. A device of the character described including a driving shaft, a control member secured thereto, an auxiliary shaft having a split end rotatable therewith but angularly adjustable thereto, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam member against movement relative to said shaft, centrifugally controlled means connecting said auxiliary shaft to said driving shaft, means formed integrally with said control member for limiting the movement of said centrifugally controlled means, and means whereby said auxiliary shaft may be angularly adjusted different amounts in response to movements of said centrifugally controlled means from its normal to its fully operated position.

4. A distributor and timer of the automatic advance type including a drive shaft, an auxiliary shaft, having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said auxiliary shaft, said cam adapted to be rotated to make and break an electrical circuit and means including a centrifugally controlled member for connecting said auxiliary shaft to said drive shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft to advance the spark and other means whereby the mechanism may be adjusted so that the spark will be advanced different amounts in accordance with the type of engine with which the device is used.

5. A distributor of the automatic advance type including a drive shaft, an auxiliary shaft having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure the cam against movement relative to said auxiliary shaft, said cam adapted to be rotated to make and break an electrical circuit, centrifugally controlled means for rotatably adjusting said auxiliary shaft relative to said drive shaft to advance and retard the spark and means for fully advancing and retarding the spark different maximum amounts in accordance with the type of motor with which the distributor is used.

6. A device of the character described including a drive shaft, a control member supported thereon, an auxiliary shaft having a split end adapted to rotate with said driving shaft and to be rotatably adjusted relative to said drive shaft, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam member against movement relative to said shaft, centrifugally controlled means connecting said shafts, said centrifugally controlled means having a normal and a fully operated position, means formed integrally with said control member for limiting the movement of said centrifugally controlled means, and auxiliary means whereby said auxiliary shaft may be adjusted to move different amounts with respect to said drive shaft when said centrifugally controlled means is moved from its normal to its fully operated position.

7. A device of the character described including a drive shaft and an auxiliary member having a split end rotatable with said drive shaft and rotatably adjustable with respect thereto, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said auxiliary member, a centrifugally controlled member connecting said shaft and auxiliary member and adapted to rotatably move said auxiliary member a predetermined amount with respect to said drive shaft when said centrifugal member is operated over its full range of movement, means formed integrally with said controlled member for limiting its range of movement, and means for permitting said auxiliary member to be rotatably moved a

different amount with respect to said drive shaft when said centrifugal member is operated over its full range of movement.

8. A device of the character described including a driving shaft, an auxiliary shaft having a split end and a current interrupter adapted to fit over said split end and to be operated thereby, a screw adapted to enter said split end to expand the same to secure said current interrupter against movement relative to said auxiliary shaft, a centrifugally controlled member for connecting said auxiliary shaft to said driving shaft and for rotatably adjusting said auxiliary shaft and said current interrupter with respect to said driving shaft, means formed integrally with said centrifugally controlled member for limiting the movement of said member, and adjustable means so that said current interrupter may be rotatably adjusted any desirable distance with respect to said driving shaft in response to movement of said centrifugal means from its normal to its fully operated position.

9. A device of the character described including a drive shaft, an auxiliary shaft having a split end rotatable therewith but angularly adjustable thereto, a current interrupter adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure the said current interrupter against movement relative to said auxiliary shaft, a control member secured to said drive shaft, a centrifugal member supported by said control member for connecting said auxiliary shaft and said drive shaft and for angularly adjusting said auxiliary shaft with respect to said driving shaft, adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said centrifugal member, and means formed integrally with said control member for limiting the movement of said centrifugally controlled member.

10. A device of the character described including a drive shaft, an auxiliary shaft having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said shaft, a centrifugally controlled member for connecting said drive shaft and said auxiliary shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft, said member consisting of a pair of plates in contact with each other except at one extremity of said plates at which point they are separated, adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said centrifugally controlled member, and a pivot pin extending through said plates at the point where they are separated.

11. A device of the character described including a drive shaft, an auxiliary shaft having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said shaft, a weighted member for connecting said drive shaft and said auxiliary shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft, said member comprising two plates normally in contact with each other except at one point where the plates are separated and are provided with orifices adapted to receive a pivot pin for pivotally supporting said weighted member, and adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said weighted member.

12. A device of the character described including a drive shaft, an auxiliary shaft having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said shaft, a weighted member for connecting said drive shaft and said auxiliary shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft, said member comprising two plates normally in contact with each other except at one point where these plates are separated and are provided with orifices adapted to receive a pivot pin for pivotally supporting said weighted member, adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said weighted member, and a groove in said pivot pin adapted to receive a member to prevent longitudinal movement of said weighted member.

13. A device of the character described including a drive shaft, an auxiliary shaft having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said shaft, a weighted member for connecting said drive shaft and said auxiliary shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft, said member comprising a pair of plates normally in engagement with each other except at one point where said plates are separated to provide spaced bearings for said weighted member, and adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said weighted member.

14. A device of the character described including a drive shaft, an auxiliary shaft having a split end, a cam member adapted

to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said shaft, a weighted member for connecting said drive shaft and said auxiliary shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft, said member comprising a pair of plates normally in engagement with each other except at one point where said plates are separated to provide spaced bearings for said weighted member, adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said weighted member, and a spring for returning said weighted member to its normal position, said spring lying in a plane between the planes of the spaced portions of the plates.

15. A device of the character described including a drive shaft, an auxiliary shaft having a split end, a cam member adapted to fit over said split end, a screw adapted to enter said split end to expand the same to secure said cam against movement relative to said shaft, a weighted member for connecting said drive shaft and said auxiliary shaft and for rotatably adjusting said auxiliary shaft relative to said drive shaft, said member formed of a pair of plates in engagement throughout the greater portion of their surfaces, a portion of one plate being formed to extend in a plane parallel to the plane of the main body portion of said plate, adjustable means whereby said auxiliary shaft may be moved various amounts with respect to said driving shaft for full movements of said weighted member, a pivot member extending through said plates, and retaining means engaging said pivot member at a point between said plates.

16. A device of the character described including a rotary shaft and a member attached thereto, an auxiliary shaft with a split end having a member attached thereto, a screw adapted to enter said split end to expand the same to secure said member attached thereto against movement relative to said auxiliary shaft, said auxiliary shaft adapted to rotate with said rotary shaft, a centrifugal member attached to the member attached to said rotary shaft, and means connecting said centrifugal member to the member connected to said auxiliary shaft for rotatably adjusting said auxiliary shaft relative to said rotary shaft, said last means being adjustable so that said auxiliary shaft may be rotated various amounts with respect to said rotary shaft.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 7th day of July, 1924.

ERNEST A. BOHLMAN.