

This Method of Operation was prepared from Issue 18 of Drawing ES-226909.

#### METHOD OF OPERATION

Panel System - Line and Trip Circuit, Panel Line Finder - Ind. Message, Coin, and Flat Rate Lines

#### DEVELOPMENT

##### 1. PURPOSE OF CIRCUIT

1.1 This circuit associates a calling subscriber's line with a line finder district circuit, and a start circuit for setting up a connection.

##### 2. WORKING LIMITS

		Resistance	
		Without	With
		"Y"	"Y"
		Wiring	Wiring
			Earth
			Po-
			tential
	Maximum external circuit loop resistance		
2.1	Flat rate and individual message rate lines	1000 ohms	1500 ohms
2.2	Coin lines with "X" and "Y" wiring		1300 ohms +20 V.
2.3	Coin lines without "X" wiring		750 ohms +20 V. -3.9 V.
2.4	Minimum line insulation resistance for above conditions - 10,000 ohms		

#### OPERATION

##### 3. PRINCIPAL FUNCTIONS

- 3.1 To cause the start circuit to function and start a line finder selector hunting for the calling line.
- 3.2 To trip the proper line finder brushes.
- 3.3 Permits simultaneous calls in both sub-groups of the same trip circuit.

- 3.4 Prevents another call being started in the same trip circuit until the first calling line has been found.
- 3.5 To operate the message register on a charge call.
- 3.6 To operate the Line Finder Time Alarm Circuit.
- 3.7 To disconnect battery and ground from the subscribers line on an incoming call.
- 3.8 Optional wiring to provide for 2 classes of service in the same line finder group.

#### 4. CONNECTING CIRCUITS

- 4.1 Any start circuit not arranged to work with trip circuits having the "lockout" feature.
- 4.2 Sender Selector Type District Selectors.
- 4.3 Grounded out-off relay type final circuits.
- 4.4 Line Finder Time Alarm Circuit.

#### DESCRIPTION OF OPERATION

#### 5. ORIGINATING A CALL

The operation of a call originating in the first ten lines of a group is as follows:- When the receiver at the calling station is removed from the switchhook, the (L) relay in the line circuit operates, through the 200 ohm resistance, winding of the (L) relay, contact of the (CO) relay, ring side of the line through the subscriber's loop, back over the tip side to ground on the armature of the (CO) relay. The line relay (L) operated, connects battery to the H terminal of the line and operates the (BA) relay through its inner winding. The (BA) relay operated, operates the (TR) relay from ground on the armature of the (BA) relay, break contact of the (O) and (K) relays, 700 ohm winding of the (TR) relay, to battery 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 and locks through its 600 ohm winding to battery on terminal and brush of the G group distributor selector, in series with the (STA) relay in the start circuit.

"Z" wiring provides for two classes of service in the same line group, and the ground for locking up the (TR) and (TR1) relays is furnished from the start circuit over the "CL1" or "CL2" lead, operating the (CL1) or (CL2) relay in the start circuit, 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.

When there is only one class of service "W" wiring is furnished which connects ground directly to the windings of the (TR) and (TR1) relays.

#### 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, thus tripping the corresponding group brushes of the associated selectors on its respective side of the frame as the line finder selector starts upward. Ground on the K lead operates the (K) relay which, (a) locks to ground on the armature of the (BA) relay under control of the (O) relay, (b) opens the circuit through the 700 ohm winding of the (TR) relay, thus preventing another line finder selector from being started by this call (c) closes a circuit from the 1500 ohm winding of the (O) relay, but the (O) relay does not operate at this time on account of insufficient current through the winding. As the line finder selector moves upward and at the end of the tripping zone, ground on the K commutator brush and segment, short-circuits the 600 ohm winding of the (TR) 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 selector brushes make contact with the terminals associated with the calling line, ground on the H spring of the (LF) multiple brush operates the (O) relay. The (O) relay operated, opens the locking circuit of the (K) relay but the (K) relay is very slow in releasing and holds the (O) relay operated through the 1500 ohm winding in order to permit the (BA) relay to release before the (O) relay; otherwise another line finder may be started by this call.

When the line has been found, the district functions and connects battery to lead S, operating the (CO) relay. The (CO) relay operated,

releases the line (L) relay which in turn releases the (BA) relay thus opening the circuit, releasing the (O) relay. Another call may now start within this same group of ten lines if the start circuit is ready for the call.

The operation for a call originating in the last ten lines of a group of twenty, will be similar to that already described for the first ten lines except that the (BA-1), (K-1), (O-1), and (TR-1) relays are involved instead of the (BA), (K), (O), and (TR) relays.

#### 8. 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 switch-hook 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) or (O1) 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.

#### 9. TIME ALARM

If the (BA) or (BA1) 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 (BA1) relay starts the operation of the time alarm circuit, and, with "R" wiring, 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.

When "S" wiring is furnished, the time alarm circuit functions to release the trip circuit after an interval of 7 to 14 seconds, by removing locking ground from the (K) or (K1) relay. With "S" wiring, the lamp and alarm will not function unless the trip circuit fails to release.

#### 10. SIMULTANEOUS CALLS

If there are simultaneous calls in both the first and last ten lines of a group of twenty lines, the relays of both sub groups will operate as already described, starting two line finder selectors in different sub groups at the same time. In this case, the inner windings of the (O) and (O-1) relays are connected together through the

make contacts of the (BA) and (BA-1) relays. The (O) and (O-1) relays will therefore operate in parallel when the H brush of either or both line finder selectors make contact with the H terminals of the calling line.

11. MESSAGE REGISTER

For message rate lines, battery over the H lead from the district when in position for registering the call, operates the message register (MR).

12. 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 the (CO) relay. The (CO) relay operated, disconnects the (L) relay and ground from 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.

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