

(No Model.)

J. D. CLARKE.

SIGNALING AND LOCK-OUT APPARATUS FOR TELEPHONE STATIONS.

No. 552,420.

Patented Dec. 31, 1895.

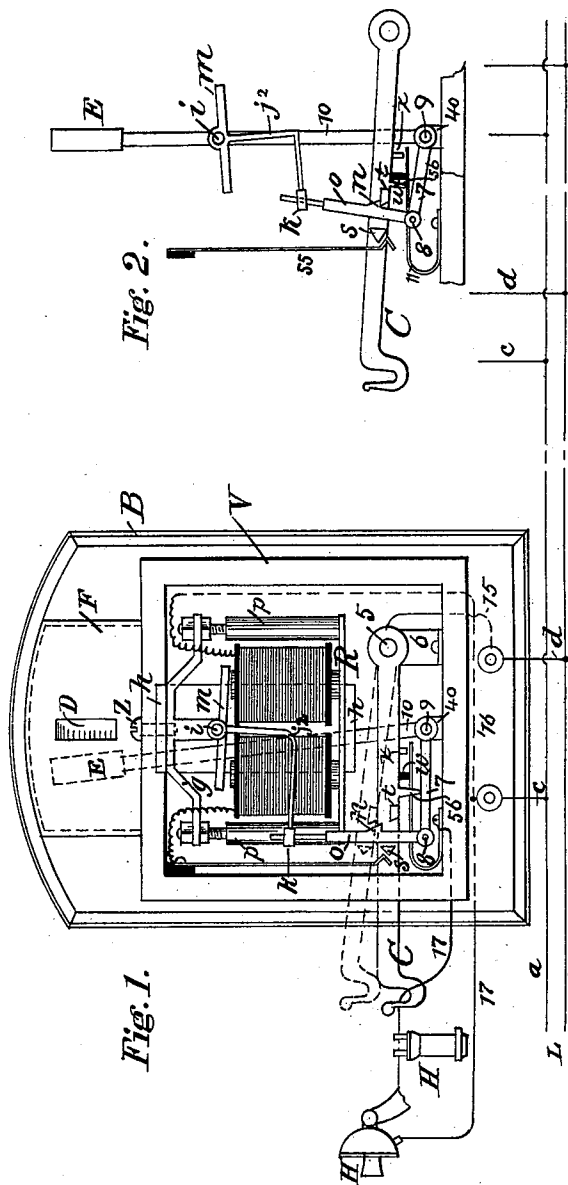


Fig. 1.

Fig. 2.

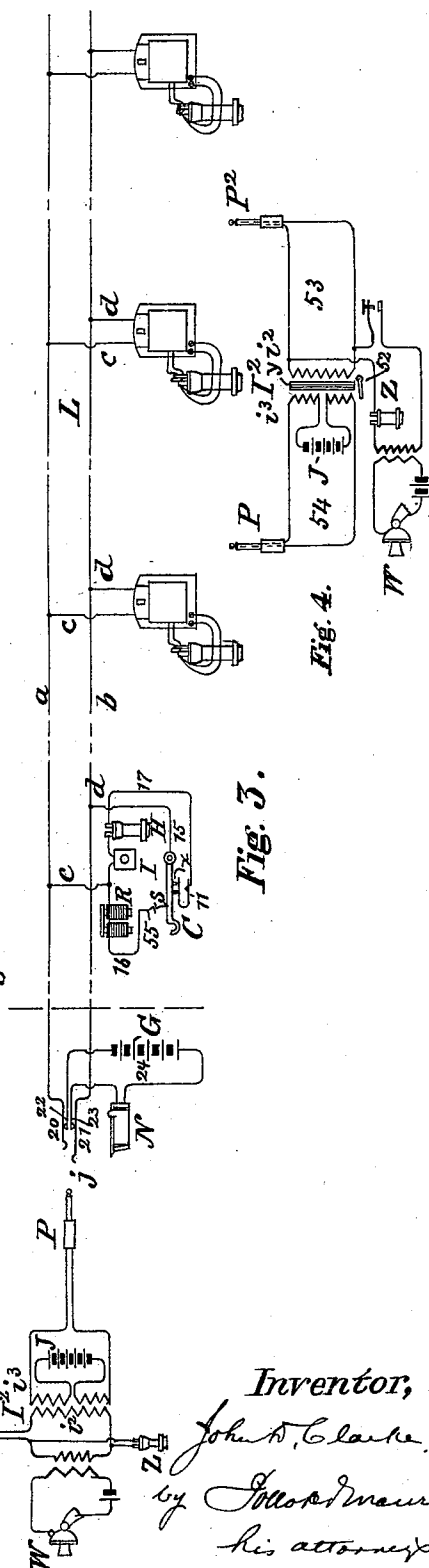
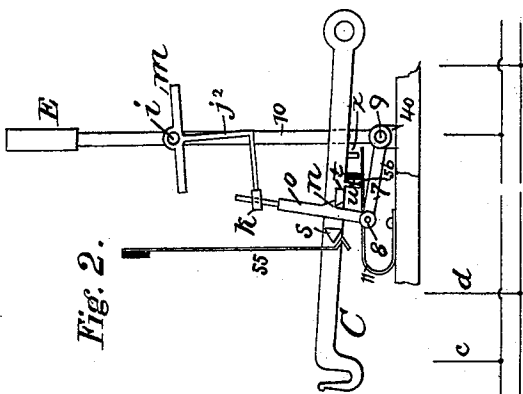


Fig. 3.

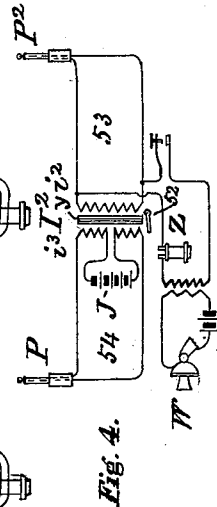


Fig. 4.

Attest.
W. R. Edlin

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UNITED STATES PATENT OFFICE.

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SIGNALING AND LOCK-OUT APPARATUS FOR TELEPHONE-STATIONS.

SPECIFICATION forming part of Letters Patent No. 552,420, dated December 31, 1895.

Application filed April 5, 1895. Serial No. 544,593. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. CLARKE, residing at Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Signaling and Lock-Out Apparatus for Telephone-Stations, of which the following is a specification.

In systems of telephonic communication it is often necessary to construct and operate main circuits or lines with which are associated a plurality of sub-stations. These are termed "party lines." When such lines are employed, it becomes desirable to place at the several sub-stations a signal device which under appropriate conditions will indicate to a station desiring to communicate whether the line is or is not already being used by some other station, and it is also desirable to associate with such device some suitable automatic locking mechanism which shall prevent any sub-station from connecting the telephones with the line if the latter is already busy by reason of the prior action of some other station, but which if the line is not busy shall not be brought into operation, and will therefore permit the connection of the telephones there with the main line to be effectuated.

Telephone systems have been devised wherein the circuit is normally open at the several sub-stations, and wherein a suitable source of current for signaling purposes is located at the central station and maintained normally in connection with the line and with a central-station signal-receiving appliance in the normal circuit thereof, and capable of being operated from any sub-station when the circuit to send a call is closed at such sub-station. In these systems it is usual to provide also at the central station a source of current for the sub-station telephone-transmitters, this being placed in the main-line circuit during the transmission of conversation, and such source is generally a battery. The current furnished by such generator is molded into voice-currents by the action of the sub-station transmitter, which voice-currents, acting upon any receiving-telephone in the circuit, enable it to transmit speech. By so relatively arranging the normal signaling-battery and the conversation-battery that the currents they re-

spectively develop in the line-circuit shall be of opposite sign or direction, I am enabled to provide an automatic busy-signal and lock-out apparatus responsive to the change in direction of the said main-line currents, so that if the telephone at any sub-station is removed from its place of rest when the line is not in use, and is connected with its normal or signaling battery, the said busy-signal and lock-out device remains inert, and the only result will be that the signal-receiving appliance at the central station will respond and indicate a call; but if the line is already in use by some other station, and consequently is connected with the conversation-battery, furnishing a current opposed in direction to that normally flowing in the line, the busy-signal and lock-out will, on the removal of the telephone, both be set by the action of said reversed current operating through the intermediation of a polar electromagnet and armature responsive to the reversal in direction of the main-line current. When the signal-battery again replaces the conversation-battery, the polarized magnet reverses its action; or, if desired, the armature thereof may be provided with a retracting spring, and thus either one of the two batteries may be dispensed with, provided the other is retained.

From what has been said it is evident that in this invention the concurrent operation of the telephone-switch is utilized, since even though the transfer of batteries be made, the station appliances will not respond unless the station-telephone be removed from its hook.

I do not consider it necessary in this specification to show any means at the sub-stations for receiving call-signals, since such means form no part of my invention, and any of the well-known appliances and plans for such operation may be adopted.

My invention then consists in a combined busy-signal and lock-out station apparatus responsive to the presence on the line-circuit of a current of definite direction, and to the concurrent operation of a circuit-changer actuated by removing the receiving-telephone from its resting-place for use; and it also consists in the combination of such a compound appliance with a centralized transmitter-bat-

tery and automatic call system of telephonic communication in such manner that it shall be irresponsive to the current of the call-generator, but responsive to the current of the transmitter-battery. By means of the normal signaling-current generator at the central station any one of the sub-stations can display the call-signal there, bringing it into action by the act of taking the receiving-telephone from the switch-hook. As the latter moves, it makes brief contact with the spring-terminal of a branch circuit through a polar electro-magnet arranged to control by its armature a visible busy-signal and a lock-out appliance, but so organized that it will not bring either of these appliances into operation as long as the said signal-current generator remains connected with the line. When the hook-switch reaches its resting position, the polar-magnet branch has been again reopened, and a second branch is closed through the station telephones. Responding to a call the central-station operator inserts the answering switch-plug of any pair electrically united by a switch-cord in the line-socket, thereby disconnecting or switching out the signaling-battery from the circuit, and switching in a new battery or generator, also located at the central station, to supply current for the operation of the transmitter of the station giving the call, the said current being of a direction opposite to that which normally flowed to line from the signaling generator. Should the telephone at any other sub-station of the circuit be now removed from its hook, the armature of the polarized electro-magnet will respond to the current of new direction, setting or displaying a signal showing the line to be in use elsewhere, and opposing a stop in the path of the hook-switch, which prevents it from moving sufficiently far as to bring the station telephones into connection with the main line.

When the telephone at any sub-station which has been engaged in conversation is replaced on its hook, and the clearing-out signal as usual displayed at the central station, the normal condition of the line concerned is restored by the withdrawal of the connecting-plug from the line-socket, which withdraws the conversation-battery and replaces the normal signal-battery. This action, of course, again reverses the line-current, and if the busy-signal and lock-out device have remained set, at such stations as have attempted to use the circuit during its busy interval, they are withdrawn as soon as the telephones there are again taken up for use, because the current then temporarily diverted through the polarized magnet is of such direction as to withdraw the signal if displayed, and free the apparatus, if locked, and to maintain such withdrawal if already existent.

In some cases the lock-out and signal armature may, as already stated, be provided with a spring, which enables it of itself to move back to its original position as soon as the attendant, observing the busy-signal to be

set, replaces his telephone. In that case the signal-battery does not act upon the said armature, and the busy-signal repeats itself as often as an attempt is made to use the telephone, but as soon as the line is free does not come into operation.

In carrying out the invention, the sub-station apparatus is preferably connected in normally-open branches or bridges, which are closed to give the signal, and the circuit-conductors at the central station have spring-terminals in a plug-socket normally united with the terminals of a local signaling-circuit, including the call-receiving appliance and the signal-generator, which, in a manner well understood, may be common to a number of circuits.

The operators' connecting-cords and plugs of a pair are inductively connected by a repeating-coil whose two windings are included, respectively, in the two conductive portions of the compound link-conductor thus formed; and in each such conductive portion is connected a transmitter-battery, if both of the circuits to be connected are of the types so far described. If, however, the circuit with which connection is desired is a trunk-line or one not fitted with my apparatus and not provided with magneto apparatus and local transmitter-batteries, there need only be a single central-station transmitter-battery, connected with but one of the connecting-cord divisions, and adapted to supply current for the transmitter at the working sub-station, and for the busy-signals and lock-outs at the remainder of the stations. The remainder of the central-station outfit may be arranged in the usual manner, and at the sub-stations the conductors of the normally-open bridges lead one from a main-line conductor to the switch-lever, while the other, from the second main-line conductor, divides into parallel and alternative branches, one of which extends through the helices of the polarized electro-magnet to a terminal contact, and the other through the telephones to a terminal contact. The switch-lever makes a grazing engagement with the former, and comes to rest in engagement with the latter when the telephone is removed therefrom.

Of the accompanying drawings, Figure 1 represents the apparatus located at a sub-station, the outer cover being removed to show the interior mechanism and circuits. Fig. 2 represents a portion of the apparatus apart from its inclosing box to illustrate the working of the invention. Fig. 3 is a diagram of a party-line circuit extending from a central station to a plurality of sub-stations, and Fig. 4 is a diagram of the looping cords and plugs employed in connection with a telephone-circuit embodying my invention.

A is the central station, at which connections are made between the party-line circuit L and any of the regular sub-stations or trunk-lines S centering thereat.

As has been stated, the telephone-circuit

L is not shown as being provided with means for being called, and any desired mode may be employed. It is, however, adapted to be connected by means of looping cords and
 5 plugs with any other circuit and conversation be carried on. The conductors *a b* of the circuit L terminate respectively at the central station in the line-springs 20 and 21 of the plug socket or jack *j*, which normally
 10 rest upon the contacts 22 and 23 of the local continuation-circuit 24, which includes the call-receiving appliance N and the calling-generator G. At the sub-station branches *c* and *d* extend from the conductors *a* and *b*.
 15 The former branch *c* is divided. One division 16 terminates in an insulated contact-spring 55 and includes the helices of a polarized electromagnet R. The other division 17 includes the transmitting and receiving tele-
 20 phones I and H and ends in the spring 11 under the hook-switch C. The second branch *d* is united to the hook-switch lever C by wire 15, and as is now obvious the said lever forming the terminal of branch *d* while moving
 25 makes a brief contact with spring 55 by stud *s* and then comes to rest in contact with spring 11 at *x*.

B is a back board supporting a box V, upon and in which the sub-station apparatus is
 30 mounted and supported.

R is a polarized electromagnet whose helices are supported by a frame consisting of the studs *p p* and bracket *g*, which with the permanent magnet *h* is secured by the screw
 35 *z* to the upper part of the box. A centrally-pivoted armature *m* is pivoted at *i* to the frame *g* and has a downwardly-projecting arm *j*² with a ring *k* at the end of a right-angled extension. An arm 10 is pivoted at 9
 40 to the standard 40, which is fixed to the bottom of the box V and terminates in a signal-target E in a casing F upon the back board B, the casing F being provided with an opening D, where the said signal-target may ap-
 45 pear.

7 is a lever forming a part of the arm 10, to the end 8 of which is pivoted an upwardly-extending lever *o*, whose end passes through the ring *k* of the bent lever *j*², the inner side
 50 of the lever *o* being furnished with the lug *n*. The hook-switch lever C projects from the side of the box and is pivoted at 5 to a standard 6. Upon the face of the lever are studs *t* and *s*, and the spring 11 rests normally upon
 55 the insulating-pin *w*.

At the central office A is shown a pair of plugs P P² in two conductive divisions 54 and 53, these being in inductive relation with each other by means of the windings *i*³ and *i*² of the
 60 repeating induction-coil I². In the division 54 is a current-generator J, and connected to the circuit 53 are the operators' telephones W Z.

S represents any circuit extending from the
 65 central station to a sub-station to which the circuit L may be connected.

The repeating-coil I² can if desired serve also

as a clearing-out signal, and opposite one end of its core *y* is for this purpose shown a shutter 52, which, when a circuit is closed through
 70 the battery J, is attracted to the core, and when the circuit is broken falls away therefrom.

In the operation of the invention when the telephone H is removed from the hook-switch
 75 C the latter rises, being impelled by the spring 11, the stud *t* passes by and above the lug *n*, and as the stud *s* touches the spring 55 a circuit is completed from one pole of generator G, *via* line-spring 20, conductor *a*, branch *c*,
 80 wire 16, helices of electromagnet R, spring 55, stud *s* and substance of hook-switch C, wire 15, branch *d*, conductor *b*, line-spring 21, and line-signal N, to the opposite pole of the generator, causing the line-signal N to be dis-
 85 played, and though the magnet R is in this circuit its armature is not affected, the direction of current being such as merely to tend to hold the same in its original position. As the hook-switch continues to rise this circuit
 90 is immediately again opened, and when it comes to rest a new circuit is established from conductor *a*, branch *c*, telephones I H, wire 17, spring 11, contact-pin *x* and substance of
 95 hook-switch C, wire 15 and branch *d* to conductor *b*. When the operator at the central station in answer to the call-signal inserts the plug P into the jack *j*, its line-springs are separated from the contacts 22 and 23 and the local circuit 24 is opened, and at the same
 100 time, as the poles of the generator J are reversed to the circuit relatively to those of the generator G, a current of opposite direction to that of the said generator flows to the telephone-circuit therefrom, as follows: *via* tip
 105 of plug P, line-spring 20, conductor *a*, branch *c*, telephones I and H, wire 17, hook-switch C, wire 15, branch *d*, conductor *b*, line-spring 21, sleeve of plug P to the opposite pole of the generator, and furnishes a supply for the sub-
 110 station transmitter. As the current flows through the winding *i*³ of the repeating-coil its core is energized and attracts the shutter thereto. The operator can now connect in her telephones and ascertain the wants of the
 115 calling sub-station and proceed to test, connect by the plug P², and call the desired sub-station connected with circuit S in a manner well understood, and the two sub-stations can converse through the repeating-coil I².
 120

If when a connection is completed as described, the telephone H at any other sub-station associated with the circuit L is removed from its hook, its stud *s* comes in contact with the spring 55 and current from the
 125 generator J circulates through the helices of the electromagnet R causing its armature *m* to swing or oscillate to the opposite pole thereof, and its lever *j*² pulls the lever *o* over to a position where the lug *n* places itself in the
 130 path of the stud *t* at the same time that the arm 10 is tilted over, as shown in Fig. 2, and its signal-target appears at the opening D to denote that the line is busy. As the hook-

switch continues to rise, its stud *t* comes under and engages the lug *n*, and as the pin *x* cannot touch the spring 11 the telephones are prevented from being brought into circuit.

5 When the telephone is returned to its hook, the lug 56 on the hook-switch presses upon the lever 7 and withdraws the target E from the opening D; but the armature *m* will remain tilted over until the plug P is with-

10 drawn from the jack *j*, thus bringing in the signaling-generator G again, when the removal of the telephone from the hook-switch will cause a current of opposite polarity therefrom to shift the armature and unlock the

15 apparatus, as will be readily seen. When the telephone H at the connected sub-station is returned to the hook-switch the circuit is thereby opened, and the shutter 52 of the clearing-out signal falls away to indicate the

20 termination of the conversation.

I claim—

1. The combination with a telephone circuit, of a combined busy signal and lock-out telephone station apparatus, a support for

25 the receiving telephone, and a circuit changer actuated by the removal of the receiving telephone from its support, the said busy signal and lock-out apparatus being responsive to the presence on the line of a current of definite

30 direction and the concurrent operation of the circuit changer, substantially as described.

2. A combined busy signal and lock out telephone station apparatus for party lines comprising an automatic switch controlling the connection of the main circuit with two independent branches; station telephones in one of the said branches; a polarized electro-magnet in the other branch; a visible signal

40 mechanically connected with the armature of said magnet and actuated thereby; and means operated by the said armature when transmitter currents of definite direction are flowing in the main circuit for preventing the said

45 automatic switch from establishing a connection between the said main circuit, and the station telephone branch, substantially as described.

3. In a telephone system the combination

50 of a main telephone circuit; a signal current generator normally connected therewith; an independent associated voice current generator, having its poles relatively reversed so as to cause currents of opposite direction to

55 traverse said main circuit, combined with a station apparatus comprising a polarized electro-magnet responsive to the voice current generator, but not to the signal current

60 generator; an automatic telephone switch controlling the connection of the said magnet with the main circuit; a busy signal actuated by said magnet; and a lock out device also controlled by said magnet, and itself controlling the range of movement of the said

65 switch; substantially as described.

4. The combination with a telephone circuit normally including a plug socket, a call sig-

nal appliance and a signaling current generator; and a plug and cord connection containing in its circuit an independent trans-

70 mitter current generator reversed relatively to the signaling current generator; of a plurality of substations connected with the said telephone circuit by means of normally open bridges; and each provided with a telephone

75 hook switch; a polarized electro-magnet, and transmitting and receiving telephones; and a locking device operated by said electro-magnet; whereby when the said plug is inserted in its socket a current adapted to operate said

80 polarized magnet is sent to line, substantially as described.

5. The combination with a telephone circuit whose line conductors terminate in a spring jack which normally closes a local circuit in-

85 cluding a line signal and a signal current generator; a plurality of substations connected to the said telephone circuit by means of normally open branches in which are located the telephone hook switch; a polarized electro-

90 magnet and a locking device operated thereby, and transmitting and receiving telephones at each substation; of a looping cord and plug including an independent transmitter current generator adapted to send currents op-

95 posed in direction to the signal currents to line, whereby upon the removal of a telephone from its hook switch at any substation the said line signal is displayed, and upon the insertion of the plug into said jack the tele-

100 phone transmitter at said substation is energized, and the apparatus at the other substations rendered inoperative, substantially as described.

6. The combination with a telephone circuit

105 whose line conductors terminate in a spring jack which normally closes an extension circuit including a call receiving appliance and a signaling current generator; of a number of substations connected to the said telephone circuit by means of normally open branches and provided each with a telephone auto-

110 matic switch, a polarized electro-magnet and a busy signal and locking device operated thereby; of a looping cord and plug including a transmitter current generator reversed relatively to the signal current generator with respect to the line, whereby upon the removal of a telephone from its support at any sub-

120 station the said line signal is displayed; and upon the insertion of the plug into said jack the apparatus at the other substations are rendered inoperative and their busy signals made operative.

7. The combination with a telephone circuit

125 whose line conductors terminate in a plug socket which normally closes an extension circuit including a line signal and a generator sending to line currents of definite direction; a plurality of substations each connected to

130 the said telephone circuit by means of normally open branches one of which terminates in the switch lever, the other being divided to include the telephones on one side, and the

helices of a polarized electro-magnet on the other side; with locking and busy test devices operated by the said magnet; of a looping cord and plug including an independent generator sending to line currents of opposed direction; whereby upon the removal of a telephone from its hook switch at any substation and the insertion of the said plug into the socket the transmitting telephone at the substation is energized, and upon the removal of a telephone from its hook switch at any other

substation, the apparatus there is locked and a busy signal displayed.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 1st day of April, 1895.

JOHN D. CLARKE.

Witnesses:

A. B. RAYMOND,
W. J. KAVANAGH.