May 15, 1928.

1,669,531

A. J. MOTTLAU

ELECTRIC SWITCH

Filed April 9, 1927

2 Sheets-Sheet 1

Fig. 1.

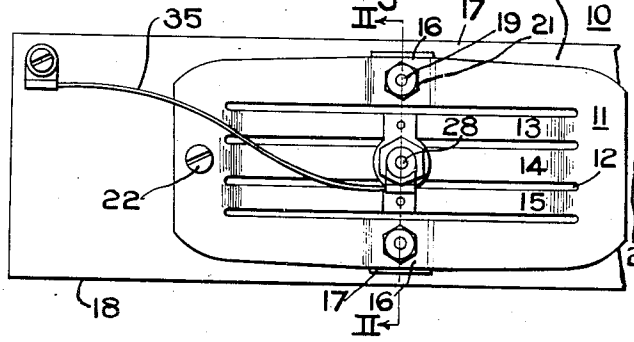


Fig. 2.

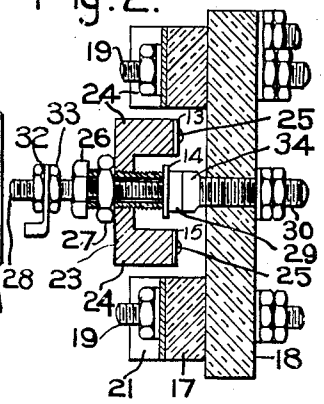


Fig. 3.

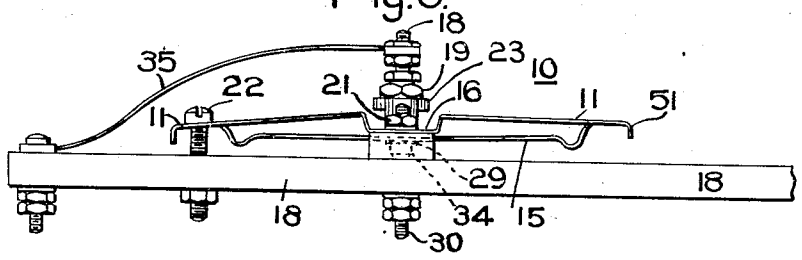


Fig. 4.

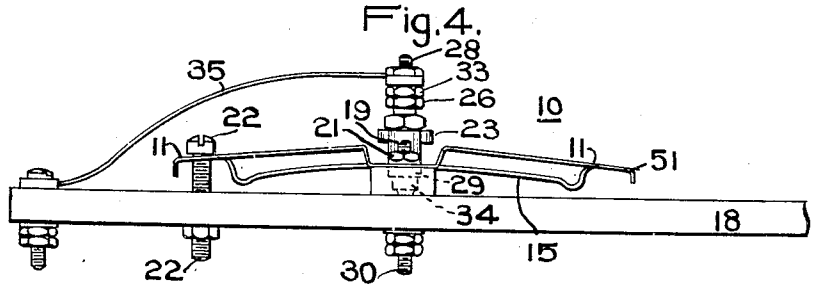
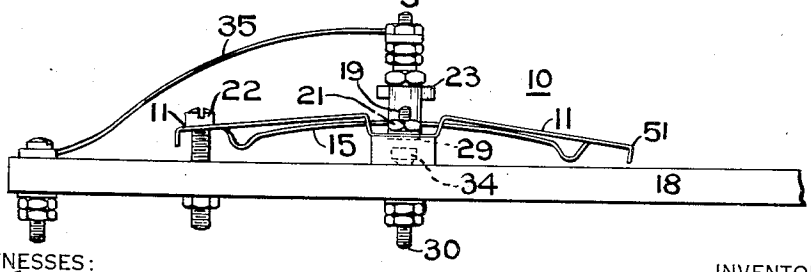


Fig. 5.



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ELECTRIC SWITCH

Filed April 9, 1927 2 Sheets-Sheet 2

Fig.6.

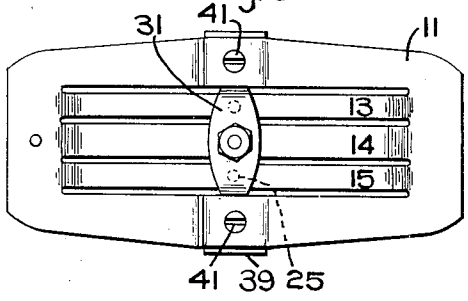


Fig.7.

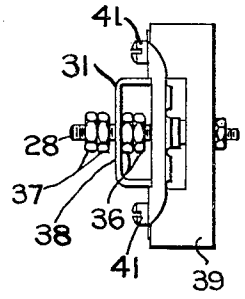


Fig.8.

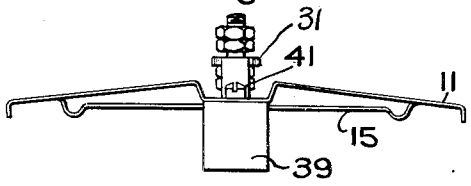
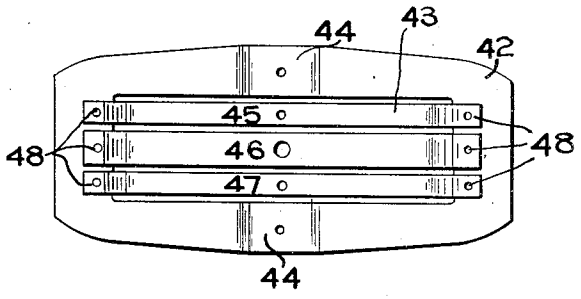


Fig.9.



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Patented May 15, 1928. 1,669,531

UNITED STATES PATENT OFFICE.

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ELECTRIC SWITCH.

Application filed April 9, 1927. Serial No. 182,195.

My invention relates to circuit-controlling devices and particularly to electric switches of the quick-break-and-make type.

An object of my invention is to provide a circuit-controlling device that shall be of simple construction and easily manufactured.

Another object of my invention is to provide an electric switch that shall have means embodied therein for actuating a movable contact member from one position to another and that shall have additional means for imparting an initial motion to said contact member.

A still further object of my invention is to provide an electric switch that shall have means embodied therein for causing positive engagement between the contact members until the time of disengagement thereof, whereby arcing at the contacts is reduced to a negligible value.

In practicing my invention, I provide an electric switch having a stationary contact member, a movable contact member and plurality of actuating members, that operate on the toggle or over-center-spring principle, for actuating the movable contact member into or out of contact with the stationary contact member. The movable contact member is carried by one of the actuating members and is adapted to be actuated from a circuit-making position with the stationary contact member to a circuit-interrupting position when the actuating member has been moved through a position of unstable equilibrium. The other actuating means operates to impart a sudden initial motion to the contact-actuating member, an instant before the contact-actuating member has been moved to its unstable position.

Thus, the contact-carrying member is actuated through its unstable position, with a positive snap motion, from its circuit-making position to its circuit-interrupting position, with the result that arcing between the contacts is reduced to a negligible value.

In the drawing, Figure 1, is top plan view of a circuit-interrupting device embodying my invention;

Fig. 2 is an enlarged end view, partially in section, taken on line II—II of Fig. 1;

Fig. 3 is a view, in side elevation, of the device illustrated in Fig. 1;

Fig. 4 is another view, in side elevation, of the device illustrated in Fig. 3;

Fig. 5 is another view, in side elevation, of the device illustrated in Figs. 3 and 4, in its circuit-interrupting position;

Fig. 6 is a top plan view of a modification of the device illustrated in Figs. 1 to 5;

Fig. 7 is an end view of the device illustrated in Fig. 6;

Fig. 8 is a view, in side elevation, of the device illustrated in Figs. 6 and 7 and

Fig. 9 is a further modification of the switch-contact-actuating mechanism illustrated in Figs. 1 to 8, inclusive.

In the drawings, a circuit interrupter or switch 10 comprises a resilient metal plate 11 having a plurality of longitudinally extending strips or bridging members 13, 14 and 15 that are formed by punching or cutting a plurality of slots 12 which may be so spaced that the strips shall be of the same width or so that the strip 14 shall be of either greater or less width than the adjacent strips 13 and 15, if so desired. As shown in Fig. 1, the strip 14 is of greater width than the others.

A depression 16, of substantially U-shape, is formed in each side portion of the frame 11 at substantially the middle portion thereof and of such dimensions as to cause a lateral deflection of the strips 13, 14 and 15.

The ends of the strips 13, 14 and 15 may be bent laterally (see Fig. 4) from the plane of the ends of the frame 11 to such an extent that these strips shall lie in a plane below that of the main portions of the frame.

The depressed portions 16 of the frame 11 may be secured to blocks 17, located on a base 18, by bolts 19 and cooperating nuts 21, or other suitable means.

One end of the frame may be held in a curved or deflected position by means of a bolt 22 that has a screw-thread engagement with the base 18.

A hammer 23, of substantially U-shape,

is disposed, in inverted position, transversely of the strips 13, 14 and 15, the short legs 24 of the hammer being secured to the strips 13 and 15 by rivets 25 or other suitable means. The portion of the hammer between the legs 24 is provided with a hollow bushing 26 that has a screw-thread engagement therewith. A lock nut 27, having a screw-thread engagement with the bushing 26, is provided for locking the bushing in any desired position with respect to the central strip 14.

A bolt 28 extends through the strip 14, the head 29 of which serves as the movable contact member of the switch. The body portion of the bolt 28 extends upwardly through the bushing 26, and its upper end is provided with a pair of nuts 32 and 33 between which may be clamped a terminal of a shunt 35. The nut 33 is spaced apart from the bushing 26 and serves as a stop member therefor, as hereinafter set forth.

A bolt 30 extends through the base 18, the head 34 of which is normally in engagement with the contact 29. Thus, the bolts 28 and 30 constitute the terminals for the switch illustrated in the drawing.

In Figs. 6, 7 and 8 of the drawings, a modification of the hammer 23, shown in Figs. 1 to 5 of the drawings, is illustrated. In this modification, the hammer 31 consists of a strip of metal of substantially U-shape that extends transversely of the strips 13, 14 and 15 and is secured to them by rivets 25 or other suitable means.

The central portion 38 of the hammer is provided with an aperture through which the bolt 28 extends. Two pairs of nuts 36 and 37 are mounted on the bolt 28 at the respective sides of the central portion 38 of the hammer. Suitable clearance is provided between the nuts 37 and the central portion 38 for a purpose to be hereinafter set forth.

Ordinarily, if the contact members 34 and 29 are in engagement, the portion 38 of the hammer rests or presses on the nuts 36.

In Figs. 6 to 8, inclusive, the frame 11 of the switch is supported on a block 39 of substantially U-shape, (see Fig. 7) and is fastened thereto by means of screws 41. The other parts of the device are the same as hereinbefore described in connection with Figs. 1 to 5.

In Fig. 9 of the drawing, is shown a modification that comprises a substantially rectangular frame 42 having an aperture 43 therein. The sides of the frame 42 may be provided with depressions 44 similar to the depressions 16 in the frame 11 of the previous figures.

A plurality of strips 45, 46 and 47, of greater length than the aperture 43, extend longitudinally of the aperture and may be restrained from longitudinal movement by securing them to the ends of the frame by rivets 48 or by welding, if so desired. Thus, the frame 42 constitutes a resilient support for the strips that operates to hold them in a stressed and deflected position to prevent longitudinal movement thereof.

The strips 45 to 47, inclusive, may be of substantially the same shape as the strips 13 to 15, inclusive, illustrated in Figs. 1 to 8. Such other details, as the bolts 28, the hammer 23 and the bolt 34, illustrated in Figs. 1 to 8 of the drawings, may be added to the strips 45 to 47 in order that a switch of similar character may be provided.

The contact members 29 and 34 may be actuated out of engagement by deflecting either or both of the ends of the frames 11 toward the base 18, as indicated by the successive deflected positions of the end 51 of the frame, (see Figs. 3 to 5, inclusive).

With reference to Figs. 2 and 3 of the drawings, the contact members 29 and 34 there shown are in engagement or circuit-making position which may be considered as the normal position of the switch. By pressing or deflecting the end 51 downwardly, to the successive positions illustrated in Figs. 4 and 5 the strips 13 and 15, being narrower than the strip 14, will deflect upwardly, with a snap motion, but in advance of a similar deflection of the latter, to actuate the bushing 26 into engagement with the nut 33.

The impact between the nut 33 and the bushing 26, caused by the momentum of the hammer 23, is sufficient to impart an initial upward snap-motion to the strip 14 in advance of the motion that would be imparted thereto by reason of its own resiliency, as it passed through an unstable position.

Thus, it is seen that, since the strips 13 and 15 are actuated upwardly with a snap-motion, in advance of the upward snap-motion of the strip 14, a positive contact pressure is maintained between the contacts 29 and 34 because the strip 14 maintains the pressure until the impact occurs between the bushing 26 and the nut 33.

Thus, an electric circuit (not shown) may be interrupted between the contacts 29 and 34 instantaneously, with the result that substantially no arcing takes place.

It is to be noted, also, that, as the end 51 of the frame 11 is bent downwardly, the hammer 23 actuates the bushing 26 into engagement with the strip 14, thereby pressing the contact 29 firmly against the contact 34 and avoiding the possibility of disengagement thereof prematurely.

The operation of the switch shown in Figs. 6 to 8, inclusive, is substantially the same as that of the device illustrated in Figs. 1 to 5. In this modification, the portion 38 of the hammer rests or presses upon the nuts 36 as the ends of the frame 11 are bent downwardly, but, upon the upward movement of the strips 13 and 15, the portion 38 of the

hammer is actuated, with a snap-motion, into engagement with the nuts 37, the impact of which imparts a sudden upward movement of the strip 14 and the contact 29 slightly in advance of an upward movement of the strip 14, which would be the natural result of the bending of the frame 11.

It may be considered that the principle of operation, or the reason for the upward snap-motion of the strips 13 to 15 and 45 to 47 of the switch illustrated in the drawings, is similar to the operation of a toggle mechanism provided with over-center springs, such mechanisms being well-known in the art.

As the ends of the frame are bent downwardly, the curvature of the strips 13 to 15 and 45 to 47, inclusive, tends to change to that illustrated in Fig. 5, but, before attaining this curvature, the position of the strips becomes unstable and, upon a further downward movement of the ends of the frame 11, the strips move suddenly from the unstable position, with a snap motion, to assume the curved or deflected position illustrated in Fig. 5.

The strip 14 is stiffer or more rigid than the strips 13 and 15, the latter are deflected from their unstable position sooner than the central strip 14. Therefore, an initial snap motion is imparted to the hammer 23 which is transmitted to the bolt 28, causing the strip 14 to pass through its unstable position positively and without hesitancy, whereby the possibility of chattering between the contacts 29 and 34 is practically avoided.

The combination of the hammer 23 and the bolt 25 may be considered a lost-motion mechanism that is common to all of the strips 13, 14 and 15, the hammer 23 constituting one part thereof and the bolt 28 a cooperating member. The hammer 23 is given momentum by means of the snap-motion of the strips 13 and 15, causing it to strike a hammer-blow upon the nut 33 and to impart an upward motion to the strip 14. The lag in the upward movement of the strip 14 is dependent upon the amount of clearance or lost-motion between the hammer and the nut 33.

The length of travel between the bushing 26 and nut 33 may be adjusted by turning the nut and the bushing 26 in such directions that the clearance therebetween is increased or decreased, as desired.

Likewise, in the device illustrated in Figs. 6 to 8, the length of travel of the hammer before it strikes the nut 37 may be adjusted by turning the nuts 36 and 37 in such direction that the clearance between the portion 38 of the hammer and the nut 37 is of the desired value.

As a further description of the operation of the switch illustrated in the drawings, it may be considered that the strips 13, 15, the hammer 23 and the frame 11 cooperate to form one toggle or overcenter-mechanism, and that the strip 14 and the frame 11 cooperate to form a second toggle-mechanism. The latter toggle-mechanism is adapted to actuate the contact member 29 out of engagement with the contact member 34, when acting alone, but, when so acting, there is a possibility of chattering between the contact members, with the result that arcing at the contacts may result.

By incorporating a second toggle-mechanism in the switch for actuating the first toggle-mechanism through its unstable position with a positive snap motion, it is possible to effect positive disengagement between the contact members 29 and 34 without substantial arcing or burning of the contact members.

The switch illustrated in the drawings may be manually or mechanically actuated or it may be actuated by a means responsive to such conditions as temperature, pressure, etc. It is to be understood, however, that the switch may be made of bimetal in order that it may be self actuating in response to certain thermal conditions to which it may be subjected.

By my invention, I have provided an electric switch or circuit-interrupting device that comprises, in general, a frame having an aperture therein and a plurality of bridging members extending thereacross. One of the bridging members is adapted to actuate a movable contact member carried thereby into and out of engagement with a stationary contact member. The others of the bridging members so cooperate with the first named bridging member that an initial motion is imparted to the central portion of the first-named bridging member, whereby it is actuated through an unstable position with a positive and unfaltering motion.

Various modifications may be made in the device embodying my invention without departing from the spirit and the scope thereof.

I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

I claim as my invention:

1. A circuit-controlling device comprising a metal plate having an aperture therein and a plurality of bridging members integral with the plate and extending across the aperture, the length of the bridging members differing from that of the aperture.

2. A circuit-controlling device comprising a metal plate having an aperture therein and a plurlaity of bridging members integral with the plate and extending across the aperture, the length of the bridging members differing from that of the aperture, and a lost-motion mechanism actuable by certain of said bridging members for actuating another of said bridging members.

3. A circuit-controlling device comprising

a metal plate having an aperture therein, the side portions of the plate being deformed laterally from the plane of the plate, and a plurality of bridging members extending across the aperture that are integral with the plate and longer than the aperture.

4. A circuit-controlling device comprising a metal plate having an aperture therein, portions of the plate at the sides of the aperture being deformed laterally from the plane of the plate, and a plurality of bridging members integral with the plate and extending across the aperture.

5. A circuit-controlling device comprising a metal plate having an aperture therein, portions of the plate at the sides of the aperture being deformed laterally from the plane of the plate, a plurality of bridging members integral with the plate and extending across the aperture, and means common to all of said bridging members and carried by certain of said bridging members for actuating one of said bridging members in response to a lateral bending of said plate.

6. A circuit-controlling device comprising a metal plate having an aperture therein, portions of the plate at the sides of the aperture being deformed laterally from the plane of the plate, a plurality of bridging members integral with the plate and extending across the aperture, and means common to all of said bridging members for actuating one of said bridging members in response to a lateral bending of the ends of said plate.

7. A circuit-controlling device comprising a metal plate having an aperture therein extending longitudinally thereof, the side portions of the plate being deformed laterally from the plane of the plate, and a plurality of bridging members, each having a portion thereof deformed laterally from the plane of the plate, extending across the aperture.

8. A circuit-controlling device comprising a metal plate having an aperture therein extending longitudinally thereof, the side portions of the plate being deformed laterally from the plane of the plate, a plurality of bridging members each having a portion thereof deformed laterally from the plane of the plate extending across the aperture, and means actuable by certain of said bridging members for actuating another of said bridging members.

9. A circuit-controlling device comprising a metal plate having an aperture therein extending longitudinally thereof, the side portions of the plate being deformed laterally from the plane of the plate, and a plurality of bridging members extending across the aperture and integral with the plate, each of said members having a portion thereof deformed laterally from the plane of the plate.

10. A circuit-controlling device comprising a metal plate having an aperture therein extending longitudinally thereof, the side portions of the plate being deformed laterally from the plane of the plate, a plurality of bridging members extending across the aperture and integral with the plate, each of said members having a portion thereof deformed laterally from the plane of the plate, and lost-motion mechanism actuable by certain of said bridging members for actuating another of said bridging members.

11. A circuit-controlling device comprising a single plate having an aperture therein, a plurality of bridging members extending across the aperture, both the side portions of the plate and the bridging members having portions extending laterally from the plane of the plate, and a stationary contact member operatively engaging one of said bridging members.

12. A circuit-controlling device comprising a single plate having an aperture therein, a plurality of bridging members extending across the aperture, both the side portions of the plate and the bridging members having portions extending laterally from the plane of the plate, a stationary contact member operatively engaging one of said bridging members, and lost-motion mechanism common to all of said bridging members for actuating one of said bridging members out of engagement with said stationary contact members.

13. In a circuit-controlling device the combination with a resilient member, end supports for restraining the resilient member to a length shorter than its unrestrained length, and a stationary member normally engaging said resilient member, said resilient member being adapted to move laterally between said supports with a snap motion in response to a movement of said supports in a lateral direction toward the stop member, of means responsive to a predetermined movement of said supports for impairting an initial movement to said resilient member thereby causing disengagement of the resilient member from the stop member.

14. In a circuit-controlling device, the combination with a resilient member, end supports for restraining the member to a length shorter than its unrestrained length, a stationary member normally engaging said resilient member, said resilient member being adapted to move laterally between said supports with a snap motion in response to a movement of said supports in a lateral direction toward the stop member, of a second resilient member disposed between said support in a restrained position for imparting an initial movement to said first resilient member in response to a certain movement of said supports in a direction towards said stop member.

15. In a circuit-controlling device, the

combination with a resilient member, end supports for restraining the member to a length shorter than its unrestrained length, a stationary member normaly engaging said resilient member, said resilient member being adapted to move laterally between said supports with a snap motion in response to a movement of said supports in a lateral direction toward the stop member, of a plurality of bridging members disposed between said end supports in a restrained position for imparting an initial movement of said first named resilient member in response to a certain movement of said supports in a direction towards said stop member.

16. In a circuit-controlling device, the combination with a resilient frame having an aperture extending longitudinally thereof, a bridging member extending longitudinally across said aperture having the ends thereof secured to said frame, said member being longer than the aperture and adapted to move laterally beween the ends of said frame with a snap motion in response to a lateral bending of the ends of said frame, of a second bridging member extending across said aperture, said member being longer than said aperture and adapted to move laterally between the ends of said frame in response to a lesser bending than said first bridging member, and means actuable by said second bridging member for imparting an initial movement to the first bridging member.

17. A circuit-controlling device comprising an apertured resilient metal plate, side portions of the plate being deformed laterally of the plane of the plate, an intermediate integral laterally deformed bridging member extending across the aperture, a plurality of outer laterally deformed integral bridging members extending across said aperture, and means mounted on the outer bridging members for causing movement of the intermediate bridging member with a snap motion upon movement of a portion of the plate laterally of its plane.

18. A circuit-controlling device comprising an apertured resilient metal plate, side portions thereof being deformed laterally of the plane of the plate, a plurality of parallel-extending integral laterally deformed bridging members extending across the aperture, said bridging members embodying means for causing a predetermined sequence of movement of the bridging members upon movement thereof in response to lateral movement of a portion of the plate.

19. In a circuit controlling device, in combination, a contact member, means for actuating said member, and means for imparting positive initial movement to said actuating means comprising a resilient strip and means for restraining said strip in an initially deflected condition whereby said strip may be caused to be actuated from one position to another through an unstable position with a snap motion.

20. An electric switch comprising a pair of contact members, an apertured plate having the aperture bridged by a strip bent laterally at predetermined points to be at least in part out of the plane of the plate whereby deflection of the strip may be effected with a snap motion between the strip and the apertured plate in response to a bending of the plate, and a momentum device actuated by said strip for operating the contact members with a quick make-and-break motion.

In testimony whereof, I have hereunto subscribed my name this first day of April, 1927.

AUGUST J. MOTTLAU.