

AUTOMATIC ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS



Bulletin 700-90M

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WALL TELEPHONE TYPE 90M — INSTALLATION AND ADJUSTMENTS —

1. DESCRIPTION

The type 90M is a self-contained wall telephone set. The terminal strip accepts wiring for either bridged or divided ringing. No soldering is required.

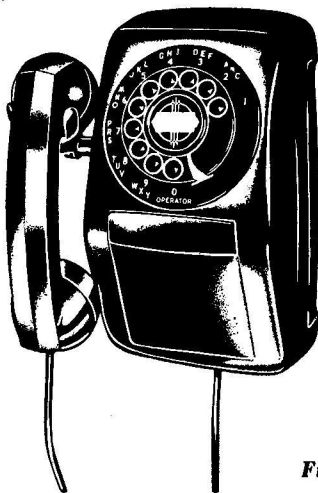


Figure 1.

For automatic systems the wall telephone type 90M is equipped with a dial, when arranged for manual systems it is not. Instructions follow for several sorts of installations:

A. E. Co. "standard" type 90 (§5)

Modified standard (§6 and §7)

Party-line station with spotter dial for S.A.T.T. system A (§7 and §8)

Party-line station for S.A.T.T. system B (§9)

Superimposed ringing (§10)

P-A-B-X and P.B.X. (§5 and §13.3 or §13.4)

2. TO MOUNT ON A WALL

About 5" below the dial, toward the bottom of the plastic housing, is a screw head. Loosen this housing screw, and lift off the plastic housing.

Pass the line wire thru the bottom of the base, as in figure 3.

Put one #8 round-head screw thru either of the top two holes as shown in figure 2. Put the second #8 round-head screw thru the slot at the bottom as in figure 2. Set the telephone so it is exactly vertical and then put in the third screw.

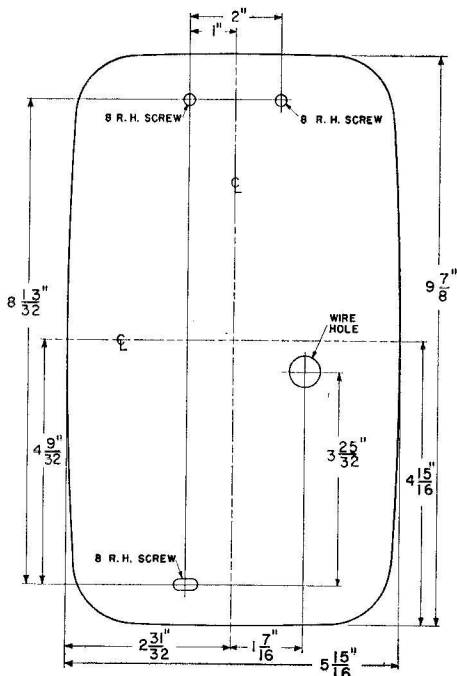


Figure 2. Locations of wall-mounting holes.

When masonry anchors are to be used, the mounting-hole spacing-dimensions in figure 2 give you the drilling layout. (Notice that the holes do *not* fall at the corners of a rectangle, but are *scattered*.)

3. TO MOUNT ON AN ELECTRIC OUTLET BOX

Order A. E. Co. Adapter-Plate D-780763-A, 3 D-760823 #8-32x 25/64" RHIL screws, 3 D-750261-A Bushings, and 2 #6-32x5/8" RHIM (or FHIM) screws. The adapter-plate (figure 3) has a number of holes in it, so it can mount on:

- a 4" square outlet box, or
- a 4" octagonal outlet box, or
- an oblong utility or "handy box".

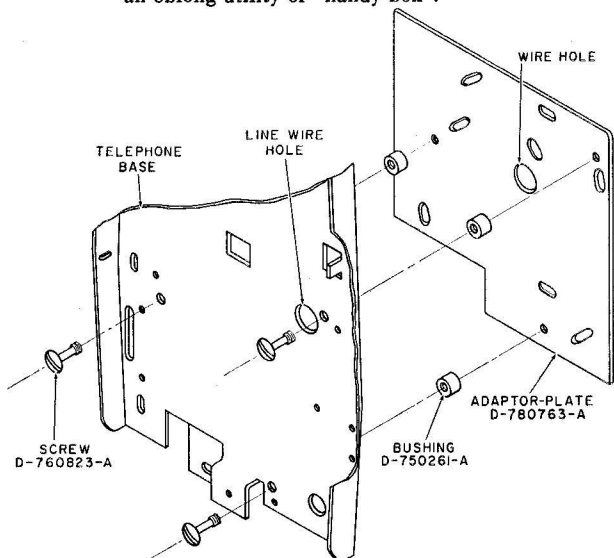


Figure 3. Adapter-plate assembly (exploded view)

Pass the telephone-line wire thru the adapter-plate "wire-hole" (figure 3). Using the outlet box 2 #8-32x1/2" RHIM screws (if any) or the 2 #6-32x5/8" RHIM or FHIM screws, and the appropriate 2 holes in adapter-plate D-780763-A, attach the adapter-plate (figure 3) to the outlet box. Align the cover vertically on the wall, and tighten the two screws.

About 5" below the telephone dial, toward the bottom of the plastic housing, is a screw head. Loosen this housing screw, and lift off the plastic housing.

Pass the line-wire thru the bottom of the base, as shown in figure 3. Using the 3 D-760823-A RHIL screws and the 3 D-750261-A bushings, attach the telephone base to the adapter-plate tapped holes (figure 3). These bushings must be assembled so that their tapped sides are toward the telephone base-plate.

4. LINE POLARITY

Line polarity is important at divided-ringing party-line stations, and in S.A.T.T. exchanges.

Connection instructions thruout this bulletin assume the interior wires between the protector (or P.B.X. switchboard, etc.) and the telephone location in the subscriber's premises have their polarities identified by these standard tracers:

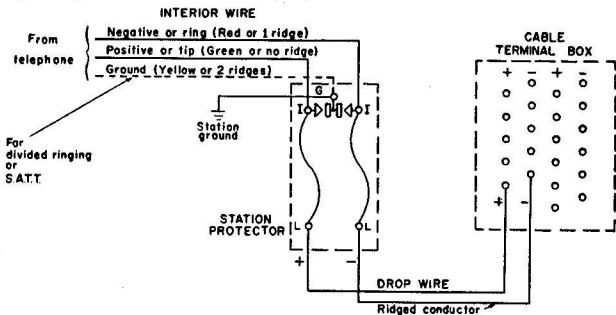


Figure 4. Typical connections to protector, cable terminal, etc.

We offer this following R alliteration — ring (—), red,

Ring (negative line) CONNECTS TO:
Red (or 1-ridge) interior-wire conductor
Right-hand station-protector terminal screw
Ridged ("tracer") drop-wire conductor
Right-hand* cable-terminal stud.

right, ridged — to help you remember these connections.

Having installed it yourself, you'll know which is the ground wire, but you may sometimes be uncertain of the polarities of the line conductors. When in doubt, clip one lead of a hand test telephone (such as A. E. Co. #L-965-A2**) to the ground wire, and touch the other clip to each line wire. You will hear a louder*** click**** when you touch the —line wire.

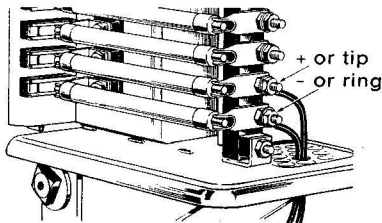


Figure 5. Polarities and drop-wire connections at a typical pole-mounted protected cable terminal.

When making connections to a transposed open-wire line at a pole where no ground connection is readily available, determine line polarity with a portable d-c (d'Arsonval) voltmeter.

*The *r* alliteration *ring=right* applies at a strand-mounted or sheath-mounted cable terminal or at an *unprotected* pole-mounted or wall-mounted cable terminal. At a *protected* pole-mounted or wall-mounted cable terminal, use instead the *t* alliteration *tip=top*, and connect the \div line to the *upper* terminal-stud of the pair, as in figure 5.

**Do *not* press buttons.

***The \div line usually will not sound completely dead, but will give a weak click, due to earth-potential difference.

****Sometimes (in a Director exchange, for example) the click on the \div line will be followed in a moment by dial tone.

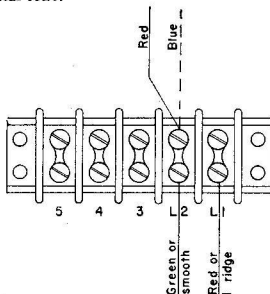


Figure 6. Terminal-strip connections for bridged ringing (non-S.A.T.T.).

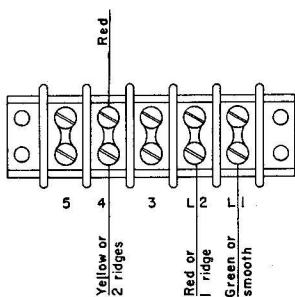


Figure 7.

Terminal-strip connections for party-line standard telephone rung on \div line ("tip").

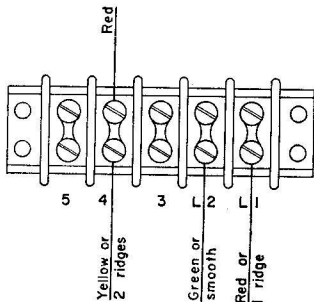


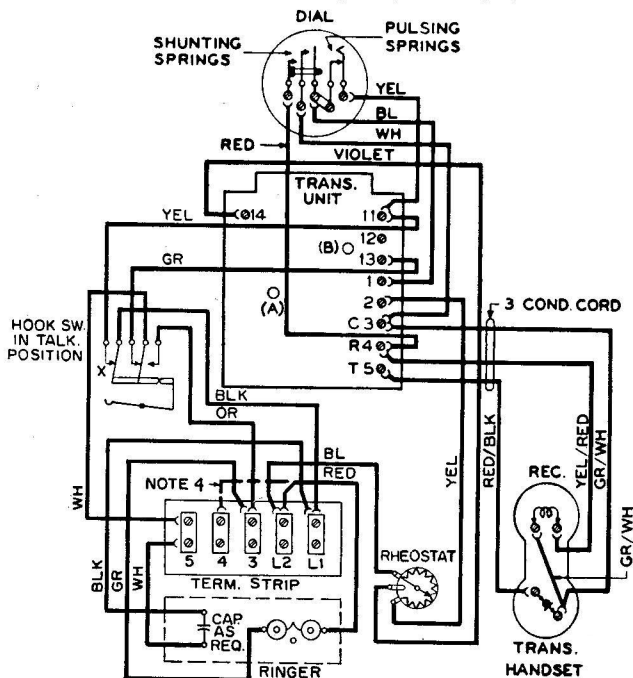
Figure 8.

Terminal-strip connections for party-line standard telephone rung on \div line ("ring"), for S.A.T.T. A or S.A.T.T. B station, or for superimposed ringing.

5. "STANDARD" TYPE 90M

Identifiable by circuit label-card D-530253-A inside the telephone

These instructions apply to a type 90M telephone with straight-line or harmonic ringer (but without party-identity [S.A.T.T.] dial and without cold-cathode tube for superimposed ringing).



Note 1. Contacts "X" break first and make last.

Note 2. If bells of biased ringer tap when dialing from another telephone on the line, reverse ringer connections at terminals 3 and L2.

Note 3. If no dial is used connect blue and yellow dial wires to terminal 2, white to terminal 3, and red to terminal 4 of dial blank.

Note 4. Wiring at terminal strip shown for metallic (bridged) ringing. For ground (divided) ringing move red lead at terminal strip from terminal L2 to 4. To ring from L2 to ground reverse line wires at terminal strip.

Note 5. Terminals (A) and (B) are for tests.

Figure 9. Wiring diagram (standard).

Mount as in §2 (or §3).

FOR BRIDGED RINGING, connect both loop-compensator blue lead and ringer red lead to terminal L2, and connect line wires as shown in figure 6.

FOR PARTY RUNG ON +LINE ("TIP"), connect ringer red lead to terminal 4, and connect line wires as shown in figure 7.

FOR PARTY RUNG ON -LINE ("RING"), connect ringer red lead to terminal 4, and connect line wires as shown in figure 8.

For a normal line in a 48- or 50-volt exchange:
If conductor-loop resistance is 200Ω or less, set loop compensator at 2.
If conductor-loop resistance is over 200Ω , set loop compensator at 0.
Review §13 and §14 for conditions which require a special setting.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

Stamp directory-number on number card as in §15 or §16.

Call the central office for a ringing test, etc.

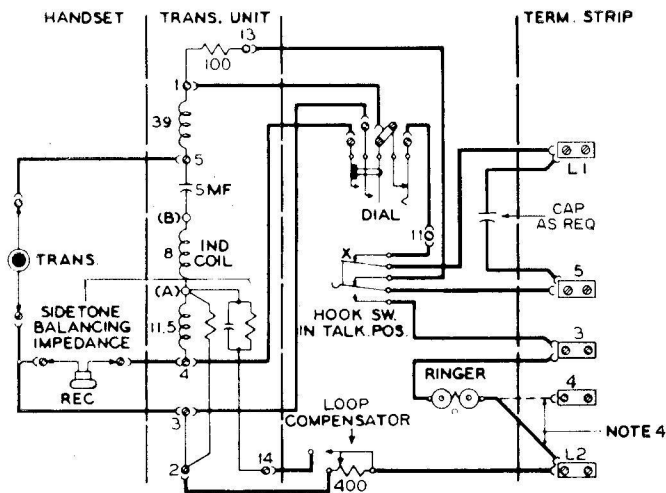
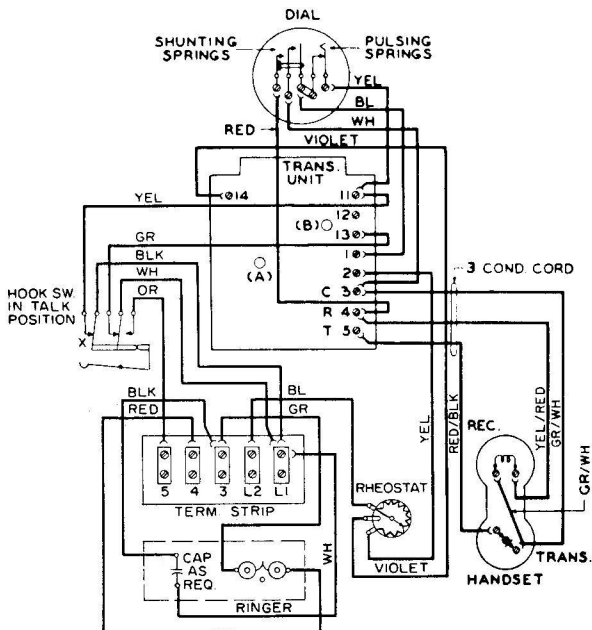


Figure 10. Schematic (standard).

6. R.E.A. TYPE 90M-W AND R.E.A. TYPE 90M-Y

Identifiable by circuit label-card D-530257-A inside the telephone

These differ from A.E. Co.'s standard type 90M only in that the ringer is connected to the line during conversation, requiring an additional capacitor. The dial pulse-spring spark-killer 1.0 μ f capacitor mounts in the transmission unit. See figures 38a and 38b. The type 90M-W is equipped with a dial. The type 90M-Y is not.



Note 1. Contacts "X" break first and make last.

Note 2. If bells of biased ringer tap when dialing from another telephone on the line, reverse ringer connections at terminals 3 and 4 of terminal strip.

Note 3. If no dial is used, connect blue and yellow dial wires to terminal 2, white to terminal 3, and red to terminal 4 of dial blank.

Note 4. Drawing shows terminal strip wiring for divided (ground return) ringing. For bridged ringing, at terminal strip connect red ringer lead to terminal L2.

Note 5. Terminals (A) and (B) are for tests.

Figure 11. Wiring diagram (R.E.A.)

Mount as in §2 (or §3).

FOR PARTY RUNG ON +LINE ("TIP"), leave ringer red lead on terminal 4, and connect line wires as shown in figure 7.

FOR PARTY RUNG ON —LINE ("RING"), leave ringer red lead on terminal 4, and connect line wires as shown in figure 8.

FOR BRIDGED RINGING, connect both loop-compensator blue lead and ringer red lead to terminal L2, and connect line wires per figure 6.

For a normal line in a 48- or 50-volt exchange:
 {If conductor-loop resistance is 200Ω or less, set loop compensator at 2.
 {If conductor-loop resistance is over 200Ω , set loop compensator at 0.
 Review §13 and §14 for conditions which require a special setting.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

Stamp directory-number on number card as in §15 or §16.

Call the central office for a ringing test, etc.

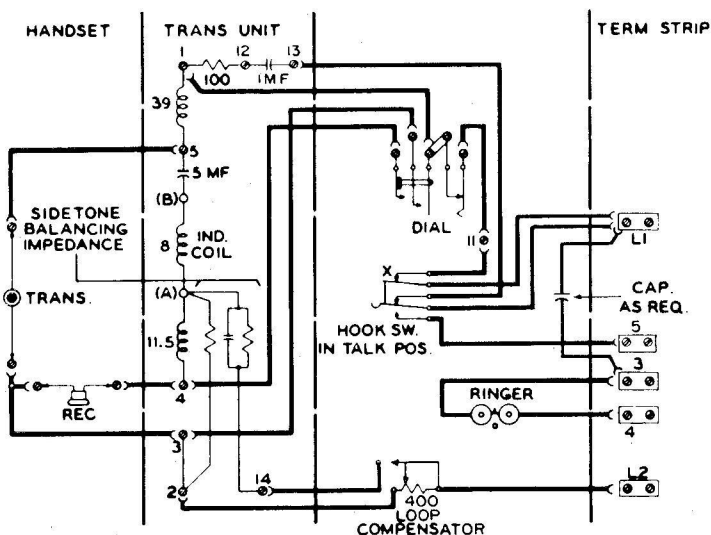
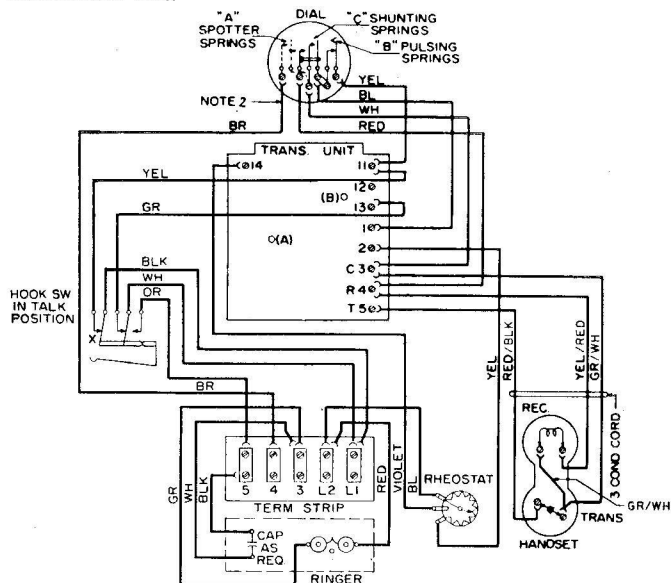


Figure 12. Schematic (R.E.A.).

7. NON-S.A.T.T. OR FOR S.A.T.T. SYSTEM A with 1 μ f dial-pulse spark-suppression capacitor

Identifiable by circuit label-card D-530258-A inside the telephone

The dial pulse-spring spark-killer 1 μ f capacitor mounts in the transmission unit.



Note 1. Contacts "X" break first and make last.

Note 2. When standard dial is used connect dial end of brown lead to terminal 4 of the terminal strip.

Note 3. "A" spotter springs (when used) to operate when "B" pulsing springs are closed.

Note 4. Maintain line polarity as shown; do not reverse line leads.

Note 5. Telephone leaves factory wired for bridged ringing. To ring from +line ("tip") to ground, move white lead from terminal L1 to terminal 4. To ring from —line ("ring") to ground, at terminal strip move ringer red lead from terminal L2 to terminal 4.

Note 6. If bells of biased ringer tap when dialing from another telephone on the line, reverse the green and red ringer leads.

Note 7. Terminals (A) and (B) are for tests.

Figure 13. Wiring diagram (1 μ f spark suppression).

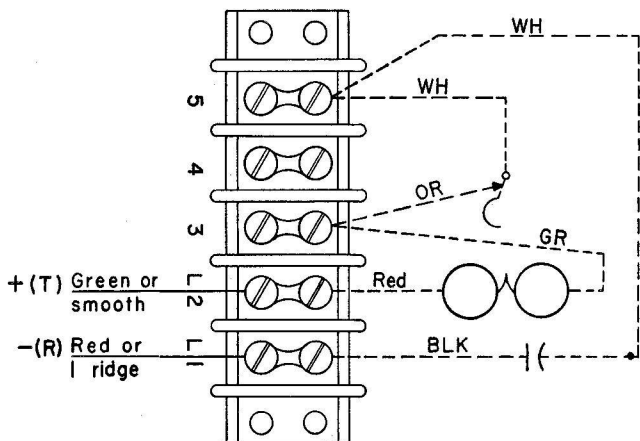


Figure 14.
Solid lines show installer's wiring for
bridged ringing [non-S.A.T.T.]
(figures 9 and 10 only).

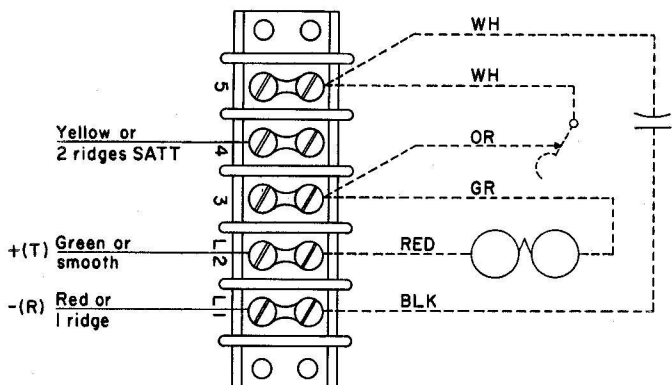


Figure 15.
Solid lines show installer's wiring for
bridged ringing [S.A.T.T. system A]
(figures 19 and 20 only).

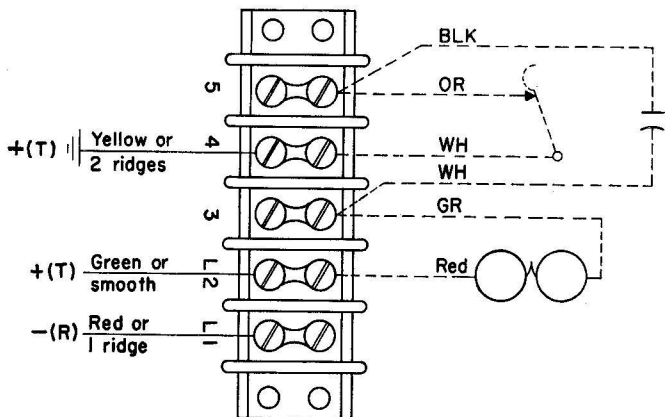


Figure 16.
Solid lines show installer's wiring for
party on +line or "tip"
(figures 13 and 18 only).

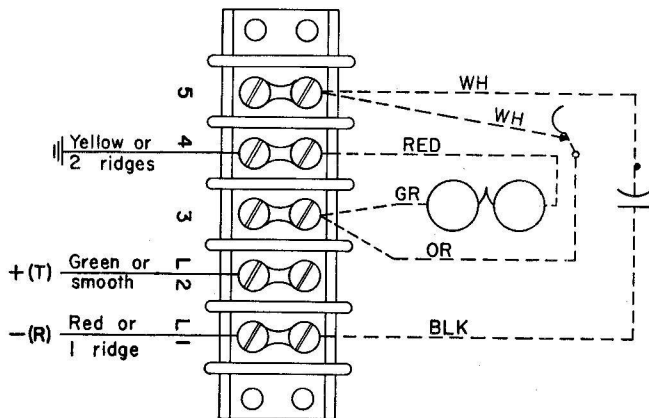


Figure 17.
Solid lines show installer's wiring for
party on -line or "ring"
(figures 9 and 10 only).

Mount as in §2 (or §3).

FOR BRIDGED RINGING (NON-S.A.T.T.), connect per figure 14* solid lines.

FOR BRIDGED RINGING (S.A.T.T. SYSTEM "A"), connect per figure 15* solid lines.

FOR PARTY RUNG ON +LINE ("TIP"), connect per figure 16** solid lines.

FOR PARTY RUNG ON —LINE ("RING"), connect per figure 17 solid lines.

If this installation uses a S.A.T.T. dial, check that the party-identity pulse will be on the +line. At the terminal strip, attach to L1 and L2 the clips of a hand test telephone (such as A. E. Co. #L-965-A2). Press test-telephone button C, and, with the subscriber's handset on the hook, dial "5" on the subscriber's dial. As the dial returns, listen at the test telephone. If you hear no click you have connected the subscriber's telephone correctly; if you hear a click, reverse the "interior" wires at telephone terminals L1 and L2.

For a normal line in a 48- or 50-volt exchange:

{If conductor-loop resistance is 200Ω or less, set loop compensator at 2.

{If conductor-loop resistance is over 200Ω , set loop compensator at 0.

Review §13 and §14 for conditions which require a special setting.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

Stamp directory-number on number card as in §15 or §16.

Call the central office for a ringing test, etc.

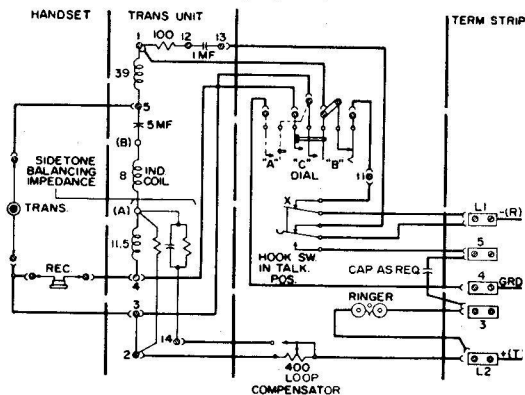


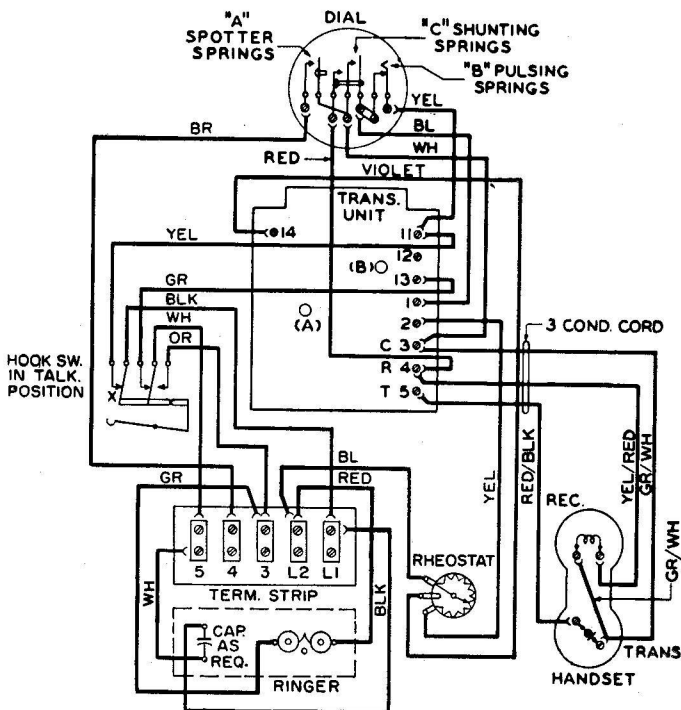
Figure 18. Schematic (1 μ f spark suppression).

*At terminal-strip terminal L2, connect both ringer red lead and loop-compensator blue lead.

**This model is never wired per figure 7. (Figure 7 applies to figures 9 thru 12, only.)

8. WITH SPOTTER DIAL FOR S.A.T.T. SYSTEM A using ringer capacitor for dial-pulse spark killer

Identifiable by circuit label-card D-530255-A inside the telephone



Note 1. Contacts "X" break first and make last.

Note 2. "A" spotter springs to operate when "B" pulsing springs are closed.

Note 3. Maintain line polarity as shown; do not reverse line leads.

Note 4. If bells of biased ringer tap when dialing from another telephone on the line, reverse ringer connections at terminals 3 and L2 of terminal strip.

Note 5. Terminals (A) and (B) are for tests.

Figure 19. Wiring diagram (S.A.T.T. system A).

Mount as in §2 (or §3).

Connect per figure 8. [In some cases the party-line first party will be equipped with a standard telephone; connect it as for an individual line, §5.]

Check that the party-identity pulse will be on the +line. At the terminal strip, attach the clips of a hand test telephone (such as A. E. Co. #L-965-A2) to L1 and L2. Press test-telephone button C, and, with the subscriber's handset on the hook, dial "0" on the subscriber's dial. As the dial returns, listen at the test telephone. If you hear no click you have connected the subscriber's telephone correctly; if you hear one or more clicks, reverse "interior" wires at telephone terminals L1 and L2 (figure 8) or reverse *drop* wires at protector (figure 4).

For a normal line in a 48- or 50-volt exchange:

{If conductor-loop resistance is 200Ω or less, set loop compensator at 2.

{If conductor-loop resistance is over 200Ω , set loop compensator at 0.

Review §13 and §14 for conditions which require a special setting.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

Stamp directory-number on number card as in §15 or §16.

Call the central office for a ringing test, etc.

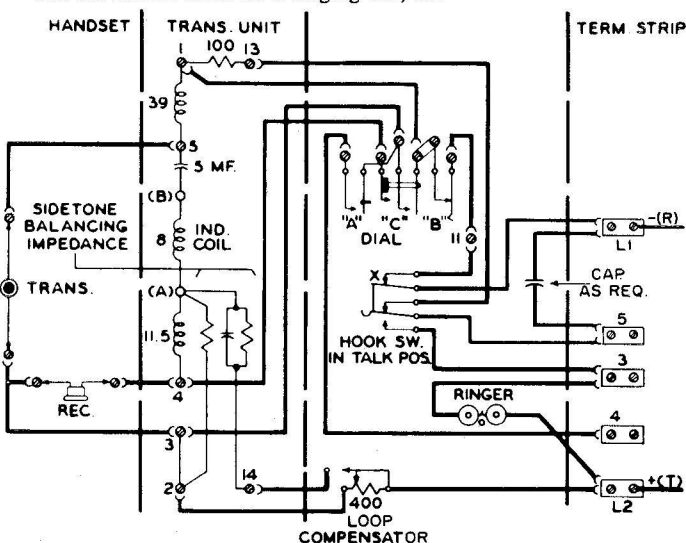


Figure 20. Schematic (S.A.T.T. system A).

For the dial pulse-spring spark killer, the telephone has a 1 μ f capacitor mounted in the transmission unit.

Mount as in §2 (or §3).

If the telephone is not already wired for the proper party-station, at telephone terminal strip reconnect ringer red lead and/or capacitor white lead thus:

| | <i>Ringer red lead</i> | <i>Capacitor white lead</i> |
|-----------------------------|------------------------|-----------------------------|
| For bridged ringing | L2 | L1 |
| For party on +line ("tip") | 4 | L2 |
| For party on -line ("ring") | 4 | L1 |

Connect line wires per figure 8.

Check that the party-identity pulse will be on the + line. At the terminal strip, attach the clips of a hand test telephone (such as A.E.Co. #L-965-A2) to L1 and L2. Press test-telephone button C, and, with the subscriber's handset on the hook, dial "0" on the subscriber's dial. As the dial returns, listen at the test telephone. If you hear no click you have connected the subscriber's telephone correctly; if you hear a click, reverse "interior" wires at telephone terminals L1 and L2 (figure 8) or reverse drop wires at protector (figure 4).

For a normal line in a 48- or 50-volt exchange:

}If conductor-loop resistance is 200Ω or less, set loop compensator at 2.
 }If conductor-loop resistance is over 200Ω , set loop compensator at 0.
 Review §13 and §14 for conditions which require a special setting.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

Stamp directory-number on number card as in §15 or §16.

Call the central office for a ringing test, etc.

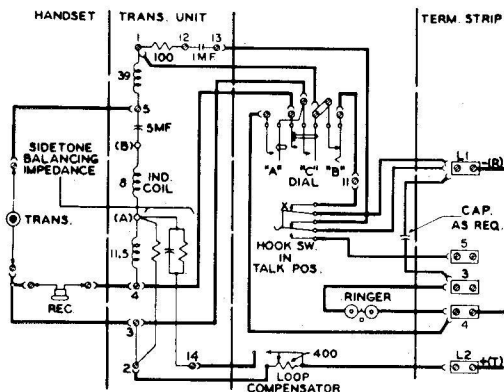
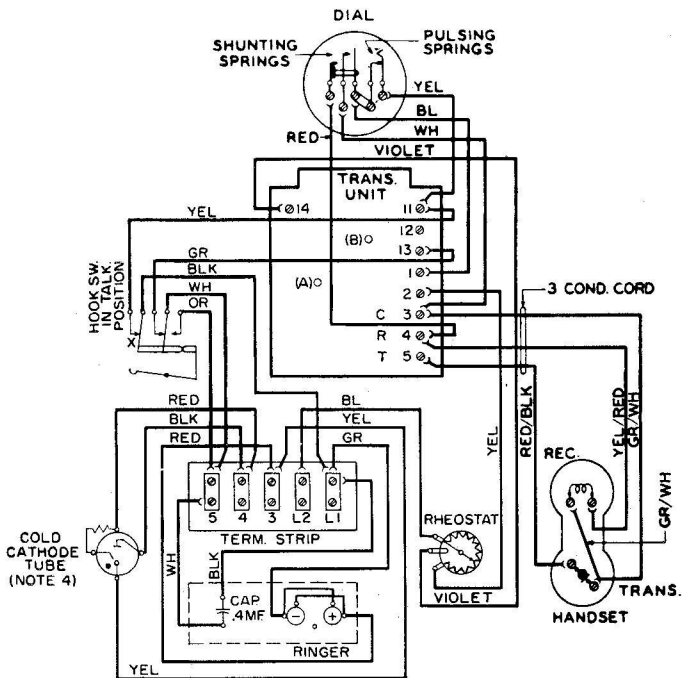


Figure 22. Schematic (S.A.T.T. system B).

10. SUPERIMPOSED RINGING

Identifiable by circuit label-card D-530254-A inside the telephone



Note 1. Contacts "X" break first and make last.

Note 2. If no dial is used connect blue and yellow dial wires to terminal 2, white to terminal 3, and red to terminal 4 of dial blank.

Note 3. Terminals (A) and (B) are for tests. Terminal (C) is not used.

Note 4. For connections for 4-party selective or 8-party semi-selective, see page 19 table.

Note 5. When + battery is connected to ringer + terminal, and - battery to other terminal, armature pulls away from pole to which it is biased.

Note 6. For ringing current use either d.c. superimposed on 20~ a.c., or 20~ pulsating d.c.

Figure 23. Wiring diagram (superimposed).

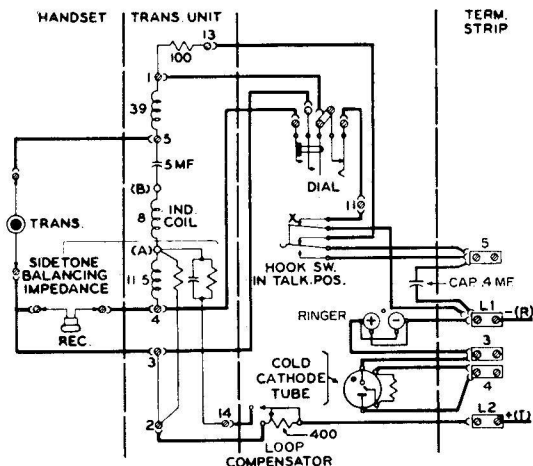


Figure 24. Schematic (superimposed).

Mount as in §2 (or §3).

If telephone is not wired already for proper party-station, reconnect ringer green and red leads, and cold-cathode-tube yellow, black, and red leads thus:

| | Ringer leads | | Tube leads | | |
|--|--------------|-----|------------|-------|-----|
| | Green | Red | Yellow | Black | Red |
| Station 1 or 5 —party on —line (“ring”) | L1 | 3 | 3 | 4 | 4 |
| Station 2 or 6 —party on +line (“tip”) | | | | | |
| Station 3 or 7 +party on —line (“ring”) | 3 | L1 | 4 | 3 | 3 |
| Station 4 or 8 +party on +line (“tip”) | | | | | |

Connect line wires per figure 8.

For a normal line in 48- or 50-volt exchange:

{If conductor-loop resistance is 200Ω or less, set loop compensator at 2.
 {If conductor-loop resistance is over 200Ω , set loop compensator at 0.
 Review §13 and §14 for conditions which require a special setting.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

Stamp directory-number on number card as in §15 or §16.

Call the central office for a ringing test, etc.

11. LOOP COMPENSATOR—*Description, purpose*

Automatic Electric Company defines "conductor-loop resistance" as the total of the resistances of the *line conductors*, the *heat coils*, and the *central-office cabling*. Thus, we don't count the resistance of the telephone instrument nor of central-office relays.

When the telephone housing has been removed (figure 25), the "loop compensator" will be found attached to the base-plate of the telephone. The "loop compensator" is a combined rheostat-and-switch. It can be set with the tip of a small screwdriver. As the arrow is turned counterclockwise from 0 to 4, the rheostat inserts 0Ω to 400Ω in series with the loop.

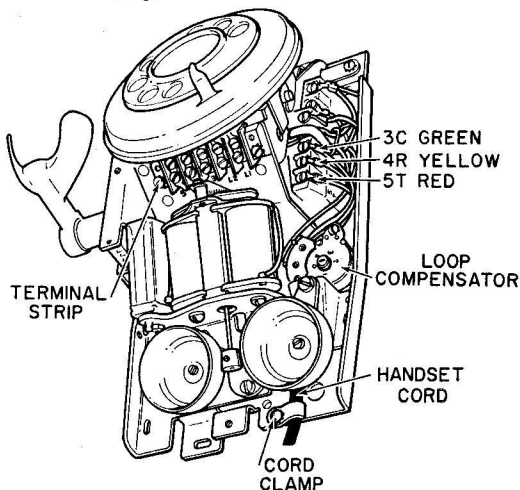


Figure 25.

When the rheostat is at 0 (as it should be for long cable loops), the *switch* element adds a capacitor and a resistor into the sidetone-balancing impedance to match more nearly the capacitive impedance of a long cable loop.

Thus, the loop compensator *minimizes sidetone*—

- (a) on a short loop by limiting transmitter current,
- (b) on a long loop by improving the balance between the sidetone-balancing impedance and the impedance characteristics of the line.

Loop compensation lessens the current diverted by a party-line subscriber near the central office listening in on conversation of another subscriber on the same line more distant from the central office.

On a reverting call, loop compensation tends to equalize the currents available to the two conversing parties.

12. LOOP COMPENSATOR—*Adjustment*

The type 90M telephone operates satisfactorily with the loop compensator adjusted according to the rules in §13, except in marginal or unusual locations. For such locations, adjust the loop compensator accurately (§14).

13. LOOP COMPENSATOR—*Adjustment rules*

13.1 Usual lines in a 48- or 50-volt exchange:

- {If conductor-loop resistance is 200Ω or less, set loop compensator at 2.
- {If conductor-loop resistance is over 200Ω , set loop compensator at 0.

EXCEPTIONS:

OPEN-WIRE LINE: If the station is connected directly to an open-wire section of over 200Ω resistance, set loop compensator midway between 0 and 1.*

NEAR LOADING COIL: If the station is on a loaded subscriber loop and is less than one loading section (for type *H* loading, less than 6000') from the nearest loading coil, set loop compensator midway between 0 and 1.*

13.2 Party-line or extension telephone. If two or more Automatic Electric Company telephones with loop compensators—type 80, 88, 90M, etc.—are used on one line (e.g., party line, or extension telephone), set the loop compensator of each as if it were the only telephone on the line.

If the type 90M telephone is used on the same line with an entirely different make or model of telephone, set the type 90M telephone loop compensator at 0 (or midway between 0 and 1 if one of the §13.1 EXCEPTIONS applies).

13.3 48-volt P-A-B-X, P.B.X., etc. In a key system or P.B.X. or P-A-B-X, a type 90M telephone may receive its transmitter current from either of two different 48- or 50-volt sources.

The general idea is to adjust the loop compensator for the transmitter current received on a trunk ("outside") call:

- {If station-loop + trunk resistance = 200Ω or less, set at 2**.
- {If station-loop + trunk resistance = over 200Ω , set at 0.

If long-line equipment or a pulse repeater at the P.B.X. or P-A-B-X supplies transmitter current on trunk calls, set loop compensator at 2**.

13.4 24-volt switchboard. If the central-office or P.B.X. switchboard operates from 24 volts and has $100\Omega + 100\Omega$ battery-feed coils or uses non-relay series-lamp line circuits, set loop compensator at 0; otherwise use one of the methods in §14.

*Because the open-wire line or open-wire line section, or the loaded cable, has less effective capacitance than has unloaded cable, the aim here is merely *not* to close the switch mentioned on page 20, just below figure 25.

**EXCEPTION: If the P.B.X. switchboard uses *non-relay* series-lamp line circuits, set loop compensator at 0.

14. LOOP COMPENSATION—*Accurate adjustment*

14.1 **Uses.** Altho the rules of §13 are adequate for most installations, occasionally it becomes desirable that current thru line and transmitter be adjusted accurately to 60 milliamperes. Examples are: where there has been a transmission complaint; or where the subscriber does not hear well over the telephone, and this seems to be due to the noise in his room. (The sidetone from *extreme* room noise can be reduced further by setting the loop compensator to limit the line current to 55 or even 50 milliamperes.)

Use one of the methods below:

14.2 **Without assistance from the central office.** With the telephone housing removed, transfer line-wire from terminal-strip terminal L1 to a milliammeter, and connect the milliammeter other post to terminal L1 (figure 26). Remove the handset from the hook, and vary the loop compensator until the milliammeter reads 60 milliamperes.

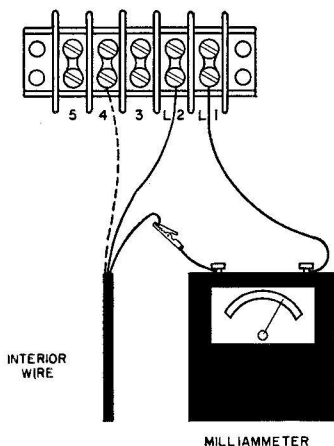


Figure 26.

Line-current measurement at subscriber's premises.

Disconnect the milliammeter, reconnect the line-wire to terminal-strip terminal L1, put on the housing, and test transmission.

14.3 Test board equipped for line-current measurement thru usual $200\Omega + 200\Omega$ battery feed. Upon completing the installation, dial the test board. Request line-current measurements. The testboardman will give you readings. Vary the loop compensator until the current is 60 milliamperes.

14.4 Test board equipped for line-resistance measurement. Upon completing the installation, dial the test board. Request line-resistance measurements. Short-circuit the line a few moments while testboardman measures loop resistance. Set loop compensator per this chart:

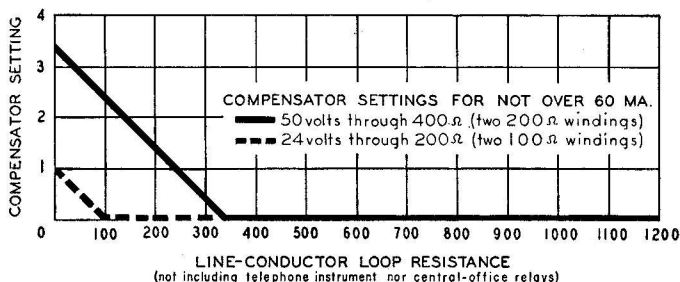


Figure 27.

14.5 Test board equipped for line-voltage measurement. Upon completing the installation, dial the test board. Request line-voltage measurement, and stay on the line. Thru a test distributor or thru a distributing-frame test shoe, the testboardman will connect to the line from which you are calling, and will connect his voltmeter across the line.

BATTERY FED THRU $200\Omega + 200\Omega$ (usual in 48- or 50-volt exchange): Vary the loop compensator until the test-board voltmeter reads 24* volts less than the central-office battery voltage.

BATTERY FED THRU $100\Omega + 100\Omega$ (used in many 24-volt exchanges): Vary the loop compensator until the test-board voltmeter reads 12 volts less than the central-office battery voltage.

*That is, when 60 milliamperes flow in the line, there will be 24 volts "drop" in the usual $200\Omega + 200\Omega$ battery feed to the calling line.

15. NUMBER CARD of dial with *metal* finger plate

Insert dial escutcheon tool H-26917 (or small screwdriver) between escutcheon ring and transparent cover, opposite finger hole 5 (figure 28). Press the tool downward until it engages the locking lever underneath. Then move tool counterclockwise toward finger hole 6. This unlocks the escutcheon ring. With the tool, lift ring from dial.

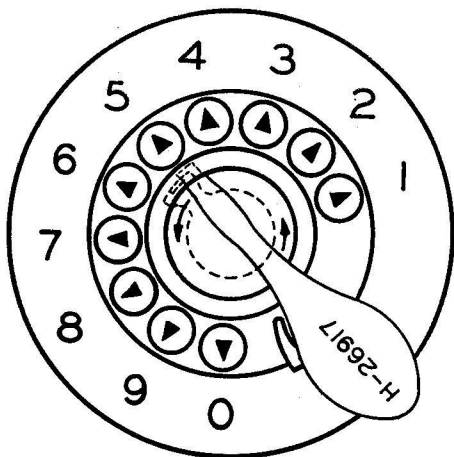


Figure 28. *Unlocking escutcheon ring.*

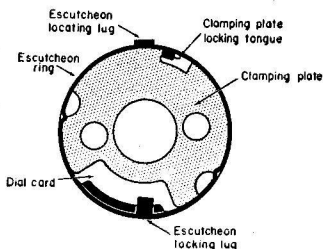


Figure 29. *Number card in escutcheon ring.*

A clamping plate holds the transparent cover and the number card to the ring (figure 29). To disassemble, rotate notched clamping plate counterclockwise.

Print or stamp the number clearly on the card.

To reassemble, first place transparent cover in escutcheon ring. Insert the number card and clamping plate. Turn clamping plate clockwise to engage its tongue, locking the assembly.

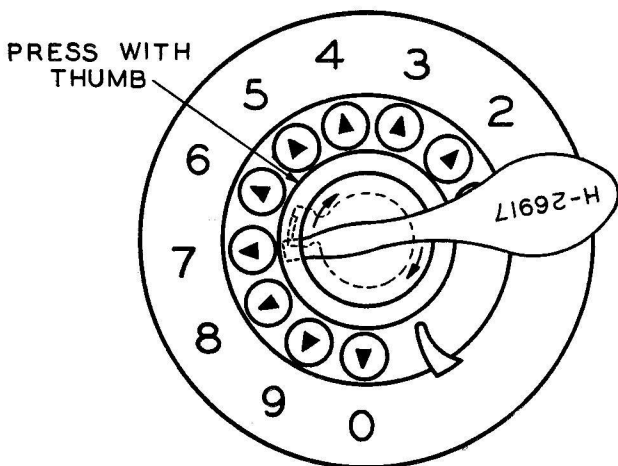


Figure 30. Locking escutcheon ring.

To mount on dial, check that the locking lever on finger plate is midway between finger holes 6 and 7 (figure 30). Insert small lug of escutcheon ring into slot near finger stop. Press assembly into finger plate. Insert dial tool under escutcheon ring opposite 7. Press tool down against locking lever underneath card and move the tool clockwise to 6. Assembly is now locked in place.

16. NUMBER CARD of dial with *plastic* finger plate

Inside the edge of the escutcheon ring, between finger holes 5 and 6 (figure 31), insert a screwdriver (such as A. E. Co. H-880622-1) between the escutcheon ring and the transparent cover. This will unlatch the escutcheon ring. Then, with the screwdriver, lift off the escutcheon ring.

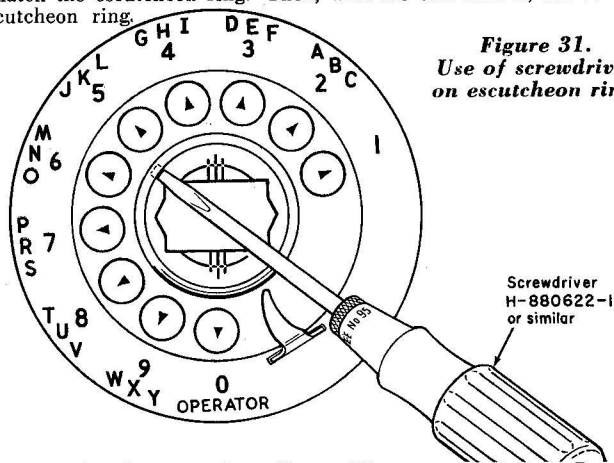


Figure 31.
*Use of screwdriver
on escutcheon ring.*

Rotate the clamping plate (figure 32) counterclockwise. Remove the number card. Print or stamp the number neatly on the card.

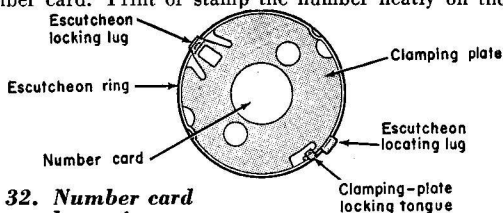


Figure 32. *Number card
in escutcheon ring.*

With the transparent cover in the escutcheon ring, add the number card and then the clamping plate. With the left thumb pressing lightly near one circular hole (figure 32, lower left), use the right-thumb nail in the other circular hole (figure 32, upper right) to turn the clamping plate clockwise to lock it.

Hook the escutcheon-ring locating lug into the dial near the finger stop. Between finger holes 5 and 6, insert a screwdriver (such as A. E. Co. H-880622-1) between the escutcheon ring and the transparent cover. Press the screwdriver tip until you hear or feel the clamping plate latch in.

17. HOOKLATCH (optional)

To add hooklatch to a type 90M telephone, order 1 each of the 3 D-numbered parts in figure 33. Remove housing. Pass shouldered screw D-760774-A thru the hooklatch and then thru the washer, put the hooklatch tip into the hookswitch-lever large irregular hole, and tighten the screw into the tapped hole shown in figure 33.

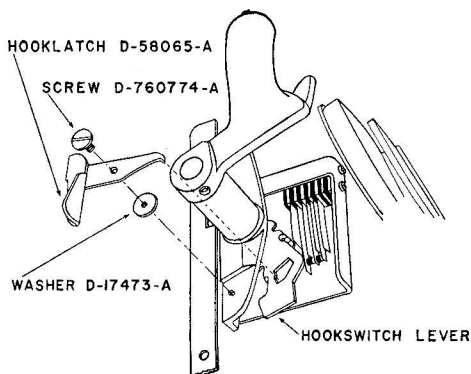


Figure 33. Hooklatch installation.

Lift handset off hook, and be sure the hookswitch springs operate partially only (connecting the receiver), as shown in figure 34. Then push the hooklatch handle. The hookswitch should operate completely (connecting the dial, the transmitter, etc.). Put the telephone housing on again.

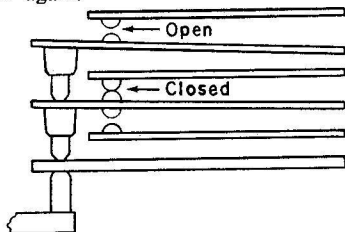


Figure 34. Hookswitch contact-sequence adjustment.

When making a call, a party-line caller takes the handset off the hook, and listens whether the line may be in use already. If he hears nothing, he pushes the hooklatch, and makes the call. *Caution the subscriber he must push the hooklatch to answer an incoming call also.*

18. RINGER-FREQUENCY CHANGE

Normally, telephones are drawn from the local storeroom, already assembled as required. If you have to change a ringer-frequency on the job, it is preferable to work in your truck rather than in the subscriber's premises . . . unless, of course, the telephone is already installed.

Change ringer-and-capacitor together as a unit, because each ringer has attached a capacitor of correct capacitance:

| <i>A.E.Co. piece number*</i> | <i>Ringer</i> | <i>Capacitor</i> |
|------------------------------|---|------------------|
| D-56562-ASL | { Straight line without } volume control } | 0.4 μ f |
| D-56562-A16 | 16.6~ | 0.7 μ f |
| D-56562-A20 | 20~ | 0.7 μ f |
| D-56562-A25 | 25~ | 0.3 μ f |
| D-56562-A30 | 30~ | 0.2 μ f |
| D-56562-A33 | 33.3~ | 0.2 μ f |
| D-56562-A40 | 40~ | 0.08 μ f |
| D-56562-A42 | 42~ | 0.08 μ f |
| D-56562-A50 | 50~** | 0.08 μ f |
| D-56562-A51 | 50~*** | 0.08 μ f |
| D-56562-A54 | 54~ | 0.08 μ f |
| D-56562-A60 | 60~ | 0.08 μ f |
| D-56562-A66 | 66~ | 0.08 μ f |
| D-56562-A67 | 66.6~ | 0.08 μ f |
| D-56562-AVT | Superimposed | **** |
| D-56562-AAC | { For P-A-X type 34A16 } only } | 0.7 μ f |

*Each piece number in the table includes standard ringer (first suffix letter *A*). Piece number for humid-climate impregnated ringer has first suffix letter *B*; for example, to order impregnated straight-line ringer without volume control, order D-56548-BSL.

**For use in exchanges with harmonic (or synchronic) ringers.

***For use in exchanges with "Decimonic" ringers.

****This has a 0.4 μ f capacitor for the dial pulse-spring spark-killer circuit.

About 5" below dial, loosen housing screw. Remove telephone housing. Disconnect ringer red and green leads and capacitor white and black leads. Take out the 3 Sems screws (figure 36) which hold the ringer to the ringer mounting bracket. There is usually no need to remove the 4 screws which hold the ringer mounting bracket to the telephone base.

Re-using the original screws, attach the new ringer (and capacitor) per figure 35 to the ringer mounting bracket. Reconnect ringer and capacitor according to applicable wiring diagram (figure 9, 11, 13, 19, 21, or 23) and/or party line instructions.

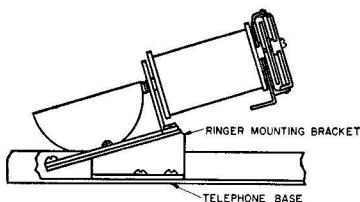


Figure 35. Ringer attached to ringer-mounting bracket and to telephone base-plate.

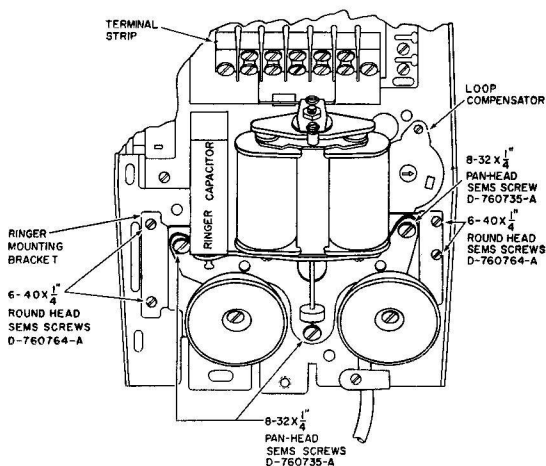


Figure 36. Ringer attached to telephone base.

Hook the plastic housing over the telephone-base top edge, and tighten the housing screw which is about 5" below the dial.

19. TRANSMITTER OR RECEIVER REMOVAL

The transmitter (at the *cord* end of the handset) and the receiver are capsule units which may be removed by simply unscrewing the earpiece and mouthpiece caps. *Hold the handset horizontally with the caps up, so the capsules will not fall out.* The transmitter capsule is so designed that it cannot be inserted in the receiver housing by error, and vice versa. Capsules cannot be repaired at the subscriber's premises because it is impossible to open them without damaging them. If difficulty is experienced with a capsule, remove it, and insert a new one. Defective units may be repaired at the factory.

20. HANDSET-CORD REPLACEMENT

About 5" below dial, loosen housing screw. Remove housing. From the transmission unit (figure 38) disconnect the 3 handset-cord leads (figure 25). Loosen cord-clamp screw (figure 25, lower right), remove clamp, and pull out the old cord (figure 36).

Insert new cord thru cord clamp and under ringer brackets. Attach red, yellow, and green leads to transmission-unit terminals 5T, 4R, and 3C (figure 25) respectively.

Without putting tension on connections to the transmission unit, pull out slack in the cord. Replace cord clamp and screw, and tighten the screw.

Remove the caps and capsules of the receiver and transmitter (§19). Remove the central contact springs from both transmitter and receiver cavities (figure 37). Loosen the screws and disconnect the leads from the central contact springs. Loosen the screws and disconnect the leads to the rim contact springs in both cavities. Pull out the old cord.

Insert the leads of the new cord thru the cord entrance hole in the transmitter end of the handset and thru the hollow hand grip until the yellow and green leads reappear in the receiver cavity. Connect the yellow lead to the receiver rim contact spring and the green lead to the receiver central contact spring as in figure 37. Place the receiver central contact spring in its proper position in the cavity. Put the receiver capsule back in, and screw on its cap.

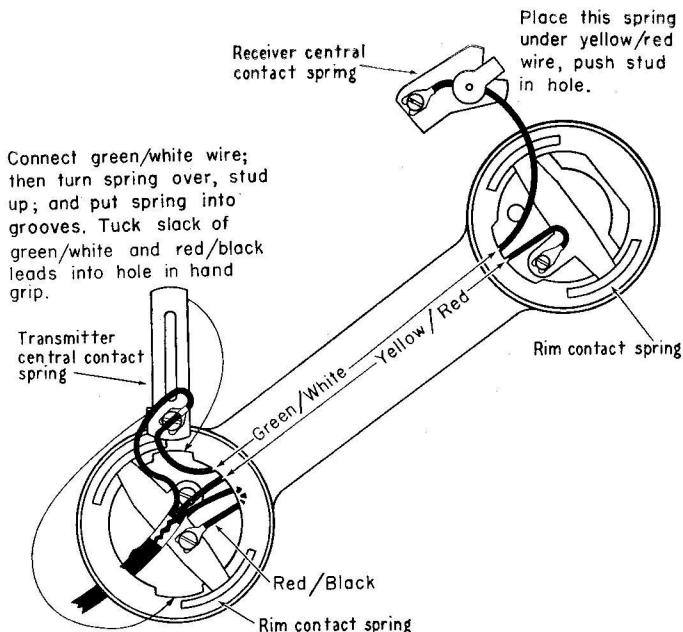


Figure 37. Handset-cord replacement.

In transmitter cavity, at the rim contact spring, attach stay cord to the screw which is on a projecting lug. Position the red-lead lug under the rim-contact-spring other screw as in figure 37, and tighten the screw.

Attach green lead to transmitter central contact spring as in figure 37. Then turn the stud over so that the wires are beneath the spring, and the stud faces up and is near the cord entrance hole. Insert the spring into the grooves of the transmitter cavity.

Loop the slack in the red and green leads, and tuck the loops into the mouth of the hand-grip hole. Put the transmitter capsule back in, and screw on its cap. Hook housing over the telephone-base top edge, and, about 5" below the dial, tighten the housing screw.

Make a test call.

21. TRANSMISSION UNIT

The transmission-unit wiring diagrams (figures 38a & b) are for information for continuity tests, ohmmeter measurements, etc. During manufacture, the transmission unit is sealed; do not attempt repairs in the field. If it becomes damaged, replace it.

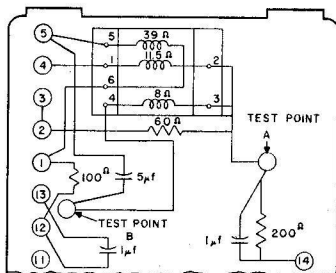


Figure 38a. Transmission unit D-38371-A internal connections.

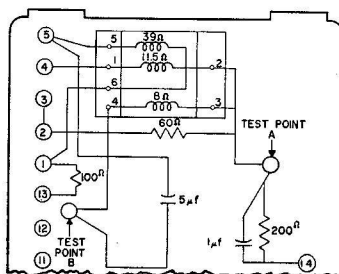


Figure 38b. Transmission unit D-38370-A internal connections.

22. COLORS AVAILABLE

Wall telephone type 90M is manufactured in 11 colors:

Black
Sand beige
Forget-me-not blue
Dawn gray
Gardenia white
Jade green

Classic ivory
Garnet red
Turquoise
Sunlight yellow
Camellia pink