May 4, 1943. T. R. ARDEN 2,317,969

TIMER FOR ELECTRICAL SYSTEMS

Filed Feb. 27, 1942

Fig. 1.

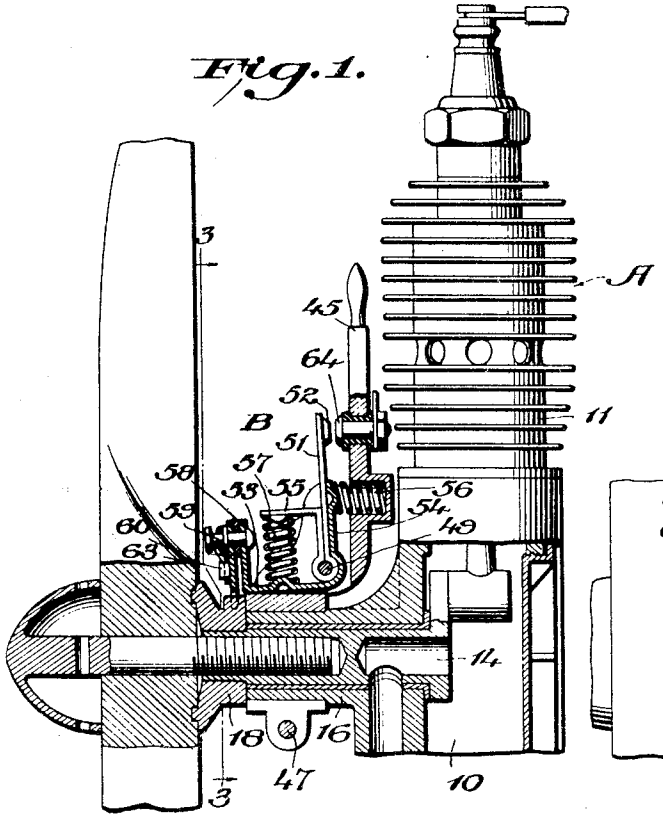


Fig. 2.

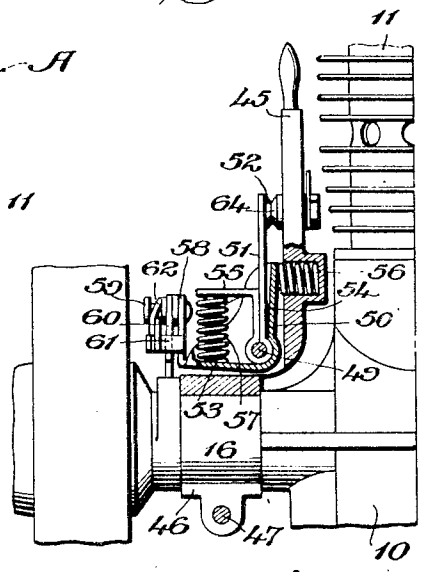


Fig. 3.

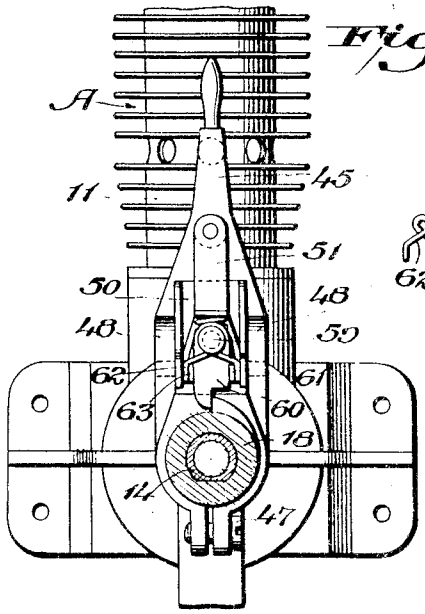
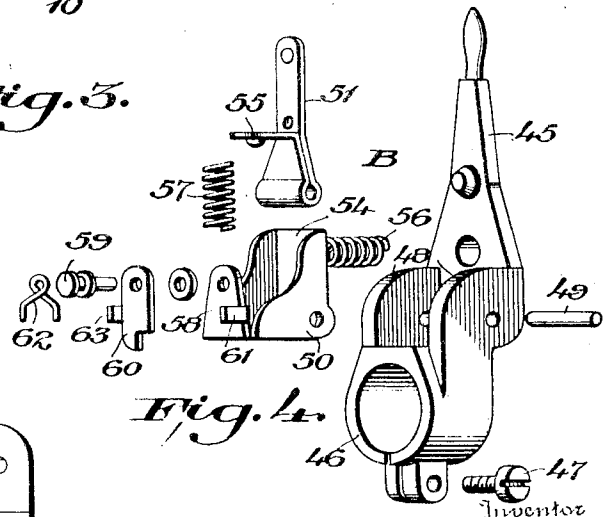


Fig. 4.



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TIMER FOR ELECTRICAL SYSTEMS

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Original application June 12, 1939, Serial No. 278,772, now Patent No. 2,274,644, dated March 3, 1942. Divided and this application February 27, 1942, Serial No. 432,710

5 Claims. (Cl. 200—30)

This invention relates to timers for use in electrical systems such as internal combustion engine ignition systems, and has particular reference to an improved timer as disclosed in my prior application, Serial No. 278,772, filed June 12, 1939, of which the present application is a division.

One special object of the invention is to provide a timer which requires very little power for its operation and which, therefore, is particularly advantageous for use in connection with miniature internal combustion engines such as are employed for miniature aircraft propulsion where loss of power in driving a timer is an important consideration.

Another special object of the invention is to provide a timer which is capable of general use and which embodies a construction insuring exceptionally quick breaking of its contact points at all engine speeds.

Another special object of the invention is to provide a timer having the characteristics stated and which is simple in construction, cheap and easy to produce and thoroughly reliable and efficient in operation.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in a timer embodying the novel features of construction, combination and arrangement of parts as fill be hereinafter more fully described, illustrated in the accompanying drawing and defined in the appended claims.

In the accompanying drawing, wherein like characters of reference denote corresponding parts in the different views:

Figure 1 is a vertical section through a portion of a miniature internal combustion engine and through a timer constructed in accordance with one practical embodiment of the invention, showing the positions of the parts of the timer when the contact points thereof are in open or circuit breaking relationship to each other.

Figure 2 is a view similar to Fig. 1 showing the positions of the parts of the timer when the contact points thereof are in contacting or circuit closing relationship to each other.

Figure 3 is a section on the line 3—3 of Fig. 1; and

Figure 4 is a perspective view showing the parts of the timer in separated relationship to one another.

Referring to the drawing in detail, A designates, generally, a portion of a miniature internal combustion engine such as is employed for miniature aircraft propulsion, and B designates, generally, a timer constructed in accordance with one practical embodiment of the invention and operatively associated with the engine A for controlling the ignition system thereof.

The engine A includes a crank case 10, a cylinder 11, a crank shaft 14 jouranled in a forward extension 16 of the crank case 10, and a timer actuating cam 18 fixed to the crank shaft 14 for rotation therewith.

The timer B comprises a lever arm 45 rotatably mounted on the crank case extension 16. A split-band portion 46 at the inner end of said lever arm embraces the extension 16 and is clamped friction-tightly into engagement therewith by a screw 47, whereby the lever remains in any rotated position to which it may be adjusted.

The lever arm 45 and the split band portion 46 are joined together by a pair of spaced side walls 48 between which extends a pivot pin 49 which is disposed transversely with respect to the said split-hand portion 46. On said pivot pin 49 are rockably mounted a substantially L-shaped hammer member 50 and an arm 51 carrying a contact 52. The hammer member 50 is disposed in front of the lever arm 45 and includes two arms 53 and 54, the former of which is disposed adjacent to the split-band portion 46 and extends substantially parallel thereto, and the latter of which extends outwardly from the inner end of said arm 53 substantially parallel to the lever arm 45. The contact arm 51 also extends outwardly and is disposed directly in front of the hammer arm 54. Moreover, said contact arm 51 includes a forwardly extending arm 55 spaced outwardly from and overlying the hammer arm 53.

Between the lever arm 45 and the hammer arm 54 is a coil spring 56 which tends constantly to rock the hammer member 50 forwardly and inwardly about the pivot pin 49, while between the hammer arm 53 and the arm 55 of the contact arm 51 is a coil spring 57 which tends constantly to swing said contact arm 51 rearwardly against the hammer arm 54.

At the front end of the hammer arm 53 is an outwardly extending arm 58 carrying at its outer end a forwardly extending pin 59 on which is mounted, for swinging movement transversely with respect to the split-band 46, a cam-follower finger 60 the inner end portion of which is disposed for cooperation with the cam 18.

Projecting forwardly from the arm 58 is a lug 61 which constitutes a stop, engageable by one

side edge of the finger 60, to limit swinging movement of said finger in the direction in which the cam 18 tends to swing same during normal operation of the engine. Said arm 60 is free to swing in the opposite direction, but constantly is urged toward the stop lug 61 and normally is held thereagainst by a suitable spring 62. In the present instance this spring 62 is of the hairpin type and is supported by the pin 59 and includes a pair of arms one of which is disposed against the outer side of the lug 61 and the other of which is disposed against the outer side of a lug 63 which extends forwardly from the finger 60.

The cam 18 is of the peripheral type and gradually rises to a peak where it abruptly ends, the face defining its abrupt trailing end being disposed either radially or being undercut as desired. Likewise, the side edge of the finger 60 which the cam last passes during normal operation of the engine is disposed either radially with respect to the axis of rotation of the cam, or, if desired, is undercut in the same manner as the face defining the abrupt, trailing end of said cam. In either case the arrangement is such that as the cam rotates it wipes the free or inner end of the finger 60 and gradually moves said finger outwardly, thereby rocking the hammer member 50 outwardly and rearwardly until the abrupt, trailing end of the cam alines with the edge of the finger 60 which the cam last passes. The finger then is released and under the influence of the spring 56 the hammer member 50 is rocked forwardly and inwardly quite suddenly due to the radial or undercut disposition of the face defining the trailing end of the cam and to the similar disposition of the edge of the finger 60 which the cam last passes during normal operation of the engine. If the engine should backfire, the finger 60 simply is swung on its pivot pin 59 by the cam and no harm results. On the other hand, since the lug 61 prevents rotation of the finger 60 on its pivot pin 59 in the direction in which the cam, during its proper direction of rotation, tends to rotate said finger, normal rotation of the cam results in periodically lifting said finger and in periodically rocking the hammer member 50 outwardly and rearwardly.

The hammer member 50 and the contact arm 51 are rockable relative to each other. When the finger 60 is engaged by the low portion of the cam 18 the hammer member 50 is held in a forwardly and inwardly rocked position by the spring 56. In this position of said hammer member the arm 54 lies against the rear face of the contact arm 51 and holds said contact arm in a forwardly swung position with its contact 52 spaced from a companion contact 64 carried by the lever arm 45 (Fig. 1). As the cam 18 lifts the finger 60 the hammer member 50 is rocked outwardly and rearwardly and, acting through the spring 57, rocks the contact arm 51 rearwardly until its contact 52 engages the contact 64. Rearward rocking movement of the contact finger 51 thereby is arrested. This occurs prior to complete lifting of the finger 60 and, consequently, prior to complete outward and rearward rocking of the hammer member 50 by the cam 18. Accordingly, following engagement of the contact 52 with the contact 64, the arm 54 of the hammer member 50 moves rearwardly away from the contact arm 51 (Fig. 9). The result is that when, finally, the cam passes the finger 60 and suddenly releases same, the spring 56 acts suddenly to rock the hammer member 50 forwardly and inwardly, thereby causing the arm 54 of said hammer member to strike the contact arm 51 a hammer blow in a forward direction. As a consequence, an exceedingly quick separation of the contact 52 from the contact 64 results.

The spring 57 may be relatively weak since its function is merely to hold the contact 52 engaged with the contact 64 when the hammer member 50 is in its position shown in Figure 9. Likewise, the spring 56 may be relatively weak because it acts through a hammer element to effect separation of the contact 52 from the contact 64. Consequently, the present timer requires very little power for its operation.

As will be understood, the contact 64 may be connected with the spark plug of the engine through a spark coil of any suitable type to cause sparking of said spark plug at proper times responsive to "breaking" or separation of the contacts 52, 64.

Quick breaking of the contact points of the present timer has the special advantages of permitting high speeds to be obtained and of assuring a uniform spark at all engine speeds; also, the advantage of reducing arcing and thereby promoting longevity of the contact points and conserving current. On the other hand, since the present timer requires very little power for its operation, it is particularly well adapted for use in connection with miniature engines which have a small power output.

From the foregoing description considered in connection with the accompanying drawing it is believed that the features and advantages of the invention will be clearly understood. It is desired to point out, however, that while only a single specific embodiment of the invention has been illustrated and described, the same is readily capable of embodiment in various other specifically different mechanical structures within its spirit and scope as defined in the appended claims.

I claim:

1. In an ignition system, a rotatable cam element having a peripheral cam face, a lever adjustably swingable about an axis coincident with the axis of rotation of said cam element, a hammer member including a pair of arms disposed at substantially right angles to each other and pivoted adjacent to their inner ends to said lever for rocking movement relative thereto, one of said arms being disposed in front of and extending in the same general direction as said lever and the other of said arms being disposed at substantially right angles to said lever, means whereby said cam cooperates with said last mentioned arm to rock said hammer member to swing its first mentioned arm toward said lever, spring means tending constantly to rock said hammer member in the opposite direction, a contact carrier pivoted for rocking movement in the same direction as said hammer member and including an arm disposed in front of the first mentioned arm of said hammer member, spring means tending constantly to urge said arm of said contact carrier against the first mentioned arm of said hammer member, a contact carried by said lever, and a cooperating contact carried by said contact carrier and normally spaced from said lever-carried contact by an amount such that the angle of rocking movement of said contact carrier necessary to effect engagement of its contact with the lever-carrier contact is less than the angle of movement imported to said ham-

mer member by said cam element, whereby cam element actuation of said hammer member results first in engagement of the contact of said carrier with said lever-carried contact and then in movement of the first mentioned arm of said hammer member into spaced relationship to said carrier arm so that upon cam release of said hammer member the first mentioned arm thereof is swung by said first mentioned spring means to strike said carrier arm and swing same to suddenly separate the contact thereof from said lever-carried contact.

2. In an ignition system, a fixed contact, a cooperating movable contact, a movable carrier for said movable contact, spring means tending constantly to move said contact carrier in a direction to effect engagement of its contact with said fixed contact, a hammer member including a portion normally engaged with said contact carrier and restraining same against such movement, cam means for moving said hammer member to permit said spring means to move said contact carrier to effect engagement of its contact with said fixed contact, said cam means being effective to move said portion of said hammer member into spaced relationship to said contact carrier after arrest of movement of said contact carrier due to engagement of its contact with said fixed contact, and spring means effective upon release of said hammer member by said cam means to move said hammer member to cause its said portion to strike said contact carrier a hammer blow to quickly move same to effect quick separation of its contact from said fixed contact.

3. In an ignition system, a fixed contact, a cooperating movable contact in front of said fixed contact, a carrier for said movable contact rearwardly swingable to engage said movable contact with said fixed contact and forwardly swingable to separate said movable contact from said fixed contact, a rockable hammer member including a pair of arms, one of said arms being disposed behind said carrier, spring means between the other of said arms and said carrier tending constantly to swing said carrier rearwardly against said first mentioned arm, other spring means tending constantly to rock said hammer member in a direction to swing the first mentioned arm thereof and said carrier forwardly to separate said movable contact from said fixed contact, and cam means operable to rock said hammer member in the opposite direction to cause said first mentioned arm to swing said carrier rearwardly until the movable contact thereof engages said fixed contact and then to swing said first mentioned arm into spaced relationship to said carrier following engagement of said movable contact with said fixed contact and then quickly to release said hammer member, thereby to permit said second mentioned spring means to act to rock said hammer member to cause the first mentioned arm thereof to strike said carrier a hammer blow in a forward direction and thus cause quick separation of said movable contact from said fixed contact.

4. In an ignition system, a rotatable cam element, a swingable lever member carrying a contact and movably mounted about an axis coincident with that of the cam element, a rockable hammer member pivotally mounted on the lever member and including right angularly disposed arms, spring means between the lever and one arm of the hammer member for exerting spring pressure outwardly on the said member, a cam follower carried by said other arm of the hammer member and cooperating with the cam element to rock the hammer member inwardly in opposition to said spring means, a contact carrier carrying a contact cooperating with the contact of the lever, said contact carrier having a common pivotal mounting to that of the hammer member and having an outstanding arm disposed above the lower arm of the hammer member, and a spring interposed between the said two last mentioned arms to yieldingly swing the contact carrier inwardly upon its pivot.

5. A structure as set forth in claim 4 in which the cam follower is pivotally mounted on the hammer member for free swinging movement in one direction, and stop means carried by the hammer to limit the swinging movement of said cam follower in the opposite direction.

THOMAS R. ARDEN.