Jan. 1, 1929.

1,697,522

G. M. CUSICK

IGNITION TIMER

Filed April 26, 1926 2 Sheets-Sheet 1

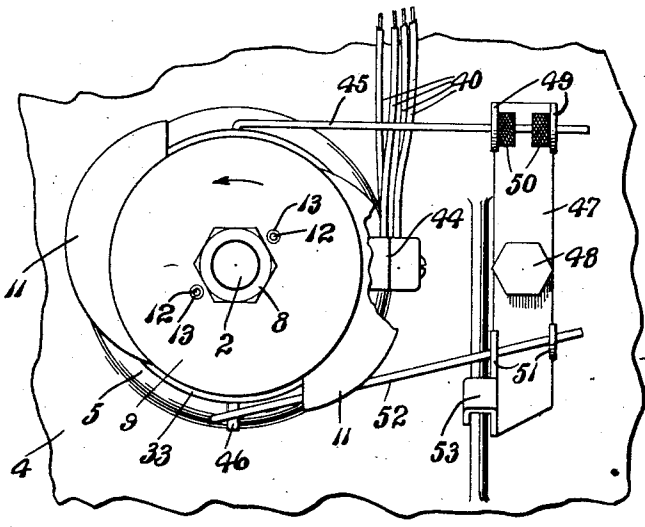


Fig. 1.

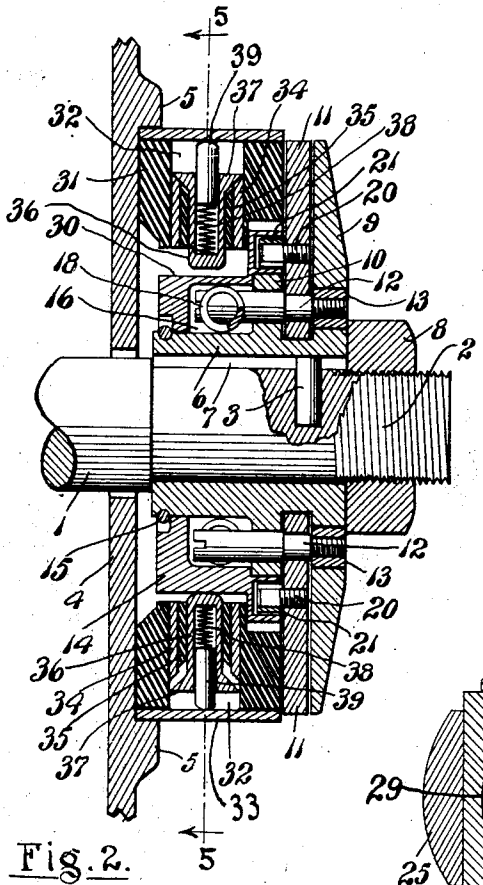


Fig. 2.

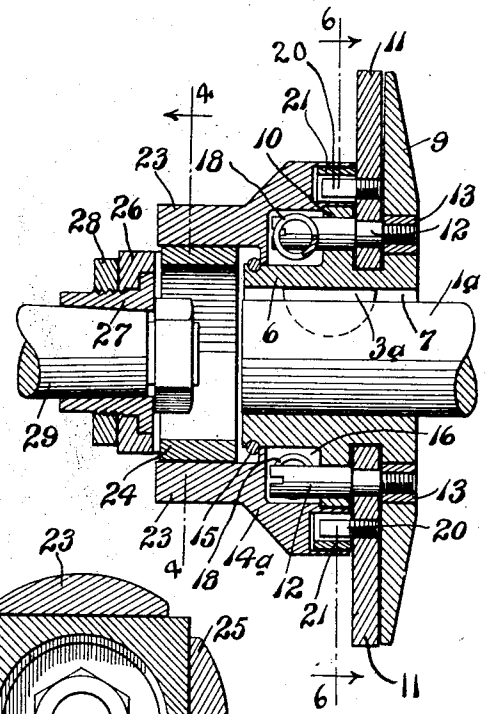


Fig. 3.

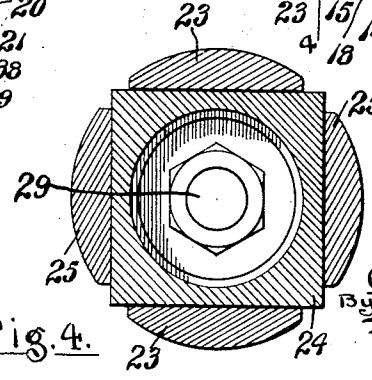


Fig. 4.

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IGNITION TIMER

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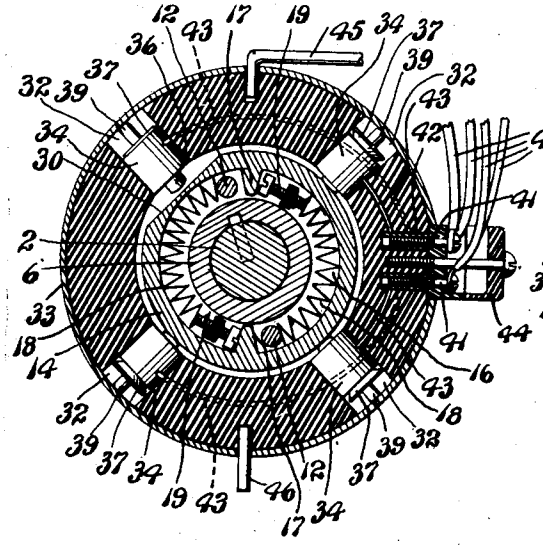


Fig. 5.

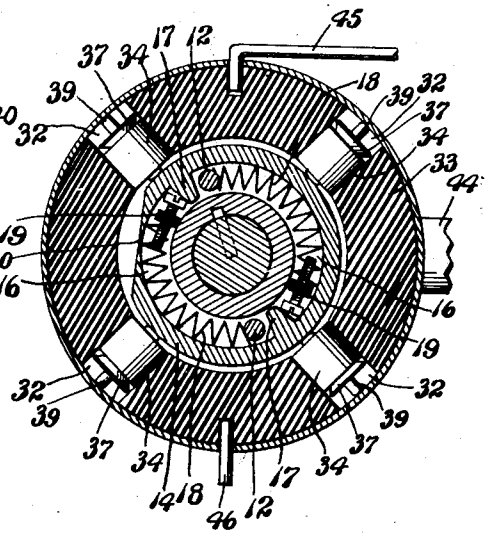


Fig. 7.

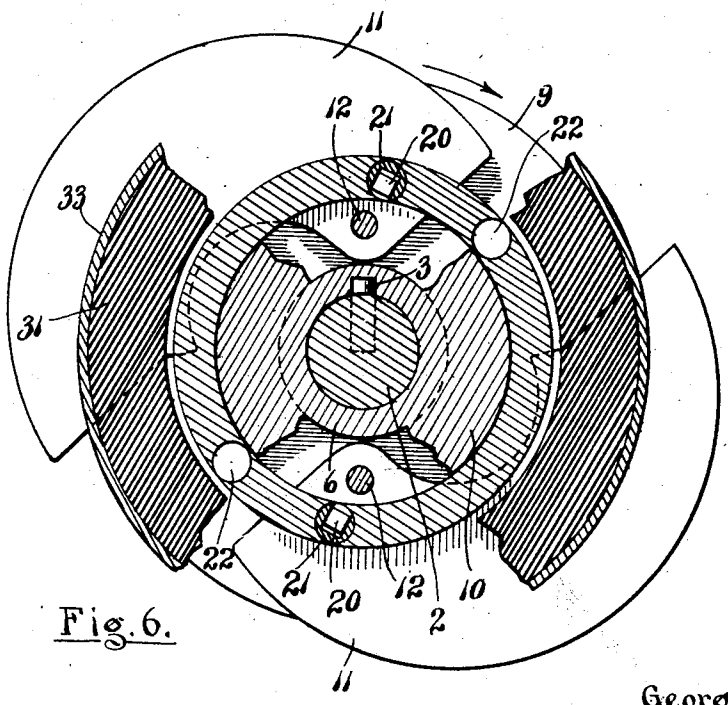


Fig. 6.

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Patented Jan. 1, 1929. 1,697,522

UNITED STATES PATENT OFFICE.

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IGNITION TIMER.

Application filed April 26, 1926. Serial No. 104,645.

This invention relates to a timing control or governing mechanism useful for controlling the time of spark in the ignition system of internal combustion engines. The present invention is applicable either directly to a timer of the type used in Ford automobiles, or may be used in conjunction with the coupling between a magneto shaft and the shaft driving the same so that the time of spark controlled by the magneto may be varied automatically and in conjunction with the different speeds of the internal combustion engine with which it is associated. The constructions embodying the invention and the functions served thereby will be apparent as understanding of the invention is had from the following description taken in connection with the accompanying drawings, in which,

Fig. 1 is a front elevation of the invention applied to a Ford timer.

Fig. 2 is an enlarged vertical section therethrough.

Fig. 3 is a section similar to that shown in Fig. 2 illustrating the same invention adapted to the coupling between a driving shaft and the shaft of a magneto driven thereby.

Fig. 4 is a section substantially on the line 4—4 of Fig. 3.

Fig. 5 is a section, reduced somewhat in size, taken substantially on the plane of line 5—5 of Fig. 2.

Fig. 6 is a fragmentary enlarged section and elevation through the apparatus, substantially on the plane of line 6—6 of Fig. 3, and

Fig. 7 is a view similar to Fig. 5 illustrating the apparatus assembled for application to a shaft rotation in a direction opposite from that indicated in the remaining figures of the drawings.

Like reference characters refer to like parts in the several figures of the drawings.

As shown in Fig. 2 the shaft 1 is the forward end of the timing or cam shaft of a Ford motor vehicle engine, it having a reduced extension 2 at its front end in which an opening is made to receive a key pin 3. The shaft 1 passes through the front end 4 of the engine block and an annular rib 5 is cast integral with and extends forward from said front end 4 of the block concentric with the shaft 1. This is structure which is well known in Ford engines, the projecting end of the shaft portion 2 being threaded, as shown. When, as shown in Fig. 3, my invention is applied to the coupling between a driving shaft and the magneto shaft, the driving shaft 1^a is equipped with a key 3^a to serve the same purpose as the key pin 3 and with which the apparatus of my invention in both cases is engaged to hold it on its shaft so as to rotate therewith.

In the construction of the device of my invention, a sleeve 6 is formed having a key way 7 cut therein, the sleeve passing over either the shaft portion 2 or the shaft 1^a so that the keys 3 or 3^a are received in the key ways 7. The sleeve is engaged at its outer end by a nut 8 threaded on the end of the shaft 2 in the form of the invention shown in Fig. 2. In each case sleeve 6 at its front end is formed with an integral outwardly extending and relatively large flange 9 and a distance from said flange, a second flange 10 is provided and also made integral with the sleeve 6, there being an annular groove between the two flanges 9 and 10. The flange 10 is of less diameter than the flange 9, as shown.

In the groove between said flanges, two weight members 11 are positioned, of the form best shown in Fig. 6 and are pivotally mounted on pins 12 which extend through the flange 10 and the weights 11, and at their outer ends are threaded to engage with nuts 13, said nuts being received in suitable cylindrical openings made through the flange 9, as shown. These weights 11 are substantially arc shaped in form and are pivoted near one end and adjacent their inner side so that with the rotation of the device as hereafter described, there is a tendency for the weights to swing outwardly about the axis of the pins 12 caused by centrifugal force; and such outward swing will become greater with the increased speed of rotation, as is evident. At the inner side of the flange 10 and around the sleeve 6 a member 14 is mounted. This member may be termed an equalizer member and is of substantially cup shape having an opening in its bottom through which the inner end of the sleeve 6 passes. A retaining split wire ring 15 is used to hold the equalizer member on the sleeve, as shown in both Figs. 2 and 3. In the construction shown in Fig. 3 the equalizer member 14^a is of slightly different form than that shown in Fig. 2, but both enclose an annular chamber 16 around the sleeve 6 into which, at diametrically opposed

points, lugs 17 extend inwardly from the equalizer member toward said sleeve, as shown in Figs. 5 and 7. The pins 12 extend into said chamber 16, one near each of the lugs 17 and coiled springs 18 located within the chamber bear at one end against the pins 12 and are engaged at their opposite ends with adjusting members 19 which in turn bear against the lugs 17, this being fully shown in Fig. 5.

From each of the members 11 described, a pin 20 extends into substantially cylindrical blocks 21 mounted in openings 22, formed in the face of the equalizer member 14. Said pins 20, where they extend into said blocks 21 are square in cross section and are received in slots cut in the blocks 21 from one side thereof nearly to the opposite side. It is evident that when the weights 11 move outwardly the same turn about the pins 12 and the squared pins 20 must move a limited distance back and forth in the slots of the blocks 21. At the same time there is a turning movement of the pins 20 about the axis of the pins 12, this causing the equalizer member 14 (or 14^a) to oscillate on the sleeve 6 whereby the lugs 17, shown in Fig. 5, move in a clockwise direction and pins 12 remaining relatively stationary the springs 18 are compressed. Said springs therefore tend to resist the outward swinging movement of said members 11 and when said members do swing outwardly the springs are compressed so that when the speed of rotation reduces the springs act to return the weighted members 11 to inner position.

It will be noted (referring to Fig. 6) that in the equalizer member there are two pairs of the openings 22 to receive the cylindrical plugs 21. This is to provide for the application of the mechanism to shafts rotating in opposite directions. When the weights are mounted, as shown in Fig. 6, the direction of rotation is clockwise but should the device be for application to a shaft rotating in the opposite direction the equalizer device is removed and turned so that when again applied the lugs 17 are at the opposite sides of the pins 12, as shown in Fig. 7. And the weighted members 11 must also be removed, reversed and again mounted on the pin 12, in which case the squared pins 20 will be located so as to enter plugs 21 placed in the openings 22 which in Fig. 6 now appear empty. In other words, by merely adding two extra openings 22 at proper positions, as shown in Fig. 6, the device can be assembled for operation when connected to shafts turning in either direction.

In the form of the invention shown in Figs. 3 and 4 the equalizer member is equipped with two spaced apart forks 23 to pass at opposite sides of a square plug 24. The other sides of the plug 24 are engaged by forks 25 extending from a member 26 which is permanently secured to the end of the magneto shaft 29, any suitable coupling means, indicated at 27 and 28, being used. This construction, shown in Figs. 3 and 4 and just described, is very similar to that set forth in my Patent No. 1,548,191, issued August 4, 1925.

When the timing governing device is applied to a timer used with internal combustion engines of the Ford type, the equalizing member 14 is flattened at one side, as indicated at 30. A ring 31 of suitable insulating material preferably bakelite, surrounds the equalizer member back of the weights 11 and in turn is surrounded by a metal ring 33, the outer diameter of which is such that it fits at its inner end within the annular rib 5 projecting from the front end 4 of the engine block. At a plurality of equally spaced points around the ring 31 cylindrical openings 32 are bored inwardly from the outer to the inner side of said ring. In each of these openings a metal sleeve 34 is fixed, the inner end of each sleeve coming to the inner side of the ring 31 but the outer ends terminating a distance short of the outer side of said ring. Within each of the sleeves 34 a second sleeve 35 of insulating material is permanently secured. Through each of the sleeves 35 a contact member 36 freely passes having its inner end bearing against the outer surface of the equalizing member 14 and being formed at its outer end with a head 37 substantially the same form as a screw head, that is, having a beveled inner side, the outer ends of the sleeves 34 being correspondingly beveled or countersunk. Each of the contact members 36 is bored inwardly from its outer end nearly through to its inner end making a cylindrical opening, in the bottom of which a coiled spring 38 is located and in the outer portion of which a pin 39 is loosely mounted, the same at its outer end bearing against the inner side of the metal ring 33 by reason of the spring 38 forcing it outward, there also being a tendency to force the member 36 inwardly.

The wires 40 carrying electric current are connected to suitable screws 41 which thread into sleeves 42 molded in the bakelite ring 31 at one side and each of the sleeves 42 is connected by a wire 43 with one of the sleeves 34. In the form shown there are four ignition wires 40 and four contacts mounted within four sleeves 34. The connections between wires 40 and the screws 41 are housed within a housing 44 of any suitable insulating material.

A rod 45 is connected with the rings 33 and 31 at one end at their upper side, when the same are installed on an engine, as shown in Fig. 1, while a pin 46 extends therefrom

downwardly. At a distance to one side of the timer a flat metal bar 47 is secured to the engine block in any suitable manner as by set screw 48. At one end the bar 47 is equipped with two spaced apart ears 49 through which the rod 45 passes, the rod between said ears having two adjusting nuts 50 threaded thereon. It is evident that by properly adjusting the nuts 50 the rings 31 and 33 with the contacts carried thereby may be adjusted to a limited extent. At the other end of the bar 47 there are additional ears 51 through which a rod 52 passes, its free end passing over the pin 46 to hold the timer mechanism from disengagement with the annular rib 5. One of the ears 51 is further formed into a retaining clip 53 engageable with a suitable projecting rib on the engine block.

In the construction shown in Figs. 1, 2 and 5, shaft 1 being continuously driven by the engine, the sleeves 6 and parts connected thereto, rotates continuously. The weights 11 tend to move outwardly as the speed of rotation increases and when the centrifugal force overcomes the resistance of the springs 18 such weights move ontwardly with a consequent change of position of the equalizing member 14. This is true not only of the construction shown in Figs. 1, 2 and 5 but also of that shown in Fig. 3. With the construction shown in Fig. 3 this change of position of the equalizing member causes the magneto connected with the shaft 29 to advance its time of sparking compared to what the time of spark is with the weights in their inner position. With the construction shown in Figs. 1, 2 and 5 the equalizer at 14 is changed in position on the sleeve 6 so that the flattened portion 30 comes to the different contact members 12 at a different time advancing the spark. It is evident that whenever the flat section 30 on the equalizer member 14 comes to a contact member 12 the member is pushed inwardly until the head 37 contacts with its associated sleeve 34, this completing a circuit for making a spark at the spark plug in one of the cylinders of the engine. Then as soon as the flat side 30 has passed by said contact member 12 it is engaged and forced outwardly breaking the electric connection between the head 37 and its associated metal sleeve 34.

It is, accordingly, clear that with the constructions which I have devised an internal combustion engine may be started with the spark properly retarded but that with the increase in speed the spark is advanced in accordance with the outward swing or throw of the members 11. This is a very valuable feature in connection with internal combustion engines. The spark is automatically retarded and advanced with decrease and increase in the speed of rotation of the engine, obviating danger of back fire when starting, increasing power by getting the full force of the explosion when the piston is at its highest point of compression, lessening the amount of carbon in the cylinders as the charge is fired when at the highest point of compression, thereby burning in a carbon form more readily, and eliminating undue strains on the engine which occur by having a spark too far advanced at low speeds. The construction is also very durable, there being no deterioration of the parts from arcing at contact points as the electric connection between heads 37 and the sleeves 34 is securely maintained all the time that current is passing and there is a stronger and hotter spark. The adjustment of the springs 18 may be made to properly govern the timing of the spark in high or low compression engines and a regulation of the timer can be obtained by the adjusting nuts at 50 and this, while the engine is running. There is, of course, also an elimination of any manually controlled spark lever, the timing of the spark being automatically controlled in accordance with the speed of the engine. This construction permits a 20 degree advance, saves a considerable portion of the wire now ordinarily used in leading to timer housings and all of the wires are in an upper accessible position out of the oil and dirt which ordinarily collects at the lower side of a timer.

This construction has been built and practically used on a great many motor vehicles and has proved particularly practical and efficient. The invention is defined in the appended claims and is to be considered as comprehensive of all forms of structure coming within their scope.

I claim:

1. In a device of the character described, a shaft, a body attached to said shaft to rotate therewith, weights pivotally mounted on the body and adapted to swing outward on rotation of said body, a member extending partially over the body and free to turn thereon, there being an annular recess between said member and the body and said member in one end near its outer side having openings therein, the open ends of which are adjacent sides of said weights, pins located outwardly from the pivots of said weights attached to said weights and extending into said openings, lugs projecting inwardly from said member into the annular recess, coiled springs between said lugs and extensions to said pivot pin passing into the annular recess whereby on rotation of the shaft said member is rotatably moved on said body against the springs, the movement being increased with the greater speeds of rotation of said shafts and vice versa.

2. In a device of the class described, a rotating shaft, a body fixed on said shaft, weights pivotally mounted on the body to swing outwardly on rotation of the body, a

member loosely mounted on the body and movable thereon about the axis of said shaft, there being an annular recess between the member and said body, springs disposed in said recess, means whereby on rotation of the member in one direction said springs are compressed, means for turning the body against said springs as said weights are thrown outwardly, and means for connecting said weights with the member at two different places to thereby render the device effective on rotation of the shaft in either direction.

3. In a timer, a contact carrying member comprising a ring of insulating material having a plurality of radial openings therethrough, a metal ring surrounding the insulating ring, a metal sleeve within each opening, an insulating sleeve within each metal sleeve, a contact member mounted within each insulating sleeve and having an opening bored longitudinally therein from its outer end toward its inner end, a spring disposed in said opening, a pin loosely mounted in said opening bearing against the spring at one end and against said metal ring at the other end, said contact member at its outer end being provided with a head which at inner position contacts against the outer end of its associated metal sleeve.

In testimony whereof I affix my signature.

GEORGE M. CUSICK.