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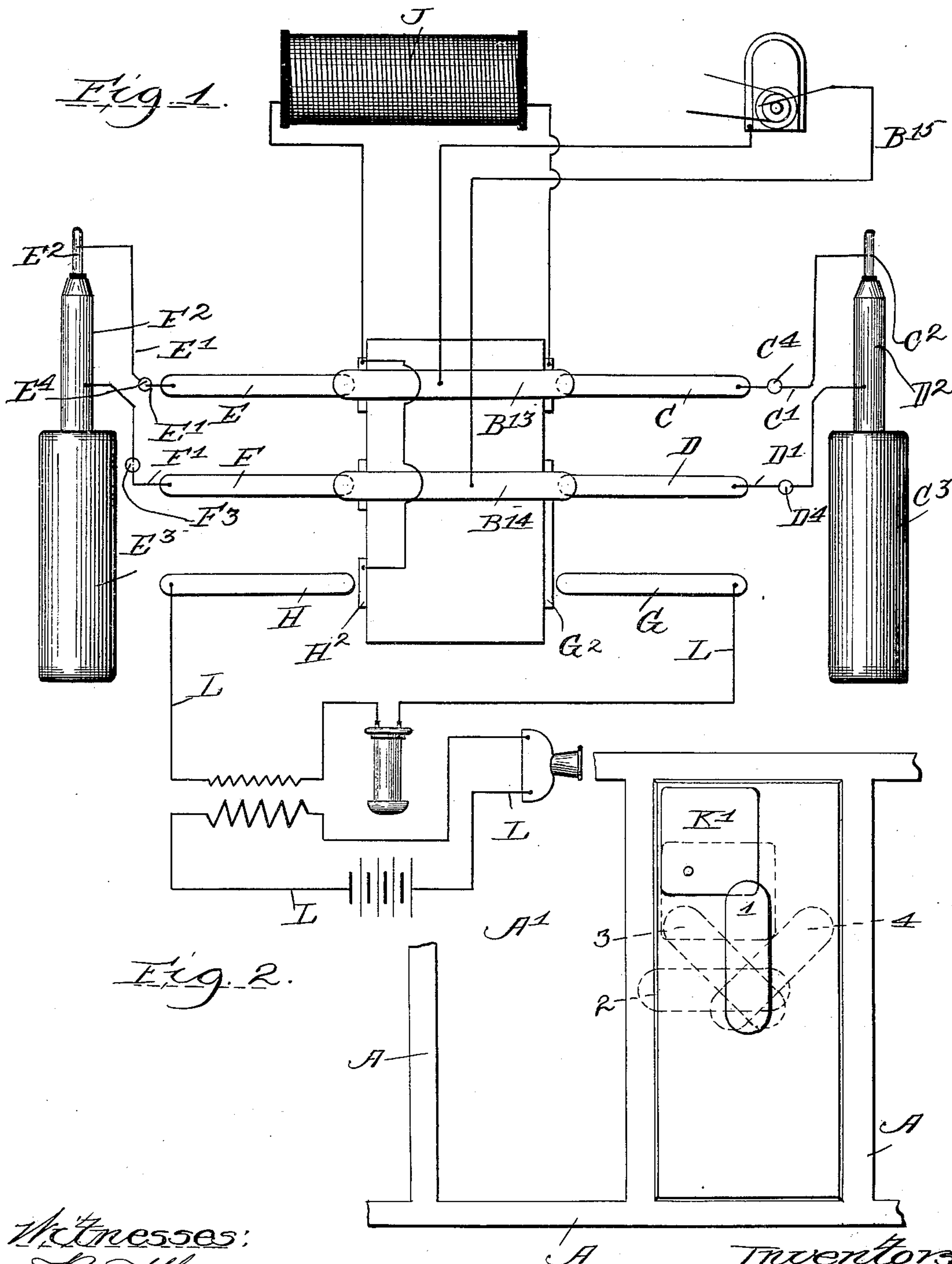
S. MORRISON & T. L. SPRINGER.

TELEPHONE SWITCHBOARD.

(Application filed May 19, 1899.)

(No Model.)

3 Sheets—Sheet 1.



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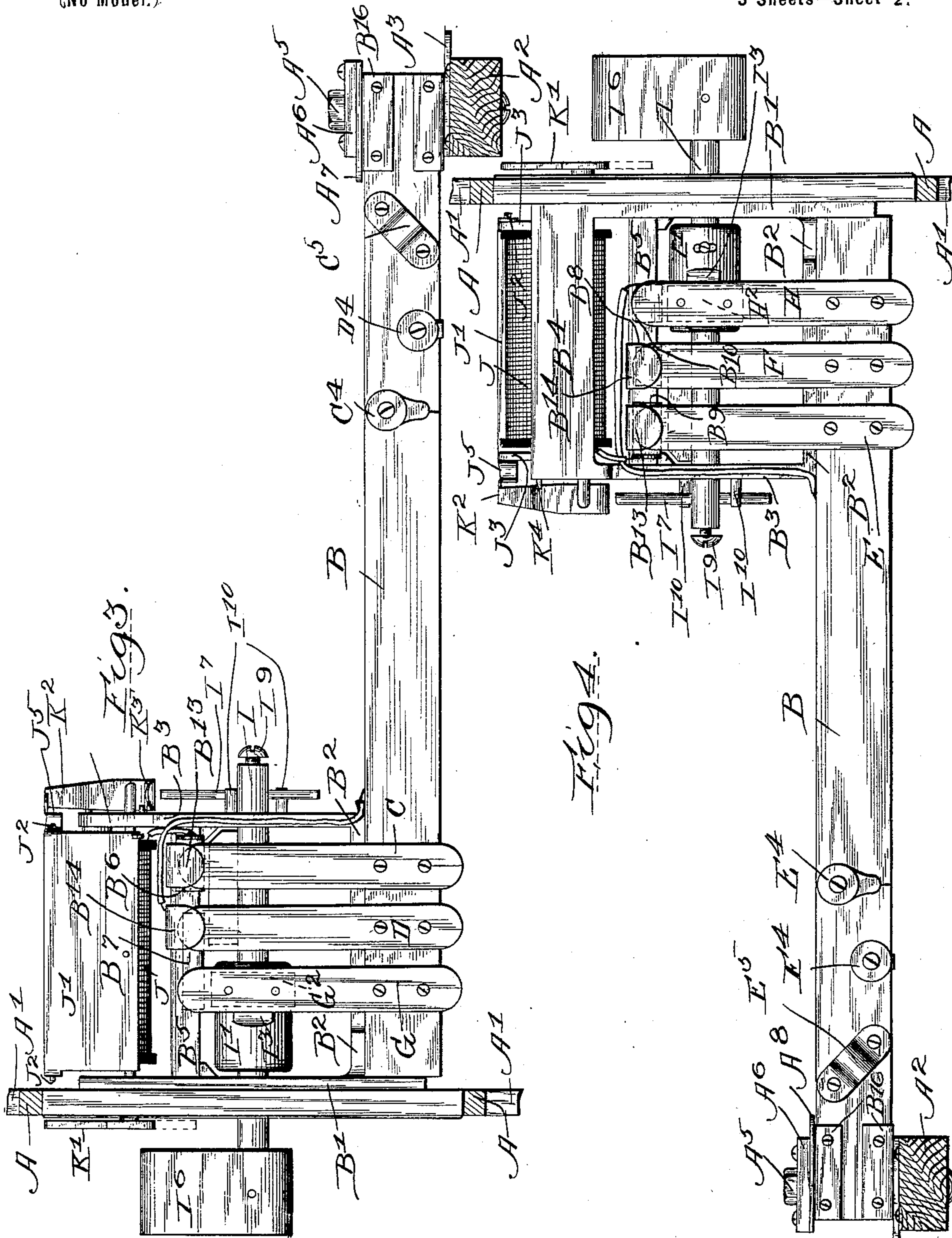
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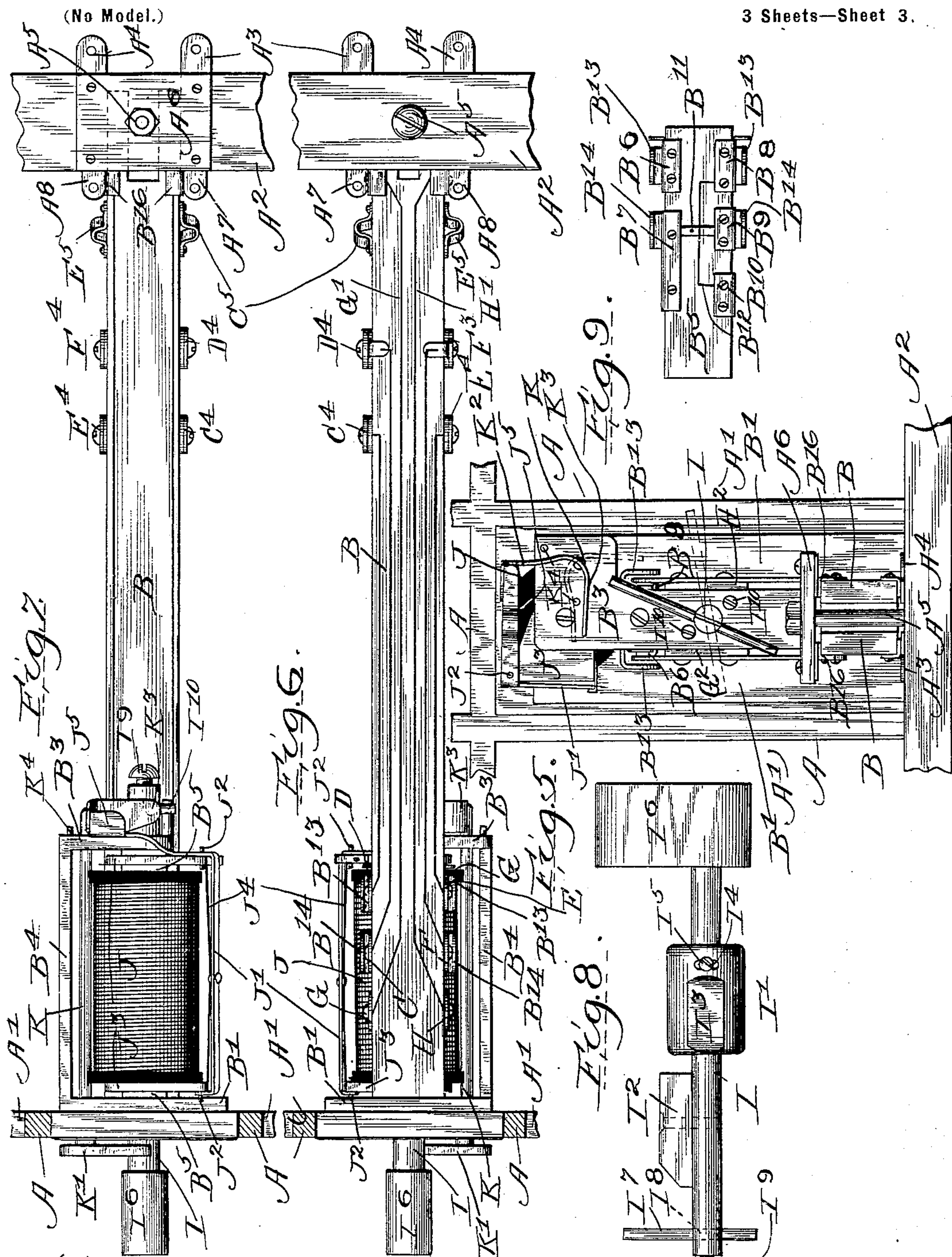
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UNITED STATES PATENT OFFICE.

SEYMOUR MORRISON AND THOMAS L. SPRINGER, OF McCORDSVILLE,
INDIANA.

TELEPHONE-SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 638,521, dated December 5, 1899.

Application filed May 19, 1899. Serial No. 717,426. (No model.)

To all whom it may concern:

Be it known that we, SEYMOUR MORRISON and THOMAS L. SPRINGER, citizens of the United States, residing at McCordsville, in the county of Hancock and State of Indiana, have invented certain new and useful Improvements in Telephone-Switchboards, of which the following is a specification.

The object of this invention is the production of a telephone-switchboard having a combined operator's cam and self-restoring clearing-out drop, which combined cam and drop is compact in form, self-contained, easily and quickly detached from its connections with the board, and readily replaced in position therein, which is simple and strong in its construction, has no delicate adjustments to become easily disordered, is speedy and accurate in its operation, wherein cross-talk between adjacent lines is eliminated, wherein the calling subscriber does not hear the noise of ringing the called subscriber, and embodying other novel features of advantage to appear later herein.

In the accompanying drawings, Figure 1 is a diagrammatic sketch illustrating the several electrical connections made in the operation of this operator's cam and drop. Fig. 2 is a face view of the operator's cam and drop, showing its relative position in the switchboard, also showing in dotted lines the several positions assumed by the cam-handle in the operation of the cam, designating each position by a number. Figs. 3 and 4 are side views of the cam and drop, taken from opposite sides thereof, the movable parts being in the relative positions incident to position No. 1 of the cam-handle, as shown in full lines in Fig. 2. Fig. 5 is a rear elevation of the cam and drop, illustrating the means of its attachment to the switchboard and representing the movable parts in positions incident to position No. 1 of the cam-handle, as shown in full lines, Fig. 2, with the drop-plate elevated. Fig. 6 is an under face view showing the electrical connections with the cam. Fig. 7 is a plan view of the cam and drop. Fig. 8 is a view of the cam-shaft removed from the cam-framework. Fig. 9 is an under face view of the bridge-block.

Like letters of reference indicate corresponding parts throughout the several views.

The mechanism hereinafter described is intended to preside over the lines connecting the respective answering-plugs and ringing-plugs on telephone-switchboards. The four positions of the cam-handle shown in Fig. 2 imply four sets of connections made by the switches within the cam. That position indicated in the drawings as position No. 1, Fig. 2, represents the operator's circuit as "bridged in" on the lines extending to the answering-plug, and therefore presumes the operator to be in communication with the calling subscriber. Position No. 2, Fig. 2, represents the cam as turned to throw the generator-lines into connection with the lines of the calling-plug, whereby the called subscriber is notified by the ringing of his bell. This connection cuts out the answering-plug lines and the operator's circuit. No. 3, Fig. 2, assumes the switches in such relative positions that the plug-lines are made continuous through the operator's cam, the operator's circuit being cut out, but the magnet for the clearing-out drop included on one of said plug-lines. Position No. 4, Fig. 2, indicates the cam in a position to connect the calling-subscribers' lines with those of the generator, whereby the call-bell of the calling subscriber may be rung, the lines of the called subscriber and the operator's circuit being cut out.

The clearing-out drop will be actuated by the operation of the hand-generator on the telephone of either subscriber, but only when the plug-lines are continuous through the cam, as assumed by position No. 3, Fig. 2, of the drawings.

In the embodiment of our invention the switchboard is fitted and arranged in substantially the ordinary manner, having the usual jacks connected with subscribers' lines occupying the upper portion of the face of the board, with the usual plugs in pairs and the operators' cams below, there being in practice one pair of plugs and one operator's cam for every ten of the jacks.

At the point of the switchboard A adapted for the reception of the operators' cams said

board is provided with rectangular openings A' in its face, into which openings the cam mechanism is placed, only the hard-rubber face thereof, with the cam-handle and drop, 5 showing on the face of the board.

Transversely across the rear part of the board the supporting-rail A² is secured, having opposite each cam the two contact-points A³ and A⁴ for the attachment of the wires of 10 the operator's circuit, also having the clamping screw-bolt A⁵. Upon this transverse rail A² the rear end of the supporting-stem of the cam rests, the screw-bolt A⁵, passing through the vertically-slotted end of said stem and 15 through the hard-rubber plate A⁶, bearing the two points A⁷ and A⁸ for the attachment of the lines of the generator-circuit.

At the forward end of the stem B of the cam and on the upper face thereof is secured the 20 cam-framework, composed of the front plate B', the base B², the rear upright B³, and the top cross-bar B⁴. In the upper part of this framework an electromagnet is arranged to release the clearing-out drop, the operation 25 of which device will be described later herein. A little below the magnet and extending between the front plate B' and the rear upright B³ of the cam-framework is secured a hard-rubber bridge-block B⁵, and affixed to one of 30 its sides are the two contacts B⁶ and B⁷, the former being one terminal of the winding of the electromagnet. On the opposite side of the bridge-block the contacts B⁸, B⁹, and B¹⁰ are affixed. The first, B⁸, is also a terminal 35 for the end of the coil of the magnet, being the opposite end of said coil from that connecting with contact B⁶. B⁹ merely connects through the strip B¹¹ with the contact B⁷ and B¹⁰ with contact B⁸ by means of wire B¹².

Two contact-yokes B¹³ and B¹⁴ are affixed 40 on the upper face of the bridge-block B⁵, their ends extending downward at a little distance from each side of said bridge-block B⁵, the ends of the yoke B¹³ lying adjacent to the contacts B⁶ and B⁸, while the ends of the yoke B¹⁴ are adjacent to the contacts B⁷ and B⁹. The yokes B¹³ and B¹⁴ are electrically connected with and form terminal contacts for 45 the generator-circuit B¹⁵. B¹⁶ are contact-points fixed at the rear upper face of the stem B for making electrical connection with the contacts A⁷ and A⁸ on the hard-rubber plate A⁶, which said contacts A⁷ and A⁸ are the terminals of the generator-line B¹⁵.

Contact-springs C and D are the terminals 55 of the respective lines C' and D', running, respectively, to the tip C³ and sleeve D² of the answering-plug C³, while contact-springs E and F are the terminals of the respective lines 60 E' and F', running, respectively, to the tip E² and the sleeve F² of the ringing-plug E³.

C⁴ and D⁴ are binding-screws for the attachment of the plug-wires C' and D', respectively, of the answering-plug C³ to the stem 65 B of the cam, and E⁴ and F³ are similar means of attachment thereto for the wires E' and F' of the ringing-plug lines.

C⁵ and E⁵ are metallic loops for binding the plug-cords to the cam-stem B, relieving the binding-screws from the weight of the plugs, 70 and preventing kinking in said cords.

The contact-springs G and H are the terminals of the operator's circuit when said circuit is broken, the lines G' and H', extending to the contacts A³ and A⁴ on the rail A², 75 forming, with those contacts, a part of said operator's circuit.

G² and H² are strips of insulating material secured, respectively, to the springs G and H, on the inner faces thereof, for engagement 80 with the cam, to be later described herein.

The free ends of the contact-springs C, D, E, and F lie normally in touch with the contacts B⁶, B⁷, B⁸, and B⁹, respectively, thus 85 connecting the lines C' and D' of the answering-plug C³ with the lines E' and F' of the ringing-plug E³, including also the winding of the magnet. By throwing the free ends of the contact-springs C and D outward into contact with the yokes B¹³ and B¹⁴ the lines 90 C' and D' of the answering-plug C³ are connected with the lines B¹⁵ of the generator, which latter lines terminate in the said yokes B¹³ and B¹⁴. In a similar manner the lines E' and F' of the ringing-plug may be placed 95 on a circuit with the generator through the contact-springs E and F. The lower ends of all said contact-springs C, D, E, F, G, and H are secured rigidly to the sides of the stem B.

The cam-shaft I, mounted in bearings in 100 the front plate B' and the rear upright B³ of the cam-framework, carries a cam I' for engaging the contact-springs G and H and a stud I² for moving the said contact-springs E and F. The cam I' is merely a metallic block 105 of cylindrical form bored out to loosely fit the cam-shaft I, having the two flattened faces I³ on opposite sides thereof and being provided with the opening I⁴, extending from its surface to its center, which opening is elongated 110 in the direction of the circumference of said cam and receives a pin or screw I⁵, whereby said cam I' has a slight oscillatory movement with relation to said shaft I. The stud I² is 115 of hard rubber or other non-conducting material and is rigidly affixed to the cam-shaft I. The forward end of the shaft I carries the handle I⁶, fixed thereon, and at the rear end the said cam-shaft has a pin I⁷, extending through an opening I⁸ in said shaft at right 120 angles to its length. This pin I⁷ is held in position by the set-screw I⁹. The oscillatory movement of the shaft I is limited by the stop-pins I¹⁰, against which the pin I⁷ impinges.

J is a magnet rigidly secured in the upper 125 portion of the cam-framework and having the armature J' pivoted at J² to the poles J³ of the magnet J. The free end of the armature is normally held from contact with the poles J³ by the action of the flat spring J⁴, which, 130 however, the energy of the magnet, when electrically excited, overcomes. The detent-arm J⁵ is formed integral with said armature and therefore has a slight vertical movement

at its free end when the armature is attracted by the magnet.

K is a shaft mounted in bearings in the upper portion of the cam-framework, having the drop-plate K' rigidly affixed by one of the lower corners of said plate to the end of said shaft K. At the rear end of said shaft K and outside the cam-framework is an L-shaped lever rigidly secured to the shaft K, having the stop-arm K² and the setting-arm K³.

K⁴ are pins which limit the amplitude of the oscillations of the shaft K.

L is the operator's circuit and includes both the primary and the secondary thereof. The primary circuit has the operator's transmitter, a battery, and the primary winding of an induction-coil, while the secondary circuit includes the operator's receiver and the secondary winding of said induction-coil.

The operation of a switchboard embodying our invention is as follows: As hereinbefore stated, the normal position of the operator's cam mechanism is such that the operator's circuit L (including the transmitter and receiver of the operator's set) is connected with the lines of the answering-plug C³, and therefore when a subscriber calls the central station and the said answering-plug is inserted into the jack of said subscribers' lines the subscriber and the operator are in circuit. Upon ascertaining the number desired by the calling subscriber the operator inserts the ringing-plug E³, connected with said answering-plug C³, into the jack on the lines of the called subscriber, at the same time turning the cam-handle I⁶ to the position designated as position No. 2, Fig. 2. This movement of the cam cuts out the operator's circuit L, (contact-springs G and H,) throwing the contact-springs E and F into touch with the yokes B¹³ and B¹⁴, respectively, turning the current of the generator-circuit B¹⁵ over the called subscriber's line and ringing the call-bell upon said subscriber's telephone. The cam-handle I⁶ upon being released from this position, No. 2, Fig. 2, returns automatically to position No. 3, Fig. 2, which joins in one circuit the calling and the called subscribers, also including within that circuit the magnet, but leaving out the operator's set L. The position indicated as position No. 4, Fig. 2, is that into which the cam-handle I⁶ is turned when it is for any reason desirable to ring the calling subscriber. In this position the contact-springs C and D are thrown by the stud I² into touch with the yokes B¹³ and B¹⁴, respectively, connecting the ringing subscribers' lines with those B¹⁵ of the generator. As soon as conversation through said telephones is concluded and either subscriber "rings off" the current thus generated by said act of ringing, passing through the coils of the magnet J, energizes the poles J³ thereof and attracts the armature J'. This movement of the armature raises the detent-arm J⁵ from the path of the stop-arm K² and permits the drop K' to fall by the force of gravitation. This sig-

nals the operator that the lines may be disconnected, which disconnection is made by withdrawing the plugs from the jacks into which they were inserted, the operator at the same time turning the cam-handle I⁶ to its normal position, (position No. 1, Fig. 2,) causing the pin I⁷ to engage the setting-arm K³, throwing said drop upward, in which position it is retained by the falling of the detent-arm J⁵ into the path of said stop-arm K².

Both mechanical and electrical connections between the cam and the switchboard are made by the one act of clamping the stem B to the rail A² by means of the screw-bolt A⁵, which electrically connects the lines of the generator B¹⁵ and the operator's circuit L with their continuing lines within the cam. The lines running to the plugs are connected by attachment to the binding-screws C⁴ and D⁴.

We claim as our invention—

1. In a self-contained operator's cam and clearing-out drop for telephone-switchboards, in combination, a cam-stem; answering-plug lines and ringing-plug lines, an operator's circuit and a generator-circuit terminating on said stem; a framework on said stem; an electromagnet in said framework; a switch for electrically connecting the plug-lines, the electromagnet and said operator's circuit, and for electrically connecting either of said plug-lines with the generator-circuit; an armature for said magnet; a detent on said armature; an annunciator; and means for automatically, mechanically restoring said annunciator by the movement of said switch.

2. In a self-contained operator's cam and clearing-out drop for telephone-switchboards, in combination, a cam-stem; answering-plug lines and ringing-plug lines, an operator's circuit and a generator-circuit terminating on said stem; a framework on said stem; an electromagnet in said framework; a switch for electrically connecting the plug-lines, the electromagnet and said operator's circuit, and for electrically connecting either of said plug-lines with the generator-circuit; an armature for the magnet; a detent on said armature; an annunciator-plate adapted to fall in a substantially vertical plane; and an arm upon said switch for mechanically restoring said annunciator-plate.

3. In a self-contained operator's cam and clearing-out drop for telephone-switchboards, in combination, a cam-stem; answering-plug lines and ringing-plug lines, an operator's circuit and a generator-circuit terminating on said stem; a framework on said stem; an electromagnet and a cam-shaft mounted in said framework; an armature for the magnet; a detent-arm on the armature; an annunciator drop-plate adapted to fall in a substantially vertical plane; a setting-arm for said drop-plate; and an arm on said cam-shaft for engaging said setting-arm and automatically, mechanically restoring said annunciator drop-plate when the electric circuits are restored.

4. In a self-contained operator's cam and

clearing-out drop for telephone-switchboards, in combination, a cam-stem; answering-plug lines and ringing-plug lines, an operator's circuit and a generator-circuit terminating on said stem; a framework on said stem; an electromagnet and a cam-shaft mounted in said framework; an armature for said magnet; a detent-arm on the armature; an annunciator drop-plate adapted to fall in a substantially vertical plane; a shaft for the drop-plate; a stop-arm and a setting-arm affixed to said shaft; and an arm on the cam-shaft for engaging said setting-arm.

5. In an operator's cam and clearing-out drop for telephone-switchboards, a single self-contained structure having, in combination, answering-plug lines and ringing-plug lines; a cam-handle; a magnet; an armature for the magnet; a shaft; an annunciator drop-plate secured, at a point on one of its faces below its center of gravity, to the end of said shaft, which plate is arranged to fall in a plane substantially parallel with the face of the switchboard; a detent for retaining the drop-plate in its elevated position; means for withdrawing the detent; and means comprising said cam-handle for automatically, mechanically restoring said drop-plate.

6. In an operator's cam and clearing-out drop for telephone-switchboards, a single self-contained structure having, in combination, answering-plug lines and ringing-plug lines; a cam-handle; a magnet; an armature for the magnet; a shaft; an annunciator drop-plate secured, at a point on one of its faces below its center of gravity, to the end of said shaft, which plate is arranged to fall in a plane substantially parallel with the face of the switchboard; a detent for retaining the drop-plate in its elevated position; a source of electrical energy; and means comprising said cam-handle for automatically, mechanically restoring said drop-plate.

7. In an operator's cam and clearing-out drop for telephone-switchboards, a single self-contained structure having, in combination, answering-plug lines and ringing-plug lines; a cam-handle; a magnet; an annunciator drop adapted to fall in a plane substantially parallel with the face of the switchboard; means for electrically exciting said magnet, whereby said annunciator-drop is released; and means comprising said cam-handle for automatically, mechanically restoring said annunciator-drop.

8. In an operator's cam and clearing-out drop for telephone-switchboards, a single self-contained structure having in combination, answering-plug lines and ringing-plug lines; circuit-changing mechanism comprising a cam-handle; a magnet; an annunciator-drop arranged to fall in a plane substantially parallel with the face of the switchboard; means for electrically exciting said magnet, whereby said annunciator-drop is released; and means comprising said cam-handle for auto-

matically, mechanically restoring said annunciator-drop.

9. In combination, a telephone-switchboard having an operator's cam, which cam comprises circuit-changing mechanism; a cam-shaft; an electromagnet; an armature for said magnet; a detent-arm rigidly affixed to said armature; an annunciator drop-plate adapted to fall in a substantially vertical plane; a shaft for said plate; a stop-arm and a setting-arm on said shaft; and an arm adapted to be automatically, mechanically operated by the circuit-changing mechanism, adapted to engage said setting-arm.

10. In combination, a telephone-switchboard having an operator's cam, which cam comprises circuit-changing mechanism; a cam-stem; the lines of an operator's circuit and of a generator-circuit on said stem; contact-points for said lines; corresponding contact-points on said switchboard; means for securing said stem to said board; an electromagnet; an armature therefor; a detent-arm on the armature; an annunciator drop-plate adapted to fall in a substantially vertical plane; a shaft for said drop-plate; a stop-arm and a setting-arm affixed to said shaft; and an arm arranged to be automatically, mechanically operated by the circuit-changing mechanism, for engaging said setting-arm.

11. In combination, a telephone-switchboard having an operator's cam, which cam comprises circuit-changing mechanism; a cam-stem; the lines of an operator's circuit and of a generator-circuit on said stem; contact-points for said lines; corresponding contact-points on said switchboard; means for securing said stem to said board; an electromagnet; an armature for said magnet; a detent-arm for said armature; a shaft; an annunciator drop-plate affixed at a point below its center of gravity to said shaft; a stop-arm and a setting-arm also affixed to said shaft; and an arm arranged to be automatically, mechanically operated by said circuit-changing mechanism, for engaging said setting-arm.

12. In combination, a telephone-switchboard having an operator's cam, which cam comprises circuit-changing mechanism; a cam-stem having a mortise-slot at its rear end; the lines of an operator's circuit and of a generator-circuit on said stem; contact-points for said lines; corresponding contact-points on said switchboard; and means extending through the mortise-slot for securing said stem to said board.

13. In combination, a telephone-switchboard having an operator's cam, which cam comprises circuit-changing mechanism; a cam-stem having a mortise-slot in its rear end; contact-points for the lines of said cam adjacent to said mortise-slot; and means extending through said mortise-slot for securing said operator's cam to the switchboard.

14. In combination, a telephone-switchboard having a supporting-rail; an operator's

circuit; an operator's cam, which cam comprises circuit-changing mechanism; a cam-stem having a mortise-slot in its rear end; contact-points adjacent to said mortise-slot for the lines of said cam; corresponding contact-points on the rail of said switchboard, which points on said switchboard are in electrical connection with the operator's circuit; a plate also having corresponding contact-points for the electrical connection of the lines of the generator-circuit; and a bolt for securing said cam to the said rail.

15. In combination, a telephone-switchboard having a supporting-rail; an operator's circuit; answering-plug lines and ringing-plug lines; and an operator's cam, which cam comprises circuit-changing mechanism; a cam-stem having a mortise-slot in its rear end;

contact-points adjacent to said mortise-slot for the lines of said cam; corresponding contact-points on the rail of said switchboard, which points on said switchboard are in electrical connection with the operator's circuit; a plate also having corresponding contact-points for the electrical connection of the lines of the generator-circuit; a bolt for securing said cam-stem to said rail; means of attachment for the said plug-lines to said cam-stem; and means for electrically connecting said plug-lines with the lines of said cam.

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