Jan. 10, 1961 E. GREAVES 2,967,919

LEVER OPERATED ELECTRIC SWITCHES

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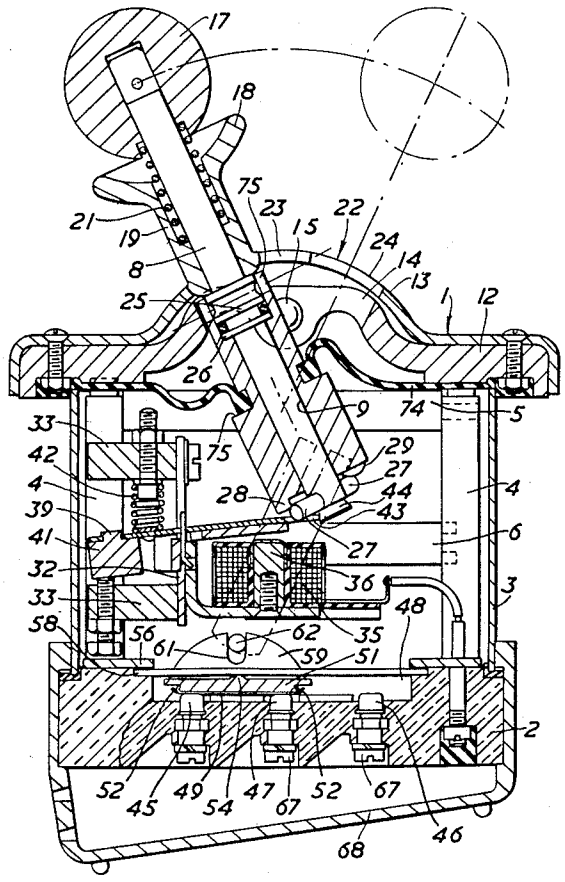


FIG. 1.

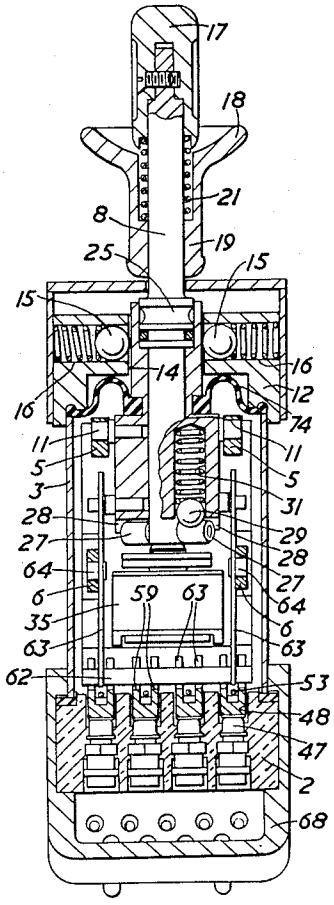


FIG. 2.

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LEVER OPERATED ELECTRIC SWITCHES

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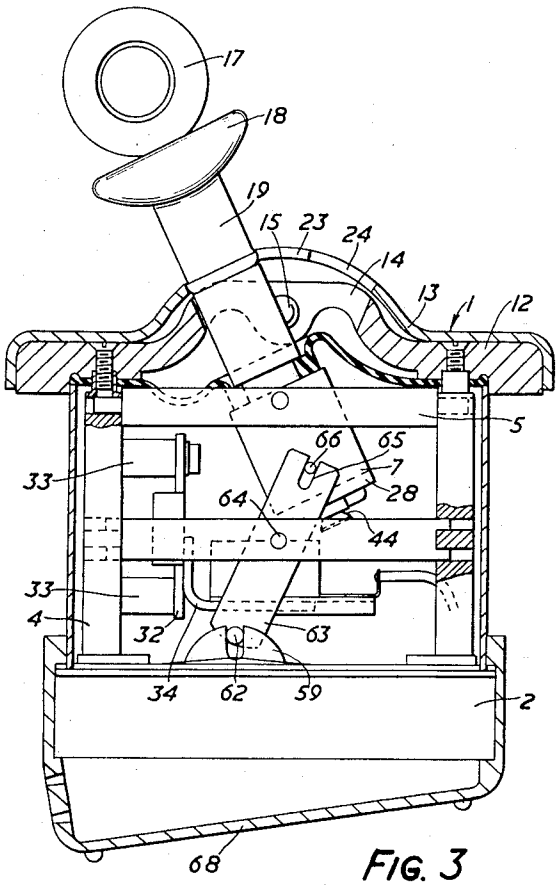


FIG. 3

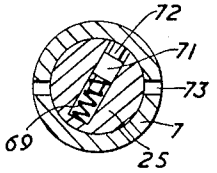


FIG. 4.

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LEVER OPERATED ELECTRIC SWITCHES

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11 Claims. (Cl. 200—106)

This invention relates to lever-operated electrical switches for use where it is desirable, firstly that under some conditions of use the switch should be locked against operation and under other conditions of use should be easily operable, and secondly that when in the locked position some method of emergency operation is possible. An example of such a switch is that used to control lowering or raising of an aircraft undercarriage, it being normally desirable to lock the switch when the aircraft is on the ground to prevent raising of the undercarriage. If, during taxiing or take-off, it becomes necessary to stop the aircraft very quickly, for example to avoid a collision, it is necessary to raise the undercarriage to drop the aircraft on to the ground to effect stopping in the shortest possible distance. Such raising of the undercarriage would then need to be effected by moving the switch against the lock.

The main object of the present invention is to provide a lever switch in which the movement to overcome locking of the lever under emergency conditions is by twisting the lever about its longitudinal axis. A further object of the invention is to provide a simple construction of lever switch in which the lever twisting action for emergency operation is accomplished by a small angle of twisting, for example about 50°, which is easily attainable by an operator at one turn of the hand.

A still further object is to provide, a lever-operated electric switch capable of being locked against normal operation by a movable pawl engageable with the lever within the switch, the lever being provided with a projection adjacent to the pawl which, on twisting of the lever, engages the pawl to move it out of locking engagement with the lever. Preferably, the twisting action is resisted by spring loading carried within the lever and reacting against the normal pivotal fulcrum of the lever. The pawl preferably comprises an armature of an electromagnet which moves into the locking position when no current is passing through the electromagnet.

One example of the invention will now be described with reference to the accompanying drawings, in which:

Figures 1 and 2 are cross-sections through the switch at right-angles to one another;

Figure 3 is a cross-section showing the structural framework of the switch; and

Figure 4 is a detailed view on the line IV—IV of Figure 1.

The switch casing comprises a gate member 1 and an insulating base member 2 which are located at opposite ends of a metallic shell 3. Within the casing a framework is located between the gate and the base members 1 and 2 comprising four metal bars 4 extending between the gate member 1 and base member 2, a pair of upper cross members 5 secured between the bars 4 and a pair of intermediate cross members 6 also secured between the bars 4. The switch operating lever is the combination of a metallic bush 7 and a rod 8 extending through the bore 9 of bush 7. The bush 7 is pivotally mounted

to the upper cross members 5 by means of pivots 11, these pivots engaging the wall only of the bush and not projecting into the bore 9. The gate member 1 comprises a lower member 12 directly secured to the bars 4 and an upper member 13 secured to the lower member 12. The lower member 12 includes a slot 14 within which the upper end of the bush 7 moves during pivotal movement about pivots 11. Centrally disposed within the slot 14 a pair of spring-loaded balls 15 are located within co-axial bores 16 extending parallel to the pivot axis of pivots 11. The balls 15 engage the upper end of the bush 7 and serve to urge the bush in its pivotal movement either to one end or the other of slot 14. The rod 8 extends upwardly from the bush 7 and at its outer end a circular operating button 17 is secured, the longitudinal axis of rod 8 extending along a diameter of the button 17. The purpose of the button is to enable the rod 8 to be twisted about its longitudinal axis. On the rod 8 between the upper end of bush 7 and the button 17 a cup 18 is mounted by means of a hollow cylindrical portion 19 which is a sliding fit on the rod 8. A compression spring 21 acting between the button 17 and the cylindrical portion 19 urges the cup towards the upper end of the bush 7. The lower end of the cylindrical extension 19 fits within a slot 22 formed in the upper member 13. This slot is narrow at its central position 23 and at either end includes a circular enlargement 24 to receive the end of the cylindrical portion 19. Thus, the cylindrical portion 19 can engage either of the circular enlargements 24 and forms an auxiliary lock on the lever in either extreme position, it being necessary to lift the cup before the lever can be moved from either extreme position.

The rod 8 at the upper end of bush 7 is formed with an enlargement 25 which engages a shoulder 26 within bore 9 whilst at its lower end it includes a transversely extending pin 27. The lower end of the bush includes a pair of diametrically opposed projections 28 which co-operate with the pin 27 to form stops on the twisting movement of the rod 8 within bush 7 to allow a total angular movement of about 50° of rod 8 about its longitudinal axis. Within the walls of the bush 7 at its lower end a pair of spring-loaded balls 29 are provided mounted in bores 31 within the bush and extending parallel to the longitudinal axis of the rod 8. The balls 29 co-operate with the pin 27 to urge it to either one or other extreme of angular twisting movement of the pin between the stops 28.

A platform 32 is supported interiorly of the switch from two bars 4 by means of supports 33, this platform carrying a yoke 34, an electromagnet winding or solenoid 35 and an electromagnet core 36. Within an opening 37 in the platform an electromagnet armature 38 is pivotally mounted, an extension 39 of this armature carries a counterbalance weight 41 and is acted upon by a compression spring 42 which serves to urge armature 38 away from the core 36. The free end 43 of the armature, when urged away from the core 36 by spring 42, engages with a groove 44 around the lower end of rod 8 when the lever is in the position shown in Figure 1 to lock the lever against movement about its pivots 11. In the position of the rod in Figure 1 the plane of the button 17 lies in the plane of pivotal movement of the lever and the pin 27 occupies an inclined position against stops 28. If the button 17 is twisted the pin 27 will move with the rod 8 about the rod's longitudinal axis so that the pin moves to its opposite position against stops 28 where the longitudinal axis of the pin lies in the plane of pivotal movement of the lever about pivot 11. In this movement one end of the pin 27 will engage against the upper surface of the armature 38 to depress out of engagement with the groove 44 thus removing

the lock on movement of the lever so that it may be moved to its opposite position.

The base 2 is provided with four sets of identical contacts which co-operate with four identical sliding contacts. For convenience, only one set of these contacts and one sliding contact will be described. Each set of contacts comprises a pair of fixed end contacts 45 and 46 and a central contact 47 located within a channel 48 formed within the base 2. The sliding contact comprises a strip of metal 49 whose length is sufficient to bridge from the centre contact 47 to one or the other of the outer contacts, this strip 49 being carried by a carrier 51 of an insulating material. The carrier 51 is channel-shaped, the strip 49 being carried by the base thereof and located by tangs 52 at the end of the strip which engage in small recesses in the carrier 51. The carrier 51 is located in position by sliding engagement within the channel 48 and is spring-urged on to the fixed contacts by means of a spring formed of steel wire 53 which engages a small projection 54 located centrally of the upper side of the carrier 51. Steel wire 53 before insertion in the switch is straight, but during insertion it is clamped in position by means of insulating plates 55 and 56 engaging the ends of the steel wire 53 and locating them in recesses 57 and 58 in the base 2. In the clamping of the wire it is elastically bent by its engagement with the projection 54 whereby the wire 53 will exert a resilient force on the carrier 51 through the projection 54 thus causing the moving contact strip 49 to be held resiliently in contact with the fixed contacts in the base 2. Each contact carrier has two side members 59 extending upwardly and in each a vertically directed slot 61 is formed. A contact moving pin 62 extends transversely in the slots 61 of all contact carriers, moving them simultaneously. Movement is applied to the pin 62 by means of a pair of auxiliary levers 63 located one on each side of the switch and pivoted in the members 6 of the framework by pivot pins 64. The auxiliary levers 63 include slots 65 at their upper ends for engagement with pins 66 extending one from either side of the lower end of bush 7. In this way it will be seen that angular movement of the operating lever will cause opposite angular movement of the auxiliary lever 63 to impart linear sliding movement to the contact carriers 51 within their grooves 48. It is arranged that at one extreme position of the operating lever within slot 14 the moving contact strips 49 bridge the fixed contacts 45 and 47 whilst in the other extreme position of the operating lever the moving contact strip 49 bridges the fixed contacts 46 and 47.

Within the underside of the base 2 a plurality of screw connectors 67 are located by which electric cables may be connected to the fixed contacts. A rubber cover 68 encloses the base 2 to cover the connections between electric cables to the screw connectors 67.

For normal operation in controlling the undercarriage of an aircraft, the switch in the position as shown in Figure 1 corresponds to the undercarriage in its lowered position and an electric circuit through the electromagnet winding 35 is arranged to be opened when aircraft weight is on the aircraft landing wheels compressing the undercarriage to some extent. Breaking of this electric circuit allows the armature 38 to lift into the position shown to act as a pawl and engage the groove 44 on rod 8 thus preventing operation of the lever to raise the undercarriage. When the aircraft has taken off and weight is then removed from the landing wheels an electric circuit is established through the winding 35 to attract armature 38 to core 36 and thus to remove the lock on the lever to allow it to be moved to a position to cause the undercarriage to be raised. When the aircraft is on the ground and, for example is taxiing, and emergency conditions arise rendering it necessary to raise the undercarriage, for example in order to avoid a collision, the pilot of the aircraft twists the button 17 to twist the rod 8 causing one end of the transverse pin 27 to engage armature 38 and move it out of locking engagement with the groove 44. The switch may then be moved in the normal way to raise the undercarriage allowing the aircraft to fall on the ground and to stop as quickly as possible. The one end of the transverse pin forms a projection to engage the armature to move it from the locked position.

It is desirable, after the button 17 has been twisted for emergency lifting of the undercarriage, that it should not be possible to twist the button back to its normal position whereby it is possible to establish at a later date that the reason for raising the undercarriage was due to a definite emergency action on the part of the pilot. For this purpose, an addition may be made to the switch as shown in the cross-section at Figure 4. In this cross-section the enlargement 25 of the rod located in the upper end of the bush 7 is provided with a transversely extending recess 69 within which a spring-loaded plunger 71 is located having an outer end 72 of reduced diameter. A slot 73 is cut across the end of bush 7 such that in the normal position of button 17 the reduced end 72 of plunger 71 is out of register with slot 73, but so that when button 17 is twisted for emergency operation the end 72 of plunger 71 will engage in slot 73 to prevent the rod being twisted back to its normal position.

For adjustment of the effective position of armature 38 to engage groove 44 the platform 32 carrying the electromagnet assembly is arranged for limited vertical adjustment on supports 33 by virtue of elongated holes in the platform through which fixing screws to the supports 33 extend.

In order to prevent entry of dust and the like into the switch a rubber cover 74 may be provided internally of the switch clamped under the member 12 and engaged around a recess 75 in the bush 7.

I claim as my invention:

1. A lever-operated electric switch comprising a switch casing, a lever mounted in the casing for pivotal switch operating movement about an axis transverse to its longitudinal axis and for twisting movement about its longitudinal axis, a pawl movably mounted in the casing and capable of locking the lever when in one switch operating position to prevent pivotal movement to another switch operating position and a projection carried by the lever within the casing and movable on twisting movement of the lever to engage the pawl to unlock the lever to permit pivotal movement thereof to another switch operating position.

2. A lever-operated electric switch comprising a switch casing; a lever mounted in the casing for pivotal switch operating movement about an axis transverse to its longitudinal axis and for twisting movement about its longitudinal axis; said lever comprising a bush pivotally mounted in the casing about an axis transverse to the axis of the bore within the bush, a rod carried in the bore of the bush so as to be capable of twisting movement and a handle at the outer end of the rod whereby twisting movement may be applied to the rod; a pawl movably mounted in the casing to engage the lever when in one switch operating position to prevent pivotal movement to another switch operating position; and a projection carried by the lever within the casing and movable on twisting movement of the lever to engage the pawl to move it out of locking engagement with the lever.

3. A lever-operated electric switch as claimed in claim 2, including a spring-loaded plunger located within the bush for co-operation within the projection to ensure that a predetermined twisting torque must be applied to the rod in order to bring the projection into switch unlocking engagement with the pawl.

4. A lever-operated electric switch as claimed in claim 3, wherein the rod is located against endwise movement within the bush by engagement of the projection with one end of the bush and by engagement of a flange on the bush with a shoulder in the bore of the bush.

5. A lever-operated electric switch as claimed in claim

4, wherein the rod within the bush includes a transversely disposed spring-loaded plunger arranged to engage a recess in the bush when the rod is twisted to unlock the switch thereby preventing the rod being twisted back to the switch locked position.

6. A lever-operated electric switch comprising a switch casing, a lever mounted in the casing for pivotal switch operating movement about an axis transverse to its longitudinal axis and for twisting movement about its longitudinal axis, a pawl movably mounted in the casing to engage the lever when in one switch operating position to prevent pivotal movement to another switch operating position, a projection carried by the lever within the casing and movable on twisting movement of the lever to engage the pawl to move it out of locking engagement with the lever, an electromagnet, and a pivoted armature for the electromagnet, this armature forming the pawl engageable with the lever whereby locking of the switch depends on energization of the electromagnet.

7. A lever-operated electric switch comprising a switch casing, a lever mounted in the casing for pivotal switch operating movement about an axis transverse to its longitudinal axis and for twisting movement about its longitudinal axis, a pawl movably mounted in the casing to engage the lever when in one switch operating position to prevent pivotal movement to another switch operating position, a projection carried by the lever within the casing and movable on twisting movement of the lever to engage the pawl to move it out of locking engagement with the lever, fixed contacts, an insulating support carrying the fixed contacts, a sliding contact co-operating with the fixed contacts, spring loading urging the sliding contact against the fixed contacts and an operative connection between the lever and the sliding contact.

8. A lever-operated switch as claimed in claim 7, wherein the spring loading comprises a strip of spring material extending substantially parallel to the path of movement of the sliding contact and elastically bent to engage the sliding contact with resilient force over the path of movement.

9. A lever-operated switch as claimed in claim 8, wherein the strip of spring material in its normal unstressed state is straight and the support in which the fixed contacts are mounted includes a pair of clamps to grip the two ends of the strip with its intermediate portion in touching the moving contact so that the strip is elastically bent and exerts resilient force on the sliding contact.

10. A lever-operated switch as claimed in claim 9, wherein the operative connection between the sliding contact and the lever comprises a pair of spaced auxiliary levers between which the pawl is mounted to co-operate with the switch operating lever.

11. A lever-operated switch as claimed in claim 10, including an electromagnet and a pivoted armature for the electromagnet which forms the pawl, both the electromagnet and the armature being mounted between the auxiliary levers.

References Cited in the file of this patent

UNITED STATES PATENTS

2,612,049	Koch	Sept. 30, 1952
2,734,963	Ardia	Feb. 14, 1956