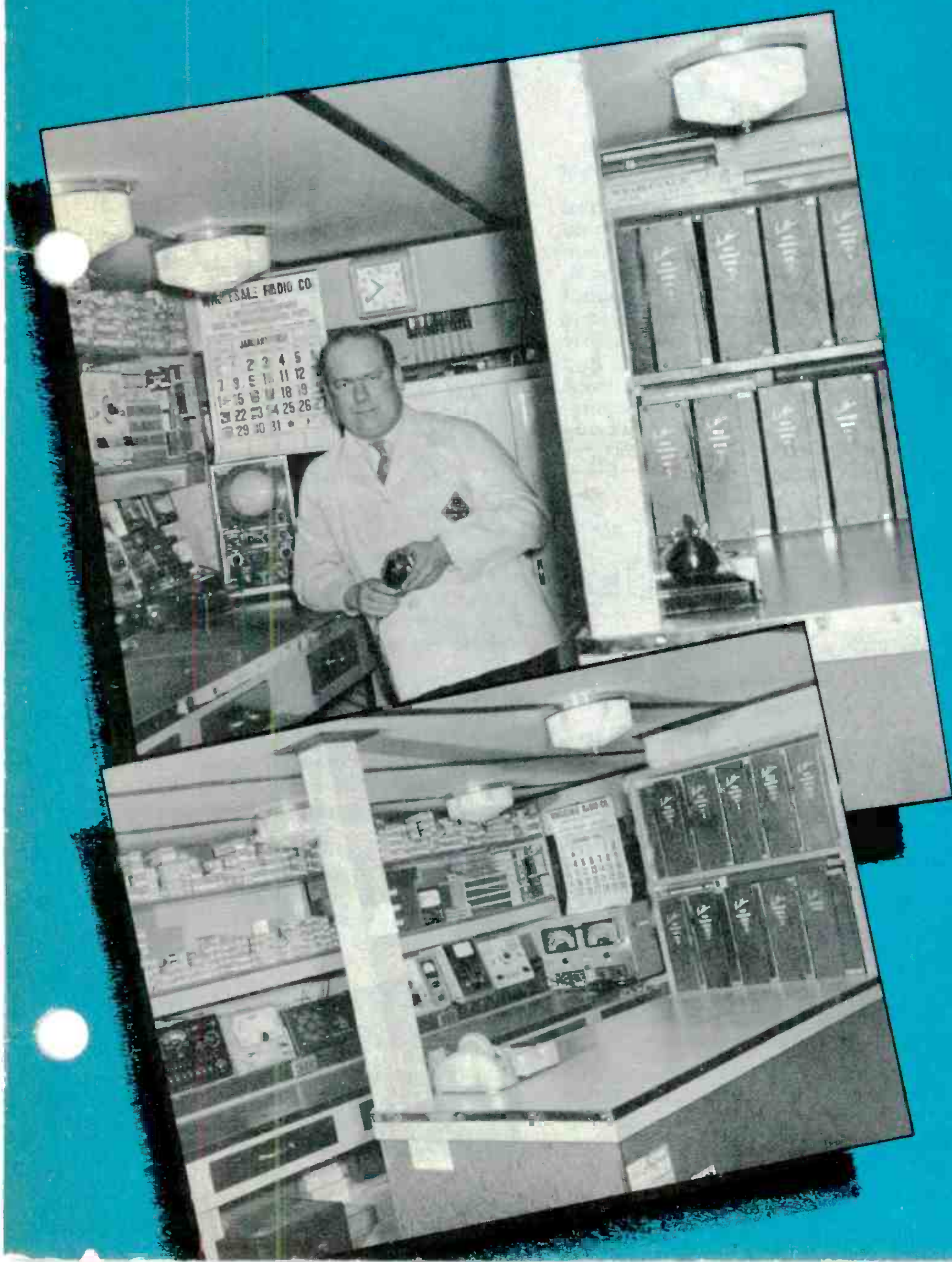
PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

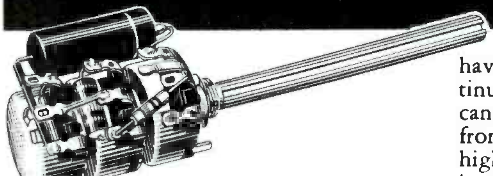
MAY • 1951
including
INDEX No.
26
COVERING PHOTOFACT
FOLDER SETS 1 THRU 134



CONTENTS

10¢

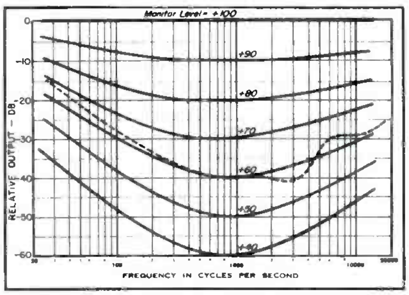
HOW TO ASSEMBLE LOUDNESS CONTROLS FOR HI-FI TONE AT ANY VOLUME LEVEL WITH IRC Q CONTROLS AND MULTISECTIONS



IRC Continuously Variable Loudness Control for Accurate Compensation in Most AM, FM, TV Sets

Here, at last, is a simple Loudness Control that actually lets the listener hear every tone with almost perfect balance—even at whisper level! It is available as a completely assembled unit, stock No. LCI or you can assemble it yourself economically, in just a few minutes, with a few standard parts obtainable from your IRC Distributor. You can install it in most audio systems as easily as you would an ordinary volume control. And you can use it to "upgrade" your service sales—because it's the very thing your customers have wanted for years.

Compare the Performance of This New Loudness Control with That of Any Other Compensating Device



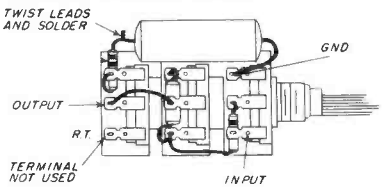
Tapped volume controls—stepped-type loudness controls—bass and treble boost circuits—you've probably tried them all at one time or another. And you probably found that none of them gave the performance of a true continuously variable loudness control.

Tapped volume controls afford compensation only when contactor is at the tap. For wider spread of compensation, two or three taps must be used—which makes the controls more difficult and expensive to manufacture. Stepped-type controls permit considerable change of volume between steps, but do not provide full flexibility of adjustment. Also, they are relatively expensive. Bass and treble boost circuits require multiple adjustments with change of volume for ideal compensation.

The new Loudness Control, originated by IRC, *does* what these other devices have failed to do. It is the only continuously variable loudness control that can be easily and inexpensively assembled from standard parts. With it, you boost highs and lows automatically as volume is decreased—maintain depth and brilliance of tone—without expensive taps or multiple adjustments. The chart at left shows response curves for control at various listening levels.

Here Are All the Parts You Need to Assemble the New IRC Loudness Control

IRC's small 15/16" Q Control and original Multisections combine with 2 Advanced BT Resistors and 2 capacitors to form the most efficient loudness control you've ever seen. This is the same Q Control with adaptable fixed shaft feature that technicians have widely used to satisfy most replacement requirements. And Multisections for months have provided an easy answer to ganged control requirements. More than likely you've already used IRC's Q Controls and Multisections to assemble standard duals.

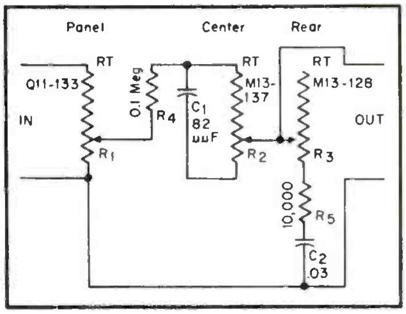


Here's How Easy It Is to Assemble the New IRC Loudness Control

Assembling the new IRC Loudness Control is simplicity itself. A glance at the pictorial schematic above will show you how completely easy it is. Here's all you do . . .

Fasten two specified Multisections to Q Control, as shown, attaching them just as you would switches. Assemble the additional parts—2 BT resistors and 2 capacitors—and make all connections as shown in the diagram. Type 76-1 or 76-2 switches may be added if required. Cut shaft to required length and wire into any high gain audio amplifier.

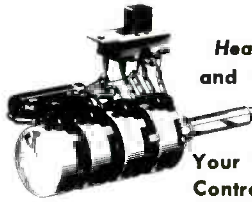
That's all there is to it. In a matter of minutes, using no special tools, you've assembled a really efficient loudness control that suits most Radio and TV sets.



Only 3 Connections Needed to Install Control. No Special Taps or Complicated Circuits Required

The above diagram of the IRC Loudness Control shows not only the simplicity of design—but the ease of installation as well. Actually, there are only 3 connections—IN, OUT and C or GROUND. It's as easy to wire into most audio systems as an ordinary volume control would be.

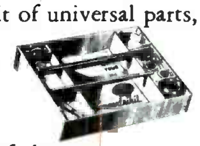
With only a few exceptions, the new IRC Loudness Control can be used to improve tonal quality in record players, amplifiers, AM and FM radio and television sets.



Hear for Yourself—and Convince Your Customers. Assemble Your Own Loudness Control Demonstrator

Every customer, who puts up with ordinary uncompensated volume control, is a prospect for the new IRC Loudness Control. This inexpensive, easily-assembled loudness control demonstrator unit will help you convince them *and sell them*. You can build it yourself—quickly and easily—with IRC's CONCENTRIKIT.

This is the simple kit of universal parts, which you may already have used to assemble concentric duals. As for instructions, we'll furnish them—free of charge.



Your request on a penny postal card will bring you full step-by-step directions for assembling the IRC Loudness Control Demonstrator Unit. We'll also be glad to send you any further information you may wish on the Loudness Control itself.

Pick of the Trade

ANTIQUE BRASS

"From the Army's top level comes the proposal that, in times of emergency, FM and TV stations should be closed down, and only AM broadcast transmitters be allowed to stay on the air. But we seem to recall that Jap planes shot down in the attack on Pearl Harbor were found to have receivers tuned to one of the local AM stations."

MILTON B. SLEEPER, Editor
FM-TV, Radio Communication
See March 1951 Issue

* * *

"During our present emergency the use of only first-class quality material will pay out. It pays big dividends to the radio technician in the end.

"At best from now on the service technician will be continuously harassed and his time will become more precious as long as the emergency lasts."

HUGO GERNSBACK, Editor
Radio-Electronics
See April 1951 Issue

* * *

"*Magnetic Recording Units* having a retail value of $15,000,000 were produced during 1950 by 46 licensees of Armour Research Foundation."

* * *

DISTRIBUTORS AND THE SERVICE MAN

"Too often the importance of the distributor is discounted by the Service Man. Actually, his value to the shop is inestimable.

"It is the distributor who provides that important component or accessory at the right time. He's the man who follows through on the shipments and sees to it that his shelves are stocked with the merchandise required for that installation or servicing call.

"His trained sales personnel often provide the Service Man with vital application guidance. It is the distributor who even assumes the credit responsibility for the service shop.

"The distributor is a true friend of the Service Man and his shop!"

LEWIS WINNER, Editor
Service Magazine
See March 1951 Issue

PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

VOL. 1 • NO. 3 MAY, 1951

JAMES R. RONK, *Editor*

Editorial Staff: Merle E. Chaney • Robert B. Dunham
W. William Hensler • Ann W. Jones • Glenna M. McRoan

Art Directors: Anthony M. Andreone • Thomas Culver

Production: Archie E. Cutshall

Printed by: The PHOTOFACT Press; Joseph C. Collins, Manager

PHOTOFACT *and* PF INDEX *Trademarks, Reg. U. S. Pat. Office*
Circulation: First Printing, 75,000 Copies

CONTENTS

HOWARD W. SAMS, *Publisher*

2201 East 46th Street • Indianapolis 5, Indiana

The PF (PHOTOFACT) INDEX is published every other month by Howard W. Sams & Co., at 2201 E. 46th Street, Indianapolis 5, Indiana, and is available from PHOTOFACT Distributors in the United States and Canada.

ABOUT THE COVER: The photograph is of R. D. Cichy, proprietor of a service shop in Belding, Michigan. Mr. Cichy writes: "Here is an actual 'unsolicited' letter of praise for Sams' Photofact services. I am the guy who always wonders how much was paid for so-called unsolicited testimonials. To keep it short, my business would soon become very tedious if it were not for your most practical way of furnishing service data. Keep up the good work. Enclosed is a photo of what you might call a Sams' shop. Your full set of manuals is one of the most important parts of my shop and as you can see I like to have all I can of it in view of the public."

MILTON S. KIVER

President, Television Communications Institute

Shop Talk

"WHAT TEST EQUIPMENT WILL I NEED AND HOW MUCH MUST I SPEND FOR IT?" is the big problem confronting every technician contemplating television servicing.

The answer to the first question has been given many times and is well known by now. Basically, you need a VTVM, an oscilloscope, an AM signal generator, and a sweep signal generator. If you wish to measure high voltage, a special probe can be bought for the VTVM which will accomplish this job. The same can be said of a high frequency probe. So if you want the absolute minimum, there you have it.

The answer to the second question has not received as much attention as the first, although, to a great extent, it is the more important of the two. While the TV service aspirant can usually figure out what he might need in the way of equipment, he does not know how low he dare go in price and still obtain something worth while. The emphasis here is on low priced equipment because if you can afford a Hickok 610A, or a Simpson Genescope, or a Precision 400-C, or an RCA scope, and others of similar quality, then by all means go out and get them. In test equipment, as in most other items, you get only what you pay for.

The major problem, as the writer sees it, concerns the man who has limited capital to spend, yet who wants to get as many different items for his few dollars as he can. With this in mind, let us examine each of the above mentioned basic instruments and see what you should try to get for your money.

VTVM. The VTVM has been around long enough by now to have become quite standard in design. You will readily discover, after some investigation, that nearly all such units employ some form of bridge circuit and that the differences in prices stem primarily from certain refinements that have been added to the instrument. Thus, one VTVM will contain a zero center scale, another will possess an extra Db scale, a third will have a special high frequency probe capable of RF measurements up to 300 mc, etc.

Most of the refinements are good to have and will, to a certain extent, make your servicing tasks easier. But 90 per cent of your TV service work deals with resistance and voltage checks - and so you have to settle in your own mind whether certain refinements are worth the extra money you have to pay for them. If you feel that you are only concerned with the work this meter will have to perform 90 per cent of the time, then get a unit which has only a DC volt scale, an AC volt scale, and a resistance scale. And you will find that it answers your purpose. But if you feel that you should have one with the additions mentioned above, then adjust your budget to include one of these.

OSCILLOSCOPES. The range of prices that you will encounter in oscilloscopes will be more extensive than those of VTVM's. Yet here again you are dealing in circuit refinement rather than basic circuit difference. An expensive oscilloscope will possess high gain and wide frequency response. A less expensive unit will have a frequency response (in its vertical amplifiers) perhaps up to 100,000 cycles and require possibly .2 of a volt input for one inch deflection on the screen. This means that more signal will have to be pumped into the circuit in order to obtain a sizeable pattern.

There is considerable controversy about the bandpass of the vertical deflection amplifiers and how wide this should be for television servicing. For ordinary servicing, where you are generally interested more in determining whether the video signal is present rather than how rectangular its sync pulses are, a frequency response to the vicinity of 100,000 cycles will suffice. The same is true of the vertical and horizontal sweep systems of the TV receiver where the fundamental frequency of the deflection voltages are quite low (vertical 60 cycles, horizontal 15,750 cycles). As the bandpass increases, the pulses more nearly approach their rectangular form. But greater bandpass means lowered gain and to offset this reduction, more amplifiers are needed. Which, in turn, raises the cost of the instrument.

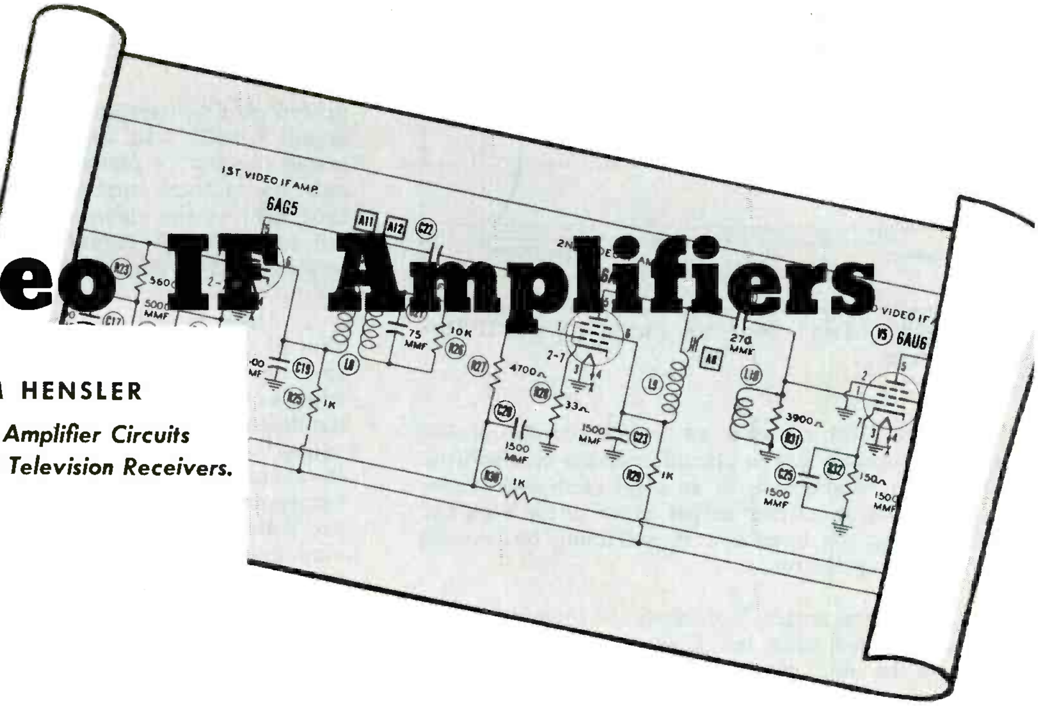
The chief difficulty you will find in low priced oscilloscopes is obtaining one which will give you a sizeable deflection for a moderate input voltage. Pay particular attention to this point because nothing will hamper your service work more than dealing with a small pattern and trying to figure out whether it conforms to the recommended shape or not. Forego a little vertical amplifier response - but try to get as high a deflection sensitivity as possible for the amount of money you can afford to spend.

SIGNAL GENERATORS. The problem of the AM signal generator and the sweep generator can be considered at the same time because they serve a common purpose - to help in aligning the various TV circuits. To gain a better appreciation of the job these instruments must do, let us briefly consider the character of the tuned circuits in television receivers.

In the RF and video IF stages you will find wide-band amplifiers designed to pass a band of frequencies from 3 to 6 mc wide. Obviously, to properly

♦ ♦ Please turn to page 49 ♦ ♦

Video IF Amplifiers



by W. WILLIAM HENSLER

A Discussion of Video IF Amplifier Circuits Employed in Commercial Television Receivers.

In order to understand the requirements of video IF amplifier systems, the nature of the signal which the amplifier must handle should be taken into consideration.

The video carrier is an amplitude modulated signal with approximately 4 mc as the maximum modulation frequency. In conventional double side-band transmission, an 8 mc bandwidth would be required to transmit this signal. Since the allocated TV channel is only 6 mc wide, it is obvious that the double sideband method cannot be employed.

It is possible, however, to transmit this intelligence using single sideband transmission. This is accomplished by filtering out one of the side bands at the transmitter. In actual practice, a high pass filter is usually placed in the transmission line between the transmitter and the transmitting antenna, thus filtering out the lower sideband beyond a point approximately 750 kc from the video carrier frequency. This type of transmission is known as "vestigial" sideband modulation, since only a small part, or "vestige," of one sideband is transmitted.

Figure 2-1 shows the frequency distribution at the output of a transmitter operating on Channel 6. The video carrier is 1.25 mc above the low end of the channel, and the sound carrier is .25 mc below the high end of the channel, making the sound and video carriers 4.5 mc apart.

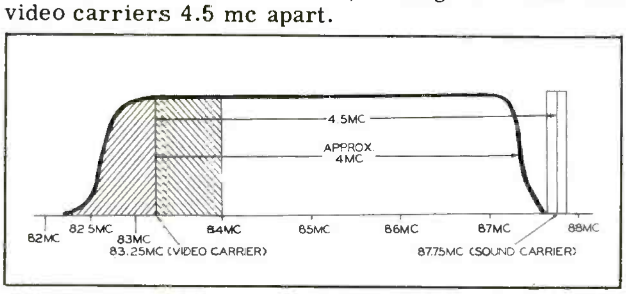


Figure 2-1. Frequency Distribution of a Channel 6 TV Transmitter.

The shaded portion to the right and left of the video carrier represents that part of the signal which has double sideband transmission. In other words, all modulation frequencies below 750 kc will be transmitted with twice the power as compared to those above 750 kc.

If special precautions are not taken in the design and alignment of receiver video IF amplifiers, the lower frequencies will be over-emphasized, resulting in poor picture reproduction.

Referring again to Figure 2-1, it can be seen that in order to utilize the complete transmitted signal, the video IF amplifier must have a bandpass of 4 mc. and must also incorporate some means of reducing the gain of the signal which carries the lower modulation frequencies.

Although the sound transmission has nothing to do with the transmission of picture information, its signal must be taken into account in the video IF amplifier design for several reasons.

There are two major classifications for video IF amplifiers: (1) The separate channel system, where sound IF and video IF signals are amplified separately, and (2) the intercarrier system, where both of the IF signals are amplified in the intercarrier strip.

In the case of the separate channel system, the sound IF signal is removed through the use of trap circuits in the video IF input, and is then fed to the sound IF channel for amplification. Hence, the nature of the sound transmission must be considered for satisfactory trap design and alignment to make sure that the sound does not get through the video IF strip.

In the intercarrier system, the sound IF signal is allowed to continue through the video IF strip, with its amplitude held at a predetermined percentage of the video IF signal.

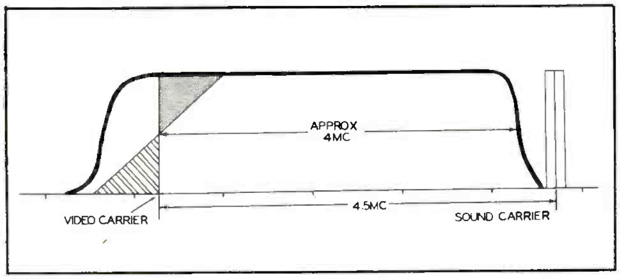


Figure 2-2A. Ideal Separate Channel Video IF Response Curve.

Figure 2-2A shows an ideal separate channel video IF response curve placed over the transmitter output curve. Since this is an ideal response curve, it follows the transmitter output curve at the high end indicating that the bandpass is sufficient to pass all modulation frequencies.

In actual practice, the bandpass may not be the full 4 megacycles wide, but it is shown here as such to indicate the ideal condition.

It should also be kept in mind that the IF response curve will be inverted from that shown in those receivers where the local oscillator operates above the incoming signal.

As mentioned above, some means of preventing over-amplification of the signal representing the lower modulation frequencies must be taken. As can be seen in Figure 2-2A, the video IF amplifier is so aligned that the video carrier is halfway up the slope. The lined area represents the amount of the lower sideband that is passed through the video IF amplifier while the dotted area represents the amount of upper sideband that is not passed. If the video carrier is at the midpoint of the slope, and the slope is straight, the lined and dotted areas will be equal. Under these conditions all frequencies will be amplified an equal amount. If, however, the video carrier is too far up the slope, too much of the lower sideband will be passed, resulting in over-emphasis of the lower frequencies. On the other hand, if the video carrier is too far down the slope, the lower frequencies will be weak, resulting in poor reproduction.

Figure 2-2B shows an ideal response of an intercarrier IF placed over the frequency distribution curve of the transmitter. The response curve is the same as that in Figure 2-2A at the video carrier end but differs at the other end. A "shelf" has been added which allows the sound IF frequency to be amplified in the video IF amplifier, but at a much lower level than the video carrier. In actual practice the "shelf" may not be nearly so pronounced as shown or, as in many cases, the sound carrier is

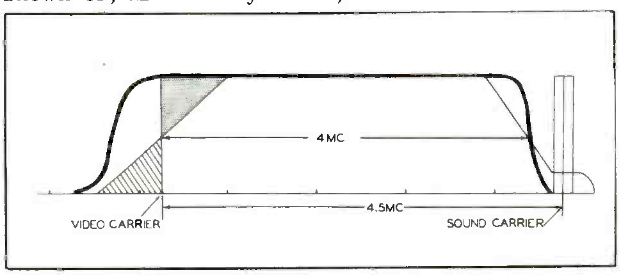


Figure 2-2B. Ideal Intercarrier IF Response Curve.

placed at a predetermined point up the slope and no actual "shelf" will be present. In either case the sound carrier is placed at a point which provides only 5% of total amplitude. At the video detector the beat note of the video and sound carriers produces a 4.5 mc sound IF signal which is trapped out and fed to the sound IF portion of the receiver.

Some means must be provided to control the gain of the video IF amplifier since all signals that are received will not be of the same strength. Otherwise, weak signals would not be amplified enough for the detected signal to be useful. Likewise, if the gain cannot be reduced when receiving strong signals, overloading will occur. Several methods have been incorporated to vary the gain of the IF amplifier. In one case a varying bias is manually applied to the bias line of the IF strip. In other circuits a control in the cathode circuits of the IF amplifiers is manually operated to control the gain.

At the present time, however, the trend is to incorporate some means of automatic gain control where the signal itself is used to develop a bias that is proportional to the amplitude of the signal. Through this means the signal will adjust the gain of the amplifier so that an approximately equal signal is developed at the video detector load whether the signal is weak or strong.

The video IF amplifier must be so designed that there is a minimum of noise developed within the circuit. Special care must be taken in selecting the type of tubes and circuits to be used. Pentode tubes are almost always used because of their high transconductance which makes possible a reasonable gain even though low Q coils are used in the tuned circuits. The amplifier must be stable at all gain settings as any tendency for oscillation will result in poor picture reproduction.

The choice of video IF frequency that is used is important. The higher the frequency, the easier it becomes to obtain full bandpass with a minimum of stages. As the frequency is increased, however, the gain decreases and the possibility of unstable operation increases. Thus it can be seen that a compromise must be made. The most popular frequencies that have been used for video and sound IF is in the region between 21 and 26 mc. At these frequencies a reasonable gain, as well as adequate bandpass, can be achieved. In a receiver using these IF frequencies, however, it is necessary to operate the local oscillator at a frequency which is within some of the television channels. Under these conditions the radiation from the oscillator may interfere with the reception on another receiver.

Considerable work has been done on tuners to keep oscillator radiation at a minimum but the results are not always the same on production models. The present trend is to increase the IF frequency which places the oscillator frequency farther away from the incoming signal. The oscillator frequency is then more easily attenuated in the tuned circuits of the tuner. With the IF in the 41 to 46 mc range, the operating point of the oscillator does not fall within any of the television channels. The recent action of the Federal Communications Commission provides tentative approval of the 41 to 46 mc range. The use of these higher frequencies is made possible by the development of higher gain tubes which will provide adequate gain at these frequencies.

In order to reject unwanted signals, trap circuits are employed in the video IF strip. The traps may be absorption, series or parallel tuned circuits. The type that is employed depends on the nature of the signal that is being rejected and also the circuit in which it is used. The operation of each of these traps will be discussed later.

The video IF amplifier must be selective. That is, it must be able to reject signals that are not within the channel which is being received. Because of past experience in radio, it is a natural tendency to associate selectivity with an amplifier having a very narrow bandpass. By definition selectivity means the ability to discriminate or separate a predetermined band of frequencies from all other signals. Thus applied to television reception, good selectivity would require that a receiver accept only those frequencies within the television band being received and reject all other signals. It would seem that such good selectivity would not be required since adjacent channel assignments are not made in a given locality. It is possible, however, to have a receiver operating at a point between two stations that are operating on adjacent channels where adjacent channel rejection would be required. It is because of this possibility that adjacent channel sound and video traps are incorporated.

Another need for good selectivity is for the rejection of interfering signals that are near the channel which is being received. The results of an interfering signal are much more objectionable in TV reception than in sound reception, since it may degrade the picture and, in some cases, may cause loss of synchronization. Obviously, if the interfering signal is within the frequency limits of the desired channel, it will be accepted as a part of the desired signal and very little can be done to reject it. Good selectivity, however, will make possible the rejection of unwanted signals outside the frequency limits of the desired channel.

From the requirements set forth so far it has been established that a video IF amplifier should provide the following:

1. Adequate Bandpass.
2. Compensation for Vestigial Sideband Transmission.
3. Trap Circuits to Reject Unwanted Signals.
4. Variable Gain.
5. Stable Operation.
6. Sufficient Gain with a Minimum of Noise.
7. Good Selectivity.

TUNED CIRCUITS

Some of the requirements above are design problems and do not directly concern the service technician. The problem of obtaining adequate bandpass, however, must be solved quite frequently when an alignment is performed on the video IF strip. The alignment procedure that is followed is governed by the type of tuned circuits that are employed. Three basic types of tuned circuits used in television video IF amplifiers, up to the present time, listed in their order of popularity, are as follows:

1. Stagger Tuned.
2. Transformer Coupled.
3. Bandpass Circuits.

The simplest method of obtaining adequate bandpass in a video IF amplifier is through the use of several single tuned stages. Each of the stages are tuned to different frequencies making possible the wide bandpass of the complete video IF strip. Since the coils are tuned to different frequencies, the tendency for oscillation is decreased, making the production problem easier as far as placement of parts is concerned. The coils themselves need not be high Q units. On the contrary they should be low Q units to provide a wider response. This makes it possible to keep down the cost of the coils resulting in lower production costs.

Figure 2-3 shows the response curve of a single tuned stage, along with a partial schematic of a stage representative of the type used in video IF amplifiers.

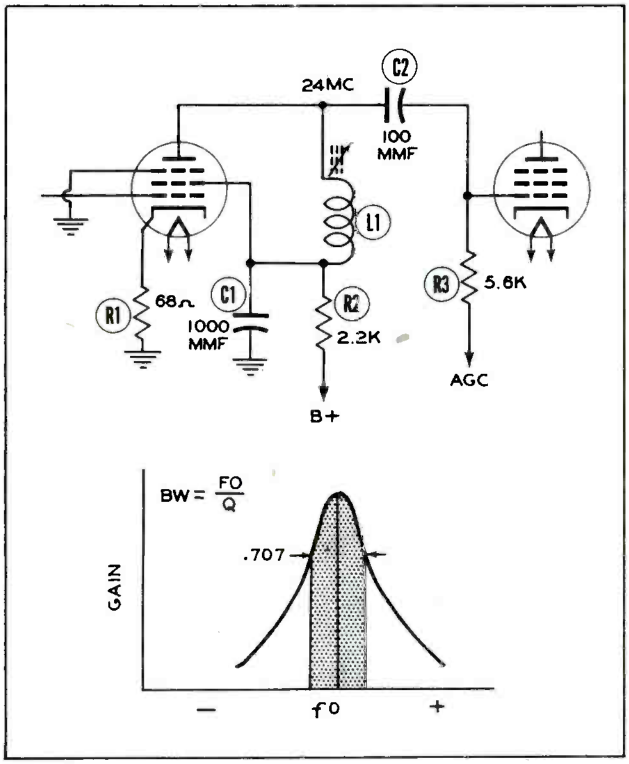


Figure 2-3. Response Curve and Circuit of Single Tuned Stage.

A single tuned coil (L1) is placed in the plate circuit of the 6AU6. L1 is tuned by the output and input capacities of the two tubes along with the distributed capacity of the wiring. Use of a minimum capacity makes possible a higher inductance value for L1 over the value which would be permissible if more capacity were placed in the capacitive branch of the tuned circuit. Thus a higher L to C ratio can be maintained, making possible more gain in the circuit.

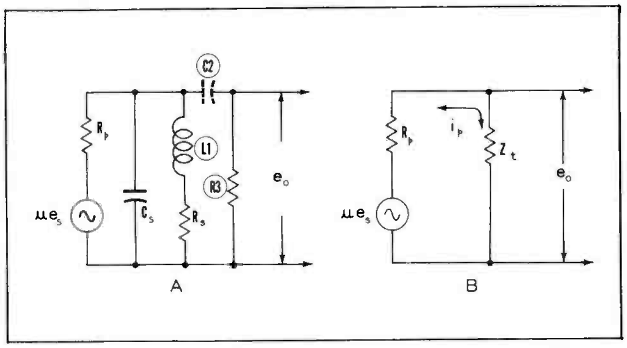


Figure 2-4. Equivalent Circuit of Circuit in Figure 2-3.

The gain of a stage having a plate load which is small in comparison with the plate resistance of the tube, is dependent upon the transconductance of the tube and the impedance of the load. Figure 2-4A shows the equivalent circuit of the video IF amplifier illustrated in Figure 2-3. E_s represents the signal voltage, R_p the plate resistance of the tube, C_s represents the tube capacity along with the distributed capacity, R_s is the series resistance of L1, and R3 is the grid resistor. C2 can be disregarded in the equivalent circuit as its reactance is so low at the operating frequency. Since the signal is developed across the parallel network of C_s, L1 and R3, these three branches can be lumped together and designated as Z_t, the total impedance of the load. This is shown in Figure 2-4B.

Current (I_p) will flow in the closed circuit and the voltage* (mu E_s) will be divided between R_p and Z_t. With Z_t extremely small in comparison to R_p, any change in Z_t (as long as its value is kept low) will not change the amount of current flowing in the circuit. Since the amount of current remains constant, the gain of the stage (the voltage across Z_t) can be changed only by varying the value of Z_t.

In conclusion, it has been said that the gain of a stage having a load which is extremely small in comparison to the plate resistance of the tube, is dependent upon the G_m of the tube and impedance of the load. In order to obtain maximum gain, the L to C ratio should be kept as high as possible and a tube having a high mutual conductance should be employed.

The impedance of a parallel resonant circuit is in proportion to the Q of the circuit. The higher the Q, the higher the impedance and vice versa. Another characteristic of the circuit which is dependent on the Q is the bandwidth. The bandwidth, at the half-power point, is equal to the resonant frequency divided by the Q of the circuit. Assuming that the resonant frequency of the circuit shown in Figure 2-3 to be 24 mc, and the Q to be 10, the bandwidth of the circuit would be 2.4 mc. By increasing the Q, in order to increase the impedance, the bandwidth of the circuit would be decreased. Some compromise must be made in arriving at the value of the effective Q so that a reasonable gain can be achieved and still maintain adequate bandpass.

The coil illustrated in Figure 2-5 is a tunable choke representative of the type that is used in stagger-tuned video IF systems. A core has been removed from another identical coil and is shown alongside to illustrate its construction. In taking measurements on this coil, the minimum inductance, with the slug all the way out, was found to be 1.75 microhenries, and the maximum inductance, with the slug all the way in, was found to be 4.1 microhenries. The Q of the coil is 75.

The circuit shown in Figure 2-3 employs this type of coil to perform the functions of L1. Note that no additional capacity is placed across L1 other than the tube capacity and the distributed capacity of the wiring. In order to resonate the circuit with the slug set all the way in, to achieve maximum inductance, the maximum allowable capacity in the circuit would be 10 mmf. The input and output capacities of the two tubes are across the coil, and, by referring to the tube manual, the sum of these two capacities is found to be 10.5 mmf. This does not allow for distributed capacity or Miller Effect, so it is obvious that this amount of inductance cannot be used. Assuming that the total capacity in the circuit is 15 mmf., an inductance of approximately 2.9 microhenries would be required. This is well within the range of the tunable choke shown in Figure 2-5.

The reactance of the coil at this setting would be 437 ohms, and assuming that the effective Q of the circuit could remain at 75, the total impedance of the

---

*The voltage developed in the circuit (Figure 2-4B) is equal to the signal voltage (E_s) times the amplification factor (mu) of the tube or mu E_s. The current that will flow in the circuit is limited by R_p and Z_t, therefore the current in the circuit can be stated as:

$$I_p = \frac{mu\ E_s}{R_p + Z_t} \quad \text{(Equation 2-1)}$$

The voltage out (E_o) equals the current through the load times the load impedance or:

$$E_o = I_p \times Z_t \quad \text{(Equation 2-2)}$$

Substituting the equation 2-1 for I_p in equation 2-2 we have:

$$E_o = \frac{mu\ E_s \times Z_t}{R_p + Z_t} \quad \text{(Equation 2-3)}$$

The voltage output of any stage equals the voltage input, times the gain or:

$$E_o = Gain \times E_s \quad \text{(Equation 2-4)}$$

Substituting equation 2-4 for E_o in equation 2-3 and removing E_s from both sides we have:

$$Gain \times E_s = \frac{mu\ E_s \times Z_t}{R_p + Z_t} \text{ or } Gain = \frac{mu \times Z_t}{R_p + Z_t} \quad \text{(Equation 2-5)}$$

Since in this case Z_t is extremely small in comparison with R_p, the quantity of R_p plus Z_t may be considered as R_p only, making the equation 2-5 read:

$$Gain = mu \times \frac{Z_t}{R_p} \text{ or } Gain = \frac{mu}{R_p} \times Z_t \quad \text{(Equation 2-6)}$$

The transconductance (G_m) of a tube equals the amplification factor (mu) divided by the plate resistance (R_p):

$$G_m = \frac{mu}{R_p} \quad \text{(Equation 2-7)}$$

Substituting equation 2-7 for $\frac{mu}{R_p}$ in equation 2-6 we have:

$$Gain = G_m \times Z_t \quad \text{(Equation 2-8)}$$

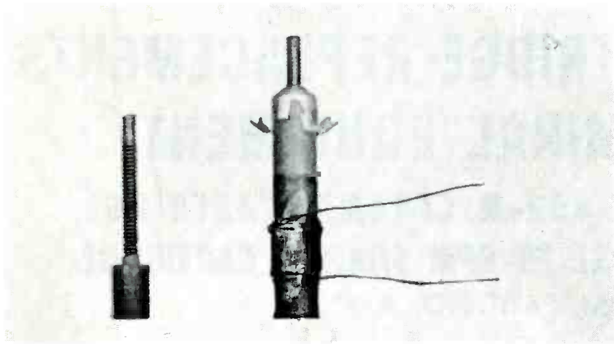


Figure 2-5. Tunable Choke Used in Stagger-Tuned Video IF Systems.

load would be 437 times 75 or 32,775 ohms. The mutual conductance of the 6AU6 tube is listed at 4450 micromhos which would provide a gain of around 145. Gains of this quantity cannot be obtained in this type of circuit for several reasons, the most important of which is the need for lowering the Q of the circuit to obtain wider bandpass. With a Q of 75, a tuned circuit of this type would have bandpass of only 320 kc which falls far short of the requirements. If the effective Q were lowered to a value between 6 and 10, however, the bandpass would widen out to between 2.4 and 4 mc, and the stage will give a gain of 10 to 17 which is average. It should be kept in mind that the above calculations do not exactly duplicate the design characteristics of the circuit, but are given as an example to show what problems are involved. By gaining a better understanding of the design problems of this type of circuit, the service technician will be able to make component replacements and be assured of proper performance.

R3, in the partial schematic of Figure 2-3, serves as the grid return for the following stage, and also acts as a shunt across L1 to aid in lowering the Q. A resistance placed across a coil lowers the Q since the resistance is shunting the load resulting in a lower total impedance. In this type of circuit, all the developed signal is coupled to the following stage. If the gain is excessive, regeneration might take place. By varying the value of the shunt in the circuit the gain of the stage can be held below the oscillation point. When making replacement of these resistors, exact duplicates must be used to maintain proper gain and bandpass in the video IF strip.

Figure 2-6 is a schematic of a video IF strip employing tunable chokes similar to the type illustrated in Figure 2-5.

Four 6AU6 type tubes are employed, having stagger-tuned circuits to obtain adequate bandpass. Note that all the coils are tuned to different frequencies which widens the frequency response and also lessens any tendency for oscillation in the strip. AGC is applied to each stage with a ladder-type decoupling network added to prevent feedback through the AGC line. The plate and screen of each stage is also decoupled by means of an RC network.

Tracing the signal through the circuit, we find that the output of the mixer has a parallel tuned circuit composed of L1 and the output capacity of the mixer tube. The mixer is decoupled by C1 and R2. The signal is coupled to the 1st IF grid by C2, and R3 serves as the grid load of the tube. The value of R3 is 8200 ohms which lowers the effective Q of L1, thereby broadening its bandpass characteristics.

The second and third IF stages are essentially the same as the first IF except for the values of the grid resistor and the decoupling resistor in the plate and screen circuit. Another change is the addition of an unbypassed 68 ohm resistor in the cathode circuit to introduce a very small amount of degeneration. This has the effect of increasing the input resistance of the tube and also lessens the change of input capacity caused by the Miller effect. The small loss in gain can be disregarded, since the advantage of decreasing the capacity change due to Miller effect overshadows this disadvantage.

The tuned circuit of the last IF stage differs from the others in that it has a resistive plate load and the coil is moved to the right of the coupling capacitor. Since it is necessary to use a low value detector load, a low DC resistive path is required at the input side of the diode to prevent a loss of signal at the input side.

It is interesting to note that this IF amplifier has no traps. The selectivity is achieved by proper stagger tuning of the tunable chokes. All of the chokes

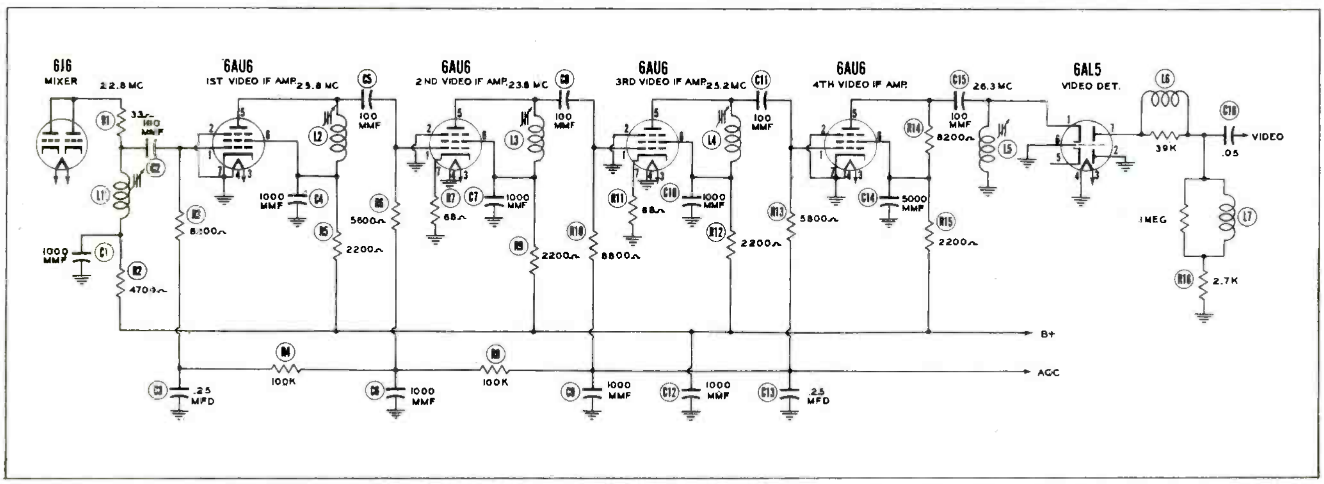


Figure 2-6. Complete Stagger-Tuned Video IF Strip Using Tunable Chokes.

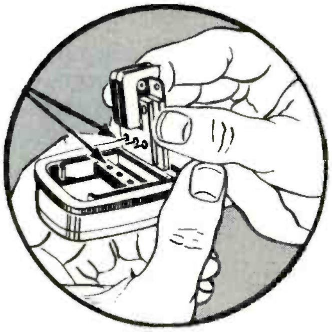
♦ ♦ Please turn to page 30 ♦ ♦

Astatic PRODUCTS DATA

ASTATIC CARTRIDGE REPLACEMENTS FOR ADMIRAL EQUIPMENT

ASTATIC MODEL 402-M CERAMIC CARTRIDGE REPLACES ADMIRAL 78 RPM SNAP-IN CARTRIDGE

(ADM. PART NO. A1372)



SIMPLE, SNAP-IN INSTALLATION OF 402-M CARTRIDGE

Installing in the Admiral Arms for which it was designed is a simple matter of inserting the three-prong terminals into the three snap-in receptacles found in these arms. Snap-in action holds the cartridge firmly in place and nothing else need be done.

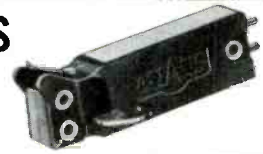
OUTPUT has been increased above that of similar cartridges. Light weight and low minimum needle pressure are additional advantages. Employs Astatic Type "G" Needle, with 3-mil precious metal tip. Needle is replaceable, slipping easily from its rubber chuck with a quarter-turn sideways.

COMPLETE REFERENCE CHART *on Astatic Cartridges which are replacements for various Admiral Phonographs and Phonograph Combinations is available. Write for Form No. 51.*

SPECIFICATIONS

Model No.	Element Type	List Price	Minimum Needle Pressure	Output Voltage 1000 c.p.s. 0.5 Meg Load	Frequency Range c.p.s.	Needle Type	Approx. Net Wt. in Grams	Code
402-M	Ceramic	$6.90	12 gr.	0.7* *Audio-tone Test Record	50 to 10,000	G-78 (osmium tip)	8	ASWZN

ASTATIC AC-AG AND AC-J CRYSTAL CARTRIDGES ARE IDEAL REPLACEMENTS FOR ADMIRAL 409A13, 409A13-1 AND 409A300 CARTRIDGES



SPECIFICATIONS

Model	List Price	Minimum Needle Pressure	Output Voltage 1000 c.p.s. 0.5 Meg Load	Frequency Range c.p.s.	Needle Type	Application	Code
AC-J	$8.90	5 gr.	1.0**	50 to 10,000	A-1 (1-mil sapphire tip)	Replaces Admiral 409A300	ASWYJ
AC-AG-J	8.90	6 gr.	1.0***	50 to 10,000	A-AG† (sapphire tip)	Replaces Admiral 409A13 and 409A13-1	ASWYH

*Audio-tone 78-1 Test Record.
**RCA 12-5-31V Test Record.

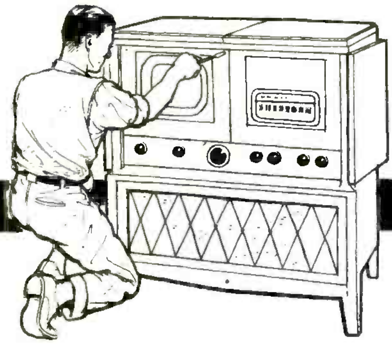
†"ALL-GROOVE" Needle tip of special design and size to play either 33⅓ and 45 RPM (narrow groove) or 78 RPM (standard groove) records.

OTHER ASTATIC REPLACEMENTS FOR ADMIRAL CARTRIDGES

ADMIRAL PART NO.	ASTATIC REPLACEMENT	ADMIRAL PART NO.	ASTATIC REPLACEMENT
A-1372-(33025)	402-M	409A13	AC-AG-J
409A1	L-92A	409A13-1	AC-AG-J
409A2	L-92A	409A300	AC-J
409A3	L-92A	409A301	AC-J
409A10	L-29		

THE Astatic CORPORATION
CONNEAUT, OHIO
IN CANADA CANADIAN ASTATIC LTD TORONTO ONTARIO

Astatic Crystal Devices manufactured under Brush Development Co. patents



Converting the RCA Victor 730TV-1 to 14 inch Operation

by Robert B. Dunham

The cabinet and chassis design of the RCA Victor Model 730TV1 (See Figure 1) is such that it may be converted to use a 14" rectangular tube with a minimum of physical changes in the chassis and the cabinet. Figure 2 illustrates this model after conversion to use a 14" tube.

This set incorporated a 10" tube as original equipment and the tube was mounted unusually high above the chassis to position it at a point that would follow the design of the cabinet. The resulting added height of the deflection yoke and focus coil above the chassis, makes it possible to mount the 14" tube in the original bracket and still allow the tube to clear the components on the chassis. The front of the tube is supported by a cutout in a subpanel at the front of the cabinet. It is necessary to cut a new opening in this subpanel to support the new tube. The front panel of the receiver can be removed by taking out the two screws at the top of the panel. This will permit the alteration of the front panel to be performed on the work bench, which is much easier than doing the work within the cabinet itself.

Because of the minor nature of the cabinet work required in this conversion, it can be performed in the service shop without the need of special wood working tools. A complete description of the cabinet work required is given later. It is suggested that no work be done on the cabinet until the electrical conversion of the chassis is completed. This practice is wise to follow on any conversion job, so that in the event the chassis cannot be converted for some unforeseen reason, it can be restored to its original circuitry and placed back in the cabinet.

Figure 1. RCA Victor Model 730TV1.

Figure 2. The Converted Receiver.

CIRCUIT CHANGES

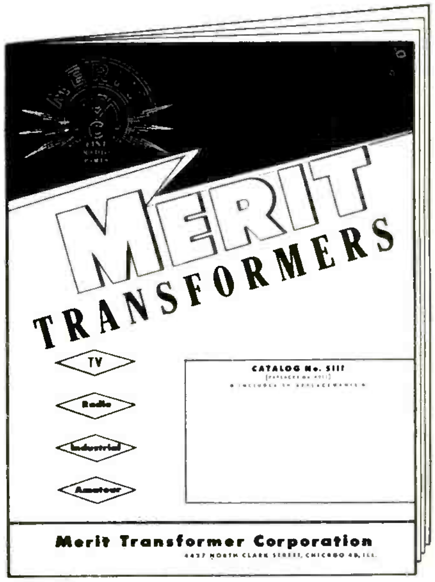
A partial schematic showing the original wiring in the horizontal circuit is shown in Figure 3. The components located in the high voltage compartment, which need to be removed in this conversion, are shown in Figure 4. These components are the horizontal output transformer, the width coil and the high voltage filter capacitor. After the removable section of the high voltage compartment was taken off, the leads to terminals 1, 4, 5 and 6 were unsoldered and the four screws which mount the horizontal transformer to the HV compartment were removed. The remainder of the high voltage compartment was then taken off which gave access to the high voltage rectifier filament leads. After these filament leads were unsoldered, the horizontal output transformer was removed. The high voltage filter capacitor is mounted in a single clip socket in this model and was removed by slipping the clip off the top connector pin and lifting the capacitor from the socket. The original width coil was then removed from the bracket. This completed the removal of the major components from the HV compartment.

Watch MERIT *For* TV *In* '51

KEEP POSTED ON TV COMPONENT PARTS WITH MERIT CURRENT LITERATURE, *FREE!*

See your Jobber!

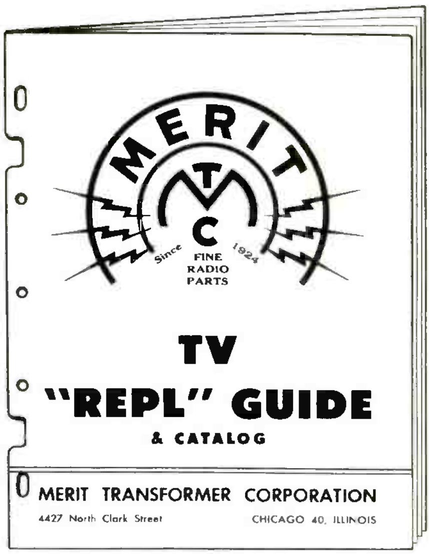
The new 1951 MERIT CATALOG #5111 shows complete up-to-date specifications on the entire Merit line of TV, Radio, Amateur and Industrial Transformers. The Merit TV line is as complete as current and advance information will permit.



You'll need the DEC. 1950 MERIT TV REPL GUIDE & CATALOG for saving time in selecting the correct replacements for all popular television receivers. This handy, easy-to-use popular guide lists model and part numbers of 70 manufacturers, covering 800 models and chassis. First two pages list all TV Transformers and Specs.

DEALER PRICE SHEET-FORM No. 2, dated MARCH 15, 1951 shows the part No., Net price and List price of over 280 parts.

AUTO VIBRATOR TRANSFORMER SHEET-FORM No. 3, dated DEC. 30, 1950, shows model No., Net, List prices and Specs. of VIBRATOR TRANSFORMERS for FORD-GM-MOTOROLA and MOPAR car radios. Also simple easy-to-read replacement guide covering 30 manufacturers.



MERIT OUTPUT TRANSFORMER CHART-FORM No. 4, single sheet shows proper Merit output transformer for use with all popular output tubes. Both MERIT specific and universal types are shown. Mounting style is included for further convenience.

MERIT TV COMPONENTS-FORM No. 5, dated APRIL, 1951—illustrated descriptive sheet on MERIT "FLYBACKS" "DEFLECTION YOKES," "FOCUS COILS" and WIDTH LINEARITY COIL WITH AGC.

MERIT comparative part number sheet for TV & RADIO FORM No. 10—shows numerical listing of MERIT part Nos. to competitive Nos. on TV—on Radio, competitive Nos. to MERIT, for easy conversion.

REFER TO MERIT'S LISTING IN SAMS PHOTOFACTS

See Your Jobber or Write Direct to

TAPE-MARKED TO HELP YOU!

Handy tape marking on every Merit Transformer shows permanent hookup data for quick reference. ORIGINATED BY MERIT.

MERIT
TRANSFORMER CORP.

4412 NORTH CLARK STREET CHICAGO 40, ILLINOIS

MERIT MTC Since 1924 FINE RADIO PARTS

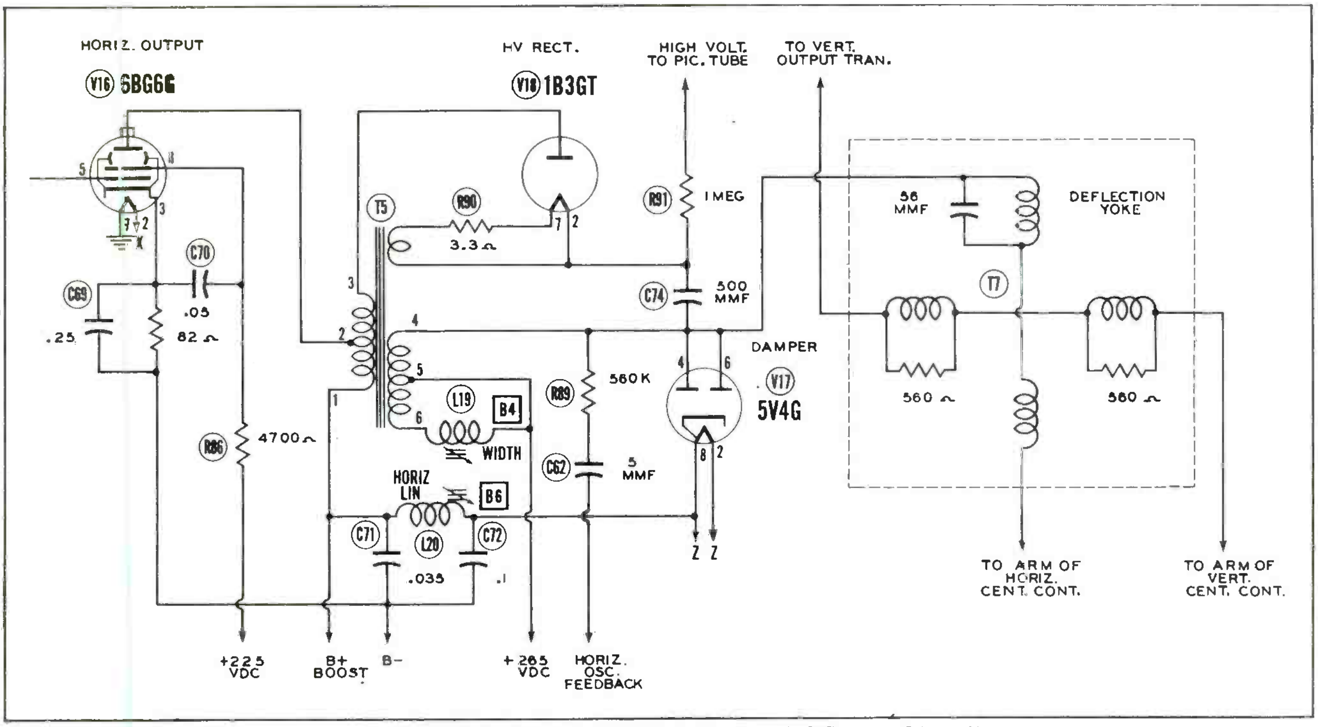


Figure 3. Schematic of Original Horizontal Sweep Circuit.

The new high voltage capacitor was then inserted in the original capacitor socket and the top clip connected. A 15 or 20 KV unit should be used since the original unit has a 10 KV rating and might break down under the voltage developed in the revised circuit. The new horizontal output transformer, a Merit type HVO-6, was then mounted. It was positioned close to the high voltage rectifier socket so that the high voltage rectifier filament leads could be kept as short as possible. This required the drilling of three holes to mount the new unit. The placement of the components is shown in Figure 6. The filament leads were then soldered to the proper tube socket terminals.

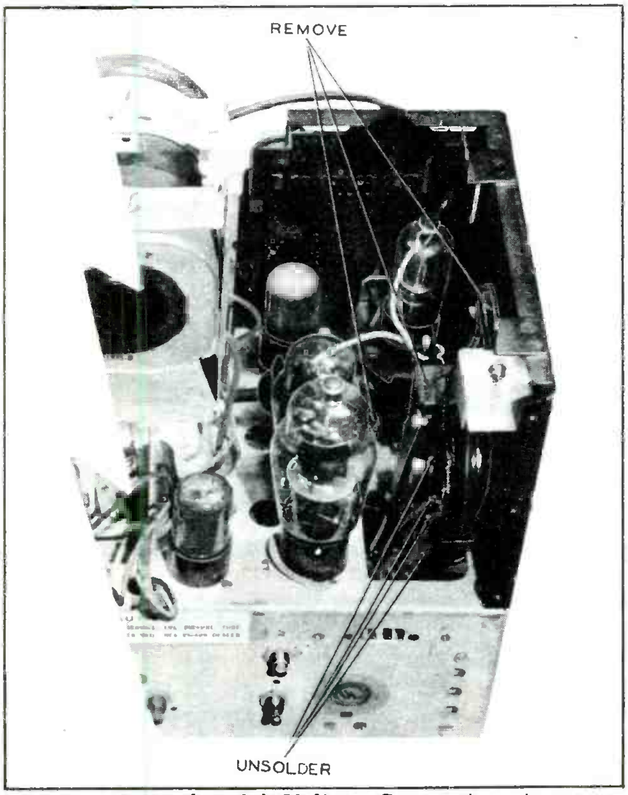


Figure 4. High Voltage Compartment.

Editor's Note: As this goes to press, the Merit Transformer Corporation is starting production on a type HVO-7 horizontal output transformer which is identical electrically to the HVO-6. The type HVO-7, however, has a mounting bracket which is drilled to fit in the same mounting holes used by the original RCA transformer. The leads on this unit are long enough to allow it to be mounted in the same location and position as the original unit. If the HVO-7 transformer is used there will be no need for drilling the new mounting holes previously described in connection with the Merit type HVO-6.

The next step was the mounting of the new width coil, a Merit type MWC-1. This coil is slightly larger than the original unit and requires slight reaming of the hole in the width coil bracket. After the width coil was mounted in the bracket, the side of the high voltage compartment was remounted on the chassis. The leads to the horizontal output transformer were then soldered to the proper terminals as indicated in the schematic of Figure 5.

The next step was the removal of the focus coil and deflection yoke. A Merit type MD-70 deflection yoke which is designed for use with tubes requiring 70 degree deflection, replaces the original yoke. The damping capacitor and resistors were first installed in the yoke per the manufacturer's instructions. The original focus coil was tried with the 14" tube but it was found that the focus point was not quite reached at the limit of the focus control. By using a higher resistance unit, such as the Merit type MF-3, proper focus could be obtained. This type focus coil is the same style as the original unit and will mount in the original bracket with no changes required.

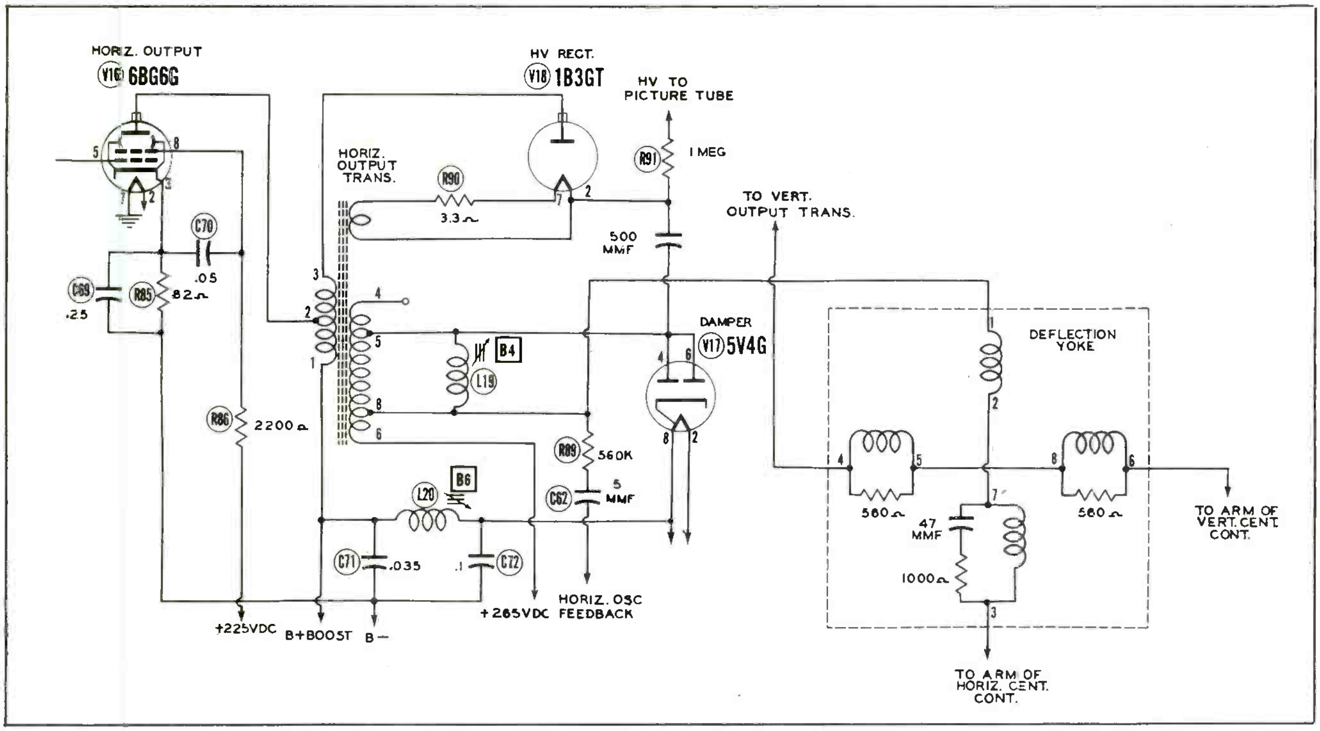


Figure 5. Schematic of Revised Horizontal Sweep Circuit.

In order to insure that the new tube will clear the top adjustment screw on the discriminator transformer, spacers were installed between the deflection yoke and the bracket to which it is mounted. About an eighth of an inch is all the spacing required and conventional steel nuts serve the purpose very well. Select them so that the center hole is slightly large, to slip easily over the studs. This small amount of added height helps considerably in providing adequate clearance.

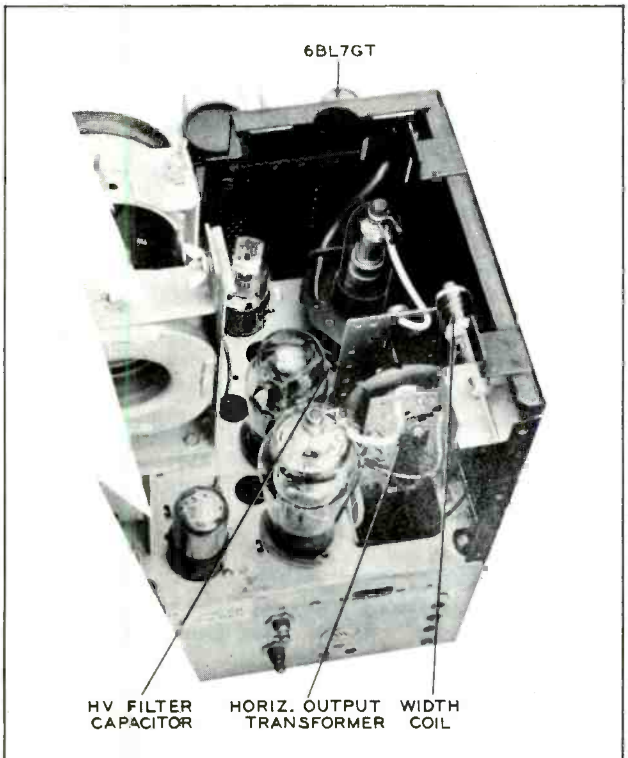


Figure 6. High Voltage Compartment after Conversion.

The screen resistor of the 6BG6G horizontal output tube was changed to a 2200 ohm, 1 watt unit. This change was made to improve horizontal linearity in the new application.

The original ion trap used in this model was an electro-dynamic type having two windings. This type trap cannot be used on the 14" tube. A 39 ohm, 1 watt resistor was wired in the circuit in place of the ion trap winding. Actually it is not necessary to remove the trap from the circuit; it can be taped to the back of the chassis and left wired in the set.

This completed the wiring and electrical changes in the chassis. The new tube was installed to check the operation. It is necessary to temporarily block up the tube during this check since there is no provision for holding the tube on the chassis. A new single permanent magnet ion trap was installed and the operation on the receiver was checked. The horizontal drive, horizontal linearity and width coil were adjusted to obtain proper horizontal linearity and width.

It was then found that it was impossible to obtain sufficient height by adjusting the height and vertical linearity controls. This model employs a 6SN7GT as a vertical oscillator and vertical output. Several new 6SN7GT tubes were tried in this application, but none would furnish sufficient power to sweep the tube vertically. A 6BL7GT was then tried and it was found to work satisfactorily with no changes required in the socket wiring or in the components. An additional tube could be added to serve as a vertical output tube but this would require the punching of a new tube socket hole and considerable wiring changes. The use of the 6BL7GT solves the vertical deflection problem and its use in this conversion is recommended.

After making all the above changes the receiver should sweep the new tube with good linearity, both

♦ ♦ Please turn to page 55 ♦ ♦

John Markus Editor-in-Chief, McGraw-Hill Radio Servicing Library

Dollar and Sense Servicing

SUMMER SLUMP. Buying of new receivers tapered off early this year, with no likelihood of revival until September at the earliest. Instead of cutting contract prices or granting dealer kickbacks to hold new-installation business up artificially a while longer even though at a loss, smart service organizations are retrenching and settling down to operate profitably with their present volume of business. In one way this business slump is good, because it means time to examine overhead expenses and pare them down, time to improve staff efficiency, time to rebuild shop benches and rearrange things for faster and better rush-season servicing, and time for well-deserved days off and vacations.

POSITIONS OPEN. There's almost a black market in engineers and technicians this spring. Companies are hiring men away from each other, and there's even some farming out of development engineers on a loan basis. At the IRE convention in March, companies hired suites of rooms in hotels, to which would be brought likely prospects for softening with refreshments. A good many dotted lines got signed on before the show was over.

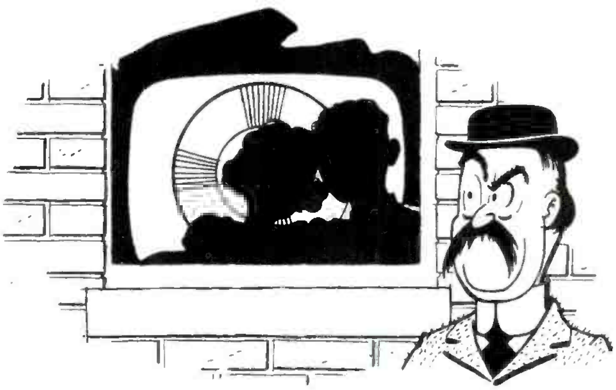
Some succumbed to the lure of a new job just to see new faces and new shop benches. Some saw their chance to try out California living, in response to one famous airplane maker's inducement of "10% more then you're making now, plus moving expenses." Many companies also provide on-the-job training and free night school or home study courses that enable a serviceman to upgrade himself.

There's even a bit of protective hiring, to get men now for military orders expected later or to improve chances of getting hoped-for contracts. All is good for servicemen, as experience in television servicing makes them highly valuable on radar, guided missile and other military electronic projects.

Hiring of servicemen has been found to pay off, in that it frees scarcer engineers for the toughest research and development jobs. The men who know their circuitry and want to kick their last griping customer out the door can just about take their choice of where to work and who to work for, on military projects that will protect our way of living.

TV NOT GROUNDS FOR EVICTION. A justice of the peace in St. Paul, Minn., ruled recently that a tenant cannot be legally evicted because he installed a TV antenna in the room of a rented house. Despite this, it's still good business to insist that a customer in a rented house show written permission from the landlord for a rooftop TV installation.

COMING DOWN THE LINE. Picture tubes in 14, 17 and 20-inch rectangular sizes using electrostatic focusing, are already on production lines of cathode ray tube makers. This means that they must have orders from manufacturers, so look for the electrostatic tubes in sets sometime during the last half of this year. Reports are that they're the same physical size and shape as magnetically focused tubes and give comparable picture quality. Electrostatic tubes save scarce cobalt, copper and nickel.



TV AND DIVORCE. In England, the judge agreed with one husband's suspicions and granted a divorce, despite his wife's assertion that the living room lights were out only so she and her gentleman friend could see television better.

SAVING TWINLEAD. When the shortage of 300-ohm ribbon loomed, one manufacturer's service division put the heat on their boys to place the antenna as near to the receiver as possible, measure the required length of line accurately and splice together and solder short lengths. This resulted in reducing the average transmission line usage per job from 123 feet to 83 feet. In addition to conserving that much scarce copper, there's a cash-on-the-line saving of almost a dollar per job, plus the time and cost of installing standoffs on 40 feet of line.

THREE KINDS OF TIME. In one service organization, there are three different ways for a serviceman to charge off his time during the working day. First is Applied Time, which is directly chargeable to specific service jobs. Second is Accountable Unapplied Time, which covers such things as being out sick, running assigned errands, doing necessary bench and shop cleaning, and suchlike. Third is Unaccountable Unapplied Time, in which the serviceman did nothing useful or can't recall what he did. At the end of each week, the slips are totalized and the results entered on a chart for all to see. The system makes men feel that their productive time receives due publicity. The fellow with the highest figure for Unaccountable Unapplied Time is in for considerable kidding by his co-workers, hence there is rivalry to keep this figure down.

THE CRYSTAL BALL. Those close to the television receiver market are saying that the present figure of 12 million TV receivers in use is closer to the final peak than we think. Unfreezing the station allocation setup, they say, will make the market only 50% bigger. This means that another 6,000,000 sets will enable the rest of the country to catch up. True, people will continue buying television receivers, but from here on the business will be gradual and seasonal. Therefore, expand your business slowly and carefully. It is far safer to solidify than expand, when in doubt about the future.

HOPE FOR MORE PARTS. To lick shortage of replacement parts for TV sets and radios, NPA early in March permitted use of extra quantities of material above allocation quotas, to be used for making replacement parts at 100 to 150% of rate a company used materials for that purpose during first half of 1950.

REBIRTH. The old capacitance loudspeaker of the 20's is being given another whirl in the research labs, in hopes it can be perfected as a substitute speaker using little or no critical scarce material. Major part in it is a sheet of aluminum foil serving as the diaphragm, moving back and forth in front of a fixed metal plate in accordance with the polarity and strength of the voltage applied between foil and plate.

STRING SAVERS. To overcome a prevalent habit among servicemen of saving used parts that might possibly someday have further use, one service manager has shellacing day once a month. On that day, usually Friday, they stop service work about two hours early and have to shellac the bench top and all shelves. After a few shellacing days their bench drawers get so crammed that they just have to throw the newly acquired junk away.

TENSENESS TEST. Can you go to sleep during a long dull sermon in church? If not, you're too tense - taking yourself or your servicing problems too seriously. But according to one minister, you've got lots of company; his complaint is that he's no longer able to put his congregation to sleep, because they're all too tense these days.

DISCOURAGE TRADE-INS. Smart servicemen are doing everything they can to encourage people to keep their small-screen set when buying a new set. The small sets are ideal for the basement, where the minority of the family can watch Captain Video or Hopalong in peace. The small sets are equally valuable in bedrooms in time of sickness, for they can be viewed comfortably at arm's length with the controls all in reach. Once a family has had two sets for a while, they become indispensable and provide twice the servicing business of one set.

When sets are traded in, on the other hand, they are seldom resold in the same locality. Instead, they are shipped in bulk to poorer sections of the country, to dealers in poorer sections of cities, or even to Cuban, Mexican and South American markets now that these countries are getting stations. Each such trade-in means the loss of one service card in your customer file.

PICTURE TUBE SIZES. Most popular picture tube in new 1951 sets will be the 17-inch rectangular if production continues at present rate. Last year it was the 16-inch round. Next year, barring a drastic change in the military situation, it could be either the 20-inch or 21-inch rectangular. At Corning, the 20-inch rectangular is already 25% of their total production of glass blanks. There is no likelihood of a shortage of glass for these big tubes, hence the public will get what it demands. You can expect a few 24-inch, 28-inch and 30-inch tubes in 1951, but not many. Engineers consider these big tubes just as safe as the 10-inchers, judging from the way in which the big tubes were displayed without safety glass at the IRE Convention.

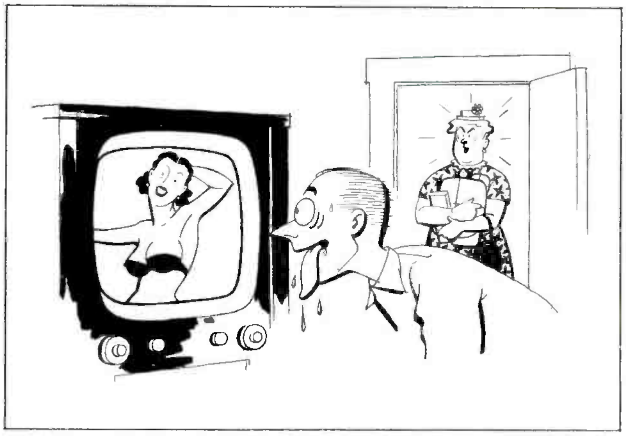
SHOCKING NEWS. Yearly death toll from homemade devices for electrifying fence wires is estimated at 10 to 15 humans and hundreds of animals. Commonest (and probably most lethal - Ed.) scheme used by novices is connecting ungrounded side of 120 volt AC power line to the fence through fuses or electric lights. This arrangement works fairly well during ordinary weather conditions, works poorly in dry weather, and is a killer during good grounding conditions such as after a rain. On the other hand, the approved commercial electric fence controller is today a safe, effective, and economical aid to modern farming. If you come across a homemade installation in your servicing travels, warn the owner tactfully that his system can become as deadly as the electric chair. Keep your customers alive.

ALMOST PERFECTION. In the famous RCA Laboratories at Princeton is one television transmitter-receiver combination that's as perfect as today's dollars and engineering brains can make it. If you hold an 8 x 10 photo in front of the camera and take an 8 x 10 photo of the picture on the receiving screen, you can't tell the two pictures apart at arm's length. The equipment uses U. S. standards for picture lines and frames. This proves that we've got the right standards now, and need to concentrate only on improving the equipment.

HABIT. Chimney-strap TV antenna installations can get to be a habit, or maybe some would call it a disease. Seems as if once an installation crew has made a few, it favors that mounting despite its many drawbacks, and goes to great lengths of roof-ridge walking and rooftop gymnastics to put up a chimney job. Check your installation boys and keep score for a while.

WOOD MASTS. In the good old days of radio, wood was the only thing accepted for outdoor antenna masts by customers. Not so today, patriotic servicemen learned to their sorrow when good-quality aluminum or steel masts became scarce. And that's why the wood masts at your jobbers have a shiny coat of aluminum paint; once up, they look like the metal jobs on neighboring homes and last just as long, so there's no complaint. The wood should be ash, oak, or an equally strong wood, though; none of this pine or fir clothes-hanger rod if you want a trouble free job. To a customer complaining about getting a wood mast, one serviceman explained: "We use only the best piece of ash in the cord."

HOMEWORK. Latest figures on per cent of television receivers fixed in homes on first call are 80% for one large manufacturer's service organization that takes in service contracts on their make of set, and 95% for another manufacturer who sends men out only on demand-service calls that for some reason or another cannot be handled by ordinary service organizations. The latter figure is achieved by using top-grade technicians who are almost full-blooded engineers. Each has a delivery truck in which he can cram all the spare parts he wants. Some of these boys come into the office only about once a week, to replenish their stocks and collect the pay check. Each morning they get the day's quota of calls by phone. The chap who gets stumped and has to bring a chassis into the shop gets a lot of friendly advice while troubleshooting with shop instruments, and a lot of ribbing if the trouble turns out to be some simple defect he overlooked in the field. Such high morale among technicians is a real credit to their service manager.



V-NECK BATTLE ON TV. How low can a V-neck gown get on television? Engineers attending the annual IRE Convention in New York City saw the answer on one picture-tube screen - all the way. To demonstrate its new flying-spot picture generator, Telechrone, Inc., used a Hollywood pretty-girl art slide (for artists only; saves costly model fees) in front of the photomultiplier pickup tube, and did a beautiful job of stopping traffic. Incidentally, for less than a thousand bucks you can get the complete equipment along with a low-power oscillator. It's fun to dream about what the next-door neighbor would say if he tuned in that picture - and what his wife would say if she caught him looking at it!

for Greatest TV Picture Quality

AMPHENOL INLINE*

*Reissue Patent No. 23,273

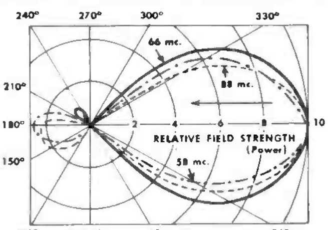
TV ANTENNAS

OUTSTANDING MECHANICAL SPECIFICATIONS

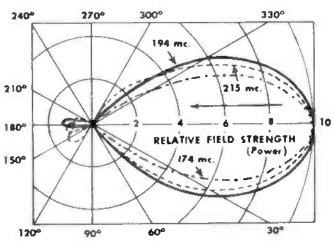
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	¾" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	3S ½ H Al.	19,000	.500"	.049"
Small Folded Dipole	3S ½ H Al.	19,000	.375"	.049"
Reflector	3S ½ H Al.	19,000	.500"	.049"
Crossarm	3S H Al.	26,000	.875"	.065"
Center Support & T Casting	Al. Alloy 45,000 psi tensile strength			

EXCELLENT RADIATION PATTERNS

These are the radiation patterns of the AMPHENOL Inline antenna at 58 mc., 66 mc., and 88 mc., in the low band, and 174 mc., 194 mc., and 215 mc. in the high band. Notice the uniformity of these lobes at all frequencies. The lack of lobes off the sides and negligible ones off the back maintains high front-to-back and front-to-side ratios necessary for the rejection of various interferences. The presence of a single forward lobe is usually a very desirable feature, especially when it is wide enough to provide adequate interception area for some differences in transmitter location, changes in the wave front's direction of travel, or physical movement of the antenna in high winds. Furthermore, it is not too critical of orientation. It is necessary only to aim it and forget it.



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.



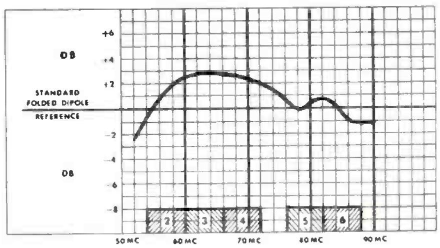
Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.

HIGHER GAIN

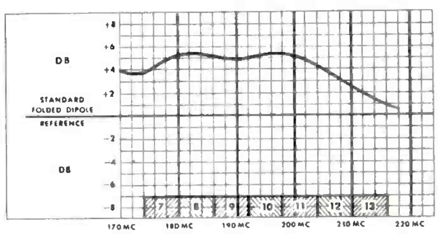
These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than a three decible change within the channel that can cause picture modulation or "fuzziness." Gain of the AMPHENOL Inline antenna is quite flat over all channels.

You will find more gain designed into the high band because of greater need for it, due to higher losses at these frequencies. Also, notice the drop-off on channel six. This is at the edge of the FM band and is subject to FM interference, so the Inline's gain is purposely held down at that frequency.

The excellent broadband characteristics, impedance match, single forward lobe radiation patterns on all channels, maximum gain, lightning protection, and superior mechanical features of the AMPHENOL Inline Antenna make it the antenna for greatest TV picture quality!



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 54 to 88 mc.



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 174 to 216 mc.

YOURS FOR THE ASKING

Send for "The Antenna Story" — a sincere discussion of TV antennas based on actual field tests.

AMPHENOL AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54th AVENUE • CHICAGO 50, ILLINOIS

WALTER R. JONES

Associate Professor of Electrical Engineering, Cornell University

As I See It

AC RECEIVER POWER SUPPLY PROBLEMS

Power Supply Impedance Considerations

Have you ever had an AC receiver brought in for servicing that had that easily recognized sickish smell of burned insulation? Usually when this happens the power transformer has become very hot and may even have been permanently damaged. Further examination may indicate a shorted rectifier tube and a ruined first electrolytic capacitor. A survey should be made initially to determine the extent of the damage. A further study should identify immediate cause of the overload, and replacement of the defective part or parts should be made. Undoubtedly most of us would stop here, if the transformer were still capable of satisfactory operation. However, there is a further point which should receive consideration to limit damage in the event of future overloads.

Examination of the circuit diagram in Sams' Photofacts may give a clue. If the resistance from one plate pin of the rectifier tube to the other is not roughly twice that shown in Table I for the rectifier tube employed, then it is highly probable that too low an impedance in the plate circuit would be responsible for the total destruction of the transformer, tube and filter capacitor.

Figure 1 indicates how the required information is given in Photofact Folders. Figure 1(a) shows a schematic of a circuit taken from Set 110, Folder 12, while Figure 1(b) shows the resistance chart. The illustrations indicate several things:

1. The center tap of the transformer is grounded.

2. The rectifier tube is a type 6X5GT.

3. Reference to 1(b) shows resistance from plate pin No. 3 to ground is 95 ohms and that from plate pin No. 5 to ground is also 95 ohms.

4. Table I indicates that rated impedance for each plate of the 6X5GT is 150 ohms. The resistance values shown represent pretty closely the total impedance in the circuit. (Calculated or measured impedance values would vary slightly from DC resistance readings, but for the purposes outlined in this article the measured resistance values can be employed satisfactorily.)

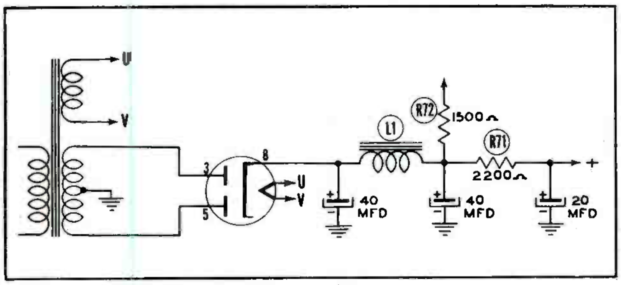


Figure 1A

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6AB4	†‡22KΩ	0Ω	‡▲.2Ω #.5Ω	0Ω	0Ω	0Ω	100Ω		
V 2	6CB6	‡0Ω ▲2.4 Meg.	350Ω	0Ω	‡▲.2Ω #.5Ω	†3.5KΩ	‡3.5KΩ	0Ω		
V 3	12AT7	†‡ 3.1KΩ †▲ Inf.	0Ω	2.4KΩ	0Ω	0Ω	†‡Inf. †▲3.1KΩ	2.2 Meg.	2.4KΩ	‡▲.2Ω #.5Ω
V 4	12AT7	†3.5KΩ	33KΩ	0Ω	0Ω	0Ω	† ‡12KΩ † ▲ Inf.	1.5 Meg.	330Ω	‡▲.2Ω #.5Ω
V 5	6CB6	1 Meg.	220Ω	‡▲ .2Ω #.5Ω	0Ω	†2.9KΩ	†2.9KΩ	0Ω		
V 6	6CB6	‡ 1.1Ω	‡ 220Ω	‡ ▲ .2Ω #.5Ω	0Ω	‡ † 2.8KΩ	‡ † 2.8KΩ	0Ω		
V 7	9001	‡100KΩ	0Ω	‡ ▲ .2Ω #.5Ω	0Ω	‡ †17KΩ	‡ † 17KΩ	0Ω		
V 8	9001	‡130 KΩ	-Ω	‡ ▲ .2Ω #.5Ω	0Ω	‡ † 28KΩ	‡ † 28KΩ	0Ω		
V 9	6AL5	0Ω	‡ 100KΩ	#.5Ω	0Ω	‡ 200KΩ	0Ω	‡ 100KΩ		
V 10	6AV6	2.2 Meg.	0Ω	25KΩ	25KΩ	470KΩ	1.6 Meg.	†220KΩ		
V 11	12AU7	†25KΩ	680KΩ	2.9KΩ	25KΩ	25KΩ	†13KΩ	470KΩ	940Ω	25KΩ
V 12	6X5GT	Inf.	25KΩ	95Ω	Inf.	95Ω	Inf.	25KΩ	‡ ▲ 16KΩ #60KΩ	

‡ TAKEN IN "FM" POSITION. ▲ TAKEN IN "AM" POSITION. † MEASURED FROM PIN 8 OF V12.
# TAKEN IN PHONO AND TV POSITIONS.

Figure 1B

5. The 95 ohms per plate is considerably less than the rated value of 150 ohms so that in the event of a short circuit in the power supply, very high currents could flow, resulting in damage to both tube and transformer.

If the transformer is still good, it might be desirable to supply two plate resistors as shown in Figure 2. Care must be taken so that these resistors, which will run pretty hot in service, are located so that they will not cause damage. If the transformer must be replaced, it would be advisable to select one having the proper resistance in the windings, thus eliminating the necessity of adding the plate resistors.

Frequently one wants to change over a receiver which has employed a 5Y3GT tube to a 6X5GT tube. Examination of Table I indicates that the required impedance for 5Y3GT tube is 50 ohms per plate while that required for the 6X5GT is 150 ohms per plate. If one desires to have trouble free results, the plate resistors must be added if the same transformer is to be used unless, of course, the resistance of the windings is reasonably close to 150 ohms per side.

Rectifier Substitution Factors

When given rectifier tube types are not available, it is often necessary to substitute another type in order that the receiver may be kept in operation.

The problems which arise in connection with the substitution of one type for another may be considered as listed below.

1. Filament requirements - voltage and current.

2. Voltage drop - in the tube itself and hence the resulting voltage applied to the filter capacitors.

♦ ♦ Please turn to page 60 ♦ ♦

FRANK J. MOCH
President of National Alliance of Television and Electronic Service Associations, Chicago.

MORTON BINDER
President of Television Engineers, Inc., Chicago.

"We believe in replacing picture tubes with the Exact original equipment!"

ART RHINE
President of Rhine Television, Yonkers, N. Y.

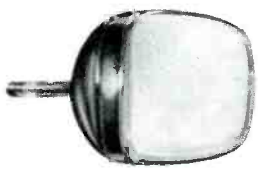
JOE McMILLIAN
President of A-1 Television and Radio Company, St. Louis, Missouri.

JAMES HAUSMAN
President of Central Radio Television Service, Chester, Pennsylvania.

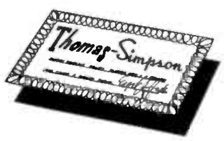
T. W. ST. CLAIR
General Manager of Wholesale Television Service Corporation, Columbus, Ohio.

These executives, heading six of the biggest TV service organizations in the United States, represent the experience gained through hundreds of thousands of house calls and shop jobs. As presidents of companies employing hundreds of technicians they know the value of replacing picture tubes with the *exact* original equipment. Their experience proves that this exact replacement saves them money because it means fewer call-backs, longer set life and more satisfied customers.

THOMAS PHOTO-TRON Picture Tubes are the exact original equipment used by the 20 famous TV set makers listed below. Servicemen everywhere know you take no chance when you replace with Thomas because you replace with the *exact tube* you are taking out. If the set is not listed in the 20 famous brands listed below you make the set perform better by using a THOMAS PHOTO-TRON picture tube!



Thomas Photo-tron PICTURE TUBE



Thomas–Simpson BONUS PLAN

Ask your THOMAS distributor for complete details on how you can obtain SIMPSON Test Equipment *without cost.*

—AS ADVERTISED IN THE SATURDAY EVENING POST

BURTON BROWNE ADVERTISING

Admiral | Hoffman | hallicrafters | Magnavox | Packard Bell | Imperial

TEI **Thomas** ELECTRONICS INC. PASSAIC, NEW JERSEY RTMA UL

Scott | Motorola

Westinghouse | Olympic | Bendix Television | CROSLEY | Starrett | Tele tone

PILOT | Lyon & Healy | Meck | Calbest | Tele King | Kaye-Halbert

Keyed AGC Application

by ROBERT B. DUNHAM and W. WILLIAM HENSLER

A procedure for adding Keyed AGC to the 630-type chassis.

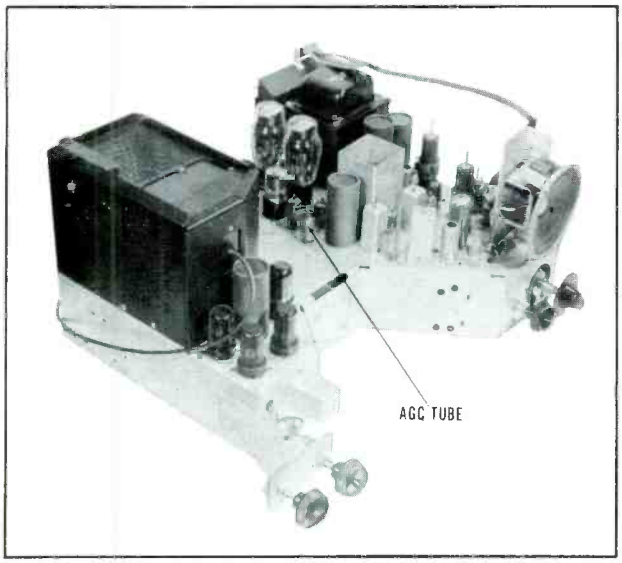


Figure 1. Type 630 Chassis with AGC Tube Mounted.

The application of keyed AGC to the 630-type chassis requires the addition of a 6AU6 tube, an AGC winding on the width coil and minor circuit changes. All the required components are standard replacement items with the exception of the width coil with an AGC winding. Some manufacturers are planning to make available a separate coil which may be slipped over the original width coil. If this type of coil can be obtained, the original width coil need not be replaced. When it is necessary, however, to use a new width coil with an AGC winding, it is imperative that the new width coil have the same inductance range as the original. The new coil should be mounted on the same bracket as the original.

A schematic of the original contrast and video circuits affected in this conversion, is given in Figure 2. Reference may be made to this schematic while rewiring the receiver.

The first step is the mounting of the socket for the AGC tube. Figure 1 shows the chassis with this

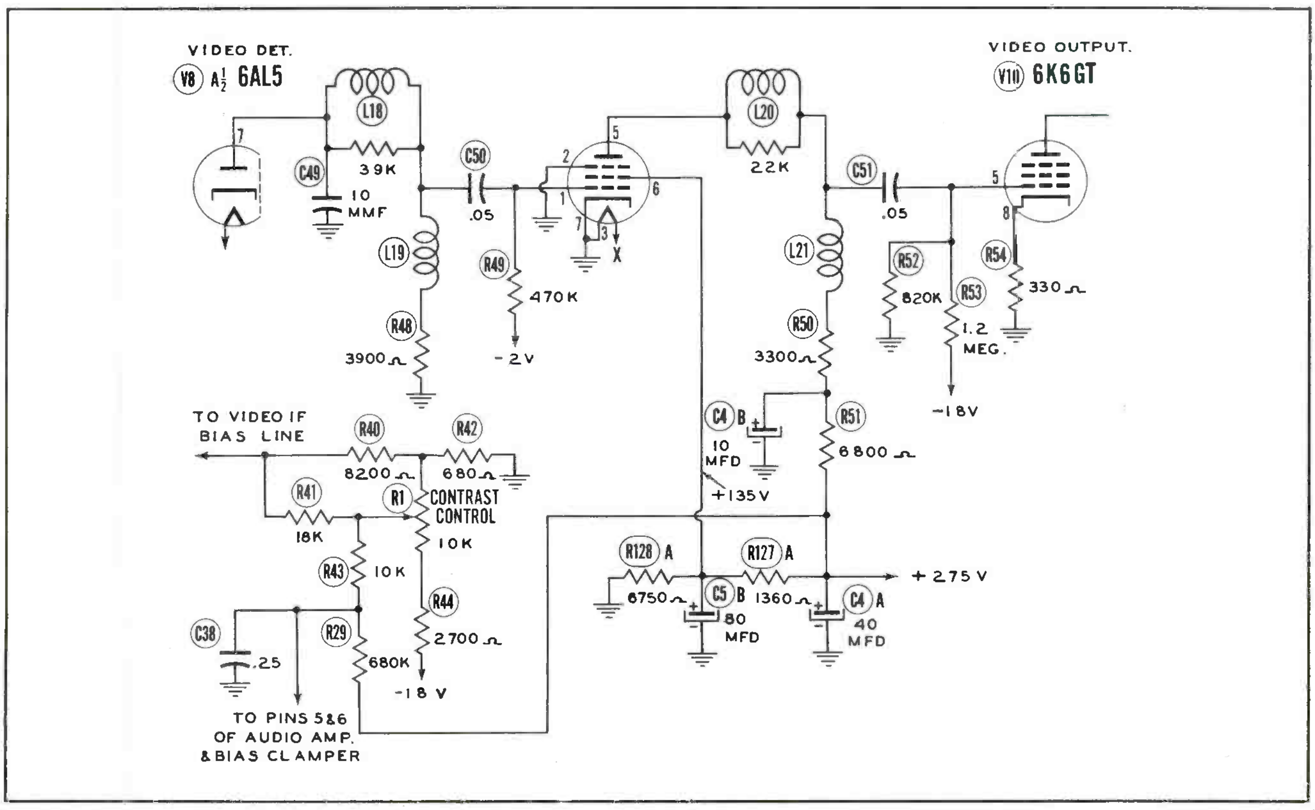


Figure 2. Original Contrast Circuit of Type 630 Chassis.

FRANK J. MOCH,
president of the
National Alliance of Television and
Electronics Service Associations.

Frank J. Moch says— "there is no other OSCILLOSCOPE like the NEW Simpson MODEL 476 MIRROSCOPE"

Simpson's new and completely advanced type of oscilloscope—Model 476 MIRROSCOPE—is designed to eliminate certain inherent disadvantages found in the conventional type of oscilloscope by use of the "Mirroscope principle." In this kind of construction the 5-inch cathode ray tube is mounted in a vertical position, thus reducing bench space requirements to an area of only 9" x 8" thereby permitting better concentration of associated equipment for any type of test procedure. The cathode ray image is reflected from an optical type front surfaced mirror mounted in the adjustable cover at the top of the cabinet bringing the viewing surface of instrument near eye level when instrument is used on benches of normal height. The mirror angle is quickly and easily adjusted to any position of the operator. The cover with integral side wings forms an effective shield against external light sources or may be closed down for protection of the tube and mirror when the instrument is not in use. The upright construction permits location of controls and connections for maximum convenience and allows for internal cathode ray tube connections at the front of the panel instead of the rear.

SENSITIVITY:

Vertical direct.......12 volts rms per in.
Vertical amplifier. 20 millivolts rms per in.
Horizontal direct.....14 volts rms per in.
Horizontal amplifier.....38 millivolts rms per in.

INPUT IMPEDANCE:

Vertical direct.....10 megohms, 15 mmf.
Horizontal direct...10 megohms, 15 mmf.
Vertical amplifier. 300,000 ohms, 30 mmf.
Horizontal amplifier......500,000 ohms, 15 mmf.

Horizontal trace expansion is over 4 times tube diameter. This makes it possible to examine minute portions of a response pattern for finer detail.

Linear Sweep frequency is continuously adjustable in five overlapping ranges from 15 cycles to 60,000 cycles. Internal, external or line frequency synchronization with variable amplitude is available.

Means for intensity or "Z axis" modulation is provided. Approximately 14 volts peak will blank a trace of normal intensity.

The vertical amplifier frequency response is within 3 DB from 20 cycles to over 300,000 cycles and is usable to well over three megacycles. Square wave slant and over-shoot is held to less than 5 per cent of amplitude. This response will be found adequate for all phases of television receiver service including observation and diagnosis of Sync. signals.

TUBE COMPLEMENT:

5UP4	Cathode Ray Tube.
4—6J6	Horizontal and Vertical Amplifiers.
1—12AU7	Vertical pre-amplifier.
1—6J6	Linear Sweep oscillator and Sync. injector.
2—6X4	High voltage rectifiers.

LINE VOLTAGE: 105-125 volts, 50-60 cycles.

SIZE: Height 16¼"; Width 9⅛"; Depth 8" over all

WEIGHT: 25 lbs.; Shipping weight 30 lbs.

Hight Frequency Crystal Probe...$7.50

DEALERS NET PRICE including operators manual $179.50

CONSERVE CRITICAL MATERIALS

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Ill.
Phone Columbus 1-1221
In Canada:
Bach-Simpson Ltd., London, Ontario

tube mounted in place. The tube is positioned near the video detector and the video amplifier tubes, V8 and V9, so that the length of the connecting leads may be kept to a minimum. After mounting the new tube socket, the following circuit changes were made.

The coupling from the video detector to the first video amplifier was changed to direct coupling by removing C50 and R49 (see Figure 2), and connecting the junction of L18 and L19 directly to pin 1 of V9. R48, the video detector diode load resistor, was changed from 3900 to 4700 ohms. Refer to Figure 4 for placement of parts. The bias on the video amplifier is now derived from the rectified signal or from the rectified noise when no signal is present.

In the contrast circuit, R40, R41, R42, R43, and R44 were removed. These components are located near the contrast control at the front of the chassis. Removing these components leaves the contrast control free from all connections. Pin 6 of V9 was then disconnected from the plus 135 volt line and connected to the arm of the contrast control, and bypassed with a .1 mfd. capacitor (C106). A 10K ohm resistor (R134) was added from the low side of the control to ground and the high side of the control connected to the plus 135 volt line.

In the plate circuit of V9, R51 and the connection to C4B were removed. The low side of R50 was then connected to plus 135 volts.

The next step was the connecting of the keyed AGC tube in the circuit. Pin 3 was grounded and pin 4 was connected to the filament line. R135, a 47K ohm isolation resistor, was connected from pin 1 of the AGC tube to the junction of L21 and R50. Pins 2 and 7 were connected to the plus 135 line. Pin 6 was bypassed to the plus 135 line with a .01 mfd. capacitor (C103), and was also connected to the plus 275 line through a 27K ohm resistor (R136).

Because of the length of the lead required to connect the AGC winding to the keyed AGC circuit, a shielded cable was used. This prevents the coupling of the sharp pulses present to the other circuits. Amphenol 21-138 microphone cable, or similar type, can be used in this application. In order that the phase relationship of the pulses fed to the AGC tube are correct, it may be necessary to reverse the connections on the AGC winding after the set is put in operation. The center conductor of the cable was connected to pin 5 of the AGC tube. The shield portion of the cable was connected to chassis through two 100K ohm resistors (R139 and R140) which were bypassed by C104. The junction of R139 and R140 was bypassed by C105 and connected to the video IF bias line where the original contrast bias voltage was applied. A lead was then connected from the junction of C104 and R140 to a terminal strip which was added near the contrast control. R137 was then wired from the termination of this lead to pins 5 and 6 of the bias clamper tube. The end of R29 which connects to the terminal strip was unsoldered and a 4.7 meg. resistor (R138) was added in series with it. The other end of the 4.7 meg. resistor was then connected to the plus 135 volt line as shown in Figure 3. Actually R29 may be removed from the circuit but due to the close spacing of components around it, it is much easier to merely connect R138 in series with it. The net result is the same.

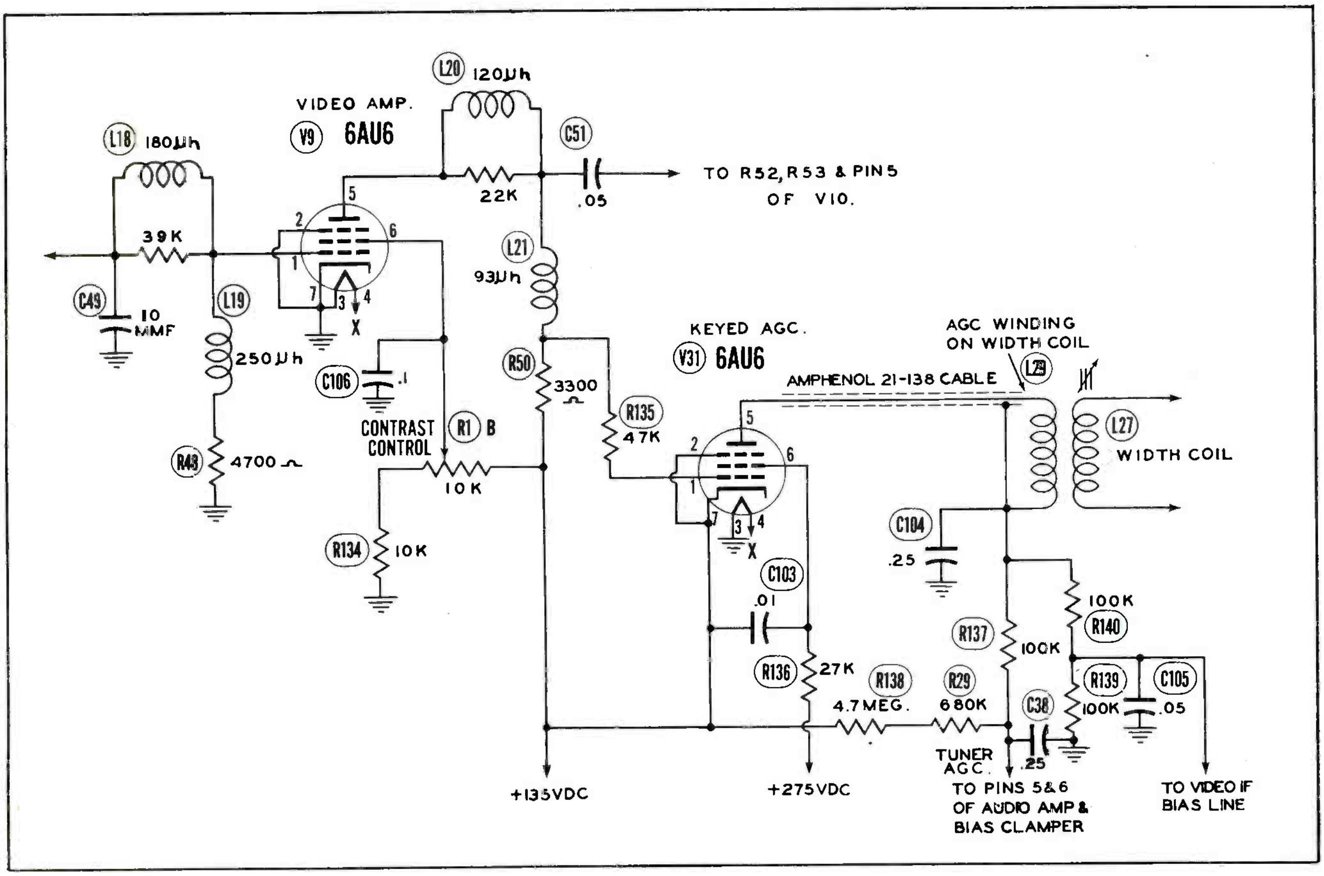


Figure 3. Keyed AGC Circuit.

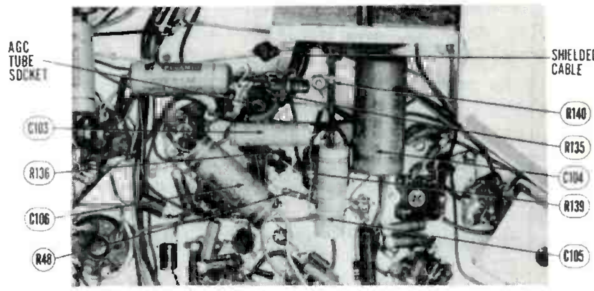


Figure 4. Bottom View of Converted Chassis.

On some models the bias line to the tuner was grounded. If this is the case on the particular model which is being converted, this line should be removed from chassis and connected to pins 5 and 6 of the bias clamper tube.

This completed the circuit changes required for the addition of the keyed AGC circuit. The set was then turned on and checked for operation. If the circuit fails to operate properly, it may be necessary to reverse the connections on the AGC coil as previously mentioned.

Although this circuit is directly adaptable to the 630-type chassis, it may be incorporated in many other models with certain modifications. The prime requisite, however, is that a positive going video signal be present in the plate circuit of the video amplifier.

* * *

ENGINEERING VIEWPOINT

A group of engineers were coming home from a party one night. They stood in front of the house of one of their number and called for the father.

"Will you please do ush a favor?" asked one.

"What do you want?" replied the father.

"Will you please come out here and pick out Jimmie so the rest of ush can go home."

\- The CORNELL ENGINEER

"Now that all our neighbors have their own TV Sets, let's get that out of here."

Experiments in Audio

by James R. Ronk

SQUARE WAVE GENERATION

A simple device for converting a sine wave signal into a square wave for general audio experimentation.

EXPERIMENTS IN AUDIO

The last few years have witnessed a widening interest in the use of visual testing and indicating methods. Television servicing requirements have undoubtedly been responsible for the major impetus in this direction, but even prior to its mass adoption, there had been a steady trend in the audio field toward visual performance checks as compared to the highly fallible listening tests. Aural impressions too frequently combine individual hearing deficiencies and personal taste, to ever contribute much to acceptable standards.

The general worth and utility of the square waveform in audio system evaluation has been well established. Properly used. and with adequate accessories, it can readily identify frequency response, phase shift, and to some extent transient behavior. In other words, it provides a rapid comprehensive picture of the amplifier system.

This article deals with a method of obtaining square waveforms from a sine wave source. Most service shops have such a source available in their standard servicing equipment. With the unit to be described, the audio output of the source need not be great, say in a range up to 5 or 6 volts, and can have single, multiple or completely variable frequency.

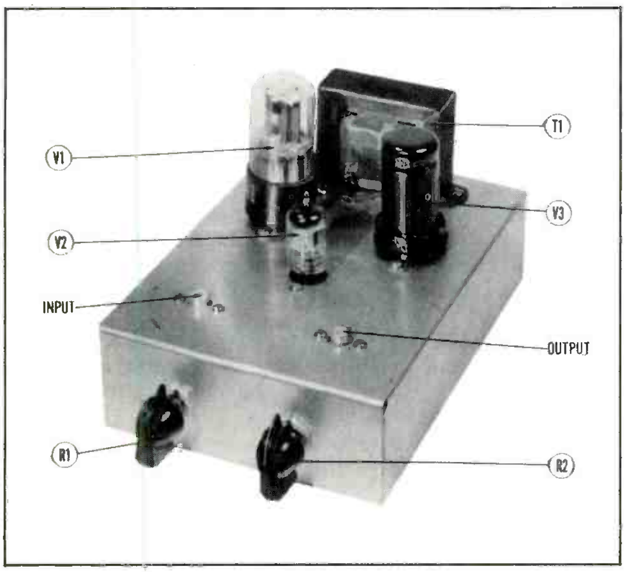


Fig. 1. Clipper Unit, Top Chassis View.

It might be wise to first review the design of the unit and then, with operating principles in mind, study its general application.

The square wave generator, or rather, clipper, is pictured in Figures 1 and 2, and the schematic diagram appears in Figure 3.

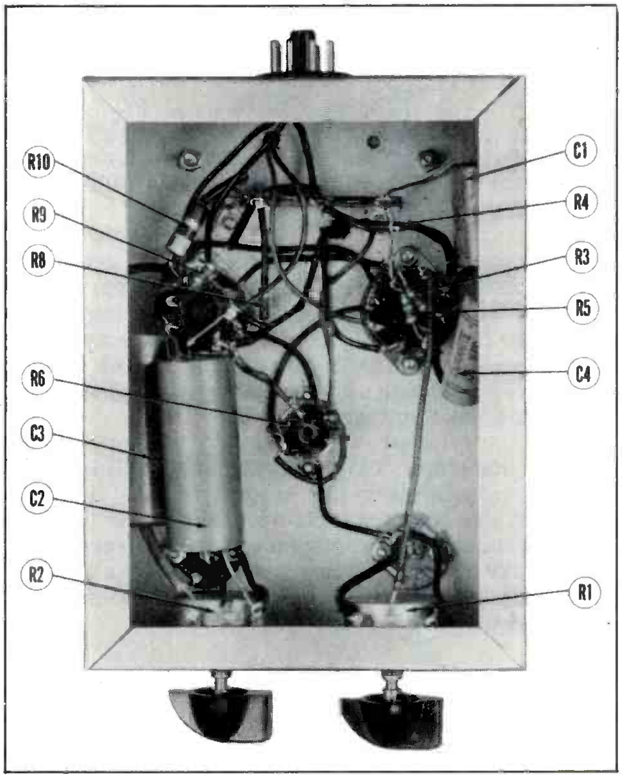


Fig. 2. Clipper Unit, Bottom Chassis View.

As indicated in these illustrations, the design does not include a self-contained power supply since our own application was in conjunction with already existing chassis and rack assemblies containing a master supply. However, power supply voltages are not critical. Standard values of 6.3 volts @ 1.2 amperes for the heaters and 275 volts @ approximately 40 milliamperes for the plate supply were used on the original.

The plate supply voltage should be well filtered since appreciable hum voltage will make comparison

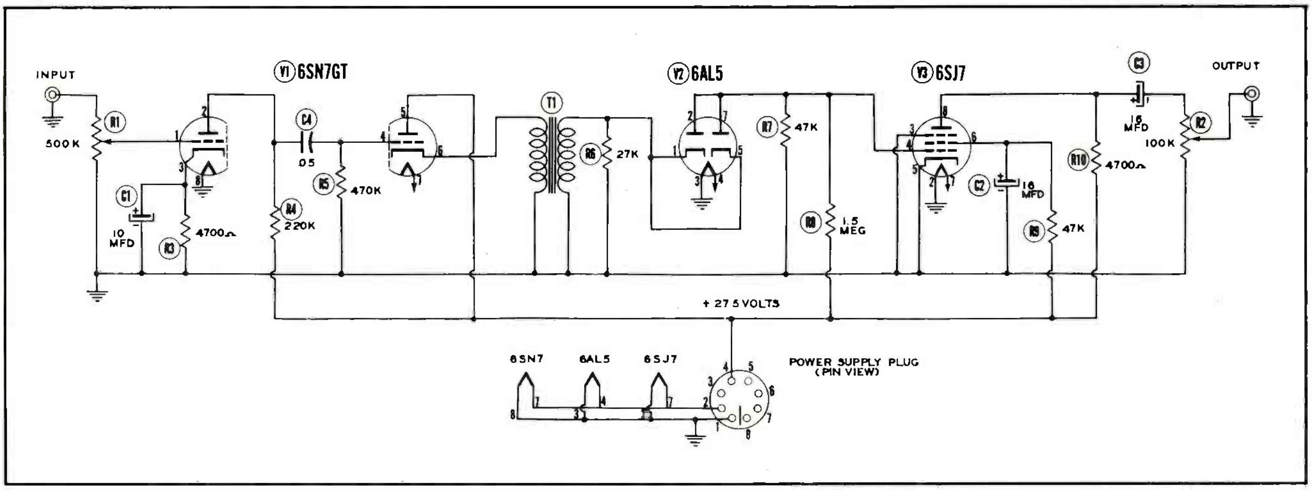


Fig. 3. Schematic Diagrams of Square Wave Clipper.

of waveforms difficult, especially at low audio frequencies.

One-half of the type 6SN7GT (V1) is used as a conventional voltage amplifier stage. Sine wave voltage input to this stage is controlled by R1. With component values as shown, the stage has an approximate gain of 17.

The remaining half of V1 is employed as a cathode follower which, through transformer T1, couples the output of the voltage amplifier to the diode rectifier.

An earlier design with which we experimented had the 6SN7GT connected as a combination voltage amplifier-rectifier stage; however, the low impedance load of the diode circuit affected the voltage amplifier to such extent that it was impossible to develop proper rectified signal for the clipper stage, with reasonable input voltage to V1.

Transformer T1 is an interstage unit having a primary to secondary ratio of 1 to 2.6. The unit employed was selected from several similar types on hand, because the DC resistance of the primary winding of 1120 ohms provides the proper bias to limit plate current to the 10 milliampere maximum recommended.

The shunt resistor R6 across the transformer secondary is included to prevent winding resonance from causing spurious "pips" or traces in the waveform. Its value, 27K ohms in this instance, should probably be arrived at by cut and try with the individual unit chosen.

Resistor R7 - 47,000 ohms - acts as the diode load, and Resistor R8 - 1.5 megohm - serves to clamp the grid of the clipper (V3) to prevent "bounce" which might occur as it returns to the zero point. Note that the grid of V3 is directly coupled to the diode output and that this is the bias source for V3. The 6SJ7 clipper tube, with a nominal 6 or 7-volt cutoff, is driven far beyond the cutoff point on the negative excursion, with the result of square wave formation in the plate circuit.

The clipper output is coupled to the 100K ohm output control by electrolytic capacitor C3. The 16 mfd. capacity of C3 is not actually required - lower values (down to 5 mfd.) will do, but these units were at hand and worked satisfactorily.

Immediately following are some measurements taken during typical operation:

Frequency	100 Cycles	1000 Cycles
Sine Wave Input (Volts) (1st Grid, Pin 1 of V1)	4.0	3.4
Signal Voltage - 2nd Grid (Pin 4 of V1)	71	61
Signal Voltage-Cathode (Pin 7 of V1)	61	52
Signal Voltage-Diode (Pins 1, 5 of V2)	100	89
Maximum Square Wave Output (Volts)	75	71

This table shows that the square wave output is sufficient for single stage analysis in conventional amplifiers.

As a general consideration, the greatest steepness of wavefront occurs with maximum sine wave signal amplitude; however, it is possible with this device to reach an overload point. Consequently, R1 should be adjusted for maximum symmetry of square wave output.

Before proceeding to application, we would like to say that no originality is claimed for the design of this clipper unit. We investigated several designs and found that, for the application which involves comparatively low sine wave voltage availability, the circuit shown here has the best operation and possibilities.

For those who are interested in experimenting with this clipper, a Parts List is included at the end of this article.

As previously mentioned, the clipper described is intended for use in the audio field. In actual use here, we had highly satisfactory results with input frequencies ranging from 100 to 10,000 cycles. Most audio square wave experimental work is done at either 400 or 1,000 cycles. It is possible, because of the richness of harmonic content of the square wave,

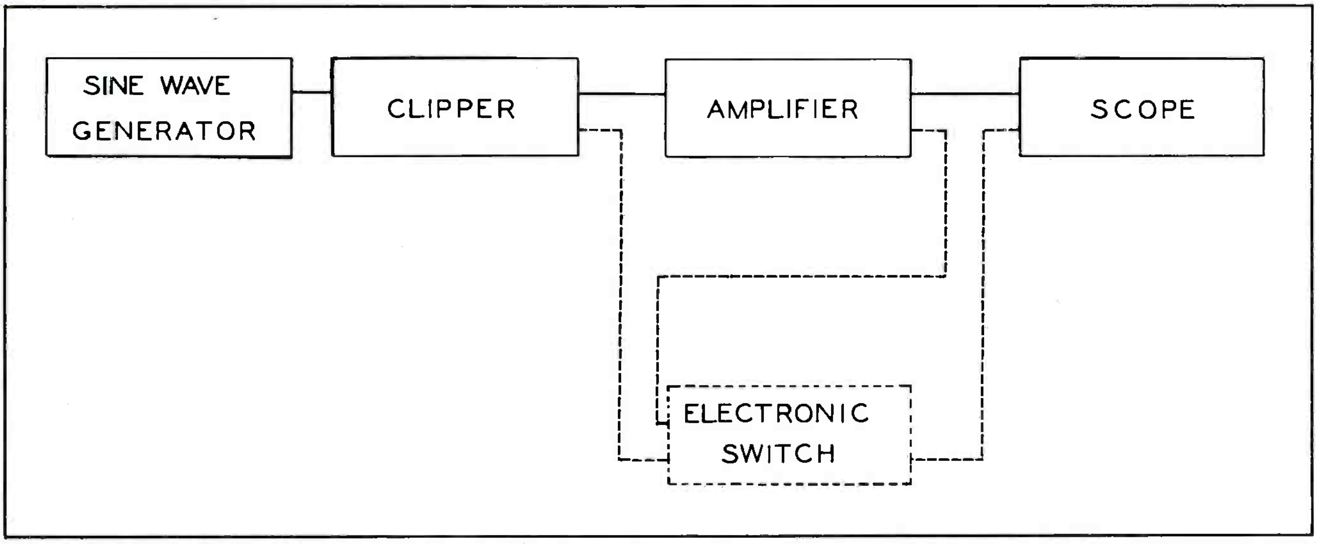


Fig. 4. Equipment Setup for Use of the Square Wave Clipper.

to observe extended frequency response, using only these two frequencies; however, for what it may be worth in future experiments, this clipper unit can provide extremely wide-range fundamentals, as the above frequency range shows.

APPLICATION

Figure 4 shows a representative setup of equipment for use in square wave analysis of amplifiers. As shown, the sine wave generator is fed into the clipper stage, the output of the clipper is applied to the amplifier, and the amplifier output is observed on the scope. The dotted portion of the figure represents optional use of an electronic switch. If at all possible, the electronic switch should be included, since it provides the basis for instantaneous comparative performance of differing or successive stages, or the ability to view the square wave output to the amplifier, and the amplifier output, simultaneously.

A word or two about the use of the scope for interpretation of the wave forms might help a little. First, keep the waveform limited to the center area of the scope. If the scope should have any nonlinearity in either the horizontal or vertical direction, it will tend to distort or amplify any variations from the square waveform, if they occur at the extreme range of the scope. Also, in observing the square waveforms, always have a minimum of two complete cycles for accurate observation.

Figure 5 is an illustration of an ideal square waveform, and the output of the clipper should very closely approximate this figure.

Figures 6 through 9 show waveforms obtained through a representative amplifier.

Figure 6 indicates poor high-frequency response of an amplifier, while Figure 7 shows an improved high-frequency response.

Figure 8 is indicative of poor low-frequency response, while Figure 9 shows an improvement in the low-frequency characteristics.

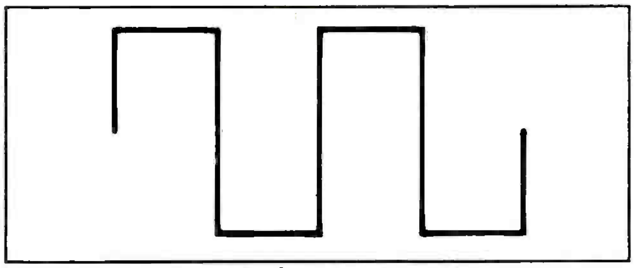


Fig. 5. Ideal Square Waveform.

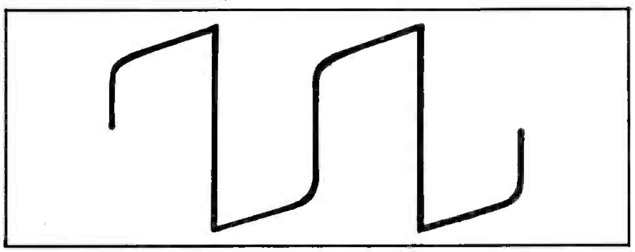


Fig. 6. Amplifier with Poor High Frequency Response.

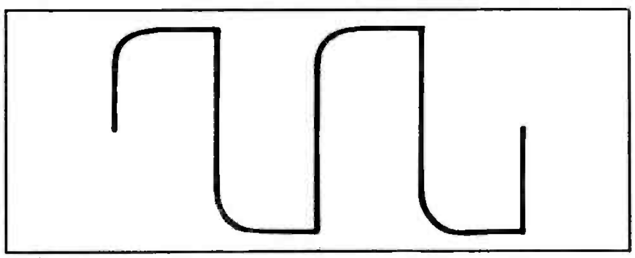


Fig. 7. Amplifier with Improved High Frequency Response.

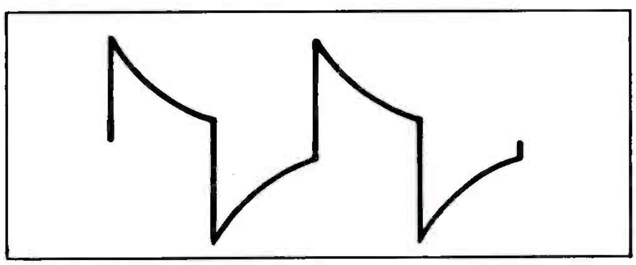


Fig. 8. Amplifier with Poor Low Frequency Response.

♦ ♦ Please turn to page 61 ♦ ♦

♦ ♦ Continued from page 9 ♦ ♦

are identical but they have sufficient range to obtain resonance from 22.8 to 26.3 mc. Each of the chokes are tuned to the different frequencies which are marked on the schematic.

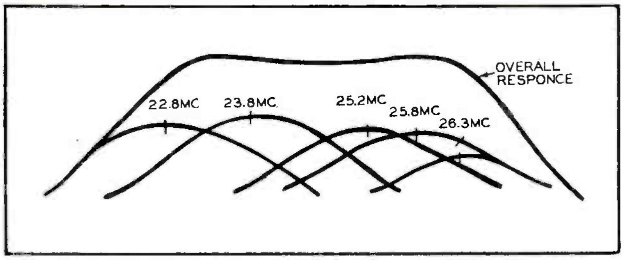


Figure 2-7. Overall Response Curve of Stagger-Tuned IF Amplifier.

Figure 2-7 illustrates the overall bandpass that is obtained through stagger tuning. The five resonant curves represent the response curve of each of the tuned chokes in the circuit. These curves are not drawn to exact scale but serve to show how the sum of the individual response curves are additive. The variation in gain is due to a difference of loading on the chokes.

Another type circuit, which has some advantages over the capacitively coupled circuit of Figure 2-6, employs dual winding transformers that are single tuned. By employing inductive coupling of this type, the gain of the stages can be controlled by varying the spacing between the windings or by changing the turns ratio itself. The response curve of this type of transformer is essentially the same as the tunable choke just described. Either the primary or secondary, or both, can be shunted to obtain the desired effective Q, thus controlling gain and bandpass.

Another advantage of this type of coupling is the low DC resistance in the grid circuit and the low capacity between stages. When the signal is capacitively coupled to a grid having a resistive load, the discharge time is much longer than the charge time, which may cause white dots or streaks to appear in the picture after noise pulses.

In order to better understand what causes this, refer to Figure 2-6 and assume that a noise pulse is received at the grid of the second IF amplifier. On the positive half of the signal the noise pulse may be strong enough to cause grid current to flow, charging

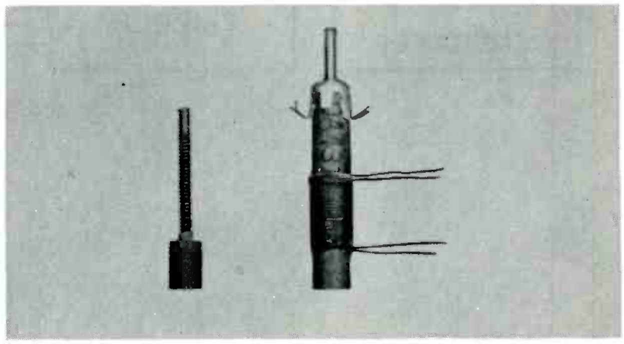


Figure 2-9. Dual Winding Transformer Having Single Tuning.

the coupling capacitor with an excess of electrons on the right side. After the noise pulse, the capacitor will discharge and the electron flow will be down through the grid resistor which will decrease the gain of the stage for an instant or may even momentarily drive the grid to cut-off. Since the discharge current of the coupling capacitor is in the reverse direction from the noise pulse, which corresponds to a "blacker than black" signal, a white dot or streak follows the noise pulse. This is especially noticeable in cases of ignition interference and in weak signal areas where there is a poor signal-to-noise ratio, resulting in "snow." Some manufacturers have placed a small coil across the grid resistor to reduce the DC resistance in the grid circuit. These coils are sometimes referred to as "grass cutters" since they tend to decrease the "snow" or "grass" in the picture.

The circuit of Figure 2-8 shows a typical video IF strip using dual winding transformers with single tuning. Three stages are used and the four IF transformers are stagger tuned to provide adequate bandpass. The grids of the first two stages are returned to the AGC line to control the gain of the IF strip. Since a change of gain of these stages causes the input capacity to vary, due to the Miller effect, an unbypassed 47 ohm resistor is placed in the cathode circuit to introduce a small amount of degeneration. This degeneration decreases the input capacity of the stage which results in a smaller change in input capacity as the gain of the stage is varied. The grid of the third stage is returned to ground and since its gain is not varied, the input capacity will remain con-

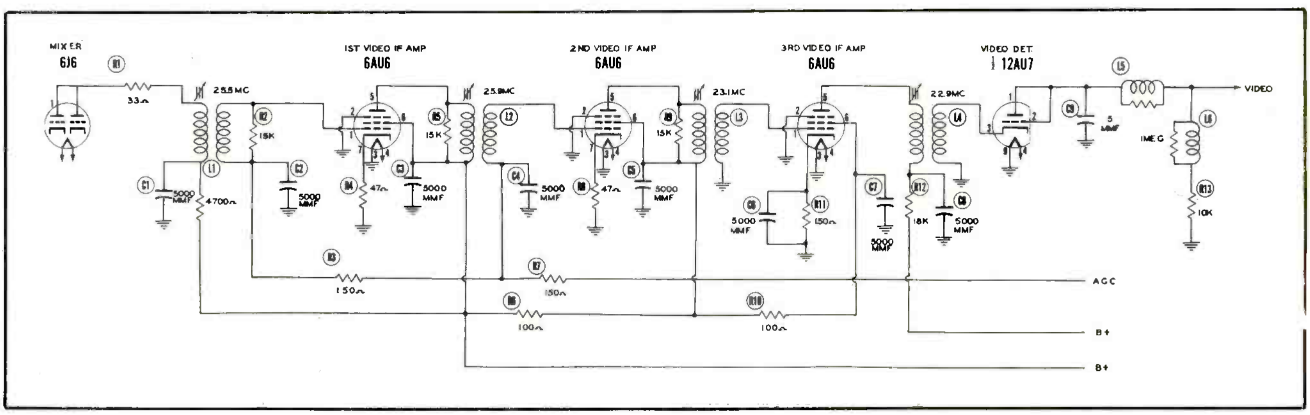


Figure 2-8. Complete Stagger-Tuned Video IF Strip Using Dual Winding Transformers with Single Tuning.

stant. This makes it possible to bypass the cathode resistor and realize more gain from the stage. The value of the cathode resistor is increased to provide adequate bias for the stage. Figure 2-9 illustrates a dual winding transformer representative of the type used in this circuit.

The alignment of either of the circuits shown in Figures 2-6 and 2-8 is comparatively simple. Each of the alignment frequencies is fed to the mixer while the appropriate coil is adjusted for maximum output at the detector load. The overall response curve can then be checked by the use of an oscilloscope and sweep driven generator. If the circuit is normal, only slight touch-up adjustments are required after checking the overall response curve.

The pre-alignment instructions should always be read carefully so that the proper bias can be applied to the circuits. In some cases, even though all components are okay, oscillation will take place in the IF amplifier. This is usually caused by mis-adjustment of the coils so that adjacent stages are tuned to the same frequency. In most cases readjustment will stop the oscillation, but should it continue, it may be necessary to inject the signal near the end of the IF strip and remove the tubes ahead of that point. After the adjustment of that stage is made, the tube in the stage ahead is replaced and the signal is injected at this point. Adjustment can then be made on this stage. By progressing forward in this manner, the IF strip can be aligned to obtain stable operation. In receivers having series filament operation, the coils can be shunted which will accomplish the same thing as far as oscillation is concerned.

Another method of obtaining wide bandpass is through the use of double tuned, over-coupled transformers. By closely spacing the primary and secondary windings, and tuning both to the same frequency, a double humped response can be obtained. Figure 2-10 shows a partial schematic of a stage employing a double tuned over-coupled transformer along with the response curves that are obtained from such a circuit. By tuning both primary and secondary to the resonant frequency, the band width can be varied by changing the spacing, or coupling, between the two windings. The three response curves shown are obtained with variations in coupling. The response that is obtained with loose coupling, less than critical, is similar to that of the single tuned choke. If, however, the spacing between the windings is decreased, the response curve starts to flatten at the top as shown in Figure 2-10. By further increasing the coupling, the bandpass increases but there is a dip in the curve at the resonant frequency. In some cases two such stages are used along with additional single tuned stages which are so aligned to fill in the dip in the response curve.

One of the advantages in the use of overcoupled transformers is the fact that the gain of the stage can be controlled so that any tendency for oscillation can be prevented. Also by referring to Figure 2-10, it can be seen that the output capacity of one stage and the input capacity of the following stage are separated by the transformer, since the two capacities are across the primary and secondary, respectively. Thus the inductance of the windings of the transformer can

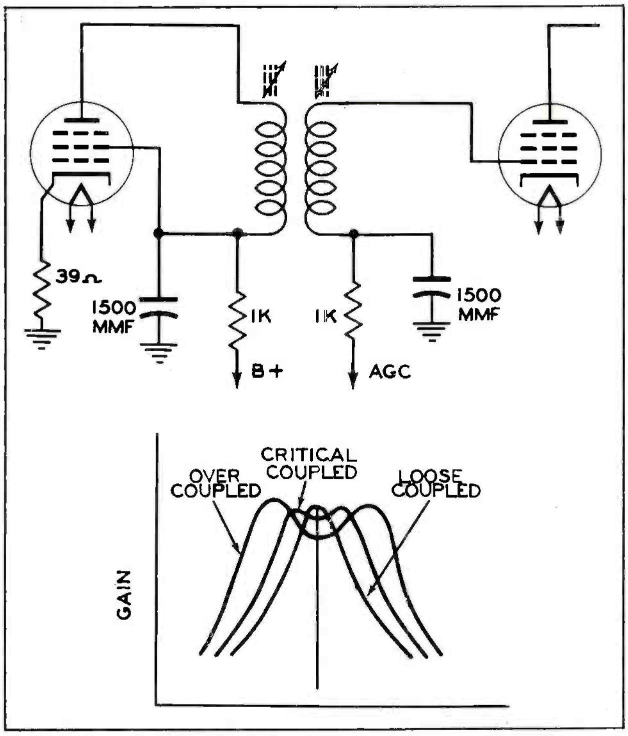


Figure 2-10. Response Curve and Circuit of Over-coupled Stage.

be made greater than the single winding tunable choke, since in this case the input and output capacities were in parallel, requiring a lower value of inductance to obtain resonance.

In some instances, a small capacitor, .5 to 5 mmf., may be added between plate and grid to provide a small amount of high side coupling to hold up the gain at the high end of the pass band.

When aligning over-coupled IF stages, a special procedure must be followed to assure proper alignment. Several methods are employed, but the most popular is through the use of a sweep signal generator and oscilloscope. With this method the response curve can be checked as alignment progresses, and any deviation from the desired results will show up immediately.

One procedure for aligning over-coupled IF stages calls for the adjustment of the transformers progressively starting from the last stage and working toward the mixer stage. The scope is connected to the video detector output and the signal is injected into the IF grids, progressing forward in the circuit. At each point, adjustments are made to obtain the desired response curve at that point. If any components are defective, they will show up in the ability to obtain the proper response at that stage. By progressing forward in the IF strip, the final response curve is obtained.

Another procedure for the alignment of over-coupled IF stages, is the adjustment of each stage separately through the use of a detector probe. The signal is injected at the grid of the stage and the response curve of that stage can be seen by connecting an oscilloscope, through a detector probe, to the

♦ ♦ Please turn to page 53 ♦ ♦

HERE'S THE BEST FOR EVERY TEST

Sylvania Radio and TV Testing Equipment

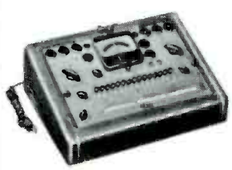
Television Oscilloscope
An exceptionally High-Gain, Wide-Band Oscilloscope Designed for Television. Accurately displays any TV pulse or wave-shape on a large, eye-saving 7" screen. Sensitivity: 0.01 v./in. Vert. response useful to 4.0 mc. Hard-tube sweeps to 50 kc; phasing control; pos. or neg. sync. control; many other outstanding features. Recommended for servicemen; laboratories; advanced schools and industry. Price $249.50.

Type 400

Type 132 Z

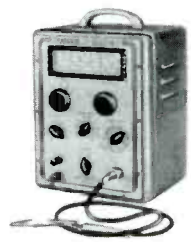
General Purpose Oscilloscope
A Versatile 7" 'Scope with Many Features Found in Type 400 above, priced as low as oscilloscopes with smaller screens. Sensitivity: 0.1 v./in.; freq. response: exceeds 7 cps. to 70 kc. Widely used by servicemen, schools and industry for AM-FM-TV testing. Price: $149.50.

Tube Tester Type 220 Made by a Tube Manufacturer for Tube Users, these instruments test for ALL usual faults—not just one particular characteristic. New and exclusive ohmmeter-type shorts/leakage test indicates "GOOD" or "REPLACE," directly on the illuminated meter. Gas and special heater-cathode leakage tests made in single operation. Single composite dynamic test for emission, trans-conductance and relative tube life. Panel-mounted roller-chart; convenient switches; provisions for future tubes. Portable Type 220 has durable metal case and handle; removable cover. Size: 6" x 11¼" x 17". Price: $114.50.



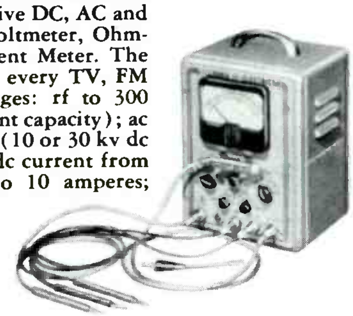
Tube Tester Type 219 The counter Type 219 is electrically equivalent to the portable type. Attractively housed in a streamlined wood and metal cabinet. Adaptable to any surroundings. Occupies small counter space. Size: 5¾" x 13" x 18¾". Price: $114.50.

TV Sweep Signal Generator
An ALL ELECTRONIC Sweep Generator for TV and FM. Fundamental center frequencies: 2-25, 20-64, 60-120, and 140-230 mc. Two adjustable sweep widths: 0-600 kc./15 mc.; excellent sweep linearity; output 0.1 v. Edge-lighted dial; simplified controls; small size: 11½" x 8½" x 7". May be used with any 'scope and marker, including those shown above and below. Price: $139.50.



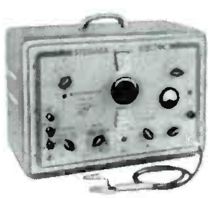
Type 500

Polymeter-TV Vacuum-Tube Voltmeter A Sensitive DC, AC and RF Vacuum-Tube Voltmeter, Ohmmeter and DC Current Meter. The basic instrument for every TV, FM and AM shop. Ranges: rf to 300 volts (only 3 μμf shunt capacity); ac and dc to 1000 volts (10 or 30 kv dc using h.v. probes); dc current from 50 micro-amperes to 10 amperes; and resistance from 0.5 ohms to 1000 megohms. Frequency range to 300 megacycles. High input impedance on all voltage ranges. Size identical to TV generator at left. Price: $99.50.



Type 221 Z

FM-AM Signal Generator Useful as a TV Marker. A versatile AM-FM generator, doubly useful for peaking alignment of TV and as a TV marker. Calibrated to 0.05%. Fundamentals 80 kc to 120 mc; harmonics to 240 mc. Modulation: 0-100% AM; 0-30/150/700 kc FM. 1.0 volt max. output. Low leakage. Built-in circuit for external crystal. Price: $139.50.



Type 216

Type 145

Audio Oscillator An Accurate Sine-Wave Generator for Better Equipped Shops and Sound Specialists. Maximum output: 22.5 volts, 20-20,000 cps, flat within 2 db. Price: $129.50.

★ ★ ★ ★

For full information about Sylvania's complete line of quality testing equipment, write today to: Sylvania Electric Products Inc., Dept. R-2805 Emporium, Penna.

SYLVANIA ELECTRIC

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 26

Covering Folder Sets Nos. 1 thru 134

HOW TO USE THIS INDEX: To find the PHOTOFACT Folder you need, look for the name of the receiver in the alphabetical listing below. Then find the required model number under the receiver name. Opposite the model you will find the number of the Set in which it appears and the Folder number. For example, under *ADMIRAL*, Chassis 3A1, the reference is **2**—24. The bold **2** identifies the PHOTOFACT Set number in which the Folder appears. The light face number, 24, identifies the individual Folder. It's easy to find the set you need.

IMPORTANT: The suffix letter "A" following the Set or Folder Number in the index listing below indicates a "Preliminary Data Folder." These Folders are designed to provide the service technician *immediately* with preliminary basic data on Television Receivers—pending their complete coverage in the standard, uniform PHOTOFACT Folder Set presentation.

*** REGULAR PHOTOFACT SUBSCRIBERS MAY OBTAIN SPECIFIC SERVICING DATA ON THIS RECEIVER PRIOR TO ITS COVERAGE IN A PHOTOFACT FOLDER BY SENDING THE *SERIAL NUMBER, CHASSIS DESIGNATION, NAME AND MODEL NUMBER,* TO US**

This Service is Free to Regular PHOTOFACT Subscribers

Please request—Schematic, Alignment Data, or whatever you require. Please accompany your request with a statement giving the number of the last PHOTOFACT Volume or Set Number that you have purchased and the name of the Parts Jobber who sees to it that you receive each Set of PHOTOFACT Folders as they are published.

BE A REGULAR PHOTOFACT SUBSCRIBER. INSTRUCT YOUR PARTS JOBBER TO SEND PHOTOFACT SETS TO YOU REGULARLY AS THEY ARE PUBLISHED. ASK ABOUT THE EASY PAY PLAN.

Production Change Bulletins contain data which is supplementary to previously issued Photofact Folders, and are listed in this Index immediately following the listing of the initial coverage of the same models or chassis.

ADMIRAL—Cont.
- Models 221K35, 221K36 Tel. Rec. (See Ch. 21F1) ... 127—1A
- Models 321K15, 321K16, 321K18 Tel. Rec. (See Ch. 21F1) ... 127—1A
- Models 321K27 Tel. Rec. (See Ch. 21F1) ... 127—1A
- Models 321K35, 321K36 Tel. Rec. (See Ch. 21F1) ... 127—1A
- Models 321K46, 321K47, 32K49 Tel. Rec. (See Ch. 21F1) ... 127—1A

AERMOTIVE
- 181-AD ... 12—1

AIRADIO
- SU-41D ... 11—1
- SU-52A, B, C (Receiver) ... 13—2
- TRA-1A, B, C (Transmitter) ... 13—1
- 3100 ... 37—1

AIRCASTLE
- DM-700 ... 85—1
- EV-760 (See Model DM-700) ... 85
- G-516, G-518 ... 48—3
- G-521 ... 54—3
- G-724 ... 52—25
- G-725 ... 50—1
- K1 ... 93—1
- P-20 ... 71—3
- P-22 ... 87—1
- PAM-4 ... 101—1
- PC-8, PC-358 ... 99—1
- PM-78 ... 100—2
- PM-358 ... 98—1
- PX ... 13—35
- REV248 ... 127—2
- SC-448 ... 62—2
- TD-6 ... 103—3
- WEU-262 ... 91—1
- WRA1-A ... 47—1
- WRA-4M ... 60—1
- XB702, XB703 Tel. Rec. ... 93A-1
- XL750, XP775 Tel. Rec. ... 93A-1
- 7B ... 52—1
- 9 ... 50—2
- 10T Tel. Rec. ... *
- 12C, 12T Tel. Rec. ... *
- 15 ... 67—2
- 16C, 16T Tel. Rec. ... *
- 101 ... 86—1
- 102B ... 98—2
- 106B ... 13—3
- 150, 153 ... 126—2
- 171, 172 ... 96—1
- 198 ... 83—1
- 201 ... 81—1
- 211 ... 65—1
- 212 ... 68—3
- 213 ... 63—1
- 2271, 227W ... 84—1
- 312 Tel. Rec. ... *
- 316 Tel. Rec. ... *
- 358VM ... 127—3
- 412 Tel. Rec. ... *
- 416 Tel. Rec. ... *
- 568 ... 14—1
- 572 ... 55—1
- 602-182144 ... 114—2
- 603-PR-8.1 ... 133—2
- 604 ... 53—2
- 606-400WB ... 119—2
- 607-314, 607-315 ... 122—2
- 621 (Ch. FJ-91) ... 14—2
- 626 ... 18—3
- 641 ... 17—1
- 651 ... 15—1
- 9151, W ... 129—2
- 935 ... 128—2
- 5000, 5001 ... 16—2
- 5002 ... 19—1
- 5003, 5004, 5005, 5006 ... 20—1
- 5008, 5009 ... 46—1
- 5010, 5011, 5012 (Ch. 110) ... 13—4
- 5015.1 ... 118—3
- 5020 ... 16—3
- 5022 ... 123—2
- 5024 ... 45—1
- 5025 ... 24—2
- 5027 ... 49—3
- 5028 ... 44—1
- 5029 ... 51—1
- 5035 ... 46—2
- 5036 ... 72—2
- 5044 ... 121—2
- 5050 ... 48—4
- 5052 ... 45—2
- 5056-A ... 120—2
- 6042 ... 61—1
- 6050 ... 74—1
- 6053 ... 97—1
- 6514 ... 18—4
- 6541 ... 17—2
- 6544, 6547 (See Model 6541) ... 17
- 6611, 6612, 6613, 6630, 6631, 6632, 6634, 6635 ... 15—2
- 7000, 7001 ... 14—3
- 7004 ... 19—2
- 7014, 7015 ... 57—3
- 7015 Early ... 47—2
- 7553 ... 45—3
- 90081, 9008W ... 99—2
- 90091, 9009W ... 97—2
- 90121, 9012W ... 94—1
- 10002 ... 56—1
- 10003-1 ... 56—2
- 10005 ... 62—3
- 10021-1, 10022-1 ... 59—3
- 10023 ... 58—1
- 10024-1 ... 58—2
- 108014, 108504 ... 57—4
- 121104 ... 73—1
- 121124 ... 61—2
- 127084 ... 55—2
- 131504 ... 60—2
- 132564 ... 69—1
- 138104 ... 54—3
- 138124 ... 64—1

AIRCASTLE—Cont.
- 139144 ... 59—4
- 147114 ... 56—3
- 149654, 150084 ... 71—4
- 159144 (See Model 139144) ... 59

AIR CHIEF (See Firestone)

AIR KING
- A-400 (Ch. 470) ... 23—1
- A-403 ... 20—2
- A-410 ... 34—1
- A-410 (Revised) ... 40—1
- A-426 ... 43—1
- A-450 ... *
- A-501, A-502 (Ch. 465-4) ... 31—3
- A-510 ... 24—3
- A-511, A-512 ... 30—2
- A-520 ... 49—4
- A-600 ... 26—3
- A-604 ... 81—2
- A-625 ... 50—3
- A-650 ... 45—4
- 800 ... 66—1
- A-1000, A-1001 Tel. Receiver ... 58—3
- A1001A Tel. Rec. ... 75—2
- A1016 Tel. Rec. ... 91—2
- A2000, A2001, A2002 Tel. Rec. (See Model A1001A) ... 75
- A2010 Tel. Rec. (See Model A1001A) ... 75
- A-2012 Tel. Rec. (See Model A1001A) ... 75
- 16C1, 16C2, 16C3 Tel. Rec. ... 121—3
- 16M1 Tel. Rec. (See Model 16C1) ... 121
- 16T1, Tel. Rec. (See Model 16C1) ... 121
- 19C1 Tel. Rec. (See Model 16C1) ... 121
- 718R Tel. Rec. (See Model 16C1) ... 121
- 2017R Tel. Rec. ... 111—2
- 4601 (See Model 4609) ... 11
- 4603 ... 3—36
- 4604 ... 4—25
- 4604D (See Model 4604) ... 4
- 4607, 4608 ... 3—1
- 4609, 4610 Early (See Model 4607) ... 3
- 4609, 4610 ... 11—2
- 4625 ... 13—8
- 4700 ... 39—1
- 4704 ... 12—2
- 4705, 4706 ... 9—1
- 4708 (See Model 4704) ... 12

AIR KNIGHT (SKY KNIGHT)
- CA-500 ... 17—4
- CB-500P ... 17—31
- N5-RD291 ... 17—3

AIRLINE
- 05BR-3021B Tel. Rec. ... *
- 05BR-3021C Tel. Rec. ... *
- 05BR-3024B Tel. Rec. ... *
- 05BR-3024C Tel. Rec. ... *
- 05BR-3027A Tel. Rec. ... *
- 05BR-3027B Tel. Rec. ... *
- 05BR-3034A Tel. Rec. ... *
- 05BR-3041A Tel. Rec. ... *
- 05BR-3044A Tel. Rec. ... *
- 05GAA-992A ... 125—2
- 05GCB-1540A, 05GCB-1541A ... 131—2
- 05GCB-3019A Tel. Rec. ... 116—2
- 05GHM-1061A ... 133—3
- 05GSE-3020A Tel. Rec. ... 117—3
- 05GSE-3037A Tel. Rec. ... *
- 05WG-1811B (See Model 94WG-1811A) ... 99
- 05WG-1813A ... 127—4
- 05WG-2748C, D, E (See Model 94WG-2748A) ... 90
- 05WG-2749D ... 129—3
- 05WG-2752 ... 100—3
- 05WG-3016A, B Tel. Rec. (See Model 94WG-3006A Set 72 and Set 110 Folder 2)
- 05WG-3030A Tel. Rec. ... 119—3
- 05WG-3031A Tel. Rec. ... 109—1
- 05WG-3031B Tel. Rec. ... *
- 05WG-3036A, B Tel. Rec. ... *
- 05WG-3038A Tel. Rec. ... 129—4
- 05WG-3039A, B Tel. Rec. ... *
- 05WG-3040 Tel. Rec. ... *
- 05WG-3042A Tel. Rec. ... *
- 05WG-3045A Tel. Rec. (See Model 05WG-3038A) ... 129
- 15GHM-936A, 15GHM-937A ... 134—2
- 15GSE-3043A Tel. Rec. ... *
- 15GSE-3047A, B Tel. Rec. ... *
- 15WG-2745C ... 130—2
- 15WG-2765A (See Model 15WG-2745C) ... 130
- 54BR-1501A, 54BR-1502A ... 2—26
- 54BR-1503A, B, C, 54BR-1504A, B, C ... 3—4
- 54BR-1505A, B; 54BR-1506A, B ... 2—34
- 54KP-1209A, B ... 8—1
- 54WG-1801A, 54WG-1801B ... 4—33
- 54WG-2500A, 54WG-2700A ... 4—15
- 64BR-916A ... 3—34
- 64BR-916B (See Model 74BR-916B) ... 17
- 64BR-917A ... 10—1
- 64BR917B (See Model 64BR917A) ... 10
- 64BR-1051A ... 2—32
- 64BR1051B (See Model 64BR1051A) ... 2
- 64BR-1205A, 64BR-1206A ... 10—3
- 64BR-1208A ... 16—4

AIRLINE—Cont.
- 64BR-1503B, 64BR-1504B (See Models 54BR-1503A, B, C; 54BR-1504A, B, C) ... 3
- 64BR-1513A, B; 64BR-1514A, B ... 24—4
- 64BR-1808A ... 16—5
- 64BR-2200A (See Model 64BR-1208A) ... 16
- 64BR-7000A ... 51—2
- 64BR-7100A, 64BR-7110A, 64BR-7120A ... 57—5
- 64BR-7300A, 64BR-7310A, 64BR-7320A ... 54—4
- 64BR-7810A, 64BR-7820A ... 53—3
- 64WG-1050A ... 10—2
- 64WG-1050B, 64WG-1050C, 64WG-1050D (See Model 64WG-1050A) ... 10
- 64WG-1052A ... 9—2
- 64WG-1052B (See Model 64WG-1052A) ... 9
- 64WG-1207B ... 18—5
- 64WG-1511A, 64WG-1511B, 64WG-1512A, 64WG-1512B ... 5—5
- 64WG-1801C (See Models 54WG-1801A, B) ... 4
- 64WG-1804A, B ... 4—27
- 64WG-1804C (See Model 64WG-1804A) ... 4
- 64WG-1807A, 64WG-1807B ... 5—4
- 64WG-1809A, 64WG-1809B (See Models 64WG-1511A, B; 64WG-1512A, B) ... 5
- 64WG-2007A, 64WG-2007B ... 5—6
- 64WG-2009A, 64WG-2009B ... 6—2
- 64WG-2010B ... 18—6
- 64WG-2500A (See Model 54WG-2500A) ... 4
- 64WG-2700A, 64WG-2700B (See Models 54WG-2500A; 54WG-2700A) ... 4
- 74BR-916B ... 17—5
- 74BR-1053A ... *
- 74BR-1055A ... *
- 74BR-1501B, 74BR-1502B ... *
- 74BR-1507, 74BR-1508A ... *
- 74BR-1513B, 74BR-1514B (See Models 64BR-1513A, B; 64BR-1514A, B) ... 24
- 74BR-1812A (See Model 74BR-1812B) ... 22
- 74BR-1812B ... 22—2
- 74BR-2001A (See Model 74BR-2001B) ... 23
- 74BR-2001B ... 23—2
- 74BR-2003A ... *
- 74BR-2701A ... 24—5
- 74BR-2702A (See Model 74BR-2702B) ... 25
- 74BR-2702B ... 25—3
- 74BR-2707A ... *
- 74BR-2708A ... *
- 74BR-2715A ... *
- 74BR-2717A ... *
- 74GSG-8400A, 74GSG-8700A ... 60—3
- 74GSG-8810A, 74GSG-8820A ... 52—2
- 74HA-8200A ... 58—4
- 74KR-1210A ... 41—1
- 74KR-2706B ... 35—1
- 74KR-2713A ... 43—2
- 74WG-925A ... 24—6
- 74WG-1050C, D (See Model 64WG-1050A) ... 10
- 74WG-1052B (See Models 64WG-1052A, B) ... 9
- 74WG-1054A ... 22—1
- 74WG-1054B (See Model 74WG-1054A) ... 22
- 74WG-1056A ... 29—1
- 74WG-1057A ... 32—2
- 74WG-1207B (See Model 64WG-1207B) ... 18
- 74WG-1509A, 74WG-1510A ... 27—1
- 74WG-1511B, 74WG-1512B (See Models 64WG-1511A, B; 64WG-1512A, B) ... 5
- 74WG-1802A ... 25—4
- 74WG-1803A (See Model 74WG-1802A) ... 25
- 74WG-1804C (See Models 64WG-1804A, B) ... 4
- 74WG-1807A, 74WG-1807B (See Models 64WG-1807A, B) ... 5
- 74WG-2002A ... 26—4
- 74WG-2004A ... 27—2
- 74WG-2007B, 74WG-2007C (See Models 64WG-2007A, B) ... 5
- 74WG-2009B (See Models 64WG-2009A, B) ... 6
- 74WG-2010A (See Model 64WG-2010B) ... 18
- 74WG-2010B ... 18—6
- 74WG-2500A (See Model 54WG-2500A) ... 4
- 74WG-2504A ... 28—1
- 74WG-2504B, 74WG-2504C (See Model 74WG-2504A) ... 28
- 74WG-2505A ... 18—7
- 74WG-2700A, 74WG-2700B (See Model 54WG-2700A) ... 4
- 74WG-2704A, 74WG-2704B, 74WG-2704C (See Model 74WG-2504A) ... 28

AIRLINE—Cont.
- 74WG-2705A, 74WG-2705B (See Model 74WG-2505A) ... 18
- 74WG-2709A ... 26—5
- 74WG-2711A (See Model 74WG-2505A) ... 18
- 84BR-1065A ... *
- 84BR-1503D, 84BR-1504D ... *
- 84BR-1515A, 84BR-1516A ... *
- 84BR-1517A, 84BR-1518A ... *
- 84BR-1815B, 84BR-1816B ... 55—3
- 84BR-2005A ... *
- 84BR-2715B ... *
- 84BR-2719A ... *
- 84BR-2726B ... *
- 84BR-3004 Tel. Rec. ... *
- 84GAA3967A ... 91—3
- 84GCB-1062A ... 52—26
- 84GDC-963B ... 51—3
- 84GDC-987A ... 53—4
- 84GHM-926B ... 55—4
- 84GSE-2730A, 84GSE-2731A ... 70—1
- 84GSE-3011A Tel. Rec. ... 82—1
- 84HA-1527A, 84HA-1528A (See Model 94HA-1527C) ... 67
- 84HA1529A, 84HA1530A ... 85—2
- 84HA-1810A, 84HA-1810C ... 69—2
- 84HA-2727A ... *
- 84HA-3002A, 84HA-3002B Tel. Rec. ... 99—3
- 84HA3007A, B, C Tel. Rec. ... *
- 84HA-3010A, B, C Tel. Rec. ... 94—2
- 84HA-3010A, B, C Tel. Rec. Prod. Chge. Bul. 11 ... 118—1
- 84KR-1209A ... *
- 84KR-1520A ... 56—4
- 84KR-2511A ... 68—4
- 84WG-1060A ... 42—1
- 84WG-1060C (See Model 84WG-1060A) ... 42
- 84WG-2015A ... 38—1
- 84WG-2506 (See Model 84WG-2721A) ... 46
- 84WG-2506B ... 58—5
- 84WG-2712A ... 43—3
- 84WG-2712B (See Model 84WG-2712A) ... 43
- 84WG-2714A ... 36—2
- 84WG-2714F, G, H, I ... 56—5
- 84WG-2718A, 84WG-2718B, 84WG-2720A ... 45—5
- 84WG-2721A, B ... 46—3
- 84WG-2724A (See Model 84WG-2718A) ... 45
- 84WG-2728A (See Models 84WG-2718A, B; 84WG-2720A) ... 45
- 84WG-2732A, B (See Model 84WG-2712A, B) ... 43
- 84WG-2734A (See Models 84WG-2718A, B; 84WG-2720A) ... 45
- 84WG-3006, 84WG-3008, 84WG-3009, (See Model 94WG 3006A) Tel. Rec. ... 72
- 94BR-1525A, 94BR-1526A ... *
- 94BR-1533A ... 88—1
- 94BR-2740A, 94BR-2741A, B ... 89—1
- 94BR3004, C, 94BR3005, C Tel. Rec. ... 91A-3
- 94BR-3017A Tel. Rec. ... 89—2
- 94BR-3017B Tel. Rec. Prod. Chge. Bul. 7 ... 110—1
- 94BR-3021, 94BR-3024A Tel. Rec. ... *
- 94GAA3654A ... 95—1
- 94GCB-1064A ... 96—2
- 94GCB-3023A, B, C Tel. Rec. (See Model 05GCB-3019A) ... 116
- 94GDC-989A ... *
- 94GSE-2735A, 94GSE-2736A ... 72—3
- 94GSE-3011, B (See Model 84GSE-3011A) ... 82
- 94GSE-3015A Tel. Rec. ... 107—2
- 94GSE-3018A Tel. Rec. ... 93A-2
- 94GSE-3025A Tel. Rec. ... *
- 94GSE-3033A Tel. Rec. ... *
- 94HA-1527C, 94HA-1528C ... 67—3
- 94HA1529A, 94HA1530A (See Model 84HA1529A) ... 85
- 94WG-1059A ... 75—3
- 94WG-1804D ... 86—2
- 94WG-1811A ... 99—4
- 94WG-2742A, C, D ... 71—5
- 94WG-2745A ... 76—4
- 94WG-2746A, B; 94WG-2747A (See Model 94WG-2742A) ... 71
- 94WG-2748A, 94WG-2749A ... 90—1
- 94WG-2748C (See Model 94WG-2748A) ... 90
- 94WG-3006A Tel. Rec. ... 72—4
- 94WG-3006B Tel. Rec. ... 85—3
- 94WG-3008A, 94WG-3009A Tel. Rec. (See Model 94WG-3006A) ... 72
- 94WG-3009B Tel. Rec. (See Model 94WG-3006B) ... 85
- 94WG-3016A, B, C Tel. Rec. (See Model 94WG-3006A Set 72 and Model 05WG-3016A Set 110 Folder 2)
- 94WG-3022A Tel. Rec. (See Model 94WG-3006B) ... 85
- 94WG-3026A Tel. Rec. (See Model 94WG-3006B) ... 85
- 94WG-3028A Tel. Rec. (See Model 94WG-3006) ... 72
- 94WG-3029A Tel. Rec. (See Model 94WG-3006B) ... 85

ALGENE
- AR5U ... 22—3
- AR6U ... 22—4

ALTEC LANSING
- ALC-101 ... 84—2
- ALC-205, ALC-206 Tel. Rec. ... 105—3
- A323B ... 66—2
- A-323C (See Model ALC-101) ... 84

AMC
- 125P ... 3—27
- 126 ... 16—1

AMERICAN COMMUNICATIONS (See Liberty)

AMPLIFIER CORP. OF AMERICA
- ACA-100DC, ACA-100GE ... 63—2
- 810DV ... *

AMPLIPHONE
- 10 ... 21—1
- 20 ... 21—12

ANDREA
- BT-VK12 Tel. Rec. ... 76—5
- CO-U15 ... 27—3
- CO-VK15, COVK16 (Ch. VK1516) Tel. Rec. ... 103—4
- CO-VK16 Tel. Rec. Prod. Chge. Bul. 8 ... 112—1
- COVK-125 Tel. Rec. (See Model BT-VK12) ... 76
- COVL-16 (Ch. VL16) Tel. Rec. ... 125—3
- C-VK19 Tel. Rec. (Supp. to CO-VK16) Prod. Chge. Bul. 8 ... 112—1
- CVK-126 Tel. Rec. (See Model BT-VK12) ... 76
- CVL-16 (Ch. VL16) Tel. Rec. (See Model COVL-16) ... 125
- P-163 (Ch. 163) ... 18—8
- T16 ... 21—2
- T-U15 ... 24—7
- T-U16 ... 21—3
- T-VK12 Tel. Rec. (See Model BT-VK12) ... 76
- TVK-127B, M Tel. Rec. (See Model BT-VK12) ... 76
- TVL-12 Tel. Rec. ... 123—3
- TVL-16 (Ch. VL-16) Tel. Rec. (See Model COVL-16) ... 125
- VJ-12, VJ-12-2 Tel. Rec. ... *
- VJ-15 Tel. Rec. ... *
- Ch. VK1516 (See Model CO-VK15) ... 103
- Ch. VL16 (See Model COVL-16) ... 125

ANSLEY
- 32 ... 5—27
- 41 (Paneltone) ... 4—38
- 53 ... 24—8
- 701 Tel. Rec. ... 71—6

APEX
- 4B5 ... 37—2
- 192A ... 17—6

APPROVED ELECTRONIC INSTRUMENT CORP.
- FM Tuner ... 41—2

ARC
- 601 ... 25—5

ARCADIA
- 37D14-600 ... 9—3

ARIA
- 554-1-61A ... 7—2

ARTHUR ANSLEY
- LP-2, LP-3 ... 62—4
- LP-4A ... 82—2
- LP-5 (See Model P-5) ... 108
- LP-7 ... 134—3
- P-5 ... 108—4
- SP-1 ... 60—4

ARTONE
- AR-23TV-1 Tel. Rec. ... 80—1
- 524 ... 76—6

ARVIN
- 140-P (Ch. RE-209) ... 25—6
- 150-TC, 151-TC (Ch. RE-228) (Late) ... 25—7
- 150TC, 151TC (Ch. RE-228-1) ... 39—2
- 152-T, 153-T ... 33—1
- 160T, 161T (Ch. RE-232) ... 49—5
- 182TFM (Ch. RE-237) ... 32—3
- 240-P (Ch. RE-243) ... 42—2
- 241P, 244P, 2410P (Ch. RE-244, RE-254, RE-255, RE-256, RE-259) ... 47—3
- 242T, 243T (Ch. RE-251) ... 52—3
- 250-P (Ch. RE-248) ... 43—4
- 253T, 254T, 255T, 256T (Ch. RE-252) ... 53—5
- 264T, 265T (Ch. RE-265) ... 64—2
- 280TFM, 281TFM (Ch. RE-253) ... 44—2
- 341T (Ch. RE-274) ... 84—3
- 350P (Ch. RE-267) ... 69—3
- 350-PB (Ch. RE-267-1), 350-PL (Ch. RE-267-2) ... 100—4
- 351P (Ch. RE-267) (See Model 350P) ... 69
- 351-PB (Ch. RE-267-1), 351-PL (Ch. RE-267-2) (See Model 350-PB) ... 100
- 352-PL, 353-PL (Ch. RE-267-2) (See Model 350-PB) ... 100
- 355T (Ch. RE-213) (See Model 356T) ... 78
- 356T, 357T (Ch. RE-273) ... 78—2
- 358-T (Ch. RE-233) (See Model 152-T) ... 33
- 360TFM, 361TFM (Ch. RE-260) ... 70—2

GENERAL ELECTRIC—Cont.
376, 377, 378 .... 45—11
400, 401 .... 118—8
404, 405 .... 121—6
408 .... 116—6
410 (See Model 404) 121
411 (See Model 400) 118
417 .... 16—15
500, 501 (See Model 64) 98
502 .... 35—9
505, 506, 507, 508, 509 (See Model 64) 98
510, 511 .... 120—7
521, 522 .... 114—5
530 (See Model 64) 98
600 .... 109—6
601, 603, 604 .... 115—3
650 .... 101—3
752, 753 .... 123—5
755 .... 130—6
800A, B, C, D Tel. Rec. (See Model 805) 78
801 Tel. Rec. (Photofact Servicer) 78
802 Tel. Rec. 91A-7
803 Tel. Rec. 97A-4
805, 806, 807, 809 Series Tel. Rec. .... 78—7
810 Tel. Receiver .... 53—12
811 Tel. Receiver .... 63—9
814 Tel. Rec. .... 69—9
815 Tel. Rec. 97A-5
817 Tel. Rec. (See Model 805) 78
818 Tel. Rec. 95A-7
820 Tel. Rec. .... *
821 Tel. Rec. (See Model 805) 78
830 Early, Tel. Rec. .... 81—9
835 Early, Tel. Rec. (See Model 830 Early) 81
840 Tel. Rec. (See Model 830 Early) 81
901 Tel. Rec. 97A-5
910 Tel. Rec. (See Model 901) 97A

GENERAL IMPLEMENT
9A5 .... 37—7

GENERAL MOTORS CORP. (GMC)
2233029 .... 93—6

GENERAL TELEVISION
1A5, 2A5, 3A5, 5A5 (Ch. 1-1) .... 1—21
4B5 .... 27—11
5B5G, 5B5Y .... 27—12
9A5 .... 39—6
9B6P .... 36—10
14A4F .... 3—21
15A5 (Ch. 1-1) (See Models 1A5, 2A5, 3A5, 5A5) 1
17A5 .... 5—22
19A5 (Ch. 1-1) (See Models 1A5, 2A5, 3A5, 5A5) 1
21A4 .... 12—14
22A5C .... 13—19
23A6 .... 14—14
24B6 .... 37—8
25B5 .... 26—15
26B5 .... 29—11
27C5 .... 36—11

GILFILLAN
56A, 56B .... 1—27
56BC1, 56BCR, 56C, 56D, 56E (See Model 56A) 1
58M, 58W .... 45—12
66A, 66AM .... 8—16
66B "The Overland" .... 8—17
66D, 66DM (See Model 66A) 8
66P, 66PM "The El Dorado" .... 9—15
68B-D .... 46—10
68F .... 46—11
68-48 .... 61—10
86C, 86P, 86U (86 Series) .... 26—16
108-48 .... 59—10

GLOBE
5BP1 .... 18—20
6AP1 (See Model 6P1) 20
6D1 .... 20—13
6P1 .... 20—12
6U1 (See Model 6D1) 20
7CP-1 .... 28—14
51 .... 19—18
62C .... 19—19
85 .... 49—9
454 .... 41—9
456 .... 40—7
457 .... 39—7
500 .... 21—18
517 .... 21—17
551 .... 16—16
552 .... 27—13
553 .... 28—15
559 .... 50—8

GODFREY
6AD .... 28—16
6SM .... 28—17

GON-SET
3-30 Meter Converter .... 61—11
10-11 Meter Converter .... 37—9

B. F. GOODRICH (See Mantola)

GOODELL
ATB-3 .... 70—5
NSA-20 .... 73—6

W. T. GRANT (See Grantline)

GRANTLINE
300 (Series B) .... 9—16
500, 501 (Series A) .... 9—17
501-7 .... 35—10
504-7 .... 21—19
508-7 .... 34—8
510-A .... 24—19

GRANTLINE—Cont.
605, 606 .... 2—17
641 .... 12—15
651 .... 11—9
5610 .... 35—11
6547 .... 11—10

HALLICRAFTERS (Also See Echophone)
CA-2, CA-2A .... 30—12
CA-4 .... 36—13
S-38 .... 3—7
S-38B .... 121—7
S-40 .... 2—19
S-40A .... 33—10
S-40B .... 122—4
S-41G, S-41W .... 10—19
S-47 .... 46—12
S-51 .... 40—8
S-52 .... 48—9
S-53 .... 39—8
S-55, S-56 .... 55—9
S-58 .... 57—8
S-59 .... 58—10
S-72 .... 82—6
S78 .... 124—5
ST-74 .... 125—8
SX-42 .... 44—6
SX-43 .... 45—13
SX-62 .... 61—12
SX-71 .... 111—6
T-54 Tel. Receiver .... 48—10
T-54 (Late) Tel. Rec. .... 91—6
T-60 Tel. Receiver .... 63—10
T-61, T-64, T-67 Tel. Rec. .... 65—7
T-68 (Tel. Rec.) (See Model T-60) 63
T-69 Tel. Rec. .... *
5R10 .... 130—7
5R11, 5R12, 5R13, 5R14 .... 129—7
400, 406, 409, 410, 411, 412 .... 52—9
505, 506 Tel. Rec. (See Model T-54) 48
505, 506 (Late) (See Model T-54 Late) 91
509, 510 Tel. Rec. (See Model T61) .... 65—7
511 Tel. Rec. .... 96—5
512C, 513 Tel. Rec. .... 80—7
514 Tel. Rec. (See Model T-54 Late) 91
515 Tel. Rec. (See Model 512C) 80
518, 519, 520 Tel. Rec. .... 92—3
520E Tel. Rec. (See Model 512C) 80
521 Tel. Rec. (See Model 518) 92
521E Tel. Rec. (See Model 512C) 80
524 Tel. Rec. (See Model 512C) 80
600, 601, 602, 603, 604 Tel. Rec. (See Model 518) 92
605, 606 Tel. Rec. .... 107—5
680, 681 Tel. Rec. .... 113—3
690 Tel. Rec. (See Model 680) 113
715 Tel. Rec. (See Model 680) 113
730, 731 (Run 1) Tel. Rec. (See Model 680) .... 113—3
732, 733 Tel. Rec. .... *
740, 741 (Run 1) Tel. Rec. (See Model 680) .... 113—3
745 Tel. Rec. .... 105—4
750, 751, Tel. Rec. (See Model 745) 105
760, 761 Tel. Rec. (See Model 745) 105
805, 806 Tel. Rec. 125-1A
810A, 811 Tel. Rec. .... 124—6
810C Tel. Rec. (See Model 805) 125-1A
815 Tel. Rec. (See Model 810A) 124
818, 820, 822 Tel. Rec. (See Model 810A) 124
832, 833 Tel. Rec. 121-1A
860, 861 Tel. Rec. (See Model 810A) 124
870, 871 Tel. Rec. (See Model 810A) 124
880 Tel. Rec. (See Model 810A) 124

HAMILTON ELECTRONICS
H-15-S .... 16—17
H-50-2S .... 16—18

HAMILTON RADIO CORP. (See Olympic)

HAMMARLUND
HQ-129-X .... 8—18
SP-400-X .... 10—20

HARVEY-WELLS
AT-3B-6, AT-3B-12 .... 32—11
ATR-3-6, ATR-3-12 .... 36—14

HEATH
HBR-5 .... 24—20

HOFFMAN
A-200 (Ch. 103) .... 4—23
A-202 (Ch. 119) .... 11—11
A-300 .... 4—41
A-309 (Ch. 119) (See Model A-202) 11
A-401 (Ch. 102) .... 11—12
A-500 (Ch. 107) .... 4—34
A-501 (Ch. 108ST) .... 3—35
A-700 (Ch. 110S) .... 12—16
B-400 .... 17—17
B-1000 .... 20—14
C-501 .... 48—11
C-502 .... 51—9
C-503 .... 50—9
C-504 (Ch. 123) .... 47—10
C-506, C-507 .... 49—10
C509, C510 .... *
C-511 (See Model C-501) 48
C-512 (See Model C-502) 51

HOFFMAN—Cont.
C-513 (See Model C-503) 50
C-514 (See Model C-504) 47
C-518 .... 61—13
C710 (Ch. 133) .... *
C1006, C1007 .... 54—9
CT-800, CT-801, CT-900, CT-901 (Tel. Rec.) .... 63—11
522, 524 (Ch. 138) .... *
600, 601 (Ch. 154, 155) Tel. Rec. 95A-8
610 (Ch. 140) Tel. Rec. 97A-6
612 (Ch. 142) Tel. Rec. (See Model 610) 97A
613 (Ch. 149) Tel. Rec. (See Model 610) 97A
630, 631 (Ch. 159) Tel. Rec. .... *
630, 631 (Ch. 170) Tel. Rec. 117-1A
632, 633 (Ch. 160) Tel. Rec. .... *
632, 633 (Ch. 171) Tel. Rec. 117-1A
820, 821, 822 (Ch. 146) Tel. Rec. .... *
826, 827, 828 (Ch. 143) Tel. Rec. 95A-8
830, 831 (Ch. 151) Tel. Rec. 97A-6
832 (Ch. 151) Tel. Rec. (See Model 830) 97A
836, 837 (Ch. 153) Tel. Rec. 93A-8
840 (Ch. 153) Tel. Rec. (See Model 836) 93A
846 (Ch. 151) Tel. Rec. (See Model 830) 97A
847, 848, 849 (Ch. 156) Tel. Rec. 97A-7
860, 861, 862 (Ch. 157) Tel. Rec. (See Model 847) 97A
866, 867, 868 (Ch. 173) Tel. Rec. 117-1A
870, 871, 872 (Ch. 170) Tel. Rec. 117-1A
876, 877, 878 (Ch. 171) Tel. Rec. 117-1A
890, 891, 892 (Ch. 175) Tel. Rec. 117-1A
912, 913 (Ch. 147) Tel. Rec. (See Model 826) 95A
914, 915 (Ch. 150) Tel. Rec. (See Model 610) 97A
917, 918 (Ch. 152) Tel. Rec. (See Model 830) 97A
920 (Ch. 152) Tel. Rec. (See Model 830) 97A
946, 947, 948 (Ch. 164) Tel. Rec. (See Model 847) 97A
950, 951, 952 (Ch. 172), 950A, 951A, 952A (Ch. 174) Tel. Rec. .... 127—6
960, 961, 962, (Ch. 176) Tel. Rec. (See Model 950) 127
Chassis 102 (See Model A401) 11
Chassis 103 (See Model A200) 4
Chassis 107 (See Model A500) 4
Chassis 108ST (See Model A501) 3
Chassis 110S (See Model A700) 12
Chassis 114 (See Model B1000) 20
Chassis 119 (See Model A202) 11
Chassis 123 (See Model C504) 47
Ch. 138 (See Models 912, 913) .... *
Ch. 140 (See Model 610) 97A
Ch. 142 (See Model 612) 97A
Ch. 143 (See Model 826) 95A
Ch. 146 (See Model 820) *
Ch. 147 (See Model 826) 95A
Ch. 149 (See Model 613) 97A
Ch. 150 (See Model 914) 97A
Ch. 151 (See Model 830) 97A
Ch. 152 (See Model 917) 97A
Ch. 153 (See Model 836) 93A
Ch. 154 (See Model 600) 95A
Ch. 155 (See Model 600) 95A
Ch. 156 (See Model 847) .. 97A
Ch. 157 (See Model 860) .. 97A
Ch. 164 (See Model 946) .. 97A
Ch. 170, 171 (See Model 630) 117-1A
Ch. 172 (See Model 950) .127
Ch. 173 (See Model 630) .117-1A
Ch. 174 (See Model 950) .127
Ch. 175 (See Model 630) .117-1A
Ch. 176 (See Model 950) .127

HOWARD
472AC, 472AF, 472C, 472F .... 31—14
474 .... 32—12
475TV Tel. Rec. Photofact Servicer 84
481B, 481C, 481M .... 67—11
482, 482A .... 48—12
901A-E, 901A-H, 901A-I, 901A-M, 901A-W (See 901A Series) 1
901A Series .... 1—8
901AP .... 10—21
902 .... *
906, 906C .... 17—18
909M .... 25—15
920 .... 5—7

HUDSON
DB47 (Fact. No. 6MH089) 25—16
DB48 (Fact. No. 6MH889) 39—9

HUDSON ELECTRONICS
332-H .... 123—6
347BL .... 121—8
350 .... 126—6

INDUSTRIAL ELECTRONIC CORP. (See Simplon)

INDUSTRIAL TELEVISION (Also See Century)
IT-40R, IT-42R (Ch. IT-26R, IT-35R, IT-39R, IT-46R) Tel. Rec. 99A-7
IT-48R Tel. Rec. .... *

JACKSON
10C, 10T Tel. Rec. .... 132—8
12C, 12T Tel. Rec. (See Model 10C) 132
14C, 14T Tel. Rec. (See Model 10C) 132
16C, 16T Tel. Rec. (See Model 10C) 132
29C Tel. Rec. .... *
150 .... 130—8
153 (See Model 150) 130
312 Tel. Rec. (See Model 10C) 132
316 Tel. Rec. (See Model 10C) 132
350 .... 131—9
412 Tel. Rec. (See Model 10C) 132
416 Tel. Rec. (See Model 10C) 132
5000, 5050 Tel. Rec. .... 88—5
5200, 5250 (See Model 5000) Tel. Rec. 88
5600, 5650 (See Model 5000) Tel. Rec. 88

JEFFERSON-TRAVIS
MR-2B .... 10—22
MR3 .... 17—19

JEWEL
300 .... 23—11
304 .... 35—12
500A, B, C; 501A, B, C; 502A, B, C; 503A, B, C; 504A, B, C; 505A, B, C .... 15—14
505 "Pin-Up" .... 18—21
801 (Trixie) .... 45—14
814 .... 51—10
910 .... 99—8
915 (See Model 910) 99
920 .... 55—10
935 (See Model 920) 55
949 .... 105—5
955 .... 98—5
960 .... 97—8
985 (See Model 910) 99
5010 .... 111—7
5050 .... 128—7
5057U .... 109—7

KAISER-FRAZER
100170 .... 128—8
200001 .... 35—13
200002 .... 56—13

KAPPLER
102T .... 54—10

KARADIO
80-C .... 66—10
1275, 1275A .... 85—7
1276 .... 115—4

KAYE-HALBERT
231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241 Tel. Rec. .... *
242 Tel. Rec. .... *
731 Tel. Rec. .... *
733 Tel. Rec. .... *
821-C, 821-T Tel. Rec. .... *
921-C, 921-T Tel. Rec. .... *
1621-C, 1621-T Tel. Rec. .... *

KAY MUSICAL INSTRUMENT CO.
77 .... 42—13

KITCHENAIRE
5 Tube Radio .... 6—14

KNIGHT
4D-450 .... 40—9
4G420 .... 88—6
5A150, 5A152, 5A154 .... 12—17
5A-190 .... 14—15
5B-160 .... 20—15
5B-175, 5B-176 .... 20—16
5B-185 .... 22—17
5C-290 .... 30—13
5D-250, 5D-251 .... 55—11
5D-455 .... 34—9
5E-250, 5E-251 (Similar to Chassis) .... 36—25
5E-457 (Similar to Chassis) .... 53—23
5F-525, 5F-526 .... 53—13
5F-565 .... 55—12
5G-563 (Similar to Chassis) .... 97—1
5H605 .... 131—10
5H-607, 5H-608 (Similar to Chassis) .... 97—15
5H-678, 5H-679 (Similar to Chassis) .... 109—7
5H-700 .... 123—7
6A-122 .... 9—18
6A-127 .... 9—19
6A-195 .... 16—19
6B-122 (See Model 6A-122) 9
6B-127 (See Model 6A-127) 9
6C-225, 6D-225, 6D-226 .... 30—14
6D-235 .... 54—11
6D-360 .... 39—10
6G-400 (See Model 449) 83
6H580 .... 126—7
7B-220 .... 27—14
7D-405 .... 39—11
8B-210 .... 20—17
8D-340 .... 46—13
8G-200, 8G-201 .... 128—9
9V-101 Tel. Rec. .... 78—8
10B-249 .... 42—14
11C-300 .... 29—12
11D302 .... 57—9

KNIGHT—Cont.
14F490, 14F495, 14F496 .... 63—12
15H609 (See Model 511B) 125
19F492, 19F497, 19F498 .... 58—11
93-017 .... 31—15
93-024 .... 32—13
93-103 .... 31—16
93-146 .... 36—15
93-155 .... 37—10
93-191 .... 38—8
93-320 .... 74—5
93-330 .... 99—9
93-350 .... 76—13
93-360 .... 79—9
93-370 .... 75—10
93-380 .... 90—8
97-870 .... 78—9
449 .... 83—5
511B .... 125—9

LAFAYETTE
FA15W, FA15Y .... 15—15
J62, J62C .... 16—21
MC10B, MC10Y .... 14—16
MC11 .... 28—18
MC12 .... 27—15
MC13 .... 15—16
MC16 .... 27—16
IN434, IN435, IN436 (Similar to Chassis) .... 98—5
IN437 (Similar to Chassis) 121—2
IN549 (Similar to Chassis) 38—5
IN551 (Similar to Chassis) 38—6
IN554, IN555 (Similar to Chassis) .... 55—10
IN556, IN557 (Similar to Chassis) .... 109—7
IN559 (Similar to Chassis) 90—7
IN560 (Similar to Chassis) 109—7
IN561, IN562 (Similar to Chassis) .... 97—8
IN819 (Similar to Chassis) 69—7

LAMCO
1000 .... 16—20

LEARADIO
Chassis R-971 .... 51—11
RM-402C (Learavian) .... 42—15
561, 562, 563 .... 1—26
565, 565BL, 566, 567, 568 .... 9—20
1281-PC (Ch. 7B) .... 49—11
6610PC, 6611PC, 6612PC .... 9—21
6614, 6615, 6616, 6619 .... 3—18
6617PC .... 16—22

LEE TONE
AP-100 .... 16—23

LEWYT
605 .... *
615A .... 11—13
711 .... 42—16

LEXINGTON
6545 .... 13—20

LIBERTY
A6K, A6P, 6K .... 20—18
507A .... 20—19

LINCOLN (Auto Radio)
7ML080 (5EH-18805-A), 7ML081 (5EH-18805-B) .... 66—11
8ML882 (8L-18805-A), 8ML882Z (8H-18805-A) (Ch. 8E82) .... 44—7
8ML985 (8L-18805-A), 8ML985E (8L-18805-B), 8ML985Z (8H-18805-A), 8ML985ZE (8H-18805) .... 83—4

LINCOLN
S13L-B .... 2—10

LINCOLN (ALLIED RADIO CORP.)
5A-110 .... 5—34

LINDEX CORP. (See Swank)

LIPAN (See Supreme)

LULLABY (See Mitchell)

LYMAN
CM10, CM20 .... 44—8

LYRIC (Also See Rauland)
546T, 546TY, 546TW .... 7—17

MAGIC TONE
500, 501 .... 5—40
504 (Bottle Receiver) .... 22—18
508 (Keg Radio) .... 38—9
510 .... 52—10
900 (See Model 508) 38

MAGNAVOX
Chassis AMP-101A, AMP-101B .... 43—12
Chassis AMP-108A, AMP-108B .... 41—10
Chassis AMP-109 .... *
Chassis AMP-110 .... *
AMP-111A, B, C .... 68—10
Chassis AMP-116 .... *
Chassis CR-188 (155B Regency Symphony) .... 18—22
Chassis CR190A, CR190B .... 46—14
Chassis CR-192A, CR-192B 41—11
Chassis CR-197C .... 37—11
Chassis CR-198A, B, C (Hepplewhite, Modern Symphony) .... 17—20
Chassis CR-199 .... 63—13
Chassis CR-200A, B, C, D, E, F .... 44—9
Chassis CR-202 .... *
Chassis CR-203 .... *
Chassis CR-204 .... *
Chassis CR-206 .... *
Chassis CR-207A, B, C, D .... 41—12
Chassis CR-208A, CR-208B 43—13
Chassis CR-209 .... *
Chassis Models CR-210A, CR-210B .... 52—11
Chassis CR-211A, B (See Ch. AMP-111A) 68

MOTOROLA—Cont.

- 10T2 (Ch. TS14, A, B) Tel. Rec. .... 92—4
- 10VK9 (Ch. TS-9E, TS-9E1) Tel. Rec. (See Models VK106 Ch. TS-9E) 77
- 10VK12 (Ch. TS14, A, B) Tel Rec. (See Model 10T2) 92
- 10VK22 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
- 10VT3 (Ch. TS-9E, TS-9E1) Tel. Rec. (See Model VK106) 77
- 10VT10 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
- 10VT24 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
- 12K1 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
- 12K2 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
- 12K2 (Ch. TS-53) Tel. Rec. .... 115—7
- 12T1 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
- 12T3 (Ch. TS-53) Tel. Rec. (See Model 12K2). 115
- 12VF4R, 12VF26 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
- 12VK11 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
- 12VK15 (Ch. TS-30, A) Tel. Rec. .... 93—7
- 12VK15 (Ch. TS-30, A) Tel. Rec. Prod. Chge. Bul. 5 .... 106—1
- 12VK18B, 12VK18R (Ch. TS-15C, TS-15C1) Tel. Rec. (See Model VK106 Ch. TS-9E) 77
- 12VT13 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
- 12VT16 12VT16B, 12VT16R (Ch. TS-15C, TS-15C1) (See Model VK106 Ch. TS-9E) Tel. Rec. 77
- 14K1, B (Ch. TS-88) Tel. Rec. .... 112—6
- 14K1BH, 14K1H (Ch. TS-115) Tel. Rec.. 121—10
- 14T1, B (Ch. TS-88) Tel. Rec. (See Model 14K1). 112
- 14T3 (Ch. TS-114) Tel. Rec. (See Model 14K1BH) 121
- 16F1 (Ch. TS-60 & Radio Ch. HS-234) Tel. Rec... 102—8
- 16F1BH, 16F1H (Ch. TS-89 & Radio Ch. HS-234) Tel. Rec. (See Model 14K1BH) 121
- 16K2 (Ch. TS-52) Tel. Rec. 93A-10
- 16K2 (Ch. TS-74) Tel. Rec. (See Model 16F1) 102
- 16K2BH, 16K2H (Ch. TS-94) Tel. Rec. (See Model 14K1BH) 121
- 16T1 (Ch. TS-60) Tel. Rec. (See Model 16F1) 102
- 16T1BH, 16T1H (Ch. TS-89) Tel. Rec. (See Model 14K1BH) .. 121
- 16VF8 (Ch. TS-16, A) Tel. Rec. (See Model 12VK15) ... 93
- 16VF8, 16VK7 (Ch. TS-16, A) Tel. Rec. Prod. Chge. Bul. 5 .... 106—1
- 16VK1 (Ch. TS-52) Tel. Rec. (See Model 16K2) 93A
- 16VK7 (Ch. TS-16, A) Tel. Rec. (See Model 12VK15) 93
- 17F1 (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) .. 121
- 17F1A (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) .. 121
- 17F1B (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) .. 121
- 17F1BA (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121
- 17F2W (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121
- 17F2WA (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121
- 17F3B (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121
- 17F3BA (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121
- 17F4 (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) .. 121
- 17F4A (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121
- 17F5, 17F5B (Ch. TS-118 & Radio Ch. HS-261) Tel. Rec. (See Model 14K1BH) 121

MOTOROLA—Cont.

- 17F5A, 17F5BA (Ch. TS-89 & Radio Ch. HS-261) Tel. Rec. (See Model 14K1BH) 121
- 17F6,B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17F6BC, C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17F7B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17F7BC (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17F8 (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17F8C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17F9,B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17F9BC,C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17K1A, 17K1BA (Ch. TS-95) Tel. Rec. (See Model 14K1BH) 121
- 17K1BE, 17K1E (Ch. TS-172) Tel. Rec. (See Model 14K1BH) .. 121
- 17K2BE, 17K2E (Ch. TS-172) Tel. Rec. (See Model 14K1BH) .. 121
- 17K3, 17K3B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) .. 121
- 17K3A, 17K3BA (Ch. TS-89) Tel. Rec. (See Model 14K1BH) .. 121
- 17K4A (Ch. TS-95) Tel. Rec. (See Model 14K1BH) 121
- 17K4E (Ch. TS-172) Tel. Rec. (See Model 14K1BH) 121
- 17K5 (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17K5C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17K6 (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17K6C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17K7,B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17K7BC,C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 17T1, 17T1B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17T1A, 17T1BA (Ch. TS-89) Tel. Rec. (See Model 14K1BH) 121
- 17T2A, 17T2BA (Ch. TS-89) Tel. Rec. (See Model 14K1BH) .. 121
- 17T2, 17T2B (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17T3 (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17T3A (Ch. TS-89) Tel. Rec. (See Model 14K1BH) 121
- 17T4 (Ch. TS-118) Tel. Rec. (See Model 14K1BH) 121
- 17T4C (Ch. TS-174) Tel. Rec. (See Model 14K1BH) 121
- 19F1, 19K1 (Ch. TS-67 and Radio Ch. HS-230) Tel. Rec. .... 111—9
- 19K2, 19K2B (Ch. TS-101) Tel. Rec. .... 122—5
- 19K2BE, 19K2E (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
- 19K3, 19K4, 19K4B (Ch. TS-101) Tel. Rec. (See Model 19K2) 122
- 20F1, 20F1B (Ch. TS-119 & Radio Ch. HS-230) Tel. Rec. (See Model 19K2) 122
- 20F2,B (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
- 20K1,B, 20K2 (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
- 20T1,B (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
- 45B12 (Ch. HS-8) ..... 9—23
- 47B11 (Ch. HS-72) ..... 29—17
- 48L11 (Ch. HS-113) ..... 47—13
- 49L11Q, 49L13Q (Ch. HS-183) .... 77—7
- 55F11 (Ch. HS-30) ..... 4—14
- 55X11A, 55X12A, 55X13A 2—22
- 56X11 (Ch. HS-94) ..... 28—24
- 57X11, 57X12 (Ch. HS-60) 28—25
- 58A11, 58A12 (Ch. HS-158) .... 52—13
- 58G11, 58G12 (Ch. HS-160) .... 64—8
- 58L11 (Ch. HS-114) ..... 45—17
- 58R11, 58R12, 58R13, 58R14, 58R15, 58R16 (Ch. HS-116) .... 49—14

MOTOROLA—Cont.

- 58R11A, 58R12A, 58R13A, 58R14A, 58R15A, 58R16A (Ch. HS-184).. 69—11
- 58X11, 58X12 (Ch. HS-125) .... 53—15
- 59F11 (Ch. HS-188) .... 68—12
- 59H11U, 59H12IU (Ch. HS-210) .... 97—9
- 59L11Q, 59L12Q, 59L14Q (Ch. HS-187) .... 78—10
- 59R11, 59R12I, 59R13M, 59R14E, 59R15G, 59R16Y (Ch. HS-167).. 79—10
- 59X11, 59X12I (Ch. HS-180) .... 81—11
- 59X21U, 59X22IU (Ch. HS-192) .... 98—6
- 65F11 (Ch. HS-31) .... 6—19
- 65F12 (See Model 65F11). 6
- 65F21 (Ch. HS-26) ..... 4—12
- 65L11, 65L12 (Ch. HS-7) . 8—22
- 65T21, 65T21B (Ch. HS-32) .... 1—1
- 65X11A, 65X12A, 65X13A, 65X14A, 65X14B (Ch. HS-2) .... 4—8
- 67F11, 67F12, 67F12B, (Ch. HS-63) .... 31—20
- 67F14 (Ch. HS-122) ..... 55—15
- 67F61BN (Ch. HS-69) .... 44—14
- 67L11 (Ch. HS-59) ..... 31—21
- 67X11, 67X12, 67X13 (Ch. HS-58) .... 30—20
- 67XM21 (Ch. HS-64) .... 32—14
- 68F11, 68F12, 68F14, 68F14B, 68F14M ..... 58—13
- 68L11 (Ch. HS-119) ..... 45—18
- 68T11 (Ch. HS-144) ..... 54—14
- 68X11, 68X12 (Ch. HS-127), 68X11A, 68X12A (Ch. HS-127A). 56—16
- 69L11 (Ch. HS-175) ..... 76—15
- 69X11, 69X12I (Ch. HS-181) .... 82—9
- 75F21 (Ch. HS-91) .... 19—21
- 75F31 (Ch. HS-36), 75F31A, B (Ch. HS-36A), 76F31 (Ch. HS-98) .... 29—18
- 77FM21 (Ch. HS-89) 77FM22, 77FM22M, 77FM22WM, 77FM23 (Ch. HS-97) .... 33—13
- 77XM21, 77XM22, 77XM22B (Ch. HS-102) . 34—12
- 78F11, 78F11M (Ch. HS-150), 78F12M (Ch. HS-155) .... 56—17
- 78FM21, 78FM21M (Ch. HS-132), 78FM22M (Ch. HS-128) .... 59—13
- 79FM21, 79FM21B, 79FM21R (Ch. HS-178). 88—7
- 79XM21, 79XM22 (Ch. HS-168) .... 85—9
- 85F21 (Ch. HS-22) ..... 6—20
- 85K21 (Ch. HS-52) ..... 5—3
- 88FM21 (Ch. HS-133).... 54—15
- 91FM21 (Ch. HS-230A) (See Model 19F1)..... 111
- 95F31, 95F31B (Ch. HS-39) 95F33 (Ch. HS-38) .... 19—22
- 99FM21R (Ch. HS-170)... 80—10
- 107F31, 107F31B, (Ch. HS-87) .... 33—14
- 309 .... 63—14
- 400 .... 99—10
- 401 .... 131—12
- 405 (Ch. AS-13) .... 3—8
- 405M .... 21—25
- 408 .... 38—12
- 409 (See Model 408) ... 38
- 500 .... 98—7
- 501 .... 133—10
- 505 (Ch. AS-14) .... 4—37
- 508 .... 39—13
- 509 (See Model 508).... 39
- 600 .... 97—10
- 605 (Ch. AS-15) .... 5—1
- 608 .... 39—14
- 609 (See Model 608).... 39
- 700 .... 100—8
- 705 (Ch. AS-16) .... 7—19
- 708 .... 40—12
- 709 (See Model 708).... 40
- 800 .... 103—10
- Ch. AS-13 (See Model 405) 3
- Ch. AS-14 (See Model 505) 4
- Ch. AS-15 (See Model 605) 5
- Ch. AS-16 (See Model 705) 7
- Ch. AS-22 (See Model BK-6) 10
- Ch. HS-2 (See Model 65X11A) 4
- Ch. HS-6 (See Model 5A1) 2
- Ch. HS-7 (See Model 65L11) 8
- Ch. HS-8 (See Model 45B12) 9
- Ch. HS-15 (See Model 5A5) 3
- Ch. HS-18 (See Model WR6) 5
- Ch. HS-22 (See Model 85F21) 6
- Ch. HS-26 (See Model 65F21) 4
- Ch. HS-30 (See Model 55F11) 4
- Ch. HS-31 (See Model 65F11) 6
- Ch. HS-32 (See Model 65T21) 1
- Ch. HS-36 (See Model 75F31) 29
- Ch. HS-36A (See Model 75F31A) 29
- Ch. HS-38 (See Model 95F33) 19
- Ch. HS-39 (See Model 95F31) 19
- Ch. HS-50 (See Model 55X11A) 2

MOTOROLA—Cont.

- Ch. HS-52 (See Model 85K21) 5
- Ch. HS-58 (See Model 67X11) 30
- Ch. HS-59 (See Model 67L11) 31
- Ch. HS-60 (See Model 57X11) 28
- Ch. HS-62 (See Model 5A7) 29
- Ch. HS-62A (See Model 5A7A) 29
- Ch. HS-63 (See Model 67F11) 31
- Ch. HS-64 (See Model 67XM21) 33
- Ch. HS-69 (See Model 67F61BN) 44
- Ch. HS-72 (See Model 47B11) 29
- Ch. HS-87 (See Model 107F31) 33
- Ch. HS-89 (See Model 77FM21) 33
- Ch. HS-91 (See Model 75F21) 19
- Ch. HS-94 (See Model 56X11) 28
- Ch. HS-97 (See Model 77FM22) 33
- Ch. HS-98 (See Model 76F31) 29
- Ch. HS-102 (See Model 77XM21) 34
- Ch. HS-108 (See Model VK-101) 51
- Ch. HS-113 (See Model 48L11) 47
- Ch. HS-114 (See Model 58L11) 45
- Ch. HS-116 (See Model 58R11) 49
- Ch. HS-119 (See Model 68L11) 45
- Ch. HS-122 (See Model 67F14) 55
- Ch. HS-124 (See Model 68F11) 58
- Ch. HS-125 (See Model 58X11) 53
- Ch. HS-127 (See Model 68X11) 56
- Ch. HS-127A (See Model 68X11A) 56
- Ch. HS-128 (See Model 78FM22M) 59
- Ch. HS-132 (See Model 78FM21) 59
- Ch. HS-133 (See Model 88FM21) 54
- Ch. HS-137 (See Model VK101) 51
- Ch. HS-144 (See Model 68T11) 54
- Ch. HS-150 (See Model 78F11) 56
- Ch. HS-155 (See Model 78F12M) 56
- Ch. HS-158 (See Model 58A11) 52
- Ch. HS-160 (See Model 58G11) 64
- Ch. HS-167 (See Model 59R11).... 79
- Ch. HS-168 (See Model 79XM21) 85
- Ch. HS-170 (See Model 99FM21R).. 80
- Ch. HS-175 (See Model 69L11).... 76
- Ch. HS-178 (See Model 79FM21) 88
- Ch. HS-180 (See Model 59X11).... 81
- Ch. HS-181 (See Model 69X11).... 82
- Ch. HS-183 (See Model 49L11Q)... 77
- Ch. HS-184 (See Model 58R11A) 69
- Ch. HS-187 (See Model 59L11Q)... 78
- Ch. HS-188 (See Model 59F11) 68
- Ch. HS-192 (See Model 59X21U)... 98
- Ch. HS-210 (See Model 59H11U)... 97
- Ch. HS-223 (See Model 5M1) 101
- Ch. HS-224 (See Model 5J1)...... 100
- Ch. HS-226 (See Model 6L1) 102
- Ch. HS-228 (See Model 5C1)...... 116
- HS-230 (See Model 19F1). 111
- Ch. HS-234 (See Model 16F1) 102
- Ch. HS-242 (See Model 5R11U).... 115
- Ch. HS-243 (See Model 5X11U).... 114
- Ch. HS-244 (See Model 5H11U).... 117
- Ch. HS-245 (See Model 6X11U).... 112
- Ch. HS-246 (See Model 9FM21).... 114
- Ch. HS-247 (See Model 8FM21) 121
- Ch. HS-249 (See Model 5M1) 101
- Ch. HS-250 (See Model 5J1)...... 100
- Ch. HS-253 (See Model 17F1) 121
- Ch. HS-258 (See Model 5C1)...... 116
- Ch. HS-259 (See Model 5X21U).... 120
- Ch. HS-261 (See Model 17F5) 121

MOTOROLA—Cont.

- Ch. HS-262 (See Model 5C1)...... 116
- Ch. HS-264 (See Model 6F11)..... 117
- Ch. HS-265 (See Model 7F11)..... 113
- Ch. HS-270 (See Model 5C1)..... 116
- Ch. HS-271, HS-272 (See Model 5C1)..... 116
- Ch. M-5 (See Model AR96-23) 11
- Ch. OB (See Model SROB). 105
- Ch. TS-3 (See Model VK-101) 51
- Ch. TS-4B Thru J (See Model VT-71)..... 55
- Chassis TS-4J Late (See Model VT-73)......... 71
- Ch. TS-5 (See Model VK101) 51
- Ch. TS-7 (See Model VK101) 51
- Chassis TS-8 (See Model VF103).......... 73
- Ch. TS-9, TS-9A, TS-9B, TS-9C (See Model VT105) 67
- Ch. TS-9D (See Model VT105) Photofact Servicer 82
- Ch. TS-9D1 .... *
- Ch. TS-9E, TS-9E1 (See Model VK106).... 77
- Ch. TS-14, A, B (See Model 10T2)..... 92
- Ch. TS-15 (See Model VT121).... 91A
- Ch. TS-15A .... *
- Ch. TS-15B .... *
- Ch. TS-15C, TS-15C1 (See Model 12VK18B).. 77
- Ch. TS-16, A (See Model 12VK15)... 93
- Ch. TS-18, A (See Model 7VT1) 83
- Ch. TS-23, A, B (See Model 10T2)..... 92
- Ch. TS-30, A (See Model 12VK15)... 93
- Ch. TS-52 (See Model 16K2)..... 93A
- Ch. TS-53 (See Model 12K2)..... 115
- Ch. TS-60 (See Model 16F1) 102
- Ch. TS-67 (See Model 19F1)..... 111
- Ch. TS-74 (See Model 16F1) 102
- Ch. TS-88 (See Model 14K1)..... 112
- Ch. TS-89 (See Model 16F1BH)... 121
- Ch. TS-94 (See Model 16K2BH).. 121
- Ch. TS-95 (See Model 17K1A) 121
- Ch. TS-101 (See Model 19K2) 122
- Ch. TS-114 (See Model 14T3) 121
- Ch. TS-115 (See Model 14K1BH) .. 121
- Ch. TS-119 (See Model 19K2) 122
- Ch. TS-172 (See Model 14K1BH) 121
- Ch. TS-174 (See Model 14K1BH) 121
- Ch. 1A .... 134—8
- Ch. 8A .... 46—16
- Ch. 10A .... 106—10

MUNTZ

- M30 (Ch. TV-16A1) Tel. Rec. .... 108—8
- M31 (Ch. TV-16A2) Tel. Rec. (See Model M30) 108
- M31 (Ch. TV17A2) Tel. Rec. .... 116—10
- M31R (Ch. TV17A3) Tel. Rec. (See Model M31)... 116
- M31R, M32 (Ch. TV-16A3) Tel. Rec. (See Model M30) 108
- M32 (Ch. TV17A2) Tel. Rec. (See Model M31).. 116
- M32, M32R (Ch. TV17A3) Tel. Rec. (See Model M31)..... 116
- M33 (Ch. TV17A4) Tel. Rec. (See Model M31).. 116
- M34 (Ch. TV-17A4) Tel. Rec. (For Tel. Rec. Chassis See Model M31) 116
- M41, M42 (Ch. TV17A3A) Tel. Rec. (See Model M31)..... 116
- M46 (Ch. TV17A7) Tel. Rec. (See Model M31) 116
- M49 (Ch. TV17A7) Tel. Rec. (See Model M31) 116
- M-158 Tel. Rec. 97A-10
- M-159 Tel. Rec. 97A-10
- M-159A, B Tel. Rec. 97A-10
- M-169 Tel. Rec. .... 96—6

MURPHY

- 112 .... 2—15
- 113 .... 2—2
- 122 (See Model 112)..... 2

MUSITRON

- PT-10 .... 15—20
- PX .... 16—28
- SRC-3 (See Model 101)... 13
- 101 "Piccolo" .... 13—21
- 103 "Piccolo" .... 15—21
- 105 .... 21—26
- 202 .... 21—27

POLICALARM
PR-8 ... 103—12
PR-31 ... 105—8

PONTIAC
984170 ... 20—27
984171 ... 14—22
984172 ... *
984247 ... *
984248, 984249 ... *
984273 ... *
984296, 984570 ... 95—4

PORTO BARADIO (Also See Porto Products)
PA-510 (9008-A), PB-520 (9008-B) ... 33—16
PA-510, PB-520 (Revised). 48—21

PORTO PRODUCTS
SR-600 (Ch. 9040A "Smokerette") (See Porto Baradio Model PA-510) ... 33

PREMIER
15LW ... 6—24

PURE OIL (See Puritan)

PURITAN
501 (Ch. 5D15WG), 502 (Ch. 5D25WG) ... 4—5
501X (Ch. 5D15WG), 502X (Ch. 5D25WG) ... 4—26
503 ... 10—25
503W (See Model 503) ... 10
504 (Ch. 6A35WG) ... 5—39
504W (See Model 504) ... 5
506 (6D15SW), 507 (6D25SW) ... 3—10
506X, 507X (See Model 506) ... 3
508 (Code 7A35SW) ... 4—31
509 ... 26—21
515 ... 25—24

RADIO APPARATUS CORP.
(See Policalarm)

RCA VICTOR
AAPU-1 ... *
A55 (Ch. RC-1087) ... 109—10
A106 (Ch. RC-622) ... 97—12
B1-A, B1-B, B1-C (Ch. KCS24-1, KRK1-1, KRS20-1, KRS21-1) Tel. Rec. ... *
B2-C, B2-F, B2-G, B2-H (Ch. KCS24-1, KRK1-1, KRS20-1, KRS21-1) Tel. Rec. ... *
B3-A, B3-B ... *
B4-A, B4-B, B4-C ... *
B5-A, B5-B ... *
B-411 (Ch. RC1098) ... 132—12
BX6 (Ch. RC-1082) ... 103—13
BX55 (Ch. RC-1088), BX57 (Ch. RC-1088A) ... 102—11
MI-12224, MI-12224A ... 81—12
MI-12236, -A, -B, -C, MI-12237, -A, MI-12238, -A, MI-12239, -A ... 78—13
MI-12287, MI-12288 ... 89—12
MI-12289, MI-12290 ... 80—12
MI-12291, MI-12292, MI-12293, MI-12294 .. 86—8
MI-12295 (See Model MI-12287). 89
MI-12296, MI-12298 (See Model MI-12289). 80
MI-12299 (See Model MI-12287). 89
MI-13159 ... 10—26
MI-13167 ... 35—19
PPAU-1 ... *
RV151 (Ch. RK121C, RS-123D) ... 61—17
S1000 (Ch. KCS31-1, RC617B) Tel. Rec. ... 91A-11
T100 (Ch. KCS-38) Tel. Rec. ... 93—9
T120, T121 (Ch. KCS 34C) Tel. Rec. (See Model T100) ... 93
T164 (Ch. KCS40) Tel. Rec. ... 109—11
TA-128 (Ch. KCS42A), TA-129 (Ch. KCS41-1) Tel. Rec. ... 110—11
TA169 (Ch. KCS43 & Radio Ch. RK135D) Tel. Rec. ... 108—10
TC124, TC125, TC127 (Ch. KCS34, B) Tel. Rec. (See Model T100) ... 93
TC165, TC166, TC167, TC168 (Ch. KCS40A) Tel. Rec. (See Model T164) ... 109
X551, X552 (Ch. 1089B, C) ... 129—9
X711 (Ch. RC-1070A) ... 133—11
2T51 (Ch. KCS45) Tel. Rec. ... 111—11
2T51 (Ch. KCS-45) Tel. Rec. Prod. Chge. Bul. 11 ... 118—1
2T60 (Ch. KCS-45A) Tel. Rec. Prod. Chge. Bul. 11 ... 118—1
2T60 (Ch. KCS45A) Tel. Rec. (See Model 2T51) 111
2T81 (Ch. KCS48, Radio Ch. RC-1090) Tel. Rec. *
6T53 (Ch. KCS47AT, T) Tel. Rec. (See Model 6T54) ... 113
6T53 (Ch. KCS47AT, T) Tel. Rec. Prod. Chge. Bul. 12 ... 120—1
6T54 (Ch. KCS47, A) Tel. Rec. ... 113—7
6T54 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12 ... 120—1

RCA VICTOR—Cont.
6T64, 6T65 (Ch. KCS47, A) Tel. Rec. (See Model 6T54) ... 113
6T64, 6T65 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12 ... 120—1
6T71 Ch. KCS47, A) Tel. Rec. (See Model 6T54) 113
6T71 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12 ... 120—1
6T72 (Ch. KCS 40B) Tel. Rec. (See Model T164) ... 109
6T74, 6T75, 6T76 (Ch. KCS47, A) Tel. Rec. (See Model 6T54) ... 113
6T74, 6T75, 6T76 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12 ... 120—1
6T84 (Ch. KCS48, Radio Ch. RC-1090 or RC-1092) Tel. Rec. ... *
6T86, 6T87 (Ch. KCS48, Radio Ch. RC1090 or RC1092) Tel. Rec. ... *
7T103, 7T104 (Ch. KCS47B, C) Tel. Rec. .. 134—9
7T112 (Ch. KCS47B, C) Tel. Rec. (See Model 7T103) ... 134
7T122, 7T123, 7T124, 7T125 (Ch. KCS47B, C) Tel. Rec. (See Model 7T103) ... 134
7T143 (Ch. KCS48A) Tel. Rec. (See Model 7T103) ... 134
8B41 (Ch. RC-1069), 8B42 (Ch. RC-1069A), 8B43 (Ch. RC-1069B) .. 76—16
8B46 (Ch. RC-1069C) (See Model 8B41) ... 76
8BX5 (Ch. RC-1059) ... 46—20
8BX6 (Ch. RC-1040C) ... 44—18
8BX54, 8BX55 (See Model 8BX5) ... 46
8BX65 (See Model 8BX6). 44
8F43 (Ch. RC-1037B) ... 97—13
8PCS41, 8PCS41B, 8PCS41C (Ch. KCS24B-1, KRK1A-1, KRK4, KRS20A-1, KRS20B-1, KRS21A-1, RS-123C) Tel. Rec. ... 90—9
8R71 (Ch. RC-1060), 8R72 (Ch. RC-1060A) .. 53—20
8R74, 8R75, 8R76 (Ch. RC-1060, A) (See Model 8R71) ... 53
8T241, 8T243, 8T244 (Ch. KCS28) Tel. Rec... 74—8
8T270 (Ch. KCS29, KCS29A) Tel. Rec. ... 85—13
8TC270, 8TC271 (Ch. KCS29, KCS29A) Tel. Rec. (See Model 8T270) 85
8TK29 (Ch. KCS32, KCS32A, KCS32B, KCS32C, RK135, RK135A) Tel. Rec. ... 88—9
8TK320 (Ch. KCS33A-1) (Radio Ch. RK-135A-1) Tel. Rec. (See Model 8T270) ... 85
8TR29 (Ch. KCS32, KCS32A, KCS32B, KCS32C, RK135, RK135A) Tel. Rec. (See Model 8TK29) ... 88
8TS30 Tel. Rec. (See Model 630TS) ... 54
8TV41 (Ch. KCS25D-1, KCS25E-2, RK117A, RS-123A) Tel. Rec. ... *
8TV321, 8TV321B, 8TV323, 8TV323B (Ch. KCS30-1) (Radio Ch. RC616B, C, J, K) Tel. Rec. (See Model 8T241) 74
8V7 (Ch. RC-615) (See Model 77V1) ... 38
8V90 (Ch. RC-618, RC-618A), 8V91 (Ch. RC-616A, RC-616H) ... 56—20
8V111, 8V112 (Ch. RC-616) ... 58—18
8V151 (See Model RV151) 61
8X53 (Ch. RC-1064) ... 39—17
8X71, 8X72 (RC-1070) ... 63—15
8X521 (RC-1066), 8X522 (RC-1066A) ... 52—17
8X541, 8X542 (Ch. RC-1065, RC-1065A) 59—16
8X544, 8X545, 8X546, 8X547 (See Model 8X541) 59
8X681, 8X682 (Ch. RC-1061) ... 65—10
9BX5 (Ch. RC-1059B, C) (See Model 8BX5) ... 46
9BX56 (Ch. RC-1068) ... 79—13
9EY31, 9EY32 ... 98—10
9PC41A, B, C (Ch. KCS24C-1, D, KRK-4, KRS20B-1, KRS21A-1, RS-123C) Tel. Rec. (See Model 8PCS41) ... 90
9T57 (Ch. KCS49, A, AT, T) Tel. Rec. ... 122—8
9T77 (Ch. KCS49, A, AT, T) Tel. Rec. (See Model 9T57) ... 122
9T79 (Ch. KCS49, A, AT, T) Tel. Rec. (See Model 9T57) ... 122
9T89 (Ch. KCS60, T) Tel. Rec. (See Model 9T57). 122
9T105 (Ch. KCS49B, C) Tel. Rec. (See Model 7T103) ... 134

RCA VICTOR—Cont.
9T126 (Ch. KCS49B, C) Tel. Rec. (See Model 7T103) ... 134
9T128 (Ch. KCS49B, C) Tel. Rec. (See Model 7T103) ... 134
9T147 (Ch. KCS60A) Tel. Rec. (See Model 7T103) ... 134
9T240 (Ch. KCS28, A) Tel. Rec. (See Model 8T241) ... 74
9T246 (Ch. KCS28C) Tel. Rec. (See Model 8T241) 74
9T246 (Ch. KCS38) Tel. Rec. (See Model T100) .. 93
9T256 (Ch. KCS38C) Tel. Rec. (See Model T100) .. 93
9T270 (Ch. KCS29, KCS29C) Tel. Rec. (See Model 8T270) ... 85
9TC240 (Ch. KCS28B) Tel. Rec. (See Model 8T241) ... 74
9TC245 (Ch. KCS34B) Tel. Rec. (See Model T100) .. 93
9TC247 (Ch. KCS34, B) Tel. Rec. (See Model T100) .. 93
9TC249 (Ch. KCS34, B) Tel. Rec. (See Model T100) .. 93
9TC272, 9TC275 (Ch. KCS29, KCS29C) Tel. Rec. (See Model 8T270) ... 85
9TW309 (Ch. KCS41-1, RK135C) Tel. Rec. ... 95A-11
9TW333 (Ch. KCS30-1, Radio Ch. RC616N) Tel. Rec. (See Model 8T241). 74
9TW390 (Ch. KCS31-1, RC617A) Tel. Rec. (See Model S1000) ... 91A
9W101, 9W102, 9W103 (Ch. RC-618B), 9W105 (Ch. RC-618C) ... 73—10
9W106 (Ch. RC-622) (See Model A106) ... 97
9X561 (Ch. RC-1079B), 9X562 (Ch. RC-1079C). 101—9
9X571 (Ch. RC-1079), 9X572 (Ch. RC-1079A) 107—7
9X641 (Ch. RC-1080), 9X642 (Ch. RC-1080A). 87—9
9X651 (Ch. RC-1085), 9X652 (Ch. RC-1085A). 104—9
9Y7 (Ch. RC-1057B) ... 75—13
9Y51 (Ch. RC-1077) ... 98—11
9Y510 (Ch. RC1077A), 9Y511 (Ch. RC1077B) .. 131—13
45-EY-3 ... 126—11
54B1, 54B1-N, 54B2, 54B3 (Ch. RC589) ... 7—22
54B5 (Ch. RC1047) ... 17—25
55AU (Ch. RC1017) ... 2—16
55U (See Model 55AU) ... 2
55F (Ch. RC-1004E) ... 4—6
55FA (See Model 55F) ... 4
56X, 56X2, 56X3 (Ch. RC-1011) ... 1—16
56X5 (See Model 56X10) .. 1
56X10 (Ch. RC-1023B) ... 1—12
58AV, 58V (Ch. RC-604) ... 1—32
59AV1, 59V1 (Ch. RC-605) 6—25
63E (Ch. RS-127) ... 28—28
64F1, 64F2 (Ch. RC1037), 64F3 (Ch. RC1037A) ... 4—16
65BR9 (Ch. RC-1045) ... 23—16
65F (See Model 55F) ... 4
65AU (Ch. No. RC-1017A) 14—23
65U, 65U-1 (See Model 65AU) ... 14
65X1, 65X2 (Ch. RC-1034) 4—30
65X1, 65X2 (Ch. RC-1064) 31—26
65X8, 65X9 (See Model 65X1) ... 4
66BX (Ch. RC-1040, RC-1040A) ... 14—24
66E (Ch. RS-126) ... 17—26
66X1, 66X2, 66X3, 66X4 .. 7—23
66X7, 66X8, 66X9 (See Model 66X1) ... 7
66X11 (Ch. RC-1046A), 66X12 (Ch. RC-1046), 66X13, 66X14, 66X15 (Ch. RC-1046B) ... 27—20
67V1, 67AV1 (Ch. RC-606) ... 9—27
68R1, 68R2, 68R3, 68R4 (Ch. RC-608) ... 23—17
75X11, 75X12 (Ch. RC-1050) ... 33—21
75X14, 75X15 (Ch. RC-1050) (See Model 75X11) ... 33
75X16, 75X17, 75X18, 75X19 (Ch. RC-1050B) (See Model 75X11) ... 33
77U (Ch. RC-1057A) ... 38—17
77V1 (Ch. RC-615) ... 38—18
77V2 (Ch. RC-606-C) ... 39—18
610V1 (Ch. RC610C) 610V2 (Ch. RC610) ... 31—27
612V1, 612V2, 612V3 (Ch. RK-121, RS-123) .. 17—27
612V4 (See Model 612V1) 17
621TS (Ch. KCS21-1) Tel. Rec. (Servicer) ... 78
630TCS Tel. Rec. (See Model 630TS) ... 54
630TS Tel. Rec. ... 54—18
641TV (Ch. KCS25A1-1, KCS25C-2, RK117A, RS-123A) Tel. Rec. ... 91A-11
648PTK (Ch. KCS24-1, KRK1-1, KRS20-1, KRS21A-1, RK-121A, RS-123A) Tel. Rec. (See Model 8PCS41) ... 90
648PV (Ch. KCS24A-1, KRK-1A, KRS20-1, KRS21A-1, RK-121A, RS-123B) Tel. Rec. (See Model 8PCS41) ... 90

RCA VICTOR—Cont.
710V2 (Ch. RC-613A) ... 40—15
711V1 (See Model 711V2) 22
711V2, 711V3 (Ch. RK-117 & RS-123) ... 22—24
721TCS (Ch. KCS26-1, 2) Tel. Rec. (See Model 730TV1) ... 70
730TV1 (Ch. KCS27, RC610A) Tel. Rec. ... 70—7
730TV2 (Ch. KCS27, RC610B) Tel. Rec. (See Model 730TV1) ... 70
741PCS (Ch. KCS24B-1, KRK1A-1, KRS20A-1, KRS21A-1, RS-123C) Tel. Rec. (See Model 8PCS41) ... 90
Ch. KCS-20A-1 (See Model 630TS) ... 54
Ch. KCS-20B-1 (See Model 630TCS ... 54
Ch. KCS-20J-1 (See Model 8TS30) ... 54
Ch. KCS21-1 (See Model 621TS) ... *
Ch. KCS24-1 (See Model 8PCS41) ... 90
Ch. KCS24A-1 (See Model 8PCS41) ... 90
Ch. KCS24B-1 (See Model 8PCS41) ... 90
Ch. KCS24C-1 (See Model 8PCS41) ... 90
Ch. KCS24D (See Model 8PCS41) ... 90
Ch. KCS25A1-1 (See Model 641TV) ... *
Ch. KCS25C-2 (See Model 641TV) ... *
Ch. KCS25D-1 (See Model 8TV41) ... *
Ch. KCS25E-2 (See Model 8TV41) ... *
Ch. KCS26-1, KCS26-2 (See Model 721TCS) ... *
Ch. KCS27 (See Model 730TV1) ... 70
Ch. KCS28, A, B, C (See Model 8T241) ... 74
Ch. KCS29, KCS29A (See Model 8T270) ... 85
Ch. KCS29C (See Model 8T270) ... 85
Ch. KCS30-1 (See Model 8T241) ... 74
Ch. KCS31-1 (See Model S1000) ... 91A
Ch. KCS32, KCS32A, KCS32B, KCS32C (See Model 8TK29) ... 88
Ch. KCS33A-1 (See Model 8T270) ... 85
Ch. KCS34, B, C (See Model T100) ... 93
Ch. KCS-38, C (See Model T100) ... 93
Ch. KCS40, A, B (See Model T164) ... 109
Ch. KCS41-1 (See Model TA-128) ... 110
Ch. KCS42A (See Model TA-128) ... 110
Ch. KCS43 (See Model TA169) ... 108
Ch. KCS45, A (See Model 2T51) ... 111
Ch. KCS47, A, AT, T (See Model 6T54) ... 113
Ch. KCS47B, C (See Model 7T103) ... 134
Ch. KCS48 (See Model 2T81) ... *
Ch. KCS48A (See Model 7T143) ... 134
Ch. KCS49, A, AT, T (See Model 9T57) ... 122
Ch. KCS49B, C (See Model 9T105) ... 134
Ch. KCS60, T (See Model 9T89) ... 122
Ch. KCS60A (See Model 9T147) ... 134
Ch. KRK-1A (See Model 8PCS41) ... 90
Ch. KRK1-1 (See Model 8PCS41) ... 90
Ch. KRK1A-1 (See Model 8PCS41) ... 90
Ch. KRK4 (See Model 8PCS41) ... 90
Ch. KRS20-1 (See Model 8PCS41) ... 90
Ch. KRS20A-1 (See Model 8PCS41) ... 90
Ch. KRS20B-1 (See Model 8PCS41) ... 90
Ch. KRS21A-1 (See Model 8PCS41) ... 90
Ch. RC-589 (See Model 54B1) ... 7
Ch. RC-604 (See Model 58AV) ... 1
Ch. RC-605 (See Model 59AV1) ... 6
Ch. RC-606 (See Model 67V1) ... 9
Ch. RC-606C (See Model 77V2) ... 39
Ch. RC-608 (See Model 68R1) ... 23
Ch. RC-610 (See Model 610V1) ... 31
Ch. RC610A, RC610B (See Model 730TV1) ... 70
Ch. RC610C (See Model 610V1) ... 31
Ch. RC-613A (See Model 710V2) ... 40
Ch. RC-615 (See Model 77V1) ... 38
Ch. RC-616 (See Model 8V111) ... 58

RCA VICTOR—Cont.
Ch. RC-616A, RC-616H (See Model 8V91) ... 56
Ch. RC-616B, RC-616C (See Model 8T241) ... 74
Ch. RC-616J, RC-616K (See Model 8T241) ... 74
Ch. RC-616N (See Model 8T241) ... 74
Ch. RC617A, B (See Model S1000) ... 91A
Ch. RC-618, RC-618A (See Model 8V90) ... 56
Chassis RC-618 B, C (See Model 9W101) ... 73
Ch. RC-622 (See Model A106) ... 97
Ch. RC-1004E (See Model 55F) ... 4
Ch. RC-1011 (See Model 56X) ... 1
Ch. RC-1017 (See Model 55AU) ... 2
Ch. RC-1017A (See Model 65AU) ... 14
Ch. RC-1023B (See Model 56X10) ... 1
Ch. RC-1034 (See Model 65X1) ... 4
Ch. RC-1037, RC-1037A (See Model 64F1) ... 4
Ch. RC-1037B (See Model 8F43) ... 97
Ch. RC-1038, RC-1038A (See Model 66X1) ... 7
Ch. RC-1040, RC-1040A (See Model 66BX) ... 14
Ch. RC-1040C (See Model 8BX6) ... 44
Ch. RC-1045 (See Model 65BR9) ... 23
Ch. RC-1046, A, B (See Model 66X11) ... 27
Ch. RC-1047 (See Model 54B5) ... 17
Ch. RC-1050, RC-1050B (See Model 75X11) ... 33
Ch. RC-1057A (See Model 77U) ... 38
Chassis RC-1057B (See Model 9Y7) ... 75
Ch. RC-1059 (See Model 8BX5) ... 46
Ch. RC-1059B, RC-1059C (See Model 9BX5) ... 46
Ch. RC-1060 (See Model 8R71) ... 53
Ch. RC-1060A (See Model 8R72) ... 53
Ch. RC-1061 (See Model 8X61) ... 65
Ch. RC-1064 (See Model 8X53) ... 39
Ch. RC-1064 (See Model 65X1) ... 31
Ch. RC-1065, RC-1065A (See Model 8X541) ... 59
Ch. RC-1066 (See Model 8X521) ... 52
Ch. RC-1066A (See Model 8X522) ... 52
Ch. RC-1068 (See Model 9BX56) ... 79
Ch. RC-1069A, B (See Model 8B41) ... 76
Ch. RC-1070 (See Model 8X71) ... 63
Ch. RC-1070A (See Model X711) ... 133
Ch. RC-1077 (See Model 9Y51) ... 98
Ch. RC1077A, B (See Model 9Y510) ... 131
Ch. RC-1079, A (See Model 9X571) ... 107
Ch. RC-1079B, RC-1079C (See Model 9X561) ... 101
Ch. RC-1082 (See Model BX6) ... 103
Ch. RC-1085, RC-1085A (See Model 9X651) ... 104
Ch. RC-1087 (See Model A55) ... 109
Ch. RC-1088, RC-1088A (See Model BX55) ... 102
Ch. RC1089B, C (See Model X551) ... 129
Ch. RC-1090 (See Model 2T81) ... *
Ch. RC-1092 (See Model 9T57) ... 122
Ch. RC1098 (See Model B411) ... 132
Ch. RK-117 (See Model 711V2) ... 22
Ch. RK-117A (See Model 8TV41) ... *
Ch. RK-121 (See Model 612V1) ... 17
Ch. RK-121A (See Model 8PCS41) ... 90
Ch. RK-121C (See Model RV151) ... 61
Ch. RK-135, RK-135A (See Model 8TK29) ... 88
Ch. RK-135A-1 (See Model 8T270) ... 85
Ch. RK135C (See Model 9TW309) .. 95A
Ch. RK135D (See Model TA169) ... 108
Ch. RS-123 (See Model 612V1) ... 17
Ch. RS-123A, B, C (See Model 8PCS41) ... 90
Ch. RS-123D (See Model RV151) ... 61
Ch. RS-126 (See Model 66E) ... 17
Ch. RS-127 (See Model 63E) ... 28

TELE-TONE—Cont.
G-1430 43—19
G-4108 (See Model G-418) 26
G-7205 (See Models G-721, G-722, G-723) 24
H-411 47—23
H-521 (See Model G-521) 28
H-622 (See Model G-622) 44
H-727 (See Model G-725) 34
TV-1776, TV-1777, TV-1778, TV-1779 Tel. Rec. 66—16

TEMPOTONE
500 E Series 2—8

TEMPLETONE (See Temple)

THORDARSON
T-30W08A 8—31
T-31W10A 30—30
T-31W10-AX 57—22
T-31W25A 9—33
T-31W50A 20—34
T-32W00, T-32W10 76—18

TONE PAK
AC8HF 24—28

TRAD
T-20, A Tel. Rec. 133—14

TRANSVISION
Chassis Model A Tel. Rec. 107—11
Chassis A-3 Tel. Rec. 130—15
WRS-3 Tel. Rec. 112—10

TRANSVUE
601 (Ch. 16AX23, 25, 26) Tel. Rec. *
610 (Ch. 16AX23, 25, 26) Tel. Rec. *

TRAV-LER
10T Tel. Rec. 86—11
12L50, A Tel. Rec. 108—13
12T Tel. Rec. (See Model 10T) 86
14B50, A, 14C50, A Tel. Rec. (See Model 12L50) 108
16G50A Tel. Rec. (See Model 12L50) 108
16R50A, 16T50A Tel. Rec. (See Model 12L50) 108
16T Tel. Rec. (See Model 10T) 86
5000 (See Model 50001) 11
50001 11—27
5002 Series (Ch. 109) 12—28
5007, 5008, 5009 (Ch. 104) 1—36
5010, 5011, 5012 (Ch. 105) 2—5
5015 36—25
5019 23—30
5020 (Ch. 800) 11—28
5021 43—20
5022 101—14
5027 31—30
5028 34—24
5029 33—29
5030, 5031 32—25
5036 54—19
5049 45—24
5051 32—26
5054 36—26
5056-A 90—12
5060, 5061 116—11
5066 42—24
6040 49—25
6050 56—23
7000, 7001 59—21
7003 (Ch. 501) 12—29
7014 (See Model 7000) 59
7016, 7017 84—11
7023 83—13
7036 112—11
Chassis 104 (See Model 5007) 1
Chassis 105 (See Model 5010) 2
Chassis 109 (See Model 5002) 12
Chassis 501 (See Model 7003) 12
Chassis 800 (See Model 5021) 11

TRELA
HW301 14—28

TRUETONE
D1034B, C (See Model D1046A) 102
D1046A 102—15
D1046C, D (See Model D1046A) 102
D1090 Tel. Rec. *
D1092 Tel. Rec. *
D1612 28—34
D1644 12—30
D1645 (Factory 26A76-650) 6—33
D1747, D1748 32—27
D1752 (Factory 7901-14) 34—25
D1835 (Factory Model 25A86-856) 44—25
D1836, D1836A (Factory 26A85-856) 45—25
D1840 (Fact. No. 138PCXM) 46—24
D1845 31—31
D1846A, B, C 40—23
D1850 (Series A) 51—23
D1949 60—20
D1950, D1951 (See Model D1850) 51
D1952 (See Model D1949) 60
D1990, D1992 (Factory No. 7AF22) Tel. Rec. 69—13
D1991, B, D1993, B, D1994 Tel. Rec. 77—11
D1996 Tel. Rec. (See Model D2983) 68
D1997A Tel. Rec. *

TRUETONE—Cont.
D1998A Tel. Rec. *
D2017, D2018 101—15
D2020 106—15
D2025A (Fact. Mod. 26A95-906) 83—14
D2027A 97—18
D2050A Tel. Rec. *
D2603 (Factory No. 461) 13—33
D2604 13—34
D2605 (Factory Model 2AW2) 9—34
D2606 65—15
D2612 (Code SW-9022-G) 3—9
D2613 13—37
D2615 (Factory Model 6D110) 2—18
D2616 (Factory Model 6D117) 10—32
D2616-B 31—32
D2619 (Factory No. 2701) 27—29
D2620 1—28
D2621 4—32
D2622 14—30
D2623 11—29
D2624 (Factory 27D14-600) 2—6
D2626 (Fact. No. 457-2) 52—22
D2630 (Factory 27D14-602 Issue A) 1—10
D2634 12—31
D2640 (Factory No. 459) 43—21
D2642 12—32
D2644 (Factory No. 101C) 11—30
D2645 4—39
D2661 (Factory 4B19) 2—23
D2663 (Ch. 4C1) 11—31
D2665 (Factory 4B114 Series A) 22—31
D2692 39—28
D2709 (Factory No. 470) 27—30
D2710 (Factory No. 24D22-630BR) 23—31
D2718 (Factory No. 227D14-638IU) 23—32
D2743 25—29
D2745 (See Model D1645) 6
D2748 (Ch. 7156) 26—27
D2806, D2807 (Factory Model 181) 44—26
D2810 (Factory No. 24D24-730BB) 36—27
D2815 48—25
D2819 (Factory No. 26A82-738) 35—24
D2851 38—28
D2906 (Factory No. 189) 69—14
D2910 65—16
D2919 (Fact. No. 6DF21) 59—22
D2963 73—13
D2982 Tel. Rec. *
D2983 Tel. Rec. 68—18
D2985 Tel. Rec. 70—11
D2987 (See Model 1990) Tel. Rec. 69
D2988, D2989 Tel. Rec. *
D2990 Tel. Rec. *
D3615 (Factory 25BD2-606) 18—32
D3619 (Factory 5P110) 10—33
D3630, D3630N 19—33
D3720 24—29
D3721 (Factory 110BX) 32—28
D3722 (Fact. No. 472) 51—24
D3809 (Factory No. 178) 43—22
D3810 39—27
D3811 (Fact. No. 114BXH) 47—24
D3840 49—26
D3910 (Fact. Model 140611) 74—10
D4620 (Factory No. 5C12) 26—28
D4630 (Factory 26C19-61) 7—28
D4818 (Fact. No. 134DX) 45—26
D4832 (Fact. No. 25C22-82) 47—25
D4842 (Fact. No. 26C21-81) 50—21
2D1088A Tel. Rec. 105—11
2D1088B Tel. Rec. *
2D1089A Tel. Rec. 113—10
2D1089B Tel. Rec. *
2D1093A, 2D1094A Tel. Rec. 119—12
2D1095 Tel. Rec. 134—11
2D2052 Tel. Rec. (See Model 2D1095) 134
2D2053 Tel. Rec. 120—11

ULTRADYNE
L-46 4—21

UNITED MOTORS SERVICE (See Delco or Buick, Chevrolet, Oldsmobile and Pontiac)

U. S. TELEVISION
C-12923P Tel. Rec. *
C16030 Tel. Rec. 99A-12
C19031 Tel. Rec. (See Model C16030) 99A
CFM-12823P Tel. Rec. *
CFM-15925 Tel. Rec. *
CFM-16926 Tel. Rec. *
K-25936 Tel. Rec. *
K-30936 Tel. Rec. *
KFM-25-PIC Tel. Rec. *
KFM-25836 Tel. Rec. *
KFM-30836 Tel. Rec. *
KRF-15933 Tel. Rec. *
KRV-12831P Tel. Rec. *
KRV-15831P Tel. Rec. *
T-3X4836 Tel. Rec. *
T502M, T502P Tel. Rec. *
T-507, T-507M Tel. Rec. *
T-525L Tel. Rec. *
T621M, T621P Tel. Rec. *
T-10823 Tel. Rec. 89—15
T-10925 Tel. Rec. *
T-12823 Tel. Rec. *
T-12923P Tel. Rec. *
T-15823 Tel. Rec. *
T-15925 Tel. Rec. *
T16030 Tel. Rec. (See Model C16030) 99A

U. S. TELEVISION—Cont.
T19031 Tel. Rec. (See Model C16030) 99A
5A16, 5B16, 5C16 (See Model 5C66 Early) 17
5A66, 5B66, 5C66, 5D66MPA 24—30
5C66 Early 17—9
8-16M (Dumbarton) 26—29

UNITONE
88 5—26

V-M
1001-A 10—34

VAN-CAMP
576-1-6A 7—29

VIDEO CORP. OF AMERICA (See Videola)

VIDEODYNE
10FM, 10TV, 12FM, 12TV Tel. Rec. 69—15

VIDEOLA
VS-160, VS-161 Tel. Rec. 92—9
VS-165, VS-166, VS-167, VS-168 Tel. Rec. (See Model VS-160) 92

VIEWTONE
RC-201A, RRC-201 11—32

VIZ
RS-1 14—31

VOGUE
532 A-P 11—33
Ch. Models 553R, 554R 8—32

WARWICK (See Clarion)

WATTERSON
ARC-4591A 16—36
PA-4585, APA-4587 3—2
RC-4581 16—35
4581 3—32
4582 6—34
4782 24—31
4790 16—34
4800 43—23

WEBSTER-CHICAGO
66-1A 34—26
100-608 121—14
100-621 113—11
130 119—13
161-1 55—23
288 117—14
362 105—12
760 112—12
762 (See Model 362) 105

WEBSTER (Telehome)
W606M 56—24
604M 57—23

WESTERN AUTO (See Truetone)

WESTINGHOUSE
H-104, H-105 4—11
H-104A, H-105A, H-107A, H-108A 21—36
H-107, H-108, H-110, H-111 4—19
H-113, H-114, H-116 (See Model H-117) 11
H-117, H-119 11—34
H-122 6—35
H-122A, H-122B (See Model H-122) 6
H-125, H-126 3—19
H-130 (See Model H-122) 6
H-133 14—34
H-137 (See Model H-138) 6
H-138 6—36
H-147 31—33
H-148 15—37
H-148A (See Model H-148) 15
H-153, H-153A (Ch. V-2103) 35—25
H-154 (See Model H-104A) 21
H-155 (See Model H-153) 35
H-156 (See Model H-153) 35
H-157 (Ch. V-2122) 33—31
H-161 (Ch. V-2118) 34—27
H-162 (See Model H-117) 11
H-164 (Ch. V-2119-1) 36—28
H-165 32—29
H-166, H-167 (See Model H-164) 36
H-168, H-168A, H-168B (Ch. V-2118) (See Model H-161) 34
H-169 (Ch. V-2124-1) 37—24
H-171, H-171A, H-171C (Ch. V-2103) (See Model H-153) 35
H-178 (Ch. V-2123) 35—26
H-181 Tel. Rec. *
H-182 (Ch. V-2128), (Ch. V-2128-1) 53—25
H-183, H-183A 48—26
H-184 (See Model H-153) 35
H-185 (Ch. V-2131, V-2131-1) 54—20
H-186M, H-187 (Ch. V-2132) 60—21
H-188 (Ch. V-2133) 51—25
H-190, H-191, H-191A (Ch. V-2134) 59—23
H-195 (See Model H-184) 54
H-196 Tel. Rec. 65—17
H-196A (CHV-2130-1) Tel. Rec. (See Model H-196) 65
H196A (DX) (Ch. V-2130-11DX or V-2130-12DX) Tel. Rec. 84—13
H-198 (Ch. V-2137-2) 73—15
H-199 (Ch. V-2137-1) 69—16
H-202 (Ch. V-2128-2) 50—22
H-203 (Ch. V-2137) 62—21
H-204 (See Model H-202) 50
H-207A (Ch. V-2130-1, V-2137) Tel. Rec. (See Model H-196) 65

WESTINGHOUSE—Cont.
H207A (DX) (Ch. V-2130-11DX or V-2130-12DX and Radio Ch. V-2137) Tel. Rec. (See Model H196A [DX]) 84
H207B (DX) (Ch. V-2130-21DX or V-2130-22DX and Radio Ch. V-2137) Tel. Rec. (See Model H196A [DX]) 84
H-210, H-211 (Ch. V-2144, V-2144-1) 61—20
H-212 (Ch. V-2137) (See Model H-203) 62
H-214, H-214A (Ch. V-2103-3) 75—16
H-216, H-216A (Ch. V-2146-05, V-2146-45, V-2149-1) Tel. Rec. 97A-14
H-217, H-217A (Ch. V-2146-1, V-2137, V-2149) Tel. Rec. *
H-217, H-217A (Ch. 2146-11DX, V-2137, V-2149) Tel. Rec. (Supp. to H-217B, Set 91) 99A-14
H-217B (Ch. V-2146-35DX, V-2137, V-2149) Tel. Rec. 91—14
H-220 (See Model H-190) 59
H-223 (Ch. V-2150-01, V-2150-02) Tel. Rec. 78—14
H-225 (DX) (Ch. V-2130-31DX or V-2130-32DX) Tel. Rec. (See Model H196A [DX]) 84
H-226 (Ch. 2146-21DX, 2146-25DX, 2149) Tel. Rec. (See Model H-217B) 91
H-231 (Ch. 2150-51 and V-2137-3 or V-2137-3S, V-2149-2) Tel. Rec. 99A-14
H-242 (Ch. 2150-31) Tel. Rec. 97A-14
H-251 (Ch. V-2150-81, -82, -84) Tel. Rec. 99A-14
H300T5, H301T5 (Ch. V-2148) 88—14
H-302P5 (Ch. V-2151-1) 91—15
H303P4, H304P4 (Ch. V2153) 89—16
H-307T7, H-308T7 (Ch. V-2136) 100—13
H-309P5, H-309P5U (Ch. V-2156) 101—16
H-310T5, H-310T5U, H-311T5, H-311T5U (Ch. V-2161, V-2161U) 99—18
H-312P4, H-312P4U, H-313P4, H-313P4U, H-314P4, H-314P4U, H-315P4, H-315P4U (Ch. V-2153-1) 98—13
H-316C7 (Ch. V-2136-1) 112—13
H-317C7 (Ch. V-2136-1) (See Model H316C7) 112
H-318T5, U (Ch. V-2157, U) 117—15
H-320T5, U (Ch. V-2157, U) (See Model H-318T5) 117
H-321T5, U, H-322T5, U (Ch. V-2157-1, U) (See Model H-318T5) 117
H-323T5, U (Ch. V-2157-2, U) (See Model H-318T5) 117
H-324T7, H-325T7, U (Ch. V-2136-2) 113—13
H-326C7 (See Model H-316C7) 112
H-327T6U (Ch. V-2157-3U) 126—14
H-336T5U, H-337T5U (Ch. V-2157U) 134—12
H-600T16 (Ch. V-2150-61, A, B) Tel. Rec. 98—14
H-601K12, H-602K12 (Ch. V-2150-41) Tel. Rec. (See Model H-600T16) 98
H-603C12 (Ch. V-2152-01 & V-2149-3) Tel. Rec. 100—14
H-604T10, H-604T10A (Ch. V-2150-91A, -94, -94A) Tel. Rec. (Supp. to H-609T10, Set 95) 99A-14
H-605T12 (Ch. V-2150-101) Tel. Rec. 97—19
H-606K12 (Ch. V-2150-111, A) Tel. Rec. 120—12
H-607K12 (Ch. V-2150-111, A) Tel. Rec. (See Model 606K12) 120
H-608C12 (Ch. V-2152-01, V-2149-3) Tel. Rec. (See Model H-603C12) 100
H-609T10 (Ch. V-2150-94C) Tel. Rec. 95—7
H-610T12 (Ch. V-2150-136) Tel. Rec. 105—13
H-611C12 (Ch. V-2152-16) Tel. Rec. 112—14
H-613K16 (Ch. V-2150-146) Tel. Rec. 107—12
H-614T12 (Ch. V-2150-136) Tel. Rec. (See Model H610T12) 105
H-615C12 (Ch. V-2152-16) Tel. Rec. (See Model H-611C12) 112
H-617T12 (Ch. V-2150-176) Tel. Rec. 103—17
H-617T12 (Ch. V-2150-176, U, V-2150-177U) Tel. Rec. Prod. Chge. Bul. 10 116—1
H-618T16 (Ch. V-2150-186) Tel. Rec. (See Model H-617T12) 103

WESTINGHOUSE—Cont.
H-618T16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10 116
H-619T12,U (Ch. V-2150-176,U) Tel. Rec. (See Model H-617T12) 103
H-619T12 (Ch. V-2150-176, U, V-2150-177U) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10 116
H-620K16 (Ch. V-2150-186) Tel. Rec. (See Model H-617T12) 103
H-620K16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10 116
H-622K16 (Ch. V-2150-186,A,C,CA) Tel. Rec. (See Model H-617T12) 103
H-622K16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10 116
H-625T12 (Ch. V-2150-197) Tel. Rec. 114—11
H-626T16 (Ch. V-2172) Tel. Rec. 116—13
H-627K17 (Ch. V-2171) Tel. Rec. (See Model 626T16) 116
H-628K16, H-629K-16 (Ch. V-2171) Tel. Rec. (See Model H-626T16) 116
H-630T14 (Ch. V-2176) Tel. Rec. (See Model H-626T16) 116
H-633C17, H-634C17 (Ch. V-2173) Tel. Rec. 122—11
H-636T17 (Ch. V-2175) Tel. Rec. (See Model H-626T16) 116
H-637T14 (Ch. V-2177) Tel. Rec. (See Model H-626T16) 116
H-638K20 (Ch. V-2178) Tel. Rec. 129—13
H-639T17 (Ch. V-2192, -1) Tel. Rec. 133—15
H-640T17 (Ch. V-2175-3, -4), H-640T17A (Ch. V2192) Tel. Rec. (See Model H-639T17) 133
H-641K17 (Ch. V-2175-1, -5), H-641K17A (Ch. V-2192-1) Tel. Rec. (See Model H-639T17) 133
H-642K20 (Ch. V-2178-1, -3) Tel. Rec. (See Model H-638K20) 129
H-643K16 (Ch. V-2179, V-2179-1) Tel. Rec. 127—13
H-646K17 (Ch. V-2192) Tel. Rec. (See Model H-639T17) 133
H-647K17 (Ch. V2175-3) Tel. Rec. (See Model H-639T17) 133
H-654T17 (Ch. V-2175-3, -4, V-2192, -1) Tel. Rec. (See Model H-639T17) 133
H-1251 (See Models H-125, H-126) 3
Ch. V-2102 (See Model H-104) 4
Ch. V-2102-1 (See Model H-138) 6
Ch. V-2103 (See Model H-153) 35
Chassis V-2103-3 (See Model H-214) 75
Ch. V-2107 (See Model H-133) 14
Ch. V-2118 (See Model H-161) 33
Ch. V-2119-1 (See Model H-164) 36
Ch. V-2120 (See Model H-165) 32
Ch. V-2122 (See Model H-157) 33
Ch. V-2123 (See Model H-178) 35
Ch. V-2124-1 (See Model H-169) 37
Ch. V-2128, V-2128-1 (See Model H-182) 53
Ch. V-2128-2 (See Model H-202) 50
Chassis V-2130-1 (See Model H-196) 65
Ch. V-2130-11DX, V-2130-12DX (See Model H196A [DX]) 84
Ch. V-2130-21DX, V-2130-22DX (See Model H196A [DX]) 84
Ch. V-2130-31DX, V-2130-32DX (See Model H196A [DX]) 84
Ch. V-2131, V-2131-1 (See Model H-185) 54
Ch. V-2132 (See Model H-186M) 60
Ch. V-2133 (See Model H-188) 51
Ch. V-2134 (See Model H-190) 59
Ch. V-2136 (See Model H-307T7) 100
Ch. V-2136-1 (See Model H-316C7) 112
Ch. V-2136-2 (See Model H-324T7) 213
Ch. V-2137 (See Model H-203) 62

ADDITIONAL BENEFITS FROM PHOTOFACTS

From time to time, PHOTOFACT Folder Sets include valuable "bonus" materials, as well as useful data of a special nature. The following useful materials are extra benefits available in the Sets indicated at no additional cost.

	Set No.
1—RMA Production Source Code (July 1, 1946)	**5**
2—RMA Production Source Code (Jan. 1, 1949)	**70**
3—RMA Production Source Code (Revisions as of July 1, 1949)	**92**
4—TRADE DIRECTORY— Parts Manufacturers	**12**
5—National Electrical Code on Antennas	**88**
6—Record Changer Cross Reference by Manufacturer and Model	**118**
7—Mica Capacitor Color Codes	**48**
8—Ion Trap Alignment	**62**
9—"Let's Look at the Sync Pulses"	**64**
10—Replacement of Disc & Plate Type Ceramic Capacitors	**68**
11—Certificate entitling subscriber to PHOTOFACT Volume Labels for Vols. 1-10	**62**
12—Certificate entitling subscriber to PHOTOFACT Volume Labels for Vols. 11-20	**102**
13—Certificate entitling subscriber to 100 Door Knob Hangers	**80**
14—Photofact Television Course appearing serially in	**38-51, 54**
15—CR Tube Dimension Chart	**112**
16—CR (Electromagnetic) Tube Characteristics Chart	**112**
17—CR Tube Interchangeability Chart	**112**
18—NPA maintenance and repair information	**130**
19—Proposed Television channel allocation	**132**

RECORD CHANGERS

(CM-1) indicates service data *also* available in Howard W. Sams 1947 Record Changer Manual. (CM-2) indicates service data available in Howard W. Sams 1948 Record Changer Manual. (CM-3) indicates service data available in Howard W. Sams 1949, 1950 Record Changer Manual.

ADMIRAL
RC-150 ....(CM-1) **26—31**
RC-160, RC-160A, RC-161, RC-161A (Supplement to RC-200) ....(CM-1) **21—37**
RC-170, RC-170A..(CM-1) **31—2**
RC-180, RC-181 ..(CM-2) **76—1**
RC-182 Supplement (CM-2) **76—2**
RC-200 ....(CM-1) **9**
RC210, RC211, RC212 (CM-3) **72—1**
RC-221, RC-222 ...(CM-3) **79—1**
RC220, RC221, RC222 Changes ......(CM-3) **108—2**
RC320, RC321, RC322 (See Model RC220 Changes) .....(CM-3) **108**
RC400 ....**104—1**
RC500 ....**132—2**

AERO
46A ....(CM-1) **19—34**
47A ....(CM-2) **77—2**

AVIOLA
100 ....(CM-1) **33—32**

BELMONT
C-9 ....(CM-2) **34—31**

COLUMBIA
104 ....**124—2**

CRESCENT
C-200 ....(CM-1) **20—37**
6 Series ....(CM-3) **89—4**
250 Series ....(CM-2) **78—5**
350 Series ....(CM-2) **80—3**

FARNSWORTH
P-51, P56 ....(CM-1) **13—36**
P-72, P73 ....(CM-2) **75—8**

GARRAD
RC-60 ....(CM-2) **81—7**

GENERAL ELECTRIC
P6 ....(CM-2) **79—8**

GENERAL INDUSTRIES
RC130L ....(CM-1) **22—33**

GENERAL INSTRUMENT
204 ....(CM-1) **23—34**
205 ....(CM-1) **10**

LEAR
PC-206A ....(CM-1) **18—33**

MAGUIRE
ARC-1 ....(CM-1) **7**

MARKEL
70, 71 ....(CM-2) **84—8**
74, 75 ....(CM-3) **91—7**
74, 75 Supplement......**131—11**

MILWAUKEE ERWOOD
10700 ....(CM-1) **16—37**
11200 ....(CM-2) **86—6**
11600 ....(CM-3) **72—7**

MOTOROLA
B24RC, B25RC, B27RC, B28RC ..(CM-1) **12—35**
RC30 ....(CM-2) **80—9**

OAK
6666 ....(CM-1) **19—35**
9201 ....(CM-3) **111—10**

PHILCO
D10, D10A ......(CM-1) **14—21**
M-4 ....(CM-1) **25—30**
M-7 ....(CM-1) **28—35**
M-8 ....(CM-2) **83—7**
M-9C ....(CM-2) **74—7**
M-12C ....(CM-3) **109—9**
M-20 ....(CM-3) **103—11**

RCA
RP168 ....(CM-3) **72—10**
RP-176 ....(CM-1) **25—31**
RP-177 ....(CM-2) **44—27**
RP-178 ....(CM-2) **79—12**

SEEBURG
K ....(CM-1) **11—36**
L ....(CM-1) **24—34**
M ....(CM-1) **32—19**
S, SQ ....(CM-2) **78—12**

SILVERTONE
101.761-2, 101.762-2 .....(CM-2) **77—10**
101.761-3, 101.762-3 .....(CM-2) **83—11**
101.762, 101.763 ......(CM-2) **88—11**

SPARTON
C48 ....(CM-2) **87—11**

THORENS
CD-40 ....(CM-1) **39—29**

TRAV-LER
A ....(CM-3) **72—13**

UNIVERSAL CAMERA
100 ....(CM-1) **36—30**

UTAH
550 ....(CM-1) **8**
650 ....(CM-1) **22—34**
7000 ....(CM-1) **27—31**
7001 ....(CM-2) **83—15**

V-M
200-B ....(CM-1) **15—36**
400 ....(CM-1) **26—33**
400 (Late) ....(CM-2) **90—13**
402, 400C ....(CM-2) **82—12**
402D, 400D .....(CM-2) **87—14**
404 (See Model 405) (CM-3) **73**
405 ....(CM-3) **73—14**
406, 407 ....(CM-3) **102—16**
800 ....(CM-1) **21—38**
800-D ....(CM-2) **84—12**
802 ....(CM-3) **77—12**
910 ....(CM-3) **115—14**
950 ....(CM-3) **107—13**
950 Supplement.........**131—17**

WEBSTER
50 ....(CM-1) **24—35**
56 ....(CM-1) **17—36**
70 ....(CM-1) **29—28**
133 ....(CM-2) **82—13**
148 ....(CM-2) **86—12**

WEBSTER—Cont.
246 ....(CM-2) **74—11**
256 ....(CM-2) **88—13**
346 ....(CM-3) **100—12**
356, 357 ....(CM-3) **106—16**

WESTINGHOUSE
V4914 ....(CM-2) **47—26**
V4944 ....(CM-2) **86—13**
V6235 ....**134—13**

ZENITH
S11468 ....(CM-1) **23—35**
S11680 ....(CM-1) **27—32**
S14001 ....(CM-2) **75—17**
S13675, S14002, S14006, S14008 (CM-2) **85—15**
S14004, S14007 ..(CM-2) **79—18**
S14012, S14014 (CM-3) **110—14**
S14022 ....(CM-3) **112—15**
S14023 ....(CM-3) **105—14**
S14024, S14025 (See Model S14022) (CM-3) **112**
S14026 (See Model S14023) ......(CM-3) **105**
S14027 (See Model S14022) ......(CM-3) **112**

MISCELLANEOUS
Series 700F ......(CM-2) **89—9**
Series 700F 33/45 (CM-3) **75—11**
Series 700FLP ...(CM-2) **101—6**
Series 700FS ....(CM-2) **104—8**
Series 700R .....(CM-2) **91—8**

RECORDERS

AMPRO
730 ....**133—4**

BRUSH SOUND MIRROR
BK-401 Tape Recorder (CM-1) **42—25**
BK-403 ....(CM-2) **78—3**
BK-416 ....(CM-2) **81—4**

BRUSH MAIL-A-VOICE
BK-501, BK-502, BK-503 ....(CM-1)

CRESCENT
H-1A ....**130—5**

CRESCENT—Cont.
H-2A1 Series ....(CM-3) **119—4**
H-19 Series "Steno" ....**122—3**
H-22A1 ....**125—4**
M-2000, M-3000 Series...**120—4**
1000 Series ......(CM-2)
1000 Series Revised (CM-3) **77—4**

CRESTWOOD
CP-201 ....(CM-3) **118—4**

EICOR
1000 ....(CM-3) **90—4**

GENERAL INDUSTRIES
R70, R90 ....(CM-1) **35—28**

INTERNATIONAL ELECTRONICS
PT3 ....(CM-2) **88—4**

LEAR DYNAPORT
WC-311-D ....(CM-2) **80—8**

MAGNECORD AUDIAD
AD-1R ....(CM-2) **84—7**

MASCO
375 ....(CM-3) **117—7**

RCA
MI-12875 ....(CM-2) **85—12**

REELEST
C1A ....**123—13**

SILVERTONE
70 (Ch. 567.230, 567.231) ....**121—11**
771 ....(CM-1) **26—32**
101.774-2, 101.774-4 (CM-3) **114—10**

ST. GEORGE
1100 Series Wire Recorder ..(CM-1) **40—24**

WEBSTER-CHICAGO
79-80 Wire Recorder (CM-1) **37—26**
178 ....(CM-3) **113—12**

WEBSTER ELECTRIC
Ekotape ....(CM-3) **116—12**

WIRE RECORDING CORP.
WP ....(CM-2) **76—19**

INDEX TO ADVERTISERS

" SHOP TALK " (Continued from page 4)

align such circuits we require a sweep generator. The generator should be capable of generating the frequencies we desire and its output should be constant over the section of the range it is sweeping. (Note that this does not mean its output need be constant over its entire frequency range.)

Basically, the foregoing is all you require of any sweep generator. Any other function that such a unit can perform is desirable (if it helps you shorten your work) but not absolutely essential. Hence, for the fellow with a limited amount of money to spend, only the two basic requirements stated above need be given service consideration.

Built-in marker generators are handy, but seldom essential since a separate AM generator is usually available. The ability to blank out the return trace will make it more convenient to do your job but here, too, is a refinement that the fellow with limited capital can forego.

The choice of an AM signal generator is a little more critical because it is this generator upon which you will lean heavily during nearly all of your alignment work. In stagger-tuned IF systems, this generator will be used to help you accurately peak the various coils prior to an overall check. And, when the sweep check is being made, the same AM generator will be used as a frequency marker, showing you exactly what the response of the circuit is. It will tell you if the video carrier is at the 50 per cent level; it will tell you at what frequency the response drops; it will show you how wide the passband is and it will reveal whether the traps are where they should be.

In short, it will tell you everything that the sweep generator cannot tell you - and if the AM generator is accurately calibrated, it will tell you all this in precise terms.

In view of the importance of this AM generator, any extra money lying around should be sunk into this instrument. You can get by with AM generators possessing an accuracy of only 5%, but if you want to be sure, get one that has an accuracy of 1 per cent. Better still, get an AM generator which uses a crystal calibrator and has a large, easy-to-read dial face. And get one that permits you to read up to 150 mc or better, on fundamentals. Harmonics can and have been used - but you will frequently find that spurious signals will develop which will confuse and mislead you. If possible, stick to fundamentals up to whatever frequency you desire to reach.

The foregoing discussion is intended to serve as a guide to those entering the TV service field. It is a result of the author's experience plus the experience of his associates. No attempt was made to indicate specific models because within the same price class there are generally several units of similar quality to choose from. Some men may prefer one instrument, others may prefer a different make, etc., and both groups will be equally vehement about the virtues of their choice.

Choose whichever instrument you prefer, but make sure it serves the purpose you intended.

* * *

REVIEW: This month we are concerned with the review of an article for improving sound reproduction of typical television receivers. The article is as follows:

IMPROVED AUDIO QUALITY
FROM STANDARD TV RECEIVERS
by G. C. Proud
AUDIO ENGINEERING - October 1949

Subscription Price $3.00 per year
in U. S. A., Possessions, and Canada

In every television receiver, the major design emphasis is on the video circuits and the quality of the picture that is produced. The sound section of the receiver is relegated to a secondary position and, as a consequence, it has suffered considerably in quality. The most widely used arrangement, as exemplified by the audio section of the RCA 630TS circuit (shown in Figure 1), consists of a high-mu triode with contact potential bias for the first stage, and a pentode output stage without feedback. As Mr. Proud points out in his article, add to this an output transformer, which has a 5/8 x 5/8 inch core, and a small speaker with inadequate baffling, and the sound you hear is bound to be less than ideal.

As a start toward the improvement of the sound quality, it is suggested that the output transformer be changed to one containing more iron in its core. Just what type to get will be governed by the amount of space that you have available on the chassis for mounting the unit.

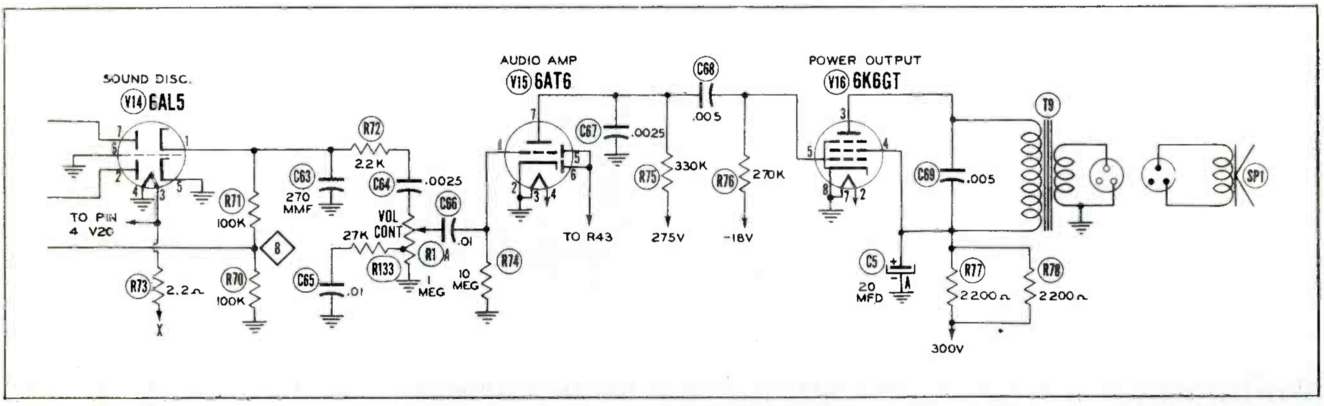
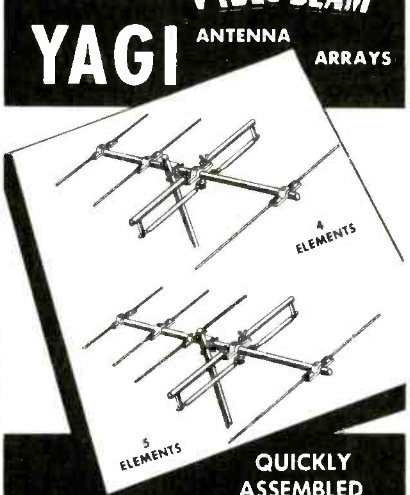


Figure 1. Audio Section RCA Victor 630TS.



The next step is an alteration of the circuit itself involving a change in tubes, replacement of some of the components, and the inclusion of negative feedback. The revised circuit diagram of the 630TS is shown in Figure 2. Principally, the following changes have been made.

1. The 6AT6 audio stage has been replaced by substituting a type 6AU6 for audio amplification and a type 1N34 germanium diode for the diode rectifier.

2. The 6K6 audio output stage was changed to employ a type 6V6GT

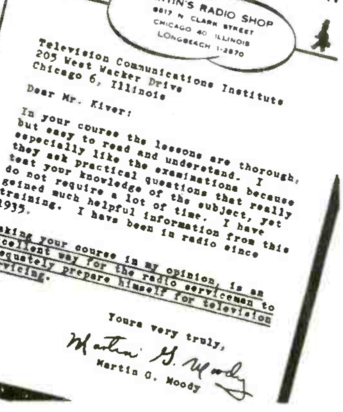
3. The interstage coupling capacitor, C67, has been increased in value (to aid low-frequency response). For the same reason, C64 has been changed, too.

4. C67 and C69 have been eliminated.

5. Feedback from the plate of the 6V6 to the cathode of the 6AU6.

6. The arm of the volume control is now connected directly to the grid of the 6AU6, permitting the elimination of C66.

Martin Moody at work in his busy Chicago radio repair shop.



MARTIN'S RADIO SHOP
6817 N. CLARK STREET
CHICAGO 40 ILLINOIS
LONGBEACH 1-2870

Television Communications Institute
205 West Wacker Drive
Chicago 6, Illinois

Dear Mr. Kiver:

In your course the lessons are thorough, but easy to read and understand. I especially like the examinations because they ask practical questions that really test your knowledge of the subject, yet do not require a lot of time. I have gained much helpful information from this training. I have been in radio since 1935.

Taking your course in my opinion, is an excellent way for the radio serviceman to adequately prepare himself for television servicing.

Yours very truly,

Martin G. Moody

Martin G. Moody

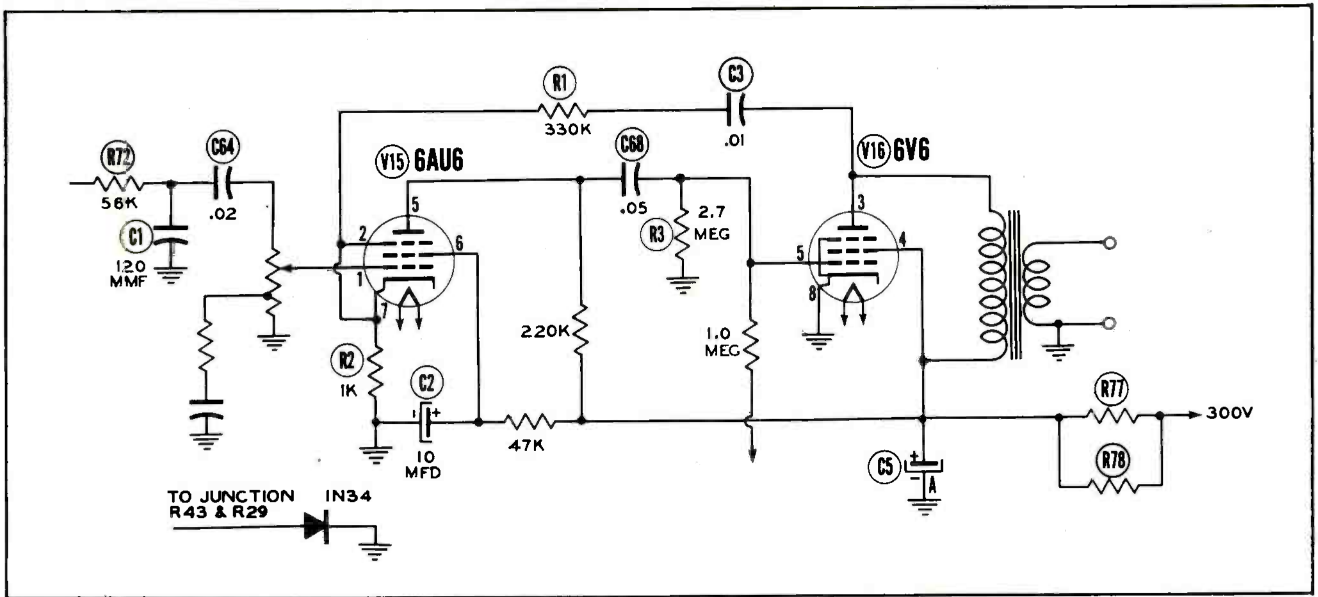


Figure 2. Revised Audio Section RCA Victor 630TS (Type 1).

Since the diode portion of the 6AT6 is used in the contrast control circuit of this particular receiver, provision must be made to replace this when the 6AU6 is substituted for the 6AT6.

A germanium crystal, 1N34, will do this very nicely.

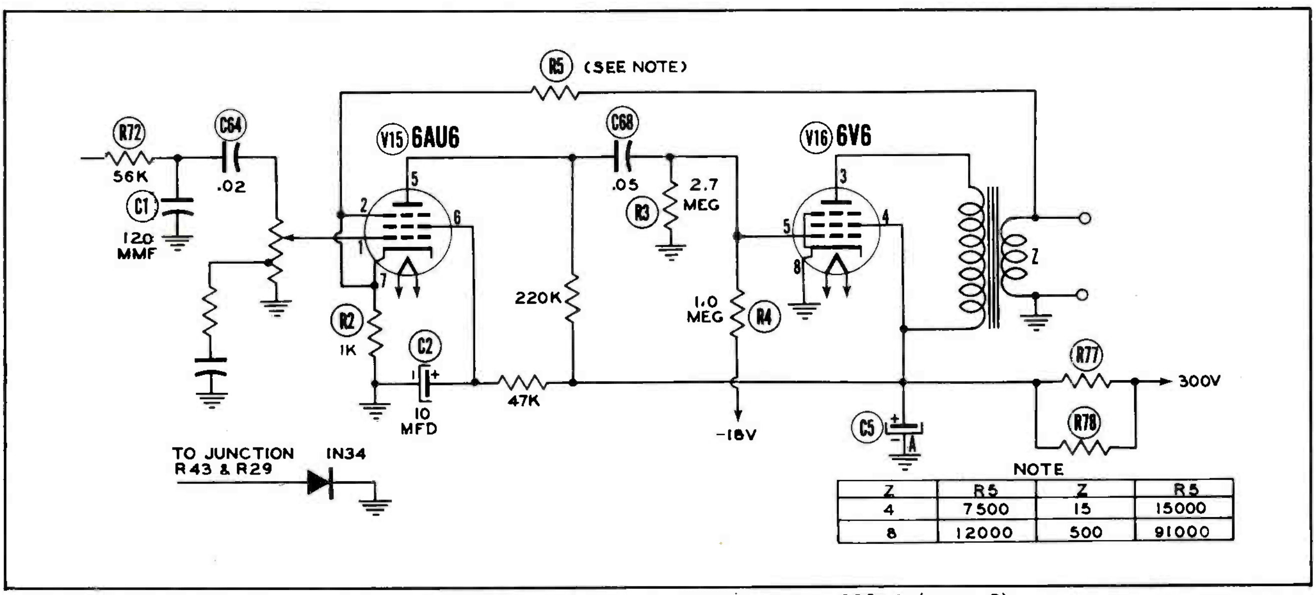
An alternate diagram is suggested by Mr. Proud, one in which the output transformer is included in the feedback loop (see Figure 3).

To determine which side of the secondary winding of the output transformer the resistor R5 (feedback resistor) should be connected to, the following test is suggested.

Make a temporary ground connection to one side of the transformer secondary. Then, with a signal passing through the set, momentarily connect the feedback resistor R5 to the other output lead. If the output is reduced, correct polarity is indicated. If not, reverse the connections to the transformer secondary.

When these changes have been made, you will find that additional filtering of the B+ voltage to both stages is desirable in view of the improved low-frequency response. In this particular receiver, the 300 volts B+ is obtained from the power supply just before the filter choke (i. e., on the rectifier side of the choke). If this connection is transferred to the other side of the filter choke, the hum level will decrease. In the 630 receiver, there is an adequate number of filter condensers and no additional units need be added. In other receivers, it may help to include additional filter capacitors of 40 to 80 mfd.

It might be pointed out that there is a considerably more elaborate system outlined in a recent article, "Viewer's Amplifier" by Melvin C. Sprinkle in the January 1951 issue of FM-TV Radio Communications. However, the amplifier described is actually a custom built project from scratch, so to speak, so that it lies a little bit outside typical TV receiver improvement. However, the equipment described is capable of excellent reproduction and should a custom application arise it would be well to consult Mr. Sprinkle's write-up.



Z	R5	Z	R5
4	7500	15	15000
8	12000	500	91000

Figure 3. Revised Audio Section RCA Victor 630TS (Type 2).

♦ ♦ Continued from page 31 ♦ ♦

plate of the following tube. By adjusting each of the stages to the proper response, the over-all response will be correct.

One of the disadvantages of this type of transformer is the inability to vary the mutual coupling between the coils. In other words the bandpass is fixed since it is dependent on the mutual coupling between the coils. In many cases one of the windings is wound on a tubular form which is slipped over the other winding. Should this tube slip or change position in any way, the bandpass of the circuit will be changed.

Another way of obtaining the same results is through the use of a "common impedance" type coupling. In this circuit a capacitor or coil, or both, is placed in the circuit so that it is a part of both the output circuit of one stage and the input circuit of the following stage. By adjusting the common impedance component so that its impedance is equal to that of the mutual inductance in the overcoupled transformer, similar bandpass characteristics are obtained.

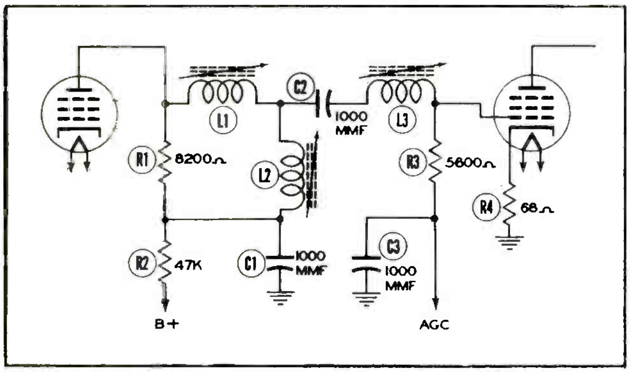


Figure 2-11. "Common Impedance" Coupled Video IF Stage.

Figure 2-11 is a partial schematic showing a "common impedance" coupling. The tuned circuit in the input consists of L1 in series with L2, shunted with the output capacity of the tube along with the distributed capacity in the wiring. The tuned circuit in the output consists of L3 in series with L2, shunted by the input capacity of the tube and the distributed capacity in the wiring. C2 serves as a DC blocking capacitor and its reactance is so low at the IF frequency that it need not be considered as a part of the tuned circuit. Since L2 is a part of both the input and output circuits, the signal is coupled from one stage to the next, and the pass band is dependent on the inductance value of L2. In the schematic of Figure 2-11, L2 is shown as a variable inductance. In many cases, however, the common impedance coil is not variable, its value having been predetermined to provide proper bandwidth. R1 and R3 shunt the input and the output circuits respectively, lowering the Q of the circuit to make possible wider bandpass characteristics.

It is possible to use a capacitor as the "common impedance" component instead of an inductance, but less gain is realized. As a result, the inductance is most commonly used.

TRAP CIRCUITS

Up to this point our discussion of video IF amplifiers has dealt with the circuits which were designed to give amplification of the signal. Equally important are the trap circuits which are used for rejecting certain unwanted signals.

There are four basic type trap circuits employed in the video IF amplifiers. They are:

1. Absorption Traps.
2. Parallel Resonant Traps.
3. Series Resonant Traps.
4. Bridged T Traps.

The three frequencies which are undesirable in the video IF strip are the adjacent channel sound IF, the adjacent channel video IF, and the accompanying sound. Obviously all frequencies that are not a portion of the video signal would be undesirable. The three signals mentioned above, however, are ones which will occur at a certain point when a channel is properly tuned, making it possible to tune traps to reject them. One exception to the above would be in the case of an intercarrier receiver in which case the sound IF is allowed to continue through the video IF strip but at a much lower level than the video IF signal.

As a general rule the traps which are tuned to the most objectionable signals will be located near the front end of the IF strip. Thus the signal can be rejected while it is still at a lower level. If this signal were allowed to go through several amplifying stages before it was trapped, it would be much more difficult to reject.

In many cases two traps that are tuned to the same frequency will be used. This is especially true in the case of the accompanying sound IF signal in receivers having separate sound and video IF channels. The first sound IF trap, which also serves as a sound IF take-off point, is usually located in the plate circuit of the mixer. The second trap is located in the last IF stage and is normally some form of absorption trap.

Figure 2-12 shows a few of the most frequently used trap circuits. The circuit shown in (A) is an absorption type trap. The secondary, or trap winding, is positioned close to the primary so that the two windings are mutually coupled. The trap has a very high Q winding, usually around a Q of 300, and at its resonant frequency will "suck out" a very narrow band of frequencies. The energy that is required to set up parasitic oscillations in the trap winding is taken from the primary of T1, thus it is not passed on to the rest of the circuits. This trap winding is an excellent source for the sound IF signal and the circuit shown in (A) has a lead connected to a tap on the trap winding which is connected to the input of the sound IF.

Circuit (B) shows a similar absorption trap, except that in this case the primary is in the cathode circuit of the tube instead of the plate circuit. At the resonant frequency of the trap (usually the sound IF), degeneration is introduced into the cathode circuit, thus reducing the gain of the stage at this frequency. The Q of this trap winding is usually around 300, which makes possible the rejection of a very narrow band of frequencies. In some cases the trap circuits of (A) and (B) will both be used in the same video IF strip. The small amount of signal which is not rejected by circuit (A) will be rejected by circuit (B). Note that in circuit (B) C2 bypasses R1 to prevent degeneration at frequencies other than the resonant frequency of the trap.

The trap circuit illustrated in (C) is also a form of absorption trap. At first glance it appears to be a parallel resonant circuit which would present maximum impedance at the resonant frequency. If this were the case there would be an increase in the signal level instead of the desired decrease. The answer lies in the value of C1, which in this case is 1.2 mmf. With this low value, the reactance of C1, even at the comparatively high IF frequency, is quite high. Thus the resonant circuit of L1 and C2 can be considered to be loosely coupled to the secondary of T1. This is the same condition which exists when two coils are loosely coupled, in that energy will be coupled from one to the other. Another approach to the subject would be to realize the fact that the energy that is dissipated to ground, due to the parasitic oscillations of the resonant circuit C2 and L1, must be taken from the grid circuit, therefore rejecting the unwanted signal. This type of trap seems to be gaining in popularity, probably due to the fact that it can be added almost anywhere in the circuit without disturbing existing components.

The trap circuit of (D) is a form of parallel resonant trap. A portion of the circuit, C2 and L2, is in series with the plate current path for the preceding stage. When a signal is passed by the preceding stage that corresponds to the resonant frequency of the trap circuit, degeneration will be introduced into the plate circuit. In this manner the undesired signal will be trapped out. It is interesting to note that in many respects this circuit resembles that of (C). In the case of (C) the signal was coupled to the trap by a small capacitor while in the case of (D) the signal is coupled across only a small portion of L2.

The trap circuits shown in (E) are parallel resonant traps and are placed in series with the signal. At the resonant frequency, the trap will present maximum impedance to the signal which will produce a loss in the coupling circuit. In most cases the traps shown are adjusted to the accompanying sound IF and adjacent sound IF signals, but they may be used for rejection of any signals.

The series tuned trap is less frequently used than those previously described. A trap of this type consists of a capacitor and a tunable choke in series and is usually placed between the plate and ground. One application of the series resonant trap is in the plate circuit of the mixer. The trap is tuned to the center of the adjacent channel IF frequency and aids in rejecting any interference from this source.

The bridged T trap in circuit (F) produces good results but is not used very often, probably due to the

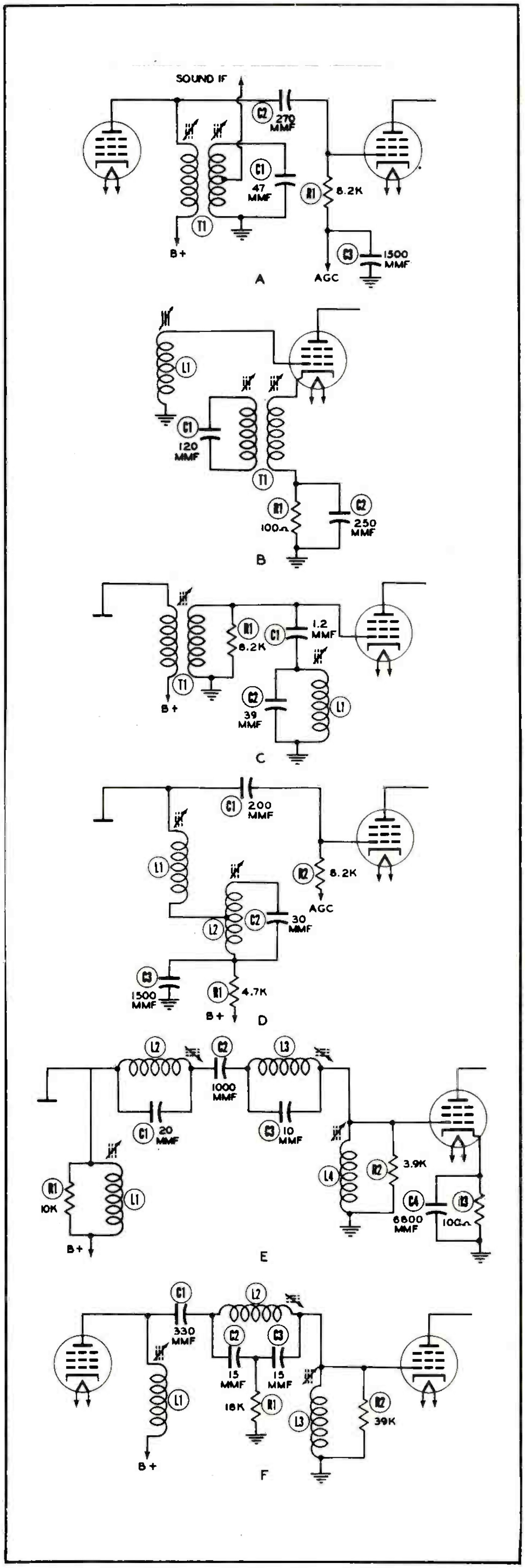


Figure 2-12. Representative Types of Trap Circuits.

expense of the extra components. A circuit of this type will produce a much narrower null point than a parallel resonant trap alone. The trap consists of L2, C2, C3 and the resistor R1 connected between the junction of the two capacitors and ground. L2 is adjustable so that the circuit can be resonated at the desired frequency. The bridge is balanced when the reactance of the capacitive branch equals the reactance of the inductive branch, and the resistor is equal to approximately 1/4 of the parallel resistance of the circuit. In the event of replacement of the capacitors or resistor, the new part should exactly duplicate the original to maintain proper balance of the circuit.

Another version of this same trap consists of a center tapped coil with a single capacitor across it. The operation of the circuit is the same as that of circuit (F).

The adjustment of the traps in the video IF circuit is very critical. Misaligned traps may result in poor picture reproduction, excessive interference in the picture, or loss of the sound signal. The most positive method of adjusting the traps is through the use of sweep alignment. By increasing the level of the sweep signal and the marker, a more positive indication can be obtained on the scope. An even greater degree of accuracy can be obtained by decreasing the sweep width in the generator so that only a narrow band is swept on either side of the trap "notch." This has the effect of increasing the width of the notch making possible a more critical adjustment.

As previously stated, most of the requirements of the video IF amplifier are design problems and are solved at the manufacturing level. The service technician, on the other hand, is very frequently called upon to align the TV receiver. This operation is probably the most exacting of all adjustments and the result may mean the difference between a good picture or an unacceptable one.

♦ ♦ Continued from page 15 ♦ ♦

vertically and horizontally. If it does not, check the wiring carefully for any errors that might have been made.

The design of the new horizontal transformer used in this conversion is such that a much higher degree of efficiency is obtained over that of the original unit. Even though greater power is required in the deflection yoke to sweep the larger tube, the current drain through the 6BG6G tube is less in the revised circuit than it was in the original circuit. In the original circuit the total current through the 6BG6G was 100 ma. In the revised circuit the current is only 87 ma. The total B plus current drain in the set fell from 250 ma to 225 ma. The added resistance in the focus coil circuit reduced the low B plus voltage approximately 5 volts. This reduction will not affect the operation of the receiver.

CABINET CHANGES

The first step in altering the cabinet to accommodate the new tube was the enlarging of the cutout in the subpanel. The four tube mounting brackets were removed and the subpanel was marked to indicate the points where the cutout was to be made. All dimensions for making this cutout are given in Figure 8. The four corners were cut diagonally to provide additional strength. Cutting the enlarged opening out to square corners may weaken the panel. The subpanel can be sawed very easily with a keyhole saw or hacksaw blade. The dimensions given should be followed very closely so that the mounting brackets can be positioned to hold the new tube. After making the cutout, four holes were drilled in the subpanel to secure the mounting brackets. The positioning of these brackets is not critical but it is suggested that they be mounted in approximately the same position as those in Figure 7, where two brackets are mounted at the bottom and one on each side near the top. This provides adequate support for the tube as well as a means of properly positioning it. These brackets were originally mounted with the ears pointing toward the front of the cabinet. The new mask, however, made it necessary to move the tube farther back in the cabinet which caused the edge of the tube to miss the brackets. The brackets were turned around with the ears facing to miss the back but even then it was found that the particular mask which was used forced the tube back to a point where the tube rested on the edge of the ears. To overcome this, longer bolts were used in the mounting brackets and spacers were placed between the mounting brackets and the subpanel. These spacers were made of small blocks of 1/4 inch plywood which moved the brackets back enough to support the tube. The position of the tube is dependent on the type of mask that

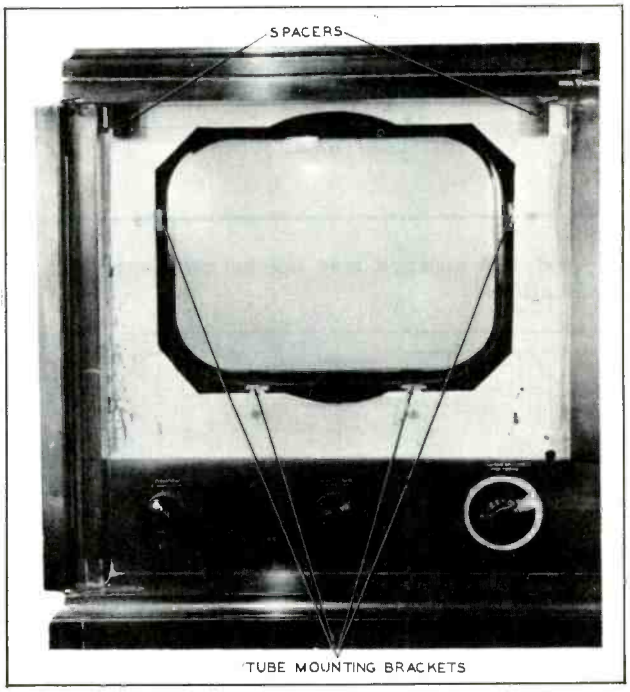


Figure 7. Sub-Panel Cutout and Tube Mounting Arrangement.

is used, and spacers may not be necessary in some applications.

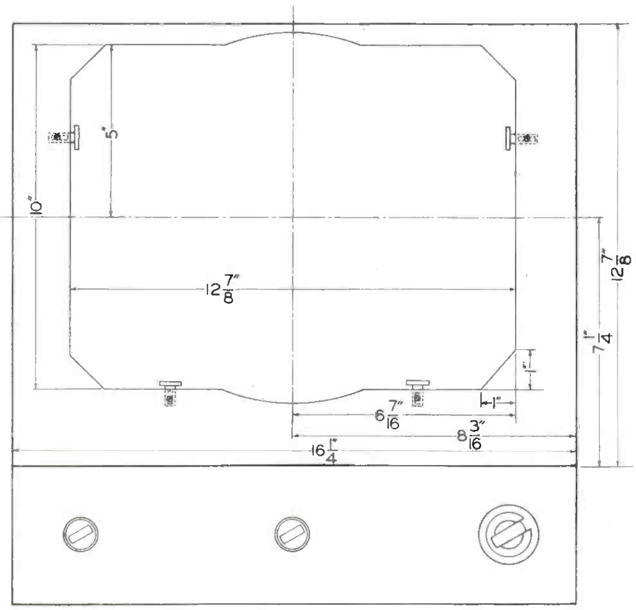


Figure 8. Dimensions of Sub-Panel Cutout.

The next step was that of making the cutout in the front panel. The dimensions of the new opening are given in Figure 9. The dotted line shown in this figure represents the decorative groove that is cut in the front panel. The top and bottom grooves may be used as guide lines while the sides should be cut 3/8 inch beyond the side grooves. This size opening is proportional to the face of the tube. Note that the corners have a 1/2 inch radius curve which gives a neater appearance than would be obtained if the corners were perfectly square. The edge of the cut-out should be sanded and stained. The rounded corners can be sanded by wrapping the sandpaper around a GT type vacuum tube.

The panel was then ready for the mounting of the mask. Figure 10 is a back view of the panel with the mask in place. In order to prevent the face of the plastic mask from being scratched, a piece of glass was placed in front of the mask. The use of this glass is optional. However, not only will it protect the mask, but it will also prevent dirt from falling between the mask and the panel. Since the glass has a much smoother surface than the mask, a better seal to the back of the front panel can be obtained. Three strips were then cut which had the same thickness as the combined thickness of the mask and the glass. These strips were glued to the back of the front panel to form a sort of frame for the mask. After the glue had dried, three more wider strips were mounted by screws so that the inside edge lapped over the mask, holding it in place, as shown in Figure 10. Extreme care must be taken that the screws are not too long so as to extend through the panel and come out the front which would obviously ruin the appearance of the front panel. They should be long enough, however, to extend just into the panel itself so that the support of the mask does not depend upon the glued strips alone.

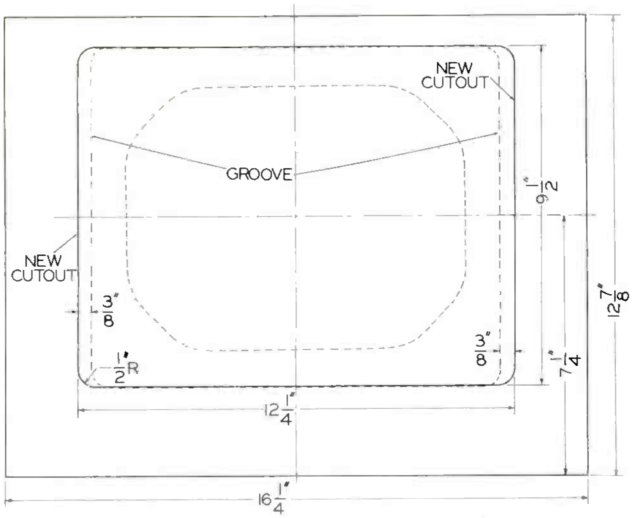


Figure 9. Dimensions of Front Panel Cutout.

With the mounting arrangement described above, the mask and glass can be very easily removed for cleaning by loosening the screws that hold the mounting strips, and sliding the mask and glass up out of the frame.

This completed the work on the front panel. It was then installed on the cabinet to determine what thickness spacers would be required to bring the front panel out flush with the radio panel. These spacers may be mounted as shown in Figure 7 or they may be slipped over the two screws that hold the front panel in position.

The chassis was then installed in the cabinet and the 14" tube was inserted from the front. The bolts which hold the chassis should not be tightened, as yet, to permit slight shifting of the chassis if required. The tube mounting brackets were then adjusted to properly position the tube and the front panel was installed. If the tube is too far forward, it is necessary to loosen the bolts holding the deflection yoke mounting hood, allowing it to be shifted back. This should allow the TV front panel to fit flush with the radio panel. If required, the complete chassis may be shifted a small amount to allow the tube to move back far enough into the cabinet. After the front panel is in position, the chassis bolts should be tightened and the deflection yoke mounting hood should be moved forward as far as possible. This is important, as failure to do so may result in the cutting off of the corners of the picture. When the tube is properly positioned, the tube should be clear forward against the mask, and the deflection yoke should be against the bulb of the tube. Check to see that the tube is not pressing against the high voltage compartment or any of the components at the front of the chassis.

The ion trap was then mounted on the tube and the high voltage and tube socket connections were made. The audio and AC plugs were inserted into the proper sockets in the radio chassis. The set was then turned on and the ion trap setting as well as the required deflection yoke and focus coil adjustments were made. It is suggested that the set be operated for a few hours before delivery is made to check for any possible failure due to lead dress or faulty components. Check especially for any arcing or corona discharge in the high voltage compartment.

All of the wiring changes outlined in this article will also apply to the RCA Victor model 730TV2, which is an identical set except for the cabinet. The chassis incorporated in models 721TS and 721TCS are identical to the TV chassis of the above models except that an audio output is incorporated. Therefore the wiring changes required for conversion will also apply to these models. The cabinet changes outlined apply to the model 730TV1 only and cannot be used on any other model. The instructions for converting the chassis may serve as a guide, however, in making changes on other models.

ADDITIONAL RCA VICTOR TELEVISION RECEIVERS SUITABLE FOR CONVERSION

The following list of RCA Victor TV receiver models have similar deflection circuits and can be converted by following a similar procedure to that outlined under "Wiring changes" in this article.

8T241	8TV323	9TC247	T121
8T243	9T240	9TC249	TA128
8T244	9TC240	9TW309	TA129
8TK29	9T246	9TW333	TC124
8TR29	9T256	T100	TC125
8TV321	9TC245	T120	TC127

No change should be required in the vertical deflection circuit of any of these models since all of them employ a type 6K6GT tube which ordinarily supplies enough power for vertical deflection.

If the horizontal circuit of any of these receivers is rewired as shown in the schematic of Figure 5, it should adequately sweep from 14" to 20" picture tubes. It should be kept in mind that the cabinet design of most of these receivers will not accommodate a larger tube. If the chassis is to be mounted in another cabinet, however, such a conversion can be made.

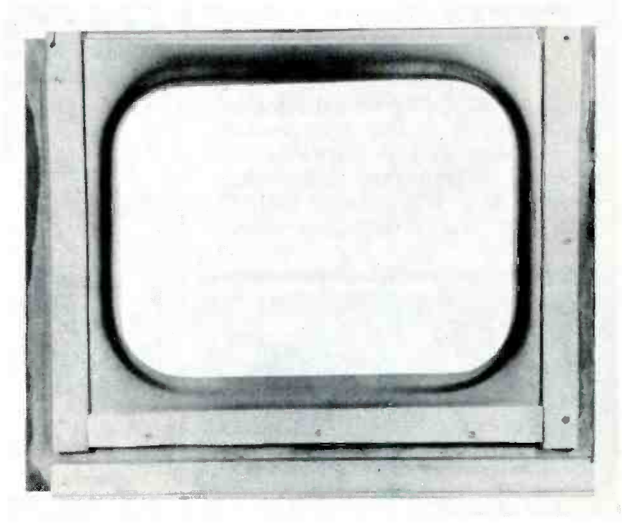


Figure 10. Rear View of Mask Assembly.

Any methods or techniques that are offered here should be considered as suggestions rather than recommendations, since they may not necessarily be the easiest way to effect the conversion. However, our experiments on these models have enabled us to present data known to be effective.

PARTS LIST

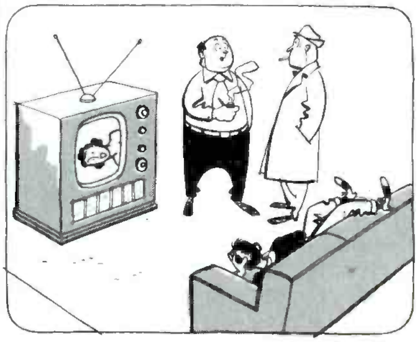
1 - Horiz. Output Trans.	Merit HVO-6 or HVO-7
1 - Width Coil	Merit MVC-1
1 - Deflection Yoke	(Merit MO-70 or MD-70-F (Stancor DY-7
1 - Focus Coil	Merit MF-3*
1 - 15KV or 20KC H.V.Filter Capacitor	(Aerovox HV20C (CRLTV2 - 502 (Erie 410-501
1 - 2200 Ohm, 1 Watt Resistor	IRC BTA-2200
1 - 39 Ohm, 1 Watt Resistor	IRC BW-1-39
1 - 6BL7GT Tube	Sylvania Type 6BL7GT
1 - Single Magnet Ion Trap	
1 - Mask for 14" Rect. Tube	

* If this chassis is converted to employ a short-neck type picture tube, a thin focus coil unit such as the Merit type MF-2 should be employed.

* * *

TELEVISION: As a solution to appearance problem of indoor TV antennas, Volk-M-Rick Co., Minneapolis, Minn., is offering a flower pot with built-in antenna. (Tide)

* * *



"I had it custom built so my teenage son won't have to sit up to watch TV."

PICTURE TUBE
REPLACEMENT DATA

The picture tube replacement chart on the facing page lists the standard replacement type tube which can be used to replace practically all type picture tubes that have been used in television receivers. In some cases it will be found that the original type tube is no longer in production and cannot be obtained. The type tube which is available and will make an effective replacement can be determined from the replacement chart.

Particular attention should be paid to all notes following a replacement listing. Each note indicates a variation of the replacement tube from the original and it should be determined if this variation would prevent the use of the replacement in each particular application. This is especially true on those replacement listings which are followed by Note 5. In these cases the replacement tube is slightly larger than the original and measurements should be made to determine whether the cabinet and mounting structure will accommodate the larger unit.

The presence of Notes 1 and 6 indicates that a different style ion trap magnet is required on the replacement tube than was used on the original unit while Note 3 indicates that no ion trap magnet is required on the replacement tube.

Where Note 2 follows a replacement listing care must be taken after the new tube is installed to see that the outer coating of the tube is grounded. Since the original tube did not have a coating there is a possibility that the manufacturer did not provide a grounding clip. If such is the case a grounding clip should be added to prevent arc-over from the coating to ground. Note 4 indicates that the high voltage connector must be changed and Note 7 indicates that a high voltage capacitor must be added at the tube end of the high voltage filter resistor. This is required because the replacement tube listed does not have an outside coating to perform the required filtering.

Where no listings are given in the replacement columns, no substitution of tube types should be made.

PICTURE TUBE REPLACEMENT DATA

ORIGINAL TUBE	SYLVANIA Replacement	THOMAS Replacement
7JP4	7JP4	
8BP4	8BP4	
10BP4,A	10BP4,A	10BP4A
10CP4	10FP4	10BP4A
	Notes 4,5	Notes 1,5
10DP4		
10EP4	10BP4,A	10BP4A
	Notes 2,4	Notes 2,4
10FP4,A	10FP4A	10BP4A
		Note 1
10HP4	10HP4	
10MP4,A	10MP4	
12AP4		
12CP4		
12JP4	12KP4	12LP4A
	Notes 2,3,4	Notes 2,4,5,6
12KP4,A	12KP4A	12LP4A
		Notes 5,6
12LP4,A	12LP4A	12LP4A
		Note 6
12QP4,A	12LP4,A	12LP4A
	Notes 1,2,4,5	Notes 2,4,5
12RP4	12LP4,A	12LP4A
	Notes 1,2,4,5	Notes 2,4,5
12TP4	12LP4,A	12LP4A
	Note 2	Note 2,6
12UP4,A,B	Glass Equivalent	Glass Equivalent
	12LP4,A	12LP4A
	Notes 2,4	Notes 2,4,6
12VP4,A	12VP4A	
12WP4		
14BP4	14BP4	14CP4
		Note 6
14CP4	14CP4	14CP4
14DP4	14CP4	14CP4
	Notes 2,6	Notes 2,6
14EP4	14CP4	14CP4
	Note 5	Note 5
14GP4	14GP4	
15AP4	16LP4,A	16DP4A
	Notes 1, 2,4,5	Notes 2,4,5,6
15CP4	16LP4,A	16DP4A
	Notes 2,5	Notes 2,5,6
15DP4	16LP4,A	16DP4A
	Notes 1,2,4,5	Notes 2,4,5
16AP4,A,B	16AP4A	Glass Equivalent
		16CP4A
		Notes 2,4,6
16CP4,A	16LP4,A	16CP4A
	Notes 2,5	Notes 2,6
16DP4,A	16JP4,A	16DP4
	Note 2	Notes 2,6
16EP4,A,B	Glass Equivalent	Glass Equivalent
	16JP4,A	16DP4A
	Notes 2,4,5	Notes 2,4,5,6
16FP4	16JP4,A	16DP4A
	Notes 1,2,4,5	Notes 2,4,5,6
16GP4,A,B,C	16GP4,B	Glass Equivalent
		16DP4A
		Notes 2,4,5,6

ORIGINAL TUBE	SYLVANIA Replacement	THOMAS Replacement
16HP4,A	16JP4,A	16DP4A
		Note 6
16JP4,A	16JP4A	16JP4A
16KP4,A	16KP4	16KP4
16LP4,A	16LP4A	16CP4A
		Note 6
16MP4,A	16JP4,A	16DP4A
		Note 6
16QP4	16KP4	16KP4
	Notes 2,6	Notes 2,6
16RP4	16RP4	16KP4
16SP4,A	16WP4A	16DP4A
		Notes 5,6
16TP4	16TP4	16KP4
		Note 5
16UP4	16KP4	16KP4
	Note 2	Note 2
16VP4	16JP4,A	16DP4A
	Notes 1,2,5	Notes 2,5
16WP4,A	16WP4A	16DP4A
	Note 2	Notes 2,5,6
16XP4	16KP4	16KP4
	Notes 2,6	Notes 2,6
16YP4	16JP4,A	16DP4A
	Notes 1,5	Note 5
16ZP4	16ZP4	16CP4A
		Note 6
17AP4	17BP4A	17BP4
	Note 5	Note 5
17BP4,A,B	17BP4A	17BP4
	Note 2	
17CP4	Glass Equivalent	Glass Equivalent
	17BP4A	17BP4
	Notes 2,4	Notes 2,4
17FP4	17FP4	
19AP4,A,B,C,D	19AP4A,B,C,D	Glass Equivalent
		19BP4A
		Notes 2,4
19BP4,A		19BP4A
19DP4,A		19BP4A
		Note 6
19EP4		
19FP4		19BP4A
		Notes 2,6
19GP4		19BP4A
		Notes 2,5
19JP4		
20BP4		
20CP4,A	20CP4,A	20CP4
20DP4,A	20DP4,A	
20FP4		
20GP4	20GP4	

NOTES:

1. Use double magnet ion trap.
2. Outer coating must be grounded.
3. Ion trap not used.
4. High voltage connector must be changed.
5. Space permitting.
6. Use single magnet ion trap.

" AS I SEE IT " (Continued from page 21)

TABLE I

RATED IMPEDANCE IN PLATE CIRCUIT
FOR VARIOUS RECTIFIER TUBES

TYPE	BASE	PLATE PINS	RATED IMPEDANCE
5AX4	5T	4 and 6	50
5AZ4	5T	4 and 6	50
5U4G	5T	4 and 6	170
5V4G	5L	4 and 6	100
5W4GT	5T	4 and 6	50
5Y3GT	5T	4 and 6	50
5Y4G	5Q	3 and 5	50
5Z3	4C	2 and 3	170
5Z4GT	5L	4 and 6	50
6AX5GT	6S	3 and 5	50
6X4	5BS	1 and 6	150
6X5GT	6S	3 and 5	150
7Y4	5AB	3 and 6	150
7Z4	5AB	3 and 6	75

3. The current drain to be required.

4. The heating time of the rectifier tube compared to the rest of the equipment.

These problems will now be considered one at a time.

Filament Requirements -

It is important to compare the ratings of the proposed substitute tube to learn whether the present filament winding on the transformer will handle the additional current if any is required. If it is desired to substitute a cathode type six volt heater tube for a 5 volt one, it is necessary to determine whether the six volt heater winding will handle the added drain and also whether the present six volt winding is tied to ground or chassis at any point. If it is, then there might be a greater possibility of a heater to cathode short developing than if the heater is floating. Table II indicates the filament requirements of several of the most commonly used rectifier tubes.

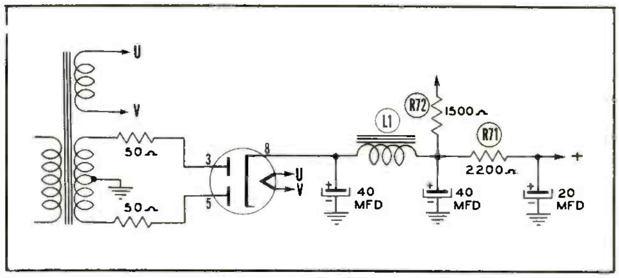


Figure 2

Voltage Drop in the Tube -

The voltage drop in the tube is a function of the spacing between the plate and cathode (or filament in directly heated tubes) and the current flowing. In a given circuit which requires a certain plate current drain, and a given power transformer, the relation between voltage drop and voltage applied to the filter is such that the total remains practically constant. Figure 3 illustrates this and "A" designates "tube drop" while "B" indicates that voltage available at the filter. The sum of "A" and "B" is constant for a given receiver application. Thus the greater the voltage drop ("A") in the tube, the lower the voltage across the filter ("B"). A comparison of these values in Table II for the original tube type and the proposed type will indicate whether this problem will be encountered if the substitution is made. If "B" is much higher than the rating of the filter capacitors, breakdowns might occur if that substitution were carried out.

Current Drain -

When a substitution is contemplated it is necessary to make certain that the proposed tube can supply the required current without being overloaded. Table II also gives a listing of current ratings for various types of rectifiers.

TABLE II

RECT. TUBE TYPE	FILAMENT VOLTAGE	FILAMENT CURRENT (AMPERES)	HEATING TIME	RATED PLATE CURRENT (MILLI-AMP.)	"A" TUBE DROP AT RATED PLATE CURRENT (VOLTS)	"B" *
5AZ4	5.0	2.0	FAST	125	60	Et-60
5U4G	5.0	3.0	FAST	225	58	Et-58
5V4G	5.0	2.0	SLOW	175	25	Et-25
5W4GT	5.0	2.0	FAST	110	50	Et-50
5Y3GT	5.0	2.0	FAST	125	60	Et-60
5Y4G	5.0	2.0	FAST	125	60	Et-60
5Z3	5.0	3.0	FAST	125	58	Et-58
5Z4GT	5.0	2.0	SLOW	125	20	Et-20
6X4	6.3	0.6	SLOW	70	22	Et-22
6X5GT	6.3	0.6	SLOW	70	22	Et-22
7Y4	6.3	0.5	SLOW	70	22	Et-22
7Z4	6.3	0.9	SLOW	100	40	Et-40
80	5.0	2.0	FAST	125	60	Et-60

* E_t indicates the voltage rating of one-half of the secondary (high voltage) winding. The expression E_t-60, as used in the text, actually means the maximum DC voltage developed minus the 60 volt drop in the tube. Transformer regulation, input filter capacitance, etc., represent variables so that it is impossible to translate the transformer AC voltage rating into the developed DC voltage value without these variables being known.

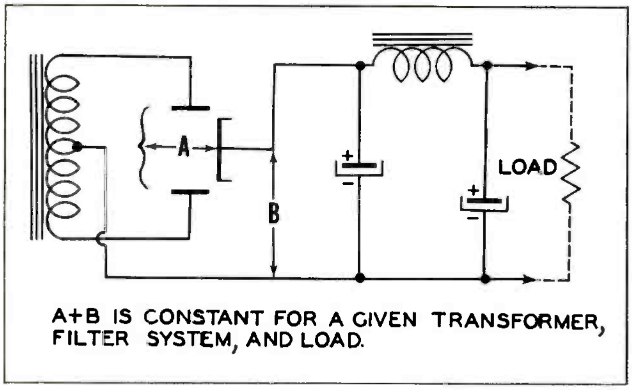


Figure 3

Heating Time -

The heating time of a directly heated tube is much less than that of an indirectly heated tube. This means that voltage will be available at "B" in Figure 3 much sooner than with an indirectly heated tube. If the tubes constituting the load in the receiver are of the cathode or indirectly heated types then they will not require current for an appreciable time after there is voltage available at "B" if the rectifier tube is a fast heater. This would cause the voltage at "B" to increase considerably until the receiver began to draw current. This increase is due to the fact that with little or no current drain the voltage drop in the rectifier tube ("A") is very small. This may be further increased by the regulation of the power transformer. Thus if the substitution of a fast heating rectifier is contemplated, steps must be taken to prevent this voltage rise. Table II also includes a column indicating slow or fast heating time.

The substitution of rectifier tubes requires consideration of many factors. It is hoped that this article will help the reader to make intelligent substitutions so that receivers may be kept in operation.

♦ ♦ Continued from page 29 ♦ ♦

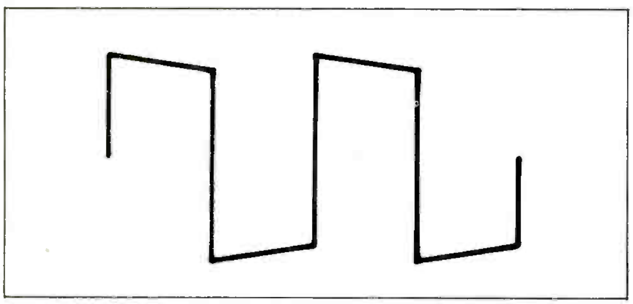


Fig. 9. Amplifier with Improvement in Low Frequency Response.

These waveforms were taken through amplifier stages employing RC (Resistance-Capacitance) coupling.

In general, a rounding off or dropping of the leading edge of the wavefront points toward deficiencies in high-frequency characteristics, while similar characteristics in the trailing edge can be interpreted as deficiencies in the amplifier's low-frequency response.

At the time of writing, we have not completed our experiments in either the RC field, or more particularly, the inductively coupled systems. In terms of either accentuation or attenuation of bands of frequencies, inductively coupled systems are far more likely to have such characteristics.

Additionally, since inductively coupled systems have sharper resonance properties, we can expect to find greater tendencies toward oscillation in the waveform.

We intend to continue presenting the results of our experiments in this and allied fields as they are available. Again, we make no attempt to formulate conclusions from this material; rather, we are interested in providing a basis for study and experimentation on behalf of those interested in this activity.

PARTS LIST

Item	Description	
V1	Type 6SN7GT Tube	Sylvania or equivalent
V2	Type 6AL5 Tube	Sylvania or equivalent
V3	Type 6SJ7 Tube	Sylvania or equivalent
R1	500K Ohm Input Control	(IRC Q13-133 (Clarostat AG0 60-Z, (FS-3 (Centralab B-60
R2	100K Ohm Output Control	(IRC Q13-128 (Clarostat AG-51-Z, (FS-3 (Centralab B-41
R3	4700 Ohm 1/2 Watt	IRC BTS - 4700
R4	220K Ohm 1/2 Watt	IRC BTS - 220K
R5	470K Ohm 1/2 Watt	IRC BTS - 470K
R6	27K Ohm 1/2 Watt	IRC BTS - 27K
R7	47K Ohm 1/2 Watt	IRC BTS - 47K
R8	1.5 Megohm 1/2 Watt	IRC BTS - 1.5 Meg.
R9	47K Ohm 1/2 Watt	IRC BTS - 47K
R10	4700 Ohm 1/2 Watt	IRC BTS - 4700
C1	10 Mfd. @ 25 Volts	(Aerovox PRS 25/10 (Cornell-Dubilier (BR102A (Sprague TVA-1204
C2,C3	16 Mfd. @ 450 Volts	(Aerovox PRS 450/16 (Cornell-Dubilier (BR1645A (Sprague TVA-1707
C4	.05 Mfd. @ 600 Volts	(Aerovox P688-05 (Cornell-Dubilier (PTE 6S5 (Sprague 6TM-S5
T1	Interstage Transformer 1 to 3 pri. to sec. ratio	(Stanco A-4155* (Merit A-2912* (Chicago IN-15*

* Additional cathode resistance may be necessary if DC resistance of primary winding is less than 1100 ohms. If resistance must be added, connect between low side of primary winding and ground, and bypass the resistor with 10 Mfd. @ 25 volt electrolytic capacitor.

+ More or Less –

On behalf of our entire organization, we would like to extend sincere thanks to all those who filled out and returned questionnaires enclosed with the first issue of PHOTOFACT INDEX and TECHNICAL DIGEST.

We appreciate how difficult it is to find time in a busy day, or in the rarely uninterrupted evenings, to give the amount of consideration to this matter, which is evident in the extent of the replies and in the detail of their contents.

You know a lot of firms in all sorts of endeavors use the questionnaire approach as a means of obtaining statistics. Immediately upon their return, someone is assigned to assemble an impressive stack, a posed photograph produced, and suitable figures turned over to the Sales and Advertising Departments for blow-up or dissemination.

If that were our objective in sending out the questionnaire, then we in no way would be worthy of the generous response which we have received from you.

We simply would like to go on record that we had a genuine interest in finding out what the service field needed in terms of technical help and general information . . . . and it is gratifying to us to find the same genuineness in your expressions.

We can tell you quite frankly that it was our original intention (and will continue to be) to fashion PF INDEX and TECHNICAL DIGEST to the interests and desires of the service technician. The start you have given us should guarantee the success of this policy.

Just in case you're curious about how your preferences compare with nationwide averages of questionnaires analyzed to date, here is the ranking of the first ten subject treatments most requested. Also listed are their percentages of total requests.

Subject	% of Total
1. Test Instrument Applications	10.7
2. TV Receiver Difficulties and General Trouble Shooting	9.7
3. General Circuit Analysis	8.3
4. Short Cuts in Servicing	6.0
5. Fringe Area Information (Antennas, Boosters, Installations, Alignment)	6.0
6. Waveform Analysis (What we see, not what we should see)	4.86
7. TV Receiver Conversions	4.3
8. Latest Circuit Designs	4.3
9. TV Tuner Data (more)	4.0
10. Color Television	4.0

To all those who included some form of inquiry in the returned questionnaires, may I say that we are handling them just as fast as possible. If you have not already received a reply, you will in the near future. While we are attempting to make individual analyses of each questionnaire returned, and to forward individual replies, I believe you can realize the size of this undertaking and the consequent length of time that may be required to complete the job.

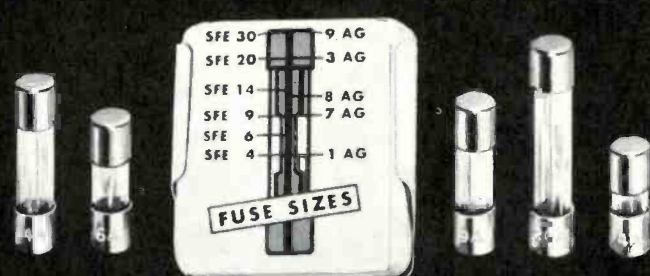
Please, then, let this column express an overall "Thank you" until individual correspondence can catch up.

- J.R.

LITTELFUSE

Be sure of your fuse!
You know you are getting *original component quality* when your fuses come in the handy green dispenser box

Be sure of your fuse
by the handy fuse size guide
on every LITTELFUSE
dispenser box



The only improvement in fuse packaging in 25 years. Another LITTELFUSE first. One at a time dispensing. No lost covers. LITTELFUSE INC., 4757 Ravenswood, Chicago 40. LOngbeach 1-4970

...undeliverable for any reason, notify ...nder, stating reason, on Form 3547, ...postage for which is guaranteed.

TO: Remodeling

AEROVOX Capacitors

ASTATIC
PHONO-CARTRIDGES
PHONO-NEEDLES

BURGESS
BATTERIES

Centralab
CONTROLS
CAPACITORS

CHICAGO TRANSFORMER
CTC
TRANSFORMERS

EVEREADY
BATTERIES

Electro-Voice
PHONO-CARTRIDGES
PHONO-NEEDLES

IRC
CONTROLS
RESISTORS

Select your replacement needs from these high quality product lines listed in Photofact Folders.

Aerovox Corporation	Littelfuse, Incorporated
The Astatic Corporation	Meissner Manufacturing Division
Burgess Battery Company	Merit Transformer Corp.
Centralab Div.	National Carbon Division
Chicago Transformer Div.	Quam-Nichols Company
Clarostat Mfg. Co., Inc.	The Radiart Corporation
Cornell-Dubilier Electric Corp.	Radio Receptor Company, Inc.
Electro-Voice, Inc.	Shure Brothers, Incorporated
Erie Resistor Corporation	Sprague Products Company
International Resistance Company	Standard Transformer Company
Jensen Manufacturing Company	Sylvania Electric Products, Inc.

Thomas Electronics, Inc.

ERIE
CAPACITORS

CORNELL-DUBILIER CAPACITORS
CAPACITORS
VIBRATORS

LITTELFUSE
FUSES

SPRAGUE
CAPACITORS

Quam Adjusta-Cone
SPEAKERS

SYLVANIA
TUBES
SELENIUM RECTIFIERS

CLAROSTAT
CONTROLS

Meissner
COILS

Thomas
CATHODE-RAY TUBES

MERIT
TRANSFORMERS
DEFLECTION YOKES
FOCUS COILS

RADIO RECEPTOR CO.
Seletron
SELENIUM RECTIFIERS

RADIART
VIBRATORS

Jensen
SPEAKERS

STANCOR
TRANSFORMERS
DEFLECTION YOKES
FOCUS COILS

SHURE
PHONO-CARTRIDGES
PHONO-NEEDLES