April 7, 1942. D. KUMPMAN 2,278,704

THERMOSTATICALLY CONTROLLED ELECTRICAL SWITCH

Filed July 25, 1940

Fig. 1.

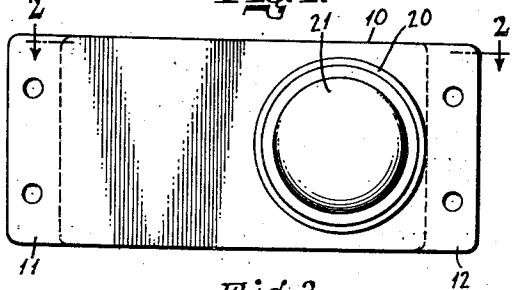


Fig. 3.

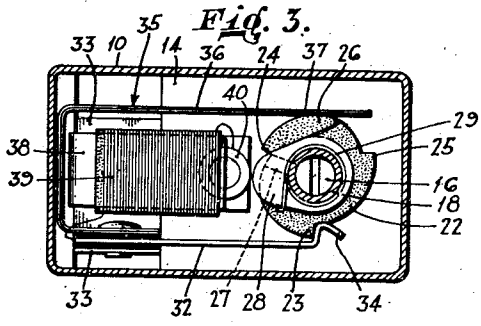


Fig. 2.

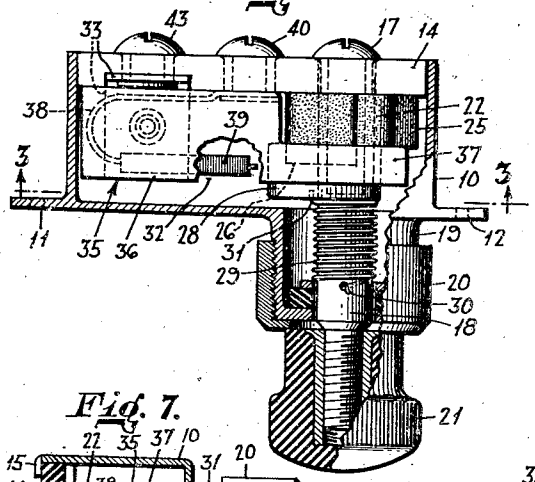


Fig. 4.

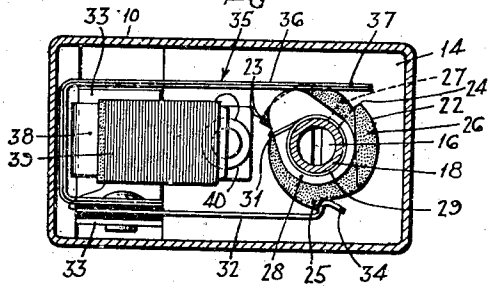


Fig. 7.

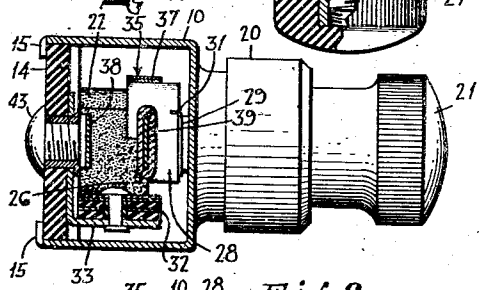


Fig. 5.

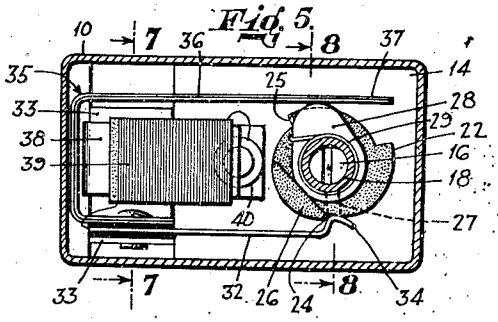


Fig. 8.

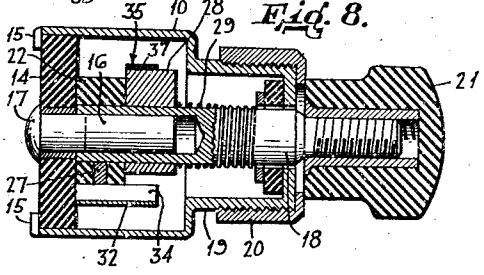
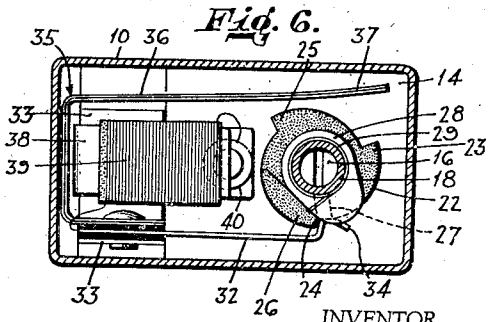


Fig. 6.



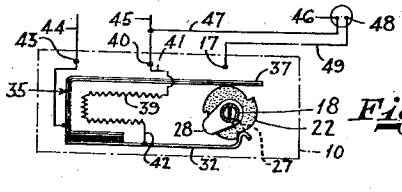


Fig. 9.

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THERMOSTATICALLY CONTROLLED ELECTRICAL SWITCH

Daniel Kumpman, Dover, N. J.

Application July 25, 1940, Serial No. 347,356

8 Claims. (Cl. 200—122)

This invention relates to an electrical switch and, more particularly, to an electrical switch which, through a thermostat, automatically opens the circuit to an electrically operated device at a pre-determined length of time after the switch has been manually operated to open the circuit.

An object of this invention is to provide a switch, the circuit opening action of which is delayed, the delayed action being controlled by a thermostat.

Another object of the invention is to provide an electrical switch which may be used either to open an electrical circuit immediately upon manual actuation thereof or delay the circuit opening action an interval of time after the manual actuation of the switch.

A further object of this invention is to provide an electrical switch which, automatically through a thermostat, opens an electrical circuit at a predetermined interval of time after manual operation of the switch in which the contact controlling elements are simple and inexpensive to make and assemble.

Other objects of the invention will become apparent in the course of the following specification.

The above and other objects of this invention may be realized in providing a casing in which is mounted a shaft having a cam member of insulating material fixedly mounted thereon, the shaft being rotatable by means of a knob on the outside of the casing. Rotatably mounted on the shaft is a movable contact member having a greater radius than the radius of the cam member. A spring is also mounted on the shaft, one end being fastened to the shaft and the other end bearing against the movable contact member. The shaft is in electrical connection with a terminal in the casing. Bearing on the surface of the cam member at one side thereof is a bi-metallic strip and bearing on the surface of said cam on the opposite side thereof is a contact strip of flexible material adapted to engage a contact on the cam surface, which contact is connected to the shaft. Mounted within the casing adjacent the bi-metallic strip is a resistance coil, one end of which is connected to a terminal on the casing and the other end connected to the contact strip of flexible material. The bi-metallic strip is connected to another terminal on the casing.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawing, showing by way of example a preferred embodiment of the invention.

In the drawing:

Figure 1 is a front view in elevation of the switch of this invention;

Figure 2 is a longitudinal section taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken on the line 3—3 of Figure 2, showing the switch mechanism of this invention in its normal "off" position;

Figure 4 is a view similar to Figure 3 but shows the switch mechanism in its conventional "on" position, the thermostatic control being disconnected and in its inoperative position;

Figure 5 is a view similar to Figure 3 but shows the switch mechanism in its "on" position, the thermostatic control being connected and in its operative position;

Figure 6 is a view similar to Figure 3 but illustrates the position of the switch mechanism after the thermostatic control has operated and before the bi-metallic strip has returned to its normal position;

Figure 7 is a sectional view taken on the line 7—7 of Figure 5;

Figure 8 is a sectional view, showing in section the movable contact mechanism taken on the line 8—8 of Figure 5; and

Figure 9 is a wiring diagram, showing the connections between the various parts of the switch.

Like numerals refer to like parts throughout the several views.

The switch of the present invention comprises a casing 10 having lugs 11 and 12 thereon for mounting the same.

The casing 10 is open at the back thereof to accommodate a strip of insulating material 14 which is fastened to the casing by any desirable means such as lugs 15 to form the back thereof.

Mounted on the strip 14 is a split pin 16 of conductive material adapted to receive a screw 17 which acts as a terminal for one of the electrical connections to the switch. Rotatably mounted on the pin 16 is a shaft 18 which extends transversely of the casing 10 and outwardly thereof through an extension 19 on the opposite side of the said casing. A cap 20 is adapted to fit over the extension and a knob 21 of non-conductive material is fastened to the projecting end of the shaft.

Fixedly mounted on the shaft 18 adjacent the backing 14 is a cam 22 of insulating material having three detents 23, 24 and 25 in the surface thereof. The cam surface between said detents is substantially spiral. Adjacent the detent 24

and extending toward the detent 25 is a projection 26 widening the cam surface at this point.

Within the detent 24 of the cam 22 is a contact 27 in electrical connection with the shaft 18 and pin 16.

Loosely mounted on the shaft 18 is a movable contact arm 28, the length of which is greater than the greatest radius of the cam 22. The arm 28 is in electrical connection with the shaft 18 and pin 16. A coil spring 29 is also mounted on the shaft 18, one end 30 of which is fastened to the shaft and the other end 31 of which bears against the arm 28, the tension of the spring normally pressing the arm 28 against the projection 26 on the cam 22.

A fixed contact arm 32 of spring material is mounted at one end thereof on a bracket 33 and insulated therefrom. The opposite end of the arm 32 has a projection 34 thereon adapted to engage the detents 23, 24 and 25 and travel on the cam surface therebetween, the tension in the spring arm 32 pressing the same tightly against the cam surface, so that said contact arm will tightly engage the contact 27.

Also mounted on the bracket 33 and insulated from the arm 32 is a substantially U-shaped bi-metallic thermostatic strip 35, one side 36 thereof having an extension 37 adapted to engage only the extension 26 on the cam 22 and the movable contact arm 28, on the side of the cam opposite to that engaged by the projection 34 on the fixed contact arm 32.

The bi-metallic strip is in electrical connection with the terminal 43 in the backing 14. Mounted on a bracket 38 on the backing 14, preferably between the sides of the U-shaped bi-metallic strip 36, is a resistance coil 39, one end of which is connected to the terminal 40 through the lead 41 and the other end is connected to the fixed contact arm 32 by the lead 42.

In use, one lead 44 of an electrical source is connected to the terminal 43 of the switch of this invention (see Figure 9); the other lead from the electrical source 45 is connected to the switch terminal 40. One connection 46 of the electrical device to which the electrical energy is conveyed is connected to the switch terminal 40 by the lead 47, while the other connection of the electrical device 48 is connected to the switch terminal 17 through the lead 49.

In the normal "off" position of the switch of this invention, as illustrated in Figure 3 of the drawings, the end 34 of the fixed contact arm 32 is positioned within the detent 23 in the cam 22. The extension 37 on the thermostatic strip 35 bears against the extension 26 on the cam 22, the circuit from the lead 44 through the terminal 43 and bi-metallic strip 35 to the electrical device being open.

When it is desired to close the circuit to the electrical device, the knob 21 is turned in a clockwise direction until the projection 34, after traveling over the cam surface between the detent 23 and the detent 25, snaps into the detent 25 in the cam surface. This conventional "on" position is shown in Figure 4. The movable contact arm 28, as shown in Figure 4, is in engagement with the extension 37 of the bi-metallic strip 35. The spring 29 is charged sufficiently to hold the arm 28 against the extension 37, so that a good electrical connection is obtained.

When in the conventional "on" position, current from one pole of the electrical source will flow through the lead 44, terminal 43, bi-metallic strip 35, movable contact arm 28, shaft 18, pin 16, terminal 17, lead 49, to the connection 48 on the electrical device to be operated. The other connection 46 on the electrical device is in direct connection with the other pole of the electrical source through the lead 47, terminal 40 and lead 45.

When it is desired to turn off the current to the electrical device, but only after the lapse of an interval of time a further clockwise turn is given to the knob 21 on the switch until the projection 34 snaps into the detent 24 in the surface of the cam 22. The position of the parts of the switch after this turn is shown in Figure 5 of the drawings. The movable contact arm 28 remains in contact with the extension 37 on the bi-metallic strip 35. This latter turn, however, has further charged the spring 29 and has placed the fixed contact arm 32 through the projection 34 thereon in electrical connection with the contact 27 in the detent 24 on the surface of the cam 22.

In the position shown in Figure 5, the flow of electrical current from the source to the electrical device follows the same paths as it followed in the position shown in Figure 4, as hereinbefore set forth. A secondary circuit, however, between the resistance coil 39 and the electrical source has been set up.

This secondary circuit flows from one pole of the electrical source through the lead 44, terminal 43, bi-metallic strip 35, movable contact arm 28, shaft 18, electrical contact 27, projection 34 and fixed contact arm 32 to one end of the coil 39 through the lead 42. The other end of the coil 39 is connected to the terminal 40 through the lead 41 and thence to the opposite pole of the electrical source through the lead 45, as shown in Figure 9. Heat is thereby created in the resistance coil, which heat, after obtaining a pre-determined temperature, causes the side 36 of the bi-metallic strip 35 to raise to the position shown in Figure 6, releasing the contact between the extension 37 and the movable contact arm 28, breaking the electrical connection therebetween and opening the circuit between the lead 44 of the electrical source and the connection 48 of the electrical device. The tension in the spring 29 causes the movable contact arm 28 to be moved in a clockwise position (see Figure 6), when the side 36 of the thermostatic strip moves away from the arm, due to the heat created by the resistance coil 39.

Should it be desired to open the circuit to an electrical device immediately, that is, without any delayed action, as above described, it would be merely necessary to turn the cam 22, through the knob 21, in a clockwise direction from the position shown in Figure 4 until the projection 34 engages the detent 23. By the further turning of the knob 21, the spring 29 is charged as the projection 34 passes over the cam surface between the detents 24 and 23 to a point where the tension in the spring 29 is sufficient to move the movable contact arm 28 out of contact with the extension 37 on the bi-metallic strip, which breaks the circuit from the electrical source through the lead 44 to the connection 48 of the electrical device.

Should the spring 29 for any reason fail to move the arm 28 out of contact with the extension 37 engagement of the projection 26 with the arm upon further rotation of the knob 21 will cause disengagement between the arm 28 and the extension 37.

It is apparent that the specific illustrations

shown have been given by way of illustration and not by way of limitation and that the structure above described is subject to a wide variation and modification without departing from the scope or intent of the invention, all of which variations and modifications are to be included within the scope of the present invention.

What is claimed is:

1. In an electric switch, a manually actuated rotatable shaft, a spring-urged contact arm loosely mounted on said shaft and adapted to normally rotate with said shaft, a bi-metallic contact strip normally disposed circumferentially in the plane of said contact arm adapted to engage said arm and restrain rotation thereof against spring tension, the spring tension increasing upon further rotation of the shaft in the same direction until the arm by increased tension is caused to disengage the strip, said arm and said strip when in engagement being adapted to close a circuit between an electrical source and an electrically operated device, an electrical heating element adjacent said bi-metallic strip, a rotatable contact member fixedly mounted on said shaft, a fixed contact disposed circumferentially in the plane of said rotatable contact and adapted to be engaged thereby while said arm and said strip are in engagement and close an electrical circuit to said heating element whereby heat from said heating element will cause said bi-metallic strip to disengage said spring-urged arm the spring tension causing said arm to move out of contact with said strip.

2. In an electric switch, a manually actuated rotatable shaft, a spring-urged contact arm loosely mounted on said shaft and adapted to normally rotate with said shaft, a bi-metallic contact strip normally disposed circumferentially in the plane of said contact arm adapted to engage said arm and restrain rotation thereof against spring tension, the spring tension increasing upon further rotation of the shaft in the same direction until the arm by increased tension is caused to disengage the strip, said arm and said strip when in engagement being adapted to close a circuit between an electrical source and an electrically operated device, an electrical heating element adjacent said bi-metallic strip, a cam member of insulating material fixedly mounted on said shaft having a plurality of detents in the periphery thereof, an electrical contact in one of said detents, a fixed contact disposed circumferentially in the plane of said cam member having a projection thereon adapted to travel on the periphery of said cam and engage the detents therein and allow rotation of said cam in one direction only said contact in one of said detents being adapted to engage said fixed contact while said arm and said strip are in engagement and close an electrical circuit to said heating element whereby heat from said heating element will cause said bi-metallic strip to disengage said spring-urged arm the spring tension causing said arm to move out of contact with said strip.

3. In an electric switch comprising a casing, a manually actuated shaft rotatably mounted in said casing, a spring-urged contact arm loosely mounted on said shaft and adapted to normally rotate with the shaft, a bi-metallic contact strip mounted within the casing and disposed circumferentially in the plane of said contact arm adapted to engage said arm and restrain rotation thereof against spring tension, the spring tension increasing upon further rotation of the shaft in the same direction until the arm by increased tension is caused to disengage the strip, said arm and said strip when in engagement being adapted to close a circuit between an electrical source and an electrically operated device, an electrical heating element adjacent said bi-metallic strip, a cam member of insulating material fixedly mounted on said shaft having a plurality of detents in the periphery thereof, a fixed contact member disposed circumferentially in the plane of said cam member having a projection thereon adapted to travel on the periphery of said cam and engage the detents therein and allow rotation of said cam in one direction only, one of said detents being so positioned in said cam as to engage the fixed contact and prevent rotation of the shaft in an opposite direction when the contact arm and the bi-metallic strip are not in engagement, the next succeeding detent being so positioned on said cam as to engage the fixed contact and hold said cam against movement in an opposite direction by said spring-urged arm when said arm and said strip are in engagement, and the next succeeding detent engaging said fixed contact and holding said cam against movement in an opposite direction by the spring-urged contact arm while the arm and the bi-metallic strip are in engagement, an electrical contact in said cam adjacent the last mentioned detent adapted to engage said fixed contact and close an electrical circuit to said heating element whereby heat from said heating element will cause said bi-metallic strip to disengage said spring-urged arm, the spring tension causing said arm to move out of contact with said strip.

4. In an electric switch comprising a casing, said casing having a removable back of insulating material, a pin fixedly mounted in said back and extending into said casing actuated shaft rotatably mounted on said pin, a spring-urged contact arm loosely mounted on said shaft and adapted to normally rotate with said shaft, a bi-metallic contact strip mounted on said back and disposed circumferentially in the plane of said contact arm adapted to engage said arm and restrain rotation thereof against spring tension, the spring tension increasing upon further rotation of the shaft in the same direction until the arm by increased tension is caused to disengage the strip, said arm and said strip when in engagement being adapted to close a circuit between an electrical source and an electrically operated device, an electrical heating element mounted on said back adjacent said bi-metallic strip, a cam member of insulating material fixedly mounted on said shaft having a plurality of detents in the periphery thereof, a fixed contact mounted on said back and disposed circumferentially in the plane of said cam member having a projection thereon adapted to travel on the periphery of said cam and engage the detents therein and allow rotation of said cam in one direction only, one of said detents being so positioned in said cam as to engage the fixed contact and prevent rotation of the shaft in an opposite direction when the contact arm and the bi-metallic strip are not in engagement, the next succeeding detent being so positioned on said cam as to engage the fixed contact and hold said cam against movement in an opposite direction by said spring-urged arm when said arm and said strip are in engagement and the next succeeding detent engaging said fixed contact and holding said cam against movement in an oppo-

site direction by the spring-urged contact arm while the arm and the bi-metallic strip are in engagement, an electrical contact in said cam adjacent the last mentioned detent adapted to engage said fixed contact and close an electrical circuit to said heating element whereby heat from said heating element will cause said bi-metallic strip to disengage said spring-urged arm the spring tension causing said arm to move out of contact with said strip.

5. In an electric switch, a manually actuated rotatable shaft, a contact arm loosely mounted on said shaft a spring mounted on said shaft one end thereof being attached thereto and the other end bearing against the contact arm causing said arm to normally rotate with said shaft, a bi-metallic contact strip normally disposed circumferentially in the plane of said contact arm adapted to engage said arm and restrain the rotation thereof against the tension of the spring, the spring tension increasing upon further rotation of the shaft in the same direction until the arm by increased tension of the spring is caused to disengage the strip, said arm and said strip when in engagement being adapted to close a circuit between an electrical source and an electrically operated device, an electrical heating element adjacent said bi-metallic strip, a cam member of insulating material fixedly mounted on said shaft having a plurality of detents in the periphery thereof, an electrical contact in one of said detents, a fixed contact disposed circumferentially in the plane of said cam member having a projection thereon adapted to travel on the periphery of said cam and engage the detents therein and allow rotation of said cam in one direction only, said contact in one of said detents being adapted to engage said fixed contact while said arm and said strip are in engagement and close an electrical circuit to said heating element whereby heat from said heating element will cause said bi-metallic strip to disengage said contact arm, the increased tension of the spring causing said arm to move out of contact with said strip.

6. In an electric switch, a manually actuated rotatable shaft, a contact arm loosely mounted on said shaft a spring mounted on said shaft one end thereof being attached thereto and the other end bearing against the contact arm causing said arm to normally rotate with said shaft, a bi-metallic contact strip normally disposed circumferentially in the plane of said contact arm adapted to engage said arm and restrain the rotation thereof against the tension of the spring, the spring tension increasing upon further rotation of the shaft in the same direction until the arm by increased tension of the spring is caused to disengage the strip, said arm and said strip when in engagement being adapted to close a circuit between an electrical source and an electrically operated device, an electrical heating element adjacent said bi-metallic strip, a cam member of insulating material fixedly mounted on said shaft having a plurality of detents in the periphery thereof, an electrical contact in one of said detents, means carried by said cam member for forcibly disengaging said contact arm upon further rotation of said shaft, a fixed contact disposed circumferentially in the plane of said cam member having a projection thereon adapted to travel on the periphery of said cam and engage the detents therein and allow rotation of said cam in one direction only, said contact in one of said detents being adapted to engage said fixed contact while said arm and said strip are in engagement and close an electrical circuit to said heating element whereby heat from said heating element will cause said bi-metallic strip to disengage said contact arm, the increased tension of the spring causing said arm to move out of contact with said strip.

7. In an electric switch, a manually rotatable switch circuit controller, a resilient circuit governing mechanism energizable by the rotation of said switch circuit controller, a deflectable thermostatic contact arm for restraining said movement when said switch circuit controller is turned beyond the closed position of said switch whereby said circuit governing mechanism will become tensioned for circuit closing movement, a heating coil for controlling said thermostatic contact arm and means connected with said switch circuit controller for establishing a secondary circuit in said heating coil when said switch circuit controller is rotated a predetermined distance from the closed position whereby said circuit governing mechanism will be released to open the circuit after a predetermined lapse of time.

8. In an electric switch, a manually actuated rotatable shaft, a spring-urged contact arm loosely mounted on said shaft and adapted normally to rotate with said shaft, a thermostatic contact strip for restraining the rotation of said contact arm against the spring tension when said switch circuit controller is turned beyond the closed position, a heating coil for controlling said thermostatic contact strip, means connected with said switch circuit controller for establishing a secondary circuit in said heating coil when said switch circuit controller is turned a predetermined distance from said closed position whereby said contact arm will be released to open said circuit after a predetermined lapse of time.

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