March 2, 1954

E. G. GAYNOR

SWITCH

2,671,138

Filed July 17, 1951

2 Sheets-Sheet 1

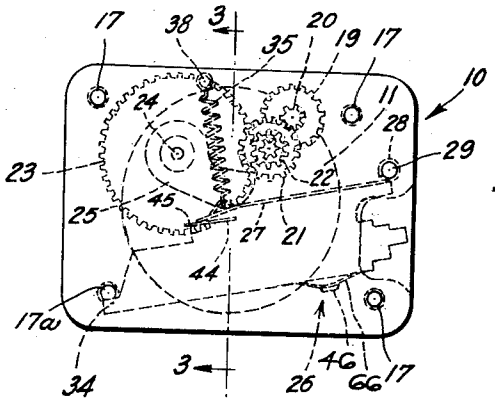


Fig. 1.

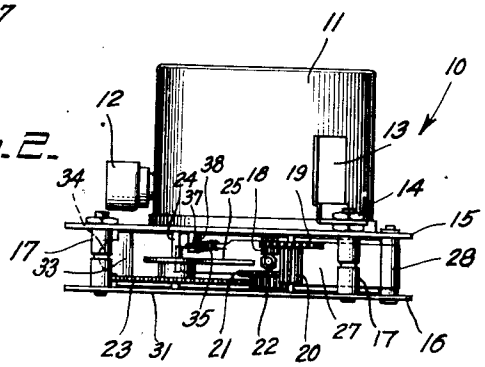


Fig. 2.

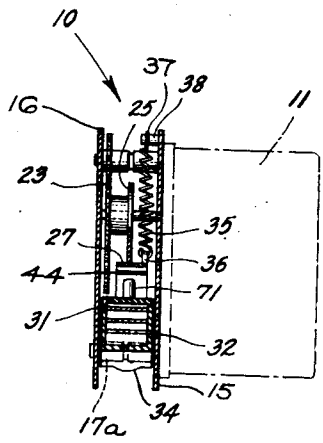


Fig. 3.

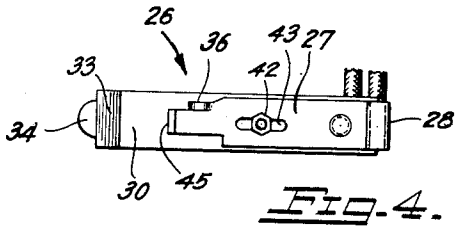
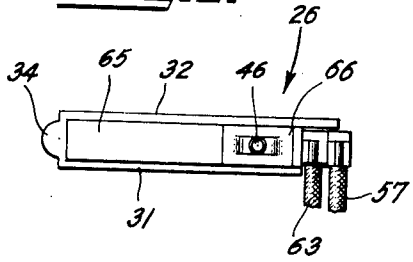


Fig. 4.

Fig. 5.



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Fig. 6.

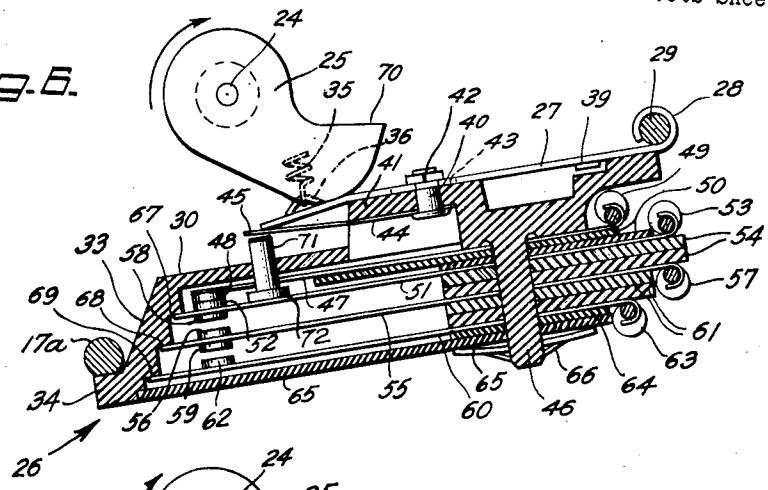


Fig. 7.

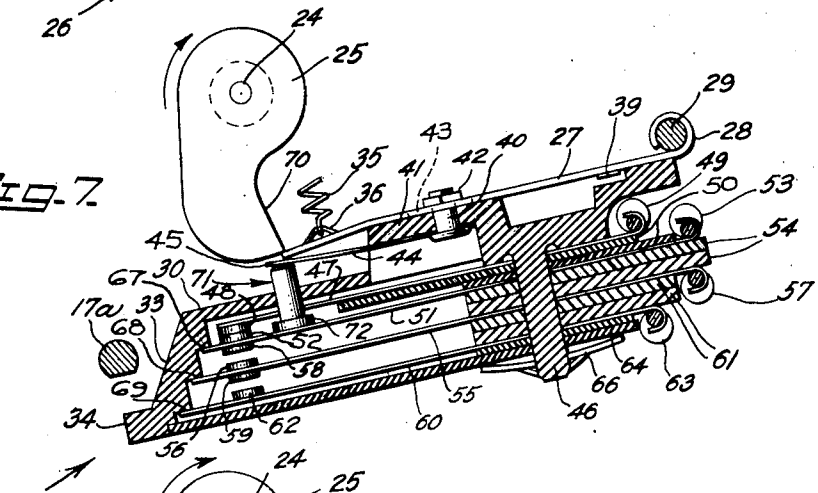
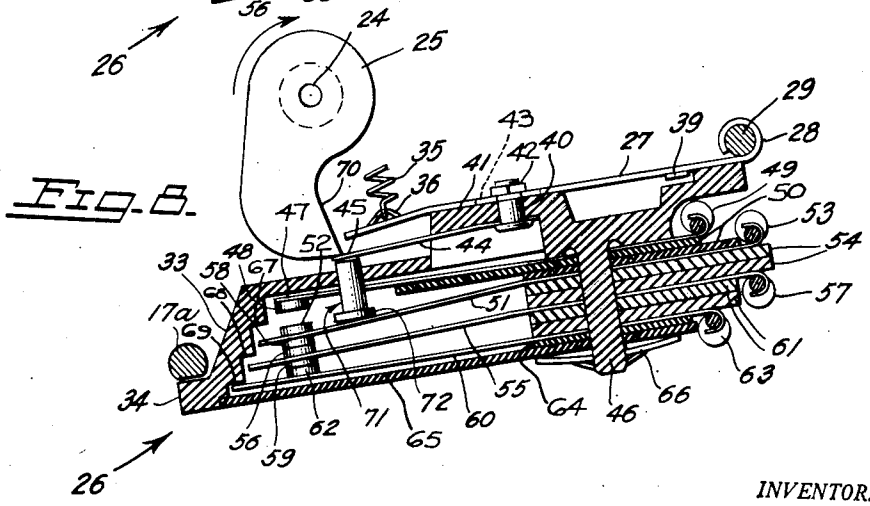


Fig. 8.



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SWITCH

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13 Claims. (Cl. 200—27)

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This invention relates to new and useful improvements in switches.

An object of the invention is to provide a switch in which a pair, or more, of contacts are opened and closed rapidly and surely due to the relatively slow motion of a member as, for example, due to the slow motion of a clockwork driven cam.

A more specific object is to provide a movably mounted frame carrying contacts movable therewith and relative thereto, a cam for moving said frame and its contacts against the tendency of a spring, and wherein said cam has an abrupt step allowing the spring to suddenly move the frame back toward its initial position to indirectly forceably bring one of the contacts against the cam resulting in a sudden and sure shifting of said contact relative to the frame and to another contact in the frame.

Another object is to provide a switch as in the immediately preceding object and wherein as the cam further progresses said abrupt step allows the shifted contact suddenly and surely to regain its original relation with the frame and said another contact in the frame.

Other objects and advantages of the invention will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawings wherein a satisfactory embodiment of the invention is shown. However, it is to be understood that the invention is not limited to the details disclosed but includes all such variations and modifications as fall within the spirit of the invention and the scope of the appended claims.

In the drawings:

Fig. 1 is a side elevational view showing the switch means of the invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is a sectional view through the switch frame and its mounting and related portions of the driving or clockwork mechanism, the view being taken as along the line 3—3 of Fig. 1 but not through the driving motor;

Fig. 4 is a top plan view of the switch frame alone;

Fig. 5 is a bottom plan view thereof;

Fig. 6 is an enlarged longitudinal sectional view through the switch frame in its normal position and prior to any movement by the slowly driven member or cam;

Fig. 7 is a view similar to Fig. 6 but showing the switch frame as shifted and immediately prior to its release by the shifting member or cam; and

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Fig. 8 is a similar view but showing the switch frame and its contacts immediately following sudden release and movement of the frame and the shifting of the relationship of the contacts therein.

Referring in detail to the drawings, at 10 is generally indicated a clockwork mechanism including a small electric motor 11 having terminals 12 to which leads may be attached and such motor, as by means of one or more of the angle pieces 13 and nuts 14, is clamped against a side plate 15. In parallel relation with the side plate 15 is a second side plate 16, said plates being held in spaced parallel relation by a series of posts 17 of which one, designated 17a, comprises a stop device as will later be set forth.

Motor 11 drives a small gear 18 meshing with and driving a larger gear 19 on the shaft with a gear 20. Gear 20 in turn meshes with and drives a larger gear 21 of a dual gear including a gear 22 and the latter meshes with and drives a large diameter gear 23 mounted on a shaft 24 with a cam 25. With such a clockwork structure it will be seen that as the motor 11 operates, it slowly drives the gear 23 and shaft 24 and thereby slowly revolves or moves the cam 25. In the present instance, the relationships are such that the cam 25 is given a revolution in each ten minutes of operation of the motor 11.

Mounted between said plates 15 and 16, and thus conveniently supported by the clockwork 10, is a switch generally designated 26 including (see particularly Figs. 6, 7 and 8) a stiff top plate 27 preferably of metal as, for example, steel at one end formed into an eye 28. Switch 26 is pivotally mounted by means of this eye 28 and to the desired end a post 29 mounted in the side plates 15 and 16 extends through this eye 28.

Switch 26 includes a body preferably molded of insulating material and shown as comprising a top wall 30, side walls 31, and 32, and an end wall 33, the latter toward its lower end having a forward extension 34 the upper side of which is designed to normally lie against a flat side of the post 17a. In fact, a coil spring 35 has one end anchored to the metal top plate 27, as to the lanced and pressed up portion 36 of the latter, and the other or upper end portion 37 of this spring is hooked onto a pin 38 carried by the side member 15. Clearly, the spring 35 is constantly urging the switch 26 about the pivot post 29 in a direction to carry the extension 34 of the switch frame or body into a position against the combined post and stop 17a. As will later more fully appear, each time the cam

25 is given a complete revolution it rocks the switch 26 downwardly on its pivotal mounting on the post 29 and suddenly releases the switch and on movement of the cam from engagement with the switch, spring 35 returns the switch toward its normal position.

The metal top plate 27 is provided with a depending lug 39 serving as a locating means and then such top plate is shown as secured in place by a bolt 40 passing through a top wall portion 41 of the switch frame and at its upper side provided with a nut 42. Top plate 27 has an elongated opening 43 through which the bolt 40 passes whereby the position of said top plate may be adjusted as and for a purpose to be described.

At the underside of the frame portion 41 a thin steel spring 44 is anchored in place by the head of the bolt 40 and this thin steel spring extends longitudinally of the switch frame whereby it includes a portion 45 projecting beyond the forward end of the stiff rigid top plate 27 with its upper surface downwardly offset from the upper surface of the top plate and with its end forwardly spaced from the end of the top plate. The bolt 40 and the slot 43 are provided whereby the top plate may be adjusted forwardly or rearwardly to determine the extent to which the portion 45 of the spring 44 projects forwardly beyond the forward end of the top plate and the purpose of this will be set forth.

In addition to the above described structure, the switch frame has molded therewith a downwardly extending stud or post 46. Slipped over said stud and located between the side walls 31 and 32 of the switch frame is an elongated contact spring 47 having at its underside a contact button or lug 48. A lead 49 may be connected with the contact spring 47. Then insulation, as the pair of layers 50, is disposed over the contact spring 47 and on the lowermost of such layers is a second elongated contact spring 51 at its upper side carrying a contact button 52.

A lead 53 is connected with the rear end of the contact spring 51. Then layers of insulation 54 separate the contact spring 51 from another contact spring 55 at its upper side carrying a contact button 56 and at its outer or rear end having a lead 57 connected therewith. Here it is noted that contact springs 51 and 55 in addition to the contacts 52 and 56 on their upper sides, at their lower sides carry contact buttons 58 and 59, respectively.

Extending parallel with the contact spring 55 and also located between the side walls 31 and 32 of the switch frame or housing is yet another elongated contact spring 60 separated from the contact spring 55 by insulators 61 and at its upper side provided with a contact button 62. A lead 63 is connected with the rear end of the contact spring 60. Against the lower side of said contact spring and about the post 46 is an insulator 64 and over such insulator and, in fact, forming a cover for the lower side of the switch housing, is a stiff insulating plate 65 and the latter is held in place as by means of a speed nut 66 or the like on the outer or lower end of the stud 46.

With this construction the contacts and their separating insulators are simply dropped or pushed over the post or stud 46 and then extend longitudinally between the side walls 31 and 32 of the switch frame or housing. The spring contacts 51, 55 and 60 have free end portions extending beyond their contact buttons and normally these end portions are against step-like formations or shoulders 67, 68 and 69 formed in the inner surface of the end wall 33 of the switch frame or housing.

Normally all of the spring contact strips 47, 51, 55 and 60 are in parallel relation with the contact buttons 48 and 52 of the strips 47 and 51 in engagement but with all the other contact buttons of the separate spring strips spaced (see Figs. 6 and 7). Thus, the contact strips 47 and 51 with their contact buttons 48 and 52 constitute a normally closed switch while the contact button 58 of the strip 51 and contact button 56 of strip 55 being normally open, such strips and buttons constitute a normally open switch. In addition, the buttons 59 and 62 of strips 55 and 60 are normally spaced whereby such strips and buttons constitute a normally open switch.

With the structure described, as the cam 25 rotates in the direction of the arrows in Figs. 6, 7 and 8, it first engages the stiff top plate 27 on the upper side of the switch. The initial engagement will be about as shown in Fig. 6 wherein the switch is in its normal relation to the stop post or pin 17*a*. As the clockwork or other means continues to slowly drive the cam in the mentioned direction, the top plate 27 does not yield and the entire switch frame with its contacts is rocked downwardly about the pin or post 29 as to the position of Fig. 7 where it is noted that there is no change in the relationship of the contacts but that the switch has moved away from the stop pin 17*a*. In this figure, the cam 25 is about to leave the rigid cover 27 on the switch frame and the spring 35 is extended.

Now it is noted that the cam has an abrupt drop-off or step 70 and on very slight movement beyond the position of Fig. 7 the cam moves off the rigid top plate 27. This occurs suddenly because of the abrupt step 70 and the spring 35 immediately snaps the switch frame containing the contacts toward its normal position. This brings the extended portion 45 of the light steel spring 44 against the cam as in Fig. 8. The light steel spring 44 is very flexible and it yields under the force applied to the moving of the switch frame by the coil spring 35 and is deflected downwardly.

Under the projecting portion 45 of steel spring 44 is a button or contact shifter 71 including a stem portion passing through the spring contact strip 47 and at the lower side thereof having a head 72 normally resting on the upper side of the spring contact strip 51. As the switch is snapped back toward its normal position by the spring 35 on the abrupt step 70 of the cam moving off the top plate 27 and the free end portion of the thin steel strip 44 is deflected, the contact shifter or button 71 is held down while the switch frame and contacts are moved upwardly by spring 35.

This results in the spring contact arm 51 being deflected downwardly carrying its contact button 52 from engagement with the contact button 48 of the arm 47, the latter at this time remaining stationary. Thus, with a sudden action, the switch represented by the spring arms 47 and 51 and their contact buttons is rapidly or quickly and surely opened.

At the same time as the spring contact strip 51 is deflected to carry its contact button 52 from engagement with the contact button 48 its contact button 58 is carried into engagement with the contact button 56 of the spring contact arm 55 thus closing the normally open switch repre-

sented by the arms 51 and 55 and their adjacent buttons.

The closing of such switch is a quick and a sure action. Additionally, the pressure of the contact button 58 against the contact button 56 results in a downward deflection of the spring contact arm 55 whereby its under contact button 59 is carried into engagement with the contact button 62 of the spring contact arm 60 thus closing an additoional circuit where that is desired.

As the cam 25 continues to be driven it soon moves off the free end portion 45 of the light steel spring 44 and then the spring contact arms and particularly the arms 51 and 55, as they return to their normal positions, move the contact shifter or button 71 back to its normal position. This closes the circuit between the contacts 52 and 48 and opens the circuit between the other contacts.

This also is a sodden and sure action since the cam with its abrupt step 70 abruptly leaves the free end portion of the thin flexible spring 44. Preferably, the structure is such that in the position of the parts as viewed in Fig. 8, the extension 34 of the switch housing is not quite against the stop 17a whereby the spring 35 is yet exerting a pull on the switch frame and such pull, acting through the contact shifter or button 71, is maintaining the contacts in their shifted or deflected positions.

From the foregoing it will be seen that I have provided a structure providing for the opening and closing of a pair (or more) of contacts rapidly and, above all, surely by the relatively slow motion of a member as, for example, a cam driven by a simple clockwork mechanism. By the switch of the invention, the contacts are shifted initially by a rapid and sure motion as the cam moves from the rigid top plate 27 and again the contacts rapidly and surely return to their initial positions as the cam leaves the shifter or button 71. In this connection it will be understood that having the cam engage the portion 45 of the flexible steel spring 44 prevents wear or damage on the button since there could be a direct contact and the switch yet operated in the manner intended.

The distance that the thin steel spring 44 projects beyond the free end of the rigid top plate 27 determines the length of time the switch is justifying its existence. On loosening of the nut 42 the top plate 27 may be shifted longitudinally to have more or less of the portion 45 exposed and whereby the cam will leave the top plate 27 at an earlier or later time interval and will, for a greater or lesser time interval, be in engagement with the portion 45 of the thin steel spring and thus be maintaining the contacts in their relationship of Fig. 8. Where such an adjustment is not necessary, clearly a rivet may be substituted for the bolt and nut 40 and 42.

Thus, it will be seen that the present invention provides for the mounting of contacts on a movable frame and the slow moving of this frame and its contacts by a cam and against the pull of a spring which is moored to the frame. An abrupt step in the cam allows the frame to partially, in a sudden motion, regain its original position (Fig. 8). Full recovery of the frame or the complete movement of the frame back to its normal position is checked by one of the contacts indirectly (through the button 71) landing on a movable step means, comprising a portion of the cam.

The sudden motion of the frame and the sudden check by this landing on the cam of the contact results in that contact being shifted from or against an associated contact rapidly and surely. As the cam progresses its abrupt step allows the indirectly engaged contact to quickly regain its original position and allows a complete return of the switch frame to its original position.

One particular job for which the present invention is useful is in the defrosting of a refrigerator. In such an installation, the motor 11 is in circuit with the refrigerator light. Therefore, when the refrigerator door opens the motor 11 starts and accumulates in the clock mechanism time equal to the time the refrigerator door is open. This time accumulation is represented by an advancing of the cam 25.

When the selected time interval has been accumulated (for example, ten minutes) the switch operates to defrost the refrigerator. In one instance, at least, this is accomplished by pumping the hot refrigerant back through the evaporator. This is a fast operation and thus in the switch illustrated the relationship of the parts is such that the cam will maintain the switch contact shifted (Fig. 8) for a period of ten seconds.

Having thus set forth the nature of my invention, what I claim is:

1. In a switch, an elongated insulating housing including a top wall and side walls and an insulating stud carried by said top wall and depending between said side walls, a pair of spring contact arms mounted between said side walls and through which said stud passes, means insulating said contact arms from one another, means on said stud and retaining said contact arms thereon, and a contact shifter extending through said top wall and engaging one of said contact arms and adapted to be depressed to deflect said arm to shift its contact relative to the contact of the other of said arms.

2. The switch as in claim 1 wherein said shiftable arm comprises a flat spring adapted to be deflected during such shifting, and said switch housing including a step-like formation comprising a stop limiting return movement of said spring arm on the same being deflected and released.

3. In a switch, a support, a frame movably mounted on said support, means biasing said frame for movement in one direction, stop means limiting said movement in said one direction, a pair of contact means carried by said frame, one of which is movable relatively to the other to make and break contact therewith and is biased for movement in said biased direction of movement of said frame, contact shifter means associated with said biased contact means arranged to impart movement thereto in opposition to its biased direction of movement, actuating means mounted on said support having a cyclic movement wherein it successively engages said frame to move it in opposition to its biased direction of movement, releases it for biased return movement, engages said contact shifter means to effect a relative movement between said biased contact means and said frame as the latter continues its return movement whereby the relation of said pair of contact means is changed, and releases said contact shifter means to allow said biased contact means to return to its normal position in relation to said frame and the other contact means.

4. The switch as in claim 3, wherein a spring acts between said frame and support to bias said frame.

5. The switch as in claim 3 wherein said biased contact means comprises a leaf spring.

6. The switch as in claim 3 wherein said actuating means comprises a rotatable cam having, successively, a gradual rise, a dwell, and an abrupt drop.

7. The switch as in claim 3 wherein said frame is pivotally mounted at one end.

8. The switch as in claim 3, wherein said frame includes a rigid top plate having an upper surface upwardly offset from said contact shifter means adapted for engagement by said actuating means in the initial stage of said cyclic movement thereof and having a forward end adjacent said contact shifter means, and wherein said contact shifter means has an upper surface downwardly offset from said upper surface of said top plate next engageable by said actuating means in its cyclic movement as said actuating means moves from said end of said top plate, and said contact shifter means having an end forwardly spaced from said end of said top plate from which said actuating means next moves in its cyclic movement.

9. The switch as in claim 3, wherein said frame includes a rigid top plate having an upper surface upwardly offset from said contact shifter means adapted for engagement by said actuating means in the initial stage of said cyclic movement thereof and having a forward end adjacent said contact shifter means, and wherein said contact shifter means has an upper surface downwardly offset from said upper surface of said top plate next engageable by said actuating means in its cyclic movement as said actuating means moves from said end of said top plate, said contact shifter means having an end forwardly spaced from said end of said top plate from which said actuating means next moves in its cyclic movement, and a shiftable connection means between said frame and said top plate whereby relative adjustment between said frame and said top plate adjusts the spacing of said end of said top plate from the end of said contact shifter means.

10. The switch as in claim 3, wherein said frame includes a rigid top plate pivotally mounted at one end upon said support having an upper surface upwardly offset from said contact shifter means adapted for engagement by said actuating means in the initial stage of said cyclic movement thereof and having a forward end adjacent said contact shifter means, and wherein said contact shifter means has an upper surface downwardly offset from said upper surface of said top plate next engageable by said actuating means in its cyclic movement as said actuating means moves from said end of said top plate, said contact shifter means having an end forwardly spaced from said end of said top plate from which said actuating means next moves in its cyclic movement, and a shiftable connection means between said frame and said top plate whereby relative adjustment between said frame and said top plate adjusts the spacing of said end of said top plate from the end of said contact shifter means.

11. The switch as in claim 3 wherein a second pair of contact means is carried in said frame, one of which is movable relatively to the other to make and break contact therewith and is biased for movement toward said biased contact means of said first pair, and being arranged to be moved in opposition to its biased direction of movement through movement of said biased contact means of said first pair in opposition to its biased direction of movement.

12. The switch as in claim 3 wherein said contact shifter means comprises a button movably mounted in said frame having one end contacting said biased contact means.

13. The switch as in claim 3 wherein said contact shifter means comprises a button movably mounted in said frame having one end contacting said biased contact means, and a thin leaf spring carried by said frame engaging the other end of said button and adapted to be engaged by said actuating means.

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