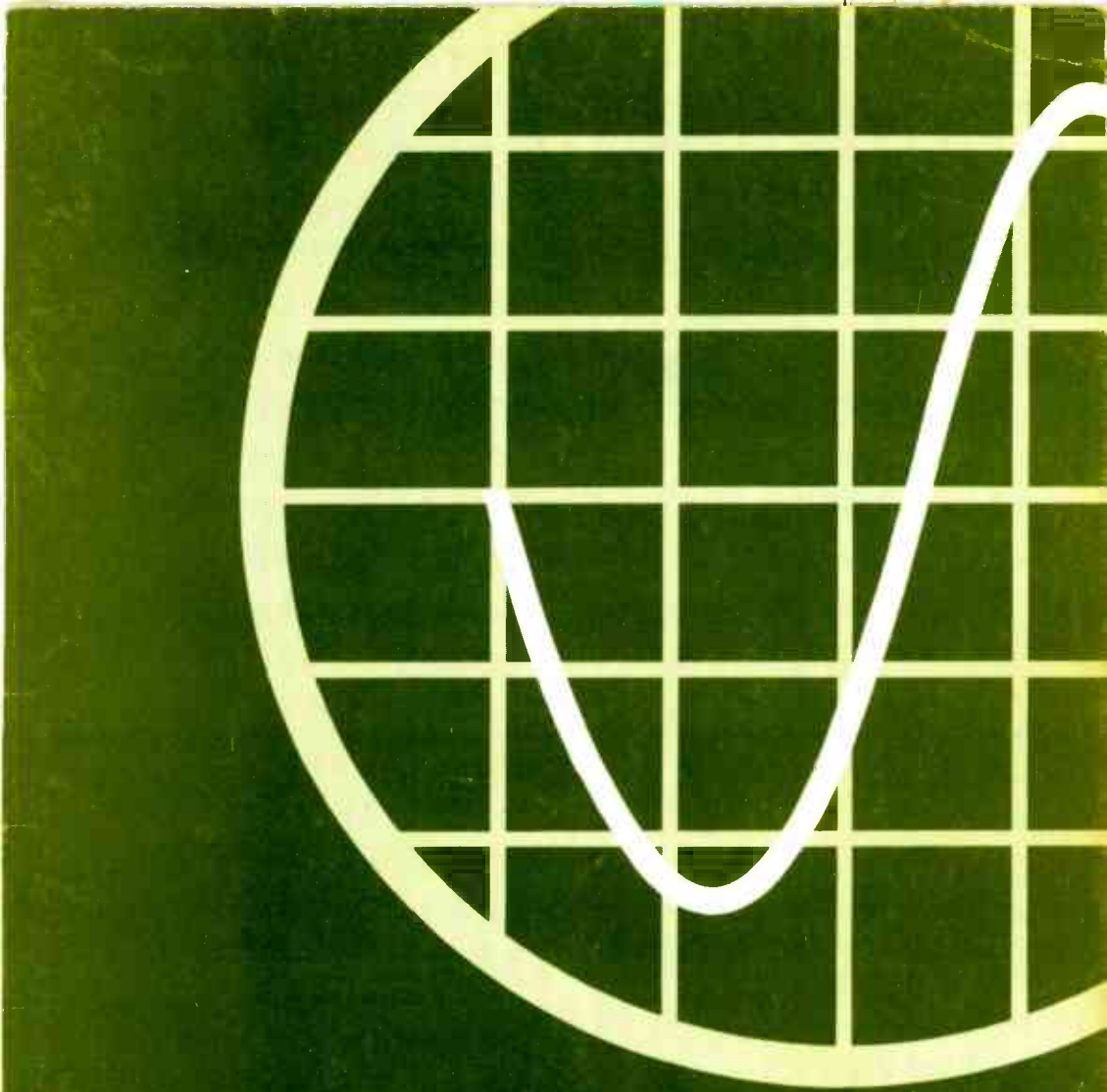

SERVICING ISSUE:

What to do when the music doesn't
More adventures in spare-time servicing
It's here: automotive mechanic certification

nri journal

March/April 1973

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Our cover shows an artist's representation of an oscilloscope screen. An oscilloscope is one of many useful pieces of servicing equipment. In this issue of the Journal you will find three articles on servicing: One on auto radio servicing, one on general radio/TV servicing tips, and one on the auto industry's new mechanic certification.

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John Q steps into his car bright and early Monday morning--well, early anyway--and begins his daily sojourn to the office. A short distance down the road, John notices that he isn't being cajoled into a state of full alertness by the familiar tones from his favorite radio station.

John reaches for the volume control knob and gives it a twist, wondering who turned his radio off. A sickening feeling comes over him when he fails to sense that reassuring click of the power switch. His radio is on--but it isn't on. He turns it off and on a few times--nothing. John doubles up his fist and gives the dash a good swift slam--nearly smashes his hand, and knocks his sunglasses off the visor in the process. Of course the radio just carries on, staring through its dial in mock silence.

Well, we all know what this does for John's disposition. You can bet he is already planning a trip to your service shop. Are you ready for him?

By Phillip D. Deem

WHAT TO DO WHEN THE MUSIC DOESN'T

When John arrives to solicit your assistance, the first thing you do is figure out how to get the radio out of John's car and onto your service bench--right? Wrong! If you have removed a radio from an automobile you know that it can often be quite a task. Oh sure, most manufacturers still use the standard 3-point system of holding in the radio (the two control mounting nuts and a third bolt or screw in the metalwork).

The first two usually aren't bad: just slip off the knobs and use your socket wrench or nut driver to loosen the mounting nuts. Locating the third is sometimes easy–provided you didn't have to remove the glove box or part of the heating duct to get at it. Then when you are able to move the radio freely and can disconnect the antenna, power, and speaker connections, you still can't get it out, you rapidly

become convinced that the whole dash was installed *after* the radio. Finally through thoughtful examination of the installation and much trial and error, you get it out.

After one or two auto radio removals you'll be surprised how many tests you come up with to be sure that the trouble is really in the radio chassis and not something external. And this is exactly what you should do. Of course, there is no better way to learn this lesson than to spend a great deal of time removing a radio only to discover that it works perfectly on your service bench!

When a customer comes to you with a complaint about his auto radio, be sure to question him thoroughly about the trouble. Often you will be able to coax information from him which will give you a good idea of what may be causing the trouble. Understanding your customer's complaint is especially important when the radio is not "dead" but just not operating to his satisfaction. Sometimes you may not notice the problem during routine servicing. Your customer will be quite unhappy if, for example, he still can't receive his favorite station clearly.

When the radio doesn't operate at all, you may not get much help from your customer in determining what the trouble may be. It will be up to you to find the cause. In doing this you must follow a few basic steps in an orderly fashion before removing the radio from the car. You don't have to follow them in the exact order given here, but work out a system which enables you to make the tests efficiently.

does the radio have power?

Turn the radio on, be sure the ignition switch is in the accessory position, and listen for a "thump" in the speaker. A thump is an effective indication that the radio has power; lack of a thump, however, does not necessarily mean that the radio does not have power. Some circuits have been deliberately designed to eliminate this. If you hear no thump, use your meter to check between the auto chassis--some part of the car which you know is a good connection to the negative side of the battery, such as a bolt into the dash or firewall--and the radio power connector, which you have temporarily removed. Adjust your meter to measure about 12 volts dc. You may come across a few 6-volt systems--but most will be 12 volts.

If you do not find 12 volts at the connector, check the fuse. The fuse may be housed in the power connector line or the regular auto fuse block. Don't just inspect it visually; remove it and use your ohmmeter to make a definite check. A blown fuse pretty much indicates trouble in the radio chassis, but don't overlook the possibility of a shorted power cable. Try a new fuse with the power connector disconnected from the radio. If the fuse holds, use your meter to confirm that you have 12 volts at the connector. If voltage is present, turn off the ignition switch and the radio. Replace the power connector and turn the ignition switch to the accessory position. Turn the radio on--if it plays, the trouble may have been a temporary short in the radio which has cleared itself, or the fuse may have broken from vibration or other mechanical reasons.

the speaker system

If you find the power OK at the connector, check the speakers by substituting a known good one from your shop. You may have to use a couple of clip leads to accomplish this test. Often the radio power connector also contains the leads to the speaker. In this case you will have to use a clip lead between the removed power connector and the correct pin in the socket on the radio chassis to supply power to it. Be sure to identify the connections carefully. Connect your test speaker between the auto chassis and the speaker pin at the radio chassis. If the radio works, the auto speaker is defective or the lead to it is shorted to the chassis or open.

If you get no sound from the test speaker, use another clip lead to connect between the radio chassis and a good ground point on the car. Remember, the ground return for the auto radio is through the auto chassis to the negative side of the battery. Although it is unlikely that this may cause trouble, it never hurts to check, especially since it is such an easy test.

check the antenna system

If you still have no sound, remove the clip leads and replace the power and speaker connectors. You must check the antenna system next. The auto radio is extremely well shielded and depends upon the antenna system to feed a signal into it. If you have repaired auto radios, you probably noticed that you were able to receive few, if any, stations until an antenna was connected to the radio. It is a good idea to keep an auto antenna available for substitution. Remove the regular antenna connector from the radio chassis and plug in your substitute antenna. Be sure the volume control is turned up and tune the radio up and down the band. If you still hear no stations, you will have to remove the radio from the car and work on it at your bench. You have taken all reasonable steps to determine that the trouble is in the radio and not due to some external connection or component.

equipment on the bench

Once again, try to develop a system of tests which works best for you, depending upon the suspected trouble or the customer's complaint. You must be able to work efficiently if servicing auto radios is to be profitable for you.

One of the important things you should do is organize your bench for the task at hand. Be sure you have the equipment to do the job. At a minimum, you will need a source of 6-12 volts dc, an auto antenna, a substitute speaker, a TVOM or VTVM and a good selection of tools. If you are just starting, you will be able to wade through a few repairs with just this equipment. You will want to add a signal generator and a ***tuned*** signal tracer just as soon as possible. You really should have these last two items at the start if you can afford them. You will easily recover their cost in the time they save you on repair work.

getting the job started

Make sure your test equipment is on so it will be ready when you are. Remove the top and bottom covers from the radio. It is always handy to keep a paper cup or plastic bowl on the bench to hold the screws you remove, so you will be able to reassemble the radio rapidly without having to hunt around for them.

When you have the covers off, make a fairly thorough visual inspection to look for broken wires, loose components, burned parts or any noticeable physical damage. While you are doing this, try to familiarize yourself with the circuitry. Note the location of the front end, i-f, and audio stages. If you see nothing obviously wrong, connect the power, antenna, and test speaker to the radio. It's time to put your equipment and knowledge to work.

servicing the "dead" radio

This type of repair is probably the easiest of all. The signal path has been completely interrupted. All you have to do is find the exact point at which the signal is missing, then find out why and make the repair. Figure 1 is a block diagram of an AM auto radio. Use your signal tracer to check for the presence of the appropriate signal between each of the stages, as shown. Start at the point between the antenna and rf amp and work back toward the speaker until you find the point at which the signal is missing. The stage you just passed is where the defective component is located.

Use your meter to check the voltages at the transistor leads and compare your measurements with the typical readings given in the schematic diagram. What's that? You're not using a schematic? Then you must be an experienced technician. If you are, fine. You know approximately what voltages to expect. You know that a correctly biased NPN silicon transistor will have between 0.5 and 0.7 volt from the emitter to the base, with the base more positive than the emitter. You are

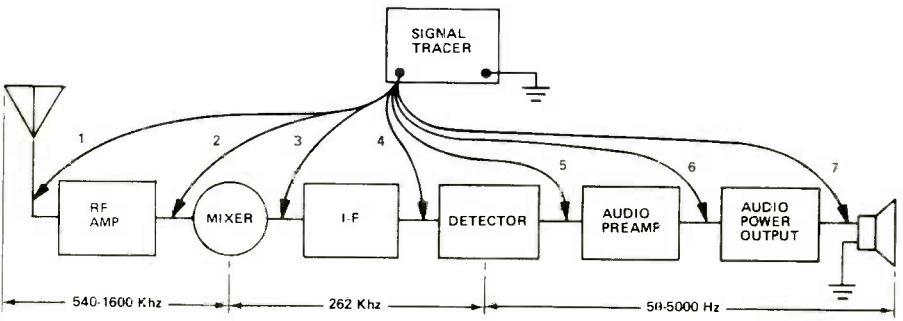


FIGURE 1. SIGNAL TRACING A "DEAD" RADIO.

familiar with the procedure of checking for current flow by measuring the voltage drop across the emitter or collector resistor, and you know that the typical current for a small signal transistor stage is between 0.3 and 2 ma. These and *many* more facts are available to the experienced technician–but if you are just starting out–GET A SCHEMATIC! You don't travel to an unfamiliar place without a road map, do you?

Once you come across a voltage measurement that is not within ± 20% of the typical reading given in the schematic, try to determine what may cause this unusual reading by studying the diagram. If you suspect a component, remove it or lift one lead and test it using your ohmmeter. If you suspect that a transistor is the cause of an incorrect voltage, remove the transistor and test it or select a suitable replacement and install it in place of the original.

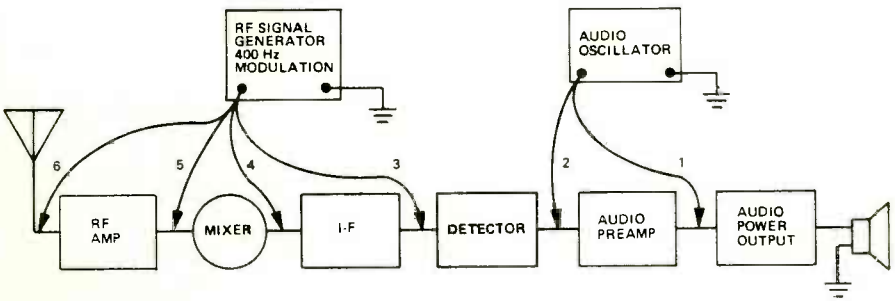


FIGURE 2. SIGNAL INJECTION METHOD OF TROUBLESHOOTING A "DEAD" RADIO.

Another way to locate the faulty stage is by signal injection, as shown in Figure 2. When you use this method, you work backwards. Inject the signal first between the audio preamp and the power output stage. Then, work back toward the antenna. You will have to change the frequency and amplitude of the injected signal as you progress toward the antenna. You must use an audio signal for the audio stages and listen for a tone from the speaker. As soon as you pass the detector, you will have to use a modulated signal generator adjusted to the i-f frequency, usually 262 Khz. Finally, you will need to adjust the generator output to the frequency the radio is tuned to receive. In each case, you will be listening for the tone from your audio oscillator or the tone which is used to modulate your rf signal generator. Be careful not to use too strong a signal, as it is often possible to force a signal through a defective stage. If you do this, you may waste time in testing a stage that was all right in the first place.

checking a radio with distorted sound

While this one is still in your car, be sure you use your substitute speaker. The extremes of temperature and vibration found in an automobile can really be rough on speakers. Traveling at highway speeds often necessitates operating the radio at

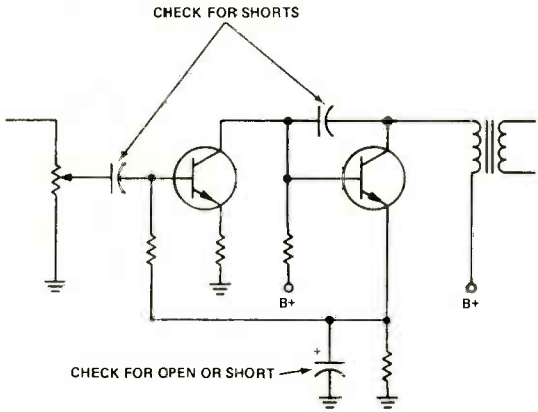


FIGURE 3. POINTS TO CHECK IN A TYPICAL AUDIO STAGE.

relatively high audio levels. Warped frames, broken cones, and intermittently open voice coil leads are often the end result.

If the speaker proves to be good (since you hear the same distortion when using the test speaker) the trouble will nearly always be located in the audio stages. Other sections of the receiver can cause distortion, but these problems occur infrequently.

Here is where the signal tracer is an invaluable asset. Use it to monitor the signal at the power output stage and work back toward the detector until the distortion disappears. Once you have located the faulty stage, pay particular attention to the bias voltage. Distortion means that something is operating in a nonlinear fashion. In other words, the output signal is not an exact replica but a more powerful replica of the signal at the input. This is frequently caused by a change in the transistor's bias point, causing it to operate on the nonlinear portion of its characteristic transfer curve.

Look for resistors that have changed value, shorted coupling capacitors, and open or shorted bypass capacitors, as shown in Fig. 3. Any of these can cause a change in the bias voltage.

the weak radio

Repairing this one is a little more difficult. The trouble can be in almost any stage. When you are repairing auto radios, get into the habit of making a quick run through them with your signal tracer, after you have completed the repair. Pay close attention to the control settings as you check each stage. You may wish to make a brief record of these settings or approximate stage gains. This information will be of value to you when you have a weak radio to repair. By checking the gain of each stage, you will be able to determine which one has the faulty component.

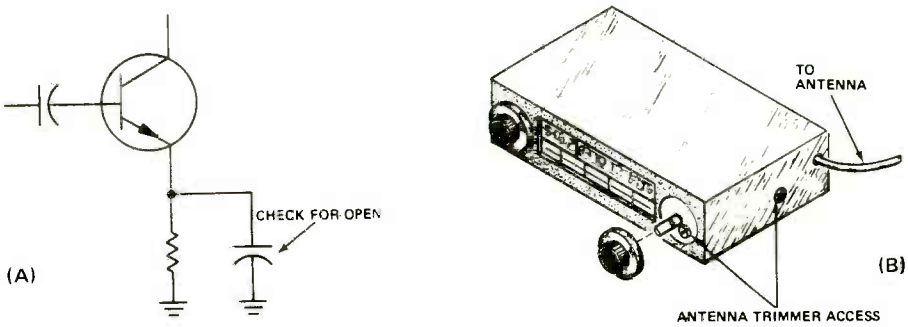


FIGURE 4. TESTING A WEAK RADIO.

If you are unfamiliar with the approximate gain to expect in each stage, locate the trouble by checking the voltages and comparing them with those on the schematic. When you come to one that doesn't seem right, check the stage carefully. Pay particular attention to emitter bypass capacitors. If a bypass is open (Fig.4A), the gain of the stage will be reduced considerably. This introduces degenerative feedback by allowing signal voltages to build up across the emitter resistor, instead of following their normal path through the bypass capacitor to ground.

While the unit is in the car, be sure to check the antenna trimmer, shown in Fig.4B. This adjustment is usually located behind the tuning knob. On some models, you may find it on the side of the chassis, near the antenna input connector.

Most manufacturers recommend that this adjustment be made when receiving a station near the high end of the dial, around 1400. Choose a weak station, otherwise the AVC voltage may upset the adjustment. If you install a new antenna or the customer does not want the antenna fully extended, be sure to make this adjustment. Tune for maximum sensitivity and minimum noise.

tackling the intermittent radio

An auto radio which has an intermittent problem is probably the most difficult to repair. Question the customer thoroughly when you get this complaint. You will need all the clues you can dig up to get it back into operating condition. Ask how often the trouble occurs and under what conditions it occurs. Pay particular attention to the antenna system when checking the unit in the car.

Again, the automobile environment is often responsible for this type of problem. A part may have jarred loose from vibration. A component lead may not have had enough slack in it to allow for the temperature extremes. When the component is cold enough, it may cause the lead to break loose from the connection.

When you have the radio on your bench, use the insulated end of a screwdriver, alignment tool, or pencil eraser to press the components and the circuit board to see if you can cause the intermittent condition to show up. Try holding your soldering iron near the components to heat them. If you have access to both sides of a printed circuit board, try using a high-intensity lamp from the opposite side to inspect it for cracks in the copper foil.

If you can't make the trouble show up, inject a signal at the input to the last audio stage before the speaker. Listen for the trouble to appear while you are doing other work. If it doesn't act up within a reasonable period of time, move the signal to the next stage toward the antenna and so on, until you finally find it.

We have discussed several methods of attacking auto radio problems rather than circuit operation. Naturally, you must understand how the circuits operate before you can repair them. Your NRI lesson texts will provide this instruction. If you are interested in additional information, I recommend, "Auto Radio Servicing Made Easy", by Wayne Lemons and "1-2-3-4 Servicing Automobile Stereo" by Forest H. Belt. Both of these books are available from Howard W. Sams and Company. □

MOWBOT: IT MOWS WHILE YOU DOZE

To be able to lie back in the sunshine or go about something more productive while the lawn is being cut automatically has long been one of the most popular and fanciful ideas of what electronics can do for the consumer. The usual method considered for such a robot device is radio control. For some time now, the idea has been technically, if not economically, feasible although the negotiation of flower beds, trees and other obstacles would probably have one sitting on the edge of the deck chair rather than relaxing in it. To overcome this, S. L. Bellinger, an electronics engineer, invented MOWBOT in his spare time.

Manufactured by MOWBOT, Inc., of Tonawanda, N. Y., MOWBOT is an automatic, battery-powered, electronically controlled lawn mower which operates without any human control or surveillance. It operates almost completely in silence, day or night, even in the rain. Its principle of operation is based on the engineering theory of random motion and the statistical theory of probability.

The lawn area to be mowed and all permanent obstacles are encircled by a continuous-loop border wire buried just below the ground surface. The border wire leads to a signal generator which converts ordinary house current to a low voltage 3000 cycle signal to which the control mechanism responds when the mower approaches the signal wire. Left and right side sensors are fitted front and rear in conjunction with a solid-state electronic controller.

This is another in a series of articles written by Mr. J. B. Straughn (former chief of Consultation Service) about his adventures in spare-time servicing. Mr. Straughn retired in 1968 after thirty-eight years of service. Since then he has been raising and feeding cattle in Alabama and doing a little servicing work.

In this article he points out a couple of general servicing tips which will be helpful to any beginning serviceman. They deal with bad habits which are easy to pick up, but time-consuming to continue. The two he examines are the replacement of capacitors and the use of lever-operated tube testers, like the NRI emission tester.

MORE ADVENTURES IN SPARE-TIME SERVICING

In the olden days—40 years or so ago—capacitors from 0.001 mfd to 0.5 mfd were paper encased and were used for bypass and coupling work. The troubles encountered were predictable. The capacitors could short, become leaky, open or could do any of these things intermittently. As a matter of fact you don't have to go back that far—some of the sets you will be called on to fix will have old style paper encased capacitors that will have all of these troubles.

The more modern capacitors enclosed in plastic containers do not seem to have these troubles as frequently. They do develop leakage, they do short, but they rarely open and are not intermittent often enough to be suspected of this right off the bat.

In times past, the thing to do if a capacitor was suspected was to replace it. This has become standard practice with some servicemen and you may even get advice to this effect. Now, I don't say that as a last resort you should not start replacing capacitors in the hope it will clear up the trouble, but this should be a *last* resort.

Recently I have been getting sets which were first given to some other service shop where the serviceman evidently thinks vertical troubles must *always* be caused by faulty bypass and coupling capacitors! Invariably all the capacitors in the circuit will be replaced with new shiny red units and the trouble is still present, perhaps

intermittently. There is one character around here who always installs a new capacitor from one side of the power line to the chassis, along with those in the vertical and sync circuits which could cause trouble. Generally I find that the defect is due to resistors that have changed in value or which have opened. This happens even in resistors that I would never have suspected in the days of radio servicing because they are in circuits where no dc is applied to them.

See Figure 1, which is a vertical sweep circuit. Look at resistors R_1, R_2, R_5, R_6, R_{10}, R_{11}, R_{12}, and R_{13}. There is no direct current through any of these resistors. However, through habit, servicemen look for dc voltages that could cause a capacitor to break down and become shorted or leaky.

AC can break down a capacitor even faster than dc because of the peak voltage involved. For example, if you measure 100 volts ac across a capacitor, the peak voltage is 1.41 (approx.) times as much or about 141 volts! R_{13}, through which no dc flows, is rated at 1 watt! Due to the large amount of signal current flow, these resistors can overheat, change in value, or burn out. Don't forget this.

When you suspect a capacitor of being leaky or shorted, disconnect one lead (the low potential one) and check it with an ohmmeter or with a high resistance voltmeter. For the voltmeter test, a dc source is required. If there is dc applied to the capacitor (as in the case with C_6 in Figure 1) and the low potential lead is disconnected, the job is easy.

First, however, what is meant by the low potential side of a capacitor? It is the side with the least voltage between it and the chassis. This is the right-hand lead of C_6.

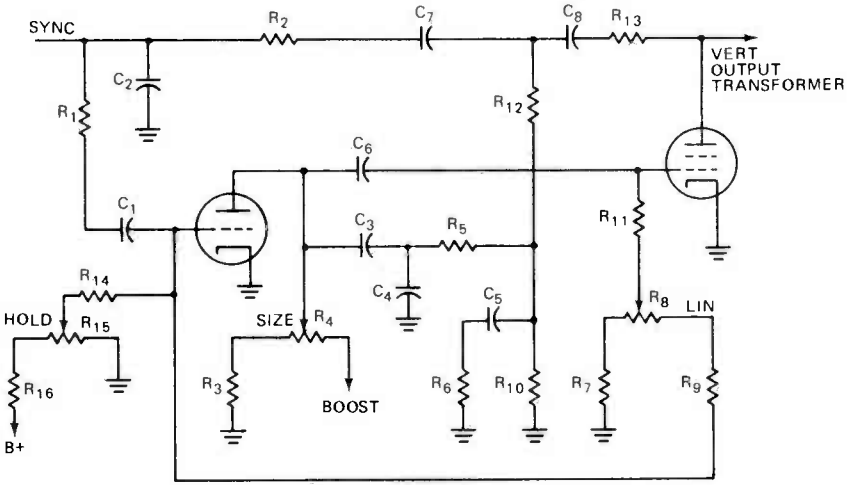


FIGURE 1. BLOCK DIAGRAM OF THE TWO-METER TRANSCEIVER.

The negative lead of the voltmeter is clipped to the chassis and the set is turned on (turn the brightness down so the CRT screen won't be burned, due to lack of vertical sweep). Then touch the positive lead of the meter to the free lead of C_6. There will be a momentary reading as the capacitor charges up. The reading should quickly drop to zero as there is no longer any current flow. If a reading remains, the capacitor has some leakage, permitting current to flow and causing the indicated voltage drop across the meter. The higher the meter reading, the lower the leakage resistance of the capacitor.

If the capacitor is not in a dc source circuit, C_4 for example, you can either settle for the ohmmeter test or you can disconnect the ungrounded end of C_4, leaving the other end grounded. Then clip the negative lead of the voltmeter to the free end of C_4 and touch the positive test lead to a B+ source. A steady reading shows the capacitor is leaky. Where you would have to disconnect both capacitor leads (as would be the case with C_7) this test might be passed up. To check C_7 with a voltmeter, one lead of C_7 would have to be connected to a positive voltage source and the voltmeter would have to be connected between the other lead and the chassis. The voltmeter is better than the ohmmeter because the leakage may not show up without the application of a much higher voltage than exists in an ohmmeter.

There is one other odd trouble which appears in capacitors, and which is more often found in TV sets than was the case in radios. When a capacitor is used in a circuit where the ac passed by the capacitor is quite high, and where the connection between the capacitor leads and the foil plates with which the unit is made is not quite up to snuff, a strange chemical reaction takes place. Changes occur in the metal forming the leads, the plates or both and a dc voltage is set up. With the capacitor disconnected, a dc voltmeter will read a small dc voltage across the capacitor leads even after the unit has been thoroughly discharged. As a result, the capacitor acts more like a resistor and less like a bypass or coupling device. I have run across this trouble time after time in capacitors used in series with the horizontal yoke windings. The symptom is that the sweep will draw in from the sides and, after a time, the horizontal will fail completely with loss of sync and then all sweep and high voltage. Where trouble is encountered and such a capacitor is used, see if a dc voltage exists across the unit after discharge. If it does, then replace the capacitor. The trouble occurs in other circuits as well and in all cases a new capacitor should be installed.

Notes on the NRI Tube Tester

No tube tester is perfect and all must be used with discretion. If the tester indicates the tube is bad, it undoubtedly is bad but may still work O.K. in the set. For example, if you have a receiver using a power transformer and the tube has a cathode to heater leakage, this may not matter if both the cathode and one side of

the heater are grounded. In this case replacement of the tube will have no effect on reception. In a set using a filament string, cathode to heater leakage may short out part of the string, and, if so, the tube should definitely be replaced.

In other cases the emission of the tube may be O.K. and there may not be any cathode to heater shorts or other leakage. Still the tube may not work properly in the circuit from which it was removed. The tube might be gassy or have some other defect the tester cannot show. When in doubt try another tube regardless of the test indication. Don't let this shake your faith in tube testing. My NRI emission tube tester is something I could not get along without and while I don't always believe everything it shows, it is right most of the time.

A good serviceman must be a skeptic at all times or he will easily get off the track and waste valuable time. Knowledge and experience will inform you when a tube is to be suspected and you will come to know when to try another. In the meantime never hesitate to try a new tube if you have any doubts.

The NRI tube tester does not become obsolete because of the lever switches used to connect the various tube elements to the proper test points. When a lever is in the down position, it connects to all other levers in the same position. In the center position, it checks the element to which it is connected against all other elements for leakage. In the upper position the element is connected to the filament source which is applied between this element and the other side of the heater in the lower lever position. In some tubes, more than one connection is used for the cathode and you are directed by the tube chart to throw ***both*** elements to the center or short test position. If only one lever is thrown a short is indicated between it and the other element internally connected inside the tube, but no harm results. When both levers are in the short position the short indicator light goes out. However, if the lever is thrown to the ***filament*** position rather than the ***short*** position, the filament voltage is applied between the two cathode connections and may burn out this lead inside the tube, causing an unnecessary tube replacement. When checking for leakage, the levers are ordinarily thrown one at a time to the short position and then back down again.

I have developed the bad habit of throwing the lever right through the short position to the filament position and back down to short. This does not matter if the element in question is not connected to another inside the tube. In the case of dual cathode leads, the connection inside the tube can burn brightly and open up. I have managed to ruin a number of tubes by this sloppy testing technique! Don't do likewise—when testing for shorts throw the element levers ***only*** to the center position and then back down. If more than one lever is indicated to be thrown for a test, throw ***both*** before paying any attention to the neon lamp glow used to indicate leakage.

In testing tubes which normally draw a high plate current (such as a damper or horizontal output tube) check in the usual manner, then set the tube tester filament switch to the next *lowest* position. This reduces the cathode temperature and if the tube is reaching the end of its useful life it will cause the meter needle to drop into the Yellow (questionable) or Red (bad) portion of the scale. The next time you check tubes try this out until you know what to expect. As far as I have been able to determine this trick is of no value in tubes with low cathode currents—such as high voltage rectifiers. Limit it to dampers, horizontal output tubes, and low voltage rectifier tubes where the drop in filament voltage is not more than 10 or 15%.

Now let's take a look at some interesting case histories.

Truetone Guitar Amplifier 5DC9824

This amplifier came in and had a terrific hum and no guitar music. There was no diagram available at the wholesalers, so I removed the back and took out the necessary screws so the amplifier plate containing the works could be removed. A visual inspection did not show anything wrong so I located the output of the full-wave power supply and checked the dc voltage, which was about 4 volts. The ac ripple was almost as high. I located the filter capacitor which is a 1,000 mfd unit and disconnected it from the printed circuit board. A check with the ohmmeter showed nothing wrong here. I also disconnected one lead of each of the power supply rectifiers. Their forward and reverse resistances, as checked with the ohmmeter, seemed normal.

I happened to touch the power transformer and found it to be hot after less than a minute of operation. With the rectifier leads again disconnected from the amplifier, a voltage check from the free ends to the "chassis" showed 30 volts dc, which is what it should have been with the leads in place! This showed excess current drain on the power supply. The most likely suspect was the output transistors. I decided I wanted a schematic so off I went, the next time in town, to Western Auto, which sells Truetone. I have a friend there and he went through his factory manuals. We came up with a Model 5DC9858. This is the same thing as the amplifier I had, except for the Vibrato, which mine didn't have. The schematic of the output and power stages are shown in Figure 2.

I removed the output transistors marked 2SB463 and with my ohmmeter checked their base and emitter circuits in the amplifier—everything normal. Next, I checked the emitter to collector resistance of the transistors. They were both very low—only a few ohms regardless of reversal of the ohmmeter test leads. This test showed without any doubt an emitter to collector short or as we say a "punch through" existed in both units.

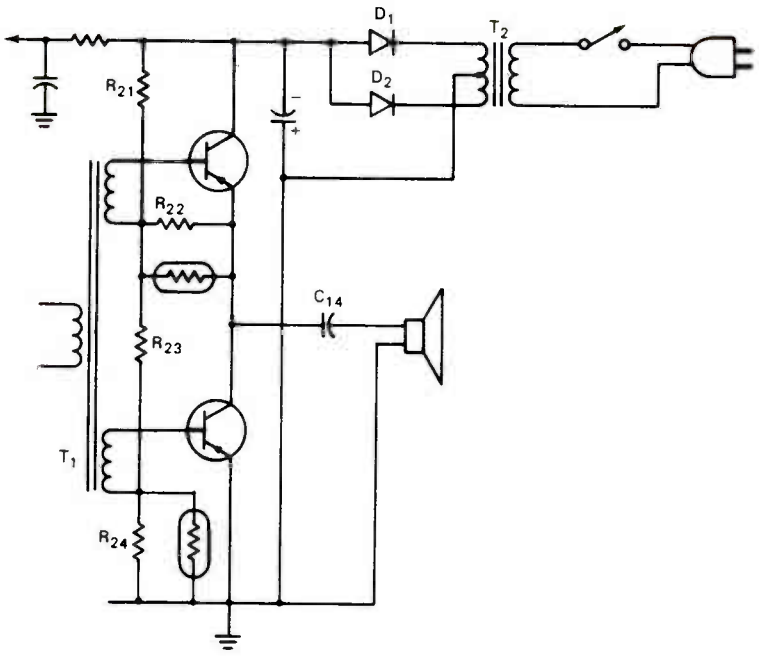


FIGURE 2. POWER SUPPLY AND OUTPUT OF TRUETONE GUITAR AMPLIFIER.

These are Japanese transistors but a check in my substitution manual (given to me by one of the wholesalers) showed the proper replacement. I discarded the mica insulator between the body of the transistor and the chassis since the new replacements have insulators packed with them. The insulators are coated with a thin layer of the special silicone grease used for this purpose (it gives a better *heat connection* between the transistor body and the chassis for heat dissipation) and the insulators are put on the base of each transistor. I put the transistors in place on the chassis and bolted them to it. The amplifier now works like new. I cautioned the owner about leaving the unit plugged in all the time, as an electrical storm might result in a line voltage surge, jump the on-off switch if off, and short out the new output transistors. This is what I think happened initially.

Truetone EIS1015A-96

The complaint on this TV set was that it played for a time and then the picture faded out. The raster and sound were still present. Aha, I thought, trouble in the video output tube—should be easy to fix. I tried the set out and confirmed the customer's complaint. After the set had cooled off, the trouble would recur. This indicated that the trouble was not due to a tube but to some part such as a resistor or capacitor affected by heat. When I got around to it, I took off the back and

looked inside to locate the video output tube and circuit. Lo and behold there wasn't any tube. I mean the set was a hybrid, using tubes in the sweep and high voltage circuits but transistors elsewhere.

At once I concluded the output transistor was shot. However, a little thought convinced me that if a transistor broke down it would probably stay that way. I could make a big deal out of this tale by saying I traced the signal with my scope and found it disappeared at the collector of the video output transistor and that collector voltage failed at the same time. However, that's not what happened.

I took a mirror off the wall and propped it up where I could see the picture when I was behind the set. Then I took a long-handled screwdriver and started banging around with the handle end near the video output transistor. Before you could repeat the resistor color code backwards I found a point where banging caused the picture to fade in and out. With the set turned off, I tried wiggling things with my fingers and found something that appeared to be loose. It was a big resistor. I unplugged the yoke, the picture tube socket, high voltage cap and tuner. Then I removed the bolts holding the chassis in place and turned it so I could see the foil side of the printed circuit board. When the resistor in question was moved you could see the lead move in the foil. It had broken loose or had not been soldered. A hot iron and a little solder held the connection firmly in place. An extended operational check did not result in a return of the original condition.

The video circuit of the receiver is shown in Figure 3. The resistor in question is the 6k-ohm, 3 watt collector supply resistor for the video output transistor. When the lead moved in the board, due to heat expansion, the circuit was broken and there was no collector voltage. As you can see, this would result in no signal reaching the picture tube cathode but would have no effect on the raster or on the sound, which is taken off from the output of the previous stage.

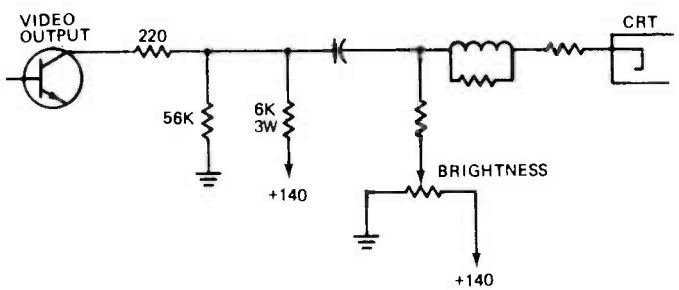


FIGURE 3. VIDEO AMPLIFIER OF TRUETONE HYBRID RECEIVER. SOUND AND RASTER BUT NO PICTURE DUE TO LACK OF COLLECTOR VOLTAGE FOR THE VIDEO OUTPUT TRANSISTOR.

I charged $13.50 for this job, which paid for the Sam's manual I bought and left me $10.00 for labor. Then I found out the owner did not know that an antenna was required for uhf reception. He had been getting it poorly, 20 miles away, with no antenna. I showed him how a circular antenna (connected and mounted on the antenna posts of the set) worked and sold him same. I get these six at a time and am always running out. Looks like stores sell sets and neglect to tell the owner about the necessity of an antenna of some kind.

Admiral Chassis H3-1A

This set came in with a terrific hum and no sound, raster, or picture. I tried to find a bad tube but, of course, couldn't. I got out the schematic, as I find this always helps me to think. I located a dc supply point and checked the voltage. Instead of the 140 volts dc expected, I got about 60 volts and measured a large ac ripple with the ac range of my vtvm. I wondered if the rectifier X1 in Figure 4 was at fault. This was easy to get at so I clipped one of its leads and checked it with my meter. The reading was normal in both directions. I also checked the shunting capacitor across X1 to see if it was shorted—it was O.K.

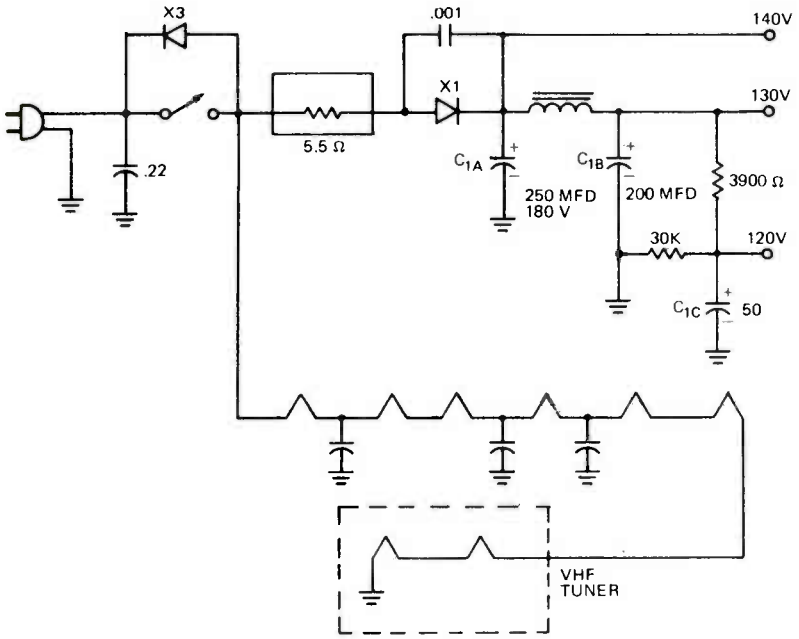


FIGURE 4. LOW VOLTAGE POWER SUPPLY OF ADMIRAL H3-1A. X3 IS FOR INSTANT ON/OFF AND KEEPS THE TUBE FILAMENTS WARM. NOTE ITS POLARITY WITH REGARD TO X1. WITH THE SWITCH OFF, THERE IS NO B-SUPPLY VOLTAGE AND NO REDUCED FILAMENT CURRENT.

The electrolytic can housing C_{1A}, C_{1B}, and C_{1C} looked O.K.—no corrosion around the leads—but this does not mean the capacitor is good. With the lead of X1 soldered back in place, the set was turned on, hum and all. Then I connected the positive lead of a 150 mfd, 300 volt capacitor from the cathode of X1 to the chassis. The hum disappeared and sound came in from a local TV station. Holding the capacitor in place I couldn't see the screen but was willing to bet that the raster and picture were both restored.

The next time I went downtown, the wholesaler had more or less of an exact replacement for what I thought was an exorbitant price so I didn't buy it. Instead I got a 250 mfd, 180 volt single cardboard encased unit. I was able to mount this on top of a number of parts on the printed board and extend the leads through the proper electrical connection in the circuit. I could have made the positive connection to the exposed cathode lead of X1 but had cut this previously and didn't want to try a resoldering job where there might be some strain. The new capacitor fixed everything up, with the exception of some cathode-to-heater leakage in the front end mixer tube. I replaced this and then looked at the front end schematic and saw that both the cathode and one side of the heater were grounded—so the old tube went back in. I charged $14.75 which is a gross profit of $12.25. But if another capacitor goes in the old can in the next six months or so I will feel obligated to fix it.

RCA Chassis KCS 144B

This set had sound but the raster was pulled in at both sides and had a trapezoidal shape, being wider at the bottom than at the top. In practically all cases, this indicates a defect in the yoke. I disconnected the yoke by unplugging it and checked the horizontal windings with my NRI scope. How this is done is described in the scope manual. No defect was indicated so my confidence in my diagnosis was shaken a little bit. However, I was still sure the trouble was centered around the yoke. As on most RCA sets, the horizontal windings connect to pins 8 and 4 of the yoke plug. Thinking that there might be a capacitor in series with the yoke return lead, I checked with the ohmmeter between yoke socket terminals 4 and 8 on the chassis. I measured only a few ohms, showing that there was no series capacitor. The resistance was about right for the flyback transformer terminals where the windings connect.

This brought me back to the rather inescapable conclusion that the yoke was at fault. A yoke job would cost the customer about $35.00 minimum, and I knew the owner would regard this as a catastrophe. I got in touch with the customer and to my surprise he said to fix it regardless. The set did pick up a vhf and a uhf station

and gave a picture. However, the vhf picture and sound suddenly disappeared. A check showed the uhf to still be present. The station had not gone off the air as I received it on my own set. This was a pretty good indication that the oscillator in the vhf tuner was not working. I tried another 6U8, which is used as the mixer-oscillator and, sure enough, the vhf station was back. I didn't bother to check the tube as it was apparent the triode section was at fault.

Since this would run the repair up even more I wondered if I had a yoke that would work. From time to time I get sets that are not worth fixing and sometimes I buy them from the customer for little or next to nothing. From this supply I found an old RCA chassis and pulled the yoke. The set did not use the same tubes as the KCS144B but this was something I had wanted to try for a long time. I had always thought that a more or less exact duplicate yoke has to be used. I didn't have a Sam's on the set and didn't know if they both required the same replacement yoke.

The second-hand yoke used an 8-prong plug which was going to make substitution easy. However, it had an extra lead to pin 5. An ohmmeter check showed it went to the center tap of the horizontal winding. This I cut, as I didn't know what might be on terminal 5 of the KCS144B. I installed the "new" yoke and fired up the set. To my surprise, and delight, the thing worked like it was made for the set! Got a beautiful picture.

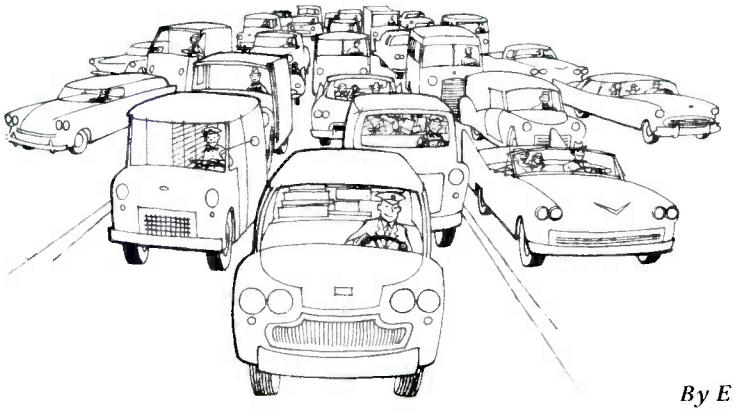
The next time I go to town I'll check and see if the two sets require the same replacement yoke. Even if the yoke which was installed had not been O.K., no damage should have occurred in the time it took to see if the yoke would work, providing the connections to the yoke plug were the same. I might add that the resistance of the windings on the two yokes were the same. This helped but the inductance of the yoke windings is the important thing; it does not necessarily follow that because the dc resistances are equal, the inductances are also equal. Since the yoke had been paid for by other parts used out of the set, I decided a price of $20.00, including the new 6U8 tube, would be about right: delight the customer and give me a nice profit. □

ham ads

Wanted: Old Gonset G-76 for parts. Also need diagram and manual. Mickey Sarra, Jr. – WN8MLC, Box 722, Charlestown, WV 25414

Sell: Milovac cassette recorder in perfect condition–$35; 80-10M mobile antenna with mount–$25; phone patch–$25; Heath HA-20 6-meter linear–$50. Mike Ford–WA9PAD, 7011 Tillman Rd., Ft. Wayne, IN 46816

Sell: Drake R-4B receiver and matching speaker (MS-4), brand new, perfect condition. Never been used, original carton–$425; 50' RG-8/U–$5. Will trade for 4-track reel-to-reel recorder. George Reed, 20 Altdorf Lane, Tell City, IN 47586



By Ed Cochran

IT'S HERE: AUTOMOTIVE MECHANIC CERTIFICATION

For a number of years there has been much said and written about the automotive repair industry. People in the industry have been called everything from stupid fools to crooks and thieves. They have been criticized by Congress, agencies of the government, John Q. Consumer, and, of course, Ralph Nader. And the sad part of it is that, in some instances, the charges have been justified.

The auto industry has set out to improve this tarnished image. They have put together a program to recognize those mechanics who are fully competent and qualified to do expert repair work on the automobile. This is accomplished by a series of four tests plus at least two years of experience. Those mechanics who pass all four tests and have the required experience will be certified as a General Automobile Mechanic.

A new organization was formed to administer the program. It is known as the National Institute of Automotive Service Excellence (NIASE) and is located in Washington, D.C. The board of directors for NIASE is made up of representatives of all segments of the auto industry. These include the Automotive Manufacturers Association (AMA), National Automotive Dealers Association (NADA), Automotive Service Industry Association (ASIA), Independent Garage Owners of America (IGOA), and others in the industry. The original program was funded by the four auto manufacturers through the AMA. Within the next year the NIASE is expected to become self-sufficient. Although Detroit is well represented in NIASE it will not dominate it.

this is how the program works. . .

To become certified, you must pass four tests, *but* you do not have to take all of the tests at the same time. The tests are prepared and administered by the

Educational Testing Service (ETS) of Princeton, N.J. This is a nonprofit organization which prepares such tests as the College Entrance Examination Board, Graduate Record Examination Board, the Law School Admission Test, the National Teacher Examinations, and various tests for vocational licensing and certification.

Each test consists of 80 questions and you are given three hours to complete each test. To take the test you must register in advance and pay a test fee of $10.00 for each test. The tests are offered twice each year (in the spring and fall) in major cities throughout the United States.

Besides passing the tests, you must present evidence of at least two years of work experience as an auto mechanic. You may substitute formal training for up to one year of work experience. You may take the tests before you have the two years experience but you will not be issued a certificate until the experience requirement has been met.

Each time you take a test, you will receive a Score Report showing the tests you have passed, the tests you will need to pass, and whether or not you have satisfied the experience requirement. Your General Automobile Mechanic Certificate will be good for three years. To remain certified, you must pass a test dealing mainly with new developments in the automotive service field. Tests for various types of automotive specialists are being developed and will be put into the program in the fall of 1973.

now, how do you get started?

To begin, write to the Certified Mechanic Program, P.O. Box 2611, Princeton, N.J., 08540 and ask for the Bulletin of Information. You will receive a copy of the bulletin which tells you all about the test and which contains 40 sample questions for practice. All of the test questions are multiple-choice and there is no penalty for guessing.

The bulletin includes a registration form that must be filled out carefully and completely. The registration form, with a check or money order for $10.00 for each test you wish to take, should then be mailed to Educational Testing Service at the address just given.

Each of the four tests covers different systems that make up the automobile. Test #1 covers Engines/Fuel, Induction, Ignition, and Exhaust Systems. Test #2: Automatic Transmissions/Manual Transmissions, Drive Lines, and Axles. Test #3: Steering, Suspension, and Wheels/Brakes. Test #4: Starting and Charging Systems/ Electrical (Body and Chassis) and Basic Air-Conditioning (A/C) Systems. Each test also includes questions about shop practices and safety.

You are tested in three areas of knowledge and skill. The first is Basic Technical Knowledge (What is it? How does it work?). You must be familiar with what is in a system and how the system operates. Procedures and precautions to be followed are also included.

The second area is Correction or Repair Knowledge and Skill (What is the likely source of a malfunction? How do you fix it?). You must understand and apply accepted procedures and precautions. You must also know how to use shop manuals and precision tools of the trade.

The third area is Testing and Diagnostic Knowledge and Skill (How do you find what's wrong? How do you determine the effectiveness of the work done?). You must be able to recognize the existence of a problem and to use generally available measuring and testing equipment to diagnose the difficulty.

I took the test

The first series of tests in the Washington area were given last fall in November and December on successive Tuesday evenings. I took the tests which were given at the Prince George's Community College in Maryland. This was the test site for the Washington, D.C. area. To prevent cheating or misrepresentation, the tests were administered by the college under very strict rules. Each person had to have identification with a picture so they were sure who was taking the test.

As mentioned before, three hours were allotted to complete the test. That was more than ample time. I spent between one and two hours on each test. I wasn't the first finished, nor was I the last. You are allowed to leave as soon as you are finished.

I spent quite a bit of time talking to the people who were taking the tests. All agreed that the test was fair and that the questions were good. The best advice I can give anyone taking the test is to do some boning up and to *read the questions carefully*. The questions are not tricky, but you must read them carefully to be sure you know what they are. Don't jump to conclusions. The questions are very thorough. For example, the first 40 questions for Test #2 were all on automatic transmissions. If you have studied the seven lessons on automatic transmissions in the Master Automotive Servicing course, you should have no trouble with that test. For that matter, if you have successfully completed the Master Automotive Servicing course, you should not have any difficulty with any of the tests. You also have very good material for reviewing before you take the tests.

I think this NIASE certification will be the most respected one in the industry. The automotive industry would rather have their own program than have the government come in and do it for them, and I agree. It won't be long until you will see the "Mechanic On Duty" signs come down and replaced by "Certified Mechanic On Duty."

One last note: I would like to hear the comments of any of you who take the tests. I'm sorry I can't tell you how well, or how poorly, I did because I have not received the report. It takes from four to six weeks after the last test for ETS to send the results to you. □

HAM NEWS

By Ted Beach K4MKX

The only comment I've gotten so far on the two-meter transceive idea presented last time came just the other day – via two meters! I was on my way to a meeting Saturday morning and was listening to the 31/91 Tysons Corner repeater as usual. After having a short chat with a couple of the fellows, I got a call from K3LSB. Seems as how Brian is an NRI student and just wanted to say Hi and give me his feelings (favorable, thank you) on the Ham News column.

It certainly is nice to hear some of you guys "in person," although it looks like it'll have to be on two meters until I finish putting up my low band antenna. All of which brings me to the "subject" of the column this time: "Antenna Tuners" or "How to Load a Wet Kite String on Any Band."

Most transmitters today are designed to feed a 50 to 75 ohm unbalanced load. Unfortunately there aren't many antennas around that present a 50 or 75 ohm unbalanced load. The impedance of a theoretical halfwave dipole is 75 ohms, but it is a *balanced* impedance. Thus, connecting a 75 ohm coax to the center of a halfwave dipole should work, but in all likelihood there will be uneven current distribution on the antenna as well as some standing waves on the line, all of which adds up to a system that works but which is usable on one band only and only over a narrow frequency range within the band. Try to use the antenna on another band or QSY too far from the designed frequency, and your SWR goes up, efficiency down.

If you want to operate on more than one band, then you'll need more than one dipole. The "parallel dipole" arrangement is one compromise I'm sure you've all heard of, but this setup is an open invitation to out-of-band radiation. Tune up on 80 meters and you *could* be putting out a swell signal on 40 or 15 as well!

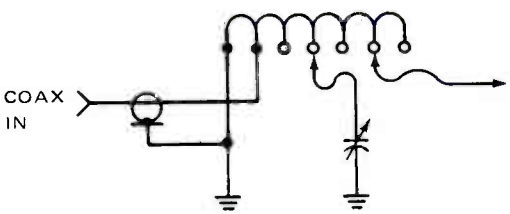
For multiband operation, the best solution is to have an antenna system that can be tuned to resonance at any desired frequency. Notice that I said "antenna system" and not "antenna." As mentioned earlier, of the first importance is being sure that you present the correct load to the transmitter. This will ensure that the transmitter power gets to the load and does not merely heat up the coax or the final tank!

Next we must be sure that the load connected to the coax is capable of radiating a signal (this is where the wet kite string bit comes in). A dummy load, of course, will accept and dissipate power, but it doesn't do an awful lot of radiating. The solution is to get lots of wire outside the shack and up as high in the air as possible, free from obstructions. Now, since a wire doesn't look like 50 or 75 ohms to the transmitter, we will need a tuner for matching purposes.

The whole purpose of the tuner is to make the antenna look like 50 or 75 ohms to the transmission line at any desired frequency. If we use just any old piece of wire for an antenna (which I intend to do), there will be no way to predict what sort of tuner will be needed. Thus we need a flexible tuner which can be connected and reconnected, as needed, to accomplish the required tuning.

The tuner that I made up for this purpose consists of a tapped coil and a single variable capacitor mounted on an aluminum panel. The coil has 30 turns of No. 22 wire and is wound (evenly spaced) on a 2 inch length of 1-1/4" diameter PVC pipe. Taps are brought out every five turns (more taps would provide even more flexibility). The taps were made by simply twisting the wire into a 1/4" pigtail every fifth turn. A small screw secures the wires at the ends of the coil form. After the coil has been wound, it should be coated with Coil Dope or varnish to hold the windings in place. The illustration below shows the electrical arrangement. The capacitor is a 420 pf unit liberated from an old AM radio. The rotor is grounded, and the stator connects via a clip lead to one of the coil taps. The antenna also clips to the taps on the coil.

One end of the coil is grounded, and the coax input is soldered directly to the first tap (five turns). And that's it. Real simple. And it works!



The electrical arrangement for a simple antenna tuner.

The tuner just described will handle only about 20 watts (the capacitor will arc), but you can use a transmitting type capacitor, a larger gauge wire in the coil, and then you can run much higher power. You must also have an SWR meter in the line from the tuner to the transmitter to make the thing work properly. This is an absolute must.

Hook up your antenna, a *good* ground, and the SWR meter, and you're all set. Select two taps at random for the antenna and capacitor, then turn on the rig and tune the final to resonance (dip). Do *NOT* try to load the transmitter yet. With the SWR meter in the *reverse* or *reflected* position, tune the capacitor for a *minimum* indication. If you can't get a 1:1 reading, try another tap (turn the transmitter off!) for the capacitor. If you can get a deep null (SWR almost 1:1) with the capacitor, try different antenna taps for a perfect reading. When you have gotten a 1:1 SWR, then increase the transmitter loading for rated power input. Be sure to note the positions of the taps so that you can return to this combination whenever you return to the same frequency.

And that's it. You can buy a commercial tuner for about $150 which includes an SWR monitor and rotary inductor, or you can "do it yourself." In any event, a flexible tuner will let you get on the air on almost any band using only a "wet kite string." Good luck!

All of you who we've heard from since last time are listed in the gallery below.

Charles	WB4CGX	C	Key West, FL
John	WB4SXM*	A	Wilmore, KY
David	WN8NQE	N	St. Louis, MO
Tom	WA8MXP (?)*	T	Kalamazoo, MI
Bob	WN8NRK	N	Princeton, WV
R.M.	WN8OCK	N	Bedford, OH
Julian	WN9IHW	N	Northfield, IL
Bill	WNØINS	N	Boulder, CO
Doug	WA1MJT	G	Thomaston, CT
Carl	WB5FIK*	E	Glencoe, OK
Larry	WN8MMU	N	Wapakoneia, OH
Emmet	W9HR	—	Kenosha, WI
Bill	WB9HZI*	T	Peoria, IL

*Just upgraded — congratulations!

WB4CGX wrote us a most interesting letter and proposes to be doing a little Maritime Mobile operating about now. Charles started operating out of Guantanamo Bay Cuba on January 2, and then moves on to San Stefano near Sardinia and Corsica where he will be for two years. He is most anxious to contact NRI hams while he is operating as WB4CGX/IS. On board ship, Charles runs an SB102/SB220 to a Marconi 110' above the water. Ashore and mobile he runs a Yaesu FT-101 with a home brew inverted vee and full set of Hustlers respectively. If anyone hears Charles on, give him a shout.

John, WB4SXM, wrote to thank NRI for the training that enabled him to get his Advanced license recently. Shucks, John, at least *half* the credit goes to you!

The question mark following the WA8MXP call is because Tom has passed the Tech exam but has not received his new license. I don't know whether they've gotten into the B's in 8-land yet or not. Tom got 46 out of the 50 questions right on the exam and is really looking forward to getting his General in a month or so. Best of luck Tom!

That's about all the news and views from the Ham Course students, so let's see what's up with the other rogues this time.

First of all, not listed is Sparky (no other name given) who is presently not licensed but operates 20 wpm CW all the time aboard the Army training ship Shearwater (sister to the Pueblo). Sparky says it is the last training ship in the Army (The Wackiest, etc.?). He wants to know how many Communications Course lessons he has to have under his belt before he can get a General ticket. Well, OM, there is no real answer to that one. By the time you get to the C200 series you should be in pretty good shape. Then all you need to do is brush up on the rules and regulations. I would suggest the ARRL License Manual for a start, Sparky.

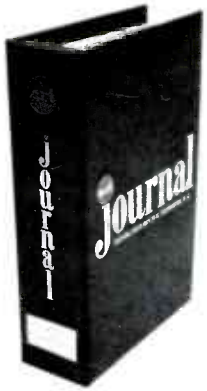
Doug, WA1MST, writes that he has "cheated" a little in getting into amateur radio (Novice, Technician and now General) instead of actively pursuing his Electronics Course studies. Nothing wrong with that, Doug – it all helps. He operates two meters and AM and CW on 10 through 80. Doug would like very much to QSO (and QSL) fellow NRI students.

Larry, WN8MMU, is taking the NRI Color TV course and appears to be an excellent home brewer also. His rig is a BC453 receiver with converter and a home brew 75 watt transmitter with VFO (new rules, remember?). Sounds real good, Larry, hope you get your General real soon.

WB9HZI tried for General, but like so many of us, he blew the code and had to settle for Tech. Bill says he is practicing code every night now and hopes to try again early in the Spring. Best of luck, Bill.

And that about wraps it up again, gang. Next time we'll have a little more on two meter FM (my present first love) or maybe something else – we'll see. Very 73 and we'll BCNU –

TED – K4MKX



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more ham ads

Sell: Bass guitar w/strap and 15′ pickup cord (cost $99 in 1969); 35-watt piggyback amp and speaker unit (cost $106 in 1969). Both in good condition—$75. Tom Narcock—WN8MXP, 1692 Mandigo Rd., Kalamazoo, MI 49002

Sell: Heath HR-1013 amateur band receiver and HRA-10-1 100kc calibrator, both new—$85; Heath IG-102 signal generator in perfect condition with test block—$35. Pickup only, no shipping. I. Schoonover, 570 Atlantic St., Stamford, CT 06902

Wanted: Information, manuals, etc., on RT-465 WRA1 radio transmitter and receiver, U.S. Navy. Ham News, 3939 Wisconsin Ave., NW, Washington, D.C. 20016

NRI HONORS PROGRAM AWARDS

For outstanding grades throughout their NRI courses of study, the following November and December graduates were given Certificates of Distinction along with their NRI Electronics Diplomas.

With Highest Honors

Ronald E. Adam, Cicero, IL
Kenneth J. Bigelow, Bladensburg, MD
Ira Noel Childress, Imperial Beach, CA
Ronald Chin, San Francisco, CA
Richard L. Craig, Jr., Chicora, PA
David F. Gleason, Birmingham, AL
John D. Hammond, Hendersonville, NC
William P. Jackson, Jr., Salisbury, MD
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Jerome J. Lochtedfeld, Albuquerque, NM
Rodolfo R. Mata, Chicago, IL
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Larry A. Moore, Houston, TX
John N. Oliver, Rantoul, IL
Charles M. Rackliffe, Wakefield, MA
Ray M. Schluter, Arnold, MD
Thomas J. Sherry, North Canton, OH
Henry A. Sosh, Portage, IN
Don E. Tolan, Washburn, IL

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David P. Andrews, Reading, PA
Donald E. Auger, Andover, ME
Robert A. Batty, Boulder, CO
Wallace R. Baxter, APO San Francisco
Chester D. Bays, Jr. Crane, IN
Robert L. Bresnahan, Yuba City, CA
Thomas E. Britton, Mountain Home AFB, ID
David G. Butkay, Manhattan, MT
Henry D. Clay, Tully, NY
G. E. Connell, Marietta, GA
Gary S. Covington, Biloxi, MS
William R. Cox, Nelsonville, OH
Ernest A. Cross, Vienna, VA
Gil M. DaPonte, Bristol, RI
David L. Dean, Hanahan, SC
Martin M. Ferrick, Tyler Hill, PA
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Robert T. Grubbs, Hitchcock, TX
P. C. Guelfo, Jr., Lansing, IL
Frederick K. Gunther, Canal Winchester, OH
Donald L. Hawkins, Burlington, NC
Wayne F. Henley, Chesapeake, VA
Paul G. Herder, McConnell AFB, KS
Jerome J. Herrick, Aberdeen, SD
Jerry J. Hodson, Kokomo, IN
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Kenneth R. Hooten, Carlsbad, NM
Gary Lynn Howell, Benton, AR
R. C. Iams, Canonsburg, PA
Thomas J. Kelly, Bethpage, NY
William J. Lakomy, Pittsburgh, PA
Samuel I. Leibell, Toronto, ON Canada
Charles H. Leiding, Chicago, IL
Louis J. Long, Alexandria, VA
Robert J. Lorenz, Rockford, IL
Jean-Claude Major, Touraine, PQ Canada
William P. Majosky, Milltown, NJ
Alvin Mallette, Kearney, NJ
David A. Massey, Blountville, TN
William E. McCormick, Indianapolis, IN
Edward A. Milavec, Somerville, NJ
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John A. Moeller, Washington, DC
W. J. Mulder, Miranda, CA
Steven C. Overton, Portland, OR
Clarence Edward Parsons, Lenoir, NC
Melvin D. Perkins, Metaline Falls, WA
Clifford W. Pitts, El Reno, OK
David L. Platter, Buffalo, NY

Don W. Rain, Poughkeepsie, NY
Joe R. Rivera, Roswell, NM
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Howard F. Smith, Delmar, NY
William James Stevens, Farmingdale, NY
Garland E. Thames, Stafford, TX
W. Benjamin Thomas, Miami, FL
William H. Thornberry, Columbia, MO
Walter J. Utz, Jr., Santa Clara, CA
Jay R. Wilson, APO NY

With Honors

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Richard J. Amos, Medway, OH
Jhinnu Ali Asgar, APO San Francisco
Harold T. Bailey, Loveland, OH
George Bank, Jr., Fayetteville, GA
Joseph Boyd, Denver, CO
Charles H. Buchanan, N. Biloxi, MS
William Bullock, Jr., Augusta, GA
Carlton H. Cochran, Skagway, AK
Anthony Colarusso, Chula Vista, CA
Armando Conchola, Salida, CA
James D. Dallas, Hill AFB, UT
Jerry Wayne Dossett, Henderson, KY
Robert E. Duff, Longview, WA
Raymond W. Durston, Cudahy, CA
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Ronald E. Fawver, Aberdeen Proving Grounds, MD
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Kenneth David Keyte, Colorado Springs, CO
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Dominic LaSalle, Bethpage, NY
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Charles C. Leyes, Frankfort, KY
Roy James Libby, Stratford, CT
LeRoy R. Mason, Batavia, NY
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George Walter Mitchell, Spencerport, NY
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Richard A. Rapp, Kankakee, IL
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Zenon M. Wyszynski, Aberdeen Proving Grounds, MD

DIRECTORY OF ALUMNI CHAPTERS

CHAMBERSBURG (CUMBERLAND VALLEY) CHAPTER meets at 8 p.m., 2nd Tuesday of each month at Bob Erford's Radio-TV Service Shop, Chambersburg, Pa. Chairman: Gerald Strite, RR1, Chambersburg, Pa.

DETROIT CHAPTER meets 8 p.m., 2nd Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich. 841-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 p.m., 2nd Wednesday of each month at Andy Jobaggy's shop, G-5507 S. Saginaw Rd., Flint, Mich. Chairman: Stephen Avetta, 239-0461.

LOS ANGELES CHAPTER Chairman: Graham D. Boyd, 3177 Virginia Ave., Santa Monica, Calif. 90404. (213) 828-8129.

NEW YORK CITY CHAPTER meets 8:30 p.m., 1st and 3rd Thursday of each month at 199 Lefferts Ave., Brooklyn, N.Y. Chairman: Samuel Antman, 1669 45th St., Brooklyn, N.Y.

NORTH JERSEY CHAPTER meets 8 p.m., 2nd Friday of each month at The Players Club, Washington Square, Chairman: George Stoll, 10 Jefferson Ave., Kearney, N.J.

PHILADELPHIA-CAMDEN CHAPTER meets 8 p.m., 4th Monday of each month at K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: John Pirrung, 2923 Longshore, Philadelphia, Pa.

PITTSBURGH CHAPTER meets 8 p.m., 1st Thursday of each month in the basement of the U.P Church of Verona, Pa., corner of South Ave. & 2nd St. Chairman: Charles Kelley.

SAN ANTONIO (ALAMO) CHAPTER meets 7 p.m., 4th Thursday of each month at Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 Block of N. New Braunfels St. (3 blocks north of Austin Hwy.), San Antonio. Chairman: Robert E. Bonge, 222 Amador Lane, Antonio, Tex. 78218, 655-3299

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8 p.m., last Wednesday of each month at the home of Chairman John Alves, 57 Allen Boulevard, Swansea, Massachusetts.

SPRINGFIELD (MASS.) CHAPTER meets 7 p.m., 2nd Saturday of each month at the shop of Chairman Norman Charest, 74 Redfern Dr., Springfield, Mass. 734-2609

TORONTO CHAPTER meets at McGraw-Hill Building, 330 Progress Ave., Scarborough, Ontario, Canada. Chairman: Branko Lebar. For information contact Stewart J. Kenmuir (416) 293-1911.

DETROIT CHAPTER ENTERTAINS NATIONAL PRESIDENT OF NRI-AA

At the November meeting of the Detroit Chapter, Mr. Andrew Jobbagy, the 1972 NRI Alumni National President, gave a talk on TV antenna cross-over networks and how the new "Instant On" TV sets operate. The Chapter wishes to thank Mr. Jobbagy for traveling the distance to Detroit and for his very fine talk.

At the December meeting Mr. Jim Kelley, Chapter Chairman, gave a talk on the color TV kit that he is assembling. At the same meeting Mr. John A. Nagy, Secretary of the Chapter, gave a demonstration and talk on phasing and matching audio speakers. The Chapter wishes to thank both these gentlemen for their efforts. It is because of men like them that the Chapter in Detroit is always an interesting place to attend.

Alumni News

FLINT-SAGINAW VALLEY CHAPTER HEARS TECHNICAL LECTURES

Andrew Jobbagy, the National President of NRI-AA for 1972, gave a lecture at the December meeting entitled "Voltage Analysis of Tough-Dog Repair jJobs." He noted how simple it is to make a mistake when you take a voltage measurement such as grid bias on a vacuum tube. It is quite easy to miscalculate this voltage reading and fool yourself into thinking that everything is OK. Andy went on to discuss voltage analysis of sync separator stages. He explained the effect of a leaky capacitor on the voltage reading and how easy it is to make a mistake in analysis when an open capacitor is present.

During the second half of the meeting, Steve Avetta, Chapter Chairman, demonstrated how *not* to set your voltage regulator circuit. This was the last meeting for 1972 and everyone wished everyone else a Merry Christmas and a Happy New Year.

The January meeting was devoted to electing new officers for the Chapter and planning a dinner in their honor, which was to be held Feb. 11 at the Bonanza Steak House. The newly elected officers are: *Steven J. Avetta*, Chairman; *William P. Salerno*, Vice Chairman; *Henry J. Hubbard*, Secretary; *Andrew J. Jobbagy*, Corresponding Secretary; *Clyde B. Morrissette*, Programming Director; *Joe Washington*, Goodwill Ambassador; *Robert Newell*, Sgt. at Arms; *Fred Malik* and *Dennis Besser*, Membership Committee; *Gilbert Harris, Wendel McKeown, George Rashead,* and *Barry Northon*, Information and Educational Directors; *Richard S. Jobbagy*, photographer.

For the second part of the January meeting, Andrew Jobbagy described the microwave oven and the future wonders

that will be available, such as the sonic washing machine and the transmission of power by microwaves.

NEW YORK CHAPTER PLAYS HOST TO EXECUTIVE SECRETARY

On December 7, 1972, Tom Nolan, Executive Secretary, visited the New York Chapter and gave a talk on troubleshooting high-voltage power supplies in color television receivers. The meeting was well attended and ended with refreshments shared by all.

The new officers for the Chapter, who were sworn in by Tom at the December meeting, are as follows: *Steve Kross*, Chairman; *Robert White*, Exec. Chairman; *Pete Carter*, 1st Vice President; *Charles Vivo*, 2nd Vice President; *Ted Freije*, Secretary; and *Roy DaSilva*, Treas.

The Chapter wishes to note another honored quest, Brother Bernard Frey, formerly of the Springfield Chapter. Brother Frey came from upper New York State to attend Tom's lecture and the Executive Secretary appreciated the gesture. Tom says that he greatly enjoyed Brother Frey's company at dinner a few weeks back when Brother Frey was in the Washington, D.C. area.

NORTH JERSEY CHAPTER CONGRATULATES NEW NATIONAL PRESIDENT

At the November meeting the North Jersey Chapter congratulated their Chairman, George Stoll, for being elected President of the NRI Alumni Association for 1973. George wishes to thank all of those who voted for him and is looking forward to a good year. George is known to be a diligent worker who has served well in previous offices. Congratulations and best wishes to you, George.

The members spent an interesting evening troubleshooting with two color TV sets of the same make and model. Mr.

New York Chapter members who enjoyed Dec. talk on troubleshooting high-voltage power supplies in color TV receivers.

Shevtchuk's chassis was hooked up to Mr. Walt Klucovsky's picture tube, and convergence and purity adjustments were made until satisfactory picture and color were obtained. Then Walt's set was hooked up to the picture tube and the same procedure was repeated. A green amplifier tube was found to be defective. Time did not allow completion of the troubleshooting of a heating problem, but it sure was an educational evening and the time went fast.

The installation of officers for 1973 was held at the January meeting. The new officers are *George Stoll*, Chairman; *Franklin Lucas*, Vice Chairman; *LeRoy Frienschner*, Treasurer; and *Harry Weitz*, Secretary. The Chapter now meets on the second Friday in the month instead of the last Friday. It is expected the change will be more attractive to the members and will avoid conflict with long holiday weekends.

The practical troubleshooting period at the last meeting (November) was successful. Walter Klucovsky said the bad green amplifier tube was replaced, the convergence was adjusted, and the set works fine now.

For the January meeting, Chairman George Stoll obtained another set which was having trouble; this set belonged to a student who worked nights. Again, the members pitched in to locate the trouble. Three problems were found, one ground wire was hooked to the B+ line, there was a burned resistor, and a diode was missing. It is expected that the set will be repaired at the next meeting. The members say they are thoroughly enjoying these troubleshooting sessions.

PITTSBURGH CHAPTER ENTERTAINS GE REPRESENTATIVE

At the November 2 meeting of the Pittsburgh Chapter Mr. William Sinclair, the field representative for General Electric, discussed the new GE Color TV chassis, Model MA. Mr. Sinclair gave a

Springfield Chapter at their Dec. meeting where Tom Nolan discussed the British "PAL" system.

Pittsburgh Chapter officers. Seated left to right: C. Kelley, J. Benoit, T. Schnader. Standing left to right: D. Benes, G. McElwain, J. Wheeler, and J. Burnelis.

detailed description of the Model MA receiver, explaining how it works and the best way to service the chassis. This receiver is something like the Motorola-Quasar in that it is a solid-state construction with removable boards. It does seem to be very simple to repair but it may necessitate stocking the necessary component boards.

At the December meeting new officers were elected: *Charles Kelly*, Chairman; *John L. Benoit*, Vice Chairman; *George McElwain*, Treasurer; *Joseph M. Burnelis*, Secretary; and *Thomas D. Schnader, James L. Wheeler,* and *David Benes*, Directors.

SAN ANTONIO CHAPTER ELECTS OFFICERS AND ENJOYS CHRISTMAS PARTY

The new officers of the San Antonio Chapter are *Robert E. Bonge*, Chairman; *Sam T. Steinbaugh*, Vice Chairman; *J. J. Harrison*, Secretary; and *Sam Dentler*, Treasurer. The Chapter wants to recognize the stedfast service of Sam T. Steinbaugh in the office of Secretary. Sam has been elected to the Vice Chairman's spot and is being replaced as Secretary by another good man, Mr. J. J. Harrison.

On December 16 the Chapter held their annual Christmas party for members and their families. There were thirteen members, twelve wives, and six children present. The members wish to express their gratitude to their most gracious hosts, Betty and Jim Rivet. Jim is probably doing the largest TV repair business in the organization. Members and wives enjoyed the instructive tour through his large well-equipped shop. They then filled themselves with barbecue and all the trimmings, not to mention the contents of Jim's well-stocked and spacious bar. Unanimously, the Chapter agrees, "This was undoubtedly the most successful Christmas party we have enjoyed since our organization was formed. Thanks again to Jim and Betty."

SPRINGFIELD CHAPTER ENTERTAINS NATIONAL SECRETARY

The Chapter wishes to thank Mr. Tom Nolan, National Executive Secretary, for his annual visit and lecture on December 6, 1972. Having just returned from London where he attended the marriage of his son, Tom gave a short talk on the British system of television broadcasting. The British use the so-called "PAL" system which means phase alternate line. In the PAL system it is not necessary to have a tint control on your color receiver because the tint is automatically taken care of by the broadcast station. The British are phasing out the 440-line scanning system and have now adopted a 625-line raster. This compares with a 525-line scanning rate in the United States. Tom says the quality of British TV is really superior to that of the United States and there is little hope that the United States will change systems because of technical and economic problems.

Tom went on to discuss the servicing of solid-state radios and TVs and spoke at length on servicing the high-voltage regulator sections of modern color-television chassis.

On behalf of the Alumni Association, the Chapter Secretary wishes to thank Mr. George Desnoyers for supplying the Springfield Chapter with 500 membership cards. This entailed considerable time on Mr. Desnoyers' part and the Chapter is deeply grateful. Thanks to Mr. Desnoyers, it didn't cost Springfield one cent.

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25.01- 30.00	1.50	4.00		
30.01- 35.00	2.05	4.50		
35.01- 40.00	2.65	4.75		
40.01- 50.00	3.00	5.00		
50.01- 60.00	4.15	5.50		
60.01- 70.00	5.50	6.00	6.40	4.50
70.01- 80.00	7.00	6.50	8.00	5.00
80.01- 90.00	8.00	7.75	10.10	5.00
90.01-100.00	9.00	8.75	12.60	5.25
100.01-110.00	10.00	9.75	14.80	5.50
110.01-120.00	11.00	10.75	16.20	6.00
120.01-130.00	12.00	11.75	17.60	6.50
130.01-140.00	13.00	12.75	19.40	7.00
140.01-150.00	14.00	13.75	21.60	7.50
150.01-160.00	15.00	14.75	23.20	8.00
160.01-170.00	16.00	15.75	24.80	8.50
170.01-180.00	17.00	16.75	26.20	9.00
180.01-200.00	18.00	17.00	27.90	10.00
200.01-220.00	20.00	18.50	29.80	11.00
220.01-240.00	22.00	20.00	32.40	12.00
240.01-260.00	24.00	22.00	35.20	13.00
260.01-280.00	26.00	24.00	38.20	14.50
280.01-300.00	30.00	24.50	41.20	15.50
300.01-320.00	32.00	25.50	44.20	17.00
320.01-340.00	35.00	27.00	47.80	18.00
340.01-370.00	38.00	28.00	52.40	18.50
370.01-400.00	42.00	29.50	57.20	20.00
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PRINT FULL NAME ..... Age .....

HOME ADDRESS ..... CITY ..... STATE ..... ZIP CODE .....

HOME PHONE ..... HOW LONG AT THIS ADDRESS .....

( ) OWN HOME ( ) RENT RENT OR MORTGAGE PAYMENTS $ ..... PER. MO.

WIFE'S NAME ..... MARITAL STATUS-( ) MARRIED ( ) SINGLE

NUMBER OF DEPENDENT CHILDREN .....

PREVIOUS ADDRESS ..... HOW LONG? .....

B ➤ WHERE DO YOU WORK?

YOUR EMPLOYER ..... POSITION ..... MONTHLY INCOME $ .....

EMPLOYER'S ADDRESS ..... HOW MANY YEARS ON PRESENT JOB? .....

Street ..... City ..... State .....

PREVIOUS EMPLOYER ..... HOW LONG? .....

Name ..... Address .....

WIFE'S EMPLOYER ..... MONTHLY INCOME $ .....

Name ..... Address .....

C ➤ WHERE DO YOU TRADE?

BANK ACCOUNT WITH ..... ( ) CHECKING

Street ..... City ..... State ..... ( ) SAVINGS

CREDIT ACCOUNT WITH ..... ( ) LOAN

Street ..... City ..... State .....

CREDIT ACCOUNT WITH ..... TOTAL OF ALL MONTHLY PAYMENTS INCLUDING CAR $ .....

Street ..... City ..... State .....

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