

No. 662,784.

Patented Nov. 27, 1900.

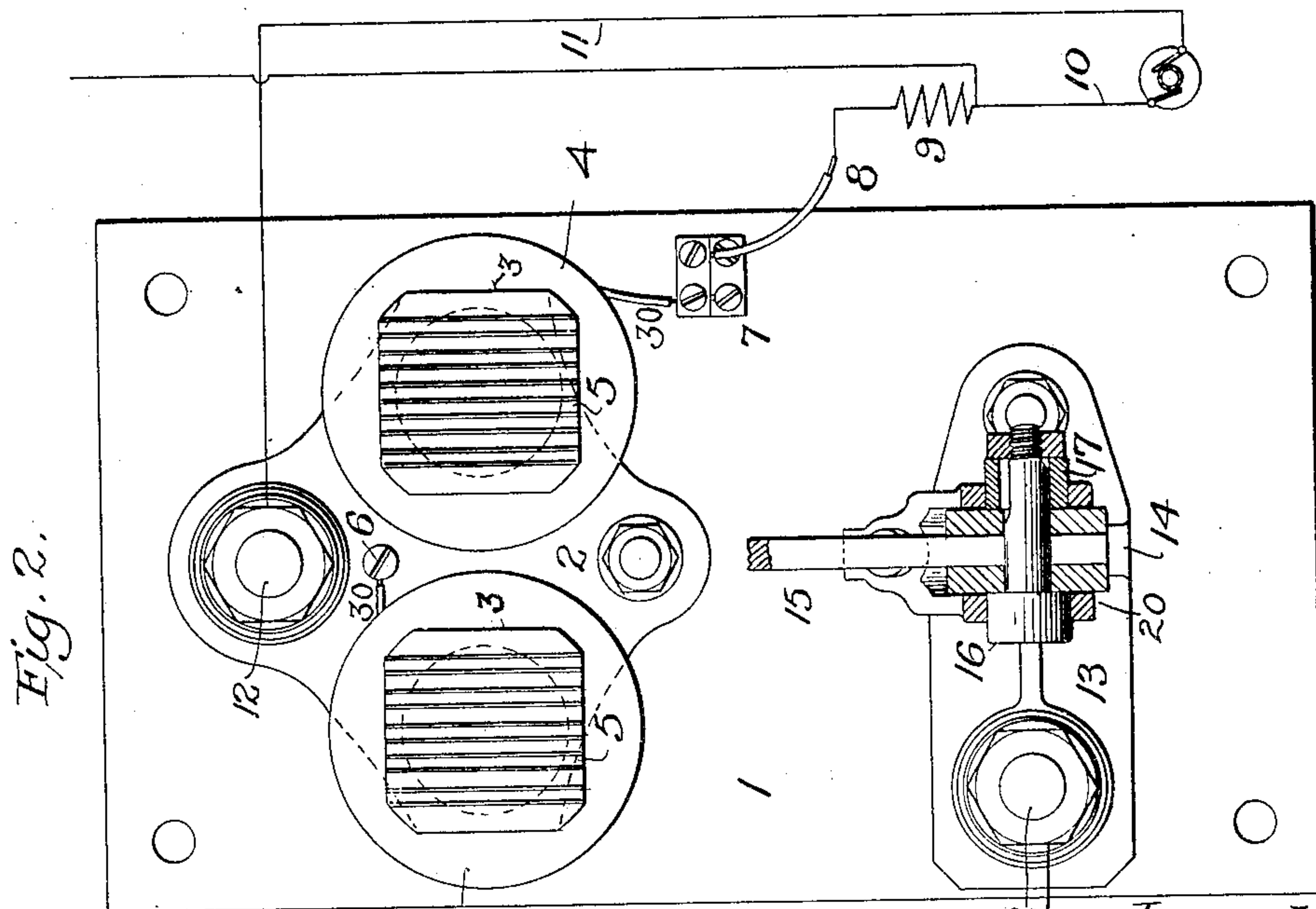
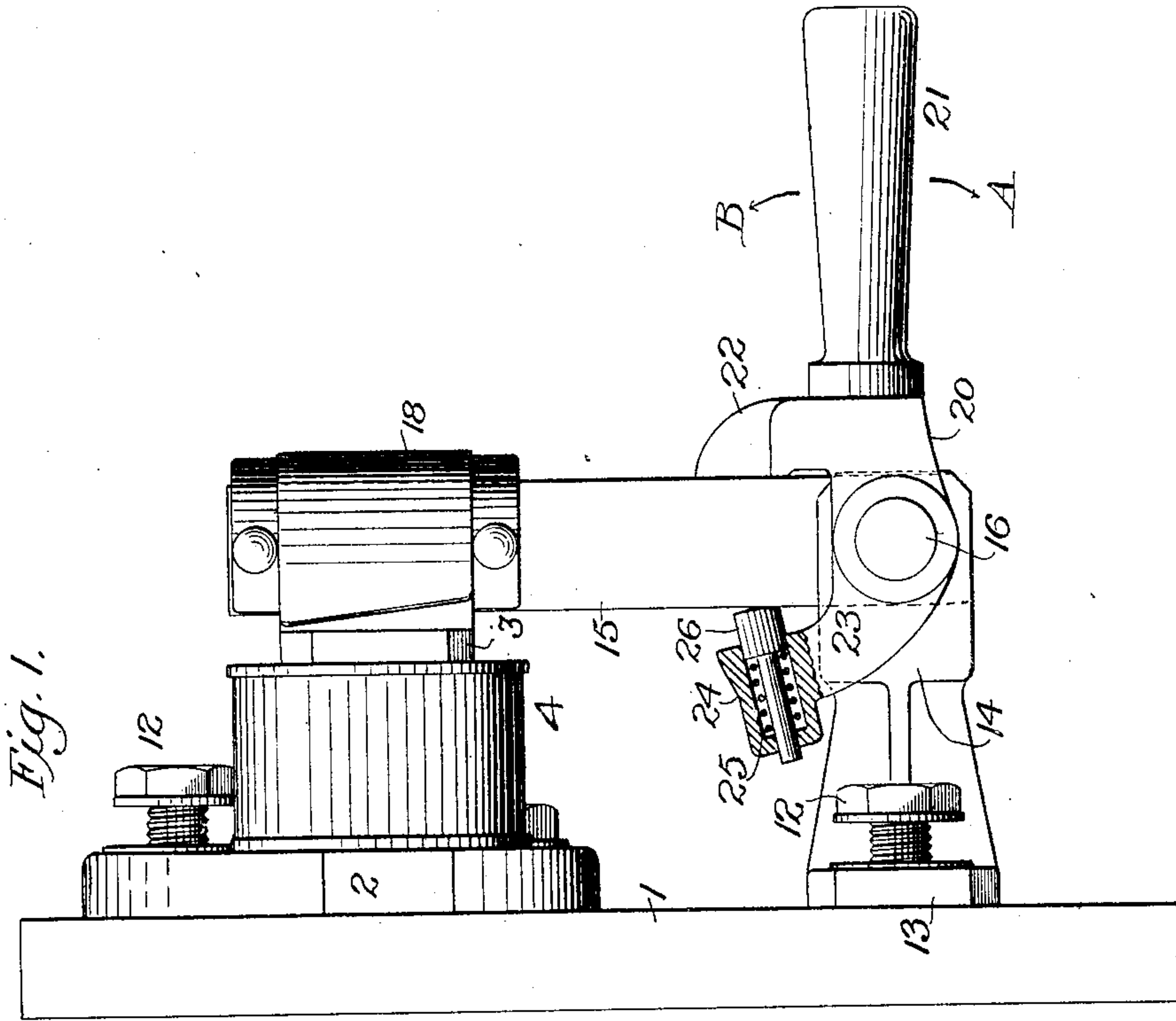
W. GRUNOW, JR.

APPARATUS FOR INTERRUPTING RELATIVELY HIGH POTENTIAL CIRCUITS.

(Application filed Nov. 20, 1899.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:

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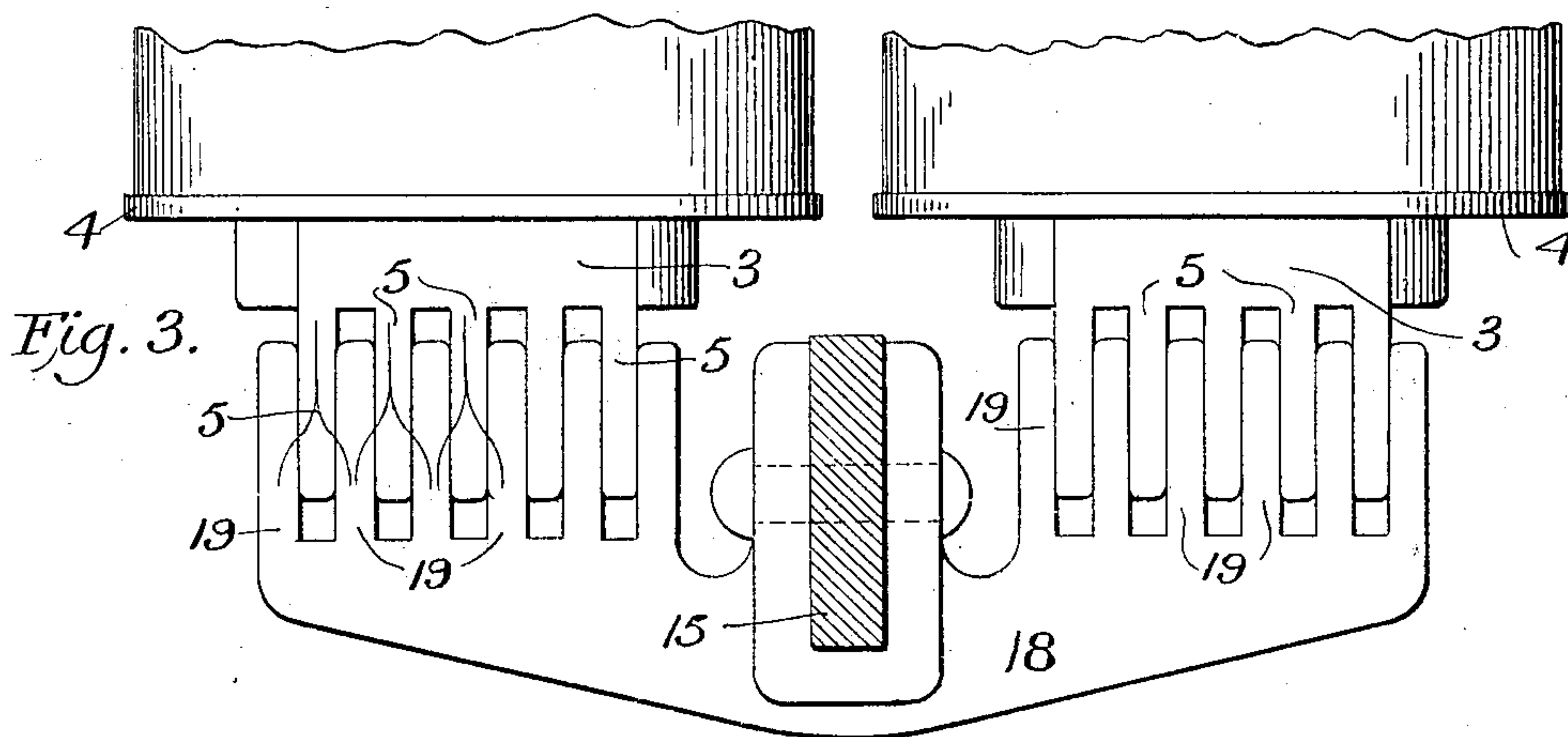
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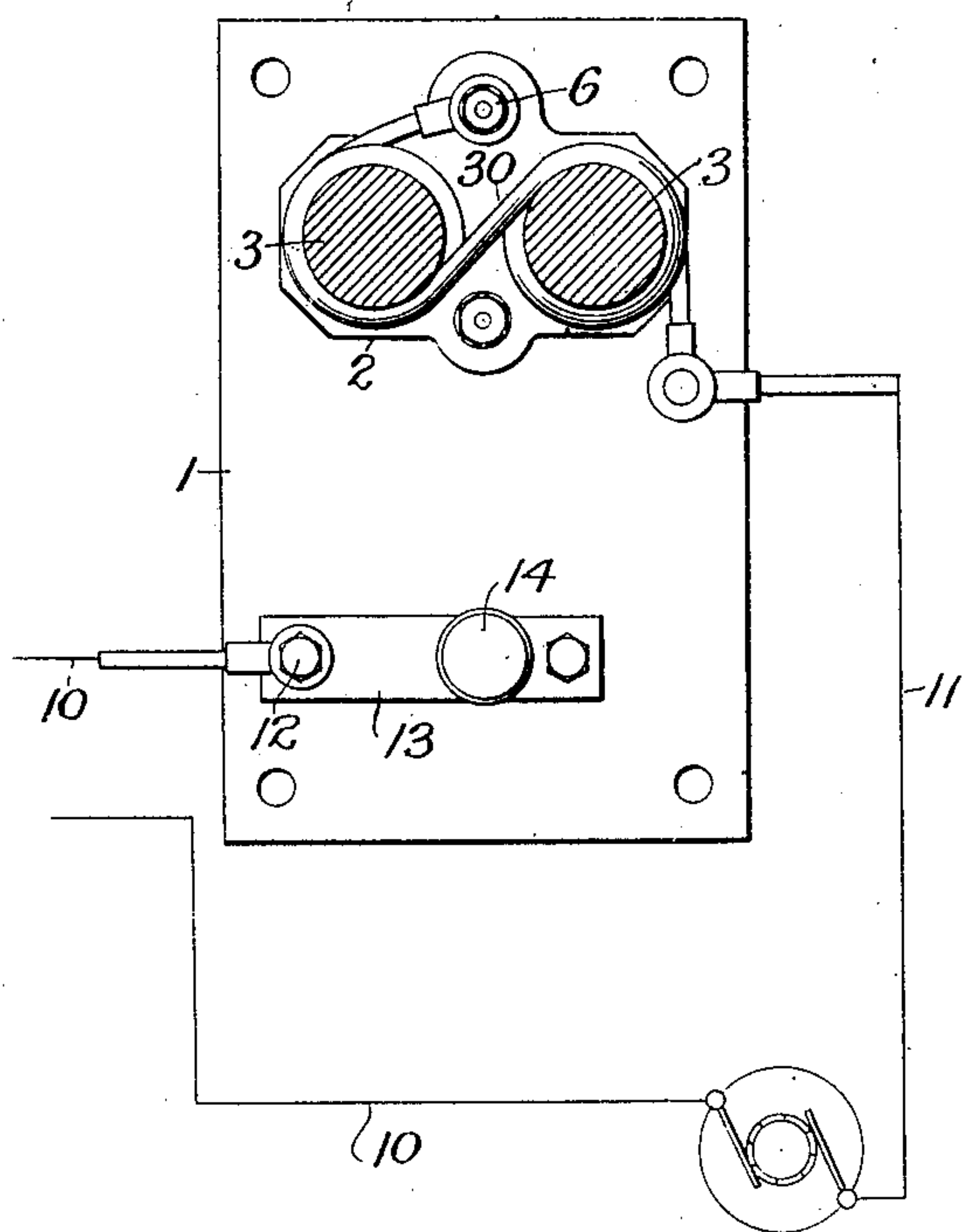
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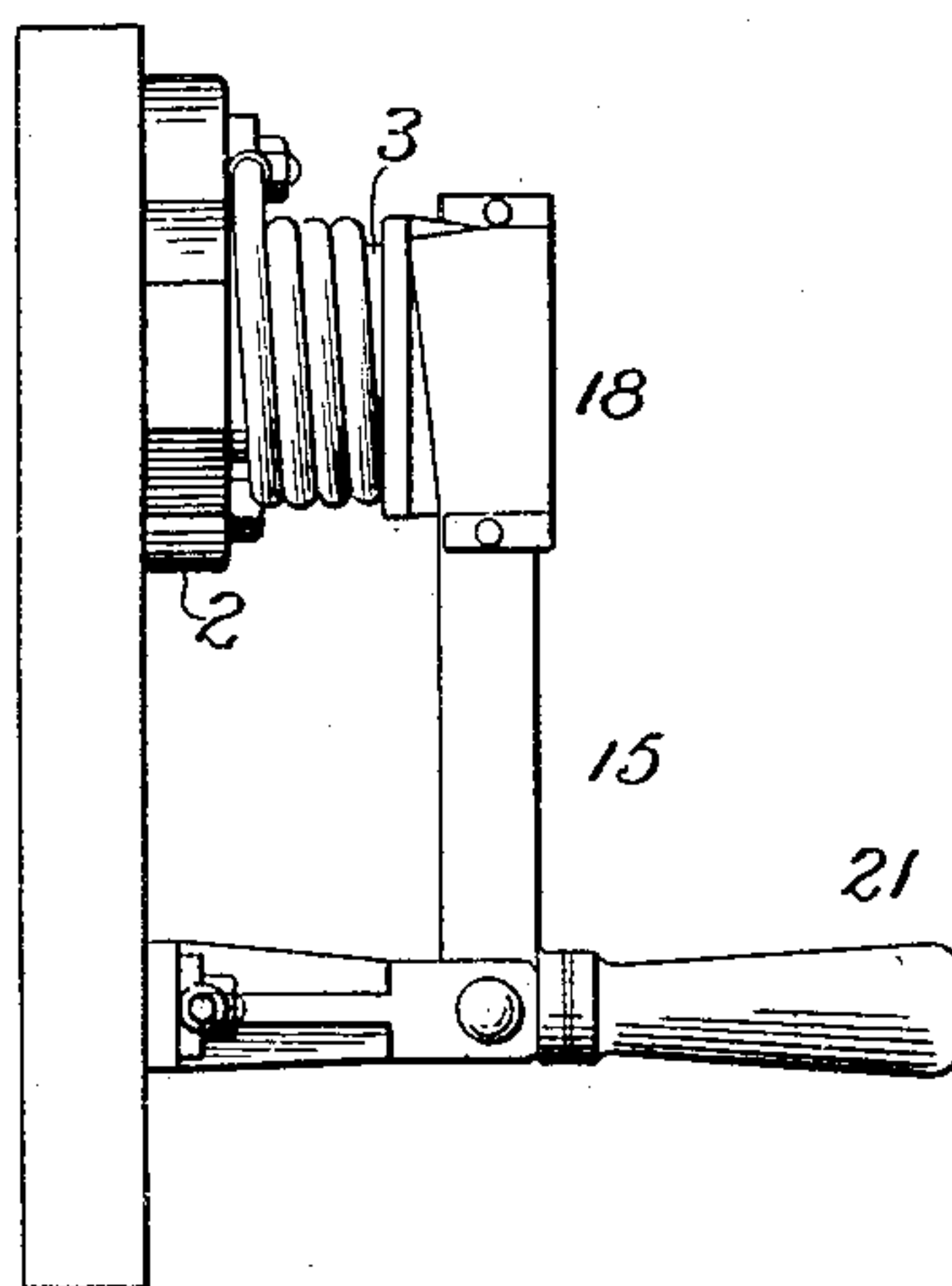
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*Fig. 4.*



*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

WILLIAM GRUNOW, JR., OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO THE  
McELROY-GRUNOW ELECTRIC RAILWAY SYSTEM, OF SAME PLACE.

APPARATUS FOR INTERRUPTING RELATIVELY HIGH POTENTIAL CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 662,784, dated November 27, 1900.

Application filed November 20, 1899. Serial No. 737,587. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM GRUNOW, Jr., a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have made a new and useful Invention in Apparatus for Interrupting Relatively High Potential Electrical Circuits, of which the following is a specification.

My invention is directed particularly to improvements in apparatus for interrupting relatively high potential electrical circuits; and it has for its object to effect this result without dangerous or damaging arcing and will be fully understood by referring to the accompanying drawings, in which—

Figure 1 is a side elevational view of a hand-switch embodying my invention, a part of the switch-operating mechanism being shown in section. Fig. 2 is a part plan and part transverse sectional view of the apparatus shown in Fig. 1, said figure illustrating also diagrammatically its connection in shunt relation with a source of electrical energy. Fig. 3 is an enlarged end elevational view of the contacting terminals of the switching apparatus. Fig. 4 is a part plan and part sectional view of the apparatus with the upper portion of the switching mechanism removed, its connection being also illustrated diagrammatically in series relation with a source of electrical energy; and Fig. 5 is a side elevational view of the entire apparatus illustrated in plan view in Fig. 4.

Prior to my invention it has been customary to interrupt electrical circuits of relatively high potential without establishing an arc which shall be either dangerous to the operator or damaging to the apparatus by setting up or effecting a magnetic field in close proximity to the switching terminals where the interruption is effected in such manner as to cause the lines of force thereof to flow substantially at right angles to the direction of current-flow, thus "blowing out" the arc, so to speak, by the magnetic action of the field. It is also old in the art to extinguish an abnormal arc established in an electrical circuit including an electrical generator and translating devices through the agency of superimposed currents of enormously high potential, such as lightning, by setting up a

magnetic field at a point where the arc is thus established, in which field the magnetic lines of force flow in lines substantially parallel with the flow of the arc-establishing current, as disclosed in United States Patent to Elihu Thomson, No. 470,721, dated March 15, 1892. In another pending application, filed by me in the United States Patent Office on the 13th day of June, 1900, and bearing Serial No. 20,114, I have described and claimed, broadly, means for effecting the before-mentioned result when the circuit, which includes a high-potential generator itself, is interrupted by establishing a magnetic field at one terminal of the circuit in such manner that the magnetic lines of force flow in substantially the same direction as does the current which it is sought to interrupt.

The present invention is limited to the structural apparatus hereinafter described and will be understood by referring to the drawings in detail, in all of which like characters of reference represent like parts wherever used.

1 represents the usual insulating-base of a hand-switch, and 13 a standard made of metal, which standard is secured to the base and constitutes the pivotal support of a movable terminal 18, adapted to contact electrically with a fixed terminal in the nature of a bipolar magnet 4, provided with cores 3 3, secured to a yoke 2, which in turn is attached directly to the base 1. The upper ends of the cores 3 3 are slotted, as shown in Figs. 2 and 3, so as to constitute contacting fingers 5 5, adapted to pass between corresponding fingers 19 19 at the lower end of the movable terminal 18, which terminal is secured, as shown in Figs. 1 and 3, directly to the outer end of an arm 15, pivotally supported by a bolt 16, passing through upwardly-extending arms 14 from the standard 13. 20 is a yoke pivoted upon the same bolt 16 and washer 17 and carrying at its upper end an insulating operating-handle 21, 22 and 23 being oppositely-disposed arms located, respectively, above and below the arm 15. 24 is a socket at the lower end of the arm 23, in which is secured a sliding pin 26, resting upon a spiral spring 25, located within the socket, the arrangement being such that when the operat-



ing-handle 21 is moved in the direction of the arrow B the terminal 18 is placed in closed position, and when moved in the direction of the arrow A the switch is actuated after the manner of well-known forms of snap-acting switches. No novelty is claimed for these especial details with relation to the yoke 20, arms 22 and 23, pin 26, and spring 25, as the same come within the terms of well-known forms of snap-acting electrical switches and are simply described here for the purpose of illustrating a complete switch embodying my invention.

12 and 12 are binding-posts, the former connected to the standard 13 and the latter to the yoke 2.

10 and 11 (see Fig. 2) represent diagrammatically the circuits running from a source of electrical energy to translating devices (not shown) with which my novel switching apparatus is designed to be used for the purpose of interrupting the circuit without dangerous or damaging arcing.

9 represents a resistance, and 8 a shunt-circuit running to a binding-post 7 on the base of the switch, which in turn is connected by a conductor 30, constituting the coils of the magnet 4, the opposite end of which coils is connected at 6 directly to the yoke 2, so that the fingers 5 of the bipolar magnet constitute the stationary or fixed terminal of the switch, the fingers 19 constituting the movable terminal thereof.

The operation of the apparatus is as follows: The current from the generator (see Fig. 2) passes by the conductor 11 to the binding-post 12, yoke 2, cores 3 of the magnet, fingers 5 of the fixed terminal, fingers 19 of the movable terminal 18, arm 15, standard 13, binding-post 12, conductor 11 to the translating devices, returning again by the conductor 10 to the generator. A shunt or branch circuit passes at the same time by the conductor 11 to the binding-post 12, binding-post 6, coils 30 of the magnet 4, binding-post 7, conductor 8, resistance 9, conductor 10 to the generator, thereby giving to the poles and fingers 5 of the bipolar magnet a definite polarity and establishing a magnetic field at numerous points where the circuit is to be interrupted of sufficient intensity to blow out or interrupt the arc when the switch is moved in the direction of the arrow A, Fig. 1.

In the modified form shown in Fig. 4 the current from the generator passes directly through the coils 30 of the magnet, thence to the binding-post 6, base 2, cores 3 of the magnet, movable terminal 18, (see Fig. 5,) standard 13, (see Fig. 4,) binding-post 12, conductor 10 to the other terminal of the generator. When, therefore, the movable terminal of the switch is moved by forcing the handle 21 in the direction of the arrow A, the fingers 19 are caused to be drawn from between the fingers 5 and the circuit interrupted at a number of points in a manner well understood. By reason of the fact that there is a strong magnetic

field established at these points the magnetic lines of force which are flowing substantially in the same direction as is the current-flow will cause the individual arcs which tend to be established at the several points to be instantly extinguished, and this whether the magnetic field be established either by a derived or shunt circuit, as illustrated in Fig. 2, or by a series circuit, as illustrated in Fig. 4.

I make no claim in the present application to apparatus for applying the principle of extinguishing an arc between a pair of circuit-interrupting terminals in an electrical circuit by establishing a magnetic field in which the magnetic lines of force flow in substantially the same direction as does the current-flow, as this feature constitutes the subject-matter of the separate application above referred to.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. Means for interrupting relatively high potential electrical circuits without dangerous or damaging arcing, consisting of two circuit-interrupting terminals located in the circuit to be interrupted, one of said terminals being provided with an operating-handle; in combination with means for setting up or establishing an electromagnetic field about said terminals, in which field the magnetic lines of force are caused to flow in substantially the same direction as does the current-flow; said terminals being each provided with a series of fingers adapted to interrupt the circuit at a number of points, substantially as described.

2. Means for interrupting relatively high potential electrical circuits without dangerous or damaging arcing, consisting of two circuit-interrupting terminals located in the circuit to be interrupted, one of said terminals being provided with an energizing coil or coils adapted to set up or establish an electromagnetic field in which the magnetic lines of force tend to flow in substantially the same direction as does the current to be interrupted and the other with an operating-handle, said terminals being so constructed as to interrupt the circuit at a number of points, substantially as described.

3. Means for interrupting relatively high potential electrical circuits without dangerous or damaging arcing, consisting of two circuit-interrupting terminals located in the circuit to be interrupted, one of said terminals being in the nature of a bipolar electromagnet having coils in circuit with a source of electrical energy and adapted to establish a magnetic field at the poles of the bipolar magnet in which the magnetic lines of force tend to flow in substantially the same direction as does the current-flow to be interrupted, the other terminal being in the nature of a movable armature and both terminals provided with fingers adapted to interrupt the circuit at a number of points, substantially as described.

4. Means for interrupting relatively high



potential electrical circuits without dangerous or damaging arcing, consisting of two circuit-interrupting terminals located in the circuit to be interrupted, one of said terminals  
5 being a stationary electromagnet, the coils of which are connected in series relation with the source of current-supply and the core or cores thereof; the other or movable terminal being connected to the translating devices  
10 and source of current-supply, the arrangement being such that the magnetic lines of force of the stationary terminal tend to flow

in substantially the same direction as does the current-flow through the poles thereof and the movable terminal, substantially as described. 15

In testimony whereof I have hereunto affixed my signature in presence of two witnesses.

WILLIAM GRUNOW, JR.

Witnesses:

CHARLES S. ROGERS,  
M. L. SHAY.