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PATENTED JUNE 5, 1906.

M. G. KELLOGG.
 MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES.
 APPLICATION FILED APR. 24, 1893.

Fig. 1.

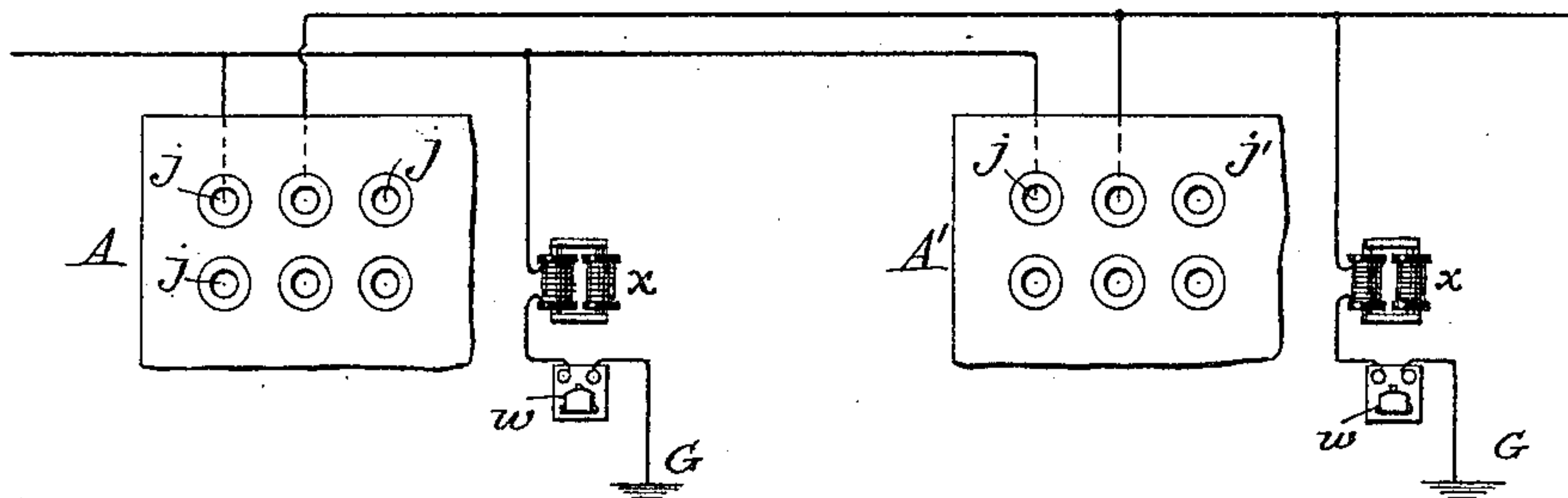


Fig. 2.

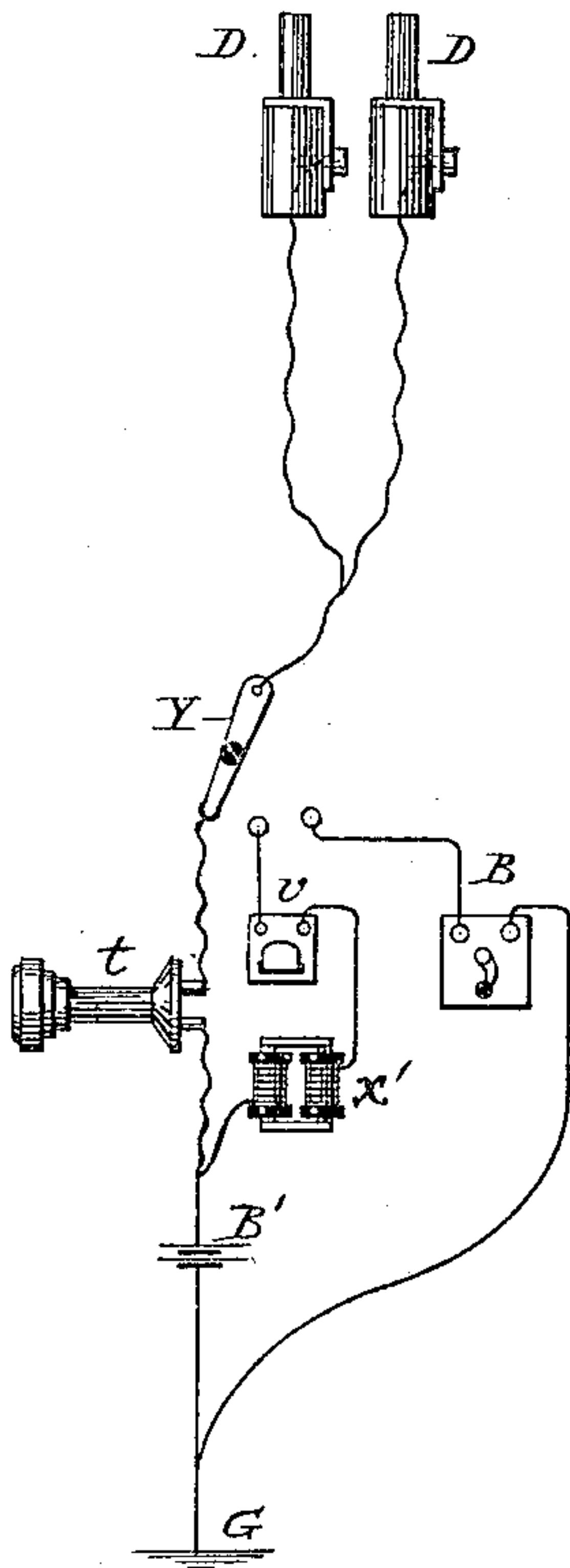


Fig. 3.

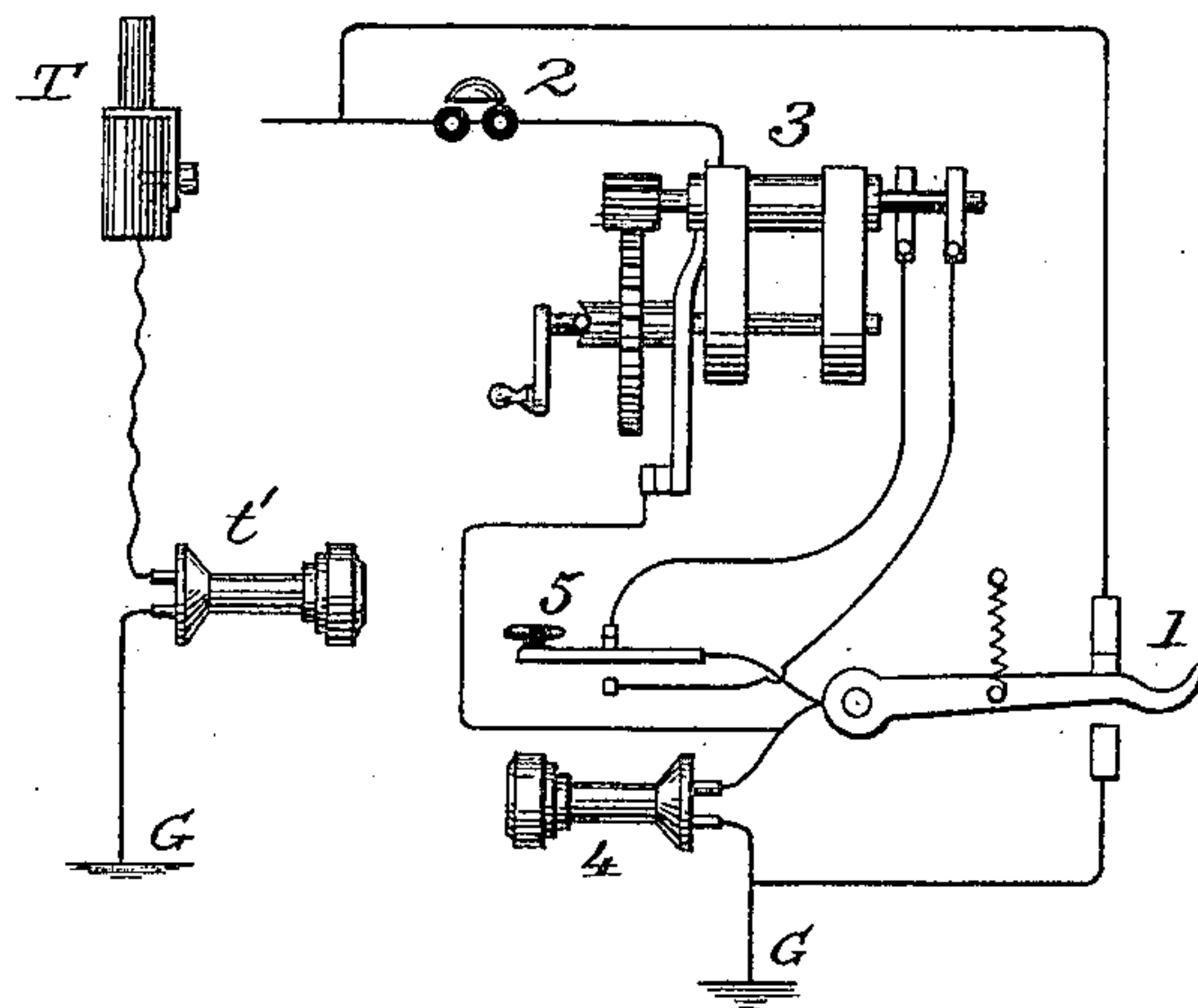
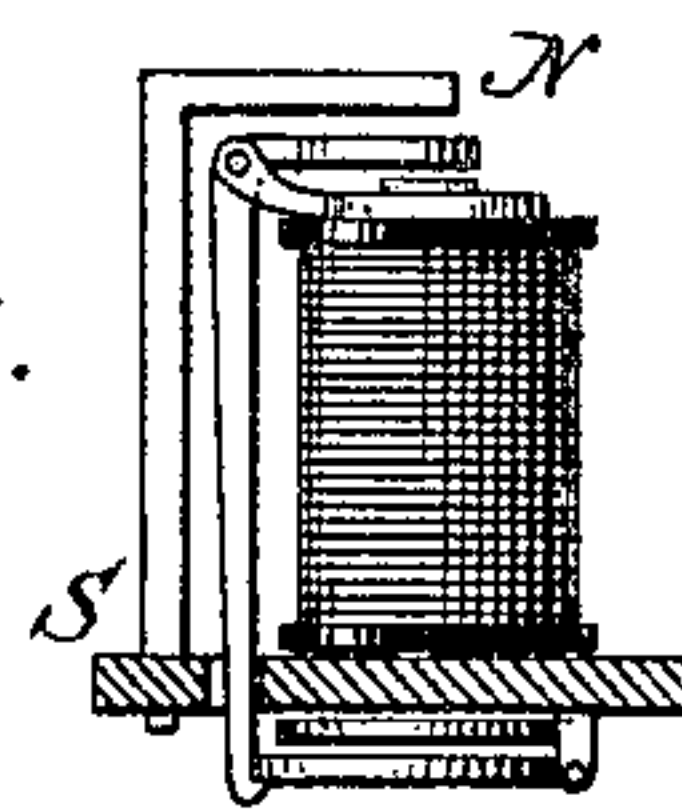


Fig. 4.

Fig. 5.



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MULTIPLE SWITCHBOARD FOR TELEPHONE-EXCHANGES.

No. 822,611.

Specification of Letters Patent.

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Application filed April 24, 1893, Serial No. 471,713.

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Multiple Switchboards for Telephone-Exchanges, 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 a telephone-exchange system in which the lines are each connected to a metallic switch-terminal at each board adapted to receive and make contact with a switch-plug which may be inserted; and it consists of a system of calling from the subscribers' stations and from the central office switching, testing, and clearing-out connections which I shall describe, and claim in detail.

In the drawings illustrating my invention, Figure 1 represents front views of sections of two switchboards with metallic sockets or switch-terminals for several lines and two lines connected to the two boards with their line-annunciators, retardation-coils, and central-office connections. Fig. 2 shows an operator's cord system adapted to be used at each board; Fig. 3, an operator's test system adapted to be used at each board; Fig. 4, a diagram of the subscriber's station apparatus for each line, and Fig. 5 a polarized annunciator for each line.

In Fig. 1, A A' are the two switchboards. $j j$ are metallic sockets or switch-terminals, one for each line on each board. Each socket or switch-terminal is adapted to receive and form connection with each switch-plug at its board. (Shown in Fig. 2 and marked D D.) $w w$ are the line-annunciators, and $x x$ retardation-coils, one annunciator and one retardation-coil for each line. Each line is connected to its metallic socket or switch-terminals on the boards and is grounded through its annunciator and retardation-coil, as shown. It is preferable, as will hereinafter appear, that the annunciators be polarized annunciators and be connected in the circuits, as will hereinafter be indicated. The retardation-coils are desirable to retard the passage to ground at the central office of telephone-currents which may be passing over the circuit of two lines connected to-

gether for conversation. The annunciators may be so constructed as to offer the retardation effect required.

In Fig. 2, D D are a pair of switch-plugs, each adapted to be inserted into the switch-terminals and form the connections, as hereinafter described. The contact-pieces of the pair are connected by a flexible conducting cord-circuit, as shown. Y is a switch, v a clearing-out annunciator, and x' a retardation-coil for the pair of plugs. t is the operator's telephone. B is a calling-generator, and B' a test-battery, of which there may be one of each for the exchange. The lever of the switch Y is connected with the cord-circuit. One of the switch-bolts, on which the lever may be placed by the operator, is connected through the operator's telephone and the test-battery to the ground. Another bolt is connected through the clearing-out annunciator and retardation-coil of the pair of plugs and the test-battery to the ground. The third bolt is connected through the calling-generator to the ground. Other pairs of plugs with their special apparatus may be connected to the operator's cord system substantially as shown and as will be evident to those skilled in the art.

In the operator's test system (shown in Fig. 3) T is the test-plug, which is adapted to be brought into connection for testing with any metallic socket or switch-terminal j at its board. t' is the test-receiving instrument. The plug is connected through a flexible conductor to the test-receiving instrument and through the instrument to the ground.

Each operator has one cord system and one test system located at the board where she operates.

In the diagram of the subscriber's station apparatus shown in Fig. 4, 1 is the telephone-switch. 2 is the signal-receiving bell. 3 is the calling-generator. 4 is the operator's telephone, and 5 is a calling-key. The generator is constructed with the usual automatic device, whereby it is shunted or switched from the line-circuit while not operated. The insulated contact-piece on the shaft of the armature, to which is connected one end of the armature-wire and which conducts the generated current to the line through the stationary spring-contact (or contacts) provided for it, is a half-circle, the

remaining part of the circle being an insulation, as shown. I provide two stationary spring contact-pieces, as shown, each bearing on the diametrically opposite part of the circle of the shaft of which said insulated contact-piece is a part. The key 5 is provided with two pairs of contact-points, as shown, one pair being normally closed and the other pair normally open, and when the key is depressed the normally open pair of contacts is closed and the normally closed pair is opened. The connection of the key to the contact-springs of the generator and to the line-circuit is as follows and as shown: The spring-lever, which forms one of the contacts of each pair of contact-points, is connected with one side of the main-line circuit. The two other contact-pieces of the pairs of contact-points are connected to the two contact-springs, respectively. As stated above, one end of the armature-wire is connected with half-circle contact-piece on the generator-shaft, on which the springs alternately bear when the generator is being turned. The other end of the armature-wire is connected with the other side of the main-line circuit. The automatic shunt device mentioned before may shunt that part of the circuit containing the armature-wire and the key when the generator is not being turned.

It is well known that when magneto-generators are turned and operated a current of one polarity is generated during one-half of the revolution of the armature and a current of the other polarity is generated during the other half of the revolution of the armature. It will be apparent from the description of the subscriber's station apparatus which has been given and from the circuits that when the generator is being operated and the key remains in its normal position the armature-wire is in circuit through one of the contact-springs, and that only, and a current of one polarity will be sent to the line, and that when the generator is being operated and the key is depressed the armature-wire is in circuit through the other contact-spring, and that only, and a current of the other polarity will be sent to the line. The subscriber can therefore at will send currents of either polarity to line as he does not or does press on the calling-key.

The line-annunciators should preferably be connected into their respective circuits in such a direction as to be operated by the current from the subscriber's generator when it is operated while the calling-key is not depressed. The clearing-out annunciators may be non-polarized annunciators. The test-battery should preferably be connected in such a direction that when it is connected to the circuit of any line by means of a switch-plug being inserted into the terminal of the line its current will be of the same polarity or direction in the line as is the current from the

line-generator when it is operated and the subscriber's key is depressed.

The operation of the system is as follows: When a subscriber desires to make a call, he operates his generator without pressing his key *k*. A calling-current is thereby sent to the line which operates the line-annunciator. The operator then places one of her switch-plugs into the switch-terminal of the line and places the switch Y so that her telephone is in circuit with the line and finds out by conversation what line is wanted. She then tests the line wanted, as will be described, and if she finds that it is "free" or unswitched she places the other plug of the pair in its switch-terminal at her board. The two lines are then connected in a circuit, and the circuit is grounded at the central office through the annunciator and retardation-coil of each line. The operator then moves the lever of the switch Y so that the calling-generator B is connected to the circuit, and a split current goes in both directions to the circuit and rings the bell of the subscriber wanted and also that of the calling-subscriber if he has replaced his telephone on its switch. The operator then moves the lever of the switch Y so that the circuit is grounded through the annunciator and retardation-coil of the pair of plugs used. The lines are thus connected together for conversation, and the circuit is grounded through the annunciators and retardation-coils of both lines and of the pair of plugs. The retardation effect of the annunciators and retardation-coils will, however, be such as not to interfere with the telephone-currents which may pass over the circuit.

The operator's calling-generator B should preferably be such as to give but one polarity of current and should be so connected as not in calling to send the polarity of current to the lines which will operate their annunciators, and the subscriber's signal-receiving bells should be such as to respond to currents of that character. Any usual forms of apparatus which produce these results may be used.

The test system is as follows: When a line is switched for conversation, its circuit is grounded through the test-battery B'. If when it is in that condition a test-plug is applied to its switch-terminal at any board, a complete test-circuit is established, which contains the battery and the operator's test-receiving instrument, and the instrument will sound, indicating that the line is already switched for use. This complete circuit is from the ground through the test-battery to the switch-terminal where the line is used, thence to the switch-terminal where the line is tested, and thence through the test-plug and test-receiving instrument to the ground. When a line is tested which is not switched for use, no circuit is established which con-

tains the operator's test-receiving instrument and a battery, and the instrument will not sound, and the operator thereby knows that the line is not switched. When the calling-generator B is connected to a line-circuit and the line is tested, there will be a current from the generator through the test-receiving instrument which will give an indication that the line is busy. When either the operator's telephone or a clearing-out annunciator is connected to the line, the test-indicator comes from the battery B'. In any case, therefore, the line will test busy when a switch-plug is in one of its metal sockets or terminals.

The test-battery should not be strong enough to operate any clearing-out annunciator when connected to the circuit of two lines, as described. It will, however, reinforce the clearing-out current sent from either station and may be of such strength as to do this in a material way. With certain forms of apparatus this may be necessary or desirable, as only part of the current generated when a clearing-out signal is given goes through the clearing-out annunciators, the remainder going to ground through the line-annunciators of the two lines and the subscriber's ground of the line in which the clearing-out signal did not originate.

The system herein shown is a ground-circuit system; but certain features of calling and operation are applicable to metallic-circuit systems as well.

Instead of a clearing-out annunciator and retardation-coil for each pair of plugs an annunciator may be used of comparatively high resistance and of such construction as to offer comparatively high retardation to telephone-currents.

I claim as my invention—

1. In a telephone-exchange system, a pair of switch-plugs, each adapted to be connected to the switch-terminal of each line at its board and the two plugs connected together by a conducting-circuit, in combination with battery grounded on one side, an operator's telephone and a clearing-out annunciator special to said pair of plugs, each connected on one side to the other side of said battery, and switch apparatus for said pair of plugs to connect at will its conducting-circuit with the other side of either the telephone or clearing-out annunciator, substantially as set forth.

2. In a telephone-exchange system, a pair of switch-plugs, each adapted to be connected to the switch-terminal of each line at its board and the two plugs connected together by a conducting-circuit, in combination with battery grounded on one side, an operator's telephone, a circuit connection special to said pair of plugs, a clearing-out-annunciator circuit of high retardation in said circuit connection, said telephone and said circuit connection being connected on one side to the other

side of said battery, and switch apparatus for said pair of plugs to connect at will its conducting-circuit with the other side of either said telephone or said circuit connection, substantially as set forth.

3. In a telephone-exchange system, pairs of switch-plugs, each plug being adapted to be connected to the switch-terminal of each line at its boards, the two plugs of each pair being connected together by its conducting-circuit, in combination with battery grounded on one side, an operator's telephone connected on one side to the other side of said test-battery, a circuit connection for each pair of plugs, connected on one side to the other side of said battery, a clearing-out annunciator for each pair of plugs in its said circuit connection, and switch apparatus for each pair of plugs to connect at will its conducting-circuit with either the other side of said telephone or the other side of its said circuit connection, substantially as set forth.

4. In a telephone-exchange system, two telephone-lines connected together for conversation, in combination with a battery grounded on one side, an operator's telephone and a circuit connection containing a clearing-out annunciator, each connected on one side to the other side of said battery, and switch apparatus to connect at will either said telephone or said circuit connection on its other side to the circuit of said lines, substantially as set forth.

5. In a telephone-exchange system, two telephone-lines connected together for conversation, in combination with battery grounded on one side, an operator's telephone and a circuit connection of high retardation of which a clearing-out annunciator is a part, each connected on one side to the other side of said test-battery, and switch apparatus to connect at will either said telephone or said circuit connection in said circuit of said lines, substantially as set forth.

6. In a telephone-exchange system, two telephone-lines connected together for conversation, in combination with battery grounded on one side, an operator's telephone and a circuit connection of high retardation of which clearing-out annunciator is a part, each connected on one side to the other side of said battery, a switch to connect at will either said telephone or said circuit connection on its other side to the circuit of said lines, and a test-receiving instrument grounded on one side and connected on its other side to a test-plug or device adapted to be brought into connection with either line, substantially as set forth.

7. In a telephone-exchange system, two telephone-lines connected together for conversation, in combination with battery grounded on one side, an operator's telephone and a circuit connection containing a clearing-out annunciator, (not one of the line

annunciators) each connected on one side to the other side of said battery, a calling-generator, grounded on one side, switch apparatus, to connect at will either said telephone,
5 said circuit connection or said generator on its other side to the circuit of said lines, and a test-receiving instrument grounded on one side and connected on its other side to a test-plug or device adapted to be brought for

testing into connection with either line, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

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H. M. WALKER.