H. N. FARIS.

TELEPHONE SYSTEM.

APPLICATION FILED FEB. 21, 1914.

1,242,338.

Patented Oct. 9, 1917.

2 SHEETS—SHEET 1.

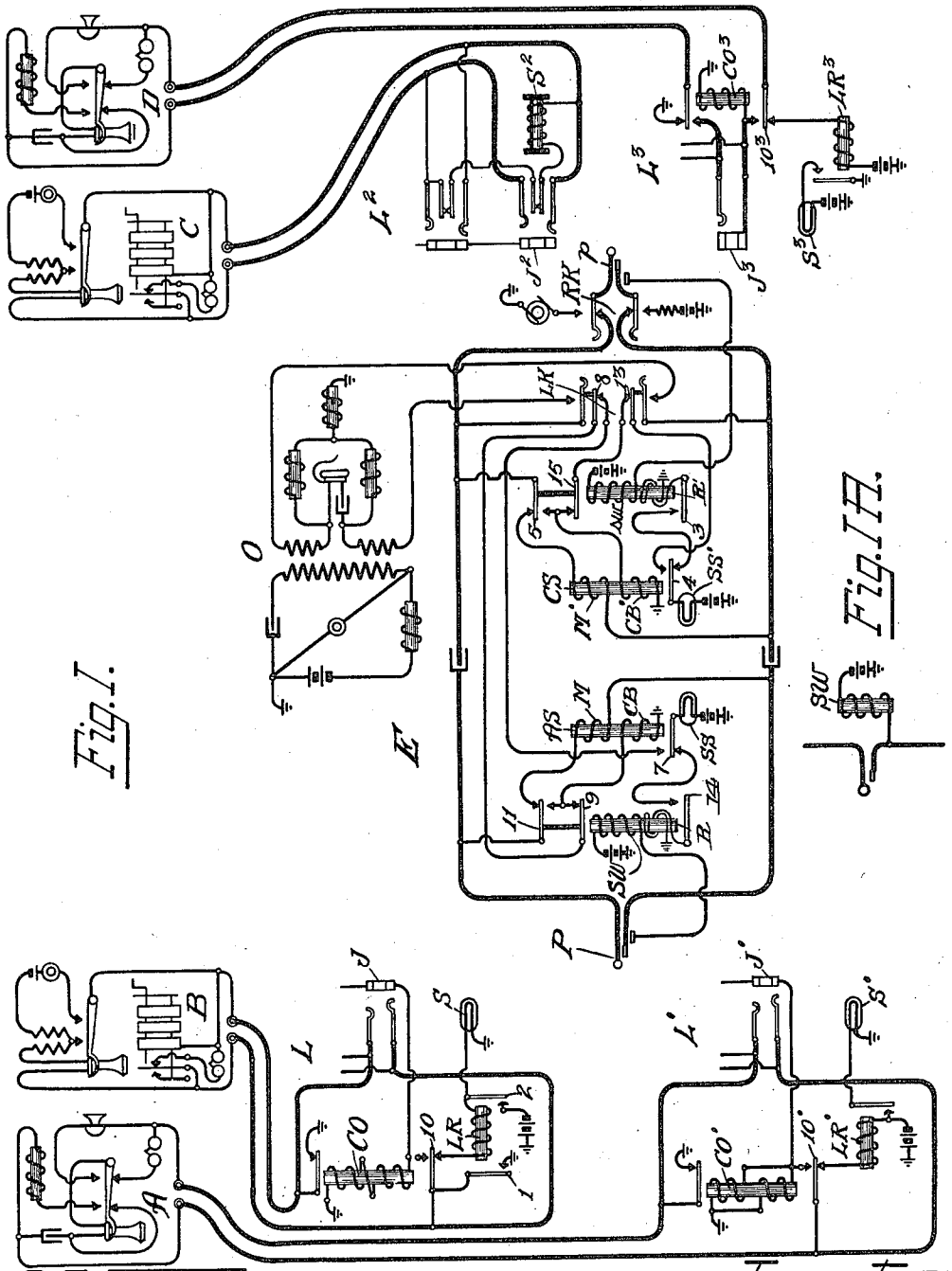

Fig. I.

Fig. II.

Witnesses:

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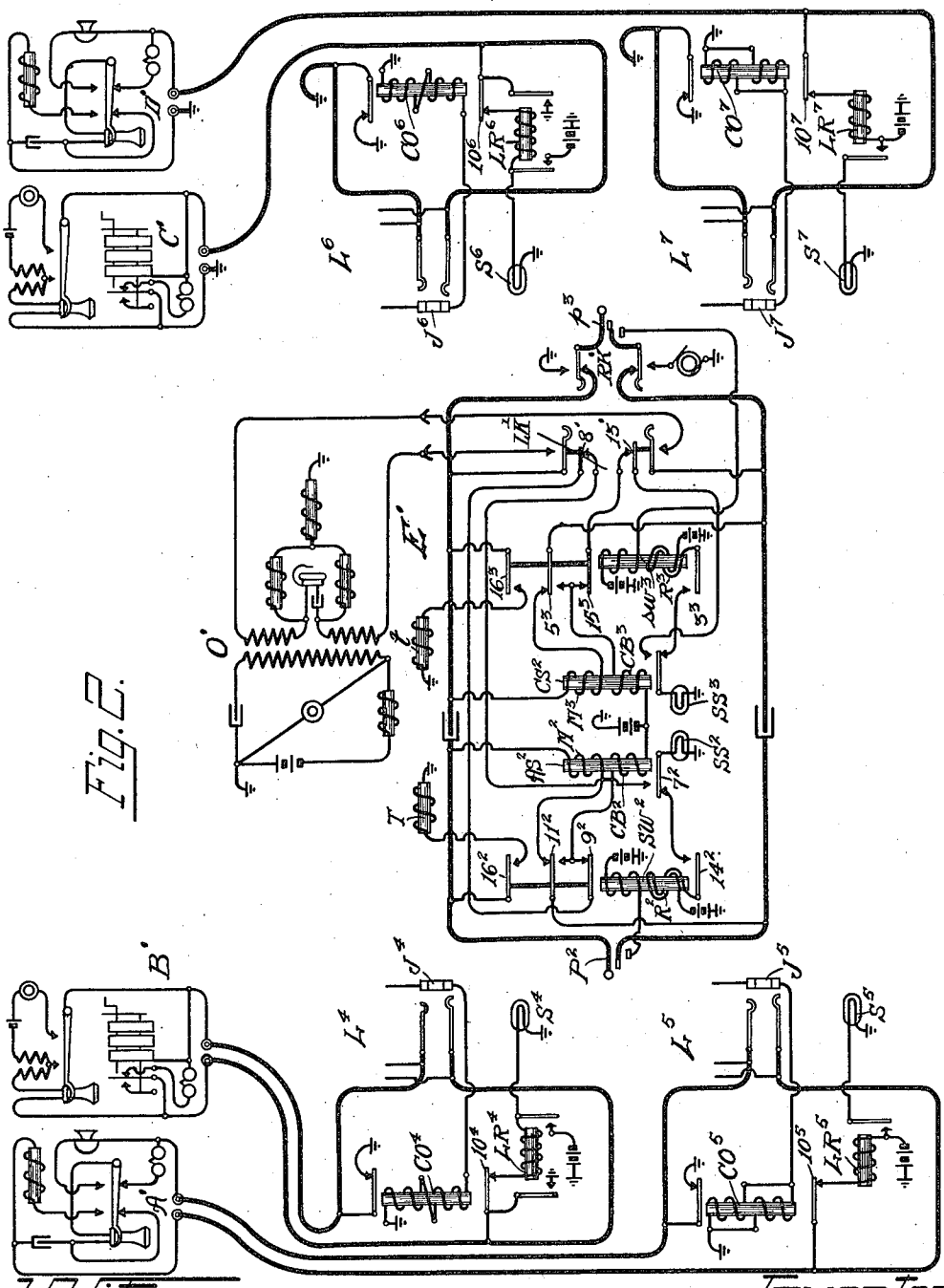

Fig. 2.

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TELEPHONE SYSTEM.

1,242,338. Specification of Letters Patent. Patented Oct. 9, 1917.

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To all whom it may concern:

Be it known that I, HARRY N. FARIS, a citizen of the United States of America, residing in Kansas City, county of Wyandotte, State of Kansas, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention has to do with telephone systems in general, certain features thereof relating more particularly to telephone systems comprising so-called magneto and common battery lines with means for interconnecting these lines. In systems of the above character wherein common battery and magneto substations are provided and in which relay controlled signals such as lamp signals are supplied for cord supervisory signaling, the relays for operating such signals over the common battery lines ordinarily maintain the lamp signal lighted or effaced, as the case may be, by a control of the direct current which flows over the common battery line. Where such lamp signals are controlled over a magneto line, means are usually provided in the form of a locking relay which is initially energized responsive to a flow of current from the substation generator and then locked up by local means to maintain the signal operated after the generator is stopped. In systems of this character after the magneto subscriber has operated for disconnection the supervisory signal remains in its operated position and the magneto subscriber has no way of signaling the operator should the subscriber desire to converse with the operator for a recall or for other purposes prior to the removal of the connecting plug. Also in such case there is no means whereby the operator can distinguish between a disconnect and recall operation of such signals. Therefore, I have provided means whereby when a magneto subscriber has operated the supervisory signal for disconnection, a continued or subsequent actuation of the substation generator will affect the supervisory signal in a distinctive manner by an induced current flow so that the operator knows the subscriber at the magneto station desires to converse with her.

Another feature of my invention is the provision of means whereby a common supervisory signal at the cord circuit is effected differently according to whether connection is made with a magneto or common battery line thereby indicating to the operator the kind of line connected with.

In working out my invention I have embodied it in several different forms, these being shown in the accompanying drawings in which like reference characters indicate like parts and in which—

Figure 1 illustrates a universal system comprising common battery and magneto telephone lines in which metallic line circuits are provided;

Fig. 1^A illustrates the manner of using a two conductor plug when all lines are changed to common battery; and

Fig. 2 illustrates a system having magneto and common battery lines including both metallic and grounded line circuits.

I will first describe the system illustrated in Fig. 1, wherein two common battery substations A and D are shown terminating in line circuits L^1 and L^3 and two magneto substations B and C terminating in line circuits L and L^2. A link circuit E is provided which is adapted for interconnecting the different types of lines shown. That is substations A and B may be connected to C and D or connections may be established between A and B or C and D. Or, connection may be established between two telephone lines of like character. Ordinarily there are not as many different types of line circuits used in a single switchboard as is shown in Fig. 1, but the four kinds are illustrated so that the flexibility of my invention will be understood.

At the left of Fig. 1, I have shown convertible line circuits L and L^1 for magneto and common battery lines respectively, these circuits comprising similar apparatus and differing only in the connections. Referring first to the magneto line, it comprises the usual magneto substation B terminating in a line circuit L consisting of a cut-off relay CO, line relay LR and line signal S, this circuit being so arranged that when the substation generator is operated the relay LR is energized and locked up over a local circuit maintaining the line

signal S lighted until an answering plug is inserted and the cut-off relay energized. The line circuit L is so arranged that it may be readily converted into a common battery line circuit L^1 by simply changing the connections of the line and cut-off relays as shown. For common battery use a well-known form of substation A is illustrated, and the magneto substation shown is also a well-known arrangement. In connection with relays CO and CO^1, when used for magneto service the relay CO has its windings connected in series so as to provide a high resistance path from the jack sleeve to ground but when used for a common battery line circuit as L^1 this relay CO^1 has its windings connected in multiple so as to provide a low resistance path from the jack sleeve. This variation of resistance of the cut-off relays is for the purpose of effecting the operation or non-operation of the switching relays SW, *sw* of the link circuit when connection is made with the line so as to connect the common battery or the magneto supervisory winding in circuit with the connected line.

At the right of Fig. 1 is shown a magneto substation C and common battery substation D connected to line circuits L^2 and L^3 respectively, line circuit L^2 being of the simple line drop type which may be multiply connected. The line circuit L^3 is of a well-known two-wire multiple type, its jack J^3 having its sleeve so arranged that it will cross the ring and sleeve conductors of the plug when inserted.

The operator's cord or link circuit E comprises answering and calling plugs P, *p*, connected by the heavily marked talking conductors, there being also a switching relay as SW connected to a third contact of each of the plugs. These switching relays are energized when connection is made with a common battery line so as to bridge the corresponding supervisory relay AS or CS across the connected line. When connection is made with a magneto line these switching relays are not operated and thus maintain the magneto winding in circuit of the line. As previously referred to the cut-off relays of the magneto and common battery lines are preferably of a different resistance, relay CO being sufficiently high to prevent the operation of the switching relay and the cut-off relays of the common battery lines are preferably of a low enough resistance to permit operation of the switching relay but in either case the cut-off relay operates. It will also be noticed that when the cut-off relay of a common battery line with three contact jacks is energized, due to the closing of its alternate contact 10^1 the ring and sleeve contacts of the jack are crossed or connected so that the talking battery supply flows through the winding of the switching relay and the crossed ring and sleeve contacts to the sleeve conductor of the line, part of the current flowing through the cut-off relay and part over the line to the tip conductor and through the lower winding of the supervisory relay AS to ground. When a magneto line is connected with, the switching relay does not operate and therefore the magneto winding M remains in bridge of the line to be operated by current from the substation generator.

As previously referred to I preferably arrange the link supervisory signals as SS so that an operator can determine what kind of a line is connected with the corresponding end of the link circuit. When a common battery line is connected to and the switching relay is operated, the supervisory signal is controlled through the corresponding resistance R, this resistance being sufficiently low to permit a bright illumination of the signal SS. But when a magneto line is connected with, the switching relay is not energized, the supervisory signal SS is included in a series circuit with the corresponding winding CB which is preferably of a higher resistance than its associated resistance R so that a dimmer illumination of the supervisory signal is effected. In case of a recall from a common battery line to the relay AS or CS as the case may be, is operated to wink the lamp SS according to the operations of the substation switchhook. In case of a recall from a magneto line the cord supervisory relay is first operated by current from the substation generator and then locks its armature with the signal SS connected in series with the associated winding CB and upon further actuation of the generator at the substation which is recalling, a flow of alternating current is effected through the magneto winding M of the associated supervisory relay producting an induced current flow in the associated winding CB and causing a flickering of the lamp SS. Thus it will be apparent that although the supervisory relay is locked up when a disconnect signal from a magneto line is received, still the subscriber is able to cause a distinctive operation of this same signal when the attention of the operator is desired.

In regard to the various resistance values elementary to the preferred control of the switching and signaling circuits, I have found in practice that with the following values successful operation is secured. Relay CO 1000 ohms (each winding 500 ohms) CO^1 250 ohms, and SW 100 ohms. By the use of 70 ohms resistance R and 100 ohms for resistance CB, lamp SS will operate as described, this lamp being a six volt lamp and I preferably employ a battery voltage of 24. Although I have given these values it will be apparent to those skilled in the

art that the resistances and voltage may be varied as may also the type of lamp. I also preferably wind the resistance as R inductively on the associated relay SW so as to provide a four coil cord circuit.

Now as to the lines shown at the right of Fig. 1, when connection is made with line circuit L^2 the line signal S^2 is disconnected and the ring contact being preferably on open circuit, the switching relay does not operate. When connection is made with a line circuit L^3, both the switching relay and cut-off relay CO^3 operate and the ring and sleeve contacts of the plug are crossed by the broad sleeve of the jack.

In connection with the operation of the supervisory signals upon disconnection and recall, when the receiver of a common battery line is hung up for disconnection a steady bright light is shown and when a common battery subscriber desires to recall there is a winking of the bright lamp effected by the winking of the switch-hook. When a subscriber at a magneto substation desires to disconnect, the operation of the substation generator will effect a steady dull glow of the supervisory lamp, but should the subscriber at the magneto substation desire to recall or again attract the attention of the operator, any operation of the substation generator subsequent to the first, will effect a flickering operation of the dull glowing lamp.

Operation Fig. 1.

Having described more in general the apparatus shown in the system of Fig. 1, the operation of various connections will now be described. Assuming first that a call is initiated from a magneto substation B, responsive to the operation of the substation generator alternating current flows over a circuit including the winding of relay LR and lamp S whereby the relay LR energizes closing a locking circuit for itself through its alternate contacts 1, 2 and thus maintaining the line signal S lighted. The operator now inserts an answering plug P into a jack J of the calling line thereby connecting the switching relay SW and cut-off relay CO in series, this circuit permitting the operation of CO but due to the high resistance of CO the relay SW does not operate. The energization of CO effects a restoration of relay LR and due to the fact that SW did not operate the answering supervisory relay AS has its magneto winding M maintained in bridge of the calling line. The operator now throws her listening key LK and finding that connection is wanted with the common battery line of substation D, a jack J^3 of this line is tested in the usual manner and finding the line idle the operator inserts the calling plug *p* into a jack J^3 thereby connecting switching relay *sw* and cut-off relay CO^3 in series and causing the operation of both of these relays. The operation of CO^3 extends the talking conductors of the link circuit E to the called line and the operation of relay SW closes a circuit through its alternate contact 3 and normal contact 4 including lamp SS^1 and resistance R^1 causing a bright glow of lamp SS^1. Due to the crossing of the sleeve and ring contacts of plug *p* by the sleeve of jack J^3, battery is supplied to the called line through the relay *sw* and therefore when the subscriber responds due to receiving a signal caused by the actuation of ringing key RK, current flows over the called line returning over the tip conductor, alternate contact 5 and the winding CB^1 to ground operating relay CS and effacing lamp SS^1. Substations B, D are now connected by a conversational circuit including the heavily marked conductors.

Assuming now that disconnection is desired the subscriber at the calling magneto substation B operates his hand generator in the usual manner thereby causing a flow of current through the bridged winding M of the relay AS whereby alternate contact 7 is closed establishing a locking circuit for relay AS traced from battery through lamp SS, alternate contact 7, normal contacts 8, 9 and the winding CB to ground. It will be noted that lamp SS is included in circuit with the resistance CB so that a dull glow of lamp SS is effected. The operator is thus aware that this signal was received from a magneto substation. To effect operation of the disconnect signal from the called common battery substation D, the subscriber thereat replaces his receiver interrupting the flow of current through the winding CB^1 of relay CS, but relays *su* and CO^3 are still maintained energized over the local circuit. Upon deënergization of CS its normal contact 4 is closed again connecting the lamp SS^1 and resistance R^1 in series thus effecting a bright illumination of the signal SS^1 and indicating to the operator that a disconnect signal has been received from a common battery line. The operator may now withdraw the answering and calling plugs from their respective jacks thereby effecting the restoration of relay *sw* and effacing lamp SS^1. The relay AS it will be remembered was energized and locked up over a local circuit including normal contact 8 of key LK and therefore the operator now actuates the listening key to interrupt this normal contact 8 thereby effecting the restoration of relay AS and effacing signal SS.

Assuming now that the subscriber at substation B desires an immediate recall, or wishes to converse with the operator for some other reason prior to the removal of the plug P from jack J, a subsequent or continued operation of the hand generator

at B transmits an alternating current through the magneto winding M of the supervisory relay. An induced current is therefore set up in the winding CB and this winding being included in circuit with the supervisory signal SS a flickering effect of this lamp is produced, thereby indicating to the operator that a call is being sent in from a connected magneto line. Without these distinctive signals the operator might disconnect when a recall is desired. The operator may then throw her listening key LK and converse with the subscriber, this act automatically restoring signal SS by the interruption of contact 8.

Should the subscriber at the called substation D desire to converse with the operator he will simply wink the switch-hook thereby causing a corresponding winking of the signal SS^1 and thus indicating to the operator that the subscriber is calling and not signaling for disconnect.

Assuming now that a call has been initiated from the common battery substation A, a flow of current through the line relay LR^1 is effected thereby operating the line signal S^1. The operator in response to this call inserts an answering plug P into a jack J^1 of the calling line whereby relays CO^1 and SW are connected in series and both of these relays are energized. Responsive to energization of CO^1 its alternate contact 10^1 is closed thereby connecting the sleeve and ring contacts of the connected jack and plug so that battery through relay SW also flows over the calling line returning over the tip strand and through alternate contact 11 and the common battery winding CB to ground causing the energization of relay AS. When relay SW energized, the operation of its contact 11 disconnected the magneto winding M from the cord and the connected common battery winding CB thereto. The operator now operates her listening key to connect her telephone O in circuit with the calling line and finding that connection is desired with magneto substation C she will test the line in the usual manner and finding it idle inserts the calling plug *p* into a jack J^2 of this line. The line signal S^2 is therefore disconnected and no circuit being provided for the switching relay *sw* this relay remains inert maintaining the magneto winding M^1 of the calling supervisory relay CS in bridge of the called line. The ringing key RK is now actuated to ring the bell of substation C and upon removal of the called substation receiver the lines are connected by a conversational circuit including the heavily marked conductors.

Upon termination of conversation the subscribers actuate their apparatus for disconnection in a manner as already described, the actuation of the generator at substation C causing the lighting of a dull signal SS^1 while the restoration of the receiver at substation A effects the lighting of a bright signal SS. The operator therefore effects disconnection and restoration of the signals in a manner as previously described, the actuation of her key LK causing the interruption of its normal contact 13 to restore the relay CS and lamp SS^1. Should either of the subscribers desire to attract the attention of the operator prior to the removal of the connecting plugs, the supervisory signals are effected in a manner as previously described.

Should a connection be made between the lines of substations B and A, the operation of supervisory apparatus of the cord circuit will be readily followed in view of the connections already described. Likewise a connection between substations C and D or between two stations of like character will be readily understood from the foregoing explanations.

Fig. 1A.

In the above mentioned figure I have illustrated the manner in which the switching relays are connected to the sleeve talking conductor when all of the lines have been converted into common battery lines. That is, when all of the lines on the switchboard have been converted into common battery lines it is no longer necessary to use a three-conductor plug but a two-conductor plug and cord may be used thus cutting down the cost of maintenance. Thus when all lines are common battery lines with the circuits connected as indicated at L^1, by the use of two-conductor plugs the operation of the system will be apparent in view of the previous description of operation. With the switching relays connected to the sleeve strand, upon insertion of a plug into the jack of a line circuit as L^1 (or L^3) the switching relay will energize in the manner as already described and battery through the switching relay will be fed through the cut-off relay to ground and also over the telephone line. It is to be understood that the switching relays at both the answering and calling ends of the cord circuit are to be connected as shown in Fig. 1^A. By the use of a plug in which the sleeve contact crosses the sleeve and ring contacts of the jacks J^1, it is immaterial whether the alternate contact 10^1 is or is not used, because in such case battery will be fed through the switching relay directly to the ring and sleeve contacts of the jack and these contacts will be crossed by the sleeve of the plug. When used with line circuits as L^3, the operation will be obvious.

Fig. 2.

In Fig. 2, I have illustrated a system adapted for a so-called three-wire multiple system in which the line circuits have their

cut-off relays energized over a circuit independent of the talking contacts of the jacks. Furthermore this system is adapted for providing service to both metallic and grounded lines. Connections may be made between any two types of lines shown. As I desire in this system to maintain the energizing circuit for the cut-off relay independent of the talking circuit, I preferably provide independent connections from battery to the tip and ring conductors or contacts of the plugs. It will be remembered that in the system of Fig. 1 a connection was provided from battery to the third contact of the plug and by crossing the ring and sleeve contacts of the jack by the alternate contact 10 of the cut-off relay, or by the broad sleeve of the jack as at L^3, this single battery connection provided an energizing circuit for cut-off relay and also for the substation transmitter. In the line circuits of Fig. 2, alternate contact 10 of the cut-off relays is omitted so as to maintain the cut-off relay circuit and talking circuit independent.

In order to more readily see the resemblance existing between the systems of Figs. 1 and 2, I have used the same reference characters for indicating parts having like functions except for the suffix.

The connections of line circuit L^4 of Fig. 2, are the same as in the line circuit L of Fig. 1 but the line circuit L^5 differs from L^1 in that no alternate contact 10 is provided at the cut-off relay CO^5. Line circuits L^6 and L^7 are similar to L^4 and L^5 respectively except that circuits L^3 and L^7 are arranged for grounded lines. Although four different types of line circuits are shown in Fig. 2 it is to be understood that the cord circuit E^1 is adapted for interconnecting any two lines whether of different or like character.

The same character of supervision is provided in connection with the cord circuit E^1 as that described in connection with the cord circuit E. That is the same methods of distinguishing between magneto and common battery lines by the particular effect produced by the supervisory signals SS^2 and SS^3. Switching relays SW^2 and sw^3 cooperate with the cut-off relays as described in Fig. 1. That is when a magneto line is connected with, the switching relays do not operate but when a common battery line is connected with, the switching relays do operate. As previously stated, I preferably provide a different connection for supplying talking current in the cord circuit E^1 than in E, and it will be noted that when a switching relay is energized an alternate contact 11^2 or 5^3 (as the case may be) thereof closes to connect the common battery winding of the associated supervisory relay to the sleeve strand of the cord whereby talking current is supplied to the sleeve conductor and line returning over a path including the tip winding of the switching relay to ground through an impedance coil as T. Of course when a magneto line is connected with, the switching relay does not operate and therefore no central talking battery is connected to the line and the magneto supervisory winding is maintained connected in bridge of the connected line as in Fig. 1.

The lamp controlling resistances R^2, R^3, are shown non-inductively wound on their associated switching relay so as to save providing a separate spool.

Operation Fig. 2.

Having described in a general way the difference between the systems of Figs. 1 and 2, the operation of the system of Fig. 2 will now be described.

Assuming that a call is initiated from the common battery substation A^1, the associated line relay LR^5 is operated to light line signal S^5 whereupon the operator inserts an answering plug P^2 into a jack J^5 of this line connecting the lower winding of switching relay SW^2 in series with CO^5 and causing the energization and operation of both these relays. The operation of CO^5 of course disconnects relay LR^5 and the operation of SW^2 disconnects the magneto winding M^2 at normal contact 11^2 and by the closing of alternate contacts 11^2, 16^2, windings CB^2 and T, are connected in bridge of the calling line. A flow of current is thus established from battery through winding CB^2, alternate contact 11^2, sleeve conductors, over a circuit including the calling line and returning over the tip strand through alternate contact 16^2 and winding T to ground. This flow of current through winding CB^2 effects the operation of supervisory relay AS^2 but without any effect upon the associated supervisory signal SS^2 at this time. The operator now throws the listening key LK^1 and finding that connection is wanted with magneto substation C^1 she inserts the calling plug p^3 into a multiple jack J^6 of the wanted line connecting the lower winding of relay sw^3 and relay CO^6 in series. This circuit results in the energization of CO^6 but due to the comparatively high resistance of its winding the switching relay does not operate and therefore the magneto winding M^3 is maintained in bridge of the called line. The operator now actuates ringing key RK^1 to ring the substation bell, the ringing current flowing over the sleeve and through the bell of C^1 to ground, and upon response of the called subscriber substations A^1 and C^1 are connected by a conversational circuit including the heavily marked conductors.

When disconnection is desired the subscriber at magneto substation C^1 actuates the generator thereat transmitting a flow of alternating current through the winding M^3

over a circuit traced from ground at substation C^1 through the said substation generator, the sleeve conductor of the line and calling end of the cord, winding M^3, normal contact 5^3, the tip strand and through the tip contacts of the plug and jack to ground. Relay CS^3 therefore attracts its armature closing a locking circuit for itself including lamp SS^3 and its winding CB^3 in a manner as already referred to. This lamp therefore produces a dull glow indicating to the operator that a magneto substation has transmitted a disconnect signal. Upon restoration of the receiver at calling substation A^1 the circuit through windings CB^2 and T is interrupted whereby relay AS^2 restores its armature closing a circuit through supervisory signal SS^2 including resistance R^2. This results in a bright glow of the lamp SS^2 and apprises the operator that a common battery substation has hung up for disconnection.

Should the subscriber at the called magneto substation C^1 desire to immediately recall the operator and not send a disconnect signal, a continued or subsequent operation of the substation generator will transmit a further flow of alternating current over the previously described path including winding M^3, and therefore the resulting induced flow of alternating current through the associated winding CB^3 causes a flickering of the lamp SS^3, thus indicating to the operator that she is wanted. Should the subscriber at the common battery substation A^1 desire to recall the operator prior to the removal of the connecting plug, the switch-hook is operated in the usual manner to effect a winking of the signal SS^2. By the operation of her listening key the locked supervisory relay is released and its signal effaced.

Assuming now that a connection is to be established from a calling magneto substation B^1 to a called common battery substation D^1, the call from B^1 is initiated in the usual manner and the operator inserts an answering plug P^2 in a calling jack J^4. This results in the operation of cut-off relay CO^4 but not of the switching relay SW^2. Upon insertion of the calling plug p^3 into a jack J^7 of the wanted line the relays sw^3 and CO^7 are connected in series resulting in their energization and operation. The winding CB^3 is thus connected to the sleeve talking strand of the calling end of the cord and when the subscriber at D^1 removes his receiver in response to the operation of his call signal, a flow of current through winding CB^3 is established traced from battery through said winding, alternate contact 5^3, sleeve strand of the cord and line and through substation D^1 to ground resulting in the operation of relay CS^2 and the effacement of signal SS^3.

After the subscribers have finished conversation and disconnection is desired, the replacing of the receiver at D^1 interrupts the circuit through winding CB^3 resulting in the deënergization of relay CS^2 and the lighting of signal SS^3. By the disconnect operation of generator at B^1 a flow of alternating current is established through the winding M^2 resulting in the operation of relay AS^2 and the establishment of a locking circuit through its winding CB^2 and lamp SS^2, thereby lighting lamp SS^2 in a manner which will be readily understood from the previous description. A further or continued operation of the hand generator at B^1 will result in transmitting an induced current flow through the winding CB^2 to cause the flickering of the lamp SS^2 as already set forth. Any winking of the switch-hook at substation D^1 will of course effect the relay CS^2 and thereby cause a corresponding winking of the associated lamp SS^3.

The system of Fig. 2, is also so arranged that a connection may be established between substations A^1 and B^1 or between substations C^1 and D^1. Also a connection can be established between any two lines of like character. However, a detail description of such connections will not be given as it is thought the operation of the apparatus during such connections may be readily followed in view of the previous description.

From the various modifications of my invention as illustrated it will be evident that it is applicable to a variety of systems and it is to be understood that I contemplate employing my invention in other ways than shown. Therefore I do not desire to be limited to the exact structures as shown and described but I aim to cover broadly all such changes and modifications as come within the spirit and scope of the appended claims.

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

1. A telephone system comprising common battery and magneto telephone lines, a link circuit adapted for connecting to either one of said lines, and a supervisory signal for said link circuit differently affected for disconnection according to whether associated with a common battery or magneto line.

2. A telephone system comprising common battery and magneto telephone lines, a link circuit for interconnecting said lines, and a supervisory signal for said link circuit differently affected for disconnection according to whether associated with a common battery or a magneto line.

3. A telephone system comprising common battery and magneto telephone lines, a link circuit for interconnecting said lines, supervisory signals for said link circuit, and

means controlled over the connected lines for differently affecting each of said signals for disconnection according to the character of the associated lines.

4. A telephone system comprising common battery and magneto telephone lines, a link circuit for interconnecting said lines, and a supervisory lamp signal for said link circuit differently affected for disconnection according to the character of the associated lines.

5. A telephone system comprising telephone lines of different character, a link circuit for interconnecting said lines, supervisory lamp signals for said link circuit, and means controlled over the connected lines for differently affecting each of said signals for disconnection according to the character of the associated lines.

6. A telephone system comprising telephone lines of different character, a link circuit for interconnecting said lines, supervisory lamp signals for said link circuit, each of said lamp signals being adapted to be lighted to different magnitudes, and means controlled over the connected lines for lighting said lamp signals to said different magnitudes according to the character of the associated lines.

7. A telephone system comprising telephone lines of different character, a link circuit for interconnecting said lines, supervisory lamp signals for said link circuit, and means controlled over connected lines for including either of said lamp signals in high or low resistance energizing circuits according to the character of the associated lines.

8. A telephone system including magneto telephone lines, a link circuit for interconnecting said lines, supervisory signals for said link circuit, means controlled over connected lines whereby the operation of the substation generator will cause a fluttering operation of said signals to denote recalls, a listening key for connecting the operator's telephone to the link circuit, and means controlled by said key when answering recalls for rendering said signal inactive.

9. A telephone system including magneto telephone lines, a link circuit for interconnecting said lines, supervisory lamp signals for said link circuit, means controlled over connected lines whereby the operation of the substation generators will cause a flickering operation of said lamp signals, a listening key for connecting and disconnecting the operator's telephone and the said link circuit, and means responsive to an operation of said key to extinguish said supervisory lamps.

10. A telephone system comprising telephone lines of different character, operators' link circuits for interconnecting said lines, supervisory signals for said link circuits, each of said signals being controlled by lines of different character, means controlled over connected lines for operating said signals for disconnection, and means whereby the operator can distinguish the character of line effecting the disconnect signal.

11. A telephone system comprising common battery and magneto telephone lines, a link circuit for interconnecting said lines, supervisory lamp signals for said link circuit, and means controlled over said lines for causing a steady or a flickering operation of said signals according to the character of the connected lines.

12. A telephone system comprising common battery and magneto telephone lines, a link circuit for connecting to said lines, a supervisory lamp signal for said link circuit, and means located at the central office differently operative according to the character of the line connected with for causing a steady or a flickering operation of said signal.

13. A telephone system including common battery and local battery telephone lines, a link circuit for connection therewith, a supervisory electromagnet connected to said link circuit, a supervisory signal for said link circuit having an energizing circuit inductively related to the winding of said electromagnet, means controlled over a connected local battery line for varying the current flow through said supervisory electromagnet whereby said supervisory signal is inductively operated responsive to such variation, and means controlled over a connected common battery line for operatively energizing and deënergizing said electromagnet whereby said electromagnet operates to open and close a second circuit for said supervisory signal.

14. A telephone system including common battery and local battery lines, a manual link circuit for connection to said lines, a supervisory signal for said link circuit, means controlled over a common battery line for intermittently operating said supervisory signal when a recall is desired, and means controlled over a local battery line for inductively operating said signal when recall is desired.

15. A telephone system comprising common battery and magneto telephone lines, an operator's link circuit for interconnecting said lines, supervisory signals for said link circuit, and means whereby the operator can distinguish between a disconnect and recall operation of said signals and can also distinguish the character of the line signaling.

16. A telephone system comprising common battery and magneto telephone lines, a universal link circuit including three conductor plugs for interconnecting said lines, a switching relay connected to one of the conductors of each plug, talking strands for

said link circuit connected to the other conductors of the plug, said link circuit being adapted for use with two conductor plugs for serving said common battery lines by connecting said switching relay to one of said talking strands.

17. A telephone system comprising common battery and local battery lines, a universal cord circuit for interconnecting said lines, said cord circuit comprising two relays associated with each end, a supervisory signal for each end of said cord circuit, and circuit connections whereby said signals are controlled by one of said relays when connection is made with a local battery line and by two of said relays when connection is made with a common battery line.

18. A telephone system comprising common battery and local battery lines, a cord circuit for interconnecting said lines, a pair of relays associated with each end of said cord circuit, supervisory signals for said cord circuit, and circuit connections whereby said signals are controlled by one of said relays when connection is made with a local battery line and by two of said relays when connection is made to a common battery line.

19. A telephone system comprising local battery and common battery lines, a universal cord circuit adapted to be connected to said lines as calling lines, a supervisory signal associated with said cord circuit, and means for differently affecting said supervisory signal for disconnection according to the character of the calling line.

20. A telephone system comprising local battery and common battery lines, a universal cord circuit adapted to be connected to said lines as calling lines, a supervisory signal associated with said cord circuit, and means located at the central office for differently affecting said supervisory signal for recall according to the character of the calling line.

21. A telephone system comprising common battery and local battery lines, a link circuit provided with a calling terminal for connection to said lines as called lines, a supervisory signal associated with said terminal, and means for differently affecting the said supervisory signal for disconnection according to the character of the connected called line.

22. A telephone system comprising common battery and local battery lines, a link circuit provided with a calling terminal for connection to said lines as called lines, a supervisory signal associated with said terminal, and means located at the central office for differently affecting the supervisory signal for recall according to the character of the connected called line.

23. A telephone system comprising common battery and local battery telephone lines, a cord circuit provided with an answering signal adapted to be connected to lines of either character, and means controlled over the connected lines for differently affecting said signal for disconnection according to the character of the connected lines.

24. A telephone system comprising local battery and common battery lines, a cord circuit adapted to be connected to said lines as calling lines, a supervisory signal for said cord circuit, means controlled from the substations of said lines for causing said supervisory signal to flicker to denote recalls, the said means being controlled by an intermittent operation on the part of a common battery subscriber and by a continuous operation on the part of a local battery subscriber.

25. A telephone system comprising common battery and local battery telephone lines, a link circuit adapted for connecting to either one of said lines, and a supervisory signal for said link circuit differently affected for disconnection according to whether associated with a common battery or local battery line.

26. A telephone system comprising common battery and local battery telephone lines, a link circuit for interconnecting said lines, and a supervisory signal for said link circuit differently affected for disconnection according to whether associated with a common battery or a local battery line.

27. A telephone system comprising common battery and local battery telephone lines, a link circuit for interconnecting said lines, supervisory lamp signals for said link circuit, and means for causing a steady operation of said signals when said common battery lines are signaling and for causing a flickering operation of said signals when said local battery lines are signaling.

28. A telephone system comprising common battery and local battery telephone lines, a link circuit for connecting to said lines, a supervisory lamp signal for said link circuit, and means differently operative according to whether the line connected with is one of said common battery or one of said local battery lines for causing a steady or a flickering operation of said signal.

29. A telephone system comprising common battery and local battery telephone lines, a universal link circuit for interconnecting said lines, a supervisory signal for said link circuit, and means for differently affecting said signal for disconnection according to the character of the connected lines.

30. A telephone system comprising common battery and local battery lines, a universal cord circuit provided with a pair of terminals for interconnecting said lines, an

answering and a calling supervisory signal for said cord circuit, and means controlled from the connected lines for differently affecting the said signals for disconnection according to the character of the associated lines.

Signed by me at Kansas City, county of Wyandotte, and State of Kansas, in the presence of two witnesses.

HARRY N. FARIS.

Witnesses:
ALTA SWANSON,
J. J. CONNOR.