THE EICO MODEL 145
MULTI - SIGNAL TRACER

The Eico Model 145 Multi-Signal Tracer features a crystal diode with a response to well over 200 megacycles. It is an extremely versatile instrument used for the tracing of A.F., R.F., I.F., and television video frequencies. Besides audible signal tracing with the internal speaker or earphones, provisions are included for visual signal tracing with a VTVM or Oscilloscope. The unit may also be used as a small public address system or intercommunication system unit. The serviceman will find it an indispensable instrument for his service bench.

ASSEMBLY INSTRUCTIONS

The assembly of the MODEL 145 Multi-Signal Tracer is not difficult, and if care is used, no trouble should be encountered. First, unpack all of the parts, checking them against the parts list, identifying each one to make sure no parts are thrown away with the packing.

The standard manufacturing values may be interchangeable. We are forced to order from several sources to assure the supply of these kits. You may, therefore, find that a value may vary within the permissible circuit tolerance, e.g., a resistance of 470,000 ohms may be substituted for 500,000 ohms, or may measure 510,000 ohms, etc. All parts supplied will work just as well as the part for which it is substituted. Most parts have a tolerance rating of 20% and the circuit is designed to take these variations into account.

The tools needed for the work are a cleaned and tinned soldering iron, screwdriver, plier, and diagonals. Use a good grade of rosin core solder. Do Not use acid core solder or flux. When making solder connections, wrap the wire securely around the joint and then solder, making sure solder flows into the joint.

BEFORE starting the ACTUAL CONSTRUCTION, study the schematic and pictorial wiring diagrams thoroughly, getting all the steps clear in your mind. Do not rush assembly. Care will pay dividends. Most troubles in building kits can be traced to wrong connections or reversed parts.

ASSEMBLY PROCEDURE

Follow the procedure suggested by the assembly prints for best results. The numbered parts such as #7 represent components given on the parts list. The circled numbers such as ⑧ represent soldered connections shown on the assembly prints. Each solder connection point has a different circled number.

Mount the main components on the chassis as in Assembly Print No. 1. Mount the speaker last of all to prevent damaging the cone.

Attach the panel to the chassis by means of the gain potentiometer and output switch.

After finishing all the steps indicated in Assembly Print No. 1, go on to Assembly Print No. 2. Keep the leads to the gain control as close to the chassis ground as possible to reduce hum pick-up. Wire with spaghetti where indicated.

After completing assembly print No. 2, proceed with assembly print No. 3, which completes the wiring. The ELECTROLYTIC CONDENSERS should be wired with the POSITIVE TERMINAL CONNECTED AS SHOWN. Be sure to mount the grill with the speaker using the 1/2" screws. In wiring the diode probe, make sure that the spaghetti tubing covers the diode and resistor connections so that no short circuits can occur. The probe tip and rear washer are force fitted into the probe shell.

Before checking the operation, go over the wiring to make sure nothing has been omitted or wired wrong. A few minutes spent checking the wiring may eliminate hours of trouble shooting.

CHECKING THE OPERATION

Before plugging into the line, measure the resistance from B- to ground (Pin No. 8, 6X5 tube, to ground). This should be infinite resistance; in other words, open circuit. Insert the tubes, and connect to 110 V.A.C. Turn the unit on and allow a minute for the tubes to heat up. Plug in the probe tips to the INPUT terminals, connecting the shielding to ground. Turn the output switch to "Signal-Trace." Touching the probe tip will cause a loud hum in the speaker due to stray AC pick-up. This will indicate the amplifier is operating.

Place the ground lead tip into the VTVM ground jack for ground connection and clip the alligator clip onto the B- of a broadcast receiver. Reverse the receiver plug if hum exists. Place the probe tip on the first I.F. grid and the broadcast station will be heard coming through the speaker of the signal tracer. This indicates that the diode inside the probe is functioning.

IN CASE OF TROUBLE

1. Check wiring carefully to see nothing has been omitted or wired wrong.
2. Check tubes.
3. Check all parts to see that they have been wired in their proper places.
4. Trace out entire wiring, using a colored pencil over the wiring diagram.
5. Check the diode probe carefully to see that it is not shorted.

6. If you still cannot find the trouble, write our Engineering Dep't. giving all information which may be helpful. We will gladly try to help you find the trouble.

7. If desired, your instrument may be returned to the factory. It will be put in operating condition for a charge of $2.50 plus any parts or alterations required due to damaged or improper construction. Pack well and mark fragile. Ship prepaid. Instrument will be returned as soon as possible.

USING THE MULTI-SIGNAL TRACER

To trace through a faulty receiver, set the receiver dial to a known broadcast station or connect a signal generator to the receiver, setting both to the same frequency.

Connect the ground alligator clip to the receiver B-, the other end being plugged into the VTVM ground jack on the signal tracer. If hum results in the tracer speaker, reverse the receiver line plug. With the probe cable plugged in (shield to ground), start at the antenna coil touching the probe tip to the primary and then the secondary. The signal level at this point in the receiver is lowest and an antenna may be required to hear the broadcast signal in the tracer speaker.

The secondary of the antenna coil is usually connected to the tuning condenser stator terminal, which is readily accessible. On small AC-DC radios, the antenna loop is the secondary coil and is connected to the tuning condenser stator.

Continue tracing back from the receiver front end touching the mixer plate, first I.F. grid, first I.F. plate, and the diode plate of the second detector tube. At each of these points the broadcast station or the signal generator modulation should be heard. When the signal stops, the stage preceding is defective.

The audio section can be traced in a similar manner by touching grids and plates starting backward from the second detector and going to the speaker. The speaker connection should also be contacted in order to ascertain whether the speaker is open, the output transformer secondary is open, or the circuit is open. The receiver speaker may be tested by obtaining a signal on the signal tracer from a previous stage. Then the receiver speaker is connected to the OUTPUT pin jacks of the signal tracer and the output switch switched to "TEST AMPLIFIER". The signal should be heard on the receiver speaker unless it is defective. The secondary of the output transformer in the receiver may be tested by connecting it to the OUTPUT terminals of the signal tracer and switching the output to "TEST SPEAKER". The signal should then be heard over the signal tracer speaker.

The gain in each stage is indicated by the amount the gain control of the signal tracer must be reduced to maintain equal volume, giving a rough indication as to whether a stage is operating correctly.

Distortion, noise or hum may be followed through a radio and isolated. The power supply filters may be checked by touching the test prod to each section and noting the effectiveness of the filters. Video circuits can also be traced by the characteristic buzz which is the audio frequency component of the video signal. Thus, major troubles in a television set can be traced, using the same procedure as described here.

If it is desirable to use earphones with the signal tracer, the earphone tip may be connected to the VTVM terminals and the output switched to "TEST AMPLIFIER" or "TEST SPEAKER" to silence the speaker.

USING THE MULTI-SIGNAL TRACER AS A SMALL PUBLIC ADDRESS SYSTEM

Connect either a phonograph pick-up or high impedance crystal microphone DIRECTLY to the INPUT terminals using the phone tips (the probe is not needed and causes some distortion.) Use either the internal speaker or a remote speaker connected to the OUTPUT pin jacks (output switched to "TEST AMPLIFIER" in the latter case).

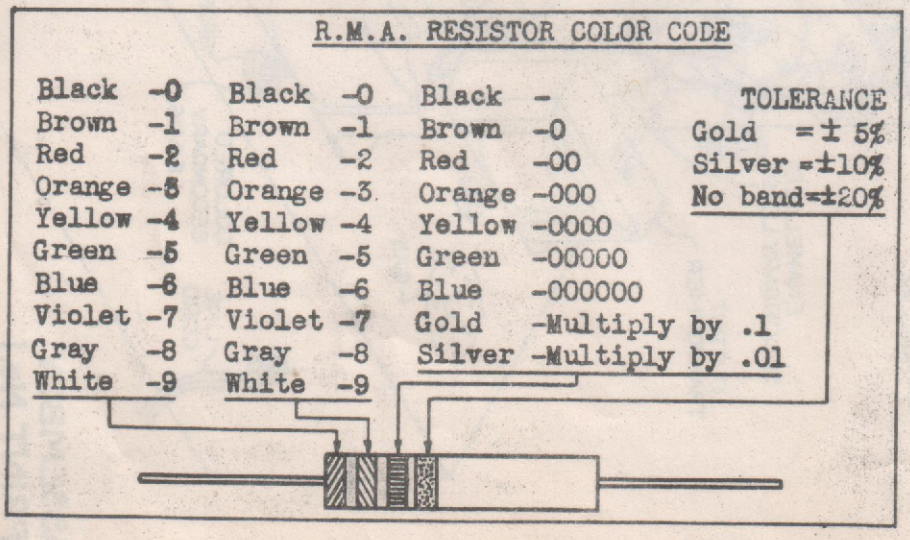
VISUAL SIGNAL TRACING

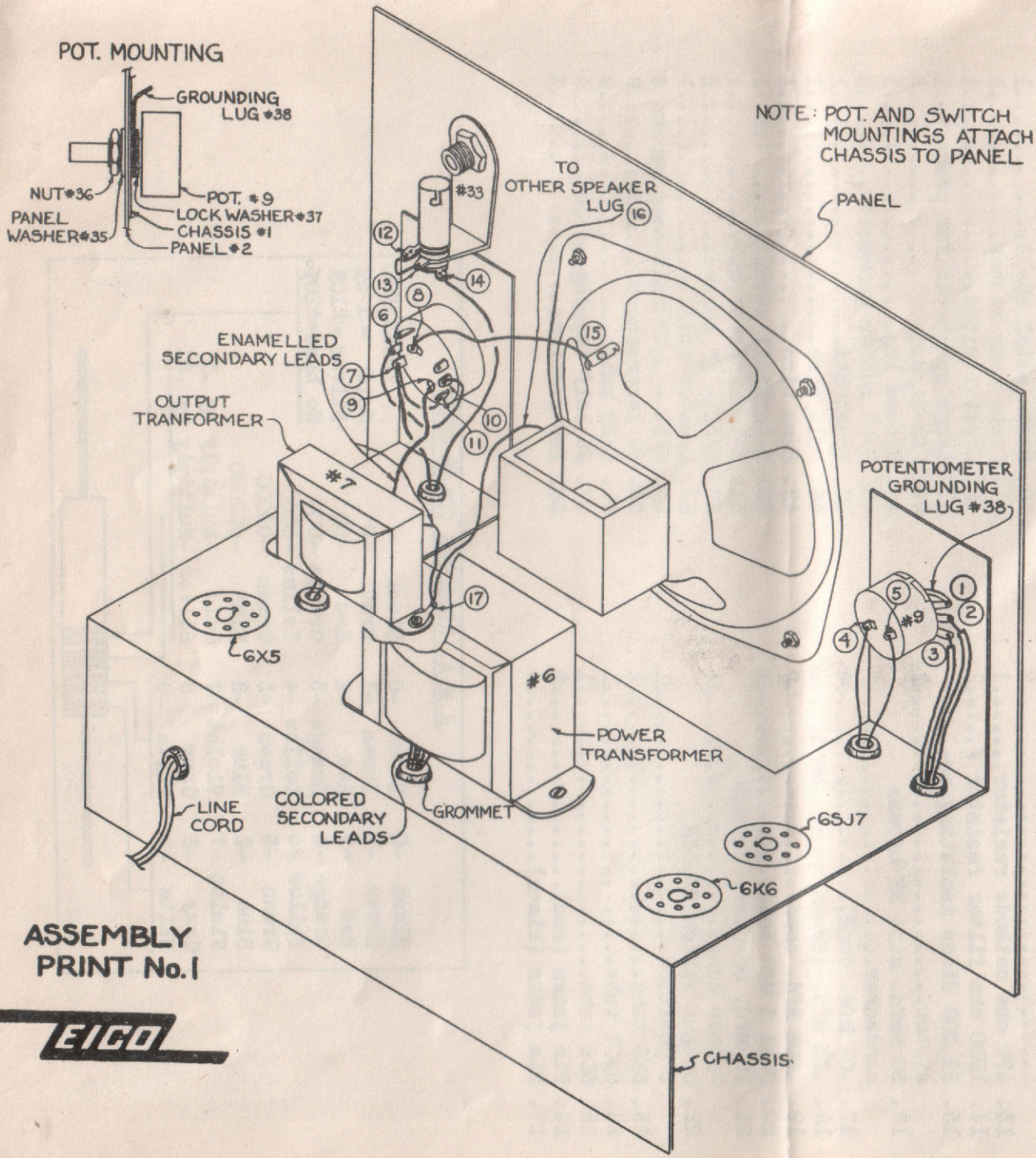
For visual signal tracing, insert the AC test prod from a vacuum tube voltmeter into the VTVM terminals. Connect the ground connection of the vacuum tube voltmeter into the VTVM ground. Feed a constant modulated signal into the receiver and note the output voltage at the input and output of the stage being tested, giving the gain increase in that stage. An oscilloscope may be connected to the VTVM terminals for visual signal tracing. With this arrangement, distortion in the receiver is easily located.

EICO

PARTS LIST - MODEL 145

1. Chassis.....1
2. Panel.....1
3. Cabinet.....1
4. Handle.....1
5. Alligator Clip.....1
6. Power transformer.....1
7. Output transformer.....1
8. Speaker.....1
9. 500,000 pot with SPST switch...1
10. 10 megohm grid leak resistor...1
11. 2 megohm screen resistor.....1
12. 510,000 plate and grid resistors 2
13. 470 ohm cathode resistor.....1
14. 1000 ohm filter resistor 1
15. 51,000 diode isolating resistor.....1
16. 50 mmfd. mica RF bypass condenser.....1
17. .01 Mfd. cond.....4
18. .05 Mfd. screen bypass cond....1
19. .002 Mfd. cond.....2
20. Dual 8 Mfd cond.....1
21. 10 Mfd. or over, cathode bypass cond.....1
22. Output switch 2 pole 3 position.....1
23. 6X5 tube.....1
24. 6SJ7 tube.....1
25. 6K6 tube.....1
26. Pin jacks (red).....3
27. Pin jacks (black).....3
28. Knobs.....2
29. Pin jack lock washers.....6
30. Line cord and plug.....1
31. Shielded cable.....1
32. Ground lead.....1
33. Pilot light assembly.....1
34. Pilot light bulb.....1
35. 3/8" panel washers.....2
36. 3/8" nuts.....2
37. 3/8" lock washers.....2
38. Pot grounding lug.....1
39. Probe tip.....1
40. Probe metal shell.....1
41. Probe rear washer.....1
42. Crystal diode.....1
43. Large spaghetti for probe....1
44. Pin tips.....3
45. Ground lug.....1
46. 3/8" rubber grommets.....8
47. Spaghetti.....1
48. Roll wire.....1
49. Bare wire.....1
50. 3-terminal strip.....1
51. 1-terminal strip.....1
52. 6/32 - ¼" screws.....5
53. Speaker grill.....1
54. 6/32 - 1/2" flat head screws.4
55. #6 lockwashers.....9
56. 6/32 nuts.....9
57. #6 self tapping screws.....9
58. Instructions.....1





ASSEMBLY PRINT No. 1

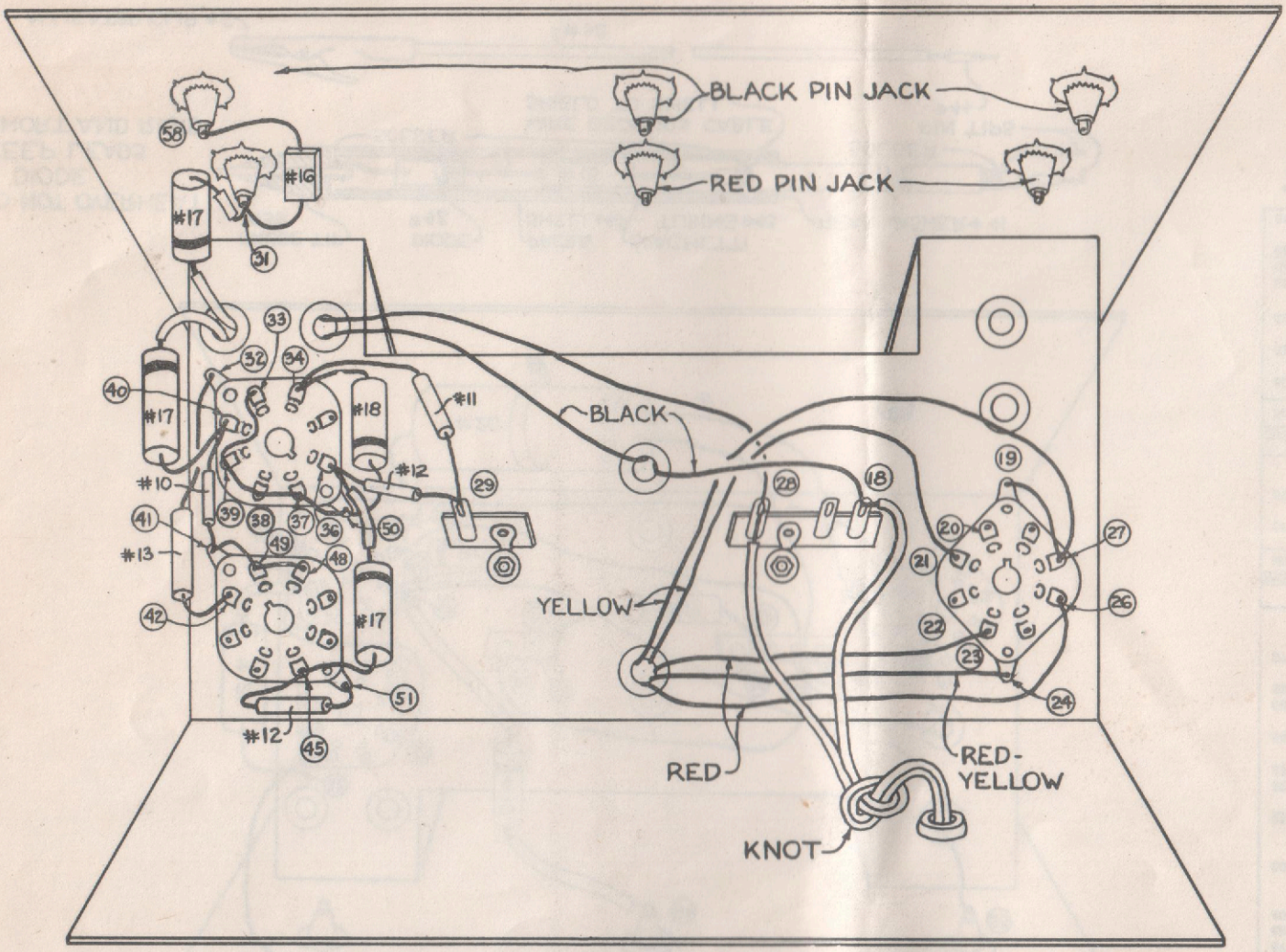
EICO

MOUNTING				
STEP NO.	PART #	DESCRIPTION	HARDWARE	REMARKS
1	#9	500K Pot	1#35,1#36 1#37,#38	Attaches Panel to Chassis
2	#22	Output Switch	1#35,1#36 1#37	Attaches Panel to Chassis
3	#6	Power Trans.	2#52,2#55 2#56	Mounted with #50 and #51*
4	#33	Pilot light Assembly		
5	#7	Output Trans.	2#52,2#55 2#56	
6	#46	Grommets	8#46	On all 5/8" Holes

WIRING					
STEP NO.	PART #	DESCRIPTION	FROM	TO	REMARKS
7	Wire	Bare	(12)	(13)	
8	Wire	Hook up	(7)	(11)	
9	Wire	Hook up	(6)	(10)	
10	Out-put Trans	Enamelled Lead	Trans	(17)	
11	Out-put Trans	Enamelled Lead	Trans	(9)	
12	#38	Pot Gnd Lug	Gnd	(1)	

*On Assembly Print No. 2

Circled numbers such as (7) represent soldered connections on pictorial diagrams



BOTTOM VIEW OF CHASSIS

ASSEMBLY PRINT No.2

EICO

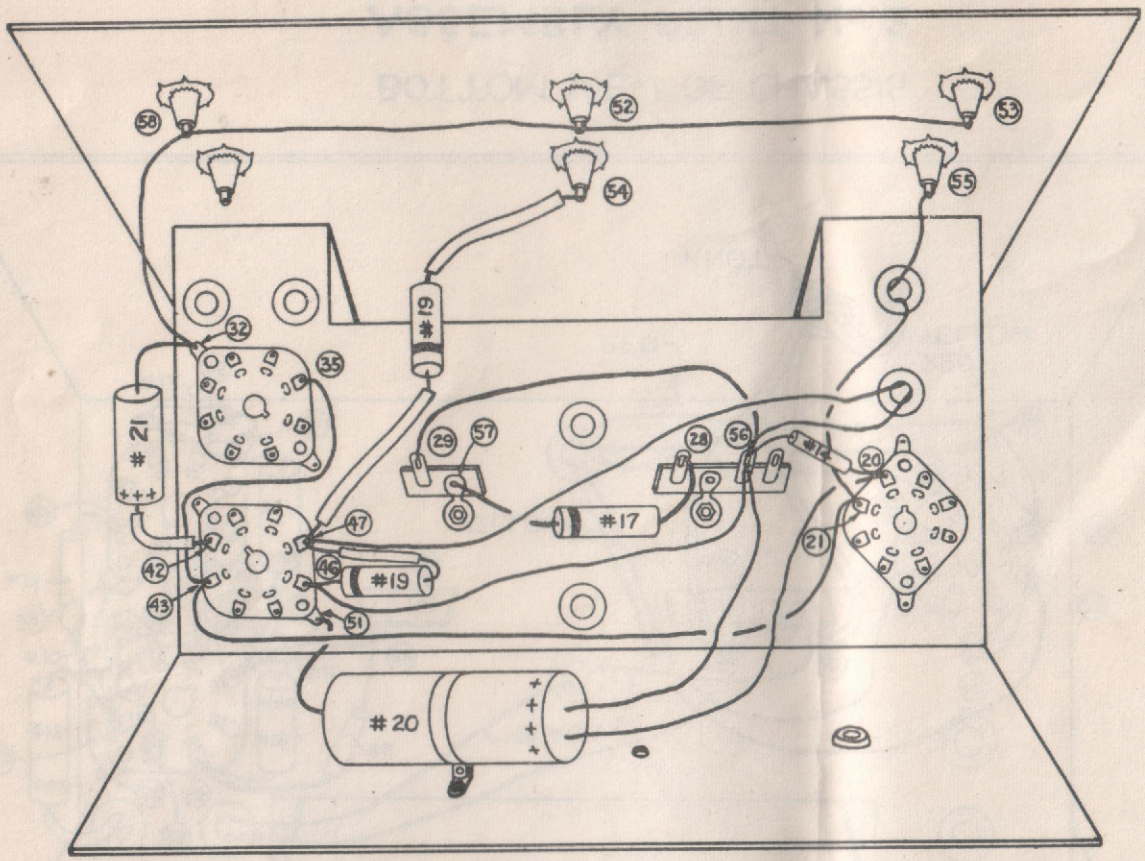
MOUNTING				
STEP NO.	PART #	DESCRIPTION	HARDWARE	REMARKS
13	3#27	Black Pin Jacks	3#29	On Bot. Panel Holes
14	3#26	Red Pin Jacks	3#29	On Upper Panel Holes

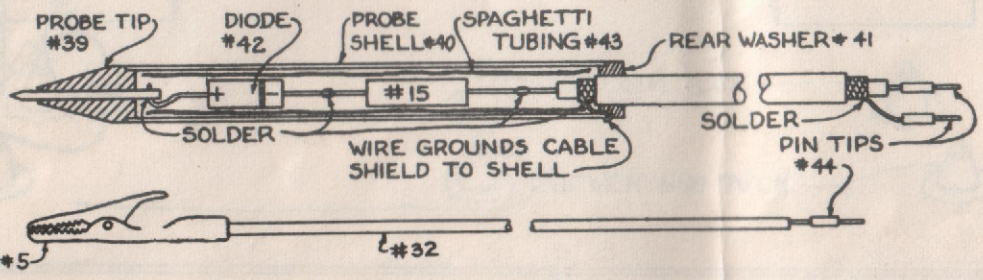
WIRING					
STEP NO.	PART #	DESCRIPTION	FROM	TO	REMARKS
15	Power Trans	Black lead	Trans	(18)	
16	Trans	Black lead	Trans	(5)*	
17	Trans	Red lead	Trans	(28)	
18	Trans	Red lead	Trans	(23)	
19	Trans	Red Yellow	Trans	(24)	
20	Trans	Yellow	Trans	(27)	
21	Trans	Yellow	Trans	(21)	
22	Wire	Bare	(27)	(19)	Gnd
23	Wire	Hook up	(28)	(4)*	
24	#16	50 Mmfd. mica cond.	(28)	(51)	
25	1#17	.01 Mfd. Cond.	(5)	(5)*	Spaghetti
26	1#17	.01 Mfd. Cond.	(40)	(2)*	Spaghetti
27	#18	.05 Mfd. Cond.	(34)	(50)	
28	#17	.01 Mfd. Cond.	(35)	(45)	Spaghetti
29	#12	510K Res.	(48)	(51)	
30	Wire	Bare	(33)	(35)	
31	Wire	Bare	(31)	(38)	
32	Wire	Bare	(36)	(37)	
33	Wire	Bare	(37)	(39)	
34	#10	10 Meg. Res	(40)	(41)	
35	#13	470 ohms Resistor	(32)	(42)	
36	Wire	Bare	(41)	(43)	
37	Wire	Bare	(44)	(46)	
38	#12	510K Res.	(36)	(29)	
39	#11	2 Meg. Resistor	(34)	(29)	
40	#30	Line cord	Line	(18)	
41	#30	Line cord	Line	(22)	

*On Assembly Print No. 1
Circled numbers such as (8) represent soldered connections on pictorial diagrams

EICO

ASSEMBLY PRINT No.3





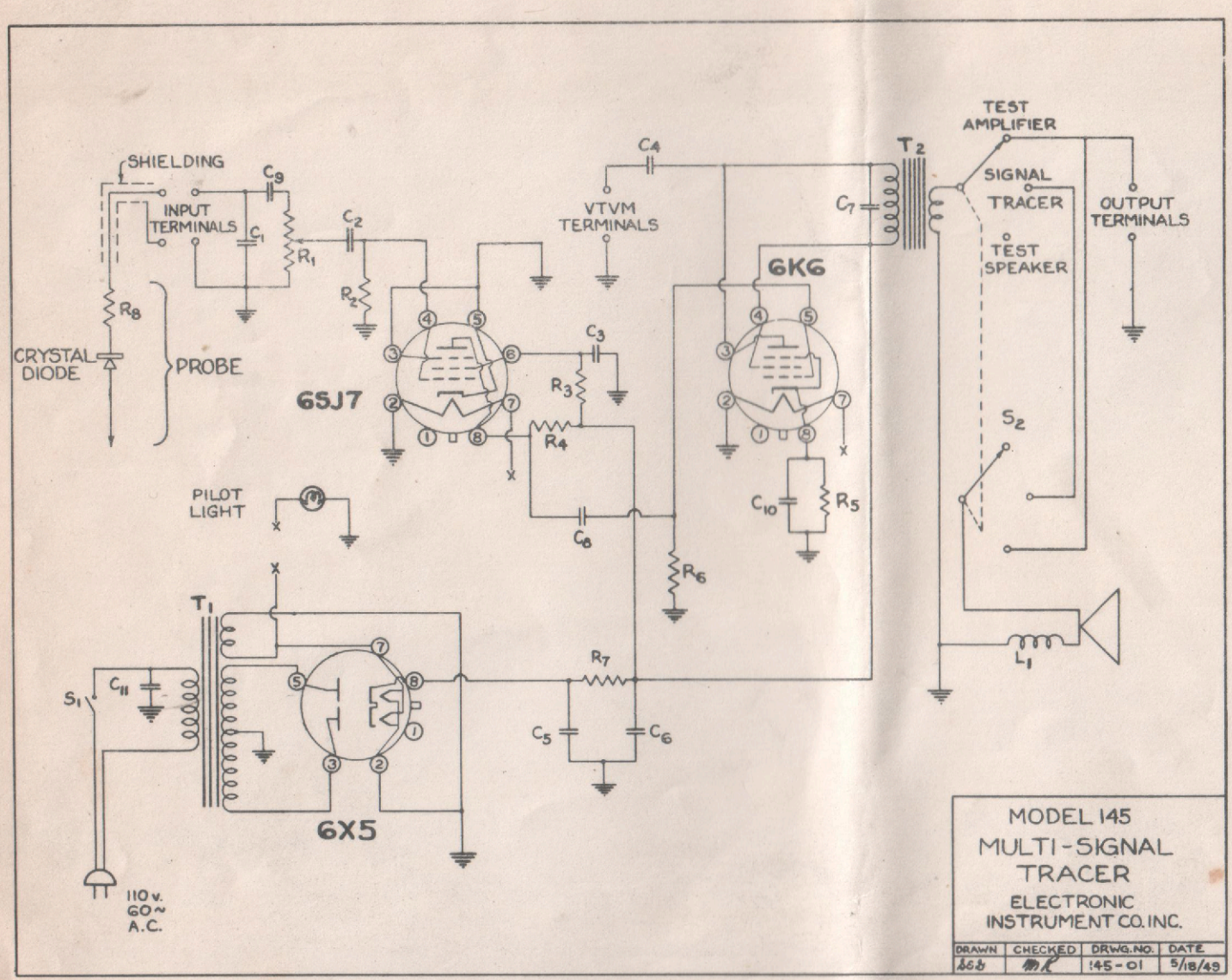
1. DO NOT OVERHEAT DIODE
2. KEEP LEADS SHORT AND RIGID

WIRING					
STEP NO.	PART #	DESCRIPTION	FROM	TO	REMARKS
42	Wire	Bare	(52)	(52)	Use one 9" bare wire
43	Wire	Bare	(53)	(53)	
44	Wire	Bare	(54)	(54)	
45	Wire	Hook up	(32)	(42)	
46	Wire	Hook up	(43)	(43)	
47	Wire	Hook up	(51)	(15)*	
48	Wire	Hook up	(28)	(56)	
49	Output trans	Lead	Trans	(47)	
50	Output trans	Lead	Trans	(58)	
51	#14	1000 ohms Resistor	(56)	(20)	
52	Wire	Hook up	(56)	(46)	
53	#19	.002 Mfd. Cond.	(46)	(47)	Spaghetti
54	#19	.002 Mfd. Cond.	(47)	(54)	Spaghetti
55	Wire	Hook up	(55)	(7)*	
56	#17	.01 Mfd. Cond.	(28)	(57)	
57	#21	10 Mfd. or Over Electrolytic	(42)	(32)	Spaghetti

MOUNTING				
STEP NO.	PART #	DESCRIPTION	HARDWARE	REMARKS
58	#8	Speaker	4#54, 4#55 4#56	With #55 Grill
59	#20	Dual 8 Mfd. Condenser	1#52, 1#55 1#56	Bend Cond. Bracket

WIRING					
STEP No.	PART #	DESCRIPTION	FROM	TO	REMARKS
60	#20	Dual 8 Mfd. Condenser	Red Lead	(20)	
61	#20	Dual 8 Mfd. Condenser	Red Lead	(56)	
62	#20	Dual 8 Mfd. Condenser	Black Lead	(51)	Gnd.
63	Wire	Hook up	(8)*	(15)*	
64	Wire	Bare	(17)*	(18)*	
65	Gnd Lead	Assemble as shown			
66	Probe	Assemble as shown			

*On Assembly Print No. 1
Circled numbers such as (8) represent soldered connections on pictorial diagrams.



MODEL 145
MULTI-SIGNAL TRACER
ELECTRONIC INSTRUMENT CO. INC.

DRAWN	CHECKED	DRWG. NO.	DATE
AGA		145-01	5/18/49

EICO

ITEM	PART #	SPECIFICATION
R1	9	500K POT. WITH SWITCH
R2	10	10 MEG. RESISTOR
R3	11	2 MEG. RESISTOR
R4	12	510K RESISTOR
R5	13	470 OHM RESISTOR
R6	12	510 K RESISTOR
R7	14	1000 OHM RESISTOR
R8	15	51000 OHM RESISTOR
C1	16	50 MMF MICA CONDENSER
C2	17	.01 MFD. CONDENSER
C3	18	.05 MFD. CONDENSER
C4	19	.002 MFD. CONDENSER
C5	20	DUAL 8 MFD. CONDENSER
C6	20	" " " "
C7	19	.002 MFD. CONDENSER
C8	17	.01 MFD. CONDENSER
C9	17	.01 MFD. CONDENSER
C10	21	10 MFD. OR OVER CONDENSER
C11	17	.01 MFD. CONDENSER
T1	6	POWER TRANSFORMER
T2	7	OUTPUT TRANSFORMER
S1		PART OF R1
S2	22	OUTPUT SWITCH

CONSTRUCTION OF NEW PROBE FOR MODEL 145 MULTI-SIGNAL TRACER

The probe provided in your kit is of a new improved type. The method of construction is given on this sheet. The construction diagram on Assembly Print 3 and the accompanying instructions on page 2 of your Construction Book are for the old probe only and should be ignored. In order to eliminate any confusion, you are requested to strike off the parts list in the Construction Book all of the following parts which together form a parts list for the old probe (given by part number): 1#15, 1#31, 1#39, 1#40, 1#41, 1#42, 1#43, 2#44. The entire parts list for the new probe is given below.

NEW PROBE PARTS LIST

Stock#	Description	Am't.	Stock#	Description	Am't.	Stock#	Description	Am't.
89524	probe shell	1	42019	rubber washer	1	58000	hook-up wire	pc.
89511	nose-piece	1	51500	alligator clip	1	95000	crystal diode	1
89512	probe tip	1	58403	co-axial cable	1	10022	res., 51,000Ω	1
54510	term. board	1	58002	stranded wire	pc.	51004	pin tips	2
47001	spring	1						

NOTE: When ordering replacement parts, please include the stock number of the part and the description given in the parts list.

Follow the step-by-step assembly and wiring procedure that follows closely and carefully for best results. IMPORTANT: USE THE BEST GRADE OF ROSIN CORE SOLDER ONLY, preferably one containing the new activated fluxes such as Kester "Resin-Five", Ersin "Multicore" or similar types. UNDER NO CONDITION USE ACID CORE SOLDER OR ACID FLUX since acid flux can cause serious corrosion. If for any reason it is necessary to resolder a joint, be sure to use new solder.

Construction is begun by mounting the parts on the terminal board as shown in Figs. 3 and 4. First, press fit the probe tip into the rectangular notch at one end of the board as shown in Fig. 1. Then install the crystal diode on the same side of the board the solder lug is on (Fig. 3) between the probe tip and eyelet 1, cathode to eyelet 1 (cathode side of crystal indicated by band or by direction of rectifier symbol — cathode K anode). To do this, pass the cathode lead of the crystal through eyelet 1 and bend back this lead on the other side of the board when the crystal is positioned properly. Solder the anode lead of the crystal to the flat shank of the probe tip and trim off excess. On the same side of the board, install the 51,000Ω resistor between eyelet 1 and eyelet 2 by passing one lead through eyelet 1 and the other lead through eyelet 2. Bend back the leads on the other side of the board to lock the resistor in place, and then trimming off excess. Solder eyelet 1 (see Fig. 2). To avoid overheating the crystal diode, hold each crystal diode lead with pliers when soldering the terminal to which the lead is connected. When soldering is completed, lay the terminal board aside.

Fig. 1

Fig. 2

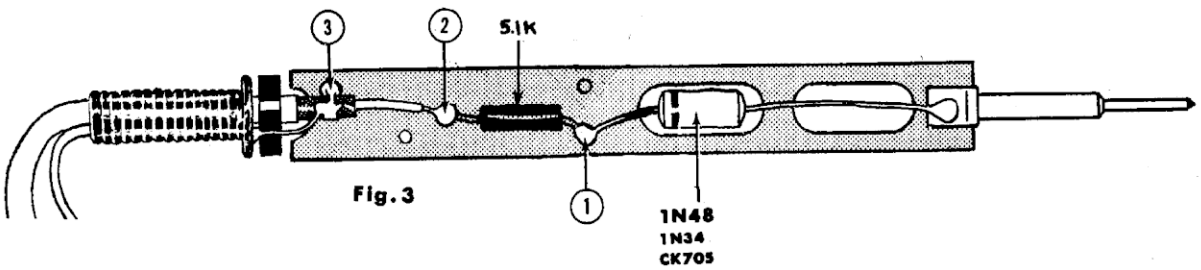


Fig. 3

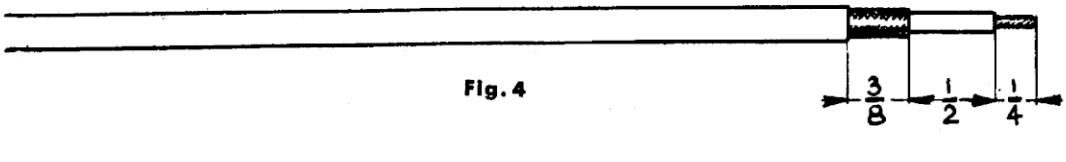


Fig. 4

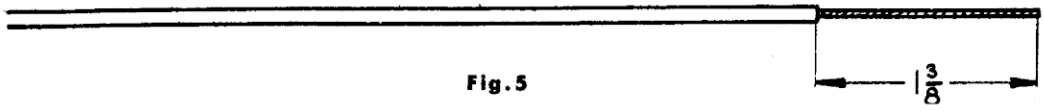


Fig. 5

Strip the co-axial cable and the ground lead (stranded wire) as shown in Figs. 4 and 5. Position the ground lead in the spring as shown in Fig. 6, and solder it to the spring, as shown, at the point indicated in the drawing. Then insert the co-axial cable in the spring as shown in Fig. 6. Push the rubber washer over the stripped end of the co-axial cable on to the outside insulation and position it as shown in Fig. 3. Next position the stripped end of the co-axial cable so that the end of the outside insulation rests inside the semi-circular notch in the end of the terminal board and the outside braid lays across the solder lug. (Check to see that the inner co-axial conductor reaches eyelet 2.) Then bend the solder lug over to grip the cable braid (Fig. 7 is a profile view) and solder the connection, keeping in mind that overheating will soften the inner co-axial insulation with the consequent danger of a short. Bring the stripped end of the ground lead (extending from the solder point on the spring) around the outside of the rubber washer and insert it in eyelet 3 (Fig. 3), after which solder eyelet 3. Insert the inner conductor of the co-axial cable in eyelet 2 (Fig. 3), after which solder eyelet 2.

Pass the free ends of the co-axial cable and the ground lead through the probe shell from the threaded end. Then grasp the probe tip with one hand and with the other hand move the shell down over the probe body with a rocking motion and without forcing. When the large end of the spring is flush against the rolled over end of the shell, pass the plastic nosepiece over the probe tip and screw it into the shell (see Fig. 8). At the opposite end of the cable, strip away 3" of outer insulation and 2 1/2" of the outer braid. Cut off 3 1/2" of stranded wire and strip off 1/2" of insulation from one end. Wrap the stripped end around the exposed cable braid and solder, being careful not to overheat the cable. Finally, solder a phone tip to the opposite end of this lead and to the inner conductor of the co-axial cable.

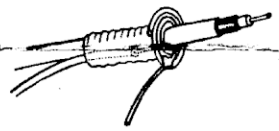


Fig. 6

Fig. 7

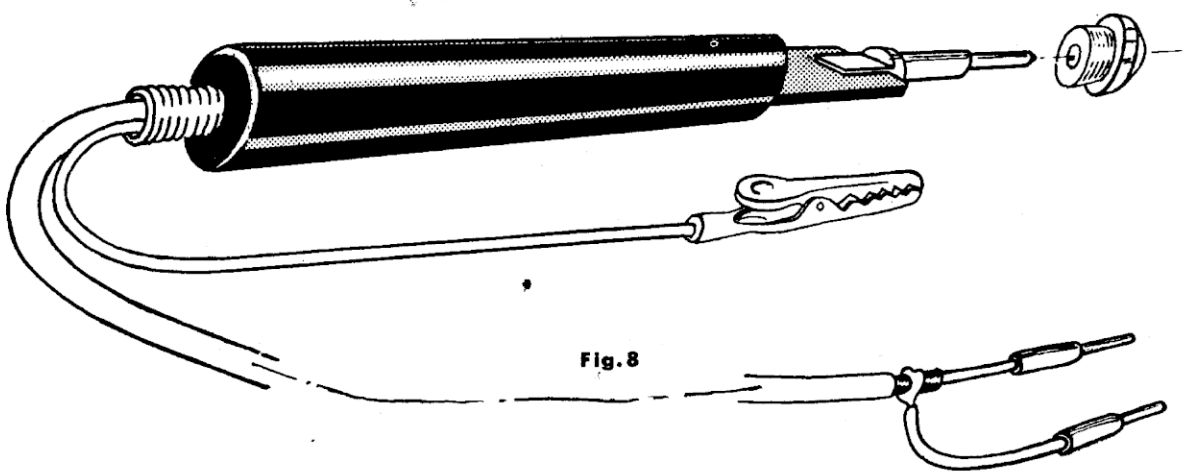


Fig. 8