

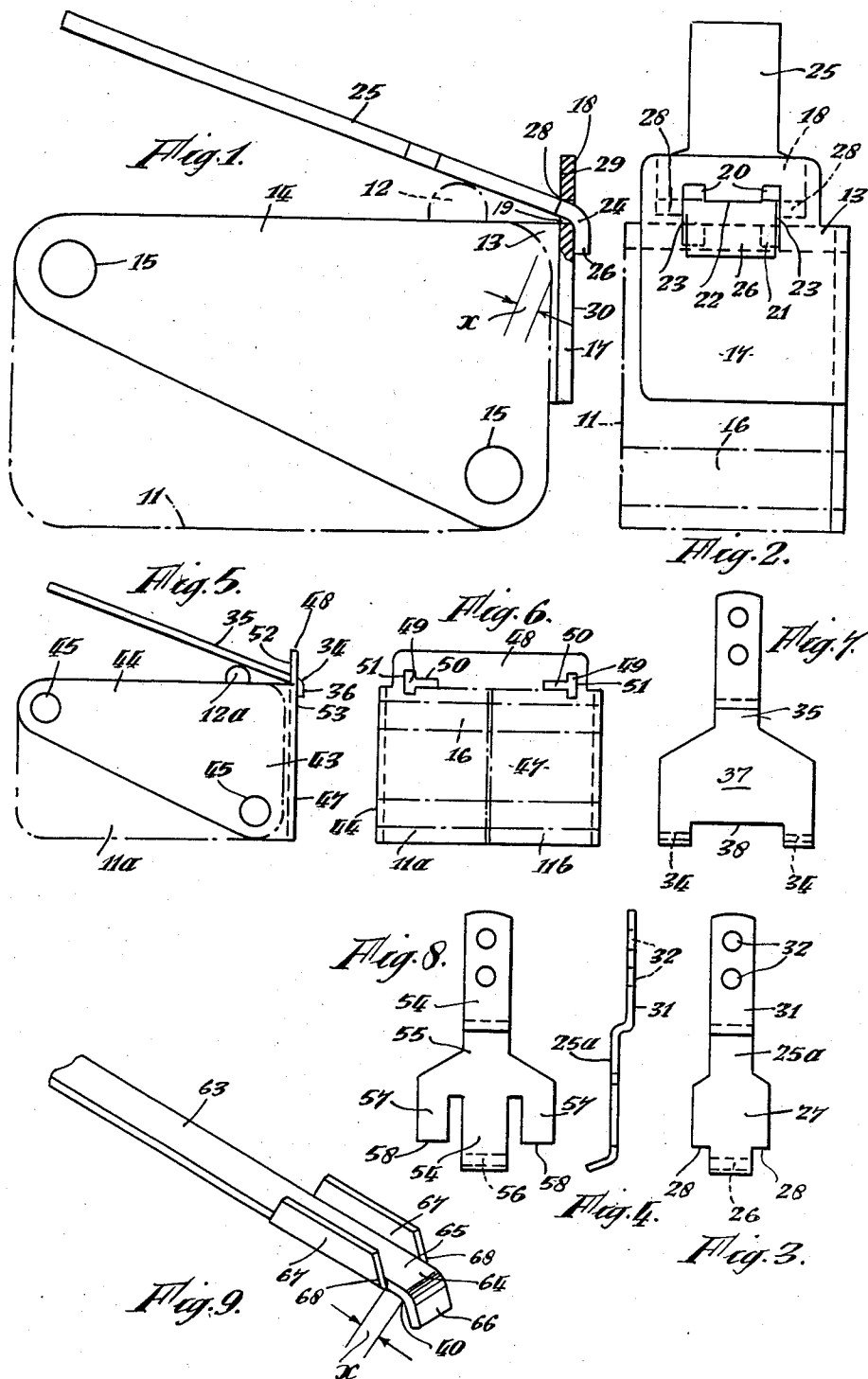
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ACTUATORS FOR ELECTRICAL SWITCHES

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ACTUATORS FOR ELECTRICAL SWITCHES

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This invention relates to actuator members for electrical switches operated by push-button, and particularly to the type of such switches which is adapted for rapidly making and breaking electrical circuits in apparatus of advanced design or function, and is usually of small and compact construction and capable of operating under relatively heavy electrical loads by application of a light operating force.

Such a switch (which for convenience of reference will hereinafter be referred to as a "switch of the type stated") is frequently provided, so that it may be operable by an extremely light force, or from a somewhat remote point, or by an element moving otherwise than parallel to the line of displacement of the push-button, with an actuator in the form of a lever usually a second order lever, associated with the switch so as to bear on the push-button thereof, which is resiliently supported within the switch.

The present invention has for an object to provide, for a push-button operable switch, and particularly for a switch of the type stated, an actuator and means for mounting the same on a switch, of simple and economic construction and having a long life and a high degree of reliability.

The invention accordingly provides a switch actuator comprising a bracket attachable to the switch and having in a laminar plane portion a slot extending transversely to the direction of movement of the push-button, and a laminar second order lever, having a tongue, and at least one shoulder or like abutment at the base of the tongue, which penetrates the slot up to said shoulder, the lever bearing upon the push button while being oblique to the plane of said portion of the bracket and the tongue being so bent that in co-operation with the shoulder it serves to limit outward displacement of the lever under the outward resilient force of the push-button.

A modified actuator according to the invention may be adapted for the simultaneous actuation of two like switches disposed side by side, the lever having lateral extensions behind a pair of shoulders one on each side of the tongue and each of these extensions bearing on the push-button of one of the switches. If desired, the bracket in which the lever is mounted may be such as to secure the two switches together, or jointly to a mounting element. Such bracket may, for example, be U-shaped to embrace the two switches.

In an alternative modified actuator for operating two switches, the lever may have a broad head wide enough to bear on the two push-buttons simultaneously, and two bent tongues spaced apart laterally, a transverse edge of said head extending between the two tongues serving as the aforesaid shoulder, and the tongues being inserted in two similarly spaced, aligned slots in the bracket. These slots may be formed entirely within the material of said portion of the bracket, or may be a pair of recesses extending inwardly from opposite sides of said portion of the bracket.

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When the lever in its position of outward displacement is oblique to said laminar portion of the bracket, its limit position is determined by the tongue and the or each shoulder bearing on opposite surfaces of said bracket portion at locations spaced apart in the plane thereof, whereby the lever is held firmly extending from the bracket portion with its centre line in a plane perpendicular to that of said bracket portion and in a direction such that its free end is positioned in the path of a moving element by which such lever is usually actuated. Thus, when the lever is depressed to a position substantially perpendicular to said bracket portion, the tongue and shoulder become further spaced apart than the surfaces of said bracket portion, so that the lever is capable of limited angular movement in its own plane relative to said bracket portion, but will always resume its predetermined oblique position when the push-button is permitted to displace it outwardly.

The lever may be a stub adapted to have secured to it by suitable means an extension element for providing a requisite length, such as a laminar strip or a piece of wire or tubing or channel, or alternatively a yoke carrying a roller, for enabling operation by an element moving otherwise than parallel to the line of displacement of the push-button, according to the circumstances in which the actuator is required to be operated.

Usually the lever, or such an extension thereof, is relatively rigid, the switch construction permitting overtravel of the push-button to an extent, proportionate to the leverage ratio, affording where required, a sufficient freedom for overtravel of the moving element by which the lever is actuated. However, where the switch allows no freedom for overtravel of the push-button, the actuator lever may be so integrally constructed as to have a resiliently flexible outer portion and a stub-portion made rigid by longitudinal corrugation, flanging or equivalent means. For example, such a lever may have a laminar strip body with one end bent obliquely as the aforesaid tongue, and a pair of trapezoidal, longitudinal flanges extending perpendicularly or obliquely to its plane in the opposite sense to the tongue, inclined margins of said flanges extending in a plane parallel to that of the tongue and spaced from said plane by a distance substantially equal to the thickness of the slotted portion of the bracket.

The or each slot in the bracket may for economy of construction be formed by punching. This method may have the disadvantage that the corners of the slot are not cleanly cut and therefore do not afford satisfactory guide surfaces for the tongue on the lever. In order to avoid this disadvantage, the or each slot may be of H-form, so as to present two pairs of mutually perpendicular guide surfaces which are cleanly formed, and from which all internal corners of the slot are spaced apart. In the case where a lever has a pair of transversely spaced tongues, these may be engaged in recesses in opposite sides of a portion of the bracket, which for the like purpose are each of T-form, with their shank portions, in which the tongues engage, disposed in alignment, extending away from one another, and open to the sides of said bracket portion.

Alternatively, such a pair of tongues may be engaged in a pair of T-form slots made wholly within the material of the bracket and with their shank portions, in which the tongues engage, disposed in alignment and extending either towards or away from one another so that the opposed surfaces of their head portions present a pair of laterally constraining surfaces engaging either the outer or the inner pair of the longitudinal edges of the tongues.

Some embodiments of switch actuators according to

the invention will be described by way of example with reference to the accompanying drawings, wherein:

Fig. 1 is a side elevation of one embodiment;

Fig. 2 is an end elevation of the same, both on an enlarged scale;

Figs. 3 and 4 are a plan and an elevation on a less enlarged scale of a lever suitable for use in the actuator of Figs. 1 and 2;

Fig. 5 is a side elevation of another embodiment;

Fig. 6 is an end elevation of the bracket thereof, and

Fig. 7 is a plan of the lever thereof;

Fig. 8 is a plan of a further modified lever, and

Fig. 9 is an isometric view of another kind of lever suitable for use in the actuator of Figs. 1 and 2.

The actuator of Figs. 1 and 2 is adapted for attachment to a switch of the type stated, as indicated by the chain-dotted line 11, with a protruding push-button 12. A bracket 13 of the actuator has a substantially triangular wing 14 with two holes 15 which register with holes 16 passing through the body of the switch 11, and the actuator is secured to the switch by bolts (not shown) passing through these holes. The bracket has a plane portion 17 perpendicular to the wing 14 with an upstanding lug 18 wherein is formed a slot 19 the effective portion of which extends transversely to the direction of motion (vertical as shown) of the push-button 12. For economy of manufacture, the slot is formed by punching or stamping, and so as to avoid corners with burrs which might impair the clean outline of the slot the latter is made in H-form as shown in Fig. 2, so that such burrs if they occur are located in the corners of the upwardly and downwardly extending limbs 20 and 21, and the effective portion of the slot is defined by the clean pairs of edges 22 and 23. In this slot is inserted a tongue 24 of a lever 25 with a bent-down end 26, the lever has a broader portion 27, as shown in Fig. 3, which presents two shoulders 28 to bear on the inner surface 29 of the bracket portion 17 while the end 26 bears on its outer surface 30.

The lever 25 may be of any desired length, and may be of plane laminar form as shown in Fig. 1. An alternative form is shown in Figs. 3 and 4, where the lever 25a is a stub adapted to have secured to it an extension element or a yoke carrying a roller. To this end the lever has a cranked portion 31 with two holes 32 for bolts or rivets.

An embodiment of actuator for the simultaneous operation of two switches is shown in Figs. 5-7. The bracket 43 is of U-section in plan, with two parallel wings 44 having registering holes 45 adapted to embrace two switches 11a, 11b and secure these together by bolts or rivets passed through the holes 45 and holes 16 in the switches. The plane portion 47 of bracket, which is perpendicular to the wings 44, has an upstanding lug 48 in which are formed two T-form slots 49 with their shanks 50 horizontally aligned and directed towards one another and their head surfaces 51 vertical. Two tongues 34, with bent-down ends 36, of a lever 35, are inserted one in each of the slots 49. The lever is shown in plan in Fig. 7, and may be plane as shown in Fig. 5, or cranked with a side elevation similar to that shown in Fig. 4. The broad inner end 37 of the lever has a transverse edge 38 extending between the tongues 34, which serves as a shoulder to bear on the inner surface 52 of the lug 48 while the tongue ends 36 bear on its outer surface 53. The width over the tongues 34 and the dimensions and spacing of the slots 49 are such that the lever is laterally constrained by the surfaces 51, and the inner sides of the tongues do not extend to the inner ends of the slot shanks 50, so that if there should be burrs in any of the internal corners of the slots, these cannot impede the operation of the lever.

An alternative form of lever for actuation of two switches simultaneously is shown in Fig. 8, this lever

also having an arm cranked in elevation as shown in Fig. 4. The lever 55 has a single tongue 54, with a bent-down end 56 in alignment with the lever arm 54, and is generally of trident form with two lateral, parallel limbs 57 each adapted to operate the push-button of one of two switches embraced in a bracket similar to that shown in Figs. 5 and 6, but having a single H-form slot at the middle of the lug 48 instead of the two T-form slots 49. The ends 58 of the limbs 57 serve as shoulders to bear on the inner surface of the lug while the tongue end 56 bears on the outer surface.

A modified lever for the actuation of a single switch, as shown in Fig. 9, is formed with a single tongue 64 having a bent-down end 66, at one end of a body 65 made rigid by upstanding lateral flanges 67 and with a flexible arm 63.

In each of the levers, as shown, and according to a feature of the invention, between the line 40 of the angle or angles inside the tongue or tongues, and the plane of the pair of shoulders 28 (Fig. 3) or 58 (Fig. 8) or a single shoulder 38 (Fig. 7) or of the inner ends 68 of the flanges 67 shown in Fig. 9, which are parallel to the tongue end 66 and serve as shoulders to abut the inner side of the bracket lug, the spacing x (Figs. 1 and 9) is slightly greater than the thickness of the bracket lug 18 or 48. Thus, the lever is permitted to attain a position oblique to the plane of the bracket lug under the resilient force exerted on the lever by the switch push-button, limited by engagement of the bent end of the tongue and the shoulder or shoulders respectively with opposite surfaces of said lug. When the lever is depressed to actuate the push-button, and is held so depressed, e.g. in an attitude perpendicular to the plane of the lug, the spacing x permits a limited angular movement of the lever in its own plane. This movement is evidently relatively greater in the case of a lever as illustrated in Fig. 3 or Fig. 9 than in the case of a lever as shown in Fig. 7 or Fig. 8, but is appreciable in any case, and so, together with permissible overtravel, enables considerable freedom in the design of apparatus wherein switches having actuators according to the present invention are embodied, as concerns the cycle of movements of the member which operates the switch or switches. Moreover, the actuator lever, when released by said moving member and returned to its oblique position, always attains an attitude wherein its centre line is in a plane normal to the plane of the bracket lug and so can be positively located, for actuation, in the path of said moving member.

It may be noted further that the lever 25 is maintained in assembled position with the bracket 13 so long as the bracket is mounted on a switch. Thus the shoulders 28 prevent the lever 25 from being moved to the right through the slot 19 and the portion 26 prevents the lever from being moved to the left. When the bracket, however, is removed from the switch the two elements may be readily disassembled.

I claim:

1. A switch actuator comprising a bracket attachable to the switch and having in a laminar plane portion a slot extending transversely to the direction of movement of the push-button, and a laminar second order lever, having a tongue, and at least one shoulder or like abutment at the base of the tongue, which penetrates the slot up to said shoulder, the lever bearing upon the push-button while being oblique to the plane of said portion of the bracket and the tongue being so bent that in co-operation with the shoulder it serves to limit outward displacement of the lever under the outward resilient force of the push-button.

2. A modification of the actuator according to claim 1, for the simultaneous actuation of two like switches disposed side by side, the lever having lateral extensions behind a pair of shoulders one on each side of the tongue

and each of these extensions bearing on the push-button of one of the switches.

3. A modification of the actuator according to claim 1, wherein the lever has a broad head to bear on the two push-buttons simultaneously, and two bent tongues spaced apart laterally, a transverse edge of said head extending between the two tongues serving as the said shoulder, and the tongues being inserted in two similarly spaced, aligned slots in the brackets.

4. A switch actuator according to claim 3, wherein the two slots are formed within the material of said portion of the bracket.

5. A switch actuator according to claim 3, wherein the two slots are a pair of recesses extending inwardly from opposite sides of said portion of the bracket.

6. A switch actuator according to claim 2, wherein the bracket serves to secure the two switches together.

7. A switch actuator according to claim 2, wherein the bracket serves to secure two switches together and jointly to a mounting element.

8. A switch actuator according to claim 1 wherein the slot is of H-form.

9. A switch actuator according to claim 2, wherein the two slots are of T-form, disposed with their shank portions in alignment.

10. A switch actuator according to claim 1, wherein the lever is a stub adapted to have secured to it an extension element carrying a roller.

11. A switch actuator according to claim 1, wherein the lever has a resiliently flexible outer portion integral with a rigid stub portion.

12. A switch actuator according to claim 1, wherein the lever has a laminar strip body with one end bent obliquely as the aforesaid tongue, and a pair of trapezoidal, longitudinal flanges extending perpendicularly or obliquely to its plane in the opposite sense to the tongue, inclined margins of said flanges extending in a plane parallel to that of the tongue and spaced from said plane by a distance substantially equal to the thickness of the slotted portion of the bracket, the end of the lever extending beyond the flanges being resiliently flexible.

13. A switch actuator according to claim 1, wherein the outer limit position of the lever is determined by the tongue and the shoulder bearing on opposite surfaces of said bracket portion at locations spaced apart in the plane thereof, whereby the lever is held firmly extending obliquely from the bracket portion with its centre line in a plane perpendicular to the plane of said bracket portion, and in a direction such that its free end is positioned in the path of a moving element by which such lever is actuatable, and, when the lever is depressed to a position substantially perpendicular to said bracket portion, the tongue and shoulder become further spaced apart than the surfaces of said bracket portion, so that the lever is capable of limited angular movement in its own plane relative to said bracket portion, and resumes its predetermined oblique position when the push-button is permitted to displace it outwardly.

14. An electrical switch actuator for mounting on a switch said actuator being independent of said switch and consisting of at least two elements constituting a lever and frame, a fulcrum on one of said elements about which said lever is rockable, supporting means on said frame for supporting said actuator on said switch with at least a part of said lever overlying said switch and means on said lever cooperating with means on said frame so that when said actuator is mounted on said switch said lever is retained against removal from said frame.

15. The switch actuator of claim 14 wherein said supporting means are formed for engagement by switch mounting means.

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