(No Model.) 2 Sheets—Sheet 1.

E. POPE.

TELEPHONE EXCHANGE SYSTEM.

No. 515,939. Patented Mar. 6, 1894.

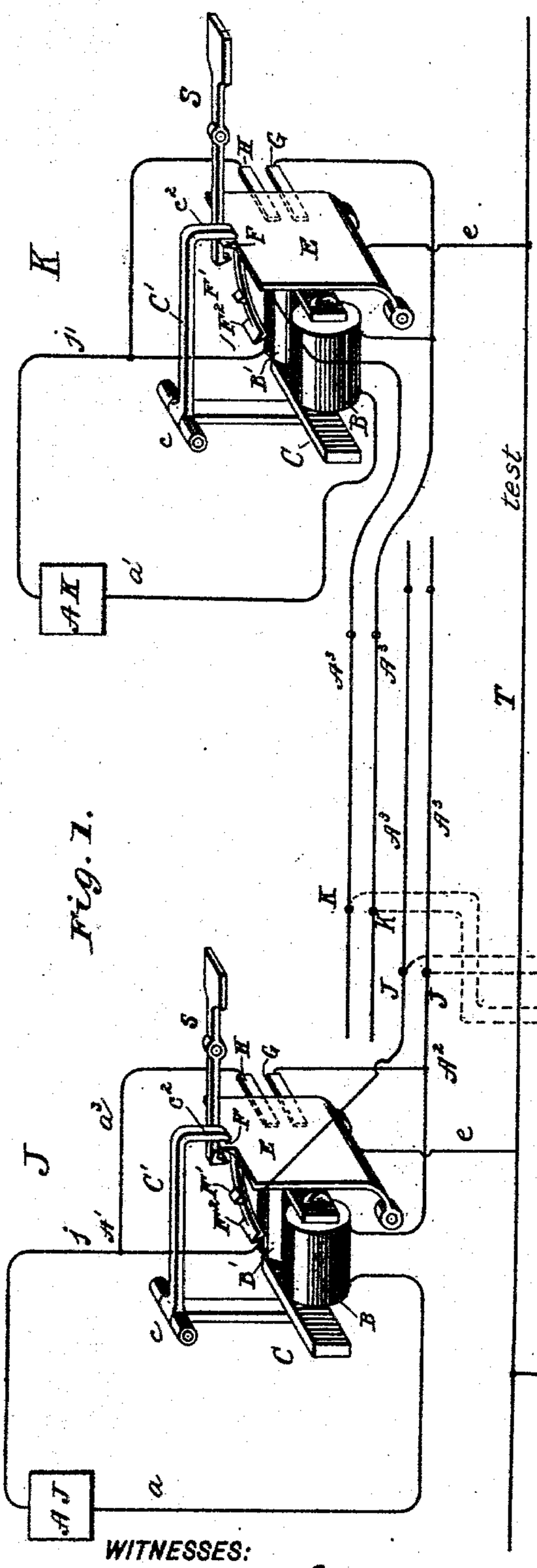


Fig. 1.

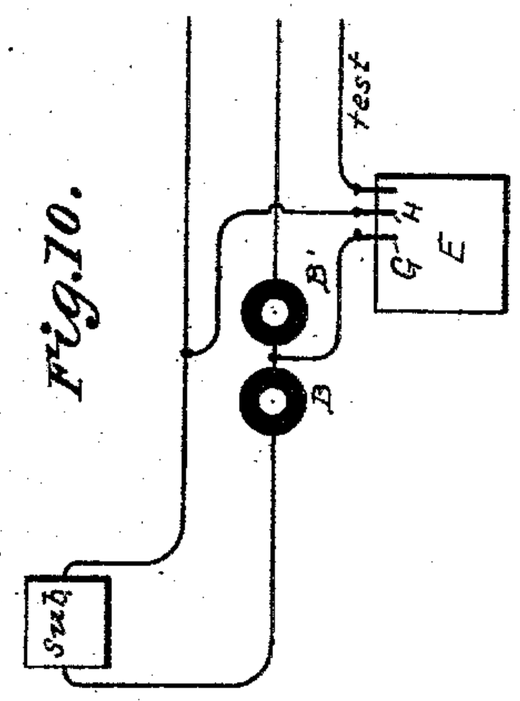


Fig. 10.

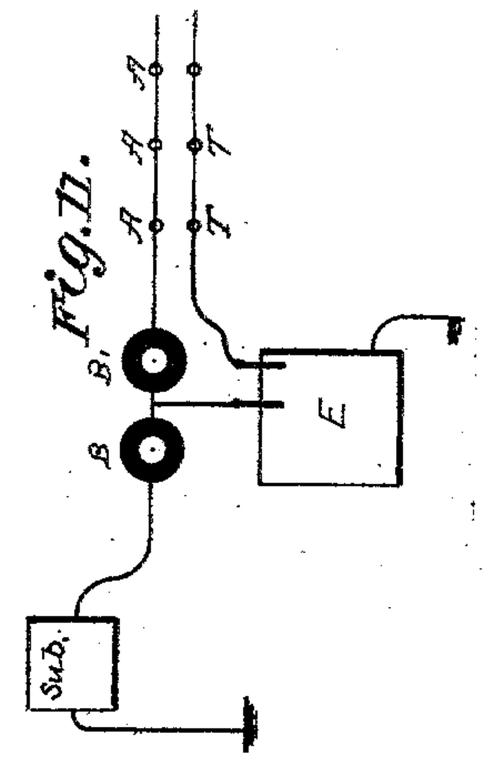
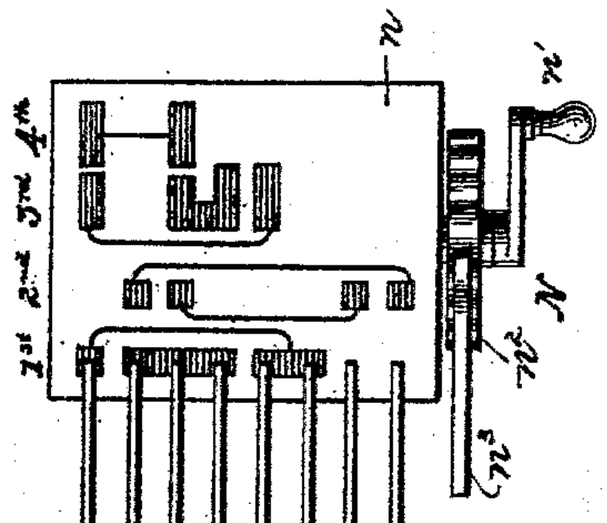


Fig. 11.



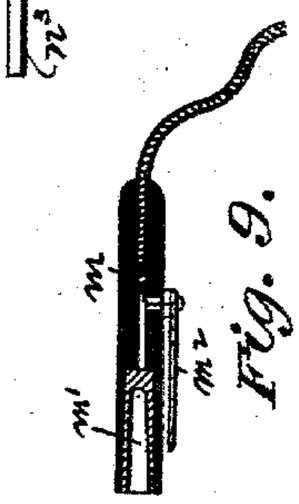


Fig. 9.

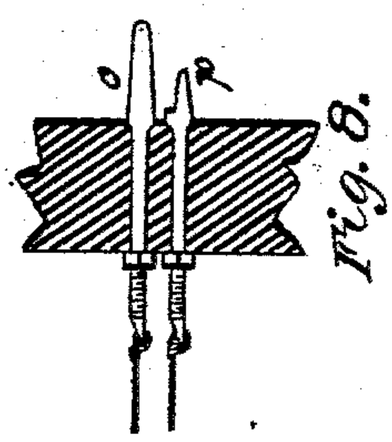


Fig. 8.

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(No Model.) 2 Sheets—Sheet 2.

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TELEPHONE EXCHANGE SYSTEM.

No. 515,939. Patented Mar. 6, 1894.

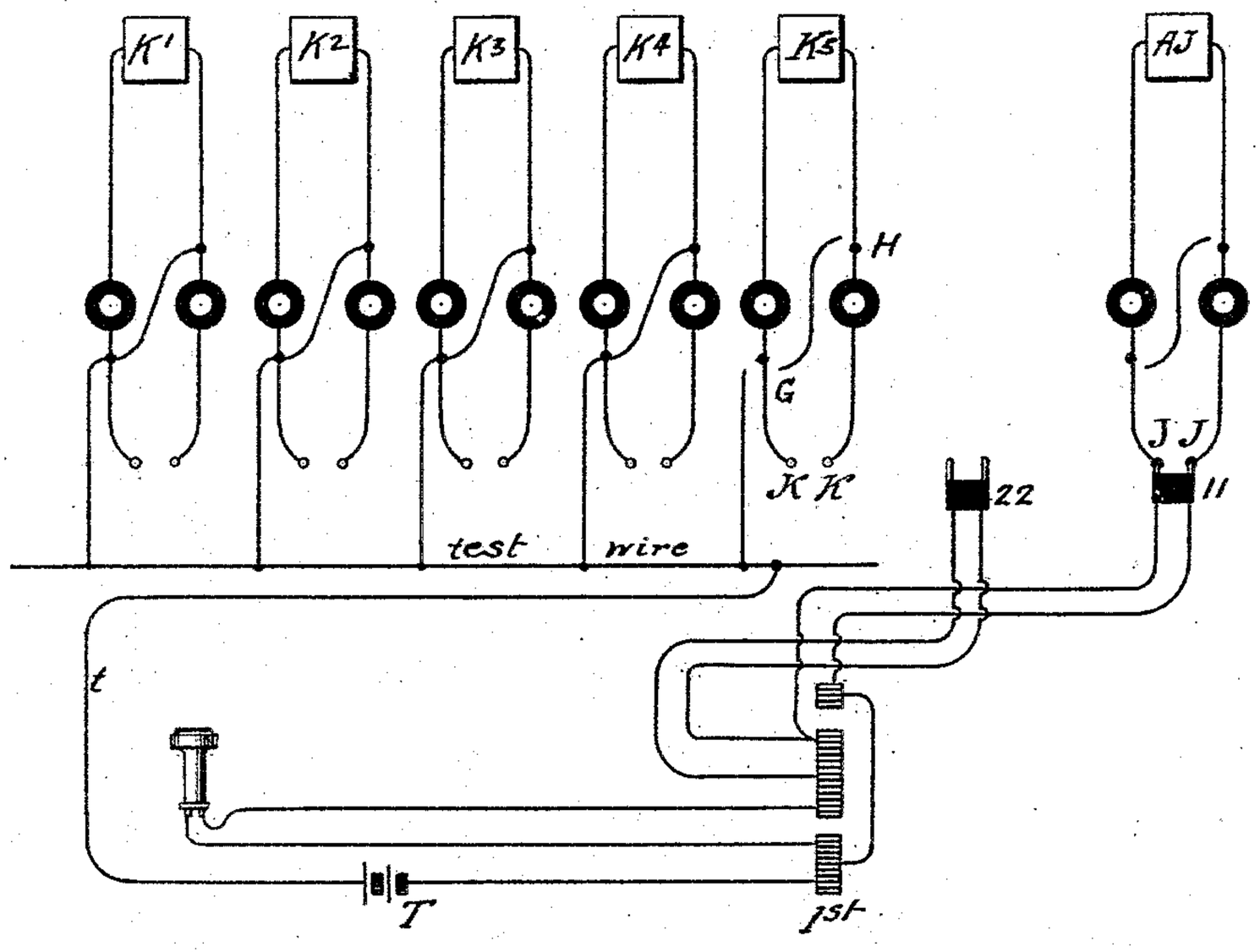


Fig. 2.

Fig. 6.

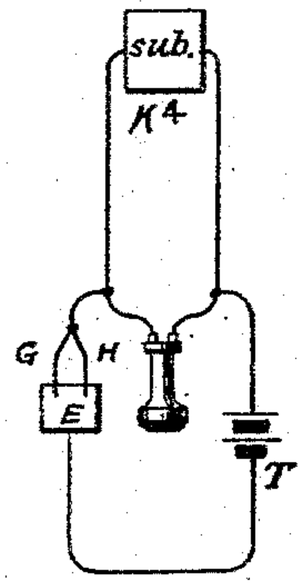


Fig. 4.

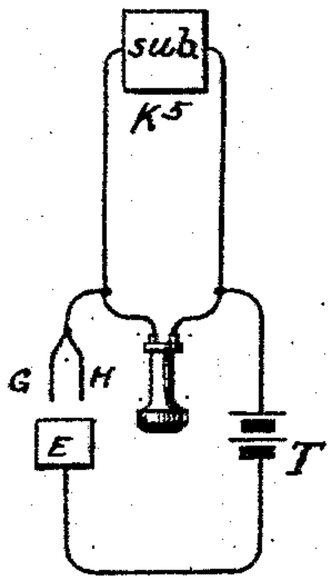


Fig. 3.

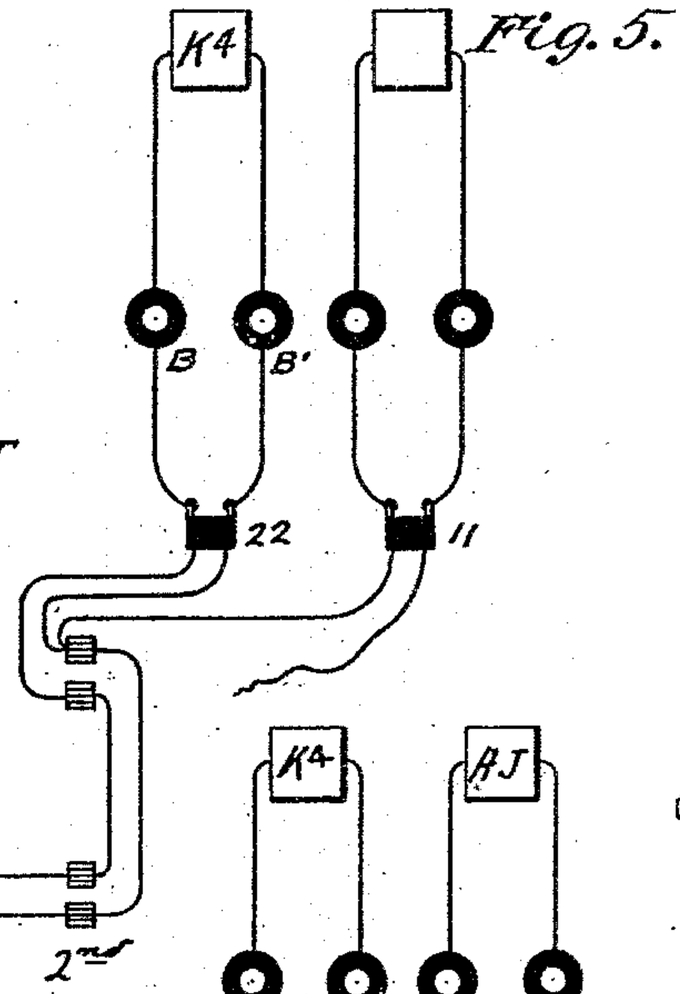
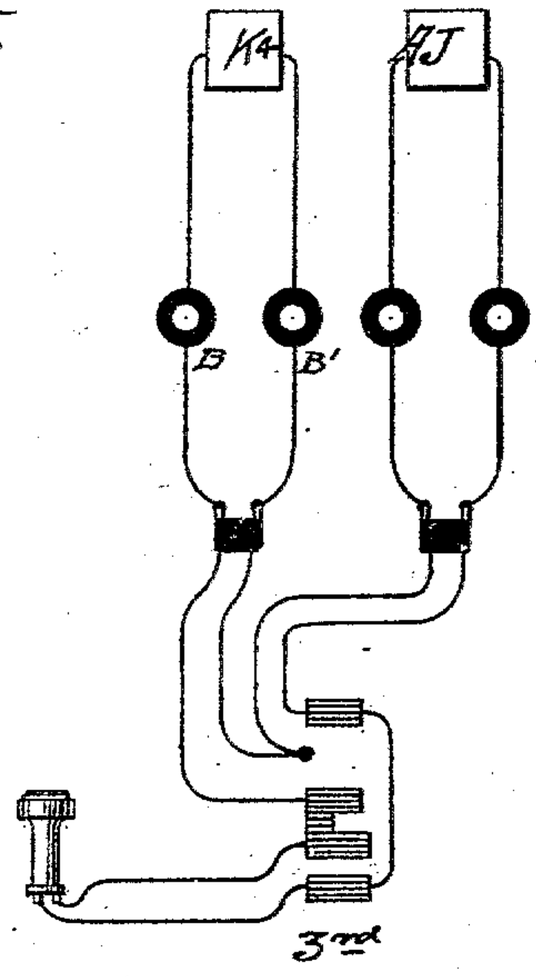


Fig. 5.



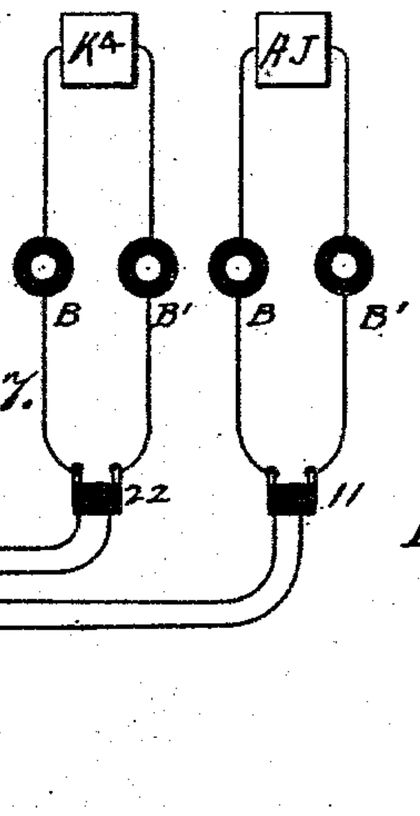


Fig. 7.

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UNITED STATES PATENT OFFICE.

EDWIN POPE, OF QUEBEC, CANADA.

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 515,939, dated March 6, 1894.

Application filed August 3, 1892. Serial No. 442,011. (No model.)

To all whom it may concern:

Be it known that I, EDWIN POPE, a subject of the Queen of Great Britain, residing at Quebec, in the Province of Quebec, Canada, have invented certain new and useful Improvements in Telephone-Exchange Systems, of which the following is a full, clear, and exact description.

This invention relates to telephone exchange systems, and has special reference to the construction and operation of multiple switchboards for metallic circuit systems, the objects being to simplify the construction and thereby lessen the cost, and to simplify the operation of connecting together subscribers.

The invention entirely dispenses with the use of spring jacks, and substitutes therefor plain contact points in the circuit.

The invention will be described in detail with reference to the accompanying drawings, in which—

Figure 1, represents, diagrammatically, the apparatus and circuits of two subscribers, together with a switching apparatus by means of which communication between subscribers may be established. Fig. 2, illustrates the circuits of a number of subscribers in connection with a test wire and switch. Figs. 3, and 4, illustrate the condition of a subscriber's circuit when "busy" and "free," respectively. Figs. 5, 6, and 7 represent various circuits established by the operation of connecting subscribers together. Fig. 8 is a sectional detail of the switchboard. Fig. 9, is a sectional detail of the plug connected with the switching apparatus. Fig. 10, illustrates a modification in the connections, and Fig. 11, shows how the invention may be applied to single or grounded circuit systems.

Referring to the drawings by letters and figures, A J and A K are respectively two subscribers' stations, the two wires leading from each of which are represented respectively by a, j, and a', j'. These wires extend respectively to corresponding drop magnets and connect the coils B and B′ of said magnets in parallel. From the two coils the wires lead to open "plugging in" points J. J. or K. K., &c., located, one pair on each section of the multiple board. The wires extending through the switchboard are represented by A^3 A^3. The point A′ on the wire j, and the point A^2 on the wire a, are connected by a branch conductor a^3. This conductor includes a circuit breaker consisting of two contact springs G and H, which when the drop E is up are electrically connected together. A closed circuit including the subscriber and coil B is thereby established, leaving the coil B′ in open circuit.

C is the armature of the drop magnet, and C′ is a bell crank lever pivoted at c, and carrying at its forward end a dog c^2, which engages with three stops, F, F′, F^2, respectively, carried by the drop E; these stops determine the various positions which the drop may take. The third stop F^2 is made wider than the others, so that it will engage with the detent S, arranged alongside of the dog c^2, and in such a position that F^2 will strike S before it strikes c^2. For convenience we will assume that the drops of the two magnets are located on sections J and K, respectively, of a multiple switchboard, and it is to be understood that the drop magnets are constructed and connected up alike, and that the drop E of each one is in constant communication by wires e, with a test wire T. Each of the switchboard operators is provided with a number of switching devices N, say a dozen, the number being sufficient to make all the connections required at any one time. This switch consists preferably of a cylinder n of insulating material, having located in its surface four longitudinal rows of metallic contact pieces. The positions of the contacts of each row are shown in Fig. 1, and indicated by 1st, 2nd, 3rd, 4th. Upon the cylinder eight metallic springs 1, 12, 2, 3, 3, 4 and 5, 5, bear. A crank n' is used to rotate the cylinder from one position to another to bring the rows of contacts beneath the springs, and a spring n^3 bearing upon the periphery of a notched wheel insures the accuracy of movement of the cylinder. The wheel has eight notches allowing the cylinder to turn eight times in a revolution, and making one full connection in a half revolution. The springs 1, 12, are connected through a flexible cord with two contacts carried by a plug 11, and springs 2, 12, connect with another plug 22, through a flexible cord in the same manner; the springs 3, 3, connect with the operator's instruments; spring 4 with the test battery T′ and test wire, and springs 5, 5, with the magneto current used for calling.

The construction of the plugs 11 and 22 is shown in detail in Fig. 9, wherein it will be seen to consist of a block of insulating material m, carrying a cup-shaped metallic socket m', and a metallic spring m^2 insulated from the socket. The socket and spring are respectively connected with the wires of the flexible cord leading to the springs on the switch, as described. The face of the switch-board is preferably a slab of slate, marble or other fireproof material forming a good insulator through which are passed bolts or pins o, p, with a shoulder in front and fastened with a nut in the back. (See Fig. 8.) These are arranged in pairs, one of each pair adapted to fit the socket m', and the other to make contact with the spring m^2, when the plug is adjusted.

The operation of the system is as follows: The normal or "free" condition of the apparatus is shown in Fig. 1. When subscriber A J calls, the current which he sends over line passes through coil B, and circuit breaker G H E. C is attracted and drop E fall. But as the circuit is opened between G and H immediately, B becomes de-energized, and c^2 engages with the stop F'. Operator at board noting which subscriber has called, puts plug 11 of one of the switches N into the subscriber's line at the points J J. Now the springs of the switch are supposed to be in the first position upon the cylinder; consequently when 11 is plugged into J J, the operator's telephone O, P, is put into circuit with the calling subscriber. This circuit is traced as follows: from operator's telephone to spring 3, through the switch to spring 12, wire A^3, wire a, subscriber A J, wire j, wire A^3, flexible cord and spring 1, through the switch to spring 3, and back to telephone. Operator gets the number of connection wanted then puts plug 22 into K K which represents the subscriber wanted. If the line is free a click is heard in the telephone, which is caused by the testing battery T', acting through the following circuit: from battery T', to spring 4, through the switch to spring 3, operator's telephone, second spring 3, through the switch to spring 2, wire A^3 from K board, contact G, drop E, wire e, test wire T, wire t and back to test battery. When this circuit is established the current is free to take either of two paths one of which is the one just traced, and the other is through the spring 12, wire A^3, and coil B', of the drop magnet, but as the current takes the path of lowest resistance, very little of it will flow through the magnet and the drop will remain up. If subscriber A K had been busy, his drop E would have been down and the connection G H E broken, consequently the calling operator would have gotten silence, instead of the click when she plugged into K K. "Silence" or a "click" is therefore the indication of a "busy" or "free" line. If the line is free the operator turns the switch N to the second position which puts the magneto current into the called subscriber's line by the following circuit: from magneto to spring 5, through the switch to spring 12, cord and wire A^3, coil B', wire j' subscriber A K, wire a', coil B, wire A^3, spring 2, through the switch to spring 5 and back to the magneto instrument. As this current passes through B and B' at K, drop E falls, and as this circuit is not affected by G H, it remains closed. Operator at J then moves the switch to the third position which connects the two lines together with her telephone in circuit, as folows: from operator's telephone to spring 3, through the switch to spring 1, cord and wire A^3, wire j, subscriber A J, wire a, wire A^3, spring 12, cord and wire A^3, from board K, wire j', subscriber A K, wire a', wire A^3, spring 2, through the switch to spring 3, to operator's telephone. Then finding the connection properly made operator puts the switch to the fourth position, which leaves the two subscribers together with the central instrument out, as follows: from subscriber A J by wire a, wire A^3 spring 12, wire A^3 from K board, wire j', subscriber A K, wire a', wire A^3 to spring 2, through switch to spring 1, wire A^3, wire j and back to subscriber A J. When subscriber "rings off," E at board J drops until F^2 strikes S, and the operator sees by the position of the plugs that it is a "ring off" and therefore restores E to its first position, takes out plugs and moves the switch to the next position, which is its first. When the operator calls up a subscriber whose annunciator is at another board the magneto current acting continuously on the magnet at that board allows the drop to fall until it strikes S, which is its third position. When the call is completed which is determined by the armature coming to rest, the operator at that board presses the outer end of the stop S, and allows the stop F^2, to escape and engage with c^2, at the fourth position. Then when the subscriber rings off, E drops to its lowest position and the operator restores it to first position.

Fig. 2 shows the connections when the switch is in first position, and plug 11 placed to answer a call from A J with central instrument in circuit. If subscriber K^5 is the connection wanted, operator puts plug 22 to that wire, but the connection G H E being broken the local battery and test wire do not act, and the telephone is silent, indicating that the line is engaged, see Fig. 3. If another, K^4, is wanted, plug 22 is put to that wire, and G H E being connected the test battery acts indicating that the line is free, see Fig. 4.

Fig. 5 shows the connections when the switch is in its second position with the calling current on K^4.

Fig. 6 shows the connections when the switch is in its third position with A J and K^4 connected and central instruments in.

Fig. 7 is the fourth position of the switch, showing the two subscribers connected straight and central out.

In Fig. 10 a modification of the connections is shown wherein the two coils of the drop magnet are connected in series on the subscriber's circuits, but the connections G H E are so arranged as to produce the same results. The test wire here leads to a third spring upon drop E also.

Fig. 11 shows how my invention may be used on single wire or grounded circuits. The subscriber's wire leads directly through the coils of the drop magnet and thence through the switchboard as before, a branch leads from the line between coils to ground through drop E. Line T is the test which terminates in a spring against drop E. The operation is the same as for metallic circuits. Putting double plug into A T gives either a click or silence.

Having described my invention, I claim—

1. In a telephone exchange system, a drop magnet having two coils, one in a normally closed circuit with the subscriber and the other in a normally open circuit, in combination with a circuit breaker controlled by the drop and connections whereby the circuit breaker will put the two coils into the same or separate circuits, substantially as described.

2. In a telephone exchange system, the combination with a subscriber's circuit, of a test battery normally in connection therewith, and mechanism controlled by the subscriber's drop for breaking the connection with the test battery, for the purpose set forth.

3. In a telephone exchange system, an annunciator and armature having a drop provided with a plurality of stops to limit its movement, in combination with a circuit breaker operated by the drop, and controlling the circuit of the drop magnet.

4. In a telephone exchange system, a drop magnet having its coils connected respectively in the two wires of a subscriber's circuit, in combination with a normally closed branch circuit, putting one of said coils in a closed circuit with the subscriber, the subscriber's two wires being otherwise disconnected, and means whereby the drop magnet may open said branch circuit, for the purpose set forth.

5. In a telephone exchange system, the combination with a subscriber's circuit, of a test battery normally in connection therewith and mechanism controlled by the subscriber for breaking the connection with the test battery, for the purpose set forth.

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

EDWIN POPE.

Witnesses:
W. A. H. CUFF,
A. CASAULT.