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IN THIS ISSUE

How to Use Schematic Diagrams

Looking Ahead with Television

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The Value of Courtesy in Business

People complain more about discourteous and uninterested clerks than about any of the other faults a store or business can have.

You have a chance to use courtesy in every single dealing with your customers, regardless of whether you are working for some one else or have a Radio-TV service shop of your own. In every single branch of business, courtesy is badly needed today.

Courtesy helps you to get ahead. Courtesy adds zest and enjoyment to your work. It is more fun to be courteous.

Courtesy develops good manners. Good manners are petty sacrifices which cost you nothing but which bring great returns and make you more popular.

How can you be courteous? Here are a number of ways:

Say "thank you," and be sure you sincerely mean it. Genuine courtesy comes from the heart.

Be especially courteous to those who don't buy from you, who cannot do you any good today, and then you can be sure of being sufficiently courteous to those who do buy. Courtesy becomes a habit if practiced long enough.

Be courteous even to the very lowest persons who serve you. Remember Owen D. Young's words to a pullman porter, "I wish I could always be sure of doing my job as well as you do yours."

Treat your customers as you would want to be treated if you were in their place. Learn what your customer wants, and give it—don't try to force your own ideas onto him. And give your courtesy with a smile. There is an old Chinese proverb which says, "A man who doesn't smile shouldn't keep a shop."

J. E. SMITH, President.

J. B. Straughn

How to Use Schematic Diagrams

By J. B. STRAUGHN

NRI Assistant Director of Instruction

THE purpose of this article is to aid you in understanding and using circuit diagrams in your service work. Many service men habitually work without the aid of a schematic but a diagram will help, except in those cases where the trouble is obvious and requires only a simple replacement.

When you have a real service problem which calls for the use of trouble shooting techniques, a schematic is invaluable.

Receiver manufacturers give a great deal of information on some of their diagrams and you should be able to use all of it to best advantage. In other cases, you may have only the diagram itself but, as your general fund of knowledge increases, you will find that much of the data given on some diagrams is repetitious and a simple schematic with part values is all that you will generally require.

What You Need to Know About Schematics

After finishing just a few lessons in the NRI course you will recognize the symbols used in drawing schematic diagrams. A few lessons more and you learn how the various parts work together in circuits and you will be able to tell how an electronic circuit should function by studying its schematic. This is known as analyzing the schematic diagram.

When service men speak of reading a diagram, they are referring to the connection of the parts which is shown on the diagram and to tracing electrical paths between parts and points in a diagram circuit.

Other important uses of schematics are to give part values which are necessary for replacement purposes and to make it easy to locate parts which you have decided, from your tests and a study of the diagram, require checking.

Analyzing and Reading Circuit Diagrams

Fig. 1 shows in schematic form the power supply for an AC-DC receiver. In analyzing this circuit we see that the tube filaments are in series and are connected across the power line when switch SW is closed. This causes the filaments of all of the tubes to heat up. In the B supply circuit the heat of the rectifier filament is transferred to the cathode, causing electrons to be emitted from the 35Z5 cathode. These are attracted to the plate when it is positive. This completes the circuit through the load which, in a complete receiver, consists of the cathode-to-plate circuits of all the receiving tubes.

The electron movement is from the power line, through the On-Off switch, through the load, through filter choke CH, from the cathode to the plate of the rectifier, through the filament tap, 2-3 of the rectifier and the shunting pilot lamp to the other side of the power line.

Since the rectifier conducts only on half cycles (when its plate is positive), the filter system consisting of C1, C2 and CH is used. Actually condenser C2 charges up and becomes the virtual power supply for the load. It is kept charged by the rectifier tube and by means of condenser C1 and choke CH. Thus all ripple is removed and pure dc is maintained across C2 although the rectifier conducts only on half cycles. If it were

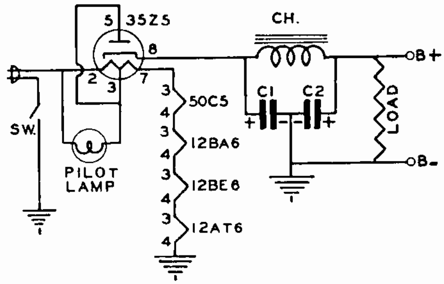


FIG. 1. Typical power supply for an AC-DC receiver. The tube filaments are connected in a string, like Christmas tree lights, forming a series connection across the power line. The same current then flows through the entire string.

not for this filtering action, a terrific hum would result.

From the above you can see how it is possible to analyze circuit operation with the schematic. The material in your NRI lessons teaches you to do this and reference books 17X and 35X will give you a great deal of practice in circuit analysis.

In reading the diagram in Fig. 1 we want to see how the parts are electrically connected. We need to know this in order to locate the parts in the set, to see if they are connected as shown in the diagram and to decide where to place ohmmeter and voltmeter probes when testing the circuits.

From Fig. 1 we see that one line cord lead connects to pin 2 of the 35Z5 tube and that the other connects to one side of the On-Off switch. The other side of the switch, known as the "set side," connects to the chassis which serves as a wire connection between the switch, negative leads of the filter condensers, one side of the load and filament pin 4 of the 12AT6 type tube.

The pilot lamp connects to pins 2 and 3 of the 35Z5 tube. Pin 8 (the cathode) of the 35Z5 connects to choke CH and to the positive lead of C1. The other lead of CH connects to the positive lead of C2 and to the load.

Examining the filament string we have already seen that it is connected across the power line. Pin 5 which is the plate of the rectifier connects to the tap (pin 3) of the 35Z5 filament. The other filament connections as shown on the diagram are:

Pin 7 of the 35Z5 to pin 3 of the 50C5.
Pin 4 of the 30C5 to pin 3 of the 12BA6.
Pin 4 of the 12BA6 to pin 3 of the 12BE6.
Pin 4 of the 12BE6 to pin 3 of the 12AT6.
Pin 4 of the 12AT6 to the chassis and through it to the set side of the On-Off switch. As you can see, reading a schematic diagram is a very simple matter. Using the diagram to locate receiver parts takes a little skill and specialized knowledge but, once you have learned how, you will be able to find your way around in even the most complicated radio or TV chassis.

Uses for Circuit Diagrams

The underside of any radio or TV chassis, when viewed as a whole is a maze of resistors, condensers, coils, and connecting leads. Although the expert sees the same jumble of wires and parts as the beginner, such a sight does not confuse him. The expert knows his interest lies in only a small portion of the complete receiver, perhaps only the grid or plate circuit of a single tube.

Here we will see how to use schematic diagrams to locate sections, stages, circuits and parts. We will see how any special information furnished by the receiver manufacturer can be put to use in servicing the set. It is important to remember that when a schematic diagram is available the service man does not analyze the entire circuit to see how it operates. He should, however, be capable of doing this, for at times the understanding of stage or circuit operation is necessary to rapid correction of a defect.

In general, the nature of the complaint will lead the service man to suspect a limited number of parts. He then uses the diagram to locate these parts so they can be tested for whatever defect is suspected. Also he uses the diagram to identify the type of receiver. This is advisable because some symptoms indicate an entirely different servicing technique in receivers of different design.

Take, for example, an AC-DC receiver and an ac operated receiver using a power transformer. Both receivers are dead and in each only some of the tube filaments light.

Figs. 2A and 2B show the filament supply circuits for these two types of receivers. From the captions we know what will make all the tube filaments in Fig. 2A go out and only one or more of the filaments in 2B fail to light.

If some of the tubes in Fig. 2B do not have lighted filaments, we would immediately suspect the unlighted tubes of having burned out filaments. Such tubes should be removed and their filament continuity checked with an ohmmeter or tested in a tube checker. In most cases, an ohmmeter test is the quickest way to determine if the filaments are open.

If some of the tubes in Fig. 2A do not light, we would not look for an open filament, because if any of the tubes had open filaments none of the remaining tubes would light. Instead, we would look for a short across the filaments of the unlighted tubes. A short of this type frequently oc-

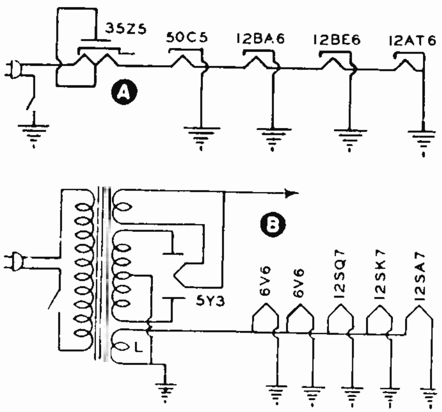


FIG. 2A. Shows the cathodes of the receiving tubes at ground potential. In some receivers there may be a bias resistor between the 50C5 cathode and ground. Here a cathode to heater short would ruin the cathode bias condenser and perhaps burn out the resistor. Until the resistor failed a loud hum would be heard.

FIG. 2B. Here we have a typical AC type power supply. Note that the chassis is used as one filament lead.

curs due to cathode-to-heater leakage and, if the cathode of the shorted tube connects to ground, the filament of this tube and of any other tubes between the short and the grounded end of the filament string may fail to light. To check for the cause of this trouble, another tube is tried or the suspected tube or tubes are removed and checked in a tube tester for cathode-to-heater leakage.*

In the example just discussed we can go immediately from the effect to the cause of the trouble. This is true because, if a receiver were playing properly before it went dead, it would be unreasonable to believe that a short had occurred in the wiring or that some of the filament wiring in Fig. 2B had opened. Since everything points to a single cause of the trouble, the location of the actual defect is a simple matter.

Usually the location of the trouble is not quite so easy to find as you may be able to think of a number of possible reasons for the failure. When the probable causes are decided, each suspected part may be tested or it may be necessary to localize the trouble to the defective section, the defective stage, the correct circuits in that stage and then to the part.

*An ohmmeter would give inconclusive results in checking for a cathode-to-heater short. The short is due to expansion of the filament when heated.

On removal of the tube for a check between cathode and heater with an ohmmeter the filament may cool and contract sufficiently to remove the short by the time the test probes are applied. A tube tester incorporating a sensitive short check, such as the NRI Professional Model 70, will show up leakage of this nature.

Diagrams Are Useful In Diagnosing Troubles

Suppose we have a receiver which distorts and, by following the procedures outlined in your course, the trouble has been localized to the audio section. Fig. 3 will serve as our example. Experience, gained by following the NRI Practical Training Plan, would lead you to suspect incorrect operating voltages on VT1 or VT2. This could be due to a change in part values or, a defective part. Distortion is usually due to incorrect control grid voltage which causes the tube so affected to operate on the curved, rather than the straight part of its eg-ip characteristic.

Leakage in either C3 or C5 would cause incorrect grid voltage on the tubes to which they are connected and these parts should be checked first. Next, you would check for leakage in C6 and then for a change in value of R3, R4 or R6.

Note that R5 was omitted from our check list, because a change which could reasonably be expected to occur in its value, due to a defect, would not change the control grid voltage of VT2 and hence would not cause distortion. The bias for VT1, on the other hand, is developed across R3 by grid current flow, so a change in value in this resistor could upset the bias on this tube resulting in distortion.

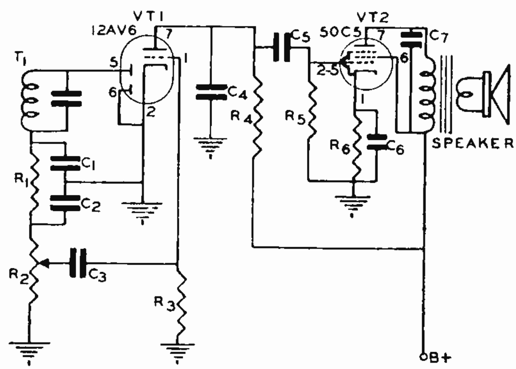
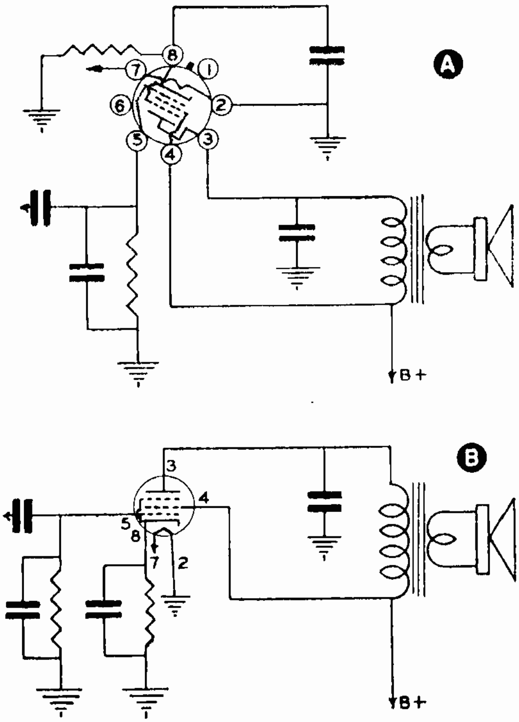


FIG. 3. This is an audio section which might be found in an AM type receiver. The second detector, first and second audio stages respectively demodulate and amplify the signal which is fed to the loudspeaker.

In some instances there may be so many possible causes for a symptom that it is best to use a localization procedure, as explained in your course, to trace the trouble to a single stage. Then there are not so many parts to be located and tested.



FIGS. 4A and 4B. Electrically the circuits in A and B are identical. However, note difference in appearance due to different methods of illustration.

The sections, stages, circuits and parts are easy to see on a schematic diagram but it then becomes necessary to locate them in the receiver. Once you become familiar with the methods used it will be a matter of only a minute or two to find any part, section, circuit or stage in a radio or TV set.

The schematic plays a vital role in such a search. Even when a diagram of the set you have for repairs is not available, the experience you have gained by studying other diagrams will enable you to go to the desired point in the receiver. All sets have certain things in common, and as you will see, it is possible to use these similarities to locate the part you wish to check.

With a diagram, sections are easily found by noting the tubes used in that section. Tubes are made for specific purposes and it is seldom that you will find two tubes of the same type used in different sections of a receiver.

In Fig. 3 you can see that two tubes are used, a 12AV6 and a 50C5. These tubes would not normally be used in other sections of the receiver, but the diagram would show if there was an extra 50C5, used possibly as a phono oscillator. You could distinguish between the tube sockets on the chassis, even if they were unmarked, because VT2 feeds the output transformer and the loudspeaker.

REMEMBER: IN A RECEIVER IT IS SIMPLE TO IDENTIFY A TUBE IN A CHASSIS WITH ONE SHOWN ON A DIAGRAM. JUST LOOK TO SEE IF THE TUBE CONNECTS TO THE PARTS SHOWN ON THE SCHEMATIC.

In the case of VT2 in Fig. 3 note that its plate, which is shown as pin 7, connects to output transformer T2. After locating pin 7 on the tube socket, trace from there to T2. You can identify T2 because two of its leads, as shown on the schematic, connect to the loud speaker voice coil.

REMEMBER: BY REVERSING THIS SIMPLE PROCEDURE YOU CAN USE THE TUBE SOCKET TERMINALS TO LOCATE PARTS IN THE RECEIVER. Suppose you wanted to locate coupling condenser C5 in Fig. 3. An examination of this schematic shows that C5 connects to pin 7 of the 12AV6 tube and to pins 2 or 5 of the 50C5. First, locate the 12AV6 on the chassis, find pin 7 of this tube and trace from there to C5. Note that C4 also connects to this pin. You can distinguish between C4 and C5 easily, since the other lead of C4 connects to the chassis while the other lead of C5 connects to pin 2 or pin 5 of the 50C5.*

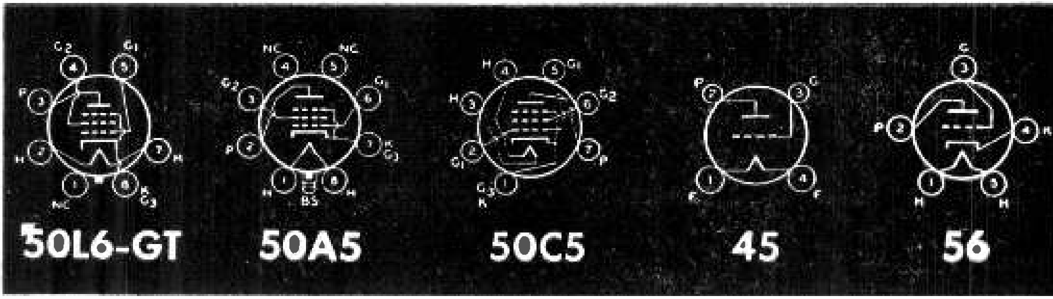
Thus you may find C5 connected to either pin 2 or pin 5. Nothing may be connected to the other pin or it may be used for the connection to R5 which also goes to the control grid of the 50C5.

Tube Prong Identification

Locating the pins on a tube socket is a simple matter if a pictorial of the tube socket base is shown on the schematic. Fig. 4A shows an output stage drawn in this manner. Note the locating lug which is a slight projection on the tube base key. This is shown between pins 1 and 8 and is on the bottom of the tube base, or you can see the indentation into which it slips on the socket if the tube is removed. Sometimes, but not always, the numbers will be molded on the socket, next to the pins they identify. Don't count on this—learn how to identify the tube socket numbers.

Usually a schematic circuit will be drawn as shown in Fig. 4B. Again, locating the tube electrodes is easy because they are numbered on the diagram and by locating the pins on the socket you can identify the plate, screen, control grid,

*We specified pin 2 or pin 5 of the 50C5 because either may be used. When two or more pin numbers are shown in this manner it means that these pins are connected to the same element in the tube and that either of the pins so indicated may be connected to the circuit in the actual set.



A B C D E

FIG. 5. Base socket connections of tubes often encountered in servicing. Reading from left to right we see: an octal, a loctal, a miniature, a four prong and a five prong socket.

cathode and heater connections. In a case of this sort, you can locate a particular pin by counting the pins on the bottom of the socket, starting from pin 1 and proceeding around the socket in a clockwise direction.

On octal base and loctal base tubes, pin 1 is always the first pin in a clockwise direction from the locating projection on the key. This is illustrated in Figs. 5A and 5B. In Fig. 5B pins 3 and 4 (marked NC—no connection) do not connect to tube electrodes and are not used. In Fig. 5A pin 6 is not required and has been left off the tube base. This, however, does not affect the position or numbers of the other prongs.

In miniature tubes there is always a wider than average spacing between two of the pins, as shown in Fig. 5C. The first pin in a clockwise direction from the blank space is number 1. In the older type tubes, one of which is illustrated in Fig. 5D the two filament prongs are larger than the others so that the tube will fit into its socket in only one way. The number 1 pin is always the first in a clockwise direction when considering the space between the two pins. In 5E the filament prongs which are numbers 1 and 5 are the same size as the other prongs but are closer together.

Tube Charts and Basing Diagrams

When the pin numbers are not marked on a diagram and you are unfamiliar with the plate, cathode, grid, etc. connections for a tube you should refer to a tube chart which will give this information. Large single sheet layouts, as shown in Fig. 6, can be obtained free of charge from most radio part jobbers. Reference to the correct socket layout to use is given with the data for the tube. However, when such charts are spread out, they are somewhat unwieldy.

It is much more practical to use a small, compact tube manual. An example is shown in Fig. 7. Such manuals contain, in addition to the base connections, operating data on the tube, which is sometimes useful, but not necessary in service work.

From time to time tube manufacturers have printed booklets showing only basing diagrams of tubes. These are easy to use and, as shown in Fig. 8, at least as many as three tubes may be looked up at the same time. This is a great time saver when you are examining a receiver section using several tubes. This particular chart, prepared by RCA, consists of three physically separated sections, containing duplicate information. Thus by opening the pages of the separate sections to the desired tube base you see at least three of the tube bases in which you are interested.

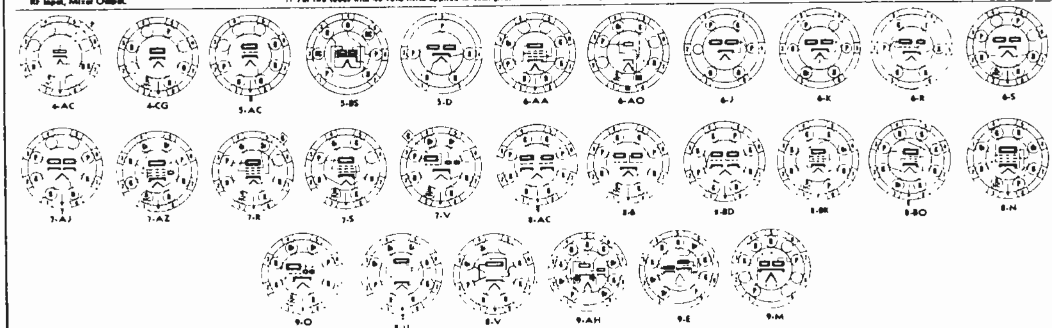
Tube charts and tube basing booklets can be purchased from most radio parts jobbers or from the tube manufacturers. When ordering by mail it is a good idea to write first for the price of the desired item as prices change from time to time.

For a long time, radio manufacturer's service organizations and servicemen have been concerned with actually locating parts in a receiver from the schematic. This problem has been solved in a number of ways. Some manufacturers simply give a schematic and leave it up to the serviceman to locate the parts. Others will give a diagram and also a chassis parts layout, showing the relative position of the various parts. Actually, as you will see, it is a little difficult to find a specific part on such a layout. The main use for a chassis parts layout, as far as the author is concerned, is to make it easy to identify some part which is shown by a visual inspection to be defective. If an inspection for surface defects shows a part which is obviously damaged, you can compare its identification number, shown on the chassis layout to that on the schematic. From the schematic or parts list you can find the correct electrical value for replacement. A study of the schematic will enable you to decide if the failure was due to a defect in another part and what tests, if any, should be made prior to the replacement of a damaged part. For example,

SYLVANIA TUBES — AVERAGE CHARACTERISTICS

Type	Construction: Bulb Size or Style	Construction: Class	Construction: Basing Diag.	Emitter: Type	Emitter: Volts	Emitter: Amps.	Note (1) (2) Capacitances in µµf.: Cgp.	Cin.	Cout	Use	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resistance Ohms	Micromhos Mutual Conductance	Amplification Factor	Ohms Load for Stated Power Output	Undistorted Power Output Milliwatts	Type
6Y7G	ST-12	Duotriode	8B-0-0	Cathode	6.3	0.60				Power Amp.	180 250	0.0 0.0		7.5# 10.5#		(Class B Operation) (Class B Operation)			7,000* 14,000*	5,500 8,000	6Y7G
6Z4	ST-12	Duodiode	5D-0-0	Cathode	6.3	0.50				F-W Rect.	325 A-C Volts Per Plate, RMS, 60 Ma. Output Current Condenser Input to Filter. 450 A-C Volts Per Plate, RMS, 60 Ma. Output Current Choke Input to Filter										6Z4
6Z5	ST-12	Duodiode	6K-0-0	Cathode	6.3 12.6	0.80 0.40				F-W Rect.	230 A-C Volts Per Plate, RMS, 60 Ma. Output Current.										6Z5
6Z7G	ST-12	Duotriode	8B-0-0	Cathode	6.3	0.30				Power Amp.	135 180	0.0 0.0		3.0# 4.2#		(Class B Operation) (Class B Operation)			9,000* 12,000*	2,500§§ 4,200§§	6Z7G
6ZY5G	ST-12	Duodiode	6S-0-0	Cathode	6.3	0.30				F-W Rect	325 A-C Volts Per Plate, RMS, 40 Ma. Output Current Condenser Input to Filter.										6ZY5G
7A4	Lock-In	Triode	5AC-L-0	Cathode	6.3	0.30	4.0	3.4	3.0	Amplifier	90 250	0.0 8.0		10.0 9.0		6,700 7,700	3,000 2,600	20 20			7A4
7A5	Lock-In	Beam Amp.	6AA-L-0	Cathode	6.3	0.75	0.44	13.0	7.2	Power Amp	110 125	7.5 9.0	110 125	40.0 44.0	3.0 3.3	14,000 17,000	5,800 6,000		2,500 2,700	1,500 2,200	7A5
7A6	Lock-In	Duodiode	7AJ-L-5	Cathode	6.3	0.15				Det. Rect	150 A-C Volts Per Plate, RMS, 8 Ma. Current Output Per Plate.										7A6
7A7	Lock-In	Pentode	8V-L-5	Cathode	6.3	0.30	.003m	6.0	7.0	R-F Amp.	100 250	1.0 3.0	100 100	13.0 9.2	4.0 2.6	120,000 ♦ 800,000 ♦	2,350 2,000				7A7
7A8	Lock-In	Octode	8U-L-7	Cathode	6.3	0.15	0.15m	7.5	8.0	Converter	100 250	3.0 3.0	75 100	1.8 3.0	2.7 3.2	650,000 ♦ 700,000 ♦	375▲ 550▲	(Go = 100 V., 2.8 Ma.) (Go = 250 V.□, 4.2 Ma.)			7A8
7AB7	Lock-In	Pentode	8BO-L-0	Cathode	6.3	0.15	.06m	3.5	4.0	R-F Amp.	250	2.0	100	4.0	1.3	500,000	1,800				7AB7
7AD7	Lock-In	Pentode	8V-L-5	Cathode	6.3	0.60	0.03	11.5	7.5	Amplifier T-V Amplifier	300 300	Self Self	150 125	28 25	7.0 6.0	300,000	9,500		(Rk = 68 Ohms) (Rk = 68 Ohms)		7AD7
7AF7	Lock-In	Duotriode	8AC-L-0	Cathode	6.3	0.30	2.3*	2.2*	1.6*	Amplifier (per unit)	100 100 250	0 3.0 10		10.8 5.0 9.0		6,500 8,400 7,600	2,600 1,900 2,100	17 16 16			7AF7
7AG7	Lock-In	Pentode	8V-L-5	Cathode	6.3	0.15	.005m	7.0	6.0	R-F Amp.	250		250	6.0	2.0	750,000	4,200		(Rk = 250 Ohms)		7AG7
7AH7	Lock-In	Pentode	8V-L-5	Cathode	6.3	0.15	.005m	7.0	6.5	R-F Amp.	250		250	6.8	1.9	1 Meg.	3,300		(Rk = 250 Ohms)		7AH7
7AJ7	Lock-In	Pentode	8V-L-5	Cathode	6.3	0.3	.007m	6.0	6.5	R-F Amp.	100 250	1.0 3.0	100 100	5.7 2.2	1.8 0.7	400,000 >1.0 Meg.	2,275 1,575				7AJ7
7AK7	Lock-In	Pentode	8V-L-0	Cathode	6.3	0.8	4.0 SatoP 0.7	12.0	9.5	R-F Amp.	150 150 150	0 11 0	90 90 90	40 2.0 Max. 2.0 Max.	21 0.45 43 Max.	11,300	6,500				7AK7

(1) Values are given shielded unless marked with (*).
(2) Converter tube capacitances given are signal grid-to plate; RF Input, Mixer Output.
(3) Has special mechanical and/or life characteristics.
§§ With Average Power Input of 320 Mw. Grid to Grid.
†† For two tubes with 40 volts RMS applied to each grid.
* Applied through 250,000 ohms.
\# Per Tube or Section.
| Plate and Target Supply Voltage.
□ Applied through 20,000 ohms.
▲ Conversion Transconductance.
** Triode Operation.
‡ Pentode Operation.
* Plate to Plate.
♦ Approximate.
• maximum.



SYMBOLS FOR BASE DIAGRAMS: A—Anode; A1—Anode 1; A2—Anode 2; D1—Deflector 1; Dp—Diode Plate; F—Filament; Fc—Filament Center; G—Control Grid; Ga—Anode Grid, Gm—Modulator Grid; Go—Oscillator Grid; Gq—Quadrature Grid; Gs—Screen Grid; H—Heater; Hc—Heater Center; Ht—Heater Tap; IC—Internal Connection; J—Jumper; K—Cathode; NC—No Connection; P—Plate; Rc—Ray Control; S—Metal Shell; SA—Starter Anode; Su—Suppressor Grid; T—Target; XS—External Shield; □—Top Cap; —►Locating Pin

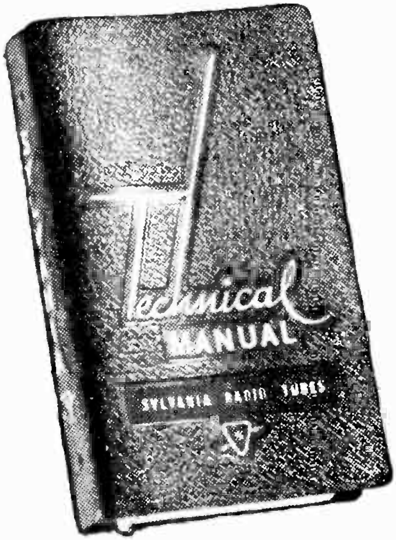
Courtesy Sylvania Electric Corp.

FIG. 6. Here is a small portion of a large tube chart. The types are listed in numerical and alphabetical order. The second column lists the bulb size or style of construction, whichever is most helpful in describing the tube. The letter "ST" refers to the dome topped bulb while "T" would refer to a tubular shaped bulb. Columns are included to show the type of emitter (cathode or filament) and for interelectrode capacitances of those types having this rating. In the column headed "Basing Diagram" is found the information referred to in this article. Note that the basing for the 7A7 is 8V-L-5. This means that active elements are connected as shown in the base diagram 8V, and that the internal shielding (in this case the Lock-In base) is connected to the lug (L) and the internal shield to pin 5. This is done to avoid having a separate base diagram for types with minor differences in shielding. The figures 0-0 indicate no external and no internal shielding respectively.

if you had a burned out resistor, you would look to see if there is a condenser shown on the schematic which, if leaky or shorted, could have caused excess current to flow through the resistor and burn it out.

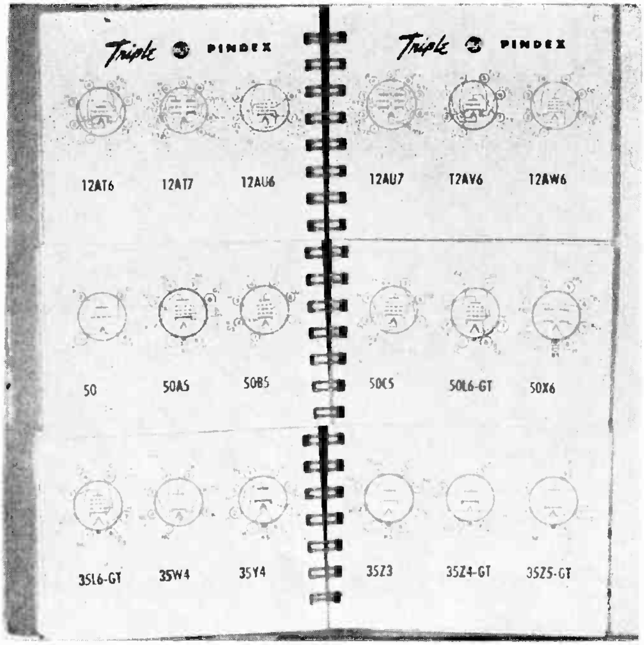
Other manufacturers will give a slightly different chassis layout, showing the actual wiring and the parts in pictorial form with either their electrical values or the identifying number on the schematic.

In Figs. 9 and 10 you will find a diagram of a receiver and a chassis parts layout. If the resistor marked R10 in the chassis parts layout has previously been burned you can locate R10 on the schematic and see exactly where it is used in the circuit. You will note that R10 is the bias resistor for the type 76 audio amplifier tube. From the schematic, you would decide the possible causes of excess current through R10 and would check these possibilities. In looking at the circuit the possibility of a short in the 76 or 6AC5G tubes is apparent as is leakage in C48. R10 could fail due to a defect in the resistor itself so, if no external cause for failure is found, you can see from the parts list that a 22,000 ohm carbon resistor would make a satisfactory replacement. The wattage of the resistor is not given but one of the same physical size or larger would be a safe replacement.



Courtesy Sylvania

FIG. 7. This loose leaf type manual contains individual base layouts and the important characteristics of each receiving tube type.



Courtesy RCA

FIG. 8. This is the handiest type basing chart for the busy service man. Shows tube base connections only.

To examine another possibility, suppose this set is dead and that a circuit disturbance test* shows that the second i-f is alive but that the first i-f does not pass the disturbance. A voltage check might show that there is no screen voltage on the i-f tube. Other voltages are measured to be more or less normal.

With an ohmmeter we find that there is no continuity between the screen of the first i-f tube and the filament of the rectifier. On the other hand there is also no continuity between the screen of this tube and the chassis. This eliminates the possibility of a breakdown in screen bypass C39. The fact that plate voltage is present on the 6Q7 shows that resistor R18, choke L2 and resistor R16 are not open and that condensers C55, C54 and C53 have not broken down. By process of elimination, these tests point definitely to an open in resistor R3.

With the information furnished by the manufacturer, you can examine the chassis parts layout for resistor R3. You will find it between the pictorial of the electrolytic condenser can and the 6K7 tube socket diagonally to the left of the can. Actually it would be just about as quick to locate the screen grid socket terminals of the 6A8 and 6K7 tubes and trace from either of them to the resistor. You might try your hand at locating specific parts on the schematic and then seeing how much difficulty you encounter in finding them on the chassis layout.

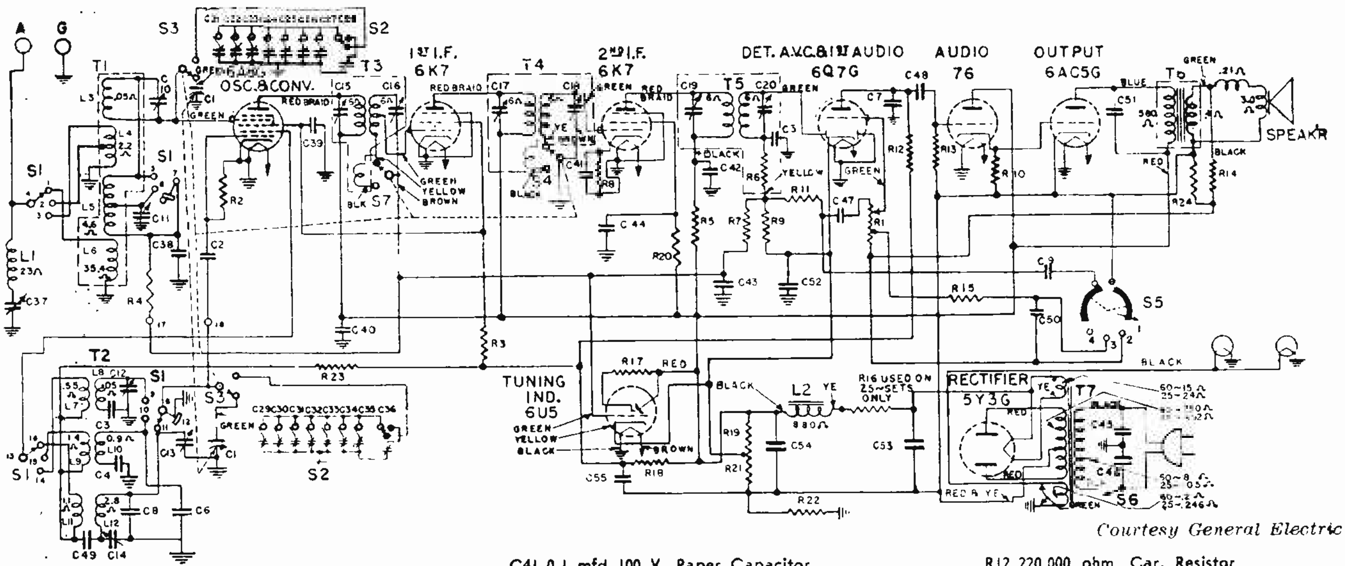
*Described in the NRI Lessons.

As pointed out previously, the main purpose of the chassis layout is to enable you to identify parts quickly which are obviously defective. When I want to find parts I have decided to test from an examination of the schematic, I would rather trace from a known point in the receiver to the part in question, if a chassis parts layout of this sort is given.

As an example, suppose you wish to find resistor R22. Referring to diagram, you will see that it connects between the negative leads of condenser C55, C54 and C53 and the chassis. It is a simple matter to find the negative lead coming from these condensers and trace from there to resistor R22*.

Actually on the chassis parts layout, resistor R22 is between the 6Q7 tube socket and the side of the chassis.

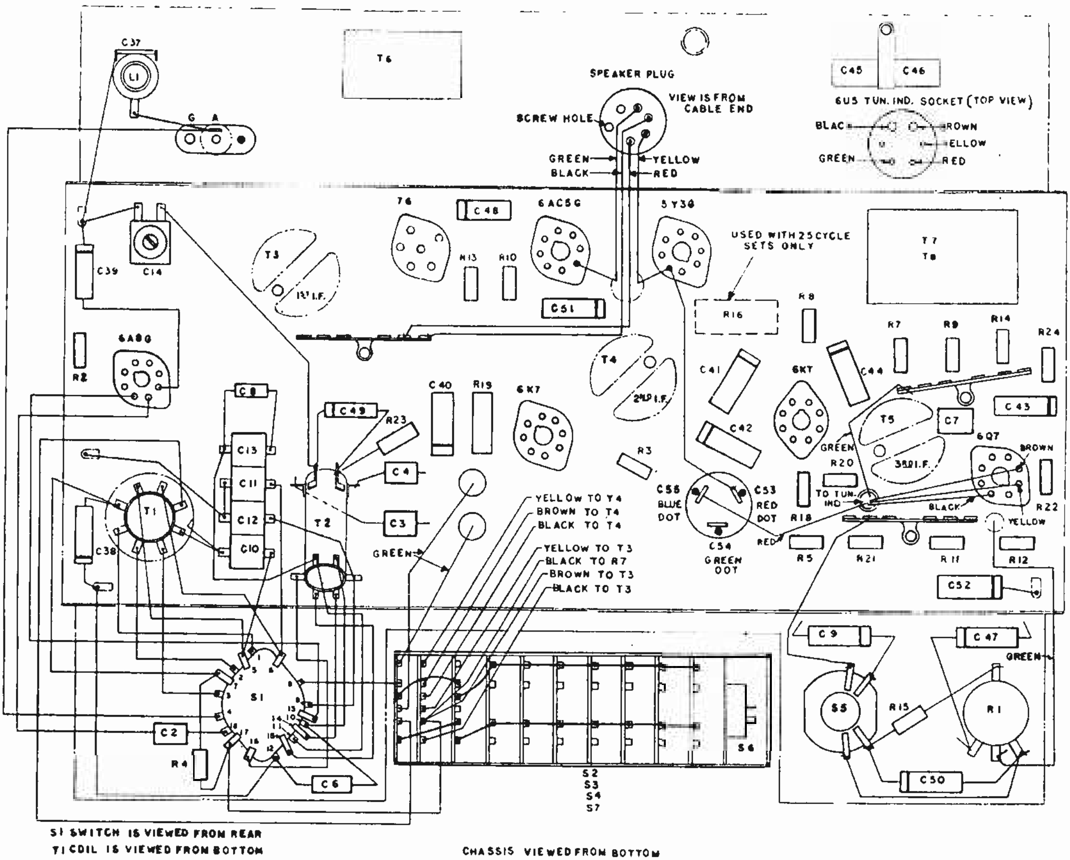
*The physical appearence of an electrolytic condenser makes it easy to spot on the chassis. If it is in a metal shield, the shell is the negative lead; otherwise the negative lead will be black.



Courtesy General Electric

C1 Tuning Condenser
C2 50 mmf Mica Capacitor
C3 3900 mmf Mica Capacitor
C4 1200 mmf Mica Capacitor
C5 47 mmf Mica Capacitor
C6 6 mmf Mica Capacitor
C7 47 mmf Mica Capacitor
C8 20 mmf Compensating Capacitor
C9 .0012 mf 600 V. Paper Capacitor
C10 3120 mmf "D" Ant. Trimmer
C11 3-20 mmf "B" Ant. Trimmer
C12 3-20 mmf "D" Osc. Trimmer
C13 3-30 mmf "B" Osc. Trimmer
C14 300-650 mmf "B" Padder
C15 200-400 mmf 1st I.F. Pri. Trimmer
C16 200-400 mmf 1st I.F. Sec. Trimmer
C17 200-400 mmf 2nd I.F. Pri. Trimmer
C18 200-400 mmf 2nd I.F. Sec. Trimmer
C19 200-400 mmf 3rd I.F. Pri. Trimmer
C20 200-400 mmf 3rd I.F. Sec. Trimmer
C21-C28 Antenna Trimmer Strip
C29-C36 Oscillator Trimmer Strip
C37 30-70 mmf Wave Trap Trimmer
C38 .05 mfd 200 V. Paper Capacitor
C39 .05 mfd 400 V. Paper Capacitor
C40 0.1 mfd 400 V. Paper Capacitor
C41 0.1 mfd 100 V. Paper Capacitor
C42 .05 mfd 400 V. Paper Capacitor
C43 .05 mfd 200 V. Paper Capacitor
C44 .05 mfd 400 V. Paper Capacitor
C45 .01 mfd 250 V.—Ac Line Capacitor
C46 .01 mfd 250 V.—Ac Line Capacitor
C47 .003 mfd 600 V. Paper Capacitor
C48 .005 mfd 600 V. Paper Capacitor
C49 .005 mfd 600 V. Paper Capacitor
C50 .004 mfd 600 V. Paper Capacitor
C51 .02 mfd 600 V. Paper Capacitor
C52 0.1 mfd 100 V. Paper Capacitor
C53 12 mfd 450 V. Dry Electro
C54 8 mfd 400 V. Dry Electro
C55 8 mfd 200 V. Dry Electro
L1 Wave Trap Coil
R1 2 megohm, Volume Control
R2 47,000 ohm, Car. Resistor
R3 15,000 ohm, Car. Resistor
R4 470,000 ohm, Car. Resistor
R5 1,000 ohm, Car. Resistor
R6 47,000 ohm, Car. Resistor
R7 2.2 megohm, Car. Resistor
R8 1,000 ohm, Car. Resistor
R9 220,000 ohm, Car. Resistor
R10 22,000 ohm, Car. Resistor
R11 82,000 ohm, Car. Resistor
R12 220,000 ohm, Car. Resistor
R13 1,000,000 ohm, Car. Resistor
R14 82 ohm, Car. Resistor
R15 120,000 ohm, Car. Resistor
R16 470 ohm, 3 watt, Car. Resistor
R17 1.0 megohm, Car. Resistor
R18 6800 ohm, Car. Resistor
R19 39,000 ohm, 2 watt, Car. Resistor
R20 82,000 ohm, Car. Resistor
R21 150 ohm, Car. Resistor
R22 180 ohm, Car. Resistor
R23 3300 ohm, Car. Resistor
R24 22 ohm, Car. Resistor
S1 Band Change Switch
S2 Station Selector Switch
S3 Man.-Auto. Switch
S4 I.F. Band Expansion Switch
S5 Tone Control
S6 Power Switch on S-3
S7 I.F. Band Expansion Switch
T1 Antenna Transformer
T2 Oscillator Transformer
T3 1st I.F. Transformer
T4 2nd I.F. Transformer
T5 3rd I.F. Transformer
T6 Output Transformer
T7 50-60 Power Transformer

FIG. 9. **Here is the diagram of a General Electric Model G-85 All-Wave Receiver. Note the part values are shown in a separate list rather than being marked on the schematic.**



Courtesy General Electric

FIG. 10. The physical location of the parts but not their electrical connections are shown here for the G.E. Model G-85.

The wiring may not run directly to this resistor and you may have to use its color code in locating it or may have to try pulling on any leads coming from the negative terminal of the electrolytic condenser can to see which wire moves in a remotely placed group. In this way it is possible to trace a long wire through a chassis.

Another method of locating a part is to hold a low range ohmmeter test probe on the negative lead of the condenser can and touch the other ohmmeter test probe to the leads of various resistors. When you find one that gives zero resistance, examine it to see if it is the correct one. In this case it could be either resistor R21 or R22. R22 can easily be identified, however, since it connects to the chassis while resistor R21 connects to numerous other parts above chassis potential.

A somewhat different type of service information which is an aid in locating parts in the receiver is shown in Figs. 11 and 12. In Fig. 12B note that the physical position of the parts is shown and that many of the connections are also given. This makes it easy to locate parts in the set found on the schematic or to locate on the schematic parts you have picked out in the receiver. Suppose, for example, in Fig. 12B you find that one of the leads of condenser C6 has partially come loose inside the condenser case. An examination of Fig. 12B shows that this condenser connects between the center lug of the volume control and pin 3 of the 14B6 type tube. An examination of the schematic shows that pin 3 of this tube is the control grid and that the condenser must be the .01 mfd coupling condenser feeding the audio signal from volume control to the grid of the tube.

The replacements parts list shown in Fig. 12B is useful when it is necessary to purchase exact

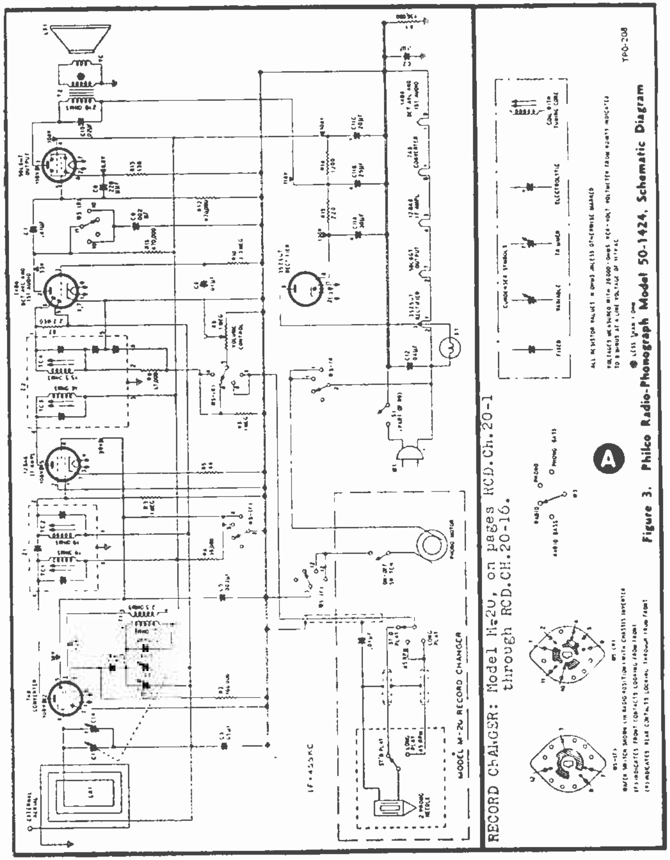


Figure 3. Philco Radio-Phonograph Model 50-1424, Schematic Diagram

FIG. 11A

ALIGNMENT PROCEDURE

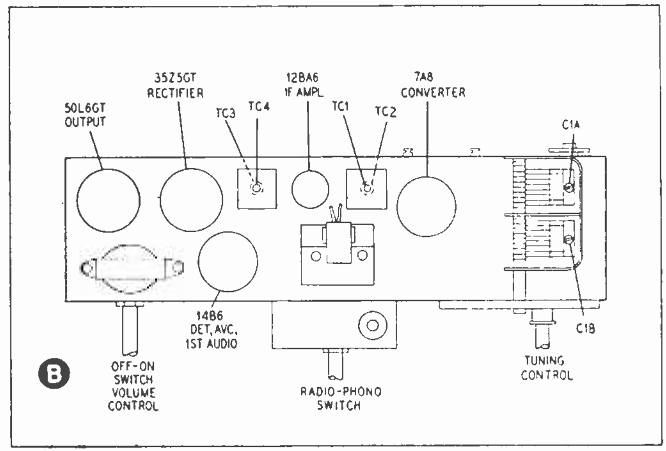
DIAL POINTER—Turn tuning condenser to full-mesh position. Set dial pointer to the index mark, located to the left of "55".

CONTROLS—Turn on power, and set volume control to maximum.

OUTPUT METER—Connect across voice-coil terminals.

SIGNAL GENERATOR—Connect as indicated in chart.

OUTPUT LEVEL—During alignment, adjust signal generator output to hold output-meter indication below 1.25 volts.



TPO-209

Figure 4. Top View, Showing Trimmer Locations

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to B: output lead through .1-uf. condenser to pin 6 of 7A8 tube.	455 kc.	540 kc. (gang fully meshed).	Adjust tuning cores, in order given, for maximum output.	TC4—2nd I-F sec. TC3—2nd I-F pri. TC2—1st I-F sec. TC1—1st I-F pri.
2	Radiating loop (see note below).	1600 kc.	1600 kc.	Adjust for maximum.	C1B—osc.
3	Same as step 2.	1500 kc.	1500 kc.	Adjust for maximum.	C1A—aerial

RADIATING LOOP: Make up a 6-to-8 turn, 6-inch-diameter loop from insulated wire; connect to signal-generator output leads, and place near radio loop aerial.

FIG. 11B

FIGS. 11A and 11B, 12A and 12B. Typical service information furnished on one manufacturer's receiver (Philco Model 50-1424) by John F. Rider, publisher of NRI Professional Service Manuals.

SPECIFICATIONS

CABINET	Wood console, mahogany finish
CIRCUIT	8 tube superheterodyne (with 1 r-f stage)
FREQUENCY RANGE	540—1620 kc.
AUDIO OUTPUT	3 watts
OPERATING VOLTAGE	105—120 volts, 60 cycles, a.c.
POWER CONSUMPTION	
Radio	50 watts
Phonograph	65 watts, total
INTERMEDIATE FREQUENCY	455 kc.
AERIAL	Built-in low-impedance loop; provision for external aerial
PHILCO TUBES (6)	7B7 r-f ampl., 7B7 i-f ampl., 7A8 converter, 14B6 det.-a.v.c.-1st audio ampl., 35L6GT output, 50Y6GT rectifier
PHONOGRAPH	Philco Model M-20 All-Speed Automatic Record Changer. (For service information, refer to Service Manual PR-1731.)

A

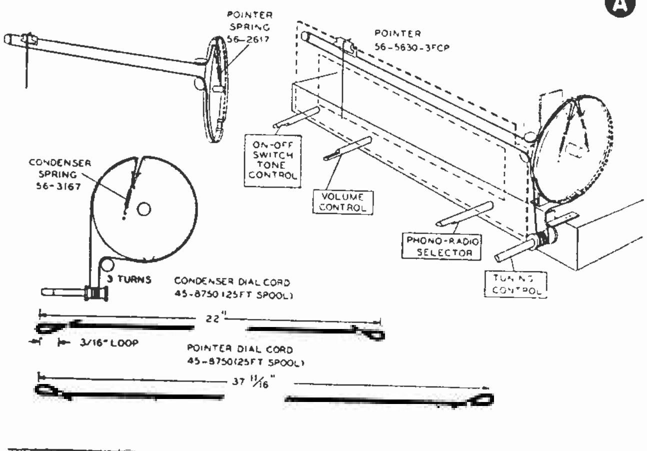
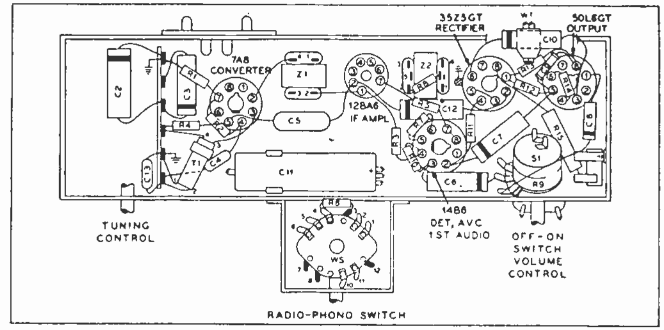


Figure 1. Drive-Cord Installation Details

FIG. 12A



B

Figure 2. Symbolized Chassis, Showing Parts Placement

REPLACEMENT PARTS LIST

Reference Symbol	Description	Part No. Service
C1	Condenser, tuning, 2-section	31 2751 4
C1A	Condenser, aerial trimmer	Part of C1
C1B	Condenser, oscillator trimmer	Part of C1
C2	Condenser, by-pass, .1 µf.	61-0113*
C3	Condenser, a-v-c filter, .05 µf.	61 0122*
C4	Condenser, d-c blocking, 47 µµf.	62-051009001*
C5	Condenser, screen by-pass, .003 µf.	61-0109*
C6	Condenser, d-c blocking, .01 µf.	61 0120*
C7	Condenser, d-c blocking, .01 µf.	61-0120*
C8	Condenser, tone compensation, hi-cut, .002 µf.	61 0062*
C9	Condenser, grid by-pass, 220 µµf.	62-122001001*
C10	Condenser, tone compensation, .02 µf.	61-0108*
C11	Condenser, electrolytic, 3-section	30-2573
C11A	Condenser, filter, 30 µf., 150v	Part of C11
C11B	Condenser, filter, 25 µf., 150v	Part of C11
C11C	Condenser, filter, 20 µf., 150v	Part of C11
C12	Condenser, line by-pass, .04 µf.	45-3500*
C13	Condenser, temperature compensating, 7.5 µµf.	30-1224 8
I1	Pilot lamp 6 8 volts, brown bead	34-2068
LA1	Loop-aerial assembly	76-2127-10
LS1	Speaker, 5-1/4", round, p-m	36 1629-6
R1	Resistor, leakage, 150 000 ohms	66 4158340*
R2	Resistor, grid return, 100,000 ohms	66-4108340*
R3	Resistor, a-v-c load, 1 megohm	66-5108340*
R4	Resistor, dropping, 39 000 ohms	66-3398340*
R5	Resistor, cathode bias, 68 ohms	66 0688340*
R6	Resisor, diode return, 1 megohm	66 5108340*
R7	Resistor, diode load, 2.2 megohms	66-5228340*
R8	Resistor, i-f filter, 47 000 ohms	66-3478340*
R9	Volume control (with off-on switch) 1 megohm	33-5538-37
R10	Resistor, grid return, 3.3 megohms	66-5338340*
R11	Resistor, plate load 470 000 ohms	66 4478340*
R12	Resistor, grid return, 470,000 ohms	66 4478340*
R13	Resistor, cathode bias, 130 ohms	66-1128740*
R14	Resistor, filter, 1200 ohms	66 2128340*
R15	Resistor, filter, 220 ohms, 2 watts	66-1225340*
S1	Switch, off-on	Part of R9
T1	Transformer oscillator	32 4263
T2	Transformer, output	32 8384
W1	Line cord	L 2183*
WS	Switch radio phono	42 1922
Z1	Transformer, 1st i-f	32-4160-6A
Z2	Transformer, 2nd i-f	32-42402A

MISCELLANEOUS

Description	Service Part No.
Cabinet	10797
Baffle-and-cloth assembly	40-7883
Bottom	54-8074
Butt hinge (2)	56 6434
Foot (4)	56 7778
Gasket, speaker	54-8089
Washer, fibre, speaker mounting (3)	27-7467
Glass dial scale	54-5086
Strap, scale mounting (2)	56-5155FA3
Knob volume and tuning	54 4527 26
Knob, radio-phono switch	54-4527 27
Lid support	56 7947
Sleeve changer mounting (3)	54 7798
Speed nut changer mounting (3)	W-2554FCP
Spring changer mounting heavy (3)	56-7059FA9
Spring changer mounting, light (3)	56-7059-1FJ47
Dial Backplate Assembly	76-5705
Drive cord, 25 foot spool	45-8750*
Pointer	56-4362-8FCP
Spring, drive	56 3167
Pilot lamp assembly	76 1179 7
Pilot lamp bracket-and-clip assembly	76-5708
Pulley and shaft assembly	76-3671-1
Bushing	27 9437
Fastener, hairpin	57-1468FA1
Rubber mount, gang mounting (3)	27-4771-1
Socket, Loktal (2)	27 6177
Socket, miniature	27 6203
Socket, octal (2)	27 6174
Switch cable, shield, and guide assembly	76-5707
Terminal panel, aerial	38 9161-9

FIG. 12B

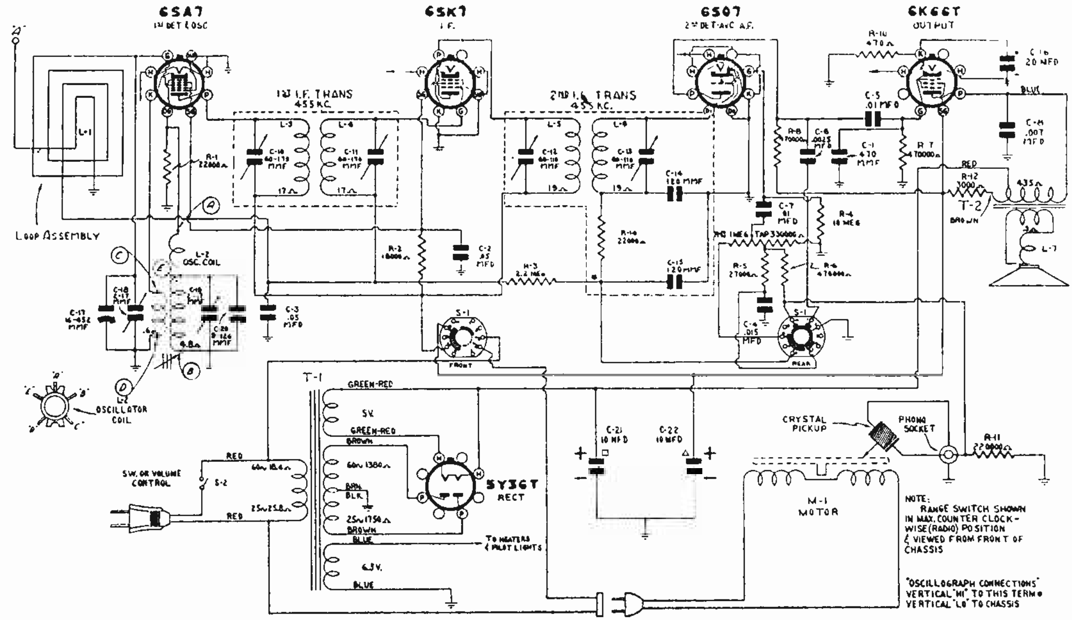


FIG. 13. Receiver schematic showing the tube sockets in pictorial form.

duplicate parts from the manufacturer's distributor. This is unnecessary in the case of standard replacement parts such as resistors, condensers, the volume control and i-f transformers. Loops and tuning condensers, for instance, may be available only through the manufacturer or his local distributor.

In Fig. 12A the manufacturer has given detailed instructions on restringing the dial cords. This is extremely useful, since unless you are very mechanically inclined, you can spend hours trying to restring a dial cord to make the dial pointer more in the correct direction with respect to the tuning condenser gang. Note that the length of the cords is given, together with the manufacturer's part number. In most cases ordinary dial cord which can be obtained from any parts distributor may be used.

In Fig. 11B you will find alignment data and also the correct tube layout. Frequently a set owner will remove the tubes from a receiver to have them tested and not replace them in the right sockets. With the aid of the schematic you can determine the right socket, but a layout of this sort is a real time saver. Also note that the tube pin numbers and normal operating voltages are marked on the schematic.

In the alignment procedure note that the physical location of the various alignment adjustments is shown. This is a time-saver, although practical experience plus a schematic will make trimmer or tuning slug location possible in most cases. The i-f adjustments for each can are shown as being coaxial. That is, one adjustment is inside the other. Two different types of tools are generally employed to adjust coaxially mounted iron core slugs.

The most helpful type of service information is shown in Figs. 13 and 14. Note that the chassis wiring diagram is actually a drawn "photograph" of the underside of the receiver chassis. All the parts and their connections are shown and each part is clearly labeled so it can be found on the schematic.

Before you draw a breath of relief and say "that's for me," carefully compare the chassis wiring diagram with the schematic circuit diagrams. You will find that occasionally there will be inconsistencies between the pictorial and schematic diagrams which could be confusing to a beginner. This particular service data was originally chosen at random from our files as a typical illustration but was inserted to put you on your guard. However, if you know your theory, you can tell what is right or wrong, and if variations make any difference. Actually the circuit shown in the chassis wiring diagram will work satisfactorily even though there are minor variations between it and the schematic diagram. Note particularly which filament prongs of the 6SQ7 in the schematic and in the wiring diagram

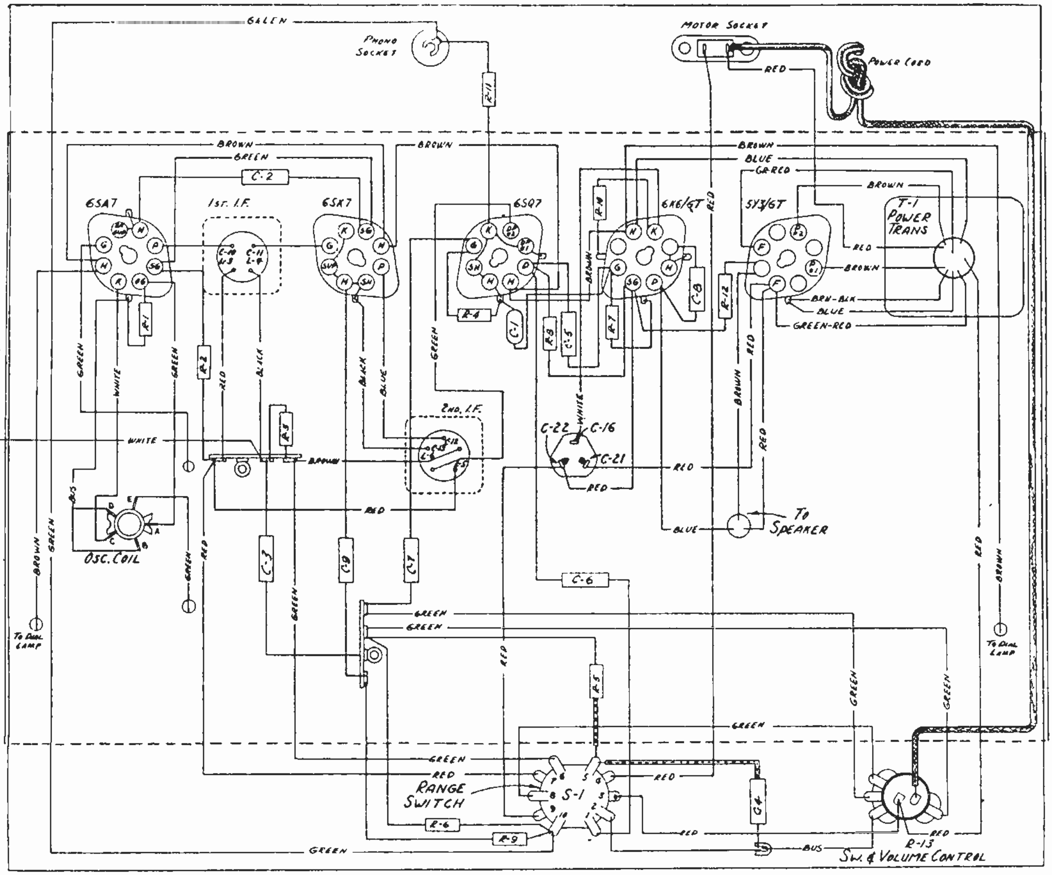


FIG. 14. A pictorial or wiring diagram of the receiver in Fig. 13. All under chassis parts and connections are shown.

are used as the grounded filaments. Also notice the error in the pictorial in labeling some of the terminals on the second i-f transformer.

This does not mean that all information should be suspected but that, when you find a contradiction in the manufacturer's data, you should stop and decide what is satisfactory before doing any rewiring.

Frequently a manufacturer will make slight modifications in the wiring of a receiver, perhaps to speed the assembly work, and in some cases a schematic revision does not follow. In this case the filament circuit change would not have been so apparent if the tube bases were not shown pictorially on the layout.

The summary which follows will give the important uses for manufacturer's service data and the forms in which it will be presented. If you are a beginner, complete familiarity with each point will come as you progress in your studies.

Uses for Service Data

1. To decide how a circuit should work.
2. To decide why a circuit works improperly.
3. To show how to apply service instruments to best advantage after trouble has been localized.
4. To enable you to break down the equipment into sections, stages and circuits.
5. To show the electrical values of the parts used.
6. To show the electrical location of the parts.
7. To enable you to find, in the chassis, the individual parts shown in the schematic.
8. To show the physical location of the tubes.
9. To show the alignment technique which should be used.

10. To show or make possible to find the physical location of the alignment adjustments.

11. To show or enable you to approximate the point-to-point resistance and voltage values which should exist in the circuit.

Manufacturers use the following methods to present the required service information. The methods are listed in the order in which they are most frequently presented.

1. Schematics with values indicated beside the symbols of the individual parts.

2. Schematics on which parts are numbered R1, C2, L6, T1 etc. and a parts list giving the electrical value of each.

3. Schematics as in 2 with an accompanying chassis layout showing the approximate physical location of parts.

4. Schematic as in 2 with a pictorial diagram showing the parts location and actual wiring.

5. Either 1, 2, 3 or 4 plus a chassis layout showing tube positions and the physical locations of alignment adjustments together with instructions for making the adjustments.

6. Either 1, 2, 3 or 4 plus a tube socket view giving the B— to pin voltage and B— to pin resistance for each tube.

———n r i———

Converting TV Sets for UHF

Students and graduates frequently ask: "Can I convert my TV set so that it will receive the new UHF stations?" Here are the answers.

Converting a TV receiver for UHF reception is generally a simple process. Special UHF coil strips are available for all receivers that use the Standard Coil Tuner. To purchase these new coil strips, simply tell your local dealer what channel is being used in your area, and tell him the letter that appears on the original coil strips. That letter is important because it allows the dealer to identify the proper coil strip for your particular set. (If it is convenient to do so, take one of the old strips with you to the wholesaler.)

Those sets that do not use the Standard Coil Tuner require external converters. Complete information for installing the converter is given in the literature that comes with it, but here is the general procedure: Connect the output of the converter to the input (antenna terminals) of the receiver, and connect the UHF antenna and the VHF antenna to the proper terminals on the converter.

When the new stations start operating in your area, additional information on UHF equipment (antennas, lead-in, etc.) will probably be available from your local wholesaler. Keep in touch with him.

Our Cover Photo

High-Fidelity seems to have been given quite a boost with the announcement by several major manufacturers of lines of hi-fi equipment. The attractive model on this issue's cover is posing with GE's new line, described below.

Chicago, Ill.—The General Electric Company recently announced its entry into the field of home high fidelity sound systems with the "Custom Sound Ensemble," consisting of a preamplifier control unit, a 10-watt amplifier, and a dual coaxial speaker. In addition to these basic units, a deluxe tone arm was announced.

Because the high fidelity customer is given a choice of components and can own as elaborate a system as he desires, a specific cost estimate on the complete system cannot be given. However the cost of the basic units for home record reproduction, without furniture, would be in the neighborhood of $200.

G-E's new preamplifier control unit (Model A1-200) was designed primarily for use with the company's variable reluctance cartridges and with the "Custom Sound Ensemble" but can be used with other make cartridges through slight circuit modification. The preamplifier control is self-powered, provides full bass boost, has adjustable record compensation, three input jacks, bass and treble controls, loudness control, loudness-volume switch and level set control. Suggested selling price $57.95.

The G-E Model A1-300 10-watt amplifier is a compact unit of the push-pull variety. The amplifier can be used with all preamplifier control units; as a booster amplifier for driving additional speakers in all types of audio systems; or as a monitor amplifier for broadcast and recording studios. Suggested selling price is $47.75.

G-E's new coaxial speaker (Model A1-400) features wide range and smooth, realistic reproduction. A 12 inch woofer and a 2¾ inch tweeter are assembled coaxially. The speaker features a new development which G-E engineers refer to as a "wave front shaper." A center plug attached to the pole piece in the tweeter smooths out high frequencies and reduces distortion to a minimum. Suggested selling price $39.95.

G-E's deluxe tone arm is available in two sizes. Model A1-500 for 12 inch turntables lists at $24.95. Model A1-501, for 16 inch turntables lists at $25.95. The new tone arms are for use with good quality single play turntables. A scale, calibrated in grams, with a sliding weight, is attached to the side of the head parallel to the supporting shafts. This weight makes stylus pressure adjustable from 0 to 10 grams.

At a later date, General Electric expects to augment its high fidelity system with the addition of an AM-FM tuner.

Looking Ahead With Television

By JOHN H. BATTISON

NRI Director of Education

John H. Battison

SINCE the freeze ended last year, seventy-five new television stations have gone on the air! At the time of writing this report, there are 184 television stations in operation in the United States. Fifty-nine of these started operation since January 1, 1953.

All over the United States, television activities and construction are booming. No matter where you go, you will find the magic word "Television" on almost everyone's tongue. I am sure that you all know from personal contact and experiences with friends and customers, how important television is these days. But here are some figures which, perhaps, you did not know. There are 349 construction permits outstanding. (A construction permit is an authorization by the FCC to build a transmitting station, Radio, Television, FM, etc.). Of these 349 construction permits outstanding, 124 are for VHF television stations and 225 are for UHF. On the operating side, we find there are 148 VHF and 36 UHF television stations comprising the total of 184 operating stations mentioned in the first paragraph.

When a construction permit for a new station is granted in any specific area it is not 100% certain that a television station *will be* constructed. However, in most cases the construction permit is consummated and the station goes on the air in due course. Occasionally, of course, construction permit holders do cancel them for various reasons—the usual one being inadequate financing. So far, only two or three construction permit holders have relinquished them. At the time of writing, the latest to do so was KCTV in Austin, Texas. Generally, when a construction permit is relinquished, another company is more than anxious to step forward and file an application for a new station to replace the cancelled one. The only way in which the public suffers is by experiencing a little more delay in getting television service.

UHF Television Reports

With the opening on June 6, of KTCY in Kansas City on Channel 25, the Television Broadcasting Industry—and of course, all its associated servicemen—has a realistic opportunity of observing what happens when a UHF-TV station opens in a VHF one station market. From the very first time that UHF television was proposed, in addition to VHF servicemen, engineers and, of course, businessmen, have been concerned about the pulling power of UHF TV when such a station has to commence operations in an existing VHF city, or market as such areas are generally called.

As readers may recall, Portland, Oregon, (Channel 26) was the first city in the world to get regular UHF Television service. This commenced in the fall of 1952. However, Portland previously had no television service, except perhaps a little sporadic reception from distant Seattle, Washington. In the case of Kansas City, KTCY on Channel 25 (also owned by Empire Coil Company, owners of WXEL in Cleveland and KPTV in Portland) is bucking WDAF-TV on Channel 4. This means, of course, that the new station will have to supply programs so good and appealing that Kansascitians will be willing to pay an extra $20 to $50 for new receivers or having old ones converted to receive the new station.

Because Kansas City has only one VHF TV station (affiliated with NBC) viewers in that area do not have any choice of programs, which means that they have to take what the station offers. With the opening of this second outlet, the other three networks (CBS, ABC and DuMont) have a much greater chance to present their wares to the people of Kansas City.

Another interesting point in this original market area is the fact that in about four or five months' time, KCMO-TV on Channel 5 will probably go on the air and offer additional competition. However, KCTY has this time in which to become established on UHF and offer alternate programming to WDAF-TV and thus build up a body of loyal UHF-TV viewers.

Already, 25% of the sets in Metropolitan Kansas City have been converted to receive UHF TV.

Before we leave UHF-TV and go on to other topics in the Radio and Television field, here is an incidental piece of information which may be of interest to many readers. It indicates the rate at which conversion of VHF Television receivers to UHF reception is expected. As far as is known, this is the first time that any Television station has priced its time services in this manner. With a normal charge of $400 an hour for air time, KCTY offers 40% reduction during June and July, 30% reduction in August, 20% in September, and 10% in October. This sliding scale of time charges is to allow for increasing audience size as more and more VHF receivers are converted, for UHF-TV reception.

Color Television

Still the rumpus over color Television continues! Every day you read in the papers some new and conflicting statement by important people in the industry. Not long ago it was stated publicly that RCA was going to ask the FCC on July 1 to establish new color Television standards to replace the old field sequential standard established in 1950. Not long after that Dr. W. G. Baker, President of the National Television Systems Committee (in which I am serving on three of the panels) told the newspapers that he felt it was better to wait a few more months and make *absolutely sure* that the new color television system and standards be very carefully tested in the field before the country is finally committed to a new set of standards.

Dr. Allen B. DuMont, the famed developer of modern cathode ray tubes, said that color television is still four or five years away. Now, whom should we believe?

All over the country in varying degrees this continued color television talk is hurting TV receiver sales. Of course in new television markets, people are so anxious to get TV reception that they are not perturbed by talk of possible obsolescence of black and white receivers so they go right ahead and buy. On the other hand, in many markets where the audience is close to saturation (saturation in this sense means the percentage of the total number of homes in the area which have television receivers), such as New York and Philadelphia, television receiver sales have slowed tremendously because people are waiting to see if color is going to be here "tomorrow."

I don't believe that any of us need to be unduly worried by the possible imminence of color television! The National Television Systems Committee is hoping to file an application with the FCC for new color TV standards before the end of this year and it is probable that RCA will withhold action until then. By the time this appears in print, we shall know whether this is so, but even if RCA does jump the gun, it is very likely that the FCC would consolidate both the RCA and NTSC applications into one hearing. Assuming that color TV standard applications are filed this year, about the earliest that we could expect an FCC decision would probably be in the Spring of 1954. This would mean that possibly a few very special hand-made receivers and very few commercial color television receivers can be expected on the market before the end of 1954.

Even when color TV receivers do come on the market, they are bound to be extremely expensive, since on the average they require *almost twice* as many tubes as present black and white receivers. Today the cost of an RCA color tube including the necessary high voltage, and scanning and deflection components, is about $280 to $300. These tubes are available only to manufacturers and organizations with a real and sincere interest in color television. Even when these tubes are introduced in quantity, real mass production methods will not be available at first and the tubes will probably cost at least twice the equivalent size black and white tubes. Receivers will probably cost anything from $700 up, although of course when production begins, manufacturers will no doubt find many ways in which costs can be shaved just as they did with black and white television.

There is no doubt that color television is beautiful. My experience with color TV dates back to 1946 when I was associated with CBS and the development of the CBS field sequential system. That was the *first* cheap and simple method of providing color television for the masses. Unfortunately FCC approval came much too late, when it was impossible to convert the millions of television receivers in existence to the CBS field sequential standards. Today, having been at many of the color television demonstrations and field tests, I can honestly say that in my opinion color television offers better colors than the best colored movie.

Early in May I attended some of our all-night sessions at the Bayside Laboratories of Sylvania. Here the field test panel of NTSC examined the performance of experimental receivers of many manufacturers, among them RCA, Hazeltine, Admiral, Zenith, Sylvania, Motorola, Emerson and Westinghouse.

From midnight on, a group of engineers observed still and moving pictures on the screens of all these receivers and evaluated them in terms of brightness contrast, color fidelity, etc. You may be wondering why it was necessary to stay up so late! The NTSC color signal is not as yet an officially approved FCC waveform. Therefore, it comes under the heading of experimental transmissions. This means that it may only be transmitted between the hours of 1 A. M. and 6 A. M.—the experimental transmission period for standard commercial television stations. When dawn came, color-crazy and weary, we had a pretty good idea of what hand made color television receivers would do on transmissions on Channels 4 and 5. Nevertheless, a tremendous amount of work still remains to be done in evaluating these results and continuing our tests until we are absolutely *sure* that the system we finally present to the FCC, and the American people, is the best that can be produced for many years to come.

It is always interesting to note the way in which new developments bring new words into use. When black and white television started we talked about the white flecks on the screen as snow. These flecks on color television are multicolored and engineers have coined the term "confetti" to describe "colored snow."

Community Antenna Systems

Activity in this field continues to increase and in the last year community antenna systems have grown from 70 to 80 to a little over 200. The number of subscribers has risen from 10,000 to 100,000. On the average, each system has over 500 subscribers. In fact two of them have more than 2000!

A new idea in community antenna systems can almost be called "community television systems." Operators of some of these systems have realized that, particularly in one station areas, there is a demand for additional entertainment. In Forence, South Carolina, the operator of a system with over 1000 subscribers will feed them film and disc jockey television programs nine hours daily! This operator has two DuMont camera chains and RCA community equipment. Here is another source of work for the alert and aggressive Radio or Television service man. These community antenna systems are not as complicated as television stations and provide an extremely good way of gaining experience of television equipment without having to give up other Radio or Television service work.

The largest community television system in the country is run by Martin Malarkey in Pottsville, Penna. He has over 2900 homes in Pottsville and Minorsville served by three channels.

Operators of these, what might be called, "closed circuit television stations," plan to include commercials in their disc jockey and film shows and in general, program their television operations on the same lines as a television station, with the exception that the programs are not broadcast over the air. Of course, they do not plan to interject their own local commercials into network or "off the air" programs.

A very important point is the fact that the FCC now appears to consider community antenna systems do not come under their jurisdiction and the field is wide open for development.

Receiver Notes

It is usual at this time of the year for all the major Radio and Television manufacturers to come out with their new 1954 and Fall lines. Many sets now feature combination UHF and VHF tuners, as well as external UHF converters. 24-inch rectangular sets are gaining in popularity. The 27-inch tube of course is the "big set", unfortunately they are still very expensive.

As a matter of fact, the 17-inch receiver is actually gaining in popularity, especially as a second set for many homes.

In the first five months of the year, about 3,400,000 television receivers were produced. It looks as though by the end of the year production will top the 7,000,000 mark!

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"No coaching from the audience, please!"

Technical Ramblings

By B. VAN SUTPHIN
NRI Consultant

Question: How Does a Tube Amplify?

ONE of the most puzzling phenomena to beginners is the manner in which a vacuum tube amplifies a signal. The fact that an amplified ac signal can be obtained in the plate circuit of a tube—a dc device—is sometimes difficult to understand. Let's see how a tube amplifies, and how the ac signal is obtained in the plate circuit.

Basic Amplifier Facts

Fig. 1 shows a basic amplifier circuit. The symbol in the grid circuit represents the input signal Ei applied between the grid and the cathode (The ac path to the cathode is completed through by-pass condenser Cg.)

The bias voltage is chosen so that the input signal will swing over the straight portion of the characteristic curve to give amplification without distortion.

As the grid voltage varies, the plate current of the tube will also vary. The amplified signal across Rp is coupled into external circuits through condenser Cc.

These are the basic facts about the amplifier circuit. Now let's see how the actual amplification occurs.

How An Amplifier Works

Fig. 2 shows the Eg-Ip curve of a typical tube. To obtain an output voltage that is an enlarged reproduction of the input voltage, the tube must be operated on the straight portion of the curve. Notice that 5 volts of bias allow a 2 volt (peak-to-peak) signal to stay within the straight, but relatively steep, portion of the curve.

When no signal is applied to the grid, the plate current will remain constant; of course, the plate current will be determined by the bias and plate voltage.

When a signal is applied to the tube, the potential on the grid varies to either side of the normal bias point. As the grid becomes more negative, the plate current decreases; and as the grid becomes less negative, the plate current increases. This produces a plate current that is pulsating dc. These pulsations are dependent upon the changes in voltage at the grid of the tube.

The plate current of the tube flows through resistor Rp. As the current through this load changes, the voltage drop across the resistor will also change.

For example, the plate current of the tube is 10 ma. when —5 volts is applied to the grid of the tube, and the changes in grid voltage cause

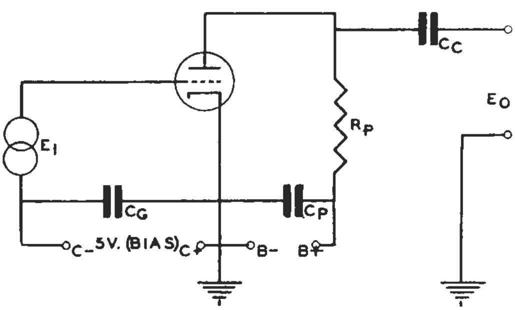

FIG. 1

the plate current to vary between 5 ma. and 15 ma.; this variation in current will produce a varying voltage drop across the load.

Suppose the load resistor is 10,000 ohms. Also, we will consider 10 ma. as a reference point because it is the value of plate current when no signal is applied to the tube. With no input signal, 100 volts will exist across resistor Rp.

When the grid voltage decreases to —4 volts, the plate current will be 15 ma., and the voltage drop across the plate resistor will be 150 volts. When the grid voltage is —6 volts, the plate current will be 5 ma., and the voltage drop across the plate resistor will be 50 volts.

You can see that the voltage across the plate resistor is varying in an ac manner. That is, the voltage across the load is increasing to a value that is greater than the reference value, and decreasing to a value that is less than the reference. The voltage is actually pulsating dc.

Pulsating dc can always be considered as pure dc plus an ac component. In this particular case, we have the dc plate voltage of the tube plus a 100 volt peak-to-peak (150-50) ac signal.

This ac signal at the plate circuit of the tube is produced by the 2 volt peak-to-peak (6-4) ac signal in the grid circuit. The signal has been amplified fifty times.

The B+ end of the load resistor is connected to ground, so far as the signal is concerned through the action of Cp. Therefore, the ac signal in the plate circuit appears between the plate of the amplifier tube and ground.

Condenser Cc couples the ac signal into external circuits as required. As the condenser will not pass dc, only the amplified ac signal (Eo) appears at the output terminals.

In actual amplifier circuits, the load may be a coil, a resistor or a tuned circuit. However, the basic operation of the circuit is always the same. Variations in grid voltage cause the plate current to vary, and produce an ac signal across the load.

Discussion

Does the input signal to an amplifier appear in the output circuit?

No. The input signal appears only in the input circuit. In that circuit it causes a varying potential to exist between the grid and the cathode. This varying potential causes a varying plate current which produces the output signal as a varying voltage across the load. The original input signal does not appear in the output circuit; it gets no further than the grid and cathode of the tube.

What limits the possible amplification of a given circuit?

Of course, there are many factors; but the most important are: the steepness of the Eg-Ip curve, and the ac impedance of the plate load. The steepness of the Eg-Ip curve of a given tube depends on the plate voltage that is available, and on the type of load used in the plate circuit. (If a resistor is used as plate load, a certain amount of dc drop will exist across the load; this drop will decrease the dc plate voltage.) For maximum amplification, the ac impedance of the load must be as high as possible; coils and tuned circuits are frequently used as loads so that the ac impedance of the load will be high while the dc resistance will be low.

Can an amplifier work on dc?

Yes, changes in dc voltage in the grid-cathode circuit cause the plate current to change, and a meter in the plate circuit can be calibrated in terms of the dc voltage change in the grid circuit. Modern vacuum tube voltmeters use dc amplifier circuits in this manner. Of course, dc amplifiers must use direct coupling between the various stages.

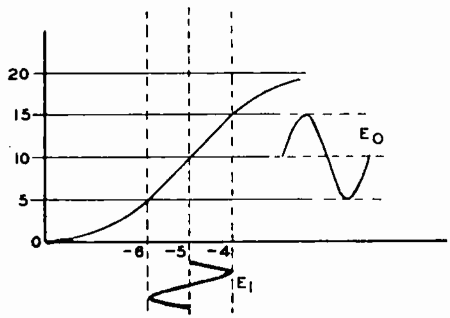

FIG. 2

How can more amplification be obtained?

There is a limit to the amplification possible in a single stage. To obtain greater amplification, stages must be connected in cascade so that the amplified signal from the output of one stage is fed to the input circuit of the next stage.

Why is the output signal 180° out-of-phase with the input signal?

Let's consider the current-voltage relationships for a moment. As the grid becomes more negative with respect to cathode, the plate current decreases; and as the plate current decreases, the voltage drop across the plate load decreases. Therefore, the voltage between the tube plate and cathode becomes more positive as the tube grid becomes more negative. Likewise, the voltage between the tube plate and cathode becomes less positive as the grid voltage becomes more positive. This effect keeps a steady 180° phase difference between the input circuit and the output circuit.

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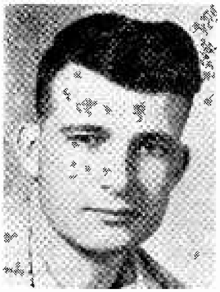
Before a man can wake up and find himself famous, he must wake up and find himself!

Your failures won't harm you until you start blaming them on the other guy.

Today is the day you worried about yesterday.

Read How NRI Graduates Are Forging Ahead In Radio and Television



NRI Grad Says Training is Necessary to Get Ahead Today

"I am employed at Radio Station KREW, announcing and performing maintenance on the station's broadcast equipment, and working on new equipment for our new station. It is very interesting work.

"I have seen a lot of men, with a chance to get the best of training, muff their chance. It is the man who knows what he is doing who will advance as fast as possible. I feel that the man with the training offered by NRI is going to be a long ways out in front of the game."

LESTER L. WARRINER
c/o Radio Station KREW
Sunnyside, Wash.

Has Full-Time Radio and TV Shop In Home

"I studied Radio before enrolling with NRI, but without much success. I could read and write English, but not very well. I found your course so well written that I believe anyone can understand it.

"Three months after enrolling I started a spare time radio shop. Now I have a full time shop in my own house, and am doing TV service as well as radio—business is coming in very well.

"As of today I have my own house and a good business in hand. My family's future is assured, thanks to NRI."

LUCIEN LEBLANC
80 Jean De Lalande St. Simon
Drummondville, P.Q., Canada

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NRI Training Prepared This Graduate For a Good Full-Time Job

"Before beginning your course I didn't know anything about radio or television. After studying the first six lessons I began to absorb the fundamentals, which later helped me to service radios in my own neighborhood. I earned about $5 or $10 a week during my studies.

"By the time I graduated I had earned enough to buy extra test equipment. I now have plenty of work in spare time servicing radios and TV.

"The training I received from NRI got me a job at the Philco Corporation. I owe it all to you. Thanks for the opportunity."

GABRIEL VAGNONI
4991 Thompson St.
Philadelphia, Penna.

Spare-Time Radio-TV Business Paid For Test Equipment

"The NRI course made it possible for me to buy all the instruments shown in my picture. I could easily make a good living from Radio and TV work. All my work is recommended by friends and neighbors. I do no advertising other than word of mouth.

"I have four garages in the neighborhood that give me car radio work. Am doing so well in radio and TV that I will always recommend NRI training to anyone looking for good training."

GEORGE F. SEAMAN
199 Sherman Ave.
New York, N. Y.

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Owns Combination Radio-TV-Electrical Store

"We have an appliance and service store. I service all of the radios and delicate electrical work. We are now beginning to service a few television sets. I have arranged with stores in other towns to do their repair work also.

"This is a big deal, since we have the only service shop for radios and television sets within a large trade area. We have two service benches, one for radios and the other for electrical work."

WILLIAM M. WEIDNER
Fairfax
South Dakota

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Doing a Fine Spare-Time Business at Home

"I am really proud to be a graduate of NRI. Your course helped me in many ways.

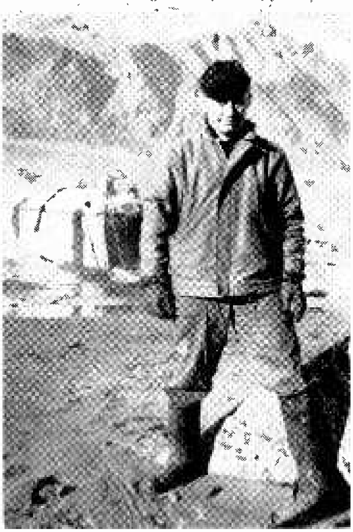
"I have a part time shop in my home and am doing a good business. Have earned enough to pay for my course and about $250 in equipment and $125 worth of radio tubes and parts.

"I didn't know a condenser from a resistor when I enrolled with NRI. Now I can handle any job that comes to my bench."

PAUL S. SNYDER
Richfield
Pennsylvania

As space permits, from time to time, we plan to devote a page or two in NR-TV News to short success stories such as above. They are taken from testimonial letters we have on file. Photographs and letters of this kind are always greatly appreciated by us. We feel we should pass them on to our readers for the inspiration to be gained from a reading of them.

NRI Training Helps Coast Guard Electrician's Mate



U.S.C.G. Cutter Coos Bay, at Sea

Dear Mr. Smith:

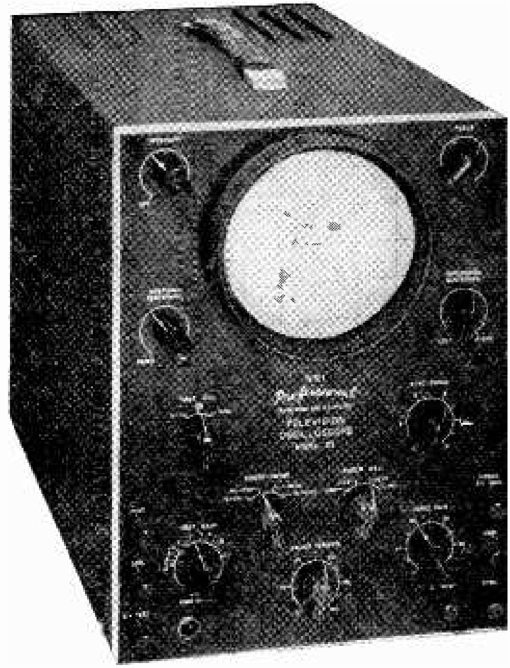
"Words cannot fully describe my gratitude to NRI for all the assistance I have received in helping me to know and understand radio and electronics.

"I am a member of the U. S. Coast Guard serving in the capacity of Electrician's Mate, first class. Recently I took the examination for Chief Electrician's Mate. This exam was more than fifty per cent questions on P.A. systems, electronic constant frequency units and vacuum tube voltage and syncro amplifiers. Thanks to your splendid servicing course I was able to do quite well on the test.

"I have also earned enough money fixing my shipmates radios and phono's to pay for a Tube Tester, VTVM, Signal Generator and a Scope. I fully recommend NRI course for any electrician who is working with electronic control equipment.

"The picture enclosed was taken in Fredericksdahl, Greenland, while we were unloading electronics gear via small boat."

Sincerely,
James Lewis, EMI, U.S.C.G.
7 Cleveland St., Broadview Pk.
So. Portland, Maine.



MODEL 55

NRI Professional TV Oscilloscope Again Available for Immediate Delivery

Supply has at last caught up with demand and the scope for which many of you waited patiently is now available. Designed for TV, AM-FM and general electronic applications. A few of the many outstanding specifications are listed below. If interested send order now or write for complete details.

1. HIGH SENSITIVITY—one inch deflection with signal voltage of .014 volts (RMS).
2. WIDE-BAND RESPONSE—±3 db from 10 cycles to 4.5 mc. Useful to 7 mc.
3. PUSH-PULL DEFLECTION AMPLIFIERS—in both horizontal and vertical amplifier circuits.
4. WIDE-RANGE SWEEP, 10cps.-100 kcs.
5. FUSE PROTECTION.
6. VOLTAGE REGULATED POWER SUPPLY
7. HIGH IMPEDANCE INPUT.
8. POSITIVE SYNC CIRCUIT.
9. FREQUENCY-COMPENSATED 3-STEP VERTICAL ATTENUATOR, CALIBRATED TO READ PEAK-TO-PEAK VOLTS DIRECT.
10. CALIBRATION TEST VOLTAGE.
11. INTENSITY MODULATION — RE-TRACE BLANKING.
12. EMPLOYS 13 MODERN TUBES.
13. POWER—50-60 cycle, 110-120 volts A.C.
14. DETAILED INSTRUCTION MANUAL.

Only $127.50

Shipped by express, collect.

N.R.I. ALUMNI NEWS

NOMINATIONS FOR 1954

ONCE again it is time for the members of the NRI Alumni Association to select their candidates to fill offices during the coming year. We will vote for nominees for President and for four Vice Presidents.

The two men receiving the largest number of votes for the office of President, will be declared nominees. The eight men receiving the largest number of votes for Vice Presidents will be declared nominees. The names of the nominees will be published in the October-November issue of NR-TV News. That, of course, is our next issue.

Our members then will be asked to choose from among the nominees, a President and four Vice Presidents. The election will take form during the month of October. The final day for voting will be October 24, inasmuch as the usual date, the 25th, this year falls on a Sunday. However, before we get to that we must hold our primary to select our nominees. The final day for voting in the primary is August 25, 1953. So please get your ballot in early.

It might be interesting to our members, at this point, to quote from our Constitution. The following portion of our Constitution is taken from Article VI, pertaining to the election of officers. Here it is.

1. The election of the President and the Vice President shall be by ballot.

2. The President shall be eligible for re-election only after expiration of at least one year following his existing term of office, and when not a candidate for President, may be a candidate for any other office. Other officers may be candidates to succeed themselves, or for any other, but not more than one, elective office in the Association.

3. The election of officers shall be held in October of each year, on the day designated by the Executive Secretary, but not later than the twenty-fifth of the said month.

4. The Executive Secretary shall advise Members by letter, or through the columns of the National Radio-TV News, on or before August first of each year that names of all nominees shall be filed in his office not later than August twenty-fifth following.

5. Each Member shall be entitled to submit, in writing, one nomination for each office, and the two nominees receiving the highest number of votes shall be the nominees for the office for which nominated.

6. The Executive Secretary, before placing any name on the ballot, shall communicate with each nominee, to ascertain his acceptance of the office, if elected. If such tentative acceptance is withheld, the eligible nominee having the next highest number of votes shall be the nominee for that office.

7. The Executive Secretary, on or before October first of each year, shall furnish Members a ballot listing the names of the nominees for each office.

8. No Member shall be entitled to vote if he is in arrears in the payment of dues.

9. Ballots, properly executed and valid according to the instructions plainly printed thereon, shall be returned to the Executive Secretary on or before midnight of October twenty-fifth of each year.

10. The Executive Secretary shall designate three Election Tellers from the staff of the Institute, who shall count the ballots and certify the results, together with the return of the ballots, to the Executive Secretary.

11. In the event of a tie vote for any office, the Executive Secretary shall cast the deciding ballot.

12. The nominee receiving the greater number of votes for the office for which nominated shall be declared by the Executive Secretary to be elected to that office, and notice of such election shall be forwarded in sufficient time, prior to January one, to permit such elected officer to enter upon the duties of said office on that date.

The ballot will found on page 27. The polls for nomination, we repeat, will close August 25, 1953. This will allow us five days in which to count the votes and announce the nominees in the October-November issue of NR-TV NEWS which goes to the printer on September 1. Balloting on the nominees will then take place and the successful candidates will be announced, in the December-January issue of NATIONAL RADIO-TV NEWS, in time to take office on January 1, 1954.

A most conscientious member of long-standing, Mr. Norman Kraft of Perkasie, Pa. will on January 1st, step out of the office of President. Mr. Kraft has done much for our Alumni Association, particularly in the local chapter in Philadelphia. He richly deserves the honors which our members have bestowed upon him.

In order that our members may have a list of candidates to choose from we are submitting some names of members located in various parts of the country. These are submitted merely to be of assistance. See next two columns.

We have only two recommendations. It would be nice to have our President, this year, come from the far West. Oliver B. Hill of Burbank, California, who has served as Vice President for a number of years, is most deserving and would make an excellent President.

Another man who should soon receive recognition is Floyd Buehler of Detroit. He has been very active in Detroit Chapter. Always ready to extend a helping hand to a member, Mr. Buehler would make a fine Vice President.

Use your own judgment, however. Vote for whom you please, just so he is a member of the NRI Alumni Association. This is your election. Please vote.

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Try praising your wife, even if it frightens her at first!

Woman's chief asset is man's imagination!

A good woman inspires a man;
A brilliant woman interests him;
A beautiful woman fascinates him;
And a sympathetic woman gets him.

A honeymoon is the thrill of a Wifetime!

Nomination Suggestions

T. E. Berryhill, Pomerene, Ariz.
Gordon E. DeRamus, Selma, Ala.
Don Smelley, Cottondale, Ala.
Edgar E. Joiner, El Dorado, Ark.
A. R. Waller, Keo, Ark.
Oliver B. Hill, Burbank, Calif.
Jos. E. Stocker, Los Angeles, Calif.
Herbert Garvin, Los Angeles, Calif.
A. W. Blake, Denver, Colo.
Chas. Bost, Leadville, Colo.
Albrecht Koerner, Stamford, Conn.
Joseph Medeiros, Hartford, Conn.
Joseph Snyder, Danbury, Conn.
Eric Woodin, Naugatuck, Conn.
Wm. F. Speakman, Wilmington, Del.
Jos. Certesio, So. Wilmington, Del.
Max Yacker, Washington, D. C.
Wm. G. Spathelf, Washington, D. C.
Glen G. Garrett, Bonifay, Fla.
Henry C. Hasse, St. Petersburg, Fla.
Stephen J. Petruff, Miami, Fla.
W. P. Collins, Pensacola, Fla.
Raymond Marsengill, Atlanta, Ga.
R. R. Wallace, Ben Hill, Ga.
Joseph Bingham, Twin Falls, Idaho
H. C. Eskridge, Gannett, Idaho
Erwin Andrews, Batavia, Ill.
Robert Reid, Evanston, Ill.
Fred J. Haskell, Waukegan, Ill.
Jerry C. Miller, Skokie, Ill.
Herbert Lausar, Chicago, Ill.
John Janesick, Chicago, Ill.
Harold Bailey, Peoria, Ill.
Dick Michael, Hartford City, Ind.
Chase E. Brown, Indianapolis, Ind.
Paul Knapp, Evansville, Ind.
H. E. McCosh, Charles City, Iowa
E. C. Hirschler, Clarinda, Iowa
C. Hopkins, Hutchinson, Kans.
Wm. B. Martin, Kansas City, Kans.
K. M. King, Wichita, Kans.
George Springmeier, Covington, Ky.
R. B. Robinson, Louisville, Ky.
L. H. Ober, Alexander, La.
Louis E. Grossman, New Orleans, La
Walter Dinsmore, Machias, Maine
Harold Davis, Auburn, Maine
Ralph E. Locke, Calais, Maine
Emil M. Stetka, Baltimore, Md.
J. B. Gough, Baltimore, Md.
Woodrow Marks, Hagerstown, Md.
G. O. Spicer, Hyattsville, Md.
Manuel Enos, Fall River, Mass.
Louis Crestin, Boston, Mass.
A. Singleton, Chicopee, Mass.
Omer Lapointe, Salem, Mass.
Robert Swanbum, Duluth, Minn.
Arthur J. Haugen, Harmony, Minn.
Ray Williams, Minneapolis, Minn.
F. Earl Oliver, Detroit, Mich.
Chas. H. Mills, Detroit, Mich.
Harry R. Stephens, Detroit, Mich.
Floyd Buehler, Detroit, Mich.

Walter Jenkins, Biloxi, Miss.
Robert Harrison, West Point, Miss.
C. S. Burkhart, Kansas City, Mo.
A. Campbell, St. Louis, Mo.
C. W. Wichmann, Inverness, Mont.
Earl Russell, Great Falls, Mont.
V. S. Capes, Fairmont, Nebr.
Albert C. Christensen, Sidney, Nebr.
C. D. Parker, Lovelock, Nev.
L. R. Carey, Elko, Nev.
Clarence N. George, Dover, N. H.
Geo. Stylianos, Nashau, N. H.
J. A. Stegmaier, Arlington, N. J.
Delbert Delanoy, Weehawken, N. J.
Claude W. Longstreet, Westfield, N. J.
C. Evan Yager, Albuquerque, N. Mex.
Solomon Cruz, Raton, N. Mex.
Denver Stevens, Castle Pt., N. Y.
Alfred R. Guiles, Corinth, N. Y.
Thomas Hull, Jr., New York, N. Y.
L. J. Kunert, Massapequa, N. Y.
Charles W. Dussing, Syracuse, N. Y.
Henry R. Zeman, Charlotte, N. C.
Irvin Gardner, Saratoga, N. C.
Max J. Silvers, Raleigh, N. C.
Arvid Bye, Spring Brook, N. Dak.
Wilbur Carnes, Columbus, Ohio
H. F. Leeper, Canton, Ohio
Chas. H. Shipman, E. Cleveland, Ohio
Byron Kiser, Fremont, Ohio
Robert Bond, Okla. City, Okla.
Emil Domas, Ritter, Oreg.
Folia T. Hall, Portland, Oreg.
Norman Kraft, Perkasie, Pa.
Harvey Morris, Philadelphia, Pa.
Elmer E. Hartzell, Allentown, Pa.
Chas. J. Fehn, Philadelphia, Pa.
Laurent Vanaudenhove, Pawtucket, R. I.
James F. Barton, Greer, S. C.
Joel J. Lawson, Aberdeen, S. Dak.
John Wenzel, Gettysburg, S. Dak.
Newell M. Comer, Tullahoma, Tenn.
Matthew Duckett, Memphis, Tenn.
Oscar C. Hill, Houston, Texas
Dan Droemer, Ft. Ringgold, Texas
N. G. Porter, Cedar City, Utah
Clyde Kiebach, Arlington, Va.
Wm. L. Cline, Daphne, Va.
Floyd Goode, Richmond, Va.
B. C. Bryant, Alburg, Vt.
C. R. Thompson, Vancouver, Wash.
Alfred Stanley, Spokane, Wash.
G. Bloomberg, Aberdeen, Wash.
Edgar Maynard, Red Jacket, W. Va.
Wm. Wiesmann, Fort Atkinson, Wisc.
J. C. Duncan, Duncan, Wyo.
Cleone Young, Cheyenne, Wyo.
M. Martin, New Westminster, B. C., Canada
E. D. Smith, Winnipeg, Man., Canada
H. V. Baxter, St. John, N. B., Canada
W. F. Arseneualt, Dalbousie, N. B., Canada
Donald Swan, Springhill, N. S., Canada
J. A. Hehir, Smiths Falls, Ont., Canada
G. Favreau, Montreal, P. Q., Canada
Thos. Crooke, Saskatoon, Sask., Canada

Nomination Ballot

L. L. MENNE, *Executive Secretary*
NRI Alumni Association,
16th and You Sts., N.W.,
Washington 9, D. C.

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for the year 1954.

(Polls close August 25, 1953)

MY CHOICE FOR PRESIDENT IS

....

City.............................. State........

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. ....

City.............................. State........

2. ....

City.............................. State........

3. ....

City.............................. State........

4. ....

City.............................. State........

Your Signature ....

Address ....

City.............................. State........

Student Number ....

On these pages is a photo, taken from the left and right side of the aisle, showing the fifty-five charter members of our new Pittsburgh Chapter.

A Chapter is Organized in Pittsburgh

Fifty-five members of the NRI Alumni Association met in Pittsburgh and signed up as charter members of a Chapter in that city. Frank Cook and L. L. Menne, from NRI Headquarters, attended the first meeting.

On June 4 a charter was delivered and the Chapter is now well under way. Officers elected are as follows:

Chairman: Francis P. Skolnik
616 Springfield Avenue, Phone, WA 19272
Vice Chairman: David C. Benes
1628 Grandview Ave., N. Braddock, Pa.
Financial Secretary: Joseph Kyler
4430 Evergreen Road, WE 12458R
Recording Secretary: John J. Olejar
3721 Bear Street, WE 10209J
Financial Committee: W. J. Simmons, 510 Meridan Street, EV 18470. K. J. Shipley, 300 Brosville Street, EV 18976.

A set of By-laws is being prepared. These are being worked out with the cooperation of Headquarters. In these By-laws it is proposed to change the title of the office of Financial Secretary to Treasurer and that of the Recording Secretary to Secretary, which titles, it is believed, more clearly designate the responsibilities of the two offices and may avoid possible confusion in the performance of duties. This change will be made in the general election at the close of the current year.

Chairman Skolnik was complimented for locating the very desirable hall at 134 Market Place. Here Pittsburgh Chapter seems to have everything desired to make for pleasant and profitable meetings.

The members voted to meet once a month at 8:00 P.M., on the first Thursday of each month. The officers have held several meetings to plan programs for the benefit of members. Many members have contributed suggestions. Letters have been received from officers of other Chapters giving aids of various kinds based on years of experience. In this connection special mention is made of the fine cooperation extended by Mr. Jules Cohen, Secretary of Philadelphia-Camden Chapter, who has been very helpful.

Students and graduates in the Pittsburgh area are cordially invited to attend meetings as guests to get acquainted. If they then wish to join the Chapter students may do so as Associate Members, graduates as Full Members. The dues are nominal. Information will gladly be supplied by any of the officers whose phone numbers are given above.

Watch Pittsburgh Chapter grow!

Chapter Chatter

Detroit Chapter brought a very successful season to a close with the customary party the last week in June. This year it was a stag held at the Chry-Moto Club in Windsor, Ontario, Canada. Arrangements were made by Clarence McMaster, ably assisted by Chairman Kenneth Kacel, and Vice President Earl Oliver. There was good food, plenty to drink, and lots of fun.

The Chapter is considering purchasing a Television dynamic demonstrator for use at our meetings. We had the privilege of seeing Mr. John R. Meager of RCA demonstrate such a board, and it seems to be ideal for Chapter purposes.

Mr. Harold Heiple, of Chase Television, spoke to us on TV Service Methods used in a modern service organization. Several films were also shown. One is titled "Television and How It Works" and the other concerns "Phonevision."

After some experimenting, the Chapter has decided to continue to meet at the St. Andrews Society Hall at 431 East Congress.

As is customary with Detroit Chapter, meetings are suspended during July and August. We will resume meetings in September with a big get-together.

New Orleans Chapter is doing very nicely with Chairman Louis E. Grossman, appreciably aided by the new Assistant Secretary, Mr. A. H. Buckley. Mr. Buckley has submitted complete reports of recent meetings which show that Mr. Peter Fonte, Technician, spoke on alignment of TV sets, and Mr. Gene Carr, District Supervisor for General Electric, spoke on servicing and operation of GE-TV Sets. At another meeting there was a film on manufacturing and installation of TV antennas. Following the showing of this film there was an open forum at which time many questions were asked and answered by the more experieneed members of our chapter. This was a very worthwhile discussion.

At still another meeting, Mr. Mike Suchaneck demonstrated alignment procedure on Television sets. The equipment was furnished by our chapter's Secretary, C. E. Davidson, Jr. Mr. Suchaneck promised to return very soon to resume his interesting talk.

Chairman Louis E. Grossman may be reached at 2229 East Napoleon Avenue and Assistant Secretary Anthony H. Buckley may be addressed at 2817 Burgandy Street in New Orleans.

Baltimore Chapter is looking forward to the Fall Season. In the meantime, the Chapter is being nicely supplied with late Radio and Television information by Mr. Rathbun and Mr. Shue.

New York Chapter, always in high spirits and enthusiastic, is determined to keep its place at the head of our Chapters in point of attendance. These fellows are very proud of their turnouts and it is a poor meeting indeed when attendance falls below fifty.

Mr. Philip Spampinato continued his series of talks on "Audio Systems in Radio and TV Receivers." Mr. Ralph Georg spoke on "DC Restoring Circuits in TV." At another meeting Vice

Chairman Thomas Hull, Jr., conducted our Radio Clinic after which he delivered a very fine talk on I-F Alignment.

At still another meeting Mr. Alex Remer spoke on how to make a cathode tube repair kit. Mr. William Fox was another speaker who spoke on his experiences while servicing TV receivers. At our final meeting in June, refreshments were served. Meetings are suspended during July and August.

Philadelphia Chapter, instead of holding a regular meeting, visited Station WCAU in Philadelphia. Ordinarily these tours are held only in the daytime but through splendid cooperation on the part of the officials at WCAU and the kindness of Miss Helen Bainbridge of the staff, a tour was planned especially for our group to be held in the evening.

Fifty-two members made this tour through this $10,000,000 structure. We were given an opportunity to visit the control rooms, broadcasting rooms, TV studios, and to see how programs are arranged and screened. It was a very impressive visit.

A meeting was set aside to honor Mr. Charles Fehn, who has filled one or another office in our organization almost continuously since our Chapter was organized about twenty years ago, and also to honor Mr. Harvey Morris, who has been so devoted to our Chapter in his talks and demonstrations for our benefit. The occasion was also used for the purpose of doing a little celebrating with Mr. Fehn who was recently married. Both Mr. Fehn and Mr. Morris were presented with several pieces of silver.

Three new members are Steven J. Gilbert, Bernard J. Reinhardt and Frederick Schonbach.

Philadelphia-Camden Chapter continues meetings right through the summer. Meeting nights are the second and fourth Monday of each month. The hall is Knights of Columbus, Tulip and Tyson Streets in Philadelphia. The Secretary is Mr. Jules Cohen who can be reached at 7124 Souder Street, telephone FIdelity 2-8094.

Chicago Chapter meets on the second and fourth Wednesday of each month in the Tower Space in the American Furniture Mart, 666 Lake Shore Drive, Chicago. Please use West Entrance.

Talks have been given recently on TV Tuner Troubles, Continuity, Cabinet Care and Repairs. As a special feature, Secretary Frank Ziecina has a little group meet with him after the meeting at which time he gives information on how to get an amateur Radio License. Students and graduates in this area are cordially invited to attend our meetings.

SCIENCE QUESTION BOX

By Scientists of the General Electric Company

Q: Years ago I had a so-called "barometer," consisting of a sealed glass tube containing a liquid with some small crystals in the bottom. These would sometimes grow higher into a feathery mass, and this was supposed to foretell a storm. How did this device work?

A: What you describe is the "camphor glass," which was introduced in England about 1825. It contains a solution of various salts, which is sensitive to changes in temperature. Crystals may be formed when the liquid is cooled and dissolved when the temperature is raised. Although occasional temperature changes before a storm might alter the appearance of the crystals, it is not considered a reliable indicator of future weather conditions. A true barometer measures changes in atmospheric pressure, but the Camphor glass is really a thermoscope, which gives only a rough indication of changes in temperature.

Q: I know that light waves can be polarized, or made to vibrate in a single direction. Can this also be done with radio waves, which are supposed to be similar to light waves, except that the radio waves are much longer?

A: Polarization of light waves may be accomplished with special polarizing filters. Whereas ordinary light vibrates from side to side, up and down, as well as at other angles, light that has been polarized vibrates only in one direction; up and down, for example. The same thing can be done with radio waves, especially the short ones like those used for television. One simple method is to have the transmitting antenna horizontal for horizontal polarization, or vertical for vertical polarization. In the U. S. the waves used for TV are horizontally polarized, and the receiving antennas are also horizontal. However, some other countries use vertical polarization and then the TV receiving antennas have to be in a vertical position.

Q: What is ozone?

A: Ozone is a form of oxygen. Ordinarily oxygen consists of molecules, each of which is made of two oxygen atoms, but the ozone molecule is made of three such atoms. These are produced by electrical discharges, or by the action of ultraviolet rays. It is difficult to obtain ozone in large concentration, because it reacts with water vapor, always present in the air, to form hydrogen peroxide. In low concentrations it is used to freshen the air of a room. It is possible to smell one part of ozone in ten million parts of air.

Here and There Among Alumni Members

Congratulations to John Zimmerman, of Miami, Fla., who is now Radio and TV Service Shop Foreman for the Service Corporation of America.

———n r i———

Ellis Rice, of Glasgow, Ky., has purchased a 4-place airplane for use in his business. He does two-way communications service, aircraft radio installation and service, in addition to a conventional Radio-TV business.

———n r i———

Harvey E. Horne, of Erwin, N. C., is now an authorized RCA dealer.

———n r i———

Edwin Holscher, of Spencer, Iowa, manufactures a hinged tower for fringe TV installations, in addition to a thriving service business. Although simple installations are not possible in his area, Holscher reports reception 90% of the time from seven TV stations.

———n r i———

Graduate A. H. Ayers, formerly of Washington, D. C., has moved to St. Petersburg, Florida, where he is continuing operation of his Radio-TV Shop from his home.

———n r i———

Larry Dolan of Detroit Chapter sent us a very cute announcement of a baby girl born June 11, 1953. Name, Valerie June. He passed out cigars at the Detroit Chapter stag. Congratulations to Mr. and Mrs. Dolan.

———n r i———

Grad Luther R. Johnston, of North Platte, Nebr., now has his first-class radiotelephone license and is ready to locate in a broadcasting station.

———n r i———

Wilber E. Jordan, of West Warwick, R. I., is "on the road" as a salesman for one of the largest Electronic wholesale distributors in his part of the state.

———n r i———

R. W. Tilson, of Biltmore, N. C., has his FCC license and is working at Station WWNC.

———n r i———

Clyde C. Cook, of Millbrae, Calif., has received his first-class radiotelephone license and is employed as a Radio-Electronics Mechanic with Trans-World Airlines.

———n r i———

Louis A. Malacarne, of Providence, R. I., has gone into business for himself. The business is a partnership called "Industrial T. V. Co."

———n r i———

Edward Bryant, NRI Graduate from Dover, Florida, is stationed at Fort Monmouth, N. J., as a Radar repairman. Bryant recently graduated among the top of his class in the repair school.

From Olney, Texas, Grad I. L. Tomlinson writes that his Radio-TV business is on the increase—doing work for two local concerns.

———n r i———

Congratulations to Wayne A. Shingler, of Mattawana, Penna., who is now Service Manager of the Montgomery Ward Store in Lewistown.

———n r i———

Doug Bradshaw, of Hamilton, Ont., is serviceman for Dun-Ham Radio. Doing well.

———n r i———

Albert Patrick, of Tampa, Florida, reports that reception from the new local UHF outlet is quite good, with range up to 60 miles (Channel 38).

———n r i———

We have just received word that our good friend Robert L. O'Neal, of Camp May, N. J., passed away several months ago. Mr. O'Neal was a loyal member of the NRIAA.

———n r i———

H. I. Hungerpiller, of Newton, Kansas, a former shipboard radio operator, has just completed four years of training with the Prairie Bible Institute. He is now gaining further experience with Station KJRG, Newton, Kansas, in preparation for going to Liberia, Africa, in missionary radio work.

———n r i———

Alumnus Ted Smith, formerly a member of Chicago Chapter of NRIAA, is convalescing at his sister's home in Grove City, Ohio. Until his illness, Grad Smith was in industrial electronics maintenance with the Continental Can Co. in Chicago. Best wishes for a rapid and complete recovery.

———n r i———

George Tinker, Radio and Television Dealer from Ft. Mill, S. C., has received the Admiral dealership for his county. He employes two NRI students in his service organization, James Tollison and Paul Ferrell.

———n r i———

Paul G. Miller, of Maumee, Ohio, owner of a very well established Service Organization for Radio and TV, reports that he has become an official Bendix-Ford Automotive parts distributor. Also Authorized Ford Car Radio Service Station.

———n r i———

Jack Helsdon, of Tillsonburg, Ont., Canada, is doing well as Chief TV Technician for a large store. Nearly doubled his pay in past five years.

———n r i———

Graduate Daniel B. McDonald, of Pacoima, Calif., writes that he has all the work he can handle—mostly TV. Also selling TV receivers.

———n r i———

Harry Stephens, former President of the NRIAA, has moved from Rochester, Michigan, back to Detroit. He liked the country but the 60-mile daily round trip from Detroit, was tiresome. Detroit Chapter boys are glad to have him back.

NATIONAL RADIO-TV NEWS
16th & U Sts., N.W. Washington 9, D. C.

For:

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Denver 2, Colo.

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