No. 626,132. Patented May 30, 1899.

J. A. BARRETT.

SELECTIVE PRIVACY SWITCH FOR MULTIPLE STATION TELEPHONE LINES.

(Application filed July 28, 1898.)

(No Model.)

3 Sheets—Sheet 1.

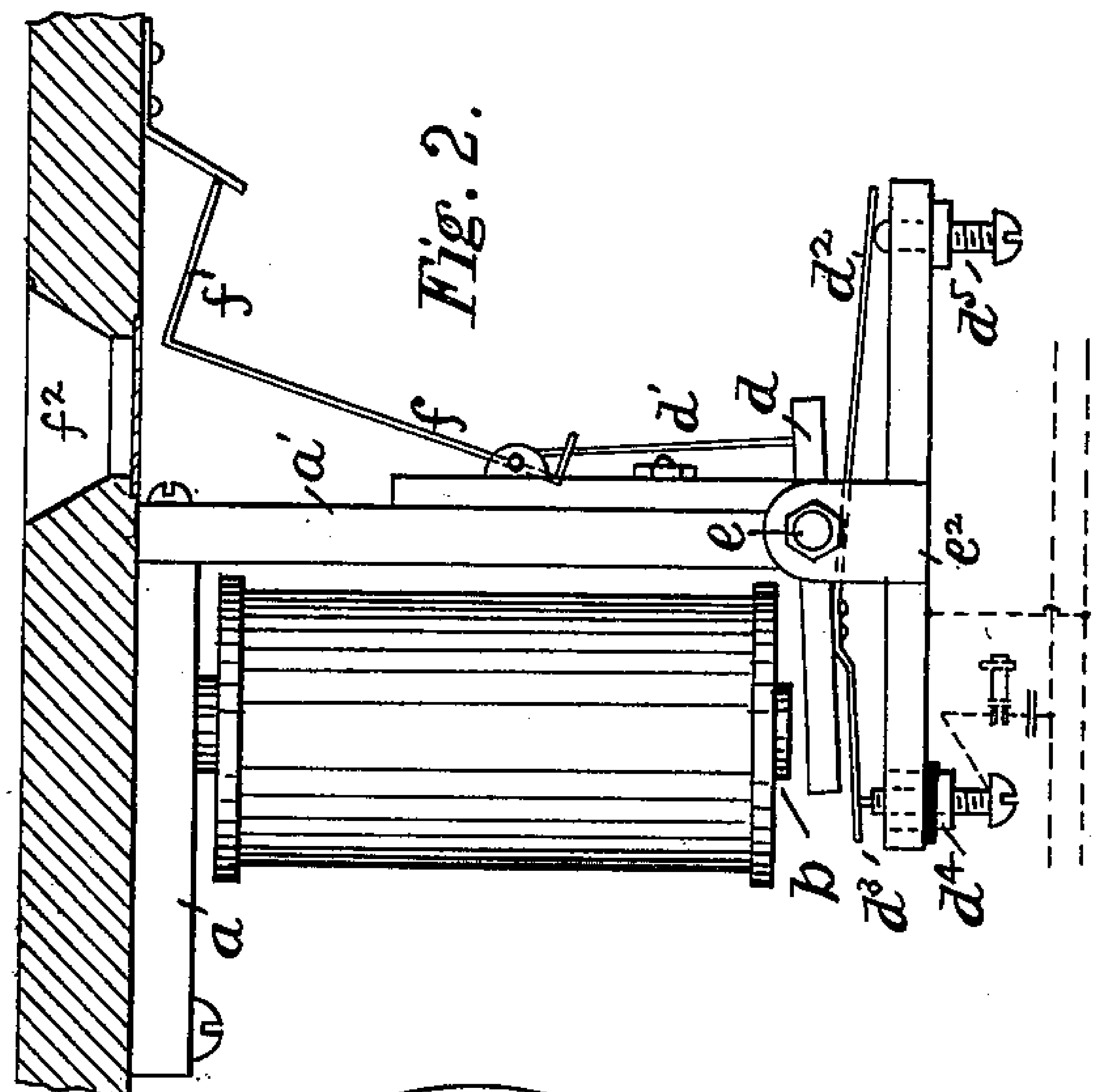

Fig. 2.

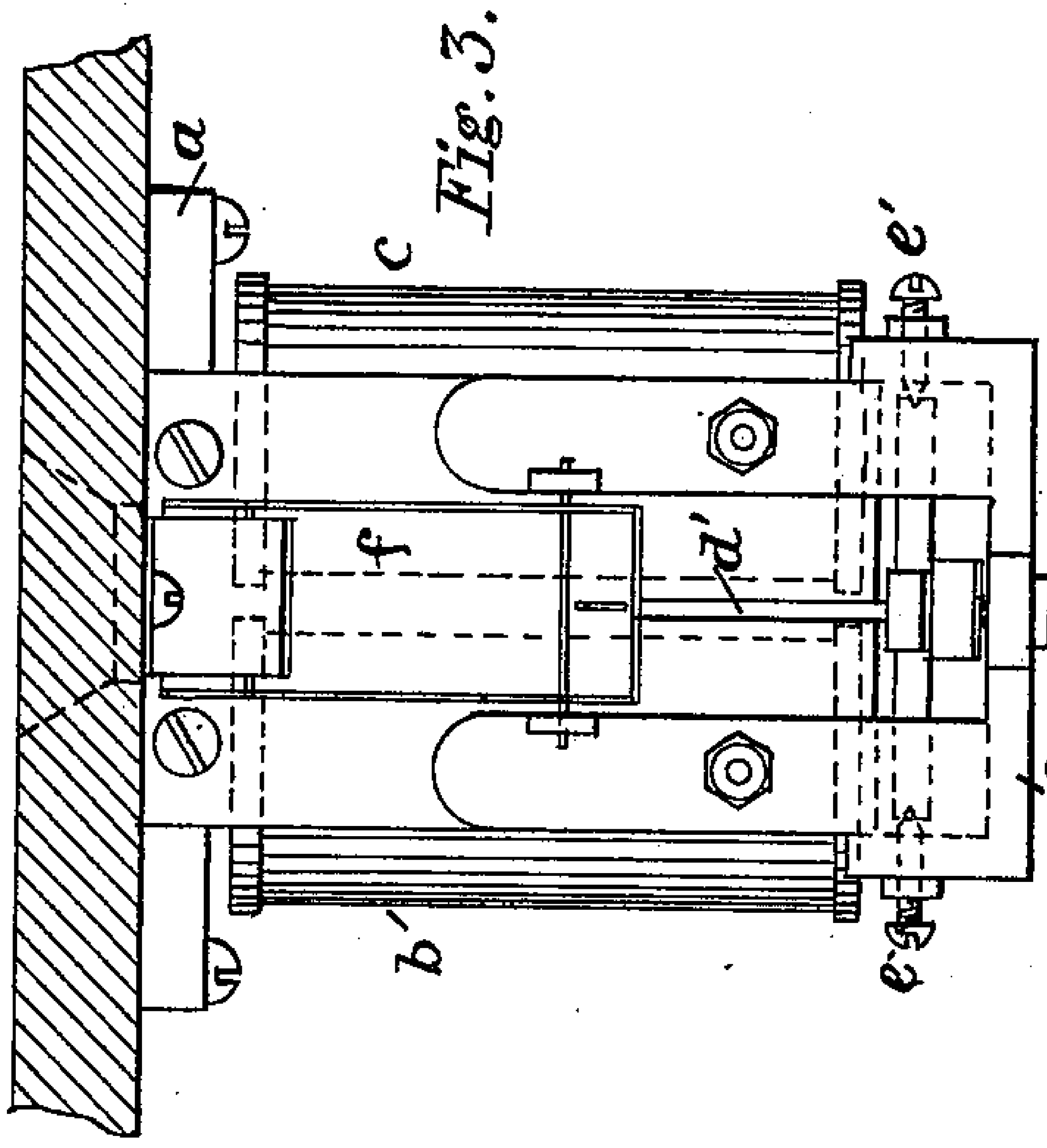

Fig. 3.

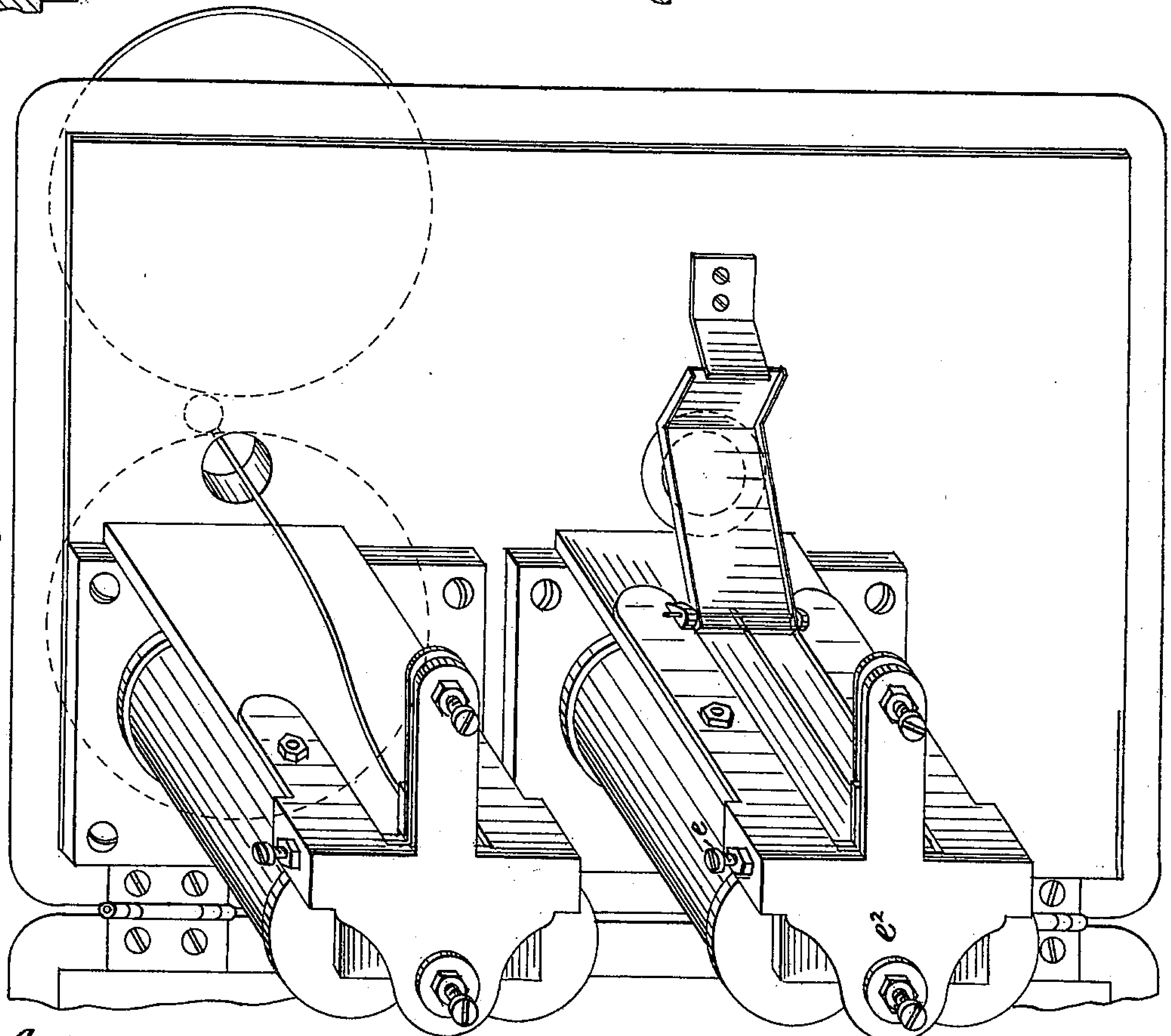

Fig. 1.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

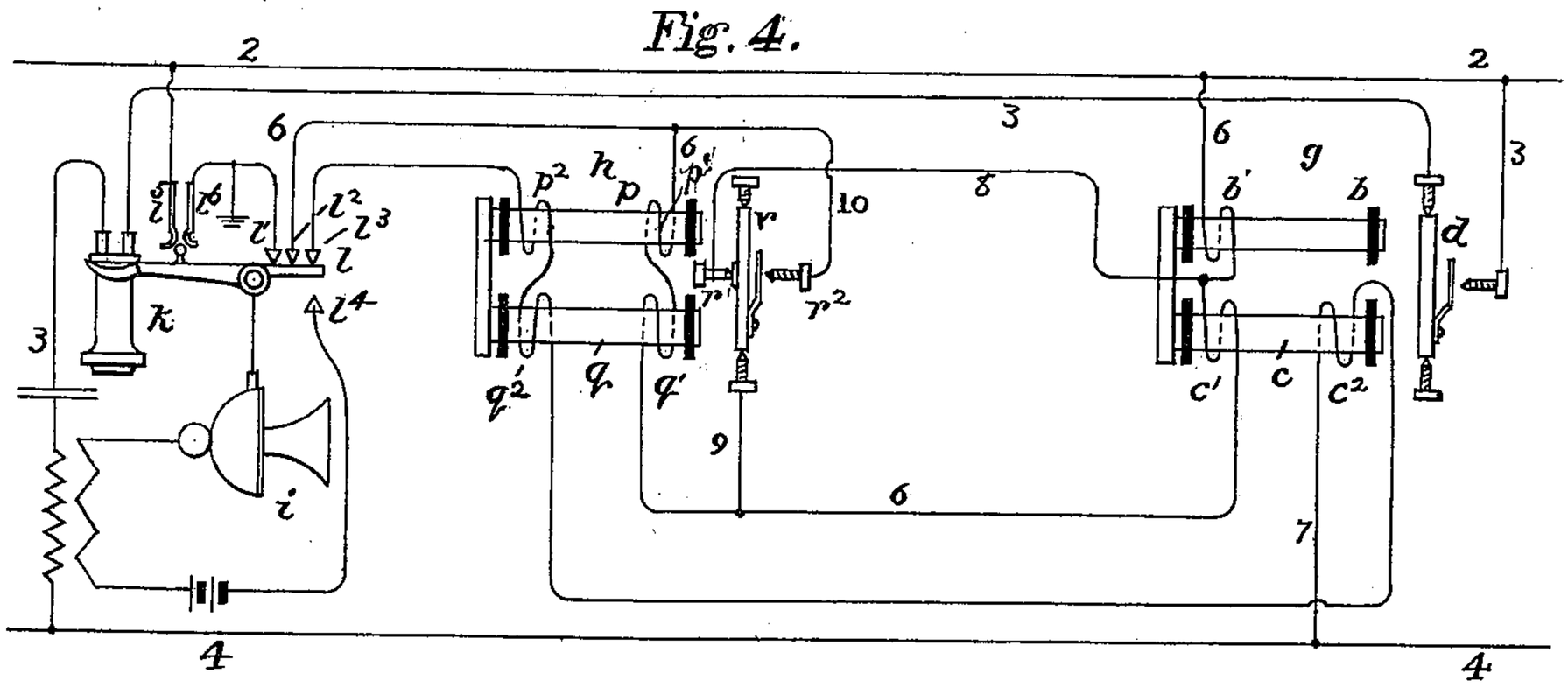


Fig. 5.

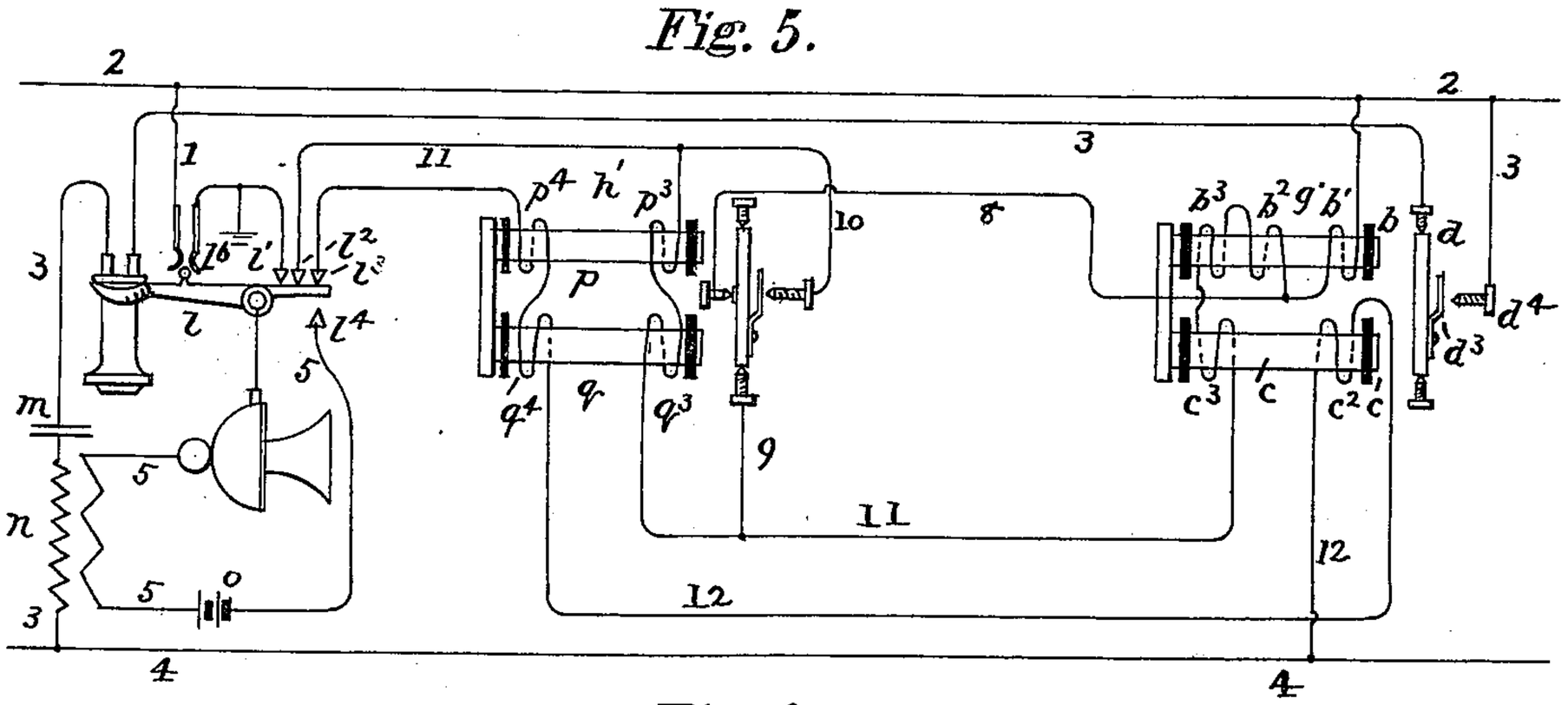
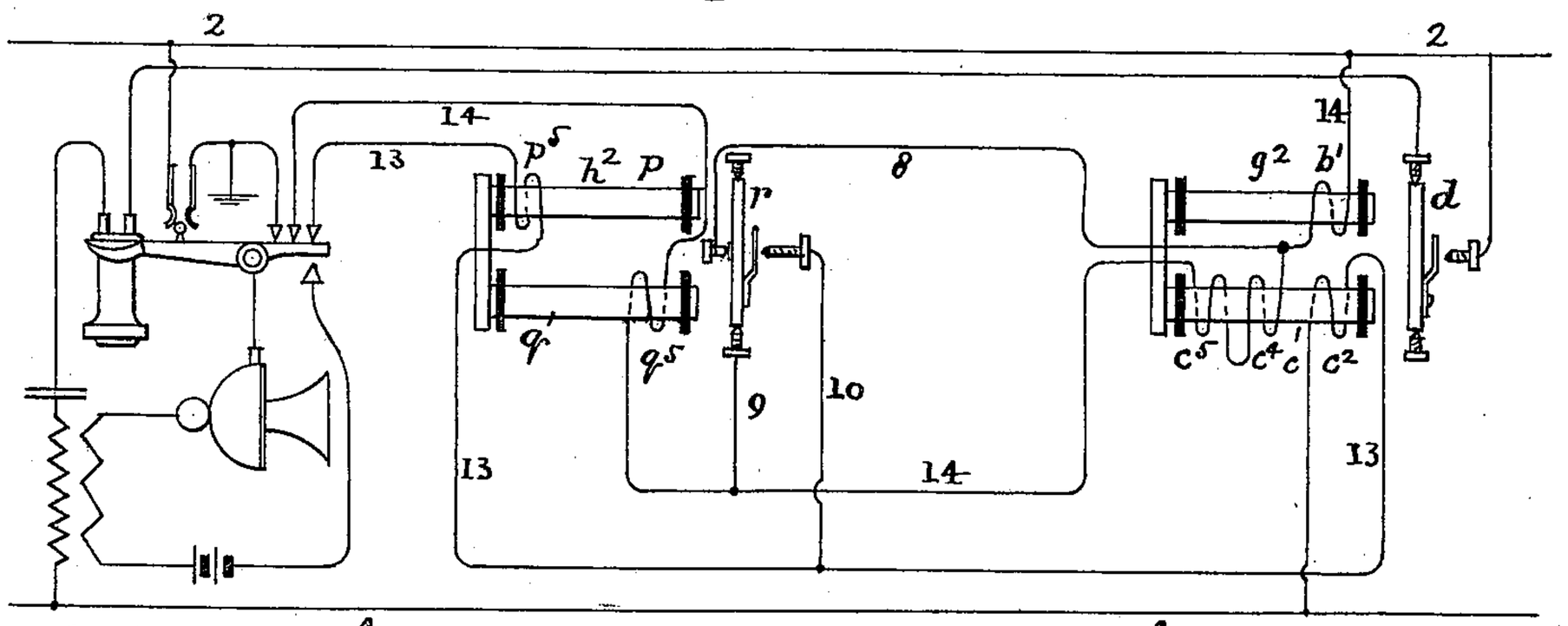


Fig. 6.



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3 Sheets—Sheet 3.

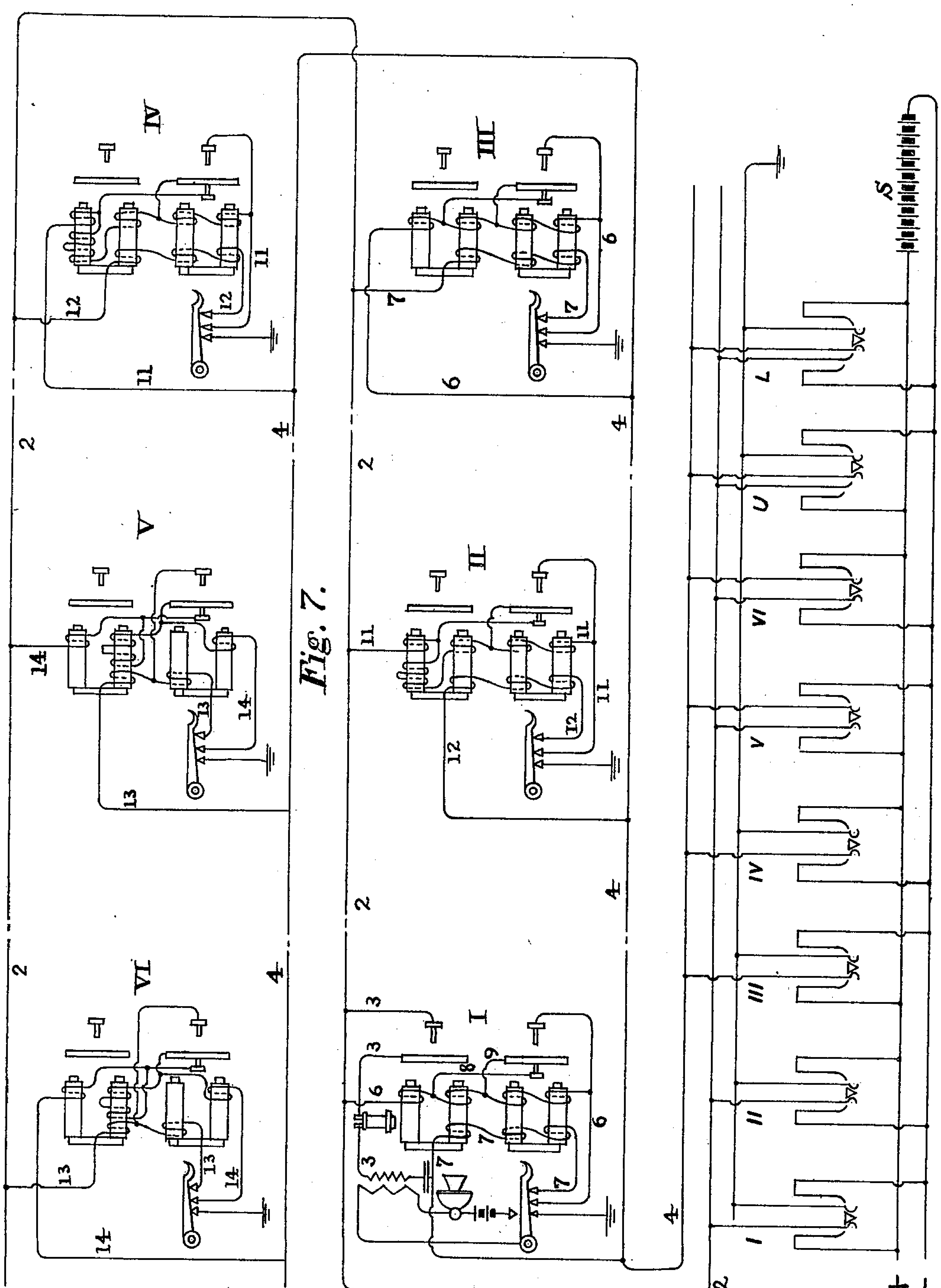

Fig. 7.

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UNITED STATES PATENT OFFICE.

JOHN A. BARRETT, OF SUMMIT, NEW JERSEY, ASSIGNOR TO THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY, OF NEW YORK.

SELECTIVE PRIVACY-SWITCH FOR MULTIPLE-STATION TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 626,132, dated May 30, 1899.

Application filed July 28, 1898. Serial No. 687,105. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. BARRETT, residing at Summit, in the county of Union and State of New Jersey, have invented certain Improvements in Selective Privacy-Switches for Multiple-Station Telephone-Lines, of which the following is a specification.

This invention concerns selectively-operative privacy-switches for multiple-station telephone-lines. Its object is to permit the simultaneous switching into or out of circuit of telephones at all of the stations of a line or the selective switching into the circuit of a telephone at one or more stations, as desired, and barring the remaining telephones from the circuit.

The invention is designed for association with a system of selective signals which I have described in another application, filed of even date herewith, in an organization wherein the act of selectively calling any station automatically switches the circuit connections at the station into condition to permit the use of the telephones there and bars the telephones at the other stations. The present invention is further allied to the invention of the other application in the employment as its essential feature of a new elemental appliance described in the before-mentioned application—namely, a tripolar magnet which is made operative only in the simultaneous excitement in a particular sense of two electromagnetic helices. This tripolar magnet of the application referred to consists of a permanent magnet and a polarized pivoted armature connected therewith and two electromagnetic helices surrounding cores connected with one pole of the permanent magnet and presented to the armature. The armature of this magnet stands normally attracted to the two cores. It can be moved only by the simultaneous magnetization of the two cores in the proper direction to repel the polarized armature. The appliance is most readily adapted for the actuation of selective signals at six stations on a single line. In such application two of the tripolar magnets are connected in a ground branch from each of the line conductors and two in a metallic circuit, the different members of the groups of two being adapted for operation by currents of different polarity. The pivoted armature of the tripolar magnet may carry a bell-hammer to strike a gong or may otherwise operate suitable signal-sounding mechanism. In adapting this tripolar magnet for use as a privacy-switch I arrange the armature to actuate any suitable mechanical or electrical device for effecting or maintaining an inoperative condition of the telephone at the corresponding station when the armature stands attracted, the function of the armature when repelled being to restore the operative condition of the telephone, and I may add a busy-signal, moved in the action of the same magnet, to be displayed when the armature is attracted, but concealed when the armature is repelled to place the telephone in operative condition.

The circuit connections of the tripolar privacy-switch are so disposed at each station with relation to the main circuits that all the privacy-switches may be placed in their locked positions to bar the telephones from the circuit by current of some predetermined polarity on each of the line conductors and may be placed in their unlocked positions to admit the telephones to the circuit by current of opposite polarity in the same paths, combinations of currents being selected for locking and unlocking the privacy-switches which are not adapted for the operation of any of the selective signals, and an operative relation is established between the selectively-operative signal and the privacy-switch at each station through the agency of either mechanical or electrical devices, as may be desired, such that the actuation of the selective signal changes the relation of the tripolar magnet of the privacy-switch to the signaling-currents in a way to make it operative through the action of such currents. A suitable means for attaining this end is found in the provision of neutralizing or auxiliary magnetizing-helices on the electromagnet-cores of the tripolar magnet, interposed in a path normally shunted by the switch-contacts of the selective signaling instrument. The disposition of the neutralizing and secondary or auxiliary windings of the privacy-switch

must of course be adapted at each station to the peculiar combination of currents selected to operate the bell at the same station, to the end that the resultant effect of all the active windings of the privacy-switch at any called station may produce a repellent action on the armature of the privacy-switch at the station.

In brief, the invention in its preferred form consists in the combination, with call-bells connected with the line and return conductors, adapted for operation through the agency of differing combinations of current, of privacy-switches at the different stations, all adapted normally to be locked by like combinations of current, and secondary windings and circuits of the privacy-switches, controlled by switch-contacts of the call-bells, adapted to direct current through the actuating-magnets of the privacy-switches in suitable relation to effect their unlocking. The mechanism and circuit connections of this form of the invention are shown in the drawings herewith.

Of the drawings, Figure 1 represents a bell, a privacy-switch, and busy-signal as they appear mounted in the hinged cover of a telephone-box. Fig. 2 is a plan of the privacy-switch with the circuit connection of the telephone in miniature, and Fig. 3 is a side elevation of the same. Fig. 4 illustrates the circuit connections of the bell and privacy-switch at two stations. Fig. 5 represents the connections of the same appliances at two other stations, and Fig. 6 similarly shows the circuit connections for the remaining two stations. Fig. 7 is a diagram showing the complete circuits of six stations with the mechanism for selectively calling the stations and for operating the privacy-switches of the line.

The actuating-magnet of the privacy-switch, as described in the companion application hereinbefore referred to, consists, essentially, of a permanent magnet, comprising a base or heel piece a and a magnetized portion a', two electromagnetic cores b and c, carrying windings, and an armature d, facing the free poles of the permanent magnet a and the cores b and c. This armature is pivoted in trunnions e and e', carried in a bracket e^2, which is secured to the free extremity of the magnet a' as a support. The armature carries a short arm d', which passes through an opening in the extremity of a pivoted lever f, which carries a target f', designed to appear before a window f^2 in the face of the telephone-box. It will be apparent that a movement of the armature will thus cause an amplified movement of the target f', whereby it may be concealed or brought into view before the window f^2 through the action of the magnet on the armature. The armature carries also a flexible spring d^2 secured to it. Of this spring one extremity d^3 serves as a contact-spring and is designed to rest normally on an insulated contact-anvil d^4, and the other extremity bears upon an adjustable stop d^5, carried in an extension of the bracket e^2. The pressure of the spring d^2 upon its stop d^5 is so adjusted with respect to the attraction of the armature d and the cores b and c that the armature will stand in either of its extreme positions when the cores b and c are not subject to the influence of any current in the windings about them.

The equipment of the different telephone-stations, as shown particularly in Figs. 4, 5, and 6, comprises in addition to the privacy-switch g a selective call-bell h, a transmitting-telephone i, and receiving-telephone k, and a telephone-switch l. The telephones and telephone-switch are of the usual type. The switch l has three contact-anvils l', l^2, and l^3, against which its lever rests while supporting the weight of the telephone, and a contact-anvil l^4, upon which the lever impinges when relieved of the weight of the telephone. It is also furnished with a pair of switch-springs l^5 l^6 and with a stud or projection which crosses the springs together momentarily as the telephone-switch rises. The spring l^5 at each station is connected by a wire with the line conductor 2, leading to all the stations, while the remaining spring l^6 is grounded. The function of these parts is thus to put a temporary ground on the line conductor 2 as the telephone-switch rises in passing to its upward position when freed from the weight of the telephone for the purpose of operating an annunciator at the office terminal of the line. The receiving-telephone k is included, together with a condenser m and the secondary winding of the induction-coil n, in a bridge 3 between the line conductors 2 and 4, the continuity of which is controlled by the switch-contacts d^3 d^4 of the privacy-switch g at the corresponding station. The transmitting-telephone i is included with the primary winding of induction-coil n in a local circuit 5, controlled at the switch-contact l^4 and when closed supplied with energy by a battery o.

The tripolar magnets of all the privacy-switches g and h may be constructed alike as respects their polarity, and for the purpose of this description it may be assumed that the permanent magnet imparts a north polarity to the armature d of each of these magnets and a south polarity to the free poles of the soft-iron cores, so that in each case the armature is normally attracted to the poles, and the development of a resultant north polarity in each of the electromagnetic cores is essential for the repulsion of the armature to effect its function.

Inasmuch as the six stations comprise three groups of two each, the members of which groups are similar, but are operative on currents of reversed polarity, three typical arrangements of the circuits for the selective signals and the privacy-switches must be considered. These arrangements are shown in detail in Figs. 4, 5, and 6.

Fig. 4 shows apparatus which it may be assumed is adapted for use at station No. 1.

Each of the cores p and q of the tripolar magnet of the signal h at this station carries two windings, which are designated by letters p' p^2 and q' q^2, respectively. The windings p' and q' are interposed serially in a conductor 6, leading from line-wire 2 of the system to the anvil l^2 of the switch and thence normally through the contact l' to ground or other return-conductor. Their direction of winding or the sense in which they are traversed by the current is such that when excited by positive current flowing from line-wire 2 they tend to develop north poles in the cores p and q, respectively. The remaining windings p^2 and q^2 are serially included in a conductor 7, leading from the line conductor 4 of the main circuit to the other contact l^3 of the telephone-switch and thence to ground, these windings being adapted to impart south polarity to core p and north polarity to core q, respectively, when traversed by positively-directed current from line-wire 4. Thus current of positive polarity flowing to earth from the line-wire 2 would produce the north magnetization of the cores p and q requisite for repelling the armature of the bell h, while current of either polarity from the line conductor 4 through the wire 7 would produce a diverse magnetization of the cores p and q, so that one or the other of them would in all cases maintain its hold on the armature r of north polarity. The conductor 6 includes serially two windings b' and c' of the cores b and c of the privacy-switch g at station 1. The direction of winding of coil b' is such as to produce a resultant north pole in the core b when traversed by positive current from line conductor 2. The direction of winding of coil c' on the core c is similar; but this coil is normally shunted from the circuit through wires 8 and 9, which lead from conductor 6 between the windings b' and c' to the normal resting-stop r' of the bell h and from a point of the same conductor between the windings c' and q' to the armature r, respectively. The core c carries a second winding c^2, interposed in the conductor 7, of such direction with respect to the core as to develop a north pole in the core when traversed by positively-directed current from the line conductor 4. Hence the privacy-switch g may be caused to attract its armature, and thus to break the circuit of the telephone and to display the busy-signal through the action of negatively-directed currents from line conductors 2 and 4 to ground or may be caused to repel its armature to close the telephone-circuit by means of positively-directed currents from line conductors 2 and 4 to earth at the station. If, however, while the appliance g is in position to bar the telephone from the circuit current suitable for actuating the bell h be sent in the line conductor 2—namely, a positively-directed current to earth—the magnet of this bell will repel its armature and open the shunt 8 9 about the winding c'. This winding, being then excited by a current of suitable direction to develop the north pole in the core c, will coöperate with the north pole of core b, developed through the action of positive current from line conductor 2 through winding b' to repel the armature d and to close the bridge 3, containing the telephones. Thus, in brief, after the telephone at station 1 has been locked out through the agency of negative current applied over both line conductors 2 and 4 to earth the act of ringing the bell h at the station by means of positive current applied to line conductor 2 will so adjust the relations of the windings of the privacy-switch g at the same station to the current for ringing the bell at that station as to effect the operation of the privacy-switch and bring the telephone into circuit. The concealment of the busy-signal at station 1 is incidental to the completion of the telephone-circuit. A wire 10 is led from the normally-grounded terminal of wire 6 to a rear contact r^2 of the armature r, whereby the armature when repelled is permitted to complete a shunt of the windings p' and q', which excite the repellent polarity in cores p and q. Hence through the action of this shunt the bell is thrown into vibration and caused to ring the bells continuously during the application of suitable current to the line conductor 2.

The arrangement of apparatus for station 2 is shown in Fig. 5. Here windings p^3 and q^3 of the bell h' are connected in a conductor 11, leading normally from line-wire 2 to earth at the station, the conductor being controlled by the switch-contacts l' l^2 of switch l, and other windings p^4 and q^4 on the cores p and q are interposed in wire 12, leading from line conductor 4 to earth through the contact l^3 of the switch. The windings p^3 and q^3 are connected in the circuit in direction to produce a resultant north polarity of the cores p and q when a negatively-directed current flows to earth from line conductor 2. The windings p^4 and q^4 are connected in the circuit in reverse direction with respect to each other, so that current of neither direction flowing from line conductor 4 can produce a north polarity of both poles p and q at the same time through the agency of these windings. The conductor 11 includes also a winding b' of the magnet b of the privacy-switch g' of station 2, and the wire 12 includes a winding c^2 on the core 2 of the same magnet, these windings being in all respects like the windings b' and c^2 of the actuating-magnet of the privacy-switch g at station 1, so that the privacy-switch at station 2 also may be locked with negatively-directed current on both line conductors or unlocked with positively-directed current on both line conductors. The circuit is normally complete from the inner terminal of winding b' to the conductor 11, leading to the bell through the shunt 8 9, as in the apparatus at station 1; but the means whereby the applied ringing-current for operating the bell h' at station 2 serves to produce the resultant north polarity

of both magnets b and c of the privacy-switch g' at the same time is necessarily different from the means employed at station 1, inasmuch as the calling-current for bell h' is of different polarity. This means consists in three windings b^2 and b^3 on the core b and c^3 on the core c, these being connected in series with the winding b' in the wire 11. The winding b' when affected by the negatively-directed ringing-current for ringing the bell h' would tend to further increase the normal south polarity of the pole of core b. Hence the winding b^2 is adapted to counteract or neutralize this magnetizing effect, while the windings b^3 and c^3 are adapted to coöperate to produce in the cores b and c the resultant north polarity necessary to repel the armature d and to close the bridge 3 containing the telephone. The winding b^2 I term a "neutralizing-helix" from its function, and the windings b^3 and c^3 are designated "secondary magnetization-modifying helices" in view of their effect in producing resultant poles in the polarized cores.

The circuit connections of the apparatus for station 3 are in all respects similar to those for station 1, (shown in Fig. 4,) excepting that the wire 6 is connected with the line conductor 4, and the wire 7 is connected with the line conductor 2, these connections involving a mere reversal of the connection between the line conductors and those circuits which determine the operation of the selective bell and the privacy-switch. Similarly the apparatus and circuit connections for station 4 are the reverse of those for station 2, as shown in Fig. 5, the wire 11 being connected with the line conductor 4 and the wire 12 with line conductor 2.

Referring to Fig. 7, the bell h^2, designed for use at stations 5 and 6, has one winding on each of its cores p and q, these being designated p^5 and q^5, respectively. The former of these is in a ground branch 13 from the line conductor 4, its direction being such that a negative current from the conductor 4 to earth will create a resultant north pole in the core p. The latter winding q^5 is interposed in a wire 14, leading to earth from the line conductor 2, its direction being such that a positive current from the line conductor will produce a north pole in the core q. The privacy-switch g^2 carries the usual windings b' and c^2 on its cores b and c, each adapted to produce a north pole in its core when traversed by a positive current from the line conductor. The winding b' is connected in the wire 14, while the winding c^2 is interposed in the wire 13. The bell h^2 is to be rung by a positive current flowing from wire 2 to earth and a negative current from wire 4 to earth, or, in effect, by a positive current from wire 2 to 4. Hence the windings of the tripolar magnet of switch g^2 must be of such a nature that when the bell h^2 is operated resultant north poles shall be produced in the cores b and c of the magnet. The effect of the winding b' is suitable for this purpose; but the effect of winding c^2 must be neutralized, and an opposite polarity to that which it would tend to produce must be set up by a separate winding. To this end the core c carries two other windings c^4 and c^5, which are interposed in the wire 14, but are normally shunted by wires 8 and 9, controlled by the armature of the bell. The winding c^4 when traversed by positive current from line conductor 2, neutralizes the effect of winding c^2 when traversed by negative current from line conductor 4. The winding c^5 when the positive ringing-current from conductor 2 is diverted through it imparts a north polarity to the core c, so that the armature d is repelled and closes the telephone-circuit. The shunt 9 10, which is closed by the bell h^2 when its armature is repelled, short-circuits both windings of the magnet of the bell.

The circuits for the sixth station are like those for the fifth station, excepting that the wires 14 and 13 are connected with the line conductors 4 and 2, respectively.

Fig. 7 is a diagrammatic representation of the circuits of the bells and privacy-switches at six stations I, II, III, IV, V, and VI, with keys for applying current to the line conductors for ringing the different bells and for locking and unlocking the privacy-switches. Thus the key I when operated will apply a positive current to line conductor 2 and will ground the negative conductor of the source S of current, applying no current to the line conductor 4. The key II will apply a negative current to line conductor 2, grounding the positive pole of the source of current. The key III is adapted to apply a positive current to line conductor 4, grounding the negative pole of the battery s. The key IV applies a negative current to the line conductor 4 and grounds the positive pole of the battery. Key V loops the battery s into circuit of the line-wires 2 and 4, applying the positive pole to the line-wire 2. Key VI loops the battery into circuit with the line conductors in the reverse sense. Key U applies a positive current to both line conductors, grounding the negative pole of the battery, while key L applies a negative current to the two line conductors, grounding the positive pole of the battery. Thus all the privacy-switches of the line may be locked to bar the telephones from the circuit and to display the busy-signals by pressing the plunger of the key L, whereby negative currents are produced in the conductors 2 and 4 to earth. This is in practice the first step in the process of calling a station on the line. After the locking of the telephones the operator rings selectively any of the six stations on the line by pressing the corresponding key I, II, III, IV, V, or VI, whereby, as traced individually for the bells and privacy-switches for the several stations, the bell at the selective station is operated and the privacy-switch is put in position to bring the telephone into the

circuit. When the use of the line is finished, the operator may at any time release all the privacy-switches and throw the telephones into the circuit by means of the key U, which applies the positive current to both line conductors, grounding the negative pole of the source S of current.

The invention is defined in the following claims:

1. The combination with the line conductors of a multiple-station telephone-line and the telephones at the stations thereof, of a privacy device at each station determining the operative condition of the telephone, the actuating-magnet of said device being connected with the line conductors, and the privacy devices at all of the stations being organized to act simultaneously to simultaneously render all telephones operative or inoperative, the circuit connections of the different privacy devices being arranged in diverse combinations, and means at the central office for producing in the line specialized currents adapted to actuate any corresponding privacy device through the agency of said circuit combinations, as described.

2. The combination with the line conductors of a multiple-station telephone-line and the telephones at the stations thereof, of privacy devices at the stations adapted to determine the operative condition of the telephones at the corresponding stations, each privacy device having an actuating-magnet connected with the line conductors, said actuating-magnets being adapted for operation by similar currents, auxiliary selective devices at the different stations diversely connected with the line conductors and adapted for operation through the agency of different combinations of currents therein, each of said selective appliances being adapted, when actuated, to alter the circuit connections of the privacy device to make it responsive to current for operating the selective appliance; whereby all the privacy devices may be locked or unlocked simultaneously, or any one of them may be operated selectively, as described.

3. The combination with the line conductors of a multiple-station telephone-line and the telephones at the stations thereof, signaling devices at the different stations adapted for selective operation through the agency of different combinations of current in the line conductors, and means at the central office for transmitting currents in suitable combinations for operating the signals, of privacy devices at the different stations each adapted to determine the operative condition of the telephone at the station, the actuating-magnets of said privacy devices being connected with the line conductors to be responsive to currents of like character in the conductors, but to be unaffected by currents in the combinations for operating the signals, and a switch actuated by each signaling appliance controlling circuit connections of the corresponding privacy-switch adapted to change the circuits thereof to make the privacy device responsive to currents adapted for the operation of the bell; whereby the privacy device may be locked at will, or may be unlocked in operating the signal, as described.

4. The combination with the line conductors of a multiple-station telephone-line and the telephones at the stations thereof, of a telephone-switch at each station having a tripolar actuating-magnet, magnet-windings of said tripolar magnet being connected with the different line conductors to make the said switches responsive to like currents in the line conductors, secondary windings of the said magnets normally out of circuit, and means controlled from the central office adapted to bring said secondary windings into operative connection with the line conductors, said secondary windings being arranged in diverse combinations of circuits with the line conductors, whereby the switches may be locked with like currents, but may be unlocked through the agency of diverse combinations of currents, as described.

5. The combination with the line conductors of a multiple-station telephone-line and the telephones at the stations thereof, of signal-bells at the different stations having actuating-magnets comprising two normally-polarized cores and a polarized armature, and helices on the cores for producing a reversed resultant polarity in the said cores, said helices being connected with the line conductors in diverse ways, whereby signals may be selectively operated by different combinations of current, of an electromagnetic telephone-switch at each station having its electromagnets connected with the line conductors, said switches being adapted to open the telephone-circuits when excited by similar currents in the line conductors, and circuit connections of each telephone-switch controlled by the bell at the same station adapted to alter the normal disposition of currents in the magnets of the switch to adapt the magnet of the switch for response to the currents for operating the signal, substantially as described.

6. The combination with the line and return conductors of a multiple-station telephone-line and the telephones at the stations thereof, a call-bell at each station having a tripolar actuating-magnet adapted to actuate the armature when the polarity of both electromagnets is reversed, the magnetization-modifying helices being connected in diverse ways with the line and return conductors, whereby any selective bell may be operated through the agency of suitable combinations of current in the line conductors; of a telephone-switch at each station having a tripolar actuating-magnet, adapted to make the telephone operative when the armature of the magnet is repelled, the magnetization-modifying helices of the said switch-magnets being similarly connected with the line conductors, secondary magneti-

zation-modifying helices of the switch-magnets, and switch-contacts of the bell at each station controlling current from the line conductors through said secondary helices of the corresponding switch, said secondary helices being adapted to produce a repellent polarity in the magnet-cores of said switch when they are traversed by the currents for operating the bell at the same station; whereby the telephones at all stations may be barred from the circuit and the telephone at any station is brought into the circuit in calling the station, as described.

7. The combination with the line and return conductors of a multiple-station telephone-circuit and the telephones at the stations thereof, a call-bell having a tripolar actuating-magnet at each station, the windings of said magnets being connected in different ways with the line conductors and the return-circuit, whereby different combinations of currents are required to repel the armatures of the signals at the different stations; of a privacy-switch and busy-signal at each station having a tripolar actuating-magnet like that of the bell, and magnetization-modifying helices adapted to develop repellent polarity in the cores of the magnet normally connected with the line conductors in like manner, whereby the telephones at all stations may be barred from or brought into the circuit; secondary magnetization-modifying helices on the cores of the said switch-magnet connected with the line conductors in the same manner as the magnetization-modifying helices of the corresponding bell are connected, and switch-contacts of the bell normally shunting said helices, whereby the privacy-switch at any station is unlocked in the act of calling the station, as described.

8. In a station appliance for multiple-station telephone-lines, a bell having a tripolar actuating-magnet and magnetization-modifying helices on the cores thereof connected with the different line conductors whereby a definite combination of currents in the line conductors is required to actuate the bell; a privacy-switch having a tripolar actuating-magnet and windings thereof connected with the line conductors adapted to produce repellent polarity in the magnet-cores when traversed by currents different from those required to operate the bell, neutralizing-windings equal in number and effect to said first-mentioned windings, and secondary magnetization-modifying windings on the same cores, the circuits of said neutralizing-windings and said secondary magnetization-modifying windings being controlled by switch-contacts of the bell, said neutralizing-windings being adapted, when traversed by current for operating the bell, to neutralize the effect of said first-mentioned windings, the said secondary magnetization-modifying windings being adapted to produce repellent polarity in the poles of the tripolar magnet, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 21st day of July, 1898.

JOHN A. BARRETT.

Witnesses:
ARTHUR A. MARSTERS,
HARRY H. BRIGHAM.