JUNE—JULY 1949
VOL. 1—No. 3

KEN-RAD RADIO TUBES

Techni-talk on AM, FM, TV Servicing

THE HEAD-END—1

In the previous issues the television antenna together with its installation and typical problems were discussed. The television receiver will now be considered—not, however, as a single unit but as a number of separate units as shown in Fig. 1. This block diagram illustrates the different sections of a television receiver together with the types of signals found in each section. An effort will be made to describe the function performed by each section together with defects which occur and how to recognize them. In this way the technician can identify the section or sections which is causing a particular trouble and thereby establish an orderly trouble-shooting procedure.

The logical point at which to start is the section where the incoming signal first enters the receiver. This is the head-end which is usually an individual section mounted in such a way that it can be removed as a unit from the rest of the television receiver. The RF amplifier, mixer and oscillator are contained in this assembly and their operation is very similar in principle to the ordinary AM or FM receiver. It has been designed, however, to operate at higher frequencies and to pass at least the full 6 mc band width for each channel. The coils and capacitors used are much smaller than those used in AM receivers and the tolerances are more critical. Special tubes also have been designed to provide greater gain and stability at television frequencies.

The incoming signal which arrives at the receiver via the antenna and transmission line must be matched to the input impedance of the receiver, as was discussed in previous issues. In most cases this impedance is 300 ohms, however, some manufacturers use a 75 ohm input and others have provision for both impedances.

Let us follow the television signal through the head end of the receiver shown in Fig. 1. The channel selector is set to No. 3 and the signal having a 6-mc band width is similar in appearance to Fig. 2. The one or more RF amplifiers selects and amplifies the frequency for which it is tuned, i.e., 60 to 66 mc. The amplified signal is coupled to the grid of the mixer tube and at the same time the oscillator is generating an 87.65 mc frequency which is also coupled to the mixer grid. The sound carrier for channel No. 3 is 65.75 mc which when mixed with the 87.65 mc oscillator frequency results in a difference frequency of 21.90 mc (87.65—65.75).

The video carrier frequency of 61.25 mc when mixed with the oscillator frequency results in a difference frequency of 26.40 mc (87.65—61.25). The result at the plate of the converter tube is a curve similar to the one shown in Fig. 3. The audio carrier is now 4.5 mc lower than the video carrier whereas at the input to the converter it was 4.5 mc above it. There are a number of frequencies other than the picture IF and sound IF with associated sidebands present at the plate of the converter tube but these are not important due to the IF transformers being designed to pass only the IF frequencies and the trap circuits tuned to absorb most other unwanted frequencies. The sound frequency (21.9 mc) may be taken off at the plate of the converter tube or at some other point further along the IF strip depending upon the particular receiver design. In receivers using the intercarrier sound system the sound may not be picked off until it reaches one of the video amplifier stages. The oscillator frequency will vary in different makes of receivers, therefore, the sound as well as the video carrier frequencies, although 4.5 mc apart, will also be different. At the present time, however, the frequency of the oscillator is always higher than the channel frequency and the resultant curve at the mixer plate will have the same characteristics as Fig. 3 although the frequencies may be different.

RF amplifiers also help to prevent the oscillator frequency from feeding back into the antenna and acting as a miniature transmitter, thereby causing interference in other receivers.

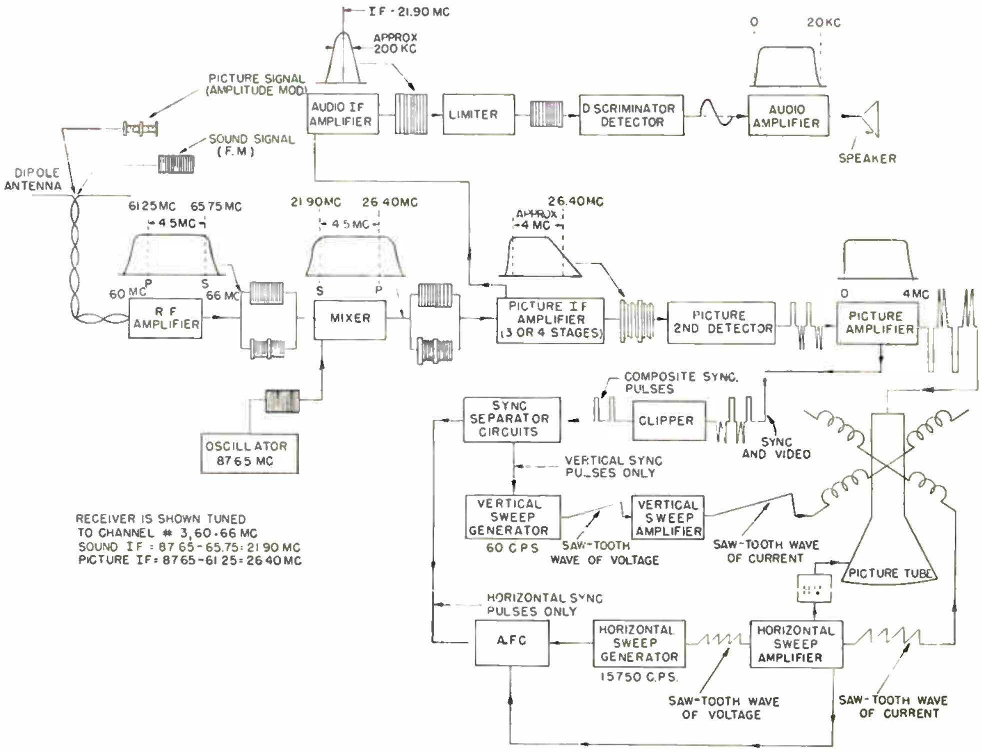

Fig. 1. Block diagram of typical television receiver

TUNING SYSTEMS

Tuning must be accomplished by varying simultaneously either the capacity or the inductance or both of the RF, oscillator and mixer circuits. There are a number of different types of tuning systems which can be broadly classified either as switch type or continuous tuners. The switch type is more generally used although it may in some cases become noisy after prolonged use. This type of tuner has the advantage of being very efficient due to the use of individual coils or transformers peaked for only one or two channels. Most service technicians will recall that AM push-button receivers which used individual coils for each push button generally had better reception on the push buttons than when the same stations were tuned in manually.

A typical example of a switch type tuner which uses individual coils and transformers is G-E Model 810 shown in Fig. 4. This receiver uses a separate transformer for each channel from 2 through 7. On channels 8 through 13 three separate transformers are used, each one having a band width broad enough to accept two television channels instead of one. The transformer windings are self-tuned by the distributed and tube capacities to provide maximum gain. Variable trimmers C5 and C6 are however shunted across the primary and secondary windings to permit compensation for misalignment resulting from differences in tube capacities when a tube change is necessary. On channel No. 2 the transformer is triple tuned to provide better image frequency attenuation of the 88–108 mc FM band. The switching arrangement is the same for the oscillator section i.e., individual coils for channels 2 through 7 and three coils for the six high frequency channels 8 through 13. The variable capacitor C80 is used as a fine tuning control on the lower six switch positions. On the upper three positions it tunes the oscillator to one or the other channel covered by that switch position.

Another type which uses individually tuned inductances arranged in series to form a resonant circuit for each channel is illustrated in Fig. 5 which is the head end used in G-E Model 805. As the switch selector is rotated

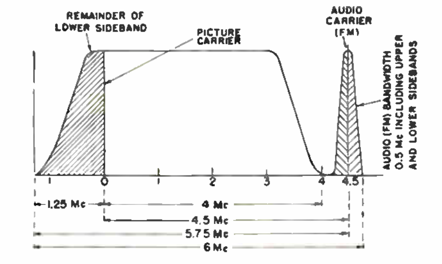

Fig. 2. Television signal up to grid of mixer tube

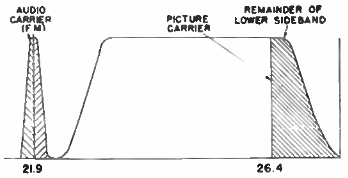

Fig. 3. Television signal at output of mixer tube

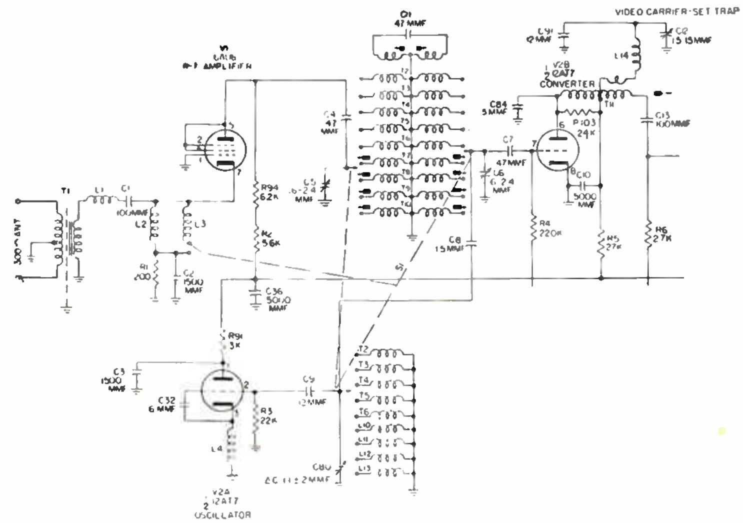

Fig. 4. Head-end of G-E Model 810

from channel 13 toward channel 2, additional inductances are switched in, resulting in a resonant circuit for each particular channel only. The fine tuning control C213 adjusts the oscillator for optimum reception.

A continuous type tuner uses a single coil to cover either the low frequency band (54 to 88 mc) or the high frequency band (174 to 216 mc) or both. A typical example of a continuous type tuner is the Belmont Model 21A21 which uses a permeability tuning system in which the band switch mechanically raises and lowers the iron cores and thereby varies the inductance of six different coils. Three coils are switched in on the low frequency band and the other three are in use only on the high frequency band.

The "Inductuner," manufactured by P. R. Mallory Company, uses a system which consists of three separate variable inductance units ganged together on a common shaft. This tuner varies the inductance by shorting out a part of each coil and covers all frequencies including the FM band from 44 to 216 mc. Receivers using the "Inductuner" usually have an input impedance of 75 ohms which means that the antenna system should have the same terminal impedance.

TROUBLE SHOOTING

Head-end trouble can be recognized as a condition which affects both the video and audio signals as is evident in the block diagram. Power supply trouble will also affect both the video and audio signals but this can be eliminated if the scanning raster is present, as shown in Fig. 6. Incidentally, in this figure we have tried to indicate photographically that the vertical retrace lines which are the diagonal white lines will be fluctuating up and down when trouble exists in the head end. This indicates a free running vertical oscillator. If however, these lines are steady as indicated in Fig. 7, the vertical oscillator is receiving the sync pulses and the trouble will be found somewhere between the point where the sync pulses are taken off and the picture tube. In the latter case the audio signal would be normal.

Tubes are one of the more frequent causes of trouble and at this time, only the tubes which affect both the video and sound should be tested. It is suggested that the technician have available a schematic diagram of either the specific receiver being serviced or a similar receiver which will indicate the chassis layout as well as the tube functions. Probably the best source of this information is the Rider Television Manual Volumes 1 and 2 which contain in general complete information on all makes and models of television receivers. As previously stated, the only tubes which should be checked at this time are the ones which may be causing the trouble in the head end. The reason for this is twofold: first, if the test is being made in the customer's home, the impression will be most favorable if you can locate the source of trouble and cure it immediately: second, by testing and replacing tubes in other portions of the receiver, the alignment or stability of some other circuit may be affected thereby making the job of localizing the trouble considerably more difficult.

Even if the tubes in the head end check satisfactorily, other new tubes should be substituted one at a time. This is particularly true of the oscillator tube which in some receivers may be very critical and operate only on the lower frequency channels. In this case it may be necessary to try several oscillator tubes before satisfactory operation is obtained on all high frequency channels. In some receivers when the RF tube is replaced it may be necessary to touch up on the RF alignment. If the trouble is other than tubes the chassis must necessarily be removed from the cabinet and probably it will be advisable to take the receiver to the shop for repair.

In receivers using individual coils for each channel, an open coil will of course only affect that particular channel. An open coil which covers either the low or high band will affect the whole band as in the previously mentioned Belmont Model 21A21. The "Inductuner" which covers from 44 mc to 216 mc would have little or no reception on any band. Receivers having a head end with series tuned inductances similar to Fig. 5, will operate on all channels above the one in which an open coil exists due to the circuit being completed by the switch arm. An open coil will, therefore, affect the operation of that individual channel plus all lower channels.

A resistance or voltage measurement will help to locate either a short circuit or an open coil assuming of course that these parts are accessible. In some receivers it may be necessary to remove the head-end unit in order to make these measurements. If it should be necessary to remove or repair the head end, every effort should be made to prevent any change in lead dress or placement of parts.

In the next issue trouble shooting in the head end will be continued as well as a discussion of the IF string including the IF intercarrier system.

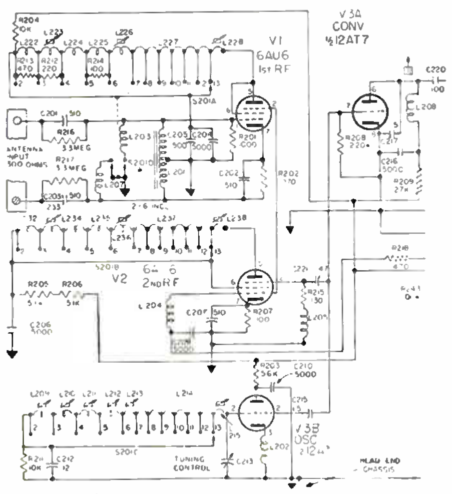

Fig. 5. Head-end of G-E Model 805

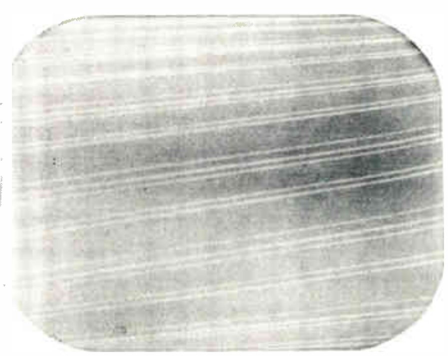

Fig. 6. Scanning raster indicating a free running vertical oscillator

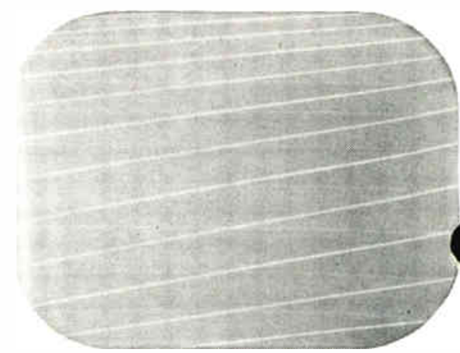

Fig. 7. Scanning raster stabilized by sync pulses

SELECTING AN OSCILLOSCOPE FOR TELEVISION SERVICING

Fig. 1. The new General Electric Oscilloscope Type ST-2A.

The oscilloscope has only recently come into its own as an indispensable tool on the serviceman's bench. Not too many years ago, it was found only in laboratories where its use was restricted to highly trained engineers and scientists. Since the use of an oscilloscope enables the user to virtually "see" into a circuit, it was only natural that it would find its way into more common usage. Along with its more common usage came a reduction in price as mass production techniques were used to build oscilloscopes. This process has been carried on until today good oscilloscopes can be purchased for the price of a good radio. As the sale of oscilloscopes became more competitive, it was natural that manufacturers began to look for ways of cutting costs of manufacture. Some of the results were good and, unfortunately, some were bad. It is the purpose of this article to point out important features of oscilloscopes and how to judge which oscilloscope will do the job for you particularly for servicing television receivers.

Let us turn our attention to the matter of specifications and how to interpret them. Oscilloscope specifications in part are usually written in the following manner:

Frequency Response

Vert. Amp.	X cycles to Y KC within 10%
Hor. Amp.	X cycles to Y KC within 10%

Sensitivity

Vertical	X volts rms/inch
Horizontal	X volts rms/inch

Let us stop for a moment and discuss just the first specification. Frequency response—X cycles to Y kilocycles within 10%—what does this mean? It merely means that a sine wave of X cycles (usually 20 cycles or thereabout) fed into the vertical or horizontal amplifier input terminals will give a certain deflection—let's say 2 inches. Now as the frequency is increased (but the input amplitude is kept constant) up to Y KC (say 100 KC or thereabout) the amplitude of the deflection produced does not change more than 10% (i.e., 2.1 to 1.9 inches). To the user this means that faithful reproduction of *sine* waves may be obtained throughout the above-mentioned range of frequencies.

But what if the wave is not a sine wave? This imposes an entirely different problem. Probably the best over-all test for faithful reproduction of non-sinusoidal waveforms can be made with a square wave. This is a wave that looks exactly like the name sounds. (See Fig. 2.) It basically consists of at least 30 harmonically related sine waves all combined to result in a square wave. Let us suppose that the fundamental frequency or repetition rate of the square wave is 15,750 cycles (television horizontal sweep voltage frequency). Since we have previously stated that the square wave contains up to the 30th harmonic of the fundamental this would mean our 15,750 cycle wave has harmonics up to 30 × 15,750, or 472,500 cycles. For the scope amplifier to faithfully reproduce this wave it must have essential flat sine wave response to 472,500 cycles!

But the problem does not end there—we have said nothing about transient response. Transient response is a rather high-powered sounding term, so let us break this down into

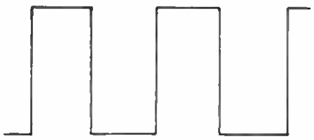

Fig. 2
Ideal Square Wave

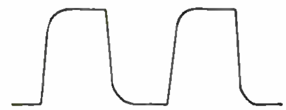

Fig. 3A
Distortion representing loss of high frequency components

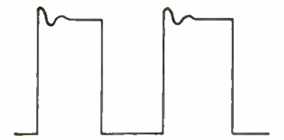

Fig. 3B
Distortion representing over-shoot, high frequency components too prominent

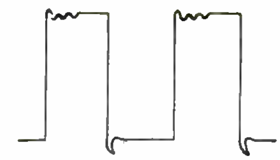

Fig. 3C
Damped oscillation on square wave

simpler and more useful terminology. First, let's compare visually the appearance of a sine wave and a square wave. The former has all rounded corners and no abrupt changes, whereas the latter is nothing but a series of sharp corners and straight lines; in other words, the square wave has rapidly rising leading edges or, conversely, rapidly declining trailing edges, whereas the sine wave has relatively slow changes. Engineers speak of these rapidly rising or declining edges as steep wave fronts. Now to the amplifier the steep wave fronts present quite a problem. The input capacities of the tubes or stray wiring capacity tend to prevent the grid from following the abrupt change and any lead inductances get all excited when they see such a wave coming. Instead of following the wave exactly, they subtract a portion of the sharp corner, or they may even do worse and add a little peak at the corners. (As shown in Fig. 3A & 3B.) To explain why these stray capacities and inductances do these things is beyond the scope of this article so it is sufficient to say that they do present problems if not properly handled. Out of all of this, we begin to see that specifications which mention frequency characteristics in terms of sine wave response only, does not insure good reproduction of complex waves. Something more must be added. As stated before, one convenient way of conveying more information is by stating the range of frequency over which a good square wave may be amplified without distortion thusly: Square response 20 cycles to 15 KC. Accordingly it can be said that an oscilloscope to be satisfactory for complete television servicing should have a sine wave frequency response (vertical amplifier) essentially flat from 30 cycles to 300 KC and a good square wave response from 60 cycles to at least 15 KC.

There is still one other important feature regarding frequency response to consider before the matter is dropped. This is the matter of attenuation. Many oscilloscopes now on the market are rated in terms of frequency response at full gain and/or minimum attenuation. At half gain the response may be something entirely different. Practically always in the case of very inexpensive gain controls, the frequency response drops off with a decrease in the setting of the gain control. If the signal to be observed is a high frequency *sine* wave, the effect is not too serious—it simply means that as the gain is decreased, the amplitude on the cathode-ray oscilloscope tube screen drops very rapidly, much more rapidly than if the signal was a low frequency sine wave. But consider for a moment what happens to a square wave as the gain is varied. We have previously stated that a square wave consists of as many as 30 harmonically related waves hence we immediately see that in this case as the gain control is decreased not only the amplitude of the entire square wave is decreased but certain high frequency components of the wave are decreased more in proportion and instead of reproducing the square wave we would get something that looks like the three configurations shown in Figures 3A, 3B and 3C. From this we learn to look at the specification on response carefully —does it mean at full gain setting only or at any gain setting? Needless to say, the scope that does not change its frequency response with gain setting is the better.

The above discussion had been limited mainly to the response of the vertical amplifier. All of the above statements hold equally true of the horizontal amplifier, but the importance is not nearly as great, as the horizontal amplifier is nearly always used to amplify the oscilloscope sweep voltage and it need only be sufficient to pass this voltage without distortion.

Let us now turn our attention to the matter of sensitivity. In general, the more sensitivity in the scope amplifiers, the more useful they become. (Again, this is particularly true of the vertical amplifier.) As shown above, scope amplifiers are usually rated as x volts rms/inch which means, with x volts rms of signal impressed on the input terminals, one inch of deflection will be produced (gain at maximum). For some applications in television servicing, high sensitivity is not necessary as large voltages are available in certain circuits in the receiver chassis, but for the all important single stage or head-end alignment, smaller voltages are all that are available and a scope with high sensitivity is essential. In general, an oscilloscope with a vertical amplifier sensitivity of from .01 to .1 volts rms/inch is satisfactory for complete television servicing.

Another all important specification of the oscilloscope is input impedance, again particularly of the vertical amplifier. This rating is usually given as so many ohms shunted by so many mmfs capacity. Needless to say, the higher the resistance and the lower the capacity the better. It is easy to understand why this is important—simply to prevent excessive loading by the oscilloscope of the circuit under test. A simple analogy presents itself: Consider the man who attempted to measure the high voltage on the picture tube of a receiver with a 1000 ohm per volt voltmeter. Naturally, the answer he got was erroneous because of the loading effect of the volt-meter. The same is true with certain circuits contained in a television receiver into which the oscilloscope may be connected. Many scopes now on the market are provided with low capacity, input probes. These have long been useful, and for complete and accurate television servicing are an essential. Desirable input impedance for such a probe should be at least 1 megohm resistance shunted by not more than 10 mmfs capacity.

Practically all service notes show wave forms of several types. The ones usually shown are the sync and sweep voltage configurations at various stages in the receivers. Along with the configurations usually there are given voltage amplitudes. The problem now arises as to a method of measuring these voltages. The obvious way is with a calibrated oscilloscope. Many scopes have incorporated internally a means for calibrating the amplifier. This feature is certainly convenient but not absolutely necessary as an external means (audio oscillator and voltmeter) may be used to calibrate any scope.

It has been mentioned that the scope is a useful instrument for hum tracing. Indeed it is, provided the scope itself is free from inherent hum. Unfortunately, this is one characteristic that is rarely mentioned by the manufacturer in his specifications. On the other hand, it is fortunate that this characteristic can easily and quickly be checked by the user or the prospective purchaser. The input terminals of the vertical amplifier should be shorted and the sweep set at something below 60 cycles. The vertical gain control should be varied throughout its range. Any hum present in the oscilloscope itself will now be present on the screen. The amplitude of the hum should not exceed 1/20 inch in order to be negligible under normal use.

Below are listed specifications for the General Electric Type ST-2A Oscilloscope. This unit, pictured on previous page, has been designed to meet all requirements for television servicing.

Frequency Response

Vertical Amplifier

Probe and AC—20 cycles to 500 KC +0 −20%. Square wave response 60 cycles to 40 KC at any gain setting, 20 cycles to 1 mcs +0 −50%.

DC −0 to 500 KC +0 −20% at full gain setting.

Horiz. Amp. 0 to 100 KC +0 −20% at full gain setting.

Sensitivity

Vertical

1. AC input .015 volts rms/inch
2. DC input 2.0 volts DC/inch
3. Probe .20 volts rms/inch

Horizontal—1.0 volts DC/inch (.35 volts rms/inch)

Input Impedance

Vertical

1. AC input—1 megohm shunted by 36 mmf
2. DC input—1 megohm shunted by 80 mmf
3. Probe—1 megohm shunted by 10 mmf

Sweep Range

10 cycles to 100 KC is six ranges

Synchronization—Internal, external, or power line

Calibrating Voltages—.3, 1.5, 3, 15, 30, 150, and 300 peak to peak volts.

Power requirements

105–125 volts AC, 50–60 cycles 100 watts.

Physical Specifications

15½ inches high
10 inches wide
17 inches deep
43 pounds weight

HOW TO GET THE MOST OUT OF YOUR TEST EQUIPMENT

In the previous articles we discussed the volt-ohm-milliammeter and the tube tester. In this issue the capacitance-resistance bridge will be examined.

THE CAPACITANCE-RESISTANCE BRIDGE

This is unquestionably the most useful instrument on the service bench for locating intermittent condensers as well as condensers which are about to either short or become intermittent. For the service technician just starting in business this instrument can be invaluable in establishing a reputation for fixing "intermittents" and "lemons" which will be discussed in detail later on.

RESISTANCE MEASUREMENT

Fundamentally most capacitance bridges operate on the Wheatstone bridge principle similar to the circuit shown in Fig. 1. If the switch is closed current will flow through every possible path from A to C. The path through which the most current will flow depends upon the resistance in each path. If all of the resistors shown are equal in value, the voltage drop across each resistor will also be equal. Therefore, if we assume that the applied voltage is six volts DC there will be a voltage drop of three volts across each resistor. However, due to there being an equal voltage drop across RA and RS there will not be any voltage difference between points B and D, and therefore, no current will flow between these two points. This represents a balanced bridge circuit. If however, RX is larger or smaller than RS the voltage drop across each of these resistors will change and the potential between points B and D will also change from zero volts to either a positive or negative voltage. There will also be a current flow indicated on the galvanometer "M" connected between these two points, and the circuit will be unbalanced.

Now let us assume that RA is 5000 ohms and RB is 1000 ohms and RS is 50 ohms and RX is 10 ohms. The ratio of RA to RB and RS to RX is the same or 10 to 1 in each case.

We know from Ohm's law $\left(I = \frac{E}{R}\right)$ that more current will flow from A to D to C $\left(\frac{6v.}{60\Omega} = .1 \text{ amp.}\right)$ than from A to B to C $\left(\frac{6v.}{6000\Omega} = .001 \text{ amp}\right)$. However, due to the voltage drop across RS ($E = IR = .1$ amp. $\times 50\Omega = 5.0$ volts), being the same as the voltage drop across RA (.001 amp.$\times 5000\Omega = 5.0$ volts), the voltage between B and D will be zero and again no current will flow between these two points.

In order to obtain a balanced condition, the ratio of any two adjacent resistors must equal the ratio of the other two resistors.

Therefore: $\frac{RA}{RS} = \frac{RB}{RX}$ and $\frac{RA}{RB} = \frac{RS}{RX}$ or $RA \cdot RX = RB \cdot RS$ and from this we obtain the equation: $RX = \frac{RB \cdot RS}{RA}$. From this we can see that a bridge circuit can be used to determine the value of an unknown resistance RX if RS is calibrated and varied until the circuit is balanced, as indicated by a zero reading on meter "M." The range of this bridge circuit can also be extended by switching in other fixed resistors which will change the $\frac{RA}{RB}$ ratio.

CAPACITY MEASUREMENT

An accurate measurement of capacity can be obtained by using an AC voltage source and changing the two resistors RS and RX to a calibrated condenser CS and an unknown capacitance CX as shown in Fig. 2. Earphones or some other AC null indicator must be substituted for the galvanometer "M."

Another condenser bridge circuit is shown in Fig. 3 in which a variable resistor RS is calibrated in capacitance. The impedance across RS CX is balanced against the impedance of RA CB. The range is varied by a switch arrangement which connects condensers of different values into the circuit.

The circuits shown are general in character and are used merely to indicate basic fundamental circuits. Commercial instruments usually use some variation of the Wheatstone bridge, but due to the various switch arrangements and circuit refinements can not be easily recognized as such. Some instruments are also designed to measure inductance, the turn ratio of transformers as well as resistance. The inductance measurement would be particularly valuable if it were necessary to rewind a coil to replace one not otherwise available. Numerous tests to determine the quality of condensers are also incorporated. Complete information on the various tests is given in the manufacturer's instructions.

USING THE RESISTANCE CAPACITANCE BRIDGE

The Rider Survey conducted a few years back indicated that only about 50% of the service technicians who were in business 10 years or less owned capacity testers. This would indicate that a considerable number of technicians are not familiar with the practical value of this instrument.

Every technician, however, is familiar with the number of receiver defects which are directly due to leaky, open or shorted capacitors. It may not be too difficult to locate an open capacitor by bridging each one suspected of being open with a good condenser or by using the ohmmeter to detect one that is shorted. This type of test however, will rarely indicate a condenser which is intermittent or one that is leaky to the extent that it may break down a few hours after the set is returned to the customer's home. The condenser tester will, when properly used, pick out these condensers, as well as any others that may cause trouble in the near future.

Intermittent midget sets usually have only a half dozen paper condensers which can be tested in a matter of five or ten minutes, and it usually doesn't take any more than fifteen or twenty minutes to check the critical condensers in larger receivers that may cause trouble., e.g., those having over 50 volts applied, plus those in the AVC circuit.

Some makes of receivers use either poor quality condensers or condensers which are being operated at voltages too close to or exceeding their working voltage. It is advisable in these sets, which the technician will soon learn to recognize, to check every paper condenser, and replace every one which does not check perfect. A good indication of the general condition of condensers in any particular receiver can usually be obtained by checking the audio coupling condenser in the grid circuit of the output tube and the by-pass condenser in the plate circuit of the same tube. If these condensers are defective or have been replaced, it is advisable to check at least a few of the other paper condensers.

If you are contemplating the purchase of a condenser tester, keep in mind that the speed and accuracy of such an instrument are very important. Prior to actual purchase, several makes should be compared either by reading the operating instructions or by making actual tests primarily of leaky condensers. The instrument which has been found most practical is the type which indicates a leaky condenser at the same time that the capacity is being checked. When making this test, the dial is rotated until the eye opening reaches its peak. If a condenser is leaky the edges of this opening will be fuzzy and the eye will not open to the full width. This is one of the most important features that a condenser tester can have since it eliminates the necessity for making a separate time consuming leakage test.

FILTER CONDENSERS

The filter condensers should be tested on every receiver which is being repaired and replaced whenever necessary. Loss of capacity, high power factor, and high leakage current will materially affect the operation of a receiver. Some discretion must of course be used on the replacement of higher priced parts which may be defective but still usable. A customer will usually balk at a charge which approaches either the original or the replacement cost of a receiver. It is almost always advisable to obtain the owner's permission before replacing parts which may amount to considerably more than originally anticipated.

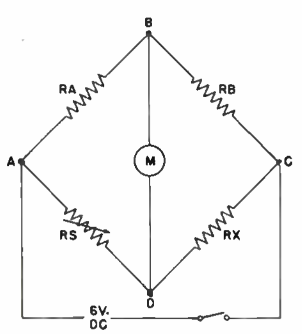

Fig. 1. Wheatstone bridge for measuring resistance

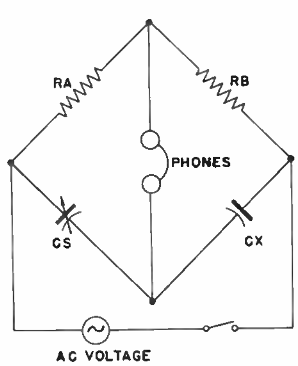

Fig. 2. Bridge circuit for measuring capacitance

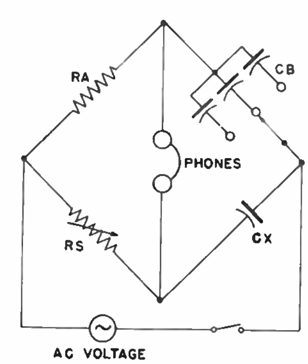

Fig. 3. Another capacity indicating bridge circuit

BENCH NOTES

Contributions to this column are solicited. For each question, shortcut or chronic-trouble note selected for publication, you will receive $10.00 worth of electronic tubes. In the event of duplicate or similar items, selection will be made by the editor and his decision will be final. Send contributions to The Editor, Techni-Talk, Tube Division, General Electric Company, Schenectady 5, New York.

TWIN LEAD CONNECTORS

Surplus crystal holders having half-inch spacing make wonderful connectors for 300 ohm flat line. Merely saw off the top of the holder, remove the crystal leads, and insert the two legs of the flat line into the empty pins. The spacing is almost perfect. These holders, containing crystals ground to unusable frequencies, are available at surplus houses at a very low cost. Any standard crystal socket will complete a neat transmission line termination.

—Ted Miner, Cleveland, Ohio

SELENIUM RECTIFIER TROUBLE

In many cases a General Electric Model 140 Radio will play on battery but not on AC. When this occurs, it may be due to the internal resistance of the selenium rectifier increasing with age. The effect is to increase the filament series resistance to the extent that the voltage drop across one of the tubes, generally the 1U4, IF stage, is too low to heat the filaments sufficiently to cause good emission. A simple check, to locate the trouble, is to shunt a 2000 ohm resistance across R-14, momentarily; R-14 being a 1200 ohm resistor which connects the two sections of the dual 40 MFD filter condenser. If the radio plays with the shunt in place, and stops when it is removed, look for trouble in the rectifier.

—Henry C. Gates, San Antonio, Texas

HI-LO TV RECEPTION

In any area having stations operating at both ends of the TV bands it is urged that two separate transmission lines be used—one from the low-frequency antenna and one from the high-frequency antenna.

Both transmission lines should be twisted at least one turn per foot along the length of the line. Keep the lines at least one foot apart and peg them down every four feet or so.

When the installation has been completed run ONE hand backwards along the transmission line slowly away from the receiver terminal posts. A spot will be found three to six feet along the line where the picture will brighten up considerably.

At this point wrap a piece of tinfoil snugly around the 300Ω line. Tape it temporarily (not securely).

Assuming that you have been working on the high-frequency station, now switch to the low-frequency station and repeat the process, that is place another piece of foil around the low-frequency transmission line at the point where the picture is brightest. The foil can be taped permanently at this point.

Return to the high-frequency station and note whether the point of peak reception has shifted (it will have varied slightly). Re-locate the foil and tape it neatly and permanently at its new location.

No switching arrangement is necessary and both transmission lines can be connected together at the receiver terminal posts if the above is followed carefully. Any metallic foil can be used. The writer uses cigarette package foil.

—John F. Cashell, Dorchester, Mass.

POOR RECEPTION ON SHORT WAVE BAND

The Philco 42-1010 has a low impedance loop consisting of two turns. Three leads come from the loop, one from each end and one from the center of the loop. When the set is turned to the short wave position, two of the loop terminals are grounded, so that one half of the loop is absorbing and grounding most of the signal.

The easiest way to remedy this situation is to disconnect No. 3 connection inside the chassis. (Note: this connection is used only on short wave position.) Then it is necessary to remove about three turns from the short wave shunt coil in order to compensate for increased loop inductance.

The short wave sensitivity will now be maximum, and at least 8 or 10 times greater than it was previously.

—Jerry Sabin, Tampa, Florida

NO FM RECEPTION

Set: Farnsworth GV 086
Complaint: Does not work on FM

In checking it was found that all tubes received a bias of ± 50 V when band switch was in the FM position. This was caused by a type 6SV7-GT tube used as third FM IF amplifier oscillating, due to it not being sufficiently shielded. Replacement with a G-E metal type 6SV7 cured this complaint.

—William G. L. Vanderhaas, Mobile, Ala.

JOHN Q. PUBLIC BUYS TV SET

The following excerpts were taken from letters written to dealers by purchasers of TV sets:

"I was told my antenna would be strung up today and all your men did was put up a pole with metal sticks on it."

"My picture has slipped down on the screen, please send someone to push it up."

"My husband tightened up all of the loose screws on the back of the set and it still doesn't work."

"Can't you get the television down from the roof without the big wax cable? Send it down by radio or something?"

"After 11:00 p.m. all I get on my set is a big white spot."

"What is this, the food business? My service man says I have a herring bone in my picture from a ham. I bought a television set—not a refrigerator."

Electronics Department
GENERAL ELECTRIC Company
Schenectady 5, N. Y.

Sec. 562, P. L. & R.
U. S. POSTAGE
PAID
Schenectady, N. Y.
Permit No. 148

Boyd's Radio Service
411 Fredericksburg Rd.
San Antonio 1, Texas
E-223/J-75

6-13-

POSTMASTER: If addressee has moved and new address is known, notify sender on Form 3547, postage for which is guaranteed. When Form 3547 is sent abandon this mailing. Return only if no correct address is available.