

G. RITTER.
TELEPHONIC INSTALLATION.

No. 597,782.

Patented Jan. 25, 1898.

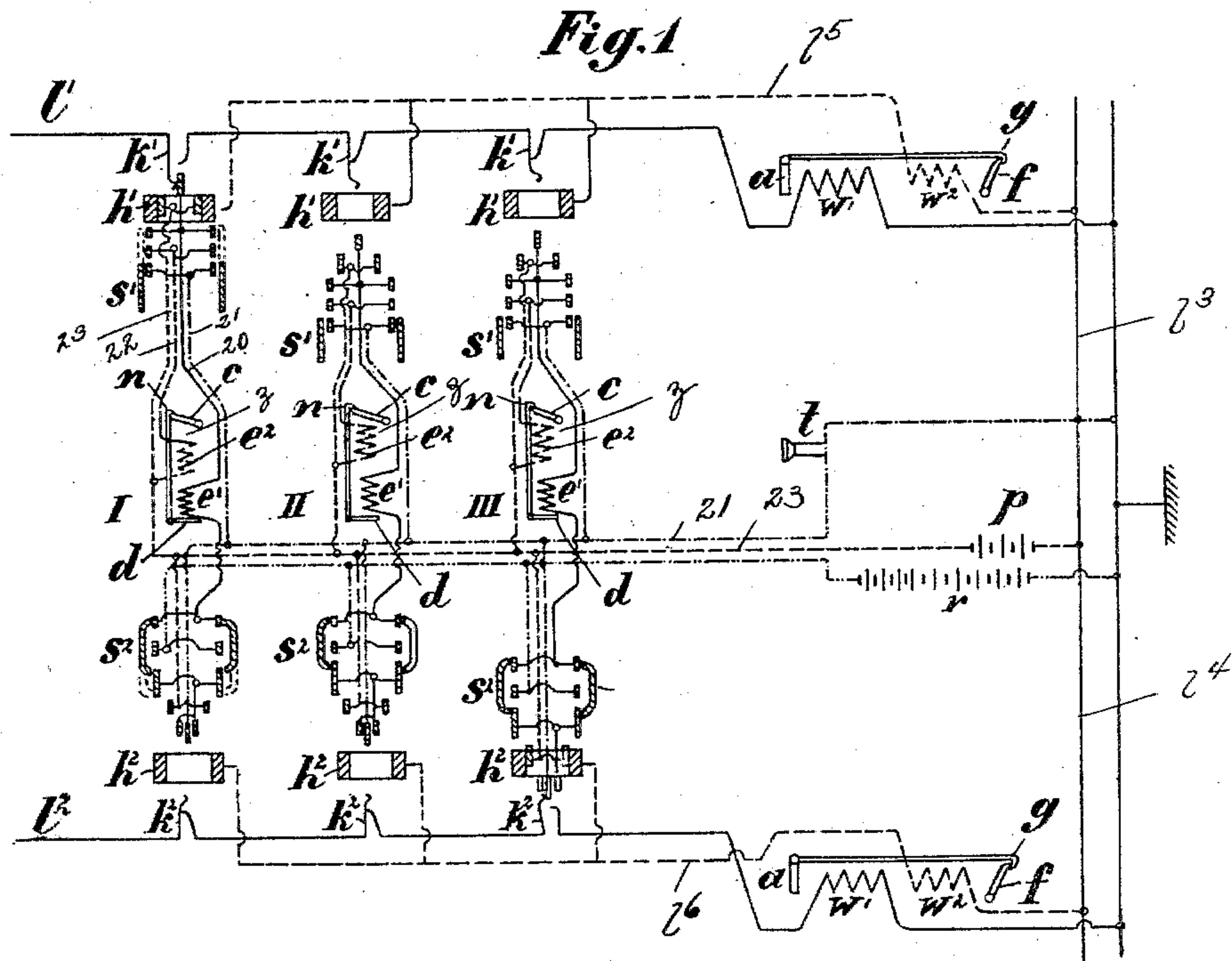


Fig. 2

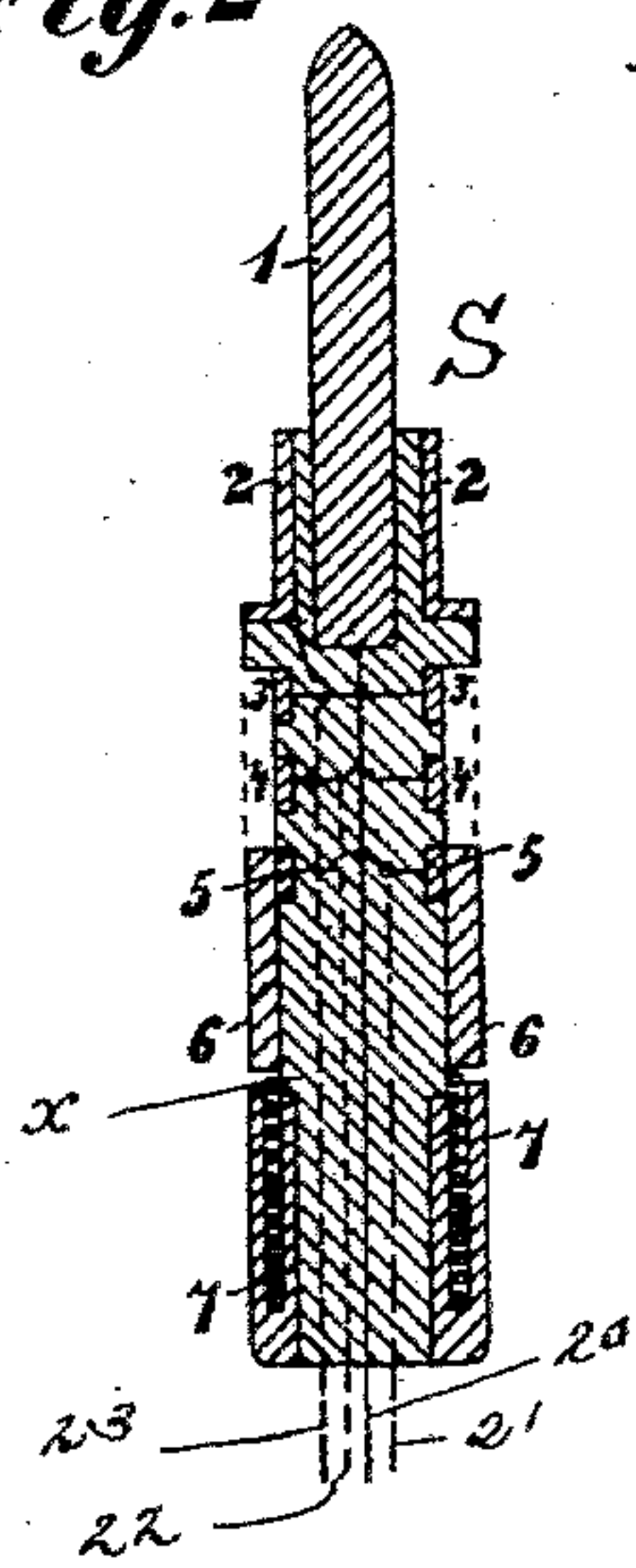


Fig. 3

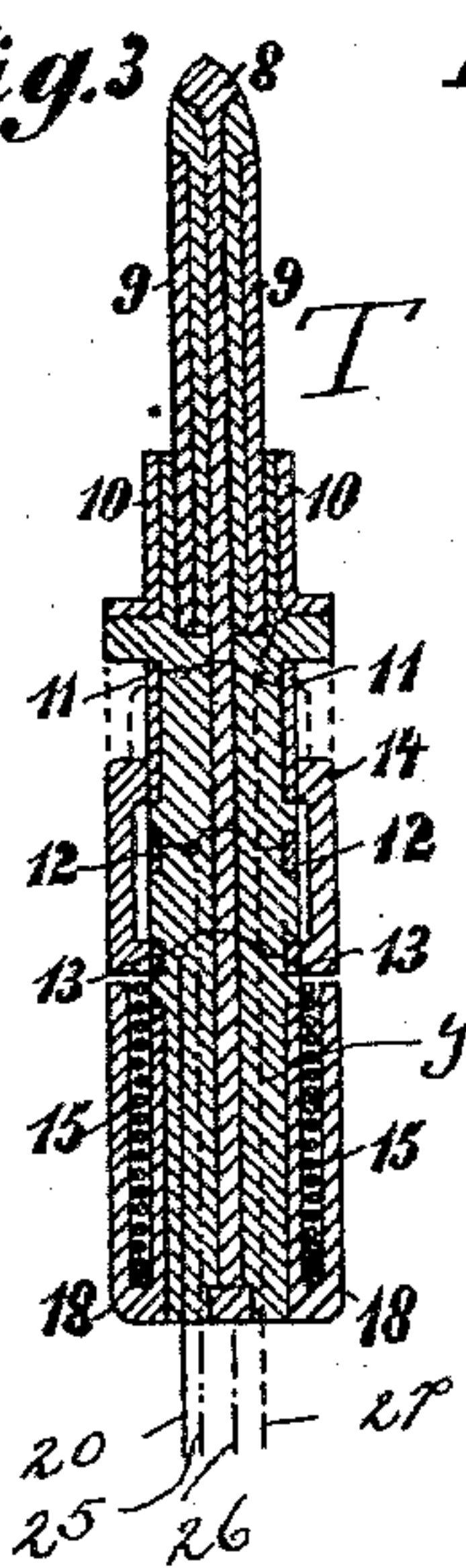


Fig. 4

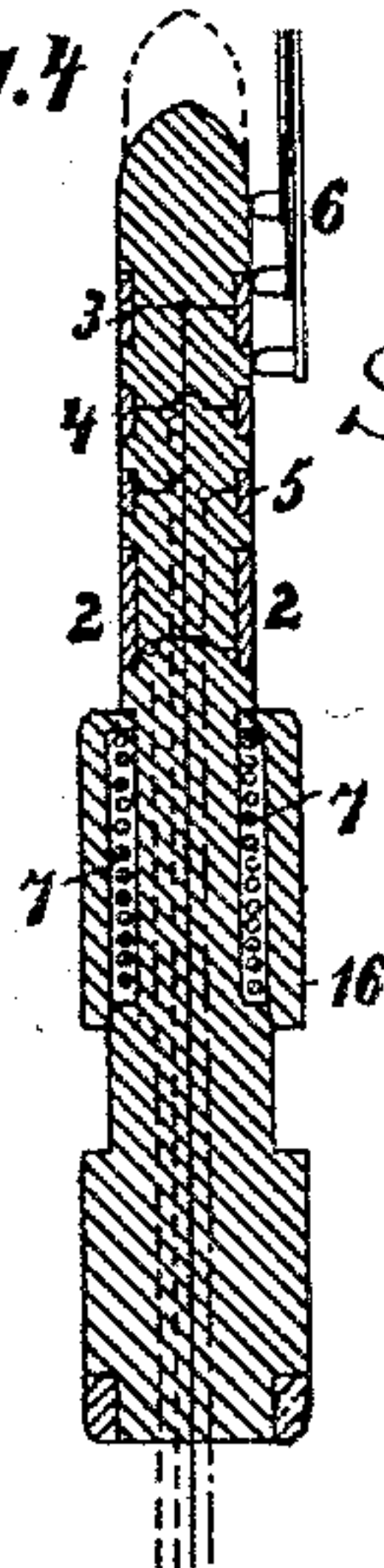
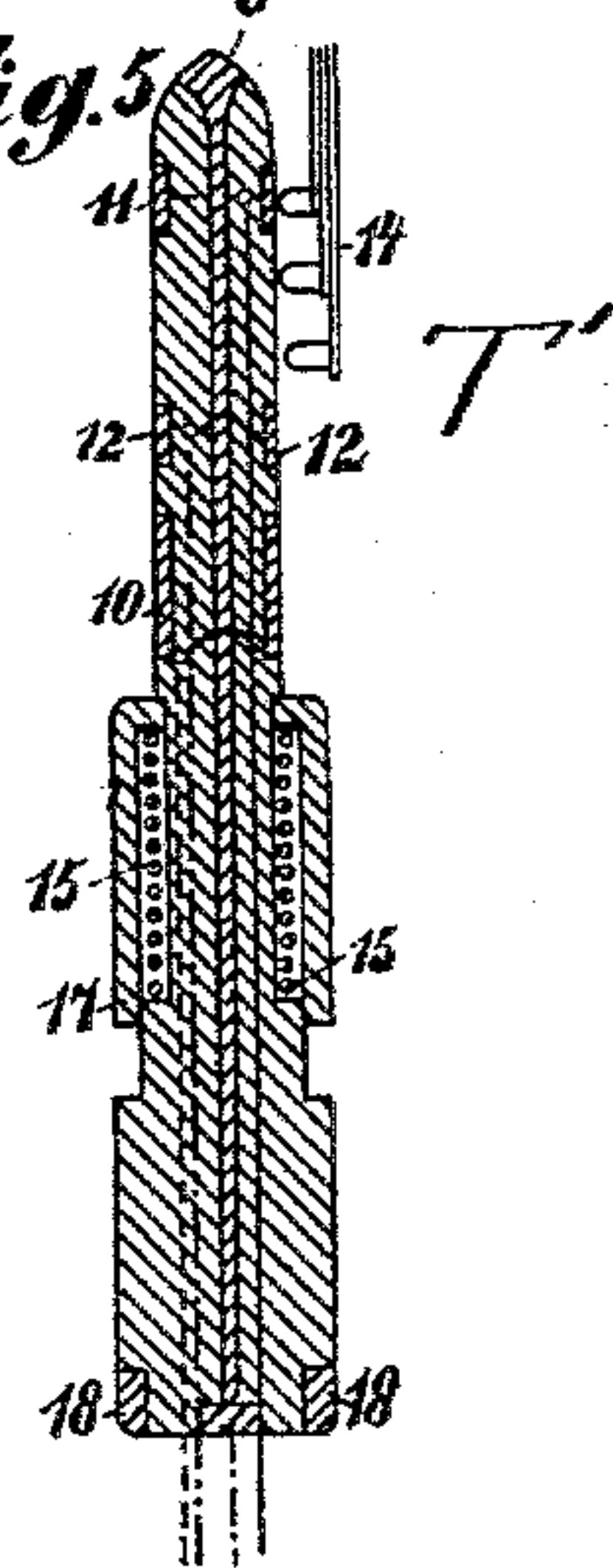


Fig. 5



Witnesses

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(No Model.)

3 Sheets—Sheet 2.

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Fig. 6

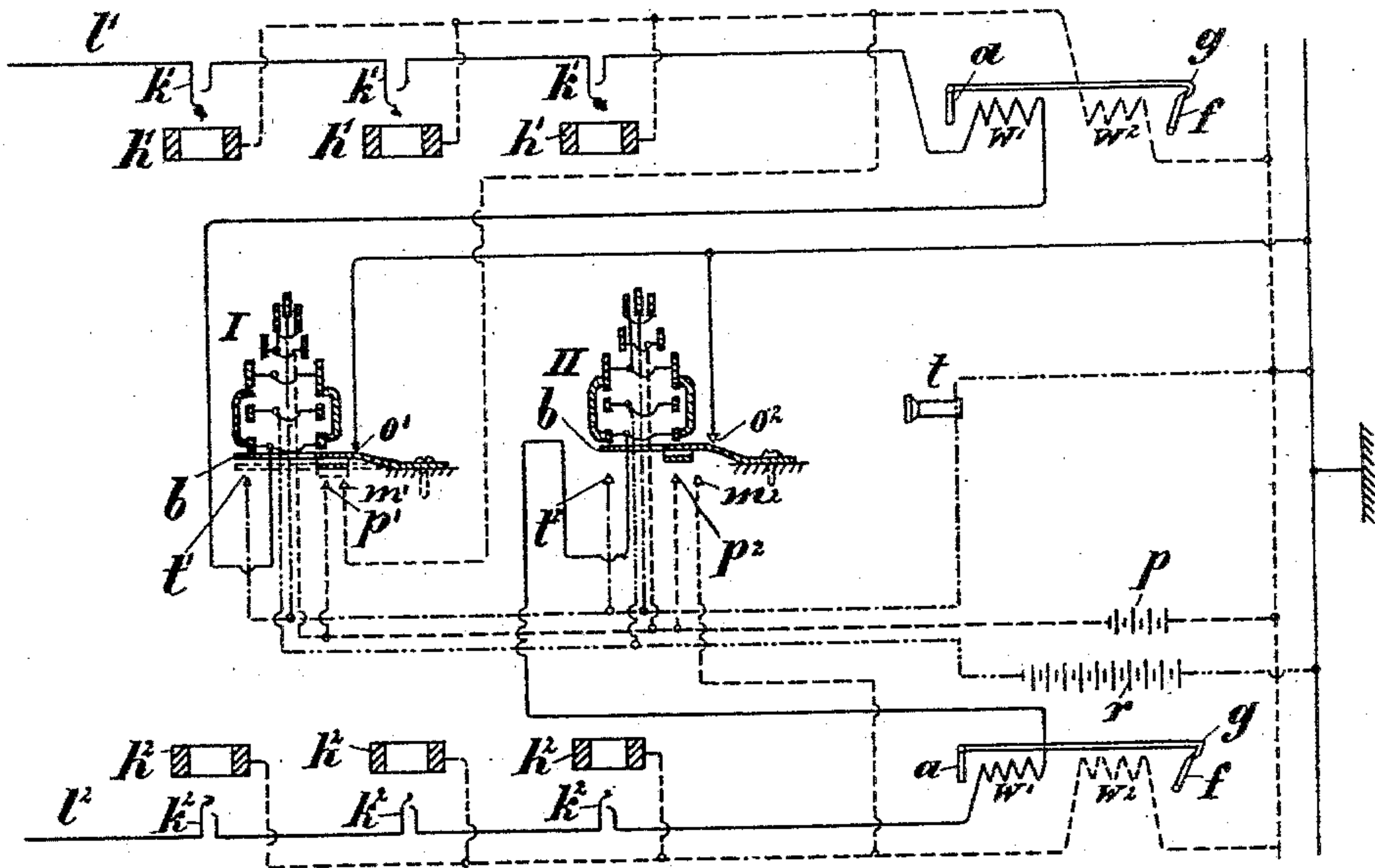
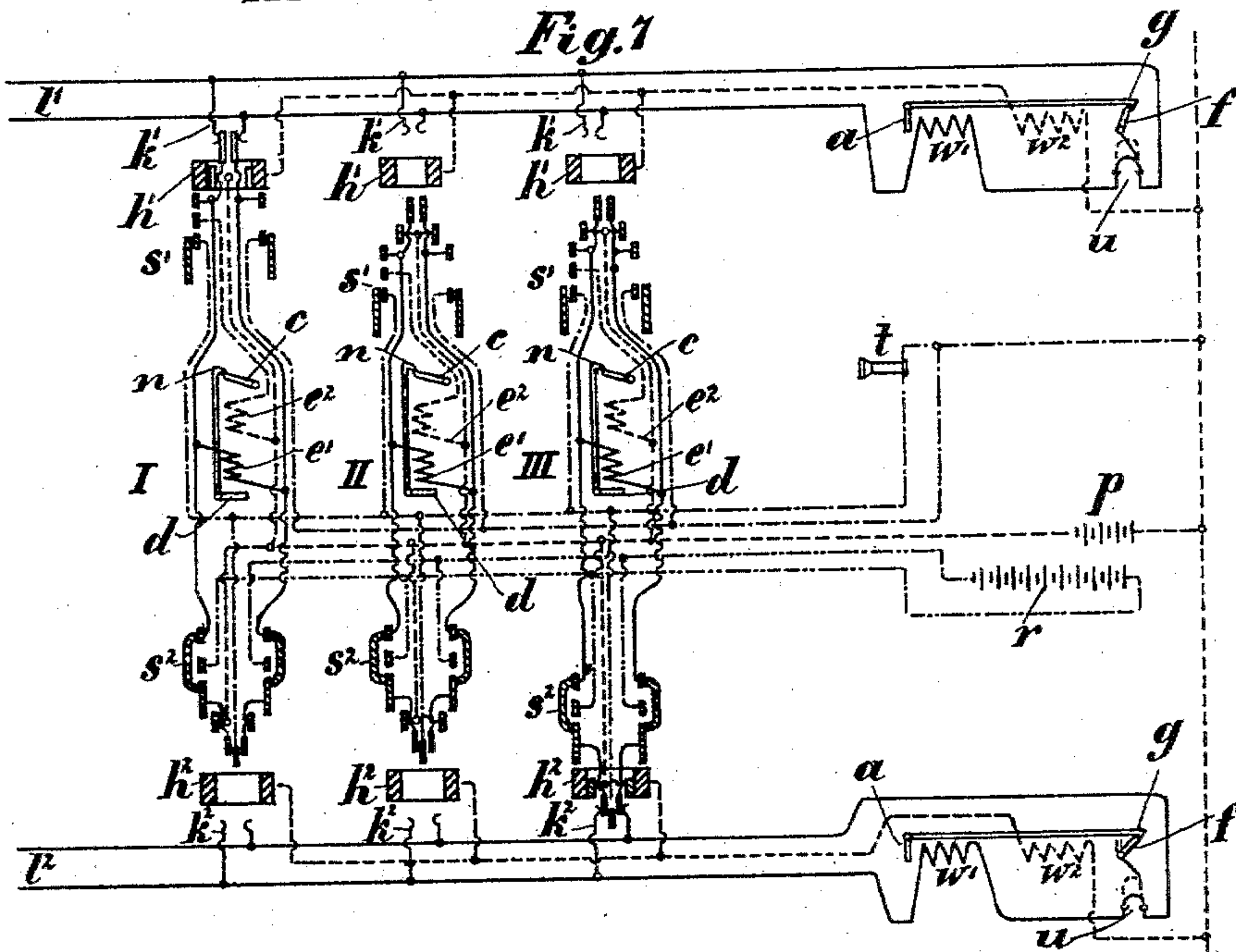


Fig. 7



Witnesses

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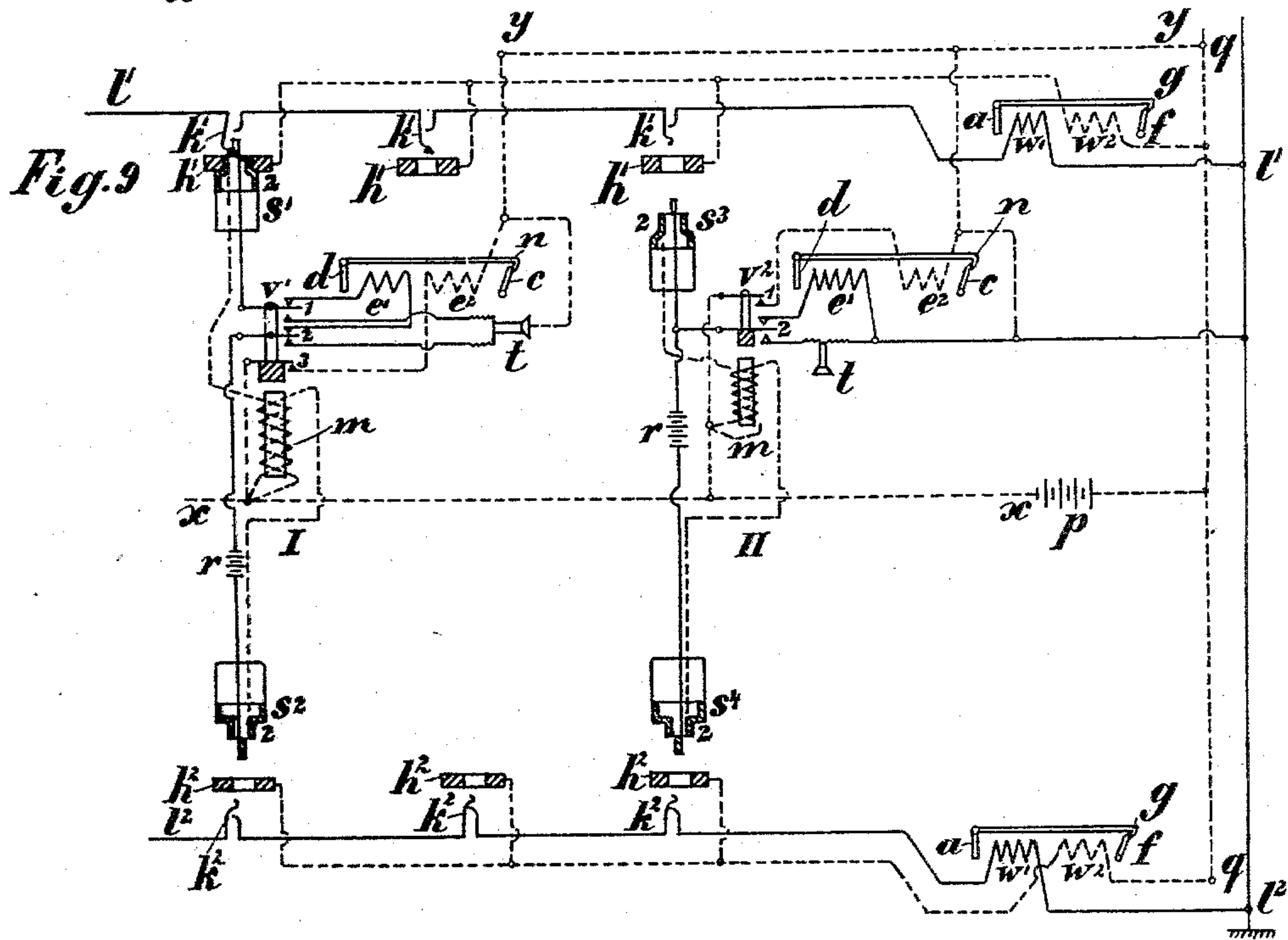
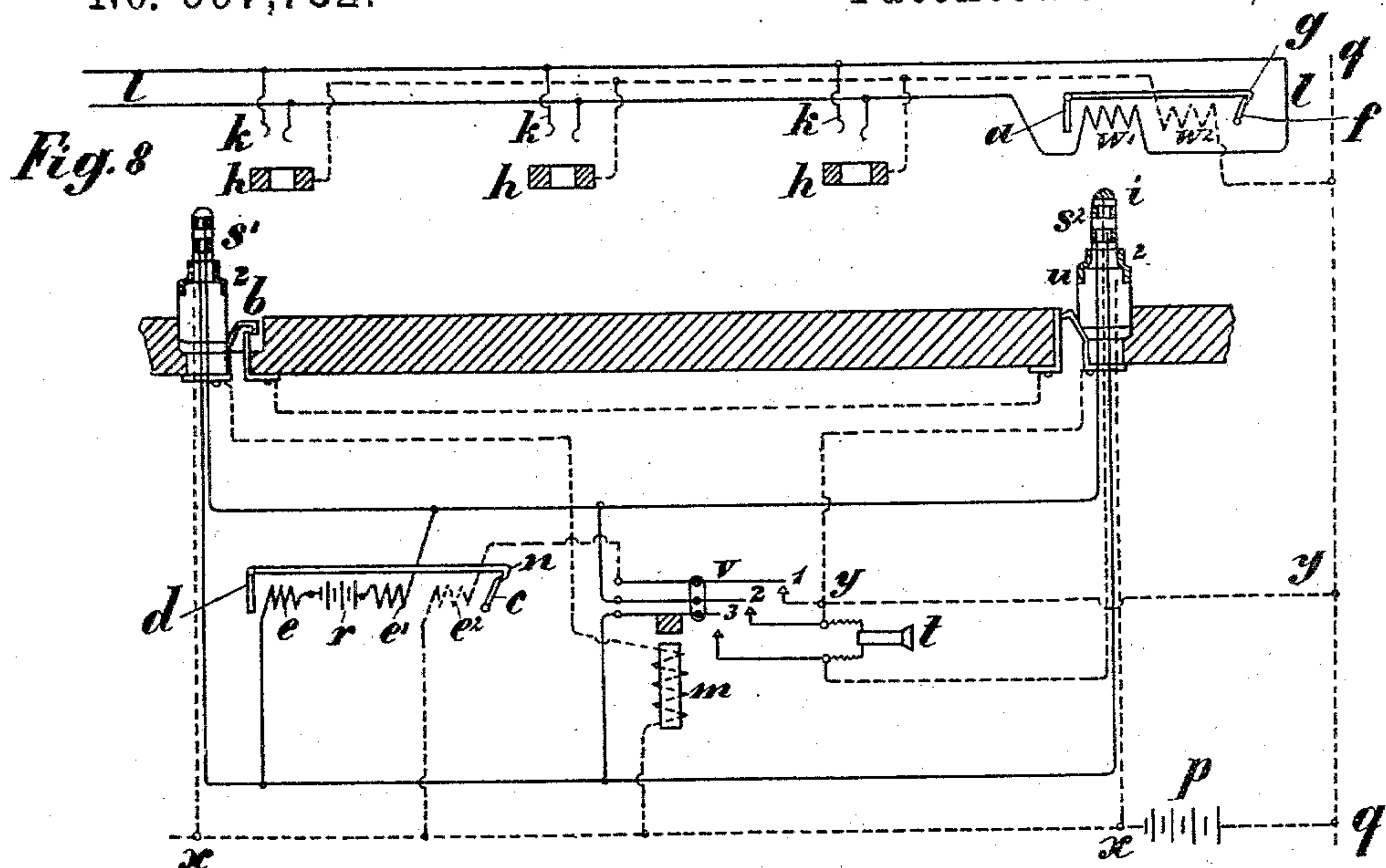
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GEORG RITTER, OF STUTTGART, GERMANY.

TELEPHONIC INSTALLATION.

SPECIFICATION forming part of Letters Patent No. 597,782, dated January 25, 1898.

Application filed June 11, 1896. Serial No. 595,203. (No model.) Patented in Germany May 26, 1893, No. 76,224, and in England August 4, 1894, No. 15,004.

To all whom it may concern:

Be it known that I, GEORG RITTER, of 2 Marktstrasse, Stuttgart, in the Kingdom of Württemberg, German Empire, have invented
5 certain new and useful Improvements in Telephonic Installations, of which the following is a specification.

My invention relates to switchboard systems for telephone - exchanges, for which I
10 have received Letters Patent in England, No. 15,004, dated August 4, 1894, and in Germany, No. 76,224, dated May 26, 1893.

The invention will be fully understood from the following description and claims when
15 taken in conjunction with the annexed drawings, in which—

Figure 1 is an illustration of one embodiment of my invention, in which lines from two subscribers' stations are each connected with
20 three spring-jacks upon a switchboard and with an individual annunciator and with three pairs of plugs with their connecting-circuits and signaling appliances, the two lines being adapted to be connected together for conversation by one of the plug-circuits. Fig. 2 is
25 a longitudinal sectional view of one of the plugs which are always used for making the connections necessary to the answering of a calling subscriber. Fig. 3 is a similar view
30 of one of the plugs which are always used for connecting the called-for subscriber. Figs. 4 and 5 are views illustrating modifications of the plugs shown in Figs. 2 and 3, respectively; and Figs. 6 to 9 are diagrams illustrating modifications of my improved switchboard system.

For convenience of description reference will first be had to Figs. 1 to 3 of the drawings.

40 The apparatus at each substation may be of the usual character, comprising a signaling-generator, a signal-bell, a telephone-receiver, a transmitter, and a gravity-switch, none of which it is deemed necessary to illustrate.
45 The parts named, with the exception of the gravity-switch, are connected to one side of a line-circuit—those of one station to side l' of one circuit and those of the other station to side l'' of another circuit—while the gravity-switches are grounded at the substations—
50 that is to say, connected with earth. The

gravity-switch at each station is arranged to connect the call apparatus or the telephone apparatus alternately into the line-circuit according to the position of the switch. The
55 lines l' l'' extend to the exchange, where they are each connected to line-springs k' k'' , respectively, upon the switchboard. Connections between the lines l' l'' and the earth include the operating-coils w' of the individual
60 annunciators g , while the connections l^3 l^4 include the retaining and restoring coils w^2 of said annunciators g . The operation of these annunciators will be readily understood. The pivoted armatures a are arranged adjacent to
65 the coils w' or the magnets of which said coils form a part. They are provided with catches adapted to release pivoted shutters or indicators f , of metal, when the magnets w' are energized, the said indicators f being adapted
70 to be raised or returned to their normal position in engagement with the catches when the magnets w' are disenergized and the magnets w^2 are energized, as presently described. Spring-jacks s' s'' are provided with test-
75 rings h' h'' , respectively, which are normally insulated from the two series of line-springs k' k'' , as shown. Said rings are connected together and with the circuit connections l^3 l^4 ,
80 as shown.

The connecting outfit comprises the connecting-plugs S T, three of each being shown in pairs I II III. The plugs S, one of which is shown in detail in Fig. 2, are designed for answering a calling subscriber, while the
85 plugs T, one of which is shown in Fig. 3, are designed for connecting a called-for subscriber. As better shown in Fig. 2, each of the connecting-plugs S comprises a body x of insulating or non-conducting material, a con-
90 ductive core 1, a metallic collar 2, mounted on the body and insulated from core 1, metallic rings 3, 4, and 5, fixed on the body and insulated from each other, an adjustable ring 6 for electrically connecting the rings 3 and
95 4 with the ring 5, and a coiled spring 7, connected with the ring 6 and the body and tending to normally hold said ring out of contact with any of said rings, except ring 5, for a purpose presently described. As better shown
100 in Fig. 3, the plugs T each comprise a body of insulating material, a conductive tube 9,

fixed on said body, a conductive test-rod 8, arranged in the body and extending through but insulated from the tube 9, the collar 10, fixed on the body y , the three metallic rings 11, 12, and 13, also fixed on the body and insulated from each other and from the collar 10, and a slidable collar 14, having its inner side recessed, said collar being normally held in contact with the rings 11 and 13 and out of contact with ring 12 by a spiral spring 15, connected to it and with the body y , as shown.

z indicates clearing-out annunciators, of which three are shown. These clearing-out annunciators are similar in construction to the individual annunciators g , and respectively comprise a shutter or indicator c of metal, an armature d , and a catch connected to the armature and adapted to engage and hold the shutter or indicator.

e' e^2 indicate operating and restoring coils, respectively, the former being adapted to act on the armature d and the latter on the shutter or indicator, as presently described.

t indicates the operator's telephone set, which is represented by a receiver and is connected at one side to earth.

r indicates the calling-generator, which has one of its poles connected with earth, and p a test-battery which has one of its poles connected to the conductor-lines l^3 l^4 , as shown.

The plugs S T, comprised in the three pairs shown, are connected in a similar manner, and therefore a description of the connections of one pair of plugs S T at the left of Fig. 1 will suffice for all.

The core 1 and ring 3 are connected by a line 20, in which the operating-coil e' of clearing-out annunciator z is arranged with the adjustable ring 14 and consequently with the ring 13 and tube 9 of the plug T. The ring 5 of the plug S is connected to one side of the operator's telephone set t by a line 21. The ring 4 of said plug S is connected with one pole of the test-battery p by a line 22, in which is arranged the retaining or restoring coil e^2 , and the ring 2 of said plug S is connected by a line 23, which merges into the line 22 with the same pole of the test-battery p .

As above described, the collar 14 of the plug T is connected by a line 20 with the core 1 and ring 3 of plug S. The test-rod 8 of said plug T is connected by a line 25 with the line 21, leading to one side of the operator's telephone set t . The collar 10 is connected by a line 26 to the line 23, leading to one pole of the test-battery p , and the ring or collar 12 is connected by a line 27 with one pole of the calling-generator r .

The operation of my improved switchboard system is as follows: Suppose that the subscriber on line l' desires to converse with the subscriber on line l^2 . He operates the calling-generator at his substation, sending current over the line l' and through earth, which finds current through the operating-coil w' of the individual annunciator g , thereby operating the annunciator and attracting the at-

tention of the attendant operator at the exchange-station to the line of the subscriber calling. The operator thereupon inserts a connecting-plug S—for instance, one of the pair I—which is ready at hand, into the spring-jack s' of that line, so that ring 2 contacts with test-ring h' and pushes the ring 6 to such a position that it electrically connects the fixed rings 3 4 5, thereby connecting her telephone set t to the calling-line. The test-battery p is now provided with a circuit from one of its poles through the line l^3 , restoring-coil w^2 of annunciator g , whereby the shutter or indicator f is raised, the line l^5 , the test-ring h' , the collar 2, and the lines 23 22 to its other pole. A portion of the current from the test-battery p finds its way to the operator's telephone set t , and there passes through the line 21, ring 5 of plug S, adjustable ring 6, ring 4, line 22, coil e^2 of annunciator z , and line 23 back to the battery, whereby the shutter or indicator c , which is normally down or open when not in use, will be raised. Furthermore, the operator's telephone set t will be connected with the subscriber's line l' , the current passing from one side of said telephone set through line 21, ring 5 of plug S, adjustable ring 6, ring 3, core 1, line-spring k' to one side of the telephone apparatus at the subscriber's station, and thence from the other side of such apparatus to earth and from earth to the opposite side of the operator's telephone set at the exchange. Thus the operator is enabled to converse with the calling subscriber. After the number of the called-for subscriber is ascertained the ring 6 is released, when it will be drawn back into its normal position by spring 7 and out of contact with any of the rings of plug S except ring 5. In consequence of this the telephone set t will be disconnected from the subscriber's line l' , and the circuit through coils e^2 of the clearing-out annunciator c will be interrupted. Having learned with what line the calling subscriber desires connection, the operator proceeds to test the spring-jack of the line wanted. This is accomplished by applying the test-rod 8 of the plug T to the test-ring h^2 of the spring-jack. If a connection already exists to some other spring-jack of the line, as is actually the case in Fig. 1, the current from one pole of the test-battery p will pass through the lines 23 26, the collar 10 of the fully-inserted plug, the ring h^2 , in which said plug is inserted, the line l^6 in direction of arrow, the ring h^2 at the extreme left, the test-rod 8 in contact with said ring, the line 25, the line 21, leading to one side of the operator's telephone set t , and the line leading from the other side of said set to the opposite pole of the test-battery, whereby a click or clicking noise will be produced in the telephone-receiver, which will be understood by the testing operator as an indication that the line is already in use. If, on the contrary, the line l^2 is not in use, the test-rings h^2 of the line would be insulated, and no test-current could

by any possibility reach the receiver of the operator's telephone set when a test was made. Assuming that the line l^2 was not in use, the operator at the exchange-station fully inserts the plug T at the left of Fig. 1 in ring h^2 , so that the conductive tube 9 contacts with the line-springs k^2 and at the same time pushes the ring 14 down, so as to establish connection between rings 11 and 12 of plug T. This done current will find circuit from one pole of the calling-generator r through line 27, ring or collar 12, adjustable ring 14, ring 11, conductive tube 9, the line-spring k^2 , the line l^2 , a telephone set at the subscriber's station, so as to ring the signal-bell thereof, and through earth back to the other pole of the calling-generator. The circuit remains interrupted for the operator, and consequently for the calling subscriber, until the former releases the ring 14. When this is done, the spring 15 will draw the ring 14 into such a position that it will establish connection between rings 11 and 13, and consequently electrical connection with the calling-generator r will be interrupted. On the other hand, electrical connection is effected between lines l^2 through ring h^2 , tube 9, ring 13, and adjustable ring of plug T, line 20, the core 1 of plug S, and line-spring k' . When the communicating subscribers have completed their conversation, one of them sends a signaling-current from the generator at his substation, which passes over his telephone-line, the spring-jacks thereof, through the contact-pieces of one or the other of the connecting-plugs, the line 20, and thence through the operating-coil e' of the clearing-out annunciator z , which is thereby operated and by the release and fall of the shutter or indicator c notifies the operator that the connection is no longer desired. The operator proceeds to disconnect the lines by removing the plugs S T from the spring-jacks thereof.

In Fig. 4 of the drawings I have shown a connecting-plug S', which is a modification of that shown in Fig. 2, while in Fig. 5 I have shown a plug T', which is a modification of that shown in Fig. 3. These plugs S' T' are designed to serve the same purposes as the plugs S T, respectively, and the corresponding parts of plugs S S'—that is to say, the parts that serve the same purposes—are similarly numbered while the corresponding parts of plugs T T' are similarly numbered.

In the plug S' the rings 3, 4, and 5, as well as the ring 2, which corresponds to the collar 2 of plug S, are mounted on the contact-core instead of on the body of the plug. Said parts 2, 3, 4, and 5 of plug S' have, however, the same connections as the parts 2, 3, 4, and 5 of plug S, and a spring 6 is provided in Fig. 4 to take the place of ring 6 in Fig. 2, while a sleeve 16, backed by a spring 7, is provided to bear a test-ring. In using the plug S' it is inserted in the test-ring until the sleeve 16 bears against the shoulder of the plug-body. In this position the fixed spring will connect

the rings 3, 4, and 5, when the same result will be effected as when the rings 3, 4, and 5 of plug S are electrically connected by the sleeve 6. The ring 2 will also contact with the test-ring for the same purpose as collar 2 of plug S contacts therewith. When pressure on the plug S' is released, the spiral spring 7 will automatically withdraw the same a sufficient distance to leave only the ring 3 in contact with the spring 6 and thereby with the calling-subscriber's line.

The plug T' is used in testing in the same manner as the plug T. It is also designed to be inserted in a test-ring as far as possible, when the foremost contact of the spring 14, which is designed to serve the same purpose as ring 14 of plug T, will touch the ring 12, while the other two contacts of said spring bear upon the insulated part of the core. The effect will be the same as when the ring 14 of plug T contacts with the ring 12 thereof. The ring 10 of plug T', like ring 10 of plug T, is designed to contact with a test-ring h^2 . When pressure on the plug T' is removed, the spring 15 will automatically withdraw it until the ring 11 is connected with the third contact of spring 14, when the same result will be accomplished as when the ring 14 of plug T contacts with the ring 11 thereof.

Should the switchboard system described be applied to switch frames or cabinets embodying a single-cord arrangement, only one plug each of either of the constructions shown in Figs. 3 and 5 would be required, it being simply necessary to provide a metallic sleeve 18 at the lower end of the plug-body and connect the same through the ring 11 or ring 13 with the plug-circuit or subscriber's circuit. In Fig. 6 is illustrated a switchboard system embodying this arrangement, the parts similar to those of Fig. 1 being similarly lettered. The connecting-plugs T', forming the ends of the subscriber's circuits, rest upon springs b , impinging against contacts connected with earth and capable of being depressed through the medium of the plugs, so as to release them from their earth-contact and allow them to bear against the contacts t' t' , connected with one side of the operator's telephone set t , whereby the latter is connected to the circuit of the depressed plug. Upon the under side of the springs b are arranged contact-plates which are insulated therefrom and bear when depressed against the contacts p' m' p^2 m^2 owing to the contacts p' p^2 being connected with one pole of the test-battery and the contacts m' m^2 being connected with the other pole of the test-battery, so that when one of the springs b is depressed the current will pass through the restoring-coil m^2 , with which it is in circuit, and the shutter or indicator f of the individual annunciator will thereby be raised. The connection between the two subscribers' lines is effected as follows: As the shutter f of the annunciator in subscriber's line l' falls by reason of a current sent over said line through operating-coil w' en-

energizing said coil, the plug T' at the left of Fig. 6 is depressed and the calling subscriber questioned, while the shutter f is simultaneously raised by the energization of the coil w^2 . After receiving the number of the called-for subscriber the line of said subscriber is tested in exactly the same manner as described with reference to Fig. 1. If the line be disengaged, the plug at the right of Fig. 1 is fully inserted in the test-ring h' and line-springs k' of the spring-jack of the line l^2 , whereby a current will be sent from the calling-generator r over line l^2 to the signal-bell of the telephone set at the subscriber's station. When the closing-signal is sent from either one of the subscribers' stations to the exchange-station, the shutter or indicator f of the individual annunciator of the calling subscriber drops as the retaining-coil w^2 is disengaged, whereupon the operator interrupts the connection by withdrawing the plug T' .

In embodying my invention in switchboard systems with double circuits the current is made to flow in the manner shown in Fig. 7, the earth connection being replaced by a return-line. The same reference letters and numerals employed in Fig. 1 are applied to corresponding parts in Fig. 7, and therefore the system shown in Fig. 7 will be readily understood from the description of Fig. 1.

In order to connect two subscribers, the following manipulation takes place: Should, for instance, subscriber 1 wish to speak to subscriber 2, the armature a of the former's annunciator will be attracted in consequence of the call-current sent off by him to the office, whereby the shutter f is allowed to fall. The attendant now inserts one of the free plugs s' (that of pair I in the case shown) in the ring h' of the to-and-fro circuit and pushes at the same time the ring C over the rings 3, 4, and 5, (see plug in Fig. 2,) causing the following actions, to wit: In consequence of the contact between the ring 2 and plug-ring h' the circuit from the test-battery to the corresponding coil m^2 is closed and the shutter f is raised. The circuit from battery p to the telephone t , ring 5, ring 4, (by means of ring 6,) and thence back to battery p through coil e^2 of the clearing-out annunciator being now likewise closed the latter device, which was open before, is now attracted; also, the telephone t is connected to the circuit l' of the calling subscriber through rings 5, 3, and 6. After giving out the number of the subscriber required to be called (No. 2 in present case) the ring 6 is first released, whereby the telephone t is thrown out of the circuit. The testing-pin 8 of the plug s^2 (I pair) is now used to find out if the circuit is free. If so, the plug s^2 is inserted in ring h^2 and the jack-spring k^2 , and the ring 14 of plug (see Fig. 3) is shifted in order to connect the rings 11 and 12, whereby the circuit l^2 of the called-for subscriber is connected to the call-battery, and a bell indicates the same. The circuit between the opera-

tor and the calling subscriber remains broken so long as the operator presses ring 14 forward, but on releasing this ring the rearward connection is automatically established, while the connection with the calling-generator is broken.

The above-described device is advantageous for the reason that it diminishes the number of manipulations necessary to connecting or disconnecting the subscribers of the system, the switches being moved through the medium of the plugs.

In Fig. 8 a system is illustrated which corresponds to the one shown in Figs. 1 and 7, the same being intended for loop-circuits, but which can also be employed to advantage for single circuits. l l is one subscriber's loop, having three line-springs k and one individual annunciator g . The test-rings h of the spring-jacks are connected with the test-battery p by means of an auxiliary conductor. Moreover, a pair of connecting-plugs s s^2 , with parts belonging thereto, are indicated. The plug s' is used as a calling-plug, while the plug s^2 is used as a testing-plug, it being provided with a testing-head i . The bodies of the plugs are provided with two rings which are connected with a circuit, while the collars z , which by inserting the plugs come into contact with the test-rings h , are thus connected with the test-battery p by the auxiliary wires. When the plug s' is inserted, the current from the battery p is closed through the restoring-coil w^2 of the individual annunciator g , so that the shutter or indicator f thereof is raised. In order to automatically connect the operator's telephone set t , the plugs s s^2 have contact devices b u so arranged that one of the plugs (the calling-plug s' , for instance) is open when in its normal position, but closed when the plug is taken off. The contact device u of the testing-plug s^2 is the opposite. The two contact devices b u are thus connected with the test-battery p , and the conductor branches off from the circuit x x and magnet m b u y y q q , whereby the electromagnet m is energized and attracts the armature which is connected with the switch v , so that thereby the telephone set t comes between the two subscribers' circuits. At the same time the arm i of the switch v closes the current of the battery p by means of the wires x x and q q from the restoring-coil e^2 of the individual annunciator, so that the indicator or shutter f thereof is closed automatically. The operator can now ask the calling subscriber immediately for the number of the called-for subscriber, when, in order to make the desired connection, the plug s^2 is also withdrawn, when the current from battery p to magnet m is broken at u , so that the armature of the magnet m becomes free and the telephone set is thus disconnected as also the restoring-coil e^2 of the individual annunciator.

The test, whether a circuit is free or engaged, is made in the same manner as before

described. If the collar z of an inserted plug is in contact with a ring h , and is thus connected through $x x$ with the pole of the battery p , when the test-button i of the plug s^2 is placed against a ring h of the engaged circuit, the current will pass from battery p to button i , to the test-circuit and the telephone set t , and from this to the wires $y y$ and $q q$ to the other pole of the battery p , thus causing a clicking noise in the telephone-receiver which will apprise the operator of the fact that the line is busy. In order to also automatically produce the calling-signal, the calling-generator r is situated between the coils $e e'$ of the clearing-out annunciator, so that the current of this battery is closed from the subscriber's station. The apparatus at the latter is so arranged that in normal position the signal-bell is in circuit and in the position of speaking is cut out, so that the signal-bell of the called-for subscriber sounds all the time until he disconnects it by lifting off the telephone and thereby cuts out the bell and throws the telephone into circuit.

When it is desired to have a special test-line in the plugs, the arrangement must be made in such a manner that the operator's telephone set t is disconnected only when the second plug is inserted into the contacts of the line of the subscriber to be called. Such a system is shown in Fig. 9, which also has the advantage that the plugs need not be used in a certain order, as in Fig. 8. The switch-board is shown for single lines, but can be employed also for loop-circuits.

The lettering of Fig. 9 is similar to that of Fig. 8. The electromagnet m is interposed in the circuit $x x$ and in the lines parting from there and the collars $z z$, so that said electromagnet has two coils in which the current from the battery p circulates in opposite directions. If in calling a subscriber the plug is inserted, the current from the test-battery p is closed from $x x z h' v^2 q q$, whereby the armature of the magnet m is attracted and the operator's telephone set t thrown into the circuit; also, the restoring-coil e^2 of the clearing-out annunciator is energized. By passing through plug s' or s^2 the pole of the test-battery p , connected to $x x$, comes into circuit with the collars h of the line. When the point of the test-plug contacts with one of the test-rings, the current from p is closed through the speaking-line of said plug and through the lever 2 of the switch v through the telephone set t and through the auxiliary wires $y y$ and $q q$, causing a clicking or cracking noise in the telephone-receiver. When the line is clear no such cracking noise is heard. When also the second plug of the couple is inserted, the opposite current through the second coil of the magnet m will operate against that through the first coil and render said magnet m powerless, so that the armature falls off and the telephone set t is disconnected and the restoring-coil of the clearing-out annunciator receives no current. It is

obvious that the two coils can be brought also upon two magnets, counteracting the effect of each other.

In Fig. 9 two kinds of connections of the telephone set t for the operator at the exchange-station are shown in the line. In the first case (the pair I) the telephone t in exchange with the operating-coil e' of the clearing-out annunciator is thrown into the line of the pair of plugs by the arms 1 and 2 of the switches v , while the arm 3 connects the restoring-coil e^2 of said annunciator with the test-battery p . In the second case (pair II) the operating-coil e' of the clearing-out annunciator is connected to the line of the pair of plugs in exchange with the telephone set t by means of the arm 2 of the switch v , while the arm i brings the restoring-coil e^2 of the annunciator in connection with the battery p . The calling of the desired subscriber may be effected automatically by placing the second plug in its spring-jack, when current will find circuit from the calling-generator r through the line of the connecting-plug. In the arrangement chosen for the second pair of plugs II the calling-generator r may also be placed in the earth-circuit behind the clearing-out annunciator, whereby one common battery is sufficient for all pairs of plugs in one station. Finally, it may be remarked that the switch v can be provided with keys, that the same may be manipulated by hand through the office in case they want to be in circuit with the line.

Having thus described my invention, what I claim is—

1. The combination with a line-circuit extending from a subscriber's station to an exchange-station, of a test-battery, a clearing-out annunciator having operating and restoring coils adapted to act oppositely through the medium of suitable mechanism upon an indicator, an individual annunciator having operating and restoring coils adapted to act oppositely through the medium of suitable mechanism upon an indicator, the restoring-coil being included in the line-circuit, and connecting-plugs provided with contact devices partly fixed and partly loose so as to permit of the connections and the auxiliary operations being effected by the plugs; the said connecting-plugs being arranged in the line-circuit and operator's telephone set having one side connected with the line-circuit, and the test-battery p , having one of its poles connected with an auxiliary circuit and a shunt through the restoring-coil of the clearing-out annunciator to certain contact devices of one of the connecting-plugs; said test-battery having its other pole connected with the operator's telephone set as well as certain contact devices of the connecting-plugs through the restoring-coil of the individual annunciator in such manner that the connecting-plugs, when properly manipulated are adapted to establish the connections and automatically raise the indicator of

the clearing-out annunciator, substantially as specified.

2. In a multiple-switchboard system for telephone-exchanges, the combination of connecting-plugs s' , s^2 , contact devices b , u , arranged in the seats of the plugs, an electromagnet m , a test-battery p , a switch v , and the operator's telephone set t , and a clearing-out annunciator; the same being electrically connected in such a manner that in lifting the plug s' , from its seat the battery p , is closed from the magnet m , and by means of the switch v , the restoring-coil of the clearing-out annunciator is thrown into circuit, while by lifting the plug s^2 , the current from test-battery p , is broken and thereby the clearing-out drop is thrown into the line and the operator's telephone set t , and the restoring-coil of the clearing-out annunciator are disconnected, substantially as specified.

3. In a multiple-switchboard system for telephone-exchanges, the combination of an electromagnet m , a test-battery p , a switch v , the operator's telephone set t , connecting-plugs, and the clearing-out annunciator having the operating and restoring coils e' , e^2 ; the whole being electrically connected in such a manner that the coil of the electromagnet m , is so brought into auxiliary conductors from the test-battery p , to the connecting-plugs that the coil of said electromagnet m , receives the current of the test-battery when one connecting-plug is manipulated whereby the two coils of the magnet have one pair of plugs so combined that their effects counteract each other to act upon the switch v , connecting the operator's telephone set t , to the restoring-coil e^2 , of the clearing-out annunciator by the insertion of one plug, while by the insertion of the second plug, said switch v , is set free and consequently the operator's telephone set t , and the restoring-coil e^2 , of the clearing-out annunciator are thrown out of circuit but the operating-coil e' , of the same is connected with the line in case the latter is not connected with the same permanently, substantially as specified.

4. The combination with the two line-circuits extending from two subscribers' stations to an exchange-station; of individual annunciators at the exchange-station having two coils adapted to act oppositely through suitable mechanism upon an indicator, the operating-coils of said annunciators being included in the said line-circuits, a clearing-out annunciator having an operating-coil e' , and a restoring-coil e^2 , an operator's telephone set t , a test-battery p , a calling-generator r , test-rings h' , h^2 , arranged in a circuit passing

through the restoring-coils of the individual annunciators, suitable connecting-plug S, a suitable connecting-plug T, a circuit connecting said plugs and passing through the operating-coil e' , of the clearing-out annunciator, a circuit connecting the plug T, and the operator's telephone set t , a circuit connecting the plug S, and the test-battery p , and passing through the restoring-coil e^2 , of the clearing-out annunciator, a circuit directly connecting the plug S, and the same pole of the test-battery p , as the last-named circuit, the circuit connecting the plug T, and operator's telephone set t , the circuit connecting the plug T, and the test-battery p , the circuit connecting the plug T, and one pole of the calling-generator r , and passing through earth, circuits passing from the pole of the test-battery p , farthest from the connecting-plugs and through the restoring-coils w^2 , of the individual annunciators to the test-rings h' , h^2 , and a circuit connecting the last-mentioned pole of the test-battery p , and the side of the operator's telephone set connected to earth, substantially as specified.

5. In a switchboard for telephone-exchanges, the combination of a test-ring and a connecting-plug for insertion in the test-ring comprising a body of insulating material; a plurality of contact-pieces fixed upon said body and insulated from each other, a contact-piece for electrically connecting certain fixed contact-pieces on the body, and a spring for moving the plug when released so that the contact-piece will contact with but one of the fixed contacts on the plug-body, substantially as specified.

6. In a switchboard for telephone-exchanges, the combination with a test-ring; of a connecting-plug for insertion in the ring, comprising a body of insulating material, a plurality of contact-pieces fixedly arranged upon said handle and insulated from each other, a movable contact-ring arranged on the handle, and a spring for normally holding said contact-ring in engagement with but one fixed contact-piece; said movable ring adapted to be moved by the insertion of the plug in the test-ring so as to effect electrical connection between two of the fixed contact-pieces, substantially as specified.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

GEORG RITTER.

Witnesses:

WILHELM LEVY,
CHRISTIAN BAUER.