Oct. 9, 1928.

1,686,686

T. A. EDISON, JR

IGNITION TIMER

Filed Oct. 19. 1922

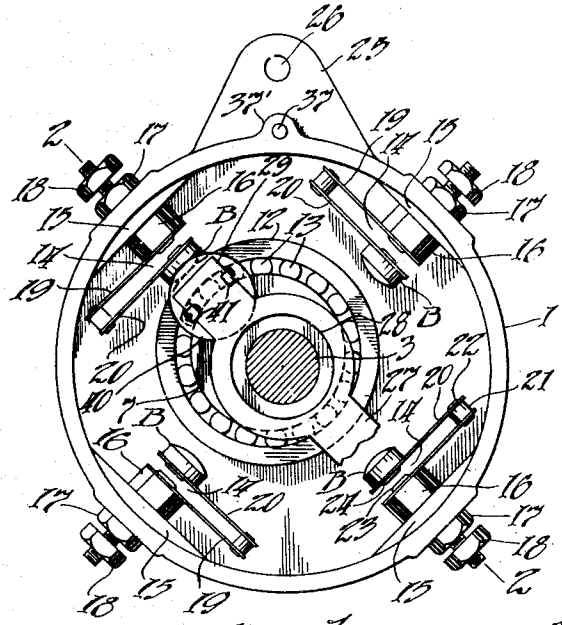


Fig. 1

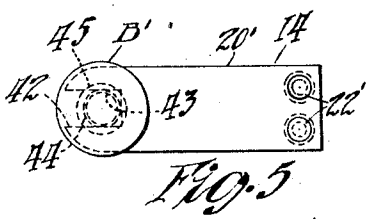


Fig. 5

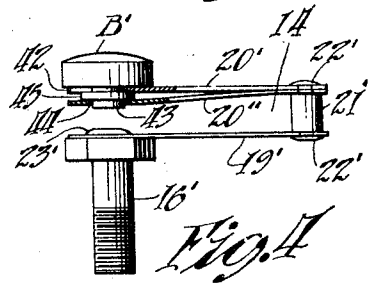


Fig. 4

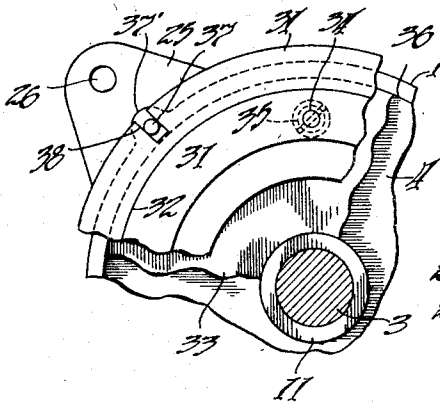


Fig. 3

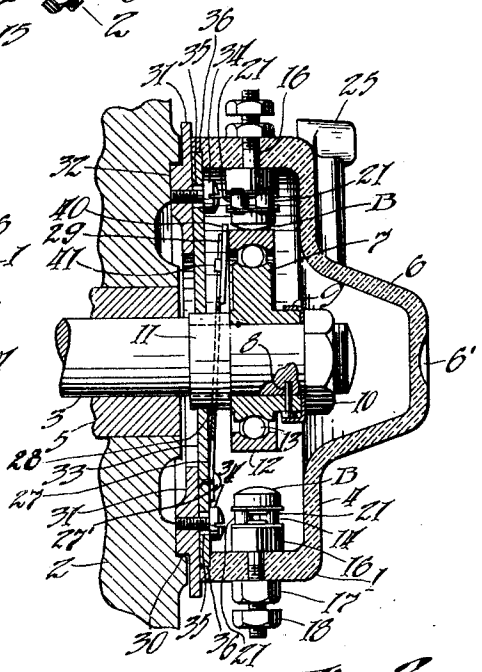


Fig. 2

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Patented Oct. 9, 1928. 1,686,686

UNITED STATES PATENT OFFICE.

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IGNITION TIMER.

Application filed October 19, 1922. Serial No 595,525.

My invention relates to devices for closing the electric circuits of the several spark plugs of multi-cylinder internal combustion engines, which are generally referred to as ignition timers.

One of the principal objects of my invention is to insure the correct and concentric positioning of the timer casing and the contacts carried thereby with respect to the timer shaft of an internal combustion engine, regardless of any eccentricity of the timer recess in the engine frame with respect to said shaft.

My invention further resides in an improved arrangement and improved features of construction for ignition timers, whereby the wear and the likelihood of breakage of various parts are reduced to a minimum, and whereby when the timer is in operative position the effective grounding of the contact member of the rotor to one set of terminals of the spark plugs is assured at all times.

Further objects of my invention are to reduce the friction in the movable parts of this type of ignition timers to a minimum, to effect a contacting engagement between the contact member of the rotor and the fixed spaced contacts cooperating therewith which constantly shifts to different surface points of both the contact member and contacts, and to provide for the ready replacement of those parts of the timer which are most likely to wear.

Other features of my invention reside in the construction of parts and combinations of elements hereinafter more fully described and claimed.

For a clearer understanding of my invention, attention is directed to the following description, in connection with the drawing accompanying and forming a part of this specification and in which:

Figure 1 is a view in rear elevation, partly in section, of one form of ignition timer in accordance with my invention, with the adapted means omitted;

Fig. 2 is a sectional view, partly in elevation, showing the timer applied to the engine housing, the section being taken on a line corresponding to line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view in rear elevation of the timer provided with the adapter or locating and centering means.

Fig. 4 is an enlarged view in elevation, partly in section, of a modified form of contact which may be used in place of the fixed spaced contacts of the construction shown in Figs. 1 and 2; and

Fig. 5 is a plan view of the contact shown in Fig. 4.

Referring to the drawing, reference character 1 represents the timer casing, which is cylindrical in form and which is mounted for oscillatory movement on the engine housing 2 in a special manner, presently to be described, enabling the same and the spaced contacts carried thereby to be positioned absolutely concentrically with the timer actuating shaft 3 and insuring the maintenance thereof in such concentric position in the various angular adjustments made in advancing and retarding the spark. The timer casing 1 is provided at its front end with a cover 4, preferably formed integrally therewith. The timer shaft 3, driven by suitable gearing (not shown) in synchronism with the engine shaft, is journaled in a suitable bushing 5 within an opening in the engine housing 2, and extends from the latter into the timer casing 1. The cover 4 of the timer casing is formed with a central forwardly extending portion 6 into which the end of the timer shaft 3 projects. This portion 6 of the cover 4 is provided with a recess 6′ forming a seat for the usual spring (not shown) employed to hold the timer casing 1 in proper position with respect to the engine housing 2.

The portion of the timer shaft 3 extending into the timer casing is reduced, and an eccentric 7 is secured to such reduced portion of the shaft as by means of a pin 8 extending through the hub of the eccentric and into the shaft. A sheet metal cap 9 takes over the end of the hub of the eccentric 7 and the head of pin 8 and acts as a retainer to hold the latter in place. A nut 10 is threaded onto the end of shaft 3 and a spacing sleeve or bushing 11 is mounted on the reduced end portion of the shaft between the shoulder formed by such reduced portion and the eccentric 7. The nut 10, of course, holds the retainer 9 in place, and when tightened coacts with the shoulder on shaft 3 to rigidly secure the eccentric 7 and spacing sleeve 11 to the shaft to turn therewith. Mounted on the eccentric 7 so that the latter is capable of free rotary movement with respect thereto, is a contact ring 12. In order to reduce the friction between the eccentric 7 and the ring 12, a roller bearing,

preferably a ball bearing 13, is disposed between the said ring and eccentric, the outer and inner raceways of such bearing preferably being respectively provided on the inner and outer opposed walls or peripheral surfaces of the ring 12 and eccentric 7. The contact ring 12 cooperates with a plurality of contacts 14 of special form, which are carried by the casing 1 and equi-spaced about the axis of the shaft 3. The cylindrical casing 1 is provided on its inner side with equi-spaced integrally formed projecting portions 15 corresponding in number to the contacts 14 and having flat inner faces. Each of the contacts 14 comprises a headed metallic member 16, the shank of which extends through one of the inwardly projecting portions 15 of the casing 1 and the wall of the casing, and the polygonal head of which bears against the inner flat face of said portion 15. The outwardly extending end portion of the shank of the headed member 16 is threaded, and a nut 17 turned up on such threaded end portion tightly against an outer flat surface portion provided on the cylindrical wall of the casing 1, serves to rigidly secure the contact to the latter, as shown in Figs. 1 and 2. The usual conductors (not shown) respectively leading from one set of terminals of the spark plugs are respectively adapted to be connected to the contacts 14 between the nuts 17 and nuts 18 threaded on the outwardly extending end portions of the members 16. Each of the contacts 14 also comprises a pair of similar flat springs 19 and 20 firmly secured together at one end so that they will be in spaced and substantially parallel relation, as by means of a pair of spacing pins or rivets 21, each having reduced end portions which respectively extend through the springs 19 and 20 and are peaned over as indicated at 22. The spring 19 is firmly secured at its other end to the head of the headed member 16 of the respective contact 14, as by means of an inwardly extending reduced portion formed on said head, which extends through spring 19 and is peaned over as indicated at 23. The corresponding adjacent end of the spring 20, which is spaced inwardly from the headed member 16, is free and carries on its inner side a metallic contact button B, the latter being firmly secured to spring 20 by means of a reduced portion formed on the button which extends through the spring and is peaned over as indicated at 24. The contacts 14 are preferably secured to the wall of the casing 1 in the position shown, with the springs 19 and 20 of each contact extending within the casing from the headed member 16 supporting the same, in a direction opposite to that in which the timer shaft 3 and eccentric 7 are rotated, the direction of rotation of the latter, looking at Fig. 1, being clockwise. The timer shaft 3, eccentric 7, contact member or ring 12 and bearing 13 are all formed of conducting material and are grounded to the engine frame or casing 2, and are accordingly electrically connected with the other set of terminals of the spark plugs, which are likewise grounded to the engine frame. The casing 1 is formed of suitable insulating material, preferably a phenolic condensation product such as condensite or bakelite, and it is therefore unnecessary to provide insulating bushings for the headed members 16 of contacts 14 in order to insulate the latter from each other.

With my improved timer properly applied in operative position, as shown in Figs. 1 and 2, it will be apparent that as the timer actuating shaft 3 is rotated, by the operation of the engine, the eccentric 7 connected to this shaft will cause the contact member or ring 12 to successively engage and disengage the contact buttons B of the contacts 14 at the central portion of their inner convex surfaces, to thereby successively open and close the corresponding spark plug circuits at the proper time. As the eccentric 7 is capable of free rotary movement with respect to the contact ring 12, the movements imparted to the latter towards and from the successive contact buttons B will be radial, or at least the major components of such movements will be radial. As a matter of fact, when the timer is operated, the rollers or balls of the bearing 13 slip somewhat on the raceway of the eccentric 7 and tend to rotate the ring 12 in a direction opposite to that of the shaft 3 and eccentric 7, and in the absence of any means to retard or impede rotary movement of the contact ring under the action of said rollers or balls, this ring would actually rotate at an appreciable speed, much less however than that of the shaft 3 and eccentric 7, in a direction opposite to the eccentric. However, I preferably provide suitable means for retarding such rotation of the contact ring 12 so that the same will rotate as described only at an exceedingly slow rate. This means as shown comprises a thin resilient member or arm 27 formed of conducting material such as thin spring steel or other resilient sheet metal. The member or arm 27 is secured at one end, as by one or more rivets 27', to the conductive plate 33 of the adapted means, presently to be described, for locating and centering the timer casing with reference to the axis of the timer shaft 3. The member 27 extends diametrically of the timer casing and is provided intermediate its ends with an enlargement having a circular opening 28 somewhat larger in diameter than the sleeve or bushing 11 and through which, when the timer is assembled, said sleeve and the shaft 3 loosely extend as shown in Fig. 2. The arm 27 is bent sufficiently so that it tends under its own resiliency to normally assume a position with its free end 29 somewhat to the right of where it is shown in Fig. 2. Accordingly when the timer is assembled,

the said end 29 of arm 27 is adapted to engage the adjacent side of contact ring 12 under such pressure that when the timer is operated, the resulting friction will retard the rotary movement of said ring to the extent desired. The end 29 of arm 27 is subject to a slight wear by reason of its frictional engagement with the ring, and to obviate any disadvantage which might result from such wear, the said end 29 may be provided with a replaceable contact piece 40 for engagement with the contact ring. This contact piece 40 is formed of thin resilient sheet metal, is preferably circular, and has a pair of spaced spring fingers or tabs 41 stuck therefrom between which and the main body portion of the contact piece the end 29 of arm 27 is adapted to be received. The fingers 41 lie so closely to the main body portion of the contact piece 40 that when the latter is slipped onto the end 29 of arm 27 to the position shown in Figs. 1 and 2, such fingers will be forced or sprung outwardly and will accordingly act to frictionally grip the arm 27 so as to prevent any displacement or movement of the contact piece with respect to the arm in the operation of the timer. Should the contact piece 40 become appreciably worn it may be readily and quickly replaced. While it is advisable under some circumstances, to employ the contact piece 40, the latter is, of course, not essential to the successful operation of the timer.

The contact effected between the ring 12 and the contact buttons B of my improved timer, as distinguished from the timers now on the market, is practically non-wiping and non-rolling and may be aptly termed a "bumping" contact. The very slow rotary movement of the ring 12 during the operation of the timer suffices, however, to insure a constant shifting of the points in the contacting surface of the ring where the buttons B intermittently engage the ring, and accordingly the ring will not become pitted or burned as might happen in case each of the buttons B successively made contact therewith only at a given point in the contacting surface thereof.

The use of contacts 14 of the special construction shown and described herein, results in a number of advantages. The springs 19 and 20 are without bends and may be readily treated to bring the same to a high and uniform temper. Moreover, by reason of the connection of the respective pairs of springs 19 and 20 to each other at one end and to the headed members 16 and the contact buttons B respectively at the other end, the bending strains resulting from the engagement of the buttons B by the ring 12 in the operation of the timer, will be divided by the springs. Consequently, the bending strains to which each of the springs 19 and 20 is subjected will be slight, and the likelihood of the springs crystallizing and breaking in the long continued use of the timer is so reduced as to be negligible. Moreover, as the convex surface portions of the buttons B become worn, the bending strains to which the springs 19 and 20 are subjected and also the rate of wear of the buttons will continually be reduced, for by reason of the wearing of the buttons, both the periods of engagement of the ring 12 with each button and the distance through which the latter is moved by the ring gradually lessen. It is to be understood, of course, that by reason of the "bumping" engagement of the ring 12 with the contact buttons B, the wearing of these buttons just referred to, even for a long period of operation of the timer is but slight.

In place of the contacts 14 of the construction shown in Figs. 1 and 2, I prefer to employ contacts of the form shown in Figs. 4 and 5. In the contact 14′ of Figs. 4 and 5, the headed member 16′, flat springs 19′ and 20′, and the spacing pins 21′ are of the same construction and arrangement as the corresponding elements of the contacts 14 shown in Figs. 1 and 2, except that the spring 20′ is provided at its free end with an open-ended slot 42. The reduced ends of the pins 21′ which extend through the flat springs 19′ and 20′ at one end are peaned over at 22′ to secure these springs rigidly together in fixed spaced relation at said end, and the head of member 16′ is provided with a reduced projection extending through the other end of spring 19′ and peaned over at 23′ to rigidly secure said member and spring together. A flat spring 20″, similar to spring 20′, is secured at one end on the reduced end portions of pins 21′ between the shoulders formed by such reduced end portions and the spring 20′. The spring 20″ is provided adjacent its other or free end with a circular opening 44. The spring 20″ tends, under its own resiliency, to assume a position in which it lies closely against the spring 20′ throughout its length. The contact button B′ of each contact 14′ is of the same general form as the contact buttons B of contacts 14 shown in Figs. 1 and 2. The button B′, however, is removably and rotatably mounted on the free ends of the springs 20′ and 20″, as follows: The button B′ on the side thereof opposite its inner convex contacting side or surface, is provided with a cylindrical projection or stem 43, the diameter of which is less than the diameter of hole 44 in spring 20″, and also slightly less than the width of slot 42 in spring 20′. The stem 43 is provided intermediate its ends with a cylindrical enlargement or collar 45. To apply the button B′ in place as shown in Fig. 4, it is merely necessary to press and hold the free end of spring 20″ a considerable distance from the corresponding end of spring 20′, to then slide that portion of stem 43 of the button between the collar 45 and

the head of the button into the slot 42 until it engages the end wall of the slot, and to thereupon release the free end of spring 20″. Upon so releasing the free end of spring 20″, the latter will immediately move or spring into engagement with the collar 45, with the opening 44 therein taking over the outer end portion of stem 43 on the button. It is apparent that the button, by reason of the engagement of stem 43 thereof in the circular opening 44 of spring 20″, will be firmly held or locked against displacement when the timer is in operation. Moreover, by reason of the width of slot 42 and the diameter of opening 44 being greater than the diameter of stem 43, the button B′ is rotatable on its mounting. Accordingly, when the button is engaged by the contact ring 12 in the operation of the timer, said ring will, because of its slow rotary movement, tend to rotate the button. As a matter of fact, this action of the ring 12 on the button B′ effects a very slight angular movement of the latter on each engagement, with the result that the button presents a constantly changing point of contact to the ring 12. Accordingly the wear and pitting of the contacting surfaces of the contact buttons, when contacts of the form shown in Figs. 4 and 5 are employed, are reduced to a minimum. In case any of these buttons become worn, pitted or otherwise damaged to such an extent as to impair the operation of the timer, the same may be quickly replaced by a new button. To do this it is merely necessary to press the free end of spring 20″ away from spring 20′ a distance sufficient to disengage the stem 43 from the opening 44, remove the button by sliding the same laterally on the spring 20′ until the stem 43 is disengaged from the slot 42, and to then insert a new button as described above.

The timer casing 1 is provided with an outwardly extending arm or bracket 25, preferably formed or molded integrally therewith, having a recess 26 adapted to receive one end of the usual rod or link, not shown, to effect angular adjustment of the timer casing in either direction about the axis of the shaft 3 for the purpose of "retarding" or "advancing" the spark.

Reference character 30 (Fig. 2) represents the usual circular recess provided in the engine frame as a seat for the timer casing. This recess, especially in the case of Ford cars, is very frequently slightly eccentric to the axis of the timer or cam shaft 3. Accordingly, I have designed a novel and simple adapter means which, when the timer is assembled in operative position, as shown in Fig. 2, properly locates the timer casing 1 and maintains the same absolutely concentric with the axis of the timer shaft 3 with the buttons B of the contacts 14 carried by the casing equidistant from said axis, thereby compensating for any such eccentricity of the recess 30 with respect to the timer shaft. This is an important feature of my invention as it insures absolutely accurate timing of the sparks produced in the cylinders of the engine, regardless of whether the timer shaft 3 is out of center with the recess 30, which result it is impossible to obtain with the constructions heretofore employed. This novel adapter means comprises a flat adapter ring 31 of conductive material provided with an annular projection 32 on one side adapted to fit somewhat loosely in the timer recess 30, and a circular locating plate 33 of conductive material having a central opening in which the cylindrical bushing or sleeve 11 is adapted to fit very closely, the ring 31 and plate 33 being connected, as shown, by a pair of screws 34 which extend through openings 35 in the plate and are threaded into the ring. The openings 35 are preferably circular and, while less in diameter than the heads of the screws 34, are considerably greater in diameter than the shanks of these screws, and accordingly upon loosening the screws, the ring 31 and plate 33 may be relatively adjusted. The locating plate 33 is adapted to fit very closely within the open end of the cylindrical timer casing 1, as indicated at 36, and to seat against the adjacent end surfaces of the projecting portions 15 to form a closure for said casing. To enable the timer casing 1 to be applied in the correct angular position, and also to cause the adapter means to turn with the casing when the latter is adjusted to advance or retard the spark, the casing 1 is provided with a rearwardly extending pin or stud 37 which is firmly secured at one end in a lug 37′ formed on the casing, and the adapter ring is provided with a radial open-ended slot or recess 38 with which the pin 37 is adapted to engage.

In installing or assembling my improved timer in operative postion, the cylindrical bushing or sleeve 11 is first slipped onto the reduced end portion of the timer or cam shaft 3 against the shoulder thereon. The screws 34 connecting the ring 31 and plate 33 of the adapter means are then loosened and the latter is placed over the shaft and the ring 31 and plate 33 thereof adjusted so that the annular projection 32 of the ring seats within the timer recess or seat 30 on the engine housing 2 with its slot 38 in a predetermined angular position, and so that the central opening in the plate is engaged by the bushing or sleeve 11, after which the screws 34 are tightened. The rotor, comprising eccentric 7, contact ring 12 and the ball bearing 13, is next placed on the shaft 3 with the said ring bearing against the end 29 of the spring member 27 or the removable wear piece 40 carried by said member, and is fastened to the shaft by the pin 8, after which the pin retainer cap or ring 9 is slipped over the shaft 3 into operative position and the nut 10 is applied

to the end of the shaft and turned up tight. The timer casing 1 is then placed in position with the stud or pin 37 engaging the slot 38 in the adapter ring 31 and so that the locating plate 33 fits accurately within the open end of the casing and seats against the projections 15 of the latter. The free end of the usual spring arm (not shown) for holding the timer casing in position is now seated in the recess 6′ of the cover 6 of the timer casing and the spring tightened, the end of the rod (not shown) for advancing and retarding the spark is engaged with the recess 26 of the bracket 25 of the timer casing, and the wires or leads from the spark plugs are respectively connected to the proper contacts 14 between the nuts 17 and 18.

In advancing and retarding the spark, it will be apparent that the casing 1, adapter ring 31 and locating plate 33 will be turned together about the axis of the timer shaft 3. However, the maximum angular movement of these parts in adjusting the spark is approximately twenty degrees, and the annular projection 32 of the adapter ring 31 does not fit the recess 30 with sufficient tightness to result in binding upon such movement.

It is to be especially noted that contact ring 12 is grounded to the frame 2 at the seat 30 and outwardly of the shaft 3 through a direct path including the sheet metal spring member 27, and the conductive means engaging said sheet and comprising the locating plate 33 and adapter ring 31, as well as through bearing 13, eccentric 7 and shaft 3. Consequently, should the electrical connection between the ring 12 and eccentric 7 become impaired in any way as by presence or accumulation of oil, dirt or other foreign matter in the bearing 13, the ring would still be in good electrical connection with one set of terminals of the spark plugs.

It is to be understood that the construction shown and described herein is subject to various modifications and changes in the size, shape and arrangement of parts, without departing from the spirit of my invention or the scope of the appended claims.

Having now described my invention, what I claim as new and desire to protect by Letters Patent is as follows:

1. The combination with an internal combustion engine having a rotary element and a recess provided in the engine frame substantially concentric with the axis of said element, and a timer casing carrying a plurality of radially arranged, spaced contacts and adapted to be applied to said frame with said contacts in cooperative relation to said rotary element, of adapter means for insuring the concentric positioning of the timer casing and the contacts carried thereby with respect to the axis of the rotary element, said means comprising a pair of adjustably connected members one of which is adapted to take within and coact with said recess and the other of which is adapted to fit closely within the timer casing and over said rotary element.

2. In an ignition timer, a casing, and a contact carried by said casing comprising a member having an open-ended slot, a contact element having a head and a shank, said shank having a collar intermediate its ends, said contact element being mounted on said member with that portion of its shank above said collar engaging said slot, and a resilient member connected at one end with said slotted member and having an apertured free end, the apertured end of the resilient member normally being held under the resiliency of such member in engagement with the lower end of the shank of the contact member, substantially as described.

This specification signed this 18th day of Oct. 1922.

THOMAS A. EDISON, JR.