

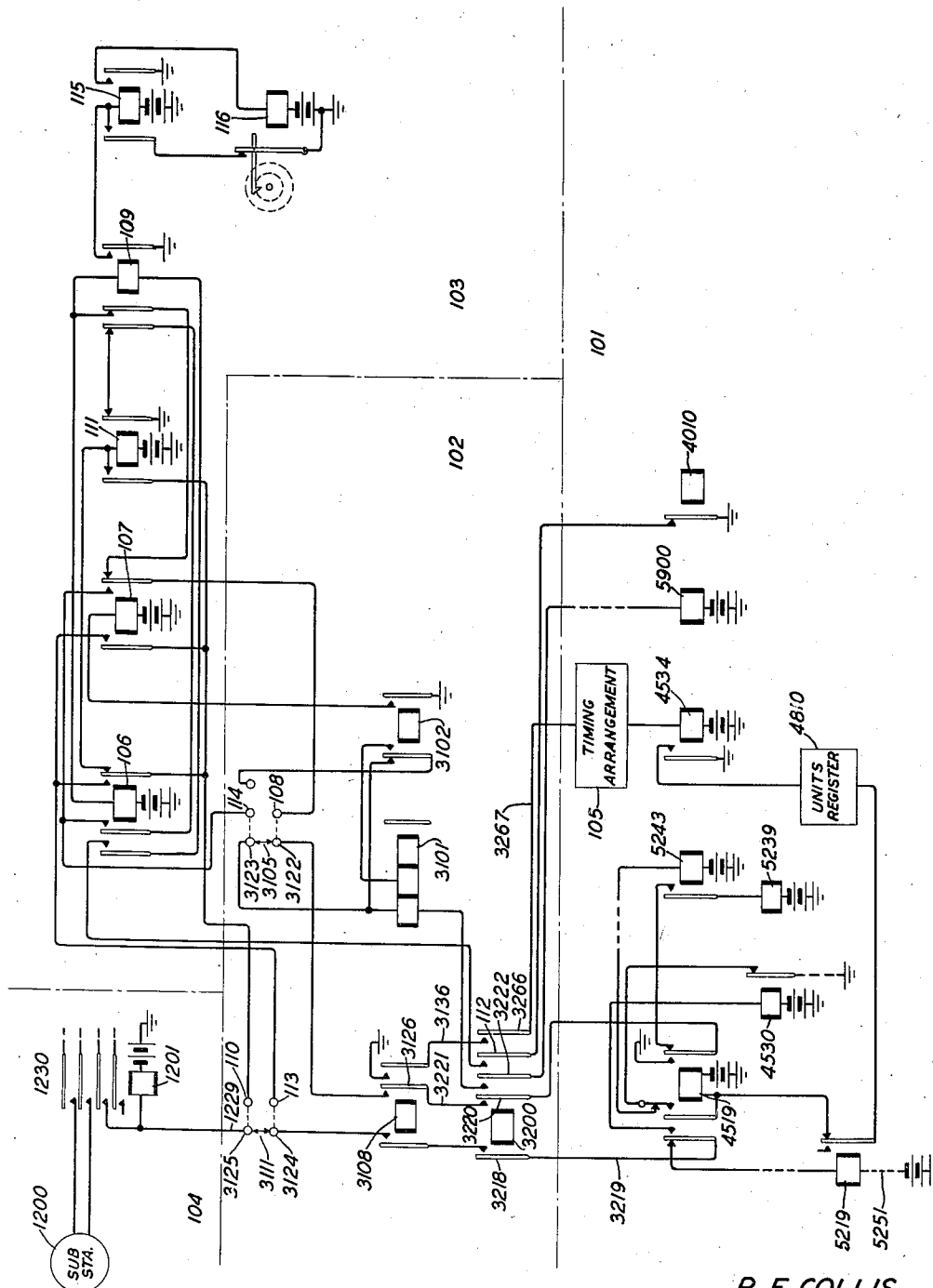
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LINE OVERFLOW RECORDER

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LINE OVERFLOW RECORDER

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8 Claims. (Cl. 179—8)

This application relates to telephone systems and has for its object to increase the efficiency of such systems.

More specifically the invention provides means for indicating the number of times a line is called while it is busy.

Arrangements of this sort are available at the present time but such arrangements are not applicable to the cross-bar system since they either require an extra terminal for the line and a corresponding brush on the switch having access thereto or depend on the connection with the busy line being maintained for an appreciable length of time. A typical example of the cross-bar system is disclosed in the patent of W. W. Carpenter, No. 2,089,921, granted Aug. 10, 1937, in which it will be observed that the busy or idle condition of the line is determined by the common control equipment known as markers which recognize absence of ground on the line sleeve as the idle condition but do not immediately mark the line engaged.

In accordance with the present invention, when it is desired to record the number of times that a line is called while busy, the arrangement of the invention is inserted in the two leads individual to the line at the line choice connector. Means is provided for holding the line idle to the marker irrespective of its actual condition together with means responsive to the test by the marker for recording the test and transmitting a busy indication to the marker if the line is busy. This recording means comprises a pair of counting relays, only one of which is operated if the line is idle and both of which are operated if the line is busy.

The invention will be more clearly understood from a consideration of the following description in connection with the drawing which shows parts of a terminating marker, line choice connector and line switch together with the line overflow register forming the basis of the invention. In general the elements of the drawing have been selected from the drawing of the Carpenter patent and the same reference characters have been employed. Reference is also made to that patent for a description of the complete operation of the system.

In general, the establishment of a connection with a called line is under the control of a marker, which obtains access to the line by means of a line choice connector. The line choice connector is equipped with a number of twenty-block relays each closing points in two circuits individual to each of twenty lines. One of these

is the sleeve or busy test circuit and the other is a position indicating circuit. These circuits terminate in two cross-connecting racks at the first of which appear the sleeve leads of the lines and at the other of which appear terminals of the position relays. Cross-connections are made at these racks to permit any desired arrangement of the lines on the switch frames.

When it is desired to record the number of attempts to reach a line or private branch exchange group which fail because of a busy condition, the line overflow register circuit is inserted in place of these two cross-connections.

Referring to the drawing, a portion of a marker is shown in rectangle 101, a portion of a line choice connector is shown in rectangle 102, the line overflow register in rectangle 103 and line 1200, primary line switch 1230 and hold magnet 1201 in rectangle 104.

When the marker has received the wanted line number it translates the designation into an indication of the choice, hundred-block and twenty-block within which the line lies. It connects with the choice by means of connector 102, operating relay 3200. The hundred-block and twenty-block indications cause the operation of twenty-block relay 3100. With relays 3100 and 3200 operated the twenty pairs of circuits controlled by relay 3100 are closed.

Assuming first a normal connection, the sleeve conductor 1229 of line 1200 which appears at rack 3111 in terminal 3125 is connected as indicated by the arrow to terminal 3124 and to one of the left contacts of relay 3100. Likewise the corresponding right contact of relay 3100 which appears at rack 3105 in terminal 3122 is cross-connected as indicated by the arrow to terminal 3123 leading to the left winding of relay 3101.

Therefore, when relay 3100 operates, it closes two circuits for each line, one from the sleeve of the line which will be grounded if the line is busy, for example, over conductor 1229, cross-connecting terminals 3125 and 3124 at rack 3111, left front contact of relay 3100, armature 3210 of relay 3200, conductor 3210, back contact of relay 4519, to the winding of test relay 5219 which is connected over conductor 5251 to battery. A similar circuit is closed for each of the other lines in the twenty-block. A second circuit, individual to line 1200 may be traced from battery through the winding of relay 5230, left contact of relay 5243, which was operated over the normal contact of relay 4519 and the other relays of that group, right back contact of relay 4519, armature 3220 of relay 3200, conductor 3221, 55

armature 3126 of relay 3108, cross-connecting terminals 3122 and 3123 at rack 3105, left winding of relay 3101, armature 3222 of relay 3200 to the winding of relay 5900 and battery.

Under these conditions, if the line is idle, none of the relays 5219, 5239, or 5900 operate. Relay 3108 in operating connects ground over conductor 3136, armature 3266 of relay 3200, and conductor 3267 to a relay arrangement shown for convenience as the timing arrangement 105 resulting, after an interval sufficient for the operation of relay 5219 and other relays of the group, in the operation of relay 4534. Relay 4534 closes a circuit through the units register 4810 to the armature of that relay of the group represented by relay 5219 which is connected to the wanted line. Assuming that the circuit extends to relay 5219 and that the relay is unoperated because the line is idle, this circuit extends over the back contact of relay 5219 to the winding of relay 4519 and battery. Relay 4519 operates and locks over the back contact of relay 4530, opening the sleeve test circuit and connecting ground to the circuit of relays 3101 and 5900 to start selection of a connecting channel. The sleeve circuit is connected to the winding of relay 4530 as a busy guard test during the selection of the channel.

If the line had been busy, relay 4519 would not be operated, but the circuit controlled by relay 4534 would extend over the front contact of relay 5219 to the busy back relay.

Assuming that it is desired to record the number of times that line 1200 is tested while busy, the cross-connections indicated by arrows at racks 3111 and 3105 are opened and the connections indicated by dotted lines are closed.

Whenever the line 1201 becomes busy, ground is connected to conductor 1229 which with the recorder 103 in service, completes a circuit over terminals 3125 and 110, right back contact of relay 106, winding of relay 111 and battery. Relay 111 locks over terminal 110 independent of relay 106 as long as the line remains busy.

When now relay 3108 operates in making a line test, the sleeve test circuit is open at the contacts of relays 106 and 107. Therefore, relay 5219 cannot operate and after an interval relay 4519 operates. Relay 4519 closes a circuit from ground over its right front contact, armature 3220 of relay 3200, conductor 3221, armature 3126 of relay 3108, contacts 3122 and 108 at rack 3105, back contact of relay 107, inner left back contact of relay 109, winding of relay 106 and battery.

Assuming first that line 1200 is idle and relay 111 unoperated, the operation of relay 106 closes a locking circuit through the windings of relays 106 and 109, outer left contact of relay 106, armature 112 of relay 3200 to ground at the back contact of relay 4010. Relay 109 is held shunted by the operating circuit of relay 106. Relay 106 opens the operating circuit for relay 111 and connects terminals 3125 and 3124 together by way of terminal 110, right front contact of relay 106 and terminal 113, thereby preparing the operating circuit of the hold magnet 1201.

Relay 106 also completes a circuit, if the line is idle, from ground at the back contact of relay 111, back contact of relay 109, inner left contact of relay 106, terminals 114 and 3123, left winding of relay 3101, armature 3222 of relay 3200, winding of relay 5900 and battery, substituting this circuit for the circuit normally closed by relay 4519. The call now progresses in the usual manner. When the connection has been established

and tested for continuity, relay 4010 operates, opening the locking circuit of relay 106 without permitting relay 109 to operate therein.

If the line is busy and relay 111 is operated, the operation proceeds as for an idle line until relay 4519 operates. However, the circuit of relay 5900 is open at the contact of relay 111 so that no channel selecting operations can be started. As before, relay 106 operates over the right front contact of 4519 and connects the sleeve of the line through to the left armature of relay 4519 so that the busy ground now operates relay 4530. Relay 4530 opens the locking circuit of relay 4519 and that relay releases, transferring the grounded sleeve back to the test relay 5219 which operates and in turn operates the busy-back relay. The release of relay 4519 opens the operating circuit of relay 106, permitting relay 109 to operate in the locking circuit. Relay 109 further opens the operating circuits of relays 106 and 5900 and closes a circuit for relay 115 which in turn operates meter 116 to record one attempt to reach the line while busy.

The operation in the case of a group of private branch exchange trunks is the same, since the last trunk of such a group is wired in the same way as individual lines.

In the case of number checking on toll calls, the line will, of course, be busy and, in order to prevent recording the number check as an attempted connection, relay 107 is provided. This relay operates from relay 3102 in the line choice connector which in turn is operated as soon as the connector is seized in connection with a number checking call. Relay 107 in operating, immediately connects terminals 3125 and 3124 together and terminals 3122 and 3123 together, by-passing the recorder. It also opens the operating circuit of relay 106 to further prevent the functioning of the recorder.

What is claimed is:

1. In a telephone system, a telephone line, means to mark said line busy by applying a busy condition to a conductor individual to said line, common control means including means for testing said line, and means for recording the number of times said line is tested while busy, comprising means inserted in said individual conductor responsive to said testing means when said line is idle to transmit a position indication to said control means and responsive to said testing means when said line is busy to record said test and transmit a busy signal to said control means.

2. In a telephone system, a telephone line, means to mark said line busy by applying a busy condition to a conductor individual to said line, common control means including means for testing said line, and means for recording the number of times said line is tested while busy, comprising a pair of counting relays, inserted in said individual conductor, one of said relays responsive to said testing means when said line is idle to transmit a position indication to said control means and both of said relays responsive to said testing means when said line is busy to record said test and transmit a busy signal to said control means.

3. In a telephone system, a telephone line, means to mark said line busy by applying a busy condition to a test circuit individual to said line, a position indicating circuit also individual to said line, common control means including means for preparing said test circuit and said position indicating circuit, and means inserted in said

test circuit and said position indicating circuit for recording the number of times said line is tested while busy, comprising means for normally holding said test circuit open, means operated by
5 said testing means over said position indicating circuit for completing said test circuit and effective to transmit a position indication to said control means if said line is idle.

4. In a telephone system, a telephone line,
10 means to mark said line busy by applying a busy condition to a test circuit individual to said line, a position indicating circuit also individual to said line, common control means including means for preparing said test circuit and said position indi-
15 cating circuit, and means inserted in said test circuit and said position indicating circuit for recording the number of times said line is tested while busy, comprising means for normally hold-
20 ing said test circuit open, means operated by said testing means over said position indicating circuit for completing said test circuit and effective to transmit a position indication to said control
25 means if said line is idle, means operated under the control of a busy line for canceling said position indication and means responsive to the completion of said test circuit to a busy line to operate a meter.

5. In a telephone system, a telephone line, means to mark said line busy by applying a busy
30 condition to a test circuit individual to said line, a position indicating circuit also individual to said line, common control means including means for preparing said test circuit and said position indicating circuit, and means inserted in said
35 test circuit and said position indicating circuit for recording the number of times said line is tested while busy, comprising a pair of counting relays, means under the control of one of said relays for normally holding said test circuit open, means
40 for operating said one relay over said position indicating circuit and means controlled by said one relay effective if said line is idle to complete said test circuit and to transmit a position indication to said control means and to prevent the
45 operation of said second counting relay.

6. In a telephone system, a telephone line, means to mark said line busy by applying a busy
50 condition to a test circuit individual to said line, a position indicating circuit also individual to said line, common control means including means for preparing said test circuit and said position

indicating circuit, and means inserted in said test circuit and said position indicating circuit for recording the number of times said line is tested while busy comprising a pair of counting
5 relays, means under the control of one of said relays for normally holding said test circuit open, means for operating said one relay over said position indicating circuit, means controlled by said one relay effective if said line is idle to complete
10 said test circuit and to transmit a position indication to said control means and to prevent the operation of said second counting relay, means operated under the control of a busy line for canceling said position indication, and means responsive to the completion of said test circuit to
15 a busy line to cause the second of said counting relays to operate a meter.

7. In a telephone system, a telephone line, switching means having access to said line, com-
20 mon control means, means in said control means for making an initial busy test of said line, means responsive to said initial busy test for identifying the position of said line, means responsive to said position identification to select idle switching
25 means for connection with said line, means effective during said switch selection to maintain a busy guard test of said line, means for recording the number of times a line is called when busy comprising a meter, means for marking
30 said line idle to said initial busy test, and means responsive to said busy guard test if said line is busy to operate said meter.

8. In a telephone system, a telephone line, switching means having access to said line, com-
35 mon control means, means in said control means for making an initial busy test of said line, means responsive to said initial busy test for identifying the position of said line, means responsive to said position identification to select idle switching
40 means for connection with said line, means effective during said switch selection to maintain a busy guard test of said line, and means for recording the number of times a line is called when busy comprising a pair of counting relays, a meter, means under the control of one of said
45 relays for marking said line idle to said initial busy test, and means responsive to said busy guard test if said line is busy to cause the other of said counting relays to operate said meter.

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