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 ISSUE NO. 12

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EXPLANATION
 OF
 200 LINE FINDER UNIT CIRCUIT
 H-35868

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit serves 200 single relay line circuits with or without permanent lockout and may be arranged for class of service tone, if required.

2. PARTS OF CIRCUIT

- Fig. 1 Line circuit without or with lines connected to class of service tone.
 Fig. 11 Line circuit without or with lines connected to class of service tone and with permanent signal lockout.

- Fig. 2 Start circuit.
 Fig. 3 Group relay circuit.
 Fig. 4 Distributor.
 Fig. 5 Line finder circuit.

OPERATION

3. FUNCTIONS

- 3.1 Operates line relay to its first step from subscriber's loop.
 3.2 Starts the finder, which has been preselected.
 3.3 Elevates the wipers to the level on which the subscriber's line appears.
 3.4 Rotates the wipers to the contacts to where the subscriber's line appears.
 3.5 Extends the subscriber's line to the succeeding switch.
 3.6 The line relay fully operated, clears the line of attachments.
 3.7 Makes the subscriber's line busy to other calls.
 3.8 Prevents false operation during rotary when booster battery is encountered.
 3.9 The distributor selects the next idle finder for the succeeding call.
 3.10 Finder releases upon the end of the call.
 3.11 Causes the partner group of finders to handle the call if a finder fails to step.
 3.12 Rotates to the eleventh rotary step when the finder fails to step and cause the distributor to allot the next idle finder to the call.
 3.13 Transfers the call to the partner group when all the finders in a group are busy.
 3.14 Allows testing of the associated finders in a group.
 3.15 Clears the line from attachments on incoming calls.
 3.16 Locks out a "permanent" line.
 3.17 Provides discriminating service by levels in groups of 10 or 20.

4. DETAILED DESCRIPTION

4.1 GENERAL

The finders in this system are divided into two groups each having a

distributor and group relays.

Normally the group relays and distributor of each group allot the finders of their associated group to handle the calls of that group. However, in case trouble occurs in the group or all the finders are busy in that group, the associated group relays will transfer the call or calls to the other group.

Two hundred lines are connected to the finder banks, the first 100 of which are connected to levels one to five inclusive of one group and to levels six to ten inclusive of the other group and the second 100 lines to the remaining levels of each group.

In the following explanation, Group "A" will be considered entirely, the operation of Group "B" being exactly the same.

4.2 SEIZURE

When the calling subscriber closes the loop, L is energized to its intermediate position and closes the X contacts only.

Relay L

Prepares the stopping circuit for the finder.

Grounds the start lead.

Vertical bank contact corresponding to the level where the calling line is connected is marked.

When Fig. 12 or 13 is used instead of Fig. 1 or 11, L operates from ground on the negative line instead of over the loop of the dialing station. The remainder of the operation is the same regardless of which line circuit is used.

4.3 START

Relay C3 operates

Closes circuit to P3 in series with motor magnets.

Grounds ST. SIG. lead thru lamp.

P3 Operates (but not the motor magnet)

Grounds the F ST. lead.

Prepares its locking circuit.

Connects the guard lead to the motor magnet.

Prepares the circuit to the finder VERT lead.

Prepares the circuit to the TEST-1 lead.

Closes circuit to B3.

Maintains N3 operated.

B3 Operates

Closes circuit to H3. (S.O.)

H3 Operates and locks

Closes #1 winding of F3.

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Provides locking ground on P3.
Places ground on the GRD 5-"A" lead.
F3 Operates and locks to the F, ST, lead.
Provides multiple ground to P3.
Opens the circuit to B3.
Connects ground to the windings of J3 and K3.

B3 releases but on account of its weighted armature the circuit to H3 is intermittently closed for further period, thus preventing its release.

B in Fig. 5 Operates from ground on F. ST. lead

Closes the circuit to the VERT MAGNET
Prepares a circuit to the ROT MAGNET
Places ground on the C lead.
Removes ground from the A.T.B. GRD. lead.
Closes TEST-2 lead.
Places 500Ω across the + and + lines to pre-energize the selector A relay and to place a multiple ground on the "C" trunk.

4.4 VERTICAL MOVEMENT

VERT Magnet of the finder operates

Elevates the shaft and closes its interrupter springs.

A3 Relay

Follows the INT pulses and when operated, breaks the circuit to the vertical magnet. This action continues until the vertical wipers reach the level marked by ground. On this level, after INT springs open, D3 operates its "X" contact, due to ground on the vertical wiper, TEST-1 lead, #1 winding of D3 to A3. A3 is held operated and therefore the circuit to the vertical magnet remains open.

D3 Operates

Fully thru its #2 winding.
Transfers the circuit from VERT to ROT lead.
Opens the initial circuit of P3.
Opens its #1 winding.
Connects TEST-1 lead to #1 winding of K3.

4.5 ROTARY MOVEMENT

ROTARY MAGNET

Operates and closes its interrupter-contact.

A3 Operates

From ground on INT leads and breaks the circuit to ROT magnet.
This action continues until one of the C wipers find the contact marked by 600 ohm battery.

When the wipers reach the contacts to which the subscriber's line is connected, the C-2 or C-1 wiper, depending upon whether the subscriber's line appears in the upper or lower bank, encounters battery thru the cutoff winding of L which closes the circuit to the windings of K3 or J3, respectively.

If the subscriber's line is on the upper bank, K3 Operates.
Opens the rotary magnet circuit, and
Closes the circuit to relay A of the finder.

Relay A Operates

Connects the -, + and C trunks to the upper bank.
Connects its winding to the C trunk.
Places ground to the GUARD lead to make the finder busy.
Opens the circuit to the winding of D.
Opens the incomplete release circuit.
Opens the rotary circuit.

If the subscriber's line is on the lower bank J3 Operates:
Opens the rotary magnet circuit; and
Closes the circuit to relay D of the finder.

Relay D Operates

Connects the -, + and C trunks to the lower bank.
Connects its winding to the C trunk.
Places ground to the GUARD lead to make the finder busy.
Opens the circuit to the winding of A.
Opens the incomplete release circuit.
Opens the rotary circuit.

In case both C1 and C2 contacts of the same rotary position have battery connected, both J3 and K3 relays will operate but K3 relay, in operating, will open the circuit to relay D, and thus the upper bank contacts will have preference in switching.

The circuit to the A and D relays is taken thru the interrupter relay springs. This arrangement prevents any switch thru operation to take place until such time as the rotary magnet in the finder has restored.

Relay L of the line circuit Fig. 1 or 11 operates completely.

Provides a locking circuit through its "X" springs.
Removes its start windings from the line
Opens the start ground
Relay L0 does not operate from exchange battery. Its operation for the lockout condition will be described under heading #9.

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Preventing false operation when booster-battery is encountered during the rotary searching of the finder

Should the C-2 or C-1 wiper pass over a contact on which positive booster-battery is present for operating a meter associated with that line and contact, the circuit of K3 or J3 would be closed but the rectifiers in series with these relays offer high resistance to current of such direction. If booster battery is not used, the rectifiers may be omitted or shorted by wiring changes as indicated by note 17 on H-35868.

4.6 DISTRIBUTOR SELECTS NEXT IDLE FINDER

Ground on the GUARD lead closes the circuit to the distributor motor magnet over the MM lead and short circuits P-3. The distributor motor magnet operates; opens the circuit to P3; and prepares to step the wipers of the distributor one step.

C3 Restores if no other call has been originated in the group

Opens part of the starting circuit to P-3.
Removes ground from the ST SIG lead.

P-3 Restores

Removes ground from the F Sf. lead
Removes ground from winding of #2 of F-3.
Transfers the GUARD lead to the MOT MAGNET interrupter springs.
Opens the circuit to the MOT MAGNET.
Opens its locking circuit.
Removes the switching ground.
Removes ground from H-3 through the vibrating armature springs of B-3.
Removes ground from #2 winding of D-3.

D-3 Restores

Prepares the circuit for P-3.
Prepares the VERT pulsing and TEST-1 circuits.

H-3 Restores

Opens #1 winding of F-3.
Prepares an incomplete circuit for E-3.
Removes ground from the GRD 5-"A" lead.

F-3 Restores

Places ground to the starting circuit of P-3.
Prepares the starting circuit of B-3.
Removes ground from the windings of J-3 and K-3.

B of the finder restores

Opens the 500 ω shunt across the line.
Places multiple ground on the GUARD lead.
Opens the VERT ROT TEST-2 leads.

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The distributor magnet restores; advances the wipers to the distributor to the contacts associated with the next finder; extends the GUARD lead to the distributor motor magnet; and prepares the starting circuit to P-3.

If the next finder is busy, the LEV "A" wiper of the distributor encounters ground on the GUARD lead upon being advanced to the contacts associated with the next finder. Ground on the GUARD lead closes the circuit over the DI lead, thru the distributor interrupter spring, to the distributor motor magnet, also short circuiting the winding of P-3 to prevent its operation should C-3 operate due to another call being made before the distributor has found a free finder.

The distributor motor magnet operates; prepares to advance the wipers of the distributor to the next finder; and opens its own circuit. The distributor motor magnet restores and advances the wipers to the succeeding finder. If this finder is also busy, the circuit will again be closed to the distributing motor magnet and above sequence followed.

When the idle finder is found by the distributor, the circuit is no longer closed to the distributor motor magnet and there is an absence of ground on the winding of P-3 thus allowing it to reoperate if there is another call.

Should there be more than one subscriber's line relay holding ground on the START lead, C-3 will remain operated and the sequence when one of the lines is found is the same as above.

4.7 RELEASING

Upon completion of the call, ground is removed from the C lead by a succeeding switch.

A or D restore

Completes the circuit of the RLS magnet.
Opens the -, +, and C trunks.

L of the line circuit restores

Connects the start windings of L to the line.

The CN lead of the line circuit becomes unguarded and ready to receive incoming calls.

The release magnet operates in series with G-3.

G-3 Operates

Lights the RLS lamp and gives alarm if the switch does not restore after a certain interval, grounds the P C METER lead, causing the operation of a meter (if used) which records the total number of calls handled by the associated group of finders.

When the shaft and wipers of the finder return to normal, the VON springs restore; opens the circuit to the RLS magnet and RLS; remove ground from

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the GUARD lead, making this finder free to the associated distributor and group relays; connect a multiple ground to the ATB GRD lead; and connect the C lead to the GUARD lead. RLS restores. G-3 restores and removes ground from the RLS LAMP and PC METER leads.

5. DISCRIMINATING SERVICE

- 5.1 For discriminating service on both groups of a level, X wiring is used and Y wiring omitted. The operation of the normal post springs sends ground over the EC lead from the C lead to provide discriminating service.
- 5.2 For discriminating service only on the upper group of a level Y wiring is provided and X wiring omitted which sends ground over the EC lead by the operation of the A relay and the normal post springs.

6. GROUP RELAYS CHANGE OVER

6.1 FAILURE IN VERTICAL OR ROTARY STEPPING

In case a call is originated and the finder fails to reach its destination, the call will be transferred to the partner group.

H-3 relay has been held operated by the vibrating contacts of B-3. Since the amplitude of this vibration is gradually decreasing, H-3 will finally release.

H-3 Restores

Closes #1 winding of E-3.
Opens #2 winding of D-3 (if operated).
Opens #1 winding of F-3.
Removes a multiple ground from P-3.
Removes ground from the Grd. 5-"A" lead.

D-3 Releases (if operated)

E-3 Operates

Closes its locking circuit to the ATB GRD lead of the partner group.
Removes the ATB GRD lead from N-3.
Short circuits P-3.
Removes N-3 relay from the partner group.
Grounds the MOT MAGNET.

P-3 Restores

Opens the circuit to B of the finder over the F ST lead.
Opens the circuit to #2 winding of F-3.
Opens the circuit to N-3.
Opens the circuit to #1 winding of E-3.
Transfers the GUARD lead to the MOT MAGNET interrupter spring.

F-3 Restores

Prepares ground for P-3.

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N-3 Restores

Opens the circuit of C-3.
 Opens the circuit of the MOT MAGNET.
 Closes the ATB chain.
 Transfers the start circuit to the partner group.
 Opens the circuit of the 5-"B" level, removing ground from this lead to allow a group "B" finder to search above level 5 for a free line in the "A" group.

C-3 Restores

Opens the start circuit of P-3.
 Removes ground from the ST SIG. lead.

B of the finder restores

The MOT MAGNET steps on and opens its interrupter springs. Locking the F-3 relay under control of the P-3 relay insures that the proper length of kick-off pulse is sent to the MOT MAGNET.

E-3 is held operated until all finders are busy in the other group or until the other group transfers as explained above or until manually released by momentarily operating the busy key of either group. In case all trunks are busy in the other group, E-3 will release after H-3 is opened and N-3 on re-operating transfers the call to the next finder in the same group. N-3 on restoring, transfers the start circuit.

6.2 THE FINDER FAILS TO FIND THE SUBSCRIBER'S LINE

During the rotary searching of the finder, should the finder fail to encounter battery thru the subscriber's L relay on the C-1 and C-2 wiper, the shaft and wipers would be rotated to the eleventh rotary position. Upon reaching the eleventh rotary position, the CAM SPRINGS operate and place ground on the GUARD lead, closing the circuit to the distributor motor magnet which in turn advances the distributor wipers to the contact of the next finder. P-3 releases its circuit being opened by the MOT MAGNET interrupter springs.

During the vertical searching of the finder, should the finder fail to find ground on the level on which the calling line appears, it will raise its shaft and wipers to the fifth level. Since this level is grounded from a make contact of H-3, through the contacts of N-3 of Group "B", the finder will cut in on this level, rotate to the eleventh rotary position, and release, as described in the paragraph above.

6.3 ALL FINDERS BUSY IN A GROUP

When all the finders in a group are busy, ground is removed from the ATB GRD lead of that group when P-3 restores after the last free finder in the group has completed its operation. N-3 restores; transfers the start circuit from C-3 of that group to the corresponding relay in the other group; opens the circuit to P-3; closes the ATB CHAIN lead within that group; and opens the circuit of the GRD 5-"B" to level 5 of the vertical banks of the group "B" finders. The operation of the other

group from here on is the same as explained above.

7. TESTING

To test the group of finders controlled by this circuit, a connection is made between springs #1 and #2 of the test jack. Ground on test spring #2 is thereby extended to the start circuit. As explained, this circuit finds an idle finder and causes it to search over the vertical bank. When the shaft and wipers of the finder reach the fifth vertical contact (unless the finder wipers have encountered a line making a legitimate call while searching over the vertical bank), ground ordinarily connected to this contact causes the finder to rotate the shaft and wipers over the contacts of the fifth level. Under control of its CAM SPRINGS (unless the finder wipers encounter a line making a legitimate call while searching over the fifth level), the finder releases after searching over the level and causes the distributor to connect this circuit to the next idle finder. The next idle finder is likewise caused to search over its fifth level and release. This action continues as long as the springs #1 and #2 of the test jack are connected. A finder coming up on a legitimate call will search for that call and when it has completed its operation, the distributor will start the next idle finder which will follow the above sequence.

Springs #3 and #4 of the test jack are connected to a test line and when a short is placed across these springs, the finder which has been allotted by the distributor will seize this line. By opening the connection between springs #3 and #4 of the test jack the distributor steps to the next idle finder and allows the finder to release.

Each finder is provided with a BANK test jack which permits determining whether an operated finder is connected to a line in its upper bank, or its lower bank. If the lower bank is in use, D is operated, and short circuiting the BANK test jack grounds the LBL lead, to light a LOWER BANK lamp associated with the alarm lamps. If the upper bank is in use, D is normal, and short-circuiting the BANK test jack does not light the LOWER BANK lamp.

8. CALLS TO THE SUBSCRIBER'S LINE

When a call is made to the subscriber's line, the connector associated with the dialing line tests the dialed line over the CN lead.

If the dialed line is busy, ground on the C lead from the succeeding switch in the train causes the connector to give the dialing party busy tone.

If the dialed line is free, ground thru a winding of the "cut thru" relay of the connector over the CN lead, closes the circuit to the #1 winding of L.

L Operates

Places ground on the C lead to make the dialed line busy; and clears the line of attachments, preparing the circuit for the ringing of the dialed station.

9. LOCKING OUT A "PERMANENT" LINE

A line may become "permanent" due to a short circuit or a ground on the negative line lead. This will have the same effect as will a displaced receiver and

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will cause L to operate as explained previously. A subscriber removing the receiver and failing to dial will also cause the line to become "permanent".

If dial impulses are not received before the expiration of a given time interval after the line has been seized by a finder, a pulse of booster battery is sent back over the C lead causing LO to operate; disconnect the "-" LINE from L; place direct ground on the "+" LINE; which closes the locking circuit for LO; grounds the CN lead to the COMM BANKS to make this line busy to calls; and ground the PERM LAMP lead to bring in an alarm. LO will not operate from exchange battery but will remain operated thru its #1 winding from exchange battery.

Ground on the "+" LINE shunts the #2 winding of L and, since "+" LINE has been disconnected from L, L restores freeing itself and the finder by which it has been seized.

When the "permanent" condition has been corrected, the locking circuit to LO is opened. LO restores and the line circuit is at normal.

10. BUSY KEYS

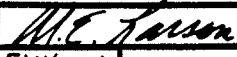
The BUSY KEY on the finder when operated transfers the GUARD lead from the C lead to ground thereby making this switch busy; and removes a multiple ground from the ATB chain associated with that group of finders.

The BUSY KEY in the group relays circuit when operated, opens the circuit to N-3 which upon restoring transfers the calls to the other group; and opens the locking circuit to E-3.

SPARK SUPPRESSION

The non-inductive windings of the release magnet of the finder prevent excessive sparking at the VON springs when they open the release circuit. A condenser and a resistance in series, connected between ground and a contact of D-3 prevent excessive sparking at contacts of A-3 during vertical pulsing of the finder. The non-inductive winding of A-3 prevents excessive sparking at the interrupter spring contacts of the vertical and rotary magnets of the finder during vertical and rotary pulsing. The condenser and resistance in series, connected between ground and a terminal of the distributor motor magnet, prevent excessive sparking at the motor magnet interrupter springs. A condenser in series with a resistance connected to a contact of J3 prevents excessive sparking at the contacts of A3 during the rotary pulsing of the finder and at the springs of K3 and J3 when they operate to seize the calling line.

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AUTOMATIC ELECTRIC COMPANY CHICAGO, U. S. A.	<div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: small;">APPROVED</div> <div style="margin-left: 10px;">  FLY/ML 8-8-51 </div> </div>	<div style="display: flex; justify-content: space-between;"> <div style="border: 1px solid black; padding: 2px;">DR.</div> <div style="border: 1px solid black; padding: 2px;">CHK.</div> </div> <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">PAGE 10 OF 10</div>	E-35868
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