

(No Model.)

2 Sheets—Sheet 1.

J. J. CARTY.
TELEPHONE EXCHANGE APPARATUS.

No. 564,173.

Patented July 14, 1896.

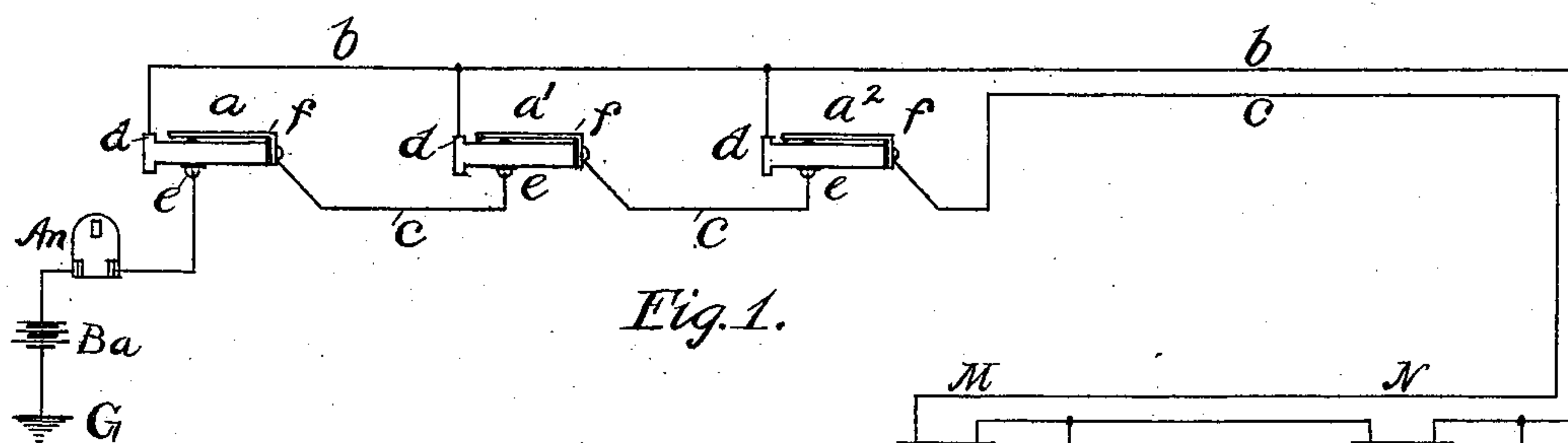


Fig. 1.

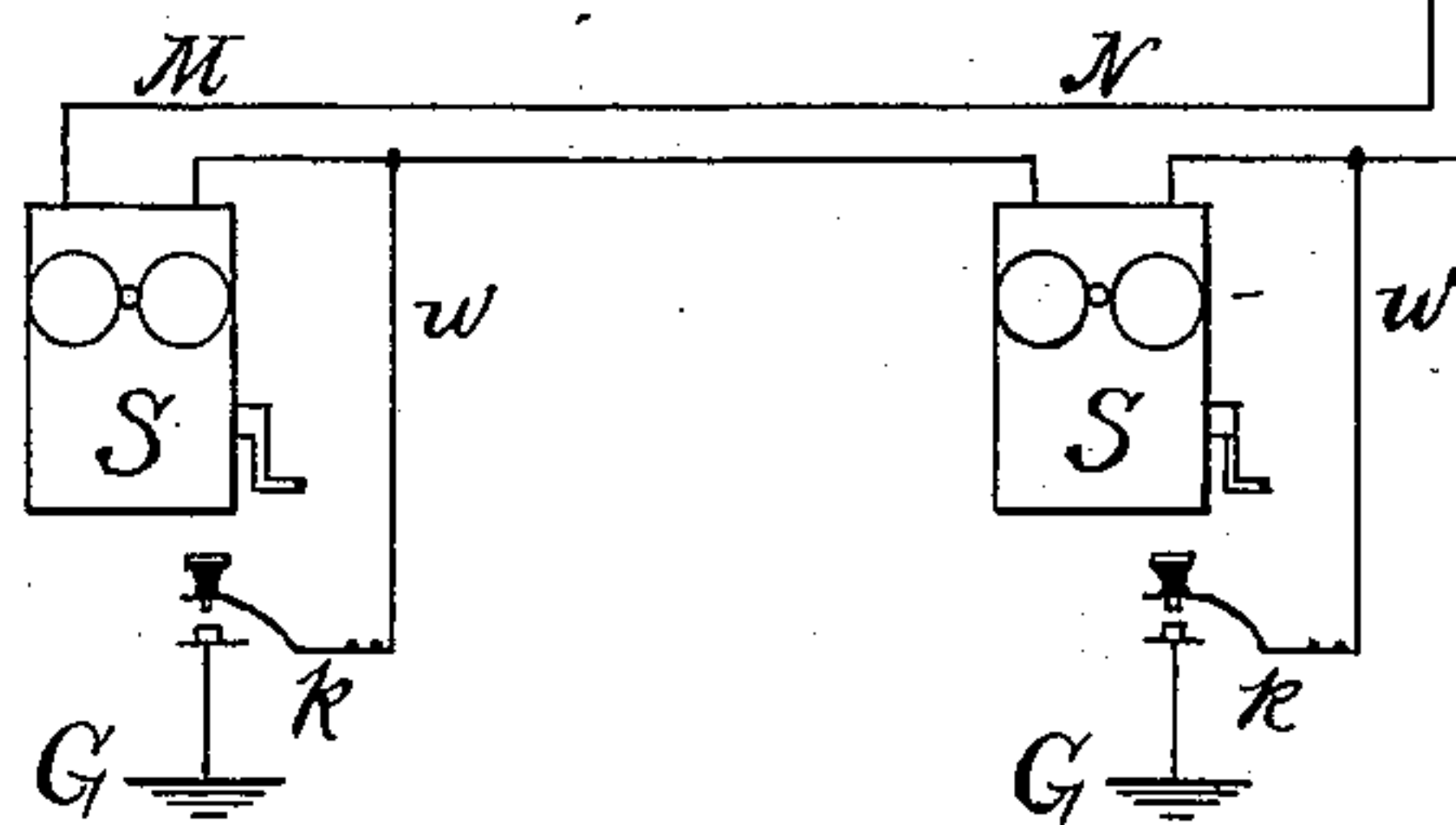


Fig. 2.

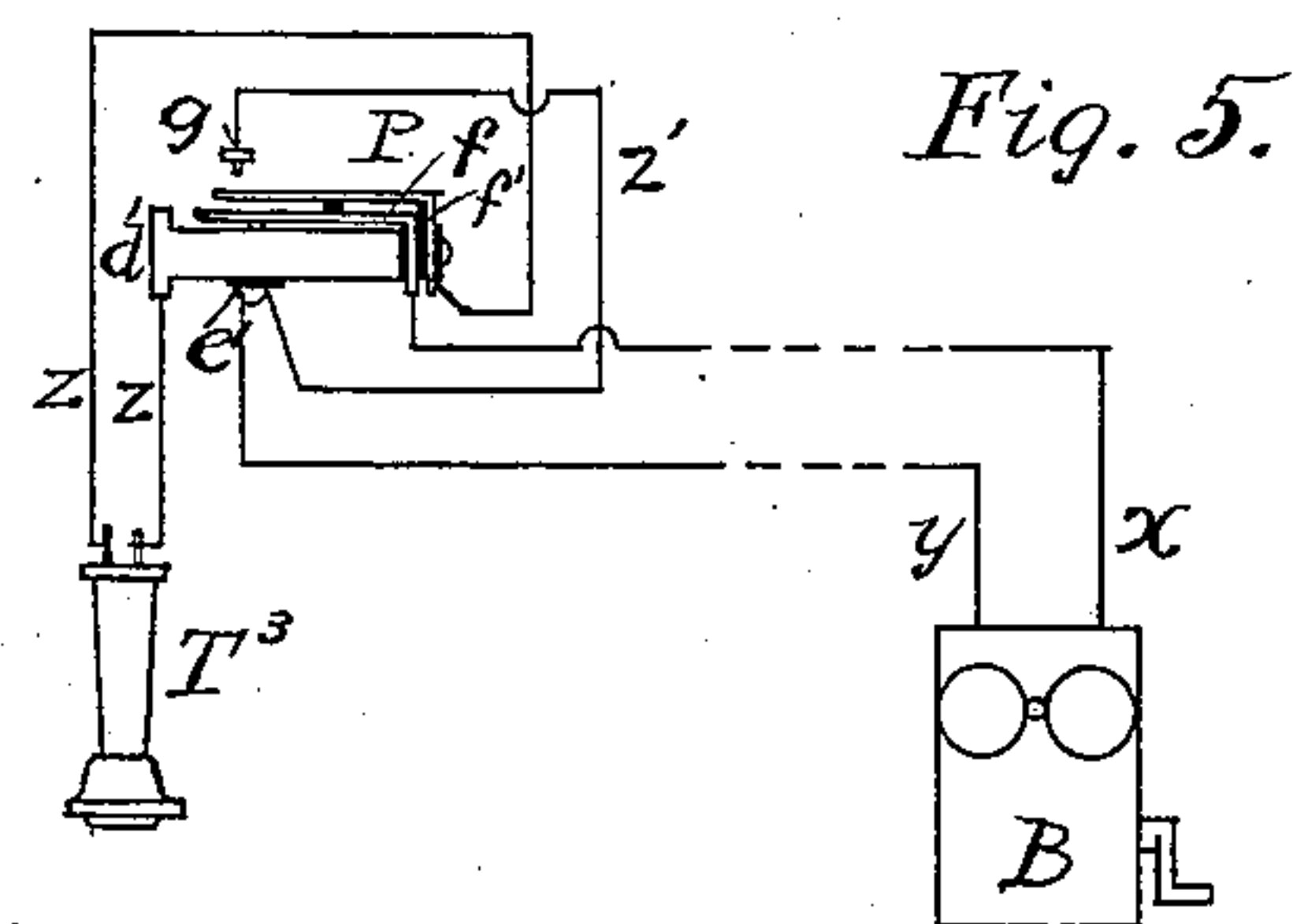
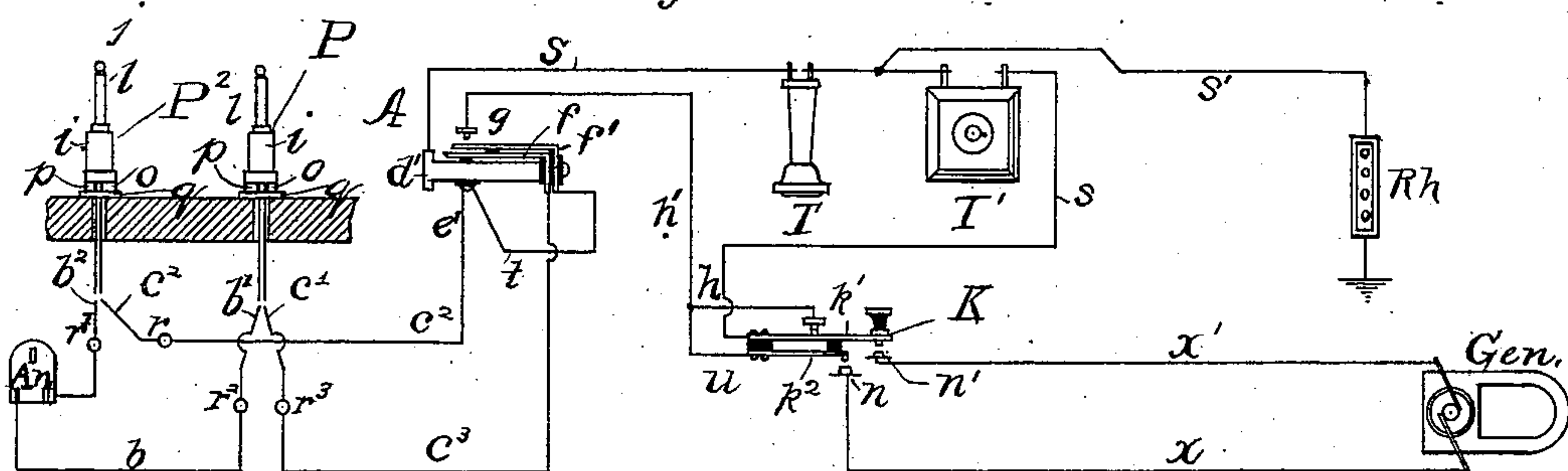


Fig. 4.

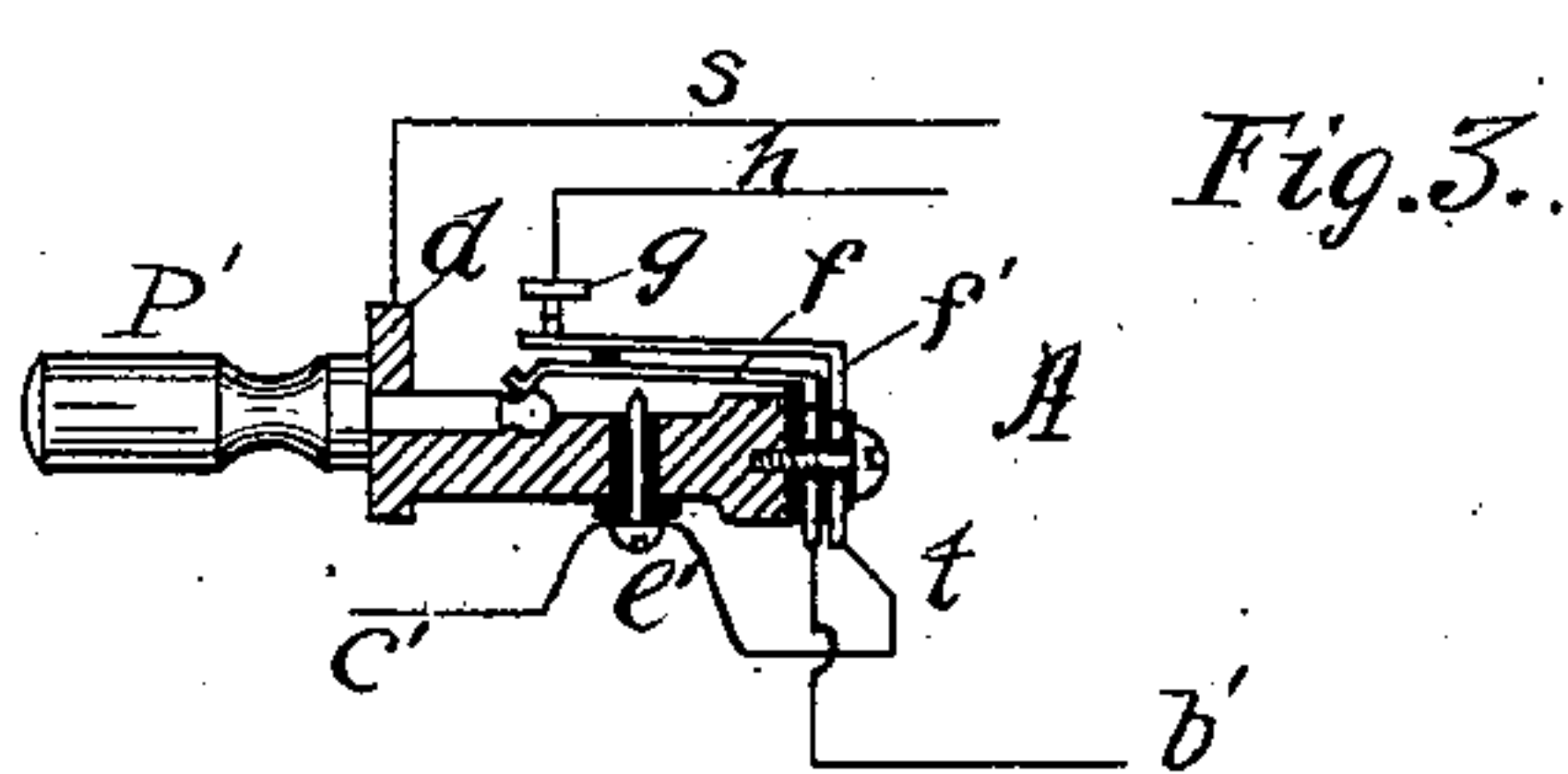


Fig. 5.

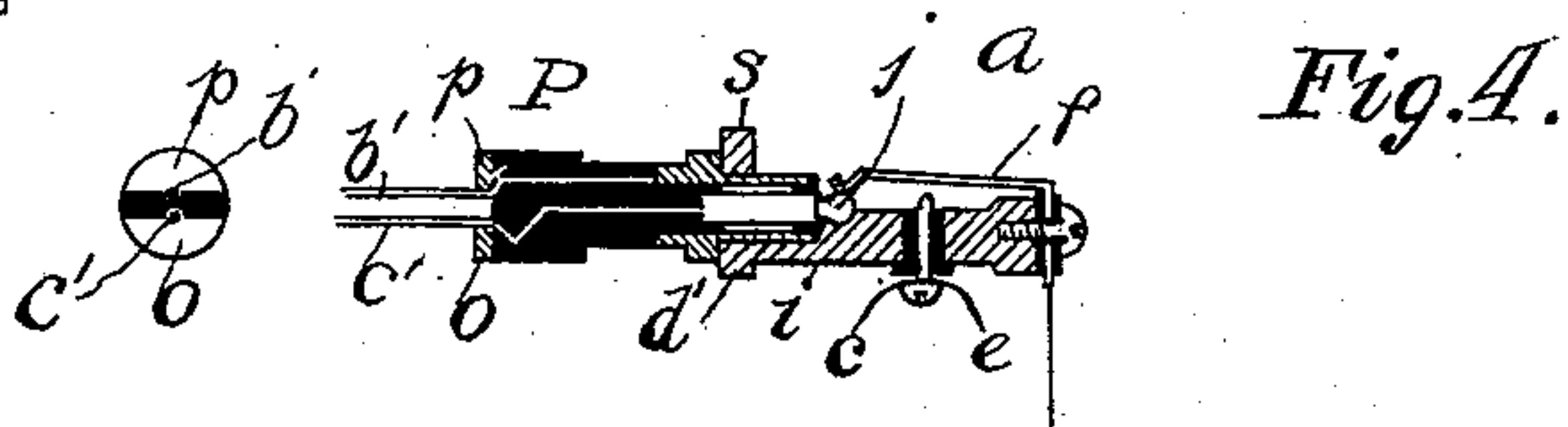


Fig. 6.

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(No Model.)

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Fig. 7.

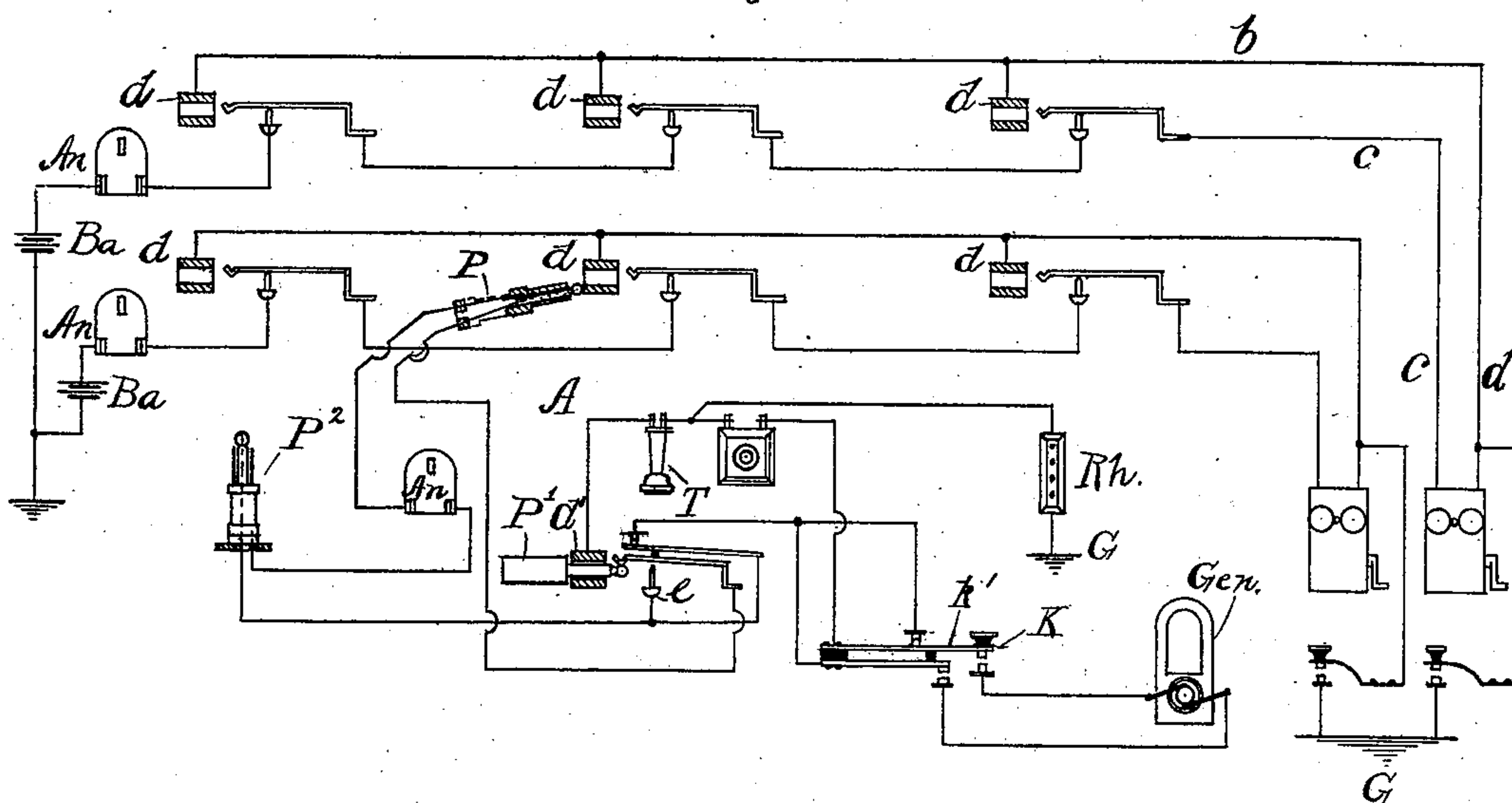
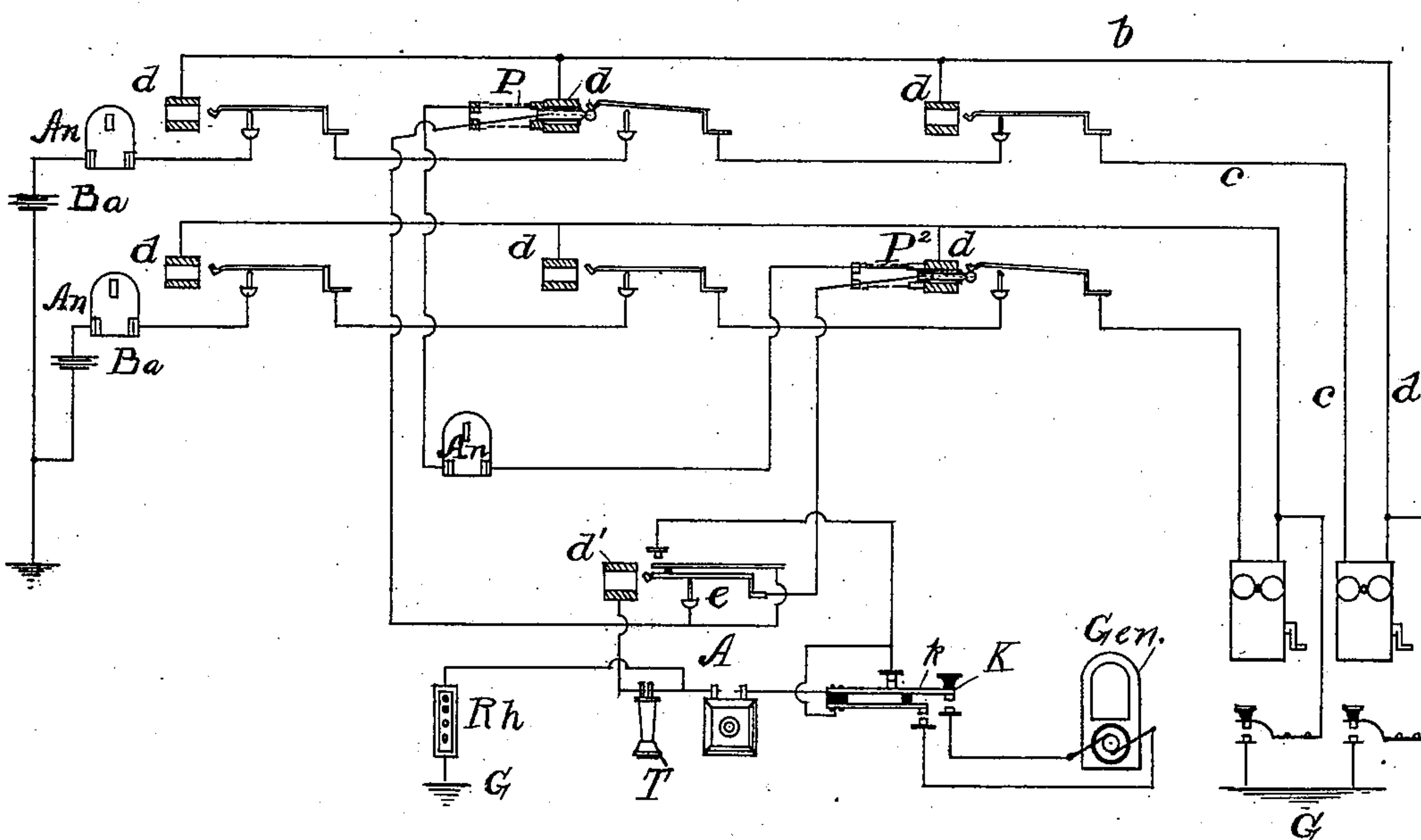


Fig. 6.



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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 564,173, dated July 14, 1896.

Application filed November 17, 1887. Serial No. 255,380. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. CARTY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Telephone-Exchange Apparatus, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone-exchange systems and circuits, particularly to such systems in which metallic circuits are employed between the central office and the substations, and has special reference to certain operations necessary to be performed by the central-office operator in communicating with the substation, and vice versa, and in the circuits and apparatus therefor, and may specifically be stated as, first, improved means for signaling in metallic circuits between the central office and the substations, and vice versa; second, an improved system of central-office testing, whereby an operator at one board, in a system of multiple boards, may find out whether a line is in use or not on any other board; third, an improved device for looping the operator's instrument set into the line leading to a subscriber's station; fourth, an improved double connector-plug arranged to maintain the continuity of that portion of the metallic circuit having the central-office-operator's instruments in its circuit, when the plug is employed in the switchboard-socket or at rest on its metal plate; fifth, a metallic circuit both ends of which are in the central office, one end being normally open and the other end being connected to ground through an electrical generator and an annunciator arranged so that when connections are made a closed metallic circuit is formed.

To describe my invention in detail, Figure 1 of the drawings illustrates the connections of a substation-line on three switchboards and the connecting-sockets on each board in a metallic-circuit central-office multiple system at the one end, while located at different positions on the circuit are two substations, as shown. Fig. 2 illustrates the central-office operator's looping-in metallic-circuit apparatus, consisting of double connecting-plugs,

telephones, looping-in socket and plug, calling-key, and electric generator. Fig. 3 shows a section of a looping-in socket with a plug inserted. Fig. 4 shows a section of a switchboard-socket with a connecting-plug inserted. Fig. 5 represents a modification of the operator's circuit-changing socket. Fig. 6 is a diagram of two metallic circuits connected through the central office. Fig. 7 is a view showing the manner of testing.

In Fig. 1, a , a' , and a^2 are the terminal connecting-sockets of a line-circuit, one on each of three boards in the central office. These sockets are of the ordinary kind employed on the multiple switchboards of telephone central offices, composed of a metal body d , having an orifice for the reception of a plug, an insulated contact-screw e , upon which rests normally a spring f . One wire b of the metallic circuit is connected to the metal body d , the other wire c of said circuit being connected to the tail of the spring f . Both wires b and c run to the substation or stations, two being shown, as M and N . I have shown the wires b and c as connected to the signal apparatus of each substation only, the telephones and other apparatus not being shown.

Each signal apparatus is looped into the line, but I show a ground-wire W and a normally open key K at one side of the apparatus, for a purpose to be hereinafter explained.

The wire c leaves the contact-screw e of the socket a , connecting in the line-annunciator An' , and goes to ground through battery Ba .

The operator's looping-in apparatus is shown in Fig. 2, of which P and P^2 are double connecting-plugs composed of a body of insulating substance i , a central metal plug j , surrounded by but insulated from the tubular plug l on one end, with wires c' and b' extending from the plugs j and l through the body to two metal plates o and p at the opposite end of the plug and to the binding-posts r and r' , as shown. When the plugs P and P^2 are at rest, the plates o and p at their lower ends rest upon metal plates q and close the circuit between the wires c' and b' at those points.

A is a looping-socket of the same general construction as the line-terminal sockets a , but has an additional spring f' attached thereto, as shown, outside of the spring f

and insulated therefrom, but moving with it, its free end arranged to make contact with the stop g and its opposite end connected by wire t with the contact-screw e' . I arrange one of these sockets A for each pair of plugs P and P² and their wires or cords on the operator's table. The wire c^2 of the plug P² connects with the contact-screw e' , the wire b^2 extending from said plug through annunciator An' to the binding-post r^2 , which is connected by wire b' with the metal p of the plug P. The other plate o of the plug P connects by wire c' to binding-post r^3 , from which runs wire c^3 to the spring f of looping-in socket A. A wire s runs from the body d' of the socket A through the telephones T and T' to the part k' of a double key K, and a wire h extends also from the stop g to the back contact of the said key. A wire u connects the lower part k^2 of the key K with the wire h , as shown. The key K is arranged to strike the two anvils n and n' to loop in the generator Gen. From the wire s I run a wire s' to ground through a resistance Rh for a purpose fully explained in the following description of the operation of my improved circuits and apparatus.

If a substation desires to call the central station, the operation can be performed in two ways: first, by means of the crank-magneto S, depressing the key K forms a ground connection at the substation, and at the same time turning the crank, sending a current over the line, through the annunciator and battery at the central office, causing its drop to fall, and going to ground through the battery Ba; or, secondly, by depressing the key K and utilizing the battery Ba at the central office to cause the annunciator to fall.

When the central-office operator wishes to test a line to ascertain whether it is in use or not, the plug P' (see Fig. 3) is inserted into the looping-in socket A, thereby looping into circuit the telephone T, as the spring f leaves the screw-contact e' and the spring f' makes contact with the stop g , so that a local metallic circuit then exists from plate q of plug P², wires c^2 , contact-screw e' , wire t , spring f' , stop g , wire h' , key k' , wire s , including telephone T, socket d' , plug P', spring f , wire c^3 , plate q of plug P, wire b' and b^2 , to plate q again. This circuit is now broken by the removal of the plug P from its rest-plate q , the operator to test touching its terminal j to the metal socket d of the line wanted. The operator at the middle board, as shown in Fig. 7, has thus applied the tip of plug p to the test plate or tube d of the line which is being tested. When one of the pair of plugs is thus used for testing, it will be understood that the other plug of the pair will have been inserted in the spring-jack switch of the calling-subscriber's line in making the initial connection therewith. In Fig. 7, however, the plug p^2 is not shown thus inserted. It may be convenient at times to test a line, as shown, leaving the other plug of the pair

in its socket, but ordinarily connection is first made with the calling-subscriber's line with one plug, and the order being received for connection with another line the line thus wanted is tested. If the line is in use, there will be no click in the operator's telephone, as the battery Ba will have been removed from the line by the plug used to connect the line-terminal with the one called. If the line is not in use, a "click" will be heard, as a circuit will have been formed from, via ground, battery Ba, conductor c , stations M, N, conductor b , socket d to plug P^h, continuing by wires c' c^3 , spring f , plug P', socket metal d' , wires s and s' through resistance Rh to ground. This resistance Rh is sufficient to prevent appreciable loss of voice-current, while affording a path to ground for the test-battery.

The operator's telephone being connected in metallic circuit could not be used in testing for line, so I put in a ground branch s' with resistance Rh sufficient in amount to prevent the annunciator An from being thrown down during the testing. The resistance Rh , besides serving to cut down the battery-current to a strength insufficient to actuate the annunciator, serves to prevent the noise in the operator's telephone, due to the presence of a ground on her metallic circuit. It is a well-known fact that when a ground connection is extended from a metallic telephone-circuit a path to ground is furnished for static charges induced upon the line, and that the effect of such charges upon the telephone is to cause a noise therein, and this noise may be diminished or prevented by inserting in the ground connection a resistance. Having found the line free, and wishing to call the substation, the operator next inserts the double plug P into the socket of the line, thus connecting the operator's local metallic circuit into the line metallic circuit, as will be seen by tracing the course of the circuit, starting from plate p of the plug P, annular plug end l , socket-frame d , by wire b to substation through its bell S, returning by wire c , spring f , part j of plug P to plate o of the plug. The local metallic circuit having already been described need not be again traced.

In Fig. 6 the metallic telephone-circuit bc is shown looped in metallic circuit with the other telephone-line. When the plug P is first inserted, the line bc is connected with operator's telephone set, provided a plug P' is inserted in the looping-in jack A, as shown in Fig. 3. Now the final connection between the two lines is made by inserting the corresponding plug p^2 of the pair in the spring-jack loop-switch of the other telephone-line on the same board, or, as shown in Fig. 6, upon an adjoining board or section of the switchboard. In this manner the two telephone-lines are looped together for conversation. The operator, to call the attention of the called subscriber thus wanted, next depresses the double key K, looping in the gen-

erator Gen, which may be a magneto-generator or any other source of electricity.

I have not made mention of the circuits and apparatus except as they relate to signaling and the necessary connections to effect that result; but it will of course be understood that the signaling-circuits are talking-circuits and that telephones will be used, although not so shown or described.

The double connecting-plug P may also be used to connect together the central-office terminals of two line-circuits, and in practice I so use them.

In Fig. 5 I show, in connection with the operator's looping-in socket, a modification in the manner of connecting the operating parts, the operator's instrument outfit being represented by the telephone T³, and a substation B being shown without any of the intervening apparatus. In this case the spring *f*, instead of making a part of the line, is used to connect the telephones in. The wires *y* and *z* from a substation connect, after passing through the switchboard and double plugs, with contact-screw *e'* and spring *f* of the socket *d*, respectively, the wire *z* being connected to the socket *d*, looping in the telephones and terminating with the tail of spring *f'*, the stop *g* being connected with the contact-screw *e'*. When the metallic plug P' is not inserted in the jack, the circuit enters the spring-jack by the contact *e'*, passing thence to the line-spring *f* and to line again. When the plug P' is inserted, the circuit may be traced from line to contact *e'*, thence to contact-point *e'* by wire *z'*, thence to the upper spring *f'*, through telephone T³ to body *d'* of switch, through metallic plug P' to line-spring *f*, and then to line.

It is obvious that the arrangement I have described admits of testing by other methods than the one I have described. For instance, one end of an independent conductor may be applied to the frame of the spring-jack and the other to the tongue of the operator, in which case the presence or absence of the battery would be noted by an electrolytic taste or by the absence thereof; or I may provide a permanent electromagnetic testing device with a normally open terminal, such as a flexible conductor terminated by a metal plug, which, when touched to the frame of any jack, will operate the testing device by means of the line-battery, if said line is not already in use.

I claim—

1. In a multiple-switchboard telephone system, a metallic return-line circuit extending from a central station to a series of substations and normally open at the said central stations; a spring-jack or contact socket therefor at each of a number of boards, the metal frames of said spring-jack being united to one wire of the said metallic line-circuit; and the contacts of said jack insulated from said frame being successively included in the circuit of the second line of said circuit; a battery connected with the said second line between the

final spring-contact and the ground, a loop extension at the central station including a ring-off annunciator, and provided at each end with a double conductor-plug, whereby the said metallic line-circuit may be connected with any other metallic circuit; and a testing or try signal device comprising an auxiliary spring-jack with a spring-contact forming part of the loop extension, a ground-branch circuit connected to the frame thereof; a receiving-telephone and a resistance-coil or its equivalent included in the said ground branch and a solid plug adapted when inserted to bring said ground branch into contact with the loop extension in the manner and for the purposes specified.

2. The combination in a multiple telephone-switchboard, of a pair of double-contact or metallic-circuit connecting-plugs, a local loop-circuit including the said plugs, and a spring-contact; a telephone or telephones; a normally open extension of the said local loop-circuit including the said telephones; and a spring-jack socket and solid plug therefor controlling the spring-contact of the loop-circuit and adapted upon the insertion of the said plug in the said socket to open the said spring-contact, and to close a second, whereby the normally open telephone extension-circuit is made to form a part of the local loop-circuit, substantially as hereinbefore described and for the purpose specified.

3. In a multiple switchboard wherein each line entering the office is represented upon each board by a separate contact spring-jack, the hereinbefore-described looping-in device consisting of the double conductor-plugs, the metal ring seat therefor upon which the said plugs normally rest and which serve to connect the two conductors in each plug together, so that when one is lifted the other maintains the continuity of the local circuit; a local loop-circuit extending by double conducting-cords from the two plugs; an auxiliary jack included in the said local circuit; a solid metal plug controlling the contacts thereof, a continuation of the said circuit controlled by the said auxiliary jack and plug and including the office-telephones; and a double key controlling the signaling appliances, as and for the purposes specified.

4. The combination in a multiple telephone-switchboard adapted for the interconnection of metallic line-circuits of a series of connecting sockets or spring-jacks, one for each line on every board; with a double-wire connecting and signaling apparatus composing the following elements, a local loop-line provided at each end with a double-conductor connecting-plug, whereby the switchboard spring-jack of one line may be connected with that of another line; an auxiliary spring-jack forming part of the said loop-line; a solid metal plug adapted for insertion therein; a normally open continuation loop-circuit including telephones, having its open terminals in and controlled by the auxiliary spring-jack,

and a double key included in said continuation circuit; a calling-generator or equivalent source of energy in a second continuation loop, adapted to be connected with the
 5 first by depression of the said double key, all arranged and connected as described, whereby when one or both of the double plugs are in use, the office-telephones may be introduced or looped in by the insertion of the solid plug
 10 in the auxiliary jack, or signals may be transmitted by pressure of the keys, substantially as hereinbefore described.

5. The combination with a series of pairs of connecting cords and plugs, each provided
 15 with two conductors for the connection of metallic circuits, of a local spring-jack and a solid plug for each pair, with a continuation loop-circuit including telephones and signal-sending keys common to the series and adapted
 20 to form a part of the circuit of any pair of cords and plug connectors through the local spring-jack thereof and upon the insertion of the plug of the said jack as described.

6. In a multiple-switchboard system for metallic circuits, the try-circuit and testing apparatus consisting of the normally open metallic line-circuit, a spring-jack on each
 25 board therefor, each jack having contacts serially connected in one side of the line-circuit, and having its insulated frame connected by a branch with the other side of the line-circuit, the battery normally connected
 30 with the contact side of the line, the testing-plug P, the auxiliary jack and the solid plug therefor, a ground branch circuit including a receiving-telephone, and a suitable resistance, and a connecting-wire between the plug P and the auxiliary jack which by the
 35 insertion of the solid plug is brought into contact with the telephone ground branch, whereby by inserting the solid plug and touching the frame of any of the line spring-jacks, it may be ascertained by the presence or absence of
 40 a click caused by the battery whether or not the line is in use or any other board.

7. A pair of loop-plugs having the corresponding terminals thereof connected together by different strands of flexible cords, an
 50 operator's metallic telephone-circuit adapted to be connected in circuit with said strands, and a ground connection from said opera-

tor's metallic circuit, containing a resistance adapted to prevent the disturbance of the operator's telephone set by static discharges, substantially as described. 55

8. A pair of loop-plugs having the corresponding terminals thereof connected together by different strands of flexible cords, an operator's local metallic circuit including a
 60 telephone, a switching device adapted to connect said local circuit in circuit with said strands, and a connection to ground from said local circuit containing a resistance adapted to prevent the disturbance of the operator's
 65 telephone by static discharges, substantially as described.

9. In a telephone system, the combination with a telephone-line, of a normally-closed connection to ground at the central station containing a battery and a calling device,
 70 a grounded testing set adapted to be connected with the line at any board, and a resistance included in circuit with said grounded testing set so adjusted relatively to the voltage of said battery that said calling device
 75 remains unactuated when circuit is closed through said grounded testing set, said resistance being also adjusted to prevent the disturbance of the operator's telephone when on metallic circuit, due to static charges passing
 80 to earth through said ground connection substantially as described.

10. In a telephone system, the combination with a telephone-line, of a normally-closed connection to ground at the central station
 85 containing a testing-battery, an operator's metallic circuit containing her telephone set, a ground connection from said metallic circuit, whereby said operator's telephone may be included in circuit with said testing-battery, and
 90 a resistance included in said ground connection adapted to prevent the disturbance of the operator's telephone when on metallic circuit due to static charges passing to earth through said ground connection, substantially as de- 95
 scribed.

In witness whereof I hereunto subscribe my name this 7th day of November, A. D. 1887.

JOHN J. CARTY.

Witnesses:

CHARLES A. TERRY,
 DANL. W. EDGEComb.