Dec. 14, 1954 V. R. DESPARD 2,697,143

A.C. SWITCH WITH KNOB ACTUATION

Filed Nov. 7, 1952

FIG. 6.

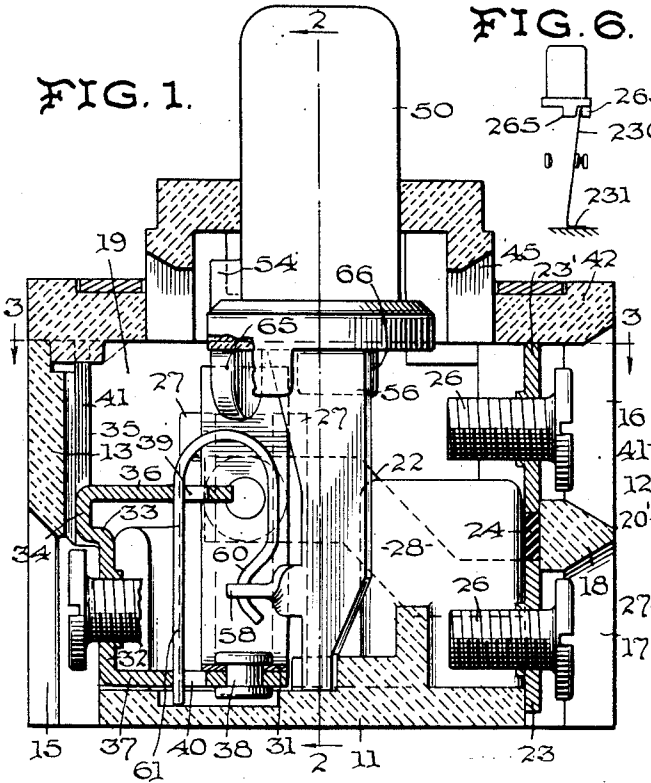


FIG. 1.

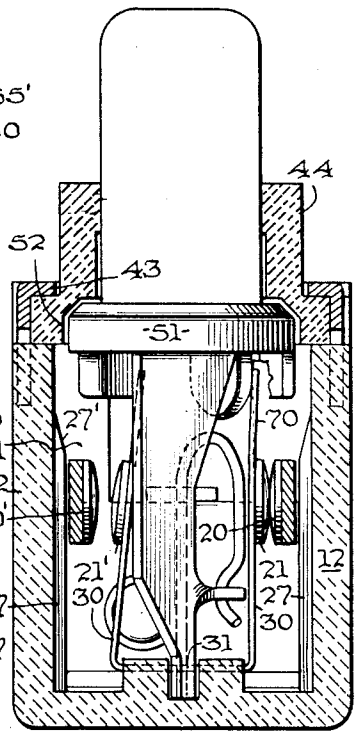


FIG. 2.

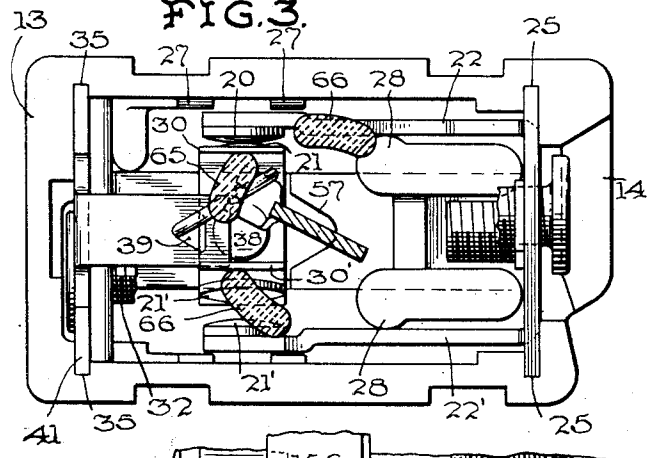


FIG. 3.

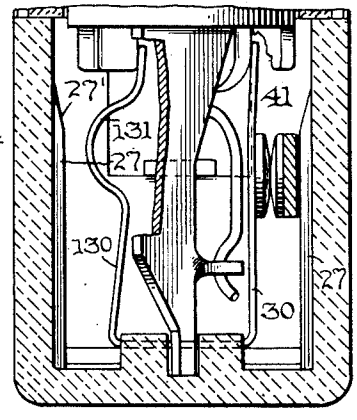


FIG. 4.

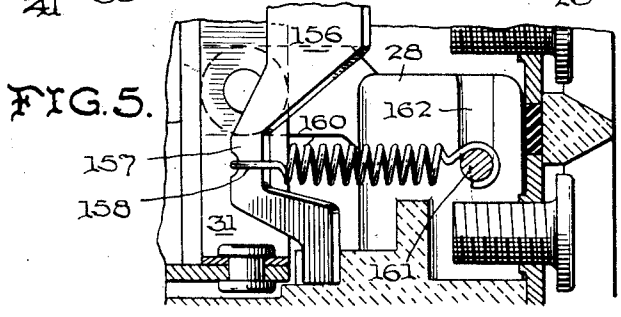


FIG. 5.

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A. C. SWITCH WITH KNOB ACTUATION

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7 Claims. (Cl. 200—6)

The invention relates to flush or wall mount electric switches, and more particularly to such switches of the alternating current, slow-break type actuated by an oscillatable knob.

It is a general object of the invention to provide a novel and improved switch of the type described.

More particularly it is an object of the invention to provide, in a switch of the type described, a novel arrangement for and mounting of fixed and movable contacts.

Another object resides in the provision of a unique mount for the switch operator over-center spring incorporated with a terminal plate and conductor strip.

Among the unique features of the invention may be enumerated the following:

Alternative use of compression or tension spring for over-center operation.

Arrangement of single or dual contact sets for operation transversely of the housing.

Use of the contact springs to cushion the switch operator to a stop at the end of its stroke in either direction.

Disposition of the over-center spring longitudinally of the housing.

Support of the stationary contacts against opposite side walls of the housing.

Other and further objects and features of the instant invention will become more apparent to those skilled in the art as the disclosure proceeds in the following specification and accompanying drawings wherein are disclosed several exemplary embodiments of the invention with the understanding that such changes therein and combinations thereof may be made as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Fig. 1 is a longitudinal central section, taken through the axis of knob rotation, of an A. C. switch of the slow-break, rotary knob-actuated type constructed according to the present invention;

Fig. 2 is a transverse central section thereof taken on line 2—2 of Fig. 1;

Fig. 3 is a top plan view thereof with the cover removed and showing the switch operator in section on line 3—3 of Fig. 1;

Fig. 4 is a view similar to Fig. 2 but depicting a single pole switch with a non-contact-carrying spring blade;

Fig. 5 is a fragmentary view similar to Fig. 1 but illustrating an embodiment using a tension type over-center spring for the switch operation; and

Fig. 6 is a diagrammatic showing of a further embodiment using a single spring blade in a double throw switch.

The switch of the present invention is primarily intended for but not necessarily limited to use in wall and switch boxes for general interior wiring for illumination and like loads, and may be mounted in multiple with like or other wiring devices in a single gang box in a known manner, being supported from a strap or bridge plate as clearly indicated in my earlier Patent 1,992,059, granted February 19, 1935. In order to permit of this use, the switch is provided with a suitably sized and shaped housing of molded insulating material having a closed bottom wall **11**, solid side walls **12**, and similar end walls **13** and **14**, the first having a single opening **15** near the bottom and the latter two such openings **16** and **17** separated by horizontal partition **18**. These three openings are to provide access to terminal screws, as

will be later described. The housing top is open to provide access to a relatively large, generally rectangular chamber **19**.

The switch illustrated in Figs. 1 to 3, inclusive, is what is known in the industry as a three-way switch, but is actually a single-pole double-throw switch. The contact structure therefor is extremely simple and comprises two similar sets of contacts each including a stationary contact button **20**, **20'** and a movable contact button **21**, **21'**. Each stationary contact button is arranged at the outer end of an offset strap **22**, **22'**, each being formed integral with its corresponding terminal plate **23**, **23'**. These latter are vertically separated by an insulating strip **24** and the whole assembly is received in channels **25** in the housing side walls adjacent end wall **14**, as clearly seen in Figs. 1 and 3. Each terminal plate is equipped with a terminal screw **26**, as seen, for the attachment of conductor wires thereto. The straps **22** and **22'** are offset one upwardly and the other downwardly and are bent in at right angles from the ends of the terminal plates, as clearly seen in Fig. 3. In this figure the outer ends of the straps are seen to be offset outwardly so that they rest against a pair of spaced runners **27** formed integral with the housing wall and having sloping upper ends **27'**. The straps are tightly held against the runners by bolsters **28**, extending upwardly from the housing bottom as seen in Figs. 1 and 3. Thus the stationary contact buttons are secured rigidly in position against movement in any direction.

The movable contacts **21** and **21'** are carried respectively on the cantilever arms **30** and **30'** of a U-shaped spring having a flat base portion **31**. The arms of the spring converge toward the top so that the movable contacts are biased toward open position, as seen at the left of Fig. 2. The U-shaped spring is positioned by and connected to terminal plate **32** arranged adjacent opening **15** in end wall **13**. This plate has a flange portion **33** along its upper edge to offset vertical portion **34** whose ends are extended vertically as legs **41** to fit in grooves **35** in the side walls as seen in Figs. 3 and 4. Parallel arms **36** and **37** spring, respectively, from the top and bottom of plate **32**, arm **37** extending along the bottom of the housing and beneath the base of the U-shaped spring and being mechanically and electrically connected thereto by rivet **38**. This positions the spring so that its contacts are in spaced conforming relationship to the stationary contacts. The arms **36** and **37** are respectively provided with openings at **39** and **40** in vertical alignment with each other for a purpose to later appear.

The slots **35** in the side walls are filled to the top of the housing with the terminal and insulating plates **23**, **23'** and **24** at one side and by the legs **41** on the other.

The terminal and insulating plates are held in position and the housing closed by a cover plate **42** extending across the whole area of the top thereof. This plate is maintained in position by a metal collar and strap combination **43** which serves to fasten the two portions of the housing together. The cover has a centrally positioned protruding neck **44** equipped with notches **45** for attaching the same to the mounting strap as previously mentioned. The neck is centrally bored to journal the knob **50** used for manipulating the switch. This knob is preferably more or less cylindrical and may be longitudinally fluted on its exposed surface to improve the finger grip. It is of relatively small diameter and small protrusion beyond the face of the neck, which is normally flush with the wall plate. Formed integrally with the inner end of the button is a larger diameter flange or disc **51** chamfered on its upper edge and closely received in a correspondingly shaped counterbore **52** in the neck to act as a thrust bearing to prevent the knob from being withdrawn. In some embodiments the knob may be provided, above the flange, with stop lug **54** seen in Fig. 1, operating in an arcuate channel, the ends of which provide stops to limit knob oscillation. The total range of oscillation is not greater than twenty-five degrees.

Extending downwardly from the knob is the switch operator comprising metal strip **56**, reduced in width at the lower end to provide a bearing received in a suitable notch **57** in the bottom of the housing, as seen in Fig. 3.

Stamped from the metal of the plate **56** is the twisted crank arm **58** notched at its outer end to receive the incurved portion **60** of one leg of a U-shaped spring whose opposite leg **61** passes through and is supported in the openings **39** and **40** in the parallel arms extending from terminal plate **32**, as clearly seen in Figs. 1 to 3. The spring is biased to the shape shown and because of its position in respect to the switch operator tends to throw the crank arm **58** to one side or the other in what is termed herein an over-center action. Thus the switch operator can only temporarily maintain a position other than at one of the ends of its range.

For moving the free ends of spring arms **30**, **30'**, which terminate just beneath the under surface of the disc **51**, this disc is provided with depending lugs, three in number as seen in Fig. 3. The center one **65** of these lugs is the circuit closing one and depends a greater distance than the other two, as seen in Figs. 1 and 2, and has a curved, slightly pointed lower end. The other two lugs, **66**, **66'** are of similar but opposite disposition and all lugs are at the periphery of disc **51** and are spaced apart a considerable distance so that one of the outer lugs and the principal lug form a straddling relationship to each of the free ends of the contact button carrying springs.

As viewed in Fig. 3, the principal operating lug **65** is in engagement with spring **30** and has flexed it to the extent that its contact **21** is in electrical engagement with stationary contact **20**, thus closing one circuit. At the same time lug **65** is well removed from the free end of spring **35** which by its own resilience has withdrawn its contact from stationary contact button **20'**. Reliance, however, is not placed solely on the resilience of springs **30** and **30'** to separate the contacts, since there is the possibility of welding or sticking. This explains the purpose of auxiliary operating lugs **66** and **66'** which are so positioned that as principal lug **65** flexes one spring to closing position the following auxiliary lug engages the other spring and forces and maintains separation of its contacts, against any possibility of jarring or vibrating to closed position. The principal lug **65**, in what may be termed a neutral position, which of course can never be maintained except by holding the knob, is exactly between the arms of the U-shaped spring and thus is in position to engage each of them at the best possible angle. Note that when engaged the lug contact centers transversely of the spring.

Lug **54** on knob **50** coming in contact with the ends of its groove serves as a positive stop at each end of the knob stroke, yet this is only a secondary safeguard since actual stopping of the knob is effected in a resilient manner by the principal lug **65** which is in engagement with one of the other of the arms of the U-shaped spring and serves to flex the spring above the engaging contacts, as seen, for instance, at **70** in Fig. 2, thereby bringing the knob to a quiet stop. This form of stopping the knob insures against any substantial noise in the operation of the switch and if the fingers are held on the knob until it reaches the end of the stroke, operation can be almost entirely silent.

This feature of stopping the knob by spring action is made use of where only a single pole switch is desired, as illustrated in Fig. 4. Here the arm **30** of the U-shaped spring is fitted with a contact button as in the previous embodiment, but the other arm **130** of the spring has no button nor is there a stationary one. In order that the spring may stop against something it is provided with an arcuate offset **131** to engage against the ribs **27** on the wall of the housing to stop the spring in about the same position the corresponding one is stopped by contact engagement. Thus the feel and operation of this embodiment, in its simpler form, is substantially the same as in the other or more complex switch. Obviously in this embodiment one of the terminal plates at the end **16** of the housing is omitted and its place taken by a blank of insulating material.

The spring **60**, **61** formed of piano wire or the like to generally a U-shape with one long and one short leg is a compression spring. In cases where a tension spring is desired for one reason or another the switch operating member may be altered as illustrated in Fig. 5, where the metal strip **156** is shown as equipped with a crank portion **157** having a narrow notched crank pin **158** around which the loop of helical tension spring **160** is fastened. The other end of this spring is looped about a transverse rod **161** of insulating material, the ends of which are housed in the bottoms of channels **162** formed in the facing or inner walls of the bolsters **28**. This spring has over-center action like the compression spring of the other figures and is in some cases simpler to assemble. Because of its greater length it gives a somewhat smoother action, changing less in relative length from central to end position than the compression type spring.

The U-shaped spring of the previous embodiments can be eliminated by the construction of Fig. 6 and both contact buttons secured, **230** having a foot **231** for attachment to the terminal plate strap. In this form the knob disc needs but two operating lugs **265**, **265'**. The form of spring saves a small amount of metal but is more difficult to make because of the difficulty of brazing or soldering the silver contact buttons onto the bronze spring.

It will be noted that each movable contact button is positioned substantially at a nodal point in the length of its cantilevered spring arm to produce a minimum of vibration or chattering during the closing operation. This closing operation is relatively slow, as is the opening one, because of the manual manipulation of the switch operator, which is not under control solely of the spring. When the operator moves to its over-center position and engages the contacts, continued movement flexes the upper end of the cantilever spring and rocks the contacts to insure their self cleaning and their tight engagement, which is eliminated by the over-center spring, as will be appreciated.

The construction just shown and described provides a switch which is small in size, relatively cheap to construct, effective in operation and which provides increased current carrying capacity with a relatively small number of simple parts.

I claim:

1. A slow-break, A. C. switch comprising, in combination, a housing of rectangular configuration having side and end walls, top and bottom, a terminal plate supported at each end wall, a strap on one of said plates extending along a side wall and having its free end supported thereby, a contact button on said free end with its back to said wall, a strap extending from said other plate over and supported by said bottom, a U-shaped spring having its base secured to said last mentioned strap, a second contact button intermediate the ends of one of the arms of said spring and supported thereby in separate but confronting relation to the first button, a switch operator including a knob, a shaft and a crank arm, means pivoting the shaft end in said bottom, said knob extending through and journalled in said top, a spring extending between said crank arm and the housing to provide over-center movement for said switch operator, and spaced lugs eccentrically carried by said operator and straddling the free end of said spring arm to move and hold the latter and its contact button in contact-open or contact-closed position under the action of said over-center spring.

2. The switch as defined in claim 1 in which a second terminal plate is arranged at the same end wall as that supporting the stationary contact and in turn supports a second stationary contact against the opposite side wall, a second movable contact button on the other arm of said U-shaped spring for cooperation with said second stationary contact and a third lug on said operator adapted with one of the previously mentioned lugs to straddle and actuate the other spring arm alternatively with the first.

3. A slow-break, A. C. swich comprising, in combination, a housing having side and end walls, top and bottom, a terminal plate supported at each end wall, a strap extending from one of said plates along a side wall and having its free end supported thereby, a contact button on said free end with its back to said wall, a strap extending from said other plate over and supported by said bottom, a cantilever spring secured to said last mentioned strap, a second contact button intermediate the length of said spring and supported in spaced confronting relation to the first button, a switch operator including a knob extending through and oscillatable in said top, a spring arranged to provide over-center movement for said switch operator, and spaced lugs eccentrically carried by said operator and straddling the free end of said spring arm to move it to contact-open or contact-closed position under the action of said over-center spring.

4. The switch as defined in claim 3 in which the second terminal plate is provided with an arm extending substantially parallel to and spaced above the bottom supported strap, superposed openings in said arm and bot-

tom supported strap, and in which said over-center spring is of inverted U-shape with one arm journalled in said openings and the other in direct engagement with a crank arm on said switch operator, said arms being biased toward each other by said assembly arrangement to act as a compression spring.

5. A slow-break, A. C. switch comprising, in combination, a closed housing of rectangular configuration, terminal plates oppositely mounted in the housing, a strap on one plate extending along a wall of the housing and having its end supported thereby, a contact button on said end with its back to said wall, a strap extending from the other plate over and supported by another wall of the housing, a cantilever spring arm secured to said last mentioned strap, a second contact button intermediate the length of said spring and supported thereby in separate but confronting relation to the first button, a switch operator including a knob extending through a wall of said housing for rotation therein, an over-center spring for said operator, and spaced lugs eccentrically carried by said operator and alternatively engageable with the free end of said spring arm to move and hold the latter in contact-open or contact-closed position under the action of said over-center spring.

6. The switch as defined in claim 5 in which said cantilever spring is duplicated and positioned parallel to and spaced from the first, said second spring having an arcuate, outwardly directed bight substituted for a contact button and engageable with a side wall of the housing when its spring is urged by one of said knob lugs toward "contact-closed" position whereby this spring resists and stops operator motion resiliently similarly to the first spring.

7. A slow-break, A. C. switch comprising, in combination, a housing having side and end walls, top and bottom, a terminal plate supported at and along each end wall, a strap extending integrally from one of said plates along a side wall and having its free end supported thereby, a contact button on said free end, a strap extending integrally from said other plate over and supported by said bottom, a cantilever spring secured to said last mentioned strap, a second contact button intermediate the length of said spring and supported thereby in spaced confronting relation to the first button, a switch operator including a knob and a cranked shaft, means pivoting the shaft in the bottom and knob in the top of said housing, said knob extending through said top, a tension coil spring extending between said crank and an abutment in the housing to provide over-center movement for said switch operator, and spaced lugs eccentrically carried by said operator and straddling the free end of said spring arm to move and hold the latter in contact-open or contact-closed position under the action of said over-center spring.

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