May 5, 1959 R. H. BENTLEY ET AL 2,885,515

SINGLE-BUTTON ACTUATED SLOW MAKE AND BREAK SWITCH

Filed Nov. 6, 1956 3 Sheets-Sheet 1

FIG. 2

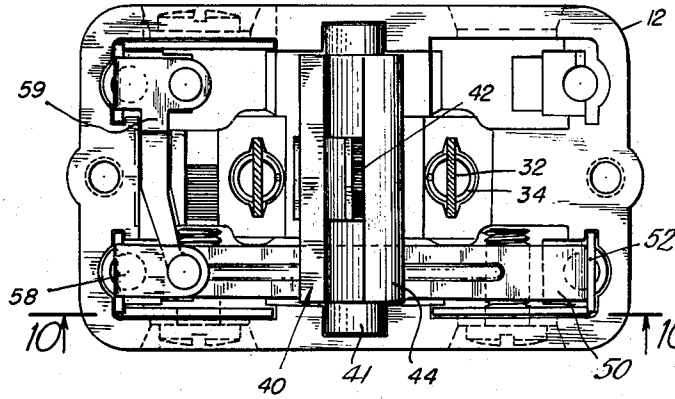


FIG. 4

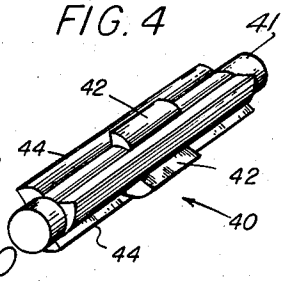
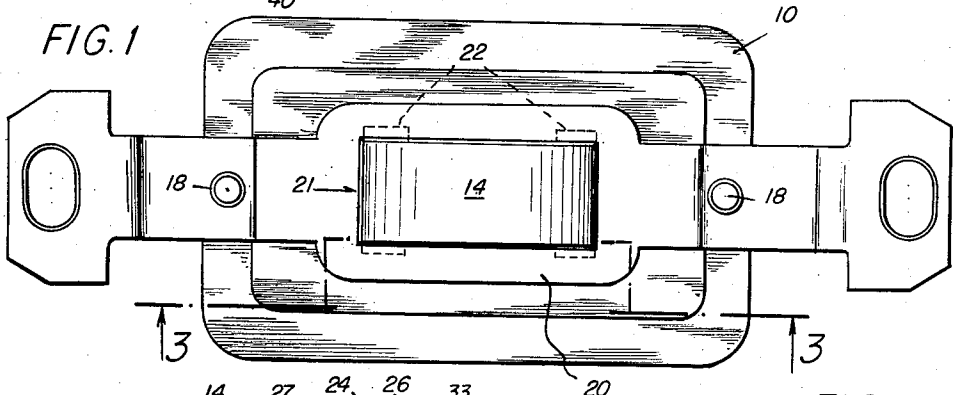


FIG. 1



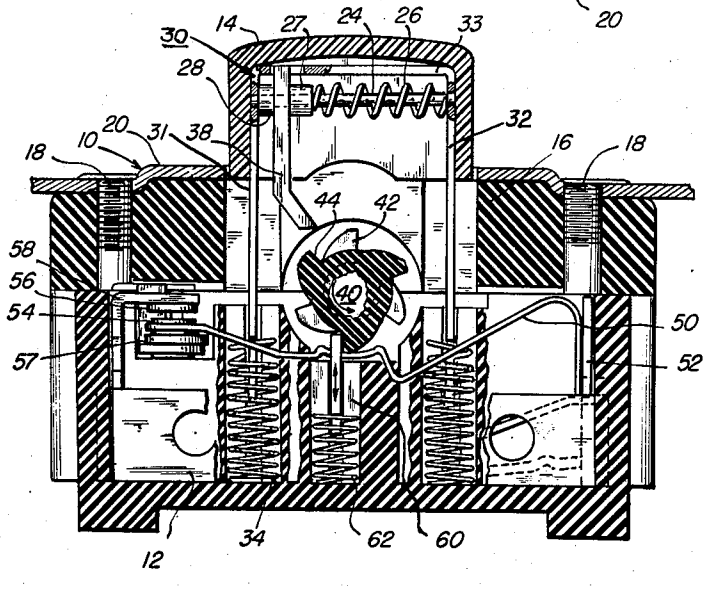
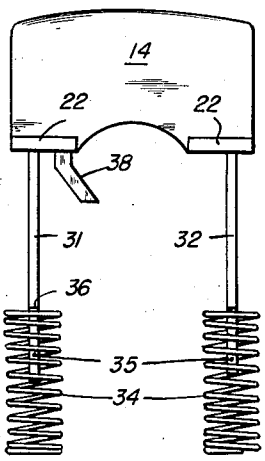


FIG. 3

FIG. 5



INVENTORS
John E. Aspinwall
Robert H. Bentley
By their attorneys
Howson and Howson

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FIG. 6

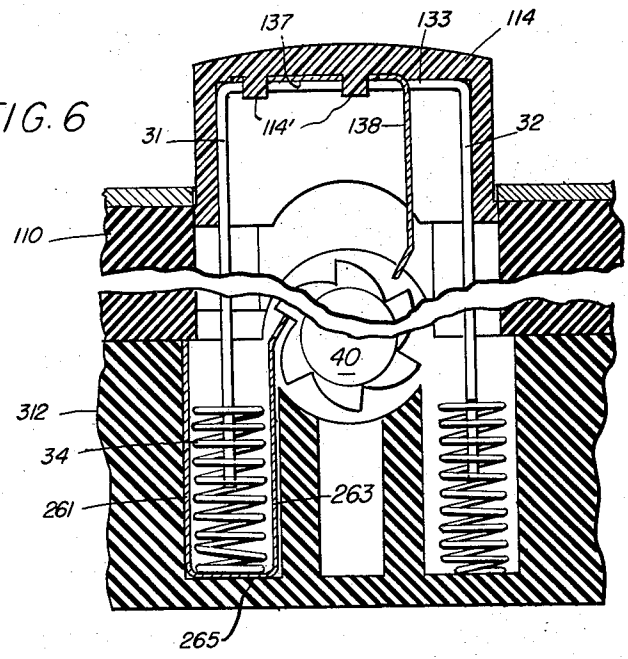


FIG. 8

FIG. 7

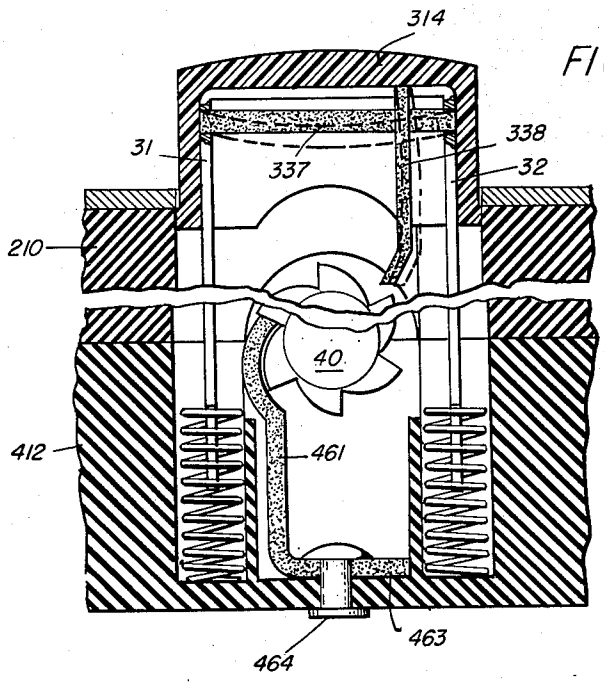


FIG. 9

INVENTORS
John E. Aspinwall
Robert H. Bentley
By their attorneys
Howson and Howson

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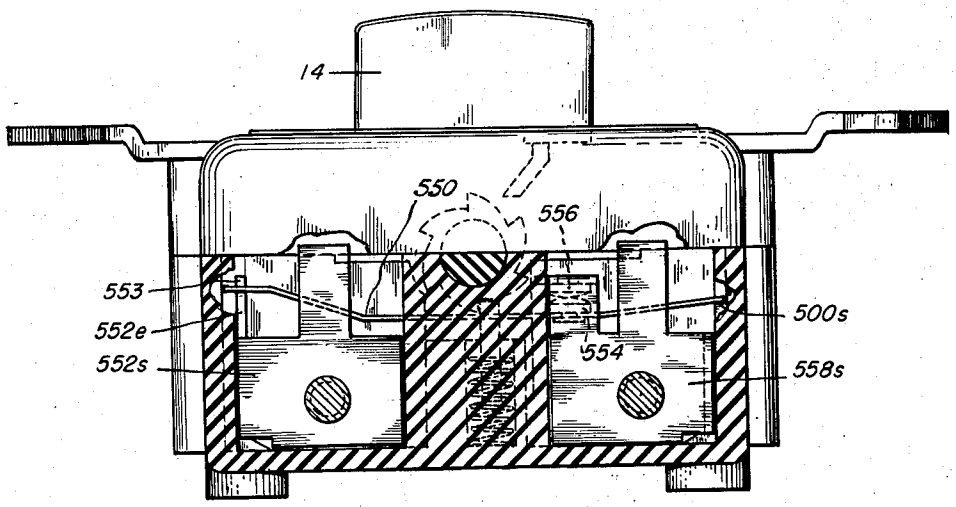


FIG. 10

FIG. 11

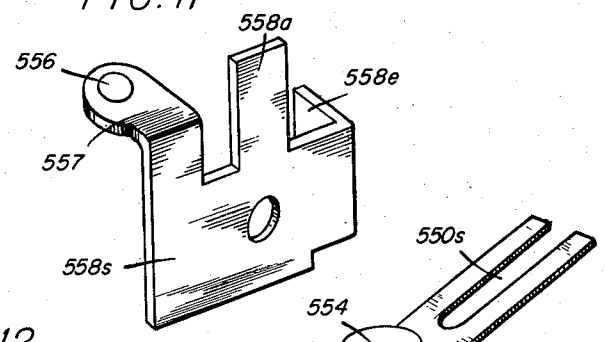
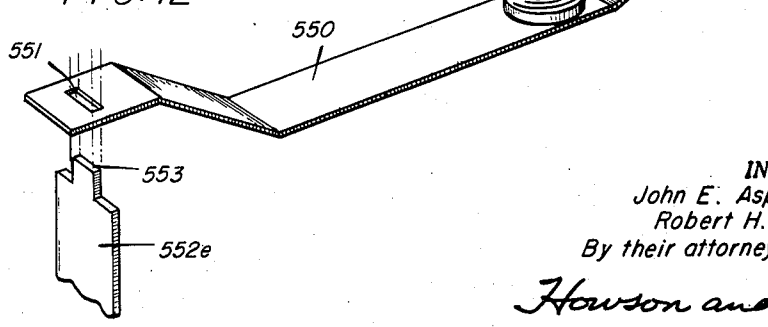


FIG. 12



INVENTORS
John E. Aspinwall
Robert H. Bentley
By their attorneys
Howson and Howson

United States Patent Office 2,885,515 Patented May 5, 1959

2,885,515

SINGLE-BUTTON ACTUATED SLOW MAKE AND BREAK SWITCH

Robert H. Bentley, Hartford, and John E. Aspinwall, Bolton Center, Conn., assignors to The Arrow-Hart & Hegeman Electric Company, Hartford, Conn., a corporation of Connecticut

Application November 6, 1956, Serial No. 620,658

8 Claims. (Cl. 200—156)

This invention relates to electric switch mechanisms and more particularly to mechanisms for slow making and breaking engagement of switch contacts, preferably butt-type contacts. The invention, moreover, relates to a single push-button-actuator for the switch, the switch mechanism being particularly adapted for operation by a single operating button whose actuation causes alternate making and breaking of the contacts as the button is successively depressed.

Objects of the invention are to provide a single-push button operated switch of the slow-make-and-break type which is certain and reliable in operation over long periods, which may be made mainly from sheet materials or molded insulation parts, which may be easily and economically assembled and which is adapted to single or double pole or three or four way usage.

Other objects of the invention will appear as it is described in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a plan view of a switch embodying the invention.

Fig. 2 is a plan view of the switch of Fig. 1 with the cover and supporting bridge removed.

Fig. 3 is a longitudinal section view taken along line 3—3 of Fig. 1.

Fig. 4 is a perspective view of the rotor.

Fig. 5 is a detailed view in side elevation of the push button return springs and guide member.

Figs. 6 and 7 illustrate two other forms of push button and pawl structure.

Figs. 8 and 9 illustrate two other forms of catch to prevent return rotation of the rotor.

Fig. 10 is a side elevation view partly broken away and in longitudinal section of another form of fixed and movable contact arrangement.

Figs. 11 and 12 are perspective views of the fixed contact and terminal and of the movable contact and terminal, respectively, of Fig. 10.

Referring to Figs. 1–5, the parts are mounted within an insulating casing comprising cover and base portions **10, 12.** The base is hollowed out to receive the various parts hereinafter described. The cover portion fits upon and overlies the base which has a rectangular opening **16** in its center in which is mounted a depressible button **14.** The cover and the base are held together by securing screws **18** passing through holes bored through the bottom of the base and through the cover, and threading into tapped holes in a metallic mounting strap or bridge **20** which lies upon the cover and fits in a molded recess in the top surface thereof. A hole is formed in the center of the bridge to permit the button to reciprocate through it. Four shoulders **22** are formed at the inner corners of the button and project laterally outward from the sides thereof, so as to engage with the under or inner surface of the bridge when the button is spring-pressed outwardly to the maximum of its travel. The shoulders limit the movement of the button in an outward direction.

The button is hollowed out to receive a U-shaped

guide member **30** stamped from sheet metal having legs **31, 32** extending inwardly into the casing. The transverse portion **33** of the guide member is lodged adjacent the ceiling of the button. Coiled compression springs **34** each have one end seated on the bottom of parallel spaced bores running from front to back in the base **12.** Their other ends are around fingers **35** extending from the lower or inner ends of the legs **31, 32** and engage shoulders **36** between the fingers and legs to push the guide member and push button up until stopped by the push button shoulders **22** engaging the bridge **20.**

Mounted upon a rod **24** within the button **14** and parallel to the transverse portion of the guide member is a coiled compression spring **26,** one end of which presses against one of the legs of the guide member while the other end presses a pushing or spacing sleeve **27** on the rod which, in turn, presses against a pawl member **38.** The pawl member **38** made of Bakelite or other suitable material is spaced from the opposite leg of the guide member by a spacing washer or bushing **28.** In this fashion, the pawl is resiliently held upon the rod by the spring. There is an aperture through the top of the pawl for the rod to pass through, the aperture being large enough to permit the pawl to tilt on the rod **24** as the button is depressed, as will hereinafter more fully appear.

The lower end of the pawl **38** is inclined inwardly and is adapted to engage a radial face on one or another of a series of ratchet teeth **42** around the periphery of an insulating rotor **40** or switch contact actuating member.

The rotor is preferably a molded insulation member. As viewed in Fig. 4, this member comprises journal portions **41** at opposite ends adapted to fit in bearings in the top and bottom adjacent surfaces of the base and cover, respectively. This rotor also has formed on it three actuating-cam surfaces or teeth **44.**

These actuating cams are endwise extensions of alternate ratchet teeth, as may be readily seen in perspective view in Fig. 4. In the form illustrated there are six ratchet teeth located at the center of the rotor, each comprising a flat surface extending approximately radially and an arcuate surface curving from the outer edge of the radial surface toward the periphery of the rotor body. As the button **14** is depressed, the pawl **38** engages with the flat radial surface of the teeth, causing rotation of the rotor until the button is fully depressed. As the button reaches the lower end of its depression, the inner end of the pawl is required by the body of the rotor to move radially outward slightly. This outward movement or tilting of the pawl **38** is permitted by reason of the spring mounting of the upper end of the pawl upon the rod, as hereinbefore described.

For operating flexible movable contact members such as **50,** the cam-actuating extensions of alternate ratchet teeth overlie and engage the surface of the movable contact member.

The movable contact **50** consists of a flexible strip of thin sheet metal extending lengthwise of the casing, being anchored on one end by attachment to a terminal plate **52** conventionally held in slots running from front to back of the casing. The other or free end on the contact has contact button **54** on its top or bottom surfaces, or both, for engagement with fixed contact buttons **56, 57** on conventional terminal plates **58, 59** also fitted in slots in the casing.

When the rotor is in the position shown in Fig. 3, the high point of one of the contact engaging cam-actuating extensions **44** is in engagement with the movable contact **50** and has moved it as far as possible to cause disengagement of the upper button **54** on the end of the contact from the top fixed contact button **56** overlying the same.

The next time the operating button **14** is depressed,

the rotor will be caused to move 60°. Since there is no contact engaging extension on alternate ratchet teeth, there is a space which permits the movable contact to rise by its inherent spring bias to cause the top contact button to engage with the top fixed contact again. The switch may be made in single-pole, double-pole, three-way or four-way form.

In order to prevent the rotor from reversely rotating after it has been moved to cause opening or closing of the switch contact, a locking catch **60** in the form of a small flat plate stamped from sheet material is reciprocatively mounted in diametrically opposite slots in the sides of a bore in the bottom of the base. A coiled compression spring **62** is located between the catch and the bottom of such bore. The upper end of the catch **60** engages the flat or radial surface of the ratchet teeth and, thus, prevents reverse rotation as may readily be seen by reference to Fig. 3. Upon the next rotation of the rotor, the curved inclined surface of the next ratchet tooth will cause depression of the catch until the edge of the next tooth reaches the edge of the catch, at which time the catch will snap into locking position thus to prevent reverse rotation of the rotor from the new position.

In Fig. 6 another form of pawl is illustrated consisting of an inverted L-shaped strip of thin metal stamped from Phosphor bronze or other resilient metal. In this and in other subsequent forms, like reference numerals represent like parts of the previous described form; and equivalent parts of different configurations are represented by reference numerals in different hundreds.

One leg **137** lies flush against the ceiling of the button **114** and between it and the transverse portion **133** of the spring guide member **30**. An aperture is provided, in this transverse portion, for the other leg **138** of the pawl to extend through toward the rotor **40**. The inner end of the leg **138** is bent toward the rotor so as to engage the ratchet teeth as the button is depressed. Due to the resilient nature of the pawl, the leg **138** may flex laterally or radially away from the rotor as the operating button **114** is depressed, in a manner similar to the tilting of the pawl **38** in the previously described form.

Nubs **114'** may be formed on the interior surface or ceiling of the operating button **114** passing through apertures stamped in the leg **137** and having a friction fit therewith, if desired.

The spring guide **30** presses against the leg **137** also tending to hold the pawl in place.

In Fig. 7, another form of pawl is illustrated. The pawl in Fig. 7 is formed from nylon and is of generally cross shape. One member **337** of the cross is parallel to the ceiling of the button while the other, **338**, extends perpendicularly thereto with one end being longer than the other and extending down toward the rotor. The end of the extending leg **338** is turned toward the rotor. Due to the resilience of nylon, when the inturned end of the member **338** is flexed by the rotor, as the button is depressed, it can move laterally (see dotted lines). At that same time, the member **337** of the pawl may bend (see dotted lines). As the button is restored when finger pressure is removed therefrom, the pawl will return to its original condition as illustrated in full lines.

In Fig. 8, there is illustrated an alternate form of catch for preventing reverse rotation of the rotor. In this figure, the catch is located in the recess in which one of the return springs **34** is located, the recess being enlarged and made rectangular to accommodate the catch. The catch consists of a U-shaped thin sheet metal strip having one leg **263** longer than the other and with the end of the longer leg turned toward the rotor. The other leg **261** is supported by the base **312** when the longer leg is put under lateral stress. The return spring **34** rests at its bottom upon the transverse portion **265** of this catch member. The leg **263**, being flexible, will move laterally as the rotor turns to permit the rotor teeth to pass over the inturned end which thereafter will snap behind each tooth in succession, preventing reverse rotation.

In Fig. 9, a third form of catch is illustrated. In this instance, the catch is made from nylon or other similar flexible material and is formed in L-shape. A bottom leg **463** of the L rests upon the floor of the casing and is secured thereto by a rivet **464** which passes through the bottom of the casing and through a hole punched in the leg **463**. The other leg **461** of the catch extends upwardly from the bottom of the base toward the rotor and is formed arcuately at its upper end to fit around the curvature of the ratchet teeth. Due to the flexibility of the material from which the catch is made, the leg **461** may move laterally as the rotor is turned and as each ratchet tooth presses against the end of the catch. After passing over the edge of a tooth, the catch will snap into its original position as illustrated in Fig. 9 to prevent return rotation of the rotor.

In Fig. 10, another form of a combined terminal and fixed contact member and of movable contact for cooperation therewith is illustrated. In this form, the movable contact **550** is a strip of thin flexible metal extending longitudinally of the casing as in Figs. 2 and 3. The movable contact, however, need not necessarily have a hump in the center thereof but is straight, as illustrated. The left end of the contact (as viewed in Fig. 10) is connected with a combined terminal and contact mounting member **552** which is stamped from sheet metal into L-shape with one part **552***s* lying along the interior side surface of the base and the other part **552***e* lying along the interior surface of the end wall of the base and extending upward nearly to the top of the casing. On the top of this end portion, there is a projection **553** or finger which extends through an aperture **551** in the end of the movable contact strip **550** and is peened over thus to hold the movable contact strip upon the top of the end portion **552***e* of the terminal.

In this form, the other end of the movable contact (the right end as illustrated in Fig. 10) instead of being free to move, is pressed down on a shoulder **500***s* formed in the end of the casing just below the top edge thereof. The flexible contact is thus supported at both ends. The rotor imparts pressure at the center of the movable contact **550** and thus holds the right end upon the shoulder **500***s*, the left end being held on the terminal and support member **552**.

A movable contact button **554** is mounted upon the flexible contact member between the point of engagement of that member by the rotor and the shoulder-engaging end. This movable contact button is adapted to engage and be separated from a fixed contact button **556** mounted above it on an overhanging arm **557** which is bent inwardly of the casing from an upward extension of the side **558***s* of the contact-supporting and terminal member. This contact-supporting and terminal member may conveniently be stamped from sheet metal into the form shown in Fig. 11. As there shown, the body portion **558***s* is adapted to lie along the side of the casing and has, in addition to the upward contact supporting extension, another extension **558***a* situated generally midway along the upper edge of the body portion which is adapted to be engaged at its top by the cover of the casing, thus to hold the terminal member down in place.

The terminal member is bent into L shape, providing an end portion **558***e* which lies along the end wall of the casing. The edge of the end portion of the terminal and contact supporting member may lie in a vertical slot in the casing to hold the terminal from moving lengthwise in the casing.

From the foregoing, it will be observed that when the rotor is turned by depression of the operating button **14** the movable contact will be bent downwardly at its center, separating the movable contact button **554** from the fixed contact button **556** while both ends of the movable contact **550** are supported within the casing. Upon

the next depression of the operating button, the rotor will turn permitting the movable contact to move upwardly until the movable button engages the fixed button. At this point, the flexible strip is still under stress (providing the necessary pressure of the movable button 554 against the fixed button) because the ends of the contact strip are still maintained on their supports hereinbefore described. Thus, in both positions of the movable contact, the flexible strip is under compression. This avoids bouncing or chattering of the movable contact button against the fixed contact button.

In order to increase the flexibility of the strip at the end thereof nearer the contact button 554, a longitudinal slot 550*s* is formed therein running from near the button toward the end, or entirely to the end, if desired.

From the foregoing, it will be observed that we have provided a number of forms in which our invention may be embodied in a single push-button-actuated switch mechanism whose parts may be easily and economically formed from conventional and readily available materials, and which may be assembled readily. In usage, the invention is positive in operation and reliable for many thousands of successive operations.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the specific embodiments illustrated and described.

What is claimed is:

1. In an electric switch, a hollow insulating base, a hollow depressible push button, means to restore said button to original position when manual pressure is released, a rotor operable by movement of said button, a rod transversely mounted in said button, a pawl slidably mounted on said rod, spring means on said rod resiliently maintaining said pawl in a predetermined position thereon, said pawl being engageable with said rotor to move it as said button is moved, a flexible contact member engaged and movable by said rotor between two switching positions, a fixed contact engageable by said movable contact member in one of its positions.

2. In an electric switch, a hollow insulating base, a depressible push button, means to restore said button to original position when manual pressure is released, a rotor having teeth thereon, a pawl movable concomitantly with said button and engageable with said rotor to turn the rotor, a movable contact operable by said rotor as said rotor turns, a fixed contact engageable by said movable contact in one position thereof, means to positively prevent reverse rotation of said rotor comprising a resilient U-shaped catch member mounted in said base and biased to engage with said rotor and having a leg engageable with said rotor and a second leg parallel to the first and supported by a wall in said base, said restoring means comprising a U-shaped guide member seated in said button and having legs extending into said base, and springs engaging said legs, one of said springs being between the legs of the catch member.

3. An electric switch as claimed in claim 1 wherein said restoring means comprises a U-shaped guide member seated in said button straddling said motor and having legs in said base, and springs engaging said legs biasing said guide member and button.

4. In an electric switch, a hollow insulating base, a depressible push button, means to restore said button to original position when manual pressure is released comprising a U-shaped guide member seated in said button and having legs extending into said base, springs engaging said legs biasing said guide member and button, a rotor having teeth thereon, a pawl movable concomitantly with said button and engageable with said rotor to turn the rotor, a movable contact operable by said rotor as said rotor turns, a fixed contact engageable by said movable contact in one position thereof, means to positively prevent reverse rotation of said rotor comprising a catch separate from said button and biased into engagement with the rotor and mounted in said base, the rotor engaging portion of said catch being movable radially away from said rotor as the latter turns and snapping behind successive teeth as the rotor turns, thereby preventing reverse rotation from successive rotor positions.

5. An electric switch as claimed in claim 1 wherein the means to positively prevent reverse rotation of said rotor comprises a catch member slidable radially with respect to the rotor in slots in the base, and spring means in the base pressing said catch toward said rotor for snapping behind successive teeth as said rotor turns.

6. An electric switch as claimed in claim 1 wherein the means to positively prevent reverse rotation of said rotor comprises a resilient catch having an arm engageable with said rotor and a second arm at an angle to the first supported from the base, the rotor engaging portion of said first arm being movable radially from the rotor and adapted to snap behind successive teeth thereon.

7. An electric switch as claimed in claim 1 wherein the means to positively prevent reverse rotation of said rotor comprises a resilient U-shaped catch member mounted in said base and having a leg biased into engagement with said rotor, and a second leg parallel to the first and supported by a wall in said base.

8. In an electric switch, a hollow insulating base, a hollow depressible push button, means to restore said button to original position when manual pressure is released comprising a U-shaped member straddling said rotor and having its transverse portion within said button and its legs extending into said base, spring means in the base biasing said U-member and button, a rotor operable by movement of said button and having a ratchet portion thereon, a pawl mounted within said button comprising a resilient member having one leg extending interiorly toward the rotor and a second leg at an angle to the first supported transversely of the button and flexing to enable tilting of said first leg toward and from said rotor, said second leg of the pawl being parallel to the transverse portion of the U-member and the first leg of the pawl being parallel to the legs of the U-member, said pawl being engageable with said ratchet portion to turn said rotor, a flexible contact member engaged and movable by said rotor between two switching positions, and a fixed contact engageable by said movable contact member in one of its positions.

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