No. 666,457. Patented Jan. 22, 1901.

J. A. BARRETT.

PRIVACY DEVICE APPARATUS FOR POLYSTATION TELEPHONE LINES.

(Application filed Sept. 8, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

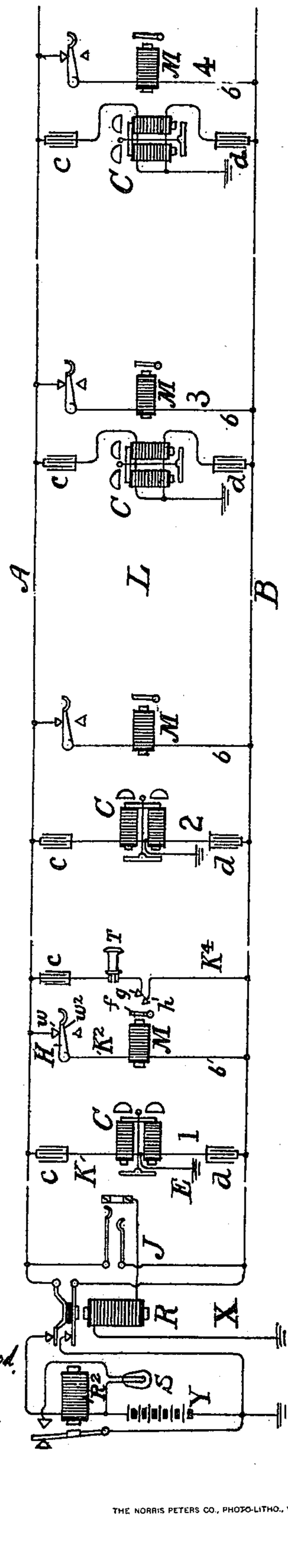
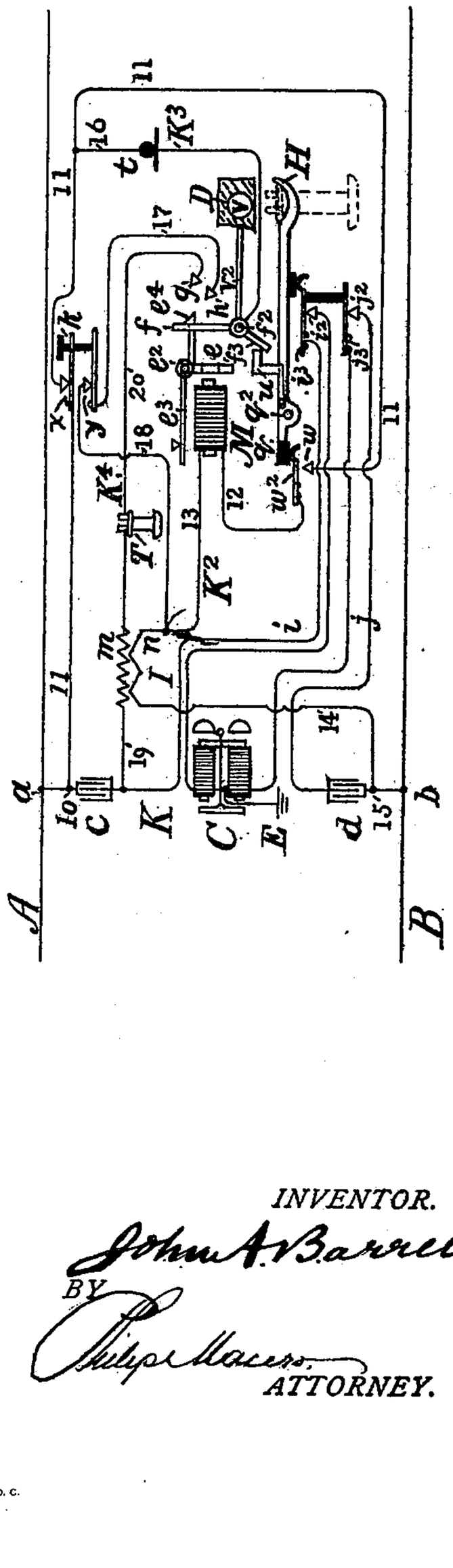


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

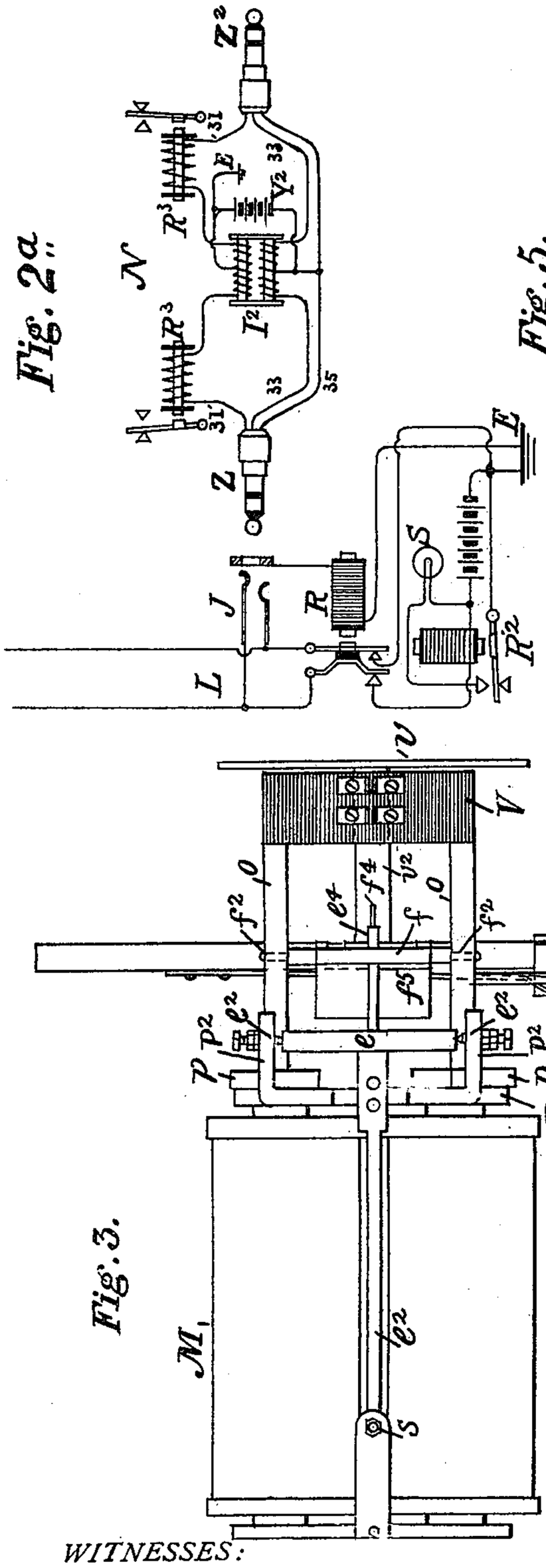

Fig. 2a.

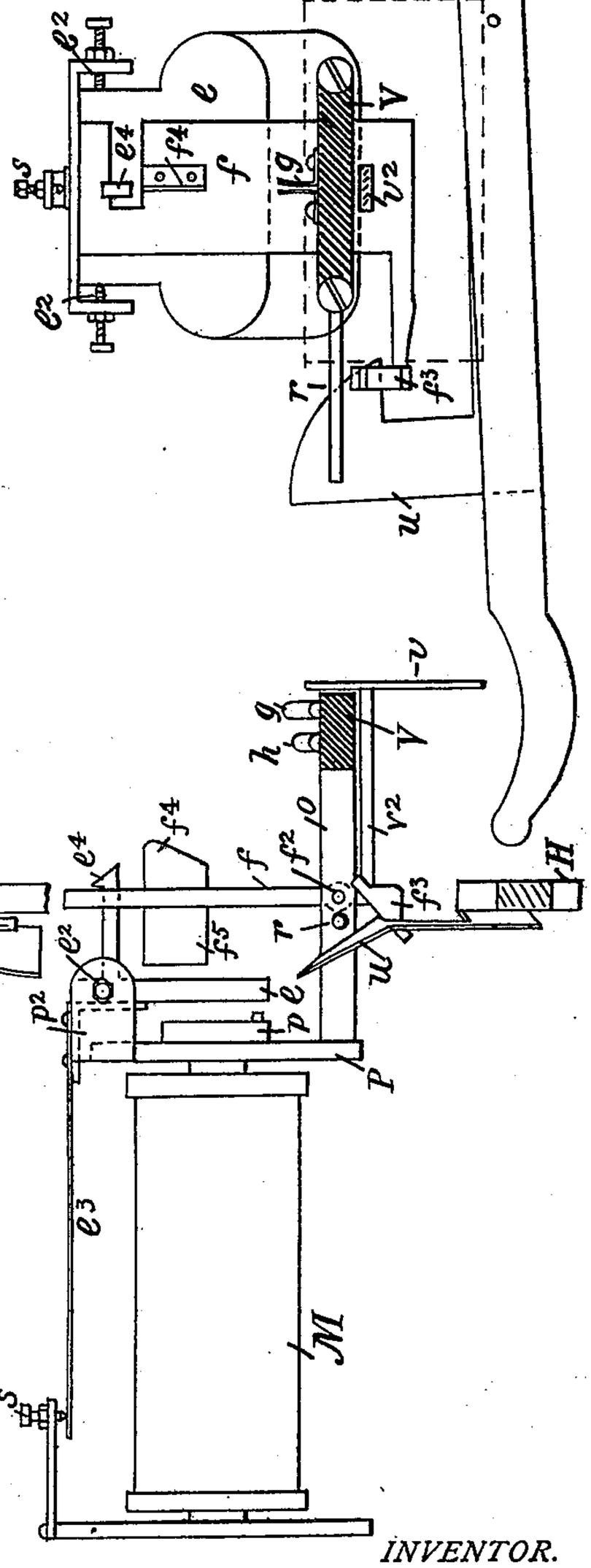

Fig. 5.

Fig. 3.

Fig. 4.

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PRIVACY-DEVICE APPARATUS FOR POLYSTATION TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 666,457, dated January 22, 1901.

Application filed September 8, 1900. Serial No. 29,438. (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 Privacy-Device Apparatus for Polystation Telephone-Lines, of which the following is a specification.

This invention relates to substation apparatus for polystation telephone-lines of a central-battery telephone-exchange, and in particular concerns privacy devices, sometimes termed "lockouts," to be associated with any preferred signaling substation apparatus, selective or otherwise.

The privacy device described herein is one of that class which provides that the telephones at a substation can only be connected with the main telephone-circuit through the intermediation of an electromagnet (which either is itself of high resistance or is placed in a bridge or branch of high resistance) brought into operation by removing the receiving-telephone from its hook and that the telephone branch when so connected shall, being relatively of low resistance, be enabled to serve as a shunt not only for its own high-resistance magnet, but also for those at each and all of the other substations of the circuit, so that if at any of these the telephone is removed from its hook-support an operative connection cannot be established with the line, for the reason that although such action does operate to introduce the high-resistance electromagnet into the circuit there is not sufficient current to excite it, the major part of the line-current passing through the low-resistance telephone branch of the station in occupancy.

The objects of this invention are to provide a positive and certain establishment of the telephone-branch circuit when the same is completed at a substation obtaining access to a previously-unoccupied main circuit; to insure the trustworthy and efficient operation of the privacy device under all conditions of operation; to provide for the absolute and reliable disestablishment of said privacy device on the discontinuance of a telephonic conversation, the same being effectuated by the act of restoring the receiving-telephone to its hook, and the severance of normal earth connections at any station occupying the line for conversation during such occupancy.

In my invention the two main conductors of a central-battery-exchange circuit may extend to four substations and may at each be provided with any desired form of signaling apparatus in which the conductive connection between the main-circuit conductors and the bell apparatus is interrupted by condensers. The hook-lever at each substation, serving in the usual manner as a support for the receiving-telephone when out of use, has no direct control over the bridge or branch containing the station-telephones, but is arranged to close a bridge through an electromagnet of high resistance when the telephone is taken from the hook and to reopen the same when the telephone is replaced. The armature of the said electromagnet normally holds a drop plate or bar in a substantially vertical position against the opposing force of gravitation and when attracted by said magnet frees the same, allowing it to fall. Normally-discontinuous terminal contacts of the telephone branch circuit or circuits are mounted below the said drop-plate, in line therewith, and within range thereof; the said plate being adapted to make contact with and unite them when, released by the excitement of the magnet, it falls. The electromagnet, its armature, and drop-plate thus constitute an electrogravitation circuit controller or switch adapted, when actuated, to close the substation branch or bridge through the station-telephones, thus bringing them into active association with the main conductors. The resistance through the said telephone branch does not generally exceed one hundred ohms, or thereabout, and as the resistance of the privacy-device-magnet branch previously closed is high (five thousand ohms having been found to give satisfactory results) it follows that by far the larger part of the current in the main circuit passes by way of the said telephone branch, the previously-closed magnet branch at the same station being practically drained, so that a very small portion of the current passes that way; and it is apparent that not only is this a fact, but also that if under these conditions the telephone at any other substation be removed

from its hook the branch or bridge at such station through the high-resistance magnet will be closed, but the armature of said magnet would not be attracted, and that its drop-plate would not fall, because owing to the low resistance of the telephone branch at the first station such small portion of current as does pass through the magnet at the second station is not sufficient for its operation, the same being true for the several other substations.

It is desirable that on the discontinuance of a communication at any substation the restoration of the drop-plate of the electro-gravity circuit-controller shall be automatically performed by the replacement of the receiver. This I accomplish by a spring attachment of the hook-lever, which engages an extension or heel of said drop-plate and exercising elastic pressure thereon elevates the said drop-plate as the said hook-lever is depressed. It is also desirable that the connection normally existing between the bell-magnets and the two condensers, one on each side thereof, shall be broken while the station-telephones are being employed, and in my invention it is provided that the connections of each condenser are led through a set of separable contact-points directly controlled by the hook-lever; the said points of each set being in contact when the telephone is on the hook, maintaining the same in its lower position, and the said points being separate, and the bell-coils and their ground connection severed from the main circuit when, the telephone being removed, the hook-lever has passed to its higher position.

In the drawings accompanying this specification, Figure 1 is a diagram conventionally illustrating a four-station telephone-circuit and the relative arrangement at each substation of the bell and privacy device, the telephone branch circuit for simplification being shown at one of the substations only. Fig. 2 is a diagram of the arrangement of appliances and circuits of each substation in detail. Fig. 2ª is a diagram showing the central-office connections of such a substation-circuit as that of Fig. 1 in association with a switch-cord having central-battery connections for transmitter-current supply. Fig. 3 is a plan view of a practical form of privacy device which has been constructed and found convenient and satisfactory. Fig. 4 is a side elevation of the same appliance; and Fig. 5 is a front elevation thereof, particularly illustrating the telephone hook-lever and its association with mechanism for restoring the drop-plate.

Referring to the drawings, L is a telephone-exchange circuit having line conductors A and B, and extending between a central station X, where it is provided with one or more switch-socket terminals or spring-jacks J and a plurality of substations 1, 2, 3, and 4. At the central station the line conductors are continued through the armature-contacts of the cut-off relay R to the poles of a battery or other source of current Y and contain the magnet-coils of the line-relay R^2, which controls the signal device S.

In Fig. 2^a the central-station connections and appliances are reproduced and are associated with a plug-circuit N. In this plug-circuit, Z and Z^2 are the switch-plugs, having main cord conductors 31 and 33 and local or cut-off relay conductors 35. Supervisory relays R^3 may be connected in one of the main conductors, as shown, one on each side of the connection of the working battery Y^2, which is bridged between the main cord conductors, the impedance-coil I^2 being also connected in a manner well understood.

Should the receiving-telephone be taken from its hook-lever at the substation of an unoccupied line which has no switch-plug inserted, the necessary line-current is furnished by the source Y; but in the case of a substation-circuit switched for conversation the said source Y is of course disconnected by the operation of the cut-off relay, and the switch-plug being placed in the jack or socket the line-current is supplied by the source Y^2.

The call-bell C at each substation may be of any desired character, selective bells of that class adapted by a special arrangement of coil-winding to respond, respectively, to currents transmitted over either line conductor to earth, to currents transmitted over either line to return by the other, and to currents transmitted over the two line conductors in parallel to earth, as described in Patent No. 626,131, granted to me May 30, 1899, being, however, indicated by the drawings and in some measure preferred. The bell at each of the stations is furnished for ringing-circuit purposes with a ground connection E and is placed in a bridge conductor K between the mains A and B, condensers *c* and *d* being placed between the said bell and the said mains, respectively.

M is the privacy-device electromagnet. H is the telephone-supporting hook-lever; T, the receiving-telephone; *t*, the transmitter, and I the transmitter induction-coil. The relative electrical arrangement of these parts is best shown in Fig. 2, while the mechanical arrangement and construction of certain features of the invention are well illustrated by Figs 3, 4, and 5.

The privacy-device magnet M is in a normally-discontinuous bridge K^2 between the main-circuit conductors A B, the said bridge leading through separable contacts w w^2 of the hook-lever H in such manner that when the said lever is supporting the receiver and is therefore in its normal position the bridge 6 is open, and when the receiver is taken from the hook and the latter consequently in its second position the said bridge is closed. The privacy-device-magnet bridge K^2 may be thus traced from point *a* on the main conductor A to point 10, conductor 11, including the key *k*, separable contacts w w^2 of the hook-lever

H, conductor 12, the coils of magnet M, conductor 13, primary winding *n* of the induction-coil I, conductor 14, and point 15 to *b* on main conductor B. The resistance of the bridge K^2 of the privacy-device magnet M is high—for instance, about five thousand ohms. This may be mainly comprised in the exciting-coils of the magnet, or (since so great a coil energy is not essential) the said coils may be wound up to twenty-five hundred ohms, and the remaining twenty-five hundred ohms may be formed of German-silver wire inserted in the bridge and wound into a special coil. The armature *e* of the electromagnet M is pivoted at e^2 and is furnished with a counter-spring e^3. It carries a latch or hook e^4, passing through a slot cut in a drop plate or bar *f* and engaging the edge of said slot, so as to hold the drop-plate, which is pivoted at f^2, in a normally vertical position against the potential action of gravity, generally in the same manner as the shutter or signal-plate of an annunciator is supported. The drop-plate *f* carries a signal-disk *v* on a rod v^2, which disk is exhibited at a window D, cut in the door or casing, as long as the drop-plate *f* remains in its normal vertical position and will disappear therefrom when the said plate has been released and has fallen. The drop-plate *f* has also a heel extension f^3, which, as will presently appear, is an element of the restoring mechanism. The drop-plate is made of or is faced with a suitable metal, and in the line of its fall are two fixed contact-points *g h*. These become electrically united to one another and to the substance of the said plate or any conductor attached thereto when the said plate falls and comes to rest against them. The station-telephones are also contained in branches or bridges between the main conductors A and B, the transmitter and induction-coil primary being in one branch K^3 and the receiving-telephone, induction-coil secondary, and a condenser in another, K^4, the branch K^3 being normally open at the contact-point *h* and the branch K^4 normally open at the contact-point *g*. The primary bridge K^3, beginning at point *a* of conductor A, may be traced by point 10, conductor 11 and the upper contacts *x* of key *k*, conductor 16 and the transmitter *t*, the drop-plate *f* of the privacy device, fixed contact-point *h*, conductor 17, contact *y* of key *k*, conductor 18, primary winding *n*, conductor 14, and point 15 to the point *b* of main conductor. The secondary bridge K^4, beginning at the same point *a*, passes by point 10, condenser *c*, conductor 19, secondary-induction-coil winding *m*, receiving-telephone T, conductor 20, fixed contact-point *g*, through the conducting substance of the drop-plate *f* to contact-point *h*, and from thence to main conductor B over the remaining portion of the primary bridge. It is apparent that the normally open telephone-bridges K^3 K^4 will be closed by the fall of the drop-plate *f* and that the primary bridge K^3 will then be conductively complete between the main conductors, while the secondary bridge K^4, since it includes the condenser *c*, will be inductively complete between the said mains. The drop-plate *f* and contact-points *g* and *h* constitute, therefore, a circuit-controller for the telephone-bridges.

The telephone-supporting hook-lever H is shown as being in its depressed or normal position, the receiver being indicated by dotted lines. The associated circuit-closing points *w* w^2 of the bridge K^2, containing the magnet M, are shown as being placed in the line of motion of the heel *q* of the lever, which is pivoted at q^2, and when the said lever, relieved from the weight of the receiver and yielding to the influence of the usual or other retracting spring, changes its position the points *w* w^2 are brought into contact, so that the circuit of the source of current Y is closed through the magnet M. The hook-lever thus exercises direct control over the privacy-device-magnet bridge K^2, closing it when the telephone is removed from the hook and reopening it when the said telephone is replaced upon the hook; but the telephones can only be brought into active relation with the circuit by the operation of the magnet M and the consequent fall of the drop-plate *f*, and the hook-lever therefore does not exercise any direct control over them or over the branches or bridges within which they are connected. While in the case of ordinary substation apparatus the removal of the receiver from the hook and the following movement of the hook-lever brings the telephones at once into operative association with the circuit, in my apparatus the connection of the telephones can only be effectuated if, after such removal of the telephone from its hook and the consequent closure of the bridge through the magnet M, a sufficient current to operate such magnet is permitted to flow through the coils thereof. These conditions occur when the telephone T is taken from the hook at any substation, no other station being in previously-contracted occupancy of the line. In that case the magnet M will be excited and will attract its armature *e*, which, releasing the drop-plate, permits the latter to connect the telephone and at the same time withdraw the signals *v* from the window. But the resistance of the telephone-bridge thus closed does not ordinarily exceed one hundred ohms, and the establishment of such a low-resistance bridge at the substation in parallel with the high resistance of the magnet M shunts the latter, withdrawing by far the greater part of the current therefrom, so that although the magnet-bridge K^2 remains closed at the points *w* w^2 there is no longer sufficient current through the magnet to maintain the excitement thereof, and its armature *e* is retracted by the spring e^3 and is ready to reëngage the drop-plate *f* when the same shall have been lifted to its normal vertical position. Furthermore, the establishment of the telephone-bridge in this way at any

one station acts also to shunt the high-resistance magnet-bridge K^2 at all of the other stations of the circuit, and if at any other station an attempt is made to use the telephones and the receiver is taken from the hook for that purpose no connection can be made, for the reason that the current of the main circuit is drained away through the low-resistance telephone-bridge at the substation which has previously connected its telephones with the line. Hence when any one of the stations has obtained occupancy of the main circuit for conversation no other station of the circuit can interrupt or connect its telephones, and any station desiring to use the line must await its turn.

The hook-lever H carries a spring-arm or auxiliary lever *u*, adapted to engage the heel projection f^3 of the drop-plate, and after the latter has fallen to act in association with the said heel projection when the receiver is replaced on the hook-lever H and to restore the drop-plate to its vertical position, enabling it to be reëngaged by the latch e^4.

It is not necessary to employ a special condenser for the telephone-bridge K^4, and I preferably so arrange the connections that the condenser *c* of the normal bell-bridge may be made available for this purpose. To this end I extend a loop *i* of the bell-bridge K between the condenser *c* and bell C, to and through separable contacts i^2 and i^3 beneath, and controlled by the hook-lever H, and in order to obviate all liability to disturbance due to currents incoming by way of the substation ground connection E a second loop *j* of the bridge on the other side of the bell C and between it and the condenser *d* is also provided, which passes through similar and similarly-placed separable contacts j^2 and j^3. Both of these sets of contacts are, as shown, placed in such mechanical relation to the hook-lever that when the telephone is removed from the hook their members separate, breaking the circuit of their respective loops, and when the telephone is replaced on the hook the contacts of both sets are reunited and the loops are once more closed. To facilitate this operation, one member of each set of contacts is fixed or rigid, while the other is made resilient. Hence the bell C and its ground connection E are absolutely disconnected at a station which has connected its telephones for conversation.

The bridge K^2, containing the high-resistance privacy device magnet M, and the transmitter-bridge K^3, lead through separate separable contacts *x* and *y*, respectively, of the key or push-button *k*. The purpose of this arrangement is to facilitate the establishment of communication between two substations of the same circuit. Supposing station 2 to desire communication with station 4 and to have called the central station to indicate such desire, the central-station operator will direct station 2 to press the button *k* and listen at telephone T until the voice of the subscriber at 4 is heard. The pressure on the button separates the contacts *x* and *y*, thus breaking the high-resistance bridge K^2 and the transmitter-bridge K^3, cutting the line-battery from both. There being then no current on the line, (the bell-bridge also being open because the telephone has been removed from the hook,) the regular and familiar supervisory signal (not shown) will be displayed at the central station, indicating to the operator that her instructions have been carried out. The central station now having the line free sends a ringing-current to call station 4, who is able to connect the telephones and answer, for the transmitter-circuit being open the current is not short-circuited by the operation of the privacy device at station 2, as would be the case if the button *k* were left unpressed. The answering words of station 4 can, however, readily be heard in the telephone at station 2, the said telephone having a circuit between the main conductors A and B by way of the condenser *c*, conductor 19, coil *m*, receiver T, contact-point *g*, drop-plate *f*, conductor 16, transmitter *t*, conductor 11, circuit-closing points *w* w^2, magnet M, conductor 13, coil *n*, conductor 14, and point 15. When the subscriber at station 2 hears the voice of the subscriber at station 4, the button *k* is released and the two stations will be in full communication—a fact announced to the central station by the extinguishment of the signal-lamp.

In Figs. 3, 4, and 5 to the projecting ends of the cores of the two spools of the high-resistance electromagnet M is secured, by means of large-headed iron screws *p*, a brass plate P, which carries lugs p^2, between which in the pivots e^2 the armature *e* is hung. The flat retracting-spring e^3 of the armature secured to it extends backward and engages a tension-adjusting screw *s*, and the latch-lever e^4 is also secured to the armature near the pivotal axis thereof. At points near the lower corners of the plate P are rigidly fixed two posts *o*, of brass, between which at f^2 is pivoted the drop-plate *f*, extending upwardly when at rest and slotted for normal engagement with the latch e^4, as shown and hereinbefore described, being adapted, however, to be released by said latch when the armature *e* is attracted toward the magnet-poles *p* and thereupon to fall forward. The contact-points *h g* of the primary and secondary telephone-circuits are by preference each formed as double contact-springs, the two members thereof pressing toward one another, and are mounted on a base V, of hard rubber or like non-conductor, secured to the posts *o*. To the front face of the drop-plate *f* is affixed the thin metal blade-contact f^4, so shaped and placed that when the plate *f* falls forward the blade enters between the leaves of both of the double spring-contacts, establishing electrical connection between the said two sets of contacts *g* and *h* and between the drop-plate and

both. From the lower end of the drop-plate *f*, at a point below its pivots, the arm v^2 extends and has attached to its outer end the plate *v*, which forms the visible signal of the apparatus and which by its visibility or nonvisibility at a window or aperture D, Fig. 2, indicates the busy or free state of the line. Upon the back face of the drop-plate *f* is fixed a block of metal or similar weight f^5, which in the vertical position of the plate serves as a counterweight to the signal-carrying rod v^2 and signal-plate *v* and which in the forward fall of the said plate tends to force the blade f^4 into more effective contact with the springs *g h*.

The structure, as thus far described comprises the magnet, drop, and contact mechanism constituting the electrogravity-switch or circuit-controller.

The drop-plate-restoring mechanism comprises the rigid projection or heel-piece f^3 of the drop-plate, the resilient arm or auxiliary spring-lever *u*, riveted to the telephone hook-lever, near the pivot thereof, and the laterally-projecting pin *r*, extending rigidly from the side of the adjacent post *o*. The heel-piece f^3 in this embodiment of the invention is formed at its end into a short cross-head having its upper surface dressed smooth and turned at such an angle with the plane of the drop-plate *f* that when the said drop-plate is in its forward or fallen position the upper face of the cross-head of the heel-piece f^3 is nearly horizontal. So far as these parts are indicated in Fig. 2 the hook-lever H and its resilient arm *u* are shown in their normal position, the telephone being assumedly in place on the hook. Under these conditions the overhanging end of the spring-arm *u* bears upon the inclined face of the cross-head with an elastic pressure. If now the telephone be taken from the hook and the hook lever allowed to move to its upper limit, the spring-arm *u* slides forward and up on the inclined face of the heel-piece cross-head until the inclined portion of the spring *u* bears upon the pin *r*, and the further upward movement of the hook-lever carries the spring still upward and backward out of engagement with the cross-head. Then when the magnet is excited and the drop-plate falls forward the cross-head of the heel-piece f^3 swings backward into a substantially horizontal position. To restore the plate *f* to its normal engagement by the latch e^4 of the magnet, the telephone is replaced upon the hook-lever, which is thereby depressed to its lower limit, and the inclined portion of the spring-arm *u* slides forward under the pin *r* into engagement with the cross-head. The drop is thus elevated to its vertical position, and before the hook-lever concludes its downward motion the overhanging portion of the spring-arm *u* is caused to slide along the face of the cross-arm, which is now inclined until its original position is attained.

The advantage of employing a yielding or resilient engagement between the hook-lever and the drop-plate heel-piece is that a considerable range of accommodation to the movement of the said hook-lever is thus provided and certainty in restoring the drop without necessary dependence upon exact adjustment or unvarying action of the hook-lever is secured. In the mechanism shown the hook-lever moves downward from its upper limit about one-quarter of its whole movement before engaging the heel-piece and about the same distance to the lower limit after the drop-plate is restored to its normal position, so that the restoring movement does not require any careful or accurate adjustment and is not liable to get out of order.

The drop-plate plan of establishing the telephone branches or bridges involves several advantages. The telephone-contacts being made by a uniform exercise of the force of gravity are more uniformly firm and trustworthy than they could be if made directly by the operation of the high-resistance electromagnet varying widely with varying line conditions. An appreciable interval of time elapses between the closing of the magnet and telephone branches, insuring that the work of the former branch shall be fully performed before it is again opened or before its magnet is shunted.

Since the liberation of the drop-plate is the only work required of the electromagnet, which is virtually a means for imparting the stored energy of the weighted telephone hook-lever upon the circuit-controlling drop-plate, the said magnet may work on a much lower minimum current than if it were required to directly produce an equally perfect closure of the telephone branches. Moreover, by the use of the drop-plate device the necessary extent of movement of the visible signal is secured in a much easier and more convenient way than it could be were the said signal attached by direct connection to the armature.

Having now fully described the invention and its operation, I claim—

1. The combination of a main metallic telephone-circuit provided at a central station with switch devices and a source of current, and extending therefrom to a plurality of substations; a normally open branch circuit at each station including the station-telephones; and a hook-lever adapted to support the receiving-telephone when unemployed; with a lock-out appliance or privacy device at each substation, comprising a high-resistance electromagnet in a normally open branch of said main circuit controlled by said hook-lever; an electrogravity circuit-controller actuated by said electromagnet and adapted on the excitement thereof to close the said telephone branch, thereby shunting the said high-resistance magnet at said substation and at any other substation where the receiver may be taken from its hook; and mechanism actuated by the replacement of the telephone on the hook-lever for restoring

the normal condition of the said circuit-controller, and for thereby reopening the said telephone branch; substantially as set forth.

2. In a privacy device for the substations of a polystation telephone-circuit, the combination with the main circuit conductors of a normally incomplete branch or bridge including the station-telephone; an electrogravity-switch controlling the continuity of said telephone branch; a normally incomplete branch or bridge having a resistance high relatively to that of the said telephone branch, and containing the actuating-electromagnet of said switch; and a hook-lever serving as a telephone-support, actuated by the removal and replacement of the said telephone, and controlling the continuity of said high-resistance branch; substantially as specified herein.

3. In a privacy device for the substations of a polystation telephone-circuit, and in combination with the two main conductors of said circuit; a normally incomplete branch circuit including the station-telephones; an electrogravity-switch comprising an electromagnet, an armature therefor, and a circuit-controller for the said telephone branch actuated by said magnet and armature; an independent normally incomplete branch containing the electromagnet of said electrogravity-switch; a hook-lever serving as the support of the receiving-telephone, and actuated by the removal and replacement thereof; and circuit-controlling terminal points for the said magnet branch, separated in the normal position of said hook-lever, but pressed into contact with one another to complete said branch, by said hook-lever in its working position; substantially as set forth.

4. In a polystation telephone-circuit, the combination of the two main conductors thereof, and a central source of current connected with said conductors; with apparatus at each substation consisting of the telephone-supporting hook-lever; a normally open bridge of said conductors adapted to be closed by said hook-lever when relieved of the weight of the telephone; a normally open telephone-bridge, and station-telephones connected therein; an electrogravity-switch controlling the continuity of said telephone-bridge, and comprising a high-resistance electromagnet included in the first-named bridge, a drop-plate normally maintained in a vertical position by the armature of said magnet, but adapted to yield to gravity and fall when released therefrom, and thereupon to close said telephone-bridge; and a visible signal-plate carried on a rod rigidly secured to the axis of the drop-plate of said electrogravity-switch and adapted to appear at or disappear from an aperture or window according to the position of said drop-plate, and thereby indicate the engaged or disengaged condition of the line; substantially as set forth.

5. In the substation apparatus of a polystation telephone-circuit, the combination substantially as hereinbefore described, of two normally incomplete parallel bridges of said circuit, one containing the receiving-telephone, the induction-coil secondary and a condenser, and the other containing the transmitter-electrodes and induction-coil primary; an electrogravity-switch comprising an electromagnet, the normally discontinuous contact-terminals of said bridges mounted in proximity thereto, an armature for said magnet carrying a latch or detent, and a conductive drop-plate normally latched in a vertical position by said armature, but adapted to fall into contact with said terminals and to complete said bridges when released by the attraction of said armature; a normally incomplete bridge of said circuit including the said electromagnet, and having a high resistance composed mainly or in part of the resistance of said magnet; a telephone-supporting hook-lever, operated in one direction by the removal and in the other direction by the replacement of the telephone; and a circuit-closer for the said electromagnet-bridge actuated by said hook-lever.

6. In the substation apparatus of a telephone-circuit, the combination of an electrogravity-switch controlling the continuity of a branch circuit containing the station-telephones, and comprising an electromagnet, its armature, a drop-plate normally held in a vertical position by said armature but adapted to fall into a horizontal position when released therefrom, and terminals of said branch circuit adapted to be united by said plate when in the latter position; with a telephone-supporting hook-lever held in its normal position by the weight of the telephone, and operated by the removal and replacement thereof; and restoring mechanism actuated by said hook-lever, as indicated, for elevating the said drop-plate when fallen, when the said lever is moved by the replacement of the telephone thereon; substantially as and for the purposes specified.

7. In the substation apparatus of a telephone-exchange circuit having two main conductors, the combination with the electromagnetic call-bell; and the telephone-supporting hook-lever; of separable contact-points held together by the said hook-lever while the telephone is on its support, but permitted to separate on the removal of said telephone; and a bridge conductor including the magnet of the said call-bell and a condenser, the said bridge conductor being looped at a point between the condenser and the bell-magnet through the said separable contact-points; substantially as described and for the purposes set forth.

8. The combination in the substation apparatus of a telephone-exchange circuit having two main conductors, of the electromagnetic signal-bell; and the telephone-supporting hook-lever; of two associated sets of separable contact-points, the points of both sets being normally held together by the pressure

of said hook-lever, when the telephone is supported thereby, and adapted to separate, when, by the removal of the telephone, the said pressure is removed; of a bridge conductor between the said main conductors including the magnet of said bell; two condensers one on each side of said bell, also contained in said bridge; and two loop conductors extending to and through the said two sets of separable contacts respectively, from points on said bridge between the respective condensers and the bell, whereby the said bridge may be disestablished, and the said bell wholly disconnected when the telephone is removed from the said hook-lever; substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 4th day of September, 1900.

JOHN A. BARRETT.

Witnesses:
GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.