Feb. 9, 1937. A. A. VARELA 2,070,072

IGNITION TIMER

Filed Aug. 29, 1934 3 Sheets-Sheet 1

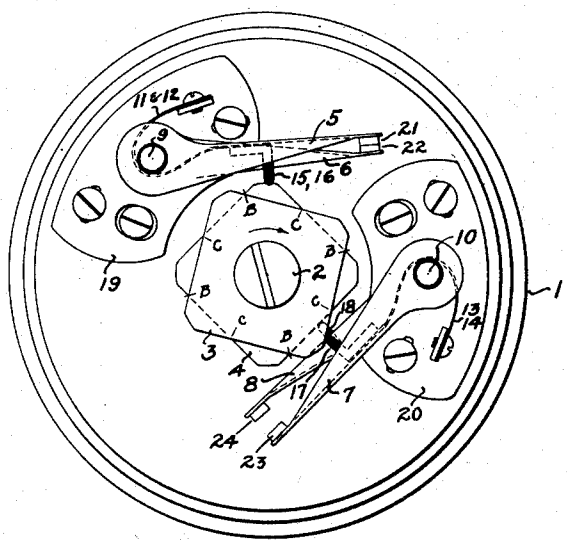


Fig. 1

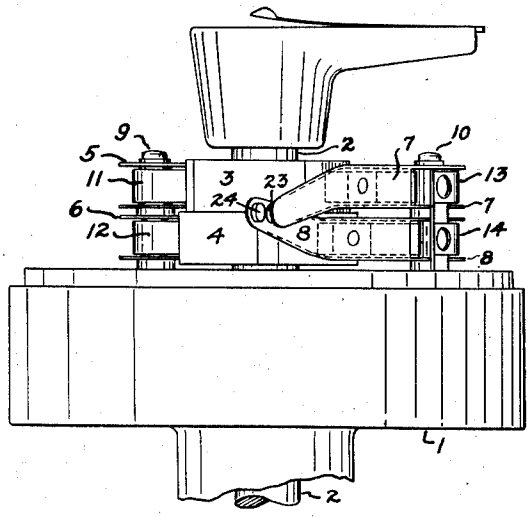


Fig. 2

Inventor

Arthur A. Varela

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IGNITION TIMER

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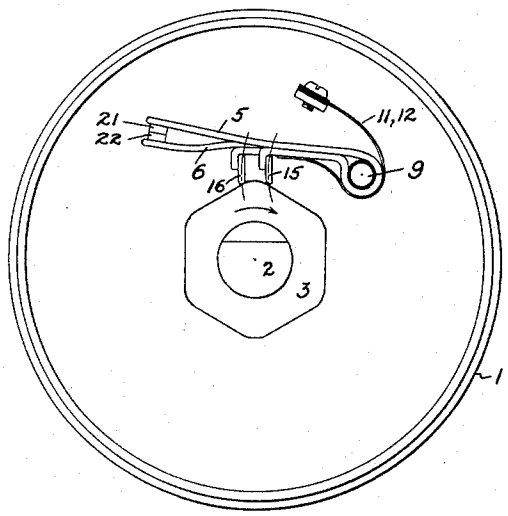


Fig. 3

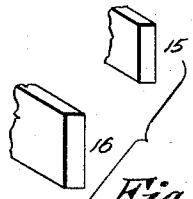


Fig. 8

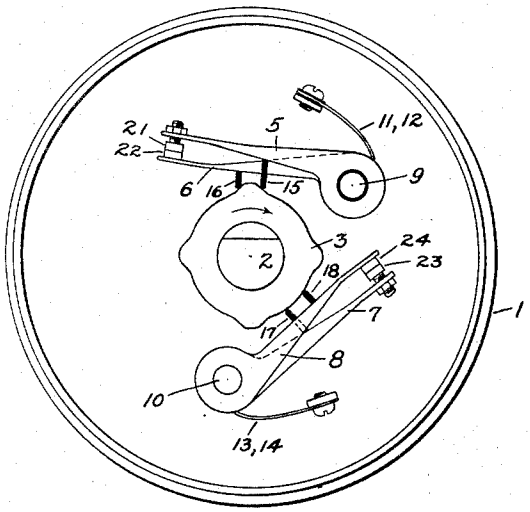


Fig. 4

Inventor

Arthur A. Varela

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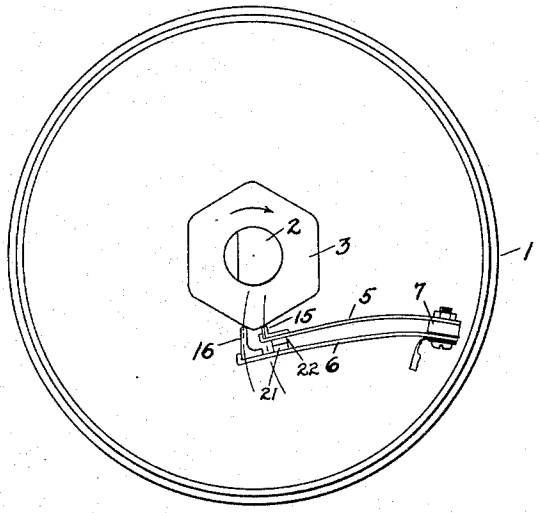


Fig. 5

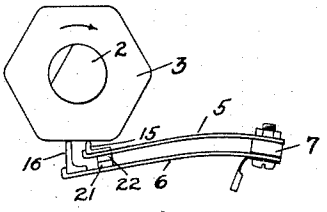


Fig. 7

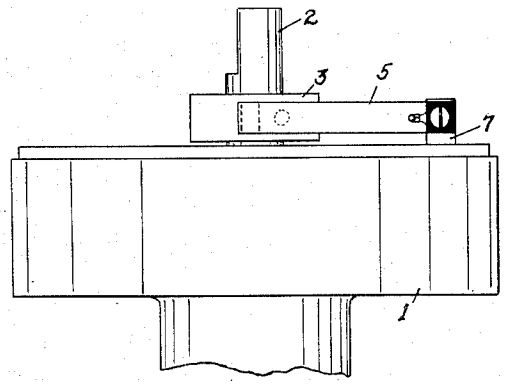


Fig. 6

Inventor

Arthur A. Varela

Patented Feb. 9, 1937 2,070,072

UNITED STATES PATENT OFFICE

2,070,072

IGNITION TIMER

Arthur Alexis Varela, Washington, D. C.

Application August 29, 1934, Serial No. 741,886

3 Claims. (Cl. 200—27)

This invention relates to periodic electrical switch mechanisms, but more particularly to internal combustion engine ignition timers.

The objects of this invention are to provide timer mechanism wherein shift of ignition timing due to wear is eliminated, arcing of the contacts is greatly reduced by rapid separation of the contacts, and wherein relatively low velocities of the contacts at closing permit the use of low inertia spring contact arms without danger of chatter.

To accomplish these objects each contact of the one or more pairs of co-operating contacts employed is mounted upon a movable member and the members are caused to reciprocate by cam action by means of properly proportioned wear pieces which provide compensation of wear. The principles involved are fully set forth in the following descriptions of preferred embodiments with reference to the drawings.

Figures 1 and 2 illustrate embodiment of the invention in an eight cylinder ignition timer-distributor having two sets of contacts and two cams. Figure 1 is the plain view from the top with the high tension distributing arm and cap removed. Figure 2 shows the vertical elevation with the distributing arm in place but with the cap removed.

Figure 3 is the plan view of a six cylinder timer having a single cam and with the distributing arm and cap removed.

Figure 4 is the plan view of an eight cylinder timer having two sets of contacts but with a single cam.

Figures 5 and 6 illustrate another embodiment wherein contact arms consisting of simple spring strips having low moments of inertia are employed. Figure 5 is the plan view from the top and Figure 6 is the vertical elevation.

Figure 7 shows the relative positions of the cam and contact arms of the timer shown in Figures 5 and 6 at the instant the contacts come together.

Figure 8 is a view of the ends of the wear pieces 15, 16 of the timer illustrated in Figure 3.

It is intended that a conventional high tension distributing arm and cap be used in each of the embodiments shown by the figures.

Similar reference numbers indicate corresponding parts in Figures 1 and 2, and as far as possible in the other figures.

In Figures 1 and 2, 1 is the timer mechanism base of the conventional type housing the automatic timing shift mechanism; 2 is the timer driving shaft; 3 and 4 are cams mounted on the shaft 2 and each having four symmetrically arranged straight sections to its periphery; 5 and 6 are independently movable lever arms mounted 5 above 6 upon a common pivot pin, 9, and having co-operating contacts, 21, 22, upon their free ends. 7 and 8 are a similar pair of levers likewise mounted upon a pivot 10 at a position 135 degrees from 9 and bearing the second pair of co-operating contacts 23, 24. The co-operating levers, 7, 8 and 5, 6, are formed as shown in Figure 2 so that the co-operating contacts may meet evenly. 11, 12, 13, and 14 are springs urging the levers to swing toward the cams. Each of the levers, 5, 6, 7, 8, has mounted upon it a wear piece, 15, 16, 17, 18 respectively, consisting of a small strip or block of bakelite, fibre, or other suitable material disposed to engage the opposite cam.

In Figure 1 the contact lever assemblies are shown mounted on plates 19 and 20 arranged to permit a small amount of movement about the cam axis to provide for timing adjustment. This is perhaps a desirable adjunct but is not part of this invention.

The cams 3 and 4 are fixed in their relation to each other with an angle somewhat less than 45 degrees between the corners of cam 3 and the corresponding corners of cam 4 in the direction of rotation. The purpose of this uneven displacement is to obtain relatively high speed of separation of the contacts upon disengagement and relatively low speed to engagement, arcing with consequent damage to the contacts being kept down by rapid separation of the contacts upon disengagement and any tendency of the contacts to bounce or chatter being obviated by low engagement speed.

As the cams 3 and 4 revolve they actuate the levers 5, 6, 7, 8, causing them to swing back and forth. While the lever 6 is moving outward the lever 5 moves inward and when the line of contact of the wear pieces is at C, Figure 1, the contacts 21, 22 come together. The levers then move outward together by action of cam 4 on lever 6, the wear piece on lever 5 being moved from engagement with its cam, 3. When the corner or rounded portion of cam 4 has passed under the wear piece 16 the levers 5 and 6 move inward, the contacts 21, 22 remaining engaged until point B is reached. The wear piece 15 on lever 5 then comes into engagement with cam 3 and lever 5 then moves outward. Lever 6 continues to move inward under action of the biasing spring 12 and the contacts 21, 22 separate, each moving away from the other. When the following position C is reached the contacts re-engage and the operation is repeated. Levers 7 and 8 are actuated in a

similar manner, but the contacts 23, 24 disengage at about the same instant that the contacts 21, 22 engage and therefore the two sets of contacts should operate separate ignition circuits.

It is intended that the wear pieces 15, 16 and 17, 18 be designed to wear away at substantially the same rate and that the center lines of the wear pieces be along the arcs from the lever pivots 9, 10. Wear of these pieces will then simply result in a gradual shift of the levers together toward the cams with no change in the position of lever 5 with respect to lever 6, or of lever 7 with respect to lever 8 for a given cam position. There will therefore be no change in the cam positions for engagement and disengagement of the co-operating contacts resulting from wear of the wear pieces.

Wear of the cams 3 and 4 will be compensated in like manner by a mutual shift of the co-operating contact levers.

A second method of obtaining the desired operation is shown by Figure 3 wherein a single cam is employed instead of two displaced cams and the wear pieces on the co-operating levers are disposed to make displaced lines of contact with the periphery of the cam.

In Figure 3, 1 is the cylindrical casing and base; 3 is a symmetrical six-sided cam mounted on the driving shaft 2; 5 and 6 are independently movable levers carrying on their ends co-operating contacts 21, 22. The levers 5, 6 are mounted one above the other on the pivot 9 and are formed so that the contacts 21, 22 may meet evenly. The levers are insulated from each other by suitable bushings and are urged against the cam by springs 11 and 12, respectively.

In order to obtain a desirable leverage relationship it is preferred to mount the levers so that they point in a direction contrary to the direction of rotation of the cam, as shown in Figure 3. The wear piece 15 on the lever 5 carrying the outer contact 21 is then mounted nearer to the pivot 9 than is the wear piece 16 on the inner lever 6. The force with which the wear piece 16 bears on the cam during disengagement of the contacts will then be less than that of the wear piece 15, the spring torques being equal, and the friction of the wear pieces with the cam will be more nearly equal.

The phase difference in the independent movement of the levers, and hence the rate of movement of the contacts in separating relative to the rate of movement into engagement, is determined by the displacement of the wear pieces 15, 16. With the wear pieces disposed to engage the cam as shown in Figure 3 the contacts upon disengagement will each move away from the other at a substantially maximum rate, whereby damage to the contacts from arcing is reduced to a minimum.

Figure 4 represents an application of the principles of Figure 3 to an eight cylinder engine ignition timer-distributor wherein two separate sets of contacts operate alternately to break and make a single ignition circuit. There are eight make and break operations per revolution of the cam and it is therefore desirable that the periods of disengagement of the contacts be very short relative to the periods of engagement and that the range of movement of the contact levers be small, in order that the primary current build-up periods be sufficiently long at high speeds.

Figure 4 differs from Figure 3 essentially only in the cam design. In the embodiment shown in Figure 4 the cam 3 mounted on the driving shaft 2 has four small lobes symmetrically disposed upon an otherwise cylindrical surface. 5 and 6 are independently movable levers carrying co-operating contacts 21, 22, respectively, pivoted on a common pin 9 and urged against the cam by springs 11 and 12 respectively. One of the levers is insulated from the pivot and from the other lever by suitable bushings and washers. 7 and 8 are a similar pair of levers carrying co-operating contacts 23, 24 and likewise mounted one above the other upon a pivot 10. The contacts 21 and 23 are provided with threaded shanks and are held in position on the levers 5 and 7, respectively, by lock nuts, by which means adjustment is obtained.

Wear pieces 15 and 16 are mounted on the levers 5 and 6, respectively, in differing positions such that when a lobe of the cam is exactly between them as shown the wear pieces make contact with the cam along corresponding lines on opposite sides of the lobe at positions of maximum slope. With the cam and levers in this position the contacts 21, 22 barely meet. The wear pieces 17 and 18 are mounted on levers 7 and 8 in a similar manner.

When a cylindrical section of the cam is under the wear pieces of either pair of levers the co-operating contacts on the levers are engaged, the wear piece on the outer contact lever not making contact with the cam. As the cam rotates a lobe first engages the wear piece of the inner contact lever and the levers then move outward together, and then inward as the wear piece passes onto the other side of the lobe, the contacts remaining engaged and the levers moving as one until the lobe comes halfway between the two wear pieces. The lobe then engages the wear piece of the outer contact lever and that lever is then moved outward. The other lever continues to move inward by action of the biasing spring and the contacts separate. The wear piece of the inner contact lever having come onto the succeeding cylindrical section of the cam that lever ceases to move. As the lobe passes under the wear piece of the outer contact lever that lever ceases to move outward and then moves inward until the contacts become re-engaged.

When disengagement of the contacts occurs the wear pieces of the respective levers are in contact with opposite sides of a cam lobe at positions of maximum rate of change of cam radius, therefore each of the contacts moves away from the other at a maximum rate and the arcing time is at a minimum.

The outer contact lever 5 is mounted above the inner contact lever 6, while the outer contact lever 7 is mounted below the inner contact lever 8. This arrangement is preferred as it results in equalized wear of the cam.

In Figures 5 and 6 the co-operating contacts 21, 22, are mounted near the ends of spring arms, 5 and 6, respectively. The arms 5, 6 are mounted upon opposite sides of a common standard 7 and are insulated from each other by suitable washers and bushings. Wear pieces 15, 16 are mounted upon the ends of the arms, the end of the arm 6 extending beyond that of the arm 5. The arms are flexed so that the wear pieces tend to bear against the cam 3. The wear pieces are mounted so that they may straddle a corner or rounded section of the cam and engage neighboring straight sections as shown in Figure 5.

As the cam 3 moves from the position shown in Figure 5 arm 5 moves inward toward the cam and arm 6 moves outward, the contacts 21, 22 separat-

ing. Since at the instant of separation of the contacts the wear pieces are in contact with straight sections of the cam near the ends of those sections the rate of movement of the contacts away from each other is substantially maximum.

Figure 7 shows the positions of the members when the contacts become engaged. The wear pieces are near the center of a straight section of the cam and the contacts therefore come into engagement with relatively low rate of movement. By such slow speed engagement of the contacts bouncing and chatter are prevented.

In connection with Figures 4, 5, and 6 wear of the wear pieces is balanced in the same manner as explained above in connection with Figure 3.

It is not intended to limit this invention to the arrangements and details of construction as shown and described herein. Interchange of various features of the embodiments shown and described is contemplated, and applications other than in ignition circuits are intended.

I claim as my invention:

1. An ignition timer mechanism comprising, in combination, cooperating contacts independently mounted upon movable members, a cam member, wear pieces mounted upon said movable members and engaging said cam member so that rotation of said cam member actuates said movable members to alternately engage and disengage said cooperating contacts, said wear pieces having relative wearing abilities such that the piece mounted upon the movable member carrying the outer of said cooperating contacts wears slightly faster, compensating for wear of the other and wear of said cooperating contacts.

2. An ignition timer mechanism comprising, in combination, co-operating contacts independently mounted upon movable members, a cam member, wear pieces mounted upon said movable members and engaging said cam member so that rotation of said cam member actuates said movable members to alternately engage and disengage said co-operating contacts, said wear pieces having their wearing surface areas relatively proportioned so that wear of the one wear piece compensates for wear of the other so that no substantial change in the timing of engagement or disengagement of said co-operating contacts results from wear of said wear pieces.

3. An ignition timer mechanism comprising, in combination, co-operating contacts independently mounted upon movable members, a cam member, wear pieces mounted upon said movable members and engaging said cam member so that rotation of said cam member actuates said movable members to alternately engage and disengage said co-operating contacts, said wear pieces being made of differing materials having relative wear resistance such that wear of the one wear piece compensates for wear of the other so that no substantial change in the timing of engagement or disengagement of said co-operating contacts results from wear of said wear pieces.

ARTHUR A. VARELA.