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John Babcock of Minneapolis is NRIAA President for 1959

(Details and other election results—page 14)

John Babcock

Radio, TV, and . . . APPLIANCES? Why not?

Radio-TV servicemen are frequently called upon to service all types of small appliances—fans, toasters, irons, frypans, etc. Some technicians would rather specialize in Radio-TV and "steer clear" of any other repair jobs. But others look upon Appliance work as a chance to build up their prestige, customer good-will, and earn some extra cash.

This is one of the primary reasons why the NRI course in Servicing Electrical Appliances is extremely popular among our Graduates. Anyone who has the knowledge, tools, and facilities to repair Radio & TV receivers should have no trouble tackling Appliance sales and service—an ideal supplement for even greater income opportunities. Students and Graduates alike will find the article—"Practical Experience in Appliance Servicing" on page 9 timely and worthwhile reading.

CHRISTMAS SUGGESTIONS
See Page 16

Peace on Earth - - Good Will Toward Men

Nations all over the world have their holidays, carnivals, festivals, and religious rites. Popular statesmen, war heroes and other notables are acclaimed when they are raised to leadership, or a mournful dirge is tolled when they pass away. But once every year, the entire Christian world stands still to celebrate the birth of our Savior—to join in the spirit of Christmas.

While we are enjoying the double pleasure of giving and receiving gifts—the cheery family reunions in the warmth and comfort of our homes—let us stop a moment and pray that with the help of God, and mutual understanding and cooperation among all nations, we will make rapid strides toward true Peace on Earth; Good Will Toward Men.

May the spirit of Christmas abide and be with you and your families. And may the New Year bring you good health and genuine happiness. Much has been written but no words can better convey our wishes to you at this season than the simple expression, with all sincerity—Merry Christmas and a Happy New Year.

J. E. Smith
Founder

Amplifier Square-Wave Testing

by John G. Dodgson
NRI Consultant

The ideal square wave consists of a fundamental sine wave and all its odd harmonics in a definite phase and amplitude relationship to each other.

By applying such a waveform to an electrical circuit an examination of the output waveform of the circuit will show how the circuit affected the amplitude of the harmonics, as well as their phase relation. Since the fundamental and the harmonics are applied simultaneously, a rapid check can be made of a very wide range of frequencies. Oddly enough square-wave testing is rapid and simple because the square wave itself is so complex!

Necessary Equipment

Obviously it is necessary to have a square-wave generator to produce the square waves and an oscilloscope to examine them.

John G. Dodgson

The square-wave generator should deliver square waves at frequencies from the lowest frequency response of the system to be studied to a frequency one tenth the highest frequency response of the system.

Thus for checking P.A. amplifiers frequencies from 100 cps to 1 kc would be satisfactory, while the newer high-fidelity amplifiers would require frequencies from 50 cps to at least 10 kc. Video amplifiers require even a wider range—from 50 cps to 500 kc. Of course, it isn't practical to have three or even two different generators for different types of work. The type generator obtained should be capable of producing all of the frequencies necessary for the type of work encountered. The radio-TV serviceman will require square waves from 50 cps to 500 kc while the serviceman specializing in audio work will require square waves from 50 cps to only 10 kc. The output of the generator should be continuously adjustable from 0 to at least 5 volts, and the output impedance should be 600 ohms or less.

The oscilloscope used for square-wave testing must have characteristics superior to the circuit under test. For example, for video testing the scope's vertical amplifiers must be within ±3db from 50 cps to 2 or 3 mc. It is particularly important that the square-wave response of the scope be "clean" and free from transients. Such transients as in Fig. 2A are often a result of peaking networks designed into the scope to extend the high frequency sine-wave response for advertising purposes. It is far better to have a poorer response at the high end to eliminate the transients, even though the square waves would tend to be rounded as in Fig. 2B. The vertical sensitivity of the scope should be at least 1 volt peak-to-peak.

Since it is desirable to examine a minimum of two cycles of each waveform, the horizontal sweep range of the scope should

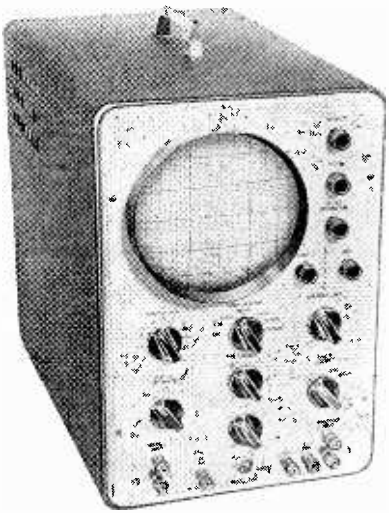

Fig. 1. The NRI Model 250 Five-Inch Oscilloscope (kit) with its clean, wide, vertical response, high gain, and extended horizontal sweep range is an ideal instrument for square-wave testing.

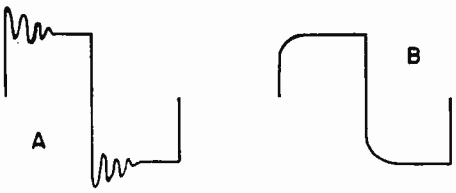

Fig. 2

A. High frequency square-wave showing transients.
B. Loss of high frequencies and lack of transients.

extend from 25 cps to 250 kc. In addition the sweep should be linear.

Square-Wave Testing Limitations

Probably the most obvious limitation of square-wave testing is that it does not show amplifier overloading. In fact, overloading simply results in making the square wave more "square." A sine wave must be used to indicate the point of overloading.

Since a square wave contains the fundamental and odd harmonics only, any sharp dip or peak in a circuit response that falls between the odd harmonics will not be shown. However, this is not usually serious since most circuits' response varies smoothly. Furthermore, additional square-wave testing at different frequencies could show any such dips or peaks. For example, if an amplifier has a sharp peak at 1500 cps a square-wave test at 1000 cps would not show the peak, since the first odd harmonic occurs at 3000 cps. However, another check at 500 cps would clearly show the peak, since the first odd harmonic would be exactly 1500 cps.

By means of Fourier analysis it is possible to show that an ideal square wave consists of a fundamental frequency and an infinite number of odd harmonics. Unfortunately it is almost physically impossible to obtain an ideal square wave. Even if an ideal wave was obtainable, it is extremely difficult to detect any changes in the waveship due to deterioration of signals higher than the tenth harmonic. Because of this it is necessary to use square waves at approximate decade values (100, 1kc, 10kc, etc.) for testing. From a practical viewpoint, some in-between values are also necessary.

Testing

For over-all testing of an amplifier the square-wave generator should be connected with as short leads as possible to the Tuner, Crystal, or Auxiliary input jack of the amplifier, and the amplifier input selector switch (if any) should be set according to the generator connection point. The output of the amplifier must be properly loaded by a resistor of the same value as the output impedance. Most amplifiers have a choice of impedances, normally 4, 8 and 16, and experience shows it is best to use the highest impedance.

The resistor load should theoretically be non-inductive, but in practice this is rarely necessary — an ordinary wire-wound resistor can be used. The resonant point of these resistors usually falls above one megacycle, well above audio frequencies. Since 4, 8 and 16 are not standard RETMA values, the next closest values are satisfactory. It is usually best to parallel a few resistors to more closely watch the impedances, and this is also an easy way to get the necessary power rating. For example, for a 16-ohm load I use four 25-watt, 72-ohm resistors in parallel. This computed load of 18 ohms would have been perfectly okay, but due to tolerances the actual resistance is 16.5 ohms, and the 100-watt power rating is more than sufficient. It is a good idea though to use a power rating twice that of the amplifier under test.

For over-all testing, the oscilloscope is normally connected across the load resistor. If standard test leads are used, keep them short. A shielded cable, of course, could be up to 3 feet long. Since neither the square-wave generator nor the scope used for testing will be "perfect" instruments, it is desirable to periodically directly check the output of the generator with the scope, particularly when poor waveforms are encountered. This should be kept in mind when the units are interconnected so that the leads can be ar-

(*Continued on page* 21)

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A Look At the New Auto Sets

by Joseph Schek
NRI Consultant

J. Schek

When auto manufacturers switched to 12-volt ignition systems, principally to obtain better ignition operation, but also to save some copper, little did they realize the impact that this would have on car-radio design. Soon after this change to 12-volt electrical systems, a practical way was found to produce tubes that operate satisfactorily with 12 volts from the car battery applied directly to their plates and screens as well as to their filaments. These new tube types are used principally in the rf, i-f, and af driver stages. Transistors are usually used in the output stages.

As you can see, this startling change in tube design makes possible a car radio that can operate without any power supply other than the car battery. An auto set that includes both transistors and tubes is termed a "Hybrid" receiver.

Analysis of a Typical Hybrid Receiver

One such arrangement is used in Motorola receivers. A look at the typical hybrid schematic diagram in Fig. 1 shows there is no vibrator, no power transformer and no power rectifier in this set.

The antenna input circuit of this set is standard except for the antenna coupling system consisting of C_1 and R_1. Both low-frequency ignition and radio signals produce a voltage drop across C_1. Practically none of the low-frequency signals across C_1 reach the control grid of the rf amplifier because of the low coupling capacity of C_3. Those that do get through are shorted to ground through the resonant circuit in the plate of the 12AC6 and the output filter capacitor. RF signals which produce a signal across C_1 are stepped up when L_1-C_2 are tuned to resonance, and the resulting large resonant step-up voltage is applied to the rf tube for amplification. The tuned plate load of the rf amplifier is at the same frequency as the resonant input circuit. Therefore the rf stage selects and amplifies desired signals while rejecting all others.

The rf amplifier stage uses a 12AC6 tube, and is fairly conventional except for the avc arrangement. With only 12 volts applied to the plate, current is cut off when the avc voltage reaches approximately —6 volts. To insure that the rf amplifier tube will cut off at —6 volts, the avc voltage is applied to the suppressor grid as well as the control grid. When the rf amplifier stage is cut off, the signal reaching the grid of the converter tube does so only through the interelectrode capacities of the rf tube. This greatly reduces the amplitude of the signal applied to the converter, and prevents overloading from strong local signals.

The converter stage uses a 12AD6 tube. In this stage, the primary winding of the oscillator coil is connected so that the screen current passes through it. In this way the screen serves as the oscillator anode. At the i-f value, the primary reactance is quite low, and at this frequency the screen shields the plate from the control grid.

The i-f amplifier is a 12AC5 tube. In this stage the suppressor grid is brought to ground through a 560-ohm resistor to provide a way of introducing enough regeneration to increase the gain of the stage. The voltage divider (R7-R8) in the avc line prevents full avc voltage from reaching the grid so that the i-f amplifier will work at its highest possible gain to compensate for low-voltage plate operation. A high-gain pentode tube, type 12F8 is used as a combination avc, second-detector, audio amplifier. Note that pin 1 is the avc diode plate, and pin 6 is the second detector diode. Between the 12F8 and the output transistor stage, a driver stage is added to supply sufficient power to the transistor input. The driver stage uses the recently developed 12K5 tube, which produces as much as 50 milliwatts output.

A cross-sectional diagram of the 12K5 is shown in Fig. 2. This tube uses the space-charge principle of operation. A No. 1, or

space-charge grid is placed between the cathode and the No. 2, or control, grid, and has a high positive accelerating voltage applied to it. This gives the tube high transconductance.

The power amplifier stage uses a type 2N176 junction transistor wired in a grounded-collector circuit. Since this is a PNP transistor and the collector supply voltages must be negative, the collector is grounded.

Forward bias for the emitter-base junction is produced by applying B+ through the auxiliary winding of T4, and the pricurrent flows from ground through R23, the auxiliary wining of T4, and the primary of T3 to the base. Superimposed on this bias current is the output signal of T3 which is applied directly to the base, and through the large 200-mfd capacitor, C15 to the emitter. The auxiliary winding of T4 acts as a high impedance to prevent the signal from being shunted by the operating bias circuit. R23 is used to com-

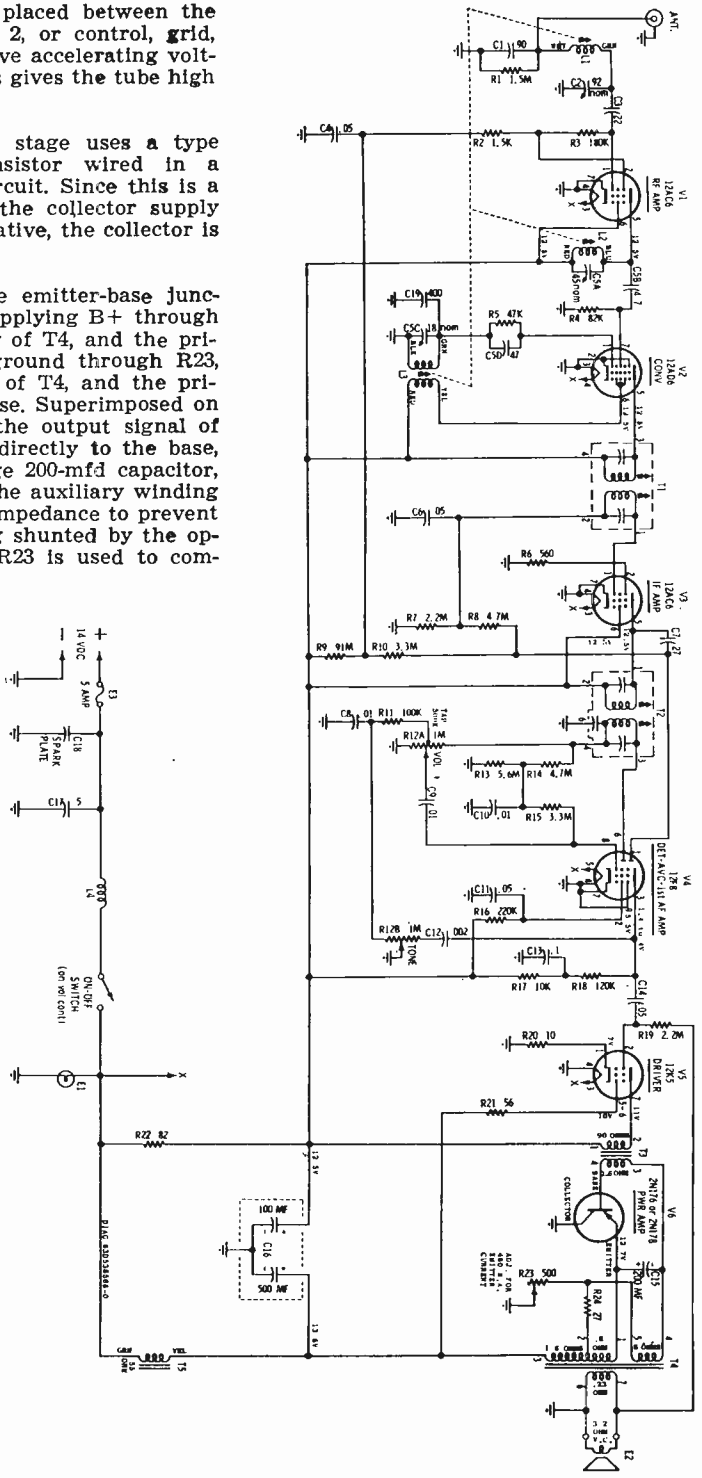

Fig. 1
Typical
hybrid
auto set.

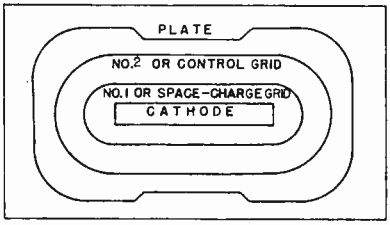

Fig. 2. Location of special space-charge or accelerating grid in 12K5 tetrode.

pensate for varying transistor characteristics when the output transistor is replaced.

The gain of this stage is such that a 1-ma change in base current causes a change of almost 40-ma in the output current.

Since power transistors consume far more current than power vacuum tubes, there must be provisions for effectively and efficiently dissipating the heat produced. One means of doing so is to place heavy aluminum fins on either side of the transistor. Another method is to use the chassis as a heat sink. The metal housing of the transistor is tightly fastened to the chassis, which provides a large radiating surface. Inside the housing, the collector is attached to the housing, because most of the heat is developed at the collector. When the collector is not connected directly to ground, the transistor case is electrically insulated from the chassis by mica spacers through which the heat transfer can still take place.

Servicing the Hybrid Set. When measuring voltages in the transistor stage, care should be taken so as not to short the base electrode to ground. Doing so will cause the transistor to draw so much current, that it will be permanently damaged.

When a transistor has to be replaced, it

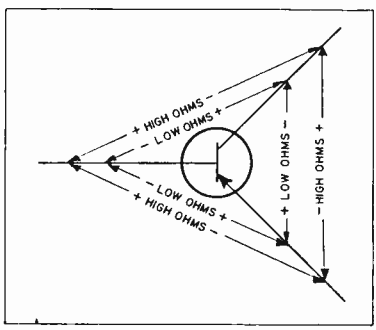

Fig. 3. Ohmmeter connections for checking the power transistor.

is nearly always because of shorts or opens. Checking it with an ohmmeter will generally disclose these faults. The resistance check is similar to that given to a germanium diode. Fig. 3 shows the relative resistances across the transistor electrodes with the ohmmeter leads connected first for conduction (inside marks), and then for non-conduction (outside marks). Do not use an ohmmeter scale on which the internal battery voltage is more than 18 volts. Although a resistance check is sufficient to detect most defective transistors, a more positive check is to substitute a good transistor for the suspected one.

Some receivers have a bias control to adjust the operating point of a transistor

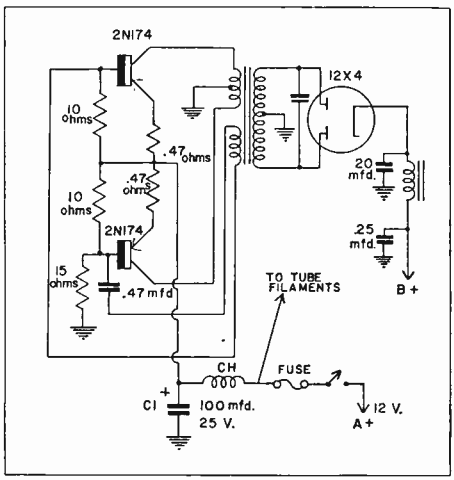

Fig. 4. Transistorized power supply requires no vibrator.

when a new one is installed. This should be done according to the manufacturer's recommendations. In this Motorola model, it is done as follows:

1. Connect a 0-1 or 0-2 ammeter having a low internal resistance of 0.1-ohm, maximum in series with the emitter.

2. With no signal applied, adjust the variable bias resistor (R23) until the current reading is 480 milliamperes (about one-half ampere).

This adjustment is necessary so that the new transistor will operate at approximately the same level as the original one. The bias current that flows through the emitter circuit may vary from transistor to transistor. Therefore, it is important for the emitter current to be reset whenever the transistor is replaced, Also make sure

that the new transistor is securely mounted to insure proper heat dissipation.

Transistors Used in the Power Supply

Some hybrid receivers use conventional tubes requiring about 200 volts in their plate circuits in the rf stages, but use transistors in the power supply to replace the conventional vibrator.

Fig. 4 shows two 2N174 power transistors wired to form an oscillator circuit. This is a blocking oscillator that operates at about 20,000 cycles. At this ultra-sonic frequency, buzz, hum, and filtering problems are greatly simplified. The operating frequency is set mainly by the characteristics of the primary windings of the power transformer. As you can see, there are two primary windings, a center-tapped winding and an auxiliary winding.

While the first transistor is conducting through the center-tapped primary, the second transistor is cut off. When the first transistor reaches saturation, the magnetic field in the center-tapped primary collapses, inducing a voltage that is of opposite polarity in the auxiliary winding. This voltage then drives the second transistor into conduction and cuts off the first transistor. Since current from the second transistor flows in the opposite direction in the transformer, an ac signal is produced.

Through the step-up action of the secondary winding, the primary voltage is increased to 200-250 volts ac. This is rectified by the 12X4 tube, then filtered and applied to the plate and screen circuits of the rf, converter, i-f, and audio driver stages. C_1 and choke CH prevent the power supply oscillator signals from feeding back into the receiver through the filaments of the tubes.

Servicing Procedure. To check the operation of this power supply, measure the voltage across the secondary of the transformer. If there is no voltage, check first to see that the battery voltage is applied to the transistors, and make sure the collector shields have not been shorted to ground. Then check with a scope to see that the oscillator is working at the correct frequency.

Faulty operation can be caused by a bad transistor, a defective power transformer, or by excessive loading of the B+ line to the set. To open the load circuit of the secondary, simply remove the 12X4 rectifier tube from its scoket.

With any transistorized equipment the supply voltage must have the right polarity. If the wrong polarity is used the transistors will be ruined.

Search-Tuning Systems

For convenience and safety in tuning an auto set while driving, automatic search-tuning mechanisms are becoming more popular.

A search-tuning mechanism provides a means of tuning in a desired station by simply depressing a bar or pushing a button. To adjust the over-all set sensitivity, the receiver will have a "Town" and "Country" two-position panel switch for search-tuning either strong signal areas or the weaker signals in rural areas.

Search-tuning (or signal-seeking) radios operate with a reversible motor, which, when energized, actuates tuning coil cores to cover the entire broadcast band. The motor is automatically cut off when a signal of sufficient strength triggers the control circuit.

The schematic of a typical search tuner is shown in Fig. 5. When the search selector switch is actuated, it momentarily closes E7 or E8. Closing either switch will ground the plate side of relay E5, completing the relay circuit and energizing the relay winding. This pulls the relay contacts, A, B, C, D, and E, down, completing their circuit to B— or ground. Closing contact A grounds the hot side of the speaker voice coil, thus muting the speaker during the time the tuner is searching for a station. Closing contact B completes the sensitivity-switch circuit, which increases the sensitivity of the set during the search cycle. Closing contact C shorts out the bias resistor for the relay section of the 12AL8 trigger-relay tube, allowing the tube to conduct sufficiently to hold relay E5 in an energized position, even though E7 or E8 is now open. Closing contact D completes the circuit for the search-mechanism motor E3. Closing contact E completes the circuit of the solenoid E2, engaging the drive wheel.

With the carrier gear engaged, motor E3 is coupled to the manual tuning shaft of the set through a gear system. This allows the tuner to go through the broadcast band, first in one direction, and then in the other, the direction being reversed

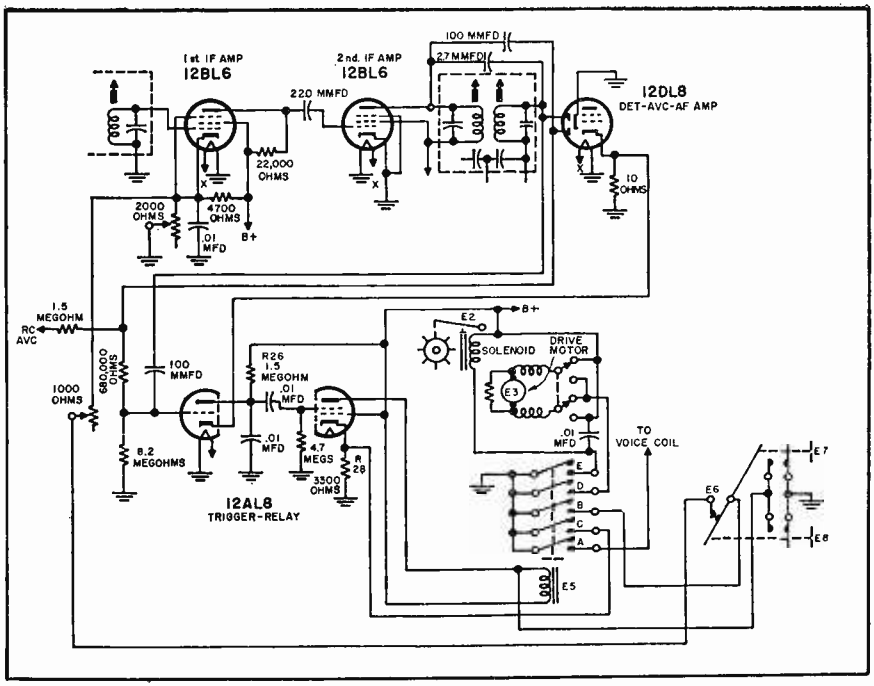

Fig. 5. Circuit diagram of search tuner mechanism of Motorola ST-228.

by switching the drive motor. This is done automatically by the reversing switch mounted on the tuning mechanism.

As the tuner approaches a station, a signal is developed at the grid of the trigger section of the 12AL8 tube by the combined AVC and i-f voltages. The cut-off of the relay control section is started approximately 2.5 kc away from the on-station target. As the drive to the trigger section increases, the current through R26 reduces the plate voltage, producing a negative pulse at the control grid of the relay section of the tube, cutting it off.

When the relay control section is cut off, relay E5 is de-energized, the carrier gear is disengaged, and the motor coasts to a stop. The coasting distance of the tuner is approximately 2.5 kc. This corresponds to the interval between the start of the trigger action and the on-station point, so the dial pointer and the tuner come to rest at the proper places. **Servicing the Search Tuner.** When the search tuner fails to operate properly, this preliminary trouble-shooting procedure may be used to isolate the cause:

The receiver should be connected to the power source, with the lead to the positive side, and the radio case to the negative side. Then the set should be allowed to warm up, and the input voltage, if an A eliminator is used at the bench, adjusted to 13.2 volts. If the tuner sweeps as soon as the power is turned on before the search button is pushed in, or the tubes have had time to warm up, you should check for a defective search switch (E7 or E8), defective switch contacts, or internal shorts in the 12AL8 tube. If the tuner starts to sweep after the set warms up, the 12AL8 should be checked by substitution.

With the information given here, you are ready to start servicing the new auto radio sets.

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IT HAS BEEN SAID .....

"Thank God every morning when you get up that you have something to do that day which must be done, whether you like it or not. Being forced to work and forced to do your best, will breed in you temperance and self-control, diligence and strength of will, cheerfulness, and contentment, and a hundred virtues which the idle never know."

Dale Stafford

Obtaining Practical Experience in Appliance Servicing

by Dale Stafford
NRI Consultant

One of the problems facing the beginner in any trade or profession is that of obtaining practical experience. He can learn the theory from books but the practical experience which enables him to proceed easily, confidently and profitably must be gotten by actually doing the work.

No one supposes that a surgeon performs his first major operation with the ease and confidence he will display one thousand operations later. Neither will the appliance serviceman complete his first service job with the skill and speed he will acquire with experience.

Perhaps the comparison between a surgeon and a technician seems rather farfetched. However, they have one very important thing in common. Both need experience to develop the ease, speed, and confidence necessary for success.

Appliance Servicing vs. Radio-TV Servicing

Obtaining practical experience in appliance servicing cannot be carried out in the same way as in radio or TV servicing. A radio, even the simplest AC-DC set, is a rather complicated piece of electronic equipment. As such, it is subject to the possibility that one or more of an infinite variety of defects may occur, causing complete failure of the receiver or impairing its performance.

Fortunately, many of these defects can be easily duplicated in a practice receiver. That is, the novice technician can use a receiver that is in operating condition and introduce defects into it by disconnecting wires, replacing parts with defective or wrong value components, etc. The symptoms can then be observed and a standard trouble-shooting technique used to locate the defect.

By using care and judgment in introducing these defects, it is unlikely that any serious damage to the receiver will result. Should an accident occur, the damage will probably be limited to a burned-out resistor or burned-out tube.

This procedure is not applicable to appliance servicing for several reasons. First, the electrical systems in appliances do not lend themselves readily to the introduction of defects.

The purpose of the electrical system is to create heat, to create motion, or both. The design is fairly simple and straight-forward and the number of defects that can be safely introduced is necessarily limited.

Also, most of the components that are likely to cause trouble cannot be profitably repaired in the shop. For example, it is seldom practical for the serviceman to attempt to repair a defective timer, clock or thermostat and the usual procedure is to replace the defective unit. A defective motor can usually be traded in on a new one more economically than it can be repaired. These parts are made so that it is difficult to introduce any defects without damaging the unit and making replacement necessary.

Still another difficulty in applying radio troubleshooting practice methods to appliance servicing is the fact that most of the work in appliance servicing is purely mechanical. Much of the trouble is due to worn-out parts. These defects cannot be readily duplicated in another appliance. For example, should the technician wish to

Listen Americans!

by

Dr. George S. Benson

Director—National Education Program
Searcy, Arkansas

Inflation can be more damaging and destructive to a nation's people than war—even H-bomb war. This is a fact difficult for people to accept, and that makes inflation all the more dangerous; for unless people are frightened of the consequences of inflation they will take no effective action to halt it. Today in the United States, continuing "modest" inflation and the threat of wild, runaway inflation constitute one of the major dangers to our prosperity, our freedom and even to our survival.

There are many grim lessons in history on the destructive power of inflation. Despots have deliberately debauched the currency to gain dictatorial control over a nation's people; bloody revolutions have been brought on by conditions of wild inflation; and in nation after nation the value of momentary wealth has been wiped out by inflation, leaving a whole population prostrate. No condition could be of greater value to the Communist leaders plotting to conquer the world than run-away inflation in the United States.

The fact that since 1939 inflation has gradually eaten away 52% of the dollar's purchasing power should alarm and alert every American citizen; but unfortunately it hasn't.

It is vitally necessary for the people of America to understand inflation, its principal causes and some of the more dramatic examples of its effects. It is vitally necessary for them to act intelligently to cope with this expanding danger. Inflation is caused by the existence of more money in the market place than there are goods to satisfy the demands. The over-abundance of dollars in ratio to goods cheapens the dollars; each dollar's purchasing power is reduced. Government spending, higher wages without bigger man-hour production, expanding public or private debt, and other related factors bring about the cheapening of money which is called inflation.

Your individual stake in continuing inflation can perhaps best be understood by recalling what happened in Germany in the 1920's. At the advent of the Socialist controlled government in 1919, four and one-fifth German marks were equivalent in purchasing power to one dollar in American money. German inflation gathered momentum through 1919 and 1920, and began to run wild in 1922-23.

By July of 1923, 160,000 marks were required to equal a dollar's purchasing power.

By October, 1923, it required 242,000 marks to make a dollar.

By November 20, 1923, the mark was valued at 4,200,000,000,000 to the dollar. A newspaper in Berlin sold for 200 billion marks per copy. There was an actual case of a young German being left an inheritance of 650,000 marks in 1920 (worth $65,000 at that time) with the provision that he would receive it at age 21. He became 21 in mid-1923. With his entire inheritance he was then able to buy only one skimpy meal.

———*n r i*———

Practical Experience in Appliance Servicing

(*from page* 9)

install a defective part in a fan to observe the effect and work out a trouble-shooting technique, it is unlikely that he would have such a worn-out part to install. It is also unlikely that he would be able to simulate the fault in any other way without taking a chance of damaging the fan.

Usually, the effect is so obvious that it is easy to locate the damaged part when the appliance is disassembled sufficiently to expose the defect. Sometimes taking an appliance apart and putting it back together again can be a real problem. In many cases, far more time and effort is spent on this phase of the job than on the actual repair.

There is a similarity among all applicances of a particular type (fans, irons, etc.) on the market and the problem of dismantling and servicing them is approached in the same general way. However, the equipment manufactured by different companies (or even by the same company in different years) may differ so much that no standard procedure can be devised.

The competition in this field is active and intense. Each manufacturer is constantly striving to make his product more appealing to the consumer and maintains a large staff for this purpose. The latest model of any particular appliance may differ considerably from the previous model. The

change may require a modification of the method of dismantling the appliance and may even require a special tool.

For this reason, it is extremely difficult to outline any definite step-by-step instructions for handling a specific repair job which will be applicable to more than one make and model of a particular appliance.

However, the technician will find that the job is not so difficult if he asks himself "What is this appliance supposed to do and how is it supposed to do it?"

Basically, all makes and models of a particular appliance are the same, even though the outward appearance of those made by two different manufacturers may differ. The purpose of the appliance and the manner of accomplishing it is the same. A fan moves air with a set of blades turned by a motor. An iron generates heat by passing an electric current through a heating element. The fan may have a speed control, reversing switch, or an oscillating mechanism to swing the fan through an arc so that the air is distributed over a wide area. The iron may have a thermostat to control the heat, a control to set the thermostat for different fabrics, a steam chamber or even a mechanism to spray the clothes.

The NRI course in Appliance Servicing is designed to give the serviceman the working knowledge he needs to understand what an appliance is supposed to do, how it is supposed to accomplish its purpose, and the probable reasons for any failure in its operation.

No attempt has been made to write a service manual for each individual appliance on the market. This would not only be impratical because of the bulk and expense of such an undertaking but it would be an unnecessary duplication of the service information available from the manufacturer.

Instead, the basic electrical and mechanical operation of each appliance is thoroughly explained. Electrical and mechanical control devices are analyzed, their effect on the operation is explained, and the methods of connecting these devices into the basic circuits are given. Basic procedures for dismantling and reassembling appliances and instructions for locating and repairing defects are thoroughly covered. When it is felt that such information would be helpful, step-by-step instructions for correcting a specific fault in a particular appliance is given.

Ways to Gain Practical Experience

There are many opportunities for obtaining practical experience. For example, suppose you are operating a repair shop and a customer brings in a piece of equipment with an obvious fault, such as a broken line cord. After replacing the cord, you can do one of two things. You can set the appliance away on a shelf until the customer calls for it or you can try to learn something from it. A careful study of the appliance may be worth far more than the fee for replacing the broken cord.

Look the appliance over. Try to visualize every defect which could possibly occur and decide how you would go about repairing each defect. Observe what parts must be removed for each repair. If they can be removed easily and you feel sure you can replace them correctly, remove the parts and examine them. Do not remove any parts which you are not sure you can replace but in any case do not let an appliance get out of your shop without learning as much as possible about it.

If your wife, sister, or girl friend has an iron, a toaster, or a mixer, try to persuade her to let you take it apart and put it back together again. She may not like the idea at first. This is a situation which must be handled with just the proper shade of diplomacy. Don't become impatient if the "little woman" needs a bit of convincing. This is practical experience of the most valuable sort. Diplomacy is something you are going to need when Joe Blank's toaster burns the toast just after you repaired it (you thought). And don't think that can't happen to you. Believe me, it can and will. If you can obtain the manufacturer's service data, use it as a guide. If not, disassemble the appliance very carefully, noting how it comes apart so you can put it back together. Make notes or drawings, if necessary. In any case, make sure you can reassemble the parts.

When dismantling any equipment, be careful not to break or bend any of the parts. Some appliances contain small parts easily damaged by rough handling as I learned the first time I took an electric razor apart. A moment's carelessness cost me $4.00, a

4 in 5 Now Have TV

A census survey recently completed by the Department of Commerce revealed that 83% of all households now have TV receivers as compared with 12% in April, 1950. In addition to the continued spread of TV to more homes, there is also a proportionate number who have more than one set. About 7% now have two or more receivers.

month's delay in completing the repair, and considerable strain on my New Year's resolution not to use that kind of language.

Many of your neighbors probably have one or more appliances that need repairing. Often a fan or toaster or some other appliance stops working and the owner just doesn't bother to take it to a shop. Instead, it is set on a shelf or up in the attic and forgotten.

Here is a golden opportunity to gain practical experience and pick up a few welcome dollars while doing so. If the owner doesn't wish to have the appliance repaired, he can often be persuaded to part with it for a small sum. He may be glad to give it to you to get it out of the way.

Often these appliances can be repaired at a very small cost and resold for a tidy profit. There will be cases, of course, when you will find it impossible to resell the appliance for a price high enough to cover the price of the necessary repairs. With reasonable care, these cases should be infrequent and should be more than counterbalanced by the profit you make on other transactions.

In any case, the experience gained from making the repairs should be worth the small investment. Also, the appliance will be yours to tear down and study before you resell it. Since you naturally feel more at ease practicing on your own equipment rather than on that of a customer, you will probably learn much more.

A beginner usually feels some misgivings about removing any parts unnecessarily when working on a customer's appliance. He is afraid of damaging one of the parts or that he won't be able to get everything back together again. This causes him to pass up many opportunities to learn. If the equipment belongs to him, he can practice as much as he likes. If he makes a mistake, it may cost a dollar or two but it won't cost him any customers.

The appliance you find in your neighbor's attic will probably be a year or more old and may not look like the latest model of the same appliance displayed in the store windows downtown. Therefore, this method of gaining experience cannot be recommended as a way of keeping up with the latest developments. However, the new appliance is probably the old model with one or two added refinements and basically there is little difference in the two.

There is one fact that a technician, beginner or old-timer, should always remember. The chief requirement for learning is an inquiring, analytical mind. The man wo learns is the one who isn't satisfied to know that a certain thing happens, but wants to know "how" it happens and "why" it happens. If every task is approached with that attitude, there are few jobs so simple that one cannot learn something from them.

———*n r i*———

Jet Fighter Pilots at Sioux City Air Base, Iowa, Briefed Over Closed-Circuit Television

Jet pilots of the Air Defense Command's 53rd Fighter Group at Sioux City Air Base, Iowa, are briefed over closed-circuit television system that links the alert hangar with the weather station two miles away. The Sioux City closed-circuit system is the second installed for the Air Defense Command by RCA. The initial system is in operation at the ADC's Duluth, Minnesota, base.

An ADC spokesman said the Sioux City installation, like its counterpart at Duluth, provides pilots with faster and more complete weather information by means of the closed-circuit TV hookup, the weather officer can carry out his briefing sessions without leaving the base weather station, while briefing requests made over the audio circuit of the TV system can be filled immediately.

The system involves a master control console at the weather station and eight monitors, linked by more than two miles of cable.

———*n r i*———

Mild Approach

Grandpa's purchase of a Missouri mule for his farm was a sad deal. Unable to make the critter gee or haw or whoa or anything, he hired a professional mule trainer. The first thing the trainer did was to whack the mule over the head with a two-by-four plank. The mule didn't budge. The trainer whacked him again. "Hey," protested Grandpa, "are you aimin' to kill off my mule?" "Guess you don't know nothin' about trainin' mules," the trainer said. "First off, you gotta get their attention."

Sigma Delta Chi Newsletter

Hi-Fi Corner

By JOHN G. DODGSON
NRI Consultant

Speaker Re-coning: While investigating a new speaker treating product—Flexicone, I had an opportunity to visit the local manufacturer who is also in the re-coning business. I found it very interesting and informative to watch the actual re-coning process.

When a speaker arrives for re-coning, it is first tagged with pertinent data such as name and date. Then the cone, voice-coil and spider are removed and the frame is cleaned of left-over glue, etc. Next the voice coil gap is carefully cleaned by compressed air and then by hand with the aid of special tools. If this doesn't remove metal particles, which are attracted by the magnet, the speaker frame is inserted in a special de-gaussing machine which "kills" the magnet. The particles can then be removed and the magnet re-magnetized by the same machine.

After preparing the speaker, the actual re-coning is begun by fitting the voice coil in the exact center of the gap with the help of special hand-made circular shims. Whenever possible exact replace-parts are used. After fitting the voice coil the spider is glued in place on the frame. Then cement is placed on the top edge of the voice-coil form to attach the form, spider, and cone together. The cone is then carefully placed in position and the outer cone rim is cemented to the speaker frame. Next, the cardboard outer rim or gasket is cemented in place and the speaker is placed cone down to prevent the cement on the voice-coil form edge from running down into the gap. The circular shim is left in place until the cement sets. The final step is to remove the shim and carefully check out the speaker.

The fitting of the parts together must be done quickly and accurately to prevent the cement from drying before the job is completed. This is particularly complicated by the fact that tolerances of .005 to .006 inches must be met in the voice-coil gap. Probably the most difficult part of the job is using the correct amount of cement on the coil form edge. If too much cement is applied it will run down into the voice-coil gap while if too little is used the coil form, spider, and cone will not be firmly attached and will rattle or come apart. Although regular speaker cement can be used, a special non-shrinking compound is used at Howard that was developed by the owner, Vince Howard.

One interesting feature of a re-coned speaker is that it is actually put together better than it was when it originally left the factory! This is due to the fact that in its initial factory assembly the voice-coil, spider and cone are assembled in one piece and tolerances are necessarily higher. Due to the complication of re-coning a speaker and the fact that it must be done by hand, it is not an inexpensive process. If the speaker size is under 8 inches it is often more economical to purchase a new replacement speaker than to have the old one re-coned. For example, the present price on re-coning a 5 inch speaker is $1.85 while a new one can be purchased for about $1.50. Surprisingly, though, Howard does re-cone quite a few small speakers because of odd mounting brackets or mounted transformers that would require replacement with special higher-cost units.

Since the price of new 8 inch speakers averages about $4 while the re-coning cost is only $2.85, it is well worthwhile to have these larger speakers re-coned. Perhaps the greatest value is in the re-coning of high fidelity speakers since the replacement cost can be quite high. I had a particularly fine 8 inch high fidelity speaker, a Stromberg-Carlson RF460, purchased about six years ago. Although the basket and magnet were in good shape, the cone had warped and periodic overloads had damaged the voice-coil. Since the speaker cost $20 it was well worth $7.50 to have it re-coned. The re-coning charge on high-fidelity speakers varies with the units since exact replacement parts are always used. It is interesting to note that the resonance after re-coning was 79 CPS which is exactly the same as the original resonance of the speaker when it was new. Incidentally this same speaker was later treated with Howard's Flexicone product which reduced the cone resonance to 45 CPS improving it considerably.

Although most of Howard's business is local, he does some out of town business. He cautions that speakers should be carefully packed and sent by Prepaid Express. The address is : Howard Re-Cone Service, 824 Kennedy Street, N.W., Washington 11, D. C.

NRI ALUMNI NEWS

Howard Smith .....President
F. Earl Oliver .....Vice President
Jules Cohen .....Vice President
William Fox .....Vice President
Joseph Stocker .....Vice President
Theodore E. Rose .....Executive Sect.

John Babcock Wins Presidency of NRIAA for 1959

William Fox of New York, F. Earl Oliver of Detroit, and Jules Cohen of Philadelphia returned to office as Vice Presidents. Howard Smith of Springfield, Mass., elected to Vice Presidency.

John Babcock of Minneapolis has won the race for the Presidency of the NRI Alumni Association for 1959.

It was not by any means an easy victory. Tom Hull, who held the office in 1955 and is an industrious and able leader of the New York City Chapter, gave Babcock quite a race. It is all the more to John Babcock's credit that he won out over such a strong contender.

As is usually true, the votes for the Vice Presidents were more evenly divided except in the case of Earl Oliver of Detroit. Oliver seems unbeatable, having again received the largest number of votes for a Vice-Presidency. William Fox of New York City and Jules Cohen of Philadelphia managed to win again, too, but with a smaller margin of votes than Oliver. Our President for 1958, Howard Smith of Springfield, Mass., was again honored by being elected a Vice President, an office he held once before, in 1956.

John Babcock, who will take office as President on January 1, was born in Brainerd, Minn., on September 28, 1919; attended school in Northern Minnesota and completed high school in Preston, Iowa. He joined the U. S. Army 3rd Infantry at Fort Snelling, Minnesota, on December 7, 1937, was honorably discharged with the rank of Sergeant in December, 1940. In the same month he was married to his charming and vivacious wife and they now have two lovely daughters, Karen, aged 16, and Barbara, 7.

Recalled to service in the Army in July, 1943, he served as Drill Instructor until honorably discharged in February, 1946, and in the following month was employed by the Ford Motor Company in the Production Control Department. He enrolled for NRI training in March, 1951, was graduated in June, 1952. Since 1951 he has operated his own part-time Radio-TV Service business from his home.

Mr. Babcock suggested establishing a Chapter of the Alumni Association in the Minneapolis-St. Paul area and was successful, with the help of other charter members, in organizing the Minneapolis-St. Paul (Twin Cities) Chapter in 1954. He served the Chapter as its first Secretary, as Chairman in the following year, and was elected as a National Vice-President for 1957.

Besides his membership in the NRI Alumni Association, he is a member of the 3rd Infantry Veterans Association and of the Minnesota Society of Industrial Engineers. His hobbies are fishing, photography and golf. In the summer months he and his family spend much of their time at their cottage on Coon Lake, within commuting distance of the Twin Cities.

A man of proven ability and leadership—always anxious to do his best for his Chapter and for the NRI Alumni Association—John Babcock, when he takes office on January 1, will be a President of whom our membership can be proud.

NRI ALUMNI NEWS

Chapter Chatter

PITTSBURGH CHAPTER'S Tom Schnader delivered a talk on dynamic signal tracing. During this talk he used the Chapters' dynamic Radio demonstrator which is now completely wired. Mr. Schnader has been the guiding light in the construction of this device and chapter members cannot begin to express their appreciation for his diligence and effort in wiring the demonstrator. Mr. Schnader also employed

the Chapter's signal tracer to trace an inoperative transistor Radio receiver.

Secretary Ken Shipley used the blackboard and the schematic of the amplifier from April-May issue of NRI NEWS to illustrate and explain the changes necessary to add the second speaker and the modifications necessary to match the preamplifier to a high input crystal cartridge. Some of the members present indicated their intention to assemble a similar amplifier, as they were witnesses to a demonstration of it at the September meeting.

A tour through the facilities of television station WIIC was made on the evening of October 23. Members, their wives, and guests were conducted through the studios, control rooms, and shown the transmission equipment. Everyone who attended was tremendously impressed and fascinated by the complex array of electronic material. Mr. Milton Augenstene started the tour and various members of the operating staff answered questions about the equipment. WIIC operates on Channel 11 and the transmitting antenna is about 1,300 feet above Pittsburgh's famous rivers. The facilities are located on Fineview and command an impressive view of Pittsburgh and the Golden Triangle. The Pittsburgh Chapter expresses its appreciation to a very courteous and friendly neighbor, WIIC.

Stanley Huczko and Stanley Niecgorski were appointed to the Executive Committee to fill vacancies on this committee.

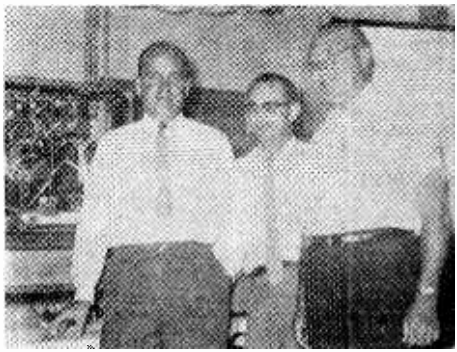
NRI graduates and students in the area should take advantage of the opportunity to attend the meetings of the Pittsburgh Chapter for the valuable help and information available on Radio-TV problems. The Chapter welcomes visits from all NRI graduates and students. The meetings are held at 8:00 P.M. on the first Thursday of each month at 134 Market Pl., Pittsburgh. If you'd like more information about the activities of the Chapter, contact Chairman Frank Skolnik, 616 Springfield Ave., or Secretary Kenneth Shipley, 1009 St. Martin, Pittsburgh.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER has been giving more thought to its programs, with a view to making them more helpful to individual members. A general decision was reached to bring before the group the Radio-TV problems that individual members are faced with, for discussion and solution. Speakers, when available, will deliver talks and take the lead in these discussions.

NRI students and graduates in the Cumberland Valley should take advantage of the opportunity to attend these meetings for the valuable practical help they can get at them. All students and graduates will be cordially welcome at the meetings, which are held at 8 P.M. at the Northend Hagerstown Senior High School, Hagerstown, on the second Wednesday of each month. Secretary Edwin M. Kemp, 618 Sunset Ave., Hagerstown, will be glad to furnish more information about the meetings upon request.

PHILADELPHIA-CAMDEN CHAPTER is continuing to set some kind of a record for attracting new members. The latest are Alfred Mann, Feasterville, Pa.; Jack Feinstein, Philadelphia; Martin Bayliss, Maple Shade, N. J. A hearty welcome to these three new members.

Due to a misunderstanding a representative of the Motorola Corporation got his dates mixed up and was unable to fulfil



Guest speakers who delivered talks and demonstrations on Sylvania TV and Hi-Fi at a meeting of the Philadelphia-Camden Chapter. L to r: Pete Langer, Sylvania Field Engineer; Chas. Unrath, Sylvania Technician; and Russ Mauger, Service Manager for Sylvania Philadelphia distributors. Kurt Stein, Sales Manager for Philadelphia Distributors, was also present but left before this photo was taken.

his appointment as a guest speaker at a meeting of the chapter. As a last-minute substitute Vice-Chairman Fred Seganti gave a very interesting talk on alignment using the Sweep generator and scope. He also went into considerable detail on how to clean tuners and gave some very good suggestions on home servicing. This talk was enjoyed very much by the members.

Chapter members are still plugging away on the chapter's TV Dynamic Board and it should not be long before it is finished and ready to be put into use.

The Chapter has a well worked out sched-

(*Continued on page* 18)

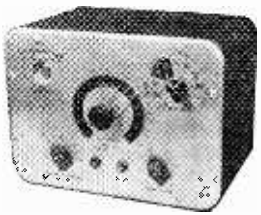
Christmas Suggestions

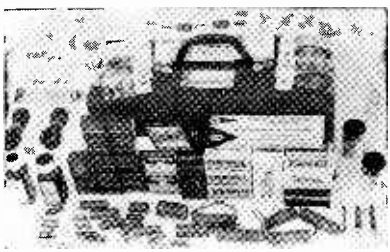
See pages 22-23 of the October-November NRI News for prices and descriptions of other items available through your Supply Division. Remember—monthly terms can be arranged on any one or more items when each is priced over $18.00. Write for full particulars but do it now as time is running short for Christmas orders. For cash orders, use the convenient blank on page 17.

ARGOS Tube Caddies. The easy, orderly way to store tubes or carry tubes and tools on service calls. Just the thing for spare-time servicing. Choice of two Caddies. Popular Carry-All Caddy built of sturdy ⅝" and ¼" plywood covered with tough, luggage-type pyroxilin fabric. Size: 21" x 15" x 8". Capacity—262 tubes. **NRI Price $13.95.**

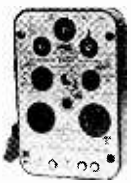
Junior Tube Caddy. Size 15¾" x 12½" x 8". Holds 143 tubes. **$9.95.**

New Model 114 R-C Tester. Measures resistance, capacity, leakage, power factor. Has a definite place in every service shop for greater profits, more satisfied customers, quicker, more efficient servicing. The Model 114 uses highly-accurate bridge-type circuit with a guaranteed accuracy of plus-minus 5% or better. Tuning eye null indicator. Extra sensitive leakage test circuit. Applies actual DC working voltages up to 400 volts. A basic test instrument that will not become obsolete. Shipped Express Collect. Price **$39.95** complete with detailed, step-by-step operating instructions.





Radio Replacement Parts Kit. $24.75. Most needed replacement parts for Radio-TV service work. Assortment would run over $50 at dealer's net prices. Condensers, resistors, rectifiers, transformers, oscillator coils, pilot lamps, volume controls, electrolytics, line cords, belt and dial cord repair kit, radio hardware. Fresh, first quality, name brand parts—*not surplus.* Priced to save and earn you money. **$24.75** including heavy gage steel tool box. Shipped Express Collect; weight 15 lbs.

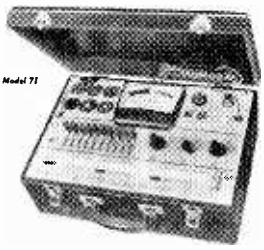


NRI Model O Series String Filament Tester. Completely self-contained. Quick checks receiver and TV picture tubes for filament continuity. Uses two long-life pen light cells. A real time saver on servicing jobs. Has built-in pin straighteners and also checks fuses, pilot lamps. Easily carried in jacket; size: 1" x 3½" x 5⅜". Handsomely styled, custom made case, brushed aluminum panel with black lettering. Complete instructions printed on back. The ideal "extra" Christmas gift priced at only **$5.50,** postpaid, complete with batteries.

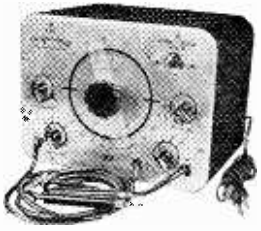
Speedex fully-automatic Wirestripper. Delayed return action. A real time-saver. Well built. **$4.95** postpaid.

Drake Model 400 Soldering Iron, $3.75. Made by the well-known Drake Electric Works. Rated at 60 watts, 110-120 volts. ¼" pyramid tip. Perfect for experiments —service work. Complete with stand.

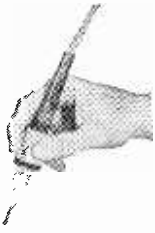
New Model 71 NRI Professional Tube Tester. Features ease of operation; four position element switches for flexibility; triple window, high-speed geared roll chart; freedom from obsolescence; impressive—professional in appearance and operation. Checks for shorts, "opens," leakage, and emission. Giant 4½" jeweled D'Arsonval meter with plus-minus 2% accuracy. Eight tube sockets, seventeen filament voltages. Actual weight 11 lbs.; shipping weight 15 lbs. Sent Express Collect. Price **$59.50** with detailed operating instructions.



Picture Tube Adapters for Use with the Model 71. Checks shorts—emission. 70°-90° Adapter **$4.98.** 70°-90° and 110° Adapter—both for **$9.75.**



New NRI Professional Model 35 Signal Tracer. A Multi-Purpose instrument; traces signals and aligns receivers. Tuned-type. Separate AF and RF inputs; built-in output indicator; visual and speaker output; calibrated attenuators; four bands with tuned circuits; range 170 kc. to 11.6 mc. plus audio. Actual weight 10¼ lbs.; shipping weight 12 lbs. Shipped Express Collect. 50-60 cycle, 110-120 volts AC. Sturdy black crackle finish case with brushed aluminum panel and deep etched lettering. A "twin" to the Model 114 R-C Tester in size and general appearance. Only **$57.50** with instruction manual and test leads.



Ungar Soldering Pencil Kits. Ideal for printed circuit work. Requires practically no maintenance. Time saving; heats to soldering temperature in a few seconds. Comfortable—handle is always temperate. Interchangeable heating units with easily replaceable tips.

Junior Kit includes handle with cord, one 37½ watt heating unit and one package of ten tips. List price $5.00. NRI student price **$3.98** postpaid.

Senior Kit has handle with cord, three heating units (47½, 37½, and 23½ watt) and package of 10 tips. List price $9.25. NRI student price **$7.40** postpaid.

POPULAR WEN POWER SAW ONLY $21.00

A big seller! *Cuts practically anything.* 2" x 4" wood or ½" steel in seconds. Does work of a rip saw, jig saw, crosscut, scroll, coping, hack, band, and keyhole saw. Safe to use; easy to handle. Powerful 1.8 amp motor delivers 2650 strokes per minute. Red and silver finish. Shipped complete with course tooth, medium tooth and fine tooth (metal cutting) blade. List price $29.95. **Cost you $21.00.**

ORDER BLANK

National Radio Institute Supply Div.
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Washington 16, D. C.

I enclose $..... (check or money order).
Send me the following item(s):

- ☐ Argos Carry-All Tube Caddy $13.95
- ☐ Argos Junior Tube Caddy .....$ 9.95
- ☐ Model 114 R-C Tester $39.95
- ☐ Radio Replacement Parts Kit $24.75
- ☐ Model O Filament Tester .....$ 5.50
- ☐ Speedex Wirestripper .....$ 4.95
- ☐ Drake Soldering Iron .....$ 3.75
- ☐ Model 71 Tube Tester $59.50
- ☐ 70°-90° Picture Tube Adapter .....$ 4.98
- ☐ 70°-90° & 110° Adapters .....$ 9.75
- ☐ Model 35 Signal Tracer $57.50
- ☐ Junior Ungar Soldering Kit .....$ 3.98
- ☐ Senior Ungar Soldering Kit .....$ 7.40
- ☐ WEN Power Saw $21.00
- ☐ Tell me how I can buy the instruments I have checked on monthly terms.

Name .....

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If you live in Washington, D. C., add 2% D. C. Sales Tax.

NRI ALUMNI NEWS

Chapter Chatter

(*Continued from page* 15)

ule planned for a good many months ahead—has made arrangements for representatives from two different companies to attend its meetings and give talks on Hi-Fi and stereophonic systems. This is something that is being developed rapidly now and the members want to learn as much about it as they possibly can.

The Chapter meets at 8 p.m. on the second and fourth Monday of each month at the Knights of Columbus Hall, Tulip and Tyson Sts., Philadelphia. All NRI graduates and students will be cordially welcomed at the meetings. For more information about the activities of the chapter get in touch with Secretary Jules Cohen, 7124 Souder St., Philadelphia.

NEW YORK CITY CHAPTER HAS been pleased to welcome the many new members admitted to membership at the past few meetings, and expresses the hope that they will be with the chapter for a long time to come.

Among the speakers at the last several meetings was James Eaddy, who spoke on Transistors in Auto and regular portable receivers. Tom Hull delivered a talk on voltage divider tube circuits and how cathodes produce B+ voltages for other tubes in the set. He also gave a demonstration on how to align the Chapter's RCA demonstrator set and showed the members how to remove parts from a printed circuit board using a special soldering iron.

Secretary Dave Spitzer told of an experience he had with an audio output tube that supplied the B+ voltages to other parts of the set in a Philco portable TV receiver.

Chairman Ed McAdams brought in a TV set showing a defect on the picture tube. A discussion was held as to what the members thought was causing this defect and why. The members came to the conclusion that it was in the horizontal high voltage section possibly the 6W4 tube. Ed then displayed a group of GE Techni-Talk Booklets sent the chapter by National Headquarters to serve as a basis for group discussions.

Everett Rogers related his experience in repairing a set that someone else had altered—modified the circuits—and how he had to change it back to the original wiring and parts in order to make it operate.

Cres Gomez, while in Washington on business, dropped in at the Institute for a visit. He was visibly impressed with NRI's new building. Incidentally, Cres wants it known that he claims the championship as the graduate who has interested and helped enroll the most students with NRI.

The Chapter wishes all its affiliated Chapters and members of National Headquarters in Washington a very Merry Christmas and a Happy New Year.

NRI students and graduates are always welcome at the Chapter's meetings. These meetings are held on the first and third Thursdays of each month at 8:30 P.M. at the St. Marks Community Center, 12 St Marks Place, New York City. The Chairman is Edward McAdams, 3420 Irwin Ave., the Secretary is David Spitzer, 2052 81st St., Brooklyn.

SPRINGFIELD (MASS.) CHAPTER is pleased with the results of its plan for "Shop" meetings. As reported in the October-November issue of NRI NEWS, the chapter holds a regular meeting on the first Friday of each month, as in the past, then meets at a member's shop on the Saturday following the third Friday of each month.

The first such Saturday meeting was held at the service shop of Arnold Wilder in Springfield. At this first Saturday meeting, the members had a tendency to let the host do the work while they looked on, but hereafter the members will be encouraged to do the work themselves under the direction of the more experienced technicians. The 22 members who attended this first Saturday meeting obviously enjoyed it—got a lot out of it—so the chapter is going to continue this plan of "Saturday shop" meetings.

At another meeting Vice-Chairman Walter Ciszewski built and demonstrated a display panel of defective components. Members tested these components and Walter gave the case history explaining the effects of each.

Walter Ciszewski also delivered a talk on block diagrams and their application in servicing TV sets. The Chapter's Technical Advisor Lyman Brown is maintaining his ever-popular question and answer period, during which members get valuable advice and help on their servicing problems.

Plans have been made to repair a TV set belonging to the chapter, then raffle it off. The proceeds will be added to the chapter's equipment fund.

Joe Marcik while on his way home from a trip to Florida came in for a visit at the Institute. He made a tour of the building and met some of the folks at NRI. It was good to see you, Joe.

The Chapter's first Friday meeting of each month is held at 7 P.M. at the U. S. Army Headquarters Building, 50 East St., Springfield. The location of the shop meetings is announced at the first-Friday meetings. All NRI students and graduates in the area are cordially invited to both the regular and the shop meetings, and will derive a great deal of benefit from attending them. For more information about the activities of the chapter, get in touch with Secretary Howard Smith, 53 Bangor St., Springfield, Mass.

NEW ORLEANS CHAPTER continues to hold its meetings at 8 P.M. on the second Tuesday of each month at the home of Secretary Louis Grossman, 2229 Napoleon Ave., New Orleans.

At the most recent meeting that can be covered by this issue of the NRI NEWS, Chairman Patrick Boudreaux delivered a very fine and enlightening talk on hi-fi.

All NRI students and Graduates are cordially invited to the meetings either as guests or prospective members. For more information about the meetings and activities of the chapter, get in touch with Secretary Louis Grossman, 2229 Napoleon Ave., New Orleans.

FLINT (SAGINAW VALLEY) CHAPTER voted to postpone its October meeting so that as many of its members as were able could journey to Detroit as guests at the Detroit Chapter's Twenty-Fifth Anniversary Party. These members felt that this was a good opportunity to get a few ideas on what the bigger chapters were doing along entertainment and educational lines. They thoroughly enjoyed an evening of education and entertainment at the party.

Chairman Neuman, at another meeting, read a letter from National Headquarters concerning G-E "Techni-Talk" bulletins sent the Chapter by National Headquarters in Washington. After some discussion it was decided to split up the bulletins among the attending members and at subsequent meetings the members would trade with one another, so that in this way all members would have an opportunity to study over the bulletins.

At the same meeting two 35mm slide films were shown. They were entitled "Molecular Forces in Matter" and "Effects of Molecular Action." Since the Chapter had been having sound movies, it was necessary to secure a slide projector to show these films. One was borrowed from the Bay City Boy Scouts and in appreciation for their kindness, a collection was taken up and Chairman Neuman was delegated to deliver it to the Scouts with the thanks of the members.

The Chapter holds its meetings at 7:30 p.m. on the second Saturday of each month at Vice-Chairman Aaron Triplett's Repair Shop, 2538 Walcott St., Flint. All NRI students and graduates are cordially invited to attend the meeting. For more information, contact Vice Chairman Aaron Triplett or Secretary George L. Hinman, 603½ State St., Bay City, Mich.

LOS ANGELES CHAPTER has been pleased to admit two more new members to membership in the Chapter. They are Frederick Tevis and Clarence Henry. Congratulations to these two new members!

Joe Stocker and Chairman Tom McMullen delivered well-received talks on the scope and demonstrated how to utilize the patterns on the scope.

NRI students and graduates in the area, who will be cordially welcomed at the meetings, can learn a great deal from these talks and demonstrations. The Chapter meets at 8 P.M. on the second Friday of each month at St. Joseph's Catholic School Hall, 1220 S. Los Angeles St., Los Angeles. For further information contact Chairman Thomas McMullen, 1002 W. 187th Place, Gardena, or Secretary Earle B. Allen, Jr., 11523 S. Broadway, Los Angeles.

DETROIT CHAPTER held its Twenty-Fifth Anniversary Party at St. Andrews Hall Auditorium on October 11. Some fifty members and guests were present to make it a truly gala affair.

Following an excellent roast beef dinner Howard Smith, President of the NRI Alumni Association for 1958, extended greetings and congratulations to the Chapter on behalf of J. E. Smith, Founder of the National Radio Institute. Vice President Earl Oliver then presented to Howard Smith an Honorary Membership Card for J. E. Smith. Charlie Mills, a Charter Member of the Chapter, was also the recipient of an Honorary Membership.

Several other out-of-town guests attended the celebration, including the following members of the Flint (Saginaw Valley) Chapter: William Neuman, Chairman; George Hinman, Secretary; Stanley Austin and Harm Gillean. These guests and others traveled from as far away as Saginaw, Flint, and Bay City to be present at the celebration.

Guest Calvin Morgan of KLA Laboratories gave an unusually interesting demonstration and talk on recording from the earliest days of the wax cylinder through present day stereophonic reproduction. Thanks to Chairman John Nagy and his employers, KLA Laboratories, there was plenty of good music for dancing. It was evident that all those present enjoyed a very pleasant and memorable evening.

Mr. Otha C. Petty was recently admitted to membership in the Chapter. Congratulations, Otha.

The Chapter holds its regular meetings at 8 PM on the second and fourth Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. All NRI students and graduates are cordially invited to the meetings. For more information get in touch with Chairman John Nagy, 1406 Euclid, Lincoln Park, or Secretary Ellsworth Umbreit, 12523 Racine Ave., Detroit.

SOUTHEASTERN MASSACHUSETTS CHAPTER marked its first anniversary meeting with a buffet supper held at the New Bedford Hotel, New Bedford, Mass. NRIAA Executive Secretary Ted Rose was present on a visit to the Chapter. J. B. Straughn, Assistant Director of the NRI Instruction Department and Chief, Consultation Service, was also a visitor at this meeting.

Following the very tasty buffet supper (including lobster sandwiches yet!) and the business meeting, Ted Rose congratulated the Chapter members on the fine job they had done in the brief span of one year. He then introduced Mr. Straughn, who delivered an absorbing talk on the design and features of the new NRI Model 250 5-Inch-Wide-Band Oscilloscope. After this discussion Mr. Straughn demonstrated use of the scope, employing a TV receiver brought in for the purpose by Secretary Ernest McKay, who ably assisted Mr. Straughn in the demonstration.

The members present were so interested in this talk and demonstration that the customary quitting time had come and gone before anyone realized it. This was indeed an excellent meeting and represents a real loss to any one who missed it.

The Chapter encourages visits from all NRI Graduates and students in the area. For more information get in touch with Chairman Michael Lesiak, 20 Cooper St., Taunton, Mass., or Secretary Ernest McKay, 16 Austin Court, New Bedford. The meetings are regularly held at 8 P.M. on the last Wednesday of each month at the DAV Hall, 120 Third St., Fall River, Mass.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER has adopted a new program under which the chairman invites a Chapter member who is thoroughly familiar with a given subject to prepare a short lecture for a formal study period. Under this program two lectures are to be delivered at each meeting, one lecture on some section or circuit in a TV receiver and the other lecture on some development such as the transistor or other timely subject.

Several dog TV and Radio receivers took up the entire workshop part of another meeting, as it has at a good many of the meetings lately. But this is very much worthwhile. Each member has his chance at trying to diagnose the defect in these dogs and when the defect is located he has another case history to add to his memory file on complaints and cures. One especially interesting case was a printed circuit board which looked perfect on visual inspection but had a poor solder connection which made the set intermittent.

The Chapter has a standing invitation to all NRI graduates and students in the area to attend its meetings. They are held at 8:00 P.M. on the second Thursday of each month at Walt Berbee's Radio-TV Shop, 915 St. Clair, St. Paul. For more information about the meetings, contact Chairman John Berka, 2833 42nd Ave., S. Minneapolis.

MILWAUKEE CHAPTER was pleased to receive a visit by J. B. Straughn, Assistant Director of the NRI Instruction Department and Chief, Consultation Service, and the Executive Secretary of the NRI Alumni Association, Ted Rose.

Mr. Straughn's purpose on this visit was to deliver a talk on the function of the oscilloscope in Radio-TV Servicing, and on the design and features of the new NRI Model 250 5-Inch Oscilloscope Kit. Employing a TV receiver provided by Slavko Petrich, Mr. Straughn demonstrated the Model 250 in actual use. The members present were visibly impressed with the talk and demonstration. It was one which no member of the chapter should have missed.

The Chapter holds its meetings on the third Monday of each month at the Radio-TV Store and Shop of Slavko Petrich, 5901 W. Vliet St., Milwaukee. NRI students and graduates in the Milwaukee area are invited to attend the meetings either as guests or prospective members. For more information about the meetings and the Chapter's activities contact Secretary Erwin Kapheim, 3525 N. Fourth St., Milwaukee.

Amplifier Square-Wave Testing

(*Continued from page 3*)

ranged for easy manipulation. In the usual high fidelity amplifier, one side of the input jack and the "common" output jack are both connected to B—. For direct checking of the generator it is then only necessary to disconnect the "hot" lead of the generator and the vertical input lead of the scope from the amplifier and connect them together. The ground leads of both instruments will be connected together through the amplifier B—.

Remember that this quick method of "monitoring" can be used only when the common output terminal of the amplifier is connected directly to B—. Amplifiers that feature "variable damping," or utilize current feedback from the secondary of the output transformer for some other reason, do not have this common terminal grounded. For monitoring, then, it would be necessary to disconnect both the vertical and ground leads of the scope and connect them directly to the output of the square-wave generator.

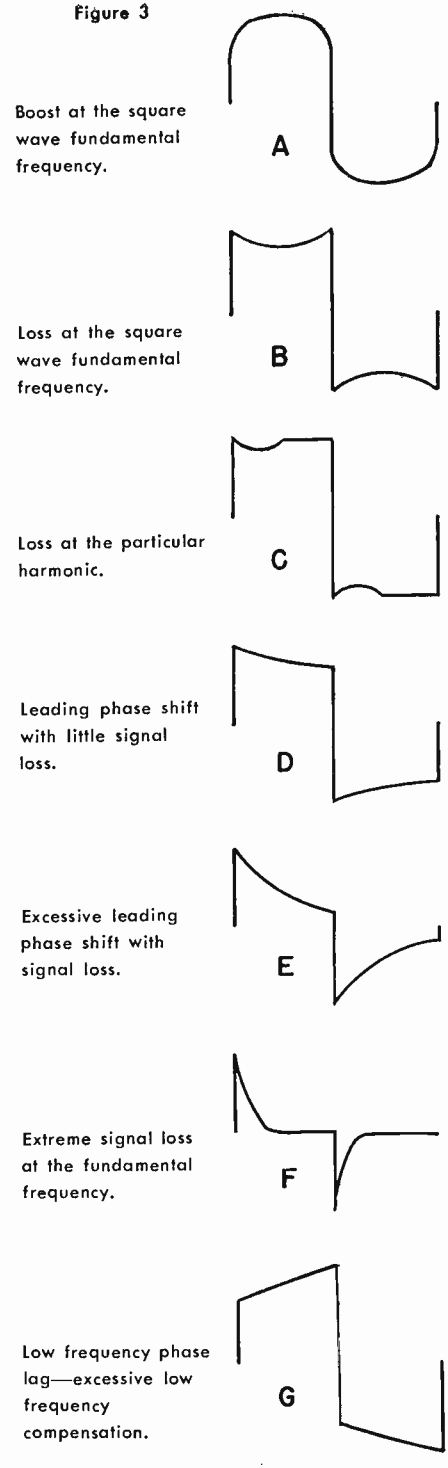
Of course the ideal method of monitoring is to use an electronic switch which permits observation of the input and output signals simultaneously.

Low-Frequency Response

Fig. 3 shows waveform distortion obtained under different conditions with low frequency square waves. These waveforms are typical of those obtained with a 50 cps square wave fed through a high fidelity amplifier (including the tone-control stages but not the magnetic cartridge pre-amp).

An ideal square wave is not shown—except perhaps for some laboratory models perfect square-wave response will not be obtained at 50 cps with commercial high-fidelity amplifiers. Due to the small coupling capacitors in the tone control, network leading phase shift is always encountered. Thus, even the best amplifiers that are flat within ½ db to 20 cps will show a 50 cps square wave similar to Fig. 3D. In the medium priced amplifiers where the low-frequency response begins to drop off, the 50 cps square-wave response will be more similar to Fig. 3E. Because of phase shift, a perfect square wave at 50 cps could only be obtained if the amplifier response was flat within ½ db to about 5 cps (approximately 1/10 of the square-wave fundamental frequency.) However, this is only a rough rule of thumb. An amplifier could be flat down to 5 cps and still have sufficient phase shift to distort a 50 cps square wave.

Figure 3



The bass control network components are generally chosen to be most effective at 50 cps. Thus a slight clockwise rotation (boost) of the bass control will result in a waveform like 3A. Conversely a slight counter-clockwise rotation (cut) will cause a waveform like 3E. Further turning of the control will eventually result in 3F. Of course with the bass control set to its mid-position (or Flat) any waveform similar to A generally means a defective part in the tone control network. Waveforms like E or F indicate loss of low-frequency response which could be anywhere in the amplifier.

Because of the phase shift problem explained above, it is normally not possible to obtain perfect square-wave response below 200 cps in commercial high-fidelity amplifiers. Medium priced amplifiers will generally have satisfactory response from 200 cps to 2000 cps, indicating satisfactory (within ± 1 db) sine-wave response between 20 cps (1/10 x 200) and 20,000 (10 x 2000).

High-Frequency Response

Fig. 4 shows some waveform distortions obtained under various conditions with high-frequency square waves. A slight loss of high frequencies, as shown in A is typical above 2000 cps. The back edge of the square wave would also tend to round above 3000 cps. Somewhere above 5000 cps, depending on the amplifier quality, the square wave will deteriorate to that shown in B. This is normal since a perfect square wave at 5000 cps could only be obtained if the amplifier sine-wave response was within 1 db at 50,000 cps.

The square wave shown in C is often obtained from commercial amplifiers from about 500 cps to several thousand cps. The slight pip on the leading edge of the square wave may be narrower or higher, or both. In any case, it does indicate a resonance at some higher frequency. Most often the pip is due to the natural resonance of the treble control circuit components which, by design, has not been completely damped. If the pip is not larger than that shown in C it can be considered a satisfactory condition.

However, if the pip is much higher in amplitude it should be further checked by turning the treble control clockwise (boosting) while watching the waveform. Insufficient damping could cause the circuit to break into uncontrolled ringing, as shown in D.

Very often a square wave such as shown in E is obtained. Although it is due to loss at the square-wave fundamental frequency it is more practical to consider it caused by peaking at higher frequencies due to either the treble control network, a deliberately built-in high-frequency peaking network, or more often, both. A simple high-frequency peaking network is often designed into an amplifier to extend the high-frequency sine-wave response for "sound" reasons and advertising purposes. This peaking network is usually very simple—most often a small capacitor (500 mmf to .005 mfd) connected across a cathode resistor. It is perfectly all right providing the Q is low enough so it does

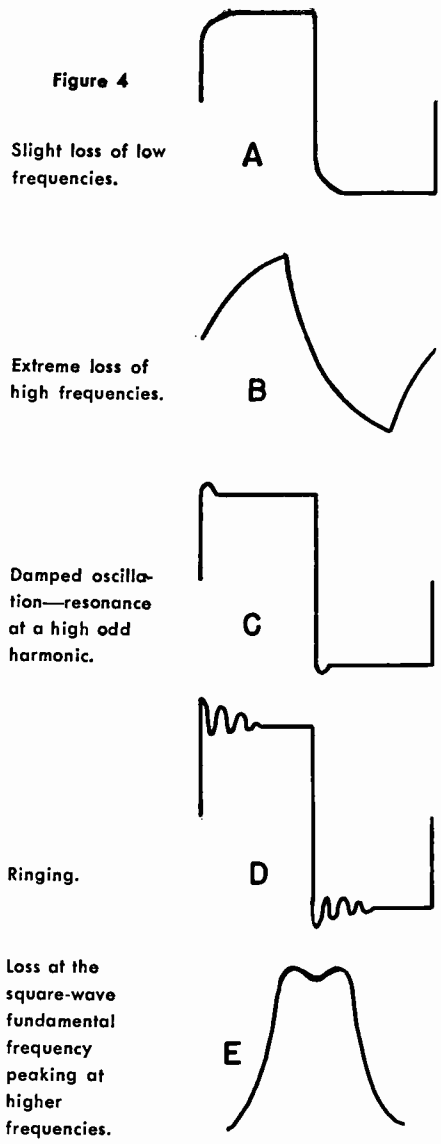


Figure 4

not cause ringing. Even with a low Q (determined by the resistor value) too much high end peaking can cause the high frequencies to sound harsh. The dip shown in E is about all that can be tolerated.

General Considerations

The quality of the square-wave response of an amplifier will depend entirely on the quality of the amplifier itself. Don't expect a $30 amplifier to have as good a square-wave response as a $100 unit. On the other hand, don't be surprised at the poor square-wave response of many very expensive "big name" amplifiers. Very often the manufacturer's money is put into stability, dependability, and low harmonic and intermodulation distortion rather than extended frequency response. It doesn't do much good to have an amplifier flat out beyond a bat's hearing if it breaks down every week. More important, it's far better to have low distortion than to have extended range.

Unfortunately the high cost of some amplifiers is not due to the high quality, but to high profits and expensive advertising. The specifications are advertising specifications and not laboratory specifications.

It's possible with hand chosen components, careful layout and construction to come up with a good amplifier. However, if the layout and construction is changed to reduce assembly costs, if the component tolerances are increased to reduce cost, and if the amplifier is merely checked to see if it works—but not how well, the final product will be a poor copy of the original. Specifications of the original unit will then bear little resemblance to the actual specifications of the final product. In general, be wary of an amplifier advertised with exorbitant specifications. For example, I recently had the opportunity to check out, with square waves, two identical 30-watt amplifiers. Both were similar in square-wave response—poor—yet the specifications claimed "essentially undistorted square-wave response from 20 cps to 20 kc." This means, of course, that the amplifier would have to be flat from 2 cps to 200 kc! Such amplifiers are made—but they're special laboratory models costing about $700.

Normally don't expect as much from kit-type amplifiers as from factory built units since the ability of the builder will affect the over-all quality. However, if the unit utilizes printed circuits and the soldering is good, or if it has been very well built, there's no reason why it shouldn't equal factory built amplifiers costing at least one-third more.

The best way to get the most out of square-wave testing is to familiarize yourself with commercial amplifier quality. Never pass an opportunity to check a commercial amplifier with square waves, and if at all possible, listen to some familiar records through the amplifier before and after testing.

When using square waves to check individual stage response, keep in mind that some stages inherently have poorer response than others—such as tone control stages. Other stages may then be designed with excessive low- or high-frequency response (or both) to make up for inherently poor stages. Since the program source, tuner or record, must pass through the entire amplifier, it is the over-all response that counts.

Since many of the amplifier controls affect the frequency response, it is important to set them properly before checking with square waves. Rumble or scratch filters should be turned off or otherwise disabled. Bass and treble controls should be set to their mid-positions (flat), but remember their apparent mid-positions may not be their true mid-positions because of the potentiometer tolerance (usually 20%), or the physical placement of the indicator (shaft and knob). The loudness control, if any, should be disabled for the tests, but the amplifier should also be tested with the loudness control adjusted to where it is usually set to be sure it doesn't cause oscillation. Some amplifiers contain only a loudness control which automatically provides bass and treble boost as the gain is lowered. In this case, the square waves will normally be distorted accordingly.

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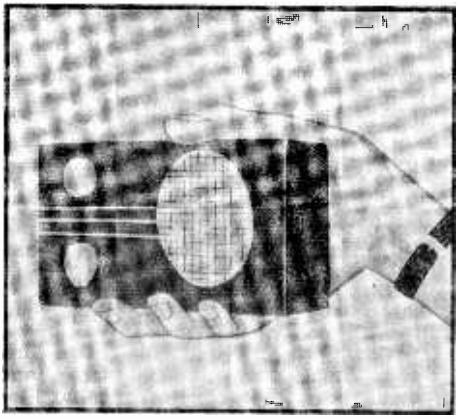
A business man was allowed to have one single wish come true. In order to go as far as possible in many different directions, he asked for a copy of his state newspaper dated exactly six months into the future.

Miraculously, the paper was placed in his hands. He made many notes on stocks that had gone up, others that went down. He noted the positions of baseball teams in order to make some private bets among friends. He read up on the international situation and the political developments that had occurred.

On the last page was the obituary column. Heading the list was his own name. He had suffered a heart attack the previous day.

The single greatest blessing we have in life is not to know what lies ahead.



Things to Remember When Servicing Transistorized Receivers

by John N. McCaul

Courtesy, Sylvania News

The transistor is here—and it is becoming a greater factor in electronics as each year goes by. It is estimated that a total of 60 million transistors will be manufactured in 1958 for use in home radios as well as industrial and military applications. About half of these will fit the first category, home entertainment, and this is the business of the Radio-TV serviceman. Therefore, in order to get your fair share of this expanding servicing market you must become thoroughly familiar with transistors and their associated components.

The transistor is extremely durable in some ways and equally as fragile in others. It can take shock and vibration in the order of thousands of times what the ordinary receiving tube can bear. But, and this is important, the transistor is extremely sensitive to heat or to the application of the wrong polarity D.C. biasing voltages. Both can destroy the ability to get what is called "transistor action." Too much voltage, an improperly used soldering iron or a poor connection to a heat sink as well as ambient temperature can create heat at the junction. And heat is one factor that must be carefully avoided at all times.

In order to avoid these two ways of causing destruction to the transistor, we first must become familiar with the two main types we run into. This familiarity includes not only an understanding of the two opposite types, but also the symbols that describe them. The two types are the NPN and the PNP. What is the correct polarity? Just look at the center letter or, as some put it, the "ham in the sandwich." Take the NPN. "P" is the center, the ham, and plus is the polarity of the large voltage that is applied to the collector. The same for the PNP. "N" is the center, negative is the correct collector voltage. Suppose you do not know from the schematic whether you have a PNP or an NPN. Look at the symbol—it will tell you very easily. If, for example, the symbol looks like the one shown in Fig. 1A you have an NPN. How can you remember this? In an NPN transistor the outsides are "N," and this indicates electrons are the carriers. Current flows opposite to electrons. The carriers, however, always go from the emitter to the collector. The arrow coming out from the emitter indicates to you that this is an NPN transistor. In like fashion, should the arrow be pointing towards the emitter as in Fig. 1B you have a PNP transistor and "hole" carriers, as they are called. "Hole" carriers go in the same direction as the current, and the arrow points the direction of the current.

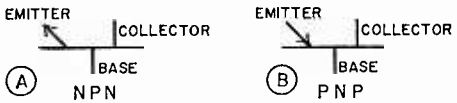


Fig. 1. How to identify NPN and PNP transistors from their schematic symbols.

Thus, by looking either at the symbol in Fig. 1A (NPN) or the type (NPN), you know the correct polarity to apply to the collector. Always determine this first, for the large reverse collector bias, if applied to the collector incorrectly, will cause so much current to flow across the collector-base junction that it will quickly heat up and be destroyed. It is a simple matter then to connect the emitter. Apply to it the opposite polarity to that applied to the collector. Every Sylvania transistor carton carries a basing diagram to help you.

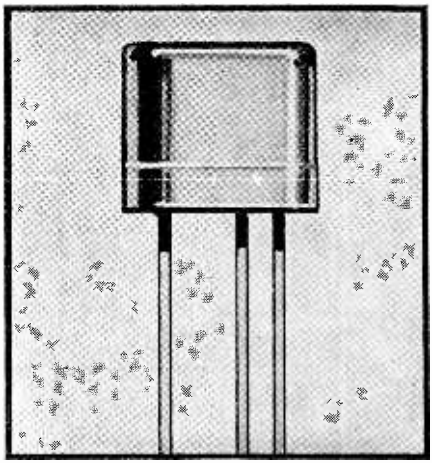
Before doing any actual servicing in a transistorized radio, it is wise to give all components and wiring an intense visual check. Look for such things as broken antenna leads, cracks or breaks in the circuitry, poor solder joints, corroded or bent battery terminals, solder or dirt between leads, poor grounds and other similar

items. Test your battery. It is desirable to do this under load for, among other things, many circuits are extremely sensitive to their voltage supply. Check your on-off switch if your battery is weak or dead. The tiny switches used can become worn more rapidly than the larger units you are used to. Then they do not turn off the power supply, thereby draining the battery.

When measuring a tranisistor circuit, the serviceman should know his instruments. An ohmmeter check is inadvisable unless the voltage of the ohmmeter is known, and it is also known that this voltage does not exceed the ratings of the transistor or, and this is often forgotten, the ratings of the miniature capacitors. In the case of the transistor, the ratings of the emitter-base junction, which is forward biased, are extremely low and cannot be exceeded without permanent injury. The collector-base junction, which is reverse biased, has a much higher rating but even this, if exceeded, will cause destruction due to a breaking of the covalent bonds. This is sometimes called Zener breakdown. In the case of the capacitors, they generally carry ratings of somewhere betweer. 2 and 10 volts and, in addition, the capacitors have a polarity which must be observed.

To quickly check whether a transistor is good or possesses "transistor action," you can use a simple circuit such as shown below using a milliameter. As shown, the polarities are set up for an NPN transistor as is indicated by the symbol with the arrow leaving the emitter. For a PNP type, just reverse polarities.

Selection of 1.5 volts and a resistance 1.5 K in the emitter circuit provides a current flow of 1 mil across the emitter-base junction. We know the ratio of our collector current to emitter current (a) should be something around .95 to .97. If our meter indicates .95 to .97 mils then we can safely assume that our transistor possesses transistor action. The collector bias, of course, should be chosen so that it does not exceed the collector rating of the unit tested. When replacing a defective transistor or component to avoid damaging current surges, make sure the power supply is off. If working on a hybrid auto radio, make sure the speaker is connected before applying power.



Avoid excessive heat by using long-nosed pliers between the transistor or component and the joint to be soldered. The pliers will draw off the iron's heat. If the set you are working on has plug-in transistors, then remove them if you are going to solder any surrounding circuitry.

Remember your two types of transistors and their symbols so that correct polarity is observed. Avoid heat in every way possible, and take extreme care to note the value of the voltages applied. Applying these rules with your knowledge should greatly simplify transistor servicing.

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Additional Suggestions

by J. B. Straughn

Identical procedures cannot be used to isolate defects in tube type and transistorized receivers. Let's see where these differences arise and the methods which

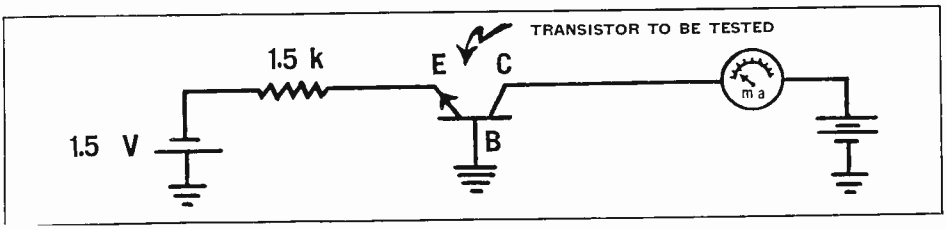

Fig. 2. Set up to check transistor action.

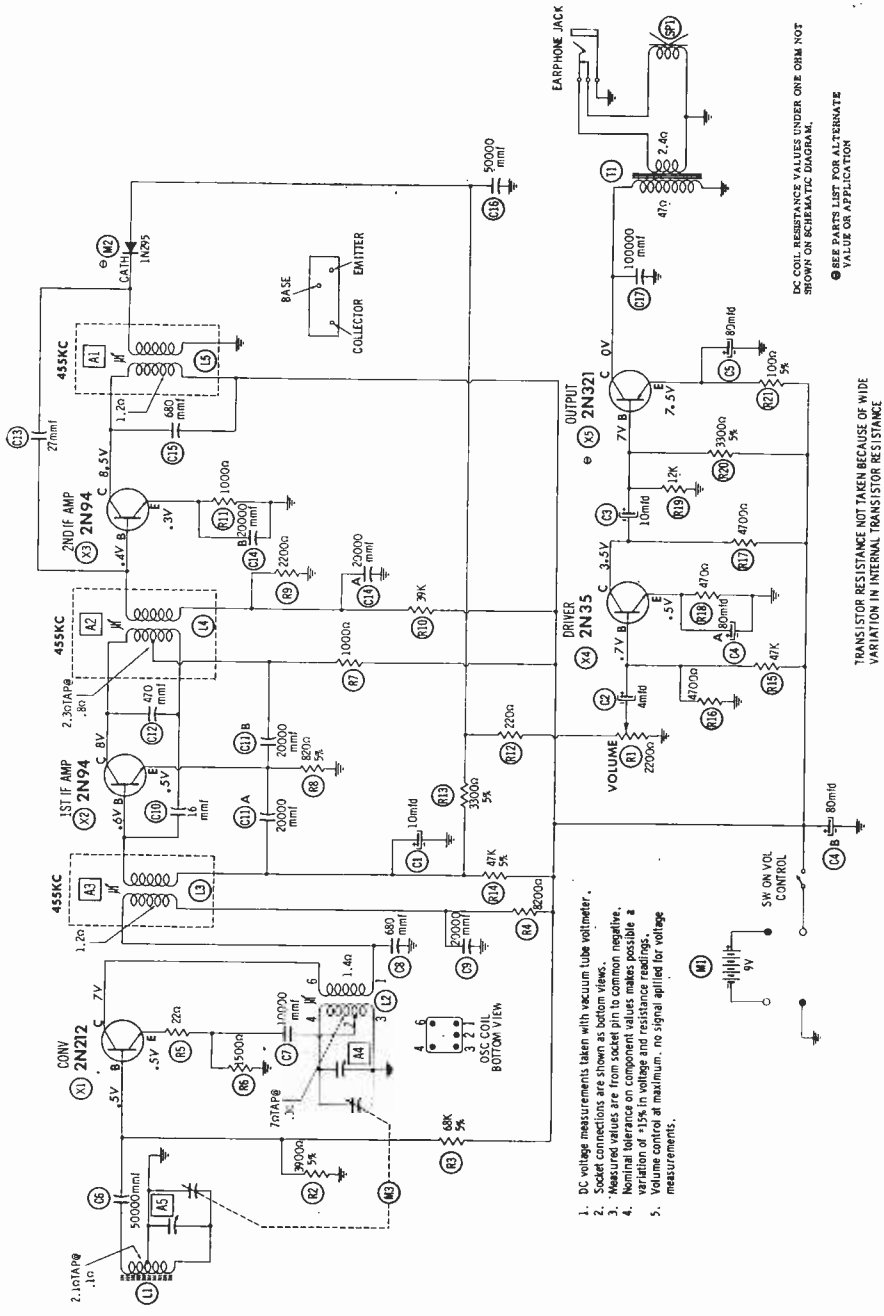

Fig. 3. Diagram of a typical transistor receiver using NPN transistor in the mixer i.f. amplifier and 1st audio stages. Receiver uses a PNP transistor in the power output stage. Easiest way to make a circuit disturbance test is to connect a 100,000 ohm resistor to the positive terminal of the battery and then touch the free end of the resistor to the base of each transistor in turn, starting at the output and working toward the mixer. Notice an r.f. bypass is not used across R6, the emitter resistor of the 2N212 mixer. Installation of a .005 mfd. capacitor across this resistor may improve oscillator at low battery voltages.

can be used with success in transistor sets.

Dead Receivers:
In a set using vacuum tubes, trouble can be quickly localized by means of a circuit disturbance test. This can be accomplished by touching high-impedance points in the circuit, such as the control grids or the hot side of the volume control, with your finger or with a screw driver blade in contact with your hand. The resulting electrical shock will produce a thud, buzz, or click in the loudspeaker if everything is all right between the point of disturbance and the speaker. This procedure enables you to spot a dead stage almost at once.

In a transistor receiver the base, collector, and emitter circuits have a very low impedance, and nothing will be heard in the speaker if you touch one of these points. Other methods of localizing the trouble to a stage must be employed. However, because transistor sets are battery powered, the first thing to do is to measure the battery voltage when the battery is in place and is turned on. Unlike a battery-operated vacuum-tube receiver, a transistor set will operate at considerably reduced voltage. If the battery voltage is more than 20% below normal a new battery should be tried.

Two methods are in common use to make a circuit disturbance on a transistorized receiver. If the set uses NPN transistors with the arrow symbol of the emitter pointing away from the base, I have often disturbed the stage by shorting the emitter to the chassis momentarily, with a screw driver. The resulting sharp change in collector current will cause a click in the loudspeaker if everything is working between the point of connection and the speaker. A check on the power output transistors using this method is a debatable procedure. I have done it often, but with some circuit configurations damage to the output transistors might result. This method cannot be used with the PNP transistors.

A better method, safe to use on both NPN and PNP, consists of connecting a resistor of at least 100,000 ohms to the ungrounded side of the battery with a wire. Use the free end of the resistor as a probe and momentarily touch it to the base of each transistor in turn. A click will be heard when the connection is made and when it is broken. When you go from a point where you get a click to a point where no click is heard you have passed through the defective stage. Then a few checks with your voltmeter should disclose the cause of the trouble.

A disturbance test will not tell you if the local oscillator is working. To check the oscillator operation a number of methods are open. You can, depending on the test equipment available:

1. Measure the ac tank voltage in the oscillator circuit with a meter.

2. Look at the oscillator wave shape with a suitable cathode-ray oscilloscope.

3. Pick up the local oscillator signal with a tuned Signal Tracer or on another receiver.

Case #1. A vacuum tube voltmeter which will measure rf and which has a high input impedance can be used to measure the ac voltage across the oscillator tuning capacitor. The average VTVM cannot be used for this measurement, but the NRI model W VTVM works very well. In general, an ac voltage between 5 and 15 volts shows that the oscillator is working.

Case #2. A high gain, wide band oscilloscope with a high frequency sweep that goes up to 500 kc may be used to directly view the rf voltage across the oscillator tuning capacitor. The new Model 250 NRI 5 inch scope is ideal for this purpose and will sync perfectly with the oscillator signal. Due to its high input impedance it will not load the oscillator circuit excessively. The scope will show cases of excess or of insufficient feedback voltage in the oscillator circuit.

Case #3. Just as in the case of a vacuum tube receiver, the local oscillator in a transistor set will radiate. Tune a nearby set to a station around the high frequency end of its dial. Now tune the transistor receiver over its complete range. At some point on the transistor receiver dial a squeal should be heard in the other receiver due to the signal from the transistor oscillator stage heating against the broadcast station you have tuned in. If the transistor set uses a if of 455 kc, and most do, the transistor dial setting at which the squeal occurs should be the receiver dial setting minus about 455 kc.

When the local oscillator in a transistor receiver does not work, the first thing to do after checking the battery voltage, is to go over all soldered connections in the transistor stage with a hot soldering iron. In many cases, removal of a rosin joint will restore oscillator operation. Should trouble continue, unplug the battery and transistors and measure the value of the two biasing resistors in the base circuit and the value of the emitter resistor. If any have changed, they should be replaced. The resistance of the oscillator coil windings should be checked at this time. New

fixed capacitors of the correct size should be tried in the base circuit, across the emitter resistor and between the oscillator coil and the emitter. The original capacitors should be removed for this check. Of course if an RC bridge is available your tests will be speeded by checking each capacitor when only one of its leads is removed from the circuit. These capacitors should be of approximately the correct value if satisfactory oscillator operation is to be achieved. A large variation, particularly in the base and emitter resistor capacitors, will result in "squigging." This causes squeals, improper mixing action and shows up on a scope as non-sine waves. Only if all other parts prove good should you try a new oscillator coil. The transistor is hardly ever at fault, although this possibility should be born in mind.

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Allied Radio's 1959 Electronics Catalog Ready

ALLIED RADIO CORPORATION, Chicago, announce the release of their 1959 general catalog of electronic parts and equipment, including a complete line of high-fidelity components. The new 452-page catalog (208 pages in rotogravure and 4-color covers), lists over 32,000 items.

The 1959 line of 60 Allied Knight-Kit electronic kits is illustrated and described in 2-color rotogravure. Included are professional-quality electronic instruments for the engineer, technician, serviceman and for production line work; new monaural and stereo hi-fi kits, and kits for the radio amateur. Other kits—from basic radio circuits to complex receivers—are designed for hobbyists, experimenters and electronics training.

Industrial equipment includes comprehensive listings of receiving, cathode-ray and special-purpose tubes, transistors, semi-conductors and diodes, 2-way radiotelephone systems, sound-powered telephones, new intercom units, FM receivers for communications services, photoelectric systems, electric counters, laboratory test equipment, rectifiers, converters, relays, switches, variable voltage and other transformers, fluorescent fixtures and accessories. Technical books are included in a well-organized section.

A full presentation of the latest high-fidelity components in all leading makes is shown, as well as complete hi-fi systems in a wide range of prices. Amplifiers, tuners, speakers, enclosures, pick up arms, cabinets, record changers, needles and other accessories, plus "do-it-yourself" amplifier, preamplifier, tuner and enclosure kits are listed.

Tape recorders for professional and home use, including such famous brands as Ampex, Magnecord, American-Concertone, Viking, Bell, Pentron and Sony are listed. Recording tape includes Minnesota-Mining's "Scotch," Audiotape, Reeves and the highly popular Knight brand.

Highlighting this section of the catalog is a complete listing of newest "3-dimensional" stereophonic sound equipment, including complete stereo systems and leading makes of individual stereo units, recording and playback decks, and add-on components for conversion of conventional hi-fi systems to stereophonic sound. Listed also is a special selection of the new stereo records as well as a wide choice of stereophonic pre-recorded tapes with RCA Victor, Mercury, Westminster-Sonotape, Cook and other famous labels.

The extensive public address section contains U.L. Approved KNIGHT amplifiers in complete PA systems ranging from 8 to 60 watts—plus the latest intercom, paging and music distribution systems, microphones, speakers, baffles, phono motors, cable and connectors.

The TV section offers boosters, rotators, towers and UHF converters; latest types of antennas; accessories for virtually any type of antenna installation; and exact-replacement TV parts, controls and other components.

The larger amateur radio section lists the latest in communications equipment, including new receivers, transmitters, marine radio gear, direction finding equipment, kits, keys and all parts required for building and maintaining "Ham" stations.

Allied's new 1959 electronics catalog is available free upon request. Write to ALLIED RADIO CORPORATION, 100 N. Western Ave., Chicago 80, Illinois.

Soldering Hints for the Old-Timer and Beginner

by J. B. Straughn

Chief, Consultation Service

Poor soldering causes more trouble in both commercial and kit equipment than you would think. You cannot always tell by inspection that a defective connection exists.

In some cases, a rough-looking joint, which has a dull grey appearance is obviously bad. If you wiggle a wire or part lead and you see it move in the solder, you know the connection is loose.

Most troubles, however, are due to unmelted rosin inside a smooth, shiny joint that looks perfect. There is only one way to see if such a rosin joint exists, and that is to remelt the solder on the joint. Any rosin trapped inside the joint will bubble out. Then you have a good connection.

Rosin joints can cause almost any trouble found in electronic equipment, but are more likely to show up in oscillator circuits and in high-impedance control-grid circuits.

Frequently, newly wired equipment works perfectly, but in time the rosin residue in the joint will set up a chemical reaction and trouble appears. This was demonstrated very forcibly recently. We built a VTVM about two years ago and recently noticed it was acting up. Finally, it showed all the symptoms of rosin joints. Sure enough, when the critical joints were melted, out bubbled the rosin and the trouble cleared up.

I have noticed the same difficulty in manufactured receivers a year or so old, and resoldering (remelting) all connections in the circuit of a dead oscillator stage and in high resistance grid circuits is often well worthwhile when usual tests fail to show up the cause of trouble. Certain sets which were dip-soldered and which use printed circuits frequently show this trouble after a year or so of satisfactory operation.

We often find it necessary to remelt all connections in kits returned to our laboratory for repair. When we do this, we also

(*Continued on page* 30)

J. B. Straughn

From a talk by: Irvin D. Daniels

Chairman, 1958 GE All-American Awards Program

"In this dawning of the space age, it is obvious that the electron is the king of the future. What is perhaps not so apparent at the moment—and which needs pointing up—is that our very future depends on the men who will service electronic devices and keep them operating. Their job will be just as important as the job of the original designers of equipment."

"The television service man is a true American—of, by, and for the people. He is a man who must not merely solve highly intricate electronics problems—but must tailor the solutions to the personalities, needs, and desires of individuals."

"As a result, we have found that some of the best service technicians are men who participate in public and community service. They have built their reputations and their businesses not only through technical competence — but also by demonstrating their competence as community-spirited Americans."

"These pioneering 'grass roots electronic experts' serve in a sense above and beyond the call of duty. It is their combination of human and technical excellence that we wish to honor in this program."

Soldering Hints

(*from page 29*)

remove excess solder. This is easy to do. If you hold your iron tip so the solder runs onto it through gravity, you can pick up some solder from the joint on the tip of your iron. This solder should be flipped off the tip or wiped off on a cloth. The process is repeated until no more solder can be picked up. This will leave just enough solder to cover the leads, whose outline can be seen through the solder. Remember, use all the solder you want when making connections, but remove the excess!

Your iron needs all the heat it can put out when making new connections or remelting old ones. A tip covered with scale will not melt solder easily. Keep your tip clean and tinned at all times. Special tinning blocks on which you can rub the tip of an iron are a real help. Pushing the tip into a compressed wad of steel wool and rotating it also works well. The tip should occasionally be removed and scale scraped off the shank of the iron. When you do this, tap the iron barrel against the edge of the bench to remove scale in it. Refile and retin the tip when it becomes pitted. On solder guns, keep the tip clean and tinned and periodically tighten the nuts holding the tip leads in place. Inspect your iron each day before you begin work.

Use the best rosin-core solder you can buy. The best quality has a composition of 60% tin and 40% lead and is called 60/40 type. 40/60 type solder is 40% tin and 60% lead. 40/60 works but requires much more heat. Don't buy radio solder anywhere but a radio parts store unless the container is plainly *marked* Radio Rosin Core Solder. Acid-core solder is for use on pots and pans. It will permanently ruin any electronic equipment on which it is used. Also avoid *all types* of solder paste. Hardware and 10¢ stores may carry both rosin and acid core solder, but often they don't stock rosin core and the clerks usually don't know the difference between the two types. Many times a student has asked for rosin core and has gotten acid core, which has ruined valuable equipment. The container in which the solder came was undoubtedly marked acid core. Acid-core solder spits and gives off an acrid odor when melted. This is a sure sign you have solder unusable for electronic work.

When soldering, don't be afraid of using enough heat to make the solder melt completely. This is necessary for a permanently satisfactory trouble-free connection. Copper wires cannot be damaged by the heat from an iron or gun. Of course, the tip must touch only the joint. It must not touch any of the parts, and the barrel must be kept off parts.

When you solder a joint, heat will run out along the wires to the parts. This can damage some parts. Parts which can be damaged by heat conducted from a joint are germanium rectifiers, phono-crystal cartridges, transistors, and ½-watt resistors with a value less than 1000 ohms. The resistors may only suffer a small change in value, but the rectifiers, phono units, and transistors may be ruined. You can stop the heat from traveling along a lead to a part by holding the lead with a pair of pliers between the joint and the part. Then the heat will flow into the pliers instead of going to the part. We call the pliers a "heat sink" because the heat sinks into them.

Use the right soldering tool for the job. For general work, a solder gun is satisfactory, particularly on calls, because you don't have to wait for it to heat up before you start work, or wait for it to cool before you put it back in your tool kit. Don't try to use a gun on printed circuits—it gets too hot and will cause the copper plating to pull off the circuit board. Unlike a soldering iron, a gun continues to build up heat as long as it is on.

For bench work most servicemen prefer a 60 or 75-watt iron with a long thin (not over ¼") tip. 100-watt irons are also satisfactory. A gun can be used if you don't mind waiting the few seconds it takes to heat up for each connection you make.

For printed circuits, pencil-type irons ranging from 25 to 50 watts are ideal. A regular 60-watt iron can be used if you are very careful, but even this relatively small iron is too bulky for working in close quarters.

———*n r i*———

———*n r i*———

Too often the person who gets lost in thought does so because its unfamiliar territory.

The Golden Rules

It is said that if you wish to be successful, watch the ways of successful men. Most successful men have rules of living to which they cling tenaciously. Charles M. Schwab, noted industrialist, attributed his success to the following rules—his "Ten Commandments."

1. Work hard. Hard work is the best investment a man can make.

2. Study hard. Knowledge enables a man to work more intelligently and effectively.

3. Have initiative. Ruts often deepen into graves.

4. Love your work. Then you will find pleasure in mastering it.

5. Be exact. Slipshod methods bring slipshod results.

6. Have the spirit of conquest. Thus you successfully battle and overcome difficulties.

7. Cultivate personality. Personality is to a man what perfume is to a flower.

8. Help and share with others. The real test of business greatness lies in giving opportunity to others.

9. Be democratic. Unless you feel right toward your fellow-men, you can never be a successful leader of men.

10. In all things do your best. The man who has done his best has done everything. The man who has done less than his best has done nothing.

———nri———

———nri———

OVERHEARD

Maybe we should think about getting a new television. We've seen everything on the old one.

"Let's see — $5 for the call — one 5U4 tube — three diodes the kid swallowed ...."

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