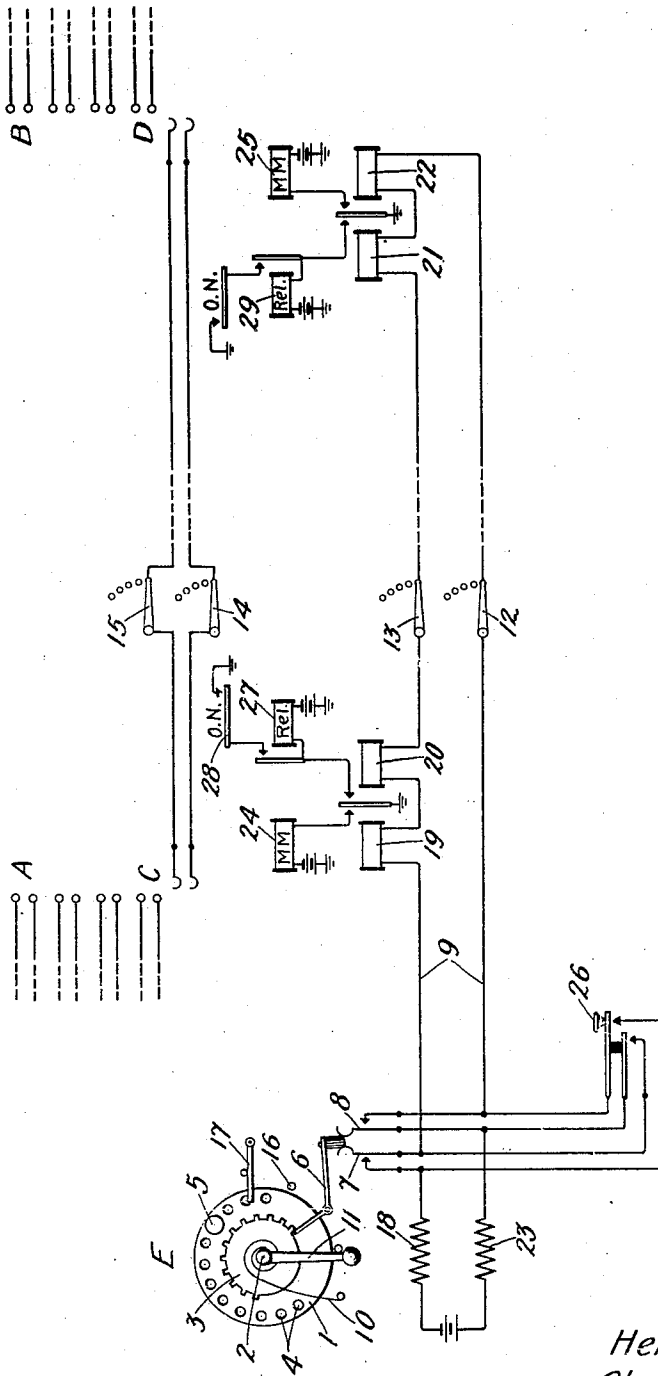


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 TELEPHONE EXCHANGE SYSTEM.
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1,340,935.

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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

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To all whom it may concern:

Be it known that we, HENRY P. CLAUSEN and CHARLES L. GOODRUM, citizens of the United States, residing at Mount Vernon, in the county of Westchester and State of New York, and at New York, in the county of New York and State of New York, respectively, have invented certain new and useful Improvements in Telephone-Exchange Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to improvements in telephone exchange systems and has particular reference to a testing circuit therefor.

In telephone exchange systems, and particularly the type employing machine switching, it has been customary to establish one or more main exchanges and associate therewith others of smaller capacity, such as private branch exchanges. In systems of this character, it is important for service and economical reasons that the maintenance department in the larger exchanges have direct supervision of the smaller ones. This supervision has heretofore been accomplished by occasional visits to the small exchanges of so-called trouble men or by the installation of expensive circuit systems for displaying at a central office signals produced by unstandard conditions at a branch exchange, of fuses, various switches, relays, battery voltage, dials, special testing and talking means and other like apparatus.

An object of the present invention is to provide a simple and inexpensive circuit arrangement designed to be installed at a central exchange to permit of tests being made thereat for unstandard conditions at various distance exchanges.

In carrying out the above object, switches at a central exchange and a branch exchange are simultaneously operated by means of impulses transmitted from the central exchange, to engage terminals in associated banks which correspond to the particular apparatus to be tested at the branch exchange.

Another object is to provide an impulse sending device having means whereby the same may be caused to transmit a plurality of sets of impulses to step the above mentioned switches to various testing terminals in response to a single setting or manipulation of said device.

The inventive idea involved is capable of receiving a variety of expressions one of which, for the purpose of illustrating the invention, is shown in the accompanying drawing; but it is to be expressly understood that said drawing is employed merely for the purpose of facilitating the invention as a whole and not to define the limits thereof, reference being had to the appended claims for this purpose.

The drawing illustrates diagrammatically a testing circuit and impulse sending device employed in carrying out the invention.

Briefly, a main exchange or central office is provided with a terminal bank A, the terminals of which are connected to indicating signals corresponding to the various tests to be made. Each of a group of smaller distant exchanges, such as private branch exchanges, is provided with a terminal bank B, the terminals of which are likewise connected to the various apparatus to be tested so that when two like groups of terminals in banks A and B are joined, the indicating signal for the particular test will be operated at the main office. Associated with the terminal bank A is a switch C which is operated simultaneously with a switch D at the branch exchange to cause the brushes of said switch to engage the corresponding terminals in their respective banks.

An impulse sending device E is provided at the central exchange and preferably comprises a dial 1 secured to a shaft 2 to which is also fixed an impulse wheel 3. The dial 1 is provided with a plurality of openings into any one of which may be inserted a stop pin 5. Coöperating with the impulse wheel 3 is a contact member 6 designed to operate the spring contacts 7 and 8 to transmit impulses over a switch controlling circuit 9 when the impulse wheel is being returned to normal under the influence of a spring 10 after the sending device has been set by the handle 11. It will be obvious that when handle 11 is being rotated in a clockwise direction to set the impulse device, contact member 6 will be ineffective to operate springs 7 and 8.

When it is desired to make a test for unstandard conditions at the branch exchange to which terminal bank B and switch D is individual, the operator at the main exchange first sets wipers 12, 13 and 14, 15

to engage contacts, as shown in the drawing, so as to extend the connection from the brushes of switch C to those of switch D and also connect the operating mechanism of said switches over the controlling circuit 9. The other contacts associated with wipers 12, 13 and 14, 15 are connected to the switches of other branch exchanges. The operator may then rotate handle 11 of the impulse sending device in a clockwise direction until same engages the stop 16. If it is desired to make tests of all the various apparatus at the branch exchange, it is necessary that the brushes of switches C and D be engaged with each pair of associated terminals in the respective banks in turn. When the dial 1 has been rotated to the extent of its movement, the first opening 4 shown at the left of the figure will then assume substantially the position occupied by the last opening. The operator then inserts pin 5 into the first named opening and releases handle 11. Dial 1 and impulse wheel 3 will then rotate toward their normal position under the influence of spring 10 until pin 5 engages the stop arm 17. Impulse wheel 3 will actuate member 6 to open and close spring contacts 7 and 8 and when closed, a circuit will be established extending from negative pole of battery, resistance 18, contact 7, windings of polarized relays 19 and 20, wiper 13, windings of polarized relays 21 and 22, wiper 12, contact 8 and resistance 23 to the positive pole of battery. Current flowing in this direction will energize the relays 19 and 22 but will not affect relays 20 and 21. Therefore, in response to the interruptions in the controlling circuit 9, motor magnets 24 and 25 of the respective switches C and D will be operated to simultaneously step the brushes of said switches over terminal banks A and B. When pin 5 engages stop arm 17, spring contacts 7 and 8 will be permanently opened and motor magnets 24 and 25 will cease to operate, thus stopping the brushes of the switch on the desired terminals so that a test can be made of the apparatus with which said terminals are associated. After the first test is made, the operator may first grasp handle 11 to prevent movement of the dial and impulse wheel and then remove pin 5 and insert same into a succeeding opening. By releasing handle 11, the impulse sending device will again be operated in the same manner as previously described to set the brushes of switches C and D on the terminals corresponding to the next test to be made. In this manner it will be apparent that all of the various apparatus at the branch exchange may be tested by a single setting of the impulse sending device which will then, in accordance with the positioning of pin 5, transmit a plurality of sets of impulses over the controlling circuit.

When the test is completed the operator, by depressing a key 26, will reverse current flowing over the previously described controlling circuit and thus cause polarized relays 20 and 21 to be energized while relays 20 and 22 remain inert. Energization of relay 20 establishes a circuit for release magnet 27 of switch C extending from grounded battery winding of said magnet and front contact and armature of relay 20 to ground. In energizing, magnet 27 establishes a locking circuit for itself extending through its winding, armature and front contact and off-normal contact 28, which is closed upon the first step of the switch, to ground. Magnet 27 operates to return the brushes of switch C to normal at which time off-normal contact 28 restores and magnet 27 releases. In the same manner release magnet 29 of switch D is operated by the energization of relay 21 to restore the brushes of the switch to normal.

What is claimed is:

1. In a telephone system, a main exchange, a branch exchange, switches at said exchanges, terminal banks for said switches, a circuit for controlling said switches, an impulse sending device for transmitting impulses over said circuit to operate said switches, means for setting said device to transmit a definite number of impulses, and means for stopping said device at predetermined positions in its return movement whereby said switches may be intermittently operated to stop on various terminals of their respective banks before said sending device is restored to normal.

2. In a telephone system, a main exchange, a branch exchange, switches at said exchanges, terminal banks for said switches, a circuit for controlling said switches, an impulse sending device for transmitting impulses over said circuit to operate said switches, means for setting said device to transmit a definite number of impulses, means for stopping said device at predetermined positions in its return movement whereby said switches may be intermittently operated to stop on various terminals of their respective banks before said sending device is restored to normal, and means at said main exchange for releasing said switches.

3. In a telephone system, a main exchange, a branch exchange, switches at said exchanges, terminal banks for said switches, a circuit for controlling said switches, an impulse sending device for transmitting impulses over said circuit to operate said switches, means for setting said device to transmit a definite number of impulses, means for stopping said device at predetermined positions in its return movement whereby said switches may be intermittently operated to stop on various terminals of

their respective banks before said sending device is restored to normal, means for reversing the current through said controlling circuit, and means responsive to said reversal of current for releasing said switches.

4. In a telephone system, a main exchange, a branch exchange, switches at said exchanges, terminal banks for said switches, a circuit for controlling said switches, an impulse sending device for transmitting impulses over said circuit to operate said switches, means for setting said device to transmit a definite number of impulses, means for stopping said device at predetermined positions in its return movement whereby said switches may be intermittently operated to stop on various terminals of their respective banks before said sending device is restored to normal, a manually operable key at said main exchange for reversing the current through said controlling circuit, and polarized relays in said circuit responsive to said reversal of current for controlling the release of said switches.

5. In a telephone system, a main exchange, a branch exchange, switches at said exchanges, terminal banks for said switches, a circuit for controlling said switches, means responsive to current flowing in one direction over said circuit for causing the operation of said switches, means responsive to current flowing over said controlling circuit in a reverse direction for causing the release of said switches, an impulse sending device for transmitting impulses over said controlling circuit to step said switches upon certain terminals of said banks, and means for reversing the current over said controlling circuit to render active the second named means.

6. In a telephone system, a group of branch exchanges, a main exchange common to said group, switches at said exchanges,

terminal banks for said switches, means at said main exchange for selecting any one of said group of branch exchanges, a controlling circuit between the switches at the main and selected branch exchanges, an impulse sending device for transmitting impulses over said circuit to operate said switches, means for setting said device to transmit a definite number of impulses, and means for stopping said device at predetermined positions in its return movement whereby said switches may be intermittently operated to stop on various terminals of their respective banks before said sending device is restored to normal.

7. In a telephone system, a group of branch exchanges, a main exchange common to said group, switches at said exchanges, terminal banks for said switches, means at said main exchange for selecting any one of said group of branch exchanges, a controlling circuit between the switches at the main and selected branch exchanges, an impulse sending device for transmitting impulses over said circuit to operate said switches, means for setting said device to transmit a definite number of impulses, means for stopping said device at predetermined positions in its return movement whereby said switches may be intermittently operated to stop on various terminals of their respective banks before said sending device is restored to normal, a manually operable key at said main exchange for reversing the current through said controlling circuit, and polarized relays in said circuit responsive to the reversal of current for releasing said switches.

In witness whereof, we hereunto subscribe our names this 9th day of July, A. D., 1919.

HENRY P. CLAUSEN.
CHARLES L. GOODRUM.