April 19, 1960 H. H. HARADA 2,933,568

ELECTRIC SWITCH

Filed Sept. 11, 1958 2 Sheets-Sheet 1

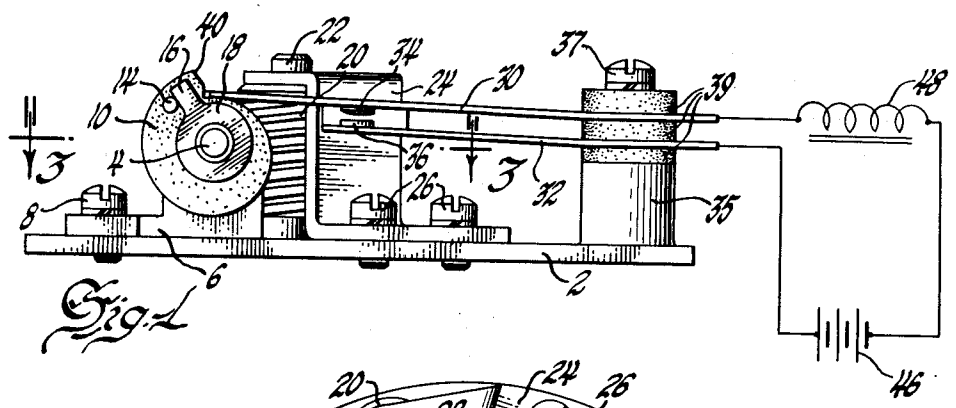


Fig. 1

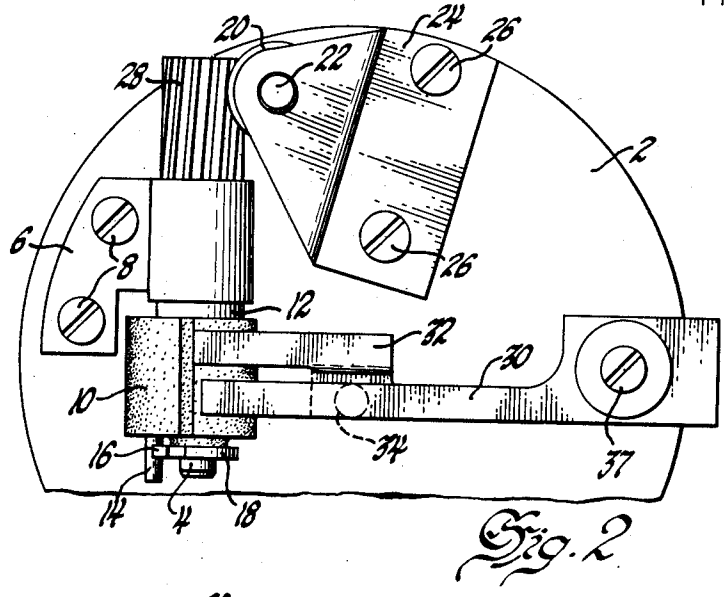


Fig. 2

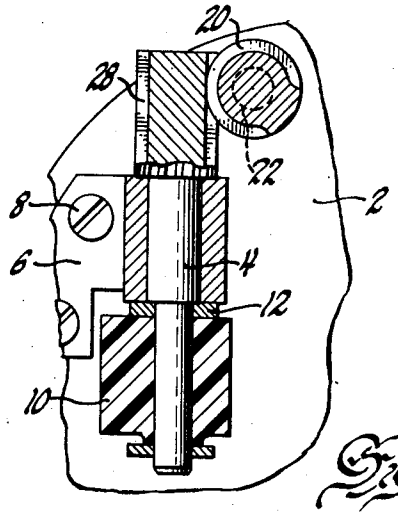


Fig. 3

INVENTOR.
Henry H. Harada
BY
John W. Lovett
ATTORNEY

April 19, 1960 H. H. HARADA 2,933,568

ELECTRIC SWITCH

Filed Sept. 11, 1958 2 Sheets-Sheet 2

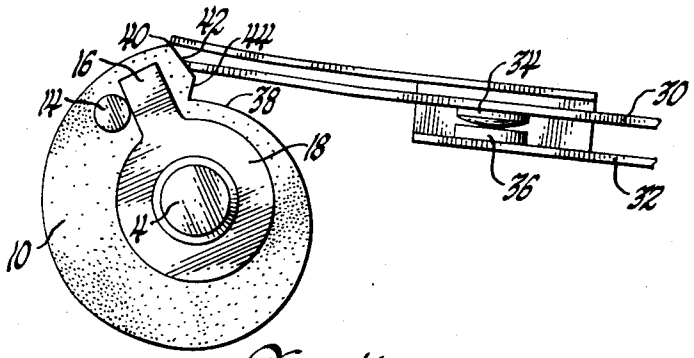


Fig. 4

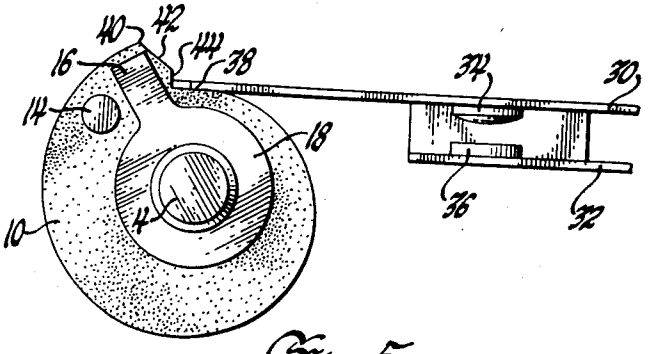


Fig. 5

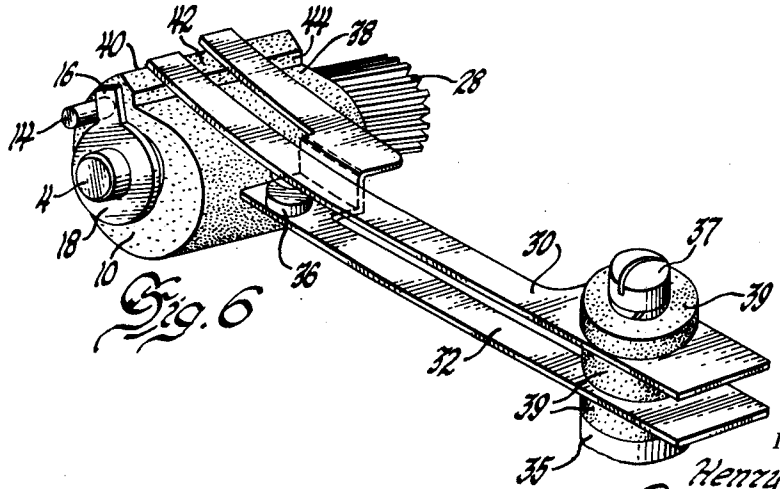


Fig. 6

INVENTOR.
Henry H. Harada
BY
John W. Lovett
ATTORNEY

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2,933,568

ELECTRIC SWITCH

Henry H. Harada, Grand Blanc, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application September 11, 1958, Serial No. 760,401

5 Claims. (Cl. 200—38)

This invention relates generally to electric switches and more particularly to the construction of a cam-operated switch to obtain relatively short electrical contact duration with a slow cam driving speed and to prevent a permanent closure of the contacts regardless of the stopped angular position of the cam driving shaft.

One object of the invention is to provide an improved switch and operating means therefor to obtain a periodic closure of the switch contacts of relatively short duration. A further object is to so construct the switch and operating means that under no conditions can there be a permanent closure of the contacts.

Other objects of the present invention will be apparent from the following description of the embodiment illustrated in the accompanying drawings.

Fig. 1 is a side elevation of the switch and the operating means therefor.

Fig. 2 is a fragmentary plan view of the parts shown in Fig. 1.

Fig. 3 is a fragmentary sectional view taken substantially on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary side elevation showing the switch contacts and operating means in one position.

Fig. 5 is a view similar to Fig. 4 showing the switch contacts and operating means in a different position.

Fig. 6 is a perspective view of the switch and its operating means.

In the drawings, the switch and a portion of the operating means therefor have been shown as mounted on a base plate 2. The operating means includes a shaft 4 which is rotatably supported by a bracket 6 secured to the plate 2 by screws 8. A cam 10 of insulating material is rotatably mounted on a reduced portion of the shaft 4 at one side of the bracket 6 and spaced therefrom by a washer 12. The cam 10 is provided with an axially extending pin 14 which extends into the path of a drive arm 16 on member 18 secured to the shaft 4.

The shaft 4 is adapted to be rotated at a relatively slow speed by any suitable driving means. Only a portion of the means for rotating the shaft 4 has been shown herein as including a worm 20 on a drive shaft 22 having one end mounted in a bracket 24 secured to base plate 2 by screws 26 with the worm 20 engaging a worm wheel or gear 28 formed on the shaft 4.

The switch includes a pair of resilient or spring arms 30 and 32 of conducting material. Each of these arms is fixed adjacent one end thereof to the base plate 2 on a post 35 by means of a screw 37 with insulating washers 39 to space and insulate the arms from each other and from the post and screw. The arms 30 and 32 extend toward the shaft 4 and the free ends of these arms ride on the cam 10 and are adapted to be maintained in engagement therewith under tension and function as followers to which motion is imparted by the cam.

For a portion of their lengths, the spring arms 30 and 32 are substantially parallel and vertically spaced as shown in the drawings. The spring arm 30 is provided

with a contact 34 on its lower side which is directly above a contact 36 on the upper side of the spring arm 32. The spring arm 32 is bent laterally and upwardly at a point adjacent the contact 36 and then extends in side by side relation to the spring arm 30 to engage the cam 10. For a purpose to be explained hereinafter, the free end of the arm 32 projects slightly beyond the free end of the arm 30.

The cam 10 is formed with an operating surface which is generally eccentric to the shaft 4 with the distance of this surface from the shaft 4 increasing from a low portion 38 on the cam to a high portion where the eccentric surface terminates in a shoulder 40 having a sloping or tapered back surface 42 extending toward the low portion 38 on the cam and joined therewith by an oppositely inclined wall 44. The spring arms 30 and 32 are adapted to ride on the cam 10 and the tapered back surface 42 is so formed that during each revolution of the cam the free ends of the spring arms will slide along this surface before dropping to the low portion 38 of the eccentric surface of the cam.

As the shaft 4 is rotated in a counterclockwise direction, the cam 10 will be similarly rotated by the engagement of drive arm 16 with pin 14 with the spring arms 30 and 32 riding on the eccentric surface of the cam and contact 34 spaced from contact 36 until the shoulder 40 passes beyond the free end of the shorter spring 30 and the free end of this arm slides downwardly along the surface 42 of the cam to engage the contact 34 with contact 36 on the longer spring arm 32 as shown in Fig. 4. As the free end of spring arm 30 slides along surface 42, it exerts a force on such surface by wedging action to push the cam forwardly or counterclockwise. When the free ends of spring arms 30 and 32 are in engagement with the shoulder 40 or surface 42 such arms also exert downward forces on the cam with the direction of these forces eccentric to the axis of rotation of the cam on the side of said axis opposite the fixed support for the arms to also rotate the cam counterclockwise. The cam 10 will therefore be moved by the spring action of arms 30 and 32 to the position shown in Fig. 5 in which the pin 14 on the cam is spaced from the drive arm 16 and both of the spring arms have dropped to the low portion 38 of the eccentric surface on the cam to separate the contacts 34 and 36.

It will be apparent from the foregoing description that the time interval during which the contacts are engaged is relatively short and it has been found in actual practice that the contact duration can be controlled by providing some degree of friction between the shaft 4 and cam 10 to retard the free movement of the cam on the shaft. A dampening fluid such as silicone can, for instance, be used as the lubricant between the bearing surfaces of the shaft and cam to prevent snap action of the cam away from the drive arm 16 in response to the pressure exerted by the spring arms 30 and 32 and thereby lengthen the duration of contact engagement.

It will also be apparent that the present switch and operating means are so constructed and arranged that there can be no permanent closure of the contacts regardless of the stopped angular position of the shaft 4 or drive arm 16. The only time during rotation of the shaft 4 when the contact 34 can engage the contact 36 is when the cam 10 is in substantially the position shown in Fig. 4 and as previously explained, the spring arms 30 and 32 are then exerting forces that push and rotate the cam 10 to the position shown in Fig. 5 to immediately separate the contacts.

As will be obvious to those skilled in the art, the present switch arrangement is of general application and may be employed wherever it is desired to obtain a

periodic and momentary closure of an electric circuit and insure against permanent closure of the circuit regardless of the stopped angular position of the cam operating shaft. As diagrammatically shown in Fig. 1, the spring arms **30** and **32** may, for instance, be connected in a circuit with a battery **46** and the coil **48** of a solenoid or electromagnet to periodically operate any desired mechanism when the coil is energized upon closure of the contacts **34** and **36**.

Although many other uses are contemplated for the switch and circuit arrangement shown in Fig. 1, it could, for example, be used to control the operation of the time indicating mechanism of an electric clock. In such an application the shaft **4** would be driven by suitable means at a speed to provide one revolution of the cam **10** per minute and intermittently energize the solenoid for operating a pawl and ratchet drive of a time indicating mechanism such as disclosed in my copending United States patent application, Serial No. 666,115, filed June 17, 1957, entitled "Drum Type Electric Clock Mechanism."

It will be understood that the present invention is not limited to the particular details of the single embodiment shown and described herein and that various changes and modifications may be made and are contemplated as coming within the scope of the following claims.

I claim:

1. In a cam-operated electric switch in which a rotating cam is provided with a cam surface having high and low portions and said surface is engaged by a pair of spring arms of different lengths having normally spaced contacts adapted to close upon relative movement of the cam engaging ends of said arms as said ends move successfully from the high to the low portion of said cam surface during rotation of said cam, the improvement consisting of a one-way driving means for the cam, said cam being free to rotate relative to said driving means in the driving direction, and a sloping surface on said cam between the high and low portions of the cam surface, said sloping surface being engaged successively by the cam engaging ends of the spring arms during rotation of said cam and so arranged with reference thereto that the pressure of said arms on said sloping surface will rotate said cam in the driving direction relative to said driving means until the cam engaging ends of said arms are in engagement with the low portion of said cam surface.

2. The elements set forth in claim 1 in which said cam is rotatably mounted on a shaft and said one-way driving means includes a drive arm fixed to said shaft and a pin on said cam which extends into the path of movement of said drive arm.

3. The elements set forth in claim 1 in which the cam surface is formed by a surface which is eccentric to the axis of said cam and terminates at the high portion thereof in a shoulder with said sloping surface extending from said shoulder toward the low portion of said eccentric surface.

4. In an electric switch and operating means therefor, a rotatable cam having a surface eccentric to its axis which terminates in a shoulder with a tapered back surface extending toward the low portion of said eccentric surface, a pair of spring arms supported at one end with the free ends of said arms engaging and riding on the eccentric and tapered surfaces of said cam, opposed contacts on said spring arms which are spaced from one another when the free ends of both spring arms are riding on the eccentric surface of said cam and arranged to engage one another upon relative movement of the free ends of said spring arms, and means to provide for such relative movement upon rotation of said cam by forming one of said spring arms shorter than the other whereby the free end of the shorter arm will slide along the tapered surface of said cam prior to the free end of the longer arm.

5. In an electric switch and operating means therefor, a rotating shaft, a cam rotatably mounted on said shaft and having a surface eccentric to its axis which terminates in a shoulder with a tapered back surface extending toward the low portion of said eccentric surface, a pair of spring arms supported at one end with the free ends of said arms engaging and riding on the eccentric and tapered surfaces of said cam, opposed contacts on said spring arms which are spaced from one another when the free ends of said spring arms are riding on said eccentric surface but arranged to close when the free end of one arm moves relative to the free end of the other arm, one of said spring arms being shorter than the other whereby the free end of the shorter arm can slide along the tapered surface of said cam while the free end of the longer arm is supported on the eccentric surface thereof to thereby close said contacts, means on said shaft to engage and rotate said cam when the free ends of both spring arms are riding on the eccentric surface of said cam and permit the pressure of said arms on said cam to rotate said cam relative to said shaft when the free ends of said arms are sliding along the tapered surface of said cam so that the free ends of both of said spring arms will then drop to the low portion of the eccentric surface of said cam to separate said contacts.

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