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[56] **References Cited**
UNITED STATES PATENTS
3,175,060 3/1965 Crissinger et al. 335/205
3,256,400 6/1966 Wintriss 335/188 X
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[54] **MAGNETIC SNAP ACTION SWITCH**
5 Claims, 4 Drawing Figs.
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200/67 F, 335/188
[51] Int. Cl. H01h 5/02,
H01h 5/30
[50] Field of Search 335/188,
205; 200/67 F

ABSTRACT: A combination spring and magnetic snap action switch of the momentary type. It employs spaced-apart pairs of stationary contacts and a movable contactor which are formed of magnetic materials. A spring-biased reciprocably movable plunger carrying convexly curved spring washers on opposite sides of the contactor acts upon movement of the plunger in opposite direction to move the contactor with snap action between the spaced-apart pairs of stationary contacts.

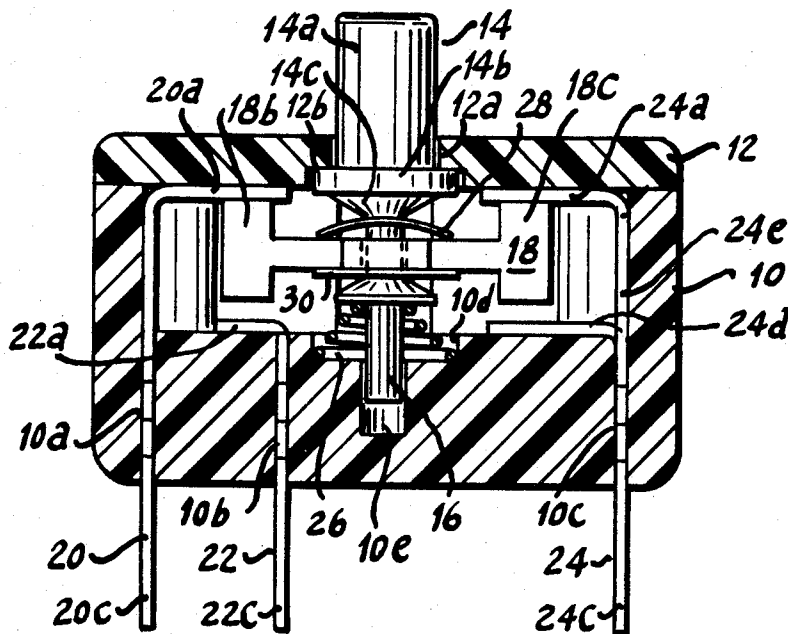


Fig. 2

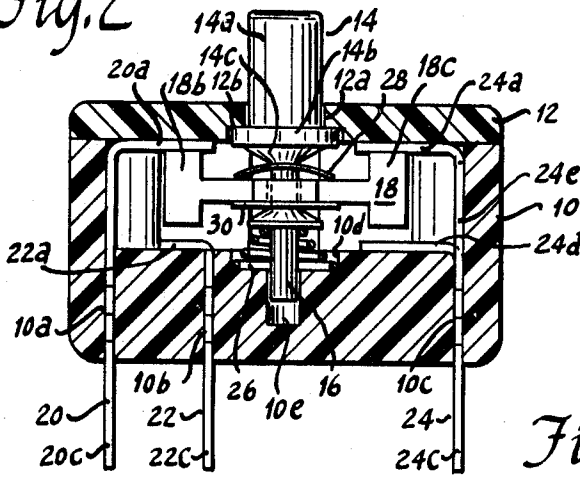


Fig. 1

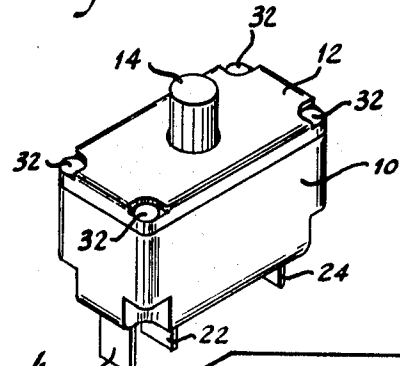


Fig. 4

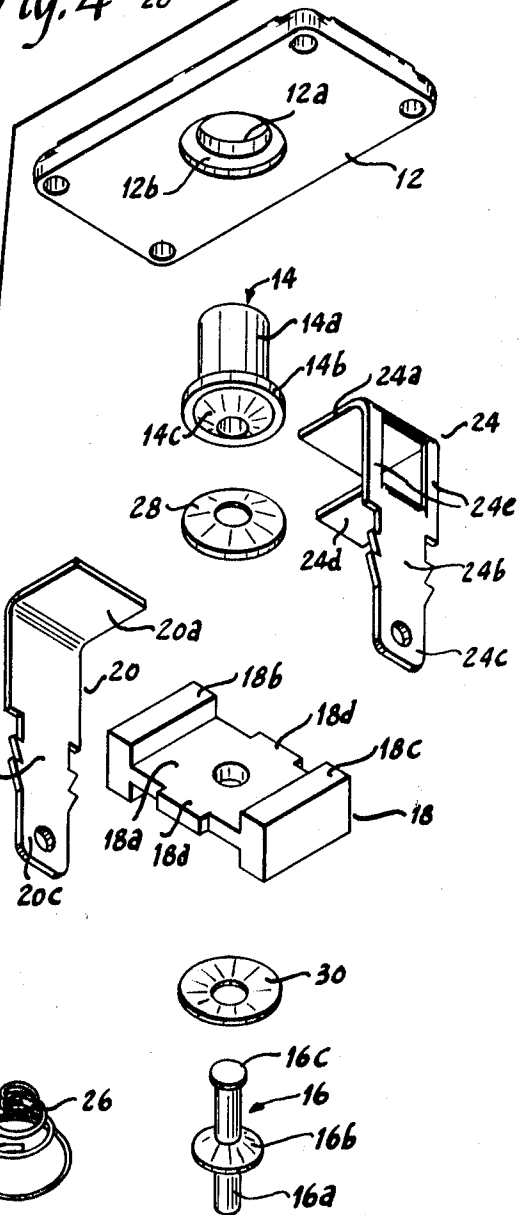
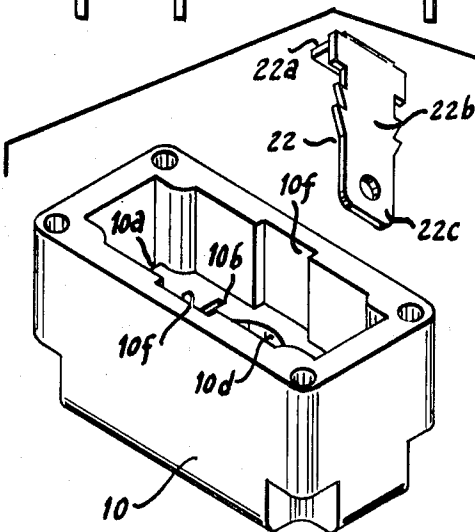
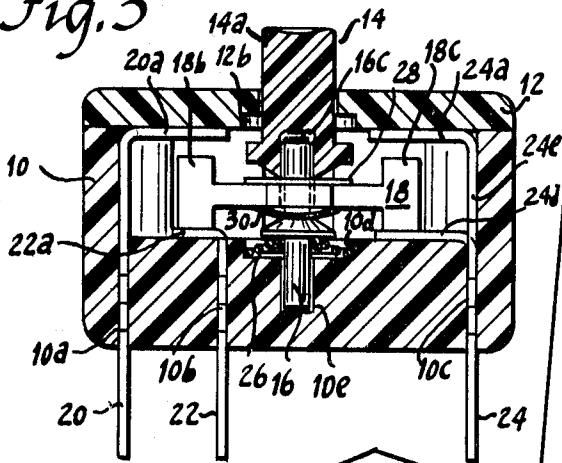


Fig. 3



MAGNETIC SNAP ACTION SWITCH

It is a primary object of the present invention to provide a novel form of snap action switch of the momentary type, and

Another object is to provide a switch of the aforementioned type wherein the snap action movement of a contactor is afforded by a combined use of opposed springs and magnetic attraction between the contractor and the contacts with which it engages.

Other objects of the invention will hereinafter appear.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a switch constructed in accordance with the invention.

FIG. 2 is a sectional view in side elevation of the switch.

FIG. 3 is a view like FIG. 2 but showing the switch in a different operating condition, and

FIG. 4 is an exploded isometric view showing the different parts of the switch.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The switch comprises a molded insulating base 10, a separate cover 12, an insulated actuating button 14, an operating plunger 16, a movable magnetic iron contactor 18, and stationary contacts 20, 22 and 24. It further comprises helically coiled, conical plunger return spring 26, and, convexly curved spring discs or washers 28 and 30.

Base 10 has slots 10a, 10b and 10c extending through the bottom wall thereof and oversized serrated edge portions 20b, 22c and 24c of contact terminal members 20, 22 and 24 engage with and are anchored to base 10 within their respective slots. Members 20, 22 and 24 each have alike terminal portions integral with the portions 20c, 22c and 24c which extend between the bottom surface of the base 10. Member 20 has a portion integral with portions 20a which extends along an inner side wall of base 10 and is bent at a right angle so that its upper surface is coplanar with the upper surface of the base. Member 22 has a portion 22a integrally connected and extending at a right angle from portion 22b to lie against the inner bottom wall of member 10. Member 24 has a portion 24d which is integrally connected to portion 24b and extends therefrom at a right angle to lie against the inner bottom wall of the base 10. Member 24 also has a portion 22a which is connected to portions 24b and 24c by the spaced apart connecting legs 24e. The portion 24a is bent at a right angle to the legs 24e and its upper surface is coplanar with the upper surface of the base. The members 20, 22 and 24 are preferably formed by shearing and stamping the same from sheet iron material and then silver or silver alloy plated to provide good electrical conductivity.

The spring 12 at its larger coiled end seats against the bottom wall of a recess 10d formed in the inside bottom wall of base 10. At its smaller coiled end spring 12 bears against a frustoconical abutment portion 16b formed on the shank 16a of plunger 16. The shank 16a adjacent its lower end moves with a cylindrical recess 10e which at its upper end communicates with the bottom wall of the recess 10d.

The shank 16a above the portion 16b extends through a clearance opening in the spring washer 28, the web portion 18a of contactor 18, the spring washer 26 and terminates at an enlarged flattened head 16c which is snapped into place in actuator button 14. Contactor 18 is formed of a permanent magnetic material, such as Alnico V, and has parallel contacts engaging portions 18b and 18c which are integrally formed with the web portion 18a. Portions 18d extending from each side of the web 18a projects into and move up and down in complementally formed guide recesses 10f formed in the opposing inner sidewalls of base 10. Contactor 18 is preferably plated with a silver or silver alloy metal.

Actuating button 14, which is preferably formed of a resilient material such as nylon, has a main cylindrical portion 14a that extends through a clearance opening 12a formed in the cover 12, a flanged portion 14b which seats against the

upper end of a recess 12b formed in the inner surface of cover 12, and a lower frustoconical end portion 14c. Cover 12 is secured to base 10 by rivets 32 which extend through aligned clearance openings in the cover and base at each of the four corners thereof.

FIG. 1 shows the position of the switch which it assumes when no external operating force is exerted on button 14 inwardly on the base 10. In this position contact-engaging portions 18b and 18c engage with portions 20a and 24a of members 20 and 24 thereby completing an electrical circuit between terminals 20c and 24c. It will be observed that in the position of the switch spring washer 30 is flattened between the upper end of portion 16b of plunger 16 and the lower surface of portion 18a of contactor 18 due to the force exerted by the spring 26. The washer 28, due to the free spacing between the upper surface of contactor and the lower frustoconically shaped end 14c of button 14 assumes its natural convex shape.

Now let it be assumed that an operating force is applied downwardly against the outer end of button 14, and that plunger 16 is consequently moved downwardly. Spring washer 28 is progressively flattened as button 14 moves inwardly and exerts an increasing force on the contactor 18. When this downward force exceeds the magnetic attraction force afforded by the permanent magnet material of contactor 18 in engagement with contact portions 20a and 24a, the stored energy in the flattened spring washer 28 drives contactor 18 downwardly with snap action into engagement with the contact portions 22a and 24d of members 22 and 24 as depicted in FIG. 3. An electrical circuit is thereby completed between terminals 22c and 24c.

In the position of contactor 18 shown in FIG. 3, spring washer 30 assumes its natural convex shape because of the free space between the upper end of the abutment portion 16b of plunger 16 and the lower surface of portion 18a of contactor 18. Now when the aforementioned actuating force applied downwardly on button 14 is released, the stored energy in compressed spring 26 will move plunger 16 upwardly and the upper end of portion 16b bearing against spring washer 30 will flatten it thereby exerting increasing force on contactor 18. Ultimately snap action deengagement of contactor portions 18b and 18c from contacts 22a and 24d occurs and such contactor portions are driven into engagement with contacts 20a and 24a as shown in FIG. 1.

It will be seen from the foregoing that the combination of the permanent magnet contactor, magnetic stationary contacts, and the spring washers affords the snap action movement and contact disengaging action of the movable contactor.

I claim:

1. In a snap action electrical switch, in combination;
 - a. an insulating housing having a cavity and an opening through one side thereof;
 - b. spaced apart stationary contacts formed of a magnetic material mounted within said housing cavity;
 - c. reciprocable switch operating means comprising an actuator extending through the housing opening and a plunger within said cavity having spaced apart abutments thereon;
 - d. a contactor formed of a permanent magnet material disposed about said plunger;
 - e. a convexly curved spring washer disposed about said plunger between one of said abutments and one side of said contactor;
 - f. means biasing said plunger in a direction wherein said contactor assumes a given operating position relative to said stationary contacts and said actuator assumes an outward extreme position relative to said housing, said actuator being movable against said bias inwardly of said housing to compress said spring washer to thereby build up stored energy to effect following snap action movement of said contactor to an opposite operating position relative to said stationary contacts.

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2. The combination according to claim 1, wherein said switch is provided with a second pair of spaced-apart stationary contacts mounted within the housing cavity in parallel-spaced arrangement relative to respective ones of the first-mentioned stationary contacts, and wherein another convexly curved spring washer is disposed about said plunger between the other of said abutments and the other side of said contactor.

3. The combination according to claim 2, wherein said contactor when said actuator is in its outward extreme position is in engagement with said first mentioned stationary contacts, and wherein in such position of the actuator the last-mentioned spring washer is compressively flattened between said

other of said plunger abutments and said other side of said contactor.

4. The combination according to claim 3, wherein engagement of said contactor with said first mentioned pair of stationary contacts completes one electrical circuit, and wherein movement of said contactor out of engagement with said first-mentioned contacts with snap action and into engagement with said second pair of stationary contacts interrupts said one electrical circuit and completes a second electrical circuit.

5. The combination according to claim 2, wherein said stationary contacts and said contactor have an outer layer of a good electrical conductive contact metal.

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