

A. H. WEISS.  
SEMI-AUTOMATIC TELEPHONE SYSTEM.  
APPLICATION FILED MAR. 28, 1908.

Patented Nov. 17, 1914.

2 SHEETS—SHEET 1.

1,117,290.

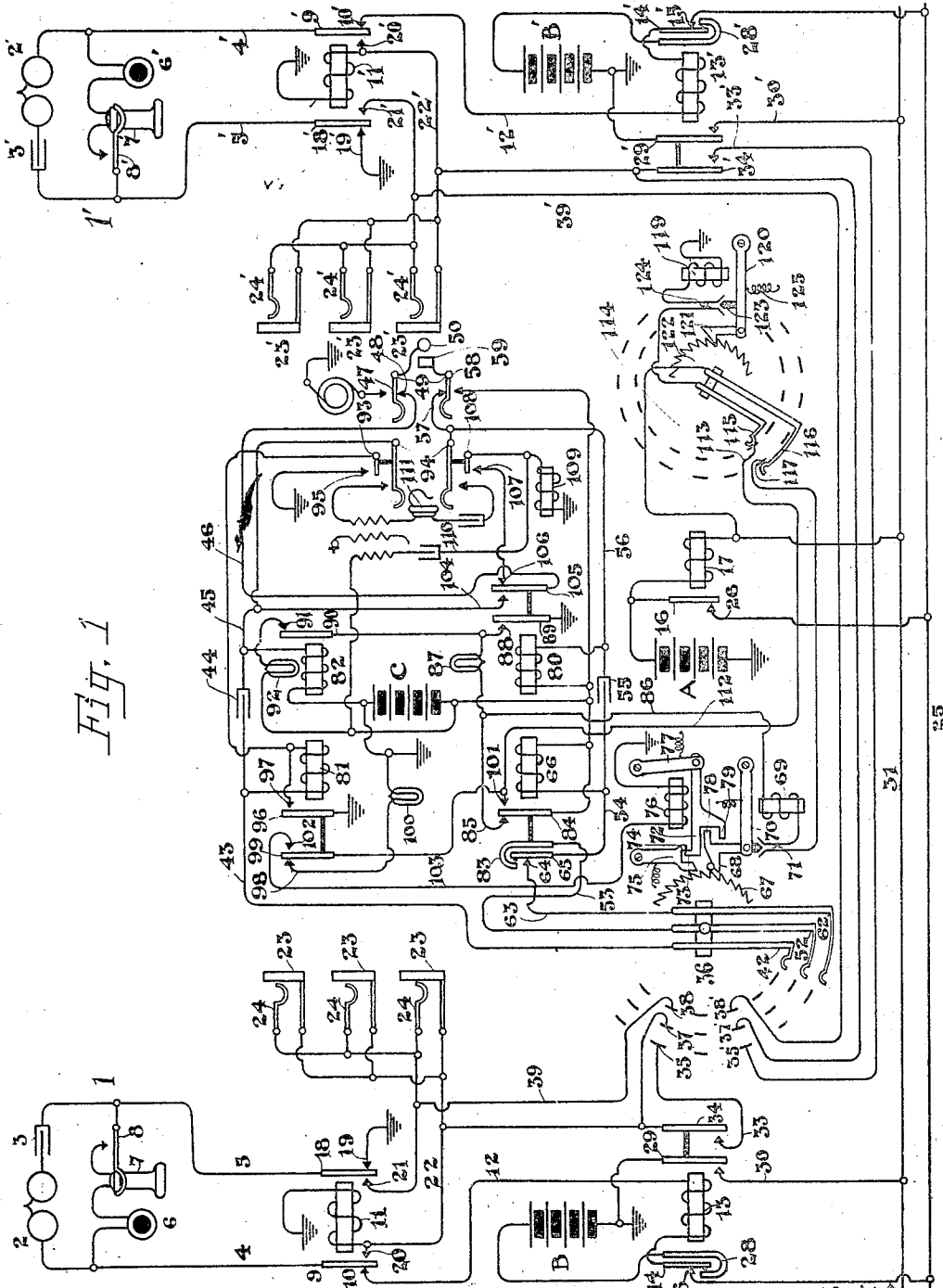


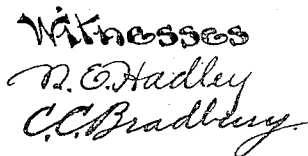
Fig. 1

Witnesses  
D. C. Hadley  
C. C. Bradbury

Alfred H. Weiss  
Inventor.  
By Curtis Blamp  
Attorney

1,117,290.

2 SHEETS—SHEET 2.



Alfred H. Weiss  
Inventor  
By Curtis B.ampf  
Attorney

# UNITED STATES PATENT OFFICE.

ALFRED H. WEISS, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## SEMI-AUTOMATIC TELEPHONE SYSTEM.

1,117,290.

Specification of Letters Patent.

Patented Nov. 17, 1914.

Application filed March 28, 1908. Serial No. 423,956.

*To all whom it may concern:*

Be it known that I, ALFRED H. WEISS, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Semi-Automatic Telephone Systems, of which the following is a specification.

My invention relates to telephone systems of the class known as semi-automatic systems, or that class of systems in which a portion of the operation necessary for completing a conversational connection is accomplished automatically and the rest is accomplished manually.

In my system a switchboard of the usual multiple type is used, each section of the switchboard being provided with a number of cords and multiple jacks but having no answering jacks and no signals individual to the lines terminating in the board.

Generally speaking, the operation of my system is as follows: When a party removes his receiver from the switch hook automatic mechanism at the central office is set into motion and connects one of the cord circuits of the switchboard directly with the calling line, thus saving the time usually required for the operator to raise her answering plug and insert it into the answering jack. The remainder of the operation, that of obtaining a desired number, plugging into the multiple jack of the desired line, ringing and receiving the disconnect signals, is the same as in any manual switchboard. It will thus be seen that by the use of my invention a less number of operators will be required to handle the calls of a given number of subscribers because a part of the work usually performed by the operator is automatically performed by the mechanism of the system. Further advantages of my system over the fully manual systems arise from the decrease in the original cost of installation, the system of my invention requiring a considerably less number of switchboard sections for a given number of lines.

In my system I provide for each switchboard section an idle cord selector which automatically steps forward one step for each new connection and is constantly in connection with the next idle cord circuit,

such that all of the cords of a position will be used in sequence.

My system also has a line connector for each cord circuit, these connectors having multiple contacts corresponding to each line terminating in the particular switchboard section and are adapted to be set in motion one at a time to connect to the calling telephone lines as the calls are sent in. With this arrangement the calling subscribers are automatically connected with the idle cord circuits in the same sequence as the calls are sent in from the substation. The operator cannot show any favoritism in answering calls because she has no way of knowing what subscriber is calling.

It will be understood that the connecting apparatus shown in this application is typical and that the system may be changed in many details to operate with automatic connectors of different construction than those herewith illustrated and that the mechanical construction of the connector itself forms no part of this invention.

My invention is illustrated in the accompanying drawings in which—

Figure 1 represents a calling and called telephone line and the apparatus which would come into operation in completing the connection between the two lines, the line on the left here representing the calling telephone line, and Fig. 2 represents three connecting circuits and the relation they bear one to the other and to the cord selector.

Referring to Fig. 1, the subscriber's station 1 is equipped with the annunciator 2 and condenser 3 in a permanent bridge between the line conductors 4 and 5, and with the transmitter 6 and receiver 7 in a bridge maintained normally open by contacts of the switch-hook 8. At the central office line conductor 4 connects through contacts 9 and 10 of cut-off relay 11, conductor 12, the coil of line relay 13, contacts 14 and 15 of relay 13, the battery normal 25 and the closed contacts 26 and 16 of the master relay 17 with the live pole of battery A. The other line conductor 5 is connected with earth through the normally closed contacts 18 and 19 of cut-off relay 11. The cut-off relay 11 has the normally open inside contacts 20 and 21.

The contact 20 is connected through the coil of relay 11 to earth, and through conductor 22 with the sleeve contacts 23 of the multiple jacks, and with spring 34 of the line relay 13 and contact 37 of the line connector 36, and the contact 21 is connected with the tip contacts 24 of the multiple jacks and with the contact 38 of the line selector 36.

Line relay 13 has the contact 28 adapted, when the relay is actuated, to be connected with its contact 14 before contact 14 is disconnected from contact 15. This contact 28 is connected with the live pole of battery B which is preferably the same as batteries B' and C. Relay 13 also has the normally open contacts 29 and 30, contact 29 being connected with earth and contact 30 being connected with the common conductor 31 which connects through the coil of the master relay 17 with the live pole of battery A. Relay 13 also has the normally open contacts 33 and 34, contact 33 being connected with the contact 35 of the line connector 36 and contact 34 being connected as before described.

The called subscriber's line is equipped with apparatus identical with the apparatus of the calling line and the corresponding apparatus of this line is here designated by like figures with the suffix "'." The called subscriber's line shown is one of the subscriber's lines which terminates at the same switchboard section with the calling subscriber's line. If, however, this subscriber's line had been one which terminated at another section, the connections would be the same except that contacts 15' and 30' would connect to another pair of common conductors than 25 and 31, and contacts 33' and 34' and the conductor 39' would connect to the contacts of another line connector and not with the line connector 36.

The cord circuit for completing the connection between the calling and called lines has the tip strand extending from the contact spring 42 of the line connector 36 through conductor 43, condenser 44, conductors 45 and 46, contacts 48 and 47 of the operator's ringing key 49 to the tip contact 50 of the calling plug. The cord circuit also has the sleeve talking strand extending during conversation from the brush 52 of the line connector 36 through conductors 53 and 54, condenser 55, conductor 56 and the contacts 57 and 58 of the operator's ringing key 49 to the sleeve contact 59 of the calling plug. The line connector has the third or private contact 62 which is normally connected through conductor 63 and contacts 64 and 65 of supervisory relay 66 with the sleeve cord conductor 54.

The line connector which is constructed on the well known step by step principle has a set of contacts 35, 37 and 38, and 35', 37' and 38', etc., for each line terminating at the position. This connector has the ratchet

wheel 67 adapted to be engaged by the pawl 68 when the rotary magnet 69 is actuated. The energization of the magnet 69 moves its armature 70 and causes the contacts 71 to be separated such that the magnet continues to 70 actuate, making and breaking its own circuit when the circuit through the rotary magnet 69 is closed. As the pawl 68 moves toward the electro-magnet 69 on its first stroke the extension 78 engages the extension 79 upon the release dog 72 moving the latter such that its projection 73 is disengaged from the projection 74 upon the retaining pawl 75, thus allowing the retaining pawl to engage the ratchet 67, to prevent the wheel from returning to its normal position due to the tension coil spring not shown. The release magnet 76 is adapted, when energized, to attract its armature 77 and move the dog 72 such that its projection 73 again engages the projection 74 upon the retaining pawl 75 drawing the pawl 75 away from the ratchet wheel when the release magnet is again deenergized. The parts here shown are only intended to represent the mechanical construction of my connector in a conventional way, the details of this connector being shown and described in another application.

The cord circuit proper has four relays—66, 80, 81 and 82—corresponding to the tip and sleeve relays of the well known two-wire manual cord circuit. The relay 66 has, in addition to the contacts previously described, the contact 83, which is adapted to make connection with contact 65 before that contact is separated from the contact 64, this type of relay being known as a "make before break" relay. The contact 83 is connected with conductor 53. Relay 66 also has the normally closed contacts 84 and 85, the contact 84 being connected with the live pole of battery C and the contact 85 being connected through conductor 86 with the coil of the rotary magnet 69 and also with one terminal of the signal 87. The other terminal of the signal 87 connects with the normally open contact 88 of relay 80, the latter relay also having the contact 89 connected with earth and adapted to connect with contact 88 when the relay is actuated. The contact 88 is also connected through the normally closed contacts 90 and 91 of relay 82 with the signal 92, the other terminal of this signal being connected with the live pole of battery C.

The relay 81 has its coil connected between the tip strand 43 and the normally disconnected contact 93 of the operator's listening key 94, the contact 93 being adapted to connect with earth through contact 95 when the key is actuated. Relay 81 has normally open contacts 96 and 97 in parallel with the contacts 93 and 95 adapted to complete a locking circuit for the relay 81. This relay

also has the normally closed contacts 98 and 99, the contact 98 being connected through the signal 100 with earth and the contact 99 being connected with the normally open contact 101 of relay 66. The contact 99 of relay 81 is adapted to connect with contact 102 of that relay when the relay is actuated, this contact 102 being connected through conductor 103 and the coil of release magnet 76 with earth. The relay 80 also has the normally open contacts 104 and 105 maintaining a normal separation between conductors 45 and 46 of the cord circuit. Contact 105 is normally connected through contact 106 with the normally open auxiliary contact 107 of the operator's listening key 94, this contact being adapted to be connected with the contact 108 when the key is actuated, the contact 108 being connected with the impedance coil 109 and with one terminal of the condenser 110, the other terminal of this condenser being connected through the tertiary of the operator's induction coil with the live pole of battery O. The operator's receiver 111 is adapted to be placed in a bridge between the talking strands of the cords by the actuation of the operator's listening key 94. The contact 101 of relay 66 is also connected through conductor 112 with the contact 113 of the idle cord selector 114. This cord selector is adapted to automatically step its brushes 115 and 116 forward step by step so that the brush 116 normally stands in contact with one of the contacts 117, which connects with an idle line connector or, in other words, with an idle cord circuit, inasmuch as there is one line connector for each cord circuit. The movement of this cord selector is brought about upon the demagnetization of the rotary magnet 119. This magnet is adapted to attract the armature 120, which in turn moves the ratchet-pawl 121 one tooth forward upon the ratchet wheel 122. At the same time the projection 123 separates the series contacts 124 in the circuit of the rotating magnet 119 and permits the armature 120 to be drawn back by the tension spring 125, thus moving the brushes 115 and 116 from the contacts 113 and 117 to the next following set of contacts, and if this next following set of contacts connects with a cord circuit which is already busy the cord selector will continue to actuate until the brushes 115 and 116 connect with an idle cord circuit.

The contacts 124 of this device as well as the contacts 70 of the line connector are mechanically arranged so as to remain broken until the armatures of the magnets have returned to their normal positions, at which time the contacts will be again closed. In this manner the armatures are caused to make their full stroke every time the circuit through the contacts is closed.

Fig. 2 represents three cord circuits of the type shown in Fig. 1, and shows the method of connecting the lines to the line connectors and the cords to the cord selector. In this figure the same designation numerals are used but no part of the line circuits are shown except the multiple wiring which connects with the line connectors. It will be seen that the cord selector 114 is shown connected with the top cord circuit and that the next two cord circuits will be connected by the brushes 115 and 116 as the cord selector rotates. It will be understood further that the cord selector 114 has contacts through its entire circumference, and that it is adapted to rotate continuously in one direction. The line connectors 36, however, are adapted to rotate in both directions, being rotated clockwise by the step-by-step mechanism and being returned to the starting point by a coil spring (not shown in the drawing) when the release magnet is energized and again deenergized.

In the operation of this system, referring particularly to Fig. 1, the call will be considered as originating at subscriber's station No. 1. When this subscriber removes his receiver 7 from the switch-hook 8 he completes a path for current from the live pole of battery A, through contacts 16 and 26 of master relay 17, conductor 25, contacts 15 and 14 of line relay 13, conductor 12, contacts 10 and 9 of cut-off relay 11, line conductor 4, transmitter 6, receiver 7, the contacts of switch-hook 8, line conductor 5 and the contacts 18 and 19 of cut-off relay 11 to ground. Current in this path actuates the line relay 13 changing all of its contacts to their abnormal condition. The actuation of contact 28 closes the circuit of contact 14 with the live pole of battery B and thereby interrupts the circuit of the battery A through contact 15 of relay 13. The completion of the connection between contacts 29 and 30 closes the circuit from the live pole of battery A through the coil of master relay 17, conductor 31 and contacts 30 and 29 of relay 13 to ground. Current in this path actuates the master relay 17 holding its contacts 16 and 26 open and removing battery from the wire 25. The closing of contacts 33 and 34 of relay 13 connects the contacts 35 and 37 of the line connector 36. The connection of contacts 29 and 30 of relay 13 also completes the circuit from the live pole of battery C through contacts 84 and 85 of relay 66, conductor 86, the coil of the rotary magnet 69, the normally closed contacts 71, the now closed contacts 117 and 116 of the idle-cord selector 114, conductor 31 and the contacts 30 and 29 of relay 13 to ground. Current in this path actuates the rotary magnet 69 of the line connector 36. The actuation of the rotary magnet 69 attracts its armature 70 causing the pawl 68

to engage the teeth upon the ratchet wheel 67 and also causing the contacts 71 to be periodically interrupted whereby the circuit through the coil of the rotary magnet 69 will be periodically completed and the line connector will be stepped around one step at a time until the wiper 62 arrives at and makes connection with the contact 35. When this wiper connects with the contact 35 a path for current is completed from the live pole of battery C through the coil of relay 66, contacts 65 and 64 of relay 66, conductor 63, contacts 62 and 35 of the line connector 36, the now closed contacts 33 and 34 of relay 13, conductor 22 and the coil of the cut-off relay 11 to ground. Current in this path will actuate the cut-off relay 11 and the cord relay 66. The actuation of the cut-off relay performs the usual function of interrupting the circuit of the line relay and connecting the limbs of the line with the contacts of the multiple jacks and with the contacts of the line connector. The actuation of cord relay 66 interrupts the current through its contacts 85 and 84 which are in series with the rotary magnet 69 of the line connector and thereby stops the rotation of the line connector leaving it standing with its three wipers 42, 52 and 62 in connection with the contacts 38, 37 and 35. The connection of contact 84 with the contact 101 of relay 66 completes a path for current from the live pole of battery C through contacts 84 and 101 of relay 66 through conductor 112, contacts 113 and 115 of the idle-cord selector 114, through the contacts 124 of that selector and the coil of the rotary magnet 119 to ground. Current in this path actuates the rotary magnet and steps the idle cord selector one step forward such that it is in connection with the next idle cord circuit and the next idle line connector. The actuation of relay 66 also completes a circuit from the live pole of battery C through contacts 84 and 101, thence through contacts 99 and 98 of relay 81 and through the call lamp 100 to ground.

The operator, when she sees the call lamp 100 displayed, throws her listening key and inquires the desired number. When the listening key 94 is thrown the circuit of the coil of relay 81 is completed through the auxiliary contacts 93 and 95 of the listening key 94. Therefore, current flows from the live pole of battery C through the coil of relay 66, the now closed contacts 65 and 83 of that relay, conductor 53, contacts 52 and 37 of the line connector, conductor 22, the now closed contacts 20 and 9 of cut-off relay 11, line 4, transmitter 6, receiver 7, switch-hook 8, line 5, contacts 18 and 21 of cut-off relay 11, conductor 39, contacts 38 and 42 of the line connector, conductor 43, the coil of relay 81, and contacts 93 and 95 of the listening key 99 to ground. The cur-

rent in this path maintains the actuation of relay 66 and actuates relay 81. The actuation of relay 81 closes a locking circuit for itself including its contacts 96 and 97 which are in parallel with the contacts 93 and 95 of the listening key 94 and also severs the circuit of the call lamp 100.

The completion of the circuit between contacts 99 and 102 of relay 81 completes a circuit from the live pole of battery C through contacts 84 and 101 of relay 66, contacts 99 and 102 of relay 81, conductor 103 and the coil of the release magnet 76 to ground. This actuates the release magnet which is arranged to release the line connector only after it has been energized and again deenergized. The energization of the release magnet 76 attracts the armature 77 and causes the projection 73 upon the arm 72 to catch back of the projection 74 upon the retaining pawl 75. When the circuit is again broken through the release magnet, which does not occur until the conversation is terminated, the spring connected with its armature draws the armature back to normal position and pulls the pawl 75 out of its engagement with the ratchet 67. The operator now tests the idle or busy condition of the desired line, inserts her calling plug and rings upon the line in the usual way. Upon the insertion of the plug, current flows from the live pole of battery C through the coil of relay 80, conductor 56, contacts 57 and 58 of the ringing key, sleeve contacts 59 and 23' of the plug and jack, conductor 22' and the coil of cut-off relay 11' to ground. The current in this path actuates the relays 80 and 11'. The actuation of relay 11' disconnects the line apparatus from the limbs of the telephone line and connects the telephone line directly with the contacts of the jack. The actuation of relay 80 closes its normally open contacts 88 and 89 and completes the circuit of the calling supervisory lamp 92, displaying this lamp. When the called subscriber answers his call the circuit is completed from the live pole of battery C through the conductors formerly described to the contact 20' of the cut-off relay 11', thence through contact 9', line conductor 4', transmitter 6', receiver 7', switch-hook 8', line conductor 5', contacts 18' and 21' of cut-off relay 11', tip contacts 24' and 50 of the jack and plug, contacts 47 and 48 of the ringing key 49, conductor 46, the now closed contacts 105 and 104 of relay 80 and the coil of relay 82 to the ground pole of battery C. The current in this path actuates relay 82 and effaces the calling supervisory signal 92. During conversation the battery current for supplying the substation transmitters is furnished to the calling line through the coils of relays 66 and 81 and to the called line through the coils of relays 80 and 82.

When the called subscriber hangs up his receiver he interrupts the circuit of relay 82 causing that relay to fall back and again complete the circuit of the calling supervisory signal 92. When the calling subscriber hangs up his receiver he interrupts the circuit of the relay 81. When this relay falls back it opens the contacts 99 and 102 and severs the circuit through the release magnet 76 of the line connector 36 allowing the armature of that magnet to return to its normal position, drawing the retaining pawl 75 with it and releasing the ratchet wheel 67 such that the wipers 42, 52 and 62 return to their normal positions. When this is done the circuit of relay 66 is interrupted at the contacts of the line connecting switch and contacts 84 and 85 of relay 66 are closed and complete the circuit of the calling supervisory signal 87. When the operator observes the two supervisory signals displayed she removes her calling plug from the jack and thereby severs the circuit through the relay 80 allowing that relay to fall back to its normal position and interrupt the circuit through both the calling and answering supervisory signals. The signals are now all out at the central office and the apparatus has again resumed its normal position with the exception that the cord selecting switch 114 now stands in connection with the next cord circuit such that if the same subscriber, No. 1, should again call he would not be connected with the same cord circuit but would be connected with the next following cord circuit. The relation of the cords, lines and connectors is shown in Fig. 2 and it is to be understood that the multiple jacks on the right may or may not be connected with the contacts of the line connectors here shown.

There may be one hundred lines for each switch-board section and ten connectors for each one hundred lines which would be sufficient to permit one tenth of the subscribers to talk at one time as calling subscribers or would permit one fifth of all of the subscribers to be in conversation. Of course, these numbers are immaterial and may be varied for different conditions.

While my system is shown in combination with many details it is to be understood that many of these are not essential and may be omitted or changed without in any way departing from the spirit or scope of my invention.

I claim:

1. In a telephone system, the combination with a plurality of telephone lines, of a cord circuit to connect therewith for conversation, a switch individual to the cord circuit, a plurality of contacts associated with said switch and arranged in groups, each group being associated with one of said telephone lines, one contact of each of said groups be-

ing normally disconnected and adapted to be connected to earth when its associated line is calling the central office, a cut-off relay connected in circuit between said earth connection and said contact, means normally passive but effective upon initiation of a call to give said switch an independent movement until the movable contacts of said switch arrive upon the contacts of the line which is calling, a relay for the cord, and a series circuit closed upon such connection to energize said cut-off relay and said cord relay to render said moving means inert, substantially as described.

2. In a telephone system, the combination with a plurality of telephone lines, a line and cut-off relay for each of said lines, a source of current normally connected with all of said lines, the actuation of any line relay being adapted to remove said source from its connection with all of the rest of the lines, substantially as described.

3. In a telephone system, the combination with a plurality of telephone lines, of a line and a cut-off relay for each of said lines, a cord circuit to connect with the lines for conversation, a supervisory relay and a connector switch for said cord circuit, the actuation of one of said line relays being adapted to set an idle connector switch into operation and to cause its contacts to move to the contacts associated with the calling line, a circuit including the cut-off relay of the line and a supervisory relay of the cord circuit completed through the contacts of the connector switch for interrupting the circuit of the line relay, and contacts on said supervisory relay interrupted responsive to its said energization to interrupt the movement of said switch, substantially as described.

4. In a telephone system, the combination with a plurality of telephone lines, of a line and a cut-off relay for each of said lines, a cord circuit to connect with the lines for conversation, a supervisory relay and a connector switch for said cord circuit, the actuation of one of said line relays being adapted to set an idle connector switch into operation and to cause its contacts to move to and stop upon the contacts associated with the calling line, and an energizing circuit including the cut-off relay of the line and a supervisory relay of the cord circuit completed through the contacts of the connector switch for interrupting the circuit of the line relay, the release of said line relay and energization of said supervisory relay being adapted to interrupt the circuit of the motor magnet of said connector switch at said line and supervisory relays, substantially as described.

5. In a telephone system, the combination with a plurality of telephone lines, of line and cut-off relays for each of said lines, a

source of current normally connected with each of said telephone lines, a cord circuit, a connector switch associated with the cord circuit and having its contacts adapted to move to and stop upon the contacts of a calling line, the actuation of the line relay being adapted to disconnect said source from all of the other telephone lines, the actuation of the cut-off relay being adapted to interrupt the circuit of the line relay, whereby said source is again connected to all of the other telephone lines, substantially as described.

6. In a telephone system, the combination with a telephone line, of a cord circuit, means for automatically connecting said cord and line for conversation, a pair of answering supervisory relays for said cord circuit, a cut-off relay for the line, a path for current completed through the coils of the sleeve supervisory relay and said cut-off relay when the cord circuit is automatically connected with a calling line, whereby said relays are actuated, a call signal adapted to have its circuit closed by the actuation of said sleeve supervisory relay and opened by the actuation of the tip answering supervisory relay, and means under the control of the operator for causing the actuation of the tip supervisory relay, substantially as described.

7. In a telephone system, the combination with a telephone line, of a cord circuit, means for automatically connecting said line and cord for conversation, a pair of answering supervisory relays for said cord circuit, a cut-off relay for the line, a path for current completed through the coils of the sleeve supervisory relay and said cut-off relay when the cord circuit is automatically connected with a calling line, whereby said relays are actuated, a call signal adapted to have its circuit closed by the actuation of said sleeve supervisory relay and opened by the actuation of the tip answering supervisory relay, the circuit of the tip supervisory relay being normally interrupted by auxiliary contacts of the operator's listening key, the actuation of the key being adapted to close the circuit of the tip supervisory relay to efface the call signal, substantially as described.

8. In a telephone system, the combination with a group of telephone lines, a cut-off relay for each line, of a cord circuit, means for automatically connecting said cord with any of said lines, a call lamp for said cord circuit, a pair of relays for the cord circuit, one adapted to be actuated over a local circuit including the coil of the cut-off relay to close the circuit of said call lamp, and the other being adapted to be actuated over the calling telephone line to open the circuit of said call lamp, the circuit through the coil of the latter relay being initially controlled

by contacts of the operator's listening key, substantially as described.

9. In a telephone system, the combination with a group of telephone lines, a cut-off relay for each line, of a cord circuit, means for automatically connecting said cord with any of said lines, a call lamp for said cord circuit, a pair of relays for the cord circuit, one adapted to be actuated over a local circuit including the coil of the cut-off relay to close the circuit of said call lamp, and the other being adapted to be actuated over the calling telephone line to open the circuit of said call lamp, the circuit through the coil of said latter relay being under the control of the operator whereby the call lamp is effaced at the will of the operator, substantially as described.

10. In a telephone system, the combination with a group of telephone lines, cut-off relays for said lines, of a plurality of cord circuits associated with the group, of telephone lines, supervisory relays for said cord circuits, a distributor switch for said cord circuits adapted by its actuation to maintain an idle cord circuit in readiness to be connected with a calling telephone line, a connector switch individual to the cord circuit and having contacts adapted to move to and connect with contacts of the calling line, and a circuit including the cut-off relay and the supervisory relay, completed upon said connection for interrupting the movement of said connector, substantially as described.

11. A telephone system comprising telephone lines, a calling line, a cord circuit, a connector switch for said cord adapted to connect with any one of said lines, a motor magnet for said switch, a line relay for said line energized upon initiation of the call, and an energizing circuit for said magnet completed through contacts of said relay upon its energization.

12. A telephone system comprising a telephone line, a cord circuit, a connector switch individual to the cord and adapted to connect said cord with said line, a motor magnet for said switch, a line relay for said line, an energizing circuit for said magnet completed through contacts of said relay upon initiation of a call from said line.

13. A telephone system including telephone lines, a cord circuit, a supervisory relay therefor, an automatic switch adapted to connect said cord with any line, a motor magnet for moving said switch operative upon initiation of a call to connect said cord with a calling line, a supervisory relay for said cord having contacts included in the motor magnet circuit and energized responsive to said connection to render said magnet inoperative.

14. A telephone system including telephone lines, a line relay for each line, a



cord circuit, a supervisory relay therefor, an automatic switch adapted to connect said cord with any line, an operating magnet therefor, an energizing circuit for said magnet adapted to be completed through contacts of any line relay upon initiation of a call from its line, and a supervisory relay for the cord for opening said circuit.

15. In a telephone system, the combination with telephone lines, of an operator's cord circuit, an automatic connector switch, means actuated upon initiation of a call to cause said switch to connect the cord with a calling line, a release magnet for said switch energized upon the response of the operator, and means under the control of the calling subscriber to deenergize said magnet.

16. In a telephone system, the combination with a calling telephone line, of a line relay for said line energized upon the initiation of the call, a cord circuit, an automatic switch individual to the cord for connecting said cord and said line, a motor magnet for said switch, and an energizing circuit for said magnet closed through contacts of said line relay upon energization thereof.

17. A telephone system comprising telephone lines, a line relay for each of said lines, a common relay for said line relays, a source of current connected through contacts of said common relay to each of said line relays, and circuit connections whereby when a line relay is energized the common relay is energized to disconnect said source from the other of said line relays and maintain the last said line relay energized, link circuits common to said lines, and means responsive to energization of the line relay for connecting the calling line with an idle one of said link circuits whereby said line and common relays are again deenergized.

18. A telephone system comprising telephone lines, a line relay for each of said lines, a common relay for said line relays, a source of current connected through contacts of said common relay to each of said line relays, automatic switches responsive to said line relays for extending the circuit of said telephone lines when calling, said common relay also being responsive to the actuation of any one of said line relays to disconnect said source of current from the other line relays to prevent their operation.

19. A telephone system comprising telephone lines, a line relay and source of energizing current connected with each of said lines, operators' cord circuits, automatic switches for extending the talking circuit of said telephone lines to idle ones of said operators' circuits responsive to said line relays, and means also responsive to the actuation of one of the line relays to interrupt the energizing circuit of the other of said line relays to prevent their operation.

20. A telephone system comprising tele-

phone lines, a line relay and source of current connected with each of said lines, line selectors responsive to said line relays for selecting said lines when calling, and means also responsive to the actuation of one of the line relays to prevent a simultaneous operation of any of the other line relays.

21. A telephone system comprising telephone lines, a line relay and source of current connected with each of said lines, line selectors responsive to said line relays for selecting said lines when calling, and means effective upon actuation of one of the line relays to start a line selector and to prevent a simultaneous operation of any of the other line relays until the first calling line is selected.

22. A telephone system comprising telephone lines, a line relay and source of current connected with each of said lines, line selectors responsive to said line relays for selecting said lines when calling, a relay common to said line relays, means effective upon actuation of one of said line relays to start a line selector in search of the calling line, said common relay also being responsive to actuation of a line relay to prevent a simultaneous operation of any of the other line relays until the first calling line is selected.

23. A telephone system comprising telephone lines, a line relay and source of current connected with each of said lines, line selectors responsive to said line relays for selecting said lines when calling, means also responsive to the actuation of one of the line relays to prevent a simultaneous operation of any of the other line relays until the calling line is selected, and a cut-off relay for each of said lines effective upon connection made with the line by a line selector to restore the actuated line relay.

24. A telephone system comprising a telephone line, a line selector, a cord circuit for said line selector, a supervisory relay for the cord circuit adapted to be energized upon connection made with said line by the line selector, a motor magnet for the line selector, a line relay, and an energizing circuit for the motor magnet including normally open contacts of the line relay and normally closed contacts of the supervisory relay.

25. A telephone system comprising a telephone line, line and cut-off relays for said line, a line selector having a cord circuit individual thereto, a supervisory relay for the cord circuit, a motor magnet for the line selector, an energizing circuit for the motor magnet including normally open contacts of the line relay and normally closed contacts of the supervisory relay whereby when said line relay is operated said motor magnet operates said selector to connect with the line when calling, and a circuit including said cut-off and supervisory relays adapted

to be closed upon such connection whereby said supervisory relay is energized to interrupt the circuit of the motor magnet.

26. A telephone system comprising telephone lines, a line relay for each of said lines, line selectors, a master switch having contacts and a cooperating wiper, a motor magnet for each of said line selectors connected with an individual contact of the master switch, connections extending from the wiper of said master switch to normally open contacts of each of said line relays, a source of current having one pole connected to said motor magnets and the other pole to contacts on the line relays whereby when a line relay is energized an operating circuit is established through the wiper of the master switch and an associated contact to the connected motor magnet.

27. A telephone system comprising telephone lines, operators' link circuits for extending the circuits of said lines, a signal for each of said link circuits, automatic switches for interchangeably connecting calling lines and link circuits, means responsive to such a connection to operate the signal of the connected link circuit to indicate the call, an operator's telephone and manual means for connecting it to the link circuit, circuit connections responsive to said manual means for effacing said signal,

and means controlled over the connected calling line for again operating said signal for disconnection.

28. A telephone system comprising telephone lines, operators' link circuits for extending the circuits of said lines, tip and sleeve supervisory relays for said link circuits, means normally rendering the tip relay inoperative, a supervisory signal and operating circuit therefor including contacts of said relays, automatic switches for interchangeably connecting said lines when calling and said link circuits, means responsive to such a connection to energize the sleeve supervisory relay and close the energizing circuit to operate said signal to indicate the call, means controlled by the operator for rendering said tip supervisory relay effective to efface said signal, said tip supervisory relay being thereby controllable over the connected line for again operating said signal for disconnection.

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

ALFRED H. WEISS.

Witnesses:

CLIFFORD C. BRADBURY,  
MARJORIE E. GRIER.