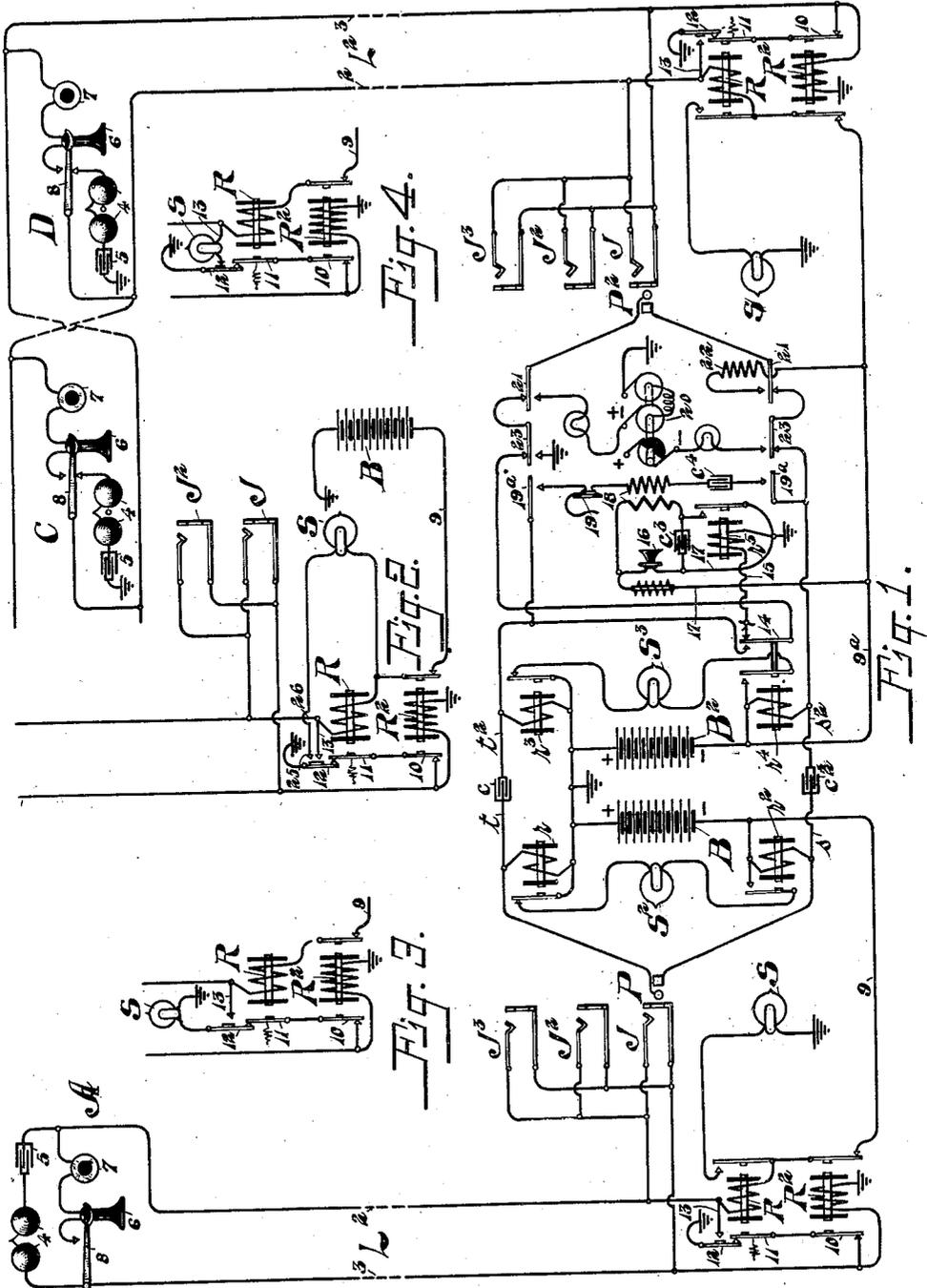


A. H. WEISS.  
TELEPHONE SYSTEM.  
APPLICATION FILED DEC. 13, 1902.



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# UNITED STATES PATENT OFFICE

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## TELEPHONE SYSTEM.

No. 897,042.

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*To all whom it may concern:*

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

My invention relates to telephone systems of the common battery type and in which only two wires extending throughout the switchboard are required for conversation and for the operation of the various cut-off and supervisory relays associated with the lines.

It has particular reference to means whereby in such two wire common battery multiple switchboard systems it is not necessary to provide normally open contacts in the line circuits.

Other objects are the provision of a system of the type mentioned that is simple and convenient to install and one that is efficient and durable in operation.

In the accompanying drawing in which the same reference characters indicate like parts throughout the several views Figure 1 is a diagram of the system embodying my improvement; Fig. 2 is a diagram of a modification in the line circuit; Fig. 3 is a diagram of a different arrangement of the line lamp, and Fig. 4 is a diagrammatic view of still a different arrangement.

Referring to Fig. 1, L and L<sup>2</sup> indicate subscribers' lines extending in two limbs 2 and 3 from their respective substations to the central office. Upon the line L a single station A is shown at which are provided a call bell 4 and condenser 5, preferably in a permanent bridge of the line conductors, while a receiver 6 and a transmitter 7 are connected in a normally open bridge by the switch-hook 8. At the central office the line is fitted with an answering jack J and any suitable number of multiple jacks such as J<sup>2</sup> and J<sup>3</sup> having their tip and sleeve contacts permanently connected and forming extensions of the respective line conductors. The line conductor 2 includes the winding of the line relay R as well as the normal contact of the cut-off relay R<sup>2</sup> and is thence connected by a main lead 9 with the live pole of a central and common source B of steady current. The relay R controls through its normally open contacts the circuit of the line signal S which is preferably in the form of a small in-

candescent lamp. The sleeve line conductor 3 permanently includes the helix of the cut-off relay R<sup>2</sup>, and has a branch to ground, in addition, which is normally closed through spring 10 of relay R<sup>2</sup> and springs 11 and 12 of relay R, the latter spring being adapted to make connection with the branch conductor 13 before it is separated from the spring 11 when the relay R is actuated. The line L<sup>2</sup> is in this instance shown as a party-line or as a poly-station line, the arrangement being substantially the same at each sub-station as at the station A except that the bells are grounded from the different line conductors.

The operator's outfit includes a cord circuit having an answering plug P and a calling plug P<sup>2</sup>, each provided with tip and sleeve contacts adapted to register with the similar contacts of the connecting jacks. The tip contacts of the plugs are joined by the strands *t* and *t*<sup>2</sup> of the cord circuit and the interposed condenser *c*, while the sleeve contacts of said plugs are likewise joined by the flexible strands *s* and *s*<sup>2</sup> and the interposed condenser *c*<sup>2</sup>. The battery B is bridged across the answering end of the cord circuit and includes upon one side the supervisory relay *r* and upon the other side the sleeve supervisory relay *r*<sup>2</sup>, the former controlling through its normally closed contacts and the latter through its normally open contacts the local circuit of the supervisory signal S<sup>2</sup> associated with the plug P and preferably charged from the battery B. The battery B<sup>2</sup> is similarly connected across the calling end of the cord circuit and is provided upon one side with the tip supervisory relay *r*<sup>3</sup> and upon the other with the sleeve supervisory relay *r*<sup>4</sup> which together control the supervisory signal S<sup>3</sup> associated with the plug P<sup>2</sup>. The tip strand of the cord circuit is severed at spring 14 of relay *r*<sup>4</sup> by which its forward portion is normally connected through a common conductor 15 with the high impedance and high resistance test relay *r*<sup>5</sup>, the other pole of which is grounded. This relay is preferably common to the cord circuits of each operator's position and serves through its normally open contacts to complete a path for current through the operator's induction coil to thereby cause a click in her receiver. The operator's transmitter 16 is connected in a conductor 17 which is joined to the common wire 9<sup>a</sup>. The primary helix

of the operator's induction coil 18 and the condenser  $c^3$  are in a shunt of the transmitter 16. The operator's receiver 19, the secondary of her induction coil and the condenser  $c^4$  are adapted to be bridged across the calling end of the cord circuit by the springs 19<sup>a</sup> of any suitable listening key. The calling generator 20 is adapted by the operation of ringing springs 21 to deliver alternating current to the tip side of the line, while connecting the sleeve side through resistance coil 22 with the omnibus bar 9<sup>a</sup>. The same generator by the depression of springs 23 of the ringing key is arranged to deliver pulsating current, preferably of negative polarity with the sleeve line conductor and at the same time grounding the tip conductor.

Upon taking up the receiver at the station A the line conductors are closed together thus permitting current from the battery B to flow over the branch 9 and the tip conductor 2, through the sub-station instruments and back to the central office over the line conductor 3 through spring 10 of relay R<sup>2</sup> and springs 11 and 12 of relay R to ground. The line relay R responds to this current closing through its normally open contacts the circuit of the lamp S and also connects a locking circuit for itself through the branch 13 and spring 12 to ground. This locking circuit is completed before the spring 11 is separated from 12 whereby the line relay is maintained actuated, and the ground connection from the sleeve conductor is severed. Upon noticing the signal the operator inserts the answering plug of the cord circuit thereby completing a path for current from the battery B over the sleeve strand  $s$  through the sleeve conductors of the jacks, and through the branch containing the cut-off relay R<sup>2</sup>, which is actuated to open the circuit of the line relay thus rendering the same and the line signal inoperative and opening at a different point the said ground branch from the sleeve conductor of the line. At the same time the sleeve supervisory relay  $r^2$  is energized to close the circuit of supervisory lamp S<sup>2</sup> which, however, is prevented from operating at this time by the actuation of relay  $r$  which is in the path of current over the line conductor to the substation.

The wanted line is tested in the usual manner by touching the tip of a calling plug to a test ring thereof. Under normal conditions the test rings are connected to ground and since the tip of the plug is likewise connected the testing of an idle line gives no click, but if the line is busy the test rings are connected through the sleeve strand of the cord circuit with the live pole of a battery whereby they are raised to a potential above earth, and the application of a testing plug thereto results in a flow of current through the test relay  $r^5$  causing it to close a path for current through the induction coil in the operator's

outfit. This relay is preferably of high resistance and high impedance to prevent a large or sudden change of current upon the tested lines. It will be obvious that the relay may be replaced by a third winding in the operator's induction coil or in other ways.

Upon finding the line idle the calling plug is inserted in one of the multiple jacks of the line whereupon the line relay R is given an impulse by current to ground over the tip conductor of the plug. Upon the actuation of this relay the short circuit is removed from the coil of the cut-off relay R<sup>2</sup> and the latter is immediately operated by current over the sleeve conductor of the cord. The circuit of the line signal S is thereby closed and opened again so quickly that the signal will not be displayed. The ringing key is now operated and the depression of springs 21 connects the generator with the tip side of the line and operates the bell at station D, while the sleeve connection with the live pole of battery B<sup>2</sup> is maintained through the coil 22 to maintain the cut-off relay actuated during ringing and to provide a low resistance path for ringing current in case of the response of the subscriber during ringing. The operation of springs 23 of the ringing key connects the said generator with the sleeve line conductor and thereby operates the bell at the station C. The pulsating current serves to maintain the cut-off relay of the called line in actuated condition while the tip spring closes a low resistance path to ground for the return of the ringing current. It will be apparent that either set of springs may be employed for calling single subscribers located upon metallic lines.

Before the response of the called subscriber the supervisory relay  $r^4$  operates to close a local circuit of the supervisory lamp S<sup>3</sup> which is lighted and remains in this condition until the subscriber responds. At the same time the test relay is disconnected and the tip strand  $t^2$  completed through the spring 14 for conversational purposes. The response of the called subscriber permits a flow of current from the battery B<sup>2</sup> over the metallic line thus operating supervisory relay  $r^3$  to extinguish lamp S<sup>3</sup>.

During conversation the two batteries are connected with their respective lines to furnish current for transmission and for the operation of the various relays associated therewith. The subscriber's set is intended to typify any of the usual or desired type of common battery outfits. The cut-off relays R<sup>2</sup> are preferably in the neighborhood of 500 ohms resistance while the line relays and the supervisory relays may be of 100 ohms resistance. At the termination of the conversation the return of the receivers to the hooks opens the line circuits to steady current thereby deenergizing supervisory relays  $r$  and  $r^3$  and permitting the two super-

visory lamps to operate. Upon noticing these the operator takes down the connection and restores all parts to normal condition.

5 Fig. 2 shows a modification in which the additional contact upon the line relay is dispensed with by extending the local circuit of the lamp to a second forward contact 25 of line spring 12. Or the said line lamp may  
10 obviously have its circuit otherwise connected to produce the same result without departing from the spirit of my invention. The operation of this form of the invention is manifest.

15 Fig. 3 shows a slightly different modification in which the lamp S is placed in the ground branch from the spring 12, it being merely necessary to use a lamp that will light through the resistance of the line relay R.

20 Fig. 4 shows the lamp located in the branch 13, the operation being otherwise the same as before described.

Other modifications, it is apparent, may be made without departing from the principle or scope of the invention for which reason I do not wish to be limited in all respects and in all claims to this special form shown.

I claim:

30 1. The combination with a telephone line extending in two limbs to the central station, of a signal circuit associated therewith, a relay winding permanently connected between one of said limbs and a third conductor and  
35 out of the path of calling current from the subscriber's station, a contact in said signal circuit controlled by said winding, a source of current at the central station adapted to be connected between said third conductor and the limb with which said relay winding  
40 is connected and to send current through said relay winding over a circuit including a portion of the talking circuit of the telephone line, said source also serving to furnish current  
45 to the subscriber's station for talking, substantially as described.

2. The combination with a telephone line extending in two permanent limbs direct to the line contacts in the switchboard at the  
50 central station, of a relay winding connected between one of said limbs and a third conductor and out of the path of calling current from the subscriber's station, a contact controlled by said winding, a signal circuit controlled by said contact, a cord connector  
55 terminating in a connecting plug, a charging source of electricity at the central station connected between said third conductor and one strand of the cord connector and adapted  
60 to be included in the metallic circuit of the line to furnish current to the substation of the line for talking, and to send current through said relay winding over a circuit including one of the main terminals of the connecting  
65 plug to deprive said signal circuit of

current, a portion of the cord circuit, and a line contact of the telephone line, substantially as described.

3. The combination with a telephone line extending in two continuous limbs to the  
70 spring jacks at the central station, of a signal controlling electro-magnet normally connected with the line, a relay for opening the circuit of said electro-magnet and having its winding permanently connected with one of  
75 said limbs out of the path of calling current from the subscriber's station, a source of current at the central office adapted to be included in the metallic circuit of said line to furnish current to the subscriber's station for  
80 talking, and means for closing circuit from said source through said relay winding over a portion of the talking circuit of the telephone line when connection is made with the line, substantially as described. 85

4. The combination with a telephone line extending in two limbs to the central station, of a connection terminal having its contacts permanently connected with the line, a line signal, a relay for rendering said signal inoperative and permanently connected with the  
90 line and out of the path of the calling current from the subscriber's station, a source of current at the central office adapted to be included in the metallic circuit of said line to furnish current for talking to the substation, and means for closing circuit through said relay over a portion of the talking circuit when  
95 connection is made with the line, substantially as described. 100

5. In a telephone system, the combination with a telephone line extending in two continuous limbs to the spring jacks at the central office, of a line signal therefor, means for  
105 operating the same by calling current sent over the line from the subscriber's station, a cut-off relay for the line permanently connected therewith and out of the path of calling current, said relay being adapted when actuated to restore the line signal to normal  
110 condition, and means for energizing said relay over a portion of the talking circuit when a connection is established with the line, substantially as described.

6. In a telephone system, the combination  
115 with a telephone line having its limbs extending continuously throughout the switchboard, of a line signal therefor, a line relay to actuate said signal when a calling current is sent over the line by the subscriber, a cut-off  
120 relay permanently connected with the line out of the path of calling current and adapted when operated to open the circuit of said line relay, and means for energizing the cut-off relay by current flowing over a portion of  
125 the talking circuit when a connection is established with the line, substantially as described.

7. In a telephone system, the combination with a telephone line extending in two con- 130

tinuous limbs to the spring jacks at the central office, of a source of current with which said limbs are connected at the central office, a line relay or electro-magnetic signaling device connected with one of said limbs, a cut-off relay permanently connected between one of said limbs and a third conductor, said cut-off relay being out of the path of the current in the line when the subscriber is calling the central office, and adapted to be actuated when a connection is established by current over a portion of the talking circuit and the third conductor, substantially as described.

8. In a telephone system, the combination with a telephone line extending in two continuous limbs to the spring jacks at the central office and included in the talking circuit, of a central source of current with which the limbs of said lines are normally connected, a line relay connected with one of said limbs, a cut-off relay legged to ground from the other limb out of the path of current when the subscriber is calling the central office and adapted when actuated to render said line relay inoperative, and means for actuating said cut-off relay by current over a portion of the talking circuit and ground when a connection is established with the line, substantially as described.

9. In a telephone system, the combination with the telephone line, of a source of current

with which the limbs thereof connect, a line relay in one of the limbs, said relay serving when actuated to open the other limb, a cut-off relay connected with the latter limb beyond the point of opening the same, and means for actuating the latter relay over a portion of the talking circuit when a connection is established with the line, substantially as described.

10. In a telephone system, the combination with a telephone line provided with spring jacks upon the switchboard at the central office, the limbs of said line being continuous to the contacts of said jacks, a line signal for the line at the central office, a cut-off device associated with the line but out of the path of current therein when the subscriber is calling the central office, said cut-off device being operated by current over a path including a portion of the talking circuit when a connection for conversation exists with the line to thereby restore the line signal to normal condition, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 10th day of December 1902.

ALFRED H. WEISS.

Witnesses:

GAZELLE BEDER,  
ROBERT LEWIS AMES.

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