Dec. 20, 1960 H. P. LEWIS ET AL 2,965,737

ELECTRICAL SWITCHING DEVICE

Filed July 22, 1957 2 Sheets-Sheet 1

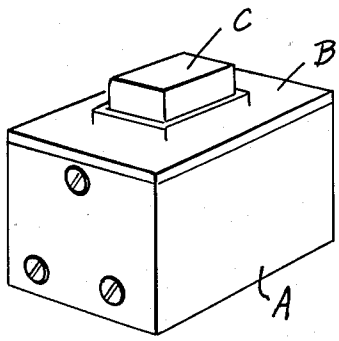

Fig. 1.

Fig. 2.

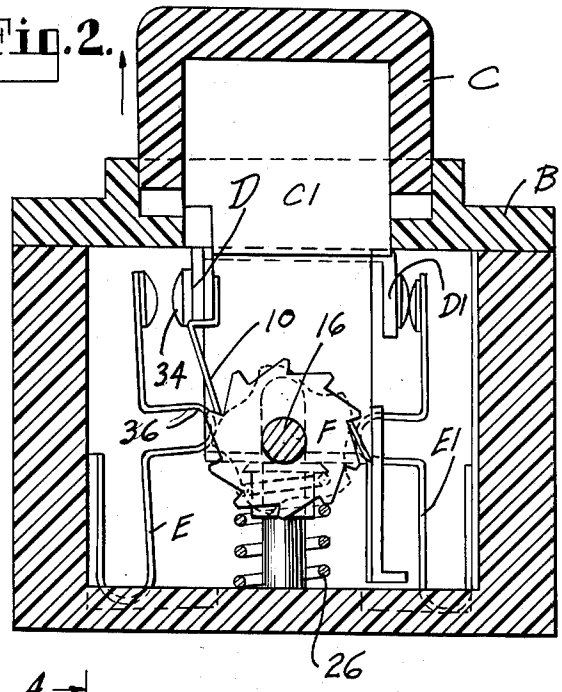

Fig. 3.

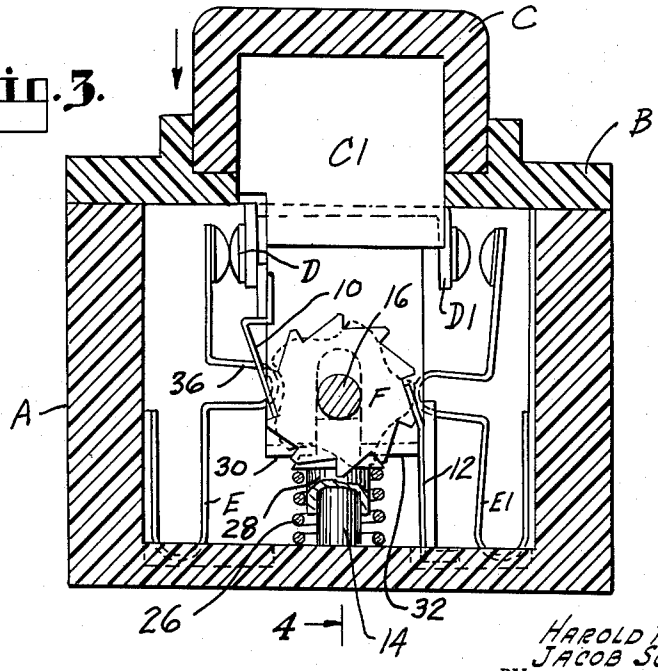

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Fig. 4.

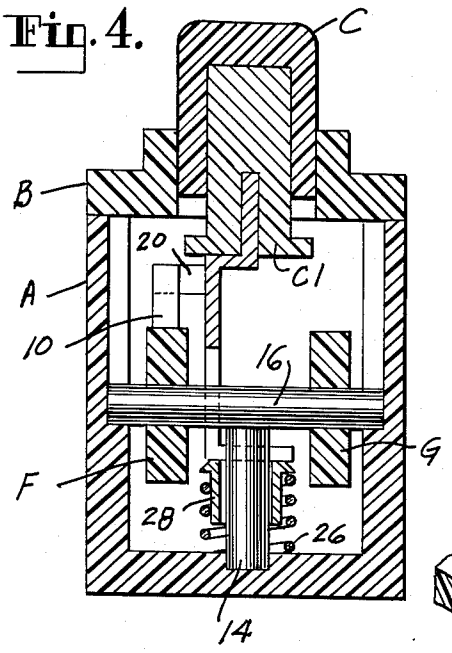


Fig. 5.

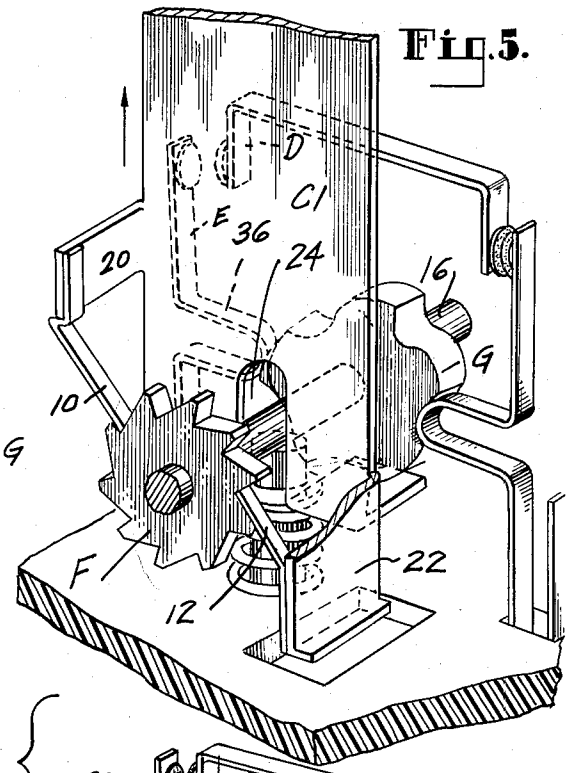


Fig. 6.

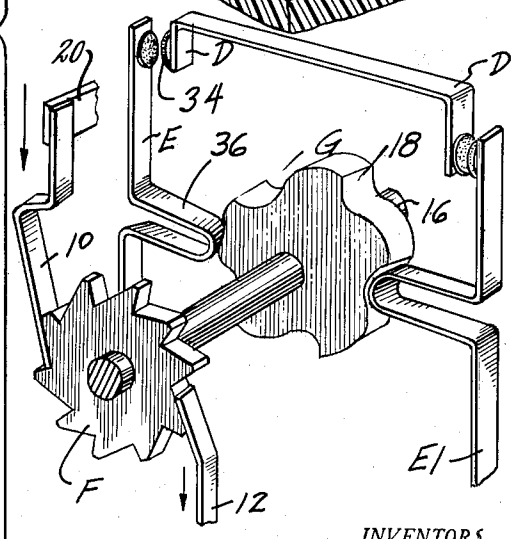
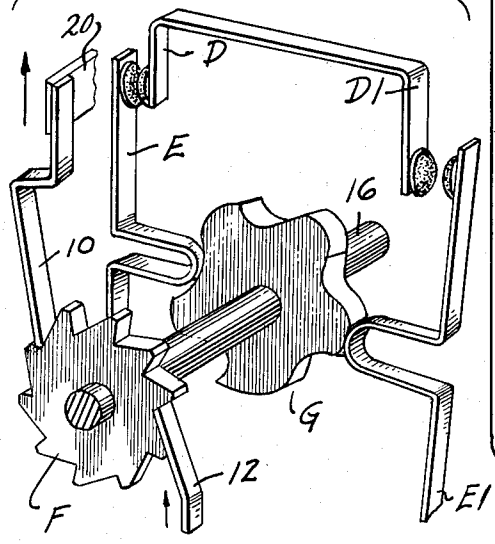


Fig. 7.



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United States Patent Office

2,965,737

Patented Dec. 20, 1960

2,965,737

ELECTRICAL SWITCHING DEVICE

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Filed July 22, 1957, Ser. No. 673,336

3 Claims. (Cl. 200—156)

Our invention relates to an electrical switch wherein the circuit is made by applying a direct linear pressure to the control button and releasing the button, and the circuit is broken by repeating the identical operation of pressing and releasing the control button.

This invention is a continuation-in-part of our prior filed patent application, Serial No. 570,302, filed March 8, 1956, and which is now Patent No. 2,820,113, January 14, 1958.

A primary object of our invention is to construct an electrical switch which opens and closes the circuit by repeatedly pressing the push button, which may be assembled on a "Despard" type of mounting plate.

It is an object of our invention to provide a shallow and narrow electric switch wherein a ratchet wheel which is securely mounted on the same shaft that carries and rotates a cam moves one of the electrical contacts to open or to close the electrical circuit.

Another object of our invention is to provide a switch which opens and closes an electrical circuit by repeatedly pressing and releasing the push button, which is simple in construction and which has relatively few parts as contrasted with our invention as set forth in our prior filed application, Serial No. 570,302.

Another object of our invention is to provide an electrical switch which opens and closes an electrical circuit by repeatedly pressing and releasing the push button, which has a relatively small number of parts and which is easily and accurately assembled in production.

Another object of our invention is to provide a switch which will carry a heavy load over a relatively large period of time without being rendered inoperable.

Another object of our invention is to provide an electrical switch which is actuated by a push button that opens and closes the circuit by repeatedly pressing the push button and which carries two actuating pawls, one of which always serves as a locking pawl.

Our invention is applicable to a single circuit as well as a double circuit switch, a three-way switch, or a four-way switch.

It is an object of our invention to provide a switch to control the energizing or de-energizing of an electrical circuit by applying a direct pressure to the control button instead of turning, twisting, or flipping a control knob or lever.

Another object of our invention is to provide an electrical switch wherein the contacts will assume a fully "on" position or a fully "off" position.

Another object of our invention is to provide an electrical switching device with a single push button which is adaptable either to manual operation, such as electric light circuits and home appliances, or to automatic operation, such as in the control of circuits in automatic machinery.

Another object of our invention is to provide an electrical push button switching device which is relatively quiet in operation compared with existing switches.

Another object of our invention is to provide an electrical switch which is sufficiently small and sturdy to fit into "Despard" type switch plates.

A further object of our invention is to provide an electrical switching device of the push button type which, because of its size, and particularly because of the shape of the operating button thereof, will fit all installations where standard type toggle switches are now used, making it unnecessary to replace wall boxes and switch plates when the switching device revealed herein is used as a replacement for toggle type switches.

Another object of our invention is to provide an improved electrical switch which controls the circuit in "on" position by direct pressure upon and release of the control button and wherein the same control button is pressed and released to de-energize the circuit to "off" position. In other words, the circuit is alternately changed even though the identical linear pressure is repeated.

Another object of our invention is to provide an electrical switch applicable to controlling household electrical circuits wherein the terminals, upon assembly, readily slide into position within a complementary casing.

It is another object of our invention to provide an electrical switch which may be rapidly and accurately assembled, and wherein the switch will have a long and useful life.

Another object of our invention is to provide an electrical switch wherein the circuit is controlled by a cam which is actuated by a ratchet wheel mounted upon the same shaft, and wherein the shaft is held in its bearings by insulated strips.

Another object of our invention is to provide a cam for actuating the make-and-break contacts of an electrical switch whereby the cam allows only the extreme fully "off" or fully "on" position.

In order to achieve the aforementioned objects, we utilize a casing wherein the electrical contacts are located, and the contacts are actuated by means of a cam mounted upon the same shaft as the ratchet wheel wherein the ratchet wheel is actuated by a push button which carries two pawls to move the ratchet wheel wherein one pawl moves the ratchet wheel one ratchet tooth and the other pawl moves the ratchet tooth a second ratchet tooth and wherein one of the two pawls also serves as a locking pawl.

In certain motor loads, it is customary, and even required by the underwriters, to break the circuit on both sides, which our invention will do, otherwise the live line may not be broken but only the ground line would be broken, and the motor will continue to operate thereby creating a dangerous situation; thus, where a 220 v. circuit is used, if the motor should become grounded while one line is open, the other line may continue to have 110 v. directly grounded through the motor.

It is of interest here to note that in electrical switches, when the contacts are brought into close proximity with each other, but not quite touching, an electrical arc will continue to burn until the contact points have been consumed. Conversely, when electrical contacts which have been closed, forming an electrical circuit, are opened slightly, an arc will burn between them until the contacts have been completely burned away. The failure of switches under such circumstances constitutes a serious fire hazard. However, with the present invention, contacts form either a fully opened or a fully closed position.

Other objects of our invention are to provide an improved device of the character described, that is easily and economically produced, which is sturdy in construction, and which is highly efficient in operation.

With the above and related objects in view, our invention consists in the details of construction and com-

bination of parts, as will be more fully understood from the following description, when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a push button switch embodying our invention.

Fig. 2 is a sectional view taken transversely of the switch of Fig. 1 with the first pair of contacts open and the second pair of contacts closed.

Fig. 3 is a sectional view similar to Fig. 2 with the first pair of contacts closed and the second pair of contacts open.

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3.

Fig. 5 is a fragmentary perspective view showing the relationship of two pawls mounted upon a pawl supporting bar with respect to the ratchet wheel and to the cam which are securely mounted upon a single shaft.

Fig. 6 is a perspective view of a ratchet wheel engaged by two pawls; when the control button is moved inwardly, the ratchet wheel mounted upon the same shaft as the cam does not change the position of either pair of contacts.

Fig. 7 shows the position of the contacts after the pawls have completed their inward and outward cycle of operation, the movement upwardly of the two pawls when the control button is released causes the contacts on the right side to be opened and the contacts on the left side to be closed.

Referring now in greater detail to the drawings, wherein similar reference characters refer to similar parts, we show a push button switch having a housing or casing, generally designated as A, a cover plate, generally designated as B, and a control or push button, generally designated as C, which projects through the plate B.

Within the housing, there are three electrical contacts, one of which is stationary, and is generally designated as D, and the other two electrical contacts are movable, and designated as E and E1. The movement of the push button is in a retilinear direction and is always pressed inwardly and released to either open or to close the circuit, and the push button has attached thereto a pawl supporting bar C1 which carries a pair of pawls **10**, **12** thereon. The pawl supporting bar C1 carries a first flexible pawl **10** and a second flexible pawl **12**, which function in a manner hereinafter described. A trunnion **14** projecting upwardly from the bottom guides a spring **26** and its complementary washer **28**.

Upon a shaft **16** is securely mounted in spaced relationship a ratchet wheel, generally designated as F, and a cam, generally designated as G. Each end of the shaft **16** is mounted upon a bearing **11** located within the casing walls **13**, **15**. The upper portion of the bearing recesses in the walls **13**, **15** are closed by fibrous strips **17**.

The cam G carries a series of lobes **18**, which lobes are of the same configuration throughout but which define a cammed surface in varying distances from the center of the shaft **16**. The pawl supporting bar C1 is securely affixed to the push button C and has a first side projecting arm **20** which carries the first pawl **10**, and it has a second side projecting arm **22** which carries the second pawl **12**. The lower end of the bar C1 has a slot **24** therein which straddles the trunnion **14** and shaft **16**. The helical spring **26** surrounds the trunnion **14** and projecting between the helical spring **26** and the trunnion **14** is a cylindrical or washer member **28**, which is directly engaged by the edges **30** and **32** (see Fig. 3) on the pawl supporting bar C1. The spring **26** and the cylindrical washer member **28** are interlocked by virtue of a flange on the washer resting upon the spring. The inherent characteristic of the washer is to abut the edges **30** and **32** of the bar C1 to press the pawl supporting bar C1 and the push button C outwardly of the casing chamber. The ratchet wheel F and the cam G are rigidly affixed to the shaft **16** so that they rotate in unison.

When the push button C is pressed inwardly the first pawl **10** engages one tooth on the ratchet wheel F to rotate the shaft **16** and the ratchet wheel a distance equal to the arcuate length of one-half of the linear length of a tooth, while the second pawl **12** serves as a holding pawl. The second pawl **12** on its upward stroke, serves to move the ratchet wheel F the other half of the tooth length while the first pawl **10** serves as a holding pawl. Thus, the pawls **10** and **12** move the ratchet wheel in a counter clockwise direction one tooth length upon movement of the push button inwardly and outwardly.

When the push button C is pressed outwardly, the pawl **12** serves to push the ratchet wheel F the arcuate distance of one-half tooth. In other words, as Figs. 2 and 3 are viewed, the pawl **10** moves the ratchet wheel F counterclockwise and the pawl **12** on its upward movement continues to move the ratchet wheel counterclockwise a total arcuate distance of one ratchet tooth and each pawl serves alternately as a pushing pawl and as a holding pawl.

The stationary contact D has a contact button **34** at each end which are fastened to the contact in a conventional manner.

The movable contacts E and E1 have an intermediate portion of a U-shaped configuration **36**, which is adapted to engage the cam so that as the cam rotates, contacts E and E1 are alternately moved against the contact D to close the circuit; or away from the contact D to open the electrical circuit.

The ratchet wheel **10** in this particular illustration, has 10 teeth, whereas the cam G has five lobes or cam surfaces thereon. Pushing upon and releasing the push button C results in the ratchet wheel moving a total distance of one ratchet tooth, whereas the lobe moves from a high position **18A** to a low position **18B**, or from a low position **18B**, to a high position **18A** in consecutive order.

In our previous patent application, Serial No. 570,302, filed March 8, 1956, now co-pending, we have disclosed an electrical switch wherein a touch of the button, thereby moving it in a rectilinear direction, will actuate the switch. In the present invention we have a ratchet and pawl control wherein the inward movement of the push button moves a first pawl downwardly towards the base of the casing thereby rotating the ratchet wheel one-half the arcuate length of one tooth, and when the push button is released it moves upwardly returning to its initial state carrying with it a second pawl which moves the ratchet wheel arcuate another half of a tooth length thereby completing the cycle of movement of one ratchet tooth. Hence, the ratchet wheel moves one-half the ratchet tooth distance while the push button moves inwardly a distance equal to one-half of its complete stroke or cycle; and the push button moves outwardly the other half of its stroke to complete the arcuate movement of one tooth.

By construction of the switch in this application it may be made smaller in order to obtain the same linear or arcuate movement of the cam as compared to our previously disclosed switch.

In our previously filed patent application, we show that the switch may be used to have two sets of contacts which are opened simultaneously or closed simultaneously.

The switch shown herein is a three-way switch.

We also may use a visual indicator to indicate whether the circuit is open or closed.

Due to the small size of this switch it may be readily converted to a "Despard" type of mounting plate.

The switch plate B may have guide surfaces **38** therein so that the switch button C will move only in a rectilinear direction.

Although our invention has been described in considerable detail, such description is intended to be illustrative rather than limiting, since the invention may be variously

embodied, and the scope of the invention is to be determined as claimed.

We claim as our invention:

1. An electrical switch comprising a molded insulation casing having a chamber therein, a cover for said casing having guide surfaces therein, a push button movable in a rectilinear direction only and located partially within said casing and guided by said guide surfaces, a pawl supporting bar securely attached to said push button, a pair of pawls mounted upon said pawl supporting bar and extending towards one another, a spring urging said pawl supporting bar and said push button outwardly of said casing, a ratchet wheel having a plurality of teeth located between said pawls, one end of said pawl supporting bar bifurcated, a shaft rotatably mounted and securely carrying said ratchet wheel and located within bifurcated end of said bar, a cam mounted upon said shaft and rotatable therewith, a pair of electrical contacts, and means whereby one contact will engage or be disconnected from the other contact by actuation of said cam.

2. An electrical switch comprising a molded insulation casing having a chamber therein, a cover for said casing, having guide surfaces therein, a push button movable in a rectilinear direction only in said guide surfaces, a pawl supporting bar securely attached to said push button and having a vertically extending slot therein, a pair of pawls mounted upon said pawl supporting bar and extending towards one another, a spring urging said pusher bar toward said push button, a ratchet wheel having a plurality of teeth located between said pawls, a shaft rotatably mounted and securely carrying said ratchet wheel and being located between said pawl supporting bar slot, a cam mounted upon said shaft and rotatable therewith, a pair of electrical contacts, and means whereby one contact will engage or be disconnected from the other contact by actuation of said cam.

3. An electrical switch comprising a molded insulation casing having a chamber therein, a cover for said casing at one end of said chamber, said cover having an opening defined by guide surfaces, a rectilinearly movable push button in said opening, a rectilinearly movable pawl-supporting bar within said chamber, said bar being connected at one end to said push button and extending toward the opposite end of said chamber, spring means biasing said bar toward the said one end of said chamber, a pair of oppositely disposed spaced pawls on said bar, a transverse shaft in said chamber, said shaft extending through the space between said pawls and having a ratchet wheel and a cam coaxially mounted thereon, the teeth of said ratchet wheel and the cam surface of said cam being coaxial, said pawls being in operative engagement with the teeth of said ratchet wheel, a movable electrical contact and a fixed electrical contact in said chamber, said movable contact being normally urged into engagement with said fixed contact, a cam follower on said movable contact, said follower being in operative engagement with the cam surface of said cam, and said cam surface being contoured to provide alternate land and groove portions whereby when said follower is in engagement with said land portions, the movable contact is separated from the fixed contact while when said follower is in engagement with said groove portions, the movable contact is in engagement with the fixed contact.

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