

PANEL SYSTEM  
START CIRCUIT  
FOR USE WITH PANEL LINE FINDER  
WITH TRIP CIRCUIT LOCKOUT FEATURE  
MODIFICATION OF ES-240293  
FOR TWO CLASSES OF SERVICE  
IN SAME 400 LINE GROUP

CHANGES

A. CHANGED AND ADDED FUNCTIONS

- A.1 Provision added for operating a separate peg count register for each class of service.

B. CHANGES IN APPARATUS

- B.1 Added

2 - R1964 rels. (PC1) & (PC2) (Fig. 2)

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Main drawing is shown as Fig. 1, and Fig. 2 added, covering addition of (PC1) and (PC2) relays so wired that on a call from a class 1 subscriber, relay (PC1) operates, causing the peg count register for class 1 to operate, and on a call from a class 2 subscriber, relay (PC2) operates, causing the peg count register for class 2 to operate. Circuit note 116 added, to cover use of Fig. 2.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

This circuit is used to control the routing of calls to the respective line finder selectors and to start an idle selector hunting over the line terminals for the calling line. It is a modification of ES-240293 for two classes of service in the same 400 line group.

2. WORKING LIMITS

- 2.1 None.



### 3. FUNCTIONS

- 3.1 To start a selector hunting for the calling line.
- 3.2 To distinguish between two classes of service in the same line group and to indicate to the district which class of subscriber is making a call.
- 3.3 To release the trip relay in the associated trip circuit, thus permitting another call to start in any other group.
- 3.4 To prevent a second call being served in any trip circuit until all calls waiting in other trip circuits have been served.
- 3.5 Each regular start circuit is equipped with an emergency plug and jack for immediately replacing the regular circuit with an emergency circuit at any time.
- 3.6 To transfer a call to the opposite sub-group of line finders, should a call be originated in one sub-group when all districts of that sub-group are busy.
- 3.7 To test the line finders.
- 3.8 To return to normal.
- 3.9 To free the start circuit.
- 3.10 Provision for timed release of start circuit on failure of line finder to hunt or failure of start circuit to release after a call.
- 3.11 Provision for operating a separate peg count register for each class of service.

### 4. CONNECTING CIRCUITS

This circuit will function with:

- 4.1 Trip circuit arranged with lockout feature.
- 4.2 Any sender selector-type line finder and district circuit.
- 4.3 Miscellaneous alarm circuit.
- 4.4 Message register connector circuit.

### DESCRIPTION OF OPERATION

### 5. ORIGINATING CALL

When the receiver at the calling station is removed from the switchhook on a call originating in the first 20 lines of a group of 40 lines, various relays in the line and trip circuits operate operating the (STA) relay from ground over lead I, break contacts of the (CA) and (SB) relays to battery through the (K) resistance in parallel



with the winding of the (STA) relay and operating the (AL) relay over lead AL. The (STA) relay operated short-circuits the 500 ohm winding of the (CA) relay preventing it from operating and starting a line finder in sub-group B while a call is going through, connects ground to lead K, operates relay (ST) and removes battery from the TR lead, thereby preventing calls in other trip circuits from starting until the line finder brush has been tripped. The (ST) relay operating, removes the short circuits from the (CL1) and (CL2) relays. If a subscriber in class No. 1 is calling, the (CL1) relay will operate in series with the (STA) relay and the (TR) relay in the trip circuit, over the CL1 lead. If a subscriber in class No. 2 is calling the (CL2) relay will operate in series with the (STA) relay and the (TR) relay in the trip circuit, over the CL2 lead. The (CL2) relay operating, causes relays (CL3) and (CL4) to operate, grounding lead ST through contacts on the (STA) relay, thereby starting a line finder hunting for the calling line. The (CL3) and (CL4) relays also connect low resistance battery to the Y lead to either sub-group of districts, thereby causing a marginal relay in the district to operate and lock as soon as a line finder starts up, as an indication that a class No. 2 subscriber is calling. For a subscriber in class No. 1, the (CL1) relay operates and grounds lead ST through contacts on the (STA) relay, starting a line finder hunting for the calling line. In this case, relays (CL3) and (CL4) do not operate and the marginal relay in the district is not operated, thereby indicating to the district that a class No. 1 subscriber is calling. Ground on lead K operates the (K) and (LO) relays in the trip circuit, releasing the (AL) relay if it is not held operated through other trip circuits. The (AL) relay operated holds any (LO) relays locked up that may be operated in any trip circuits thereby preventing a second call from starting in any trip circuit until all calls waiting in other trip circuits have been served.

## 6. STARTING LINE FINDER

As the line finder starts upward, a circuit is closed over lead Y operating the (GA) relay. The (GA) relay operated removes ground from lead ST, locks to ground on the armature of the (STA) relay and closes a circuit operating the STP(A) magnet. The STP(A) magnet remains operated until the release of the (STA) relay. Ground is also connected to lead CH operating the (CA) or (CB) relay when all line finder selectors in a sub-group are off normal. As the line finder continues upward, ground is momentarily connected to lead K, thus releasing the (TR) relay in the trip circuit and the (CL1) relay or the (CL2), (CL3) and (CL4) relays in the start circuit, but holding the (STA) relay operated. The (CL1) relay, or the (CL3) and (CL4) relays, releasing opens the circuit through the STP(A) magnet which releases and steps the brushes of the A group distributor selector to the next terminals. When ground is disconnected



from lead K, the (STA) relay releases and (a) opens the locking circuit of the (GA) relay, which releases (b) opens the circuit over lead X, thereby opening the locking path of the line finder make busy relay (c) releases the (ST) relay, which reconnects battery to the TR lead, thereby allowing calls to be handled in other trip circuits, and (d) removes the short circuit from the 500 ohm winding of the (CA) relay which does not operate unless all selectors in the group are busy.

The operation for a call originating in the last 20 lines of a group of 40 lines will be similar to that already described for the first 20 lines except that the (STB), (GB) and (GB) relays and STP(B) magnet and the (TR1) relay in the trip circuit are involved instead of the (STA), (CA) and (GA) relays and STP(A) magnet and the (TR) relay in the trip circuit.

#### 7. EMERGENCY RELEASE OF START CIRCUIT

If either the (STA) or (STB) relay or the (CL2), (CL3) and (CL4) relays remain operated due to the failure of the (TR) or (TR1) relay in the trip circuit to be shunted out and released, the (KF) relay operates as soon as interrupter contacts I, III and V close and locks under control of the (STA), (STB), (CL3) or (CL4) relay. If it remains locked for approximately two seconds, interrupter contact II operates relay (KF1), which connects battery thru resistance (L) to the "ST" leads, to shunt down the (LF) relay in the associated line finder, in case of failure of line finder to hunt, and connects ground to either the (TR) or (TR1) relay in the trip circuit, depending on whether the call is through the A or B sub-group, releasing the (TR) or (TR1) relay and the (CL1) relay or the (CL2), (CL3) and (CL4) relays. The operation of relay (KF1) also closes ground to the STP(A) or STP(B) magnet thru make contacts on the (GA) or (GB) relay, to prevent the switch from advancing and allotting the next line finder until interrupter contact II opens, in order to allow more time for shunting down the (LF) relay. The (KF1) relay releases when interrupter contact II opens, and releases the (STA) or (STB) relay which in turn releases the (KF) relay restoring the circuit to normal.

#### 8. START CIRCUIT ALARM

The closure of the interrupter contact VI which occurs at the same time contact II is closed while the (KF) relay is operated, operates the (KA) relay. The (KA) relay operated locks under control of the key at the trouble desk, lights a lamp at the trouble desk individual to the line finder frame and operates an alarm. The operation of the key releases the (KA) relay, extinguishing the lamp and silencing the alarm.





## 9. ALL SELECTORS IN ONE SUB-GROUP BUSY

If all the selectors in sub-group A, for example, are busy the (CA) relay operates in a circuit from ground over lead CH, 500 ohm winding of the (CA) relay to battery through the 600 ohm resistance (C). The (CA) relay operated transfers the circuit over lead I from the winding of the (STA) relay to battery through the winding of the (SA) relay and the break contact of the (SB) relay. When a call is now received the (SA) relay operates in turn operating the (STB) relay. The (STB) relay operated on the operation of the (ST) relay and either the (CL1) relay or the (CL2), (CL3) and (CL4) relays operates a relay in the district, thus starting a selector in the B sub-group hunting for the calling line, and closes a locking circuit through the 1000 ohm winding and make contact of the (CA) relay. This is to prevent the release of the (CA) relay should a selector become available in the A sub-group while a call is going thru the B sub-group. If all selectors in sub-group B are busy the operation is similar except that the (CB), (SB) and (STA) relays now operate. The (STA) relay operated, starts a selector in the A sub-group hunting as explained before.

## 10. ALL SELECTORS IN BOTH SUB-GROUPS BUSY

If all the selectors in both sub-groups are busy, both the (CA) and (CB) relays are operated. Should a call be received in either sub-group under these conditions, the corresponding (SA) or (SB) relay operates but neither the (STB) nor (STA) relay operates as the circuits to ground on the armatures of the (CA) and (CB) relays are open. When a call is received in the A or B sub-group while all selectors are busy, the message register in the start circuit operates through the make contacts of the (SA) relay to ground on the armature of the (CB) relay if the call is in sub-group A or through the make contacts of (SB) relay to ground on the armature of the (CA) relay if the call is in sub-group B. The message register thus indicates the number of calls which were originated while all the line finders were busy.

## 11. TESTING LINE FINDER SELECTORS

The testing equipment which is shown associated with the start circuit provides for the testing of any particular line finder selector at any time. The test line used with the test box circuit for making the test is the first or bottom line of the bottom bank in both the A and B sub-groups, the first line terminals, in both sub-groups being connected together. When the #184 plug shown on the line finder circuit is inserted in the test jack of the line finder under test, the ST and ST1 leads are connected together, and the circuit which supplied the battery to the ST lead through the (LF) relay in the line finder circuit



is transferred to lead Z, or if the automatic test circuit is used, the winding of the (LF) relay in the line finder circuit is connected through the test circuit to the start circuit over lead Z. When the plug of the test box cord is inserted in the test jack or the line finder is being tested by the automatic test circuit, the (A) relay operates from a resistance ground on the test jack or lead to automatic test circuit if relays (STA), (STB) and (AL) are normal, indicating that the start circuit is idle and that there are no calls waiting to be served; and also in the case of the automatic test circuit, provided the line finder is idle. The (A) relay operating locks to battery on its contact, opens the circuit over the TR lead, thereby preventing any other calls from starting, opens the battery supply lead to the (AL) relay thereby preventing this relay from operating on calls waiting to be served, and connects ground to the winding of the (B) relay which operates if both (STA) and (STB) relays are normal, indicating that the start circuit is ready to handle the test call. The (B) relay operating locks under control of the (A) relay, closes the test line through, thereby operating the (L) relay in the test line, opens the series path for locking up (TR) relays in all trip circuits beyond the first, in series with the (STA) relay, thereby preventing a call from being started in a succeeding trip circuit after the start circuit is free and before the test circuit has had time to start the line finder under test, operates the (C) and (Cl) relays and connects battery to the winding of the (D) relay.

If the automatic test circuit has found the line finder busy the circuit through the (A) relay is left open, the (A) relay does not operate, and the test call is blocked until the line finder becomes idle. The (C) relay operated (a) opens the circuit through the (SA) relay preventing this relay from operating and starting a line finder in the B group in case all the line finders in the A group become busy while the test call is going through, (b) opens the normal ST lead, (c) opens the circuit through the (STB) relay, and (d) opens the operating circuit of the (AL) relay. The (Cl) relay operated (a) closes the circuit over the TR lead from battery on the normally closed contacts of the (STA) and (STB) relays, (b) connects the K lead of sub-group A with the K lead of sub-group B thereby connecting the K commutator segments of all the selectors of both sub-groups together, (c) connects the Y lead of sub-group A with the Y lead of sub-group B so that the (GA) relay will be operated by a selector in either sub-group and (d) connects lead Z through to the (STA) relay in the start circuit. When the (L) relay in the test line operates, the trip circuit functions and connects ground through the (TR) relay in the trip circuit over lead TR, make contact of (Cl) relay, break contacts of (STA) and (STB) relays to battery, operating the (TR) relay in the



trip circuit. The above (TR) relay locks over lead I, break contacts of (CA) and (SB) relays to battery thru the winding of the (STA) relay in parallel with the 1000 ohm resistance, operating the (STA) relay. The (STA) relay operated short-circuits the 500 ohm winding of the (CA) relay, connects ground to lead K, operates the (ST) relay, and closes a circuit through the make contacts of the (C1) relay over lead Z to battery through the (LF) relay in the line finder circuit. The (ST) relay operating, removes the short circuit from the (CL1) relay, which operates in series with the (TR) and (STA) relays and connects ground to the (STA) relay contacts operating the (D) relay, and also the (LF) relay in the line finder circuit over lead Z, thereby causing the line finder to start hunting for the calling line. The (D) relay operated locks to ground on the armature of the (A) relay, and prepares a circuit for operating the (E) relay on the release of the (CL1) relay. When the (CL1) relay releases after the line finder has passed the tripping zone, the (E) relay operates from the ground thru the back contacts of the (CL1) and (CL2) relays, make contacts of the (D) relay to battery through the break contact and winding of the (E) relay. The (E) relay operated locks to ground on the armature of the (A) relay, releases the (C) and (C1) relays, closes the series path for locking up the (TR) relays in the trip circuits beyond the first, which was opened by the (B) relay, closes the circuit from battery on the contacts of the (STA) and (STB) relays which was opened by the operation of the (A) relay and later closed by the operation of the (C1) relay through to the TR lead, and closes battery to the (AL) relay which was removed by the operation of the (A) relay. This leaves the start circuit prepared to handle regular calls.

The trip circuit in which the test line is located is normally arranged to serve class No. 1 subscribers. To check the operation of the marginal relay in the district which gives the indication for class No. 2, the resistance ground put on the S lead by the test circuit is replaced by a direct ground. This ground operates the (A1) relay in multiple with the (A) relay. The (A1) relay locks under control of the (E) relay, transfers the CL1 lead from the trip circuits, to the (CL2) relay and closes a locking circuit for the (C) relay, preventing this relay from releasing until the (A1) relay has released. The (CL2) relay operates instead of the (CL1) on the operation of the (ST) relay. Relay (CL2) in turn operates relays (CL3) and (CL4), grounding the (STA) relay contacts to start the line finder and also connecting low resistance battery to the Y lead to operate the marginal relay in the district for giving the class No. 2 indication. The operation of the (D) relay, in addition to its other functions, opens the operating path of the (A1) relay, preventing this relay from reoperating from ground in the test circuit when re-



lay (C) releases, and thereby preventing chance of wrong class indication.

When the plug of the test box cord is removed from the jack, or the automatic test circuit has been restored to normal, the (A) relay is released, releasing the (B), (D) and (E) relays and restoring the testing equipment to normal.

#### 12. SUB GROUP A LINE FINDERS ONLY EQUIPPED

When only sub-group A line finders are equipped, J wiring is omitted and K wiring furnished, and the operation of relay (SA) when a call comes in with all A line finders busy and relay (CA) operated, operates the message register. Also relay (STB) is prevented from operating under this condition by the omission of J wiring.

#### 13. SUB-GROUP B LINE FINDERS ONLY EQUIPPED

When only sub-group B line finders are equipped, H wiring is omitted and M wiring furnished, and the operation of relay (SB) when a call comes in with all B line finders busy and relay (CB) operated, operates the message register. Also relay (STA) is prevented from operating under this condition by the omission of H wiring.

#### 14. PREVENTION OF WRONG CLASS INDICATION

Should the (CL3) or (CL4) relay (relays giving the second class indication) be falsely operated, the TR lead is opened through the back contacts of the (CL3) or (CL4) relay, thereby preventing calls from being started and the (KF) relay is operated by ground from the (CL3) or (CL4) relay front contacts, through interrupter contacts I, III and V. After two seconds, relay (KA) operates through interrupter contact VI, and contacts of (KF) relay. Relay (KA) locks and operates an alarm, as covered in paragraph 8.

Should contacts 1 and 2T or 3 and 4B of (CL3) or (CL4) relay become crossed ground from the district over the Y lead when the (LF) relay in the line finder operates, causes the (KA) relay to operate and lock and operate an alarm, as covered in paragraph 8.

Should the (A1) relay remain operated after being operated by the test circuit, for testing the marginal relay in the district for class No. 2 indication, the (C) relay is held operated, preventing any regular calls from being started. If a call comes in, the (STA) relay will remain operated, operating the alarm as covered in paragraph 8.





Should contacts 1 and 2B of the (A1) relay become crossed, thereby causing the operation of both (CL1) and (CL2) relays on calls originated by either class of subscriber, the circuit for operating the (CL3) and (CL4) relays and giving the indication for class No. 2 subscriber is opened by the operation of the (CL1) relay. Also the (KA) relay is operated and locked on ground through front contacts of (CL1) and (CL2) relays in series, operating the alarm.

#### 15. PEG COUNT REGISTERS - (FIG. 2)

When Fig. 2 is furnished, relay (CL1) operating on a call from a class 1 subscriber, operates relay (PC1), which in turn operates the peg count register for class 1. Similarly, relay (CL3) operating on a call from a class 2 subscriber, operates relay (PC3), which in turn operates the peg count register for class 2.

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