

TYPE N, O, AND ON CARRIER TELEPHONE SYSTEMS
TYPE 240 AMPLIFIER
INSTALLATION AND MAINTENANCE

This section describes the procedures for installing and maintaining the 240-type amplifier in a cable span between N or ON repeaters for amplification in either one (see Fig. 1) or two (see Fig. 2) directions of transmission. The practice is divided into two sections: Installation and Maintenance. These sections are applicable to both types of installations.

This section is revised to include the 240A2, B2, and C2 amplifiers. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

In order to attain maximum efficiency when cutting the amplifiers into service, it will be necessary to have personnel located at the following points:

- (a) One attendant at the repeater station ahead of the amplifier installation.
- (b) One attendant at the amplifier location.
- (c) One attendant at the office following the amplifier installation.
- (d) Forces at system terminal offices to turn circuits down and back up.

Each location should have the following test equipment and amplifier units available:

Location (a) — 2J Repeater Test Set, J94002J

Location (b) — 2J Repeater Test Set, J94002J

— KS-14510, Volt-Ohm-Milliammeter (VOM)

— KS-15538 Carrier Frequency Voltmeter (CFVM)

— P4AP Adapter Cord

— *At a one-way amplification location*, 240A or A2 amplifiers for odd-numbered positions (1 through 23) within the apparatus case, and 240B or B2 amplifiers for all even-numbered positions (2 through 24)

Note 1: For a fully equipped case, a maximum of twelve 240A or A2 and twelve 240B or B2 amplifiers will be needed.

Note 2: If the total number of N systems to be treated is an odd number, the next even-numbered position will contain a 4038A network.

Note 3: On lightly loaded carrier routes, it may be desirable from a service protection standpoint to equip the odd-numbered positions with 240A or A2 amplifiers and the even-numbered positions with 4038A networks. The splicing will be different for this arrangement.

— **At a 2-way amplification location,** a 240A or A2 and a 240B or B2 amplifier for each system connected into the apparatus case.

Location (c) — 2J Repeater Test Set, J94002J

Location (d) — None required

Note: The KS-15538 carrier frequency voltmeter will be required only if the total carrier power is too low to be read with the 2J repeater test set.

Before the apparatus case cable stub is spliced into the cable, all amplifier positions are equipped with 4038B networks to maintain continuity during and after the splicing operation. The 4038B networks should be left in positions associated with pairs spliced into the apparatus case, but not equipped with amplifiers or 4038A networks during the installation procedure. Types N and ON systems that are to be equipped with amplifiers will have to be turned down two at a time for installation of one-way amplification and one at a time for installation of 2-way amplification in accordance with their assignment within the apparatus case.

The system assignment versus position within the 469A apparatus case is determined by pair splicing at the time of the case installation. Figure 3A shows the 469A apparatus case and Figure 3B shows a sketch of the position locations and numbering within the case. Information for the systems associated with these positions should be provided by the job or circuit order for the installation. Installation procedures for and strapping options of the 240-type amplifiers are determined by the type of installation; i.e., if the 240A or A2 amplifier is installed in a cable pair that connects to a -130 volt supply, it and its paired 240B or B2 amplifier or 4038A network are strapped between terminals 1 and 3, 2 and 4, Fig. 4. If the voltage is +130 volts, the strapping is 1 and 2, 3 and 4, Fig. 5. In any case, the 240B or B2 amplifier and the 4038A network are always strapped the same as the 240A or A2 amplifier. The potentiometers on the 4039A network, Fig. 6, attached to the 469A apparatus case are factory set for maximum resistance. Recheck this setting prior to inserting the amplifiers into the apparatus case.

The 240A2, B2, and C2 amplifiers are provided with gain steps of 12, 16, and 20 db, as shown in the following table:

GAIN-DB	OPTION
12	X, Y
16	X
20	None

Note: It is assumed that the 469A apparatus case is installed per Section 632-520-210 before starting this procedure.

APPARATUS:	
2J Repeater Test Set, J94002J	
KS-14510, Volt-Ohm-Milliammeter, or equivalent (VOM)	
KS-15538 Carrier Frequency Voltmeter and W20C Cord (CFVM)	
240C or C2 Switching Amplifier (for maintenance)	
P9E Switching Cord (for maintenance)	
P4AP Adapter Cord	
INSTALLATION	
STEP	PROCEDURE
1	<p>(a) One-way Amplification: Turn down two systems and, at the receiving office, install the noise control unit, the power bypass lead, and the correct span pad as specified on the circuit layout card. If 4038A networks are to be used in all even positions on lightly loaded routes or for service protection, only one system need be turned down at a time.</p> <p>Warning: Initially, these circuits have dc voltages present; therefore, for the sake of safety, remove associated fuses.</p> <p>(b) Two-way Amplification: Turn down one system and, at each receiving end of the cable section, install the noise control units, the power bypass lead, and the correct span pad, as specified on the circuit layout card. At the low-group transmitting end, install transmitting pad as specified on the job or work order.</p>
2	Remove 4038B networks from the positions within the cases that are associated with the turned-down systems.
3	Install a 240A or A2 amplifier in the odd-numbered position. Check that proper gain option is provided on A2 amplifiers and gain is marked on the face of the unit in the space designated DB_____.
4	Install a 240B or B2 amplifier in the even-numbered position. Check that proper gain option is provided on B2 amplifiers and gain is marked on the face of the unit in the space designated DB_____.
5	Adjust sending office, power feed, build-out resistance to the new value, as specified on the circuit layout card. For adjustment instructions, refer to Section 362-405-502.
	Power Adjustment for Electron Tube Repeater Line
6	Check the voltage at the repeater receiving power with the repeater powered. The present N carrier requirement of 140 ± 5 volts still holds.
	Note: If the repeater dc voltage before installation of either the pads or the amplifiers is 142 to 145 volts, it is unlikely that any build-out resistance adjustment will be required when the amplifiers are inserted.

STEP	PROCEDURE
	<p>Power Adjustments for Transistor-Repeater Line</p>
7	See that the proper current is being fed to the transistor repeater beyond the 240-type amplifier location, as specified in Section 362-410-515.
8	Adjust the potentiometer on the 4039A network that is associated with the apparatus case positions involved until the voltage, as measured across test points TP4 and TP5, is 2.5 volts dc, Fig. 7A. Figure 7B lists case positions associated with each 4039A section.
9	Allow approximately 20 minutes for the N system repeatered line to stabilize.
10	Check average carrier power output of each amplifier with the 2J repeater test set and the P4AP adapter cord.
11	To measure the output of a 240A or A2 amplifier, connect the 9-pin Cinch connector on the P4AP cord (with attached 2J repeater test set) to the J1 9-pin connector located on the front plate of the next higher even-numbered (240B or B2) amplifier position, Fig. 8. The 2J repeater test set should be set on E-W.
12	Compare the reading obtained with the computed values specified on the circuit layout card.
13	<p>Record this result, if it is within ± 1.5 db of the computed value, on the front plate of the 240A or A2 amplifier in the odd-numbered position.</p> <p><i>Note:</i> This value will be used, if necessary, as a reference for future trouble shooting purposes. If the computed total power measurement is below the -5 minimum reading on the 2J repeater test set, the CFVM should be used as in Step 14, otherwise proceed to Step 16.</p>
14	<p>Connect CFVM using the P4A adapter cord and W20C cord, to the appropriate amplifier, and set the CFVM input switch to E-W OUT, Fig. 9.</p> <p>On N1 and N2 systems equipped with channels 1 through 12, measure the carrier frequency output of channels 1, 7, and 12. On N1 and N2 systems equipped with channels 2 through 13, measure the carrier frequency output of channels 2, 7, and 13. On ON2 or N3 systems, measure the carrier frequency output of carriers 1, 6, and 12.</p>
15	Record and compare the readings obtained in Step 14 with the values on the circuit layout card. These readings should be within ± 1.5 db of the computed value.
16	Repeat Steps 9 through 13 for the 240B or B2 amplifier. In this case, the test set connections will be to the 240A or A2 amplifier in the next lower odd-numbered position.
17	<p>Complete Steps 1 through 13 for all other positions within the cabinet.</p> <p><i>Note:</i> Figures 3B and 7B show the position pairing that exists in the 469A apparatus case and the test position on the 4039A network associated with the position pairs.</p> <p>If an odd number of one-way systems has been wired into the apparatus case, install a 240A or A2 amplifier and 4038A network in the last odd and even positions, respectively. All other tests are the same, except that the gain of the 4038A network is not measured.</p>

MAINTENANCE	
STEP	PROCEDURE
1	<p>For a reported system trouble involving a 240-type amplifier, establish that an amplifier is actually involved by measuring total carrier output at the N or ON repeater preceding the amplifier location and also by checking office dc power circuits to ascertain that dc power is being fed to the amplifiers. Next, measure the total average carrier output at the J1 test connector (9-pin Cinch) located on the front panel of the amplifier that is paired with the suspected unit with the 2J repeater test set and P4AP adapter cord, Fig. 8. For a defective unit, the level measured will not agree with the recorded reading on the front plate of the suspected unit. For an amplifier the initial levels of which were measured using the CFVM, repeat the measurement at the carrier frequencies indicated, Fig. 9.</p>
2	<p>Remove the defective amplifier by connecting the P9E switching cord to jack J1 on the 240C or C2 switching amplifier located in position 25 of the 469A apparatus case and connecting the other end of the P9E cord to the amplifier paired with the defective unit, Fig. 10. Observe the following notes.</p> <p><i>Note 1:</i> To switch an amplifier in an odd-numbered position in the 469A apparatus case, connect the P4AP adapter cord or the P9E switching cord to jack J1 (9-pin Cinch connector) on the amplifier or network in the next higher numbered position.</p> <p><i>Note 2:</i> To switch an amplifier in an even-numbered position in the 469A apparatus case, connect the P4AP adapter cord or the P9E switching cord to jack J1 (9-pin Cinch connector) on the amplifier or network in the next lower numbered position.</p>
3	<p>Using the VOM, measure across test points TP4 and TP5 section 13 on the 4039A network. Adjust the potentiometer at section 13 for a reading of 2.5 volts across the test points TP4 and TP5.</p>
4	<p>Remove the defective unit, Fig. 11, and replace it with a good unit. Check that the gain strap is applied correctly on 240A2 and 240B2 amplifiers.</p> <p><i>Note:</i> If the amplifier is installed in a pair connected to a +130 volt power supply, change the strap option on the replacing unit prior to installation.</p>
5	<p>Maintenance procedures to be followed upon failure of systems or of directions of transmission with 240-type amplifiers powered in series are as follows:</p> <p>(a) One-way Amplification: If the system failure involves two systems that have amplifiers paired within the apparatus case, measure first across test points TP4 and TP5 on the 4039A section associated with the pair of case positions in difficulty. If there is no voltage present, an open in the dc power circuit through the two amplifiers is indicated.</p> <p>(b) Two-way Amplification: If the system failure involves both directions of transmission, measure across test points TP4 and TP5 on the 4039A section associated with the case position in difficulty. If there is no voltage present, an open in the dc power circuit through the two amplifiers is indicated.</p>

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STEP	PROCEDURE
6	Replace one amplifier at a time per Step 2, rechecking after each replacement until the voltage across the test points has been re-established.
7	If replacement of the second unit re-establishes the circuit, return the first unit to its original position following the switching procedure as specified in Step 2.
8	If Steps 6 and 7 do not restore the system, check the dc continuity through the 4039A network by first removing one of the two amplifiers involved and then measuring the resistance of the potentiometer and test point resistor associated with the case positions involved.
9	If the potentiometer is open, replace it with a new potentiometer.

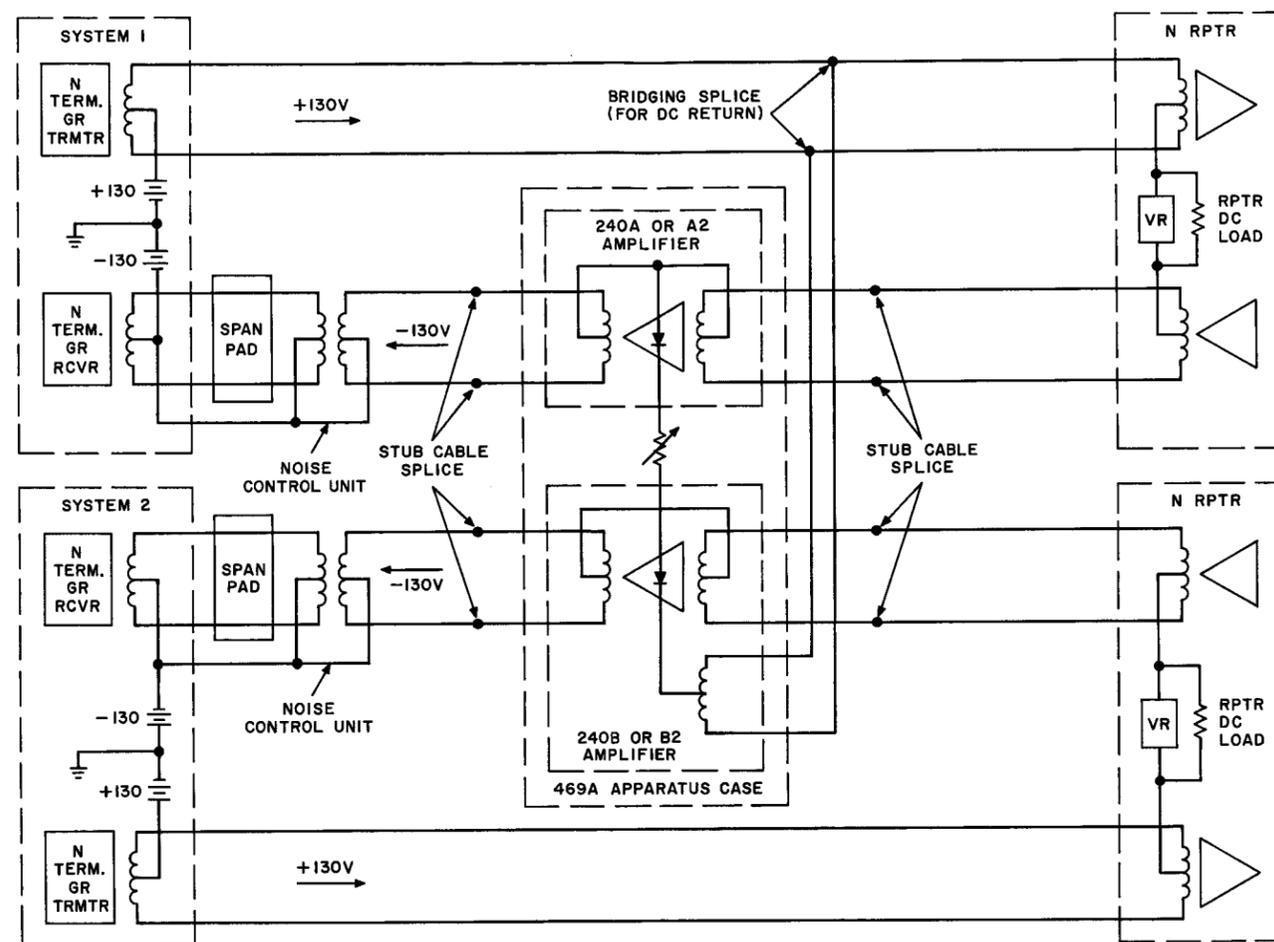
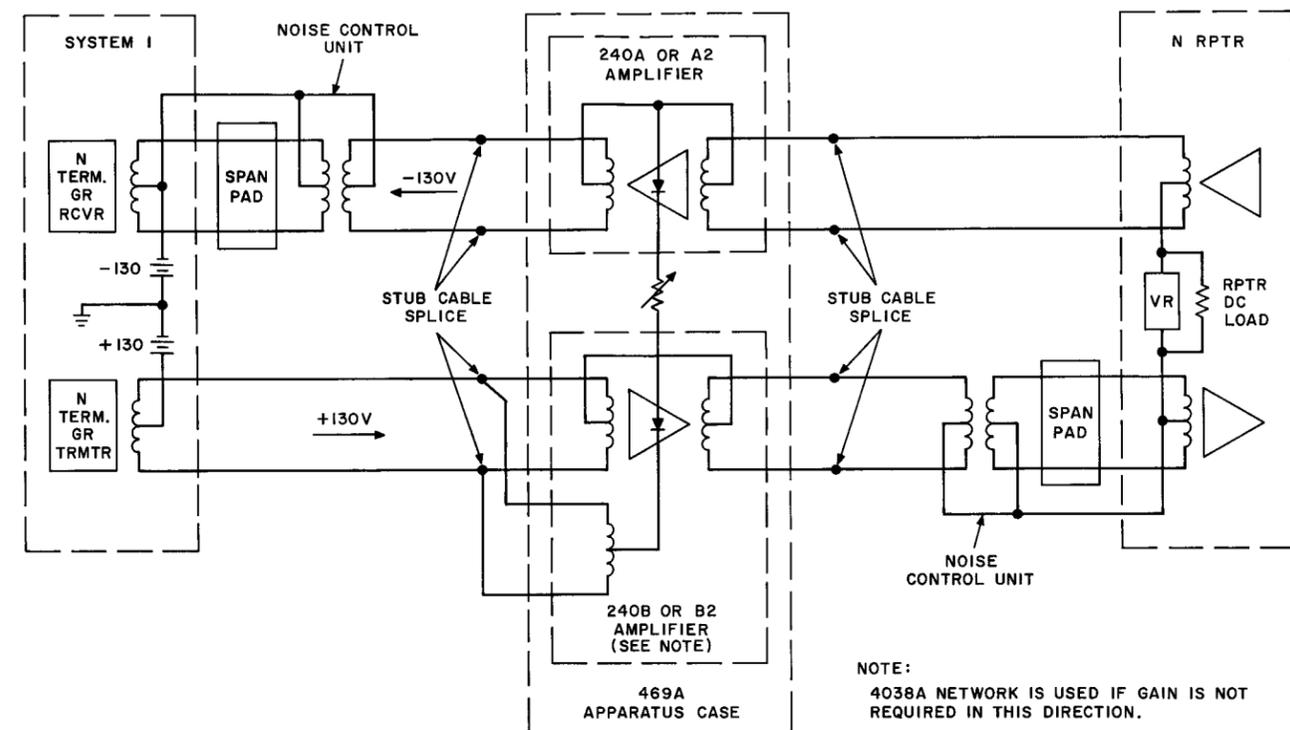


Fig. 1 — Typical One-Way Installation



NOTE:
4038A NETWORK IS USED IF GAIN IS NOT
REQUIRED IN THIS DIRECTION.

Fig. 2 — Typical Two-Way Installation

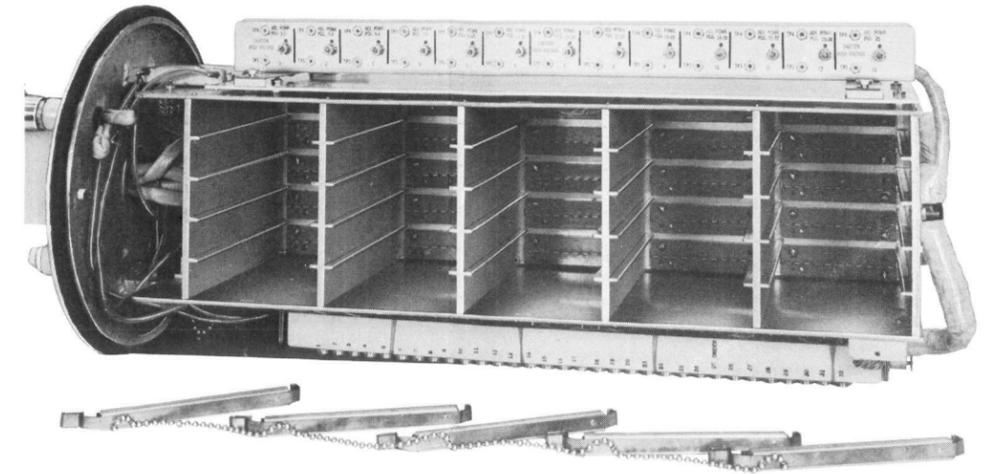


Fig. 3A — 469A Apparatus Case

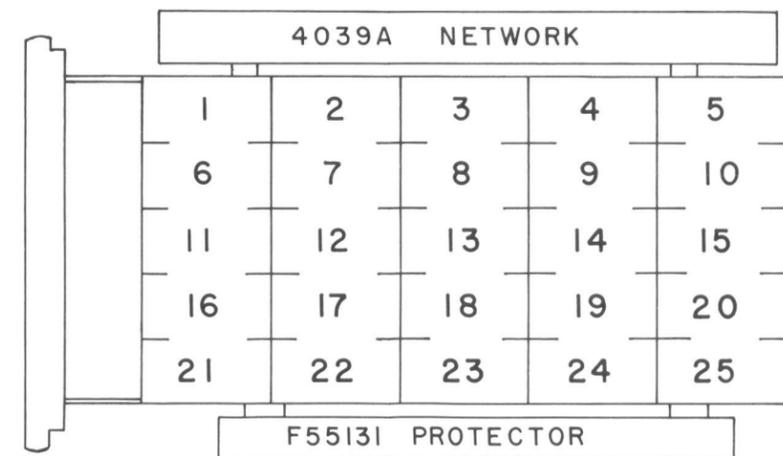


Fig. 3B — 469A Apparatus Case Positions

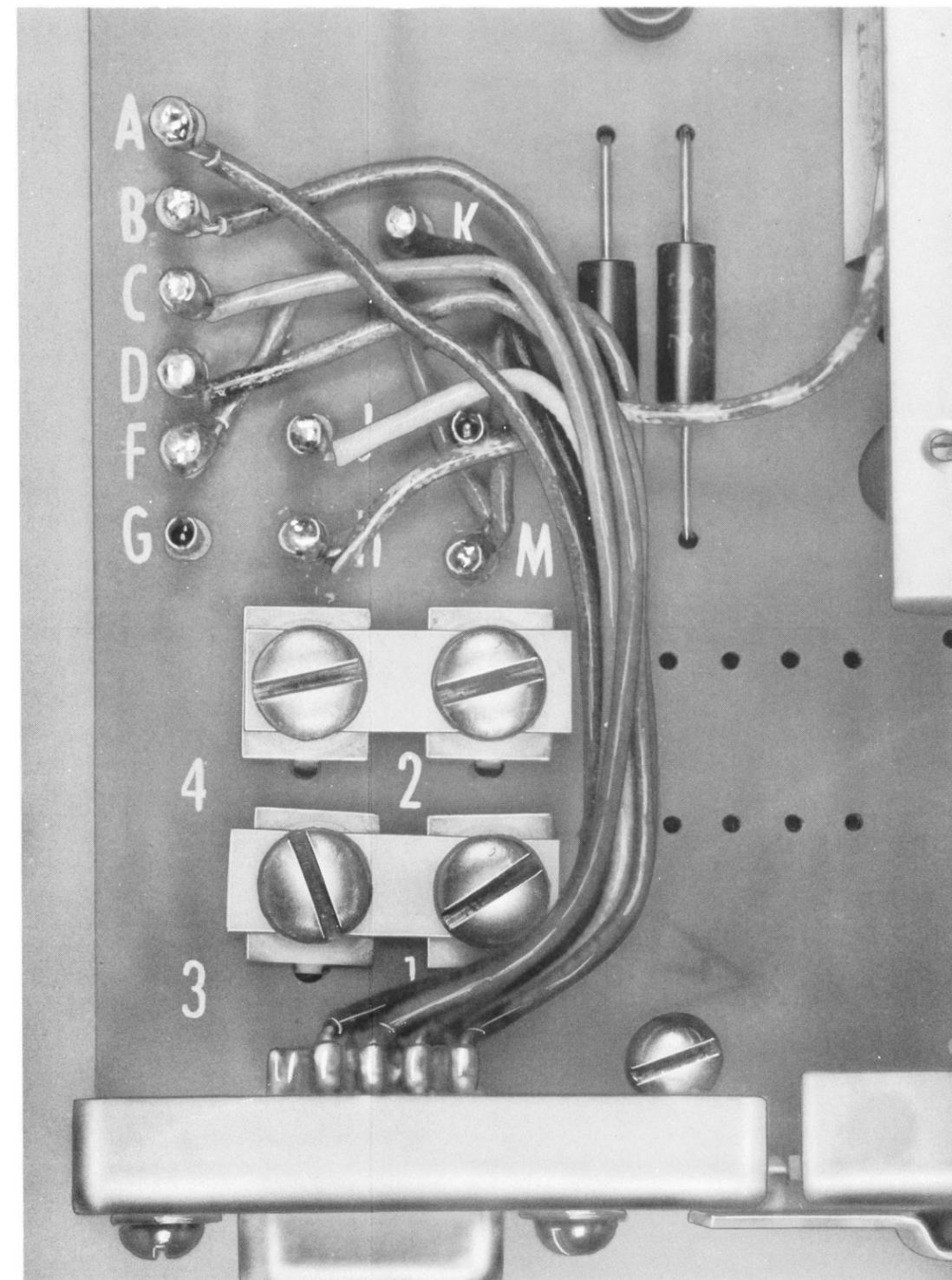


Fig. 4 — Strapping for —130 Volt Carrier Line

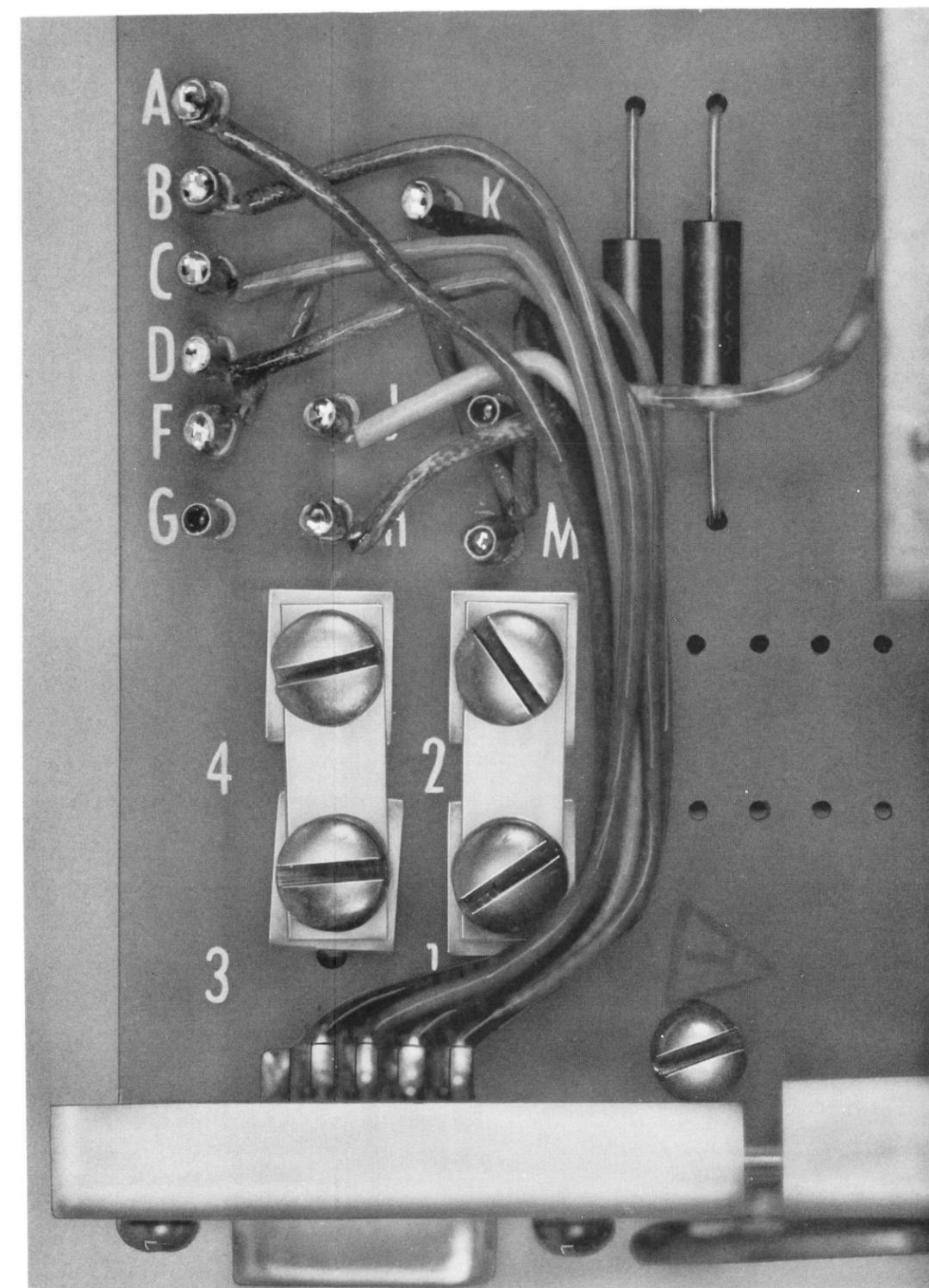


Fig. 5 — Strapping for +130 Volt Carrier Line

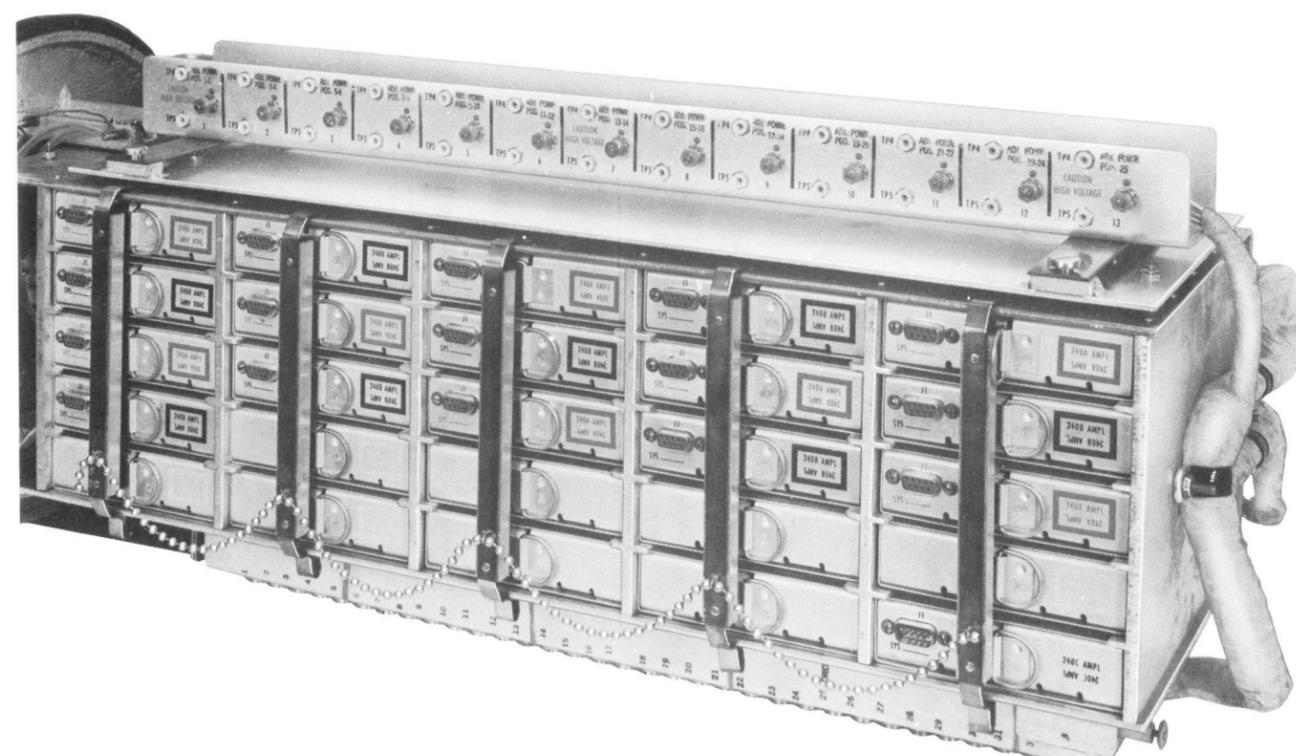


Fig. 6 — 4039A Network on 469A Apparatus Case

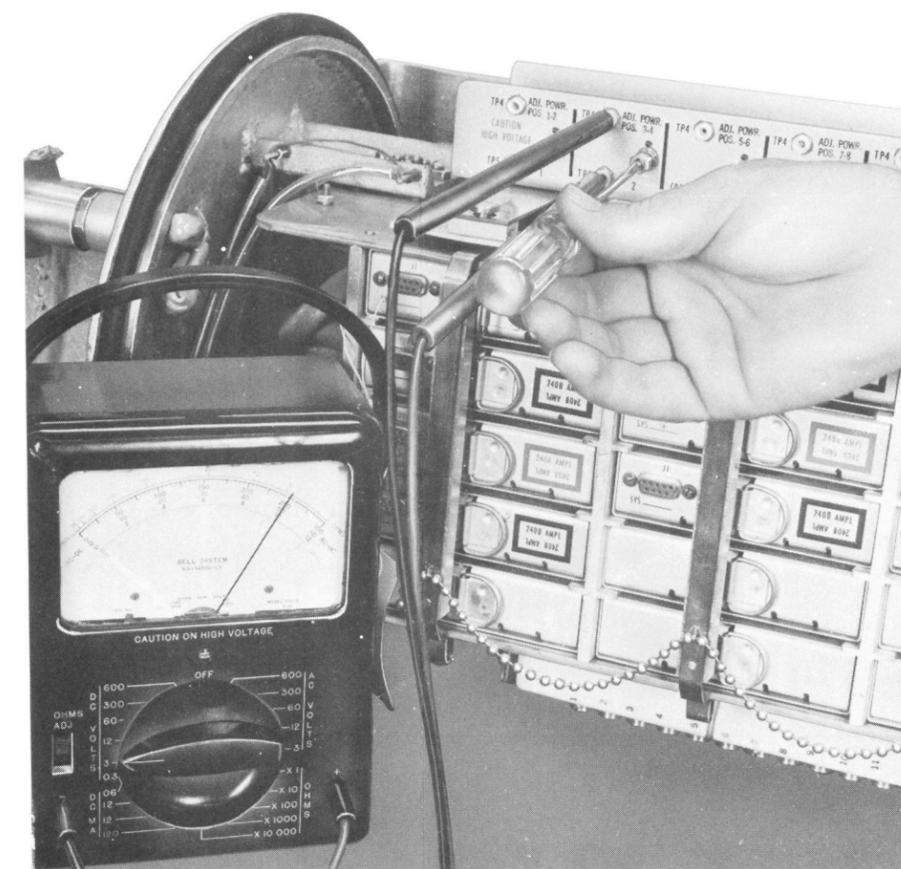


Fig. 7A — Adjusting Potentiometers on the 4039A Network for 2.5 Volts at TP4 and TP5 Section 2

CASE POSITIONS	4039A SECTIONS
1 & 2	1
3 & 4	2
5 & 6	3
7 & 8	4
9 & 10	5
11 & 12	6
13 & 14	7
15 & 16	8
17 & 18	9
19 & 20	10
21 & 22	11
23 & 24	12
25	13

Fig. 7B — Case Positions and Associated 4039A Network Sections

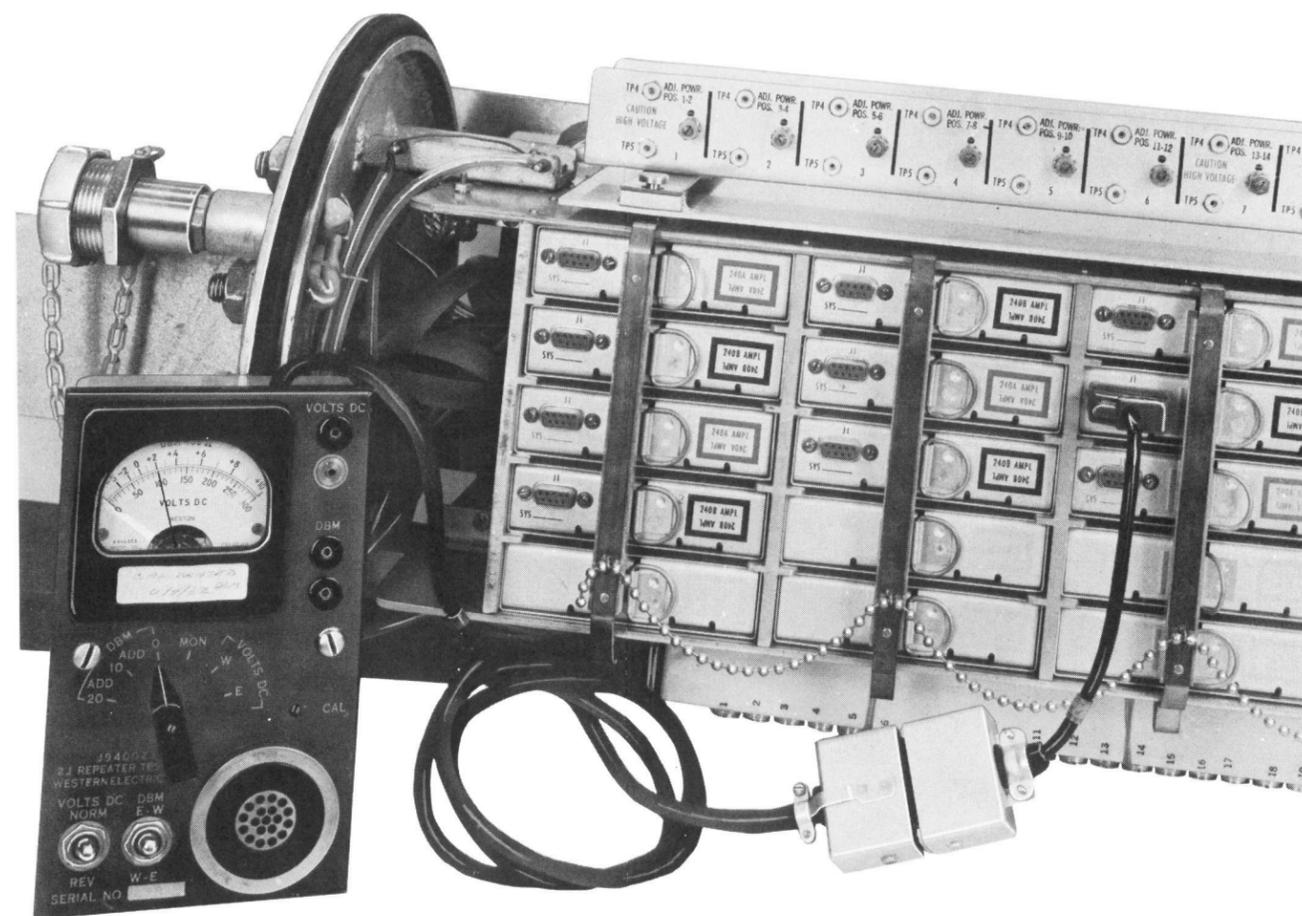


Fig. 8 — Measuring Average Carrier Output of 240A or A2 Amplifier, Using 2J Repeater Test Set

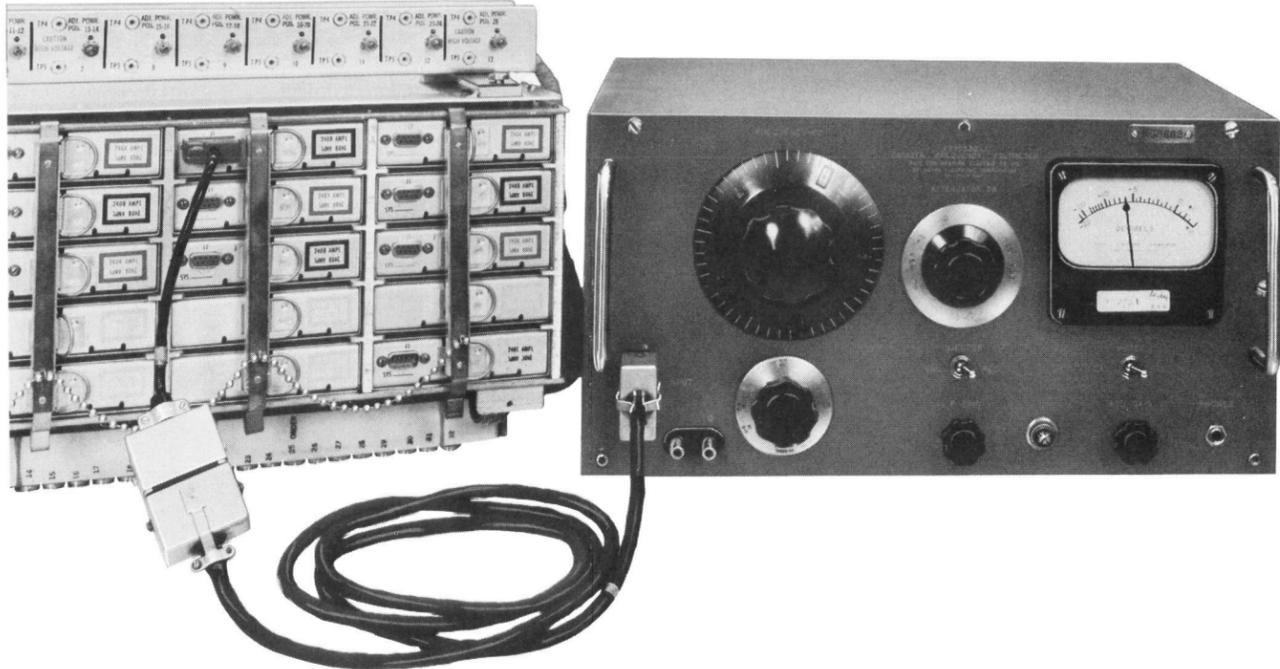


Fig. 9 — Measuring Single-Frequency Carrier Output with KS-15538 Carrier Frequency Voltmeter

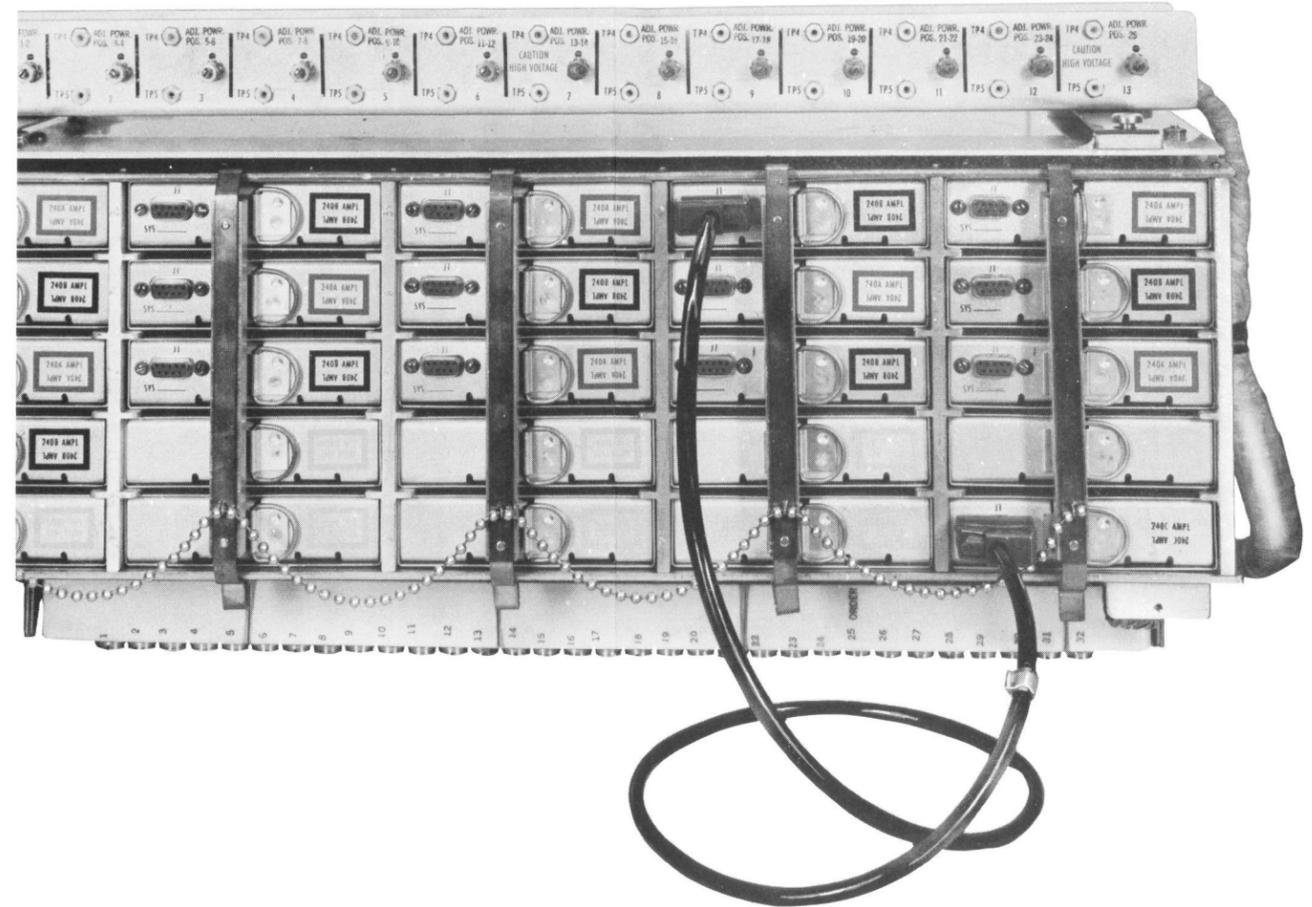


Fig. 10—Replacing a 240A or A2 Amplifier—
Bridged Condition

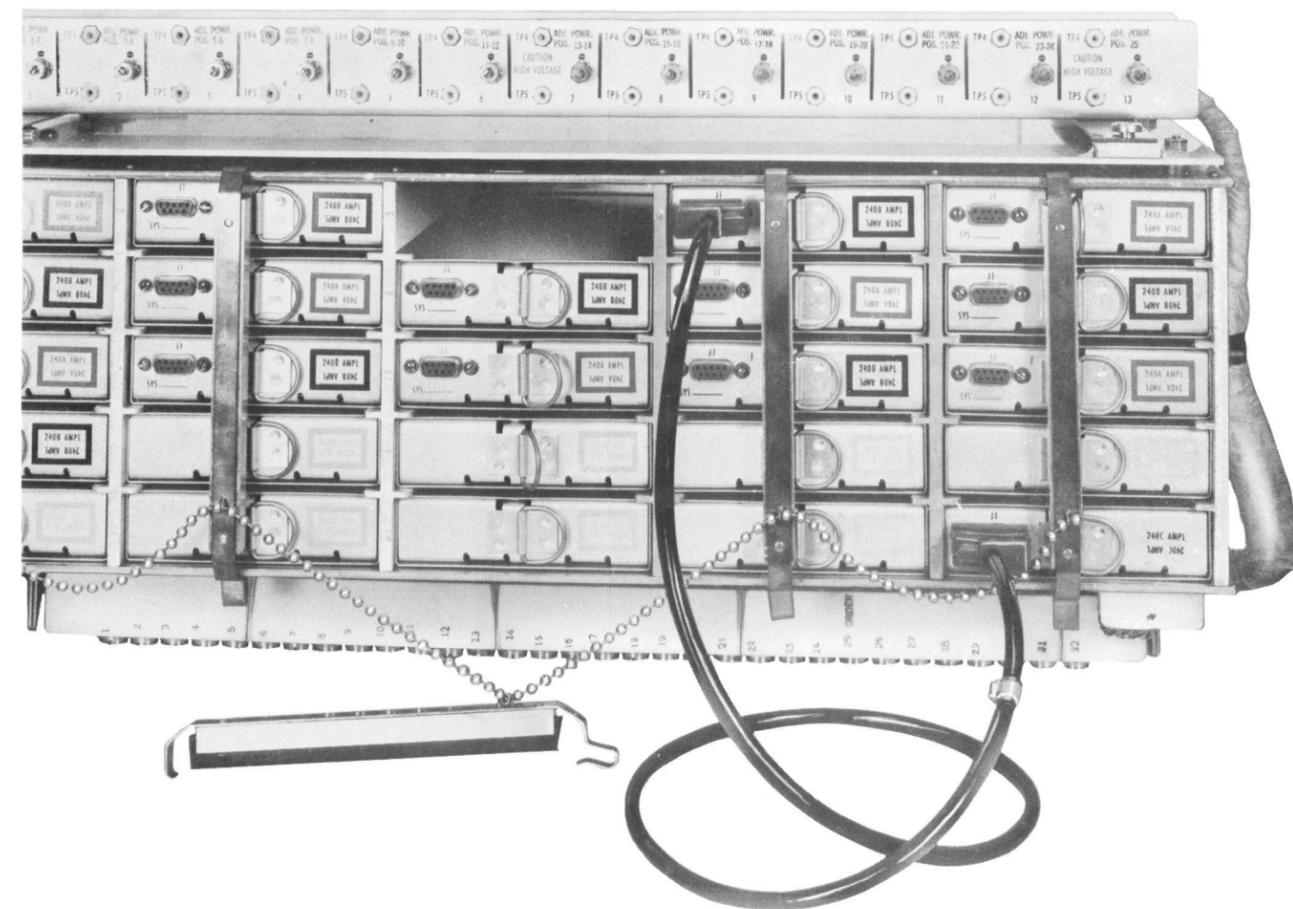


Fig. 11 — Replacing a 240A or A2 Amplifier — Defective Amplifier Removed