

COMMON SYSTEMS
AUXILIARY LINE CIRCUIT
FOR TEN PARTY TERMINAL PER STATION
OR TEN PARTY JACK PER STATION
CODE RINGING LINES
FOR USE WITH TRUNKS
OTHER THAN STEP BY STEP CALL INDICATOR
FOR PANEL OFFICE OR
SWITCHBOARD NO. 1, 1C, 1D OR 11

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 On sheet -011 "A&M Only" is added to Fig. B.
- D.2 On sheet -013 Figures IK, IN, CK, 2K and 2M are rated "Mfr. Disc."
- D.3 Fig. 2R is rated "A.T.&T. Co. Prov."
- D.4 Figs. 51 and 52 are added.
- D.5 Lead designations are added to leads to Fig. IK, IL, & IM.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340

LBS)
FJS)BF

COMMON SYSTEMS
AUXILIARY LINE CIRCUIT
FOR 10 PARTY TERMINAL PER STATION
OR 10 PARTY JACK PER STATION
CODE RINGING LINES
FOR USE WITH TRUNKS
OTHER THAN STEP-BY-STEP CALL INDICATOR
FOR PANEL OFFICES OR
SWITCHBOARD NO. 1, 1C, 1D OR 11

CHANGES

A. CHANGED AND ADDED FUNCTIONS

- A.1 Cross-connections are added for the No. 1 Switchboard.
- A.2 The (S) relay is changed to a slow operate relay to prevent it from operating falsely from line surges when the circuit is seized in setting up a terminating call.

B. CHANGES IN APPARATUS

- B.1 The (S) relay is changed from a U160 to a U172.

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

- C.1 The armature travel for the (CT) relay U693 is changed from 33 to 53.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The (S) relay U160, formerly shown in figure 1, is shown in figure D, and the (S) relay U172, figure E, is added. Note 105 is added to specify that figure D is rated "MFR. DISC.", replaced by figure E, which is standard.

All other headings, No Change.

DEPT. 332

BELL TELEPHONE LABORATORIES, INC.

ACP)
FJS)C

COMMON SYSTEMS
AUXILIARY LINE CIRCUIT
FOR 10 PARTY TERMINAL PER STATION
OR 10 PARTY JACK PER STATION
CODE RINGING LINES
FOR USE WITH TRUNKS
OTHER THAN STEP-BY-STEP CALL INDICATOR
FOR PANEL OFFICES OR
SWITCHBOARD NO. 1, 1C, 1D OR 11

CHANGES

A. CHANGED AND ADDED FUNCTIONS

- A.1 Circuit is arranged to give supervision for originating calls when ringing start is delayed.
- A.2 Circuit is arranged to prevent the subscriber's line from being unbalanced by the ringing start arrangement.

B. CHANGES IN APPARATUS

B.1	Removed	Replaced By	Added
(P1) to (P10) relay	U554	U694	
(TR) "	U288	U132	
(CT) "	U332	U693	
(LR) "	U179	U586	
(PU) "	U156		
(RS) "	U564		
(RT) "			U600
(S) "			U160
(L1) "			J20
(C) Cond.			LMF

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The wiring of Figure 1 is completely revised, and a make contact is added on the (P1) to (P10) relays in Figure 2 to close the (S) relay operating circuit.
- D.2 Cross-connections are changed.

All other headings under Changes, No Change.

1. PURPOSE OF CIRCUIT

- 1.1 To provide means for ringing the proper station of a ten party, terminal per station or jack per station code ringing line.

2. WORKING LIMITS

- 2.1 Maximum external circuit loop 1500 ohms.
- 2.2 Minimum insulation resistance 10,000 ohms.
- 2.3 Maximum station capacity of either side of subscriber line to ground 2.5 MF.

3. FUNCTIONS

- 3.01 To identify the called station.
- X 3.02 To provide a busy indication to all associated final station terminals or subscriber multiple jacks in manual offices, while the subscriber's line is in use.
- 3.03 To recognize when ringing is connected to the ring side of the line.
- 3.04 To trip machine ringing when supplied to the ring side of the line.
- 3.05 To establish the polarity of the ringing current supply to the line for ringing the called station.
- 3.06 To recognize when the ringing interrupter and alarm circuit is normal or is starting a ringing cycle, so that partial code signaling on the initial cycle will not be given.
- X 3.07 To furnish a start signal to the ringing interrupter and alarm circuit after the tripping relay arrangement is set.
- 3.08 To supply code ringing signals, under joint control of the party identification relay and the ringing interrupter and alarm circuit.
- X 3.09 To supply audible code ringing signals for the calling party.
- 3.10 To trip on either silent or ringing interval when the called party answers.
- 3.11 To provide means for operating an alarm, associated with the ringing interrupter and alarm circuit, if the pickup, start, or code lead is open.
- 3.12 To restore to normal when disconnection takes place.

- 3.13 To avoid any interference with dialing or conversation on originating calls.
 - 3.14 To provide subscriber supervision when ringing start is delayed.
 - 3.15 To provide for reringing the called subscriber.
4. CONNECTING CIRCUITS
- 4.1 Ringing Interrupter and Alarm Circuit.
 - 4.2 Panel B.C.O. Final Selector Circuits.
 - 4.3 Panel B.C.O. Subscriber Line Circuits.
 - 4.4 Panel G.C.O. Final Selector Circuits.
 - 4.5 Panel G.C.O. Subscribers Line Circuits.
 - 4.6 Manual Swbds. No. 1, 1D, 1C and 11, Subscribers Cord Circuits.
 - 4.7 Manual Swbds. No. 1, 1D, 1C and 11, Trunk Circuits other than the Step-by-Step Call Indicator.
 - 4.8 Manual Swbds. No. 1, 1D, 1C and 11, Subscribers Line Circuits.

DESCRIPTION OF OPERATION

5. SEIZURE

When this circuit is seized by a final selector (panel office operation), or by an operator inserting a plug in one of the associated multiple jacks (manual office operation), ~~ground or~~ battery is connected to lead "S". This ~~ground or~~ battery operates relay (SL), Figure A, (B), or C, depending on the type of office, and the cut-off relay in the associated subscribers line circuit (subscribers line switch circuit in some G.C.O. relay panel offices), and makes the circuit test busy for the duration of the call. The operation of relay (SL), operates relay (SL1) which connects battery to the (P) relays of Figure 2, and also furnishes ground for subscriber supervision to be described later.

6. PARTY IDENTIFICATION

When the incoming selector circuit advances to the ringing position, or in manual switchboards when the trunk or cord closes, through for ringing, it connects ground to the tip and ringing current to the ring. Ground on the tip conductor operates relay (P) which locks under control of relay (SL1), disconnects its winding from the tip conductor to avoid interference with conversation, connects ground to

lead "N" of Figure 1 if the associated station requires ringing current to be supplied to the ring of the line, or connects ground to lead "RV" of Figure 1 if the associated station requires ringing current to be supplied to the tip of the line, extends the tip and ring connection from the final, or subscribers multiple in manual offices, to Figure 1, and connects the associated "C" lead to relay (CD). Ground on lead "RV" operates relay (RV) which prepares the circuit for supplying ringing current to the tip of the line and supplies off normal ground for the code ringing and tripping arrangement. Thus, the operation of relay (P) identifies the called station and supplies the ringing control circuit with the necessary signals for connecting the proper code ringing to the subscriber's line.

The connection of the "C" leads from the interrupter circuit to the (CD) relay is through series contacts on all the (P) relays to prevent the possibility of two "C" leads being connected together in case of a double connection to the line circuit.

7. TRIPPING OF RINGING IN PANEL INCOMING SELECTOR OR MANUAL TRUNK

In order to supply the proper audible ringing signal to the calling subscriber and to provide the talking circuit immediately after the called party answers, it is necessary to trip the ringing current of the incoming selector, or the manual trunk, before starting code ringing to the called station. When ringing current is connected to the ring lead, relay (L) operates, and connects the winding of the (L1) relay to the ring lead. The (L1) relay is operated by the ringing current, operating relay (TR) which operates relay (RT) and holds open the operating circuits for relays (CT) and (LR) to prevent start of code ringing until relay (TR) releases indicating that the ringing current from the incoming trunk has been tripped or that the operator has ceased ringing in the case of connection with a manual ringing cord. Relay (RT) locks to ground supplied by either relay (RV) or the (P) relay of the called station, prepares a path for connecting the primary winding of the (CT) relay to the "PU" lead when the (TR) relay releases, connects ground to lead "TA", and connects ground to resistance (A) to trip machine ringing. Relays (L) and (L1) remain operated as long as ringing current is furnished by the incoming selector circuit, manual trunk, or cord circuit even when shunted by resistance (A), but release during the silent period of the ringing cycle and when machine ringing is tripped or when manual ringing ceases. In either case, release of relay (L1) releases relay (TR) which removes the tripping condition to avoid charging before the called party answers, and completes the path for connecting the primary winding of the (CT) relay to the "PU" lead of the ringing interrupter and alarm circuit. Occasionally, it will be possible for relay (TR) to operate

near the end of the machine ringing interval operating relay (RT) but failing to trip machine ringing because it is released by the cessation of ringing current before ringing has been tripped. In this case, relay (TR) may operate during the code ringing interval and trip machine ringing while the called station is being signalled. This might distort the party line ringing on the initial cycle, but thereafter the proper code ringing signal will be furnished.

8. CODE RINGING

If the ringing interrupter and alarm circuit is in position to start a ringing cycle, when the (TR) relay releases, ground on lead "PU" will operate relay (CT) which locks by its secondary winding, disconnects the (S) relay from the subscribers line and closes the tip and ring conductors through from the line to the trunk or cord circuit, and completes a circuit for operating the (LR) relay. If the ringing interrupter and alarm circuit is off normal at the time the (TR) relay releases, the operation of relay (CT) will wait for the interrupter circuit to start its next ringing cycle at which time it grounds the pick-up lead "PU". Relay (LR) locks by its secondary winding under control of the ringing trip relay (R), connects ground to the "ST" lead to start the ringing interrupter and alarm circuit for furnishing the ringing code interruptions, connects battery to the winding of the code interrupter relay (CD), and transfers the tip and ring leads to the ringing supply leads through the contacts of the polarity reversing relay (RV). At this point, the circuit waits for the ringing interrupter and alarm circuit to supply the code signaling pulses to the code lead (C1 to C5) of Figure 2. When this occurs, relay (CD) operates and releases on the interruptions which represent the code for ringing the called station. The first operation of relay (CD) releases relay (RT). This removes ground from lead "TA" as an indication that the "PU", "ST" and "C" leads are not open, and opens the operating circuit of the (LR) relay leaving it locked under control of the operation of the ringing trip relay (R). Each time relay (CD) operates, it connects audible ringing current through condenser (A) to the tip conductor of the calling subscriber's line and connects ringing current through the winding of relay (R) to the called line. Each time relay (CD) releases, it disconnects ringing from the calling line and from the called line, and connects battery to the winding of relay (R) so that code ringing may be tripped during the silent interval.

9. TRIPPING OF CODE RINGING

Ordinarily the (RT) relay releases when the (CD) relay operates by the first ringing code impulse as described in paragraph 8. However, if the receiver should be removed

from any station on the line immediately after the (LR) relay operates but before the (CD) operates, the (R) relay will operate by the silent interval battery and release first the (RT) relay and then the (LR) relay. The (RT) relay is locked under control of the (CD) relay to hold ground on the "TA" lead until the (CD) relay operates indicating that the ringing interrupter and alarm circuit is operating to supply the ringing code pulses, otherwise the grounded "TA" lead will start an alarm.

When the called station answers the (R) relay operates, releasing relay (LR), and relay (RT) if it is not already released, disconnects ground from the "ST" lead, removes battery from the winding of the (CD) relay, disconnects the tip and ring of the called line from the ringing supply and closes the tip and ring towards the trunk or cord circuit thereby establishing the circuit for talking.

10. RERING OF CALLED STATION

On an incoming toll call, it may be necessary for the toll operator to recall the called party. In this case, the toll operator will cause the toll trunk circuit to transmit ringing current, operating relays (L) and (Ll) which operates relay (TR). The operation of relay (TR), releases relay (CT) which opens the tip and ring leads thereby removing ringing current from the line, and operates the (RT) relay. The (RT) relay locks under control of the (CD) and (R) relays and prepares a path for reoperating the (CT) relay when the (TR) relay releases. The ringing current may momentarily actuate some of the station ringers of the ten party line before relay (CT) releases, but the reaction from this momentary ring should not be serious because ten party subscribers are accustomed to await a full code cycle to identify the called party before answering. When ringing current is disconnected by the toll operator, relay (Ll) releases, releasing relay (TR) which completes a path from the primary winding of the (CT) relay to the "PU" lead of the ringing interrupter and alarm circuit. The (CT), (LR), (CD), (R) and (RT) relays, then function as described in paragraphs 8 and 9, to supply code ringing to the called station until the called party answers.

11. DISCONNECTION

11.1 Panel Offices

When the calling party disconnects, the connection releases up to the final selector circuit, which releases immediately, if the called party has disconnected, or releases after a time interval if the called party has not disconnected. Release of the final selector removes ground from lead "S", releasing relay (SL) which releases all operated relays.

11.2 Manual Switchboards

When the calling party disconnects, the operator receives a signal and removes the plug from the line jack thereby disconnecting battery from the "S" lead, releasing relay (SL) which releases all operated relays.

12. DELAYED RINGING

In cases where connection is established to this circuit and the operator delays ringing, such as on delayed toll connections, the tip and ring conductors are open towards the operator at the (CT) relay and the (S) relay is connected to the subscriber line through back contacts on the (CT) relay to provide for supervision in case a subscriber originates a call during this time.

When the receiver is removed at any station on the line, the (S) relay operates in a circuit from ground over the tip and back over the ring to battery through the winding of the (S) relay. The (S) relay operates and in turn operates the (CT) relay which locks and then disconnects the (S) relay from the line, and closes through the tip and ring towards the operator thereby enabling the subscribers to obtain supervision. If the receiver is replaced at the sub. station, the (CT) relay remains operated until the toll operator rings whereafter the circuit functions as described in paragraph 10 for "Rering of called Subscriber."

13. NO-TEST CALLS - PANEL OFFICE

When an operator receives a request to determine whether a called line is busy, a "no-test" incoming selector circuit is used. This circuit does not supply ground to the tip conductor and therefore does not operate any (P) relay of Figure 2. In order to provide for monitoring by means of "no test" calls, an eleventh set of terminals per line is provided.

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