July 3, 1928. 1,676,185

C. F. GILCHRIST ET AL.

COMBINED TIMER AND DISTRIBUTOR

Original Filed Jan. 24, 1921 2 Sheets-Sheet 1

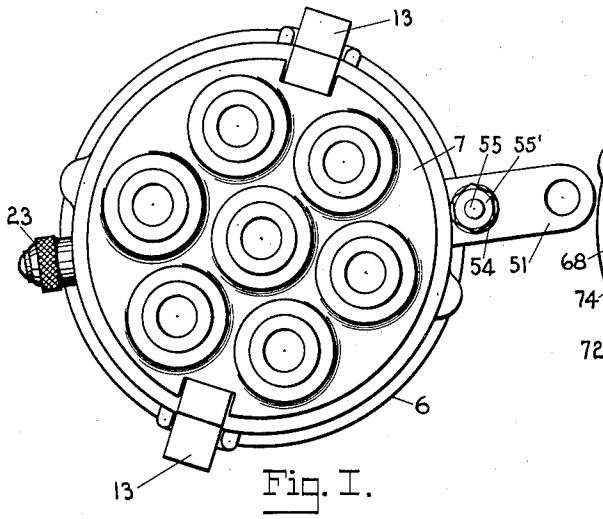


Fig. I.

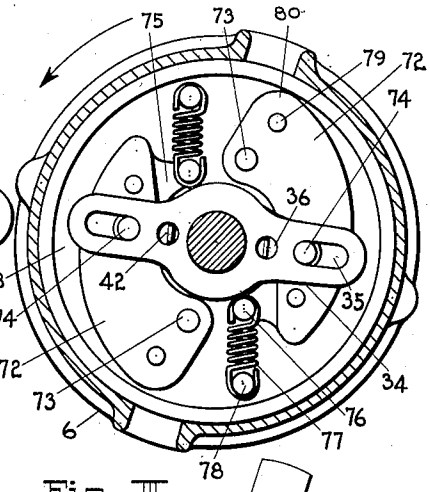


Fig. III.

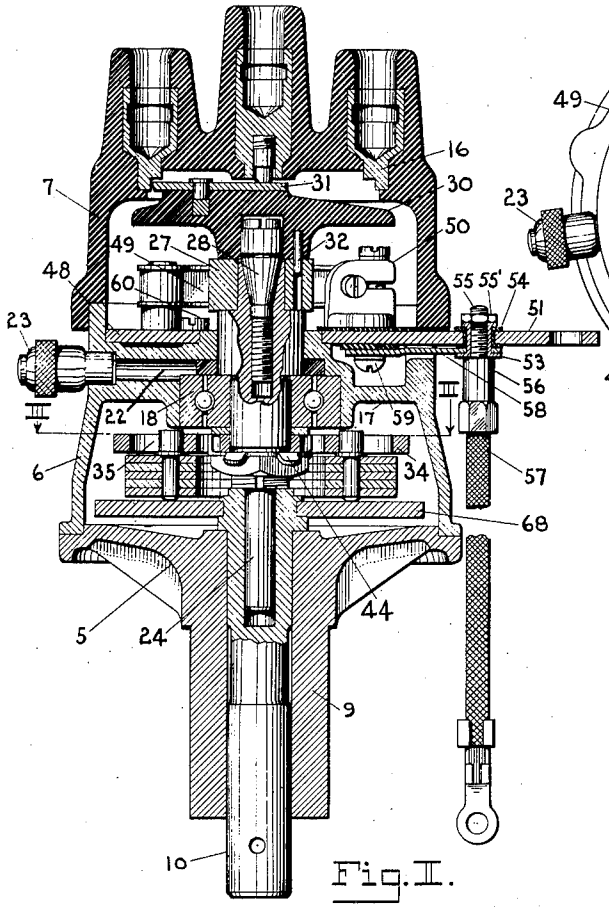


Fig. II.

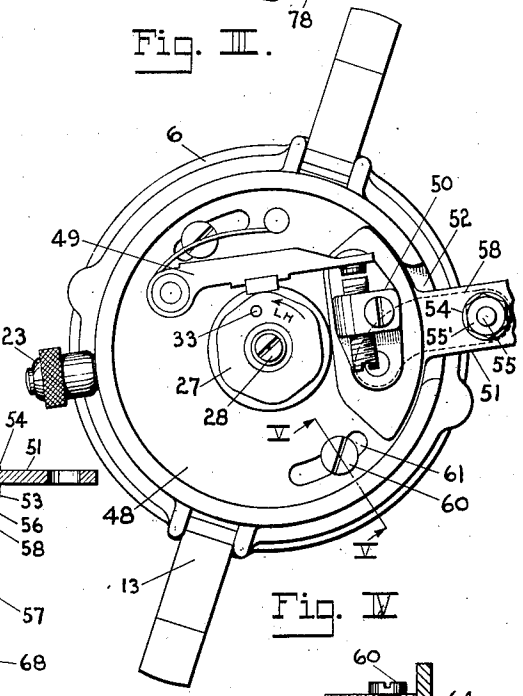


Fig. IV.

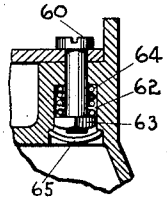


Fig. V.

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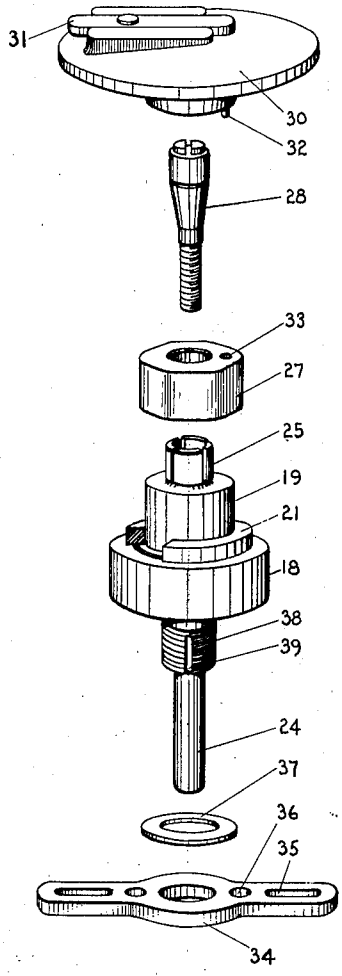
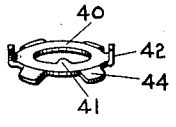


Fig. VI



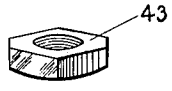
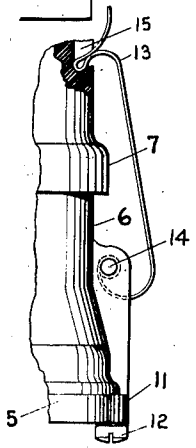
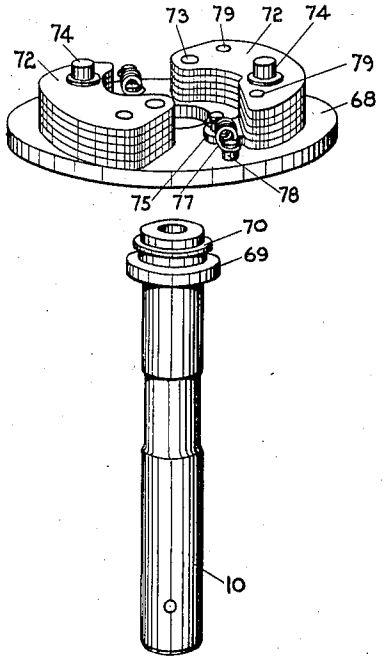


Fig. VIII





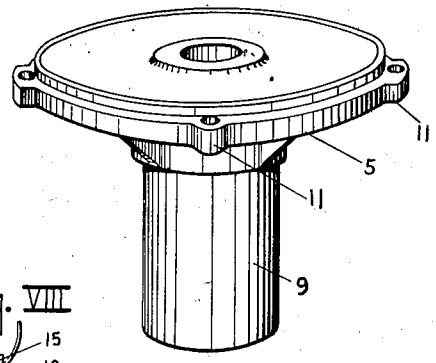


Fig. VII

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UNITED STATES PATENT OFFICE.

CLARENCE F. GILCHRIST AND HARRY R. PATTERSON, OF TOLEDO, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE ELECTRIC AUTO-LITE COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

COMBINED TIMER AND DISTRIBUTOR.

Application filed January 24, 1921, Serial No. 439,521. Renewed August 15, 1925.

This invention relates to ignition systems for multiple cylinder internal combustion engines and more particularly to a timer and distributor mechanism used in an ignition system for timing and distributing the ignition sparks for such an engine.

An object of our invention is to provide an improved device of this character in which the time of occurrence of the sparks shall be automatically advanced as the speed of the engine increases.

Another object of our invention is to produce an automatic spark advance mechanism wherein by making relatively slight changes in structural details or arrangement the character of spark advance may be varied at will.

Another object of our invention is the provision of an improved means for connecting the battery lead with the timer mechanism and a novel type of breaker contact carrying means associated therewith.

Still another object of our invention relates to the assembly and associated operative parts of the mechanism whereby the same are operatively connected, supported and housed.

Further objects of our invention relate to details of construction of various parts and various part assemblies, which not only cooperate in the combination structurally or functionally, but also have novel features of advantage in the parts and part assemblies per se. The objects of the invention also include structures providing economies of manufacture as will hereinafter appear from the detailed description to follow. We accomplish the objects of our invention in one instance by the devices and means described in the following specification but it is evident that the same may be varied widely without departing from the scope of the invention as pointed out in the appended claims. A structure constituting an embodiment of our invention is illustrated in the accompanying drawing forming a part hereof, in which:

Figure I is a top plan view of an improved spark timing and distributing device constructed according to our invention.

Fig. II is a longitudinal section view of the same.

Fig. III is a cross sectional view showing the centrifugal device for advancing the spark and taken on the line III—III of Fig. II.

Fig. IV is a top plan view of the device with the distributor cap removed to show the interrupter mechanism.

Fig. V is a fragmentary sectional view taken on the line V—V of Fig. IV.

Fig. VI is a disassembled view of the cam shaft and parts carried thereby.

Fig. VII is a similar view of the base, drive shaft, and centrifugal device carried thereby.

Fig. VIII is a fragmentary elevation showing one of the cap securing springs.

In the drawings, the same reference numerals refer to similar parts throughout the several views, and the sectional views are taken looking in the direction of the arrows at the ends of the section lines.

In the drawing a housing for the operative parts of the combined timer and distributor is shown comprising a base 5, a cylindrical casing 6 mounted thereon and supporting a distributor cap 7. The base 5 has a central stem portion 9 by means of which the device may be supported and which also provides a long bearing for the drive shaft 10. The base 5 is provided with four extensions 11 through which pass screws 12 for removably securing the casing 6 thereto. The distributor cap 7 sets on the casing 6 and is detachably secured thereto by a pair of spring clips 13 which are pivoted at 14 to the exterior of the casing 6 and have their upper portions engaging in suitable notches 15 formed in opposite sides of the cap 7. The upper portion of the distributor cap is provided with terminal inserts 16 to whose outer ends high tension leads may be connected and whose inner ends lie adjacent the path of travel of the distributor finger. Intermediate its upper and lower edges the casing 6 is provided with a partition 17 which separates the housing into upper and lower chambers and which serves to support the outer race of a ball bearing 18 for the cam shaft 19. The inner race of this ball bearing is permanently secured to the cam shaft and a packing overlies the opening between the two races and connects with a

suitable oil passage 22 having an oil cup 23. The lower end of the cam shaft 19 is reduced as at 24 to fit into an opening at the upper end of the drive shaft 10 and be guided thereby. The upper end of the cam shaft 19 also has a reduced extension 25 slotted as shown in Fig. 6 and provided with a tapped opening therein. A cam 27 having upper and lower flat faces and a cylindrical central opening, adapting it to fit over the portion 25 of the cam shaft with either side uppermost, is firmly secured to the cam shaft by the screw 28 which has a tapered shank adapted to engage in and expand the slotted reduced portion 25 to firmly secure the cam to its shaft. A distributor 30 having a metallic finger 31 fits over the head of the screw 28 and has a pin 32 imbedded in it for engaging in a suitable hole 33 extending through the cam.

A two-armed member 34 having a pair of slots 35 and a pair of openings 36 is adapted to fit over the cam shaft 19 below the ball bearing and is separated therefrom by a washer 37. Below the member 34 the cam shaft 19 has a screw-threaded portion 38 through which extends a spline 39. In order to prevent relative rotation between the arm member 34 and the cam shaft, a washer 40 is provided with a tongue 41 which engages in the spline 39 and has a pair of upwardly extending ears 42 which engage in the openings 36 of the arm member 34. The nut 43, after being threaded upon the portion 38 to securely clamp the parts 34, 37 and 40 against the ball bearing is held against backward rotation by ears 44 on the washer 40 which may be bent down after the nut has been tightened so as to engage its outer faces and thereby prevent the nut from working loose.

The partition 17, in addition to dividing the housing into two chambers and supporting the ball bearing for the cam shaft, also serves to support and to guide the plate 48 which carries the interrupter arm 49 provided with a movable contact and the stationary contact member 50 which, as shown, is insulated therefrom. The carrier plate 48 is shown provided with an integral outwardly extending arm 51 which projects through a suitable opening 52 formed in the wall of the casing 6 and by means of this arm the interrupter mechanism may be angularly adjusted to advance or retard the spark entirely independent of the automatic means hereinafter described:

The pin 32 of the distributor is shown located opposite the finger 31 although such is not necessary while the hole 33 in the cam is located slightly to one side of one of the lobes as shown, for example, in Fig. IV. The cam is constructed to be secured to its shaft with either side up, Fig. IV illustrating it applied for counter-clockwise or left-hand rotation, in which case the hole 33 leads the adjacent lobe of the cam. Since the actual break at the interrupter points occurs before the cam reaches the position illustrated in Fig. IV, the angle at which the pin hole 33 leads the adjacent cam lobe is made equal to the angle through which the cam moves from the instant the interrupter contacts open until the opening reaches a maximum. The distributor cap is adapted to fit on and be secured to the casing only in a definite angular position and the location of the pin 32 is so chosen relative to the finger 31 that the latter will be in a position opposite an insert 16 at the instant the primary circuit is broken by the cam. As a result of this construction it is only necessary, in order to change from right hand to left hand rotation or vice versa, to remove the cam and apply it inverted, the position of the pin 32 and hole 33 will, in either case, insure positioning of the distributor finger opposite or in substantially the same position relative an insert at the instant of spark occurrence.

At a point external of the casing the arm 51 carries a metallic sleeve 53 suitably insulated therefrom by a sleeve 54 and adapted to receive the reduced threaded portion 55 of a terminal 56. A flexible conductor 57 connected in the primary circuit of the ignition system is secured to the terminal 56 which is held to the arm by a nut 55'. A strap 58 of conducting material connects the sleeve 53 with a screw 59 extending up into and serving to secure the stationary contact member 50 to the plate 48. For yieldingly holding the plate 48 on its seat and to permit a limited rotative movement thereof, a pair of screw bolts 60 is provided which pass through slots 61 in the plate and through portions of the casing 6 into enlarged openings 62 therein. These openings are preferably made polygonal to correspond with a nut 63 on the bolt so as to prevent turning of the nut and surrounding the bolt is a coil spring 64 to provide the necessary pressure between the plate and the casing. The mouth of the opening 62 is closed by a plate 65 which is preferably dish-shaped and of a size to snugly fit the mouth of the opening. It is inserted with its convex side outward and after it has been struck a blow it will flatten out and firmly engage the walls of the opening. Effective means is thereby provided to prevent the loss of the nut 63 and spring 64 should the nut become detached from the bolt.

The means for automatically advancing the spark in accordance with the speed of rotation will now be described: The drive shaft 10 carries on its upper end a circular plate 68 which may be firmly secured thereto by rolling over a flange 70 of the shaft against the upper face of the plate. This

plate carries a pair of similar weights 72 which are pivoted thereto by pivot pins 73 and which carry pins 74 for engaging into openings 35 of the double-armed member 34. Each of the weights 72 is shown built of a series of plates or laminations, five in the case illustrated, four of which are identical in shape while the fifth plate, shown on the bottom in Fig. VII, is similar to the others but has an extension or ear 75. This ear carries a pin 76 embraced by one end of a coil spring 77 whose opposite end is looped around a pin 78 carried by the plate 68. Each of the pins 76 and 78 has a groove near its upper end for receiving an end of the spring 77. The two pins 76 and 78 are so positioned that when the weight is in its normal retracted position, such as illustrated in Fig. III, the centers of these two pins and the pivotal center of the weight lie in a straight line. The effect of this arrangement is, therefore, that when the weights are in their normal retracted position the force of the springs opposing outward movement of the weights on their pivotal centers is zero and increases as the weights swing outward with a function of the angle of displacement. The layers comprising the weights are secured together by rivets 79. Each pin 74 sliding in its slot 35 serves to rotate the member 34 an amount substantially proportional to the angular movement of the weights on their pivots. Each of the weights 72 is shown provided with an extension or hump 80 lying approximately in radial alinement with the pivotal center of the weight when in its retracted position. However, as the weight swings on its pivotal center due to the effect of centrifugal force, this portion 80 takes a position such that it opposes further outward movement of the weight and this opposing force rapidly increases as the weight swings outward on its pivot. The effect of this extension or hump is therefore, to reduce the effective lever arm of the centrifugal force acting upon the weight and tending to rotate it on its pivotal center. The shape and position of this extension 80 may be varied at will to produce a variety of results in the functioning of the apparatus. With the parts subtantially as shown in Fig. III it has been found that the rate of advance of the cam shaft with increasing speeds of the drive shaft follows a substantially straight line. Inasmuch as all engines do not require or operate to the best advange when the spark is advanced in exact proportion to the increased speed, it is possible with this device as by modifying the shape and size of the weights to produce wide variations in the character of the spark advance and to obtain automatically an advance characteristic which is best suited for a particular engine.

It will be readily understood from the description above that when the drive shaft is rotated, rotative movement is communicated to the cam shaft through the instrumentality of the centrifugal device just described and as the speed increases the weights swing outward on their pivots, the pins 74 sliding in the slots 35 of the arm member 34 to effect the proper advance of the cam shaft and cam automatically.

In the construction of the above described centrifugal device provision is made for assembling the parts to adapt the device for either right hand or left hand rotation, it having been found more satisfactory to always rotate the device with the weights trailing rather than leading their pivotal centers. The carrier plate 68 is accordingly a plain flat plate with four holes, two for the pivot pins 73 and two for the spring holding pins 78. If the device is to rotate to the left, or counterclockwise as viewed from above, these pins 73 and 78 are inserted projecting upward with the plate as shown in Fig. III; if the opposite rotation is desired the plate is inverted and the pins then inserted. For clockwise rotation the weights are also reversed, from that illustrated by Fig. III, each layer or lamination, beginning with the bottom one having the extension 75, being first inverted before building up the complete weight. After the layers have been riveted together the pin 74 is driven in on the side opposite the ear 75. By this construction a single plate 68 will suffice for either right or left hand rotation and the weights, whether for right or left hand rotation, may be built up from similar stampings. Absolute uniformity in the mass of the two weights constituting a pair is thereby assured.

Instead of inverting each lamination before building up the weights, as described above for clockwise rotation, the weights as built up for counterclockwise rotation and illustrated in Figs. III and VII may simply be inverted as units, the pin 74 of each, of course, being inserted at the opposite face. In this inverted position the ear 75 will come at the top instead of at the bottom of a weight. In order that the spring 77 may be adapted for the weight when inverted as well as when in the position illustrated, the pins 76 and 78 are made of such length that the spring is carried substantially midway between the planes of the upper and lower faces of a weight. By this provision all weights may be constructed identical regardless of the intended direction of rotation and the pull of the spring will be the same under both conditions.

Inasmuch as the invention herein disclosed is susceptible of various other embodiments and as various changes might be made in the embodiment set forth, it is to be understood that all matter described above

or shown in the accompanying drawing is to be interpreted as illustrative only, and not in a limiting sense.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In an ignition timer having a cam shaft, a drive shaft and a centrifugal device for advancing said cam shaft in accordance with the speed of rotation of said drive shaft, an arm carried by said cam shaft and having means to engage with said centrifugal device and means for firmly securing said arm to said cam shaft including a washer splined on said cam shaft and having portions interengaging with said arm.

2. In an ignition timer having a cam shaft, a drive shaft and a device for advancing said cam shaft in accordance with the speed of said drive shaft, an arm carried by said cam shaft and co-operating with said device and means for firmly securing said arm to said cam shaft comprising a nut threaded on said cam shaft and an intermediate member splined on said shaft and having projections engaging said arm and said nut to prevent relative rotation thereof.

3. In an ignition timer having a cam shaft, a drive shaft and a centrifugal device for advancing said cam shaft in accordance with the speed rotation of said drive shaft, an arm carried by said cam shaft and adapted to be moved by said centrifugal device, a nut threaded on said cam shaft, and a sheet metal washer intermediate said arm and said nut, said washer having an ear bent to engage in an opening in said arm and having another ear bent to engage a peripheral face of said nut.

4. In a centrifugal device for an ignition timer, a rotatable supporting member, a weight having opposite substantially parallel faces, means whereby said weight may be pivotally mounted on said support with either the one or the other of said faces adjacent said support depending upon the direction of rotation, a restraining member for said weight extending parallel therewith, and means for attaching said restraining member to said weight at a point substantially midway its two faces whereby the effect of said restraining member is substantially the same with the weight mounted in either manner.

5. In an ignition timer, a casing, a carrier plate mounted therein to have limited angular adjustment, movable and stationary interrupter contacts carried by said plate, an adjusting arm projecting from said plate, a conductor terminal carried by said arm, and means for conductively connecting said terminal with one of said contacts.

6. In an ignition timer, a casing, a carrier plate mounted therein to have limited angular movement, interrupter mechanism comprising a stationary contact and a movable contact supported by said plate, an arm on said plate projecting through said casing whereby said plate may be adjusted, a terminal for a flexible conductor secured to the projecting portion of said arm and a conductor connecting said terminal with said stationary contact.

7. In an ignition timer, a casing, a rotatively adjustable carrier plate therein, a cam operated contact lever mounted thereon, a stationary co-operating contact also mounted thereon and insulated therefrom, an adjusting arm carried by said plate and projecting through said casing, a flexible conductor having a terminal secured to and insulated from said arm and a strap for electrically connecting said terminal with said stationary contact.

8. In an ignition timer having a casing and an interrupter carrying plate adjustably supported thereon, a bolt passing through said plate and casing, a nut thereon, a spring between said casing and said nut, said casing having an opening to receive and prevent relative rotation of said nut and a plate fitting into the mouth of said opening to prevent accidental loss of said nut and spring.

9. In an ignition timer, the combination of a circuit controlling device, a cam for operating said device, a cam shaft, means for securing said cam to said shaft either in one position for rotation in one direction or in inverted position for rotation in the opposite direction.

10. In an ignition timer, the combination of a circuit controlling device, a cam for operating said device to open a circuit, a cam shaft, means for securing said cam to said shaft in either erect or inverted position, a distributor, means for connecting said distributor to said cam with the cam in either of said positions.

11. In an ignition timer, the combination of a circuit interrupter, a cam for operating said interrupter, a cam shaft carrying said cam, a distributor, a plurality of terminals adjacent the path of travel of said distributor and means for operatively connecting said distributor with said cam, when rotated in one direction to cause said distributor to have a predetermined angular relation with said terminals at the instant of spark occurrence, said cam being constructed to be applied to said shaft in inverted position for reverse rotation thereof and said means being automatically effective thus to position said distributor in substantially the same angular relation at the instant of park occurrence.

12. In an ignition timer, the combination of an interrupter arm, a cam having a plurality of lobes for operating said arm to open a circuit, a cam shaft, means for secur-

ing said shaft in either erect or inverted position, a distributor having a finger driven by said cam, a plurality of stationary contact terminals arranged adjacent the path of travel of said distributor finger, a pin carried by said distributor, said cam having an opening therethrough spaced angularly from one of said lobes for receiving said pin whereby with said cam in one position on said shaft and with rotation in one direction said finger will lie opposite one of said terminals at the instant said circuit is opened and with said cam in inverted position on said shaft and with rotation in the opposite direction said finger will also lie opposite the same terminal at the instant said circuit is opened.

13. In an ignition timer mechanism the combination of the high tension timer arm, a low tension interruptive mechanism, a camming element having a plurality of camming faces to produce a given sequence of interruption of said low tension interrupter, and a connection between camming element and the high tension timer arm, said camming element being reversible and said connecting means between the cam and the timer arm being equally effective both in normal and reversed position of the cam.

14. A cam unit for ignition camming mechanism comprising a block having a plurality of camming surfaces on the periphery thereof, means for mounting said block for rotation, said block having an aperture extending therethrough adapted to receive cam holding means on either side of the cam.

15. A camming unit for ignition surface including a casing, a current interrupting mechanism within the casing, a shaft within the casing rotatable therein, and a cam positioned on said shaft adapted to contact with said current interrupting mechanism whereby the current flow is periodically interrupted when the cam is rotated, said cam having means for permitting adjustment in normal or reversed position.

16. In a centrifugal device for an ignition timer, a rotatable reversible supporting member; a weight having opposite substantially parallel faces; means whereby said weight may be pivotally mounted on said support with either the one or the other of said faces adjacent said support depending upon the direction of rotation; a restraining member for said weight extending parallel therewith; and means for attaching said restraining member to said weight at a point substantially midway its two faces whereby the effect of said restraining member is substantially the same with the weight mounted in either manner.

17. In a centrifugal device for an ignition timer, a rotatable supporting member adapted to carry means movable with varying speeds including a reversible weight having two faces which may be pivotally mounted on said supporting member with either of said faces adjacent thereto; a restraining member for said weight; and means for connecting said restraining member intermediate the two faces of said weight.

18. In a centrifugal device for an ignition timer, a rotatable reversible supporting member; a reversible weight which may be pivotally mounted on said support with either of its faces adjacent thereto, said weight having an extension adjacent to one face thereof; a restraining member; and means for connecting said restraining member at a point intermediate the two faces of said weight.

19. In a centrifugal device for an ignition timer, a rotatable supporting member; a reversible weight having two opposite faces which may be pivotally mounted on said supporting member with either of its faces adjacent thereto; a pin carried by said supporting member; a restraining member connected at one end to said pin; and means for connecting the other end of said restraining member intermediate the two faces of said weight.

20. In an ignition timer the combination of a carrier plate; movable and stationary cooperating contacts carried by said plate; a projecting arm; a conductor terminal carried by said arm; and means for conductively connecting said terminal with one of said contacts.

21. In an ignition timer the combination of a carrier plate; movable and stationary interrupter contacts carried by said plate; a projecting arm; a flexible conductor having a terminal secured to and insulated from said arm; and a strap for electrically connecting said terminal with one of said contacts.

22. In an ignition timer the combination of a carrier plate; movable and stationary interrupter contacts carried by said plate, one of said contacts insulated from said plate; a projecting arm; a conductor terminal carried by said arm; and a strap for electrically connecting said terminal with one of said contacts.

23. A carrier plate for an ignition timer adapted to support movable and stationary interrupter contacts, one of said contacts insulated from said plate; an arm connected to said plate; a conductor terminal carried by said arm and insulated therefrom; and a strap supported by said plate for electrically connecting said terminal with one of said contacts.

24. A carrier plate for an ignition timer adapted to carry movable and stationary contacts, one of said contacts insulated from said plate; an arm connected to said plate; a conductor terminal carried by said arm and insulated therefrom; and a strap car-

ried by said plate having a common support with one of said contacts for connecting said contact to said terminal.

25. In an ignition timer a casing; a carrier plate mounted therein; means for yieldingly holding said plate to the casing; an opening in said casing adapted to receive said means; and means fitting into the mouth of said opening to retain the first mentioned means.

In testimony whereof, we affix our signatures.

CLARENCE F. GILCHRIST.
HARRY R. PATTERSON.