May 3, 1949. N. H. KOERTGE 2,469,119

TOGGLE ACTUATED SWITCH

Filed Dec. 20, 1946

Fig. 1.

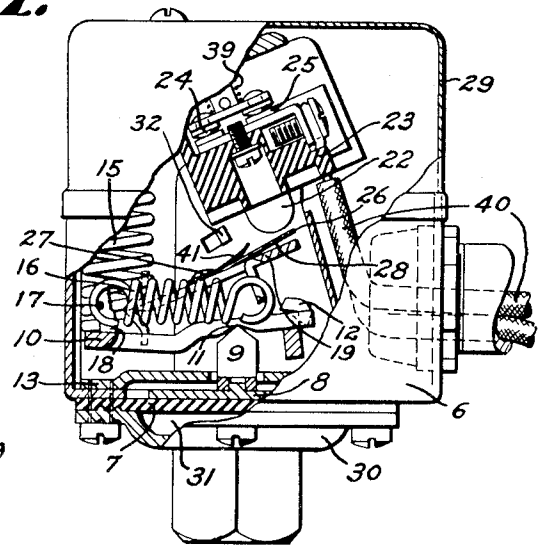


Fig. 2.

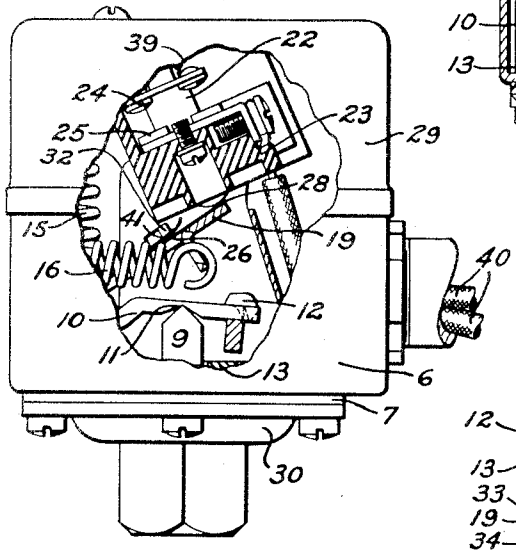


Fig. 3.

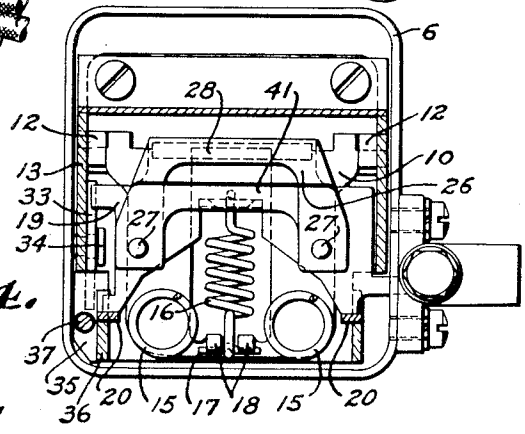
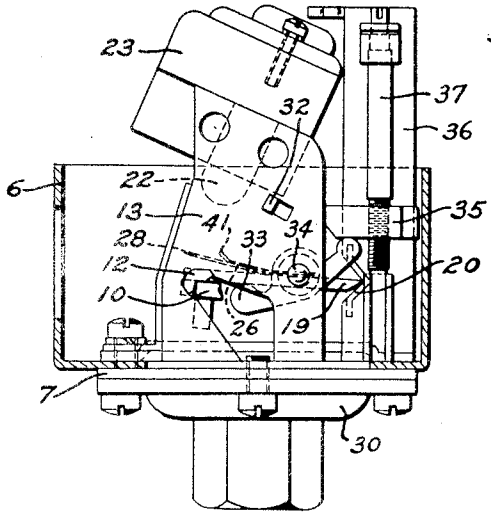


Fig. 4.



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TOGGLE ACTUATED SWITCH

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6 Claims. (Cl. 200—83)

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The present invention relates in general to improvements in the art of manufacturing electrical control apparatus, and relates more specifically to improvements in the construction and operation of electric switches of the general type shown in U. S. Patent No. 2,193,126, granted March 12, 1940.

As shown and described in the above identified prior patent, it has heretofore been proposed to provide a fluid pressure motivated compact electric switch assemblage wherein the movable contacts are actuated with a snap action by means of toggle mechanism interposed between the reciprocable contact carriers and a diaphragm which is flexed by the fluid pressure. While these prior switches have gone into extensive successful commercial use and have proven quite satisfactory, it has been found that the movable contacts thereof frequently close with a double click due to the action of the main toggle springs, and this double clicking is detrimental to the electrical contacts. I have discovered that such detrimental double clicking of the contacts, may be readily eliminated so as to considerably prolong the life of these electric switches, by utilizing a simple auxiliary spring for preventing slow or delayed closing action and possible rebound of the movable contacts, and such life prolonging devices may be readily applied either to existing or new switch assemblages of the patented type, as well as to other toggle actuated switches.

It is therefore a primary object of my invention to provide simple and effective instrumentalities for greatly improving the action of toggle operated electric switches by eliminating double clicking of the snap actuated movable contacts of such devices.

Another object of the present invention is to provide improved means for prolonging the life and usefulness of snap actuated electric toggle switches, especially of the above described type.

A further object of this invention is to provide a simple and durable auxiliary spring which is effectively cooperable with a main spring actuated toggle, to prevent rebound of the toggle actuated element or member.

Still another object of the invention is to provide an improved impact member for switch contact actuating toggles or the like, which may be readily applied to electric switches at moderate cost, and which functions automatically to eliminate double clicking of the contacts.

An additional object of my invention is to provide an improved fluid pressure motivated toggle actuated electric switch assemblage provided with simple means for improving the snap action of

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the switch contacts so as to positively prevent rapid deterioration thereof.

These and other objects and advantages of the invention will be apparent from the following detailed description.

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

Fig. 1 is a partial elevation and part transverse central vertical section through a typical fluid pressure motivated toggle actuated electric switch, having the improvement embodied therein and showing the actuating toggle in inactive position while the contacts are closed;

Fig. 2 is a somewhat similar view of the same switch assemblage, but showing the actuating toggle in active position with the switch contacts open;

Fig. 3 is a transverse horizontal section through the switch with the closure cover removed, and showing a plan view of the improved snubber and leaf spring; and

Fig. 4 is a side view of the same switch assemblage showing the range adjusting mechanism for the toggle impact plate and a section through the main casing.

While the invention has been shown and described herein by way of illustration as being readily and advantageously applicable to a fluid pressure motivated and toggle actuated electric switch of the type specifically revealed in the patent above referred to, it is not my desire or intention to unnecessarily limit the scope or utility of the improvement by virtue of this restricted embodiment.

Referring to the drawing, the improved fluid pressure motivated and toggle actuated electric switch shown therein, comprises in general a cup-shaped main lower casing 6 having a central bottom opening which is normally sealed by means of a flexible diaphragm 7 coacting at its top with a flat movement transfer plate 8 having a U-shaped member 9 secured centrally thereto; a main approximately horizontal lever 10 having a medial notch 11 coacting with the upper points of the member 9 and being fulcrumed at one end upon hardened bearings 12 secured to the spaced side walls of a rigid frame 13; a pair of similar laterally spaced upright helical compression springs 15 coacting with the other swinging end

of the main lever 10 and constantly urging the lever notch 11 against the points of the member 9 in opposition to the action of the diaphragm 7; an approximately horizontal helical tension spring 16 having one end detachably connected by a pin 17 to ears 18 formed integral with the swinging end of the toggle lever 10, while its opposite end is attached to the swinging end portion of a toggle striker or impact plate 19 which is fulcrumed to swing about V-shaped sockets 20 also carried by the frame 13; one or more laterally spaced contact carrier bars 22 slidably mounted in a contact supporting block 23 and having lower ends disposed in proximity to the swinging end of the striker plate 19, the bars 22 also being provided at their upper ends with movable switch contacts 24 adapted to engage adjacent fixed switch contacts 25 supported upon the block 23; an auxiliary leaf spring 26 secured to the striker plate 19 by screws or rivets 27 and having a flexible upwardly biased outer end portion 28 engageable with the lower ends of the contact carrier bars 22; mechanism for varying the compression of the springs 15 and the range of travel of the striker plate 19; and suitable closures including a top cover 29 and a lower plate 30, the latter having a pipe connection for conducting fluid under pressure from any desired source to the diaphragm flexing chamber 31 to which the bottom of the diaphragm 7 is constantly exposed.

The main lower casing 6, transfer plate 8, push member 9, toggle lever 10, frame 13, toggle member or impact plate 19, cover 29, and lower plate 30 may all be formed of sheet metal of suitable thickness, with the aid of punches and dies; and the diaphragm 7 is preferably formed of flexible material such as rubber, and is firmly clamped between the casing 6 and lower plate 30 so as to seal the pressure fluid confining chamber 31. The compression springs 15 which coact with the lever 10 should be provided with suitable means for varying the compression thereof, and the extent of downward swinging of the toggle impact plate 19 is adjustable with the aid of mechanism such as shown in Figs. 3 and 4, so that the functioning of the switch may be readily varied to meet different conditions of operation.

The upward swinging motion of the impact plate 19 is arrested by fixed stops 32, and the mechanism for varying the range of travel of this plate, consists of a stop lever 33 having its medial portion swingably connected to one side wall of the rigid main frame 13 by a pivot pin 34, while one end of the lever 33 is adapted to engage the lower face of the plate 19 and the opposite end thereof engages a vertically adjustable block 35. This block 35 is snugly but slidably confined between the casing 6 and an integral side plate 36 of the frame 13, and is vertically adjustable with the aid of an adjusting screw 37 journalled on the frame plate 36. Since the striker plate 19 is fulcrumed in the fixed V-shaped sockets 20 and is swingable across the axis of the toggle spring 16 with a snap action, movement of the block 35 up or down, will naturally vary the extent of swing of the plate 19 by varying the location of the stopping end of the lever 33.

The contact carrier bars 22 and the contact supporting block 23 may be formed of any suitable insulating material, and the bars 22 are surrounded near their upper ends by compression springs 39 which tend to urge the adjacent movable contacts 24 toward closed position at all times. The fixed contacts 25 which are mounted upon the supporting block 23 may be connected to conductors 40, and the movable contact carrier bars 22 should be freely slidably confined in the block 23 with their lower ends protruding into the path of swing of the toggle impact plate 19. In order to insure proper closing of the movable contacts 24 from fully open position and with a snap action under the influence of the springs 39, it is necessary that the restraining pressure exerted against the lower ends of the bars 22 when the contacts 24 are being held in open position, be quickly released; and it is also desirable to open the switch with a similar snap action and to maintain the movable contacts 24 fully open after each snap action has taken place.

The auxiliary leaf spring 26 which is mounted upon the toggle impact plate 19 by means of the rivets 27 is provided for the purpose of insuring such proper closing and opening of the movable contacts 24 with a snap action, and thus avoiding double clicking and undesirable rebound. This auxiliary spring 26 has its free portion 28 biased away from the swinging end of the plate 19 and toward the lower ends of the bars 22; and a curved snubber leaf spring 41 which is also secured to the impact plate 19 by the rivets 27, coacts with the opposite side portions of the leaf spring 26 so as to prevent undesirable vibration thereof and thus prolong its life. The springs 26, 41 should be formed of durable metal, and may obviously be applied to the striker plates 19 of either existing or new switches without in any manner interfering with the operation of other parts.

When the improved switch assembly has been properly constructed as above described, it may be connected to a suitable source of fluid under pressure and to the motor or other electrical devices to be controlled, and after the tension of the compression springs 15 has been properly adjusted, the normal operation will be as follows. Assuming the switch contacts 24, 25 to be closed as shown in Fig. 1, with the toggle impact lever 19 in its lowermost position as determined by the stop lever 33 and the auxiliary leaf spring 26 out of engagement with the lower protruding ends of the movable contact carrier bars 22, as the fluid pressure in the chamber 31 increases, the diaphragm 7 will be flexed upwardly thereby raising the plate 8 and push member 9. This upward movement of the member 9 will elevate the swinging end of the lower lever 10 against the springs 15, and will simultaneously stretch the toggle spring 16 slightly and will carry the axis of this spring upwardly until this axis crosses the toggle center line or plane.

As soon as the axis of the tension spring 16 crosses the toggle center, the upper toggle impact plate 19 will be swung upwardly with a snap action about its fulcrum sockets 20 against the stops 32 as shown in Fig. 2, and during this rapid displacement of the plate 19 by the spring 16, the outer end portion 28 of the auxiliary leaf spring 26 will initially contact the lower ends of the movable contact carrier bars 22 and will flex downwardly into approximate engagement with the outer end of the plate 19. While this action is taking place, the movable contact closing springs 39 will be subjected momentarily and gradually to slight pressure exerted by the flexing spring 26, but this slight pressure will immediately be followed by the impact exerted by the relatively heavy plate 19 as it swings against the stops 32. Any tendency on the part of this plate 19 to rebound from the stops 32 will however be absorbed by the auxiliary leaf spring 26 which will prevent the springs 39 from

returning the movable contacts 24 to closed position after they have once begun to open.

When the fluid pressure within the chamber 31 decreases, the heavy compression springs 15 will move the swinging end of the main toggle lever 16 downwardly thereby causing the member 9 and plate 8 to flex the diaphragm 7 downwardly, and simultaneously lowering the axis of the toggle spring 16. As this spring axis again crosses the toggle center line or plane while thus being lowered, the upper toggle impact plate 19 will swing downwardly about the fulcrum sockets 20 toward the stop lever 33, and during the initial part of this lowering movement of the plate 19, the auxiliary spring 26 will remain flat against the plate 19 as this plate begins to swing downwardly, until the greater combined strength of the springs 39 has closed the movable contacts 24. When these contacts 24 have thus been closed, the spring 26 becomes effective to snap the plate 19 toward the stop lever 33, and this action of the leaf spring 26 eliminates double clicking by preventing possible repeated engagement of the bars 22 with the impact plate 19 after the contacts 24 have actually been closed. The downward movement of the plate 19 which is initiated by the spring 26 is of course augmented by the toggle spring 16.

The opening and closing of the switch contacts may be thus rapidly repeated without danger of contact deterioration due to double clicking or arcing resulting from momentary delay in the movement of the impact bar 19. The snubber spring 41 functions to prevent undesirable vibration of the auxiliary leaf spring 26 when the latter has been released from engagement with the contact carrier bars 22, and the spring 26 is so formed and coacts with the curved snubber in such manner that the pressure exerted by the outer transverse spring portion 28 gradually but quickly diminishes as the outer side portions of the spring 26 roll along the adjacent curved surface of the snubber spring 41. The range of throw of the impact member of plate 19 may also be readily varied by merely adjusting the screw 37, and the pressure range of operation of the switch may be just as conveniently varied by adjusting the tension of the main springs 15.

From the foregoing detailed description it should be apparent that the present invention provides an improved toggle actuated electric switch assemblage which is simple and compact in construction and highly efficient in operation, and wherein deterioration due to ineffective closing and opening of the contacts resulting from the action of the toggle is positively eliminated. The auxiliary spring 26 and its snubber spring 41 may be readily applied to the toggle impact member or plate 19 of old or new switches, without interfering with the normal operation of other parts of the assemblage, and this spring 26 is especially adapted to eliminate double clicking of the contacts. It has been found that the embodiment of the improved devices greatly prolongs the life of toggle actuated switches of the type shown herein, and is applicable thereto at but slight additional cost; and it has also been discovered that the use of the snubber spring 41 in conjunction with the auxiliary leaf spring 26 materially increases the life of the latter.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation, herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art; and it is furthermore contemplated that specific descriptive terms used herein be given the broadest possible interpretation consistent with the disclosure.

I claim:

1. An electric switch comprising, a contact support, a fixed contact mounted upon said support, a movable contact having a carrier bar slidably cooperable with said support to guide said contacts for coaction with each other, resilient means for constantly urging said movable contact toward said fixed contact, a toggle having a rigid impact member for opening and closing said contacts with a snap action, a leaf spring interposed between said impact member and said bar for preventing double clicking of said contacts, and a snubber with which said leaf spring is gradually increasingly engageable and cooperable to prevent destructive vibration of the latter.

2. An electric switch comprising, a contact support, a fixed contact mounted upon said support, a movable contact having a carrier bar slidably cooperable with said support to guide said contacts for coaction with each other, resilient means for constantly urging said movable contact toward said fixed contact, a toggle having a rigid impact plate the swinging end of which is cooperable with said movable contact carrier bar to open and to permit closing of said contacts, a leaf spring carried by said plate between said impact plate end and said contact carrier bar for preventing double clicking of said contacts, and means for preventing destructive vibration of said leaf spring.

3. An electric switch comprising, a contact support, a fixed contact mounted upon said support, a movable contact having a carrier bar slidably cooperable with said support to guide said contacts for coaction with each other, resilient means for constantly urging said movable contact toward said fixed contact, a toggle having a rigid impact plate the swinging end of which is cooperable with said movable contact carrier bar to open and to permit closing of said contacts, a leaf spring carried by said plate between said impact plate end and said contact carrier bar, and a snubber spring gradually increasingly engageable with said leaf spring to retard vibration thereof.

4. An electric switch comprising, a stationary contact support, a fixed contact mounted upon said support, a movable contact having a carrier bar slidably engaging said support to guide said movable contact for cooperation with said fixed contact, a spring for constantly urging said movable contact toward said fixed contact, a toggle having a rigid impact plate swingable toward and away from said bar to open and to permit closing of said contacts, and a leaf spring mounted upon the swinging portion of said plate and being cooperable directly with said bar to eliminate double clicking of said contacts, and means carried by said plate for preventing destructive vibration of said leaf spring.

5. An electric switch comprising, a stationary contact support, a fixed contact mounted upon said support, a movable contact having a carrier bar slidably engaging said support to guide said movable contact for cooperation with said fixed contact, a spring for constantly urging said movable contact toward said fixed contact, a toggle having a rigid impact plate swingable toward and away from said bar to open and to permit closing of said contacts, a leaf spring mounted upon the swinging portion of said plate and being cooperable directly with said bar to eliminate

double clicking of said contacts, and a snubber spring gradually increasingly engageable with said leaf spring to retard vibration thereof.

6. An electric switch comprising, a stationary contact support, a fixed contact mounted upon said support, a movable contact having a carrier element slidably engaging said support to guide said movable contact for coaction with said fixed contact, a spring for constantly urging said movable contact toward said fixed contact, a snap actuated toggle member having a rigid portion movable toward and away from an end of said contact carrier element, a leaf spring carried by said member and having a flexible portion spaced from said rigid portion and engageable directly with said element and laterally separated outwardly biased resilient side portions connecting said flexible portion with said member, and a snubber mounted upon said member

and having curved portions gradually increasingly engageable with said resilient side portions to retard vibration of said leaf spring.

NOBEL H. KOERTGE.

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