(No Model.) 3 Sheets—Sheet 1.

A. B. HERRICK.

ELECTRIC SWITCH.

No. 504,528. Patented Sept. 5, 1893.

FIG. 1.

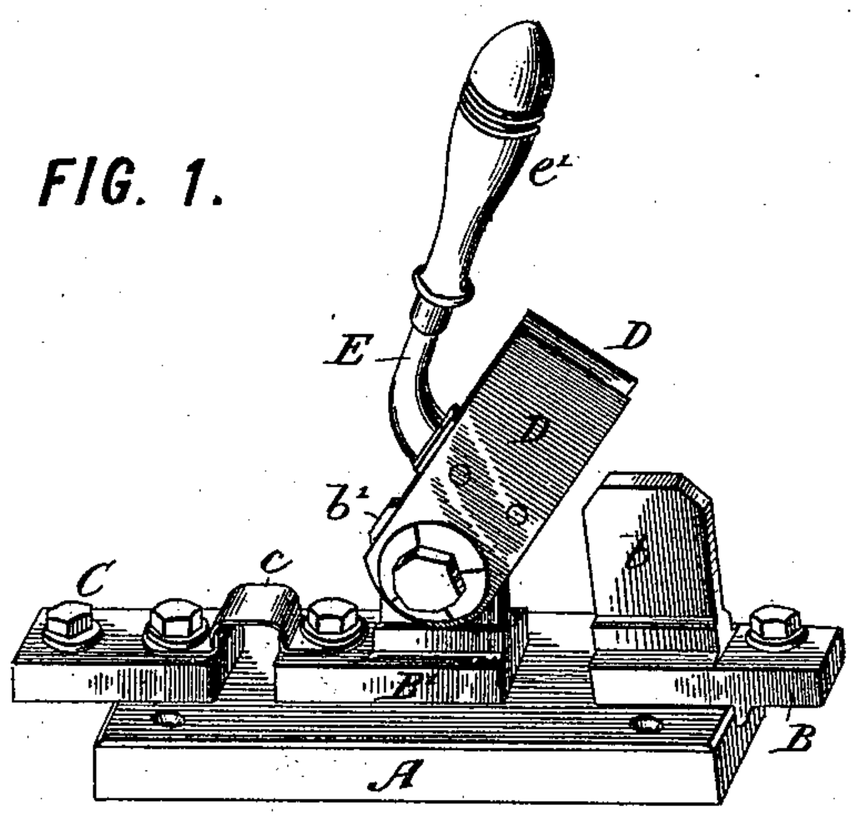


FIG. 2.

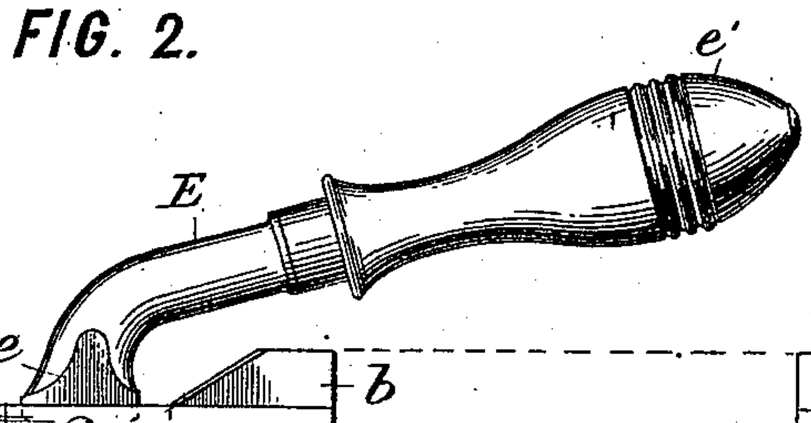


FIG. 6.

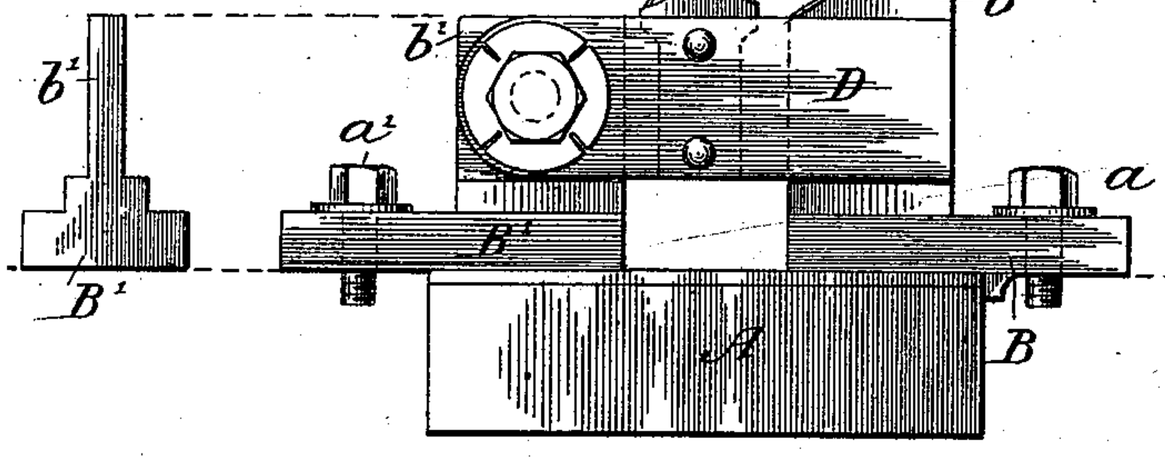


FIG. 7.

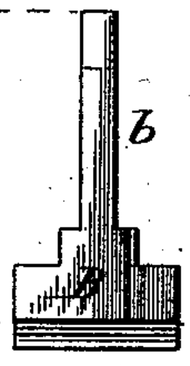
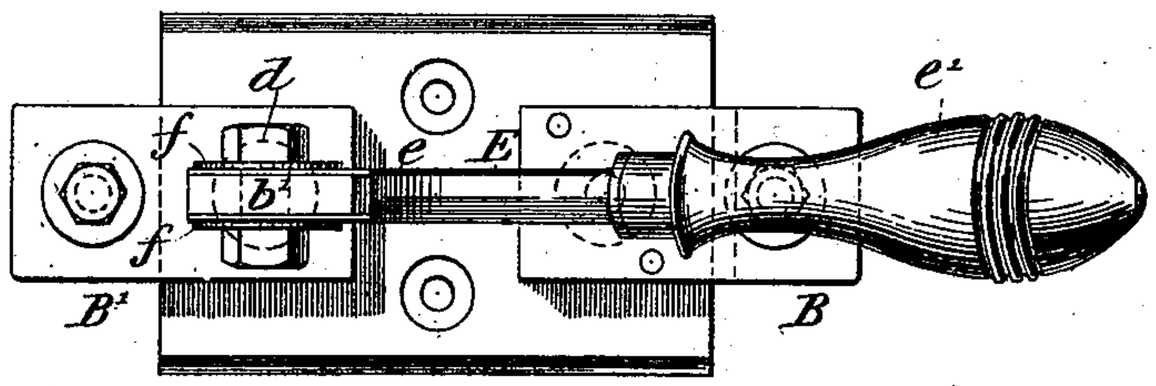


FIG. 3.



WITNESSES:
John A. Rennie
Fred White

INVENTOR:
Albert B. Herrick,
By his Attorneys,
Arthur G. Fraser & Co.

(No Model.) 3 Sheets—Sheet 2.

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FIG. 4.

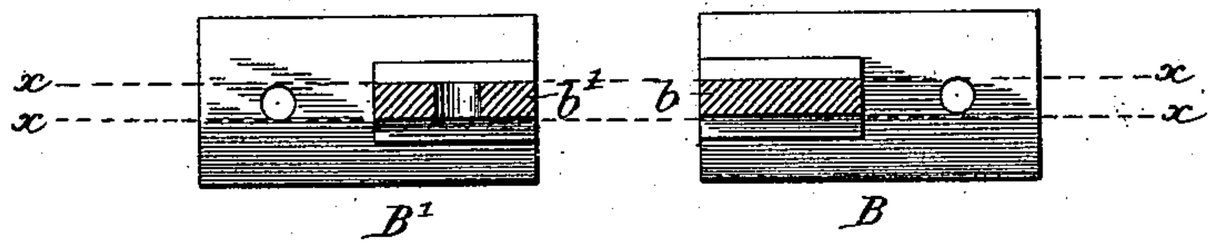

FIG. 5.

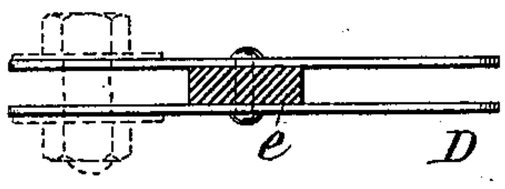

FIG. 9.

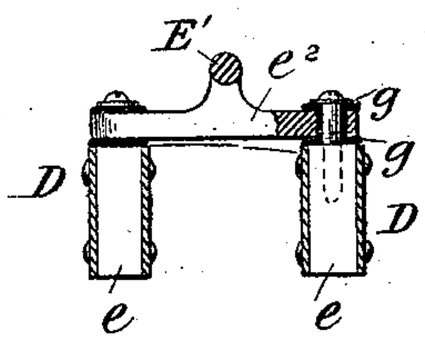

FIG. 8.

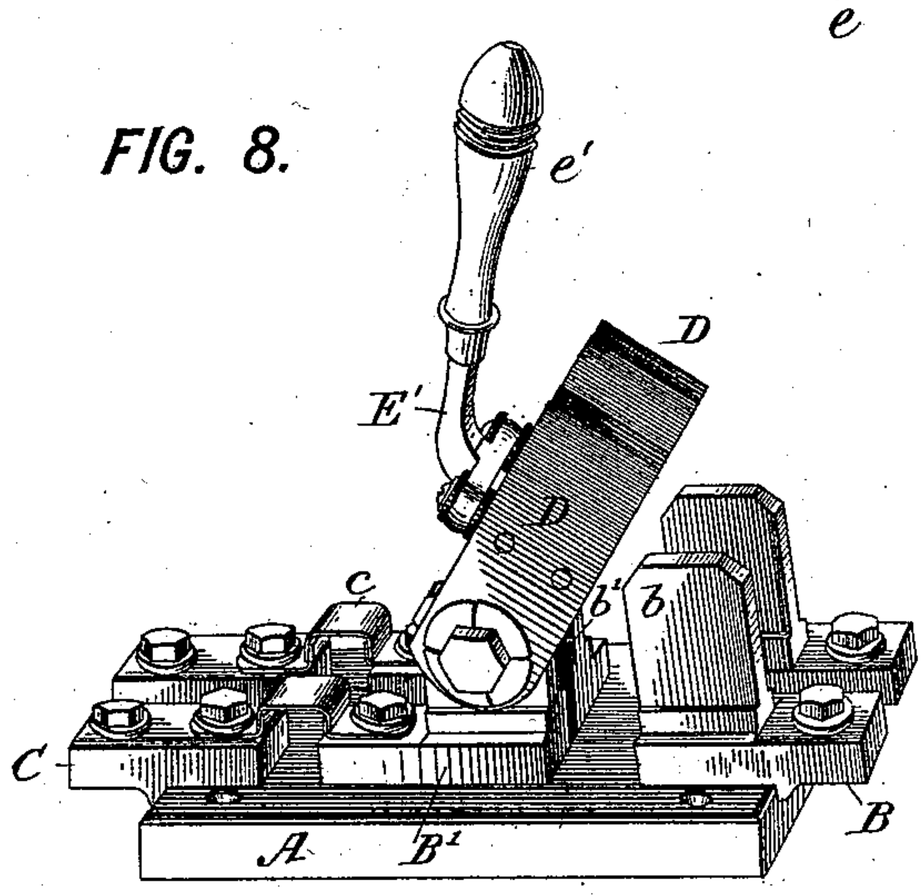

FIG. 10.

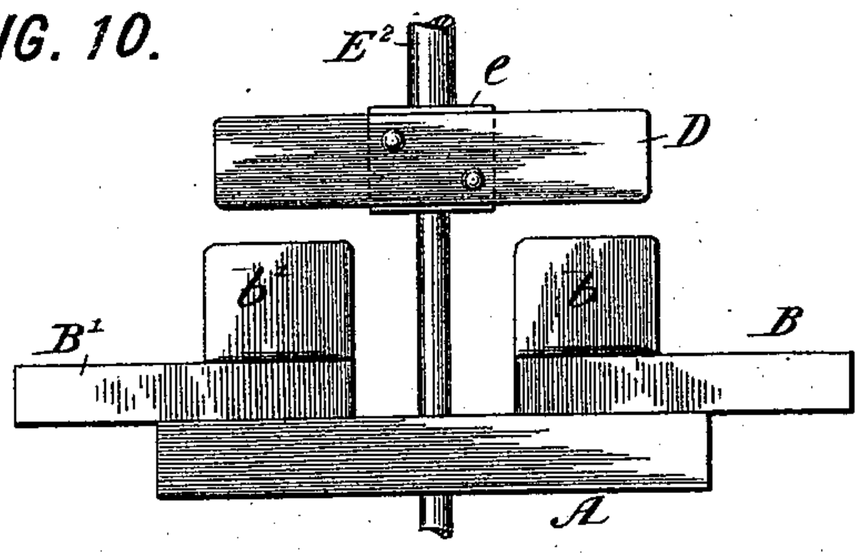

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FIG. 11.

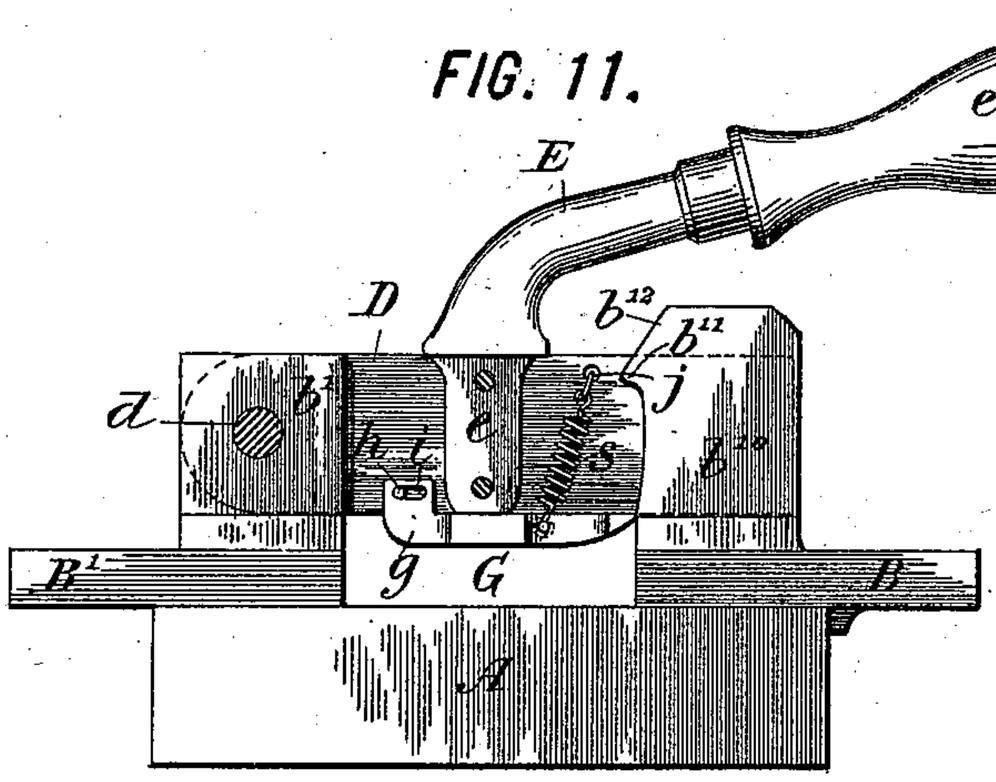


FIG. 12.

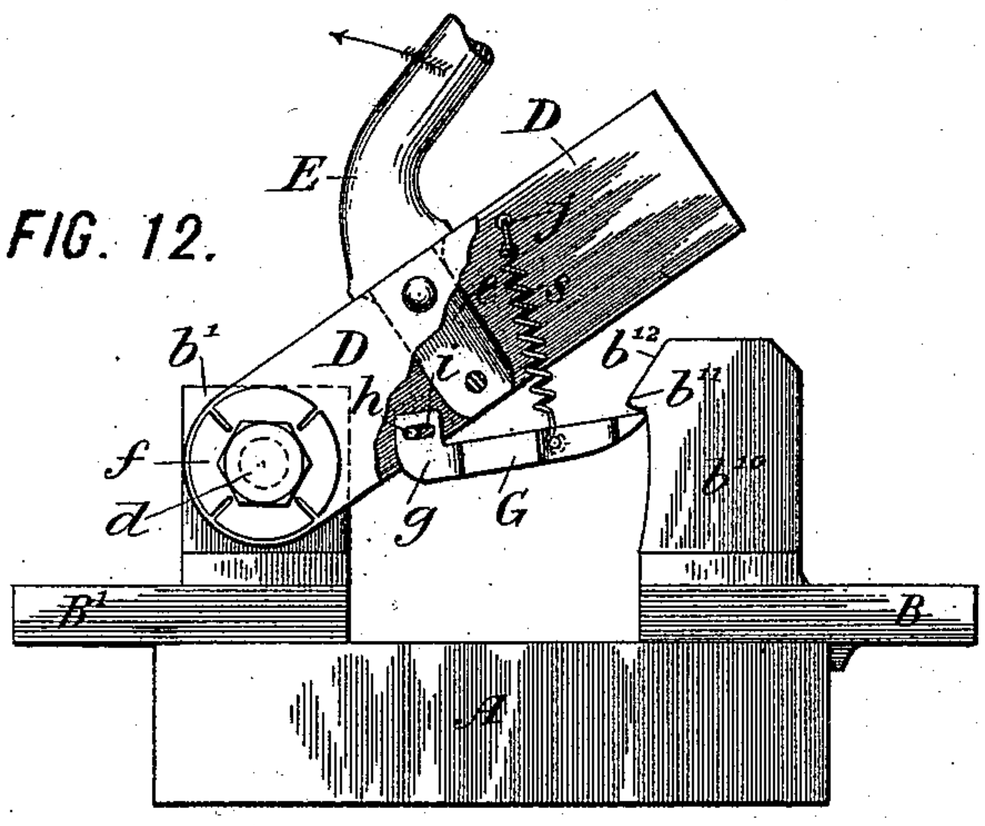


FIG. 13.

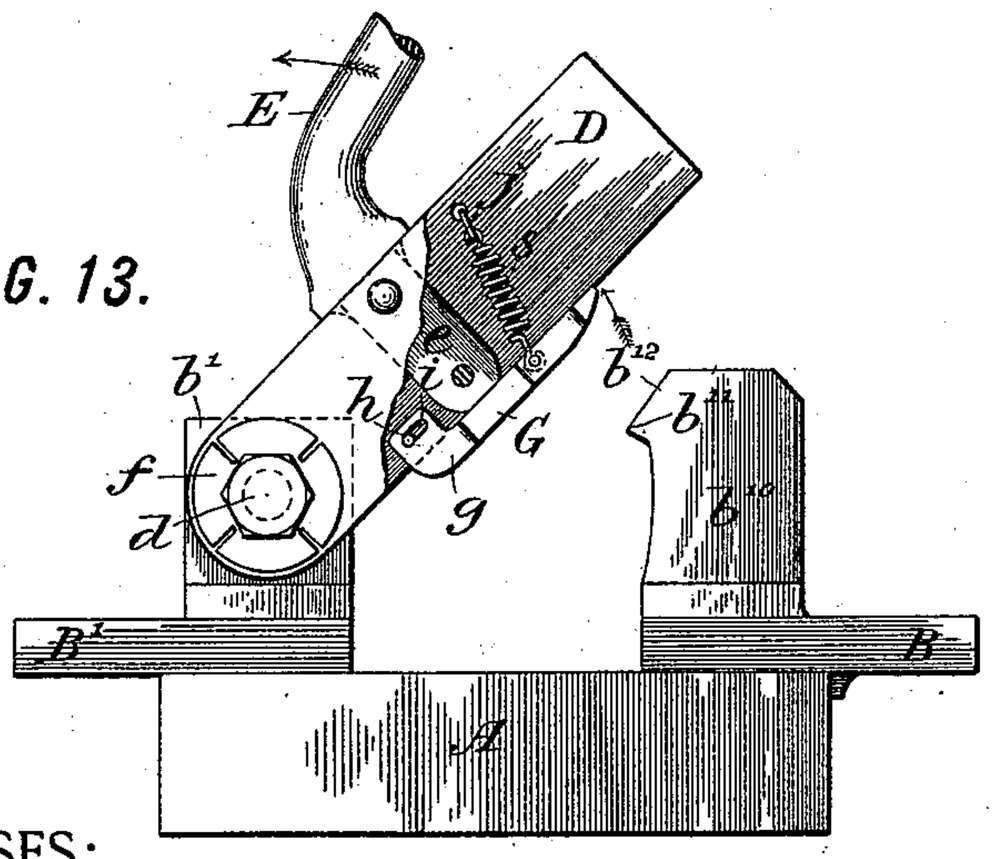
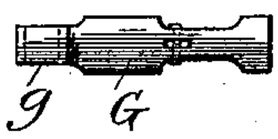


FIG. 14.



WITNESSES:
John A. Rennie.
Fred White

INVENTOR:
Albert B. Herrick,
By his Attorneys,
Arthur C. Fraser & Co.

UNITED STATES PATENT OFFICE.

ALBERT B. HERRICK, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF BOSTON, MASSACHUSETTS.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 504,528, dated September 5, 1893.

Application filed July 21, 1892. Serial No. 440,768. (No model.)

To all whom it may concern:

Be it known that I, ALBERT B. HERRICK, a citizen of the United States, residing in Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

Switches for carrying heavy electric currents as now generally used are constructed with two terminal plates from each of which two spring blades project upwardly, and with a conducting bar or bridge-piece pivoted between one pair of blades and having a handle by which its free portion can be thrust between the other pair of blades to close the switch, or thrown up out of contact therewith to open the switch. The elastic blades of each pair by reason of their springiness embrace the bridge-piece or bar between them, so that a considerable contact surface under spring pressure is provided presenting a path for the current of fairly low resistance. The construction of such switches presents some practical objections which render them imperfect. The elastic blades are soldered into slits or grooves milled across the top surfaces of the terminal plates, the operation of soldering being found to impair the temper of the blades and to be liable to warp them slightly, even a slight warpage being found to seriously impair the perfection of the contact surfaces and increasing the resistance of the switch, which leads to heating and loss of energy. Difficulty is also experienced in bringing the contact surfaces of the respective pairs of blades into parallelism with each other and with the surfaces of the conducting bar or bridge.

My invention provides an improved construction of electric switch whereby these disadvantages are avoided. The terminal plates are formed with projecting lugs, and the movable member of the switch consists of a pair of spring blades adapted to embrace the respective lugs between them at their opposite ends. A handle or carrier is applied to the blades to fasten them together, and to form a means for moving them to bring them into simultaneous contact with the respective lugs, or to displace them so as to break contact with one or both of the lugs. Preferably the pair of blades is pivoted at one end to one of the lugs, the opposite or free ends of the blades being movable over and embracing the opposite lug to close the switch, or capable of being thrown up therefrom to open it.

Figure 1 of the accompanying drawings is a perspective view showing a single-pole switch constructed according to my invention, in the open position. Fig. 2 is a side elevation thereof showing the switch closed. Fig. 3 is a plan thereof. Fig. 4 is a plan of the terminal plates of the switch showing the upright lugs in section. Fig. 5 is a plan of the pair of blades showing the intervening portion of the handle in section. Figs. 6 and 7 are end elevations of the respective terminal plates and lugs. Fig. 8 is a perspective view showing the application of my invention to a double-pole switch. Fig. 9 is a transverse section through the two pairs of spring blades shown in Fig. 8, showing the application of the handle to them. Fig. 10 is a side elevation showing a modified construction of the switch. Fig. 11 is a side view of my improved blade switch of the general construction shown in Figs. 1 to 7, and with the addition of my improved snap devices by which the switch is adapted to circuits of high potential. In the figure, the switch is shown as closed and one of the blades removed. Fig. 12 is a similar view showing the switch in the act of being thrown open, one of the blades being partly broken away. Fig. 13 is a similar view to Fig. 12 showing the switch immediately after the instant of finally breaking contact. Fig. 14 is a plan view of the snap-tongue removed.

I will first describe the construction shown in Figs. 1 to 7. Let A designate a base plate of any suitable insulating material, such as slate or porcelain. On this are fastened the two terminal plates B B′ of conducting metal. Each of these plates is formed with an upwardly projecting contact lug, the respective lugs being lettered *b b′*. The circuit terminals are connected to the terminal plates B B′ by any suitable means, as by screws *a a′*. In Fig. 1, a fusible bridge *c* is shown connecting the plate B′ with the plate C to which the terminal wire is connected. The movable member of the switch consists of a pair of blades D D

of elastic metal plate, preferably phosphor bronze. These blades are connected together at their middle portions through the medium of an interposed block *e* forming part of an operating lever or carrier E, and to which block they are riveted or otherwise fastened. In the preferred construction, the blades are pivoted to one of the contact lugs, being shown as pivoted to the lug *b'*. This pivoting is preferably effected by passing a bolt *d* through the lug and the end portions of the respective blades, split or elastic washers *f f* being provided in order both to make a frictional connection upon the screwing up of the bolt and to press the ends of the blades into firm conductive contact with the opposite sides of the lug, which is embraced between the blades. The operating lever E is preferably provided with a handle *e'* for convenience in operating the switch. When thrown down to the position shown in Fig. 2, the free ends of the blades embrace between them the contact lug *b*, but when thrown up to the position shown in Fig. 1, they break contact with this lug, thereby opening the switch. As the opposite surfaces of the lugs *b b'* are perfectly true and parallel, and as the blades D D are mounted in exact parallelism and are elastic, the lugs are embraced closely between the opposite end portions of the blades, and an intimate and extended area of contact is secured, thereby affording the highest possible conductivity.

One important advantage of my improved switch is the absence of all soldered joints.

Another advantage is the reduction of the number of pieces to the minimum, there being, aside from fastening screws and washers, only five pieces in my switch to seven in the old style of single-pole switch.

A further and most important advantage is found in the ease and certainty by which the respective contact surfaces can be brought to parallelism in order to make a broad, extended and uniform contact. In the construction of the switch, the terminal plates B B' are fastened to the base A or otherwise brought into their eventual relative positions, and being placed in a milling machine, the opposite sides of the lugs *b b'* are milled, together, by means of two cutters set the proper distance apart, being finished to the planes indicated by the dotted lines *x x* in Fig. 4. Preferably also the block *e* of the handle or lever E is held in a chuck so as to be presented simultaneously to the action of the milling cutters, so that its opposite sides are cut to the exact width of the lugs. The blades D D being of perfectly flat elastic phosphor bronze plate, are fastened against the opposite sides of the block *e*, and on putting the parts together, the whole switch will be found to be perfectly adjusted, and the maximum area of contact is obtained.

Fig. 8 shows a double-pole switch constructed according to my invention. It consists of two switches of the construction already described, arranged side by side, and with the respective pairs of blades connected both to one handle or operating lever E'. This lever has a T-head or bridge-piece e^2, the opposite ends of which are connected to but insulated from the blocks *e e*, to which the respective pairs of blades D D are fastened, insulating washers *g g* being interposed to avoid making electrical connection between the handle and the blocks *e e*.

Although I have stated that it is preferable to pivot the pair of blades at one end to one of the lugs so that the blades shall turn as a swinging bridge upon this pivot, yet this construction is not essential to my invention.

In Fig. 10, I show a construction wherein the blades D D are connected together through the medium of an interposed block *e* to which they are fastened, which block is mounted on an operating rod E^2 mounted to slide up and down. When slid down the respective ends of the pairs of blades embrace between them the respective contact lugs *b b'*, but when elevated to the position shown, the blades pass out of contact with both lugs, thus opening the switch.

The embodiments of my invention already described are designed for carrying heavy currents under somewhat low electro-motive force. For high potential circuits, it is practically necessary to employ switches of the class known as "snap-switches," or those which are so constructed as to extinguish the arc which is liable to be formed upon the separation of the circuit-breaking terminals.

My improved construction of switch is readily adaptable to circuits requiring a snap-switch. The feature of my invention now to be described constitutes an improvement in so called snap-switches, and has for its object to perfect the operation of such switches so as to cause the breaking of the circuit at the separation of the terminal contacts with the utmost rapidity, so as to reduce to a minimum the volatilization of the metal of the arc, by which volatilization the resistance of the arc is lowered. The quicker the contact points can be separated the less is the volatilization, and consequently the higher the resistance of the arc, and the more rapidly is its resistance increased by elongating it.

Referring to Figs. 11 to 14, which show the snap-switch, the parts A, B B', D D, E, *e e'*, *d*, *f*, are unchanged, being the same parts as shown in Figs. 1 to 7, the only difference being that the terminal plates B B' are preferably placed somewhat farther apart to allow more room between them, and the blades D D consequently made somewhat longer. The plate B' has a contact lug *b'* projecting from it as in the first construction, and the plate B has a contact b^{10} projecting from it in exactly the same manner as the lug *b* in the first construction, except that the lug b^{10} is constructed with a slightly projecting shoulder b^{11}, above which is a beveled face b^{12}. Beneath the spring blades D D is mounted a snap-tongue or dog G consisting of a piece of metal piv-

otally connected at one end to the blades D D, and adapted to engage the contact lug b^{10} at its opposite or free end or nose. The pivotal end g of this tongue passes up between the spring blades and is embraced thereby to make a good electrical connection therewith. It is formed with a slotted pivot i engaged by a pin h passing across between the blades. A spring s is arranged to press the tongue G upward so that it normally lies close against the blades, as shown in Fig. 11. This spring preferably reacts against the blades themselves, or their handle E. It is shown as being attached to a bent wire j crossing between the blades. The spring is so mounted as to exert its pressure against the tongue in a diagonally forward and upward direction, so that it tends to draw the tongue forward and press its nose against the lug b^{10}, its slotted pivot h affording sufficient longitudinal motion to accomplish this result. When the switch is closed as shown in Fig. 11, the current is conducted chiefly through the blades D D between the contact lugs. But in the act of opening the switch, when the blades are thrown up and part contact with the lug b^{10}, as shown in Fig. 12, the tongue G has its nose caught and arrested by the shoulder b^{11}, with which it makes firm contact, being pressed thereagainst by the spring s, and the current continues to flow for the moment, its path being through the tongue G. As the upward movement of the blades is continued, the spring s is distended, the tongue G remaining in contact with the shoulder b^{11} until the backward movement of the blades has become sufficient to pull the tongue G out from underneath the shoulder b^{11}, whereupon it parts company therewith and snaps or springs quickly upward under the tension of its spring s. Any arc that may follow the nose of the tongue will be quickly extinguished by this instantaneous upward movement. Fig. 13 shows the parts immediately after breaking the arc. In closing the switch again, the tongue G being held close against the under side of the blades, moves down with them until its nose strikes the inclined face b^{12}, by which it is pressed backward, its slot h sliding against the pin i, until its nose passes beneath the shoulder b^{11}, whereupon by reason of the oblique action of the spring the tongue slides forward bringing its nose against the inner face of the lug b^{10}, and leaving it in the position shown in Fig. 11, ready for the next circuit breaking operation.

As compared with other forms of quick-break or snap-switches, my invention has the advantage that it does not necessitate the moving of the whole contact blade of the switch at a high velocity. It is well understood that velocity is dependent upon the mass that is moved and the friction under which it moves, and by my invention instead of applying stiff springs to impart a high velocity to the entire contact blade or moving member of the switch, the only part which moves at a high velocity is the snap-tongue G, which is of small mass, and is so mounted as to move with very trifling friction, so that under a given spring effort, the velocity is very high and a stiff spring is not required.

One important advantage of my improved snap-switch is, that whatever corrosion is due to the arc in the act of breaking the circuit, occurs at the nose of the tongue G and at the shoulder b^{11}, the surfaces of which are entirely independent of the contact surfaces which when the switch is closed are relied upon to conduct the current, these contact surfaces being the side faces of the lug b^{10} and the inner end surfaces of the blades D D in contact with them. It results from this that the contact surfaces that ordinarily carry the current are not corroded by the arc formed in breaking the circuit, so that no amount of arcing can impair the conductivity of the switch in ordinary use.

My invention provides an exceedingly simple arc-extinguishing or snap-switch, one which possesses high conductivity when in the closed position, which insures the breaking of the circuit with the utmost rapidity, and which consequently reduces the deleterious effect of the arc to the minimum.

In the construction of my switch, the circuit-breaking points, that is to say, the shoulder b^{11} and the nose of the tongue G, may be of carbon, iron, platinum, or any other suitable material. The tongue G is preferably of metal, but may be of any conducting material.

The construction of the snap device may be greatly varied without departing from my invention. All that is essential is the provision of a spring-actuated tongue, arm, plate, or other equivalent member carried by the movable member of the switch, and actuated by spring pressure, with its free end or portion arranged to be engaged by a projecting shoulder to restrain it until the movable member of the switch has been moved to a predetermined extent, accompanied by the yielding of the spring, until by the movement of the moving member the tongue is pulled out from engagement with said projecting shoulder, so that by the tension of the spring it snaps away therefrom. The tongue G may be itself a spring plate instead of having a separate spring applied to it.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. A switch comprising an insulated base, a pair of terminal metal plates fastened thereto and formed with integral contact lugs projecting from them, the opposite sides of said lugs being finished in parallel planes in line with one another, a pair of flat elastic metal blades arranged to embrace the respective lugs between them flatwise to close the switch, and a block interposed between said blades, fastened to them, and by which they are moved.

2. A switch comprising an insulated base, a pair of terminal metal plates fastened thereto

and formed with integral contact lugs projecting from them, the opposite sides of said lugs being finished in parallel planes in line with one another, a pair of flat elastic metal blades arranged to embrace the respective lugs between them flatwise to close the switch, said blades being pivoted to one lug and movable around it to bring their free ends into or out of contact with the opposite lug, a block interposed between said blades and fastened to them, and a handle projecting from said block by which to swing the blades.

3. A switch comprising an insulating base, a pair of terminal plates fastened thereto and formed with respective contact lugs projecting from them, the opposite sides of said lugs being finished in parallel planes in line with one another, a pair of elastic blades adapted to embrace the respective lugs between them to close the switch, and a block interposed between said blades to which they are fastened and by which they are moved, the opposite faces of said block being finished in parallel planes coincident with those of the lugs.

4. A snap-switch comprising a movable member adapted to form a bridge between the stationary terminal plates, one of said plates having a projecting shoulder combined with a spring-pressed snap-tongue carried by said movable member, and adapted during the opening movement of the switch to engage and be restrained by said projecting shoulder until by the movement of said movable member it is drawn out of engagement with said shoulder, whereupon it overtakes the movable member by a quick snap action adapted to break any arc that may form at the points of separation.

5. A snap-switch comprising two stationary terminals, one of said terminals having a projecting shoulder, and a movable member adapted to constitute a conducting bridge between them, combined with a snap-tongue carried by said movable member drawn toward it by spring pressure, and arranged to engage said projecting shoulder and be restrained thereby during the opening movement of the switch until after said movable member has itself parted contact with said terminal, after which by the continued movement of said movable member said tongue is disengaged from said shoulder and springs toward the movable member, whereby the arc resulting from the breaking of the circuit is formed between said tongue and shoulder, and the normal contact surfaces between the terminal and movable members are preserved from oxidation.

6. A snap-switch consisting of two stationary lugs constituting the respective terminals, a pair of elastic blades adapted to embrace the lugs between them and constituting the movable member, and a snap-tongue pivotally connected to said blades in conductive contact therewith, pressed toward them by spring pressure, and a projecting shoulder formed on one of the terminal lugs adapted to engage the free part of said tongue during the opening movement of the switch and restrain it until the blades have parted contact with said lug, after which by the continued movement of the blades the tongue disengages itself from said shoulder and flies toward the blades.

7. A snap-switch comprising a stationary lug constituting one terminal, a pair of elastic blades pivoted thereto, a stationary lug constituting the other terminal, and formed with a projecting shoulder, an operating lever or carrier connected to said blades by which they are moved to open or close the switch, and a spring-pressed tongue carried by said blades and having its free end arranged to be engaged by said shoulder and restrained thereby during part of the opening movement of the switch.

8. The combination to form a snap-switch of terminals B B′, one of them formed with projecting shoulder b^{11}, elastic blades D D, handle E, and spring-pressed snap-tongue G pivoted between said blades and having its free end arranged to engage said shoulder.

9. The combination to form a snap-switch, of terminal plates B B′, one of them formed with projecting shoulder b^{11} and inclined face b^{12}, elastic blades D D pivoted to the opposite terminal, handle E, snap-tongue G provided with slotted pivotal connection *h i* at one end by which it is joined to said blades, and spring *s* for drawing said tongue toward the blades.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALBERT B. HERRICK.

Witnesses:

SOPHIE B. HERRICK,

HENRY F. MARX.