

CIRCUIT EXPLANATION

CONN. CKT., LOCAL OR SIMPLIFIED
TOLL-TRK. & LEV. HTG. WITH NIGHT LINE
SERV. ON ALL LINES EXCEPT 1ST IN
GRP., NON-REV. BAT. SUPN. ON
SPEC. LEVS GRD. OR BAT. GEN.
H-580260

(Written specifically for circuit issue 16,
but may also apply to later issues. Refer
to H print for appropriate E issue number.)
*Not updated for NAFM Figs.

FEATURES

- (a) Permits seizure by battery or absence of ground searching Selectors
- (b) Flash busy for simplified Toll Train
- (c) Last party or calling party release
- (d) Free service on specified levels
- (e) Night line service on all lines except first in group
- (f) Flash busy by reverse battery controlled by ground projected forward over EC lead or 4th wire
- (g) Provides timed disconnection

CIRCUIT OPERATION

1. Seizure (Operated: VON Springs)

Battery via #2 winding of relay C on lead C marks this switch idle. When seized ground via lead C closes #2 winding of relay C and relay A is closed via leads +LINE and -LINE. Relay C operates. Relay A operates and closes relay B. Relay B operates, closes relay L (if FIG LR is used) or connects ground to lead X (if "W" wiring is used) connects ground to lead C to hold the preceding equipment and to mark this switch busy. (When seized by a toll switch train, ground forwarded via lead C short-circuits relay L when relay B operates and connects ground to lead C via #2 winding of relay L.) Relay L operates its "X" contacts, locks via its #2 winding and short-circuits its #1 winding.

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WRITTEN BY
H. J. O'Keefe

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2. Vertical Stepping (Operated: Relays A, B, C, and possibly L) (VON springs)

Relay A follows the pulses(s) of the first digit and when at normal, opens relay B, and closes #1 winding of relay C in series with the VERT magnet. The VERT magnet operates, and steps the switch shaft to the dialed level. The VON springs restore on the first vertical step [Relay J (FIG FS) could be closed at the end of vertical stepping (see Section 9)]. Relays B and C do not restore during dialing due to their slow-to-release characteristics. After the last pulse of the digit, relay A remains operated and opens #1 winding of relay C and the VERT magnet. After its slow-to-release interval, relay C and the VERT magnet restore.

3. Rotary Stepping (Operated: Relays A, B, and possibly L and/or J)

Relay A follows the pulses of the second digit and when at normal closes the ROT magnet and relay E. The ROT magnet operates and steps the switch to the dialed line. Relay E operates and connects relay K to the C wiper. After the last pulse of the digit, relay A remains operated and opens relay E and the ROT magnet. The ROT magnet restores. Relay E does not restore at this time due to its slow-to-release characteristic.

4. Testing the Called Line (Operated: Relays A, B, E, and possibly L and/or J)

4.1 Calls to an Individual Line

4.11 Called Line Busy

If the called line is busy, ground via the C wiper closes relay K before relay E restores. Relay K operates. After its slow-to-release interval, relay E restores, closes #2 winding of relay M and opens relay K. Relay M operates and locks. After its slow-to-release interval, relay K restores and connects lead BUSY TONE to lead -LINE via capacitor N, connects lead 60 IPM to lead EC and closes the #1 winding of relay D via the 60 IPM. Relay D follows the 60 IPM pulse and intermittently connect and disconnect ground from lead EC to provide a flash busy signal to the preceding switch train.

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(ACCESS "B"). For reverse battery supervision, a reversal of battery by relay D via leads +LINE and -LINE alerts the Operator to a busy condition if lead EC is not used (ACCESS "A").

If the dialed number represents the last line of a group, ground via the meter or 1200 ohm resistor and the EC wiper cannot operate relay P since its non-inductive winding and shunt resistor prevent its operation.

4.12 Called Line Idle

If the called line is idle, relay K does not operate. After its slow-to-release interval, relay E restores and connects #1 winding of relay G to wiper C. Battery via wiper C closes #1 winding of relay G. Relay G operates its "X" contacts, locks via its #2 winding, operates fully, short-circuits the #1 winding of relay G, connects ground to wiper C to mark this line busy, closes relay N. Relay N operates as described in Section 5.

4.2 Calls to the First Line of a Trunk Hunting Group

4.21 Called Line Idle

Operation is the same as that described in Section 4.12

4.22 Called Line Busy

Operation is similar to that described in Section 4.11 except that when relay E restores, the #1 winding of relay P is closed in series with the #2 non-inductive winding of relay P via ground on wiper EC, the #2 winding of relay M is closed, and relay K is opened. Relay M operates and locks via the rotary interrupter springs. Relay P operates to its "X" contacts, short circuits its #2 winding, operates fully, locks, transfers wiper EC to the #1 winding of relay M, connects resistor C to the C wiper, closes the ROT magnet and re-closes relay K which did not release due to its show-to-release characteristic. Relay G does not operate at this time due to the busy ground on the C wiper. The ROT magnet operates, steps the wipers to the next bank contact, and opens relay K and the #2 winding of relay M via its interrupter springs. Relay K does not restore during trunk hunting due to its slow-to-release characteristics. Relay M restores and opens the ROT magnet. The ROT magnet restores and closes M and K. Interaction between relay M and the ROT magnet continues, stepping the switch, until an idle line is found, the last trunk in the group is reached, or the eleventh rotary step is taken. If an idle line is found, resistance battery is returned via wiper C, closing the #1 winding of relay G. Relay G operates to its "X" contacts, operates fully, locks, removes ground from the rotary

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interacting circuit, connects ground to the C wiper, opens the EC wiper and closes relay N. Relay M restores. The ROT magnet restores. Relay N operates and opens relay P. Relay P restores. After its slow-to-release interval, relay K restores. Further operation is similar to that described in Section 4.12.

4.23 All Trunks in Group Busy

If the last trunk in a group is busy, ground is returned via wiper C and resistance ground is returned via wiper EC. Relay M remains operated via ground on wiper EC. The ROT magnet remains operated opening relay K. After its slow-to-release interval, relay K restores, opens the ROT magnet and connects lead BUSY TONE and 60 IPM as described in Section 4.11.

4.24 Level Hunting

If a trunk group covers more than one level and all the trunks on the first level are busy, the switch wipers will be stepped to the eleventh rotary step operating the CAM SPGS. In the eleventh rotary position, #1 winding of relay M is opened. The ROT magnet held operated opens #2 winding of relay M. Relay M restores and opens the ROT magnet. The ROT magnet restores and closes relay H. Relay H operates, closes the RLS magnet and the VERT magnet and opens #1 winding of relay G. The VERT magnet operates partially to keep the shaft from restoring vertically. The RLS magnet operates and releases the switch shaft. As the switch shaft restores to rotary normal, the vertical wiper connects to the vertical bank, connecting direct ground to the VERT magnet. The CAM SPGS restore, open the RLS magnet, and close #2 winding of relay M. The RLS magnet restores. Relay M operates. The VERT magnet operates completely, raises the switch shaft to the next bank level, and opens relay H. Relay H restores, opens the VERT magnet, and closes the ROT magnet. The ROT magnet operates, steps the switch shaft to the first bank contact and trunk-hunting continues as explained in Section 4.12, 4.22, and 4.23.

5. Ring the Called Line (Operated: Relays A, B, G, and possibly L or J)

5.1 (Figs 11-18, 20-21, and 24-25) (NAFM)

After its slow-to-operate interval, relay N operates, connects lead RB TONE to the calling line via capacitors M and N, and connects the ringing current (FIG BD or FIG GG) to the called line via #1 winding of relay F. Relay F will not operate on alternating current.

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5.2 (Figs 19,22,23 and 26)

Relay N (fast coil) operates, connects lead RB TONE to the calling line via capacitors M and N, and connects the ringing current (FIG BG OR FIG GG) to the called line via #1 winding of relay F. Relay F will not operate on alternating current.

6. Called Party Answers (Operated: Relays A, B, G, N, and possibly L or J)

6.1 (Figs 11-18, 20-21, and 24-25) (NAFM)

When the called party answers, relay F is closed via wipers 4- and 5+. After its slow-to-operate interval, relay F operates to its "X" contacts, operates fully and locks via its #1 winding, disconnects lead RB TONE from the calling line, disconnects the ringing circuit (FIG BG OR FIG GG) from the called line and closes relay D and connects ground to lead SUPY 1. Relay D operates, gives supervision by reversal of polarity on leads +LINE and -LINE, and/or by connecting ground to lead EC ("W" wiring). (If FIG FS is used, polarity will not be reversed as explained in Section 8).

6.2 (FIGS 19,22,23, and 26)

When the called party answers, relay F is closed via wipers 4- and 5+. After its slow-to-operate interval, relay F operates to its "X" contacts, operates fully and locks via its #1 winding, disconnects lead RB TONE from the calling line, disconnects the ringing circuit (FIG BG OR FIG GG) from the called line, closes relay D, and transfers relay B from ground to lead TB. Relay D operates, gives supervision by reversal of polarity on leads +LINE and -LINE, connecting ground to lead EC ("W" wiring), and transfers relay B from lead TD to ground. (If FIG FS is used, polarity will not be reversed as explained in Section 9).

7. Release

7.1 From a Completed Call (Operated: Relays A, B, D, F, G, N, and possibly L and/or J)

7.11 Last Party Release ("L" wiring) (FIGS 11-18, 20-21, and 24-25) (NAFM)

7.11.1 Calling Party Disconnects First

When the calling party disconnects first, the circuit to relay A is opened via leads +LINE and -LINE. Relay A restores and opens B and closes relay E. Relay E operates and disconnects wiper C from lead C. After its slow-to-release interval, relay B restores, removes ground from lead C and opens relay E. After its slow-to-release interval, relay E restores and re-connects wiper C and ground to lead C to mark this switch busy.

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When the called party disconnects, the circuit to relay D is opened via wipers 5+ and 4-. Relay D restores, restores polarity to normal if relay J is not operated, opens relay N, #2 winding of relay L (if operated), relay J (if operated), #2 winding of relay G, and #2 winding of relay F, removes ground from lead SUPY 2 and lead EC ("W" wiring) and connects ground to lead SUPY 1. Relay G restores.

After its slow-to-release interval due to the short circuit of its #1 winding, relay L restores (if operated), and/or relay J restores (if operated). After its slow-to-release interval, relay F restores, disconnects leads +LINE and -LINE via capacitors P and N respectively from wipers +5 and -4 and removes ground from lead SUPY 1. After its slow-to-release interval, relay N restores and removes ground from lead C and wiper C and closes the RLS magnet. The RLS magnet operates and returns the switch shaft to normal. The switch shaft at normal operates the VON springs. The VON springs operate, open the RLS magnet and connect resistance battery via #2 winding of relay C to lead C. The RLS magnet restores and the circuit is at normal.

7.11.2 Called Party Disconnects First

When the called party disconnects first, the circuit to relay D is opened via wipers 5+ and 4-. Relay D restores, connects ground to lead SUPY 1 and returns polarity to normal if relay J (FIG FS) is not operated and removes ground from lead EC ("W" wiring).

When the calling party disconnects, operation is similar to that described in Section 7.11.1 except that relay B also opens relay F, G, N, and L or J (if operated).

7.12 Calling Party Release (Figs 11-18, 20-21, and 24-25) (NAFM)

7.12.1 Calling Party Disconnects First

When the calling party disconnects first, the operation is similar to that described in Sections 7.11.1 and 7.11.2 except that when relay B restores, it also opens relays F, G, N, and L and/or J (if operated). When relay N restores it opens relay D. Relay D restores, removes ground from lead SUPY 1 and lead EC ("W" wiring) and returns battery polarity to normal if relay J (FIG FS) is not operated. The RLS magnet and subsequent operations are the same as described in Section 7.11.2.

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7.12.2 Called Party Disconnects First

Operation is the same as that described in Section 7.11.2.

7.13 Calling Party Release with Timed Disconnection (Figs 19, 22, 23, and 26)

7.13.1 Calling Party Disconnects First

When the calling party disconnects first, the circuit to relay A is opened via leads +LINE and -LINE. Relay A restores and opens B and closes relay E. Relay E operates and disconnects wiper C from lead C. After its slow-to-release interval, relay B restores, removes ground from lead C, opens relay E, relay N, #2 winding of relay L (if operated), relay J (if operated), #2 winding of relay G, and #2 winding of relay F. After its slow-to-release interval, relay E restores and re-connects wiper C and ground to lead C to mark this switch busy. Relay G restores and removes ground from wiper C and lead C. After its slow-to-release interval due to the short circuit of its #1 winding, relay L restores (if operated), and/or relay J restores (if operated). Relay N restores, opens relay D, disconnects leads +LINE and -LINE via capacitors P and N, respectively, from wipers 5+ and 4- and closes the RLS magnet. After its slow-to-release interval, relay F restores. Relay D restores, returns polarity to normal if relay J is not operated, and removes ground from lead EC ("W" wiring). The RLS magnet operates and returns the switch shaft to normal. The switch shaft at normal operates the VON springs. The VON springs operate, open the RLS magnet and connect resistance battery via #2 winding of relay C to lead C marking this switch idle. The RLS magnet restores and the circuit is at normal.

7.13.2 Called Party Disconnects First

When the called party disconnects first, the circuit to relay D is opened via wipers 5+ and 4-. Relay D restores, returns polarity to normal if relay J is not operated, removes ground from lead EC ("W" wiring), and transfers relay B from ground to lead TD.

When the calling party disconnects, operation is similar to that described in Section 7.13.1 except that relay D is restored before relay N.

If the calling party does not disconnect, after a certain time interval a high resistance ground from lead TD opens relay B. After its slow-to-release interval, relay B

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restores and subsequent operations are similar to that described in Section 7.13.1 except that when ground is removed from lead C (relay N restored), the preceding switches in the Selector restore which in turn opens the loop to relay A via leads +LINE and -LINE. Relay A restores. The RLS magnet operates and further operations are the same as described in Section 7.13.1.

7.2 From a Busy Condition (Operated: Relays A, B, M, and possibly P, D, G, and L and/or J)

7.2.1 (Figs 11-18, 20-21, and 24-25) (NAFM)

Operation is similar to that described in Section 7.12.1, except that when relay B restores, it opens relays M and P and L and/or J, removes ground from lead C and wiper C and closes the RLS magnet. Relay M restores, removes lead BUSY TCNE from lead -LINE via capacitor N and lead 60 IPM from #1 winding of relay D. Relay D if operated restores, returns polarity to normal if relay J (FIG FS) is not operated and removes ground from lead EC ("W" wiring). Relay P restores. Relays L and/or J restore as described previously. The RLS magnet operates and further operation is the same as described in Section 7.11.1.

7.2.2 (Figs 19, 22, 23, and 26)

Operation is similar to that described in Section 7.13.1 except that when relay B restores, it opens relays M and P, G and L and/or J, removes ground from lead C and closes the RLS magnet. Relay M restores, removes lead BUSY TONE from lead -LINE via capacitor N and lead 60 IPM from #1 winding of relay D. Relay D is operated restores, returns polarity to normal if relay J is not operated and removes ground from lead EC ("W" wiring). Relay P restores. Relay G restores and removes ground from wiper C. Relay L and/or J restore as described previously. The RLS magnet operates and further operation is the same as described in Section 7.13.1.

7.3 From an Unanswered Call (Operated: Relays A, B, G, N, and possibly L and/or J)

7.3.1 (Figs 11-18, 20-21, and 24-25) (NAFM)

Operation is similar to that described in Section 7.12.1 except that relays F and D are not operated. When relay N restores, it disconnects the ringing circuit from wipers 5+ and 4-.

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7.3.2 (Figs 19, 22, 23, and 26)

Operation is similar to that described in Section 7.13.1 except that relays F and D are not operated. When relay N restores, it disconnects the ringing circuit from wipers 5+ and 4-.

8. Night Service for Trunk Group

To access the trunk-hunting service, the pilot or first number of the group must be dialed. This causes the automatic rotary stepping relays M and P to operate if the first trunk is busy.

For night service any number of the group can be dialed except the pilot or first number. The absence of direct ground on wiper EC will not permit relay P to operate to start the automatic trunk-hunting. Thus the switch will act as an ordinary Connector.

9. Free Service on Specified Levels

When free service is desired on certain levels FIG FS is used. The LT NP SPGS are adjusted so that when the switch stops vertical stepping on the specified level relay J is closed via ground on lead X ("W" wiring). Relay J operates and disconnects leads -L1 from J and +L1 from M and connects leads -L1 to K and +L1 to N so that when relay D operates, battery polarity will not be reversed to the calling line. Since reversal of polarity normally controls service charges, calls to these specified levels would be charge free.

10. Test Facilities

10.1 Test Jacks

By inserting a Hand Test Telephone with a four prong plug into TEST JACKS 1, 2, 3, and 4, this switch can be monitored or seized as described in Section 1 for testing purposes.

10.2 Busy Key

By operation of the BUSY KEY, ground is connected to lead C to mark this switch busy to all switches which have access to it.

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