P1 CARRIER TELEPHONE SYSTEM

IDENTIFICATION, GENERAL DESCRIPTION, AND USE

1.00 INTRODUCTION

1.01 This section covers the identification, general description, and use of the P1 carrier telephone system for rural subscriber lines. It is reissued to incorporate changes in equipment and application.

1.02 Due to extensive changes marginal arrows have been omitted.

2.00 GENERAL

2.01 The *derived* voice frequency circuits covered in this section are the subscriber circuits obtained by means of the P1 carrier system.

2.02 The subscriber *physical* voice frequency circuits described in this section are obtained by filter distribution from the carrier pair.

3.00 SYSTEM FEATURES

3.01 The P1 carrier system provides rural customer telephone service at a reduced cost in outside plant construction. It is a fully transistorized 4-channel carrier system utilizing plug-in printed wiring boards, designed to provide flexibility of application and ease of installation and maintenance.

3.02 The design of the P1 carrier system allows its use on nonloaded cable, B-rural wire, B-underground wire, or open-wire lines served by dial or manual common battery offices.

3.03 From one to four 2-way channels can be added to an existing 2-wire circuit by the addition of filter networks to the line, for separating voice frequency and carrier frequency circuits.

3.04 Each channel can serve 8 customers, making it possible to increase the capacity of a single rural line to 40 customers, 32 by carrier (8 per channel on 4 channels) and 8 by physical 2-wire circuit.

3.05 A P1 carrier system working over a 2-wire circuit can handle five simultaneous conversations, one for each channel and one for the physical 2-wire circuit.

3.06 Ringing arrangements are provided for one-, 2-, or 4-party selective, 8-party semi-selective, or divided code ringing.

3.07 Each channel consists of two terminals. One is rack-mounted in the central office, and the other is located along the cable or wire line in a pole-mounted case (see Fig. 1). Other pole-mounted equipment includes repeaters, power plants, junction line filters, line terminations, and several types of low- and high-pass filter networks to separate voice and carrier frequency circuits.

4.00 SYSTEM APPLICATION

4.01 Fig. 2 illustrates a typical application of a 4-channel system. Voice frequency is transmitted to the customer from the central office by combining the voice frequency with the carrier frequency in the central office terminal and then sending the combined signals out over the line to their respective remote terminals. At the remote terminals the carrier and voice frequencies are separated. The voice frequency is then transmitted to the customer. Speech in the reverse direction is handled in the same manner. Repeaters are provided as required, up to a maximum of four per system on a single pair of wires.

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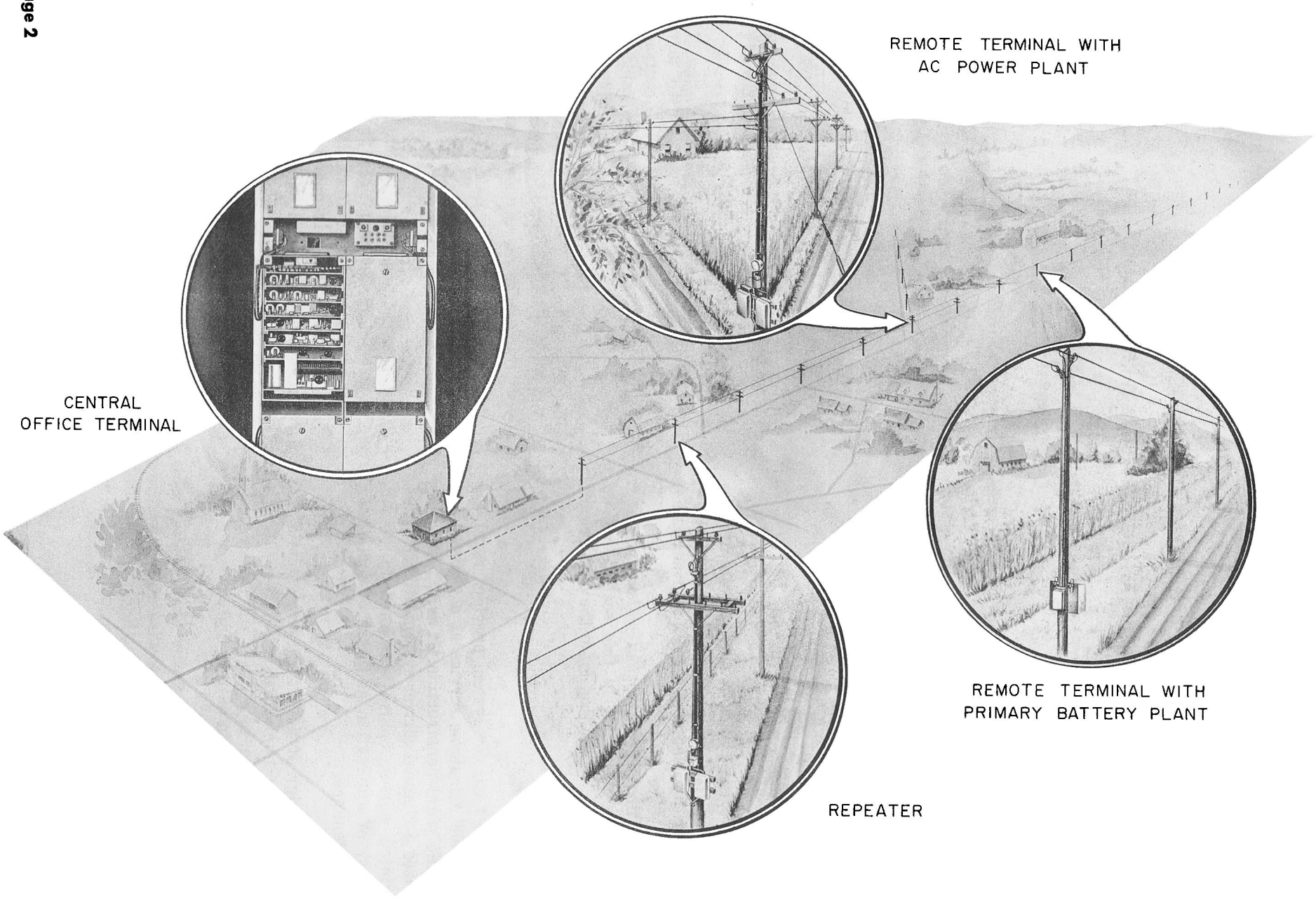

Fig. 1 — P1 Carrier Telephone System

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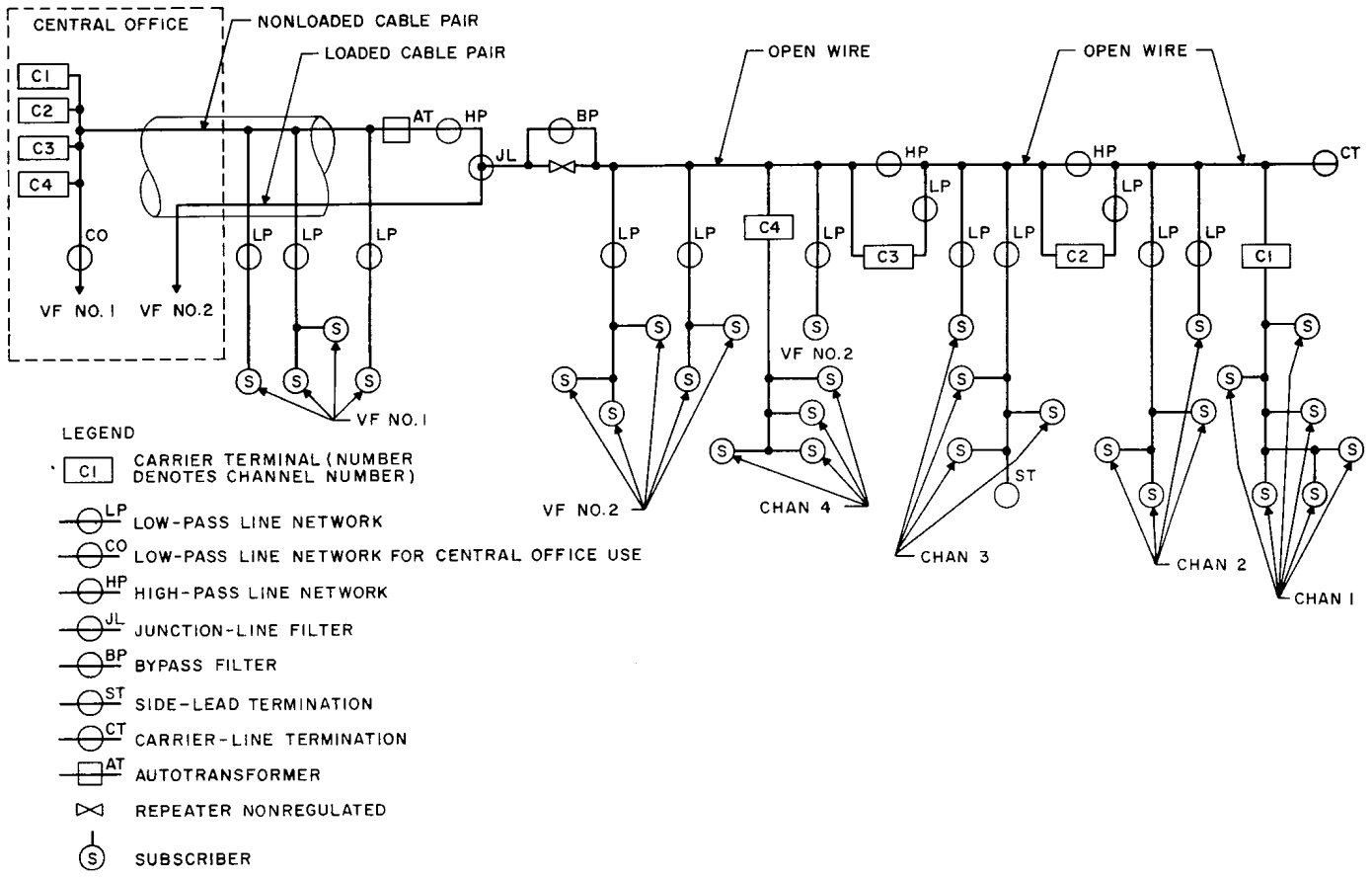

Fig. 2 — Example of Normal Grouped P1 Carrier System Application

4.02 In the illustration (Fig. 2), the customers nearest the central office are served over the physical voice frequency circuit. A low-pass filter placed between the physical voice frequency circuit and the customer drop or branch line prevents carrier frequencies from reaching the customer and causing interference. The filter also reduces the carrier-frequency bridging loss of the customer lead. When a repeater is used, a bypass filter arrangement is required to pass the voice frequency around the repeater while the repeater amplifies the carrier frequencies. All the remote terminals are bridged to the physical line. Channel 1 serves the most remote customers, as it employs the lowest carrier frequency and has the least line attenuation. Intermediate channels 2, 3, and 4 are bridged on the line, with channel 4, which employs the highest frequency, nearest the central office. A carrier line termination is required at the last terminal to properly terminate the line at carrier frequencies. Proper termination eliminates reflections which cause excessive line loss.

4.03 Two ways of distributing the voice frequency are:

1. ***Wire distribution*** as indicated for channels 1 and 4, in which the voice frequency circuit is distributed by conventional means.
2. ***Filter distribution*** as indicated for channels 2 and 3 and the physical voice frequency circuit. With this method, both the carrier frequency and the derived voice frequency circuits (or physical voice frequency circuits) make common use of the wire facilities and are separated from each other by means of low- and high-pass filters. The high-pass filters pass the carrier frequencies but do not pass the voice frequencies. The low-pass filters pass the voice frequencies but do not pass the carrier frequencies. In filter distribution, a side-lead termination is required whenever the side lead exceeds a specified length or capacity (as shown for channel 3).

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CHART A

FREQUENCY ALLOCATION

Frequency	Transmitted from Remote Terminal		
kc	(A)	(B)	(C)
12	1	1	
18			1
24		2	
30			2
36		3	
42			3
48		4	
54			
60	2A		
66			
72			
78			
84			
90			
96	4		

(A) Stackable frequency arrangement (nonrepeatered circuits).

(B) Grouped frequency arrangement (required for repeatered circuits). Grouped normal arrangement.

(C) Grouped staggered arrangement.

Note: Numeral indicates channel number.

Frequency	Transmitted from Central Office		
kc	(A)	(B)	(C)
12			
18			
24	1		
30			
36			
42			
48	2A		
54			
60		1	
66			1
72		2	
78			2
84	4	3	
90			3
96		4	

4.04 At the central office end, the circuit will usually be in cable. If the cable is nonloaded, the same pair may be used for the voice and carrier channels. If the cable is long enough to require loading on the voice frequency circuit, a separate nonloaded pair will be required for the carrier. An autotransformer matches the cable and open-wire impedances. A junction line filter connects the carrier circuit and voice frequency circuit to the open wire. If customers are served by filter distribution on the nonloaded cable pair and open wire, an additional high-pass network is required between the autotransformer and the junction line filter. This application is shown in Fig. 2.

5.00 FREQUENCY ARRANGEMENT

5.01 Double sideband amplitude modulation is used. Each channel employs two transmitted carriers, one for each direction of transmission. The carrier frequencies range from 12 to 96 kc and are spaced at 12-kc intervals.

5.02 Three frequency arrangements are provided: one stackable arrangement for nonrepeatered systems, and two grouped arrangements, normal and staggered, for repeatered systems (see Chart A).

- ***Stackable channels*** employ adjacent, oppositely directed carriers, each channel consisting of a pair of carriers successively higher in frequency than the preceding channel.
- ***Grouped channels,*** employed on repeatered systems, use frequency allocations in which the carriers are divided into two groups of high and low to form the two directions of transmission.

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1. The *normal* grouped arrangement provides a 4-channel system. The lower carriers, 12, 24, 36, and 48 kc, are grouped together in one direction of transmission. The upper carriers, 60, 72, 84, and 96 kc, are grouped together in the opposite direction of transmission.

2. The *staggered* group arrangement, employed to improve crosstalk performance, is used with the normal grouped arrangement on separate pairs of the same lead having excessive mutual crosstalk. This arrangement provides a 3-channel system with the lower carriers, 18, 30, and 42 kc, grouped together in one direction of transmission, and the higher carriers, 66, 78, and 90 kc, grouped together in the opposite direction of transmission.

6.00 EQUIPMENT FEATURES

WIRING BOARDS

6.01 All apparatus components for a terminal or repeater are mounted on wiring boards. Terminal connectors mounted on the rear of the wiring boards are designed to correspond with the grid wires of the housing assembly (803-type connector). The terminal connectors make contact with the grid wires when the wiring board is fully inserted. Test points are brought to the front of the board for convenience in connecting test equipment. Each board (coded network) is assigned a position in the connector. Fig. 3 and 4 show a typical wiring board.

CONNECTORS

6.02 The printed wiring boards are inserted into grooves of the connector (Fig. 5), which is a phenolic box containing a grid of wires for interconnecting the wiring boards. The 803A connector is for the central office or remote terminal, and the 803B connector is for the repeater. These connectors are identical in appearance except that the wire grids are cut in a different manner. In each case there are 36 wires in a grid. These count from left to right as viewed from the front.

6.03 Plug-in type construction allows quick and easy replacement. All networks can be replaced in the connector, or the entire connector can be replaced. Fig. 6 shows an 803A connector without the line connector board. Fig. 7 shows an 803A connector with the protective cover in place. Terminals are shipped from the factory and transported in the field with the protective cover in place. Fig. 8 shows an 803B connector without line connector board.

6.04 The network codes for each coded network and their locations in the 803A connector (central office or remote terminal) are shown in Chart B.

6.05 The network codes for each coded network and their locations in the 803B connector (repeater) are shown in Chart C.

6.06 ***In central office locations,*** two 803A connectors can be mounted side by side or back to back on standard 19- or 23-inch relay racks by means of special mounting details (see Fig. 9). A maximum of 20 terminals can be mounted on an 11-foot 6-inch rack. If rack space is limited, terminals can be wall-mounted (or pole-mounted outside the central office, subject to temperature and other limitations) as maintenance operations can be performed from the front of the terminal.

6.07 ***At the remote terminal,*** the 803A connector is pole-mounted in a hermetically sealed 386A apparatus case (see Fig. 10). A specially designed one-piece sealing gasket fitted between cover and case provides the hermetic seal for the 803A connector when the apparatus case is closed. The apparatus case is given a white finish to reflect heat from the sun. A small bag of desiccant in the apparatus case absorbs small amounts of moisture that may be trapped inside when the cover is sealed.

SIGNALING

6.08 Supervisory and dialing signals from the customer to the central office are transmitted by the interruption of the carrier frequency from the remote terminal. An off-hook condition is indicated by transmitted carrier. At the central office, received carrier-frequency power is converted to relay operation to operate the central office equipment.

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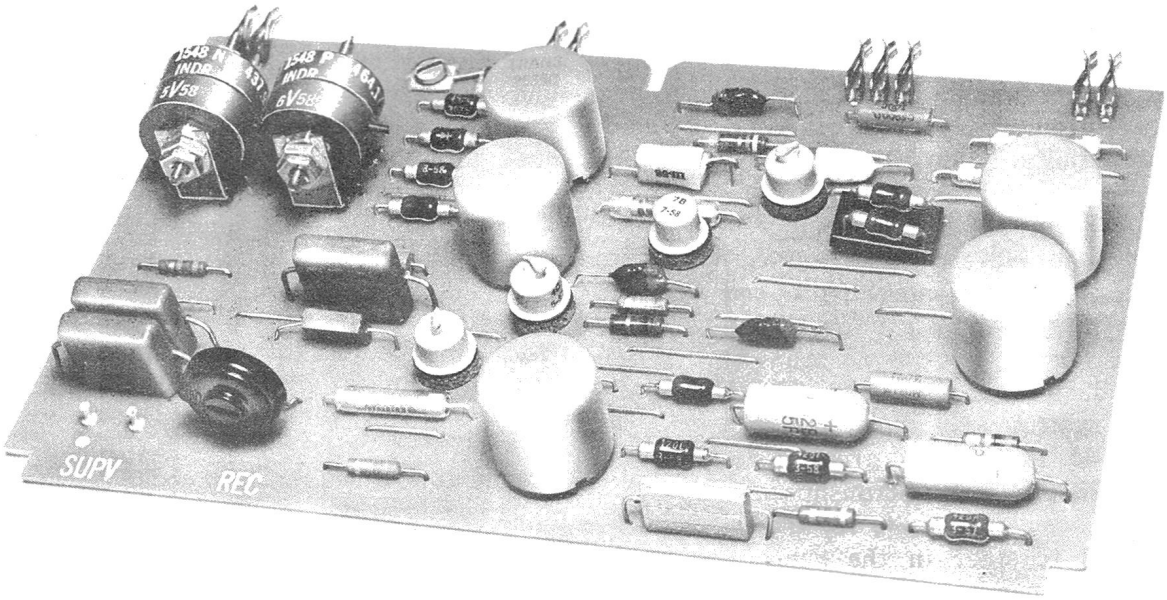

Fig. 3 — Typical Wiring Board, Apparatus Side

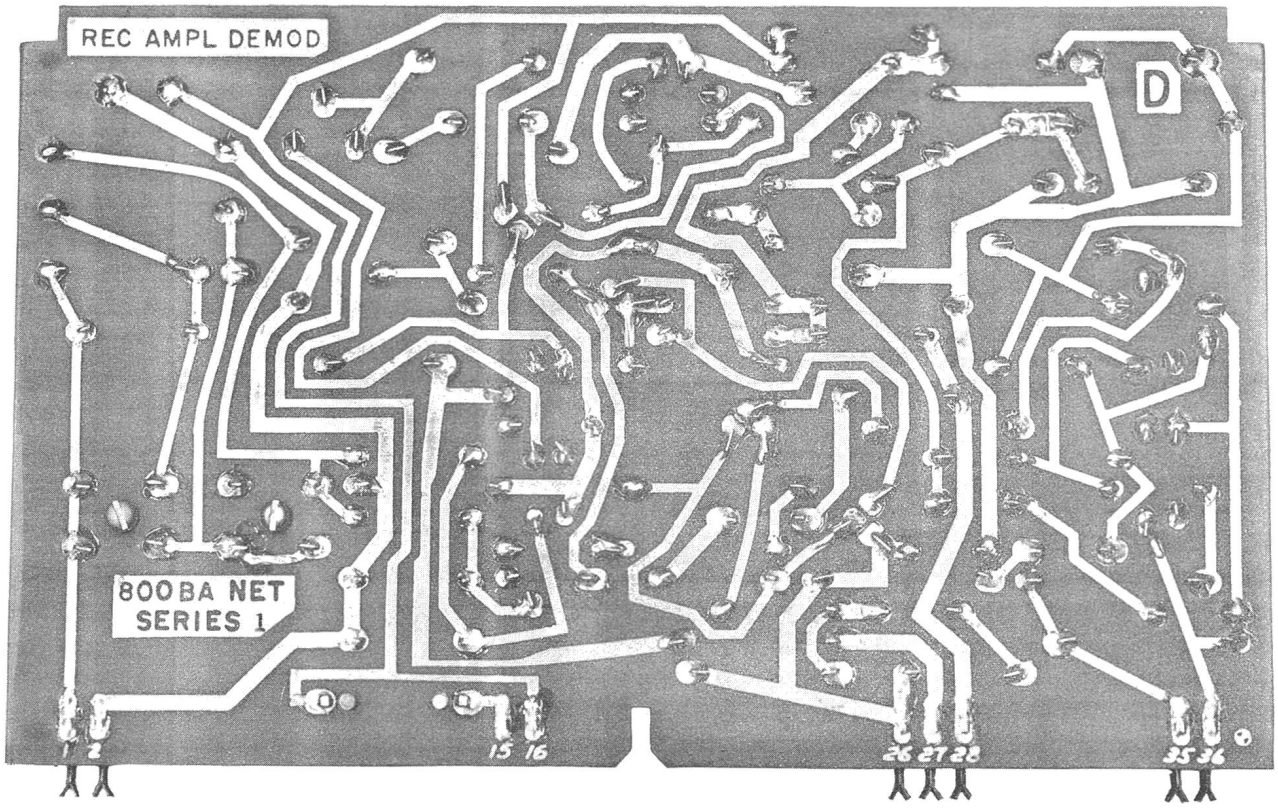

Fig. 4 — Typical Wiring Board, Wiring Side

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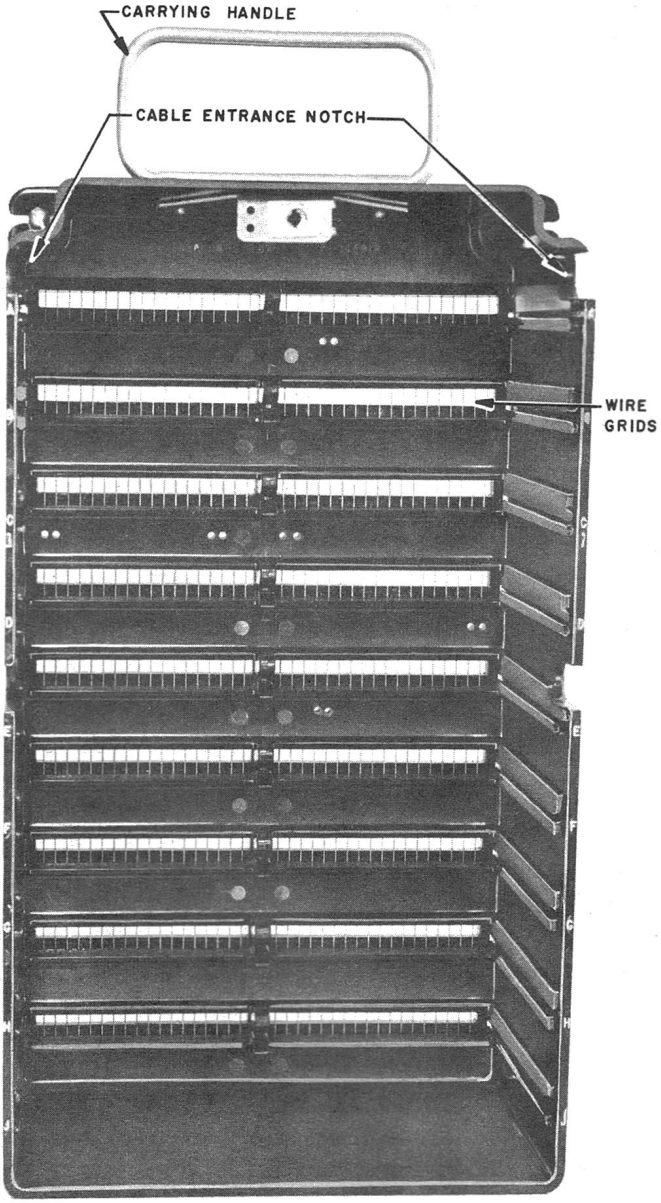

Fig. 5 — 803A Connector

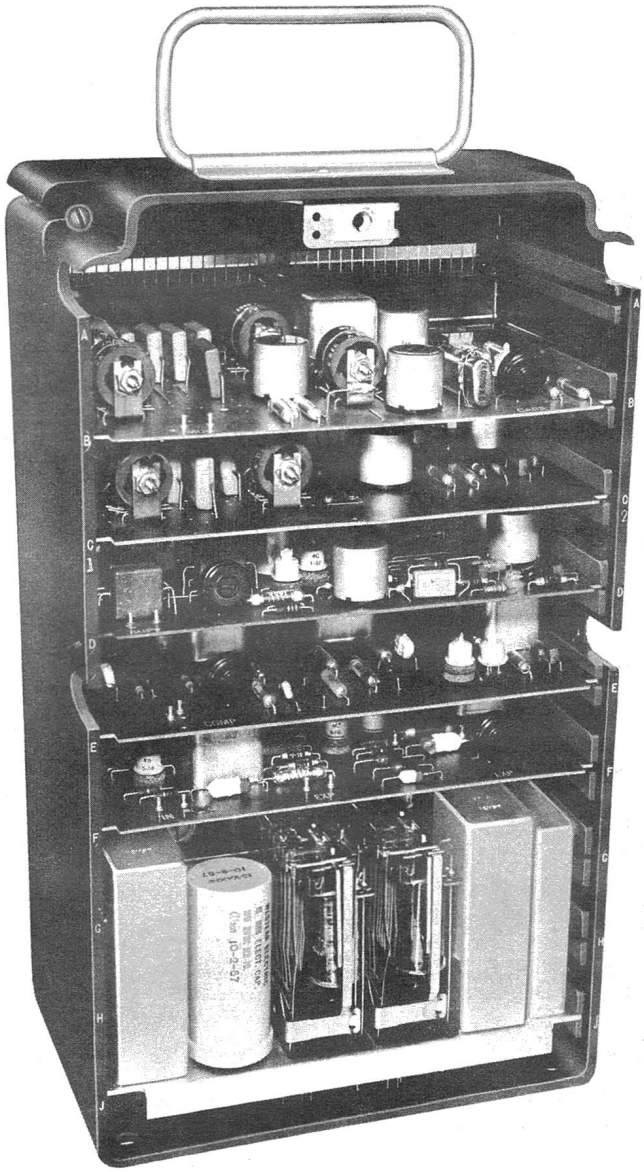

Fig. 6 — 803A Connector, Fully Equipped, Without Line Connector

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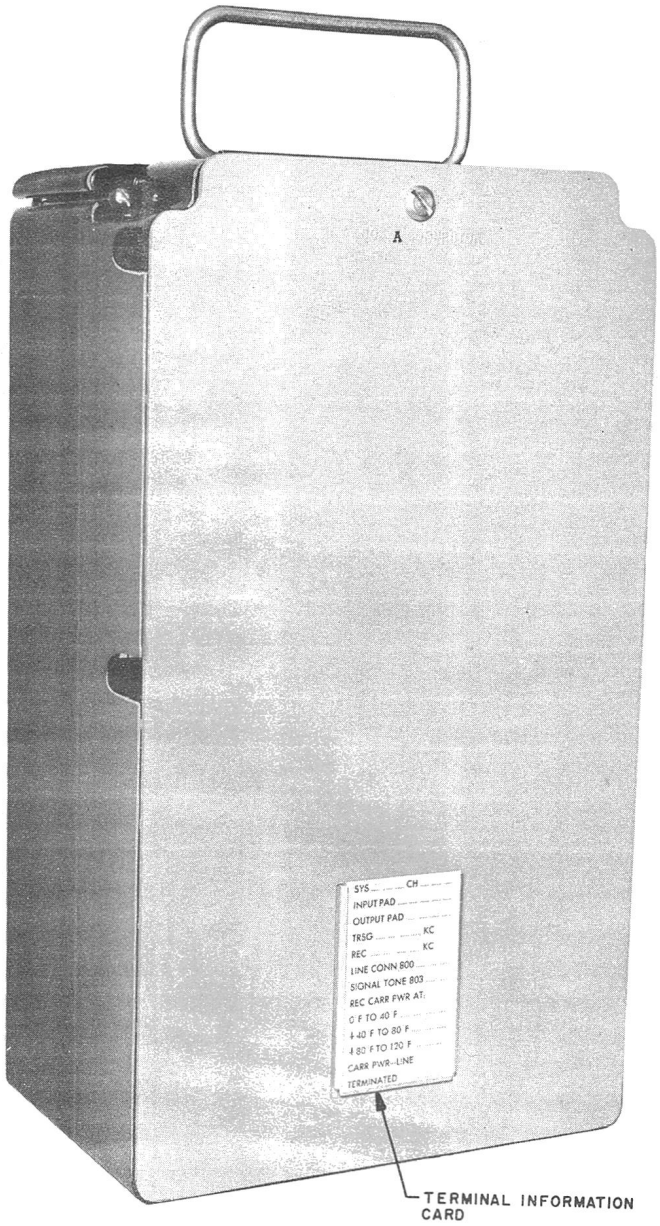

Fig. 7 — 803A Connector With Protective Cover

Fig. 8 — 803B Connector, Fully Equipped, Without Line Connector

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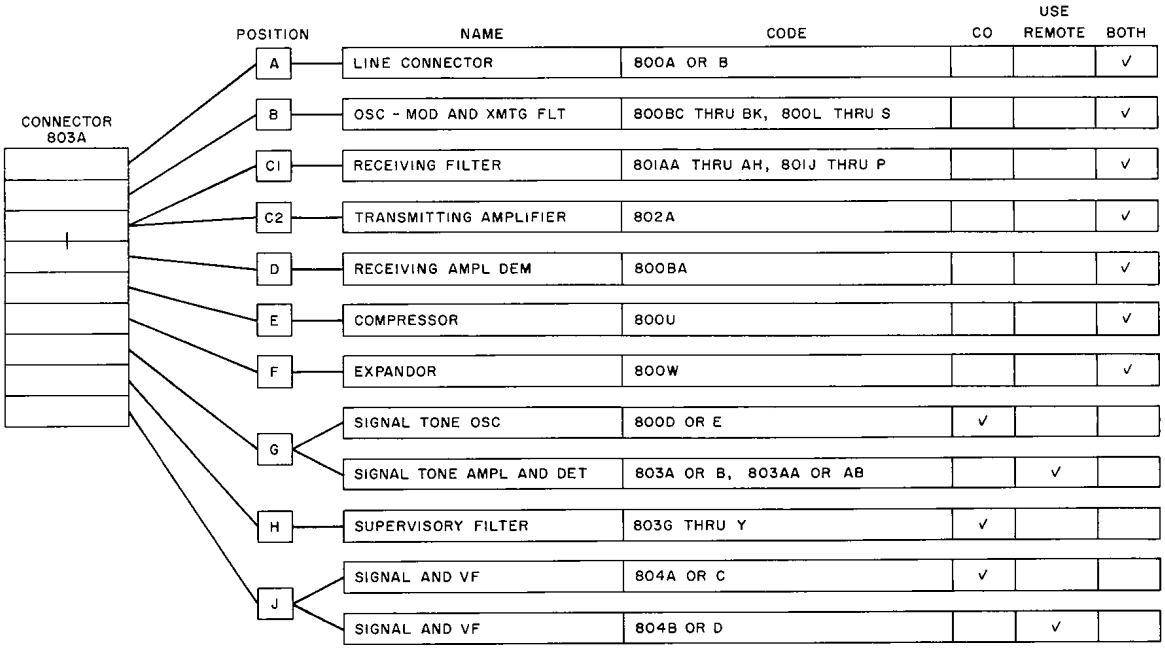
CHART B

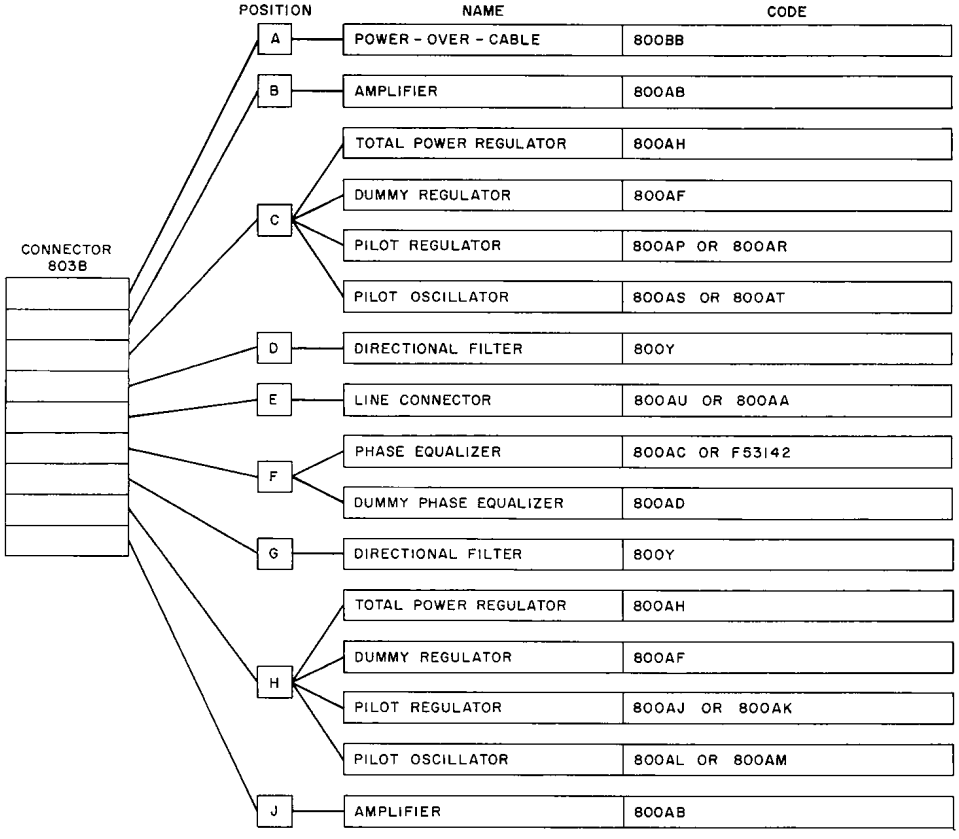
803A CONNECTOR — NETWORK NAMES, CODES, AND LOCATIONS (CENTRAL OFFICE OR REMOTE)



POSITION	NAME	CODE	USE CO	USE REMOTE	USE BOTH
A	LINE CONNECTOR	800A OR B			✓
B	OSC - MOD AND XMTG FLT	800BC THRU BK, 800L THRU S			✓
C1	RECEIVING FILTER	801AA THRU AH, 801J THRU P			✓
C2	TRANSMITTING AMPLIFIER	802A			✓
D	RECEIVING AMPL DEM	800BA			✓
E	COMPRESSOR	800U			✓
F	EXPANDOR	800W			✓
G	SIGNAL TONE OSC	800D OR E	✓		
	SIGNAL TONE AMPL AND DET	803A OR B, 803AA OR AB		✓	
H	SUPERVISORY FILTER	803G THRU Y	✓		
J	SIGNAL AND VF	804A OR C	✓		
	SIGNAL AND VF	804B OR D		✓	

CHART C

803B CONNECTOR — REPEATER NETWORK NAMES, CODES, AND LOCATIONS



POSITION	NAME	CODE
A	POWER - OVER - CABLE	800BB
B	AMPLIFIER	800AB
C	TOTAL POWER REGULATOR	800AH
	DUMMY REGULATOR	800AF
	PILOT REGULATOR	800AP OR 800AR
	PILOT OSCILLATOR	800AS OR 800AT
D	DIRECTIONAL FILTER	800Y
E	LINE CONNECTOR	800AU OR 800AA
F	PHASE EQUALIZER	800AC OR F53142
	DUMMY PHASE EQUALIZER	800AD
G	DIRECTIONAL FILTER	800Y
H	TOTAL POWER REGULATOR	800AH
	DUMMY REGULATOR	800AF
	PILOT REGULATOR	800AJ OR 800AK
	PILOT OSCILLATOR	800AL OR 800AM
J	AMPLIFIER	800AB

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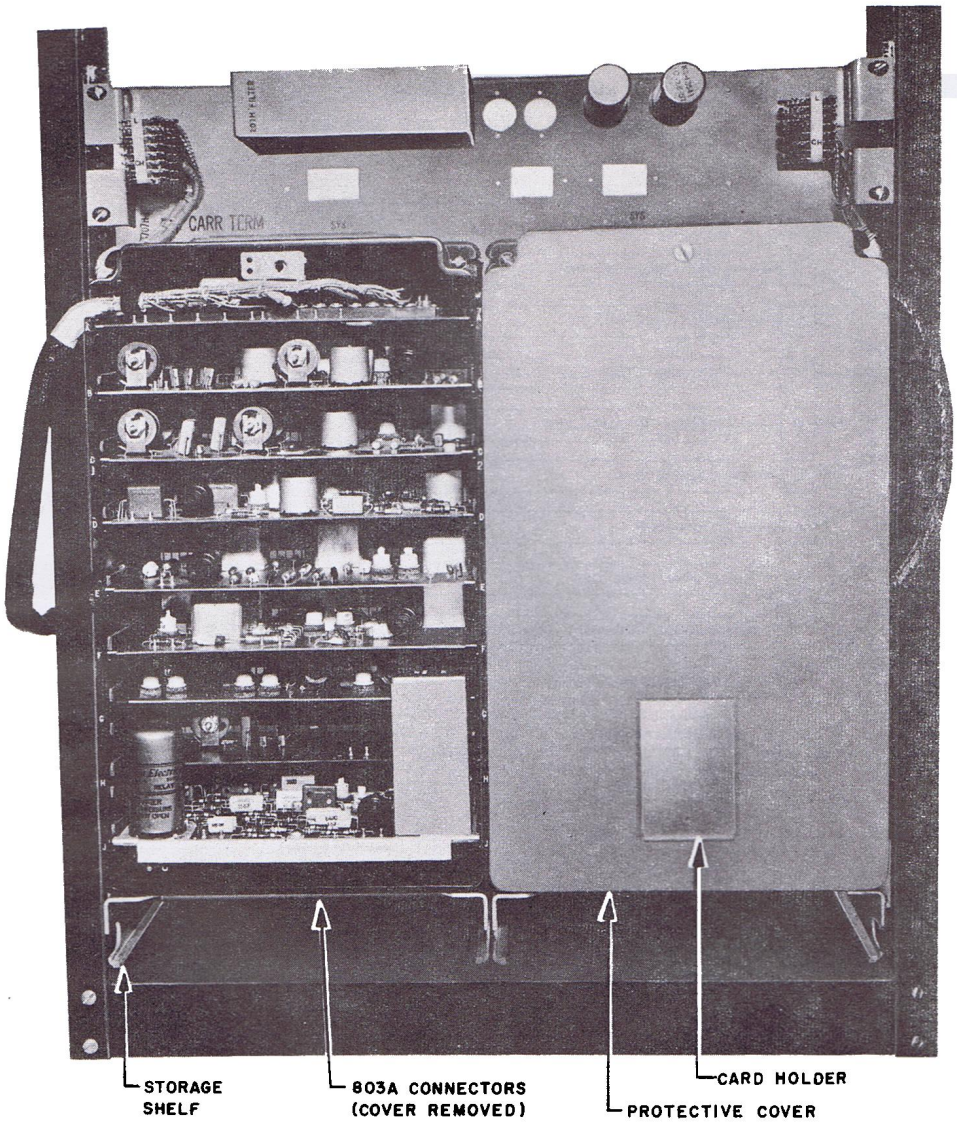

Fig. 9 — Central Office Terminal

6.09 Ringing from central office to the remote terminal utilizes in-band signal tones of 2500, 1750, and 1150 cps. The signal tones are amplified and rectified at the remote terminal and operate relays in the signaling equipment to ring the called customer (see Chart D).

REPEATERS

6.10 Repeaters are similar in appearance to terminals and may be pole-mounted or installed in the central office on relay racks. Printed wiring boards mounted in the 803B connector make up a repeater. When pole-mounted, the repeater is installed in a 386A apparatus case. Certain leads are brought out to a terminal block mounted on top of the 386A apparatus case for external connections and easy-access tests points. When the repeater is office-mounted, a mounting panel similar to the terminal mounting panel is used. One repeater will amplify from one to four channels (one system) on a grouped basis in both directions of transmission.

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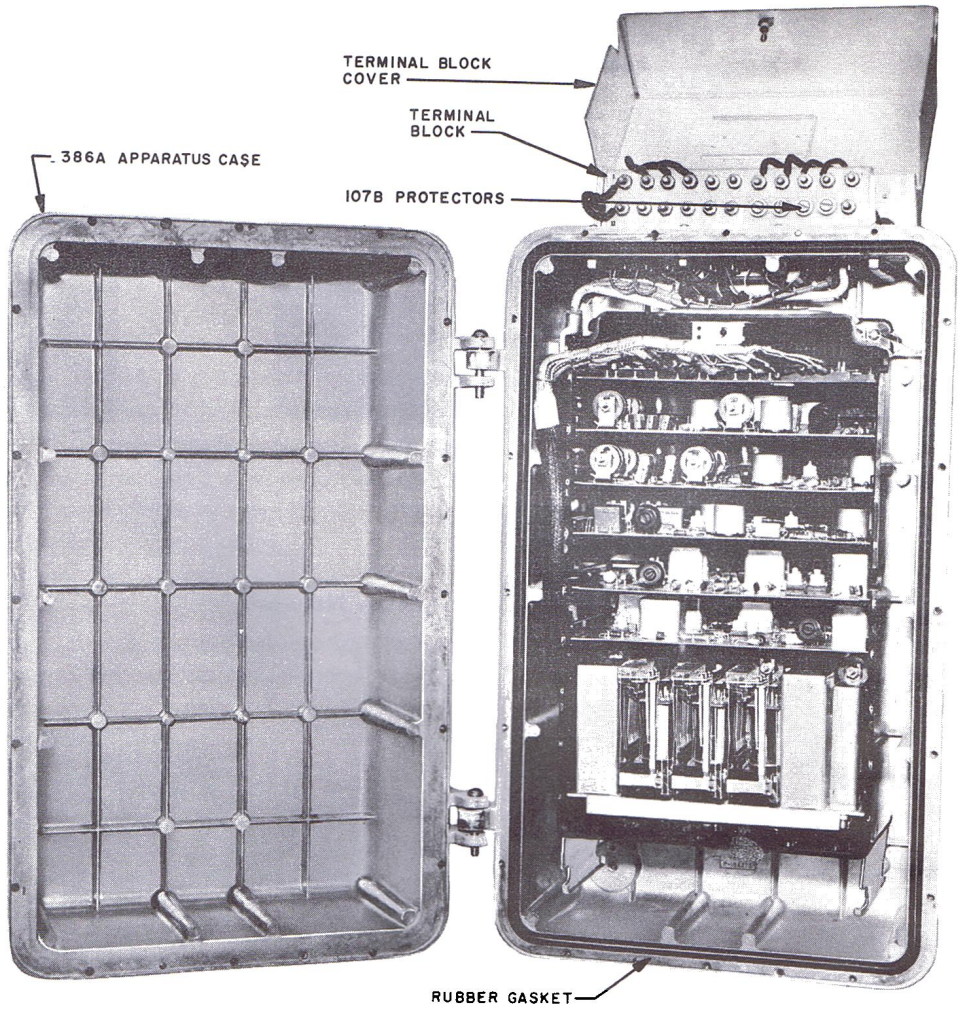

Fig. 10 — Remote Terminal

CHART D

SIGNAL TONE COMBINATIONS CORRESPONDING TO RINGING SIGNALS

Network	Station	Party Position	Tone Signal cps
804A and B	Ring Party —	1 and 5	2500 and 1150
	Tip Party —	2 and 6	2500, 1750, and 1150
	Ring Party +	3 and 7	2500
	Tip Party +	4 and 8	2500 and 1750
804C and D	Ring Party —	1 and 5	2500 and 1150
	Tip Party —	2 and 6	2500 and 1750
	Ring Party +	3 and 7	2500
	Tip Party +	4 and 8	2500, 1750, and 1150

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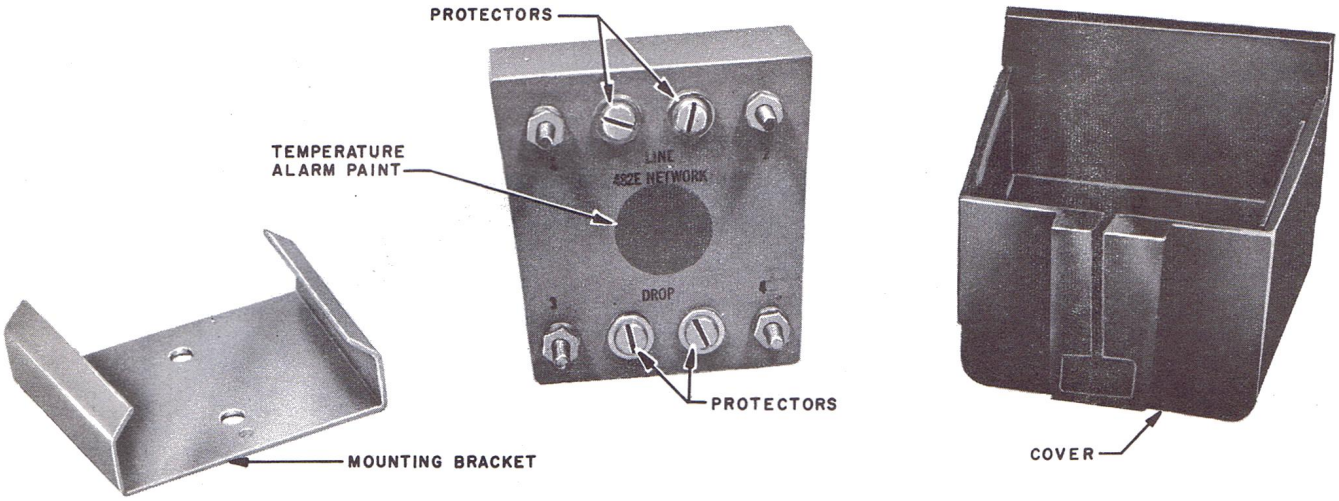

Fig. 11 — 482-Type Filter Network

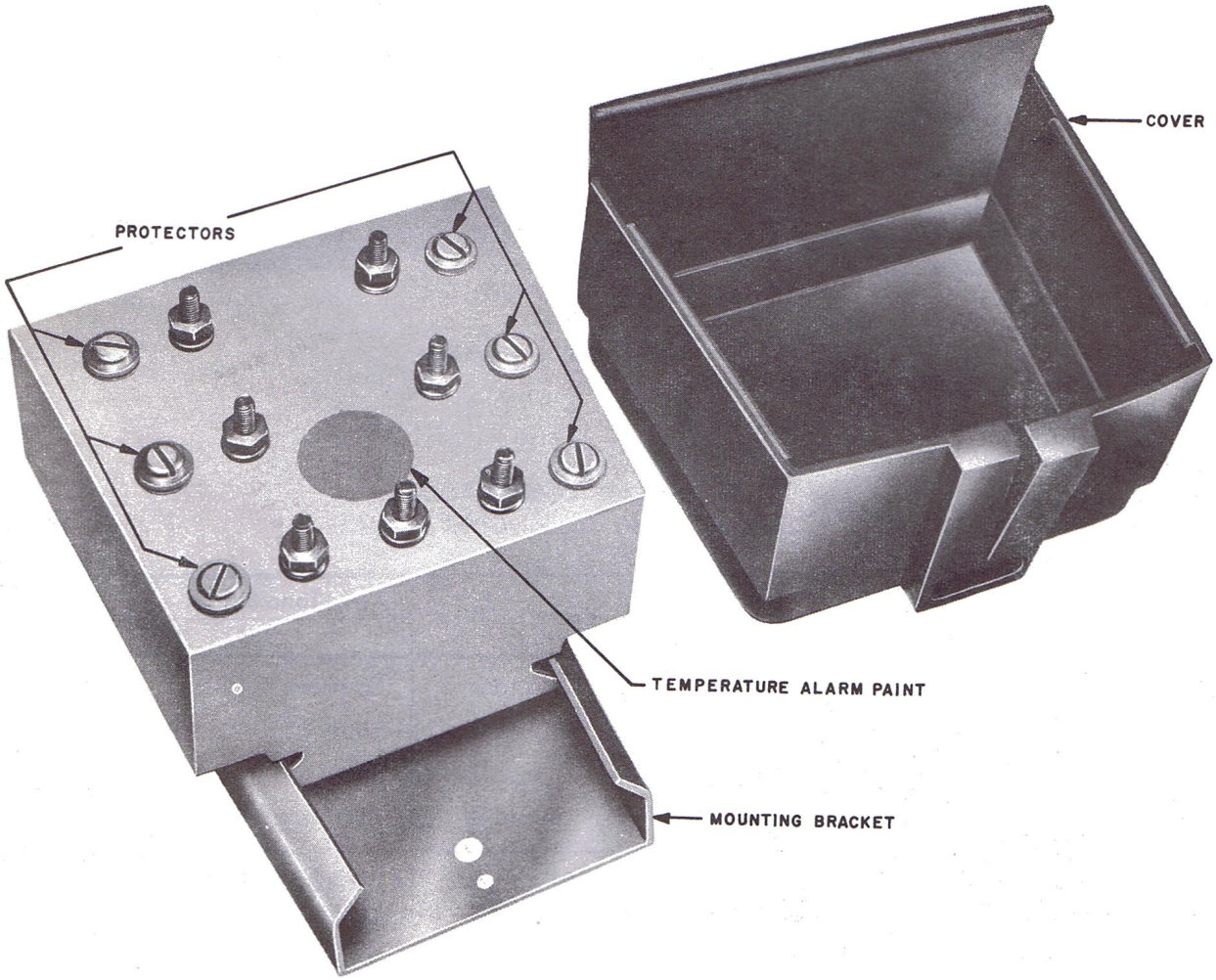

Fig. 12 — 562-Type Filter Network

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POWER EQUIPMENT

6.11 Power requirements of the system are low because of the use of transistors in terminals and repeaters. A nominal battery supply of 22.5 volts, with an emergency low limit of 17.5 volts, is required at remote carrier terminals or repeaters.

6.12 In the central office, 24 or 48 volts is supplied to the carrier bay, and voltage-dropping resistors drop the voltage to 22.5 volts required for the P1 carrier system.

6.13 ***At remote or repeater terminals,*** two types of pole-mounted power supplies are available:

1. An ac-operated power plant where commercial power is economically available.
2. A primary battery plant where commercial power is not available.

In the case of repeaters, the first repeater may be powered by supplying power from the central office over the cable pair as a replacement for the two previously mentioned methods. This method may be used only when there are no physical voice circuits on the pair.

6.14 Pole-mounted power plants for the P1 carrier system are covered in C Section entitled Station Systems, P1 Carrier, Power Plant, J86463A and the related C Section for J86463B.

TERMINATION AND FILTER NETWORKS

6.15 Various termination and filter networks are provided in accordance with the engineering for each specific carrier system installed. The terminating networks properly terminate the line at carrier or voice frequencies. High- and low-pass filters separate the voice and carrier frequency circuits. These networks contain carbon protectors to protect them from power or lightning surges. A change of color in a small round patch of heat-sensitive (Temp-Alarm) paint indicates the network coils have been damaged by high-voltage contact.

6.16 The 482-type filter networks are designed for pole-mounting and are shipped complete with a mounting bracket and rubber cover (see Fig. 11).

6.17 ***The 482A, B, and C networks*** are low-pass filters. They permit the voice frequencies to pass but block the carrier frequencies. These networks are used in filter distribution of voice frequency circuits.

6.18 ***The 482D network*** is a side-lead termination used in conjunction with the 482B network in filter distribution of voice frequency circuits. This network ensures proper voice-frequency transmission and is required when the side lead exceeds a specified length or capacity.

6.19 ***The 482E network*** is a high-pass filter which permits the carrier frequencies to pass but blocks the voice frequencies. This network is used in filter distribution of voice frequency circuits.

6.20 ***The 482F network*** is a carrier-line termination used to terminate the carrier line at the last remote terminal bridging point. This network eliminates reflections that cause excessive carrier loss.

6.21 ***The 482G network*** is an autotransformer required at the junction of cable and open-wire facilities. It matches the impedance of the two facilities and prevents excessive carrier-frequency loss.

6.22 ***The 482H network*** is a phase equalizer. It equalizes the phase distortion caused by two 562A filters. A 482H network must be used with every repeater bypass arrangement (two 562A filters). Also, one may be required when one 562A filter is used as a junction line filter.

6.23 ***The 562A network*** is a junction line filter. It is required at the junction of cable and open wire when the cable facilities require loading on the voice frequency circuit. A separate nonloaded cable pair is required for the carrier circuit. Two 562A filters are used as bypass filters for voice frequency at repeater locations. (See Fig. 12.)

6.24 ***The 201H filter*** is a panel-mounted, low-pass filter required in the central office when a physical voice frequency circuit is distributed on the carrier line.

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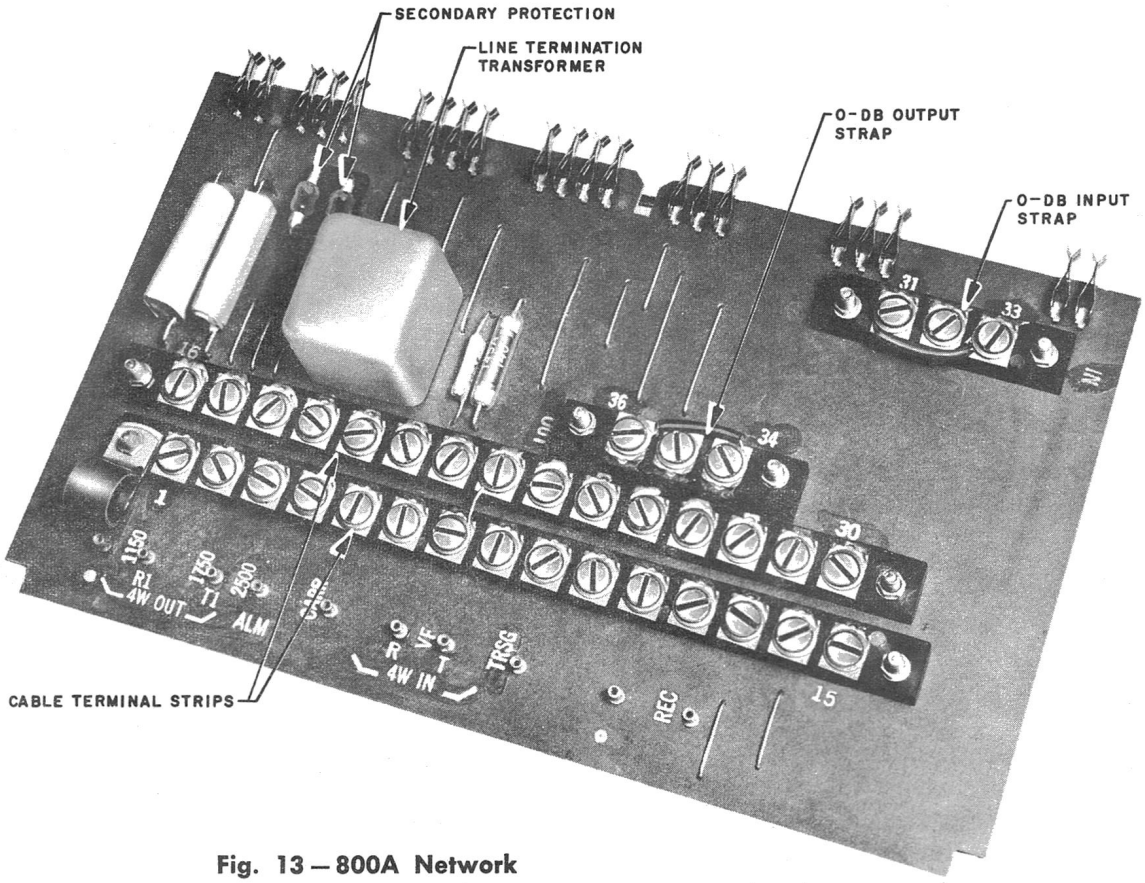

Fig. 13 — 800A Network

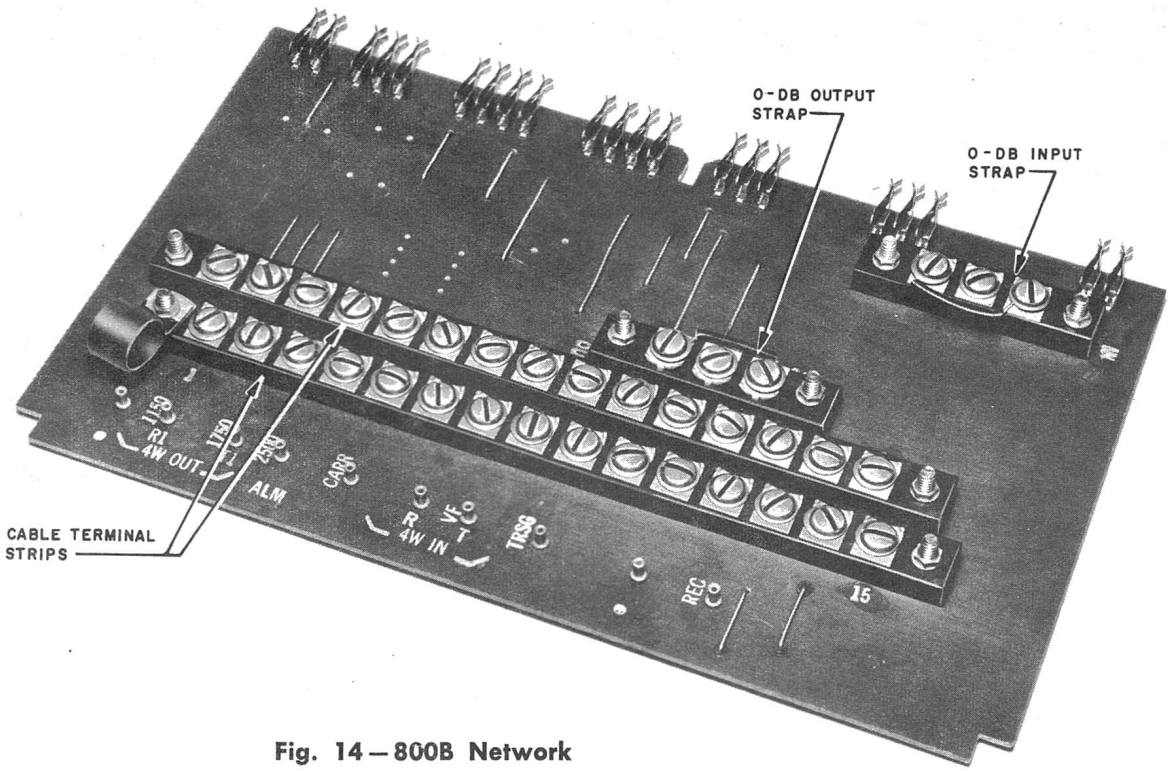

Fig. 14 — 800B Network

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7.00 CODED NETWORKS

TERMINALS

7.01 ***The 800A and B networks*** connect the carrier terminals to the carrier and voice-frequency lines, and connect the power supply to the terminals. They contain test points and removable input and output pads to adjust for desired carrier-frequency circuit loss. The pads are coded as 27- or 29-type pads; code letters A through R, behind the pad type number, indicate 2- to 30-db loss in 2-db steps. The boards are shipped with straps for 0-db loss. If other than 0-db loss is required, the straps are removed and the appropriate pads are added. The *800A* network contains the line-terminating equipment and secondary protection (see ***Note).*** In central office or at remote locations where more than one terminal is bridged on the carrier line at the same point, only the first terminal requires the *800A* network. Other terminals on the same carrier line are equipped with *800B* networks and are multipled to the line through the first terminal. (See Fig. 13 and 14.)

> ***Note:*** Secondary protection is provided to protect the transistors from damage due to low voltage or sneak currents that will not operate the primary protection. Silicon alloy diode voltage limiters provide this protection.

7.02 ***The 800BC through BK and 800L through S networks*** are oscillator-modulator and transmitting filter networks. Each lettered suffix indicates a channel frequency (see Charts E and F). Each board mounts a crystal-controlled oscillator for generating the channel carrier frequency, a double-balanced modulator for modulating the carrier with the voice frequency, and a filter to pass the channel carrier frequency at a bandwidth of ±3.2 kc (see Fig. 15).

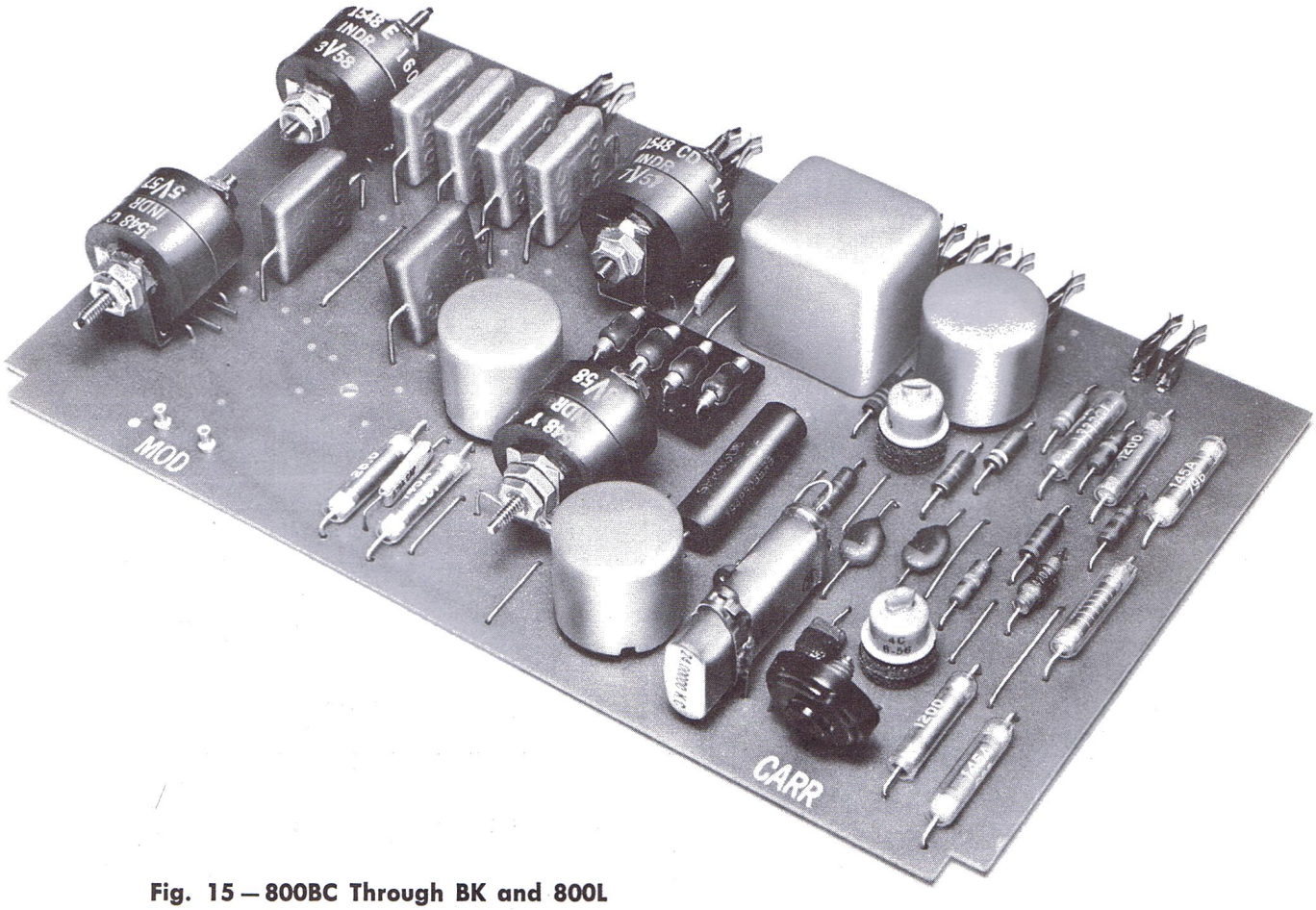

Fig. 15 — 800BC Through BK and 800L Through S Networks

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CHART E

NORMAL FREQUENCIES

Network Code	Frequency kc
800BC	12
BD	24
BE	36
BF	48
800BG	60
BH	72
BJ	84
BK	96

CHART F

STAGGERED FREQUENCIES

Network Code	Frequency kc
800L	18
M	30
N	42
800P	66
R	78
S	90

7.03 ***The 800BA network*** is the receiving amplifier and demodulator for use in central office or remote terminals. It replaces the 800T network. The network amplifies, regulates, and demodulates the received carrier signal and delivers the voice-frequency signal into the expandor at a level of —6 db. It also delivers the necessary power for operation of the supervisory relay at the central office. (See Fig. 16.)

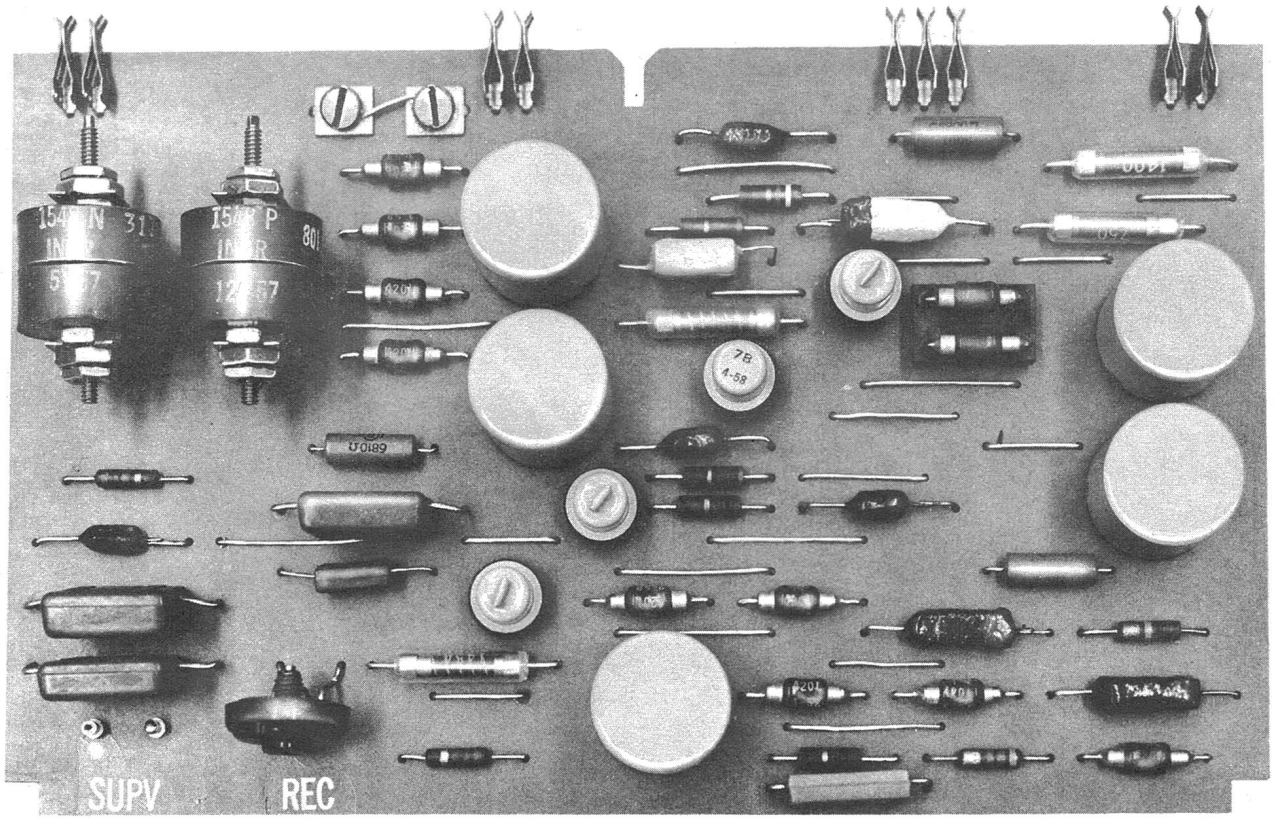

Fig. 16—800BA Network

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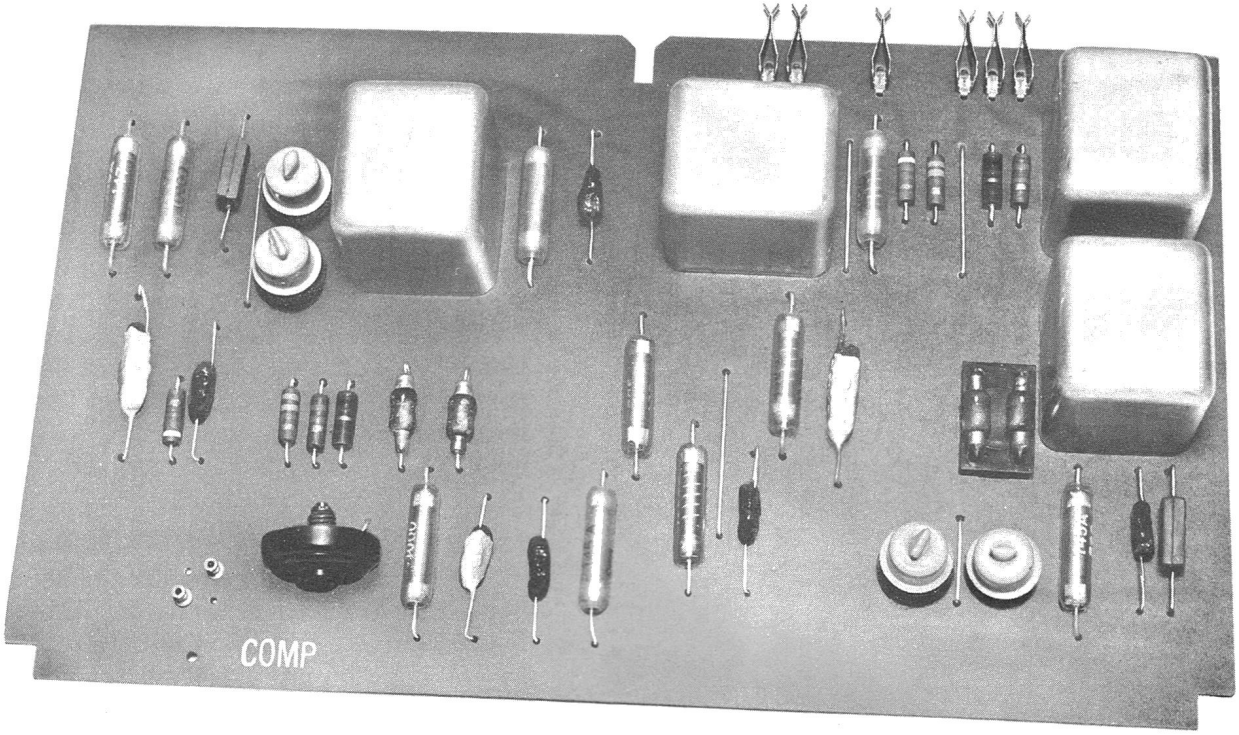

Fig. 17 — 800U Network

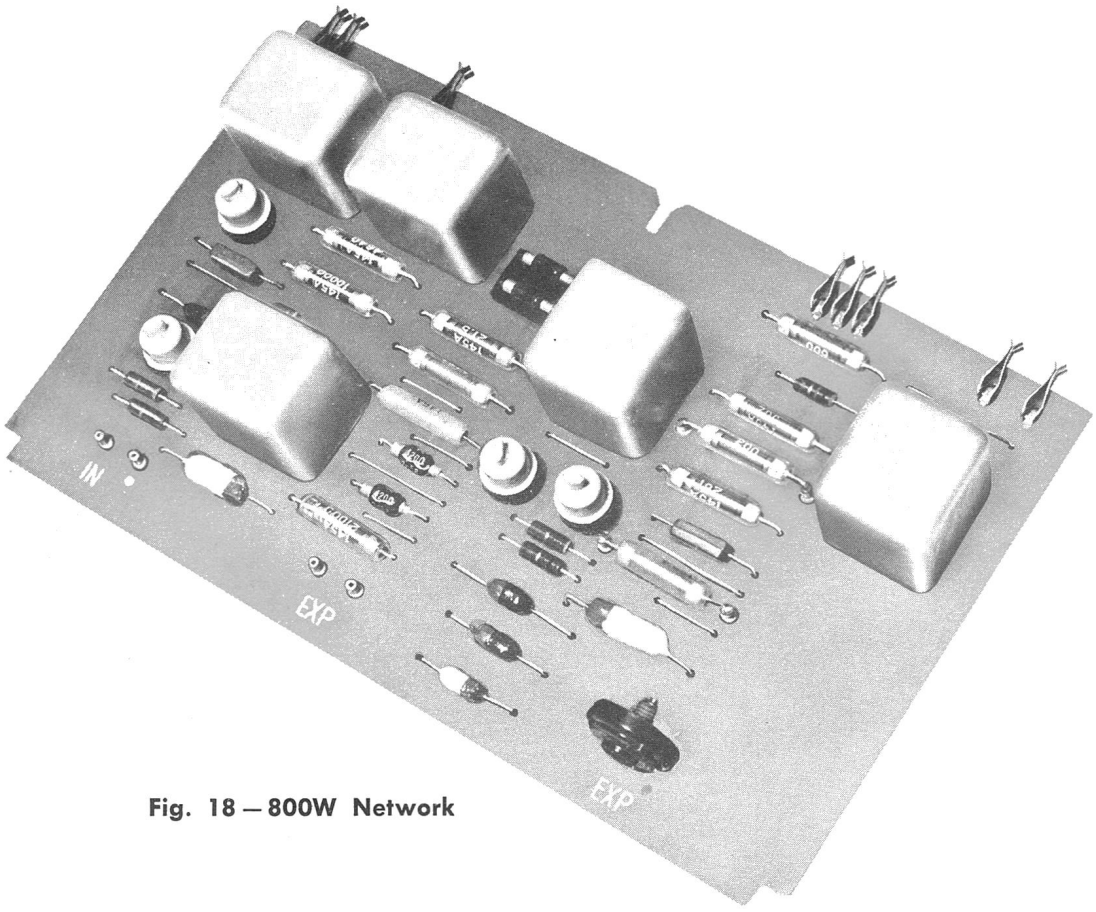

Fig. 18 — 800W Network

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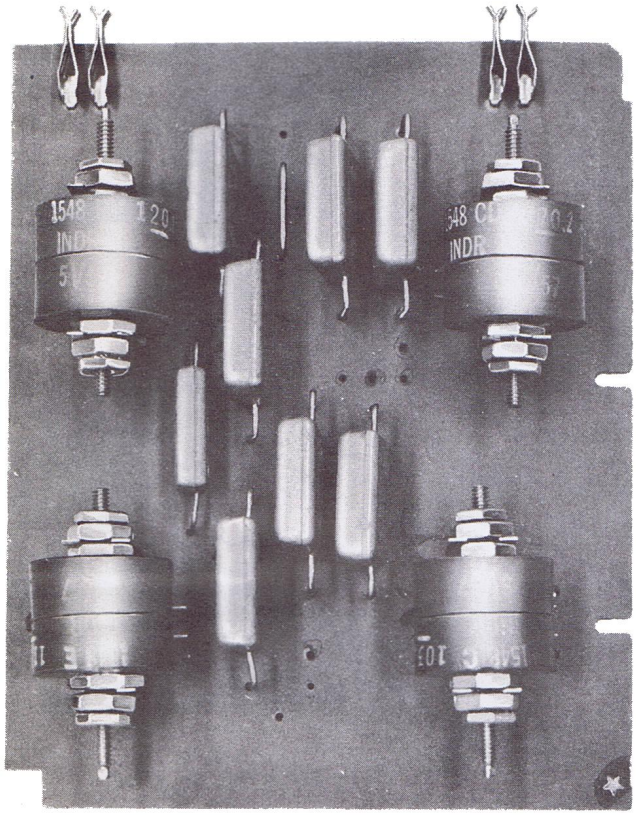

Fig. 19 — 801AA Through AH and 801J Through P Networks

7.04 ***The 800U network*** is the compressor. It receives a voice-frequency input signal of a 40-db range and compresses it to a range of 20 db. (See Fig. 17.)

7.05 ***The 800W network*** is the expandor. It restores voice-frequency signals from the receiving amplifier and demodulator to their original db range. The network delivers the voice-frequency output into the voice-frequency section of the signaling equipment at 0-db level. The combination of the expandor and the compressor improves the signal-to-noise ratio of voice-frequency signals. (See Fig. 18.)

7.06 ***The 801AA through AH*** and the ***801J through P networks*** are the receiving filter networks. Each letter suffix identifies a channel frequency (see Charts G and H). The networks accept signals of the proper frequency from the carrier line and pass the channel carrier frequency with a bandwidth of ±3.2 kc to the receiving amplifier and demodulator. (See Fig. 19.)

7.07 ***The 803G through Y*** are supervisory filter networks. These filters accept and pass the channel carrier frequency to the central office

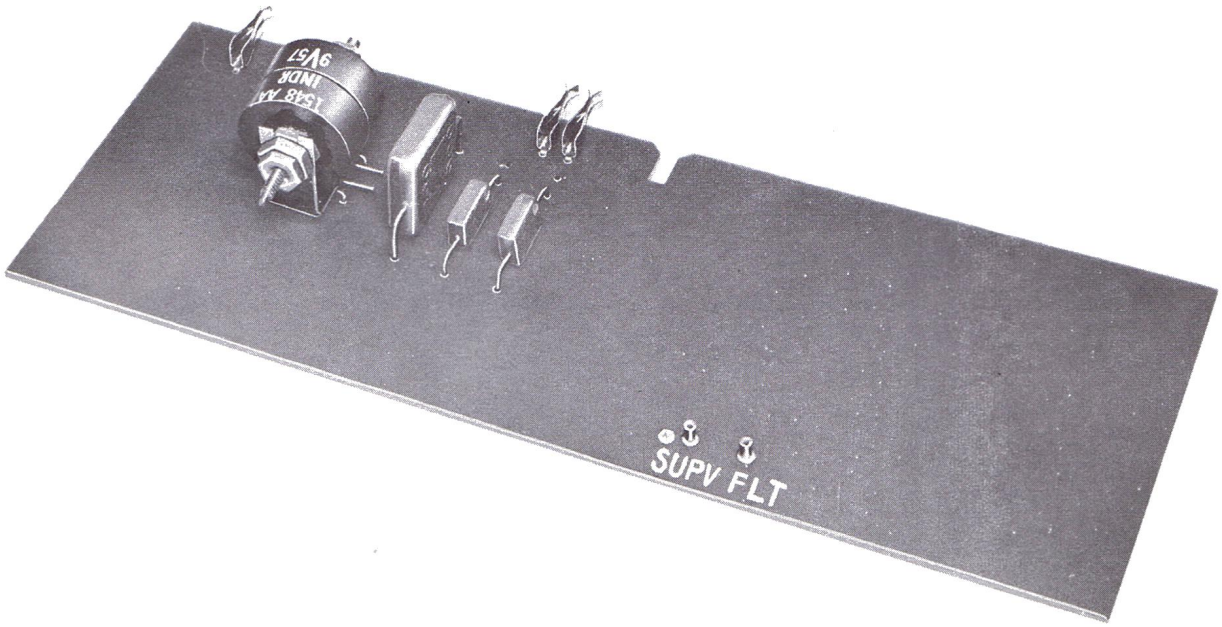

Fig. 20 — 803G Through Y Networks

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supervisory circuits. The design of these filters eliminates carrier sideband and noise to prevent false operation of the supervisory circuits. (See Charts G and H and Fig. 20.)

7.08 ***The 802A network*** is the transmitting amplifier. It amplifies the modulated carrier frequencies received at a low level from the modulator to a level suitable for transmission over the carrier line. (See Fig. 21.)

7.09 ***The 803AA network*** is the signal tone amplifier and detector at the remote terminal. It amplifies and rectifies signal tones of 2500, 1750, and 1150 cps. It passes the resultant dc voltages on to the signaling equipment to operate ringing relays to signal the customer. This network is required for 4-party full selective or 8-party semiselective ringing. (See Fig. 22.)

7.10 ***The 803AB network*** is the signal tone amplifier similar in function to the 803AA network. Only the 2500- and 1750-cycle tones are amplified and rectified. The 803AB network is required for private-line and divided code ringing. (See Fig. 23.)

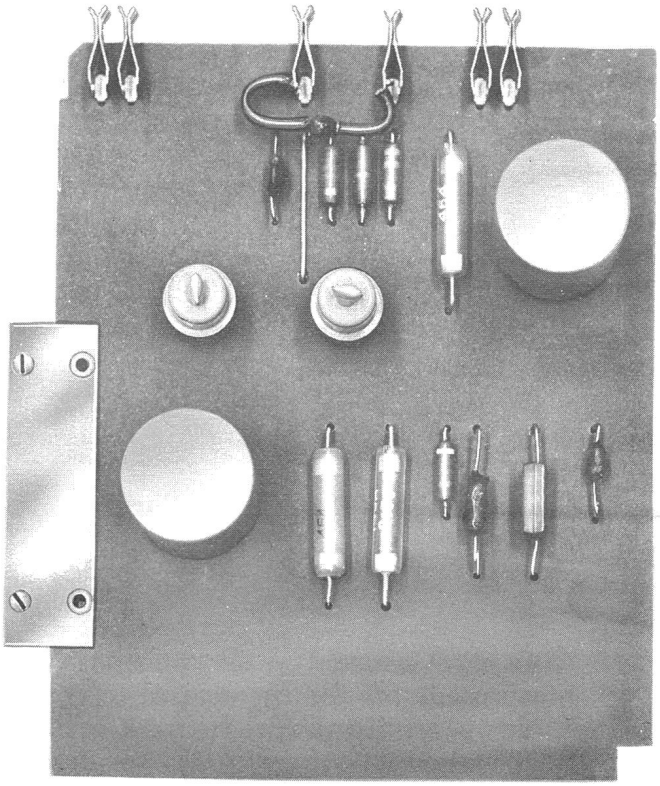

Fig. 21 — 802A Network

CHART G

NORMAL FREQUENCIES

Network Code		Frequency
Receiving Filter	Supervisory Filter	kc
801AA	803G	12
AB	H	24
AC	J	36
AD	K	48
801AE	803L	60
AF	M	72
AG	N	84
AH	P	96

CHART H

STAGGERED FREQUENCIES

Network Code		Frequency
Receiving Filter	Supervisory Filter	kc
801J	803R	18
K	S	30
L	T	42
801M	803U	66
N	W	78
P	Y	90

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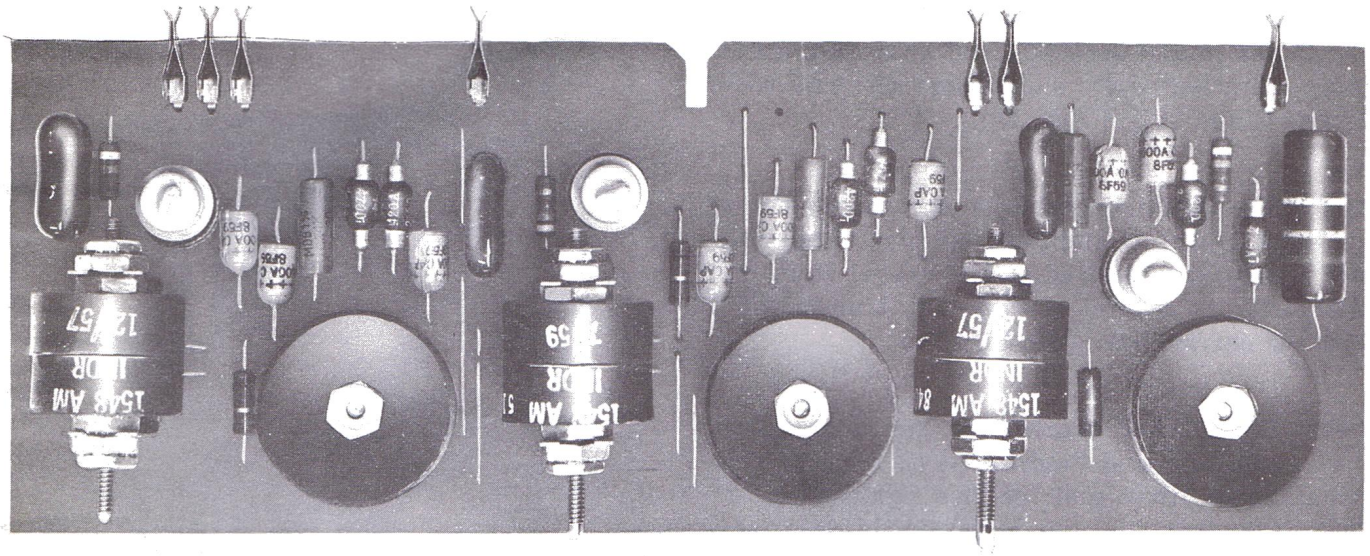

Fig. 22 — 803AA Network

7.11 *The 803D network* is the common signal tone oscillator for the central office terminals (one per system). The network contains three oscillators that generate the signal tones of 2500, 1750, and 1150 cps. This network is required for 4-party full selective and 8-party semiselective ringing. (See Fig. 24.)

7.12 *The 803E network* is a signal tone oscillator similar in function to the 803D network. This network contains only two oscillators for 2500 and 1750 cycles. It is required for private-line and divided code ringing. (See Fig. 25.)

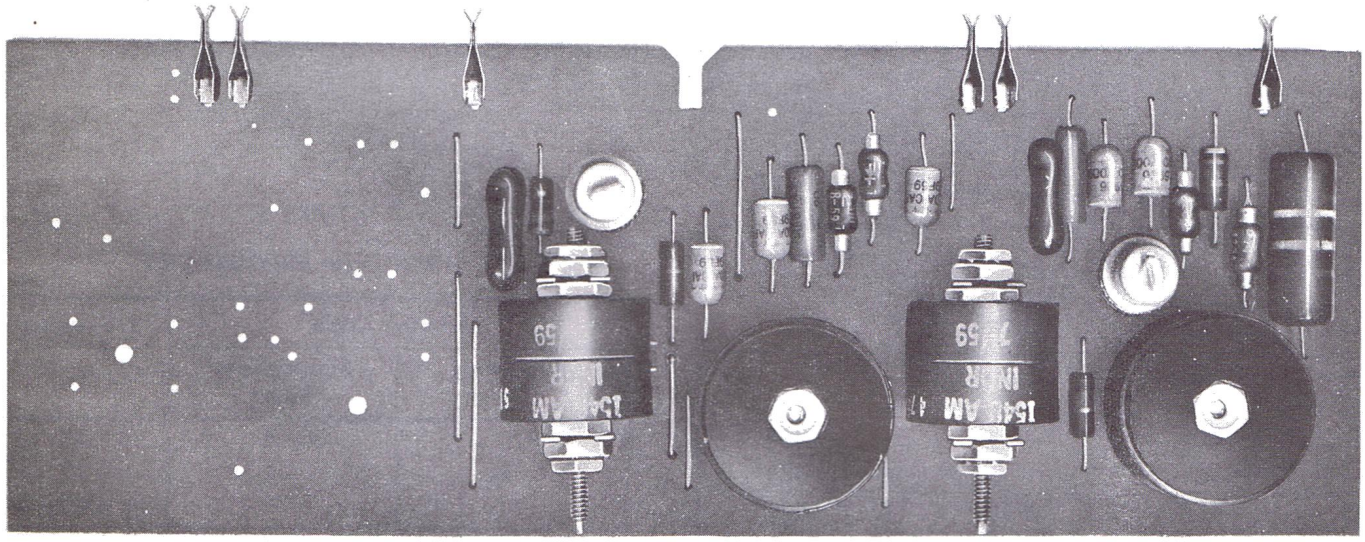

Fig. 23 — 803AB Network

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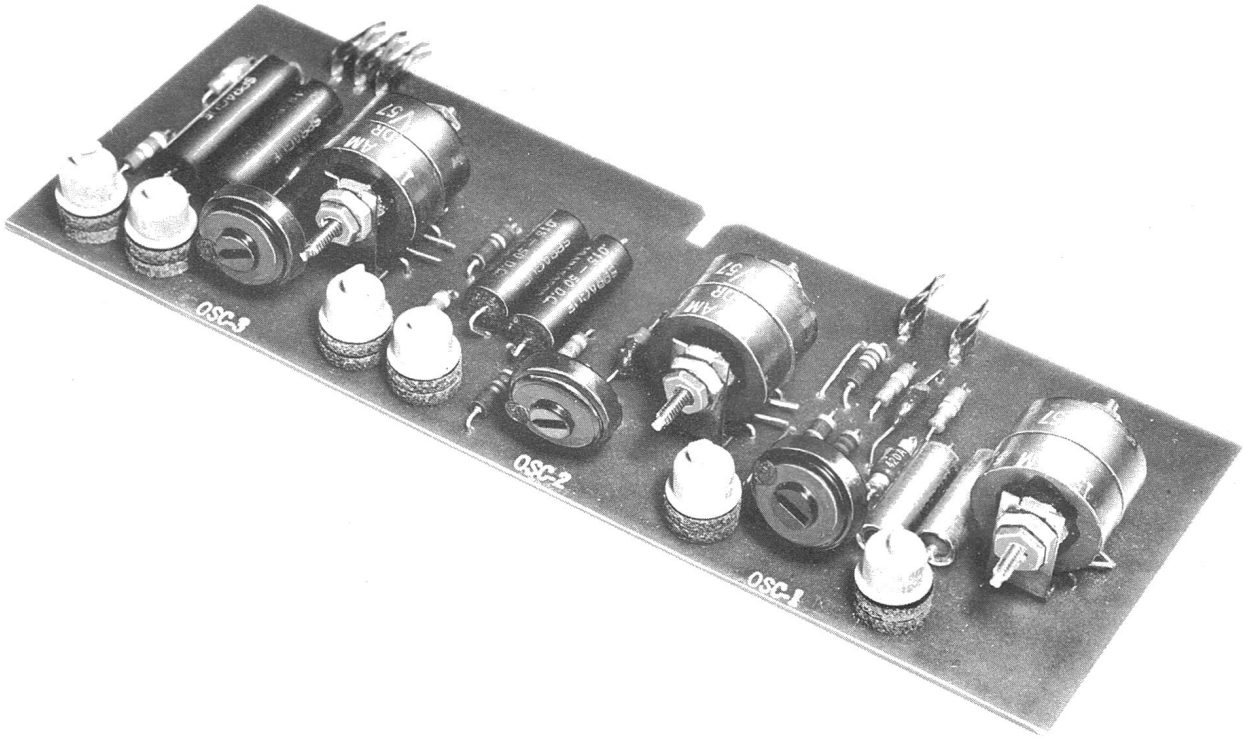

Fig. 24 — 803D Network

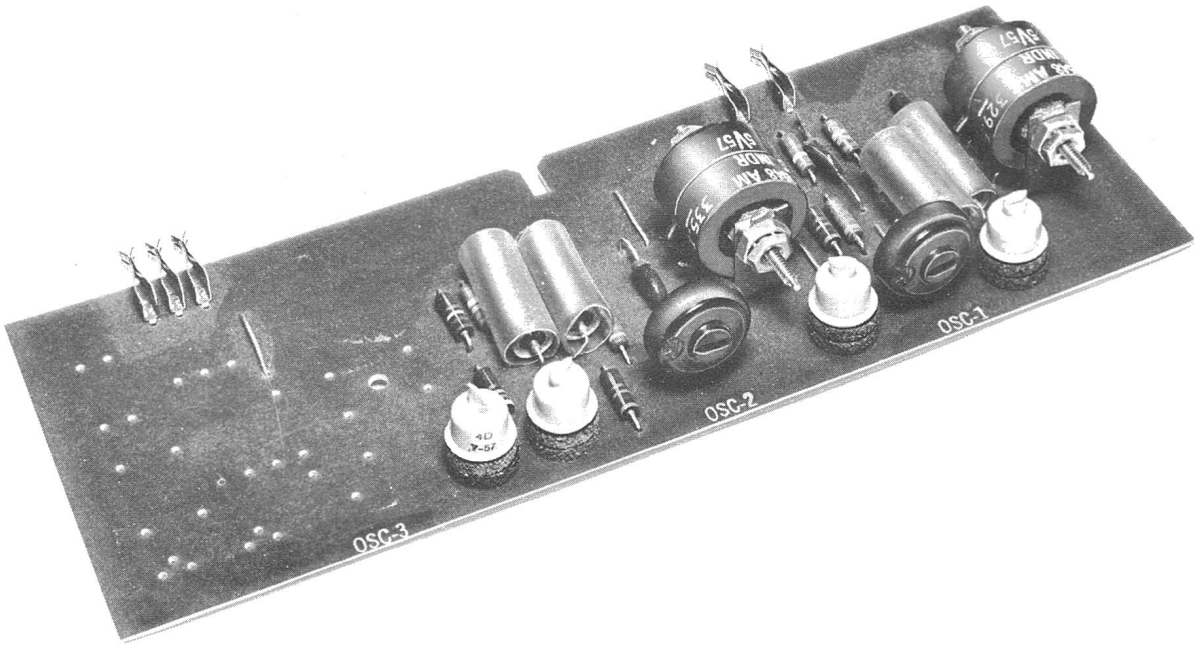

Fig. 25 — 803E Network

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7.13 ***The 804A or C network*** provides the supervisory, signaling, and voice frequency terminating circuits required for a central office terminal. It also includes secondary protection for the terminal on the voice-frequency side, and a voltage divider and filter to provide bias voltage for the transistors in the terminal. (See ***Note*** following 7.01, and Fig. 26 and 27.)

7.14 ***The 804B or D network*** provides signaling, supervisory, and voice-frequency functions for a remote terminal. It provides secondary protection for the terminal on the voice-frequency side. (See ***Note*** following 7.01.) The network also contains means for turning off power to the compressor, oscillator-modulator, and the transmitting amplifier during on-hook periods to save power. (On channels of 12 and 18 kc, the oscillator-modulator is not controlled by switchhook condition, as these oscillator-modulators are powered at all times.) Signaling options are provided for 4-party full selective, 8-party semiselective, private-line, or divided code ringing. Two 291-type relays are furnished with the network. One or two additional plug-in relays and/or 404A shorting plugs must be furnished separately to provide the option desired. The 404A shorting plugs are not required in the 804D network. (See Fig. 28 and 29.)

7.15 A functional block diagram of one channel in the P1 carrier system is shown in Fig. 41 (attached). The blocks represent various functions performed at each terminal. Letters above blocks indicate the printed wiring board's position in the 803A connector.

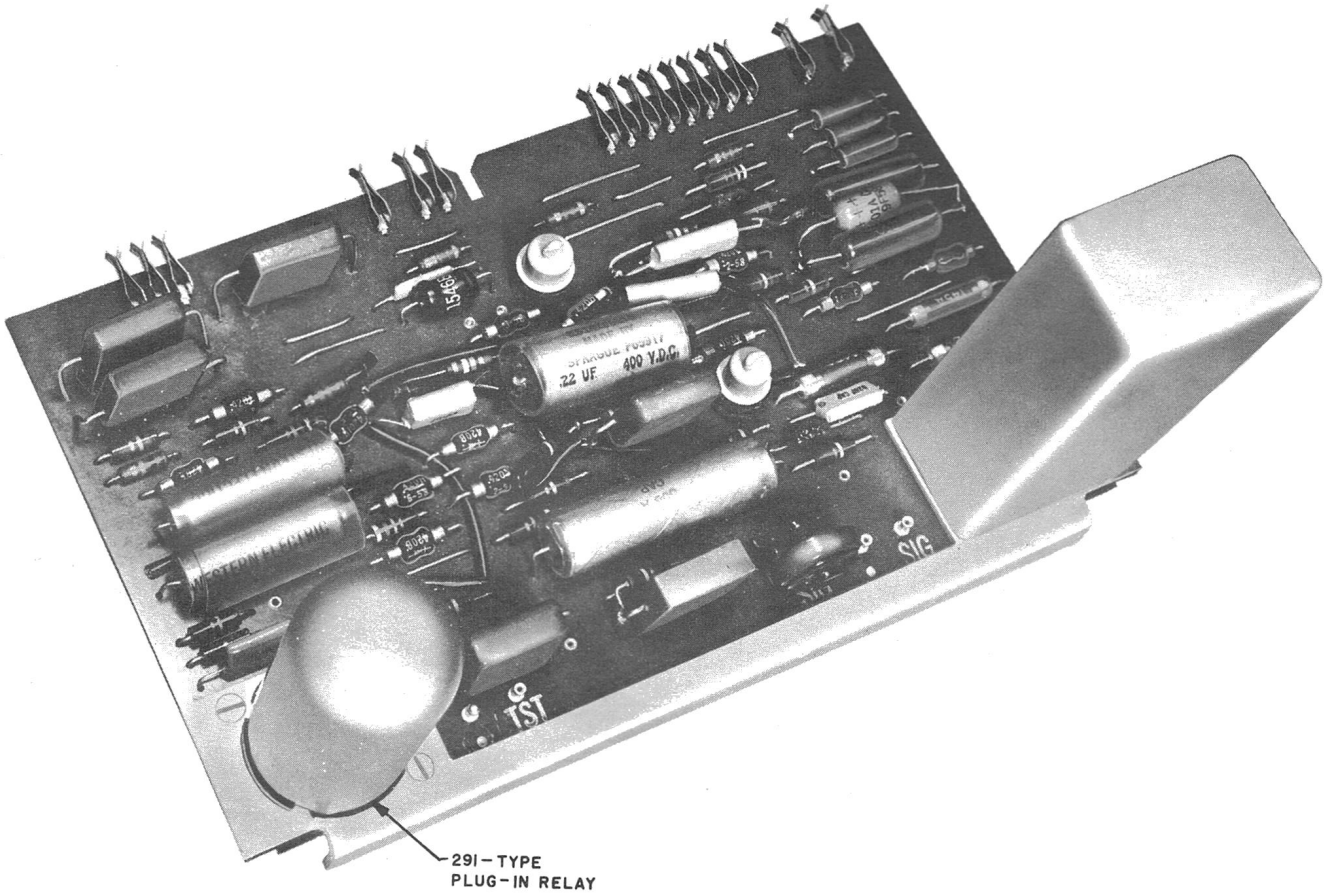

Fig. 26 — 804A Network

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REPEATERS

7.16 ***The 800AU network*** is a line connector for the repeater and replaces the 800AA network. It contains a terminal strip for connecting a local cable and two line transformers to isolate the unbalanced repeater circuit and the balanced carrier line. The line transformer provides an impedance match between repeater and line. Repeater low-voltage protection is provided by a varistor and resistance circuit associated with each line transformer. (See Fig. 30.)

7.17 ***The 800AB network*** contains the line equalizer, input and output pads, and an amplifier. The line equalizer and pads are mounted with screw terminals on the network. Only 29-type pads can be used. The amplifier is a 3-stage transistor-amplifier providing 50 db of gain over the P1 carrier band. (See Fig. 31.)

7.18 ***The 800AC network*** is a phase equalizer required to compensate for the phase distortion caused by the directional filters (see Fig. 32).

7.19 ***The 800AD network*** is a dummy phase equalizer required to provide bypass circuits when no phase equalization is necessary (see Fig. 33).

7.20 ***The 800AF network*** is the dummy regulator required to provide connections between input pads and the amplifier. The network contains a pad to simulate the midrange of the regulator. (See Fig. 34.)

7.21 ***The 800Y network*** is the directional filter which separates the two bands of frequencies used for the two directions of transmission (see Fig. 35).

7.22 ***The 800AH network*** is the total power regulator. The network provides a variable loss ahead of the amplifier controlled by the amplifier output. This action keeps the power output of the amplifier constant and controls the transmission from the central office to remote terminal. Regulation is normally used when two or more repeaters are in a system. (See Fig. 36.)

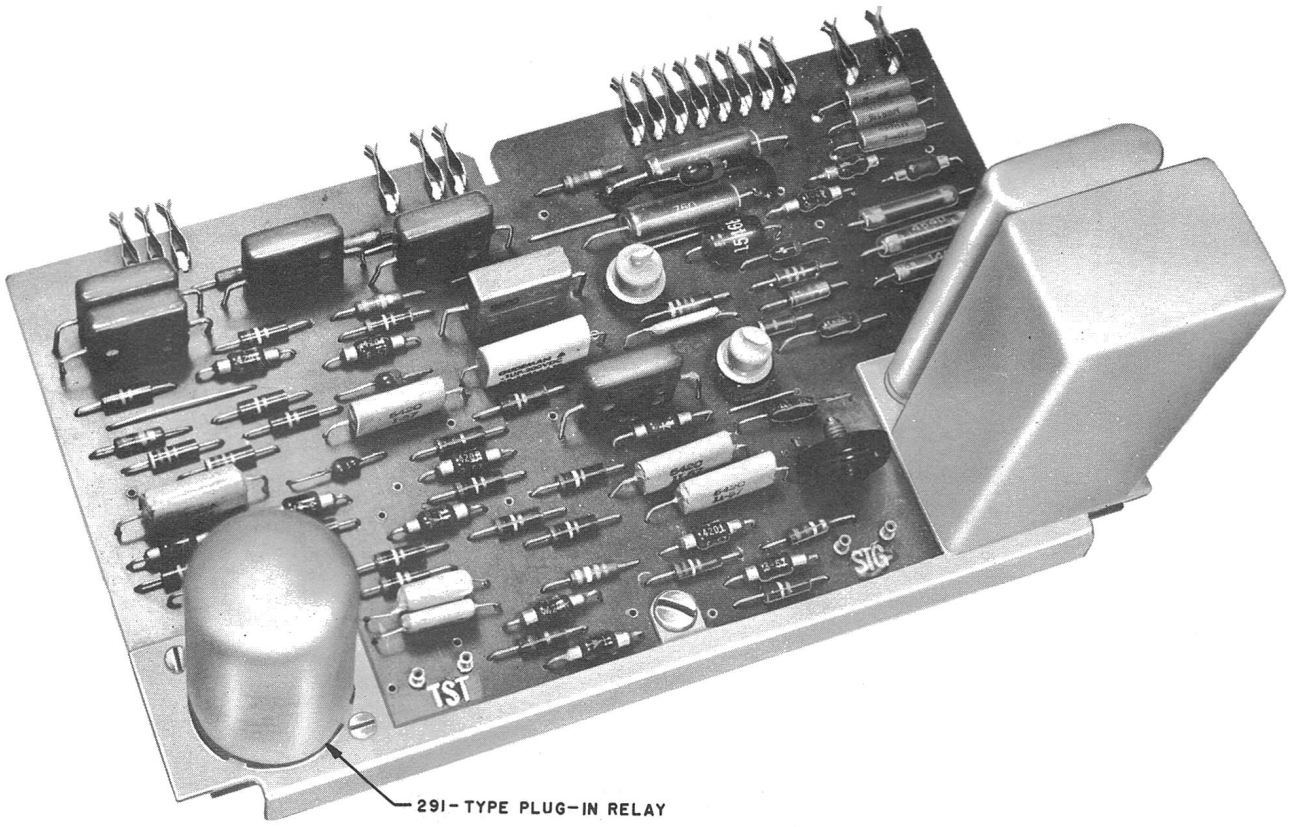

Fig. 27 — 804C Network

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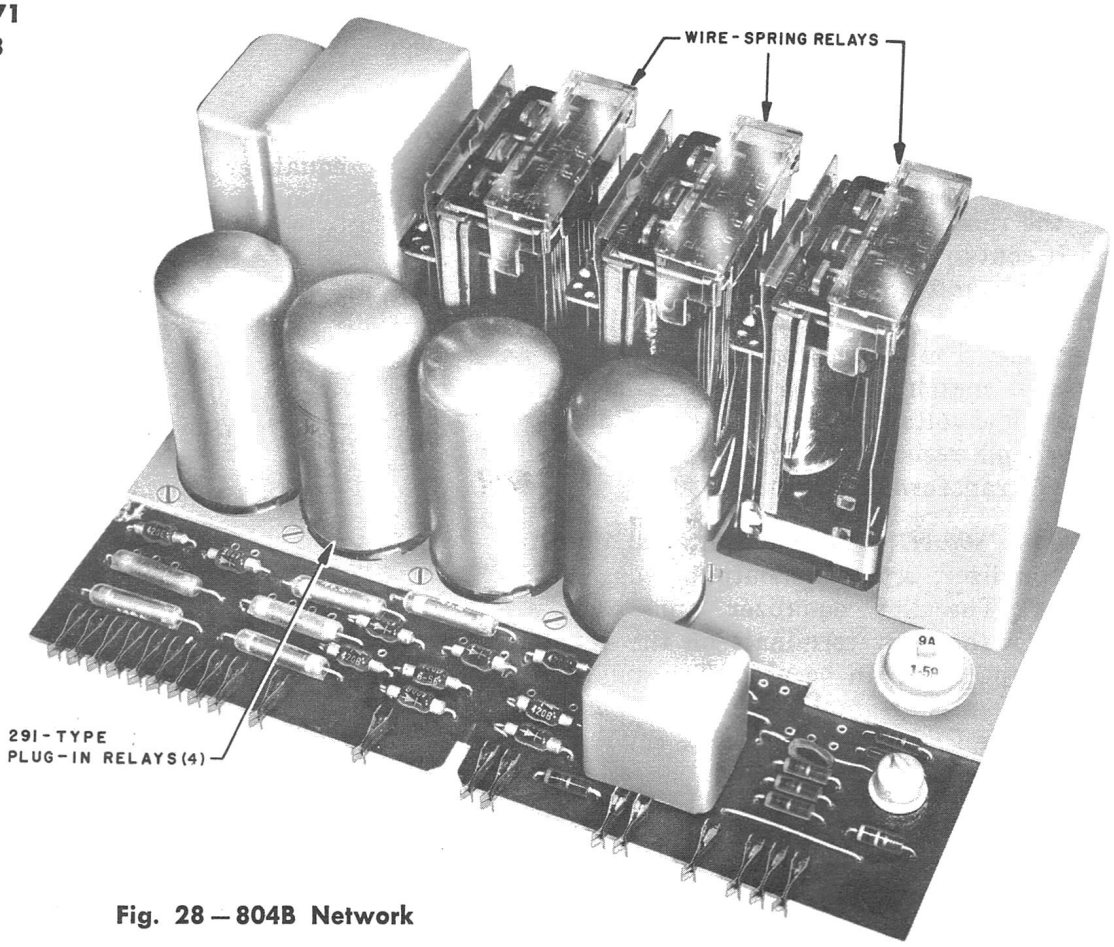

Fig. 28 — 804B Network

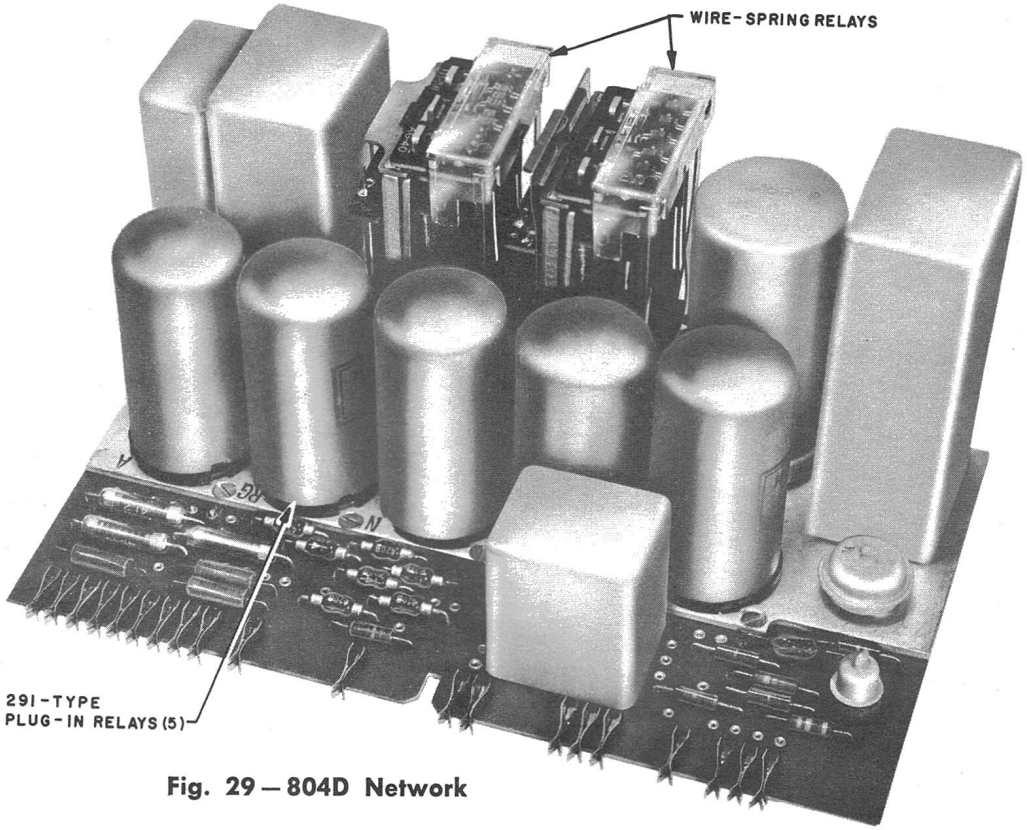

Fig. 29 — 804D Network

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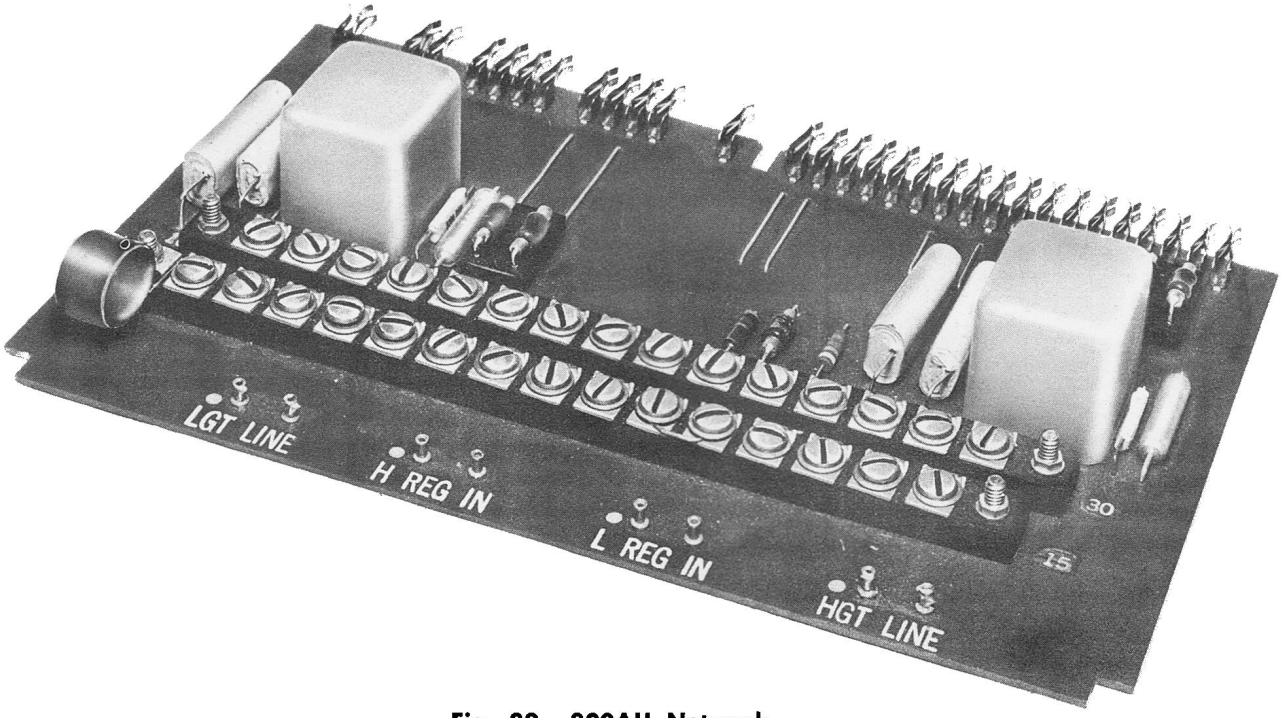

Fig. 30 — 800AU Network

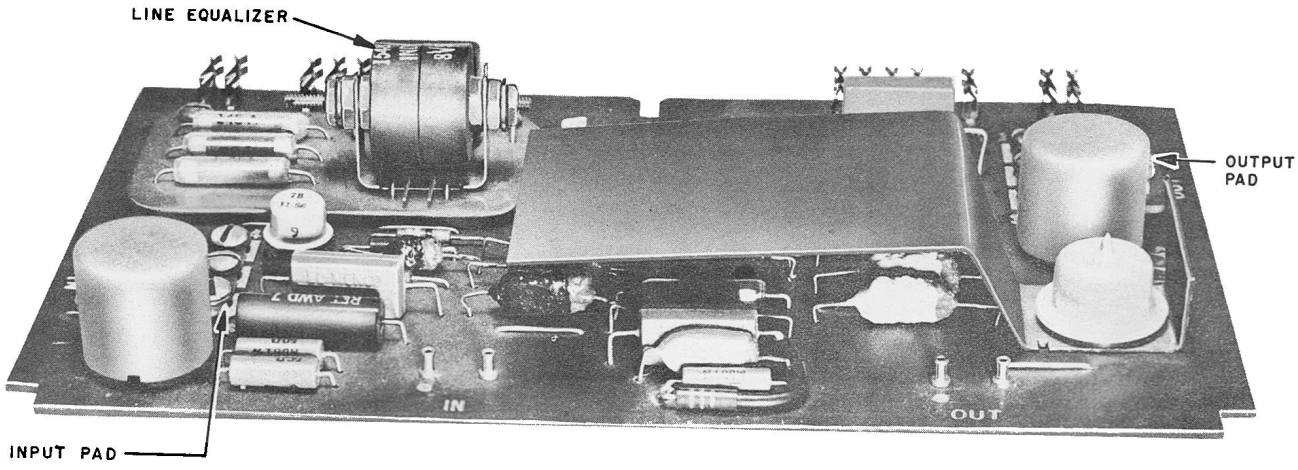

Fig. 31 — 800AB Network

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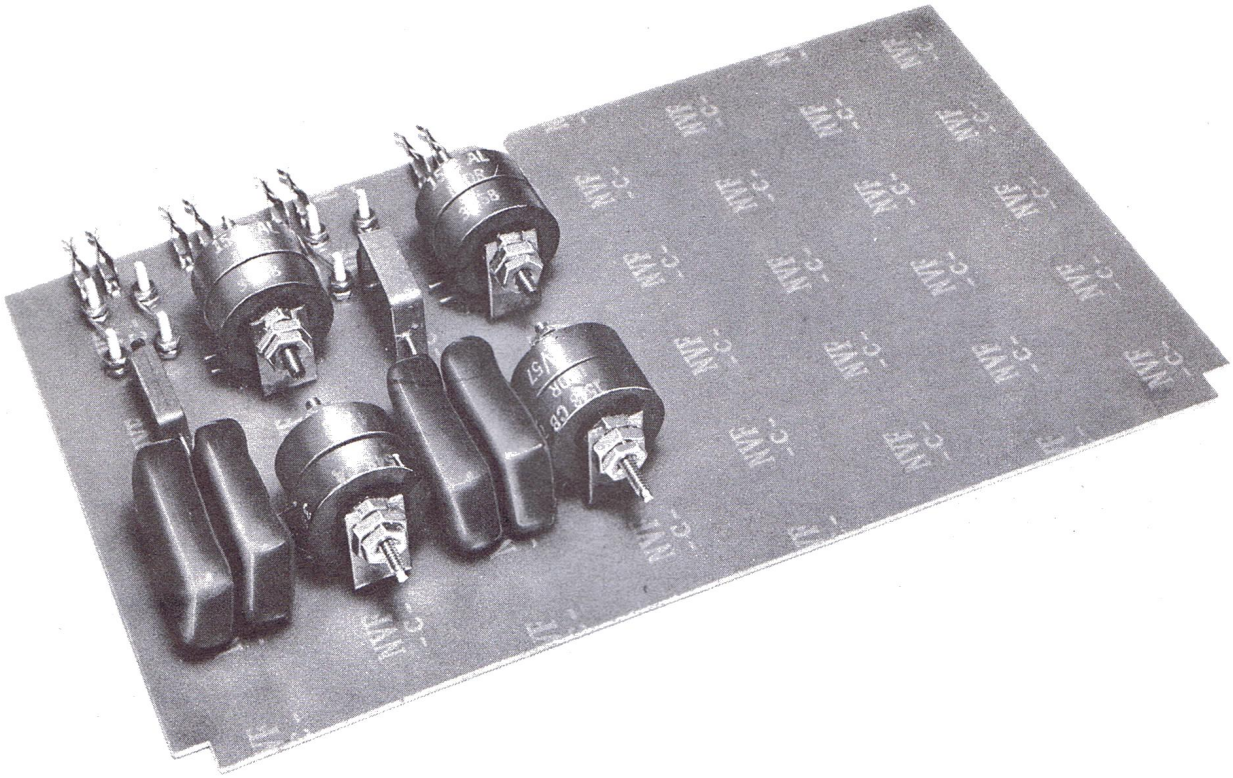

Fig. 32 — 800AC Network

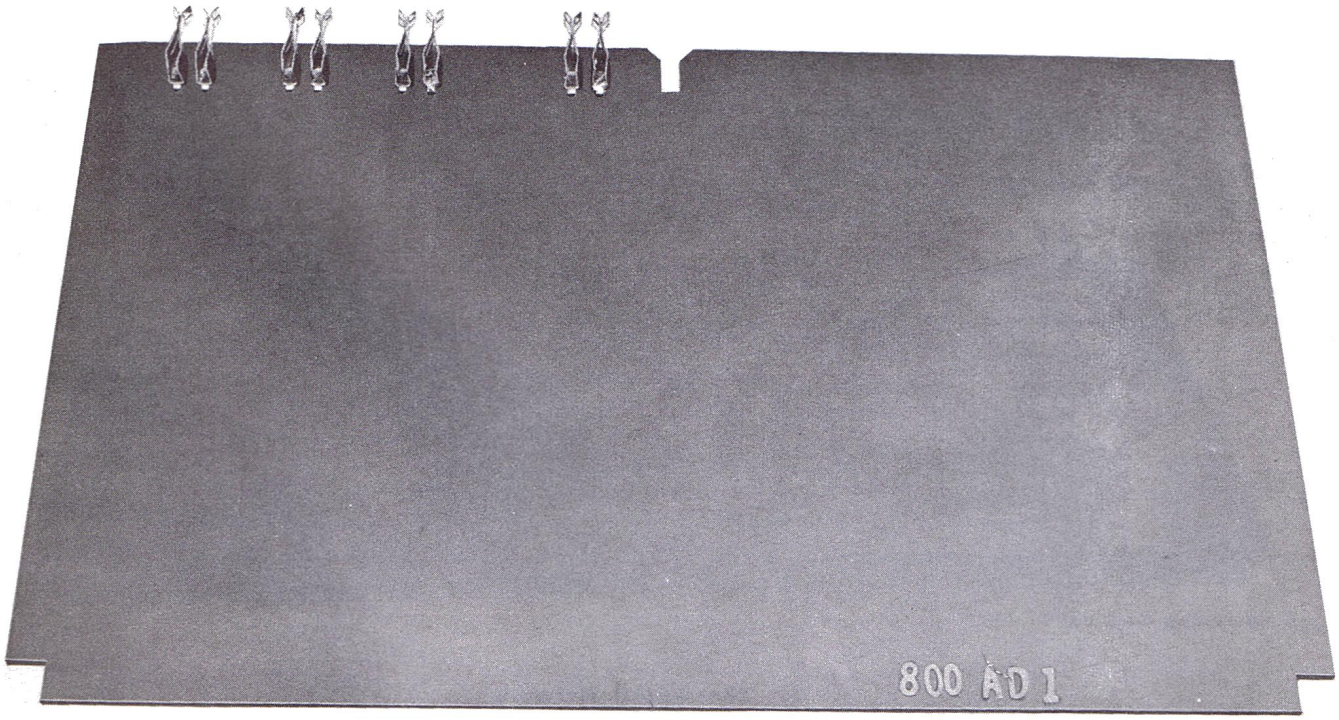

Fig. 33 — 800AD Network

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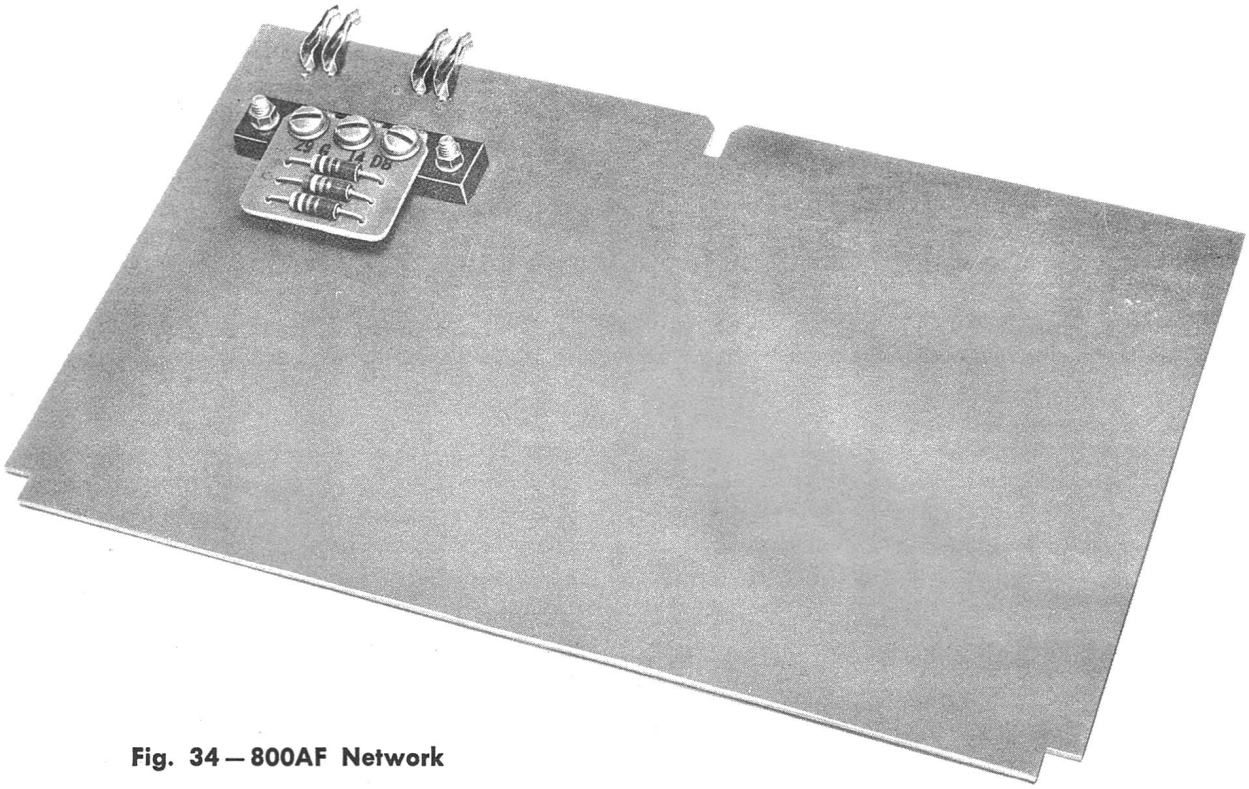

Fig. 34 — 800AF Network

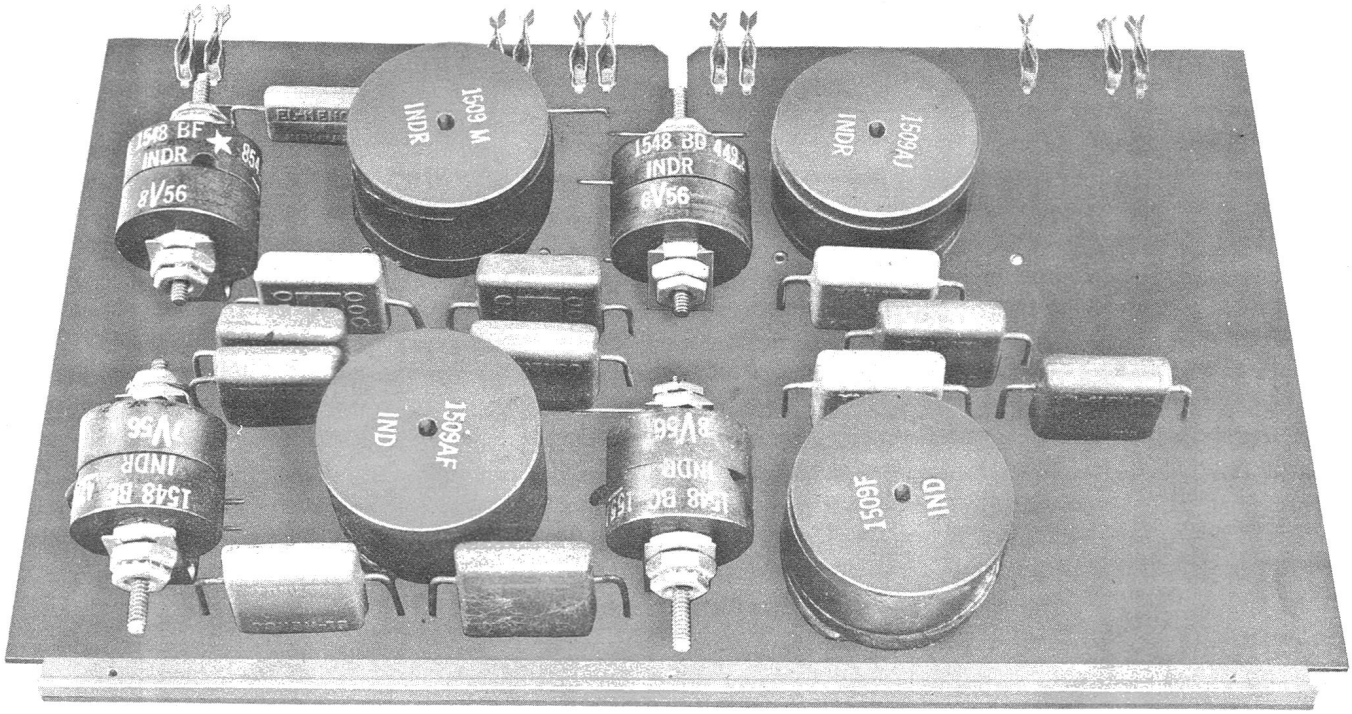

Fig. 35 — 800Y Network

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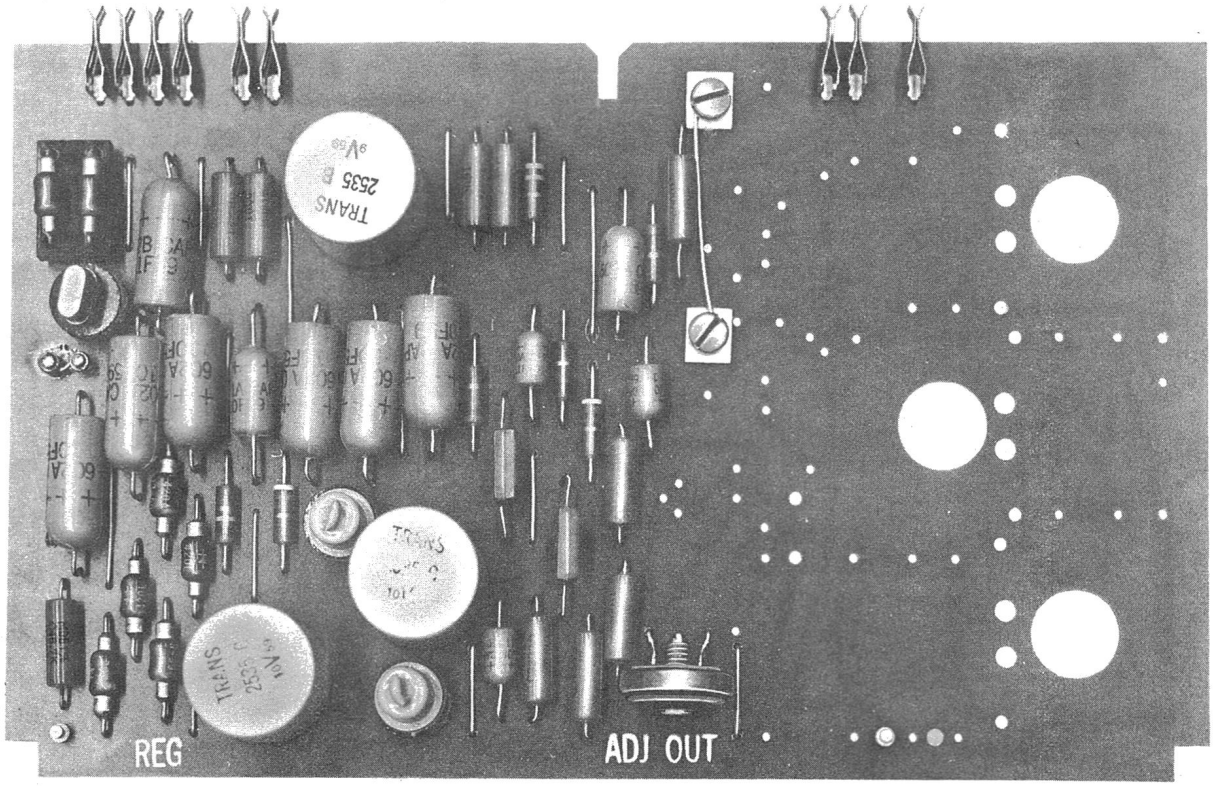

Fig. 36 — 800AH Network

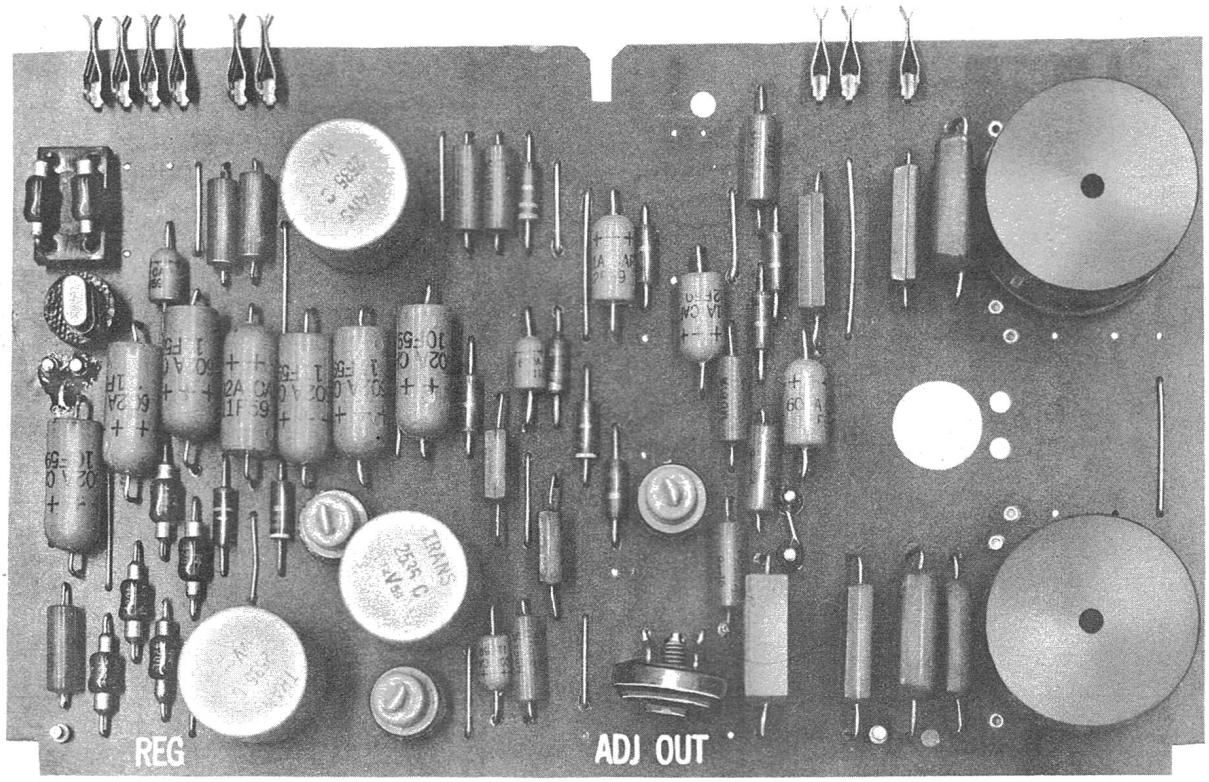

Fig. 37 — 800AK Network

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7.23 ***The 800AJ, AK, AP, and AR networks*** are pilot regulators. These networks provide a variable loss ahead of the amplifier. The output level of the pilot tone determines the amount of loss in the regulators. This action keeps the amplifier output level constant. Pilot regulators control transmission from the remote terminal to the central office. (See Fig. 37.) The network codes are as follows:

- 800AJ — Low group for staggered system (34.5-kc pilot frequency)
- 800AK — Low group for normal system (31.5-kc pilot frequency)
- 800AP — High group for staggered system (73.5-kc pilot frequency)
- 800AR — High group for normal system (76.5-kc pilot frequency)

7.24 ***The 800AL, AM, AS, and AT networks*** are pilot oscillators used in the repeater nearest the remote terminal. They supply power to the pilot regulator. (See Fig. 38.) The network codes are as follows:

- 800AL — Low group for staggered system (34.5-kc pilot frequency)
- 800AM — Low group for normal system (31.5-kc pilot frequency)
- 800AS — High group for staggered system (73.5-kc pilot frequency)
- 800AT — High group for normal system (76.5-kc pilot frequency)

7.25 ***The 800BB network*** is the power-over-cable network. The network regulates the power fed to the first repeater over the cable from the central office. (See Fig. 39.)

7.26 A functional block diagram of the repeater is shown in Fig. 40 (attached).

8.00 DERIVED VOICE FREQUENCY CIRCUITS

8.01 The P1 carrier telephone system furnishes talking battery to the customers on the system from the same 22.5-volt supply used to power the remote terminals. This decrease from the normal 24- or 48-volt exchange battery requires the use of 500-type telephone sets only on derived voice frequency circuits.

8.02 The loop requirements for derived voice frequency circuits between remote terminal and subscriber stations are:

- 20,000 ohms minimum insulation resistance
- 390 ohms maximum loop resistance

8.03 Chart J gives the maximum number of main and extension ringers permitted for each channel of a P1 carrier telephone system.

CHART J

RINGER LIMITATIONS, P1 CARRIER TELEPHONE SYSTEM

Type of Service	804B Network		804D Network	
	Ringers		Ringers	
	Capacitor	Tube	Capacitor	Tube
One-Party (Bridged)	4	*	10	*
2-Party (Grounded)	8	*	20	*
4-Party Semiselective		4		12
4-Party Full Selective	†	8	†	24
8-Party Semiselective	†		†	
8-Party Divided Code	8	4	20	12

* Tube-type ringing bridges not used on this type of service.

† Capacitor-type ringing bridges not used on this type of service.

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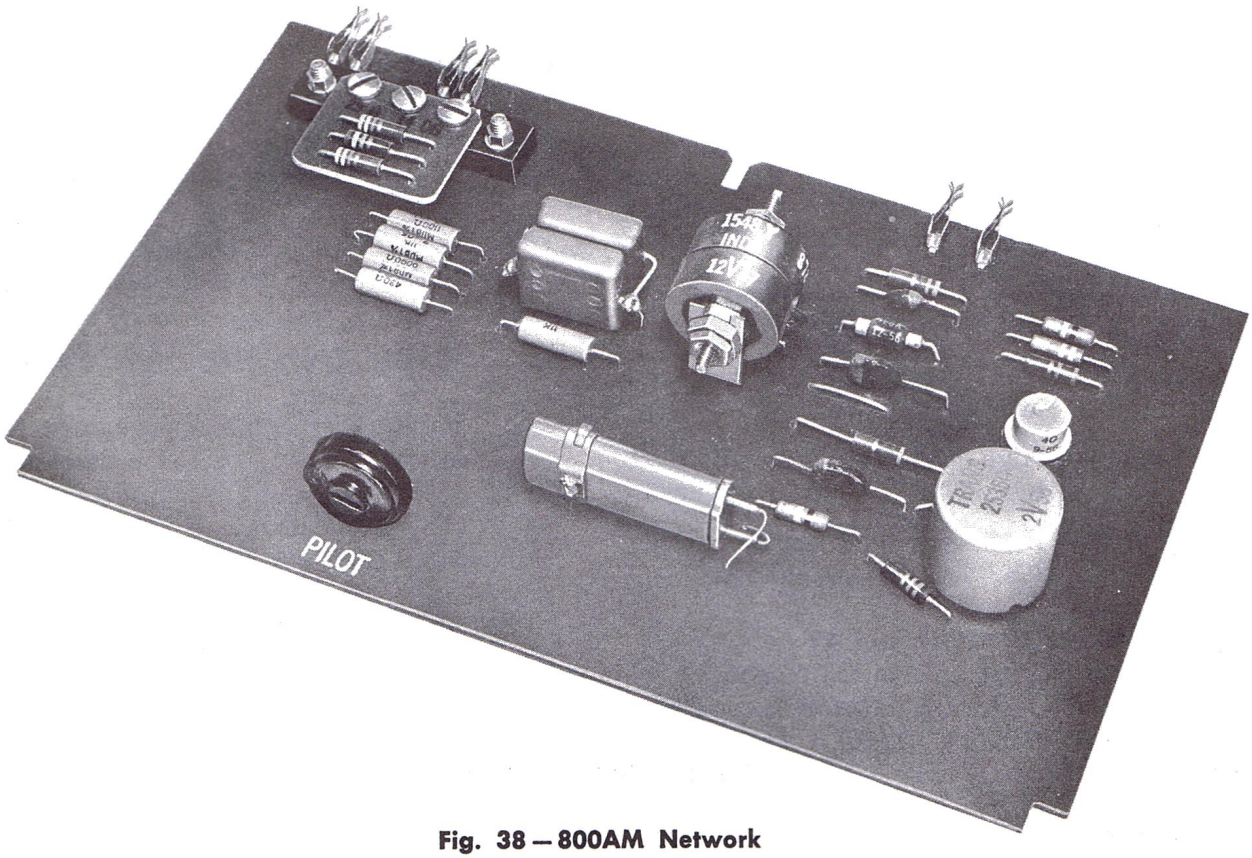

Fig. 38 — 800AM Network

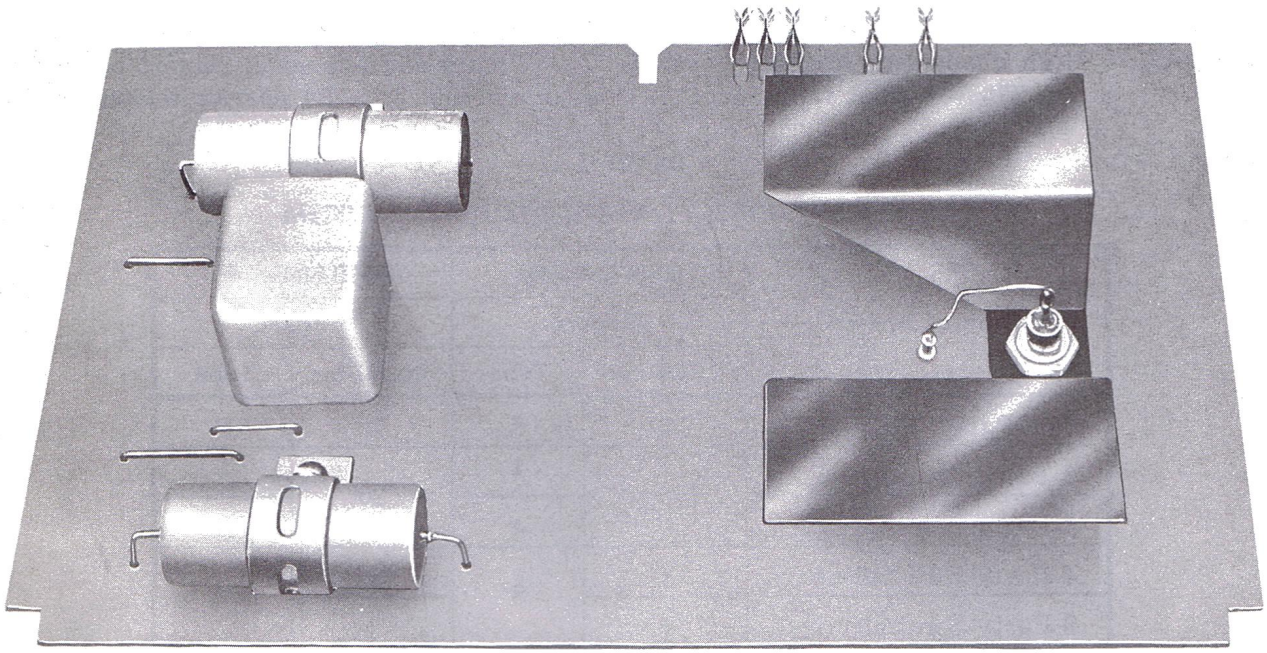

Fig. 39 — 800BB Network

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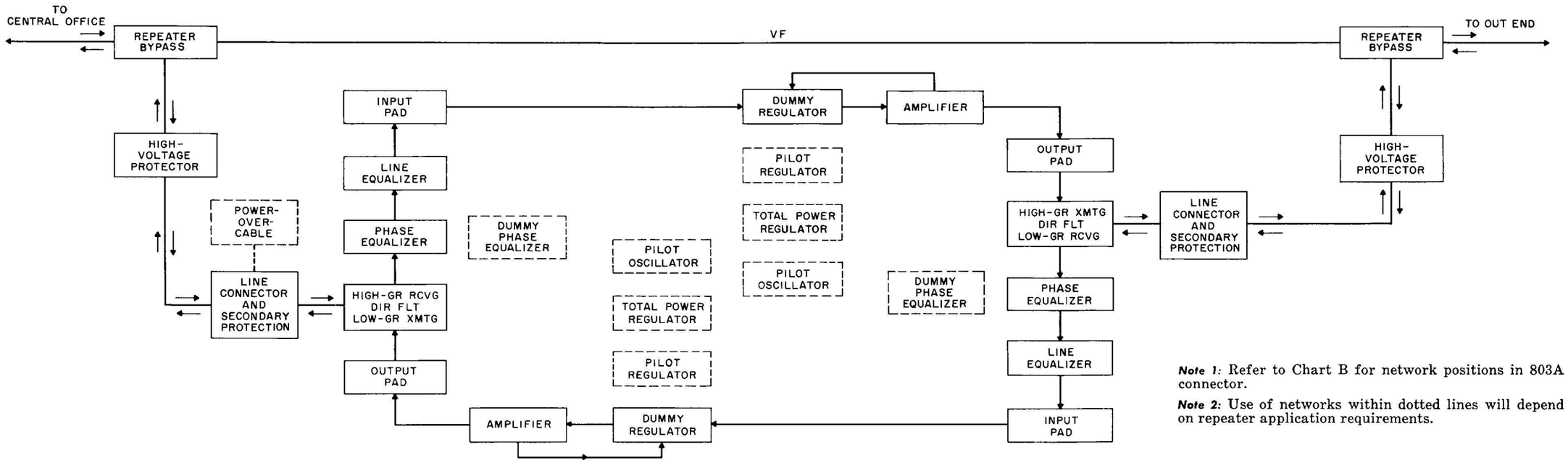
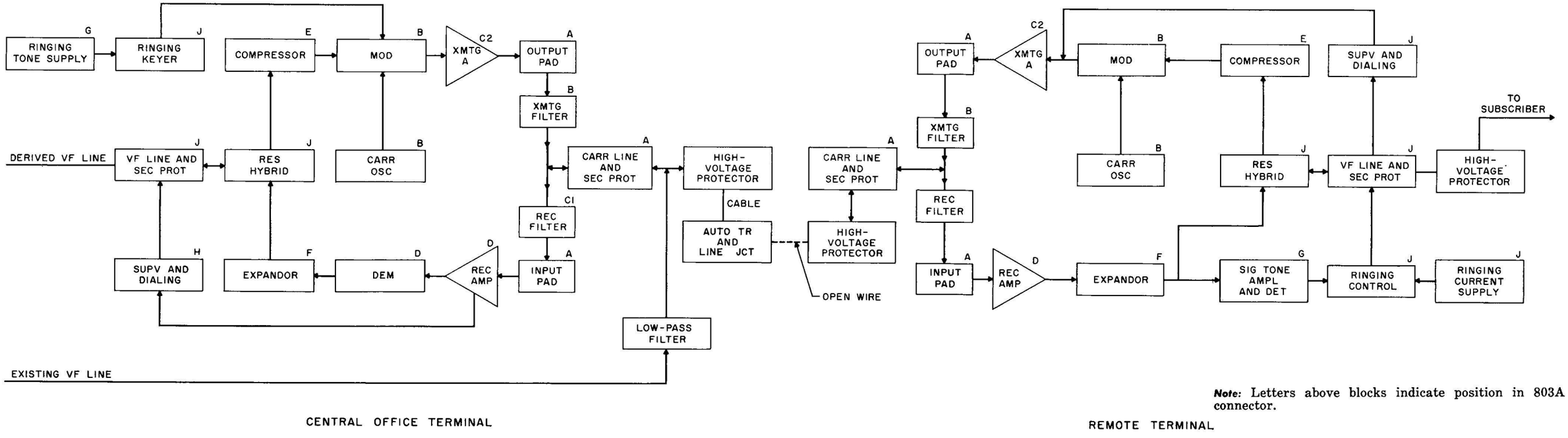


Note 1: Refer to Chart B for network positions in 803A connector.

Note 2: Use of networks within dotted lines will depend on repeater application requirements.

Fig. 40 — Functional Diagram, Nonregulated Repeater



Note: Letters above blocks indicate position in 803A connector.

Fig. 41 — Over-All Block Diagram

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