

No. 775,201.

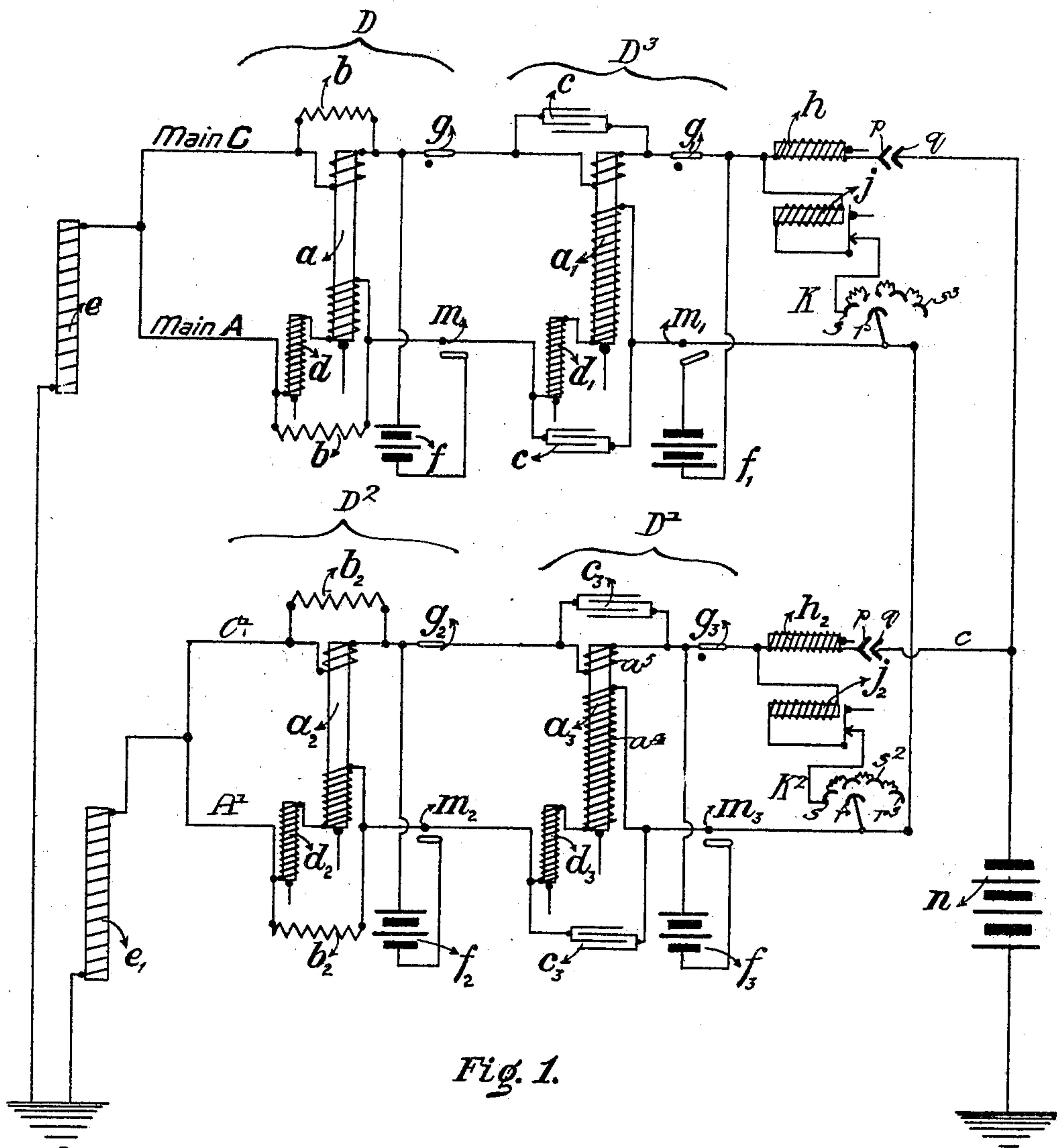
PATENTED NOV. 15, 1904.

W. R. WHITEHORNE.
TELEPHONE SYSTEM.

APPLICATION FILED APR. 27, 1904.

NO MODEL.

2 SHEETS—SHEET 1.



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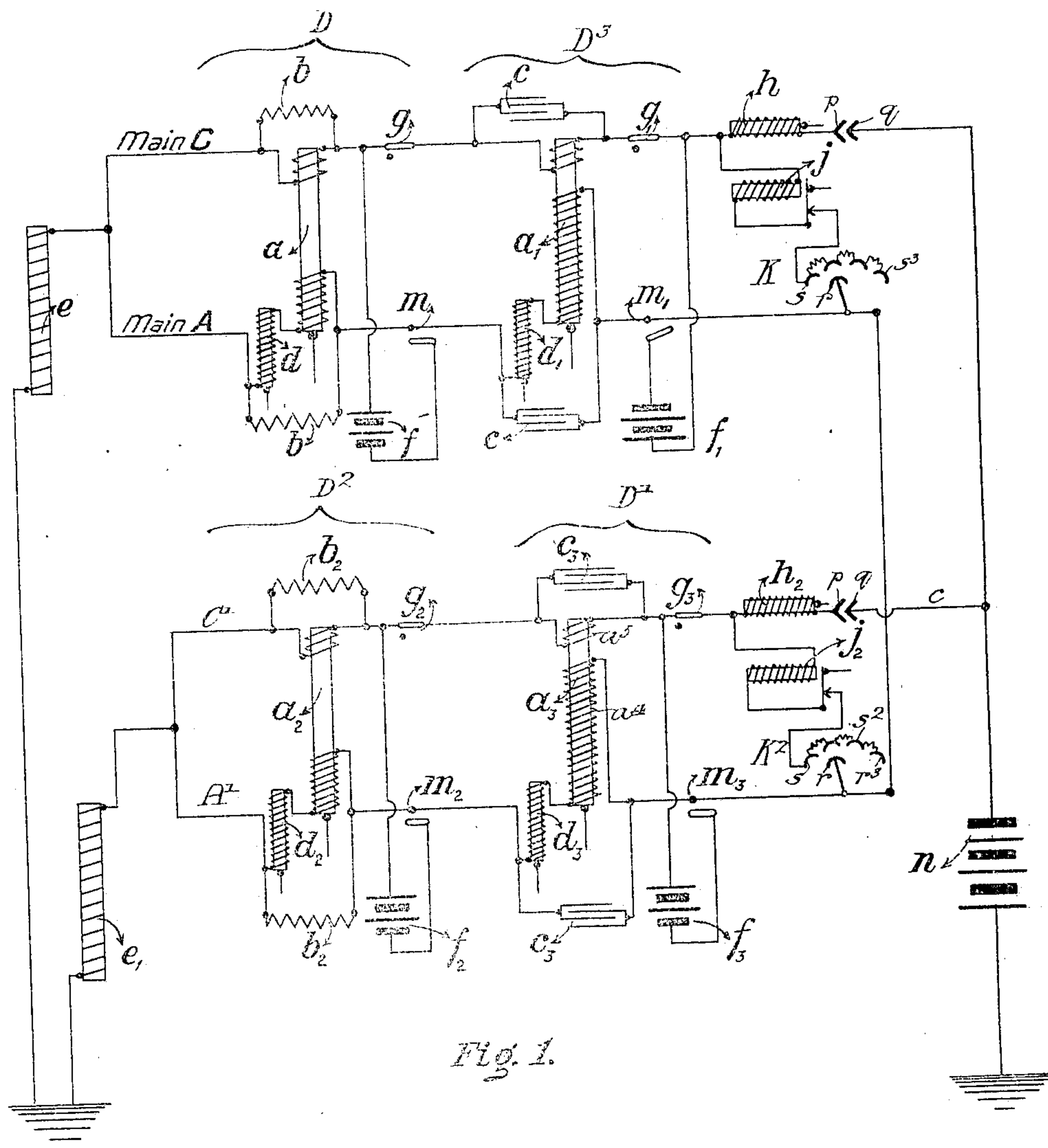


Fig. 1.

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2 SHEETS—SHEET 2.

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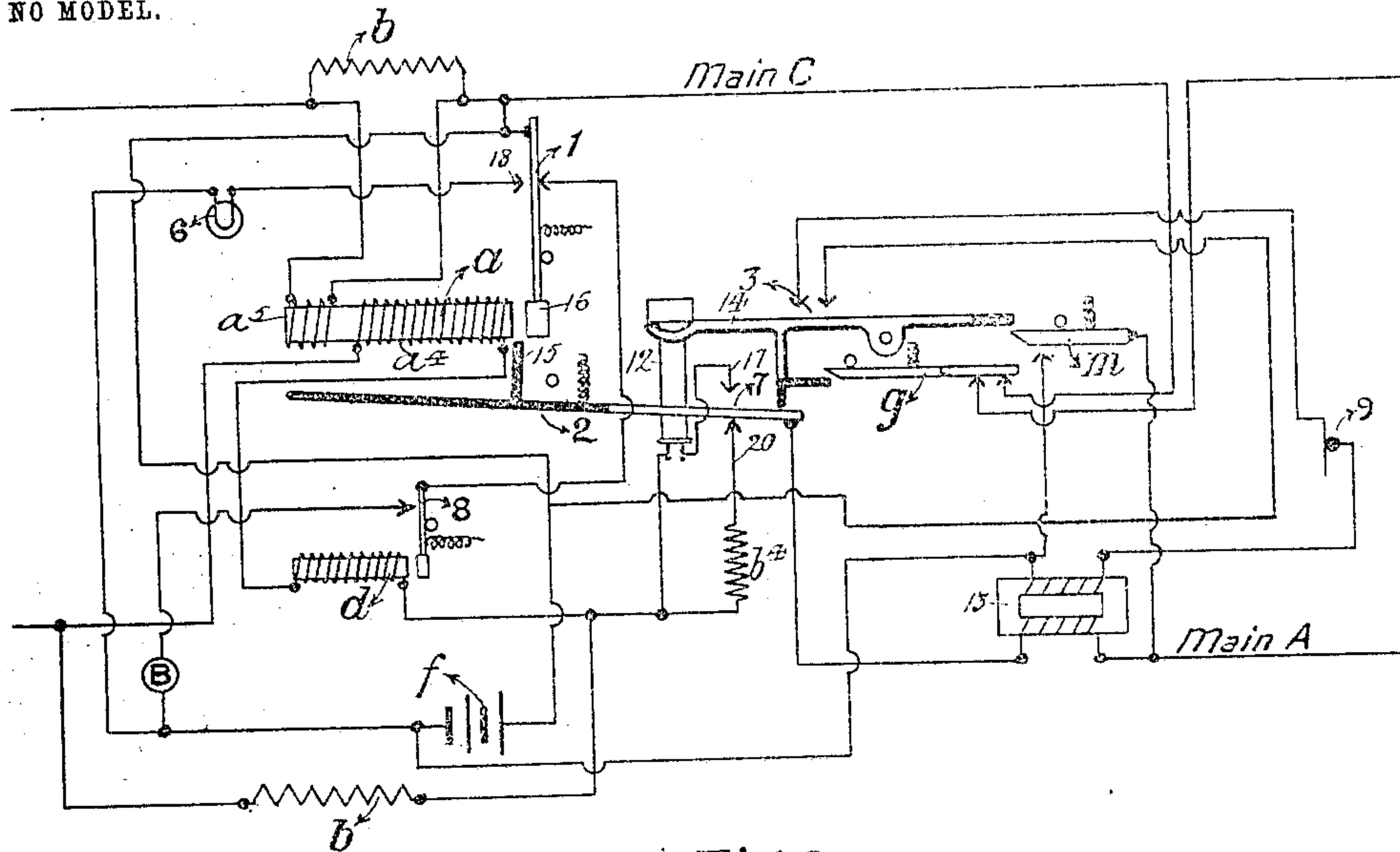


Fig. 2.

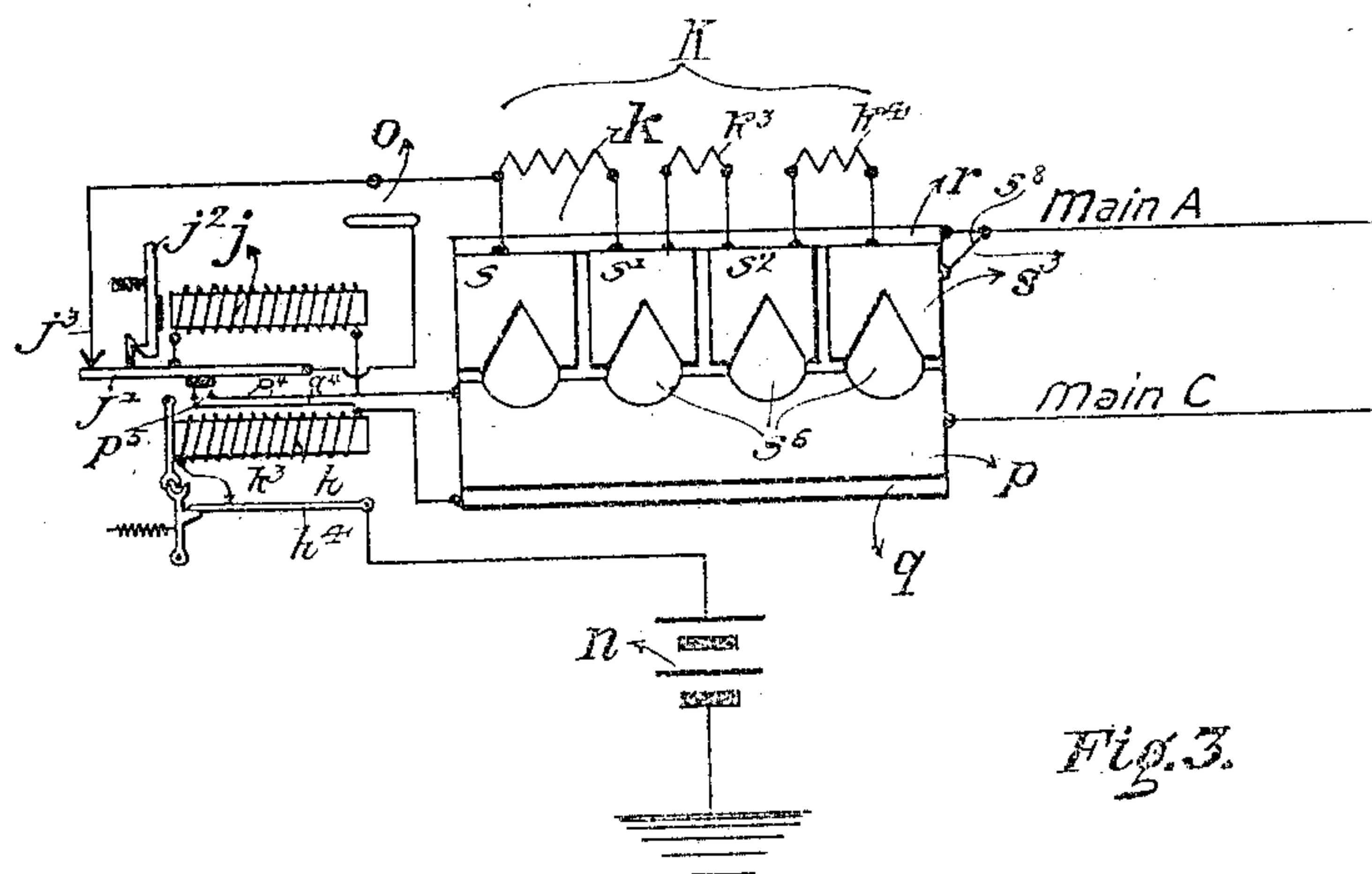


Fig. 3.

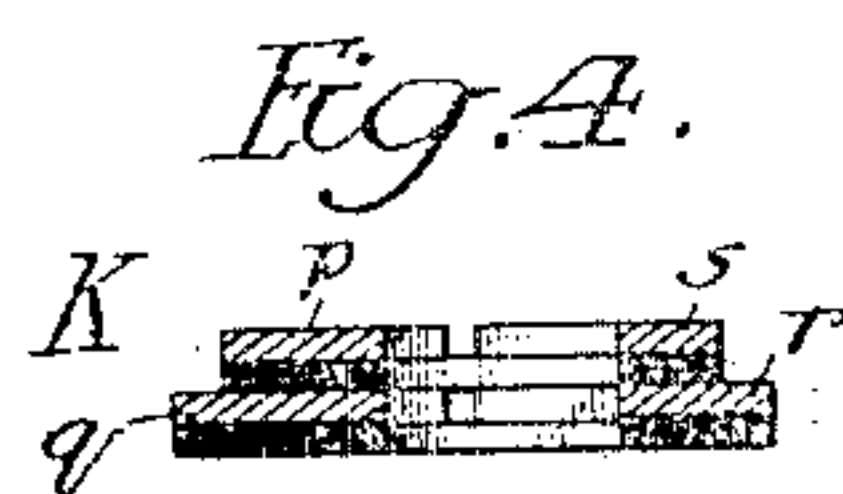


Fig. 4.

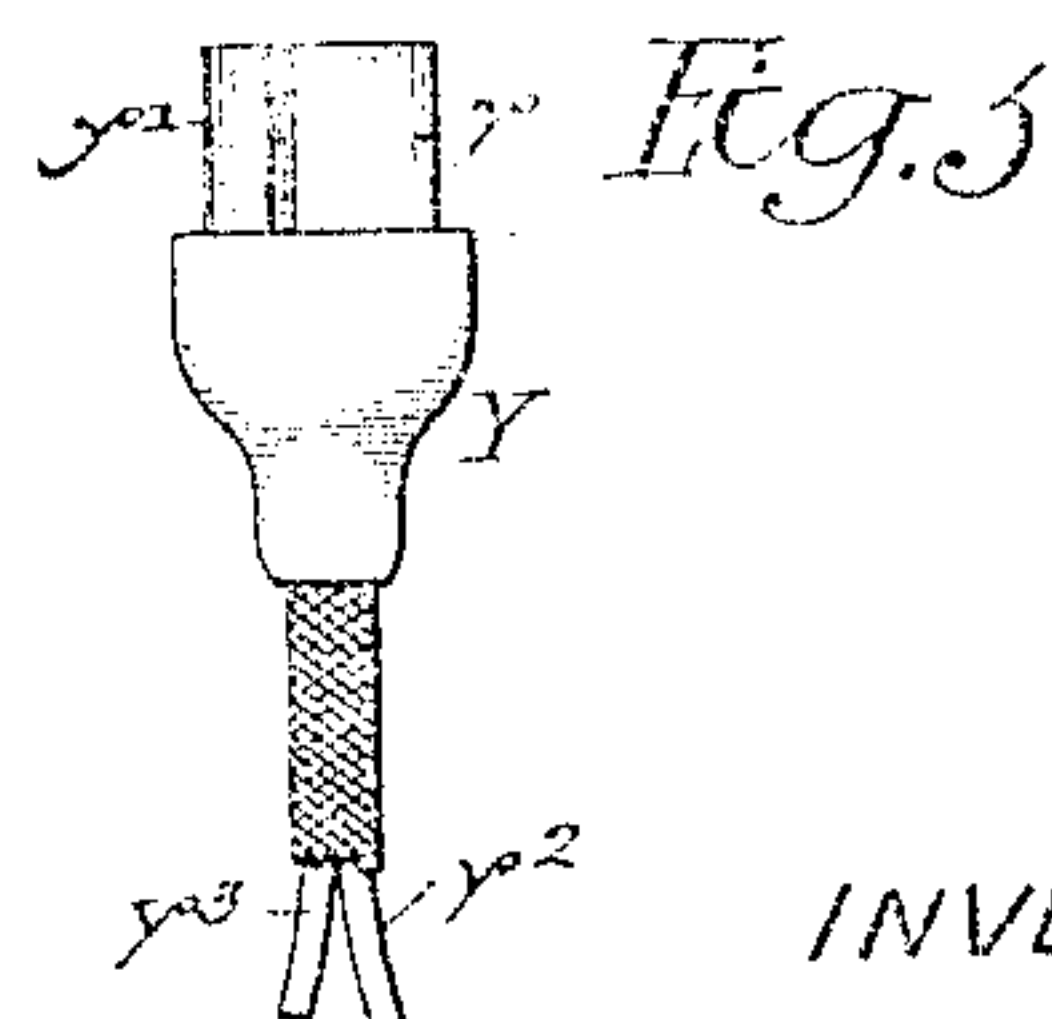


Fig. 5.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 775,201, dated November 15, 1904.

Application filed April 27, 1904. Serial No. 205,143. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. WHITEHORNE, a subject of the King of Great Britain, residing in Bethlehem, Pennsylvania, have invented certain Improvements in Telephone Systems, of which the following is a specification.

One object of my invention is to provide a party-line telephone system with apparatus so designed and connected that when one subscriber calls or is talking the instruments of all the other subscribers on the same line are rendered inoperative and are, moreover, made to indicate, visually or otherwise, that the line on which they are connected is busy.

A further object of the invention is to so equip a telephone system that even though there be a number of subscribers on the same line the central operator will be enabled to call or ring up any desired one of said subscribers and that without ringing the bell of any of the other instruments in the circuit. Moreover, my invention is so designed that it is impossible for any subscriber on the given line either to call up or to listen if any other subscriber on the same line is using his instrument.

The invention further contemplates such a combination of apparatus that the bell of an instrument called by the central operator is caused to ring by the act of said operator making the usual plug connections on the switchboard, thus obviating the necessity for the usual ringing switches, generators, &c., at central and effecting a saving in the time required for making connections.

In addition to the above objects it is desired that the apparatus for carrying out my invention shall not only be relatively simple and inexpensive, but of such a nature that it shall not be difficult to instal nor likely to get out of order.

These objects, together with other advantageous results which will be noted in the description, I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating the preferred arrangement of the apparatus comprising my invention, certain of the

detail connections being omitted for the sake of clearness. Fig. 2 is a diagrammatic view illustrating the apparatus and connections thereof as found in each subscriber's instrument. Fig. 3 is a diagrammatic view showing in detail that portion of the system usually placed at the central office. Fig. 4 is a sectional elevation of the rheostatic plug-switch shown in Fig. 3, showing the relative positions of certain of its parts; and Fig. 5 is a side elevation of one of the plugs used by the central operator in making connections between subscribers.

In carrying out my invention I employ in each telephone instrument a differential magnet whose windings usually have different numbers of turns and which is provided with an armature movable by the core of the magnet into a position such that the telephone instrument will be rendered inoperative, except when such currents flow through the respective windings of the magnet that there is substantially no action upon the armature, and consequently no motion thereof. It is upon this device and upon the principle involved therein that the main features of my invention are based.

In the above drawings, Fig. 2 illustrates the apparatus and connections found in each telephone instrument, said apparatus including a magnet a , having two windings a^1 and a^2 of different numbers of turns, of which the latter winding, a^2 , is connected permanently in series with one of the main line-wires C , there being also in circuit with said wire a normally closed switch g . The second line-wire (designated as main A) has in circuit with it a switch 7, (which is closed as long as the receiver 12 is on its hook 14,) a bell-controlling magnet d , and the second winding a^1 of the magnet a . There is also in circuit with the main A one winding of a transformer or induction-coil 13, whose second winding is in circuit with the transmitter 9 of the telephone. The transmitter-circuit also includes a local battery f and a normally open switch 3, formed in the present instance by a pair of terminals and a portion of the receiver-hook 14, this switch being closed when said hook is in its uppermost position.

The receiver-hook 14 is so constructed as to act upon the pivoted bar of the switch m , so that said switch will be momentarily closed as the receiver end of said hook rises and will be unaffected by the downward motion of said end caused by the hanging up of the receiver. Similarly the blade of the switch g , above referred to, is also placed to be acted on by the receiver-hook in such manner that while it is unaffected as the receiver end of the hook rises it is made to momentarily open when said end moves downwardly.

Suitably placed adjacent to the magnet a is a bar 2, having an arm 15, which is interposable between the armature 16 of said magnet and its core, so as to prevent movement of said armature, there being a spring, as shown, tending to move said bar into such position. It is normally held in the position shown in Fig. 2 by the receiver-hook 14, being only permitted to move and lock the armature of the magnet a when said hook rises by the removal from it of the receiver 12. In the normal position shown the metallic blade 7 of said bar 2 completes the circuit of the main A through the telephone instrument independently of the receiver, while when the hook 14 is in its uppermost position said bar by engaging a contact 17 causes said receiver to be placed in circuit with said main A. The pivoted bar 1, upon which is carried armature 16 of the magnet a , normally contacts with a terminal in connection with a bar 8, supporting the armature of the bell-controlling magnet d , while when said armature 16 is attracted by the magnet a said bar 1 engages contact-point 18 in circuit with a small incandescent lamp 6, whose second terminal is connected to one pole of the local battery f . It will be seen that said bar 1 is permanently connected to the opposite pole of said battery.

In Fig. 3 is shown the apparatus employed at the central station for making the necessary connections between the subscribers, and this consists of a small rheostatic plug-switch K and two circuit-breakers j and h for each party-line.

The switch K preferably includes metallic plates r and q , respectively connected to the main A and to one terminal of a current-generator n , whose second terminal is grounded, the connection between the plate q and said current-generator being made, as shown in Fig. 3, through the circuit-breaker h . The main C is connected to a metallic plate p , placed over but insulated from the plate q , which plate p is also connected to the magnet of a circuit-breaker j , and there are mounted upon but insulated from the plate r a series of plates s s' s'' , &c., connected to each other through banks of resistance k , k^2 , and k^4 , each of which is preferably different in amount from the others. These plates p q r and s , s' , s'' , and s^3 are assembled upon a suitable

supporting-base, as shown, and provided with recesses or openings s^5 of such form as to receive a cord-plug of the construction indicated at Y in Fig. 5. Such plugs consist of two metallic terminals y and y' , insulated from each other and connected, respectively, to the wires y^2 and y^3 of a cable, said terminals being of such a shape that the plug is necessarily inserted in the holes s^5 , so that the terminal y' always electrically connects plates p and q , while the terminal y always connects one of the plates s s' , &c., with the plate r . It will be further noted that there is a connection directly between main A and the plate s^3 for a purpose hereinafter noted.

The magnet of the circuit-breaker j is provided with a pivoted switch-arm j' , normally held closed by a latch connection with the armature j^2 of said magnet, and when so closed is in electrical contact with a terminal j^3 , connected to one end of the resistance k . This magnet of the circuit-breaker is polarized, so that it will affect its armature only when current flows through its winding in one direction. There is also a switch o , by which the switch formed by the bar j' and the terminal j^3 of circuit-breaker j may be short-circuited to permit of the establishing of a circuit independently of said breaker.

The circuit-breaker h is provided with a magnet having a winding connected at one end to plate q of switch K and at the other end to a terminal h^3 , normally engaged by a switch-blade h^4 , connected to the circuit-generator n . This blade is held in contact with said terminal by any desired form of escapement mechanism, so that it will be released so as to disengage the terminals only after the winding of the circuit-breaker h has been twice deenergized. It will be noted that the movable elements h^4 and j' of the circuit-breakers h and j are intended to be returned to their normal positions after release by the central operator.

In Fig. 1 the above-described apparatus is shown as connected in a complete telephone system which includes two two-party lines, although it will be understood that there is no reason why any desired practical number of subscribers could not be similarly connected on each line. The ends of the two mains A and C of each line are connected to each other and to ground, this latter connection being preferably made through a body of inductive resistance, as e or e' , so as to reduce as much as possible the flow of stray currents due to the difference of potential between the points at which the said mains and the battery n are grounded.

If considered advisable, a bank of non-inductive resistance b or b^2 or a condenser c or c^3 may be connected in shunt to the various windings of the magnets a a' , &c., and similarly there may be a body of resistance b^4 in circuit with the terminal 20, so that the cur-

rent flowing when the blade 7 engages said terminal is substantially the same as when the receiver 12 is in circuit.

Before proceeding to describe the operation of my system I wish to point out that in the arrangement of apparatus shown there are included a number of magnets a , a' , a'' , &c., each having two windings usually of different numbers of turns, one winding being in series of one of the line-wires, as A, and the other being in series with the other line-wire, as C. It will, moreover, be noted that usually no two magnets connected on the same pair of line-wires or mains have both of their windings of similar numbers of turns.

If the subscriber whose instrument is indicated at D in Fig. 1 removes his receiver 12 from its hook 14 in order to make a call, the receiver end of said hook will rise, as will also the bar 2, causing the arm 15 of said bar 2 to be interposed between the armature 16 and its magnet a and opening the circuit of main A. Immediately thereafter the switch m is momentarily closed and then opened by the action of hook 14 upon its blade, thus momentarily connecting the local battery f across the mains A and C and energizing the winding of the polarized circuit-breaker j . The winding of this circuit-breaker and the connections of said battery f are such that the armature j'' is attracted, thus not only releasing the blade j' and indicating to the central operator that a subscriber is calling, but also opening the switch of which said blade j' forms a part, and consequently breaking what is practically a short circuit between mains A and C. If desired, this movement of the blade j' or of the armature j'' may be made to operate any of the well-known visual or auditory signals well known in the art, though since the pivoted blade itself is the equivalent of such a device this feature of the invention has not been further illustrated. The rise of the receiver end of the hook 14 also connects the terminals of the switch 3 in Fig. 2, so as to throw into circuit the transmitter 9, and finally permits the bar 2 to move into engagement with the terminal 17, so as to place the receiver in circuit with main A. The central operator now plugs into the circuit by inserting the operator's plug or plugs in switch K, thus permitting current to flow from the battery n at the central station through the main C to ground and connects said operator's instrument, so that conversation with the subscriber is possible. Since all of the magnet-windings a'' are in series with each other and with the main C, all of the magnets a' , a'' , &c., are energized and all, with the exception of the magnet a , attract their armatures toward their cores. This action cannot occur with the magnet a because of the previous interposition of the arm 15 on the bar 2 between its armature and the core, as above noted. In each case where the ar-

mature of the magnet has moved toward its core the incandescent lamp 6 or other form of visual or auditory signal is operated from the local battery f , the armature-supporting bar 1 being moved into contact with the terminal 18 in order to permit the necessary current to flow. A "busy signal" is therefore displayed on each telephone instrument on the line other than the one calling the central. After having been informed as to the number of the telephone with which the calling subscriber desires connection the central operator inserts the second one of the plugs Y in that one of the openings of the switch K^2 which corresponds to the number of the instrument called for.

By inspection of the figures it will be seen that the banks of resistance k , k^2 , k^4 , &c., are so proportioned relatively to the two sets of windings on the various magnets a , a' , &c., that the current from the generator n flowing through wire e will divide between the mains A' and C', so that the field produced by one of the windings on a certain magnet a^2 or a^3 , connected between said lines, will neutralize that produced by the second winding upon said magnet—that is to say, when the central operator has plugged into one of the openings— s^5 , for example—of switch K^2 the current from the generator n will divide into two currents of predetermined strengths, so that the effect of the winding a^2 upon the magnet a^3 will be substantially neutralized by the effect of the winding a^4 upon said magnet, thereby causing no motion of the armature of this magnet. On the other hand, since the ratio to each other of the turns of the two windings upon the magnet a^2 is different from that of the turns of the windings upon the magnet a^3 the currents flowing on the two mains are not properly adjusted to render said magnet a^2 inoperative, and it will cause motion of its armature. The result of such action is that the flow of current through the main A' energizes the bell-controlling magnets d of each telephone instrument, so that said magnets are caused to move their armatures and close the switches 8. Such closing of said switches will have no effect except in the case of the instrument which it is desired to call up—viz., that having the magnet a^3 —since the armature 16 of this instrument is the only one which is in a position such that there is a complete circuit from its local battery f to the bell B and the bar 1. As a consequence the bell B is rung continuously until the receiver of the instrument having the magnet a^3 is lifted from its hook, which action, by temporarily connecting the local battery f between the lines A' and C', operates the polarized circuit-breaker j at central, thereby also opening the circuit of main A', deenergizing magnet d , and opening the local bell-circuit. It will be noted that current from generator n cannot actuate the polarized mag-

net j^2 , since the current therefrom will not flow through said magnet in the proper direction to cause movement of its armature. This armature is, however, immediately moved by the action of the momentary flow of current caused by the closing of switch m^3 , so that the short-circuit connection between mains A' and C' is removed. The bells of the other telephone instruments, as D², are not rung by the local battery f , because the windings of the magnets a^2 in said instruments act together and move armatures 16 so as to break the bell-circuits, whereas when central sends current to ring these windings are so arranged and connected as to act in opposition and neutralize each other.

It will be noted that as soon as current has been allowed to flow through the mains A' and C' by the central operator plugging in all of the telephone instruments other than the one called are rendered inoperative, since even though the receiver of one of these instruments be removed from its hook there is no possibility of the bar 2 of said instrument rising, since such motion is prevented by the armature 16 of the magnet being interposed in the way of the arm 15. The lifting of the receiver 12 of the instrument called permits the hook 14 of said instrument to rise, as before noted, and by its action upon the blade of switch m temporarily connects the local battery f across the mains A' and C', and thereby causes opening of the circuit-breaker j .

When the hook 14 of the subscriber called is in its uppermost position, the circuit of main A' is closed through said subscriber's receiver, the transmitter being also connected so as to be operative, so that conversation can be successfully carried on between the subscribers using the instruments D and D'. It will be noted that, as in the case of line in which is connected the instrument of the subscriber calling up, so with the line having the instrument D', all other instruments on the same line have automatically displayed a busy signal. This is due to the completion of the circuit through their respective incandescent lamps 6 by the action of magnets a^2 , &c., upon the respective armatures 16 and bars 1, which throws the local batteries f into circuit with said lamps.

Upon the receiver 12 of the instrument D' being returned to its hook at the close of conversation the receiver and then the transmitter-circuits are broken and the hook 14 momentarily opens the switch g , which, as before noted, is in the circuit of the main C. Since current flowed upon said main when the central operator first plugged in and again flows after the momentary opening of switch g , the escapement of circuit-breaker h has been twice permitted to act, and thus caused to drop its bar h^4 , indicating to central that the instrument D' is no longer in use. The removal of the plugs Y from the switches K and K² cuts

off generator n from the system and the various parts return to their normal positions, the bars j' and h^4 being returned to their set positions by hand.

If the subscriber using the instrument D had wished to be connected to instrument D², the central operator would have inserted plug Y in that one of the openings s^6 of switch K² which would introduce sufficient resistance k^3 , &c., in line A to cause the current from generator n to divide, so as to render the windings of magnet a^2 inoperative upon their armature, while causing motion of all the other magnet-armatures operative on the same line.

Should the subscriber using instrument D desire to be connected with an instrument, as D³, on the same pair of lines A and C, the central operator would simply reinsert a plug Y in that one of the openings s^6 of switch K which would cut an amount of resistance into circuit with main A to cause the windings of said instrument D to neutralize each other, also closing switch o , so as to permit current to flow around the open circuit-breaker j .

If it be desired to prevent the possibility of a second subscriber connecting his instrument on the line by removing his receiver from its hook during the brief interval elapsing between the making of a call and its answer by the central operator, I may use conductors q^4 and p^4 , connected, respectively, to the plates p and q , as shown in Fig. 3. Said conductors have terminals p^5 placed to be electrically connected by the bar j' when this latter has been released by the movement of the armature of the circuit-breaker j . With such an arrangement of parts current from generator n is permitted to flow through main C as soon as a calling subscriber removes his receiver from its hook, thus effectually locking all the other telephone instruments on the same line even before the central operator has plugged in.

I claim as my invention—

1. A system including a two-conductor line grounded at one end, a plurality of telephones connected thereon, each provided with mechanism for rendering it inoperative and each having a calling device, with means for simultaneously actuating the mechanism on certain of said telephones and for actuating the calling device of the remaining telephone only, said means having one terminal grounded, substantially as described.

2. A system including two lines, a plurality of telephones connected thereon, each having a calling device and a magnet, each magnet being provided with two independent windings connected respectively in said lines, a set of mechanism controlled by each of said magnets for rendering inoperative one of the telephones and a selective switch for causing operation of all but a single one of said sets

of mechanism and for causing actuation of the calling device of that telephone whose mechanism is not actuated, substantially as described.

3. A telephone system including a multiparty two-conductor line, each instrument on said multiparty-line having mechanism for rendering it operative and a calling device, with apparatus for actuating said mechanism on certain of said telephones and for actuating the calling device of the remaining telephone, said apparatus including a magnet having differential windings respectively connected in series with the conductors of the multiparty-line, substantially as described.

4. A telephone system including two conducting-lines in the same circuit, a plurality of electrical instruments connected thereon, each provided with a locking device, including a differentially-wound magnet, an indicator and a calling device, with means having its terminals connected respectively to the ends of said lines for operating the calling device of any instrument and for actuating the indicators and the locking devices of the remaining instruments, substantially as described.

5. A telephone system including two conducting-lines on the same circuit, a plurality of telephone instruments connected thereon, each including a switch for controlling its operations, a locking device for the switch including a differentially-wound magnet an indicator and a calling device, with means having its terminals connected respectively to the ends of said lines for operating the calling device of any instrument and for actuating the locking devices and the indicators of the remaining instruments, substantially as described.

6. A telephone system including a two-conductor line, instruments connected thereto having magnets and armatures therefor, a switch in circuit with each receiver controlled by one of said armatures and means for causing any one of the magnets to become inoperative and simultaneously actuating the remaining magnets, said means having its terminals connected respectively to the ends of said line, with a calling device on each instrument controlled by the said magnet thereof, substantially as described.

7. A telephone system including instruments each having a circuit provided with a calling device and two switches, magnets having armatures for respectively controlling said switches, and means for causing all but a predetermined one of said magnets to operate their switches, substantially as described.

8. A system including telephone instruments each having two non-polarized magnets, switches respectively controlled by said magnets, and a calling device in circuit with said switches, with means for energizing one magnet on all the instruments and the second

magnet on all but one of said instruments, substantially as described.

9. A system including telephone instruments each having two magnets, a normally closed switch controlled by one magnet of each instrument, a normally open switch controlled by the second magnet of each instrument, calling devices in circuit with each pair of said switches and means for actuating the second magnet of each instrument and the first magnet on all but one of these instruments, substantially as described.

10. A system including telephone instruments each having two magnets, a normally closed and a normally open switch controlled by one magnet, an indicator in circuit with the normally open switch, a normally open switch controlled by the second magnet, a calling device in circuit with the closed switch of the first magnet and the switch controlled by the second magnet, with means for actuating one magnet of all the instruments and the second magnets in all the instruments but one, substantially as described.

11. A system including a central station, a plurality of telephone instruments on the same line, a circuit-breaker connected to said line at the central station, an indicator actuated by said circuit-breaker, and a current-generator for each instrument provided with means whereby it may actuate said circuit-breaker, substantially as described.

12. A system including a central station, a plurality of telephone instruments on the same line, and a circuit-breaker including an indicator connected to said line at the central station, each instrument having a current-generator, a normally open switch and means for temporarily closing the same on each instrument, substantially as described.

13. A system including a central station, a plurality of telephone instruments on the same line, a polarized circuit-breaker and indicating means operatively connected to said line at the central station, a current-generator, a normally open switch and means for temporarily closing the same on each instrument, with a current-generator at the central station and mechanism for each instrument actuated from said latter current-generator, substantially as described.

14. A system including a central station, a current-generator, conducting-lines having telephone instruments connected to them, each instrument having a current-generator and a normally open switch, with a polarized circuit-breaker and indicating means connected between said lines at the central station, substantially as described.

15. A system including a central station, a main current-generator, conducting-lines having telephone instruments each provided with a current-generator and a switch, with two automatic circuit-breakers at the central station, one of the same being connected between

the lines and the second being interposed between the lines and the main current-generator, substantially as described.

16. A system including a central station, a main current-generator, conducting-lines having telephone instruments each provided with a current-generator and a switch with two automatic circuit-breakers at the central station, one of the same being polarized and connected between the lines and the second being interposed between said lines and the main current-generator, substantially as described.

17. A system including a central station, a main current-generator, conducting-lines having telephone instruments each provided with a current-generator and a switch with two automatic circuit-breakers at the central station, one of the same being connected between the lines, the second being interposed between said lines and the main current-generator, and having escapement mechanism whereby it is required to be twice energized before it will operate, substantially as described.

18. A system including a current-generator, a circuit-breaker having escapement mechanism requiring a plurality of flows of current before it permits the circuit-breaker to open, with telephone instruments electrically connected to said circuit-breaker, substantially as described.

19. A system including a current-generator and a circuit-breaker having mechanism requiring two flows of current before it permits the breaker to open, with a series of telephone instruments electrically connected to said circuit-breaker, each having a normally closed switch in circuit with the same and means for opening said switch, substantially as described.

20. A system including a current-generator, a switch and a circuit-breaker having mechanism requiring a plurality of current-flows

for its operation, with a series of telephone instruments, each having a receiver, a hook therefor, a normally closed switch and means operated by motion of the receiver-hook for temporarily opening the same, substantially as described.

21. A telephone system including instruments having a double-wound magnet, an armature therefor, a receiver and a hook therefor, a piece controlled by the receiver-hook and movable to prevent motion of said armature, with a calling device including a switch controlled by the armature, substantially as described.

22. A telephone system including instruments each having a double-wound magnet, an armature therefor, a receiver and a hook therefor, a piece controlled by the receiver-hook and movable to prevent motion of said armature, with calling and indicating devices including switches, controlled by the armature, substantially as described.

23. A system including two lines, a series of telephones connected between said lines, and each having a receiver and a hook therefor, a magnet provided with windings respectively connected to said lines, an armature for the magnet, a second magnet connected to one of the lines and having an armature, a calling device having switches controlled by said two armatures and mechanism controlled by the receiver-hook of each instrument for preventing movement of one of the armatures, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM R. WHITEHORNE.

Witnesses:

WILLIAM E. BRADLEY,
JOS. H. KLEIN.