

F. M. SLOUGH.

RELAY.

APPLICATION FILED DEC. 7, 1916.

1,413,691.

Patented Apr. 25, 1922.

2 SHEETS—SHEET 1.

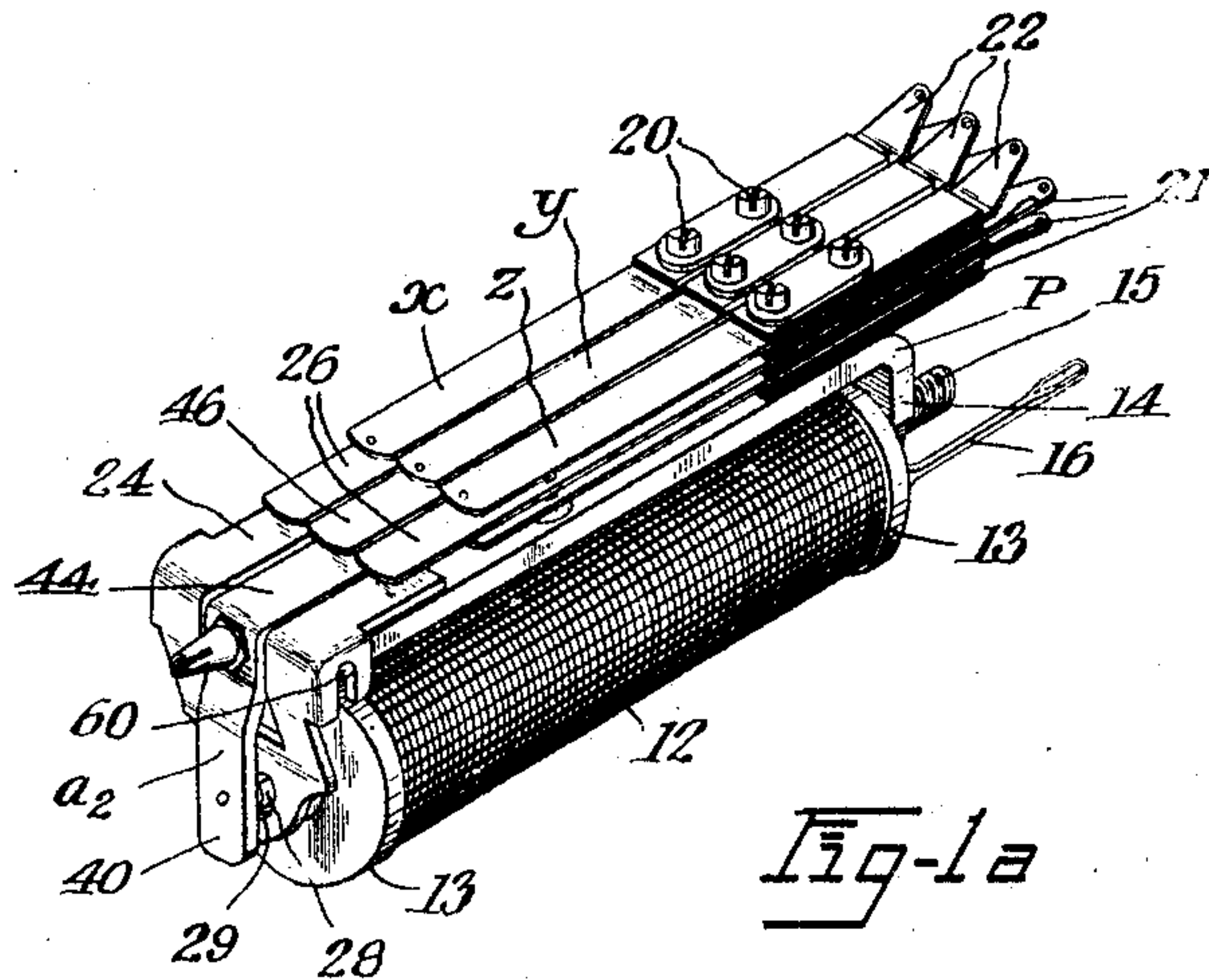


Fig. 1a

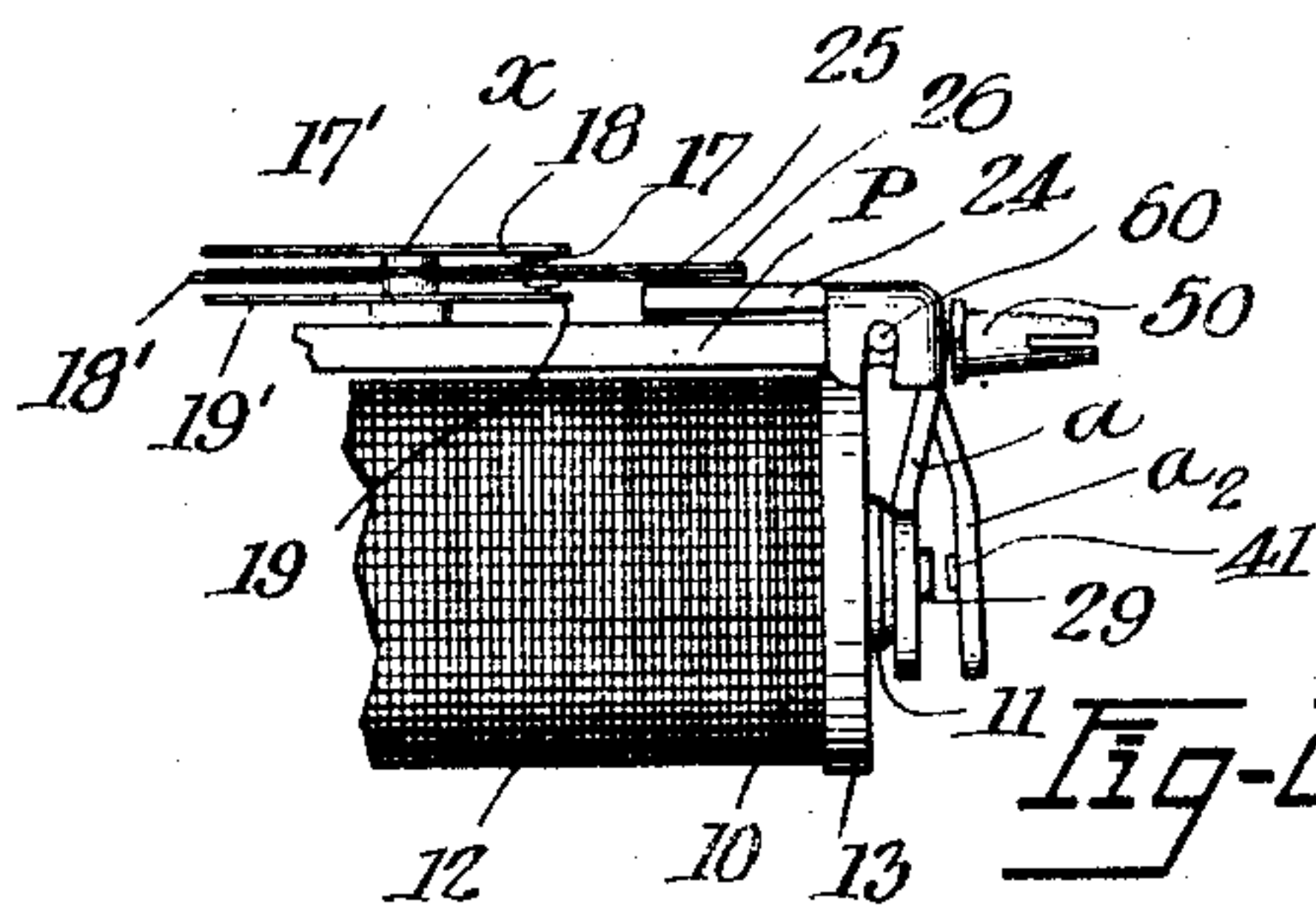
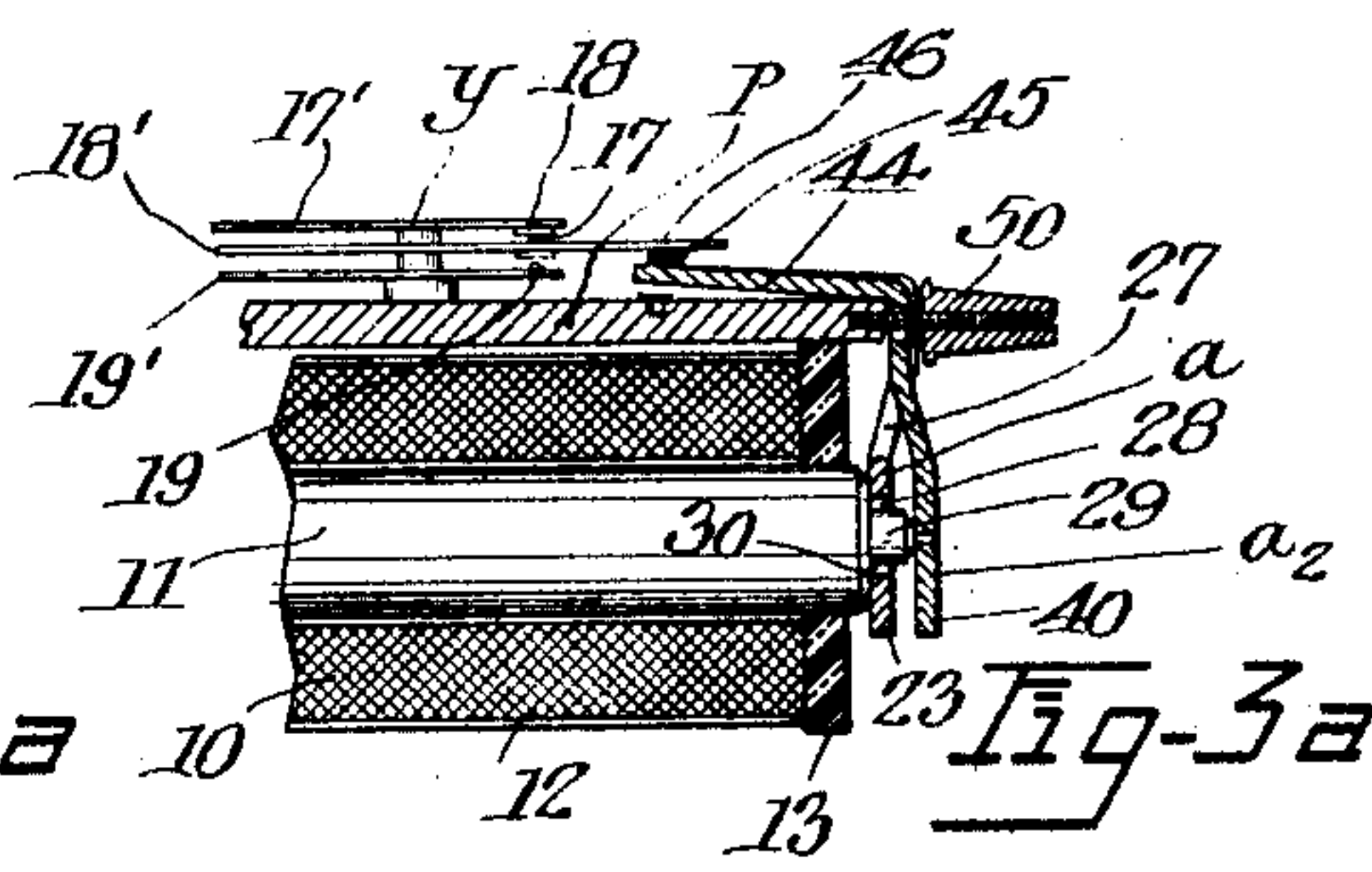


Fig. 2a



F. M. SLOUGH.
RELAY.

APPLICATION FILED DEC. 7, 1916.

1,413,691.

Patented Apr. 25, 1922.

2 SHEETS—SHEET 2.

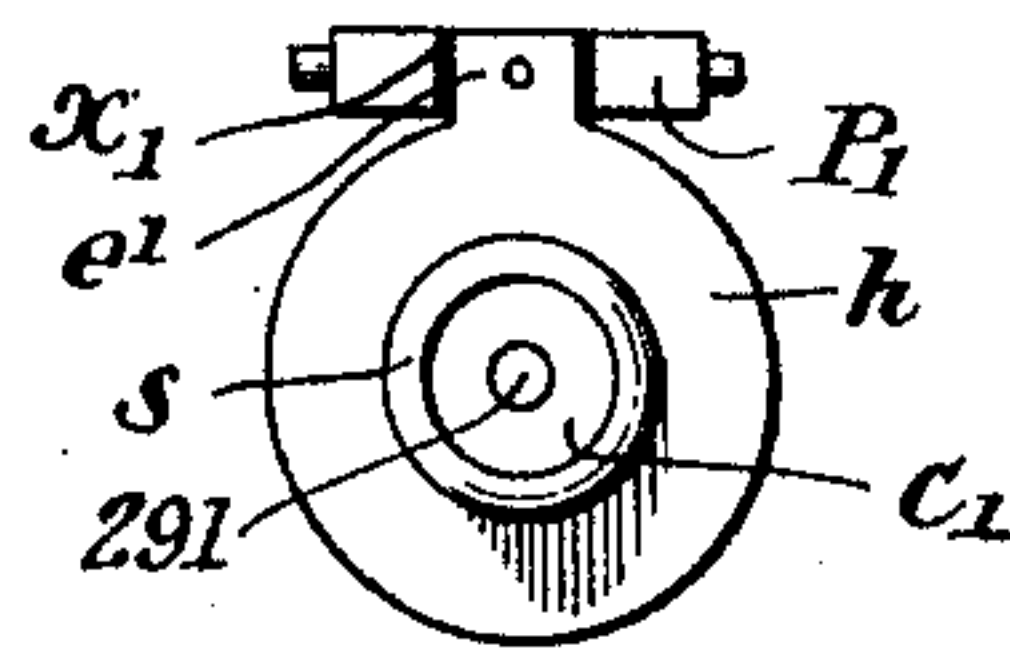


Fig-1b

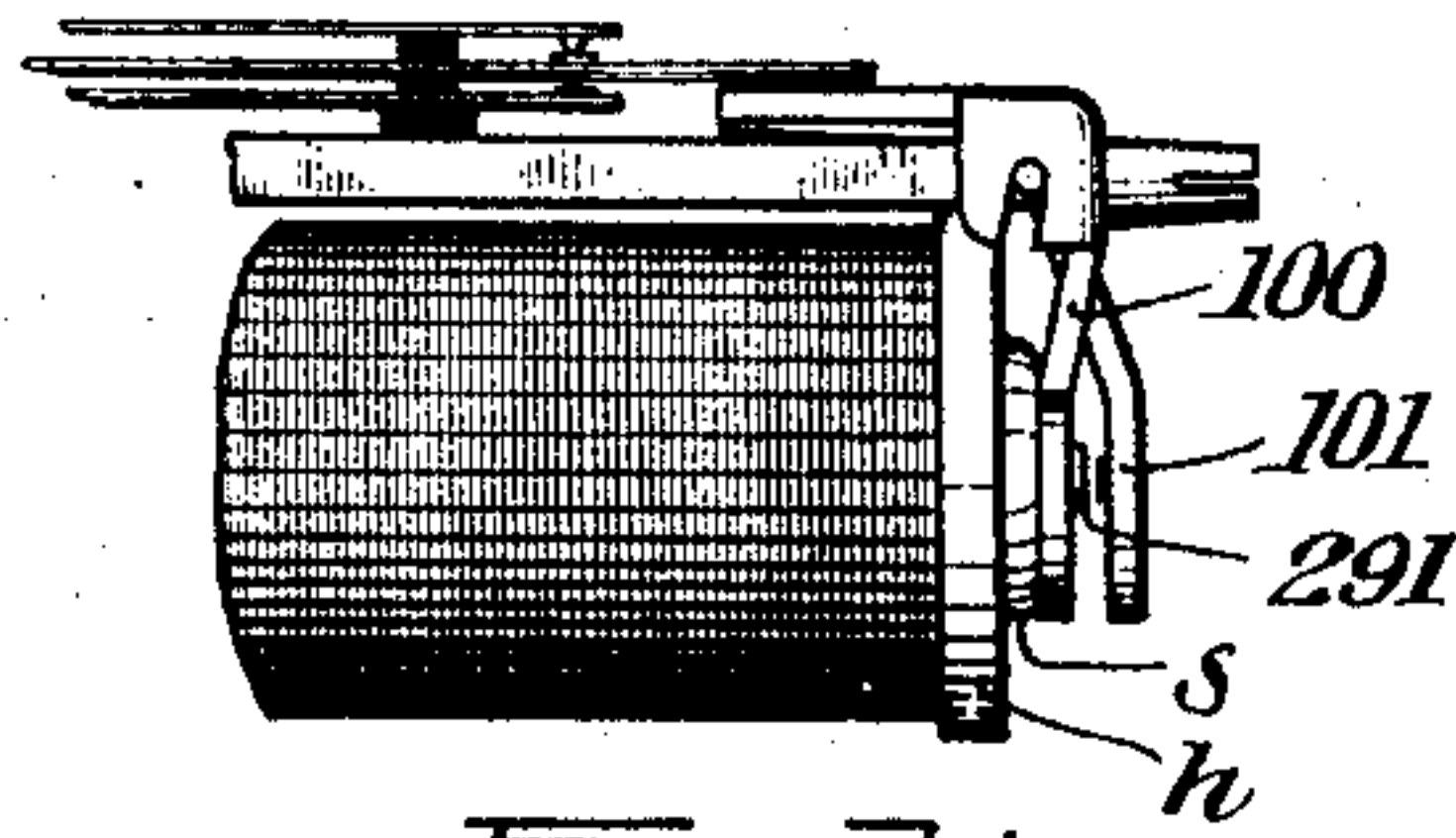


Fig-2b

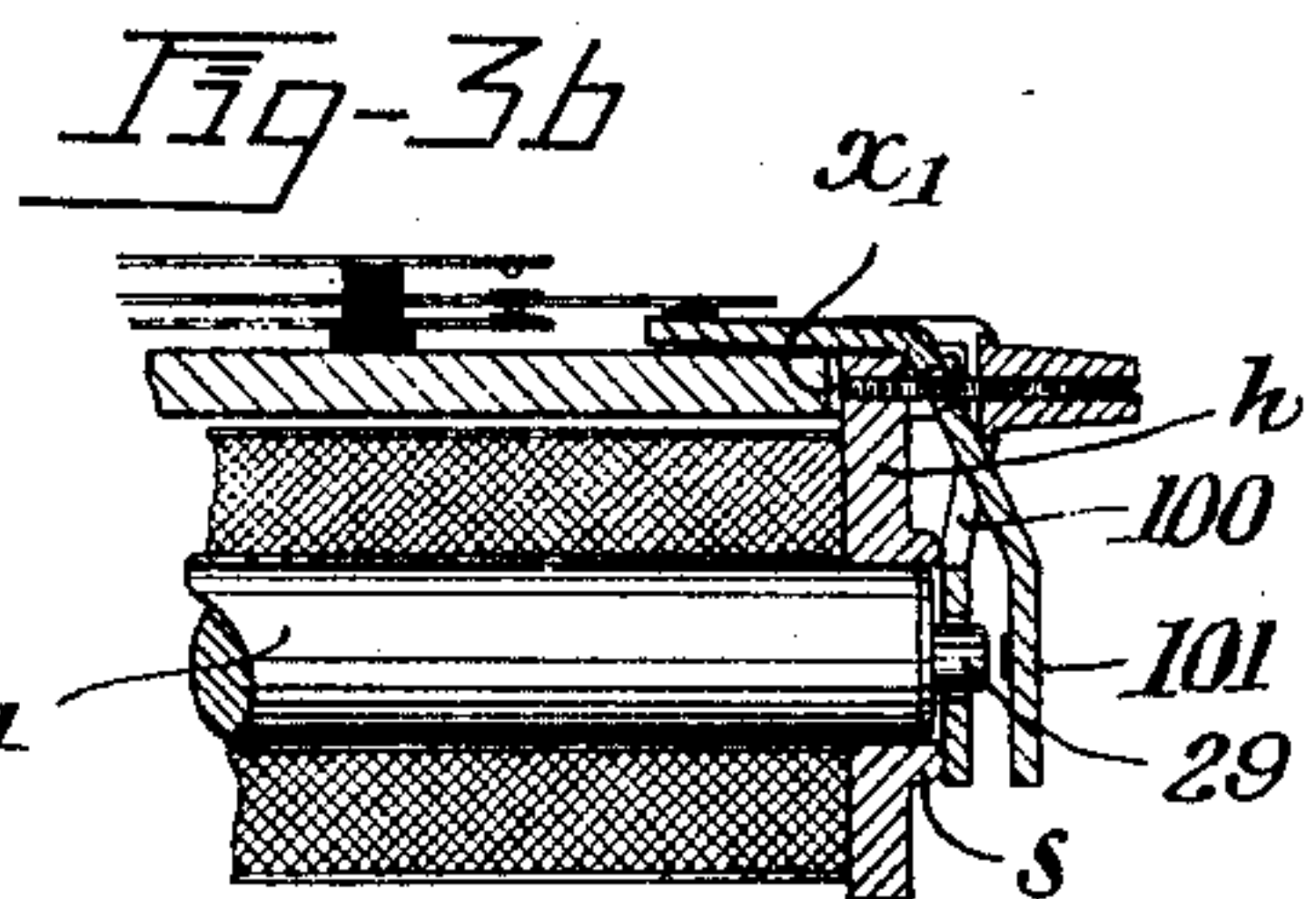
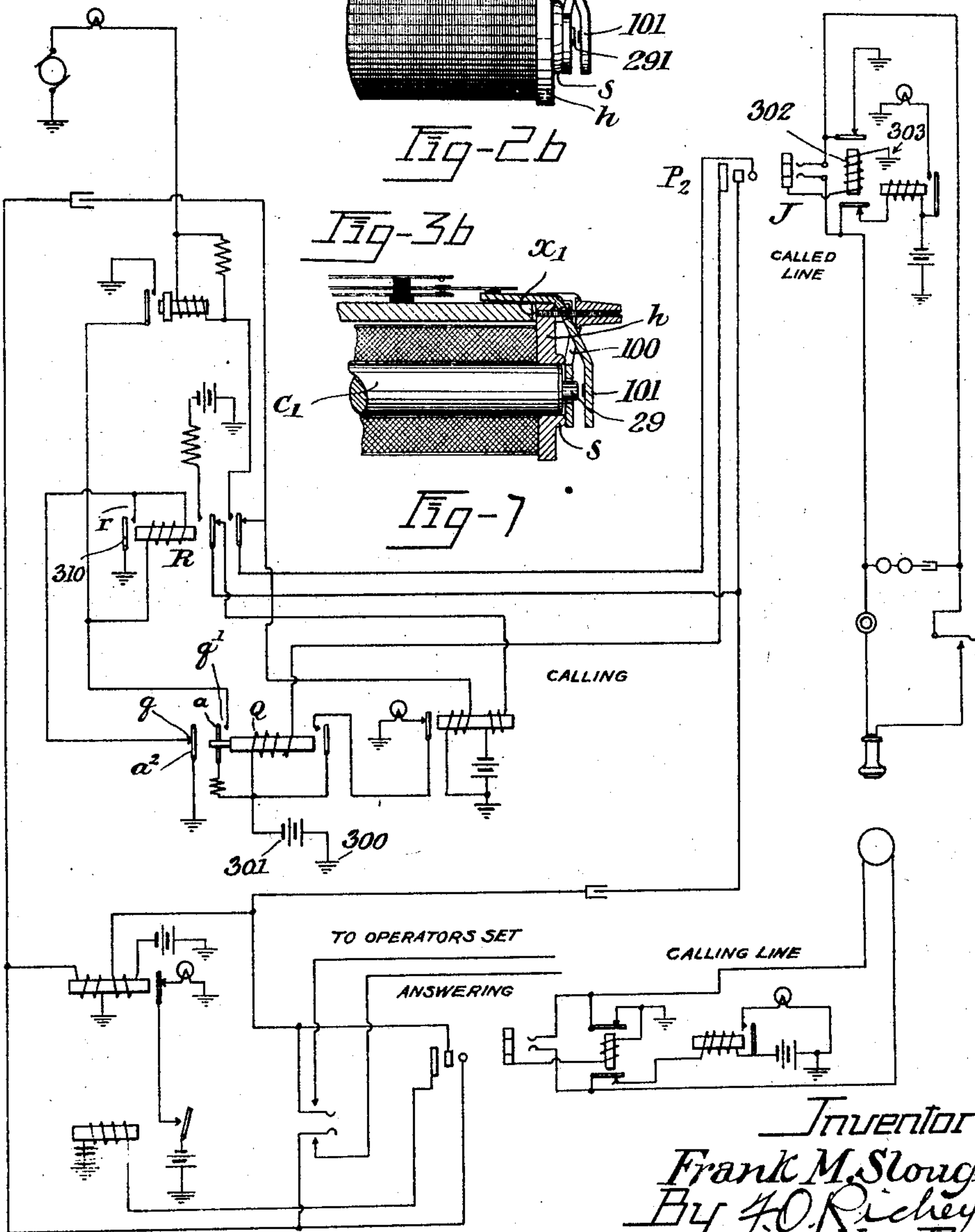


Fig-3



Inventor
Frank M. Slough
By H. O. Richey
His Attorney

UNITED STATES PATENT OFFICE.

FRANK M. SLOUGH, OF ROCHESTER, NEW YORK, ASSIGNOR TO STROMBERG-CARLSON
TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPO-
RATION OF NEW YORK.

RELAY.

1,413,691.

Specification of Letters Patent. Patented Apr. 25, 1922.

Application filed December 7, 1916. Serial No. 135,636.

To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Relays, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates generally to improvements in electro-magnetic relays. I aim more particularly to produce a relay of this class especially suited for telephone switchboards and the like, where the space for the employment of relays is limited, and where small currents only are available for operating them.

In telephone circuits of the latest type more relays are employed than in the older circuits, and as the switch-board cabinets were designed for the relays of the older circuits, there is no space for the convenient mounting and housing of additional relays.

By my invention I produce a relay which successfully performs the functions of a plurality of relays, occupying the space of a single relay and responding to the current of the strength available in telephone systems.

These and other objects of my invention, as well as the invention itself, will be understood from a description of an embodiment of the invention.

Fig. 1^a is a perspective view of a relay embodying my invention.

Fig. 2^a is a side elevation of the front end of the embodiment shown in Fig. 1^a, showing one of the armatures in its operative position and the other armature unoperated.

Fig. 3^a is a vertical section (partly broken away) of the embodiment shown in Fig. 1^a with both armatures operated.

Fig. 4^a is a front end view of the embodiment shown in Fig. 1^a with both armatures unoperated.

Fig. 5^a is a similar view showing one armature only operated.

Fig. 6^a is an end view showing both armatures operated.

Fig. 1^b is a front end view of a second embodiment of my invention with the armatures removed.

Fig. 2^b is a side elevation (partly broken away) of the relay shown in Fig. 1^b with the armatures mounted in position.

Fig. 3^b is a longitudinal section (partly broken away) of the embodiment shown in Figs. 1^b and 2^b.

Fig. 7 is a diagram of a circuit illustrating a use of the relay of my invention.

Referring now to the drawings and to the embodiments of my invention shown therein, and first to the embodiment shown on the first sheet, the electromagnet of the relay is shown at 10, comprising a core 11 and a magnet winding 12. The magnet is provided with heads 13 at the ends of the winding. The return pole piece is shown at P and in the embodiment illustrated, is mounted on top of the winding. The pole piece P preferably consists of a flat piece of iron turned down to form an arm 14 on the back end where the relay may be attached by some suitable means, such as a screw 15 to the supporting frame. Suitable terminals are provided for the winding, one of which is shown at 16.

Relay contacts are shown at 17, 18 and 19. These contacts are mounted upon contact springs 17', 18' and 19'. Any suitable number of sets of springs may be employed and any suitable combination of contacts and springs employed in a set. I have illustrated three sets, *x*, *y* and *z*, each set consisting of a pair of springs in which the contacts are normally made and a pair which are normally open. The normally made contacts are adapted to be opened and the normally open contacts closed when the controlling armature is operated.

In the embodiment illustrated, the springs are connected to the relay by screws, shown at 20. The springs are separated from each other by insulating material, such as shown at 21. I prefer to connect the back ends of the springs and the back end of the pole piece together, the terminal ends of the springs projecting to the rear of the relay.

The relay is provided with a plurality of armatures, each controlling one or more of the switches consisting of the relay contacts. In the embodiment shown, each armature is made angular in shape and comprises two limbs, one extending across the face of the relay and the other along the pole piece P. The armature *a* is provided with a limb 23 extending down the front of the relay and a limb 24 extending along the pole piece and adapted to operate the switches controlled by this armature. In the embodiment shown, insulating studs 25 are provided for

the limb 24 which engage one end 26 of one or more of the contact springs. The limb 23 of the armature a is provided with an opening 27, for a purpose to be described and with a second opening 28 through which projects the end 29 of the core 11. In the embodiment shown this end consists of a cylindrical lug projecting from the flat face 30 of the pole piece. The opening 28 is made larger than the lug 29 to provide free movement of the armature a as it swings back and forth in operation.

A second armature is shown at a_2 , provided with a limb 40 extending down in front of the relay magnet. In the embodiment shown this armature is in front of the end of the lug 29 and provided with a stop 41 adapted to engage the lug 29 when the armature is attracted, as shown in Fig. 3^a. The armature a_2 fits in the opening 27 and is connected to the relay frame, preferably to the pole piece, by any suitable means, such as a screw 50. The armature a_2 is provided with a second arm 44 which extends along the top of the pole piece and provided with a lug 45 engaging the end 46 of one of the contact springs. The armature a is connected to the relay frame by any suitable means, such as by trunnions 60.

It will be seen that when the parts are in normal position the armature a will partake of the polarity of the pole piece P and will monopolize the lines of force passing from the pole piece to the magnet core, thus shielding the armature a_2 . When current is connected to the magnet winding, this condition will continue until the armature a has been fully attracted and drawn to the position shown in Fig. 2^a. When in this position, the armature a will partake of the magnetic polarity of the magnet core and will no longer shield the armature a_2 , which still partakes of the magnetic polarity of the return pole piece P , and will be attracted and drawn to the position shown in Fig. 3^a. It will thus be seen that by my arrangement I provide a relay in which I insure the operation of two or more switches at predetermined intervals of time, and that the construction is such that it will be impossible to operate the armatures otherwise, unless an unreasonable strength of current is placed upon the magnet, which, of course, is not contemplated in the operation of a telephone system.

The employment of the lug 29 improves the operation of the relay in that it is possible to so proportion the parts that the small flux which would pass through the armature a_2 and this lug would be insufficient to cause any action of the armature a_2 , but when the parts are in the position shown in Fig. 2^a the lug will render more active the action upon the armature a_2 .

In the embodiment shown in Fig. 1^b to

Fig. 3^b the head is shown at h provided with a flange tip s , around the end of the core C_1 . The pole piece P_1 is cut away, as shown at a_1 for the reception of an extension e_1 of the head h . The armatures are shown at 100 and 101, the armature 101 being pivoted directly to the extension e_1 . The lug is shown at 291.

In Fig. 7 I have shown a diagram illustrating a use of my invention. The relay of my invention is shown at Q and the ringing relay at R in a cord circuit employed in a telephone system. It is desired to make the circuit of the relay R and after the expiration of an interval of time, to break the circuit in this particular use. During the interval a locking circuit is made for the relay R . For example, when the calling plug P_2 is inserted into the jack J a circuit was made for the relay Q from ground at 300—through the battery 301—relay Q —through the relay 302—to ground at 303. Relay Q attracts its armature a , closing the switch q' and completing a circuit for the relay R , which includes ground 300—battery 301— R —and the switches q and q' .

As soon as the relay R is energized, it attracts its armature 310 and closes the switch r , thereby locking itself up. A little later the relay Q attracts its armature a_2 and opens the switch q . It will thus be seen that the relay Q actuates one armature and a little later, the other armature, and that between such operations there will be time enough for the relay R to close its locking circuit.

I have illustrated and described this particular use and these particular embodiments of my invention for the purpose of explaining the invention, not that I wish to be limited either to this use or to those embodiments or the details thereof, it being apparent to those skilled in the art that numerous and extensive departures may be made from the embodiments and their details without departing from the spirit of the invention, and that the devices of my invention are capable of numerous other uses than those illustrated and explained.

I claim:—

1. In a telephone switch, the combination of a magnet provided with a core and a pole piece, a plurality of switches on said pole piece, an armature for controlling one of said switches provided with a central slot, said armature having an inwardly turned arm, a second armature having an outwardly turned arm mounted in said slot and controlling another of said switches, the first mentioned armature being positioned between the second armature and the end of the magnet core.

2. In a relay, the combination of a magnet provided with a core and a return pole piece, switch contacts for said relay, an ar-

mature for controlling said contacts provided with a limb having a portion in front of the end of the core, a second armature controlling said contacts provided with a slot in which the first armature is mounted and with a limb normally positioned between the end of the core and the first named armature.

3. In a relay, the combination of a magnet provided with a core and a pole piece, a switch contact controlling armature having an outwardly extending limb, a portion of which is in front of the end of the magnet core and a second switch contact controlling armature provided with a slot in which the first armature is mounted and an inwardly extending limb having a portion normally positioned between the first armature and the end of the magnet core.

4. In a relay, the combination of a magnet having a core provided with an extension on one end thereof, switch contacts for the relay, a pair of switch contacts controlling armatures, one of which is provided with an outwardly extending limb adapted to be attracted to the magnet core, the other armature provided with a slot in which the first armature is mounted and with a limb adapted to be attracted to the magnet normally positioned between the first armature and the end of the magnet core and provided with an opening for said core extension.

5. In a relay, the combination of a magnet including a magnet head and a return pole piece, switch contacts, a pair of superposed switch contact controlling angle armatures, said armatures having limbs ex-

tending in planes at substantially right angles to each other, one supported from said head and the other from the pole piece, one of said armatures normally shielding the other from the magnetic flux of the magnet.

6. In a relay, the combination of a magnet provided with a magnet head and a pole piece, switch contacts, a pair of switch contact controlling armatures, one of which is supported from the magnet head and the other from the pole piece, one of said armatures being provided with a recess in which the other is mounted and one of said armatures normally shielding the other from the magnetic flux.

7. In a relay, the combination of a magnet having a core provided with an extension on one end thereof, said magnet being provided with a magnet head and a return pole piece, switch contacts for the relay, a pair of switch contact controlling armatures, one of which is mounted on the magnet head and the other on the pole piece, one of said armatures being provided with an outwardly extending limb adapted to be attracted to the magnet core and the other armature provided with a slot in which the first armature is mounted and with the limb adapted to be attracted to the magnet and normally positioned between the first armature and the end of the magnet core and provided with an opening for said core extension.

In witness whereof, I have hereunto signed my name this 4th day of December, 1916.

FRANK M. SLOUGH.