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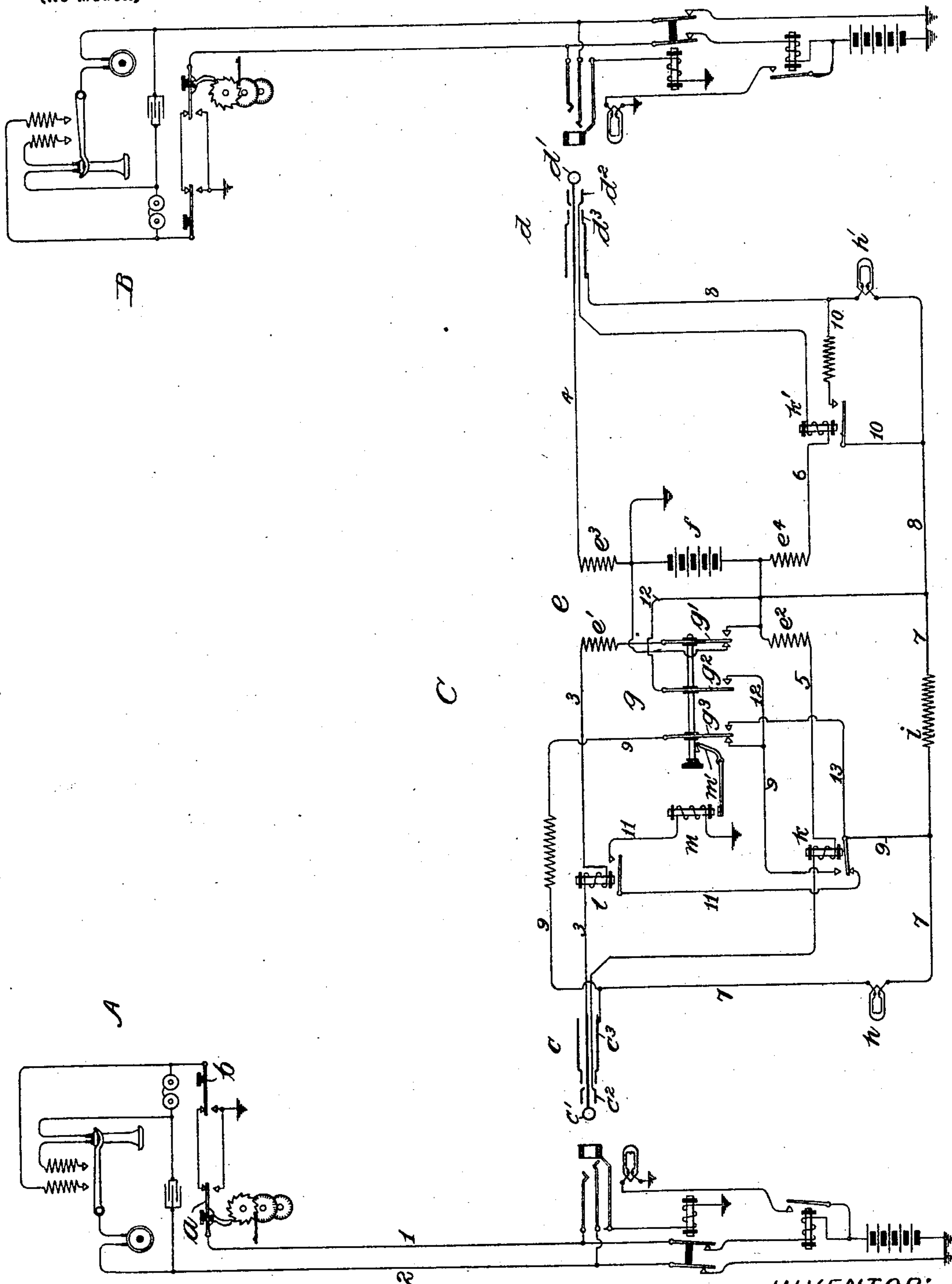
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W. W. DEAN.

TOLL APPARATUS FOR TELEPHONE EXCHANGES.

(Application filed Jan. 14, 1902.)

(No Model.)



WITNESSES:
J. M. Skinkle.
H. H. Leach.

INVENTOR:
WILLIAM W. DEAN,
BY *Georg Barton*
ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM W. DEAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TOLL APPARATUS FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 710,318, dated September 30, 1902.

Application filed January 14, 1902. Serial No. 89,657. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Toll Apparatus for Telephone-Exchanges, (Case No. 36,) of which the following is a full, clear, concise, and exact description.

My invention relates to toll apparatus for telephone-exchanges; and its object is in general to provide means whereby a charge may be made for each use of a subscriber's telephone in originating a connection in which the subscriber is actually placed in communication with the party called for.

My invention contemplates the employment of a toll device at the substation of a telephone-line, adapted for manual operation by the subscriber, and a blocking device adapted to be actuated at the central office in the course of making connection from the line in question to another to render telephonic communication over the line impossible until the subscriber has operated his toll device, said toll device when actuated serving to bring about the operation of mechanism which restores or counteracts the blocking device. The subscriber may be relieved of the special act and no charge made when a connection called for cannot be made or when the line is used in response to calls from other stations, the blocking device in such cases not being set.

My invention is designed especially for use in modern telephone-exchanges wherein a common source of current is provided at the central office of the exchange for supplying the substation transmitting instruments of all the lines of the system, the current being sent out to the substation over the line conductors during the period of use of the telephones. In accordance with my invention the supply of current for the subscriber's transmitting-telephone is controlled by a device adapted to be actuated at the central office in the course of the establishment of telephonic communication with another subscriber, whereby the calling-subscriber's telephone may be rendered inoperative by depriving it of current, and electromagnetic mechanism con-

trolled through the agency of a switch at the calling-subscriber's station, associated with a toll device, such as a manually-operated connection-register, is provided for reversing or counteracting said device to reestablish the flow of current through the transmitting-telephone, so that the telephone apparatus may be restored to its operative condition by actuating the register. The centralized "talking-battery" is usually applied in a bridge between the line conductors at the exchange office, between the windings of the repeating-coil of the operator's plug-circuit with which connections are made; and in the preferred form of my invention the operator is furnished with a blocking-switch adapted to be manually set for changing the connections of the battery with the line—as, for instance, cutting off one of the line conductors from its normal battery connection and connecting said conductor with the other pole of the battery to which the other line conductor is connected. In other words, both line conductors may be connected by the switch aforesaid with the same pole of the battery. The opposite pole of the battery is grounded. The subscriber's telephone transmitting apparatus, which is included in circuit between the two sides of the lines at the substation, may thus be deprived of current, so blocking the use of the telephone. The switch which effects this change in the battery connections may be set manually by the operator and may be restored automatically by a magnet which is controlled through the agency of a flow of current in one of the line conductors. The flow of current for controlling the release of the central-office blocking-switch may be determined by mechanism actuated in the operation of the subscriber's toll device. After the blocking-switch has been set at the central office the subscriber may therefore restore the operative condition of his telephone apparatus by actuating his connection-register. In the preferred form of my invention the magnet which controls the release of the blocking-switch is included in a local circuit controlled jointly by two relays, one of said relays being in circuit with each limb of the line, and the toll device at the substation is provided with switch mechanism arranged to establish a cer-

tain electrical condition of each limb of the line independent of the other limb, whereby said relays may be controlled independently. The relays can be arranged to close the circuit of the releasing-magnet only when one of said relays is excited and the other inert, and this condition can ordinarily be brought about only through the operation of the switching mechanism of the toll device, so that the independent operation of the releasing device is guarded against.

I will describe my invention more particularly and explain further features thereof by reference to the accompanying drawing, which is a diagram illustrating by means of conventional symbols a telephone-line extending from a substation to a central office, together with that portion of the apparatus at the central office which is concerned in the operation of my improved service-meter.

The drawing represents two telephone toll-lines extending from substations A and B to a central office C. The telephone-line extends in two limbs 1 2 from the substation to the line-springs of a jack at the central office and is provided with the usual line-signal apparatus, which is well known in the art. At the substation the telephones and accessory signal-receiving apparatus are included in bridges of the line-circuit, and the usual telephone-switch is provided for controlling the circuit through the telephone apparatus. Two switch-keys *a b* are provided at the substation, each comprising a movable switch-lever normally resting against an upper contact-anvil, but adapted when depressed to break connection therewith and engage a lower alternate contact-anvil. The lever of key *a* is connected to the limb 1 of the telephone-line, and the lever of key *b* is connected through the substation apparatus and switch-hook with the other limb 2 of the line. The normal resting-contacts of the keys are connected together, thus completing the circuit, and the lower contacts of both are connected to earth. Each key when depressed is thus adapted to open the circuit between the two limbs of the line and ground the limb with which it is connected. At the central office a pair of plugs *c d* is provided, the two plugs being united by the link conductors 3 4 5 6 of a cord-circuit, whereby any two lines may be connected together by inserting the plugs into the spring-jacks of their respective lines. The plug *c* is the answering-plug and the other the calling-plug. Each plug has the usual tip, ring, and sleeve contacts *c' c² c³ d' d² d³*, respectively, the tip and ring contacts forming the terminals of the link conductors and adapted to engage the short and long springs, respectively, of any jack into which the plug may be thrust, while the third contact of each plug engages the test-ring of the jack.

A repeating-coil *e* is interposed in the plug-circuit, and a central battery *f* is bridged across the circuit between the windings of

said coil. A loop is thus formed between the tip and ring contacts of each plug, each loop including serially the battery *f* and two of the windings of the repeating-coil. The normal loop-circuit from tip to ring of plug *c* is made up of conductor 3, winding *e'*, battery *f*, winding *e²*, and conductor 5, and the loop from tip to ring of plug *d* is made up of conductor 4, winding *e³*, battery *f*, winding *e⁴*, and conductor 6. The two plugs are thus united inductively as well as conductively through the repeating-coil.

A blocking-switch *g* is provided for making certain changes in the plug-circuit connections, the principal change being to connect winding *e'* with winding *e²* directly instead of through the battery, so that both conductors 3 and 5 will be connected in multiple branches from the lower pole of the battery. The upper pole of said battery is permanently connected to earth or other return-conductor.

A local circuit from the free pole of battery *f* is completed in registering-contacts of each plug and any jack into which it may be inserted, such local circuit including a supervisory signal-lamp and the cut-off relay of the line with which connection is made. The portion of the local circuit from battery *f* to plug *c* is made up of the conductor 7, a resistance *i*, and a supervisory lamp *h*, and the portion of the local circuit to plug *d* is formed by conductor 8, including the supervisory lamp *h'*. The lamps *h h'* are provided with shunts 9 10, which are controlled by supervisory relays *k k'*, included in the link conductor 5 6 between the battery connection and the plugs *c* and *d*, respectively. Said relays are thus located in the path of current from said battery to the lines with which the plugs may temporarily be connected and are controlled by the switches at the substations of such lines.

A relay *l* is included in the cord-strand 3 between the tip of plug *c* and the battery connection, and a local circuit 11 from the free pole of the battery *f* to earth, including a tripping-magnet *m*, is controlled jointly by the relays *k* and *l*. This local circuit is closed by the simultaneous excitement of relay *l* and inert condition of relay *k* and may be traced from the battery *f* through a portion of conductor 7, including the resistance *i*, to the armature of relay *k*, from the back contact of said armature to the armature of relay *l*, and from the front contact of relay *l* through the helix of magnet *m* to earth.

The switch *g* is provided with three contact-springs *g' g² g³*. All three springs are arranged to be simultaneously depressed by a plunger, and each is adapted when so depressed to engage an alternate or front contact-anvil. The springs *g'* and *g³* have also other contact-anchors, against which they rest when in their normal positions; but the spring *g²* has no normal resting-contact. Spring *g'* is connected with the winding *e'* of the repeating-coil, and so with conductor 3. It nor-

mally closes the circuit of said conductor to the winding e^3 and grounded pole of the battery f , but when depressed transfers the connection of said conductor directly to winding e^2 , and so to the other or free pole of the battery, thus bringing both tip and ring strands 3 and 5 into multiple branches from the battery. Spring g^3 is connected with the third contact of the answering-plug c through a resistance adapted to shunt the supervisory lamp h and normally establishes the shunt-circuit 9 to the front contact of the relay k , said shunt being then completed when the armature of relay k is drawn up. In its alternate position spring g^3 is connected by a conductor 13 directly to the armature of relay k . The spring g^2 when depressed closes a path 12 from battery f directly to the front contact of relay k to short-circuit the resistance i . The resistances, battery, and lamp h are so proportioned to one another that said lamp will light when resistance i is short-circuited, even though the shunt 9 be closed about the lamp. The plunger of the key g has a lug which is adapted to be engaged by a detent m' , operated by the armature of magnet m . When the plunger is once depressed, it is "set" or held by the detent until the magnet m shall be excited and the detent withdrawn. When the plunger is released, the springs will return to their normal positions. In order that the magnet m may get current, the relay k must be inert and relay l excited. Such a condition can only be brought about by the operation of the switch-key a of the toll device at the substation.

It is understood, of course, that the plug-circuit may be equipped with the usual ringing and listening keys with their accessory apparatus; but these are omitted from the drawing for the sake of clearness.

The operation of the system may be traced as follows: When a subscriber desires his line to be connected with some other line for conversation, he transmits a signal to the central office in the usual way by taking his telephone from its switch-hook, and thus closing the circuit through the line-relay, which draws up its armature and brings about the lighting of the line-signal lamp. The central-office operator responds to the signal by inserting her answering-plug c in the spring-jack of the calling-line and by bringing her telephone into circuit learns the number of the line to which connection is desired. Having secured this information, the operator thereupon inserts the other plug d of the pair into the jack of the line wanted and then sets the key g , at the same time telling the calling party to operate his toll device. By setting key g both sides 3 5 of the portion of the plug-circuit leading to the answering-plug are connected in multiple to the free pole of the grounded battery f , and the mechanism is locked in that condition by the detent m' . Although the supply of current for the calling-subscriber's transmitter is now cut off, he

may still hear in his receiver any sounds transmitted from the called station, since a complete circuit for the telephone-currents is still established between the two stations by way of the repeating-coil e in the plug-circuit. The calling subscriber may therefore wait until the called party answers before he complies with the operator's request to actuate his toll device. When the called party answers, the calling subscriber after hearing his response can instantly put his telephone in operative condition by depressing the key a . This breaks the line-circuit and grounds the limb 1 of the line, so that relay l receives current, while relay k does not, the result being that the local circuit 11, controlled jointly by said relays, is closed and the magnet m in said circuit is excited. The magnet m drawing up its armature removes the detent m' and restores the switch g to its normal position, so that the battery f is again included in a bridge of the calling-line. If for any reason the calling party should desire to signal the central-office operator before the called party answers, this may be accomplished by depressing the key b . The effect of this is to close the circuit of conductor 2 to ground, while leaving conductor 1 open. Relay l is therefore left inert; but relay k is excited and closes the short circuit 12 about the resistance i , so that the signal-lamp h is lighted by the increased current. Should the calling subscriber attempt to restore the operative condition of his transmitting-telephone by merely touching a grounded wire to one of the line-terminals of his apparatus, both relays will be excited and the circuit 11 will not be completed. The lamp h , moreover, will be lighted to attract the attention of the operator, since the short circuit 12 will be closed by relay k .

I claim—

1. The combination with a telephone-line extending from a substation to a central office, of a blocking-switch at the central office, a magnet connected with the line at the central office, mechanism controlled by said magnet for restoring the blocking-switch, a toll device at the substation and means controlled in the operation of the toll device for determining the flow of current through said magnet independent of the blocking-switch.

2. The combination with a telephone-line extending from a substation to a central office, of a transmitting-telephone at the substation of the line, a source of current connected with the line at the central office, adapted to supply current to said transmitting-telephone, means at the central office for making connection between said telephone-line and another line, a blocking-switch at the central office adapted when set to interrupt the flow of current from said battery through the subscriber's transmitter, a toll device at the substation to be actuated by the subscriber, and means controlled in the operation of said toll device for restoring said

blocking-switch to reestablish the flow of current through said transmitter, substantially as set forth.

3. The combination with a telephone-line
5 extending in two limbs from a substation to a central office, of a transmitting-telephone connected in circuit between the limbs of the line at the substation, a source of current normally included in a bridge of the line at
10 the central office, for supplying current to said transmitting-telephone, a blocking-switch at the central office adapted when set to disconnect one limb of the line from its normal battery connection, whereby the flow of current
15 through the transmitting-telephone is interrupted, means controlled by the flow of current in the other limb of the line for releasing said blocking-switch and thereby restoring the normal circuit connections of the battery
20 with the line, and a switch at the substation for completing the circuit from the aforesaid battery through said last-mentioned limb of the line.

4. The combination with a telephone-line
25 extending from a substation to a central office, of a transmitting-telephone in a bridge of the line at the substation, a source of current in a bridge of the line at the central office, adapted to supply current to said transmitting-telephone, a blocking-switch adapted
30 to be set at the central office, for interrupting the flow of current from said battery through the transmitter, a magnet connected with the line and mechanism controlled thereby for restoring said blocking-switch, and
35 means at the substation of the line, for determining the flow of current through said magnet independent of said blocking-switch, substantially as described.

40 5. The combination with a signal-circuit including serially a source of current f , a resistance i and a signal h , of a shunt 9 about said signal, a relay k controlling said shunt, a switch g adapted when set to open said
45 shunt 9, and to close a second shunt 9, 13, about said signal independent of said relay, and a shunt 12 about the resistance i brought under the control of the relay when said switch is set, substantially as described.

50 6. The combination with two united telephone-lines having transmitting and receiving telephones in bridges at the respective substations thereof, of a source of current normally connected in a bridge of the united

lines for supplying current to the substation- 55 transmitters, an induction device, a switch at the central office adapted to block one of said lines by disconnecting one limb thereof from its normal connection with said source of current, said source being left connected 60 between the blocked line and a return-conductor, the lines being telephonically united through said induction device, but the transmitter of the blocked line being deprived of current for its operation, a toll device for the 65 blocked line, adapted for actuation by the subscriber, a switch actuated in the operation of the toll device for controlling the circuit of said source of current through the blocked line and the aforesaid return-con- 70 ductor, and a responsive device at the central office in the last-mentioned circuit.

7. The combination with two line conductors, of a source of current, one pole whereof is connected to a return-conductor, relays one 75 in each of said line conductors, a signal controlled by one of said relays, a local circuit controlled by both of said relays jointly, closed in the normal switch-contacts of one relay and the alternate contacts of the other, 80 a responsive device in said local circuit, and switches for independently completing the circuit of either line conductor.

8. The combination with a telephone-line
85 extending in two limbs from a substation to a central office, of a source of current normally connected in a bridge of the line at the central office for supplying current to the substation, one pole of said source being connected to a return-conductor, a blocking- 90 switch adapted to be set to connect both limbs of the line with the free pole of said source, magnets, one in the path of current to each line conductor, a toll device at the substation, a switch actuated in the operation of said 95 toll device for opening the circuit of one limb of the line and connecting the other to the return-conductor, and a restoring device for said blocking-switch, controlled jointly by 100 said magnets and brought into operation by the simultaneous excitement of one magnet and inert condition of the other.

In witness whereof I hereunto subscribe my name this 18th day of December, A. D. 1901.

WILLIAM W. DEAN.

Witnesses:

DE WITT C. TANNER,
W. W. LEACH.