

April 17, 1945.

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2,373,681

HEAVY DUTY SNAP SWITCH

Filed Aug. 23, 1944

2 Sheets-Sheet 1

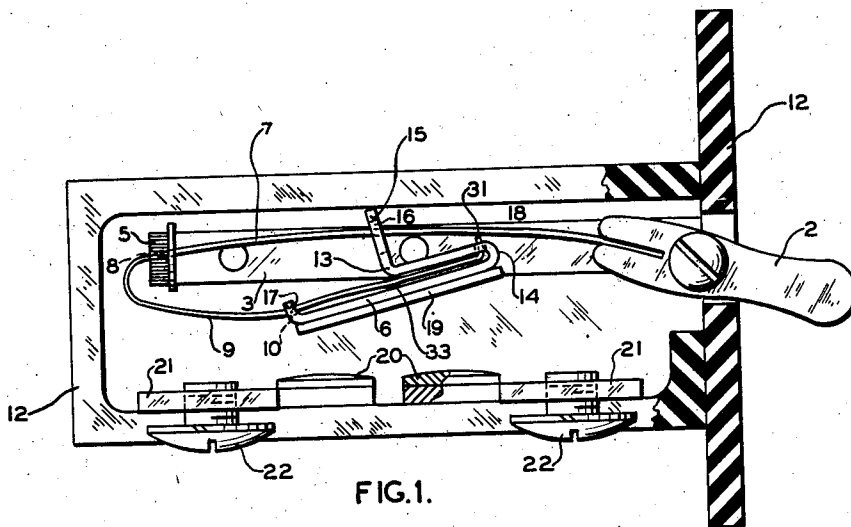


FIG. 1.

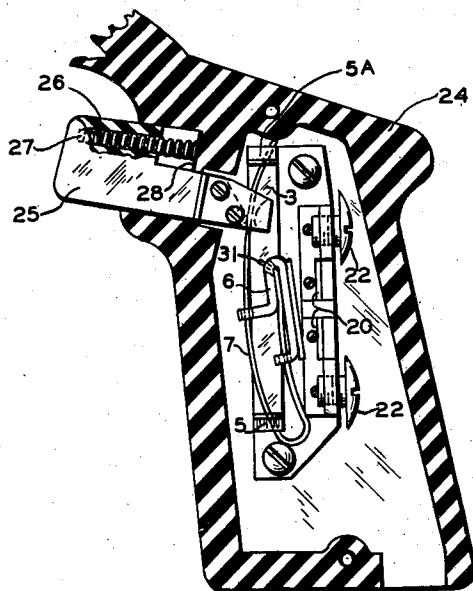


FIG. 2.

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2 Sheets-Sheet 2

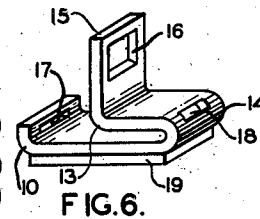
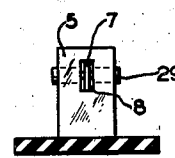
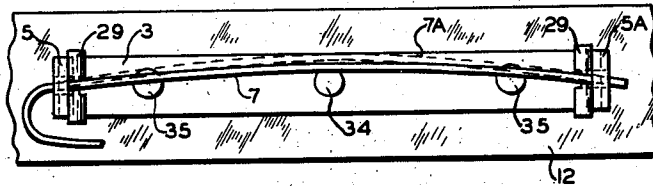
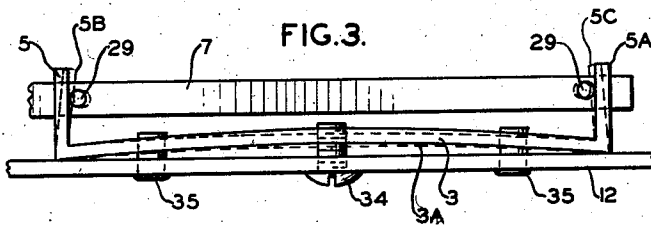


FIG. 4.

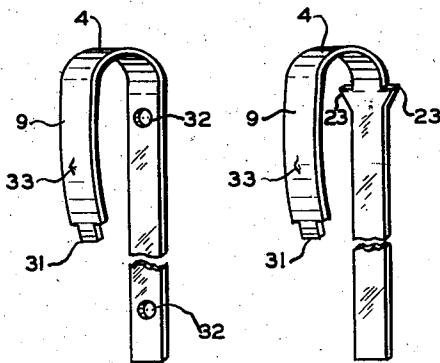
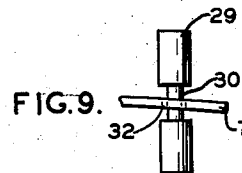


FIG. 8.

FIG. 7.

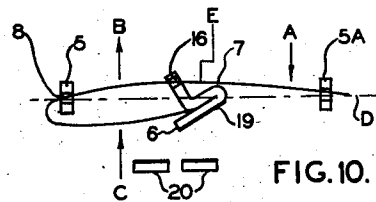


FIG. 10.

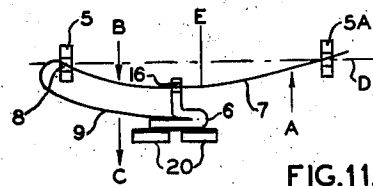


FIG. 11.

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2,373,681

HEAVY DUTY SNAP SWITCH

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Application August 23, 1944, Serial No. 550,815

10 Claims. (Cl. 200—67)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates to snap action switches and has for its primary object the provision of a compact and heavy current carrying mechanism of this character.

Another object of this invention is to provide a switch, of the type set forth hereinbefore, having a large throw despite its compact size.

A further object of this invention in conjunction with the last named object is to provide an instantaneous make and break mechanism of simple but rugged design.

A still further object of this invention is to provide a switch mechanism which eliminates the flow of current in the spring mechanism.

Another object of this invention is to provide a switch of the type first described which will provide low contact resistance due to heavy contact pressure.

An ideal attainment in snap switches of the type to be described in this specification would be the reduction to a minimum of the time interval between contact position and no-contact position. Inasmuch as a compromise must exist between the shortest time interval obtainable in a switch of this type and the inertia introduced by the weight of the movable contact, the time interval between contact and non-contact will be controlled by these factors. By combination of simple and rugged parts, this invention attains an efficiency which will provide a switch, compact in structure, capable of handling large electrical currents, and having a minimum time lapse between contact and no-contact position. The ability of the invention to handle large currents, without loss of spring action efficiency, is due to the fact that the current handled by said invention does not pass thru the spring mechanism but bypasses same.

With these and other objects in view, many of which will become apparent from the following description of the illustrative embodiments of the invention shown in the accompanying drawings, the invention resides in the novel method, steps, elements, arrangement of parts in cooperative relation, as hereinafter more particularly pointed out in the claims, and exemplified in the practical embodiments of the device herein described as follows:

Fig. 1 illustrates an open view of one embodiment of the assembled invention, and a cross-section of the housing.

Fig. 2 illustrates a cross-section of the housing and an open view of an alternative embodiment of the invention.

Fig. 3 depicts a side elevation of part of the leaf spring and its supporting means together with adjusting means.

Fig. 4 and Fig. 5 show, respectively, top plan and end elevation of the leaf spring and its supporting means.

Fig. 6 is a perspective view of a contact support.

Fig. 7 is a perspective view of a leaf spring in one embodiment.

Fig. 8 is a perspective view of a leaf spring in an alternative embodiment.

Fig. 9 is an enlarged view of the means used to constrain the spring member.

Figs. 10 and 11, respectively, illustrate the mode of operation of the invention.

Referring more particularly to Fig. 1, the invention comprises supporting means 3 affixed within the housing 12, said supporting means 3 including a vertical portion 5, said vertical portion being formed by bending to define a right angle to the longer portion which is affixed within the housing 12. A narrow aperture 8 of rectangular configuration is positioned with its longer axis along the longitudinal axis of the aforesaid vertical portion 5.

Pivotaly affixed to the housing 12 in a position opposite to the vertical portion 5 is a toggle member 2. Affixed to said toggle member 2 is the longer arm of a leaf spring 7 of generally J-shaped configuration. The other end of the longer arm 7 of said leaf spring is passed through the aperture 16 in contact support 6 and the aperture 8 in the vertical portion 5 of aforementioned supporting means 3.

At the point where the longer arm of the leaf spring 7 enters the aperture 8, the said leaf spring is provided with shoulders 23, Fig. 7, along the edge thereof, which means prevent the continued passage of the leaf spring 7 thru aperture 8 and coact to bow the said leaf spring as will be explained hereinafter.

The length of the longer arm of the leaf spring 7, from the end affixed to the toggle member 2 and the point of the shoulders 23, is longer than the distance between the vertical portion 5 of the supporting member 3 and the point at which the leaf spring is attached to the toggle member 2. This difference in length causes the leaf spring to assume a bowed configuration under tension, the reason for this particular arrangement will be described further along.

The leaf spring 7, following the shoulders 23,

forms a loop 4 and continues on as the shorter arm 9. Affixed to the shorter arm 9 of the said leaf spring 7 is a contact support 6 of general T-shaped configuration.

The said contact support Fig. 6 is formed from an elongated strip in the following manner: one end of an elongated strip is bent at right angles to the main portion of said elongated strip to define a short vertical portion 10.

The head of said contact support is formed by folding back the elongated strip at the end opposite the vertical portion 10 to a point 13 which is intermediate the folded portion 14 and the short vertical portion 10. At the point 13 the elongated strip is again bent at right angles to the so-called head of the T-shaped support so that it defines a stem 15.

An aperture 16 of rectangular configuration is transversely positioned in the stem 15. Another aperture 17 of rectangular configuration is also transversely positioned in the vertical portion 10 of the said contact support. In addition to the aforesaid apertures another aperture 18 is indicated in the folded end 14 of the said T-shaped contact support.

Aperture 16 is sufficiently large to allow spring 7 to pass thru the equilibrium point (D Figs. 10, 11) without appreciably moving contact 6, thus insuring a rapid closing or opening action.

The longer arm of the leaf spring 7 is first passed thru the aperture 8 of the vertical portion 5 of said supporting member 3. By means of the aperture 16 in the stem 15 of the T-shaped support, said contact support 6 is slipped over the longer arm of the leaf spring 7 and in this position the shorter arm 9 of the said leaf spring is passed through the aperture 17 provided in the slightly upturned end 10, and thence into the aperture 18.

A short tab 31 on the end of the shorter arm 9 of the leaf spring 7 extends through the aperture 18 of the contact support 6 in a manner which prevents the said contact support from slipping off the end of the shorter arm 9 of said leaf spring 7. The end of the longer arm of said leaf spring opposite the loop 4 is fastened to the toggle member 2 which in turn is pivotally affixed to the housing 12 as hereinbefore described.

Fig. 2 depicts a second embodiment of the invention wherein the switch mechanism is affixed within a pistol-grip type housing 24. Trigger-like actuating means 25 are used to operate the switch mechanism. In this particular embodiment, the trigger member 25 is attached to the longer arm of the leaf spring 7 at a point intermediate the supporting member 5A of the T-shaped contact support 6. A helical spring 26 is placed within a well 27 in the trigger member 25, said spring 26 resting against an abutment 28 in the pistol-grip housing 24, coacts to restore the longer arm of the leaf spring 7 to an open contact position. In effect this arrangement produces a momentary contact switch. In this particular embodiment the leaf spring 7 is held in a bowed position between the vertical supports 5, 5A of the spring supporting means 3. The arrangements of the other parts of this invention, as they relate to this particular embodiment, are the same as described for Fig. 1.

An alternative method for supporting the leaf spring 7 and in addition providing means for adjusting said support is illustrated in Figs. 3, 4 and 5, respectively in elevation, top and end view.

As illustrated, the leaf spring support is formed from a flat elongated member, both ends being

bent at right angles to the main portion of said elongated member to define two vertical supports 5, 5A. Apertures 8 of rectangular configuration are provided in the aforesaid vertical supports 5, 5A to loosely encompass the longer arm of said leaf spring 7 when same is passed therethrough.

The longer portion 3 immediately adjacent to the housing 12 is bowed slightly in an upward direction from the housing 12.

The supporting means 3 are affixed to the housing 12 by means of rivets 35 adjacent the ends 5 and 5A. In the center of the longer portion of said support 3 a threaded member 34 is screwed into a threaded aperture provided therefor.

To adjust the chord of the bowed configuration of leaf spring 7 it is only necessary to adjust the threaded member 34, said adjustments causing the distance between the supports 5, 5A to vary, as indicated by the broken lines 3A, 5B, 5C and 7A. By this simple expedient the chord of the bowed leaf spring is varied and this in turn regulates the pressure between contacts 19 and 20.

In this particular embodiment of the supporting means, pins 29 are placed in apertures 32 in a manner more clearly illustrated in Fig. 9. The apertures 32, Figs. 7 and 8, are large enough to accommodate the largest diameter of the pins 29. However, the annular groove 30 of the pins 29 is made smaller in diameter than the aperture 32.

This arrangement permits a loose fit for the pins 29 and allows the pins 29 to adjust themselves against the inner surface of the vertical supports 5, 5A. In addition, the tension of spring 7 at apertures 32 against grooves 30 retains the pins 29 in position.

The use of pins 29, as a means for bowing the leaf spring 7 instead of using a leaf spring having two shoulders 23, as illustrated in Fig. 7, along the edge thereof, has the advantage of simplicity in manufacture.

Referring to Figs. 7 and 8, attention is called to the extrusion 33 positioned intermediate the loop 4 and the tabbed end 31 of the shorter arm 9. The purpose of extrusion 33 is to permit the inner surface of contact support 6 to so balance on the extruded point 33 that when contact is made with the two lower contacts 20 it will cause contact 19 to exert equal pressures on the entire surface of said contacts 20 and to prevent the contacts from rocking against each other during the transitional stages of switch operation, thus preventing arcing between the surfaces of contacts 19 and 20.

The operation of the switch is illustrated in Figs. 10 and 11. Pressure at point A Fig. 10 in the direction indicated will cause point B to move, initially, in the opposite direction due to the fact that a downward thrust at point A Fig. 10 tends to straighten spring 7 in the region about point A, thus forcing said spring to assume a more curved configuration at point B Fig. 10. Point C will follow in the same direction as B, since point C is a continuation of spring 7 from point B thru aperture 8.

Thus the contactor 19 will be held away from the contacts 20 during the initial motion of the spring 7. After point E has moved thru the central position D in the direction indicated in Fig. 10, the spring 7 will suddenly snap into position illustrated in Fig. 11, striking the contacts 20 a sharp blow accompanied by a small swiping action as the switch closes.

At this juncture it will be noted that points B

and C Fig. 11 are pressing downward. Now if point A in Fig. 11 is pushed upwardly as indicated, points B and C will be pressing in an opposite direction or down as indicated, thus holding the contacts 19 and 20 closed during the initial stages of the transition, that is, during the time the spring 7 is releasing its pressure against the lower part of the aperture 16.

When spring 7 moves thru the balance position D it will strike the upper part of the aperture 16 on the contact support 6 a sharp blow causing the contact 19 to be instantaneously withdrawn from the contacts 20. At this time, position B has changed its direction of travel and is moving upward and C follows in the same direction and aids the opening of the switch. The contact pressure can be varied by increasing the thickness of the spring 7 and the throw varied by increasing the bow of the spring as hereinbefore described.

While what has been described hereinbefore are the preferred embodiments of this invention, it will be apparent that other mechanical uses of the device will occur to those skilled in the art as, for example, it is possible to increase the contact pressure by the use of a laminated type of leaf spring instead of the single leaf spring hereinbefore described and, therefore, it should be clearly understood that this invention is not limited to those forms shown and described in the accompanying drawings but rather by the scope of the appended claims.

What is claimed is:

1. In a snap switch: a leaf spring having a generally J-shaped configuration, supporting means having apertures therein thru which the longer arm of the said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the end of the shorter arm of said leaf spring being fastened to the head of the said contact support, means whereby when pressure is exerted on the convex side of said bow causes said bowed arm to snap to an oppositely bowed position with great rapidity and force and by the last named means provides a large throw from one position to another.

2. In a snap switch: a leaf spring having a generally J-shaped configuration, a portion of the end of the shorter arm of said leaf spring being narrower in width than the overall width of the said leaf spring, spaced supporting means comprising a flat elongated element angularly bent at both ends to define two vertical supporting elements having apertures therein thru which the longer arm of the said leaf spring is passed, the plane surface of said leaf spring being at right angles to the elongated plane surface of the supporting means, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the narrow end of the shorter arm of said leaf spring being fastened to the head of the said contact support, means whereby when pressure is exerted on the convex side of said bow causes said bowed arm to snap to an oppositely bowed position with great rapidity and force.

3. In a snap switch: a leaf spring having a generally J-shaped configuration, a portion of the end of said spring being narrower in width than the overall width, spaced supporting means

having apertures therein thru which the longer arm of the said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, said means including apertures in said leaf spring for the insertion of pins to maintain said leaf spring in bowed configuration between the said supporting means, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the narrow end of the shorter arm of said leaf spring being fastened to the head of the said contact support, means whereby when pressure is exerted on the convex side of said bow causes said bowed arm to snap to an oppositely bowed position with great rapidity and force.

4. In a snap switch: a leaf spring having a generally J-shaped configuration, a portion of the end of said spring being narrower in width than the overall width, spaced supporting means having apertures therein thru which the longer arm of said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the narrow end of the shorter arm of said leaf spring being fastened to the head of the said contact support, said contact support being a flat member, one end bent at right angles to its plane surface, said bent portion having an aperture therein for the insertion of the shorter arm of the spring, part of the opposite end of said flat member being folded back to a point intermediate the bent apertured end and the apex of the fold, said apex of the fold having an aperture therein on the underside of the head of said T-shaped contact support, thus providing means for fastening the narrow end of spring therein, said folded portion being again bent at right angles to the said intermediate point to form the stem of the T and said stem having an aperture therein, thru which the longer arm of said spring is passed and by the aforementioned means positions the contact support intermediate the spring supporting means, and means whereby when pressure is exerted on the convex side of said bow causes said bowed arm to snap to an oppositely bowed position with great rapidity and force.

5. In a snap switch: a leaf spring having a generally J-shaped configuration, spaced supporting means having apertures therein thru which the longer arm of the said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the end of the shorter arm of said leaf spring being fastened to the head of the said contact support, and means for exerting pressure on the convex side of said bow in one direction said means including trigger-like element having a helical spring coacting to return the trigger element and bowed arm to their normal position.

6. In a snap switch: a leaf spring having a generally J-shaped configuration, spaced supporting means having apertures therein thru which the longer arm of the said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the end of the

shorter arm of said leaf spring being fastened to the head of the said contact support, and means operable by a toggle-like member to actuate the bowed spring member and cause same to snap to an oppositely bowed position with great rapidity and force.

7. In a snap action mechanism: a spring having a generally J-shaped configuration comprising a plurality of leaf-like members, spaced supporting means comprising a flat elongated element angularly bent at both ends to define two vertical supporting elements having apertures therein thru which the longer arm of said spring is passed, the plane surface of said spring member being positioned at right angles to the elongated plane surface of the supporting means, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed, the end of the shorter arm of said leaf spring being fastened to the head of said contact support, means whereby when pressure is exerted on the convex side of said bow causes said bowed arm to snap to an oppositely bowed position with great rapidity and force.

8. In a snap action mechanism: an elongated housing, a leaf spring member having a generally J-shaped configuration, spaced supporting means affixed within said housing comprising: a flat elongated member angularly bent at both ends to define two vertical supporting elements having apertures therein, said elongated member being arched intermediate the two vertical portions and in an upward direction from the housing, the apex of said arch having a threaded aperture therein, means operable by a threaded member for altering the chord of the arch and in turn altering the distance between the ends of the vertical members of the supporting means, said threaded member passing thru an aperture in the housing and screwed into the threaded aperture of the arch of the supporting means, means cooperating with said supporting means to cause the longer arm of said spring member to assume a bowed configuration, means operable by said threaded means and arched portion of the sup-

porting means to alter the chord of said spring member and by such means to adjust the tension of the bowed spring member.

9. In a snap action mechanism: a leaf spring having a generally J-shaped configuration, spaced supporting means having apertures therein thru which the longer arm of the said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a T-shaped contact support having a wide rectangular aperture in the stem thereof thru which said longer arm is passed and by the last-named means positions the said contact support intermediate the supporting means, the end of the shorter arm of said leaf spring being fastened to the head of the said contact support, means whereby when pressure is exerted on the convex side of said bow causes the bowed arm to strike one side of the aperture in the stem of the T-shaped contact support a sharp blow driving the said contact to an opposite position and conversely upon release of the pressure means the bowed arm strikes the other side of the aforesaid aperture and rapidly drives back the contact to its normal position.

10. In a snap action mechanism: a leaf spring having a generally J-shaped configuration, supporting means having apertures therein thru which the longer arm of said leaf spring is passed, means cooperating with said supporting means to cause said longer arm to assume a bowed configuration, a movable T-shaped contact support having an aperture in the stem thereof thru which said longer arm is passed and having a predetermined retracted position effected by action of said spring, the end of the shorter arm of said leaf spring being fastened to the head of said contact support, actuating means for applying pressure to the free end of the bowed arm to cause said arm to snap to an oppositely bowed position whereby the T-shaped contact support is moved from said first named position to a second position with a rapid snap action, and contact means for arresting movement of said support at second named position.

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