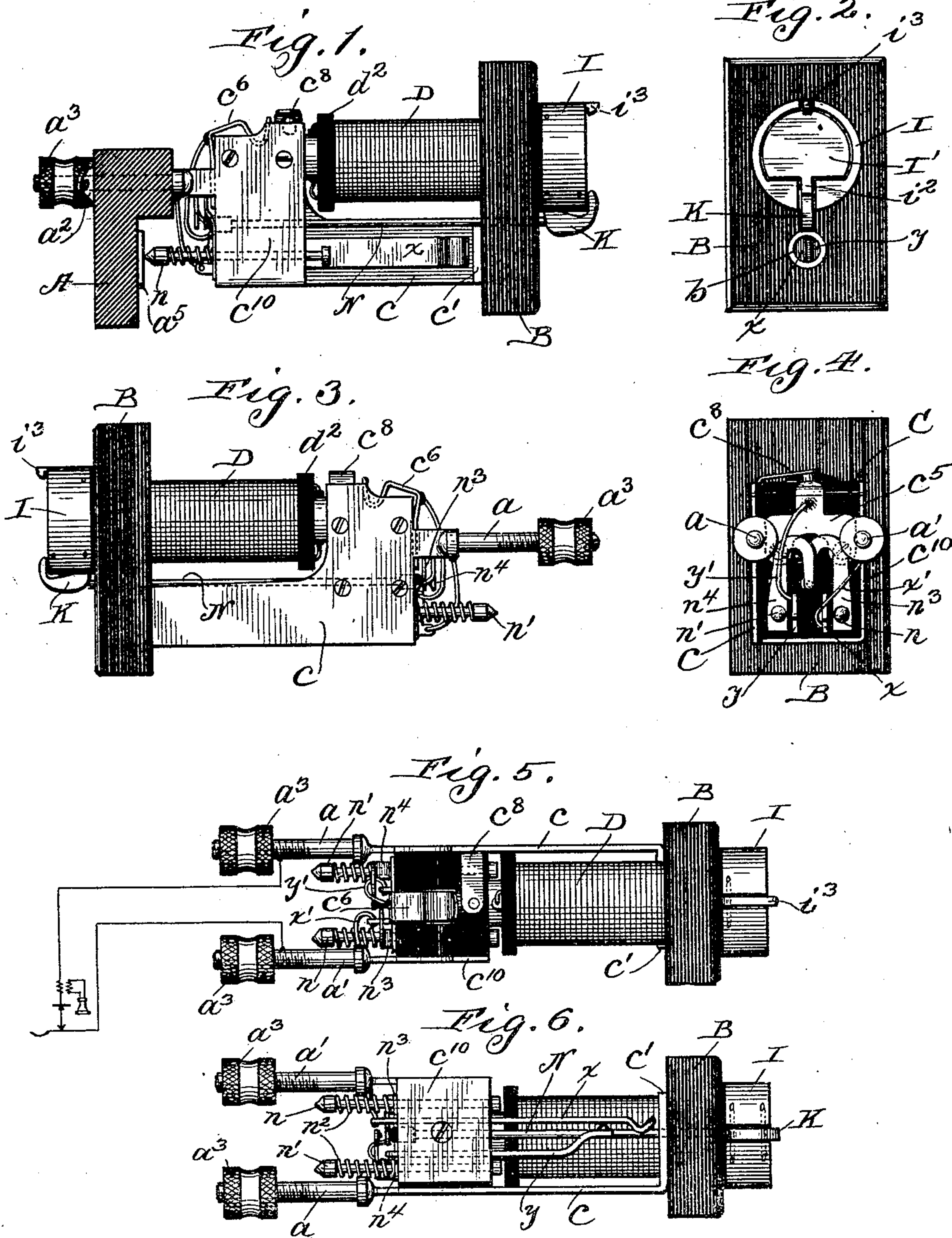


No. 824,431.

PATENTED JUNE 26, 1906.

W. E. McCORMICK.
TELEPHONE SWITCHBOARD.
APPLICATION FILED AUG. 26, 1901.

3 SHEETS—SHEET 1.



Witnesses:
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3 SHEETS—SHEET 3.

Fig. 13.

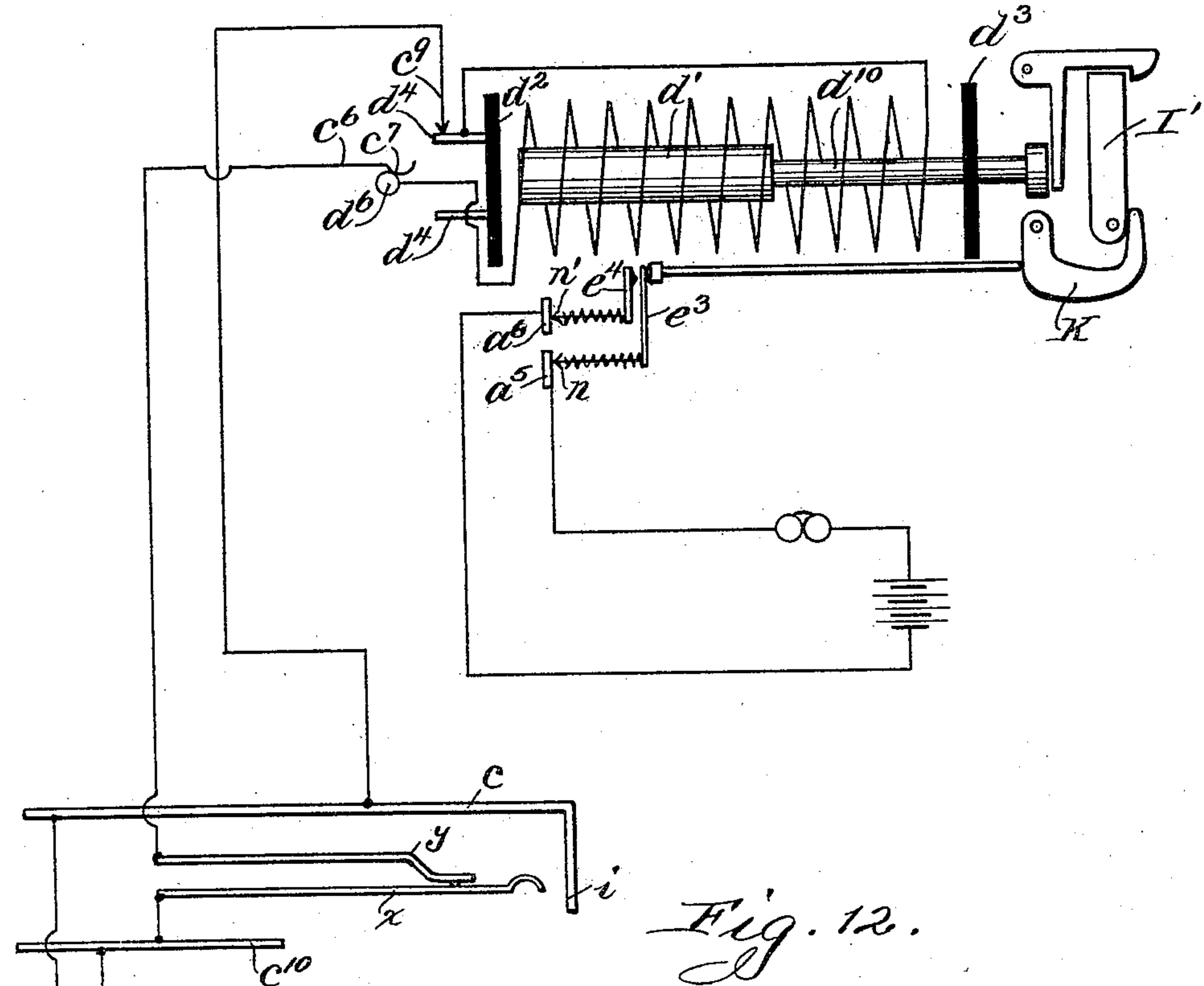
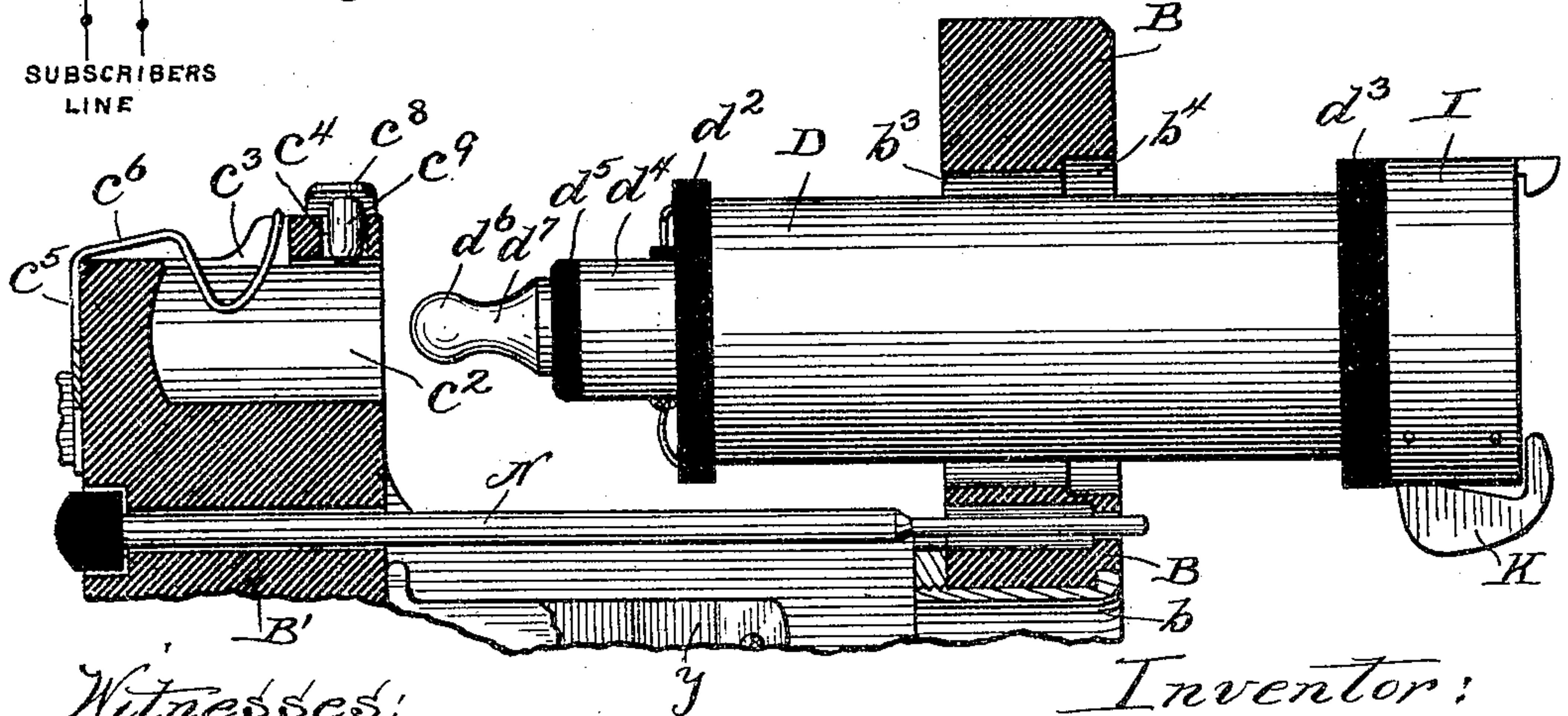


Fig. 12.



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UNITED STATES PATENT OFFICE.

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TELEPHONE-SWITCHBOARD.

No. 824,431.

Specification of Letters Patent.

Patented June 26, 1906.

Application filed August 26, 1901. Serial No. 73,365.

To all whom it may concern:

Be it known that I, WILLIAM E. McCORMICK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone-Switchboards; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to telephone-switchboards, and more particularly to that class of switchboards wherein all of the mechanical and electrical devices pertaining to each subscriber's line at the central station are included in a unitary structure capable of being placed in and removed from the switchboard as a single device.

The principal object of my invention is to provide a line-jack and annunciator of the combined or unitary type wherein all the mechanism, including all of the electrical devices associating with or coöperating with the jack, drop, and plug pertaining to each subscriber's line at the central station, is embodied in a single structure capable of bodily assembling in and disassembling from the switchboard frame or cabinet.

Another object of my invention is to provide an improved device of this unitary character wherein the magnet and drop, together with the operating parts of the drop, may be readily disassembled from the frame of the unitary structure for repairs or replacement and easily and quickly replaced therein.

Another object of my invention is to provide an annunciator of the drop-shutter type having simple and efficient means to mechanically and automatically restore the drop by means of the plug.

A further object of my invention is to provide a novel and simple construction and arrangement of all of the parts comprising a combined or unitary drop and jack structure, whereby all the electrical devices of each unitary device may be automatically included in their proper circuits by the placing of the device in position on the board.

A further object is to provide novel and efficient means for closing the night-bell circuit when the drop falls to signaling position.

Other objects of my invention will be apparent from the disclosure thereof.

With the objects of my invention in view the invention consists in certain novel features of construction and in the combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, which illustrate the preferred organization of my invention, Figure 1 is a side elevation of a combined or unitary jack and drop structure exemplifying my invention. Fig. 2 is a front elevation thereof with the drop or annunciator in its normal or non-signaling position. Fig. 3 is a side elevation of the parts shown in Fig. 1, but taken on the side opposite to that shown in Fig. 1. Fig. 4 is a rear elevation illustrating various mechanical and electrical devices employed. Fig. 5 is a top plan view. Fig. 6 is a bottom plan view. Fig. 7 is a vertical sectional view showing the drop in signaling position and the plug in position to enter the jack. Fig. 8 is a detail view of the core and actuating-coil of the solenoid or electromagnet employed. Fig. 9 is a detail view of the drop-case and sliding armature employed, the parts illustrated in Figs. 8 and 9 being shown as disassembled upon their common axial line. Fig. 10 is a front elevation of the structure, showing the drop in signaling position. Fig. 11 is a vertical central sectional view of the structure on an enlarged scale. Fig. 12 is a detail view of part of the frame of the combined jack and drop structure, together with the solenoid employed, and illustrates the method of assembling and disassembling these parts. Fig. 13 is a diagrammatic view of the circuits and circuit connections of my combined jack and drop structure at the switchboard.

The reference-letter A represents a portion of a switchboard cabinet or support, such as a rear rail thereof, provided with holes for the passage of screw-threaded rods *a* and *a'*, which are electrically connected with their respective line-jacks in a manner hereinafter explained and by means of which the frames of the jack and drop structures and the associated parts are secured to the cabinet or back of the switchboard by suitable thumb-nuts *a*³, which bind the parts together and to which the subscriber's line-wires are con-

connected, as by means of suitable clips a^2 , providing soldering-terminals, all as shown in Figs. 1 and 7. The part A is also provided with suitable strips a^5 and a^6 , forming the board-terminals of a normally open night-alarm circuit, including a battery and a signal device, as shown in Fig. 13, and which are adapted to be engaged by suitable corresponding frame-terminals, as hereinafter described.

The frame of each combined jack and drop structure comprises a face-plate B and a rear block C, which are rigidly connected together in alinement by a metallic conducting-plate c . The plate c is secured by screws or other suitable means to one side of the block C, where it is in electrical connection with the screw-rod a and is provided at its forward end with an angular extension c' , which is suitably tapped for screw-threaded electrical connection with a plug-socket b of the jack, which passes through the face-plate and is preferably flared at its outer end to provide an annular shoulder to securely bind the parts together, as well as to make an enlarged mouth for the plug.

The plate B is provided with a suitable bore or passage b^3 , having a shoulder b^4 , and the block C is provided with a rearwardly-extending socket or channel c^2 , which is arranged in the same axial line as the passage b^3 and has upwardly-directed openings c^3 and c^4 in its top wall, leading out upon the upper face of the block. A suitable conducting-plate c^5 is attached to the rear face of the block and is provided with a forwardly-extending spring-arm c^6 , which has a downwardly-bent and preferably rounded portion or terminal c^7 lying in the opening c^3 and projecting into the socket c^2 . A second conducting-plate c^8 is attached to the side of the block under and in electrical connection with the plate c and has an inwardly-directed spring-arm which carries a lug c^9 , projecting through the opening c^4 into the socket c^2 . This organization of the parts is clearly shown in Figs. 4, 5, 7, 11, and 12. A conducting-plate c^{10} , in electrical connection with the screw a' , is attached to the side of the block opposite the plate c and is extended around the lower portion of the block to support an intermediate strip c^{11} of insulating material, which closes suitable slots or kerfs in the bottom edge of the block in which suitable conducting-strips x and y are held. These strips extend forwardly different distances in the line of the plug-socket b and are normally in electrical connection near their front ends, as shown in Fig. 6. The strip x constitutes the spring of the jack and has a suitable bent end to engage the neck of the tip of the plug, whereby when the plug is inserted in the jack the electrical connection between the strips is broken and the plug is held in place within the jack. The strip x is in electrical connection

by a suitable conductor x' with the screw-rod a' , and the strip y is in electrical connection by a suitable conductor y' with the plate c^5 .

The reference-letter D represents a solenoid adapted to be removably mounted in the frame and having a hollow core d , in which plays a sliding armature d' , which may be solid or hollow and is of such length that when the solenoid is energized it is drawn into the core in order to release the drop or annunciator, as hereinafter described. The helix is wound upon the core, which carries the usual heads d^2 and d^3 , and the core projects beyond the rear head in a sleeve d^4 and has its rear end closed by a suitable block or plug d^5 , of insulating material, carrying a conducting-tip d^6 , having a reduced neck or diameter d^7 . The terminals of the helix are electrically connected with the sleeve d^4 and the tip d^6 by the conductors 1 and 2, respectively, the conductor 2 passing through an insulating spool in the sleeve to the interior thereof, as clearly shown in Fig. 11.

The solenoid fits within the frame and is readily removed from and replaced therein, the spool d^3 entering the opening b^3 and engaging the shoulder b^4 to limit the position of the parts, and the sleeve and tip entering the socket c^2 , where the contacts c^7 and c^8 engage the tip and sleeve terminals, respectively, of the helix, the spring-contact c^7 serving to hold the solenoid against accidental displacement. When in position in the frame the solenoid is automatically connected in the subscriber's line-circuit, which is traced through the screw a' , connection x' , strip x , strip y , connection y' , plate c^5 , tip d^6 , connection 2, through the helix and connection 1 to sleeve d^4 , lug c^9 , plate c^8 , plate c to screw a , whereby the helix is energized when a subscriber sends an incoming signal.

The energization of the helix of the magnet is employed to operate the line-signal or drop corresponding to the calling subscriber. This may be accomplished in a number of different ways and through a variety of means adapted to be associated with the particular form of magnet shown. I have illustrated a practical and simple form of device for this purpose which embodies my preferred construction in this respect and which I will now describe.

The core of the electromagnet receives at its front end a removable sleeve d^8 , which projects slightly beyond the core at its front, where it is screw-threaded for a purpose to be described. The sleeve is divided into front and rear bores or chambers by a channeled bearing d^9 , in which a plunger-rod d^{10} is mounted for reciprocation. The rod or plunger engages at its inner end with the armature d' and is surrounded by a spring d^{11} within the rear bore of the sleeve interposed between the armature and bearing to hold the

parts in the relation shown in Fig. 11. The front end of the plunger or rod carries an insulating-disk d^{12} , which is adapted to be projected into the recess or socket of a suitable drop-case I when the armature is affected by the energization of the magnet.

The case I is preferably circular in cross-section and is provided with a central tap or screw-threaded aperture to engage the thread of the sleeve d^8 , as clearly shown in Fig. 11. The case is preferably substantially cup-shaped, and the drop or target I' is pivoted thereto in a slot i in the lower thickened wall thereof by means of a lug i^2 at the lower end of the drop. The drop is adapted to be engaged at its upper end and retained in normal or non-signaling position by an annular latch i^3 , pivoted in a slot in the upper portion of the case and normally lying flush with the periphery thereof. The latch is provided with a depending arm or tail-piece i^4 , which lies in the path of the disk d^{12} of the plunger, whereby when the latter is projected forward into the chamber of the case the latch is raised to release the drop. The drop or target I' may be pivoted in the case in such manner as to fall by gravity to the position shown in Figs. 7 and 10 when released by the latch, as by having it normally occupy or stand in a forwardly-inclined position, or the arrangement of the parts may be such that the drop will be projected slightly over the pivot-point by the forward movement of the plunger.

A restoring arm or lever K is pivotally supported in the slot i of the case by means of an upwardly-extending arm k and is provided at its front with a curved or hooked end k' , against which the drop strikes when in signaling position. The hook k' is in front of the lug i^2 of the drop, and the lower end of the arm k rests against a spring-pressed rod N when the parts are assembled. The arm or lever is bulged or thickened in vertical cross-section from the hook toward its rear, and its lower edge is rounded or curved to form a cam edge k^2 , projecting in a rearwardly and downwardly direction.

The drop or annunciator I' normally stands within the case I in substantially the relation shown in Fig. 11, and when the magnet is energized by the incoming signal of the subscriber the armature is drawn within the core against the force of the spring d^{11} , raising the latch and allowing or causing the drop to fall to signaling position. (Shown in Fig. 7.) The relation of the parts when the drop has fallen is such that the arm K is pressed down by the drop into the path of the plug employed by the operator to connect her instrument with the subscriber's line to ascertain the number of the called subscriber desired, the arm or lever presenting its inclined surface k^2 to the handle of the plug and adapted to be raised thereby.

The plug P is provided with the usual insulated tip and sleeve portions, which engage the spring x and the plug-socket b , respectively, when the plug is inserted in the jack and also with the usual handle p , forming a shoulder p' in the usual manner. When the plug is inserted in the jack, the shoulder engages the curved or cam face of the arm or lever and raises the same, whereby the hook k' , bearing against the drop or shutter, restores it to place as the arm is raised by the plug, the increasing thickness of the arm or lever in vertical section from front to rear serving to produce this upward thrust.

The frame of each combined jack and drop structure is provided with suitable terminals, adapted to cooperate with the board-terminals a^5 and a^6 when the structure is assembled on the board. These frame-terminals are preferably in the form of head-rods n and n' , mounted in bores or holes near the lower edge of the block and held in rearward extension thereof by means of suitable springs n^2 , inclosed between the block and heads. Each head has an associated contact n^3 and n^4 , respectively, through which it preferably passes and with which it is electrically connected by the engagement of the parts and by the associated spring n^2 . These contacts are preferably in the form of J-shaped spring-plates and are inverted on the rear face of the block, their free ends being offset from the block and carried inwardly to overlap, as shown in Fig. 4. These contacts are normally disconnected, whereby when the frame is mounted on the board they form normally open terminals of the night-bell circuit, and they are adapted to be brought into contact to close the circuit by means of a rod N, which is mounted in suitable openings in the face-plate and block parallel with and above the plane of the jack-strips. The front end of this rod extends into the path of the movement of the lever or arm K and is provided at its rear end with a suitable insulating button or disk, which rests against the spring n^3 . When the drop falls, its weight causes the arm K to be pressed back to the position shown in Fig. 7, whereby the rod N is forced rearwardly against the stress of the spring-contact n^3 , which in turn is carried rearwardly to engage the contact n^4 and close the circuit through the night-alarm, which is thereby caused to operate. The positions of the parts when this operation takes place are clearly shown in Fig. 7. The frame-contacts n and n' , being spring-pressed, engage their corresponding board-terminals with close contact at all times, whereby the contacts are in perfect electrical connection regardless of the thickness of the rear rail or board.

In operation the frame carrying all of the mechanism pertaining to a subscriber's line at the central station is attached to the switchboard by means of the screw-bolts a

and a' , this placing the electromagnet in the circuit of the subscriber's line over which it presides, the electrical connections being established by means of the line-terminals engaging the screw-bolts in any desired manner. The night-bell terminals of the frame are likewise placed in electrical connection with the corresponding terminals of the board. When a call is made by a subscriber, the electrical current energizes the electromagnet and its armature is caused to move within the core, raising the latch and permitting the annunciator to fall. The annunciator bears the arm K downwardly and rearwardly to close the normally open night-alarm spring-contacts n^3 and n^4 by means of the sliding rod N, completing the night-bell circuit. When the plug is inserted in the jack, its tip engages the spring-strip x , causing its electrical disconnection from the strip y , electrically removing the electromagnet from the subscriber's line and placing the cord-connectors of the plug in electrical connection with the subscriber's line in order to permit the operator to listen over said line to ascertain the number of the called subscriber and afterward connect the two subscribers in circuit. The insertion of the plug also mechanically removes the arm K, causing the hook thereof to raise the drop into its normally elevated position, where it is retained by the latch, the deenergizing of the electromagnet by the separation of the strips x and y permitting the armature to return to its normal position and retracting the plunger within the sleeve. When the arm K is raised, the stress of the spring-contact n^3 moves the rod N to its normal position and automatically opens the night-bell circuit.

By constructing a combined jack and drop in the manner above described the devices connected with the subscribers' lines are compactly arranged in a unitary structure which is capable of bodily removal from and replacement in the board and enables the electrical connections necessary to establish the proper circuits through the device to be made by the act of making the mechanical attachments. The provision for readily disassembling the magnet and its associated parts from the frame and these several parts from each other for repair and replacement is important, as it enables an unskilled operator to detach and replace any part which may have become worn or out of order. The magnet, together with the drop devices, may be detached from the frame merely by forcing it out from engagement with the retaining-spring c^6 . The drop and armature may in turn be detached from the magnet by sliding the sleeve d^8 out of the core. The drop-shutter and its immediate associated parts included within the drop-case may be detached from the sleeve by unscrewing the

connection. In this manner any part may be removed and replaced by an ordinary operator.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a telephone-switchboard, the combination with a frame, having contacts normally included in the line-circuit, of an electromagnet having a sleeve and a tip electrically connected with its coil and engaging the contacts when the electromagnet is in place on the frame.

2. In a telephone-switchboard, the combination with a frame, consisting of a front plate having an opening and of a block having a socket, and line-contacts in the socket, of an electromagnet having a sleeve and a tip electrically connected with its coil and adapted to enter said socket and engage with said contacts.

3. In a telephone-switchboard, the combination with a frame, consisting of a front plate having an opening and of a block having a socket, and spring-pressed line-contacts in the socket, of an electromagnet having a sleeve and a tip electrically connected with its coil and adapted to electrically connect with said contacts when the sleeve and tip enter the socket.

4. In a telephone-switchboard, the combination with a frame, consisting of a front plate having an opening and a block having a socket provided with openings in its wall, plates on the block in electrical connection with the subscriber's line and having spring-pressed contacts in said openings, of an electromagnet having a sleeve and a tip at its rear in electrical connection with its coil and adapted to enter said socket to engage said contacts.

5. In a telephone-switchboard, the combination with a frame, consisting of a front plate having an opening and of a block having a socket provided with openings in its top, plates on the block in electrical connection with the subscriber's line and having spring-contacts in said openings, of an electromagnet having a sleeve and a tip at its rear in electrical connection with its coil and engaging said contacts when the electromagnet is in position, said tip having a neck to receive one of the spring-contacts.

6. In a telephone-switchboard, the combination with a frame, consisting of a front plate having a shouldered opening and of a block having a socket provided with openings, of an electromagnet having a front spool adapted to said shouldered opening, a core provided with a sleeve, a plug in the sleeve, a tip on the plug having a neck, said tip and sleeve being in electrical connection with the magnet-coil, a spring-contact engaging the neck to prevent the accidental

displacement thereof, and a second spring-contact engaging the sleeve, said contacts being included in the subscriber's line.

7. In a telephone-switchboard, the combination with a frame, consisting of a front plate B having a shouldered opening b^3 and of a block C having a socket c^2 and openings c^3 and c^4 , of an electromagnet D, having a front spool adapted to said shouldered opening, a core d provided with a rear sleeve d^4 , a plug in the sleeve, a tip d^6 in the plug having a neck, said tip and sleeve electrically connected with the electromagnet-coil, a line-plate c^5 having a spring c^6 provided with a contact c^7 in the opening c^3 , and a second line-plate c^8 having a spring-lug c^9 in the opening c^4 , said contact and lug being in electrical connection with the tip and sleeve respectively.

8. In a telephone-switchboard, the combination with an electromagnet having a spring-pressed armature and a plunger moving with the armature, of a hinged drop supported on the front of the electromagnet, and a hinged latch having a portion thereof located in the path of and actuated by the plunger to release the drop.

9. In a telephone-switchboard, the combination with an electromagnet having a hollow core, a spring-pressed armature sliding therein and provided with a plunger moving with the armature, of a removably-mounted drop, and a pivoted latch having a tail-piece which projects into the path of and is actuated by the plunger to release the drop.

10. In a telephone-switchboard, the combination with an electromagnet having a hollow core, a spring-pressed armature sliding in the core, a sleeve adapted to the core, and a plunger moving with the armature and passing through the sleeve, of a drop-case mounted on the sleeve and having a pivoted annunciator, and a latch engaging the annunciator and having a tailpiece located in the path of and engaged by the plunger, when the armature is attracted by the electromagnet, to release the annunciator.

11. In a telephone-switchboard, the combination with an electromagnet having a hollow core, a spring-pressed armature sliding in the core, a plunger moving with the armature, and a sleeve removably fitting the free end of the core, of a drop-case having a screw connection with the sleeve and carrying a pivoted drop, and a latch having a tail located in the path of the plunger and engaged by the latter to release the drop.

12. In a telephone-switchboard, the combination with an electromagnet having a hollow core, an armature sliding therein, a sleeve removably fitting within the core, and a spring-pressed plunger moving with the armature and passing through the sleeve, and of a drop-case on the sleeve, a drop pivoted

on the case, and a latch for the drop in the path of the plunger.

13. In a telephone-switchboard, the combination with an electromagnet having a hollow core, an armature sliding therein, a sleeve removably fitting the core, a spring-retracted plunger on the armature passing through the sleeve, of a drop-case having a screw connection with the sleeve, a drop pivoted on the case, and a latch engaged by the plunger upon the movement of the armature to release the drop.

14. In a telephone-switchboard, the combination with an electromagnet having a hollow core, an armature sliding therein, a sleeve removably adapted to the core, a spring-retracted plunger on the armature passing through the sleeve, of a drop-case having a screw connection with the sleeve, a drop pivoted on the case, and a latch normally engaging the drop and having a tailpiece in the path of the plunger.

15. In a telephone-switchboard, the combination with a jack, a drop, and an electromagnetic latch device for said drop, of an arm below and adapted to engage the front face of the drop and to be depressed thereby into the path of a plug, and a plug adapted to engage the arm to restore the drop as it is inserted in the jack.

16. In a telephone-switchboard, the combination with a jack, a drop, and an electromagnetic latch device for said drop, of an arm pivoted above the jack and normally out of the path of a plug, a hook on the arm adapted to coact with the drop to move the arm into the path of a plug when the drop falls and to restore the drop when the arm rises, and a plug adapted to raise the arm as it is inserted in the jack.

17. In a telephone-switchboard, the combination with a jack, a drop, and an electromagnetic latch device for said drop, of an arm pivoted intermediate the drop and jack and normally out of the path of the plug, a hook on the arm to cooperate with the drop, a cam on the arm in the path of the plug when the arm is down, and a plug to engage the cam to restore the drop.

18. In a telephone-switchboard, the combination with a jack, a drop, and an electromagnetic latch device for said drop, of an arm pivoted between the drop and jack normally above the path of a plug and adapted to be depressed into said path by the drop, a hook on the arm to restore the drop when the arm is raised, and a cam on the arm to cooperate with a plug to raise the arm to restore the drop.

19. In a telephone-switchboard, the combination with a jack, and an electromagnet having an armature, of a drop pivotally mounted on the electromagnet, a latch for the drop controlled by the armature, an arm

mounted on the electromagnet and adapted to restore the drop, and a plug adapted to move the arm as it enters the jack.

20. In a telephone-switchboard, the combination with a jack, and an electromagnet having a sliding armature, of a drop pivotally mounted on the electromagnet, a latch for the drop carried by the electromagnet and controlled by the armature, an arm adapted to restore the drop and having a cam adapted to enter the path of a plug when the drop falls, and a plug adapted to coact with the cam to raise the arm as it enters the jack.

21. In a telephone-switchboard, the combination with a jack, and an electromagnet having an armature, of a drop-case mounted on the electromagnet, a drop pivoted on the case, a latch for the drop pivoted on the case and controlled by the armature, a lever or arm pivoted on the case below the drop and having a projection engaging with the drop, a cam on the arm, and a plug which when the drop is in signaling position engages the cam as it enters the jack.

22. In a telephone-switchboard, the combination with a frame carrying an electromagnetic drop device at its front, terminals of a normally open night-bell circuit on the rear of the frame, a rod, and a drop-restoring arm actuated by the drop when the latter falls to move the rod and close said circuit through said terminals.

23. In a telephone-switchboard, the combination with a frame carrying an electromagnetic drop device at its front, of spring-terminals of a normally open night-bell circuit on the rear of the frame, and a rod normally held by one of said terminals in position to be moved by the drop to close the circuit through said terminals as the drop falls.

24. In a telephone-switchboard, the combination with a frame, an electromagnetic drop device supported therein, and a drop-restoring arm, of terminals of a normally open night-bell circuit comprising inverted-J-shaped spring-strips having their short ends overlapping but normally separated, and a rod in contact with one of said terminals and extending into the path of the restoring-arm, whereby when the drop falls the restoring-arm is pressed against the rod so

that the latter is retracted to close the circuit through said spring-strips.

25. In a telephone-switchboard, the combination with a frame, an electromagnetic drop device carried thereby, and a drop-restoring arm, of terminals n^3 and n^4 of a night-bell circuit normally out of contact, and a rod N normally held by one of said terminals in the path of the restoring-arm and adapted to be retracted by the latter when the drop falls.

26. In a telephone-switchboard, the combination with a frame and an electromagnetic drop device supported thereon, of spring-strips constituting normally separated terminals of a night-bell circuit, connections between the drop device and terminals whereby electrical connection is established between said terminals when the drop falls, frame-contacts comprising rods mounted in the frame and passing through said terminals, and springs adapted to project said rods rearwardly.

27. In a telephone-switchboard, the combination with a board or cabinet having suitable contacts normally included in an open night-bell circuit, of a frame supporting the electromagnetic drop device, terminals on the frame adapted to be closed by the operation of the drop device, and frame-contacts in electrical connection with said terminals and comprising spring-pressed rods adapted to contact with said board-contacts when the frame is assembled in position on the board.

28. In a telephone-switchboard, the combination with a board or cabinet having contacts of a night-bell circuit, of a frame adapted to be mounted on said board, an electromagnetic signal device on said frame, terminals adapted to be placed in electrical connection by the operation of the signal device, and frame-contacts in electrical connection with said terminals and comprising headed rods mounted on said frame and coil-springs on the rods between the heads and frame.

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

W. E. McCORMICK.

Witnesses:

ROBERT K. GUSTAFSON,
JOSIAH McROBERTS.