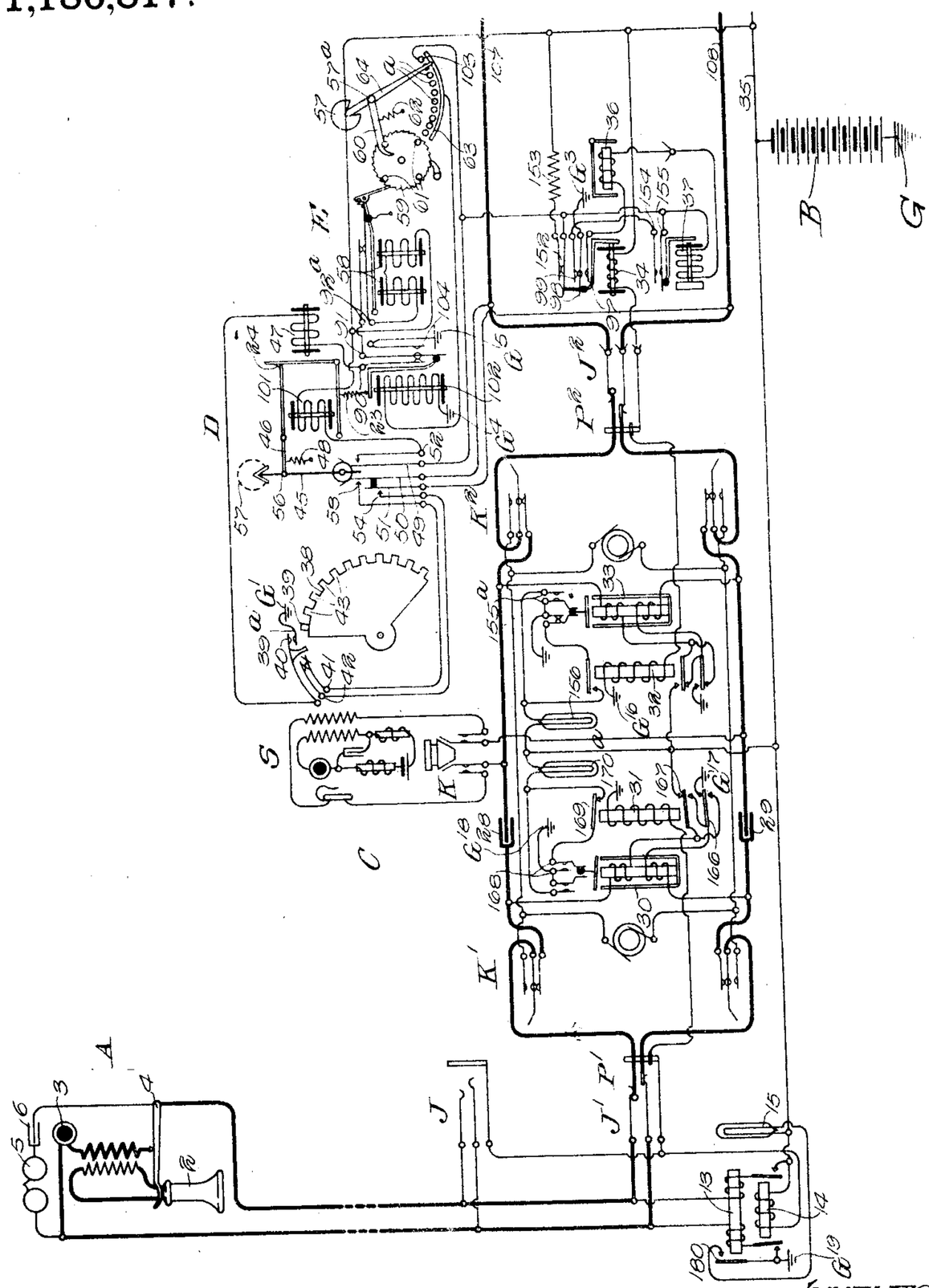
E. A. MELLINGER.

SEMI-AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED MAY 9, 1913.

1,186,817.

Patented June 13, 1916.

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## SEMI-AUTOMATIC TELEPHONE SYSTEM.

1,186,817. Specification of Letters Patent. Patented June 13, 1916.

Application filed May 9, 1913. Serial No. 766,559.

*To all whom it may concern:*

Be it known that I, EDWARD A. MELLINGER, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Semi-Automatic Telephone Systems, of which the following is a specification.

My invention relates to improvements in semi-automatic telephone systems, and it relates more particularly to means for automatically connecting an operator's calling device with an idle trunk.

My invention is adapted for use in a system in which calls are received on a manual board, from which board the call is to be extended through automatic switches to the called line. In such a system, according to my invention, each of the operators upon the manual board has a calling device for transmitting impulses to control these automatic switches, and each operator has access to a plurality of trunk lines leading to these automatic switches.

An object of my invention is to provide means associated with these calling devices whereby, when an operator operates her calling device in accordance with the called number, this calling device is automatically connected with an idle trunk line.

A further object is the provision of a signal associated with each trunk line to indicate with which trunk the calling device has been connected.

A further object is the provision of means for automatically disconnecting the calling device from the selected trunk when the operator plugs into the jack of the trunk in order to extend the talking connection over this trunk.

These and other objects of my invention will be more clearly understood by reference to the accompanying drawings, in which I have represented diagrammatically a manual calling line and an operator's cord circuit connected with a trunk line. It is to be understood that this trunk line represents one of a plurality of trunks which extend to an automatic exchange, a connection to a called subscriber's line being completed through the ordinary selectors and connectors of such exchange. These switches being of a well-known type, it is not thought necessary to illustrate the same in the drawings.

The manual substation A may be of any suitable or approved type and, as shown herein, comprises the receiver 2, transmitter 3, switch hook 4, ringer 5 and condenser 6.

At the central office the line of the substation A is provided with an answering jack J′, one or more multiple jacks J, a double-wound line relay 13, cut-off relay 14 and line lamp 15.

The operator's cord C is adapted for use for either connecting two manual lines or for connecting a manual line with the automatic exchange. This cord comprises the usual answering and calling plugs $P^1$ and $P^2$ connected together through the condensers 28 and 29. The supervisory circuits of the cord are controlled through the medium of the relays 30, 31, 32 and 33. The relays 30 and 33 are double-wound polarized relays of any desired construction. As shown herein, the winding of the relay is mounted between the two limbs of a U-shaped permanent magnet. The two windings of the relays 30 and 33 are normally bridged in series across the cord circuit through the contacts of the relays 31 and 32. When either of the relays 31 or 32 is energized, one winding of the corresponding relay 30 or 33 is connected to ground and the other winding of said relay is connected to the non-grounded terminal of the battery. The cord circuit is provided with the usual ringing keys $K^1$ and $K^2$. An answering key K is provided for the purpose of connecting the operator's talking set S with the cord. The trunk circuit leading to the automatic exchange is provided with a multiple jack $J^2$ upon each operator's position in the manual board. The sleeve conductors of the jack $J^2$ are connected to the battery lead 35 through the winding of a relay 34. Each trunk is also provided with a visual busy signal 36 on each operator's position. Each trunk is also provided with a slow-acting

relay 37 which is rendered slow to deenergize by the provision of a ring of copper around one end of the core.

In order to complete calls through an automatic exchange, each operator is provided with an automatic calling device, represented herein by an impulse wheel 38 and impulse springs 39, 40, 41 and 42. The impulse wheel 38 may be conveniently controlled by the operator through the medium of a dial provided with finger holes in a well-known manner. The impulse wheel is preferably arranged so that as the calling device is operated, preparatory to calling any digit, the impulse tooth 38 momentarily forces the spring 40 into contact with the spring 39, after which a certain number of the teeth 43, corresponding to the digit to be called, are rotated past the end of the spring 41 without separating said spring from the spring 42. As the impulse wheel returns to normal position after being thus operated, the teeth 43, after they pass the end of the spring 41, separate said spring from the spring 42 a number of times corresponding to the digit to be called. The spring 39 should be arranged so as not to operate the spring 40 during the return movement of the impulse wheel.

For connecting the operator's calling device with the trunk lines there is allotted to each operator's position an automatic switching mechanism D. As shown herein, this switching mechanism is similar in general respects to the subscriber's individual or line switch disclosed in British patent to R. W. James No. 26,301 of 1906. This switch comprises a plunger 45 carried upon the end of a so-called plunger arm 46. The plunger arm is normally held in its retracted position, as shown in the drawing, by the engagement of a catch on the armature of the magnet 47 with the rear end of the plunger arm 46. When the magnet 47 is energized, the plunger arm is released and the spring 48 draws said plunger downward, causing the lower end thereof to force the springs 49, 50 and 51 into engagement with the springs 52, 53 and 54, respectively. The springs 54 and 53 are connected with the impulse springs 42 and 41 of the calling device, while the springs 50 and 51 are connected with the trunk conductors 107 and 108. Although only one set of springs 49—54 is shown, the switch D is provided with a plurality of such sets, one for each trunk line leading to the automatic exchange. These sets of springs are arranged on the arc of a circle opposite the end of the plunger 45, and are in reality rotated through an angle of ninety degrees from the position shown, so that as the plunger oscillates back and forth about its pivot 56 its lower end will move back and forth across its sets of contact springs. The means for moving the plunger back and forth comprises the master switch E. The rear end of the plunger 45 normally engages a V-shaped slot in a so-called plunger shaft 57. This shaft 57 is controlled through the medium of the motor magnet 58 of the master switch, ratchet wheel 59 and the arm 60. In the ratchet wheel 59 there are a number of pins 61 which coöperate with the arm 60 in such a manner as to cause the plunger shaft 57 to oscillate about the point 57' as an axis to move the end of the plunger 45 from one set of bank springs to another each time the magnet 58 is energized. When the plungers reach a position opposite the last trunk terminal and the magnet 58 is again energized, the pin 61, which is then in engagement with the arm 60, passes beyond the end thereof, whereupon the spring 62 draws the arm 60 down until it strikes the next pin 61, whereby the plungers are returned to a position opposite the first trunk. Associated with the master switch there is a bank of contacts comprising the common segment 63 and an individual contact *a* for each of the trunk lines. The wiper 64 is adapted to maintain the common segment 63 in electrical connection with the individual contact of the trunk line before which the plunger of the switch D is resting. One master switch E may control the switches D of all the operators who have access to the same group of trunk lines—that is, all of said switches D may be arranged side by side and their plungers caused to engage the same plunger shaft 57. Each pair of trunk conductors 107 and 108 is connected with the springs 50 and 51 of corresponding sets in the banks of all the switches D, while the springs 41 and 42 of each calling device are connected with the springs 53 and 54 of all the sets in the banks of its own switch.

Having given a general description of the apparatus, it will now be explained in detail how the calling manual subscriber obtains connection with a trunk line leading to an automatic exchange. The removal of the receiver at the calling substation closes a bridge across the line through the transmitter 3, thereby energizing the line relay 13 at the central office in the usual manner. The relay 13, upon energizing, closes the circuit of the line lamp 15. Upon noting the signal displayed by the lamp, the operator inserts the plug $P^1$ of the cord C into the answering jack $J^1$ and operates the answering key K to connect the talking set S with the cord and inquires the number of the line desired. Upon learning that a connection with a line in the automatic exchange is desired, the operator restores the key K and then begins to operate the calling device in accordance with the number called for. It will be understood that the plunger

[illegible]

[illegible] line is busy, how- [illegible] the next contact pro- [illegible] a guarding potential, which [illegible] the relay 102 energized. The [illegible] immediately upon the [illegible] of the interrupter springs 92ª, [illegible] still energized on ac- [illegible] engaged a [illegible] the magnet will [illegible] the springs 9ª to come [illegible] the magnet is still there- [illegible] to advance the [illegible] the upper 61 another [illegible] continue to ad- [illegible] in the above [illegible] finally engages the [illegible] whereupon the re- [illegible] the operating [illegible] The plunger [illegible] rest with all of [illegible] standing [illegible] of the operator's [illegible] position [illegible] for the [illegible] separates the im- [illegible] number of times [illegible] to the first digit of the called [illegible] Each time these springs are sep- [illegible] over the trunk line 107— [illegible] The dial is then operated [illegible] digits of the called num- [illegible] corresponding impulses [illegible] for extending a con- [illegible] through suitable au- [illegible] and connectors in the [illegible] The springs 39ᵉ and 40 [illegible] are, of course, forced [illegible] by each operation of the calling [illegible] digits, but the en- [illegible] of these springs at these times [illegible]

After the operator at the cord circuit has completed the operation of the calling device for the last digit, she inserts the plug [illegible] into the jack J² of the trunk [illegible] selected by the switch D [illegible] when the calling device was first operated. [illegible] explained, the operator is noti- [illegible] trunk line she is to plug into by [illegible] the operation of the signal 36 of that trunk. Upon the insertion of the plug P² into the [illegible] a circuit is closed from ground G¹⁰ [illegible] the cord through the relay 32, thence [illegible] through the third conductor of the plug P² [illegible] and jack J² and relay 34 to the battery lead [illegible] The relay 32 is not operatively ener- [illegible] this circuit, but the relay 34 op- [illegible] to shift the spring 98 out of contact [illegible] and into contact with the [illegible] and to close the contact between [illegible] springs 152. The closure of the contact [illegible] the springs 152 connects the bat-

plurality of trunk lines terminating in jacks with which said cord circuit is adapted to be connected, an operator's set associated with said cord, and a calling device associated with said set and normally disconnected from said trunks, said calling device including a rotary dial, means operated upon the forward rotation of said dial for automatically connecting the said calling device with an idle one of said trunks, and means operated upon the backward rotation of said dial for transmitting a series of impulses over the selected trunk.

2. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord circuit is adapted to be connected, an operator's set associated with said cord, a calling device associated with said set and normally disconnected from said trunks, said calling device including a rotary dial, means operated upon the forward rotation of said dial for automatically connecting the said calling device with an idle one of said trunks, means operated upon the backward rotation of said dial for transmitting a series of impulses over the selected trunk, and a signal associated with each trunk for indicating to the operator the trunk with which said calling device has been connected.

3. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord circuit is adapted to be connected, an operator's set associated with said cord, a calling device associated with said set and normally disconnected from said trunks, said calling device including a rotary dial, means operated upon the forward rotation of said dial for automatically connecting the said calling device with an idle one of said trunks, means operated upon the backward rotation of said dial for transmitting a series of impulses over the selected trunk, and means for again disconnecting said calling device from said trunks when the operator connects the cord circuit with the jack of the selected trunk.

4. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord circuit is adapted to be connected, an operator's set associated with said cord, a calling device associated with said set and normally disconnected from said trunks, said calling device including a rotary dial, means operated upon the [illegible] said

trunks when the operator connects the cord circuit with the jack of the selected trunk.

5. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunk lines, a line switch, means controlled by the initial operation of said calling device for tripping said line switch to connect said calling device with one of said trunks, and a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk.

6. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunk lines, a line switch, means controlled by the initial operation of said calling device for tripping said line switch to connect said calling device with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, and a signal associated with each trunk for indicating to the operator the trunk with which said calling device has been connected.

7. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunk lines, a line switch, means controlled by the initial operation of said calling device for tripping said line switch to connect said calling device with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, and means for again disconnecting said calling device from said trunks when the operator connects the cord circuit with the jack of the selected trunk.

8. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunk lines, a line switch, means controlled by the initial operation of said calling device for tripping said line switch to connect said calling device with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, a signal associated with each trunk for indicating to the operator the trunk with which said calling device has been connected, and means for again disconnecting said calling device from said trunks when the operator connects the cord circuit with the jack of the selected trunk.

9. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunks, said calling device comprising a rotary dial adapted to be rotated forward and back, a line switch, means for tripping said line switch upon the forward rotation of said dial to connect with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, and means controlled by the backward rotation of said dial for transmitting a series of impulses over the selected trunk.

10. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunks, said calling device comprising a rotary dial adapted to be rotated forward and back, a line switch, means for tripping said line switch upon the forward rotation of said dial to connect with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, means controlled by the backward rotation of said dial for transmitting a series of impulses over the selected trunk, and a signal associated with each trunk for indicating to the operator the trunk with which said calling device has been connected.

11. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunks, said calling device comprising a rotary dial adapted to be rotated forward and back, a line switch, means for tripping said line switch upon the forward rotation of said dial to connect with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, means controlled by the backward rotation of said dial for transmitting a series of impulses over the selected trunk, and means for again disconnecting said calling device from said trunks when the operator connects the cord circuit with the jack of the selected trunk.

12. In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with

said cord, a calling device associated with said operator's set and normally disconnected from said trunks, said calling device comprising a rotary dial adapted to be rotated forward and back, a line switch, means for tripping said line switch upon the forward rotation of said dial to connect with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, means controlled by the backward rotation of said dial for transmitting a series of impulses over the selected trunk, a signal associated with each trunk for indicating to the operator the trunks with which said calling device has been connected, and means for automatically disconnecting said calling device from said trunks when the operator connects the cord circuit with the jack of the selected trunk.

[illegible] In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunk lines, a line switch, means controlled by the initial operation of said calling device for tripping said line switch to connect said calling device with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, a release magnet for said line switch, and means for momentarily energizing and then deenergizing said magnet when said cord circuit is connected with the selected trunk, to thereby disconnect said calling device from said trunk lines.

[illegible] In a telephone system, a cord circuit, a plurality of trunk lines terminating in jacks with which said cord is adapted to be connected, an operator's set associated with said cord, a calling device associated with said operator's set and normally disconnected from said trunks, said calling device comprising a rotary dial adapted to be rotated forward and back, a line switch, means for tripping said line switch upon the forward rotation of said dial to connect with one of said trunks, a master switch for controlling said line switch, whereby said line switch makes connection with an idle trunk, means controlled by the backward rotation of said dial for transmitting a series of impulses over the selected trunk, a release magnet for said line switch, and means for momentarily energizing and then deenergizing said magnet when said cord circuit is connected with the selected trunk, to thereby disconnect said calling device from said trunk lines.

[illegible] In a telephone system, a plurality of trunks and an operator's [illegible]

[illegible] said trunks, a [illegible] a calling [illegible] said [illegible] connecting [illegible] one of [illegible]

[illegible] of [illegible] connecting [illegible] said trunks, a [illegible] calling [illegible] said [illegible] said [illegible] said [illegible] said [illegible] the switch [illegible]

[illegible] the cord circuit [illegible] the jack of the [illegible]

[illegible] a plurality of trunk [illegible] comprising [illegible] a cord [illegible] calling device [illegible] said trunks, [illegible] the calling [illegible] said trunks, [illegible] the calling [illegible] said trunks [illegible]

[illegible] said [illegible] said [illegible] said [illegible] said [

line with another line, a calling device for operating said automatic switch to connect with said other line, another automatic switch for connecting said calling device with said trunk to operate said automatic switch, said other switch controlled by said calling device, means for thereafter connecting said line with said trunk, and means controlled by said last mentioned means for releasing said other switch.

Signed by me at London, England, this 22nd day of April, 1913.

EDWARD A. MELLINGER.

Witnesses:
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ALBERT JONES