SECTION 500-112-100CA
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Bell Canada
Standard

INDUCTIVE NOISE

1. INTRODUCTION

1.01 This section covers the relative contributions to inductive noise which may be controlled or moderated by the proper use of subscriber station equipment.

1.02 This section is reissued to incorporate supplement and update information.

1.03 Inductive noise is noise which is induced in the telephone system and brought to the telephone receiver electrically. Inductive noises arise most often from sources external to the telephone plant, such as induction from exposure to foreign systems, particularly power circuits. Surrounding noise (room noise) picked up by the transmitter and carried on the circuit is not included. For correction of room noise interference, refer to the Sections entitled, "Apparatus for Use at Noisy Locations."

2. GENERAL

Station apparatus and associated wiring should not be located close to possible sources of inductive noise than the separations specified in the sections covering wiring, clearances, and station set location.

2.01 Radio frequency induction from radio transmitters should be corrected as recommended in the Section entitled, "Radio Signal Suppression in Telephone Sets."

2.02 Poor insulation or resistance unbalance of the telephone circuit contributes to noise resulting from inductive interference. Locating and eliminating the cause of high leakage or resistance unbalance may adequately solve the problem.

2.03 The balance-to-ground of the customer station sets is often the controlling factor in the susceptibility to inductive noise.

Note: The unbalance between the two sides of a line which has only the capacitance afforded by the air dielectric between the tip and ring shall not exceed three volts on the meter at the local test desk.

3. STATIONS EMPLOYING CAPACITOR-TYPE RINGING BRIDGES

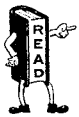
3.01 Both low-impedance or red-striped ringers, when used for grounded ringing, increase the line's susceptibility to inductive noise. All low-impedance ringing bridges on a line troubled with inductive noise should be changed to high-impedance capacitor-type ringing bridges. The high-impedance ringing bridges connected on each side of a line should balance within certain limits. The unbalance between the two sides of a line shall not exceed three units. The Section entitled, "Ringing Bridge Limitations," lists figures as units of unbalance which may be applied to the various ringing bridges to determine the unbalance between the two sides of the line.

3.02 B-type ringers, which were manufactured with magnetic iron cores in the ringer coils, have red-striped markings on both coil covers. They are lower in impedance and increase the susceptibility to inductive noises on grounded ringing party lines. It may be necessary to replace them. The ratio of receiver noise-to-noise-to-ground is in the order of 5 db greater for sets with magnetic iron core ringers (red-stripped) than for sets with permalloy core ringers.

3.03 Inductive noise encountered at local battery talking tip-party stations, which employ 266A Inductors as a bridge in the receiver circuit, may be moderated by reversing the leads. of the 266A Inductor, as shown in the sections covering such local battery set connections.

3.04 The unbalances due to nongrounded ringing bridges are small and receiver noise resulting from the action of induced voltages on these unbalances is usually negligible.

3.05 When inductive noise is excessive on lines with high-impedance capacitor-type grounded ringing bridges, tubes or ringer isolators may be utilized to minimize the effects of the induced voltage.



In areas where tubes or ringer isolators are required, individual lines should be wired metallic (not as ring party) to minimize the possibility of a noise problem.

3.06 From the standpoint of susceptibility to inductive noise, a grounded station ringer equipped with a tube or ringer isolator is equivalent to a nongrounded ringer (provided the induced voltage between the line and ground is not high enough to cause conduction of the tube, or exceed the limits of the ringer isolator, and that tip party identification is not used).

4. COIN COLLECTOR STATIONS

4.01 Dial and manual prepay coin collector lines are susceptible to inductive noise in exposed areas. Older types of prepay coin collectors have a large shunt unbalance caused by the connection of the coin relay from one line wire to ground. Later types correct this unbalance by the use of centre-tapped 101B Induction Coils or 425B Networks with the coin relay connected from the centre tap to ground.

4.02 Where noise problems arise with older-type coin collectors, it will be necessary to replace the coin collector arrangement with one employing a 101B Induction Coil or 425B Network.

4.03 Earth potential or long loops may interfere with the proper operation of the coin relay. Earth potential may be either positive or negative. If negative, it opposes the negative coin battery and reduces the coin return range; similarly, if positive, it reduces the collect range. Station equipment is available which employs a sensitive low-resistance relay (S36) wired in series with the coin relay which, when it operates, multiples the tip and ring conductors at the station and thus reduces the total resistance in the control path, especially after the customer hangs up. In dial offices, coin collect and return current is normally applied to both tip and ring conductors at the central office. At some manual offices only the tip side is used, in which case the use of this type of subscriber equipment would be of no benefit without central office coin line circuit rearrangements.

4.04 Available subscriber sets employing S36 Relays and also 101B Induction Coils for use at coin collectors stations are covered in the Section entitled, "Subscriber Sets, Common Battery, Induction Coil Type, Connections." Network types are covered in the connection Sections for 685A Subscriber Sets.

4.05 The electromagnet associated with 10-cent operation is connected in series with the line. In order to minimize the effect of the electromagnet on transmission, a 452A or B 4-uf Capacitor is connected in parallel with it. In areas of low frequency inductive interference it may be necessary to increase the size of this bypass capacitor, in order to keep the noise pickup within acceptable limits. A Mallory TCN 3520 Electrolytic Capacitor (20 MFD 350 volts nonpolarized) or equivalent may be used for this purpose. Purchase locally.

4.06 At common battery talking coin collector stations, the above electrolytic capacitor will only improve the noise condition when used with sets equipped with 101B Induction Coils or 425B Networks.

5. DEVICES TO MINIMIZE INDUCTIVE NOISE

5.01 Three different electrical devices may be used to minimize the effect of inductive noise.

- 426-type, 3-element, gas-filled cold cathode electron tube (shown for maintenance purpose only).
- 425-type, 4-element, gas-filled cold cathode electron tube (shown for maintenance purpose only).
- PO895087 solid-state ringer isolator kit (For new installations).

5.02 Table A shows usage of the tubes and ringer isolator for the various party services.

5.03 Tube isolators usually require either superimposed ringing (ac ringing voltage plus a dc bias voltage), or a pulsating ringing current, in order to assure satisfactory ringer operation. If a suitable supply is not available, tube isolators cannot be used.

5.04 The limitations on the number of tube equipped ringing bridges and the permissible loop resistance are more restricted than for regular capacitor-type ringing bridges. The reduction in limitations is different for various central office ringing arrangements. For the limitations, refer to Section 500-114-100.

5.05 Tube isolators may be used on 2-party or multi-party lines provided tip-party identification is not required.

3-Element Tube (426-Type Shown For Maintenance Purposes Only)

5.06 The 426-type 3-element tube may be added to high-impedance grounded ringers to minimize the effects of inductive noise.

5.07 When 3-element tubes are used to combat inductive interference, station ringers should be connected as shown in Fig. 1.

5.08 For positive stations on lines experiencing inductive interference, induced noise voltages of 20 to 30 volts RMS may be sufficient to cause the control gap to conduct. This conduction ("flashover") will result in noise (sputtering) on the line during conversation.

5.09 For negative stations, the control gap is bridged across the line, and the main gap is connected between the line and ground in series with the ringing bridge (Fig. 1, negative stations). The main gap will normally withstand 70 to 80 volts RMS of induced noise before "flashover" (conduction) occures.

5.10 For additional information on the 3-element tube, see Section 501-320-100.

4-Element Tube (425-Type Shown For Maintenance Purposes Only)

5.11 The 425-type 4-element tube may be required in cases where the induced voltage on the telephone line exceeds the values for satisfactory operation of the 3-element tube.

5.12 The control gap of the 4-element tube is bridged across the line (and the main gap connected between the line and the ground) for both positive and negative stations (Fig. 2). The line is protected from induced noise by the high breakdown point of the main gap.

5.13 For additional information on the 4-element tube see Section 501-320-100.

Ringer Isolator (PO895087 Kit Of Parts)

5.14 The PO895087 Ringer isolator kit should be used where induced noise voltage is a problem (up to 140 volts RMS) it should also be used as a replacement for defective 425-426 type tubes.

5.15 This isolator kit is to be mounted loose in telephone sets and subscriber sets etc. No mounting bracket is necessary as its small size and weight allows it to be placed in any available space. The only necessary precaution required is to dress the leads in such a way as to prevent any interference with dial contacts, hookswitch or ringer armature. Bridging of the ringer isolator leads to ringer may be made through the use of QCM12A Connector.

5.16 The ringer isolator is intended for use with all grounded ringers except those used in 4-party full selective and 8-party semi-selective ringing service (Fig. 3). The ringer isolator may be used at subscriber stations requiring tip party identification. Identification connections are made in the normal manner, but only the 2650-ohm identification circuit should be used. One ringer isolator is required for each grounded ringer (Fig.5).

TABLE A

DEVICE	2-PARTY	DIVIDED CODE (MULTI-PARTY)	4-PARTY SEMISELECTIVE RINGING	8-PARTY SEMISELECTIVE RINGING	2-PARTY WITH TIP PARTY IDENTIFICATION
3-Element Tube	●	●	●	●	
4-Element Tube	●	●	●	●	
Ringer Isolator	●	●	●		●

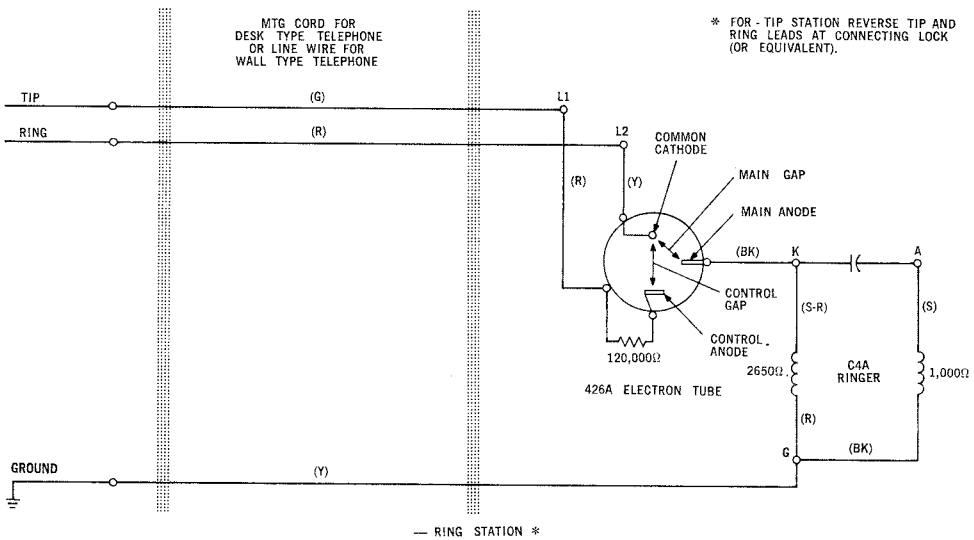
5.17 Check the following locations for information on ringer isolator connections:

- 3-Element Tube Connections (Fig. 1)
- 4-Element Tube Connections (Fig. 2)
- Typical Ringing Bridge Connections (Fig. 3)
- Tip party Identification Connections (Fig. 4)
- Princess Connections (Para. 5.20)
- Contempra Connections (Table C)
- Bell Chime Connections (Fig. 5)
- 592 Subscriber Set Connections (Figs. 6 or 7)

Lines equipped with ringer isolators cannot be tested for continuity by conventional test desk procedures. This device should be installed in such a manner as not to interfere with electrical or mechanical operation of the telephone set.

5.18 For additional information on the P895087 Kit of Parts (ringer isolator see Section 501-375-100.

5.19 If the installation of ringer isolators does not clear the noise problem, refer to Section 331-840-901 entitled, "Loop Noise Investigation and Reduction for Additional Corrective Action."



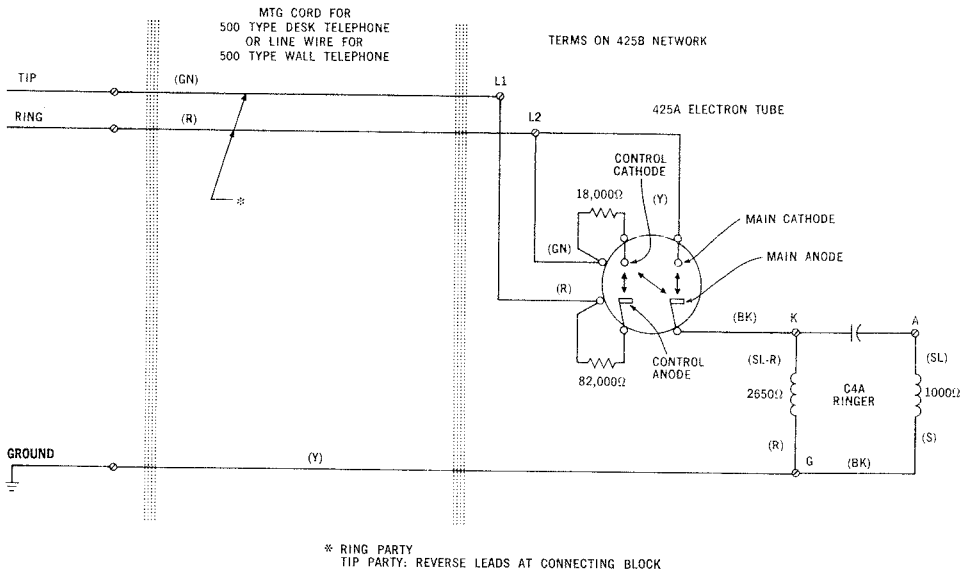
Three Element Tube

Modify the telephone set for the three element tube as follows:

1. Connect the RED lead from the 426A gas tube to post L1 of the 425B network.
2. Connect the YELLOW lead from the gas tube to post L2 of the network.
3. Connect the BLACK lead from the gas tube to post K of the network.
4. Remove the SLATE-RED ringer lead from post A and connect to post K.
5. Remove the SLATE ringer lead from K and connect to A.
6. Remove the RED ringer lead from L2 and connect to G.

The telephone is wired as a Ring party; reverse the leads at the connecting block for a tip party.

Fig. 1 — 3-Element Tube, Typical Ringing Bridge Connections



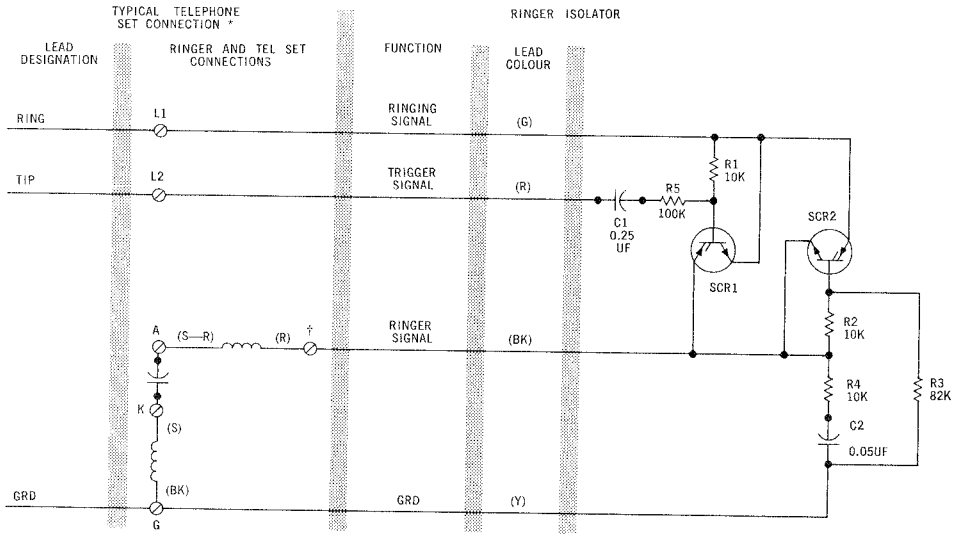
Four Element Tube 425A

Modify the telephone set for the four element tube as follows:

1. Connect the RED lead from the 425A gas tube to post L1 of the 425B network.
2. Connect the GREEN lead from the gas tube to post L2 of the network.
3. Connect the YELLOW lead from the gas tube to post L2.
4. Connect the BLACK lead from the gas tube to post K of the network.
5. Remove the SLATE-RED ringer lead from post A and connect to post K.
6. Remove the SLATE ringer load post K and connect to post A.
7. Remove the RED ringer lead from post L2 and connect to post G.

The telephone is wired as a Ring party; reverse leads at the connecting block for a tip party.

Fig. 2 — 4-Element Tube, Severe Induction Ringing Bridge Connections



* RING STATION. FOR TIP STATION REVERSE TIP AND RING LEADS AT CONNECTING BLOCK (OR EQUIVALENT).

† USE SPARE TELEPHONE SET TERMINAL OR D—161488 OR QCM9A CONNECTOR.

Fig. 3 — Ringer Isolator, Typical Ringing Bridge Connections

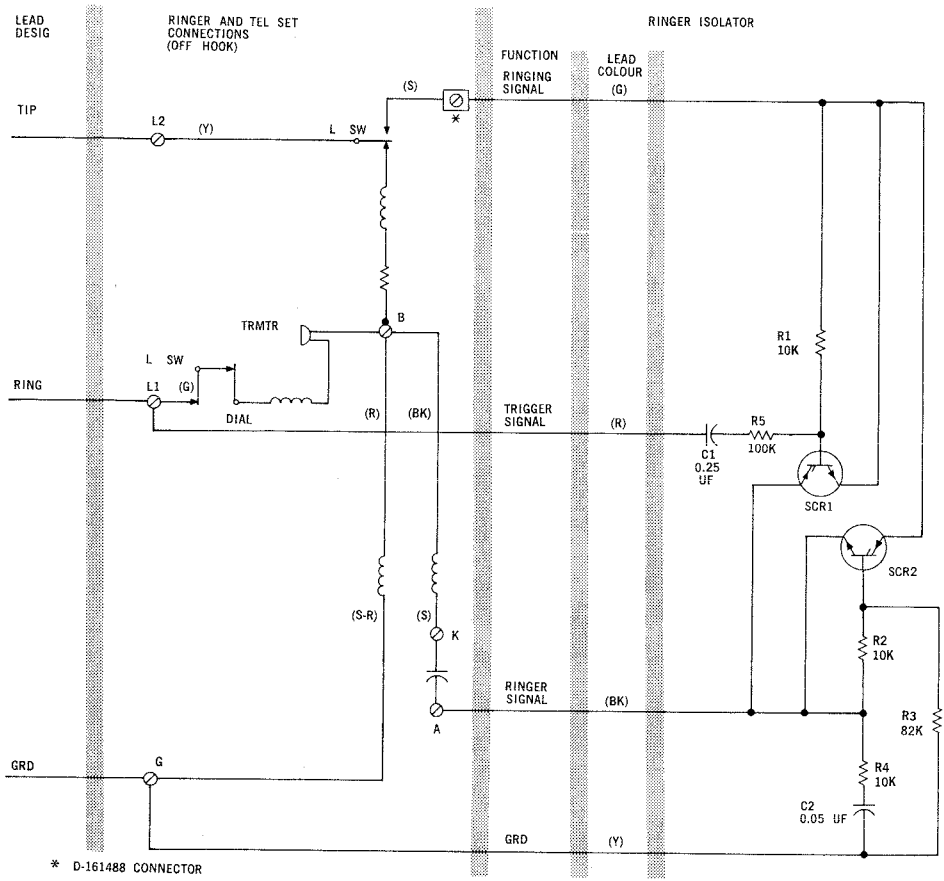


Fig. 4 — Ringer Isolator Connections for Tip Party Identification —2650 Ohms

Princess Set Connections

5.20 The 701B Princess Set associated with the E1A Ringer cannot be fitted with the PO895087 Ringer isolator due to space limitation. When it is required, substitute the 702BQ1A Princess Set and wire in accordance with the steps outlined below:

(1) Disconnect Red and Green mounting cord leads from L2 and L1 respectively.

(2) Insert ***PO96B583 Connectors*** in L2 and L1 terminals (Flatten the shanks of the connectors with long nose pliers, first).

(3) Insert the Red and Green mounting cord leads in the rear slots of the PO96B583 Connectors (Red to L2, Green to L1).

(4) Disconnect Red ringer lead from K.

(5) Using a QCM12A or PO96B583 Connector, splice Red ringer lead to one lead of a 548A Capacitor (order separately).

(6) Using a QCM12A or PO96B583 Connector, splice the other lead of 548A Capacitor to BK lead of PO895087 ringer isolator.

(7) Terminate Yellow lead of ringer isolator of G terminal of network.

(8) Terminate Red and Green ringer isolator leads in front slots of PO96B583 Connectors as per Table B.

TABLE B

Component	Lead Colour	Ring Party	Tip Party (No. A.N.I.)	Tip Party (A.N.I.)
Ringer Isolator	R	L2	L1	L1
	G	L1	L2	L2

Notes: *1* Refer to Table A of Section 502-710-403CA for remaining set connections.

2 Install Ringer Isolator between the legs of the Dial Mounting Bracket.

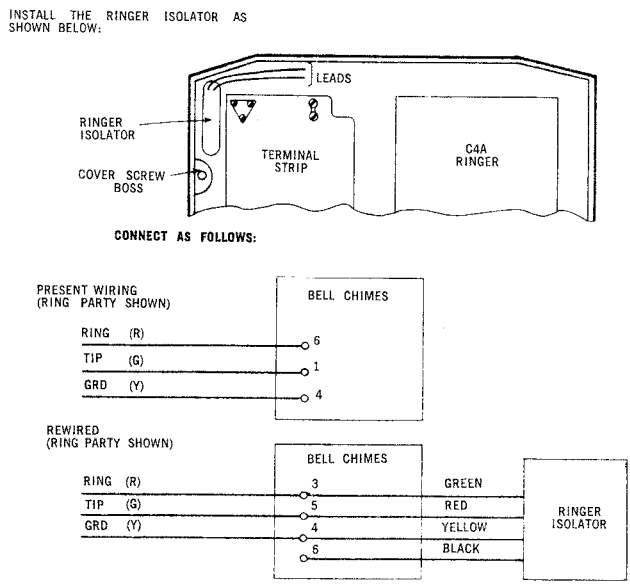
3 Dress the 548A Capacitor along the front of the network.

5.21 Contempra Set Connections (Table C)

TABLE C

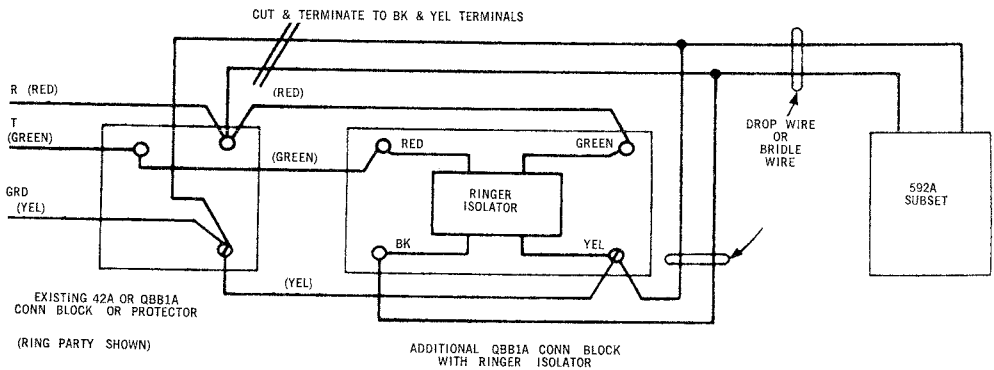
Set Wiring	Lead Designation	Colour	Ring Party	Tip Party (See Note 1)
RINGER		R BK S S-R	MOVE FROM L3 to G1 LEAVE ON G LEAVE ON K LEAVE ON A	MOVE FROM L3 to G1 LEAVE ON G LEAVE ON K LEAVE ON A
RINGER ISOLATOR (INSTALL BETWEEN HOOKSWITCH AND NETWORK)		R G BK Y	CONNECT ON L1 CONNECT ON L3 CONNECT ON G1 CONNECT ON G	CONNECT ON L3 CONNECT ON L1 CONNECT ON G1 CONNECT ON G
LINE WIRING OR MOUNTING CORD	TIP RING GRD	G R Y	L1 L2 G	L2 L1 G
SWITCHHOOK LEADS		S S-Y S-BR	L3 L2 C	L3 L2 C

Note 1: This set cannot be wired for A.N.I.



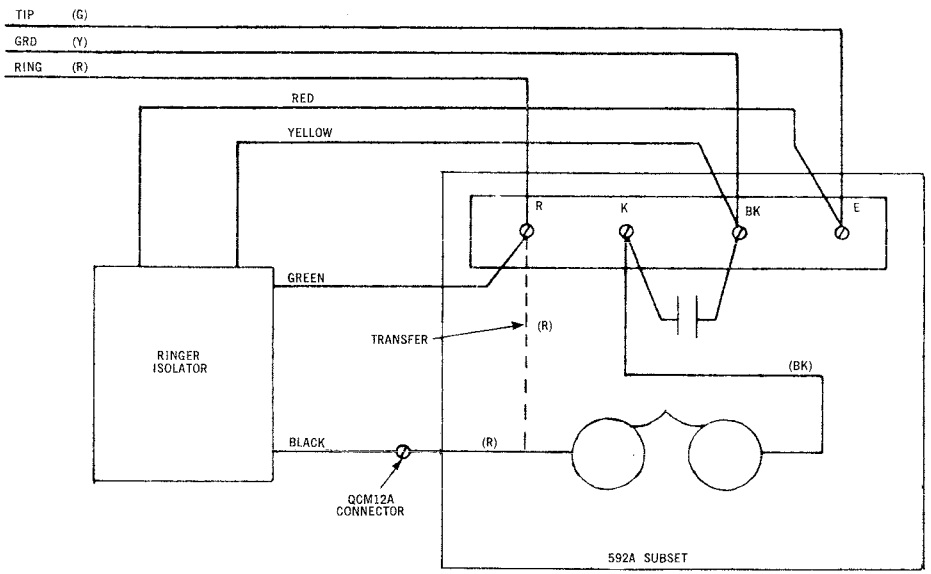
Note: For tip party (no A.N.I.) reverse red and green line wires and red and green ringer isolator leads.

Fig. 5 — Bell Chime Connections



Note: For tip party (no A.N.I.) reverse the red and green line wires and red and green ringer isolator leads.

Fig — 6
592A Subscriber Set Connections
(Served by a 2 Wire Conductor)



(RING PARTY SHOWN)

1. Dotted line shows original wiring.
2. Install Ringer Isolator over the top of B1A ringer (in front of terminal strip.)
3. For tip party (no A.N.I.) reverse the red and green line wires and red and green ringer isolator leads.

Fig. — 7
592A Subscriber Set Connections
(Served by 3 or 4 Wire Conductor)