

March 28, 1961

T. Y. KORSGREN, SR., ET AL  
SWITCH AND ACTUATOR ASSEMBLY

2,977,447

Filed Oct. 23, 1957

2 Sheets-Sheet 1

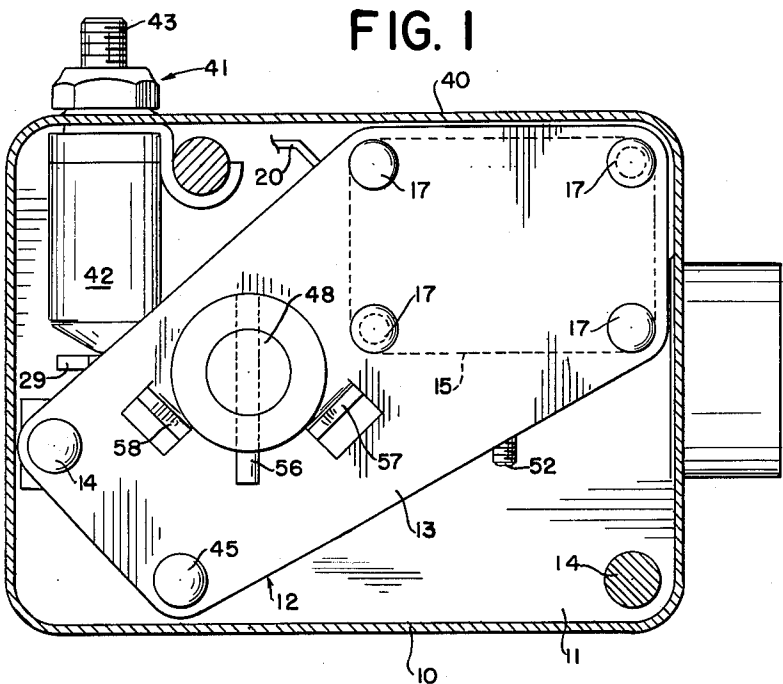
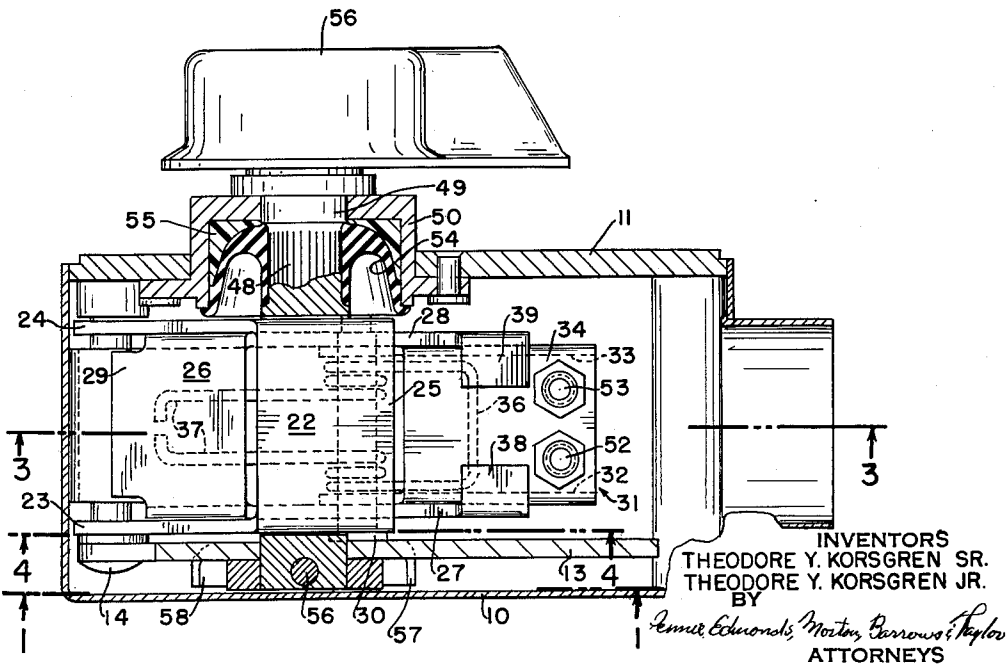


**FIG. 2**



INVENTORS  
THEODORE Y. KORSGREN SR.  
THEODORE Y. KORSGREN JR.

BY

*Emmett Edmunds, Morton Barrows, Taylor*  
ATTORNEYS



1

2,977,447

## SWITCH AND ACTUATOR ASSEMBLY

Theodore Y. Korsgren, Sr., Woodbury, and Theodore Y. Korsgren, Jr., Wolcott, Conn., assignors to Haydon Switch, Inc., Waterbury, Conn., a corporation of Connecticut

Filed Oct. 23, 1957, Ser. No. 691,932

16 Claims. (Cl. 200—153)

The present invention relates to switch and actuator assemblies, and more particularly to an improved assembly of this type which is especially adapted for use in aircraft, for example, where the assembly may be subjected to substantial shock forces.

One of the features of the present invention resides in the provision of a switch and actuator assembly, advantageously of an hermetically sealed construction, which comprises a relatively delicate or sensitive switching device and rugged, heavy-duty means for effecting actuation of the switch. In this respect, the actuating means of the assembly is arranged to withstand relatively severe shock forces, as may occur in the landing of aircraft, for example, so that accidental actuation of the switch means is avoided.

In conjunction with the foregoing feature, the assembly of the invention comprises an actuator mechanism having relatively heavy spring means for retaining the actuator in a normal position and including means to isolate the action of such heavy spring means from a relatively delicate switching device.

Another specific feature of the invention resides in the provision of a switch and actuator assembly of the type and having the characteristics set forth above, which includes novel arrangements for adjusting the actuator mechanism. In this respect, the actuating mechanism includes adjustable means acted upon by a relatively heavy spring and adapted to have excess movement or overtravel in a direction toward the actuator of the switching device without causing the strong force of the heavy spring to be applied to the switch actuator. The arrangement is such that positive actuation of a sensitive switching device is assured, using a rugged, heavy-duty actuating mechanism, while at the same time effecting the actuation of the switch by relatively sensitive means to avoid damaging the switch.

For a better understanding of the invention reference should be made to the following description and the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of the new switch and actuator assembly, taken generally along line 1—1 of Fig. 2;

Fig. 2 is a cross-sectional view of the assembly of Fig. 1, taken generally along line 2—2 of Fig. 4;

Fig. 3 is a cross-sectional view of the assembly of Fig. 1, taken generally along line 3—3 of Fig. 2, illustrating the actuating mechanism of the assembly in an operating position; and

Fig. 4 is a cross-sectional view, taken generally along line 4—4 of Fig. 2.

Referring now to the drawing, the reference numeral 10 designates a housing, which may form part of a sealed enclosure for the new switch and actuator assembly. The housing 10 may include a wall 11, which mounts most of the assembly components, the wall 11 being secured in sealed relation to the remainder of the housing, as by brazing.

Carried by the housing wall 11 is a frame structure

2

12, including a plate 13 held in spaced relation to the wall 11 by a plurality of posts 14. At one end, the plate 13 of the illustrated apparatus mounts a pair of switches 15, 16 in side-by-side relation, the switches being secured to the plate by means such as rivets 17. Advantageously, the switches 15, 16 are relatively sensitive, snap-acting devices having movable actuators 18 projecting therefrom. The switches may also include spring arms 19 which overlie the actuators 18, so that the actuators may be moved by the application of forces which are offset somewhat from the actuators. Suitable leads or terminals 20, 21 project from the switches and are adapted to be connected to electrical conductors (not shown).

Mounted on the frame plate 13 and housing wall 11, by means of one of the posts 14, is an arm 22 which is adapted for limited pivotal movement about the axis of the post 14. The arm 22 may be formed of sheet metal material and comprises spaced arm portions 23, 24 connected at their outer ends by a cross strip 25. For convenience of reference the arm 22 may be referred to as a mounting arm.

Pivotaly mounted at the outer end of the mounting arm 22 is a second arm 26 comprising spaced arm portions 27, 28 connected by a cross strip 29. The arm 26, which may be referred to as an adjusting arm, is connected to the mounting arm 22 by means of a pin 30 which engages the adjusting arm 26 intermediate its ends and permits limited pivotal movement of the arm 26 with respect to the arm 22.

Also pivotaly connected to the mounting arm 22, by means of the pin 30, is a third arm 31 comprising spaced arm portions 32, 33 connected by a cross strip 34. The arm 31, which may be referred to as an actuating arm, is pivoted at its left hand end, as viewed in Fig. 3, for example, and has a free end portion projecting beyond the right hand end of the adjusting arm 26 and generally underlying the actuators 18 of switches 15, 16.

In accordance with one aspect of the invention the actuating arm 31 is acted upon by one end 35 of a relatively light wire spring 36. The spring 36 of the illustrated apparatus has one or more convolutions about the pivot pin 30 and has its other end 37 bearing against the cross strip 29 of the adjusting arm 26. The action of the spring 36 is such as to urge the actuating arm 31 to pivot in a counterclockwise direction with respect to the adjusting arm 26.

As shown best in Figs. 2 and 3, the adjusting arm 26 is provided at its right hand end with a pair of inwardly projecting tabs 38, 39 which overlie the cross strip 34 of the actuating arm and limit the extent to which the arm 31 may pivot with respect to the adjusting arm 26. Thus, when the apparatus is in the condition shown in Fig. 3 the actuating arm 31 urged by the spring 36 against the tabs 38, 39 so that, in effect, the arms 26, 31 form a unitary element.

Mounted on one wall 40 of the assembly housing 10 is an adjustable post assembly 41 having an end portion 42 projecting into the housing and being adjustably positioned therein by means of an adjusting screw 43. The post assembly 41 which, in itself, forms no part of the present invention, may advantageously be of the construction illustrated and described in the copending application, Serial No. 691,931 of Korsgren, Sr. et al.; filed October 23, 1957. In this respect, the projecting end portion 42 of the post assembly includes a movable element surrounded by a flexible sealing element and adapted to have limited adjusting movement toward and away from the housing wall 40, the adjustment being effected by appropriate manipulation of the screw 43.

In the illustrated apparatus the innermost end of the post assembly 41 directly overlies the cross strip 29 of the adjusting arm 26. Accordingly, the post assembly 41

forms an abutment limiting the extent of upward movement of the cross strip 29. The function of the post assembly will become more apparent in connection with the following description.

In accordance with the invention, a spring 44, which is quite strong in relation to the wire spring 36, acts between a post 45, of the housing and frame structure, and the mounting and adjusting arms 22, 26, in a manner urging the rams upwardly with a relatively strong force. As shown best in Figs. 3 and 4 the spring 44 is a generally U-shaped element of flat cross section, the spaced arms of which lie on opposite sides of the pin 14, upon which the mounting arm 22 is pivoted. At one end, the spring 44 has a curved portion 46 bearing against the post 45, and at its other end the spring has a T-shaped head 47 which underlies and presses upwardly upon the spaced arm portions 27, 28 of the adjusting arm 26.

Advantageously, the end 47 of the spring 44, which may be referred to as the main spring, bears directly upon the adjusting arm 26 at a point adjacent the pivot pin 30 but spaced from the pin 30 toward the pin 14 supporting the mounting arm 22. The arrangement is such that the upward force of the spring 44, applied through end 47 thereof, tends to pivot the adjusting arm 26 in a clockwise direction with respect to the mounting arm 22. However, such counterclockwise movement of the adjusting arm is limited by the adjustable post assembly 41, so that the spring 44 actually has a combined action or effect, urging the adjusting arm 26 in a clockwise direction relative to the mounting arm 22 and urging the mounting arm 22 in a counterclockwise direction.

To limit the extent of upward movement of the mounting arm 22 there is provided an abutment which, in the illustrated form of the invention, is a shaft 48. The shaft 48, which may be referred to as the operating shaft, is journaled at one end 49 in a bushing 50 mounted on the housing wall 11 and at its other end in the frame plate 13. Intermediate its ends the shaft 48 is provided with flat surface portion 51 (see Fig. 3) which normally faces downwardly and directly overlies the cross strip 25 of the mounting arm 22. Accordingly, when the operating shaft 48 is in its normal position, as shown in Fig. 4, the surface 51 thereof forms a rigid abutment limiting the upward or counterclockwise pivoting movement of the mounting arm 22 under the influence of the main spring 44.

When the mounting arm 22 is in its upper limit position the force of the spring 44 seats the cross strip 29 of the adjusting arm 26 firmly against the lower end of the adjusting post assembly 41. Accordingly, by appropriate adjustment of the post assembly 41, the normal or initial position of the adjusting arm 26 relative to the mounting arm 22 may be varied within predetermined limits.

Adjustably secured in the outer end portion of the actuating arm 31 are spaced adjusting screws 52, 53, which project toward and underlie the spring arms 19 and actuators 18 of the respective switches 15, 16. The arrangement is such that when the actuating mechanism comprising arms 22, 26, 31 is in its normal position, as shown in Fig. 4, the adjusting screws 52, 53 bear upon the spring arms 19 to urge the actuators 18 upwardly and maintain the switches 15, 16 in actuated condition.

In accordance with one aspect of the invention the adjustment of the post assembly 41 is such that, when the actuating mechanism is in its normal position, the tabs 38, 39 are spaced somewhat above the cross strip 34 of the actuating arm 31. Thus, the switch actuators 18 are acted upon by the actuating arm 31, under the force of the wire spring 36. Advantageously, the effective force applied by the spring 36 is sufficient to actuate the switches 15, 16, but not sufficiently in excess of the necessary actuating force to overstress delicate components of the switches.

In the illustrated form of the invention, operation of

the assembly is effected by rotation of the operating shaft 48. To this end, the shaft 48 is provided with a flexible rotary sealing element 54 which is bonded to the shaft 48 and to the bushing 50, being supported between the bonded areas by a parting element 55 formed of a material such as Teflon (polytetrafluoroethylene). The construction and arrangement of the rotary seal is described more fully in the beforementioned copending application, Serial No. 691,931.

One end of the shaft 48 projects outwardly of the housing 10 and carries a suitable knob 56 adapted for manual operation. The other end of the shaft 48 projects somewhat beyond the frame plate 13 and carries a pin 56. The pin 56 acts in cooperation with tabs 57, 58, projecting from the frame plate 13 to limit the rotation of the shaft. As shown in Fig. 1, the tabs 57, 58 may be so positioned as to permit the operating shaft 48 to be rotated somewhat less than 45° from its normal position.

The switch and actuator assembly is operated by rotating the knob 56 in either direction, whereby to tilt the abutment surface 51, substantially as shown in Fig. 3. The abutment surface 51 thus forms, at least in effect, cam means for forcing the mounting arm 22 to pivot in a clockwise direction against the action of the main spring 44. The initial clockwise movement of the mounting arm 22 moves the pivot pin 30 downwardly, tending to carry with it the adjusting arm 26. However, the main spring 44 tends at all times to pivot the adjusting arm in a clockwise direction, so that the left hand end of the adjusting arm is held seated against the post assembly 41.

During the initial downward movement of the pivot pin 30, the actuating arm 31 is held against the switch actuators 18 by the action of the wire spring 36. However, after a short initial movement the actuating arm 31 is picked up by the inwardly projecting tabs 38, 39 of the adjusting arm 26, whereupon the actuating arm becomes effectively rigid with the adjusting arm and moves away from the switch actuators 18 to effect operation of the switches 15, 16.

When manual operating force is released from the knob 56 the action of the main spring 44 automatically rotates the shaft 48 to its initial position, restoring the actuating mechanism to its initial position, substantially as shown in Fig. 4. Advantageously, the adjustment of the post assembly 41 is such as to provide a certain amount of overtravel in the adjusting arm 26, so that the actuating arm 31 is acted upon by the wire spring 36 to apply predetermined actuating force to the switch actuators 18.

One of the important features of the invention resides in the novel actuating mechanism, including a relatively strong spring which readily absorbs high shock loads and forcefully restores the mechanism to its initial position when manual or other external operating force is released. At the same time the relatively heavy forces of the main spring 44 are wholly isolated from the more or less delicate switch assemblies 15, 16, so that the switch components are not overstressed or otherwise damaged in operation.

It should be understood that the specific form of the invention herein illustrated and described is intended to be representative only, as certain changes may be made therein without departing from the clear teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

We claim:

1. A switch and actuator assembly comprising a frame, a switch mounted on the frame and having a movable actuator, a mounting arm pivoted on the frame, heavy spring means urging said mounting arm in a first direction, an adjusting arm pivoted on said mounting arm, said heavy spring means urging said adjusting arm in a

5

second direction, adjustable stop means for limiting movement of said adjusting arm in said second direction, an actuating arm pivoted on said mounting arm and having a portion adapted to bear upon said movable actuator, light spring means urging said actuating arm in said first direction, means for limiting movement of said mounting arm in said first direction, operating means for moving said mounting and adjusting arms in said second direction, and interengaging means on said adjusting and actuating arms operative upon movement of said adjusting arm in said second direction to move said actuating arm away from said actuator.

2. A switch and actuator assembly comprising a frame, a switch mounted on the frame and having a movable actuator, an actuating arm mounted for movement toward and away from said actuator, movable mounting means pivoted on said frame and pivotably mounting said actuating arm, said mounting means being movable generally toward and away from said actuator, heavy spring means urging said mounting means toward said actuator, abutment means limiting movement of said mounting means toward said actuator, light spring means urging said actuating arm toward said actuator, operating means for moving said mounting means away from said actuator, and interengaging means acting between said mounting means and actuating arm for moving said actuating arm away from said actuator together with said mounting means.

3. A switch and actuator assembly comprising a frame, an adjustable member, a switch mounted on the frame and having a movable actuator, an actuating arm mounted for movement toward and away from said actuator, movable mounting means comprising a mounting arm and an adjusting arm pivoted on said mounting arm, said mounting means being carried by the frame and mounting said actuating arm, said mounting means being movable generally toward and away from said actuator, heavy spring means urging said mounting means toward said actuator, abutment means acting on said mounting arm and limiting movement of said mounting means toward said actuator, light spring means urging said actuating arm toward said actuator, operating means for moving said mounting means away from said actuator, and interengaging means acting between said mounting means and actuating arm for moving said actuating arm away from said actuator together with said mounting means.

4. The assembly of claim 3, characterized by said mounting arm being pivoted on said frame, said heavy spring means acting on said adjusting arm between the pivoting axis of the mounting arm and the pivoting axis of said adjusting arm, said adjustable member acting on said adjusting arm between said axes.

5. A switch and actuator assembly comprising a frame, a switch mounted on the frame and having a movable actuator, an actuating arm mounted for movement toward and away from said actuator, movable mounting means carried by the frame and mounting said actuating arm, said mounting means being movable generally toward and away from said actuator, heavy spring means urging said mounting means toward said actuator, abutment means limiting movement of said mounting means toward said actuator, light spring means acting between said mounting means and said actuating arm and urging said actuating arm toward said actuator, operating means for moving said mounting means away from said actuator, and interengaging means acting between said mounting means and actuating arm for moving said actuating arm away from said actuator together with said mounting means.

6. A switch and actuator assembly comprising a frame, a switch mounted on the frame and having a movable actuator, an actuating arm mounted for movement toward and away from said actuator, movable mounting means comprising a mounting arm pivoted on said frame

6

and an adjusting arm pivoted between its ends on said mounting arm, said mounting means mounting said actuating arm, said mounting means being movable generally toward and away from said actuator, heavy spring means urging said mounting means toward said actuator, abutment means acting on said mounting arm for limiting movement of said mounting means toward said actuator, an adjustable member acting on said adjusting arm and operative in conjunction with said mounting arm to determine the position of said adjustment arm when said mounting arm is against said abutment means, light spring means urging said actuating arm, toward said actuator, operating means for moving said mounting means away from said actuator, and interengaging means acting between said mounting means and actuating arm for moving said actuating arm away from said actuator together with said mounting means.

7. A switch and actuating assembly comprising a switch having a movable actuator, an actuating arm movable toward and away from said actuator, movable mounting means mounting said actuating arm and movable toward and away from said actuator, said actuating arm being pivoted on said mounting means, heavy spring means urging said movable means toward said actuator with a strong force, light spring means acting between said mounting means and actuating arm and tending to pivot said actuating arm toward said actuator with a light force, and operator means acting in opposition to said heavy spring means for moving said actuating arm away from said actuator.

8. A switch and actuator assembly comprising a frame, a switch mounted on the frame and having a movable actuator, an actuating arm mounted for movement toward and away from said actuator, movable mounting means carried by the frame and mounting said actuating arm, said actuating arm being movable relative to said mounting means, said mounting means being movable generally toward and away from said actuator, heavy spring means urging said mounting means toward said actuator, abutment means limiting movement of said mounting means toward said actuator, light spring means urging said actuating arm toward said actuator, said actuating arm being movable by said actuator against said light spring means relative to said mounting means, said light spring means supplying substantially the only direct loading force on said actuator, operating means for moving said mounting means away from said actuator, and interengaging means acting between said mounting means and actuating arm for moving said actuating arm away from said actuator together with said mounting means.

9. The assembly of claim 8, characterized by said operating means comprising a cam-like member, and said abutment means comprising a portion of said cam-like member.

10. The assembly of claim 9, characterized by said cam-like member comprising a rotatable shaft having a flat portion forming said abutment means.

11. A switch and actuator assembly comprising a switch having a movable actuator, an actuating arm movable toward and away from said actuator, movable mounting means mounting said actuating arm and movable toward and away from said actuator, said actuating arm being movable relative to said mounting means, heavy spring means urging said movable means toward said actuator with a strong force, light spring means urging said actuating arm toward said actuator with a light force, said actuating arm being movable by said actuator against said light spring means relative to said mounting means, said light spring means supplying substantially the only direct loading force on said actuator, and operator means acting in opposition to said heavy spring means for moving said actuating arm away from said actuator.

12. The assembly of claim 11, including adjustable

7

means acting on said mounting means for determining in part the limit of movement of said adjustable means toward said actuator.

13. A switch and actuator assembly comprising a switch having a movable actuator, a light spring powered means acting in a direction toward said actuator and supplying substantially the only direct loading force on said actuator, operator means to move said light spring powered means in a direction away from said actuator, and heavy spring powered means acting in opposition to said operator means connected to said light spring powered means and acting to move said light spring means in a direction toward said actuator.

14. The assembly of claim 13, characterized by said light spring powered means comprising an actuating arm and a spring acting on said actuating arm, and said heavy

8

spring powered means comprising mounting means for said actuating arm.

15. The assembly of claim 13, including a frame, and characterized by said operator means comprising a rotatable cam-like member journaled in said frame, and said heavy spring powered means comprising a mounting arm movable in said frame and acted upon by a heavy spring.

16. The assembly of claim 11, including adjustable means acting on said mounting means for determining in part the limit of movement of said adjustable means toward said actuator.

#### References Cited in the file of this patent

#### UNITED STATES PATENTS

2,092,085 Riley ----- Sept. 7, 1937