June 14, 1960 M. BEGIAN 2,941,049

IGNITION DISTRIBUTORS

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3 Sheets-Sheet 1

FIG. 2.

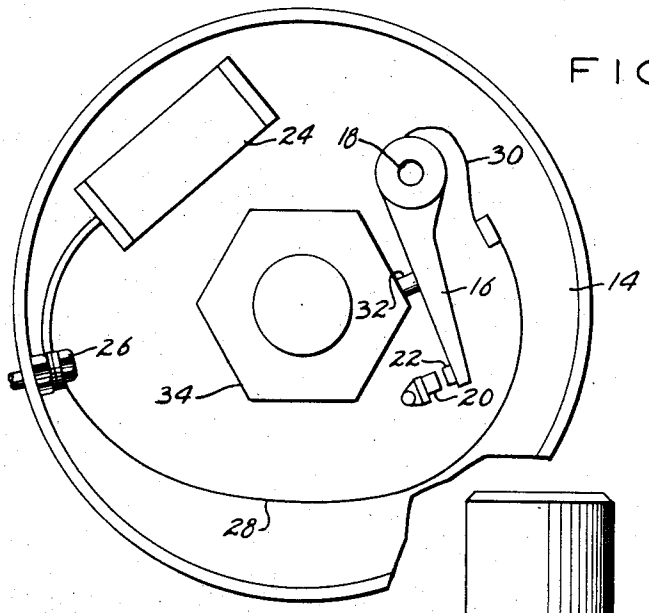
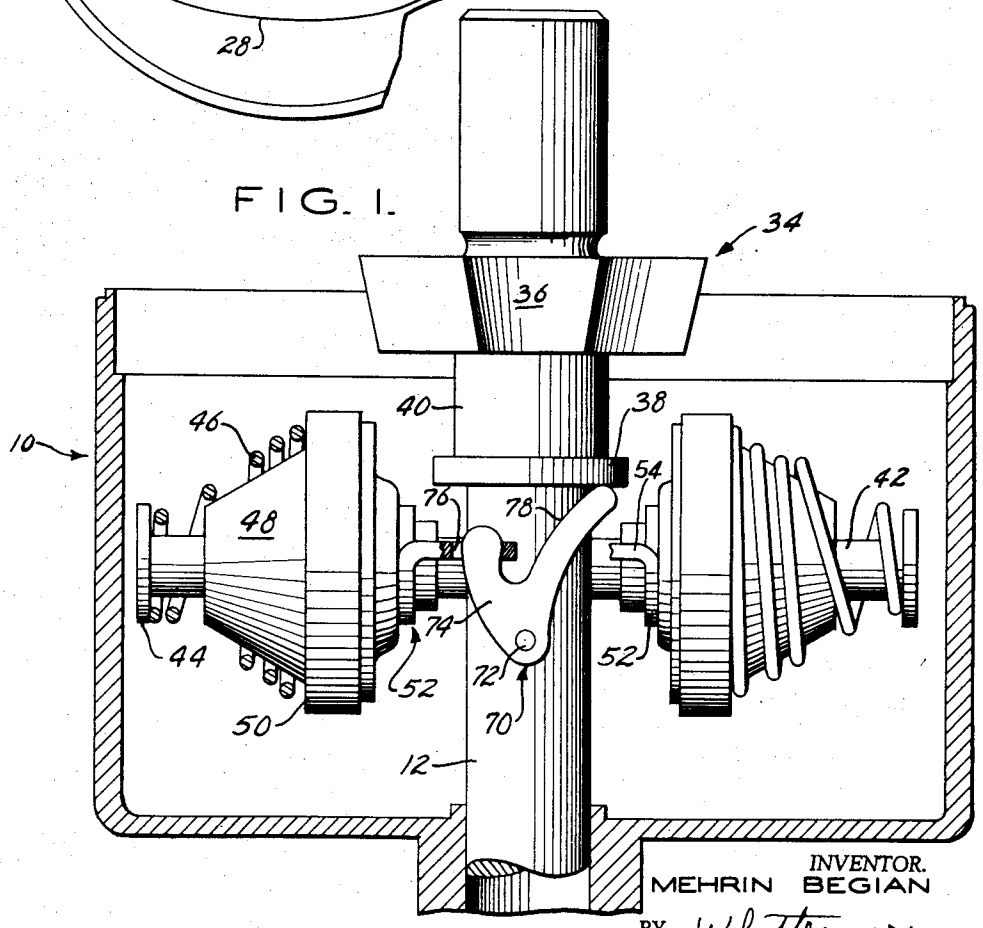


FIG. 1.



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FIG. 3.

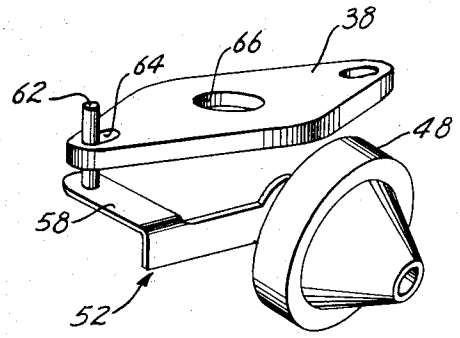


FIG. 4.

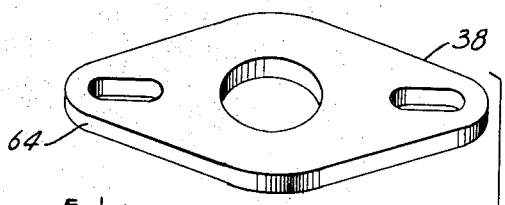
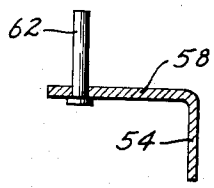


FIG. 5.



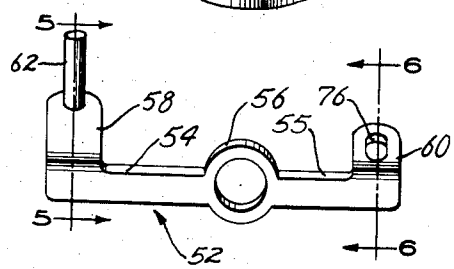
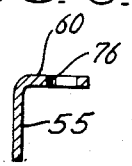


FIG. 6.



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FIG. 7.

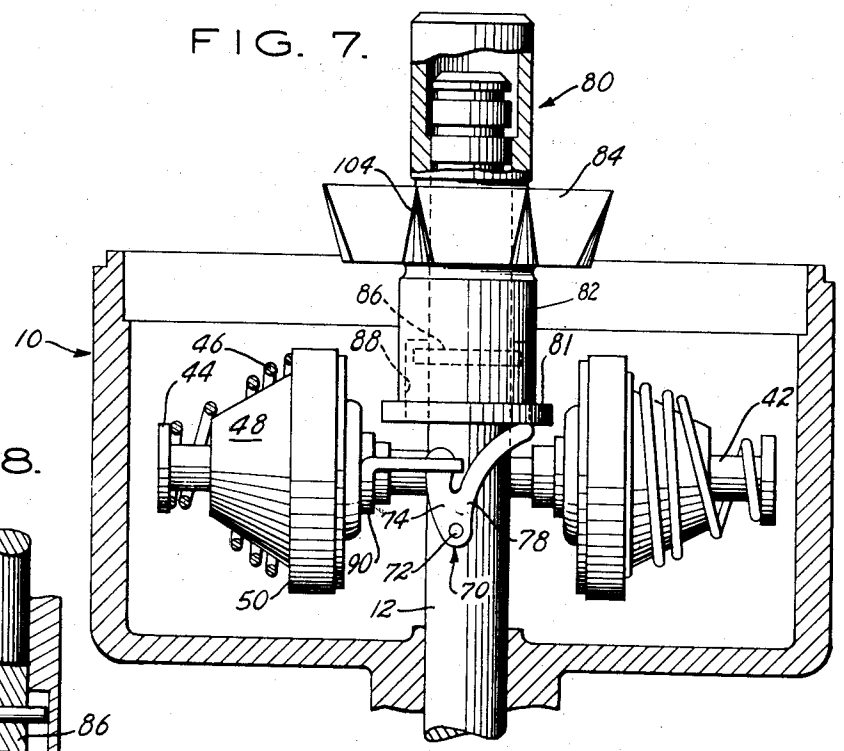


FIG. 8.

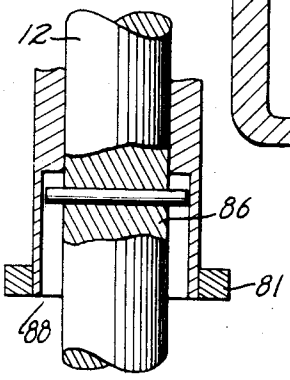


FIG. 10.

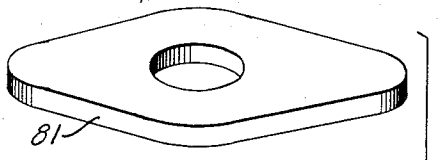


FIG. 9.

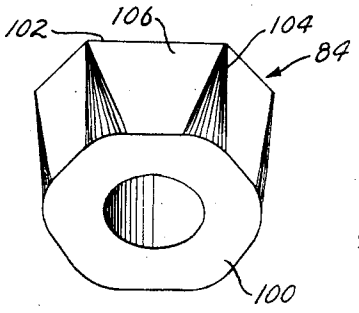
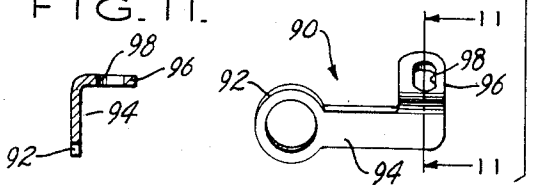


FIG. 11.



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United States Patent Office 2,941,049 Patented June 14, 1960

2,941,049

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Filed Dec. 27, 1957, Ser. No. 705,693

18 Claims. (Cl. 200—31)

The present invention relates to ignition distributors.

At very high speeds, the time available for current flow to the ignition coil is very short and as a result the current cannot reach its maximum value and the output voltage is reduced. It has been proposed, in ignition distributors which must operate at speeds where this reduced output is serious, to provide two sets of contacts, wired in parallel and arranged so that their periods of closure overlap. This method increases the closed or dwell time throughout the entire speed range but has the disadvantage that at low speeds where the ignition coil normally saturates anyway, additional energy is provided which must be dissipated in the form of heat.

It is an object of the present invention to provide a means of increasing the dwell time with an increase in engine speed without the disadvantages inherent in prior devices.

More specifically, it is an object of the present invention to provide speed responsive means effective to produce an increase in the dwell time as well as a timing advance.

It is a feature of the present invention to provide in an ignition distributor, a timing cam carried by a rotating drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, in combination with speed responsive means carried by the shaft and operable to produce independent angular and axial adjustment of the cam relative to the shaft.

It is a further feature of the present invention to provide in structure as described in the foregoing a cam of symmetrical pyramidal shape.

It is a further object of the present invention to provide in an ignition distributor, a timing cam carried by a rotating drive shaft for rotation therewith and for limited axial adjustment relative thereto, in combination with speed responsive means carried by the shaft and operates to produce axial adjustment of the cam relative to the shaft.

Still more specifically, it is a feature of the present invention to provide a rotary drive shaft, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in accordance with drive shaft speed, a timing cam on said drive shaft adapted to rotate therewith and to have limited angular and axial adjustment relative thereto, and independent means carried by said members and operatively associated with said cam for effecting independent angular and axial adjustment of said cam relative to said drive shaft upon radial movement of said members.

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

Figure 1 is an elevation view of the ignition distributor, partly in section and with parts omitted.

Figure 2 is a diagrammatic plan view of the ignition distributor with the cover removed.

Figure 3 is a fragmentary perspective view of part of the distributor.

Figure 4 is a perspective exploded view of a cam plate and actuator therefor.

Figure 5 is a fragmentary view taken substantially on the line 5—5, Figure 4.

Figure 6 is a section on the line 6—6, Figure 4.

Figure 7 is an elevational view of a modified form of distributor partly in section and with parts omitted.

Figure 8 is a fragmentary sectional view showing connection of the cam to the shaft.

Figure 9 is a perspective view of a cam form suitable for use in the construction of Figure 7.

Figure 10 is an exploded perspective view of details of the cam actuating mechanism.

Figure 11 is a section on the line 11—11, Figure 10.

The distributor comprises a housing 10 into which extends a rotary drive shaft 12 adapted to be connected to a rotating part of the internal combustion engine of which the distributor is a part. The distributor includes a breaker plate 14 shown in Figure 2, on which is pivoted a breaker arm 16 the pivot connection therefor being indicated at 18, and serving to mount the breaker arm 16 for rocking movement about an axis spaced from and parallel to the axis of the shaft 12. The ignition circuit includes a stationary contact 20 and a movable contact 22 is carried by the breaker arm 16 for movement into and out of engagement with the stationary contact 20. The circuit includes a condenser 24 connected to a terminal 26 from which an electrical conductor 28 leads to the breaker arm 16 through a spring 30, and additional means (not shown) are provided which are effective to bias the breaker arm 16 clockwise as seen in Figure 2. A rubbing block 32 is carried by the breaker arm 16 and is engageable with the cam 34. As is apparent from an inspection of Figure 2, rotation of the cam causes the breaker arm 16 to move back and forth, making and breaking contact between the contacts 20 and 22.

It will be appreciated that the ignition circuit is adapted to produce sparks within the cylinders of the internal combustion engine in properly timed relation to piston movement therein and as is well understood, it is desirable to advance the spark upon increase in speed.

In accordance with the present invention means are also provided which are effective to prolong the interval or angular movement of saft 12 during which the contacts 20 and 22 remain in contact upon an increase in speed of the internal combustion engine. This is accomplished by providing the cam 34 in the configuration best illustrated in Figures 1 and 2 and by providing for both limited angular and axial adjustment of the cam relative to the shaft 12.

The cam, which is herein illustrated as hexagonal, may of course have a different number of sides depending upon the number of cylinders in the internal combustion engine. Inasmuch as separate angular and axial adjustment is provided for the cam and since these adjustments may be independently controlled by proper design of the mechanism, it is possible to employ a cam having inclined flat surfaces 36. In other words, the cam is a symmetrical pyramidal body. This is of practical importance since this body may be readily produced by simple and inexpensive methods and apparatus. It is thus possible to avoid the production of contoured cams having three dimensional curves which would otherwise be required.

The cam 34 has rigidly connected thereto a cam plate 38 the plate being connected to the cam by a sleeve 40 and the cam, sleeve and plate being freely mounted on the rotary drive shaft 12 for angular and axial movement relative thereto.

Means are provided for driving the cam and cam plate in rotation with the drive shaft and at the same time for effecting limited relative angular and axial adjustment thereof.

This means comprises a cross shaft 42 fixedly carried by the drive shaft 12. The cross shaft at its ends includes heads 44 constituting abutments for springs 46. Slidably mounted on the cross shaft 42 for movement radially of the drive shaft 12 are centrifugal weights 48 having flanges 50 engaging the ends of the springs 46. Accordingly, during rotation of the shaft 12 centrifugal forces developed by rotation of the weights 48 tend to move the weights radially outwardly on the cross shaft 42 and this movement is opposed by the springs 46. Thus, the instantaneous position of the centrifugal weights 48 is determined by the corresponding speed of the drive shaft 12.

In order to employ radial movement of the weights 48 resulting from changes in speed of the shaft 12 to effect independent angular and axial adjustment of the cam 34, each of the weights 48 is provided with a bracket 52 details of which are best seen in Figures 3–6. The bracket 52 comprises an elongated portion 54 including an enlarged central eye portion 56 slidable on the cross shaft 42. At its opposite ends it carries forwardly projecting arms 58 and 60. The arm 58 is relatively long and adjacent its outer end carries a pin 62.

The plate 38, as best seen in Figure 3, is elongated and adjacent its outer ends is provided with elongated slots 64 for receiving the pins 62. The plate 38 includes a central opening 66 which receives the shaft 12. It will be observed in Figure 3 that the axis of the weight 48 is positioned to intersect the axis of the shaft extending through the opening 66. Accordingly, it will be understood that the pin and slot connection 62, 64 interconnecting the arm 58 of the bracket 52 and the cam plate 38 is located laterally of both the shaft 12 and the cross shaft 42. Thus, movement of the centrifugal weight 48 on the cross shaft in a direction radial with respect to the drive shaft 12 results in angular movement of the cam plate 38 relative to the drive shaft 12. The amount of such movement is of course a function of the spacing of the pin 62 from the axis of the shaft and this may be determined independently of the means for effecting axial movement of the cam plate. In addition it will be observed that the pin and slot connection 62, 64 serves in all positions of angular adjustment of the cam plate 38 to transmit the driving rotation from the shaft 12 through the cross shaft 42, weight 48, and bracket 52 to the cam plate 38.

The means for effecting axial adjustment of the cam plate 38 comprises a pair of levers 70 pivoted to the shaft 12 as indicated at 72. The levers 70 are bell crank levers and each includes a first arm 74 slidable in an elongated slot 76 in the arm 60, and a second arm 78 in engagement with the underside of the cam plate 38, as best seen in Figure 1. It will be apparent that movement of the weights 48 on the cross shaft 42 results in rocking movement of the bell crank levers 70 and corresponding axial movement of the cam 34 relative to the shaft 12. Again, it will be observed that this axial adjustment of the cam is entirely independent of its angular adjustment and the action can be modified by changes in design of the bell crank levers without affecting angular adjustment of the cam.

Upon an increase in engine speed, the centrifugal weights 48 move radially outwardly relative to the drive shaft 12 and this movement through the medium of the arms 58 and the pin and slot connection 62 and 64 results in appropriate advance of the spark. At the same time outward movement of the weights 48 through the medium of the arms 60 and levers 70 results in upward movement of the cam 34 as seen in Figure 1. This results in causing the rubbing block 32 to engage a portion of the pyramidal surface of the cam at a path closer to the axis of the shaft 12. In other words, outward movement of the breaker arm 16 resulting from engagement between the rubbing block 32 and high points of the cam surface takes place later and terminates earlier than at slower speed, thus resulting in an increase in the duration of closure of the contacts 20 and 22 measured in degrees of rotation of shaft 12.

Referring now to the embodiment of the invention illustrated in Figures 7–11, the basic structure is similar and the same reference numerals are applied to identical parts and these parts will not be further described.

In this embodiment of the invention a modified cam device indicated generally at 80 is employed. The cam device in this case is intended to be rotated by the shaft 12 but its adjustment relative to the shaft in response to changes in speed is in this case limited to axial displacement on the shaft. For this purpose the cam device 80 includes a plate 81 at the lower end of a tubular sleeve 82 extending downwardly below the cam body 84. The shaft 12 is provided with the bell crank lever 70 as previously described, having the arm 78 engageable with the lower side of the plate 81 to effect vertical movement of the cam device upon radial movement of the centrifugal weights 48. In order to drive the cam and at the same time to prevent relative angular movement between the cam device and shaft, the shaft 12 is provided with a cross pin 86 as best seen in Figure 8, the pin being slidably received in slots 88 provided at the interior of the sleeve portion 82.

Since only vertical adjustment of the cam device is contemplated, it is possible to omit the structure corresponding to the pin 62 and slot 64 as seen in Figure 4, and accordingly the centrifugal weights are each provided with brackets 90 including a centrifugal eye 92 slidable over the cross shaft 42 and a single laterally extending arm 94 having a forwardly extending portion 96 provided with an elongated slot 98 to receive the actuating arm 74 of the bell crank lever 70.

Referring now to Figure 9 there is illustrated a suitable shape for the cam body 84. It will be recalled that upon an increase in speed of the drive shaft 12 the cam body moves vertically upwardly and accordingly the portion of the periphery of the cam body which is engaged by the rubbing block 32 is nearer to the bottom. As seen in this figure, the bottom of the cam is indicated at 100 and the top surface at 102. The surfaces 104 constitute camming surfaces separated by flat areas 106 intermediate the camming area. It will be observed that the camming areas have more angular extent adjacent the bottom thereof and hence may be designed to maintain the contacts 20, 22 closed for a longer period at high speed. The function of advancing the spark in conjunction with increasing the duration of contact closure on an increase in speed may be provided by disposing the camming surfaces 104 somewhat inclined to the axis of the cam.

The drawings and the foregoing specification constitute a description of the improved ignition distributors 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. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited adjustment relative thereto, said cam being in the form of a regular prism having the outer surfaces of its lobes modified to be of concentric circular cross-section of progressively varying radius axially of said cam, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, said cam having lobes operable to move said breaker arm to separate said switch contacts, said cam having lobes shaped to increase the period

of closure of said contacts and to advance the instant of closure relative to the rotational position of said shaft, and means responsive to variations in shaft speed to adjust said cam.

2. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited adjustment relative thereto, said cam being in the form of a regular prism having the outer surfaces of its lobes relieved to occupy portions of a single conical surface coaxial with said cam, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, said cam having lobes operable to move said breaker arm to separate said switch contacts, said cam having lobes shaped to increase the period of closure of said contacts and to advance the instant of closure relative to the rotational position of said shaft, and means responsive to variations in shaft speed to adjust said cam.

3. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, and means responsive during engine operation to variations in shaft speed for effecting simultaneous limited angular and axial adjustment of said cam.

4. A distributor as defined in claim 3 in which said breaker arm is mounted for rocking movement about an axis parallel to the axis of said shaft, and said cam is a symmetrical pyramidal body.

5. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, first means connecting said plate and said members to effect angular adjustment of said plate relative to said drive shaft upon radial movement of said members, and second means connecting said plate and members to effect axial adjustment of said plate relative to said drive shaft upon radial movement of said members.

6. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, first means connecting said plate and said members to effect angular adjustment of said plate relative to said drive shaft upon radial movement of said members, and second means independent of said first means connecting said plate and members to effect axial adjustment of said plate relative to said drive shaft upon radial movement of said members.

7. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive

shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, first means connecting said plate and said members to effect angular adjustment of said plate relative to said drive shaft upon radial movement of said members, said first means comprising pin and slot connections located laterally from said cross shaft and drive shaft, and second means connecting said plate and members to effect axial adjustment of said plate relative to said drive shaft upon radial movement of said members.

8. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, first means connecting said plate and said members to effect angular adjustment of said plate relative to said drive shaft upon radial movement of said members, and second means connecting said plate and members to effect axial adjustment of said plate relative to said drive shaft upon radial movement of said members, said second means comprising levers pivoted to said drive shaft having arms operatively connected to said members and to said plate.

9. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, first means connecting said plate and said members to effect angular adjustment of said plate relative to said drive shaft upon radial movement of said members, and second means connecting said plate and members to effect axial adjustment of said plate relative to said drive shaft upon radial movement of said members, said second means comprising bell crank levers pivoted to said drive shaft having arms operatively connected to said members and to said plate.

10. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, first means connecting said plate and said members to effect angular adjustment of said plate relative to said drive shaft upon radial movement of said members, said first means comprising pin and slot connections located laterally from said cross shaft and drive shaft, and second means connecting said plate and members to effect axial adjustment of said plate relative to said drive shaft upon radial movement of said members, said second members comprising levers pivoted to said drive shaft having arms operatively connected to said members and to said plate.

11. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a switch in the ignition circuit including contacts, a breaker arm

on which one of said contacts is mounted, a cam follower on said breaker arm, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, a plate fixed to said cam, a bracket carried by each of said members having a pair of arms extending toward said drive shaft and spaced laterally therefrom, pin and slot connections between corresponding arms carried by said brackets and said plate to provide limited angular adjustment of said plate relative to said drive shaft upon radial movement of said members and to transmit driving torque to said plate in all positions of angular adjustment while providing for independent axial adjustment of said plate, and levers pivoted to said drive shaft having lever arms operatively connected to the remaining arms of said brackets and to said plate.

12. In combination, a drive shaft adapted to be connected to an internal combustion engine for rotation therewith, a timing cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a cross shaft carried by said drive shaft, centrifugal members carried by said cross shaft for movement radially of said drive shaft in accordance with changes in speed thereof, and independent means connecting said members and said cam for effecting angular and axial adjustment thereof relative to said drive shaft.

13. In combination, a drive shaft adapted to be connected to an internal combustion engine for rotation therewith, a timing cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a cross shaft carried by said drive shaft, centrifugal members carried by said cross shaft for movement radially of said drive shaft in accordance with changes in speed thereof, and independent means connecting said members and said cam for effecting angular and axial adjustment thereof relative to said drive shaft, the means for effecting angular adjustment of the cam comprising pin and slot connections between said members and said cam located laterally of said drive shaft and said cross shaft and effective to transmit driving torque to said cam in all positions of angular adjustment.

14. In combination, a drive shaft adapted to be connected to an internal combustion engine for rotation therewith, a timing cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a cross shaft carried by said drive shaft, centrifugal members carried by said cross shaft for movement radially of said drive shaft in accordance with changes in speed thereof, and independent means connecting said members and said cam for effecting angular and axial adjustment thereof relative to said drive shaft, the means for effecting axial adjustment of the cam comprising levers pivoted to said drive shaft having arms operatively connected to said members and to said cam.

15. In combination, a drive shaft adapted to be connected to an internal combustion engine for rotation therewith, a timing cam carried by said drive shaft for rotation therewith and for limited angular and axial adjustment relative thereto, a cross shaft carried by said drive shaft, centrifugal members carried by said cross shaft for movement radially of said drive shaft in accordance with changes in speed thereof, and independent means connecting said members and said cam for effecting angular and axial adjustment thereof relative to said drive shaft, the means for effecting angular adjustment of the cam comprising pin and slot connections between said members and said cam located laterally of said drive shaft and said cross shaft and effective to transmit driving torque to said cam in all positions of angular adjustment, the means for effecting axial adjustment of the cam comprising levers pivoted to said drive shaft having arms operatively connected to said members and to said cam.

16. Structure as defined in claim 12 in which said cam has the form of a truncated pyramid.

17. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a switch in the ignition circuit of said engine including a movable arm adjacent said shaft having a switch contact thereon, a cam carried by said shaft for rotation therewith and for axial adjustment thereon, a cam follower on said arm engageable with said cam, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, levers pivoted to said drive shaft having arms operatively connected to said members and to said cam to adjust said cam axially of said drive shaft upon a change in engine speed.

18. An ignition distributor for an internal combustion engine comprising a drive shaft adapted to be driven at speeds dependent on engine speed, a switch in the ignition circuit of said engine including a movable arm adjacent said shaft having a switch contact thereon, a cam carried by said shaft for rotation therewith and for axial adjustment thereon, a cam follower on said arm engageable with said cam, a cross shaft carried by said drive shaft, centrifugal members movable radially on said cross shaft in response to changes in drive shaft speed, levers pivoted to said drive shaft having arms operatively connected to said members and to said cam to adjust said cam axially of said drive shaft upon a change in engine speed, said cam having the form of a regular prism having each of its lobes relieved an increasing amount from one end thereof to the other.

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