

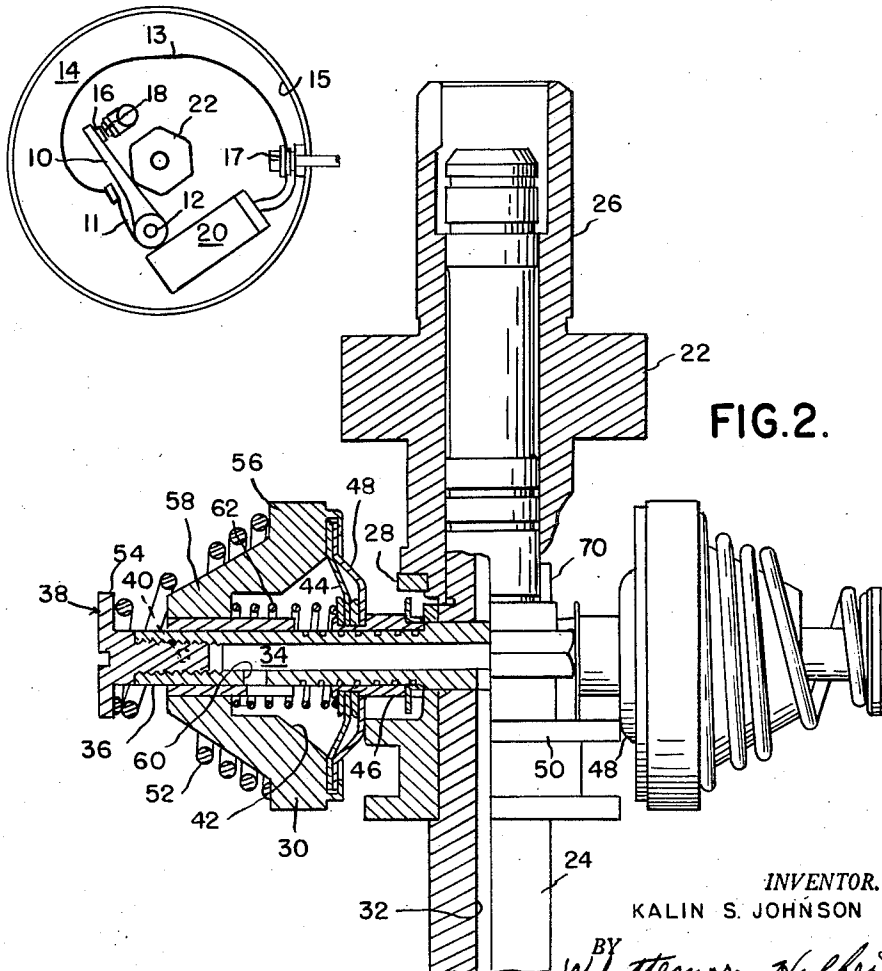
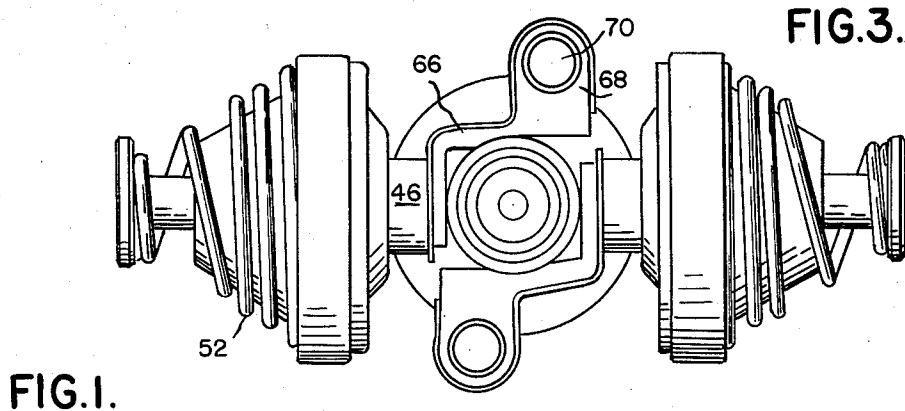
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K. S. JOHNSON
IGNITION DISTRIBUTOR

2,905,162

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

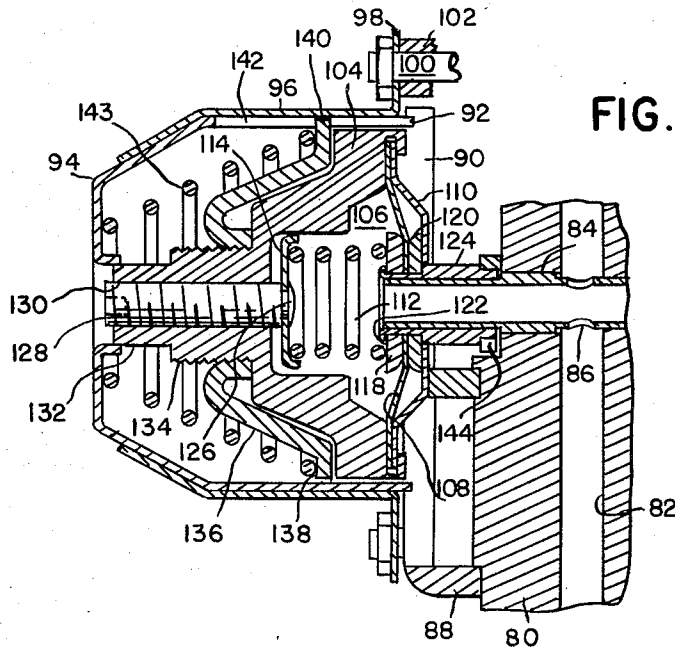


FIG. 6.

FIG. 4.

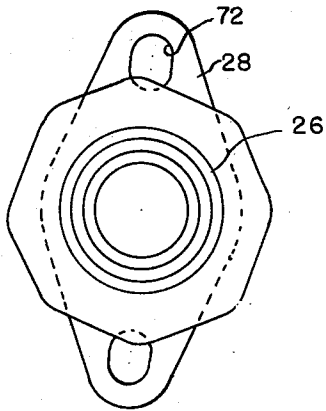
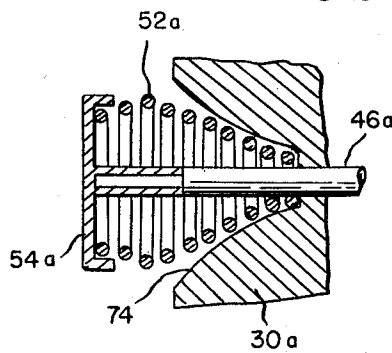


FIG. 5.



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11 Claims. (Cl. 123—117)

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The present invention relates to an ignition distributor. It is an object of the present invention to provide speed responsive means for effecting spark timing adjustment capable of producing variable spark timing adjustment throughout a wide range of speeds in accordance with desired operation.

More specifically, it is an object of the present invention to provide in a speed responsive device for effecting spark advance, spring means opposing outward movement of a centrifugal weight, and means associated with the spring means for controlling the effective length of the spring.

Still more specifically, it is an object of the present invention to provide a centrifugally responsive device including a coiled compression spring of variable diameter in association with means engageable with the spring and adapted upon compression of the spring to extend its contact progressively along a convolution thereof to reduce effective spring length.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagrammatic plan view of an ignition distributor with the cover removed.

Figure 2 is a side elevation partly in section of the mechanism for rotating and adjusting the timing cam.

Figure 3 is a plan view of the structure shown in Figure 2 with the cam removed.

Figure 4 is a fragmentary plan view of the cam with the cam adjusting plate secured thereto.

Figure 5 is a fragmentary sectional view of a different form of the present invention.

Figure 6 is a fragmentary sectional view through a modified form of cam adjusting device.

Referring first to Figure 1 the ignition distributor comprises a spring pressed arm 10 pivoted as indicated at 12 to a supporting plate 14 located in a housing indicated at 15, and having a contact 16 at the end of the arm. Contact 16 is connected to terminal 17 by means of wire 13 and conductive spring 11. A stationary contact 18 suitably grounded to plate 14 is provided. A condenser 20 is connected to terminal 17 to provide arc protection for contacts 16 and 18. A cam 22 is provided against which the arm 10 is urged by the spring and as the cam rotates, contact is rapidly made and broken between contacts 16 and 18.

Referring now to Figures 2-4 the ignition distributor comprises a shaft 24 adapted to be connected to a rotating part of the internal combustion engine with which the distributor is associated. For example, the shaft 24 may be geared to the cam shaft of the engine and driven at one-half crankshaft speed. The cam 22 in practice is provided on a tubular shaft 26 and is rotatable upon the upper reduced end of the drive shaft 24. Firmly secured to the lower end of the shaft 26 is the cam adjusting plate 28 the outline of which is best seen in Figure 4.

It is desirable to effect angular adjustment of the cam

relative to the shaft 24 to advance or retard the spark in accordance with operating conditions. These conditions are engine speed and load; the load being considered as variable in accordance with manifold vacuum.

The mechanism for effecting limited angular adjustment of the cam 22 during its rapid rotation by the shaft 24 comprises centrifugal elements 30 having manifold pressure responsive devices associated therewith. Specifically, the shaft 24 has a central fluid passage 32 therein which communicates with a passage 34 in a cross shaft 36. At its outer end the cross shaft 36 is internally threaded and receives a spring abutment screw 38 provided with friction means such for example as a nylon plug indicated diagrammatically at 40. The centrifugal element or weight 30 is provided with a recess 42 in its radially inner end closed by a flexible diaphragm 44 secured to a tubular slide 46 slidable longitudinally on the cross shaft 36. Connected to the periphery of the weight 30 is a dished cover plate 48 which as illustrated in Figure 4 abuts against an annular flange 50 to limit radial inward movement of the weight 30 under the influence of the governor spring 52. The governor spring, as shown, is a conically coiled compression spring having its small end seated against the head 54 of the screw 38. The larger end of the spring seats against a radially outwardly facing surface 56 on the centrifugal weight. Outwardly of the surface 56 the weight is provided with a contour 58 which is generally conical for a purpose which will subsequently be described. The weight moves radially on the shaft 36 to a position of balance as determined by forces developed by the spring 52 and centrifugal action. Manifold vacuum is introduced through the passages 32 and 34 and a port 60 to the chamber formed by the recess 42 where it is applied to the interior surface of the flexible diaphragm 44. A relatively light coil compression spring 62 urges the flexible diaphragm radially inward.

From the foregoing it will be seen that the position of the slide 46 is the result of the position of the centrifugal weight 30 and of the manifold vacuum effective within the chamber formed by the recess 42.

As best seen in Figure 3, each of the slides 46 includes an offset arm 66 having an outwardly extending portion 68 carrying an upwardly extending pin 70. A portion of one of the pins 70 is seen at the right in Figure 2.

The cam adjusting plate 28 as best seen in Figure 4, is provided with a pair of diametrically disposed radially extending slightly elongated openings 72 adapted to receive the pins 70. It will be observed that the two pins are movable toward and away from each other substantially tangentially of a circle concentric with the axis of the shaft 24, and that accordingly, as the pins 70 are moved, rotation is imparted to cam adjusting plate 28 and hence effects advance or retardation of the cam 22 relative to the shaft 24.

The design of the conically coiled compression spring 52 and the conical spring engaging surface of the centrifugal weight 30 permits an accurately predeterminable control over cam adjustment. The spring 52 has the convolutions thereof adjacent the large end rather closely spaced from the adjacent portion of the conical surface 58. As the weight 30 moves radially outwardly under the influence of centrifugal force, the compression spring 52 yields and initial yielding is concentrated in the outer convolutions at the large end of the spring. Accordingly, as radial outward movement of the weight continues, the outermost convolution of the spring progressively engages the adjacent conical surface of the weight, thus reducing the effective length of the spring by the amount thereof which has moved into contact with the conical surface. This shortening of the spring has the effect of producing an increasing spring rate, the rate of increase being pre-

determined by the design of the spring engaging surface 58, and the design and spacing of the convolutions of the spring. It is thus possible to obtain close conformance to any desired spark advance-engine speed curve.

In Figure 5 there is diagrammatically illustrated a similar arrangement in which case a centrifugal weight 30a is provided with a tapered recess 74 which receives a conically coiled compression spring 52a. The spring is engaged by a seat 54a which may be adjustably carried at the end of a transfer tube 46a. In this case it will be observed that the contour 76 of the spring engaging recess may be shaped as required to produce the desired progressive engagement of the spring from adjacent the small end thereof toward the large end with the interior surface of the recess. This again results in shortening of the effective length of the spring and accordingly provides a controllable increasing spring rate.

Referring now to Figure 6 there is illustrated a somewhat different embodiment of the present invention. In this case the drive shaft is illustrated at 80 having an axially extending fluid passage 82 therein. Extending transversely of the shaft 80 is a transfer tube 84 having an opening 86 therein to afford communication between the passage 82 and the interior of the transfer tube.

Fixedly mounted on the shaft 80 is a bracket 88 having upstanding posts 90 slotted as indicated at 92 and receiving the edges of a housing 94 which is of circular cross-section. It will be appreciated that two housings located diametrically opposite each other are provided in the assembly. Each of the housings is retained in position by a housing clamp 96 having upstanding ears 98 adapted to be interconnected together by a tie member 100 having a spacing sleeve 102 surrounding the tie member and engaging confronting surfaces of the ears 98. The arrangement is such that the housing clamps retain the housing members in position and provide for angular adjustment of the housing members.

Movably received within each of the housing members 94 is a centrifugal weight 104 having its inner side recessed to provide a chamber 106 closed by a flexible diaphragm 108 which is protected by an annular plate 110. Within the recess 106 is a compression spring 112 having one end engaged against an adjustable seat 114 and having its other end engaged against a washer 118. The inner edge of the diaphragm 108 is gripped between the washer 118 and a similar washer 120, the washers being retained in assembled relation by bent over end portion 122 of a sleeve 124 slidable longitudinally on the end portion of the transfer tube 84.

The spring seat 114 is riveted or otherwise secured as indicated at 126 to the inner end of a screw 128 which is threaded in an opening 130 extending through an outwardly projecting reduced portion 132 of the weight 104. The outwardly projecting portion 132 of the weight is externally threaded as indicated at 134 and adjustably threaded thereto is a contoured spring seat 136. The spring seat includes a radially extending spring abutment flange 138 which includes a lateral extension 140 received in a slot 142 provided at one side of the housing.

Received within the housing is a conically coiled compression spring 143 having one end seating against the flange 138 on the spring seat member 136, and having its other end engaging the outer end of the housing 94. It will be observed that compression of the spring 112 may be adjusted by the screw 128 and independent adjustment of the spring 143 accomplished by rotation of the housing 94, which in turn imparts rotation to the contoured spring seat 136 by virtue of engagement with the laterally extending ear 140. At this time rotation of the weight 104 about its axis is prevented by reason of cover plate 110, slide 124, and the offset arms (not shown) which include the annular slide engaging portions 144.

It will be appreciated that two sleeves 124 are provided on opposite end portions of the transfer shaft 84 and that these sleeves move toward and away from each other

under the influence of changing centrifugal force due to speed variation or changing vacuum existing within the chamber 106, as in the embodiment of the invention previously described. In this case each of the sleeves is provided with a laterally offset arm corresponding to the arm 66, and having an annular portion 144 by means of which it is secured to the sleeve. These offset arms may be connected to an adjusting plate by pin and slot constructions similar to or identical to that described in conjunction with the embodiment of the invention illustrated in the preceding figures.

In this case also the spring engaging contour of the spring seat 136 is chosen to cause a desired progressive extension of contact between the spring and the external conical contoured surface of the spring seat, so as to cause the operation to conform to the desired spark advance-engine speed curve.

In both cases it will of course be appreciated that the final result is effected by the precise spring engaging contour of the weight, the lead or axial advance per turn of the conical spring, and other considerations. The spring contour, while illustrated as conical, may be otherwise tapered. In general however, the arrangement is such that under compression, the effective length of the coiled spring is continuously decreased, thus providing for a corresponding increasing spring rate.

While in the specific embodiments illustrated herein, the combinations of speed responsive means (centrifugal devices) and means responsive to a separate engine condition (specifically manifold vacuum) have been shown, it will of course be appreciated that the particular features of novelty of the speed responsive centrifugal device may be used alone to effect engine control. Alternatively of course, the particular speed responsive centrifugal device may be associated with means responsive to engine conditions other than manifold vacuum to effect engine control.

The drawings and the foregoing specification constitute a description of the improved ignition distributor in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. In an ignition distributor for an internal combustion engine comprising a rotary shaft, a cam angularly adjustable on said shaft, centrifugal weights connected to rotate with said shaft, conical coil compression springs opposing outward movement of said weights, conical means between said weights and springs engageable progressively with successive convolutions of said springs upon outward movement of said weights, pressure responsive means carried by said weights adapted to be connected to manifold vacuum and including movable members connected to said cam to effect angular adjustment thereof in accordance with shaft speed and manifold vacuum.

2. In an ignition distributor, a timer shaft adapted to be connected to an engine, a cam shaft angularly adjustable on said timer shaft, said timer shaft having an axially extending passage adapted to be connected to engine manifold pressure, a hollow cross shaft connected to said timer shaft and having an axially extending passage communicating with the passage in said timer shaft, spring seats at the end of said cross shaft, centrifugal weights slidable longitudinally on said cross shafts, coil compression springs interposed between said spring seats and weights, said weights having tapered portions extending within the convolutions of said springs to progressively contact successive convolutions thereof upon radial outward movement to thereby provide a progressively shorter effective length of spring and a correspondingly increasing spring rate, said weights having pressure responsive chambers connected to the passage in said cross shaft, said chambers including movable members connected to said cam shaft.

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3. In an ignition distributor, a timer shaft adapted to be connected to an engine, a cam shaft angularly adjustable on said timer shaft, a cross shaft connected to said timer shaft, spring seats at the end of said cross shaft, centrifugal weights slidable longitudinally on said cross shaft, conically coiled compression springs interposed between said spring seats and weights with the small ends thereof engaged on said spring seats, said weights having conical portions extending within the large end of the conically coiled convolutions of said springs to progressively contact successive convolutions thereof upon radial outward movement to thereby provide a progressively shorter effective length of spring and a correspondingly increasing spring rate.

4. In spark advance mechanism for an ignition distributor comprising a drive shaft, a transfer shaft connected to said drive shaft to extend transversely thereof, a mount fixed to said drive shaft, housings connected to said mount for angular adjustment about the transverse axis occupied by said transfer shaft, a centrifugal weight movable in each of said housings axially thereof, a coiled compression spring in each of said housings opposing outward movement of the weight therein, a spring seat threaded to each of said weights, means preventing rotation of said weights about said transverse axis, a connection between said spring seat and housing to effect rotation of said seat upon angular adjustment of said housing.

5. In spark advance mechanism for an ignition distributor comprising a drive shaft, a transfer shaft connected to said drive shaft to extend transversely thereof, a mount fixed to said drive shaft, housings connected to said mount for angular adjustment about the transverse axis occupied by said transfer shaft, a centrifugal weight movable in each of said housings axially thereof, a coiled compression spring in each of said housings opposing outward movement of the weight therein, a spring seat threaded to each of said weights, means preventing rotation of said weights about said transverse axis, a pin and slot connection between said spring seat and housing to effect rotation of said seat upon angular adjustment of said housing.

6. In spark advance mechanism for an ignition distributor comprising a drive shaft having a fluid passage adapted to be connected to engine manifold vacuum, a transfer shaft connected to said drive shaft to extend transversely thereof, said transfer shaft having a passage extending longitudinally thereof and connected to said fluid passage, a mount fixed to said drive shaft, housings connected to said mount for angular adjustment about the transverse axis occupied by said transfer shaft, a centrifugal weight movable in each of said housings axially thereof, a coiled compression spring in each of said housings opposing outward movement of the weight therein, a spring seat threaded to each of said weights, means preventing rotation of said weights about said transverse axis, a connection between said spring seat and housing to effect rotation of said seat upon angular adjustment of said housing, said weights having chambers at their inner sides in communication with the passage in said transfer tube, movable closures for said chambers, and means for connecting said movable closures to a cam carried by said drive shaft.

7. In spark advance mechanism for an ignition distributor comprising a drive shaft, a transfer shaft connected to said drive shaft to extend transversely thereof, a mount fixed to said drive shaft, housings connected to said mount for angular adjustment about the transverse axis occupied by said transfer shaft, a centrifugal weight movable in each of said housings axially thereof, a conical coiled compression spring in each of said housings opposing outward movement of the weight therein, a spring

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seat threaded to each of said weights, said spring seats having conical spring engaging surfaces shaped to extend contact progressively along said spring upon compression thereof, means preventing rotation of said weights about said transverse axis, a connection between said spring seat and housing to effect rotation of said seat upon angular adjustment of said housing.

8. In spark advance mechanism, a drive shaft, a cross shaft, adjustable spring seats at the ends of said cross shaft, centrifugal weights movable on said cross shaft radially of said drive shaft, said weights each having a tapered spring engaging surface, and a correspondingly tapered coil spring extending between each spring seat and the spring engaging surface of the adjacent weight, said spring and surface being shaped to cause spring contact to extend progressively along said spring upon compression thereof, said weights being of unitary construction.

9. In an ignition distributor for an internal combustion engine comprising a rotary shaft, a cam angularly adjustable on said shaft, centrifugal weights connected to rotate with said shaft, tapered compression springs opposing outward movement of said weights, smoothly tapered spring seats between said weights and springs engageable progressively with successive convolutions of said springs upon outward movement of said weights, pressure responsive means carried by said weights adapted to be connected to manifold vacuum and including movable members connected to said cam to effect angular adjustment thereof in accordance with shaft speed and manifold vacuum.

10. An ignition distributor comprising a timer shaft adapted to be connected to an engine, a cam shaft angularly adjustable on said timer shaft, a cross shaft connected to said timer shaft having oppositely and radially extending arms, annular outer spring seats at the outer ends of said arms, centrifugal weights slidable on said arms, said weights being elongated in the direction of the axes of said cross shaft and having the inner ends thereof adjacent the timer shaft radially enlarged to form annular inner spring seats substantially larger in diameter than said outer spring seats, the radially outwardly facing surfaces of said weights being tapered to a smaller diameter at the ends thereof adjacent the outer spring seats, tapered coiled compression springs disposed between said outer and inner spring seats, the outwardly facing surfaces of said weights and the shape of said springs being related to provide for a controlled progressive engagement along said springs commencing at the ends thereof seated on said inner spring seats.

11. An ignition distributor comprising a timer shaft adapted to be connected to an engine, a cam shaft angularly adjustable on said timer shaft, a cross shaft connected to said timer shaft having oppositely and radially extending arms, annular outer spring seats at the outer ends of said arms, centrifugal weights slidable on said arms, said weights being elongated in the direction of the axes of said cross shaft and having the inner ends thereof adjacent the timer shaft radially enlarged to form annular inner spring seats substantially larger in diameter than said outer spring seats, the radially outwardly facing surfaces of said weights being tapered to a smaller diameter at the ends thereof adjacent the outer spring seats, tapered coiled compression springs disposed between said outer and inner spring seats, the outwardly facing surfaces of said weights and the shape of said springs being related to provide for a controlled progressive engagement along said springs commencing at the ends thereof seated on said inner spring seats, the radially enlarged inner ends of said weights having inwardly facing cavities therein, movable pressure responsive closures overlying said cavities, means connecting said cavities to a source of

variable pressure, and means connecting said movable closures to said cam.

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