March 19, 1940. B. E. SHAW 2,194,128

SWITCH STRUCTURE

Filed April 10, 1939

Fig. 4

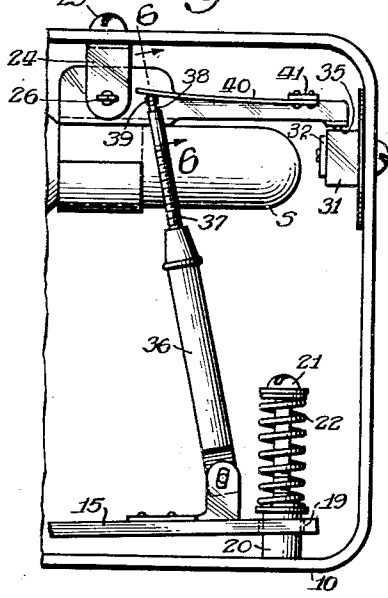


Fig. 8

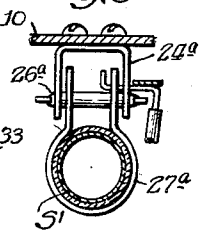


Fig. 5

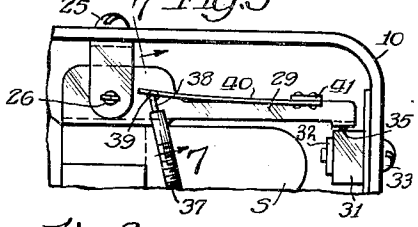


Fig. 3

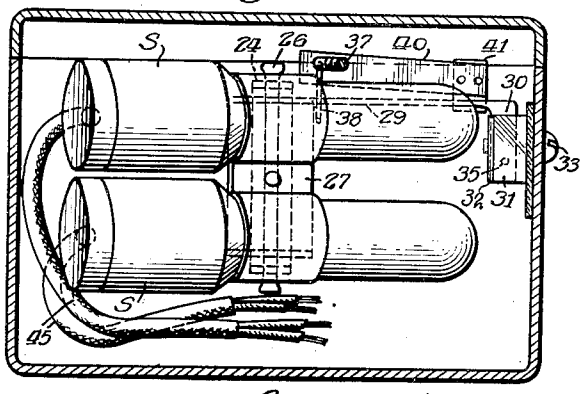


Fig. 2

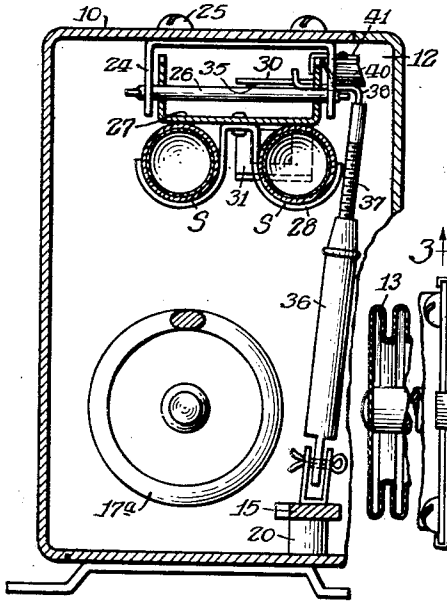


Fig. 1

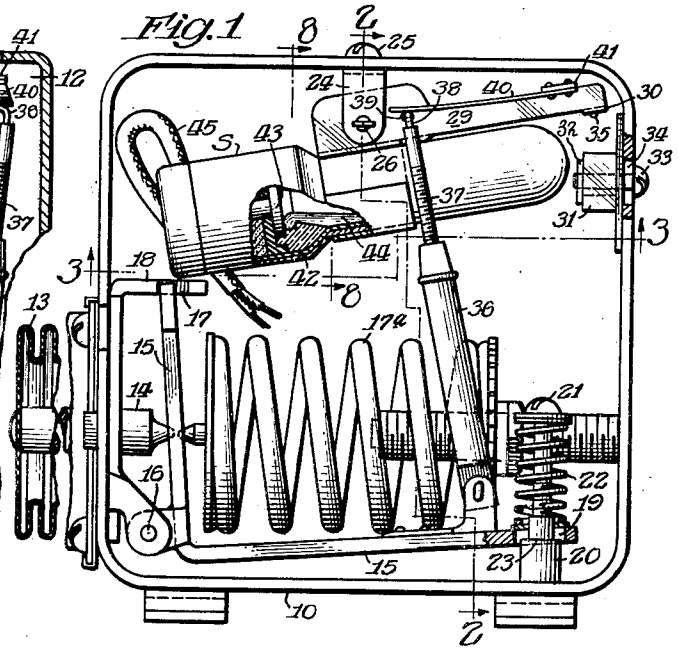


Fig. 6

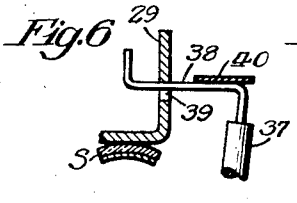
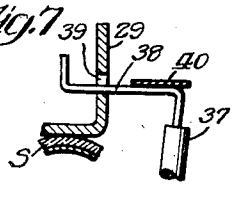


Fig. 7



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2,194,128

SWITCH STRUCTURE

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Application April 10, 1939, Serial No. 266,944

7 Claims. (Cl. 200—83)

An object of my invention is to provide a switch structure, particularly adapted for efficient operation of a mercury tube type of switch in response to a condition responsive element.

Another object is to provide a switch structure including convenient means to mount one or more mercury switch tubes for oscillating movement between opened and closed positions in response to the condition responsive element.

Another object is to provide means for mounting the mercury switch tube consisting of a pair of U-shaped brackets one being mounted stationarily in the casing of the switch and the other being pivoted to the first one and in turn supporting a mercury switch tube. The second bracket being connected by link mechanism to an actuating element for operation in response to movement thereof.

Still a further object is to provide a magnet cooperating with the mercury tube switch to insure quick movement thereof to the opened and closed circuit positions with the connection between the mercury switch tube and an actuating element therefor including a lost motion connection and resilient means biasing the lost motion connection to one of its limits of movement.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my switch structure, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawing, in which:

Figure 1 is a front elevation of a switch structure embodying my invention. The cover of the switch being removed and portions of the structure being broken away and shown in section to illustrate details thereof.

Figure 2 is a sectional view on the line 2—2 of Figure 1.

Figure 3 is a sectional view on the line 3—3 of Figure 1 and showing a bottom plan view of a pair of mercury tube switches of my switch structure.

Figure 4 is a view similar to a portion of Figure 1 showing the switch in open circuit position as compared to closed circuit position as shown in Figure 1.

Figure 5 is a similar view of a portion of Figure 4 showing the switch at the start of the closing operation.

Figure 6 is an enlarged sectional view on the line 6—6 of Figure 4.

Figure 7 is a similar sectional view on the line 7—7 of Figure 5; and

Figure 8 is a sectional view as taken on the line 8—8 of Figure 1 and showing a modified construction.

On the accompanying drawing I have used the reference numeral 10 to indicate a casing and 12 a cover therefor. A condition responsive means in the form of a bellows 13 is provided, the head of the bellows having an actuating pin 14 extending into the casing 10. The pin 14 coacts with a bell crank lever 15 pivoted at 16.

A range adjusting spring 17*a* is provided opposing pressure against the head of the bellows 13. One end of the bell crank 15 is positioned in a limiting slot 17 of a bracket 18 while the other end has an opening 19 surrounding a post 20. An adjusting screw 21 is threaded into the post 20 and a spring 22 is interposed between the bell crank 15 and the head of the screw 21. The post 20 is provided with a shoulder 23 engaged by the lower end of the spring in the open circuit position of the switch as shown in Figure 4.

The spring 22 serves to load the bell crank 15 when in cut-in position of Figure 1, but has no effect on the cut-out point of the switch because of engagement of the lower end of the spring with the shoulder 23 when in the cut-out position of Figure 4.

A U-shaped bracket 24 is mounted in the casing 10 as by screws 25. The arms thereof carry a pivot pin 26. Oscillatably mounted on the pivot pin 26 is a second U-shaped bracket 27. The U-shaped bracket 27 supports a pair of mercury switch tubes S, as shown in Figure 2, a clip 28 being riveted to the U-shaped bracket 27 and engaging the switch tubes S under tension to normally retain them in the desired position relative to the bracket 27.

In Figure 2 I have shown a two tube switch while in Figure 8 I illustrate modified forms of brackets 24*a* and 27*a* for a single tube switch. The bracket 27*a* is formed to encircle the single switch tube S' and is made of initially smaller size than the external diameter of the tube so that the tube is frictionally held therein. A relatively shorter pivot pin 26*a* is shown for the modified form of Figure 8. The U-shaped bracket 27*a* has an arm 29 extending therefrom and terminating in an armature portion 30 bent laterally from the arm. The armature portion 30 is adapted to cooperate with a magnet 31 which is mounted in position in the casing 10 by means of a clamp plate 32 and clamp screw 33. The casing is slotted as at 34 so that the magnet 31 can be adjusted upwardly or downwardly to change the inclination of the switch tubes S in their open circuit

position of Figure 4. In this position the magnet 31 acts as a stop for the arm 29 by reason of protuberances 35 on the armature portion 30 engaging the poles of the magnet.

An operative connection is provided between the bell crank 15 and the bracket 27 in the form of a link 36 having an extension 37. The extension 37 has a portion 38 extended through an opening 39 of the bracket 27 and the extension is somewhat smaller than the diameter of the opening. A leaf spring 40 is secured to another lateral extension 41 of the arm 29 and contacts with the upper surface of the portion 38 as shown in Figures 6 and 7. The opening 39 and the portion 38 therein constitute a lost motion connection and the leaf spring 40 tends to bias this connection to the open switch position thereof.

The switches S may be of any desired mercury type. By way of illustration in Figure 1 the portion of the switch is broken away to show a metallic casing 42 constituting one electrode of the switch and a disc 43 constituting the other electrode thereof. Within the tube, mercury 44 serves as a means of electrically connecting the terminals together. The usual flexible leads 45 extend from the terminals 42 and 43.

Practical operation

In the operation of my switch structure, when the pressure is low against the head of the bellows 13, the parts will assume the position illustrated in Figure 1 with the mercury 44 bridging the terminals 42 and 43 of the switch. An increase in pressure against the head of the bellows 13 will move the horizontal arm of the bell crank 15 downwardly toward the position of Figure 4. During all of this movement the leaf spring 40 will hold the portion 38 of the link extension 37 against the lower edge of the opening 39 as shown in Figure 7. During the last portion of this movement, the magnet 31 will cooperate with the armature 30 to quickly swing the switch S to its open position as in Figure 4. The magnet, during this last portion of the movement of the switch, swings the armature and the bracket 27 downwardly against the tension of the spring 40 so that the parts will assume the position shown in Figure 6.

When the pressure on the head of the bellows 13 recedes, the link 36 will be raised and will first move the portion 38 of the link extension 37 from the position of Figures 5 and 7 to the position of Figure 6. This places the leaf spring 40 under additional tension and when the portion 38 engages the top of the opening 39 it will positively move the bracket 27 thus moving the armature 30 into a weaker magnetic field of the magnet 31. This will effect a quick movement of the switch S toward the closed circuit position of Figure 1. Thus by means of the armature and magnet and the lost motion connection I am able to insure satisfactory movement of the switches S from one position to another. This is particularly desirable where the two switches are to be synchronized for simultaneous opening and closing of circuits whereas without the snap action provided by the armature and magnet such synchronization is extremely difficult to obtain.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a switch structure, a casing, a condition responsive actuating element therein, a U-shaped bracket secured to said casing, a pivot pin carried by the arms thereof, a second U-shaped bracket having arms pivotally mounted on said pivot pin, a mercury switch tube supported in a loop of said second U-shaped bracket, a lost motion connection between said actuating element and said second U-shaped bracket, a magnet cooperating with said second U-shaped bracket to bias it to move towards open switch position and a leaf spring carried by said second U-shaped bracket and constraining said lost motion connection towards switch closing position.

2. In a switch structure, a casing, a condition responsive actuating element therein, a bracket secured to said casing, a pivot pin carried thereby, a second bracket mounted on said pivot pin, a mercury switch tube, a clip secured to said second bracket for mounting said mercury switch tube thereon, a lost motion connection between said actuating element and said second bracket, a magnet cooperating with said second bracket to bias it to move towards open switch position and a leaf spring carried by said second bracket and constraining said lost motion connection towards switch closing position.

3. In a switch structure, a condition responsive actuating element, a mercury switch tube pivotally mounted, an actuating element therefor, a lost motion connection between said actuating element and said switch tube, an armature connected with said switch tube, a magnet cooperating with said armature to bias it to move towards one switch position and thereby tending to move said lost motion connection to one of its limits and resilient means constraining said lost motion connection towards the opposite limit of its lost motion.

4. In a switch structure, a casing, a condition responsive actuating element therein, a bracket secured to said casing, a pivot pin carried thereby, a second bracket mounted on said pivot pin, a mercury switch tube, an arm extending from said second bracket and terminating in an armature, a magnet for cooperation with said armature and tending to bias it toward switch open position, said armature having a protuberance for contact with said magnet, said second bracket having an opening therein, a link extending from said actuating element and having a portion in said opening of less size than the diameter of the opening and a leaf spring carried by said second bracket and biasing said portion toward the side of said opening engaged thereby normally upon said actuating element moving toward switch open position.

5. In a switch structure, a mercury switch tube pivotally mounted, an actuating element for said mercury switch tube, an arm extending therefrom and terminating in an armature, a magnet for cooperation with said armature and tending to bias it toward one position, said arm having an opening therein, a link extending from said actuating element and having a portion in said opening of less size than the diameter of the opening, and spring means biasing said portion toward the side of said opening that permits said magnet to draw said armature against the bias of said spring.

6. In a switch structure, a condition responsive actuating element, a mercury switch tube

tiltably mounted, an arm extending therefrom and terminating in an armature, a magnet for cooperation with said armature, said armature having a protuberance for contact with said magnet, said arm having an opening therein, means extending from said actuating element and through said opening, said means being of less size than the diameter of the opening, a leaf spring carried by said arm and biasing said means toward one side of said opening and stationary means biasing said arm to move in a direction in opposition to said leaf spring, said stationary means overcoming said leaf spring when said arm is on one side of a critical position and being incapable of doing so when said arm is on the opposite side of said critical position.

7. In a switch structure, a casing, a condition responsive element, an actuating element operated thereby, a mercury switch oscillatably mounted in said casing, an armature movable simultaneously with said mercury switch, a magnet cooperating with said armature, a lost motion connection between said actuating element and said mercury switch and resilient means constraining said lost motion connection to one of its limits of movement, said armature being movable away from said magnet against the constraint of said resilient means, said magnet acting as a stop for said armature in the open position of the switch and being movable relative to said casing to stop the switch at selective positions of inclination of the switch.

BURTON E. SHAW.