(No Model.) 2 Sheets—Sheet 1.

V. WIETLISBACH.

TOLL BOARD APPARATUS FOR TELEPHONE EXCHANGES.

No. 566,829. Patented Sept. 1, 1896.

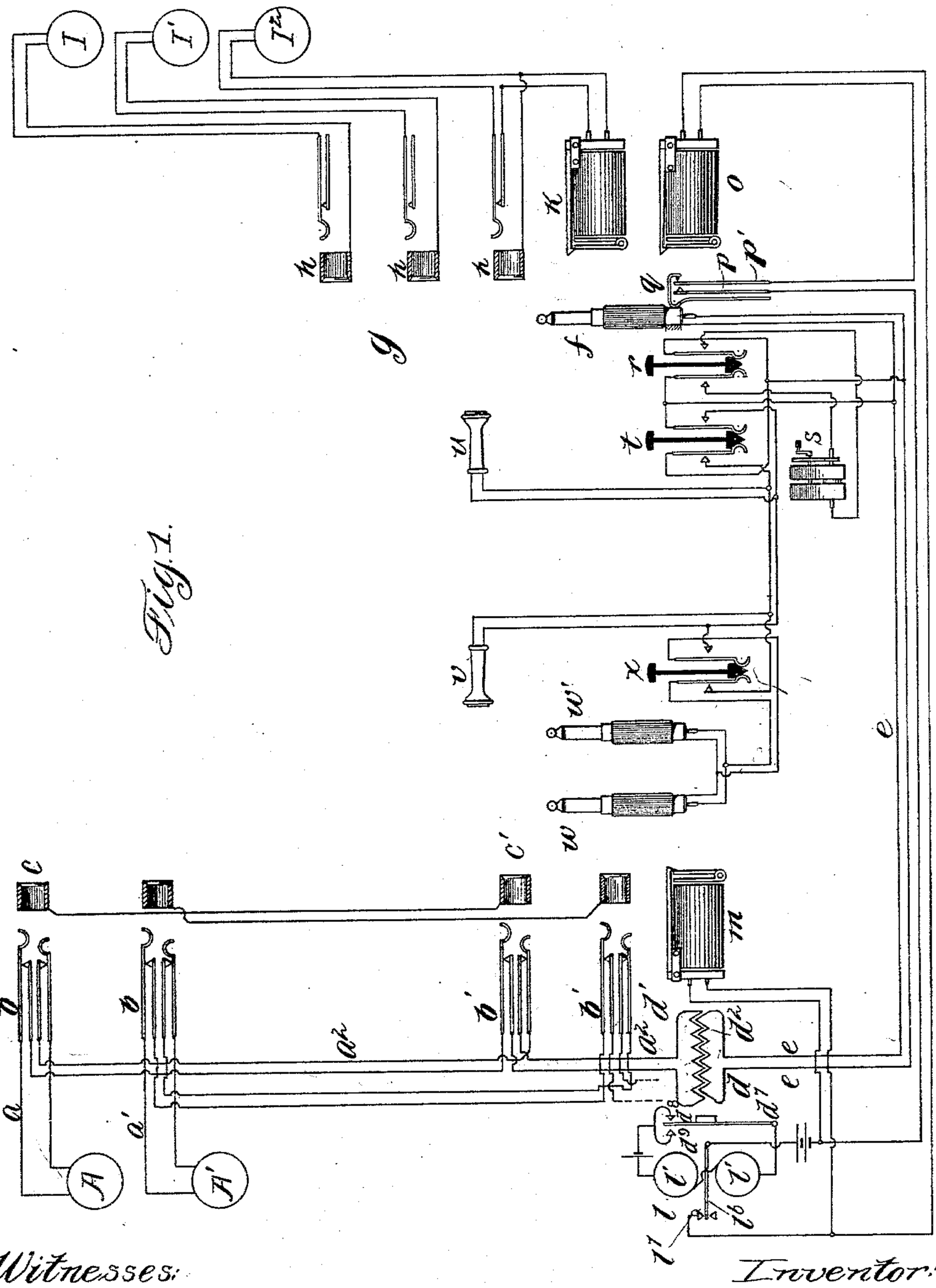

Fig. 1.

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Fig. 2.

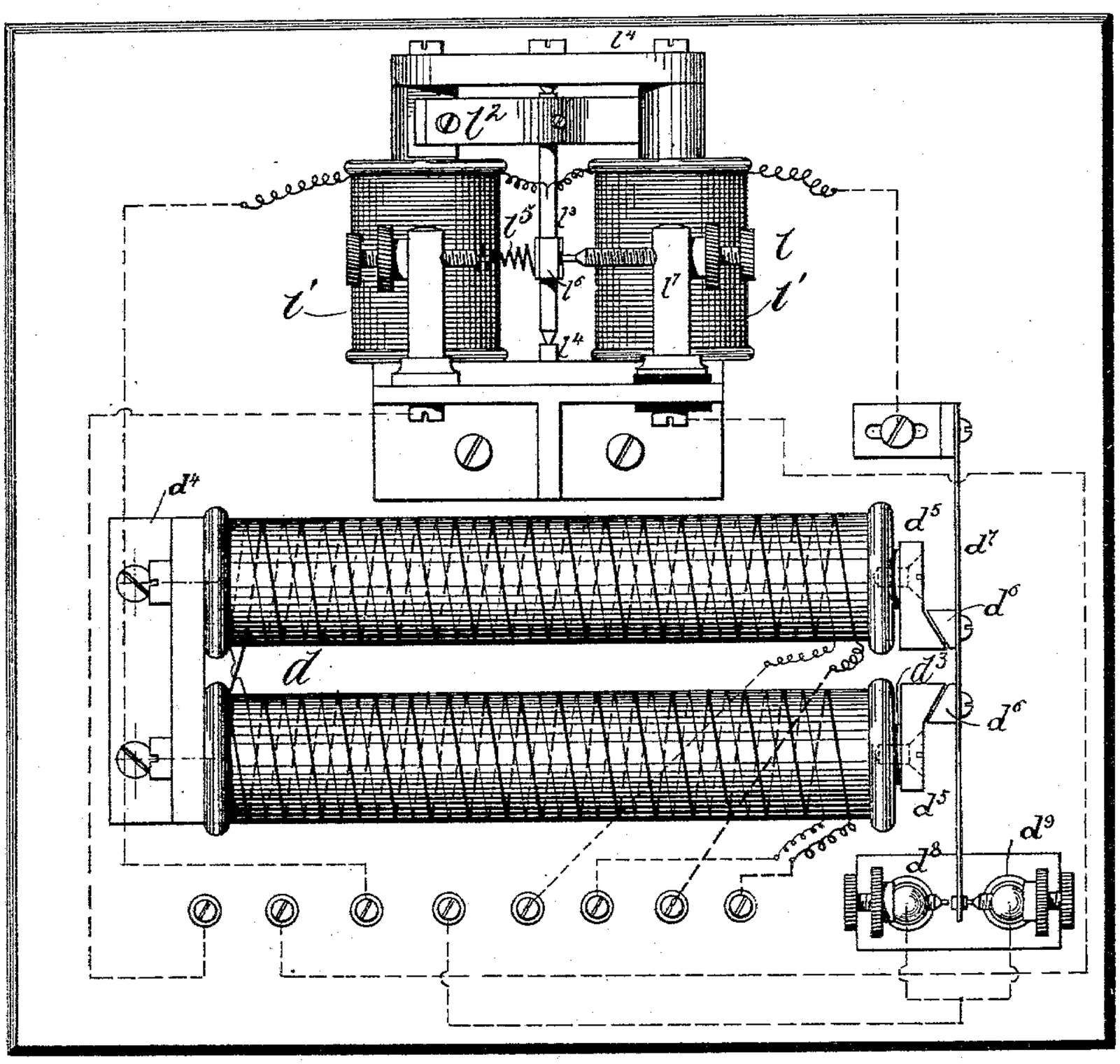
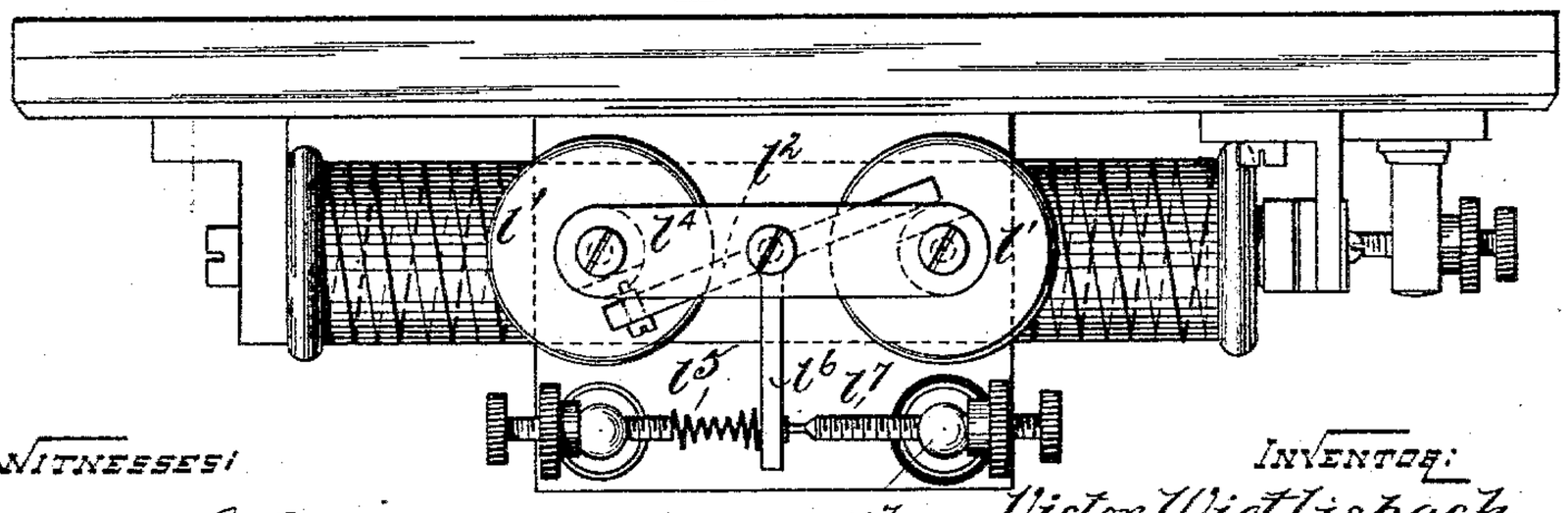


Fig. 3.



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UNITED STATES PATENT OFFICE.

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TOLL-BOARD APPARATUS FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 566,829, dated September 1, 1896.

Application filed February 1, 1895. Serial No. 537,024. (No model.)

To all whom it may concern:

Be it known that I, VICTOR WIETLISBACH, a citizen of Switzerland, residing at Bern, in the canton of Bern, Switzerland, have invented a certain new and useful Improvement in Toll-Board Apparatus for Telephone-Exchanges, (Case No. 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to switching apparatus of telephone-exchanges, particularly to the circuits and apparatus for use in connection with toll-lines, in uniting these lines with other lines of the telephone-exchange. Its primary object is to provide means whereby a signal for disconnection from a toll-line may be received both at the special switchboard provided for toll-lines and at the ordinary or subscribers' boards when a connection exists between a toll-line and a subscriber's line, and to prevent the operation of the signal at the subscriber's switchboard when no connection exists therewith over the toll-line.

A secondary object is to avoid the connection of an annunciator in the toll-line and to make use of the repeating-coil which is ordinarily included in such lines to control a local circuit including the necessary annunciators or other mechanism.

It will be understood that in telephone-exchanges comprising both long-distance or toll lines, for the use of which a special toll is required, and subscribers' lines, for which an annual rental is charged, it is customary to bring the toll-lines to a special switchboard, at which provision is made not only for establishing the desired connection, but for recording the length of time the line is in use and other necessary contingencies of its use, while the subscribers' lines are connected with a different switchboard, and special transfer-circuits and apparatus are used in making connection between a toll-line terminating at a toll-board and a subscriber's line terminating upon a subscriber's switchboard. It is to apparatus of this character that my invention pertains.

In carrying out my invention I utilize the core of a repeating-coil, one of whose helices is included in the toll-line circuit, to actuate an armature carrying relay-contacts controlling a local circuit including two annunciators, one of which is placed upon the toll-board and the other upon a subscriber's switchboard. The remaining helix of the repeating-coil has its terminal connected with the two contact parts of a terminal plug, located upon the subscriber's switchboard, whereby connection may be established between the toll-line and a subscriber's line by inserting the terminal plug into a subscriber's spring-jack in the usual way. This terminal plug rests normally in a socket provided with a cord-switch controlling the continuity of the circuit including the annunciator upon the subscriber's switchboard, the cord-switch operating to maintain this circuit open while the terminal plug is in the socket. By this means the annunciator upon the subscriber's switchboard is in complete connection with the local circuit only while the terminal plug of the corresponding toll-line is in use at the subscriber's switchboard in making a connection from the toll-line to a subscriber's line. I prefer to control the local circuit including this annunciator through the medium of a relay which is itself controlled by the repeating-coil rather than directly by the repeating-coil.

My invention is illustrated in the accompanying drawings.

In Figure 1 are represented two sections of toll-switchboard and one subscriber's switchboard, toll-lines being connected with the toll-boards and my improved system of annunciators and transfer-circuits being employed between the toll-switchboards and the subscriber's switchboard.

In Figs. 2 and 3 the repeating-coil relay and the auxiliary relay in connection therewith are shown in detail, Fig. 2 being a plan view of the apparatus and Fig. 3 a side elevation of the same.

Considering Fig. 1, the toll-lines a and a' are seen to be connected each with a spring-jack b upon a toll-board c and with another spring-jack b' upon a second toll-board c'. As many toll-boards may be thus connected with the lines as are necessary to accommodate the business of the toll-lines. After passing the last spring-jack the line a^2 from station A is completed through one helix of a repeating-coil d. The remaining helix of this repeating-coil is included in a local circuit

e, terminating in a connecting-plug *f* upon the subscriber's switchboard *g*. Upon this board the usual subscriber's spring-jacks *h* are placed, each connected with a station, as I I′ I², each line also including an individual annunciator, as *k*.

The mechanism of the repeating-coil relay and the auxiliary relay may be best understood by reference to Fig. 2. The repeating-coil *d* consists of two spools, upon each of which two coils are wound, the coils being connected together in pairs in the usual way. I have designated each united pair of coils a helix of the repeating-coil, these helices being *d′* and *d²*, respectively. Each spool of the repeating-coil is provided with a central iron core *d³*, the cores being united at one end of the repeating-coil by a yoke *d⁴* and terminating at their other extremities in pole-pieces *d⁵*, presented to armature-pieces *d⁶*, carried upon a vibrating lever *d⁷*. The extremity of this lever plays between adjustable contacts *d⁸* *d⁹*. The relay *l* is of ordinary construction, comprising an electro-magnet *l′*, to whose poles a movable armature *l²* is presented. The armature *l²* is carried upon a spindle *l³*, pivoted in trunnions *l⁴* in the frame of the apparatus. The relay-armature is normally retained at a slight distance from the magnets by a light compression-spring *l⁵*, acting upon an arm *l⁶*, attached to the spindle *l³*, and forcing it against an adjustable stop *l⁷*.

The relay-contacts *d⁸* *d⁹* of the repeating-coil are connected together and form one terminal of a local circuit including the coils of magnet *l′*, together with a battery, the other terminal of the circuit being connected with the lever *d⁷*.

In the normal position of the apparatus the contact-bearing extremity of the lever *d⁷* rests in contact with its stop *d⁹*, thus closing the local circuit. The magnets *l′* are thus normally excited and hold their armature in position to separate the arm *l⁶* from its contact-stop *l⁷*. When a pulsating or alternating current finds circuit through either helix of the repeating-coil, the lever *d⁷* is thrown into vibration between its stops *d⁸* *d⁹*, the local circuit including the magnets of relay *l* being open during the moment in which the lever *d⁷* is in intermediate position between the stops. In this moment then the magnets *l′* are deënergized and permit the arm *l⁶* to close upon the stop *l⁷*. The object of employing the two contact-points *d⁸* *d⁹* in connection with the relay *l* is to avoid the effects of residual magnetism in the cores of the repeating-coil or of an accidental or leak current through either helix of the coil. It will be seen that in either case the armature of the repeating-coil will be permanently attracted and the lever will be closed upon its forward stop *d⁸*, thus still placing the local circuit in its normal closed condition. The first reverse pulsation of current through the repeating-coil will neutralize the residual magnetism or the magnetic effect of the accidental current and will permit the armature to separate from the poles and to momentarily open the local circuit of relay *l*.

Returning now to Fig. 1, the contact arm or lever *l⁶* and stop *l⁷* of the relay *l* will be seen to constitute the normally-separated terminals of a local circuit divided into two parallel branches and including a battery. One of these branches is permanently closed and extends through a clearing-out annunciator *m* upon the toll-board *c′*. The other branch extends through a similar clearing-out annunciator *o* upon the subscriber's switchboard *g*, and also through the contact-points *p* *p′* of a cord-switch *q* for the terminal plug *f* of the corresponding line. These contact-points are constructed to be separated while the terminal plug is in its socket, but to close together when it is removed. Hence the branch of the local circuit through clearing-out annunciator *o* is complete only when the corresponding terminal plug is in use upon the subscriber's switchboard. The usual calling-key *r* is provided for connecting a generator *s* of signaling-current with the extension of the toll-line circuit, and also a listening-key *t* for connecting the operator's telephone *u* with the same circuit. This telephone *u* is connected with the telephone *v* of the toll-operator at toll-board *c′*, in order to permit of the oral communication of orders for connections between the toll-lines under the control of the toll-operator and subscribers' lines under the control of the subscriber's operator at switchboard *g*. The toll-operator at board *c′* has the usual pairs of connecting-plugs *w* *w′* and a listening-key *x* for each pair by which she may connect her telephone temporarily with the plug-circuit. When a signaling-current is transmitted from toll-station A, the current finds circuit through the helix *d′* of the repeating-coil, energizing the cores of the repeating-coil. The lever *d⁷* is thus thrown into vibration, and the relay *l* is permitted to close the local circuit. The branch of this local circuit including the annunciator *o* is open at the cord-switch *q*, but the branch including annunciator *m* is permanently closed, and this annunciator is operated and indicates the signal to the toll-operator at toll-board *c′*. This operator then inserts one plug *w* of a pair into the spring-jack *b′* of the corresponding line, depresses the plunger of her listening-key *x*, and receives the order for the desired connection. If this order be for another toll-line, the toll-operator makes the connection upon her toll-board by means of the remaining plug *w′*, after having tested to determine whether the toll-line is in use in the usual way. If, however, the order is for a connection with a subscriber's line, which must be completed at switchboard *g*, the toll-operator addresses the subscriber's operator through her telephone *u* and orders the connection of the particular toll-line to the desired subscriber's line. The subscriber's operator then

inserts the terminal plug *f* of the toll-line *a* into the spring-jack of the subscriber's line. The toll-station and the subscriber's station are thus put into communication, through the medium of the repeating-coil, over a circuit which may be traced as follows: from station A through the spring-jack *b* upon toll-board *c*, thence through spring-jack *b'* on toll-board *c'* and through the helix *d'* of repeating-coil *d*. From thence the telephonic or alternating currents are translated into circuit *e*, from which they find a path through terminal plug *f* to the subscriber's spring-jack, and thence over the line connected therewith to the subscriber's station. It is customary for the toll-operator having received an order from a toll-line for a connection to note both the time of beginning and the time of finishing the conversation. When the conversation between the substations is completed, a signal-current may be transmitted from either station, and will find circuit through the repeating-coil *d*. The relay *l* will then be again permitted to close the local circuit, whereby both annunciators *m* and *o* will be caused to display their signals, the terminal plug *f* being withdrawn from its socket, and the cord-switch *q* closed. The toll-operator is thus notified of the termination of the conversation, while at the same time the subscriber's operator at switchboard *g* is notified to disconnect the lines. This she does by withdrawing the terminal plug *f* from the spring-jack into which it has been inserted and replacing it in its socket. If connection with a toll-line were called for by a subscriber, the order would be received at the switchboard *g*, and the operator, after inserting the terminal plug *f* of the desired toll-line into the spring-jack of the subscriber calling, would inform the toll-operator at the switchboard *c* or *c'* of the completion of the connection. When the disconnection-signal was given, the annunciators at both switchboards would be operated as before. By the term "repeating-coil," as employed in the specification and claims, I mean a coil having primary and secondary windings interposed in the circuit, whereby the currents pass from one to the other by induction.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with an induction and repeating coil, of a movable armature for the core thereof, a local circuit including an electromagnet actuating a signal device adapted to display its signal only when said magnet is not excited, contact-points controlled by said armature adapted to close said local circuit when said armature is in its attracted position, also when the armature is in its position of rest, but to open the circuit while the armature is moving from either one of the positions to the other; substantially as described.

2. The combination with the core of a repeating-coil, of a movable armature therefor, a lever carrying said armature, a front and a back contact-stop for said lever, a local circuit having one terminal connected with the lever and the other terminal connected with both said contact-stops, a relay having its magnets included together with a battery in the said local circuit, a second local circuit including electric annunciators controlled by said relay to be closed when the relay-magnets are demagnetized, substantially as described.

3. The combination with two switchboards upon which different telephone-lines terminate, of an electromagnet in a line at one switchboard controlling a local circuit including an annunciator at each of the switchboards, and means for extending a connection from the line having the electromagnet to the line upon the other switchboard, whereby the signal for disconnection is received at both switchboards, substantially as described.

4. The combination with a toll-line terminating at a toll-switchboard, of an extension from said toll-line to a terminal plug upon a subscriber's switchboard, an electromagnet connected with the toll-line controlling the local circuit including an annunciator at each of the switchboards, and a cord-switch in connection with the terminal plug of the toll-line adapted to open the circuit of the annunciator at the subscriber's switchboard while the plug is not in use, substantially as described.

5. The combination with a toll-line extending to a toll-switchboard and means for making connection with the toll-line thereat, of a repeating-coil having one helix included in the toll-line and its other helix included in a circuit terminating in a plug at a subscriber's switchboard, relay-contacts controlled by the core of the repeating-coil included in a local circuit together with a battery and two annunciators in parallel branches of the local circuit, one upon each of the switchboards, and a cord-switch for the terminal plug adapted to open the circuit of the annunciator at the subscriber's switchboard when the plug is not in use, substantially as described.

6. In a telephone system, the combination with a telephone-line extending from a substation to the central station, of an induction and repeating coil included in the circuit of the telephone-line at the central station, a local circuit at the central station, an armature-lever controlling said local circuit and situated opposite the pole of the core of said induction and repeating coil, whereby the continuity of the local circuit is controlled by the current traversing the induction and repeating coil, substantially as described.

In witness whereof I hereunto subscribe my name this 12th day of January, A. D. 1895.

VICTOR WIETLISBACH.

Witnesses:

ALOIS REDING,

JOHN WÄBER.