

NORTH

TELEPHONE HANDBOOK



SERIES

N-541, N-542

N-546, N-547

N-551, N-552

N-556 & N-557

Telephone Sets

NORTH ELECTRIC COMPANY

553 SOUTH MARKET STREET • GALION, OHIO





Administrative Offices & Plant # 1

NORTH ELECTRIC COMPANY
553 South Market Street
Galion, Ohio

REGIONAL WAREHOUSES

North Electric Company,
387 S. Market Street,
Galion, Ohio
Telephone 2-4201

North Electric Company,
754-756 Ponce de Leon Place N.E.,
Atlanta, Georgia.
Telephones EL 6564 and
EM 2618

NORTH TELEPHONE HANDBOOK

Issue No. II

Copyright © 1956

North Electric Company

Galion, Ohio U.S.A.

TELEPHONE HANDBOOK

CONTENTS

	Paragraph	Page
List of Illustrations		ii
CHAPTER 1 INTRODUCTION		
Section I Description	1	1
II Service Applications	2	1
III Optional Features	3	1
IV Components	4-17	1-3
CHAPTER 2 INSTALLATION		
Section I General	18-19	4
II Connections	20-27	4-6
III Adjustment	28-30	6-9
IV Test	31	9
V Final Procedure	32-33	9
CHAPTER 3 MAINTENANCE		
Section I Inspection	34	10
II Trouble Shooting	35-39	10-18
CHAPTER 4 ADJUSTMENT		
Section I General	40	19
II Ringers	41-43	19-21
III Dial	44-50	21-23
CHAPTER 5 SUPPLEMENTARY DATA		
Section I Replaceable Parts List		25-26
II Table of Color Code: Colored Telephones		26
III Table of Ringers and Ringer-Capacitors		26-27

TELEPHONE HANDBOOK

LIST OF ILLUSTRATIONS

	Page
Fig. 1 Telephone with Housing Removed	
Fig. 2 Connector Block, Terminals	5
Fig. 3 Network, Terminals	5
Fig. 4 Wiring Diagram and Table of Ringer Connections	7
Fig. 5 Superimposed Ringing, Wiring Diagram	8
Fig. 6 Cradle-switch Latch, Wiring Diagram	8
Fig. 7 Dial and Cover, Rear View	13
Fig. 8 Handset, Exploded View	15
Fig. 9 Ringer Marking	15
Fig. 10 Straight-Line Ringer	16
Fig. 11 Frequency Selective Ringer	17
Fig. 12 Cradle-Switch	18
Fig. 13 Bias Check, Schematic Diagram	20
Fig. 14 Gong Adjustment, Schematic Diagram	20
Fig. 15 Telephone, Exploded View	24

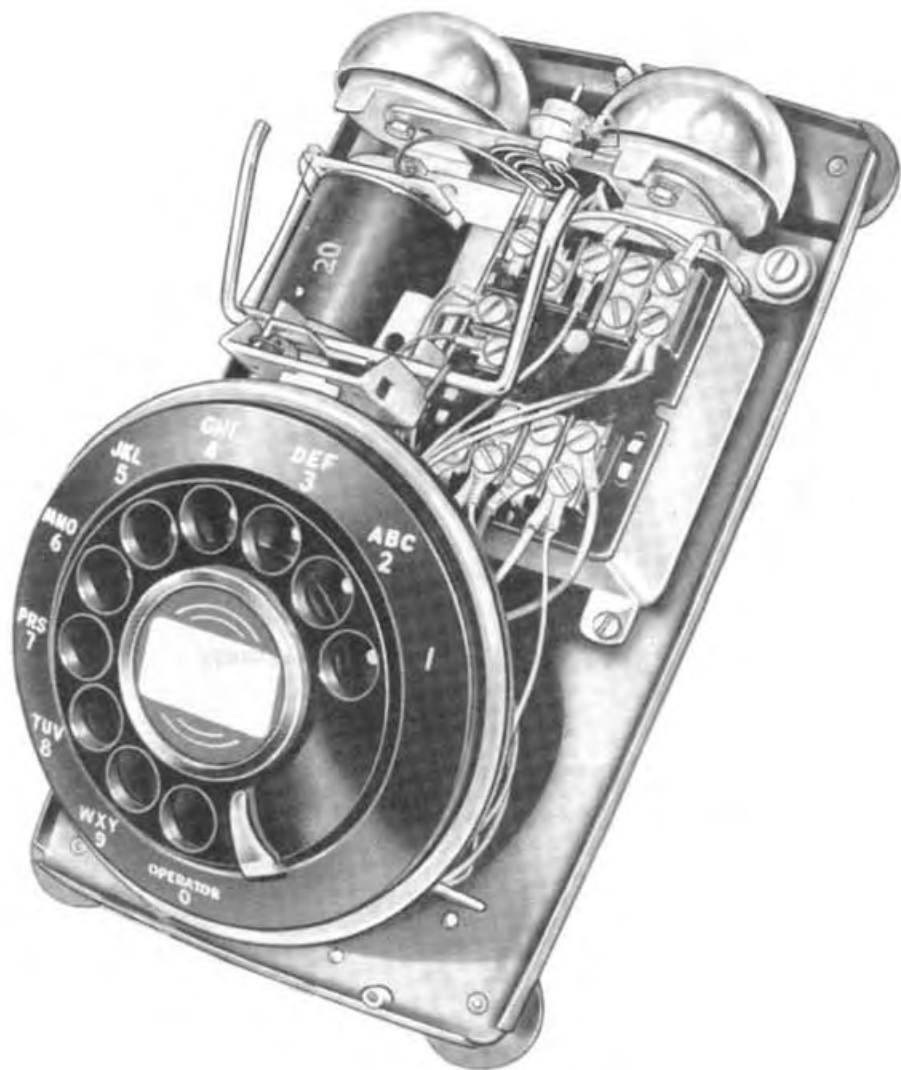


Fig. 1. N-541 Telephone, Housing Removed

TELEPHONE HANDBOOK

CHAPTER 1

INTRODUCTION

Section I DESCRIPTION

1. GENERAL

The North N-541 type telephone is a modern high gain anti-sidetone desk set. The controlled level provides improved quality transmission on either short or long lines.

Section II SERVICE APPLICATIONS

2. PURPOSE AND USE

The N-541 type set is designed for all classes of common battery manual and dial services. It is available for any of the following ringing methods:

- a. Straight line ringing and superimposed systems.
- b. Frequency selective ringing, harmonic, synchromonic and decimonic systems.

Section III OPTIONAL FEATURES

3. NOMENCLATURE

The optional features available with the North N-541 type telephones are identified as follows:

- a. N-541 Straight hand-set cord.
- b. N-542 Cradle-switch latch and straight hand-set cord.
- c. N-546 Coiled handset cord.
- d. N-547 Cradle-switch latch and coiled hand-set cord.
- e. N-551 Superimposed ringing, straight handset cord.
- f. N-552 Cradle-switch latch, superimposed ringing and straight handset cord.
- g. N-556 Superimposed ringing, coiled handset cord.
- h. N-557 Cradle-switch latch, superimposed ringing, coiled handset cord.

Section IV COMPONENTS

4. GENERAL

There are three major assemblies: the Handset, Base, and Housing. The components of each are identified in the following paragraphs.

5. HANDSET

Consists of the Handle, Handset Cord, Transmitter Cup, Transmitter, Receiver, Transmitter and Receiver Caps.

6. BASE ASSEMBLY

Consists of the Plate, Cradle-Switch, Desk Cord, Network, Ringer, Dial or Dial Blank, and for superimposed ringing systems a cold cathode tube.

7. PLATE

The formed metal plate has a heavy corrosion resistant finish. Four large rubber feet are riveted to the base.

8. CRADLE-SWITCH

a. Consists of a frame, switch spring pile-up and binder, laminated phenolic actuating card, metal actuator brazed to the cradle switch lever, and lever coil spring.

b. Model numbers ending in 2 or 7 have a latch on the cradle switch. This holds transmitter circuit open until release button is pressed. See Fig. 6.

9. DESK CORD

A three-conductor cord with green, yellow, and red coding, spade terminals and strain-relief provisions at both ends.

10. NETWORK

The telephone set contains a network Part No. 500,084, which includes the induction coil, talking capacitor, a 45 mf ringing capacitor, equalizing varistors, sidetone balance impedance, and a radio interference suppression circuit across the dial contacts.

11. RINGERS

a. There are two types of ringers, Straight Line and Frequency Selective. They are single coil types. The impedance is 600,000 ohms at 1000 cps. Coils have a d.c. resistance of 7500 ohms.

b. The straight line ringer (SL) is designed to operate over the following frequency range.

Frequency (cycles per second)	Voltage Required (low bias)
16 cps	55 volts
20 cps	50 volts
25 cps	65 volts
30 cps	85 volts
33 cps	110 volts

12. STRAIGHT-LINE RINGERS

The armature for "SL" ringers has a biasing spring swaged in the end near the reed. In the rest position the bias spring holds the armature toward the right hand pole piece and the clapper near but not touching the high-pitch gong. This is to prevent the ringer from tapping on dial pulses.

13. FREQUENCY SELECTIVE RINGERS

On frequency selective ringers, each armature is mechanically tuned to vibrate at a specific frequency and responds only to the ringing frequency for which it is tuned. The rest position of the armature and clapper is approximately equidistant between the pole pieces and gongs.

14. DIAL 7 TYPE

The pulsing and off-normal springs have double contact points. With exception of the finger-wheel, all working parts are enclosed. Contact springs, governor and gear train are enclosed in a dust-tight plastic cover. The dial has a modern extended number plate, standard number card, and is mounted on a snap-in bracket.

15. DIAL BLANK

The dial blank for manual systems has the same contour as the type 7 dial and mounts on the snap-in bracket.

16. HOUSING

The housing is of high-impact plastic with threaded inserts for mounting on the base. A hand-hole is provided for lifting the instrument. The plastic hand-hole cover serves as a retainer for the two plastic cradle-switch plungers.

17. CONNECTOR BLOCK

The molded connector block has 4 threaded inserts (2 double, 2 single) fitted with machine screws. The single inserts are equipped with a removable strap. The block has two, three, or four terminals available. An additional insert receives the cover retaining screw.

TELEPHONE HANDBOOK

CHAPTER 2

INSTALLATION

Section I GENERAL

18. UNPACKING

Carefully inspect the local service order to insure installing the correct instrument. Markings on the ringer coil may be observed through the rectangular window in the base plate. The coil is marked SL for straight line, SU for superimposed. The frequency in cycles per second appears on frequency selective ringers.

19. LOCATION OF INSTRUMENT

The telephone set and connector block may be installed in any practical location. Positions near grounded objects such as radiators, sinks, gas or water pipes and electric outlets are considered hazardous. This is especially true where grounded station protectors are placed in the line. Keep the instrument at least two feet from neon signs, fluorescent lights and other apparatus known to create disturbances in telephones. Power stations require special protective measures. Areas containing explosive gases are particularly dangerous. Avoid areas of excessive vibration. In all cases the location should have ample accessibility for inspection and maintenance.

Section II CONNECTIONS

20. FACTORY CONNECTIONS

The ringer, dial and network are connected at the factory. A wiring diagram, including figs. 4, 5, and 6, is packed with each instrument.

21. DESK CORD

The three conductors of the desk cord are color coded and connected to the network terminals (Fig. 3) as follows: GREEN to L1, RED to L2, and YELLOW to K. At the connector block GREEN and RED are connected to the outside terminals, and YELLOW to the center (strap) terminals (Fig. 2).

22. LINE

a. Connect the "LINE" (tip and ring) to the outside terminals (GREEN and RED desk cord leads) of connector block. (Fig. 2).

b. Divided Ringing - Connect a ground wire to the center

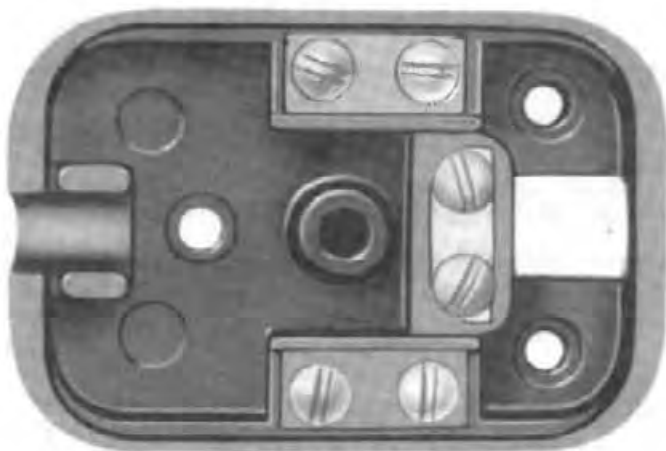


Fig. 2. Connector Block

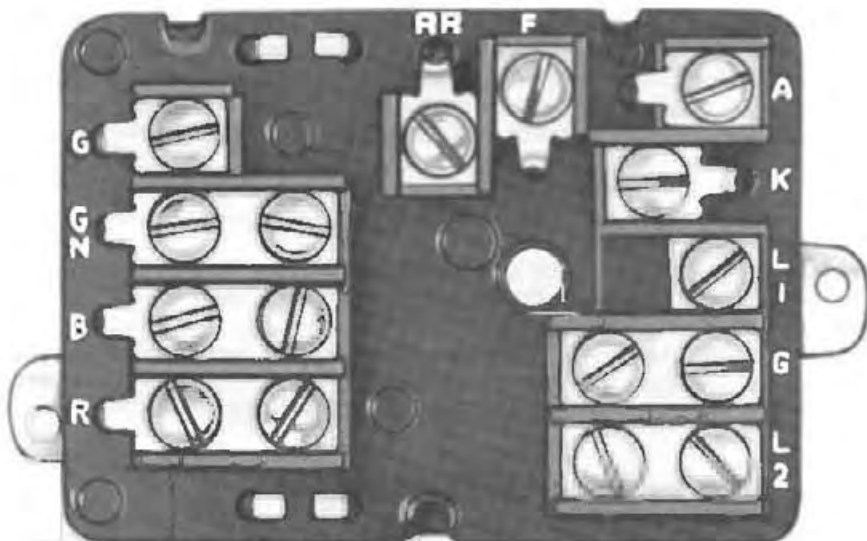


Fig. 3. Network

terminal (yellow lead) of connector block.

c. Bridged Ringing - At the connector block, connect the YELLOW lead of desk cord to the same terminal as the GREEN lead.

d. Superimposed Ringing - When shipped, phones are connected for L2 - party. For L1 - party, reverse line at connector block. For L1 + or L2 + party the network connections must be changed in accordance with Fig. 5.

23. NETWORK CONNECTIONS

The wiring diagram (Fig. 4) illustrates the proper connections for the various service applications. When replacing the ringer, network, dial, handset, handset cord, or desk cord, refer to the wiring diagram.

24. RINGER CONNECTIONS

a. The ringer has two color coded leads, one RED and one BROWN.

b. Straight-Line and Frequency Selective Ringers - The straight-line, 16, 16-2/3 and 20 cycle ringers use the ringing capacitor built into the network. Connect RED lead to L2 and BROWN lead to A of network. The 25 to 66-2/3 cycle ringers are equipped with a capacitor, suitable for their frequencies, wired in series with the RED lead. Connect RED lead to terminal L2 and BROWN to terminal K of the network.

c. Superimposed Ringers - The superimposed ringers are straight-line ringers. The ringing circuit includes a cold cathode tube. The wiring diagrams, Fig. 5, shows the connections for "L2 (-)" and "L2 (+)" parties. For "L1 (-)" and "L1 (+)" parties, use the same connections and reverse the line (tip and ring) at the connector block. When shipped, phones are connected for L2 (-) party.

25. CRADLE-SWITCH LATCH

The cradle-switch latch holds the slate lead contact of the cradle-switch open until the latch is released. The wiring diagram (Fig. 6) shows the dial and cradle-switch connections related to latch equipped telephones.

26. DIAL

The type 7 dial has four color coded (Blue, Green, and two White) leads. Changing from manual to dial requires connections to network. Transfer SLATE lead (cradle-switch) from RR to F. Connect WHITE leads (dial) to GN and R. Connect BLUE lead to F and GREEN lead to RR. When cradle-switch latch equipped telephones are used, the wiring diagram (Fig. 6) shows the changes required in the related dial connections.

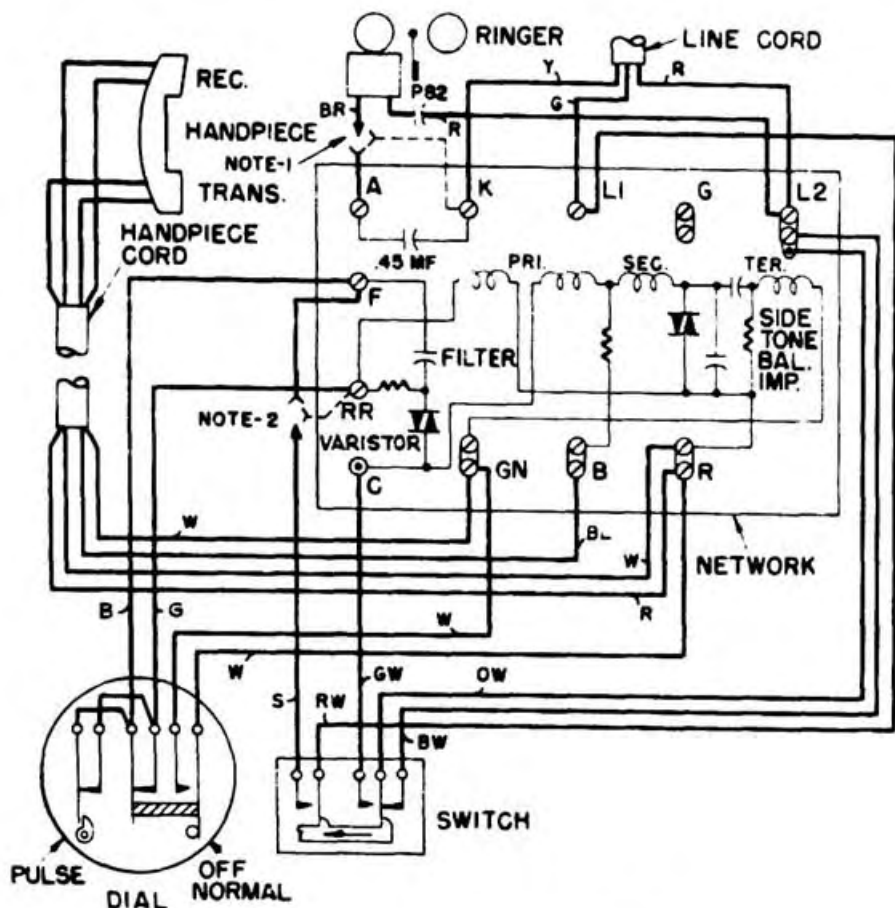
27. DIAL BLANK

Manual service desk sets are equipped with a dial blank. These instruments have the SLATE lead (of cradle-switch) connected to RR on network.

Section III ADJUSTMENT

28. STRAIGHT-LINE RINGERS

Only minor adjustments may be required on the type instrument



NOTE-1

TABLE OF RINGER CONNECTIONS

	<u>FREQUENCY</u>	<u>COND. MFD.</u>	<u>CONNECT BROWN RINGER LEAD TO TERMINAL</u>
SL, 16,	16-2/3, 20	.45	A
	25	.27	P82 K
	30, 33-1/3	.18	Cond. K
	40, 42, 50	.10	Equipped K
	54, 60	.07	On K
	66, 66-2/3	.05	Ringer K
SU			See Fig. 5

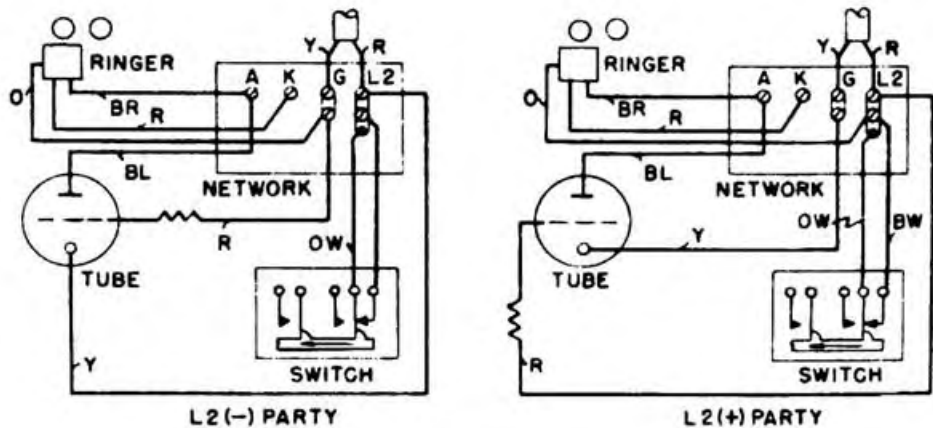
NOTE-2 For manual service replace dial with dial blank and transfer slate lead from F to RR.

NOTE-3 For bridged ringing, connect yellow line cord lead to L1 at wall terminal block.

Fig. 4. Wiring Diagram and Table of Ringer Connections

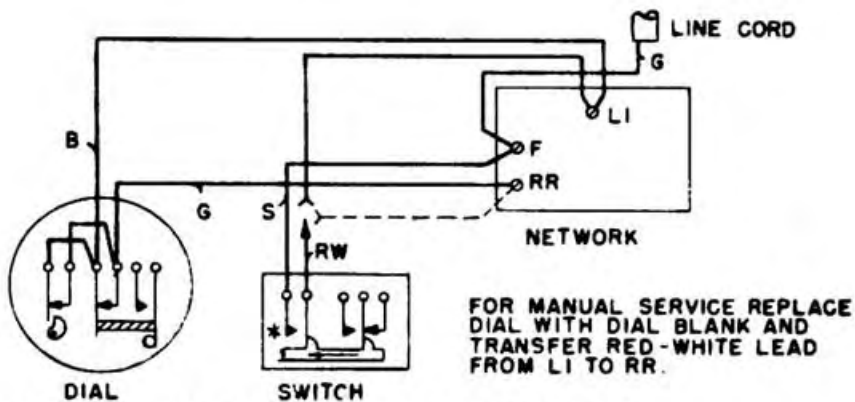
listed on the service order.

a. Ringer Tapping - Tapping of the ringer, during dialing is sometimes encountered on bridged ringing systems. The ringer is less likely to tap if the positive (+) side of line is connected



FOR LI(-) OR LI(+) PARTY, REVERSE LINE CONNECTIONS AT WALL TERMINAL BLOCK.

Fig. 5. Wiring Diagram Superimposed Ringing



*-THIS CONTACT HELD OPEN UNTIL LATCH IS RELEASED

Fig. 6. Wiring Diagram Cradle-Switch Latch

to (Green lead of desk cord) terminal LI of network assembly. Reversal of the line at the connector block may eliminate tapping. If this fails, increase the bias as outlined under "Bias-Spring."

b. Bias-Spring - Two bias-spring positions enable the ringer to meet widely varying line conditions. As shipped from the factory the spring is in the low-bias position shown on fig. 10. To increase the bias, remove the housing held to the base by two screws. With a very small screw driver, or pencil, CAREFULLY move the bias spring to the high bias position underneath the "L-shaped" portion of the retainer. Replace the housing and check operation of the ringer.

29. FREQUENCY SELECTIVE RINGERS

The position of the gongs is the only adjustment necessary on these ringers. NO OTHER ADJUSTMENTS SHOULD BE ATTEMPTED IN THE FIELD.

30. RINGER CUTOFF

Ringer cutoff can be accomplished at the connector block.

a. On divided ringing systems remove the jumper between the "YELLOW" lead of desk cord and ground (center screws of connector block).

b. On bridged ringing systems remove "YELLOW" lead from green lead terminal and connect to center terminal of connector block.

Section IV TEST

31. GENERAL

Check the service order specifications and perform operation tests in accordance with local practices. The universal tests are ringing, dialing, transmission, reception, directory number, and freedom from noise.

Section V FINAL PROCEDURE

32. NUMBER CARD

Remove the number card, protector and retainer ring from glassine envelope. Mark directory number on card. Place card and protector on retainer disc with the two cut-out sections over the locating extrusions. Place flange of ring over top edge of retainer disc and place both thumbs on face of ring at top. Maintain pressure on thumbs and move thumbs downward on face of ring. With final pressure at bottom, ring snaps in place.

33. INSTRUCTION TO SUBSCRIBER

Demonstrate the correct use of the dial to the subscriber. Call attention to the directory number and obtain a ring-back for subscriber to identify ringing. Instruct subscriber regarding special numbers (applicable to the area) for Information, Long Distance, Emergency, and Repair Service.

TELEPHONE HANDBOOK

CHAPTER 3

MAINTENANCE

Section I INSPECTION

34. ROUTINE CHECKS

The suggestions outlined will materially aid the maintenance and repairmen in performing their routine inspections.

a. Handset Assembly - Check handle, transmitter and receiver caps for cracks or breaks. Listen for noisy transmitter. Make sure all connections and caps are tight.

b. Housing and Plungers - Check the following; housing for cracks or breaks, plungers for free operation and mounting screws of housing for tightness.

c. Dial or Dial Blank - Make sure dial or dial blank is securely mounted. Check dial for operation.

d. Number Card - Check number card, window and retainer ring for legibility, tightness or damage.

e. Desk and Handset Cords - Check cords for cracks, splits or damaged conductors.

f. Connections - Place receiver to ear, check for loose connections by tapping handset and housing. Shake desk and handset cords.

g. Ringer - Check ringer operation by obtaining ringback.

h. Transmission and Reception - Check by calling wire chief, repair service, or other designated party.

Section II TROUBLE SHOOTING

35. GENERAL

The troubles encountered in many cases are the result of incorrect installation or misplacement of wires when housing is removed for inspection. The table facilitates location of the more common faults and indicates the recommended corrective measures.

36. FIELD MAINTENANCE

Field Maintenance should be limited to the adjustments covered by paragraphs 28, 29, and 30; routine checks par. 34 and trouble shooting remedies par. 37.

CAUTION: NO ADJUSTMENT SHOULD BE MADE EXCEPT WHERE TROUBLE EXISTS.

37. TROUBLE SHOOTING TABLE

FAULT	CAUSE	REMEDY
Bell does not ring.	Incorrect ringer for assigned frequency.	Check ringer frequency assigned on service order.
	Ringer disconnected or wired wrong.	Check ringer connections.
	Open ringer coil.	Replace ringer.
	Obstruction between magnet and armature or gongs and clapper.	Remove obstruction or relocate obstructing wires.
	Open ringer capacitor.	Replace ringer capacitor. (See foot note 1.)
	No ground at connector block. (divided ringing)	Check connections per par. 22-b.
	Gongs not properly adjusted.	Adjust gongs. (par. 42, 43)
	Bias-spring in high position.	Move to low position.
CAUTION: Armature reed is mechanically tuned. DO NOT CHANGE frequency adjustment. This includes clapper and spiral reed-support spring.		
Bell taps while dialing.	Line connections reversed at connector block.	Check line connections. (par. 22)
	Bias-spring in low bias position.	Increase bias (par. 28-b, 41)
Bell rings when other party is called. (cross or false ring)	Line connections reversed at connector block. (divided ringing)	Check line connections (par. 22).
	Incorrect ringer for assigned party.	Check ringer frequency on service order.
	Gongs set too close.	Adjust gongs (pars. 42,43)
Bell continues to ring with handset removed from cradle.	Open circuit in handset cord, transmitter unit, or pulse contacts of dial.	Replace handset cord (par. 39-g), transmitter unit (par. 39-b), or dial (par. 39-h).

FAULT	CAUSE	REMEDY
(Bell continues to ring with handset removed from cradle.)	Open circuit in network induction coil.	Replace network (par. 39-n).
	Cradle-switch line contacts do not close.	Replace telephone set. (See foot note 2.)
Bell rings but cannot hear anyone on line.	Open circuit in handset cord or receiver unit.	Replace handset cord (par. 39-g) or receiver unit (par. 39-a).
	Off-normal dial contacts closed.	Replace dial. (See foot note 3).
No dial tone.	Pulse contacts open.	Replace dial (See foot note 3.)
	Open circuit in network.	Replace network. (Par. 39-n).
	Cradle-switch line contacts do not close.	Replace telephone set. (See foot note 2).
	Open circuit in desk cord.	Replace desk cord. (Par. 39-m)
Cannot break dial tone.	Pulse contacts do not open.	Replace dial. (See foot note 3.)
	Dial filter capacitor short-circuited.	Replace network (par. 39-n).
	Ringer capacitor short-circuited (bridged ringing).	Replace ringer capacitor (See foot note 1).
Loud clicks in receiver while dialing.	Off normal dial contacts do not close.	Replace dial. (See foot note 3.)
	Loose connection.	Check connections (Fig. 4 wiring diagram).
Called party cannot hear.	Open circuit in transmitter unit.	Replace transmitter unit. (Par. 39-b).
	Open circuit or loose connection in handset cord.	Check connections or replace handset cord. (Par. 39-g).
High sidetone level.	Network sidetone impedance defective.	Replace network. (Par. 39-n).

Foot Notes:

1. Replacement .45 mf capacitors are available as part 564827. See Ringer Capacitor par. 39-k.
2. Cradle-Switch may be replaced at the exchange. See Par. 39-o.
3. Off-normal and pulse contact springs may be replaced at the exchange. See par. 48-e.

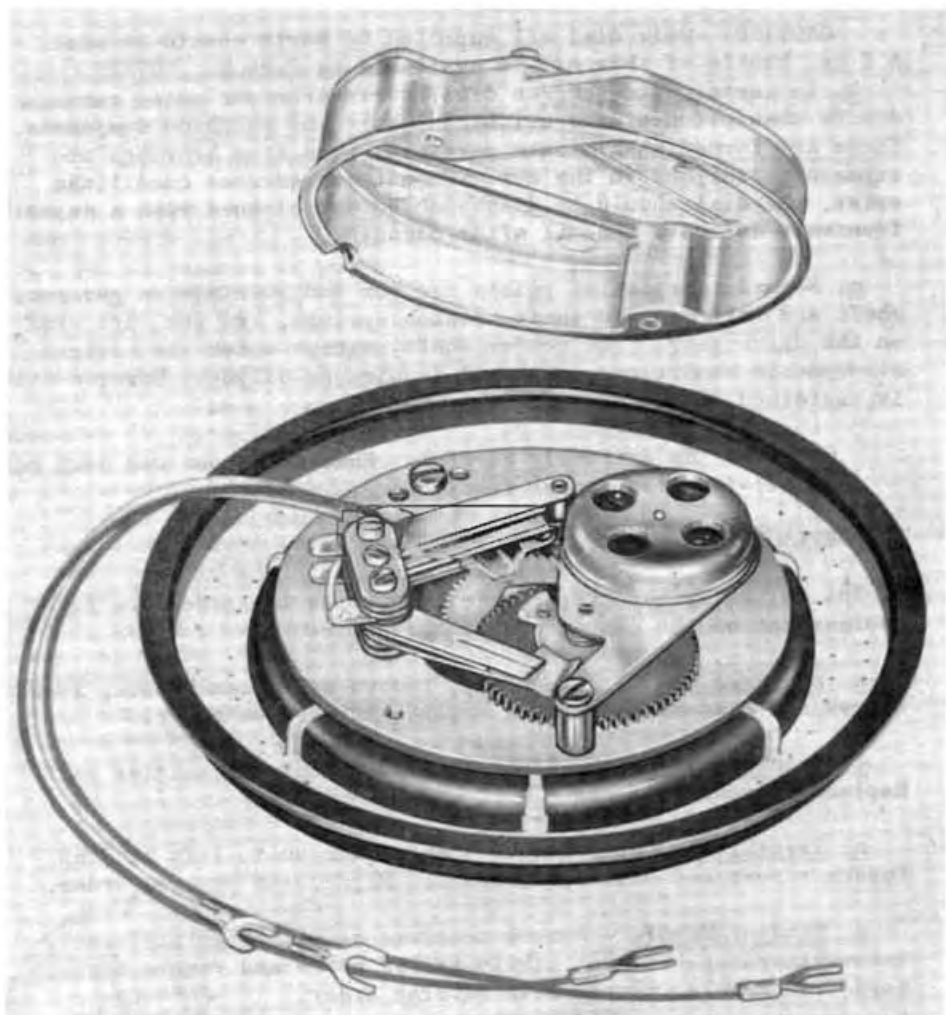


Fig. 7. Dial and Cover, Rear View

38. LUBRICATION

a. The dial mechanism is the only part of the N-540 telephone which may need lubrication. Oil should be sparingly applied. Perform dial lubrication at the exchange.

CAUTION: Only dial oil supplied by North should be used. A 2 oz. bottle of this oil is available as Part No. 567472.

b. In certain atmospheres dial bearings become quite gummy, due to absorption of the oil by sulphate and sulphide compounds. These are formed when minute particles worn from bearings are exposed to sulphur in the air. When these adverse conditions exist, the dial should be disassembled and cleaned with a deposit-free safe solvent. Re-oil after cleaning.

c. Normal lubrication points are the end bearings on governor shaft and intermediate shaft, clutch springs, and the lift stud on the drive gear. The center shaft, except under the adverse atmospheric conditions, will not require re-oiling. Reserve oil is contained in the oil groove.

CAUTION: Be extremely careful. Governor shoes and drum must be oil-free for proper functioning.

39. REPLACEMENT OF COMPONENTS

The following paragraphs briefly outline the procedure for replacement of the components or assemblies.

a. Receiver Unit - Remove cap, remove unit from handle, loosen screws and disconnect wires. Replace in reverse order.

b. Transmitter Unit - Remove cap, lift out transmitter unit. Replace in reverse order.

c. Transmitter Cup - Remove transmitter unit, lift out cup. Loosen screws and disconnect wires. Replace in reverse order.

d. Handset Handle - Remove receiver unit, transmitter unit, transmitter cup. Loosen strain-relief screw and remove handset cord from handle. Replace in reverse order.

e. Housing - Remove handset from cradle. Loosen two screws (one at front, one at back edge) under base plate. When housing is free lift off. Replace in reverse order.

f. Plungers - Remove housing and turn upside down. Remove screw of hand-hole cover. Lift out cover. Lift out plungers. Replace in reverse order.

g. Handset-Cord - Remove receiver unit, transmitter unit, transmitter cup, handset handle and housing. Disconnect handset-cord leads from terminals GN, B, and R of network. Remove strain-relief hook-retaining screw from base plate. Remove handset-cord. Replace in reverse order.

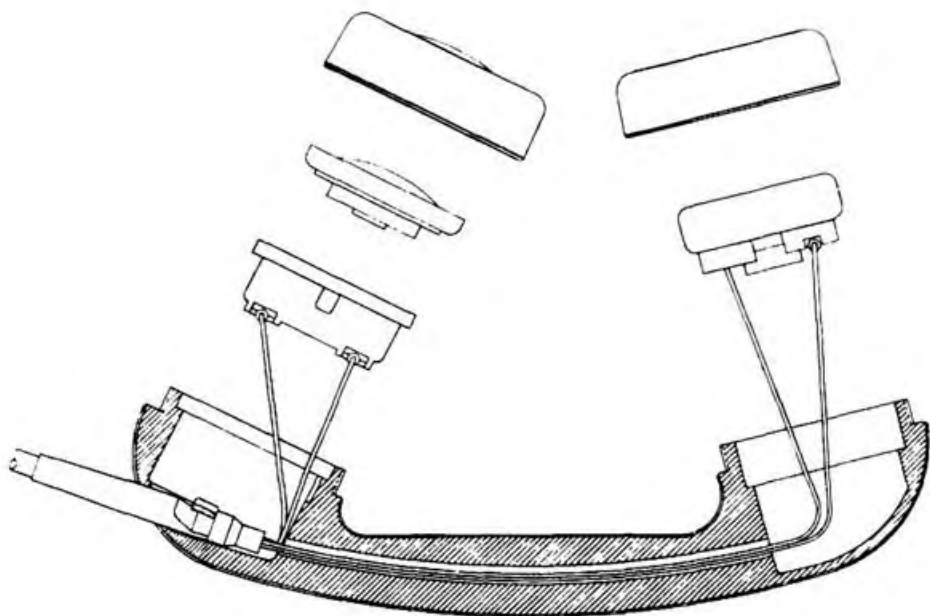


Fig. 8. Handset, Exploded View

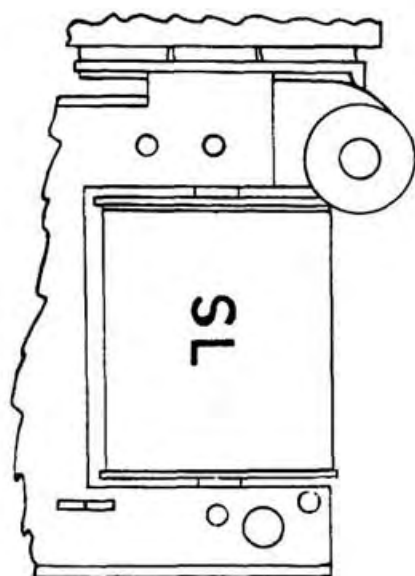


Fig. 9. Ringer Marking

h. Dial - Remove housing. Disconnect dial-leads from terminals F, RR, GN, and R of network. Grasp two front feet of dial bracket between thumb and fingers, squeeze lightly and release feet from slots in base plate. Lift dial up and remove tongue from cradle-switch bracket. Turn dial face down and remove two mounting screws. Remove dial from bracket. Replace in reverse order.

i. Dial Blank - The dial blank is mounted on the bracket by two screws (the same as the dial).

NOTE: Mounting screws hold plastic dust-cover on dial. Replace screws to retain cover in place.

j. Ringer - Remove housing. Disconnect the RED and BROWN leads from terminals L2 and A or K of network. Remove two mounting screws from base plate. Move ringer toward back of plate to remove tongue from cradle-switch bracket. Lift out ringer. Replace in reverse order.

CAUTION: DO NOT LOOSEN ANY PART OF THE MAGNETIC CIRCUIT. This includes the pole pieces, bar magnet and retaining clamp, spacer, coil core, coil, and armature. When necessary to replace any of these parts, return ringer to North Electric Company for repair.

k. Ringer Capacitor - Straight-line and 16 to 20 cps frequency selective ringers utilize the .45 mf capacitor in network. If failure occurs, transfer BROWN lead from A to K. Remove bare wire from coil terminals and replace with capacitor 564827 .45 mf. For other ringers, replacement capacitors are listed on page 26.

l. Gong - Remove housing. Remove mounting screw from dome of gong and lift gong off resonating chamber. Replace in reverse order.

m. Desk-Cord - Remove housing and ringer. Disconnect desk-cord leads from connector block and terminals L1, L2, and K of network. Remove strain-relief hook-retaining screw from base plate and remove desk-cord. Replace in reverse order.

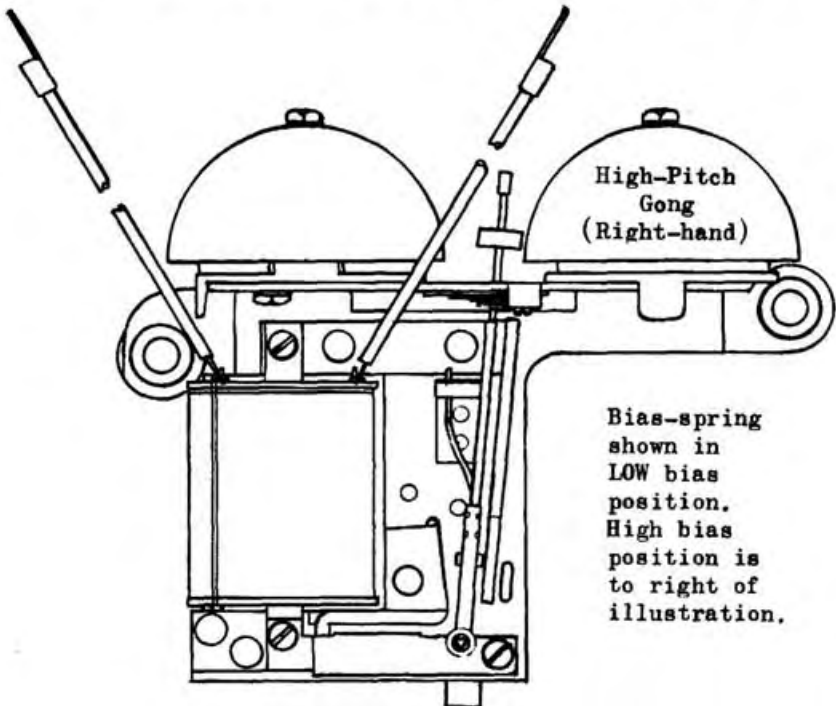


Fig. 10. Straight-Line Ringer

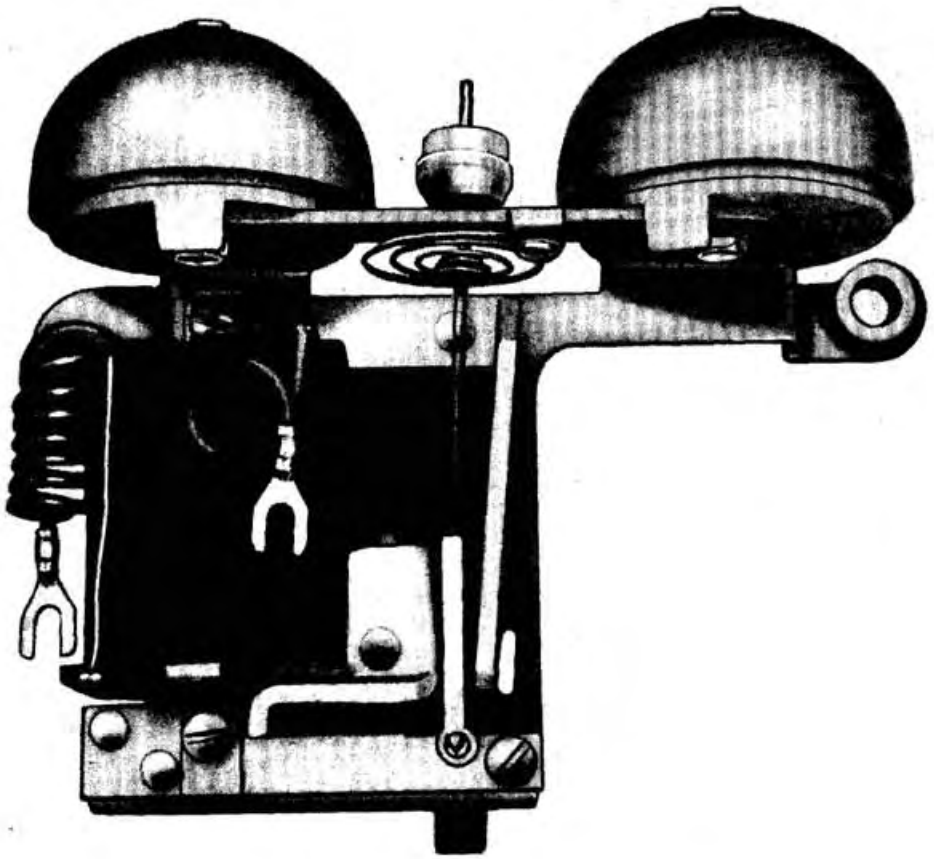


Fig. 11. Frequency Selective Ringer

n. Network - Remove housing, dial and ringer. Disconnect all leads from network. Remove mounting screws from plate and lift out network. Replace in reverse order. Refer to wiring diagram.

NOTE: If network is riveted to base plate, carefully drill out rivets. Mount replacement network with 1/4 inch long #4 Binder-head machine screws and hexagon nuts.

o. Cradle-Switch - The mounting bracket, which serves as a spring pile-up mounting, is attached to the base plate by two screws. The pile-up must never be removed from the bracket. In event the pile-up needs replacement, the complete cradle-switch must be replaced. To replace a cradle-switch lift out the dial and mounting bracket. Remove SLATE, RED-WHITE, GREEN-WHITE, ORANGE-WHITE, and BROWN-WHITE leads from network terminals F, L1, C, and L2. Remove two screws holding cradle-switch on plate. Replace in reverse order. Plungers should extend above housing $19/64 \pm 1/64$ inch. Adjust arms of switch lever to meet this.

NOTE: If cradle-switch is riveted to the base plate, carefully drill out rivets. Mount replacement cradle-switch with 1/4 inch long #4 Binder-head machine screws and hexagon nuts.

p. Lever and Actuator - Unhook the coil-spring and lift out lever. When replacing lever be sure to place the actuator behind the card extension.

q. Operating Card - Remove lever and actuator. Lift card extension and gently remove card through cradle-switch mounting bracket. To reassemble, press pile-up lever-spring nearest binder toward mounting bracket. Insert card through mounting bracket and into pile-up binder until proper notch is past lever-spring. Release spring and set card in place. Replace lever and actuator (See note).

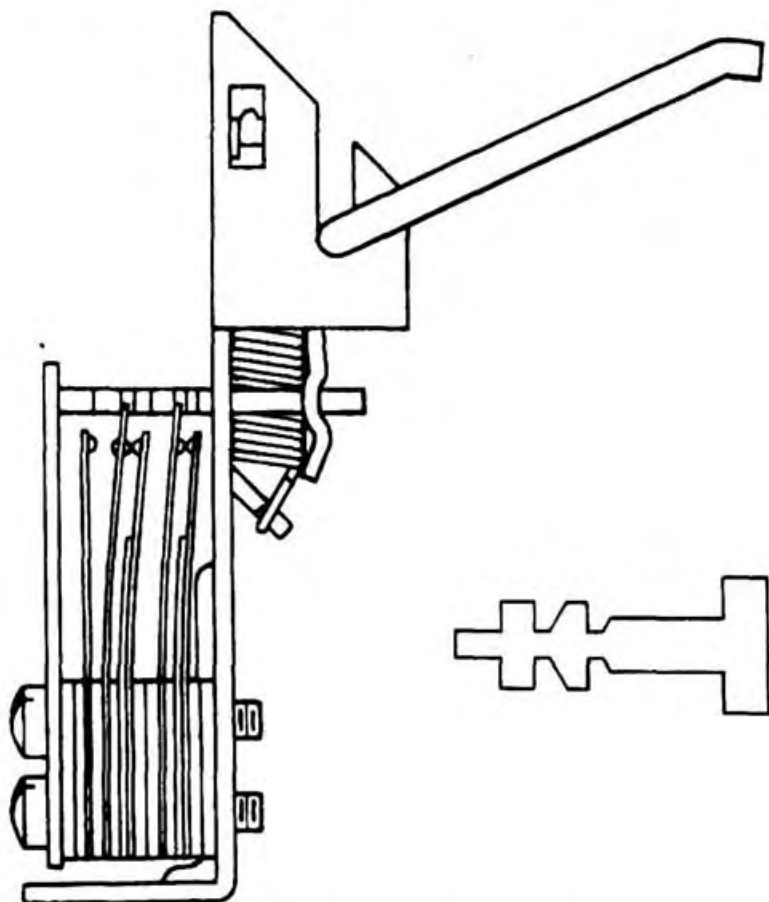


Fig. 12. Cradle-Switch (Card Inset)

NOTE: When lever does not pull against upper stop, card may be cracked or chipped, coil spring may be weak, or lever bearing points may be gummy and sticking. Replace spring or card and clean bearing points with safe solvent.

r. Number Card - Lift off retainer ring and replace number card as outlined in paragraph 32.

TELEPHONE HANDBOOK

CHAPTER 4

ADJUSTMENT

Section I GENERAL

40. EQUIPMENT

Adjustments of the ringer, dial and cradle-switch should be performed at the exchange. Ringer should be properly mounted on the base-plate when adjustments are made. The following equipment will be required in the adjustment procedures outlined.

Gram Gauge	0-30 grams
Feeler Gauge	.010", .012", .015", .018", and .024".
A.C. Voltmeter	0-150 volts, sensitivity 1000 ohms/volt or higher.
D.C. Milliammeter	0-10 milliamperes
Potentiometer	1000 ohms 10 watt minimum.
Spring Tool	North 500,470

Section II RINGERS

41. STRAIGHT-LINE RINGER B-225

a. The recommended method of checking the bias adjustment is the current flow test. This requires a variable source of d-c voltage and a milliammeter. The potentiometer connected across a 48 volt battery will provide a variable d-c voltage. Make sure the bias-spring is in the low-bias position. Connect the ringer, milliammeter and potentiometer to 48 volt battery as shown in the diagram (Fig. 13). The ringer should be mounted in the telephone for this test.

b. Slowly increase current through ringer from zero to maximum and back to zero again to condition the iron in the magnetic circuit. Slowly increase current until armature is pulled from the rest position and note current flow. The current should be between 4.0 and 5.0 milliamperes. If current is higher decrease bias-spring tension, and if lower increase tension until the above current reading is obtained. Tension is varied by gently bending bias-spring.

42. GONG ADJUSTMENT STRAIGHT-LINE RINGER B-225

a. The gongs can usually be set by eye. Loosen the mounting screws and move both gongs "out". Have armature in the rest position. Move the right hand gong (indicated on fig. 10) "in"

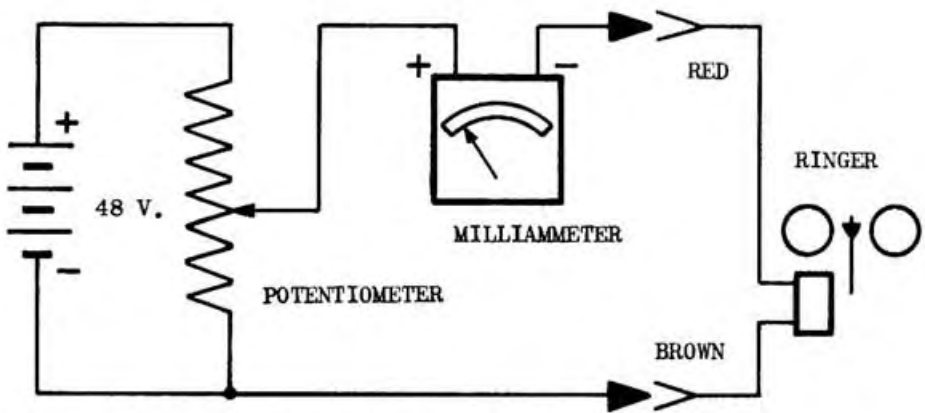


Fig. 13. Bias Adjustment

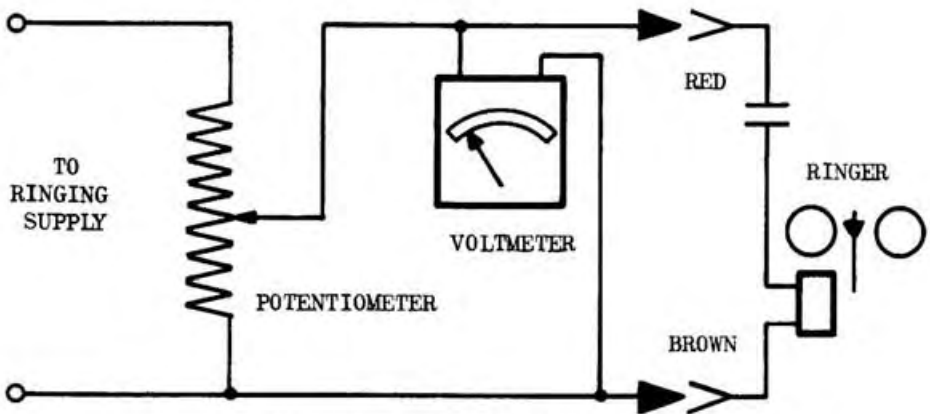


Fig. 14. Gong Adjustment

until almost touching the clapper and tighten mounting screw.

NOTE: In the rest position, the clapper must not touch the gong as this will deaden the vibrations during ringing. Improper adjustment of gong may alter bias to such an extent that it will be impossible to prevent ringer from tapping.

b. Move and hold armature against stop to the left (operated position), move left hand gong "in" until almost touching the clapper and tighten mounting screw. Apply ringing voltage to check quality of ring. Make any minor readjustment necessary.

43. FREQUENCY SELECTIVE RINGER B-245

a. Adjustments, other than setting the gongs, should never be attempted on frequency selective ringers. The resonating chambers have their mounting screw holes slightly off center. Rotation produces an eccentric motion, moving the gong in and out. Connect the ringer, a-c voltmeter and potentiometer to the ringing supply as shown in the diagram (Fig. 14).

b. Adjust potentiometer to provide the voltmeter reading shown in the table for the frequency of the ringer under adjustment.

Frequency (cycles per second)	Voltage (Gong Adjustment)
16, 16-2/3	50
20, 25	55
30, 33-1/3	60
40, 42	65
50, 54	70
60, 66, 66-2/3	80

c. Loosen mounting screws and move both gongs "out" until clapper does not strike either gong. Move one gong "in" until clapper starts striking it and tighten mounting screw. Move other gong "in" until both are being struck equally and tighten mounting screw. Set potentiometer (fig. 14) to minimum ringing voltage and slowly increasing voltage (to prevent starting on surge) to make certain ringer operates at proper voltage. Repeat several times.

Section III DIAL

44. DIAL-SPEED

The governor spring is positioned, at each end, in notches contained in the governor weights. Adjustment is made by shifting the spring ends to a different notch. Place dial face down and remove plastic dust cover. Rotate finger wheel slightly until end of spring is visible through piercing of governor drum (toward outer edge). With tool 500,470 (or very small screw driver) gently press end of spring inward until released from notch in governor shoe. Move end of spring counter-clockwise to increase dial speed or clockwise to reduce dial speed. When spring has been moved to last notch and further adjustment is required, remove the governor spring and stretch or compress spring, as needed, to obtain desired speed adjustment. Stretch to increase speed; compress to reduce speed.

45. PULSE RATIO

The pulse ratio may vary slightly due to normal wear (or contact burn-off) and decrease the proportion of make time. Adjustment is made by bending the support of the break spring, towards the pulsing spring, until the normal ratio of 60/40, b/m (60% break to 40% make) is reached. The air gaps should be .010" min. when contacts are open. The closed contact pressure should be 15 grams minimum measured directly behind contacts.

46. OFF-NORMAL SPRING PILE-UP

The North 7B dial provides a safety factor in switching time by one extra pulse on each digit. The last pulse is cut-off by the closing of break contacts (of off-normal spring pile-up) before

The last pulse, shorting the pulsing contacts. The opening and closing times for the receiver shunting contacts of off-normal spring pile-up are not critical. These need only comply with the following contact pressures and air gaps.

Contact Pressure (measured directly behind contact)	15 grams Min. 20 grams Max.
Air gap (contacts open)	.010" Min.

There should be 1/64" clearance (gauged by eye) between the foot of off-normal pile-up lift-spring and drive-gear when dial is off-normal.

47. FINGER-WHEEL TENSION

The finger-wheel tension is controlled by the main spring contained in a brass cup. A key-way locates the cup on the keyed top of the center or main shaft. To adjust tension, remove center screw in finger wheel disc and carefully lift off wheel. Very carefully raise brass cup just enough to permit rotation. To increase tension rotate cup 1/4 turn clockwise. To decrease tension rotate cup 1/4 turn counter-clockwise. Normally, when dial is at rest, spring should have 1-1/2 turns on it and never more than 2 turns. Replace finger wheel by reversing the procedure.

48. PARTS REPLACEMENT

Replacement of dial parts as outlined below, requires adjustment be checked in accordance with preceding subparagraphs.

a. Finger Wheel - Remove number card. Remove three screws securing retainer disc and finger wheel. Remove wheel. Replace in reverse order.

b. Number Plate - Remove number card and finger wheel. Remove center screw and lift off finger wheel support. Remove three screws and number plate. Replace in reverse order.

CAUTION: Removing center screw releases clamping of main-spring cup. Care must be exercised that cup and spring do not fly off shaft.

c. Finger Stop - Remove number card, finger wheel, and number plate. Remove screw holding finger stop and remove stop. Replace in reverse order.

d. Governor Drum - Remove plastic dust-cover. Remove two screws holding governor drum and bearing plate. Replace in reverse order. Be sure that end of cam stop-spring protrudes through hole provided in bearing plate.

e. Intermediate Shaft - Remove the governor drum. Lift out governor. Lift off cam. Lift out intermediate shaft. Replace

parts in reverse order. When replacing intermediate shaft, position gear so one lobe of drive washer is perpendicular to line through center of dial mounting holes and pointed toward this line.

f. Off-Normal and Pulse-Contact Springs - Remove plastic dust-cover. Remove ONLY the center pile-up screw. This does not disturb pile-up tightness or contact adjustments. DO NOT LOOSEN OUTSIDE PILE-UP SCREWS AT ANY TIME. Replace in reverse order.

Section IV CRADLE-SWITCH

49. AIR GAP AND CONTACT PRESSURE

a. Adjustment of the cradle-switch should never be attempted except where definite indications of switch trouble exist. The adjustments are as follows:

Air, Gap, Contacts open	.015" minimum
Contact pressure - (per contact, measured directly behind the contacts)	15 grams minimum 20 grams maximum

b. The proper opening and closing time of contacts is determined by inserting feeler gauges between the top of actuator and upper stop. The break contacts of the cradle switch are the contacts that open when the hand-set is replaced on the cradle. (Switch in operated position.) There are 2 sets of break contacts and 1 set of make contacts.

All contacts closed	.018" feeler gauge inserted
Break contacts opened	.024" feeler gauge inserted
Make contacts opened	.012" feeler gauge inserted

c. Contact pressure is adjusted by proper tensioning of break springs against spring supports.

50. CRADLE-SWITCH LATCH

The air-gap, contact pressures and clearances on latch equipped cradle-switches will be published in a supplement to this handbook.

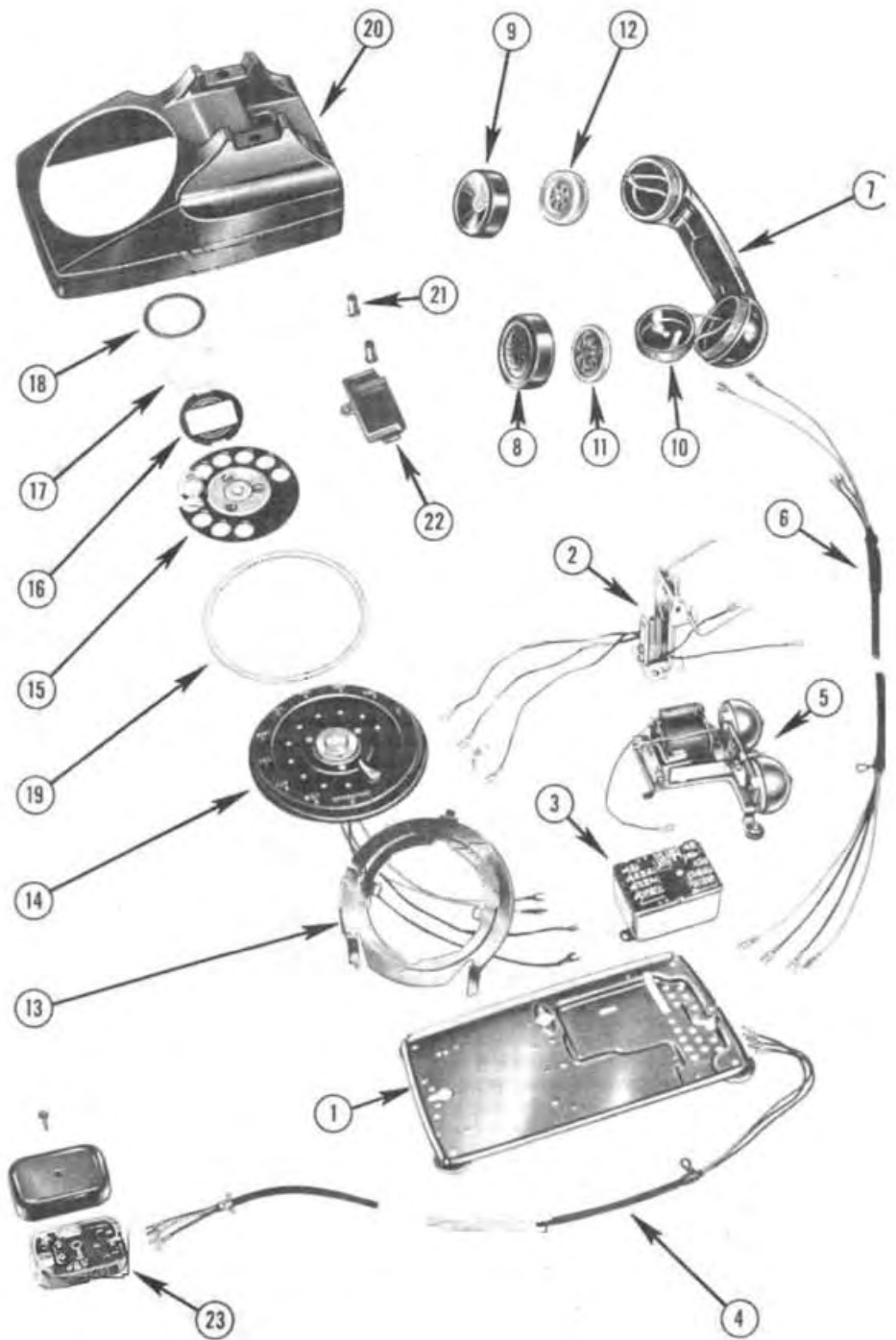


Fig. 15. Exploded View, Telephone

TELEPHONE HANDBOOK

CHAPTER 5

SUPPLEMENTARY DATA

Section I REPLACABLE PARTS LIST

FIG. 15 REF.	QUAN. REQ'D	PART NUMBER	NOMENCLATURE	REPLACES	
1	1	568254	Base with feet	Black	B-259
		568253		Emperor Blue	B-259-B
		568252		Tawny Green	B-259-G
		568251		Executive Gray	B-259-G12
		568250		Indian Ivory	B-259-J
		568249		Richland Red	B-259-R
		568248		Coral Sand	B-259-T
		568247	Chartreuse Yellow	B-259-Y	
	2	563239	Screws, Housing mounting	B-116	
2	1	564924	Switch	w/o latch	B-210
		564856		with latch	B-252

REPLACEABLE PARTS FOR SWITCH

	1	564929	Lever and actuator	B-215	
	1	563307	Actuating card	B-126	
	1	563308	Return spring	B-127	
	1	563362	Latch return spring (used on 564856 only)	B-164	
	2	561582	Screws, switch mounting (order 561582 for sets which have tapped holes in base- plate instead of switch frame).	9462	
3	1	500084	Network		
	2	561582	Screws, network mounting	9462	
4	1	564808	Cord, desk	Black	B-202
		564809		Emperor Blue	B-202-B
		564810		Tawny Green	B-202-G
		564811		Executive Gray	B-202-GR
		564812		Indian Ivory	B-202-J
		564813		Richland Red	B-202-R
		564814		Coral Sand	B-202-T
564815	Chartreuse Yellow	B-202-Y			
5	1	561591	Screw, strain relief, S-hook	H-186	
	1	See Table	Ringer		
	2	561631	Screws, ringer mounting	9463	

FIG. 15 REF.	QUAN. REQ'D	PART NUMBER	NOMENCLATURE	REPLACES
		565181	Black	B-206
		564833	Black, with Coiled Kord	B-241
		564834	Emperor Blue, w/ Coiled Kord	B-241-B
	1	564835	Tawny Green, w/ Coiled Kord	B-241-G
		564836	Executive Gray, w/ Coiled Kord	B-241-GR
		564837	Indian Ivory, w/ Coiled Kord	B-241-J
		564838	Richland Red, w/ Coiled Kord	B-241-R
		564839	Coral Sand, w/ Coiled Kord	B-241-T
		564840	Chartreuse Yellow, w/ Coiled Kord	B-241-Y

REPLACEABLE PARTS FOR HANDSET

		565000	Black	B-203	
		565010	Black, Coiled Kord	B-223	
		565011	Emperor Blue, Coiled Kord	B-223-B	
6	1	565012	Tawny Green, Coiled Kord	B-223-G	
		565013	Executive Gray, Coiled Kord	B-223-GR	
		565014	Indian Ivory, Coiled Kord	B-223-S	
		565015	Richland Red, Coiled Kord	B-223-R	
		565016	Coral Sand, Coiled Kord	B-223-T	
		565017	Chartreuse Yellow, Coiled Kord	B-223-Y	
		563247	Black	B-101	
		563246	Emperor Blue	B-101-B	
7	1	563245	Tawny Green	B-101-G	
		563244	Executive Gray	B-101-GR	
		563243	Indian Ivory	B-101-J	
		563242	Richland Red	B-101-R	
		563241	Coral Sand	B-101-T	
		563240	Chartreuse Yellow	B-101-Y	
		563248	Trans- mitter cap	Black	B-102
		563249		Emperor Blue	B-102-B
		563250		Tawny Green	B-102-G
8	1	563251		Executive Gray	B-102-GR
		563252		Indian Ivory	B-102-J
		563253		Richland Red	B-102-R
		563254		Coral Sand	B-102-T
		563255	Chartreuse Yellow	B-102-Y	
		563256	Receiver cap	Black	B-103
		563257		Emperor Blue	B-103-B
		563258		Tawny Green	B-103-G
9	1	563259		Executive Gray	B-103-GR
		563260		Indian Ivory	B-103-J
		563261		Richland Red	B-103-R
		563262		Coral Sand	B-103-T
		563263	Chartreuse Yellow	B-103-Y	

10	1	564891	Transmitter cap ass'y	Black	B-204	
		564892			Emperor Blue	B-204-B
		564893			Tawny Green	B-204-G
		564894			Executive Gray	B-204-GR
		564895			Indian Ivory	B-204-J
		564896			Richland Red	B-204-R
		564897			Coral Sand	B-204-T
564898	Chartreuse Yellow	B-204-Y				
11	1	500262	Transmitter unit			
12	1	500263	Receiver unit			
	1	563373	Clip, Strain relief		B-169	
	1	561679	Screw, Strain relief clip		9403	
13	1	561591	Screw, Strain relief, S-hook		H-186	
	1	565038	Bracket, Dial mounting		B-249	
14	1	568342	Dial Type 7-B	Black		
		568343			Emperor Blue	
		568344			Tawny Green	
		568345			Executive Gray	
		568346			Indian Ivory	
		568347			Richland Red	
		568348			Coral Sand	
568349	Chartreuse Yellow					
1	1	565084	Dial Blank Ass'y	Black	B-238	
		565085			Emperor Blue	B-238-B
		565086			Tawny Green	B-238-G
		565087			Executive Gray	B-238-GR
		565088			Indian Ivory	B-238-J
		565089			Richland Red	B-238-R
		565090			Coral Sand	B-238-T
565091	Chartreuse Yellow	B-238-Y				
	2	561559	Screws, Dial Blank mtg.		9183	
	2	562516	Lockwashers, blank mtg. screw		9054	

REPLACEABLE PARTS FOR DIAL
AND DIAL BLANK

15	1	568224	Finger Wheel (Dial Only)	Black	9722	
		568223			Emperor Blue	9772-B
		568222			Tawny Green	9772-G
		568221			Executive Gray	9772-GR
		568220			Indian Ivory	9772-J
		568219			Richland Red	9772-R
		568218			Coral Sand	9772-T
568217	Chartreuse Yellow	9772-Y				
	3	561609	Screw, Finger wheel mtg. (dial only)		9448	
	1	565576	Dust cover (dial only)		9775	
	2	561475	Screws, Dial & Dust cover mtg. (dial only)		9453	

		563294	Molding, Dial Blank	Black	B-118
		563295		Emperor Blue	B-118-B
		563296		Tawny Green	B-118-G
1		563297		Executive Gray	B-118-GR
		563298		Indian Ivory	B-118-J
		563299		Richland Red	B-118-R
		563300		Coral Sand	B-118-T
		563301	Chartreuse Yellow	B-118-Y	
	1	565093	Card support	9241	
	3	561681	Screw, Card support mtg. (dial blank only)	9460	
16	1	563217	Card, dial	9774 & 9394	
17	1	563214	Card cover	9192	
18	1	563215	Ring, card holder	9187	
		564899	Black	B-205	
		564900	Emperor Blue	B-205-B	
		564901	Tawny Green	B-205-G	
		564902	Executive Gray	B-205-GR	
		564899	Black	B-205	
20		564900	Emperor Blue	B-205-B	
	1	564901	Tawny Green	B-205-G	
		564902	Housing, Executive Gray	B-205-GR	
		564903	Indian Ivory	B-205-J	
		564904	Richland Red	B-205-R	
		564905	Coral Sand	B-205-T	
		564906	Chartreuse Yellow	B-205-Y	
	1	564816	Housing. For sets with cradle switch latch. Black.	B-234	
REPLACEABLE PARTS FOR HOUSING					
		564800	Black	B-201	
		564801	Emperor Blue	B-201-B	
	1	564802	Housing Tawny Green	B-201-G	
		564803	Executive Gray	B-201-GR	
		564804	Indian Ivory	B-201-J	
		564805	Richland Red	B-201-R	
		564806	Coral Sand	B-201-T	
		564807	Chartreuse Yellow	B-201-Y	
21	2	563283	Plunger	B-109 + code	
		563281	Cover, Hand hole	Black	B-107
		563280		Emperor Blue	B-107-B
		563279		Tawny Green	B-107-G
22	1	563278		Executive Gray	B-107-GR
		563277		Indian Ivory	B-107-J
		563276		Richland Red	B-107-R
		563275		Coral Sand	B-107-T
		563274	Chartreuse Yellow	B-107-Y	
	1	561680	Screw, mtg., Hand hole cover	9404	
	1	563361	Plunger (for cradle switch latch only)	B-163	

	1	563360	Clip, retainer (for cradle switch latch only)	B-162
		563068	} Connector Block	Black
		563067		Emperor Blue
		563066		Tawny Green
23	1	566065		Executive Gray
		563064		Indian Ivory
		563063		Richland Red
		563062		Coral Sand
		563061	Chartreuse Yellow	
				H-267
				H-267-B
				H-267-G
				H-267-GR
				H-267-J
				H-267-R
				H-267-T
				H-267-Y

Section II TABLE OF RINGERS AND RINGER-CAPACITORS

RINGER PART NO.	FREQUENCY C.P.S.	CAPACITOR PART NO.	CAPACITY M.F.
565083	33-1/3	564829	.18
565082	50	564830	.10
565081	66-2/3	564832	.05
565080	16-2/3	564827 *	.45
565079	25	564828	.27
565078	20	564827 *	.45
565077	30	564829	.18
565076	42	564830	.10
565075	54	564831	.07
565074	40	564830	.10
565073	60	564831	.07
565072	66	564832	.05
565071	16	564827 *	.45
565059	Straight Line	564827 *	.45
565058	Superimposed	**	.45

* "This Part for replacement only, .45 mf capacitor normally in network."

** "With Tube 500354."