

SELF-RETAINING ACTUATOR ASSEMBLY

This invention relates to an actuator assembly for actuating a switch and particularly to an actuator assembly that is self-retaining. It is often necessary to mount an actuator on a housing in order to actuate a device within the housing. One application for such actuators is in conjunction with a push-to-talk (PTT) switch for a portable radio. A switch, such as a popple switch, can be provided on the interior of the radio housing and can be actuated by the depression of a push-to-talk button mounted on the outside of the housing.

One known approach is to mount an actuator on the housing utilizing an ultrasonically welded cover. A PTT button mounted on the housing engages the cover to operate the actuator. While the use of an ultrasonically welded cover on the actuator provides a water seal, this approach is both expensive and time consuming in manufacture. It is desirable to provide an actuator assembly that is both easy to manufacture and inexpensive, while provided both a seal and retention of the actuator and button to the housing.

According to one of two aspects of the present invention, there is provided a self-retaining actuator assembly, a switch and a housing in combination, wherein: the actuator assembly comprises: a button including a plurality of fingers received through an opening in the housing, each finger including lip means within the housing for retaining the button to the housing, an actuator means in mutual engagement with the button, the actuator means being formed of resiliently flexible material and extending through the housing opening between the fingers, and a seal means positioned about the actuator means and engaging the button and the housing about the opening; and wherein the switch is mounted independently of the actuator assembly within the housing and has switch actuator means separate from the actuator means of the actuator assembly, mounted for actuating by the actuator means of the actuator assembly.

According to the other aspect of the present invention, there is provided a self-retaining actuator assembly for actuating a switch comprising: a housing having an opening; a button including a plurality of fingers received through said opening, each finger

including lip means within the housing for retaining the button to the housing; an actuator means mutually engaging the button and extending through the housing opening between the fingers; and a seal means being positioned about the actuator means and engaging the button and the housing about the opening, wherein the actuator means and the seal means are integrally formed of resiliently flexible material.

The switch may be a push-to-talk switch.

A preferred embodiment of the invention is now described with reference to the drawings, in which:

Fig. 1 is a fragmentary front elevational view of an actuator assembly in accordance with the present invention; and

Fig. 2 is an exploded view of the actuator assembly and switch.

Referring first to Fig. 1, it will be understood that the actuator assembly 10 is carried by a housing 11. In the preferred embodiment, the actuator assembly 10 is utilized to actuate a switch 12 that is located on the interior of the housing 11.

Referring now to Fig. 2, it will be seen that the actuator assembly 10 includes an actuator/seal 13. The actuator/seal 13 includes a cup shaped seal 14, comprising seal means, having a smaller diameter seal surface 15 and an opposite larger diameter seal surface 16 interconnected by web 17. Extending from the smaller diameter seal surface 15, through the larger diameter seal surface 16, is an actuator portion 18 comprising actuator means. The actuator portion 18 is formed, in cross-section, in the shape of an X or a cross, the end 19 of which provides an engagement surface for actuating the switch 12. A button 20 includes a plurality of locating and retaining fingers 21 carried by a longitudinal button body 22. In the preferred embodiment there are four fingers 21 which are positioned to receive the actuator portion 18. Each finger 21 includes a lip portion 23 at its end remote from the body 22. The button 20 is preferably made of resilient plastic material and includes opposed end feet 27 and 28.

In order to assemble the switch actuator assembly 10, the actuator/seal 13 is positioned with its smaller diameter seal surface 15 against the button body 22 and the actuator portion 18 between the fingers 21. The housing 11, as seen in Fig. 1, includes a depression 25 that is dimensioned to receive the button 20. A

central axial opening or hole 26 through the housing 11 in a depression 25 receives the fingers 21 and actuator portion 18. Pressure applied by pushing against the button 20 is used to force the fingers 21 to converge against their resilient force and that of the actuator portion 18. The lips 23 each provide a cam surface for deflecting the fingers 21, and pass through the opening 26. Once the lips 23 have passed through the hole 26, the fingers 21 return to their normal position. The lips 23 engage the inside wall of housing 11 about the opening 26, preventing withdrawal of the fingers 21 from the hole 26. In this position, the larger diameter seal surface 16 of the actuator/seal 13 engages a groove 30 in the exterior wall of the housing 11 within the depression 25. The actuator portion 18 extends into the housing 11 with its end 19 positioned adjacent to the switch 12. The feet 27 and 28 engage the housing 11 within the depression 25 to permit bending of the button 20 when it is pressed.

In order to actuate the switch 12, the button 20 is pressed toward the housing 11 causing the button to flex or bend and the cup shaped seal 14 to deform. The actuator end 19 moves toward and into engagement with the switch 12 thereby actuating the switch 12. When the button 20 is released the resiliency of the button causes it to return to its original position and the resilient force of the seal 14 and actuator portion 18 draw the actuator end 19 away from the switch 12.

The actuator assembly 10 provides a seal about the opening 26 with the smaller diameter seal surface 15 engaging the button body 22 and the larger diameter seal surface 16 engaging the housing groove 30. The lips 23 engage the inside wall of the housing 11 to capture the button 20 and the actuator/seal 13, maintaining them in position. The switch 12, which in the preferred embodiment is mounted on a printed circuit board (not shown) and functions as a PTT switch, is positioned so as to be actuated when the button 20 is depressed. The actuator/seal 13 of the preferred embodiment is integrally molded of resiliently flexible material such as silicone rubber. In the event of over travel by the actuator portion 18, it will resiliently compress thereby preventing damage to the switch 12.



Claims

1. A self-retaining actuator assembly, a switch and a housing in  
5 combination, wherein:  
the actuator assembly comprises  
a button including a plurality of fingers received through an  
opening in the housing, each finger including lip means within the  
housing for retaining the button to the housing,  
10 an actuator means in mutual engagement with the button, the  
actuator means being formed of resiliently flexible material and  
extending through the housing opening between the fingers,  
a seal means positioned about the actuator means and  
engaging the button and the housing about the opening;  
15 and wherein the switch is mounted independently of the  
actuator assembly within the housing and has switch actuator means  
separate from the actuator means of the actuator assembly,  
mounted for actuating by the actuator means of the actuator  
assembly.  
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2. A self-retaining actuator assembly, switch and housing as  
defined in claim 1, in which said switch is a push-to-talk switch.
3. A self-retaining actuator assembly, switch and housing as  
25 defined in claim 1 or 2 in which said switch is mounted on a printed  
circuit board.
4. A self-retaining actuator assembly, switch and housing as  
defined in claim 1, 2 or 3 in which said resiliently flexible material  
30 is silicone rubber.
5. A self-retaining actuator assembly for actuating a switch  
comprising:  
a housing having an opening;  
35 a button including a plurality of fingers received through said  
opening, each finger including lip means within the housing for  
retaining the button to the housing;



an actuator means mutually engaging the button and extending through the housing opening between the fingers; and

a seal means being positioned about the actuator means and engaging the button and the housing about the opening,

5 wherein the actuator means and the seal means are integrally formed of resiliently flexible material.

6. A self-retaining actuator assembly as defined in claim 5, in  
10 which the housing contains a switch and the actuator means selectively actuates the switch.

7. A self-retaining actuator assembly as defined in claim 6, in which said switch is a push-to-talk switch.

15 8. A self-retaining actuator assembly as defined in claim 6 or 7 in which said switch is mounted on a printed circuit board.

9. A self-retaining actuator assembly as defined in any one of  
20 claims 5 to 8 in which said resiliently flexible material is silicone rubber.

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