Oct. 19, 1937. T. W. BRYANT 2,096,294

AUTOMATIC IGNITION TIMER FOR INTERNAL COMBUSTION MOTORS

Original Filed Nov. 15, 1934 2 Sheets-Sheet 1

Fig. 1.

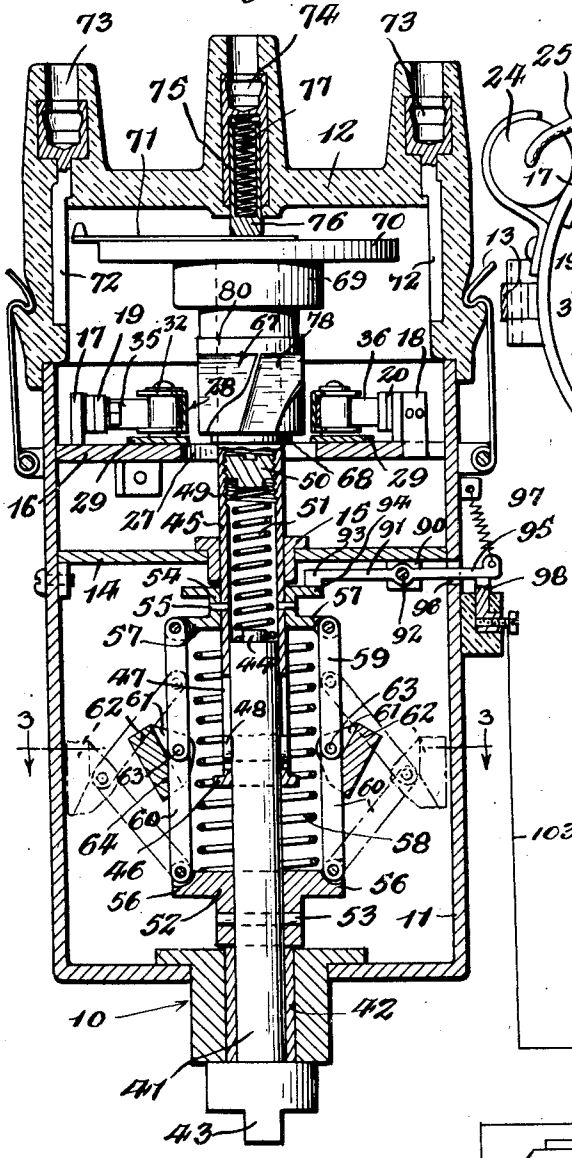
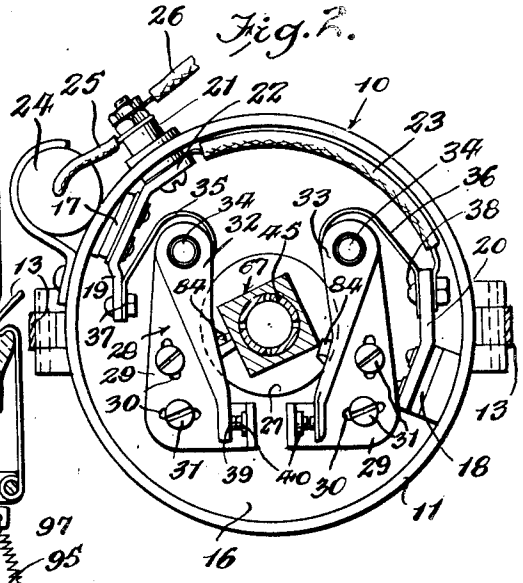


Fig. 2.



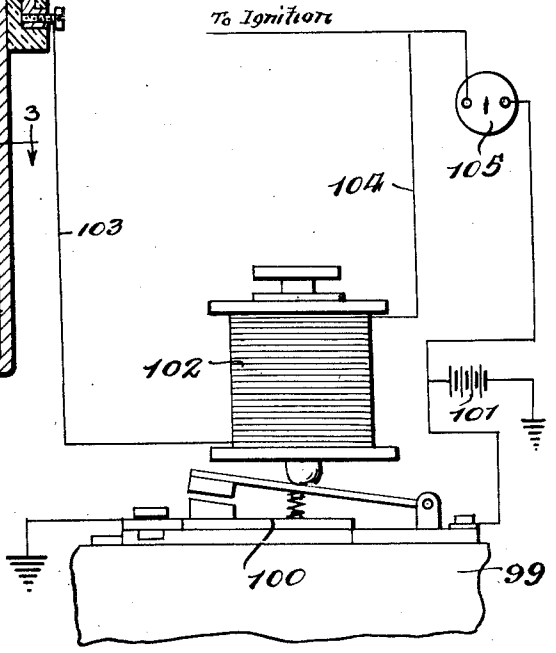
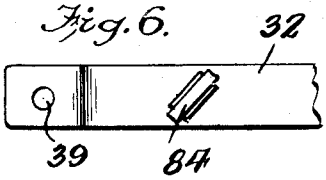


Fig. 6.



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Fig. 3.

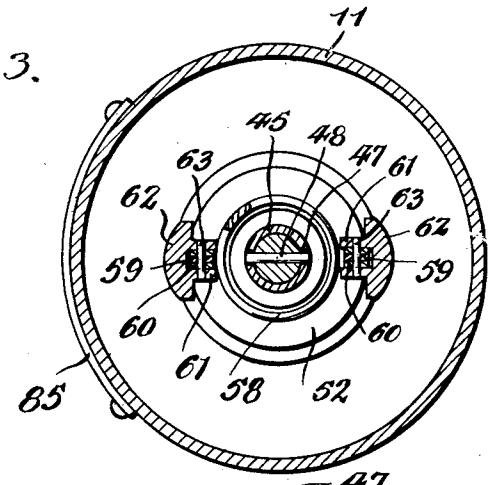


Fig. 4.

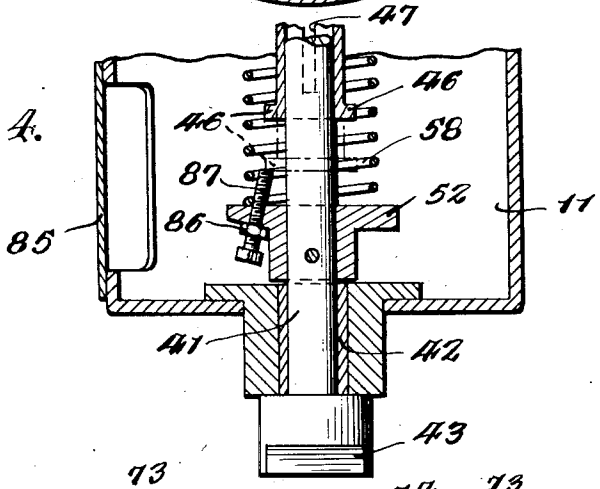


Fig. 7.

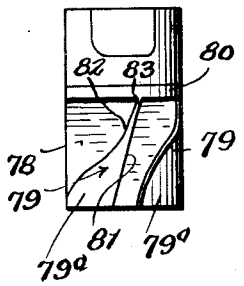
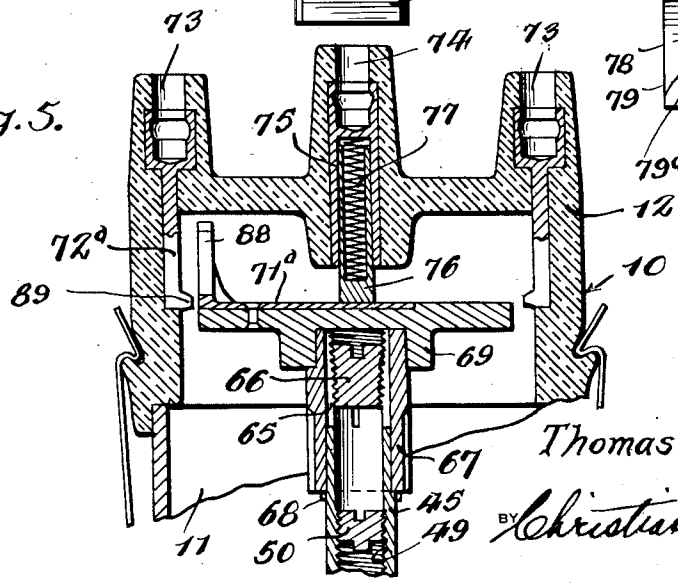


Fig. 5.



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2,096,294

AUTOMATIC IGNITION TIMER FOR INTERNAL COMBUSTION MOTORS

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Application November 15, 1934, Serial No. 753,236
Renewed August 30, 1937

5 Claims. (Cl. 200—31)

This invention relates to ignition timers for internal combustion engines and more particularly to automatic means for controlling the spark and it consists in the constructions, arrangements and combinations herein described and claimed.

It is an object of the invention to provide a timer construction embodying means for automatically regulating the intensity of the spark in accordance with motor speeds.

A still further object of the invention is to provide a novel construction of cam for effecting the make and break in a primary circuit producing a current through the primary winding of a transformer coil, the loading and unloading of which is controlled through the action of the cam, thus establishing a secondary current in the secondary winding, which in turn, as the circuit is broken, effects a high tension spark of even intensity throughout varying speeds of the engine.

It is a still further object of the invention to provide a novel governor mechanism for effecting actuation of the cam member.

A further object of the invention is the provision of a novel construction of rotor and distributor head, as well as a novel construction of rubbing block.

A still further object of the invention is the provision of automatic means, cooperable with the governor for starting an internal combustion engine.

Additional objects, advantages and features of invention will be apparent from the following description and accompanying drawings, wherein

Figure 1 is a vertical section through an ignition timer illustrating my invention, showing the automatic starting mechanism graphically.

Figure 2 is a cross section on the line 2—2 of Figure 1.

Figure 3 is a cross section on the line 3—3 of Figure 1.

Figure 4 is a fragmentary sectional view through a portion of the timer illustrating an adjustable stop means for the cam.

Figure 5 is a vertical section through a modified form of the timer head and rotor.

Figure 6 is a top plan view of one of the breaker arms illustrating the rubbing block.

Figure 7 is a side elevation of the cam.

It is generally understood by those versed in the art that the electric ignition of engines of motor vehicles is timed and controlled by the rotation of the engine shaft, and that there is a shorter duration of the ignition contact when the engine shaft is moving at a high speed than when the engine is operating slowly. Obviously, this is a disadvantage for if the ignition is timed for slow speeds, it is inadequate for high speeds. There is more need for efficient spark at high speeds than at low speeds, for the reason that a greater amount of gas is being supplied to the engine and the latter is operating under higher compression.

In carrying out my invention I overcome this defect in the provision of a cam and centrifugally operated mechanism so coordinated that the closed period of the induction coil remains constant throughout the varying speeds of the engine.

There is illustrated generally, a timer 10 which comprises a cylindrical casing 11 upon which a head 12 is detachably connected by means of swinging hooks 13. Within the casing 11 a plate 14 is mounted, centrally apertured and bossed, as at 15, and immediately above this plate there is an assembly plate 16. The plate 16 has a pair of upstanding ears 17 and 18. To the ear 17 a bus bar 19 is fixed and affixed to the ear 18 there is a bus bar 20. The bus bar 19 is electrically connected to a stud 21 of the casing 11, as indicated at 22, and the bus bar 20 is in circuit with the stud 21 by virtue of a conductor 23.

A condenser 24 is carried by the casing 11, exteriorly thereof and is connected to the stud 21 by the conductor 25, a source of energy being supplied to the stud and condenser through a primary conductor 26.

Attention is particularly invited to Figure 2 of the drawings, wherein it may be clearly seen that the plate 16 is provided with a central aperture 27 and upon opposite sides thereof, there is mounted a pair of breaker arm assemblies 28. The assemblies 28 are identical in construction and comprise a mounting plate 29, slotted as at 30 for reception of screws 31 which are threadedly engaged with the plate 16. Breaker arms 32—33 are pivotally mounted upon the plates 29, as at 34, and each arm is tensioned by a spring 35—36. The spring 35 is anchored to the bus bar 19 at 37, and the spring 36 is anchored to the bar 20, as at 38. Each breaker arm 32—33 includes a breaker point 39 operatively related to a breaker point 40.

A shaft 41 is revolubly mounted in a bushing 42 of the casing, the outer end 43 of which is provided with any suitable means for establishing a driving connection. The inner end of the shaft 41 extends inwardly of the casing a substantial distance and terminates in a reduced stud 44.

Within the bushing 15, a sleeve 45 is reciprocably and rotatably mounted, the sleeve being of a size to snugly receive the shaft 41 therein, the lower end of the sleeve terminating in a collar 46. Opposed slots 47 are cut in the sleeve 45, extending longitudinally thereof, and a pin 48 fixed in the shaft 41 have their opposite ends confined within respective slots of the sleeve. By the construction it will be apparent that the sleeve 45 will be rotated by the shaft 41, and yet the sleeve may move longitudinally upon the shaft, the function of which will be more readily understood as the description proceeds.

The sleeve 45 is interiorly threaded as at 49, and receives a screw plug 50 therein and by adjusting the plug 50 inwardly or outwardly, the tension of the helical spring 51 may be varied. The spring it will be noted is housed within the sleeve, seated upon the stud 44 and in bearing relation with the plug 50.

A collar 52 is fixed to the shaft 41 by a pin 53, and this collar is so located upon the shaft with respect to the bushing 42 that lengthwise movement of the shaft is prevented. A collar 54 is fixed to the sleeve 45 in any suitable manner, pins 55 being employed in the present instance, and each of these collars 52 and 54 are provided with ears 56 and 57 respectively, arranged in opposition to each other. A helical spring 58 is interposed between the collars 52 and 54 and any tendency of the collar 54 to move toward the collar 52 will be resiliently opposed by the springs.

It should be noted that the spring 58 does not contact the collar 54, in the normal position of the parts, but is spaced therefrom, and only functions at the higher speeds, which is permitted only after compression of the smaller spring 51.

A link 59 is pivoted to each of the ears 57 and a pair of links 60 are pivotally mounted to the ears 56. The links 59 and 60 are apertured, and the links 60 receive a link 59 therebetween with apertures aligned and over the links thus assembled, ears 61 of respective weight members 62 are positioned. The ears 61 are apertured and aligned with apertures of the links and a pin 63 extended through aligned apertures secures the assembly. The weights 62 are pivotally mounted upon the links and the face 64 of the weights is preferably at such angle as to rest upon the links 60 a substantial distance below the pivotal connections between the links 59—60, thereby tending to maintain the links in vertical extended position. The aforementioned structure constitutes a centrifugal governor.

The upper end of the sleeve 45 is preferably provided with a series of longitudinally extending slots 65 and the interior of the sleeve is threaded to receive a tapered threaded plug 66 (see Fig. 5). A cam 67 is disposed upon the sleeve 45 and rests upon the shoulder 68 of the sleeve, and it will be apparent from the foregoing that upon expansion of the sleeve by manipulation of the plug 66 the cam will be rigidly fixed to the sleeve.

The upper end of the cam has a flattened portion as customary, and has mounted thereon a rotor 69. The rotor comprises a disk 70 upon the upper face of which there is fixed a conductor arm 71. This arm extends from the medial portion of the disk to one side, stopping short of contact members 72 mounted in the head 12. The contact members are rigidly molded within the head 12, the members 72 extending a substantial distance downwardly along the inner wall of the head, all of which is clearly shown in Figure 1. It is essential that the contact members 72 have a substantial length, since in the operation of the device, the rotor 70 will travel upwardly and downwardly within the head 12 and during such travel, the contact members and the arm 71 must have such relationship as to transmit the electrical energy necessary for the operation of the device. The contact members 72 terminate in usual clip sockets 73 for connection of spark plug terminals (not shown). The cap 12 also includes a socket 74 for connection of a high tension lead (not shown) as is customary. The socket 74 is centrally disposed within the cap 12 and has a bore 75 opening in the direction of the rotor 70 and within the bore 75 there is seated a brush 76. The brush 76 is hollow for a portion of its length, the open end thereof being disposed toward the base of the bore 75, and a helical spring 77 is housed within the hollow portion of the brush, one end thereof being in bearing relation with the base of the bore 75. Obviously, the brush 76 will be forced into contacting relation with the arm 71 regardless of the longitudinal movements of the rotor.

From the foregoing description of the invention thus far it will be apparent that as the shaft 41 is rotated by the engine, the weights 63 will move due to centrifugal force to a position as indicated in dotted lines in Figure 1, causing the sleeve 45 to be moved downwardly imparting a similar movement to the cam 67; the location of the cam being governed by the speed of the engine, the cam in turn controlling the actuation of the breaker arm assembly 28.

The cam 67 comprises, in the present instance, four lands 78, separated by cam faces 79. The cam 67 is of cylindrical shape, and adjacent its upper end a circumscribing ring 80 is formed, from which the cam faces 79 extend, the leading edge 81 of which is formed at an angle which will vary according to the particular construction of engine in order to accomplish the proper point of break of the breaker arm assemblies 28. The rear edge 82 of the cam faces extend at a slight angle to the leading edge for approximately one-half the length thereof, whence it is given an arcuate flare away from the leading edge, thereby defining a graduated enlarged face 79a at the base of the cam. A cam thus formed will have a relatively narrow upper cam face 83 and a substantially wide face 79a at the base, this latter face varying in area, due to its arcuate rear edge, providing a camming surface having a relatively longer dwell, as will be required for slow speeds. The operation of the cam will be dealt with in greater detail hereinafter.

In view of the fact that the cam faces are inclined, the fiber blocks 84 of the breaker arms 32—33 are mounted thereon at an inclination (see Fig. 6) to more readily follow the cam faces, thereby reducing wear to the fibre blocks as well as making for more even movement of the breaker arms when encountering the cam faces.

The circumscribing ring 80 of the cam may be employed as a means for setting the distributer for maintaining a motor vehicle within a given speed, and functions as follows:

When a motor vehicle is to be maintained at a predetermined maximum speed, the cover plate 85 is removed from the casing 10 so that access may be had to the governor, and the cap 12 is likewise removed from the casing 10. The lock nut 86 of the stop bolt 87 is loosened so that the bolt may be readily adjusted by means of a wrench. Then a downward pressure upon the rotor 70 will move the sleeve 45 toward the collar 52, which ob-

viously tensions the spring 51. The sleeve 45 is moved downwardly until the boss 46 thereof encounters the end of the stop bolt 87. The bolt 87 is then adjusted so that at the maximum speed of the engine the boss will encounter the bolt, thereby preventing further downward movement of the sleeve 45. Since the high speeds of the vehicle will necessitate the movement of the sleeve to its lowermost positions, limiting such movement will necessarily limit the speed of the engine. The ring 80 of the cam would at speeds above the maximum be encountered by the fiber blocks 84 due to downward movement of the cam and since the ring is devoid of any cam action, the breaker assemblies would be inoperative, but as the speed of the engine diminishes, the cam 67 rises upwardly, again bringing the cam faces into alignment with the breaker assemblies.

It is important to note that during operation of the governor as the weights 62 swing outwardly at the lower speeds of the engine, the spring 51 first opposes the downward movement of the sleeve 45, but as the speed of the engine is accelerated, the resistance offered by the spring is overcome and the collar 54 then moves into engagement with the heavier spring 58. Thus, there is provided a drive between the governor and cam which is highly sensitive to varying speed changes, and reduces governor lag to an appreciable extent.

The theory of operation of induction coils is so well understood by those versed in the art that a lengthy discussion here is not thought necessary to the understanding of the present invention, but it may be pointed out that the quicker the break of the contacts 39—40, as the speed of the engine increases, a stronger spark is created at the spark plugs of the engine, and any tendency of weakening of the spark is offset by the varying area of the faces of the cam, the duration of contact at the timer increasing or decreasing, in direct ratio to the speed of the engine. so that the breaking of the primary circuit occurs at all speeds at the peak of the coil.

In Figure 5 a modification of the rotor is shown, in which the arm 71*a* is provided with an integral arm 88, extended in a plane parallel with the contact members 72*a*, and the latter are also provided with a lateral projection 89 extended into proximity of the arm 71*a*. By such arrangement it will be apparent that throughout the varying longitudinal movements of the rotor, the arm 71*a* will always be in such position as to establish the required electrical circuit. The present construction provides for a more compact structure, since the arms 72*a* may be made considerably shorter than in the first described form.

The present distributer is well suited for installation of an automatic starter for an engine equipped therewith, and in Figure 1 I have illustrated a preferred construction of starting mechanism, as will now be described.

Upon the plate 14 a pair of ears 90 are formed, between which an arm 91 is rockably mounted, as at 92, one end 93 of the arm being disposed in the path of and adapted to be engaged by a flange 94 of the collar 54. The other end 95 of the arm is extended through a slot 96 of the casing 11, and is resiliently anchored by a spring 97. A contact 98 is mounted upon the casing 11 immediately beneath the end 95 of the arm, and functions in conjunction with the arm to close an electrical circuit to a starting motor, as will presently appear.

A starting motor 99 is shown, which includes a switch 100 in circuit with a storage battery 101, and a solenoid 102 is so related to the switch 100 that upon energization of the solenoid the switch will be moved to close the circuit to the motor which in turn will cause a cranking of the engine. The solenoid 102 is electrically connected to the contact 98 by a lead 103 and is also in circuit with the battery 101 through the lead 104 of the ignition circuit.

Thus, as soon as the engine ceases to function, the governor likewise comes to rest, causing the flange 94 to engage the portion 93 of the arm, giving it an upward movement, causing the opposite end 95 to move into engagement with the contact 98, against the action of the spring 97. When the arm 91 and the contact 98 are thus engaged the circuit to the solenoid will have been completed, causing actuation of the switch 100 of the starting motor. As soon as the engine has been started, the governor will have drawn the flange 94 away from the end 93 of the arm and the spring 97 will break the circuit with the contact 98, thereby de-energizing the solenoid. Preferably a key actuated switch 105 controls the circuit to the ignition and starting motor although separate ignition and starting motor switches may be installed in the circuits, if desired.

While I have shown and described preferred embodiments of the invention I am aware that modifications may be made, and I therefore consider as my own all such variations in construction as fairly fall within the scope of the appended claims.

I claim:—

1. In an ignition timer for internal combustion engines, a casing, a cap therefor, a plurality of conductors in the cap extending longitudinally thereof and exposed upon the inner wall of the cap, a shaft revolubly mounted within the casing, a sleeve longitudinally movable upon the shaft and rotatable therewith, spring means opposing movement of the sleeve toward the shaft, a collar fixed to the sleeve, a collar fixed to the shaft, said collars being in opposed relation, link members connecting the collars, a weight member pivotally mounted upon the links, a helical spring interposed between the collars and adapted to be compressed between the collars after compression of the first named spring, a cam member on the sleeve having elongated cam faces, the fall edge of which is flared away from the leading edge thereof to provide cam faces of increasing area toward the base of the cam, breaker members operatively related to the cam faces, a rotor on the sleeve, said rotor having an arm stopping short of the conductors within the cap and said rotor and cam having longitudinal and rotary movements coincident with rotary and longitudinal movements of the sleeve.

2. In an ignition timer for internal combustion engines, a cap therefor, a plurality of conductors in the cap extending longitudinally thereof and exposed upon the inner wall of the cap, a shaft revolubly mounted within the casing, a sleeve telescopically arranged upon the shaft, said sleeve having opposed longitudinally extended slots, a pin in the shaft having an end thereof disposed in respective slots, said sleeve being interiorly threaded adjacent the outer end, a helical spring within the sleeve and seated upon the end of the shaft disposed within the sleeve, a screw threaded plug engaged with the threaded portion of the sleeve and in bearing relation with the spring, a collar fixed to the sleeve, a collar fixed to the shaft, said collars being in opposed relation, link members connecting the collars, a weight mem-

ber pivotally mounted upon the links whereby rotation of the shaft will cause movements of the sleeve toward the shaft against the action of the spring, a spring interposed between the collars, said spring being of greater strength than the first named spring and adapted to be compressed between the collars after compression of the first named spring, a cam member on the sleeve having elongated cam faces, the fall edge of which is flared away from the leading edge thereof to provide cam faces of increasing area toward the base of the cam, breaker members operatively related to the cam faces, a rotor on the sleeve, said rotor having an arm stopping short of the conductors within the cap, and said rotor and cam having longitudinal and rotary movements coincident with rotary and longitudinal movements of the sleeve.

3. In an ignition timer for internal combustion engines, a casing, a cap therefor, a plurality of conductors in the cap extending longitudinally thereof and exposed upon the inner wall of the cap, a shaft revolubly mounted within the casing, a sleeve longitudinally movable upon the shaft and rotatable therewith, spring means opposing movement of the sleeve toward the shaft, adjustable means for limiting downward movement of the sleeve, a collar fixed to the sleeve, a collar fixed to the shaft, said collars being in opposed relation, link members connecting the collars, a weight member pivotally mounted upon the links, a helical spring interposed between the collars and adapted to be compressed therebetween after compression of the first named spring, a cam member on the sleeve having elongated cam faces, a fall edge of which is flared away from the leading edge thereof to provide cam faces of increasing area toward the base of the cam, breaker members operatively related to the cam faces, a rotor on the sleeve, said rotor having an arm stopping short of the conductors within the cap, and said rotor and cam having longitudinal and rotary movements coincident with rotary and longitudinal movements of the sleeve.

4. In an ignition timer for internal combustion engines, a casing, a cap therefor, a plurality of conductors in the cap exposed upon the inner wall thereof, a shaft revolubly mounted within the casing, a sleeve longitudinally movable upon the shaft and rotatable therewith, spring means within the sleeve opposing movement of the sleeve toward the shaft, a collar fixed to the sleeve, a collar fixed to the shaft, the collars being arranged in opposed relation, link members connecting the collars, a weight member pivotally mounted upon the links, a helical spring interposed between the collars and adapted to be compressed therebetween after compression of the spring first named, a cam member on the sleeve having elongated cam faces, said cam faces merging with a circumferential ring presenting an uninterrupted surface at their junctures, breaker members operatively related to the cam faces, a rotor on the sleeve, said rotor having an arm stopping short of the conductors within the cap, said rotor and cam having longitudinal and rotary movements coincident with rotary and longitudinal movements of the sleeve, and a set screw in the collar upon the shaft adjustable inwardly and outwardly in the direction of movement of the sleeve.

5. In an ignition timer for internal combustion engines, a casing and cap member, a rotary shaft in the casing, a sleeve rotatable therewith and having longitudinal movements, spring means opposing longitudinal movement in one direction, link means connected between the shaft and sleeve, centrifugally actuated means associated with the links tending to draw the sleeve against the action of the spring, spring means opposing such movement, a rotor on the sleeve, said rotor having cam faces extending longitudinally thereon, and having a circumscribing ring portion adjacent one end thereof, said cam faces merging with the ring to present a smooth uninterrupted surface, breaker members operatively associated with the cam faces, an arm on the rotor operatively related with contacts in the cap, and adjustable means in the path of the sleeve whereby the length of movement of the sleeve may be varied.

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