July 4, 1961 G. B. BENANDER ET AL 2,991,344

PUSH BUTTON A.C. SWITCH

Filed Oct. 31, 1958

FIG. 1.

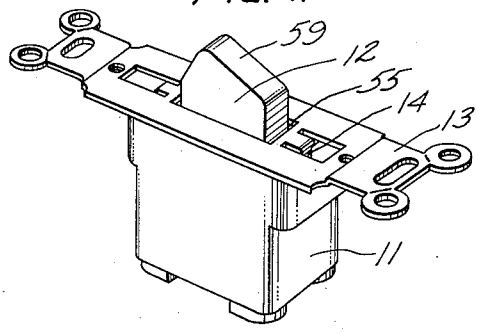


FIG. 2.

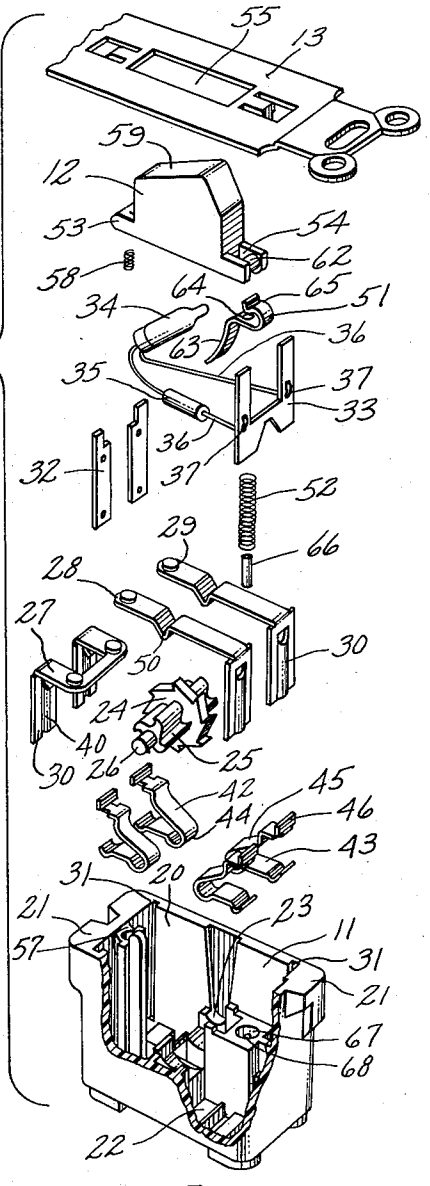


FIG. 3.

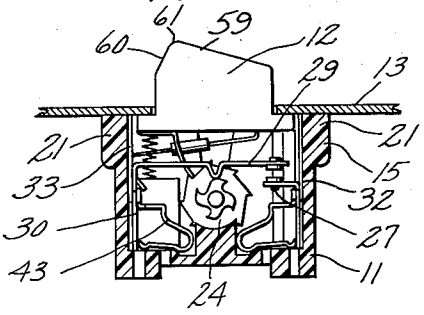


FIG. 4.

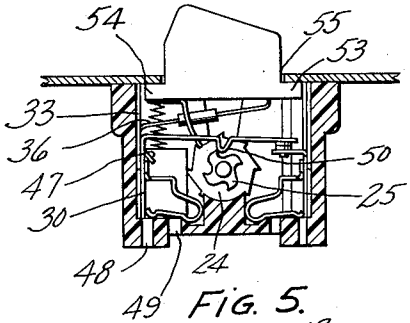
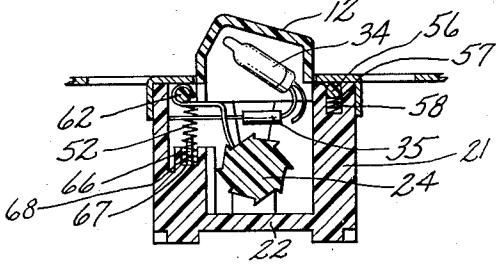


FIG. 5.



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PUSH BUTTON A.C. SWITCH

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The present invention relates to electric switches and particularly to a fast make and slow break A.C. switch with a push button switch actuator.

The increasing popularity of silent mercury switches has fostered in recent years the development of more quiet switch mechanisms for use in residental wiring. Switches that are used in D.C. circuits require a snap acting mechanism to extinguish the electrical arc that is drawn between the contacts. This does not hold true for A.C. circuits because the current reaches a zero value 120 times per second and facilitates the ease of extinguishing the arc when the circuit is opened. Since alternating current is widely used today, switches are now being designed that will only operate in alternating current circuits. Such switches have fast make and slow break contacts which make very little noise as the contacts open and close.

The principal object of this invention is to provide a quiet A.C. switch with a push button switch actuator that has a novel springing arrangement for the ratchet mechanism.

A further object of this invention is to provide a quiet sounding push button A.C. switch with a ratchet mechanism that has a spring means which performs the dual function of resisting the downward movement of the push button and supplying the pawl with the necessary resilience on the return of the button.

A further object of this invention is to provide a push button switch with a resilient bearing support and bumper means for the switch actuator to reduce the noise of the switch mechanism to a minimum.

The present invention is embodied in a compact switch design with a push button switch actuator, screwless wire terminals, and a neon glow lamp and resistor assembly within a translucent switch actuator to illuminate the actuator and serve as a "finder light." A ratchet wheel is rotatably mounted within the housing and has a camming member associated therewith that engages the movable contact means for opening and closing the circuits through the switch. The switch actuator is pivoted at one end to the switch housing while the opposite end is provided with a fulcrum means for a pawl that cooperates with the ratchet wheel. This pawl is a relatively stiff member that is pivotally mounted to the switch actuator. Associated with the pawl is a compression spring that is seated in the housing and bears against the pawl adjacent its pivoted end. This spring means serves the dual function of resisting the downward movement of the switch actuator and it also allows the pawl to pivot as the pawl wipes the teeth of the ratchet wheel when manual pressure is released from the actuator.

Our invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

FIGURE 1 is an isometric view of a push button A.C. switch embodying the present invention.

FIGURE 2 is an exploded view of the switch of FIGURE 1 showing a portion of the switch housing cut away to expose the interior thereof.

FIGURE 3 is a cross-sectional elevational view of the switch of FIGURE 1 showing the nature of the camming means for holding the movable contact of the switch in the open position.

FIGURE 44 is a cross-sectional view similar to that of

FIGURE 3 after the switch has been operated one time to close the circuit through the movable contact.

FIGURE 5 is a cross-sectional view through the center of the switch to provide an improved showing of the springing means for the pivoted pawl of the switch actuator.

Referring in detail to the drawing and in particular to FIGURE 1, there is shown a switch formed by a recessed base member **11**, a switch actuator **12** and a metal mounting strap **13**. As seen in FIGURE 3, the switch actuator **12** extends the length of the open top wall of the recessed base **11**. Hence, it is not necessary to add a separate insulating plate underneath the metal strap **13** as in prior art devices. As is commonly done in this art, metal strap **13** has bendable tabs **14** which are formed downwardly to engage with suitable abutments **15** on the end walls of the base **11** for holding the switch in an assembled condition.

Turning now to a consideration of the exploded view of FIGURE 2, the metal mounting strap **13** is shown at the top with the push button switch actuator **12** just beneath the strap. At the lower extremity of the figure the recessed base member **11** is seen with portions of the walls cut away to expose the interior thereof. The base **11** has two opposed side walls **20**, two opposed end walls **21** and a bottom wall **22**. Open bearings **23** are formed on the interior of the side walls **20** for receiving the ends of a shaft of a ratchet wheel assembly **24**. This part **24** includes the ratchet wheel, a cam member **25** on each side of the wheel and shaft-like ends or trunnions **26** that support the wheel from the open bearings of the base. This ratchet wheel assembly **24** is a composite member that is molded as a single element from insulating material.

The drawing illustrates in FIGURE 2 a three-way switch that embodies the present invention, but it should be recognized that this invention is not limited to such an application. Both the single pole and three-way switches are now being produced and they have exhibited uniformly reliable results under test. A three way switch has a common pair of fixed contacts **27** and a separate pair of movable contacts **28, 29**. The movable contacts **28** and **29** alternately engage the common fixed contact **27** for controlling the switch circuits. Each contact has a down-turned terminal **30** which is slipped into the base **11** between opposed grooves **31** and thus braced against an end wall **21**. These terminals **30** are supoprted on the bottom wall **22** of the base and are held down by suitable strips of fiber insulation **32** and **33**. The strips **32** are two in number and they engage in the same grooves **31** as do the terminals **30**. All of the strips of insulation **32** and **33** extend to the top surface of the base and are held down by the mounting strap **13**, as is best seen in FIGURE 3.

The strip of insulation **33** is made in one piece because it is associated with a neon glow lamp assembly **34** which includes a resistor **35** in series therewith. The lamp assembly has lead wires **36** which are to be connected across the movable contacts **28** and **29** so that the glow lamp will be energized when the switch circuit is open. A pair of small openings **37** are formed in the insulating strip **33** and the lead wires **36** of the lamp merely extend through the openings a short amount. When the strip **33** is forced into the base between grooves **31** on the opposite side walls **20** of the base, the lead wires **36** will be wedged between the end wall **21** and the topmost portion of the terminals **30** of the movable contacts **28** and **29**. This is best seen in FIGURE 4 of the drawing. Each contact terminal **30** has an embossed wire-receiving groove **40**. The upper portions of the terminals do not include the groove **40** so that it is possible for the strips of insulation **32** and **33** to slip down behind the contact terminals until they rest on the embossments.

As mentioned previously, the illustrated switch of this invention embodies screwless wire terminals. These terminals comprise locking members **42** which are four in number. Each locking member is provided with a spring locking tongue **43**, re-entrant end **44**, a movable offset arm **45** and an anchoring portion **46** which is engaged by a lanced tab **47** on the contact terminals **30**. Hence, the anchoring portion **46** of the locking members is incapable of moving upwardly since the contact terminals are held fixed within the base by the strips of insulation **32** and **33**. The bottom wall **22** of the base includes a wire-receiving opening **48** and an adjacent release opening **49** for each locking member **42** of the switch. Wires are fastened to the switch by merely stripping off a portion of the insulation on the end of the wire and thrusting the wire through the opening **48** to deflect the spring locking tongue **43** until the wire becomes wedged between the locking tongue and the contact terminal **30**. This locking principle is well understood in this art and is fully disclosed in the Benander Patent No. 2,705,785 that is assigned to the same assignee as is the present invention.

Turning back to a consideration of the ratchet wheel **24** with its camming members **25** on either side, the movable contact blades **28** and **29** are each provided with a cam follower **50** of folded V-shape formation for cooperation with the lobes of the cams **25**. The movable contacts **28** and **29** are inherently biased into engagement with the fixed contacts **27**. This can be seen in FIGURE 4 of the drawing where the cam **25** is free of engagement with the cam follower **50**. The opposite situation is illustrated in FIGURE 3 where the cam has been turned through an angle of 45 degrees so that a lobe or tooth of the cam supports the cam follower **50** in a raised position, thereby holding the circuit open. The two camming members **25** which are on opposite sides of the ratchet wheel **24** are out of phase with each other so that when one cam member holds contact blade **28** open, the other cam member will allow the contact blade **29** to close, and vice versa. This is necessary for the proper operation of a three-way switch, as will be understood by those skilled in this art. As illustrated in FIGURE 3, one of the movable contacts **28** or **29** is always pressing down on the ratchet wheel assembly **24** to retain the assembly in its bearings **23**. In the single pole switch, an additional through-splice contact (not shown) of generally U shape is used with the single movable and fixed contacts to hold the ratchet assembly down. The two arms of the U-shaped through-splice contact are terminal ends such as terminals **30** and they are confined against the opposite end walls **21**. The base of the U-shaped contact merely bridges the two arms or terminals although it is adapted to engage with the related cam member **25** to confine the ratchet assembly in place.

The most important part of the present invention lies in the mechanism for turning the ratchet wheel assembly **24**. This mechanism is exemplified by the switch actuator **12**, a relatively stiff ratchet pawl **51** and a compression spring **52**. First, the switch actuator **12** is a member of insulating material that extends from one end wall **21** to the other, although the actuator is not wide enough to span the space between the side walls **20** of the base. The actuator **12** is of translucent insulating material of ivory color and it is hollow, as seen in FIGURE 5, to receive the neon glow lamp **34**. The actuator has two end extensions **53** and **54**. The main portion of the actuator **12**, except for the end extensions **53** and **54**, protrudes through an opening **55** in the metal strap **13**. The end extension **53** is a pivot member that has a cross piece **56** which is adapted to seat in an open bearing **57** that extends from one end wall **21** of the base, as best seen in FIGURE 2. To reduce the noise of the switch action, a miniature spring **58** is fastened in the bearing to resiliently support the pivoted end of the actuator and take up any looseness of fit. An alternative would be to substitute a slug of rubber for the spring **58**. To obtain the greatest mechanical advantage, it is preferable to apply manual pressure at a point on the actuator that is remote from the pivoted end **53**. Accordingly, the top surface of the actuator is provided with an inclined surface **59** that merges with a perpendicular slope **60**, thereby forming an apex **61**. Usually, the switch will be mounted in the wall so that the apex **61** will be toward the lower edge of the switch box. Hence, the inclined surface **59** will be facing upwardly toward the person operating the switch. Then it is possible to rub an elbow down over the inclined surface **59** of the actuator to operate the circuit.

The opposite end **54** of the actuator has a similar cross member **62** and it is adapted to support the pawl **51**. The pawl is a relatively stiff member of steel or the like material. It may be considered as having three sections, namely, a blade section **63**, a flat heel portion **64** and a clip-on end **65**. The clip end **65** is adapted to slip over the cross piece **62** of the actuator, as is best seen in FIGURE 5. The bottom of the actuator bears on the heel portion **64** of the pawl. When downward pressure is exerted on the actuator, the blade **63** of the pawl will engage the ratchet wheel **24** and turn it through an eighth of a turn or 45°. A compression spring **52** bears upwardly against the heel portion **64** of the pawl adjacent the clip end **65** to satisfy a dual function. This compression spring **52** not only resists the downward movement of the switch actuator **12** and returns the actuator to the raised position when manual pressure is released. The spring also allows the steel pawl **51** to pivot about its fulcrum as the blade **63** of the pawl wipes the teeth of the ratchet wheel when the actuator is returning to its raised position. Since the resilient action of the pawl is supplied by the compression spring **52**, the pawl may be made quite rigid, thereby increasing its life span since it is necessary that it act as a compression member in turning the ratchet wheel. As seen in FIGURE 2, the lower end of the compression spring **52** is provided with a rubber insert **66** which extends within the spring. The spring in turn is seated in a well **67** in the base. The well **67** has a central pin or post **68** over which the spring is dropped. Hence, the rubber insert **66** rests on the post **68** and serves as a stop to cushion the depression of the actuator. The introduction of the novel bearing spring **58** and the bumper **66** represent refinements which lighten the action of the switch and reduce its noise to a minimum.

Having described above our invention of a novel push button A.C. switch, it will be readily apparent to those skilled in this art that we have reduced the complexity of the switch mechanism and added several conveniences such as the screwless terminals and the neon glow lamp assembly with a push button switch actuator. We have combined the actuator-return spring with the rigid pawl member so that the pawl of the switch can be expected to have a long life before failure due to fatigue should occur. The switch is remarkably quiet and easy to operate with only a slight manual pressure.

Modifications of this invention will occur to those skilled in this art and it is to be understood, therefore, that this invention is not limited to the particular embodiments disclosed but that it is intended to cover all modifications which are within the true spirit and scope of this invention as claimed.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An electric switch comprising a housing, a ratchet wheel pivotally supported in the housing, fixed and movable contact means included in the housing, a cam member associated with the ratchet wheel for turning therewith and engageable with the movable contact means for opening and closing the circuit through the switch, a pivoted switch actuator being pivoted at one end on a portion of the housing, the mid-section of the actuator

constituting a finger piece which extends outwardly of the housing, the opposite end of the actuator having a pivoted pawl that hangs down below the actuator and is engageable with the teeth of the ratchet wheel, and spring means seated in the housing and bearing against the pawl adjacent its pivoted end, the spring serving to resist the downward movement of the actuator and return the actuator to its normal position after it has been depressed, the same spring means also allowing the pawl to pivot as the pawl wipes the ratchet teeth as the actuator returns to its normal position.

2. An electric switch comprising a hollow housing, a ratchet wheel having a shaft that is supported on the opposite side walls of the housing, camming means included on the shaft for turning with the ratchet wheel, fixed and movable contact means assembled in the housing, the movable contact means being operated by the camming means for controlling the opening and closing of the circuits through the switch, a push button switch actuator pivotally mounted with a finger piece extending outwardly of the housing, the push button having two end extensions, one extension including pivot means about which the push button will fulcrum, the opposite extension serving as a pivot means for a pawl, the pawl having a free end that is engageable with the teeth of the ratchet wheel so that downward pressure exerted on the push button will force the pawl to rotate the ratchet wheel, a compression spring seated in the housing and bearing upwardly at its opposite end against the pawl adjacent its pivotal support, the spring serving the dual function of resisting the downward movement of the push button and also resisting the pivotal movement of the pawl as the pawl wipes the teeth of the ratchet wheel after manual pressure is released from the push button.

3. An electric switch comprising an insulating housing, a ratchet wheel assembly pivotally suspended in bearings within the housing, a cam member arranged on opposite sides of the ratchet wheel and movable therewith, electrical contact means in the housing which overlie the cam members and confine the ratchet assembly in its bearings, a switch actuator that is pivotally supported at one end from the housing, the opposite end of the actuator carrying a pawl that cooperates with the ratchet

wheel, a compression spring seated in the housing and bearing upwardly against the pawl so that the depression of the actuator will force the pawl to turn the ratchet wheel with its cam members thereby controlling the circuitry of the said contact means.

4. An electric switch as recited in claim 3 wherein the pawl is pivotally mounted to the actuator, and the compression spring bears against the pawl adjacent this pivotal mounting, whereby the spring resists the depression of the actuator and allows the pawl to pivot aside as the pawl wipes the teeth of the ratchet wheel once manual pressure is released from the actuator.

5. An electric switch as recited in claim 4 wherein a rubber-like bumper is confined within the lower extremity of the spring and serves as a resilient stop.

6. An electric switch as recited in claim 4 wherein the switch actuator is pivotally supported in an open bearing that includes a resilient seat for reducing the noise of the switch mechanism.

7. An electric switch with a ratchet mechanism for controlling the position of a movable contact of the switch relative to a fixed contact, a pivoted switch actuator that supports a pawl which forms a part of said ratchet mechanism, the actuator being pivotally mounted in a bearing, the bearing having a spring seat for resiliently supporting the actuator.

8. An electric switch as recited in claim 7 wherein the ratchet mechanism includes a compression spring that resists the depression of the switch actuator, the interior of the spring having a rubber-like bumper at its lower extremity which acts as a stop member to reduce the noise made by the switch mechanism.

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