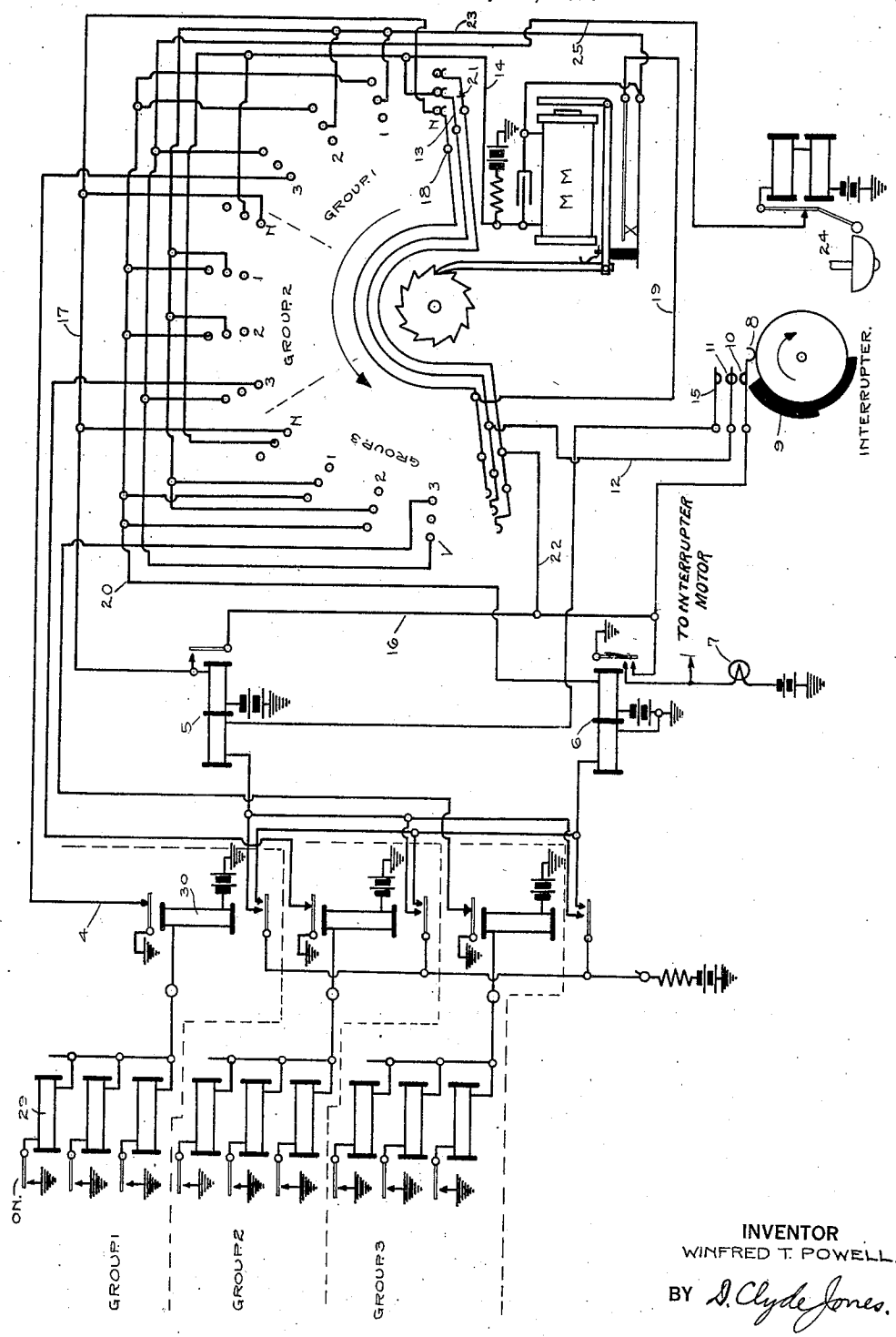
Apr. 3, 1923. 1,450,563

W. T. POWELL

TROUBLE LOCATING DEVICE

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WINFRED T. POWELL, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

TROUBLE-LOCATING DEVICE.

Application filed May 16, 1919. Serial No. 297,578.

To all whom it may concern:

Be it known that I, WINFRED T. POWELL, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Trouble-Locating Devices, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone systems, and more particularly to telephone systems employing automatic switches in completing a connection from a calling substation to a called substation.

The present invention has for its purpose the provision of means normally inoperative, but functioning as soon as an abnormal condition arises in the exchange to locate and indicate the nature of the trouble, and to operate an alarm to inform an attendant that certain of the apparatus is not operating properly.

The drawings diagrammatically represent the circuits of the trouble locating and indicating means, with the exception that at the left of the drawing there is diagrammatically shown three groups of apparatus, the apparatus of each group being set off by dotted lines.

In the present description reference will be made to a step-by-step switch. This switch may be of any well known type in which three series of contacts are arranged to form an arcuate bank. Three sets of brushes are rotatably mounted to engage the series of contacts and are rotated by a well known stepping magnet. In the present disclosure duplicate sets of brushes are provided which are spaced 180 degrees apart. A duplication of these sets of brushes is, however, not necessary to the present invention. It will be noted that one of the brushes of each set, such as the brush designated 21, is of the bridging type; that is, the brush 21 makes connection with a contact of one series before it breaks engagement with a contact of the series with which it was last in engagement. The so-called bridging wipers or brushes are well known in this art and need not be further described.

Reference will also be made to a timing device which consists of a rotating shaft provided with various cam segments to close contacts in the proper sequence. This timing device may be arranged to operate continuously, or may be arranged to operate only when an unstandard condition arises in the apparatus or circuits of the exchange.

It is believed that the operation of this system will best be understood by describing the method of locating and indicating an abnormal condition in one of the groups of apparatus of the exchange. Let it be assumed that some part of the apparatus located in group 1, fails to function properly. For the purposes of the present disclosure we have assumed that the difficulty exists in the failure of a selector or connector switch to completely release when disconnection is desired. Under these conditions, a circuit is closed from grounded battery, through the normally open contact ON associated with the faulty switch, winding of the release magnet 29 of that switch, winding of the relay 30, which is common to this group of apparatus, to grounded battery. The relay 30 attracts its armatures. At its upper armature it opens a break point in the group test conductor 4, and at its lower armature closes break points in the circuits leading to the left hand winding of the relays 5 and 6. The relay 6 attracts its armature and closes a circuit for lighting the lamp 7. A circuit similar to that for lighting the lamp may be closed at this time for starting the operation of the timing device, or interrupter.

In the present description we will assume that this interrupter is constantly operated. As soon as the brush 8 of the interrupter encounters the insulated portion 9 on the shaft, contact 10 engages contact 11 to close a circuit from ground, armature and contact of the relay 6, through the mentioned contacts, conductor 12, brush 13 and the normal contact with which it is in engagement, conductor 14, resistance, to grounded battery. This circuit places a shunt path about the motor magnet MM, so that it does not operate to advance the brushes at this time. When the contact 11 is brought into engagement with the contact 15, if the trouble still continues, a circuit is closed from grounded battery, resistance, lower armature and front contact of the relay 30, left hand winding of the relay 5, contacts 11 and 10, right hand front contact and armature of relay 6, to ground. The relay 5 is energized in this

circuit and attracts its right hand armature to complete a locking circuit for itself over conductor 16 to ground at the right hand front contact and armature of relay 6.

When the relay 5 attracts its armature, ground is connected to the normal contacts of the switch over conductor 17 and through brush 18, conductor 19, self interrupting springs and winding of the motor magnet MM, resistance, to grounded battery, but the motor magnet is still short-circuited over brush 13 of the switch, so that it does not operate at this time. As the interrupter continues to rotate, the contact 15 will be out of engagement with contacts 10 and 11, but these last two mentioned contacts will continue to remain in engagement. In this way if one of the relays similar to one of the relays 30 should be operated just before the interrupter opens, the contacts 10 and 11, the motor magnet MM will not be operated in this short interval of time. As the interrupter continues to rotate, the contacts 10 and 11 will move out of engagement, and if the abnormal condition has been removed during this interval of time, the switch will not have moved from its normal position. Assuming, however, that the abnormal condition still continues to exist, the motor magnet MM will now be operated to advance the switch one step, since it is no longer short circuited. This energizing circuit extends from grounded battery, winding and interrupter springs of the motor magnet, over conductor 19, brush 18, over conductors 17 and 16, right hand front contacts and armatures of relays 6 and 5, to ground.

When the finder brushes come to rest on the first set of contacts, a locking circuit is completed for the relay 6, from grounded battery, through its right hand winding, conductor 20, brush 21, conductor 22, right hand contact and armature of relay 6, to ground. Relay 5 also continues to be locked up over conductor 16; and the motor magnet MM is energized, this time over a circuit extending from ground, armature and front contact of the relay 6, contacts 10 and 11 in the next revolution of the interrupter, conductor 12, brush 13, conductor 23, winding of the motor magnet MM, resistance, to grounded battery. The motor magnet MM continues to attract its armature until the contacts 10 and 11 are opened in the further rotation of the interrupter. At this time the motor magnet MM deenergizes and advances the brushes to the second set of contacts. Relay 6 still continues to be locked up over conductor 20 and brush 21 of the switch. The motor magnet MM is again energized over a circuit similar to that just described; namely, from grounded battery, resistance, winding of the motor magnet, conductor 23, brush 13, contacts 11 and 10 which have again been closed by the rotation of the interrupter, right hand front contact and armature of relay 6, to ground.

The motor magnet remains energized until the contacts 11 and 10 are again open, whereupon the motor magnet MM deenergizes to advance the brushes of the switch into engagement with the third set of contacts. Since the relay 30 of the first group has been operated owing to some abnormal condition in this group, ground will be removed from the third set of contacts corresponding to this group at the finder switch, so that when this set of contacts is engaged by the brushes, they will remain in that position until an attendant has corrected or removed the unstandard condition. As soon as the brush 21 engages the third set of contacts, the bell 24 is operated by a circuit completed from grounded battery, windings, armature and back contact of the bell magnet, conductor 25, brush 21, conductor 22, right hand front contact and armature of relay 6, to ground. The bell will notify the attendant of the abnormal condition, and by noting the position of the brushes of the finder he can ascertain in which group the trouble exists.

If the trouble had existed in the second group instead of the first group, the finder brushes would have been moved from the third contact of the first group to the normal contact of the second group by an energizing circuit for the motor magnet, closed from grounded battery, resistance, winding and self interrupting contact springs of the motor magnet MM, conductor 19, brush 18, conductor 4, back contact and armature of relay 30 of the first group, to ground. The finder brushes would then be advanced over the first and second sets of contacts in a manner similar to that described in connection with group 1.

Thus it will be seen that the relay 30 of any group must be operated for a certain interval of time before the rotary finder switch will be started, thereby saving wear of the switch. Furthermore, after the switch starts another interval of time is measured off before the alarm is given, thereby providing a sufficiently long interval of time to permit successive operations of the relays 30 of the several groups. The interval of time to be measured off may be varied to suit operating conditions by variously adjusting the speed of the interrupter, and by the spacing or arrangement of the contacts of the rotary finder switch.

What I claim is:

1. In a telephone system, a plurality of pieces of apparatus co-operating to complete telephone calls, a device operating to locate faulty conditions in said apparatus, an operating circuit for said device, and a

second circuit for completing a shunt path about said operating means to delay the operation thereof.

2. In a telephone system, a plurality of pieces of apparatus co-operating to complete telephone calls, a switch operating to hunt for faulty conditions in said pieces of apparatus, means for operating said switch, a circuit for said operating means, and a second circuit for preventing the operation of said means for a predetermined minimum interval, said circuits being completed through said switch.

3. In a telephone system, a plurality of pieces of apparatus co-operating to complete telephone calls, a hunting switch having groups of terminals corresponding in number to the groups of apparatus, each group of terminals comprising several series of terminals, a test circuit common to the apparatus of each group for indicating the condition of the apparatus of that group, said circuit terminating in its related group of terminals at said switch, and operating circuits for said switch controlled through said terminals for determining when said switch shall begin to hunt for unstandard conditons.

4. In a telephone system, pieces of telephone apparatus arranged in groups, a relay common to each group, means actuated in the normal operation of each piece of apparatus to operate its common relay, means functioning to hunt for a group containing faulty apparatus, and a timing device co-operating with said relays and effective after a predetermined minimum interval of time to actuate said hunting mechanism.

5. In a telephone system, a plurality of pieces of telephone apparatus arranged in groups, a relay common to each group, a hunting switch normally inoperative but functioning to locate a group containing faulty apparatus, timing mechanism co-operating with one of said relays to prepare said hunting switch to operate, and means including said timing mechanism for delaying the operation of said hunting switch.

6. In a telephone system, a plurality of pieces of telephone apparatus arranged in groups, a relay common to each group, a rotary hunting switch normally inoperative but functioning to locate a group containing faulty apparatus, timing mechanism co-operating with one of said relays to prepare said hunting switch to operate, and means including said timing mechanism for delaying the operation of said hunting switch.

7. In a telephone system, a plurality of groups of telephone apparatus, a rotary switch having sets of contacts corresponding to each of said groups of apparatus, brushes in said switch engaging said contacts and a motor magnet for progressively advancing said brushes in a step-by-step manner over said sets of contacts, a relay common to each group of telephone apparatus, means for operating said relay whenever any piece of telephone apparatus of its related group is in operation, a timing device co-operating with any of said relays when actuated to measure a minimum interval of time, circuits for said motor magnet, one of which is effective to actuate the same and another for disabling said motor magnet, said last mentioned circuit being controlled by said timing device, and an alarm controlled by said switch.

8. In a telephone system, a plurality of pieces of apparatus co-operating to complete telephone calls, an alarm effective to give a signal whenever the operation of any of said telephone apparatus is faulty, a progressively movable switch having contacts for locating faulty apparatus, a rotary interrupting device for preparing an operating circuit for said switch and for simultaneously preparing a disabling circuit for said switch, said disabling circuit being closed for a predetermned minimum interval, and operating means for said alarm controlled by said switch.

9. In a telephone system, a plurality of pieces of apparatus co-operating to complete telephone calls, a timing device and a progressively movable switch for locating faulty apparatus, said timing device functioning to measure an interval of time equal to the maximum amount of time consumed by said apparatus in its noral operation, and thereby preventing said switch from operating except when some of said apparatus is faulty, an alarm, and circuits completed by said switch to operate said alarm when the faulty apparatus is located.

10. In a telephone system, a plurality of pieces of apparatus co-operating to complete telephone calls, a hunting switch for locating unstandard conditions in said pieces of apparatus, a timing device, a circuit for operating said switch closed when said apparatus is used, and a second circuit for preventing the operation of said switch said last mentioned circuit being completed for an interval of time after said apparatus is in use, said interval being measured by said timing device.

In witness whereof, I hereunto subscribe my name this 13th day of May A. D. 1919.

WINFRED T. POWELL.