

STATION EQUIPMENT ASPECTS OF AUTOMATIC NUMBER  
IDENTIFICATION

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FIGURES 1 - 7

1. GENERAL

- 1.1 This section provides REA borrowers, consulting engineers, and other interested parties with information for use in the design, construction and operation of REA borrowers' telephone systems. It discusses several methods of providing Automatic Number Identification (ANI). Particular emphasis is given to those methods which involve special components and/or wiring changes that must be made in the subscribers' telephone sets. Information regarding central office aspects of ANI can be found in TE & CM 328, "Application Guide for Preparation of Part III - Specification of Detailed Requirements for Direct Distance Dialing Equipment," and REA Form 537, "REA Specification for Automatic Number Identification - CAMA."
- 1.2 The term ANI implies the identification of the calling station regardless of the class of service of the line. Equipment must be provided in the central office to translate the basic identification mark into the Subscriber Directory Number (SDN) for billing purposes. Automatic Line Identification (ALI) implies that equipment is provided in the central office to identify only the calling line. With suitable translation equipment ANI can frequently be provided on one party lines in

offices equipped with ALI. ALI offices can also provide ANI on multi-party lines if "circle digit" dialing is used. ANI provided by circle digit requires the calling party to dial a non-verified digit (or digits) to identify the calling station. Circle digit ANI on party lines does not require any wiring or component changes in the station sets other than furnishing a number card stamped with the proper circle digit.

- 1.3 Automatic number identification is an important feature in modern telephone systems which provide Direct Distance Dialing (DDD). Therefore, it should be provided where feasible. Information is given on the requirements and limitations of station equipment when converting a regular station to an ANI station. Studies should be made to determine the technical and economic feasibility of ANI versus other means of identification when a system is being upgraded.
- 1.4 An alternative to ANI is Operator Number Identification (ONI) which requires the calling party to furnish his number to the operator. Where several grades of service are offered within an exchange ANI is recommended on one- and two-party lines, while ONI is recommended for lines having more than 2 parties.
- 1.5 The preferred arrangements in most systems are discussed in the following paragraphs.

## 2. CALLING NUMBER IDENTIFICATION FOR ONE-PARTY EXCHANGES

- 2.1 There are no requirements for station modifications to provide ANI on one-party lines. Identification is handled entirely by the switching equipment.
- 2.2 Provide standard line and ringer connections for bridged ringing in all telephone sets on one-party lines regardless of the type of exchange service.

## 3. CALLING NUMBER IDENTIFICATION FOR ONE- AND TWO-PARTY EXCHANGES

- 3.1 Provide ANI on the one-party lines as in paragraph 2.
- 3.2 On two-party lines, the ring party stations are connected in the standard manner for divided ringing with straight line (biased) ringers as indicated by Figure 1, and are identified by the absence of a dc marking ground in the

"off hook" condition. Tip party stations are identified by the presence of a dc marking ground at the station in the "off hook" condition, as indicated in Figure 2. This requires changes in the wiring connections within the telephone set at the time of installation. This type of ANI is recommended for most two-party lines in preference to either ONI or Circle Digit identification, even though it has certain disadvantages, because it is the only truly automatic identification system available for more than one party per line. In the ground mark system identification accomplished without any specific action by the caller other than going "off hook."

- 3.21 Modern telephone sets, such as are now on our "List of Materials Acceptable for Use on Telephone Systems of REA Borrowers", are represented schematically by Figures 1 and 2. These sets have been designed to provide two-party ANI economically by utilizing the resistance of a portion of the ringer winding as part of the dc identifying ground pulse circuit at "tip" party stations. The inductance of that same winding is used as a high ac impedance to prevent excessive loss of the ac signal. A high degree of longitudinal balance at voice frequencies is maintained by splitting the primary of the hybrid (induction) coil, and by connecting the ground leg at an electrically neutral point between the transmitter and a balancing resistor (Point B in Figure 2). Accessible terminals and specific instructions are provided with each telephone set to facilitate the necessary wiring changes. Older sets may not have these features.
- 3.22 Where it is necessary to provide tip party ANI at a station equipped with a set that does not have a split primary, the set should be replaced with one of a more modern design. Special ANI networks are available for older type sets but are moderately expensive. In view of the probable age of these older sets replacement, rather than conversion, is recommended.
- 3.3 The disadvantages of ground mark identification are: (1) it complicates station installation and maintenance, (2) it may increase circuit noise to some extent, (3) it requires special circuitry and adjustments for use with positive booster battery on the tip side of the line, and (4) it cannot be used with ordinary station carrier equipments as they will not transmit the ground identification.

- 3.31 Station installations are complicated only to the extent of connecting the ringer at tip party stations in a special manner in accordance with specific instructions furnished with each telephone set. Maintenance must be more precise because proper line polarity and connections are essential to achieve satisfactory operation of the ANI system.
- 3.32 Except in the impractical case of zero influence, every path to ground will cause noise unless the circuit and its equipment terminations are precisely balanced longitudinally. The split primary winding insures a good degree of longitudinal balance within the telephone set. The use of a ringer winding in the ground leg minimizes transmission losses through the ground connection at voice frequencies. Whether a high impedance ground termination on a circuit will cause objectionable noise will depend on the power line influence, overall degree of circuit and termination balance, and the degree of coupling between the power and telephone circuits. The two-party ground mark ANI system involves a ground connection at each party on a two-party line. The tip party ground is through the split primary of the induction coil as explained above and as shown in Figure 2. The ring party ringer is connected from line to ground as shown in Figure 5. It is this unbalanced impedance to ground at the ring party that is primarily responsible for the noise contributed by two-party ANI. While this unbalance path has a high impedance (in the order of 200,000 ohms for one ringer at voice frequencies), it may still be undesirable from noise considerations.
- 3.33 Noise created by ANI ground marks can be reduced to a negligible value by the use of an auxiliary ANI network at each tip party telephone. This arrangement is shown in Figure 6, and involves using bridged 20 and 30 Hz tuned ringers as recommended in TE & CM 212 rather than straight line divided ringers. However, as the ANI auxiliary networks are expensive, and the REA objective is one-party service, these devices are not recommended unless noise problems are known to exist.
- 3.4 Figure 3 compares the mounting cord and connecting block terminations required for bridged ringing, such as used on one-party lines, and the tip and ring parties of a two-party

ANI system. Figure 4 illustrates a typical telephone set connection chart as provided by the manufacturer.

- 3.5 The modern ringer has a 1000 ohm and a 2650 ohm winding. Some suppliers recommend use of the 1000 ohm winding as the ground leg for tip party ANI. REA, however, recommends use of the 2650 ohm winding as indicated by Figure 2 to minimize longitudinal ac currents. The identification circuitry will work satisfactorily over a 4300 ohm loop plus a 2650 ohm ground leg.
- 3.6 The use of booster battery can cause a problem on two-party ANI systems unless positive action is taken to prevent it. When long line adapters (LLA) are used with booster battery, the COE specification requires booster battery to be furnished through the LLA as a positive voltage on the tip side of the line. When this is done, opening of the dial pulse contacts does not completely open the circuit through the pulsing relay at the CO because the pulse contacts open only one side of the line as indicated in Figure 7. The continued flow of current through half of the relay winding with the pulse contacts open may prevent the relay from releasing. In addition, the standard LLA does not provide continuity for the COE to sense the ground mark.
  - 3.61 There are several acceptable methods of preventing this problem as follows:
    - a. Install a LLA which is specifically designed to work with tip party ground mark type of ANI.
    - b. Install a loop extender designed for ANI tip party marking.
- 3.7 Loop limits for two-party ANI over physical pairs are usually the same as for the regular switching equipment. However, when loops requiring range extension devices are involved, the switching equipment manufacturer should be consulted to determine if the range extension equipment will pass the ANI signals.
- 3.8 Two-party ANI can be provided by some specially designed station carrier equipment. The cost of this equipment is high, so ONI is recommended for two-party station carrier installations.

4. CALLING NUMBER IDENTIFICATION FOR ONE-, TWO-, AND MULTI-PARTY EXCHANGES

4.1 Exchanges which provide one-, two-, and multi-party (more than two parties per line) service should provide calling number identification on the one- and two-party lines as described in paragraph 3. ONI should be provided on the multi-party lines.

4.11 Although one or more systems exist to provide ANI on a multi-party basis, they are not recommended for use in REA borrower's systems. ONI is recommended for more than two parties per line until the exchange can be upgraded to one-party, or to one- and two-party operation.

# SCHEMATIC DIAGRAM TELEPHONE INSTRUMENT TWO PARTY ANI (RING PARTY)

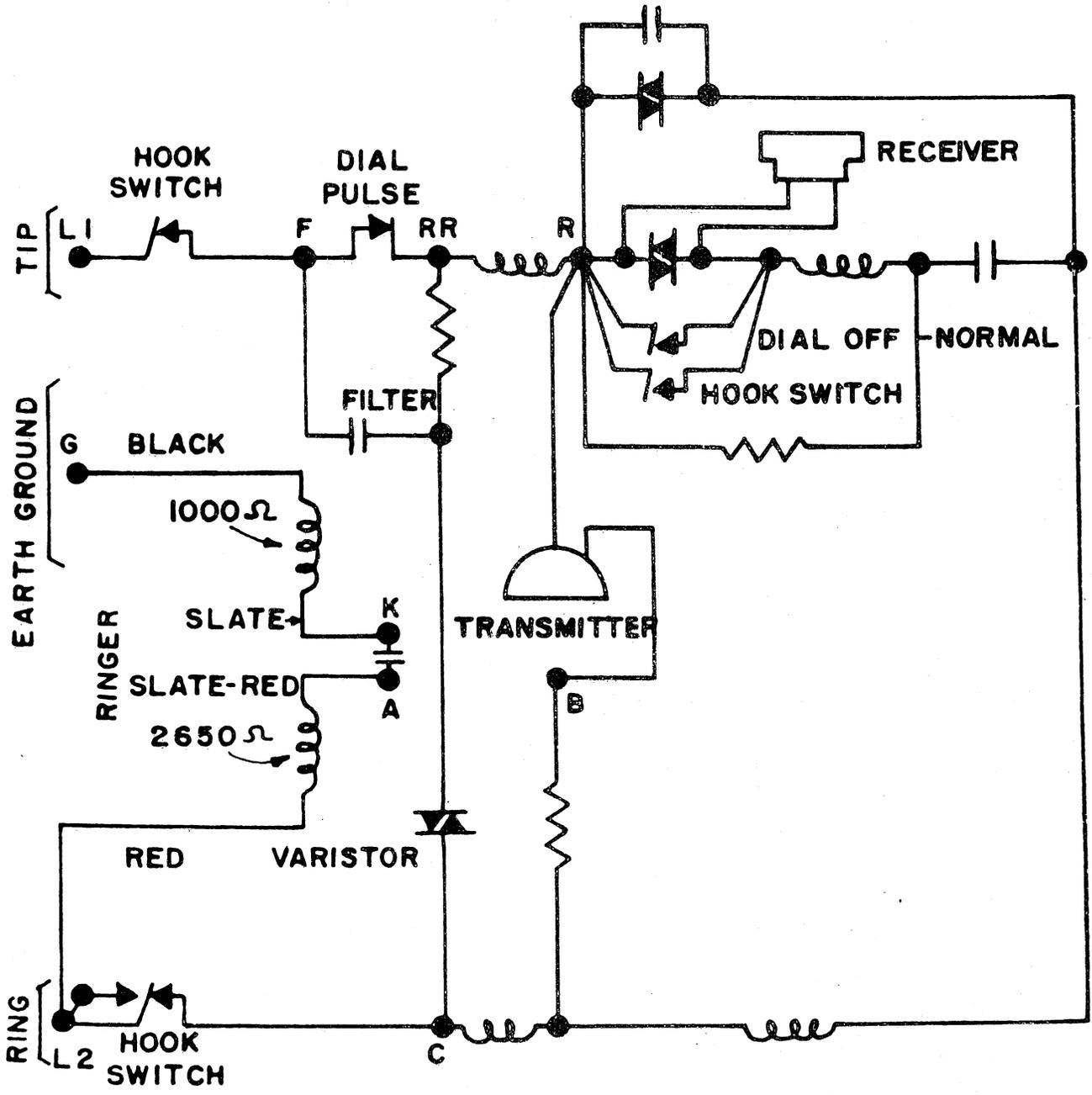


FIGURE 1

**SCHEMATIC DIAGRAM  
TELEPHONE INSTRUMENT  
TWO PARTY ANI (TIP PARTY)  
2650 $\Omega$  IDENTIFICATION  
VIA RINGER WINDING**

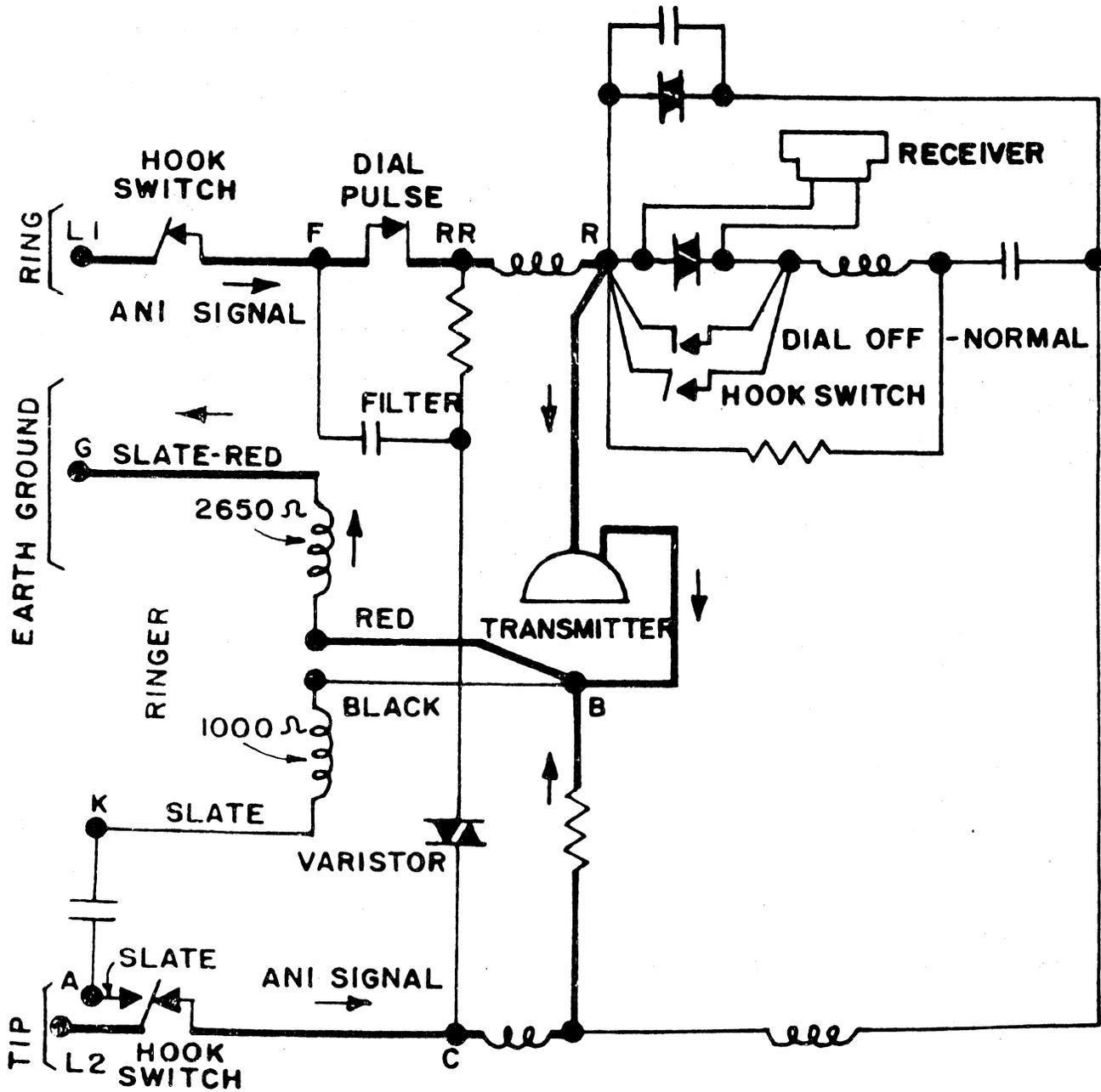
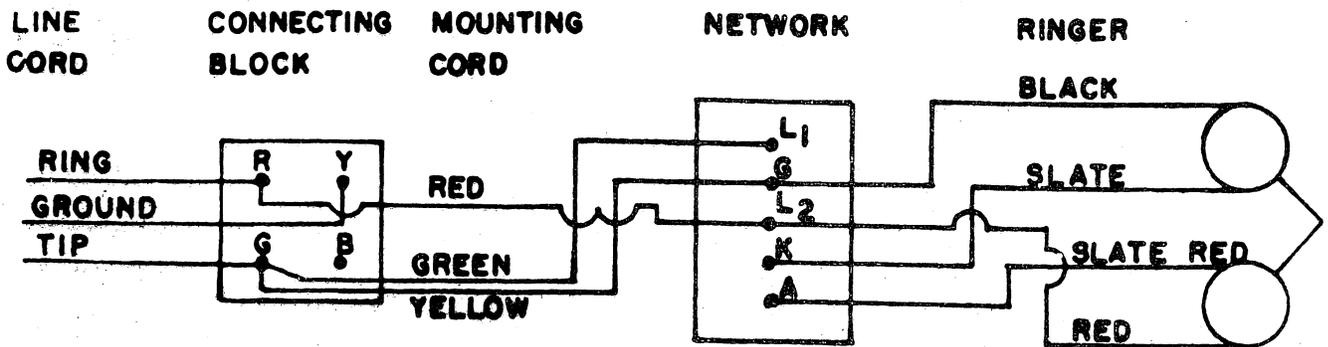
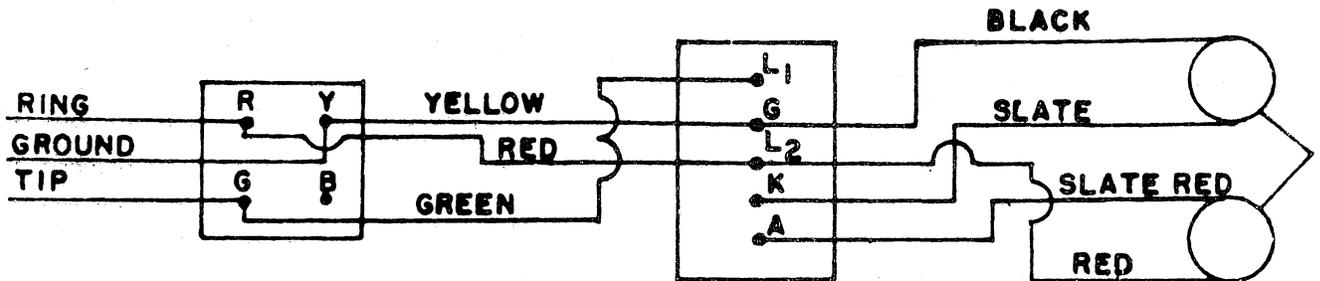


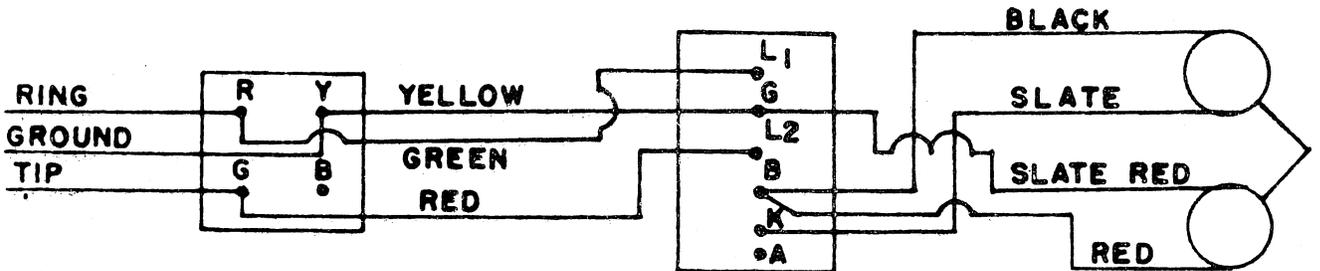
FIGURE 2



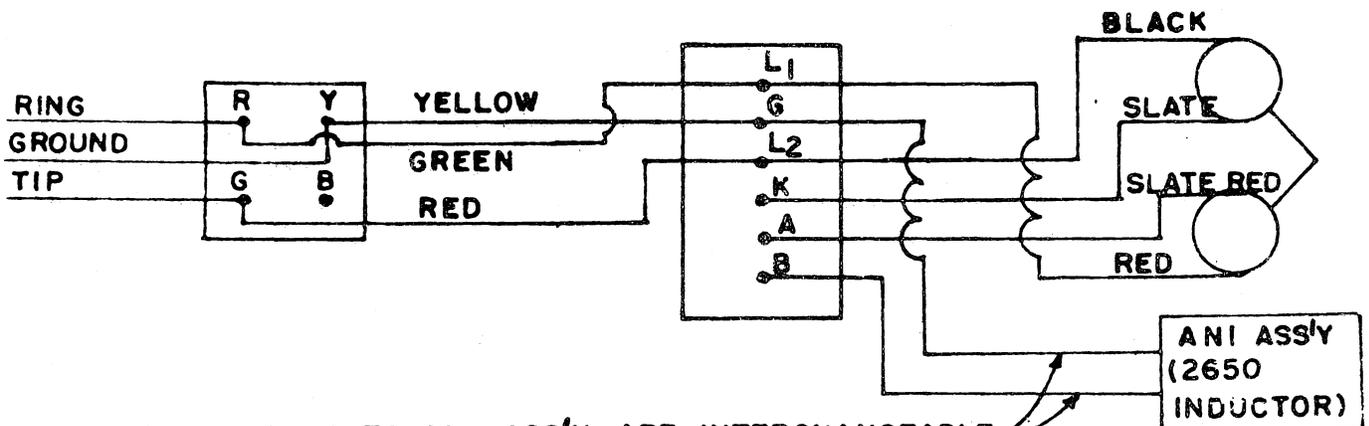
A. BRIDGED RINGING



B. RING PARTY - DIVIDED RINGING



C. TIP PARTY ANI + DIVIDED RINGING



LEADS TO ANI ASS'Y ARE INTERCHANGEABLE

D. TIP PARTY - ANI ASSEMBLY + BRIDGED RINGING

FIG. 3 - ANI CONNECTIONS

Wire or Lead	Color	Bridged	Ring Party	Tip Party No ANI	Tip Party Identification Ground	
					Normal	Ringer Silenced
Ringer Leads	Red Black Slate Slate/Red	L <sub>2</sub> G K A	L <sub>2</sub> G <sup>2</sup> K A	L <sub>2</sub> G <sup>2</sup> K A	B B K G	B K K G <sub>7</sub>
Hookswitch Lead	Slate	L <sub>2</sub>	L <sub>2</sub>	L <sub>2</sub>	A	L <sub>2</sub>
Mounting Cord In Set	Red Green Yellow	L <sub>2</sub> L <sub>1</sub> G <sup>1</sup>				
Mounting Cord At Con. Block	Red Green Yellow	R G G	R G Y	G R Y	G R Y	G R Y
Line Wire At Con. Block	Ring Tip Ground	R G Y	R G Y	R G Y	R G Y	R G Y

NOTE: Letters in Boxes are Terminal Designations

FIG. 4 - Typical Telephone Connection Chart

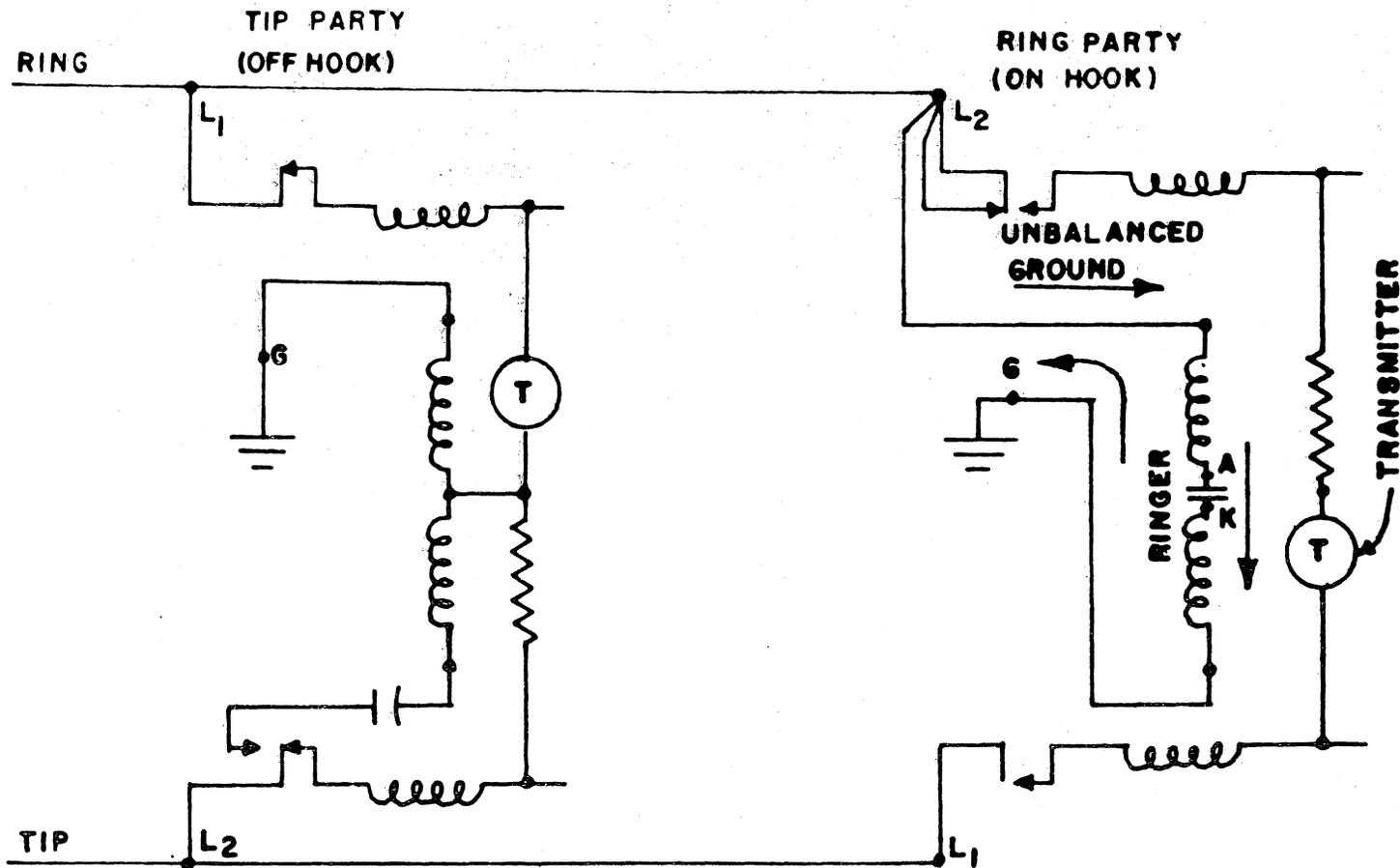


FIG.5 - UNBALANCED CONDITION IN TWO PARTY ANI  
USING RINGER WINDING TO GROUND

# SCHEMATIC DIAGRAM TELEPHONE INSTRUMENT

TWO PARTY ANI (TIP PARTY)

IDENTIFICATION VIA AUXILIARY NETWORK

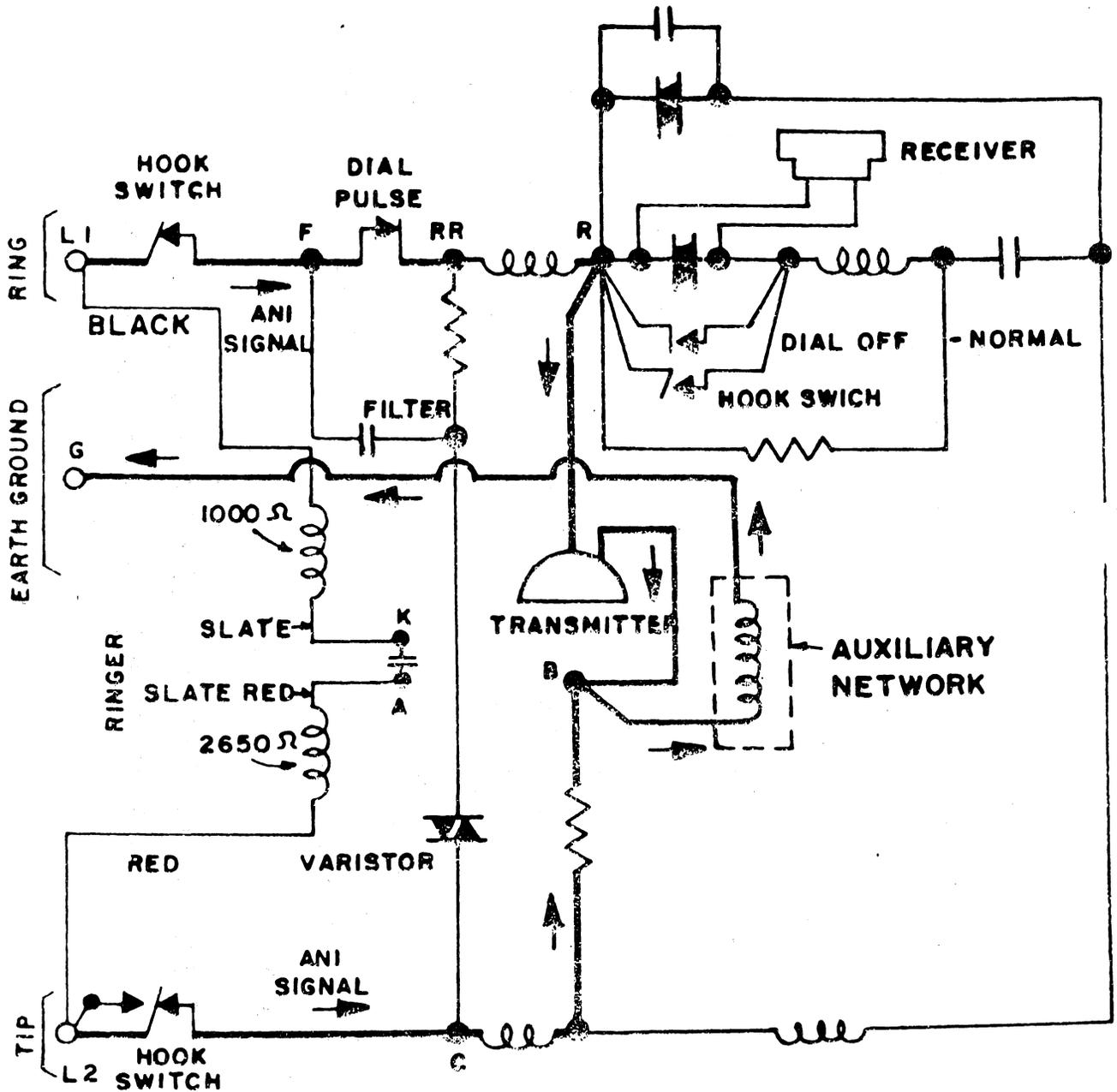
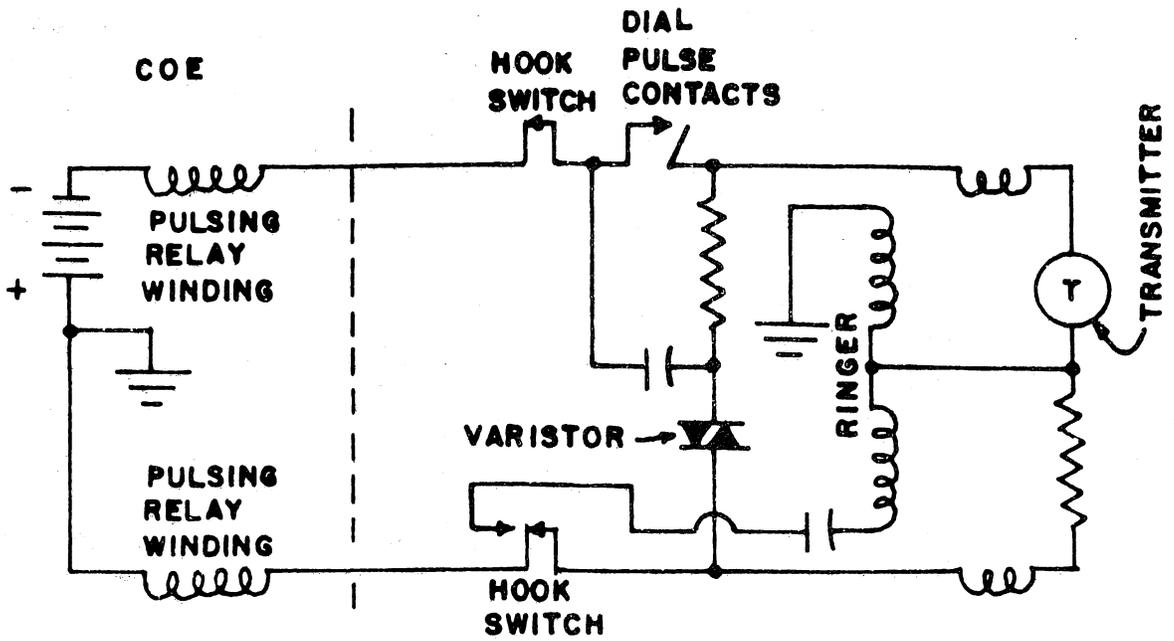
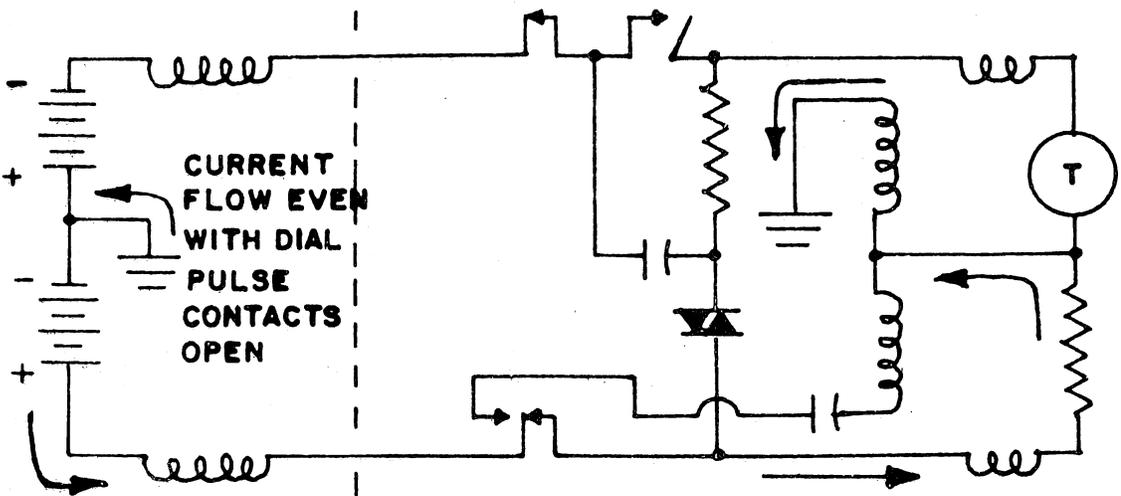


Fig. 6



A. NORMAL 48V OPERATION



B. GROUND RETURN PATH BYPASSING DIAL PULSE CONTACTS WHEN POSITIVE BOOSTER BATTERY IS EMPLOYED IN THE TIP SIDE OF THE LINE.

FIG. 7 TWO PARTY ANI (TIP PARTY) POSITIVE BOOSTER BATTERY