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IN THIS ISSUE

The FM Pilotuner

Servicing the Majestic 90 Receiver

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IT gives me great pleasure once again to have the opportunity to extend cordial season's greetings to each and every one of our Students and Graduates.

It was Dickens who said "There seems a magic in the very name of Christmas." We greet our friends and neighbors with the warm feeling that Christmas always brings. Yes, magic and joy, good fellowship, understanding. If only we could carry the spirit of Christmas with us throughout the whole year.

May the deep joy of the holiday season be with you. And may the good cheer that this season brings remain to brighten each day during the coming year. On behalf of myself and the entire staff at NRI we wish you Good Luck, Good Health, Good Fortune.

J. E. SMITH, *President.*

Louis E. Garner, Jr.

The FM Pilotuner

Note: We wish to thank the Pilot Radio Corp. for technical data and illustrations used in this article.

By LOUIS E. GARNER, JR.

NRI Consultant

AS more and more FM broadcasting stations come on the air, a greater and greater proportion of the general public has become interested in FM reception. FM reception, of course, offers many advantages over ordinary AM reception.

First, however, for those who are not too familiar with the term, let us define FM. FM means frequency modulation. That is, instead of varying the amplitude or strength of a carrier signal in accordance with the music or speech being transmitted, the frequency is varied. The amount of frequency change from the carrier "resting frequency" will depend upon the strength of the audio signal—the greater the audio signal, the greater the change from the resting frequency. The frequency of the audio signal will determine how many times the frequency change occurs in the carrier per second.

In other words, a high frequency audio note will cause the carrier frequency to change more times per second than will a low frequency audio note.

The basic theory underlying frequency modulation transmission and reception is covered in the regular NRI Course.

There are many advantages to using FM for broadcasting. One advantage is the reduction of noise interference. Most noise, of course, causes amplitude or strength changes in the signal. Since an FM receiver is designed to respond only to frequency changes, then most noise such as that produced by static will be reduced or, in many cases, eliminated.

Another advantage is the higher fidelity which can be achieved with FM broadcasting. This is, of course, of importance when one is listening to classical music or to "live" talent programs.

Even though FM will allow much higher fidelity, such fidelity cannot be utilized unless the sound reproducing system used is also capable of high fidelity—this means that a high fidelity audio amplifier must be used and that good speakers must be used.

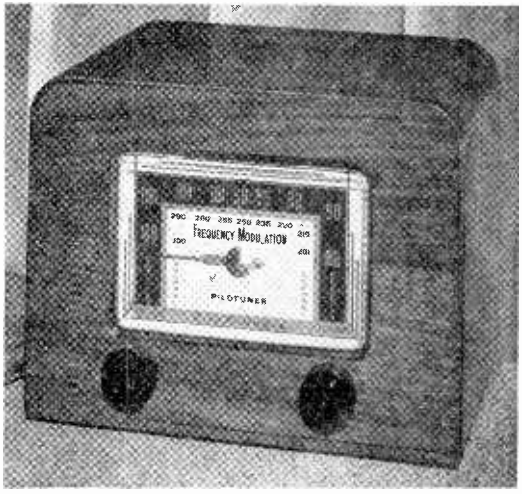


Fig. 1—The FM Pilotuner

Even where a high fidelity sound reproducing system is not available, FM still offers remarkable advantages. Not only because of the reduction in noise but because audio systems in most receivers are capable of reproducing a wider range of frequencies than they normally reproduce.

This means that the audio system—audio amplifier and loudspeaker could, if one wished, be used with a "tuner" to receive FM broadcasts. This is desirable since many people already have a large investment in ordinary AM radios and hesitate to invest considerably more money in combination AM-FM receivers or in straight FM receivers.

From a practical viewpoint, of course, it is quite difficult, if not impossible, to convert an ordinary AM set to receive FM broadcast—not only are changes in the tuning necessary but in the type of detector used.

An FM tuner, however, offers a solution since the AM antenna, AM r.f. system and AM detector can be more or less "by passed" and a corresponding FM system substituted. The audio amplifier and loudspeaker of the radio can still be used to advantage.

The FM Pilotuner, (Illustrated in Fig. 1) which has been manufactured by the Pilot Radio Corporation, is such a tuner.

General Discussion of Pilotuner

The Pilotuner allows an FM antenna and FM tuner to be substituted for the AM antenna and AM tuner, while still utilizing the audio system of a receiver as shown in Fig. 2. Naturally, since the cost of this unit is comparatively low, the general public has become tremendously interested.

As an example of this, in a survey conducted at the end of August by Station WMRC-FM of Greenville, South Carolina, it was found that 15,000 FM sets were in use in their service area. Of the 15,000 sets, 4,000 were FM Pilotuners.

With many of these units in use, the average service man will often be requested to install or connect such a unit, to connect antennas, and, in the future, probably to service the units. The use of an FM tuner does not prevent the receiver from being used for ordinary AM reception—either reception can be chosen at will.

The schematic diagram of the FM Pilotuner is shown in Fig. 3—the layout of the trimmer and adjustment condensers is also shown here. Let us analyze the circuit briefly. First, we see that the new miniature glass tubes are used.

A three gang tuning condenser is used—the first stage is an r.f. pre-selector, the next stage is the

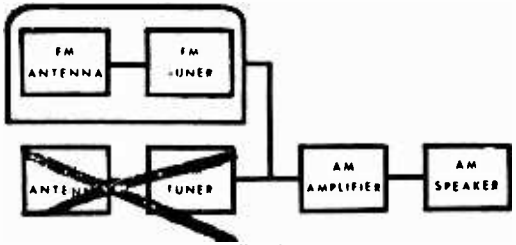


Fig. 2

oscillator-mixer and this is followed by two stages of i.f. amplification. A ratio type detector (discriminator) is used and the output of this detector is fed to the audio system.

An a.c. type power supply (power transformer and rectifier) is used with a selenium rectifier instead of a vacuum tube type rectifier. A resistance-condenser filter is used in the power supply.

Space does not permit a detailed analysis of each stage in the receiver. Considerable basic information will be found in the advanced lessons of your regular NRI Course.

Any audio system may be connected to the output of the tuner—it is not necessary that it be the audio system of an AM receiver. A public address system, a phonograph amplifier, or any similar audio amplifier and loudspeaker combination could be used. The tuner might be combined with a high fidelity audio amplifier to build up a "custom-made" installation.

Installation of the Pilotuner

There are several things which must be considered when installing the Pilotuner. We will assume, of course, that the Pilotuner is to be attached to an ordinary receiver. It is to be understood, of course, that the Pilotuner may still be connected to an amplifier (as mentioned above). All installation connections, both to the amplifier and to the antenna, are made *from* and *to* the back of the FM Pilotuner—there are seven terminals here on a terminal strip as shown in Fig. 4A.

Not only must the connection to the audio system be considered, however, but one must also consider the antenna. Let us discuss the antenna connections first. Antenna connections are made to terminals 1, 2, and 3. There are provisions for three different types of antennas.

The "built-in" (power line type) antenna can be used; a short single wire can be used; or a dipole antenna might be used.

The type of antenna used depends upon the

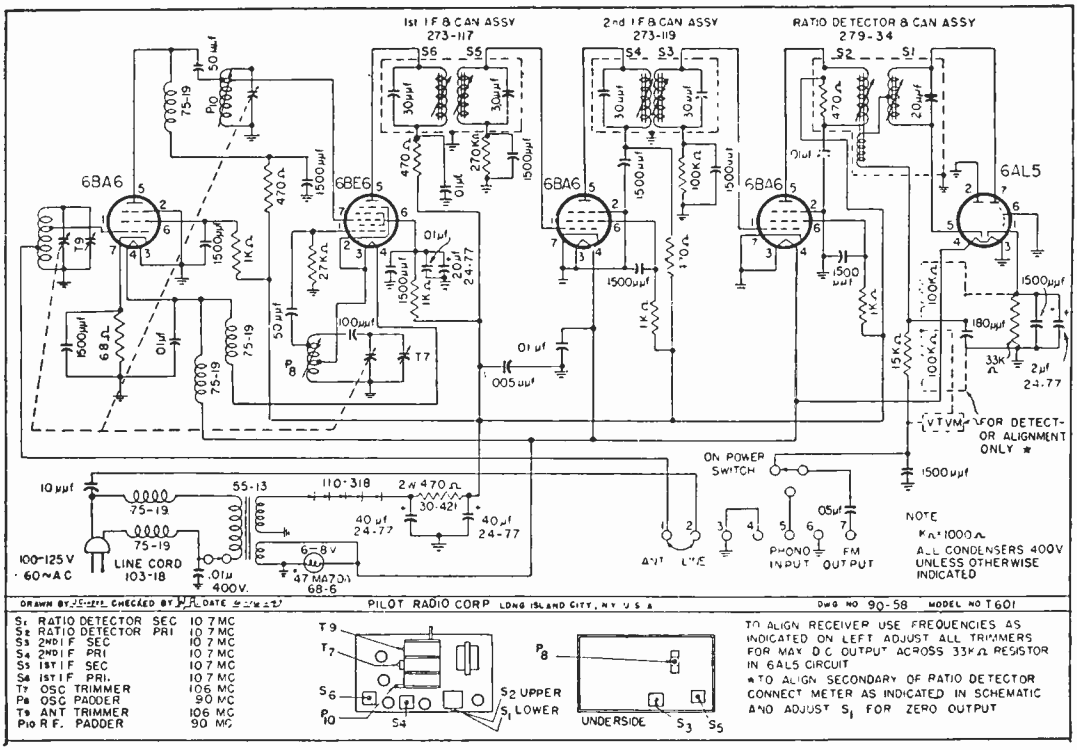


Fig. 3—Schematic Diagram of FM Pilotuner

strength of the stations in the locality where the Pilotuner is to be installed.

Where local high-powered stations are being received, the connecting link between terminals 1 and 2 is left in place—this is installed at the factory. Refer to Fig. 4B. With this link in place, one side of the power line is used as the antenna —note the small coupling condenser between terminal 2 and the power line on the schematic.

When receiving local stations which are weak in a particular locality, the connecting link between terminals 1 and 2 is removed. Then, a short length of ordinary wire is connected to terminal 1. This should be approximately four feet long. The connection of this small antenna is shown in Fig. 4C.

Finally, for very weak stations or for more distant stations, an outside dipole type antenna should be used. A commercial dipole of the type shown in Fig. 4D or a less elaborate comparative type should be satisfactory.

This dipole is connected to terminals 1 and 3, as shown in Fig. 4E. The connection between the dipole antenna and the terminals should be made

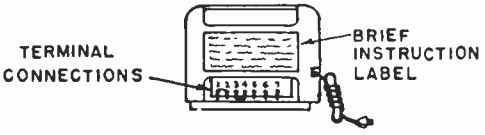


Fig. 4A

Fig. 4B

with standard 300 ohm flat lead-in. "Twin-lead" transmission line would be satisfactory for this application.

Connecting the Pilotuner to the Receiver

In the more modern sets, and in some of the older sets, it is quite easy to connect the Pilotuner to the receiver. In fact, in some cases, it is so easy that the purchaser of the unit may make the installation himself without requiring the services of a trained technician. The connection

Fig. 4C

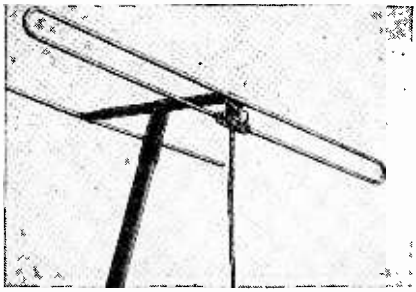


Fig. 4D

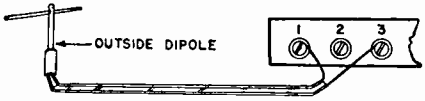


Fig. 4E

to the receiver is easy to make where the set has a connection for a phonograph.

Remember, the Pilotuner operates through the audio system of the receiver. Further, where phonograph connections can be made, these are usually made through the audio system of the set.

A five foot shielded cable is furnished with the FM Pilotuner. This cable has one end provided with spade lugs so that connections to the rear of the Pilotuner can be made easily. This is illustrated in Fig. 5A.

The spade lugs are connected to terminals 6 and 7 of the Pilotuner terminal strip as illustrated in Fig. 5B. The outside or shielded wire of the connector cable connects to terminal 6 and the center wire of the cable connects to terminal 7.

Where the phono connection of the receiver is a terminal strip of the "screw type," as illustrated in Fig. 5C, then the connections from the Pilotuner are made as shown in Fig. 5D.

The central wire is connected to the "high" or "hot" terminal. You can determine which is the "high" terminal by turning the volume control of the receiver up and touching each terminal with your finger. When you touch the "high" terminal, you will notice that a heavy hum comes from the loudspeaker. The shield connects to the "ground" or "low" side of the two connections.

In some cases, there will be only one screw type phono connection—this is also shown in Fig. 5D. In this case, the central wire goes to this single terminal and the shield is soldered to the chassis of the receiver.

In other sets, a different type of connection might be provided for the phonograph. Where a plug as shown in Fig. 5E is used, the connections are made as shown—the shield going to the cap of the plug and the central wire going to the pin.

In some cases, there will be a two-hole plug phono terminal. In this case, the connections are as shown in Fig. 5F. Again it is necessary to determine which is the "high" side and which is the "low" side. Simply remember that the central wire connects to the "high" side.

Of course, in some cases, there will be no phonograph connection provided on the receiver. When this is the case, it is necessary for a trained technician to made the installation—naturally, a small installation fee should be charged.

When making an installation in this type of receiver, it is first necessary to determine the type of detector circuit employed—that is, whether grid leak-condenser, C bias or diode type detection is used. Refer to the schematic diagram of the receiver and rely upon your knowledge of electrical circuits to determine the type of detector used in the set.

Where a C bias detector is used, the circuit of Fig. 6A is employed. The additional parts necessary are a double pole—double throw switch, a .001 mfd. mica condenser (C2) and resistor R2—R1, C3 and C1 are already in the circuit. Where the detector tube is a triode, a 3000 ohm, 2 watt resistor will be satisfactory for R2. The purpose of the resistor is to shunt the present resistor R1 to provide proper bias so the tube may be used as an audio amplifier.

The Pilotuner is connected to terminals 1 and 2—the central wire of the cable going to terminal 1 and the shield going to terminal 2. In the left-hand position of the d.p. d.t. switch, the Pilotuner will be used and in the right hand position, the ordinary receiver will be used.

In Fig. 6B, 6C and 6D are shown a number of different diode-detector circuits. These circuits are all basically the same except for minor refinements—therefore, about the same type of connection is used in each case.

The only additional part for the circuit in Fig. 6B is the single pole—double throw switch. Here, again, the FM Pilotuner is connected to terminals 1 and 2—the "high" side or central wire connecting to terminal 1. In the right hand position,

Fig. 5A

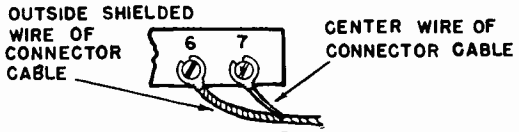


Fig. 5B

Fig. 5C

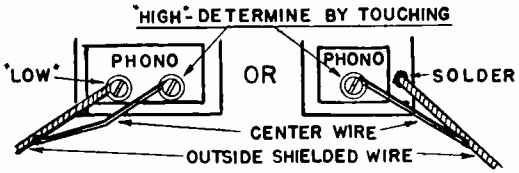


Fig. 5D

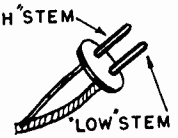


Fig. 5F

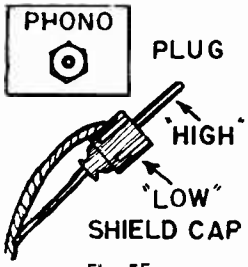


Fig. 5E

the regular receiver is used and in the left hand position, the Pilotuner is used.

In Fig. 6C and 6D, a similar circuit is used—the only additional parts needed being the switch. The Pilotuner connections are still made to terminals 1 and 2.

In Fig. 6E, however, we have a grid leak—condenser detector. When a conversion is made using this circuit, it is necessary to install condenser C3 (a .001 mfd. mica condenser), condenser C4 (.1 mfd., 600 volt paper condenser), the 2 watt resistor R2 (resistance of 250,000 ohms), and a s.p.d.t. switch. The C battery is a 4.5 volt battery.

The purpose of these changes are to make the tube operate as an audio amplifier rather than as a detector. It may be necessary to experiment somewhat with the C bias. Be sure to check the wiring of R1 and C1 (these are already in the receiver). In some cases, R1 may be connected between grid and ground or between grid and cathode—in this case, rewire the circuit exactly as shown.

The Pilotuner does not have a volume control built in. Therefore, the volume control of the receiver should be used—this is accomplished easily where the connection is made to a phono terminal on the back of the set. Where a special installation is used, however, some change may be necessary.

The easiest way of accomplishing this is to add another volume control between the Pilotuner and the receiver connections as shown in Fig. 7. The volume control may be used in place of resistor R2 if desired in Fig. 6E.

Of course, if desired, the volume control already present in the set may be used in the case of the circuits shown in Fig. 6B, 6C and 6D—in these cases, however, distributed capacity is often in-

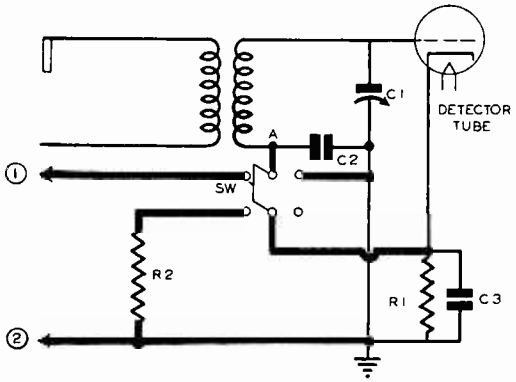


Fig. 6A

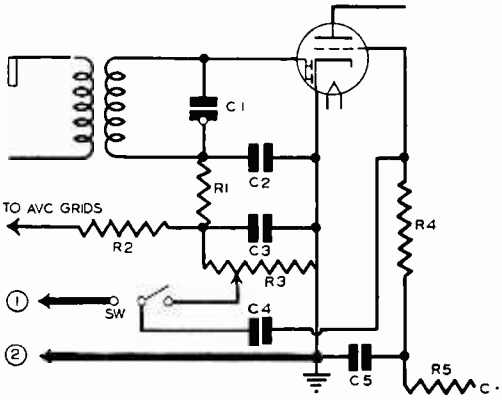


Fig. 6B

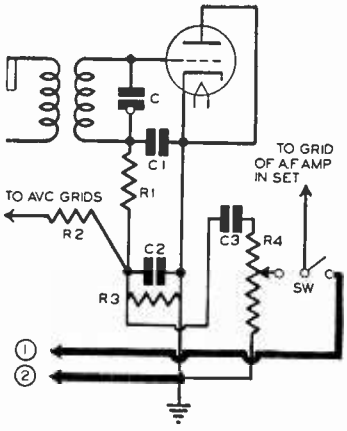


Fig. 6C

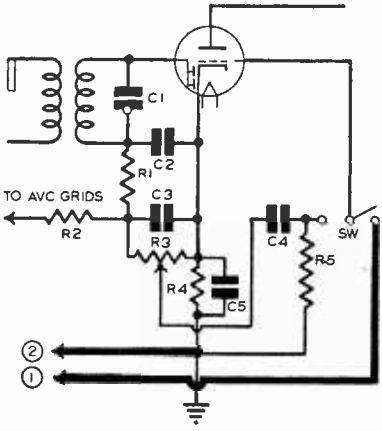


Fig. 6D

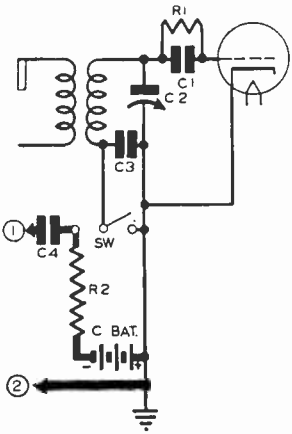


Fig. 6E

troduced between leads and in the control itself so that the ordinary AM program may come through along with the FM program if the receiver happens to be tuned to an AM station. You will have to determine whether the regular volume control can be used or not by experimentation.

Where the regular volume control is used, for example, in Fig. 6B, the connection between the left hand side of R3 and the junction of R1 and R2 should be broken. The center arm of the volume control is then connected directly to C4. The left hand side of the volume control should be connected to the central terminal of the switch and the junction of R1, R2 and C3 connected to the right hand terminal of the switch.

In this way, the volume control present in the set can be used—there may be some undesirable effects due to distributed capacities, however. A similar system may be used in Fig. 6C and in Fig. 6D.

Once the Pilotuner has been connected to a receiver, a phono connection is quite easy to make. The phono connection is made to terminals 4 and 5 of the Pilotuner.

The low side of the phonograph connects to

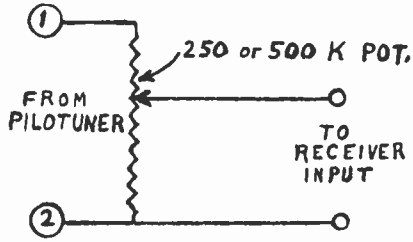


Fig. 7

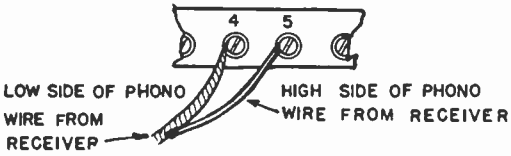


Fig. 8

terminal 4 and the "high" side of the phonograph pickup connects to terminal 5 of the Pilotuner. These connections are illustrated in Fig. 8. Then, when the Pilotuner is turned "off," the phonograph is automatically connected to the receiver.

Alignment of the FM Pilotuner

The FM Pilotuner can be aligned by following the sequence of the alignment chart. (See page 9.) To align the tuner, you should use insulated alignment tools, an output meter with a range of at least 20 volts—this output meter should be a high resistance d.c. voltmeter or a vacuum tube voltmeter. In addition, a signal generator should be available which will cover frequencies of 10.7, 90 and 106 megacycles.

Allow the Pilotuner to warm up for at least thirty minutes before making any adjustments. Follow the sequences exactly as indicated and refer to the schematic diagram given in Fig. 3 —the location of the various trimmers and "slugs" are shown at the bottom of the schematic.

Incidentally, the Model 88 NRI Professional Signal Generator, which will soon be available to NRI men is an excellent instrument for alignment of FM sets—the instrument covers up to 60 megacycles on fundamentals and can

(Page 15, please)

ALIGNMENT CHART

(Follow sequence as indicated)

CIRCUIT ALIGNED	STEP	RCVR. DIAL POINTER	SIGNAL GEN. FREQ.	SIGNAL GEN. CONNECTIONS	METER	METER CONNECTIONS	TRIMMER OR SLUG ADJUSTMENT	PROCEDURE
IF	1	88 mc	10.7 mc	Through .01 mfd. cap. to grid of 6BE6	VTVM or high resistance voltmeter	Across two 100K resistors —indicated by dotted lines in schematic	S2, S1, S4, S3, S6, S5	Adjust for maximum output
	2		Repeat Step No. 1					
Ratio Detector	3	88 mc	10.7 mc	Same as No. 1	VTVM or high resistance voltmeter	From: Junction of two 100K resistors TO: Audio output of ratio detector. Connections indicated by dotted lines in schematic.	S1	Adjust meter to zero (Check proper zero set) Meter should register reverse polarity when slug is rotated through zero output.
Oscillator	4	90 mc	90 mc	Through carbon 300 ohm resistor to Ant. Terminal	VTVM or high resistance voltmeter	Same as Step No. 1	P8	Same as Step No. 1
	5	106 mc	106 mc	Same as No. 4	VTVM or high resistance voltmeter	Same as No. 1	T7	Same as No. 1
	6		Repeat Steps No. 4 & 5					
RF	7	90 mc	90 mc	Same as No. 4	VTVM or high resistance voltmeter	Same as No. 1	P10	Same as No. 1
	8	106 mc	106 mc	Same as No. 4	VTVM or high resistance voltmeter	Same as No. 1	T9	Same as No. 1

J. A. Dowie

SERVICING THE MAJESTIC 90 RECEIVER

By J. A. DOWIE

NRI Chief Instructor

IT is a rather unusual fact that despite the great advances that have been made in radio, many owners cling to old sets that long ago should have found their way to the scrap heap. One of these, the Majestic 90, has been the subject of so many technical consultation letters that we feel it is desirable to present technical data on the servicing of this receiver.

The schematic diagram of this receiver is shown in FIG. 1. The receiver is an eight tube tuned radio frequency (t.r.f.) set using type 27 tubes in the 1st, 2nd, 3rd and 4th r.f. amplifier stages and in the detector stage. Two type 45 tubes are used in the push-pull class A amplifier which drives the loudspeaker. B power is supplied by a full-wave rectifier supply using an 80 tube.

The power pack is connected to the receiver by means of a cable. The schematic diagram of the power pack is shown in FIG. 2 and a wiring diagram is also shown. As many of the service troubles are associated with the power pack, let's carefully examine this section of the circuit.

The Power Pack

Referring to the wiring location diagram in FIG. 2, the condenser bank is shown at the lower right of the drawing. A sketch showing the internal connections of this bank appears in FIG. 3. The terminals of the block have been numbered from 1 to 6, reading from top to bottom on the drawing.

Tracing from the 80 rectifier filament to the 220 ohm choke and then to terminal 6, we come to the 2 mfd. filter condenser. Now trace to the second 220 ohm choke (both chokes are contained in the same unit) and then to terminal 5 and the 2 mfd. output filter condenser. Then trace to the +308 volt terminal of the terminal strip. (Shown in upper right of wiring diagram.)

From terminal 5 we go to the 2000 ohm internal choke in the power unit and from it to terminals 2 and 3 (See FIG. 3), then to the +306 volt terminal on the terminal strip. Terminal 1 is the common ground. Terminal 4 of the condenser bank, for the 1 mfd. unit, connects to the +144 terminal on the terminal strip at the upper right.

To test the condenser block, disconnect leads from terminal 1. Then, test for leakage between 1 and other terminals on the condenser block. The leakage resistance of each condenser should be high, above 10 or 20 megohms. If a capacitance bridge is available, the capacities may be checked. Instruments which would be useful in performing these tests are the NRI Professional Volt-Ohm-Mil-Ammeter and the NRI Professional Resistor-Condenser Tester.

The usual service troubles associated with the power pack are:

Defective filter condensers
Open choke
Defective ballast resistor
Broken wire in power cable
Loose connection on terminal strip
Open resistor
Shorted turns in power transformer

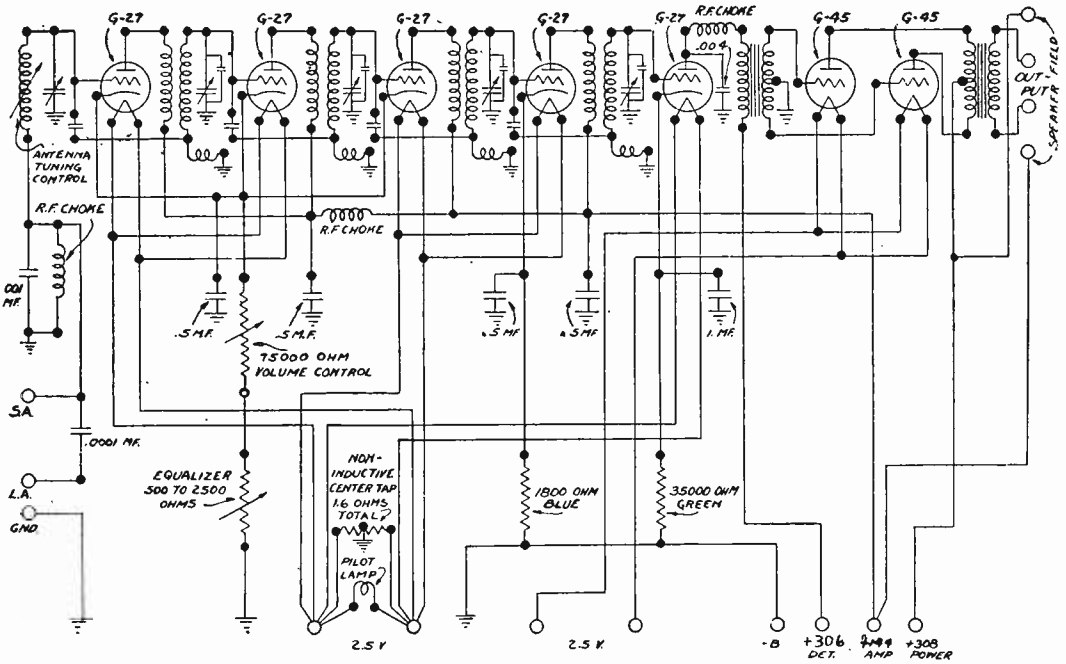


Fig. 1—Schematic Diagram of Majestic Model 90

If a filter condenser becomes defective, this does not mean the entire bank need be replaced. For example, if the 2 mfd. condenser connected to terminal 6 breaks down, but the other condensers are good, we need replace only the 2 mfd. section. To do this, disconnect the leads to terminal 6. Then connect a new condenser between those leads and terminal 1. Similarly, other condensers in the block may be replaced. In the case of the 2 mfd. unit connected to 2 and 3, the wires would be taken off both terminals 2 and 3 and would be connected to one terminal of the replacement condenser. The other terminal of the condenser would then be connected to terminal 1.

If the 2000 ohm choke between terminals 2 and 5 opens up, an equivalent choke may be shunted across these terminals or a 2000 ohm resistor. If excessive hum is heard, connect the + terminal of an 8 mfd. 475 volt electrolytic to terminal 3 and ground the negative terminal of the electrolytic.

In a similar way, should one of the 220 ohm chokes open up, the circuit continuity can be restored by shunting the open choke with an equivalent unit. The inductance value may be 10 or 20 henrys with a d.c. current rating of 90 to 120 ma. d.c. Using a conservative (higher) current rating is desirable to avoid saturation and decreased filter efficiency.

If the 2 mfd. condenser connected to terminal 6 opens up or becomes leaky, it should be replaced with an 8 mfd. 450 volt electrolytic condenser. The output 2 mfd. filter can also be replaced with an 8 or 10 mfd. 450 volt unit. The negative side would be grounded, the positive connected to the +308 volt terminal.

If the ballast resistor (contained in ballast tube) becomes defective, the tube can sometimes be repaired. It may be simply a matter of bending the prong contacts apart slightly to get better contact when the tube is inserted in its socket. or in some cases the resistance wire in the tube may be burned out. Then, it becomes necessary to repair or replace it. The ballast tube can be taken apart by prying up the metal retaining lips of the protective cage with the edges of a diagonal cutters or screwdriver blade. Find the break and twist the two ends of the broken wire together to form a solid mechanical joint. The resistance wire can't be soldered.

If this procedure fails, obtain a replacement ballast tube from a radio distributor. Clarostat and JFD Mfg. Company make suitable replacements.

A broken wire in the power cable can readily be located by making the usual voltage and resistance tests. For example, if there is no voltage between the 27 detector plate and chassis,

but there is voltage between the +306 volt terminal of the power pack and chassis, we would suspect a broken wire in the connecting cable. We could check for continuity between the +306 terminal in the receiver and the +306 terminal in the power pack. If there is a break in the circuit and it is not at either end of the cable where it could be repaired, a new wire may be taped to the original cable and the ends connected at the proper terminal points to bridge the open circuit.

The cable assembly is shown in FIG. 4. A loose connection can be repaired by doing a simple re-soldering job.

An open resistor repair job is simple—use an equivalent unit as a replacement. Submitting the original part to the distributor may help in some cases in getting a proper replacement.

We have discussed various power supply troubles and remedies. Now let's consider some of the faults in the signal stages.

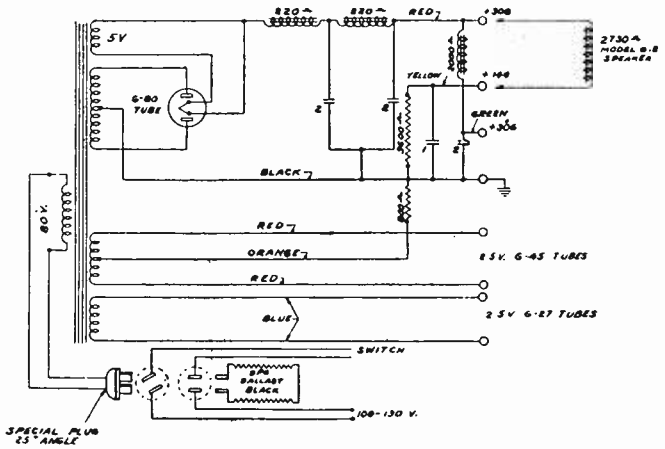
The Receiver Circuits

If an outside antenna is connected to L.A. and the .0001 mfd. condenser opens up, the signal will be blocked. The condenser may be checked by replacing it or testing with an R-C Tester.

Shorted turns in the r.f. choke or a breakdown in the .001 mfd. condenser will cause loss of volume. An open in the antenna tuning control will also cause loss of volume. Rubbing and shorting plates or trimmers in the gang condenser tuning circuits will cause the set to go "dead" or be very weak. When the tuned circuit is checked with an ohmmeter, be sure to isolate the condenser by disconnecting one lead of the shunt coil. Otherwise, the coil resistance will be in parallel with the condenser and will cause a false indication of condenser failure. Very often, the faults in trimmers and tuning condensers can be found by careful inspection alone. Bent plates which cause short circuits can be straightened by exerting pressure with the flat blade of a screwdriver.

It is very common, in this set, to find the condensers in the plate return circuits of the 27 r.f. amplifier tubes have broken down completely or have developed excessive leakage. Zero or lower than normal plate voltages on those tubes points to probable trouble in the condensers. However, an open in the primary of an r.f. transformer will prevent normal plate voltage from

SCHEMATIC DIAGRAM OF 9P6 POWER UNIT



WIRING DIAGRAM FOR MAJESTIC POWER UNIT-MODEL 9P6

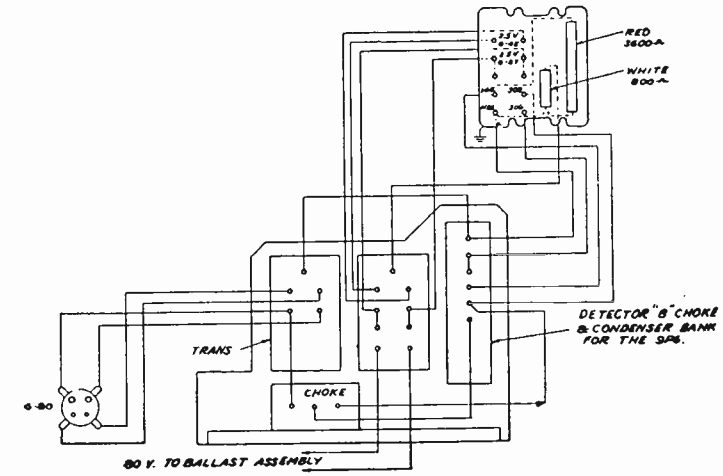


Fig. 2

being applied to the preceding 27 tube.

With regard to the detector, an open in the r.f. choke or the primary of the audio transformer in this stage will cut off the plate voltage.

An open in the secondary of the transformer which couples the 27 detector to the 45 grids would cause the set to go "dead." An open in ½ of the secondary would result in lowered volume, an increased hum level and a certain amount of distortion, particularly at high volume levels.

An open in the primary of the output transformer which couples the 45 plates to the voice coil circuit of the electrodynamic loudspeaker would cut off the plate voltages to these tubes and the set would be "dead." An open in ½ of the primary would cut off the plate voltage to one output tube and result in increased hum and distortion as well as lowered volume. An open in the secondary of the output transformer would result in no sound output from the loudspeaker and in addition the signal voltages on the output tube plates would rise to very high values and possibly damage the tubes and output transformer primary. The effect would be somewhat equivalent to suddenly removing the load from a generator, as the output tubes can be thought of as signal generators supplying audio power to the loudspeaker.

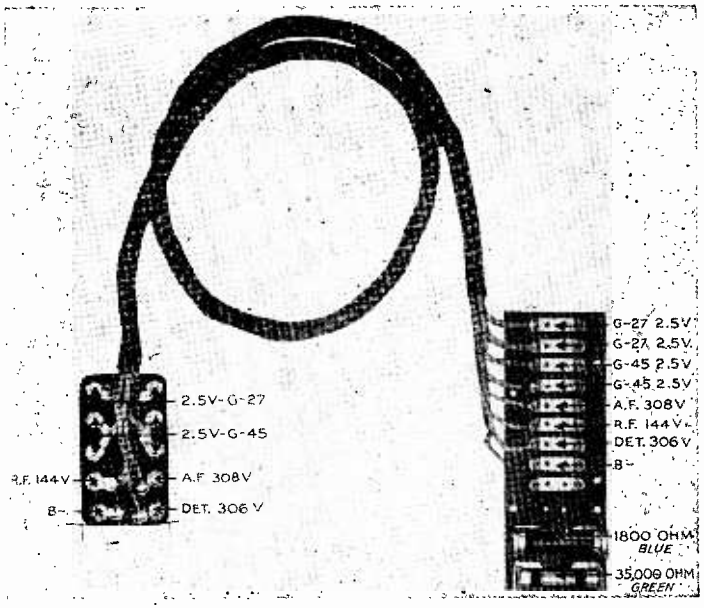


Fig. 4

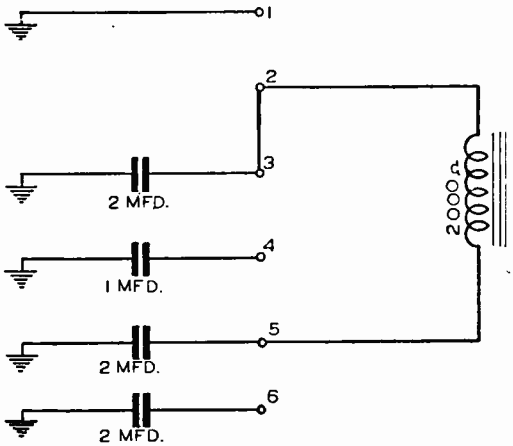


Fig. 3

An open in one of the plate return R.F. bypass condensers will result in instability and oscillation and an open in a cathode circuit bypass such as the .5 mfd. unit common to the 1st, 2nd and 3rd r. f. amplifier tubes very likely will cause strong oscillations to develop, due to coupling between these stages in the common high impedance of their cathode circuit. With the cathode bypass condenser "open" the R.F. impedance from cathode to ground is very high. Normally, at r.f. frequencies, it should be very low.

If one side of the 1.6 ohms non-inductive center tap resistor in the 27 filament circuit opens up, the result may be a tunable hum. A short circuited pilot lamp socket or short circuited wires connected to it may cause severe overloading of the power transformer filament winding connected to this circuit.

An open in the .5 mfd. condenser in the cathode circuit of the 4th r.f. amplifier tube will result in loss of gain in this stage and weak reception. A short circuit in this condenser may result in oscillation due to reduced bias and abnormally high gain.

An open in the 1800 ohm cathode circuit resistor would result in higher than normal plate to chassis voltage and reduced gain in the 4th r.f. stage.

An open in the cathode circuit resistor of the 27

detector causes distortion and loss of gain. A short circuit in the cathode bypass condenser removes bias from this tube and will result in a dead set or muffled reception and possibly damage to the detector tube, r.f. choke, and primary of the transformer in the detector stage. Some of the troubles are so common that we may list them as follows:

Common Troubles

CUTTING IN AND OUT. Check bypass condensers across cathode resistors to ground for opens. There are two in metal containers. Replace defectives with .5 or 1 mfd. condensers.

HUM that is apparent when tuned off of the station and becomes very loud at resonance may be caused by an open filter condenser. Hum on resonance only may be caused by any condenser after the power supply filter network.

CARRIER HUM OR RESONANCE HUM can often be eliminated by fastening the ground wire of the receiver to the A.C. floor outlet box. In more obstinate cases this can be eliminated by bypassing the 110 volt line to the ground post of the receiver through a .01 to .5 mfd. condenser. If this does not eliminate the trouble, try connecting a .001 to .1 mfd. mica condenser from each rectifier plate to the rectifier filament. It is sometimes necessary to try different values between the sizes indicated for best results.

SPEAKER RATTLE. Smear the overlap of the cone with collodion. Sometimes it is necessary to remove the wires which normally hold the overlap in place. Burping on high volume is usually due to poorly matched 45 tubes.

LOSS OF VOLUME AND EXTREME DISTORTION often indicate an open in the r.f. choke in the antenna stage. A further indication of this trouble is the absence of grid bias on the first r.f. tube, with resulting high plate current.

FADING is often due to the equalizer on the end of the tuning condenser shaft being defective. This can easily be checked by setting the volume control at maximum, connecting an ohmmeter between the cathode hole in any of the first three r.f. sockets and chassis. Erratic motion of the ohmmeter needle as the tuning knob is turned shows the volume compensator defective.

MOTOR-BOATING. Inspect the flexible lead soldered to the sliding arm attached to the trimmer cup. After a time this wire wears, breaks.

NOISE, MOTOR-BOATING. Generally traceable to defective .5 mfd. r.f. bypass condenser. The condenser may be open.

INTERMITTENT OPERATION. Intermittent operation in this model is often caused by a defective choke coil in the r.f. plate leads. Simply shorting across this choke cures the trouble and the performance of the set is not hindered by doing this.

DEAD—WEAK—LOW VOLTAGES—NO DET. PLATE VOLTAGE. The bypass condenser across the detector B supply lead frequently breaks down. On making a replacement, by inserting a 35,000 ohm resistor in place of the 2000 ohm choke, the chances of future trouble of this nature are lessened. In order to make the changes, disconnect the (generally green) wire which leads to the second and third lugs (from the top) on the condenser bank, leaving these lugs free. Now connect a 2 mfd. 600 V. replacement condenser between the first or top lug on the condenser bank and the wire which you disconnected. Connect the resistor between this wire and the fifth lug on the condenser bank.

If only the condenser is to be replaced, cut the wire between the second and third lugs, leaving the third lug free. Connect the replacement condensers between the first and second lugs.

NOISY OPERATION — CUTTING OUT — LOW SENSITIVITY. Sometimes caused by volume control—more frequently caused by dirt and fine metal peelings between the plates of the tuning condensers. Thoroughly clean between the plates with a pipe cleaner such as may be obtained from any tobacco shop.

In some cases the peelings have to be burned out by a high voltage. Unsolder *all* connections to the condenser gang. Apply a voltage of 100 to 500 volts between the stator and rotor connections of each condenser in turn, rotating the tuning control while the voltage is applied. After the peeling are burned out, resolder the leads to the gang.

VOLTAGE TESTS. In servicing the receiver, testing the operating voltages aids in diagnosing the condition of the set. Voltage values are given in the following table:

VOLTAGE TABLE

Tube Purpose	Type	Filament Voltage	Plate Voltage	Grid Bias Voltage	Cathode Volts
1st R.F.	G-27	2.35	130	8	8
2nd R.F.	G-27	2.35	130	8	8
3rd R.F.	G-27	2.35	130	8	8
4th R.F.	G-27	2.35	130	9	9
Detector	G-27	2.35	230	25	25
Power	G-45	2.45	250	50	..
Power	G-45	2.45	250	50	..

Line Voltage 115 A.C. on 115 volt tap.

Plate voltage on the 27 tubes is measured between plate and cathode, not plate and chassis. Grid voltage is measured between grid and cathode—not grid and chassis. Cathode voltage is mea-

sured from cathode to chassis. On the 45's plate voltage is measured from plate to filament and the bias between grid and filament.

Loss of sensitivity may be caused by lowered operating voltages or some other fault in a signal stage, but often is due to misalignment. The following alignment data should prove helpful.

Alignment

Remove chassis from the cabinet and connect for operation on a table or bench where the adjusting points will be accessible.

Supply a 1350 K.C. signal to the input of the receiver and tune the receiver to the exact resonance point of this signal with both the main tuning control and the trimmer. Then turn the volume control to maximum volume position.

Temporarily replace the first r.f. tube with a "balancing tube" (one having an open filament so that it will not heat) and adjust the first R.F. neutralizing condenser for minimum output.

Proceed in the same manner to neutralize the remaining R.F. stages, using the "balancing tube" in each stage being neutralized. The neutralizing condensers are reached through the top of the chassis.

Supply a 950 K.C. signal to the input of the receiver and tune it to this signal.

Adjust all gang condenser aligning condensers (on the condenser gang) for maximum output.

In all the above procedures be sure the shield cans are over the tubes and the volume control in maximum position when making any adjustments.

If available, employ an output meter to indicate exact resonance point when aligning the receiver. It should, however be disconnected when neutralizing the receiver.

This concludes the information on servicing the Majestic 90. It should help those who find the servicing of this set necessary.

The FM Pilotuner (Concluded from page 8)

easily cover up to 120 megacycles with second harmonics.

It should not be necessary to align the Pilotuner since the units are well aligned as they come from the factory. Alignment should only be made if it becomes necessary after use.

Summary

When the Pilotuner is installed, the customer should be instructed briefly in its operation. An instruction manual is included with the Pilotuner.

When operating the Pilotuner through a receiver, both the Pilotuner and the radio receiver should be turned on. If the receiver has a phono connection on the back and this is being used, then the switch should be turned to the phono position. The volume of reception is regulated either by the volume control of the receiver or by the volume control which has been installed as in Fig. 7.

If excessive hum is obtained, reverse the electric line cord plug either to the receiver or to the pilotuner. Also check to be sure that the "high" and "low" audio connections have been made properly.

When tuning the Pilotuner, be careful to tune the station sharply. The station is being received properly when the side-band noise disappears. It may be necessary, until the customer gets familiar with the tuner, for him to move the tuning knob of the tuner very slowly .

The Pilotuner seems to be one of the right answers where it is desired to add FM to a present AM receiver, or to make an inexpensive "custom" installation. Radio service men who are interested in buying these units for resale should contact the manufacturer directly. Address:

Mr. Norman Skier, Domestic Sales Dept.
Pilot Radio Corporation
37-06 36th Street
Long Island City 1, New York

Television Technicians Wanted

The RCA Service Company, Inc., has openings for a limited number of young men interested in television installation, service and repair.

Openings are in New York Metropolitan area; Philadelphia, Pa.; Washington, D. C.; Chicago, Ill.; St. Louis, Mo.; Albany, N. Y.; Detroit, Mich.; Baltimore, Md.; Cincinnati, Ohio; Richmond, Va.; Boston, Mass.; Los Angeles, Calif.; and St. Paul, Minneapolis, Minn.

Young men, age 21 to 35, with a high school education, good personality, and two years' experience in electronic maintenance are preferred. Applications should be in writing, giving detailed information as to qualifications and experience. Address letters to: *RCA Victor, Front and Linden Sts., Camden, N. J., Att. Mr. Moser.*

Willard R. Moody

How to Service Automatic Record Changers

PART TWO

By Willard R. Moody
NRI Consultant

This article, Part Two, concludes Mr. Moody's discussion of "How to Service Automatic Record Changers." Part One of this article appeared in the October-November, 1947, issue of NATIONAL RADIO NEWS.—*The Editor.*

RCA Model RP-139-A and RP-145 Changers

ANOTHER popular record changer is the RCA RP-139-A and RP-145 shown in Fig. 1. The RP-139-A and RP-145 automatic record changers are very similar in design and construction. Most of the parts and adjustments are identical on both. The RP-139-A turntable is driven through a worm gear in the motor housing while the RP-145 turntable is driven through a friction drive disc mounted on the turntable spindle.

On the Model RP-145 it is important that the drive motor spindle, and rubber tires on the main driving disc and idler pulley, be kept clean and free from oil, grease, dirt or any foreign matter at all times. Any quick-drying naphtha is satisfactory for cleaning these parts. The RP-145 drive motor bearing is lubricated from an oil well filled and sealed at the factory. It should not require lubrication in the field.

The RP-145 turntable is not removable from the spindle. However, the rubber tire driving disc is fastened to the spindle by means of a tapered pin (see 24, Fig. 1). If necessary to remove these parts, the tapered pin should first be removed. The driving disc can then be removed from the spindle, and the turntable and spindle assembly is lifted upward from the motorboard. If this is done, great care should be taken not to bend the spindle. At the same time the spindle bearing should be oiled and the cup and ball thrust bearing oiled and checked for proper position. Before servicing the automatic record changer, inspect the assembly to see that all levers, parts, gears, springs, etc., are in good order and correctly assembled. *A bind or jam in the mechanism can usually be relieved by rotating the turntable in the reversed direction.*

The changer can be conveniently rotated through its change in cycle by pushing the index lever to "reject" and revolving the turntable by hand. Six turntable revolutions are required for one change cycle. If the record changer or cabinet is not perfectly level, normal operation is likely to be affected. The ten inch and twelve inch records must be absolutely flat for smooth operation. A pickup shorting switch, located under the motorboard, operates when the pickup is moved outward to the pickup rest.

Miscellaneous service hints:
Incorrect adjustment of a particular mechanism of the changer is generally exhibited in a specific mode of improper operation. The following relations between effects on operation and the usual misadjustments will enable ready adjustments in most cases. (These adjustments are described under a following section, where adjustments are listed alphabetically.)

1. For any irregularity of operation, the adjustment of the main lever (15) should be checked first. (See "A" under section on "Adjustments.")
2. Needle does not land properly on both ten inch and twelve inch records—make complete adjustments "D" and "E."
3. Needle does not land properly on twelve inch record but correct on ten inch—effect adjustment "E."
4. Failure to trip at the end of the record—in-

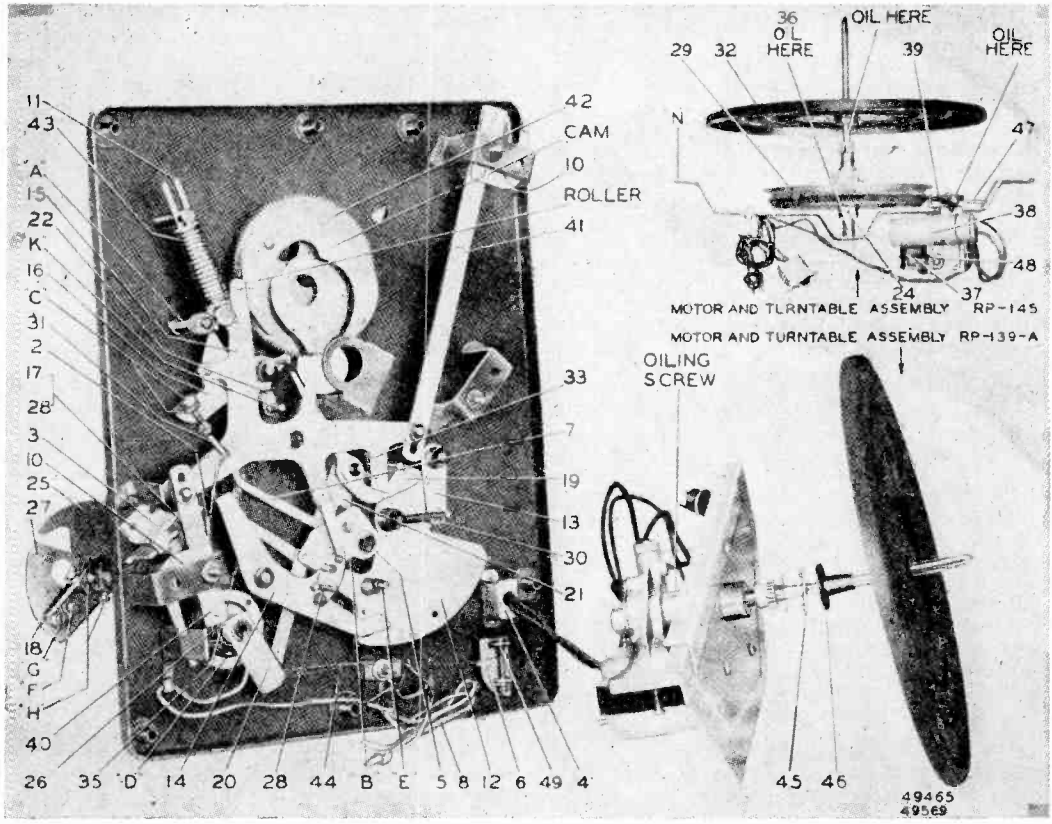


Fig. 1—The RCA Model RP-145 Record Changer

crease clutch (5) friction by means of screw "B." Also see that levers (7) and (12) are free to move without touching each other.

5. Pickup strikes lower record of stack or drags across top record on turntable—adjust cable for adjustment "C".
6. Needle does not track after landing—Friction clutch (5) adjustment "B" may be too tight; bind in tone arm vertical bearing; levers (7) and (12) fouled; or pickup output cable twisted.
7. Cycle commences before record is complete—record is defective, or adjustment "B" of friction clutch (5) is too tight.
8. "WOW" in record reproduction—record is defective; or instrument is not being operated at normal room temperatures. On Model RP-145, oil, grease, dirt or other foreign matter on motor spindle, main driving disc or idler pulley rubber tire. Clean with any quick drying naphtha. Also, on RP-145, the motor support bracket (N) should be moved in its mounting holes until the motor spindle is parallel to the turntable spindle and exactly at right angles to the main driving disc (29). The bracket mounting nuts should then be securely tightened.
9. Record knives (25) strike edge of records—records warped; record edges are rough; or knife adjustments "F" and "G" are incorrect.
10. Record not released properly—adjust record shelf (27) assemblies in respect to shaft by means of adjustment "H".
11. When playing both ten and twelve inch records mixed, and needle lands incorrectly in ten inch position or twelve inch, or misses record entirely—increase tension of mixed record discriminating lever spring "M".

Adjustments

A. *Main Lever.*—This lever (15) is basically important in that it interlinks the various individual mechanisms which control needle landing, tripping, record separation, etc. Rotate the turntable until the changer is out-of-cycle;

and check rubber bumper bracket (A). The roller should clear the nose of the cam plate by approximately 1/16 inch.

B. *Friction Clutch.*—The motion of the tone arm toward the center of the record is transmitted to the trip pawl (22) by the trip lever (7) through a friction clutch (5). If the motion of the pickup is abruptly accelerated or becomes irregular, due to swinging in the eccentric groove, the trip finger (7) moves the trip pawl (22) into engagement with the pawl on the main gear, and the change cycle is started. Proper adjustment of the friction clutch (5) occurs when movement of the tone arm causes positive movement of the trip pawl (22) without tendency of the clutch to slip. The friction should be just enough to prevent slippage, and is adjustable by means of screw (B). If adjustment is too tight, the needle will repeat grooves; if too loose, tripping will not occur at the end of the record.

C. *Pickup Lift Cable Screw.*—During the record change cycle, lever (16) is actuated by the main lever (15) so as to raise the tone arm clear of the record by means of the pickup lift cable. To adjust pickup for proper elevation, stop the changer "in-cycle" at the point where pickup is raised to the maximum height above turntable plate, and has not moved outwards; at this point adjust locknut (C) to obtain 1 inch spacing between needle point and turntable top surface.

D. & E. Needle Landing on Record.—The relation of coupling between the tone arm vertical shaft and lever (20) determines the landing position of the needle on a 10 inch record. The position of eccentric stud (E) governs the landing of the needle on a 12 inch record; this, however, is dependent on the proper 10 inch adjustment.

To adjust for needle landing, place 10 inch record on turntable; push index lever to reject position and return to the 10 inch position. Referring to Fig. 2, see that pickup locating lever (17) is tilted fully toward turntable; rotate mechanism through cycle until needle is just ready to land on the record; then see that pin (V) on lever (14) is in contact with "Step T" on lever (17). The correct point of landing is 4 & 5/8 inches from the nearest side of the turntable spindle. Loosen the two screws (D), see Fig 1, and adjust horizontal position of tone arm to proper dimension, being careful not to disturb levers (14) and (17). Leave approximately 1/32 inch end play between hub of lever (20) and pickup base bearing, and tighten the blunt nose screw (D); run mechanism through several cycles as a check, then tighten cone pointed screw (D).

After adjusting for needle landing on a 10 inch record, place 12 inch record on turntable; push index lever to reject and return to 12 inch position; rotate mechanism through cycle until needle is just ready to land on the record; the correct point of landing is 5 & 5/8 inches from nearest side of spindle. If the landing is incorrect, turn stud (E) until the eccentric end adjusts lever (14) to give correct needle landing. (The eccentric end of the stud must always be toward the rear of the motorboard, otherwise incorrect landing may occur with 10 inch records.)

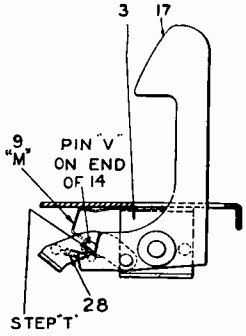


Fig. 2

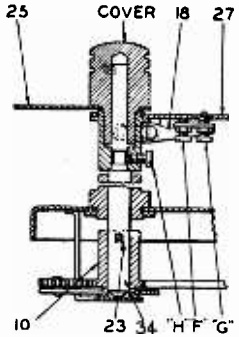


Fig. 3

F. & G. Record Separating Knife. (See Fig 3)—The upper plate (knife) (25) on each of the record posts serves to separate the lower record from the stack and to support the remaining records during the change cycle. It is essential that the spacing between the knife and the rotating record shelf (27) be accurately maintained. The spacing for the 10 inch record is nominally .055 inch, and for the 12 inch record is .075 inch.

To adjust, rotate the knife to the point of minimum vertical separation from the record shelf and turn screw and locknut (F) to give .052-.058 inch separation. Screw (G) must not be depressed during this adjustment. After setting screw (F) adjust screw (G) so that when its tip is depressed flush with top of record shelf, the vertical spacing between the knife, in its lowest rotational position, and the shelf, is .072-.078 inch.

H. Record Support Shelf.—The record shelf revolves during the change cycle to allow the lower record to drop onto the turntable. Both posts are rotated simultaneously by a gear and rack coupled to the main lever (15), and it is necessary that adjustment be such that the record is released from both shelves at the same instant. To adjust, place a 12 inch record on the turntable, rotate mechanism into cycle to the point where both separating knives have turned clockwise as far as the mechanism will turn them; lift record upward until it is in contact with both separating knives. Then loosen screws (H) and shift record shelves (27) so that the curved inner edges of the shelves are uniformly spaced approximately 1/16

inch from the record edge. (See Fig. 3.) Some backlash will be present in the rotation of these shelves. They should be adjusted so that the backlash permits them to move away from the record but not closer than the approximate 1/16 inch specified above. Tighten the blunt nose screw (H), run mechanism through cycle several times to check action, then tighten cone pointed screw (H).

If record shelves or knives are bent, or not perfectly horizontal, improper operation and jamming of mechanism will occur.

J. Tone Arm Rest Support (not shown).—When the changer is out-of-cycle, the front lower edge of the pickup head should be 5/16 inch above surface of motorboard. This may be adjusted by bending the tone arm support bracket, which is associated with the tone arm mounting base, in the required direction.

K. Trip Pawl Stop Pin.—The position of the trip pawl stop pin (K) in relation to the main lever (15) governs the point at which the roller enters the cam. By bending the pin support either toward or away from trip pawl bearing stud, the roller can be made to enter the cam later or earlier, respectively. This adjustment should be made so that the roller definitely clears the cam outer guide as well as the nose of the cam plate.

Lubrication.— Petrolatum or petroleum jelly should be applied to cam, main gear, spindle pinion gear, and gears of record posts.

Light machine oil should be used in the tone arm vertical bearing, record post bearings, and all other bearings of various levers and pulleys on underside of motorboard. The turntable spindle bearing of RP-145 must be lubricated from the top of the motorboard. Using an oil can with a long spout, reach in between the turntable and motorboard and apply oil directly to the spindle.

On Model RP-139-A apply a few drops of light machine oil (S.A.E.-10) to the motor oil hole adjacent to the spindle bearing after each 1,000 hours of operation. The oil hole has a screw plug.

Do not allow oil or grease to come in contact with rubber mounting of tone arm base, rubber bumper, rubber spindle cap, or rubber parts of friction drive mechanism of Model RP-145.

Farnsworth S-30

Another type of record changer quite commonly encountered in servicing is the Farnsworth S-30 shown in Fig. 4. The various parts have the following numbers in the manufacturer's service notes. The numbers should be used to identify parts when ordering replacements.

3167 Tone Arm Support.

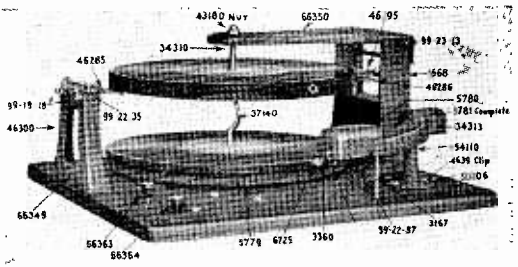


Fig. 4—Farnsworth Model S-30 Changer

3360 Needle Screw.
4639 Wire Clip.
5568 Record Support and Lowering Bracket Ass'y.
5779 Turntable.
5780 Tone Arm.
5781 Tone Arm Complete.
6725 Brush.
35310 Record Centering Pin.
34313 Tone Arm Hinge Pin.
37140 Motor Spindle. (Part of 6287).
43180 Record Centering Pin Nut.
46285 Record Support, 10" Front.
46286 Record Support, 12" Rear.
46295 Record Support, 10" Rear.
46300 Record Support Bracket, Front.
50206 Grommet, Rubber.
54110 Tone Arm Support Housing.
66349 Record Support Bracket Ass'y, Front.
66350 Record Support Plate and Pin Ass'y. (Farnsworth).
66391 Record Support Plate and Pin Ass'y. (Capehart).
46284 Record Support Plate (Farnsworth).
46330 Record Support Plate (Capehart).
66363 Reject Knob (Late Production: 6069).
66364 10" or 12" Stop Cam Knob (Late Production: 6069).
Decalcamanias: 50226 and 50227 used on late production with Knob #6069.
99-19-18 8/32 x 5/16 R.H.M. Screw.
99-22-35 6/32 x 1/4 Bind. H.M. Screw.
99-22-37 4/36 x 1/8 Bind. H.M. Screw.
99-23-13 8/32 x 3/8 Hinge Pin Screw.

Where (Capehart) appears behind a part, this part is used on Capehart-Panamuse Instruments exclusively.

Where (Farnsworth) appears behind a part, this part is used on Farnsworth changers exclusively.

An additional view is given in Fig. 5. The parts are identified by number.

2328 Crystal Pickup only (Capehart).
715-1 Crystal Pickup, Lead & Plug Ass'y. (Farnsworth) AK-59 only.
716-1 Crystal Pickup, Lead & Plug Ass'y. (Farnsworth—76, 95, & 96.)
3671 Motor Drive Pulley.

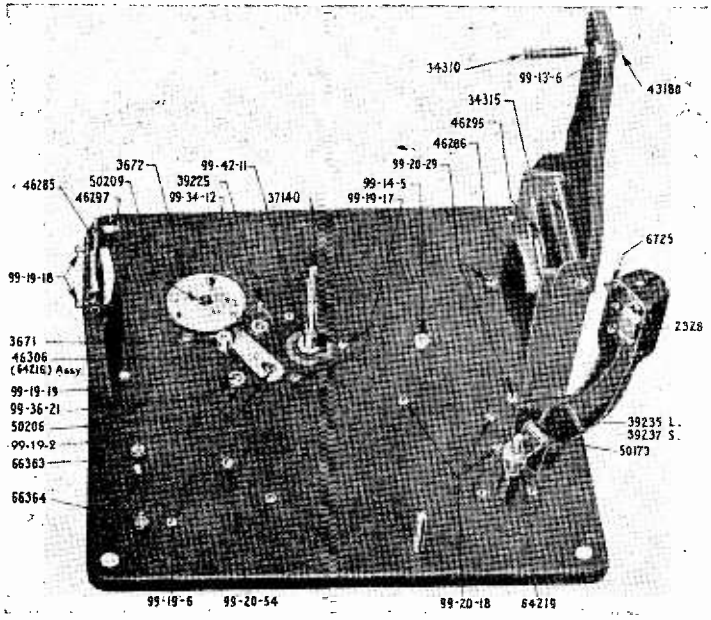


Fig. 5—Top View Farnsworth Model S-30

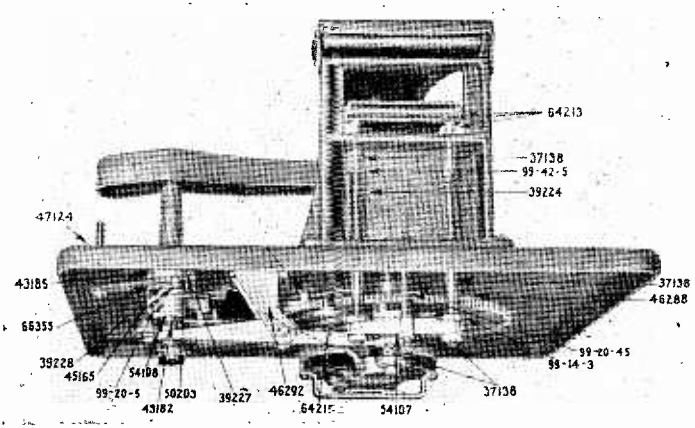


Fig. 6—Side View Farnsworth Model S-30

46286 Record Support Rear, 12" (Part of 64213).
46295 Record Support Rear 10".
46297 Record Support Front 12".
46303 Drive Disc Bracket.
50173 Tone Arm Bushing.
50206 Grommet Rubber.
50209 Drive Disc Thrust Washer.
64216 Turntable Bracket and Stud Ass'y.
64219 Tone Arm and Bracket Ass'y.
66363 Reject Knob (6069 Used on Later Models).
66364 10-12 Stop Cam Knob (6069 Used on Later Models). Decalcamanias #50226 & #50227 Used on Later Models With Knob #6069.
99-13-6 Hex Nut.
99-14-5 ¼ x 28 Hex Nut.
99-19-2 8/32 x ¼ RHM Screw.
99-19-6 8/32 x ½ RHM Screw.
99-19-17 8/32 x 5/6 RHM Screw.
99-19-18 8/32x 5/16 RHM Screw.
99-19-19 8/32 x 7/16 RHM Screw.
99-20-18 10/32 x ¼ RHM Screw.
99-20-29 10/32 x 5/16 RHM Screw.
99-20-54 10/32 x 1½ RHM Screw.
99-34-11 Hairpin Cotter Key.
99-34-12 Hairpin Cotter Key.
99-36-21 Washer.
99-42-11 Turntable Stop Washer.

A side view is given in Fig. 6. The corresponding part numbers are:

37138 Record Support Rod (Part of 64213).
39224 Spring—Record Lowering.
39227 Spring — Trip Friction, Flat.
39228 Spring—Trip Friction, Coiled.
43182 Tone Army Lift Rod.
43185 Trip Friction Collar Upper.
45165 Friction Trip Lever.
46288 Main Gear Starting Lever.
46292 Tone Arm Lift Bracket.
47124 Base Plate.
50203 Trip Friction Drive—cork.
54107 Record Lowering Link (Part of 63-119).
54108 Tone Arm Crank.
3672 Turntable Drive Pulley.
6725 Brush.
34310 Record Centering Pin.
34315 Record Support Hinge Pin.
37140 Motor Spindle (Part of 6287).
39225 Idler Spring (Changed to 39245 on Later Models).
39235 Spring—Pickup Wire Clip, Long.
39237 Spring—Pickup Wire Clip, Short.
43180 Record Centering Nut.
46285 Record Support Front, 10".

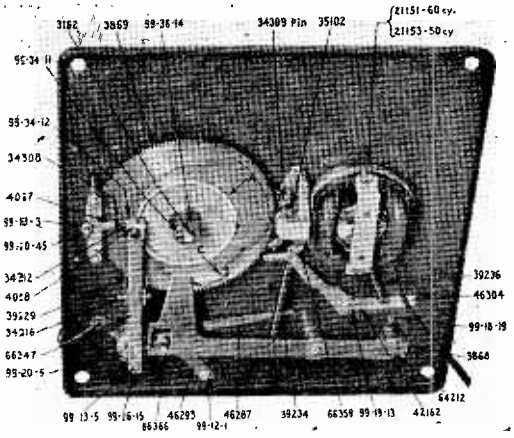


Fig. 7—Bottom View Farnsworth Model S-30

64215 Start Lever Release Trip and Hub Ass'y.
66355 Collar, Pin and Set Screw Ass'y. Lower.
99-14-3 ¼ x 28 Hex Nut.
99-20-5 10/24 x ½ RHM Screw.
99-20-45 10/24 x 2 RHM Screw.
99-42-5 Washer.

An underside view is shown in Fig. 7. The cam gear and motor are visible in the photograph. The corresponding part numbers are:

3162 Main Cam Stud.
3868 Tone Arm 10-12 Stop Cam.
3869 Main Cam.
4057 Roller—Record Lowering. (Part of 63119).
4058 Roller—Tone Arm Lift.
21151 Motor—60 cy., A.C.
21153 Motor—50 cy., A.C.
34308 Pin—Record Lowering. (Part of 63119).
34309 Pin—Motor Spindle Gear.
34312 Pin—Tone Arm Lift Lever.
35102 Motor Spindle Gear (Part of 6287).
39229 Spring—Tone Arm Lift Lever.
39234 Spring—Tone Arm Return Lever.
39236 Spring—Reject Lever.
42162 Shoulder Spacer.
46287 Trip Finger.
46293 Trip Finger Stop.
46304 Reject Lever.
64212 Tone Arm Return Lever & Hub Ass'y.
66347 Tone Arm Lift Lever Ass'y.
66366 Tone Arm Crank and Clamp Ass'y.
66359 Spindle Gear and Bracket Ass'y.
99-12-1 8/32 Hex. Nut.
99-13-3 10/24 Hex. Nut.
99-13-5 10/32 Hex. Nut.
99-18-19 6/32 x 7/16 RHM Screw.
99-19-13 8/32 x ¾ RHM Screw.

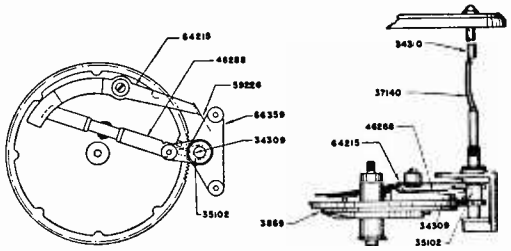


Fig. 8

99-20-5 10/24 x ½ RHM Screw.
99-20-45 10/24 x 2 RHM Screw.
99-26-15 10/32 x ½ RHM Screw.
99-34-11 Hair Pin Cotter Key.
99-34-12 Washer—¾ OD x 1/16 x 17/64 TH.
99-36-14 Washer—⅞ OD⅜C1/16.
7344-1 Gauge For Adjusting S-30.
63119 Record Lowering Link Ass'y Complete.
64213 12" Record Support & Shaft Ass'y Complete.
34311 Shelf Pin 10"-12" Front & Rear Record Support Ass'y.
66351 Friction Trip Ass'y Complete.
4949 Felt Washer for Motor Spindle.
54109 Spindle Support Bracket.
6287 Motor Spindle & Gear Ass'y.

Additional mechanical details are shown in Fig. 8. The corresponding part numbers are:

3869 Main Cam.
6287 Spindle and Gear Assembly.
34309 Main Cam Starting Pin.
34310 Record Centering Pin.
35102 Motor Spindle Gear.
37140 Motor Spindle.
39226 Starting Lever Release Spring.
46288 Starting Lever.
64215 Starting Lever Release Trip and Hub Assembly.
66359 Spindle Gear and Bracket Assembly.

All of the service adjustments which may be required in servicing this equipment will not be covered—for complete instructions refer to the manufacturer's service literature covering this model. However, some typical adjustments will be described.

Setting Tone Arm Drop.

The needle should drop on the record about ⅛" from the edge. To make the proper adjustment, first be sure that the record changer is in the playing position—that the Tone Arm has moved over so that the needle is on the record.

Set button 66264 for ten-inch records and loosen screw 99-20-5 in the Tone Arm Crank, 54108.

Place the needle on the record ⅛" from the edge. Press the Tone Arm Return Lever 64212 firmly against the Main Cam, holding the Tone Arm Crank against the side of the square hole, away

from the record, and at the same time hold the Tone Arm Crank firmly against the collar above it. Tighten set screw 99-20-5, making sure the Tone Arm still has a little up and down motion of the Lift Rod, 43182. Check the adjustment by letting the record changer go through a cycle.

Load 12 inch records and set Button 66364 for 12". Adjust screw 99-18-19 until the needle drops properly on 12" records, approximately ⅛" from the edge. Never set for 12 inch records first and then for 10 inch records as the 10 inch adjustment affects the 12 inch setting.

Changer Will Not Trip.

If the reject button has no effect and the record changer will not trip when the needle enters the change grooves, see that the Reject Lever 46304 is not caught on or behind the Starting Lever Release Trip 64215. The Reject Lever should be free to move, have very little motion up and down, and should hit the center of the Trip Finger 46287. The up and down motion of the Reject Lever may be corrected by tightening the nut that holds it against the base. Do not tighten it so that it causes the lever to bind—it must move freely.

If the changer will not trip when the needle enters the change groove but does change when the reject button is pushed, bend the Starting Lever Trip Spring 39226 towards the Motor Spindle Gear. On records where the recording occupies only 1/3 to ½ the available space, if the changer fails to trip in the change grooves, it may be necessary to loosen the Bristol Set Screw in the Trip Friction Collar, 43125, and to move the collar slightly. Use a 6/32 Bristol wrench, 6075, for this adjustment. Turn the collar a small amount clockwise, when viewed from the bottom of the changer. Check the operation of the changer on standard records as it is possible to move the collar too far.

Changer Trips Too Soon.

If the changer trips when only half the record has been played, check the position of the Starting Lever Release Trip 39226. The Dog on the Motor Spindle Gear, 35102, should throw the Spring back so the Starting Lever Release Trip 64215 overlaps the Starting Lever 46288 by approximately 1/16". If the overlap is less, bend the Spring slightly toward the Motor Spindle Gear until the proper overlap is secured.

If the changer trips near the end of the record, set the needle 1¾" from the record spindle, loosen the setscrew in the Collar, Pin and Set Screw Assembly 66355, turn the Collar slightly counterclockwise (viewed from the bottom of the changer). This will decrease the tension on the Friction Trip Lever Spring 39228. Next, tighten the set screw and check the tripping action on records again.

CONSTRUCTION OF SUPPORT FOR SERVICING CHANGERS

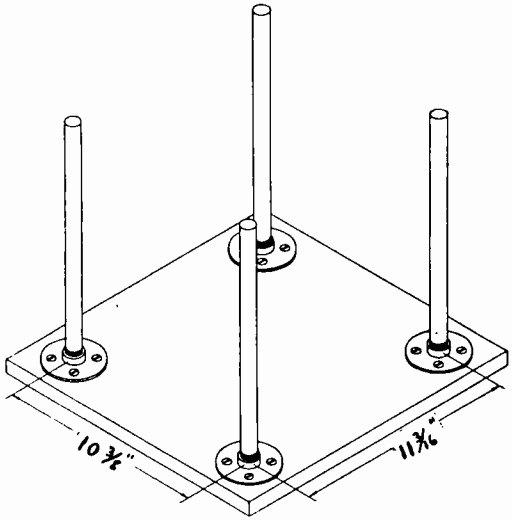


Fig. 9

Adjustment of Tone Arm Height.

With a 10 inch record on the turntable and a standard needle in the pickup, and 10 inch records stacked in the magazine, there should be approximately ¼" clearance between the top of the pickup and the underside of the bottom record in the magazine during the change cycle. This clearance is obtained by adjustment of screw 99-26-15.

With a 10" record on the turntable and the pickup in playing position, lift the pickup off the record so that both the brush and needle clear the record. The point of the needle should drop ¾ of the thickness of the record below the top surface of the record. This height adjustment is secured by bending the Tone Arm Support, 64219.

To adjust the needle pressure, move the Tone Arm so that the brush is fully on the record but the needle clears the edge. Adjust the Brush, 6725, by the screw in the pickup head so the needle is halfway between the top and bottom faces of he record. Care should be taken to see that there is some slack in the pickup lead between the pickup arm and base. If the lead is too tight, the needle will skip over the record instead of stopping in the first groove.

Squeak and Rumble.

A squeak during the change cycle is usually caused by a lack of oil on Roller 4058. A drop of oil placed on it will usually cure it. Any rumble

(Page 32, please)

Trouble Shooting Modern FM Circuits

Servicing the New-Band Receivers Calls for Attention to Novel Features—Short Cuts and Helpful Hints Given

Reprinted through courtesy of "Radio and Television Retailing."

FM servicing is here. No longer something to anticipate, it's now a concrete factor to deal with. To keep servicers abreast of the latest circuits and to allow them to get the benefit of early field experiences in FM servicing, **RADIO** and Television **RETAILING** will report the information offered by the various managers of the service departments handling the most widely distributed FM receivers. The following advice and data is available through the courtesy of Westinghouse Electric Corp.

The r-f end of an FM receiver has somewhat the same functions to perform as in an AM receiver. However, i-f rejection is of less importance, as the 10.7 mc i-f is comparatively interference free. Image rejection also is not a major problem, as the high i-f places images of FM stations outside the band.

The major function of the r-f end of the receiver, therefore, is to add as much as possible to the gain of the set so that a good signal-to-noise ratio will be obtained.

Details of RF Circuit

Figure 1 shows the r-f amplifier, mixer and oscillator circuits of the Westinghouse Model H-119 AM-FM receiver. Only the FM portion of the circuit is shown; all band switches and components associated with AM have been deleted for the sake of simplicity in following the FM operation.

It will be noticed that one wire of the two-wire transmission line from the antenna, is connected to chassis ground; the other wire is connected to a tap on the antenna coil. The tap location has been selected for maximum signal voltage delivery to the 6SG7 r-f amplifier grid and is correct for use with transmission line impedances of 50 to 300 Ω.

The tuned circuits, both physically and electrically, are more or less conventional, as compared with regular AM circuits, except for the size of the tuning capacitors and coils. One and one-half volts of negative bias for the 6SG7 r-f amplifier tube is obtained from the voltage drop across a resistor in series with the power transformer high-voltage winding center tap and additional bias from the AVC circuit.

The r-f energy from the 6SG7 plate is fed to a tap on the mixer r-f coil in order to obtain the proper impedance match between the 6SG7 plate and the 6SB7Y signal grid.

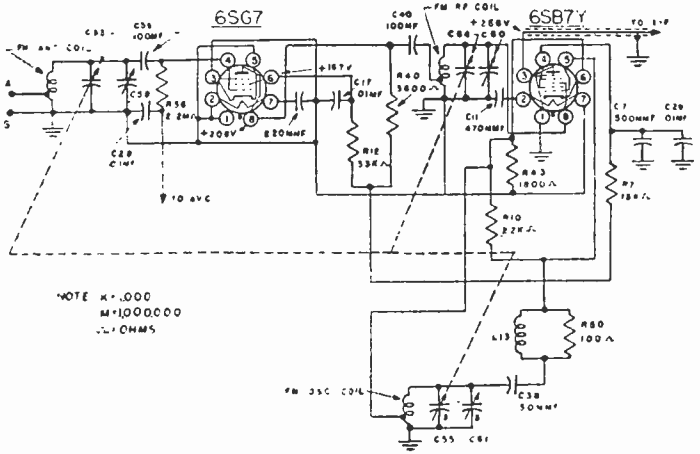


Figure 1—FM portion of the r-f amplifier, mixer and oscillator circuit of Westinghouse Model H-119 receiver.

This mixer-oscillator tube is a 6SB7Y which is a special metal-shell type developed for converter service on the new 88-106 mc. FM band. The circuit and connections are similar to those of the ordinary 6SA7 type; however, the interelectrode capacitance of the 6SB7Y is much lower than that of the 6SA7 and the 6SB7Y is fitted with a low-loss base.

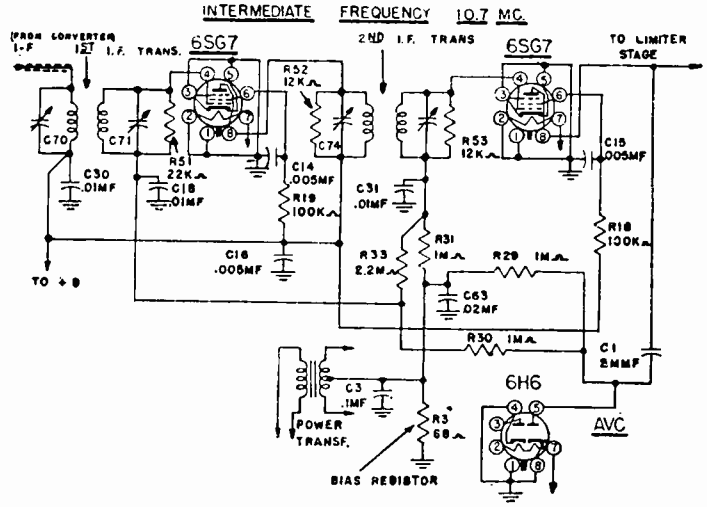


Figure 2—Circuits between converter and limiter, showing only FM components. This is typical of many radios, even though parts values and details may vary.

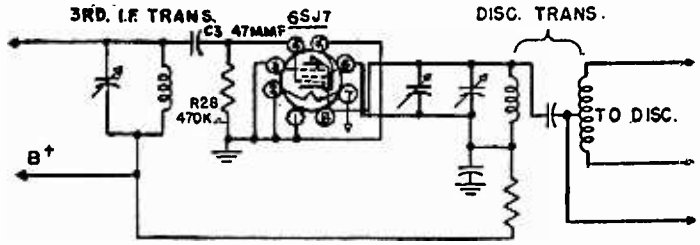


Figure 3—The limiter circuit of any FM set involves components having critical values. Check voltages with a very high impedance instrument, such as a VTVM, after first trying one or two new tubes.

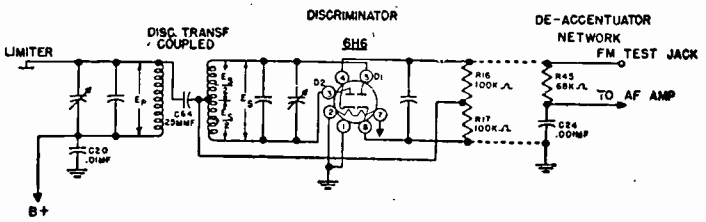


Figure 4—For a full explanation of the functioning for FM, refer to standard texts or manufacturers' service manuals. Several basic types are in use in the newest receivers.

The oscillator circuit is a conventional tapped-coil Hartley type. The coil and resistor network, L13 and R50, is a parasitic suppressor circuit.

Electrically, the i-f amplifier circuits of the H-119 are more or less conventional. The 10.7 mc. i-f transformer windings are connected in series with the regular 455 kc. AM i-f windings. In tuning such composite i-f units, the AM or 455 kc. trimmers are adjusted first and the FM or 10.7 mc. trimmers last.

It will be noticed that a 22,000 ohm loading resistor is connected across the secondary winding of the first i-f transformer and 12,000 ohm resistors across the primary and secondary windings of the second i-f transformer.

The purpose of the resistors is to permit "peaking" of the i-f circuits; unless resistor loading is used, it would be necessary to "flat-top" the i-f circuits in order to obtain proper band-pass characteristics. There is some curvature, of course, in the top portion of the resistance-loaded frequency response curve but the limiter acts to clip off this curvature providing, in effect, a wide-band flat-top response at the discriminator input.

Figure 2 shows the 68 ohms voltage dropping bias resistor in the power transformer high-voltage center tap. Note that the signal for the AVC rectifier is taken directly from the plate of the 6SG7 second i-f tube through a fixed capacitor. This permits the same AVC circuit to function on both AM and FM without becoming involved in complex switching arrangements. In every other respect the i-f amplifier is strictly conventional.

The limiter circuit is shown in Figure 3. Limiter tube voltages are quite critical. When replacing the grid condenser or the grid and plate resistors, the exact value specified by the

manufacturer must be used.

Figure 4 illustrates the discriminator, typical of many used in a wide range of other models and makes of FM receivers. At the right of this illustration is seen a deaccentuator network.

The time constant of this network is from 70 to 100 micro-seconds and the values are quite critical. When replacing these components, be certain that the values are identical with those specified by the manufacturer.

Check List of FM Service Tips

A. Noise and Hiss

1. Noisy r-f or converter tube.
2. Defective antenna system.
3. Excessive plate voltage on limiter.
4. Regeneration.

B. Regeneration

1. Improper lead dress.
2. Incorrect alignment.
3. Defective shield or ground straps.
4. Open bypass condenser (r-f or i-f circuits).

C. Distortion and Poor Tone Quality

1. Limiter not functioning due to:
   a. Bad 6SJ7 limiter tube.
   b. Incorrect limiter voltage.
   c. Limiter circuit not properly aligned.
   d. I-F circuits not properly aligned.
   e. Bad i-f amplifier tube.
   f. Open loading resistor across i-f winding.
   g. Open bypass condenser, i-f circuit.
   h. Incorrect voltages on i-f tubes.
2. Bad resistors or capacitors in de-accentuator network.
3. Insufficient signal for limiter saturation due to:
   a. R-F circuits out of alignment.
   b. Bad r-f tube.
   c. Inefficient antenna system.

D. Dynamic Range or Reproduction Poor

1. Limiter not functioning properly.
2. Regeneration in i-f due to open bypass condenser or open loading resistor across i-f transformer.
3. I-F circuits, limiter or discriminator not properly adjusted.

E. Lack of Highs on FM Stations

1. Check resistance-capacitance values in de-accentuator network.

F. Trouble Shooting in the Discriminator

Trouble: Severe Amplitude Distortion During High Audio Signal Levels.

Remedy: This trouble is frequently due to poor discriminator alignment. High level audio signals correspond to wide frequency deviations around the center intermediate frequency. If the discriminator is far out of alignment, the widely deviated signal, which corresponds to a loud noise, will go over the "hump" of the characteristic curve and distortion will result.

If the discriminator is only slightly out of alignment, the audio quality will be good except on the very loud passages where the response leaves the linear portion of the curve and passes over to the peak. To correct, realign the discriminator transformer primary and secondary trimmers.

Another possibility is that one-half of the discriminator transformer secondary winding may be open; or, the phasing condenser between the primary and secondary windings may be open. Either of these troubles will cause loss of one reference voltage and thereby introduce distortion.

G. Trouble Shooting in the Limiter

Trouble: Distortion in Discriminator A-F Output.

Remedy: The same basic operating principle is involved in all present-day limiter circuits. A 6SJ7 sharp cut-off pentode is operated so that grid swing condition between cut-off and zero grid volts is of the order of 3 or 4 volts. The plate and screen voltage is maintained at approximately 63 volts. Under such operating conditions, with a strong signal applied to the limiter grid, plate current saturation is quickly reached. The most frequent trouble in limiter circuits, with the possible exception of tube trouble, is a change in plate voltage due to changes in the value of the plate load resistor or to partial short-circuit of the plate circuit bypass condenser. If the plate and screen voltages are too high, the "threshold" voltage may change as much as 50 to 150 microvolts or more.

This means that the limiter will function as an i-f amplifier and little or no limiting action will take place. As the signal frequency swings with modulation, it passes over the slope of the i-f characteristic curve generating an AM signal which can be passed on to the discriminator. The discriminator will respond to AM as one-half of the 6H6 tube can act as diode rectifier. Unless the limiter removes the AM response, this condition will occur. The i-f response curve is not linear, so considerable distortion will take place when the FM signal is converted to AM. This is not normal FM reception and the conditions just described are due to a lack of limiter action.

———*n r i*———

Do we have your name on our list to receive information about the new **Model 88 NRI Professional Signal Generator?** We expect to start deliveries early in January, 1948!

Graduate Larkin McNiel Now Full-time Service Manager

Dear Mr. Smith:
"I'm enclosing a photograph of our radio service shop. Reading from the left is Mr. Bryon Peebles, center is myself, and Mr. Sam P. Peebles on the right. The Peebles are owners of this store. I have charge of all sales and service of radio and electric appliances. Business is fine.

If you will notice in the photograph, at the top of the instrument panel, you will see my NRI Diploma, of which I am very proud.

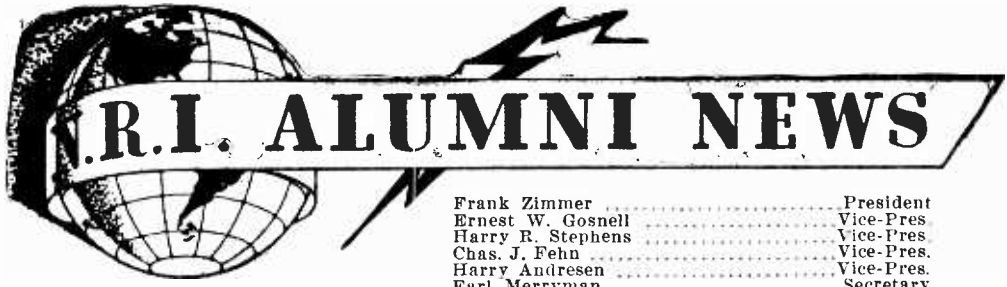
I can truthfully say that the NRI Course has pleased me and put me in a good position for a comfortable living. I was a professional musician for fifteen years when my health failed. I then moved out on a small farm. Saw your NRI Course advertised in a national magazine, so I decided to take up Radio Service work.

I began your Course in 1942 and in two months took a part-time job with E. M. Peebles and Sons, in Lexington, Texas. After completing the NRI Course in December, 1943, I moved to Rockdale, Texas, to accept a position in a bigger store with the same firm.

At present, I am making $200 a month plus 5% on all radio and electrical appliance sales and 25% on my service work. I am the only service man in our shop.

Mr. Smith, I want to compliment you on your training, for I feel grateful to you for making me what I am today. Thank you and all instructors for your interest in me."

Very truly yours,
LARKIN MCNIEL,
Rockdale, Texas.



Ernest W. Gosnell of Baltimore is President-elect of the NRI Alumni Association

Stephens of Detroit, Morris of Philadelphia, Rathbun of Baltimore and Newbeck of New York are Vice Presidents

THE tally of the ballots for President of the NRI Alumni Association for the year 1948 shows Ernest W. Gosnell of Baltimore as elected. His friendly opponent, Harry G. Andresen of Chicago, showed plenty of strength but not enough to overcome the popular vote from the Eastern section which was given to Gosnell.

Mr. Gosnell has long been a very hard worker for our Alumni Association. He is personally known to a considerable number of our members. For five years he served as Chairman of Baltimore Chapter. During that time he earned the rare distinction of having never missed a single meeting. Mr. Gosnell also served as Vice President of our national organization for a number of years. Always intensely interested in chapter activities, Mr. Gosnell has on several occasions visited Philadelphia and New York Chapters where he made many friends.

It is fitting that Ernie, as he is affectionately called, should be honored with the highest office within the gift of our members. He has been a member of Baltimore Chapter for many years. Eventually he was elected to a minor office such as Sergeant-at-Arms. Although his responsibilities were overshadowed by those of men in higher offices, Ernie Gosnell nevertheless took such an interest in all of the affairs of his Chapter's activities that his team-play spirit was quickly recognized. He gradually worked through the chairs in his Chapter, then into the National Organization as a Vice-President. Now he is rewarded by being returned President of this International Organization with more than 7,000 members in all sections of the world.

Mr. Gosnell is a fine gentleman, a good citizen, and a happy father. With Mrs. Gosnell he enjoys the companionship of two fine sons, two daughters, two daughters-in-law and five grandchildren. To be seated at the dinner table with this grand family of Ernie's, as we have had the pleasure of doing, gives one the feeling that here indeed is the great American family such as has made this nation strong. With Ernest W. Gosnell at the head of the NRI Alumni Association it is sure to continue to march forward in 1948.

Four Vice Presidents were elected. Harry R. Stephens of Detroit was reelected to office. New names are those of Harvey Morris of Philadelphia, H. J. Rathbun of Baltimore and James J. Newbeck of New York. So, this year, we have three new faces in the picture of our National Organization, all true and tried members of local chapters. The four elected Vice Presidents for 1948 are justly entitled to these honors because all have given so much of their time and energy toward helping their fellow radio men, expecting no reward except a slight indication of appreciation now and then.

With this fine slate of officers to take over on January 1, 1948, we are assured of another successful year just as we enjoyed during 1947 under the fine leadership of our current national officers who will retire from office on December 31. Here's to our success and progress in 1948.

Chapter Chatter

Press time again . . . So here goes with the Chapter Chatter. Baltimore . . . had a big blowout over there at Baker's Inn . . . Plenty of good food . . . and refreshments too. Preceding the dinner there was a short business meeting at Headquarters . . . some good pep talks by Gosnell and Rathbun . . . swell fellows in that outfit . . . some good new timber too . . . A new member is Leroy J. Bradley. Mr. Whitt gave a fine talk on the fundamentals of Television . . . very instructive and interesting. Mr. Whitt is an authority on Television.

Now let's see what's going on in Philadelphia. Norman Haffler and Norman Kraft, both of Perkasie, which is about forty miles from Philadelphia, gave the members a most interesting demonstration on the RCA Demonstrator. These fellows deserve a great deal of credit for making the long trip to our meetings with reasonable regularity. Kraft, by the way, is a past Chairman of our Chapter. Our own Harvey Morris gave us a fine talk about the characteristics of crystal pickups . . . Have undertaken the building of an amplifier . . . New members are John L. Baker, Page W. Kille, Thomas H. Ahlers, Earl L. Meris, Francis Legel, Leo Rominechi, Louis G. Krautwein, John Zanger and Howard W. Anderson . . . At our last meeting we held a door prize drawing. Page W. Kille was the lucky winner . . . a beautiful pair of three-purpose Philco pliers.

On to New York . . . That fine Chairman, Bert Wappler, and equally fine secretary, Lou Kunert, keep Headquarters fully posted on every activity . . . Alex Remer continues to do excellent work with his quiz programs. Gave a fine lecture on Dead Receivers . . . In New York they have a very interesting stunt. They have a flood light control placed on their RCA demonstration board which brings out the parts in detail. The rest of the lights in the room are turned off, thus centering all attention on the board . . . They say it helps the members to concentrate. Sounds good . . . New speakers are Robert Wiener who gave us a bang-up talk on "Getting a Better Understanding of Modulated Stages."

Jack Scheinhaus, another new member, also did very well in his talk on Dial Lamps . . . Thomas Bushy, who does a lot of Radio repair work including automobile radios, is another chap who has developed into an excellent lecturer . . . Bert Wappler was in bed for a week with a sore back. Hurt himself somehow. Had to wear a corset for a time. The sissy! . . . Our good friend Schlette, who entertained us so well at our last party, was in Lebanon Hospital at last report. Operation. Best wishes from all the fellows . . . Attendance has been running from fifty-five to sixty-five. Good programs . . . By the way . . . no party this year . . . food conservation . . . fair enough. Franklyn C. J. Slay spoke at one of the meetings as did our good friend William Fox who is always ready to step in with something good for the members. E. Williams also does his share . . . In fact, they have so many speakers prepared in advance sometimes it is necessary to hold some over until the next meeting . . . That's because of the good planning on the part of the Executive Committee . . . Programs are worked out weeks in advance . . .

Now let's swing back to the Middle West and stop at Detroit. A swell letter by Chairman Earl Oliver and Secretary Harry R. Stevens to all of the members. Gave an outline of the program for the next several months and covered a number of details regarding place of meeting, time, lectures, and other things which everyone wants to know but which require almost too much time at regular meetings . . . Took in seven new members last meeting.

Had a very interesting talk on the slide rule. Did not think it would go so well with their members but Floyd Buehler put it over in great style. There's a fellow for you . . . Buehler is a great asset to Detroit Chapter. It is he who arranged for them to meet at their present inviting quarters where they have so many facilities. And what do you know? . . . After one of the meetings Floyd, on his own hook, furnished the refreshments What a spirit! . . . He also gave a talk on Television together with a motion picture showing the use of vectors and graphs.

Chairman Oliver has made arrangements with Westinghouse, Sylvania and Philco to furnish speakers for forthcoming meetings . . . Another innovation at Detroit . . . They are ordering large buttons on which will be written or printed the name of each member. The idea is for the member to wear this button at meetings in the lapel of his coat so everyone will know his name. It certainly will help all get acquainted.

Now the hop over Lake Michigan to Chicago . . . The fellows in Chicago are working out a program whereby a certain member will be a monitor for several others. That is to see that they come to meetings. Chairman Steve Bognar and Secretary Brodhage are working on that plan . . . Harry Andresen is arranging for some good speakers . . . Executive Secretary Menne is expected at one of the meetings very soon. Everything is OK in Chicago Chapter.

And just to remind you . . . have you picked out that gift for your wife or sweetheart? . . . A Merry Christmas and Happy New Year to all.

n r i

Ernest W. Gosnell of Baltimore, Md., President-elect of the NRI Alumni Association. Mr. Gosnell will take office January 1, 1948.

The Executive Committee of New York Chapter in session. Left to right, Kunert, Zimmer, Patten, Ruocco, Fox, Remer, Krebs, Bockelman, and Wappler. Mr. Ruocco and Krebs were invited guests.

Local Chapter Meetings and Officers

NEW YORK—Meet at 8:15 P.M. on 1st and 3rd Thursday of each month at St. Mark's Community Center, 12 St. Mark's Place — between 2nd & 3rd Ave., New York City.

Chairman, Bert Wappler, 27 W. 24th St., New York City.

Secretary, Louis J. Kunert, 145-20 Ferndale Ave., Jamaica 4, N. Y.

PHILADELPHIA — Meet at 8:15 P.M. on 2nd and 4th Monday of each month at 4510 Frankford Ave.

Chairman, Harvey Morris, 6216 Charles St., Phila.

Secretary, Clifford Hill, 1317 N. Alden St., Phila.

BALTIMORE — Meet at 8:15 P.M. on 2nd and 4th Tuesday of each month at 745 West Baltimore St.

Chairman, H. J. Rathbun, 506 East 26th St., Baltimore.

Secretary, P. E. Marsh, Box 2556, Arlington Station, Baltimore.

DETROIT—Meet at 8:15 P.M. on 2nd and 4th Friday of each month at Electronics Institute, 21 Henry St., corner Woodward (fourth floor).

Chairman, F. Earl Oliver, 3999 Bedford, Detroit.

Secretary, Harry R. Stephens, 5910 Grayton Rd., Detroit.

CHICAGO—Meet at 8:15 P.M. on 2nd Wednesday of each month at 2759 So. Pulaski Road.

Chairman, Steve Bognar, 4443 Cortez St., Chicago.

Secretary, Louis Brodhage, 4820 N. Kedzie Ave., Chicago.

———*n r i*———

Our Thanks to Retiring Officers

We are closing the year of 1947 with a record of genuine achievement. Our sincere thanks to the NRI officers who have served us so well.

To Frank Zimmer, who served as President during 1947; to Harry G. Andresen and Charles J. Fehn, who for the past several years served as Vice Presidents, and to Earl A. Merryman, who has served as Secretary continuously since 1929, we take off our hats and give three cheers. Their work has been very well done.

We know we can always depend upon these loyal members for help whenever it may be needed. Their advice, based on long experience, is invaluable to us.

L. L. Menne

Fellowship---As I See It

By L. L. Menne, Executive Secretary

Christmas is a good time to say some things which, in the busy rush of other months might sound philosophical. There is no better time than now to thank you for your fine cooperation during the past year, and for your friendly greetings which have made this work a genuine pleasure.

The N.R.I. Alumni Association is an organization of fellowship. From personal experience I can say that fellowship is the stoutest link in the chain of commercial life. It involves the most magnificent rules in the big job of living.

When the time comes for you and me to go to that great enchanted spirit land from which no man returns, let us be remembered not by how much worldly goods we acquired, but how we played the game. We need have no illusions about our success in life; most of us will have failed much. One might chisel an epitaph for all men: "Here lies a man who tried hard, who meant well, but failed much!"

I remember when I was a very young man, away from my boy, then two years old, for the first time. I was in a western city among strangers, feeling the cold pangs of men who were not interested in what I was trying to sell. I returned to the hotel at night, tired and discouraged. On the dresser was an advertisement, and printed on the back of it was a poem by Louise Tarkington, "The Land of Beginning Again." I read it, and in my receptive mood, it impressed me so much I memorized it. These lines I shall never forget—

"I wish that there were some wonderful place
Called the Land of Beginning Again,
Where all our mistakes and all our heartaches
And all our poor, selfish grief—could be
Dropped, like a shabby old coat at the door
And never to be put on again.

"I wish we could come on it all unaware,
Like the hunter who finds the lost trail,
And I wish that the one whom our blindness
Had done—the greatest injustice of all
Could be at the gates like an old friend who
waits—for the comrade he's gladest to hail.
"We would find all the things we intended to do
But forgot, and remembered—too late, like
Praises unspoken, little promises broken, and
All of the thousand and one—little duties
Neglected that might have perfected—the day
for one less fortunate."

Forgotten! Yes, too often since then I have forgotten, and so have you. All the new resolutions you and I make and break this glad New Year will count for nothing. It is the one we keep which will help shape our life.

Not long ago, good friend, I stood by the fresh sod over one of my faithful friends. The sun was setting with its beautiful benediction of a perfect day; a kindly Pastor was telling of his simple virtues, but one-half will never be told. This friend of mine had done so many fine things for others, that conventional platitudes sounded out of place; one of those noblemen who had faced the drab daily grind of trying to get ahead, but who had spent most of his life wearing half-soled shoes that his children might go through school. There were those there who said he had been a failure, but still—

That place of worship was filled to the door with neighbors who had shared his fellowship; there were sobs of honest grief. He was just one of those millions who had feverishly worked for his family, paid his bills and his taxes, had a word of good cheer for his neighbors. A respectable citizen, a fond father, and a faithful husband. His life was a lesson in loyalty and service.

I hope some day as much may be said for me and for you.

Perhaps it is the season of the year that prompts me to greet you with this message. If I am a bit emotional you will pardon me, I know. I like to feel the Alumni Association is composed of men such as my friend to whom I have paid tribute. For without human fellowship and friendly contact, irrespective of the judgment of men, unless we are prepared to make fellowship part of our lives, we have failed.

As I measure my worldly goods I have no more than a year ago, but I am rich. I have the respect and confidence of my superiors, I have my family and I have friends such as you. In this spirit I greet you at this Christmas season. May the New Year bring you much peace and happiness and may it see the fruition of all your hopes and ambitions.

Here And There Among Alumni Members

Graduate F. P. Skolnick, of Pittsburgh, Pennsylvania, was kind enough to send us several excellent photographs showing him at work at his radio bench. We always get a big kick out of receiving photographs from members. How about it, Alumni? We'd like to see you and your shop, too!

———n r i———

George Fountain, Prospect Park, Pennsylvania, writes that he has just constructed his first Television receiver, and is getting very good results. Fountain is also the owner of a successful spare-time servicing business which nets him around $1,500 annually.

———n r i———

We were delighted recently to have Graduate C. F. Smith, Sr., of Portsmouth, Virginia, as a visitor of the National Radio Institute. Mrs. Smith accompanied her husband on their trip to Washington. We enjoyed meeting these fine people.

———n r i———

How's this for a full-time radio servicing job! Alumnus Jay Garris, of Denver, Colorado, is "pulling down" $87 a week. Nice going, Jay!

———n r i———

Carl E. Stauth, of Corydon, Indiana, tells us of a new addition to his family — an 8-lb. 3-oz. baby boy. The young man has been named "Mark Allen." We are also glad to learn that Stauth's public address and radio repair business is doing quite well.

———n r i———

Graduate F. L. Lenz, of Langley, Washington, now has his "ham" ticket (W7LGB) and expects to get his second-class 'Phone ticket soon. Congratulations!

———n r i———

We were pleased to hear from Canadian Alumnus Norbert Lapointe, who is now finishing a 52-week Electronic Course with the RCAF. Also a "ham," Lapointe's call is VE3AEB.

———n r i———

Mrs. Pearl Cooper, one of our rather few women Alumni members, lives in Yakima, Washington. Besides doing some spare-time radio service work she is kept busy with a nineteen-month-old daughter—not to mention a seventeen-year-old son, and another daughter, age 20. We wish her success in her radio work.

———n r i———

Another recent visitor to NRI was Alumnus E. S. Reese, Hagerstown, Maryland. Mr. Reese has a fine spare-time Radio service business, and is now ready to take another step forward by establishing his own full-time shop.

———n r i———

Elmer L. Theisen, of Richmond, Minnesota, now has his first-class 'Phone license. Says he's had several offers from broadcast stations, but now is studying Radio Announcing under the GI Bill. He wants to learn all phases of broadcast work before accepting a position. We wish you the best of everything, Alumnus Theisen.

———n r i———

Another Canadian member, Frederick A. Foran, is now employed as a Radio Operator with the Department of Transport in Canada. He is located at the Radio Range Station, Medicine Hat, Alberta, Canada.

———n r i———

Harold Chase, Master of Ceremonies at a Detroit Chapter Dinner Party points a finger at a guest for not singing. Penalty—sing a solo. That's Mrs. Chase with the captivating smile. Chairman Earl Oliver is at the extreme left.

Alumnus Orval Ingle, of Evansville, Indiana, tells us that the volume of his service business forces him to move from his home location to a business district. He is very pleased to be operating his own shop.

———n r i———

Merrill E. Breeze, one of our GI Graduates, is now with the Sunset Radio Company, Long Beach, California, specializing in intercommunications and public address equipment. We believe Alumnus Breeze has a fine start toward a career in "Sound" work.

———n r i———

John W. Grubbs, Alumnus from Louisa, Va., would like to locate a servicing position in Richmond. Anyone have any tips for Grubbs?

———n r i———

Thanks for the very nice photo of you and your shop, Alumnus J. M. George. Graduate George is the proud owner of "George's Radio Lab," in Portales, N. Mexico. He says business is good, and loudspeaker work alone nets from $50 to $100 per month.

———n r i———

Clive W. Kcemer, Box 2472, Asheville, N. C. is interested in any worthwhile position in Radio manufacturing, sales, or repair in Asheville. He formerly owned his own business in Connecticut.

Our Cover Photo

The petite young ladies holding the holly wreath at the entrance of NRI are, (at the left) Mildred Whitney, of the Stenographic Division, and (at the right) Claire Porter Farr, Secretary to L. L. Menne, of the NRI Alumni Association. These little ladies give our readers a good sampling of the many prepossessing workers at NRI who play so important a part in servicing our students. And all join in wishing each and every Student and Graduate a very Joyous Holiday Season.

———*n r i*———

How to Service Automatic Record Changers (Concluded from page 22)

occuring during the change cycle between the Motor Spindle Gear and the Main Cam Gear can be minimized by loosening the three screws, 99-19-17 and properly positioning the Motor Spindle. Retighten the screws.

Servicing Techniques

The servicing of the automatic record changer is simplified, as mentioned in the beginning of this article, by first of all securing familiarity with the normal operating characteristics of the equipment and secondly by using proper tools and aids in servicing.

The use of a special support to permit the serviceman to check the changer efficiently on the test bench is particularly recommended. A support of this kind is shown in Fig. 9 and may be constructed if desired. However, radio distributors have record changer service racks available and there is no need to construct you own unless you prefer to do so.

Here's a list of the materials required for construction of the support shown in Fig. 9.

1 piece ¾" Plywood 14½" x 15½"
4—½" Floor Flanges
16 Flat Head Wood Screws, ¾" long (Diameter determined by size hole in Floor Flange)
4 pieces of ½" Pipe, 12½" long, threaded at one end.

This concludes the article on servicing automatic record changers. Practical servicing hints have been given and information on the constructional details, arrangements and adjustments of a few, typical types. Gaining skill in servicing equipment of this kind is largely a matter of experience and application of the basic tool of servicing: effect to cause reasoning. In time, if you have a certain amount of natural mechanical skill, you should become quite proficient in the art of servicing the modern automatic record changer.

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Index

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