April 10, 1951 W. J. ALLAN 2,548,280

ELECTRIC SWITCH

Filed June 4, 1949

Fig. 1.

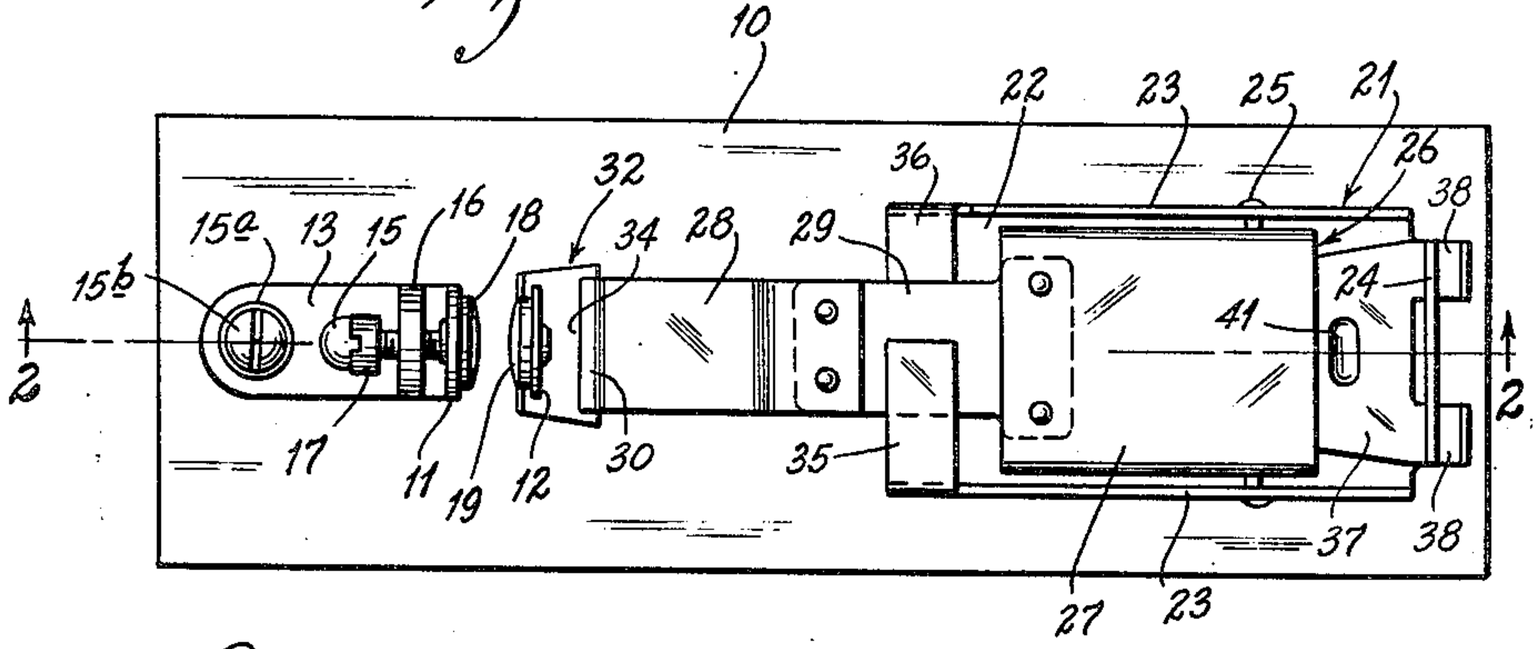


Fig. 7.

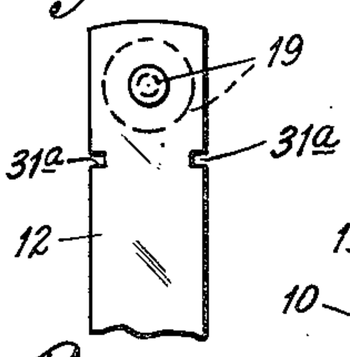


Fig. 2.

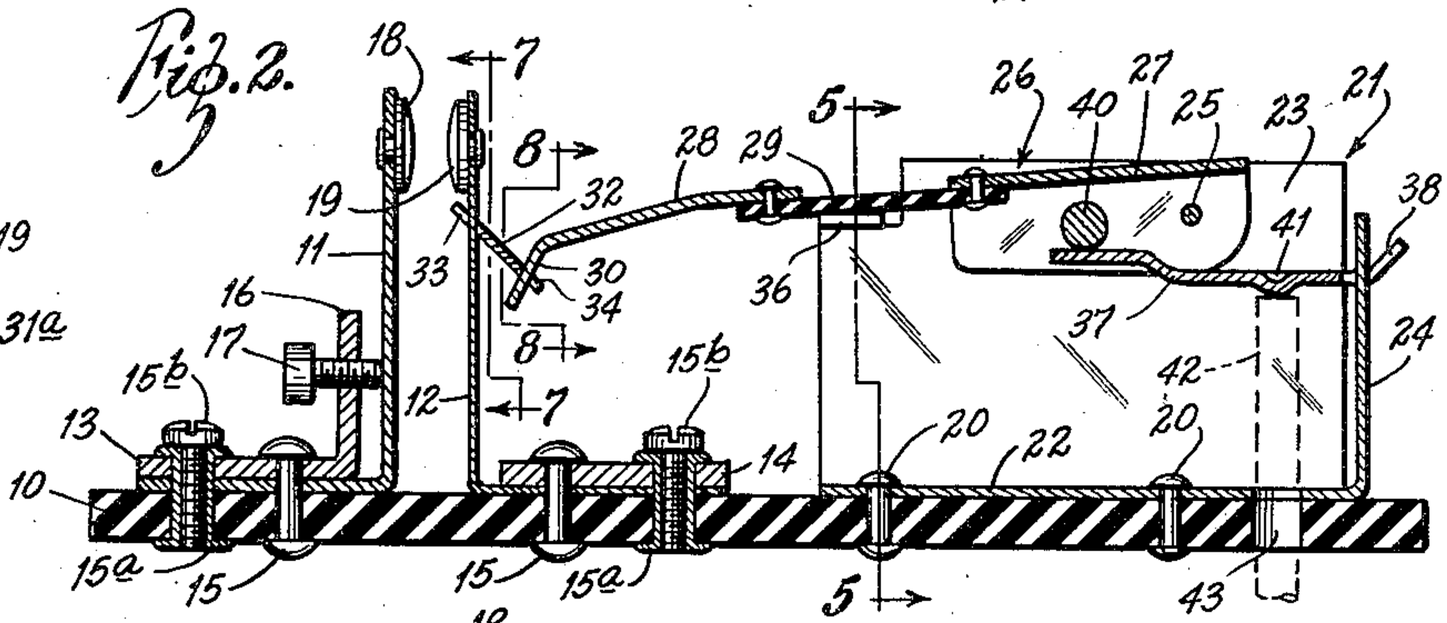


Fig. 8.

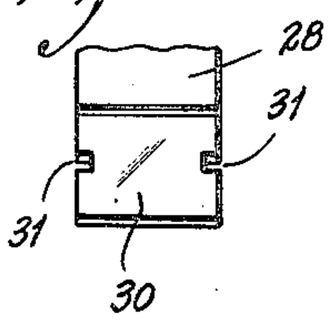


Fig. 3.

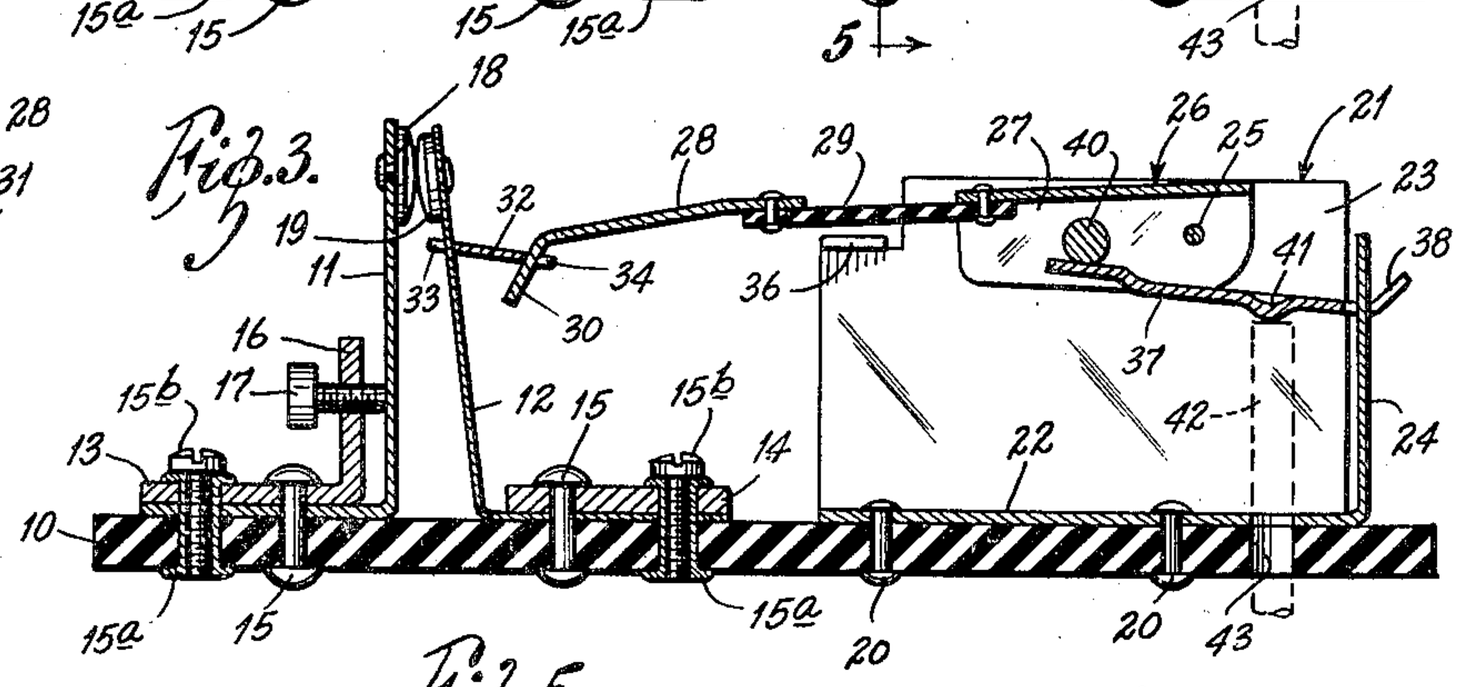


Fig. 4.




Fig. 5.




Fig. 6.




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## ELECTRIC SWITCH

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5 Claims. (Cl. 200—67)

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This invention relates to electric switching devices and more particularly to snap action switches of the self return type.

An object of the present invention is to provide a novel switching mechanism having mechanical snap action accomplished by the stressing of resilient members and in which contact bounce, heretofore characteristic in switches of this type, is obviated.

A further object is the provision of a snap action switch employing a toggle mechanism in which the linear motion developed by the toggle mechanism is applied in the direction of movement of the switch contacts and in which the toggle mechanism provides a lock against bouncing of the contacts as they are rapidly engaged.

Further objects and advantages will become apparent when reading the following description in connection with the accompanying drawing.

In the drawing,

Fig. 1 is a plan view of a switching device constructed in accordance with the principles of the present invention;

Fig. 2 is a longitudinal sectional view of the switch shown in Fig. 1 and is taken on line 2—2 of Fig. 1;

Fig. 3 is also a longitudinal sectional view of the switch shown in Fig. 1 taken on line 2—2 of Fig. 1, but showing the switch elements in different operative positions;

Fig. 4 is a right end or rear elevation of the switch shown in Fig. 1;

Fig. 5 is a transverse sectional view of the switch shown in Figs. 1 and 2 and is taken on line 5—5 of Fig. 2;

Fig. 6 is a view of one of the toggle links shown apart from the switch structure;

Fig. 7 is a fragmentary view of one of the switch blades showing the notches therein into which one end of the toggle link shown in Fig. 6 is fitted. The view is taken on line 7—7 of Fig. 2 the toggle link itself being omitted;

Fig. 8 is a front end view of the other toggle link showing the notches therein into which is fitted the other end of the toggle link shown in Fig. 6. The view is taken on line 8—8 of Fig. 2 the toggle link itself being omitted.

In the illustrated embodiment of the present invention the structure includes a base member 10 preferably of a dielectric material. However, it may be of metal in which case suitable necessary insulators would be included. Mounted on base 10 near the left or front end are switch blades 11 and 12 of conductive material. The blades 11 and 12 are formed at right angles at their lower

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ends and are clamped between plates 13 and 14 respectively and the base 10. The switch blades and plates are rigidly attached to the base by rivets 15 and 15*a*. The rivets 15*a* are tubular rivets internally threaded to receive screws 15*b* which provide suitable terminal means for detachably connecting conductors. The plate 13 has an upwardly formed portion 16 lying parallel to the blade 11, in which is threadedly engaged an adjustment screw 17, the projecting end of which engages the switch blade 11. Suitably attached to the upper ends of blades 11 and 12 are contact members 18 and 19 respectively. The blades 11 and 12 are both resilient. The blade 12, however, is substantially more resilient than the blade 11 as is indicated by its relative thinness.

Also mounted on the base 10 and toward the right or rear end thereof and attached thereto by rivets 20, is a generally U-shaped frame generally indicated at 21 having a base 22, side walls 23 and a rear plate 24. There is a pivot 25 supported in the frame side walls on which is pivotally mounted one end of a member generally indicated at 26, which is one link of a toggle joint. The member 26 has a rearward metallic portion 27 formed as an inverted U, through the side walls of which pass the pivot 25. The member 26 also has a forward metallic portion 28 which is spaced from the portion 27 by a section of dielectric material 29. The forward portion 28 of the link 26 is therefore insulated from the frame 21.

The forward end of the link portion 28 is formed downwardly as indicated at 30 and is provided with notches 31 at its sides, as indicated in Fig. 8. The switch blade 12 is also provided with similar notches 31*a* near its upper end just below contact 19, as indicated in Fig. 7. The second member or link of the toggle joint is indicated at 32 and is shown in detail in Fig. 6. The link 32 comprises a flat plate having wide shallow notches 33 and 34 at its ends. The notches 33 and 34 are sufficiently wide to permit freely spanning of the switch blade 12 and the forward portion 30 of the link 26 at the base of the notches 31 and 31*a* respectively. When the toggle link 32 is inserted between the blade 12 and the portion 30 of toggle link 26 it is retained against movement laterally or axially relative to the blade 12 or link portion 30 due to the interlocking notches 31, 31*a* and 33, 34. The dimensional relations of the notches and the link 32 are such however to permit free rotation between the link 32 and the blade 12 and link 32 and the portion 30. The

link 32 is held in engagement longitudinally by pressure of the resilient switch blade 12.

There is an upper stop 35 and a lower stop 36 formed as integral parts of the frame side walls 23 which extend, one above, and the other below the toggle member 26 at the point of its insulating portion 29. The rotation of link 26 is thereby limited. In its lowermost position the link 26 rests on the lower stop 36 as indicated in Fig. 2 and the short link 32 assumes the position substantially as shown in this view. When the link 26 is rotated clockwise about its pivot 25 to the position shown in Fig. 3 wherein any further clockwise rotation is arrested by stop 35, the toggle links 26 and 32 approach alignment and the resulting linear motion is imparted to the switch blade 12 substantially in line with the direction of movement of contact 19.

There is a multiplying arm 37 having a pair of tongues 38 which engage a pair of notches 39 in the upper end of the rear frame member 24 thereby pivotally mounting one end of the arm 37 therein. Supported in the vertical walls of the inverted U-shaped section 27 of the link 26, is a round bar 40 adapted to be engaged by the other end of the multiplying arm 37. The arm 37 may be provided with a rounded protuberance 41 on its under surface in order to provide point contact with any suitable switch actuating member such as a rod 42 shown in part in dotted lines, and the base 10 may have an opening as at 43 to admit the rod 42.

*In operation*

When the switch is in its normal returned position as indicated in Fig. 2 and an actuating force is applied to arm 37 at 41 as by a rod 42, an initial degree of resistance to rotation of the arm 37 and the toggle links 26 and 32 is encountered due to the yielding resistance of the blade 12 and the angularity of the links 26 and 32 relative to each other. This degree of resistance causes some flexing of the multiplying arm 37. Energy is thereby stored. It will be understood that either or both the link 26 and arm 37 may be constructed so as to flex sufficiently under switch actuating pressure to store up sufficient energy to provide a suitable subsequent snap action. In the illustrated embodiment however, the multiplying arm 37 is preferably constructed so as to flex sufficiently for this purpose, while the link 26 is constructed so as not to flex any appreciable amount.

As the initial resistance is overcome by the actuating force and the arm 37 and links 26 and 32 are rotated toward the position shown in Fig. 3, the developed linear motion due to the relative rotation of toggle links 26 and 32 will move the switch blade 12 and contact 19 toward the left or closed position. Also, as the links 26 and 32 are rotated and approach alignment, the rate of yieldably resisted linear motion developed by further rotation decreases rapidly and the energy stored in the flexed arm 37 is released to provide a snap action. It will be seen that as the toggle links 26 and 32 approach alignment they provide a non-yielding bar or strut between the blade 12 and the pivot 25, which strut is substantially parallel to the direction of travel of the switch contact 19. It will also be noted that the point of engagement of toggle link 32 with blade 12 is immediately adjacent its contact 19 so that flexing of the blade 12 between these points is negligible and the strut formed by the substantially aligned toggle links



is for all practical considerations acting between the fixed pivot 25 and the contact 19. This arrangement prevents the contact 19 from bouncing back as it rapidly engages the contact 18 due to the snap action.

It will be understood that the switch blade 11 while having some resiliency is sufficiently rigid to obviate any bouncing away from the contact 19 when rapidly contacted thereby. It will also be understood that the toggle links 26 and 32 are stopped just short of alignment or dead center by the upper stop 35 so as to permit the self return of the mechanism under the urging of the resilient blade 12.

The foregoing description is intended to be illustrative and not limiting, the scope of the invention being set forth in the appended claims.

I claim:

1. In a device of the class described, a pair of spaced parallel switch blades fixed at one end and having attached at their free ends a pair of normally spaced cooperating contact elements, both of said blades being resilient but one of said blades being substantially more flexible than the other, a pair of toggle links pivotally connected at their inner ends, one of said links having a pivotal connection at its outer end with said more flexible blade, the other of said links being pivoted at its outer end on a fixed pivot, said toggle links being so arranged with respect to said blade that a line through the centers of their outer pivots is substantially perpendicular to said blade, and stop means for limiting the rotation of said toggle links in one direction to a point slightly before dead center.

2. In a device of the class described, a base member, a frame member supported on said base member, a pair of spaced parallel switch blades connected at one end to said base member and carrying at their free ends a pair of normally spaced cooperating contact elements, both of said blades being resilient but one of said blades being substantially more flexible than the other, a pair of toggle links pivotally connected at their inner ends, one of said links having a pivotal connection at its outer end with said more flexible blade at a point on said blade near its free outer end, the other of said links being pivotally supported in said frame member, said toggle links being so arranged with respect to said blade that a line through the centers of their outer pivots is substantially perpendicular to said blades, stop means for limiting the rotation of said links in one direction to a point just short of dead center, and adjustment means for engaging said least flexible blade at a point intermediately of its ends.

3. In a device of the class described, a pair of flexible switch blades lying substantially parallel to each other and in spaced relationship, said switch blades being fixed at one end and having attached at their free ends a pair of normally spaced contact elements having surfaces arranged for abutting engagement, means for adjusting the normal spacing between said contact elements comprising a threaded adjusting element operatively engaging one of said flexible blades at a point intermediately of its length, a toggle mechanism comprising a pair of toggle links pivotally connected at their inner ends, one of said links having a pivotal connection at its outer end with the other of said flexible blades at a point thereon closely adjacent said contact elements, the other of said toggle links being pivoted at its outer end on a fixed pivot, said

toggle links being so arranged with respect to said other blade that a line through the centers of their outer pivots is substantially perpendicular to said blade, means for rotating one of said toggle links, and stop means for limiting the rotation of said toggle links in one direction to a point slightly before dead center.

4. In a device of the class described, a pair of flexible switch blades lying substantially parallel to each other and in spaced relationship, said switch blades being fixed at one end and having attached at their free ends a pair of normally spaced contact elements having surfaces arranged for abutting engagement, means for adjusting the normal spacing of said contact elements comprising a threaded adjusting element operatively engaging one of said flexible blades at a point intermediately of its ends, a toggle mechanism comprising a pair of toggle links pivotally connected at their inner ends, one of said links having a pivotal connection at its outer end with the other of said switch blades at a point thereon closely adjacent said contact elements, the other of said links being pivoted at its outer end on a fixed pivot, said toggle links being so arranged with respect to said other blade that a line through the centers of their outer pivot points is substantially perpendicular to said other blade, actuating means for rotating one of said toggle links in a direction toward alignment of said links, a resilient member between said actuating means and said link, and stop means for limiting the rotation of said toggle links in one direction to a point slightly before dead center.

5. In an electric switching device, a resiliently mounted stationary contact element, a movable contact element having a fixed path of movement



toward and away from said stationary contact element, said contact elements having surfaces arranged for abutting engagement, resilient means for urging said movable contact in a direction away from said fixed contact, a toggle mechanism comprising a pair of links pivotally connected at their inner ends, one of said links being operatively associated at its outer end with said movable contact, the other of said links being pivoted at its outer end on a fixed pivot, said toggle mechanism being arranged so as to cause the movement of said movable contact toward said stationary contact as said toggle links are rotated toward alignment, and said toggle links being arranged so as to be substantially parallel with and substantially coinciding with the path of travel of said movable contact element when said links are aligned on dead center, thereby to provide a non-yielding strut between said fixed pivot and said movable contact, actuating means for rotating said toggle links in one direction, and stop means for limiting the rotation of said links in one direction to a point just slightly before dead center.

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