

Western Electric Co. Incorporated,
Engineering Dept.,
New York.

(15 Pages) Page 1,
Issue 1 - BT-441152
May 19, 1921.

METHOD OF OPERATION

INTEROFFICE INCOMING SELECTOR CIRCUIT

Schematic - 4 Party Semi - Selective Ringing - Full Mechanical Power Driven System.

GENERAL DESCRIPTION

1. This circuit is used to establish a connection mechanically, from a district, or office selector, in a local mechanical office or from a sender tandem center through a final selector to the called line. It provides talking battery to the terminating subscriber and is arranged to automatically signal any one of four subscribers on a four party semi-selective line.

DETAILED DESCRIPTION

TRUNK SELECTED

2. The L relay operates when a hunting district or office selector brushes seizes this interOffice trunk from battery, inner winding, lower outer contact of cam T, upper inner contact of cam S, T compensating resistance, over the tip, through the associated sender circuit, back over the ring, R compensating resistance, upper inner and lower outer contact of cam R to ground.

3. The L relay operated is held operated from battery, inner winding, lower outer contact of cam H, make contact of the L relay, lower inner contact of cam T, upper inner contact of cam S, T compensating resistance, over its operating circuit as described in paragraph 2 to ground on the lower outer contact of cam R, advancing the switch to position 2 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

BRUSH SELECTION

4. The UP magnet energizes from battery, winding of the magnet, lower inner contact of cam D, upper outer contact of cam E, make contact of the L relay to ground, carrying the selector brushes upward for brush selection.

5. As the selector brush rod moves upward in position 2, carrying the commutator brush over the A commutator segments, ground is intermittently connected to the tip of the fundamental circuit through the upper outer contact of cam T, upper inner contact of cam S, T compensating resistance, holding the L relay operated through the upper outer and lower inner contacts of cam T, but successively short circuiting the sender STP relay which releases and re-operates "running down" the sender counting relays. When sufficient impulses have been sent back to satisfy the sender for incoming brush selection, the fundamental circuit opens in the sender, releasing the L relay.

(15 Pages) Page 2
Issue 1 - BT-441152
May 19, 1921.

The L relay released advances the switch to position 3, from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground, and releases the UP drive magnet.

6. The TM magnet energizes from battery, winding of the magnet, both lower contacts of cam I to ground rotating the trip rod for tripping the selector brush.

7. The L relay operates as described in paragraph 2 advancing the switch to position 4 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

GROUP SELECTION

8. The UP magnet energizes as described in par. 4, carrying the selector brushes upward for group selection. As the selector brushes move upward in position 4, a brush is tripped by a trip finger of the trip rod, causing the brush to make contact with the bank terminals of the group selected.

9. As the selector switch moves upward in position 4, carrying the commutator brushes over the B commutator segments, ground is intermittently connected to the tip of the fundamental circuit through the lower outer and upper inner contacts of cam S, and T compensating resistance, holding the L relay operated through the lower outer contact of cam S and the lower inner contact of cam T, but successively short circuiting the sender STP relay which releases and re-operates, "running down" the sender counting relays. When sufficient impulses have been sent back to satisfy the sender for incoming group selection, the fundamental circuit opens in the sender releasing the L relay, advancing the switch to position 5, from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground.

10. The L relay operates from battery, outer winding, lower outer contact of cam O, break contact of the PU relay, lower inner and upper outer contact of cam M to ground, advancing the switch to position 6 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

11. A selector group register operates for peg count purposes when the switch reaches position 5 1/2 during its advance, from ground, both outer contacts of cam R, both lower contacts of cam L, break contact of the PU relay, upper outer contact of cam N, to the group register circuit.

TRUNK HUNTING

FIRST TRUNK IDLE

12. If the tripped brush has made contact with an idle trunk, the L relay releases as the switch advances to position 6, since its circuit is open at the upper outer contact of cam M.

FIRST TRUNK BUSY

13. If the tripped brush has made contact with a busy trunk, the L relay is held operated as the switch advances to position 6, from battery, inner winding, lower outer contact of cam H, make contact of the L relay, both upper contacts of cam I, S terminal of the trunk multiple to ground in a busy final circuit. The L relay operated in position 6, energizes the UP magnet from battery, winding of the magnet, lower inner contact of cam D, upper outer contact of cam E, make contact of the L relay to ground.

14. The UP magnet energized causes the selector brush rod to travel upward, wiping the springs of the tripped brush over the bank terminals of a group. When an idle trunk is found as indicated by no ground connected to the S terminal of the trunk multiple, the holding circuit through the inner winding of the L relay is opened. The L relay however, will not release immediately since a circuit is closed from battery, outer winding, lower outer and upper inner contacts of cam Q, C commutator segment and brush to ground.

"C" COMMUTATOR

15. The adjustment of the C commutator brush with relation to the tripped brush is such that it does not break contact with the C commutator segment until slightly after the holding circuit through the inner winding of the L relay is opened by the sleeve brush leaving a busy terminal and making contact with the S terminal of an idle trunk. The UP magnet therefore remains operated and the selector rod continues to travel upward, until the brushes are carried slightly above the center of the trunk terminals, allowing the locking pawl to enter a notch on the rack attached to the brush rod. At this time, the holding circuit through the outer winding of the L relay is opened at the C commutator, releasing the L relay. The L relay released, (a) Disconnects ground from the commutator feed bar G, (b) De-energizes the UP magnet, dropping the selector rod into place, centering the brush on the trunk terminals; (c) Immediately connects a temporary busy ground to the S terminal of the selected trunk thus holding it busy to other hunting selectors until the switch advances to position 6 3/4. This circuit is from ground, both outer contacts of cam K, break contact of the L relay, upper contacts of cam I, to the S terminal of the trunk, (d) Advances the switch to position 7, from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground. When the switch reaches position 6 3/4 during its advance, a permanent busy ground is connected to the S terminal of the selected trunk through the lower outer and upper inner contacts of cam I to the S terminal. During trunk hunting in position 6 only,

(15 Pages) Page 4,
Issue 1 - BT-441152
May 19, 1921.

the commutator feed ground is supplied through one of the make contacts of and under control of the L relay through the lower outer and upper inner contacts of cam E, which prevents the re-operation of the L relay by the closing of a circuit between the C commutator brush and segment on an overthrow of the selector rod or as it drops into place.

16. The L relay operates with the switch in position 7 from battery, inner winding, both lower contacts of cam T, both outer contacts of cam I to ground and is held operated from battery, inner winding, lower outer contact of cam H, make contact of the L relay, upper inner contact of cam G, over the ring to ground in the final circuit and advances the switch to position 8 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

SELECTION BEYOND

17. When the switch reaches position 7 $\frac{3}{4}$ a circuit is closed from battery, through the final line relay, over the tip, upper inner contact of cam F, T compensating resistance, over the fundamental tip, through the associated sender, back over the fundamental ring, R compensating resistance, upper inner contact of cam D, upper outer contact of cam E, make contact of the L relay to ground. The final circuit then satisfies the sender for final brush, final tens, and final units selection and then advances opening the holding circuit through the inner winding of the L relay, releasing it and advancing the switch to position 9 from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground.

INCOMING ADVANCE

18. With the switch in position 9, the L relay awaits a closure of the fundamental circuit in the sender. When this is made, the L relay operates from battery, inner winding, upper inner contacts of cam E, and D respectively, R compensating resistance, over the fundamental ring, through the associated sender, and back to the fundamental tip, T compensating resistance, upper inner contact of cam S, lower inner contact of cam T, both outer contacts of cam I, to ground. The L relay operated, advances the switch to position 10, from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground, the A cam continuing the advance of the switch to position 11.

19. When position 9 $\frac{3}{4}$ to 10 is reached during the advance of the switch, the outer and inner windings of the L relay are connected in parallel, increasing the current flow through the sender to insure the operation of a sender polarized relay over a long loop. For this purpose, position 10 is "pass by" to give increased time for this sender polarized relay to operate.

The circuits are from battery, outer winding, lower contacts of cam O, upper inner and lower outer contacts of cam L, upper contacts of cam R, R compensating resistance to the fundamental ring, and from battery, inner winding, upper inner contacts of cams E, and D respectively, R compensating resistance to the fundamental ring, holding the L relay operated. As the switch advances out of position 10, the L relay releases.

USED WITH 1200 - 1300 OHM FUNDAMENTAL (N Wiring).

20. With the switch in position 11, the incoming awaits trunk closure in the district. When this is made, the A relay operates from battery through its winding, lower inner and upper outer contacts of cam Q, upper outer and lower inner contacts of cam S, over the tip, through an associated district circuit, back over the ring, lower inner and upper outer contact of cam R, upper outer and lower inner contacts of cam P, other winding to ground.

21. The A relay operated, operates the L relay from battery, inner winding, upper inner contact of cam E, lower outer contact of cam D, make contact of the A relay to ground. The L relay operated, is held operated from battery, inner winding, lower contacts of cam H, make contact of the L relay, outer contacts of cam I to ground and advances the switch to position 12 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

USED DIRECTLY OR INDIRECTLY ON SENDER TANDEM CENTER (M Wiring)

22. The A relay operates in position 11 as described in par. 20, with the exception that its operating circuit is closed through the lower outer contacts of cam P. The A relay operated, operates the D relay from battery, winding of the relay, make contact of the A relay to ground. The D relay operated is held operated from battery, winding and own make contact, lower contacts of cam V to ground, and operates the L relay from battery, inner winding, upper inner contact of cam E, lower outer contact of cam D, make contact of the D relay to ground on cam V. The L relay is held operated, advancing the switch to position 12 as described in par. 21.

23. As the switch moves out of position 11 during its advance, the holding circuit for the A relay at cam P, is transferred from the lower outer to the lower inner contact of cam P, make contact of the D relay, winding of the A relay to ground. In case the fundamental circuit is momentarily opened while the apparatus at a sender tandem center is advancing from a selection beyond position or in case the A relay "chatters" on a long loop, the A relay, which is slow in releasing, holds the D relay operated. In case the opening of the fundamental circuit is prolonged and the A relay releases, the D relay which is slow in releasing, maintains a circuit through its made contact as described in paragraph 22, operating the A relay as soon as the fundamental circuit closes.

(15 Pages) page 6,
Issue 1 - BT-441152
May 19, 1921.

RINGING

24. The switch has two ringing positions namely 13 and 14. In position 13, positive ringing current is connected to the ring brush of the selector and in position 14, negative ringing current is connected to the ring brush of the selector. Stations which are rung with positive ringing current are assigned numbers which are reached through final trunks terminating in either group 0 or 2 on an incoming frame. Stations which are rung with negative current are assigned numbers which are reached through final trunks terminating in either groups 1 or 3 on an incoming frame. The ringing of stations on the tip side of the line is cared for by a cross connecting and reversing scheme at the distributing frames. The switch stops in position 13 when the selector is on a final trunk so located that the circuit through the P commutator brush and segment is open, but advances to position 14 when the selector is on a trunk so located that the circuit through the P commutator is closed.

GROUPS 0 and 2.

25. As the switch advances out of position 11, with the selector in group 0 or 2, the L relay releases since its holding circuit from battery, inner winding, upper inner contact of cam E, upper outer contact of cam D, to the P commutator brush is opened at the P commutator segment. The L relay released, operates the PU relay from battery winding of the relay, lower outer contact of cam N, break contact of the PU relay, lower inner and upper outer contact of cam L, break contact of the L relay, outer contacts of cam K, to ground. The PU relay operated is held operated from battery, winding of the relay, lower contacts of cam N, continuity contacts of the PU relay, lower contacts of cam J, break contact of the R relay, make contact of the D relay (M wiring), or make contact of the A relay (N wiring) to ground, advancing the switch to position 13, from battery, winding of the R magnet, upper outer contact of cam O, make contact of the PU relay, upper outer contact of cam K to ground.

26. With the switch in position 13, ringing current for the one bell code is connected to the line over the R-1 ringing lead, lower contacts of cam U, winding of the R relay, make contact of the PU relay, outer contacts of cam G, over the ring, through the called subscriber's loop and sub-set, to ground. The R relay is marginal and does not operate until the receiver is removed from the switchhook.

GROUP 1 or 3.

27. As the switch advances out of position 11 with the selector in group 1 or 3, the L relay is held operated from battery, inner winding, upper inner contact of cam E, upper outer contact of cam D, P commutator brush and segment, through the G commutator segment and brush, outer contacts of cam J, break contact of the R relay, make contact of the D, or A relay to ground.

28. In this group the PU relay awaits its ground in position 12 through a pick-up interrupter. When a circuit is closed at the interrupter contacts, the PU relay operates from battery, winding of the relay, lower contacts of cam N, break contact of the PU relay, lower inner and upper outer contact of cam L, make contact of the L relay, upper outer contact of cam H, through the pick-up interrupter resistance lamp, pick-up interrupter contacts to ground. The PU relay is held operated advancing the switch to position 13 as described in paragraph 25.

29. When the switch reaches position 13, the L relay is held operated from battery, inner winding, upper inner contact of cam E, upper outer contact of cam D, P commutator brush and segment, G commutator brush and segment, upper contacts of cam M to ground, continuing the advance of the switch to position 14 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

30. As the switch advances out of position 13, the L relay is held operated from battery, inner winding, lower contacts of cam H, make contact of the L relay, outer contacts of cam I to ground. As the switch advances out of position 13 1/2, the L relay is held operated from battery, inner winding, lower contacts of cam H, make contact of the L relay, upper contacts of cam L, make contact of the PU relay, upper outer contact of cam K to ground.

31. With the switch in position 14, ringing current for the two bell code is connected to the line over the R-2 ringing lead, upper inner contact of cam U, to the ring as described in paragraph 26.

AUDIBLE RINGING

32. Ringing current passes through the .02 m.f. condenser, both outer contacts of cam C, winding of the S relay, 7-8 winding of the repeating coil, to battery inducing an audible ringing tone which is transmitted back to the calling subscriber.

CALLED SUBSCRIBER ANSWERS

33. When the receiver is removed from the switchhook at the called station, the ringing circuit is closed back over the tip, lower outer contact of cam F, to generator ground increasing the current flow operating the R relay. The R relay operated, releases the PU relay. The R relay is not necessarily slow acting, but is less responsive to alternating than direct current.

34. The PU relay released with the switch in position 13, operates the L relay. The L relay operates from battery, outer winding, lower contacts of cam O, break contact of the PU relay, lower inner and upper outer contacts of cam M to ground. The L relay operated, advances the switch to position 14 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground. As the switch advances out of position 13, the L relay releases. When position 14 is reached, the switch continues its advance to position 15, from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground.

35. The PU relay released with the switch in position 14, operates the S relay.

36. The S relay operates from battery, winding of the relay both outer contacts of cam G, break contact of the PU relay, lower outer contact of cam G, ring of the line, called subscriber's loop and sub-set, tip of the line, lower outer contact of cam F to generator ground. The S relay operated performs no useful function at this time, but the repeating coil circuit is closed through the subscribers set, preventing a battery click while the switch is rotating through positions 13, 14, and 15. When position 14 3/4, is reached the lower outer contact of cam F is opened and the circuit is transferred through the upper outer contact of cam F, 4-3 winding of the repeating coil to ground. The L relay operates from battery, inner winding, upper inner and lower outer contact of cam E to ground. The L relay operated, advances the switch to position 16, from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground.

37. As the switch advances out of position 15 (a) The S relay is held operated through the upper outer contact of cam G (b) The A relay is held operated from battery, through its winding, upper inner contact of cam O, break contact of the PU relay, both lower contacts of cam M, upper outer and lower inner contact of cam S, over the fundamental tip, through the associated district, back over the fundamental ring, lower inner and upper outer contacts of cam R, lower contacts of cam L, break contact of the PU relay, inner contacts of cam H, other winding of the A relay to ground (H wiring) or make contact of the D relay, other winding of the A relay to ground (E wiring); (c) The L relay is held operated from battery, inner winding, upper inner contact of cam E, lower outer contact of cam D, make contact of the A or D relay to ground.

38. The PU relay operates in position 16, from battery, winding of the relay, upper contacts of cam H, make contact of the S relay to ground. The

PU relay operated, transfers the circuit of the A relay as described in paragraph 37, as follows, from battery, through its winding, inner contacts of cam O, make contact of the PU relay, inner contacts of cam K, 6-5 winding of the repeating coil, upper outer and lower inner contacts of cam R, over the ring, through the district, back over the tip, lower inner and upper outer contacts of cam S, 2-1 winding of the repeating coil, inner contacts of cam J, make contact of the PU relay, inner contacts of cam N, winding of the A relay to ground or make contact of the D relay, winding of the A relay to ground thus reversing both battery and ground on the fundamental circuit, causing a relay in the associated district to function, thus operating the charge relay.

DISCONNECTION

39. When the receiver is replaced on the switchhook at the called station, the S relay releases. The S relay released, releases the PU relay. The PU relay released, reverses battery over the tip and ring, causing the associated district to advance and release the A relay. The A relay released, releases the D relay. The A, or D relay released, releases the L relay which advances the switch out of position 16 from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground. The A cam continues the advance of the switch to position 18.

40. When used with 1200-1300 ohm fundamentals, if another hunting district or office selector seizes this incoming trunk, the instant it is released by the district or office selector of a preceding connection with the switch starting out of position 16, a circuit is closed from 24 volt battery, winding of the A relay, inner contacts of cam O, lower contacts of cam M, upper outer and lower inner contacts of cam S, over the fundamental tip, to the associated sender in its incoming test position, back over the fundamental ring lower inner and upper outer contacts of cam R, lower contacts of cam L, break contact of the PU relay, inner contacts of cam N, other winding of the A relay to ground. Under this condition, the A relay does not operate and the sender remains in its incoming test position until this incoming selector reaches position 1, connecting 48 volt battery to the fundamental tip through the L relay as described in paragraph 2.

41. The D magnet energizes in position 18, from battery, winding of the magnet, inner contacts of cam T, outer contacts of cam I to ground. The D magnet energized, disengages the locking pawl from the selector rod rack and causes the rod to be lowered to normal, re-setting the tripped brush. With the selector rod normal, the switch advances to position 1 from battery, winding of the R magnet, lower inner contact of cam B, Y brush and commutator, G brush and commutator, inner contacts of cam C, to ground.

OVERFLOW

42. Should all trunks in a group be busy, the selector while trunk hunting

in position 6 as described in paragraphs 12, 13, and 14, continues upward under control of the L relay held operated by ground from the busy 8 terminals until the overflow terminals are reached at the top of the group. As the sleeve of the overflow terminal is open, the L relay releases, advancing the switch to position 7 as described in paragraphs 14 and 15. The L relay operates in position 7 advancing the switch to position 8 as described in paragraph 16.

43. As the switch advances out of position 7, the L relay releases since the ring to a final circuit is opened. The L relay released, continues the advance of the switch to position 9 as described in paragraph 17.

44. With the switch in position 9, the L relay operates advancing the switch to position 11 as described in paragraph 18, but instead of satisfying a sender for final selections, the sender overflow relay operates, causing the district to advance to its overflow position, disconnecting the sender and opening the fundamental releasing the L relay. If the call has been routed through an operator, a position lamp flashes, or if routed without the aid of an operator, a tone is passed back from the district to the calling subscriber.

45. As the district circuit advances to its overflow position, trunk closure is momentarily made operating the A relay as described in paragraph 20, operating the L relay and advancing the switch to position 12 as described for paragraph 21. The A relay releases when the district reaches its overflow position. As the switch advances out of position 11, the L relay releases since a circuit through the P commutator is open.

46. The PU relay operates with the switch in position 12, as described in paragraph 25, and is held operated from battery, winding of the relay, lower contacts of cam N, make contact of the PU relay, upper outer contact of cam J, both upper contacts of cam M to ground, advancing the switch to position 13 as described in paragraph 25. The PU relay releases when the switch advances from position 12.

47. With the switch in position 13, no ringing current is connected to the ring, since the PU relay is normal. The L relay operates with the switch in position 13, from battery, outer winding, lower outer contact of cam O, break contact of the PU relay, lower inner and upper outer contacts of cam M to ground. The L relay operated, advances the switch to position 14 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground. The advance of the switch releases the L relay which advances the switch to position 15, from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground.

48. The L relay operates in position 15 from battery, inner winding, upper inner and lower outer contacts of cam E, to ground advancing the switch to position 16 from battery, winding of the R magnet, upper outer contact of cam B, make contact of the L relay to ground. As the switch advances out of position 15, the L relay releases, continuing the advance of the switch out of position 16 from battery, winding of the R magnet, lower outer contact of cam B, break contact of the L relay to ground, the A cam continuing the advance of district to position 18, where it is restored to normal as described in paragraph 41.

TELL TALE:

49. During selections in position 2, 4, or 6, there are possibilities that the UP magnet may fail to release. The brush rod then continues upward, until the X brush makes contact with the X commutator segment at the top of the bank. Such a condition could be caused by a dirty or grounded commutator, failure of the L relay to release, failure of the fundamental to open in the sender, spring adjustment, etc.

50. When the X commutator brush makes contact with the X commutator segment, with the switch in position 2, 4, or 6 and the L relay fails to release, the switch advances to position 3, 5, or 7 from battery, winding of the R magnet, lower outer contact of cam B, X commutator brush and segment, G commutator to ground, releasing the L relay. During the time the selector rod is moving upward in position 2 or 4, the A or B commutator sends impulses back to the sender, "running down" the sender counting relays for incoming selectors and possibly for final selections.

51. If the L relay does not release when the switch advances out of position 2, 4 or 6, the switch continues its advance to position 12, under control of ground through the make contact of the L relay and also through the X commutator, through the upper outer and lower outer contacts of cam B. As the switch passes through position 9, battery is connected to the fundamental ring as described in paragraph 18, operating the sender overflow relay as described in paragraph 44.

52. If the L relay releases when the switch advances out of position 2 or 4, it re-operates over the fundamental circuit, closed through the sender in one of its incoming or final selection positions, advancing the switch to position 4 or 6, the X commutator continuing its advance to position 5 or 7. In position 5, the L relay re-operates over the fundamental circuit, advancing the switch to position 6, the X commutator continuing its advance to position 7. With the switch in position 7, the L relay operates as described in paragraph 16, advancing the switch to position 8, the X commutator continuing its advance

(15 Pages) Page 12,
Issue 1 - BT-441152
May 19, 1921.

to position 9. In position 9, the L relay re-operates over the fundamental circuit, as described in paragraph 18, advancing the switch to position 11, operating the sender overflow relay as described in paragraph 44. With the switch in position 11, the A relay finds a closure through the district, operating the relay advancing the switch to position 12, in turn operating the PU relay, advancing the switch to position 13. The PU relay releases in position 13, and the L relay operates advancing the switch to position 14, where the L relay releases, causing the switch to advance to position 15. In position 15, the L relay reoperates, advancing the switch to position 16, releasing the L relay, the X commutator continuing the advance of the switch to position 18, where it is restored to normal by the "Y" commutator.

CONVERSION TO KEY INDICATOR ("L" WIRING)

53. This circuit may be arranged to work as an incoming from manual key indicator by means of cuttings at cams B, G, and H, and using 12000 - 27 ohm bridged relay supervision. The operation of this circuit when converted to key indicator is similar to the full mechanical except on overflow calls.

54. When an incoming selector working from key indicator goes to overflow, the switch advances to position 12, as described in paragraphs 42 to 46 inclusive, the switch continuing its advance to position 17 from battery, winding of the B magnet, upper inner contact of cam B, Z commutator brush and segment to ground. An A relay (not shown in this drawing), operates over the trunk and is held operated through the "A" operator's cord circuit. When position 15 is reached, the L relay operates from battery, inner winding, upper inner contact of cam E, lower outer contact of cam D, make contact of the A relay to ground.

55. When position 17 is reached, interrupted ground is closed from an interrupter circuit, upper inner contact of cam H, make contact of the L relay, both upper contacts of cam G, winding of the S relay, 7-8 winding of the repeating coil to battery, operating and releasing the relay simultaneously short circuiting the 12,000 ohm winding of the A relay (not shown), flashing the "A" operator's supervisory lamp. The withdrawal of the plug of the "A" operator's cord circuit from the jack of the trunk releases the A relay releasing the L relay advancing the switch to position 18 and it is restored to normal as described in paragraph 41.

CIRCUIT REQUIREMENTS

OPERATE

NON-OPERATE

RELEASE

Mechanical Requirements.

- 114-AK (a) The flutter spring should not lie flat against the armature
(R) when the armature is in the operated position.
- (b) There should be a clearance of .034" between the back contact and the flutter spring when the flutter spring is pressed flat against the armature and the armature is in the operated position.

Electrical Requirements.

114-AK (R)	Test with "Testing Circuit" or by connecting 630 ohms $\pm 1\%$ non-inductive resistance in series with the relay during ringing period. Readj. .032 amp.	Test with "Testing Circuit" or by connecting 1,165 ohms $\pm 1\%$ non-inductive resistance in series with the relay during ringing period. Readj. .030 amp.
------------	--	--

NOTE: The above "TEST" resistances are based on a ringing machine speed of approximately 1200 R.P.M. (20 cycles) and an A. C. voltage of 95-110.

B1 (S) After a soak of approximately
24 Volt .3 amp.
Test .021 amp.
Readj. .015 amp.

After a soak of
approximately .3 amp.
Test .0037 amp.
Readj. .005 amp.

B1 (S) After a soak of approximately
48 Volt .3 amp.
Test .038 amp.
Readj. .025 amp.

After a soak of
approximately .3 amp.
Test .007 amp.
Readj. .009 amp.

(15 Pages) Page 14.
Issue 1 - BT-441152
May 19, 1921.

CIRCUIT REQUIREMENTS.

	<u>OPERATE</u>	<u>NON-OPERATE</u>	<u>RELEASE</u>
B 144 (A) Windings in series aiding (24 volt)	Test .0055 amp. Readj. .0052 amp.	Test .0033 amp. Readj. .0035 amp.	
(48 volt)	Test .0053 amp. Readj. .005 amp.		Test .002 amp. Readj. .0022 amp.
E526 (L) Inner Winding (1000 ohms)	Test .0168 amp. Readj. .016 amp.	Test .0114 amp. Readj. .012 amp.	
Outer winding (1000 ohms)	Test .043 amp.		
NOTE: Relay to be equipped with special armature stop. (piece part 163914).			
E859 (D)	Test .037 amp. Readj. .035 amp.		Test .0009 amp. Readj. .001 amp.
E1012 (PU)	Test .024 amp. Readj. .022 amp.		Test .0038 amp. Readj. .004 amp.

CIRCUIT REQUIREMENTS

OPERATE

NON-OPERATE

RELEASE

NOTE: When necessary to readjust this relay, adjust the straight outside spring of the make - break combination through which the relay locks to give a contact pressure of at least 20 grams.

E1525 Test .024 amp.
(PU) Readj. .022 amp.

Test .0038 amp.
Readj. .004 amp.

NOTE: When necessary to readjust this relay, adjust the straight outside spring of the make - break combination through which the relay locks to give a contact pressure of at least 20 grams.

ENG.--ANB-ML.

CHK'D.--CHW-CWP.

APPROVED - C. L. SLUYTER, G. M. L.

50-8/12/24

Western Electric Company, Inc.,
Engineering Department,
New York,

(3 Pages) Page 1,
Appendix 1,
Issue 1, BT-441152
November 1, 1922.

METHOD OF OPERATION
INTEROFFICE INCOMING SELECTOR CIRCUIT

Schematic -- Four Party Semi-Selective Ringing -- Full Mechanical Power Driven System.

The requirements for 114-AK, 114-BL and B1 relays shall be changed to read as follows:-

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY.

MECHANICAL REQUIREMENTS

- 114-AK (a) The flutter spring shall be adjusted so it will lie approximately half way between the back contact and the armature, when the armature is in the operated position.
- (R) (b) There should be a clearance of .034" between the back contact and the flutter spring, when the flutter spring is pressed flat against the armature and the armature is in the operated position.

ELECTRICAL REQUIREMENTS

OPERATE

Readj. .036 amp.
Test with "Testing Circuit" in offices in which a testing circuit is furnished or by connecting 550 ohms $\pm 1\%$ non-inductive resistance (for 1200 R.P.M. -20 cycle offices) or 700 ohms $\pm 1\%$ (for 1000 R.P.M. - 16 $\frac{2}{3}$ cycle offices) in series with the relay during the ringing period.

NON-OPERATE

Readj. .034 amp. Test with "Testing Circuit" in offices in which a testing circuit is furnished or by connecting 1165 ohms $\pm 1\%$ non-inductive resistance (for 1200 R.P.M. -20 cycle offices) or 1420 ohms $\pm 1\%$ (for 1000 R.P.M. - 16 $\frac{2}{3}$ cycle offices) in series with the relay during the ringing period.

RELEASE

- NOTES: (1) No testing shall be done if the ringing voltage is less than 95 volts or over 110 volts.
- (2) The "TEST" resistances for the 1200 R.P.M. offices are based on a ringing machine speed of approximately 1200 R.P.M. (20 cycles) and A.C. voltage of 95 to 110 volts.
- (3) The "TEST" resistances for the 1000 R.P.M. offices are based on a ringing machine speed of approximately 1000 R.P.M. (16 $\frac{2}{3}$ cycles) and an A.C. voltage of 95 to 110 volts.
- (4) If the relay fails to meet its test requirements, it shall be readjusted to its readjust requirements. If, after having been readjusted, the relay still fails to meet its test requirements, its adjustment shall be modified until it does meet the test requirements.

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY.

MECHANICAL REQUIREMENTS

- 114-BL (a) There shall be a clearance of .015" between the back contact and the flutter spring when the flutter spring is lying flat against the armature and the armature is in the operated position.
(R)
- (b) The flutter spring shall be adjusted so that it will lie approximately half way between the armature and the back contact when the armature is in the operated position.

ELECTRICAL REQUIREMENTS

OPERATE

NON-OPERATE

RELEASE

Special requirements to insure A.C. operation

Readj. .052 amp.

Test with "Testing Circuit" in offices in which a testing circuit is furnished or by connecting in series with the relay 790 ohms resistance (non-inductive $\pm 1\%$ for 72-99 A.C. volts and 30-34 D.C. volts, or 1040 ohms resistance (non-inductive $\pm 1\%$ for 64-80 A.C. volts and 42-46 D.C. volts.

Readj. .049 amp.

Test with "Testing Circuit" in offices in which a testing circuit is furnished or by connecting in series with the relay 1140 ohms resistance (non-inductive $\pm 1\%$ for 72-88 A.C. volts and 30-34 D.C. volts, or 1320 ohms resistance (non-inductive) $\pm 1\%$ for 64-80 A.C. volts and 42-46 D.C. volts.

NOTE:- The above "Test" resistances are based on a ringing machine speed of 1100 to 1200 R.P.M. (20 cycles).

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY.

OPERATE

NON-OPERATE

RELEASE

B1 When used with loops having a maximum resistance of 750 ohms

(S) After a soak of approxi-
mately .3 amp.
Readj. .015 amp.
Test .021 amp.

After a soak of
approximately .3 amp.
Readj. .005 amp.
Test .0037 amp.

When used with loops having a maximum resistance of 900 ohms.

After a soak of
approximately .3 amp.
Readj. .015 amp.
Test .019 amp.

After a soak of
approximately .3 amp.
Readj. .005 amp.
Test .0037 amp.

Special requirements to meet 48 volt supervision.

When used with loops having a maximum resistance of 750 ohms.

After a soak of
approximately .3 amp.
Readj..025 amp.
Test .038 amp.

After a soak of
approximately .3 amp.
Readj. .009 amp.
Test .0073 amp.

When used with loops having a maximum resistance of 900 ohms.

After a soak of approxi-
mately .3 amp.
Readj. .025 amp.
Test .034 amp.

After a soak of
approximately .3 amp.
Readj. 009 amp.
Test .0073 amp.

ENG.--CFS-MM.

CHECKED BY: LBS-CWP.

APPROVED: J.I.DOW, G.M.L.

8/11/24

Western Electric Co., Incorporated,
Equipment Engineering Branch, Hawthorne.

(1 Pages, Page 1)
Issue 1 BT 441152
Appendix #2
October 23, 1924.

This appendix was prepared from issue (8) of T-441152.

METHOD OF OPERATION

Interoffice Incoming Selector Circuit - Four Party Selective Ringing - Full
Mechanical - Power Driven System.

This appendix cancels all circuit requirements in issue 1 and in
issue 1, appendix 1.

ENG.--J.J.B.
October 20, 1924.
FP.

CHK'D.--G.E.H.

APP'D.--E. R. COOKE
H. G. J.