

CIRCUIT DESCRIPTION
SYSTEMS DEVELOPMENT DEPARTMENT
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PANEL SYSTEM
INCOMING FROM MANUAL KEY INDICATOR SYSTEM
WITH 4 PARTY SEMI-SELECTIVE RINGING

CHANGES

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

- C.1 The operate requirements of the 114 KA relay were changed to add new operate and readjust requirements for 1500 ohm loops on subscriber lines as follows: Operate test from .026 to .025 ampere and operate readjust from .025 to .024 ampere.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 332

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FJS) YF

PANEL SYSTEM
INCOMING FROM MANUAL KEY INDICATOR SYSTEM
WITH 4 PARTY SEMI-SELECTIVE RINGING

CHANGES

B. CHANGES IN APPARATUS

B.1 Added

11A Res. lamp
114KA (R1) relay

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

C.1 Adjustments added for the (S) and (S1) relays to care for
1500 ohm subscribers line loops.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 "E" wiring was part of the main figure and "F" wiring and
apparatus and notes 12 and 13 added.

D.2 Note 3 superseded by note 14.

D.3 Note 15 and 114KA relay added.

D.4 In C.D. the working limits paragraph 2.3 should read as
follows:

2.3 The external circuit loop resistance for supervision
toward the called subscriber shall not exceed 750
ohms when the talking battery is 24 volts. The line
leak resistance shall not be less than 10,000 ohms.

D.5 In C.D. add a paragraph 2.4 to the working limits as
follows:

2.4 The external circuit loop resistance for supervision
toward the called subscriber shall not exceed 1500
ohms when the talking battery is 48 volts and the
line leak is not less than 10,000 ohms.

All other headings, no change.

PANEL SYSTEM
INCOMING FROM MANUAL KEY INDICATOR SYSTEM
WITH 4 PARTY SEMI-SELECTIVE RINGING

CHANGES

A. CHANGED AND ADDED FUNCTIONS

- A.1 The circuit is changed to provide for advance of the sequence switch from position 7 should the connecting final ring conductor be open.

B. CHANGES IN APPARATUS

- B.1 Superseded Superseded By
Seq. switch D-81035 D-96980

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Cam SS3-K is changed to provide a closure in position 7 to insure advance of the sequence switch from this position should the connecting final ring conductor be open.
- D.2 Note 11 is added to provide a record of the change.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used in establishing connections on calls from key indicator manual offices to panel machine switching offices.

2. WORKING LIMITS

- 2.1 The external circuit loop for selections shall not exceed 1550 ohms and shall not include more than 12 miles of cable. The trunk conductor loop resistance shall be compensated to 900 ohms minimum.
- 2.2 The external circuit loop resistance for supervision toward the calling subscriber shall not exceed 1400

ohms and the trunk leak resistance shall not be less than 30,000 ohms.

- 2.3 The external circuit loop resistance for supervision toward the calling subscriber shall not exceed 750 ohms when the operate test requirement for the B1 relay is .021 ampere and shall not exceed 900 ohms when the operate test requirement for the B1 relay is .019 ampere. In either case the line leak resistance shall not be less than 10,000 ohms.

OPERATION

3. FUNCTIONS

- 3.01 Recognizes seizure.
- 3.02 Makes brush selection.
- 3.03 Trips the selected brush.
- 3.04 Makes group selection.
- 3.05 Selects and centers the multiple brushes on, the terminals of the first idle trunk.
- 3.06 Grounds the sleeve terminal of the selected trunk as soon as it is seized and maintains a ground on the sleeve terminal until the incoming is released by the key indicator operator.
- 3.07 Closes the fundamental circuit for, and during, final selections.
- 3.08 Recognizes the completion of final selections and signals the sender that all selections have been completed.
- 3.09 Recognizes trunk closure from the manual operator's cord circuit.
- 3.10 Closes the ringing circuit at the proper time for signalling the called station with the correct ringing code.
- 3.11 Transmits ringing induction to the calling subscriber while the ringing circuit is closed.
- 3.12 Opens the ringing circuit when the receiver is removed from the switchhook at the called station.
- 3.13 Furnishes talking battery to the called station, as soon as the ringing circuit is opened, and until the connection is released.

- 3.14 Signals the operator when the receiver is removed from the switchhook at the called station.
- 3.15 Signals the operator when the receiver is replaced on the switchhook at the called station.
- 3.16 Furnishes repeating coil and condenser transmission during the time the calling and called stations are connected.
- 3.17 Returns the elevator to normal, resets the brushes, and advances the switch to normal when released by the manual operator.
- 3.18 Registers each advance of the switch from normal.
- 3.19 If all of the trunks in the selected group are busy when the selector hunts for an idle trunk, the elevator stops on the top set of terminals in the group (known as the overflow terminals) and functions as follows: (a) Signals the sender that an overflow condition exists, (b) recognizes trunk closure, (c) registers the overflow condition, (d) signals the operator that an overflow condition exists, and (e) returns to normal when released by the manual operator.
- 3.20 When the elevator travels to the top of the frame on a trouble condition (tell-tale) the circuit functions as follows: (a) Releases the UP magnet, (b) signals the sender as on an overflow condition, (c) recognizes trunk closure, (d) signals the operator as on an overflow condition, and (e) returns to normal when released by the operator.
- 3.21 Provides fuse protection against excessive current.
- 3.22 Returns to normal if the switch is moved off normal manually.
- 3.23 Recognizes a wipe-out condition as soon as the switch enters the ringing position, opens the ringing circuit, and returns to normal.

4. CONNECTING CIRCUITS

This circuit functions with:

- 4.1 Manual cords equipped with key indicator apparatus including an associated sender.
- 4.2 Standard final selector circuits.

4.3 Vacant incoming mult. intercepting trunk circuits.

DETAILED DESCRIPTION

5. SEIZURE

When the trunk to an incoming selector is seized by a key indicator link circuit, and the associated sender closes the fundamental circuit for incoming brush selection, the incoming (L) and sender (STP) relays operate. The (L) relay, operated locks in the fundamental circuit and advances the switch to position 2.

6. BRUSH SELECTION

In position 2 the (L) relay holds through its make contact, the (A) commutator is connected to the tip side of the fundamental circuit, and the up magnet is energized. During the upward travel of the elevator the (A) commutator causes the operation of the sender counting relays by alternately connecting and removing ground from the tip side of the incoming trunk. When the sender is satisfied it opens the fundamental circuit releasing the incoming (L) relay. The (L) relay released releases the up magnet and advances the switch to position 3. The TRIP magnet is energized in positions 3/4.

7. GROUP SELECTION

As soon as the sender closes the fundamental circuit for group selection the (L) relay reoperates advancing the switch to position 4. In position 4 the (L) relay holds, the (B) commutator is connected to the tip side of the fundamental circuit, and the up magnet is again energized. The selected multiple brush is tripped as the elevator moves upward in position 4. When the (B) commutator has satisfied the sender for group selection the sender opens the fundamental circuit releasing the incoming (L) relay. The (L) relay released releases the up magnet and advances the switch to position 5.

8. TRUNK HUNTING

In position 5 the (L) relay operates through its secondary winding and advances the switch to position 6. If the first trunk in the selected group is idle the (L) relay releases when the switch leaves position 5 1/4. The trunk is made busy by ground through the back contact of the (L) relay and the switch advances to position 7. If the first trunk in the group is busy the (L) relay holds through its primary winding to ground on the sleeve terminal and in position 6 the up

magnet is operated and the elevator moves upward. The (L) relay is held operated between terminals by ground on the (C) commutator. When an idle trunk is found the (L) relay releases placing a busy condition on the sleeve, releasing the up magnet and advancing the switch to position 7. Busy ground is connected directly to the sleeve terminal of the selected trunk in positions $6 \frac{3}{4}$ to $16 \frac{1}{4}$.

9. The adjustment of the (C) commutator brush with relation to the tripped sleeve multiple brush is such that it does not break contact with the (C) commutator segment until slightly after the holding-circuit through the inner winding of the (L) relay is opened by the sleeve brush leaving the busy terminal and making contact with the sleeve terminal on the idle trunk. The up magnet therefore, remains operated and the selector continues to travel upward until the brushes are carried slightly above the center of the trunk terminals allowing the locking pawl to engage the rack attached to the brush support rod.

10. SELECTION BEYOND AND INCOMING ADVANCE

The (L) relay operates in position 7 advancing the switch to position 8. The (L) relay locks over the ring side of the selected trunk to ground in the final until all selections are completed. In position 8 the fundamental circuit is closed through to the final. When selections have been completed the final removes ground from the ring side of the trunk releasing the (L) relay. The (L) relay released, advances the switch to position 9. In position 9 the (L) relay is connected to the ring side and ground is connected to the tip side of the fundamental circuit and when the circuit is closed by the sender, the incoming (L) and the sender (STP) and (OFL) relays operate. The (L) relay operated advances the switch to position 10. The (L) relay releases when the switch advances.

11. TRUNK CLOSURE

With the sequence switch in position 10 the (A) relay is connected to the trunk, awaiting closure from the manual operator's cord circuit. With the plug of the calling cord inserted in the outgoing trunk jack, battery and ground in the cord circuit operates the incoming (A) relay through its windings in series aiding. The (A) relay, operated, operates the (CS-1) relay in turn operating the (L) relay. The (L) relay, operated, operates the (R-2) relay which locks under control of the (L) relay, and advances the switch to position 11. The (L) relay operated also operates the (R2) relay. The (R2) relay operated locks under con-

trol of the (L) relay and advances the switch to position 11. The (A) cam advances the switch to position 13. After the switch advances from position 10 1/2 the (L) relay holds under control of the (A) relay.

12. RINGING

Four-party lines which are served by final trunks which terminate in the 0 and 2 groups on the incoming frames require a one-ring code, and lines which are served by final trunks which terminate in the 1 and 3 groups on the incoming frame require a two-ring code. The one-ring code ringing circuit is closed in position 13 and the two-ring code ringing circuit is closed in position 15. The PU interrupter and the (P) commutator control the closing of the two-ring code ringing circuit in such a manner that both rings of the two-ring code are always given. The two parties which are signalled by the same ringing code are selected by reversing the leads from the final multiple to the line at the distributing frame.

13. If the selected trunk is in either the 0 or 2 group the (R2) relay holds in position 13 and the one-ring code ringing circuit is closed. If the selected trunk is in either the 1 or 3 group the (R2) relay is short-circuited by the (P) commutator when the switch enters position 11, causing the release of the (R2) relay. The (P) commutator also advances the switch from position 13 to position 14. The (R2) relay reoperates in position 14 under control of the (PU) interrupter advancing the switch to position 15 in which the two-ring code circuit is closed. A .02 mf condenser is connected from the ringing lead to one side of the repeating coil thus transmitting ringing induction to the calling subscriber.

14. TALKING

When the receiver is removed from the switchhook at the called station the (R 1) relay operates releasing the (R2) relay. The (R2) relay, released opens the ringing circuit and connects talking battery to the line thus operating the (S) relay. The (S) relay, operated, short circuits the 12,000 ohm winding of the (A) relay, thereby causing operation of the calling cord supervisory relay in the manual office. If X wiring is used the (S-1) relay also operates, aiding in short-circuiting the 12,000 ohm winding of the (A) relay.

15. DISCONNECTION

When the receiver is replaced on the switchhook at the called station the (S) and (S-1) relays release removing the short circuit from the 12,000 ohm winding of the (A) relay and therefore causing release of the calling cord supervisory relay in the manual office. When the plug of the calling cord is removed from the outgoing trunk jack, the (A) relay releases, in turn releasing the (CS-1) relay. The (CS-1) relay, released, releases the (L) relay advancing the switch to position 18, in which position the DOWN magnet is operated and the elevator is returned to normal. The brushes are reset when the elevator reaches normal and ground on the Y commutator advances the switch to normal.

16. OVERFLOW

If all of the trunks in the selected group are busy when the selector is hunting in position 6, the elevator stops on the top set of terminals in the group (known as the overflow terminals). The sleeve overflow terminal is never connected to ground and the (L) relay releases advancing the switch to position 7. Ground on the Z commutator advances the switch to position 9, in which position the incoming (L) and sender (STP) and (OFL) relays are operated as described for "Incoming Advance". The sender has not completed selections and recognizes this as an overflow condition, returning to normal. The (L) relay, operated, advances the switch to position 10. Trunk closure from the cord circuit in the manual office operates the (A), (CS-1), (L) and (R2) relays advancing the switch to position 11. The A cam advances the switch to position 13. Ground on the Z commutator advances the switch to position 14 if Z wiring is used. Ground on the armature of the operated (R2) relay advances the switch to position 15 and (with Z wiring) ground on the Z commutator advances the switch to position 16. In position 16 interrupter ground operates and releases the (S) relay. Operation and release of the (S) relay alternately short circuits, and removes the short circuit from the 1200 ohm winding of the (A) relay thereby causing alternate operation and release of the calling cord supervisory relay in the manual office. If Z wiring is not furnished the switch does not advance from position 13. In either case when the operator removes the plug from the outgoing trunk jack the (A), (CS-1) and (L) relays release advancing the switch to position 18. Return to normal is completed as described for a completed call. While the switch is advancing through

positions 13 1/2 to 15 ground is connected to the tip overflow terminal operating the overflow register which is connected thereto.

17. TELL-TALE (T wiring)

If the selector is driven to the top of the frame (tell-tale) in any of the up-drive positions ground on the X commutator advances the switch to position 9. The switch is advanced from position 9 to position 13 as described for "Overflow" condition. Ground on the X commutator advances the switch to position 16. Return to normal is completed as on "Overflow" condition.

18. TELL-TALE (S wiring)

If the selector goes to tell-tale in any of the up-drive positions ground on the X commutator and on the make contact of the (L) relay advances the switch to position 7, awaiting final. The switch stays in position 7 until released manually.

19. SELECTOR GROUP REGISTER

Each time the switch advances through position 13 3/4 ground is connected to the lead "to Selector Group Register", operating the register.

20. BUSY FLASH FROM FINAL (X wiring)

When X wiring is used and the final selects a busy line interrupted battery over the tip from the final alternately operates and releases the (S-1) relay thereby alternately short-circuiting and removing the short circuit from the 12,000 ohm winding of the (A) relay. The calling cord supervisory lamp is thus caused to flash and at the same time a busy tone is inductively transmitted from the final over the tip through the repeating coil to the manual operator and calling subscriber.

21. OPEN FINAL RING CONDUCTOR

Should the circuit be installed in accordance with issue 13 or subsequent issues and should select a final circuit having an open ring conductor, a ground closure through cam K in position 7 is provided to operate the (L) relay and thereby advance the switch to position 8. In this position the (L) relay would release due to the open ring conductor and would advance the switch to position 9. The (L) relay and sender (OFL) and (STP) relays will operate, cause advance of the incoming selector switch to position 10 and cause the sender

to dismiss as result of the reversed battery condition occurring before selections are completed. Trunk closure in position 10 will cause this switch to advance to the proper talking position as on a regular call previously described. The switch will remain in the talking position until the originating operator disconnects when the circuit will return to normal as described for "Disconnection".

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