No. 686,918. Patented Nov. 19, 1901.

H. P. BALL.

AUTOMATIC CIRCUIT BREAKER.

(Application filed June 25, 1900.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 2.

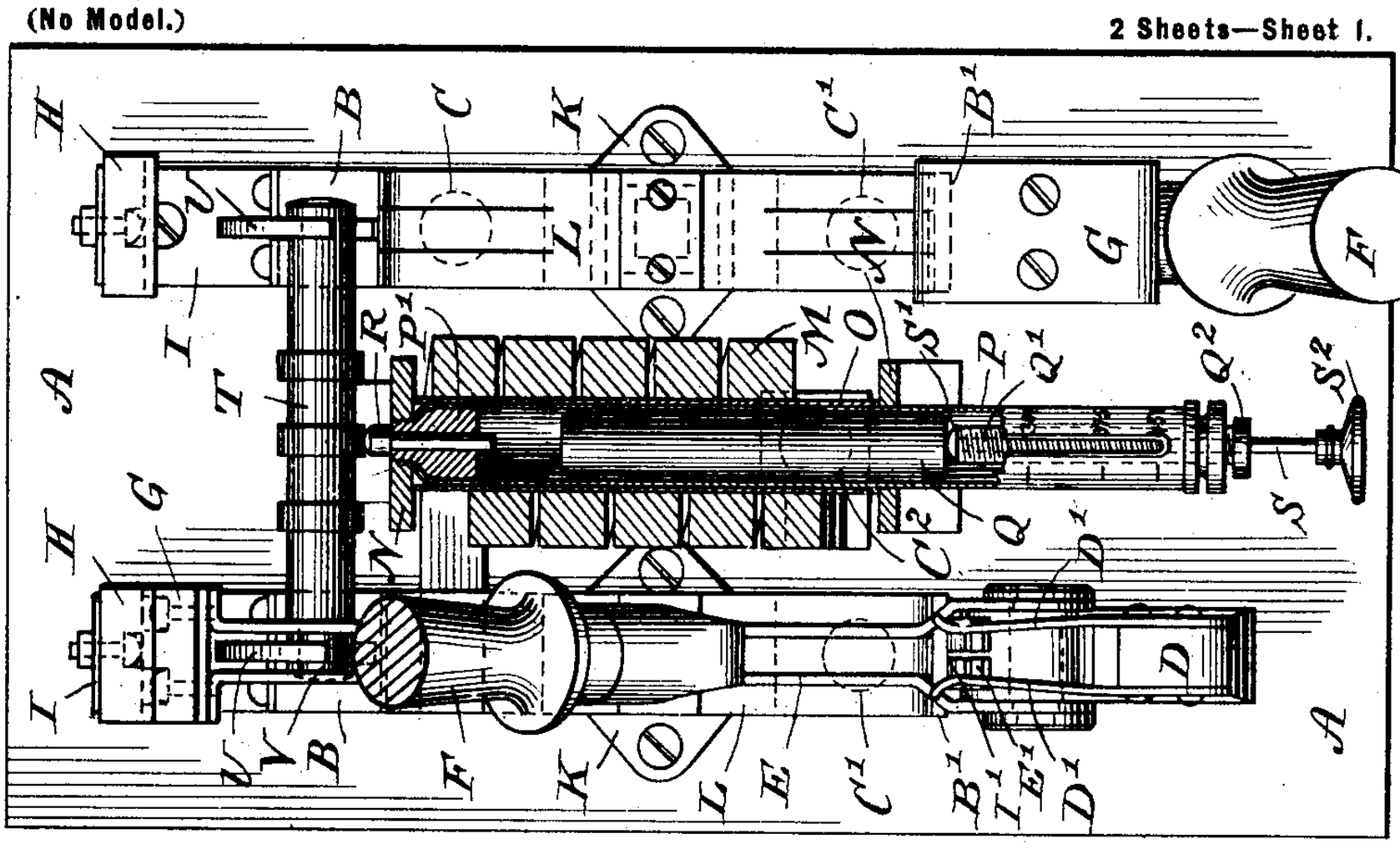

FIG. 1.

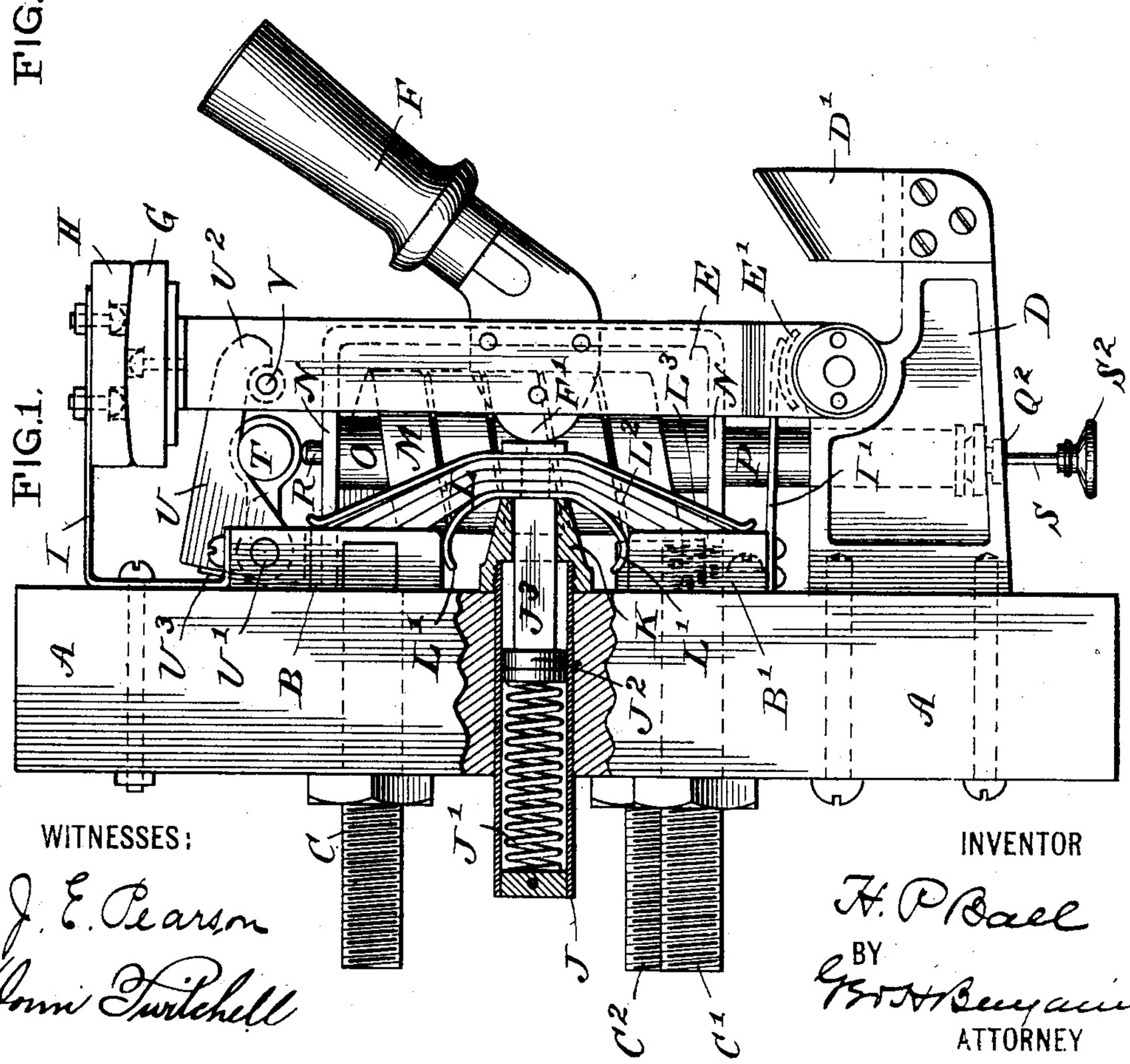

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FIG. 4.

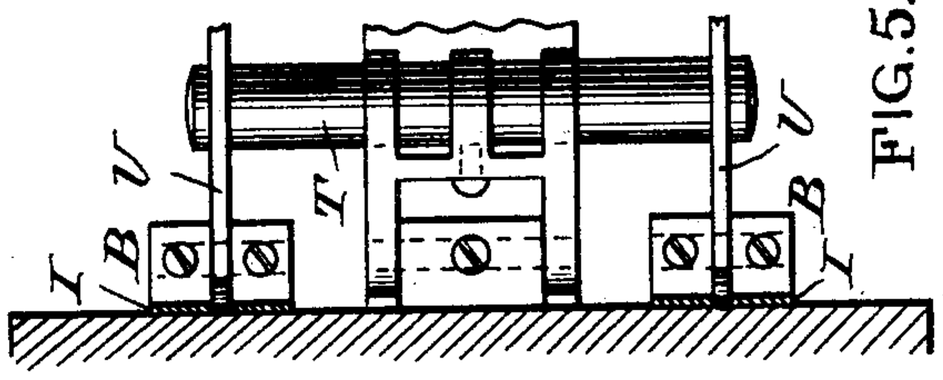

FIG. 5.

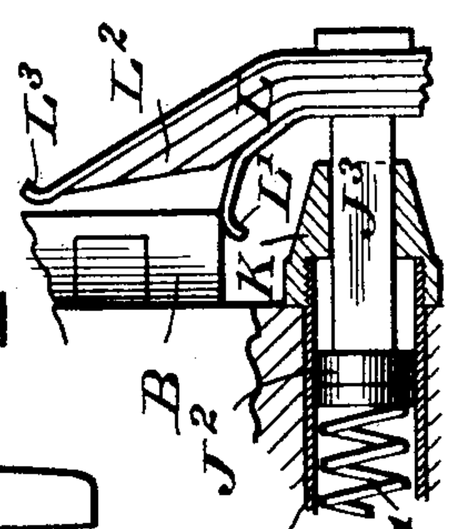

FIG. 6.

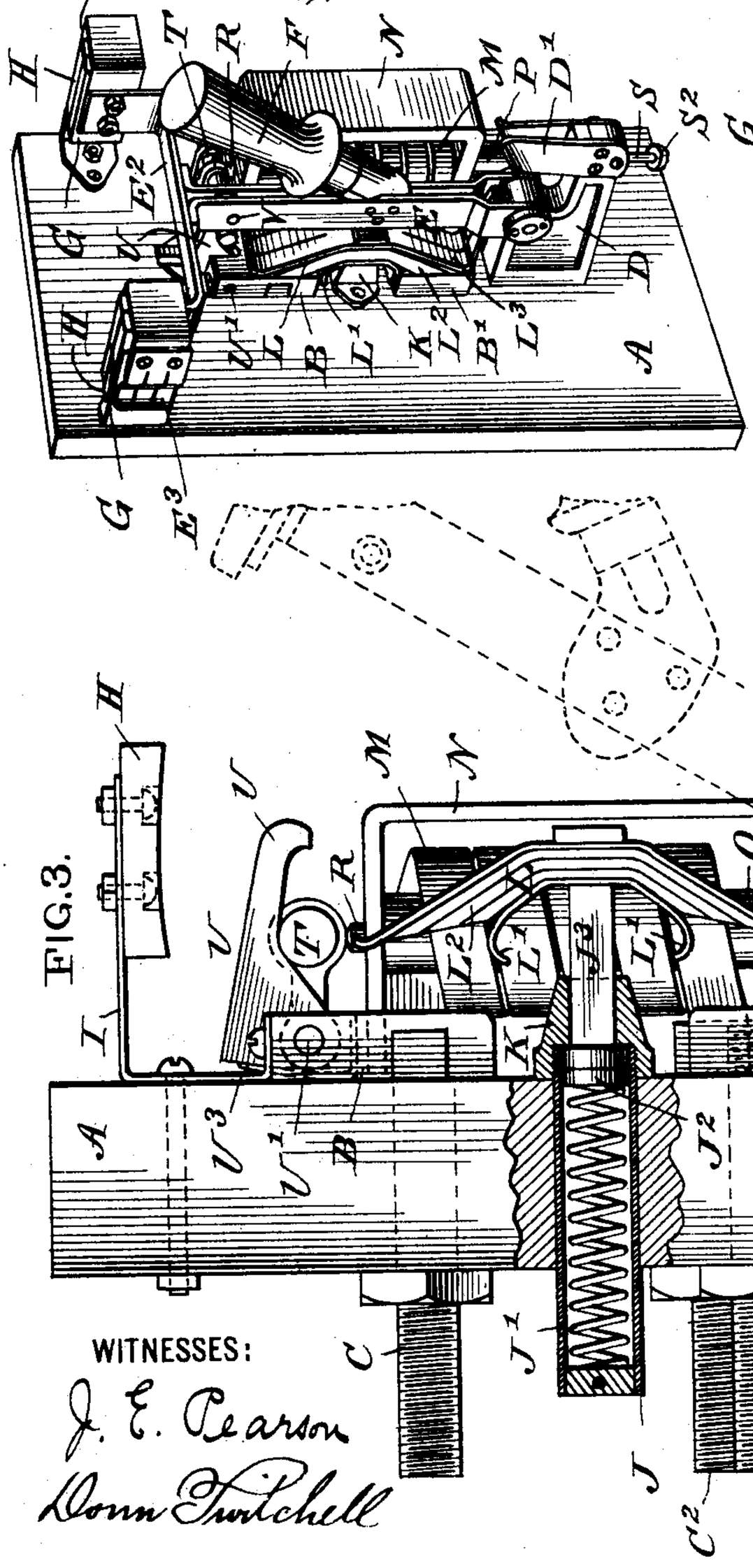

FIG. 3.

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UNITED STATES PATENT OFFICE.

HENRY PRICE BALL, OF NEW YORK, N. Y., ASSIGNOR TO GENERAL INCANDESCENT ARC LIGHT COMPANY, OF NEW YORK, A CORPORATION.

AUTOMATIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 686,918, dated November 19, 1901.

Application filed June 25, 1900. Serial No. 21,451. (No model.)

To all whom it may concern:

Be it known that I, HENRY PRICE BALL, a citizen of the United States, residing at New York city, county and State of New York, have invented certain new and useful Improvements in Automatic Circuit-Breakers, of which the following is a specification.

My invention relates to circuit-breakers of the type which are adapted to automatically break an electrical circuit when the current transmitted through the instrument is in excess of the predetermined amount.

The object of my invention is an improvement in the construction of circuit-breakers by reason of which the automatic operation of the instrument is rendered certain, perfect metallic contact maintained without the employment of knife-switches or other friction devices, and the formation of a dangerous arc or arcs made impossible.

The accompanying drawings will serve to illustrate my invention, and in which similar letters of reference indicate like parts.

Figure 1 is a side elevation of a double-pole switch with the circuit closed through both poles. Fig. 2 is a front elevation of a double-pole switch with the actuating-magnet in section and with one pole closed and the other pole open. Fig. 3 is a side elevation of a double-pole switch with both poles open. Fig. 4 is a transverse section of the switchboard and top view of the latch mechanism. Fig. 5 is a detailed view illustrating the position of the laminated contacts when the switch has been opened, but before the final break of the metallic contacts has been made. Fig. 6 is a perspective view of a single-pole switch of similar construction.

In the drawings, A represents a base-plate, and B B′ metallic contact-blocks made of copper or other suitable good conducting material. These contact-blocks are connected to the base-plate by means of the bolts C C′, which also serve, through suitable devices common in the art, as a means of connection for the electrical conductors to the instrument. The contact-blocks B B′ are arranged in pairs, and the faces of all of the blocks occupy the same vertical plane, which is parallel with the face of the base-plate.

Connected to the base-plate and situated below the contact-blocks are brackets D. Pivotally mounted in the brackets D are the switch-levers E. In Fig. 2 two of such levers are shown. In Fig. 6 one lever is shown. Each of the switch-levers E consists of a pair of parallel plates carrying a handle F, arranged at an angle to the lever and having a convex protuberance F′ on its lower end, which projects beyond the inner face of the switch-lever. Mounted upon the upper end of each switch-lever is a carbon contact-plate G, having a convex upper surface. These plates coact with carbon contact-plates H, having concave under surfaces and elastically supported on spring-plates I, projecting from and secured to the base-plate A and in electrical contact with the contact-blocks B. At the lower end of each switch-lever E and between the parallel plates is arranged a segmental bearing-shoulder E′, upon which rest the spring-plates I′, secured to and in electrical contact with the contact-blocks B′.

In Fig. 6, where but a single switch-lever is employed, a pair of vertically-arranged carbons are mounted upon opposite ends of a horizontally-disposed plate E^2 and coact with a pair of vertically-arranged carbons secured to the base-plate. The horizontal plate E^2 also carries at its end vertically-arranged springs E^3, by reason of which the carbons G and H are maintained in good contact when opposed to each other.

Located on the outer end of each bracket D are a pair of spring-plates D′, which serve to receive between them and to cushion the downward movement of the switch-levers E.

Arranged in a perforation in the base-plate A is a tube J, carrying the helical spring J′, which spring bears upon a piston J^2. Projecting from the piston is a rod J^3. Located in front of the base-plate A and in line with the tube J is a perforated block K, through which the piston-rod J^3 projects and moves. Mounted on and secured to the ends of the piston-rod J^3 is a leaf-spring L. This spring for the purpose of description may be divided into three parts—first, the inner spring L′, which bears upon the opposing surfaces of the contact-blocks B B′ and which may consist of one or more plates of resilient good conducting metal; second, the middle spring

L^2, which bears upon the outer surfaces of the contact-blocks B B′ and which is composed of a number of superposed layers of resilient good conducting metal, and, third, the outer spring L^3, which bears upon the outer surfaces of the contact-blocks B B′, but at a distance from and not in contact at its lower ends with the upper surface of the last layer or leaf of the middle spring or portion L^2 and which may be composed of one or more leaves of resilient good conducting metal. The spring L is designed to form three points of metallic contact and by reason of the shape of the inner, middle, and outer portions of the spring to maintain contact with the contact-blocks for different periods of time; or, in other words, the springs L′ L^2 L^3 may be considered as a bridge with three metallic contacts, which will successively make contact when the instrument is closed and break contact when the instrument is opened.

It will be understood from the foregoing description that when the instrument is closed the main portion of the current will be transmitted through the spring L and but a very small portion through the switch-levers E and carbon contacts H G, and that when the instrument is opened the spring L will be projected for some distance forward and out of contact with the blocks B B′ by the action of the spring J′ and its own resilient effect.

To hold the switch in a locked position and to release the switch, I make use of an electromagnetic device, which I will now describe.

Projecting from the front of the instrument and in electrical contact at one end with the bolts C and at the other end with the bolts C^2 is a solenoid M. Arranged over this solenoid and secured to the base-plate is a bracket N. Located within the solenoid and secured at its ends to the bracket is a tubular core O. Located within the core O is a tube P, preferably of non-magnetic material. In the upper end of this tube is a perforated plug P′, threaded at its upper end and secured to the bracket N. Situated within the tube P is a metallic armature Q. Mounted over the top of the bracket N and having its stem projecting through the opening in the plug P′ is a lifting-pin R. This pin is free to move up and down in the plug P′. Located under the armature Q is a screw Q′, adjustable by means of the head Q^2, located outside of the tube P, by means of which the limit of the downward movement of the armature may be determined. The screw Q′ is longitudinally perforated, and located in such perforations is a rod S, having the upper head S′ and lower head S^2 situated outside of the tube P. The object of this rod is to give an upward impulse to the armature Q when it is desired to release the switch-levers by hand.

Pivoted to the base-plate A and over the lifting-pin R is a horizontally-disposed rod T, of insulating material. Located over the ends of this rod, on each side of the instrument and between the side plates of the switch-levers, are the pivoted hooks U, pivoted at U′ to the blocks B. The outer end U^2 of these hooks when the switch-levers are closed take over the horizontal pins V in the upper end of the switch-levers. Located behind the hooks U are the springs U^3, which exert a forward-and-downward movement upon the hooks.

The operation of my improved automatic switch will be readily understood. When a current of electricity in excess of a predetermined amount is sent through the instrument, the armature Q is caused to move rapidly upward in the solenoid M. This upward movement is transmitted through the lifting-pin R to the rod T, lifting this rod vertically, which in turn raises the hooks U, thereby releasing the switch-levers E, which are projected forward by the action of the spring J′ and the middle and outer portions of the springs L. As the switch-lever E is moved forward the middle portion L^2 of the springs L first leaves the contact-plates B B′, the outer portion L^3 follows, and finally the inner portion L′. This breaks the metallic circuit and leaves the circuit established through the switch-levers E and the carbon contacts H and G. Subsequently by the further outward movement of the switch-levers the circuit is broken through the carbon contacts H and G. The levers E finally fall into and between the springs D′ on the end of the bracket D, and at the same time the spring-plates I′ have left the segmental shoulders E′ on the levers E. Manifestly the lifting-pin may be omitted and the armature arranged to impinge directly upon the rod T.

It will be observed that in making the circuit through the instrument before the pins V on the end of the switch-levers E can be brought under the hooks U the middle and outer portions of the spring L as well as the spring J′ must be put under pressure. The effect of this construction is to insure a practically-perfect metallic contact with the contact-blocks and to establish a live-spring pressure tending at all times to throw the circuit-closing spring and switch-levers outward, and thus break the circuit. Further, that when the switch-levers are thrown forward at right angles to the base-plate the electrical connection through these levers is entirely severed by the spring-plate I′ leaving the segmental shoulders on the switch-levers, (shown in Fig. 3,) therefore avoiding the possibility of the formation of an arc between the levers and the contact-blocks. It will also be observed that in the construction described for a two-pole switch it will be impossible to make a circuit through the switch when the transmitted current is above the predetermined capacity of the switch—*i. e.*, overload—for if one switch-lever be closed it will immediately fly open when an attempt is made to close the opposite lever. This is a point of great practical advantage.

In this specification I have described two preferred forms of my improved device. I

wish it understood, however, that various changes may be made therein in a manner well understood by electricians, which while the mechanical features will be somewhat altered will still embody and make use of the feature of the release of the switch-levers and the rupture of the circuit by the positive upward movement of the armature energized by the overload passing through the solenoid and of the feature of metallic circuit-closing springs not connected to the switch-lever exerting a constant active pressure upon the switch-levers to open the circuit, which features I consider to be broadly new with me.

Having thus described my invention, I claim—

1. In an automatic circuit-breaker, the combination of contact-blocks, a reciprocating bridge device, an independent pivoted lever, a resiliently-supported carbon contact, and a carbon contact carried on the end of the independent lever.

2. In an automatic circuit-breaker, the combination of pairs of contact-blocks, a pair of reciprocating bridge devices, a pair of independent levers, a latch for each lever, a tripping device coacting with both latches, and an electromagnetic device arranged to coact with said tripping device to release the levers.

3. In an automatic circuit-breaker, the combination of contact-blocks, a reciprocating bridge device consisting of two sets of spring contact-plates so arranged that one set will be brought into and out of contact with the contact-blocks before the other set, and an independent pivoted lever arranged to impart a forward movement to both sets of contact-plates.

4. In an automatic circuit-breaker, the combination of contact-blocks, a reciprocating bridge device, an independent lever, a latch for said lever, a pivoted insulated bar arranged under the latch, and means for lifting the insulated bar and latch to release the lever.

5. In an automatic circuit-breaker, the combination of contact-blocks, a reciprocating bridge device, a resiliently-supported carbon contact, a pivoted lever independent of the bridge device, and a carbon contact carried on the end of the independent lever; said parts so arranged as regards each other that in closing the circuit-breaker an electrical circuit will be established between the carbon contacts before the bridge device coacts with the contact-blocks.

6. In an automatic circuit-breaker, the combination of a pair of contact-blocks, a spring device adapted to reciprocate toward and from said blocks, a pivoted lever, a latch for locking said lever, a solenoid, an armature located in said solenoid, a lifting-pin, and a horizontally-pivoted rod located between said latch and said lifting-pin.

7. In an automatic circuit-breaker, the combination of a pivoted lever having a segmental bearing-shoulder on its lower end, of a spring-plate bearing on said shoulder and connected to one of the conductors, a carbon contact mounted on the end of the lever, a carbon contact connected to the opposite conductor, a latch for holding said lever in a closed position, and means for releasing the latch.

8. In an automatic circuit-breaker, a pair of contact-blocks arranged vertically and in line, a horizontally-reciprocating resilient bridge device, an auxiliary resilient device coacting with said bridge device, a pivoted lever independent of said bridge device, and means for locking said lever and holding said resilient bridge device and auxiliary device under tension.

9. In an automatic circuit-breaker, a pair of contact-blocks, a reciprocating bridge device, an independent pivoted lever, a lock for said lever, an electromagnet, a pivoted insulated bar located under the lock, and means energized by the magnet for imparting an upward movement to said bar.

10. In an automatic circuit-breaker, the combination with an independent pivoted lever, a magnet, a lock for said lever, a pivoted insulated bar under said lock, and means energized by the magnet for imparting an upward movement to said bar.

In testimony whereof I affix my signature in the presence of two witnesses.

HENRY PRICE BALL.

Witnesses:
J. E. PEARSON,
W. H. PUMPHREY.