TELEPHOTOGRAPHY — STATION EQUIPMENT
LINE-UP OF ONE-WAY LOCAL CHANNELS AND EQUIPMENT AT SUBSCRIBER LOCATIONS

CONTENTS PAGE

1. GENERAL

1.01 This issue replaces issue 1, dated December 1957 and Addendum, issue 1, dated May, 1959.

1.02 This section describes the transmission tests which should be made on the telephotograph station equipment designed for one-way service. This section also describes the transmission measurements which should be made on the local channel and the method of equalizing the channel to make the loss-frequency characteristics meet the prescribed limits.

1.03 This section is issued to specify the limits within which the loss-frequency characteristics of the customer's receiving local channel should be equalized. The same requirements apply to a transmitting local channel in cases where the equipment arrangements described in this section are used for transmitting as well as for receiving. Information is included which provides for a temporary adjustment of the level at the input to the receiving channel when, because an equalizer is not immediately available, the level at the customer's station would be inadequate at the picture carrier frequency.

1.04 The illustrations in this section contain references to several figures. These figures and the circuit schematics illustrated herein are shown on Long Lines Drawing SM-10458-SD. The figure numbers used herein will not be the same as the figure number on the drawing, however. If this drawing is not available locally it can be obtained upon request from:

American Telephone and Telegraph Co.
Long Lines Department
Assistant Director of Operations — Engineering
32 Avenue of the Americas
New York 13, New York

2. PRELIMINARY TESTS ON LOCAL CHANNEL AND STATION EQUIPMENT

2.01 The following tests should be made before proceeding with more detailed measurements.

Caution: The station equipment includes repeating coils which can be damaged through the application of direct current or excessive alternating current to the coil windings, causing core magnetization. Common dc buzzers must not be used for making continuity tests.

2.02 Inspect the wiring at the customer's location for neatness and adequacy of protection against damage. This includes the wiring between the channel terminals and the 105-type

Copyright, 1957, by American Telephone and Telegraph Company
Printed in U. S. A.

apparatus box (or boxes) and that between the apparatus box and the subset.

2.03 Measure the 1000-cycle loss of the channel from the LP EQ jacks at the telephoto bay (or the equivalent if there is no telephoto bay) to the terminals of the channel pair on the customer's premises. For these measurements the wiring between the local channel terminals on the customer's premises and the terminating arrangements should be disconnected. The loss measured should agree with the sum of the circuit layout card losses for the equipment and local channel within ±3 db. Deviations outside of this limit should be investigated since they may be indications of cable trouble. Bridged taps, incorrect repeating coil ratios or loading irregularities may also be indicated.

2.04 Make ringing tests, if this type of service is provided. To make this test, send 1000-cycle ringing current, at the proper level, into the 1000 x 20 ringer at the central office serving the customer. If the signaling is not satisfactory, test for continuity of the signaling path and make adjustments of the equipment at the central office or at the customer's station, as required, to obtain satisfactory ringing. In performing these tests use care that working services are in no way affected.

2.05 Where the 15D key telephone unit is provided instead of the 687A-3 or equivalent subset, check for proper operation of the relay when receiving ringing current.

3. TESTS ON STATION EQUIPMENT

(A) Equipment Arrangements

3.01 Fig. 1A shows typical equipment units used at the customer's premises for a single, receiving only, local channel telephoto termination. Fig. 1B indicates typical monitoring arrangements that may be provided as part of the terminating equipment. Fig. 1C shows a cutoff or transfer key circuit which may be used to provide a 600-ohm resistive termination in place of the telephoto machine.

3.02 Fig. 2 shows typical equipment used at customer's premises when the local telephoto channel termination is used to provide secondary local channels that feed two telephoto receiving machines located at different places. For simplicity the local monitoring equipment, the cutoff or transfer key equipment, the 15D key telephone unit that may be associated with each local secondary channel and the connection of conductor shields is not shown in Fig. 2.

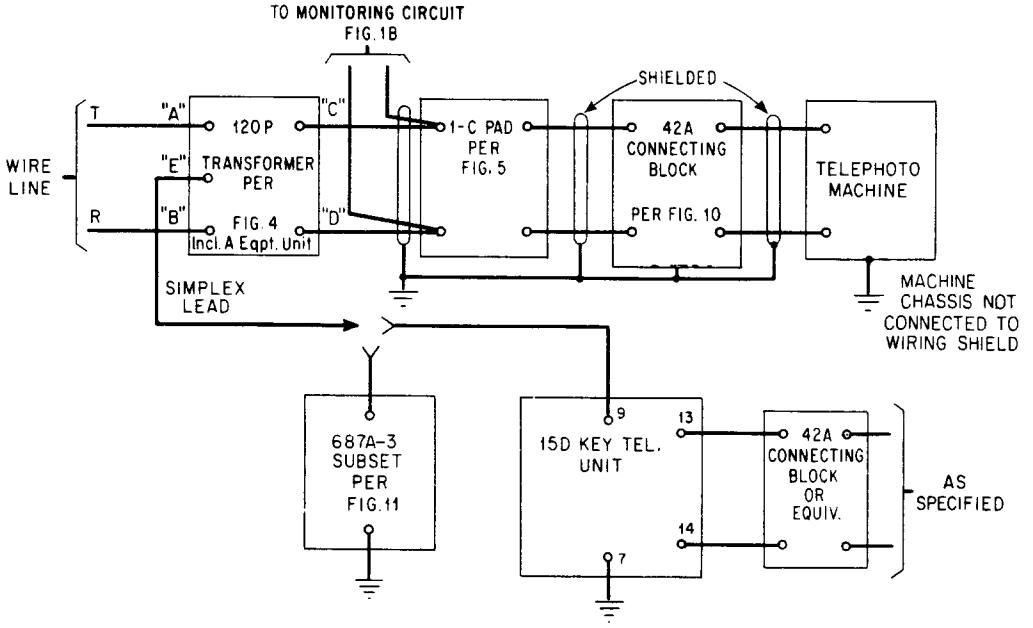

Fig. 1A — Single Station Receiving

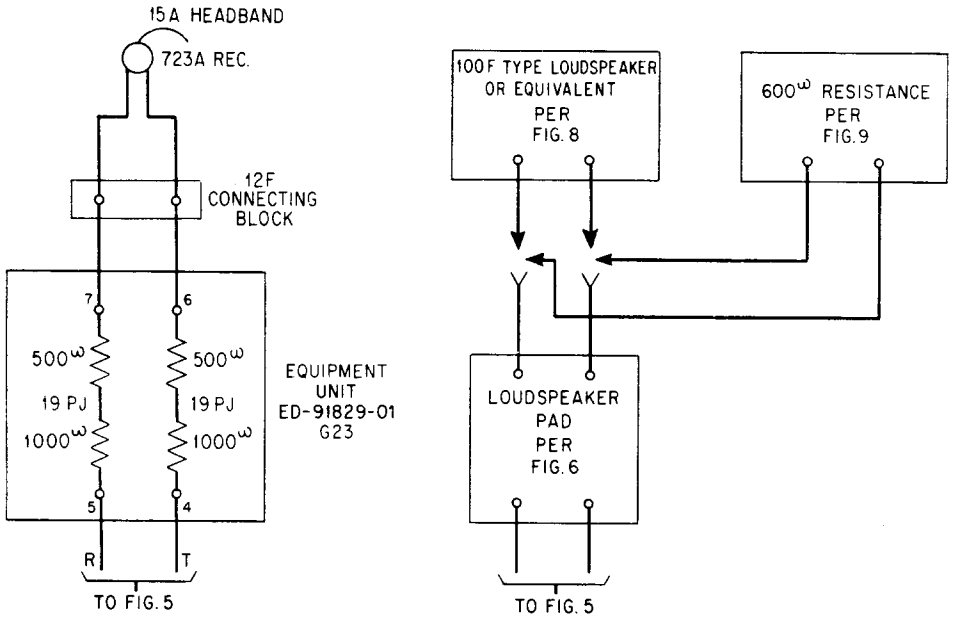

Fig. 1B — Monitoring Circuits

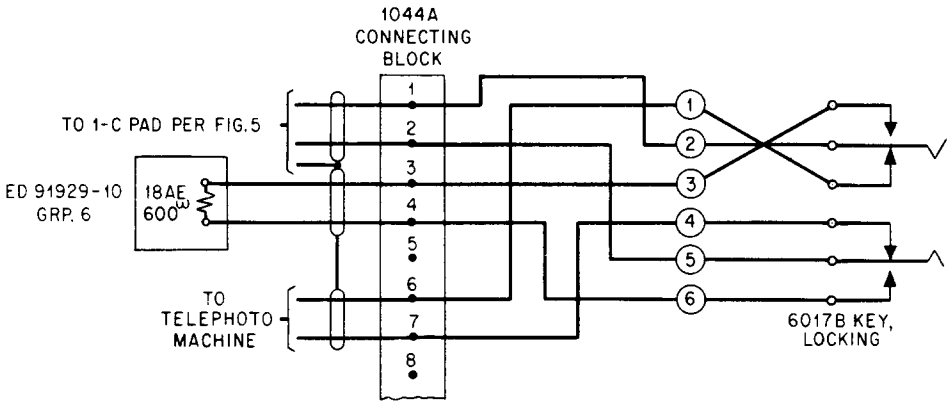

Fig. 1C — Cutoff or Transfer Key

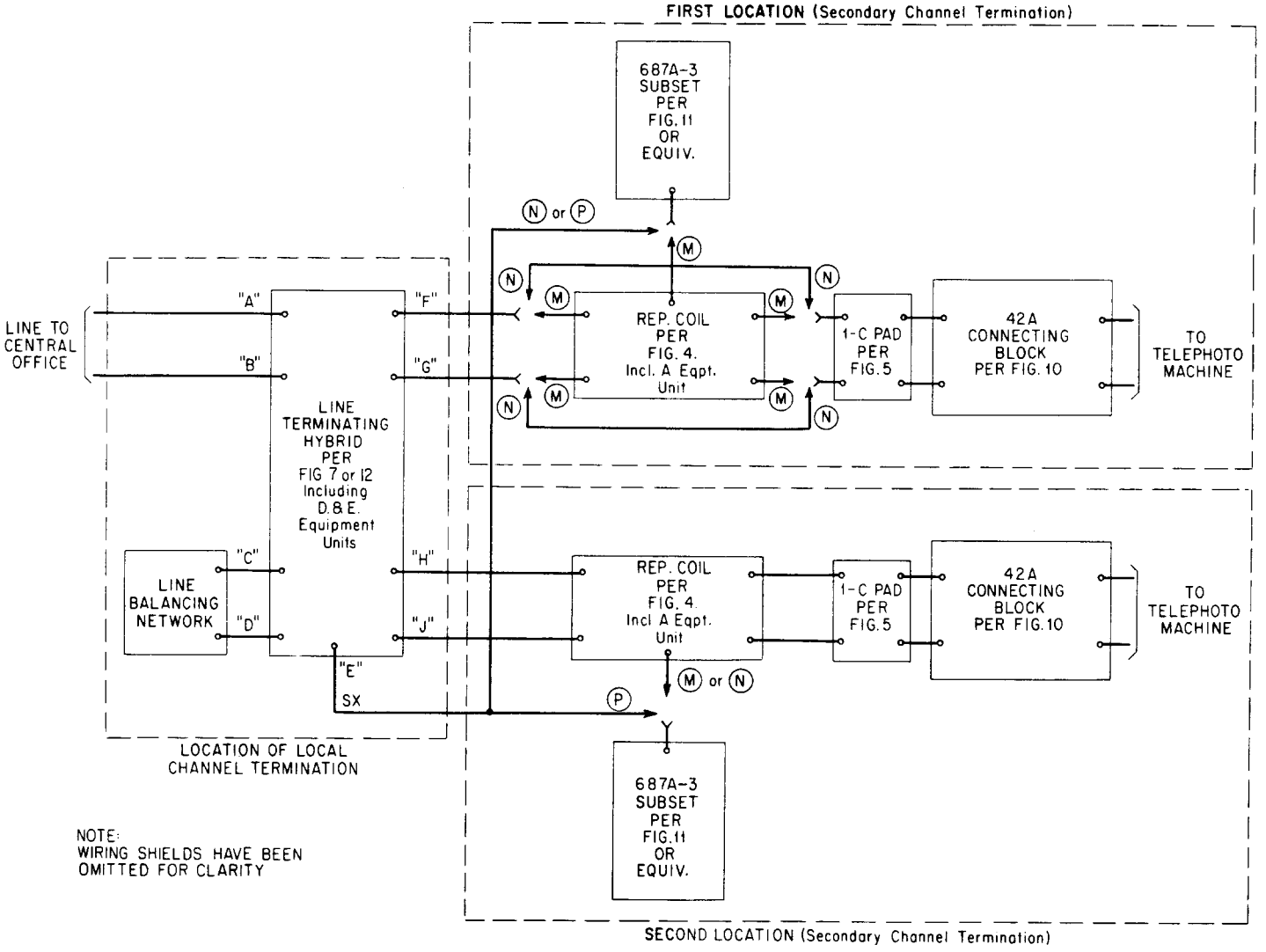

Fig. 2 — Termination for Two Secondary Channels

3.03 Simplified schematics of options M, N, and P are shown in Fig. 3.

3.04 Option M wiring is used where the Fig. 7 equipment is remote from the telephotograph machines. Option N is used when the two machines are in different locations and the Fig. 7 equipment is located near one of them. Option P is used for signaling to the two locations when separate dc pairs are provided between the Fig. 7 equipment and the subsets or other signaling equipment located near the telephoto machines.

3.05 Separate dc pairs are usually required for signaling when the ac ground potentials at the secondary channel terminations are appreciably different. If the separate signaling pairs are not used, picture impairment may result.

3.06 The line repeating coil for a single receiving machine is shown in Fig. 4. It is usually mounted in a 105-type apparatus box together with the equipment shown in Figs. 5 and 6.

3.07 A station receiving pad is shown schematically in Fig. 5. This pad consists of an equipment unit per ED-91929-01 with unit assembly P-265190 drilled for and equipped with a 1C pad in position 12, wired per ED-69101-01. An 89-type resistor of suitable value is required with the 1C pad to provide the proper transmission loss.

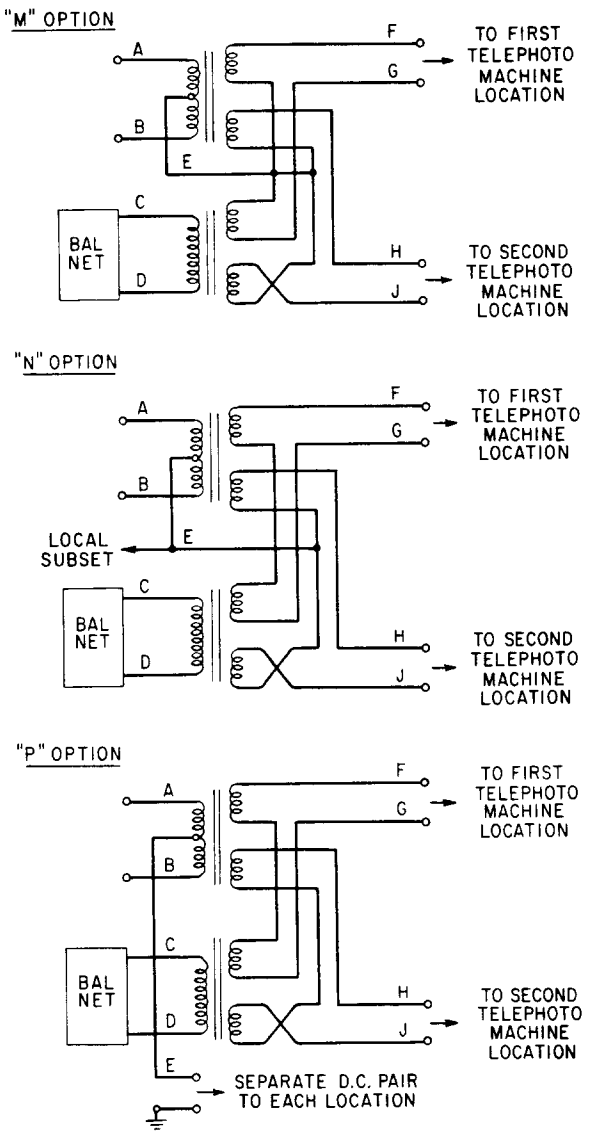

Fig. 3 — Signaling Schematics for Fig. 7 Equipment

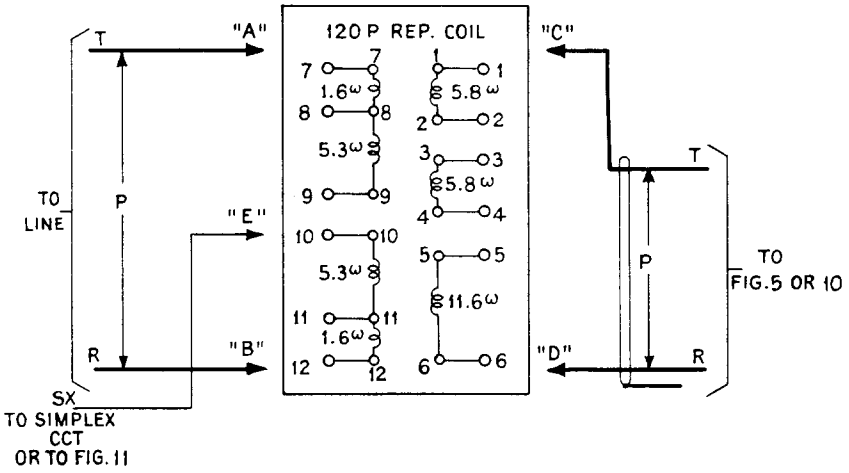

Fig. 4 — Line Repeating Coil

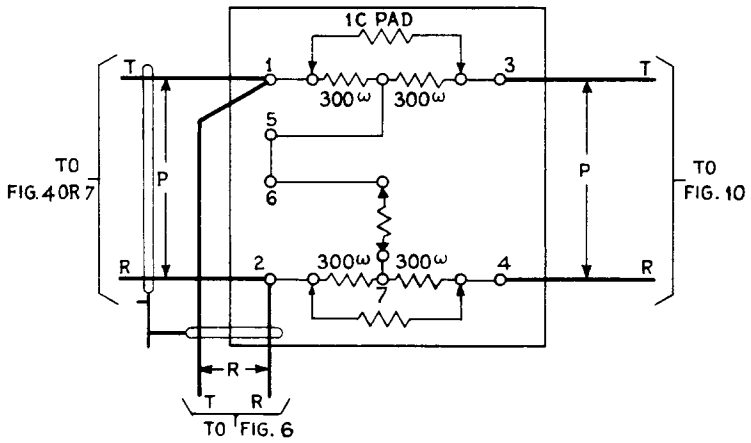

Fig. 5 — Station Receiving Pad with 89-Type Resistor

3.08 The monitoring pad is shown in Fig. 6. The pad consists of three 18-type resistors mounted in positions 1, 8, and 15 of an equipment unit per ED-91929-01, unit assembly P-265190.

3.09 A hybrid coil arrangement is required where two machines are to be connected to one receiving channel. This hybrid arrangement is shown in Fig. 7. The upper repeating coil in the figure is referred to as the "D Equipment" and the lower coil is referred to as the "E Equipment." The line impedance is balanced through the use of balance networks and building-out capacity.

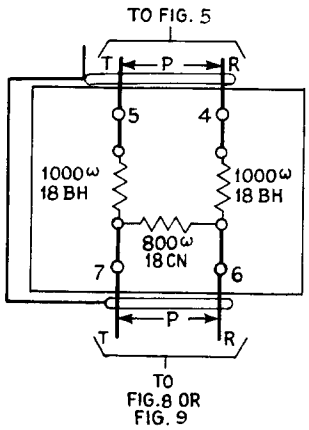

Fig. 6 — Monitoring Pad

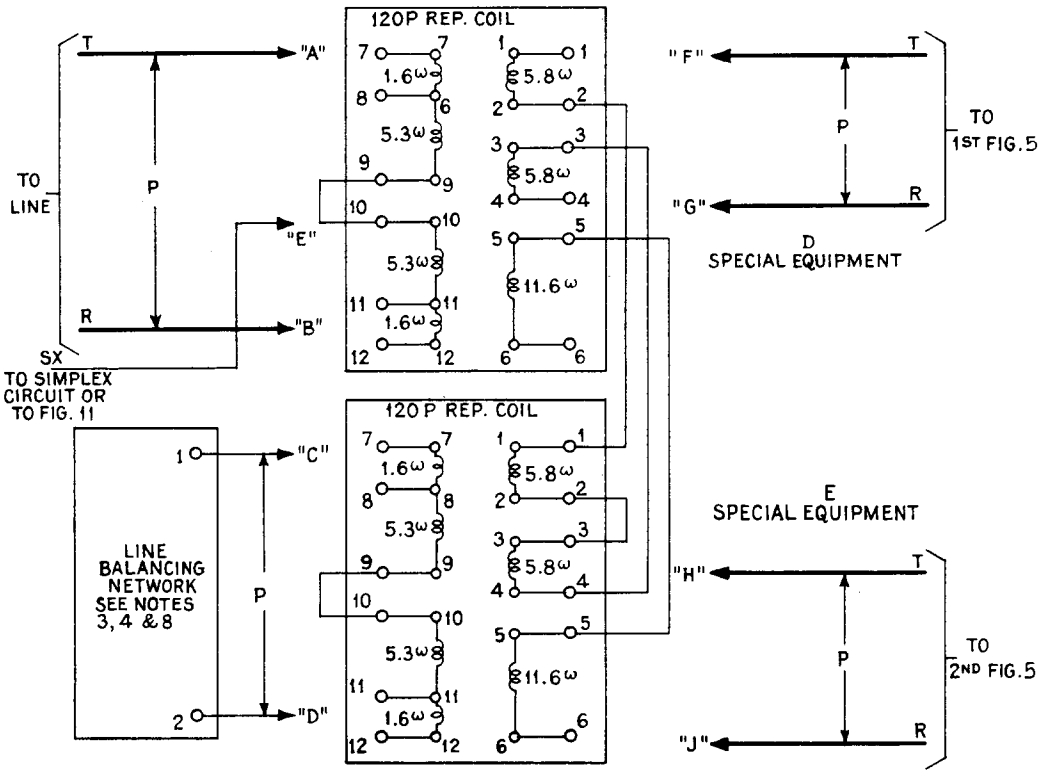

Fig. 7 — Hybrid Arrangement

3.10 The loudspeaker set is represented in Fig. 8. This set may be switched out of the circuit by a cutoff key (Fig. 1C) and a 600-ohm resistor connected in its place. This resistor is shown in Fig. 9.

3.11 The Telephone Company circuit usually terminates at a connecting block; the subscriber wires from the block to the telephotograph machine. This connecting block is shown in Fig. 10. The station subset is shown in Fig. 11.

3.12 Where the local facilities consist of non-loaded cable, open wire or where the hybrid is fed from a preceding hybrid circuit then 120N repeating coils are used in the hybrid circuit. This circuit is shown in Fig. 12. The upper coil on the drawing is referred to as the "F Equipment" and the lower coil is referred to as the "G Equipment."

3.13 The line and drop leads of Fig. 7 are connected in accordance with Table 1. The M, N, and P options apply only to the simplex signaling circuit. These options are explained in Paragraph 3.04.

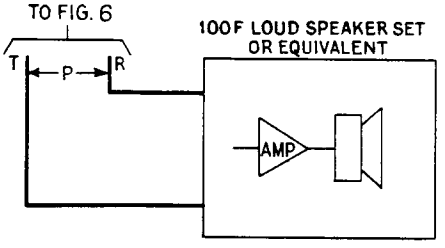

Fig. 8

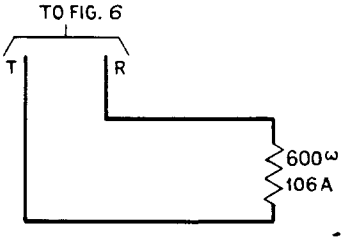

Fig. 9

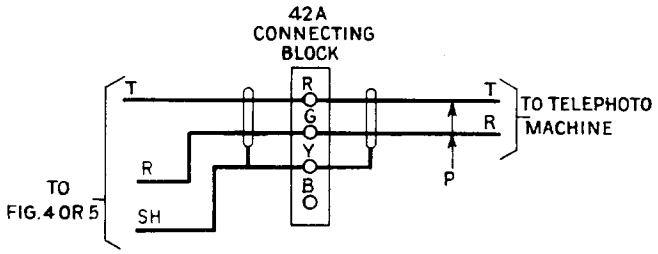

Fig. 10 — Connecting Block

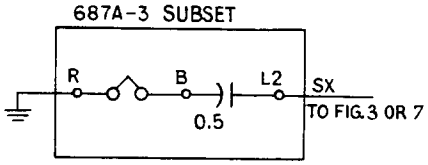

Fig. 11 — Subset

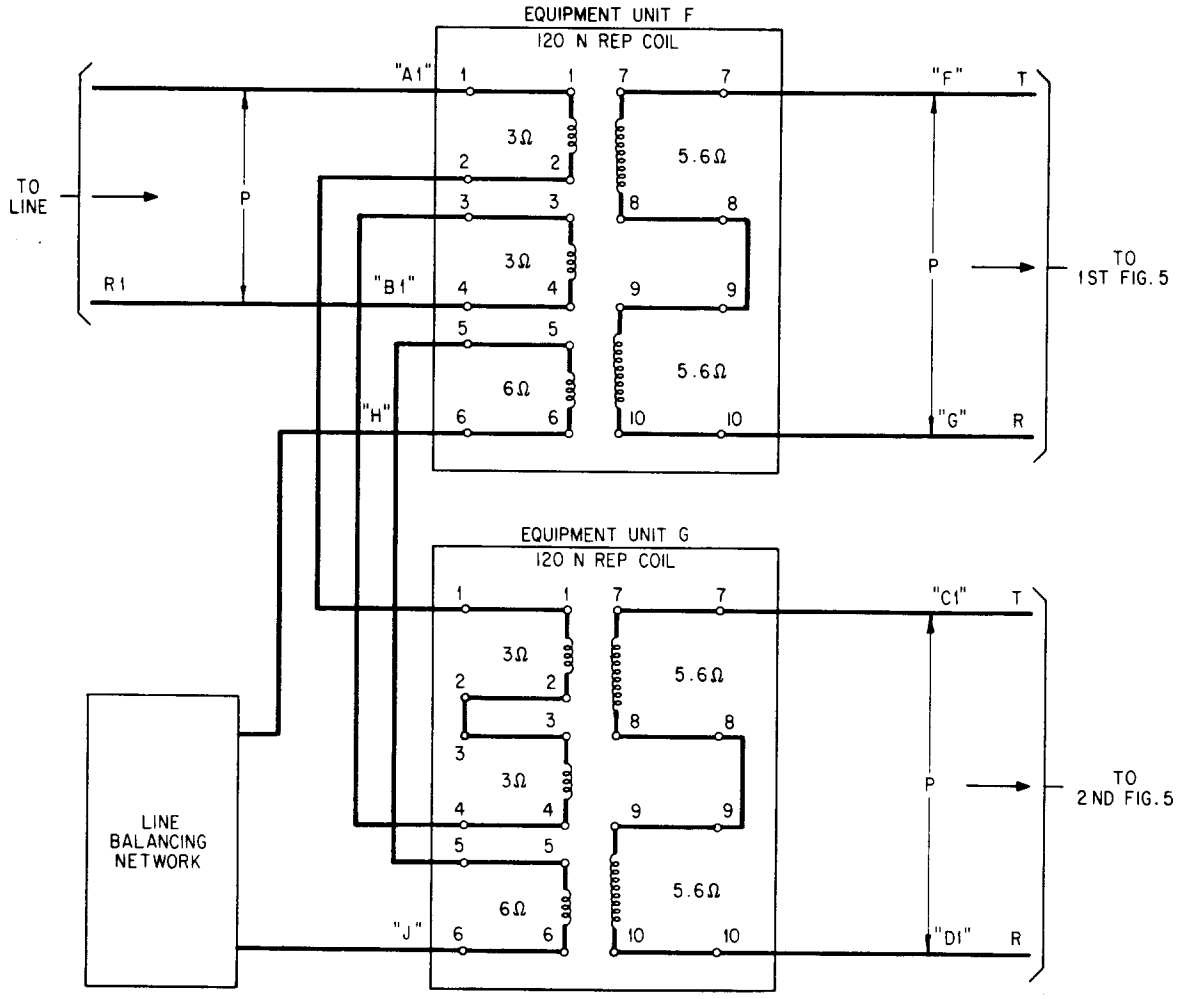

Fig. 12 — Hybrid Circuit

TABLE 1

CONNECTIONS TO HYBRID CIRCUIT

120 P REPEATING COILS

IMPEDANCE RATIO LINE:DROP	CONNECT LEAD										
					E1						
	A1	B1	C1	D1	OPTION M	OPTION N	OPTION P	F	G	H	J
900:600 (1:0.67)	D1	D4	E7	E12	E2, E3, E9, E10, D9, D10	E2, E3, E9, E10	E2, E3	D7	D12	D6	E6
1500:600 (1:0.40)	D1	D4	E8	E11	E2, E3, E9, E10, D9, D10	E2, E3, E9, E10	E2, E3	D8	D11	D6	E6
240:600 (1:2.5)	D8	D11	D6	E6	D9, D10, D5, E5, E2, E3	D9, D10, D5, E5	D9, D10	D1	D4	E8	E11 ←

Note: The letter (D or E) designate the repeating coil and the numbers refer to terminals on the coil.

3.14 The line and drop leads of Fig. 12 are connected in accordance with Table 2.

TABLE 2

CONNECTIONS TO HYBRID CIRCUIT

120 N REPEATING COILS

IMPEDANCE RATIO LINE:DROP	CONNECT LEAD										
					E1						
	A1	B1	C1	D1	OPTION M	OPTION N	OPTION P	F	G	H	J
600:600 (1:1)	F1	F4	G7	G10	G2, G3, G8, G9, F8, F9	G2, G3, G8, G9	G2, G3	F7	F10	F6	G6

Note: The letters (F or G) designate the repeating coil and the numbers refer to terminals on the coil.

(B) 1000-Cycle Transmission Tests

3.15 The following items of test equipment are required:

1 — Portable Meter per KS-14510 or equivalent
1 — 89A Resistor
2 — 600-ohm Resistors, 106A or equivalent
1 — 19C Oscillator or equivalent (See note)
1 — 13A or 21A Transmission Measuring Set
4 — 1W13A Cords
8 — Clips per KS-6278

Note: The 21A TMS contains a suitable oscillator.

3.16 Table 3 shows the 1000-cycle losses which should be measured between 600-ohm

terminations with the various terminal equipment arrangements. When these tests are made the local cable facilities and the customer's machine should be disconnected from the station equipment. If the equipment tests good between the repeating coil line winding and the connecting block it is usually unnecessary to test the repeating coil separately. Refer to Fig. 13. This is a block diagram showing the major circuit parts and the paragraphs in this section which apply to testing these circuit parts. For example if the local facilities consist of H88 loaded cable pairs the proper impedance ratio is 1200:600; this information should appear on the circuit layout card. Testing from repeating coil terminals 1 and 4 to the connecting block terminals the loss (from Table 3) should be from 4.9 to 5.3 db if Fig. 4 and 5 equipment is used or 7.1 to 7.5 db if equipment per Figs. 4, 5, 6, and 8 or 9 is used. It should be noted that only one horizontal line in Table 3 will apply to a specific installation.

TABLE 3

EQUIPMENT LOSSES

IMPEDANCE RATIO LINE:DROP	REPEATING COIL TERMINALS LINE	REPEATING COIL TERMINALS DROP	STRAPPING OF COIL TERMINALS	EQUIPMENT FIGS. USED	1000-CYCLE LOSS, DB COIL ONLY MIN.	COIL ONLY MAX.	ALL EQPT. MIN.	ALL EQPT. MAX.
571:600	1-4	7-11	2-3, 9-10	4 & 5	0.2	0.4	5.8	6.2
571:600	1-4	7-11	2-3, 9-10	4, 5, 6 & 8 or 9	1.1	1.5	7.4	7.8
800:600	7-12	1-4	2-3, 9-10	4 & 5	0.2	0.4	6.6	7.0
800:600	7-12	1-4	2-3, 9-10	4, 5, 6 & 8 or 9	0.4	0.6	7.8	8.2
1800:600	1-6	7-12	2-3, 4-5, 9-10	4 & 5	1.3	1.7	4.7	5.1
1800:600	1-6	7-12	2-3, 4-5, 9-10	4, 5, 6 & 8 or 9	2.8	3.2	7.5	7.9
1200:600	1-4	7-12	2-3, 9-11	4 & 5	0.6	1.0	4.9	5.3
1200:600	1-4	7-12	2-3, 9-11	4, 5, 6 & 8 or 9	1.9	2.3	7.1	7.5
→ 200:600	7-12	1-6	2-3, 4-5, 9-10	4 & 5	1.3	1.7	4.7	5.1
→ 200:600	7-12	1-6	2-3, 4-5, 9-10	4, 5, 6 & 8 or 9	2.8	3.2	7.5	7.9
450:600	1-4	7-12	2-3, 9-10	4 & 5	0.2	0.4	6.5	7.1
450:600	1-4	7-12	2-3, 9-10	4, 5, 6 & 8 or 9	0.4	0.6	7.7	8.3

Note: When making tests between the line winding of the repeating coil and the connecting block, the 89A resistor should be inserted in the pad socket. When measuring only the coil loss the equipment per Figs. 5, 6, and 8 or 9 (when provided) should be disassociated from the drop side of the coil.

3.17 The 1000-cycle loss of the equipment shown in Fig. 12 should be 4.2 db minimum and 4.8 db maximum when measured between terminals F1-F4 and F7-F10 or between terminals F1-F4 and G7-G10. The same losses apply to Fig. 7 equipment when measured between the line connection and either drop connection.

(C) Balance Tests on Equipment

3.18 Measure the transhybrid loss of Fig. 7 or 12 equipment if provided. To do this terminate in 600 ohms the repeating coil terminals to which line leads "A1" and "B1" are connected, and similarly the terminals to which balancing network leads "H" and "J" are connected. Measure the 1000-cycle loss between the two pairs of terminals to which the two stations are normally connected. The loss measured should be 37 db or more.

3.19 Connect the line and the balancing network to the proper coil terminals and measure the loss between the same pairs of terminals as before at 500, 1000, 1500, 2000, and 2600 cycles. The loss obtained at any of these frequencies should be greater than 20 db, and the balancing network and building-out capacitor should be adjusted to give the highest

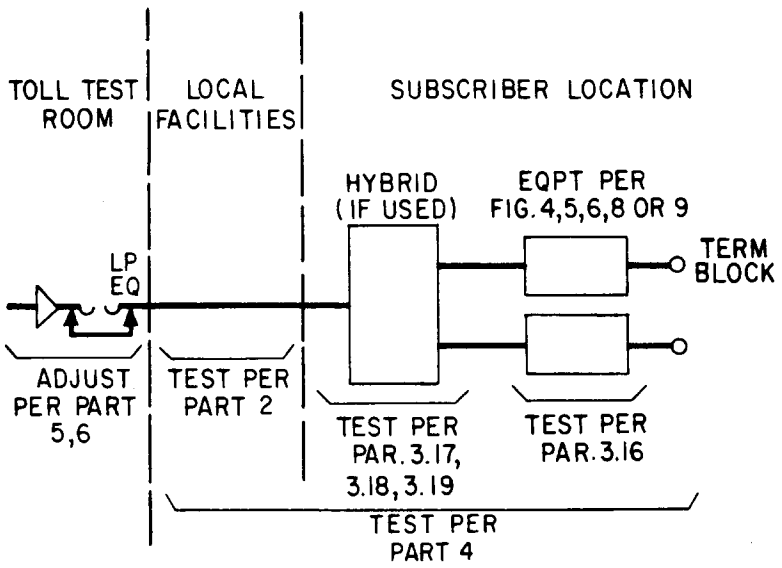

Fig. 13 — Tests Associated with a One-Way Circuit

over-all loss-frequency characteristic. If the minimum loss limit of 20 db can not be obtained the case should be referred along the lines of organization.

4. LOCAL CHANNEL MEASUREMENTS AND EQUALIZATION

4.01 Step 1 (Refer to Fig. 13)

(a) At the serving test room, send 1000 cycles at the level specified on the circuit layout card for the customer's location into the LP EQ jacks.

(b) At the customer's station disconnect the telephotograph machine from the 42A connecting block.

(c) Insert the specified 89-type resistor into the 1C pad socket.

(d) With the portable transmission measuring set attached to the terminals on the connecting block, read and record the level of the tone received from the test room. Using the specified pad value, this reading should be within ± 2.0 db of the prescribed customer receive level as indicated on the circuit layout card.

Note: Deviations from the customer's prescribed level within 2 db should be adjusted to the proper value by substituting an 89-type resistor that will result in the correct level.

4.02 Step 2

(a) Repeat Step 1, using the frequency of the customer's picture carrier. The difference between this reading and that of Step 1 indicates the amount of equalization required in the receiving amplifier or in the equalizer associated with it to give the same net loss at 1000 cycles and at the carrier frequency.

4.03 Step 3

(a) Repeat Steps 1 and 2 at frequencies of 2600 and 3000 cycles. The difference between these readings and that of Step 1 is the amount of equalization needed in the receiving amplifier or associated equalizer.

4.04 Step 4

(a) Make the adjustments of the amplifier equalizer, or other equalizing arrangements, indicated by the measurements of Steps 1, 2, and 3 as needed to give the desired deviation characteristic. Adjust the 1000-cycle

gain to that specified by the circuit layout card.

(b) Measure the receiving amplifier gain at the picture frequency. This should not exceed the 1000-cycle gain by more than 2 db. If the amount of equalization required at the picture frequency is such that the amplifier gain at this frequency would exceed the normal 1000-cycle gain by more than 2 db, the equalization should be limited to this amount and a report of the condition promptly forwarded to the engineering office responsible for the circuit order.

4.05 Step 5

(a) Measure the loss of the circuit at the frequencies listed in Table 4 below. The limits for the net-loss frequency deviations from the 1000-cycle value for the receiving channel or the transmitting channel (if this is involved) are as shown.

(b) When the circuit tests within the limits indicated restore all wiring to normal and verify that the customer is able to receive pictures satisfactorily.

TABLE 4

REQUIREMENTS FOR CUSTOMER'S LOCAL CHANNELS

NET LOSS-FREQUENCY DEVIATIONS

(Negative Sign Indicates Greater Loss than at 1000 Cycles)

FREQUENCY	DEVIATIONS FROM 1000-CYCLE NET LOSS (DB)
1000	0
→ 300	−6 to +1
→ 500	−3 to 0
1600	−0.5 to +0.5
1800	−0.5 to +0.5
2000	−0.6 to +0.6
2200	−0.7 to +0.7
2400	−0.7 to +0.7
2600	−1.0 to +1.0
2800	−1.0 to +1.0
3000	−2.0 to +2.0

5. TEMPORARY ADJUSTMENT OF LEVEL OF RECEIVING CHANNEL

5.01 If equipment for equalizing the receiving local channel is not available at the start of service, and the channel has such a high loss at 2000 cycles that the assigned 1000-cycle gain of the receiving channel amplifier at the toll test room is not great enough to provide the assigned 2000-cycle level at the customer's end of the channel, a temporary increase in this gain may be made. The gain should, however, in no case be so high that the output transmission level as measured at the local channel jacks is higher than +3 dbm at any frequency.

5.02 The required temporary output level of this amplifier should be obtained in the following manner:

(1) At the customer's end of the receiving channel connect a 13A transmission measuring set to the terminals to which the receiving machine is normally connected.

(2) At the toll test room office send 2000-cycle tone at the usual telephotograph level into the amplifier and gradually increase its gain until the required level is measured at the customer's office.

(3) If the picture carrier frequency is other than 2000 cycles the adjustment of the amplifier should be made at this frequency.

5.03 If the normal level can not be obtained at the customer's location with an amplifier output of 0 dbm, the level at the input of the receiving amplifier should be adjusted so that the amplifier output does not exceed a maximum of +3 dbm at any frequency. It may be left at this setting only until proper equalization can be provided. If standard equalizing arrangements are associated with the amplifier these should, of course, be used to get as much equalization as possible.

5.04 As discussed in Paragraph 4.01, conditions may be such that deviations from the specified customer's receive level may be encountered. Whenever possible, these conditions should be eliminated by changing the value of the 1C pad loss rather than by an adjust-

ment in repeater gain. Should the value of the pad be changed from that specified on the circuit layout card, the engineering office responsible for the circuit order and the control office should be advised as to the value of the pad used. The control office should keep a record of the pad used, correcting the circuit layout card accordingly.

6. TEMPORARY ADJUSTMENT OF TRANSMITTING AMPLIFIER

6.01 If the 1000-cycle level received at the toll test room with normal output of the customer's machine does not agree with the level given on the circuit layout card, the gain of the transmitting amplifier in the office may be temporarily adjusted so that the output into the telephotograph network is within permissible deviations from the proper value. This adjustment should only be made after it has been ascertained that the reduced level is not a result of a trouble condition existing on the line or in the terminal equipment.

6.02 If any temporary adjustment of equipment has been made in order to meet a service date, the engineering office issuing the circuit order should be informed immediately.

7. GROUNDING OF SHIELDED WIRE

7.01 Type SK or equivalent shielded wire should be used between the apparatus box and the machine, loudspeaker and/or monitoring head set.

7.02 In order for the shields to afford maximum protection from induced currents, the following rules should be applied:

(a) All shields should be electrically interconnected and attached to a common ground terminal in the apparatus box.

(b) Wire not smaller than 12 gauge should be used between the common ground terminal in the apparatus box and a cold water pipe that affords a good ground connection.

(c) The shields should be insulated from the telephotograph machine, loudspeaker and/or monitoring head set.

7.03 Whether the installation includes customer owned and maintained terminal equipment or Telephone Company owned and maintained terminal equipment, the picture machines should be provided with a ground that is separate from that of the shield system. The shield system should be electrically continuous from the apparatus box to, but not including the terminal equipment. In the case of customer owned and maintained terminal equipment, under normal practice Telephone Company responsibility ends at the connector block; local arrangements should be made with the customer to provide for a continuation of the shield through the connector block and to, but not including the customer's machine. If for some reason the customer requires that the shield be connected to the machine chassis the continuity of the shield should be broken at the connector block.