Howard W. Sams

PF PHOTOFACT ®

INDEX

JANUARY • 1954

the monthly REPORT to the

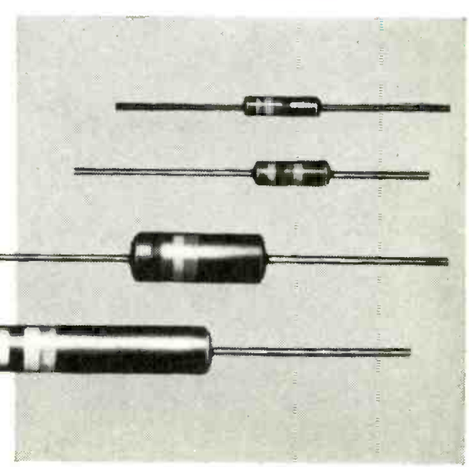
ELECTRONIC SERVICE INDUSTRY

NO. 1 CHOICE

of **ALL** *Fixed Composition Resistors by almost*

3 to 1...*

**Not Claims! Not Predictions! But Plain Facts! Unbiased, authoritative, independent surveys (made regularly since 1930) show IRC BT RESISTORS to be the Service Technicians' choice by a continually increasing margin. Today, BT RESISTORS are preferred over the total of all other brands combined!*



Ask for IRC BT's...
Most Service Technicians Do!

IRC

INTERNATIONAL RESISTANCE COMPANY

423 N. Broad Street, Philadelphia 8, Pa.

Wherever the Circuit Says -\/\/\/-

In Canada: International Resistance Co., Ltd., Toronto, Licensee

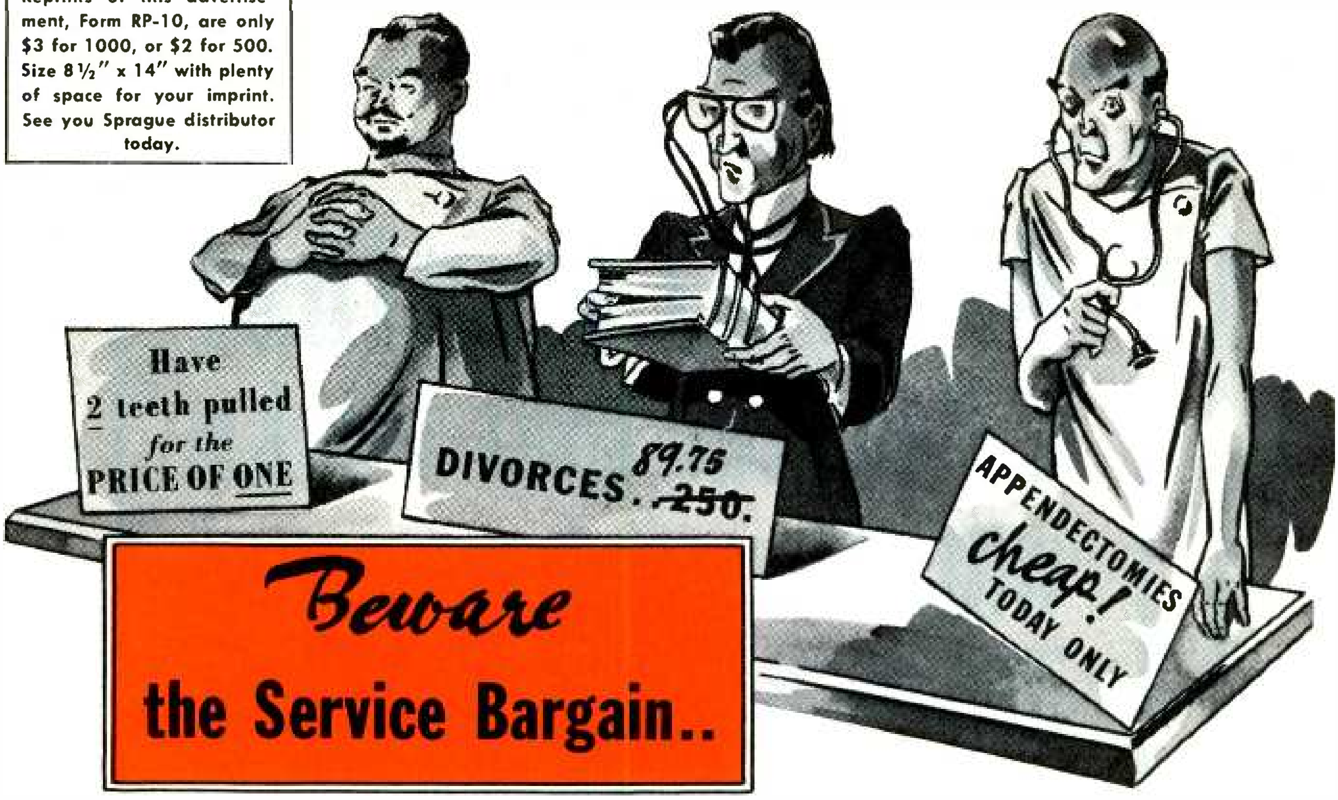
After 27 months!
a Booster that works with Cascode front ends!
The NEW Regency CASCADE 37^{50} list...

As everyone in the Electronics Industry knows, the development of a booster that would effectively increase the range of a modern TV receiver with Cascode tuner—was considered an impossible engineering assignment. A technical group in the I. D. E. A. laboratories have invested their full time for twenty-seven months in the project! The new Regency Cascade Booster is their achievement.

Edward C. Tudor

REGENCY DIV., I. D. E. A.
7900 PENDLETON PIKE, INDIANAPOLIS 25, IND.

Burton browne advertising


Have
2 teeth pulled
for the
PRICE OF ONE
DIVORCES. . 89.75 ~~250.~~
APPENDECTOMIES
cheap!
TODAY ONLY
Beware
the Service Bargain..

LOOKING AHEAD TO COLOR T V..

Featured in this issue of the PF INDEX are several articles which deal with the subject of color television. For purposes of discussion, the color receiver has been separated into sections according to the function that is performed in each section. By dividing the color receiver into sections and discussing each one separately, it is hoped that a clearer understanding of the subject will result. Also, when a subject is presented in this manner, each article can serve as a good means of reference. The reader may desire to refer to a particular discussion covering only a certain portion of the color receiver. However, this does not mean to imply that each section is completely separate and apart from the remainder of the receiver. This is not true, since each section is needed for the over-all operation of the receiver.

Since color television is an outgrowth of black-and-white television, we have as much as possible used black-and-white television for comparative purposes. By starting with something that is known and then introducing the new subject which parallels the old one, it is felt that a more thorough understanding of the new circuits can be obtained. This has been done throughout the discussions as much as the situation would allow.

The featured articles which pertain to the subject of color television in this issue are the following:

1. Comparing Monochrome and Color Receivers.
2. Picture Tubes for Color TV.
3. Color Synchronization.
4. Color Decoding and Mixing.
5. Monochrome Reception by the Color Receiver.

The order of this listing was chosen for a purpose. We feel that certain aspects of color reception may be better understood if the reader has first studied other phases of the subject. Therefore, we have listed the articles according to what we believe is their logical sequence for reading.

* * Please turn to page 5 * *

Howard W. Sams

PF INDEX

the monthly REPORT to the ELECTRONIC SERVICE INDUSTRY

VOL. 4 · NO. 1 JANUARY · 1954

JAMES R. RONK, *Editor*

LESTER H. NELSON, *Managing Editor* · W. WILLIAM HENSLER, *Technical Editor*

Editorial Staff

Phyllis J. Aukerman · William E. Burke · Henry A. Carter · Robert B. Dunham
Don R. Howe · Fred McKinney · Glenna M. McRoan · Margaret Neff
Evelyn S. Mouser · C. P. Oliphant · Glen E. Slutz · Paul C. Smith

ANTHONY M. ANDREONE, *Art Director*
ROBERT W. REED, *Photography*
ARCHIE E. CUTSHALL, DOUGLAS BOLT, *Production*

CONTENTS

HOWARD W. SAMS, *Publisher*

Business Department: Donald B. Shaw, V. P. Treasurer; F. T. Dobbs, Secretary; Joe H. Morin, Sales Mgr.; Ann W. Jones, Advertising; Shirley A. Owens, Literature Service Mgr.; J. C. Keith, V. P. Charge of Circulation. Printed by The Waldemar Press, Joseph C. Collins, Mgr.

The PF INDEX is published monthly by Howard W. Sams & Co., Inc., 2201 East 46th Street, Indianapolis 5, Indiana. The PF INDEX is on sale at 25¢ a copy at 1093 jobbers of Electronic Parts throughout the United States and Canada. (In Canada 30 cents.) When available, back numbers may be obtained by sending 35¢ for each copy desired. Acceptance under Section 34.64 P. L. & R. authorized at Indianapolis, Indiana

SUBSCRIPTION DATA: For those desiring the convenience of delivery to their homes or shops, each issue of the INDEX will be mailed direct, promptly upon publication. The subscription charge is $4.00 annually in the United States and U. S. possessions.

Looking Ahead to Color TV

(Continued from page 3)

How the color receiver differs from the monochrome receiver is pointed out in the article entitled, "Comparing Monochrome and Color Receivers." In this discussion, the similarities of the two receivers are first presented and then the additional stages which are needed for the production of color are shown. The purpose of this article is to offer to the reader an introduction to the color receiver before entering into the detailed discussion of the new sections of this receiver.

Since the heart of a television receiver is considered to be the picture tube, it is suggested that the article " Picture Tubes for Color TV" should be read next. Contained in this discussion are requirements for color reproduction, the way these requirements are met in the color picture tube, and descriptions of two experimental color tubes.

The signals which control the operation of the color tube are obtained from the output of the section for color decoding and mixing; but before the operation of this section is studied, it should be known how the receiver is synchronized for the proper decoding of the color signal. This subject is covered in the article entitled, "Color Synchronization."

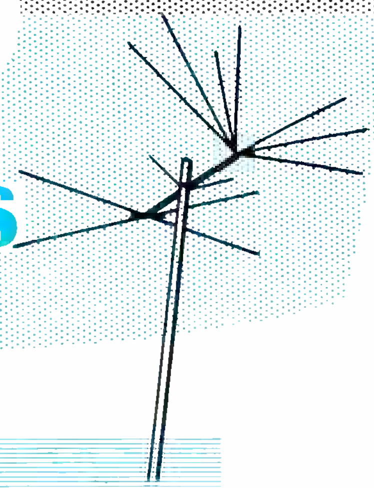
"Color Decoding and Mixing" should be read after the article on synchronization. Presented in this section is a method for detecting the color signal and the mixing process by which three signals representative of the transmitted colors are obtained.

The color-television standards have been set up so that the color signal can be received by the monochrome receiver. This results in a compatible system. To further the idea of compatibility, the color receiver should be capable of accepting the standard monochrome transmission and of producing a black-and-white picture. The color receiver is designed for this additional purpose. The method by which this is accomplished is given in the article entitled, "Monochrome Reception by the Color Receiver."

Although it may be several months before the service technician is called upon to service a color receiver, any knowledge gained at this time should help to equip him for the task when it is undertaken.

Acknowledgement is given to the Radio Corporation of America for supplying information on their experimental color receiver and to CBS-Hytron and RCA for information on their respective color tubes.

COMPARING MONOCHROME AND COLOR RECEIVERS



by C. P. Oliphant

The color receiver is a more complex unit than the monochrome receiver, since several additional stages are required for the reproduction of the picture in full color rather than in black and white. The purpose of this discussion is to present the over-all differences between the two receivers. Although the circuits used for the production of color may be new to the service technician, they consist basically of amplifiers, oscillators, and detectors all of which are designed to respond to a particular type of signal.

Let us first investigate the similarity of the two receivers and then the differences. Shown in Fig. 1 is a partial block diagram of a color receiver. The section shown performs functions that are essentially the same for both types of receivers. The block diagram shows the RF-IF-Video section, the sound section, and both the horizontal- and the vertical-deflection sections.

The sound section serves the same function as in a monochrome receiver; however, there are a couple of differences in the design, as shown in Fig. 1. These differences are: (1) the location of the takeoff point for the sound and (2) the presence of a detector at the input of the sound section. In most monochrome intercarrier receivers, the sound is taken off at a point after the video detector. The optimum ratio of picture carrier

* * Please turn to page 41 * *

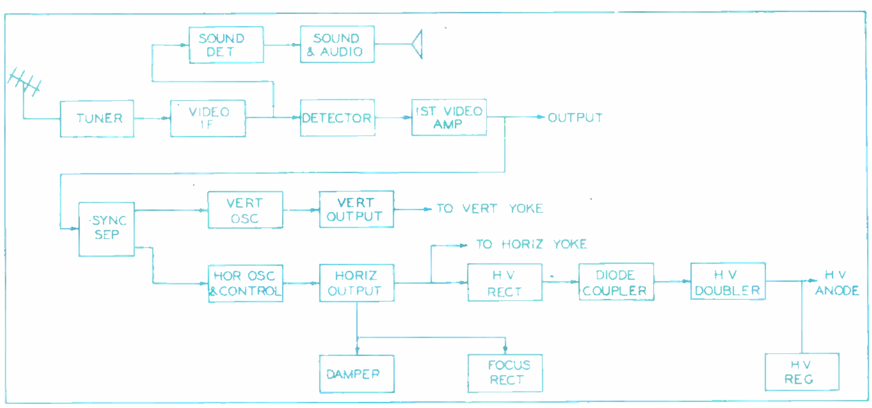
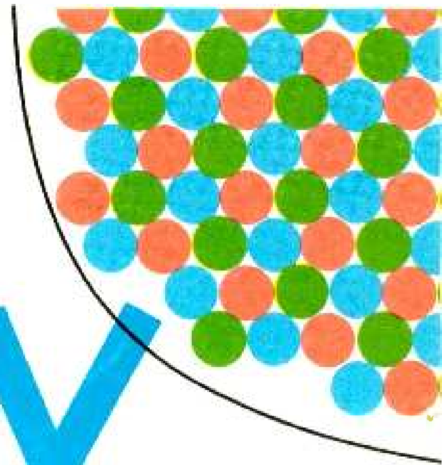


Fig. 1. Partial Block Diagram of a Color Receiver.

Picture Tubes For Color TV



The Basic Principles of Reproducing Television Pictures in Color and the Structural Details of Color Picture Tubes Which Conform to These Principles

by **WILLIAM E. BURKE** and **GLEN E. SLUTZ**

The heart of the present-day television receiver, whether monochrome or color, is the picture tube; for it has the difficult task of accepting a varying electrical signal and producing the picture which that signal represents. The monochrome picture signal varies only in respect to the variation in light content of the transmitted picture; thus, the black-and-white picture tube has only to follow this one variation. The signal applied to the color picture tube is a combination of the monochrome signal, as outlined above, and three color signals. Each of the color signals varies according to the color present in the televised picture. To fulfill the standards of a compatible system, the color picture tube must also be capable of producing a black-and-white picture when only the monochrome signal is present. It is evident, then, that the picture tube in a color receiver must necessarily be a much more complicated device than its monochrome counterpart, even though outward appearances may not give this impression. With the assumption that the reader is familiar with the basic operation of the black-and-white picture tube, we may start with a few facts about the nature of color and then proceed to a description of the color picture tube.

Color Fundamentals

The results obtained from mixing color pigments or paints may be recalled from school experience. For example, mixing a blue and a yellow paint produces green. This is referred to as a subtractive process: Pigments absorb or subtract colors from the illuminating light source, and the eye sees only the color or colors that are reflected. Yellow paint reflects red, orange, and green light in addition to yellow. Blue paint reflects green, indigo, and violet light in addition to blue. When the two paints are mixed, green is the only light that is reflected by both paints and not absorbed by one or the other; therefore, the eye sees green.

Color TV uses a different principle to provide the eye with a sensation of color. Sources which emit light of different colors are employed. The color lights are added directly to produce intermediate colors in the spectrum. No reflection or absorption process is involved.

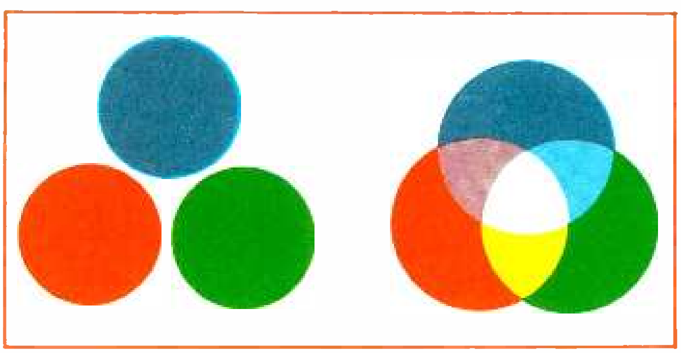


Fig. 1. Addition of Three Primary Colors As Shown by Overlapping Light Sources.

There are certain terms used in discussing color as it applies to color TV; therefore, it may be well to define a few of these. Hue is a property which is described by words such as blue, red, or yellow. Degree

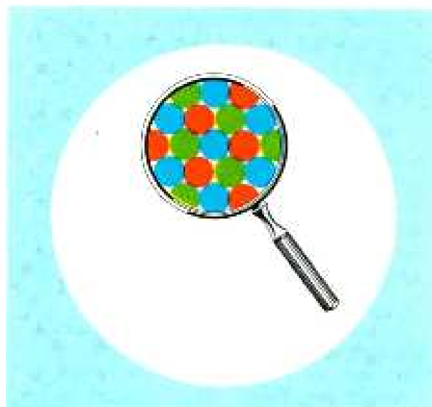
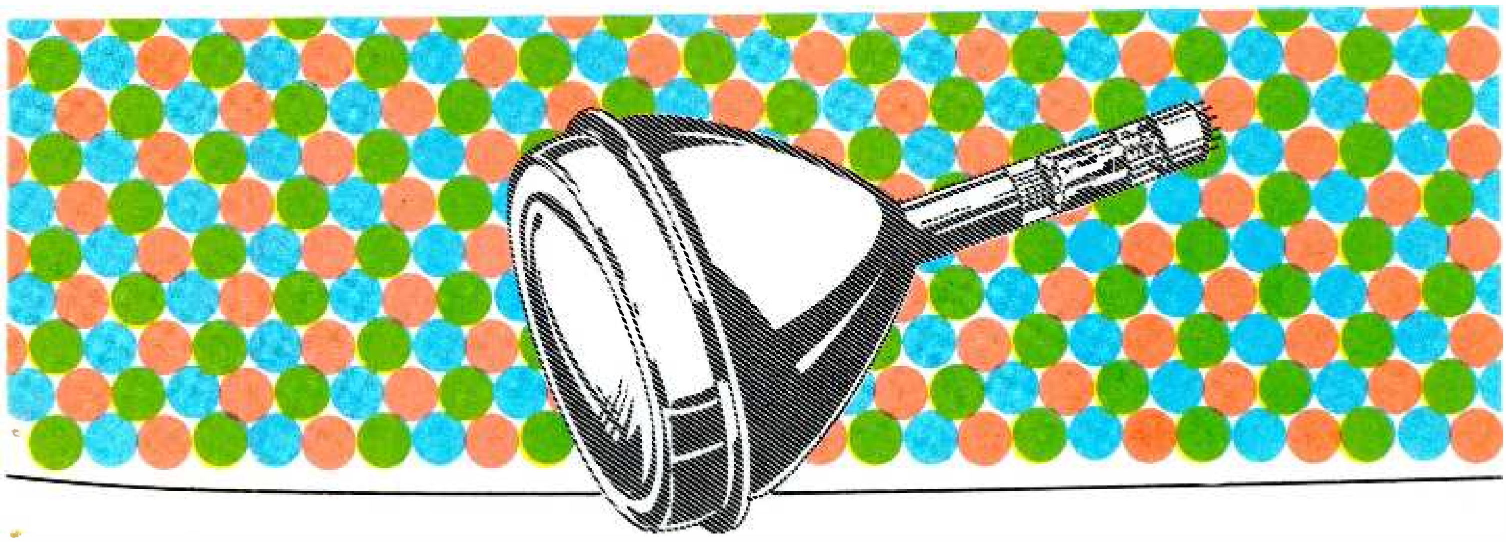


Fig. 2. Arrangement of Phosphor Dots on the Screen of the Color Picture Tube (As Seen Under Magnifying Glass).

of saturation in color light is denoted by such expressions as pastel, deep, or pale. Brightness or luminosity is given by values ranging anywhere between bright and dim. With these in mind, let us examine how certain color lights may be mixed, by addition, to produce various other colors for use in color television.

There are three colors, which when added in certain proportions will produce nearly all colors in the visible spectrum. These are called the additive color primaries and consist of red, green, and blue. When these three primaries are added together in proper proportions, the eye



registers a sensation of white. Fig. 1 illustrates this and also shows the colors which can be produced by adding pairs of lights of the primary colors. Other hues can be obtained by changing the brightness or intensity of one or more of the primary colors. If the blue light were cut off in Fig. 1, the red and green lights would combine to produce yellow as indicated; then, if the red light were decreased in brightness, the resultant color

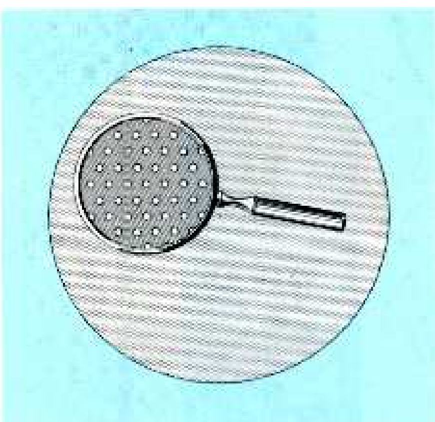


Fig. 3. Pattern of Holes in Shadow Mask (As Seen Under Magnifying Glass).

would change to a yellow-green. Any one primary color may be varied in saturation by increasing or decreasing the intensities of the other two primaries in unison.

Phosphor Screen

In the color picture tube the light sources of the primary colors do not overlap as shown in Fig. 1, but they are so small and closely spaced that the eye blends them together to give the sensation of seeing a single color. These light sources are composed of three phosphorescent materials which are energized by electron beams within the tube. The materials have been so chosen that the red, green, and blue colors which they emit are deeply saturated. This makes it possible to produce nearly all colors in the visible spectrum provided the excitation of each phosphor is properly controlled.

The phosphor on the screen of a monochrome picture tube consists of a mixture of differently colored phosphors combined in the proper proportions to produce a white light when activated. The phosphor screen in a color picture tube contains three phosphors, each separate from the others. This is to allow the excitation of any color individually or of any desired combination of colors.

Tubes employing several arrangements of the three phosphors are in the experimental or developmental stage. The system which has enjoyed the greatest acceptance at this time is one using a dot pattern of the color phosphors. Thus the description that follows pertains to this type of tube.

Picture tubes with the dot-phosphor type of screen are now being produced in the pilot-plant stage by some manufacturers. This type of phosphor screen is made by a process involving photoengraving or photographic techniques and the separate application of the various phosphors. The screen in its final form bears a pattern of dots in three colors positioned as shown in Fig. 2. The color tubes now nearing production contain approximately 7,000 dots per square inch of screen surface. A dot density of this order makes it possible for the color tube to provide a picture having a resolution only 10 to 15 per cent less than that possible with a monochrome tube. This deficiency is more than offset by the improved quality of the picture that is televised under color standards and by the improved design of the color-receiver circuits. After the phosphors are deposited on the dot screen, an aluminized coating is applied. This produces a screen having greater durability, increased light output, and protection from ion burns.

Shadow or Aperture Mask

The color picture tube employing a dot-phosphor screen requires a selective method of screen excitation; that is, the tube must be able to excite the red, green, and blue phosphor dots separately. This is done by assigning an electron beam to each of the three colors and by employing shadow techniques to insure that the beams strike only their respective color dots. Shadow techniques are usable with electron beams because the latter behave in a manner similar to light rays.

A mask having a pattern of holes through it, as illustrated in Fig. 3, can be inserted in the electron path; and the mask pattern will be produced on the phosphor screen by those electrons which pass through the holes. The placement of the reproduced pattern on the screen is fixed by the position of the electron-beam source. Fig. 4 shows how electron beams from the separate sources S_1 and S_2 can be directed through a single hole so as to illuminate separate points on

* * Please turn to page 45 * *

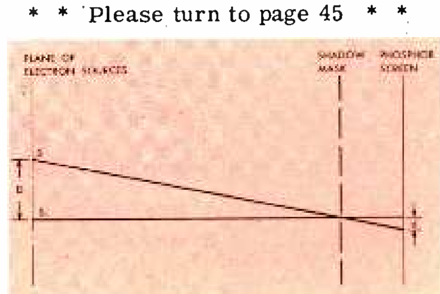


Fig. 4. Geometry of Shadow-Mask Principle.

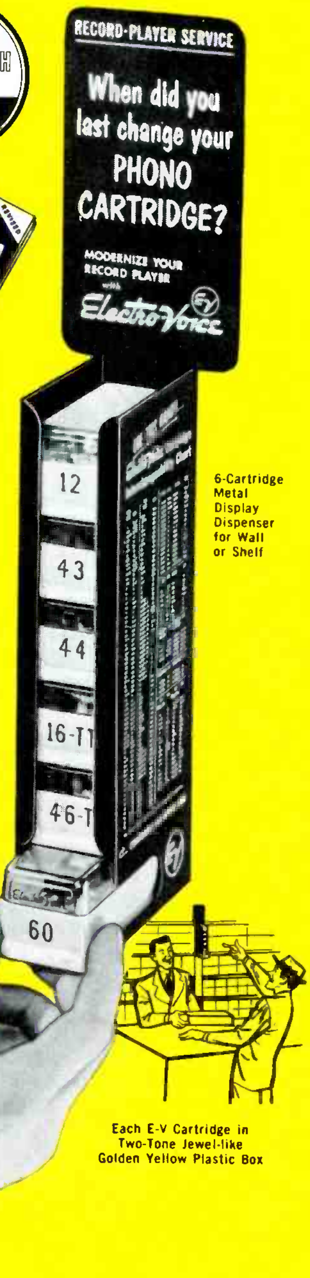
FREE—your Choice of
NEW PHONO-CARTRIDGE CARRY-KIT *or* DISPLAY-DISPENSER

Handy All-Metal Carry-Kit Holds 6 E-V Cartridges

Complete E-V Interchangeability Chart on both sides makes servicing positive and easy

PLUS
WINDOW or DOOR DECAL

PLUS
REVISED SET-MODEL REPLACEMENT GUIDE



6-Cartridge Metal Display Dispenser for Wall or Shelf

10,000,000
PHONOGRAPHS ARE WAITING TO BE SERVICED
Get your share with these E-V aids to sales!

Again E-V gives you a positive profit-maker—and helps make *you* the authority on Phono-Service in your community!

Free of extra cost, from your E-V Distributor, you can get your choice of new Cartridge Carry-Kit or Display Dispenser *plus* professional Decal and up-to-date set-model Replacement Guide, with *every* purchase of *any* 6 E-V Phono Cartridges.

Furthermore, the new E-V high output, high compliance, permanent Ceramic Cartridges revolutionize servicing. They are *not* affected by moisture or heat—can be carried in your service kit or kept on display without fear of deterioration. *And they are directly interchangeable with silent-needle type crystal cartridges that do not use a thumb screw*—yet cost no more than crystal. They are part of the famous E-V Basic 6 Preferred Types that make over 92% of all cartridge replacements.

Take advantage of this offer now! Make money selling cartridge replacements. Cash in on the $70,000,000 phono-cartridge modernization replacement market.

For a limited time only.

SEE YOUR E-V DISTRIBUTOR TODAY

Each E-V Cartridge in Two-Tone Jewel-like Golden Yellow Plastic Box

Electro-Voice

BUCHANAN, MICHIGAN

Export: 13 E. 40th St., New York 16, U.S.A., Cable: Arlab

Shop Talk

MILTON S. KIVER
President, Television Communications Institute

A fair proportion of the television receivers now in use operate under what are known as fringe-area conditions. That is, the received signal is so weak (generally under 100 microvolts) that the picture is clouded by a considerable amount of snow. Note that the set itself need not be located any great distance from the transmitter. As a matter of fact, it may be no more than 2 or 3 miles away; yet because of the shielding effect of surrounding terrain or nearby structures, the actual signal available to the receiver is no more than what the set might receive if it were out in the clear 100 miles away. Such are the vagaries of television transmission.

To cope with this and similar conditions, many manufacturers have issued special service bulletins that outline certain circuit changes designed to improve reception. These include reducing the AGC bias, particularly to the tuner, increasing video-amplifier load-resistance values, altering sync-separator operating conditions, and otherwise boosting the sensitivity of the receiver beyond its normal value. Each manufacturer tackles the problem in his own way, and the specific recommendations of each should be considered in preference to a generalized procedure.

There is one most important step that should be performed before any of these circuit modifications are carried out. This is to make certain that the receiver is in top operating condition. This means more than turning on the power and seeing that a picture appears and that sound is heard. It includes these plus a comprehensive series of checks which will assure you that you are getting all you can from this particular receiver. Of course, the best in some sets will not equal the best in others; but this we all know and expect.

The tests to be described require no special knowledge or equipment; any service man can carry them out. Furthermore, they need not be restricted solely to receivers operating in weak-signal areas. Any set no matter where used should be in peak condition, because only then will it perform as its designer intended.

The steps should be carried out in the order given. This will tend to prevent a subsequent step from disrupting a previous one.

The equipment required includes an AM generator and an oscilloscope. With the receiver set up on the bench, connect the generator signal lead to an ungrounded antenna terminal. The generator ground terminal is connected to the receiver chassis. If the receiver is of the transformerless variety, use an isolation transformer between the receiver and the power line. The generator frequency is set to the center of one of the local channels. Thus, if channel 3 (60 to 66 mc) is the one chosen, the generator frequency is set to 63 mc. The audio modulation is also turned on.

Next, take the oscilloscope and connect its vertical-input terminal to either the grid or cathode of the picture tube, depending upon which element receives the video signal. Use a series .1-mfd blocking capacitor if the oscilloscope does not incorporate one in its input circuit. Complete the scope connection by grounding the instrument to the receiver chassis.

The final preparatory step is to insert a fixed bias voltage across the AGC line of the receiver. Do this with batteries or a DC supply. Adjust the bias to a value which the system normally develops. This can be determined by a prior measurement when the set is in operation.

Turn on the set and the test equipment. Adjust the generator output and the vertical-gain control of the oscilloscope until the audio modulation (usually a 400-cycle sine wave) occupies about one half of the scope screen. A ruled mask should be placed over the screen, and the number of spaces covered vertically by the modulation signal should be carefully noted. If a mask is not available, use a soft pencil or crayon to indicate the positive and negative peak of the wave.

Keep the generator signal as low as possible and still be consistent with the above requirements. Do not overload receiver or oscilloscope, as evidenced by a distorted wave.

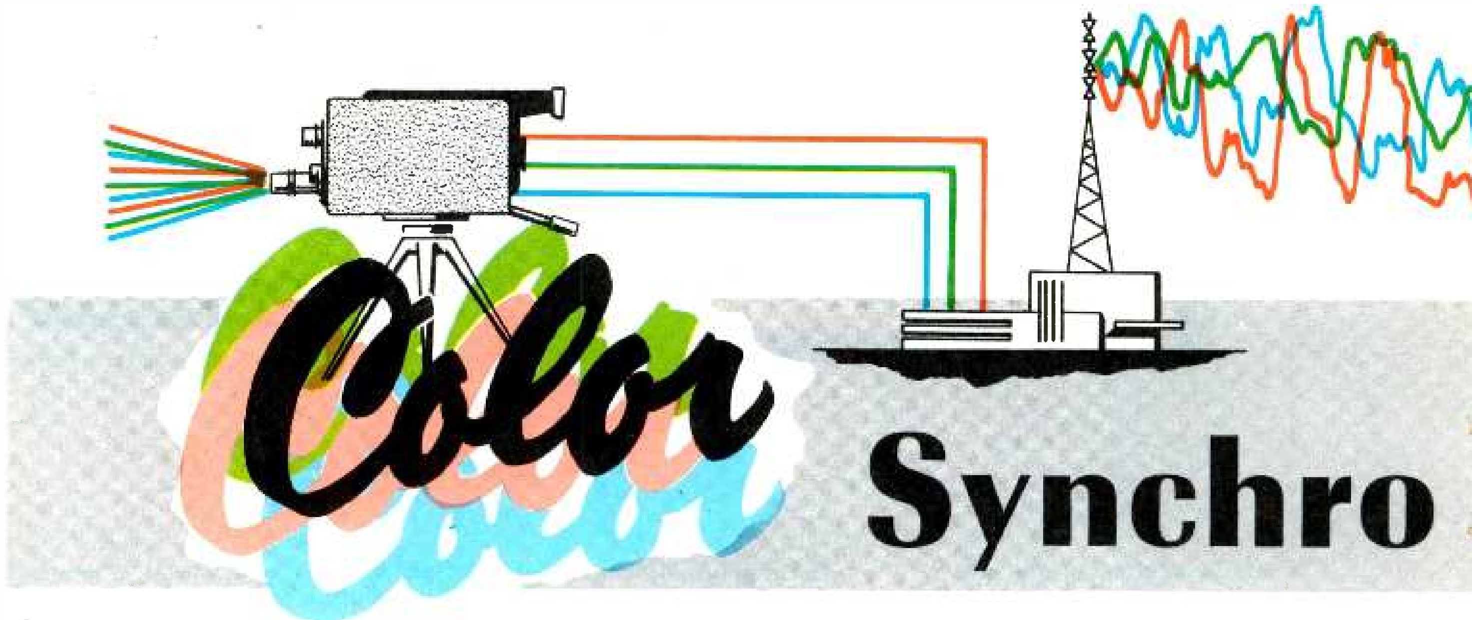
The following tests may be made:

1. Try a new set of rectifier tubes in place of those in the receiver. Note carefully whether the modulation wave on the scope screen increases in height. If it does, note by how many vertical squares. Try a number of rectifier tubes, leaving in the one that provides the greatest signal increase.

If the set uses seleium rectifiers, it may not be amiss to try another unit even though the one in the receiver is apparently functioning properly. Rectifier output decreases with age, and it is often possible to increase set sensitivity considerably by raising the B+ voltage only 10 or 20 volts.

2. Next, starting at the RF amplifier, replace each tube in turn noting after every substitution whether or not the wave on the scope screen had increased in height. When the oscillator tube is changed, be sure to retune the set for maximum output. Proceed in this manner until every tube in the RF system, video IF system, video second detector, and video-

* * Please turn to page 68 * *



Color Synchro

A Description of the Color-Receiver Circuits Which Synchronize Deflection and Color Selection at the Picture Tube With Camera Operation at the Transmitter

The color-television receiver employs two distinct channels of synchronization. These are the deflection-synchronization channel and the color-synchronization channel. It will be found that the system for synchronizing the deflection system closely approximates the method now employed in monochrome receivers. Improper operation of this section is characterized by unstable horizontal sweep, vertical sweep, or a combination of both. The color-synchronization system, however, has no direct parallel in monochrome television receivers. Improper functioning of the color-synchronization system will result in false color information being fed to the picture tube. A discussion of these systems follows, with particular emphasis being placed upon the color-synchronization channel.

Deflection Synchronization

The two stages shown in the block diagram of Fig. 1 constitute the principal items of the deflection-synchronization (sync) channel. The sync-separator inverter performs two functions and requires three sources of information to accomplish these operations. A noise-immunity action is provided by this stage and is dependent upon information received from the second detector stage and the third IF stage.

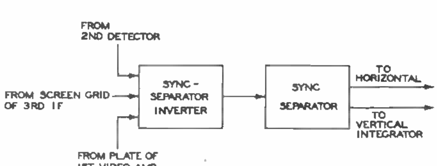


Fig. 1. Block Diagram of the Deflection-Sync System.

The schematic diagram of Fig. 2 shows that a varying plus voltage from the screen grid of the third IF stage is applied to the No. 1 control grid of the sync-separator inverter and determines the operating point of this grid. The level of this voltage is dependent upon the strength of the received signal. A negative composite-video signal from the second detector is also coupled to this grid. Strong noise pulses contained in this signal are sufficient to drive the sync-separator inverter to cut off. The combined effect of these two signals therefore provides the noise-immunity action in the sync-separator inverter stage. Separation of the sync pulses from the composite signal is also achieved here. A positive composite signal from the first video amplifier is applied to the No. 3 grid. A separated sync signal appears at the plate of the sync-separator inverter. Occasional holes appear in this signal because of noise pulses driving the tube to cut off. These sync pulses are in turn fed to the sync separator, where additional clipping action takes place. A triode is utilized in this stage. The sync separator feeds the resultant signals to the horizontal-sweep system and to a vertical-integrator network. It may be seen from the foregoing discussion that the deflection-sync system does not depart appreciably from the system employed in monochrome receivers.

Color Synchronization

Proper operation of the color-sync system is partially dependent upon certain information contained in the transmitted signal. The portion of the transmitted signal utilized by the color-sync system is referred to as the burst. Reference to Fig. 3 shows that the burst is positioned on the back porch of the horizontal-blanking pedestal. The burst is composed of approximately eight cycles of a 3.579-mc signal. It is noted that the frequency of the burst is identical to the frequency of the color subcarrier. The burst contains phase information as well as frequency information.

The recovery of color information contained in the transmitted

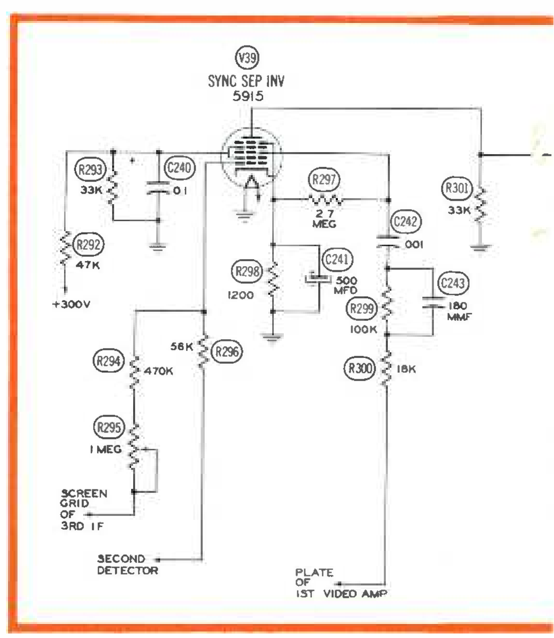
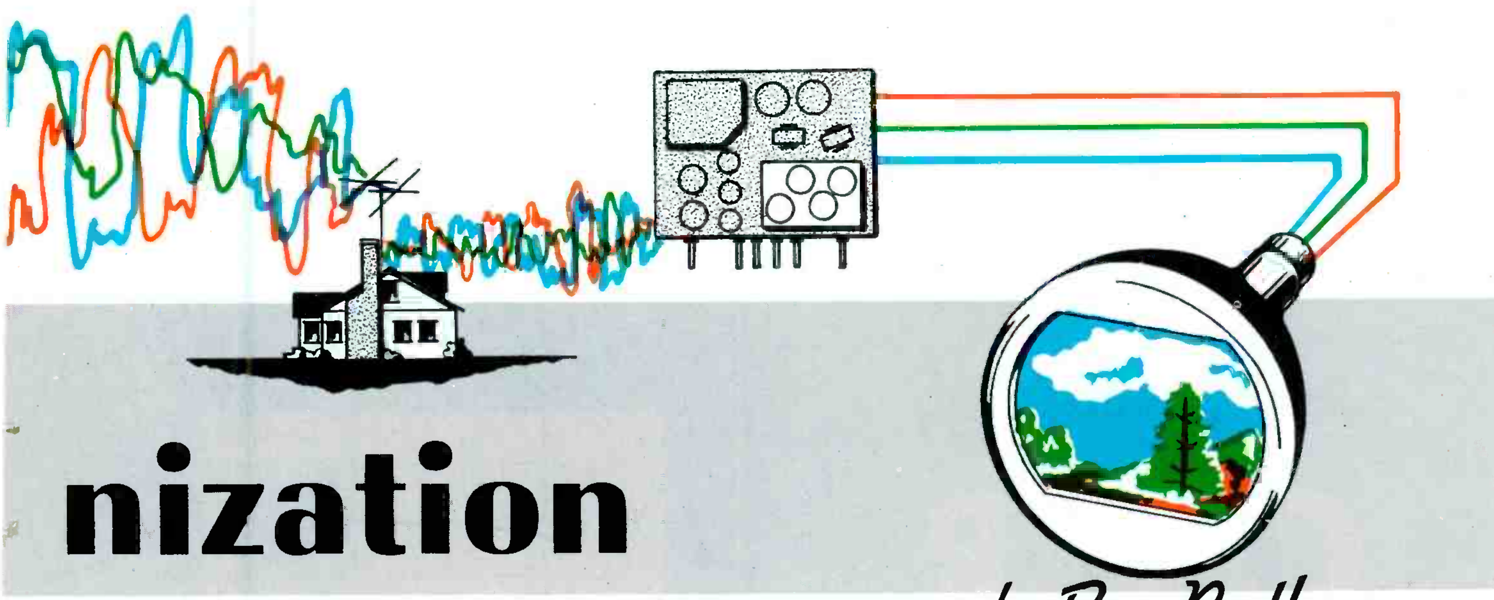


Fig. 2. Schematic of the

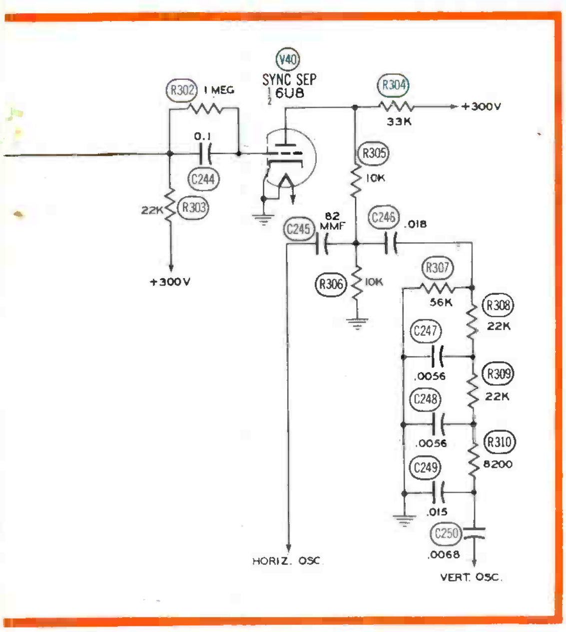


nization

by Don R. Howe

signal requires the generation of a 3.579-mc signal in the receiver. This signal is fed to the color demodulators where the actual recovery is accomplished. This locally generated signal must be at the same frequency and must posses the proper phase relationship to the color subcarrier of the transmitted signal. It is the function of the color-synchronization section of the receiver to see that these requirements are fulfilled. This is accomplished by comparing the locally generated signal with the burst signal described previously and by making appropriate corrections to the locally generated signal.

The over-all functioning of the color-synchronization system may be more easily understood by reference to the block diagram of Fig. 4.



Deflection-Sync System.

The first block encountered represents the burst amplifier. The burst signal is fed into this stage from the first video amplifier. Since the burst signal is of relatively short duration and is transmitted immediately following the horizontal sync pulse, the burst amplifier is held at cutoff during transmission of the video portion of the signal. The burst amplifier is restored to an operating condition by a pulse obtained from the horizontal-deflection circuit. After the burst signal is amplified by the burst amplifier it is then transferred to the phase detector.

As previously stated, a 3.579-mc signal must be generated in the receiver. The generation of this signal is accomplished by the 3.579-mc oscillator shown in the block diagram of Fig. 4. It is noted that the output of this oscillator is fed to the color-phase amplifier. The amplified RF signal appearing in the output of this stage is coupled to the phase detector where it is compared with the incoming burst signal from the burst amplifier. The comparison of these two signals in the phase detector results in a DC error voltage being fed to the reactance tube. The performance of a reactance tube can be compared to that of a capacitor in that it presents capacitive reactance to the circuit to which it is connected. The capacitive reactance of the reactance tube is varied by the DC error voltage from the phase detector. This varying reactance controls the phase and frequency of the 3.579-mc oscillator.

The above discussion shows how the stages function to maintain the proper phase and frequency relationship of the 3.579-mc oscillator with the color burst.

The block, shown as the color killer, is controlled by a voltage generated in the phase detector. This voltage is such that the color killer is inoperative during reception of a color signal. The purpose of the color killer is to disable the color channels during monochrome reception. A detailed explanation of this stage appears in the article entitled, "Monochrome Reception by the Color Receiver", and contained in this issue of the PF INDEX.

The block diagram indicates two additional outputs from the 3.579-mc oscillator. One of these outputs goes directly to the I demodulator; the other output goes to the quadrature amplifier. This stage provides phase shift and amplification. A phase shift of 90 degrees is introduced so that the signal may be properly utilized by the Q demodulator.

The functioning of the various stages making up the color-sync system has been shown by use of the block diagram. In order to gain a more complete understanding of how

* * Please turn to page 66 * *

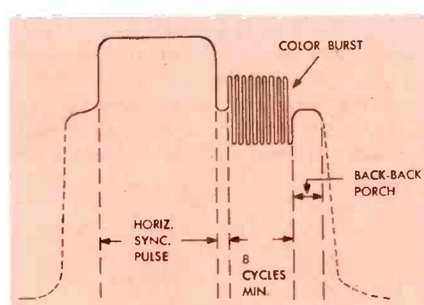
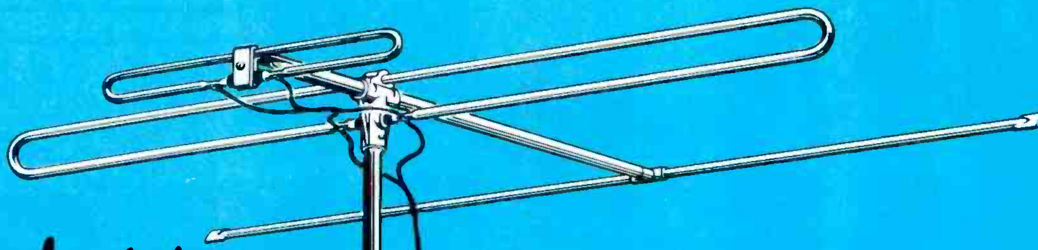


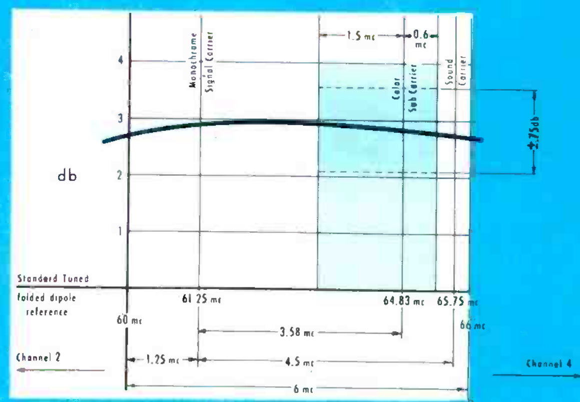
Fig. 3. Location of the Color Burst on the Transmitted Signal.



you're ready for

COLOR TELEVISION

with an AMPHENOL INLINE*



CHANNEL 3

Color television is fast becoming a reality! Sets are expected to be available the first part of next year and stations are purchasing the necessary transmitting equipment. Initial costs, unfortunately, will be high but as improvements in design and production are achieved the price of color television will become within everyone's reach.

The consumer is concerned with the problems presented by television in color. He has read reports on prices and availability; all have been conflicting. He knows, however, that his set will have to be replaced or converted. What he does not know is that if *he has an* AMPHENOL INLINE*, there will be *no extra expense in antenna or installation!* AMPHENOL engineers provided for color in the original design of the INLINE*.

Every dealer, distributor and installer will want to acquaint their customers with this reassuring information. The color television market is potentially tremendous. It certainly will prove of benefit if the consumer can be reassured on one part of the cost of conversion to color.

The fact that AMPHENOL INLINEs are able to receive color television so well reflects favorably upon the engineering ability of AMPHENOL. For in ordinary black and white television the same level-gain design has proved valuable. Set owners know, now, that their AMPHENOL INLINE* is providing them with the best black and white picture their sets can deliver.

*Reissue U.S. Pat. No. 23,273

Antenna Electrical Requirements for COLOR TELEVISION

Information now available on color television has made it clear that the receiving antenna must have these characteristics:

1. Antenna gain must be flat, no gain or loss greater than one db, within 1.5 mc below and 0.6 mc above the color sub-carrier* (a width of 2.1 mc).
2. Antenna gain must be held down across the FM frequencies. Rejection of FM signals is much more important in color than in black and white television.

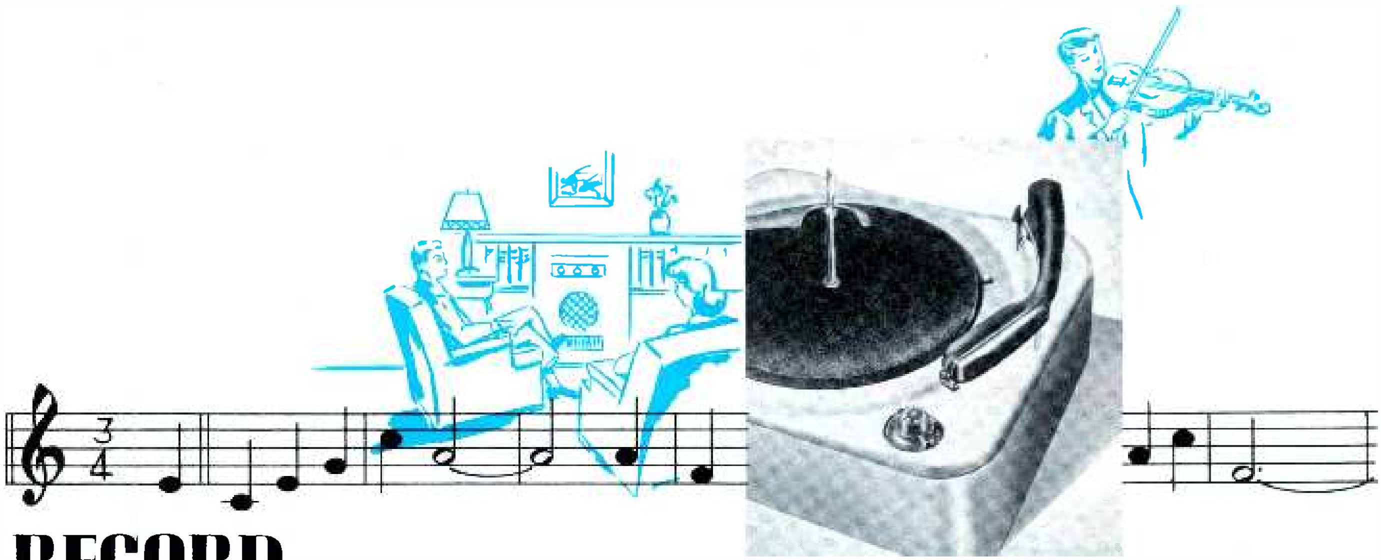
*Channel frequency widths are at present divided between the monochrome amplitude modulation picture carrier and the frequency modulation sound carrier. The addition of the color sub-carrier is made at 3.58 mc above the monochrome carrier.

The AMPHENOL INLINE fully meets the two conditions listed above. Besides being engineered to reject FM signals, from 88 mc to 108 mc, the INLINE provides very level gain across all channels, particularly over the color sub-carrier. Typical of the INLINE's performance on all channels is the gain chart† illustrated above for channel 3.*

†Measured in accordance with proposed RETMA standards.

AMERICAN PHENOLIC CORPORATION
chicago 50, illinois

AMPHENOL



RECORD CHANGER SERVICING

by Lester W. Caudell and Glen E. Slutz

PART II

Set-Down Adjustment Procedures for Several Popular Models of Record Changers

One of the most common troubles with record changers is that of improper set down of the tone arm, and this trouble is brought about usually because of misuse by the operator. The set-down mechanism of many changers can be adjusted without removing the changer from the cabinet. The location and availability of the set-down adjustment is the determining factor. Regardless of the make of the changer to be repaired, the service technician should also find out if the set-down point of the tone arm is in a positive position each time or if it changes position erratically during several trials.

The locations of adjustment points on several makes and models of changers are given in the following material. Procedures for adjusting the set down of the tone arm on these changers are discussed with the hope of making the service technician's job easier and faster.

Admiral

RC210, RC211, RC212, RC220, RC221, RC222, RC320, RC321, RC322, RC500

These Admiral automatic record changers differ somewhat in design and operation, but the location of the tone-arm set-down adjustment is the same in all units. Using the changer illustrated in Fig. 1 as a guide, we will describe the method used to make the set-down adjustment.

By observing Fig. 1, it can be noted that the set-down adjustment is made by inserting a screwdriver into a hole in the side of the tone arm; therefore, unless cabinet design is such that this cannot be done, adjustment of the set down in these models can be performed without removing the changer from the cabinet.

A. If the tone-arm set-down point is slightly off but the needle lands each time in a positive position, the following procedure is recommended:

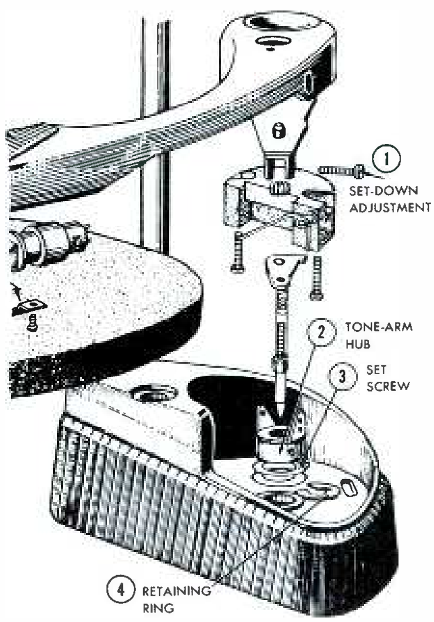


Fig. 1. Set-Down Adjustments on Admiral Changers.

1. Set the changer to play 10-inch records.

2. Place a 10-inch record on the turntable.

3. Press down on the REJECT knob momentarily. Rotate the turntable by hand in a clockwise direction until the tone arm moves in over the record and starts its downward movement.

4. At this point a fairly accurate adjustment can be made by rotating adjustment screw (1), shown in Fig. 1. Turning this adjustment screw clockwise moves the set-down point of the tone arm farther away from the spindle. Turning the screw counterclockwise moves the point closer to the spindle. When correctly adjusted, the needle should land approximately 1/8 inch in from the edge of the record.

5. After this adjustment has been made:

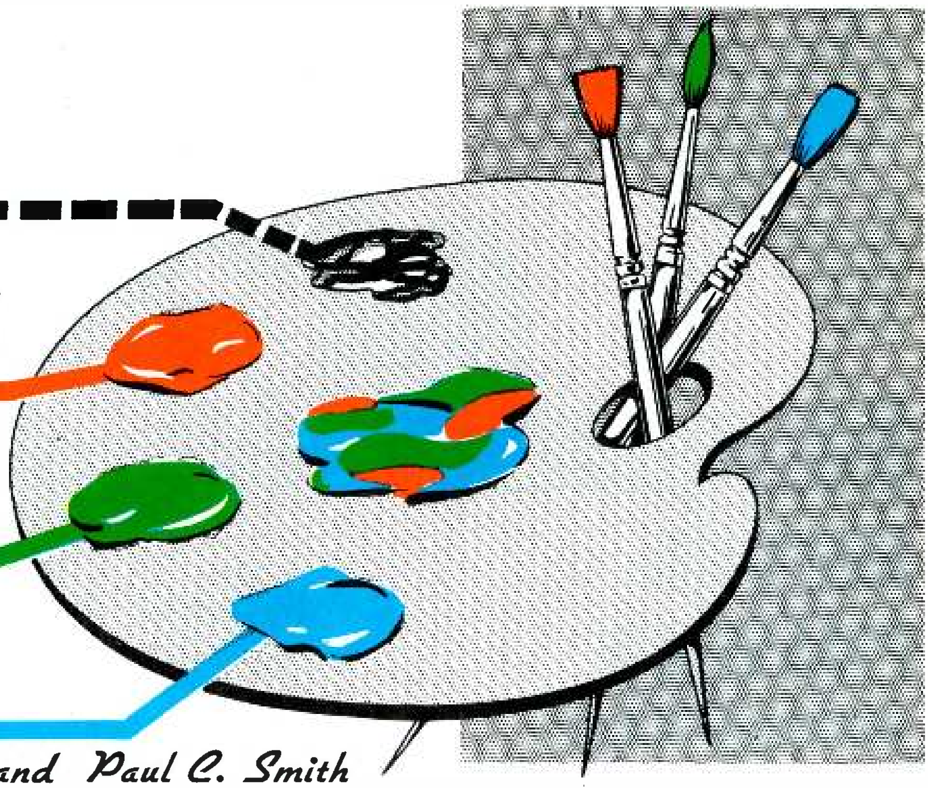
a. Load a stack of 10-inch records on the spindle and record shelf.

b. Apply power to the record changer, then reject each record after observing the landing point of the tone arm. Repeat step 5 if necessary until the set-down point is correct.

If this procedure for adjustment is made carefully, the set-down point for 7-inch or 12-inch records will be automatically correct.

* * Please turn to page 88 * *

COLOR DECODING AND MIXING



by Henry A. Carter and Paul C. Smith

Circuits Used in the Color Receiver to Separate the Color Information from the Picture Signal and to Prepare This Information for Use by the Color Picture Tube

The circuitry and operation of a color receiver and the normal black-and-white television receiver are essentially the same up to the video-amplifier stages. At this point the signal in color TV is divided and fed into the luminance and chrominance channels.

A brief review of color properties should be useful at this point. The three properties of major importance in their application to a color receiver are:

1. Hue.
2. Saturation.
3. Brightness or luminosity.

Other names exist for the above terms. Hue is also referred to as color, and is that property which distinguishes one color from the other, such as red, green, or blue. Saturation has also been called chroma, and the chrominance channel gets its name from this term. This channel is responsible for the color which appears on the picture tube. Saturation refers to the intensity of the color. Brightness or luminosity is that characteristic of a color which makes it appear as bright or dull.

To take the viewpoint of a physicist and deal with wavelengths of light in the color spectrum, hue is determined by the dominant wavelengths or frequencies present, saturation by the degree to which these frequencies are reduced toward a single frequency, and luminosity by the amount of power represented therein.

By the proper combination of three well-chosen primary colors all other colors can be matched in hue, although full saturation of all colors cannot be reached in this manner. In developing such a system as the NTSC color system, the engineers are faced with physical limitations in the available tube phosphors, color filters, and associated equipment. The resultant choice of primary colors is therefore a compromise, calculated to best meet all requirements. The three primary colors selected in that manner are a certain red, green, and blue.

Chrominance Channel

A block diagram of a portion of an RCA developmental color television receiver appears in Fig. 1. This diagram shows that the composite video signal takes two paths from the video-amplifier stage: one is from the plate circuit to the delay network and the luminance channel, the other is from the contrast control in the cathode circuit to the bandpass amplifier and its associated filter network.

Let us first consider those sections of the diagram which deal with the chrominance signal.

The bandpass filter network has a frequency characteristic calculated to pass only the chrominance subcarrier and its sidebands. This signal is then applied by a common connection to the demodulators where the color information is extracted by a process of synchronous detection. The detected Q signal passes through a low-pass filter to the Q phase splitter where two signals of opposite phase are obtained; and the output of this stage is applied to each section of the matrix, the negative-going signal being applied to the green section of the matrix and the positive-going signal being applied to the red and blue sections where they are added to the other signals from the I channel and the luminance channel. The chrominance signal, applied to the Q demodulator, is also applied to the I demodulator; and the detected I signal passes through a combined low-pass filter and delay network, then an amplifier stage. The signal output of this stage takes two paths, one to the red section of the matrix while the other is to the input of a phase-inverter stage. The output of the inverter stage is then applied to the green and blue sections of the matrix.

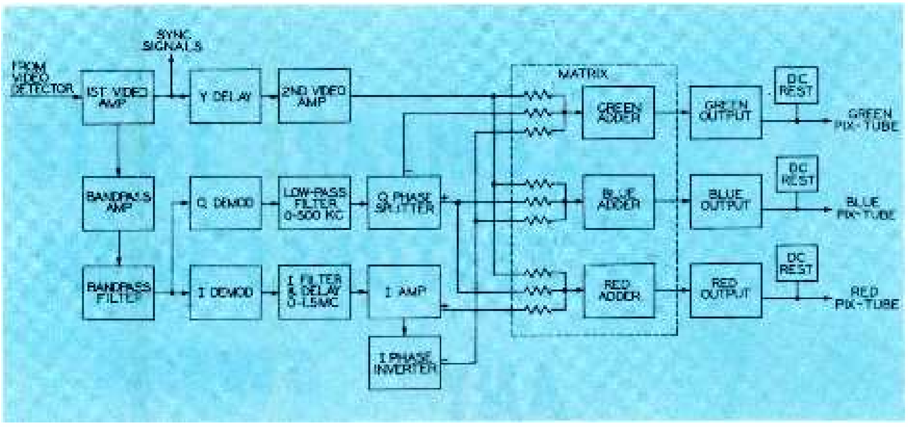


Fig. 1. Block Diagram of Luminance and Chrominance Channels and Their Associated Circuits in a Color TV Receiver.

The luminance signal is combined with the color signals at each section of the matrix; and the three resultant color signals receive further amplification in the red, green, and blue output stages before being applied to the grids of the color tube. Each signal is subjected to DC restorer action to restore the correct background level.

The nature of the luminance and chrominance signals and the operation of the afore-mentioned circuits are described in more detail in the following paragraphs.

Luminance and Chrominance Signals

The luminance signal is made up of monochrome picture information of all transmitted frequencies plus some of the higher frequencies that would normally be color detail. The chrominance signal contains the lower frequencies representing the larger color areas. These lower frequencies are limited to a range of from zero to approximately 1.5 mc. Subjects containing fine detail in color normally will require higher frequencies than 1.5 mc if the color is to be very accurately represented. However, a peculiarity of color vision makes it possible to reproduce these color details as monochrome without serious loss in the quality of the color reproduction. It has been demonstraed that as color details become smaller and smaller the ability of the eye to distinguish one color from another becomes less and less. If the color detail is small enough, no color difference will be noted by the eye; only the brightness or luminance difference will be seen. This detail, then, can be supplied in the luminance signal along with all the monochrome information.

The complete monochrome range, from white to black, is obtained at the color picture tube by a proper combination of the three colors in the following proportion: 59 per cent green, 30 per cent red, and 11 per cent blue. Whenever the chrominance signal is absent, leaving only the luminance signal to affect the color tube, the resulting picture will be colorless or neutral. This luminance or neutral signal is referred to as the Y signal. The above percentages of the primary colors (59, 30, and 11 per cent) are based on the actual contribution of the three colors to the luminosity (brightness) of any subject. When chosen in this manner, these values result in constant luminance operation of the receiver. This is another way of saying that the brightness of the picture as a whole depends upon the luminance signal and will not be materially affected by a change in hue of some sizable color area. The constant luminance property is also useful in reducing the annoyance caused by interfering signals or cross talk among the receiver channels, since such signals will then appear as color variations rather than brightness variations.

In addition to all the brightness information, the luminance signal contains the standard horizontal and vertical-synchronization pulses and the color-synchronization bursts.

As mentioned in the opening paragraph of this article, the luminance and chrominance channels follow the video-amplifier stages. The transmitted chrominance signal is a combination of the Q signal and the I signal. According to NTSC specifications, the Q and I signals have the following composition:

$$E_Q = 0.41\,(E_B - E_Y) + 0.48\,(E_R - E_Y),$$

$$E_I = -0.27\,(E_B - E_Y) + 0.74\,(E_R - E_Y).$$

By substituting the value of

$$E_Y = 0.59\,E_G + 0.30\,E_R + 0.11\,E_B$$

in the above equations, we obtain:

$$E_Q = -0.53\,E_G + 0.21\,E_R + 0.31\,E_B,$$

and

$$E_I = -0.28\,E_G + 0.59\,E_R - 0.32\,E_B.$$

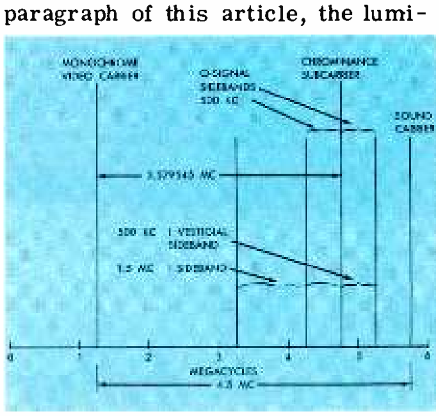


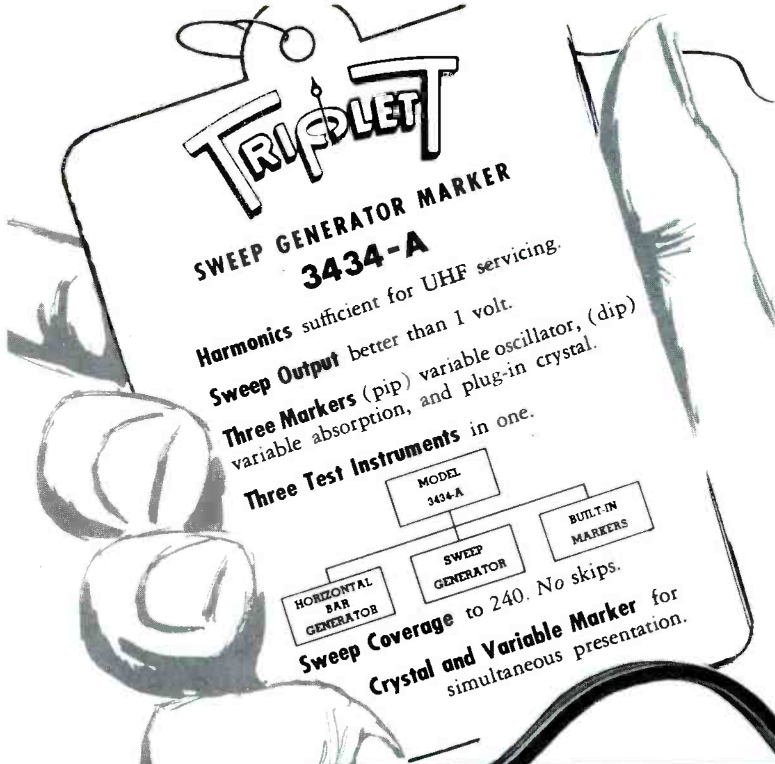
Fig. 2. Signal-Frequency Distribution of NTSC Compatible Color System.

These signals are impressed on the chrominance subcarrier as amplitude modulation with this important qualification: the I signal modulates a subcarrier which is advanced 90 degrees in phase with respect to the Q subcarrier. In this manner both signals can be applied to the same subcarrier frequency, with a saving of channel space. This quadrature feature is also the basis of the demodulation process which allows one signal to be separated from the other. It can be seen that the three color properties are represented in the complete video signal in this manner: the luminance or brightness information is contained in the Y signal, the hue is determined by the phase of the subcarrier, and the saturation of the color is dependent upon the amplitude of modulation of the subcarrier.

In Fig. 2 is shown the frequency distribution of the monochrome video or Y signal, the Q, and the I signals. The monochrome video signal is in accordance with FCC standards for black-and-white transmission. The chrominance subcarrier is 3.579545 mc above the monochrome carrier frequency. The Q signal has two sidebands approximately 500 kc wide. The I signal has one sideband approximately 1.5 mc wide; and the other sideband is vestigial, being approximately 500 kc wide.

As stated before, the separation of the two carriers is approximately 3.6 mc. The modulation of the monochrome carrier may extend to frequencies as high as 4.2 mc in the direction of the chrominance subcarrier. The modulation of the chrominance subcarrier extends 1.5 mc in the direction of the monochrome carrier. Under these conditions,

* * Please turn to page 53 * *



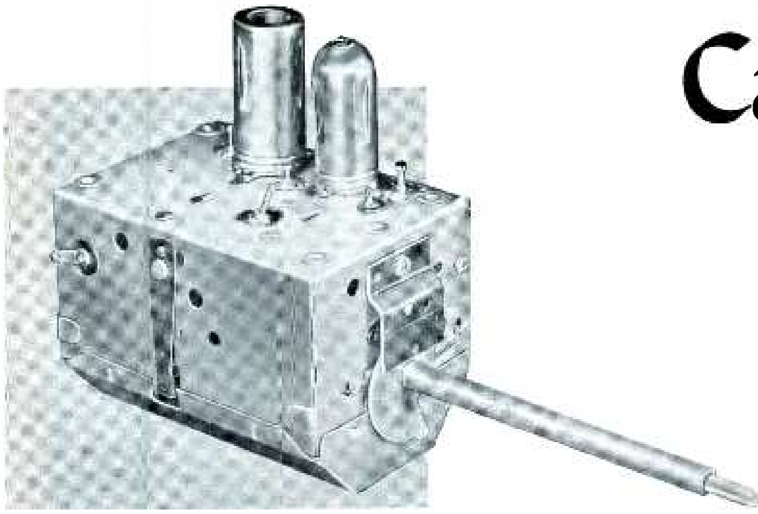
COMPARE THESE FEATURES WITH

ANY SWEEP GENERATOR

There are 16 additional features incorporated, which make it a "must" for the radio technician. All, together, emphasize the superiority in dollar value of Triplett 3434-A. See this tester at your distributor's.

And now compare the Quality per dollar

TRIPLETT ELECTRICAL EQUIPMENT CO., BLUFFTON, OHIO



Cascode Tuner installation

by **PAUL C. SMITH**

There are several reasons why the service technician might be required to convert a television receiver by replacing the original tuner with the more modern, cascode type of tuner. During the course of a tuner repair job, he may find that the total cost of labor and parts for a major repair such as replacement of a broken multiwafer switch will approach or equal the cost of installing a cascode tuner. Then, too, an exact replacement for the original tuner may be difficult to obtain in contrast to the cascode tuner which is available at most radio and television parts distributors.

The cascode tuner, with its superior signal-to-noise ratio, is a logical choice when the service technician is confronted with the problem of improvement of fringe-area reception. Any noise originating in the tuner will be amplified by the succeeding stages; and if the noise level is high compared to the signal (low signal-to-noise ratio), the result will be snow in the picture.

Some cascode tuners are designed to permit installation of UHF strips, which is certainly a worthwhile consideration when making a tuner replacement.

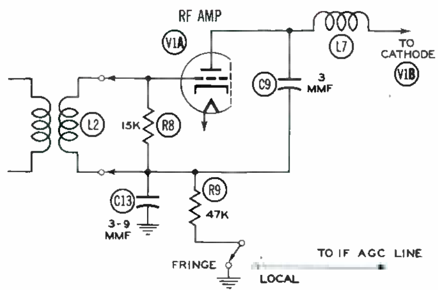


Fig. 2. RF Stage of Cascode Tuner Showing Application of "Local-Fringe" Switch.

One of the first points to be considered when planning the conversion is the physical placement of the tuner. Usually the space occupied by the original tuner will be sufficient to accommodate the newer type. If the use of the new tuner dictates addition of another hole in the cabinet front, that is a decision which lies with the service technician and the set owner. In many cases the new tuner will mount easily in the space vacated by the original one, and no alterations of the cabinet front will be necessary. Universal replacement tuners of this type are equipped with tuning and switching shafts of ample length to be cut to the necessary dimensions. One tuner has a removable shaft that may be replaced with one of extra length, if required. In any case the technician should be sure that the tuner will fit before proceeding with the conversion.

One of the most important considerations when connecting the tuner is the matter of the bias or AGC voltage supplied to the RF stage. For best sensitivity to weak signals this bias should be approximately -1 volt or less, and it should increase with strong signal input in order to prevent overloading of the video IF amplifier stages. To prevent this increase of bias until a certain signal strength is reached, some form of delay is desirable. This delay may be subject to manual control in the form of a "Local-Fringe" switch, or it may be obtained through the use of a non-adjustable delay circuit.

A partial schematic of a circuit using the first-mentioned, or manual-delay system, is shown in Fig. 1. The dotted-in parts are used in some models; and when they are used, points marked X are broken.

The 6AL5 tube V6 functions as a combined video detector and AGC rectifier. A portion of the video IF signal is applied to that half of V6 represented by pins 2 and 5, and the rectified voltage is developed

* * Please turn to page 72 * *

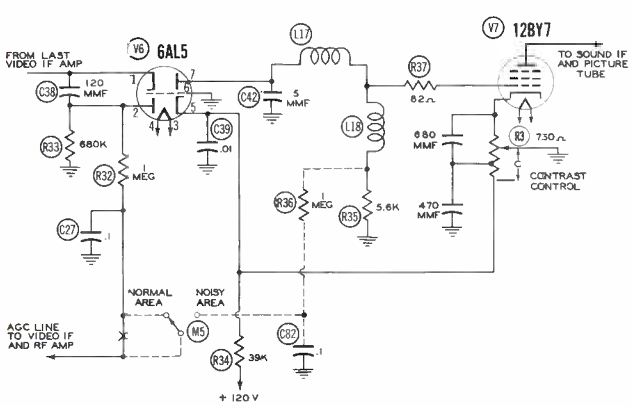


Fig. 1. AGC Circuit Using Manually Controlled Delay System.

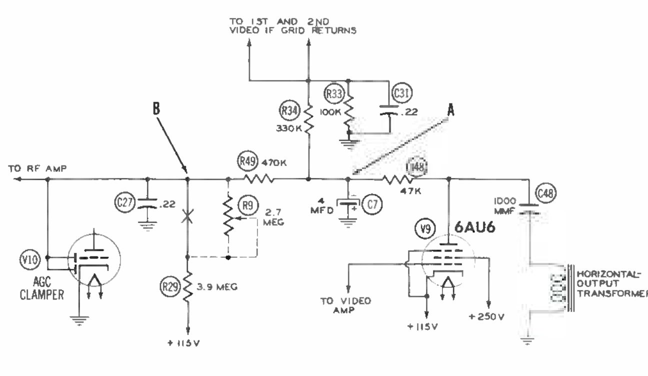


Fig. 3. AGC System Using a Keying Tube and AGC Delay.

They look alike...

. . . but what a difference!

These RCA types today give you . . .

RCA receiving tubes provide the superior performance and reliability usually associated with higher priced specialty designed types. That's because RCA receiving tubes are constantly being improved to meet the changing requirements of radio and television applications.

For instance, the RCA-5U4-G features a new electrolytic coating on its channel filament which produces a uniform, hard emitter, leading to greatly increased life over the older version.

Or take the RCA-6W4-GT. This type now uses a new RCA-developed carbonized plate-coating material which has improved heat-dissipating properties, thus contributing to longer tube life and increased reliability.

The RCA-6AL5 now utilizes double helical heaters to insure low hum and pinched cathodes to minimize cathode shift within the mount. These features make possible greatly reduced microphonics.

The superior performance of *regular* RCA receiving tubes—at *regular* prices—eliminates unnecessary call-backs, assures you of greater customer satisfaction, results in increased profits for you.

When you sell a receiving tube, your reputation and profit depend on its *performance* and *reliability*.

✓ ✓ ✓

So, you just can't afford to buy anything less than the best in receiving tubes . . . and that's RCA.

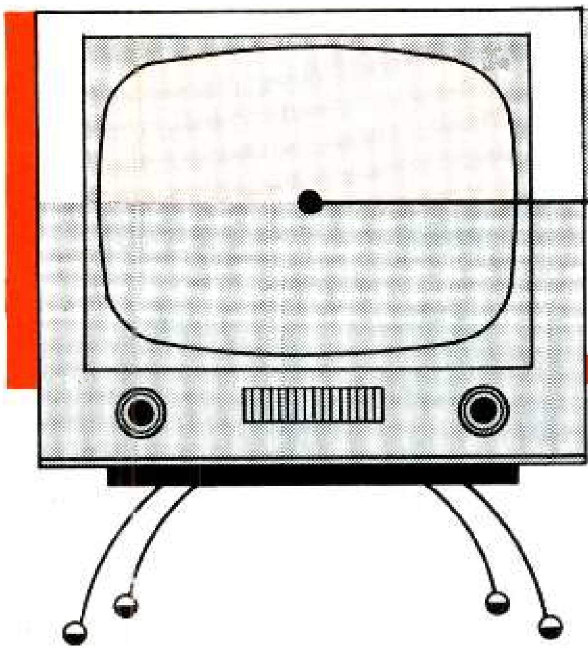
Longer Life

Superior Performance

At No Extra Cost

RADIO CORPORATION of AMERICA

ELECTRON TUBES HARRISON, N. J.



MONOCHROME RECEPTION

BY THE COLOR RECEIVER

How the Color Receiver Accepts a Standard Monochrome Signal and Produces a Black-and-White Picture

by Don R. Howe

Maximum utilization of the color receiver cannot be realized unless it is capable of receiving monochrome as well as color transmissions. The original design of the color receiver already incorporates all of the necessary stages for the reproduction of a black-and-white picture. In addition, the receiver employs many stages for color reproduction; however, these additional stages could constitute a source of interference to the faithful reproduction of a black-and-white picture on the color receiver. One method employed in the color receiver for overcoming this difficulty is explained in the following discussion.

If reception of a monochrome signal is desired, some method must be provided for disabling the color-video system. In order to provide maximum simplicity, this disabling action is made entirely automatic and therefore eliminates the necessity of adding an additional front-panel control. This automatic operation, however, requires one additional stage in the receiver. This added stage is termed the color killer.

During reception of color transmissions, all color information must pass through the bandpass amplifier. Therefore, this stage presents a logical point to disable the color system. If this stage is cut off during reception of a monochrome signal, extraneous signals are prevented from entering the color system. This cutoff is accomplished by the color killer. The ability of the color killer to distinguish between a color or a monochrome signal is dependent upon the presence or absence of the color burst on the transmitted signal. Actual derivation of this information is accomplished by the phase detector.

In order to analyze properly the color-killer operation, a schematic diagram of the system is presented in Fig. 1. Investigation of this schematic diagram will show how the color-killer system is utilized under conditions of color or monochrome reception.

Reception of a color transmission is assumed for the first analysis. Under this condition, normal operation of the phase detector results in a negative voltage at point A. This negative voltage is dependent upon a burst signal being present in the phase detector. The voltage at point A will also be present at the grid of the color killer, and under these conditions this negative voltage is sufficient to cut off the tube. The plate circuit contains a winding of the horizontal-output transformer, and this winding introduces a positive pulsating DC voltage. No current will flow through the tube because the grid is held at cutoff. Point B in the plate circuit of the color killer is connected to the grid of the bandpass amplifier. The condition of no-current flow in the color killer allows the grid of the bandpass amplifier to remain at a normal operating point, and color information is allowed to pass through this stage.

The second analysis deals with the condition existing during the transmission of a monochrome signal. This transmission does not contain a burst signal; therefore, it is obvious that no burst signal is applied to the phase detector. As a result, the voltage present at point A does not place the color-killer tube at cutoff.

As a result, the color-killer tube is in a state of conduction and plate current will flow. This plate current flows through resistor R58 and places point B at a negative potential with respect to ground. This negative potential appears as bias on the control grid of the bandpass amplifier. As a result, the bandpass amplifier is cut off and no signals are permitted to pass through this stage. Therefore, there will be no signal applied to the color demodulators.

Under the conditions outlined, for monochrome reception, the video

* * Please turn to page 92 * *

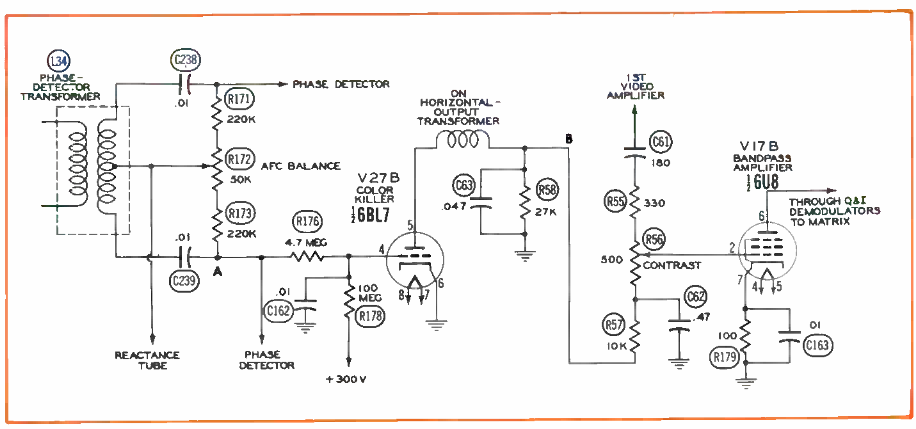
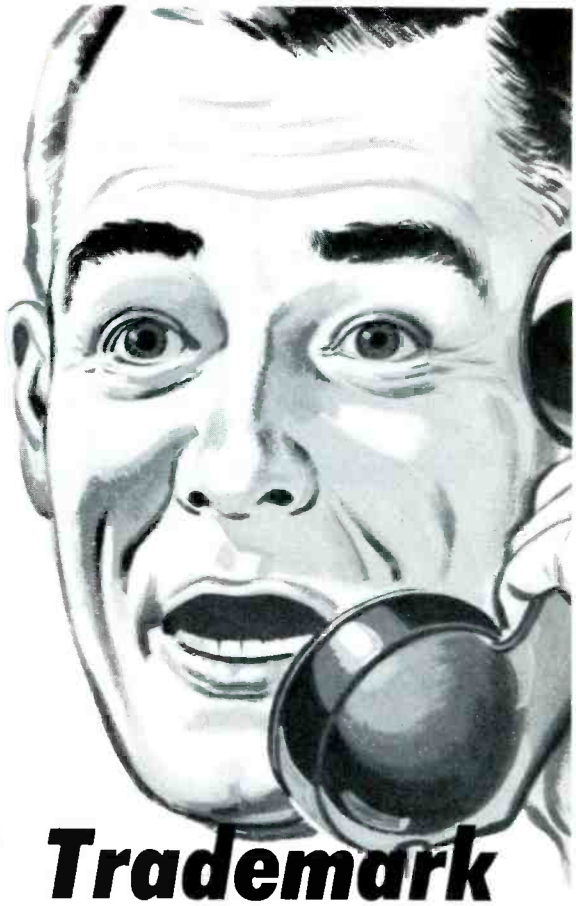


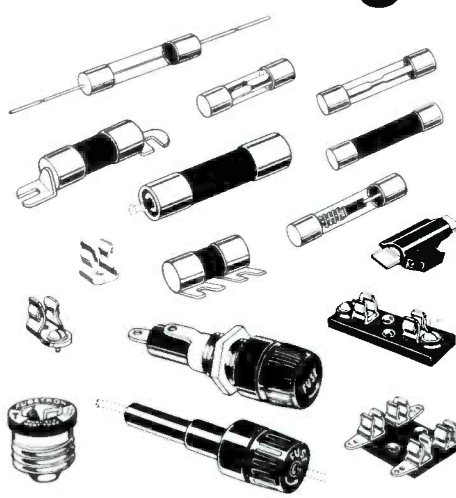
Fig. 1. Schematic Diagram of the Color-Killer Section and Associated Stages.

The Quality of Your Service can be no better than the Quality of the Parts You Handle



WHEN POOR QUALITY OR FAULTY DESIGN OF A COMPONENT PART CAUSES TROUBLE—YOU ARE MORE LIKELY TO GET THE BLAME THAN THE MAKER OF THE PART.

In Fuses the BUSS Trademark represents unquestioned High Quality!



Why take a chance with your goodwill, reputation and profits when BUSS and FUSETRON Fuses are available?

To maintain highest quality *every BUSS and FUSETRON fuse used by the electronic industries is electronically tested.* A sensitive testing device rejects any fuse that is not correctly calibrated, properly constructed and right in all physical dimensions.

BUSS quality means dependable electrical protection under all service conditions and — BUSS quality means fuses that blow to protect — never needlessly.

IN SALES AND SERVICE capitalize on the BUSS Trademark

Every BUSS Fuse you sell or use in service helps in its little way to build up your reputation for quality and service for in millions of installations in homes, on farms and in industry during the past 38 years the BUSS trademark has become known as standing for fuses of unquestioned dependability and high quality.

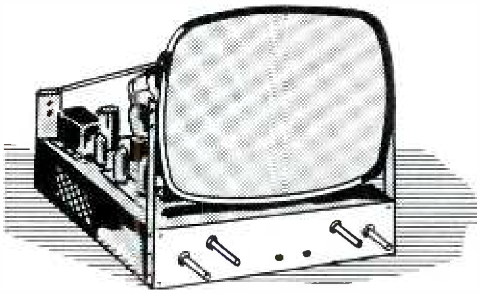
BUSSMANN MFG. CO., University at Jefferson, St. Louis 7, Mo.
(Division of McGraw Electric Company)

Bulletin SFB gives the facts on

Buss Small Dimension FUSES and HOLDERS

Send today for your copy — it's FREE!

Stocking the Tube Kit



SUGGESTED MINIMUM STOCK REQUIREMENTS FOR DELUXE OR STANDARD TUBE KITS

The servicing of television receivers in the home has become an important phase of the servicing business. Efficient and rapid trouble shooting provide the keynote of this type of servicing. In order to meet this requirement, it is necessary for the service technician to have the tools and parts needed when making a service call. However, it is impossible to have all of the facilities that are provided in the shop. The question arises as to what may be taken and what must remain at the shop. In an effort to alleviate this problem, the following service kits have been devised.

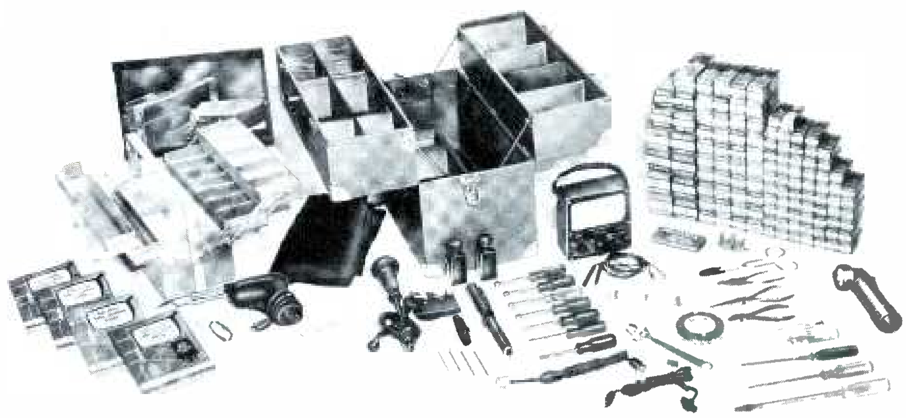


Fig. 1 The Deluxe Tube Kit

The "Deluxe Kit" illustrated in Fig. 1 is designed for the service technician making a large number of service calls before returning to the shop. It contains items which allow a very high percentage of repairs to be made on home service calls. This kit contains 117 tubes

* * Please turn to page 75 * *

CHART I

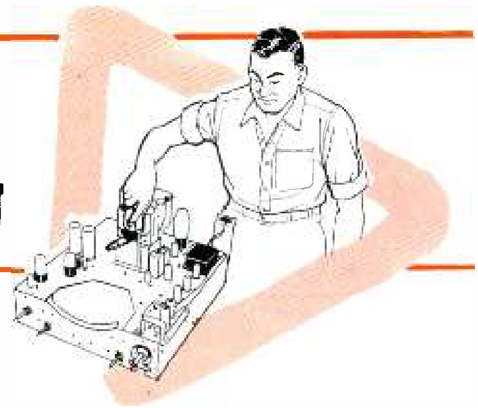
CONTENTS OF THE DELUXE KIT

TUBE TYPES	TV MODELS 52-53 (quant.)	TV MODELS 46-53 (quant.)	TUBE TYPES	TV MODELS 52-53 (quant.)	TV MODELS 46-53 (quant.)	TUBE TYPES	TV MODELS 52-53 (quant.)	TV MODELS 46-53 (quant.)	TUBE TYPES	TV MODELS 52-53 (quant.)	TV MODELS 46-53 (quant.)	TUBES TYPES	TV MODELS 52-53 (quant.)	TV MODELS 46-53 (quant.)
1B3GT	2	2	6AQ7GT	1	1	6BK5	1	1	6SL7GT	1	1	12AT7	2	2
1V2	0	1	6AS5	1	1	6BK7	1	1	6SN7GT	4	4	12AU6	0	1
1X2A	2	2	6AT6	1	1	6BL7	1	1	6SQ7	0	1	12AU7	2	2
5U4G	4	4	6AU5GT	1	1	6BN6	1	1	6SQ7GT	1	1	12AX4	1	1
5V4G	0	1	6AU6	4	4	6BQ6	3	2	6T8	2	2	12AV7	1	1
5Y3GT	1	2	6AV5GT	1	1	6BQ7	2	2	6T4*	1	1	12AX7	1	1
6AB4	1	1	6AV6	2	2	6C4	2	2	6U8	1	1	12AZ7	1	1
6AC7	2	2	6AX5GT	1	1	6BZ7	1	1	6V6GT	2	2	12BH7	1	1
6AF4*	2	2	6AX4	0	1	6CB6	3	3	6V3	1	1	12BY7	1	1
6AG5	2	2	6BA6	1	2	6CD6	2	2	6W4	3	3	12SN7GT	1	1
6AG7	1	1	6BC5	2	2	6J5	1	1	6W6GT	1	1	25BQ6GT	1	1
6AH4	1	1	6BE6	2	1	6J5GT	1	1	6X5GT	1	1	25L6GT	1	1
6AH6	1	1	6BF5	1	1	6J6	3	3	6X8	1	1	25W4GT	1	1
6AK5	1	1	6BG6G	2	2	6K6GT	2	2	6Y6G	1	1	25Z6	0	1
6AL5	2	2	6BH6	0	2	6S4	1	1	7C5	0	1	5642	2	2
6AQ5	2	2	6BJ6	0	1	6SH7	0	1	7N7	1	1			

*For UHF Areas

Tube Kit	Flashlight	Hex & Spline Wrench Set	Fuses	Hand Drill & Drills
Television Tube Location Guides, TGL 1-2-3-4	Power-Line Cords	Alignment-Tool Kit	Hardware (Misc. nuts, bolts, washers, etc.)	Picture-Tube Cleaner
Mirror	Pliers, Long Nose	Screwdriver 1/8" x 6"	Pin Straightener, 7 & 9 Pin	Contact Cleaner
Volt-Ohm-Milliammeter, Test Leads	Pliers, Combination	Screwdriver 1/4" x 6"	Electrical Tape	Wiping Cloths
Soldering Gun	Pliers, Diagonal Cutters	Screwdriver 3/32" x 3"	Tube & Parts Extractor	Cement
Solder	Wrench, Crescent	Screwdriver, Phillips #2	AC Plug	Pilot Lamps
	Knife	Screwdriver, Copper Beryllium	AC Receptacle, TV	Knob Springs
	Hex-Nut Drivers, #6-7-8-9-10-11-12	Drop Cloth		Tube Price List
				Crosshatch Generator, (Desirable)

In the Interest of . . .
Quicker Servicing



by DON R. HOWE

Observing Deflection-Coil Waveforms

The tracing of troubles in television sweep systems often requires acquisition of as much information as possible from the circuit involved. It is often desirable that this information include waveforms present in the deflection coils; however, no point is readily available where these waveforms may be observed. By a relatively simple method, such a point can be provided. This is accomplished in the following manner. A 15- to 20-ohm resistor is placed in series with one of the leads to the vertical-deflection coils. Consequently, all current flowing through these coils must pass through the resistor. The resultant voltage developed across this resistor will provide a waveform corresponding to the current in the vertical-deflection coil. An oscilloscope is then connected across this resistor. The oscilloscope presentation will be that of the desired waveform and is shown in Fig. 1A.

A similar method is employed for the horizontal-deflection coils. The current in these coils is greater than that in the vertical coils; therefore, a smaller resistor is used. The value of this resistor is from 10 to 15 ohms. The resultant waveform will be similar to the one appearing in Fig. 1B. A shorted section of the horizontal-deflection coils produced the waveform shown in Fig. 1C.

The foregoing method may be useful in localizing difficult troubles in the sweep circuits and will assist in determining the condition of the deflection coils.

A Yoke-Removal Problem

Problems in television servicing are frequently encountered in which both ingenuity and knowledge are required in their solution. Since the methods employed for solving these problems are often unusual, they may benefit other service technicians who encounter the same or similar problems. Such a condition is described in the following which is from a case history submitted by Mr. Al Lustig of the Navarre Radio and Television Laboratory, 4218 Avenue "S," Brooklyn, New York.

A television receiver was encountered in which excessive heat had been present in the deflection yoke. This heat had resulted in a melting of the yoke insulation. This insulation then flowed onto the neck of the picture tube and became hardened, thus forming a strong bond between the yoke and the picture tube. The problem was to remove the defective yoke without damaging the picture tube. Cutting away the insulation would be a laborious process and might easily result in breaking the neck of the tube. Therefore a simpler and faster method was desired. The following is a description of an effective solution to this problem.

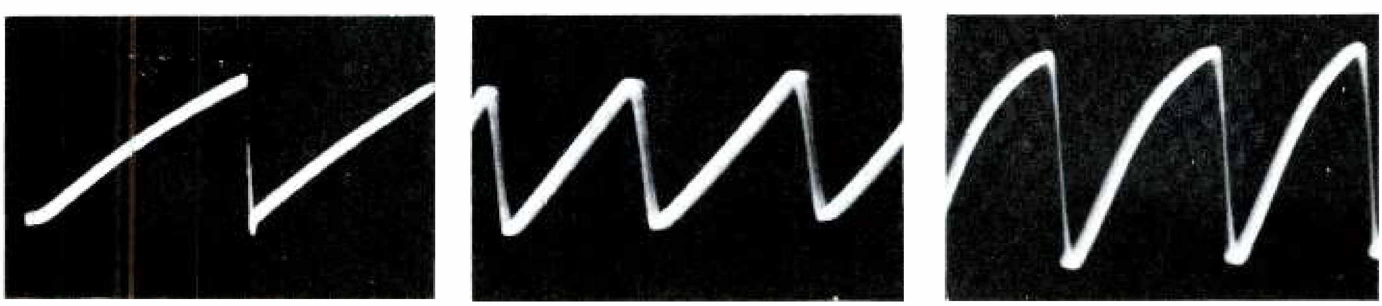
It was determined that the best method of removing the yoke would be by melting the bond formed between the yoke and the picture tube. The application of heat to melt this bond must be made in a manner that will not damage the picture-tube neck.

The four deflection-yoke leads were first disconnected from the receiver. The leads from the horizontal-deflection coils were then connected in series with a 1,200-watt electric heater, as shown in Fig. 2. Application of 117 volts AC caused current to flow through the deflection coils. This current generated enough heat to melt the insulation. After only 30 seconds, the yoke was easily removed; and the picture tube remained undamaged.

Safety-Glass Removal

In some television receivers, the safety glass may be removed from the front of the cabinet without removing the receiver chassis. Re-

* * Please turn to page 85 * *



(A) Vertical-Deflection-Coil Waveform. (B) Horizontal-Deflection-Coil Waveform. (C) Waveform With Shorted Turns in the Horizontal-Deflection Coils.

Fig. 1. Deflection Current Waveforms.

Get the Newest, Finest

UHF Conversion Handbook

from one of these Westinghouse Tube Distributors

FREE with your next 25-tube order

ALABAMA
Birmingham — James W. Clary Co.
Birmingham — Moore-Handley Hardware Co.
Mobile — Moore-Handley Hardware Co.

ARKANSAS
Little Rock — Southern Radio Supply

CONNECTICUT
Bridgeport — Hatry of Bridgeport
Hartford — Hatry of Hartford
New Haven — Hatry of New Haven
Stamford — Hatry of Stamford
Waterbury — Hatry of Waterbury
Danbury — Pilgrim Electronics Co.

DELAWARE
Wilmington — D & M Radio Sales & Service Co.

DISTRICT OF COLUMBIA
Washington — Electronic Wholesalers, Inc.
— Silberne Radio & Electronics Co.

FLORIDA
Jacksonville — Bay Co.
— Thurow Distributors Inc.
Miami — Herman Radio Supply Co.
— Thurow Distributors Inc.
Orlando — Thurow Distributors Inc.
Pensacola — Grice Radio & Electronics Supplies
St. Petersburg — Thurow Distributors Inc.
Tallahassee — Thurow Distributors Inc.
Tampa — Thurow Distributors Inc.
West Palm Beach — Thurow Distributors, Inc.

GEORGIA
Atlanta — Herndon-Thomas Electronics
— Specialty Distributing Co.
— Yancey Co., Inc.
Albany — Specialty Distributing Co.
Augusta — Specialty Distributing Co.
Macon — Specialty Distributing Co.
Savannah — Specialty Distributing Co.
— Yancey Co., Inc.

ILLINOIS
Alton — Radonics Alton, Inc.
Chicago — Broadwin Radio & TV, Inc.
— Chauncey's, Inc.
— Clayton Radio Parts
— Irving Joseph, Inc.
— J. G. Bowman & Co.
— Radio Parts Co.
— Walker-Jimieson, Inc.
Danville — Bud Electronic Supply Co.
Elgin — Elgin Electronic Supply
Joliet — Joliet Radio Supply
Kankakee — Radio Doctors Supply House
Oak Park — Melvin Electronics, Inc.
Peoria — Warren Radio Co.
Rockford — Superior Radio Co.
Rock Island — Tri-City Radio Supply, Inc.

INDIANA
Angola — Shaw Engineering Co.
Columbus — H. A. Williams & Co.—Radio Parts
Evansville — Hutch and Son
Ft. Wayne — Wall Distributing Co.
— Warren Radio Co.
Hammond — Broadwin Television & Radio, Inc. of Indiana
Indianapolis — Graham Electronics Co. Inc.
— Meunier Radio Supply Co.
— Warren Radio Co.
Marion — Mobile Radio Supply Co.
Terre Haute — Archer & Evinger
Valparaiso — Jess Bowman & Assoc.

IOWA
Cedar Rapids — Gifford-Brown, Inc.
Council Bluffs — World Radio Laboratories
Davenport — Tri-City Radio Supply
Des Moines — Gifford-Brown, Inc.
— Radio Trade Supply Co.

KANSAS
Pittsburg — Pittsburg Radio Supply
Topeka — Overton Electric
Wichita — Radio Supply Co.

KENTUCKY
Lexington — Lex-Tronics
Louisville — Peerless Electronic Equipment Co.
— Universal Radio Supply Co.
Paducah — Warren Radio Co.

LOUISIANA
Baton Rouge — 'Ole Miss Supply
New Orleans — Atlas Radio Supply
— Crescent Radio & Supply Inc.
— 'Ole Miss Supply
— Pelican Radio Supply
Sulphur — General Electronic & Engineering Service Corp.

MAINE
Hallowell — Powell Radio Supply

MARYLAND
Baltimore — Wholesale Radio Parts Co. Inc.

MASSACHUSETTS
Boston — Commercial Radio Corp.
— Gerber Radio Supply Co.
— Lincoln Electronic Supply Corp.
— Radio Wire Television, Inc.
Lynn — Essex Electrical Supply Co. Inc.
Natick — Willett Radio Supply
New Bedford — E. A. Ross & Co.
Springfield — Regent Sales, Inc.

MICHIGAN
Battle Creek — Electronic Supply Corp.
Benton Harbor — Benton Electronic Supply Co., Inc.
Detroit — Glendale Electronic Supply
Flint — Lifsey Distributing Company
Grand Rapids — Radio Parts, Inc.
Wholesale Radio Co.
Highland Park — Hi-Park Distributor
Jackson — Matteson Electronics, Inc.
Muskegon — Bell Lourim Electronics, Inc.
Pontiac — Electronic Supply Co.

MINNESOTA
Duluth — Lew Bonn Co.
Minneapolis — Electronic Center, Inc.
— Lew Bonn Co.
St. Paul — Lew Bonn Co.

MISSOURI
Kansas City — Manhattan Radio Supply
— Radiolab
St. Louis — Van Sickle Radio Co.
— Radonics Co.

NEW JERSEY
Hackensack — American Distributing Co.
Hillside — Sherwood Distributors, Inc.
Jersey City — Hallmark Electronics Corp.
Manville — Masters TV Supply Co.
Newark — Emerson-New Jersey, Inc.
— Radio Wire Television, Inc. of N.J.
— Variety Electric Co., Inc.
North Bergen — American Distributing Co.
Paterson — Jersey Electronic Distributing Co.
Perth Amboy — Bennett's Radio Supply
Teterboro — Van Dusen Aircraft Supplies
Trenton — Allied Electrical Appliance Parts, Inc.

NEW YORK
Albany — Air Waves Electronic-Radio Dist. Co.
Binghamton — Stack Electronic Supply Co.
Brooklyn — Ace Electronics
— Bay Electronic Distributors
— Benray Electronics Corp.
— Hygrade Electronics, Inc.
Buffalo — Buffalo Electric Co. Inc.
— Radio Electric Products, Inc.
Elmira — Le Valley McLeod, Inc.
Fredonia — Barker-Higbee, Inc.
Ithaca — Stallman of Ithaca, Inc.
Mineola — Emerson-Long Island, Inc.
Monticello — Fleisher Distributors, Inc.
Newburgh — Chief Electronics, Inc.
New Rochelle — Transvision, Inc.
New York City — Barry Electronic Corp.
— Bay Electronic Distributors
— Emerson-New York, Inc.
— House of Electronics
— Magic-Vue Television Corp.
— Midway Radio & Television Corp.
— Milo Radio & Electronics Corp.
— Radio Wire Television, Inc.
— Sanford Electronics Corp.
Patchogue — South Bay Radio Distributors
Poughkeepsie — Chief Electronics, Inc.
Rochester — Maseline Radio & Electronic Equipment, Inc.
Rome — Rome Electronic Supply
Staten Island — B & D Distributing Co.
Syracuse — Karl-Williams Co., Inc.
Troy — Troy Electronics Distributing
Utica — Electronic Laboratories & Supply Co.
White Plains — Emerson Radio Westchester, Inc.

NORTH CAROLINA
Charlotte — Dixie Radio Supply Co.
— Westinghouse Electric Supply Co.
Greensboro — Westinghouse Electric Supply Co.
Hickory — Victor Radio TV Supply Co.
Raleigh — Raleigh-Allied Electronics, Inc.
— Westinghouse Electric Supply Co.
Salisbury — Leonard Electronics of Salisbury, Inc.

OHIO
Akron — Sun Radio Co.
Canton — Burroughs Radio, Inc.
Cincinnati — Holub & Hogg
— Mytronic Co.
— Radio TV & Refrigeration Supply, Inc.
Cleveland — Radio Electronic Parts Corp.
Columbus — Buckeye Electronics
— Electronic Supply Corp.
— Whitehead Radio Co.
Dayton — Allied Supply Co., Inc.
— Stotts-Friedman Co.
Lima — Allied Supply Co., Inc.
Mansfield — Burroughs Radio Inc.
Marion — Servex Distributing Co.
Toledo — Lifetime Electronics
— Warren Radio Co.
Warren — Radio Specialties
Youngstown — Radio Parts Co.

OKLAHOMA
Oklahoma City — Dulaney's
— Electronic Supply Co.
Tulsa — S & S Radio Supply

PENNSYLVANIA
Allentown — Radio-Television Supplies
Braddock — Marks Parts Co.
Erie — B & D Wholesale Distributing Co.
Harrisburg — Harrisburg Radio Laboratory Supply
Hazelton — Moyer Electronic Supply Co., Inc.
New Brighton — Television Parts Co.
Philadelphia — Allied Elec. Appliance Parts, Inc
— Almo Radio Co.
— Barnett Bros. Radio Co.
— Herbach & Rademan Co.
Pittsburgh — Cameradio Co.
— Radio Parts Co. Inc.
— Tydings Co.
Scranton — General Radio & Refrigeration Co.
— Penn Electrical Engineering Co.
Wilkes-Barre — General Radio & Electronic Co.
York — York Radio & Refrigeration Parts

RHODE ISLAND
Providence — Television Accessory House

SOUTH CAROLINA
Columbia — Dixie Radio Supply Co.
— Westinghouse Electric Supply Co.
Florence — Dixie Radio Supply Co.
Greenville — Dixie Radio Supply Co.
— Westinghouse Electric Supply Co.
Spartanburg — McElhanney Co., Inc.

TENNESSEE
Chattanooga — Mills & Lupton Supply Co.
— Specialty Distributing Co.
Kingsport — Chemcity Radio & Electric Co.
Knoxville — Chemcity Radio & Electric Co.
Memphis — Electronic Supply, Inc.
— McGregor's, Inc.
— W & W Distributing Co.
Nashville — Currey's Wholesale Distributors
— Electra Distributing Co.
— Moore-Handley Hardware Co., Inc.

TEXAS
Amarillo — Dulaney's Co., Inc.
Beaumont — Covington Distributing Corp.
Corpus Christi — Hayes Radio Supply Co.
Dallas — Adleta Co.
— Crabtree's Wholesale Radio Co.
Denison — Denison Radio Supply
Ft. Worth — Sutton's Wholesale Electronics
Houston — Angie Radio & Supply Co.
— Electro-Mechanical Products Co.
— Hall, Inc.
Midland — Henderson-Hoff
San Antonio — Mission Radio, Inc.
— Modern Radio Supply
Tyler — Radio Service Supply Co.

VIRGINIA
Bristol — Bristol Radio Supply Corp.
Fredericksburg — J & J Appliance Co.
Lynchburg — Eastern Electric Co.
Newport News — Noland Co., Inc.
Norfolk — Radio Parts Distributing Co.
Richmond — Meridan Electronic Equipment Co.
Roanoke — Leonard Electronics of Roanoke, Inc.
Winchester — Leonard Electronics of Winchester, Inc.

WEST VIRGINIA
Bluefield — Superior-Sterling Co.
Huntington — TV Supply Co.

WISCONSIN
Madison — Superior Radio Co. of Madison
Milwaukee — Electronic Expeditors Co.
— Marsh Radio Supply Co.
Racine — Superior Radio Co.
Wausau — Electronics, Inc.

The above listing was closed as of November 10, 1953. Watch for new Westinghouse Distributor Appointments in your area.

ET-95046

None...
in a Million

A well-known TV and radio set manufacturer reports not one field reject during a 12-month period in which he used over 1,000,000 Mallory FP Capacitors. Yes, it's hard to believe but it happened. And it's

Proof Positive of Mallory Capacitor Dependability

Odds are staggering against such a record but they are all on your side . . . if you use Mallory Capacitors.

You can bet your bottom dollar that jobs *stay* done when you install Mallory Capacitors. That means no loss of time and money on call-backs!

Don't miss a sure thing. The Mallory FP Capacitor line is complete. There's a rating for every set. They are the only Fabricated Plate Capacitors on the replacement market. And they cost no more than ordinary capacitors.

And be sure to use Mallory Plascaps® for plastic tubular replacements. Permanently secured leads . . . no off-center cartridges . . . no premature shorts.

Prove to yourself what manufacturers and thousands of servicemen know—
YOU CAN ALWAYS DEPEND ON
MALLORY CAPACITORS.

P.R. MALLORY & CO Inc
MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

CHECKING VIDEO *Response*

by
William E. Burke

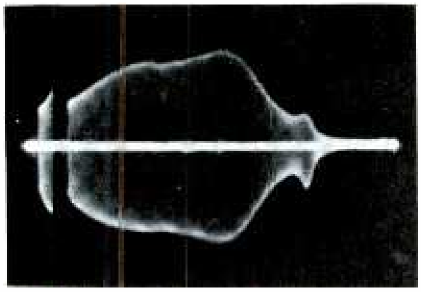
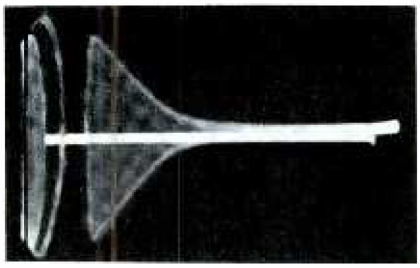


Fig. 1A. Response Curve With Generator Connected Directly to Wide-Band Oscilloscope.

(below)

Fig. 1B. Response Curve With Generator Connected Directly to Narrow-Band Oscilloscope.



A Practical Procedure for Determining the High-Frequency Response of Video Amplifiers and for Setting 4.5-Mc Traps

A complaint frequently encountered by service technicians is that a television receiver produces a picture lacking in fine detail. Since the finely detailed portions of the picture are produced by the higher video frequencies, this indicates that these high frequencies are not being presented to the picture tube. If the RF amplifier, mixer, and IF stages have been checked and are found to be operating satisfactorily, the trouble must lie in the video amplifier. A check of the video amplifier can be made with a voltmeter, but this will not give conclusive proof that the operation is normal. A further check is herein presented to give the service technician a quick, convenient method for determining whether or not a defect is present in the video-amplifier section. Also, several clues are given on the effects that various troubles will have on the high-frequencies-signal amplification.

The requirements imposed on a video amplifier are very strict. It must amplify equally all frequencies from 30 cycles to over 4 mc and still maintain an average gain of 20 to 30. That is, the amplifier must have a flat frequency response and sufficient gain. It is difficult to produce both; for if one is increased, the other will decrease, and vice versa.

Any variation in component values is likely to produce a change in the frequency response of the amplifier; and to detect this change, it is necessary that the frequency response be known. It is possible to construct a graphic curve from

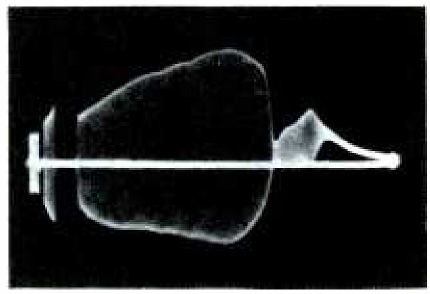
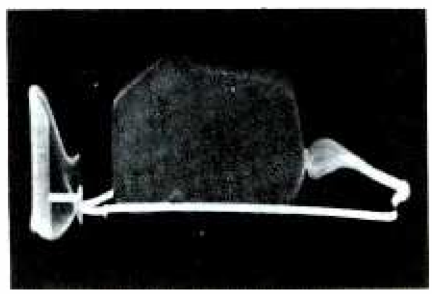


Fig. 3. Normal Response of Video Amplifier.

(below)

Fig. 4. Response Curve Showing Distortion Introduced by Input Capacity of Oscilloscope.



values obtained by measuring the amplification at various fixed frequencies, but this can become a laborious and time consuming process. A much simpler and easier method of determining the video-amplifier response is to employ an oscilloscope and sweep generator in much the same manner as is done in video IF alignment.

The output of an FM signal generator is a frequency-modulated signal that varies between upper and lower frequency limits which are

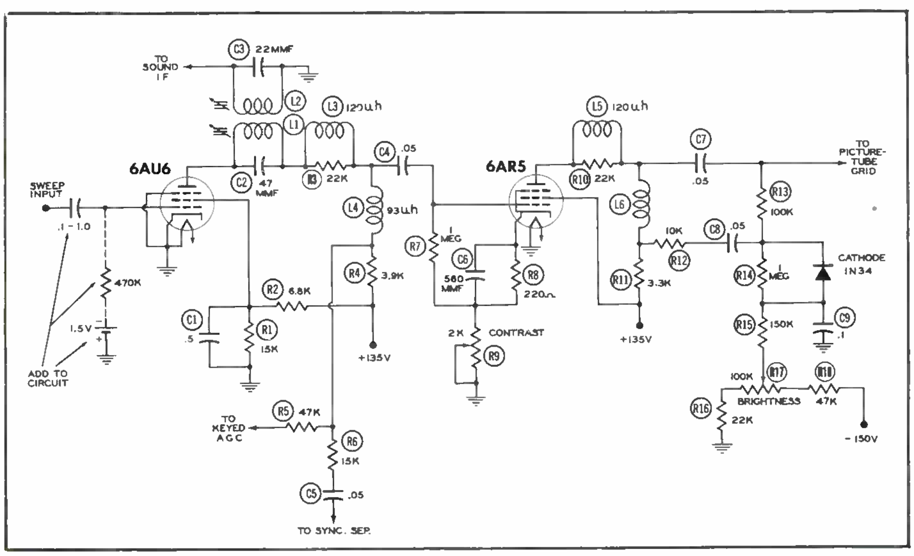
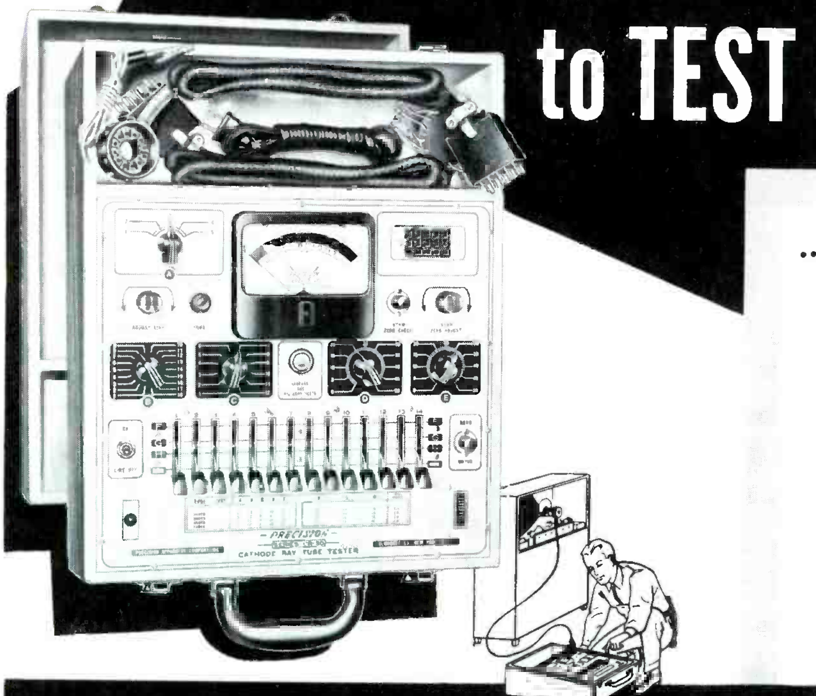


Fig. 2. Schematic Diagram of Video Amplifier Used in Test.

* * Please turn to page 61 * *

It takes a CR TUBE TESTER to TEST a CR TUBE...



...because CR tubes are electrically and physically different from all other types of electron tubes! Some of the more obvious differences include:

PICTURE PRODUCING BEAM CURRENT
EXTREMELY LOW ANODE CURRENTS
DIFFERENT, MULTIPLE OPERATING VOLTAGES
HIGH LEAKAGE and SHORT CHECK LIMITS
MORE and DIFFERENT TUBE ELEMENTS
ELECTROSTATIC FOCUS ELEMENT
ELECTROSTATIC DEFLECTION PLATES
ELECROMAGNETICALLY FOCUSED GUN
ELECTROMAGNETICALLY DEFLECTED BEAM
ETC., ETC., ETC.

YES, IT TAKES A CR TUBE TESTER TO TEST A CR TUBE...

AND THE *PRECISION CR-30*

WAS SPECIALLY DEVELOPED FOR THIS VERY IMPORTANT PURPOSE!

TESTS ALL TV PICTURE TUBES Magnetic & Electrostatic Oscilloscope & Industrial Types

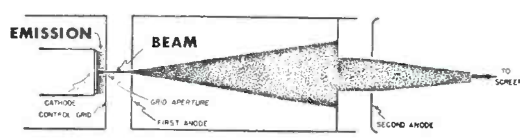
...FOR BEAM CURRENT INTENSITY (Proportionate Picture Brightness)

Stop Guess-Checking with CABLE ADAPTERS!

- *Receiving tube checkers were made for testing receiving tubes and NO CABLE ADAPTER can adapt them to do the job of the CR-30.*
- CABLE ADAPTERS only check for filament continuity, a degree of inter-element short and a so-called emission test.
- CABLE ADAPTERS do not test for the all-important, picture producing beam current.

You can't afford to guess when you test the most expensive component of a TV set.
Be sure with PRECISION Model CR-30!

***IT IS THE ELECTRON BEAM* (and NOT total cathode emission) which traces the pictures on the face of the CR tube.**



Cathode emission can be high, and yet Beam Current (and picture brightness) unacceptably low. *The CR-30 will reject such tubes because it is a Beam Current tester.* Conversely, cathode emission can be low and yet Beam Current (and picture brightness) perfectly acceptable. *The CR-30 will pass such tubes because it is a Beam Current Tester.*

The CR-30 incorporates additional special test facilities necessary for overall performance evaluation of the CR tube as will permit positive answer to the question "Is it the Picture Tube or the TV Set?" And the CR-30 gives the answer in but a fraction of the time required to test the other 2 dozen or so tubes in the set.

SERIES CR-30: In hardwood, tapered, portable case, with hinged, removable cover. 17¼" x 13¾" x 6¾". Complete with standard picture tube cable, universal CR tube test cable and detailed instruction manual. Shipping weight: 22 lbs.

NET PRICE $104.75

PRECISION TEST EQUIPMENT — Standard of Accuracy

PRECISION APPARATUS COMPANY, INC.
92-27 HORACE HARDING BLVD., ELMHURST 13, N. Y.
Export Division: 458 Broadway, New York 13, U.S.A. • Cables—Morhanex
In Canada: Atlas Radio Corp., Ltd., 560 King Street, W., Toronto 2B

Examining DESIGN FEATURES

by HENRY A. CARTER

Automatic Tractor Radio Model TR-12

The Automatic Model TR-12 shown in Fig. 1 is designed and built specifically for installations in farm tractors. The set is housed in a rugged, weather-sealed, steel case and is

Fig. 1. View of Automatic Tractor Radio Model TR-12.

mounted on a base using rubber shock mounts. Supplied with the set is a one-foot length of pipe and a floor flange for mounting the set on the tractor. There is a pamphlet packed with the unit showing four suggested methods of mounting on different types of tractors. Some of these suggested methods may require the use of additional pipe, lumber, and hardware which are readily available.

The TR-12 employs eight tubes, including the rectifier. The 6-by 9-inch speaker is driven by two 6AQ5 tubes connected in a push-pull circuit. The manufacturer states in the specifications that the set is capable of delivering 5 watts of undistorted audio output or 6 watts maximum.

The mounting mechanism is so designed that the receiver can very easily be removed from the tractor. If the tractor is left in the field overnight, the radio can be removed to prevent exposure to the elements or to guard against possible theft. This is done by simply loosening the set screw under the mounting plate and uncoupling the wire at the fuse.

As can be seen in Fig. 1, a telescoping antenna is provided as an integral part of the assembly. No separate antenna mount is required. This arrangement eliminates the need for an antenna cable which might interfere with the operation of the tractor.

Emerson Pocket Radio Model 747

The Emerson Model 747 shown in Fig. 2 has several features which should be of great interest. The most significant one is its extremely small size. Its 6-inch width, 3 1/2 inch height, and 1 1/4 inch depth earn for it the name of pocket radio. It weighs only 1 1/3 pounds complete with batteries.

The set uses a superheterodyne circuit consisting of four miniature tubes, one each of the following types:

1V6 converter

1AH4 IF amplifier

1AJ5 detector, AVC, and AF amplifier

1AG4 power output

Almost all of the components including the volume control and output transformer are miniature in size, as can be seen in Figs. 3 and 4. The speaker is 2 3/4 inches in diameter. The set is powered by an A battery and a B battery which are 1.5 and 45 volts,

Fig. 2. Cabinet View of Emerson Pocket Radio Model 747.

respectively. The B battery used is an Emerson EM 86 or equivalent.

The Emerson Model 747 has molded into the cover two civilian-defense symbols which identify proper tuning points for civilian-defense services. These frequencies are to be used during a national emergency in

* * Please turn to page 82 * *

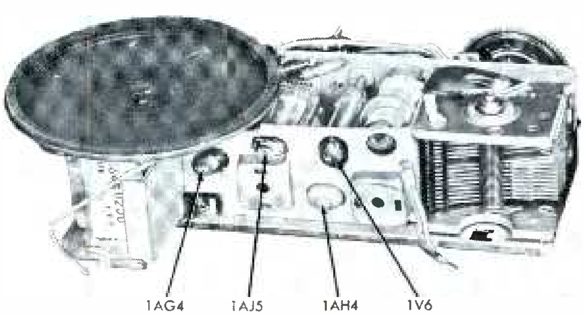


Fig. 3. View of Emerson Model 747 Showing Subminiature Tubes.

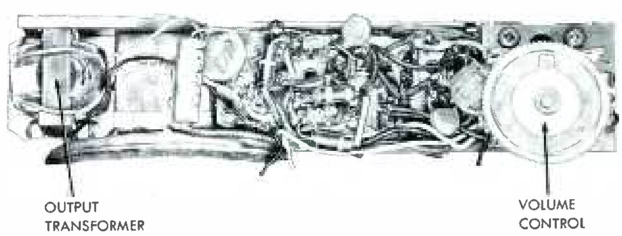
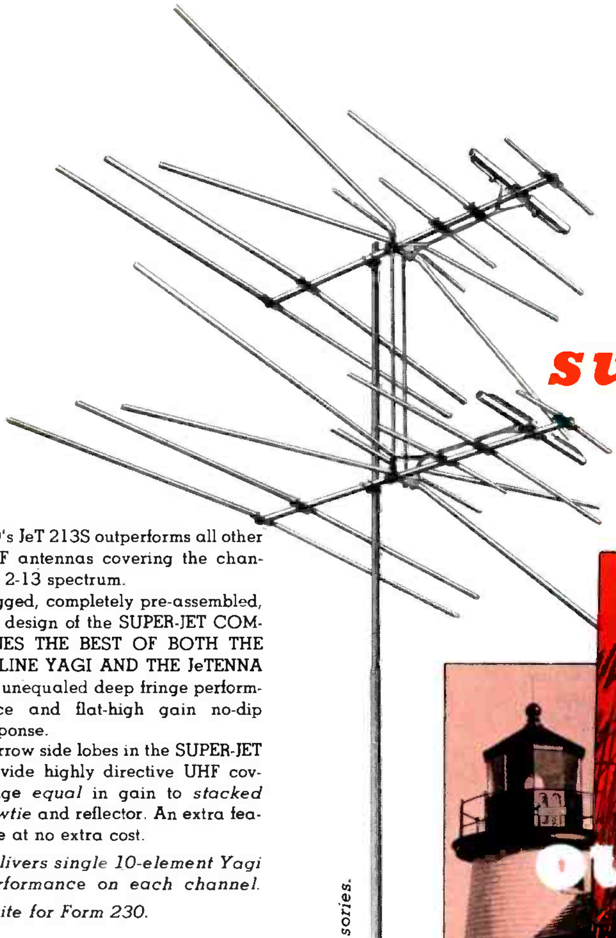
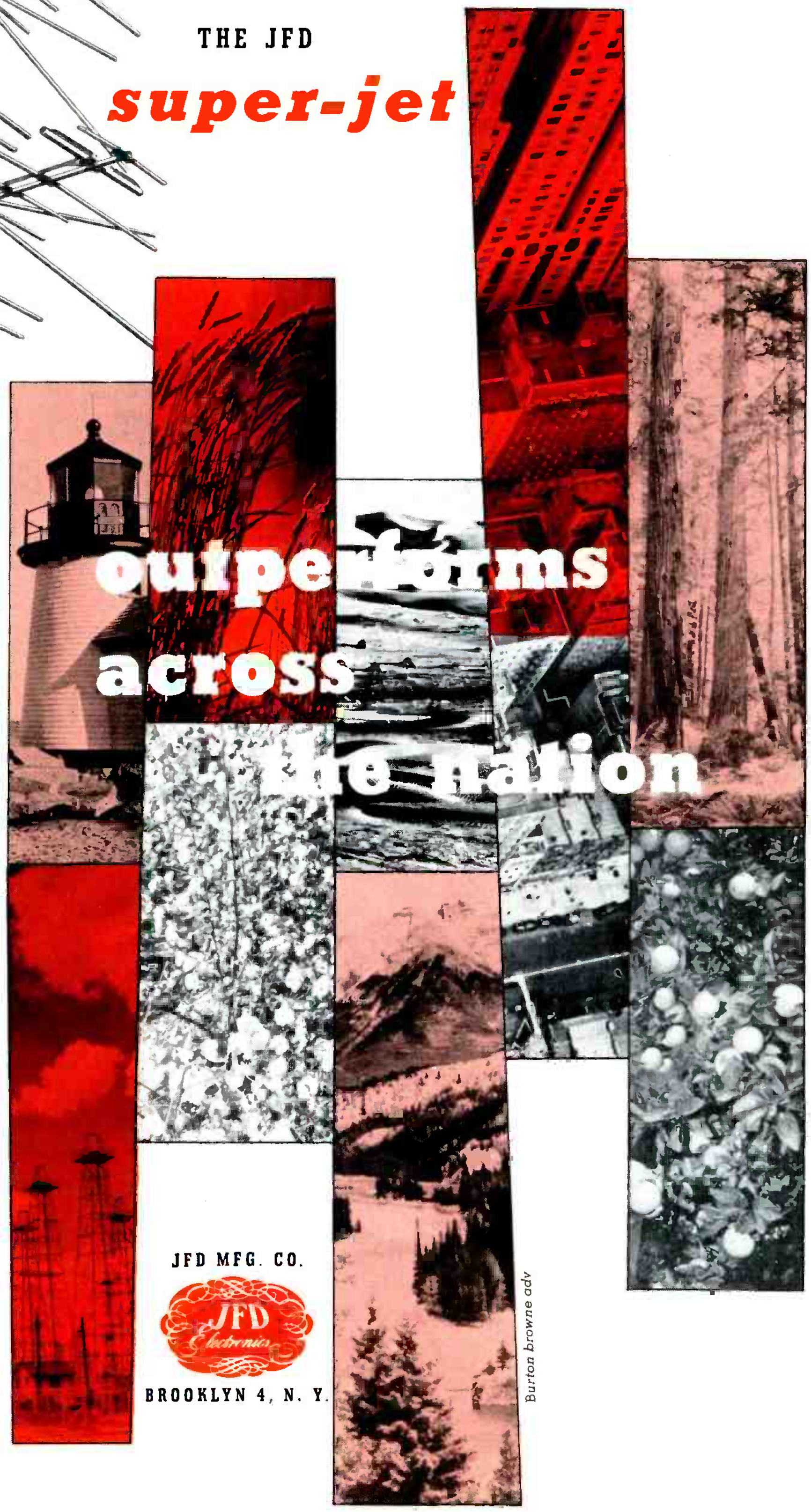


Fig. 4. View of Emerson Model 747 Showing Output Transformer and Volume Control.



THE JFD

super-jet



JFD's JeT 213S outperforms all other VHF antennas covering the channel 2-13 spectrum.

Rugged, completely pre-assembled, the design of the SUPER-JET COMBINES THE BEST OF BOTH THE BALINE YAGI AND THE JeTENNA for unequaled deep fringe performance and flat-high gain no-dip response.

Narrow side lobes in the SUPER-JET provide highly directive UHF coverage *equal* in gain to *stacked bowtie* and reflector. An extra feature at no extra cost.

Delivers single 10-element Yagi performance on each channel.

Write for Form 230.

Worlds' largest manufacturer of TV antennas and accessories.

HERE ARE THE FACTS— COMPARE FOR YOURSELF.

JFD JeT 213 S	Competitor D CHS 2-13 YAGI	Competitor C RADAR SCREEN TYPE B	Competitor B RADAR SCREEN TYPE A	Competitor A MATTRESS (4 STACK)	CHANNELS
6.5	4.50	0.75	0.0	4.0	2
7.5	5.00	3.25	3.0	5.0	3
9.5	5.75	4.5	4.0	7.0	4
8.5	3.00	3.5	3.25	6.25	5
8.5	2.50	3.5	3.0	5.0	6
11.0	3.50	6.0	4.5	5.25	7
11.0	1.00	7.0	7.0	6.0	8
12.0	0.0	6.5	7.0	5.25	9
12.0	.875	7.75	8.0	7.25	10
11.25	.875	8.0	10.0	9.25	11
12.75	.50	7.5	10.0	6.5	12
12.0	7.5	6.0	9.0	7.0	13
DB GAIN					
YES	NO	NO	NO	NO	1" Square Cross Arm
YES	NO	NO	NO	YES	Completely Pre-Assembled
$42.50	$65.90	$47.50	$34.95	$55.00	LIST PRICE

Model JeT 213 · single · $20.75 list

Model JeT 213S* · stacked · $42.50 list

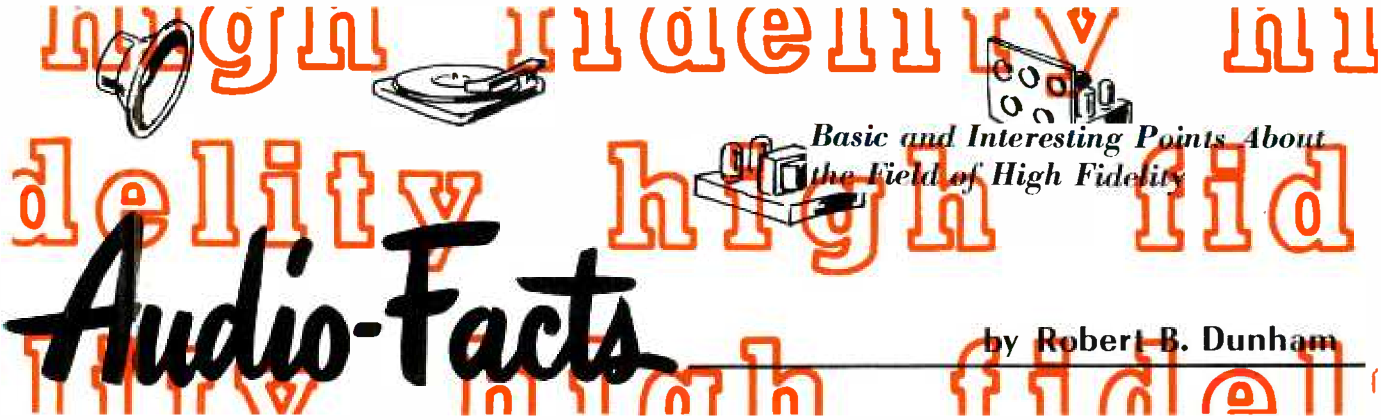
*Complete with stacking transformers.

JFD MFG. CO.

JFD Electronics

BROOKLYN 4, N. Y.

Burton browne adv



Audio-Facts

Basic and Interesting Points About the Field of High Fidelity

by Robert B. Dunham

Introduction

In the past issues of this publication, "Audio Facts" has discussed in some detail the construction, operation, and purpose of several pieces of equipment used in high quality sound systems. Having been concerned with the design and application of these certain units, we have neglected to cover the broader considerations of the how and why of this field of audio now popularly called high fidelity. Since such an approach is certainly worth while, we will now consider some of the things constituting this field, why it is so popular at this time, and also what is required when assembling a high quality audio system. Before going into detail as to the specific units needed for a complete system, it might be well to go into some past audio history and find how and why the present-day high-fidelity system differs from the sound systems of past years.

Why We Have Increased Activity

There are some definite reasons why we have the increasing activity in audio at the present time. Probably one of the most important is that program material of high quality is now available. FM and TV transmissions furnish us with some excellent program material, but no doubt the largest and most often used source is the present-day disc recording. Recording techniques and methods have progressed to such an extent that modern records have been improved to a degree that would have been thought impossible a few years ago. The music recorded on these records now has the desired qualities of full frequency response and wide dynamic range, with distortion and surface noise present only in negligible amounts.

Tape recorders have also had an influence and have gained a prominent place in the high-fidelity field because of their many advantages over other methods of recording. Although they are widely used for home recording and playback, their most important application has been in the professional field where their use in all manner of recording is nearly universal. For instance, practically all material now found on disc recordings was originally recorded on tape.

Sound Reproduced by Old Systems

The sound reproduced by the older type of audio systems that were in general use a few years ago was restricted in frequency response and limited in dynamic range. The absence of the higher frequencies and most of the extremely low tones resulted in sound that lacked naturalness and balance, to mention only two of the many qualities difficult to name or descrive but so essential to satisfactory reproduction of music. The limited dynamic range in volume between the quietest and loudest portions also reduced the effectiveness of the music.

If an effort was made to bring out the higher frequencies, the usual result was a lot of noise and distortion. This was principally because that was about all which was there to be heard, since a very small portion of these higher frequencies was transmitted or recorded. Higher percentages of distortion were also tolerated in audio equipment of that time. Noise and distortion are much more evident and disturbing at the higher frequencies.

To minimize these undesirable effects the so-called tone control (the type which functions by cutting out the highs) was brought into use. This practically eliminated the higher frequencies and gave an apparent boost in the bass response, producing the well-known bassy "juke-box effect." In most instances, the really low tones were not reproduced, but enough of the higher and medium bass frequencies were present to make it seem so.

The important thing is that the ears of the listener became so accustomed and conditioned to this restricted response that it was accepted as being normal and the desired reproduction.

In connection with ears becoming conditioned to restricted sound reproduction, it might be well to consider the fact that we seldom hear an actual live musical performance any more. Some method of sound reinforcement is used in nearly all instances, whether it is indoors or outdoors, a dance band or symphony orchestra. We have the influence of the microphones and all of the associated equipment; and if they give poor reproduction, that is what we hear. It does not sound as real as it should, although we can see the performers.

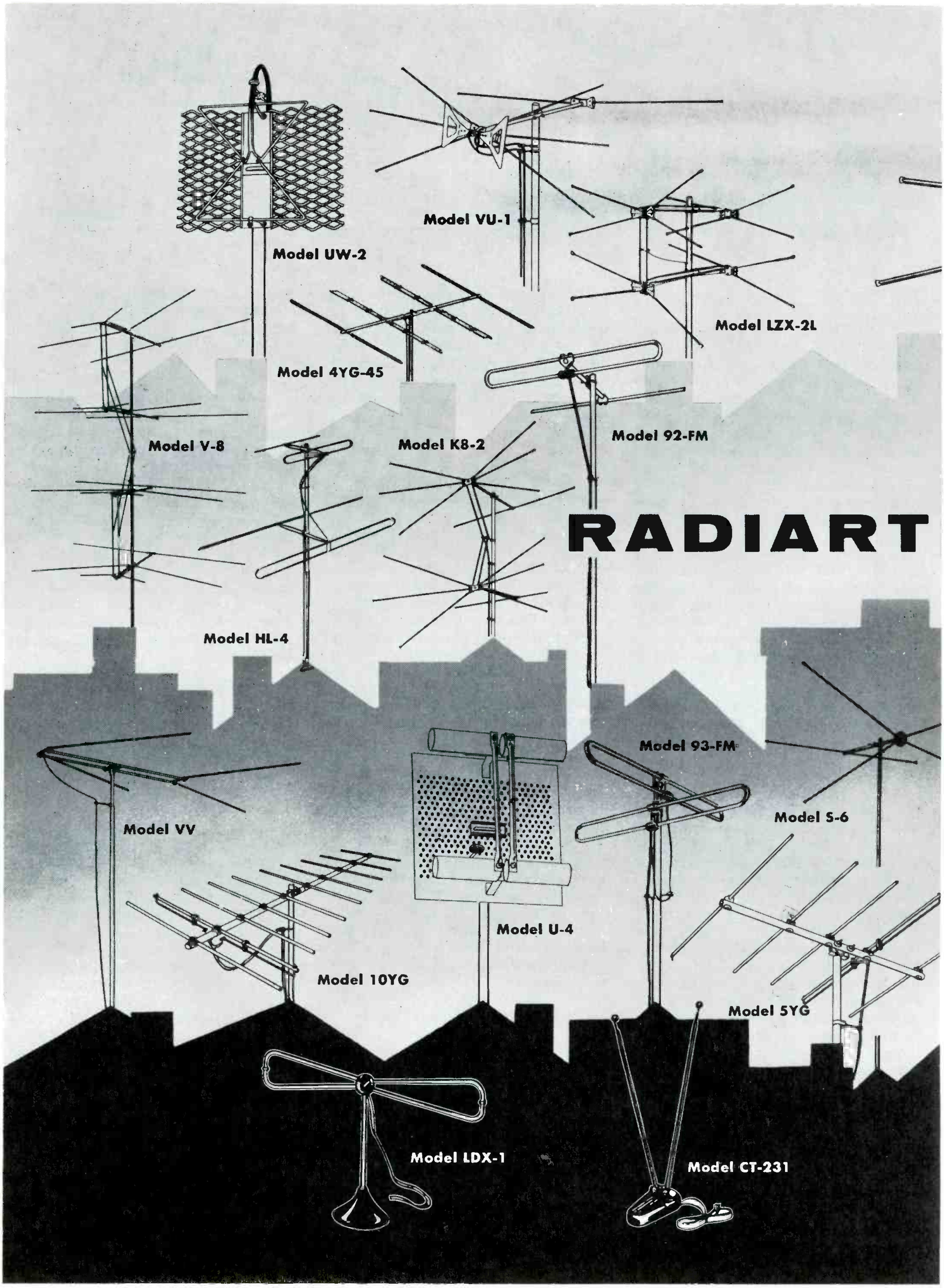
This is one reason why high-fidelity reproduction may sound strange to some one hearing it for the first time. It sounds strange, since actual or real sound is unfamiliar to him because he never hears it.

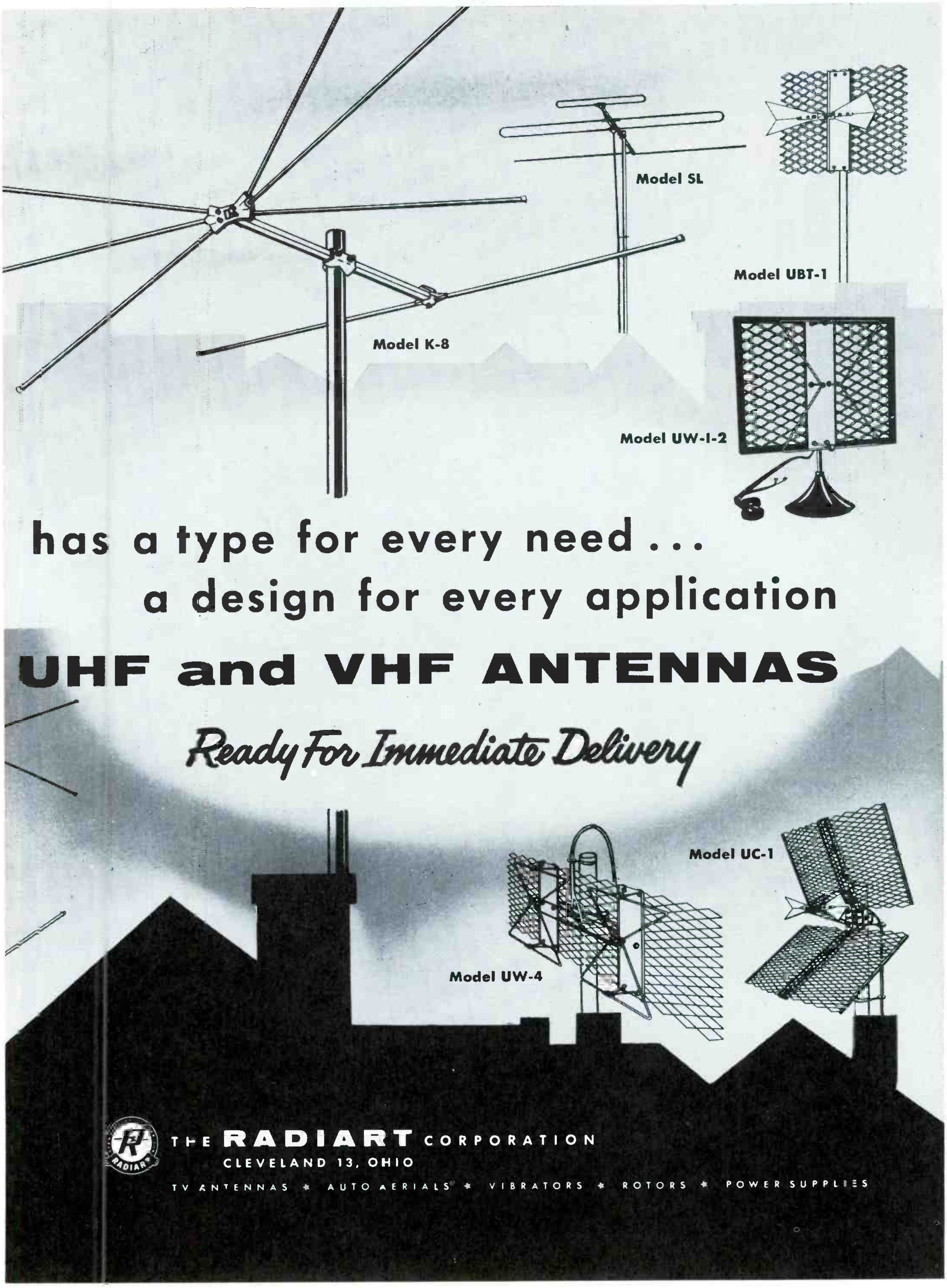
Modern Sound Systems

The modern high quality sound system is necessary if we are to reproduce faithfully the excellent program material available from the sources mentioned previously. This faithful reproduction is the purpose our system and the end result to be obtained. If the music fed into the system is effective and pleasing, it should come out of the loudspeaker just as effective and pleasing.

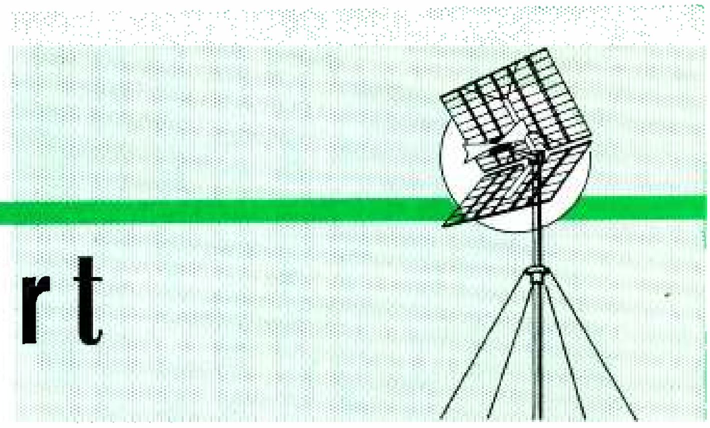
It might have been noticed that we have mentioned high quality sound often rather than high fidelity (Hi Fi). We have had a tendency to shy away from the term, because high fidelity has been applied so often to equipment which is that in name only but far from it in performance. A true high-fidelity system is one that faithfully reproduces the program material fed into it; so, whenever we use

* * Please turn to page 76 * *


Model UW-2
Model VU-1
Model LZX-2L
Model 4YG-45
Model V-8
Model K8-2
Model 92-FM
RADIART
Model HL-4
Model 93-FM
Model VV
Model S-6
Model U-4
Model 10YG
Model 5YG
Model LDX-1
Model CT-231


Model SL
Model UBT-1
Model K-8
Model UW-1-2
has a type for every need . . .
a design for every application
UHF and VHF ANTENNAS
Ready For Immediate Delivery
Model UC-1
Model UW-4
THE RADIART CORPORATION
CLEVELAND 13, OHIO
TV ANTENNAS ★ AUTO AERIALS ★ VIBRATORS ★ ROTORS ★ POWER SUPPLIES

Guying Chart



A Handy Reference for Calculating Guy-Wire Lengths

by William E. Burke

A common trouble encountered in the installation of antenna towers is the determination of the length of guy wire that is required. The average installer will usually make a rough calculation and then add an extra length so that the guy wires will always be longer than actually needed. This is then cut off after the tower is erected. The installer thus has left a number of short, almost useless lengths of wire. This chart (Fig. 1) is presented with the intention of eliminating all calculations and waste. It is also useful for determining the values of other variable factors encountered in antenna installations.

There are several stipulations that are applicable to this chart. The angle formed between the tower and any guy wire should never be less than 30 degrees. The lines on the chart are drawn at this angle and are intended to serve as a minimum limit for any guy wire. If the line drawn on the chart by the installer to determine the guy-wire length should be parallel to or in a more horizontal plane than the lines present on the chart, the installation is suitable. The installation is not recommended when the resultant line on the graph lies in a plane more vertical than the lines shown. This particularly applies when guy wires from various heights on the tower are returned to a common anchor. The wire connecting to the highest point on the tower should not produce an angle of less than 30 degrees. It can be seen that all those below this point will then form angles greater than 30 degrees. An increase of 3 to 5 feet should be made to each guy-wire length determined from the chart in order to allow for sag and fastenings.

The tower height in some installations may be limited wher any or all guy-wire-anchor locations are confined to a given area. The maximum height of tower which can

* * Please turn to page 81 * *

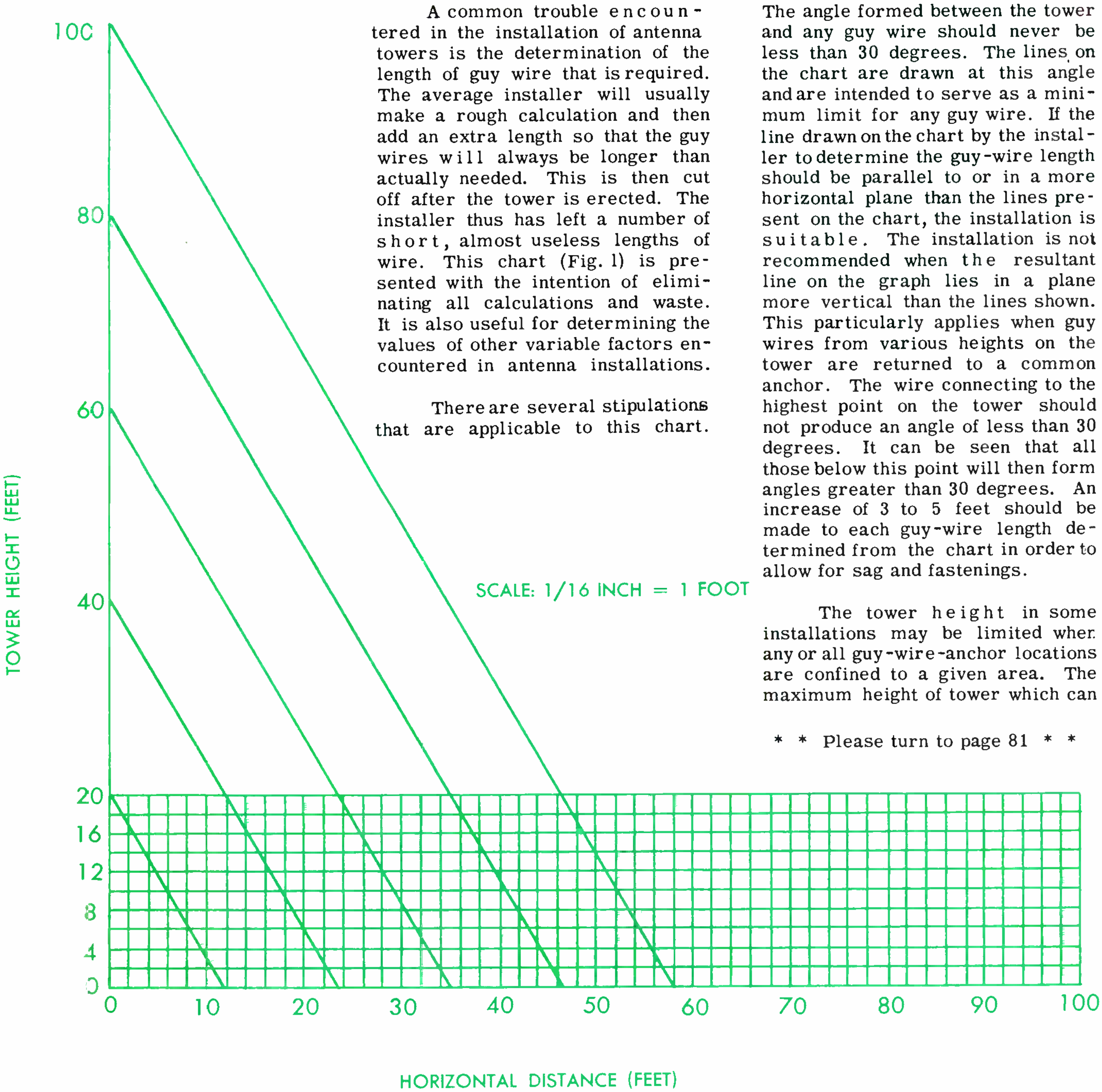


Fig. 1. Guying Chart

CBS-COLUMBIA
GENERAL ELECTRIC
PHILHARMONIC
WESTINGHOUSE
MOTOROLA
SYLVANIA
HOFFMAN
EMERSON
PHILCO
ADMIRAL
MUNTZ
RCA

Designed for quick, simple installation, these Stancor flybacks save your time. There are no holes to drill, no leads to splice. Terminal board layouts duplicate the original units—even include choke coils, resistors, tube sockets and any other components that are on the original.

Stancor TV replacements are listed in Sams' Photofact Index, Counterfacts, Rider Manuals and Tek-Files

•

CHICAGO STANDARD TRANSFORMER CORPORATION

3594 ELSTON AVE., CHICAGO 18, ILL.

•

EXPORT SALES: Roburn Agencies, Inc.
39 Warren Street • New York 7, New York

Dollar and Sense Servicing

by *John Markus*

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

CALLS. Latest average we've heard for TV, though not backed by survey statistics, is 2 calls per year per set with replacement of 4 tubes during the first 12 months of use. This is quite a drop from the 3.5 average of a year ago and the 5.5 average of 10-incher days. Likely reasons are that manufacturers are making sets and parts better these days, and at the same time users are becoming more tolerant to minor defects in pictures. In addition, transmitters are using higher power, which gives a reserve of signal strength at most receiver locations. As a result, tubes can weaken and parts can drift off value quite a bit before the effect on the picture becomes noticeable.

TREASURE. Heard that one publisher of a popular scientific magazine sold some 45,000 plans for building a radio treasure finder, at a dollar a piece. Wonder how many of these purchasers actually built the thing, and how many had to call on servicemen for help in making it work? The eternal hope of finding buried treasure—the lure of the hunt—is what makes such sales records possible.

Sales of commercial radio metal detectors build up steadily from year to year, too. Units selling for around $400 are giving excellent performance during rigid tests by engineers, but radically cheaper models are reported to be rather useless unless you already know the location of the buried metal to within a few feet. When properly overhauled and adjusted, the war-surplus SCR-625 mine detector that has been selling for around $70 comes close to matching the expensive units.

Primary requirements of a good treasure finder are sensitivity and stability. Sensitivity determines maximum depth of reliable detection of a given size of object and also determines into how many strips a given field has to be divided and walked over.

Secondary requirements are portability, ease of maintenance, over-all weight, and ability to discriminate between ferrous and non-ferrous metals. The latter feature can save digging up tons and tons of scrap iron. In one commercial unit (Fisher Laboratories, Inc., Palo Alto, California), weight is kept down by using apple-box board, painted bright red, for the carrying case as well as for the chassis. Good circuit stability is essential to eliminate having to stop and rebalance the thing every 15 minutes or so.

What more interesting way is there to spend a vacation than seeking ancient treasure on some wave-washed Caribbean Island? There, it doesn't matter much whether the search is successful; the hunting alone will have made the vacation a thousand times more enjoyable than one at a traditional social-events resort.

MINES. One of the greatest military electronic needs of this country today is equipment for detecting the new pressure-sensitive mines that are believed to be perfected now by Soviet Russia. These mines can be dropped from airplanes or submarines; are immune to all mines sweeping, detecting, and countermeasure techniques of World War II; and can even be selectively set to respond only to ships bigger than a certain size.

A ship floating right over such a mine, no matter how huge, will not set off the mine because the weight of the ship is distributed uniformly over all the bottom of that ocean. As soon as the ship starts moving, however, it creates a pressure wave pattern that is related to the size and speed of the ship; this has one peak just ahead of the ship and another, slightly weaker, trailing along behind the ship. These two pressure waves are what trigger off the pressure mine.

So far, the only way of faking the waves is with a dummy ship of the same speed and size; this is far too expensive, because the dummy gets blown up each time it finds a mine. To become a technical hero, figure out a countermeasure for pressure mines. For more non-technical information, read "The Threat of the Pressure Mine" on page 129 of the "Reader's Digest," for September 1953.

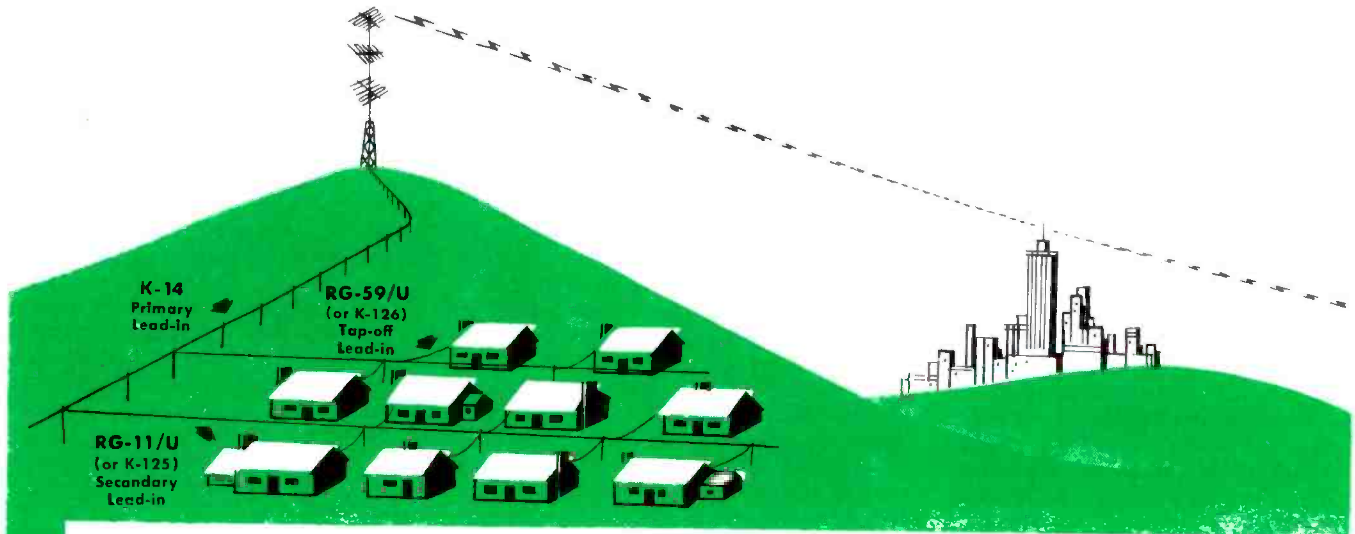
HISTORY. The change from a wood radio chassis to today's metal inverted-cake-pan chassis took place along about 1925. Before that small as well as large parts were base-mounted on a wood breadboard with connections provided by spade lugs, binding posts, spring clips, or end caps. Interconnections were usually made with heavy bare bus bar, though some insulated wire was used. Assembly of such sets was expensive, resulting in the change to pigtail leads for small parts and use of a metal chassis that permitted mounting these right on the terminals of the tube sockets and large top-chassis parts. If you ever see one of these pre-1925 sets that's in good condition, grab it; they're getting scarce and will have real collector value as antiques of radio someday.

* * Please turn to page 93 * *

NORTH, EAST, SOUTH, WEST...

Federal has a lead-in

Whatever the area or atmosphere... city or fringe... rain, snow ice, heat, dust, salt spray, polluted air or radiation... you'll find the answer in these quality-controlled cables by Federal —



FOR COMMUNITY TV
IT'S *Federal's* "BIG 5"

K-14—71-ohm shielded primary transmission line for community distribution systems. Famous for lowest line loss, long cable runs and fewer amplifiers required. Capacitance: 21.5 mmf/ft. Attenuation DB 100/ft: .57—50 Mc; .90—100 Mc; 1.42—200 Mc; 2.3—400 Mc.

RG-11/U—75-ohm shielded low-loss coaxial. One of the best small-diameter cables. Tops as a community TV secondary lead-in. Seven strands #26 tinned copper. Capacitance: 20.5 mmf/ft. Attenuation DB 100/ft: 1.5—50 Mc; 2.15—100 Mc; 3.2—200 Mc; 4.7—400 Mc.

RG-59/U—73-ohm coaxial TV lead-in cable. Highly efficient as a community system pole-to-house tap-off. Meets all needs wherever a high-grade installation is a must. Capacitance: 21 mmf/ft. Attenuation DB 100/ft: 2.7—50 Mc; 4.0—100 Mc; 5.7—200 Mc; 8.5—400 Mc.

Use these 2 for Community TV radiation:

FOR URBAN CENTERS

K-111—300-ohm shielded, balanced TV lead-in developed by FTR. Minimizes noise, snow, ghosts due to transmission line pick-ups. Ideal for many areas where good TV was impossible before. Capacitance: 4.2 mmf/ft. Attenuation DB 100/ft: 3.4—100 Mc; 6.6—400 Mc.

TV-1184—300-ohm dumbbell-shaped TV lead-in. A standard low-cost lead-in for areas without unusual conditions. Cinnamon-brown color is highly resistant to ultraviolet. Two conductors: 7/#28. Capacitance: 4 mmf/ft. Attenuation DB 100/ft: 1.28—100 Mc; 3.0—400 Mc.

TV-1182—300-ohm deluxe type heavy-duty TV lead-in with 90 mil. web. Insulated with "silver" polyethylene, Federal development that provides maximum weather protection and long life. Capacitance: 4 mmf/ft. Attenuation DB 100/ft: 1.22—100 Mc; 2.85—400 Mc.

Non-Radiating Lead-ins for MULTIPLEX TV SYSTEMS

K-125—75-ohm coaxial TV lead-in cable. Double-shielded and jacketed. Formerly listed as SP-75.

K-126—73-ohm coaxial TV lead-in cable. Double-shielded and jacketed. Formerly listed as SP-76.

K-125 alternates for RG-11/U as secondary lead-in
K-126 alternates for RG-59/U as tap-off lead-in

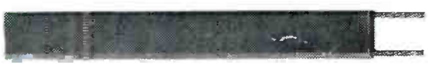
Wherever there are TV customers...

for the finest VHF-UHF

Federal's TV-1185

..."PIPELINE" of the Air!

FOR FRINGE AREAS



TV-1182—Provides remarkably low line loss in fringe areas. Outstanding for resistance to weather and sunlight. Silver-colored insulation blends with any color scheme in home decoration.

K-200 (RG-86/U)—200-ohm heavy-duty ultra low-loss lead-in. Particularly adaptable to remote-area installations — especially long runs and multi-stack antennas. Also used with rombics.

See your local Federal Distributor or write to Federal direct Dept. D 9118

TV-1185's "Silver" pigmentation lets you

INSTALL IT and FORGET IT!

FEDERAL's TV-1185 is virtually a "pipeline" for better-than-ever TV reception . . . VHF or UHF. Insulated with the revolutionary Federal-developed "silver" polyethylene, TV-1185 is amazingly tough, flexible and efficient.

TV-1185 leads in Weatherometer tests . . . fights heat, resists moisture and other destructive deposits . . . minimizes deterioration due to sunlight.

TV-1185 keeps the energy field inside the weather-proof sheath . . . providing exceptionally low loss . . . more constant impedance . . . a better TV picture regardless of area or length of lead. It's easy to install and tight-seal against all atmospheric conditions.

There's no finer tubular lead-in of its type on the market today!

Capacitance: 4 mmf/ft. Attenuation DB 100/ft:
0.5—10 Mc; 0.95—50 Mc; 1.25—100 Mc; 1.7—200 Mc;
2.6—400 Mc; 3.0—500 Mc; 4.5—1000 Mc.

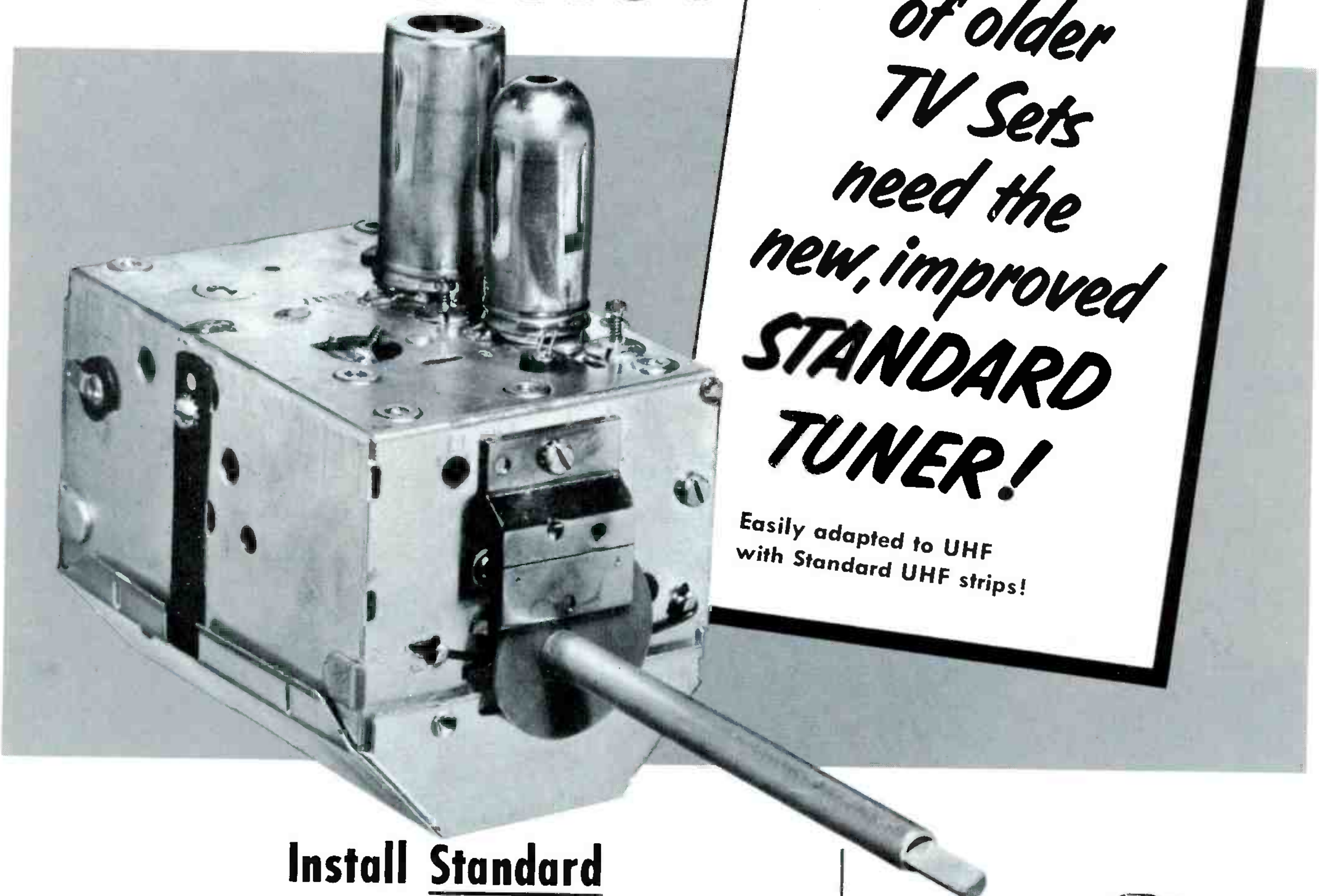
Product of America's leading producer of solid dielectric coaxial cables

FEDERAL TELEPHONE & RADIO · FTR · DIVISION OF IT&T

Federal Telephone and Radio Company

SELENIUM-INTELIN DEPARTMENT — 100 KINGSLAND ROAD, CLIFTON, N. J.
In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

BIG PROFITS!



MILLIONS of older TV Sets need the new, improved STANDARD TUNER!

Easily adapted to UHF with Standard UHF strips!

Install Standard Cascode and Pentode Tuners!

More customer satisfaction—Today's Standard tuner will give up to 50 per cent improvement in gain, provide stronger, sharper pictures. Complete redesign of the cascode and pentode circuits allows us *for the first time* to utilize the full power of the respective tubes.

More money for you—Replacement with the Standard tuner is your high profit source. The tuner is the third largest dollar item in a TV set, and the number of sets today totals 25,000,000!

Standard Coil, world's largest producer of TV tuners, built its first tuner *five years ago!* Today 10,000,000 Standard tuners are performing in sets built by 75 nationally known manufacturers. This overwhelming preference for the superior Standard tuner now means new sales, greater profits for you in the untouched tuner replacement market.

Start Extra Profits Coming Your Way NOW!

Order your Standard Cascode and Pentode tuners from your jobber today, or write for the name of your nearest jobber. Address Standard Coil Products Co., Inc., 2085 N. Hawthorne Ave., Melrose Park, Ill.

Standard
COIL PRODUCTS CO., INC.
CHICAGO LOS ANGELES BANGOR, MICH.
NO. DIGHTON, MASS.

In TV it's Standard

Monochrome and Color

(Continued from page 5)

to sound carrier at this point is approximately 15 to 1. This ratio provides the best results in a monochrome receiver. In a color receiver, it is necessary to attenuate the sound carrier greater than 15 to 1 for the purpose of reducing the 920-kilocycle beat between the sound carrier and color subcarrier. This beat note would cause an unwanted pattern on the picture.

The sound is taken off at the output of the last video IF in the receiver of Fig. 1 for the purpose of attaining the most possible sound IF gain before the sound-carrier trap is inserted. The additionally needed sound-carrier rejection is provided by a filter network after the takeoff point. After the sound information is taken off, it is detected at the input of the sound section.

The stages comprising the RF-IF-Video section are fundmentally the same for both receivers; that is, they both serve the same purpose. The difference between the two lies in the design of the stages. Most of the IF strips used in monochrome receivers are designed to provide an over-all bandwidth of less than 4 megacycles. Usually they are about 3.2 to 3.5 megacycles. For optimum reproduction of color, the IF strip is designed for a bandwidth of at least 4 megacycles and upwards to 4.2 megacycles. The first criterion of an IF strip for color is that it must pass the color subcarrier with a frequency of 3.579545 megacycles. Another criterion is that the IF strip for color must be able to pass all sidebnads of the color subcarrier; therefore, since the width of the upper sideband of the subcarrier is .5 megacycle, the bandwidth of the color IF's should approach 4.2 megacycles.

The sync-separator stage in the color receiver performs the same function as in the monochrome receiver. The signals are taken from the video amplifier, separated into horizontal and vertical sync pulses in the sync-separator section, and fed to their respective sections. The design of the sync-separator section in a color receiver is essentially the same as that in a monochrome receiver.

The high-voltage section of a color receiver serves the same purpose as that in a monochrome receiver. It must be designed to provide an output of about 20,000 volts, because the color picture tube requires this high value of second anode voltage. A flyback high-voltage system is employed; and in order to produce this level of voltage, a specially designed horizontal-output transformer must be used. This transformer must be capable of storing the considerable amount of energy that is needed for this purpose. More stages are also necessary in the high-voltage section of the color receiver. In one model, the high-voltage section contains four stages. These stages are a rectifier, a diode coupler, a doubler, and a regulator (see Fig. 1). The tubes being used for these functions are of recent design. To provide constant high voltage, a regulator is employed at the output of the high-voltage section.

As can be seen from the foregoing discussion, the sections of a color receiver, as shown in Fig. 1, are very similar to a conventional black-and-white receiver. Each stage performs the same function in both receivers. The difference lies in the design of some of the stages. The greatest difference is in the video IF

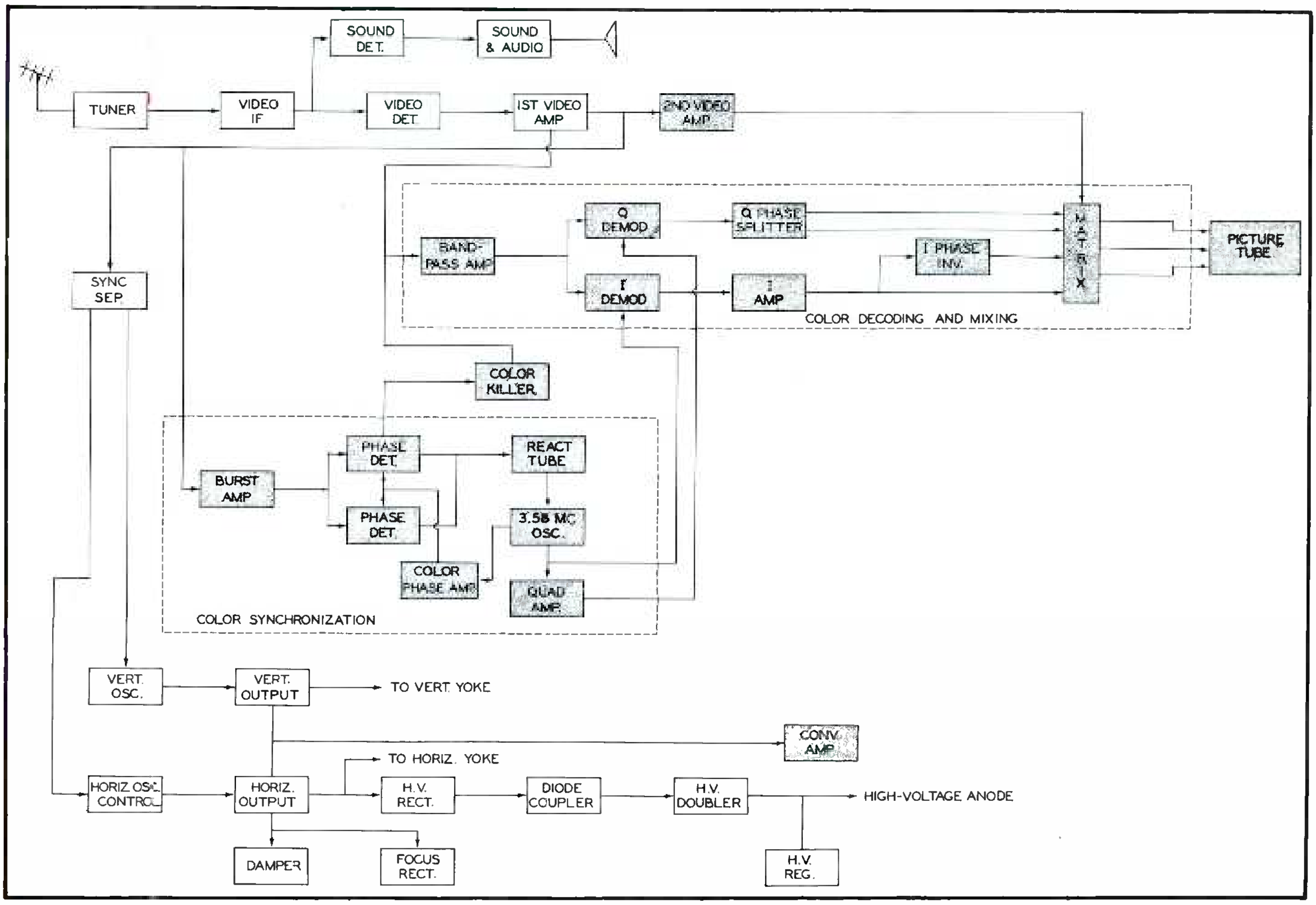


Fig. 2. Complete Block Diagram of a Color Receiver.

SPECIAL ANNOUNCEMENT!

During the next week you will receive your complimentary copy of the first issue of THE TECHNICIAN'S TIMESAVER . . . an easy-to-read 4-page publication which will point out profitable shortcuts to faster TV servicing. THE TECHNICIAN'S TIMESAVER is written and edited by Bob Middleton—author of many magazine articles and popular TV and radio servicing books.

If you do not receive your complimentary copy, write direct to SIMPSON, c/o Mailing Department, Howard W. Sams & Co., Inc., 1101 East 46th Street, Indianapolis 5, Indiana, for it. Of course, we will appreciate receiving your comments about THE TECHNICIAN'S TIMESAVER.

SIMPSON ELECTRIC COMPANY

SIMPSON MODEL 480 GENESCOPE FOR ACCURATE TESTING

approved by service managers of:

admiral

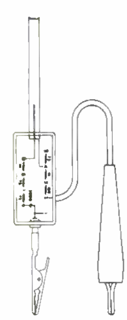
zenith

motorola

emerson

hoffman

hallicrafters



• All the necessary signal sources for alignment of FM and TV receivers • Includes the Simpson High Sensitivity Oscilloscope and high frequency crystal probe for signal tracing • Independent, continuously variable attenuators and step attenuators for both AM and FM units offer complete control of output at all times • 0-15 megacycle sweep is provided by a noiseless specially designed sweep motor based on D'Arsonval meter movement principles • The exclusive Simpson output cable (illustrated) includes a variable termination network, quickly adapted to provide open, 75 or 300 ohm terminations—the addition of a pad provides attenuation and isolation. Use of appropriate resistors across certain terminals will provide any other termination required. A .002 MFD blocking condensor can be added on any termination for use on circuits containing a DC component • The FM generator output voltage is constant within .2 DB per MC of sweep.

dealer's net $475.00

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois • Phone EStebrook 9-1121 • In Canada: Bach-Simpson, Ltd., London, Ont.

BURTON BROWNE ADVERTISING

stages which must be designed to provide adequate bandpass.

Let us add to Fig. 1 the stages that are needed for the reproduction of color. This has been done in Fig. 2 which is a complete block diagram for a color receiver. From this point on, this discussion will concern only the sections not similar to those of the monochrome receiver.

Turning attention to the portion called the color-synchronizing section, it is seen that a signal is taken from the output of the first video-amplifier stage and fed into the stage designated as the burst amplifier. This signal is a reference burst which is transmitted on the back porch of the horizontal-blanking pedestal. It consists of a minimum of eight cycles at the same frequency (3.579545 megacycles) as the color subcarrier. It is employed in the color-sync section as a reference for the generation of a local subcarrier at proper phase and frequency. By the use of this burst, the receiver subcarrier is maintained in step with the transmitted subcarrier.

The color-sync section consists of six stages. These are a burst amplifier, a phase detector, a reactance tube, a color-phase amplifier, a 3.58-megacycle oscillator, and a quadrature amplifier. These stages produce in the output a CW signal which is applied to the color demodulators to be used for the detection of the transmitted color information. The operation of this section is discussed in detail in the article, "Color Synchronization," appearing elsewhere in this issue.

Another entirely new portion is the section for color decoding and mixing. This is shown in Fig. 2 as that portion from the input of the bandpass amplifier to the output of the matrix. The six stages up to the input of the matrix are a bandpass amplifier, a Q demodulator, an I demodulator, a Q phase splitter, an I amplifier, and an I phase inverter. The combination of these stages is referred to as the chrominance channel. The purpose of this channel is to detect the color information which provides a separation of the I and Q color signals. These signals are amplified to a useful value and applied to the matrix in the proper phase. They are then mixed in the matrix unit with the luminance signal which is obtained from the output of the second video amplifier.

A second video-amplifier stage is employed in the color receiver for the purpose of amplifying the luminance portion of the color picture signal. (See Fig. 2.) Only the luminance signal passes through this amplifier, because the synchronizing and color signals are taken off at the first video amplifier. This additional stage is required in order to provide a luminance signal of sufficient amplitude and proper phase for application to the matrix.

Although not shown in the block diagram of Fig. 2, the matrix unit consists of three separate adder and amplifier stages. One section is provided for each primary color.

A detailed discussion on the operation of the portion of the receiver from the second detector to the output of the matrix is given in the article entitled, "Color Decoding and Mixing," appearing elsewhere in this issue.

The color picture tube differs greatly in physical and electrical aspects from the monochrome picture tube. It must be capable of accepting three varying signals and of producing a picture on the screen of the tube in full color. A discussion of how this is accomplished is given in the article, "Picture Tubes for Color TV," appearing elsewhere in this issue.

Two other new stages which are present in a color receiver are the color killer and convergence amplifier. The purpose of the color killer is to provide an automatic method of disrupting the operation of the color channel during the reception of a standard monochrome signal.

The convergence amplifier is employed to provide better convergence of the picture-tube beams when they approach the outer edges of the screen. A signal is taken from the deflection section and amplified in the convergence amplifier stage. The output modulates the DC potential on the convergence electrode. The potential which controls the convergence of the beams is the difference of voltage that exists between the coating of the picture-tube envelope and the convergence electrode. The potential on the tube coating is a fixed value, while the potential on the electrode is a varying one. The tube-coating potential is higher than the convergence-electrode potential. Therefore, when the electrode potential is increased, the difference voltage decreases and allows the beams to converge properly at the aperture mask when they are scanned toward the outer edge of the screen. As a result, the convergence modulating voltage from the output of the convergence amplifier increases the potential on the electrode as the beams are deflected toward the outer edge of the screen. This provides proper convergence of the beams as the angle of deflection increases.

This completes the comparison of the stages in a color receiver with those in a monochrome receiver. It can be seen that the color receiver contains almost twice the number of stages of a monochrome receiver. Current experimental color receivers contain a total of 36 to 44 tubes. This is a large number of stages when compared with monochrome receivers which have a tube complement of 20 to 24 tubes.

Physically, the color receiver is larger and heavier than the present monochrome receivers. This statement is made with a standard 16- or 17-inch monochrome-picture reproducer used as a comparison. At the present time, most experimental picture tubes for color TV are heavier than a 16-inch monochrome picture tube. This added weight of the picture tube plus the added weight of a larger number of component parts in the circuit will result in a more bulky receiver. The greater number of stages contained in a color receiver will probably result in a larger chassis.

Most experimental color receivers produced to date contain a picture tube that forms a picture which is approximately equivalent in area to that of a 12-inch monochrome picture. The tube envelope being used has a 15-inch diameter. Although there have been larger experimental tubes, the first production run of color receivers will probably incorporate a tube of the 15-inch variety.

The expected selling price of the first color receivers has been estimated by some TV receiver manufacturers to be about $700 to $1000. The major part of the cost of a color receiver will be the picture tube; however, after production of the color picture tube is stepped up, its cost will undoubtedly become less. Increased production of the chassis and improved circuit design will also effect a further decrease in production cost.

C. P. Oliphant

Picture Tubes for Color TV

(Continued from page 7)

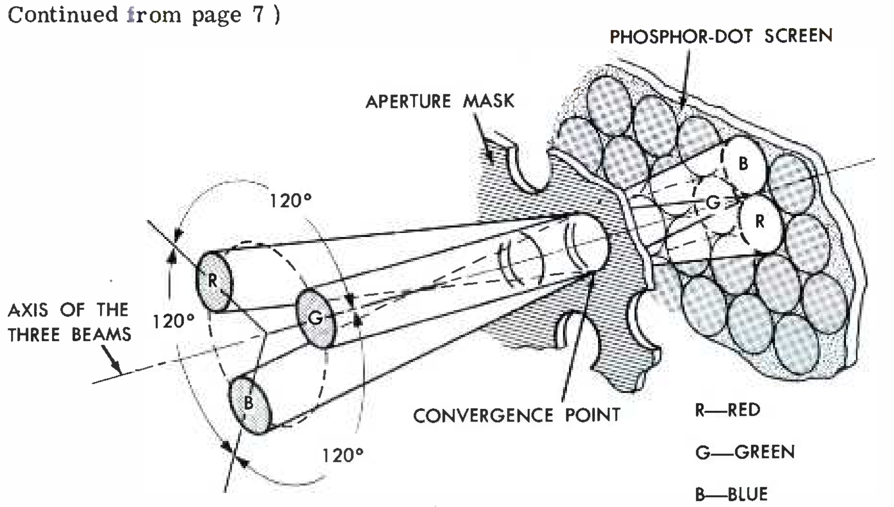


Fig. 5. The Relation Between Electron Beams, Shadow Mask, and Phosphor Screen in the Color Picture Tube.

a phosphor screen. The displacement "d" between the points on the phosphor screen is proportional to the placement "D" between the sources. The mask is placed very close to the screen so that the points on the screen are much closer together than are the sources of the beams which energize these points. The reader must bear in mind that the displacement "D" of the sources can be in any direction within a plane perpendicular to the paper at the indicated dotted line.

The foregoing principle is used in color picture tubes where three patterns of one mask are reproduced on a screen by three electron beams. The pattern produced by any one beam is displaced from the patterns produced by the other two beams by an amount proportional to the spacing between the guns which generate the beams. A solid illuminated area is formed on the screen by the three interwoven patterns. The arrangement is such that one electron beam impinges only on dots of one color over the entire screen. This relationship means that there must be three phosphor dots on the screen for each mask hole. A detailed drawing of this method of color selection is presented in Fig. 5.

One of the requirements of the shadow-mask tube is that the three beams must converge or come together at the mask. The adjustment which is used to bring this about is called the convergence adjustment. If the beams did not converge properly at the mask, one or more of the beams would strike portions of phosphor dots of the wrong color. For example, the beam associated with red dots might energize blue or green dots as well as red dots. This would produce incorrect hues in the picture.

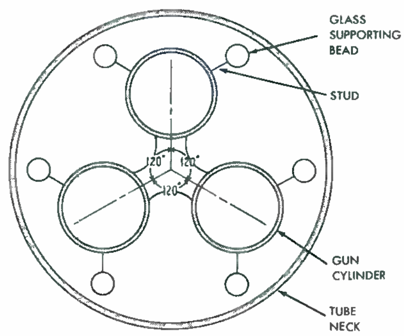


Fig. 6. End View of the Three-Gun Assembly in the Color Picture Tube.

Another requirement of the shadow-mask technique is that the phosphor screen must be at a fixed distance from the mask at all points. This eliminates any variation in dot size or in spacing between dots on different areas of the screen.

The principle behind the shadow-mask technique demands that the three sources of the beams be fixed in position relative to the mask holes and screen dots. Referring again to Fig. 5, the beam sources are located equidistant from a common axis and 120 rotational degrees apart. This triangular placement of the beams conforms to the triangular arrangement of the dots on the screen.

If the axis of the beams were not in a precise position relative to a particular aperture hole, each beam would strike the edges of phosphor dots adjacent to and in addition to the dot it should strike. This undesirable condition would result in color dilution in the reproduced picture.

Keeping in mind these requirements of the system, let us next consider the electron-gun assembly and the manner in which the beams are generated and controlled.

Electron-Gun Assembly and Beam Control Prior to Deflection

The early stages of color television development witnessed an attempt to use a single electron gun for the color presentation by incorporating a time-sharing process with the electron beam. That is, the

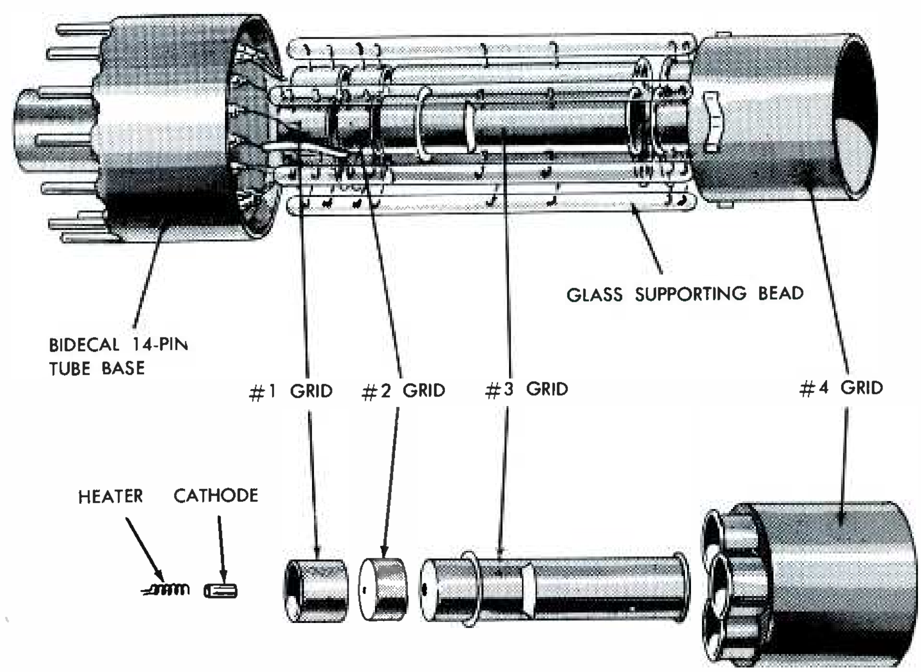
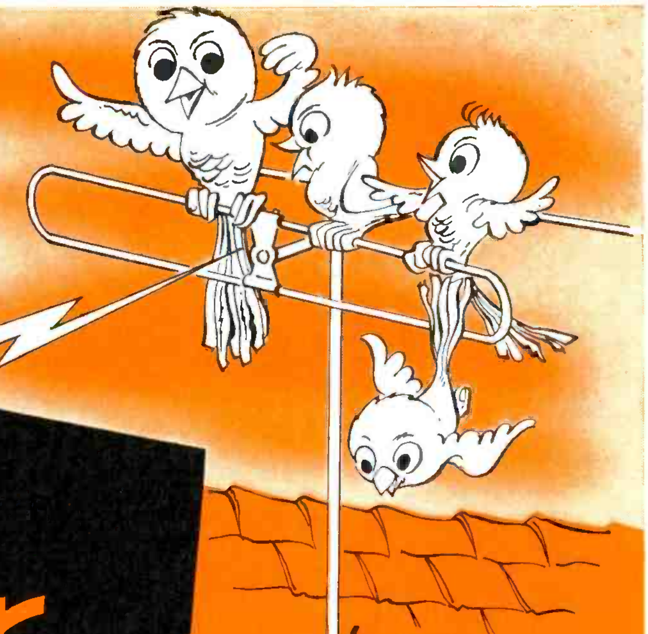


Fig. 7. Three-Gun Assembly With an Exploded View of One of the Guns.

With double lock stop...



Only Superotor®

OFFERS VP Tuning

A *Leader* First

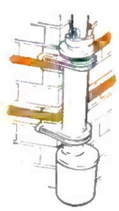
VP means Vernier Precision — sharpest tuning ever possible with any antenna rotator! With the exclusive double lock stop, and "telegraph key" fingertip action, **Superotor can** be rotated in increments of **less than ½-degree**, permitting highly critical orientation of antenna which automatically locks in position. In addition, **Superotor's** advanced design permits reading the antenna position without moving the antenna!

Pat. Applied For
Copyright

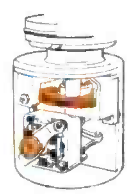
Compare All The Features, And You'll Join The Big Switch To Superotor

A *Leader* First

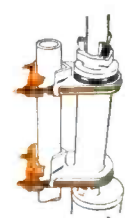
A *Leader* First



A *Leader* First



A *Leader* First



- **Quick Detachable Drive Unit**
- **Built-in Chimney Mount**
- **Double Lock Stop Prevents Drift & Coast**
- **Steel-Reinforced Construction**

Leader ELECTRONICS INC.

2925 EAST 55TH STREET • CLEVELAND 27, OHIO

LEADING THE WAY TO BETTER PRODUCTS

operational cycle was divided into three time intervals, one interval being assigned to each of the three primary colors. Through the use of a suitable switching means, the electron beam excited only one color for each interval. Because of the persistence of vision of the human eye, the three colors combined to give a resultant color — that of the picture section being scanned.

In contrast to the single-gun tube, the three-gun tube illuminates the three primary colors simultaneously by utilizing three separate electron guns. The three guns are assembled so that they are mutually parallel and their axes are equidistant from and spaced 120 degrees around the central axis of the picture tube. An end view of the three-gun assembly is shown in Fig. 6. A side view of the same assembly and an exploded drawing of one of the guns are presented in Fig. 7.

The individual guns are all identical to each other and somewhat similar to the gun used in the 5TP4 projection tube. The differences lie in the electrodes added to accomplish focus and convergence of the beams and in the shorter gun lengths. Each electron gun consists of a heater, cathode, No. 1 grid, No. 2 grid, No. 3 grid, and No. 4 grid. The No. 3 grids are individual electrodes in each gun but are electrically connected to each other. These grids are designated as the focus electrodes. The No. 4 grid is a single element which serves all three guns as a convergence electrode. The inside coating on the tube envelope, the mask, and the screen are electrically connected; and these three parts constitute the high-voltage anode of the tube.

It has been stated that one of the requirements for proper shadow-mask operation is that the beams be properly positioned with respect to the common axis and to each other. This requirement is established for the most part by the close manufacturing tolerances which are observed in the color tube. To overcome any gun misalignment which may exist in the finished tube, three beam-positioned magnets are mounted on the neck of the tube near the base. These magnets, one for each gun, may be adjusted separately so that each beam is in the proper relationship to the other two. The magnets are shown in the drawing of Fig. 8, which pictures the external components necessary with the color tube.

The heater, cathode, No. 1 grid, and No. 2 grid in each gun function as they do in the black-and-white tube. The three heaters are connected internally in parallel. Focusing of the individual beams so that they come to sharp focus at the point of beam convergence at the mask is accomplished by the electron lenses existing between the individual No. 3 grids and the common No. 4 grid.

Up to this point the three beams are traveling parallel to each other; however, it is necessary that the beams be bent toward each other so that they converge and meet at the mask. The inside coating on the tube envelope extends down into the neck. The potential difference between this coating and the No. 4 grid forms an electron lens which converges the three beams. The amount of convergence is determined by the magnitude of the voltage difference between the two grids. Since the high voltage on the neck coating is a fixed value, the No. 4 grid potential is the adjustable voltage for convergence. It is also true that the No. 4 grid potential serves as part of the focusing lens, therefore the beam focusing changes when the convergence is varied. This makes it necessary that the No. 3 grid potential be variable for focusing and that the convergence and focus controls be varied alternately whenever adjustments are made.

It may be of interest to mention the high voltages which are present in the gun structure of the typical color tube. Under average operating conditions, the voltage on grid No. 4 is about 10,000 volts and that on grid No. 3 is about 3,000 volts. Both of these voltages are applied through connections in the tube base. The voltage on the high-voltage anode is approximately 20,000 volts.

Mention has been made of the fact that color dilution occurs if the common axis of the beam system is not properly oriented. While the beam-positioning magnets are used to control the beams with respect to each other, a color-purifying coil is needed to position correctly the combined system of beams within the neck of the tube. The color-purifying coil fits around the neck of the tube, as shown in Fig. 8. Adjustments of the location of this coil and of the current through it make possible the accurate orientation of the system of beams so that the red beam strikes only red dots, the green beam strikes only green dots, and the blue beam strikes only blue dots.

Adjustment of the color-purity coil is recommended as one of the initial steps following installation of a color picture tube. This alignment can be accomplished as follows: cut off two of the three electron beams and then rotate the purifying coil on the neck of the tube while varying the current through the coil. Proper alignment will produce a uniform field of color over the central area of the screen. The color at the center must be the particular color associated with the conducting gun. Establishing color purity on areas of the screen away from the center necessitates adjustments involving other beam-controlling components.

Deflection and Its Problems

The deflection coils for the color tube serve the same purpose as they do for the black-and-white tube. They deflect the system of beams from the three electron guns so that a raster is produced on the phosphor screen. The line pattern in the color picture is exactly the same as it is in the black-and-white picture, though to the eye it may be concealed somewhat by the dot structure of the screen. The design requirements of the deflection yoke used with a color picture

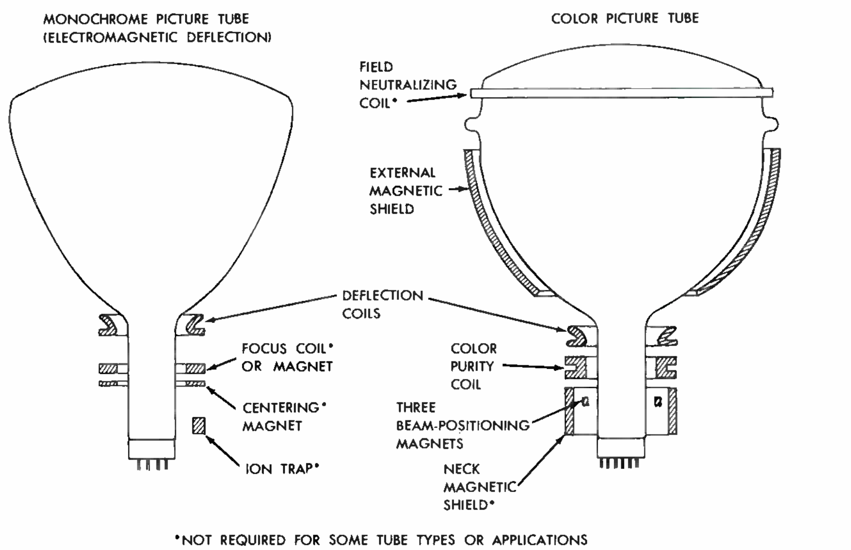


Fig. 8. Typical External Components Required on the Monochrome Picture Tube and on the Color Picture Tube.

Now... only 149^{50}

Suggested User Price

the popular RCA WO-88A

featuring . . .

- ✓ **Voltage-Measuring Facilities**
- ✓ **"Plus" and "Minus" Sync**
- ✓ **High-Input Resistance**
- ✓ **Low-Input Capacitance**

Check these "extra" features

- Direct-coupled vertical amplifier
- 5" Cathode-ray tube with magnetic shield
- 60-cycle sweep with wide-angle phasing control
- Frequency-compensated attenuators
- "Voltmeter-type" vertical attenuator
- "Voltmeter-scale" type graph screen
- 1-volt peak-to-peak calibrating voltage
- 'Scope is completely stable—even at maximum sensitivity of 25 millivolt-per-inch
- Quick "recovery" time, freedom from line "bounce"
- Completely shielded input cable eliminates hum and noise pickup

Specifications—

- **Deflection Sensitivity:** (vertical amplifier) 25 rms millivolts or better per inch.
- **Vertical-Amplifier Frequency Response:** Flat from dc to 100 Kc; within —3 db at 500 Kc; within —10 db at 1 Mc.
- **Input Resistance and Capacitance:** 10 megohms and 9.5 uuf with WG-216B Low-Capacitance Probe.
- **Sweep-Circuit Frequency (four ranges):** 15 cps to 30 Kc.
- **Square-Wave Response:** Negligible tilt and overshoot.
- **Average Rise Time** (Vert. Amp.): 0.5 microsec.
- **Power Supply:** 105-125 volts, 50-60 cycles.
- **Size** 13½" high, 9" wide, 16½" deep. Weight only 25 lbs. (net).

The WO-88A has *built-in* voltage calibrating facilities which permit *simultaneous* waveshape display and peak-to-peak voltage measurements. Frequently, the *shape* of the TV waveform under observation will be correct but its *amplitude* will be low and, consequently, cause improper operation. Therefore, a TV 'scope is complete only if it can measure the peak-to-peak voltage of the displayed waveform. *Check this feature on the "88"!*

On the WO-88A, sync polarity may be reversed instantly by simply clicking a front-panel switch. This feature is important because TV pulses may be either positive or negative, depending upon where the 'scope is connected. To avoid waveshape "jitter" or distortion, use a 'scope which will "lock in" readily on all types of TV waveforms. *Check this feature on the "88"!*

When you use the low-capacitance probe supplied with the WO-88A, the over-all input resistance is raised to 10 megohms! Because many TV circuits are extremely sensitive to resistive loading, normal circuit operation may be seriously disrupted by loading of the average 'scope. With the low-capacitance probe, however, loading problems are minimized. *Check this feature on the "88"!*

In addition, the low-capacitance probe supplied with the WO-88A decreases the over-all input capacitance to less than 10 uuf! Excessive capacitance loading can cause the horizontal oscillator to change frequency or stop oscillating. When the WO-88A is connected, the low over-all input capacitance leaves receiver operation essentially unaffected. *Check this feature on the "88"!*

GET FULL DETAILS from your RCA Distributor . . . or request Bulletin through PHOTO FACT INDEX

RADIO CORPORATION of AMERICA

TEST EQUIPMENT — **HARRISON, N. J.**

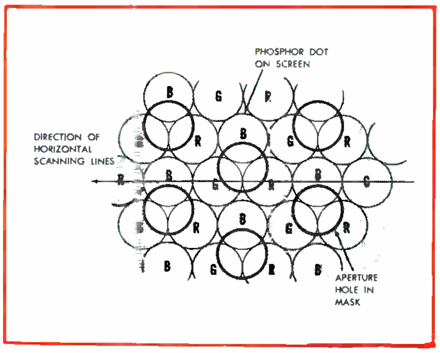


Fig. 9. View of Phosphor Screen As Seen Through Shadow Mask.

tube are more stringent because the presence of three beams in the tube, instead of one, demands that a uniform magnetic field be established over a broader portion of the space inside the yoke. Therefore, the color deflection yoke differs slightly in structure from the yoke employed with monochrome tubes.

In regard to the adjustment of deflection yokes on color picture tubes, one or two points can be mentioned. One item of interest is that the deflection yoke can no longer be used by itself to correct a titled picture. This is true because the proper rotational position of the yoke is fixed by the requirement that the horizontal scanning lines must be parallel within close tolerance to the rows of holes in the aperture mask. This is illustrated in Fig. 9. It is possible that a tube may be mounted so that these rows of holes are not horizontal, which might result in a moiré effect in the raster. To correct this, the tube must be rotated with respect to the yoke. Proper positioning of both tube and yoke produces a picture devoid of moire effect or tilt. The approximate deflection angle required to scan color tubes now in development is only 45 degrees, which is a somewhat smaller angle than is used in most present-day monochrome tubes.

As previously stated, the point at which the beams converge must be in the plane of the mask. Until now, we have considered the problems of convergence and focus as though they were static or unchanging. In practice, though, this is not the case. The beams are continually being deflected over the raster, and the distance from the plane of deflection to the mask varies with the scanning. Thus, some means must be provided to vary the focal lengths of the electron lenses which focus and converge the beams.

The problem can be seen by referring to Fig. 10 which illustrates this condition as it exists in a color tube having a flat mask and screen.

In order to obtain dynamic convergence and focus (that is, to focus and converge the beams at the edges as well as at the center of the raster), it is necessary that the focusing and converging electron lenses be changed constantly according to a set pattern. This can only be done by applying certain AC voltages to the No. 3 and No. 4 grids. Since these voltages must be synchronized with the scanning, they are usually derived from the horizontal- and vertical-sweep sections of the color receiver. The voltages are of the proper amplitude, waveform, and phase to provide dynamic convergence and focus correction over the entire raster. Consequently, the potentials on the focus and convergence electrodes consist of two parts: (1) DC voltages for static convergence and focus and (2) AC voltages to accomplish dynamic correction.

There are six controls which have to do with the nature of these voltages: (1) the horizontal-dynamic-convergence amplitude control; (2) the horizontal-dynamic-convergence phase control; (3) the vertical-dynamic-convergence amplitude control; (4) the vertical-dynamic-convergence shaping control; (5) the focus control; and (6) the DC convergence control.

The control exerted on the beams in the color tube must be much more precise than in the monochrome tube. It was found during early development that even the relatively weak magnetic field of the earth had a distinct effect on the beams in the color picture tube. After a color receiver was once properly adjusted in a certain position, it could not be turned 90 degrees without needing readjustment. To eliminate the effects of the earth's magnetic field and other stray magnetic fields, external magnetic shields are placed around portions of the color-tube envelope as shown in Fig. 8. As a further means of counteracting such effects, one make of color tube has a field-neutralizing coil encircling its face. The current through this coil is adjusted for optimum color purity of all color fields.

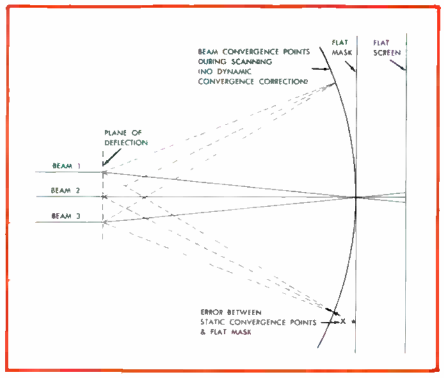


Fig. 10. Drawing Illustrating Necessity for Dynamic Convergence and Focus Correction.

Another adjustment required with color picture tubes is that of color balance. Because of the fact that the various phosphors used in the make-up of the dot screen do not have equal luminosity efficiencies, different beam currents from the three guns are required to achieve equal and blue. This insures that various shades of gray in a screen image will not be color tinted and that flesh tones will be accurately reproduced. Color balance is achieved by the proper selection of DC voltages on the No. 1 and No. 2 grids of each gun.

Summary of Beam-Control Points

The various operations performed on the electron beams from the time they are formed until they reach the mask and screen of the color picture tube can best be summarized by a step-by-step method. The drawing in Fig. 11 shows a modified block diagram of one of the guns and the operations which take place. The dotted lines outline the electron beam, and the arrows indicate the direction of forces exerted on the beam at each point in its path. The points of control are lettered and positioned roughly, not exactly, in their order of occurrence.

The electrons are emitted by the cathode which is shown on the left side of Fig. 11. The No. 1 grid is the control grid, and the force "A" which

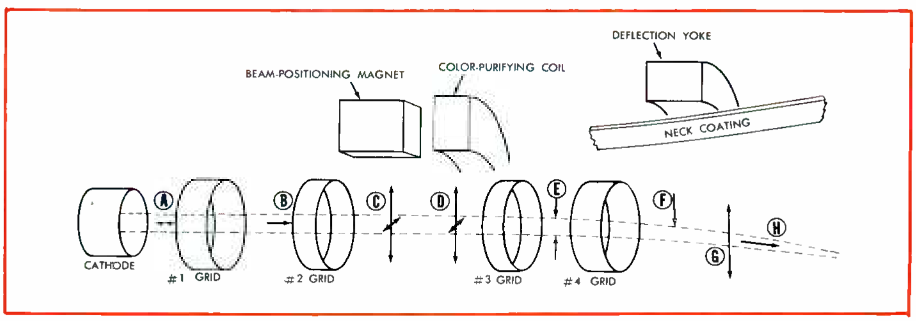
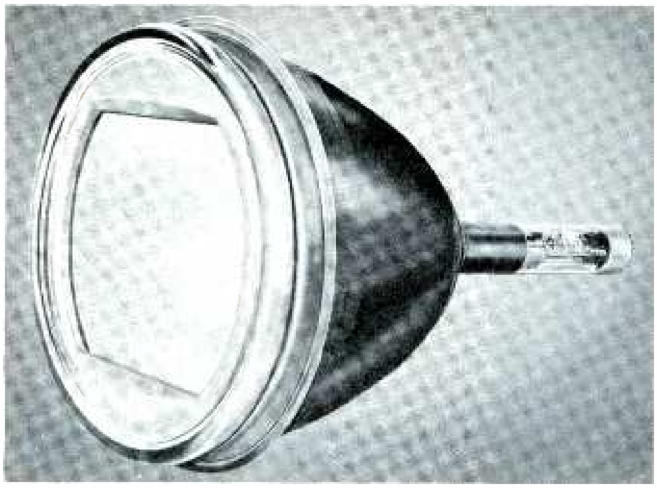
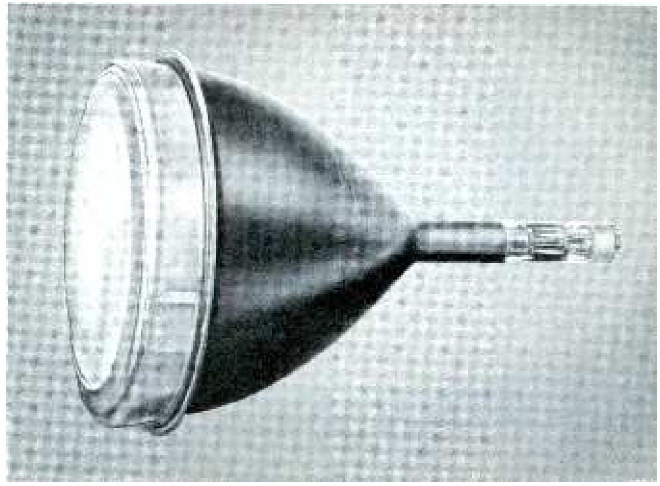


Fig. 11. Beam Path Showing Control Points.



(A) RCA Developmental No. C73599.
(Photograph Courtesy of RCA Tube Department)



(B) CBS-Colortron Type HD-187.
(Photograph Courtesy of CBS-Hytron)

Fig. 12. Typical Color Picture Tubes.

this grid exerts on the electrons is one of repulsion in varying degrees as indicated by the arrow symbol. Force "A" determines the amount of energization which is imparted to the screen phosphor and varies according to the modulating signal applied between the cathode and the No. 1 grid.

Force "B" is an accelerating force in the direction of the screen and has a magnitude determined by the voltage on the No. 2 grid (accelerating anode). The beam-positioning magnet exerts a force "C" on only the one beam in any direction at right angles to the path of the beam. The direction of force depends upon the position of the magnet. This force "C" is used to align the beam with the beams in the other guns. It contributes to satisfactory convergence by this particular beam.

The color-purity coil applies a force "D" which is similar in nature to force "C." Force "D," however, is exerted alike on all three beams. If the direction of force "D" were upward, all three beams in the gun assembly would move upward. This force is employed to direct the system of beams to the proper point in the deflection plane, so that after being deflected the beams will strike their respective color dots on the screen of the tube. The direction of force "D" is set by the position of the purity coil and by the magnitude and direction of the current through the coil.

Force "E" is applied by the electrostatic field between the No. 3 and No. 4 grids. It is a compressing force on the beam and has a focusing action determined by the nature of the potential between the two grids.

The electrostatic field between the neck coating and the No. 4 grid exerts a force "F" on the beam which is in a direction toward the axis of the three beams. This is the force which converges the beams so that they meet at the mask. The magnitude of the force is proportional to the instantaneous potential existing between the neck coating and the No. 4 grid.

Force "G" is produced by the deflection yoke and acts upon all three beams in directions at right angles to the axis of the beams. This force causes the beams to scan the screen horizontally and vertically to form the raster. Force "H" is the accelerating force contributed by the high voltage on the picture tube.

RCA Three-Gun Tricolor Kinescope and CBS-Colortron

Of the several makes of color picture tubes which have been or are now being developed, we have obtained data on two — the RCA Tricolor Kinescope and the CBS-Colortron, both shown in Fig. 12. Each tube employs the dot-phosphor screen, the shadow mask, and the three-gun assembly.

The RCA tube uses a flat mask and a flat phosphor screen. A flat screen provides a good viewing surface, and it would be an ideal situation if the flat screen could also be used as the face plate of the tube. This would be impractical because of the high vacuum in the picture tube. On the face of any sizable tube, there is a pressure of a ton or more due to atmospheric pressure; and a flat faceplate would collapse unless it were extremely thick. For this reason, the flat mask and screen must be mounted inside the tube and a curved glass faceplate is used to complete the envelope of the tube. A decorative mask is included inside the envelope just in front of the phosphor screen. This serves the same purpose as the mask on the cabinet of a monochrome receiver.

The CBS-Colortron employs a curved mask and a curved phosphor screen. The screen in this tube is deposited on the inside surface of the faceplate as in a monochrome tube. For this reason, a decorative mask is not needed within the tube envelope. The use of the curved shadow mask reduces the values of dynamic focus and convergence voltages required in this tube.

In summary may we say that although the color picture tube appears to be rather complicated, procedures for installing and adjusting the tube and its associated components are being developed and simplified. We trust that this discussion of color-picture-tube fundamentals will serve as a foundation block for the service technician who is building his background of knowledge to meet the challenge of color TV.

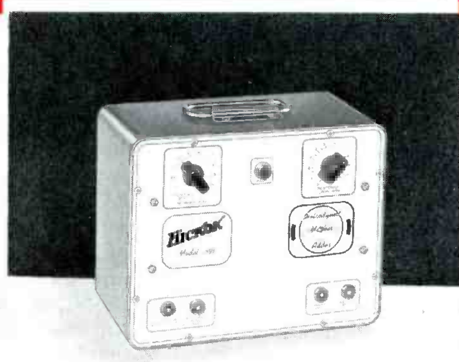
William E. Burke

and

Glen E. Slutz

"BEST FREQUENCY • STABILITY • ACCURACY"

SUMS UP ALL FIELD COMMENT ON THIS LATEST HICKOK TELEVISION ALIGNMENT EQUIPMENT



Model 690 Marker Generator

Crystal controlled. High .25 volt R.F. output. Provides dual markers with any TV sweep generator. This unit features another HICKOK First by incorporating a Non-Parallax shadow type dial. In conventional type dials, error generally is introduced in setting frequencies since the hairline or indicator is at a slight distance from the scale. This distance, however slight, can introduce error if the scale is not viewed directly at right angles.

In alignment of any type of receiver, the marker generator is the unit that is to be relied upon and must therefore be consistently accurate in frequency settings. The HICKOK Non-Parallax dial can be viewed from any angle without introducing error. The 45 inches of dial can be self calibrated to within crystal accuracy (.05%) since the unit includes a self contained crystal calibrator.

Leading features of this unit are:

(1) The simple and time saving method employed in calibration of the dial—there is no counting of beats—no interpolation—no remembering of frequencies.

(2) Provision for calibrating any other signal generator to crystal accuracy.

(3) Complete R.F. coverage up to and including channel 83. All channels have picture and sound settings marked directly on the scale—this eliminates checking on these values when they become applicable.

(4) The marker can be modulated by a self contained 400 cycle signal. This is especially valuable in stage - by - stage alignment and eliminates the introduction of another instrument.

(5) Position for adding two other crystals is provided in addition to the 2.5 MC crystal which is included.

(6) It is possible to view two markers at once on the response curve. This will include the main marker and a marker corresponding to the crystal value selected. For instance, a 4.5 MC crystal may be used to obtain two markers with a 4.5 MC separation. This will greatly speed up alignment procedures since it is not necessary to re-set dials to check response curve width.

(7) Both an electronic-eye tube and a headphone jack are available for either visual or audible indications of zero beat.

(8) Attenuation is controlled by both a step attenuator and vernier to attain complete regulation of output.

(9) The unit is completely double shielded to assure a minimum of leakage.

(10) All frequencies are covered on fundamentals with the exception of U.H.F. channels. There are no spurious or confusing beats or frequencies generated by the unit. It is an all around instrument in view of its very complete R.F. coverage.

This entirely new and advanced alignment equipment represents the latest HICKOK achievement in offering a complete, **fast and accurate solution** to TV alignment.

Many leading TV engineers have tested this new equipment and highly compliment its practical design for individual unit use or compatible set use.

The stability frequency and accuracy of this new equipment plus its ease of use make the 690 - 691 - 695 today's best tools for a more profitable TV service business.

Model 691

Heterodyned Marker Adder

This unit, in conjunction with the Model 695 Sweep Generator and Model 690 Marker Generator provides the utmost in television alignment techniques. It takes the guesswork out of receiver alignment and eliminates any errors previously introduced by overloading due to markers.

The 691 provides a marker visible at all times (including trap points) and will not change in amplitude or distort the response curve **what-so-ever**. This feature, in addition to the accuracy and minimum leakage of the other units (690 - 695), will greatly simplify any alignment.

The outputs of the sweep generator and marker generator are heterodyned and applied to an oscilloscope in such a manner that the marker signal will never pass through the receiver itself—therefore cannot cause overloading.

In short, we can say that we are calibrating the oscilloscope with a marker which is visible at all times—even on the base line.

The 691 is specifically designed as a companion to the HICKOK 690 Marker and 695 Sweep Generator; however, it will work well with any of your present equipment that has an output of 50,000 microvolts or more.

Many leading TV engineers have tested this new HICKOK equipment and highly compliment its frequency, stability and ease of use in offering today's fastest, most complete and accurate solution to TV alignment tasks. See your jobber today or write factory direct for complete technical information.

Model 695 Sweep Generator

This is a completely **new electronic** sweep generator that will exactingly fill top requirements of the professional TV serviceman or lab. There are no moving parts to produce vibration or to wear out. This unit, although moderately priced, features a sweep signal that is absolutely linear and without amplitude modulations. Features a high .3 volt output.

This unit has technical advantages over other sweep generators because:

(1) The unit is completely triple shielded to insure that there is as little leakage from the unit as is engineeringly possible. It is possible to attenuate the signal down to 3 microvolts, and the unit has a maximum output of 300,000 microvolts.

(2) A bias voltage, variable from 0 to 12 volts, and metered directly by the voltmeter on the front panel, eliminates the usual time-consuming method of obtaining bias voltage from dry cells. Since this bias voltage is variable with continuous tuning, one can determine more accurately the effects of bias on the overall response curve and can align sets to "more sensitive" for "fringe area" reception or align them to prevent "overloading" when the station signal is very powerful.

(3) Three RF oscillators provide complete VHF coverage (Channels 2 - 13) on fundamentals and heterodyned output IF frequencies 0 - 50 MC. This assures a strong signal necessary for aligning "front ends."

(4) Continuous tuning and an easy-to-read scale marked off in channels literally provides the serviceman with a foolproof method of alignment.

(5) An internal method of "retrace blanking" provides a reference base line and eliminates confusion sometimes brought about by retrace curves.

(6) Even though the sweep width is varied, it will not be necessary to readjust the phasing control.

(7) As is common to all HICKOK Signal generators, a Standby position is incorporated in which the plate voltage is removed from all the tubes leaving filament voltage alone to keep the unit at a constant temperature and ready to operate the moment the Range Selector Switch is rotated.

(8) The instruction manual accompanying the unit gives complete, detailed and easy-to-follow instructions on correct alignment procedures, uses of the instrument, and a thorough understanding of alignment.

All of these features have been developed with the TV serviceman in mind.

HICKOK

THE HICKOK ELECTRICAL INSTRUMENT COMPANY

10566 Dupont Avenue • Cleveland 8, Ohio

See your parts jobber or write direct for technical details.

Color Decoding and Mixing

(Continued from page 15)

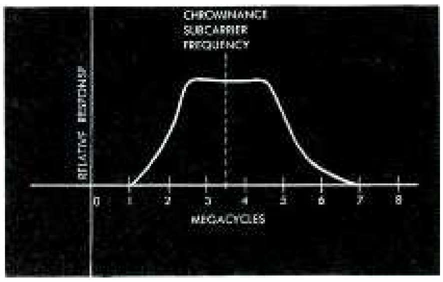
considerable overlap results, and one would expect the two signals to interfere with each other.

That would be the case, except for the minimizing effect of the frequency-interleaving principle. This principle is based on the fact that the frequency spectrum of a scanned subject is concentrated about the points that are whole multiples of the line-scanning frequency. Halfway between these points, that is, at odd multiples of half the line-scanning frequency, are frequency bands containing little information. Therefore, if two modulated carriers both subject to the same line-scanning rate are separated in frequency by an odd multiple of half the scanning rate, the concentrated bands of one carrier will occur at the vacant spaces of the other and the two will interleave.

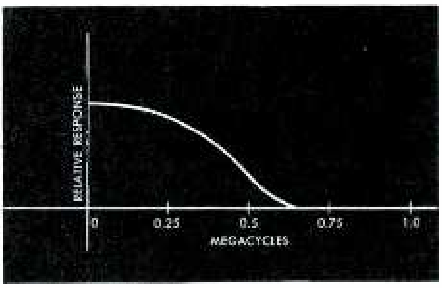
The actual value of the horizontal-scanning frequency proposed in the NTSC standards is 15,734.264 ± 0.047 cycles per second. If this value is divided by 2 to obtain one-half the line frequency and then multiplied by 455 (which is an odd number) the result will be 3.579545 mc, the frequency of the chrominance subcarrier.

Chrominance Circuit Details

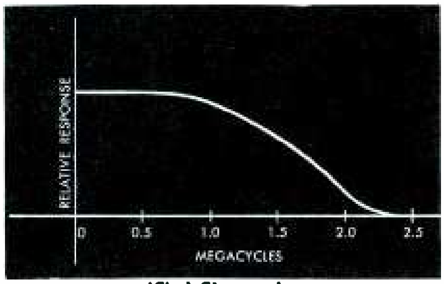
A partial schematic up to the point of application to the matrix appears in Fig. 3 showing the first video-amplifier stage with the bandpass amplifier take-off point, the bandpass amplifier, the Q demodulator, and phase splitter.



(A) Bandpass Filter.



(B) Q Channel.



(C) I Channel.

Fig. 4. Response Characteristics.

The signal for the bandpass amplifier is taken from one section of the contrast control. The other section of the contrast control is in the luminance channel, with the two sections ganged in such a manner that a constant relationship is maintained between both signals throughout the range of the contrast control. The sound signal is attenuated by a trap in the cathode circuit of the first video amplifier V9. The composite video signal is applied to the grid of the bandpass amplifier V17B.

Note that the screen grid of V17B is connected through R181 and C164 to a winding on the horizontal-output transformer. During the horizontal-retrace period, a negative pulse is thus applied to the screen. As a result, V17B is cut off and the synchronizing pulses are blocked. The signal grid of this tube is returned to ground through three resistors in series: the contrast control, R57, and R58. The last-mentioned resistor is also used as the plate load for the color-killer tube V27B. In the absence of a color signal (that is, during reception of a monochrome broadcast), V27B conducts and a negative voltage of sufficient value to cause cutoff of V17B is developed across R58. In this manner, the chrominance channel is prevented from functioning during monochrome reception.

The output signal from V17B is applied to a bandpass filter with the frequency characteristic as shown in Fig. 4A. The signal out of the bandpass filter is applied to the chroma control and thence to the No. 1 grids of the Q and I demodulators, these grids being connected directly to each other. The chroma control, with R185, forms the ground return for these grids.

The Q demodulator V29 is a type 6AS6, dual-control, RF pentode functioning as a synchronous detector. The chrominance signal is applied to the No. 1 grid; and an unmodulated

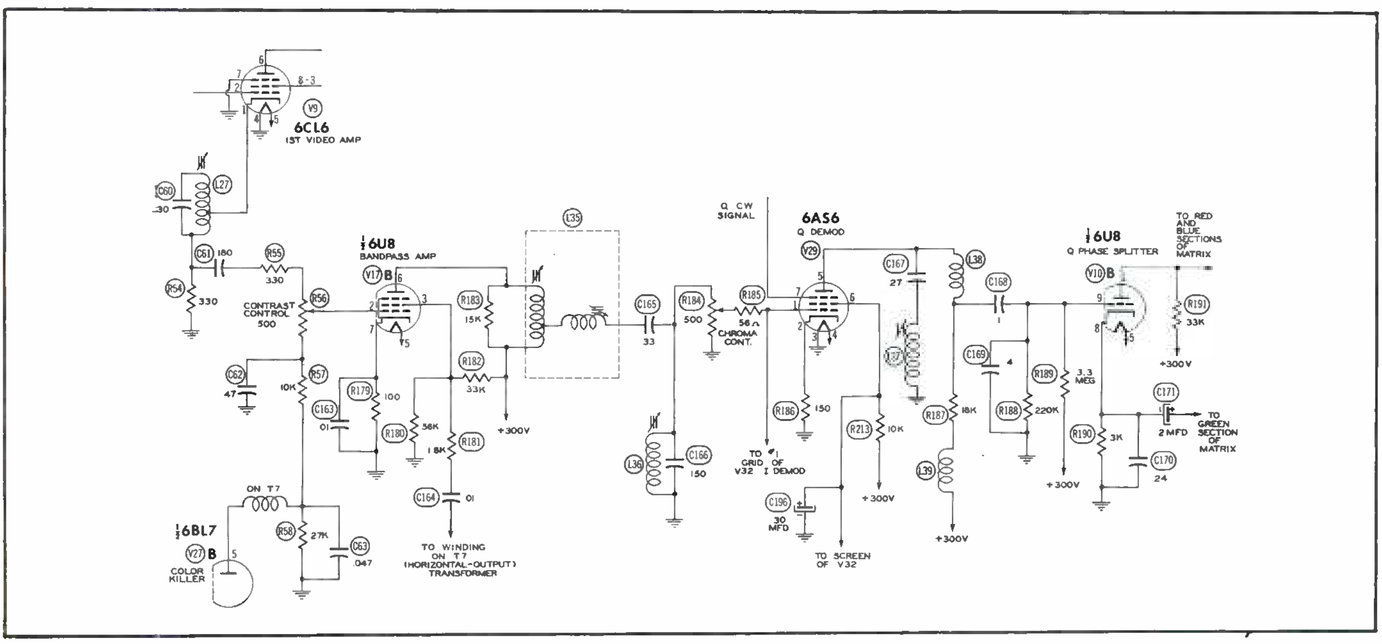


Fig. 3. First Video-Amplifier Stage, Bandpass Amplifier, and Q Channel.

Exciting and New yet . . . Backed Up With Plenty of Experience

posed by LISA LOUGHLIN *selected as one of the 10 top models in the U.S. by Esquire Magazine*

insl-x
INSULATING SPRAY

Higher dielectric strength than any other insulating spray on the market!

Proven by twenty years of use by leading component parts manufacturers!

Now packaged in easy-to-use Spra-tainer especially for you!

$1.79 LIST 12 OZ.

Available in clear, aluminum, gloss & flat black

INSL-X E-33 FOR SAFELY HANDLING "HOT" WIRES

Do away with the uncertain protection of taped tool handles. Insl-x E-33, the material used by major utility companies for insulating linesmen's tools, is now available to you! Just dip tool handles—Insl-x E-33 dries to a tough, smooth coating that provides absolute protection. In bright red for quick, positive tool identification.

Contract service calls cost money. Spray every TV installation with Insl-x E-16 and eliminate return calls. The extremely high dielectric strength of Insl-x E-16 assures positive insulation. Insl-x dries to a hard but extremely flexible finish of unusual thickness.

Use Insl-x, the material that was designed to do one specific job—INSULATE.

Specify Insl-x E-26 for complete insulation of electrical equipment and wiring.

Insulate everything in TV set except moving parts and tubes! Spray antenna and all connections. Prevent corona, arcing. Keep out moisture, rust.

TECHNICAL DATA

Dielectric strength, 800 to 1200 v/m • Drying time, 3 to 5 minutes • Hard, yet retains great flexibility. Adhesion excellent to all conventional assembly surfaces including ceramic, anodized aluminum and phenolic • Highly resistant to chemicals and moisture.

See your jobber, or write for complete technical data, Dept. 201

INSL-X SALES COMPANY, 26 Rittenhouse Place, Ardmore, Pennsylvania

Insl-x Products are available in bulk for spray, dip, and brush application.

CW signal from the quadrature amplifier is applied to the suppressor grid, pin No. 7 of V29. The frequency of the quadrature signal is the same as that of the chrominance subcarrier, 3.579545 mc; and its phase is such that the detected signal in the plate circuit of V29 is the Q signal. After passing through the low-pass filter, the Q signal is applied to the phase splitter V10B in order to obtain both negative and positive signals for the proper combinations at the matrix. The frequency characteristic of the Q channel is shown in Fig. 4B. The zero reference in this figure and in Fig. 4C should not be confused with that of Fig. 4A. In Fig. 4A the frequency spectrum is considered as having the video carrier for a zero reference, and the subcarrier frequency of approximately 3.6 mc is seen to fall at the center of the bandpass response. In Figs. 4B and 4C the detected chrominance signals are under consideration, and the response curves show the relative response of the Q and I channels to these signals.

Operation of the I channel is quite similar in many respects to that of the Q channel. A schematic of the I channel appears in Fig. 5. As mentioned earlier in the article, the No. 1 grids of both demodulators are directly connected to each other; hence, the same signal is applied to each channel. However, the 3.579545-mc CW signal supplied to the I demodulator for synchronous detection is advanced 90 degrees in phase with respect to the Q-demodulator CW signal, with the result that the I signal is the one detected. The plate circuit of V32 contains a low-pass filter and a delay circuit. The frequency characteristic of the I channel appears in Fig. 4C. The delay circuits in the I and Y channels are necessary in order to insure that signals from all three channels (I, Y, and Q) arrive at the color tube with the same time relationship they had when separated at the transmitter. The functioning of each channel is such that the Q signal suffers the greatest delay, the I signal the next greatest, and the Y signal is delayed the least. Therefore an additional small delay is added to the I channel, and a greater delay is added to the Y channel to bring the total in these channels to equal that of the Q channel.

The plate signal of the I amplifier V33A is of the correct polarity for application to the red section of the matrix, but this polarity must be reversed for application to the blue and green sections. This reversal is accomplished in the I phase-inverter stage.

The chroma control affects the amplitude of signal output from both I and Q channels. The ratio of I to Q signals is controlled by a potentiometer in the cathode circuit of the I demodulator tube. Both these controls affect the saturation of the colors finally appearing on the color tube; this is in agreement with a previous statement, that color saturation is dependent upon the amplitude of the chrominance signal and hue is dependent upon the phase of the subcarrier.

Luminance Channel and Matrix

The luminance or Y channel serves essentially the same purpose as the video stages in the monochrome receiver; that is, it amplifies the luminance signal to the proper amplitude for application to the matrix. Included in the luminance channel is a delay line for the purpose of delaying the luminance signal approximately 1.0 microsecond so that it will arrive at the matrix at the same time as the corresponding color or chrominance signal. The circuit diagram for the luminance channel is contained in Fig. 6. It includes that portion from the input of the first video amplifier to the input of the matrix.

The first video amplifier performs a number of functions. These functions are to provide the following signals:

1. Negative signal to the bandpass amplifier.

2. Deflection sync signals to the sync separators.

3. Color-burst signal to the burst amplifier.

4. Luminance signal to the second video amplifier.

The negative signal to the bandpass amplifier is taken off the contrast control in the cathode circuit of the first video amplifier. The deflection sync signals are taken directly from the plate. The color burst is obtained

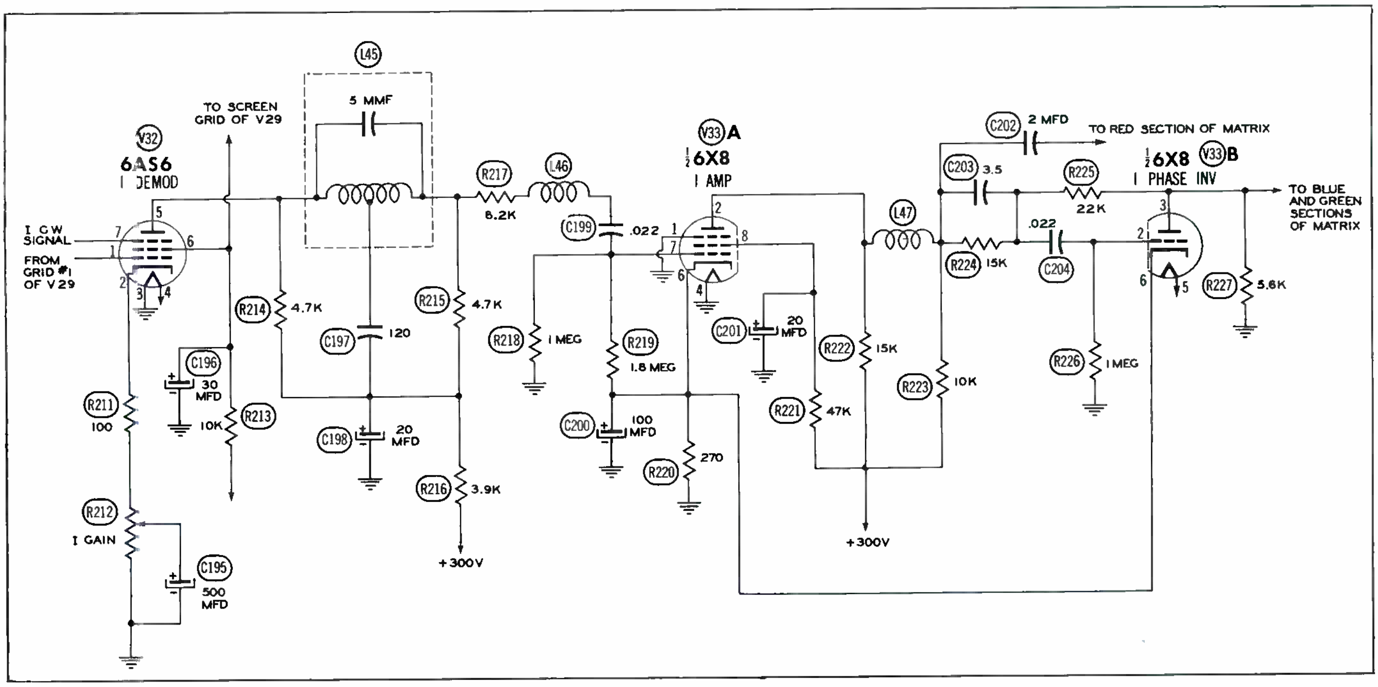


Fig. 5. The I Channel.

Color Decoding and Mixing

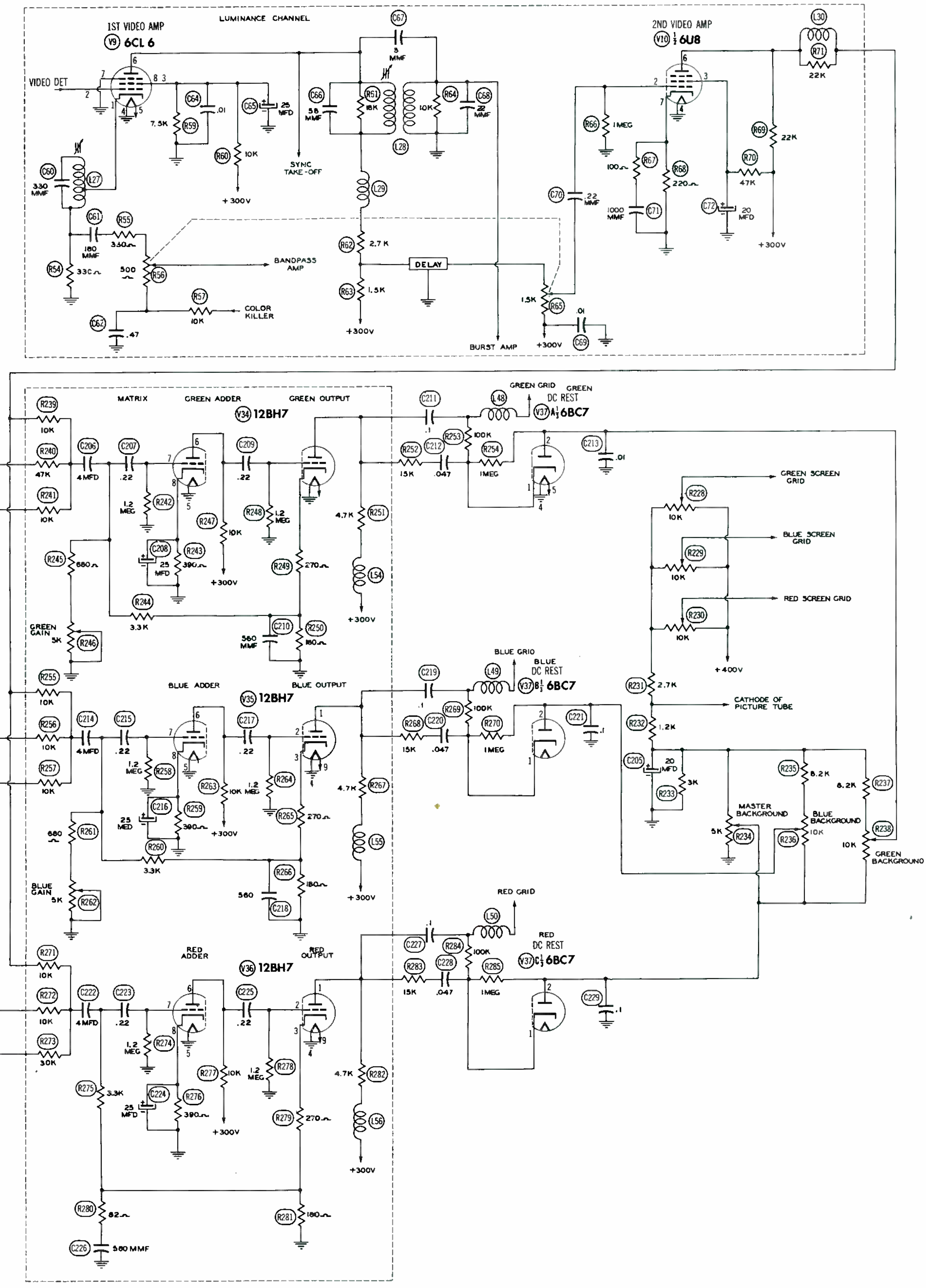


Fig. 6. Luminance Channel, Matrix, and DC Restorers.

from the secondary of the plate-circuit transformer. The luminance signal passes through the primary of the tuned transformer and is then fed into the delay line, the output of which is applied to a potentiometer that comprises one section of a two-section contrast control. This contrast control was discussed previously. Further amplification is obtained in the second video amplifier to bring the signal to the proper level for application to the matrix.

The Y (luminance) signal is comprised of part of each primary color of the picture and is represented by the equation:

$$Y = .59G + .30R + .11B,$$

thus showing what portion of each color is contained in the luminance signal. This signal is fed to each section of the matrix where it is combined with signals from the chrominance channel.

The purpose of the matrix is to take the color signals obtained from the Q and I channels and add them in the proper proportion to the luminance signal. The matrix is composed of three fixed resistive networks and their associated feedback type of amplifiers. After the mixing process has been performed, the resulting signals are further amplified by individual color amplifiers and then applied to the proper grids of the color tube.

Reference may be made to Fig. 6 for the circuit diagram of the matrix unit. Pointed out on the schematic are the different signals that arrive at the matrix as well as the place where they were generated. For proper mixing, it is necessary to have present at the input of the matrix the following signals:

1. Luminance signal (Y).
2. A positive and negative Q signal.
3. A positive and negative I signal.

The luminance signal is supplied from the output of the second video amplifier. The positive Q signal is obtained from the plate of the Q phase splitter, while the negative Q signal is taken from the cathode of this stage. The positive I signal is obtained at the plate of the I amplifier, while the negative I signal is taken from the plate of the I phase inverter.

As shown in Fig. 6, these signals are applied to the three fixed mixing resistors in the grid circuit of each adder stage. The green mixer receives +Y, -Q, and -I signals. Combining the three produces the green portion of the picture. Similarly, the blue mixer receives +Y, +Q, and -I to produce the blue; and the red mixer adds +Y, +Q, and +I to produce the red.

The Y, Q, and I signals are combined in each mixing section of the matrix in definite proportions. The gain settings of the matrix are shown in Fig. 7. Shown entering the matrix from the left are the three signals to be mixed. The numerical values shown in the squares represent the proportions in which they are combined to form the three primary colors in the output of the matrix. These colors are shown leaving the matrix unit at the bottom of the drawing.

By using the gain settings shown in Fig. 7, expressions can be obtained which represent the three color signals. These expressions are the following:

$$B = Y + 1.72\,Q - 1.11\,I$$

$$G = Y - .64\,Q - .28\,I$$

$$R = Y + .63\,Q + .96\,I$$

Substituting the equations for Y, Q, and I (as shown in Fig. 7) in the foregoing equations we obtain:

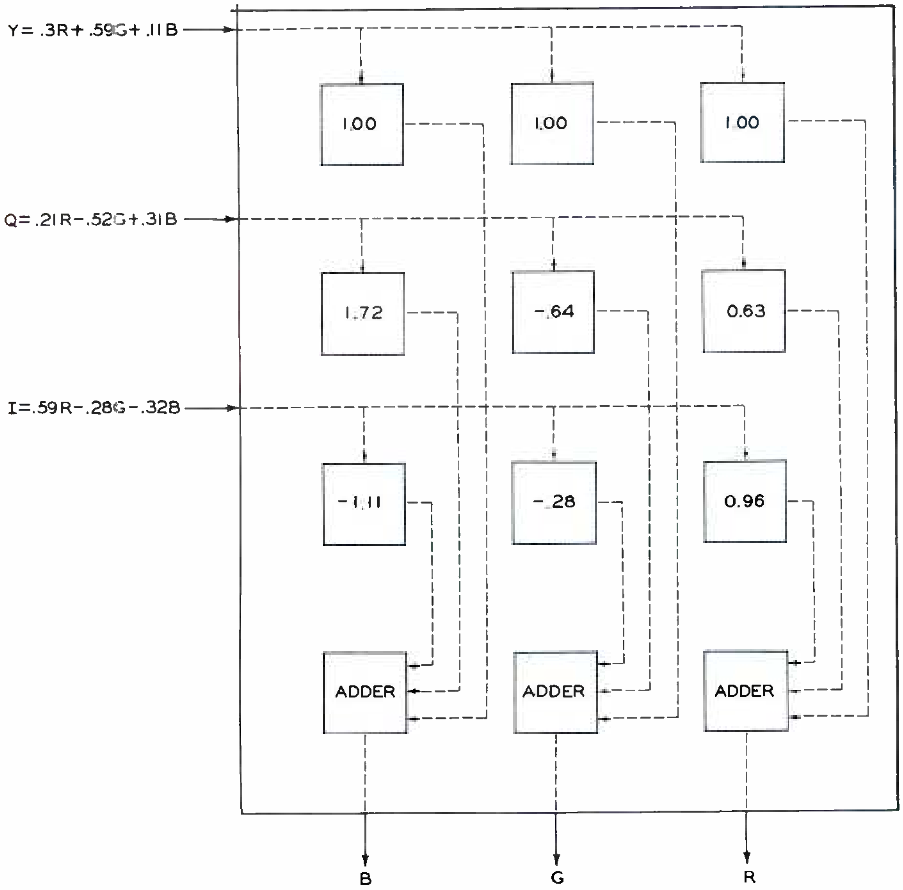


Fig. 7. Matrix Gain Settings.

$$B = .30\,R + .59\,G + .11\,B + 1.72\,(.21\,R - .52\,G + .31\,B) - 1.11\,(.59\,R - .28\,G - .32\,B)$$

$$= .30\,R + .59\,G + .11\,B + .36\,R - .90\,G + .53\,B - .66R + .31\,G + .36\,B.$$

$$G = .30\,R + .59\,G + .11\,B - .64\,(.21\,R - .52\,G + .31\,B) - .28\,(.59\,R - .28\,G - .32B)$$

$$= .30\,R + .59\,G + .11\,B - .13\,R + .33\,G - .20\,B - .17\,R + .08\,G + .09\,B.$$

$$R = .30\,R + .59\,G + .11\,B + .63\,(.21\,R - .52\,G + .31\,B) + .96\,(.59\,R - .28\,G - .32\,B)$$

$$= .30\,R + .59\,G + .11\,B + .13\,R - .32\,G + .2\,B + .57\,R - .27\,G - .31\,B.$$

Cash in on the biggest TV accessory campaign in history!

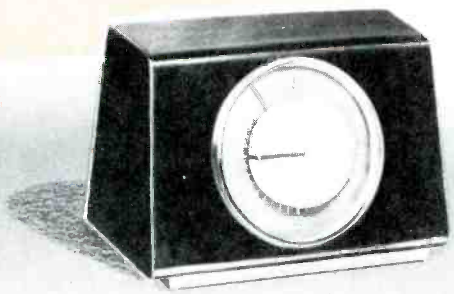
Alliance Keeps its Spring Promise of a $500,000 Fall Campaign

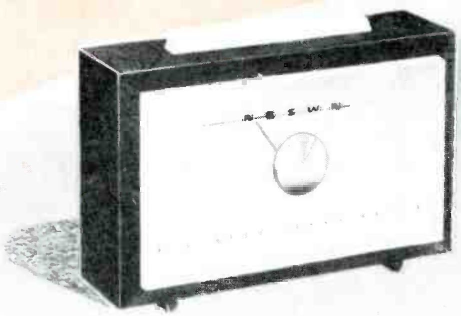
New Models **RESTYLED!**

ALLIANCE TENNA·ROTORS

New **FOR UHF!**

ALLIANCE TV CONVERTER





MODEL U-83, the only *fully automatic* antenna rotator on the market. Just "set and forget" this new model Alliance Tenna-Rotor. Reinecke-designed $44.95

MODEL T-10, finger-tip electrically controlled Alliance Tenna-Rotor with direction indicator dial. Extremely accurate. Modern styling by Reinecke & Associates $44.95

ALLIANCE TV CONVERTER—adds the new UHF channels to present sets. Leading brand in the field. The *quality* converter, priced right! $42.50

1 ***New styling sells on sight!*** Here's the biggest news in TV accessories--brand new styling! Style's the thing, and ALLIANCE has it! More eye-appeal, more buy-appeal in these bright, new ALLIANCE TENNA-ROTORS! Boost your sales, boost your profits with new ALLIANCE TENNA-ROTORS!

2 ***$500,000 ad campaign pre-sells for you!***

TV Spots—eye-compelling "home" demonstrations—more than 16 million viewers on more than 100 stations!

LIFE Magazine—full-page ad in this top consumer magazine!

Newspapers—dominant, sales-making ads in key markets!

Point-of-Sale Displays—Full color, on-the-spot reminders!

And remember ALLIANCE TENNA-ROTOR has over 1,250,000 satisfied users

ALLIANCE MANUFACTURING COMPANY
ALLIANCE, OHIO

CASH IN ON THIS BIG PROFIT-MAKING OPPORTUNITY! RELY ON ALLIANCE! SELL THE MOST OF THE BEST!

These equations were worked out for the primary colors of blue, green, and red. The addition of the Y, I, and Q signals in proper amplitude and phase is accomplished by the use of three fixed resistive mixing type of feedback amplifiers. One section of a 12BH7 is employed with three fixed matrix resistors for each adder section. Further amplification for each signal is provided by an output stage which consists of the second half of a 12BH7.

As can be seen in Fig. 6, there are only two controls in the matrix. The reason for this is that the red signal required is approximately 100 volts, while the green and blue need only be approximately 50 to 70 volts to drive the picture tube. Therefore the red is used as a standard, and the amplitudes of the other colors are controlled to balance the resulting picture.

DC restoration is obtained by a triple diode type 6BC7 tube with plate circuits that comprise a bridge which is adjusted to maintain tracking of the bias for each gun at any setting of the master background control.

Following is a brief review of the main points covered in this article.

The luminance signal compares very closely to the normal video signal in a monochrome receiver but contains in addition the color-synchronization bursts and a few higher frequencies from color detail too small for accurate discernment by the eye.

The chrominance signal contains the color information in the form of I and Q signals. The color hue is represented by the subcarrier modulation phase, and the color saturation is represented by the signal amplitude. The bandpass amplifier is designed to pass the color-subcarrier frequencies while attenuating the luminance signals. The demodulators utilize the phase difference to detect and separate the I and Q signals. Low-pass filters restrict each signal to the proper frequencies, and phase splitters and inverters supply the proper signal polarity for application of each signal to the matrix.

Since the I and Q signals each contain certain proportions of all three color signals, their combination with the luminance signal results in the separate red, green, and blue signals being available for the guns of the picture tube.

Henry A. Carter and Paul C. Smith

Checking Video Response

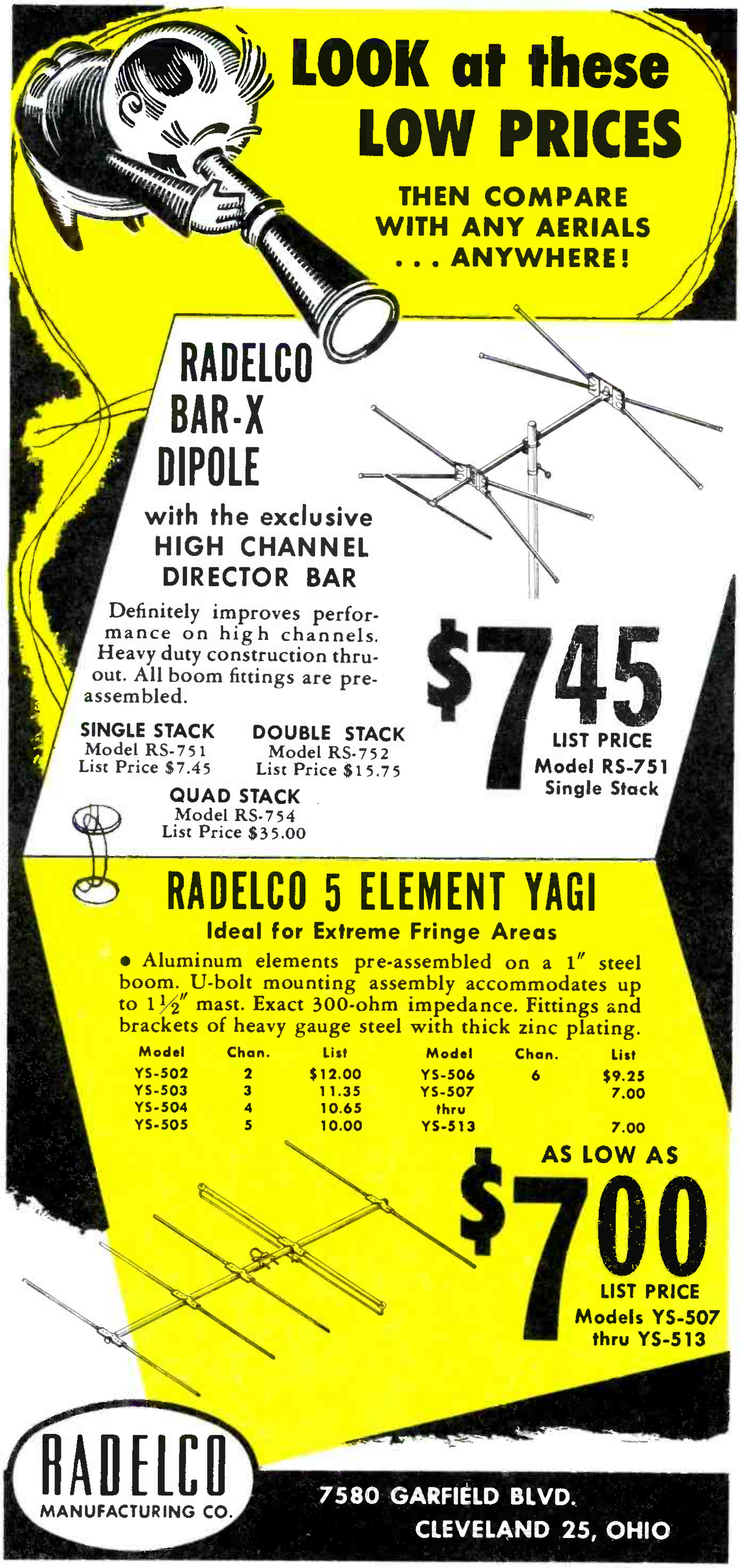
(Continued from page 27)

determined by the setting of the controls. The setting of the Center-Frequency control determines the frequency around which the signal deviation occurs. The Sweep-Width control is used to set the amount of deviation that is desired above and below the center frequency. For instance, a setting of 25 mc on the Center-Frequency dial and a 10-mc Sweep-Width setting provide a frequency-modulated signal between 20 and 30 mc. When used to align a tuned amplifier such as the video IF stages, the center frequency of the generator is adjusted to the center of the pass band of the amplifier and the limits of the sweep are adjusted to cover the upper and lower limits of the pass band. The output of the amplifier can then be displayed on an oscilloscope screen in the form of a curve. The synchronized-sweep voltage from the generator must be connected to the horizontal-input terminals of the oscilloscope. The complete horizontal trace then represents the frequency band covered by the sweep generator. Any point on

Fig. 5. Response Curve Produced by Open in Series Peaking Coil in 6AU6 Plate Circuit.

the horizontal trace can be considered to be representing a definite frequency, therefore the height of the curve at any given point represents the output of the amplifier at that frequency. Thus, a curve that is representative of the gain of the amplifier at all frequencies within the pass band can be displayed. This method can also be used for testing video amplifiers by adjusting the generator to sweep from zero cycles up to the maximum frequency to be checked. A description of this method follows.

There are many combinations of generator and oscilloscope that will provide a usable pattern, and there are others that will not. At this point, it is advisable to check the equipment on hand to be sure that the generator has enough output and the oscilloscope has a sufficiently wide response. The generator and oscilloscope are connected and the controls adjusted as if an amplifier were to be tested, except that the generator output is connected directly to the oscilloscope input.



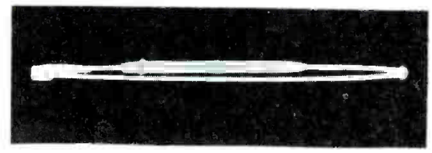


Fig. 6. Response Curve Produced by Open in Series Peaking Coil in 6AR5 Plate Circuit.

This gives a response check of both units and should produce a pattern similar to that of Fig. 1A. This photo shows the response curve produced by the generator and oscilloscope which were used to procure all the included photographs. Fig. 1B shows a curve obtained by using an oscilloscope having insufficient high-frequency response. If a check of the equipment on hand produces a pattern similar to this, the oscilloscope is not suitable for checking video-amplifier response in the manner illustrated in this article.

Connect the sweep generator to the input of the amplifier and adjust the controls to provide an output of a 4.5-mc center frequency with a sweep width of 9 mc. This setup was used to obtain the photographs accompanying this article. A wide-band oscilloscope is connected to the output of the amplifier and the synchronized-sweep output of the generator is connected to the horizontal-input terminals of the oscilloscope. The controls of the oscilloscope are adjusted so that the sweep voltage from the generator provides the horizontal trace. With this setup, the oscilloscope screen presents a response curve of the amplifier at all frequencies from zero to approximately 9 mc, and any deficiency in the frequency response of the amplifier will be apparent as a droop or sag in the curve. If it is desired, a separate marker generator can be coupled to the amplifier input and the marker pip will then identify the frequency at which the loss of amplification begins or ends.

The diode detector normally used for video detection is a low-impedance device, and its load impedance is of a very low value. To prevent this low impedance from loading the generator output, it is necessary that the detector load be

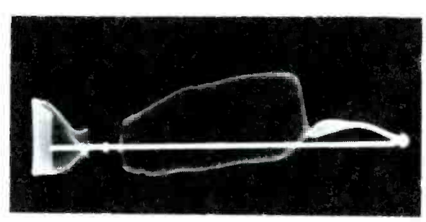


Fig. 7. Response Curve With Cathode By-Pass Capacitor Shorted.

removed from the video-amplifier input and a substitute high-impedance circuit be added. A 470-KΩ resistor and a 1.5-volt battery are connected in series from the video-amplifier grid to ground. The coupling capacitor should be as large a value as possible (.1 to 1.0 mfd). In those circuits wherein fixed bias is applied to the video-amplifier grid and capacitive coupling is used, it is only necessary to disconnect the detector-load circuit.

The video amplifier shown schematically in Fig. 2 is representative of most video amplifiers in that it is compensated to have a fairly flat response up to 4.5 mc and actually has a small amount of gain up to 6 mc. Fig. 3 is a photograph of the normal response curve of this amplifier and shows the extreme dip at 4.5 mc due to the trap formed by L1 and C2. (Note: The collapse of the curve at the extreme left does not result from a defect in the video amplifier. The sweep generator used in making these photo-

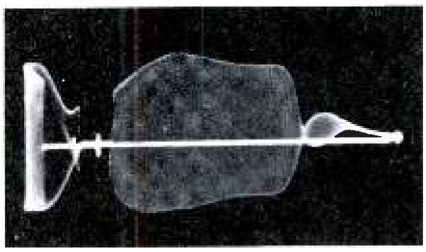


Fig. 8. Response Curve Showing Effect of Added Capacity.

graphs was of the beat-frequency type, and the output diminished to zero whenever the swept oscillator locked in with the fixed oscillator.) The amplifier has some gain above 4.5 mc, but this is of no consequence since only the frequencies below 4 mc are used to modulate the picture tube. A high-impedance probe was used on the input lead of the oscilloscope for all photographs except that of Fig. 4. This shows the distortion of the response curve due to the input capacity of the oscilloscope.

One of the troubles often found in a video amplifier is an open peaking coil. When the coil does not have a shunt resistor, such as L4 and L6 in Fig. 2, the result of an open is definite. The plate voltage is removed from the tube, and the amplification ceases. The result of an open in L3 or L5 in Fig. 2 is less definite. The shunt resistor is still in the plate circuit; the tube retains plate voltage, although at a low value; and some amplification remains. Fig. 5 shows the result of an open in L3, and Fig. 6 shows the

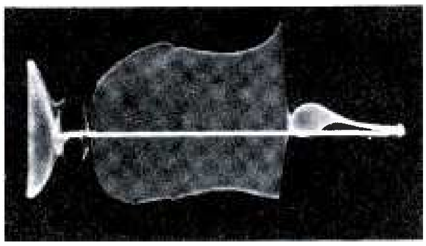


Fig. 9. Effect of Stray Capacity on High-Frequency Response.

result of one in L5. The capacitor C6 in the cathode circuit of the 6AR5 video-output stage was included in the design of the amplifier to improve the high-frequency response. If an open should occur in this capacitor, the oscilloscope pattern would be similar to that of Fig. 2 but would have a lower amplitude. If, however, this capacitor were to develop an internal short, it would

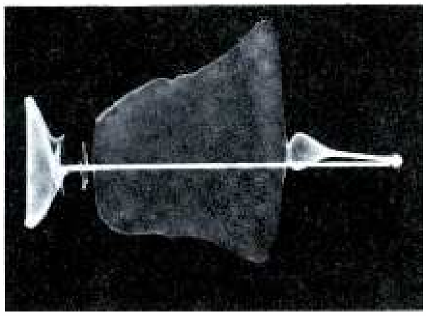


Fig. 10. Excessive Peaking of High Frequencies by Added Stray Capacity.

remove the normal bias from the 6AR5 in addition to lowering the response. Fig. 7 illustrates the result of this condition and shows the distortion resulting from the operation of the 6AR5 at approximately zero bias.

During the servicing of a receiver, it is often necessary to move leads and components from their original location. While doing this, it is possible that a lead or component could be moved close enough to the circuits of the video amplifier that an appreciable capacity to ground would be introduc-

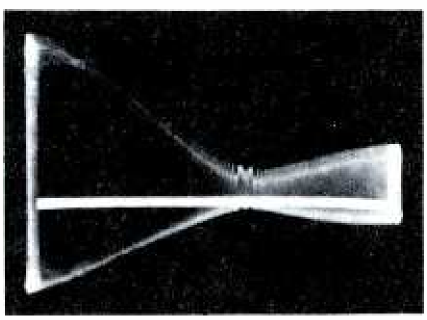


Fig. 11. Response Curve Obtained With Correct Adjustment of 4.5-Megacycle Trap.

It was way back in 1945 that Raytheon, the first tube manufacturer to recognize the Service Dealers' need for help in combating public mistrust, provided that help through the *Raytheon Bonded Electronic Technician Program.* For the past nine years this Raytheon support has helped many thousands of Service Dealers gain customer confidence and good will — substantially increase their volume and profit.

Today, with the addition of television, the Raytheon Bond is more important than ever. And today, as always, if you can qualify for it, your status as a Raytheon Bonded Electronic Technician *costs you not one cent.* It is *Raytheon's* investment in *your* future.

If you're interested in making more money, ask your Raytheon Tube Distributor to tell you about the Raytheon Bonded Program. He'll be pleased to tell you how this powerful sales stimulator can help you.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division

Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

RAYTHEON *MAKES* ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES ed into the circuit. The plate circuits of the video amplifier would be the most affected by this added stray capacity. To simulate this condition, a 5-mmf capacitor was shunted to ground from each of several points in the video amplifier, and the resulting waveforms appear in Figs. 8, 9, and 10. Fig. 8 was obtained with the capacitor connected to the plate (pin 5) of the 6AU6, in Fig. 9 the capacitor was connected to the junction of L1 and L3, and in Fig. 10 the capacitor was connected to the plate (pin 5) of the 6AR5. It can be seen that the added capacity has a very distinct effect on the high-frequency response of the amplifier. A condition of this sort could have been injected into a receiver during a previous repair by a service technician who had thoughtlessly moved a lead or component.

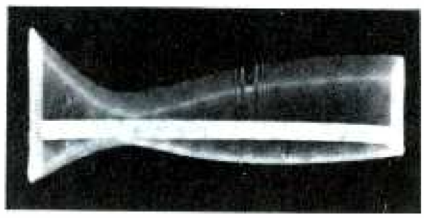


Fig. 12. Response Curve Showing Misadjustment of 4.5-Megacycle Trap.

This method of checking video response also provides a fast and very accurate way of adjusting or checking the adjustment of,the 4.5-mc trap during the response check. To achieve this, it is necessary to reduce the Sweep-Width-control setting to approximately 1 mc; adjust the Center-Frequency control to center the response curve on the oscilloscope screen; and inject a calibrated 4.5-mc signal into the input of the video amplifier. Fig. 11 shows the pattern obtained when the trap is correctly adjusted, and Fig. 12 shows an incorrect adjustment.

This procedure may seem complicated during the first several trials, but with repeated usage the complications should disappear. It will be easier to set up the equipment and obtain an over-all indication of amplifier performance at once than to make numerous readings with an ohmmeter or voltmeter. For the service technician who demands the best possible performance from the receivers he has serviced, this method should prove valuable.

William E. Burke

Color Synchronization

(Continued from page 11)

each stage performs its designated role, it is now necessary to investigate the schematic diagram of Fig. 5. This schematic diagram represents the color-sync system shown previously in the block diagram.

A pentode tube is employed as the burst amplifier. The grid of this tube is driven by the burst signal inductively coupled from the plate of the first video amplifier. It was mentioned previously that this stage was cut off during the video portion of the signal. This cutoff is accomplished by application of a plus voltage to the cathode. The tube is permitted to conduct during retrace by applying a negative pulse to the cathode. This pulse is taken from a winding on the horizontal-output transformer.

The plate load for the burst amplifier consists of a high-impedance transformer with a bifilar winding on the secondary. A signal of approximately 60 volts is developed across each half of the secondary winding. This signal is then coupled to the phase detector which consists of two triodes connected as grid-cathode diodes. The plates of these triodes act as shields for their respective section. A 3.579-mc signal from the color-phase amplifier also appears at the phase detector. This signal is representative of the locally generated signal. The phase detector compares these two 3.579-mc signals, and any difference appears as a DC error voltage at the arm of the AFC balance control. This DC error voltage is therefore present at the grid of the reactance tube. With no error voltage present, the grid of this tube is at approximately zero volts with respect to ground. Bias for the reactance tube is partially from self-bias and partially from a plus voltage introduced on the cathode. As mentioned previously, the reactance-tube stage acts as a capacitor. The amount of capacitive reactance introduced into the oscillator depends upon the conduction of the reactance tube. This conduction is controlled by the amount of DC error voltage applied to the grid.

It may be seen from the schematic diagram that the 3.579-mc oscillator is crystal controlled and is connected as a cathode follower. A transformer in the cathode of the oscillator couples a signal directly to the I demodulator. A 3.579-mc signal also drives the grid of the quadrature amplifier. This amplifier has a transformer in the plate circuit which couples the resultant signal to the Q demodulator. The quadrature-amplifier circuit introduces a 90-degree phase shift in the CW (continuous-wave) signal going to the Q demodulator.

The grid of the color-phase amplifier is also driven by a CW signal from the 3.579-mc oscillator. This stage is self-biased. The amplified signal is developed across the primary winding of the transformer in the plate circuit of the color-phase amplifier. The secondary of this transformer couples the signal to the phase detector. This circuit also contains the phase control. This adjustment controls the phase of the locally generated CW signal used as a reference in the phase detector. This, in turn, will determine to a certain extent the phase of the signals to the I and the Q demodulators. The phase control is adjusted for proper color rendition.

The over-all purpose of the color-synchronization system is to control the CW signals supplied to the color demodulators. Improper operation of this system will usually result in false color information being extracted from the transmitted signal.

Don R. Howe

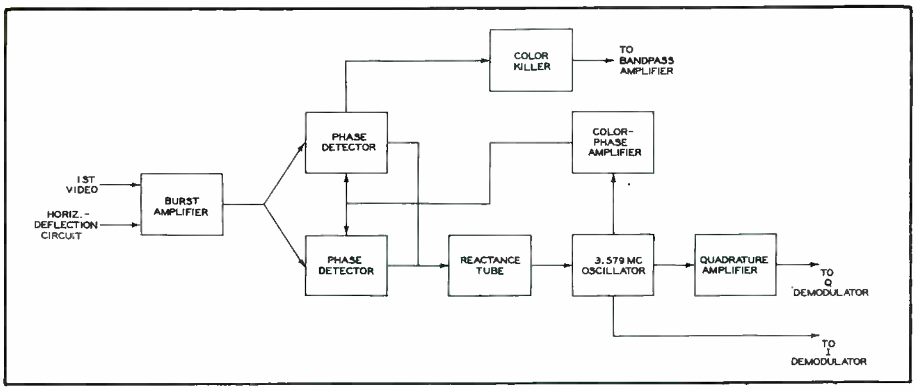


Fig. 4. Block Diagram of the Color-Sync System.

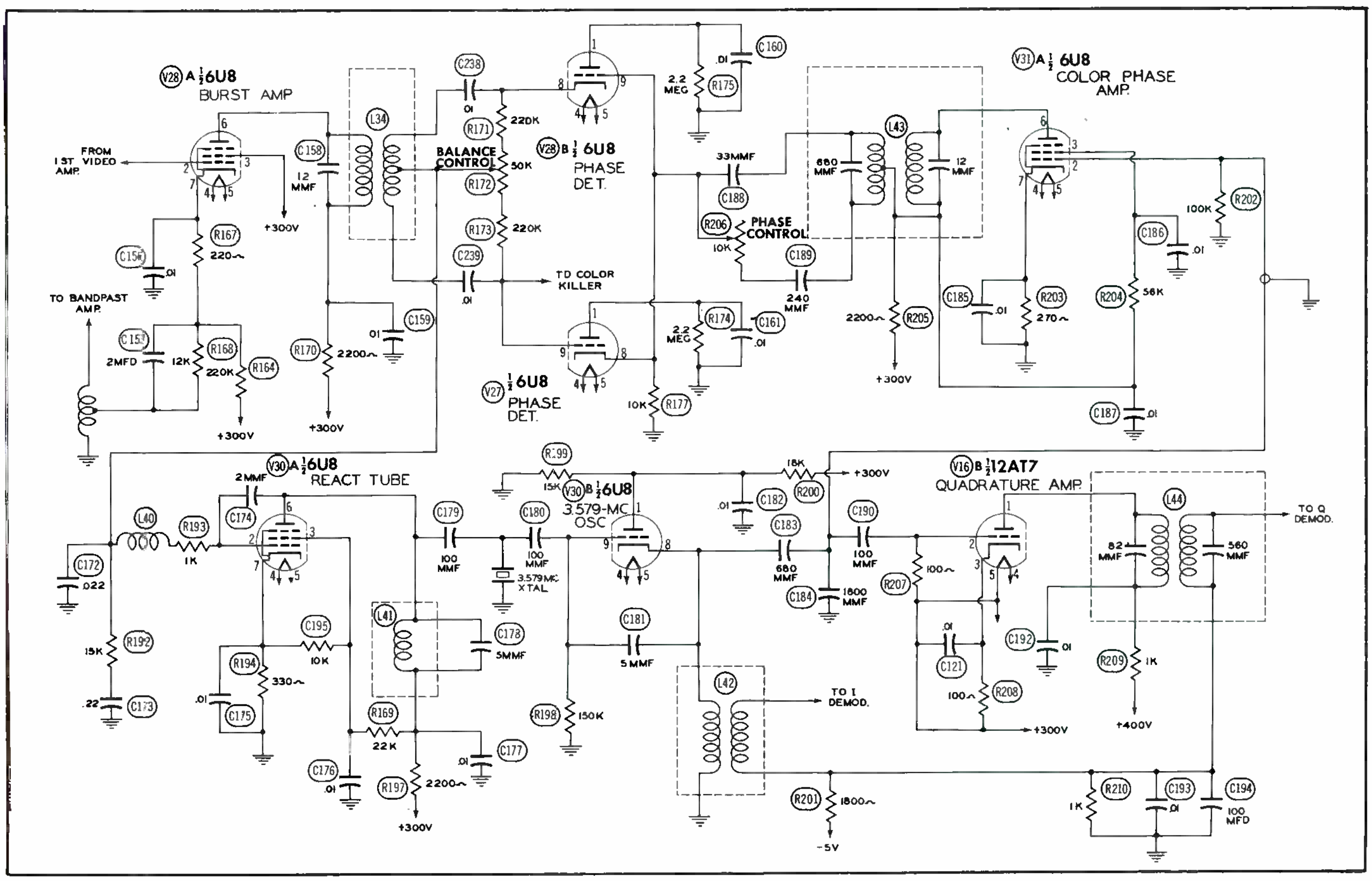


Fig. 5. Schematic Representation of the Color-Sync System.

Shop Talk

(Continued from page 9)

frequency amplifier system have been changed.

If tube substitution in the video detector and video-frequency amplifier stages does not increase the height of the wave on the scope screen, return the original tubes to their sockets. In the video IF system, realignment is advisable after changing tubes. This is particularly important when a 40-mc IF is employed. Sometimes, replacement of tubes without realignment will show no change; but after realignment, a considerable increase in sensitivity will be realized. This same precaution applies to the RF section as well.

3. Many receivers employ germanium crystals as video detectors. Substitutions should also be made for such crystals, because there appears to be wide variations between different crystals.

4. For the sound system, an aural test is usually satisfactory. If the receiver is a nonintercarrier type, set the AM generator to the sound-carrier frequency of the channel to which the set is tuned. Turn up the generator output until the audio note is just heard in the loudspeaker. Then substitute new tubes for those in the sound system of the receiver, noting whether there is any noticeable increase in sound level. If the receiver is an intercarrier type, the AM generator must be set to 4.5 mc and coupled across the video-detector load for this test.

5. For the sync separator, sweep systems, and damper tube, a suitable check can be carried out using a tube tester, perferably one that indicates mutual conductance. Test each tube first to determine whether it is up to the specifications established for it, as indicated on the meter. Then without changing any of the settings, try several new tubes to see whether a greater reading can be obtained. Use the tube that gives the best indication. Follow this same procedure for every tube in the sections mentioned.

Note that by this latter test we are not only comparing each tube against the established standard for that tube, but we are also checking each tube against new ones.

6. The high-voltage rectifier tube is best checked by substitution, measuring the high voltage after each change.

When the foregoing tests have been completed remove the instru-

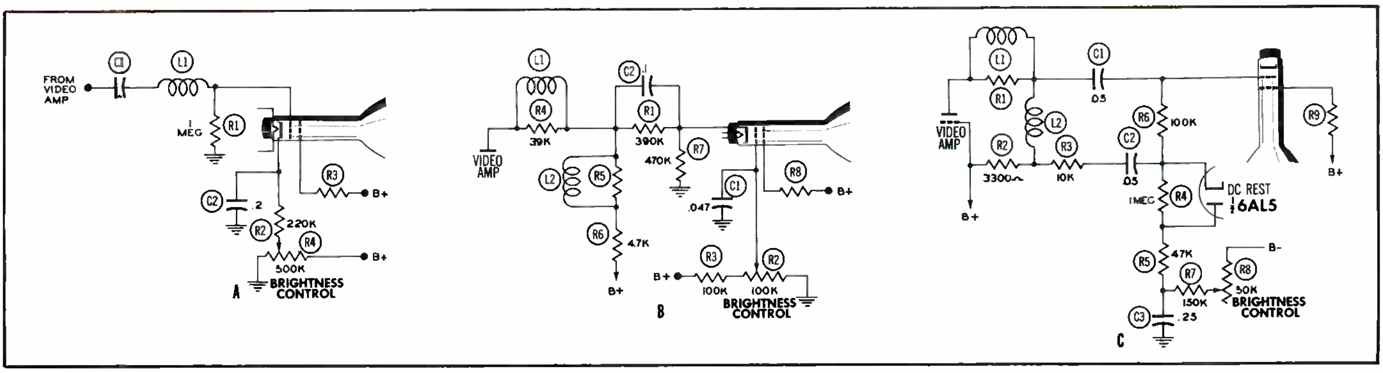


Fig. 1. Three Different Arrangements for Brightness Control.

ments and the inserted bias voltage, and air check the receiver. If after that the changes recommended by the manufacturer are still deemed necessary, they may be made with the full knowledge that the receiver is operating at peak efficiency.

REVIEW

Cyrus Glickstein, "Loss of Control Over Brightness," Radio-Electtronics, April 1952, Gernsback Publications, Inc., (formerly Radcraft Publications, Inc.), Erie Ave., F to G Sts., Phila. 32, Pa., published monthly, $3.50 per year in United States, its possessions, and Canada.

Our review this month concerns the brightness control in a television receiver. Because of the simplicity of most brightness-control circuits, one would not expect to encounter much difficulty in correcting any troubles that develop in them. Ordinarily this is true, but there are enough instances when the defect is not readily uncovered to warrant an examination of some of the causes of loss of control over brightness. This is done in Mr. Glickstein's article.

The brightness control in a television receiver consists of a potentiometer which, by its setting, varies the bias applied to the picture tube. Varying the bias, determines the average number of electrons passing the control grid and striking the fluorescent screen. In consequence, the intensity or brightness of the image is changed.

When control over brightness is lost, the trouble is not caused by any defect in the high-voltage system or inability of the signal to reach the picture tube. It arises because the brightness potentiometer cannot vary the bias between the picture-tube control grid and cathode.

Several typical arrangements of brightness-control circuits are shown in Fig. 1. In Fig. 1A, the video signal is fed to the grid of the picture tube. The DC voltage of the grid with respect to ground is zero, since the grid connects to the chassis through a 1-megohm resistor. The brightness potentiometer is in the cathode leg of the tube. One end of this control connects to the chassis, while the other end receives a B+ voltage. Making the cathode positive is equivalent to making the grid negative by an equal amount.

For most types of cathode-ray tubes, a bias of approximately -50 volts cuts off electron flow and as a result extinguishes the raster. The normal range of the brightness control is from zero volts, or a few volts negative, to more than -50 volts.

Another bias arrangement is shown in Fig. 1B. In this arrangement the cathode receives the video signal, and so the brightness control is placed in the control-grid circuit A small positive voltage is made available to the grid in order to offset partially (but not totally) the positive voltage on the cathode. The net result is a negative grid bias with respect to the cathode.

In Fig. 1C, the cathode is grounded, and a variable negative voltage is fed from the brightness control through the DC restorer network to the control grid of the cathode-ray tube.

Loss of bias control will result in loss of brightness control. There are three common defects which can affect the bias of a picture tube:

1. A defective picture tube.

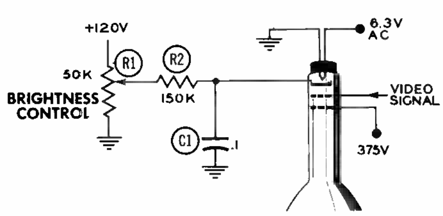


Fig. 2. A Brightness Control in the Cathode Leg of a Picture Tube.

2. A defect in the immediate bias circuit.

3. A defect which is in some other portion of the receiver and which is somehow affecting the bias of the picture tube.

A defective cathode-ray tube can cause loss of control if either of two conditions is present: (1) a short or partial short from cathode to grid or heater, or (2) a gassy tube. In the first instance, loss of control will occur if the brightness control is situated in the cathode leg of the picture tube. See Fig. 2. One side of the heater is usually grounded. Hence, when a cathode-to-heater short circuit develops, the cathode is placed at ground potential and no variation of the brightness control will alter this. Whether or not a picture is observable under these conditions depends upon the average potential of the grid. Generally, if a picture is obtained, it will be quite bright.

A gassy picture tube may cause loss of control over brightness because ionization takes place inside the tube. This causes the grid to become more positive than normal. When a picture tube is gassy, a picture may still be visable on the screen. The picture usually turns negative (white areas black and black areas white) at high levels of contrast and brilliance.

In the second category leading to loss of control over brightness are defects in the immediate bias circuit. These can include a variety of items. For example, if capacitor C2 in Fig. 1A should short out, then the cathode of the picture tube would be at a fixed ground potential. With bias thus removed, brilliance is maximum and the brightness control has no effect.

An open 100,000-ohm resistor, R3 in Fig. 1B, would effectively ground

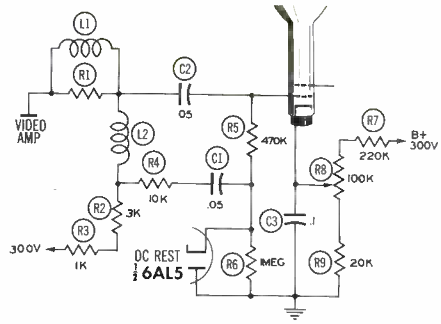


Fig. 3. Leakage Causes Control Loss.

the grid of the cathode-ray tube. The positive voltage on the cathode would then blank out the picture entirely or make it quite dark. Along the same lines would be a large increase in the resistance of R3 or an open lug at the B+ end of the brightness control.

It is interesting to note that an open lug at the ground end of the control would lead to an overly bright picture or screen. With the ground connection broken, the full B+ is applied to the control grid. The flow of current to the grid and through R2 and R3 would reduce the actual positive grid potential, but the grid would still be positive enough to make the screen very bright. As a matter of fact, the excessive tube current flow could readily lead to picture blooming (or even raster extinction) if the high-voltage supply has poor regulation.

Leaky coupling capacitors at the grid of the picture tube, C_1 and C_2 in Fig. 3, can place a positive voltage on the picture-tube control grid. This positive voltage may exceed the positive voltage present at the cathode. Under these conditions, the picture cannot be extinguished by brightness-control rotation. The picture detail may be almost normal. Depending on the amount of leakage, the control may either be unable to reduce the brightness at all or just cut it down a little.

When direct coupling exists between the final video amplifier and the picture tube (grid in Fig. 4), then the positive voltage present at the control grid is dependent upon the proper functioning of the video-amplifier tube. Under normal conditions in Fig. 4, the picture-tube control grid receives a positive potential of +150 volts; and this is offset by sufficient positive cathode voltage to establish a negative bias for the tube.

If something should cause the plate current of the video-amplifier tube to decrease appreciably or cease

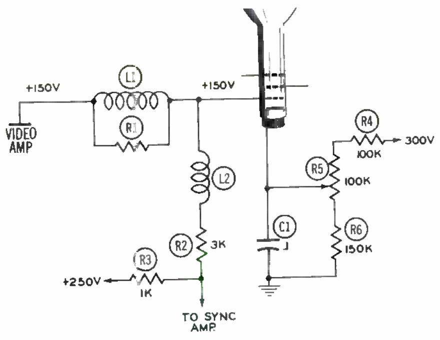


Fig. 4. Effects of Defective Video Tube. (See Text.)

altogether, then the plate voltage of the tube will rise, bringing the picture-tube grid voltage up with it. No setting of the brightness control will cut off the electron flow in the picture tube.

Perhaps the most difficult troubles to find are those which originate in some seemingly remote section of the receiver (remote with respect to the brightness-control circuit). An example of this occurred in an RCA Model 6T74 receiver. There was no control over brightness; the picture was fair, but the sync was very poor. Sound was very low and distorted. The trouble was traced to a defective 6K6 audio-output tube. This tube (Fig.5) receives +375 volts in its plate circuit and ties its cathode into the +120-volt line. When a partial short developed between cathode and filament, the +120 volts were brought close to ground potential. This caused a redistribution of the voltages across the low-voltage power supply; and the cathode of the picture tube, which operates off the +120-volt point, was drastically

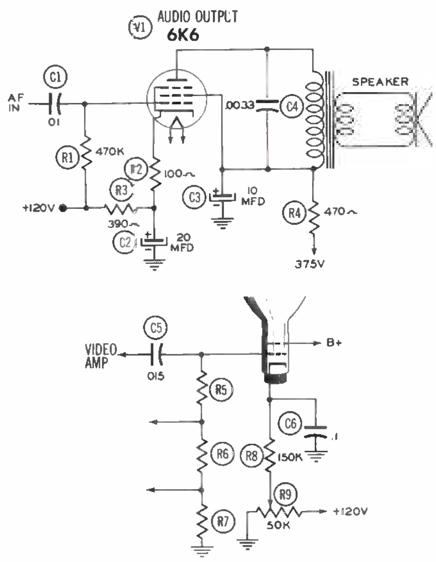


Fig. 5. A Partial Short Between Cathode and Heater of the 6K6 Resulted in Loss of Control Over Brightness at the Picture Tube.

affected. The trouble also disturbed the operation of the sound IF stages and the sync amplifier, which also connected to the +120-volt power-supply terminal.

Now that we have seen the most common causes of loss of control over brightness, let us see how the trouble can be tracked down as quickly as possible. As a first step, check to see if there are any other apparent defects. It might also pay to check the action of the other controls. If side effects are noted, such as distorted sound or no sound at all, then the trouble is likely one of low B+ somewhere in the set, and the loss of control over brightness probably stems from this. If the schematic diagram is handy, check to see whether an arrangement such as that shown in Fig. 5 is employed; and if so, then the audio output tube should be tested.

When impairment of the brightness control action is the only apparent difficulty, then the following procedure will help to localize the trouble.

Remove the base socket of the picture tube; and, with the set on, measure the voltage between the grid and cathode terminals of the socket. To be normal, the grid should be negative with respect to the cathode, and rotation of the brightness control should cause the bias to vary. Any abnormal readings will indicate that the fault is in the bias circuit. On the other hand, normal readings will localize the trouble in the tube.

In some receivers the filaments are in series parallel, and removing the tube socket will open up the filament circuit of the receiver. A jumper in the form of a piece of solder inserted in the filament holes of the tube socket will restore filament continuity.

If it is found that the trouble lies in the bias circuit, then the service technician should next determine whether it is in the grid or the cathode circuit. First measure the voltage between grid and chassis, and note whether this is what it should be (as indicated by the schematic). If the brightness control is in the grid circuit, vary its setting and see if this varies the grid potential over the proper range. Make a similar check between cathode and ground. Once the trouble is pinned down to a specific circuit, component checking is in order

Milton S. Kiver

Cascode Tuner Installation

(Continued from page 17)

across R33. This voltage is applied through the filter network, R32 and C27, to the grid circuit of the video IF and RF amplifiers. The portion of the contrast control marked C is included in the rectifier circuit and is also a part of a divider network together with R34. This network is connected to +120 volts. Thus a small fraction of +120 volts is applied to the cathode, pin 5 of V6, and acts as a delay bias which must be overcome by the video signal before rectification can take place.

For example, when portion C of the contrast control is 200 ohms, the voltage applied to pin 5 of V6 is 2/392 of 120 volts or approximately +.6 volt. As the contrast control is advanced for greater contest with weak signals, the value of C increases and a larger portion of 120 volts is applied to pin 5 of V6. Conversely, as the contrast is reduced when receiving strong signals, less voltage is applied to pin 5 and the smaller delay voltage allows a greater AGC voltage to be applied to the RF and video IF stages.

With models employing the switch M5, the action is as described in the foregoing with the switch in "Normal Area" position; but when the switch is in the "Noisy Area" position, the AGC voltage is taken directly from the video-detector-load resistor R35. No delay voltage is present in this case; so the full AGC voltage is applied, and the sensitivity of the RF and video IF stages is reduced correspondingly to offset the high noise level. In receivers where the AGC voltage is taken from the video detector and applied to RF and video IF stages alike, with no provision for delay, it may be found that the AGC voltage is sufficient to reduce the sensitivity of the RF stage by an undesirable amount, even with weak input signals. A "Local-Fringe" switch can be added, as in Fig. 2, in order to allow the RF grid to be returned to ground thus reducing the RF grid bias to the small amount developed as contact potential bias.

An example of the second type, or nonadjustable delay circuit, appears in Fig. 3. This type may easily be made adjustable by the addition of a control, as indicated by the dotted lines. Here the AGC voltage is developed by a keying tube which has several attendant advantages: (1) a greater value of AGC voltage is developed; (2) this voltage is governed by the level of the synchronization pulse tips and so is not subject to effects caused by large variations of picture information level; and (3) random noise peaks in the signal have little effect on the AGC voltage, since the keying tube conducts only during the period of the horizontal synchronization pulse.

The voltage developed at the plate of the keying tube V9 is applied to the filter section composed of R48 and C7. The resultant voltage at point A is larger than that normally applied to RF- and video IF-amplifier grids; and consequently, to obtain the correct values, this voltage is impressed on the dividing networks shown. With the values of R33 and R34 as indicated, approximately 1/4 of the voltage at point A will be applied as bias to the video IF-amplifier stages. R49 and R29 are connected in series to a +115-volt source, and the diode plates of a clamper tube (V10) are connected to their junction. The RF bias voltage is available at this junction. When voltages at point A are below a certain value, V10 will conduct, maintaining point B at approximately zero volts DC. As the voltage at point A rises in negative value, eventually a point will be reached where V10 ceases to conduct; and the voltage at point B will also start to rise in negative value, this voltage being applied as bias to the RF stage. In this manner the bias voltage to the RF stage is delayed, being approximately zero for small input signals and rising in value only after a certain signal level is reached.

Since approximately 1/4 of the voltage at point A is applied to the video IF grids while nearly 8/9 of the voltage increase at A appears at point B after the voltage at B starts to rise, eventually the voltage at B will overtake and surpass the bias on the video IF grids. This action is diagrammed in Fig. 4 where the

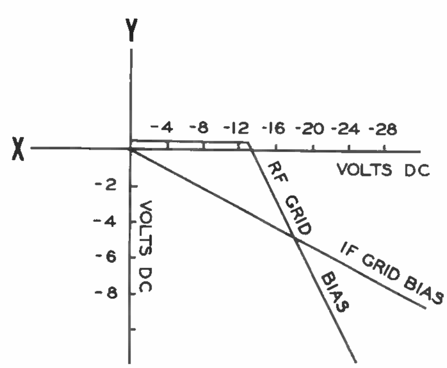


Fig. 4. Diagram of Delay Action Obtained From Circuit of Fig. 3.

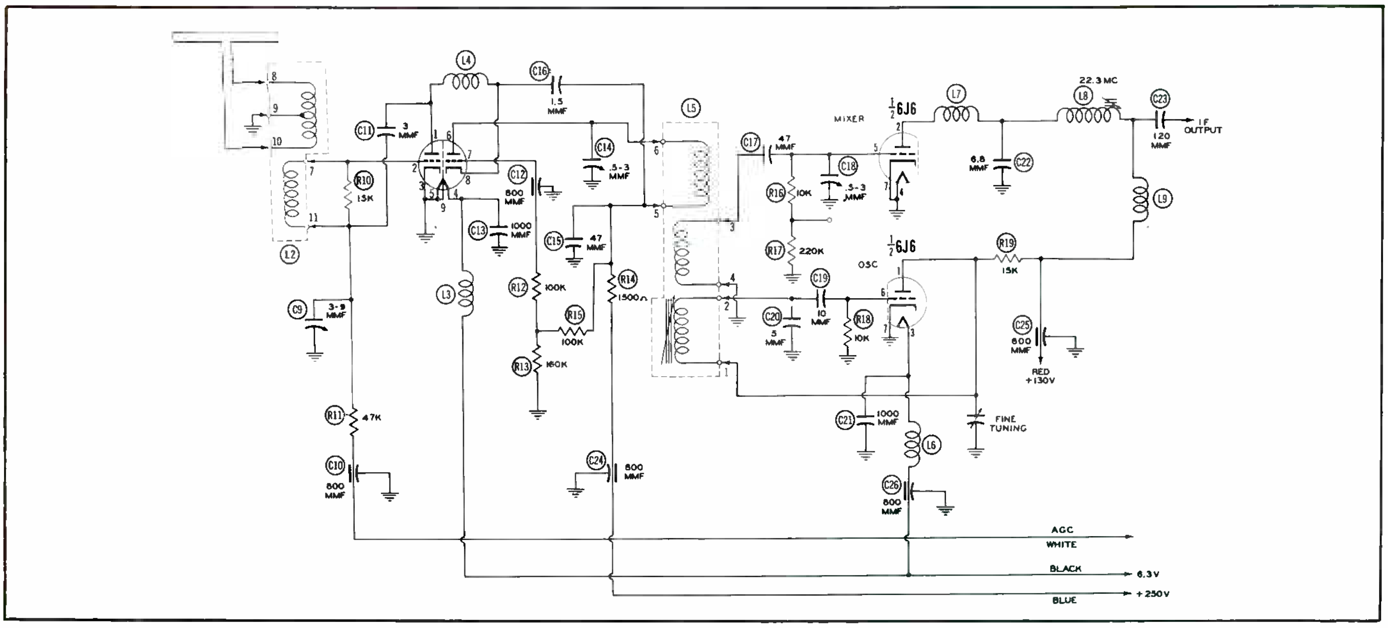


Fig. 5. Complete Schematic of a Standard Coil Cascode Tuner.

X-axis represents a linear rise of voltage at point A, while the Y-axis represents the resultant RF and IF bias voltages. This is not an exact representation of the action occurring during actual receiver operation inasmuch as the voltage at point A is assumed to increase linearly with increasing input to the receiver. However, it does serve to show that the RF grid bias is delayed, remaining at a near zero value until the voltage at point A reaches approximately -13.5 volts, then increasing at a more rapid rate than the IF grid-bias voltage. The RF grid bias is shown to start at a small positive value rather than zero; for although the resistance of the AGC clamper tube V10 is quite low during conduction, it does not reach zero which would be the necessary condition in order to obtain zero volts at point B.

The delay value should not be so great that the RF or video IF stages are allowed to overload before bias is applied to the RF stage, nor should the value be so small that sensitivity of the RF stage is reduced for comparatively weak signals.

For a given value of B+ voltage (+115 volts in this case), the ratio of R29 to R49 and the voltages at point A are the factors controlling the delay value. When installing the cascode tuner in a receiver of this type, the service technician may determine the optimum ratio by experimentation. In the example shown, R9 is dotted in, which indicates that it is used in some models. By adjusting this control the operator can select the delay voltage which works best for his particular case. For receivers not equipped in this manner, R9 could be connected temporarily while determining the best operating point; and a fixed resistor having a value of R9 + R29 could then be substituted for R29. To adjust R9 the receiver is tuned to the strongest available TV signal, R9 is then rotated until the picture overloads, then it is turned in the opposite direction enough to eliminate the overload.

A complete schematic of the Model TV-2232 Standard Coil tuner considered in this article is shown in Fig. 5. Six electrical connections are required between tuner and receiver: (1) 250-volt B+ line for RF amplifier plate, (2) 130-volt B+ for mixer plates, (3) 6.3 volts for heaters, (4) AGC line to RF stage, (5) IF output, and (6) ground connection for the entire tuner. Voltages 1 and 2 can usually be obtained at some point in most receivers. Current requirement of the tuner is low and should not differ materially from that of the original tuner. Slight variations from these values will have no noticeable effect on the tuner operation. These voltage points should be well filtered. If oscillations are encountered, additional filtering or decoupling of these voltages sources may be necessary. All connections between tuner and receiver should be no longer than necessary. Some manufacturers rely upon the metal mounting screws to furnish the ground connection between tuner and receiver, but a safe practice to follow is the use of a short length of braid soldered between the tuner and the receiver chassis.

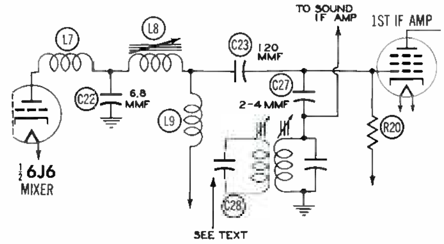


Fig. 6. Method for Adapting the Cascode Tuner to a Non-intercarrier Receiver.

Certain receiver types may not prove readily adaptable to conversion, among these being: the ones employing a series-filament string, with the accompanying problem of proper filament-current drain, and those using link coupling or special bandpass coupling circuits between the tuner and the first video IF stage.

In those receivers having a shunt-tuned coil in the grid return of the first video IF stage, the coil can be replaced by a resistor of proper value (5K to 10K ohms) and the output capacitor of the new tuner can be connected directly to the grid of the first video IF-amplifier tube. If the shunt coil is mounted on the original tuner, it naturally presents no problem because it is removed with the original tuner.

Although this particular model of Standard Coil tuner was not designed for use in nonintercarrier receivers, it may be employed in that manner, depending upon the receiver involved and the ingenuity of the service technician. If the sound take-off point is in the plate circuit of the first or second video IF stage, the conversion will be the same as for an intercarrier receiver. If the sound take-off is accomplished in the plate circuit of the mixer tube, it is usually in the form of a trap winding on the mixer plate coil. Should the coil-and-trap assembly employed on the original tuner be small enough, it may be mounted directly on the replacement tuner; but that is not an absolute requirement. The coil may be mounted on the receiver chassis allowing the trap winding to be connected to the tuner IF-output line, as shown in Fig. 6. The plate winding can be left open or shunted with a small capacitor. The need for this capacitor, and its value, can be determined during alignment by shunting the plate winding with various capacitors of values around 15 mmf and noting whether the video IF-response curve is changed appreciably. Should the addition of this capacitor result in a change of the response curve, the final value of C28 should be such that the tuned circuit resonates at a frequency below the sound IF.

The tuner has been properly aligned at the factory, but some adjustment of the mixer plate coil (L8, Figs. 5 and 6) may be necessary in order that the over-all video IF response will correspond as nearly as possible to the recommended response for the receiver.

The mixer-tube shield should be lifted slightly to remove it from ground, and the output of a sweep generator should be connected to the ungrounded shield. The sweep generator is set to cover the receiver video IF range, and the response is viewed with a scope at the video detector. Some receivers may require only a slight readjustment of the mixer plate coil. If that adjustment is not sufficient, the remainder of the video IF strip should be checked for correct alignment and realigned, if necessary. The oscillator setting should also be checked on all available channels and adjusted as required.

In summary, the following points might be mentioned as the main ones to consider when making the installation of the cascode tuner:

1. Space requirements for the cascode tuner and mounting considerations.
2. Proper B+ voltages for tuner operation.
3. Adaptability of the video IF-input circuit.
4. Application of AGC voltage to the tuner.
5. Alignment of the receiver for proper video IF response.

Paul C. Smith

Stocking the Tube Kit

(Continued from page 21)

of 79 different types which cover most of the types employed in television receivers for the 1946-to-1953 period. Included are many items which are found desirable but not absolutely essential to home servicing. A complete listing of the contents is shown in Chart 1. A possible saving of time is an attractive feature of this kit over the "Standard Kit" to be described.

Fig. 2 shows the "Standard Kit" which permits a high percentage of home repairs with a minimum number of items. The tube complement has been reduced to include 74 tubes covering 65 types. The use of combination tools further reduces the number of items in this kit which is particularly convenient where limited areas are covered not far removed from the shop location. Refer to Chart 2 for a list of items in this kit.

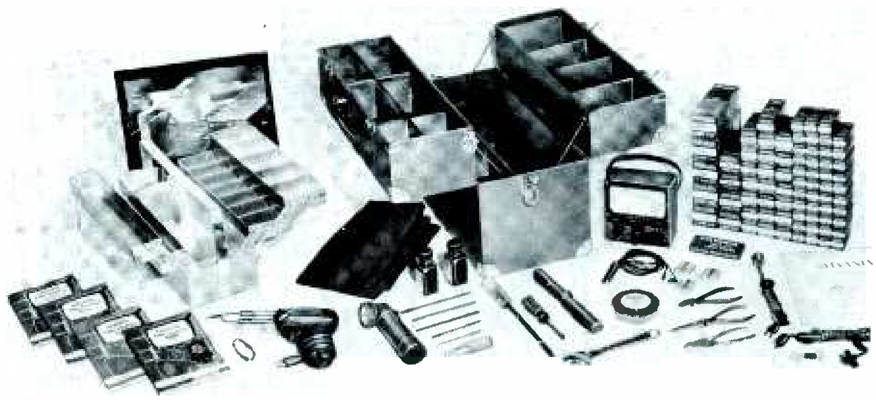


Fig. 2 The Standard Tube Kit

A feature common to both kits is a chart which tells the quantity and type of tubes found in the kit. This chart is covered with a transparent sheet of plastic. A grease pencil is provided by which a mark is made next to the tube type whenever one is used on a service call. When the service technician returns to the shop, it is only necessary to consult this chart for a rapid inventory so that tubes may be replaced in the kit. The grease-pencil markings are readily removed by merely wiping them off with a cloth. This system eliminates a tiresome tube-by-tube count upon returning to the shop.

No provisions have been made in this kit for resistor and capacitor replacement since this usually requires taking the set to the shop. However, should this type of service be desired, it is only necessary to include a supply of resistors and capacitors, since the tools necessary to replace these components are already provided.

The included tube list is derived from the number of tubes in service and the types of tubes having the highest replacement rate. Two tube lists for each kit are included. One list is to be used in areas where television reception has been provided prior to 1948 or 1949. By stocking the tubes shown in this list, the technician will be able to make tube replacements in the earlier receivers which might still be operating. The other list is to be used in areas where telecasting has started in 1952 or 1953. Practically all receivers in these areas will be new models, making it unnecessary to stock tubes for older model sets.

The model number of the set should be obtained when the customer calls, if at all possible. With this known, the service technician may consult his "Television Tube Location Guide" to determine if any tubes are employed which are not ordinarily stocked in his service kit. If any such tubes are found; they may be taken from stock in the shop and placed in the service kit.

* * * *

CHART II

CONTENTS OF THE STANDARD KIT

TUBE TYPES	TV MODELS 52-53 (quant.)	46-53	TUBE TYPES	TV MODELS 52-53 (quant.)	46-53	TUBE TYPES	TV MODELS 52-53 (quant.)	46-53	TUBE TYPES	TV MODELS 52-53 (quant.)	46-53	TUBE TYPES	TV MODELS 52-53 (quant.)	46-53
1B3GT	1	1	6AQ7GT	1	0	6BK7	1	1	6SL7GT	1	1	12AU7	2	2
1X2A	1	1	6AS5	1	1	6BL7	1	1	6SN7GT	2	2	12AX4	1	1
5U4G	2	2	6AT6	1	1	6BN6	1	1	6SQ7	0	1	12AV7	1	1
5V4G	0	1	6AU5GT	1	1	6BQ6GT	0	1	6SQ7GT	1	0	12AX7	1	1
5Y3GT	0	1	6AU6	2	2	6BQ7	1	1	6T8	1	1	12AZ7	1	1
6AB4	1	1	6AV5GT	1	1	6C4	1	1	6U8	1	1	12BH7	1	1
6AC7	1	1	6AV6	1	1	6BZ7	1	1	6V6GT	1	1	12SN7GT	1	1
6AF4*	1	1	6AX5GT	1	1	6CB6	2	2	6V3	1	1	25BQ6GT	1	1
6AG5	1	1	6AX4	0	1	6CD6	1	1	6W4GT	2	2	25L6GT	1	1
6AG7	1	1	6BA6	1	1	6J5	1	1	6W6GT	1	1	25W4GT	0	1
6AH6	1	1	6BC5	1	1	6J5GT	0	1	6X8	1	1	5642	0	2
6AK5	1	1	6BE6	1	1	6J6	2	2	6Y6G	0	1			
6AL5	1	1	6BG6G	1	2	6K6GT	1	1	7N7	0	1			
6AQ5	1	1	6BH6	0	1	6S4	1	1	12AT7	1	1			

*For UHF Areas

Tube Kit Television Tube Location Guides, TGL 1-2-3-4 Mirror Volt-Ohm-Milliammeter, Test Leads	Soldering Gun Solder Flashlight Power-Line Cords Pliers, Long Nose Pliers, Combination Pliers, Diagonal Cutters	Wrench, Crescent Alignment-Tool Kit Screwdriver Kit Screwdriver, Copper Beryllium Drop Cloth	Fuses Hardware (Misc. nuts, bolts, washers, etc.) Electrical Tape AC Plug AC Receptacle, TV	Picture-Tube Cleaner Contact Cleaner Wiping Cloths Pilot Lamps Knob Springs Tube Price List

Audio Facts

(Continued from page 31)

the term, we refer to high quality true-to-life reproduction.

Basic Forms

Having gone into some of the background of audio in general and some of the reasons why we have high-fidelity systems and what to expect from them, the system itself is due for some discussion. We will first consider the basic things needed to make up a system capable of high-fidelity output and then discuss each section in more detail in later paragraphs.

We speak of systems, for that is what they are. Whether large or a phonograph pickup as the source of signal. This can well be any of the turntables or record changers designed for playing all or any of the 33 1/3, 45, or 78 rpm records. The signal picked up by the phono cartridge is fed into the next section which, in such a system, will include a combination of voltage amplification and tone compensation or control circuits. To qualify as a high quality system it is practically essential to have treble and bass controls as a means of balancing the sound output. The power-output stage is required to drive the loudspeaker.

A system such as this may be one of the small high quality, table-model phonographs which are now being manufactured and which are capable of producing higher quality of sound than many people have ever heard before. Of course, on the other hand, any or all of the equipment making up the separate sections may be of the most expensive and select variety, since the most important qualification required of this equipment is its ability to produce high quality sound.

In Fig. 2 we have a more elaborate system, which is evident in the diagram as the preamplifier and compensation section following the pickup. The preamplifier section is required when a magnetic type of pickup cartridge is employed, as is usually the small, simple or elaborate (depending upon the desires and needs of the owner) they all follow a basic pattern of functions necessary to produce the desired high quality of reproduction. Each section or piece of equipment must function properly or otherwise it can nullify the correct operation of all the others in the system.

The block diagram shown in Fig. 1 shows the layout of a simple basic audio system. Since most sound

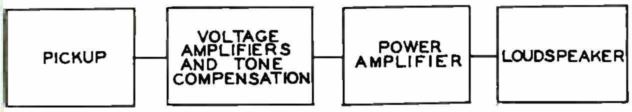


Fig. 1. Basic Audio System.

systems in the home are used mainly for the reproduction of music from records, the first block represents case in the majority of high quality systems. Equalization is also required with these pickups as well as for the various types of records played. Tone-control circuits and voltage amplifiers are required in addition to a power-amplifier section to drive the loudspeaker. This is probably the most-used layout and can be a powerful outfit with a complete loudspeaker system. In fact, it may border very closely upon the system shown in Fig. 3.

The circuit in Fig. 3 can become very elaborate and complicated. As shown, it can have signal input from a phono pickup, an AM and FM radio tuner, playback from a tape or wire recorder or from the sound section of a TV receiver. Besides the preamplifier and equalization section we must include some means of switching the wanted input into the circuit and with the desired equalization as required. Tone control, voltage amplification, and power output must be used as always. We also have an added section, the divider network, to distribute the signal to the individual units of the loudspeaker system that is usually used with an outfit such as this. We may even have a disc recorder connected to the output of the power amplifier. In fact, most anything in the audio line may be connected into this type of system, depending upon the whim and resourcefulness of the owner. But this does give the basic form of our largest systems.

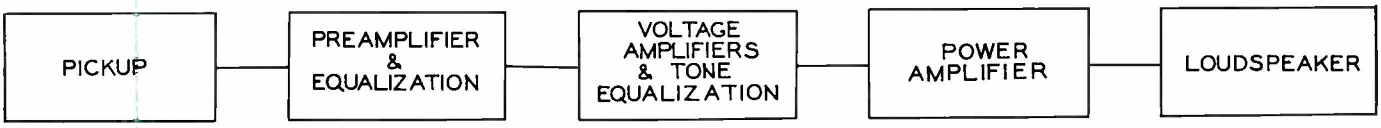


Fig. 2. A More Complex Audio System.

Cartridges

The phonograph cartridge is an important item, for the final results depend upon how well it can do its part in picking up the modulation impressed upon the record and feeding it into the rest of the system. The most popular types are the crystal, ceramic, and magnetic. Some special types, such as the lightweight FM pickup, are capable of providing excellent reproduction but have been put into only limited use to date.

The crystal and ceramic cartridges have been by far the most popular type in general use. The high output, as much as two or three volts with some crystals, and the need of very little equalization are their big advantages. The susceptibility of the crystal cartridge to high temperature and humidity and its more or less restricted frequency response have limited its use in most high-fidelity work. The ceramic cartridge is not affected by high temperature and humidity, and some recent ones are proving quite satisfactory in certain applications.

The magnetic cartridges have been used in most of the sound systems of better quality because of the excellent reproduction they afford, but they do have the disadvantage of low output and require the added gain of a preamplifier. Another disadvantage of the magnetic cartridge is that equalization is needed to bring up the bass response which is inherently low in this type. Despite these disadvantages, their fine performance noted for wide frequency response and low distortion has resulted in their nearly universal use in the best systems.

Pickup Stylus

Any discussion of pickups must also include mention of the stylus (needle), since it is such an important link in the playback network. It makes the direct contact with the record groove and transmits the modulation found there to the pickup in order to generate the signal fed to the system.

A stylus for microgroove records (33 1/3 rpm long-playing and

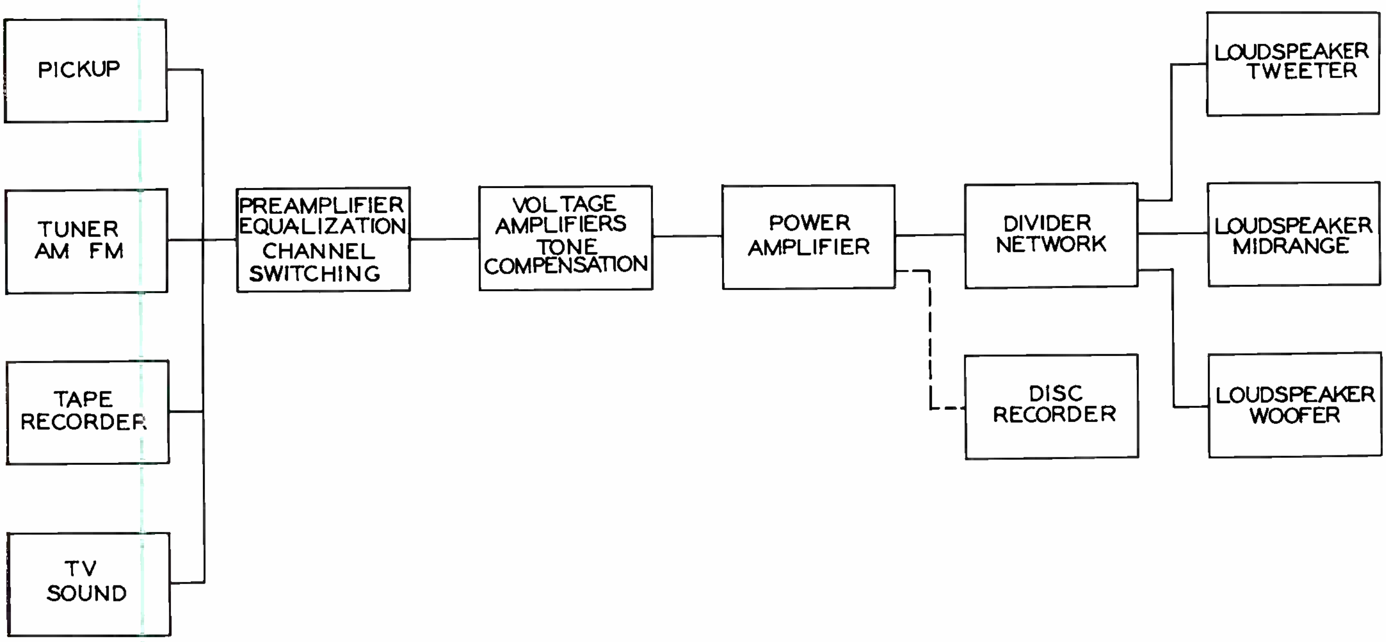


Fig. 3. Elaborate Audio System With Multiple Input and Multiple Speakers.

45 rpm) must have a tip that is .001 inch (1 mil) in diameter. A .003-inch (3-mil) stylus is used with the usual 78-rpm recordings. The .0025- and .0027-inch sizes are specified and supplied for certain types of commercial transcriptions. For home use we need two cartridges, one with a 1-mil stylus and the other with a 3-mil tip; or we need a cartridge equipped with two needles, one of each dimension, if we are to be prepared to play all three types of records.

It must fit the groove correctly if it is to give satisfactory results and not damage the record or itself during playback. Although the modern pickup is very light in weight when in playing position, the actual pressure at the point of contact of a .001-inch stylus in the groove of a microgroove record is tremendous. From this, we can recognize the importance of the condition of the stylus tip and why it must be made of the right kind of material and to very exact dimensions. The wrong stylus or a worn one can permanently damage a delicate record groove the first time it is used.

Diamond and sapphire are just about the only materials used in manufacturing needles intended for high-fidelity use, since they withstand wear better than others. Even though the first cost of the diamond stylus is higher, it is less expensive in the long run; because it will outwear several made of sapphire. In any case, a stylus should be changed before the wear it has received starts to damage the grooves of valuable records.

Turntable, Arm, and Motor

In order to play records, we must have a turntable on which to spin them and a pickup arm to hold the cartridge in position. To play all of the usual types, the turntable must revolve at a constant speed of 33-1/3, 45, or 78 rpm with no unsteadiness or vibration. Unsteadiness would be heard as wow in the reproduced sound, and vibration would register as rumble.

The high quality three-speed record changers now available were designed for this purpose. They feature smooth-running turntables driven by suitable motors and have provisions made to mount most any of the more popular pickup cartridges.

Many of the record changers in general use are equipped with two-pole motors which, although they do give good performance, do have a fairly strong hum field. Since most magnetic cartridges are sensitive to hum pickup, those changers intended for high-fidelity applications are supplied with four-pole motors which do not have a heavy hum field. In this way, the undesirable effect is avoided.

Many serious enthusiasts do not use a record changer, but instead they use a turntable of the transcription type. These precision-built units, which are usually equipped with accurately machined and dynamically balanced 12- or 16-inch cast aluminum turntables driven by powerful motors, provide exceptionally smooth and quiet operation. One of the many suitable pickup arms must be selected and mounted to accommodate the desired pickup when the transcription type of turntable is employed.

One thing seldom mentioned is the fact that some magnetic cartridges cannot be used with iron or steel turntables, because of their strong magnetic pull, unless certain precautions are taken. When this type of cartridge is in playing position on a record on a steel turntable, its weight can be increased by more than an ounce on account of this pull. If a piece of felt or some such nonmagnetic material 1/8 inch or more in thickness is placed on the turntable under the record, the increase in spacing will reduce the pull to where it has no noticeable effect and will allow normal operation.

Preamplifiers, Equalization, Compensation, and Control

Preamplifiers and control units furnishing needed amplification, equalization, and tone compensation have been mentioned in conjunction with the phono cartridges. Some detailed discussion concerning them was also given in "Audio Facts" published in PF INDEX and Technical Digest, issues March-April 1952, May-June 1952, and July-August 1952. Even though some points will be repeated, the preamplifier control unit has become such a standard feature of high-fidelity installations that the reasons for its wide use and popularity cannot be ignored here.

The added gain needed to amplify the low output of a magnetic cartridge to a level high enough for normal operation of the sound system is provided by the preamplifier. Equalization is accomplished at the same time by amplifying the low frequencies an added amount to boost them up to a normal level and thus overcome the deficiency in bass response which is characteristic in magnetic cartridges.

Small units, suitable for adapting magnetic cartridges to systems not so equipped, have been available for some time. They are easily installed and serve the purpose very well. Usually the preamplifier is somewhat more elaborate and is included with other circuits to make up a more complete control unit.

Recordings are made on various curves based on widely varying crossover frequencies and amounts of high-frequency roll-off. Therefore some form of adjustable equalization is required for correctly matching the characteristics of different records to the system in order to obtain a balanced response. These are the controls usually marked ROLL-OFF and CROSSOVER, and in most cases they are located on the preamplifier control unit.

Tone-control circuits compensate for the deficiencies that might occur in the program material and provide a means of achieving a balanced response when required, because of characteristics of the loudspeaker or the effects of the acoustics of the room in which the listening is done.

All of these circuits and controls, including the necessary channel switching if tuners and recorders are also employed, may be made up in a unit complete with its own power supply. Other similar units may draw their power from the supply in the power amplifier. These types lend themselves to remote-control operation of the complete sound system. In some cases, the unit may be built in as a permanent part of the power-amplifier chassis or the tuner used. Since many of these units are available and in such variety, it is not difficult to select one suitable for most any situation.

Power Amplifiers

Power amplifiers have also been the subject of detailed discussions in previous "Audio Facts." These appeared in PF INDEX and Technical Digest issues for January-February 1952, May-June 1952, and July-August 1953. But many things concerning power amplifiers can stand repetition and added comment because of their important function of supplying the power to drive the loudspeaker.

The development and availabiity of excellent output transformers and the application of negative feedback have been great factors in the remarkable improvements made in the modern audio power amplifier. Power-output capabilities have been increased and distortion reduced to extremely low percentages. In fact, quality of operation is so consistently high in these power amplifiers that the power-output rating is probably the main thing to consider when selecting one for a certain application.

Finding a power amplifier suitable for use in most any sound system is certainly no problem, not with the great number of excellent ones available in such a variety of shape, size, power output, and price. The usual power-amplifier chassis contains at least one or two stages of voltage amplification, while some also include the tone and equalization circuits. Several are designed for use with a certain series of matched units; but since complete specifications and ratings are supplied with all amplifiers, selecting the proper one should present no difficulties.

As mentioned, the power output required for satisfactory operation of the sound system involved is an important consideration. A small amplifier that will deliver a maximum of two or three watts of good clean output may be very satisfactory for use in a small quiet room, but it could not come close to handling the requirements of a larger and probably noisier room.

There is quite a difference in the amplifier used in the small high quality table-model phonograph and the one used in a large custom installation which includes an elaborate loudspeaker system. The quality of operation of the small amplifier can be just as high as that of the larger one, the big difference being in the amount of power output required.

We do not want to leave the impression that power output is the only thing to think of, for that is not true. We have wanted to stress the fact that of all the excellent available amplifiers which do fulfill the important requirements, the one capable of handling the work to be done must be chosen.

Loudspeakers, Enclosures, and Divider Networks

A discussion on loudspeakers, in common with the other items mentioned, could be carried on and on. This makes it difficult to cover adequately in a few paragraphs the important things concerning their selection and use. Some of the phases were dealt with in "Audio Facts" on loudspeaker enclosures and divider networks in PF INDEX and Technical Digest issues for March-April 1953 and May-June 1953.

Although basically unchanged very little over the years, loudspeakers have been the subject of much research and experimentation. This activity also includes the enclosures necessary for their proper performance. All of this has had the result of making it possible to select a single unit or a complete system which will fit most any application.

Size, power-handling ability, and price are the usual things considered when selecting these units which perform the critical function of converting the electrical signal into acoustical power. Selecting the best one possible under the circumstances is always the best policy; for whether large or small, simple or elaborate, quality in the loudspeaker will pay off in quality reproduction.

To achieve a smooth wide-range response with low distortion, most high-fidelity systems (including the small high quality table-model phonograph) employ two or more loudspeakers. These may be separate individual units or one of the coaxial type, which is actually a high-frequency "tweeter" and a low-frequency "woofer" mounted coaxially as a unit.

Where "woofers" and "tweeters" are employed, a divider network must be used to separate the high and low frequencies and to channel them to the appropriate unit.

Cabinets

Since so many high-fidelity systems are custom built, the subject of suitable cabinets to house the equipment could stand quite a lot of discussion. All manner of built-in installations have been made, book shelves have been appropriated, and cabinets have been converted to accommodate various pieces of audio equipment.

This has been true because a high-fidelity system could not be purchased as a complete unit but had to be assembled. Most of the finest pieces of equipment are large and do not lend themselves to mass production in units of a reasonable size.

A number of the large manufacturers are now marketing complete high quality sound systems housed in suitable cabinets. These afford very good reproduction excelled only by the better custom installations.

Robert B. Dunham

Guying Chart

(Continued from page 35)

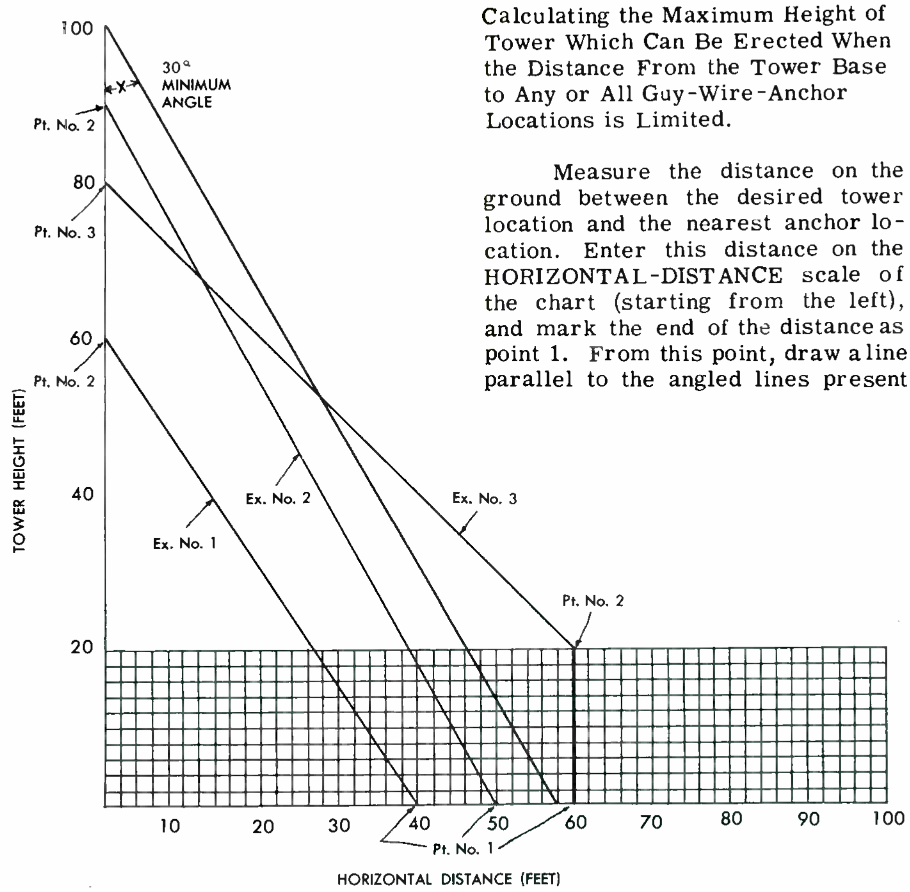


Fig. 2. Examples of Use of Guying Chart

be erected can be determined by using the chart in Fig. 1 when the distance from the tower base to guy-wire-anchor location points is known.

Three examples of the use of this chart are illustrated in Fig. 2.

EXAMPLE No. 1
Determining the Length of Guy Wire Needed for a Given Tower Height and Anchor Location.

Measure the distance on the ground between the tower location and the guy-wire-anchor location. Enter this dimension on the chart scale marked "HORIZONTAL DISTANCE," starting from the left. Mark the end of this distance as point 1. Measure the distance on the tower between the base and the guy-wire anchor. Enter this dimension on the chart scale marked "TOWER HEIGHT," starting from the bottom. Mark the end of this distance as point 2. Connect points 1 and 2 with a straightedge, and note the distance between them. The straightedge can consist of a piece of paper, and the points can be indicated by pencil marks. Align the edge of the paper with the horizontal scale of the chart, then the length of the required guy wire can be read directly.

EXAMPLE No. 2
Calculating the Maximum Height of Tower Which Can Be Erected When the Distance From the Tower Base to Any or All Guy-Wire-Anchor Locations is Limited.

Measure the distance on the ground between the desired tower location and the nearest anchor location. Enter this distance on the HORIZONTAL-DISTANCE scale of the chart (starting from the left), and mark the end of the distance as point 1. From this point, draw a line parallel to the angled lines present on the chart. The point at which this line crosses the TOWER-HEIGHT scale gives the maximum height of tower which can be erected.

EXAMPLE No. 3
Determining the Length of Guy Wire Required When One or More of the Guy-Wire-Anchor Locations Cannot Be Placed at Ground Level.

Measure the distance between the tower location and a point directly beneath the anchor location. Enter this distance on the HORIZONTAL-DISTANCE scale of the chart (starting from the left), and mark the end of the distance as point 1. Measure the vertical distance from ground level to the anchor location. Enter this distance on the chart on a vertical line above point 1, and mark the end as point 2. Measure the distance on the tower between the base and the guy-wire anchor. Enter this dimension on the chart as point 3. The distance between points 2 and 3 gives the required guy-wire length.

William E. Burke

Design Features

(Continued from page 29)

which event certain low-frequency commercial AM radio broadcasting stations will shift their operating frequencies to 640 kc and the high-frequency stations will shift theirs to 1240 kc. Each station in a given group will transmit for a predetermined number of seconds after which another station in the same group will transmit for a certain time. Such a system makes it difficult for a potential enemy to use the transmission of a broadcasting station as a navigational aid or as a homing signal.

There is a detent spring provided on the set for the purpose of tuning the set to these frequencies in total darkness. This spring can be seen in Fig. 5. To place the spring into operation, it is only necessary to remove the tuning-control knob, loosen the set screw, slide the detent spring in a clockwise direction, tighten the screw, and then replace the knob. The knob has two notches on the underside. The spring snaps into these when the knob is properly tuned to receive the signals.

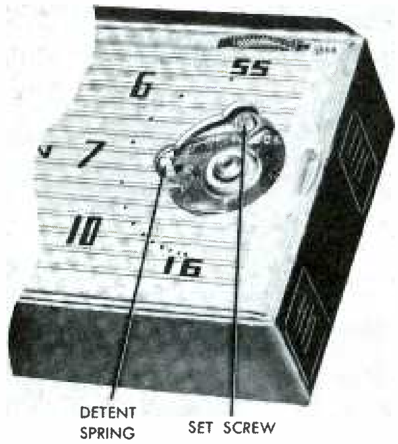


Fig. 5. View of Detent Spring for Quick Selection of Civilian-Defense Broadcasts.

To prevent damage to the closely spaced components, the use of a large soldering iron should be avoided when working on this set.

RCA Victor Portable Radio Model 3-BX-671

One of the several interesting features of the RCA Victor Model 3-BX-671 portable radio is the inclusion of seven tuning bands. Table I gives the frequency ranges of each of the bands

TABLE 1

Frequency Ranges for Each Band of the RCA Victor Model 3-BX-671 Multiband Portable Radio

"A" Band (Broadcast)	540-1600 kc
"B" Band	2.0-4.0 mc
"C" Band	4.0-8.0 mc
31-Meter Spread Band	9.45-9.85 mc
25-Meter Spread Band	11.55-12.05 mc
19-Meter Spread Band	14.90-15.55 mc
16-Meter Spread Band	17.50-18.20 mc

The RF and oscillator coils are mounted on the band switch. Holes are provided in the shields and cover to facilitate alignment. However, there are a couple of alignment points that require the use of a very limber tuning tool. Both of these are oscillator adjustments.

Also featured are three antenna systems which are shown in Fig. 6. One is a flat-loop type of antenna mounted inside the front lid of the case. This loop is intended for use on the standard broadcast band only. Another type of antenna intended for standard broadcast is also included. This type is a Ferrite rod antenna which is provided with suction cups and a long cable to permit attachment to the pane of an outside window. This setup

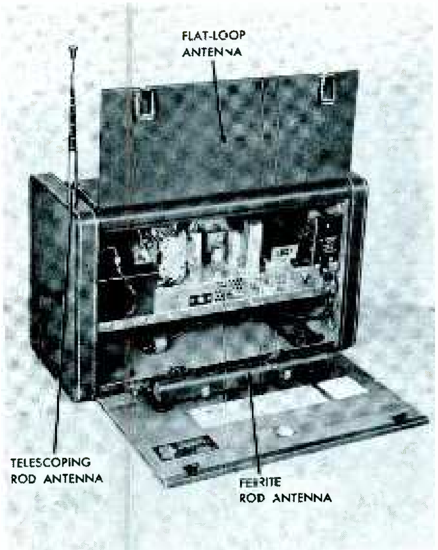


Fig. 6. Rear View of RCA Victor Receiver Model 3-BX-671 Showing Three Antennas.

usually provides better reception in such places as trains and inside buildings where steel construction may cause weak reception. For the short-wave bands, a telescoping-rod type of antenna concealed in the right side of the case is supplied. It can be placed into use by depressing the release button on the lower right side of the case and pulling up on the antenna tip which appears at its opening. The antenna should be raised until a definite click is noted. This indicates that the lower section is extended. Its complete extension is mandatory for short-wave reception.

This chassis has provisions for installing an RCA RK-186 converter for operation on 230 volts DC or on 25 to 60 cycles AC, in addition to operating on the regular 117 volts AC power or on self-contained batteries. The schematic for the converter may be seen in Fig. 7. Fig. 6 shown a photograph of the chassis inside the case. Fig. 8 shows a close-up of the converter RK-186.

Variable Definition Control

The RCA Victor Model 27-D-384 TV receiver employs an interesting new feature which is designed to aid in reproducing the best possible picture under various conditions of reception. Four modes of operation are provided through the operation of a single switch which is called a "Definition Switch." A schematic of this switch and associated circuitry is shown in Fig. 9. In position No. 1 (for snow suppression), the high noise frequencies are by-passed to B+ through C2. In position No. 2 (for normal operation), V2 and V3 (the peaking amplifier and the agitation compressor) are both out of the circuit and thereby have no effect. When the switch is in position No. 3 (for high peaking), the high frequencies are coupled from the plate circuit of the video-output tube and are developed across L2 and L3. In position No. 4 (for maximum high peaking), there is more signal developed across L2, L3, and L4. This signal is then applied to V2, which is the peaking amplifier. The high frequencies, after being amplified by the peaking amplifier, are then applied to the grid of the picture tube. At the same time the video signal is also being applied to the cathode.

On live pickup programs, best operation is usually obtained in the normal position. When the program is originating from film, operation on the high-peaking or on the maximum-high-peaking positions will usually result in a sharper or "crisper" picture. There may be times, particularly under strong signal conditions, when trailing whites will be produced when the switch is in the maximum-high-peaking position. If such is the case, switching back to position No. 3 will usually eliminate or reduce this effect.

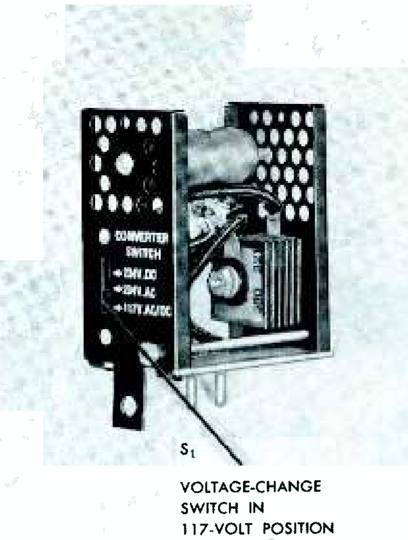


Fig. 8. Close-up of RCA Converter RK-186 Showing Power-Selector Switch.

Vocatron Intercom Models CC-20(D) and CC-45

The Vocatron Intercom Models CC-20(D) and CC-45 loudspeaking intercommunication systems employ the carrier-current system which thereby eliminates the need for connecting the units together with separate lines. The Vocatron CC-45 is shown in Fig. 10. The carrier-current system of transmission uses the power lines as its transmission medium. It is a low-cost system which is efficient. The Vocatron has incorporated in its circuit a special patented silencing

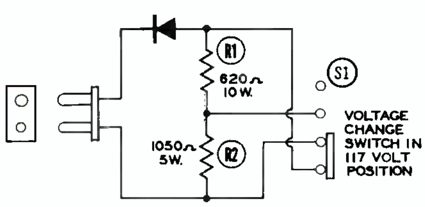


Fig. 7. Schematic Diagram of RCA Converter RK-186.

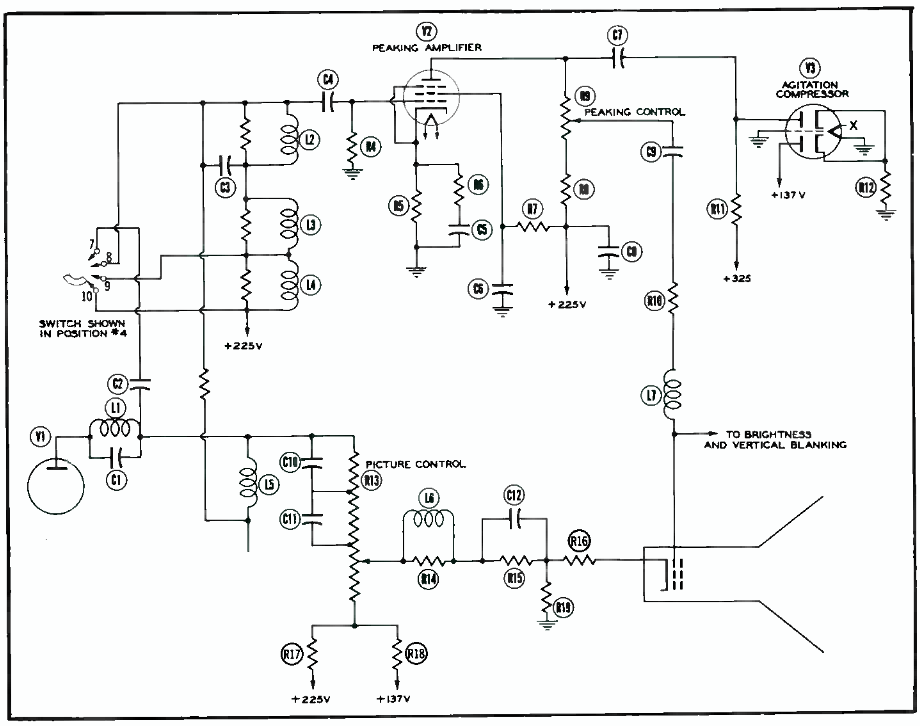


Fig. 9. Schematic Diagram of High-Peaking and Agitation-Compressor Circuit in the RCA Victor Model 27-D-384.

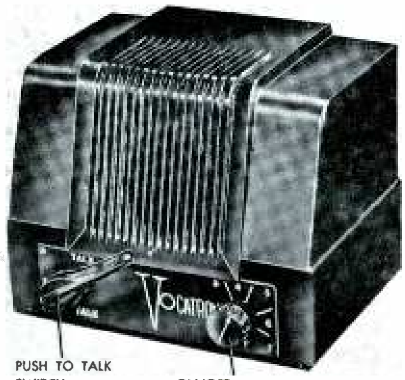


Fig. 10. Cabinet View of Vocatron Intercom Model CC-45.

circuit to keep the receiver section completely dead until keyed on by the signal from another Vocatron unit. This special silencing circuit eliminates any line noise caused by motors and machinery when the unit is not being used. There are plug-in type of filters available to reduce any such noise during communication between units.

These units can be installed quite easily because no interconnecting wires are required between units. They can very easily be moved from one room to another by simply unplugging the line cord, moving the unit to another room, and plugging in again. All units of one system must be on the same power-line transformer, since excessive losses are experienced

Fig. 11. Rear View of Zenith TV-Radio Combination Model L2281 RU Showing Mounting Method of Radio Chassis.

Fig. 12. Front View of Zenith Model L2281 RU Showing Radio Tuning Knobs.

when the carrier signal is coupled from one transformer winding to the other.

The CC-45 is a deluxe model that is designed for especially difficult installations when long-distance operation and excessive line noises are involved.

Radio Chassis 4L03 Used in Zenith TV-Radio Combination Model L2281 RU

The radio chassis in the Zenith L2281 RU combination is mounted in a very unique manner. As may be seen in Fig. 11, it is mounted on the underside of the cabinet top with the top edge of the control knobs protruding through slots in the top of the cabinet. See Fig. 12.

This manner of mounting the radio permits use of a narrow cabinet without putting the radio below the TV chassis. This eliminates the necessity of stooping to operate it.

The radio chassis employs four tubes with series filaments. The radio has its own power supply so that it need not depend on the TV chassis for power. This is a good feature, for it permits operation of the radio without using any portion of the TV chassis except the speaker.

Henry A. Carter

In the Interest of Quicker Servicing

(Continued from page 23)

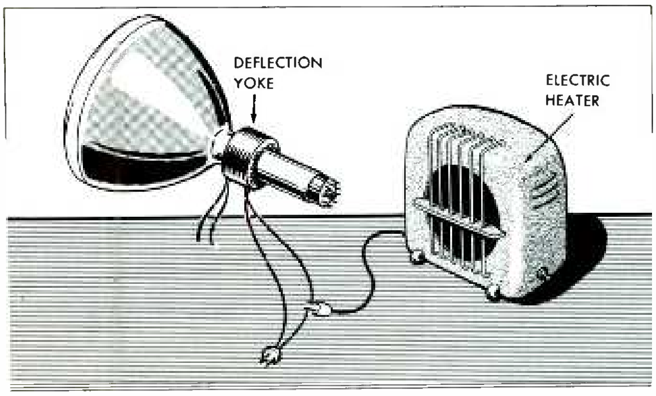


Fig. 2. Series Connection of the Deflection Yoke and 1200-Watt Heater.

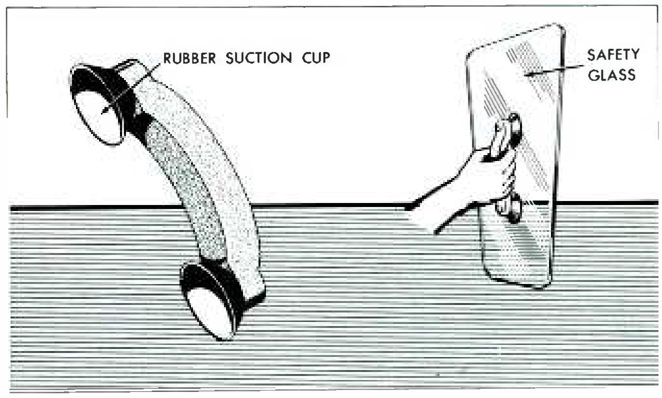


Fig. 3. A Device Used for Removing Safety Glass.

moval of this glass is desirable when cleaning the face of the picture tube; however, after removal of the items holding the glass in its frame, a close fit may prevent the glass from being easily removed. It is usually impossible to reach through the rear of the cabinet and push the glass out while still holding it from the front. A simple solution to this problem is afforded by the following device.

This device consists of two suction cups attached to a wooden handle. This is shown in Fig. 3. Placing the suction cups against the safety glass and applying a slight pressure will cause the cups to adhere to the glass. The handle is then pulled outward and the glass removed. This handle is also very convenient when replacing the safety glass.

The foregoing suggestion was submitted by Mr. Chester Merizak, 1311 West Haddon Avenue, Chicago, Illinois.

Ion Traps

There are frequently a number of television receivers in the shop awaiting replacement of picture tubes. When the picture tube arrives and replacement in the set begins, time out is sometimes necessary to look for a missing ion trap. When one is found, it may not be the original. Ion traps may also be misplaced during bench servicing, if they have been removed for some reason. This situation may be remedied in a very simple way. Take a look at the rectifier tube. If it is of the 5U4G type, an ion trap will fit very nicely over the top of this tube. Placement of the ion trap on this tube will eliminate a possible search and in addition will prevent replacement with an ion trap of an unsuitable type. This is simple but very effective.

While considering the subject of ion traps, another hint is suggested which could save time and possibly prevent damage to a picture tube. When removal of an ion trap is contemplated, a pencil mark in the form of an arrow should be placed on the trap. This arrow could be placed at a point in line with the top center of the picture tube and pointing toward the front of the tube. The ion trap then may be replaced in approximately the same position from which it was removed. This will shorten the hunting process normally required to determine correct ion-trap positioning.

Checking Horizontal-Deflection Coils

A keystone picture was observed on a 16-inch television receiver.

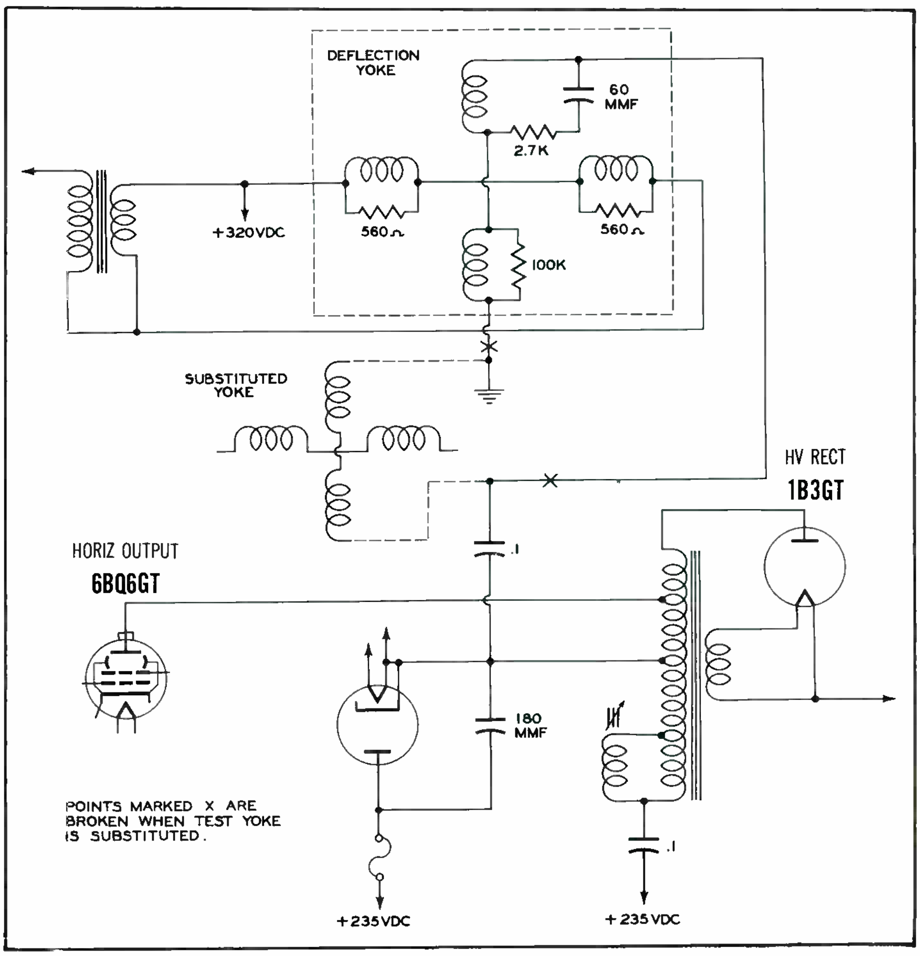


Fig. 4. Schematic Diagram of a Deflection System Showing Test Connections.

This condition ordinarily is indicative of a defective deflection yoke. The nature of this keystone pattern further indicated that the horizontal-deflection coils were at fault. Very bad blooming was also noted. A resistance measurement of these coils yielded the correct measurements and therefore seemed to indicate that the coils were good.

Three possible troubles could exist in a deflection yoke: (1) the vertical-deflection coils could short to the horizontal-deflection coils, (2) one of the coils could be open, (3) the deflection coils could have shorted turns.

The deflection system employed in this receiver, as represented in Fig. 4, indicates the presence of a DC potential on the vertical-deflection coils. If the condition of a short between the two sets of coils had existed, the DC voltage would have been shorted to ground through one of the horizontal coils. This was not the case; therefore, the first condition was eliminated. A resistance measurement eliminated the possibility of an open coil during static conditions. If several turns of a coil had been shorted, this measurement would not have been of the specified value.

The results of these measurements left considerable doubt as to the actual condition of the deflection yoke. Obviously, the yoke could be removed and a new yoke installed. This operation requires considerable time; and if the original yoke should not be defective, the time required for this replacement would be lost. Therefore, it would be a distinct advantage if some method could be employed whereby the condition of the original yoke could be positively determined. Such a method would prove particularly advantageous in this case, since examination of the yoke revealed that it had become adhered to the neck of the picture tube. It was very likely that damage might result to the yoke during the process of removal. The following procedure was employed to test the yoke without removal from the chassis.

The high voltage was measured with the brightness control turned down and was found to be 5,600 volts, which is far below normal. No picture need be visible for the following test, so the brightness control may be left in this position. In order to determine if this low voltage was caused by the horizontal-deflection coils, a new deflection yoke with the same horizontal-coil inductance was selected. The leads to the original horizontal coils were disconnected from the receiver; and the leads from the new coils were substituted temporarily, as indicated in Fig. 4. Another high-voltage reading was taken. This measurement showed a reading of 11,000 volts, which was more normal. This confirmed our suspicion of a defective deflection yoke. Upon replacement of the original yoke, the receiver returned to normal operation.

As indicated in the foregoing example, resistance measurements do not always reveal the true condition of a component. The check made by substituting a new set of horizontal-deflection coils and by comparing high-voltage readings was certainly warranted in this case. The test definitely established that the deflection yoke was defective. If the deflection yoke had not been defective, the test would have prevented possible damage to a good yoke.

Don R. Howe

GLOSSARY

OF COLOR TV TERMS

Aperture Mask - A thin, perforated plate placed between the electron guns and the phosphor-dot screen in a color picture tube.

Balance — See Color Balance.

Brightness — That attribute which makes an area appear to emit more or less light.

Chroma — That quality that embraces hue and saturation together; white, black, and values of gray have no chroma.

Chrominance — That attribute of light which produces a sensation of color apart from luminance or difference in brightness.

Chrominance Channel — In a color television receiver, the path which is intended to recover the color-difference signals from the color subcarrier and its sidebands.

Color Balance — The adjustment of electron-gun emissions to compensate for the difference in the light-emitting efficiencies of the three phosphors on the screen of the color picture tube.

Color Burst — Approximately nine cycles of color-subcarrier frequency. These cycles are added to the horizontal pedestal of the composite color signal for synchronizing the reference oscillator in the receiver with the color carrier from the transmitter.

Color Dilution — A condition brought about by mixture with white light; desaturation.

Colorimetry — The science of color measurement and specification.

Color Primaries — In the color receiver, the saturated colors of definite hue and variable luminance produced by the receiver. These color primaries, when mixed in proper proportions, form other colors.

Color Purity — Freedom from mixture with white or freedom from mixture with the other color primary or primaries not already present in the desired color.

Color Saturation — The degree to which white light is absent in a particular color.

Color Subcarrier — The modulation sidebands of this carrier are added to the monochrome signal to convey color information.

Composite Color Signal — The color picture signal plus blanking signals and all synchronizing signals.

Convergence - The meeting or crossing of three electron beams at a common point. See Dynamic Convergence and Static Convergence.

Decoding — In color receivers, the process whereby the color-difference signals are recovered from the color picture signal.

Dilution — See Color Dilution.

Dominant Wavelength Of A Color - The single wavelength of light which predominates in any particular color.

Dynamic Convergence — The convergence attained under operating conditions (during scanning).

Dynamic Focus — The focus attained under operating conditions (during scanning).

Focus — See Dynamic Focus and Static Focus.

Hue — The name of a color. Neither black nor white nor any of the values of gray are considered hues.

Luminance — Amount of radiant energy emitted from a source and evaluated with reference to its ability to evoke brightness; determined in the case of color TV by the amount of beam current striking the phosphor screen.

Luminance Channel — In a color television receiver, the path which is intended to carry the luminance or black-and-white portion of the color picture signal.

Matrix — The section of the color receiver where the three primary color signals (representing red, green, and blue) are recovered for application to the picture tube.

Misregistration — The production of wrong color or colors due to faults in the color picture tube, in components directly associated with the tube, or in adjustments.

Moiré — In television the spurious watery pattern in the reproduced picture resulting from interference beats between two sets of periodic structures in the image.

Monochrome — By strict definition, a picture having a single hue; but in practical television parlance, a picture in black and white.

Monchrome Signal — A signal or portion of a signal which contains only the brightness or luminosity values of a televised image and produces a black-and-white picture.

Planar Mask — A shadow or aperture mask which has no curvature; one which is perfectly flat.

Primaries — See Color Primaries.

Purity — See Color Purity.

Quadrature — The 90-degree phase displacement of one alternating current or voltage from another.

Saturation — See Color Saturation.

Shadow Mask — See Aperture Mask.

Static Convergence — The convergence attained when the electron beams in the color picture tube are at rest or at the position which they would occupy on the screen if scanning were not applied.

Static Focus — The focus attained when the electron beam is theoretically at rest or is at the position it would occupy if scanning energy were not applied.

System Of Beams — The three electron beams emitted by the triple electron-gun assembly. They occupy positions equidistant from a common axis and are spaced 120 degrees apart around the axis.

Record Changer Servicing

(Continued from page 13)

B. If the tone-arm set-down point is erratic in operation, the following method to determine the trouble is suggested:

1. Check the cartridge lead wires to see that they are long enough to permit free movement of the tone arm.

2. Check the tone-arm control lever to see if it is binding.

3. Check all springs that help to actuate the tone arm in order to see if they are properly connected.

4. Check the tone-arm hub (2) in order to see if it has worked loose on the tone-arm control lever. If such is the case, make the following adjustments:

a. Tighten the set screw (3) enough so that the tone arm will be actuated by the tone-arm control lever during the change cycle.

b. Place a 10-inch record on the turntable.

c. With the power plug out, press down on the REJECT knob; then rotate the turntable clockwise by hand until the tone arm just barely starts to lower to the turntable. At this point, the horizontal movement of the tone arm is fairly stable.

d. Loosen the set screw (3) and move the tone arm so that the needle is approximately over the starting grooves of the record.

e. See that the hub (2) is fairly well seated on the retaining ring (4); then tighten the set screw (3).

f. After this adjustment has been made, put the changer through a complete change cycle and observe the landing of the tone arm.

g. If a finer adjustment is necessary, it may be made as described in step 5 of part A.

h. Check the needle in the cartridge to see if it is tight.

The description of the procedure for adjusting the set-down point applies to all the models of Admiral record changers previously designated. It is obvious that some parts in the various models may be of a different design; nevertheless, the service technician should be able to recognize these differences and make any alteration necessary. It is felt that an explanation of the set-down point will be an aid in understanding the service adjustment on the other Admiral models mentioned, although the illustration used is of the Admiral RC212.

Milwaukee

11200, 11600

These Milwaukee models differ some from each other in design and operation, but the set-down adjustment which follows is precisely the same for all.

1. Place the changer on a rack in order to observe the operation of the mechanism and to make the adjustment.

2. Set the mechanism to play 10-inch records.

3. Place a 10-inch record on the turntable.

4. With the power removed, reject the mechanism; then rotate the turntable by hand in a clockwise direction until the tone arm moves inward and just starts to lower to the turntable.

5. Using the photograph of the bottom view of the Milwaukee Model 11200 (Fig. 2) as a guide to locate the parts, loosen the clamp screw (1).

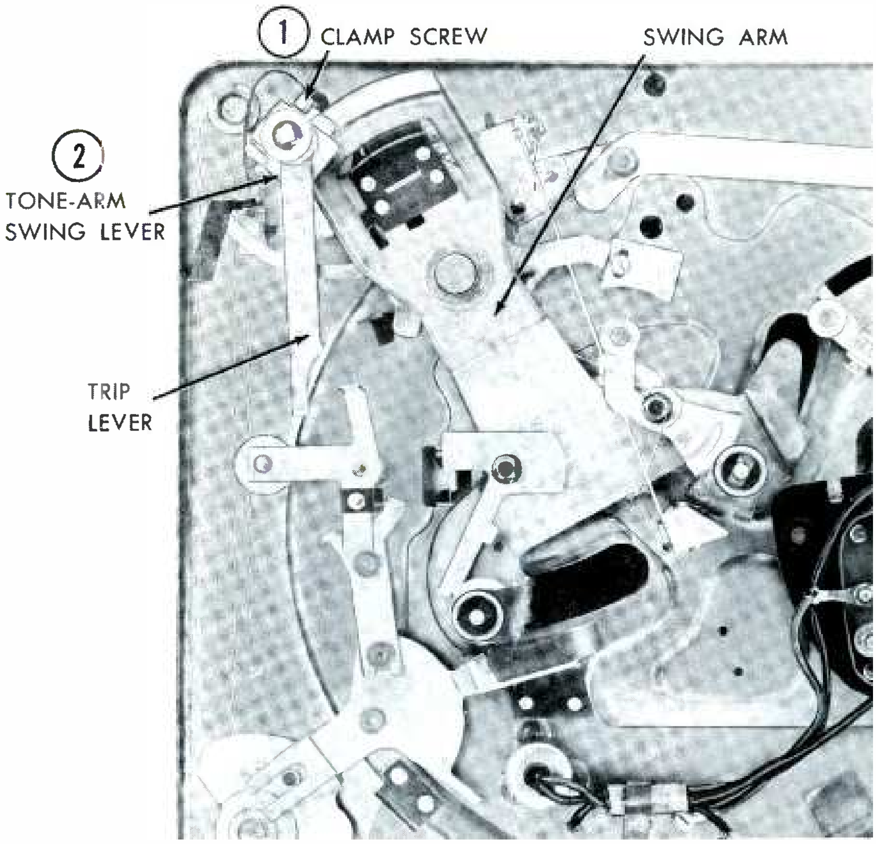


Fig. 2. Milwaukee Changer, Bottom View.

6. With the tone arm in the position mentioned in step 4, hold the tone-arm lever (2) in engagement with the set-down lever.

7. While holding these parts in engagement, move the tone arm over the starting groove of the record and then tighten the clamp screw (1).

8. Place a stack of records on the changer, and plug the changer into a convenient power receptacle of proper rating.

9. Reject the entire stack of records one at a time observing the landing point of the needle on each record. Make the above adjustment if necessary until the set down is correct.

The foregoing adjustment procedure is a definite method in which the proper set-down position of the tone arm is adjusted in these Milwaukee models. If the set-down point of the tone arm is erratic in operation, the service technician may locate and correct this erratic operation by rejecting several records and observing the actual parts that actuate the tone arm. The service technician should observe the mechanism for binding or bent parts and for missing springs.

V-M 400 Series

400D, 402-D, 404, 405, 406, 407

The various models of the V-M 400 Series of changers differ some in design and operation, such as in duo-speed or three-speed operation; however, in each case, the actual set-down adjustment is the same.

The V-M automatic record changer will be found in many different radio and television sets. Some of the differences to be noted in these changers may be in the color of the changers or in the type of tone arms used.

The set-down adjustment procedure is as follows:

1. Place a 10-inch record on the turntable.

2. Set the control knob so that the mechanism will function for 10-inch set down.

3. With the power removed from the mechanism, turn the reject knob to REJ position.

4. Rotate the turntable by hand in a clockwise direction until the tone arm moves in over the record and starts to lower to the turntable.

5. The set-down position of the needle is adjusted by means of the two adjusting screws (1A) and (1B), as shown in Fig. 3. If the needle is setting down too near the edge of the record, loosen the back screw (1A) about 1/4 turn and tighten the front screw (1B) to lock the adjustment in place. If the needle is setting down too near the center of the record, loosen the front screw (1B) and tighten the back screw (1A). When correct set down is obtained for the 10-inch position, the 12-inch and 7-inch needle set-down points will also be correct.

This adjustment can be made without removing the changer from the radio or TV cabinet. The adjustment tone screws are made accessible by raising the tone arm to a vertical position. After making the set-down adjustment and after playing a few records, if it is found that the tone-arm set-down point varies, check the following:

1. Check the cartridge lead wires to see if there is enough slack to allow the tone arm to move freely.

2. Check the catch (2), index cam (3), and index lever (4) to see that these parts are not binding. If they are binding during the automatic oper-

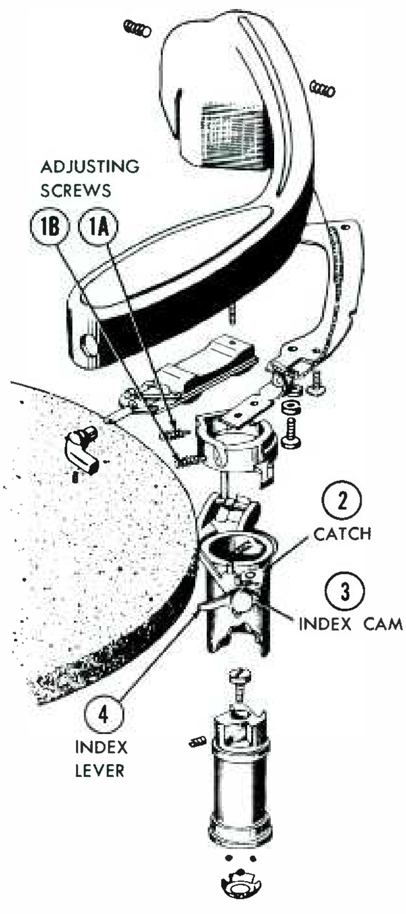


Fig. 3. Tone-Arm Assembly of the V-M 400 Series Changer.

ation of the changer, erratic tone-arm set down will result.

3. Move the tone arm back and forth over the record to see if it binds in any position. This is done by hand with the mechanism out of cycle.

If the set down is still erratic after these steps have been checked, then a careful study of the set-down mechanism and its operation should be of great help in locating the trouble.

V-M 950 Series

All automatic record changers bearing resemblance to the automatic record changer shown in Fig. 4 belong to the V-M 950 Series. The set-down adjustment may be made with the changer remaining in the cabinet.

The set-down position of the needle is adjusted by means of the set-down adjustment screw (1), as shown in Fig. 5. This screw is mounted on the tone-arm, hinge-arm assembly. Turn this adjustment screw (1) to the left or right until the needle lands in the starting groove of a 10-inch record. When the correct set-down position is obtained for 10-inch records, the 12-inch and 7-inch record set-down points will also be correct.

It is suggested that in the event the set-down adjustment of any automatic record changer does not position the tone-arm set down properly, the

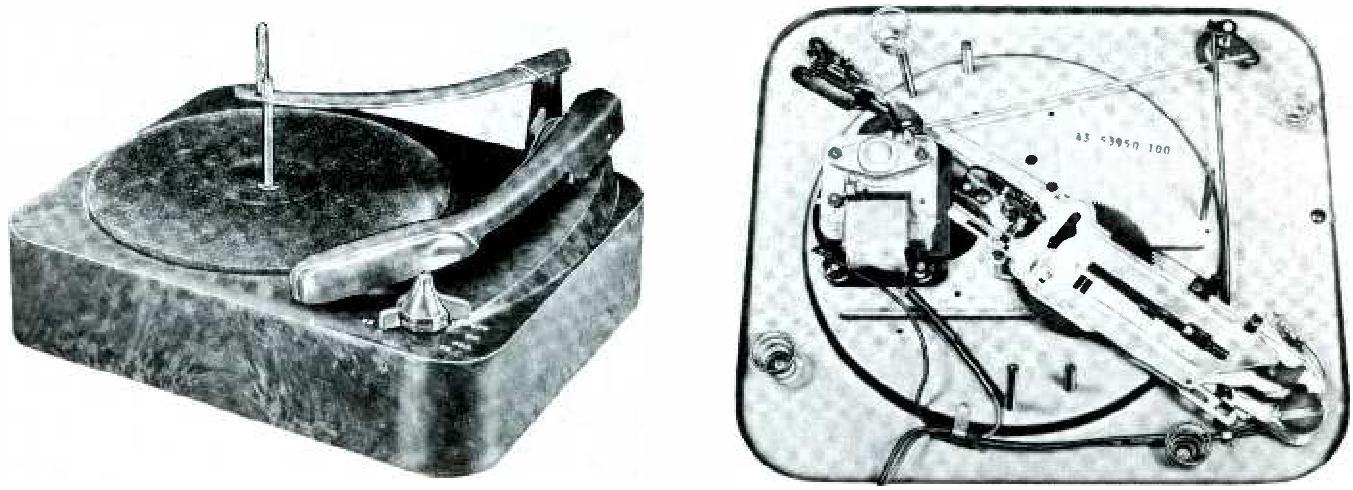


Fig. 4. V-M 950 Series.

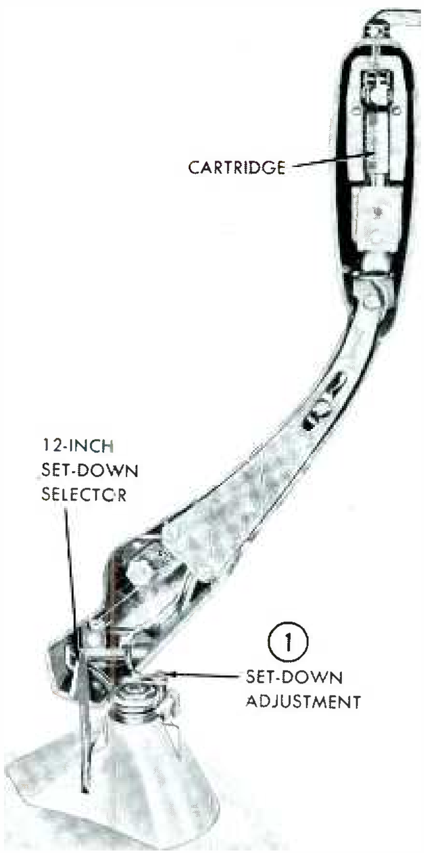


Fig. 5. Tone Arm of the V-M 950 Series.

service technician should study the movement of the tone arm in order to detect its faulty movement.

The tone arm and its connecting parts should always be checked to see that they are securely mounted and that they are all working freely. The lack of lubrication or excessive lubrication of the moving parts of the tone-arm bearings and connecting parts may also prevent the tone arm from operating properly.

Webster-Chicago

246, 256, 346, 356

Normally the set-down point is adjusted by turning the eccentric screw (1) in the hinge assembly. See Fig. 6. This adjusting screw is accessible through the top of the tone arm. Turn this screw clockwise to index the needle in toward the spindle and counterclockwise to index it away from the spindle.

Should further adjustment be necessary, proceed as follows:

1. Turn the eccentric screw (1) to a neutral position.

2. Set the record shelf to the 10-inch position.

3. Place a 10-inch record on the turntable.

4. Operate the mechanism by revolving the turntable manually in a clockwise direction until the needle drops to within 1/8 inch of the record.

5. Be sure the notch in the pickup-arm raising disc (1) shown in Fig. 7 engages the pickup raising lever (2) of Fig. 7, which is a partial drawing of some of the parts beneath the base plate.

6. The tone arm may now be regulated by adjusting the two set screws in the raising disc (1). The screws have pointed ends which fit into the off-center holes in the pickup-arm shaft (2) shown in Fig. 6. Alternately loosen one screw and tighten the other until the needle rests above the record lead-in groove at the desired point. Be sure that both set screws are tight when this adjustment is completed.

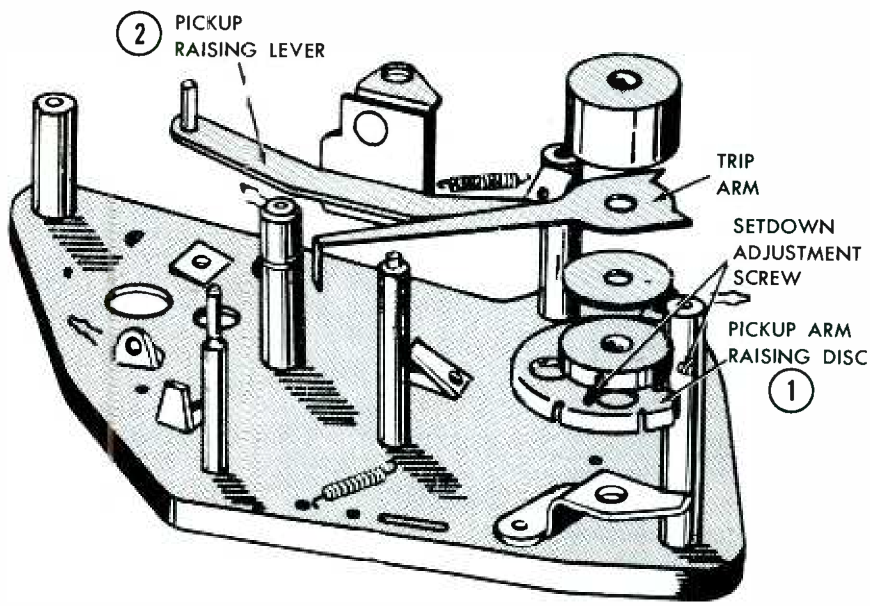


Fig. 7. Subframe of the Webster-Chicago 356.

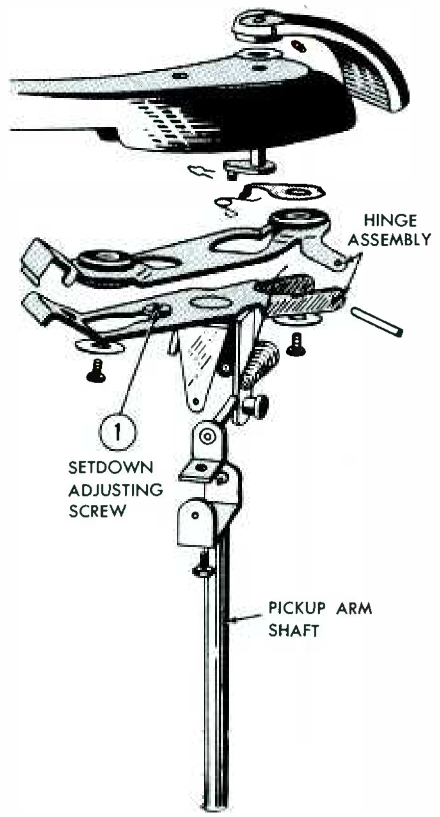


Fig. 6. Tone Arm and Hinge Assembly of the Webster-Chicago 356.

7. Complete the change cycle, and place the tone arm on the arm rest. If necessary, bend the tongue of the tone-arm raising disc (1) of Fig. 7 closer to or away from the base-plate post until the tone arm is correctly seated on the rest button when the tongue is touching the base-plate post.

CAUTION: All adjusting bends should be slight but firm.

8. Check the adjustment by placing a stack of records on the spindle, by running the changer through several change cycles, and by observing the landing of the needle. Any minor adjustments may be made by the eccentric adjusting screw (1) of Fig. 6.

9. Turn the record shelf to 12 inches and check the needle drop on a 12-inch record. If any adjustment is necessary, make it with the eccentric screw (1) of Fig. 6.

Record Changer Servicing

10. The 7-inch set-down adjustment for Webster-Chicago Model 346 is made by bending the bracket of the pickup-arm rest as follows: (a) move the tone arm to the center of the turntable; (b) trip the mechanism; (c) rotate the turntable in a clockwise direction until the tone arm reaches the approximate mid-point of its outward swing; (d) stop the rotation of the turntable and move the pickup arm toward the center post until the outside or 7-inch notch of the pickup-arm raising disc (1) engages the pick-up-arm raising lever (2), see Fig. 7; (e) rotate turntable until the pickup arm reaches the end of its outward movement; and (f) raise the 7-inch pickup-arm-rest bracket located on the base plate near the control knob and bend it in or out until it just touches the side of the tone arm. This adjusts the set-down point of the nedle for the 7-inch record.

Lester W. Caudell

Monochrome Reception

(Continued from page 19)

information contained in the transmitted signal passes normally through the luminance channel.

The video signal from the second video amplifier is applied simultaneously and in equal proportions to each section of the matrix. Since no signals are applied to the Q and I channels, no color information will be fed to the matrix from these channels. For proper operation of the color receiver, the background controls and the gains of the adder circuits must be adjusted so that each gun conducts sufficiently to contribute to the production of a black-and-white picture when signals of equal amplitude are applied to the input of the matrix. When receiving a monochrome signal, all voltages at the input of the matrix are equal, resulting in a black-and-white picture.

The deflection synchronization circuits of the color receiver operate in the same manner during reception of a monochrome signal as they do during color reception; however, the horizontal line and field frequencies employed for the two systems are slightly different. During the process of selecting the color subcarrier, it was found necessary to employ a horizontal-line frequency of 15,734.26 cycles per second with a tolerance of ±0.047 cycles per second. The standard established for monochrome transmissions is 15,750 cycles per second with a tolerance of 1 per cent. Upon comparison of the two frequencies, a difference of only 0.1 per cent is noted. This difference is well within the 1-per-cent tolerance established for the monochrome signal.

A system of 525 lines per frame was maintained for color transmissions; therefore, the new horizontal-line frequency of 15,734.26 cycles per second resulted in a new field frequency. This new field frequency is 59.94 cycles per second, as compared to the monochrome frequecny of 60 cycles per second. It was stated that the difference in frequencies is only 0.1 per cent. A variation of this amount will not be perceptible in the viewed picture.

The flexibility of the color receiver has been demonstrated by its ability to respond equally well to either a monochrome or a color transmission. The viewer is therefore not confined to the reception of color transmissions in areas where both types of signals are provided or where color programs constitute only a portion of the station's program.

Don R. Howe

Dollar and Sense Servicing

(Continued from page 37)

MAINTENANCE. When a customer complains about the high yearly cost of keeping a TV set running, try pointing out this fact: The total cost of maintaining present military electronic equipment over its useful life ranges from 10 to 100 times the initial cost of the basic equipment. The more correct average figure here is closer to the larger, or say 50 times initial cost. For a $200 TV set, then, the military would be plunking out $10,000 extra to keep it running 8 years.

ITV DETECTIVE. Industrial television gave police an eye-witness view of thieves at work in the stockroom of an RCA television service branch in Hollywood recently. Inventories revealed that some $38,000 worth of television equipment had been stolen, with all indications pointing to an inside job. With cooperation of police, an ITV camera was concealed up among the rafters of the stockroom, with the lens focused on the loading platform and with the receiver in a second-floor room some distance away.

Police stood by at the receiver for two weeks, watching closely a particular clerk who casually placed boxes of TV tubes on the loading platform during the lunch hour on Tuesdays and Thursdays when few people were around. Soon a pickup truck would back into the driveway, the clerk would help load up, and away would go the loot. When this method of operation had been detected, the trap was set. As the truck moved off with the next load, the clerk was arrested. A police car trailed the truck to its destination and there seized the driver and two alleged confederates.

CRYSTAL SETS. Still with us and selling at the rate of around 150,000 a year are the crystal sets of boyhood days. Today there are two chief markets —hospitals and youths. Headphones connected to crystal sets, with the bedspring serving as antenna and a nearby radiator or electric outlet plate as ground, provide adequate local-station reception in hospitals without disturbing other patients.

Retail prices of the sets range from $1 to $5. Cheapest have the familiar old cat whisker tickling a hunk of galena, while deluxe $5 jobs have modern germanium diodes as a rule.

The youth market for these sets is well worth encouraging, because those who play with radio today are most likely to become the enthusiastic service technicians of tomorrow. Furthermore, an interested and alert lad can be mightly useful around your shop on busy Saturdays, long before he starts his formal technical training. Get the right boy, and he'll be tickled to take his pay in the form of used parts and test equipment that's now gathering dust on the shelves.

Another thought —hook up a crystal set with phones at the front of your shop, and keep a few of the deluxe sets on hand for sale. Put up a small, simple sign something like "MODERN CRYSTAL SET — LISTEN AS LONG AS YOU LIKE" and watch how it brings back memories of bygone days. It'll ease your rush-hour tension too, just through knowing that your customer is being entertained while waiting his turn for your attention.

SALARIES. Total payroll of any TV service organization, large or small, should not exceed 40 per cent of gross income if a year-end profit is to be shown, according to an excellent new RCA booklet, "This Business of Radio and TV Servicing." If your ratio of payroll to sales is higher, three things need looking into: the budget, the size and efficiency of your technical staff, and your service rates.

BENT NECK. Many have undoubtedly mused that if the neck of a picture tube could be bent at right angles near the base of the funnel, television cabinets could be made a lot shallower. Success in doing just this is announced in a recent issue of "Philips Technical Review." This European tube manufacturer has bent the neck somewhat more than 90 degrees in order to fold it partly back along the funnel. A small 70-gauss magnet is used to get the electron beam around this bend.

The construction permits a longer neck, which gives more room for the deflection yoke and gives even better focusing than with conventional straight-necked tubes. The first tube to be placed in production is type MW36-22, having about a 10- by 13-inch screen. There are as yet no plans for U. S. sale, since this small screen size would not interest the American market. The cabinet of the set using this tube is only 13.6 inches deep.

BIG BEN. We thought we had one on Reader's Digest. They ran an item saying that people in Australia hear the chimes of Big Ben before those on the street right below the famous tower. It turned out, however, that math and memory both were shakier than we care to admit, and Reader's Digest was right.

The radio waves, fed by a mike right alongside the chimes, travel the 13,000 miles from London at a speed of 186,000 miles per second and hence take about 1/14 second. During this time, sound waves cruising along at 1,100 feet per second will get only 79 feet, which is far less than the height of Big Ben's tower.

You can readily apply these figures to an interesting local example when next called upon to speak before some local luncheon club or evening gathering. For example, those watching a football game on TV hear the game-ending gun before the people in the stands and even before the players hear it —provided the pickup mike is near the point where the gun is fired.

GOLDFISH. In one California research laboratory, goldfish are used to trace electromagnetic lines of force between electrodes immersed in an aquarium. When voltage is applied between the electrodes, the goldfish line up for minimum head-to-tail tickle, corresponding to minimum potential. Attempts to photograph the entire wave pattern for a given set of electrodes have not worked out too well, however, because some goldfish are always getting out of line and seeking less ticklish locations.

BUSES. A bus company owner in Cumberland, Maryland claims TV is forcing him out of business by keeping patrons home nights. The same lament comes from bus operators in many larger cities. Even in London, a recent fare boost was blamed on TV. Thought for meditiation: Is it better for the minds and morals of people to step out nights or to watch television? Our conclusion: In the United States, people get what they want, so television servicing booms.

COMMERCIALS. British TV seems at first thought to be the American dream come true—no commercials, no interruptions, no urgent pleas to test and compare—but critic Jack Gould of the New York Times says they can have it. Though the peace of the English living room is indescribably soothing and delightful for a time, there is a catch. You can get trapped into a solid 90 minute wordy play about Joan of Arc or something, with no station selector switch with which to seek relief. Television there is government-controlled, and there's only one station per locality. We in the U.S. are missing some excellent BBC presentations but on the other hand are escaping from some colossal bores.

GUNLESS. Confirmed rumors have it that two of the largest television picture-tube manufacturers in this country are getting somewhere with their work on a picture tube that has no electron gun. It'll be only two or three inches thick, permitting it to be hung on the wall like a picture, with the receiver and controls conveniently located in an end-table type of cabinet alongside the favorite viewing chair.

We managed to get a few inklings of construction details. Based on these, here's our guess as to how the thing will work. There'll be two sheets of glass with transparent conductive metallic lines of the sides facing each other. One glass will have around 525 horizontal lines and the other about one-third more vertical lines, corresponding to U.S. standards for lines and aspect ratio. Between these conductive grids will be the phosphor. A voltage pulse will be applied to one horizontal line and one vertical line at a time. Where these lines cross, there will be double voltage and the phosphor will glow. Scanning will be obtained by using electronic counter circuits, probably with tiny germanium diodes, to apply the voltage pulse to each conductive line in turn. Thus, each vertical line will get the pulse in sequence while one horizontal line is activated, with the process repeating for the next lower horizontal line, and so on.

So far, this only gives scanning. Getting modulation of spot brillance is the real problem on which much work remains to be done. It may be possible to have a transparent metallic grid sheet between the metalized lines on the glass, with the phosphor on both sides for energizing by the video signal. It may be possible to modulate the scanning voltages themselves, if the proper phosphor for the purpose can be found. They may even go to a black-trace tube, which is lighted in absence of signal and is darkened proportionately to the video signal during scanning. In any event, it looks as if it'll still be a vacuum tube, because the phosphor chemicals work best in a vacuum.

Such a picture tube has interesting possibilities. The larger it is, the easier becomes the construction, since the metalized lines get farther apart. Color would seem easy to achieve in large size, because there will then be room for three sets of lines in each direction to activate the dot patterns of three different colors of phosphors.

So far, no patents have been granted in Washington on this tube. Application for a patent means revealing details to competitors; hence, the companies may prefer to hold up on patent protection until they're almost ready for production. When that will be, nobody knows; it may be five years or ten, so don't make your customers enthusiastic to the point where they'll wait for it.

UNLIMITED. While visiting the home folks out in St. Paul, Minnesota this summer, the sign "Appliances Unlimited" in a suburban shopping center caught our attention and fancy. It turned out to be the business name for a dealer handling TV, radio and white goods. For a TV servicing business name, how about twisting it around to something like "Television Service Unlimited?"

BIRDNOTES. Because bird calls in their natural state are more or less a blur of high-frequency notes, magnetic tape was used on one radio program to let listeners hear the calls in slow motion. By dubbing twice at half-speed, calls were reduced two octaves and spread out to four times the original duration. This brought the highest notes down to middle whistling range and at the same time reduced the complexity of the notes. Running commentary was mixed with the calls, with the natural and the slowed-down calls both included. The work was done by Mortimer Goldberg of the CBS radio staff.

Many other tricks can be done with magnetic tape if you have a couple of machines for dubbing back and forth. For another program, CBS recorded "Twinkle, Twinkle, Little Star" as played on a flute and tuba, each on separate tape; then they did tricks to boost the tuba notes up three octaves into the flute range and cut flute notes down three octaves into the tuba range. The result was out of this world. So was "America" when scored, played on a piano, recorded backward, and the tape reversed for playback. As a result, the reverberation of the piano came before the note, giving more the effect of an organ.

For a sales-stimulating contest that'll get them talking and coming into your store, record a lot of familiar sounds at unfamiliar speeds and let people record their guesses on score cards for prizes. Put it on tape and play it every half hour in your store during the contest period, so people can look at the new models of TV sets while waiting for the program or while listening. Here are ideas: a slowed-down bicycle bell sounds like a large fire bell; a crying baby sounds like a sobbing woman. For more tricks with tape, get on the mailing list of Audio Record, published free monthly for recording enthusiasts by Audio Devices, Inc., 444 Madison Avenue, New York 22, N. Y.

FIRE. In one small New Jersey community, the chief of the volunteer fire department resigned because of the drawing power of TV. Last straw was a call right in the middle of a popular TV program, and he had to go out on it all by himself.

John Markus

TV SUPPLEMENTARY SHEET NO. 7

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
SONORA					
305 323 324 325 332	N-7172	AG-60-Z KSS-3/SWB	Vol./ Sw.	500K Ω carbon--SPST	$1.25 .60
	N-7338	RTV-336	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	N-7341	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	N-8053	RTV-335	Bright./ Contrast	50K/2500 Tap 2000 Ω Conc. Dual carbon	$3.70
	N-8071	AG-15-S FKS-1/4	Vert. Lin.	3000 Ω carbon	$1.25
350 351 352	N-7341	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	N-8071	AG-15-S FKS-1/4	Vert. Lin.	3000 Ω carbon	$1.25
	N-8158	RTV-342	Contrast/ Vol./Sw.	2500 Tap 500/500K Ω Conc. Dual carbon SPST	$4.30
	N-8279	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	N-8280	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	N-8280	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
SPARTON					
5212 5250 CHASSIS 21S172	PA4411	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	PA4431	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	PA4433-3	AK-69 KSS-3/SWB	Vol./ Sw.	330K Tap 60K Ω carbon--SPST	$1.85 .60
	PA4443-2	AG-61-S FS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	PA4444-2	AG-44-S FS-3	Hor. Hold	50K Ω carbon	$1.25
	PA4445-2	AG-49-S FS-3	Bright.	100K Ω carbon	$1.25
	PA4446	A43-1000 FKS-1/4	Hor. Drive	1000 Ω 2W-W.W.	$1.25
	PA4452	AG-58-S FKS-1/4	Focus	500K Ω carbon	$1.25
	PA4453	A43-1000 FS-3	Contrast	1000 Ω 2W-W.W.	$1.25
5288 5289 5291 5292 5293 5294 5295 5296A 5297A 5298	PA-4411	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	PA-4426-1	A10-1500 FKS-1/4	Focus	1500 Ω 4W-W.W.	$1.85
	PA-4431	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	PA-4442-4	AG-40-S FS-3	Contrast	25K Ω carbon	$1.25
	PA-4444-2	AG-44-S FS-3	Hor. Hold	50K Ω carbon	$1.25
	PA-4445-2	AG-49-S FS-3	Bright.	100K Ω carbon	$1.25
	PA-4446	A43-1000 FKS-1/4	Hor. Drive	1000 Ω 2W-W.W.	$1.25
	PA-4450-1	RTV-349	Tone/Vol./ Sw.	1 Meg/330K Tap 65K Ω Conc. Dual carbon DPST	$4.45

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
	* PA-4451-1	AG-58-S FS-3	Vert. Hold	500K Ω carbon	$1.25
	* Some Models Use Part # PA-4443-2				
STEWART-WARNER					
9202-A B.C. DA.DB DD, DDA.E.F,FA	508889	AG-44-S RS-2	Bright.	50K Ω carbon	$1.25
	508891	AG-19-S RS-2	Vert. Lin.	5000 Ω carbon	$1.25
	508893	RTV-313	Height/ Vert. Hold	2.5 Meg./1 Meg. Conc. Dual carbon	$3.10
	509314	RTV-309	Contrast/ Vol./Sw.	750/1 Meg. Tap 200K 2W-W.W./carbon Conc. Dual--SPST	$4.30
STROMBERG-CARLSON					
417C5-M 417C5-50 417C5-DEC 417TX Series 417	145079	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	145100	AM-86-S FKS-1/4	Height	6 Meg. Ω carbon	$1.25
	145128	RTV-75	Hor./ Vert. Hold	50K/2 Meg. Conc. Dual carbon	$3.10
	145129	RTV-314	Contrast/ Bright.	300/100K Ω 2W-W.W./carbon Conc. Dual	$3.10
	145132	AG-27-S FKS-1/4	Hor. Drive	10K Ω carbon	$1.25
	145142	AG-64-Z FS-3/SWB-2	Vol./Sw.	250K Ω carbon DPST	$1.25 .75
421CDM 421CM 421TX	145079	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	145100	AM-86-S FKS-1/4	Height	6 Meg. Ω carbon	$1.25
	145128	RTV-75	Hor./Vert. Hold	50K/2 Meg. Conc. Dual carbon	$3.10
	145132	AG-27-S FKS-1/4	Hor. Drive	10K Ω carbon	$1.25
	145140	RTV-227	Contrast/ Bright.	1000/100K Ω 2W-W.W. carbon Conc. Dual	$3.10
	145142	AG-64-Z RS-2/SWB-2	Vol./Sw.	250K Ω carbon--DPST	$1.25 .75
SYLVANIA					
22B-11 22M-11 23B-11 23M-11 CHASSIS 1-507-1	153-0001 37-73213-1	AG-61-S FKS-1/4	Height	1 Meg. Ω carbon	$1.25
	153-0007 R73197	AG-55-S FKS-1/4	Hor. Drive	250K Ω carbon	$1.25
	153-0009 R73154	AG-61-S FKS-1/4	AGC	1 Meg. Ω carbon	$1.25
	153-0010 R73156	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	153-0014 37-73667-1	AG-83-S FKS-1/4	Vert. Hold	1.5 Meg. carbon	$1.25
	153-3007 R73202	A43-300 FKS-1/4	Contrast	250K Ω 2W-W.W.	$1.25
	153-3009 37-73748-1	A10-20K FKS-1/4	Width	20K Ω 4W-W.W.	$2.20
	157-0009 R73153	RTV-260	Bright./ Vol./Sw.	2 Meg./1 Meg. Top 200K Ω Conc. Dual carbon SPST	$4.30

Form No. 751961010-5M-12/52

CLAROSTAT

This supplementary sheet is for use as an up-to-the-minute addition to your Clarostat TV Manual. Manuals are available through your distributor or directly from Clarostat. Price $1.00.

CLAROSTAT MFG. CO., INC.
DOVER, NEW HAMPSHIRE

PF INDEX

AND TECHNICAL DIGEST

INDEX TO ADVERTISERS
January - 1954 Issue

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this Index.

+ More or Less −

The Color Television articles in this issue are directed toward the practical interpretation of the color television system standards which the Federal Communications Commission has been petitioned to adopt. That these standards will be adopted seems virtually certain, and such action may well have taken place before these words are in print. Outlining the fundamental application of the system to the best of our ability is then presently logical and, we hope, helpful. However, we do not want our objective to be misunderstood. We are neither promoting nor decrying the prospect of commercial color television.

The articles provide the technical background; it is the purpose of this column to point out a few of the commercial factors which may be of assistance to the individual in forming his own evaluation and future planning.

First, no one should delude himself about the eventual prospects of color television. Its birth, growth, and maturity are as inevitable as night following day. As a parallel, consider the growth of color photography in print, slide and movie form. Those who have experienced the enjoyment that prints or projections in color can provide are ordinarily limited in their pursuance of this medium only by the increased cost of it. Granting that the comparison is not accurate with respect to the exact nature of reproduced color, it still points up the basic fact that the appeal of the color form is much greater.

Second, here are some factors which may serve to temper over-enthusiastic planning based on immediate color TV.

Color TV receivers will be relatively high in price. Popular estimates range from $750 to $1000. Simplifications in design and production improvements are not likely to appreciably reduce these figures during 1954.

Color TV receiver production will be limited during the coming year. Present estimates range from 50,000 to 100,000 sets during this time, dependent, of course, upon the date of standards approval by the FCC.

Color TV programming is quite likely to be sparse. If the general impression is true that staging, lightning, and technicial production costs are substantially increased, then it would seem that initial programming would be directed toward public event rather than studio programs.

Another point to bear in mind here, is that additional telecasting equipment must be provided to TV transmitting stations, and that network facilities are uncertain. Present microwave facilities can be satisfactory, but the bandpass characteristic of coaxial line is not suitable for color transmissions.

In spite of statements and promotions to the contrary, there is little doubt but that the predicted coming of color television has hurt black and white TV receiver sales. It is equally true that it will continue to do so; however, it doesn't follow that service operations on black and white TV receivers would be similarly affected. Actually, the likelihood is the other way. . . that more people will have existing black and white receivers serviced to stay in operation until the purchase of a color receiver seems in order.

The foregoing premises are fairly well established. The unknown factor (and consequently bothersome to most people) is the degree of willingness or reluctance on the part of the public to make a considerable investment in a color television receiver, with relatively small picture area as compared to the presently most popular black and white size, the 21-inch.

In the course of the next year, and particularly the next few months, all of you are going to be bombarded by color TV manufacturer promotions, technician writeups and customer questions. We repeat . . . your interests will be best served if you are adequately informed, but not misled. The practical aspects of installation, maintenance, and service operations on color television receivers have not yet arrived; neither has the income nor the profit therefrom. As far as service operations are concerned, black and white television will continue to furnish the great bulk of the revenue for a long time to come.

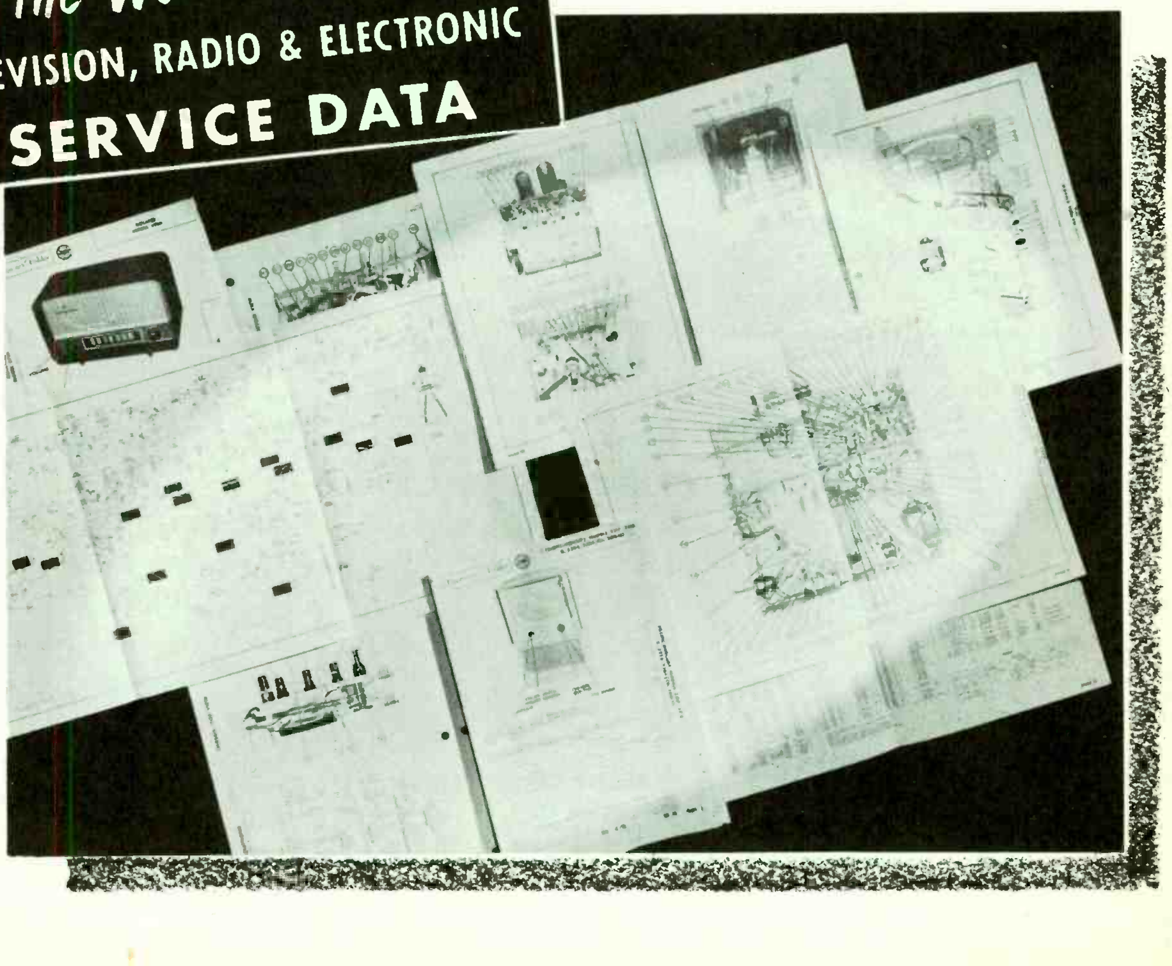
- J. R. R.

Cumulative Index No. 42

COVERING PHOTOFACT FOLDER SETS 1 THRU 227

PHOTOFACT FOLDERS

the World's Finest
TELEVISION, RADIO & ELECTRONIC
SERVICE DATA



TOP-SELLING Practical PUBLICATIONS *distributed by* **HOWARD W. SAMS & CO., INC.**

COYNE — FAMOUS SHOP-TESTED REFERENCE BOOKS

TV Servicing Cyclopedia. Covers every phase of TV, including color and UHF. Explains theory, servicing, testing, antennas, circuits, convertors—covers everything. 750 pages. Order **CTB-1** **$5.95**

Practical TV Servicing. How to service by alignment, by picture pattern; how to install antennas; how to handle any TV service problem. Data on color and UHF. 400 pages. Order **CTB-4** **$4.25**

Latest Testing Instruments. Covers proper use of all modern TV, radio and electrical testing equipment. Packed with time-saving short-cuts. Full analysis of all instrument types. 350 pages. Order **CTB-3** **$3.25**

Television and Radio Handbook. 3000 useful facts on practical radio servicing. Covers most frequently recurring problems; trouble-shooting hints. Data on UHF conversion. Practical help for speedy servicing. 375 pages. Order **CTB-5** **$2.75**

Industrial Electronics. Practical, simplified information on basic principles and practices of electronics. The ideal book for orientation in the entire field. Easy to understand. 468 pages. Order **CTB-2** **$3.75**

Applied Practical Radio-Television. Complete 5-Volume Library; 1780 pages of latest "know-how" on Radio and TV. Vol. 1, Radio & TV Principles; Vol. 2, Radio, TV and FM Receivers; Vol. 3, Radio & TV Circuits; Vol. 4, Radio & TV Testing Methods; Vol. 5, TV Servicing. Complete 5 Volume Set. Order **CTB-50** **$15.00**

Applied Practical Electricity. 8 Volume Library covering *everything* on the subject, including home wiring, motors, refrigeration, air conditioning, automotive diesel, etc. 3000 subjects. 3634 pages in 8 volumes. Order set **CTB-180** **$24.00**

Electrical Trouble-Shooting. Complete trouble-shooting course; also covers refrig., industrial electronics. 626 pages. Order **CTB-101** **$6.95**

Electricians Handbook. Code requirements, rules, tables, charts, testing guides; data on motors, currents, etc. 348 pages. Order **CTB-102** **$2.75**

BOYCE — AUTHORITATIVE TV & RADIO HANDBOOKS

Video Handbook. Full data on TV design, construction, production, installation, operation and servicing. 14 complete sections cover the entire field clearly and practically. 892 pages. Order **BB-2** ... **$5.95**

Radio Handbook. 18 sections; clearly explains radio and electronic theory; covers all phases thoroughly, including parts and circuit analyses, Sound, Recording, Testing, Antennas, TV, etc. 890 pages. Order **BB-1** **$4.95**

HOWARD W. SAMS & CO., INC.

ORDER THESE OUTSTANDING PRACTICAL BOOKS FROM YOUR PHOTOFACT DISTRIBUTOR

Howard W. Sams PHOTOFACT *Publications*

PHOTOFACT SERVICE MANUALS

Here's the radio-TV service data that saves time and helps you earn more! Preferred and used daily by thousands of Radio and TV Service Technicians. Complete, accurate—based on analysis of the actual equipment. Uniform treatment for each model. Includes Standard Notation Schematics; full chassis photo coverage; complete circuit analysis and replacement parts data; wave forms, alignment data; record changer analysis — everything you need for quick, profitable servicing. Each volume in deluxe binding.

VOL. 1—Post-war models to Jan. 1, 1947
VOL. 2—Jan. 1, 1947—July 1, 1947
VOL. 3—July 1, 1947—Jan. 1, 1948
VOL. 4—Jan. 1, 1948—July 1, 1948
VOL. 5—July 1, 1948—Dec. 1, 1948
VOL. 6—Dec. 1, 1948—May 1, 1949
VOL. 7—May 1, 1949—Oct. 1, 1949
VOL. 8—Oct. 1, 1949—Dec. 1, 1949
VOL. 9—Dec. 1, 1949—Mar. 31, 1950
VOL. 10—Mar. 31, 1950—July 31, 1950
VOL. 11—July 31, 1950—Oct. 31, 1950
VOL. 12—Oct. 31, 1950—Jan. 1, 1951
VOL. 13—Jan. 1, 1951—Apr. 30, 1951
VOL. 14—Apr. 30, 1951—Aug. 1, 1951
VOL. 15—Aug. 1, 1951—Oct. 31, 1951
VOL. 16—Oct. 31, 1951—Jan. 31, 1952
VOL. 17—Jan. 31, 1952—Apr. 30, 1952
VOL. 18—Apr. 30, 1952—July 31, 1952
VOL. 19—July 31, 1952—Nov. 30, 1952
VOL. 20—Nov. 30, 1952—Feb. 28, 1953
VOL. 21—Feb. 28, 1953—May 31, 1953
VOL. 22—May 31, 1953—Sept. 15, 1953
VOL. 23—Sept. 15, 1953—Dec. 15, 1953

② **Each Volume in DeLuxe Binder. .$21.00**

PHOTOFACT FOLDER SETS

The easiest way to own the world's finest TV-Radio Service Data. Issued three sets per month—put in your standing order for them.

② Per PHOTOFACT Set $1.75

PHOTOFACT SERVICE DATA ITEMS

②	Deluxe Photofact Binder, Each	$3.50
②	PF INDEX Binder (holds 12 issues) ...	2.50
①	Index Tabs for Sets 1-10	.40
①	Index Tabs for Sets 11-20	.40
①	Volume Labels for Vols. 1-10	.25
①	Volume Labels for Vols. 11-20	.25
①	Volume Labels for Vols. 21-30	.25
①	Index Cards, Sets 1-100	$2.50 per set
①	Index Cards, Sets 101-200 ..	2.50 per set
①	Index Cards, Sets 201-300 ..	2.50 per set
①	Mailing envelopes	2.70 per 100

EASY-PAY PLAN: Ask your Parts Distributor for details on our attractive Time Payment terms that enable you to own and use the PHOTOFACT Service Data Library on a convenient pay-as-you-earn basis.

AUTO RADIO SERVICE MANUALS

Vol. 3. Full service data on 47 chassis (80 models) used in 1950, 1951 and 1952 auto radio receivers. 288 pages, 8½ x 11". Order **AR-3** **$3.00**

Vol. 2. Covers 60 chassis (90 models) used in 1948, 1949 and 1950 auto radios. 288 pages, 8½ x 11". Order **AR-2** **$3.00**

Vol. 1. Covers 100 auto radio models made from 1946 to 1949 by 24 manufacturers. 396 pages, 8½ x 11". Order **AR-1** **$4.95**

HANDY SERVICE GUIDES

Dial Cord Stringing Guide. Vol. 2: Shows correct way to string dial cords in radio receivers made from 1947 through 1949. 96 pages, 5½ x 8½". Order **DC-2** **$1.00**

Vol. 1: Covers receivers produced from 1938 through 1946. 112 pages, 5½ x 8½". Order **DC-1** **$1.00**

Radio Receiver Tube Replacement Guide. Shows where to replace each tube in 5500 receivers made from 1938 to 1948. 196 pages, 5½ x 8½". Order **TP-1** **$1.25**

INVALUABLE TELEVISION BOOKS

Telecasting Operations. The only complete coverage of every phase of Telecasting, from theory through equipment, operation, maintenance, production—indispensable to anyone interested in Telecasting. 600 p., 6 x 9". Order **OH-1** .. **$7.95**

Photofact Television Course. Gives a clear, complete understanding of TV principles, operation and practice. 208 pages, 8½ x 11". Order **TV-1** **$3.00**

TV Servicing Short-Cuts. Describes actual TV service case histories; shows how to solve similar troubles in *any* receiver. 100 pages, 5½ x 8½". Order **TK-1** **$1.50**

TV Test Instruments. Tells how to operate each test instrument used in TV service work. 175 pages, 8½ x 11". Order **TN-1** **$3.00**

UHF Converters. Describes 21 popular converters; shows how they work. 44 pages, 8½ x 11". Order **UC-1** **$1.00**

UHF Antennas, Converters & Tuners. Covers all antenna types, transmission lines and matching networks, UHF converters and tuners. 136 pages, 5½ x 8½". Order **UHF-1** **$1.50**

Television Antennas. 2nd Edition. Tells how to select, install and service antennas. 224 pages, 5½ x 8½". Order **TAG-1** **$2.00**

Servicing TV in the Customer's Home. Short-cut methods for repairs in the field. 96 pages, 5½ x 8½". Order **TC-1** **$1.50**

Making Money in TV Servicing. Tells how to set up and operate a profitable TV service business. 136 pages, 5½ x 8½". Order **MM-1** **$1.25**

TV Tube Location Guides: Vol. 4. Shows tube positions and functions in hundreds of TV receivers. Helps quickly locate faulty tube. 192 pages. 5½ x 8½". Order **TGL-4** **$2.00**

Vol. 3. Covers receivers not included in Vols. 1, 2 and 4. 192 pages, 5½ x 8½". Order **TGL-3** . **$2.00**

Vol. 2 Covers receivers not included in Vols. 1 and 3. 208 pages, 5½ x 8½". Order **TGL-1** .. **$2.00**

Vol. 1. Covers hundreds of sets made by 56 mfgrs. 208 pages, 5½ x 8½". Order **TGL-1** . **$1.50**

AUDIO PUBLICATIONS

Recording & Reproduction of Sound. Oliver Read's biggest selling volume on all aspects of Audio; fully covers recording and amplifying methods and equipment. Authoritative, complete. 810 pages, 6 x 9". Order **RR-2** **$7.95**

Audio Amplifiers. Vol. 4. Full analysis of 75 audio amplifiers and tuners made during 1951 and 1952. 352 pages, 8½ x 11". Order **AA-4** .. **$3.95**

Vol. 3. Covers 50 amplifiers and 22 tuners made during 1950. 352 pages, 8½ x 11". Order **AA-3** **$3.95**

Vol. 2. Covers 104 amplifiers and 12 tuners produced during 1949. 368 pages, 8½ x 11". Order **AA-2** **$3.95**

Vol. 1. Covers 102 amplifiers and tuners produced from 1946-1948. 352 pages, 8½ x 11". Order **AA-1** **$3.95**

RECORD CHANGER MANUALS

Vol. 4. Full service data on 38 changers and recorders made during 1951. 288 pages, 8½ x 11". Order **CM-4** **$3.00**

Vol. 3. Covers 44 changers made in 1949 and 1950. 288 pages, 8½ x 11". Order **CM-3** ... **$3.00**

Vol. 2. Covers 45 models made in 1948 and early 1949. 432 pages, 8½ x 11". Order **CM-2** ... **$4.95**

Vol. 1. Covers 41 post-war models made up to 1948. 396 pages, 8½ x 11". Order **CM-1** ... **$3.95**

COMMUNICATIONS RECEIVERS

Vol. 2. Full analysis of 26 popular communications receivers made during recent years. 190 pages, 8½ x 11". Order **CR-2** **$3.00**

Vol. 1. Covers 50 well-known models produced from 1946 to 1948. 264 pages, 8½ x 11". Order **CR-1** **$3.00**

Get these PHOTOFACT Publications at your Parts Distributor

Cumulative Index to PHOTOFACT FOLDERS

No. 42 · Covering Folder Sets Nos. 1 through 227 · World's Finest Electronic Service Data

HOW TO USE THIS INDEX

To find the PHOTOFACT Folder you need, first look for the name of the receiver (listed alphabetically below), and then find the required model number. Opposite the model, you will find the number of the PHOTOFACT Set in which the required Folder appears, and the number of that Folder. The PHOTOFACT Set number is shown in bold-face type; the Folder number is in the regular light-face type.

IMPORTANT—1. The letter "A" following a set number in the Index listing, indicates a "Preliminary Data Folder." These folders were designed to provide immediate basic data on TV receivers. Many of these were later superseded by regular Photofact Folders. In those cases where short production runs and/or limited distribution prevented availability of a sample chassis the "A" designation has been retained.

2. Models marked by an asterisk (*) have not yet been covered in a standard Folder. However, regular PHOTOFACT Subscribers may obtain Schematic, Alignment Data or other required information on these models without charge by supplying make, model or chassis number and serial number. (When requesting such data, mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.)

3. Production Change Bulletins contain data supplementary to certain models covered in previously issued PHOTOFACT Folders, and are listed in this Index immediately following the listing of the original coverage of the model or chassis. These Bulletins should be filed with the Folders covering the models to which the changes apply.

NOTE: PCB denotes Production Change Bulletin

ADMIRAL—Cont.

Models 37K15, A, B, 37K16, A, B Tel. Rec. (See Ch. 21G1 or 21Q1 and Ch. 3C1)
Models 37K27, A, B, 37K28, A, B Tel. Rec. (See Ch. 21G1 or 21Q1 and Ch. 3C1)
Models 37K35, A, B, 37K36, A, B Tel. Rec. (See Ch. 21G1 or 21Q1 and Ch. 3C1)
Models 37K55, 37K56, 37K57 Tel. Rec. (See Ch. 21G1 or 21Q1 and Ch. 3C1)
Models 37M15, 37M16 Tel. Rec. (See Ch. 21G1 or 21Q1 and Ch. 3C1)
Models 37M25, 37M26, 37M27 Tel. Rec. (See Ch. 21Z1)
Models 39X16, A, 37X17A Tel. Rec. (See Ch. 24G1 and Ch. 5B2)
Models 39X16B, 39X17B Tel. Rec. (See Ch. 24G1 and Ch. 5D2)
Model 39X17C Tel. Rec. (See Ch. 21J1)
Models 39X25, 39X26 Tel. Rec. (See Ch. 24F1 and Ch. 5D2)
Models 39X25A, 39X26A Tel. Rec. (See Ch. 21J1)
Models 39X35, 39X36, 39X37 Tel. Rec. (See Ch. 21J1 and Ch. 3C1)
Models 47M15, A, 47M16, 47M17 Tel. Rec. (See Ch. 21W1)
Models 47M35, 47M36, 47M37 Tel. Rec. (See Ch. 21Z1)
Models 52M15, 52M16, 52M17 Tel. Rec. (See Ch. 21Y1)
Models 57M10, 57M11, 57M12 Tel. Rec. (See Ch. 21Z1A)
Model 121DX10 Tel. Rec. (See Ch. 19C1)
Model 121DX11 Tel. Rec. (See Ch. 19F1A)
Model 121DX12 Tel. Rec. (See Ch. 19C1)
Model 121DX12A Tel. Rec. (See Ch. 19C1 or 19F1)
Model 121DX16 Tel. Rec. (See Ch. 19C1)
Model 121DX16A Tel. Rec. (See Ch. 19C1 or 19F1)
Model 121DX16L Tel. Rec. (See Ch. 19K1)
Model 121DX17 Tel. Rec. (See Ch. 19C1)
Model 121DX17A Tel. Rec. (See Ch. 19C1 or 19F1)
Model 121DX17L Tel. Rec. (See Ch. 19K1)
Models 121K15, 121K16, 121K17 Tel. Rec. (See Ch. 21M1)
Models 121K15A, 121K16A, 121K17A Tel. Rec. (See Ch. 22M1)
Model 121M10 Tel. Rec. (See Ch. 22M1)
Models 121M11, 121M12 Tel. Rec. (See Ch. 21M1)
Models 121M11A, 121M12A Tel. Rec. (See Ch. 22M1)
Model 122DX12 Tel. Rec. (See Ch. 22F2)
Model 221DX15 Tel. Rec. (See Ch. 19C1)
Model 221DX15A Tel. Rec. (See Ch. 19C1 or 19F1)
Model 221DX15L Tel. Rec. (See Ch. 19K1)
Model 221DX16 Tel. Rec. (See Ch. 19C1)
Model 221DX16A Tel. Rec. (See Ch. 19C1 or 19F1)
Model 221DX16L Tel. Rec. (See Ch. 19K1)
Model 221DX17 Tel. Rec. (See Ch. 19C1)
Model 221DX17A Tel. Rec. (See Ch. 19C1 or 19F1)
Model 221DX17L Tel. Rec. (See Ch. 19K1)
Model 221DX26 Tel. Rec. (See Ch. 19C1)
Model 221DX26A Tel. Rec. (See Ch. 19F1)
Model 221DX26L Tel. Rec. (See Ch. 19K1)
Model 221DX38 Tel. Rec. (See Ch. 19C1)
Model 221DX38A Tel. Rec. (See Ch. 19C1 or 19F1)
Models 221K16, A Tel. Rec. (See Ch. 21K1)
Model 221K26 Tel. Rec. (See Ch. 21K1)
Model 221K28 Tel. Rec. (See Ch. 21K1)
Models 221K35, 221K36 Tel. Rec. (See Ch. 21K1)
Models 221K45, 221K46, 221K47 Tel. Rec. (See Ch. 21M1)
Models 221K45A, 221K46A, 221K47A Tel. Rec. (See Ch. 22M1)
Models 221M26, 221M27 Tel. Rec. (See Ch. 21K1)
Model 222DX15 Tel. Rec. (See Ch. 19H1)
Model 222DX15B Tel. Rec. (See Ch. 22M2)
Model 222DX15S Tel. Rec. (See Ch. 22C2)
Model 222DX16 Tel. Rec. (See Ch. 22C2)
Model 222DX16B Tel. Rec. (See Ch. 22M2)
Model 222DX17 Tel. Rec. (See Ch. 22C2)
Model 222DX17B Tel. Rec. (See Ch. 22M2)
Models 222DX26, 222DX27 Tel. Rec. (See Ch. 22C2)
Model 222DX27B Tel. Rec. (See Ch. 22M2)
Models 222DX48, 222DX49 Tel. Rec. (See Ch. 22C2)
Models 228DX16, 228DX17 Tel. Rec. (See Ch. 23A1)

ADMIRAL—Cont.

Model 320R17 Tel. Rec. (See Ch. 21J1)
Models 320R25, 320R26 Tel. Rec. (See Ch. 21J1)
Models 321DX15, 321DX16, 321DX17 Tel. Rec. (See Ch. 19E1)
Models 321DX15A, 321DX16A, 321DX17A Tel. Rec. (See Ch. 19E1 or Ch. 19G1)
Models 321DX15L, 321DX16L, 321DX17L Tel. Rec. (See Ch. 19N1)
Model 321DX25B Tel. Rec. (See Ch. 19E1 or Ch. 19G1)
Model 321DX26 Tel. Rec. (See Ch. 19E1)
Model 321DX26B Tel. Rec. (See Ch. 19E1 or Ch. 19G1)
Model 321DX27B Tel. Rec. (See Ch. 19E1 or Ch. 19G1)
Models 321F15, 321F16 Tel. Rec. (See Ch. 21L1 and Ch. 5D2)
Model 321F18 Tel. Rec. (See Ch. 21L1 and Ch. 5D2)
Model 321F27 Tel. Rec. (See Ch. 21L1 and Ch. 5D2)
Models 321F35, 321F36 Tel. Rec. (See Ch. 21L1 and Ch. 5D2)
Models 321F46, 321F47 Tel. Rec. (See Ch. 21L1 and Ch. 5D2)
Model 321F49 Tel. Rec. (See Ch. 21L1 and Ch. 5D2)
Models 321F65, 321F66, 321F67 Tel. Rec. (See Ch. 21W1 and Ch. 5D2)
Models 321K15, 321K16 Tel. Rec. (See Ch. 21L1 and Ch. 3C1)
Model 321K18 Tel. Rec. (See Ch. 21L1 and Ch. 3C1)
Model 321K27 Tel. Rec. (See Ch. 21L1 and Ch. 3C1)
Models 321K35, 321K36 Tel. Rec. (See Ch. 21L1 and Ch. 3C1)
Models 321K46, 321K47 Tel. Rec. (See Ch. 21L1 and Ch. 3C1)
Model 321K49 Tel. Rec. (See Ch. 21L1 and Ch. 3C1)
Models 321K65, 321K66, 321K67 Tel. Rec. (See Ch. 21N1 and 3C1)
Models 321M25, 321M26, 321M27 Tel. Rec. (See Ch. 21Y1)
Models 321M25A, 321M26A, 321M27A Tel. Rec. (See Ch. 22Y1)
Model 322DX16 Tel. Rec. (See Ch. 22E2)
Model 322DX16A Tel. Rec. (See Ch. 22P2)
Models 421M15, 421M16 Tel. Rec. (See Ch. 21Y1)
Models 421M15A, 421M16A Tel. Rec. (See Ch. 22Y1)
Models 421M35, 421M36, 421M37 Tel. Rec. (See Ch. 22Y1)
Models 520M11, 520M12 Tel. Rec. (See Ch. 22A2A)
Models 520M15, 520M16, 520M17 Tel. Rec. (See Ch. 22A2)
Models 521M15, 521M16, 521M17 Tel. Rec. (See Ch. 21Y1)
Models 521M15A, 521M16A, 521M17A Tel. Rec. (See Ch. 22Y1)

AERMOTIVE

181-AD .... 12—1

AERO (See Record Changer Listing)

AIMCEE (See AMC)

AIRADIO

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

AIRCASTLE

C-300 .... 136—3
DM-700 .... 85—1
EV-760 .... 85—1
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
RZU248 (See Model REV248—Set 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
OA-358-VM (See Model 358VM—Set 127-3)
06-F, 06-L .... 135—3
7B .... 52—1
9 .... 50—2
10C, 10T Tel. Rec. (See Model 14C—Set 140-3)
12C, 12T Tel. Rec. (See Model 14C—Set 140-3)
14C, 14T Tel. Rec. .... 140—3
15 .... 67—2
16C, 16T Tel. Rec. (See Model 14C—Set 140-3)
17C, 17T Tel. Rec. .... 140—3
20XUT Tel. Rec. .... 185—3
79A .... 137—3
88, 88W .... 142—2
101 .... 86—1
102B .... 98—2
106B .... 13—3
150, 153 .... 126—2
171, 172 .... 96—1
198 .... 83—1
200 .... 139—3
201 .... 81—1

AIRCASTLE—Cont.

211 .... 65—1
212 .... 68—3
213 .... 63—1
2271, 227W .... 84—1
312 Tel. Rec. (See Model 14C—Set 140-3)
316 Tel. Rec. (See Model 14C—Set 140-3)
350 .... 136—4
358VM .... 127—3
412 Tel. Rec. (See Model 14C—Set 140-3)
416 Tel. Rec. (See Model 14C—Set 140-3)
472.JP24, 472.JP25 (See Model 472.MP25—Set 168-1)
472.MP24 (See Model 472.MP25—Set 168-1)
472.MP25 .... 168—1
472-053VM .... 163—2
472.17XUCM, 472.17XUCM.1 (Ch. 317-B) Tel. Rec. .... 223—2
472.17XUCM.2, 472.17XUCM.3, 472.17XUCM.4, 472.17XUCM.5 (Ch. 317-D) Tel. Rec. .... 223—2
472.17XUCO, 472.17XUCO.1 (Ch. 317-B) Tel. Rec. .... 223—2
472.17XUT, 472.17XUT.1, 472.XUT.2, 472.XUT.3 (Ch. 217B) Tel. Rec. (See Model 20XUT—Set 185-3)
472.17XUT.4, 472.17XUT.5 (Ch. 317-B) Tel. Rec. .... 223—2
472.17XUT.6, 472.17XUT.7, 472.17XUT.8 (Ch. 317-D) Tel. Rec. .... 223—2
472.20XUC (Ch. 220B) Tel. Rec. (See Model 20XUT—Set 185-3)
472.20XUT, 472.20XUT.1, 472.20XUT.2 (Ch. 220B) Tel. Rec. (See Model 20XUT—Set 185-3)
472.21XUCM (Ch. 321-B) Tel. Rec. .... 223—2
472.21XUCO (Ch. 321-B) Tel. Rec. .... 223—2
472.21XUCO.1, 472.21XUCO.2 (Ch. 321-D) Tel. Rec. .... 223—2
472.21XUT, 472.21XUT.1 (Ch. 321-B) Tel. Rec. .... 223—2
472.21XUT.2 (Ch. 321-D) Tel. Rec. .... 223—2
472.217C, 472.217C.1 (Ch. 317-D) Tel. Rec. .... 223—2
472.217T, 472.217T.1 (Ch. 317-D) Tel. Rec. .... 223—2
472.221XC (Ch. 321-D) Tel. Rec. .... 223—2
472.221XT, 472.221XT.1 (Ch. 321-D) Tel. Rec. .... 223—2
472.254 .... 215—2
568 .... 14—1
568.205 .... 141—2
568.205-1 (See Model 200—Set 139-3)
568.305 .... 141—2
572 .... 55—1
594-935 (See Model 935—Set 128-2)
602-182144 .... 114—2
603-PR-8.1 .... 133—2
604 .... 53—2
606-400WB .... 119—2
607.299 .... 177—3
607-314, 607-315 .... 122—2
607.316, -1, 607.317, -1 .. 138—2
610.C351 .... 174—2
610.CL152B, M .... 208—1
610.D200 .... 142—3
610.F100 .... 138—3
610.F151 .... 172—2
610.H400 .... 178—2
610.P-651.1 .... 179—2
610.S500 .... 184—2
621 (Ch. FJ-91) .... 14—2
626 .... 18—3
641 .... 17—1
651 .... 15—1
652.A25, 652.A35 .... 169—2
652.6T1E, V .... 205—2
652.327SA .... 210—3
652.487S .... 211—3
652.505 .... 168—2
659.511, 659.513 .... 167—2
659.520E, I .... 185—4
9151, W .... 129—2
935 .... 128—2
9651, W, 965KI, W (See Model 9511—Set 129-2)
1400C, 1400T Tel. Rec. .... 140—3
1700C, 1700T Tel. Rec. .... 140—3
2000C Tel. Rec. .... 140—3
3170 Tel. Rec. (For TV Ch. See Set 140-3, For Radio Ch. See Model 150—Set 126-2)
4170 Tel. Rec. (For TV Ch. See Set 140-3, For Radio Ch. See Model 350—Set 136-4)
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 (See Model 6541—Set 17-2)
6547 .... 17—2
6611, 6612, 6613, 6630, 6631, 6632, 6634, 6635 .... 15—2
7000, 7001 .... 14—3
7004 .... 19—2
7014, 7015 .... 57—3

AIRCASTLE—Cont.

7015 Early .... 47—2
7553 .... 45—3
90081, 9008W .... 99—2
90091, 9009W .... 97—2
90121, 9012W .... 94—1
10002 .... 54—1
10003-1 .... 46—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
139114 (See Model 139144—Set 59-4)
147114 .... 56—3
149654 .... 71—4
150084 .... 71—4
159144 (See Model 139144—Set 59-4)
Ch. 217B (See Model 472.17XUT)
Ch. 220B (See Model 472.20XUC)
Ch. 317-B (See Model 472.17XUCM)
Ch. 317-D (See Model 472.17-XUCM.2)
Ch. 321-B (See Model 472.21XUT)
Ch. 321-D (See Model 472.21XUT.2)

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-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
A-1000, A-1001 Tel. Rec. .. 58—3
A1001A Tel. Rec. .... 75—2
A1016 Tel. Rec. .... 91—2
A2000, A2001 Tel. Rec. .... 75—2
A2002 Tel. Rec. (See Model A2000—Set 75-2)
A2010 Tel. Rec. .... 75—2
A2012 Tel. Rec. (See Model A1001A—Set 75-2)
12C1 Tel. Rec. (See Model 16C1—Set 121-3)
12T1, 12T2 Tel. Rec. (See Model 16C1—Set 121-3)
14T1 Tel. Rec. (See Model 16C1—Set 121-3)
16C1, 16C2, 16C5 Tel. Rec. .... 121—3
16M1 Tel. Rec. .... 121—3
16T1 Tel. Rec. .... 121—3
16T1B Tel. Rec. (See Model 16C1—Set 121-3)
17C2 (Ch. 700-96) Tel. Rec. .... 151—2
17C5, B (Ch. 700-96) Tel. Rec. .... 151—2
17C7 (Ch. 700-96) Tel. Rec. .... 151—2
17K1 (Ch. 700-96) Tel. Rec. .... 151—2
17K1C (Ch. 700.110, 700.130) Tel. Rec. .... 150—2
17M1 (Ch. 700-96) Tel. Rec. .... 151—2
17T1 (Ch. 700-96) Tel. Rec. .... 151—2
19C1 Tel. Rec. .... 121—3
20C1, 20C2 (Ch. 700-93) Tel. Rec. .... 151—2
20K1 (Ch. 700-95) Tel. Rec. .... 151—2
20M1 (Ch. 700-93) Tel. Rec. .... 151—2
718R Tel. Rec. .... 121—3
800 .... 66—1
2017R Tel. Rec. .... 111—2
4601 (See Model 4609—Set 11-2)
4603 .... 3—26
4604 .... 4—25
4704D (See Model 4604—Set 4-25)
4607, 4608 .... 3—1
4609, 4610 (Early) (See Model 4607—Set 3-1)
4609, 4610 (Late) .... 11—2
4625 .... 13—8
4700 .... 39—1
4704 .... 12—2
4705, 4706 .... 9—1
4708 (See Model 4704—Set 12-2)

AIR KNIGHT (SKY KNIGHT)

CA-500 .... 17—4
CB-500P .... 17—31
N5-RD291 .... 17—3

AIRLINE

05BR-3021B Tel. Rec. .... 150—3
05BR-3021C Tel. Rec. .... *
05BR-3024B Tel. Rec. .... 150—3
05BR-3024C Tel. Rec. .... *
05BR-3027A Tel. Rec. .... 150—3
05BR-3027B Tel. Rec. .... *
05BR-3034A Tel. Rec. .... *
05BR-3041A Tel. Rec. 145-1A
05BR-3044A Tel. Rec. .... *
05GAA-992A .... 125—2
05GCB-1540A, 05GCB-1541A .... 131—2
05GCB-3019A Tel. Rec. .... 116—2
05GCD-3658A .... 151—3
05GHM-934A .... 167—3
05GHM-1061A .... 133—3
05GSE-3020A, B, C Tel. Rec. (Also see PCB 36—Set 166-1) .117—3
05GSE-3037A Tel. Rec. .... 117—3
05GSE-3042A Tel. Rec. (Also see PCB 36—Set 166-1) .... 117—3
05WG-1811B (See Model 94WG-1811A—Set 99-4)

AIRLINE—Cont.

05WG-1813A .... 127—4
05WG-2748C, D, E (See Model 94WG-2748A—Set 90-1)
05WG-2748F .... 139—4
05WG-2749D .... 129—3
05WG-2752 .... 100—3
05WG-3016A, B Tel. Rec. (See Set 100-2 and Model 94WG-3006A—Set 72-4)
05WG-3030A Tel. Rec. .... 119—3
05WG-3030C Tel. Rec. .... 148—2
05WG-3031A Tel. Rec. .... 109—1
05WG-3031B Tel. Rec. .... *
05WG-3032B Tel. Rec. .... *
05WG-3036A, B Tel. Rec. 148—2
05WG-3036C Tel. Rec. .... *
05WG-3038A Tel. Rec. .... 129—4
05WG-3039A, B Tel. Rec. 148—2
05WG-3039C, D Tel. Rec. .. *
05WG-3045A Tel. Rec. .... 129—4
15BR-1536B, 15BR-1537B .146—2
15BR-1543A, B, 15BR-1544A, B .... 145—2
15BR-1547A .... 143—3
15BR-1548A, 15BR-1549A .191—3
15BR-2756B, 15BR-2757A .148—3
15BR-3035A Tel. Rec. .... 155—2
15BR-3048 Tel. Rec. .... *
15BR-3053A, B Tel. Rec. .. 149—2
15BR-3054A Tel. Rec. .... *
15GAA-995A .... 168—3
15GHM-934A .... 167—3
15GHM-935 .... 166—3
15GHM-936A, 15GHM-937A .... 134—2
15GHM-1070A .... 184—3
15GSE-2764A .... 165—4
15GSE-3043A Tel. Rec. .... *
15GSE-3047A, B Tel. Rec. .. *
15GSE-3047C Tel. Rec. .... *
15GSE-3052A Tel. Rec. .... *
15GSL-1564A, B, 15GSL-1565A, B, 15GSL-1566A, B, 15GSL-1567A, B .... 169—3
15WG-1545A, B, 15WG-1546A, B .... 158—2
15WG-2745C .... 130—2
15WG-2749E, F .... 151—4
15WG-2752D, E .... 151—4
15WG-2758A .... 144—2
15WG-2758B (See PCB 65—Set 202-1 and Model 15WG-2758A—Set 144-2)
15WG-2759A (See PCB 65—Set 202-1 and Model 15WG-2758A—Set 144-2)
15WG-2761A (See Model 15WG-2758A—Set 144-2)
15WG-2765A, B (See Model 15WG-2745C—Set 130-2)
15WG-3046A, B, C Tel. Rec. .... 142—4
15WG-3049A, B Tel. Rec. .. 164—2
15WG-3050A, B Tel. Rec. .. 145—3
15WG-3051A, B, C Tel. Rec. .... 142—4
15WG-3059A Tel. Rec. .... 164—2
25BR-1542A .... 203—3
25BR-1548A, 25BR-1549B .191—3
25BR-3055B Tel. Rec. .... *
25BR-3058A, B Tel. Rec. .. 200—1
25BR-3061A Tel. Rec. .... 200—1
25BR-3067A, B Tel. Rec. .. 200—1
25BR-3068A, B Tel. Rec. .. 200—1
25BR-3069A Tel. Rec. .... 200—1
25GAA-935B .... 181—2
25GAA-994B .... 170—3
25GAA-996A .... 182—2
25GDC-994A .... 167—4
25GSE-1555A .... 174—3
25GSE-1555B (See Model 25GSE-1555A—Set 174-3)
25GSE-1556A .... 174—3
25GSE-1556B (See Model 25GSE-1556A—Set 174-3)
25GSE-1557B (See Model 25GSE-1556A—Set 174-3)
25GSE-3057A Tel. Rec. .... *
25GSE-3062A, 25GSE-3063A Tel. Rec. (Also see PCB 72—Set 212-1) .... 195—2
25GSE-3065A Tel. Rec. .... 193—2
25GSE-3081A Tel. Rec. (Also see PCB 72—Set 212-1) .... 195—2
25GSE-3087A (See Model 25GSE-3062A—Set 195-2)
25GSG-2016A .... 225—2
25GSL-1560A, 25GSL-1561A .... 189—2
25GSL-1814A .... 198—1
25GSL-2000A .... 199—1
25WG-1570A, B, C, 25WG-1571A, B, 25WG-1572A, B .... 177—4
25WG-1573A .... 196—2
25WG-2758B (See PCB 65—Set 202-1 and Model 15WG-2758A—Set 144-2)
25WG-2758C, D .... 195—3
25WG-2761B (See Model 15WG-2745C—Set 130-2)
25WG-2765D, E (See Model 15WG-2745C—Set 130-2)
25WG-2766A, B .... 195—3
25WG-3049B Tel. Rec. (See Model 15WG-3049A—Set 164-2)
25WG-3056A Tel. Rec. .... 192—2
25WG-3059A Tel. Rec. (See Model 15WG-3049A—Set 164-2)
25WG-3060A Tel. Rec. .... 212—2
25WG-3066A, B, C Tel. Rec. .... 206—2
25WG-3070A Tel. Rec. .... 212—2
25WG-3071A, B, C, 25WG-3072A, B, C, 25WG-3073A, B, C Tel. Rec. .... 206—2
25WG-3075A, B, C Tel. Rec. .... 206—2
25WG-3077A, B, C Tel. Rec. .... 206—2
25WG-3079A, B, C Tel. Rec. .... 206—2
35BR-3158A Tel. Rec. .... 221—2
35BR-3167A, 35BR-3168A, 35BR-3169A Tel. Rec. .... 221—2
35GAA-3969A .... 227—1
35GSE-1555C (See Model 25GSE-1555A—Set 174-3)

NOTE: PCB denotes Production Change Bulletin

AIRLINE—Cont.

35GSE-1556C (See Model 25GSE-1556A—Set 174-3)
35GSE-3074A Tel. Rec. (See PCB 72—Set 212-1 and Model 25GSE-3063A—Set 195-2)
35GSE-3085A Tel. Rec. (See PCB 72—Set 212-1 and Model 25GSE-3063A—Set 195-2)
35GSE-3087A Tel. Rec. (See PCB 72—Set 212-1 and Model 25GSE-3063A—Set 195-2)
35GSG-2016B .... 225—2
35GSL-3064A, B Tel. Rec.. 218—3
35GSL-3083A, B Tel. Rec.. 218—3
35WG-1570B, C, 35WG-1571B, 35WG-1572B (See Model 25WG-1570A—Set 177-4)
35WG-2761C, D (See Model 15WG-2745C—Set 130-2)
35WG-2765F, G (See Model 15WG-2745C—Set 130-2)
35WG-3171A, B Tel. Rec.. 222—3
35WG-3173A, B Tel. Rec.. 222—3
35WG-3175A Tel. Rec..... 222—3
35WG-3177A Tel. Rec..... 222—3
35WG-3179A Tel. Rec..... 222—3
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—Set 17-5)
64BR-917A .... 10—1
64BR-917B (See Model 64BR-917A—Set 10-1)
64BR-1051A 2-32
64BR-1051B (See Model 64BR-1051A—Set 2-32)
64BR-1205A, 64BR-1206A . 10—3
64BR-1208A .... 16—4
64BR-1503B, 64BR-1504B (See Model 54BR-1503A—Set 3-4)
64BR-1513A, B, 64BR-1514A, B .... 24—4
64BR-1808A .... 16—5
64BR-2200A .... 16—4
64BR-7000A .... 51—2
64BR-7100A, 64BR-7110A, 64BR-7120A .... 57—5
64BR-7300A, 64BR-7310A, 64BR-7320A .... 54—4
64BR-7E10A, 64BR-7820A . 53—3
64WG-1050A .... 10—2
64WG-1050B, C, D (See Model 64WG-1050A—Set 10-2)
64WG-1052A .... 9—2
64WG-1052B (See Model 64WG-1052A—Set 9-2)
64WG-1207B .... 18—5
64WG-1511A, 64WG-1511B, 64WG-1512A, 64WG-1512B 5—5
64WG-1801C 4-33
64WG-1804A, B.......... 4-27
64WG-1804C (See Model 64WG-1804A—Set 4-27)
64WG-1807A, 64WG-1807B 5—4
64WG-1809A, B .... 5—5
64WG-2007A, 64WG-2007B 5—6
64WG-2009A, 64WG-2009B 6—2
64WG-2010B .... 18—6
64WG-2500A (See Model 54WG-2500A—Set 4-15)
64WG-2700A, B (See Model 54WG-2500A—Set 4-15)
74BR-916B .... 17—5
74BR-1513B, 74BR-1514B . 24—4
74BR-1812A (See Model 74BR-1812B—Set 22-2)
74BR1812B .... 22—2
74BR-2001A (See Model 74BR-2001B—Set 23-2)
74BR-2001B .... 23—2
74BR-2701A .... 24—5
74BR-2702A (See Model 74BR-2702B—Set 25-3)
74BR-2702B .... 25—3
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
74KG-925A .... 24—6
74WG-1050C, D (See Model 64WG-1050A—Set 10-2)
74WG-1052B (See Model 64WG-1052A, B—Set 9-2)
74WG-1054A .... 22—1
74WG-1054B (See Model 74WG-1054A—Set 22-1)
74WG-1056A .... 29—1
74WG-1057A .... 32—2
74WG-1207B .... 18—5
74WG-1509A, 74WG-1510A 27—1
74WG-1511B, 74WG-1512B (See Model 64WG-1511A—Set 5-5)
74WG-1802A .... 25—4
74WG-1803A (See Model 74WG-1802A—Set 25-4)
74WG-1804C (See Model 64WG-1804A—Set 4-27)
74WG-1807A, B (See Model 64WG-1807A—Set 5-4)
74WG-2002A .... 26—4
74WG-2004A .... 27—2
74WG-2007B, 74WG-2007C 5—6
74WG-2009B (See Model 64WG-2009A—Set 6-2)
74WG-2010A (See Model 74WG-2010B—Set 18-6)
74WG-2010B .... 18—6
74WG-2500A (See Model 54WG-2500A—Set 4-15)
74WG-2504A .... 28—1
74WG-2504B, C (See Model 74WG-2504A—Set 28-1)
74WG-2505A .... 18—7
74WG-2700A, B (See Model 54WG-2500A—Set 4-15)
74WG-2704A .... 28—1

AIRLINE—Cont.

74WG-2704B, C (See Model 74WG-2704A—Set 28-1)
74WG-2705A, B (See Model 74WG-2505—Set 18-7)
74WG-2709A .... 26—5
74WG-2711A (See Model 74WG-2505A—Set 18-7)
84BR-1815B, 84BR-1816B . 55—3
84GAA-3967A .... 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—Set 67-3)
84HA1529A, 84HA1530A . 85—2
84HA-1810A (See Model 84HA-1810C—Set 69-2)
84HA-1810C .... 69—2
84HA-3002A, 84HA-3002B Tel. Rec. .... 99—3
84HA-3010A, B, C Tel. Rec. (Also see PCB 11—Set 118-1). 94—2
84KR-1520A .... 56—4
84KR-2511A .... 68—4
84WG-1060A .... 42—1
84WG-1060C (See Model 84WG-1060A—Set 42-1)
84WG-2015A .... 38—1
84WG-2506 (See Model 84WG-2721A—Set 46-3)
84WG-2506B .... 58—5
84WG-2712A .... 43—3
84WG-2712B (See Model 84WG-2712A—Set 43-3)
84WG-2714A .... 36—2
84WG-2714F, G, H, J.... 56—5
84WG-2718A, 84WG-2718B, 84-WG-2720A .... 45—5
84WG-2721A, B .... 46—3
84WG-2724A .... 45—5
84WG-2728A (See Model 84WG-2718A—Set 45-5)
84WG-2732A, B (See Model 84WG-2712A—Set 43-3)
84WG-2734A (See Model 84WG-2718A—Set 45-5)
84WG-3006, 84WG-3008, 84WG-3009 Tel. Rec. (See Model 94-WG-3006A—Set 72-4)
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. (See PCB 7—Set 110-1 and Model 94BR-3017A—Set 89-2)
94GAA-3654A .... 95—1
94GCB-1064A .... 96—2
94GCB-3023A, B, C Tel. Rec. .... 116—2
94GHM-934A .... 167—3
94GSE-2735A, 94GSE-2736A 72—3
94GSE-3011, B (See Model 84GSE-3011A—Set 83-1)
94GSE-3015A Tel. Rec.... 107—2
94GSE-3018A Tel. Rec.... 93A—2
94HA-1527C, 94HA-1528C 67—3
94HA1529A, 94HA1530A . 85—2
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 .... 71—5
94WG-2748A, 94WG-2749A 90—1
94WG-2748C (See Model 94WG-2748A—Set 90-1)
94WG-2749A .... 90—1
94WG-3006A Tel. Rec.... 72—4
94WG-3006B Tel. Rec.... 85—3
94WG-3008A, 94WG-3009A Tel. Rec. .... 72—4
94WG-3009B Tel. Rec.... 85—3
94WG-3016A, B, C Tel. Rec. (See Set 110-2 and Model 94WG-9006A—Set 72-4)
94WG-3022 Tel. Rec..... 85—3
94WG-3026A Tel. Rec.... 85—3
94WG-3028A Tel. Rec. (See Model 94WG-3006A—Set 72-4)
94WG-3029A Tel. Rec.... 85—3

ALDENS

114G, 116G, 117G, 120G Tel. Rec. (Similar to Chassis)..... 162—7

ALGENE

AR5U .... 22—3
AR6U .... 22—4

ALLSTATE

6286-4 (Ch. 528.6286-4).. 225—3
6287-4 (Ch. 528.6287-4).. 225—3

ALTEC LANSING

ALC-101 .... 84—2
ALC-205, ALC-206 Tel. Rec. 105—3
A323B .... 66—2
A323C .... 84—2
A-333A .... 165—5
A-433A .... 165—5
303A .... 166—4

AMBASSADOR

AM17C, CB, CIM, PT, TIM Tel. Rec. .... 171—2
AM20C, T Tel. Rec....... 171—2
A17CS, A17TS Tel. Rec. (See Model 20PC—Set 178-3)
A20CS Tel. Rec. (See Model 20PC—Set 178-3)
A21QDCS Tel. Rec. (See Model 20PC—Set 178-3)
A24QDCS Tel. Rec. (See Model 20PC—Set 178-3)
CD2020 Tel. Rec......... 175—2
C1720 Tel. Rec.......... 175—2
C2020 Tel. Rec.......... 175—2
C2050 Tel. Rec. (See Model C1720—Set 175-2)
C2052 Tel. Rec. (See Model T1853—Set 197-3)

AMBASSADOR—Cont.

C2150 Tel. Rec. (See Model C1720—Set 175-2)
C2152, A Tel. Rec. (See Model T1853—Set 197-3)
C2155 Tel. Rec. (See Model T1853—Set 197-3)
C2420 Tel. Rec.......... 175—2
PL17CB, CG, PG, TM Tel. Rec. .... 171—2
T1720 Tel. Rec.......... 175—2
T2020 Tel. Rec.......... 175—2
14MC, MT Tel. Rec....... 162—2
14MT (2nd Prod.), 14MTS Tel. Rec. .... 173—2
16MC, MT, MXC, MXCS, MXT, MXTS Tel. Rec......... 162—2
16MT (2nd Prod.), MTS Tel. Rec. .... 173—2
17MC, MT, MXC, MXCS, MXT, MXTS Tel. Rec. .... 162—2
17MC (2nd Prod.), MCS, MT (2nd Prod.), MTS Tel. Rec.... 173—2
17PC, 17PCS Tel. Rec. (See Model 20PC—Set 178-3)
17PT, 17PTS Tel. Rec. (See Model 20PC—Set 178-3)
20C Tel. Rec.......... 171—2
20MC, MCS, MT, MTS Tel. Rec. .... 173—2
20PC, 20PCS, 20PCS2 Tel. Rec. .... 178—3
20PT, 20PTRS, 20PTS Tel. Rec. (See Model 20PC—Set 178-3)
21CD2A, B Tel. Rec. (See Model 21C2A—Set 191-4)
21C2A, 21C2AL0 Tel. Rec.. 191—4
23P Tel. Rec.......... 171—2
921 Tel. Rec. (See Model 21C2A—Set 191-4)
9120, LO Tel. Rec........ 191—4
9121, LO Tel. Rec. (See Model 21C2A—Set 191-4)
9820, LO, 9821, LO Tel. Rec. .... 191—4

AMC (AIMCEE)

1C23 Tel. Rec. (Similar to Chassis) .... 139—11
1C72 Tel. Rec. (Similar to Chassis) .... 126—8
1T71 Tel. Rec. (Similar to Chassis) .... 126—8
17C, CB Tel. Rec. (Similar to Chassis) .... 126—8
17CG, 17C3 Tel. Rec. (Similar to Chassis) .... 149—13
17T Tel. Rec. (Similar to Chassis) .... 126—8
17TG Tel. Rec. (Similar to Chassis) .... 149—13
17T20 Tel. Rec. (Similar to Chassis) .... 139—11
20CD Tel. Rec. (Similar to Chassis) .... 149—13
20CD2A, -1 Tel. Rec...... 188—3
20C1 Tel. Rec. (Similar to Chassis) .... 149—13
20C2A, -1 Tel. Rec....... 188—3
20C22 Tel. Rec. (Similar to Chassis) .... 139—11
20D, DB Tel. Rec. (Similar to Chassis) .... 139—11
20TG Tel. Rec. (Similar to Chassis) .... 149—13
20T21 Tel. Rec. (Similar to Chassis) .... 139—11
20T2A, -1 Tel. Rec....... 188—3
21CD2A, B Tel. Rec. (See Model 20C2A—Set 188-3)
21C2A Tel. Rec. (See Model 20C2A—Set 188-3)
24T2A, -1 Tel. Rec....... 188—3
114C, 114T Tel. Rec. (Similar to Chassis) .... 111—3
116C, 116CD, 116T Tel. Rec. (Similar to Chassis).......... 111—3
125P 3-27
126 .... 16—1

AMERICAN COMMUNICATIONS (See Liberty)

AMPLIFIER CORP. OF AMERICA

ACA-100DC, ACA-100GE . 63—2

AMPLIPHONE

10 .... 21—1
20 21-12

AMPRO (See Recorder Listing)

ANDREA

BT-VK12 Tel. Rec......... 76—5
BC-VL17 (Ch. VL17) Tel. Rec. (See Model C-VL17—Set 152-1)
BT-VL17 (Ch. VL17) Tel. Rec. (See Model C-VL17—Set 152-1)
CO-U15 .... 27—3
CO-VK15, COVK16 (Ch. VK1516) Tel. Rec. (Also see PCB 8—Set 112-1) .... 103—4
COVK-125 Tel. Rec....... 76—5
COVL-16 (Ch. VL16) Tel. Rec. .... 125—3
CO-VL19 (Ch. VL19) Tel. Rec. .... 168—4
CO-VM21 (Ch. VM21) Tel. Rec. .... 204—3
C-VK19 Tel. Rec. (See PCB 8—Set 112-1 and Model COVK15—Set 103-4)
CVK-126 Tel. Rec......... 76—5
CVL-16 (Ch. VL16) Tel. Rec. .... 125—3
C-VL17 (Ch. VL17) Tel. Rec. .... 152—1
C-VM21 (Ch. VM-21) Tel. Rec. .... 204—3
P-163 (Ch. 163).......... 18—8
T16 .... 21—2
T-U15 .... 24—7
T-U16 .... 21—3
T-VK12 Tel. Rec......... 76—5
TVK-127B, M Tel. Rec..... 76—5
TVL-12 Tel. Rec.......... 123—3
TVL-16 (Ch. VL-16) Tel. Rec. .... 125—3

ANDREA—Cont.

T-VL17 (Ch. VL17) Tel. Rec. .... 152—1
T-VM21 (Ch. VM21) Tel. Rec. .... 204—3
2C-VL17 (Ch. VL17) Tel. Rec. .... 152—1
2C-VL20 (Ch. VL-20) Tel. Rec. .... 175—3
2C-VM21 (Ch. VM21) Tel. Rec. .... 204—3
Ch. VK1516 (See Model CO-VK15)
Ch. VL16 (See Model COVL-16)
Ch. VL17 (See Model C-VL17)
Ch. VL19 (See Model CO-VL19)
Ch. VL20 (See Model 2C-VL20)
Ch. VM21 (See Model C-VM21)

ANSLEY

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

APEX

4B5 .... 37—2
192A .... 17—6
817, 920, 924 Tel. Rec.... 181—3
9120, 9121 Tel. Rec...... 181—3
9820, 9820B, 9821 Tel. Rec. .... 181—3

APPROVED ELECTRONIC INSTRUMENT CORP.

FM Tuner .... 41—2
A-600AC .... 175—4
A710 .... 177—5
A-800 .... 176—2
A-850 .... 175—5

ARC

601 .... 25—5

ARCADIA

37D14-600 .... 9—3

ARIA

554-1-61A .... 7—2

ARLINGTON

30T14A-056 Tel. Rec. (Similar to Chassis) .... 119—3
38T12A-058 Tel. Rec. (Similar to Chassis) .... 109—1
317T3 Tel. Rec. (Similar to Chassis) .... 72—4
318T4 Tel. Rec. (Similar to Chassis) .... 85—3
318T4S Tel. Rec. (Similar to Chassis) .... 85—3
318T4-872 Tel. Rec. (Similar to Chassis) .... 85—3
318T6A Tel. Rec. (Similar to Chassis) .... 85—3
318T6A-950 Tel. Rec. (Similar to Chassis) .... 85—3
318T9A-900 Tel. Rec. (Similar to Chassis) .... 78—4
321MS31C Tel. Rec. (Similar to Chassis) .... 182—5
321MS39A Tel. Rec. (Similar to Chassis) 226-11
518T6A Tel. Rec. (Similar to Chassis) .... 85—3
518T9A-918 Tel. Rec. (Similar to Chassis) .... 78—4
518T10A-916 Tel. Rec. (Similar to Chassis) .... 78—4
2318T6A-954 Tel. Rec. (Similar to Chassis) .... 85—3
2318T9A-912 Tel. Rec. (Similar to Chassis) .... 78—4
2321MS39A Tel. Rec. (Similar to Chassis) 226-11

ARTHUR ANSLEY

LP-2, LP-3 .... 62—4
LP-4A .... 82—2
LP-5 (See Model P-5—Set 108-4)
LP-6, LP6-S .... 136—5
LP-7 .... 134—3
P-5 .... 108—4
R-1 .... 200—2
SP-1 .... 60—4
TP-1 .... 173—3

ARTONE

ARC21 Tel. Rec.......... 205—3
ARC71 Tel. Rec.......... 205—3
ARD21 Tel. Rec.......... 205—3
AR14L, AR17L Tel. Rec.... 172—3
AR21 Tel. Rec.......... 205—3
AR71 Tel. Rec.......... 205—3
AR-23TV-1 Tel. Rec....... 80—1
MST12, MST14 Tel. Rec.... 170—4
14TR, 16TR Tel. Rec...... 170—4
17CD (1st Prod.) Tel. Rec.. 170—4
17CD (2nd Prod.) Tel. Rec.. 172—3
17CRR (1st Prod.) Tel. Rec. 170—4
17CRR (2nd Prod.) Tel. Rec. 172—3
17ROG (1st Prod.) Tel. Rec. 170—4
17ROG (2nd Prod.) Tel. Rec. 172—3
20CD (1st Prod.) Tel. Rec.. 170—4
20CD (2nd Prod.) Tel. Rec.. 172—3
20TR Tel. Rec.......... 170—4
112X Tel. Rec.......... 170—4
203D (1st Prod.) Tel. Rec.. 170—4
203D (2nd Prod.) Tel. Rec.. 172—3
312 Tel. Rec.......... 170—4
524 .... 76—7
819 Tel. Rec.......... 170—4
1000, 1001 Tel. Rec...... 172—3
3163CR Tel. Rec......... 170—4
8163CR, 8193CM Tel. Rec.. 170—4

ARVIN

140P (Ch. RE-209)....... 25—6
150-TC, 151-TC (Ch. RE-228) 25—7
150TC, 151TC (Ch. RE-228-1) Late .... 39—2
152T (Ch. RE-233)....... 33—1
153T (See Model 152T—Set 33-1)
160T, 161T (Ch. RE-232).. 49—5
182TFM (Ch. RE-237)..... 32—3
240-P (Ch. RE-243)...... 42—2
241P (Ch. RE-244, RE-254, RE-255, RE-256, RE-259) ...... 47—3
242T, 243T (Ch. RE-251).. 52—3

ARVIN—Cont.

244P (Ch. RT-244, RE-254, RE-255, RE-256, RE-259) ...... 47—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).... 100—4
350PL (Ch. RE-277-2).... 100—4
351P (Ch. RE-267)....... 69—3
351-PB (Ch. RE-267-1).... 100—4
351-PL (Ch. RE-267-2).... 100—4
352-PL, 353-PL (Ch. RE-267-2) .... 100—4
355T (Ch. RE-213) (See Model 356T—Set 78-2)
356T, 357T (Ch. RE-273).. 78—2
358T (Ch. RE-233) (See Model 152T—Set 33-1)
360TFM, 361TFM (Ch. RE-260) .... 70—2
440T (Ch. RE-278)....... 96—3
441T (Ch. RE-278) (See Model 440T—Set 96-3)
442 (Ch. RE-91)......... 34—2
444, 444A (Ch. RE-200)... 1—3
444AM, 444M (Ch.RE-200M) 23—3
446P (Ch. RE-280)....... 106—2
450T, 451T (Ch. RE-281).. 110—3
460T, 461T (Ch. RE-284).. 107—3
462-CB, 462-CM (Ch. RE-287-1) .... 116—3
480TFM, 481TFM (Ch. RE-277, RE-277-1) .... 107—4
482CFB, 482CFM (Ch. RE-288-1) .... 117—4
540T (Ch. RE-278)....... 143—4
542T (See Model 440T—Set 96-3)
544, 544A (Ch. RE-201)... 1—7
544AR, 544R (Ch. RE-201) (See Model 544—Set 1-7)
547A (Ch. RE-242)....... 42—3
551T (Ch. RE-297)....... 154—2
552AN, 552N (Ch. RE-231) 13—9
555, A (Ch. RE-202)..... 13—9
553 (Ch. RE-308)........ 159—4
554CCB, 554CCM (Ch. RE-306) .... 155—3
558 (Ch. RE-204)........ 3-16
580TFM (Ch. RE-313)..... 152—2
581TFM (Ch. RE333) ..... 227—2
582CFB, 582CFM (Ch. RE-310) .... 156—4
652-P (Ch. RE292) (See Model 650-P—Set 175-6)
654-P (Ch. RE-292) (See Model 650-P—Set 175-6)
650-P (Ch. RE292)....... 175—6
655 SWT (Ch. RE327).... 187—2
657-T (Ch. RE307)....... 168—5
664, 664A (Ch. RE-206)... 3-23
664, 664A (Ch. RE-206-1). 29—2
665 (Ch. RE-229)........ 18-10
740T (Ch. RE-278) (See Model 540T—Set 143-4)
741T (Ch. RE352) .... 225—4
746P, 747P (Ch. RE347)... 225—5
751TB (See Model 551T—Set 154-2)
753T (Ch. RE-348)....... 220—2
758T (Ch. RE-350)....... 221—3
760T (Ch. RE-342)....... 223—3
780TFM (Ch. RE333) ..... 227—2
2120CM (Ch. TE289-2, TE289-3) Tel. Rec. (Also See PCB 20—Set 134-1) .... 120—3
2121TM (Ch. TE289-2, TE-289-3) Tel. Rec. (Also see PCB 20—Set 134-1) .... 120—3
2122TM (Ch. TE-289) Tel. Rec. .... 97A—1
2123TM (Ch. TE-289-2, TE289-3) Tel. Rec. (Also see PCB 20—Set 134-1) .... 120—3
2124CCM (Ch. TE289-2, TE289-3) Tel. Rec. (Also see PCB 20—Set 134-1) .... 120—3
2126CM (Ch. TE289-2, TE-289-3) Tel. Rec. (Also see PCB 20—Set 134-1) .... 120—3
2160, 2161, 2162, 2164 (Ch. TE-290) Tel. Rec....... 126—3
2410P (Ch. RE-244, RE-254, RE-255, RE-256, RE-259)... 47—3
3100TB, 3100TM, 3101CM, 3120-TM, 3121TM (Ch. TE-272-1, TE-272-2) Tel. Rec........ 80—2
3160CM (Ch. TE-276) Tel. Rec. .... 93—2
4080T (Ch. TE282) Tel. Rec. 104—2
4081T Tel. Rec. (See Model 4080T—Set 104-2)
4162CM (Ch. TE-286) Tel. Rec. .... 130—3
5170CB, CM, 5171TM, 5172CB, CM (Ch. TE-302, -1, -2, -3, -4, -5A, -6) Tel. Rec. (Also see PCB 50—Set 184-1) .... 142—5
5175, 5176 (Ch. TE320) Tel. Rec. .... 179—3
5204CM, 5206CM (Ch. TE-300) Tel. Rec. .... 149—3
5210, 5211, 5212 (Ch. TE-315, -1, -2, -3, -4, -5) Tel. Rec. (Also see PCB 37—Set 166-1 and PCB 50—Set 184-1) .... 151—5
5213TM (Ch. TE334) Tel. Rec. .... 191—5
6173TM (Ch. TE-331-3, -4) Tel. Rec. (See PCB 66—Set 203-1 and Model 6175TM—Set 181-4)
6173TM-UHF (Ch. TE-332) Tel. Rec. .... 208—2
6175TM (Ch. TE-331, -1, -2, -3, -4) Tel. Rec. (Also see PCB 66—Set 203-1) .... 181—4
6179TM (Ch. TE-331, -1, -2, -3, -4) Tel. Rec. (Also see PCB 66—Set 203-1) .... 181—4
6213TB (Ch. TE-319, -1, -2) Tel. Rec. (See PCB 67—Set 204-1 and Model 6213TM—Set 195-4)
6213TB-UHF (Ch. TE-330) Tel. Rec. .... 208—2

NOTE: PCB denotes Production Change Bulletin

ARVIN—Cont.

6213TM (Ch. TE-319, -1, -2) Tel. Rec. (Also see PCB 67—Set 204-1) ....195—4
6213TM-UHF (Ch. TE-330) Tel. Rec. ....208—2
6215CB (Ch. TE-319, -1, -2) Tel. Rec. (Also see PCB 67—Set 204-1) ....195—4
6215 CB-UHF (Ch. TE-330) Tel. Rec. ....208—2
6215CM (Ch. TE-319, -1, -2) Tel. Rec. (Also see PCB 67—Set 204-1) ....195—4
6215CM-UHF (Ch. TE-330) Tel. Rec. ....208—2
6640 (Ch. RE-206-2) ....29—2
7210CB-UHF, 7210CM-UHF (Ch. TE-341, -2) Tel. Rec. (Also see PCB 63—Set 197-1) ....188—4
7210CM, CR (Ch. TE-337-1) Tel. Rec. ....189—3
7212CFP, MEA (Ch. TE-337, -1) Tel. Rec. (See Model 7210CM—Set 189-3)
7212CFP-UHF, 7212MEA-UHF (Ch. 341, -2) Tel. Rec. (Also see PCB 63—Set 197-1) ....188—4
7214CM (Ch. TE-337-1) Tel. Rec. ....189—3
7214CM-UHF (Ch. TE-341, -2) Tel. Rec. (Also see PCB 63—Set 197-1) ....188—4
7216CB (Ch. TE-337-1) Tel. Rec. (See Model 7210CM—Set 189-3)
7216CB-UHF (Ch. TE-341, -2) Tel. Rec. (Also see PCB 63—Set 197-1) ....188—4
7218CB, CM (Ch. TE-337-1) Tel. Rec. ....189—3
7218CB-UHF, 7218CM-UHF (Ch. TE-341, -2) Tel. Rec. (Also see PCB 73—Set 197-1) ....188—4
7219CM (Ch. TE-337-1) Tel. Rec. (See Model 7210CM—Set 189-3)
7219CM-UHF (Ch. TE-341-2) Tel. Rec. (Also see PCB 63—Set 197-1) ....188—4
8211TB, TM (Ch. TE-319-3) Tel. Rec. (See PCB 67—Set 204-1 and Model 6213TM—Set 195-4)
8218CB, CM (Ch. TE-319-3) Tel. Rec. (See PCB 67—Set 204-1 and Model 6213TM—Set 195-4)
Ch. RE-91 (See Model 442)
Ch. RE-200 (See Model 444)
Ch. RE-200M (See Model 444M)
Ch. RE-201 (See Model 544)
Ch. RE-202 (See Model 555)
Ch. RE-204 (See Model 558)
Ch. RE-206 (See Model 664)
Ch. RE-206-1, 206-2 (See Model 664 Late)
Ch. RE-209 (See Model 140P)
Ch. RE-228 (See Model 150TC)
Ch. RE-228-1 (See Model 150TC Late)
Ch. RE-229 (See Model 665)
Ch. RE-231 (See Model 552AN)
Ch. RE-232 (See Model 160T)
Ch. RE-233 (See Model 152T)
Ch. RE-237 (See Model 182TFM)
Ch. RE-242 (See Model 547A)
Ch. RE-243 (See Model 240P)
Ch. RE-244 (See Model 241P)
Ch. RE-248 (See Model 250P)
Ch. RE-251 (See Model 242T)
Ch. RE-252 (See Model 253T)
Ch. RE-253 (See Model 280TFM)
Ch. RE-254, 255, 256, 259 (See Model 241P)
Ch. RE-260 (See Model 360TFM)
Ch. RE-265 (See Model 264T)
Ch. RE-267 (See Model 350P)
Ch. RE-267-1, RE-267-2 (See Model 350-PB)
Ch. RE-273 (See Model 356T)
Ch. RE-274 (See Model 341T)
Ch. RE-277, RE-277-1 (See Model 480TFM)
Ch. RE-278 (See Model 540T)
Ch. RE-280 (See Model 446P)
Ch. RE-281 (See Model 450T)
Ch. RE-284 (See Model 460T)
Ch. RE-287-1 (See Model 462-CB)
Ch. RE-288-1 (See Model 482CFB)
Ch. RE-292 (See Model 650-P)
Ch. RE-297 (See Model 551T)
Ch. RE-306 (See Model 554CCB)
Ch. RE-307 (See Model 657T)
Ch. RE-308 (See Model 553)
Ch. RE-310 (See Model 582CFB)
Ch. RE-313 (See Model 580TFM)
Ch. RE-327 (See Model 655SWT)
Ch. RE-333 (See Model 581TFM)
Ch. RE-342 (See Model 760T)
Ch. RE-347 (See Model 746P)
Ch. RE-348 (See Model 753T)
Ch. RE-350 (See Model 758T)
Ch. RE352 (See Model 741T)
Ch. TE-272-1, -2 (See Model 3100TB)
Ch. TE-276 (See Model 3160CM)
Ch. TE282 (See Model 4080T)
Ch. TE-286 (See Model 4162CM)
Ch. TE-289 (See Model 2122TM)
Ch. TE-289-2, TE-289-3 (See Model 2120CM)
Ch. TE-290 (See Model 2160)
Ch. TE-300 (See Model 5204)
Ch. TE-302, -1, -2, -3, -4, -5, -5A, -6 (See Model 5170CB)
Ch. TE-315, -1, -2, -3, -4, -5, -5A, -6 (See Model 5210)
Ch. TE-319, -1, -2 (See Model 6213TM)
Ch. TE-319-3 (See Model 8211TB)
Ch. TE-320 (See Models 5175, 5176)
Ch. TE-330 (See Model 6213TB-UHF)
Ch. TE-331, -1, -2, -3, -4 (See Model 6175TM)
Ch. TE-332 (See Model 6173 TM-UHF)
Ch. TE-334 (See Model 5213TM)
Ch. TE-337-1 (See Model 7210CM)
Ch. TE-341, -2 (See Model 7210CB-UHF)

ASTATIC

CB-1 Tel. UHF Conv.-Booster 224—3

ASTORIA

A-21, A-72, A-73L Tel. Rec. (Similar to Chassis) ....182—3

ASTRASONIC (Also see Pentron)

T-3 ....121—4
748 ....53—6

ATLAS

AB-45 ....14—5

AUDAR

AV-7T ....166—6
MAS-4 "Bingo Amp." ....26—6
P-1A ....5—10
P-4A ....19—3
P-5 ....5—11
P-7 ....44—3
PR-6 ....13—10
PR-6A ....19—4
RE-8A ....25—8
Telvar BM-25, BMP-25 ....62—5
Telvar FMC-12 ....35—2
Telvar RER-9 ....65—2
WC-7T ....166—6

AUDIO DEVELOPMENT (ADC)

71-F ....128—3

AUTOMATIC

Tom Boy ....27—4
Tom Thumb Buddy ....53—7
Tom Thumb Camera-Radio ....49—6
Tom Thumb Jr. ....26—7
Tom Thumb Personal ATTP ....23—4
B-44 ....60—5
C51 ....178—4
C-54 ....186—2
C60 ....5—20
C-60X ....24—10
C 65X (See Model C-60X—Set 24-10)
C300 ....102—1
C-351 ....148—4
CL-152B, M ....192—3
CL-164B ....192—3
D200 ....104—3
D-251 ....174—4
F-100 ....103—6
F-151 ....147—2
F-790 ....23—5
M-86 ....34—3
M-90 ....67—4
P-651 ....173—4
PM-236 ....226—2
S-551 ....146—3
TV-P490 Tel. Rec. ....81—3
TV-707, TV-709, TV-710 Tel. Rec. ....60—6
TV-712 Tel. Rec. (See Model TV-707—Set 60-6)
TV-1205 Tel. Rec. (See PCB 5—Set 106-1 and Model TV-1249—Set 103-5)
TV-1249, TV-1250 Tel. Rec. 103—5
TV-1294 Tel. Rec. (See PCB 5—Set 106-1 and Model TV-1249—Set 103-5)
TV-1605 Tel. Rec. (See Model TV-1249—Set 103-5)
TV-1615 Tel. Rec. (See Model TV-1249—Set 103-5)
TV-1649, TV-1650, TV-1651 Tel. Rec. ....143—5
TV-1694 Tel. Rec. (See Model TV-1249—Set 103-5)
TV-5006 Tel. Rec. ....145—4
TV-5020 Tel. Rec. ....134—4
TV-5061 Tel. Rec. ....145—4
TV-5077 Tel. Rec. ....145—4
TV-5116R Tel. Rec. ....134—4
TV-5160 Tel. Rec. ....134—4
TVX313 Tel. Rec. (See Model TV-707—Set 60-6)
TVX404 Tel. Rec. (See Model TV-707—Set 60-6)
601, 602 (Series A) ....13—11
601, 602 (Series B) ....22—5
612X ....1—34
613X (See Model 612X—Set 1-34)
614X, 616X ....8—2
620 ....12—3
640, Series B ....10—4
660, 662, 666 ....22—6
677 ....22—7
720 ....21—4

AVIOLA (Also see Record Changer Listing)

509 ....7—3
601 ....15—3
608 ....16—6
612 ....15—3
618 ....16—6

BELL-AIR

PL17C Tel. Rec. (Similar to Chassis) ....149—13
PL20C Tel. Rec. (Similar to Chassis) ....149—13

BELL SOUND SYSTEMS

B-23 ....75—4
PA3710A-P3 (Above Serial No. 78000) ....225—6
RC-47 (RE-CORD-O-FONE) ....30—3
RT-65 ....130—4
RT-65, B ....171—3
350 ....148—5
352 ....149—4
374SS ....151—6
420 ....150—4
440L, 440S "Belfone" ....25—9
2075 ....10—5
2122 ....77—3
2122A, 2122AR ....153—1
2122B ....199—1
2122R ....76—7
2145, A ....161—2
2200 ....207—1
3706-M ....227—3
3710A (Above Serial No. 78000) ....225—6
3715 ....22—8
3723-MB, -MB3 ....224—4

BELL SOUND SYSTEMS—Cont.

3725 ....22—9
3728M ....24—11
3750 ....31—5

BELLTONE

500 ....5—33

BELMONT (Also see Raytheon)

A-6D110 ....17—7
3AW7 ....10—7
4B17 ....2—27
4B112, 4B113 (Series A) ....10—6
5D110 ....22—10
5D128 (Series A) ....9—4
5P19 (Series A) ....9—5
5P113 "Boulevard" ....28—2
6D111 ....2—33
6D120 ....24—12
8A59 ....6—4
21A21 Tel. Rec. ....93A—4
22A21, 22AX21, 22AX22 Tel. Rec. ....55—5

BENDIX

C172 Tel. Rec. ....134—5
C174 Tel. Rec. (See Model 2051—Set 111-3)
C176, B Tel. Rec. (See Model 2051—Set 111-3)
C182 Tel. Rec. (See Model C172—Set 134-5)
C192 Tel. Rec. (See Model C172—Set 134-5)
C200 Tel. Rec. ....134—5
FB21C Tel. Rec. (See Model FB21CU—Set 213-2)
FB21CU Tel. Rec. ....213—2
FM21C Tel. Rec. (See Model FB21-CU—Set 213-2)
FM21CU Tel. Rec. ....213—2
FM27C (Ch. T14-3) Tel. Rec. ....215—3
HB21C Tel. Rec. (See Model FB21-CU—Set 213-2)
HB21CU Tel. Rec. ....213—2
HB27C (Ch. T14-3) Tel. Rec. 215—3
HM21C Tel. Rec. (See Model FB21-CU—Set 213-2)
HM21CU Tel. Rec. ....213—2
KB21CU Tel. Rec. ....213—2
KM17C Tel. Rec. (See Model OAK3—Set 183-2)
KM21CU Tel. Rec. ....213—2
OAK3 Tel. Rec. ....183—2
PAR 80 ....39—3
TB21CU Tel. Rec. ....213—2
TB24DS, DU (Ch. T14-10, -11) Tel. Rec. ....215—3
TM17C Tel. Rec. (See Model OAK3—Set 183-2)
TM21CU Tel. Rec. ....213—2
TM24DS, DU (Ch. T14-10, -11) Tel. Rec. ....215—3
T170 Tel. Rec. (See Model 2051—Set 111-3)
T171 Tel. Rec. (See Model C172—Set 134-5)
T173 Tel. Rec. (See Model 2051—Set 111-3)
T190 Tel. Rec. (See Model 2051—Set 111-3)
0526A, 0526B, 0526C, 0526D, 0526E, 0526F ....1—22
17K2 Tel. Rec. (See Model C172—Set 134-5)
20K2, 20L2 Tel. Rec. (See Model C172—Set 134-5)
21KD Tel. Rec. ....183—2
21K3 Tel. Rec. ....183—2
21T3 Tel. Rec. ....183—2
21X3 Tel. Rec. ....183—2
55L2, 55L3, 55P2, 55P3 ....51—4
55X4 ....58—6
65P4 ....52—4
69B8, 69M8, 69M9 ....63—3
75B5, 75M5, 75M8, 75P6, 75W5 ....59—5
79M7 ....66—3
95B3, 95M3, 95M9 ....60—7
110, 110W, 111, 111W, 112, 114, 115 ....41—3
235B1, 235M1 (Ch. Codes MA, MB, MC, MD) Tel. Rec. ....69—4
300, 300W, 301, 302 ....40—2
416A ....43—5
526MA, 526MB, 526MC ....29—3
613 ....40—3
626-A (0626A) ....12—4
636A, B, C ....15—4
636D (See Model 636A—Set 15-4)
646A ....2—28
656A ....2—31
676B, 676C, 676D ....5—23
687A ....61—3
697A ....26—8
736B ....10—8
753F, M, W (Ch. C-19) ....199—3
847-B ....27—5
847-S "Facto-Meter" ....28—3
951, 951W ....136—6
1217, 1217B, 1217D ....29—4
1217D (Late) ....46—5
1518, 1519, 1524, 1525 ....37—3
1521 ....42—4
1524, 1525 ....37—3
1531, 1533 ....43—6
2001, 2002 Tel. Rec. ....84—4
2020, 2021 Tel. Rec. ....84—4
2025 Tel. Rec. ....99—5
2051 Tel. Rec. (Also see PCB 16—Set 126-1) ....111—3
2060 Tel. Rec. (Also see PCB 16—Set 126-1) ....111—3
2070, 2071 Tel. Rec. (See PCB 16—Set 126-1 and Model 2051—Set 111-3)
3001, 3002 Tel. Rec. ....84—4
3030, 3031 Tel. Rec. ....84—4
3033 Tel. Rec. ....99—5
3051 Tel. Rec. (Also see PCB 16—Set 126-1) ....111—3
6001 Tel. Rec. (Also see PCB 16—Set 126-1) ....111—3
6002 Tel. Rec. ....99—5
6003 Tel. Rec. (Also see PCB 16—Set 126-1) ....111—3
6090 Tel. Rec. ....111—3

BENDIX—Cont.

6100 Tel. Rec. (Also see PCB 16—Set 126-1) ....111—3
6920 Tel. Rec. ....111—3
6990 Tel. Rec. ....111—3
7001 Tel. Rec. (See PCB 16—Set 126-1 and Model 2051—Set 111-3)
Ch. C-19 (See Model 753F)
Ch. T14-3 (See Model FM27C)
Ch. T14-10, T14-11 (See Model TB24DS)

BOGEN (See David Bogen)

BREWSTER

9-1084, 9-1085, 9-1086 ....2—13

BROCINER

A100P ....198—2
CA-2 ....200—3

BROOK ELECTRONICS INC.

7 ....227—4
3B (Issue 2), 3C ....184—4
10C ....41—4
10C2-A ....43—7
10C3 ....72—5
10D ....41—4
12A ....89—3
12A2, 12A3 (See Model 12A—Set 89-3 and Model 3C—Set 184-4)

BROOKS LABORATORIES, INC.

ST-14A ....183—3
ST-10 ....195—5

BROWNING

PF-12, RJ12 ....47—4
RJ-12A ....56—6
RJ-12B ....146—4
RJ-14A ....56—6
RJ-20 ....67—5
RJ-20A ....132—3
RJ-22 ....67—5
RV-10 ....46—6
RV-10A ....131—3
RV-11 ....46—6
RV31 ....198—3

BRUNSWICK

BJ-6836 "Tuscany" ....28—4
C-3300 "Darby" ....28—4
D-1000, D-1100 ....56—7
D-6876 "Buckingham" ....29—5
T-4000, T-4000½ "Buckingham" ....29—5
T-4400, T-4400½ ....61—4
T-6000, S, SS, SX, T-6000½ "Glascow" (See Model T-4000—Set 29-5)
T-9000 ....56—7
512, 513 Tel. Rec. ....163—3
812, 816 Tel. Rec. ....163—3
5000 ....42—5
5125 Tel. Rec. ....163—3
6165 Tel. Rec. ....163—3
8125, 8165 Tel. Rec. ....163—3

BRUSH SOUND MIRROR (See Recorder Listing)

BRUSH MAIL-A-VOICE (See Recorder Listing)

BUICK

980690, 980733 ....18—9
980744, 980745 ....19—5
980782 ....62—6
980797, 980798 ....59—6
980868 ....104—4
980979 (See Model 980868—Set 104-4)
981111 (See Model 98068—Set 104-4)
981320 ....217—2
981321 ....224—5
981323 ....225—7

BUTLER BROS. (See Air Knight or Sky Rover)

CADILLAC (Auto Radio)

7253207 ....*
7256609 ....60—8
7258155 ....*
7258755 ....109—2
7260205 (See Model 7258755—Set 109-2)
7260405 ....152—3
7260905 ....152—3

CALLMASTER (See Lyman)

CAPEHART

B-504-P16 Tel. Rec. (For TV Ch. See Model 461P—Set 87-2, For Radio Ch. See Model 35P7—Set 135-4)
RP-152 ....215—4
TC-20 (Ch. C-297) ....132—4
TC-62 (Ch. CR-71) ....192—4
TC-100 (Ch. C-297) ....203—5
TC-101 (Ch. CR-36) ....203—5
T-30 ....141—3
T-522 (Ch. CR-76) ....209—1
1T17MX (Ch. CT27) Tel. Rec. (See Ch. CT-27—Set 160-2)
1T172M (Ch. CT-52) Tel. Rec. ....187—3
2C172M (Ch. CT-52) Tel. Rec. ....187—3
2T20MC (Ch. CT-38) Tel. Rec. (See Ch. CT-38—Set 160-2)
3C17MX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
3C212B, M (Ch. CT-57) Tel. Rec. ....187—3
4H212B, M (Ch. CT-57) Tel. Rec. ....187—3
5F212M (Ch. CT-57) Tel. Rec. ....187—3
6F212B (Ch. CT-57) Tel. Rec. ....187—3
7F212M (Ch. CT-57) Tel. Rec. ....187—3
8F212B (Ch. CT-57) Tel. Rec. ....187—3
9F212M (Ch. CT-57) Tel. Rec. ....187—3
10 (Ch. C-312) ....166—7

CAPEHART—Cont.

10W212M (Ch. CTR68) Tel. Rec. (For TV Ch. only see Model 1T172M—Set 187-3)
11W211M (Ch. CT58/C305) Tel. Rec. (For TV Ch. only see Model 1T172M—Set 187-3)
12F272M (Ch. CT-74) Tel. Rec. ....212—3
19N4, 21P4, 24N4, 24P4, 26N4, 29P4, 30P4, 31N4, 31P4 65—3
32P9, 33P9 ....64—3
34P10 (See Model 32P9—Set 64-3)
35P7 (Ch. P7) ....135—4
114N4 ....65—3
115P2 ....67—6
116N4, 116P4, 118P4 ....65—3
319BX, MX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
320B, M (Ch. CX-33L) Tel. Rec. (See Model 323M—Set 112-3, PCB 13—Set 122-1 and PCB 24—Set 142-1)
320BX, MX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
321ABX, AMX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
321-B, -M, 322-B, -M (Ch. CX33) Tel. Rec. (See Model 323M—Set 112-3, PCB 13—Set 122-1 and PCB 24—Set 142-1)
322RABX, RAMX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
323M (Ch. CX-33F) Tel. Rec. (Also see PCB 13—Set 122-1 and PCB 24—Set 142-1) ....112—3
324BX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
324M (Ch. CX33) Tel. Rec. (Also see PCB 13—Set 122-1 and PCB 24—Set 142-1) ....112—3
325AFX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
325F (Ch. CX-33) Tel. Rec. (Also see PCB 13—Set 122-1 and PCB 24—Set 142-1) ....112—3
325M (Ch. CX-33) Tel. Rec. (See Model 325F—Set 112-3)
326-M (Ch. CX33L) Tel. Rec. (See Model 323M—Set 112-3, PCB 13—Set 122-1 and PCB 24—Set 142-1)
326MX (Ch. CT-27) Tel. Rec. (See Ch. CT-27—Set 160-2)
331BX, MX (Ch. CT-38) Tel. Rec. (See Ch. CT-38—Set 160-2)
332-B, -M, 334-M (Ch. CX-33F) Tel. Rec. (See Model 323M—Set 112-3, PCB 13—Set 122-1 and PCB 24—Set 142-1)
335BX, MX, 336CX, FX (Ch. CT-38) Tel. Rec. (See Ch. CT-38—Set 160-2)
338MX (Ch. CT-45) Tel. Rec. (See Ch. CT-45—Set 160-2)
339MX (Ch. CT-38) Tel. Rec. (See Ch. CT-38—Set 160-2)
340X, 341X (Ch. CT-45) Tel. Rec. (See Ch. CT-45—Set 160-2)
413P, 414P ....67—6
461P, 462P12 Tel. Rec. ....87—2
501P, 502P, 504P Tel. Rec. (For TV Ch. see Model 461P—Set 87-2, for Radio Ch. see Model 35P7—Set 135-4)
610P, 651P, 661P Tel. Rec. 95A—1
1002F, 1003M, 1004B (Ch. P-8) ....135—4
1005B, M, W (Ch. C-296) ....132—5
1006B, M, W (Ch. C-2870) ....132—5
1007AM (Ch. C-318) ....150—5
3001, 3002 (Ch. CX-30, A, Prod. C-272) Tel. Rec. ....99A—1
3001, 3002 (Ch. CX-30A-2, Prod. C-272) Tel. Rec. ....99A—2
3004-M (Ch. CX-31, Prod. C-268) Tel. Rec. (See Ch. CX-31—Set 93A-5)
3005 (Ch. CX-32, Prod. C-279) Tel. Rec. (See Ch. CX-32—Set 93A-5)
3006-M (Ch. CX-31, Prod. C-274) Tel. Rec. (See Ch. CX-31—Set 93A-5)
3007 (Ch. CX-30, Prod. C-276) ....99A—2
3008 (Ch. CX-32, Prod. C-278) Tel. Rec. (See Ch. CX-32—Set 93A-5)
3011B, M, 3012B, M (Ch. CX-33) Tel. Rec. ....112—3
4001-M (Ch. CX-31, Prod. C-274) Tel. Rec. (See Ch. CX-31—Set 93A-5)
4002-M (Ch. CX-31, Prod. C-268) Tel. Rec. (See Ch. CX-31—Set 93A-5)
Ch. C-297 (See Model TC-100)
Ch. C-312 (See Model 10)
Ch. C-318 (See Model 1007AM)
Ch. CR-36 (See Model TC-101)
Ch. CR71 (See Model TC-62)
Ch. CR-76 (See Model T-522)
Ch. CT-27 (Ch. Series CX-33DX) Tel. Rec. ....160—2
Ch. CT-38 (Ch. Series CX-33DX) Tel. Rec. ....160—2
Ch. CT-45 (Ch. Series CX-33DX) Tel. Rec. ....160—2
Ch. CT-52 (Ch. Series CX-36) (See Model 1T172M)
Ch. CT-57 (Ch. Series CX-36) (See Model 1T172M)
Ch. CT-74 (See Model 12F272M)
Ch. CT-75 (Ch. Series CX-37) Tel. Rec. ....203—4
Ch. CT-77 (Ch. Series CX-37) Tel. Rec. ....203—4
Ch. CT-81 (Ch. Series CX-37) Tel. Rec. ....203—4
Ch. Series CX-30, A (See Model 3001)
Ch. Series CX-30-A-2 (See Model 3001)
Ch. Series CX-31 (See Model 3004-M)
Ch. Series CX-32 (See Model 3005)
Ch. Series CX-33 (See Model 325F)
Ch. Series CX-33F (See Model 323M)

NOTE: PCB denotes Production Change Bulletin

CAPEHART—Cont.
Ch. Series CX-33L (See Model 326-M)
Ch. Series CX-33DX (See Ch. CT-27)
Ch. Series CX-36 (See Model 1T17-M)
Ch. Series CX-37 (See Ch. CT-75)

CAPITOL
D-17 .... 30—4
T-13 .... 28—5
U-24 .... 29—6

CARDWELL, ALLEN D.
CE-26 .... 14—6

CAVENDISH (See Bell Air)

CBS COLUMBIA (Also see Air King)
17C18 (Ch. 817, -1) Tel. Rec. .... 188—5
17C18 Ch. 817-2) Tel. Rec. (See Model 18C18—Set 214-2)
17M06 Ch. 750-3) Tel. Rec. (See Model 18C18—Set 214-2)
17M18 (Ch. 817, -1) Tel. Rec. .... 188—5
17M18 Ch. 817-2) Tel. Rec. (See Model 18C18—Set 214-2)
17T18 (Ch. 817, -1) Tel. Rec. .... 188—5
17T18 (Ch. 817-2) Tel. Rec. (See Model 18C18—Set 214-2)
18C18 (Ch. 817-6) Tel. Rec. .... 214—2
18L18 (Ch. 817-2) Tel. Rec. (See Model 18C18—Set 214-2)
18L18 (Ch. 817-6) Tel. Rec. 214—2
18M08 (Ch. 817-2) Tel. Rec. (See Model 18C18—Set 214-2)
18M08 (Ch. 817-6) Tel. Rec. .... 214—2
18M18 (Ch. 817-6) Tel. Rec. .... 214—2
18M28, 18M38 (Ch. 817-6) Tel. Rec. (See Model 18C18—Set 214-2)
18T18 (Ch. 817-6) Tel. Rec. .... 214—2
18T28 (Ch. 817-6) Tel. Rec. (See Model 18C18—Set 214-2)
20M18 (Ch. 820, -1) Tel. Rec. .... 188—5
20M18 (Ch. 820-2) Tel. Rec. (See Model 18C18—Set 214-2)
20M28 (Ch. 820, -1) Tel. Rec. .... 188—5
20M28 (Ch. 820-2) Tel. Rec. (See Model 18C18—Set 214-2)
20T18 (Ch. 820, -1) Tel. Rec. .... 188—5
20T18 (Ch. 820-2) Tel. Rec. (See Model 18C18—Set 214-2)
21C11, B (Ch. 1021) Tel. Rec. .... 199—4
21C18 Ch. 821) (See Model 17C18—Set 188-5)
21C21 (Ch. 1021) Tel. Rec. 199—4
21C31B (Ch. 1021) Tel. Rec. .... 199—4
21C41 (Ch. 1021) Tel. Rec. 199—4
21T11 (Ch. 1021) Tel. Rec. 199—4
22C06 Ch. 751-3) Tel. Rec. (See Model 18C18—Set 214-2)
22C08 Ch. 821-6, -6A) Tel. Rec. .... 214—2
22C11, B (Ch. 1021) Tel. Rec. (See Model 21C11—Set 199-4)
22C18 Ch. 821-6, -6A) Tel. Rec. .... 214—2
22C21 (Ch. 1021) Tel. Rec. (See Model 21C11—Set 199-4)
22C28 Ch. 821-6, -6A) Tel. Rec. .... 214—2
22C31B (Ch. 1021) Tel. Rec. (See Model 21C11—Set 199-4)
22C38 Ch. 751-3) Tel. Rec. (See Model 18C18—Set 214-2)
22C38 (Ch. 821-3) Tel. Rec. (See Model 18C18—Set 214-2)
22C41 (Ch. 1021) Tel. Rec. (See Model 21C11—Set 199-4)
22C48, B, 22C58, 22C68, B, 22C78, E (Ch. 821-4) Tel. Rec. (See Model 18C18—Set 214-2)
22K38 Ch. 821-20 and Radio Ch. 2A1) Tel. Rec. .... 225—8
22L18 Ch. 821-6, -6A) Tel. Rec. .... 214—2
22M08, 22M18 (Ch. 821-6, -6A) Tel. Rec. .... 214—2
22M28, 22M38 (Ch. 821-4) Tel. Rec. (See Model 18C18—Set 214-2)
22T11 (Ch. 1021) Tel. Rec. (See Model 21C11—Set 199-4)
22T18 Ch. 821-6, -6A) Tel. Rec. .... 214—2
22T28, B (Ch. 821-4) Tel. Rec. (See Model 18C18—Set 214-2)
515A, 516A, 517A .... 223—4
525, 526 .... 222—4
540, 541 .... 211—4
545, 546 (See Model 540—Set 211-4)
2001 Tel. UHF Conv. .... 207—2
Ch. 2A1 (See Model 22K38)
Ch. 750-3 (See Model 17M06)
Ch. 751-3 (See Model 22C06)
Ch. 817, -1 (See Model 17C18)
Ch. 817-2 (See Model 17C18)
Ch. 817-6 (See Model 18C18)
Ch. 820, 820-1 (See Model 20M18)
Ch. 820-2 (See Model 20M18)
Ch. 821 (See Model 21C18)
Ch. 821-3 (See Model 22C38)
Ch. 821-4 (See Model 22C48)
Ch. 821-6, -6A (See Model 22C08)
Ch. 821-20 (See Model 22K38)
Ch. 1021 (See Model 21C11)

CENTURY (Also see Industrial Television)
226, 326 (Ch. IT-26R, IT-35R, IT-39R, IT-46R) Tel. Rec. .... 99A—7
721, 821, 921, 1021 (Ch. IT-21R) Tel. Rec. .... 97A—8

CENTURY (20th)
100X, 101, 104 .... 12—5
200 .... 21—5
300 .... 21—6

CHALLENGER
CC8 .... 63—4
CC18 .... 67—7
CC30 .... 68—6
CC60 .... 70—3
CC618 .... 66—4
CD6 .... 65—4
20R .... 69—5
60R .... 62—7
200 .... 69—5
600 .... 62—7

CHANCELLOR (Also see Radionic)
35P .... 30—25

CHEVROLET
985792 .... 6—5
985793 .... 19—6
985986 .... *
986067 .... 90—2
986146 .... 28—6
986240 .... 75—5
986241 .... 58—7
986388 .... 104—5
987443 .... 189—4
986515 .... 149—5
986516 .... 150—6
986668 .... 219—2
986669 .... 224—6

CHRYSLER (See Mopar)

CISCO
1A5 .... 37—4
9A5 .... 20—3

CLARION
C100 .... 1—5
C101 .... 5—9
C102 .... 9—6
C103 .... 6—6
C104 .... 1—4
C105 (See Model C-104—Set 1-4)
C105A .... 6—7
C108 (Ch. 101) .... 5—8
11011 .... 17—8
11305 .... 18—11
11411-N .... 30—5
11801 .... 23—6
11802V-M (See Model 11801—Set 23-6)
12110M .... 54—5
12310-W .... 31—6
12708 .... 41—5
12801 .... 61—5
13101 .... 46—7
13201, 13203 .... 62—8
14601 .... 60—9
14965 .... 66—5
16703 Tel. Rec. .... 102—2

CLARK
PA-10 .... 12—6
PA-10A .... 18—12
PA-20 .... 13—12
PA-20A .... 18—13
PA-30 .... 19—7

CLEARSONIC (See U. S. Television)

COLLINS AUDIO PRODUCTS
FMA-6 .... 99—6
45-D .... 72—6

COLLINS RADIO
75A-1 .... 34—4
75A-2 .... 121—4

COLUMBIA RECORDS
202 .... 219—3
360 Series "B" .... 215—5

COMMANDER INDUSTRIES
Commander 3 Tube Record Player .... 17—10
CD61P .... 19—9

CONCERTONE (See Recorder Listing)

CONCORD
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
IN563 (Similar to Chassis). 136—10
IN819 (Similar to Chassis). 69—7
6C51B .... 19—8
6C51W .... 19—8
6E51B .... 20—4
6F26W .... 19—10
6R3ARC .... 21—7
6T61W .... 22—11
7G26C .... 20—5
7R3APW .... 21—7
1-402, 1-403 .... 45—6
1-411 .... 48—5
1-501 (See Model 6E51B—Set 20-4)
1-504 .... 55—6
1-509, 1-510 (See Model 6C51B—Set 19-8)
1-516, 1-517 .... 49—7
1-601, 1-602, 1-603 (See Model 7G26C—Set 20-5)
1-606 .... 45—7
1-608 (See Model 6F26W—Set 19-10)
1-609 (See Model 6T61W—Set 22-11)
1-611 .... 46—8
1-1201 .... 55—7
2-105 (See Model 315WL—Set 53-8)
2-106 .... 54—6

CONCORD—Cont.
2-200, 2-201, 2-218, 2-219, 2-232, 2-235, 2-236, 2-237, 2-238, 2-239, 2-240 .... 62—9
315WL, 315WM .... 53—8
325WL, 325WN (See Model 2-106—Set 54-6)

CONRAC
10-M-36, 10-W-36 (Ch. 36) Tel. Rec. (See Ch. 36)
11-B-36 (Ch. 36) Tel. Rec. (See Ch. 36)
12-M-36, 12-W-36 (Ch. 36) Tel. Rec. (See Ch. 36)
13-B-36 (Ch. 36) Tel. Rec. (See Ch. 36)
14-M-36, 14-W-36 (Ch. 36) Tel. Rec. (See Ch. 36)
15-P-36 (Ch. 36) Tel. Rec. (See Ch. 36)
16-B-36 (Ch. 36) Tel. Rec. (See Ch. 36)
17-P-39 (Ch. 39) Tel. Rec. (See Ch. 39)
18-M-39, 18-W-39 (Ch. 39) Tel. Rec. (See Ch. 39)
20-M-39, 20-W-39 (Ch. 39) Tel. Rec. (See Ch. 39)
21-B-39 (Ch. 39) Tel. Rec. (See Ch. 39)
22-P-39 (Ch. 39) Tel. Rec. (See Ch. 39)
23-M-390, 23-W-390 (Ch. 39) Tel. Rec. (See Ch. 39)
24-M-36 (Ch. 36) Tel. Rec. (See Ch. 36)
25-W-36 (Ch. 36) Tel. Rec. (See Ch. 36)
26-B-36 (Ch. 36) Tel. Rec. (See Ch. 36)
27-M-40, 27-W-40 (Ch. 40) Tel. Rec. (See Ch. 40)
28-B-40 (Ch. 40) Tel. Rec. (See Ch. 40)
29-P-40 (Ch. 40) Tel. Rec. (See Ch. 40)
30-M-40, 30-W-40 (Ch. 40) Tel. Rec. (See Ch. 40)
31-P-40 (Ch. 40) Tel. Rec. (See Ch. 40)
32-M-44, 32-W-44 (Ch. 44) Tel. Rec. (See Ch. 44)
33-B-44 (Ch. 44) Tel. Rec. (See Ch. 44)
34-P-44 (Ch. 44) Tel. Rec. (See Ch. 44)
35-M-61, 35-W-61 (Ch. 61) Tel. Rec. (See Ch. 61)
36-B-61 (Ch. 61) Tel. Rec. (See Ch. 61)
37-P-61 (Ch. 61) Tel. Rec. (See Ch. 61)
38-B-61, 38-M-61 (Ch. 61) Tel. Rec. (See Ch. 61)
39-M-61 (Ch. 61) Tel. Rec. (See Ch. 61)
40-M-64, 40-W-64 (Ch. 64) Tel. Rec. (See Ch. 64)
41-B-64 (Ch. 64) Tel. Rec. (See Ch. 64)
42-P-64 (Ch. 64) Tel. Rec. (See Ch. 64)
43-B-64, 43-M-64 (Ch. 64) Tel. Rec. (See Ch. 64)
Ch. 36 Tel. Rec. .... 110—4
Ch. 39 Tel. Rec. .... 110—4
Ch. 40 Series Tel. Rec. .... 140—4
Ch. 44 Tel. Rec. (See PCB 27—Set 148-1 and Ch. 40—Set 140-4)
Ch. 61, 64 Series Tel. Rec. .... 185—5

CONTINENTAL ELCTRONICS (See Skyweight)

CONVERSA-FONE
MS-5 (Master Station) SS-5 (Sub-Station) .... 16—7

CO-OP
6AWC2, 6AWC3, 6A47WCR, 6A47-WT, 6A47WTR .... 56—8

CORONADO
FA43-8965 Tel. Rec. (See Model 43-8965—Set 86-3)
K-21 (43-9041) Tel. Rec. .... 182—3
K-72 (43-9031) Tel. Rec. .... 182—3
K-73L (43-9030) Tel. Rec. .... 182—3
RA37-43-9855 .... 227—5
05RA1-43-7755A, 05RA1-43-7755B .... 101—2
05RA1-43-7901A .... 115—2
05RA2-43-8230A .... 162—3
05RA2-43-8515A .... 110—5
05RA4-43-9876A .... 103—7
05RA33-43-8120A .... 110—6
05RA37-43-8360A .... 102—3
05TV1-43-8945A Tel. Rec. .... 145—5
05TV1-43-9005A, 05TV1-43-9006A Tel. Rec. .... 145—5
05TV1-43-9014A Tel. Rec. .... 128—4
05TV2-43-8950A Tel. Rec. .... 141—4
05TV2-43-9010A Tel. Rec. .... 146—5
05TV2-43-9010B Tel. Rec. .... 153—2
05TV6-43-8935A Tel. Rec. *
15RA1-43-7654A .... 147—3
15RA1-43-7902A .... 134—6
15RA2-43-8230A .... 162—3
15RA33-43-8245A, 15RA33-43-8246A .... 174—5
15RA33-43-8365 .... 169—4
15RA37-43-9230A .... 173—5
15TV1-43-8957A, B Tel. Rec. .... 162—4
15TV1-43-8958A, B Tel. Rec. (Also see PCB 34—Set 162-1) .... 161—3
15TV1-43-9008A Tel. Rec. *
15TV1-43-9015A, B, 15TV1-43-9016A, B Tel. Rec. .... 162—4
15TV1-43-9020A, B, 15TV1-43-9021A, B Tel. Rec. (Also see PCB 34—Set 162-1) .... 161—3
15TV2-43-9012A, 15TV2-43-9013A Tel. Rec. *
15TV2-43-9025A, B, 15TV2-43-9026A, B Tel. Rec. .... 144—3
15TV2-43-9101A, 15TV2-43-9102A Tel. Rec. .... 152—4

CORONADO—Cont.
15TV4-43-8948A, 15TV4-43-8949A Tel. Rec. .... 175—7
25TV2-43-9022A Tel. Rec. .... 183—4
25TV2-43-9022B Tel. Rec. (See PCB 65—Set 202-1 and Model 25TV2-43-9022A—Set 183-4)
25TV2-43-9022C Tel. Rec. (See PCB 65—Set 202-1, PCB 72—Set 212-1 and Model 25TV2-43-9022A—Set 183-4)
25TV2-43-9045A, B Tel. Rec. .... 199—5
25TV2-43-9045C Tel. Rec. (See PCB 68—Set 205-1 and Model 25TV2-43-9045A—Set 199-5)
25TV2-43-9060A Tel. Rec. .... 199—5
25TV2-43-9060B Tel. Rec. (See PCB 68—Set 205-1 and Model 25TV2-43-9060A—Set 199-5)
35RA2-43-5101A .... 214—3
35RA4-43-9856A .... 221—4
35RA33-43-8125 .... 217—5
35RA33-43-8145 .... 224—7
35RA33-43-8225 .... 219—4
35RA37-43-8355 .... 225—9
35TV2-43-9022C Tel. Rec. (See PCB 65—Set 202-1, PCB 72—Set 212-1 and Model 25TV2-43-9022A—Set 183-4)
35TV2-43-9045D Tel. Rec. (See PCB 68—Set 205-1, PCB 71—Set 211-1 and Model 25TV2-43-9045B—Set 199-5)
35TV2-43-9060C Tel. Rec. (See PCB 66—Set 205-1, PCB 71—Set 211-1 and Model 25TV2-43-9060A—Set 199-5)
45RA1-43-7910A, 45RA1-43-7911A (See Model 15RA1-43-7902A—Set 134-6)
43—2027 .... 11—3
43—5005 .... 28—36
43-6301 .... 7—4
43-6451 .... 10—10
43-6485 .... 46—9
43-6730 (See Model 43-8685—Set 11-4)
43-7601 (See Model 43-7601B—Set 10-11)
43-7601B .... 10—11
43-7602 (See Model 43-7601B—Set 10-11)
43-7651 .... 9—7
43-7652 (See Model 43-7651—Set 9-7)
43-7851 .... 47—5
43-8101 (See Model 94RA31-43-8115A—Set 81-5)
43-8130C, 43-8131C (See Model 94RA33-43-8130C—Set 82-3)
43-8160 .... 12—7
43-8177 (See Model 43-8178—Set 21-8)
43-8178 .... 21—8
43-8180 .... 10—12
43-8190 .... 19—11
43-8201 (See Model 43-8178—Set 21-8)
43-8213 .... 7—5
43-8240, 43-8241 .... 12—8
43-8305 .... 8—3
43-8312A .... 8—4
43-8330 .... 19—12
43-8351, 43-8352 .... 12—9
43-8353, 43-8354 .... 28—7
43-8420 .... 24—13
43-8470 .... 8—3
43-8471 .... 8—4
43-8576B .... 9—8
43-8685 .... 11—4
43-8965 Tel. Rec. .... 86—3
43-9030 Tel. Rec. .... 182—3
43-9031 Tel. Rec. .... 182—3
43-9041 Tel. Rec. .... 182—3
43-9196 .... 14—35
43-9201 .... 24—14
94RA1-43-6945A .... 69—6
94RA1-43-7605A .... 65—5
94RA1-43-7656A, 94RA1-43-7657A .... 73—2
94RA1-43-7751A .... 87—3
94RA1-43-8510A, 94RA1-43-8511A .... 71—7
94RA1-43-8510B, 94RA1-43-8511B .... 75—6
94RA2-43-8230A .... 162—3
94RA4-43-8129A, 94RA4-43-8130A, 94RA4-43-8130B, 94RA4-43-8131A, 94RA-43-8131B .... 62—10
94RA31-43-8115A, B, 94RA31-43-8116A .... 81—5
94RA31-43-9841A .... 79—3
94RA33-43-8130C, 94RA33-43-8131C .... 82—3
94TV1-43-8940A Tel. Rec. *
94TV1-43-9002A Tel. Rec. *
94TV2-43-8970A, 94TV2-43-8971A, 94TV2-43-8972A, 94TV2-43-8973A, 94TV2-43-8985A, 94TV2-43-8986A, 94TV2-43-8987A, 94TV2-43-8993A, 94TV2-43-8994A, 94TV2-43-8995A Tel. Rec. .... 78—4
94TV6-43-8953A Tel. Rec. .... 106—3
165 (See Model 94RA31-43-8115A—Set 81-5)
197, U (See Model 94RA31-43-8115A—Set 81-5)
2027 (See Model 43-2027—Set 11-3)
5005 (See Model 43-5005—Set 28-36)
5101A (See Model 35RA2-43-5101A—Set 214-3)
6301 (See Model 43-6301—Set 7-4)
6451 (See Model 43-6451—Set 10-10)
6485 (See Model 43-6485—Set 46-9)
6730 (See Model 43-8685—Set 11-4)
6945A (See Model 94RA1-43-6945A—Set 69-6)
7601, B, 7602 (See Model 43-7601B—Set 10-11)
7605A (See Model 94RA1-43-7605A—Set 65-5)

CORONADO—Cont.
7651, 7652 (See Model 43-7651—Set 9-7)
7654A (See Model 15RA1-43-7654A—Set 147-3)
7656A, 7657A (See Model 94RA1-43-7656A—Set 73-2)
7751 (See Model 94RA1-43-7751A—Set 87-3)
7755A, B (See Model 05RA1-43-7755A—Set 101-2)
7851 (See Model 43-7851—Set 47-5)
7901A (See Model 05RA1-43-7901A—Set 115-2)
7902A (See Model 15RA1-43-7902A—Set 134-6)
7910A, 7911A (See Model 15RA1-43-7902A—Set 134-6)
8101 (See Model 94RA31-43-8115A—Set 81-5)
8115A, B, 8116A (See Model 94RA31-43-8115A—Set 81-5)
8120A (See Model 05RA33-43-8120A—Set 110-6)
8125 (See Model 35RA33-43-8125—Set 217-5)
8129A, 8130A, B, 8131A, B (See Model 94RA-43-8129A—Set 62-10)
8130C, 8131C (See Model 94RA33-43-8130C—Set 82-3)
8145 (See Model 35RA33-43-8145—Set 224-7)
8160 (See Model 43-8160—Set 12-7)
8177, 8178 (See Model 43-8178—Set 21-8)
8180 (See Model 43-8180—Set 10-12)
8190 (See Model 43-8190—Set 19-11)
8201 (See Model 43-8178—Set 21-8)
8213 (See Model 43-8213—Set 7-5)
8225 (See Model 35RA33-43-8225—Set 219-4)
8230A (See Model 05RA2-43-8230A—Set 162-3)
8240, 8241 (See Model 43-8240—Set 12-8)
8245A, 8246A (See Model 15RA33-43-8245A—Set 174-5)
8305 (See Model 43-8305—Set 8-3)
8312A (See Model 43-8312A—Set 8-4)
8330 (See Model 43-8330—Set 19-12)
8351, 8352 (See Model 43-8351—Set 12-9)
8353, 8354 (See Model 43-8353—Set 28-7)
8355 (See Model 35RA37-43-8355—Set 225-9)
8360A (See Model 05RA37-43-8360A—Set 102-3)
8365 (See Model 15RA33-43-8365—Set 169-4)
8420 (See Model 43-8420—Set 24-13)
8470 (See Model 43-8305—Set 8-3)
8371 (See Model 43-8312A—Set 8-4)
8510A, 8511A (See Model 94RA1-43-8510A—Set 71-7)
8510B, 8511B (See Model 94RA1-43-8510B—Set 75-6)
8515 (See Model 05RA2-43-8515A—Set 110-5)
8576B (See Model 43-8576B—Set 9-8)
8685 (See Model 43-8685—Set 11-4)
8945A Tel. Rec. (See Model 05TV1-43-8945A—Set 145-5)
8948A, 8949A Tel. Rec. (See Model 15TV4-43-8948A—Set 175-7)
8950A Tel. Rec. (See Model 05TV2-43-9010A—Set 146-5)
8953A Tel. Rec. (See Model 94TV6-43-8953A—Set 106-3)
8957A Tel. Rec. (See Model 15TV1-43-8957A—Set 62-4)
8958A, B Tel. Rec. (See PCB 34—Set 162-1 and Model 15TV1-43-8958A—Set 161-3)
8960 Tel. Rec. .... *
8965 Tel. Rec. (See Model 43-8965—Set 86-3)
8970A, 8971A, 8972A, 8973A Tel. Rec. (See Model 94TV2-43-8970A—Set 78-4)
8985A, 8986A, 8987A Tel. Rec. (See Model 94TV2-43-8970A—Set 78-4)
8993A, 8994A, 8995A Tel. Rec. (See Model 94TV2-43-8970A—Set 78-4)
9002A Tel. Rec. .... *
9005A, 9006A Tel. Rec. (See Model 05TV1-43-8945A—Set 145-5)
9008A Tel. Rec. .... *
9010A Tel. Rec. (See Model 05TV2-43-9010A—Set 146-5)
9010B Tel. Rec. (See Model 05TV2-43-9010B—Set 153-2)
9012A, 9013A Tel. Rec. .... *
9014A Tel. Rec. (See Model 05TV1-43-9014A—Set 128-4)
9015A, B, 9016A, B Tel. Rec. (See Model 15TV1-43-8957A — Set 162-4)
9020A, B, 9021A, B Tel. Rec. (See PCB 34—Set 162-1 and Model 15TV1-43-8958A—Set 161-3)
9022A Tel. Rec. (See Model 25TV2-43-9022A—Set 183-4)
9022B Tel. Rec. (See PCB 65—Set 202-1 and Model 25TV2-43-9022A—Set 183-4)
9022C Tel. Rec. (See PCB 65—Set 205-1 and PCB 72—Set 212-1 and Model 25TV2-43-9022A—Set 183-4)
9025A, B, 9026A, B Tel. Rec. (See Model 15TV2-43-9025A — Set 144-3)
9030 Tel. Rec. (See Model K-73L (43-9031)—Set 182-3)

NOTE: PCB denotes Production Change Bulletin

CORONADO—Cont.

9031 Tel. Rec. (See Model K-72 [43-9031]—Set 182-3)
9041 (See Model K-21 [43-9041]—Set 182-1)
9045A, B Tel. Rec. (See Model 25-TV2-43-9045A—Set 199-5)
9045C Tel. Rec. (See PCB 68—Set 205-1 and Model 25TV2-43-9045A—Set 199-5)
9045D Tel. Rec. (See PCB 68—Set 205-1, PCB 71—Set 211-1 and Model 25TV2-43-9045A — Set 199-5)
9060A Tel. Rec. (See Model 25TV2-43-9060A—Set 199-5)
9060B Tel. Rec. (See PCB 68—Set 205-1 and Model 25TV2-43-9060A—Set 199-5)
9060C Tel. Rec. (See PCB 66—Set 205-1, PCB 71—Set 211-1 and Model 25TV2-43-9060A — Set 199-5)
9101A, 9102A Tel. Rec. (See Model 15TV2-43-9101A—Set 152-4)
9169 (See Model 43-9196—Set 14-35)
9201 (See Model 43-9201—Set 24-14)
9230A (See Model 15RA37-43-9230A—Set 173-5)
9841A (See Model 94RA31-43-9841A—Set 79-3)
9855 (See Model RA37-43-9855—Set 227-5)
9856A (See Model 35RA4-43-9856A—Set 221-4)
9876A (See Model 05RA4-43-9876A—Set 103-7)

CORONET

C2 .... 6—8

CRESCENT (Also see Changer and Recorder Listings)

H-16A1 .... 76—8

CRESTWOOD (See Recorder Listing)

CROMWELL (Mercantile Stores)

1010 .... 88—2
1020 .... 89—5

CROSLEY

DU-17CDB, CDM, CHB, CHM, CHN (Ch. 356-1, -2) Tel. Rec. 168—6
DU-17CDB, CDM (Ch. 1-356-3, -4) Tel. Rec. (See PCB 58—Set 192-1 and Model DU-17CDB — Set 168-6)
DU-17CHN1 (Ch. 356, -1, -2, -3, -4) Tel. Rec. (See PCB 58—Set 192-1 and Model DU-17CDB—Set 168-6)
DU-17COB, COM (Ch. 356-1, -2) Tel. Rec. .... 168—6
DU-17COL, COM (Ch. 356-3, -4) Tel. Rec. (See PCB 58—Set 192-1 and Model DU-17CDB — Set 168-6)
DU-17PDB, PDM, PHB, PHM, PHN, PHN1 (Ch. 359 and Radio Ch. 360, 361) Tel. Rec. .... 163—4
DU-17TOB, TOL (Ch. 356-1, -2) Tel. Rec. .... 168—6
DU-17TOL1 (Ch. 356-1, -2) Tel. Rec. (See Model DU-17TOL—Set 168-6)
DU-17TOM (Ch. 356-1, -2) Tel. Rec. .... 168—6
DU-20CDM, CHB, CHM, COB, COM (Ch. 357) Tel. Rec. .... 175—8
DU-21CDM1, CDN, CHM, COB, COL, COLB, COM (Ch. 357-1) Tel. Rec. .... 175—8
D-25BE, CE, GN, MN, TN, WE (Ch. 311, 311-1) .... 202—2
EU-17 COM (Ch. 380, 383) Tel. Rec. .... 186—3
EU-17COL, COLB (Ch. 385) Tel. Rec. (Also see PCB 73 — Set 214-1) .... 193—3
EU-17COLBU, COLU (Ch. 396) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-17TOB (Ch. 380, 383) Tel. Rec. .... 186—3
EU-17TOLa, TOLB (Ch. 385) Tel. Rec. (Also see PCB 73 — Set 214-1) .... 193—3
EU-17TOLBU, TOLU (Ch. 396) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-17TOM (Ch. 380, 383) Tel. Rec. .... 186—3
EU-21CDB (Ch. 381, 384) Tel. Rec. .... 186—3
EU-21CDBU (Ch. 390 and UHF Ch. 391) Tel. Rec. (See PCB 80—Set 221-1 and Model EU-17COM—Set 186-3)
EU-21CDL, CDLB (Ch. 387) (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21CDLBU, CDLU (Ch. 394) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21CDM (Ch. 381, 384) Tel. Rec. .... 186—3
EU-21CDMU (Ch. 390 and UHF Ch. 391) Tel. Rec. (See PCB 80—Set 221-1 and Model EU-17COM—Set 186-3)
EU-21CDN (Ch. 381, 384) Tel. Rec. .... 186—3
EU-21CDNU (Ch. 390 and UHF Ch. 391) Tel. Rec. (See PCB 80—Set 221-1 and Model EU-17COM—Set 186-3)
EU-21COBa (Ch. 381, 384) Tel. Rec. .... 186—3
EU-21COBUa (Ch. 390 and UHF Ch. 391) Tel. Rec. (See PCB 80—Set 221-1 and Model EU-17COM—Set 186-3)

CROSLEY—Cont.

EU-21COLBd (Ch. 386) Tel. Rec. (Also see PCB 73—Set 214-1) .... 193—3
EU-21COLBU (Ch. 394) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21COLBe (Ch. 387) Tel. Rec. (Also see PCB 73—Set 214-1) .... 193—3
EU-21COLd (Ch. 386) Tel. Rec. (Also see PCB 73—Set 214-1) .... 193—3
EU-21COLe (Ch. 387) Tel. Rec. (Also see PCB 73—Set 214-1) .... 193—3
EU-21COLU (Ch. 394) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21COMa (Ch. 381, 384) Tel. Rec. .... 186—3
EU-21COMUa (Ch. 390 and UHF Ch. 391) Tel. Rec. (See PCB 80—Set 221-1 and Model EU-17COM—Set 186-3)
EU-21COS, COSB (Ch. 387) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21COSBU, COSU (Ch. 394) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21PDBU, EU-21PDMU (Ch. 392, UHF Ch. 391 and Radio Ch. 362-1) Tel. Rec. (For TV Ch. only see PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
EU-21TOL, TOLB (Ch. 386) Tel. Rec. (Also see PCB 73 — Set 214-1) .... 193—3
EU-21TOLBU, TOLU (Ch. 393) Tel. Rec. (See PCB 73—Set 214-1 and Model EU-17COL—Set 193-3)
E10BE, CT, RD, WE (Ch. 10E, 10E-1) .... 203—6
E15BE, CE, SL, TN, WE (Ch. 15-20E) .... 201—3
E20GN, GY, MN, TN (Ch. 15-20E) .... 201—3
E30BE, GN, MN, TN (Ch. 30E, 30E-1) .... 206—3
E-75, CE, GN, RD, TN (Ch. 75E) .... 217—3
E-85, CE, GN, RD, TN (Ch. 85E) .... 217—3
E-90BK, CE, GY, RD, WE (Ch. 90E) .... 217—4
F-17TOLBH (Ch. 402) Tel. Rec. .... 223—5
F-17TOLBU (Ch. 402-1) Tel. Rec. .... 223—5
F-17TOLH (Ch. 402) Tel. Rec. .... 223—5
F-17TOLU (Ch. 402-1) Tel. Rec. .... 223—5
F-21CDLBH (Ch. 404) Tel. Rec. .... 223—5
F-21CDLBU (Ch. 404-1) Tel. Rec. .... 223—5
F-21CDLH (Ch. 404) Tel. Rec. .... 223—5
F-21CDLU (Ch. 404-1) Tel. Rec. .... 223—5
F-21COLBH (Ch. 404) Tel. Rec. .... 223—5
F-21COLBU (Ch. 404-1) Tel. Rec. .... 223—5
F-21COLH (Ch. 404) Tel. Rec. .... 223—5
F-21COLU (Ch. 404-1) Tel. Rec. .... 223—5
F-21TOLBH (Ch. 403) Tel. Rec. .... 223—5
F-21TOLBU (Ch. 403-1) Tel. Rec. .... 223—5
F-21TOLH (Ch. 403) Tel. Rec. .... 223—5
F-21TOLU (Ch. 403-1) Tel. Rec. .... 223—5
F-110BE, BK, CE, GN, RD (Ch. 110F) .... 218—4
S11-442M1U, S11-444MU, S11-453MU (Ch. 331-4) Tel. Rec. .... 153—3
S11-459MU (Ch. 321-4) Tel. Rec. .... 153—3
S11-472B1U, S11-474BU (Ch. 331-4) Tel. Rec. .... 153—3
S17CDC1, S17CDC2, S17CDC3, S17CDC4 (Ch. 331-4) Tel. Rec. .... 153—3
S17COC1, S17COC2, S17COC3 (Ch. 331-4) Tel. Rec. .... 153—3
S20CDC1, S20CDC2, S20CDC3 (Ch. 323-6) Tel. Rec. .... *
9-101 .... 58—8
9-102 .... 50—4
9-103, 9-104W .... 60—10
9-105, 9-106W .... 59—7
9-113, 9-114W .... 53—9
9-117 .... 51—5
9-118W .... 50—4
9-119, 9-120W .... 50—5
9-121, 9-122W .... 54—8
9-201, 9-202M, 9-203B .... 52—5
9-204, 9-205M .... 63—5
9-207M .... 57—6
9-209, 9-212M .... 53—10
9-213B (See Model 9-209—Set 53-10)
9-214M, 9-214ML .... 65—6
9-302 .... 47—6
9-403M, 9-403M-2 Tel. Rec. 79—4
9-404M Tel. Rec. .... 79—4
9-407, 9-407M-1, 9-407M-2 Tel. Rec. .... 66—6
9-409M3 Tel. Rec. .... 94—3
9-413B, 9-413B-2, 9-414B Tel. Rec. .... 79—4
9-419M1, 9-419M1-LD, 9-419M2, 9-419M3, 9-419M3-LD Tel. Rec. .... 94—3
9-420M Tel. Rec. .... 79—4
9-422M, 9-422MA Tel. Rec. 81—6
9-423M Tel. Rec. .... 91A—4
9-424B Tel. Rec. .... 79—4
9-425 Tel. Rec. .... 95A—2
10-135, 10-136E, 10-137, 10-138, 10-139, 10-140 (Ch. 285) 93—3
10-307M, 10-308, 10-309. 80—4

CROSLEY—Cont.

10-401 Tel. Rec. .... 95—2
10-404MU, 10-404M1U Tel. Rec. .... 114—3
10-412MU Tel. Rec. .... 114—3
10-414MU Tel. Rec. .... 116—4
10-414M1 (Ch. 292) Tel. Rec. (See Model 10-414MU—Set 116-4)
10-416MU Tel. Rec. .... 116—4
10-416M1, 10-416M-U (Ch. 292) Tel. Rec. (See Model 10-414MU—Set 116-4)
10-418MU Tel. Rec. .... 114—3
10-419MU Tel. Rec. .... 104—6
10-420MU Tel. Rec. .... 114—3
10-421MU Tel. Rec. .... 106—4
10-427MU Tel. Rec. 125-1A
10-428MU Tel. Rec. .... 129—5
10-429M (Ch. 292) Tel. Rec. (See Model 10-414MU—Set 116-4)
10-429MU Tel. Rec. .... 116—4
11-100U, 11-101U, 11-102U, 11-103U, 11-104U, 11-105U (Ch. 301) .... 127—5
11-106U, 11-107U, 11-108U, 11-109U (Ch. 302) .... 155—5
11-114U, 11-115U, 11-116U, 11-117U, 11-118U, 11-119U (Ch. 330) .... 135—5
11-126U, 11-127U, 11-128U, 11-129U (Ch. 312) .... 125—5
11-207MU, 11-208BU (Ch. 333) .... 142—6
11-301U, 11-302U, 11-303U, 11-304U, 11-305U (Ch. 303) 124—3
11-441MU (Ch. 320) Tel. Rec. .... 147—4
11-442MU (Ch. 331) Tel. Rec. .... 126—4
11-443MU Tel. Rec. (See PCB 22—Set 138-1 and Model 11-442—Set 126-4)
11-445MU (Ch. 321, -1, -2) Tel. Rec. .... 126—4
11-446MU (Ch. 325) Tel. Rec. .... 126—4
11-447MU (Ch. 321, -1, -2) Tel. Rec. .... 126—4
11-453MU (Ch. 331) Tel. Rec. .... 126—4
11-459M1U, MU (Ch. 321, -1, -2) Tel. Rec. .... 126—4
11-460MU (Ch. 331) Tel. Rec. .... 126—4
11-461 WU (Ch. 320) Tel. Rec. .... 147—4
11-465WU (Ch. 321, -1, -2) Tel. Rec. .... 126—4
11-470BU (Ch. 331) Tel. Rec. .... 126—4
11-471 BU (Ch. 320) Tel. Rec. .... 147—4
11-472BU (Ch. 331) Tel. Rec. .... 126—4
11-473BU Tel. Rec. (See PCB 22—Set 138-1 and Model 11-442—Set 126-4)
11-475BU (Ch. 321, -1, -2) Tel. Rec. .... 126—4
11-476BU (Ch. 325) Tel. Rec. .... 126—4
11-477BU (Ch. 321, -1, -2) Tel. Rec. .... 126—4
11-483BU (Ch. 331) Tel. Rec. .... 126—4
11-550MU (Ch. 337) .... 139—5
11-560BU (Ch. 337) .... 139—5
17CDC1, 17CDC2, 17CDC3, 17-CDC4 (Ch. 331, -1, -2) Tel. Rec. (See Model 11-442—Set 126-4)
17COC1, 17COC2, 17COC3 (Ch. 331, -1) Tel. Rec. (See Model 11-442—Set 126-4)
20CDC1, 20CDC2, 20CDC3 (Ch. 323-3, 323-4) Tel. Rec. .. *
46FA, 46FB .... 15—5
56FA, 56FB, 56FC .... 31—7
56PA, 56PB .... 10—9
56TA-L, 56TC-L .... 4—9
56TD .... 21—9
56TG .... 4—3
56TJ 5-14
56TN-L, 56TW-L .... 4—9
56TP .... 8—5
56TZ .... 33—2
56TR, 56TS .... 17—11
56TU .... 10—13
57TQ (See Model 56TQ—Set 33-2)
58TA .... 36—4
58TC (See Model 58TW—Set 38-2)
58TK .... 34—5
58TL .... 36—4
58TW .... 38—2
66CA, CP, CQ (See Model 66CS—Set 18-14)
66CS, 66CSM .... 18—14
66TA, 66TC, 66TW .... 5—15
68CP, 68CR .... 37—5
68TA, 68TW .... 40—4
86CR, 86CS .... 12—10
86CR, 86CS (Revised) .... 36—5
87CQ .... 36—5
88CR (See Model 87CQ—Set 36-5)
88TA, 88TC .... 38—3
88TA, 88TC (Revised) (See Set 43-8 and Model 88TA—Set 38-3)
106CP, 106CS .... 7—6
146CS .... 25—10
148CP, 148CQ .... 42—6
148CR (See Model 148CP—Set 42-6)
307TA Tel. Rec. .... *
348CP-TR1, 348CP-TR2, 348CP-TR3 Tel. Rec. .... *
154927 Tel. UHF Conv. .... 211—5
Ch. 10E, 10E-1 (See Model E10BE)
Ch. 15-20E (See Model E15BE)
Ch. 30E, 30E-1 (See Model E30BE)
Ch. 75E (See Model E-75)
Ch. 85E (See Model E-85)
Ch. 90E (See Model E-90BK)
Ch. 110F (See Model F-110BE)
Ch. 292 Tel. Rec. (See Model 10-414MU)
Ch. 301 (See Model 11-100U)
Ch. 302 (See Model 11-106U)
Ch. 303 (See Model 11-301U)
Ch. 311, -1 (See Model D-25BE)
Ch. 312 (See Model 11-126U)

CROSLEY—Cont.

Ch. 320 (See Model 11-441MU)
Ch. 321, 321-1, 321-2 (See Model 11-445MU)
Ch. 321-4 Tel. Rec. (See Model S11-442M1U)
Ch. 323 (See Model 11-443MU)
Ch. 323-3, 323-4 (See Model 20CD1)
Ch. 323-6 (See Model S20CDC1)
Ch. 325 (See Model 11-446MU)
Ch. 330 (See Model 11-114U)
Ch. 331, -1, -2 (See Model 11-442)
Ch. 331-4 Tel. Rec. (See Model S11-442MIU)
Ch. 333 (See Model 11-207MU)
Ch. 337 (See Model 11-550MU)
Ch. 356-1, 356-2 (See Model DU-17CDB)
Ch. 356-3, -4 (See Model DU-17CDB)
Ch. 357 Tel. Rec. (See Model DU-20CDM)
Ch. 357-1 (See Model DU-21CDM1)
Ch. 359 Tel. Rec. (See Model DU-17PDM)
Ch. 360, 361 Tel. Rec. (See Model DU-17PDB)
Ch. 380 (See Model EU-17CDM)
Ch. 381 (See Model EU-21CDB)
Ch. 383 (See Model EU-17COM)
Ch. 384 (See Model EU-21CDB)
Ch. 385, 386, 387 (See Model EU-17COL)
Ch. 386 (See Model EU-21COLBd)
Ch. 387 (See Model EU-21COLBe)
Ch. 390, 391 (See Model EU-21-CDBU)
Ch. 392 (See Model EU-21PDBU)
Ch. 393 (See Model EU-21TOLBU)
Ch. 394 (See Model 21CDLBU)
Ch. 396 (See Model EU-17COLBU)
Ch. 402 (See Model F-17TOLBH)
Ch. 402-1 (See Model F-17TOLBU)
Ch. 403 (See Model F-21TOLBH)
Ch. 403-1 (See Model F-21TOLBU)
Ch. 404 (See Model F-21CDLBH)
Ch. 404-1 (See Model F-21CDLBU)

CROYDON

C17FM Tel. Rec. (Also see PCB 57—Set 191-1) .... 186—4
C21FM, C21FTM (Also see PCB 57—Set 191-1) .... 186—4

CRYSTAL PRODUCTS (See Coronet)

DALBAR

Barcombo Jr., Barcombo Sr. 10—14
M8 "Tonomatic" .... 8—34
100-1000 Series .... 10—15
400 .... 9—9

DAVID BOGEN

"Twin" .... 213—3
AM901 .... 195—6
DB-10 .... 102—4
DB10-1 (See Model DB10 — Set 102-4)
DP-16 .... 166—8
EQR .... 227—6
E66 .... 85—4
E75 .... 83—2
EX-326 .... 76—9
FM801 .... 198—4
G-50 .... 30—6
GO-50 .... 26—9
GO-125 .... 22—12
GX50 .... 25—11
H15 .... 80—6
H30 .... 79—5
H50, HL50, H2L50 .... 78—6
H623 .... 71—8
HE-10 .... 154—3
HOH, HOL .... 80—5
HO10 .... 183—5
HO50 .... 84—5
HO125 .... 87—4
HX30 .... 82—4
HX50 .... 75—7
HX-632 .... 169—5
LOH, LOL .... 80—5
LP16 .... 86—4
LSC .... 227—6
PH10 .... 73—3
PH10-1 (See Model PH10—Set 68-5)
PX .... 183—5
PX10 .... 68—5
PX15 .... 72—7
RX .... 183—5
R501 .... 33—3
R602 .... 67—8
R-604 .... 175—9
R701 .... 227—6
UP16 .... 86—4
2AR, 2RS .... 28—8
11D .... 77—5
11U .... 76—10
11X .... 74—2
21D .... 77—5
21U .... 76—10
21X .... 74—2

DEARBORN

100 .... 22—13

DECCA

DP11 .... 24—15
DP29 .... 19—13
PT-10 .... 25—12

DELCO

R-705 .... 42—7
R-1227, R-1228, R-1229 .... 15—6
R-1230-A, R-1231-A, R-1232-A .... 14—33
R-1233 .... 42—8
R-1234, R-1235 .... 7—7
R-1236, R-1237 .... 29—7
R-1238 .... 38—4
R-1241 .... 62—11
R-1242 .... 31—8
R-1243 .... 32—4
R-1244, R-1245, R-1246 .... 52—6
R-1248, R-1249, R-1250 .... 66—7
R-1251, R-1252 .... 21—10
R-1253, R-1254, R-1255 .... 47—7

DELCO—Cont.

R-1408, R-1409 .... 15—7
TV-71, TV-71A Tel. Rec. .. 99A—3
TV-101 (See Model TV-102—Set 88-3)
TV-102 Tel. Rec. .... 88—3
TV-160 Tel. Rec. .... 85—5
TV-201 Tel. Rec. .... 59—8

DeSOTO (See Mopar)

DETROLA

554-1-61A (See Aria Model 554-1-61A—Set 67-2)
558-1-49A .... 7—8
568-13-221D .... 9—10
571, 571A, 571B, 571L, 571AL, 571BL .... 10—16
571X, 571AX, 571BX .... 9—11
572-220-226A .... 8—6
577-1-6A .... 8—7
579 .... 7—9
579-2-58B (See Model 579—Set 7-9)
582 .... 19—14
610-A .... 55—8
611-A .... 50—6
626 Series .... 11—5
7156 .... 48—6
7270 .... 16—8

DEWALD

A500 .... 4—22
A5001 (See Model A500—Set 4-22)
A500W (See Model A500 — Set 4-22)
A501, A502, A503 .... 4—22
A504, A505 .... 16—9
A-507 .... 26—10
A-509 .... 31—9
A-514 .... 27—6
A602, A605 .... 16—10
A608 (See Model A602—Set 16-10)
B-400 .... 35—3
B-401 .... 34—6
B-402 .... 45—8
B-403 .... 52—7
B-504 .... 43—9
B-506 .... 38—5
B-510 .... 34—7
B-512 .... 35—4
B-515 .... 63—6
B-612 .... 42—9
B-614 .... 56—9
BT-100, BT-101 Tel. Rec. .. 79—6
C-516 .... 64—4
C-800 .... 69—7
CT-101 Tel. Rec. .... 79—6
CT-102, CT-103, CT-104 Tel. Rec. .... 82—5
D-E517A .... 167—5
D-508 .... 106—5
D-517 .... 131—4
D-518 .... 100—5
D519 (See Model B-506—Set 38-5)
D-616 .... 102—5
DT-120, DT-122 Tel. Rec. .. 100—6
DT-160 Tel. Rec. .... 82—5
DT-161 Tel. Rec. .... 100—6
DT-162, DT-163 Tel. Rec. .. 118—5
DT-162R, DT-163A, R Tel. Rec. (Also see PCB 58—Set 192-1) .... 136—7
DT-190 Tel. Rec. .... 118—5
DT-190D Tel. Rec. (Also see PCB 58—Set 192-1) .... 136—7
DT-1020, DT-1020A Tel. Rec. .... 100—6
DT-1030, DT-1030A Tel. Rec. .... 100—6
DT-X-160 Tel. Rec. .... 100—6
E-520 .... 128—5
E-522 .... 141—5
ET-140, ET-141 Tel. Rec. .. 118—5
ET-140R, ET-141R Tel. Rec. (Also see PCB 58—Set 192-1). 136—7
E-170, ET-171 Tel. Rec. (Also see PCB 58—Set 192-1) .... 136—7
ET-171-20 Tel. Rec. .... 208—3
ET-172 Tel. Rec. (Also see PCB 58—Set 192-1) .... 136—7
ET-190D, R Tel. Rec. (Also see PCB 58—Set 192-1) .... 136—7
ET-190D (Revised) Tel. Rec. 208—3
FT-200 Tel. Rec. (See PCB 58—Set 192-1 and Model DT-162R—Set 136-7)
FT-200 (Revised) Tel. Rec. .. 208—3
FT-201 Tel. Rec. (See PCB 58—Set 192-1 and Model DT-162R—Set 136-7)
F-404 .... 181—5
F-405 .... 198—5
F-523 .... 170—5
G-174 Tel. Rec. .... 208—3
G-201 Tel. Rec. .... 208—3
G-210, G-211 Tel. Rec. .... 208—3
G-408 .... 220—3
511 .... 71—9

DODGE (See Mopar)

DORN'S (See Bell Air)

DREXEL (Mutual Buying Syndicate)

17CG1, 17TW Tel. Rec. (Similar to Chassis) .... 149—13

DUKANE

1A45-A .... 184—5
1A300, 1B300 .... 189—6
1U325 .... 185—6
4A100 .... 186—5
4B100 (See Model 4A100—Set 186-5)
4C25 Flexiphone .... 187—4
4C100 .... 200—4

DUMONT

RA-101 Tel. Rec. .... *
RA-102B1, RA-102B2, RA-102B3 Tel. Rec. .... *
RA-103 Tel. Rec. (Also see PCB 6—Set 108-1) .... 90—3
RA-103D Tel. Rec. (Also see PCB 9—Set 114-1) .... 93—4
RA-104A Tel. Rec. (Also see PCB 9—Set 114-1) .... 93—4

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

HOFFMAN—Cont.

7B303 (Ch. 190, B) Tel. Rec. ....201—5
7M103 (Ch. 190, B) Tel. Rec. ....201—5
7M109 (Ch. 200) Tel. Rec..205—5
7M109B (Ch. 210, M) Tel. Rec. ....205—5
7M112 (Ch. 202) Tel. Rec..205—5
7M112B (Ch. 212, M) Tel. Rec. ....194—4
7M127 (Ch. 212) Tel. Rec. (See Model 7B113B—Set 194-4)
7M302 (Ch. 190, B) Tel. Rec. ....201—5
7P105 (Ch. 190, B) Tel. Rec. ....201—5
7P111B (Ch. 210, M) Tel. Rec. ....205—5
7P114B (Ch. 212, M) Tel. Rec. (See Model 7B113B—Set 194-4)
7P304 (Ch. 190, B) Tel. Rec. ....201—5
20B102 (Ch. 183T) Tel. Rec. 168—8
20B102F (Ch. 194) Tel. Rec. ....201—5
20B501 (Ch. 183T) Tel. Rec. ....168—8
20M101 (Ch. 183T) Tel. Rec. ....168—8
20M101F (Ch. 194) Tel. Rec. ....201—5
20M500 (Ch. 183T) Tel. Rec. 168—8
20P502 (Ch. 183T) Tel. Rec. 168—8
21B107 (Ch. 191, B) Tel. Rec. ....201—5
21B116 (Ch. 196, M) Tel. Rec. ....195—8
21B122 (Ch. 211, M) Tel. Rec. ....194—4
21B134 (Ch. 211) Tel. Rec. (See Model 21B122—Set 194-4)
21B137 (Ch. 196) Tel. Rec. (See Model 21B116—Set 195-8)
21B301 (Ch. 191, B) Tel. Rec. ....201—5
21B306B (Ch. 211, M) Tel. Rec. ....194—4
21B309 (Ch. 196M, T) Tel. Rec. ....195—8
21B315 (Ch. 211T) Tel. Rec. (See Model 21B122—Set 194-4)
21B504 (Ch. 191, B) Tel. Rec. ....201—5
21B507 (Ch. 211, M) Tel. Rec. ....194—4
21B510, T (Ch. 196) Tel. Rec. (See Model 21B116—Set 195-8)
21B701 (Ch. 191, B) Tel. Rec. ....201—5
21B701 (Ch. 196M, T) Tel. Rec. ....195—8
21B716 (Ch. 211T) Tel. Rec. (See Model 21B122—Set 194-4)
21B901 (Ch. 192) Tel. Rec. (TV Ch. only) ....201—5
21B904 (Ch. 213, M) Tel. Rec. ....211—8
21B907 (Ch. 199) Tel. Rec. 221—6
21M106 (Ch. 191, B) Tel. Rec. ....201—5
21M115 (Ch. 196, M) Tel. Rec. ....195—8
21M121 (Ch. 211, M) Tel. Rec. ....194—4
21M133 (Ch. 211) Tel. Rec. (See Model 21B122—Set A401)
21M136 (Ch. 196) Tel. Rec. (See Model 21B116—Set 195-8)
21M300 (Ch. 191, B) Tel. Rec. ....201—5
21M305 (Ch. 201) Tel. Rec. 205—5
21M305B (Ch. 211, M) Tel. Rec. ....194—4
21M308 (Ch. 196M, T) Tel. Rec. ....195—8
21M314 (Ch. 211T) Tel. Rec. (See Model 21B122—Set 194-4)
21M503 (Ch. 191, B) Tel. Rec. ....201—5
21M506 (Ch. 211, M) Tel. Rec. ....194—4
21M509 (Ch. 196) Tel. Rec. (See Model 21B116—Set 195-8)
21M700 (Ch. 191, B) Tel. Rec. ....201—5
21M700 (Ch. 196M, T) Tel. Rec. ....195—8
21M715 (Ch. 211T) Tel. Rec. (See Model 21B122—Set 194-4)
21M900 (Ch. 192) Tel. Rec. (TV Ch. only) ....201—5
21M903 (Ch. 213, M) Tel. Rec. ....211—8
21M906 (Ch. 199) Tel. Rec. 221—6
21P108 (Ch. 191, B) Tel. Rec. ....201—5
21P117 (Ch. 196, M) Tel. Rec. ....195—8
21P123 (Ch. 211, M) Tel. Rec. ....194—4
21P307B (Ch. 211, M) Tel. Rec. ....194—4
21P310 (Ch. 196M, T) Tel. Rec. ....195—8
21P505 (Ch. 191, B) Tel. Rec. ....201—5
21P508 (Ch. 211, M) Tel. Rec. ....194—4
21P511 (Ch. 196) Tel. Rec. (See Model 21B116—Set 195-8)
21P702 (Ch. 191, B) Tel. Rec. ....201—5
21P702 (Ch. 196M, T) Tel. Rec. ....195—8
21P717 (Ch. 211T) Tel. Rec. (See Model 21B122—Set 194-4)
21P902 (Ch. 192) Tel. Rec. (TV Ch. only) ....201—5
21P905 (Ch. 213, M) Tel. Rec. ....211—8
21P908 (Ch. 199) Tel. Rec. 221—6
24B707 (Ch. 187, B, C) Tel. Rec. ....159—6
24M708 (Ch. 187, B, C) Tel. Rec. ....159—6
27M709 (Ch. 197) Tel. Rec. 219—6
600 (Ch. 154) Tel. Rec....95A—8
601 (Ch. 155) Tel. Rec....95A—8

HOFFMAN—Cont.

610 (Ch. 140) Tel. Rec....97A—6
612 (Ch. 142) Tel. Rec....97A—6
613 (Ch. 149) Tel. Rec....97A—6
630, 631 (Ch. 159) Tel. Rec. *
630, 631 (Ch. 170) Tel. Rec. ....150—7
632, 633 (Ch. 160) Tel. Rec. *
632, 633, 634, 635 (Ch. 171) Tel. Rec. ....150—7
634A, 635A (Ch. 173) Tel. Rec. ....150—7
636, 637 (Ch. 183) Tel. Rec. ....141—7
636B, 637B (Ch. 183 B) Tel. Rec. ....168—8
638, 639 (Ch. 180) Tel. Rec. ....144—5
816, 817 (Ch. 145) Tel. Rec. *
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—Set 97A-6)
836, 837 (Ch. 153) Tel. Rec. ....93A—8
840 (Ch. 153) Tel. Rec....93A—8
846 (Ch. 151) Tel. Rec. (See Model 830—Set 97A-6)
847, 848, 849 (Ch. 156) Tel. Rec. ....97A—7
860, 861, 862 (Ch. 157) Tel. Rec. ....97A—7
866, A, 867, A, 868, A (Ch. 173) Tel. Rec. ....150—7
870, 871, 872 (Ch. 170) Tel. Rec. ....150—7
876, 877, 878 (Ch. 171) Tel. Rec. ....150—7
876A, 877A, 878A (Ch. 173) Tel. Rec. ....150—7
880, 881, 882, 883, 884, 885, 886, 887 (Ch. 183) Tel. Rec. ....141—7
886B, 887B (Ch. 183B) Tel. Rec. ....168—8
890, 891, 892 (Ch. 175) Tel. Rec. ....150—7
893, 894, 895, 896, 897 (Ch. 185) Tel. Rec. ....141—7
896B, 897B (Ch. 183T) Tel. Rec. ....168—8
902 (Ch. 141, Radio Ch. 137) Tel. Rec. *
912, 913 (Ch. 147) Tel. Rec. ....95A—8
914, 915 (Ch. 150) Tel. Rec. ....97A—6
917, 918 (Ch. 152) Tel. Rec. ....97A—6
920 (Ch. 152) Tel. Rec. (See Model 830—Set 97A-6)
946, 947, 948 (Ch. 164) Tel. Rec. ....97A—7
950, 951, 952 (Ch. 172), 950A, 951A, 952A (Ch. 174) Tel. Rec. ....127—6
953, 954, 955 (Ch. 184) Tel. Rec. ....141—7
960, 961, 962 (Ch. 176) Tel. Rec. ....127—6
963, 964, 965 (Ch. 186) Tel. Rec. ....141—7
Ch. 102 (See Model A401)
Ch. 103 (See Model A200)
Ch. 107 (See Model A500)
Ch. 108ST (See Model A501)
Ch. 110S (See Model A700)
Ch. 114 (See Model B1000)
Ch. 119 (See Model A202)
Ch. 123 (See Model C504)
Ch. 137 (See Model 902)
Ch. 140 (See Model 610)
Ch. 141 (See Model 902)
Ch. 142 (See Model 612)
Ch. 143 (See Model 826)
Ch. 146 (See Model 820)
Ch. 147 (See Model 826)
Ch. 149 (See Model 613)
Ch. 150 (See Model 914)
Ch. 151 (See Model 830)
Ch. 152 (See Model 917)
Ch. 153 (See Model 836)
Ch. 154 (See Model 600)
Ch. 155 (See Model 601)
Ch. 156 (See Model 847)
Ch. 157 (See Model 860)
Ch. 164 (See Model 946)
Ch. 170, 171 (See Model 630)
Ch. 172 (See Model 950)
Ch. 173 (See Model 634A)
Ch. 174 (See Model 950A)
Ch. 175 (See Model 890)
Ch. 176 (See Model 960)
Ch. 183 (See Model 636)
Ch. 183B, 183M, 183T (See Model 636B)
Ch. 186 (See Model 963)
Ch. 187, B, C (See Model 24B707)
Ch. 190, B (See Model 7B104)
Ch. 191, B (See Model 21B107)
Ch. 192 (See Model 21B901)
Ch. 194 (See Model 20B102F)
Ch. 196, M (See Model 21B116)
Ch. 196T (See Model 21B701)
Ch. 197 (See Model 27M709)
Ch. 199 (See Model 21B907)
Ch. 200 (See Model 7B110B)
Ch. 201 (See Model 21M305)
Ch. 202 (See Model 7B113)
Ch. 210, M (See Model 7M109B)
Ch. 211, M (See Model 21B122)
Ch. 211T (See Model 21B315)
Ch. 212, M (See Model 7B113B)
Ch. 213, M (See Model 21B904)

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, -H, -I, -M, -W (See Model 901A Series—Set 1-8)
901A Series ....1—8

HOWARD—Cont.

901AP ....10—21
906, 906C ....17—18
909M ....25—15
920 ....5—7

HUDSON (Auto Radio)

DB47 (Fact. No. 6MH089). 25—16
DB848 (Fact. No. 6MH889) 39—9
225908 (Early) ....149—6
225908 (Late) (Ch. 749-1). 167—11
229403 (Ch. 749-2)......167—11
236476 (SH759) ....215—8
236486 (SH758) ....214—4
238060 (SH758) ....214—4

HUDSON (Dept. Stores)

30T14A-056 Tel. Rec. (Similar to Chassis) ....119—3
38T12A-058 Tel. Rec. (Similar to Chassis) ....109—1
317T3 Tel. Rec. (Similar to Chassis) ....72—4
318T4 Tel. Rec. (Similar to Chassis) ....85—3
318T4S Tel. Rec. (Similar to Chassis) ....85—3
318T4-872 Tel. Rec. (Similar to Chassis) ....85—3
318T6A Tel. Rec. (Similar to Chassis) ....85—3
318T6A-950 Tel. Rec. (Similar to Chassis) ....85—3
318T9A-900 Tel. Rec. (Similar to Chassis) ....78—4
321MS31C-A Tel. Rec. (Similar to Chassis) ....182—5
321MS39A Tel. Rec. (Similar to Chassis) ....226—11
518T6A Tel. Rec. (Similar to Chassis) ....85—3
518T9A-918 Tel. Rec. (Similar to Chassis) ....78—4
518T10A-916 Tel. Rec. (Similar to Chassis) ....78—4
2318T6A-954 Tel. Rec. (Similar to Chassis) ....85—3
2318T9A-912 Tel. Rec. (Similar to Chassis) ....78—4
2321MS39A Tel. Rec. (Similar to Chassis) ....226—11

HUDSON ELECTRONICS

RPM-71 ....186—6
3W ....191—11
11 ....194—5
39HB ....186—7
310R ....190—5
312H ....194—5
324H ....198—9
332H ....123—6
347BL ....121—8
350 ....126—6
374H ....188—7
388 ....191—12

HYDE PARK

AR14L Tel. Rec. ....169—8
AR17L Tel. Rec. ....169—8
MST12, MST14 Tel. Rec...168—9
14TR, 16TR Tel. Rec. ....168—9
17CD (1st Prod.) Tel. Rec. 168—9
17CD (2nd Prod.) Tel. Rec. 169—8
17CRR (1st Prod.) Tel. Rec. 168—9
17CRR (2nd Prod.) Tel. Rec. 169—8
17ROG (1st Prod.) Tel. Rec. 168—9
17ROG (2nd Prod.) Tel. Rec. ....169—8
20CD (1st Prod.) Tel. Rec. 168—9
20CD (2nd Prod.) Tel. Rec. 169—8
20TR Tel. Rec. ....168—9
112X Tel. Rec. ....168—9
203D (1st Prod.) Tel. Rec. 168—9
203D (2nd Prod.) Tel. Rec. 169—8
312 Tel. Rec. ....168—9
819 Tel. Rec. ....168—9
1000, 1001 Tel. Rec. ....169—8
3163CR Tel. Rec. ....168—9
8163CR Tel. Rec. ....168—9
8193CM Tel. Rec. ....168—9

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
721, 821, 921, 1021 (Ch. IT-21R) Tel. Rec. ....97A—8

INTERNATIONAL ELECTRONICS (See Recorder Listing)

JACKSON

DP-51 ....156—7
JP-20 ....173—7
JP-30 ....153—7
JP-50 ....155—9
JP-200 ....171—6
JP-300 ....174—7
JP-400 ....171—6
10C, 10T Tel. Rec. ....132—8
12C, 12T Tel. Rec. ....132—8
14C, 14T Tel. Rec. ....132—8
16C, 16T Tel. Rec. ....132—8
17XC, 17XT Tel. Rec. (See Model 10C—Set 132-8)
20XC, 20XT Tel. Rec. (See Model 10C—Set 132-8)
150 ....130—8
153 (See Model 150—Set 130-8)
214A, 217A, B, C, 220A, B, 221A, B Tel. Rec. ....171—7
254 ....173—8
255 ....179—7
312 Tel. Rec. ....132—8
316 Tel. Rec. ....132—8
350 ....131—9
412 Tel. Rec. ....132—8
416 Tel. Rec. ....132—8
1400T Tel. Rec. (See Model 10C—Set 132-8)
1700, T Tel. Rec. (See Model 10C—Set 132-8)
2000C Tel. Rec. (See Model 10C—Set 132-1)
5000, 5050 Tel. Rec. .... 88—5
5200, 5250 Tel. Rec. .... 88—5
5600, 5650 Tel. Rec. .... 88—5

JACKSON—Cont.

Ch. 114H Tel. Rec. ....162—7
Ch. 116H, 117H Tel. Rec. 162—7
Ch. 120H Tel. Rec. ....162—7
Ch. 317-8, -D Tel. Rec. ....226—3
Ch. 321-8, -D Tel. Rec. ....226—3

JEFFERSON-TRAVIS

MR-28 ....10—22
MR3 ....17—19

JEWEL

17C9, 17T9, 17TW7 Tel. Rec. ....187—7
21C9, 21T9 Tel. Rec. ....187—7
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 ....99—8
920A ....55—10
921 (See Model 920—Set 55-10)
935, 936 (See Model 920—Set 55-10)
949 ....105—5
955 ....98—5
956 ....144—6
960 ....97—8
960U, 961 (See Model 960—Set 97-8)
985 ....99—8
5007 ....183—7
5010 ....111—7
5020 ....136—10
5020U (See Model 5020—Set 136-10)
5040 ....160—5
5050 ....128—7
5057U ....109—7
5100, E, U ....159—7
5125U ....217—7
5200 ....194—6
5205 ....196—4
5250 ....206—7
5310 ....225—12

KAISER-FRAZER

100170 ....128—8
100205 ....139—6
200001 ....35—13
200002 ....56—13

KAPPLER

102T ....54—10

KARADIO

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

KAYE-HALBERT

012 (Ch. 243) Tel. Rec....169—9
014 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1)....146—8
024 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1)....146—8
033, 034, 035, 036, 037 (Ch. 242) Tel. Rec. ....139—7
044, 045, 046 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1) ....146—8
074, 076, 077 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1) ....146—8
114DX (Ch. 253DX) Tel. Rec. (Also see PCB 45—Set 179-1). 170—9
122 (Ch. 243) Tel. Rec. (See Model 012—Set 169-9)
146 (Ch. 253) Tel. Rec. (See Model 014—Set 146-8)
146 (Ch. 253DX) Tel. Rec. (See PCB 45—Set 179-1 and Model 114DX—Set 170-9)
231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241 (Ch. 231, 242) Tel. Rec. ....139—7
424, 425, 426 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1) ....146—8
425, 426 (Ch. 253DX) Tel. Rec. (See PCB 45—Set 179-1 and Model 114DX—Set 170-9)
428 (Ch. 253DX) Tel. Rec. (See PCB 45—Set 179-1 and Model 114DX—Set 170-9)
714 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1)....146—8
724 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1)....146—8
731, 733 (Ch. 231, 242) Tel. Rec. ....139—7
734, 735, 736, 737 (Ch. 242) Tel. Rec. ....139—7
744, 745 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1). 146—8
777 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1)....146—8
914 (Ch. 253) Tel. Rec. (Also see PCB 63—Set 197-1)....146—8
Ch. 231 (See Model 231)
Ch. 242 (See Model 033)
Ch. 243 (See Model 012)
Ch. 253 (See Model 014)
Ch. 253DX (See Model 114DX)
Ch. 263 Tel. Rec. ....217—8

KAY MUSICAL INSTRUMENT CO.

77 ....42—13

KITCHENAIRE

5 Tube Radio ....6—14

KNIGHT (Also see Recorder Listing)

4D-450 ....40—9
4G-420 ....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

KNIGHT—Cont.

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
5H-570 ....143—10
5H-571 (See Model 5H-570—Set 143-10)
5H-605 ....131—10
5H-607, 5H-608 (Similar to Chassis) ....97—15
5H-678, 5H-679 (Similar to Chassis) ....109—7
5H-700 ....123—7
5J-705 ....174—8
5K715 ....215—9
6A-122 ....9—18
6A-127 ....9—19
6A-195 ....16—19
6B-122 (See Model 6A-122—Set 9-18)
6B-127 (See Model 6A-127—Set 9-19)
6C-225 ....30—14
6D-225, 6D-226 (See Model 6C-225—Set 30-14)
6D-235 ....54—11
6D-360 ....39—10
6G-400 (See Model 449—Set 83-5)
6H-580 ....126—7
6K718 ....217—9
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
11D-302 ....57—9
12H-610 ....176—5
14F-490, 14F-495, 14F496. 63—12
15H-609 (See Model 511B—Set 125-9)
19F492, 19F497, 19F498.. 58—11
20H611 ....164—4
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
93-431 ....167—12
96-279 ....160—6
96-326 ....137—5
96-354 (Similar to Chassis) 139—15
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
P564 (Similar to Chassis).. 38—5
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
1P184 Tel. Rec. (Similar to Chassis) ....149—13
1P185, 1P186 Tel. Rec. (Similar to Chassis) ....149—13
17BM1 Tel. Rec. (Similar to Chassis) ....149—13
20CP Tel. Rec. (Similar to Chassis) ....149—13
27BM1 Tel. Rec. (Similar to Chassis) ....149—13

LAMCO

1000 ....16—20

LEAK

TL/12 ....166—12
RC/PA/U ....166—12

LEAR (See Record Changer Listing)

LEARADIO

Chassis R-971 ....51—11
RM-402C (Learavian) ....42—15
561, 562, 563 ....1—26
563, 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 (See Royal)

LEE TONE

AP-100 ....16—23

LEWYT

615A ....11—13
711 ....42—16

LEXINGTON

6545 ....13—20

LIBERTY

A6K, A6P, 6K ....20—18
507A ....20—19

NOTE: PCB denotes Production Change Bulletin

LINCOLN (Auto Radio)
1CH748 (1H-18805) (See Ford Model 1CF743—Set 133-7)
1CH-748-1 (1H-18805) ... 158—5
2CH753 (FAA-18805-A) .. 167—7
3SH-766 (FAG-18805-A) .. 214—5
7ML080 (5EH-18805-A), 7ML081 (5EH18805-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), 8BML985ZE (8H-18805) .... 83—4

LINCOLN
S13L-E 2-10

LINCOLN (Allied Radio Corp.)
5A-116 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 .... 38—9

MAGNAVOX
104 Series (Ch. CT301 thru CT314) Tel. Rec. .... 161—4
Chassis AMP-101A, AMP-101B 43-12
Chassis AMP-108A, AMP-108B 41-10
Chassis AMP-111A, B, C.. 68-10
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-207A, B, C, D. 41-12
Chassis CR-208A, CR-208B 43-13
Chassis Models CR-210A, CR-210B 52-11
Chassis CR-211A, B 68-10
Chassis CT-214, CT-218 Tel. Rec. 62-13
Chassis CT-219, CT-220 Tel. Rec. .... 82—7
Chassis CT-221 Tel. Rec... 62-13
Chassis CT-222 Tel. Rec... 82—7
Chassis CT-224 Tel. Rec... 97A—8
Chassis CT-232 Tel. Rec... 93A—9
Chassis CT-235 Tel. Rec... 97A—8
Chassis CT-236 Tel. Rec... 93A—9
Chassis CT-237, CT-238 Tel. Rec. (See Set 95A-9 and Ch. CT219—Set 82-7)
Chassis CT239 Tel. Rec... 93A—9
Chassis CT244, CT245, CT246 Tel. Rec. .... 93A—9
Chassis CT247, CT248, CT249 Tel. Rec. .... *
Chassis CT250, CT251 Tel. Rec. 135-1A
Chassis CT252, CT253 Tel. Rec. .... 95A—8
Chassis CT255 Tel. Rec.... *
Chassis CT257, CT258, CT259, CT260 Tel. Rec. 119-1A
Chassis CT262, CT263, CT264, CT265 Tel. Rec. 155-10
Chassis CT266, CT267, CT269 Tel. Rec. 131-1A
Chassis CT-270, CT-271, CT-272, CT-273, CT-274, CT-275, CT-276, CT-277, CT-278, CT-279, CT-280, CT-281, CT-282 Tel. Rec. 148—8
Chassis CT283 Tel. Rec.... 155-10
Chassis CT284, CT285 Tel. Rec. 131-1A
Chassis CT286 Tel. Rec.... 155-10
Chassis CT287, CT288 Tel. Rec. 131-1A
Chassis CT289 Tel. Rec.... 155-10
Chassis CT290 Tel. Rec.... 131-1A
Chassis CT291, CT293 Tel. Rec. 155-10
Chassis CT294 Tel. Rec.... 131-1A
Chassis CT295, CT296 Tel. Rec. .... *
Chassis CT297 Tel. Rec.... 155-10
Chassis CT301 thru CT314 Tel. Rec. .... 161—4
Chassis CT331 thru CT349 (105 Series) Tel. Rec. 168-10
Chassis CT350 thru 357 (105 Series) Tel. Rec. (See Ch. CT331—Set 168-10)
Chassis CT358 (107 Series) Tel. Rec. .... 226—4
Chassis CT362, CT363 (105L, M Series) Tel. Rec. .... 205—6
Chassis CT372, CT373 (105L, M, N Series) Tel. Rec. .... 205—6
Chassis CT374 (105N Series) .... 205—6
Chassis MCT228 Tel. Rec.. 95A—9

MAGNECORD (See Recorder Listing)

MAGUIRE (Also see Record Changer Listing)
500BI, 500BW, 500DI, 500DW 6-15
561BI, 561BW, 561DI, 561DW 6-16
571 44-10
661, 661A 12-18
700A 7-18
700E 15-17

MAJESTIC
G-414 Tel. Rec. .... 133—8
G-614 Tel. Rec. .... 133—8
G-624 Tel. Rec. .... 133—8
G-914 Tel. Rec. .... 133—8
5A410 (Ch. 4501), 5A430 (Ch. 4504) 1-30
5A445, 5A445R 23-12
5AK711 27-17
5AK731, 5AK780 (Ch. 5B05A) 28-19
5C-2, 5C-3 169-10
5LA5, 5LA6 .... 130—9
5LA7, 5LA8 .... 132—9
6FM714 (Ch. 6B02D) 50-10
6FM773 (Ch. 6B11D) 57-10
7BK758 (See Model 7J777R—Set 27-18)
7C432 (Ch. 4706) 14-17
7C447 (Ch. 4707) (See Model 7C432—Set 14-17)
7FM877, 7FM888 (Ch. 7C11D) 56-14
7JK777R (Ch. 4708R) 27-18
7JL866 (Ch. 7C25A) 60-14
7P420 (Ch. 4705) 26-17
7S433, 7S450, 7S470 (Ch. 4702, 4703) 22-19
7TV850, 7TV852 (Ch. 18C90, 18C91) Tel. Rec. .... *
7YR752 (Ch. 7B04A) 29-13
7YR753 (Ch. 7B09A-1), 7YR772 (Ch. 7B09A) 42-17
8FM744 (Ch. 8B06D) 30-15
8FM775 (Ch. 8B08D), 8FM776 (Ch. 8B07D) 29-14
8FM889 (Ch. 8C07D) 54-12
8JL885 (Ch. 4810B) 47-11
8S452, 8S473 (Ch. 4810).. 8-19
10FM891 (Ch. 10C23E) (See Model 10FM981—Set 65-8)
12C4, 12C5 Tel. Rec. .... 108—7
12FM475, 12FM778, 12FM779 (Ch. 41201) 28-20
12FM895 (Ch. 12C22E) 59-11
12T2, 12T3 Tel. Rec. .... 108—7
12T6 Tel. Rec. (See Model 12C4—Set 108-7)
14C4 Tel. Rec. (See Model 12C4—Set 108-7)
14CT4 Tel. Rec. .... 133—8
14T2 Tel. Rec. (See Model 12C4—Set 108-7)
16C4, 16C5 Tel. Rec. .... 108—7
16CT4, 16CT5 Tel. Rec. .... 133—8
16T2, 16T3 Tel. Rec. .... 108—7
17C62, 17C64, 17C65 (Series 106) Tel. Rec. (See PCB 43—Set 177-1 and Model 70—Set 153-8)
17DA (Ch. 101) Tel. Rec... 127—7
17GA, 17HA (Ch. 101) Tel. Rec. .... 127—7
17T6A1, 17T6B1 (Series 106) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
17T62 (Series 106) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
19C6, 19C7 Tel. Rec. .... 133—8
20C82, 20C83, 20C84 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
20FP88, 20FP89 (Series 109) Tel. Rec. 170-10
20F82, 20F83 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
20F85, 20F86, 20F87 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
20F811 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
20T8A1 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
20T82, 20T83, 20T84 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
21C30, 20C31 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
21D40, 21D41 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
21D50, 21D51 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
21F86, 21F87 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
21F88, 21F89 (Series 108-5) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
21P62, 21P63 (Series 110, 111) Tel. Rec. .... 221—7
21T20, 21T21 (Series 108) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
22 Thru 35 (Series 106-5) Tel. Rec. (See Model 70—Set 153-8 and PCB 43—Set 177-1)
70, 72, 73 (Series 106) Tel. Rec. (Also see PCB 43—Set 177-1) .... 153—8
80FMP2 .... 137—6
120, 121, 121B (Ch. 99) Tel. Rec. (Also see PCB 37—Set 166-2) .... 127—7
141, 141B (Ch. 100), 141C (Ch. 101), 142, 142B (Ch. 100) Tel. Rec. .... 127—7
143 Tel. Rec. (See PCB 37—Set 166-2 and Model 17DA—Set 127-7)
160, 160B, 162, 163 (Ch. 101) Tel. Rec. .... 127—7
170 (Ch. 101) Tel. Rec.... 127—7
173 Tel. Rec. (See PCB 37—Set 166-2 and Model 17DA—Set 127-7)
700, 701 (Series 106) Tel. Rec. (Also see PCB 43—Set 177-1) .... 153—8
712, 715, 717, 718, 719 (Series 106) Tel. Rec. (Also see PCB 43—Set 177-1) .... 153—8
800, 801, 802, 803, 804 (Series 108) Tel. Rec. (Also see PCB 43—Set 177-1) .... 153—8

MAJESTIC—Cont.
902, 903 (Ch. 103) Tel. Rec. .... 127—7
910, 911 (Ch. 103) Tel. Rec. .... 127—7
1042, G, GU, T Tel. Rec. (See Model 12C4—Set 108-7)
1043, G, GU, T Tel. Rec. (See Model 12C4—Set 108-7)
1142, 1143 Tel. Rec. (See Model 12C4—Set 108-7)
1244, G, GU, T, TX Tel. Rec. (See Model 12C4—Set 108-7)
1245, G, GU, T, TX Tel. Rec. (See Model 12C4—Set 108-7)
1348 Tel. Rec. (See Model 12C4—Set 108-7)
1400, B (Ch. 100) Tel. Rec. 127—5
1401 (Ch. 105) Tel. Rec. (Also see PCB 37—Set 166-2).... 127—7
1546, G, GU, T Tel. Rec. (See Model 12C4—Set 108-7)
1547, G, GU, T Tel. Rec. (See Model 12C4—Set 108-7)
1548, G, GU, T Tel. Rec. (See Model 12C4—Set 108-7)
1549, G, GU, T Tel. Rec. (See Model 12C4—Set 108-7)
1600, 1600B (Ch. 101) Tel. Rec. .... 127—7
1605, 1605B (Ch. 102) Tel. Rec. .... 127—7
1610, 1610B (Ch. 102) Tel. Rec. .... 127—7
1646, 1647, 1648, 1649 Tel. Rec. (See Model 12C4—Set 108-7)
1671, 1672, 1673, 1674, 1675 Tel. Rec. .... 133—8
1700C Tel. Rec. (See PCB 37—Set 166-2 and Model 17DA—Set 127-7)
1710 (Ch. 101) Tel. Rec... 127—7
1710C (Ch. 101) Tel. Rec. (See PCB 37—Set 166-2 and Model 17DA—Set 127-7)
1720, 1721 Tel. Rec. (See PCB 37—Set 166-2 and Model 17DA—Set 127-7)
1900 Tel. Rec. 95A-10
1974, 1975 Tel. Rec. ...... 133—8
2042T, 2043T Tel. Rec. (See Model 12C4—Set 108-7)
2546T, 2547T, 2549T Tel. Rec. (See Model 12C4—Set 108-7)
Ch. 5B01A (See Model 5AK711)
Ch. 5B05A (See Model 5AK731)
Ch. 6B02D (See Model 6FM714)
Ch. 6B11D (See Model 6FM773)
Ch. 7B04A (See Model 7YR752)
Ch. 7B09A (See Model 7YR772)
Ch. 7B09A1 (See Model 7YR753)
Ch. 7C11D (See Model 7FM887)
Ch. 7C25A (See Model 7JL866)
Ch. 8B06D (See Model 8FM744)
Ch. 8B07D (See Model 8FM776)
Ch. 8B08D (See Model 8FM775)
Ch. 8C07D (See Model 8FM889)
Ch. 10C23E (See Model 10FM891)
Ch. 12B26E (See Model 12FM475)
Ch. 12C22E (See Model 12FM895)
Ch. 18C90, 18C91 (See Model 7TV850)
Ch. 4501 (See Model 5A410)
Ch. 4504 (See Model 5A430)
Ch. 4506 (See Model 5A445)
Ch. 4702, 4703 (See Model 7S433)
Ch. 4705 (See Model 7P420)
Ch. 4706 (See Model 7C432)
Ch. 4707 (See Model 7C447)
Ch. 4708R (See Model 7JK777R)
Ch. 4810 (See Model 8S452)
Ch. 4810B (See Model 8JL885)
Ch. 41201 (See Model 12FM475)

MALLORY
TV-101 (Below Serial No. 200,000) Tel. UHF Conv. .... 194—7
TV-101 (Serial No. 200,000 and Above) Tel. UHF Conv... 194—8

MANTOLA (B. F. Goodrich Co.)
R630-RP 3-22
R643-PM (See Model R643W—Set 4-29)
R643W 4-29
R652, R652N 9-22
R654 PM, R654-PV .... 3—5
R655W (Ch. No. 501APH) 8-20
R662, R662N 3-33
R664, R664-PV, R664-W.. 23-13
R-743-W (See Model R643W—Set 4-29)
R-7543 18-23
R-75143 39-12
R-75152 38-10
R-75343 39-12
R-76143 (See Model 24B6—Set 25-17)
R-76162 40-10
R76262 (Fact. No. 7160-17) 51-12
R-78162 43-11
24B6 25-17
92-502 (See Model R643W—Set 4-29)
92-503, 92-504 (See Model R654PM—Set 3-5)
92-505, 92-506 (See Model R664PM—Set 23-13)
92-520, 92-521, 92-522.. 68-11
92-529 .... 150—8

MARKEL
(See Record Changer Listing)

MARK SIMPSON (See Masco)

MASCO
(Also see Recorder Listing)
AC-12, AC-24 .... 222—7
ACL .... 222—7
ACS, ACS-6 .... 222—7
CM-20 .... 218—6
EMM-6 .... 216—3
IM-5 41-13
IM-10 .... 186—8
JMR 31-17
JM-5 (Master Station), JR (Sub-Station) 42-18
JM-10 .... 187—8
JMP-6 .... 147—7

MASCO—Cont.
JMP-12 .... 147—7
MA-8N .... 119—8
MA-10HF .... 112—4
MA-10EX .... 113—4
MA-12HF 51-13
MA-17 14-32
MA-17N 50-11
MA-17P 14-32
MA-17PN 50-11
MA-20HF 28-21
MA-25 16-24
MA-25EX 60-15
MA-25HF 54-13
MA-25N 43-14
MA-25NR 49-12
MA-25P 16-24
MA-25PN (See Model MA-25N—Set 43-14)
MA-35 21-20
MA-35N 44-11
MA-35RC 21-20
MA-50 30-16
MA-50N (See Model MA-5NO—Set 45-15)
MA-50NR 53-14
MA-60 .... 119—9
MA-75 28-22
MA-75N 52-27
MA-77, MA-77R .... 190—7
MA-121 24-21
MA-125 .... 188—8
MA-808 26-18
MAP-15 26-19
MAP-18 59-12
MAP-105 25-18
MAP-105N 52-12
MAP-120 21-21
MAP-120N 46-15
MB-8N .... 196—5
MB-50N 58-12
MB-60 .... 127—8
MB-60 (Late) 148-10
MB-75 61-15
MB-77 .... 206—8
MB-125 .... 211—9
MC-10 47-12
MC-25, MC-25P 17-21
MC-25N, MC-25PC, MC-25PN, MC-25RC 57-11
MC-126, MC-126P .... 111—8
MCR-5 15-18
ME-8 152-10
ME-18, ME-18P .... 151—8
ME-27 155-11
ME-36, ME-36R .... 154—7
ME-52 .... 149—7
MHP-110 .... 114—6
MHP-110X .... 115—5
Midgetalk .... 116—7
MM-27P .... 153—9
MPA-3, MPT-4 16-25
MSD-16 .... 150—9
MU-5 .... 117—6
MU-17 .... 185—8
PR-1 .... 218—6
RK-5 (Early) 33-11
RK-5, RK-5L, RK-5M, RK-5ML, RK-5SL 168-11
RK-5SLR .... 177—9
T-16 .... 123—8
TD-16 .... 120—8
TP-16A 30-17
WF-1A .... 209—8
76, 711 20-20
86, 811 20-21

MASON
45-1A 14-18
45-1B, 45-1P, 45-3, 45-4, 45-5 (See Model 45-1A—Set 14-18)

MATTISON
630-6A Tel. Rec. .... 218—7
630-6AB Tel. Rec. .... 218—7

MAYFAIR
510, 510W, 520, 520W, 530, 530W 25-20
550, 550W 24-22

McGOHAN (Don)
MG-7 .... 195—7
MG-10B .... 190—8
MG-18B .... 191—6
MG-20-B .... 189—5
MG-30-B .... 188—9
WA-312 .... 227—9

McGRADE
M-100 16-27

MECK (Trail Blazer-Plymouth)
CD-500 (PX-5CS-EW-19) . 33-12
CE-500 (5CS-P12) 34-10
CM-500 (5D7-W18) 34-11
CR-500 38-11
CW-500 40-11
CX-500 48-13
DA601, DB6021 81-10
EC720 .... 85—8
EF-730, EG-731 (Ch. 10003) 89—8
EV-760 .... 104—7
JM717C (Ch. 9021) Tel. Rec. 148-11
JM717C (Ch. 9032) Tel. Rec. .... 186—9
JM717C (Ch. 9040) Tel. Rec. .... 220—4
JM717CU (Ch. 9021) Tel. Rec. 148-11
JM717T (Ch. 9021) Tel. Rec. 148-11
JM-717T (Ch. 9032) Tel. Rec. .... 186—9
JM717T (Ch. 9040) Tel. Rec. .... 220—4
JM717TU (Ch. 9021) Tel. Rec. 148-11
JM720C, CU (Ch. 9021) Tel. Rec. 148-11
JM720C (Ch. 9032) Tel. Rec. .... 186—9
JM720T (Ch. 9021) Tel. Rec. 148-11
JM720T (Ch. 9032) Tel. Rec. .... 186—9
JM720TU (Ch. 9021) Tel. Rec. 148-11

MECK—Cont.
JM721C, CD (Ch. 9032) Tel. Rec. .... 186—9
JM721C, D (Ch. 9040) Tel. Rec. .... 220—4
MM510T, MM512T, MM516C, MM-516T Tel. Rec. .... 110—9
MM614C, T (Ch. 9018) Tel. Rec. (Also see PCB 12—Set 120-1) .... 117—8
MM616C, T (Ch. 9018) Tel. Rec. (Also see PCB 12—Set 120-1) .... 117—8
MM-617C, T (Ch. 9032) Tel. Rec. (See Model JM-717C—Set 186-9)
MM617T (Ch. 9040) Tel. Rec. .... 220—4
MM619C (Ch. 9018) Tel. Rec. (Also see PCB 12—Set 120-1). 117—8
MM-620C, T (Ch. 9032) Tel. Rec. (See Model JM-717C—Set 186-9)
MM621C (Ch. 9040) Tel. Rec. .... 220—4
MM621RPT, RPTB (Ch. 9040) Tel. Rec. .... 220—4
MM621T (Ch. 9040) Tel. Rec. .... 220—4
M616C, T (Ch. 9023) Tel. Rec. (See Model JM717C—Set 148-11)
M620C, T (Ch. 9023) Tel. Rec. (See Model JM717C—Set 148-11)
PM-5CS-DW10 .... 2—4
PM-5CS-PW10 12-19
RC-5C5-P .... 1—9
RC-6A7-P6 31-19
SA-10, SA-20 .... 101—4
XA-701 Tel. Rec. 61-16
XE-705 (See Model XA-701—Set 61-16)
XF-777 Tel. Rec. .... 101—5
XL750 Tel. Rec. 76-14
XN-752 Tel. Rec. .... 101—5
XOB Tel. Rec. .... 110—9
XP-775 Tel. Rec. .... 101—5
XQA Tel. Rec. .... 110—9
XQA-776 Tel. Rec. .... 101—5
XQR Tel. Rec. .... 110—9
XQ-776 Tel. Rec. .... 101—5
XRA, XRPT Tel. Rec. .... 110—9
XR-778 Tel. Rec. .... 101—5
XSA Tel. Rec. .... 110—9
XSB (Ch. 9018) Tel. Rec. (Also see PCB 12—Set 120-1).... 117—8
XSC, XSD (Ch. 9018) Tel. Rec. (See Model MM614C—Set 117-8 and PCB 12—Set 120-1)
XSPT Tel. Rec. .... 110—9
XS-786 Tel. Rec. .... 101—5
XTA, XTR Tel. Rec. .... 110—9
XT-785 Tel. Rec. .... 101—5
XX900 Tel. Rec. .... 110—9
4B7 .... *
4C7 35-14
5A7-P11, 5A7-PB11 31-18
5D7/WL18 21-22
6A6-W4 16-26
514C, T (Ch. 9018) Tel. Rec. (See Model MM614C—Set 117-8 and PCB 12—Set 120-1)
614C, 614TL (Ch. 9022) Tel. Rec. (See Model JM717C—Set 148-11)
616C, T (Ch. 9018) Tel. Rec. (See Model MM614C—Set 117-8 and PCB 12—Set 120-1)
617C, 617TL (Ch. 9022) Tel. Rec. (See Model JM717C—Set 148-11)
619C, T (Ch. 9018) Tel. Rec. (See Model MM614C—Set 117-8 and PCB 12—Set 120-1)
Ch. 9018 (See Model MM614C)
Ch. 9021 (See Model JM717C)
Ch. 9022 (See Model 614C)
Ch. 9023 (See Model M616T)
Ch. 9032 (See Model JM717C)
Ch. 9040 (See Model JM717C)

MEDCO (See Telesonic)

MEISSNER
TV-1 (Ch. 24TV) Tel. Rec.. 56-15
4E .... 172—5
5A (See Maguire Model 571—Set 44-10)
6H (See Maguire Model 661—Set 12-18)
8BT .... 161—5
8C 37-12
9AJ .... 123—9
9-1065 3-15
9-1091A, 9-1091B 35-15
9-1091C .... 116—8
9-1093 55-13
16A .... 105—6
24TV Tel. Rec. (See Model TV1—Set 56-15)
574 (See Maguire Model 571—Set 44-10)
661 (See Maguire Model 661—Set 12-18)
2961 Series 27-19

MERCURY (Automobile)
GM891 (OM-18805-A) (See Ford Model GF890—Set 109-5)
SM-757 (FAF-18805-A) ... 214—5
1CM747 (1M-18805) (See Ford Model 1CF743—Set 133-7)
1CM747-1 (1M-18805) ... 158—5
2CM752 (FAB-18805-A) .. 167—7
6MM790, -E 62-12
8MM890 (Ch. 8E90) (8M-18805-B) 49-13
8MM990 (8M-18805-B) ... 69-10
8MM991 (8M-18805-B), 8MM991-E (8M-18805) .... 83—4

MERCURY (Pacific-Mercury)
2013 (Ch. 150-2) Tel. Rec. (Also see PCB 57—Set 190-1). 172—6
2080 (Ch. 150-2) Tel. Rec. (See PCB 57—Set 190-1 and Model 2013—Set 172-6)
2081 (Ch. 150-4 and Radio Ch. 155) Tel. Rec. 198-11
2113, 2115 (Ch. 150-11, -81) Tel. Rec. (Also see PCB 57—Set 190-1) .... 172—6
2116, 2117 (Ch. 150-81) Tel. Rec. (See PCB 57—Set 191-1 and Model 2013—Set 172-6)

NOTE: PCB denotes Production Change Bulletin

MERCURY—Cont.

2181 (Ch. 150-31, -61 and Radio Ch. 155) Tel. Rec. 198—11
2192 (Ch. 150-10 and Radio Ch. 160) *
2217, 2218, X (Ch. 200-11) Tel. Rec. 216—8
2224 (Ch. 200-11) Tel. Rec. 216—8
2284 (Ch. 200-11) Tel. Rec. 216—8
2401 (Ch. 150-5, -51) Tel. Rec. (Also see PCB 57—Set 191-1) 172—6
4120 (Ch. 150-2) Tel. Rec. (Also see PCB 57—Set 190-1) 172—6
4220 (Ch. 150) Tel. Rec. (Also see PCB 57—Set 190-1) 172—6
4317 (Ch. 150-7, -12) Tel. Rec. *
4317 (Ch. 150-9) Tel. Rec. 172—6
4320 (Ch. 150-2, -15 Tel. Rec. (Also see PCB 57—Set 191-1) 172—6
4421 (Ch. 150-81) Tel. Rec. (See Model 2013—Set 172-6 and PCB 57—Set 191-1)
4721 (Ch. 150-10 and Radio Ch. 160) *
Ch. 150-2 (See Model 2013)
Ch. 150-4 (See Model 2081)
Ch. 150-5 (See Model 2401)
Ch. 150-7 (See Model 4317)
Ch. 150-9 (See Model 4317)
Ch. 150-11 (See Model 2113)
Ch. 150-12 (See Model 4317)
Ch. 150-15 (See Model 4320)
Ch. 150-31 (See Model 2181)
Ch. 150-51 (See Model 2401)
Ch. 150-61 (See Model 2181)
Ch. 150-81 (See Model 2113)
Ch. 155 (See Model 2081)
Ch. 200-11 (See Model 2217)

MIDLAND

M6B 2—30

MIDWEST

P6, P8-6 14—19
R-12, RG-12, RT-12 (Ch. RGL-12) 44—12
R-12, RG-12, RT-12 (Ch. RGT-12) 44—13
R-16, RG-16, RT-16 (Ch. RGT-16) 45—16
S8, ST-8 (Ch. STM-8) 15—19
S-12, SG-12, ST-12 (Ch. SGT-12) 21—23
S-16, SG-16, ST-16 (Ch. SGT-16) 21—24
TM-8 (Ch. STM-8) 15—19
716, A (See Model S-16—Set 21-24)

MILWAUKEE ERWOOD
(See Record Changer Listing)

MINERVA

L-702 12—20
L-728 11—15
W-117, Tropic Master 6—17
W-117-3 11—14
W-702B 12—20
W710, W710A (W119) 5—25
W-728 11—15
410, 411 41—14
702H, 702H-1 30—18
729 (Portapal) 23—14

MIRRORTONE (Also see Meck)

A-17C, T (Ch. 9040) Tel. Rec. 216—4
A-21C, CB, T, TB, X, Z (Ch. 9040) Tel. Rec. 216—4
14MTS Tel. Rec. 163—7
16MC, MT, 17MC, MT, MZ-C, MZ-T Tel. Rec. 163—7
17PC (Ch. 9025) (Series "P") Tel. Rec. (See Model 20PC—Set 175-12)
17PCSB, 17PCW Tel. Rec. 204—5
17PT (Ch. 9025) (Series "P") Tel. Rec. (See Model 20PC—Set 175-12)
17PTE Tel. Rec. 204—5
20MC, MT, MZ-C, MZ-T Tel. Rec. 163—7
20PC Tel. Rec. 175—12
20PCSB, 20PCW Tel. Rec. 204—5
20PT Tel. Rec. (See Model 20PC—Set 175-12)
20PTE, 20PTS, 20PTSB, 20PTW Tel. Rec. 204—5
20TPRSB Tel. Rec. 204—5
21PCS Tel. Rec. 204—5
21QDCS Tel. Rec. 204—5
24QDCS Tel. Rec. 204—5
Ch. 9040 (See Model A-17C)

MITCHELL

T16-B, -M, T16-2KB, T16-2KM, T17-B, -M Tel. Rec. 154—8
T172B, T-172M Tel. Rec. 189—11
T212-B, -M Tel. Rec. 190—9
1250, 1251 55—14
1252, 1253 155—12
1254, 1255 159—8
1256 156—8
1267 158—7
1268R 127—9

MOLDED INSULATION CO.
(Also see Viz)

MR-6 (Wiretone) 41—15

MONITOR

M-403 (Fact. No. 470-2) 22—20
M-500 (Fact. No. 475) 28—23
M-510 (Fact. No. 472) 23—15
M-3070 29—15
RA-50 24—23
TA56M, TW56M 6—18

MONITORADIO
(Radio Apparatus)

AR-1 164—5
AR-3 175—13
M-51A 162—8
M-101 159—9

MONTGOMERY WARD
(See Airline)

MOPAR

602 (671A) 19—20
603 65—9
604 106—9
606 133—9
607 170—11
608 207—4
609 201—6
610T 220—5
802 (C-4608) 18—24
802 (C-4608) (Revised) 42—19
803 (PD-4908) 66—12
804 67—12
805 (C-4908) 71—11
806, 807 (See Model 803—Set 66-12)
808 107—6
809 (C-5009) (See Model 805—Set 71-11)
810 (C-5010) (See Model 805—Set 71-11)
812 (P-5106) 139—8
813 (D5107) 139—8
814 137—7
815 (C-5109) 139—8
816 (C-5110) 139—8
817 (C-5111) 139—8
819, 820 202—3
821 204—6
824 202—3

MOTOROLA (Also see Record Changer Listing)

AR-96-23 (M-5) 11—16
BKO-A (See Ch. 10A—Set 106-10)
BK2A (Ch. 2A and P6-2 or P8-2) 197—7
BK2M (Ch. 2M and P6-2 or P8-2) 197—7
BK-6 10—23
BK8, X (See Ch. 8A—Set 46-16)
CR-6 20—24
CR-76 25—21
CTO (See Model CT-9—Set 82-8)
CT1 (See Ch. 1A—Set 134-8)
CT1M 143—11
CT2A (Ch. 2A and P6-2 or P8-2) 197—7
CT2M (Ch. 2M and P6-2 or P8-2) 197—7
CT-6 8—21
CT8 (See Ch. 8A—Set 46-16)
CT8-A (See Ch. 10A—Set 106-10)
CT9 82—8
FD-6 7—20
FD7 (See Model FD-6—Set 7-20)
FD8 (See Ch. 8A—Set 46-16)
GMOT (See Ch. 10A—Set 106-10)
GMT2A (Ch. 2A and P6-2 or P8-2) 197—7
GMT2M (Ch. 2M and P6-2 or P8-2) 197—7
GM9T (See Ch. 8A—Set 46-16)
GM9T-A (See Ch. 10A—Set 160-10)
HJ2A (Ch. 2A and P6-2 or P8-2) 197—7
HJ2M (Ch. 2M and P6-2 or P8-2) 197—7
HNO (See Ch. 10A—Set 106-10)
HN2A (Ch. 2A and P6-2 or P8-2) 197—7
HN2M (Ch. 2M and P6-2 or P8-2) 197—7
HN8, HN9 (See Ch. 8A—Set 46-16)
ILOTC (See Ch. 10—Set 106-10)
IL2TC (See Ch. 1A—Set 134-8)
IL2T2 (See Ch. 1A—Set 134-8)
KR1 (See Ch. 1A—Set 134-8)
KR2A (Ch. 2A and P6-2 or P8-2) 197—7
KR2M (Ch. 2M and P6-2 or P8-2) 197—7
KR8, KR9 (See Ch. 8A—Set 46-16)
KR9A (See Ch. 10A—Set 106-10)
NHIC 139—9
NH2AC (See Nash Model AC-152—Set 184-9)
NH3C (See Nash Model NH3C—Set 216-6)
NH6 9—24
NH8 (See Ch. 8A—Set 46-16)
OEO (See Ch. 10A—Set 106-10)
OE2 (See Ch. 8A—Set 46-16)
OE2A (Ch. 2A and P6-2 or P8-2) 197—7
OE2M (Ch. 2M and P6-2 or P8-2) 197—7
OE6 8—21
OE8, OE9 (See Ch. 8A—Set 46-16)
PCO (See Ch. 10A—Set 106-10)
PC2 (See Ch. 8A—Set 46-16)
PC2A (Ch. 2A and P6-2 or P8-2) 197—7
PC2M (Ch. 2M and P6-2 or P8-2) 197—7
PC6 8—21
PC8, PC9 (See Ch. 8A—Set 46-16)
PC9-A (See Ch. 10A—Set 106-10)
PD2A (Ch. 2A and P6-2 or P8-2) 197—7
PD2M (Ch. 2M and P6-2 or P8-2) 197—7
SROB (Ch. OB) 105—7
SR1B (See Ch. 1B—Set 136-11)
SR2A (Ch. 2A and P6-2 or P8-2) 197—7
SR2M (Ch. 2M and P6-2 or P8-2) 197—7
SP6, SR8, SR9 (See Ch. 8A—Set 46-16)
SR9A (See Ch. 10A—Set 106-10)
TC-101, B Tel. UHF Conv. 196—6
TK-17M Tel. UHF Conv. 193—5
TK19M Tel. UHF Conv. 193—5
TK-19ME Tel. UHF Conv. (See Model TK17M—Set 193-5)
TK-20M Tel. UHF Conv. 193—5
TK-22M Tel. UHF Conv. 193—5
TK-23M Tel. UHF Conv. 193—5
TK-24M Tel. UHF Conv. 193—5
TK-24ME Tel. UHF Conv. (See Model TK17M—Set 193-5)
TK-31M Tel. UHF Conv. (See Model TK17M—Set 193-5)
TK-33M Tel. UHF Conv. (See Model TK17M—Set 193-5)

MOTOROLA—Cont.

VF102, A, C (Ch. TS-7 and Radio Ch. HS-317) Tel. Rec. 51—14
VF103, VF103M (Ch. TS-8) Tel. Rec. 73—8
VK101, 8, M (Ch. TS-5 and Radio Ch. HS-108) Tel. Rec. 51—14
VK106 (Ch. TS-9D) Tel. Rec. Photo-fact Servicer 82
VK106, B, M (Ch. TS-9, A, B, C) Tel. Rec. 67—13
VK106, VK107 (Ch. TS-9E, TS-9E1) Tel. Rec. 77—6
VTK-17M, ME Tel. UHF Conv. (See Model TK17M—Set 193-5)
VT71B, M-A (Ch. 4B through J) Tel. Rec. 55—16
VT-73, VT-73A (Chassis TS-4J Late) Tel. Rec. 71—12
VT101 (Ch. TS-3) Tel. Rec. 51—14
VT105 (Ch. TS-9D) Tel. Rec. Photo-fact Servicer 82
VT105, VT105M (Ch. TS-9, TS-9A, TS-9B, TS-9C) Tel. Rec. 67—13
VT107 (Ch. TS-9D) Tel. Rec. Photo-fact Servicer 82
VT107, B, M (Ch. TS-9, A, B, C) Tel. Rec. 67—13
VT121 (Ch. TS-15) Tel. Rec. 91A—9
WR6 (Ch. HS-18) 5—2
WR7, WR8 (See Model WR6—Set 5-2)
WS1C (See Willys Model 677012—Set 156-14)
WS2C (See Willys Model 679517—Set 172-12)
2MF (See Ford Model 2MF—Set 175-10)
3MF (See Ford Model 3MF—Set 206-5)
3MFT (See Ford Model 3MFT—Set 215-7)
5A1 (Ch. HS-6) 2—11
5A5 (Ch. HS-15) 3—11
5A7 (Ch. HS-62), 5A7A (Ch. HS-62A) 29—16
5C1 (Ch. HS-228) 116—9
5C2 (Ch. HS-258) 116—9
5C3 (Ch. HS-262) 116—9
5C4 (Ch. HS-270) 116—9
5C5 (Ch. HS-271) (See Model 5C1—Set 116-9)
5C6 (Ch. HS-272) (See Model 5C1—Set 116-9)
5H11U, 5H12U, 5H13U (Ch. HS-224) 117—9
5J1 (Ch. HS-250), 5J1U (Ch. HS-224) 100—7
5J2 (Ch. HS-250) (See Model 5J1—Set 100-7)
5J2U (Ch. HS-224) (See Model 5J1—Set 100-7)
5L1 (Ch. HS-250), 5L1U (Ch. HS-224) 100—7
5L2 (Ch. HS-250) (See Model 5J1—Set 100-7)
5L2U (Ch. HS-224) (See Model 5J1—Set 100-7)
5M1, 5M1U, 5M2, 5M2U (Ch. HS-249, HS-223) 101—7
5R11A, 5R12A, 5R13A, 5R14A, 5R15A, 5R16A (Ch. HS-280) (See Model 5R11U—Set 115-6)
5R11U, 5R12U, 5R13U, 5R14U, 5R15U, 5R16U (Ch. HS-242) 115—6
5X11U, 5X12U, 5X13U (Ch. HS-243) 114—7
5X21U, 5X22U, 5X23U (Ch. HS-259) 120—9
6F11, 6F11B (Ch. HS-264) 117—10
6L1, 6L2 (Ch. HS-226) 102—7
6X11U, 6X12U (Ch. HS-245) 112—5
7F11, 7F11B (Ch. HS-265) 113—5
7VT1, 7VT2, 7VT5 (Ch. TS-18) Tel. Rec. 83—6
8FDT (See Ch. 8A—Set 46-16)
8FM21, 8FM21B (Ch. HS-247) 121—9
8GMT (See Ch. 8A—Set 46-16)
9FM21, 9FM21B (Ch. HS-246) 114—8
9T1 (Ch. TS-18, A) Tel. Rec. (See Model 7VT1—Set 83-6)
9VT1, 9VT5 (Ch. TS-18, A) Tel. Rec. 83—6
10T2 (Ch. TS-14B) Tel. Rec. 92—4
10VK9 (Ch. TS-9E, TS-9E1) Tel. Rec. 77—6
10VK12 (Ch. TS14, A, B) Tel. Rec. 92—4
10VK22 (Ch. TS14, A, B) Tel. Rec. 92—4
10VT3 (Ch. TS-9E, TS-9E1) Tel. Rec. 77—6
10VT10 (Ch. TS14, A, B) Tel. Rec. 92—4
10VT24 (Ch. TS14, A, B) Tel. Rec. 92—4
12K1, B (Ch. TS23B) Tel. Rec. 92—4
12K2, B (Ch. TS-23B) Tel. Rec. 92—4
12K2 (Ch. TS-53) Tel. Rec. 115—7
12T1, B (Ch. TS-23B) Tel. Rec. 92—4
12T3 (Ch. TS-53) Tel. Rec. 115—7
12VF4B, R, R-C (Ch. TS-23, A and Radio Ch. HS-190) Tel. Rec. 92—4
12VF26B, B-C, R, R-C (Ch. TS-23A, B and Radio Ch. HS-190A) Tel. Rec. 92—4
12VK11 (Ch. TS-23, A, B) Tel. Rec. 92—4
12VK15 (Ch. TS-30, A) Tel. Rec. (Also PCB 5—Set 106-1) 93—7
12VK18B, 12VK18R (Ch. TS-15C, TS-15C1) Tel. Rec. 77—6
12VT13 (Ch. TS-23, A, B) Tel. Rec. 92—4
12VT16, 12VT16B, 12VT16R (Ch. TS-15C, TS-15C1) Tel. Rec. 77—6
14K1, B (Ch. TS-88) Tel. Rec. 112—6
14K1BH, 14K1H (Ch. TS-115) Tel. Rec. 121—10

MOTOROLA—Cont.

14P1B (Ch. TS-216) Tel. Rec. (See Model 14T4—Set 158-8)
14P2, 14P2U (Ch. TS-275) Tel. Rec. 174—9
14T1, B (Ch. TS-88) Tel. Rec. 112—6
14T3 (Ch. TS-114) Tel. Rec. 121—10
14T3X1 (Ch. TS-114A) (See Model 14T3—Set 121-10)
14T4, B (Ch. TS-216) Tel. Rec. 158—8
16F1 (Ch. TS-60 and Radio Ch. HS-234) Tel. Rec. 102—8
16F1BH, 16F1H (Ch. TS-89 and Radio Ch. HS-324) Tel. Rec. (For TV Ch. see Set 121-10, for Radio Ch. see Model 16F1—Set 102-8)
16K2L, L-B (Ch. TS-52) Tel. Rec. 93A—10
16K2 (Ch. TS-74) Tel. Rec. 102—8
16K2BH, 16K2H (Ch. TS-94) Tel. Rec. 121—10
16T1 (Ch. TS-60) Tel. Rec. 102—8
16T1BH, 16T1H (Ch. TS-89) Tel. Rec. 121—10
16VF8B, R (Ch. TS-16, -A and Radio Ch. HS-211) Tel. Rec. (For TV Ch. see Set 93-7, for Radio Ch. see Model 99FM21R—Set 80-10)
16VK1 (Ch. TS-52) Tel. Rec. 93A—10
16VK7 (Ch. TS-16, A) Tel. Rec. (Also PCB 5—Set 106-1) 93—7
17F1 (Ch. TS-118 and Radio Ch. HS-253) Tel. Rec. 121—10
17F1A (Ch. TS-89 and Radio Ch. HS-253) Tel. Rec. 121—10
17F1B (Ch. TS-118 and Radio Ch. HS-253) Tel. Rec. 121—10
17F1BA (Ch. TS-89 and Radio Ch. HS-253) Tel. Rec. 121—10
17F2W (Ch. TS-118 and Radio Ch. HS-253) Tel. Rec. 121—10
17F2WA (Ch. TS-89 and Radio Ch. HS-253) Tel. Rec. 121—10
17F3, B (Ch. TS-118 and Radio Ch. HS-253) Tel. Rec. 121—10
17F3BA (Ch. TS-89 and Radio Ch. HS-253) Tel. Rec. 121—10
17F4 (Ch. TS-118 and Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH) 121—10
17F4A (Ch. TS-89 and Radio Ch. HS-253) Tel. Rec. 121—10
17F5 (Ch. TS-118 and Radio Ch. HS-261) Tel. Rec. (See Model 14K1BH) 121—10
17F5A, 17F5BA (Ch. TS-89 and Radio Ch. HS-261) Tel. Rec. 121—10
17F5B (Ch. TS-118 and Radio Ch. HS-261) Tel. Rec. 121—10
17F6, B (Ch. TS-118 and Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F6BC, C (Ch. TS-174 and Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH—Set 121-10) 121—10
17F7B (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F7BC (Ch. TS-174 and Radio Ch. HS-253) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F8 (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F8C (Ch. TS-174) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F9, B (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F9BC, C (Ch. TS-174 and Radio Ch. HS-261) Tel. Rec. (See Model 14K1BH—Set 121-10)
17F11 (Ch. TS-228 and Radio Ch. HS-302) Tel. Rec. 165—7
17F12, A, B, BA (Ch. TS-325, A, 326, A, and Radio Ch. HS-319) Tel. Rec. 171—8
17F12D (Ch. TS-401) Tel. Rec. (For TV Ch. only see PCB 49—Set 183-1 and Model 21F1—Set 173-9)
17F13, B (Ch. TS-395A, 02 and Radio Ch. HS-319) (For TV Ch. see Set 192-6, for Radio Ch. see Model 17F12—Set 171-8)
17F13BC (Ch. TS-408A and Radio Ch. HS-319) Tel. Rec. (For TV Ch. see Model 21C1—Set 191-13, for Radio Ch. see Model 17F12—Set 171-8)
17F13C (Ch. TS-408A and Radio Ch. HS-319) Tel. Rec. (For TV Ch. see Model 21C1—Set 191-13, for Radio Ch. see Model 17F12—Set 171-8)
17K1A, 17K1BA (Ch. TS-95) Tel. Rec. 121—10
17K1BE, E (Ch. TS-172) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K2BE, E (Ch. TS-172) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K3, 17K3B (Ch. TS-118) Tel. Rec. 121—10
17K3A, 17K3BA (Ch. TS-89) Tel. Rec. 121—10
17K4A (Ch. TS-95) Tel. Rec. 121—10
17K4E (Ch. TS-172) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K5 (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K5C (Ch. TS-174) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K5E (Ch. TS-221A) Tel. Rec. 159—10
17K6 (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K6C (Ch. TS-174) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K7, B (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K7BC, C (Ch. TS-174) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K8, B (Ch. TS-236) Tel. Rec. 152-4A
17K8A, BA (Ch. TS-228) Tel. Rec. 165—7
17K9, B (Ch. TS-220) Tel. Rec. 159—10

MOTOROLA—Cont.

17K9A, BA (Ch. TS-228) Tel. Rec. 165—7
17K9BC (Ch. TS-221, -A) Tel. Rec. 159—10
17K10, M (Ch. TS-228) Tel. Rec. 165—7
17K10A (Ch. TS-174) Tel. Rec. (See Model 14K1BH—Set 121-10)
17K10E (Ch. TS-314A, B) Tel. Rec. 167—13
17K11, B, C (Ch. TS-236) Tel. Rec. 152-4A
17K11A, BA (Ch. TS-228) Tel. Rec. 165—7
17K12, A, B, BA, W, WA (Ch. TS-325, A, TS-326, A) Tel. Rec. 171—8
17K13A (Ch. TS-326A, B) Tel. Rec. (See Model 17F12—Set 171-8)
17K13D (Ch. TS-401) Tel. Rec. (See PCB 49—Set 183-11 and Model 21F1—Set 173-9)
17K14, A, B (Ch. TS-395, 02) Tel. Rec. 192—6
17K14BC (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17K14C (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17K14W (Ch. TS-395, -02) Tel. Rec. 192—6
17K14WC (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17K15, B (Ch. TS-395A, -02) Tel. Rec. 192—6
17K15BC (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17K15C (Ch. TS-408) Tel. Rec. (See Model 21C1—Set 191-13)
17K16 (Ch. TS-395A, -02) Tel. Rec. 192—6
17K16C (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17T1, 17T1B (Ch. TS-118) Tel. Rec. 121—10
17T1A, 17T1BA (Ch. TS-89) Tel. Rec. 121—10
17T2A, 17T2BA (Ch. TS-89) Tel. Rec. 121—10
17T2, 17T2B (Ch. TS-118) Tel. Rec. 121—10
17T3 (Ch. TS-118) Tel. Rec. 121—10
17T3A (Ch. TS-89) Tel. Rec. 121—10
17T3G (Ch. TS-221, -A) Tel. Rec. 159—10
17T3X1 (Ch. TS-118A, B) Tel. Rec. (See Model 14K1BH—Set 121-10)
17T4 (Ch. TS-118) Tel. Rec. (See Model 14K1BH—Set 121-10)
17T4C (Ch. TS-174) Tel. Rec. (See Model 14K1BH—Set 121-10)
17T4E (Ch. TS-221, -A) Tel. Rec. 159—10
17T5A (Ch. TS-214) Tel. Rec. 165—7
17T5C (Ch. TS-228) Tel. Rec. 165—7
17T5D (Ch. TS-236) Tel. Rec. 152-4A
17T5E, F (Ch. TS-314A, B, TS-315A, B) Tel. Rec. 167—13
17T6BD, C, D (Ch. TS-236) Tel. Rec. 152-4A
17T6BF, F (Ch. TS-228) Tel. Rec. 165—7
17T6G (Ch. TS-314A, B) Tel. Rec. 167—13
17T7, A (Ch. TS-325, TS-326) Tel. Rec. 171—8
17T8, A, B, BA (Ch. TS-325, TS-326) Tel. Rec. 171—8
17T9 (Ch. TS-325A, B) Tel. Rec. (See Model 17F12—Set 171-8)
17T9A (Ch. TS-326A, B) Tel. Rec. (See Model 17F12—Set 171-8)
17T9E (Ch. TS-325A, B) Tel. Rec. (See Model 17F12—Set 171-8)
17T9EF (Ch. TS-401) Tel. Rec. (See PCB 49—Set 183-1 and Model 21F1—Set 173-9)
17T10 (Ch. TS-325B) Tel. Rec. (See Model 17F12—Set 171-8)
17T10A (Ch. TS-326A, B) Tel. Rec. (See Model 17F12—Set 171-8)
17T10D (Ch. TS-401) Tel. Rec. (See PCB 49—Set 183-1 and Model 21F1—Set 173-9)
17T11 (Ch. TS-395, -02) Tel. Rec. 192—6
17T11C (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17T11E (Ch. TS-400A) Tel. Rec. 194—9
17T11EC (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17T12, B (Ch. TS-395A, -02) Tel. Rec. 192—6
17T12C (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17T12W (Ch. TS-395A, -02) Tel. Rec. 192—6
17T12WC (Ch. TS-408A) Tel. Rec. (See Model 21C1—Set 191-13)
17T13 (Ch. TS-410A) Tel. Rec. (Also see PCB 76—Set 217-1) 194—9
17T13Y (Ch. TS-410Y) Tel. Rec. (See PCB 76—Set 217-1 and Model 17T13—Set 194-9)
17T14 (Ch. VTS-410A) Tel. Rec. (See PCB 76—Set 217-1 and Model 17T13—Set 194-9)
17T14Y (Ch. VTS-410Y) Tel. Rec. (See PCB 76—Set 217-1 and Model 17T13—Set 194-9)
19F1 (Ch. TS-67, A and Radio Ch. HS-230) Tel. Rec. 111—9
19K1 (Ch. TS-67, A) Tel. Rec. 111—9
19K2, 19K2B (Ch. TS-101) Tel. Rec. 122—5
19K2E, BE (Ch. TS-119, A) Tel. Rec. (See PCB 53—Set 187-1 and Model 19K2—Set 122-5)
19K3, 19K4, 19K4B (Ch. TS-101) Tel. Rec. 122—5
20F1, B (Ch. TS-119, A and Radio Ch. HS-230) Tel. Rec. (Also see PCB 53—Set 187-1) 122—5

NOTE: PCB denotes Production Change Bulletin

MOTOROLA—Cont.

20F2, E (Ch. TS-119B, C) Tel. Rec. (See PCB 53—Set 187-1 and Model 19K2—Set 122-5)
20K1, B, 20K2 (Ch. TS-119B, C) Tel. Rec. (See PCB 53—Set 187-1 and Model 19K2—Set 122-5)
20K3, E, 20K4, B (Ch. TS-119C, C1, D) Tel. Rec. (See PCB 53—Set 187- and Model 19K2—Set 122-5)
20K6, 20K6B (Ch. TS-307) Tel. Rec. ....183—9
20T1, B, 20T2 (Ch. TS-119B, C) Tel. Rec. (See PCB 53—Set 187-1 and Model 19K3—Set 122-5)
20T2A, 20T2AB (Ch. TS-307) Tel. Rec. ....183—9
20T2B (Ch. TS-119B, C) Tel. Rec. (See PCB 53—Set 187-1 and Model 19K2—Set 122-5)
20T3, 20T3B (Ch. TS-307) Tel. Rec. ....183—9
21C1, B (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1). 191—13
21C1BD, BDY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214- and Model 21C1—Set 191-13)
21C1BY (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21C1D, DY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Se 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21C1Y Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21F1, E (Ch. TS-351, A and Radio Ch. HS-316) Tel. Rec.... 173—9
21F2, B (Ch. TS-292A, B, C and Radio Ch. HS-316A) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1)....191—13
21F2BY, 21F2F, FB, FBY, FY (Ch. WTS-292A, AY, B, BY, C, CY and Radio Ch. HS-316A) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—191-13)
21F2Y Ch. TS-292AY, BY, CY and Radio Ch. HS-316A) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21F3, B (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1). 191—13
21F3BD, BDY (Ch. WTS-292A, AY, B, BY, C, CY and Radio Ch. HS-316A) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21F3BY (Ch. TS-292AY, BY, CY and Radio Ch. HS-316A) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21F3D, DY (Ch. WTS-292A, AY, B, BY, C, CY and Radio Ch. HS-316A) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21F3Y Ch. TS-292AY, BY, CY and Radio Ch. HS-316A) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K1, B (Ch. TS-351) Tel. Rec. ....173—9
21K2, B (Ch. TS-351) Tel. Rec. ....173—9
21K3, B, W (Ch. TS-351B) Tel. Rec. (See Model 21F1—Set 173-9)
21K4, A (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1). 191—13
21K4AY (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K4B (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1). 191—13
21K4BD, BDY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214- and Model 21C1—Set 191-13)
21K4BY (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K4C, CB, CBY, CW, CWY, CY, D, DY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K4W (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1) ....191—13
21K4WD, WDY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 53—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K4WY, 21K4Y (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K5, B (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1). 191—13
21K5BD, BDY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K5BY (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)

MOTOROLA—Cont.

21K5D, DY (WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K5Y (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K6 (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1)....191—13
21K6D, DY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K6Y (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K7 (Ch. TS-292A, B, C) Tel. Rec. (Also see PCB 63—Set 197-1 and PCB 73—Set 214-1)....191—13
21K7D, DY (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K7Y (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K9, Y (Ch. WTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K10, B, BY, Y (Ch. VTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21K11, B, BY, Y (Ch. VTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21T1, B (Ch. TS-351) Tel. Rec. ....173—9
21T2, B (Ch. TS-351) Tel. Rec. ....173—9
21T3 (Ch. TS-501A, B) Tel. Rec. (Also see PCB 63—Set 197-1) ....191—13
21T4A (Ch. TS-324A, B) Tel. Rec. (Also see PCB 63—Set 197-1) ....191—13
21T4AC, ACE (Ch. TS-292B, C) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21T4ACY (Ch. TS-292AY, BY, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
21T4EA (Ch. TS-324A, B) Tel. Rec. (Also see PCB 63—Set 197-1) ....191—13
21T5A, BA (Ch. TS-324A, B) Tel. Rec. (Also see PCB 63—Set 197-1) ....191—13
21T7, B, BY, Y (Ch. VTS-292A, AY, B, BY, C, CY) Tel. Rec. (See PCB 63—Set 197-1, PCB 73—Set 214-1 and Model 21C1—Set 191-13)
42B1 (Ch. HS-306)....191—14
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
51C1, 51C2, 51C3, 51C4 (Ch. HS-288) (See Model 5C1—Set 116-9)
51L1U, 51L2U (Ch. HS-224) (See Model 5J1—Set 100-7)
51M1U, 51M2U (Ch. HS-283) ....149—8
52B1U (Ch. HS-305)....190—10
52C1 (Ch. HS-309)....191—15
52C1A (Ch. HS-309) (See Model 52C1—Set 191-15)
52C6 (Ch. HS-310)....177—10
52C6A (Ch. HS-375) (See Model 52C6—Set 177-10)
52C7 (Ch. HS-310)....177—10
52C7A (Ch. HS-310) (See Model 52C7—Set 177-10)
52C8 (Ch. HS-310)....177—10
52C8A (Ch. HS-375) (See Model 52C8—Set 177-10)
52CW1, 52CW2, 52CW3, 52CW4 (Ch. HS-329)....198—10
52H11U, 52H12U, 52H13U, 52H14U (Ch. HS-313)....176—6
52L1, A, 52L2, A, 52L3, A (Ch. HS-327, HS-357)....190—11
52M1U, 52M2U, 52M3U (Ch. HS-300)....188—10
52R11, 52R12, 52R13, 52R14, 52R-15, 52R16 (Ch. HS-289). 188—11
52R11, 52R12, 52R13, 52R14, 52R-15, 52R16 (Ch. HS-289A) (See Model 52R11—Set 188-11)
52R11A, 52R12A, 52R13A, 52R-14A, 52R15A, 52R16A (Ch. HS-317)....178—7
52R11U, 52R12U, 52R13U, 52R-14U, 52R15U, 52R16U (Ch. HS-315)....177—11
53LC1, 53LC2, 53LC3 (Ch. HS-347)....217—10
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, 58R-15, 58R16 (Ch. HS-116). 49—14
58R11A, 58R12A, 58R13A, 58R-14A, 58R15A, 58R16A (Ch. HS-184)....69—11
58X11, 58X12 (Ch. HS-125) 53—15
59F11 (Ch. HS-188)....48—12
59H11U, 59H12IU (Ch. HS-210) ....97—9
59L11Q, 59L12Q, 59L14Q (Ch. HS-187)....78—10

MOTOROLA—Cont.

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
61L1, 61L2 (Ch. HS-226) (See Model 6L1—Set 102-7)
62C1 (Ch. HS-299)....189—12
62C1A (Ch. HS-299) (See Model 62C1—Set 189-12)
62C2 (Ch. HS-299)....189—12
62C2A (Ch. HS-299) (See Model 62C2—Set 189-12)
62C3 (Ch. HS-299)....189—12
62C3A (Ch. HS-299) (See Model 62C3—Set 189-12)
62CW1 (Ch. HS-324)....196—7
62L1U, 62L2U, 62L3U (Ch. HS-308) ....183—10
62X11U, 62X12U, 62X13U (Ch. HS-314)....175—14
63L1, 63L2, 63L3 (Ch. HS-361) ....222—8
65F11 (Ch. HS-31)....6—19
65F12 (See Model 65F11—Set 6-19)
65F21 (Ch. HS-26)....4—12
65L11, 65L12 (Ch. HS-7)....8—22
65T21, 65T21B (Ch. HS-32) 1—1
65X11A, 65X12A, 65X13A, 65-X14A, 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), 68X-11A, 68X12A (Ch. HS-127A) ....56—16
69L11 (Ch. HS-175)....76—15
69X11, 69X121 (Ch. HS-181) ....82—9
72XM21 (Ch. HS-303)....176—7
72XM22 (See Model 72XM21—Set 176-7)
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, 77-FM22M, 77FM22WM, 77FM23 (Ch. HS-97)....33—13
77XM21, 77XM22, 77XM22B (Ch. HS-102)....34—12
78F11, 78F11M (Ch. HS-150), 78F-12M (Ch. HS-155)....56—17
78FM21, 78FM21M (Ch. HS-132), 78FM22M (Ch. HS-128). 59—13
79FM21, 79FM21B, 78FM21R (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—Set 111-9)
92FM21, A, B, BA (Ch. HS-316A) (See Model 21F1—Set 173-9)
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
401A....179—8
403....216—5
405 (Ch. AS-13)....3—8
405M (See Set 21-25 and Model 405—Set 3-8)
408....38—12
409 (See Model 408—Set 38-12)
412....215—10
500....98—7
501....133—10
501A....148—12
503....221—8
505 (Ch. AS-14)....4—37
508....39—13
509 (See Model 508—Set 39-13)
553....224—10
600....97—10
603 (See Mopar Model 603—Set 65-9)
604 (See Mopar Model 704—Set 106-9)
605 (Ch. AS-15)....5—1
606 (See Mopar Model 606—Set 133-9)
607 (See Mopar Model 607—Set 170-11)
608....39—14
608 (Mopar) (See Mopar Model 608—Set 207-4)
609 (See Model 608—Set 39-14)
700....100—8
701....137—8
702 (Ch. BT-2 and 6-2)...197—7
705 (Ch. AS-16)....7—19
708....40—12
709 (See Model 708—Set 40-12)
800....103—10
801....138—6
802 (Ch. BT-2 and P8-2)...197—7
804 (See Mopar Model 804—Set 67-12)
808 (See Mopar Model 808—Set 107-6)
814 (See Mopar Model 814—Set 137-7)
Ch. AS-13 (See Model 405)
Ch. AS-14 (See Model 505)
Ch. AS-15 (See Model 605)
Ch. AS-16 (See Model 705)
Ch. AS-22 (See Model BK-6)
Ch. BT-2....197—7
Ch. HS-2 (See Model 65X11A)
Ch. HS-6 (See Model 5A1)
Ch. HS-7 (See Model 65L11)

MOTOROLA—Cont.

Ch. HS-8 (See Model 45B12)
Ch. HS-15 (See Model 5A5)
Ch. HS-18 (See Model WR6)
Ch. HS-22 (See Model 85F21)
Ch. HS-26 (See Model 65F21)
Ch. HS-30 (See Model 55F11)
Ch. HS-31 (See Model 65F11)
Ch. HS-32 (See Model 65T21)
Ch. HS-36 (See Model 75F31)
Ch. HS-36A (See Model 75F31A)
Ch. HS-38 (See Model 95F33)
Ch. HS-39 (See Model 95F31)
Ch. HS-50 (See Model 55X11A)
Ch. HS-52 (See Model 85K21)
Ch. HS-58 (See Model 67X11)
Ch. HS-59 (See Model 67L11)
Ch. HS-60 (See Model 57X11)
Ch. HS-62 (See Model 5A7)
Ch. HS-62A (See Model 5A7A)
Ch. HS-63 (See Model 67F11)
Ch. HS-64 (See Model 67XM21)
Ch. HS-69 (See Model 67F61BN)
Ch. HS-72 (See Model 47B11)
Ch. HS-87 (See Model 107F31)
Ch. HS-89 (See Model 77FM21)
Ch. HS-91 (See Model 75F21)
Ch. HS-94 (See Model 56X11)
Ch. HS-97 (See Model 77FM22)
Ch. HS-98 (See Model 76F31)
Ch. HS-102 (See Model 77XM21)
Ch. HS-108 (See Model VK-101)
Ch. HS-113 (See Model 48L11)
Ch. HS-114 (See Model 58L11)
Ch. HS-116 (See Model 58R11)
Ch. HS-119 (See Model 68L11)
Ch. HS-122 (See Model 67F14)
Ch. HS-124 (See Model 78F11)
Ch. HS-125 (See Model 58X11)
Ch. HS-127 (See Model 68X11)
Ch. HS-127A (See Model 68X11A)
Ch. HS-128 (See Model 78FM22M)
Ch. HS-132 (See Model 78FM21)
Ch. HS-133 (See Model 88FM21)
Ch. HS-137 (See Model VF102)
Ch. HS-144 (See Model 68T11)
Ch. HS-150 (See Model 78F11)
Ch. HS-155 (See Model 78F12M)
Ch. HS-158 (See Model 58A11)
Ch. HS-160 (See Model 58G11)
Ch. HS-167 (See Model 59R11)
Ch. HS-168 (See Model 79XM21)
Ch. HS-170 (See Model 99FM21R)
Ch. HS-175 (See Model 69L11)
Ch. HS-178 (See Model 79FM21)
Ch. HS-180 (See Model 59X11)
Ch. HS-181 (See Model 69X11)
Ch. HS-183 (See Model 49L11Q)
Ch. HS-184 (See Model 58R11A)
Ch. HS-187 (See Model 59L11Q)
Ch. HS-188 (See Model 59F11)
Ch. HS-192 (See Model 59X21U)
Ch. HS-210 (See Model 59H11U)
Ch. HS-223 (See Model 5M1)
Ch. HS-224 (See Model 5J1U)
Ch. HS-226 (See Model 6L1)
Ch. HS-228 (See Model 5C1)
Ch. HS-230 (See Model 19F1)
Ch. HS-234 (See Model 16F1)
Ch. HS-242 (See Model 5R11U)
Ch. HS-243 (See Model 5X11U)
Ch. HS-244 (See Model 5H11U)
Ch. HS-245 (See Model 6X11U)
Ch. HS-246 (See Model 9FM21)
Ch. HS-247 (See Model 8FM21)
Ch. HS-249 (See Model 5M1)
Ch. HS-250 (See Model 5J1)
Ch. HS-253 (See Model 17F1)
Ch. HS-258 (See Model 5C2)
Ch. HS-259 (See Model 5X21U)
Ch. HS-261 (See Model 17F5)
Ch. HS-262 (See Model 5C3)
Ch. HS-264 (See Model 6F11)
Ch. HS-265 (See Model 7F11)
Ch. HS-270 (See Model 5C4)
Ch. HS-271 (See Model 5C5)
Ch. HS-272 (See Model 5C6)
Ch. HS-283 (See Model 51M1U)
Ch. HS-289, A (See Model 52R11)
Ch. HS-299 (See Model 62C1)
Ch. HS-300 (See Model 52M1U)
Ch. HS-302 (See Model 17F11)
Ch. HS-303 (See Model 72XM21)
Ch. HS-305 (See Model 52B1U)
Ch. HS-306 (See Model 42B1)
Ch. HS-308 (See Model 62L1U)
Ch. HS-309 (See Model 52C1)
Ch. HS-310 (See Model 52C6)
Ch. HS-313 (See Model 52H11U)
Ch. HS-314 (See Model 62X11U)
Ch. HS-315 (See Model 52R11U)
Ch. HS-316 (See Model 21F1)
Ch. HS-317 (See Model 52R11A)
Ch. HS-319 (See Model 17F12)
Ch. HS-324 (See Model 62CW1)
Ch. HS-327 (See Model 52L1)
Ch. HS-329 (See Model 52CW1)
Ch. HS-347 (See Model 53LC1)
Ch. HS-357 (See Model 52L1)
Ch. HS-361 (See Model 63L1)
Ch. M-5 (See Model AR96-23)
Ch. OB (See Model SROB)
Ch. P6-2....197—7
Ch. P8-2....197—7
Ch. TS-3 (See Model VT-101)
Ch. TS-4B Thru J (See Model VT-71)
Ch. TS-4J Late (See Model VT-73)
Ch. TS-5 (See Model VK101)
Ch. TS-7 (See Model VF-102)
Ch. TS-8 (See Model VF103)
Ch. TS-9, TS-9A, TS-9B, TS-9C (See Model VT105)
Ch. TS-9D (See Model VT105)
Ch. TS-9E, TS-9E1 (See Model VK106)
Ch. TS-14, A, B (See Model 10VK-12)
Ch. TS-15 (See Model VT121)
Ch. TS-15C, TS-15C1 (See Model 12VK18B)
Ch. TS-16, A (See Model 16VF8B)
Ch. TS-18, A (See Model 7VT1)
Ch. TS-23, A, B (See Model 12-VK11)
Ch. TS-30, A (See Model 12VK15)
Ch. TS-52 (See Model 16K2L)
Ch. TS-53 (See Model 12K2)
Ch. TS-60 (See Model 16F1)
Ch. TS-67 (See Model 19F1)

MOTOROLA—Cont.

Ch. TS-74 (See Model 16K2)
Ch. TS-88 (See Model 14K1)
Ch. TS-89 (See Model 16F1BH)
Ch. TS-94 (See Model 16K2BH)
Ch. TS-95 (See Model 17K1A)
Ch. TS-101 (See Model 19K2)
Ch. TS-114A (See Model 14T3X1)
Ch. TS-114A (See Model 14T3X1)
Ch. TS-115 (See Model 14K1BH)
Ch. TS-118 (See Model 17F1)
Ch. TS-118A, B (See Model 17T3X1)
Ch. TS-119, A (See Model 19K2E)
Ch. TS-119B (See Model 20F2)
Ch. TS-119C, C1, D (See Model 20K3)
Ch. TS-172 (See Model 17K1BE)
Ch. TS-174 (See Model 17F6BC)
Ch. TS-214 (See Model 17T5A)
Ch. TS-216 (See Model 14T4)
Ch. TS-220 (See Model 17K9)
Ch. TS-221, -A (See Model 17K5E)
Ch. TS-228 (See Model 17F11)
Ch. TS-236 (See Model 17K8)
Ch. TS-275 (See Model 14P2)
Ch. TS-292A, B, C (See Model 21C1)
Ch. TS-292AY, BY, CY (See Model 21C1Y)
Ch. TS-307 (See Model 20K6)
Ch. TS-314A, B, TS-315A, B (See Model 17K10E)
Ch. TS-324, A, B (See Model 21T4A)
Ch. TS-324AY, BY (See Models 21T4A and TK-19M)
Ch. TS-325, A, TS-326, A (See Model 17F12)
Ch. TS-326Y (See Models 17F12 and VTK-17M)
Ch. TS-351, A, B (See Model 21F1)
Ch. TS-395, -02 (See Model 17F13)
Ch. TS-400A (See Model 17T11E)
Ch. TS-401 (See Model 17F12D)
Ch. TS-408A (See Model 17F13C)
Ch. TS-408Y (See Models 17F13C and TK-19M)
Ch. TS-410A (See Model 17T13)
Ch. TS-410Y (See Model 17T13Y)
Ch. TS-501A (See Model 21T3)
Ch. TS-501Y (See Models 21T3 and TK-24M)
Ch. VTS-292A, AY, B, BY, C, CY (See Model 21K10, Y)
Ch. VTS-410 (See Model 17T14)
Ch. VTS-410Y (See Model 17T14Y)
Ch. WTS-292A, AY, B, BY, C, CY (See Model 21C1BD, BDY)
Ch. 1A....134—8
Ch. 1B....136—11
Ch. 2A....197—7
Ch. 2M....197—7
Ch. 8A....46—16
Ch. 10A....106—10

MUNTZ

M30 (Ch. TV-16A1) Tel. Rec. ....108—8
M31 (Ch. TV-16A2) Tel. Rec. ....108—8
M31 (Ch. TV17A2) Tel. Rec. 116—10
M31R (Ch. TV17A3) Tel. Rec. (See Model M32 (Ch. TV17A3)—Set 116-10)
M31R, M32 (Ch. TV-16A3) Tel. Rec. ....108—8
M32 (Ch. TV17A2) Tel. Rec. 116—10
M32 (Ch. TV17A3) Tel. Rec. 116—10
M32R (Ch. TV17A3) Tel. Rec. (See Model M32 (Ch. TV17A3)—Set 116-10)
M33 (Ch. TV17A4) Tel. Rec. 116—10
M34 (Ch. TV17A4) Tel. Rec. (For TV Ch. only see Model M33—Set 116-10)
M41, M42 (Ch. TV17A3A) Tel. Rec. (See Model 1750)
M46 (Ch. TV17A7) Tel. Rec. (See Model 2053)
M49 (Ch. TV17A7) Tel. Rec. (See Model 2053)
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
317T2 (Ch. 37A2) Tel. Rec. (See Model 2055—Set 207-5)
321T1, 321T2 (Ch. 17B2) Tel. Rec. (See Model 2055—Set 207-5)
324T2 (Ch. 17B8) Tel. Rec. (See Model 2763A—Set 208-7)
1750, 1751, 1752 (Ch. 17A3A) Tel. Rec. (See PCB 33—Set 159-3 and Model M31—Set 116-10)
2053 (Ch. 17A7) Tel. Rec. (See PCB 33—Set 159-3 and Model M31—Set 116-10)
2053-A (Ch. 17B1, 17B2) Tel. Rec. (See Ch. 17B1—Set 163-8)
2054 (Ch. 17A7) Tel. Rec. (See PCB 33—Set 159-3 and Model M31—Set 116-10)
2054-A (Ch. 17B1, 17B2) Tel. Rec. (For TV Ch. only see Ch. 17B1—Set 163-8)
2055 (Ch. 17A7) Tel. Rec. (See PCB 33—Set 159-3 and Model M31—Set 116-10)
2055 (Ch. 17B2, Above Serial No. 369500 or Ch. 17B6, Above Serial No. 3619500) Tel. Rec. ....207—5
2055-A (Ch. 17B1, 17B2) Tel. Rec. (See Ch. 17B1—Set 163-8)
2055A, AU (Ch. 17B2, Above Serial No. 369500 or Ch. 17B6, Above Serial No. 3619200) Tel. Rec. ....207—5
2055-B (Ch. 17B2) Tel. Rec. (See Ch. 17B2—Set 163-8)
2055B (Ch. 17B2, Above Serial No. 369500 or Ch. 17B6, Above Serial No. 3619500) Tel. Rec. ....207—5
2056 (Ch. 17A7) Tel. Rec. (See PCB 33—Set 159-3 and Model M31—Set 116-10)
2056-A (Ch. 17B1, 17B2) Tel. Rec. (See Ch. 17B1—Set 163-8)

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

PHILCO—Cont.

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes Production Change Bulletin

SILVERTONE—Cont.

185-16 (Ch. 549.101-2) Tel. Rec. *
186-19 (Ch. 549.101-3) Tel. Rec. *
187-16, 188-16 (Ch. 110.700-10) Tel. Rec. (See Model 116—Set 139-13)
189-16 (Ch. 110.700-1, -10) Tel. Rec. ....139—13
191-16 (Ch. 110.700-50) Tel. Rec. *
194-16, 195-16 (Ch. 132.890) Tel. Rec. ....130—12
210 (Ch. 132.880) ....109—12
215 (Ch. 528.174) ....117—13
217, 218 (Ch. 528.174) (See Model 215—Set 117-13)
220 (Ch. 528.173) ....110—13
222, 223, 224 (Ch. 528.173) (See Model 220—Set 110-13)
225 (Ch. 528.171-1) ....107—8
237 (Ch. 488.237) ....145—10
238 (Ch. 548.360-1, 548.361) (See Model 239—Set 115-12)
239 (Ch. 548.360-1, 548.361) ....115—12
245 (Ch. 548.358-1) ....107—9
246 (Ch. 137.906) ....111—14
249 (Ch. 548.360-1, 548.361) ....115—12
1017, 1018 (Ch. 528.210, -1, -2) ....183—11
1032 (Ch. 528.196) ....183—15
1035, A (Ch. 528.195, -1, -2) ....215—12
1040, 1045 (Ch. 528.194) .181—12
1040A (Ch. 528.194-1) (See Model 1040—Set 181-12)
1045A (Ch. 528.194-1) (See Model 1040—Set 181-12)
1052 (Ch. 132.011) ....174—10
1052A (Ch. 132.011-1) (See Model 1052—Set 174-10)
1053 (Ch. 132.011) ....174—10
1053A (Ch. 132.011-1) (See Model 1053—Set 174-10)
1054 (Ch. 132.012) ....173—12
1054A (Ch. 132.012-1) (See Model 1054—Set 173-12)
1055 (Ch. 132.012) ....173—12
1055A (Ch. 132.012-1) (See Model 1055—Set 173-12)
1058, 1059 (Ch. 101.860) .162—11
1062, 1063 (Ch. 101.860) .162—11
1066 (Ch. 100.202) ....162—10
1116-16 (Ch. 110.700-90), 1117-17 (Ch. 110.700-96) Tel. Rec. *
1117-17 (Ch. 110, 700-100, -104) Tel. Rec. ....201—8
1130-17 (Ch. 110.700-96) Tel. Rec. *
1130-17, 1130A-17 (Ch. 110.700-100, 104) Tel. Rec. ....201—8
1135-17 (Ch. 110.700-96) Tel. Rec. *
1141-20 (Ch. 110.700-93) Tel. Rec. *
1141-20 (Ch. 110.700-120) Tel. Rec. ....201—8
1145-20 (Ch. 110.700-140) Tel. Rec. ....201—8
1150-14 (Ch. 478.361, A) Tel. Rec. *
1161-17 (Ch. 110.702-10) Tel. Rec. ....205—10
1162-16 (Ch. 110.700-90) Tel. Rec. *
1162-17 (Ch. 110.700-96) Tel. Rec. *
1162-17 (Ch. 110.700-100, -104) Tel. Rec. ....201—8
1166-17 (Ch. 478.339-B) Tel. Rec. *
1171-17 (Ch. 110.702-10, -50) Tel. Rec. ....205—10
1172-17 (Ch. 110.700-100, -104) Tel. Rec. ....201—8
1173-20 (Ch. 110.700-140) Tel. Rec. ....201—8
1176-21 (Ch. 100.208) Tel. Rec. ....165—12
1181-20 (Ch. 110.700-120) Tel. Rec. ....201—8
1183-21 (Ch. 110.700-150) Tel. Rec. ....201—8
1184-20 (Ch. 528.631, -1) Tel. Rec. ....181—13
1186-21 (Ch. 100.208) Tel. Rec. ....165—12
1188-20 (Ch. 110.700-140) Tel. Rec. ....201—8
1191-17 (Ch. 110.700-97) Tel. Rec. *
1239 (Ch. 488.237) (See Model 237—Set 145-10)
1260 (Ch. 456.150, -2) Tel. Rec. *
1261 (Ch. 456.150-2) Tel. Rec. *
1266 (Ch. 456.150, -2) Tel. Rec. *
1268-21 (Ch. 456.150-1) Tel. Rec. *
1270-21 (Ch. 456.150-1) Tel. Rec. *
1271-21 (Ch. 456.150-1) Tel. Rec. *
1272-21 (Ch. 456.150-1) Tel. Rec. *
1273-21 (Ch. 456.150-1) Tel. Rec. *
1274-21 (Ch. 456.150-1) Tel. Rec. *
1275-21 (Ch. 456.150-1) Tel. Rec. *
1300 (Ch. 319.200), 1300-1 (Ch. 319.200-1) ....90—10
1301 (Ch. 319.190) ....91—11
2001, 2002 (Ch. 132.878) (See Model 1—Set 101-10)
2003, 2004, 2005, 2006 (Ch. 757.110) ....211—13
2007 (Ch. 757.100) ....198—12
2009, 2010, 2011, 2012, 2013 (Ch. 132.022) ....196—14
2014, 2015, 2016 (Ch. 132.021) ....196—15
2022 (Ch. 132.027) ....197—11
2023, 2024, 2025, 2026, 2027 (Ch. 132.826-1) (See Model 10—Set 144-11)
2028 (Ch. 528.230) ....203—8
2035A (Ch. 528.195, -1, -2) ....215—12
2041 (Ch. 528.235) ....208—11
2041 (Ch. 528.235-1) (See Model 2041—Set 208-11)
2056 (Ch. 132.026-3) ....207—9
2060, 2061 (Ch. 101.861, -1) ....203—9

SILVERTONE—Cont.

2063, 2064 (Ch. 101.860, -1) (See Model 1058—Set 162-11)
2100 (Ch. 110.700-100, -104) Tel. Rec. ....201—8
2100A (Ch. 110.817-1) Tel. Rec. ....217—15
2101 (Ch. 647.023) Tel. Rec. *
2105 (Ch. 132.024, -1, -2) Tel. Rec. ....198—13
2105A (Ch. 132.024-3, -31) Tel. Rec. ....198—13
2110A, 2111 (Ch. 528.631, -1, Ch. 528.632, -1, -2, -3, -4, -5, Ch. 528.632A, -1, -2, -3, -5) Tel. Rec. ....212—7
2115B (Ch. 528.631, -1, Ch. 528.632, -1, -2, -3, -4, -5, Ch. 528.632A, -1, -2, -3, -5) Tel. Rec. ....212—7
2130 (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
2140 (Ch. 110.817-1) Tel. Rec. ....217—15
2145 (Ch. 132.024, -1, -2) Tel. Rec. ....198—13
2145A (Ch. 132.024-3, -31) Tel. Rec. ....198—13
2145B (Ch. 132.024-4) Tel. Rec. ....198—13
2150 (Ch. 110.700-140) Tel. Rec. ....201—8
2150A (Ch. 110.820-1) Tel. Rec. ....217—15
2150B (Ch. 528.631, -1, Ch. 528.632, -1, -2, -3, -4, -5, Ch. 528.632A, -1, -2, -3, -5) Tel. Rec. ....212—7
2160, 2162 (Ch. 528.631, -1, Ch. 528.632, -1, -2, -3, -4, -5, Ch. 528.632A, -1, -2, -3, -5) Tel. Rec. ....212—7
2170-C (Ch. 100.209) Tel. Rec. ....193—10
2170-D, -E (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
2172 (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
2174 (Ch. 132.035) Tel. Rec. (See PCB 79—Set 220-1 and Model 3174—Set 206-11)
2195-21 (Ch. 100.208-1 and Radio Ch. 100.202-1) Tel. Rec. (See PCB 59—Set 193-1 and Model 1176-21—Set 165-12 for TV Ch. and Model 1066—Set 162-10 for Radio Ch.)
2200, 2202, 2203 (Ch. 528.229) ....201—9
2210 (Ch. 132.880) (See Model 210—Set 109-12)
2215, 2217, 2218 (Ch. 528.238) ....219—9
2225 Ch. 528.233) ....208—12
3007, 3008, 3009 (Ch. 757.120) ....226—9
3032 (Ch. 528.252) ....219—10
3035A (Ch. 528.195, -1, -2) ....215—12
3040 (Ch. 528.253) ....221—9
3041 (Ch. 528.235-1) (See Model 2041—Set 208-11)
3045, 3046 (Ch. 528.254) .216—10
3052, 3053 (Ch. 132.053) 225—15
3061, 3062 (Ch. 101.861-1) (See Model 2060—Set 203-9)
3105 (Ch. 132.024-5, -6) Tel. Rec. ....198—13
3106 (Ch. 132.045, -1) Tel. Rec. ....199—11
3109 (Ch. 528.264) Tel. Rec. ....227—12
3110 (Ch. 528.248, -1, -2) Tel. Rec. ....220—7
3110A (Ch. 528.242, -1, -2) Tel. Rec. ....220—7
3110B (Ch. 528.264-1, -2) Tel. Rec. ....227—12
3112B (Ch. 528.263, -1, -2) Tel. Rec. ....227—12
3115 (Ch. 528.248, -1, -2) Tel. Rec. ....220—7
3115A (Ch. 528.242, -1, -2) Tel. Rec. ....220—7
3127 (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
3145 (Ch. 132.024-5, -6) Tel. Rec. ....198—13
3150L (Ch. 528. 264, -1, -2) Tel. Rec. ....227—12
3151B, C (Ch. 528.263, -1, -2) Tel. Rec. ....227—12
3160 (Ch. 528.248, -1, -2) Tel. Rec. ....220—7
3160A (Ch. 528.242, -1, -2) Tel. Rec. ....220—7
3170 (Ch. 528.239) Tel. Rec. *
3170-B (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
3170C (Ch. 528.249, -1) Tel. Rec. ....218—11
3170D (Ch. 528.261) Tel. Rec. ....227—12
3171A (Ch. 528.247, -1) Tel. Rec. ....217—16
3174 (Ch. 132.035-2) Tel. Rec. ....206—11
3175 (Ch. 132.044) Tel. Rec. ....203—10
3177 (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
3187 (Ch. 100.210, -1, -3) Tel. Rec. ....207—10
3200 (Ch. 528.259) ....224—12
3202, 3203 (Ch. 528.259) .224—12
3210 (Ch. 528.241) ....220—8
3217 (Ch. 528.265) ....227—13
3376, 3377 (Ch. 456.200-111, -112, -113, -114, -115, -121, -122, -123, -124, -125) Tel. Rec. ....225—16
4111 (Ch. 528.264-1, -2) Tel. Rec. ....227—12
4113 (Ch. 528.263-1, -2) Tel. Rec. ....227—12
4114 (Ch. 528.264-2) Tel. Rec. ....227—12

SILVERTONE—Cont.

4115 (Ch. 528.270) Tel. Rec. ....227—12
4116, 4117 (Ch. 528.266) Tel. Rec. ....227—12
4118 (Ch. 528.263-1, -2) Tel. Rec. ....227—12
4119 (Ch. 528.263-2) Tel. Rec. ....227—12
4120 (Ch. 456.150, -2) Tel. Rec. *
4126 (Ch. 528.264-1, -2) Tel. Rec. ....227—12
4127(Ch. 528.263-1, -2) Tel. Rec. ....227—12
4128 (Ch. 528.264-2) Tel. Rec. ....227—12
4129 (Ch. 528.263-2) Tel. Rec. ....227—12
4131 (Ch. 528.263-1) Tel. Rec. ....227—12
4139 (Ch. 528.270) Tel. Rec. ....227—12
4140 (Ch. 528.247, -1) Tel. Rec. ....217—16
4140D (Ch. 528.266-1) Tel. Rec. ....227—12
4143 (Ch. 528.247, -1) Tel. Rec. ....217—16
4143D (Ch. 528.266-1) Tel. Rec. ....227—12
4145 (Ch. 528.247, -1) Tel. Rec. ....217—16
4145D (Ch. 528.266-1) Tel. Rec. ....227—12
4149 (Ch. 528.270) Tel. Rec. ....227—12
4150 (Ch. 528.247, -1) Tel. Rec. ....217—16
4150D (Ch. 528.286) Tel. Rec. ....227—12
4153 (Ch. 528.247, -1) Tel. Rec. ....217—16
4153D (Ch. 528.286) Tel. Rec. ....227—12
4155 (Ch. 528.247, -1) Tel. Rec. ....217—16
4155D (Ch. 528.286) Tel. Rec. ....227—12
6002 (Ch. 132.818) ....5—35
6011 (Ch. 132.816), 6012 (Ch. 132.816A) ....15—27
6016 (Ch. 132.820) ....27—24
6050 (Ch. 132.825-4) ....15—28
6051 (Ch. 110.451), 6052 (Ch. 110.452) ....13—29
6052A (Ch. 110.452, -1) (See Model 6051—Set 13-29)
6071 (Ch. 132.826-1) ....15—29
6072 (Ch. 110.454) ....13—30
6092 (Ch. 101.672-1B), 6093 (Ch. 101.672.1A) ....10—28
6100 (Ch. 101.660-1A) ....6—29
6104 (Ch. 101.662-2D) (See Model 6105—Set 7-26)
6105 (Ch. 101.622-2B) ....7—26
6106A (Ch. 101.662-4E) .. 29—23
6111 (Ch. 101.662-3C) ....7—26
6111A (Ch. 101.662-5F) .. 29—23
6200A (Ch. 101.800-3) ....65—12
6200A (Ch. 101.800-1) ....9—29
6203 (Ch. 101.800A) (See Model 6200A—Set 9-29)
6220, 6220A (Ch. 101.801, 101.-801-1A) ....9—30
6230 (Ch. 101.802) ....11—21
6230A (Ch. 101.802-1) ....11—21
6285A (Ch. 101.666-1B) ....20—28
6286 (Ch. 528.6286, -1, -3) 185—12
6287 (Ch. 528.6287, -1, -3) 185—12
6290 (Ch. 101.677-B) ....20—29
6293 (Ch. 528.6293-2) ....99—16
6295 (Ch. 528.6295) ....98—12
6685 (Ch. 139.150, Ch. 139.150-1), Power Shifter ....15—30
7020 (See Model 7021—Set 16-31)
7021 (Ch. 101.807, 101.807A) ....16—31
7025 (Ch. 132.807-2) ....29—24
7054 (Ch. 101.808) ....15—31
7070 (Ch. 101.817) ....30—26
7080 (Ch. 101.809) ....16—32
7080, 7080A (Ch. 101.809-2) ....58—20
7085 (Ch. 101.814) ....30—27
7086 (Ch. 110.466) ....27—25
7090 (Ch. 101.810) ....15—32
7095 (Ch. 101.826) (See Model 7115—Set 16-33)
7100 (Ch. 101.811) ....17—29
7102 (Ch. 101.814-1A) ....30—27
7103 (Ch. 110.466-1) ....27—25
7111 (Ch. 434.140) ....30—28
7115 (Ch. 101.825), 7116 (Ch. 101.825-1A), 7117 (Ch. 101.825-1B) ....16—33
7119 (Ch. 101.825-2C) ....62—18
7145 (Ch. 436.200) ....23—21
7148 (Ch. 431.188), 7148A (Ch. 431.188-1) ....23—22
7152 (Ch. 109.626) ....25—26
7153 (Ch. 109.627) ....26—30
7165 (Ch. 101.823-A, 1A). 10—29
7166 (Ch. 101.823, 101.823-1) ....10—29
7210 (Ch. 101.820) ....32—20
7220 (Ch. 101.801-2C) (See Model 6220—Set 9-30)
7226 (Ch. 101.819A) ....31—28
7230 (Ch. 101.802-2A) (See Model 6230—Set 11-21)
7300 (Ch. 435.240) ....45—22
7350 (Ch. 435.410) ....38—22
7353 (See Model 7350—Set 38-22)
8000 (Ch. 132.838) ....31—29
8003 (Ch. 132.818-1) ....53—22
8004 (See Model 8003—Set 53-22)
8005 (Ch. 132.839) ....33—26
8010 (Ch. 132.840) ....40—21
8011 (See Model 8010—Set 40-21)
8020 (Ch. 132.841) ....43—17
8021 (Ch. 132.868) ....70—10
8024, 8025 (Ch. 478.206-1) 80—15
8050 (Ch. 101.813) ....33—27
8051 (Ch. 101.839) ....49—19
8052 (Ch. 101.808-1C) ....68—15
8053 (Ch. 101.808-1D) (See Model 8052—Set 68-15)

SILVERTONE—Cont.

8070 (Ch. 101.817-1A) (See Model 7070—Set 30-26)
8072 (Ch. 101.834) ....34—19
8073 (Ch. 135.243) ....84—9
8080 (Ch. 101.852) ....52—20
8083, 8083A (Ch. 101.809-1A) ....58—20
8084, 8084A (Ch. 101.809-1B) ....58—20
8086 (Ch. 101.814-5C) ....61—18
8086A, 8086B (Ch. 101.814-6C) ....61—18
8090 (Ch. 101.821) ....49—20
8097 (Ch. 101.825-3G) (See Model 8115—Set 62-18)
8097A (Ch. 101.825.4) ....62—18
8100 (Ch. 101.829) ....51—19
8101, 8101A, 8101B, 8101C (Ch. 101.809-3C) ....58—20
8102 (Ch. 101.814-2B) ....61—18
8102A (Ch. 101.814-3B) .. 61—18
8102B (Ch. 101.814-2B) .. 61—18
8103 (Ch. 110.473) ....56—21
8104 (See Model 8086—Set 61-18)
8105, 8105A (Ch. 101.833) 35—20
8106, A (Ch. 101.833-1A) (See Model 8105—Set 35-20)
8107A, 8108, 8108A (Ch. 101.851), 8109 (Ch. 101.851-1) ....64—10
8112, 8113 (Ch. 101.851) (See Model 8107A—Set 64-10)
8115 (Ch. 101.825-3D) ....62—18
8115, A, B, C (Ch. 101.825-4) ....62—18
8115D (Ch. 101.825-4) (See Model 8115A—Set 62-18)
8117 (Ch. 101.825-3E) ....62—18
8118 (Ch. 101.825-3F) ....62—18
8118 A, B, C (Ch. 101.825-4) ....62—18
8118D (Ch. 101.825-4) (See Model 8118A—Set 62-18)
8124, 8125, 8126 (Ch. 101.831A, 101.831-1) (See Model 8127—Set 41-20)
8127, A, B, C (Ch. 101.831A), 8128, A, B, C (Ch. 101.831), Wire Recorder Amp. (Ch. 101.-773) ....41—20
8127CX (Ch. 101.831A and Wire Recorder Amp. 101.773) (See Model 8127—Set 41-20)
8130 Tel. Rec. ....49—21
8132 (Ch. 101.854) Tel. Rec. 66—15
8133 (Ch. 101.829-1, Ch. 101.846) Tel. Rec. ....66—15
8144 (Ch. 431.199) ....32—21
8145 (Ch. 109.631) ....45—23
8148 (Ch. 109.632) ....44—22
8149 (Ch. 109.633) ....48—23
8150 (Ch. 109.634) ....32—22
8152 (Ch. 109.635) (See Model 8153—Set 42-22)
8153 (Ch. 109.635), 8153A (Ch. 109.635-1) ....42—22
8155 (Ch. 463.155) ....57—17
8160 (Ch. 109.636A) ....50—17
8168 (Ch. 109.638) ....46—23
8169 (Ch. 109.638) (See Model 8168—Set 46-23)
8200 (Ch. 101.800-2B) (See Model 6200A—Set 65-12)
8201 (See Model 6200A—Set 65-12)
8210 (Ch. 101.820-1A) ....71—13
8220, 8221 (Ch. 101.801-3D) (See Model 6220—Set 9-30)
8222 (See Model 6220—Set 9-30)
8230 (Ch. 101.835) ....59—18
8231 (See Model 8230—Set 59-18)
8260 (Ch. 101.823-2B) (See Model 7165—Set 10-29)
8270 (Ch. 101.822), 8270A (Ch. 101.822A) ....57—18
9000 (Ch. 132.857) ....65—13
9005, 9006 (Ch. 132.858). 72—11
9022 (Ch. 132.871) ....76—17
9054 (Ch. 101.849) ....63—16
9073, 9073A (Ch. 135.244), 9073B (Ch. 135.244-1) ....83—10
9073C (Ch. 135.243-1) (See Model 9073—Set 83-10)
9082 (Ch. 135-245) ....101—11
9101 (Ch. 101.809-3C) (See Model 7080—Set 58-20)
9102 (See Model 7080—Set 58-20)
9105 (Ch. 132.875) ....89—14
9107A (Ch. 101.851-1) (See Model 8107A—Set 64-10)
9111 (Ch. 110.499) Tel. Rec. (See Model 9123—Set 79-16)
9112 (Ch. 110.499-1) Tel. Rec. (See Model 9124—Set 79-16)
9113 (Ch. 110.499) Tel. Rec. (See Model 9123—Set 79-16)
9114 (Ch. 110.499-1) Tel. Rec. (See Model 9124—Set 79-16)
9115 (Ch. 478.224), 9116 (Ch. 478.221) Tel. Rec. ....97—16
9116 (Ch. 478.221) Tel. Rec. 97—16
9119, 9120 (Ch. 101.865) Tel. Rec. *
9120A (Ch. 101.862-1) Tel. Rec. *
9121 (Ch. 101.867) Tel. Rec. *
9122 (Ch. 101.864) (See Model 8132—Set 66-15)
9122A (Ch. 101.868) Tel. Rec. *
9123 (Ch. 110.499) Tel. Rec. 79—16
9124 (Ch. 110.499-1) Tel. Rec. ....79—16
9125 (Ch. 478.252) Tel. Rec. *
9125A (Ch. 478.253) Tel. Rec. ....104—10
9125B (Ch. 478.253-1) Tel. Rec. *
9126 (Ch. 110.499-2) Tel. Rec. ....79—16
9127 (Ch. 100.499-2) Tel. Rec. (See Model 9126—Set 79-16)
9128A (Ch. 101.868) Tel. Rec. *
9129 (Ch. 110.499) Tel. Rec. (See Model 9123—Set 79-16)
9130 (Ch. 110.499-1) Tel. Rec. (See Model 9124—Set 79-16)
9131 (Ch. 478.210) Tel. Rec. 84—10
9132 (Ch. 110.499-1) Tel. Rec. (See Model 9124—Set 79-16)

SILVERTONE—Cont.

9133, 9134 (Ch. 101.866 and Radio Ch. 101.859) Tel. Rec. .. 95—5
9139, 9140 (Ch. 110.499-1) Tel. Rec. (See Model 9124—Set 79-16)
9153 (Ch. 435.417) ....67—16
9161 (Ch. 548.358) ....88—10
9260 (Ch. 101.850) ....51—20
9270 (Ch. 547.245) ....82—11
9280 (Ch. 528.168) ....94—9
Ch. 100.043 (See Model 133)
Ch. 100.107 (See Model 133)
Ch. 100.107-1 (See Model 149)
Ch. 100.111 (See Model 143A)
Ch. 100.112 (See Model 161-16)
Ch. 100.115 (See Model 142)
Ch. 100.120 (See Model 165-16)
Ch. 100.201 (See Model 69)
Ch. 100.202 (See Model 1066)
Ch. 100.202-1 (See Model 2195-21)
Ch. 100.208 (See Model 1176-21)
Ch. 100.208-1 (See Model 2195-21)
Ch. 100.209 (See Model 2170-C)
Ch. 100.210, -1, -3 (See Model 2130)
Ch. 100.959 (See Model 142)
Ch. 101.660-1A (See Model 6100)
Ch. 101.662-2B (See Model 6105)
Ch. 101.662-2D (See Model 6105)
Ch. 101.662-3C (See Model 6111)
Ch. 101.662-4E (See Model 6106A)
Ch. 101.662-5F (See Model 6111A)
Ch. 101.666-1B (See Model 6285A)
Ch. 101.672-1A (See Model 6093)
Ch. 101.672-1B (See Model 6092)
Ch. 101.677B (See Model 6290)
Ch. 101.773 (See Model 8127)
Ch. 101.800-1, -1A (See Model 6200A, Ch. 101.800-1, -1A)
Ch. 101.800-3 (See Model 6200A, Ch. 101.800-3)
Ch. 101.801, -1A (See Model 6230)
Ch. 101.802, -1 (See Model 6230)
101.807, A (See Model 7021)
Ch. 101.808 (See Model 7054)
Ch. 101.808-1C (See Model 8052)
Ch. 101.808-1D (See Model 8053)
Ch. 101.809 (See Model 7080, Ch. 101.809)
Ch. 101.809-1A (See Model 8083)
Ch. 101.809-1B (See Model 8084)
Ch. 101.809-2 (See Model 7080, Ch. 101.809-2)
Ch. 101.809-3C (See Model 8101)
Ch. 101.810 (See Model 7090)
Ch. 101.811 (See Model 7100)
Ch. 101.813 (See Model 8050)
Ch. 101.814 (See Model 7085)
Ch. 101.814-1A (See Model 7102)
Ch. 101.814-2B (See Model 8102)
Ch. 101.814-3B (See Model 8102A)
Ch. 101.814-5C (See Model 8086)
Ch. 101.814-6C (See Model 8086A)
Ch. 101.817 (See Model 7070)
Ch. 101.819A (See Model 7226)
Ch. 101.820 (See Model 7210)
Ch. 101.821 (See Model 8090)
Ch. 101.822 (See Model 8270)
Ch. 101.822A (See Model 8270A)
Ch. 101.823, -1 (See Model 7166)
Ch. 101.823-A, -1A (See Model 7165)
Ch. 101.825 (See Model 7115)
Ch. 101.825-1A (See Model 7116)
Ch. 101.825-1B (See Model 7117)
Ch. 101.825-2C (See Model 7119)
Ch. 101.825-3D (See Model 8115)
Ch. 101.825-3E (See Model 8117)
Ch. 101.825-3F (See Model 8118)
Ch. 101.825-3G (See Model 8097)
Ch. 101.825-4 (See Model 8097A)
Ch. 101.829 (See Model 8100)
Ch. 101.829-1 (See Model 8133)
Ch. 101.831 (See Model 8128)
Ch. 101.831A (See Model 8127)
Ch. 101.831-1 (See Model 8124)
Ch. 101.833 (See Model 8105)
Ch. 101.834 (See Model 8072)
Ch. 101.835 (See Model 8230)
Ch. 101.839 (See Model 8051)
Ch. 101.846 (See Model 8133)
Ch. 101.849 (See Model 9054)
Ch. 101.850 (See Model 9260)
Ch. 101.851 (See Model 8107A)
Ch. 101.851-1 (See Model 8109)
Ch. 101.852 (See Model 8080)
Ch. 101.854 (See Model 8132)
Ch. 101.859 (See Model 9133)
Ch. 101.859-1 (See Model 67)
Ch. 101.859-2 (See Model 64)
Ch. 101.860 (See Model 1058)
Ch. 101.861, -1 (See Model 2060)
Ch. 101.864 (See Model 9122)
Ch. 101.865 (See Model 9119)
Ch. 101.865-1 (See Model 9120A)
Ch. 101.866 (See Model 9133)
Ch. 101.867 (See Model 9121)
Ch. 101.868 (See Model 9122A)
Ch. 109.626 (See Model 7152)
Ch. 109.627 (See Model 7153)
Ch. 109.631 (See Model 8145)
Ch. 109.632 (See Model 8148)
Ch. 109.633 (See Model 8149)
Ch. 109.634 (See Model 8150)
Ch. 109.635 (See Model 8153)
Ch. 109.635-1 (See Model 8153A)
Ch. 109.636 (See Model 8160)
Ch. 109.636A (See Model 8160A)
Ch. 109.638 (See Model 8168)
Ch. 110.451 (See Model 6051)
Ch. 110.452 (See Model 6052)
Ch. 110.454 (See Model 6072)
Ch. 110.466 (See Model 7086)
Ch. 110.466-1 (See Model 7103)
Ch. 110.473 (See Model 8103)
Ch. 110.499 (See Model 9123)
Ch. 110.499-1 (See Model 9124)
Ch. 110.499-2 (See Model 9126)
Ch. 110.700 (See Model 111)
Ch. 110.700-1 (See Model 116)
Ch. 110.700-2 (See Model 134)
Ch. 110.700-10 (See Model 116)
Ch. 110.700-20 (See Model 134)
Ch. 110.700-40 (See Model 177-19)
Ch. 110.700-90 (See Model 1116-16)
Ch. 110.700-96 (See Model 1117-17)

NOTE: PCB denotes **Production Change Bulletin**

NOTE: PCB denotes Production Change Bulletin

NOTE: PCB denotes **P**roduction **C**hange **B**ulletin

NOTE: PCB denotes Production Change Bulletin

TRUETONE—Cont.

D2983 Tel. Rec. 68–18
D2985 Tel. Rec. 70–11
D2987 Tel. Rec. 69–13
D2990 Tel. Rec. *
D3120A 203–12
D3130A, B 203–13
D3210A 190–15
D3265A 189–16
D3300 225–20
D3351, D3352, D3353 224–16
D3615 (Factory 25BD2-606) 18–32
D3619 (Factory 5P110) 10–33
D3630, D3630N 19–33
D3720 24–29
D3721 (Factory 1108X) 32–28
D3722 (Fact. No. 472) 51–24
D3809 (Factory No. 178) 43–22
D3810 39–27
D3811 (Fact. No. 1148XH) 47–24
D3840 49–26
D3910 (Fact. Model 140611) 74–10
D4118, B 200–12
D4142A 142–14
D4320 227–15
D4620 (Factory No. 5C12) 26–28
D4730 Factory 26C19-61) 7–28
D4818 (Fact. No. 1340X) 45–26
D4832 (Fact. No. 25C22-82) 47–25
D4842 (Fact. No. 26C21-81) 50–21
2D1088A Tel. Rec. 105–11
2D1088B Tel. Rec. 145–1A
2D1089A Tel. Rec. 113–10
2D1089B Tel. Rec. 136–14
2D1091 Tel. Rec. 161–10
2D1093A, 2D1094A Tel. Rec. 119–12
2D1095 Tel. Rec. 134–11
2D1095A (Ch. 16AX27) Tel. Rec. *
2D1185A Tel. Rec. (See Model 2D1185B—Set 154-13)
2D1185E Tel. Rec. 154–13
2D1185C, D Tel. Rec. (See PCB 43—Set 177-1 and Model 2D1185B—Set 154-13)
2D1185I Tel. Rec. (See PCB 43—Set 177-1, PCB 46—Set 180-1 and Model 2D1185B—Set 154-13)
2D1190A, B Tel. Rec. 147–12
2D1191A (Ch. BRC20AY22 Tel. Rec. *
2D1194A Tel. Rec. 151–11
2D1195A (Ch. 16AX216) Tel. Rec. *
2D1225A (Ch. 21AY21A) Tel. Rec. *
2D1230B Tel. Rec. (Also see PCB 59—Set 193-1) 185–14
2D1235A (Ch. 17MS34S) Tel. Rec. 188–13
2D1235B, C, D, E Tel. Rec. (See PCB 54—Set 215-1 and Model 2D1235A—Set 188-13)
2D1303A Tel. Rec. 207–11
2D1315A Tel. Rec. 204–11
2D1316A Tel. Rec. 224–17
2D1325A Tel. Rec. 204–11
2D1326A Tel. Rec. 224–17
2D1344A, B (Ch. 21MS36C) Tel. Rec. 210–13
2D1354A (Ch. 9210P) Tel. Rec. 194–13
2D2043A Tel. Rec. 161–10
2D2047B Tel. Rec. 161–10
2D2049A (Ch. 16AY210) Tel. Rec. *
2D2052 Tel. Rec. 134–11
2D2052A, B (Ch. 16AY210) Tel. Rec. *
2D2052C (Ch. 17AY23) Tel. Rec. *
2D2052D, E (Ch. 17AY28) Tel. Rec. *
2D2053 Tel. Rec. 120–11
2D2149A (Ch. 17AY212) Tel. Rec. 177–14
2D2152A (Ch. 17AY26) Tel. Rec. *
2D2215A (Ch. 21AY21A) Tel. Rec. *
2D2219A Tel. Rec. 179–13
2D2223A (Ch. 21AY21A) Tel. Rec. *
2D2312A Tel. Rec. 204–11
2D2313A Tel. Rec. 224–17
2D2314A Tel. Rec. 204–11
2D2315A Tel. Rec. 224–17
2D2321A Tel. Rec. 204–11
2D2322A, B Tel. Rec. *
2D2333A, B Tel. Rec. 203–14
3D6000 Tel. UHF Conv. 221–12

ULTRADYNE

L-46 4–21

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

U. S. TELEVISION

C16030 Tel. Rec. 99A–12
C19031 Tel. Rec. 99A–12
T-10823 Tel. Rec. 89–15
T16030 Tel. Rec. 99A–12
T19031 Tel. Rec. 99A–12
5A16, 5B16, 5C16 (See Model 5C66—Set 17-9)
5A66, 5B66, 5C66, 5D66MPA 24–30
5C66 Early 17–9
8-16M (Dumbarton) 26–29

UNITONE

88 5–26

UNIVERSAL CAMERA (See Record Changer Listing)

UTAH (See Record Changer Listing)

V-M (Also see Record Changer Listing)

110 191–19
150 139–15
150A 213–9
160 187–13
970 159–15
972 203–15
975 165–16
980 138–12
985 166–16
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. 92–9

VIDEO PRODUCTS

530-DX Series Tel. Rec. 213–10
630-DXC Tel. Rec. 176–13
630-DX24C Tel. Rec. 176–13
630-K3C Tel. Rec. 176–13
630-K24C Tel. Rec. 176–13

VIEWTONE

RC-201A, RRC-201 11–32

VISION MASTER

14MC, MT Tel. Rec. (Similar to Chassis) 117–8
16MC, 16MT, 16MXC, 16MXCS, 16MXT, 16MXTS Tel. Rec. (Similar to Chassis) 117–8
17MC, 17MT, 17MXC, 17MXCS, 17MXT, 17MXTS Tel. Rec. (Similar to Chassis) 117–8

VIZ

RS-1 14–31

VOGUE

532 A-P 11–33
Ch. Models 533R, 554R 8–32

WARWICK (See Clarion)

WATTERSON

ARC-4591A 15–36
PA-4585, APA-4587 3–2
RC-4581 15–35
4581 3–32
4582 6–34
4782 24–31
4790 16–34
4800 43–23

WAVEFORMS

A-20 191–20
C-5 191–20

WEBCOR (See Webster-Chicago)

WEBSTER-CHICAGO (Also see Changer and Recorder Listings)

8-123-1 204–12
8-124-1 203–16
8-134-1 205–12
8-135-1 210–14
8-136-1 207–12
F-123-1 204–12
F-134-1 205–12
F-136-1 207–12
T-136-1 207–12
66-1A 34–26
100-608 121–14
100-621 113–11
129-1, 129-2 215–13
130 119–13
161-1 55–23
166 159–16
181-1R 221–13
268 117–14
362 105–12
760 112–12
762 105–12

WEBSTER ELECTRIC (Also see Recorder Listing)

81-15, 81-15A 142–15
82-25, 82-25A, 83-25 143–15
84-25 145–12
85-25 144–14
1105M 226–10

WEBSTER (Telehome)

W606M 56–24
604M 57–23

WELLS-GARDNER

317GS34C-218 Tel. Rec. (Also See PCB 84—Set 225-1) 195–12
317GS34C-220 Tel. Rec. (Also See PCB 84—Set 225-1) 195–12
317GS34C-278 Tel. Rec. (Also See PCB 84—Set 225-1) 195–12
321MS31C-222, -224 Tel. Rec. 194–14
321MS31C-272, -274, -276 Tel. Rec. 194–14
321MS31C-280, -282, 284 Tel. Rec. 194–14
321MS39-322 Tel. Rec. 226–11
321MS39-372-2 Tel. Rec. 226–11
321MS39-376-1 Tel. Rec. 226–11
1321MS31C-296 Tel. Rec. 194–14
2321MS39-324 Tel. Rec. 226–11
2321MS39-370 Tel. Rec. 226–11
2321MS39-396-1 Tel. Rec. 226–11

WESTERN AUTO (See Truetone)

WESTINGHOUSE (Also see Record Changer Listing)

H-104, H-105 4–11
H-104A, H-105A, H-107A, H-108A (See Set 21-36 and Model H-104—Set 4-11)
H-107, H-108, H-110, H-111 4–19
H-113, H-114, H-116 (See Model H-117—Set 11-34)
H-117, H-119 11–34
H-122 6–35
H-122A, B (See Model H-122—Set 6-35)
H-125, H-126 3–19
H-130 6–35
H-133 14–34
H-137 (See Model H-138—Set 6-36)
H-138 6–36
H-147 31–33
H-148 15–37
H-148A (See Model H-148—Set 15-37)

WESTINGHOUSE—Cont.

H-153, H-153A (Ch. V-2103) 35–25
H-154 (See Set 21-36 and Model H-104—Set 4-11)
H-155 35–25
H-156 (See Model H-153—Set 35-25)
H-157 (Ch. V-2122) 33–31
H-161 (Ch. V-2118) 34–27
H-162 (See Model H-117—Set 11-34)
H-164 (Ch. V-2119-1) 36–28
H-165 32–29
H-166, H-167 (See Model H-164) 36–28
H-168, H-168A, H-168B (Ch. V-2118) (See Model H-161) 34–27
H-168B (Ch. V-2118) (See Model H-168—Set 34-27)
H-169 (Ch. V-2124-1) 37–24
H-171 (Ch. V-2103) 35–25
H-171A, C (Ch. V-2103) (See Model H-153—Set 35-25)
H-178 (Ch. V-2123) 35–26
H-181 Tel. Rec. *
H-182 (Ch. V-2128, V-2128-1) 53–25
H-183, H-183A 48–26
H-184 (See Model H-153—Set 35-25)
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 54–20
H-196 Tel. Rec. 65–17
H-196A (Ch. V-2130-1) Tel. Rec. (See Model H-196—Set 65-17)
H-196A (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 50–22
H-207A (Ch. V-2130-1, V-2137) Tel. Rec. 65–17
H-207A (DX) (Ch. V-2130-11DX or V-2130-12DX and Radio Ch. V-2137) Tel. Rec. 84–13
H-207B (DX) (Ch. V-2130-21DX or V-2130-22DX and Radio Ch. V-2137) Tel. Rec. 84–13
H-210, H-211 (Ch. V-2144, V-2144-1) 61–20
H-212 (Ch. V-2137) 62–21
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, A (Ch. V-2146-11DX, V-2137, V-2149) Tel. Rec. (See Set 99A-14 and Model H-217B—Set 91-14)
H-217B (Ch. V-2146-35DX, V-2137, V-2149) Tel. Rec. 91–14
H-220 59–23
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. 84–17
H-226 (Ch. V-2146-21DX, -25DX, V-2149) Tel. Rec. (See Model H-217B—Set 91-14)
H-231 (Ch. V-2150-51 and V-2137-3 or V-2137-3S, V-2149-2) Tel. Rec. 99A–14
H-242 (Ch. V-2150-31) Tel. Rec. 97A–14
H-251 (Ch. V-2150-81, -82, -84) Tel. Rec. (See 99A-14 and Model H-609T10—Set 95-7)
H-300T5, H-301T5 (Ch. V-2148) 88–14
H-302P5 (Ch. V-2151-1) 91–15
H-303P4, H-304P4 (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 H-316C7—Set 112-13)
H-318T5, U (Ch. V-2157, U) 117–15
H-320T5, U (Ch. V-2157, U) 117–15
H-321T5, U, H-322T5, U (Ch. V-2157-1, U) 117–15
H-323T5, U (Ch. V-2157-2, U) 117–15
H-324T7, H-325T7, U (Ch. V-2136-2) 113–13
H-326C7 (See Model H-316C7—Set 112-13)
H-327T6U (Ch. V-2157-3U) 126–14
H-328C7, U (Ch. V-2136-4) 137–15
H-331P4, U (Ch. V-2164, U) (Also see PCB 52—Set 186-1) 171–12
H-332P4 (See Model H-331P4U—Set 171-12)
H-333P4, U (Ch. V-2164, U) (Also see PCB 52—Set 187-1) 171–12
H-334T7U, H-335T7U (Ch. V-2136-5U) 142–16
H-334T7UR (Ch. V-2136-5R) 149–14
H-336T5U, H-337T5U (Ch. V-2157U) 134–12
H-338T5U (Ch. V-2157-4U) 140–13
H-341T5U (Ch. V-2157-4U) 140–13
H-342P5U, H-343P5U (Ch. V-2156-1U) 138–13
H-345T5, H346T5 (Ch. V-2157-4U (See Model H-338T5U—Set 140-13)

WESTINGHOUSE—Cont.

H-348P5, H-349P5 (Ch. V-2156-1U) (See Model H-342P5U—Set 138-13)
H-350T7, H-351T7 (Ch. V-2180-1) (Also see PCB 52—Set 186-1) 154–14
H-354C7 (Ch. V-2180-2) 158–13
H-355T5, H-356T5 (Ch. V-2157-5) 161–11
H-357C10 (Ch. V-2180-5) 161–12
H-359T5, H-360T5 (Ch. V-2157-6) 191–21
H-361T6 (Ch. V-2181-1) 186–15
H-365T5, H-366T5 (Ch. V-2157-7) 185–15
H-367T5 (Ch. V-2157-8) 189–17
H-368P5, H-369P5 (Ch. V-2156-1U) (See Model H-342P5U—Set 138-13)
H-370T7, H-371T7 (Ch. V-2180-8) 186–16
H-372P4, H-373P4, Ch. V-2182-1 and H-377 Optional Pwr. Supply 188–14
H-374T5, H-375T5 (Ch. V-2157-9) 189–17
H-376P4 (Ch. V-2182-1 and H-377 Optional Power Supply 188–14
H-377 (Power Supply) 188–14
H-378T5, H-379T5, H-380T5, H-381T5 (Ch. V-2184-1) 211–17
H-382T5, H-383T5 (Ch. V-2157-10) 215–14
H-384T5 (Ch. V-2157-10) (See Model H-382T5—Set 215-14)
H-385T5, H-386T5 (Ch. V-2157-11) 204–13
H-387T5 (Ch. V-2157-11) (See Model H-385T5—Set 204-13)
H-388T5 (Ch. V-2157-12) 215–15
H-393T6 (Ch. V-2181-2) 210–15
H-400P4, H-401P4, H-402P4, H-403P4 (Ch. V-2164-2) 205–13
H-600T16 (Ch. V-2150-61, A, B) Tel. Rec. 98–14
H-601K12, H-602K12 (Ch. V-2150-41) Tel. Rec. 98–14
H-603C12 (Ch. V-2151-01 and V-2149-3) Tel. Rec. 100–14
H-604T10, A (Ch. V-2150-91A, -94, -94A) Tel. Rec. (See Set 99A-14 and Model H-609T10—Set 95-7)
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. 120–12
H-608C12 (Ch. V-2152-01, V-2149-3) Tel. Rec. (See Model H-603C-12—Set 100-14)
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. 105–13
H-615C12 (Ch. V-2152-16) Tel. Rec. 112–14
H-617T12 (Ch. V-2150-176, U, -177U) Tel. Rec. (Also see PCB 10—Set 116-1) 103–17
H-618T16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (Also see PCB 10—Set 116-1) 103–17
H-619T12, U (Ch. V-2150-176, U, -177U) Tel. Rec. (Also see PCB 10—Set 116-1) 103–17
H-620K16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (Also see PCB 10—Set 116-1) 103–17
H-622K16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See PCB 10—Set 116-1 and Model H-617T12—Set 103-17)
H-625T12 (Ch. V-2150-197) Tel. Rec. 114–11
H-626T16 (Ch. V-2172) Tel. Rec. 116–13
H-627K16 (Ch. V-2171) Tel. Rec. 116–13
H-628K16, H-629K16 (Ch. V-2171) Tel. Rec. 116–13
H-630T14 (Ch. V-2176) Tel. Rec. 116–13
H-633C17, H-634C17 (Ch. V-2173) Tel. Rec. 122–11
H-636T17 (Ch. V-2175) Tel. Rec. 116–13
H-637T14 (Ch. V-2177) Tel. Rec. 116–13
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. V-2192, -1, -2, -3, -4, -5, -6) Tel. Rec. (Also see PCB 28—Set 150-1) 133–15
H-641K17 (Ch. V-2175-1, -5), H-641K17A (Ch. V-2192, -1, -2, -3, -4, -5, -6) Tel. Rec. (Also see PCB 28—Set 150-1) 133–15
H-642K20 (Ch. V-2178-1, -3) Tel. Rec. 129–13
H-642K20A (Ch. V-2194, V-2194A, V-2194-1) Tel. Rec. 137–16
H-643K16 (Ch. V-2179, V-2179-1) Tel. Rec. 127–13
H-646K17 (Ch. V-2192) Tel. Rec. 133–15
H-647K17 (Ch. V-2175-3) Tel. Rec. 133–15
H-648T20 (Ch. V-2201-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-649T17 (Ch. V-2200-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-649T17 (Ch. V-2192-4) Tel. Rec. (See Model H-639T17—Set 133-15)

WESTINGHOUSE—Cont.

H-650K21 (Ch. V-2192-4) Tel. Rec. (See Model H-639T17—Set 133-15)
H-650T17 (Ch. V-2200-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-651K17 (Ch. V-2192) Tel. Rec. (See Model H-639T17—Set 133-15)
H-651K17 (Ch. V-2200-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-652K20 (Ch. V-2194-2, -3) Tel. Rec. (See PCB 31—Set 157-3 and Model H-642K20A—Set 137-16)
H-652K20 (Ch. V-2201-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-653K24 (Ch. V-2202-2, V-2210-1) Tel. Rec. (Also see PCB 35—Set 164-1) 160–13
H-654T17 (Ch. V-2175-3, -4, V-2192, -1) Tel. Rec. 133–15
H-655K17, H-656K17, H-657K17 (Ch. V-2200-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-657K17 (Ch. V-2192-4, -5, -6) Tel. Rec. (See PCB 28—Set 150-1 and Model H-639T17—Set 133-15)
H-658T17 (Ch. V-2192, -1) Tel. Rec. (See PCB 28—Set 150-1 and Model H-639T17—Set 133-15)
H-659T17 (Ch. V-2204-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-660C17, H-661C17 (Ch. V-2203-1 and Radio Ch. V-2180-3) Tel. Rec. (Also see PCB 46—Set 180-1) 157–12
H-662K20 (Ch. V-2201-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-663T17 (Ch. V-2192-2) Tel. Rec. (See PCB 28—Set 150-1 and Model H-639T17—Set 133-15)
H-663T17 (Ch. V-2204) Tel. Rec. (Also see PCB 42—Set 177-1) 154–15
H-664K17 (Ch. V-2200-1) Tel. Rec. (Also see PCB 42—Set 176-1) 154–15
H-665T16 (Ch. V-2206-1) Tel. Rec. (See PCB 42—Set 176-1 and Model H-648T20—Set 154-15)
H-667T17, H-668T17 (Ch. V-2216) Tel. Rec. (Also see PCB 40—Set 172-1) 167–15
H-673K21 (Ch. V-2217-1) Tel. Rec. (See Model H-667T17—Set 167-15)
H-676T21 (Ch. V-2217-1) Tel. Rec. (See Model H-667T17—Set 167-15)
H-678K17, H-679K17 (Ch. V-2216-1, -2, -3) Tel. Rec. (Also see PCB 40—Set 172-1, PCB 45—Set 179-1 and PCB 52—Set 186-1) 167–15
H-681T17 (Ch. V-2215-1) Tel. Rec. (See PCB 45—Set 179-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-688K24 (Ch. V-2219-1) (Also see PCB 52—Set 186-1) 174–14
H-689T16 (Ch. V-2214-1) (See PCB 40—Set 172-1, PCB 58—Set 192-1 and Model H-667T17—Set 167-15)
H-690K21, H-691K21 (Ch. V-2217-1) Tel. Rec. (See Model H-667T17—Set 167-15)
H-692T21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-695K21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-699K17 (Ch. V-2216-2, -3) Tel. Rec. (See RCB 40—Set 172-1, PCB 45—Set 179-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-700T17, H701T17 (Ch. V-2216-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 45—Set 179-1, PCB 52—Set 186-1 and Model H-667-T17—Set 167-15)
H-701K21 (Ch. V-2217-2) Tel. Rec. (See PCB 43—Set 177-1 and Model H-667T17—Set 167-15)
H-702K17, H-703K17 (Ch. V-2216-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 45—Set 179-1, PCB 52—Set 186-1 and Model H-767T17—Set 167-15)
H-704T17 (Ch. V-2216-2) Tel. Rec. (See PCB 40—Set 172-1, PCB 45—Set 179-1, PCB 51—Set 185-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-704T17 (Ch. V-2216-4, -5) Tel. Rec. 202–10
H-705K17 (Ch. V-2216-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 45—Set 179-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-706T16 (Ch. V-2207-1) Tel. Rec. 193–12
H-708T20 (Ch. V-2220-1, -3, -11) Tel. Rec. 193–12
H-710T21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-710T21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-711T21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)

NOTE: PCB denotes Production Change Bulletin

WESTINGHOUSE—Cont.

H-711T21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-713K21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-714K21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-714K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-715K21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-715K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-718K20 (Ch. V-2220-2) Tel. Rec. 193–12
H-720K21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-720K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-721K21 Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-721K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-722K21 (Ch. V-2217-2, -3) Tel. Rec. (See PCB 40—Set 172-1, PCB 43—Set 177-1, PCB 52—Set 186-1 and Model H-667T17—Set 167-15)
H-722K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-723K21 (Ch. V-2217-5) Tel. Rec. 202–10
H-724T20, H-725T20 (Ch. V2220-2) Tel. Rec. 193–12
H-730C21 (Ch. V-2218-1 and Radio Ch. V-2180-9, -10) Tel. Rec. 190–16
H-730C21 (Ch. V-2218-2 and Radio Ch. V-2180-9, -10) Tel. Rec. (Also see PCB 59—Set 193-1 and PCB 68—Set 205-1) 190–16
H-730C21 (Ch. V-2218-11 and Radio Ch. V-2180-9, -10) Tel. Rec. (Also see PCB 59—Set 193-1) 190–16
H-732C21 (Ch. V-2218-1 and Radio Ch. V-2180-9, -10) Tel. Rec. 190–16
H-732C21 (Ch. V-2218-11 and Radio Ch. V-2180-9, -10) Tel. Rec. (Also see PCB 59—Set 193-1) 190–16
H-733C21 (Ch. V-2218-1 and Radio Ch. V-2180-9, -10) Tel. Rec. 190–16
H-733C21 (Ch. V-2218-11 and Radio Ch. V-2180-9, -10) Tel. Rec. (Also see PCB 59—Set 193-1) 190–16
H-736T17 Tel. Rec. 214–10
H-737T17 (Ch. V-2216-5) Tel. Rec. 202–10
H-737T17 (Ch. V-2232-2) Tel. Rec. 212–9
H-738T17 (Ch. V-2227-1) Tel. Rec. 214–10
H-739T17, H-739TU17 (Ch. V-2227-2) Tel. Rec. 214–10
H-740T21, H-742K21, H-743K21 (Ch. V-2233-1) Tel. Rec. 212–9
H-746K21, H-746KU21, H-747K21, H-747KU21 (Ch. V-2233-4) Tel. Rec. 215–16
H-750T21 (Ch. V-2221-1) Tel. Rec. *
H-750T21 (Ch. V-2233-3) Tel. Rec. 212–9
H-751T21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-751T21 (Ch. V-2233-2) Tel. Rec. 212–9
H-752T21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-752T21 (Ch. V-2233-2) Tel. Rec. 212–9
H-753K21 (Ch. V-2221-1) Tel. Rec. *
H-753K21 (Ch. V-2233-3) Tel. Rec. 212–9
H-754K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-754K21 (Ch. V-2233-2) Tel. Rec. 212–9
H-755K21 (Ch. V-2233-2) Tel. Rec. 212–9
H-756K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-756K21 (Ch. V-2233-2) Tel. Rec. 212–9
H-757K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-757K21 (Ch. V-2233-2) Tel. Rec. 212–9
H-758K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-758K21 (Ch. V-2233-2) Tel. Rec. 212–9
H-759K21 (Ch. V-2217-4, -5) Tel. Rec. 202–10
H-759K21 (Ch. V-2233-2) Tel. Rec. 212–9
H-760T21 (Ch. V-2233-2) Tel. Rec. 212–9
H-760TU21 (Ch. V-2233-2) Tel. Rec. 212–9
H-761T21 (Ch. V-2233-2) Tel. Rec. 212–9
H-761TU21 (Ch. V-2233-2) Tel. Rec. 212–9
H-802 (Ch. V-11900-1, -2, -3, -4, -5, V-11213) Tel. UHF Conv. 209–13
H-1251 3–19
Ch. V-2102 (See Model H-104)
Ch. V-2102-1 (See Model H-138)

WESTINGHOUSE—Cont.

Ch. V-2103 (See Model H-153)
Ch. V-2103-3 (See Model H-214)
Ch. V-2107 (See Model H-133)
Ch. V-2118 (See Model H-161)
Ch. V-2119-1 (See Model H-164)
Ch. V-2120 (See Model H-165)
Ch. V-2122 (See Model H-157)
Ch. V-2123 (See Model H-178)
Ch. V-2124-1 (See Model H-169)
Ch. V-2127 (See Model H-183)
Ch. V-2128, V-2128-1 (See Model H-182)
Ch. V-2128-2 (See Model H-202)
Ch. V-2130-1 (See Model H-196)
Ch. V-2130-11DX, -12DX (See Model H-196A (DX))
Ch. V-2130-21DX, -22DX (See Model H-207A (DX))
Ch. V-2130-31DX, -32DX (See Model H-225 (DX))
Ch. V-2131, V-2131-1 (See Model H-185)
Ch. V-2132 (See Model H-186M)
Ch. V-2133 (See Model H-188)
Ch. V-2134 (See Model H-190)
Ch. V-2136 (See Model H-307T7)
Ch. V-2136-1 (See Model H-316C7)
Ch. V-2136-2 (See Model H-324T7)
Ch. V-2136-4 (See Model H-328C7)
Ch. V-2136-5R (See Model H-334T7UR)
Ch. V-2137-5U (See Model H-334T7U)
Ch. V-2137 (See Model H-203)
Ch. V-2137-1 (See Model H-199)
Ch. V-2137-2 (See Model H-198)
Ch. V-2137-3, V-2137-3S (See Model H-231)
Ch. V-2144, V-2144-1 (See Model H-210)
Ch. V-2146-05 (See Model H-216)
Ch. V-2146-11DX (See Model H-217)
Ch. V-2146-21DX, -25DX (See Model H-226)
Ch. V-2146-35DX (See Model H-217B)
Ch. V-2146-45 (See Model H-216)
Ch. V-2148 (See Model H300T5)
Ch. V-2149 (See Model H-217B)
Ch. V-2149-1 (See Model H-216)
Ch. V-2149-2 (See Model H-231)
Ch. V-2149-3 (See Model H-603C-12)
Ch. V-2150-01, V-2150-02 (See Model H-223)
Ch. V-2150-31 (See Model H-242)
Ch. V-2150-41 (See Model H-601K-12)
Ch. V-2150-51 (See Model H-231)
Ch. V-2150-61, A, B (See Model H-600T16)
Ch. V-2150-81, -82, -84 (See Model H-251)
Ch. V-2150-91A (See Model H-604-T10)
Ch. V-2150-94 (See Model H-604-T10, A)
Ch. V-2150-94C (See Model H-609T10)
Ch. V-2150-101 (See Model H-605T12)
Ch. V-2150-111, A (See Model H-606K12)
Ch. V-2150-136 (See Model H-610T12)
Ch. V-2150-146 (See Model H-613K16)
Ch. V-2150-176, U (See Model H-617T12)
Ch. V-2150-177U (See Model H-617T12)
Ch. V-2150-186, A, C, CA (See Model H-618T16)
Ch. V-2150-197 (See Model H-625T12)
Ch. V-2151-1 (See Model H-302P5)
Ch. V-2152-01 (See Model H-603-C12)
Ch. V-2152-16 (See Model H-611C12)
Ch. V-2153 (See Model H303P4)
Ch. V-2153-1 (See Model H-312P4)
Ch. V-2156 (See Model H-309P5)
Ch. V-2156-1U (See Model H-342-P5U)
Ch. V-2157, U (See Model H-318T5)
Ch. V-2157-1, -1U (See Model H-321T5)
Ch. V-2157-2, -2U (See Model H-323T5)
Ch. V-2157-3U (See Model H-327T6U)
Ch. V-2157-4U (See Model H338-T5U)
Ch. V-2157-5 (See Model H-355T5)
Ch. V-2157-6 (See Model H-359T5)
Ch. V-2157-8 (See Model H-367T5)
Ch. V-2157-9 (See Model H-374T5)
Ch. V-2157-10 (See Model H-382T5)
Ch. V-2157-11 (See Model H-385T5)
Ch. V-2157-12 (See Model H-388T5)
Ch. V-2161, V-2161U (See Model H-310T5)
Ch. V-2164, U (See Model H-331P4)
Ch. V-2164-2 (See Model H-400P4)
Ch. V-2171 (See Model H-627K16)
Ch. V-2172 (See Model H-626T16)
Ch. V-2173 (See Model H-633C17)
Ch. V-2175 (See Model H-636T17)
Ch. V-2175-1 (See Model H-641-K17)
Ch. V-2175-3, -4 (See Model H-640T17)
Ch. V-2175-5 (See Model H-641K17)
Ch. V-2176 (See Model H-630T14)
Ch. V-2177 (See Model H-637T14)
Ch. V-2178, -1, -3 (See Model H-638K20)
Ch. V-2180-1 (See Model H350T7)
Ch. V-2180-2 (See Model H-354C7)
Ch. V-2180-3 (See Model H-660C17)
Ch. V-2180-5 (See Model H-357C10)
Ch. V-2180-8 (See Model H-370T7)
Ch. V-2180-9, -10 (See Model H-730C21)
Ch. V-2181-1 (See Model H-361T6)

WESTINGHOUSE—Cont.

Ch. V-2181-2 (See Model H-393T6)
Ch. V-2184-1 (See Model H-378T5)
Ch. V-2192, -1 (See Model H-639T17)
Ch. V-2192, -3, -4, -5, -6 (See Model H-640T17A)
Ch. V-2194, V-2194A, V-2194-1 (See Model H-642K20A)
Ch. V-2194-2, -3 (See Model H-652K20)
Ch. V-2200-1 (See Model H-651-K17)
Ch. V-2201-1 (See Model H-652-K20)
Ch. V-2202-2 (See Model H-653K24)
Ch. V-2203-1 (See Model H-660C17)
Ch. V-2204-1 (See Model H-659T17)
Ch. V-2206-1 (See Model H-665T16)
Ch. V-2207-1 (See Model H-706T16)
Ch. V-2208-1 (See Model H-716T17)
Ch. V-2210-1 (See Model H-653K24)
Ch. V-2214-1 (See Model H-689T16)
Ch. V-2215-1 (See Model H-681T17)
Ch. V-2216-1 (See Model H-667T17)
Ch. V-2216-2, -3 (See Model H-678K17)
Ch. V-2216-4, -5 (See Model H-704T17)
Ch. V-2217-1 (See Model H-673K21)
Ch. V-2217-2, -3 (See Model H-692T21)
Ch. V-2217-4, -5 (See Model H-710T21)
Ch. V-2218-1, -2, 11 (See Model H-730C21)
Ch. V-2218-1 (See Model H-688K24)
Ch. V-2220-1 (See Model H-708T20)
Ch. V-2220-2 (See Model H-718K20)
Ch. V-2220-3, -11 (See Model H-708T20)
Ch. V-2221-1 (See Model H-705T21)
Ch. V-2227-1 (See Model H-736T17)
Ch. V-2227-2 (See Model H-739T17)
Ch. V-2232-2 (See Model H-737T17)
Ch. V-2233-1 (See Model H-704T21)
Ch. V-2233-2 (See Model H-751T21)
Ch. V-2233-3 (See Model H-750T21)
Ch. V-2233-4 (See Model H-746K21)
Ch. V-11213 (See Model H-802)
Ch. V-11900-1, -2, -3, -4, -5 (See Model H-802)

WILCOX-GAY (Also see Majestic) (Also see Recordio)

G-306, G-402, G-403, G-404 Tel. Rec. (See Majestic Model 12T2—Set 108-7)
G-414 Tel. Rec. (See Majestic Model G-414—Set 133-8)
G-426, G-427 Tel. Rec. (See Majestic Model 12T2—Set 108-7)
G-614, G-624 Tel. Rec. (See Majestic Model G-414—Set 133-8)
G-914 Tel. Rec. (See Majestic Model G-414—Set 133-8)
OD-446M (OD Series) Tel. Rec. 101–17
OF439-1-C (Ch. OF Series) Tel. Rec. 98–15
OD Series (See Model OD-446M)
OD Series Tel. Rec. *
9D Series Tel. Rec. *
9W Series Tel. Rec. *

WILLYS-OVERLAND

8030 (670777) 50–23
670777 (See Model 8030—Set 50-23)
677012 156–14
679517 172–12

WILMAK

W-446 "DENchum" 21–11

WIRE RECORDING CORP. (See Recorder Listing)

WOOLAROC

3-1A (Ch. 6-9022-J), 3-2A (Ch. 6-9022-K) 6–37
3-3A (Code 7-9003-D) 6–38
3-5A 22–32
3-6A/5 24–32
3-9A, 3-10A 7–30
3-11A (Ch. 56A76) 8–33
3-12/3 23–33
3-13A, 3-14A, 3-15A, 3-16A 34–28
3-17A, 3-18A 34–29
3-20A 24–33
3-29A 7–31
3-61A (See Model 3-71A—Set 36-29)
3-70A 31–34
3-71A 36–29

ZENITH (Also see Record Changer Listing)

G500 (Ch. 5G40) 83–16
G503 (Ch. 5G41) 99–19
G510, G510Y (Ch. 5GO2). 84–14
G511, G511W, G511Y (Ch. 5G01) 85–14
G516 (Ch. 5G03) 109–15
G615, G615W, G615Y (Ch. 6G05) 86–14

ZENITH—Cont.

G660, G663, G665 (Ch. 6G01) 96–12
G723 (Ch. 7G04) 104–13
G724 (Ch. 7G02) 103–18
G725 (Ch. 7G01) 101–18
G881, G882, G883, G884, G885 (Ch. 8G20) 98–16
G-2322 (Ch. 23G22) Tel. Rec. 98–17
G2322Z (Ch. 23G24) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2322Z1 (Ch. 23G24Z1) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G-2327Z (Ch. 23G24) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G-2340, R (Ch. 23G22) Tel. Rec. 98–17
G2340RZ, Z (Ch. 23G24) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2340Z1, G2340RZ1 (Ch. 23G24Z1) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2346R (Ch. 23G22) Tel. Rec. 98–17
G2350RZ, Z (Ch. 23G24) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2353EZ (Ch. 23G24) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2353EZ1 (Ch. 23G24Z1) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2356EZ (Ch. 23G24) Tel. Rec. (See Ch. 23G24—Set 91A-13)
G2420E (Ch. 24G20) Tel. Rec. 93–11
G2420-EOX (Ch. 24G20-OX) Tel. Rec. 93–11
G2420R (Ch. 24G20) Tel. Rec. 93–11
G2420-ROX (Ch. 24G20-OX) Tel. Rec. 93–11
G2437RZ, G2438RZ, Z, G2439RZ (Ch. 24G26) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2441 (Ch. 24G24) Tel. Rec. 98–17
G2441R (Ch. 24G22/24) Tel. Rec. 98–17
G2441RZ, Z (Ch. 24G26) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2441Z1, G2441RZ1 (Ch. 24G26-Z1) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2442E, R (Ch. 24G22/24) Tel. Rec. 98–17
G2442RZ (Ch. 24G26) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2442EZ1, G2442RZ1 (Ch. 24G-26Z1) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2448R (Ch. 24G22/24) Tel. Rec. 98–17
G2448RZ (Ch. 24G26) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2448RZ1 (Ch. 24G26Z1) Tel. Rec. (See Ch. 24G26—Set 91A-12)
G2454R (Ch. 24G21) Tel. Rec. 93–11
G-2454-ROX (Ch. 24G21-OX) Tel. Rec. 93–11
G2854R-OX (Ch. 28F20) Tel. Rec. (See Model 28T960—Set 64-15)
G2951, R, OX, ROX, G2952, R, ROX (Ch. 29G20, -OX) Tel. Rec. 95—8
G2957, R (Ch. 23G23 and Radio Ch. 6G20) Tel. Rec. 98–17
G2958R (Ch. 23G23 and Radio Ch. 6G20) Tel. Rec. 98–17
G-3059R (Ch. 24G23/25 and Radio Ch. 6G20) Tel. Rec. 98–17
G3062 (Ch. 24G23/25 and Radio Ch. 6G20) Tel. Rec. 98–17
G3157RZ, Z (Ch. 23G24 and Radio Ch. 8G20/22) Tel. Rec. (See Ch. 23G24 and Ch. 8G20/22—Set 91A-13)
G3157Z1, G3157RZ1 (Ch. 23G24Z1 and Radio Ch. 8G22) Tel. Rec. (See Ch. 23G24 and Ch. 8G20/22—Set 91A-13)
G3158RZ (Ch. 23G24 and Radio Ch. 8G20/22) Tel. Rec. (See Ch. 23G24 and Ch. 8G20/22—Set 91A-13)
G3158RZ1 (Ch. 23G24Z1 and Radio Ch. 8G22) Tel. Rec. (See Ch. 23G24 and Ch. 8G20/22—Set 91A—13)
G3173RZ, Z, G-3174RZ (Ch. 23G24 and Radio Ch. 8G20/22) Tel. Rec. (See Ch. 23G24 and Ch. 8G20/22—Set 91A-13)
G3259RZ (Ch. 24G26 and Radio Ch. 8G20/22) Tel. Rec. (For TV Ch. see Ch. 24G26—Set 91A-12, For Radio Ch. see Ch. 8G20/22—Set 91A-13)
G3259RZ1 (Ch. 24G26Z1 and Radio Ch. 8G22) Tel. Rec. (For TV Ch. see Ch. 24G26—Set 91A-12, for Radio Ch. see Ch. 8G20/22—Set 91A-13)
G3262Z (Ch. 24G26 and Radio Ch. 8G20/22) Tel. Rec. (For TV Ch. see Ch. 24G26—Set 91A-12, for Radio Ch. see Ch. 8G20/22—Set 91A-13)
G3262Z1 (Ch. 24G26Z1 and Radio Ch. 8G22) Tel. Rec. (For TV Ch. see Ch. 24G26—Set 91A-12, for Radio Ch. see Ch. 8G20/22—Set 91A-13)
G3275RZ (Ch. 24G26 and Radio Ch. 8G20/22) Tel. Rec. (For TV Ch. see Ch. 24G26—Set 91A-12, for Radio Ch. see Ch. 8G20/22—Set 91A-13)
G3276Z (Ch. 24G26 and Radio Ch. 8G20/22) Tel. Rec. (For TV Ch. see Ch. 24G26—Set 91A-12, for Radio Ch. see Ch. 8G20/22—Set 91A-13)
H-401, G (Ch. 4H40) 156–15
H500 (Ch. 5H40) 152–12
H-503, Y (Ch. 5H41) 151–12
H511, H511W, H511Y (Ch. 5H01) 147–13

ZENITH—Cont.

H615 (Ch. 6G05) 140–14
H615Z1 (Ch. 6G05Z1) 178–16
H661E, H661R (Ch. 6H01) 125–13
H664 (Ch. 6H02) 149–15
H665, R, RZ, Z (Ch. 6H01) 125–13
H723 (Ch. 7H04) 122–12
H723Z (Ch. 7H04Z) 134–14
H723Z1 (Ch. 7H04Z1) (See Model H724Z1—Set 163-14)
H723Z2 (Ch. 7H04Z2) 178–17
H724 (Ch. 7H02) 126–15
H724Z (Ch. 7H02Z) (See Model H723Z—Set 134-14)
H-724Z1 (Ch. 7H02Z1) 163–14
H724Z2 (Ch. 7H02Z2) 178–17
H725 (Ch. 7G01Z) 135–15
H880, H880R (Ch. 8H20 Revised) 127–14
H880RZ (Ch. 8H20) 114–12
H1083E (Ch. 10H20) (See Model H3467R—Set 120-13)
H1086R, H-1087R (Ch. 10H20) (See Model H3467R—Set 120-13)
H2029R, H2030E, H2030R (Ch. 20H20) Tel. Rec. 144–15
H2041R (Ch. 20H20) Tel. Rec. 144–15
H-2052R, H2053E (Ch. 20H20) Tel. Rec. 144–15
H2226E, R, H2227E, H2227R (Ch. 22H20) Tel. Rec. 114–13
H2229R, H2230E, R (Ch. 22H21) Tel. Rec. 151–13
H2241R (Ch. 22H21) Tel. Rec. 151–13
H2242E, R (Ch. 22H22) Tel. Rec. 151–13
H2250R (Ch. 22H20) Tel. Rec. 114–13
H2252R, H2253E (Ch. 22H21) Tel. Rec. 151–13
H2254R (Ch. 22H22) Tel. Rec. 151–13
H2255E (Ch. 22H20) Tel. Rec. 114–13
H2328E, EZ, R, RZ (Ch. 23H22, Z) Tel. Rec. 118–11
H2329R, RZ (Ch. 23H22, Z) Tel. Rec. (See Model H2328EZ—Set 118-11)
H2330E, R (Ch. 23H22) Tel. Rec. (See Model H2328E—Set 118-11)
H2341R (Ch. 23H22) Tel. Rec. (See Model H2328E—Set 118-11)
H2352R, RZ, H2353E, EZ Ch. 23H22, Z) Tel. Rec. 118–11
H2436Q Ch. 24H21) Tel. Rec. (See Model H3477R—Set 120-13)
H-2437E, H-2438R, H-2439R (Ch. 24H20) Tel. Rec. 120–13
H2443R (Ch. 24H20) Tel. Rec. (See Model H2437E—Set 120-13)
H2445R (Ch. 24H21) Tel. Rec. 120–13
H2447R (Ch. 24H21) Tel. Rec. 120–13
H-2449E (Ch. 24H20) Tel. Rec. 120–13
H2868 (Ch. 20H20 and Radio Ch. 8H20Z) Tel. Rec. (For TV Ch. see Model H-2029R—Set 144-15, for Radio Ch. see Model J880—Set 168-14)
H3068R (Ch. 22H21 and Radio Ch. 8H20Z) Tel. Rec. (For TV Ch. see Model H2229R—Set 151-13, for Radio Ch. see Model J880—Set 168-14)
H-3074 (Ch. 20H20 and Radio Ch. 10H20Z) Tel. Rec. (For TV Ch. see Model H2029R—Set 144-15, for Radio Ch. see Model H2229R—Set 151-13)
H3168R (Ch. 23H22 and Radio Ch. 8H20) Tel. Rec. (For TV Ch. see Model H2328E—Set 118-11, for Radio Ch. see Model H880RZ—Set 114-12)
H3267, R (Ch. 24H20 and Radio Ch. 8H20) Tel. Rec. (For TV Ch. see Set 120-13, for Radio Ch. see Model H800RZ—Set 114-12)
H3273E, H3274R (Ch. 22H21 and Radio Ch. 10H20Z) Tel. Rec. 151–13
H3284R (Ch. 22H22 and Radio Ch. 10H20Z) Tel. Rec. 151–13
H3467R (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. 120–13
H3469E (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. (See Model H3467R—Set 120-13)
H3475R (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. 120–13
H3477R (Ch. 24H21 and Radio Ch. 10H20) Tel. Rec. 120–13
H3478E (Ch. 24H21 and Radio Ch. 10H20) Tel. Rec. 120–13
H3490EQ (Ch. 24H21 and Radio Ch. 10H20Z) Tel. Rec. (For TV Ch. see Model H2445R—Set 120-13, for Radio Ch. see Model H3273E—Set 151-13)
J402 (Ch. 4J40) 178–18
J420T (Ch. 4J60T) 185–16
J504, Y (Ch. 5J41) 219–12
J514 (Ch. 5J03) 176–14
J615, F, G, W, Y (Ch. 6J05) 182–16
J616 (Ch. 6J03) 179–14
J644, J665E, R (Ch. 6J02) 172–13
J733, G, R, Y (Ch. 7J03) 186–17
J880, J880R (Ch. 8H20Z) 168–14
J1083E, EZ (Ch. 10H20Z) (See Model H3273E—Set 151-13)
J1086, R, RZ (Ch. 10H20Z) (See Model H3273E—Set 151-13)
J1087, Z (Ch. 10H20Z) (See Model H3273E—Set 151-13)
J2026R (Ch. 20J21) Tel. Rec. 159–18
J2027E, R, J2029E, R, J2030E, R (Ch. 20J21) Tel. Rec. 159–18
J2031R (Ch. 20J21) Tel. Rec. (See Model J2026R—Set 159-18)
J2032R (Ch. 20J22) Tel. Rec. (See Model J2051E—Set 159-18)

NOTE: PCB denotes Production Change Bulletin

ZENITH—Cont.

J2040E, J2042R, J2043R, J2044E, R (Ch. 20J21) Tel. Rec.... **159**–18
J2049R (Ch. 20J21) Tel. Rec. (See Model J2027E—Set 159-18)
J2050R (Ch. 20J21) Tel. Rec. (See Model J2027E—Set 159-18)
J2051E, J2053R, J2054R, J2055R (Ch. 20J22) Tel. Rec.... **159**–18
J2126R (Ch. 21J21) Tel. Rec. **159**–18
J2127E, R, J2129E, R, J2130E, R (Ch. 21J20) Tel. Rec.... **159**–18
J2140E, J2142R, J2143R, J2144E, R (Ch. 21J20) Tel. Rec... **159**–18
J2151E, J2153R, J2154R, J2155R (Ch. 21J21) Tel. Rec... **159**–18
J2868R (Ch. 20J21 and Radio Ch. 8H20Z) Tel. Rec. (For TV Ch. see Set 159-18, for Radio Ch. see Model J880—Set 168-14)
J2968R (Ch. 21J20 and Radio Ch. 8H20Z) Tel. Rec. (For TV Ch. see Set 159-18, for Radio Ch. see Model J880—Set 168-14)
J3069E (Ch. 20J21 and Radio Ch. 10H20Z) Tel. Rec. (For TV Ch. see Set 159-18, for Radio Ch. see Model H3273E—Set 151-13)
J3169E (Ch. 21J20 and Radio Ch. 10H20Z) Tel. Rec. (For TV Ch. see Set 159-18, for Radio Ch. see Model H3273E—Set 151-13)
K412G, R, W, Y (Ch. 4K01) **195**–13
K510, K510W, K510Y (Ch. 5K02) **181**–15
K515 (Ch. 5K03) (See Model J514 —Set 176-14)
K518 (Ch. 5J03) (See Model J514 —Set 176-14)
K526, W, Y (Ch. 5K04)... **215**–18
K622, F, G, W (Ch. 6K03). **203**–17
K666R (Ch. 6K02)........ **203**–18
K725, F, G (Ch. 7K01).... **212**–10
K777E, R (Ch. 7K20)..... **190**–17
K1812E (Ch. 19K22) Tel. Rec. **184**–15
K-1812E-3 (Ch. 19K22-3) Tel. Rec. **214**–11
K1812R (Ch. 19K22) Tel. Rec. **184**–15
K1812R-3 (Ch. 19K22-3) Tel. Rec. **214**–11
K1815E, R (Ch. 19K20) Tel. Rec. **184**–15
K1820E (Ch. 19K20) Tel. Rec. **184**–15
K1820E-3 (Ch. 19K20-3) Tel. Rec. **219**–13
K1820R (Ch. 19K20) Tel. Rec. **184**–15
K-1820R-3 (Ch. 19K20-3) Tel. Rec. **219**–13
K1846E (Ch. 19K20) Tel. Rec. **184**–15
K-1846E 3 (Ch. 19K20-3) Tel. Rec. **219**–13
K1846R (Ch. 19K20) Tel. Rec. **184**–15
K-1846R 3 (Ch. 19K20-3) Tel. Rec. **219**–13
K1850E, R (Ch. 19K20) Tel. Rec. **184**–15
K1880R (Ch. 19K20) Tel. Rec. **184**–15
K-1880R 3 (Ch. 19K20-3 and Radio Ch. 8H20Z) (For TV Ch. see Set 219-13, for Radio Ch. see Model J880—Set 168-14)
K2229E (Ch. 19K24) Tel. Rec. (See Model K1812E—Set 184-15)
K2229E-3 (Ch. 19K24-3) Tel. Rec. **214**–11
K2229R (Ch. 19K23) Tel. Rec. **184**–15
K2229R-3 (Ch. 19K24-3) Tel. Rec. **214**–11
K2230E, R (Ch. 21K20) Tel. Rec. **187**–14
K2235E (Ch. 19K23) Tel. Rec. (See Model K1812E—Set 184-15)
K2235E-3 (Ch. 19K23-3) Tel. Rec. **219**–13
K2235R (Ch. 19K23) Tel. Rec. (See Model K1812E—Set 184-15)
K2235R-3 (Ch. 19K23-3) Tel. Rec. **219**–13
K2240E, R (Ch. 21K20) Tel. Rec. **187**–14
K2258E (Ch. 19K23) Tel. Rec. (See Model K2258R—Set 184-15)
K2258E-3 (Ch. 19K23-3) Tel. Rec. **219**–13
K2258R (Ch. 19K23) Tel. Rec. **184**–15
K2258R-3 (Ch. 19K23-3) Tel. Rec. **219**–13
K2260R (Ch. 21K20) Tel. Rec. **187**–14
K2260R-3 (Ch. 21K20-3) Tel. Rec. **220**–12
K2262R (Ch. 19K23 Tel. Rec. (See Model K2229R—Set 184-15)
K2262R-3 (Ch. 19K23-3) Tel. Rec. **219**–3
K2263E (Ch. 21K20) Tel. Rec. **187**–14
K2263E-3 (Ch. 21K20-3) Tel. Rec. **220**–12
K2266, R (Ch. 21K20) Tel. Rec. **187**–14
K-2266R 3 (Ch. 21K20-3) Tel. Rec. **220**–12
K2267E (Ch. 21K20) Tel. Rec. **187**–14
K2267E-3 (Ch. 21K20-3) Tel. Rec. **220**–12
K2268R (Ch. 21K20) Tel. Rec. **187**–14
K2270H, R (Ch. 21K20) Tel. Rec. **187**–14
K2271H (Ch. 21K20) Tel. Rec. (See Model K2230E—Set 187-14)
K2271H-3 (Ch. 21K20-3) Tel. Rec. **220**–12
K2286R (Ch. 19K23) Tel. Rec. **184**–15

ZENITH—Cont.

K2286R-3 (Ch. 19K23-3 and Radio Ch. 7K21) Tel. Rec. (TV Ch. only) **219**–13
K2287R (Ch. 21K20 and Radio Ch. 8H20Z) Tel. Rec. (For TV Ch. see Set 187-14, for Radio Ch. see Model J880—Set 168-14)
K2287R-3 (Ch. 21K20-3) Tel. Rec. **220**–12
K2288E (Ch. 19K23) Tel. Rec. **184**–15
K2290R, K2291E (Ch. 21K20 and Radio Ch. 10H20Z) Tel. Rec. (For TV Ch. see Set 187-14, for Radio Ch. see Model H3273E—Set 151-13)
K2291E-3 (Ch. 21K20 and Radio Ch. 10H20Z) Tel. Rec. (For TV Ch. see Set 220-12, for Radio Ch. see Model H3273E—Set 151-13)
K2872R, K2873E (Ch. 29K20) Tel. Rec. **215**–19
L403F, G, R, Y (Ch. 4L41). **221**–14
L406R (Ch. 4L42)........ **220**–13
L505F, R, Y (Ch. 5L41).... **224**–18
L518, F, G, W, Y (Ch. 5L03) **217**–18
L622, F, G, W (Ch. 6L03). **222**–16
L721 (Ch. 7L05) **226**–12
L1812E (Ch. 19L26) Tel. Rec. **223**–14
L1812EU (Ch. 19L26) Tel. Rec. (For TV Ch. See Model L1812E—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L1812R (Ch. 19L26) Tel. Rec. **223**–14
L1812RU (Ch. 19L26) Tel. Rec. (For TV Ch. See Model L1812R—Set 223-14, or UHF Tuner See Model L2571RU—Set 227-16)
L1820E (Ch. 19L26) Tel. Rec. **223**–14
L1820EU (Ch. 19L26) Tel. Rec. (For TV Ch. See Model L1820E—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L1820R (Ch. 19L26) Tel. Rec. **223**–14
L1820RU (Ch. 19L26) Tel. Rec. (For TV Ch. See Model L1820R—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L2229E (Ch. 19L28) Tel. Rec. **223**–14
L2229EU (Ch. 19L28) Tel. Rec. (For TV Ch. See Model L2229E—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L2229R (Ch. 19L28) Tel. Rec. **223**–14
L2229RU (Ch. 19L28) Tel. Rec. (For TV Ch. See Model L2229R—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L2235E (Ch. 19L28 Tel. Rec. **223**–14
L2235EU (Ch. 19L28) Tel. Rec. (For TV Ch. See Model L2235E—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L2235R (Ch. 19L28) Tel. Rec. **223**–14
L2235RU (Ch. 19L28) Tel. Rec. (For TV Ch. See Model L2235R—Set 223-14, For UHF Tuner See Model L2571RU—Set 227-16)
L2571R, RU (Ch. 22L20) Tel. Rec. **227**–16
L2572R, RU (Ch. 22L20) Tel. Rec. **227**–16
L2573E, EU (Ch. 22L20) Tel. Rec. **227**–16
L2574R, RU (Ch. 22L20) Tel. Rec. **227**–16
L2575E, EU (Ch. 22L20) Tel. Rec. **227**–16
L2592R, RU (Ch. 22L20 and Radio Ch. 10L20) Tel. Rec. ... **227**–16
L2593H, HU (Ch. 22L20 and Radio Ch. 10L20) Tel. Rec. ... **227**–16
L2876E, EU, R, RU (Ch. 22L20) Tel. Rec. **227**–16
L2878R, RU (Ch. 22L20) Tel. Rec. **227**–16
L2879E, EU (Ch. 22L20) Tel. Rec. **227**–16
L2894HU (Ch. 22L20 and Radio Ch. 10L20) Tel. Rec. ... **227**–16
4G800 (Ch. 4E41)........ **35**–27
4G800WZ, 4G800YZ, 4G800Z (Ch. 4E41Z) **52**–23
4G903, 4G903Y (Ch. 4F40) **76**–20
4K016 (Ch. 4C52)........ **6**–39
4K035 (Ch. 4C53)........ **6**–40
5D011, 5D027 (Ch. 5C01, 5C01Z) **3**–17
5D810 (Ch. 5E02)........ **54**–21
5G003 (Ch. 5C40)........ **17**–35
5G003Z (Ch. 5C40Z), 5G003ZZ (Ch. 5C40ZZ) **30**–31
5G036 (Ch. 5C51)........ **30**–32
5R080-5R086 (Ch. 5C02, 5C04) **4**–4
6D014, 6D014W, 6D029, 6D029G (Ch. 6C01) **9**–35
6D015, 6D015Y, 6D030 (Ch. 6C05, 6C05Z) **3**–24
6D815, 6D815W, 6D815Y (Ch. 6E05) **55**–24
6G001, 6G001Y (Ch. 6C40) **3**–14
6G001YZ1 (See Model 6G001—Set 3-14)
6G004Y (Ch. 6C41)........ **20**–35
6G038 (Ch. 6C50)........ **32**–30
6G801 (Ch. 6E40)........ **53**–26
6R084 (Ch. 6C21)........ **20**–36
6R087 (Ch. 6C22)........ **7**–32
7R886 (Ch. 6E02)........ **34**–30
7H820, 7H820W (Ch. 7E01) **43**–24
7H822 (Ch. 7E02), 7H822WZ, 7H822Z (Ch. 7E02Z).... **55**–25
7H918 (Ch. 7F03)........ **75**–18
7H920, 7H920W (Ch. 7F01) **77**–13
7H921 (Ch. 7F04)........ **73**–16
7H922 (Ch. 7F02)........ **87**–15
7R070 (Ch. 6C06)........ **37**–25

ZENITH—Cont.

7R887 (Ch. 7E22)........ **54**–22
8G005Y (Ch. 8C40)...... **7**–33
8G005YT (Z1) (Ch. 8C40T) (Z1), 8G005YT (Z2) (Ch. 8C40T) (Z2) **53**–27
8H023 (Ch. 8C01)........ **4**–40
8H032, 8H033 (Ch. 8C20). **1**–33
8H034 .... **4**–40
8H050, 8H051, 8H052, 8H061 **1**–33
8H832, 8H861 (Ch. 8E20). **52**–24
9H079, 9H079E, 9H079R, 9H081, 9H082R, 9H085R, 9H088R (Ch. 8C21) **7**–34
9H881, 9H882R, 9H885, 9H888R (Ch. 9E21) **43**–25
9H984, 9H984LP (Ch. 9F22) **64**–14
9H995 (Ch. 9E21Z)........ **74**–12
12H090, 12H091, 12H092, 12H093, 12H094 (Ch. 11C21).... **2**–20
14H789 (Ch. 13D22)..... **41**–24
27T965R (Ch. 27F20) Tel. Rec. .... **95**—8
28T925, E, R (Ch. 28F22) Tel. Rec. **64**–15
28T926E, R (Ch. 28F25) Tel. Rec. (See Model 28T925—Set 64-15)
28T960E (Ch. 28F20) Tel. Rec. (See Model 28T960—Set 64-15)
28T960E-Z (Ch. 28F20Z) Tel. Rec. (See Model 28T960—Set 64-15)
28T960-GO, 28T960K (Ch. 28F20) Tel. Rec. (See Model 28T960—Set 64-15)
28T961E, 28T961-GO (Ch. 28F21) Tel. Rec. (See Model 28T961—Set 64-15)
28T962R (Ch. 28F20) Tel. Rec. (See Model 28T962—Set 64-15)
28T962R-Z (Ch. 28F20Z) Tel. Rec. (See Model 28T962—Set 64-15)
28T963 (Ch. 28F21) Tel. Rec. **64**–15
28T964R (Ch. 28F23) Tel. Rec. **74**–13
37T996RLP (Ch. 28F23 and Radio Ch. 9E21Z) Tel. Rec. (For TV Ch. see Model 42T999RLP—Set 74-13, for Radio Ch. see Model 9H995—Set 74-12)
37T998RLPU (Ch. 28F20 and Radio Ch. 9E21Z) Tel. Rec. (For TV Ch. see Model 28T960—Set 64-15, for Radio Ch. see Model 9H995—Set 74-12)
42T999RLP (Ch. 28F23, Radio Ch. 13D22) Tel. Rec. (See Model 28T964R)
Ch. 4C52 (See Model 4K016)
Ch. 4C53 (See Model 4K035)
Ch. 4E41 (See Model 4G800)
Ch. 4E41Z (See Model 4G800Z)
Ch. 4F40 (See Model 4G903)
Ch. 4H40 (See Model H-401)
Ch. 4J40 (See Model J402)
Ch. 4J60T (See Model J420T)
Ch. 4K01 (See Model K412G)
Ch. 4L41 (See Model L403F)
Ch. 4L42 (See Model L406R)
Ch. 5C01, 5C01Z (See Model 5D011)
Ch. 5C02, 5C02Z (See Model 5R080)
Ch. 5C04 (See Model 5R080)
Ch. 5C40 (See Model 5G003)
Ch. 5C40Z (See Model 5G003Z)
Ch. 5C40ZZ (See Model 5G003ZZ)
Ch. 5C51 (See Model 5G036)
Ch. 5E02 (See Model 5D810)
Ch. 5G01 (See Model G511)
Ch. 5G02 (See Model G510)
Ch. 5G03 (See Model G516)
Ch. 5G40 (See Model G500)
Ch. 5G41 (See Model G503)
Ch. 5H01 (See Model H511)
Ch. 5H40 (See Model H500)
Ch. 5H41 (See Model H503)
Ch. 5J03 (See Model J514)
Ch. 5J41 (See Model J504)
Ch. 5K02 (See Model K510)
Ch. 5K03 (See Model K518)
Ch. 5K04 (See Model K526)
Ch. 5L03 (See Model L518)
Ch. 5L41 (See Model L505F)
Ch. 6C01 (See Model 6D014)
Ch. 6C05, Z (See Model 6D015)
Ch. 6C06 (See Model 7R070)
Ch. 6C21 (See Model 6R084)
Ch. 6C22 (See Model 6R087)
Ch. 6C40 (See Model 6G001)
Ch. 6C41 (See Model 6G004Y)
Ch. 6C50 (See Model 6G038)
Ch. 6E02 (See Model 6R886)
Ch. 6E05 (See Model 6D815)
Ch. 6E40 (See Model 6G801)
Ch. 6G01 (See Model G660)
Ch. 6G05 (See Model G615)
Ch. 6G05Z1 (See Model H615Z1)
Ch. 6G20 (See Model G2957)
Ch. 6H01 (See Model H661E)
Ch. 6H02 (See Model H664)
Ch. 6J02 (See Model J644)
Ch. 6J03 (See Model J616)
Ch. 6J05 (See Model J615)
Ch. 6K02 (See Model K666R)
Ch. 6K03 (See Model K622)
Ch. 6L03 (See Model L622)
Ch. 7E01 (See Model 7H820)
Ch. 7E02 (See Model 7H822)
Ch. 7E02Z (See Model 7H822WZ)
Ch. 7E22 (See Model 7R887)
Ch. 7F01 (See Model 7H920)
Ch. 7F02 (See Model 7H922)
Ch. 7F03 (See Model 7H918)
Ch. 7F04 (See Model 7H921)
Ch. 7G01 (See Model G725)
Ch. 7G01Z (See Model H725)
Ch. 7G02 (See Model G724)
Ch. 7G04 (See Model G723)
Ch. 7H02 (See Model H724)
Ch. 7H02Z (See Model H724Z)
Ch. 7H02Z1 (See Model H724Z1)
Ch. 7H02Z2 (See Model H724Z2)
Ch. 7H04 (See Model H723)
Ch. 7H04Z (See Model H723Z)
Ch. 7H04Z1 (See Model H723Z1)
Ch. 7H04Z2 (See Model H723Z2)
Ch. 7J03 (See Model J733)
Ch. 7K01 (See Model K725)
Ch. 7K20 (See Model K777E)

NOTE: PCB denotes Production Change Bulletin

ZENITH

ZENITH—Cont.

Ch. 7L05 (See Model L721)
Ch. 8C01 (See Model 8H023)
Ch. 8C20 (See Model 8H032)
Ch. 8C21 (See Model 9H079)
Ch. 8C40 (See Model 8G005Y)
Ch. 8C40T(Z1) (See Model 8G005-YT (Z1))
Ch. 8C40T (Z2) (See Model 8G005-YT (Z2)
Ch. 8E20 (See Model 8H832)
Ch. 8G20 (See Model G881)
Ch. 8G20/22 .... **91A**–13
Ch. 8H20 (See Model H880RZ)
Ch. 8H20 Revised (See Model H880)

ZENITH—Cont.

Ch. 8H20Z (See Model J880)
Ch. 9E21 (See Model 9H881)
Ch. 9E21Z (See Model 9H995)
Ch. 9F22 (See Model 9H984)
Ch. 10H20 (See Model H3467R)
Ch. 10H20Z (See Model H3273E)
Ch. 10L20 (See Model L2592R)
Ch. 11C21 (See Model 12H090)
Ch. 13D22 (See Model 14H789)
Ch. 19K20 (See Model K1815E)
Ch. 19K20-3 (See Model K1820E-3)
Ch. 19K22 (See Model K1812E)
Ch. 19K22-3 (See Model K1812E-3)
Ch. 19K23 (See Model K2229R)

ZENITH—Cont.

Ch. 19K23-3 (See Model K2235E-3)
Ch. 19K24-3 (See Model K2229E-3)
Ch. 19L26 (See Model L1812E)
Ch. 19L28 (See Model L2229E)
Ch. 20H20 (See Model H2029R)
Ch. 20J21 (See Model J2027E)
Ch. 20J22 (See Model J2026R)
Ch. 21J20 (See Model J2127E)
Ch. 21J21 (See Model J2127R)
Ch. 21K20 (See Model K-2230E)
Ch. 21K20-3 (See Model K2260R-3)
Ch. 22H20 (See Model H2226R)
Ch. 22H21 (See Model H2229R)
Ch. 22H22 (See Model H2242E)

ZENITH—Cont.

Ch. 22L20 (See Model L2571R)
Ch. 23G22 (See Model G2322)
Ch. 23G23 (See Model G2957)
Ch. 23G24 .... **91A**–13
Ch. 23G24Z1 (See Model G2322Z1)
Ch. 23H22, 23H22Z (See Model H-2328E)
Ch. 24G20 (See Model G2420E)
Ch. 24G20-OX (See Model G2420-EOX)
Ch. 24G21 (See Model G2454R)
Ch. 24G21-OX (See Model G2454-ROX)
Ch. 24G22/24 (See Model G2441R)

ZENITH—Cont.

Ch. 24G23/25 (See Model G3059R)
Ch. 24G24 (See Model G2441)
Ch. 24G26 .... **91A**–12
Ch. 24G26Z1 (See Model G2441Z1)
Ch. 24H20 (See Model H2437E)
Ch. 24H21 (See Model H2445R)
Ch. 27F20 (See Model 27T965R)
Ch. 28F20 (See Model 28T960E)
Ch. 28F20Z (See Model 28T960E-Z)
Ch. 28F21 (See Model 28T961E)
Ch. 28F22 (See Model 28T925E)
Ch. 28F23 (See Model 28T964R)
Ch. 28F25 (See Model 28T926E)
Ch. 28K20 (See Model K2872R)
Ch. 29G20 (See Model G2951)

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. (CM-4) indicates service data available in Howard W. Sams 1951, 1952 Record Changer Manual.

ADMIRAL

RC-150 .... (CM-1) **26**–31
RC160, RC160A, RC161, RC-161A (See Model RC200—Set 9 and Model RC-160—Set 21-37)
RC-170, RC-170A .. (CM-1) **31**—2
RC-180, RC-181 ... (CM-2) **76**—1
RC-182 (See Model RC-181—Set 76-1 and Supplement—Set 76-2) (CM-2)
RC-200 .... (CM-1) **9**
RC-210, RC211, RC212 (CM-3) **72**
RC-220, RC-221, RC-222, RC-320, RC-321, RC-322 [See Set 79-1 and Changes in Set 108-2 (CM-3)]
RC400 .... (CM-4) **104**—1
RC500 .... (CM-4) **132**—2
RC-550 [See Model RC-500—Set 132-2 (CM-4) and Model RC-550 —Set 185-2]
RC600 .... **218**—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

COLLARO

RC.521, RC.522 .... **205**—4
3RC.521, 3RC.522 .... **205**—4

COLUMBIA

104 .... **124**—2

CRESCENT

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

CRESCENT—Cont.

350 Series .... (CM-2) **80**—3
500 Series .... **197**—4

FARNSWORTH

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

GARRARD

RC-60 .... (CM-2) **81**—7
RC80 .... (CM-4) **157**—5

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 [See Set 91-7 (CM-3) and Supplement—Set 131-11]

MILWAUKEE ERWOOD

10700 .... (CM-1) **16**–37
11200 .... (CM-2) **86**—6
11600 .... (CM-3) **73**—7
12300 .... (CM-4) **138**—5

MOTOROLA

B24RC, B25RC, B27RC, B28RC .... (CM-1) **12**–35

MOTOROLA—Cont.

RC30 .... (CM-2) **80**—9
RC36, A .... (CM-4) **147**—8
RC36C (See Model RC36—Set 147-8)
RC37 .... (CM-4) **141**—8
RC40 [See Model RC37—Set 141-8 (CM-4)]

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
M22 .... (CM-4) **140**—6

RCA

RP168 .... (CM-3) **72**–10
RP-176 .... (CM-1) **25**–31
RP-177 .... (CM-2) **44**–27
RP-178 .... (CM-2) **79**–12
RP190 Series ..... (CM-4) **144**—7

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
CD43 .... **222**–15

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—Set 73-14 (CM-3)]
405 .... (CM-3) **73**–14
406, 407 .... (CM-3) **102**–17
800 .... (CM-1) **21**–38
800-D .... (CM-2) **84**–12
802 .... (CM-3) **77**–12
910 .... (CM-3) **115**–14
950 [See Set 107-13 (CM-3) and Supplement—Set 131-17]
950, 951 (Late) **216**–11

WEBSTER-CHICAGO

50 .... (CM-1) **24**–35
56 .... (CM-1) **17**–36
70 .... (CM-1) **29**–28
77 .... (CM-4) **137**–14

WEBSTER-CHICAGO—Cont.

100 .... (CM-4) **135**–14
106 .... (CM-4) **146**–12
121, 122, 123, 124, 125. **206**–12
126, 127, 129 .... **208**–13
133 .... (CM-2) **82**–13
148 .... (CM-2) **86**–12
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
V6676 .... **136**–15

ZENITH

S11478 .... (CM-1) **23**–35
S11680 .... (CM-1) **27**–32
S14001 .... (CM-2) **75**–17
S13675, S-14002, 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 .. (CM-3) **112**–15
S14026 .... (CM-3) **105**–14
S14027 .... (CM-3) **112**–15
S-14028, S-14029, S-14030, S-14031 .... (CM-4) **145**–13
S-14036 .... (CM-4) **145**–13
S-14053, S-14054, S-14056, S-14057 .... **226**–13

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

AMPEX

400A, 401A .... **213**—1

AMPRO

730 .... (CM-4) **133**—4
731 (For electrical unit see Folder 166-5; for mechanical unit see Folder 133-4)
731-R (See Modeel 731)

BRUSH SOUND MIRROR

BK-401 .... (CM-1) **42**–25
BK-403 .... (CM-2) **78**—3
BK-416 .... (CM-2) **81**—4
BK-437, S-BK-439, BK-441, BK-442, BK-443P .... **164**—3

BRUSH MAIL-A-VOICE

BK-501, BK-502, BK-503 ... (CM-1)

CONCERTONE

1401 (401) ...... (CM-4) **155**—4

CRESCENT

H-1A .... (CM-4) **130**—5
H-2A1 Series .... (CM-3) **119**—4
H-19 Series "Steno" .... (CM-4) **122**—3
H-22A1 .... **125**—4

CRESCENT—Cont.

H2000 Series .... (CM-4) **120**—4
M-2001 Series ... (CM-4) **120**—4
M-2500 Series ... (CM-4) **120**—4
M-3000 Series ... (CM-4) **120**—4
M-3001 Series ... (CM-4) **120**—4
M-3500 Series ... (CM-4) **120**—4
1000 Series ..... (CM-2)
1000 Series Revised (CM-3) **77**—4

CRESTWOOD

CP-201 .... (CM-3) **118**—4

DUKANE

11A55FF, 11B55 .... **187**—5

EICOR

230 .... **223**—6
1000 .... (CM-3) **90**—4

EKOTAPE (WEBSTER-ELECTRIC)

101-4, 5, 102-4, 5, 103-4, 5, 104-4, 5 ...... (CM-3) **116**–12
101-8, 101-9, 102-9, 103-8 **170**—6
109, 110, 111, 112 (CM-4) **152**—5
114, 115, 116, 117 ..... **189**—8

GENERAL INDUSTRIES

R70, R90 .... (CM-1) **35**–28

GENERAL INDUSTRIES—Cont.

R90L [See Model R90—Set 35-28 (CM-1)]
250 .... (CM-4) **143**—8

INTERNATIONAL ELECTRONICS

PT3 .... (CM-2) **88**—4

KNIGHT

96-144 (CM-4) .... **158**—6
96-485 .... **183**—8
96-499 (CM-4) .... **158**—6

LEAR DYNAPORT

WC-311-D .... (CM-2) **80**—8

MAGNECORD AUDIAD

AD-1R .... (CM-2) **84**—7
PT6, AH, AHX, AX .... **190**—6
PT63-A, AH, AHX, AX .... **190**—6

MASCO

DC37R (CM-4) .... **148**—9
D37 (CM-4) .... **148**—9
D37R .... (CM-4) **148**—9
LD37, LD37R ..... (CM-4) **148**—9
52, 52C, 52CR, 52L, 52LR, 52R .... **214**—6
375 .... (CM-3) **117**—7

PENTRON

PB-A2, PB-1 .... **184**–11
9T-3 .... (CM-4) **153**–10
9T-3C .... (CM-4) **162**—9

RCA

MI-12875 .... (CM-2) **85**–12
SRT-301 (MI-15910) **224**–11

RECORDIO (See Wilcox Gay)

REELEST

C1A .... (CM-4) **123**–13

REVERE

T-100 .... (CM-4) **149**–11
T-500 [See Model T-100—Set 149-11 (CM-4)]
TR-200, TR-600 (For electrical unit see Folder 165-10; for mechanical unit see Folder 149-11)
T-70153, T-70157, T-70163, T-70167, T-70235, T-70257, T-70263, T-70267, T-77153, T-77157, T-77163, T-77167, T-77253, T-77257, T-77263, T-77267 .... **193**—9

SILVERTONE

70 (Ch. 567.230, 577.231) .... (CM-4) **121**–11

SILVERTONE—Cont.

771 .... (CM-1) **26**–32
101.774-2, 101.774-4 .... (CM-3) **114**–10

ST. GEORGE

1100 Series ..... (CM-1) **40**–24

TAPE MASTER

PT-121 .... **186**–14
PT-125 .... **198**–15

WEBSTER-CHICAGO

79-80 .... (CM-1) **37**–26
178 .... (CM-3) **113**–12
210 .... (CM-4) **159**–17
228 .... (CM-4) **156**–13

WEBSTER ELECTRIC (See Ekotape)

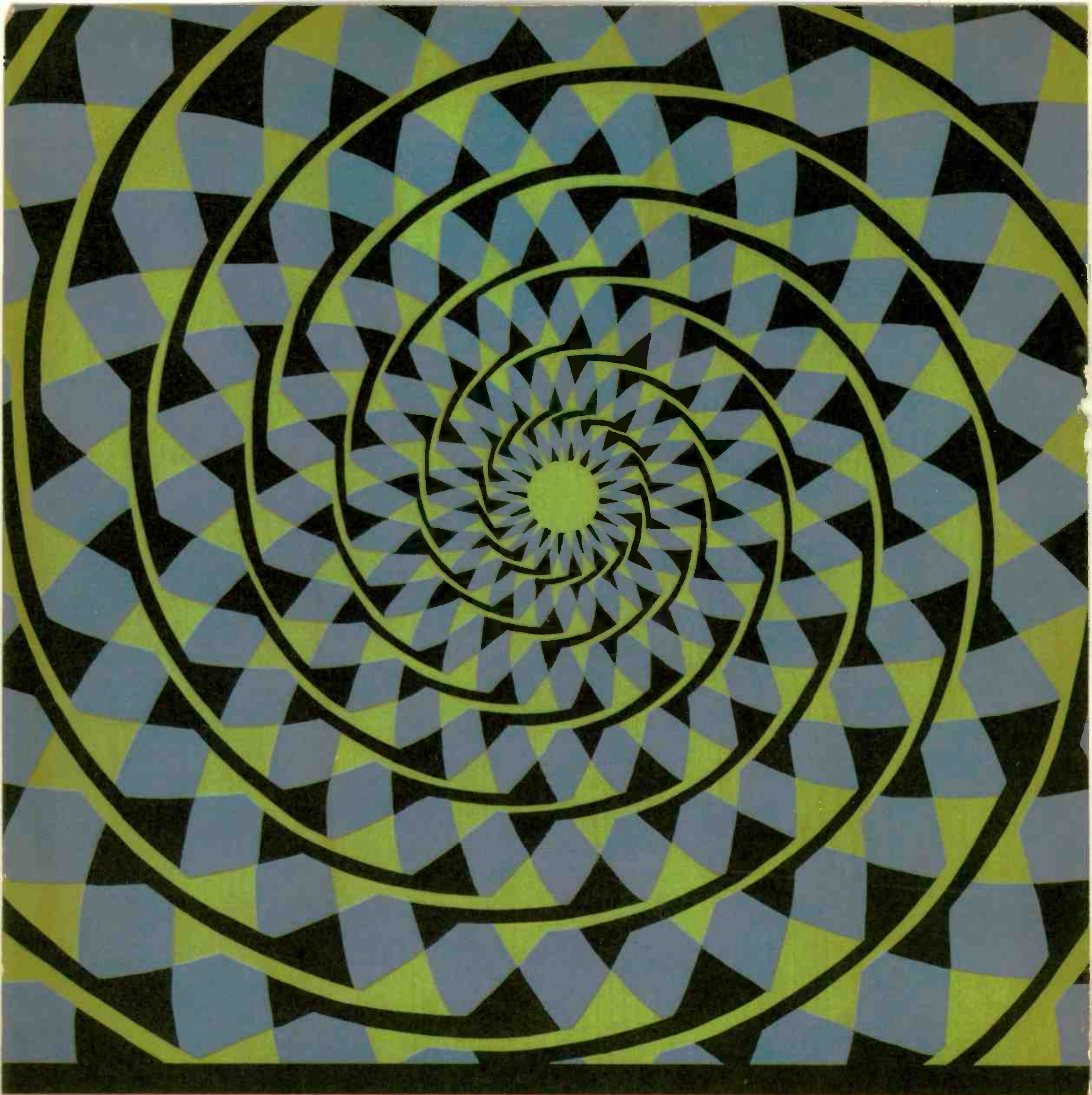
WILCOX GAY

2A10, 2A10B, 2A11, 2A11B **180**–10
3A10, 3A11 .... **200**–13
3C10 .... **215**–17
3F10 .... **220**–11

WIRE RECORDING CORP.

WP .... (CM-2) **76**–19

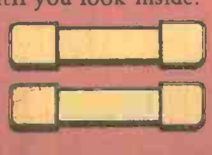
NOTE: PCB denotes Production Change Bulletin



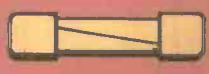
THINGS ARE NOT AS THEY SEEM...

Burton browne advertising

Things are not as they seem
These two fuses look alike . . .
Until you look inside.



This is not a spiral. **It is a series of concentric circles that do not join.**



This fuse has a straight element—cannot be made more delicate than 1/16 amp. with normal blowing characteristics.

This fuse has a bridge construction (note short filament between electrodes). This type fuse may be rated as low as 1/500 amp. with precision blowing characteristics required for protection of extremely fine instruments. Without this construction pioneered by Littelfuse—the microscopically fine filament would break in shipment, in normal operating vibration or even from nearby footsteps.

LITTELFUSE
DES PLAINES, ILLINOIS

Littelfuse leads all other fuse manufacturers in design patents on fuses.