

July 23, 1929.

E. A. BOHLMAN

1,721,727

DISTRIBUTOR

Filed April 14, 1926

2 Sheets-Sheet 1

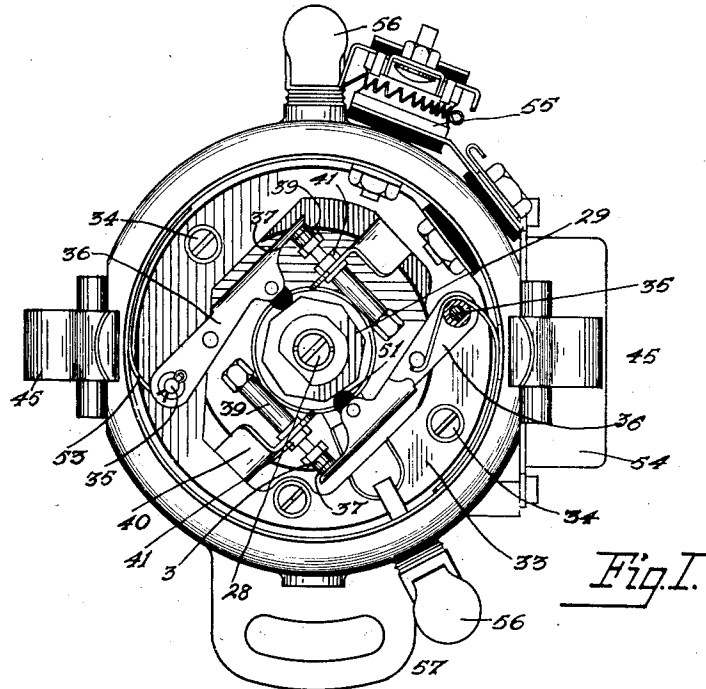


Fig. 1.

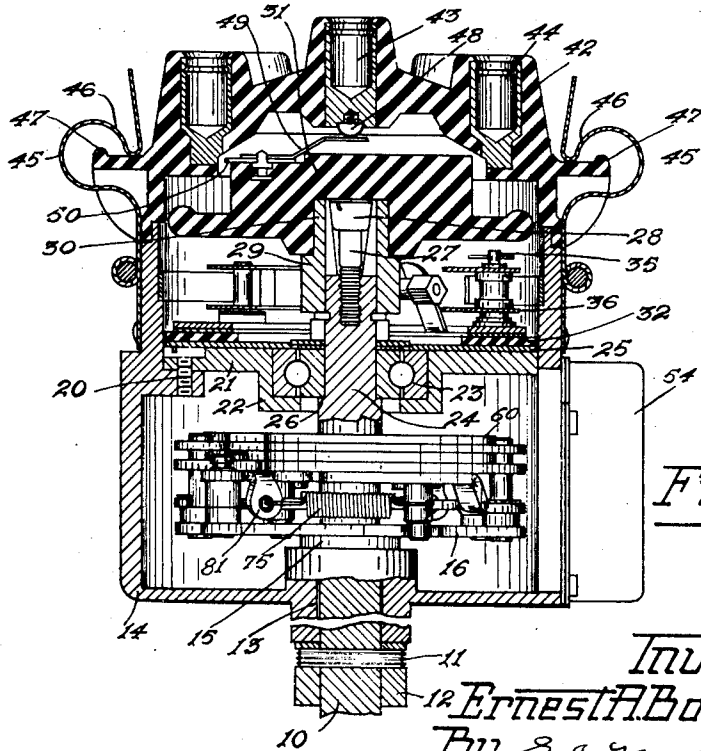


Fig. 2.

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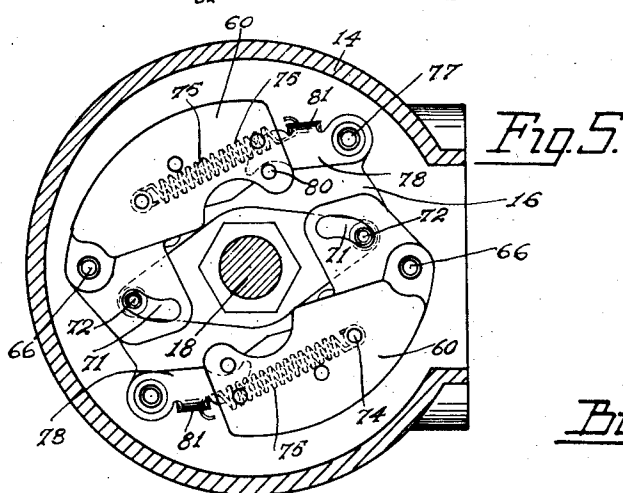
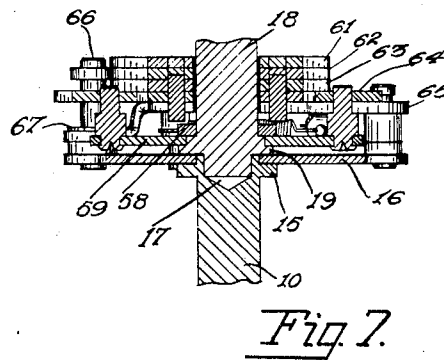
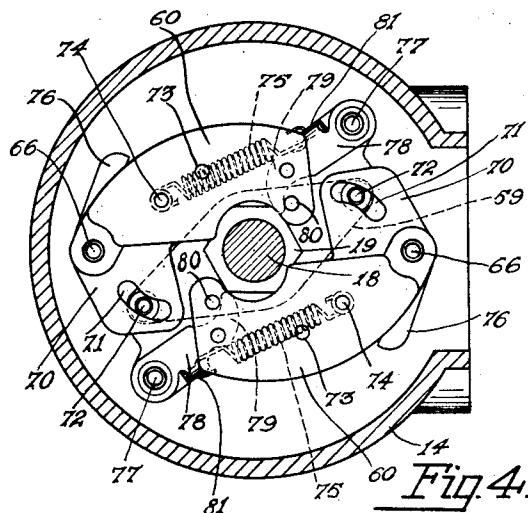
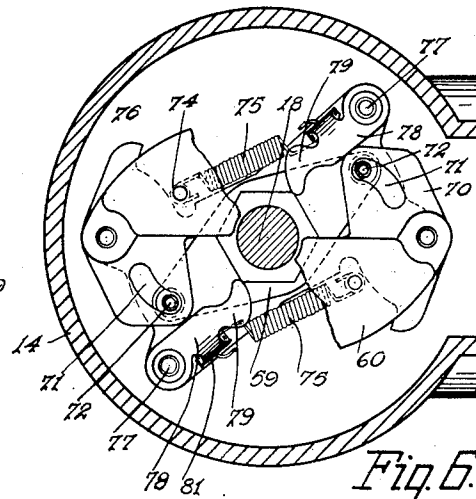
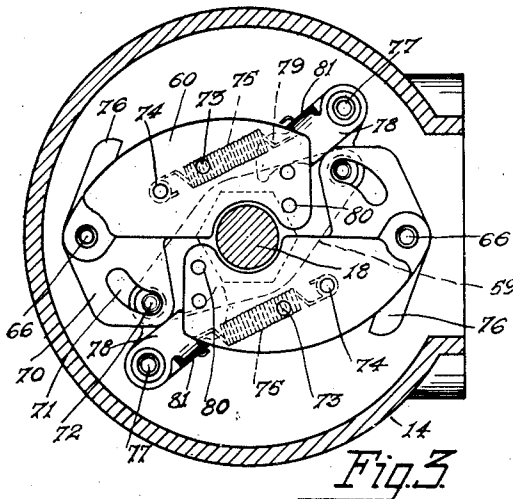
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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DISTRIBUTOR.

Application filed April 14, 1926. Serial No. 101,856.

This invention relates to distributors such as are employed to supply the spark to the cylinders of a multi-cylinder internal combustion engine and particularly to a device of this character which is adapted automatically to advance or retard the spark as the speed of the engine increases or decreases.

Devices of this character have been constructed so that, as the speed of the engine is increased, the spark is automatically advanced and as the speed of the engine decreases the spark is retarded. It has been demonstrated that the best results are not obtained when the advance of the spark is in direct ratio to the speed. That is, with engines of certain types, it is desirable that the ratio of the spark advance to the increase in speed of the motor be much greater within certain ranges of speed change than in others. With a large number of different types of motors, the best results are obtained by the provision of means whereby the spark advance is less for the higher rates of engine speed until a point is reached when little, if any, further advance of the spark is desirable.

In devices heretofore provided this variable ratio of the spark advance has been obtained by providing a plurality of springs of different tensions which come into operation successively, by providing cam contacts whereby the effective length of the lever arm of the centrifugal weight retracting means is changed or by like expedients.

The object of the present invention is the provision of an improved device of the above described character whereby the variable ratio of spark advance, above referred to, is obtained by mechanism including a single retractile (preferably spiral) spring which will be durable in construction, reliable in operation, yet, simple and cheap to manufacture.

One of the features of the present invention resides in the arrangement whereby the retractile spring for the centrifugal weight has a two point engagement with the weight, one of which is effective at all times, the other becoming effective only after the weight has become displaced from normal.

Another feature closely related to the one just referred to is the construction which acts to displace the points of attachment at the ends of the spring each from the other as the weight moves outwardly.

Other features and advantages will appear

from time to time as the description of the invention progresses.

It is believed that the invention will be understood most readily from a detailed description thereof taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of the distributor of the present invention with the insulating cap or cover removed to show the interrupter contacts and mechanism;

Fig. 2 is a vertical sectional view through the device of Fig. 1, with the cap in place, and showing the centrifugally operated spark advancing mechanism intact;

Fig. 3 is a section through the cup-shaped receptacle in which the centrifugal device is located showing the centrifugal weights or levers in fully retracted position;

Fig. 4 is a view similar to Fig. 3 but showing the centrifugal weights moved outwardly slightly from normal;

Fig. 5 is a view showing the centrifugal weights moved substantially to their outermost position;

Fig. 6 is a view similar to Fig. 3 but showing parts of the weights broken away to more clearly disclose the apparatus thereunder; and

Fig. 7 is a vertical sectional view through the centrifugal apparatus which forms the subject of the present invention.

Referring now to the drawings, in which like reference characters indicate the same parts in the different views, 10 indicates a shaft which is connected to the motor and driven therefrom in such a manner as to rotate the interrupter cams and brush of the distributor at the proper rate of speed to supply spark to the cylinders at the proper times. Secured to the shaft 10 by means of a pin (not shown) retained in position by the coil spring 11 is a sleeve or collar 12. The shaft 10 above the collar 12 passes through a bearing member 13 carried by the cup-shaped housing 14 within which the centrifugal spark advancing mechanism is arranged. The shaft 10 at the upper end thereof is provided with a flange or enlargement 15 which rests upon the upper end of the bearing member 13.

Rigidly secured to the shaft 10 above the flange 15 in any desired manner is an irregularly shaped plate 16 (see Figs. 2 and 7) upon which the movable parts of the centrifugal devices are mounted. The upper end of the shaft 10 is recessed, as indicated at 17, to re-

ceive the end of the secondary or distributor head shaft 18. Shaft 18 is provided with a flange 19 which overlies the end of shaft 10 and the central portion of plate 16.

5 Secured transversely of the housing 14 by means of screws, as 20, is a plate or diaphragm 21 provided with a recess or offset portion 22 at the center thereof within which rests the ball bearings 23 through which the reduced
10 portion 24 of secondary shaft 18 passes. Secured to the plate 21 above the bearings 23 is a second plate 25 which acts to retain the bearing members 23 in position. Shaft 18 is provided with a shoulder, as shown at 26,
15 which engages the lower side of one of the bearing blocks of bearing 23 and thus acts to prevent longitudinal displacement of the shaft 18 in an upward direction.

20 The upper end of the shaft 18 is longitudinally slotted and is provided with a tapered bore terminating in a threaded portion adapted to receive the screw 27 having a tapered head 28. Positioned about the upper end of the shaft 18 is the time cam 29, integral with
25 which is the mounting head 30 for the distributor block 31 formed of insulating material. The screw 27 with its tapered head 28 is adapted, when turned down, to expand the the upper slotted end of the shaft 18 and firmly
30 retain the distributor cam 29 in position on the shaft.

Mounted on the plate 25 is the substantially annular member 32 formed of insulating material and upon the insulating member 32 is a
35 metallic member 33 (see Fig. 1), members 32 and 33 being secured to the plate or diaphragm 21 by means of the screws 34, or in any other desired manner. Carried by the insulating plate 32 and insulated from the frame are the
40 pivot pins 35 upon which the movable arms 36 of the interrupter mechanism are mounted. Each of the arms 36 is provided with a contact 37 adapted to engage a contact carried by a pin or screw 39 adjustably mounted in
45 the bracket 40. The contact member 39 is adapted to be retained in adjusted position by any desired means, as for instance the lock nut 41.

Overlying the upper end of the housing 14
50 is a cap or cover 42 formed of insulating material within which is moulded a high tension terminal 43 and the distributor terminals 44 which are designed to be connected, respectively, to the spark plugs of the motor. The
55 cap 42 is retained in position by means of the springs 45, the upper rebent ends 46 of which engage over the flanges 47 of the cover 42. Fixed to the high tension terminal 43 is a contact 48 arranged to be engaged by the
60 inner end of the spring contact member 49 carried by the distributor block 31. In electrical engagement with the spring arm 49 is the distributor contact 50 adapted to be brought successively immediately adjacent to
65 the individual distributor contacts 44. It is

to be understood that the distributor contact 50 will be opposite the respective contacts 44 at the time the primary circuit of the ignition apparatus is interrupted at contacts 37 by the means which will now be described. 70

Carried by each of the arms 36 is a member 51 of fibre or other insulating material adapted to be held in engagement with the interrupter cam 29 by means of the springs 53, respectively. As the secondary shaft 18 and
75 interrupter cam 29 are rotated the corners of the cam 29 act in a manner well understood successively to displace the interrupter arms 36 and open contacts 37 and 39. At 54 is indicated a condenser and a resistance associated
80 with the ignition circuit is shown at 55. Oil cups 56 are provided to supply oil to the shaft or other moving parts of the distributor. Extending laterally from one side of the housing 14 is an arm or plate 57 adapted to be moved
85 forward or backward in a rotary direction in order to manually advance or retard the spark, it being understood that the lower end of the bearing member 13 (shown in Fig. 2) is rotatably supported from the motor. As
90 the distributor head herein shown forms no part of the present invention it has been only briefly described.

The automatic spark controlling mechanism forming the subject of the present invention will now be explained. As above set forth the plate 16 is fixed to the end of shaft 10 and the lower end of shaft 18 projects into the recess formed in the upper end of shaft 10. Resting on the flange 19 of shaft 18 and
100 secured thereto in any desired manner, as by the nut 58, is a plate 59, the contour of which is shown in dotted lines in Figs. 3 to 6. At 60 are indicated the centrifugal weights each of which consists of five plates or laminations
105 61, 62, 63, 64 and 65. Fixed to the plate 16 carried by shaft 10 at diametrically opposite sides are the pivot pins 66 which pass through aligned openings in the layers or laminations 62, 64 and 65, the lamination 65 being offset
110 to retain the lever or weight in spaced relation to the plate 16 as clearly indicated in Fig. 7. The movement of the weight vertically on the pin 66 is prevented by means of the split washer 67 which fits into an annular groove
115 (not shown) in the pin 66.

Each plate 64 is provided with an end 70 which extends beyond the pivot pin 66 and has therein a curved slot 71 which receives the end of a pin 72 fixed to the outer end of the plate 59. The slot 71 is so formed that as the weight 60 moves outwardly the pin 72 is operated to rotate the plate 59, and, therefore,
120 shaft 18 in a clockwise direction in relation to plate 16, as viewed in Figs. 3, 4, 5 and 6 of the drawings. This movement is clearly apparent from a comparison of Figs. 5 and 6.

The plates 61 to 65, inclusive, are held together by the rivets 73 and 74, the latter of which projects beyond the laminations to
130

form a point of attachment for one end of the spiral spring 75. This pin 74 also operates to limit the outward movement of the centrifugal weights 60 by engaging the lugs 5 76 formed integrally with plate 16. Fixed to the plate 16 at the opposite sides thereof is a pair of pivot pins 77, upon each of which is pivotally supported one end of a spring attachment arm member 78 provided with a 10 finger 79 adapted to be engaged by a pin 80 projecting downwardly from the lowermost lamination 65 of the weight 60. Extending downwardly from arm 78 is a perforated lug or ear 81 to which is secured the opposite end 15 of the spring 75. It is to be understood, of course, that each of the weights 60 and parts associated therewith are exactly identical.

Referring now to Fig. 3, it will be noted that the springs 75 act normally to retain the 20 levers 60 in their retracted positions with their inner ends substantially in engagement with the shaft 18. As the shaft 18 rotates the shaft 18 is also rotated due to the pin 72 engaging with the edges of the slot 71. As the 25 engine picks up in speed the weights 60 are moved outwardly by the centrifugal force restrained only by the action of the springs 75 on the pins 74. When, however, the weights 60 reach substantially the position 30 shown in Fig. 4 the pins 80 engage the fingers 79 integral with members 78 and the further outward movement of the weights is thus resisted at their outermost extremities as well as by the tension of springs 75 acting on pins 35 74. As the speed of the engine continues to increase each weight continues to move outwardly and in so doing rotates one of the levers or arms 78 about its pin 77 until the parts of the device assume substantially the 40 positions indicated in Fig. 5 when further outward movement is prevented by pins 72 engaging the ends of slots 71 and by pins 74 engaging extensions 76 as above described.

It will now be noted that the points of 45 attachment of the ends of springs 75 to the depending ears 81 carried by plates 78 have been moved well beyond the lines, respectively, joining pivot pins 77 to pins 74 to which are attached the ends of the springs 75. Thus 50 the latter part of the outward movement of the weights 60 is materially resisted by the fingers 79. The effect of the inward thrust of fingers 79 is particularly effective due to the fact that it acts on the portions of weights 55 60 which are remote from their pivot pins 66. Also, it will be readily understood that resistance offered by the fingers 79 increases rapidly as the arms 78 are rotated about pivot pins 77 and the points of attachment of 60 springs 75 to ears 81 pass beyond the lines joining pins 74 and 77. Thus, after the engine has reached a certain speed, the ratio of spark advance to increase in engine speed is very greatly reduced.

65 It is to be understood that the relative pro-

portions and arrangement of the parts of the device herein disclosed may be modified readily to obtain ratios of advance of the spark very different from those resulting from the structure herein disclosed. The fingers 79 70 may be arranged to engage the centrifugal weights either nearer or farther from their normal positions. Also, this engagement may take place at different points on the weights as, for instance, nearer their supporting 75 pivot pins 66. The engagement of the weights with the plates 78 may occur nearer or farther from the pivot pins 77 on which the arms 78 are mounted and a retractile spring of a different character may be employed. It is thus obvious that the device 80 may be readily modified to provide practically any varying ratios of spark advance desired. The spark controlling mechanism, above shown, operates to permit the rela- 85 tively rapid advance of the spark when the engine first speeds up and then more effectively resists the outward movement of the centrifugal weights and consequently the advance of the timing mechanism as the weights 90 move outwardly due to the increase in the speed of the engine until a point is reached where further movement of the levers, and consequently further advance of the spark, 95 is prevented.

It will be noted that the spark advancing mechanism herein disclosed consists of but a few strong and durable parts so interconnected as to reduce danger of damage or de- 100 rangement to a minimum. It also will be seen that the varying ratio of spark advance is obtained by the use of a single simple spiral wire spring, thus, not only reducing danger of breakage to the minimum, but also rendering manufacture and assembly very cheap. 105 In view of the many modifications contemplated by the inventor, the invention should be limited only by the scope of the appended claims.

Having thus described my invention, what 110 I claim is new and desire to secure by Letters Patent of the United States is:

1. In a spark distributor, a driven shaft, a second shaft, spark distributing mechanism 115 carried by said second shaft, a pivotally supported weighted lever carried by one of said shafts, a retractile spring having one end attached to said lever for normally maintain- 120 ing said lever in its innermost position, an arm pivotally supported from said one of said shafts, the other end of said spring being secured to said arm, means causing interengagement of the outwardly moving 125 portion of said lever with said arm as said lever moves outwardly impelled by centrifugal force and means, including said lever, interconnecting said shafts arranged to cause a rotary movement of said second shaft rela- 130 tive to said driven shaft responsive to the movement of said lever.

2. In a spark distributor, a driven shaft, a second shaft substantially in alignment with said driven shaft, spark distributing mechanism actuated by said second shaft, a weighted lever pivotally supported from one of said shafts, an arm pivotally supported from said one of said shafts, a spiral spring for normally retaining said lever in its retracted position, one end of said spring being joined to said lever, the other end being connected to said arm, a projection on said arm in the path of movement of the outwardly moving portion of said lever as said lever moves outwardly, and means including said lever interconnecting said shafts and arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

3. In a spark distributor, a driven shaft, a second shaft substantially in alignment therewith, spark distributing mechanism actuated by said second shaft, a plate carried by one of said shafts at substantially right angles thereto, a weighted lever pivotally mounted on said plate, an arm pivotally supported on said plate, a spring for retaining said lever in retracted position, one end of said spring being joined to said lever and the other end to said arm, said arm being positioned in the path of movement of the outwardly moving portion of said lever as said lever moves outwardly impelled by centrifugal force and means, including said lever, interconnecting said shafts arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

4. In a spark distributor, a driven rotary device, a second rotary device, spark distributing mechanism carried by said second device and a rotarily adjustable connection between said devices comprising a weighted lever pivotally joined to the said driven device, a retractile spring having one end attached to said lever, a movable member to which the other end of said spring is secured, means causing engagement of the outwardly moving portion of said weight with said member as said lever moves outwardly impelled by the centrifugal force produced by the rotary movement of said driven device and means associated with said second device for interconnecting said lever and said second device arranged to cause a rotary movement of said second device relative to said driven device responsive to the movement of said lever.

5. In a spark distributor, a driven rotary device, a second rotary device, spark distributing mechanism carried by said second device, a plate fixed to said driven device, a weighted lever pivotally joined to said plate, a retractile spring having one end attached to said lever, a movable member carried by said plate and located at the end of said plate

opposite to the end at which the weighted lever is pivoted but adjacent to the weighted portion of said lever, the other end of said spring being secured to said movable member, means causing engagement of said lever with said member as said lever moves outwardly impelled by the centrifugal force produced by the rotary movement of said driven device and means interconnecting said lever and said second device arranged to cause a rotary movement of said second device relative to said driven device responsive to the movement of said lever.

6. In a spark distributor, a driven rotary device, a second rotary device, spark distributing mechanism actuated by said second device, a plate fixed to said driven device, a weighted lever pivotally joined to said plate, a retractile spring having one end attached to said lever, a pivotally supported arm located on the end of said plate opposite to that at which the lever is pivotally supported but adjacent the weighted portion of said lever, the other end of said spring being secured to said pivotally supported arm, means causing engagement of said lever with said arm as said lever moves outwardly impelled by the centrifugal force produced by the rotary movement of said driven device, a plate fixed to said second device, and means secured to said plate fixed to said second device for interconnecting said lever and said second device arranged to cause a rotary movement of said second device relative to said driven device responsive to the movement of said lever.

7. In a spark distributor, a driven shaft, a second shaft, spark distributing mechanism actuated by said second shaft, a weighted lever pivotally supported from said driven shaft, a retractile spring having one end attached to said lever for normally maintaining said lever in its innermost position, a plate pivotally supported from said driven shaft, the other end of said spring being joined to said plate, means causing interengagement of the outwardly moving portion of said lever with said plate as said lever moves outwardly impelled by centrifugal force produced by rotary movement of said driven shaft and a plate fixed to said second shaft and a projecting stud secured thereto for interconnecting said lever and said second shaft arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

8. In a spark distributor, a driven shaft, a second shaft, spark distributing mechanism carried by said second shaft, a plate fixed to said driven shaft, a weighted lever pivotally supported from said plate, a retractile spring having one end attached to said lever for normally maintaining said lever in its innermost position, an arm pivotally supported from

an end of said plate opposite to the end at which the weighted lever is pivotally supported on said plate, the other end of said spring being secured to said arm, a depending member fixed to said lever causing inter-engagement of said lever with said arm as said lever moves outwardly impelled by the centrifugal force produced by rotary movement of said driven shaft and means inter-connecting said lever and said second shaft arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

9. In a spark distributor, a driven shaft, a second shaft substantially in alignment with said driven shaft, spark distributing mechanism actuated by said second shaft, a weighted lever pivotally supported from said driven shaft, an arm pivotally supported from said driven shaft, a spring for normally retaining said lever in its retracted position, one end of said spring being joined to said lever, the other end being connected to said arm, a projection on said arm in the path of movement of the outwardly moving portion of said lever adapted to engage said portion as said lever moves outwardly, and means interconnecting said lever and said second shaft arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

10. In a spark distributor, a driven shaft, a second shaft substantially in alignment with said driven shaft, said driven shaft having a longitudinal bore in the end thereof receiving the end of said second shaft, spark distributing mechanism actuated by said second shaft, a plate supported by said driven shaft, a weighted lever pivotally supported from said plate, an arm pivotally supported from said plate at the opposite end at which the lever is supported but adjacent to the weighted portion of said lever, a spiral spring for normally retaining said lever in its retracted position, one end of said spring being joined to said lever, the other end being connected to said arm, said arm being arranged in the path of movement of said lever as said lever moves outwardly, and

means interconnecting said lever and said second shaft arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

11. In a spark distributor, a driven shaft, a second shaft substantially in alignment therewith, spark distributing mechanism actuated by said second shaft, a plate carried by said driven shaft at substantially right angles thereto, a weighted lever pivotally mounted on one end of said plate, an arm pivotally supported on the opposite end of said plate and adjacent the weighted portion of said lever, a spring for retaining said lever in retracted position, one end of said spring being joined to said lever and the other end to said arm, said arm being positioned in the path of movement of said lever as said lever moves outwardly impelled by centrifugal force and means interconnecting said lever and said second shaft arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

12. In a spark distributor, a driven shaft, a second shaft substantially in alignment therewith, said driven shaft having a longitudinal bore in the end thereof receiving the end of said second shaft, spark distributing mechanism actuated by said second shaft, a plate carried by said driven shaft at substantially right angles thereto, a weighted lever pivotally mounted on one end of said plate, an arm pivotally supported on said plate adjacent the weighted portion of said lever, a spiral spring for retaining said lever in retracted position, one end of said spring being joined to said lever and the other end to said arm, said arm being positioned in the path of movement of said lever as said lever moves outwardly impelled by centrifugal force and means interconnecting said lever and said second shaft arranged to cause a rotary movement of said second shaft relative to said driven shaft responsive to the movement of said lever.

In testimony whereof I have signed this specification.

ERNEST A. BOHLMAN.