

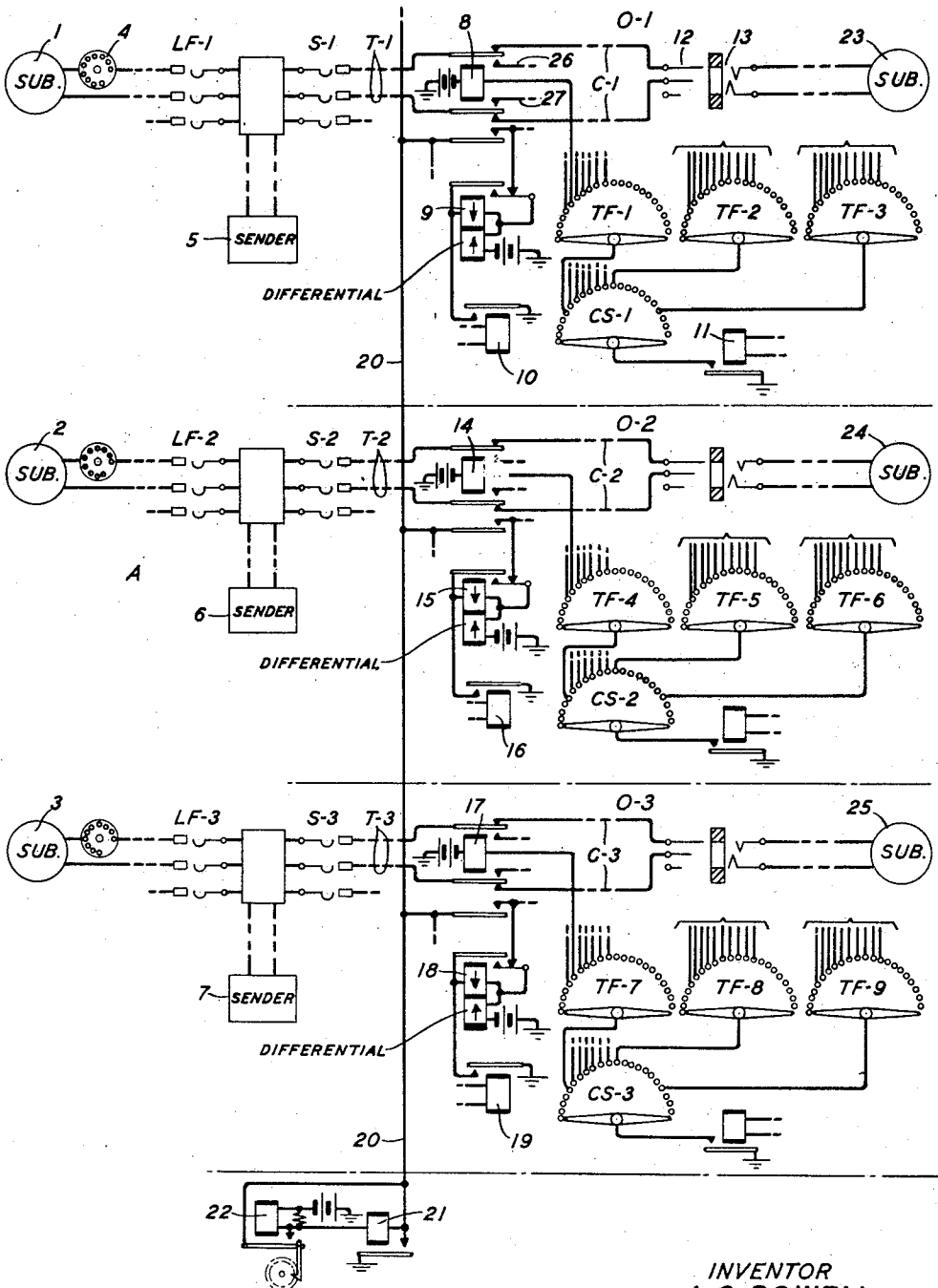
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to arrangements for measuring the use of telephone equipment.

5 The objects are to increase the efficiency and reliability of apparatus employed for registering the extent to which the equipment is used, to render such apparatus more positive in its operation, and to otherwise improve systems of this character.

10 Heretofore, systems have been employed in which a common counting register or peg-count meter is used for counting the total number of calls received over a given group of trunks. In these systems, it has been the
15 common practice to control the operating circuit of the register by relays individual to the respective calling trunks. If these individual relays remain operated for a considerable period of time, two or more calls existing
20 simultaneously may cause only one operation of the register. Thus a substantial error is introduced in the count due to the fact that the register is not permitted to operate and release with sufficient rapidity to free itself
25 from one calling trunk before the next call appears.

According to the present invention, these difficulties are overcome by an arrangement in which the operation of the common counting register is initiated by the operation of
30 a relay individual to any trunk of the group served by the register, whereas the complete operation of the register is controlled by a local circuit independent of the relay individual to the trunk. In this way, the initiating circuit originally closed by the individual trunk relay is immediately opened
35 following the initiation of the register operation so that the register, as soon as it has operated, may again release to be in readiness for a subsequent operation due to a calling condition on some other trunk.

The drawing accompanying this specification discloses a portion of a semi-automatic telephone system involving an originating
45 mechanical office and a terminating manual office. The drawing illustrates three separate operators' positions in the manual office to which the various trunks of an incoming
50 group are distributed together with the

trunk finding and position control switches.

The calling subscribers' lines 1, 2 and 3 terminate in the line finder switches LF—1, LF—2 and LF—3 in the full-mechanical office A. These line finder switches are respectively coupled to first selector switches
55 S—1, S—2, and S—3. The switches S—1, S—2, and S—3 have access to trunks T—1, T—2, and T—3 of a group extending to a distant manual terminating office. The trunk
60 T—1 is shown terminating in the operator's cord circuit C—1 at the position O—1. Trunk T—2 terminates in cord C—2 at position O—2, and trunk T—3 terminates in cord
65 circuit C—3 at position O—3. It will be understood, of course, that the arrangement disclosed is merely for illustration. At the originating office, the selector switches are controlled by central office register senders
70 5, 6 and 7. Lines 1, 2, and 3, for example, might all terminate in the same line finder switch, and trunks T—1, T—2 and T—3 might terminate in the same selector switch.

Trunks incoming to an operator's position are served by a number of trunk finder
75 switches each having access to a plurality of trunks. At position O—1 the trunk finder switches TF—1, TF—2, and TF—3 serve to find the trunks on which calls appear and to extend them to the position and indicating
80 circuits. For each three trunk finders at position O—1 there is provided a control switch CS—1. In like manner position O—2 is equipped with trunk finders TF—4, TF—5, and TF—6 and control switch CS—2,
85 and position O—3 is similarly equipped with trunk finders TF—7, TF—8 and TF—9 and control switch CS—3.

The cords C—1, C—2 and C—3 are respectively equipped with relays 8, 14 and 17.
90 The purpose of these relays is to disconnect the tip and ring conductors of the incoming trunks from the plugs of the respective cord circuits and to extend them to the indicating equipment. The position circuits at the operator's positions are respectively equipped
95 with differential relays 9, 15 and 18, the purpose of which will appear hereinafter.

The total number of calls received over a given group of trunks is recorded on a meter
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22 provided in common to all trunks of the group.

For a more complete understanding of the detailed operation of the system as a whole, reference is made to the patent to W. A. Rhodes 1,746,793 of February 11, 1930.

A detailed description of the operation will now be given. Assume that the subscriber of line 1 wishes to hold a conversation with the subscriber of line 23. The initiation of the call results in the operation of line finder LF—1 to extend the subscriber's line to the selector S—1 and to the sender 5. The subscriber manipulates his dial 4 to set up the record of the called number in the register sender 5. Thereupon, the sender controls the switch S—1 and succeeding switches in case these are necessary to extend the connection over a trunk T—1 terminating in the plug 12 of the operator's cord circuit C—1 at position O—1. The extension of the connection to the cord circuit C—1 results in the operation of trunk finder TF—1 to find the calling trunk. As soon as the trunk is selected, the relay 10 operates and completes a circuit from ground through its armature and contact to both windings of the differential relay 9 to battery. Since the relay 9 is differential, it does not attract its armature at this time.

At a subsequent period in the operation of the system, control switch CS—1 completes its preparatory functions and relay 11 operates. Relay 11 completes a circuit from ground through its armature and contact, through the brushes of CS—1 and TF—1 and the winding of the individual trunk relay 8 to battery. Relay 8 operates and extends the tip and ring conductors of the trunk T—1 over conductors 26 and 27 to the recording and indicating equipment not shown in this drawing. Relay 8 also completes a circuit from ground through the contact of relay 10, upper winding of relay 9, normal contact of relay 9, lower contact of relay 8, over a common conductor 20 through the winding of relay 21 and the winding of the register 22 to battery. Relay 21 operates in this circuit, but relay 9 being differential still retains its armature in its retracted position. Relay 21 immediately completes a local circuit from battery through the winding of register 22, winding of relay 21, contact of relay 21 to ground. This local circuit insures the complete operation of the register 22 and becomes effective immediately after the registering condition is placed on the common conductor 20. Relay 21 by applying ground potential to the common conductor 20 short circuits the upper winding of the relay 9, permitting the lower winding to operate the armature. Relay 9 at its front contact closes a locking circuit traceable from battery through the lower winding of the relay, contacts of said relay to

ground at the contact of relay 10. Relay 9 also immediately opens the branch circuit extending from the main conductor 20 to the ground of relay 10.

As soon as the register 22 has fully operated and recorded the call, it closes a circuit from battery through its winding and contact to ground at the contact of relay 21. This circuit shunts the relay 21, which thereupon releases and opens the local energizing and holding circuit of the register 22. Register 22 thereupon releases in order to be in readiness for the next call.

By this arrangement the initial energizing circuit, completed over any one of the branches extending from the common conductor 20 to the various position circuits, is opened before the register 22 has had a chance to operate and release. This eliminates the danger of overlap due to two calls existing simultaneously or nearly so at two different positions.

After the number of the called line 23 has been displayed before the operator, she seizes the plug 12 and inserts it in the jack 13 of line 23. At proper times the relays 11, 10 and 8 are released and at the end of the call the connection is taken down, and all apparatus is restored to its normal condition. For a detailed explanation of the manner in which these circuits function, reference is made to the above-noted patent to Rhodes et al.

What is claimed is:

1. In combination, a register, an operating circuit for said register comprising a main path and a plurality of branch paths, means for closing one of the branch paths to effect the operation of the register, a relay in the main path responsive to such closure, and means responsive to the operation of said relay for opening the closed branch path.

2. In combination, a register, an operating circuit for said register comprising a main path and a plurality of branch paths, means for closing a first one of said branch paths to cause the operation of the register, a relay in the main path responsive to such closure, means responsive to said relay for opening said first branch, and means controlled by said relay for causing the immediate release of said register to place the same under control of a second one of said branch paths.

3. In combination, a counting meter, an operating circuit for said meter including a plurality of parallel branches, means for closing one of said branches to initiate the operation of the meter, a relay in the operating circuit responsive to the closure of one of said branches for causing the complete operation of the meter independent of said branch, and means controlled by said relay for opening a closed branch.

4. The combination in a registering system

of a counting register, an operating circuit for said register comprising a plurality of parallel branches, differential relays, one for each of said branches, means for energizing the windings of the relay in a first one of said branches, means for closing said first branch to initiate the operation of said register without actuating said relay, and a relay common to all of said branches for causing the complete operation of the register independent of said first branch and for causing the operation of the differential relay associated with said first branch to disconnect such branch from the common register.

5. In combination, a plurality of operators' positions, a group of trunks appearing in said positions, a meter common to said trunks, an operating circuit for said meter including a branch for each of said operators' positions, means for closing one of the branches to effect the operation of the meter, and means responsive to such closure for removing the meter from control of said first mentioned branch.

6. In combination a group of lines, a meter and a meter control relay common to said lines, a relay individual to each of said lines, a conductor for connecting said meter and control relay to each of said individual relays, means effective in response to the seizure of one of said lines for connecting the corresponding one of the individual relays to said conductor to effect the operation of said control relay and said meter, means responsive to the operation of said control relay for disconnecting said one of the individual relays from said conductor, and means controlled by said meter for causing the release of said control relay to render said control relay responsive to the seizure of another one of said lines.

7. In combination a group of lines, a meter and a meter control relay common to said lines, a relay individual to each of said lines, a circuit closed in consequence of the seizure of one of said lines and including the corresponding one of said individual relays for operating said control relay without operating said one of the individual relays, contacts of said control relay for operating said meter and for operating said one of the individual relays, contacts of said one of the individual relays for opening said circuit, and contacts of said meter for causing the release of said control relay.

8. In combination a group of lines, a meter and a meter control relay common to said lines, a relay individual to each of said lines, a circuit closed in consequence of the seizure of one of said lines and including the corresponding one of said individual relays for operating said control relay without operating said one of the individual relays, a circuit closed by said control relay for operating said meter, a circuit closed by said con-

trol relay for operating said one of the individual relays, contacts of said meter for causing the release of said control relay, and contacts of said one of the individual relays for opening said circuit for operating said control relay.

9. In combination a group of trunks, a register and a register control relay common to said trunks, a differential relay individual to each of said trunks, a first circuit closed in consequence of the seizure of one of said trunks through both windings of the corresponding one of said individual relays, said first circuit being ineffective to operate said individual relay, a second circuit closed in consequence of the seizure of said trunk through one winding of said individual relay for operating said control relay, said second circuit being ineffective to operate said individual relay, circuits closed by said control relay for operating said register and said individual relay, means responsive to the operation of said individual relay for opening said second circuit, and means responsive to the operation of said register for causing the release of said control relay.

10. In combination a group of trunks, a register and a register control relay common to said trunks, a differential relay individual to each of said trunks, a first circuit closed in consequence of the seizure of one of said trunks through both windings of the corresponding one of said individual relays, said first circuit being ineffective to operate said individual relay, a second circuit closed in consequence of the seizure of said trunk through one winding of said individual relay for operating said control relay, said second circuit being ineffective to operate said individual relay, contacts of said control relay for operating said register and for short-circuiting one winding of said individual relay to cause the operation of said individual relay, means responsive to the operation of said individual relay for opening said second circuit, and means responsive to the operation of said register for causing the release of said control relay.

11. In combination a group of lines, a meter and a meter control relay common to said lines, a relay individual to each of said lines, a circuit closed in consequence of the seizure of one of said lines and including the corresponding one of said individual relays for operating said control relay without operating said one of the individual relays, contacts of said control relay for operating said meter and for operating said one of the individual relays, contacts of said one of the individual relays for opening said circuit, means for holding said one of the individual relays operated, and contacts of said meter for causing the release of said control relay.

12. In combination a group of trunks, a register and a register control relay common

to said trunks, a differential relay individual
to each of said trunks, a first circuit closed in
consequence of the seizure of one of said
trunks through both windings of the corre-
5 sponding one of said individual relays, said
first circuit being ineffective to operate said
individual relay, a second circuit closed in
consequence of the seizure of said trunk
through one winding of said individual relay
10 for operating said control relay, said second
circuit being ineffective to operate said indi-
vidual relay, contacts of said control relay
for operating said register and for short-cir-
cuiting one winding of said individual relay
15 to cause the operation of said individual re-
lay, means responsive to the operation of said
individual relay for opening said second cir-
cuit, means for holding said one of the indi-
vidual relays operated, and means responsive
20 to the operation of said register for causing
the release of said control relay.

In witness whereof, I hereunto subscribe
my name this 24th day of September, 1930.

ALBERT C. POWELL.

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