MANUALLY RESETTABLE PRESSURE ACTUATED SWITCH

Filed Aug. 17, 1953

INVENTOR.

GILBERT H. HANSEN

LIEBER & LIEBER
ATTORNEYS.
MANUALLY RESETTABLE PRESSURE ACTUATED SWITCH

Gilbert H. Hansen, Batavia, Ill., assignor to Furnas Electric Company, Batavia, Ill., a corporation of Illinois
Application August 17, 1953, Serial No. 374,659
2 Claims. (Cl. 200—83)

The present invention relates in general to improvements in electric switches, and relates more specifically to improvements in the construction and operation of manually resettable fluid pressure actuated electric switches.

The primary object of my present invention is to provide an improved toggle switch adapted to be opened and closed with a snap action, and wherein the contacts are relatively automatically movable in one direction and relatively manually movable in the opposite direction.

Some of the more important specific objects of the invention are as follows:

1. To provide an improved electric switch unit which is adapted to be opened automatically by fluid pressure and to be thereafter reset or closed at the will of an operator.

2. To provide an improved toggle switch assembly wherein the contacts are positively opened and closed with a decided snap action.

3. To provide a simple but durable electric switch comprising a few sturdy parts which may be readily constructed and assembled.

4. To provide a compact toggle actuated electric switch of the fluid pressure and manually operable type, which may be produced in various sizes and for diverse uses at moderate cost.

5. To provide an improved electric switch actuating toggle assembly which may be conveniently adjusted to vary the toggle action.

6. To provide an improved electric switch unit which is especially adapted to control the operation of heating systems wherein it is desirable to have the electric control circuit interrupted by excessive pressure in the system and to be able to restore normal operation of the system at will.

7. To provide various improvements in the construction and operation of automatic and manually operable electric switches of the toggle type, whereby the safety and dependability of such devices are enhanced to a maximum.

These and other more general objects and advantages of the invention will be apparent from the following description, from which it is to be noted that the gist of my invention is the provision of an electric switch embodying a toggle component of a rigid plate having a swinging end coacting with the swinging end of a curved leaf spring and in which the toggle is adapted to be flexed in opposite directions with a pronounced snap action to effect rapid alternate opening and closing of an electric circuit when fluid and manual pressures are alternately applied to opposite sides of the toggle plate.

A clear conception of the features constituting the present improvement, and of the construction and operation of a typical commercial switch embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views.

Fig. 1 is a vertical section through one of the improved toggle operated electric switches, showing the contacts in open position, the section having been taken along the irregular line 1—1 of Fig. 3.

Fig. 2 is a similar vertical section through the same electric switch assembly, but showing the contacts in closed position, the lower fluid pressure supply member having been omitted;

Fig. 3 is a side elevation of the same electric switch unit, looking toward the toggle plate fulcrum adjusting mechanism;

Fig. 4 is a top view of the same toggle switch; and

Fig. 5 is a bottom view of the electric switch assembly with the lower fluid pressure supply member and a portion of the fluid pressure actuated diaphragm omitted.

While the invention has been shown and described herein as being advantageously applicable to toggle switches adapted to break an electric circuit when the actuating fluid pressure becomes excessive, and to complete the circuit by manual actuation, it is not my desire or intention to unnecessarily limit the use of the improvements to such a unit; and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, the improved manually resettable fluid pressure actuated switch shown therein by way of illustration, comprises in general a main composite frame consisting of a cup-shaped base 7 having spaced fulcums 8, 9 associated therewith, and a contact housing 10 secured to the base 7; a flat and rigid toggle plate 11 having one end pivotally cooperable with the fulcrum 8; an S-shaped toggle leaf spring 12 having one end pivotally cooperable with the other from 9 while its opposite swinging end 13 coacts with the opposite swinging end of the plate 11 to form a toggle; a pair of laterally spaced fixed contacts 14 confined within the housing 10; a movable contact element 15 cooperable with the fixed contacts 14 within the housing 10; a fluid pressure actuated plunger 16 cooperable with one face of the toggle plate 11 to cause the toggle spring 12 to displace the toggle and the movable contact element 15 in one direction with a snap action; a manually replaceable slide 17 supporting the contact element 15 and having an end engageable with the opposite face of the toggle plate 11 to cause the toggle spring 12 to displace the toggle and the movable contact element 15 in one direction with a snap action; and a helical compression spring 18 interposed between the housing 10 and the movable contact element 15 for promptly completing or closing the electric circuit when the toggle is reversely displaced.

The cup-shaped base 7 of the main frame may be formed of durable sheet metal, and has a pair of oppositely disposed integral extensions or fingers 20 adapted to be projected through opposite side openings in the housing 10 and bent over at their outer ends 21 as shown in Figs. 1 to 4 inclusive, so as to firmly clamp the frame sections together. The toggle leaf spring 9 for the leaf spring 12 may be formed directly in one side wall of the base 7, but the toggle fulcrum 8 of the flat plate 11 is preferably formed in the medial portion of an L-shaped sheet metal bracket 22 one end of which is pivoted within and projects through an opening 23 in the opposite side wall of the base 7 while its opposite free end portion is engaged by an adjusting screw 24 threaded in the adjacent base wall. By manipulating this screw 24, the free end of the bracket 22 may be swung about its pivoted end at the opening 23 to vary the position of the toggle fulcrum 8 and thereby accelerate or diminish the snap action of the toggle.

The flat toggle plate 11 is preferably formed of relatively rigid sheet metal sufficiently thin to provide pivot edges at its opposite ends one of which pivotally engages the adjustable fulcrum 8, while the other edge likewise
engages the V-shaped swinging end 13 of the toggle spring 12. The medially curved toggle leaf spring is preferably formed of highly resilient sheet material and of S-shape, although not necessarily so, since any other curved shape which will impose the desired spring action on the toggle may be utilized. The pivoted end of the toggle leaf spring 12 and which coacts with the fixed fulcrum 9, is also of pivotal formation, but the swinging end of this spring 12 is bent into V-shape so as to provide an effective pivot seat on one edge at the swinging end of the toggle plate 11. The interior of the cup-shaped frame base 7 and within which the toggle is confined, should be of sufficient depth to permit free flexing of the toggle elements and to provide stops for limiting the movement of the toggle elements in opposite directions.

The switch contact housing 10 is formed of electrical insulating material and is provided at its outer portion between the openings through which the clamping fingers 20 extend, with an integral dome 26 within which the slide 17 is longitudinally movable and in which the compression spring 18 is confined. The portion of the housing remote from the dome 26 is provided with a rectangular recess 27 within which a pair of superimposed plates 28, 29 formed of electrical insulation are firmly held by the clamping fingers 20, and of which the plate 28 provides a direct support for the terminal bars 30 to which the contacts 14 are secured, while the other plate 29 snugly engages the rim of the cup-shaped base 7. The terminal bars 30 project diagonally from within the housing 10 through sloping slots formed in this housing adjacent to the recess 27, to the housing exterior, and are provided at their outer ends with terminal screws 31, as illustrated in Figs. 3 and 4.

The fixed contacts 14 may be circular as shown or of any other desired shape, and the movable contact element 15 which is adapted to bridge and interconnect the fixed contacts 14, is formed of good electric current conducting metal and provides spaced but united movable contacts cooperable with the adjacent fixed contacts. The movable contact element 15 is of substantially elliptical shape as shown in Fig. 4, and is penetrated centrally by the manually operable slide 17 which has medial shoulders 33 toward which the movable contact element 15 is constantly pressed by the compression spring 18, and as the slide 17 is preferably formed of electrical insulation and is guided near its opposite ends by the housing dome 26 and by the plate 29.

While the slide 17 is manually movable into engagement with one face of the toggle plate 11 to trip the toggle in one direction, the plunger 16 is automatically moved into engagement with the opposite face of the toggle plate 11 to throw the toggle across dead center in the opposite direction. As depicted, the plunger 16 is guided for longitudinal movement or recirculation through aligned openings in the bottom of the cup-shaped base 7 and in an inverted cup-shaped disk 35 rigidly secured to the base 7. The outer end of the plunger has a bearing plate 36 secured thereto and which coacts with a flexible diaphragm 37 formed of rubber or the like, and which is clamped to the disk 35 by a fluid supply casing 38. The casing 38 is secured to a supporting nut 40 and forms an enclosed chamber 41 to which fluid under pressure may be admitted through the nut 40 and through a small central opening in plate 42 secured to the casing 38, and the nut 40 may be utilized to support the entire switch unit while the actuating fluid may be applied from any suitable source.

When the improved toggle switch has been properly constructed, assembled and installed as above described, its normal operation is substantially as follows. With the various parts of the assembly in the position shown in Fig. 1, the movable contacts are in open position and the contact element 15 is being held in such position against the action of the compression spring 18 by the slide 17 while the toggle spring 12 and plate 11 which have caused the toggle to be thrown across dead center away from the fluid pressure actuated plunger 16 are stopped against the plate 29. The switch will then be maintained in open position until the fluid pressure within the chamber 41 again increases sufficiently to cause the plunger 16 to throw the toggle across dead center away from the fluid pressure source, whereupon the slide 17 and the movable contact element 15 will be quickly displaced to open position with respect to the fixed contacts 14, with a similar snap action while the helical spring 18 will again be compressed, as in Fig. 1. When the toggle is thrown in either direction across dead center, the toggle leaf spring 12 is placed under considerable tension and acts to effect opening and closing of the switch with a decided snap action, and this action may be augmented or diminished by manipulating the adjusting screw 24 with an ordinary screw driver or other similar implement. When the switch is being opened, the lateral projections 33 on the medial portion of the slide 17 move the contact element 15 away from the fixed contacts 14 and cause the element 15 to compress the spring 18; and when the switch is closing, the compressed spring 18 quickly brings the contact element 15 into engagement with the fixed contacts 14 while the slide 17 and its projections 33 are being moved toward the toggle.

From the foregoing detailed description it will be apparent that the present invention provides a simple, compact and durable toggle switch unit in which the contacts are adapted to be opened and closed with great rapidity and are positively held in both open and closed position until either of these positions is altered when the fluid pressure in the chamber 41 reaches a predetermined value, or manual pressure is applied to the slide 17. The switch contacts are well insulated and protected by the housing 10 and the insulation plates 28, 29, and the toggle is likewise protected by the cup-shaped base 7. The formation of the base 7 with the clamping fingers 20 prevents undue action of the toggle and automatically moves the contacts 14 simultaneously with the switch unit, and the only adjustment required after the parts have been assembled is manipulation of the screw 24 which may be easily accomplished from the exterior of the enclosure. The nut 40 also provides simple means for mounting the switch assembly at a readily accessible locality, and the improved switch has proven highly satisfactory in actual use especially as a safety control for fluid pressure heating systems. The unit is also composed of few simple parts which may be readily manufactured and assembled at moderate cost, and may be built in various sizes for diverse uses.

It should be understood that it is not desired to limit this invention to the exact details of construction and operation of the manually reset pressure actuated electric switch, herein specifically shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

1. In an electric switch, a rigid frame comprising a cup-shaped base provided with opposite side walls having thereon spaced fulcrums and a contact housing secured to the rim of the base, a rigid toggle plate having one end pivotally seated within one of said fulcrums, an S-shaped flexible toggle spring having one end pivotally seated within the other of said fulcrums while its oppo
site swinging end pivotally coacts with the opposite swinging end of said rigid plate to form a toggle, a fixed contact mounted in said housing, a movable contact confined within said housing and being cooperating with said fixed contact, a movable contact carrier cooperating directly with one face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in one direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressure actuated means cooperating directly with the opposite face of said rigid plate to cause said flexible spring to displace said toggle and said movable contact in the opposite direction with a snap action, and fluid pressu