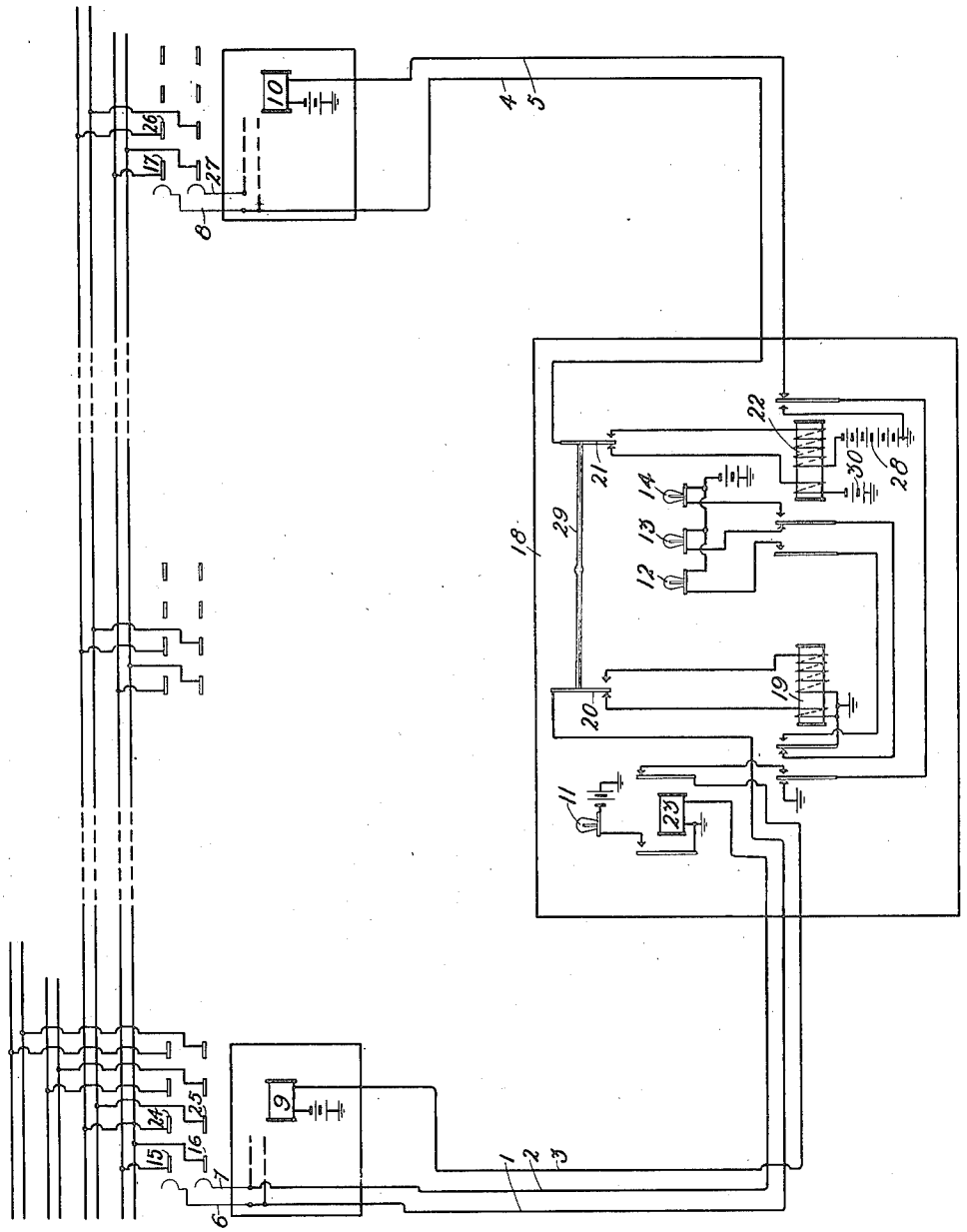
C. L. GOODRUM.

TESTING ARRANGEMENT.

APPLICATION FILED JULY 14, 1917.

1,253,228. Patented Jan. 15, 1918.



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UNITED STATES PATENT OFFICE.

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TESTING ARRANGEMENT.

1,253,228. Specification of Letters Patent. Patented Jan. 15, 1918.

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To all whom it may concern:

Be it known that I, CHARLES L. GOODRUM, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Testing Arrangements, of which the following is a full, clear, concise, and exact description.

This invention relates to testing arrangements, and more particularly to devices for making automatic routine tests of multiple banks in telephone systems.

It has for an object the provision of means for locating unstandard conditions such as "opens", "crosses", "grounds" and "high resistance connections" in a multiple bank of a telephone system.

A feature of the invention is the means for making tests for several such unstandard conditions simultaneously and successively exploring the several sets of conductors forming the multiple banks.

The invention will best be understood by reference to the accompanying drawings, in which the figure shows diagrammatically a plurality of sets of switch contact banks, having multiple connections extending therebetween, and a testing arrangement for testing for a plurality of unstandard conditions.

Within the rectangle designated 18 there are placed several relays, switches and indicating devices which comprise the testing arrangement. These are associated with the banks of selective switches through flexible conductors 1, 2, 3, 4 and 5 temporarily connected to certain points in such selective switches. Specifically conductors 1 and 2 are connected to brushes 6 and 7 and conductor 3 is connected to the motor magnet 9 of one selective switch, while conductor 4 is connected to brush 8 of another selective switch and conductor 5 is connected to the motor magnet 10 of the same switch. In practice, the conductors 1, 2 and 3 will be attached to a selective switch at one end of the multiple bank and conductors 4 and 5 will be attached to a selective switch at the other end of the multiple bank.

Motor magnets 9 and 10 of the selective switches are adapted to move the brushes 6 and 7 and 8 respectively, when energized. Brush 6 of the one selective switch corresponds to brush 8 of the other selective switch, that is, it makes connection with terminals connected to the same conductor.

In the operation of the system several indicating devices are used, being illustrated in this case as lamps 11, 12, 13 and 14. During the operation of the testing arrangement these lamps flash intermittently, but by so flashing do not indicate the detection of an unstandard condition. Only when one of these lamps burns steadily is an unstandard condition indicated.

Assume that brushes 6 and 7 have been moved into association with terminals 15 and 16 and that brush 8 has been moved into association with terminal 17. A circuit will thereupon be established from ground, the low resistance winding of relay 19, the normal contact and blade 20 of switch 29, conductor 1, brush 6, terminal 15, terminal 17, brush 8, conductor 4, blade 21 and normal contact of switch 29, low resistance winding of relay 22 to low potential battery 30 and ground. In this circuit relays 19 and 22 will be energized, whereupon a circuit will be established from ground, alternate contact and right-hand armature of relay 22, outer left-hand armature and alternate contact of relay 19, contact and right-hand armature of relay 23, conductor 3, motor magnet 9, to battery and ground. Motor magnet 9 is energized in this circuit and advances the brushes 6 and 7 into connection with the next set of terminals 24 and 25 respectively.

The circuit for the energization of relays 19 and 22 is now broken, whereupon both relays are deënergized and return their armatures to normal. Thereupon a circuit is established from ground, normal contact and outer left-hand armature of relay 19, the right-hand armature and normal contact of relay 22, conductor 5, the winding of motor magnet 10, to battery and ground. Motor magnet 10 is energized in this circuit and advances the brush 8 into association with the next terminal 26, whereupon a circuit for the energization of relays 19 and 22 is again established, providing the conductor between terminals 24 and 26 is continuous. Should this conductor be open, then neither relay 19 nor 22 will be energized and no further action will take place. The unstandard condition will, however, be reported by the steady burning of lamp 13 through

a circuit extending from ground, the inner left-hand armature and normal contact of relay 19, the inner left-hand armature and normal contact of relay 22, the lamp 13, to battery and ground.

Suppose a ground existed on the conductor extending between the terminals 24 and 26, then as brush 8 is moved into association with terminal 26 a circuit will be established from ground, battery 30, the low resistance winding of relay 22, the normal contact and blade 21 of switch 29, conductor 4, brush 8, terminal 26, to the ground constituting an unstandard condition. Through this circuit, relay 22 is energized, but since relay 19 is not energized, being short-circuited, the motor magnet 9 will not step the brushes 6 and 7 along. Under this condition a circuit will be established from ground, inner left-hand armature and normal contact of relay 19, inner left-hand armature and alternate contact of relay 22, through lamp 14 to battery and ground. The steady burning of lamp 14 indicates the existence of a ground on the conductor in association with brush 8.

Suppose that, as before described, the open circuit in the conductor extending between terminals 24 and 26 had in reality been a high resistance connection, and that the potential provided for making these tests had been insufficient to cause a current large enough for energizing relays 19 and 22 to flow. To make sure that an open circuit has been encountered the switch 29 is actuated in order to switch the connection through the low resistance windings of relays 19 and 22 to the high resistance windings of relays 19 and 22 respectively. In this circuit a battery 28 of high potential is provided, which will cause sufficient current to flow to energize these relays, if, as is assumed, a high resistance connection is encountered. Thereupon the test will advance, which indicates that the open circuit apparently encountered was in reality only a high resistance connection.

Suppose that as the brushes 6 and 7 are advanced to terminals 24 and 25 and brush 8 is advanced to terminal 26 a cross between the conductors connected to terminals 24 and 25 is encountered. In this case a circuit will be established from ground, battery, low resistance winding of relay 22, the normal contact and blade 21 of switch 29, the conductor 4, the brush 8, the terminal 26, the terminal 24, the brush 6, the conductor 1, the lower member of the switch 29, the blade 20 and normal contact of switch 29, the low resistance winding of relay 19 to ground, and in parallel therewith from the terminal 26, through the path forming the cross, the terminal 25, the brush 7, conductor 2, the winding of relay 23, to ground. Relay 23 as well as relays 19 and 22 is energized in this circuit and the attraction of its armatures prevents the energization of the motor magnet 9 as heretofore described. At the same time a circuit is established from ground, the left-hand armature and contact of relay 23, the lamp 11 to battery and ground. Another circuit is established from ground, inner left-hand armature and alternate contact of relay 19, the outer left-hand armature and contact of relay 22, the lamp 12 to battery and ground. The simultaneous burning of lamps 11 and 12 indicates the existence of a cross between the two conductors forming a pair in the multiple bank.

Suppose that the conductor connected with the terminal 25 were crossed with the conductor connected with terminal 15, they being adjacent to one another. Then as the brushes 6 and 7 are advanced to terminals 24 and 25, as at first described, a circuit will be established from ground, battery, low resistance winding of relay 22, the normal contact and blade 21 of the switch 29, conductor 4, brush 8, terminal 17, thence through the path formed by the cross between the conductors connected with terminal 15, the terminal 25, the brush 7, conductor 2, winding of relay 23, to ground. Under this condition relays 23 and 22 will be energized, and in the circuits, before described, lamps 11 and 14 will be illuminated, thereby indicating the existence of a cross between conductors of adjacent pairs in the multiple bank.

It should be noted that the testing arrangement is flexible in that the conductor 4 may be connected to either the brush 8 or the brush 27 and the conductors 1 and 2 may be suitably connected to the brushes 6 and 7.

Briefly, the operation as described consists in placing the brushes 6 and 7 on terminals connected with terminals on which brush 8 rests, then in response to standard condition advancing brushes 6 and 7, and finally in response to standard conditions again advancing the brush 8, whereupon these operations are successively repeated. When both sets of brushes are in association with the same set of multiple connections, tests for "open circuits," "grounds" and "crosses" between the conductors of the same set are simultaneously made, and when the sets of brushes are in association with adjacent sets of multiple connections, tests for crosses between conductors of adjacent sets are made.

What is claimed is:

1. An arrangement for detecting unstandard conditions in the multiple of a telephone exchange system, comprising means for simultaneously testing for a plurality of different unstandard conditions, multiple connections, contacts associated with said multiple connections at different points, and

automatic means for successively connecting said means with said contacts.

2. An arrangement for detecting unstandard conditions in the multiple of a telephone exchange system, comprising means for simultaneously testing for a plurality of different unstandard conditions, multiple connections, and means responsive to standard conditions in said multiple connections for successively connecting said testing means with said multiple connections.

3. An arrangement for detecting unstandard conditions in the multiple of a telephone exchange system, comprising a plurality of sets of multiple connections, sets of terminals connected to said multiple connections at different points, sets of brushes arranged to successively make contact with said sets of terminals, and a testing device associated with said sets of brushes comprising means for simultaneously testing said multiple connections for a plurality of different unstandard conditions, means for advancing one of said sets of brushes, means for thereupon testing said multiple connections for a still different unstandard condition, and means for thereupon advancing another of said sets of brushes.

4. An arrangement for detecting unstandard conditions in the multiple of a telephone exchange system, comprising multiple connections arranged in sets, a plurality of sets of terminals connected to each set of said multiple connections, terminal banks comprising a plurality of sets of said terminals each connected to a different set of said multiple connections, a set of brushes associated with each terminal bank, means associated with each set of brushes for operatively associating said brushes with said terminals, and a testing device comprising means responsive to standard conditions for advancing first one set of brushes and then another set of said brushes, and means responsive to a plurality of different unstandard conditions for stopping the further advance of said brushes and for indicating the nature of the unstandard condition detected.

In witness whereof, I hereunto subscribe my name this 13th day of July, A. D. 1917.

CHARLES L. GOODRUM.