

DESCRIPTION, CIRCUITS
555 PBX SWITCHBOARD

1. GENERAL

1.01 This section describes the operation of the cord, operator's telephone, dial, central office trunk and station line circuits of the 555 PBX switchboards.

2. CIRCUIT DESCRIPTION

Station Line Circuit (Figure 5)

2.01a When the handset is removed from the station telephone: Battery (through the NL relay) will flow through the station lamp, the ring side of the station jack contacts through the line circuit and telephone, the tip jack contacts to ground, causing the station lamp to light. The buzzer operates from the contacts of the NL relay in the auxiliary signal circuit.

2.01b When the call is answered by use of the right or station cord, insertion of the plug in the station jack (1) opens the jack contacts furnishing battery and ground to the station loop and extinguishes the station lamp. The NL relay is released which cuts off the buzzer. (2) A pair of contacts in the station jack are operated and furnish ground to the sleeve of the cord for supervisory purposes. This circuit is described in Paragraph 2.04a. Operation of the talk and dial key connects the operator's telephone set to the station.

Trunk Circuit (Figure 3)

2.02a Ringing current over ring (or tip) side of line, (R or T) condenser and R (or T) thermistor, through the winding of the R relay to ground. The A varistor is a half-wave rectifier. It is arranged to pass 1/2 cycle of the ringing current. The other 1/2 cycle is blocked and passes through the winding of the R relay in a series of dc pulses, operating the relay.

2.02b R relay operated locks operated by battery from contact 4 of the socket and plug, the B resistance lamp, contacts of the trunk jack, 3000-ohm resistance, the 4-3 contacts of the R relay to contact 5 (ground) of the socket and plug. The trunk lamp will now light from battery through the NL relay in the auxiliary signal circuit, contact 6 of the socket and plug, contacts 1-2 of the R relay to contact 3 (ground) of the socket and plug. The buzzer will operate from the contacts of the

NL relay. When the trunk call is answered (Figure 3 or 9), the left or trunk-station cord is used. The plug of this cord when inserted in the trunk jack (1) opens the lock-up circuit (battery) to the R relay which releases, extinguishing the trunk lamp; (2) connects battery to the sleeve of the trunk jack for cord circuit functions. This is described in Paragraph 2.05. Operation of the talk and dial key connects the operator's telephone set to the trunk.

Trunk Circuit (Figure 9)

2.03a This circuit is arranged for loop ringing. Ringing current is applied over the ring side of line, T condenser and thermistor, 3100-ohm secondary winding of R relay to the tip side of the line. The thermistor and varistors act in the same manner as described in Paragraphs 2.02b and 2.03c.

2.03b R relay operated locks operated by a circuit from contact 6 (battery) of the socket and plug (through the NL relay), 880-ohm primary winding of the R relay, contacts 1-2 of the R relay, trunk jack contacts to contact 3 (ground) of the socket and plug. The trunk lamp will light and the buzzer will operate from contacts on the NL relay in the auxiliary signal circuit.

2.03c Thermistors are heat-controlled devices. Their normal or cold resistance is about 50,000 ohms, which prevents false operation of the R relay by dial pulsing or surges from the central office line equipment when the circuit is disconnected. As ringing current is applied, their resistance drops to between 2000 to 3000 ohms in about 1/2 second permitting ringing current to flow through them. The two thermistors are shunted by either a (early type) 400E varistor and a 4300-ohm resistor, or a (later type) 317A varistor. These serve to protect the thermistors from any large current surge on the line.

Cord Circuit, Station to Station (Figure 1)

2.04a This circuit is arranged so that talking battery and ground are not applied to the cord circuit until a station cord is plugged into a station jack. When a calling station is answered, the right plug of an idle pair of cords is used. Ground, from the sleeve of the station jack to the sleeve of the cord, contacts of the night and dial through key, contacts 2-1 bottom of the T relay

through the 2500-ohm winding of the S relay to battery operates the S relay. Relay S operated:

- (a) Splits the cord circuit.
- (b) Connects condensers A and B between the "station" and the "trunk-station" cords.
- (c) Connects talking battery and ground to the "station" cord through the RB battery feed coils.
- (d) Connects talking battery and ground to the "trunk-station" cord from the CS relay windings. Battery is furnished through the secondary winding of the (CS) relay, contacts 2-1 bottom of the S relay, contacts 5-6 of the talk and dial key and ringing key contacts to the ring of the "trunk and station" cord.

Ground is furnished from contacts 2-1 of the T relay, primary winding of the (CS) relay, contacts 2-1 top of the S relay, contacts 3-4 of the talk and dial key and ringing key to the tip of the "trunk and station" cord. The circuit is arranged so that the battery-ground feed from coils RB is reversed from the battery-ground feed of the CS relay at the A-B condensers. This is to improve transmission and suppress crosstalk.

2.04b Relay AS now operates in series with the ring side of the line and the station and telephone loop. The supervisory lamp of the "trunk-station" cord will light from battery on the lamp, contacts 1-2 bottom of the CS relay, contacts 1-A of the AS relay to ground of the station cord sleeve.

2.04c When the "station-trunk" cord is plugged into the called station jack, the ringing key is operated, which splits the cord while depressed and applies ringing current to the called station. When the station answers, the CS relay will operate opening the 1-2 bottom contacts extinguishing the supervisory lamp. When the stations disconnect, the supervisory lamps will both light, and the buzzer will operate indicating to the operator that the call is completed. The cord pair is taken down and the circuit restored to normal.

Cord Circuit, Station to Trunk

2.05a The station circuit is the same as for station-to-station operation up to the point described in Paragraph 2.04a(c).

2.05b When the "station-trunk" cord is plugged into a trunk jack, relay T operates from battery on the sleeve of the trunk jack, the contacts of night and dial through key, through

the winding of the T relay to ground. Relay T operated:

- (a) Releases relay S (contacts 1-2 bottom open) removing PBX battery and ground from the cord circuit.
- (b) Operates CS relay from battery on secondary winding, 430-ohm resistance, contacts 4-3 top (T relay), primary winding (CS) relay, contacts 1-A of the AS relay to station jack sleeve ground.

2.05c When the night and dial through key is operated, the station controls the central office equipment. The ringing bridge in the trunk circuit is the only PBX equipment connected to the station. A patch cord for night connections may be made up locally and used to connect not more than three stations to one trunk. The sleeve conductors are not used.

Through Supervision (Figure J)

2.06 Relay CS operated holds operated through its 3-4 contacts to ground on contacts 8-9 of the talk and dial key (station release does not release the CS relay), and the central office equipment will release. Trunk battery and ground are extended in series with the winding of the AS relay to the station, which may place another call,

Non-Through Supervision (Figure K)

2.07 When the station releases, the CS relay will release (under control of the AS relay contacts 1-A). The H bridge will be connected to the line and the central office equipment will not be released. When this option is used, the PBX operator must place all calls for the station.

Attendant's Telephone Circuit

2.08 Transmitter battery is furnished through the P retard coil 3-4 (200-ohm or 85-ohm) winding, contact 10 of the plug and socket, tip of jack A, operator set transmitter, tip of jack B, contact 9 of the plug and socket, 2-1 winding (85- or 200-ohm) winding of the P retard coil, BB-W dial contacts, (these contacts are protected by the C condenser and A resistance) to the 8-7 contacts of the operator talk and dial key to ground. Modulated current from the transmitter is impressed on the primary winding of the induction coil through condenser P. The secondary of the induction coil is connected through the S condenser which charges to the value of the cord circuit to which it is connected. The receiver circuit is connected from one side of the induction coil to the sleeve of jack A, the receiver, sleeve of jack B, 1-2 top contacts

of the talk and dial key, to the other side of the induction coil. The B varistor is bridged across the receiver to suppress any current surge which might occur.

Split Key Operation

2.09a The split key is usually used on an inward call and permits the operator to converse with the station but prevents the party calling in to hear the conversation. When the split key is operated the SP relay operated from battery through the winding of the relay, the 1-2 bottom contacts of the split key to the 7-8 contacts of the talk and dial key to ground. SP relay operated:

- (a) Short-circuits the trunk-station cord. The tip side of the cord is extended to the 1-2 top contacts of the split key, the 4-3 bottom contacts of the SP relay to the ring side of the line.
- (b) Furnishes talking battery and ground through the A retard coil windings to the station cord circuit and bridges it to the operator's telephone circuit permitting the station and operator to converse.

2.09b When the split key is released, the SP relay releases and the cord circuit is restored to normal. The station now is connected to the trunk cord as described in Paragraph 2.05.

Monitor Key Operation

2.10 The monitor key operated opens the primary winding of the induction coil in the operator's telephone circuit, making the transmitter inoperative. The receiver circuit continues to function in the usual manner.

Operator's Dial Circuit

2.11a The operator makes outward calls with the talk and dial key operated. When the dial is moved off-normal the BB-W contacts of the dial break and relay ON operates from battery, through the 4-3 winding of the P retard coil, the operator's transmitter, the 2-1 winding of the P retard coil, winding of the ON relay over the P lead to contacts 7 and 8 of the talk and dial key to ground. The Y-BK-R contacts close, short-circuiting the tip and ring of the trunk cord (LT-LR leads) and provide the minimum resistance possible for pulsing to the central office.

2.11b The ON relay operated:

- (a) Contacts 2 and 1 top shunt the operator's receiver to prevent clicks while dialing.
- (b) Contacts 4 and 3 top connect the B resistance, through the split key contacts, in series with the A condenser across the tip and ring (RT and RR leads) of the station cord.
- (c) Contacts 2 and 1 bottom extend the P lead ground to the SP relay winding to battery operating it.

2.11c The SP relay operated:

- (a) Locks operated from battery through the winding, contacts 7 and 8 top to the P lead ground.
- (b) Splits the trunk cord from the station cord.
- (c) Provides talking and signalling battery through the 5 and 6 bottom contacts, the 3-4 winding of the A retard coil to the ring side of the station cord (RR lead). Ground is provided through the 5 and 6 top contacts, the 1-2 winding of the A retard coil to the tip side of the station cord (RT leads).
- (d) Bridges the 3-4 winding of the B retard coil in series with the A condenser across the station cord and the operator telephone circuit.
- (e) When dialing is completed and the dial restores to normal, the ON relay winding is shunted by dial contacts BB and W and releases, removing the B resistance from the 3-4 winding of the B retard coil. Dial contacts BK and R break removing the shunt from the 1-2 winding of the B retard coil which is then connected across the tip and ring (LT-RT leads) of the trunk cord. The B retard windings then act as a repeat coil between the trunk and station with the operator's circuit bridged to them as previously described (d).

2.11d The station and operator may then converse with the called party. When the operator restores the talk and dial key, relay SP releases restoring the dial circuit to normal for another call. The cord circuit is now the same as described in Paragraph 2.05.

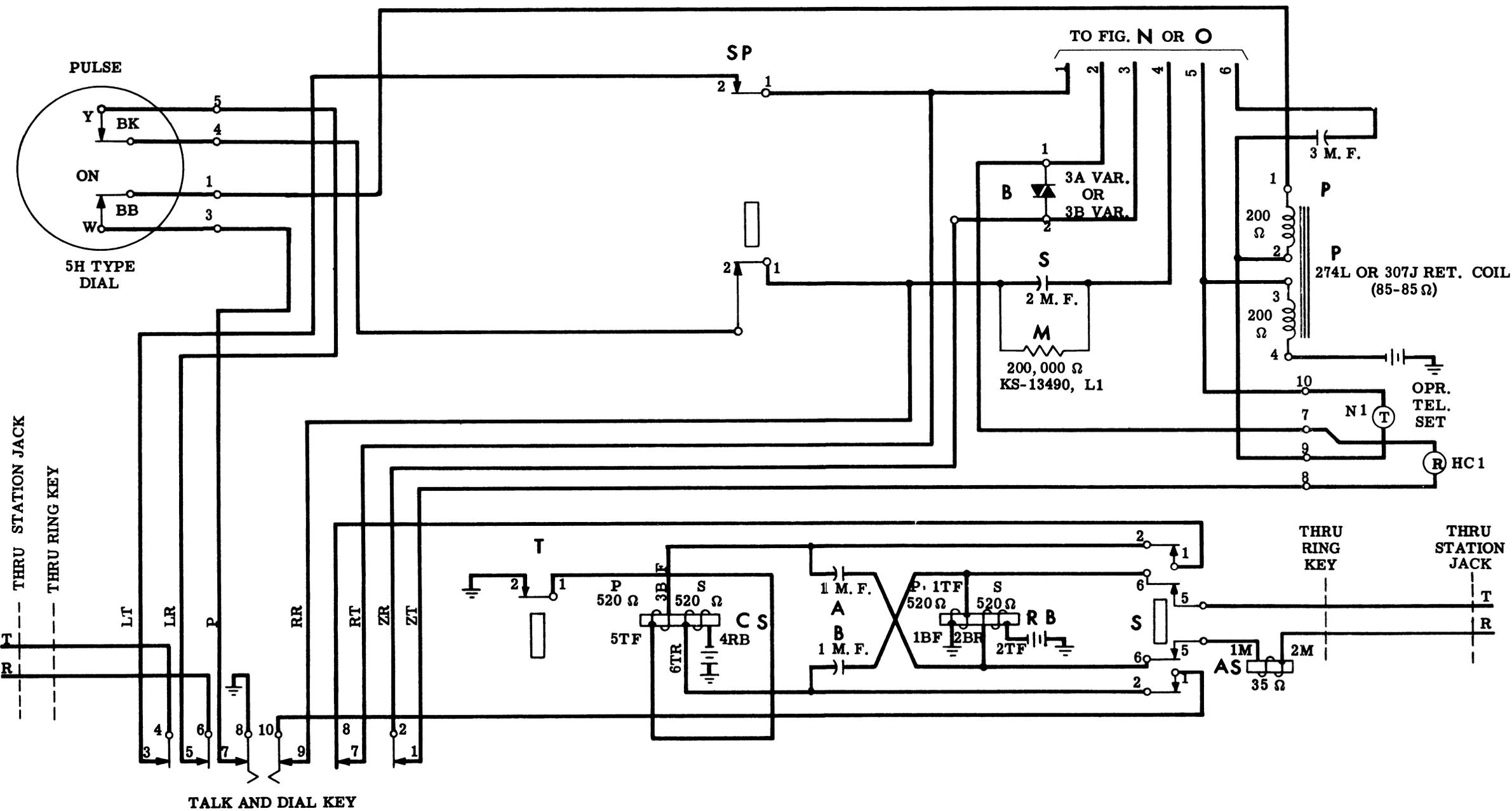
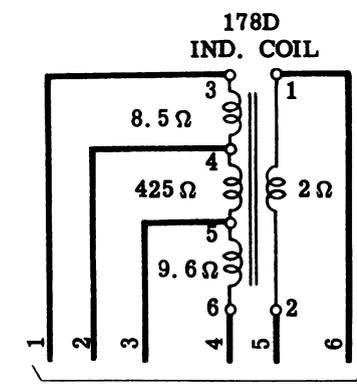
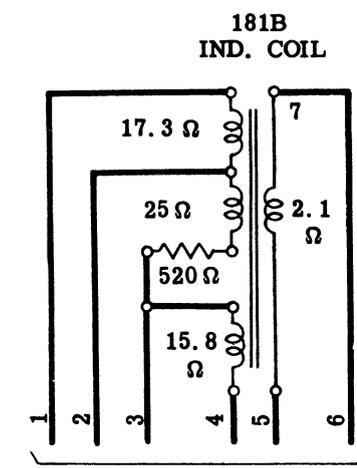


FIG. N



TO FIG. 2

FIG. O



TO FIG. 2

Exhibit 2. Circuit Diagram - Attendant's Telephone Circuit, Station to Station, Talking Condition.

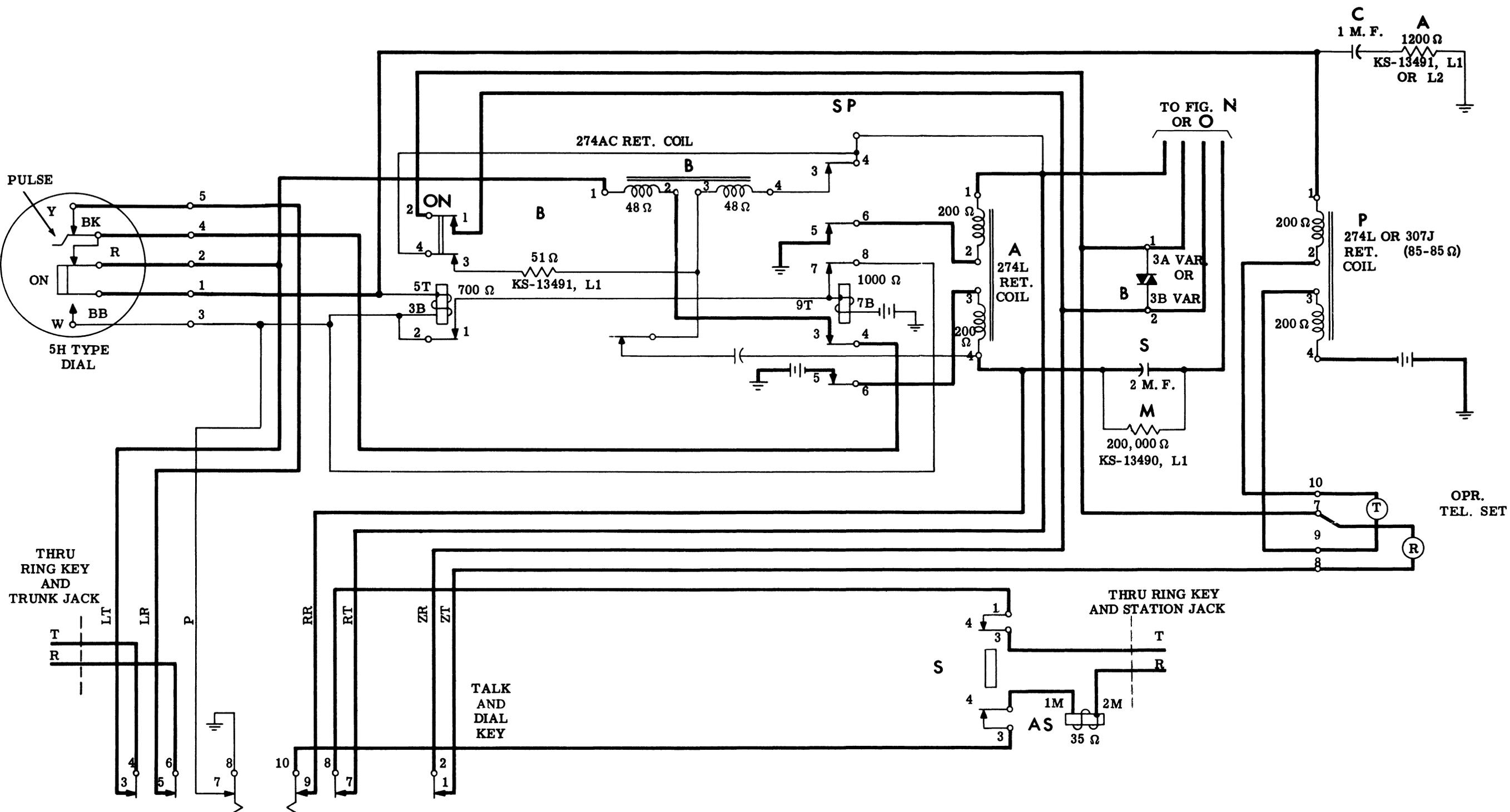


Exhibit 3. Circuit Diagram - Attendant's Telephone Circuit Station to Trunk, Dial Off Normal.

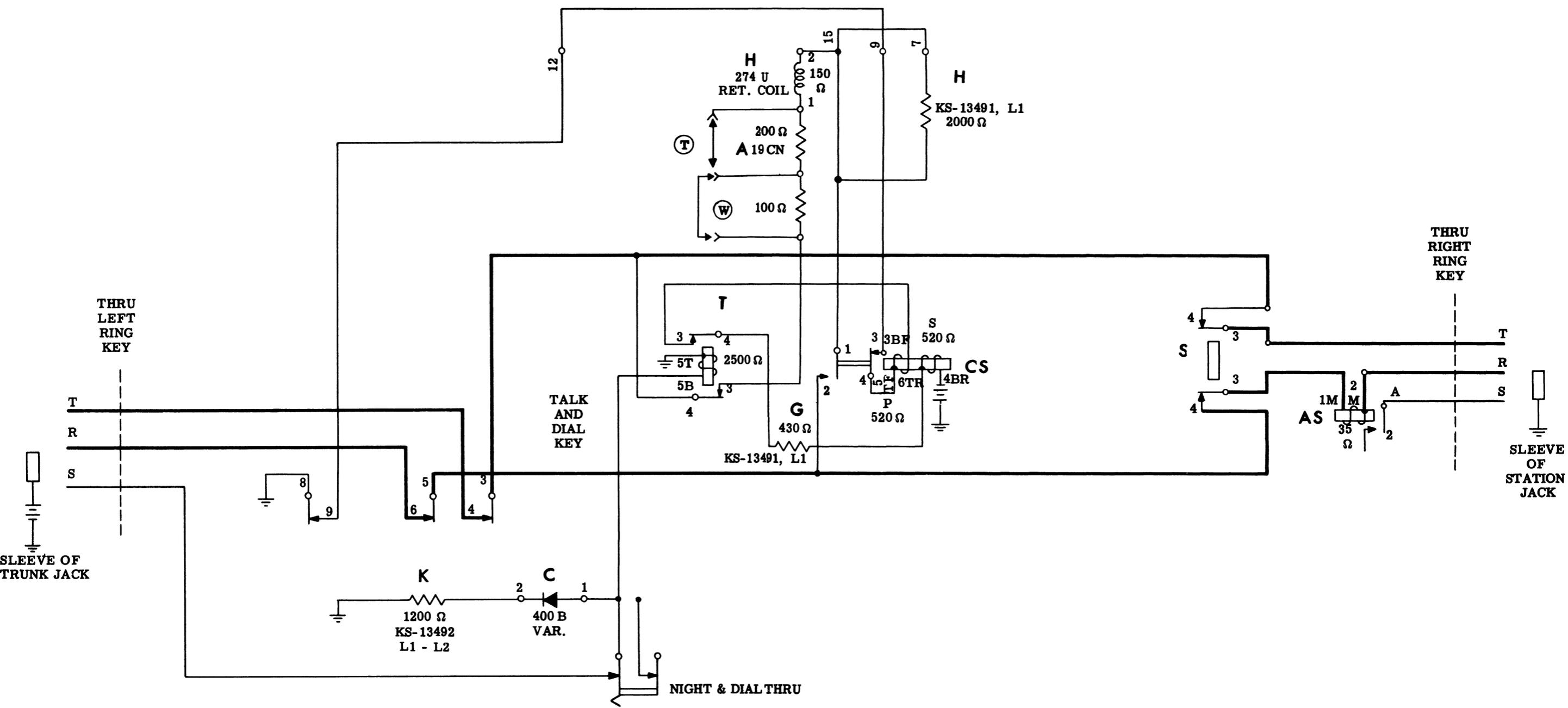


Exhibit 4. Circuit Diagram - Trunk to Station, Through Supervision, Station in Hang Up Condition.

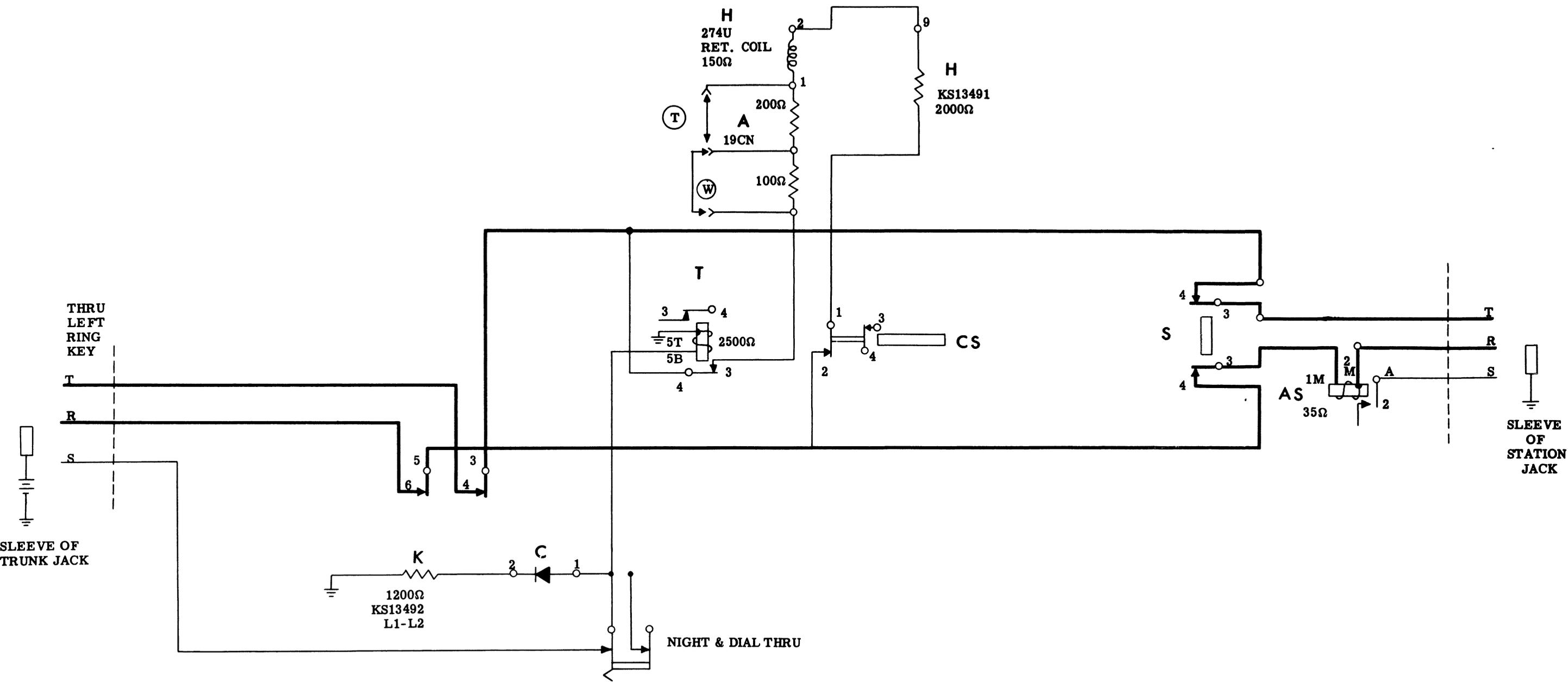


Exhibit 5. Circuit Diagram - Trunk to Station, Non-Through Supervision, Station in Hang Up Condition.

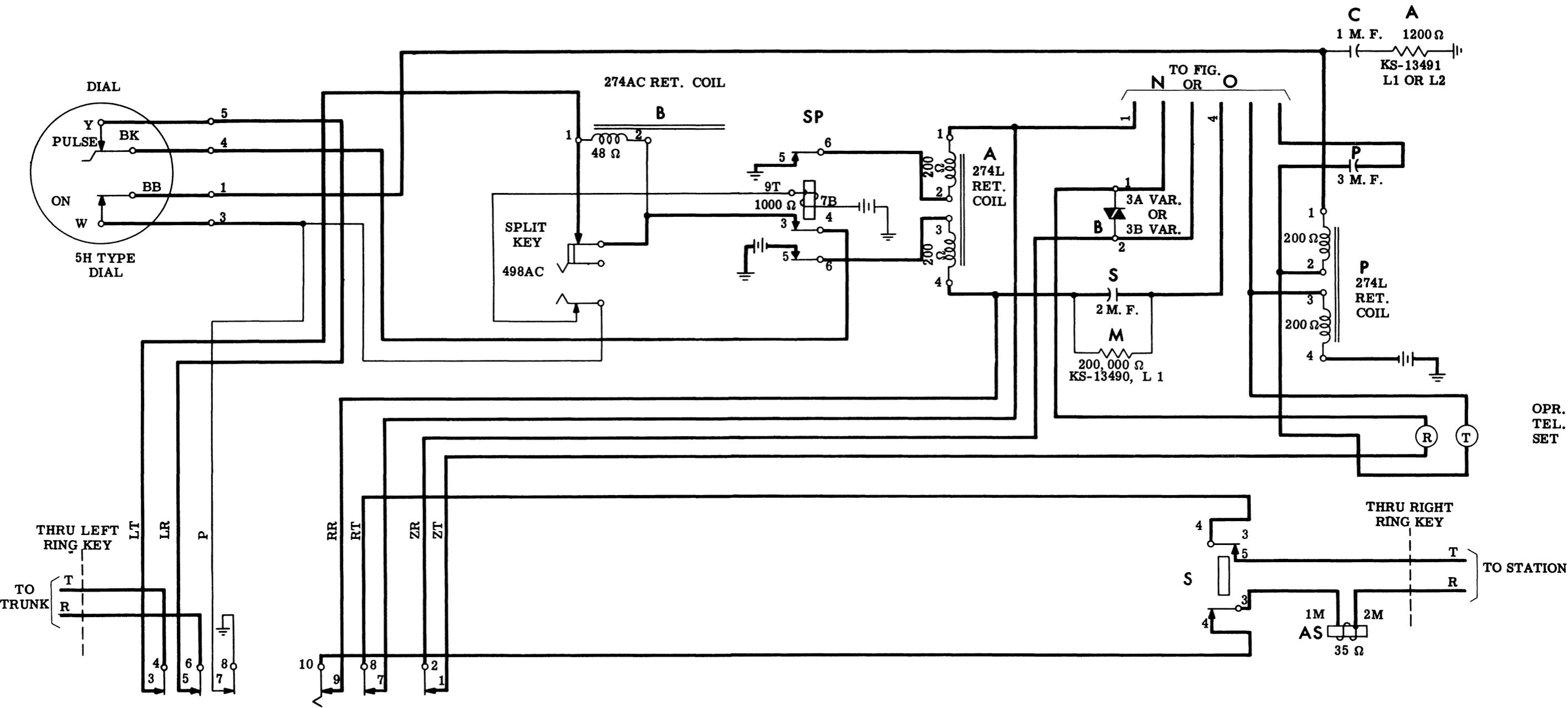


Exhibit 6. Circuit Diagram - Trunk to Station, Split Key Operated.

FIG. 4
TRUNK CABLE
CCT.

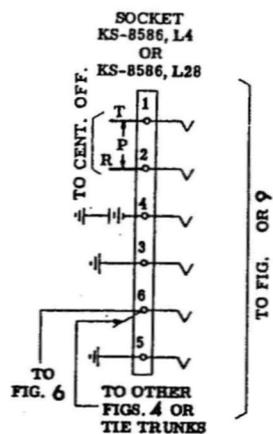
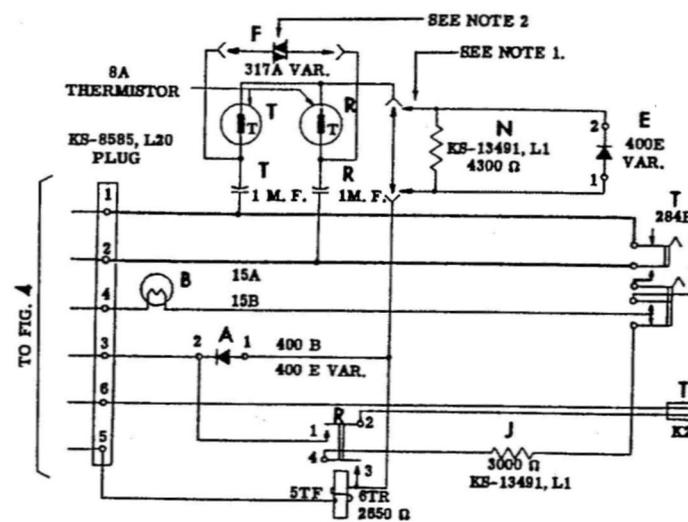


FIG. 3
CENTRAL OFFICE TRK. CCT.



NOTE 1 - EARLY TYPE THERMISTOR PROTECTION
NOTE 2 - LATER TYPE THERMISTOR PROTECTION

FIG. 9
CENTRAL OFFICE TRK. CCT.

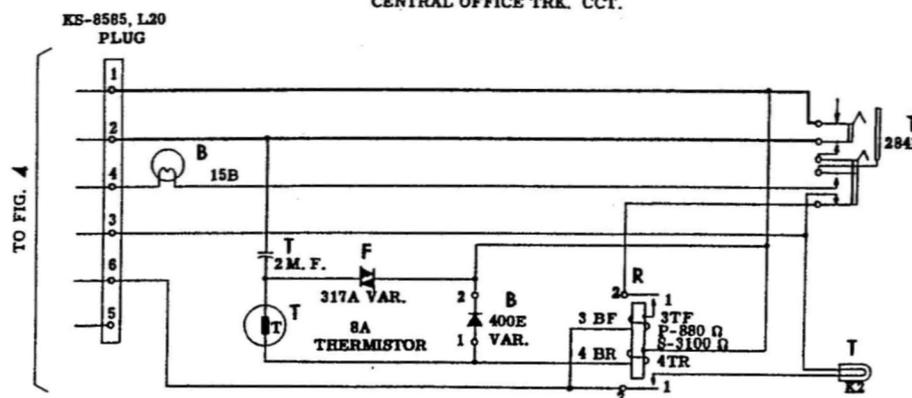


FIG. 11
SPIDER PATCH CORD FOR MULT.
NIGHT CONNECTIONS (1 TO 3)

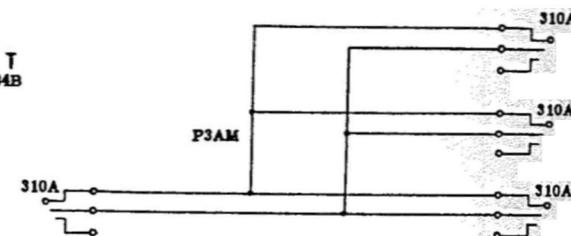
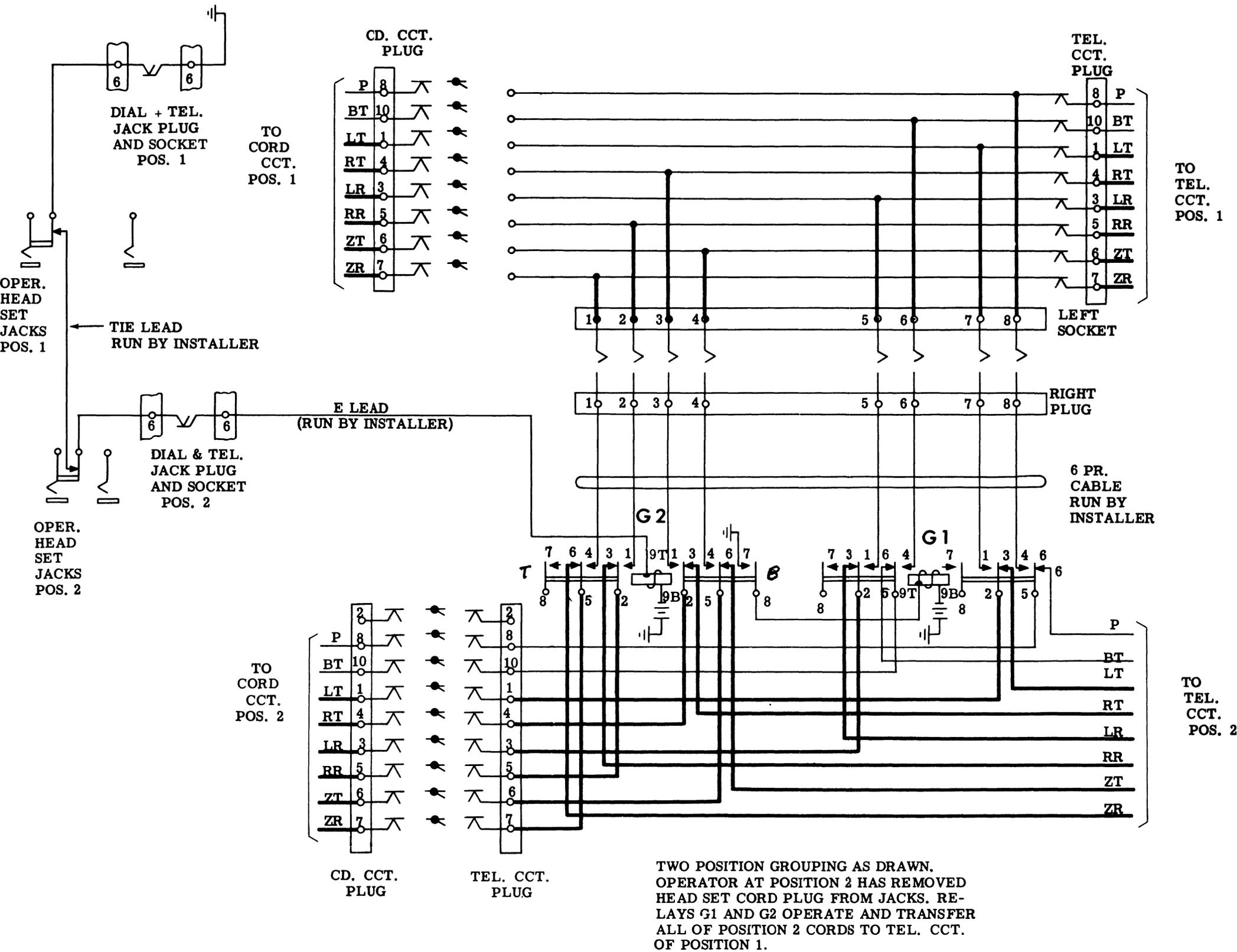


Exhibit 7. Circuit Diagrams - Trunk
Circuits and Multiple Night
Connection Circuit.



TWO POSITION GROUPING AS DRAWN.
OPERATOR AT POSITION 2 HAS REMOVED
HEAD SET CORD PLUG FROM JACKS. RE-
LAYS G1 AND G2 OPERATE AND TRANSFER
ALL OF POSITION 2 CORDS TO TEL. CCT.
OF POSITION 1.

Exhibit 8. Circuit Diagram - Relays G1 and G2 Required for Position Grouping (Position 2).