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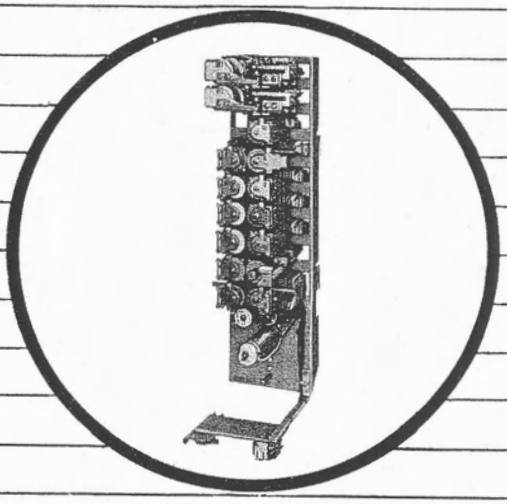
REVERTING-CALL METHODS

STROWGER AUTOMATIC TELEPHONE SYSTEMS



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ORIGINATORS OF THE DIAL TELEPHONE

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REVERTING-CALL METHODS

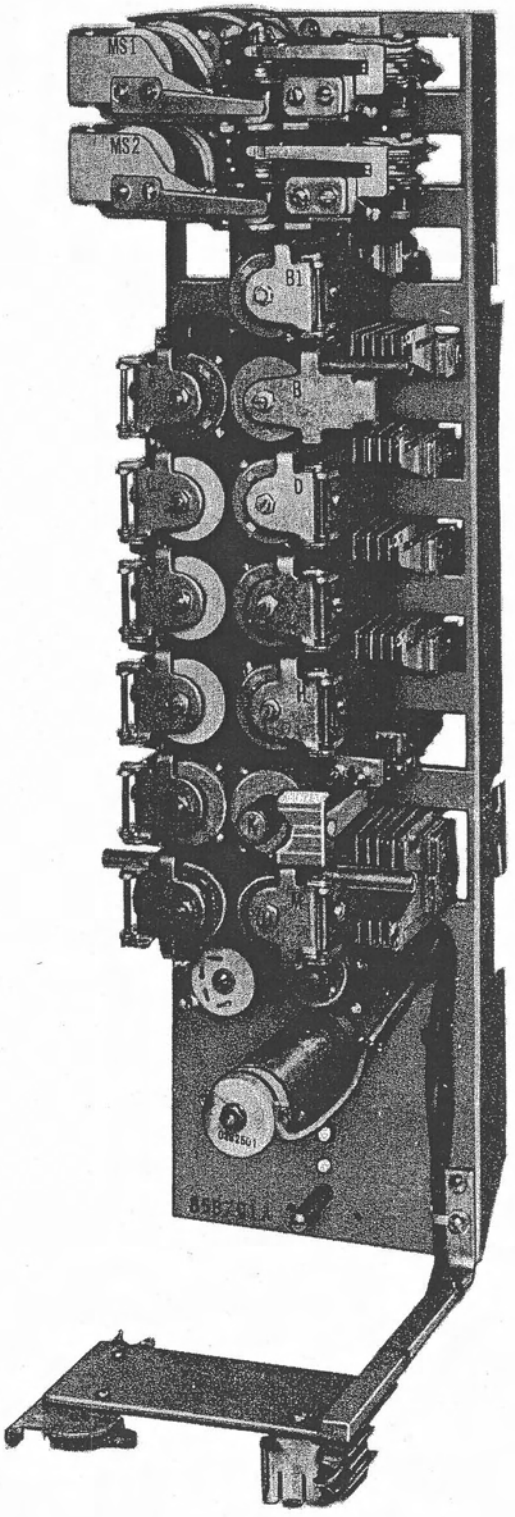

Figure 1. Typical reverting-call switch.
This reverting-call switch has been designed to give reverting-call tone, permanent timing, ground- or battery-connected generator, and extended-loop service.

REVERTING-CALL METHODS

1. INTRODUCTION

"Reverting call" is a term used in telephony to apply to a call from one subscriber on a party line to another subscriber on the same line.

In making a call of this kind, the calling subscriber cannot follow the usual procedure, since the instant he initiates the call he automatically makes his own line "busy". Because of this, in automatic exchanges, special central-office facilities are required if such calls are to be handled on a fully automatic basis.

The importance of reverting calls is determined chiefly by the extent and type of party-line development in the exchange.

In rural areas, for example, subscriber lines often are very long, and each line may serve many subscribers. Often the subscribers served by the same line have a community interest; reverting calls then are frequent.

In cities, on the other hand, the need for reverting calls is relatively small, because the proportion of party lines to total lines is low, and the number of stations per line also is low. Moreover, the community interest is likely to be such that few calls are made between stations on the same line. As a result, there is limited need for reverting-call facilities.

Reverting-call equipment is used also by installers and repairmen to ring telephones on which they may be working without requiring assistance of central-office personnel.

2. REVERTING-CALL METHODS

The operating telephone company's choice of equipment, when the central-office equipment is bought, determines in which <u>one</u> of the following two ways a caller is to place a reverting call.

<u>2.1 The caller dials the REGULAR DIRECTORY NUMBER</u>. The connector completes the call (figure 2). This method is confined almost solely to very small code-ringing exchanges.

<u>2.2 The caller dials a SPECIAL NUMBER</u>. A reverting-call switch (figure 1) completes the call (figure 3). This is the most common method.

3. CONNECTOR FOR REVERTING CALL BY DIRECTORY NUMBER (figure 2)

The caller dials the regular directory number of the desired station and, when "busy tone" is heard, restores the handset.

When the caller hangs up, the connector grounds the control wiper, then removes ground from the incoming control lead*, and connects to the incoming control lead a battery-connected test relay.

In case of a reverting call, called-line lead CN and calling-line lead C are connected together, and the control-wiper ground holds the linefinder, etc., and operates the connector reverting-call test relay. The connector then rings the called party's code. Where bridged code ringing is used, the caller's telephone, too, gives off the called party's rings.

When the called party answers, both telephones stop ringing, and the caller knows he is to come back on the line. They then converse.

When both parties hang up, the connector** releases.

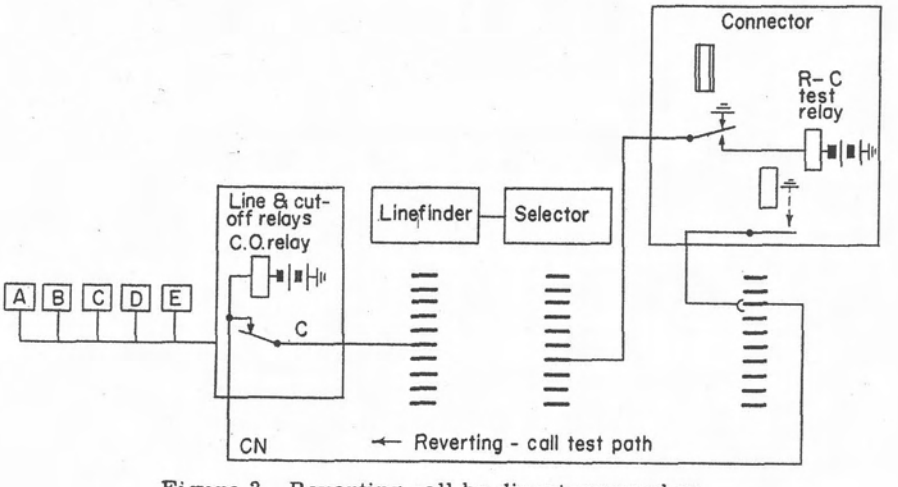

Figure 2. Reverting call by directory number.
Caller has dialed, hears busy tone, and is about to hang up.

*If this were not a reverting call but an ordinary call to another line, removal of ground from the incoming control lead would drop the linefinder and any selectors.

**If the central office is equipped for "100% lock out" (see bulletin 821, Linefinder switches), the connector may be wired to release when the called party answers.

4. REVERTING-CALL SWITCH

The reverting-call switch (figure 1) typically consists of relays and two minor switches, mounted on a sheet-metal base. The minor switches select the proper ringing-current frequencies or codes to be applied to the line and also select the proper side of the line to be rung.

The reverting-call switch usually is reached through a selector level. In a large exchange, usually "119" is dialed to reach the reverting-call switch. In a small exchange, ordinarily "9" is dialed to reach the reverting-call switch. Then the ringing code is dialed into the reverting-call switch. These special numbers are obtained by the subscriber from the information operator, a special card, or telephone-directory foreword instructions. After dialing the special number, the calling person replaces his handset on the cradle. The reverting-call switch will then ring the called telephone and (unless the caller will hear the called party's code) the calling telephone too. When the called person answers, both bells stop ringing. Continuing silence lets the calling person know that the called telephone has been answered. The calling party removes his handset and starts the conversation. If the called party does not answer, the calling party may stop ringing by momentarily lifting his handset from the cradle switch and then replacing it.

converses with the called party. When both parties disconnect, the circuit is released (but see §5.11, "lockout").

5.02 Access. The reverting-call switch usually is reached through a selector level. In a large exchange, usually "119" (see figure 3) is dialed to reach the reverting-call switch. In a small exchange, ordinarily "9" is dialed to reach the switch.

5.03 Seizure. The reverting-call switch (figure 4) is marked idle by battery through relay L winding #2 on lead C. This permits a selector to seize this circuit. When this circuit is seized, the loop circuit is closed to relay A over the + and - lines. Relay A closes the circuit of relay B. Relay B operates, and grounds lead C to hold the preceding switches and mark the circuit busy. Relay B also grounds lead ST to start the permanent timer, if one is used, and prepares the circuit for relay C and minor-switch magnet MS1 in parallel.

5.04 Dialing. Relay A follows the dial pulses of the first digit and each time it restores it closes the circuit of relay C and minor-switch MS1 rotary magnet. On the first rotary step, minor-switch MS1 off-normal springs operate and prepare a circuit for relay E. Since relays B and C are slow to release, they remain operated during pulsing.

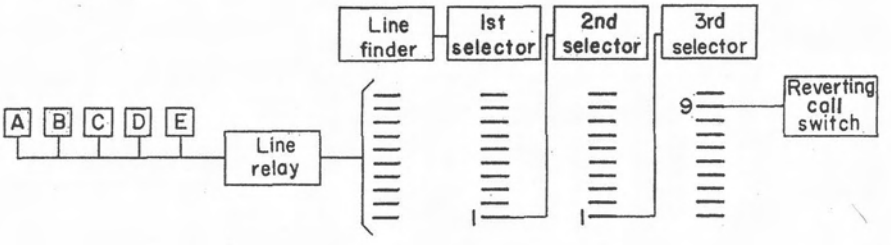

Figure 3. Reverting call by special number.

The reverting-call switch is much the same for all types of party-line ringing.

5. OPERATION OF A TYPICAL REVERTING-CALL SWITCH (figure 4)

5.01 General. The reverting-call switch circuit in figure 4 is used in an automatic telephone exchange to enable a subscriber on a harmonic divided-ringing 10-party line to signal another subscriber on the same line. When a subscriber makes a call, he removes his handset and dials the required digits. The last two digits operate this reverting-call switch and connect the calling and called parties' ringing frequencies. The caller next replaces his handset and waits for ringing to start. Ringing current is sent to the calling and called parties. When the called party answers, ringing current is cut off, indicating to the caller that the called party has answered. The caller then lifts his handset and

Relay C restores at the end of the first digit and closes the circuit of relay E. Relay E operates, locks, and transfers the pulsing circuit to minor-switch MS2 rotary magnet.

Relay A follows the dial pulses of the second digit, and each time it restores it closes the circuit of relay C and minor-switch MS2 rotary magnet. On the first rotary step, minor-switch MS2 off-normal springs operate, and prepare a circuit to relay G, and minor switch MS2. Relays B and C are slow to release and remain operated during pulsing.

Relay C restores at the end of the second digit and closes the circuit of relay G. Relay G operates, opens the pulsing circuit so that further pulses will not step the minor-switch wipers, grounds ringing-machine start lead RM ST to start the ringing machine, and prepares a circuit for relay L.

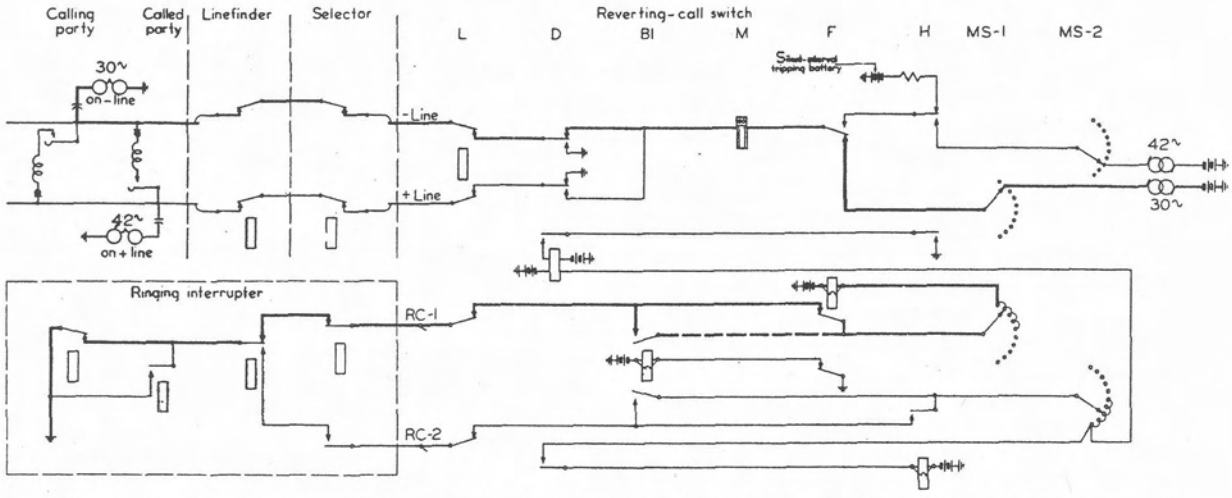

Figure 5. Ringing the calling party (assumed to be 30~ party on −line). Initial path shown by heavy dotted line. Final paths shown by heavy solid lines. In this example relay D, unoperated, connects ringing cut-off relay M to −line.

If permanent timing is used, when relay C restores, it connects ground through resistor J to relay J winding #2. Relay J operates its contacts X only, to connect time-pulse lead TP1.

5.05 Caller hangs up. When the caller has completed dialing, he replaces his handset and waits for ringing to start. When the handset is replaced, relay A restores, opens the circuit of relay B, and closes the circuit of relay L.

Relay L operates, re-closes the circuit of relay B, operates relay K, connects reversing-control leads RC-1 and RC-2 to the top wipers of minor-switches MS1 and MS2, grounds the + line, and connects battery through resistor R and relay M winding #1 to the - line.

5.06 Ringing. Five different ringing frequencies from a harmonic converter are connected to the reverting-call switch as uninterrupted generator current superimposed on the central-office battery; the reverting-call-switch relays do the interrupting. There may be ten parties on the line; five parties have ringers connected to the + side of the line and the other five have ringers connected to the - side of the line. Each ringer will respond only when its particular frequency is sent over the side of the line to which it is connected. You will recall the two digits dialed into the reverting-call switch were the frequency-selecting digits of the calling and called parties, dialed in that order. If the ringers of the calling and called parties are connected to the same side of the line, this switch alternates the selected frequencies on that side of the line. If the ringers of the calling and called parties are connected to the opposite sides of the line, this switch will send the dialed frequencies alternately, one on one side and then the other on the other side of the line.

The top banks of the minor switches are wired (per figure 4, RA to RD) as required for the office numbering scheme. If we assume figure RA is used, the ringers of parties with ringing digit 1 to 5 will be connected to the - side of the line and ringers of parties with ringing digit 6 to 0 will be connected to the + side of the line.

5.061 Ringing calling party (example: 30~party on - line). In figure 5 we have assumed party 2 is calling party 8. In this example, each time the ringing interrupter grounds reversing-control lead RC-1, current flows first via figure 5 dotted path to operate relay F, which locks to lead RC-1, connects 30~ ringing current through slow-operating relay M to - line to ring the calling party*, and operates relay B1**. After about a second, the interrupter removes ground from lead RC-1, releasing relay F which disconnects the calling party's ringing current. After relay F releases, relay B1 releases, and connects reversing-control lead RC-2 to minor-switch MS-2 bank.

5.062 Ringing called party (example: 42~party on + line). In figure 6 we still assume party 2 is calling party 8. In this example, each time the ringing interrupter grounds reversing-control lead RC-2, current flows first in dotted paths to operate relay D, which operates relay H. Relay H locks to lead RC-2, connects 42~ ringing current through relay M to + line to ring the called party, holds relay D***, and operates relay B1. After

*As will be seen from figure 4 pulse chart, on reverting calls the calling party's ringer rings just about every other second. These closely-spaced rings tell the caller that the called party hasn't answered yet.

**Although the ringing interrupter shown in figure 4 pulse chart gives a brief break between the ground pulses on leads RC-1 and those on RC-2, some ringing interrupters do not. Used with a ringing interrupter whose pulses can overlap partially, relay B1 prevents next pulse being effective until after release of relay(s) operated by earlier pulse.

***Relays D, F, and H are interlocked in such a way that relay D can transfer relay M from −line to +line and back only when no ringing current is connected to relay M; that is, if D is to operate, it must operate before F or H operates, and at the end of the ring F or H must release before D.

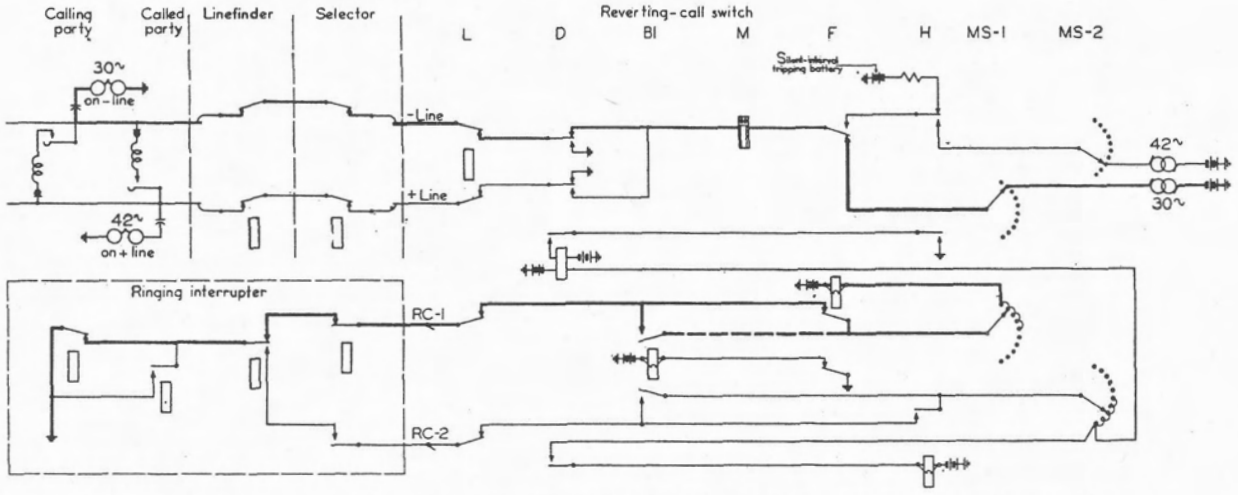

Figure 6. Ringing the called party (assumed to be 42~ party on +line). Initial paths shown by heavy dotted lines. Final paths shown by solid lines. In this example relay D operates, and connects ringing cut-off relay M to +line.

about a second, the interrupter removes ground from lead RC-2, releasing relay H which disconnects the called party's ringing current and opens the circuits of relays D and B1. Relay D releases quickly and transfers relay M back to - line. The 2000Ω noninductive winding in parallel with the operating winding makes relay B1 slightly slow to release. After relay D has had time to release, relay B1 releases, and connects reversing-control lead RC-1 to minor-switch MS-1 bank.

5.063 Ringing continues. As shown by figure 4 pulse chart, the ringing interrupter continues to send 1-second ground pulses alternately on leads RC-1 and RC-2. Reverting-call-switch relays F and H continue to ring alternately the calling and the called parties. When the ringer to be rung is connected to the - line, relay D does not operate; when the ringer to be rung is connected to the + line, relay D operates.

The sleeve on relay M lessens the inductive reactance of relay M so it impedes alternating ringing currents very little. The armature-end slug on relay M makes it slow to operate so it cannot operate on half-cycles of alternating ringing current.

5.07 Called party answers. Removal of the handset at the called* station removes the ringer capacitor from the circuit and permits direct current to flow through relay M. Relay M closes its contacts "X", through winding #2 operates completely and locks, opens the circuit of relay L, opens start lead ST, connects the armature of relay K to capacitor T, and connects release-ground lead RLS GRD to release magnets RLS of minor switches MS1 and MS2. The minor switches restore and open the circuits of relays G and E, and (if not already opened by relay L) of relays F or H and perhaps D.

RLS GRD ground comes to the release magnets through a supervisory relay so that if the release magnets fail to restore the wipers an alarm will sound.

5.08 Tick tone.** Relay L restores, opens the circuit of vibrating-reed relay K, opens the circuit of relay B, closes the plus and minus lines to relay A, and opens the reversing control (RC) leads. Relay K (figure 7) restores; the

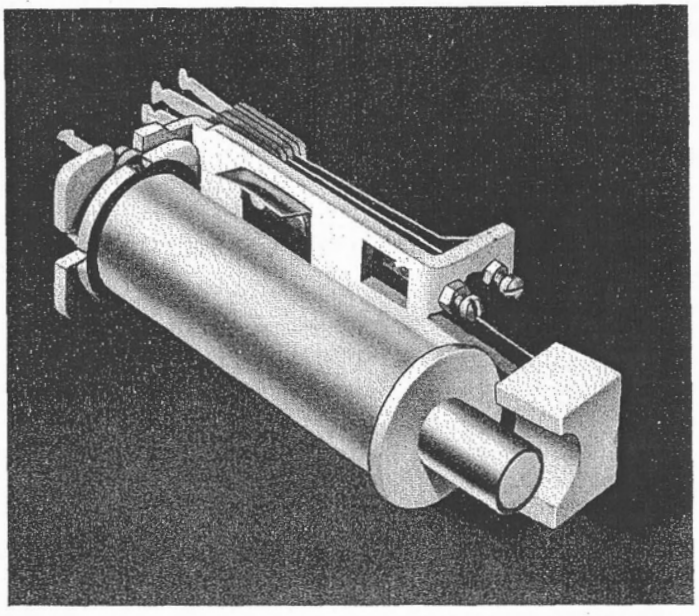

Figure 7. Vibrating-reed relay (figure 4 relay K).

weighted armature vibrates a few seconds to alternately charge and discharge capacitor T. The resultant "tick tone" informs the called party that he should wait until the caller again removes his handset. (If the switch is to drop out [§5.11], relay K holds B until end of the tick tone.)

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*If the called party does not answer, the caller should lift his own handset for a moment to trip the ringing. Then he hangs up, and releases the equipment.

**Not all reverting-call switches give tick tone. In many cases the fact that the reverting-call rings are more closely spaced than those for regular calls, is relied upon to inform the called party he has a reverting call and should wait patiently for the caller to come back onto the line.

Relay A operates, and, if the reverting-call switch is to supply talking battery during conversation, closes a circuit through strap on jack points 15 and 17 to hold relay B operated.

5.09 Conversation. Both calling and called telephones are across the + and - lines. Both calling and called parties receive voice-transmission battery through the windings of relay A (but see §5.11).

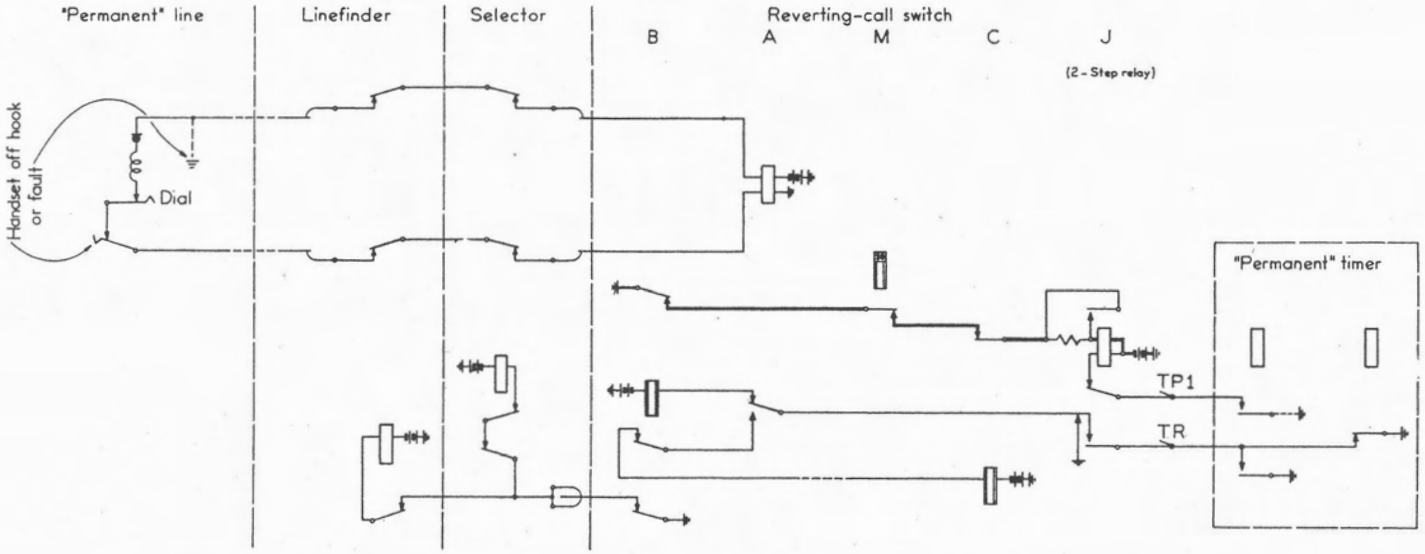

Figure 8. "Permanent timing"
If caller does not dial within 2 to 4 minutes, or does not hang up within 2 to 4 minutes after dialing, or if ringing is not tripped within two to 2 to 4 minutes, "permanent" timer opens lead TR and causes reverting-call switch to release linefinder and selector.

5.10 Disconnection. When both calling and called parties have replaced their handsets, relay A restores, and opens the circuit of relay B. Relay B restores, opens the circuit of relay M, and removes ground from lead C to allow the preceding equipment to restore. Relay M restores and re-connects relay L winding #2 to lead C for battery-searching selectors.

5.11 100% lockout. When 100% of the lines have lockout equipment (bulletin 821), the reverting-call switch does not supply transmission battery during conversation and the strap between shelf-jack points #15 and #17 is removed. When the called party answers, relay K holds relay B a few seconds (§5.08). Soon after vibrating-reed relay K comes to rest, relay B releases, and removes ground from lead C to release the preceding equipment. Lock-out type line equipment (see bulletin 821) supplies transmitter current for the conversation.

5.12 "Permanent" timing (figure 8). If it were not for permanent timing, a faulty line or a careless subscriber could tie up indefinitely one of the few reverting-call switches in the central office.

Typically, a caller is allowed 2 to 4 minutes to dial each digit, and to hang up and get an answer from the called party. Similarly the called party is allowed two to four minutes to answer.

In figure 8, one of the relays controlling this timing is relay C. If the subscriber does not dial, or dials only one digit, relay C remains unoperated a long time.

The other relay controlling timing is relay M. If the caller does not hang up after dialing, or if the called party does not answer, and the caller fails to come back on the line to stop the ringing, relay M does not operate.

Upon seizure of the switch, relay B causes two-step relay J to operate its contacts X. Within two minutes, a ground pulse on lead TP1 will operate relay J fully. Relay J locks under control of relay C and relay M, and places relay B under control not only of relay A but also of ground on lead TR. If neither relay C nor relay M unlocks relay J meanwhile, another two minutes later ground will be removed from lead TR, releasing reverting-call switch relay B. This removes ground from lead C and drops the selector and linefinder, thereby disconnecting the faulty calling line from the reverting-call switch.

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