

PANEL SYSTEM  
LINE AND TRIP CIRCUITS  
INDIVIDUAL AND TWO PARTY MESSAGE RATE  
COIN AND FLAT RATE LINES  
FOR USE WITH 400 POINT LINE FINDERS  
AND SENDER SELECTORS  
MODIFICATION OF ES-240292  
FOR OVERTIME AND ZONE CHARGING

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE APPLYING TO  
ADDED OR REMOVED APPARATUS

- C.1 Operate current flow requirements were not shown for primary winding of (TR) and (TR1) relays and current flow requirements for secondary operate and primary hold were as follows: Secondary operate test .045 ampere readjust .042 ampere, primary hold test .025 ampere readjust .023 ampere.
- C.2 Test note 3 added to page 2 to cover added test clip data for the (TR) and (TR1) relays for "N" wiring.
- C.3 Test note 4 added to page 2 to record these changes.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Ground connection at (TR) and (TR1) relays and wiring of "AL" lead to jack spring 22 designated "L" wiring, and "N" wiring added, - showing primary windings of these relays connected to lead CL1 or CL2 to start circuit, and lead "AL" connected direct to leads "H", to regular and emergency trip circuits, - to be used when two classes of services are provided for in the same 400 line group. When this circuit is connected per "N" wiring a relay in the start circuit operates in series with relay (TR) or (TR1) over the CL1 lead if the circuit serves class No. 1 subscribers or over the CL2 lead if the circuit serves class No. 2 subscribers. This relay indicates to the district which class of subscriber is calling.
- D.2 Circuit note 111 added covering the use of "N" wiring for two classes of service.

All other headings under "Changes" - No Change.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit associates a calling subscribers line with a



line finder district circuit and with a start circuit for setting up a connection.

## 2. WORKING LIMITS

- 2.1 Used with subscribers loops having maximum loop resistance of 1000 ohms and minimum line leakage of 10,000 ohms.

## OPERATION

## 3. FUNCTIONS

- 3.01 Causes start circuit to function and start a line finder hunting for the calling line.
- 3.02 Operates the proper trip magnet.
- 3.03 Permits simultaneous calls in both subgroups of the same trip circuit.
- 3.04 Prevents another call being started in the same trip circuit until the first calling line has been found.
- 3.05 Operates the proper message register on a charge call.
- 3.06 Operates "lockout" feature to prevent another call being started in the same trip circuit until calls waiting in other trip circuits have been served.
- 3.07 Operates the line finder time alarm.
- 3.08 Disconnects battery and ground from the subscribers line on an incoming call.
- 3.09 Permits overtime and zone registration.
- 3.10 Optional wiring to provide for 2 classes of service in the same line finder group.

## 4. CONNECTION CIRCUITS

- 4.1 Sender selector type district selector circuits arranged for overtime and zone charging.
- 4.2 Start circuits arranged to work with trip circuits having the "lockout" feature.
- 4.3 Grounded cut-off relay type final circuits.
- 4.4 Message register connector circuits.
- 4.5 Line finder time alarm circuit.



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## DETAILED DESCRIPTION

## 5. ORIGINATING A CALL

The operation for a call originating in the first 20 lines of a group of 40 lines is as follows: When the receiver at the calling station is removed from the switchhook, the (L) relay in the line circuit operates. The (L) relay operated connects battery to the H terminal of the line and operates the (BA) relay. The (BA) relay operated operates the (TR) relay from ground through the contacts of the (O), (BA) and (K) relays, secondary winding of the (TR) relay to battery in the start circuit over the "TR" lead. The (TR) relay operated operates the trip magnets, opens the locking series circuit through the (TR) relays in the other trip circuits, serving other groups of 40 lines of the same 400-line unit and locks through its primary winding in series with the (STA) relay in the start circuit.

When "N" wiring is furnished, the (CL1) or (CL2) relay in the start circuit operates in series with the (TR) relay over the "CL1" or "CL2" lead, depending on whether class No. 1 or class No. 2 subscribers are served by this trip circuit. This in turn indicates to the district which class of subscriber is calling.

## 6. STARTING A LINE FINDER

When the (STA) relay in the start circuit operates it starts a line finder hunting for the calling line. Each trip magnet operates its trip rod, tripping the corresponding group brush of the line finder as it passes the tripping zone. The (STA) relay of the start circuit operating also connects ground to the "K" lead, operating the (K) relay. The (K) relay operated, locks to ground on the armature of the (BA) relay through the back contact of the (O) relay, opens the circuit through the secondary winding of the (TR) relay, thus preventing another line finder from being started by this call, and operates the (LO) relay which closes the circuit through the 1500 ohm winding of the (O) relay. The (O) relay does not operate at this time on account of insufficient current through the winding. As the line finder elevator moves upward at the end of the tripping zone, ground on the K segment short-circuits the primary winding of the (TR) relay releasing this relay. The (TR) relay released closes the locking series circuit through the (TR) relays in the other groups and opens the circuit through the trip magnets which release.

## 7. RELEASING THE TRIP CIRCUIT

When the line finder brushes make contact with the terminals of the calling line, a circuit is closed from battery



thru the (O) relay and resistance, the (H) terminal and multiple brush spring, to ground thru the (H) relay in the line finder and district circuit. The (H) and (O) relays operate and the line finder stops on the calling line. The (O) relay operated opens the locking circuit of the (K) relay but the (K) relay is slow in releasing and holds the (LO) relay operated, thereby holding the (O) relay operated through its 1500 ohm winding in order to permit the (BA) relay to release before the (O) relay. Otherwise, another line finder might be started by this call.

When the line has been found the district functions and connects battery to the "S" lead operating the (CO) relay. The (CO) relay operated, releases the (L) relay which in turn releases the (BA) relay and opens the circuit through the primary winding of the (O) relay. Another call may now be started within this same group of 40 lines if the start circuit is ready for the call, provided there are no calls waiting in other groups which have not been served.

The operation for a call originating in the last 20 lines of a group of 40 will be similar to that described above for the first 20 lines, except that the (BAL), (K1) and (TR1) relays are operated instead of the (BA), (K) and (TR) relays.

## 8. LOCKOUT FEATURE

The operation of the lockout feature is as follows: The operation of the (BA) or (BAL) relay when a call is started operates the (AL) relay in the start circuit through the normally closed contacts of the (LO) relay. The (AL) relay operated, holds the (LO) relays of any other trip circuits locked up if they are operated. The operation of the (K) or (K1) relay after the (STA) or (STB) relay operates causes the operation of the (LO) relay. The operation of the (LO) relay will release the (AL) relay in the start circuit provided it is not held operated over the "AL" lead of another trip circuit by a call waiting to be served. If no calls are waiting in other trip circuits the release of the (K) or (K1) relay after the line has been found will release the (LO) relay. However, if calls are waiting to be served in other trip circuits the (AL) relay in the start circuit will remain operated, holding the (LO) relay in this trip circuit operated. The (LO) relay operated holds ground on the 1500 ohm winding of the (O) relay preventing the (O) relay from releasing until calls waiting in other trip circuits have progressed far enough to operate their corresponding (LO) relays, thereby releasing the (AL) relay. The (O) relay being held operated prevents a second call from starting in this trip circuit.



## 9. OVERFLOW

If a line finder fails to stop on a subscriber's line on account of the "H" lead being open, due to the subscriber flashing his switchhook or for other reasons, the line finder will travel to the top of the bank where the brush will make contact with the H guide terminal operating the (O) relay in the same manner as when the line is found. The "T" and "R" leads being open at overflow, disconnection takes place and the line finder returns to normal as soon as the sender is found.

## 10. TIME ALARM

If the (BA) or (BAL) relay is operated for an abnormal length of time due to a line finder failing to start or failing to find the calling line due to the brushes failing to trip or for other reasons, battery from the (BA) or (BAL) relay starts the operation of the time alarm circuit, and after a certain interval, (about one-half a minute minimum) a lamp, individual to the trip circuit is lighted and stays lighted until the trouble is cleared. Also an alarm common to the office is operated.

## 11. SIMULTANEOUS CALLS

If there are simultaneous calls in both the first and the last 20 lines of a group of 40 lines the relays of both subgroups will operate as described above, starting two line finders in different subgroups at the same time. In this case the "H" leads of the two lines are connected together and connected to battery through the (O) relay. One of the line finders will stop on the first line. The other line finder will either stop on the second line or travel to overflow and return as described under paragraph 9.

## 12. MESSAGE REGISTER

On message register calls on individual message rate lines (figure 2) the message register MR operates on battery over the "H" lead when the call is charged.

On two party message rate lines (Figure 3) the two party message rate district which is associated with this circuit is arranged to test the subscriber's line to determine which subscriber is calling. The proper message register is operated by the message register connector circuit which is also associated with the district on this call.

## 13. TERMINATING CALLS

When the final selector connects to the tip, ring and sleeve terminals of an idle line at the final multiple,



battery through a resistance in the final circuit is connected over the "S" lead to ground through both windings of the (CO) relay, (on individual lines or the last line of a group of consecutive lines) or through the 100 ohm winding of the (CO) relay (on intermediate lines of a group of consecutive lines). The (CO) relay operated disconnects the (L) relay battery bridge from across the tip and ring of the line. When the final selector returns to normal, the circuit through the winding of the (CO) relay is opened, releasing the relay and restoring the circuit to normal.

BELL TELEPHONE LABORATORIES, INC.

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