SERVICE DEALER

and ELECTRONIC SERVICING

OCTOBER 1956

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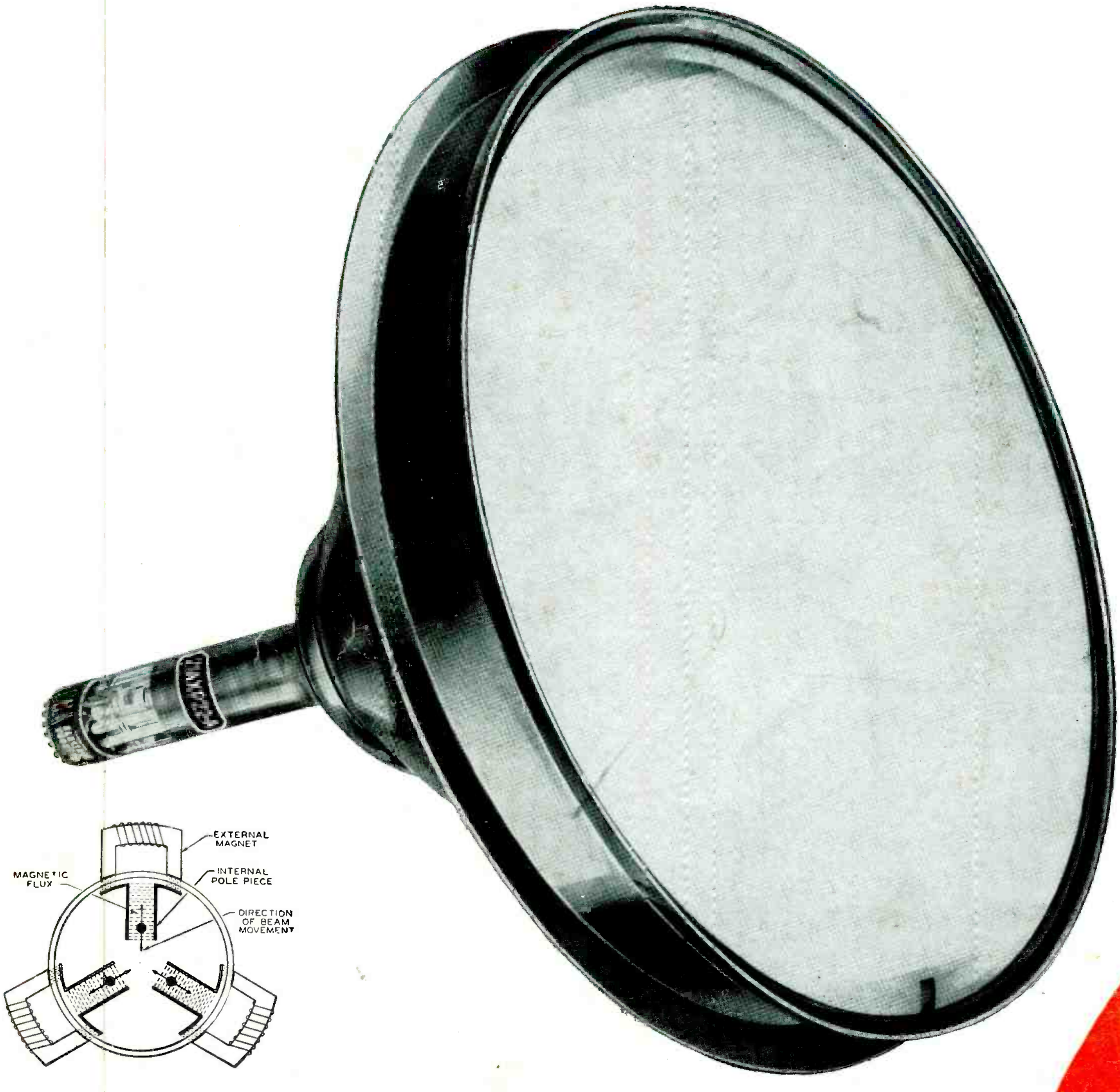
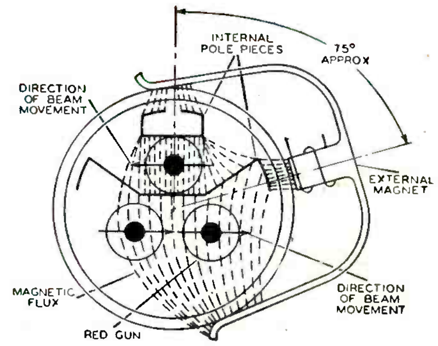




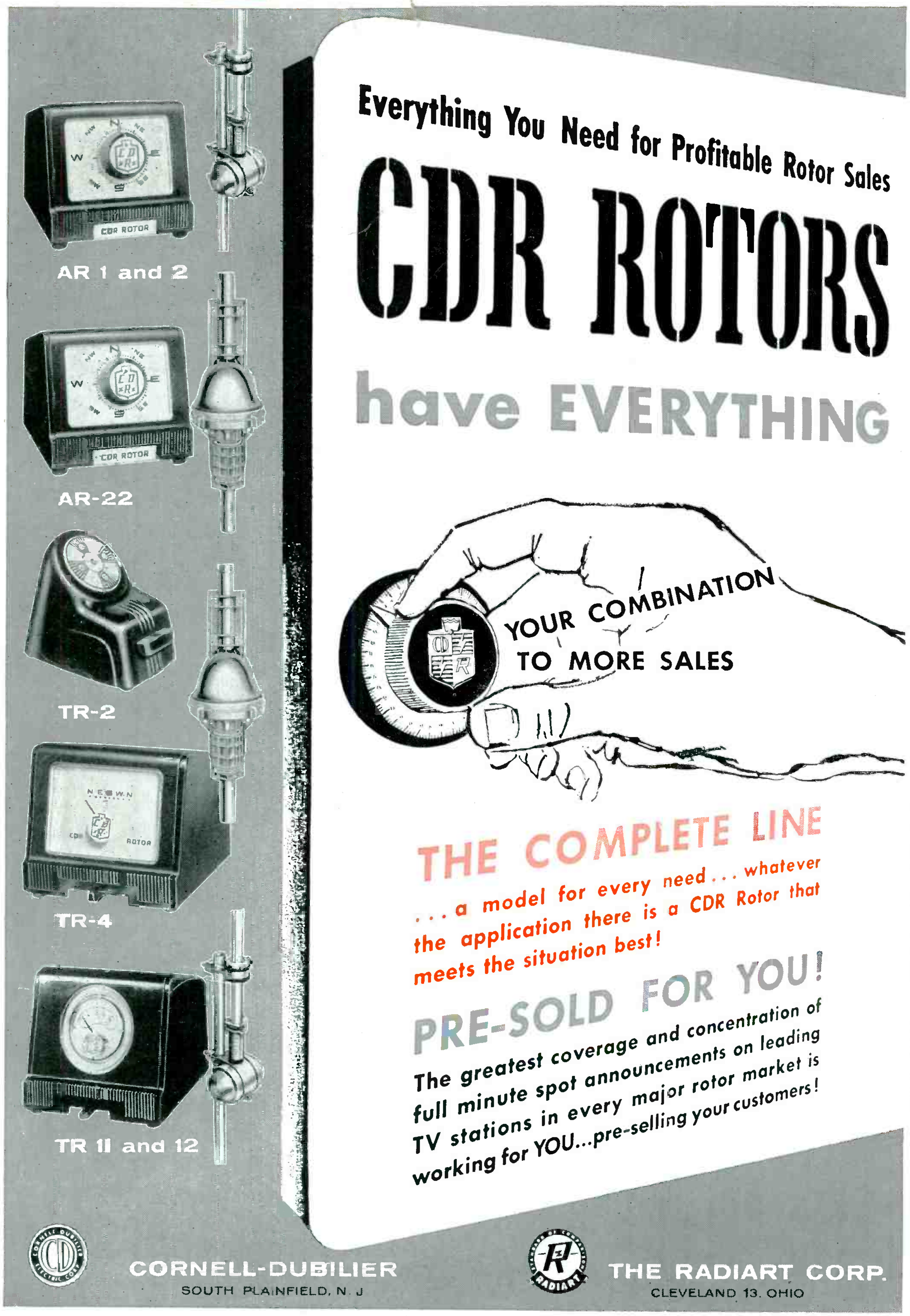
Crystal Calibrator

"Topliner" Antenna

Travelling Wave Antenna

Color Luminance Section

Tapping TV Transmission Lines



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FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

THIS MONTH'S FRONT COVER

The 21AXP22-A RCA directly viewed picture tube of the metal-shell type for use in color TV receivers is shown. Above and to the right of the tube is a schematic of lateral-converging pole pieces while the lower left drawing shows a schematic of the radial-converging pole pieces. These converging magnets are important in adjusting the color receiver.

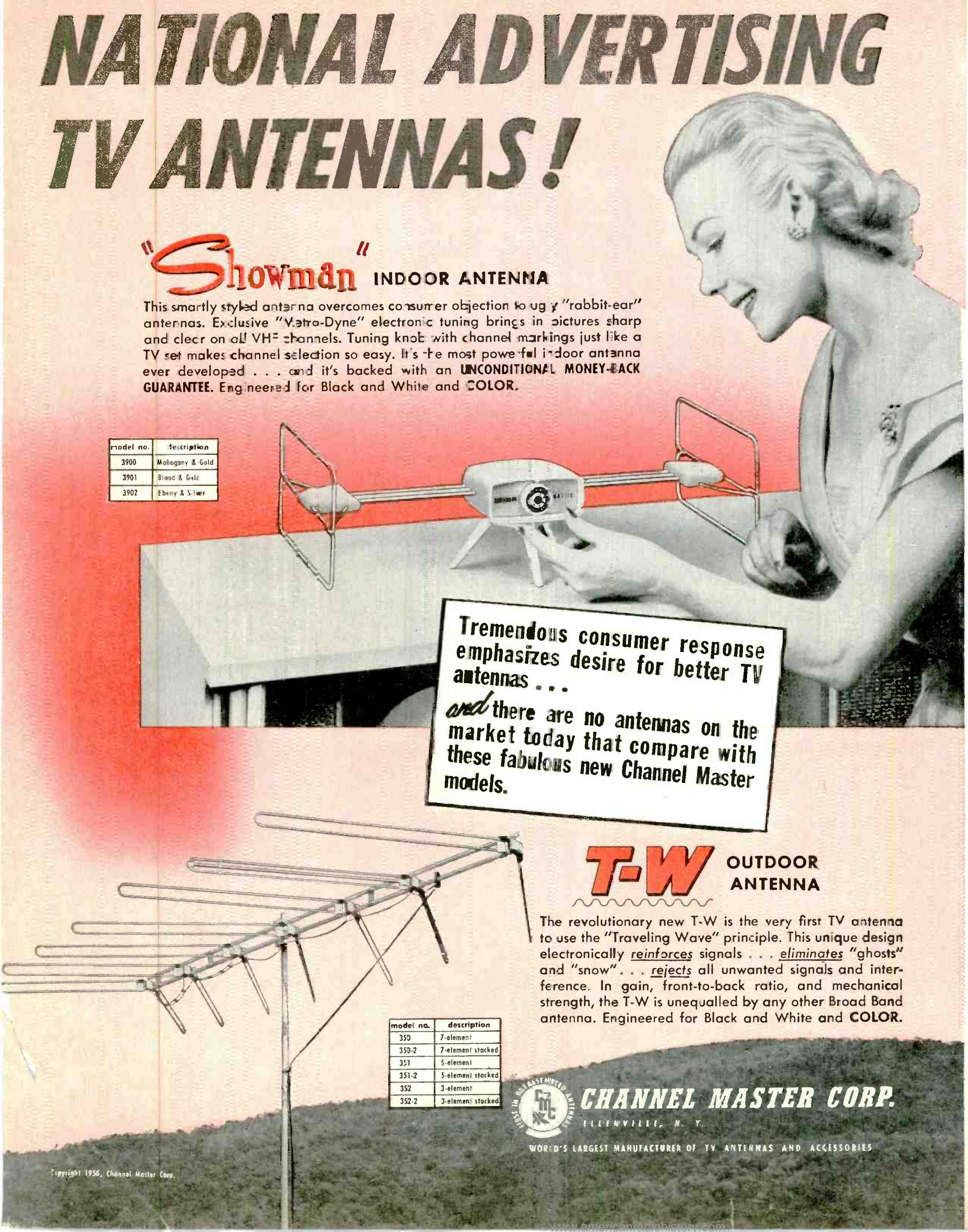
COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.

S. R. COWAN

Ad Libs

Industrial Electronics Servicing:

Pages 16 and 17 of September SERVICE DEALER and ELECTRONIC SERVICING each carried messages that set a precedent for the electronics service industry. Did you scan them carefully? One page carried the message that "TV and Electronics Servicemen are 'Wanted' by manufacturers of industrial electronic devices." The manufacturers referred to have sold and installed thousands of different types of industrial electronic devices to industry. These manufacturers, at the outset, provided factory service to the users of their equipment. But now the service volume has become so great—now the users of the equipment are located in so many remote places—now there is such an acute shortage of competent servicemen—these original equipment manufacturers want to "farm out" their service contracts. They want to appoint branch service depots which can and will take over all of their service work so they can concentrate on



selling more new equipment to new customers. The opportunities for competent independent service firms and servicemen are magnificent!

By the same token, many of our subscribers, realizing the vast new markets and profit potential now opening to them from industrial electronic and commercial communications maintenance, have told us they would like to be put in touch with electronic equipment manufacturers who wish to set up factory service branches. Our service firm subscribers do not want to give up their present radio-TV service businesses—but they do want to expand their service activities in the industrial fields.

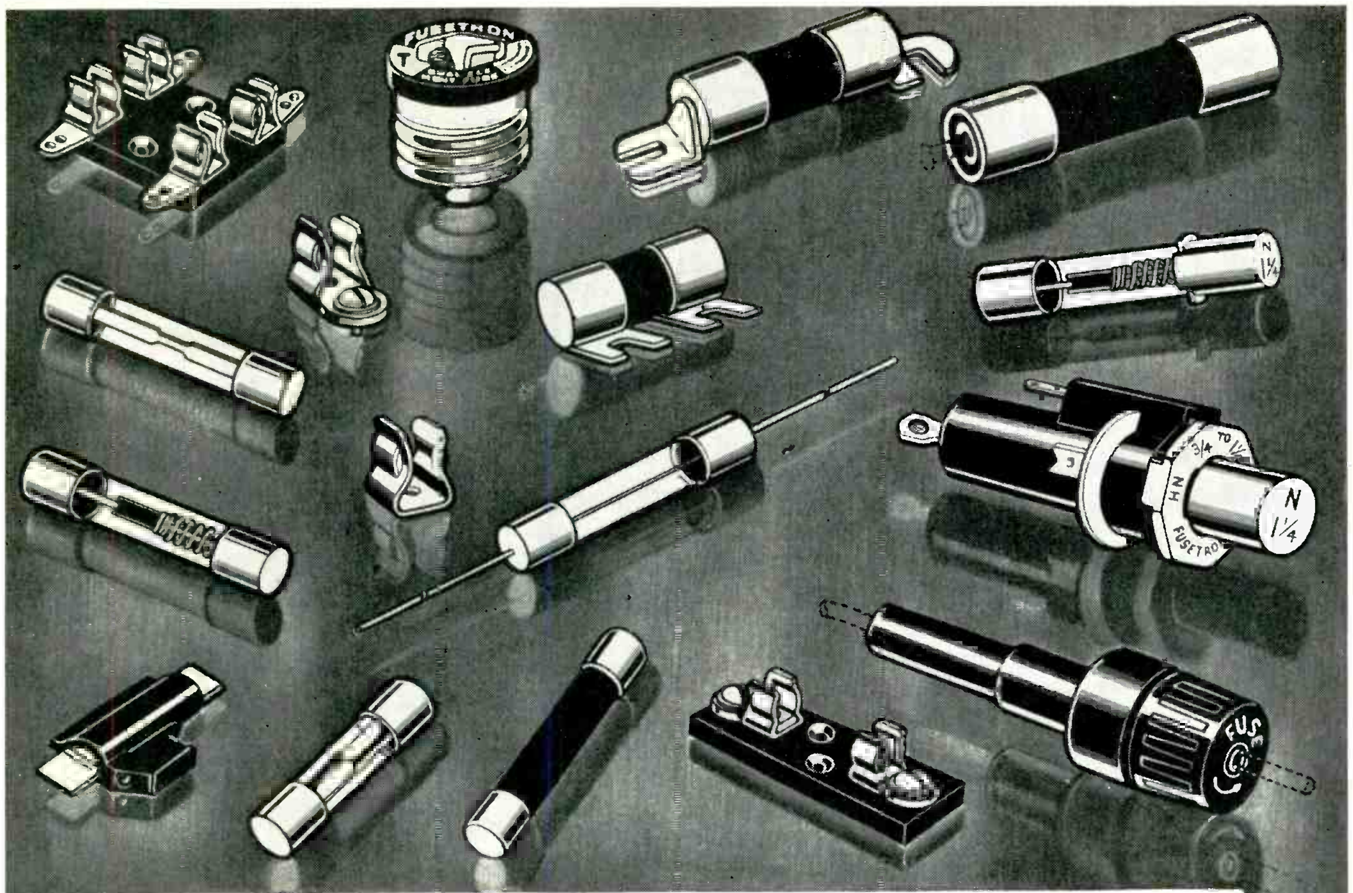
Now we are acting as a "Jobs Wanted" — "Jobs Offered" clearing house to bring the two groups—electronic equipment manufacturers and service firms—together so they will benefit mutually. There will be no charge or fee of any kind whatsoever for this liaison service.

Thinking Out Loud

New York, September 8th: This is an "open letter" addressed to servicemen everywhere.

In a few hours I will board a plane, destination Chicago. There, in the Windy City, next Saturday, September 15th, I will deliver an address titled "Opportunities In Industrial Electronic Servicing." My audience will be independent service shop owners, members and delegates who are attending the NATESA Convention.

NATESA is synonymous with the National Alliance of Television & Electronic Service Associations. NATESA is comprised of almost 60 independent servicemen's associations located in various



sections of the country and has a gross membership of approximately 8,000 independent radio-TV service from owners. It is too bad that NATESA's gross membership isn't 50 or 60 *thousand* because the one thing most needed by the radio-TV servicing fraternity as a whole is a spokesman.

Today NATESA is probably the largest single body of servicemen working together. There are other servicemen's associations and federations extant having memberships of varying sizes which, for one reason or another, have not found it expedient to join forces with NATESA, although they do interrelate their work with other associations. By the same token, it might be said that there are many extant servicemen's associations with which NATESA has failed to tie up for one reason or another. And, there are many thousands of independent service firm owners who have not as yet become affiliated with any servicemen's association whatever.

It is my opinion that solely and simply because many individuals and segments of the servicing fraternity have not been able to "get together" and work in harmony and unity—with a spokesman elected and authorized to voice the views of the majority—that today we find the service fraternity being "pushed around" and relegated to a much lesser status than it properly deserves.

I am sure that when I reach Chicago I will find delegates to the NATESA Convention hemming and hawing about certain present-day industry conditions which they deem are adverse to their best interests. But,—and this is a big "but"—what will the NATESA body be able to do about having those "adverse conditions" corrected? In view of the fact that at most NATESA can only claim to speak for 8,000 of this country's 53,000 service shop owners—15% of the total—well, that fact could dilute the degree of consideration their grievances will be given by those who are deemed the "offenders." How different it would be if NATESA, (or some other service industry spokesman), had the solid backing of 40 or 50,000 service shop owners and independent radio-TV servicemen. ■■

ASSOCIATION NEWS

by SAMUEL L. MARSHALL

Radio and Television Guild of Long Island

The first Electronics Fair of Long Island, sponsored by the Radio and Television Guild of Long Island will be held on December 6th, 7th and 8th, 1956 at the New York State University in Farmingdale, Long Island, New York.

Thousands of dealers and technicians, together with a large segment of the general public, will attend. They will see at first hand the latest advances and newest products offered in the realm of color television, high fidelity equipment, test equipment, antennas, tools, etc. . . . in short, everything pertaining to electronics.

The lecture program committee is lining up top industry speakers to discuss technical and business problems. The following is a partial list of some of the men who have offered their time to speak at our Fair:

Mr. Miller—Vidaire Electronics Mfg. Co.

Mr. Platt—Wintronics Test Equipment

Mr. Tellis—Zenith Corporation

Mr. Dynes—R.A.M. Transformer Corporation

Mr. Dressler—Chromatic Labs

Mr. Credo—R.C.A. Service

Mr. Wendell—Service Management Magazine

Mr. Rider—Rider Publications

C.B.S. Laboratories have offered the use of their closed circuit color television camera equipment. The committee is presently negotiating with General Electric for the use of their Electronic Robot which has been demonstrated several times on television.

The Guild itself is making plans to have a large display at the Fair. In the booth will be educational material pertaining to the Television service industry in general, and to Radio and Television Guild of Long Island in particular. The Fair will offer an excellent opportunity to acquaint the general public with the fact that there is a Guild and the advantages derived from doing business with licensed Guild members.

Associated Radio-Television Servicemen of New York, Inc.

Additional information obtained from Sam Marshall, lecturer of the forthcoming color series, discloses that he will be assisted by an old friend of ARTSNY's, Bob Dargan, Technical Editor, and Oscar Fisch, Assistant Editor of Service Dealer and Electronic Servicing. Bob was former chief instructor and head of technical information and training at Philco.

NATESA, Chicago

At the Omaha, Nebraska, board of directors meeting of the National Alliance of Television and Electronic Service Association, Frank Moch, president, was named chief executive director and voted a salary plus expenses, to cover the last half of the fiscal year ending August 31, 1956. A committee was established to work out ways and means, including organizational changes, to free Moch of some of his duties, to enable him to devote more time to top level executive problems.

As steps in this direction, three governors were named. Albert C. W. Saunders will serve in dual offices, as educational director and as New England zone governor; Gordon Vrooman, Central Atlantic Zone; and Robert L. Kidd, South Atlantic Zone.

Fred Colton announced his resignation at the meeting. His post as Great Lakes governor was assigned to his former business partner, John Graham.

[*Continued on page* 26]

Fig. 1—The Win-Tronix Model 120 Compatible Crystal Generator. This unit contains a precision 3.579545 mc burst frequency standard for color television.

Compatible Crystal Calibrator

Discusses the functioning and the use of an accurate test instrument for checking, aligning, and trouble shooting the reference oscillator circuits in color TV receivers

Color television servicing requires the use of a new frequency standard for the test and alignment of circuits which handle the color synchronizing and color modulation signals. This new frequency, 3.579545 *mc*, is the color carrier, more correctly referred to as the *color subcarrier*. This color subcarrier is phase modulated by the color video, and is located precisely 3,579,545 cycles above the picture carrier, just as the sound carrier is located 4.5 *mc* higher than the picture. The color carrier is a *suppressed carrier* in that it is transmitted only at the instant that some color is to be added to a certain part of the picture. It is necessary to have a 3.58 *mc color reference signal* at all times in the receiver. Therefore, it is customary to use a reference oscillator in the color TV set. This oscillator must be locked in step with the color carrier from the TV station.

In order to synchronize the receiver's reference oscillator, the station sends a short *burst* of the 3.58 *mc* unmodulated signal. The burst consists of about 8 cycles which appear on the back porch of the horizontal blanking pedestal. (See *Fig. 2*). A parallel can now be drawn between the synchronizing of the 3.58 *mc* reference oscillator and the synchronizing of the horizontal oscillator with which we are all familiar. Just as in the case of the horizontal oscillator, the 3.58 *mc* oscillator is normally controlled by an *afc* circuit, such as a balanced phase detector.

It is also common practice to provide an adjustment, either on the front panel or on the TV chassis, which is called the *color hold* control. However, in the case of the 3.58 *mc* oscillator, a reactance control tube is commonly placed between the phase detector tube and the reference oscillator. The balanced phase detector develops a *dc* output voltage proportional to the amount by which the oscillator is off frequency. This *dc* correction voltage is fed to the grid of the reactance tube, which in turn reflects a change in reactance across the oscillator, causing it to change frequency and fall into synchronization. (See *Fig. 3*). In the light of this discussion it is apparent that the 3.58 *mc* color oscillator should have a definite "pull-in" range and other synchronizing charac-

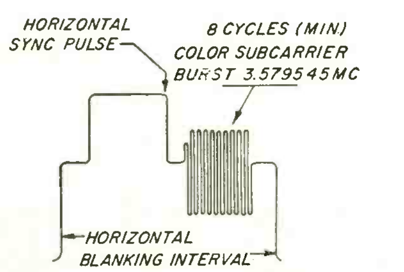


Fig. 2—Location of color sync signal on back porch.

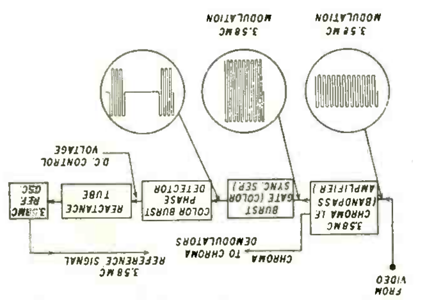


Fig. 3—Block diagram of the color sync chain showing waveforms present.

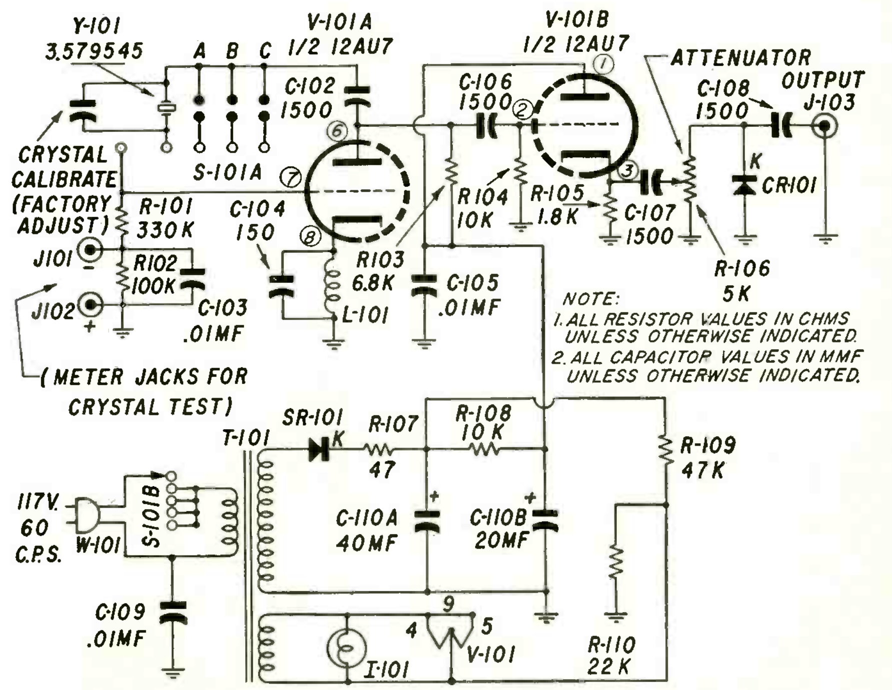


Fig. 4—Schematic of the Compatible Crystal Calibrator. A precision 3.579545 mc burst frequency standard is included in calibrator.

teristics similar to those of the horizontal oscillator.

One characteristic of the 3.58 *mc* oscillator is that it must be adjusted to a *high degree of accuracy*. Otherwise, the color reference oscillator may not be close enough for the phase control circuit to pull it on frequency. For example, if the phase detector circuit has a pull-in range of 358 cycles, this would represent a range of only .01% of the burst frequency. The average signal generator does not have this high degree of accuracy. The test instrument for aligning the oscillator should be at least 5 times as accurate as the required setting of .01%. Therefore, a 3.579545 *mc* standard frequency generator is needed which will have better than .002%. Without such accuracy there is no guarantee that a color receiver installed or repaired will lock in on a color program when one is received. The result would only be more callbacks and free service calls.

Description of Crystal Calibrator

The instrument shown in *Fig. 1* is the Win-Tronix Compatible Crystal Calibrator and includes a precision 3.579545 *mc* crystal standard which is calibrated to an accuracy better than .0017% or 17 parts per million, which is within 60 *cps* of 3,579,545 cycles. The drift and residual phase modulation in the unit is so small as to be negligible even in critical laboratory tests.

The color subcarrier standard crystal is mounted inside the unit and is selected by the *Function* switch. This switch will select any of three other crystals which can be conveniently plugged into the crystal sockets mounted on the front panel. Crystals from 100 *kc* to 20 *mc* can be used in the unit and selected instantly by the switch without any requirement for tuning. An output attenuator gives a range of better than 100 to 1, with a maximum output level of better than 1 volt *rms*. An internal mixer/modulator diode produces harmonics and sidebands for calibration markers and signal modulation by other generators.

Circuit Description

The schematic of the Model 120 Compatible Crystal Calibrator is shown in *Fig. 4*. The signal circuit is an extended

[*continued on page* 54]

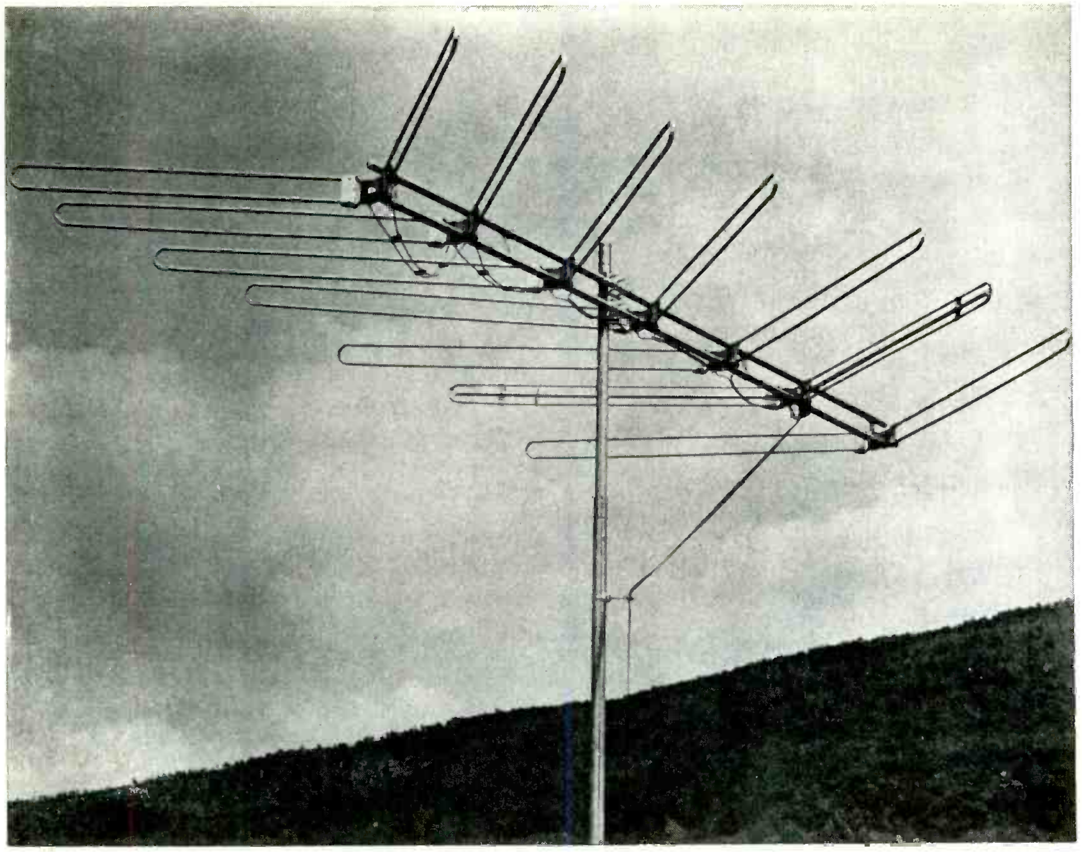


Fig. 1—Seven element terminated travelling wave antenna.

A discussion and explanation of a new basic type of antenna developed by the Channel Master Corp.

HAROLD HARRIS

Vice Pres. in charge of Sales & Engineering, Channel Master Corp.

TERMINATED TRAVELLING WAVE ANTENNA

by HAROLD HARRIS

TV ANTENNAS, over the past 10 years, represent an unusual study in swift technical progress. They actually evolved and improved more than the TV set itself, as the parade of advancing types passed by: Dipole and Reflector, Conical, Fan, Yagi, Dipole and Screen, and on up to the latest series of Broad Band VHF Yagis. This latter class has been the most powerful type of multi-channel antenna created to date, and practically every antenna manufacturer makes a version of this basic type.

The purpose of this article is to introduce and describe a new basic antenna type, which by its nature and design represents an advance in gain, front-to-back ratio, and mechanical strength.

This new antenna, shown in *Fig. 1,* is called the "Terminated Travelling Wave Antenna." It embodies a number of important features, developed by engineers of the Channel Master Corporation. Many of these are not apparent to the casual observer. For example:

1. Six of the seven elements are "driven."
2. The phasing harness is in two sections, each with a different impedance (*Z*).
3. Despite its appearance, the antenna has no conventional folded dipoles:
   a) Five dipoles are "hairpin" or "fat" dipoles, (*Fig. 2*).
   b) One is a 3-conductor high *Z* dipole with a shorting bar.
   c) One is a folded reflector.
4. All dipoles have a different length.
5. Two different "Vee-ing" angles are used.
6. A terminating resistor is employed.

The configuration of this new antenna is a series of "Vee'd" dipoles. To understand the theory of its operation, it is necessary to review the basic Vee dipole. When this dipole is approximately ½ wave on the low band, it is about 3 half waves on the high band (*Fig. 3*). Anti-phase high band operation is overcome by the fact that the center section is located 180 degrees in space behind the two outer sections. In effect, the high band dipole operates as shown in *Fig. 4.* The phase of the current changes 180 degrees as it travels to the point in space where it is abreast of the two outer dipole sections. Therefore, the current of all three sections is in phase.

It is an established and well known fact that the basic directivity patterns (and consequently, the gain) of an antenna are determined by the phase and amplitude of the current in the dipoles, as well as the position of the dipoles with respect to each other.

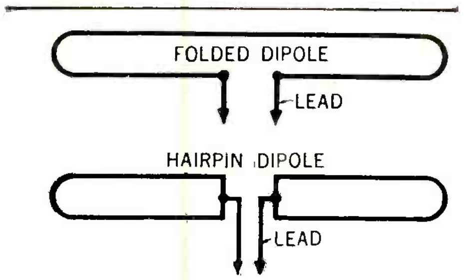


Fig. 2—Difference between folded and "hairpin" or "fat" dipole.

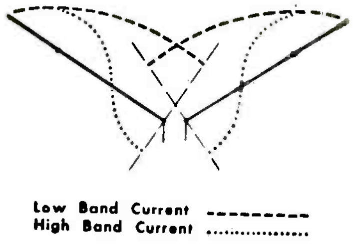


Fig. 3—High and low band current distribution of a basic Vee dipole.

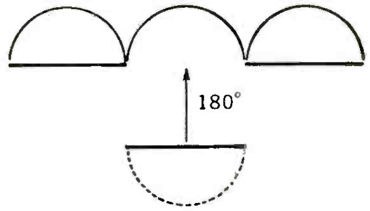


Fig. 4—Phase of current in high band dipole changes 180 degrees.

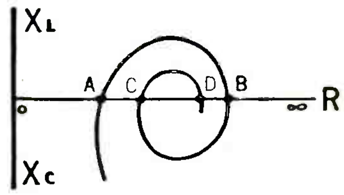


Fig. 6—Typical spiral curve of the impedance of a dipole.

Current Phase

Keeping the operation of the "Vee'd" dipole in mind, we must now think of these dipoles as impedances. *Fig. 5* shows each element of the Terminated Travelling Wave Antenna as an impedance. The lines connecting the dipoles or impedances represent the phasing harness.

The harness length between each dipole is greater than the free space distance. When the total electrical harness length of the driven elements is equal to the physical spacing, plus 180 degrees, the result is termed "Increased Directivity Condition."* This produces narrower lobes and higher gain than would be obtained if the harness length and physical spacing were of equal dimensions. However, the phase relationship which produces increased directivity is not dependent on harness length alone. The phase in each dipole also depends on its impedance. Therefore, the harness must be cut to compensate for the variations in dipole impedances as described below.

Current Amplitude

By controlling the impedance of each dipole, we control the flow of current through that dipole. For maximum performance, the value of the impedances shown in *Fig. 5* must be such that each dipole receives an equal amount of current. At first glance the solution would seem to be that since they are all in parallel, the impedances should be equal, and therefore, equal current would flow in each dipole. It must be borne in mind that these impedances occur in a travelling wave antenna and each impedance is separated from its neighbor by a significant portion of a wave length.

The major achievement in the design of this antenna is the development of a series of impedances which decrease in magnitude from the feed point of the antenna to the front end, maintaining this descending series of values for every individual vhf channel.

This is best explained by considering the concept of *reciprocity*. It holds that the gain, directivity, and impedance characteristics of an antenna are the same for both receiving and transmitting. Since this is so, an understanding of this antenna will be simplified by considering it, for the time being, as a transmitting antenna.

Referring again to *Fig. 5*, it will be seen that the dipole of highest impedance must be at the feed point, with the impedances of the other dipoles in descending order. Since the dipole at the feed point has the highest *Z*, only a small controlled amount of the total current flows through it (about 1/6 of the total) and most of it continues down the harness. The impedance at the next dipole is the highest of all the remaining dipoles, and again only a small portion of the current is permitted to flow through it. The major portion of the current continues down the harness, with each impedance (dipole) getting a portion of the remaining current. The last impedance, farthest from the feed point, absorbs the remaining current.

In a travelling wave antenna any current which is not absorbed is reflected back up the harness, and this in turn, produces rear lobes. A terminating resistor, such as used on long wire rhombics, absorbs whatever power

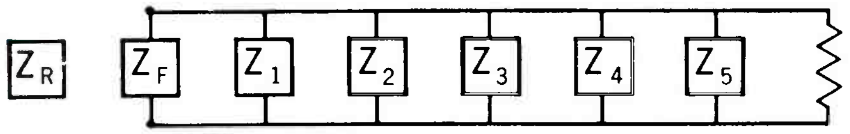


Fig. 5—Dipoles of terminated travelling wave antenna represented as impedances. Connecting lines represent phasing harness.

the dipole impedances do not. This resistor, together with the folded parasitic reflector *provides front-to-back ratios higher than 10:1 (relative voltage) on all low band channels.*

Methods of Maintaining Descending Impedances

A point of major importance concerns the method of controlling the descending impedance values over the entire frequency range. The solution to this problem lies in "tapering" the lengths of the dipoles so that each dipole gets progressively shorter as you go from the feed point to the terminating resistor. The theory behind this involves the basic characteristics of any dipole. *Fig. 6* shows the typical spiral curve of the impedance of a dipole. The horizontal line indicates resistance of 0 to infinity. Inductive reactance is indicated by the area above the line, and capacitive reactance by the area below. Wherever the spiral crosses the horizontal line the dipole impedance is purely resistive, and the dipole is resonant. Points *A, B, C,* and *D* represent the 1st, 2nd, 3rd and 4th harmonics—or in effect, what happens when a dipole is ½, 1, 1½ and 2 wave lengths long. It is important to note that the dipole's characteristics are about the same between points *A* and *B* and between points *C* and *D*. The arc *AB* represents the impedance on the low band; arc *CD,* the high band.

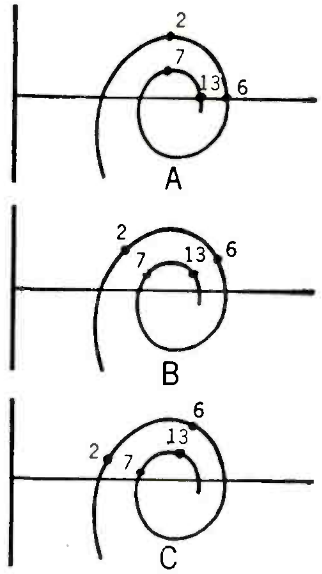


Fig. 7—Z of dipole nearest feed point is at (A); second dipole (B); and third dipole is shown at (C).

Looking at the actual antenna it will be seen that the problem of having a very high impedance at the feed point was solved by using a specially designed new type of 3-conductor dipole. The outer conductors are made of ⅜" tubing and the center conductor is ⅝" tubing. The precise impedance desired was obtained by the use of a novel shorting bar properly positioned across the 3-conductors. This new design is called the Controlled Impedance Dipole. (*CID*).

[*Continued on next page*]

*W. W. Hansen, J. R. Woodyard — "A New Principle In Directive Antenna Design," Proceedings of the Institute of Radio Engineers, 26 March 1938.

The next dipole is a hairpin type, which has better impedance characteristics than either a folded or straight type. It is cut so that it is a full wave on channel 6. Its characteristics, *Fig. 7A*, show that this dipole has its greatest low band impedance on channel 6, with the impedance decreasing with frequency. The same is true of the high band. The impedance characteristic of the second dipole from the feed point is shown in *Fig. 7B* and that of the third in *Fig. 7C*. Since the remaining dipoles are progressively shorter, the frequency points of channels 2, 6, 7, and 13 would be farther to the left. In other words, the shorter the dipole, the lower the impedance on each of the *VHF* channels. By comparing *Fig. 7A, 7B* and *7C*, which represent dipoles *A, B*, and *C* in *Fig. 8*, it will be seen that

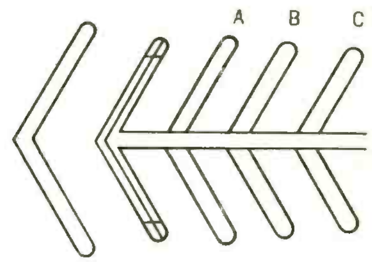


Fig. 8—Position of dipoles. Impedances decrease from feed point to shortest dipole.

no matter what channel we compare, the impedances of the dipoles decrease as we move from the feed point to the shortest dipole. This in turn creates the condition which guarantees that the current will be divided *equally* among all of the dipoles.

This is a desirable condition, since one of the basic theoretical conditions for maximum antenna performance in a multi-element antenna is that every element must receive an equal amount of current in the proper phase relationship.

This is the most basic of the limitations which cannot be overcome by the parasitic elements of a yagi. As stated earlier, both the phase and the amplitude of the current flowing in each parasite is determined by the self-impedance of the parasites and the physical spacing between them. Since there is no way to make them variable with frequency as was accomplished with the travelling wave antenna, the broad band yagi has severe front-to-back limitations as well as major problems in broad band gain.

Mechanical Features

Since there is an apparent reawakened interest on the part of TV servicemen in the mechanical strength of antennas, this new antenna design, which Channel Master calls the T-W, should attract added attention. The antenna utilizes *folded* elements exclusively. This provides definte physical advantages. Each fold is, in effect, a truss and is actually 5 times stronger than a straight dipole of the same tubing under normal operating conditions.

The structure of the antenna is strengthened still further by an unusual type of "boom bracing." This too employs the truss principle. The "boom" actually amounts to a second full-length crossarm, joined to the basic crossarm by aluminum truss members. The entire "twin boom" unit is completely and permanently assembled in the factory by riveting.

The durability of this antenna—its exceptional resistance to excessive wind and ice loading—will appeal both to profit-conscious dealers and service-conscious consumers.

Smaller Models Developed

The original design project called for the development of an antenna for deep fringe use—very high gain and very high front-to-back ratios. This led to the development of the 7 element Travelling Wave Antenna—described and illustrated above. However, this antenna lent itself ideally to modifications for both suburban and near fringe application. As a result, 3 element and 5 element models have been developed to provide improved reception and durability for these areas as well. ■ ■

Want to Speed Up

Your TV Servicing

See Page 41

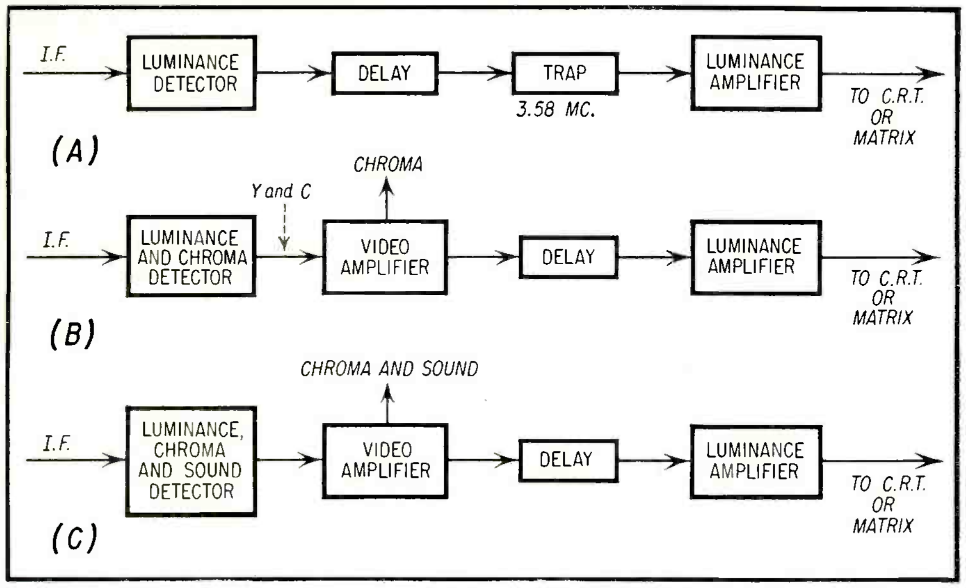


Fig. 1—Three types of luminance systems found in color TV receivers are shown in block diagram form with chroma and sound take off points.

Three different types of circuits used in the luminance section are analyzed along with such features as horizontal and vertical blanking and delay line circuitry.

By **BOB DARGAN** and **SAM MARSHALL**

From a forthcoming book entitled "Fundamentals of Color Television"

Part 2

COLOR TV LUMINANCE SECTION

THREE general types of luminance section systems are found in color TV receivers, as is shown in *Fig. 1.* In the first (*Fig. 1A*), one detector is used for the luminance signal, and another detector (not shown) is used for the chroma and sound signals. In the second (*Fig. 1B*), one detector is used for the sound signal (not shown) and the other is used for the chroma and luminance signals. In the third (*Fig. 1C*), one detector is used for the sound, chroma, and luminance signals.

Block Diagram Analysis

Referring to *Fig. 1A*, we observe that any chroma signals present in the luminance circuit are removed by the 3.58 *mc* trap located between the delay line and the luminance amplifier.

In *Fig. 1B*, the output of the luminance and chroma detector is fed into a video amplifier which in turn provides separate output paths for the chroma and luminance signals. In this case, the chroma information is attenuated by designing the response characteristic of the Y channel so that there is a rapid rolloff beyond 3 *mc*.

In *Fig. 1C*, the output of the single sound, chroma, and luminance detector is fed into a video amplifier, which in turn provides separate paths for the sound, chroma, and luminance signals.

In all of the above cases the output of the luminance amplifier is fed either to a suitable matrix where the luminance and color-difference signals are combined, or are fed directly into the cathodes of the color picture tube, in which case matrixing is effected by the color tube itself.

Of the three systems shown in *Fig. 1*, it will be observed that only the one shown in (*A*) does not require an additional video amplifier. The reason for this will be explained subsequently.

Circuit Analysis

A circuit corresponding to the block diagram system of *Fig. 1A* is shown in *Fig. 2.* The signal at the output of the second detector has a positive picture polarity. Since the signal fed into the luminance amplifier is inverted at the plate circuit, the signal fed into the picture tube cathodes will have a negative picture polarity which is correct and proper. Coils *L12, L14, L23,* and *L31,* are the usual peaking elements designed to compensate for the distributed capacities of the circuit, and to

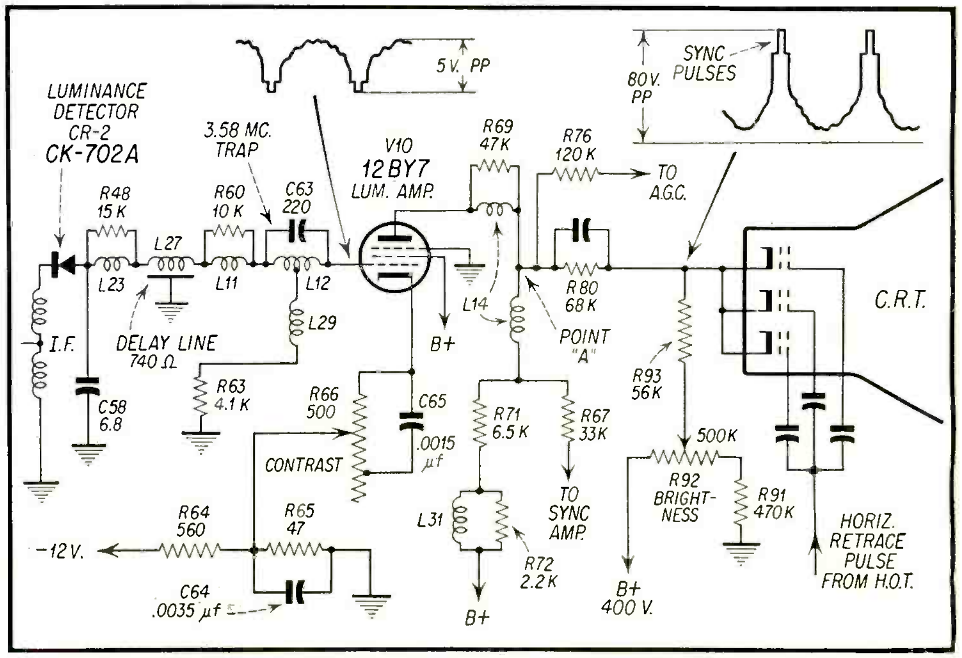


Fig. 2—Partial schematic of luminance section of Sentinel Model 1U-816.

ARE YOU COLOR-BLIND?

NOT IF YOU CAN READ THIS . . . BUT THE ANTENNAS YOU INSTALL COULD BE . . .

THE age of color ushers in your greatest challenge as well as your greatest antenna selling opportunity since the advent of television. For even the finest color TV receiver cannot deliver a satisfactory picture if the eye of the receiver—the television antenna—is "color-blind."

Exhaustive tests by leading color receiver manufacturers have proved that an antenna must possess the following electrical characteristics to render true color reception:

1. **Sufficiently high gain to override set noise and provide a clear color picture.**
2. **Flat response. Gain variation of not more than 1 db within 1.5 mc. below and .5 mc. above the color subcarrier.**
3. **Narrow unidirectional polar pattern.**
4. **Close impedance match to help effect a low V.S.W.R. to eliminate line reflections.**

11 months ago, the JFD engineering staff undertook an intensive antenna research program. Their objective: to develop a select group of antennas that more than satisfied these stringent color requirements. The results: 8 outstanding antennas, so color-perfect in performance, that we have designated them as the NCB* Colortenna line, signifying Non Color Blind performance.

8 COLORTENNA models to choose from assure you of the right antenna answer for every location or reception problem. They spell out a great new profit opportunity for you . . . in replacement antenna sales . . . in new set sales, in trade-in sales—black and white, or color. Because now, for the first time, you can guarantee your prospects and customers both the finest black and white TV today, as well as the truest color performance possible in the future when they decide to buy.

Spearheading your antenna sales break-through will be the most spectacular sales promotion in antenna history—the NCB* COLORTENNA Sell-A-Bration!

Every COLORTENNA you sell earns you merit points for all-expense paid trips to Europe, America or any place you want to go—and a host of free valuable gifts from minks to Chris Craft cruisers. Plus newspaper advertisements, displays, streamers, direct mail, TV-radio spots, and give-aways selling you and your JFD NCB* COLORTENNA performance guarantee.

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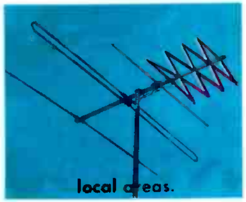
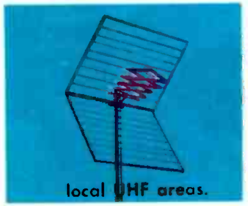


JUNIOR HELIX
Model JX311

UHF 4-BOW HELIX
Model UX211



UHF CORNER-HELIX
Model UX411

American Express all-expense paid trips to Paris, Rome, Switzerland, Hawaii, Mexico, Bermuda, Havana, Miami, Las Vegas—or *any* place you name. You go *when* you want to go, *where* you want to go, *how* you want to go or...

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Your JFD distributor has your NCB* COLORTENNA SELL-A-BRATION portfolio waiting for you. It doesn't cost you a cent—no entry blanks—no red tape. Get started *now* and *write your own ticket* in the greatest give-away in antenna history.

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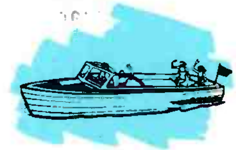
MINK COATS


CHRIS CRAFT


LIVING ROOM SUITES

Form No. 550 8-56 Litho in U.S.A.

...ntain the wideband characteristics ...he detector circuit. The tapped in-...ance *L12*, *C63*, and *R63* constitute a ...r T trap producing a high rejection ...58 *mc*. The 4.1 K resistor *R63* in ... circuit serves a dual purpose; not ... is it a part of the T trap but it ...es also as the detector load.

...he contrast control is connected in ... cathode circuit in a manner de-...ned to provide partial high frequency ...st. Inasmuch as the cathode imped-...e consists of the contrast potentiom-... (500 ohms) and *R65* (47 ohms), ...s obvious that *C64* (.0035 *uf*) will ...duce an increase in stage gain for ... high frequencies. Capacitor *C65* ...015 *uf*) is present simply to mini-...ze the changes in circuit response as ... arm of the potentiometer is moved ...oss its range from minimum to ...ximum contrast.

...n *Fig. 3* is shown a circuit corre-...nding to the block diagram of *Fig.* ... The detected signal output has a ...itive picture polarity as it is fed into ...01A th... first video amplifier. A 4.5 ...s... trap is located in the plate ...cu... his tube and is in series with the ch...ma takeoff transformer.

Note ...at the plate load of this tube consists o... the primary of transformer T701 and the resistor that connects to B plus. The chroma signal is taken off the transformer impedance, whereas the voltage drop across the resistor provides the video signal information below 3 mc. As such, this information contains the signals required for the *agc* circuit, and the horizontal and vertical sync separator.

Note that *F*... utilizes 2 tubes in the video ampli... r section. This imposes the requirement that both tubes have usable gain characteristics and that the combination shall have a single phase inversion in order to provide the signal at the CRT at its proper phase. This is accomplished by designing the video detector circuit so that it is completely off ground, and its output is fed to V401A between grid and cathode. The luminance output signal from this tube is taken from *R403* with a gain of approximately 4. This circuit is referred to as a "Bootstrap" circuit. The luminance signal is fed through the delay line and C403 (.1 *uf*) to the grid of V402, the second video amplifier. Reversal of the picture polarity at the plate of V402 imparts a negative signal polarity to the signal, and, as such, it is fed into the picture tube cathodes via the fixed matrix network consisting of *R418*, *R419*, and *R115*.

Contrast control is effected by *R103A* which is connected in series with the cathode of V402, the second video amplifier, and ground. The brightness control is connected as one leg of a voltage divider between ground and the grid of the horizontal output tube which is —40 volts with respect to ground. Variation of this control produces a change of plate current, causing a corresponding increase or decrease in the voltage at the plate of V402. Since the picture tube cathodes are connected to the plate of V402, this voltage variation is transferred to the cathodes, thereby effecting an increase or decrease in brightness.

A circuit corresponding to the block diagram of *Fig. 1C* is shown in *Fig. 4*. As in *Fig. 3* a bootstrap circuit is used in the detector output, the latter, in this case, containing sound, chroma, and luminance signals. Also, as in the circuit previously discussed, luminance is taken off at the cathode, and color is taken off at the plate through a chroma takeoff transformer. The sound, sync, and *agc* signals, in this circuit, are taken off at the plate return which is above *rf* ground by virtue of a 5K resistor (*R133*) connected between the plate return and B plus.

Connected across a portion of the secondary of the chroma takeoff transformer is a 4.5 *mc* sound trap. This trap effectively eliminates the 4.5 *mc* information and the 920 *kc* beat from the chrominance system.

Luminance information is fed, via the delay line, to the second video amplifier. The amplitude of the output signal is controlled by potentiometer *R134* (contrast control) at the end of the delay line.

The brightness control consists of a potentiometer connected between ground and the –20 volt line. As in the previous circuit described (*Fig. 3*) variation of this control provides an increase or decrease of plate voltage which is transferred as a change of cathode potential on the picture tube, thereby increasing or decreasing its brightness.

[*Continued on page 42*]

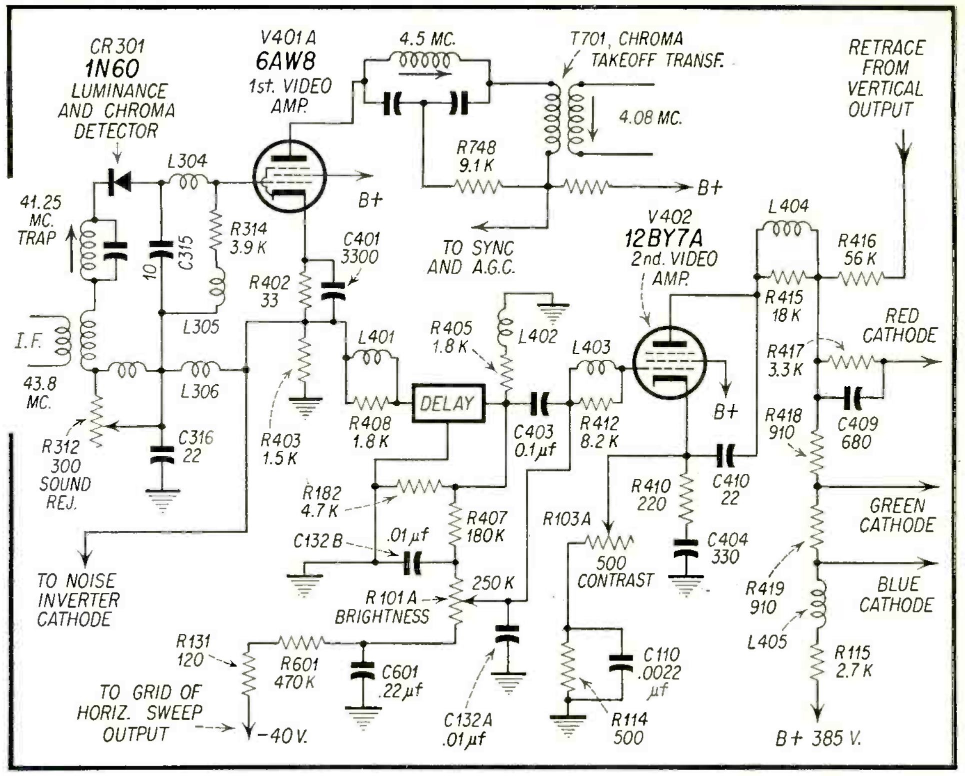


Fig. 3—The circuit diagram corresponding to the block diagram of Fig. 1B. The picture polarity is positive as applied to the first video amplifier.

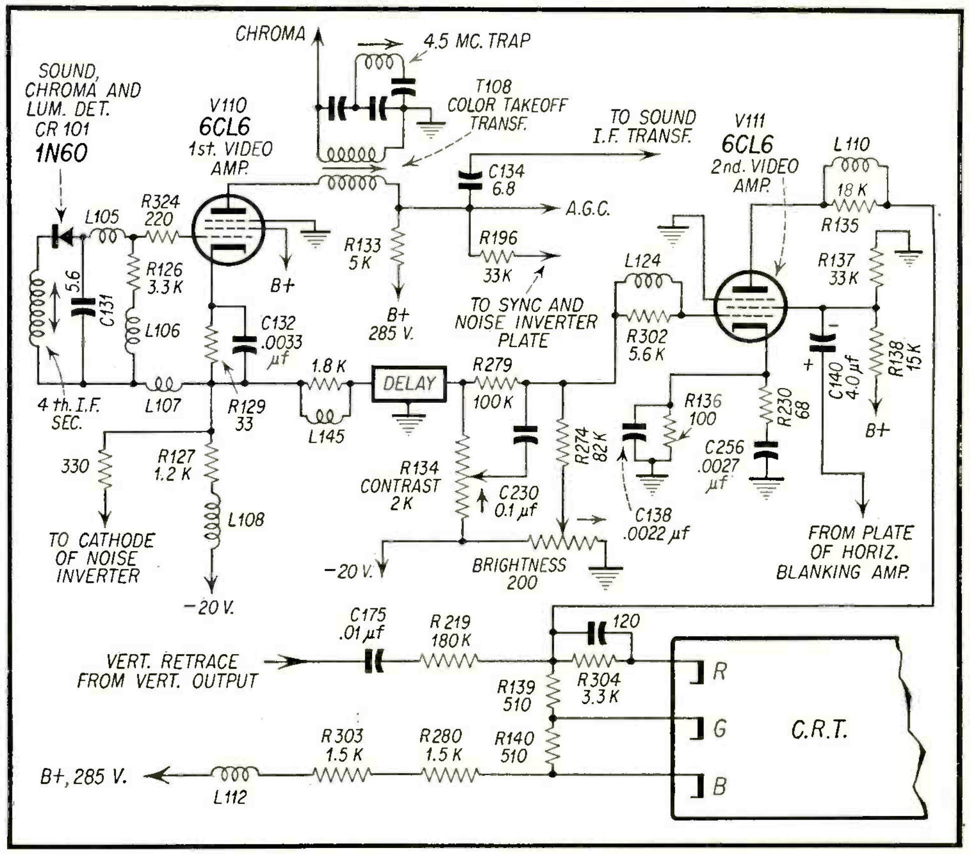


Fig. 4—The circuit diagram corresponding to the block diagram of Fig. 1C. The detector output circuit contains sound, chroma, and luminance signals.

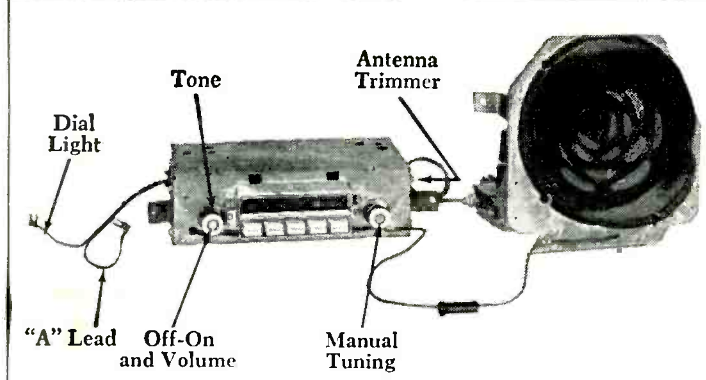


Fig. 1—The DeLuxe model with manual tuning and five push button controls.

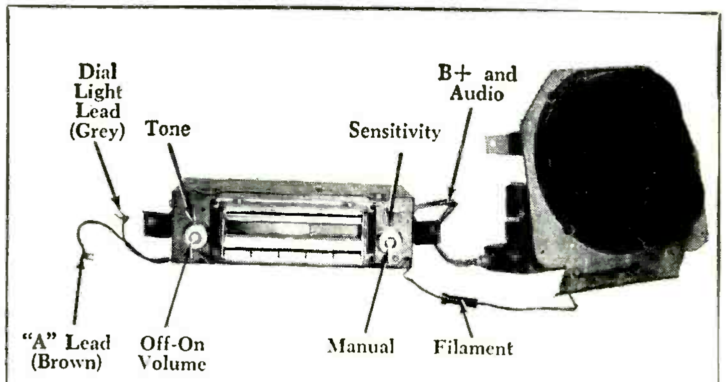


Fig. 2—The De Luxe Electromatic model features electronic signal seeking.

Auto Radios for 1956 — PONTIAC

A discussion of the important features of the two Pontiac receiver models for 1956. Tuning adjustments, removal procedures, and servicing hints are dealt with in each case.

by ANDREW V. DOPPLE
Auto Radio Serviceman
Frank A. Reeve Co.

The trend in auto radio for 1956 is toward the two unit construction type, and it is this type that Pontiac offers in two 12 volt models. Both models are interchangeable in all models of Pontiac automobiles. They are custom designed and supplied by The United Motors Service Division of General Motors.

The two units consist of a tuner or *rf* unit which contains the complete tuner section, and the speaker unit, which contains the complete power amplifier section with speaker.

The "De Luxe" model, part #988568, (see *Fig. 1*), has manual tuning plus five push-buttons, and uses six tubes in addition to a rectifier.

The "De Luxe Electromatic" model, part #988569 (see *Fig. 2*) features electronic signal seeking with five electronic push buttons. The tube complement is seven plus a rectifier.

The circuit of the Electronic model is identical with that of the De Luxe, except for the addition of a 12AU7 used to trigger the automatic feature. This set can be tuned manually by the right-hand control (see *Fig. 2*). Directly behind the manual tuning control is located the sensitivity control (see *Fig. 2*) which operates a four position rotary switch, which, when rotated clockwise,

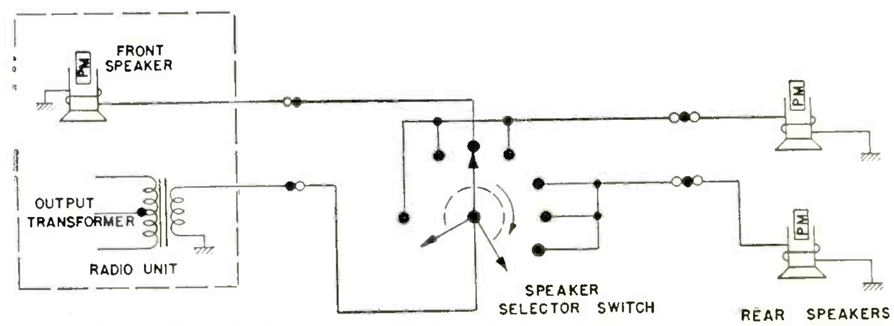


Fig. 3—Circuit diagram for the installation of dual rear seat speakers. This is optional equipment.

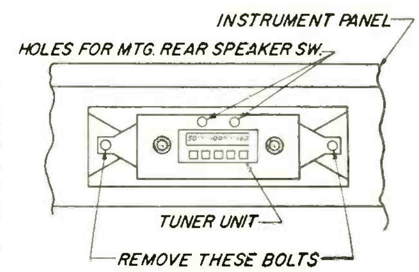


Fig. 4—Location of mounting bolts on dashboard.

increases the sensitivity of the set. Manual or automatic antennas are available.

Installation Notes

The tuner unit mounts in the center of the instrument panel directly above the glove compartment. The speaker unit mounts directly behind the speaker grille at the right-hand side of the instrument panel.

Dual rear seat speakers are optional and mount on the rear seat shelf (see *Fig. 3* for installation instructions). Provision is made at the factory for ease of installation.

Antennas mount on the right front fender. Special accessory antennas are also available for rear fender mounting.

Noise suppression at the distributor is controlled by special radio type wires and no other precautions are necessary at this point. Condensers at the generator, voltage control and coil are necessary and straightforward conventional installation is followed.

The antenna trimmer condenser is located at the right side of the tuner unit (see *Fig. 1*) toward the speaker unit. Adjust the trimmer (after set is completely installed) for maximum volume with the radio tuned to a weak station between 600 and 1000 *kc* (Note: See sticker on case).

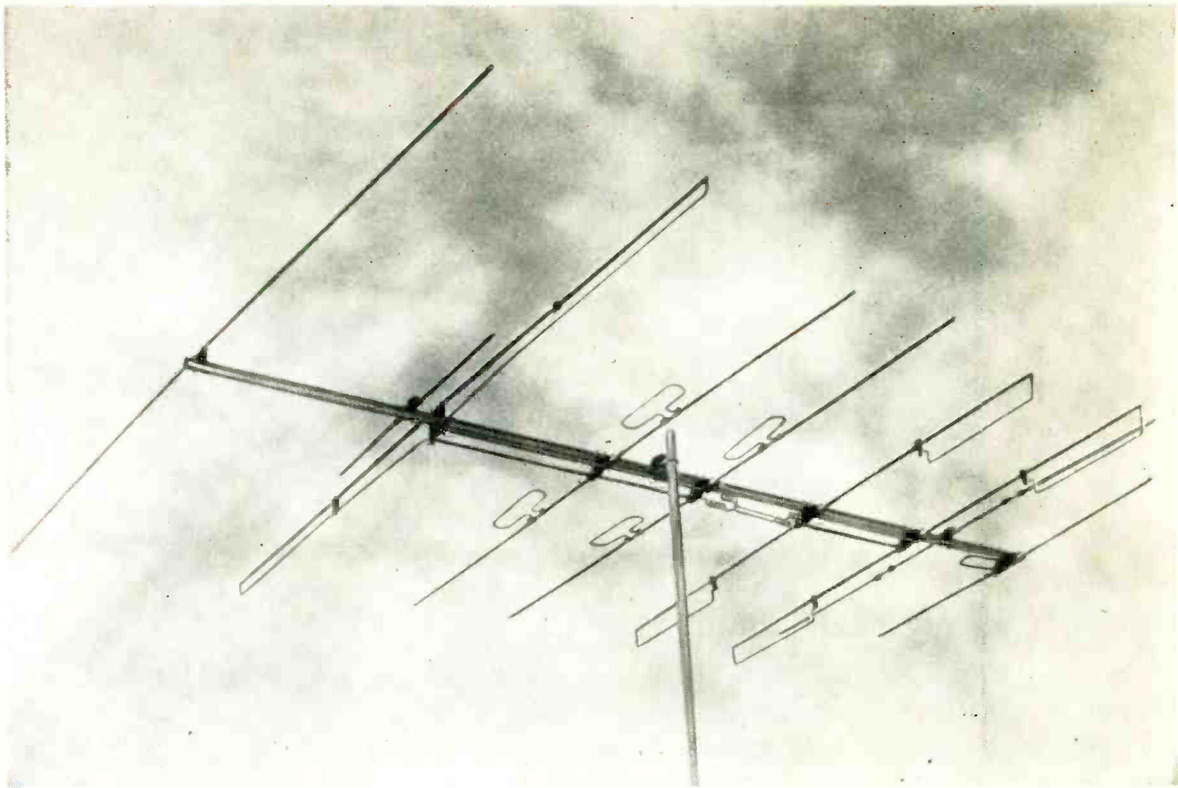
Adjustment of Push Buttons

De Luxe Model.

1. Pull push button to the right and pull out.
2. Manually tune in the desired station.
3. Push button all the way in.

De Luxe Electromatic Model.

1. Open hinged door below the tuner dial, exposing the selector tabs.
2. Tune in the nearest desired station to the left side of the dial, manually.
3. Move the first selector tab (one farthest left) until it lines up with dial pointer tip.
4. Repeat steps #2 and #3 for the remaining selector tabs, choosing stations from left to right on the dial.
5. Check the setting of each selector tab by depressing the corresponding station selector button. If [*Continued on page* 50]



TACO TOPLINER ANTENNA

A description of the construction, operation, and characteristics of the newest TACO antenna.

by F. R. VOORHAAR and ROBT. T. LEITNER

Technical Appliance Corp., Sherburne, N. Y.

IN THE early 1800's the suggestion was made that the United States Patent Office be closed because in the words of the legislator making the suggestion, "everything new and worthwhile has been invented." If he came back today, what a surprise he would get.

We, too, have come a long way from the earliest days of television when most TV receivers were installed in public places and used primarily to "bring in the customers." Again, the stations available were limited, with most TV sets receiving only a single channel. What a change has taken place since those days! It is almost impossible to find any part of this country where only a single channel can be received, and there are many areas where the multiplicity of signals would make satisfactory reception impossible if we had to be content with the antennas which were called "best" less than five years ago.

Engineers at TACO, for example, have devoted considerable engineering effort during the past several years to the design of new antennas. These antennas embrace a new concept in the use of driven elements. It is not enough that the elements be driven, but they must add something to performance not only from the standpoint of gain but also from that of pattern configuration. These new antennas incorporate an entirely new engineering design for coupling the elements for greater efficiency over both the high and low *vhf* bands.

Driving multiple elements in a streamlined yagi type array produces good "staying-power" in fringe and sub-fringe installations. It is only through this effective use of the elements in the antenna, that acceptable performance on a multiple number of channels is attained. Needless to say, these results are not possible without new theories which have been fully tested and developed. In the case of the popular *"Trapper"* series of antennas, the isolation obtained by the use of the patented traps involved new techniques. These are augmented in the *"Topliner"* series by a new development whereby maximum signal is transferred to the transmission line "in-phase," thereby further increasing the efficiency of the antenna.

The performance of this new *Topliner* series and the operation of the *delay line* principle is most easily analyzed by studying the electrical operaton of the driven elements in conjunction with the connecting network. Since this *delay line* is designed to do its work on both the high and the low bands, it will be best to describe this combinaton of antenna elements in two stages. Bear in mind also, that the frequency separation between high and low band channels involves a third factor.

First Driven Element

Fig. 1 shows a schematic drawing of the "controlled drive" type of antenna which is the subject of this article. The development of this antenna begins with a basic end fed antenna made with an ordinary open wire transmission line and illustrated in *Fig. 2a.* Here we have one wire cut shorter than the other by one halfwave length at the mean high band frequency. The instantaneous current distribution is shown by the dotted line. Let us go one step further and use two of these antennas placed end to end, feeding them in parallel. This results in the antenna shown in *Fig. 2b,* and we now have an antenna which is 3 half wave-lengths long at high band and approximately one half wavelength at the low band. However, because of the method of feeding, the operation at low band frequencies will be found to be rather inefficient.

By feeding this antenna array in series rather than in parallel, as in *Fig. 2c,* we accomplish two things. First we improve the high band characteristic by increasing the impedance and secondly we have the well known center fed half wave dipole for the low band. The short bar associated with this element becomes one conductor or a two wire transmission line, one half wavelength long at high band and because of its short length it has negligible effect at low band frequencies.

Further low band improvement is obtained by converting the element to a stepped up two diameter

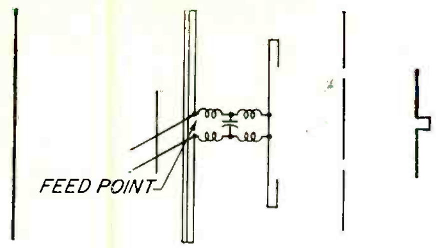


Fig. 1—Schematic drawing of a controlled drive type of antenna showing connecting delay network.

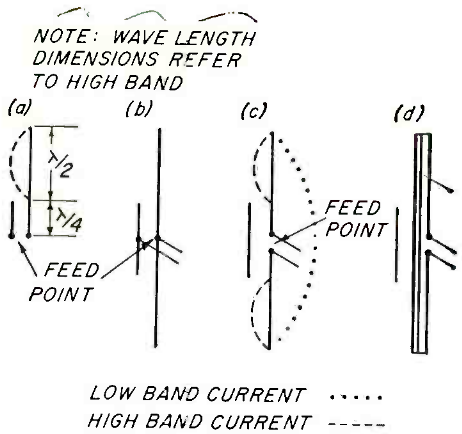


Fig. 2—(a) End fed antenna. (b) Parallel fed. (c) Series fed. (d) Two-diameter dipole antenna.

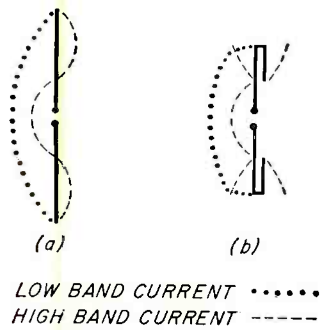


Fig. 3—By folding element (a) one-sixth from ends the resultant antenna is as shown at (b).

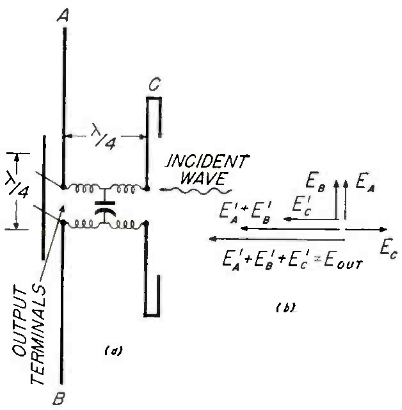


Fig. 4—The frequency selective delay line insures additive in-phase signals at the output.

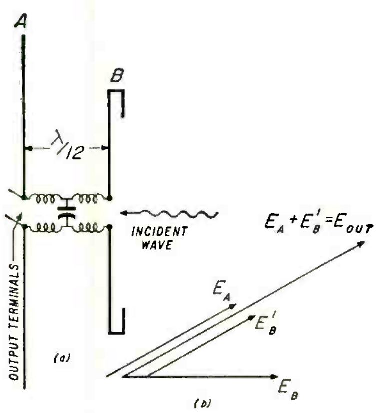


Fig. 5—The basic elements and a vector relationship for low band operation without signal delay.

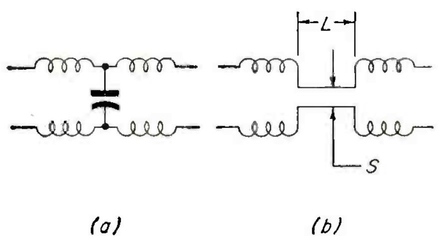


Fig. 6—(a) Delay line schematic. (b) Design considerations are length L, space S, and diameter.

dipole as shown in *Fig. 2d*. Here the low band impedance is improved greatly without sacrifice in operation on the high band. Furthermore, the resulting element is designed to be extremely effective at the low frequency (long wavelength) end of the low band. The effectiveness on the high band is obtained by having two end fed half wave elements whose signals add in-phase by means of the series connection. By thus improving the impedance characteristic and the resultant single lobe pattern, the two diameter dipole becomes the first major component in the *Topliner* antenna.

Second Driven Element

The second element in this combination may be considered as an end loaded dipole at the low band and a half wave center fed element at the high band. Referring to *Fig. 3a*, we have an element which is three half wavelengths long at the high band and one half wavelength long at the low band. By folding this element at a point approximately one-sixth of the length from the ends there results the antenna of *Fig. 3b*. Because of the close coupling between the portion folded back and the original straight portion, the antenna at the low band operates as an end loaded dipole with current distribution as shown. Its operation over the low band channels is very effective. As indicated in *Fig. 3*, the high current density at the center has been unaffected and the relatively small current at the ends contributes very little to the gain of the system. The out-of-phase currents at the ends of the element cancel each other resulting in an in-phase current at high band operation.

Thus we have produced a very important part of our new *Topliner* antenna—a combination of driven elements both of which are extremely effective over the entire *vhf* TV spectrum.

The Delay Line

The problem of connecting these elements so that the signals are additive, or "in-phase," over the entire *vhf* band is accomplished by the *delay line* network. This connecting network takes into account the phase shift encountered in the transmission line portion of the element shown in *Fig. 2*. The solution is the automatically frequency selective delay line, constructed of a combination of lumped and distributed circuit elements. Herein is illustrated the theory behind the operation of the matching network and shows how it insures additive in-phase signals.

Fig. 4a shows the basic elements for high band operation. *Fig. 4b* shows the vector relationship of the signals as they are induced on the elements and as they are additively combined at the output terminals by means of the delay line. The subscripts associated with the vectors refer to the individual elements upon which the signal is induced. The vectors with the prime (′) designation refer to the individual signals as they appear at the output terminals. Referring to the high band operation in *Fig. 4*, the induced signal E_C leads E_A and E_B signal by 90 degrees, (¼ wavelength), because of the space separation of the elements. E_A and E_B are further retarded in phase by 90 degrees in traveling through the transmission line path to the output terminals. If E_C is to be additive in phase at the output terminals, this signal must be delayed by 90 plus 90 or 180 degrees in traveling over a quarter wavelength transmission line path. The delay line automatically performs this job by giving the 180 degree phase shift over a 90 degree (¼ wavelength) path.

Fig. 5a and *5b* show the basic elements and a similar vector relationship for low band operation. For purposes of simplicity, the long element is shown as a simple dipole and the short transmission line element is omitted in this case. The constants of the delay line at low band frequencies are such that it will not act to delay the signals, therefore it will work as an ordinary straight transmission line of 30 electrical degrees, (1/12 wavelength), in length. Thus at low band the signals add in phase as in *Fig. 5b*.

[*Continued on page* 31]

THE ANSWERMAN

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

BY SERVICE DEALER & ELECTRONIC SERVICING TECHNICAL STAFF

Dear Sir:

In a Du Mont RA-340 chassis I am servicing I have a condition I would like to correct. The symptoms are that the picture jumps slightly vertically when scenes are changed. I can produce the same bounce by quickly rotating the brightness or contrast controls. All normal checks have been made. There appears to be no reason for this that I can see.

B. G.
Detroit, Michigan

A vertical bounce condition is very often due to a need for additional capacitance in the B plus boost circuit. Changes of loading on the high voltage system can momentarily disturb the electron charge on condenser C282 shown in the partial schematic of *Fig. 1*. The capacitance may not be large enough to filter and supply the necessary electrons to other circuits under all conditions. Since the vertical oscillator is operated from the boost B plus circuit an instantaneous change in the boost voltage can introduce a slight vertical bounce to the picture.

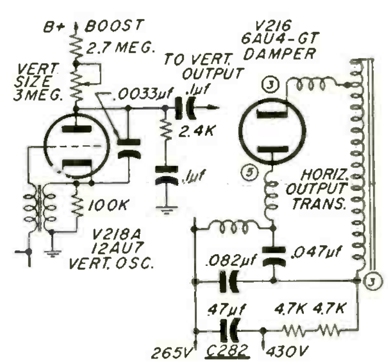


Fig. 1—DuMont RA-340 chassis B plus boost and vertical circuit.

This type of difficulty is especially evident in circuits which employ no filtering or capacitance reservoir between the boost voltage charging circuit and ground. A large capacitor from the boost voltage circuit to ground would be able to furnish a sufficient supply of electrons when called upon to do so by a change in circuit loading, such as occurs with increases of contrast or brightness control settings.

In this receiver, vertical bounce can be eliminated by changing the boost charging condenser, *C282*, to a larger value. Du Mont suggests a 10 *uf* semi-polarized capacitor, part number 03 250 421. Some RA-340 chassis employ two 20 *uf* electrolytic capacitors in series from the 430 volt boost point to ground. This type of circuit provides sufficient filtering and electron storage so that the boost condenser need not be changed. There is no vertical bounce with control adjustments or signal changes with this arrangement. The addition of two 20 *uf* condensers in series in this circuit will remedy the condition when the suggested 10 *uf* semi-polarized capacitor is not readily available.

The difficulty of vertical bounce can

be noted in many other manufacturers receivers and is generally corrected by either of the above changes.

Mr. Answerman:

I have a vertical problem with a G. E. receiver of the "N" chassis type. The difficulty is that the top of the picture is stretched a small amount. Adjustments of the height and vertical linearity controls will not correct or reduce the excessive stretch sufficiently. The voltages are just about what are called for and as far as I can determine every component is good. But something must be bad or the problem wouldn't exist.

C. O.
San Francisco, Cal.

More than likely the resistors and condensers in the vertical circuit have been measured and examined several times. Therefore, it is logical to suspect some component disassociated from the vertical oscillator circuit and yet connected to it. This component might very possibly be in the vertical blanking circuit as shown in *Fig. 2.* Quite frequently components fail in this network and cause all sorts of difficulties such as pulls at the top of the picture, bends, shading, etc. For some reason the retrace blanking circuit is often ignored in the servicing process. This case is probably another instance where the retrace elimination circuit has been overlooked. Condenser *C175*, 470 *µµf* should be tested for leakage. Only a small amount of leakage is necessary to disturb and distort the generated vertical deflection waveform. This particular 470 *µµf* condenser has been known to

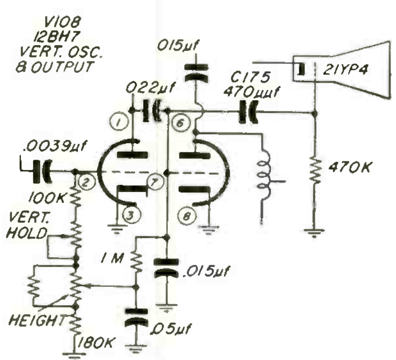


Fig. 2—Vertical output and blanking circuit of G.E. "N" chassis.

develop leakage and produce the symptoms noted here by affecting the grid bias on the vertical output tube. As a result the output waveform becomes distorted. Condenser *C175* should have a 1000 volt rating.

Dear Answerman:

I have an intermittent condition that has proved quite difficult to correct. After the receiver has been operated for a period of time the horizontal phase of the picture will slip so that the horizontal blanking bar is exhibited. Also, on occasion, the horizontal oscillator frequency may change so that the horizontal oscillator is out of sync.

Since the trouble is so infrequent, (although when the receiver has warmed up it occurs every minute or so), I have been having a difficult time trying to locate the intermittently defective part. One point of interest is that it takes about half an hour or more for the condition to appear. Once the receiver has been operated for that period of time the improper action continues for the balance of the period of use. When the horizontal oscillator slips out of phase the horizontal hold control does not seem to have too much effect upon the circuit.

What component would be most likely to cause this trouble? The receiver is a Crosley 477 chassis.

J. S.
Washington, D. C.

From the description of the symptoms, that of slipping out of horizontal phase intermittently, it appears that the automatic frequency control circuit is not holding or operating at these times.

As can be seen in *Fig. 3* a portion of the circuit consists of a special winding on the horizontal output transformer circuit. A pulse is supplied from the winding to the horizontal *afc* stage for phase comparison action with the horizontal sync pulse. This winding on the flyback transformer is one of the first points to test and is accomplished by measuring the resistance between terminals 4 and 5 on the transformer. The resistance should be about 3.6 ohms. The check should be made after the receiver is thoroughly warmed up and is performed to determine whether the winding is open or the ground connec-

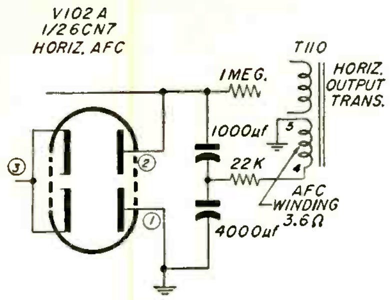


Fig. 3—Partial schematic showing Crosley 477 chassis afc circuit.

tion is intermittently open. Either condition will bring about the difficulty noted. The connections should be checked for broken leads, rosin joints, etc. More than likely the intermittently open condition is produced by the heating of the flyback transformer. The expansion of the windings during warm-up frequently results in the intermittent nature of the trouble. Since the trouble is intermittent it is possible that the resistance measurement test will prove that the winding is not open at that time. An additional means of determining whether the winding is opening is to connect a scope or a peak-to-peak reading VTVM at the flyback terminal #4. If, when the receiver slips horizontally in phase, the waveform or the VTVM reading decreases it is an indication that the winding is opening intermittently.

However, in troubleshooting this circuit with an oscilloscope it is quite possible to make an error that will considerably delay the correction of the trouble. If the winding should be open and the scope probe is brought near the transformer sufficient pulse voltage is induced into the scope probe circuit to cause a waveform to be seen, although it will not be of the correct amplitude. Even with the *afc* winding open a signal of 2.5 volts peak-to-peak or more will be found at the phase comparer circuit whereas its normal value is 15 volts peak-to-peak. Frequently, this is misleading and causes the technician to believe that the winding is good when it is open.

A final point with reference to poor horizontal lock-in action in this type of *afc* circuit is that there have been several instances where in the process of replacing a flyback transformer the ground connection has been unintentionally omitted. This produces very loose horizontal hold action with the picture slipping horizontally back and forth. ■■

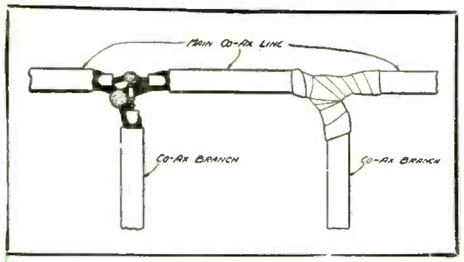


Fig. 1—Original method of tapping transmission lines.

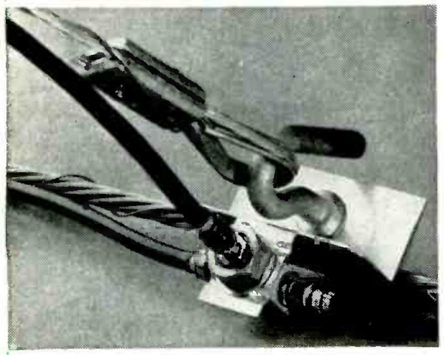


Fig. 2—Jerrold community system cable tapping device.

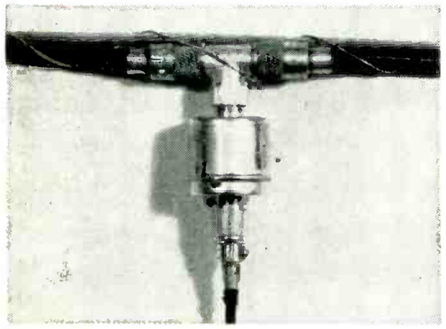


Fig. 3—Lynmar transmission line tapping device.

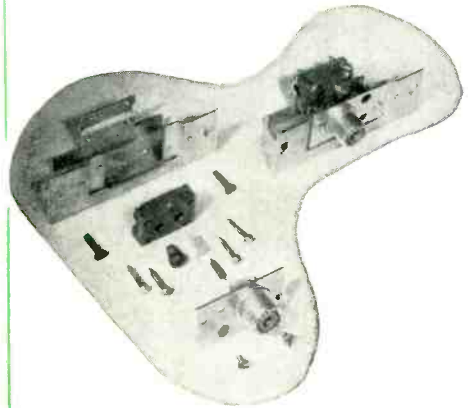


Fig. 4—Solderless coupled exploded and assembled views.

A coupling device to connect coaxial transmission lines is presented which permits quick solderless connections without disturbing the physical or electrical characteristics of the coaxial transmission line.

TAPPING TV TRANSMISSION LINES

by IRA KAMEN
Vice President Brach Division, General Bronze Corporation

THE success of TV master antenna installations and community system installations has been based upon the proper technique of tapping TV coaxial transmission lines.

In all TV master antenna system installations where a coaxial cable transmission line must be tapped at various places along the line, to transfer the TV signals to TV receivers, the tapping must be done in such a way as not to produce a change in the concentric nature of the inner and outer conductor of the coaxial cable. If the impedance of the coaxial cable is materially changed, standing waves along the line will be developed. These standing waves dissipate the TV signal energy being transmitted along the line. The amount of energy lost depends upon the impedance changes produced by the number and nature of the taps along the line. This is especially true where the taps distort the symmetrical continuity of the conductors. In some cases, the standing waves will cause a duplicate picture on the TV screen, marring the quality of reception.

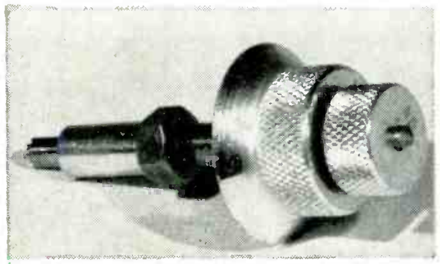


Fig. 5—RCA's tool for severing hole in coaxial transmission line.

Early Method of Tapping

When TV master antenna systems were first introduced to the market in 1948, the lines were tapped in the manner shown in *Fig. 1*, in which every effort was made to tap the transmission line with isolation resistors by a method which would distort the coaxial line to the minimum extent. This technique (*Fig. 1*) required soldering the transmission line and outlet devices and installing a resistor in an outlet box of some kind. However, this rough type of soldered connection tap-off introduced standing waves which produced serious signal loss on the high frequency band from channels 7 to 13. Further, with the soldered type of connection, the coaxial lines were always in danger, for when the soldering was completed, it was necessary in rather compact quarters to make sure that the exposed inner and outer conductors of the main line and branch lines did not short circuit each other. One manner of accomplishing this was to fill the space between the conductors with a suitable insulating compound which hardened and the other was to wrap an insulating tape between and around the various conductors as shown in *Fig. 1*.

Experience has shown that when joints are made in the manner described above that they are subject to aging, resulting in a large measure from the moisture entering the transmission line at the junction points. The aging and corrosion which were produced by this solder technique developed signal losses which, in many cases, could only be

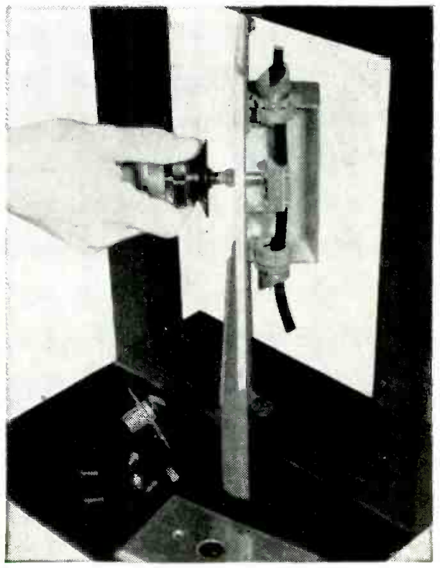


Fig. 6—Typical hole cutting procedure in tapping coaxial line.

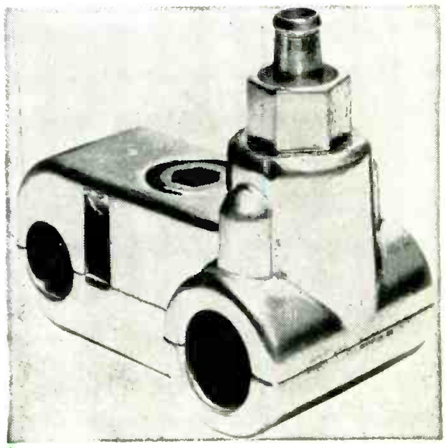


Fig. 7—Entron solderless connector for community coaxial systems.

remedied by removing the completely installed cable only a few years after its installation.

Tubular "T" Couplings

Certain manufacturers, like Jerrold and Lynmar, overcome some of the difficulties described by using tubular metallic T couplings, as shown in *Figs. 2* and *3*. These devices require the cable to be cut, each conductor skinned and, in some cases, carefully soldered to its respective point on the connector. With careful soldering these two unions will produce good performance in a system installation.

Solderless Couplers

One of the new trends toward solving the TV transmission line tapping problem is a device developed by the author under patent No. 2,615,948 for the Commercial Radio Sound Corporation, who have assigned it exclusively to the Radio Corporation of America. This coupler device is shown in *Fig. 4* in both exploded and assembled views. It is known in the field as a solderless coupler since it has been designed for installation without the use of solder. Laboratory tests indicated that these couplers could be installed without disturbing the physical or electrical characteristics of the coaxial line. Installation of this coupler along the transmission line requires the use of only the simple tool shown in *Fig. 5*. This tool is used to bore a small hole through the outer conductor of the coaxial cable, as shown in *Fig. 6*, so that the center conductor

[*continued on page* 36]

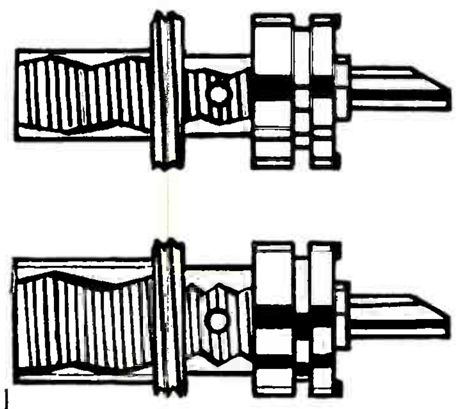


Fig. 8—Blonder-Tongue solderless cable connectors.

ASSOCIATION NEWS

[*from page* 4]

The meeting was closed with a banquet at which Friends awards were presented to several tube and component manufacturers. Dan Creato of RCA Service Co., received a personal citation for the part he has played in handling industry problems.

ESCO, Missouri

Very recently the Electronic Service Council of the Ozarks (ESCO) consisting of three associations in south Missouri, TESA of southwest Missouri, TESA of the Ozarks and the TESA South Central Mo., culminated an idea into a tangible product. The Raster will be published each month by ESCO and sent to all electronic technicians in south Missouri.

ESFETA, New York

ESFETA held their regular business meeting in the Hotel Wellington in the State Capital at Albany, New York. They had as their guests Edward M. Boor representing Doctor Persia Campbell consumer council of the governor of the State of New York. Mr. Boor spoke on the progress of the consumer council as related to the television service industry and of the investigations that have gone on in many cities of the state. He displayed several pieces of literature that the council has already published for distribution to the general public.

Publicity for ESFETA was discussed and Dan Hurley appointed as publicity and liaison chairman. Dan offered to visit all of the associations of the State (if, when, and where they meet) to offer them any assistance in the name of ESFETA. Associations wishing assistance of any sort should write to Dan Hurley, 10 Florida Rd., Syracuse 11, New York.

Movement of the manufacturer into the retail television service field was discussed with enthusiasm. Great alarm was expressed by all segments.

Syracuse Television Technicians Association, Inc.

It has come to the attention of this association of professional television technicians, who earn their livelihood at television servicing and operate from designated business zones and collect city sales taxes at the retail level, that many individuals are operating a business in a residential zone and not collecting the sales tax as required by law.

This is made apparent by the fact that more and more of our members are having difficulty collecting city sales tax from the customer who claims that other service men do not charge for this tax. We have investigated this situation and find that there are many so-called TV service men who hold jobs in factories and operate businesses from their of Syracuse to lose tax revenue from of bookkeeping or record of sales tax collections. These same men flagrantly advertise in newspapers and telephone directories.

We feel that it is unfair for the city of Syracuse to lose tax revenue from these sources while our customers have to pay this tax. We further feel that it is the duty of the tax commission to either collect these taxes or to exempt our customers from having to pay this tax.

TESA-St. Louis, Mo.

In all future phone books the telephone company has promised a committee set up by TESA to stop price advertising. This committee met with officials of the phone company at the Kingsway Hotel, to discuss price advertising in the Yellow Pages of the Telephone Directory. They have also promised a number of other things to help upgrade television service, such as: no company can advertise they are a member of a TV Service Association, unless the name of the Association is placed in the ad. Phone answering service address will not be allowed. Superlatives, such as largest in Mo., etc., will be discontinued. ■■

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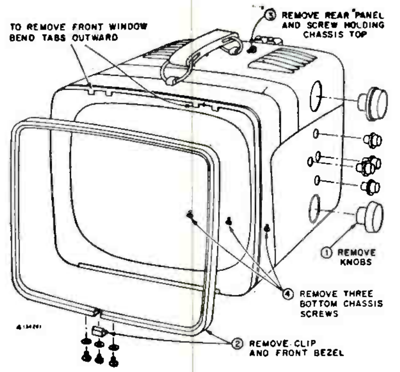


CHASSIS REMOVAL

ANTENNA INPUT
Models 14-S-7052, 14-S-7070, 14-S-7071 and 14-S-7074

The KRK32F tuner unit is designed for VHF reception only, with a 300 ohm antenna input provided.

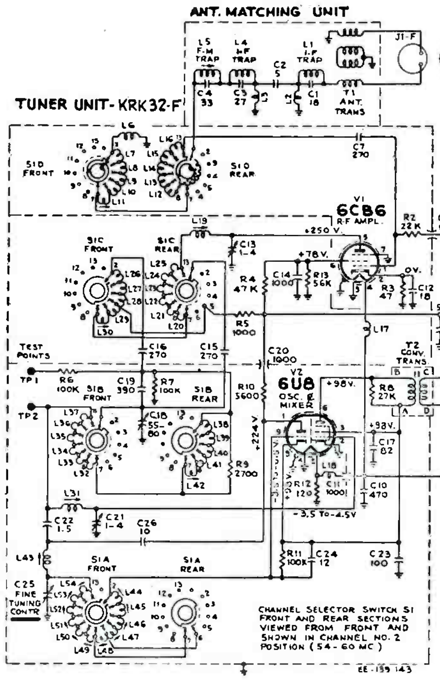
Model 14-S-7052U

The KRK29W tuner unit is designed for UHF-VHF reception with 300 ohm inputs provided for UHF and VHF use. When using a UHF antenna or a VHF antenna (or both) connect the transmission line from each antenna to the proper receiver antenna terminals.

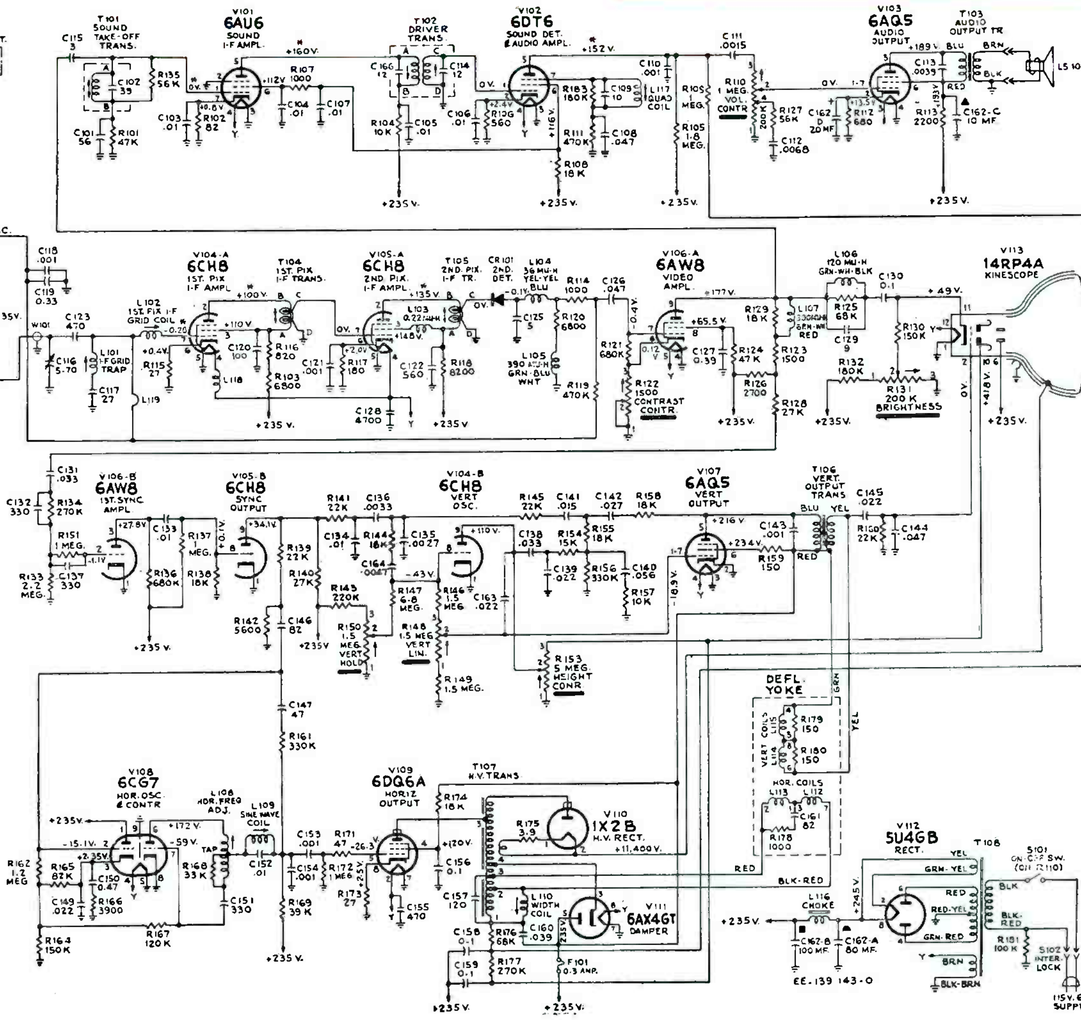
Models 14-S-7070U, 14-S-7071U and 14-S-7074U

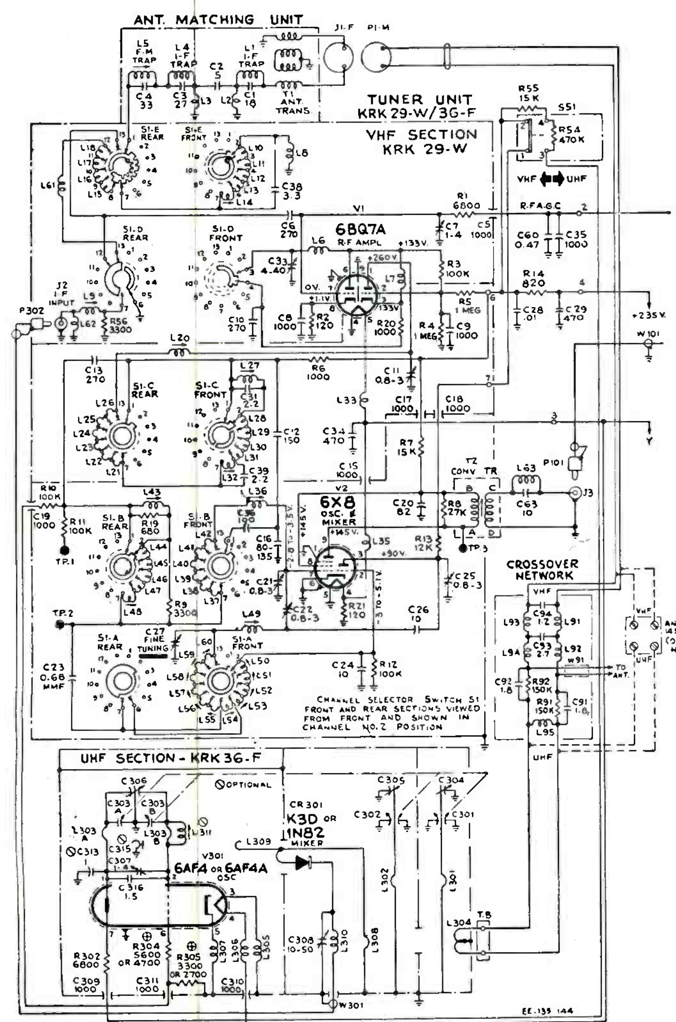
In these models the antenna input to the UHF and VHF tuner is connected to a crossover network to provide a single antenna input to the receiver. This provides for antenna input from a single VHF antenna, a UHF antenna, a combination UHF/VHF antenna, or the receiver cabinet antenna.

The attached cabinet antenna is automatically connected to the tuner inputs when the bottom rod sections are *fully* extended. When the cabinet antenna is being used disconnect the external antenna. When using the external antenna retract the rod antenna fully.

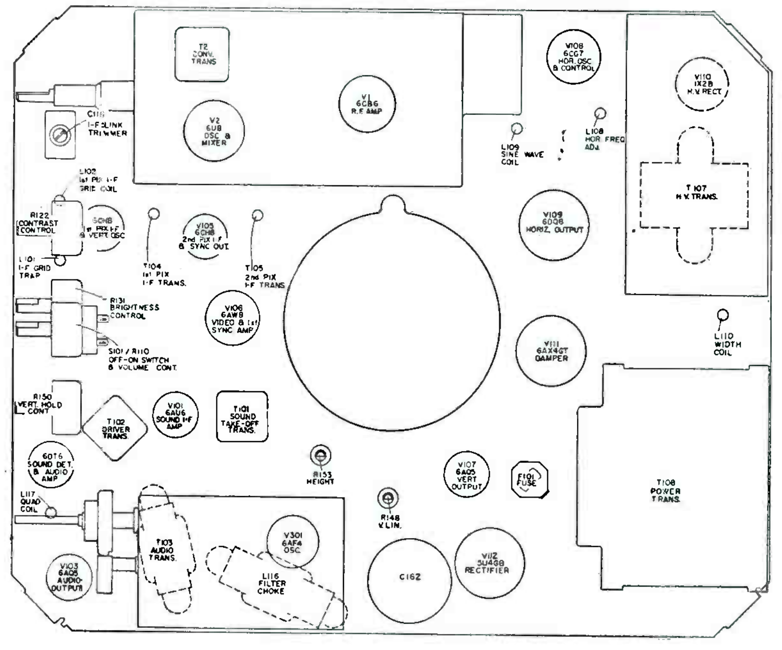


*Measured with 1 megohm ½ watt resistor in series with meter probe.





⊕REPLACE R304 AND R305 WITH THE SAME VALUE AS FOUND IN UNIT.



CHASSIS REAR VIEW

INSTALLATION CHECK LIST

Connect the antenna transmission line to the receiver antenna terminals.

Plug the power cord into the 117V. AC outlet and turn the receiver "ON". The receiver should operate normally. However, a check of the following adjustments should be made.

1. Check position of ion trap magnet and readjust for maximum raster brightness, if necessary.
2. Check raster for proper framing (tilt) in mask. Adjust yoke position by rotating.
*3. Check width and horizontal linearity, readjust width control as outlined below, if adjustment is necessary.
*4. Check for normal operation of horizontal hold control. Should hold sync for two full turns or more of the control.
5. Check centering of picture. Adjustment is made with the centering lever on the focus magnet.
6. Check height and vertical linearity, reset controls where required for 1¼" overscan.
7. Check R-F oscillator adjustment on all channels. Readjust if necessary, starting at the highest frequency channel, proceeding to the lowest.

***Width and Sinewave Adjustments**

It is possible to adjust the horizontal oscillator in the field by the following method when such adjustment is indicated.

A. Set the width coil fully counter-clockwise.
B. Adjust width for ¾" overscan at each side, with normal line voltage and normal brightness.
C. Turn horizontal hold control to the left, out of sync, to the point where interrupted oscillation occurs.
D. Adjust sinewave core, as the horizontal hold control is rotated to the left beyond the locked-in position, until 3 to 4 bars occur between the fall out point and interrupted oscillation.

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RCA TV PORTABLE
Ch. KCS102B, D
Models: 14-S-7052, -7070, -7071, -7074
14-S-7052U, -7070U, -7071U, -7074U

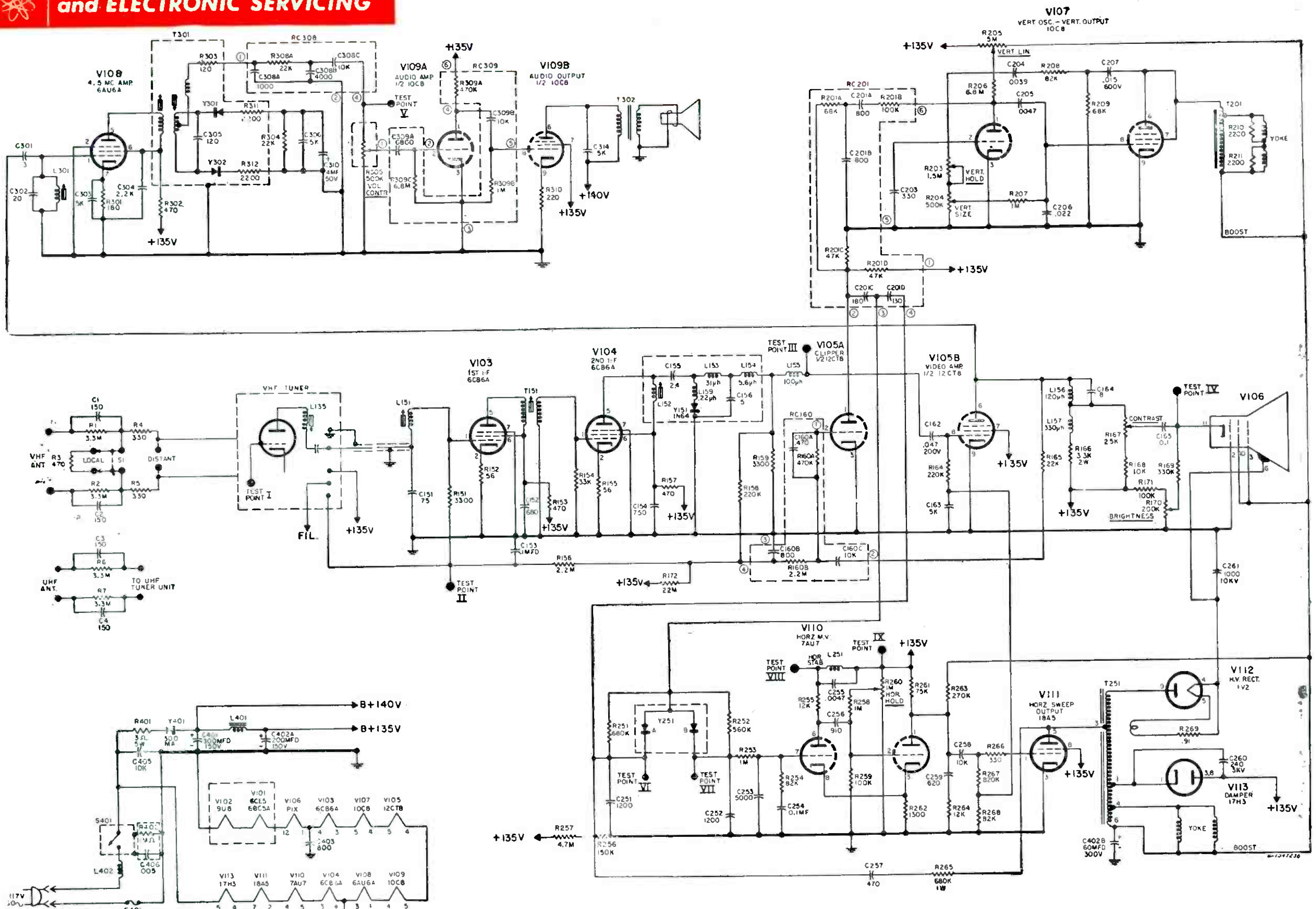


Fig. 4. Schematic Diagram, MAIN CHASSIS

INSTALLATION ADJUSTMENTS

General -The receivers are shipped complete with the picture tube mounted and all controls pre-adjusted. After powering the receiver check the controls, as outlined in the operating manual, for proper operation.

The local-distant switch is normally left in the distant position except where receiver overload, caused by exceptionally strong signals; or cross modulation, caused by one or more strong signals interfering with the desired signal; causes the picture to tear, roll or be distorted.

ELECTRICAL INSTALLATION

It is recommended that the receiver be permitted a 15 minute warm up period before final raster adjustments are made. A preliminary check of the ion trap should be made so as not to damage the picture tube.

Height and Vertical Linearity -These controls, R204 and R205 should be adjusted simultaneously to give proper vertical size consistent with good vertical linearity. Final adjustment should be made to allow the picture to extend approximately 1/8 inch beyond the edges of the mask.

PICTURE TUBE ADJUSTMENTS

Yoke Position -Loosen the yoke clamp wing nut. Seat the yoke firmly against the bell of the picture tube and rotate the assembly to correct for any tilt of the picture, squaring the picture within the mask. Tighten the wing nut after adjustment is made.

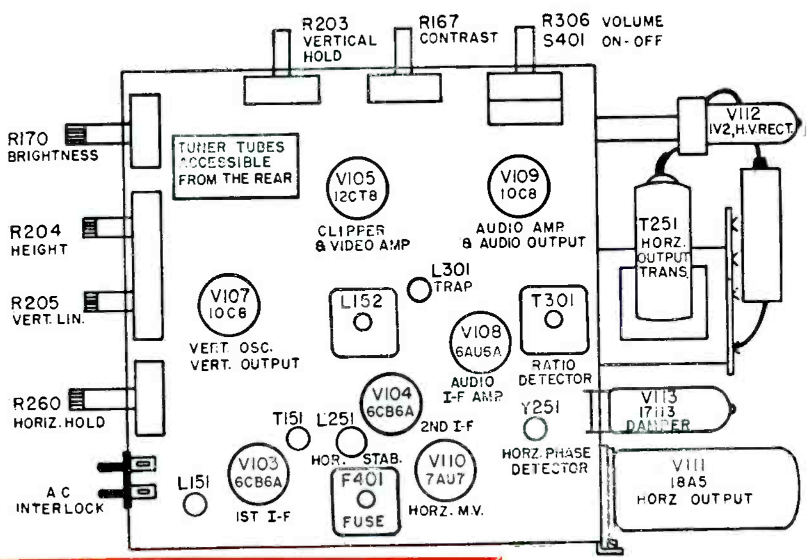
Picture Centering - The picture tube centering device is located on the neck of the tube mounted directly on the rear of the yoke. Rotate the rings with finger tips towards and away from each other to center the picture on the face.

Focus -Focus of the picture in this set is fixed and therefore no adjustment is available. Focus should be checked when making adjustment of the ion trap and best focus consistent with maximum brightness and without neck shadow.

Ion Trap -Power should not be applied to the receiver for extended periods of time without proper adjustment of the ion trap. Rotate and slide the ion trap on the neck of the picture tube to obtain maximum picture brightness without neck shadow and consistent with good focus. Brightness should be kept moderate during the ion trap adjustment.

HORIZONTAL STABILIZER ADJUSTMENT

1. Tune receiver to a weak signal and adjust controls for normal operation.
2. Short test point VI to VII.
3. Shunt L251 (horizontal stabilizer coil) with 1000 ohms. (Connect resistor between test points VIII and IX.)
4. Adjust horizontal hold potentiometer R260 so that the picture "floats" back and forth across the screen. Leave R260 set like this.
5. Remove 1000 ohm shunt across L251, and adjust L251 so that picture again "floats" back and forth across the screen. Leave L251 set like this.
6. Remove connection from test point VI and VII.



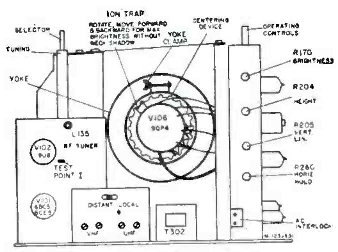


Fig. 1 Rear View of Chassis Cabinet Removed

To Remove The Chassis From The Cabinet -In order to service the tubes or component;

1. Disconnect the line cord from the power outlet. Remove any antenna connected to the antenna terminals.
2. Remove all knobs from the control shafts.
3. Remove the 8 screws located on the bottom of the cabinet at the sides (3 each) and rear (2 only).

The cabinet is then removed by sliding back off the cabinet front and bottom board assembly. This leaves all components exposed with the picture tube remaining mounted to the cabinet front and bottom board assembly

Install the cabinet to the chassis in the reverse order as the disassembly.

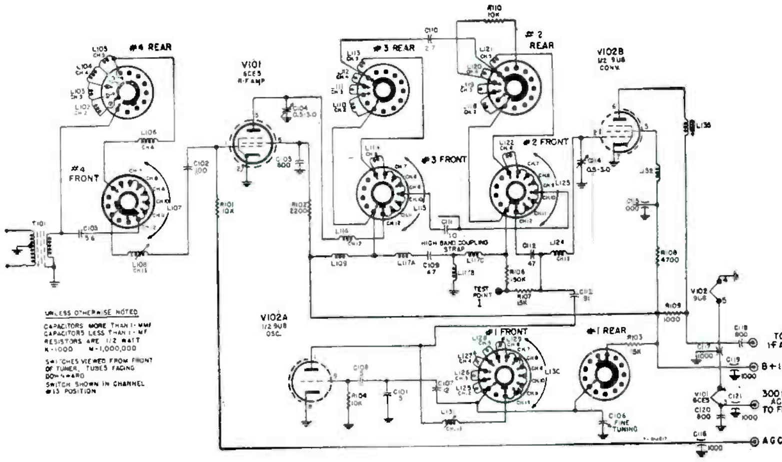


Fig. 2. Schematic Diagram VHF TUNER RJX-084

GE TV PORTABLE

Ch. "T" Line

Models: 9T001
9T002

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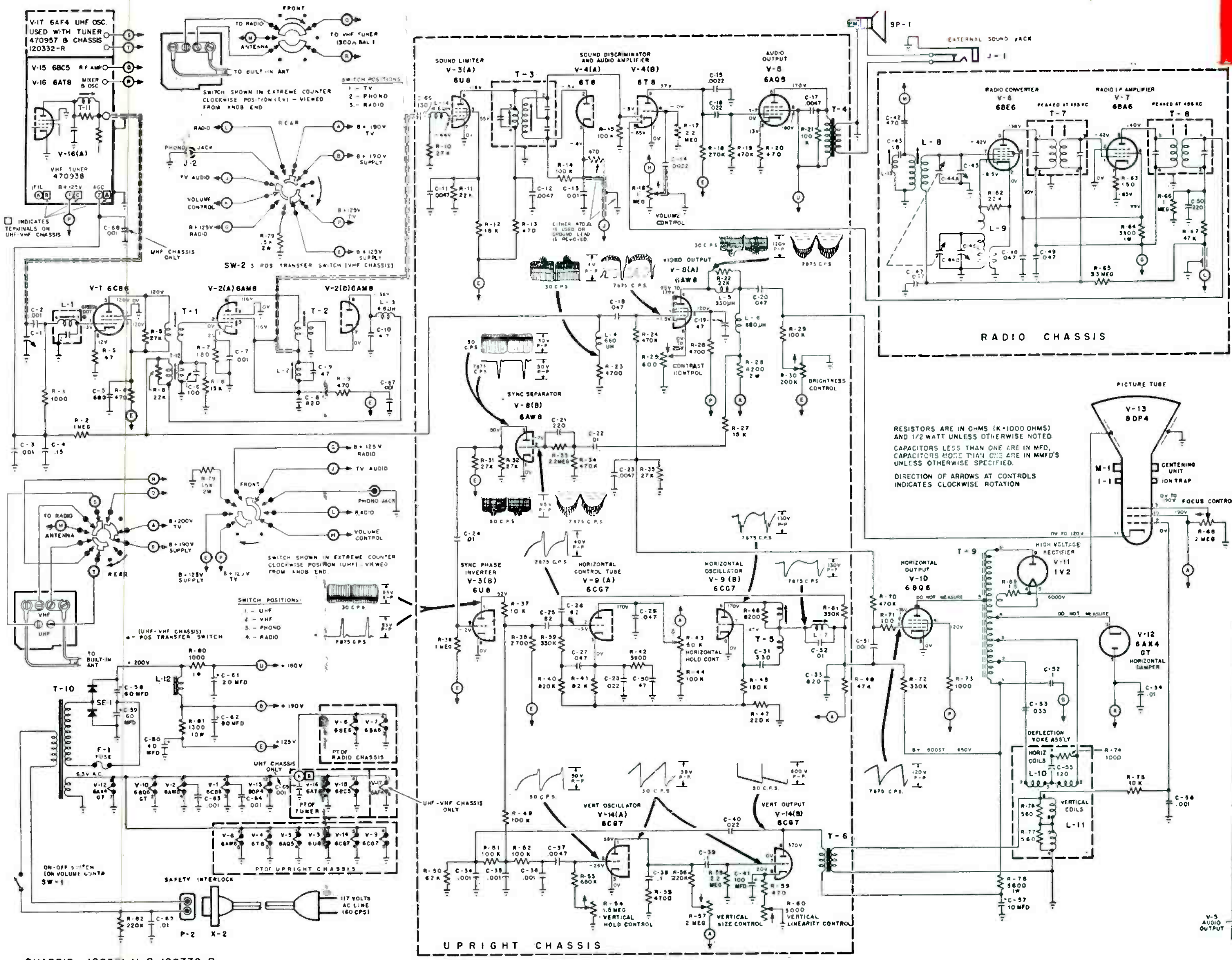
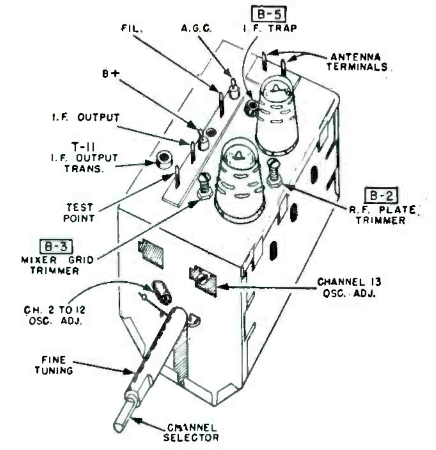


CHASSIS 120331-H & 120332-R



ALIGNMENT POINTS
VHF TUNER 470938

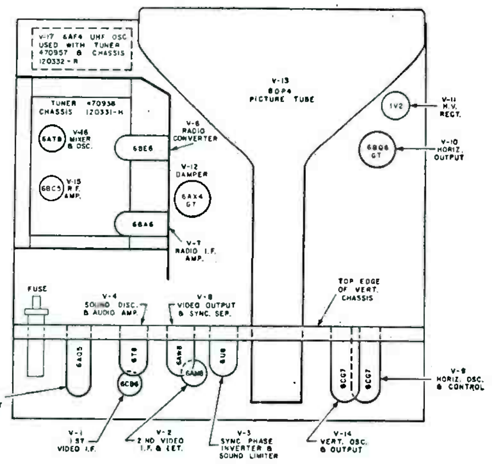


FIG. NO.2 TUBE LOCATION DIAGRAM

FIELD ALIGNMENT OF PART NO. 470938 TUNER USED IN CHASSIS 120331-H

Ordinarily the only adjustments required in the field are those necessary to compensate for variations in oscillator tube replacements. This can usually be accomplished with the channel No. 13 oscillator adjustment. If individual channel adjustments are necessary, then proceed as follows: (Since this tuner is of the incremental inductance type, all oscillator adjustments should be made commencing with the highest channel and then proceeding to the lower channels.

1. Set channel selector to channel No. 13. Set fine tuning control to electrical center of its range.
2. Adjust channel No. 13 oscillator adjustment, (See Figure No. 1) for best picture and sound. Use a non-metallic screwdriver.
3. Channels No. 2, No. 4 and No. 6 have slug adjustments and should always be adjusted starting with the higher channel. (See Figure No. 1). It is recommended that channels No. 13, No. 6, No. 4 and No. 2 slugs, only, be adjusted in the field in that order when necessary.
4. Channels No. 12 through No. 7 can be adjusted if required by bending the hair pin inductances through the hole provided (See Figure No. 1).
5. Channels No. 3 and No. 5 (split coil windings) should not have to be compressed or separated ordinarily.

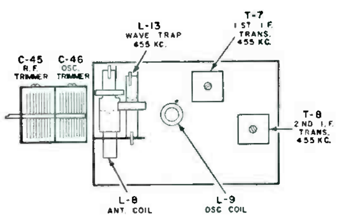


FIG. NO. 3 RADIO CHASSIS ALIGNMENT POINTS

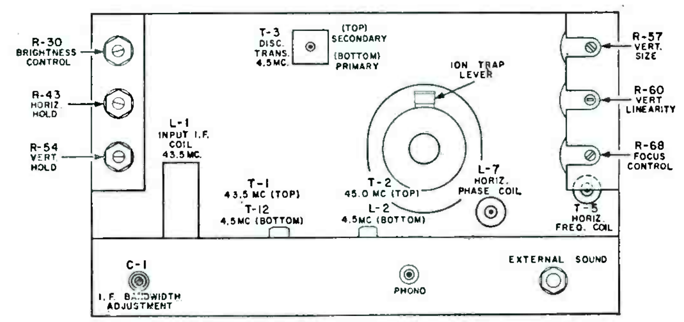


FIG. NO. 4 T.V. CHASSIS ALIGNMENT POINTS

ALIGNMENT OF MIRACLE PICTURE LOCK (Horizontal Oscillator and A.F.C.)

1. Short phasing coil (L-7) by means of a jumper wire.
2. Rotate horizontal hold control (R-43) fully clockwise.
3. Starting with horizontal frequency slug (T-5) all the way "in" looking at rear of chassis, rotate "out" until picture just locks into sync (adjust "out" additional 1/4 turn.
4. Remove short from phase coil and starting with slug all the way "in" adjust "out" until picture almost locks into sync (2-3 diagonal bars).
5. Check for horizontal hold while switching channels. If this is not obtained at extreme clockwise position of horizontal (hold control R-43) turn frequency slug (T-5) "out" slightly until desired results are obtained. If excessive squedging (Christmas Tree effect) is experienced while switching channels, repeat steps No. 1 through No. 5.

RESISTANCE READINGS FOR CHASSIS 120331-H 120332-R

SYMBOL	TUBE PIN NUMBERS								
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-1	1 Meg	47 Ω	0 Ω	0 Ω	*1KK Ω	*14K Ω	0 Ω		
V-2	180 Ω	1.2 Ω	*14K Ω	0 Ω	0 Ω	*18K Ω	0 Ω	4700 Ω	0 Ω
V-3	*26K Ω	27K Ω	*1KK Ω	0 Ω	0 Ω	*15K Ω	0 Ω	0 Ω	1 Meg
V-4	100K Ω	100K Ω	160K Ω	0 Ω	0 Ω	1 Meg	0 Ω	2.2 Meg	280K
V-5	470 Ω	470K Ω	0 Ω	0 Ω	*16K Ω	*16K Ω	470K Ω		
V-6	22K Ω	.8 Ω	0 Ω	0 Ω	*15K Ω	*19K Ω	3.2 Meg Ω		
V-7	3.2 Meg Ω	0 Ω	0 Ω	0 Ω	*15K Ω	*19K Ω	150 Ω		
V-8	0 Ω	2.7 Meg	*16K	0 Ω	0 Ω	0–600 Ω	500K Ω	*19K Ω	*22K Ω
V-9	35K Ω	1.4 Meg Ω	300K	0 Ω	0 Ω	60K Ω	350K Ω	0 Ω	0 Ω
V-10		0 Ω		*15K Ω	500K Ω		0 Ω	0 Ω	
V-11	DO NOT MEASURE								
V-12			400K Ω		*15K Ω		0 Ω	0 Ω	
V-14	Vert. SIZE Control 200K Ω to 2.7 Meg Ω	Vert. Hold Control 680K Ω to 1.7 Meg Ω	0 Ω	0 Ω	0 Ω	*400K Ω	2.2 Meg	Vert. Lin. Control 470 Ω to 5.5K Ω	0 Ω

SYMBOL	TUBE PIN NUMBERS					
	PIN 1	PIN 2	PIN 3	PIN 10	PIN 11	PIN 12
V-13	0 Ω	8.5K Ω	Focus Cont. 50 Ω to 500K Ω	*15K Ω	Bright. Cont. 100K Ω to 150K Ω	0 Ω

NOTE: Resistance readings taken with switch set on TV position except V-6 V-7 (Radio Position).

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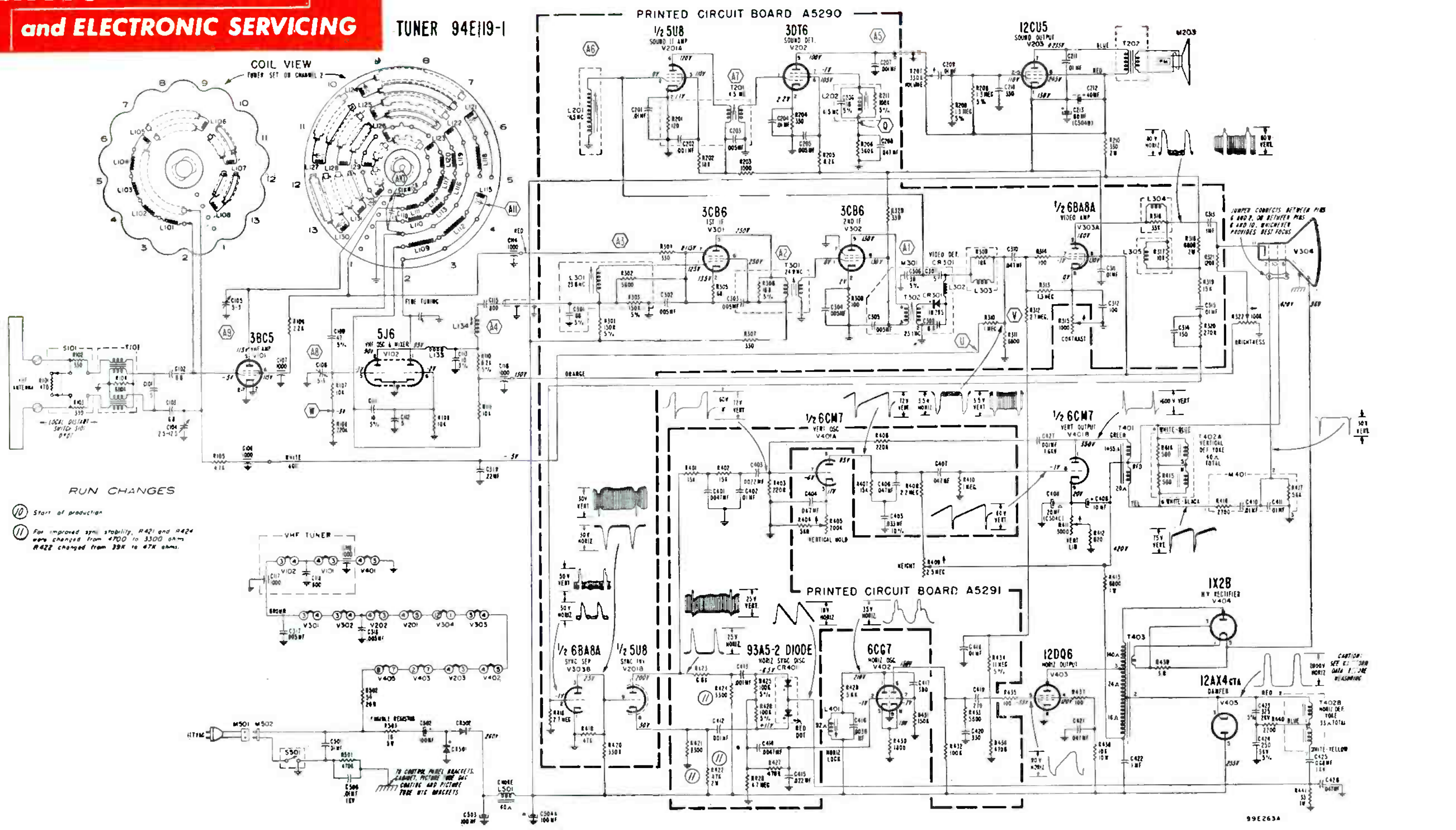
EMERSON TV PORTABLE

Ch. 120331-H
120332-R

Models: 1232, 1233



CHANNEL ADJUSTMENT

Channel adjustment of each station should be checked upon installation and at every service call. With proper adjustment, best picture is obtained at approximately center rotation of **Fine Tuning** control.

IMPORTANT: Always make adjustment on lowest channel first, then work up, in order of channel number to the highest channel. (For example, if channels 2, 9, 7 and 5 are received, adjust in this order: 2, 5, 7, 9.)

Before proceeding with adjustment, see illustration for location of channel slugs, then adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set **Channel Selector** for lowest channel to be adjusted. Set other controls for normal picture and sound.
c. Set **Fine Tuning** control at center of its range by rotating it approximately halfway between its stops.
d. Remove **Channel Selector** and **Fine Tuning** knobs and the gold escutcheon under the knobs.
e. Using a 1/8" blade non-metallic tool (Part No. 98A 30-19), carefully adjust the channel slug for best picture. (Note that sound is not loudest at this point.) Repeat procedure for remaining channels, adjusting them in order of their channel number (from lowest channel to highest channel)

View of VHF Tuner. Knobs and Escutcheon removed.

SERVICING TUBES

IMPORTANT: To prevent possibility of electric shock, do not remove or install tubes unless the set is disconnected from the power line.

Tubes in this receiver, with exception of VHF tuner, can be serviced by simply removing the cabinet back and tilting the printed circuit board. To tilt printed circuit board, remove screws mounting it to the chassis. A tube puller may be used for removing the high voltage rectifier tube (1X2B) located in the high voltage compartment.

The picture tube is accessible for replacement by removing the cabinet front, cabinet back and tilting the printed circuit board. To replace tubes in the VHF tuner, remove chassis from cabinet as instructed under "Removing Cabinet Back & Front".

LOCATING A BURNED OUT TUBE

The heaters of tubes(except V404 high voltage rectifier) are connected in a series circuit. If tubes do not light, check the interlock line cord to see that it is making good contact. Check to see that all tubes are firmly seated in sockets.

A total of 13 tubes are used in the heater circuit. The tube location diagram on the schematic page contains a simplified circuit diagram of tube heater connections Through the use of this diagram and instructions given below, an "open" burned out tube in the heater circuit can be quickly located without the need for substituting or testing of all tubes

A simplified procedure is given in the figure below for quickly locating an open heater tube. Checks are made with an ohmmeter from the tube socket pin to chassis ground with a tube removed. IMPORTANT: The picture tube mounting brackets, rear control bracket and tuner shaft are insulated from the chassis

NOTE: Tube socket pins are counted in a counterclockwise direction when viewed from the tube side of the socket.

Occasionally a tube heater will measure good when cold, but will "open" upon application of power. In this case, measuring continuity of the heater circuit with power applied may be necessary. An AC voltmeter or an electrician's neon test lamp can be used to circuit trace (check voltage) the heater circuit with AC power applied. However, be sure to observe the "High Voltage Warning"

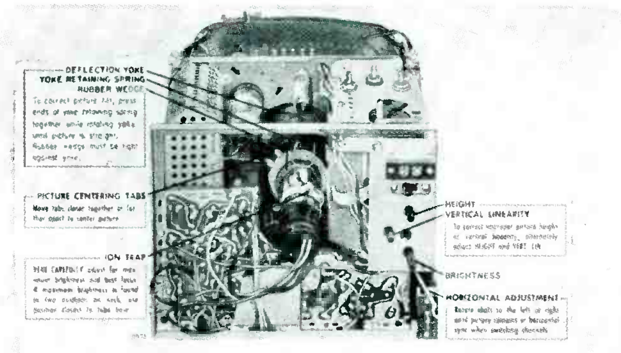
REMOVE SOCKET FROM PICTURE TUBE. MEASURE RESISTANCE FROM PIN 12 OF SOCKET TO CHASSIS GROUND.

If meter indicates continuity → RECONNECT PICTURE TUBE SOCKET. REMOVE V203 (12CU5). MEASURE RESISTANCE FROM PIN 3 OF V203 SOCKET TO CHASSIS GROUND.

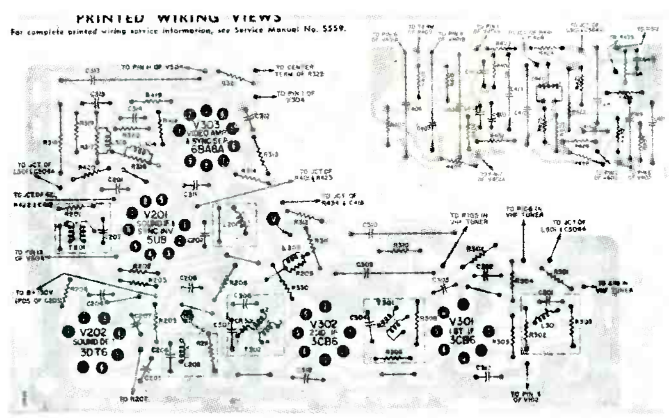
- If meter indicates open → CHECK → V402, V303, V304
- If meter indicates continuity → CHECK → V301, V302, V202, V201

If meter indicates open → RECONNECT PICTURE TUBE SOCKET. REMOVE MOUNTING SCREWS FROM PRINTED CIRCUIT BOARD. TILT BOARD, REMOVE V301 (3CB6). MEASURE RESISTANCE FROM PIN 3 OF V301 SOCKET TO CHASSIS GROUND.

- If meter indicates open → CHECK → V102, V101, V401



Rear View of Chassis Showing Adjustment Locations.



REMOVING CABINET BACK & FRONT

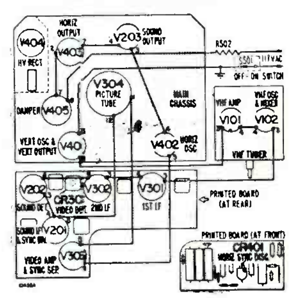
The cabinet back and front are removable. Remove mounting screws; then pull away from set. In sets with carrying handle, mounting screws must be removed from handle.

To remove chassis from cabinet shell, remove back, front and screws at bottom. Remove chassis through front.

FUSIBLE RESISTOR

A pig-tail type fusible resistor (Part No. 61A22) is used as a B+ and initial surge fuse. It is located below the tuner

TUBE LOCATIONS



IMPORTANT CAUTION: Limited space is available when adjusting picture centering tabs and ion trap. Picture centering tabs may be adjusted using a non-metallic rod.

ADMIRAL TV PORTABLE

Ch. 14YP3B

Models: T/TS-101, -102, -103, -104, -105AL, -106AL, -107AL

TACO TOPLINER ANTENNA

[*from page* 19]

The delay line is essentially a balanced "T" section composed of inductive series elements and a capacitive shunt element. By proper design of the elements, the transmission of signals is delayed at the high band frequencies, while at low band frequencies the reactance of the circuit is such that transmission is not retarded. *Fig. 6a* shows a schematic representation of the delay line. *Fig. 6b* is a sketch of the final delay line, where the length *L*, spacing *S* and wire diameter have been chosen to give the proper amount of distributed shunt capacity. The delay line is constructed of ⅛ inch aluminum wire and special insulators to maintain the spacing, on which stable operation depends.

Parasitic Elements

The desired gain and directivity has been obtained by adding several elements to the basic driven units indicated in *Fig. 1*. A conventional reflector is added for increased low band gain and improved front-to-back ratio. To equalize the gain in the low band a parasitic director is added as the first element on the crossarm. This director is insulated at the center and a phase reversing loop is inserted between the two dipoles to make the unit work in both the high and the low bands. A split director is employed to give uniform increased gain on high band channels. The resulting antenna gives a unidirectional single lobed pattern over the complete high and low band channels.

Mechanical Features

To maintain consistent day-in and day-out performance of the antenna, and in order to maintain the stability of the delay line under all operating conditions, the antenna is designed for maximum mechanical strength in all its phases. Completely factory assembled, high signal strength 5052H16 aluminum alloy is used throughout. Being many times stronger than aluminum used in antennas manufactured in the early days of television, the antenna will stand up under the rigid requirements of present day reception. Wind sway, vibration, misalignment of elements and similar conditions which would not have affected the operation of a TV receiver being used on only a single channel, cannot be tolerated in the present day multi-channel era. The alloy used is many times stronger, and in addition the elements incorporate top quality mechanical support to hold them permanently in position. Insulators are of a tough durable plastic material of high dielectric quality and have excellent impact properties thus insuring consistent operation. ■ ■

THE WORK BENCH

Unusual Service Problems And Their Solutions

by **PAUL GOLDBERG**
Service Manager

**This Month's Problem:
No Color Reception,
Using HV Transformers**

This month's installment is devoted to troubles with which a thorough knowledge of receiver circuitry is necessary.

CBS Color Receiver 205

The receiver was turned on and it was observed that the black and white picture was normal but no color was seen on the screen during color transmission. The sound was OK. In other words a black and white picture was seen at all times.

The diagram was studied and it was noted that the following tubes could cause this trouble: V16A, ½ 6AN8, band pass amplifier, V16B, ½ 6AN8, color killer, V43B, ½ 6BL7, pulse shaper. These were first replaced individually, but had no effect. V17, 6CB6 and V18, 6AL5 were also replaced but had no effect. (See *Fig. 1*)

The diagram was again studied. One can see that the chroma signal is fed from the first video amplifier V14, 6CL6's contrast control to the grid of V16A, ½ 6AN8, the bandpass amplifier. The bandpass amplifier amplifies a band of frequencies of approximately 2.1 to 4.1 megacycles (chroma) which is then fed to the demodulators.

The purpose of the color killer V16B, ½ 6AN8, is to prevent video information from passing through the bandpass amplifier and subsequent circuits when the receiver is receiving black and white

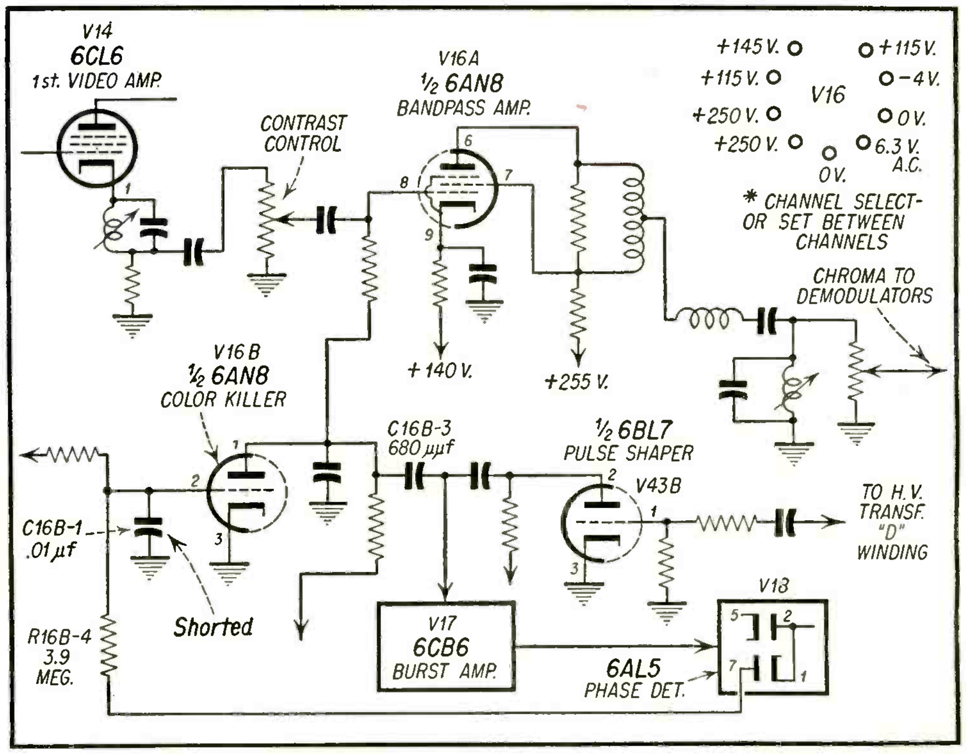


Fig. 1—Partial schematic of CBS TV receiver showing bandpass amplifier, color killer, pulse shaper, video amplifier and connecting circuitry.

transmissions. It operates in the following manner: A pulse from winding "D" on the horizontal output transformer is applied first to the grid of the pulse shaper V43B. Here it is shaped and amplified and fed to the plate of the color killer tube through C16B-3, 680 $\mu\mu f$. This pulse causes V16B to conduct, which in turn applies a negative voltage to the grid of the bandpass amplifier killing this amplifier during black and white transmissions.

During the reception of color signals the bandpass amplifier will not be biased off because the color killer tube will not be conducting. The burst information being transmitted during color transmission causes a negative voltage to appear at the plate (pin #7) of the phase discriminator, 6AL5, V18, which is fed to the grid of the color killer tube through the 3.9 meg resistor. This negative voltage is sufficient to cut off the color killer tube. Consequently no bias is presented to the bandpass amplifier.

Knowing these facts the station selector was set to a channel transmitting color and voltage measurements were made at the plate, screen and cathode of V16A. These voltages were found to be rather high. It seemed that the bandpass amplifier was not conducting. Now if V16B were continually conducting a negative voltage would be applied to the grid of the bandpass amplifier, V16A, which would be sufficient to cut off the chroma signal coming through. Because the black and white transmissions were received properly, the color killer was assumed to be supplying a sufficient negative voltage.

It was now suspected that the color killer tube V16B was not being cut off during color transmissions. The grid (pin #2) of V16B to ground, was then voltage checked. It was found to measure zero volts. The ohmmeter was then set up and a resistance measurement was made from pin #2 of V16B to ground. (Refer to diagram for voltages.) The meter read zero ohms. C16B-1, .01 μf, was then clipped out of the circuit and was found to be shorted. C16B-1 was replaced with a new .01 μf condenser and the receiver now operated properly on black and white and on color transmissions.

The cutoff bias supplied by V18, Phase Detector, to the grid of the color

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- Belden Manufacturing Co. — 4647 W. Van Buren St., Chicago 80, Ill.
- Columbia Wire & Supply Co. — 2850 Irving Park Road, Chicago 18, Ill.
- Eby Sales Co. of N. Y. — 130 Lafayette St., New York 13, N. Y.
- Federal Telephone & Radio Corp. — 100 Kingsland Road, Clifton, N. J.
- Jersey Specialty Co. — Burgess Place, Mountain View, N. J.

killer tube V16B, during color transmission was shorted to ground by the defective C16B-1, thus allowing the color killer to conduct continually which in turn cut off the band pass amplifier V16A.

RCA KCS 48T

The receiver was turned on and arcing was heard in the high voltage cage. The high voltage cage was removed and arcing was observed from filament winding to the mounting screw on the bakelite strip. This screw is connected directly to the 6BG6 plate cap.

The customer had previously stated that the HV transformer had been replaced just two weeks ago for the same reason. It was found after examination that the core mounting as well as the filament wires were burned through and had to be replaced. Before installing the transformer the circuitry was examined in an effort to discover some possible cause of the arc over. The only thing we discovered was the omission of *C198*, 8.2 $\mu\mu f$ off the plate of the 6BG6, which may be noted in *Fig. 2*.

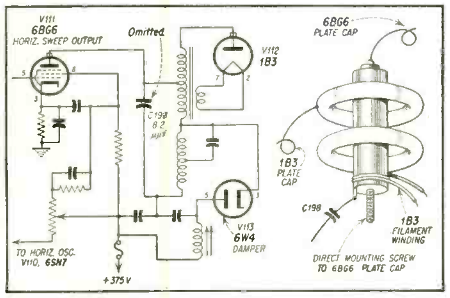


Fig. 2—Horizontal deflection circuit of RCA KCS48T chassis.

The HV transformer was next replaced. The receiver was set on the bench and turned on. After a few hours sizzling and intermittent arcing was noted from the filament wires to the mounting screw. The receiver was immediately turned off and a new *C198*, 8.2 $\mu\mu f$ was installed. For the next few days the receiver was allowed to cook. But no arcing or sizzling was heard again. We deduced therefore that the serviceman who had previously installed the HV transformer had neglected to put back *C198*. Without *C198* in the circuit the difference of potential between the filament winding and the 6BG6 plate would be great enough to cause the arc over. ■■

TAPPING TV TRANSMISSION LINES

[*from page* 25]

may be contacted by the resistor which is subsequently inserted through the hole created by the cutting tool. This "doughnut hole" cutter requires only a few easy turns to clear the outer sheath, the shield, and the small portion of polyethylene between the inner and outer conductors. The ground connection to the cable is made by means of an insert ground screw which is threaded all the way down and cuts its way through the cable sheath to establish the ground contact with the shield. Making the ground connection applies the tapped TV voltages to the coaxial outlet. Regular inspection of the boring tool is required to make certain that it is in good working order. Special attention to the proper depth setting is important to make certain that the correct amount of metal and plastic is removed from the cable.

RIDER SPEAKS

by JOHN F. RIDER

"Dean of America's Radio Servicemen"

THE BIG problem in the minds of servicing dealers and technicians is factory service. Two prominent receiver manufacturers have recently announced their intention to open a number of factory service branches in major population centers of the United States—this in addition to the one manufacturer who has had a great number of these stations in operation for the past 10 years.

Looking at the situation without rose colored glasses and analyzing its effects without emotion we do *not* foresee the end of the electronic servicing industry. As a matter of fact this conclusion is reached even after consideration of the possibility that other receiver manufacturers will do the same thing.

Some of the receiver manufacturers who will remain in the home electronic equipment field after the present battle between the giants of the industry is finished are not too happy about the prospect of direct service contact with the receiver buying public, but the likelihood is that a factory service program of some sort will be conducted by most of them. The thinking is dictated by the sales departments, which maintain that an advantage in receiver sales accrues to any organization that eases the mind of the buying public on the question of service.

A not insignificant factor in this thinking is the possibility of making the factory service branches a profitable operation, since they would service all the products made by the parent concern. As things look now it is reasonable to presuppose that the sales programs of those who stay in the manufacturing business will encompass home electronic and home white goods equipment. So, opening factory service branches is a pattern which will without doubt be adopted by most producers of TV receivers and white goods —including those concerns which at present say they'll do nothing. Competition is a powerful influence in making manufacturers change their minds.

Interestingly enough, quite a few manufacturers who have not yet declared themselves broadly on the issue of factory service have, during the past few years, operated a few scattered installations.

Let us for the moment assume the worst; that makers of the equipment *will* operate factory service branches. Experience in the past has illustrated that operating a service branch is not cheap. It costs money and we must accept the premise that factory service branches which lose money will not be continued for long. Naturally, every effort will be expended to make them profitable. The reasoning behind this statement is that sales competition between the producers is keen, and while profits can be earned even the big manufacturers question the advisability of maintaining service branches which are draining off profits earned on sales. In a limited way this has been proven; TV receiver manufacturers *have* closed down unprofitable service branches.

The factory service branch has advantages over the independent servicing facility. More money is available for advertising and there is great public trust in the words "factory service" or "service by factory trained personnel." Whether the factory service is better than that given by a technically competent service facility is debatable; a fact that is, unfortunately, not generally known.

However, let's not lose sight of the

vulnerable point—profitable operation of the factory service branch—it must operate profitably or close down. Advertising sells brand names, but the dealer who carries the line is in direct contact with the public. If he is a servicing dealer he need worry very little about factory service, because he can sell his service to his customers. After all, the dealer sold the original product, and the path of least resistance, when service is required by the customer, is back to the organization which sold him equipment.

What about the service shop which doesn't sell receivers? How does this new approach to service affect it? If the shop is located in an area of relatively low population density (which also means relatively low receiver population) it may not pay for a factory to establish a local competing service facility. Even the manufacturer with the greatest number of factory service branches presently in operation is not active in many areas, except perhaps by arrangement with a local service shop. It is doubtful that any other manufacturer can spread his service branches as widely as this one.

Widespread activity is dependent on diversification of products to be serviced. The greater the variety of products being manufactured by the organization the greater the possibility of making a factory service branch pay, because the categories of product owners who call for service are more numerous.

The ability to finance a great many factory service branches is not equal for all electronic equipment manufacturers. This statement does not reflect adversely on the financial standing of any concerns; it simply means that some manufacturers have greater financial power than others and can afford to do things which others can't.

Thus the service shop owner who is not engaged in equipment sales is not doomed to extinction. He will have the opportunity to compete to an extent which offers greater possibilities than that of mere existence. In next month's issue we'll describe the things which are being done and can be done by servicing facilities not only to maintain their standing, but to grow in spite of factory service. ■■

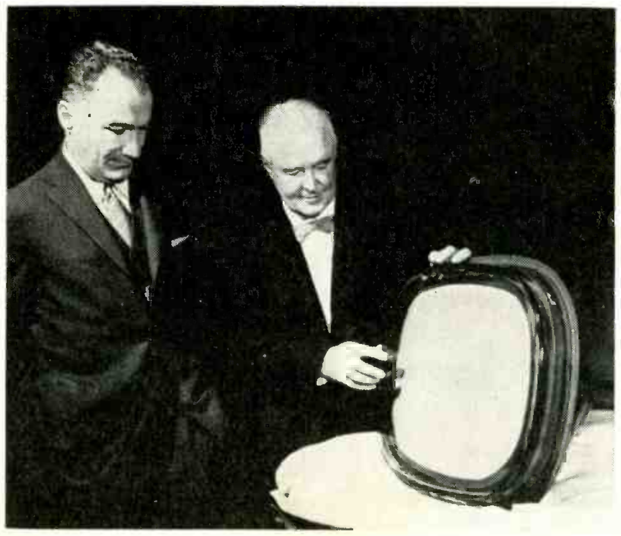
trade

Radio set shipments to dealers during June, excluding automobile receivers, increased over the June 1955 level by 47 per cent and over the first six months of 1955 by 23 per cent, the Radio-Electronics-Television Manufacturers Association announced. Radio shipments in June also increased substantially over the May shipments, it was reported. Radio receiver shipments to dealers in June totaled 798,414 compared with 551.712 sets shipped in May and 542,382 receivers shipped in June of last year. First six months of 1955 shipments had totaled 2,515,807 radios compared with 3,270,809 radios shipped to dealers during the first half of this year.

• • •

Allen B. Du Mont Laboratories, Inc., and Chromatic Television Laboratories, Inc., have reached an agreement whereby Du Mont will undertake immediately a program aimed to get the Chromatic single-gun color tube and the color television set using the Chromatron into production.

The announcement was made jointly by David T. Schultz, President of Du Mont, and Paul Raibourn, (Right) Chairman of Chromatic.



It is anticipated, according to Messrs. Schultz and Raibourn, that preparatory work leading to mass production of the tube and color receivers will be completed within a year. When production begins, it was stated, the Chromatic tube will be available to all set manufacturers as well as for Du Mont receivers.

• • •

Appointment of Kenneth C Kleidon to the newly-created post of National Color Television Manager for Hycon Electronics, Inc., Pasadena, Calif., was announced. Harry A. Kirkpatrick. general manager, said that Kleidon's chief responsibility will be to help familiarize television manufacturers, distributors, dealers, and service organizations with new techniques and equipment developed for testing and servicing color TV receivers. Kleidon will conduct color television symposiums in cities across the nation, Kirkpatrick said.

• • •

Automation, semiconductor applications, television receiver developments are but a few of the topics to be discussed when some of the nation's top electronic engineers and scientists gather in Syracuse, N. Y., Oct. 15-17 for the annual Radio Fall Meeting, the Radio-Electronics-Television Manufacturers Association announced.

• • •

A session of invited papers on "Recent Developments in Electron Devices" will be a feature of the Second Annual Technical Meeting of the IRE Professional Group on Electron Devices, to be held at the Shoreham Hotel, Washington, D. C., Thursday and Friday, October 25-26, 1956.

• • •

The marine telephone industry is ringing up record sales. Next year, if the present rate of sales holds up, 30,000 plesaure and commercial vessels will be equipped with marine-radiotelephone units compared to 3,282 in 1945. Statistics of the American Telephone & Telegraph Co. show that registrations had jumped to 15,917 by 1950, and in 1955 reached 27,343.

• • •

The General Electric Company has announced its intention to make direct factory television service available in all areas where dealers and customers demand it. The announcement was made by William L. Parkinson, planning study manager of the General Electric Appliance and Television Receiver Division's product planning section during an address before the annual meeting of the Texas Servicemen's Association. Mr. Parkinson explained that service to customers is considered a major function of his division's marketing operation and, he said, "we are going to do whatever it takes in regard to service to sell the maximum number of goods". —

flashes

"Service Dealer & Electronic Servicing" magazine and the CBS-Hytron Tube Division were honored by being given, for the first time, the Friends of Service Management Award for 1956 by NATESA at their annual convention held at Chicago September 14-16, 1956. Due to unsettled conditions in the set division, as it pertains to service, no awards were voted in the set division.

• • •

Channel Master Corp. has introduced two new television antennas which will be backed by a $50,000 national consumer advertising campaign. This is the first national consumer advertising campaign in the history of the industry. It has been announced that the New York advertising agency of Batton, Barton, Durstine & Osborn have been appointed to introduce the new Channel Master T-W outdoor antenna and the smartly styled Showman indoor antenna to the American public.

Discussing these new antennas, Mr. Harold Harris, Channel Master Vice-President in charge of Sales and Engineering, recently addressed a conference of Channel Master distributors. Checkered boxes on the tables contain miniature versions of the revolutionary new T-W outdoor antenna—only antenna to employ the "Traveling Wave" principle.

• • •

The New England Radio-Electronics Meeting jointly sponsored by the Boston and Connecticut Valley sections of the I.R.E. will henceforth be held each fall instead of in the spring as in the past decade. The decision to shift the timing was made in order to make the meetings, which have grown steadily in importance and attendance in recent years, of even greater usefulness by moving them to a time halfway between the national conventions at New York each spring. The first fall meeting of NEREM will take place this November 15 and 16 at the Hotel Bradford in Boston.

Don Cain, Admiral Distributors-Chicago Division flying serviceman, made use of Polk Brothers' courtesy helicopter service when going to the International Amphitheatre to check the TV sets installed in the work

rooms of newspapers, news magazines and press associations for the Democratic National Convention.

• • •

A new dealer-aid, to assist distributors and dealers in selling and servicing color television, has been announcd by E. P. Atcherly, merchandising manager, of Sylvania Electric Products, Inc. The new item is a 10-minute film strip entitled "Make Way for Color" and has been made available to all Sylvania's electronic products district sales offices. The film will be shown in the next few months to electronic products distributors and dealers at meetings from coast-to-coast by Sylvania sales representatives and sales engineers. The color film and recorded narrative points up selling reasons and outlines major differences in the composition of black-and-white and color television sets. It also touches on some of the new terms added to the technical vocabulary as a result of the impact of color television. According to Mr. Atcherly, the film may be requested for distributor or dealer meetings through the local Sylvania electronic products sales representative.

• • •

Walter W. Watts, Executive Vice-President of the Radio Corporation of America, said that new electronic developments—now in the laboratory or just emerging—will have a decisive impact on American living. Speaking to a luncheon meeting of Findlay civic and business leaders, the RCA executive foresaw such devices as magnetic TV tape recording for replay at home of favorite television programs, electronic refrigeration and air conditioning, mural television and a variety of new devices for industry, medicine and education. As a result of these and other developments, Mr. Watts said that the electronics industry would increase its present sales volume by more than 50 per cent by the next decade, exceeding 18 billion dollars by 1964. ■

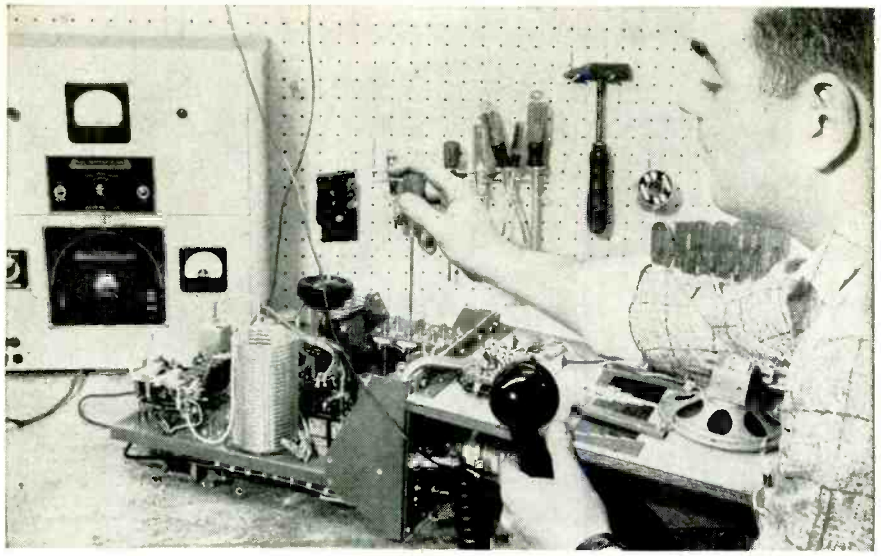


Fig. 1—Compromise measures such as coil-clip tuning are still used, as seen in this photograph, for reasons of economy.

MARINE ELECTRONIC BUSINESS

RADIO TELEPHONE CHARACTERISTICS

Part 4

The author talks of early marine transmitter design, and discusses modern trends.

by ELBERT ROBBERSON
Marine Electronics Consultant

No matter how experienced a service engineer may be with other types of radio equipment, he is likely to find marine radiotelephone a peculiar breed of cat. In fact, I've heard expressions of astonishment from technicians in practically every other electronic field, and even from amateur radio operators, over various design and constructional features of marine radio communications equipment. From some of the criticism and comment, one might think that the designers of marine equipment were out in the boondocks when the brains were passed around.

Actually, however, there is a sound reason for the way marine radiotelephones are built. This will be easily understandable after a look into the background, and the technical and economic requirements.

The first commercial marine radiotelepraph transmitter I ever worked on gave me the "willies." It was a self-excited oscillator, covering the band between 300 and 500 *kc*, and the transmitting frequency was adjusted by changing the position of clips and flexible leads on the oscillator tank coil. Fine tuning was performed by bending the flexible leads slightly. When the tuning for one channel was changed, of course, it affected the adjustment on the other channels as well. This was a trying trick, especially with an FCC inspector looking over your shoulder, wavemeter "at the ready." Mind you, this set was a first-line commercial outfit.

Later, when radiotelephony arrived on the maritime scene, I tuned up my first marine radiotelephone. Again I was aghast to find that transmitter tuning was accomplished by changing the position of clips on coils. This also was a first-line commercial product. Not only would no self-respecting amateur have had it in his shack, but the FCC would have prohibited him from putting it on the air.

This is not meant to imply, by any means, that all radiotelephones are designed in this fashion. However, it would be a very rare instance in which factors, other than excellence of design, did not, in a somewhat similar manner, alter the final outcome of the designer's dream.

The market for marine radiotelephones is very limited, compared to that for television or table-model radios. A run of a few-hundred radiotelephones is a substantial one. From this standpoint it is not so amazing that marine radiotelephones may possibly be deficient in some theoretical respect. Indeed, it *is* amazing that they have as many excellent features as they do at such a comparatively low price. Competition, and the roving ear of the FCC, which has just recently noticed a little splatter and a few harmonics around marine frequencies, have served to shake out most of the "bugs," and today's equipment is about as cleanly designed and as reliably put together as one could hope. This has been made possible only by a step-by-step evolutionary development, bringing out small improvements from time to time on the old ideas and traditional designs, and not from any dazzling and expensive exploitation of brand-new concepts. Therefore, to understand what we have today, it helps to look back a little.

One of the first and most popular pieces of equipment for this service consisted of a "Vibrapack" power supply, to change the 6 or 12-volt battery input to as high as 300-volts *dc;* a 4-tube superheterodyne receiver, and a 2-tube transmitter.

Circuits of this early telephone were simple and straightforward and designed to operate with pre-set adjustments. The operator needed no technical knowledge. A knob on the front panel changed operation of both transmitter and receiver to any one of four different operating frequencies, which provided for two ship-to-ship channels, one channel to the Coast Guard, and one channel for shore-telephone communications.

Inside the cabinet, the receiver was entirely conventional, with the exception that the superheterodyne mixer circuit was crystal controlled. The bandswitch selected the proper crystal for the channel to be received, and also selected pre-set input trimmer capacitors, which on installation of the equipment were peaked for best reception on the different frequencies. Loudspeaker reception was provided, or the receiver output could be switched to a conventional telephone handset earpiece.

The transmitter consisted of a single oscillator tube in a tuned-plate crystal-controlled circuit. The bandswitch selected the crystal for the desired transmitting channel. A single coil was used in the transmitter output circuit, and the capacitance of the antenna itself was used to establish plate resonance. Different coil taps for the antenna and the plate of the oscillator tube were selected by the bandswitch for tuning, and at the same time established some sort of impedance match.

The modulator used a single tube of the same type as the *rf* oscillator, and was transformer coupled to its plate. Audio from the carbon microphone was impressed on the modulator-tube grid through a step-up transformer. The high level output of the single-button carbon microphone obviated the need for a speech amplifier, and sufficient output was obtained for a high degree of modulation under optimum transmitter loading adjustments.

A push button on the handset operated a multi-contact control relay, which transferred "B" voltage from the receiver to the transmitter circuits, and switched the antenna likewise.

With all due respect for the dead, and for the fact that this type of equipment gave long and faithful service in its time, it possessed several features which have fortunately passed out of favor. For example, it has since been determined that the direct modulation of an oscillator tube is bad practice, since on negative modulation peaks oscillation may cease entirely, giving rise to serious distortion products.

Using the antenna as a reactive element in the transmitter tuning circuit was bad enough, and direct connection of the antenna to the plate circuit of the oscillator tube compounded the probability of spurious emanations from this type of rig. Not only was such a circuit potentially a source of interference, but it was also difficult to tune if the antenna did not have the proper impedance to serve its multiple purpose on a number of different frequencies. Accord-

[*Continued on page* 51]

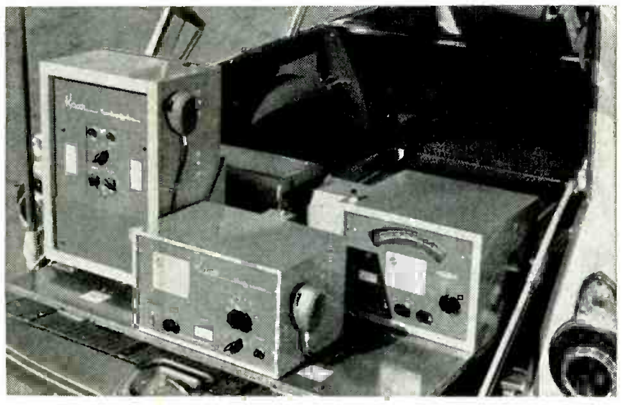


Fig. 2—A display showing the Kaar line of radiotelephones—low to high power.

Color TV Luminance Sections

[*from page 15*]

Retrace Elimination

Retrace, both horizontal and vertical, presents problems in color TV reception. Although the vertical retrace problem is the same in color receivers as in black and white, horizontal retrace presents additional problems in color receivers.

In receivers using *dc* restorers, such as the CBS 205, the presence of a burst at the demodulator will produce a recovered square wave not unlike a second horizontal sync pulse. Should this pulse exceed the horizontal sync pulse in amplitude (and the FCC specifications allow this to happen) the restoration action on the blue gun will be in error because the restorer sets up at the recovered burst amplitude instead of the horizontal sync pulse amplitude. The consequence of this action is that the picture will appear too blue. The reason that the blue color is affected more than red and green during this sequence of events is that the burst phase is recovered at greatest amplitude along the B-Y axis as compared to any other axis. This is overcome by removing the burst from the chroma signal prior to demodulation. This removal is effected by adding a horizontal blanking pulse to the chroma amplifier.

In direct coupled systems which do not require *dc* restorers, and where horizontal retrace blanking is not employed, the burst is recovered as a strip of color information in the demodulator section, and will show up as a faint greenish yellow strip occupying about 25% of the raster to the left of center. On bright scenes this coloration is effectively masked; however, on dark scenes it becomes faintly perceptible.

Horizontal blanking may be performed either by the addition of a blanking pulse to the screen grid of the video amplifier or to the screen grids of the picture tube.

In the circuit used in *Fig. 2* horizontal blanking is effected by applying a horizontal pulse to the screen grids of the picture tube. No vertical blanking is used because a resistive matrix applying both horizontal and vertical blanking pulses to the picture tube screens results in a seepage of horizontal information into the vertical sweep system, which in turn produces poor interlace.

In *Fig. 3* vertical retrace blanking is performed by feeding a positive pulse from the vertical output transformer to the CRT cathodes, thus biasing the picture tube beyond cutoff during the vertical retrace time.

Horizontal retrace blanking is obtained by feeding horizontal pulses into the chroma channel for this purpose. A more detailed explanation of this circuit will appear in a subsequent circuit analysis of this section.

In *Fig. 4* horizontal blanking is accomplished by connecting the screen grid of the second video amplifier to the output of a blanking amplifier. The latter provides a high negative horizontal pulse derived from a tap on the horizontal output transformer. This high negative pulse cuts off the tube, causing the CRT cathodes to go positive enough to produce picture tube cutoff. Vertical retrace blanking is effected by feeding a positive vertical pulse from the vertical output circuit to the CRT cathodes.

Delay Line Circuits

One of the interesting aspects of video amplifiers in color TV receivers is the manner in which a delay line is connected into the circuit. At first glance it might seem that this component is merely connected into the luminance signal path (as shown in *Figs. 2, 3* and *4*) with no regard to the impedance characteristics of the input and output circuits. This is not so, for the delay line is essentially a transmission line, and as such, its impedance characteristics, as well as the source and load impedances to which it is connected, must ideally be taken into consideration if line reflections are to be avoided.

As a practical consideration some receivers (CBS 205) have been built using a proper termination only at the load end. Terminating in this manner prevents reflections from the load end and obviously there can be no subsequent

[*Continued on page 47*]

Mfr. Philco **Chassis No.** TV-440, 444

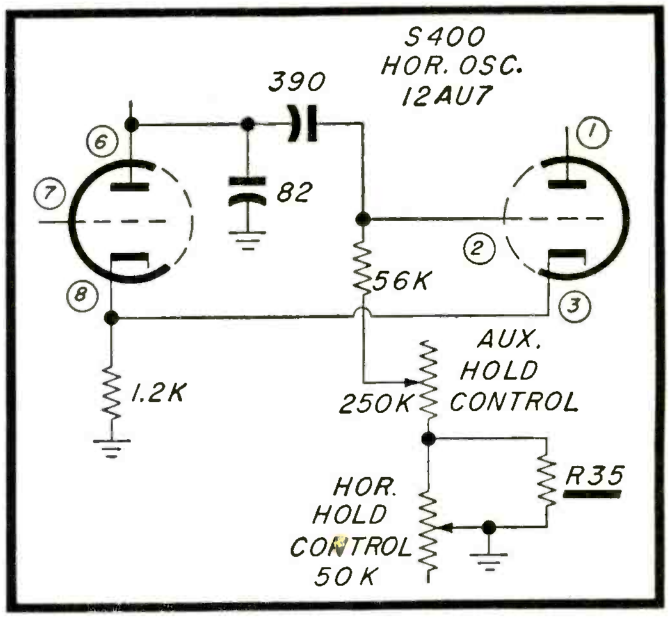
Card No. PH 440-1

Section Affected: Pix

Symptoms: Range of lock-in action of horizontal hold control is too small and thus requires more or less critical adjustments.

Reason For Change: Circuit improvement.

What To Do:
Change: Resistor *R35* (39K) across the horizontal hold control to 82K.



Mfr. Philco **Chassis No.** TV-440, 444

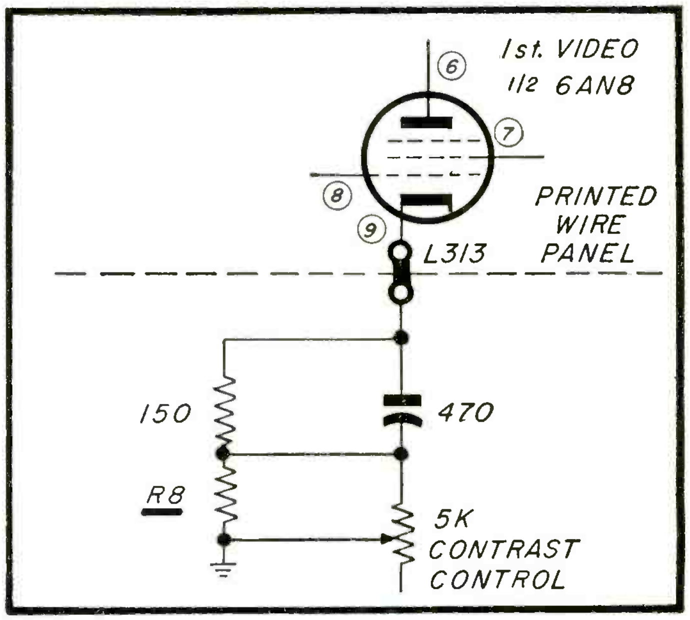
Card No. PH 440-2

Section Affected: Pix

Symptoms: Range of contrast control is too small requiring too exact an adjustment.

Reason For Change: To improve circuit operation.

What To Do:
Remove: Resistor *R8*, 2200 ohms.
Change: Contrast from 5000 ohms to 1500 ohms. (Philco Pt. No. 33-5572-31).



Mfr. Philco **Chassis No.** TV-440, 444

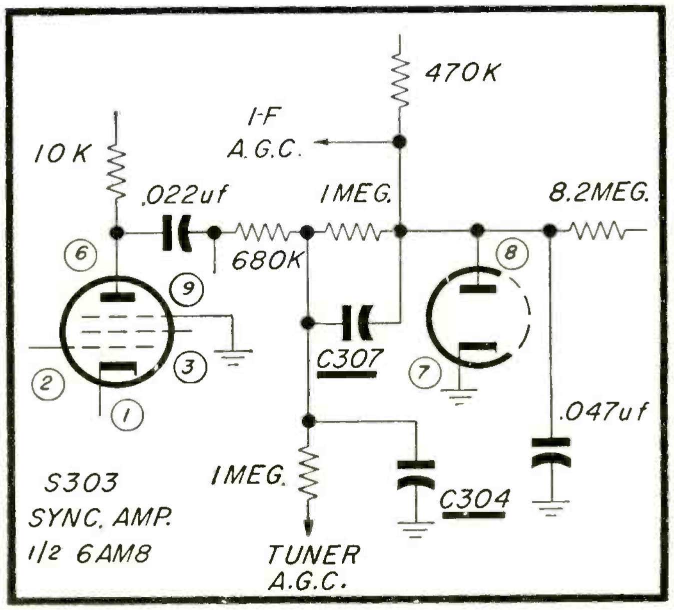
Card No. PH 440-3

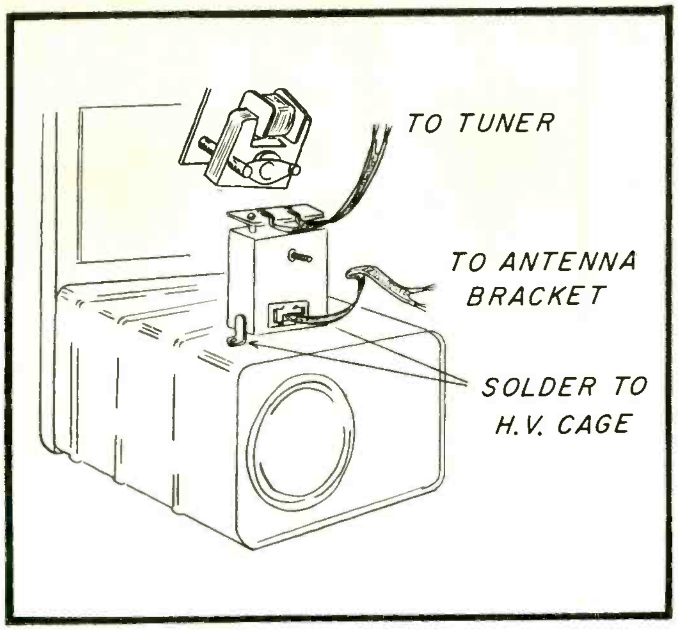
Section Affected: Raster and picture

Symptoms: When picture information is removed by station or channels are changed a motorboating takes place. The picture sometimes loses horizontal and vertical sync.

Reason For Change: Circuit improvement. The changes are incorporated to produce a more stable in-sync raster by altering *agc* filtering time constants.

What To Do:
Change: *C307* from .01 μf, to .006 μf, 400 volts, *C304* from .1 μf to .15 μf, 200 volts.





Mfr. Philco **Chassis No.** TV-440, 444

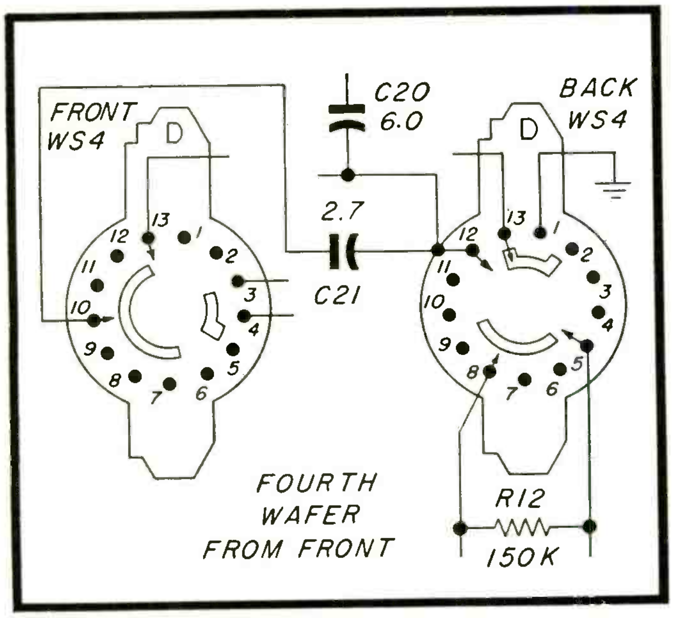
Card No. PH 440-4

Section Affected: Pix

Symptoms: Beat patterns and interference in picture in areas where 40 *mc* police or doctor call transmitter interference is present.

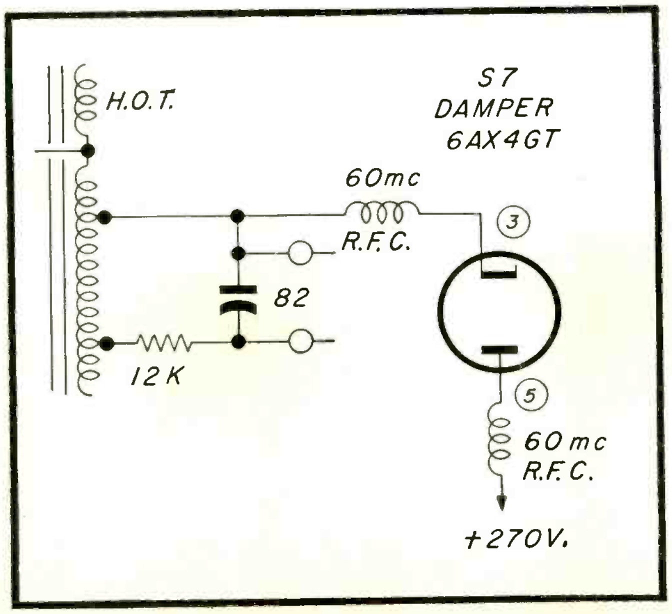
Reason For Change: Circuit improvement.

What To Do:
Install: Tunable *vhf* antenna trap, Philco Pt. No. 420-0015. Solder the trap to the high voltage cage using the mounting tabs provided.
Note: The traps are pre-tuned to 42.5 *mc*. Tune the trap if necessary to obtain minimum interference while the interfering signals are being experienced. It is suggested that a plastic tuning tool be employed.



Mfr. Philco **Chassis No.** TV-440, 444
Card No. PH 440-5
Section Affected: Pix
Symptoms: A broad overshoot in picture on Channel 2, 3 or 4. To reduce the overshoot it is possible to tune the picture into the smear condition, but this produces a lack of sharp detail.
Cause: Improper impedance match between tuner and antenna.
What To Do:
1. If the condition is moderate reduce the length of lead-in from the antenna to the set by an ⅛ of a wave length of the channel most affected. Removal of an additional ⅛ of wave-length may provide further improvement, allowing the receiver to tune smoothy to a point where no overshoot is present.
2. In extreme cases, to improve the match between the antenna and the tuner install a 1000 ohm resistor across the low channel coils. Remove the tuner cover and wire the 1000 ohm resistor across *C21*, the 27 *μμf* low band matching capacitor.

Note: Be sure to use short leads in wiring the resistor across the condenser.



Mfr. Philco **Chassis No.** TV-440, 444

Card No. PH 440-6

Section Affected: Pix and raster

Symptoms: No high voltage, no picture or raster, boost voltage is not normal. There is usually repeated failures of 6AX4GT damper tube.

Cause: 6AX4 damper tube breaks down (shorts internally).

What To Do:
Change: Damper tube from a 6AX4 tube to a 6AU4GT for more reliable operation and less frequent tube failures.

Mfr. GE **Chassis No.** 21C130—"O" Line

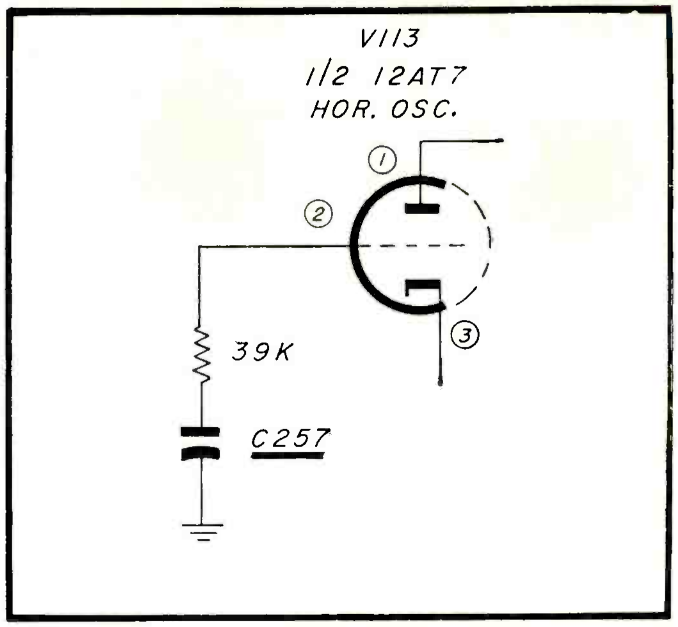
Card No. GEO-1

Section Affected: Pix

Symptoms: Horizontal jitter.

Cause: Defective component.

What To Do:
Replace: *C257* (.1 *μf*) which is open.



Mfr. GE **Chassis No.** 21C130—"O" Line

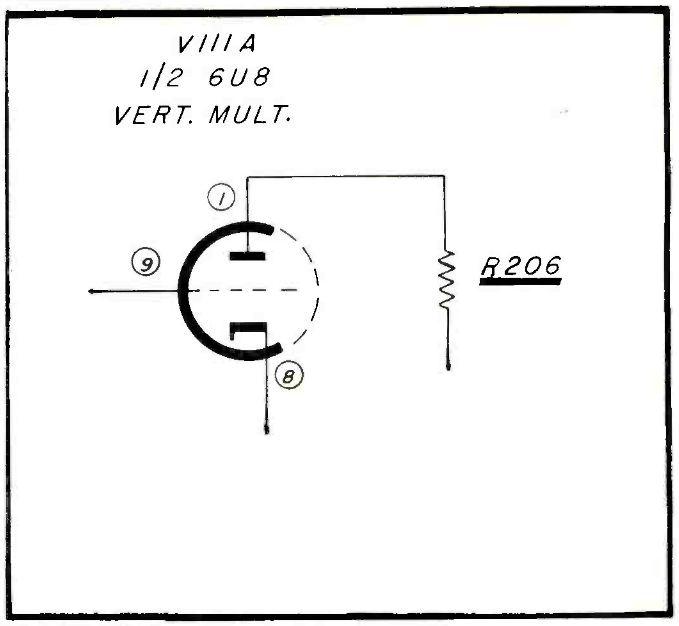
Card No. GEO-2

Section Affected: Raster

Symptom: Excessive height.

Cause: Defective component.

What To Do:
Replace: *R206* (5.6 meg.) which has decreased in value.



Mfr. GE **Chassis No.** 21C130—"O" Line

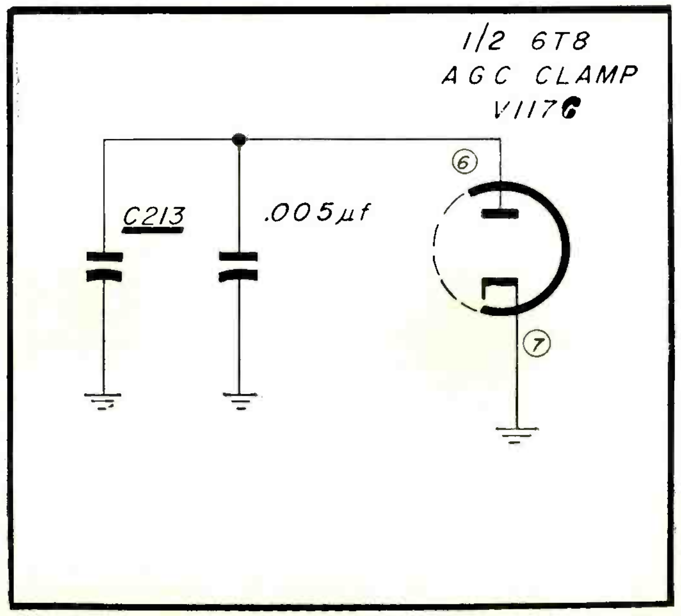
Card No. GEO-3

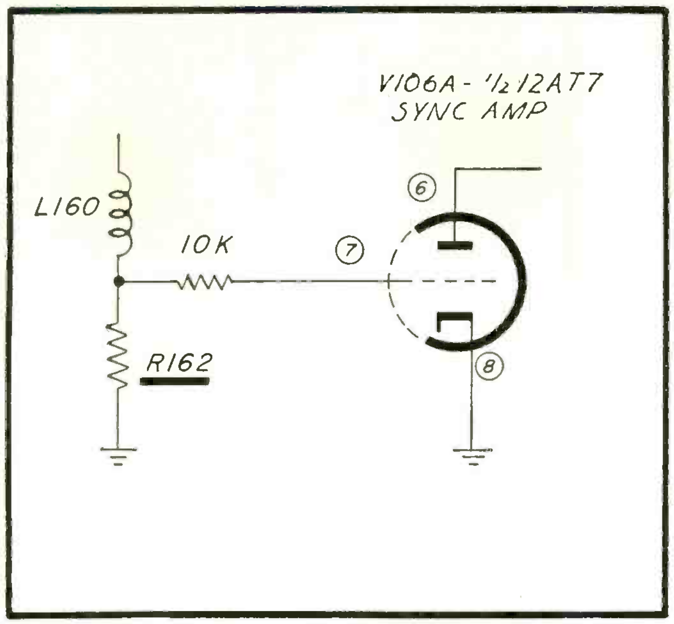
Section Affected: Pix and sound.

Symptoms: Pix and sound flutters.

Cause: Defective component.

What To Do:
Replace: *C213* (.5 *μf*) which is open.





Mfr. GE **Chassis No.** 21C130—"O" Line

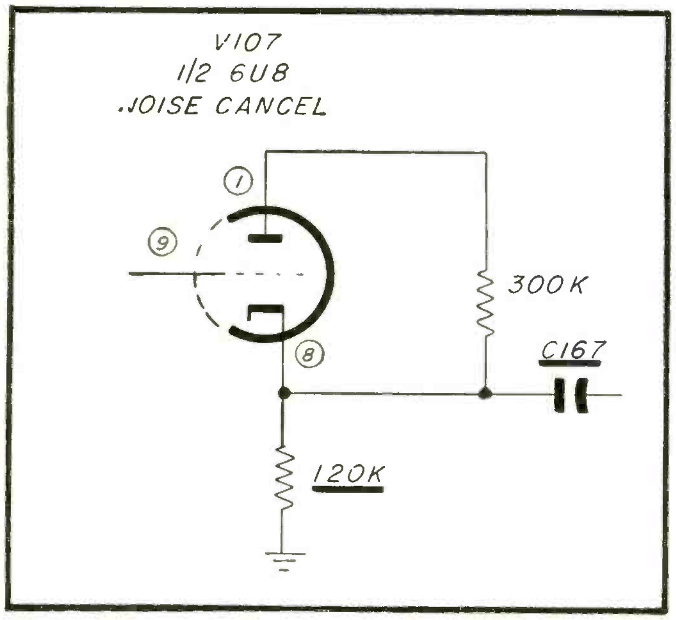
Card No. GEO-4

Section Affected: Pix

Symptom: Wiggles in background.

Cause: Defective component.

What To Do:
Replace: *R162* (3.3K) which has decreased in value.



Mfr. GE **Chassis No.** 21C130—"O" Line

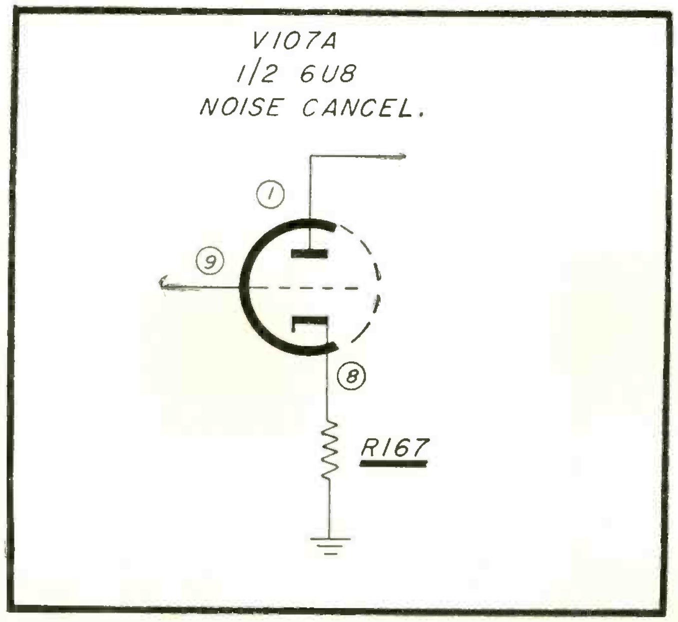
Card No. GEO-5

Section Affected: Sync

Symptom: Weak composite sync.

Cause: Defective component.

What To Do:
Replace: *C167* (.15 μf) which is leaky.



Mfr. GE **Chassis No.** 21C130—"O" Line

Card No. GEO-6

Section Affected: Pix

Symptom: Picture tearing.

Cause: Defective component.

What To Do:
Replace: *R167* (120K) increased in value.

Luminance Sections

[*from page 42*]

reflections from the incorrectly terminated receiving end.

An analysis of the impedance elements connected to the input and output terminals of a delay line will reveal that these input and output load components are generally selected to provide an impedance match to the voltage sources and input circuits to which they are connected. The delay line must then have a characteristic impedance equal to these input and output loads. Failure to adhere to these conditions will result in a waste of available signal strength, and unstable circuit operation due to reflections.

It is for the above reasons that various components are seen connected in color video amplifiers that are not otherwise seen in black and white video systems. The typical impedance range of delay lines commonly used in TV sets today is between 1500 and 4100 ohms. Although the higher impedance lines make for greater gain characteristics they are more difficult to make and harder to compensate for the bandwidths required (approximately 3.5 *mc*).

In *Fig. 3,* the input load to the delay line is shown as *R403* (1.5K), and the output load as *R405* (1.8K) in parallel with *R182* (4.7K), the combination of which is equal to 1.3K ohms. In *Fig. 4* the input load is shown as *R127* (1.2K), and the output load is the contrast control, *R134* (2K).

In *Figs. 3* and *4,* low impedance lines are used and the resultant lower gains realized necessitate the use of a 2 stage amplifier.

The need for an additional stage of video amplification is overcome by the insertion of a high Z delay line (4.1K) in the detector circuit as shown in *Fig. 2.* Here the detector impedance matches the source requirements of the line, and the terminating line resistance becomes the effective detector load. In this manner, insertion of a delay line into the video system introduces negligible loss of the Y signal. Thus, systems using this design can employ a single video amplifier to adequately drive the picture tube. [*To Be Continued*] ■■

PRICING INDEX

A SERVICEMAN'S TOOL

by SAN D'ARCY

Webster's Dictionary defines the word *Forum* as follows: "An assembly for the discussion of public matters or current questions." Well, between January and March of this year I held Forums with servicemen's groups in all parts of the country.

Many subjects were covered, such as: Licensing (pro and con); the benefits accruing to Servicemen's Association members; what retaliatory action, if any, can servicemen take against, 1) Distributors who sell at retail, or 2) Distributors who operate service departments in open competition with servicemen; should tubes be tested free?; should repair estimates on TV sets be given free?; how radio-TV service firms can expand operations by getting industrial electronic and commercial communications service contracts; how servicemen can increase their prestige and income by using the proper business forms; why servicemen must use the newest pricing lists and digests available, etc.

Discussions on all subjects and especially this last-mentioned subject were always spirited and brought to light the fact that servicemen themselves believe much public resentment against radio-TV servicemen as a group stems from the fact that so many of them either employ unorthodox pricing systems or they do not use any type of itemized bills. Many do not use price-determining references, or proper business management methods, all of which are available from several sources at very nominal cost.

Yes, the discussions sharply brought to light the astounding fact that many times servicemen unwittingly "gyp" themselves, and sometimes their customers, because they do not properly price items they sell.

Don't Gyp Yourself or Customers.

What do I mean when I say "servicemen sometimes gyp themselves or their customers unwittingly when they fail to use pricing lists?" Well, glance at *Fig. 1* for a typical example. Tube type 6A7, although not one of the most popular tubes currently in use, is produced by eight tube manufactures. Of the eight such manufacturers listed in Dave Rice's "Official Pricing Index," six list the 6A7 at $3.05, one list prices it at $2.90 and the other at $3.00. In like manner the

Receiving Tubes

Tube	C.B.S.	Delco	G.E.	R.C.A.	Ray-theon	Syl-vania	Tung-Sol	West-ing-house
5Z4	$3.60	$3.60	$3.60	$3.60	$3.60	$3.60	$3.60	$3.60
6A3		4.10	4.10		3.90	3.90	3.90	4.05
6A4/LA			3.20					
6A5G		5.70	3.90					
6A6		2.75	2.90		2.85			
6A7	3.00	3.05	3.05	3.05	2.90	3.05	3.05	3.05
6A7S			3.55					
6A8	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
6A8G		2.95	2.75	2.95	2.90	2.95	2.95	2.95
6A8GT	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
6AB4	1.70	1.70	1.70	1.70	1.65	1.70	1.70	1.70
6AB5/6N5		2.85	2.85	2.85	3.15			
6AB7	3.55	3.55		3.55		3.55		3.60
6AB7/1853			3.55		3.50			
6AC5G			2.00					
6AC5GT	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
6AC7	3.25	3.25	3.25	3.25		3.25		3.25
6AC7/1852					3.25		3.10	
6AD6G			2.40					
6AD7G	4.25	4.25	4.25	4.25	4.05	4.25		
6AE5GT							1.80	
6AE6G							1.80	
6AF4	3.40	3.40	3.40			3.40	3.45	3.40
6AF4A	3.40	3.40	3.40	3.40	3.40	3.40	3.45	3.40
6AF5G			2.00				1.80	
6AF6G		2.85	2.85	2.85	3.15	2.85		
6AG5	2.05	2.05	2.05	2.05	2.00	2.05	2.05	2.05
6AG7	3.75	3.75	3.75	3.75	3.75	3.75	3.65	3.75
6AH4GT	2.40	2.45	2.45	2.45	2.40	2.45	2.40	2.45
6AH6	3.95	3.45	3.90	3.45	3.90	3.40		3.45
6AH6V					3.90		3.95	
6AH7GT			2.45					
6AJ4		4.45	4.45		4.40			
6AK5	4.25	4.20	4.20	4.20	4.05	4.25	4.20	4.25
6AK6	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
6AL5	1.55	1.55	1.55	1.55	1.50	1.55	1.50	1.55
6AL7GT	4.10	4.10	4.10	4.10	4.50	4.10	4.10	4.10
6AM4	4.45	4.45	4.45		4.40			4.45
6AM8	2.75	2.75	2.75	2.75	2.70	2.75	2.75	2.75
6AN4		4.40			4.40	4.40		4.40
6AN8	2.95	2.95	2.95	2.95	2.90	2.95	2.95	2.95
6AQ5	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
6AQ6	1.70	1.70	1.70	1.70	1.65	1.70	1.70	1.70
6AQ7GT	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
6AR5	2.05	2.05	2.05	2.05	2.00	2.05	2.05	
6AS5	2.00	2.00	2.00	2.00	1.95	2.00	2.00	2.00
6AS6	4.85		4.85	4.85		4.85		3.45
6AS7G	6.25	6.25		6.25		6.25		
6AS7GA		6.25	6.15					
6AS8	3.00	3.00	3.00	3.00	2.90			
6AT6	1.50	1.50	1.50	1.50	1.45	1.50	1.50	1.50
6AT8	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
6AU4GT	2.90	2.90			2.85	2.90	2.90	2.90
6AU4GTA	2.90	2.90	2.90	2.90				
6AU5GT	3.45	3.45	3.45	3.45	3.50	3.45	3.45	3.45
6AU6	1.85	1.85	1.85	1.85	1.80	1.85	1.85	1.85
6AU7							2.20	
6AU8*	3.00	3.05	3.05	3.05	3.05	3.05	3.05	3.00
6AV5GA	3.45	3.45	3.45	3.45	3.50			3.45
6AV5GT		3.45			3.50	3.45	3.45	3.45
6AV6	1.50	1.50	1.50	1.50	1.45	1.50	1.50	1.50
6AW8*	3.20	3.20	3.20	3.20	3.15	3.20	3.20	3.20
6AX4GT	2.35	2.40	2.40	2.35	2.35	2.35	2.35	2.35
6AX5GT	2.25	2.25	2.25	2.25	2.25	2.25	2.05	2.25
6AX7*							2.30	
6AX8						2.75		
6AZ5							3.65	
6AZ8	3.35		3.35	3.35	3.30			
6B4G	4.55	4.50	4.50	4.55	4.50	4.50	4.50	4.50
6B5							3.45	
6B6G		2.45	2.45					
6B7	3.50		3.50		3.50	3.35		
6B7S			3.55					
6B8		3.50	3.50	3.50	3.50	3.50		3.50
6B8G	3.65		3.65		3.60		3.65	
6B8GT			.2.00					
6BA6	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
6BA7	2.90	2.95	2.95	2.95	2.90	2.80	2.60	2.95
6BA8*	3.20	3.20	3.20			3.20		
6BC4				4.10				

Fig. 1—Page from "Official Pricing Index."

list prices of tube type 6BA7 vary considerably. One of the eight brands has a list of $2.60, one lists at $2.80, two list it at $2.90 and four list price it at $2.95.

It is quite possible and very probable that a serviceman will have several different brands of tubes in his caddy—and should he happen to use the brand of 6BA7 that lists at $2.60 and charge $2.95 for it, he is in effect over-charging the customer by $.35. By the same token, if he uses one of the 6BA7 brands that lists at $2.95 and charges the customer only $2.60, then he is gypping himself. When customers are over-charged, even unwittingly, grave consequences can result and the serviceman will probably be labeled a "gyp." When servicemen undercharge because they rely on memory or do not refer to accurate price tables, they lose profits they should not lose.

All tube makers list price their 6SJ7 tubes at $2.25, but not so 6SJ7GT's. Six of them list the latter type at $2.15 while two list it at $2.25. The 6SJ7 and 6SJ7GT types, so similarly numbered, can easily confuse a serviceman and get him "in dutch" with a customer who is overcharged because the serviceman carelessly relied on memory and charged $2.25 when using a brand and type which actually lists at $2.15.

Refer to Rice's "Official Pricing Index" and you'll

[*Continued on page* 52]

AUTO RADIOS—PONTIAC

[*from page* 17]

the correct station is not tuned accurately readjust the selector tab as needed.

Removal of Tuner Section

1. Disconnect the "A" battery and dial light leads from the fuse block located under the steering column. (Current is supplied through a 7½ amp. AGW type fuse.)

2. Remove the antenna lead located on the righthand side.

3. Disconnect the three prong plug from the speaker unit.

4. Disconnect the single filament lead at the plastic connector.

5. With a 7/16" wrench remove the bracket mounting bolt, located at the right side directly above the glove compartment.

6. With an allen wrench, loosen the set screws in the front panel control knobs; remove the knobs and controls.

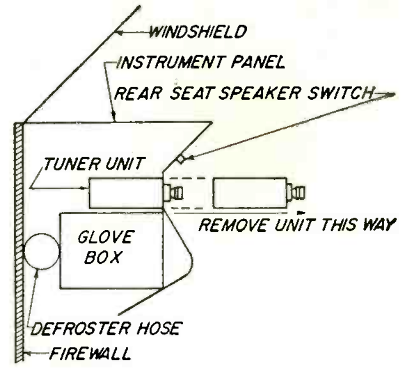


Fig. 5—Tuner unit is removed by bringing it forward and out.

NOTE: On the De Luxe push button tuner jobs, the dummy knob (right side behind manual tuner) is threaded and screws on the control.

7. With a ⅞" deep socket remove the two mounting nuts.

8. Open the glove compartment door and remove the front mounting panel.

9. With a 7/16" wrench remove the two front mounting bolts (see *Fig. 4*). NOTE: If the car is equipped with rear speakers, remove the two screws holding the switch to the unit and hold aside for removal of the tuner unit.

10. Bring unit forward and out though the front (see *Fig. 5*).

Removal of Speaker Amplifier Section

1. Remove the two phillips head screws in the lower edge of the instrument panel.

2. Remove the single phillips head screw in the left side near the glove compartment.

3. Push unit forward, down and out.

Service Hints

Complaints of excess fading, or decrease of volume when the antenna is held have been traced to broken wires in the antenna, r. f., or oscillator coils. The wires occasionally break at the output junction. Disconnect the output leads and test for continuity with an ohmmeter. If open, remove the screws and leads at the fibre board holding the coils and slide out. Complete coil should be replaced.

If a machine gun-like action is produced when the selector bar in electronic tuners is depressed, look for trouble in the gear train of the tuner. These gears become worn or loose on shafts. Remove and replace the gear train unit. Do not try to repair it. ■ ■

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF SERVICE DEALER and ELECTRONIC SERVICING, published monthly at New York, N. Y. for October 1, 1956.

1. The names and addresses of the publisher, editor and business manager are: Publisher, Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y. Editor, Samuel L. Marshall, 262 Sullivan Place, Brooklyn 25, N. Y.; Managing Editor: None; Business Manager, Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y.

2. The owner is: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.; Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y.

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4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and beliefs as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

(Signed) S. R. COWAN, Publisher

Sworn to and subscribed before me, this 18th day of September, 1956.

EMANUEL M. VIRSHUR, Notary Public

MARINE ELECTRONICS

[*from page* 41]

ingly, many of these transmitters would modulate upward on one channel, and downward on the next, and there wasn't much that could be done about it.

Since then, transmitters have all become more or less respectable. Among the refinements are that separate oscillator and *rf* amplifier tubes are used in the transmitter, and antenna-tuning and coupling circuits are separate from the *rf* amplifier plate tuning circuit. Negative modulation peaks are limited

Fig. 3—Ray Jefferson Model 460

by one means or another, harmonic radiation is reduced to a level comparable to that for other services, and audio band width has been drawn into the limits necessary for voice transmission. However, there is still a tendency toward impressing microphone voltage directly on the modulator tubes, with speech amplifiers being used only in more elaborate sets.

While the receiver design in modern inexpensive radiotelephones is basically the same as that originally used, except for new miniature tubes, more efficient *if* transformers, printed circuits, and compact components, the larger outfits have several improvements. Such improvements are squelch circuits, which mute the speaker thus cutting out noise between reception periods; and noise

[*Continued on page* 53]

PRICING INDEX

[*from page* 49]

see scores of instances where components of similar characteristics produced by different manufacturers list at prices which vary greatly. For example, one leading capacitor manufacturer has a list price of $.85 (while a competitor has a list of $.90) for a 3V. 25 uf miniature metal capacitor and a still different manufacturer lists his unit, with the same ratings, at only $.25. Strangely enough all three of these capacitor manufacturers list price their 6V. 5 uf capacitors at $.90. You figure it out! A serviceman must constantly refer to a current, reliable pricing source if he wants to operate on a proper and businesslike basis. It could happen that, failing to refer to a pricing guide, a serviceman might charge $.25 for a capacitor that actually cost him over $.40—and such a careless serviceman won't be able to stay in business long.

Despite what the politicians say, prices of most commodities have been rising constantly. In other words, every serviceman's operating costs have been going up and up. It is incumbent upon all businessmen and particularly radio-TV servicemen who work on a nominal margin to realize this and they must take advantage of it when possible. Here's an example of what I mean. According to Dave Rice's "Official Pricing Index" Vol. 1 No. 2, issued in January of this year the five picture tube manufacturers who make them had a list price of $44.75 for type 16AP4A CRT's. However, the July 1956 issue of "Official Pricing Index," Vol. 1 No. 4 shows that while two manufacturers still list the 16AP4A at $44.75 two others now list it at $46.40 and the fifth manufacturer now list prices it at $46.72. When Rice's next issue is released in October, other price changes like this will undoubtedly be recorded.

I checked with Dave Rice about his "Official Pricing Digest" and concur with his theories about it. To begin with, the "Digests" are published four times a year, January, April, July and October. They have a list price of $2.50 but a great many parts distributors buy them in large lots and gladly give them away free to their regular servicemen customers for several reasons. For example, "Digests" save the distributors much time answering servicemen's queries regarding new list prices of items. And distributors realize that it helps them when their servicemen customers charge the right prices. As for servicemen themselves, I personally feel that even if they have to buy a copy of the Pricing Index for the nominal sum involved they will get that investment back many times by making certain that they can quickly price any item, that they will neither gyp themselves, nor will they improperly charge their customers. In fact, when itemizing a bill for a customer, it's wise to refer to the index and thus show the customer that you did not guess at the prices you charged. ■ ■

MARINE ELECTRONICS

[*from page* 51]

limiting circuits, which remove sharp peaks of interference, such as those from static and engine ignition.

The relatively costly handset has been done away with in all but the luxury models, in favor of a hand microphone, with reception over the loudspeaker, which is just as practical and a great deal less expensive.

When I looked inside my first marine radiotelephone, I was very much disturbed at seeing *rf* leads, especially in the transmitter circuits, cabled together as if they were *dc* circuits. Look inside many radiotelephones built this year, and you will still see *rf* leads cabled as if they were carrying filament current. I suppose it is all right, as long as the insulation is good, for practices such as this to continue. Actually, loaded *rf* circuits are low Q, and using cabled wires and other distributed capacitances as part of the circuit reactance is permissible, if the insulation is not too muddy. Marine radiotelephones have not changed a great deal since their inception, but I'm happy to state that in the past few years things have taken a turn for the better. ■■

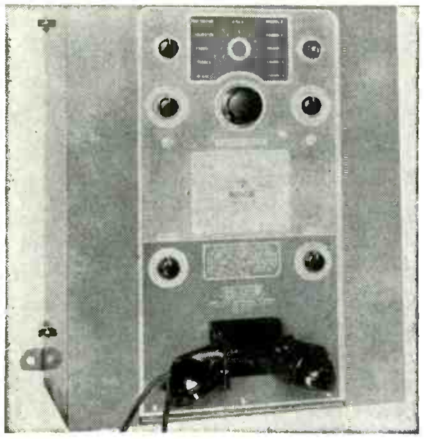


Fig. 4—Radiomarine ET-8050-HF

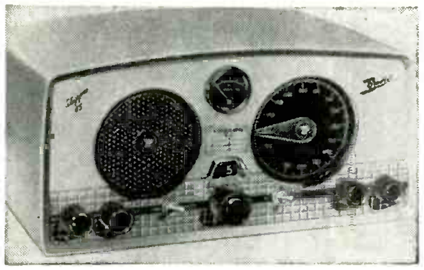


Fig. 5—The Bendix Skipper 45

COMPATIBLE CRYSTAL CALIBRATOR

[*from page* 7]

range Pierce type oscillator requiring no adjustment for crystals having fundamentals over the range of 100 *kc* to 20 *mc*. The cathode coil and condenser *L101* and *C104* form a resonant circuit to extend the range of the oscillator to the low frequencies. The oscillator *V101A* is isolated from the output by a cathode follower *V101B*. The crystal *CR101* serves as the harmonic generator, modulator and signal mixer in the output. *Y101* is the precision color carrier crystal which is calibrated to its high degree of accuracy by the ceramic trimmer across it. This is adjusted at the factory. A selenium rectifier and isolation transformer are used with a long time constant *RC* filter to provide a hum-free power supply. Test jacks *J101* and *J102* permit the use of a 0 to 100 microampere meter or multimeter to read oscillator grid current, providing an *activity test* for checking and comparing quartz crystals.

Use of the Crystal Calibrator

The front panel accessibility of the crystal sockets in conjunction with the crystal selector switch gives the instrument universal applications in both the service shop and the laboratory. When a 4.5 *mc* crystal is used in a front panel socket the instrument may be used for troubleshooting and alignment of intercarrier sound I.F. amplifiers, sound IF discriminators, 4.5 *mc* trap alignment and sideband marking for alignment sweep curves. It can be used with appropriate crystals as a frequency standard or band limit marker since the accuracy with a good crystal is better than that of the average frequency meter.

In color television the 3.579545 *mc* standard is useful not only in servicing but also in laboratory work, television transmitter testing and community antenna systems testing for color operation.

Figure 5 shows the hookup used with a color TV receiver to check and align the frequency of the 3.579545 *mc* reference oscillator. The slanting lines of color appear when the 3.58 MC reference oscillator is not on the correct frequency. These lines are analogous to the ones seen on the screen when the horizontal oscillator is not synchronized.

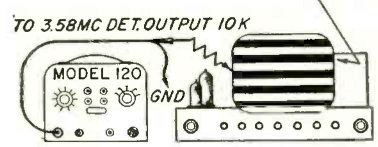


Fig. 5—Hookup to check and align reference oscillator.

In like manner, if we count the number of slanting lines of color and multiply by 60 (the vertical sweep frequency) we have the amount by which the oscillator is off frequency. Also, as we adjust the color hold or reference oscillator frequency, counting the number of lines on the screen when the phase detector circuit starts to pull the oscillator in to synchronization will give the "pull-in" range of the circuit, thus determining whether the phase detector circuit is operating properly. For example, if pull-in starts at 10 lines this shows that the pull-in range of the color phase detector circuit is 10 x 60 or 600 cycles.

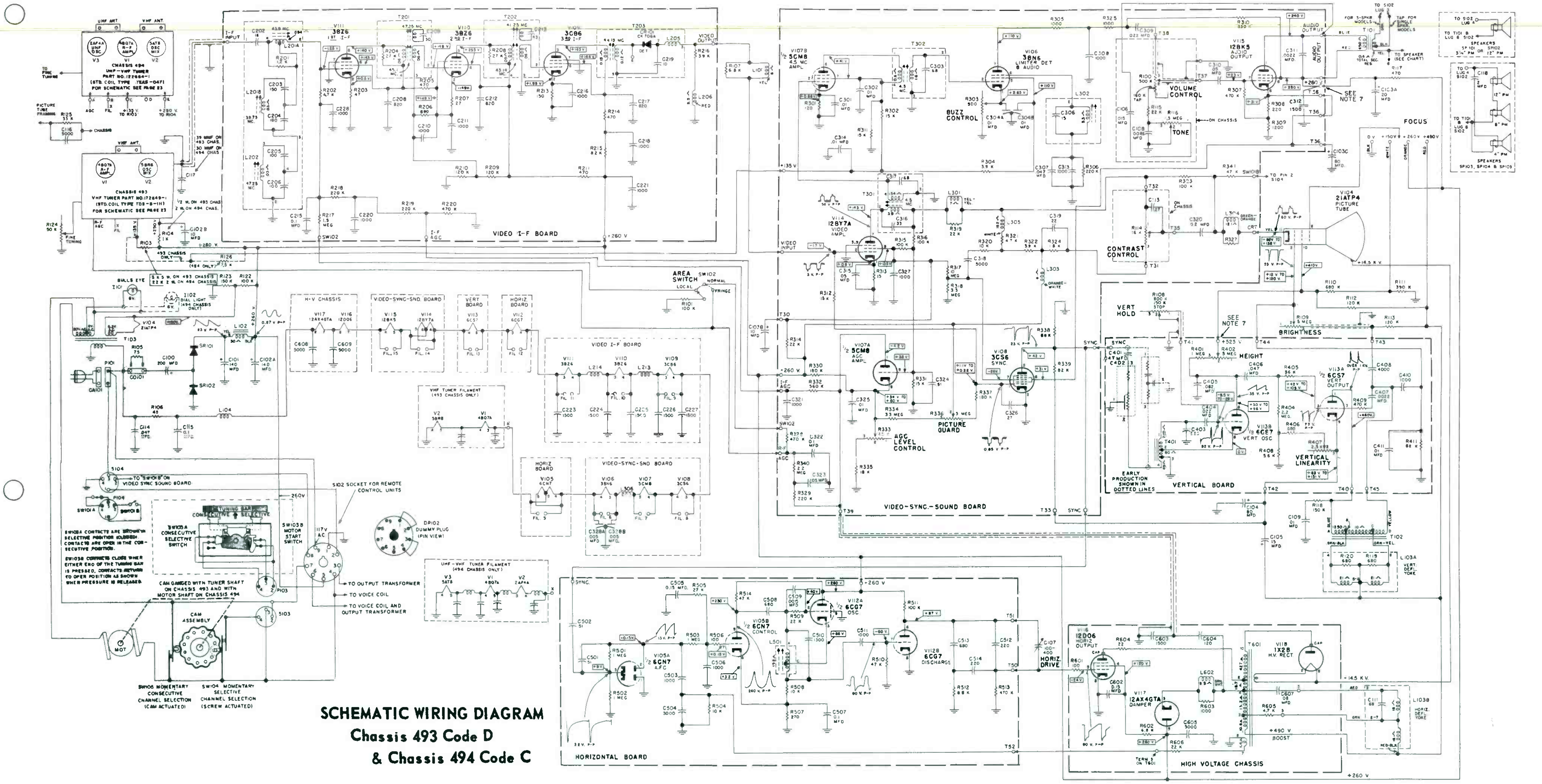
Another possibility in the servicing of color receivers is that the color circuits will not function and no color can be produced because the 3.58 *mc* reference oscillator will not operate. In this case, the Model 120 can be used to substitute for the reference oscillator to determine the exact nature of the trouble. This is a form of troubleshooting by signal substitution.

The entire burst and chroma chain can be tested by signal tracing the 3.58 *mc* signal produced by the Model 120. The signal from the Model 120 is fed to the video detector test point of the color receiver, ahead of the color take-off points. Then a broad band scope is used to trace the 3.58 *mc* signal through the *chroma circuits* to the chroma detectors, or through the *burst gate* (equivalent to a sync separator), burst amplifiers, etc, up to the color phase detector circuit. The defective stage would be located when the oscilloscope tracing reaches a point in the sync or chroma chain beyond which the signal cannot pass or is excessively low. ■■

TV CHASSIS 493
Models DT-12M, DC-12M, DT-12B, DC-14M, DC-10M, DC-16B, DC-10B, DC-18N

TV CHASSIS 494
Models DT-13M, DC-13M, DT-13B, DC-15M, DC-11M, DC-17B, DC-11B, DC-19N

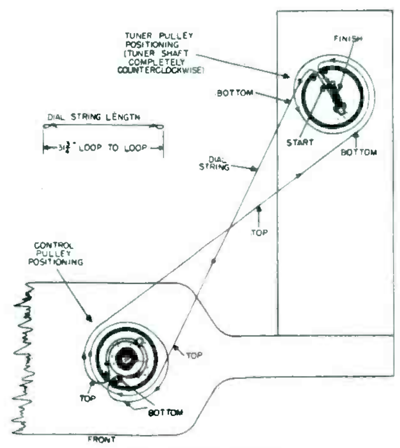
CROSLEY



SCHEMATIC WIRING DIAGRAM
Chassis 493 Code D & Chassis 494 Code C

TABLE OF SOCKET VOLTAGES 494 Chassis

Symbol	Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	4BQ7A	+110	-.6	0	*4.7	*9.0	+215	+110	+110	0
V2	5AT8	-1.5	+88	0	*0	*4.7	+175	+100	0	-1.55
V104	21ATP4 (Filament voltage measured across Pins 1 & 12 = 6.3 V.)	+150	+8				0 to +490	Pin 10 +430	Pin 11 +100	Pin 12 +150
V105	6CN7	0	+.25	+5.5	*14.5	*14.5	+1.95	+.25	+173	*11.2
V106	3BN6	+1.8	0	*17.5	*14.5	+94	0	+105	---	---
V107	5CM8	-.1	0	+.4	*22.2	*17.5	+40	+40	+40	+23.5
V108	3CS6	+.55	0	*25.3	*22.2	+45	+28.5	-5	---	---
V109	3CB6	0	+2.0	*28.5	*25.3	+135	+135	0	---	---
V110	3BZ6	+125	+126	*31.6	*28.5	+240	+242	+120	---	---
V111	3BZ6	-.1	+0.75	*34.8	*31.6	+115	+213	0	---	---
V112	6CG7	+250	+43	+71	*34.8	*41.1	+78	-66	0	0
V113	6CS7	+480	+70	+70	*47.4	*41.1	+66	-21.5	0	+115
V114	12BY7A	+.45	-.2	0	*47.4	*47.4	*53.7	+105	+110	0
V115	12BK5	+222	0	+22.5	*66.3	*53.7	+29	+22.5	+235	0
V116	12DQ6	0	*79.0	0	+132	-24	-24	*66.3	0	---
V117	12AX4GTA	0	+550	+550	0	+245	0	*79.0	*91.5	---
V118	1X2B	---	---	---	---	---	---	---	---	H.V. 14.5KV
D.C. voltages listed below measured with VHF channel selector in UHF position. UHF channel selector set to low frequency end.										
V3	2AF4A	+68	-3	*9.0	*11.2	0	-3	+68	---	---



DIAL STRINGING DIAGRAM
494 CHASSIS

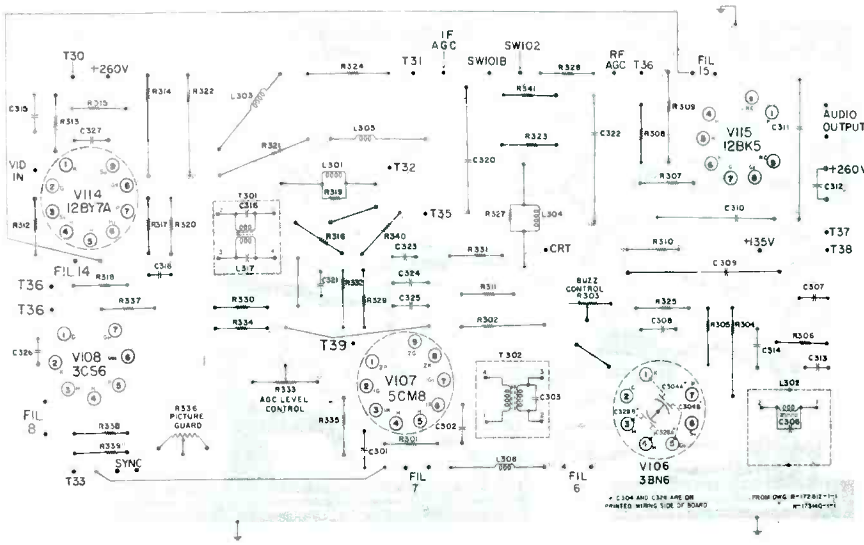
TABLE OF SOCKET VOLTAGES 493 Chassis

Symbol	Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	4BQ7A	+215	+120	+120	*4.7	*8.9	+120	-.3	0	0
V2	5BR8	-1.6	+85	0	*0	*4.7	+88	+72	0	-1.6
V104	21ATP4 (Filament voltage measured across Pin 1 & 12 = 6.3V)	+150	+8				0 to +490	Pin 10 +430	Pin 11 +100	Pin 12 +150
V105	6CN7	0	+.25	+5.5	*12.0	*12.0	+1.95	+.25	+173	*8.9
V106	3BN6	+1.8	0	*15.3	*12.0	+94	0	+105	---	---
V107	5CM8	-.1	0	+.4	*20.0	*15.3	+40	+40	+40	+23.5
V108	3CS6	+.55	0	*23.1	*20.0	+45	+28.5	-50	---	---
V109	3CB6	0	+2.0	*26.3	*23.1	+135	+135	0	---	---
V110	3BZ6	+125	+126	*29.4	*26.3	+240	+242	+120	---	---
V111	3BZ6	-.1	+.75	*32.6	*29.4	+115	+213	0	---	---
V112	6CG7	+250	+43	+71	*32.6	*38.9	+78	-66	0	0
V113	6CS7	+480	+70	+70	*45.2	*38.9	+66	-21.5	0	+115
V114	12BY7A	+.45	-.2	0	*45.2	*45.2	*51.5	+105	+110	0
V115	12BK5	+222	0	+22.5	*64.0	*51.5	+29	+22.5	+235	0
V116	12DQ6	0	*76.7	0	+132	-24	-24	*64.0	0	---
V117	12AX4GTA	0	+550	+550	0	+245	0	*76.7	*89.3	---
V118	1X2B	---	---	---	---	---	---	---	---	H.V. 14.5KV

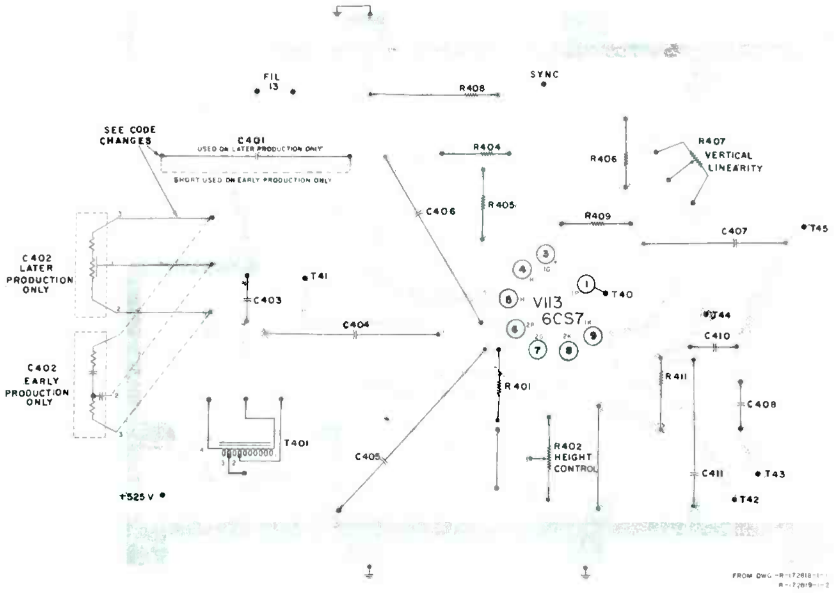
The following voltages were measured with an electronic voltmeter while the set was operating on 117 volts, 60 cycle a.c. with no signal input, antenna terminals shorted, Station Selector set to channel 3. The Brightness, Contrast and Picture Guard controls set at minimum, Area Switch set in NORMAL position. Electronic voltmeter connected between socket lug and chassis; * = A-C voltages. Voltages may vary depending upon the setting of other controls.

TV CHASSIS 493
Models DT-12M DC-12M
DT-12B DC-14M
DC-10M DC-16B
DC-10B DC-18N

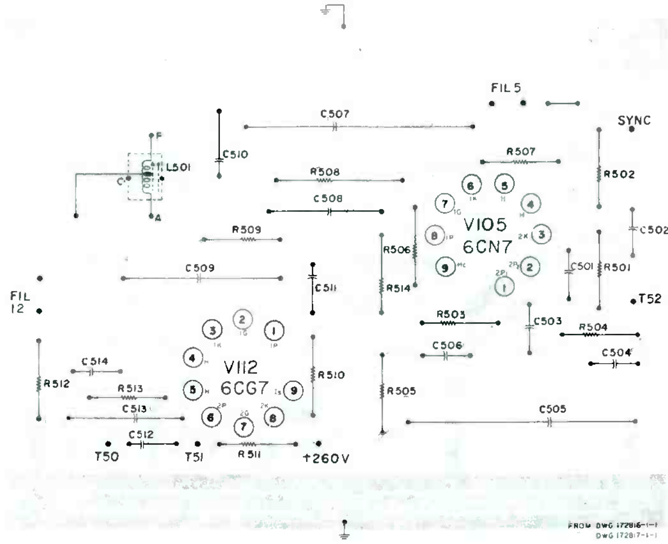
TV CHASSIS 494
Models DT-13M DC-13M
DT-13B DC-15M
DC-11M DC-17B
DC-11B DC-19N



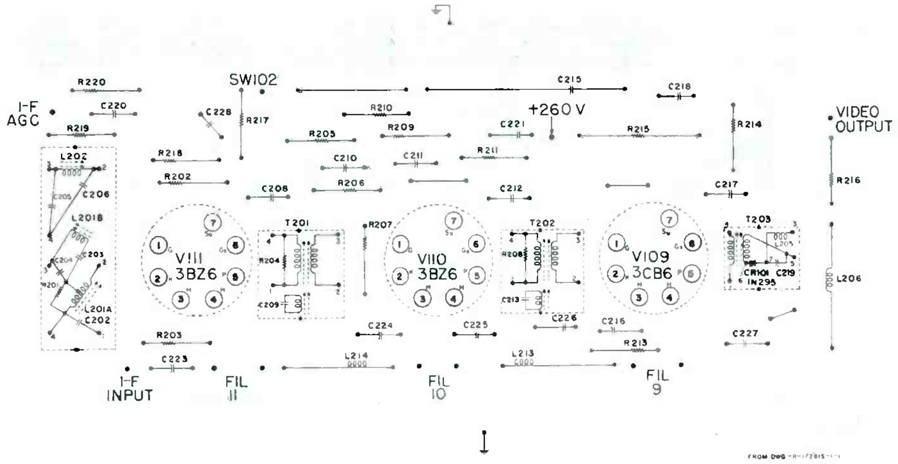
VIDEO-SYNC-SOUND BOARD



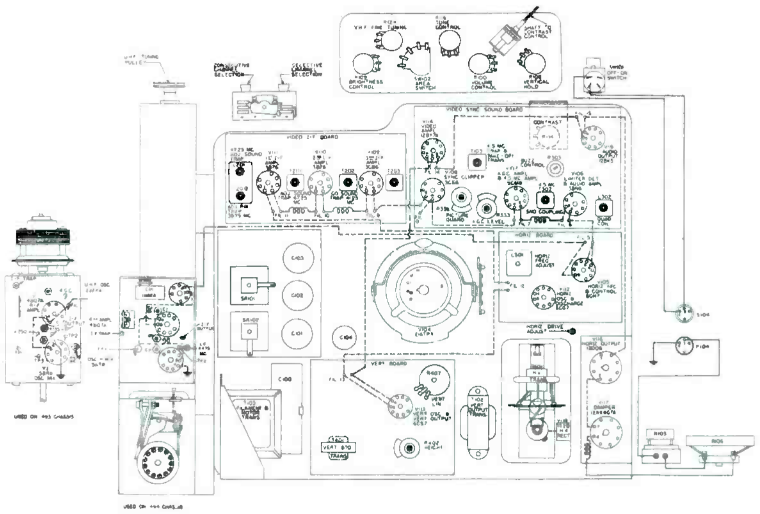
VERTICAL BOARD



HORIZONTAL BOARD



VIDEO I. F. BOARD

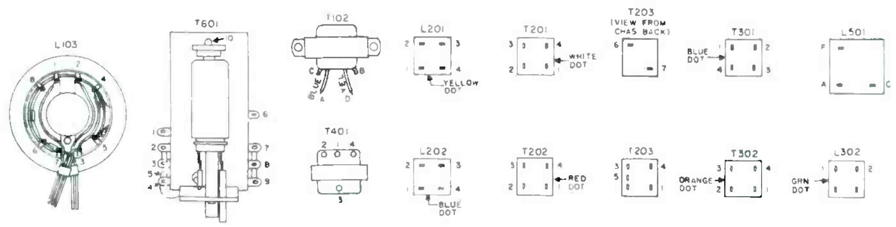


REAR VIEW OF CHASSIS 493 and 494
(Tube and Alignment Locations and Tube Filament Wiring)

PRINTED CIRCUIT BOARDS

The printed circuit boards shown below are viewed from the component side of board. The shaded area represents the printed wiring. Components mounted on the board and other connections are shown in black.

SPEAKER CHART		
SYMBOL NUMBER	SPEAKER SIZE	USED ON MODELS
SP101	5 1/4"	DT12M, DT12B DT13M, DT13B
SP102	12"	DC10M, DC10B DC11M DC11B DC12M, DC13M
SP103 SP104 SP105	12" 8" 4"	DC14M, DC15M DC16B, DC17B DC18N, DC19N



PARTS LIST

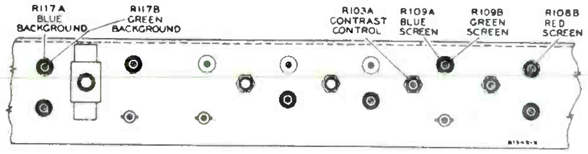
Symbol No.	Part No.	Description
R-101	172689-1	Control, Volume (500,000 ohm, 150,000 ohm Tap)
R-104	39374-201	1000 ohm, 10%, 2 w, (494 chassis only)
R-105	154089-1	7.5 ohm, 5w, Fusistor
R-106	158230-3	45 ohm, 20 w
R-109	171716-1	Control, Brightness, 5 megohm
R-114	172172-1	Control, Contrast, 16,000 ohm
R-116	172724-1	Control, Tone (1.5 megohm)
R-117	39374-109	470 ohm, 10%, 1 w
R-124	172725-1	Control, Fine Tuning (50,000 ohm)
R-125	39374-131	33,000 ohm, 10%, 1 w
R-126	170773-7	7500 ohm, 10%, 3 w (494 chassis only)
R-215	170773-4	8200 ohm, 10%, 3 w
R-303	172171-1	Control, Buzz, 500 ohm
R-321	39374-209	4700 ohm, 10%, 2 w
R-322	39374-208	3900 ohm, 10%, 2 w
R-333	172236-1	Control, AGC Level, 40,000 ohm
R-336	172235-1	Control, Picture Guard, 5 megohm
R-402	172235-1	Control, Height, 5 megohm
R-407	172275-1	Control, Vertical Linearity, 2500 ohm
R-408	170773-1	5600 ohm, 10%, 3 w
R-602	170773-2	6800 oh, 10%, 3 w
R-604	39374-93	22 ohm, 10%, 1 w
R-606	39374-129	22,000 ohm, 10%, 1w
L-102	155529-5	Choke, Filter, (50 ohm, 1 henry, 300 ma.)
L-103A	172388-1	Deflection Yoke Assem., Less Cover
L-302	172452-1	Coil, Quadrature
L-501	172339-1	Transformer, Horizontal Frequency
T-101	172978-1	Transformer, Audio Output
T-102	158726-2	Transformer, Vertical Output
T-103	172148-1	Transformer, Filament and Motor
T-201	172299-1	Transformer, 1st. I. F.
T-202	172306-1	Transformer, 2nd. I. F.
T-203	173346-1	Transformer, 3rd. I. F. (less Xtal and Cap)
T-301	172454-1	Transformer, Sound Take-Off
T-302	172457-1	Transformer, Sound Coupling
T-401	172249-1	Transformer, Vertical B. T. O.
T-601	172387-2	Transformer, Horizontal Deflection
CR-101	157465-5	Crystal, 1N295
P-101	154125-1	Receptacle, Line Cord
SR-101	155575-1	Rectifier, Selenium (350 ma.)
SR-102	155575-1	Rectifier, Selenium (350 ma.)
SW-101A	172671-1	Switch, Off-On

SERVICE DEALER & ELECTRONIC SERVICING
Manufacturer's Schematics

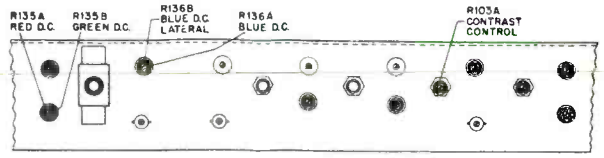
TV COLOR RECEIVER

RCA

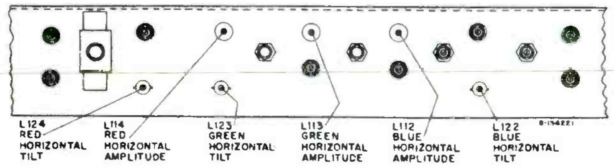
CHASSIS DESIGNATIONS	
CTC5	Models 21-CS-7815 & 21-CS-7817
CTC5A	Models 21-CS-7815U & 21-CS-7817U
CTC5B	Models 21-CT-7835 & 21-CT-7837
CTC5C	Models 21-CT-7835U & 21-CT-7837U
CTC5D	Models 21-CT-7855, 21-CT-7857, 21-CT-7865, 21-CT-7866 & 21-CT-7867
CTC5E	Models 21-CT-7855U, 21-CT-7857U, 21-CT-7865U, 21-CT-7866U & 21-CT-7867U



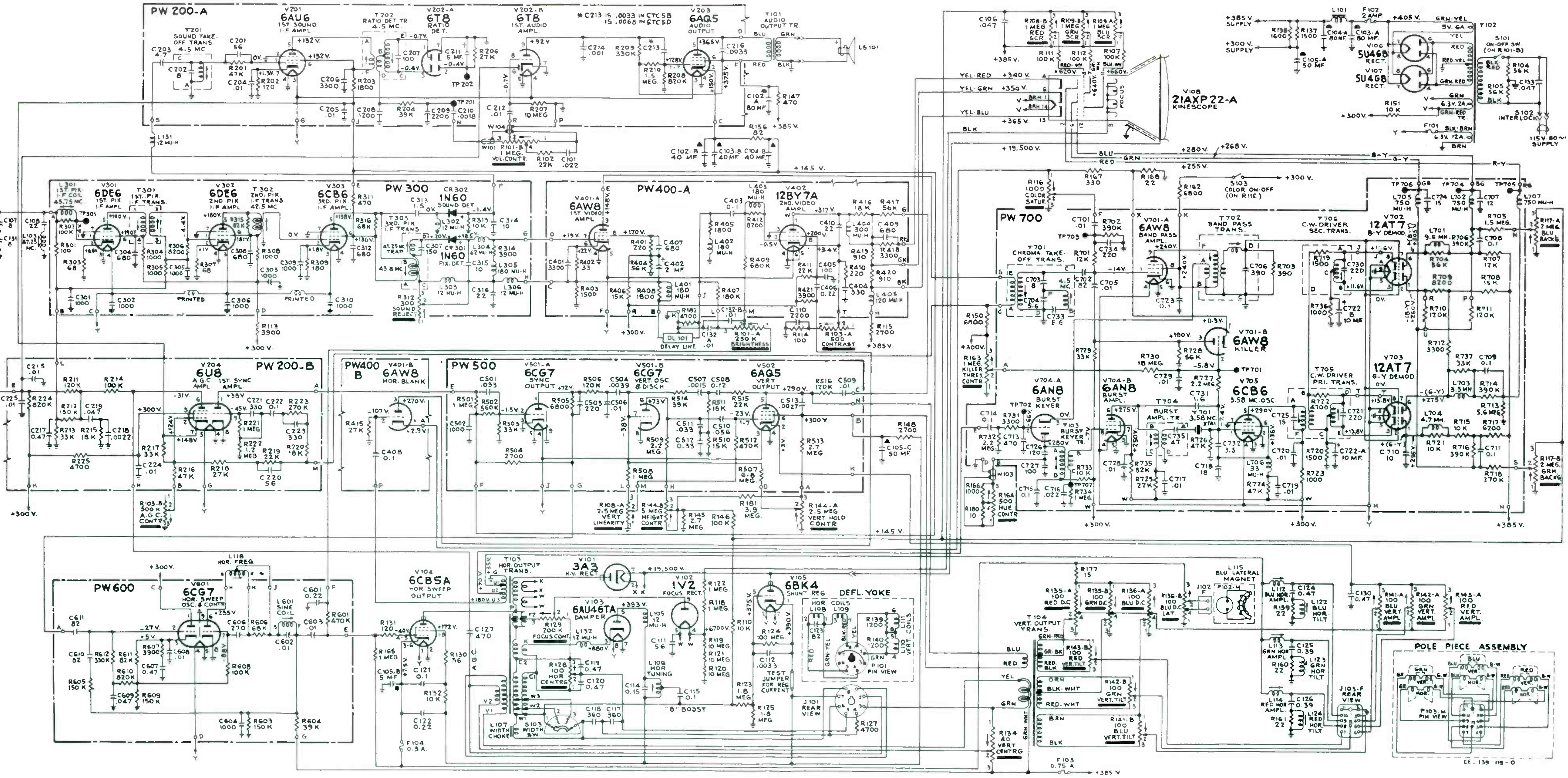
SCREEN AND BACKGROUND CONTROLS

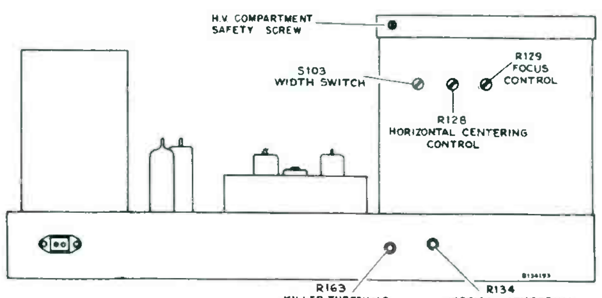


STATIC CONVERGENCE CONTROLS

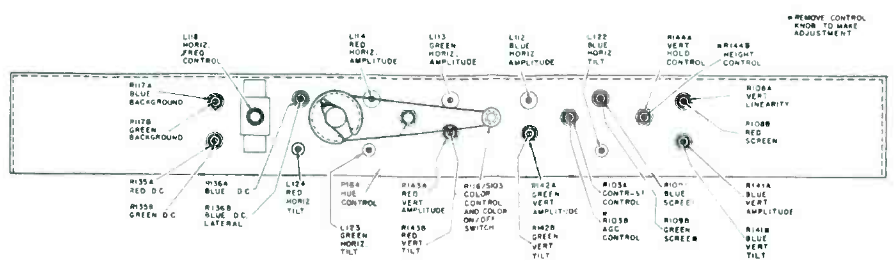


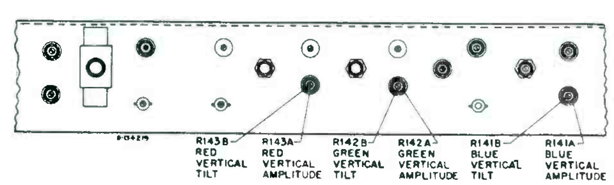
HORIZONTAL DYNAMIC CONTROLS





REAR CHASSIS ADJUSTMENTS





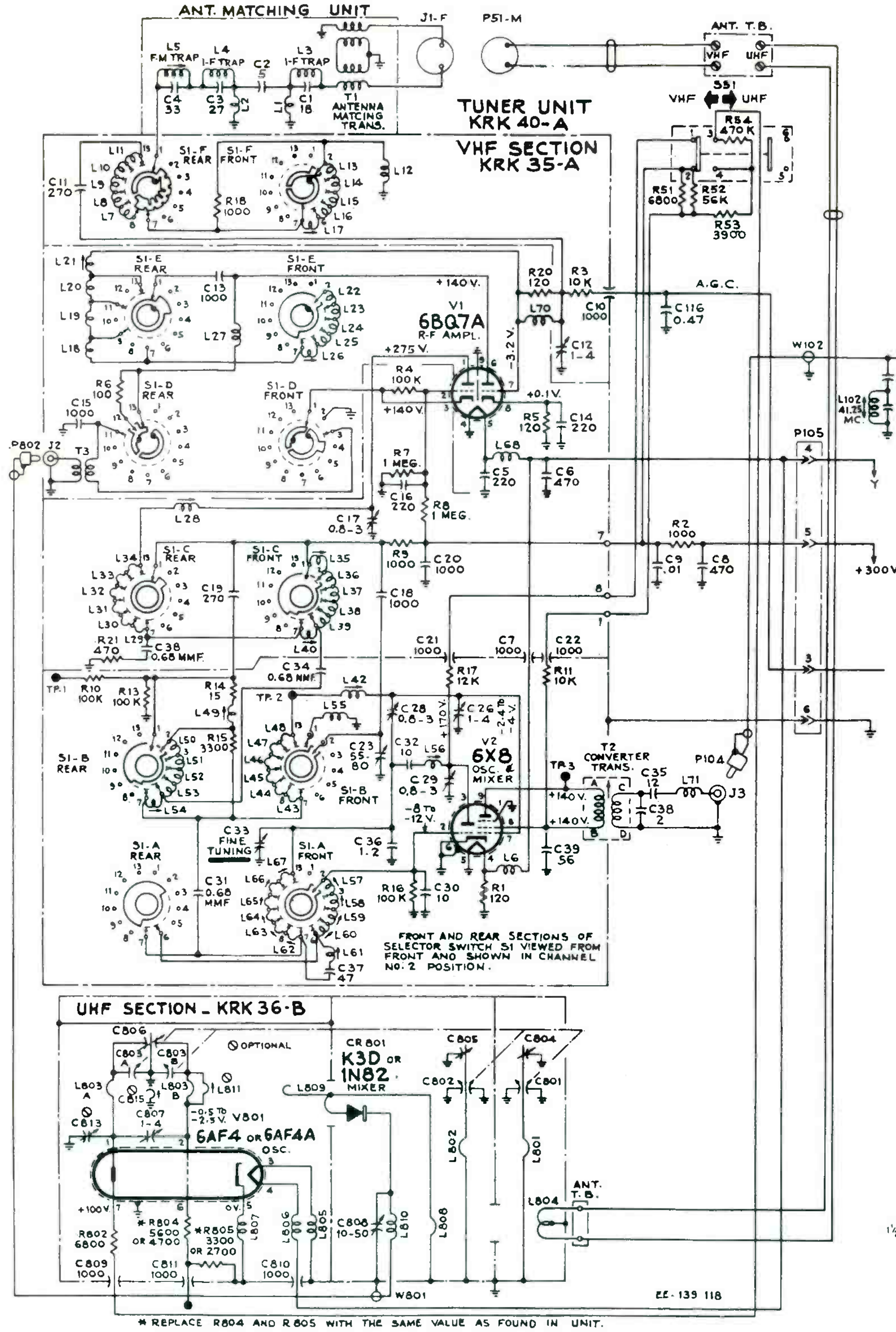
VERTICAL DYNAMIC CONTROLS

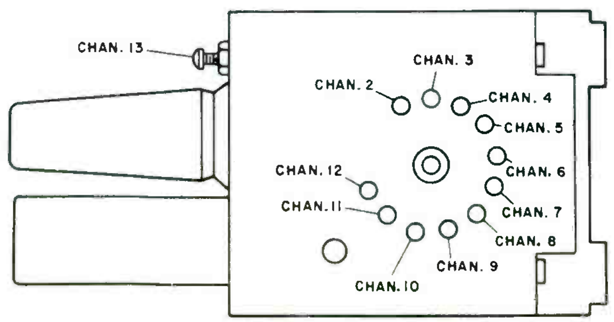
2a

RCA TV COLOR RECEIVER

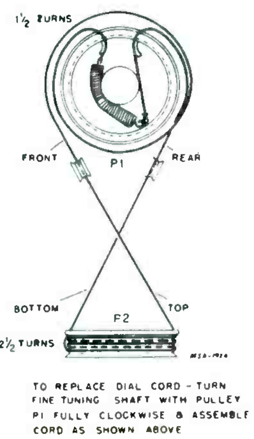
CHASSIS DESIGNATIONS

CTC5	Models 21-CS-7815 & 21-CS-7817
CTC5A	Models 21-CS-7815U & 21-CS-7817U
CTC5B	Models 21-CT-7835 & 21-CT-7837
CTC5C	Models 21-CT-7835U & 21-CT-7837U
CTC5D	Models 21-CT-7855, 21-CT-7857, 21-CT-7865, 21-CT-7866 & 21-CT-7867
CTC5E	Models 21-CT-7855U, 21-CT-7857U, 21-CT-7865U, 21-CT-7866U & 21-CT-7867U

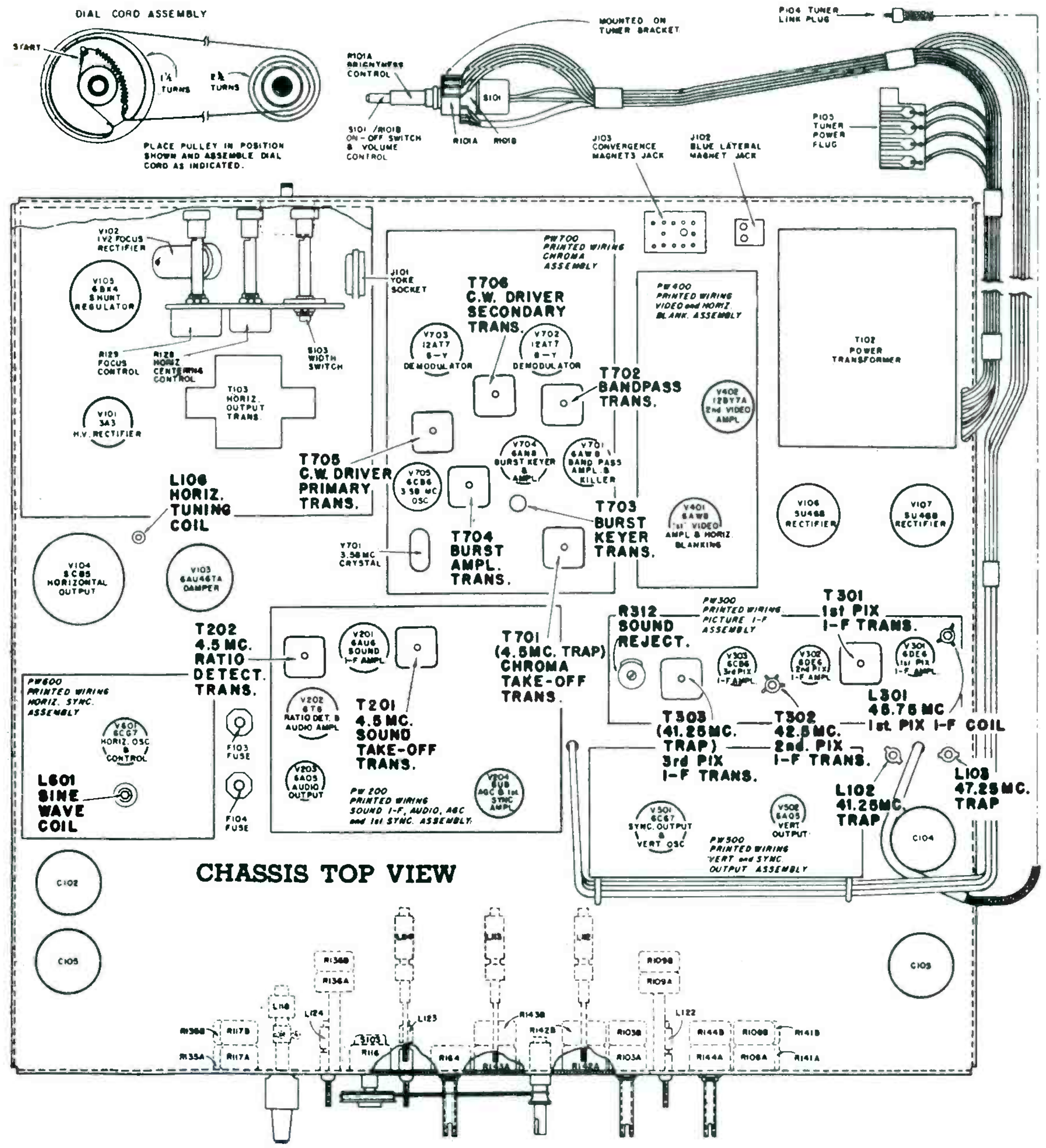




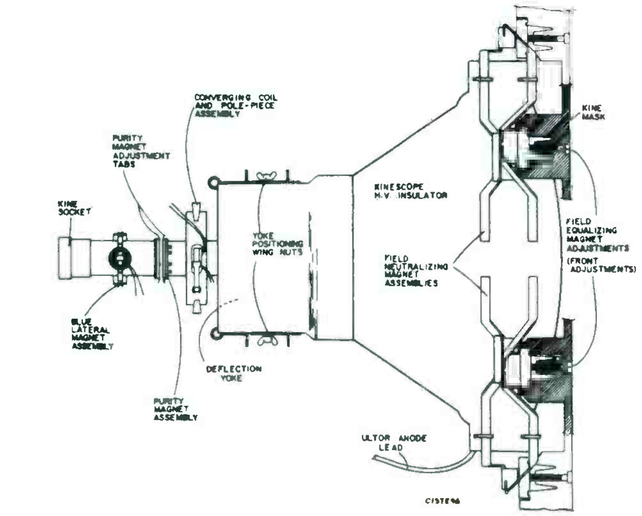
VHF R-F OSCILLATOR ADJUSTMENT



TUNER DIAL CORD



CHASSIS TOP VIEW



KINESCOPE ADJUSTMENTS AND COMPONENTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
R101A, B	102156	Control - "On-Off" volume, brightness control. Includes S101
R103A, B	102151	Control - Contrast, AGC control.
R108A, B	102144	Control - Vertical linearity, red screen control
R109A, B	102143	Control - Blue screen, green screen control
R113	102314	Resistor - Fixed, wire wound, 3900 ohms ± 10%, 7 w.
R115	102789	Resistor - Fixed, wire wound, 2700 ohms ± 5%, 7 w.
R116	102159	Control - Color saturation control
R117A, B	102145	Control - Blue background, green background control
R128	102149	Control - Horizontal centering control
R129	102150	Control - Focus control
R132	79182	Resistor-Fixed, wire wound, 10,000 ohms, ±10%, 10 w.
R137	102169	Resistor-Fixed, wire wound, 1500 ohms, ±10%, 10 w.
R138	102170	Resistor-Fixed, wire wound, 1600 ohms, ±10%, 10 w.
R141A, B) R142A, B) R143A, B)	102142	Control-Red, green, blue vertical amplitude and tilt control.
R144A, B	102146	Control - Vertical hold, vertical height control
R150	102171	Resistor-Fixed, wire wound, 6800 ohms, ± 10%, 7 w.
R163	102152	Control - Killer threshold control
R164	102157	Control - Hue control
T103	102132	Transformer-Horizontal output and high voltage transformer.
T104	102133	Transformer - Vertical output transformer.
T1	100454	Transformer - Antenna matching.
T201	102256	Transformer - Sound take-off transformer. Includes C202.
T202	102253	Transformer - Radio detector transformer. Includes C207.
L301	10227	Transformer - Filter transformer.
L302, L303	100441	Coil - R.F. choke coil, 12 microhenry.

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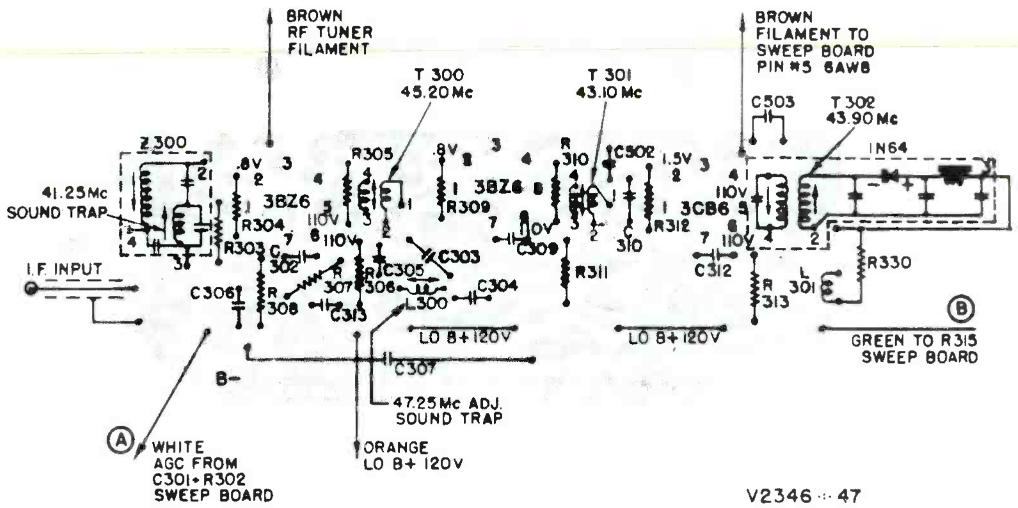
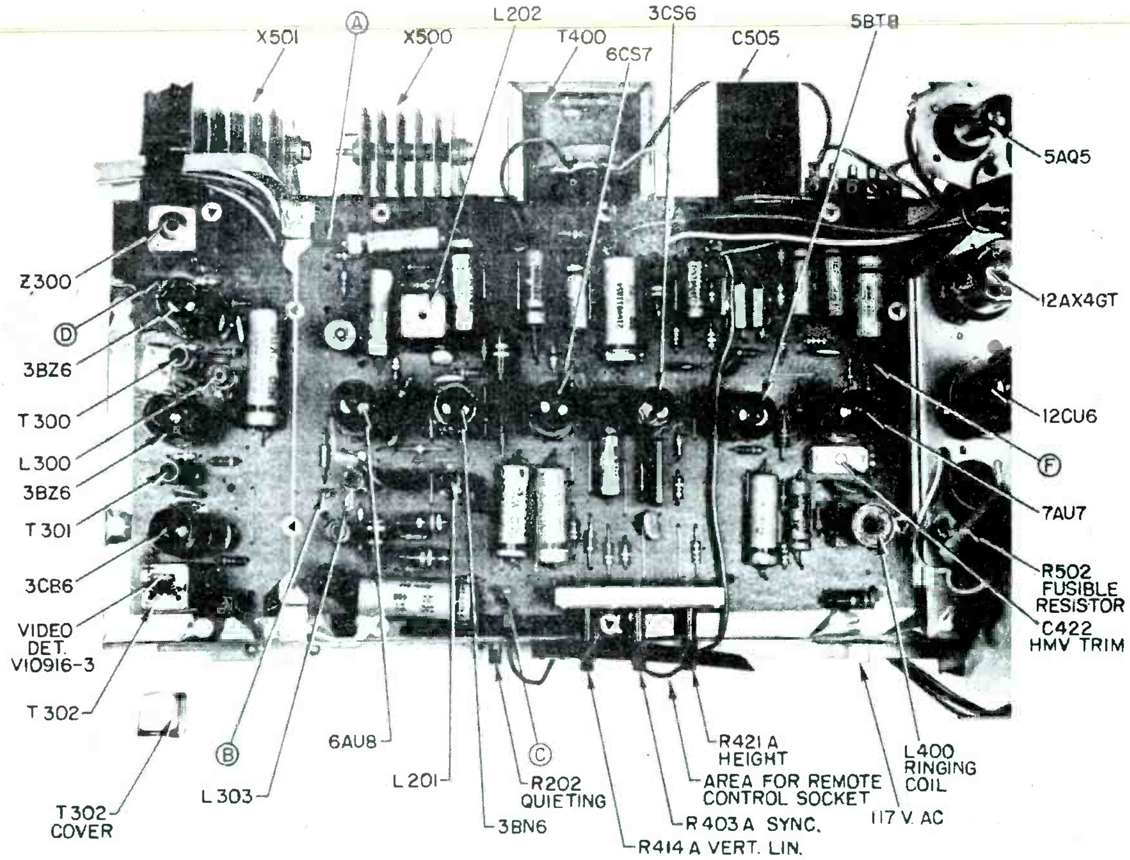
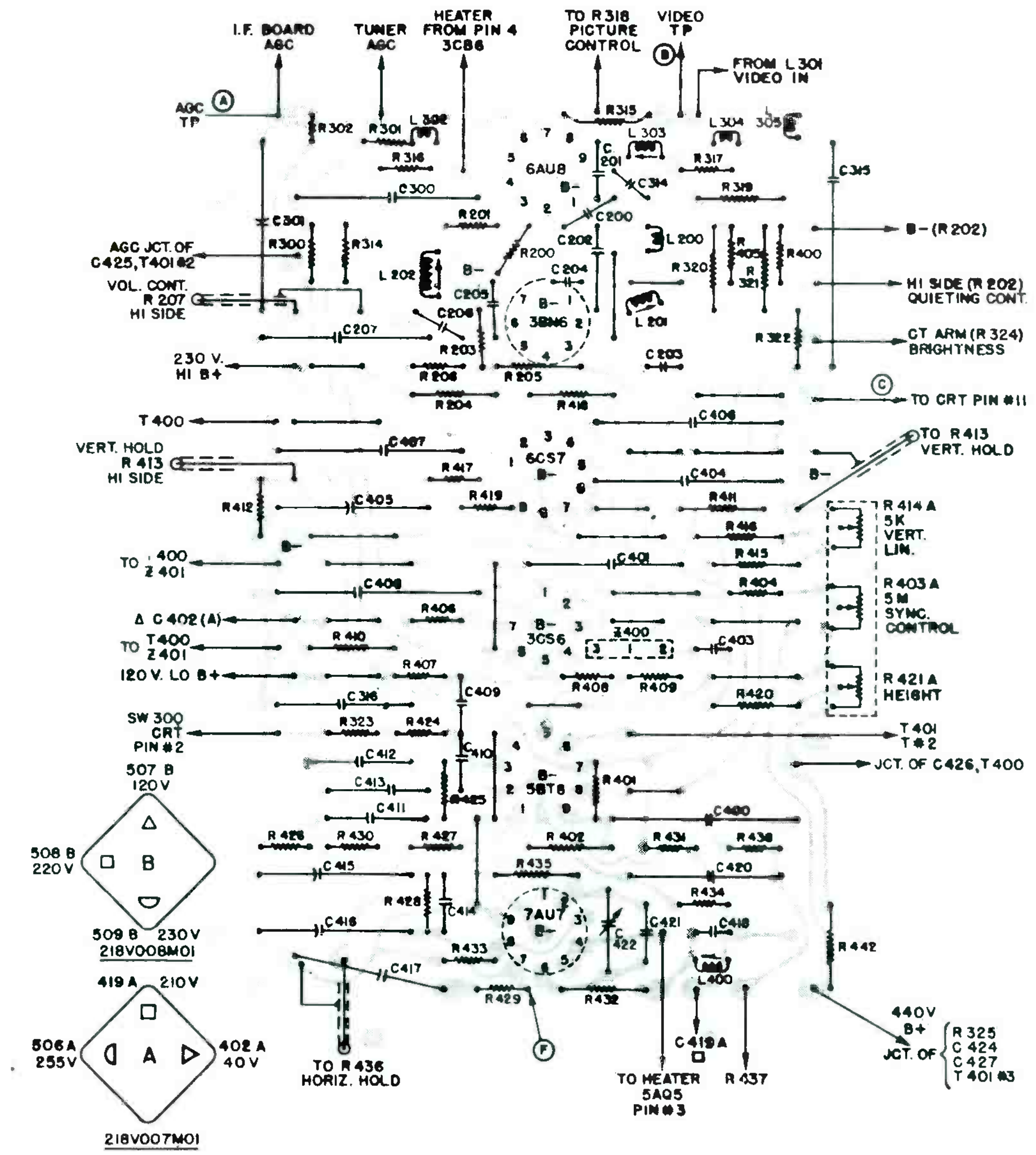
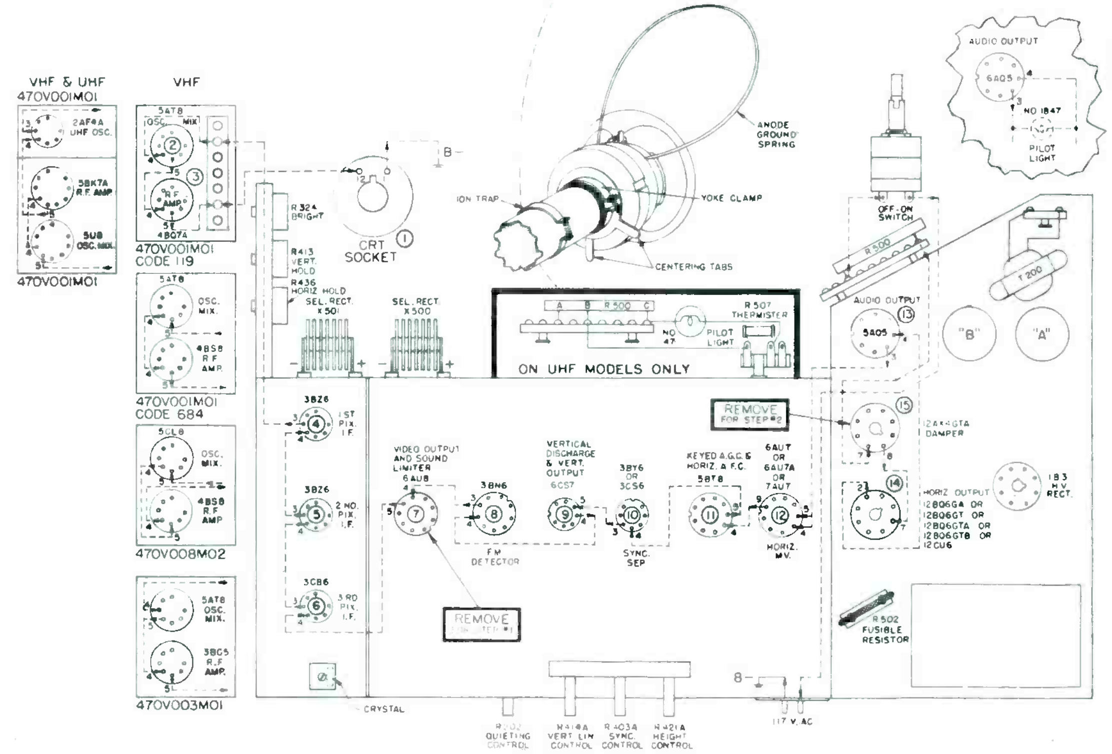




I.F. & SWEEP COMPONENTS (TOP VIEW)



3b **Bottom View of Printed Board Showing Top Components Symbolically**



Top View of Sockets for Heater Check

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Manufacturer's Schematics

Models 21T101B, 107A, 107B, 108A, 112A
21K112B, 113B
21KE113A, 115A, 116A
21KU112A, 112B, 113A, 114A, 114B, 115A, 116A
21TU101A, 107A, 107B, 108B
24KR126A
24KU126A

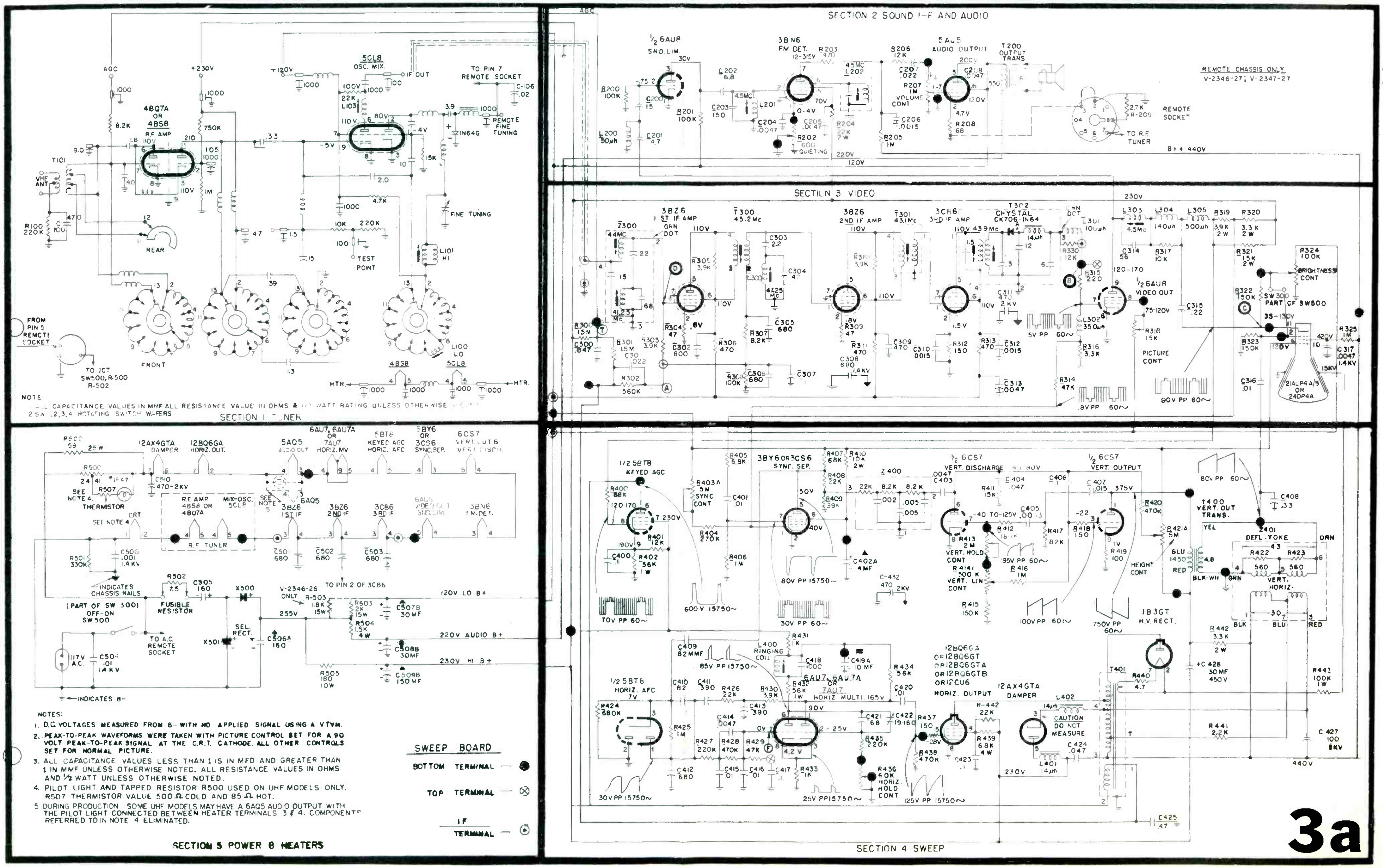
TV CHASSIS
V-2346
V-2347
V-2356
V-2357

WESTINGHOUSE

Ref. No.	Part No.	Description	Function
C427	215V300M24	Capacitor, 100 mmf 5KV	Boost
C505	V15329-1	Capacitor, elec. 160 mf 200V	Surge input
C506A	218V007M01	Capacitor, elec. 160 mf 350V (includes C403A, C419A, C506A)	Input filter
C507B	218V008M01	Capacitor, elec. 30 mf 300V (includes C507B, C508B, C509B)	Lo B+ filter
C508B	218V008M01	Capacitor, elec. 30 mf 300V (includes C507B, C508B, C509B)	Audio B+ filter
C509B	218V008M01	Capacitor, elec. 150 mf 300V (includes C507B, C508B, C509B)	Hi B+ filter
+C510	215V300M20	Capacitor, 470 mmf 1.4 KV	Heater bypass

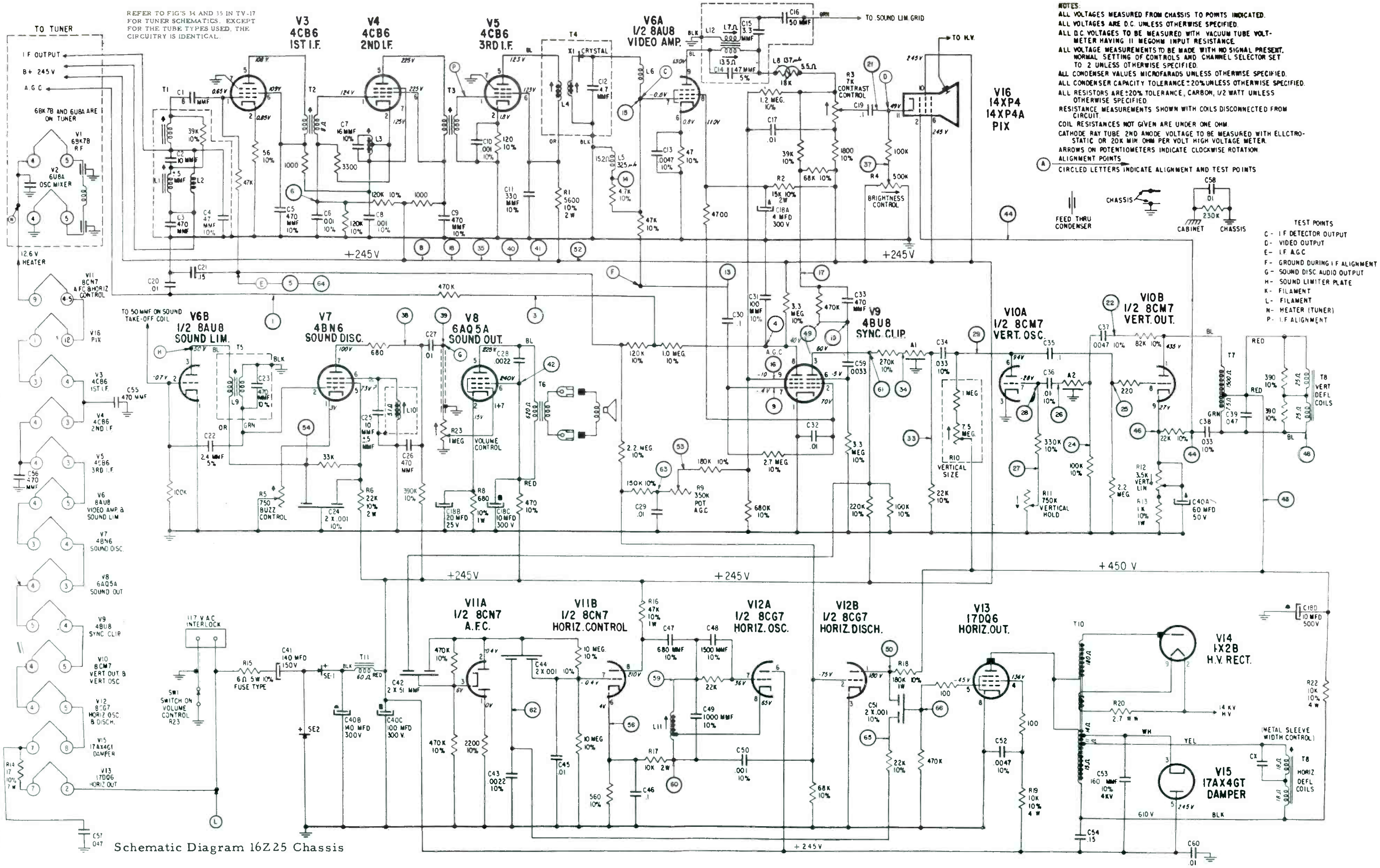
Ref. No.	Part No.	Description	Function
R202	V12709-16	Control, 600 ohms, 1/4 W.	Quieting
R207	270V002M02	Control, 1 megohm	Volume
R318	270V002M02	Control, 15,000 ohms	Picture
R324	270V003M03	Control, 100,000 ohms 1/2 W.	Brightness
R403A	270V019M01	Contro, 5 megohms triplex	Sync.
R410	250V421A03	Resistor, 10,000 ohms 2W	B+ dropping
R421A	270V019M01	Control, 5 megohms triplex	Height
R413	270V003M04	Control, 2 megohm	Vert. hold
R420	250V224A74	Resistor, 470,000 ohms 1/2W	Plate load
R436	270V003M02	Control, 60,000 ohms	Horiz. hold
R500	251V011M01	Resistor, 59 ohms 25W	Filament dropping
R500	251V015M02	Resistor, 25W A-B-24 ohms,	Filament dropping

Ref. No.	Part No.	Description	Function
R502	259V002MO1	Resistor, 7.5 ohms	Fusible
+R503	251VO17MO2	Resistor, 2,000 ohms 15W	Filter
+R503	251V017M06	Resistor, 1,800 ohms 15W (V2346-25 chassis only)	Lo B+ decoupling
+R504	251V020M01	Resistor, 1,500 ohms 4W	Filter
+R505	251V017M01	Resistor, 180 ohms 10W	Filter
R507	251V013M01	Thermistor, 85 ohms Cold 2W 500 ohms hot (used only on UHF receivers equipped with pilot light)	Protection
+SW500	270V002M02	Switch, (includes R207, R318, SW300, SW500)	On-Off
X500	V-15920-2	Rectifier, selenium 350 MA	Rectifier
X501	V-15920-2	Rectifier, selenium 350 MA	Rectifier



TV CHASSIS 16Z25
Models Z1510L
Z1511B
Z1512J

ZENITH

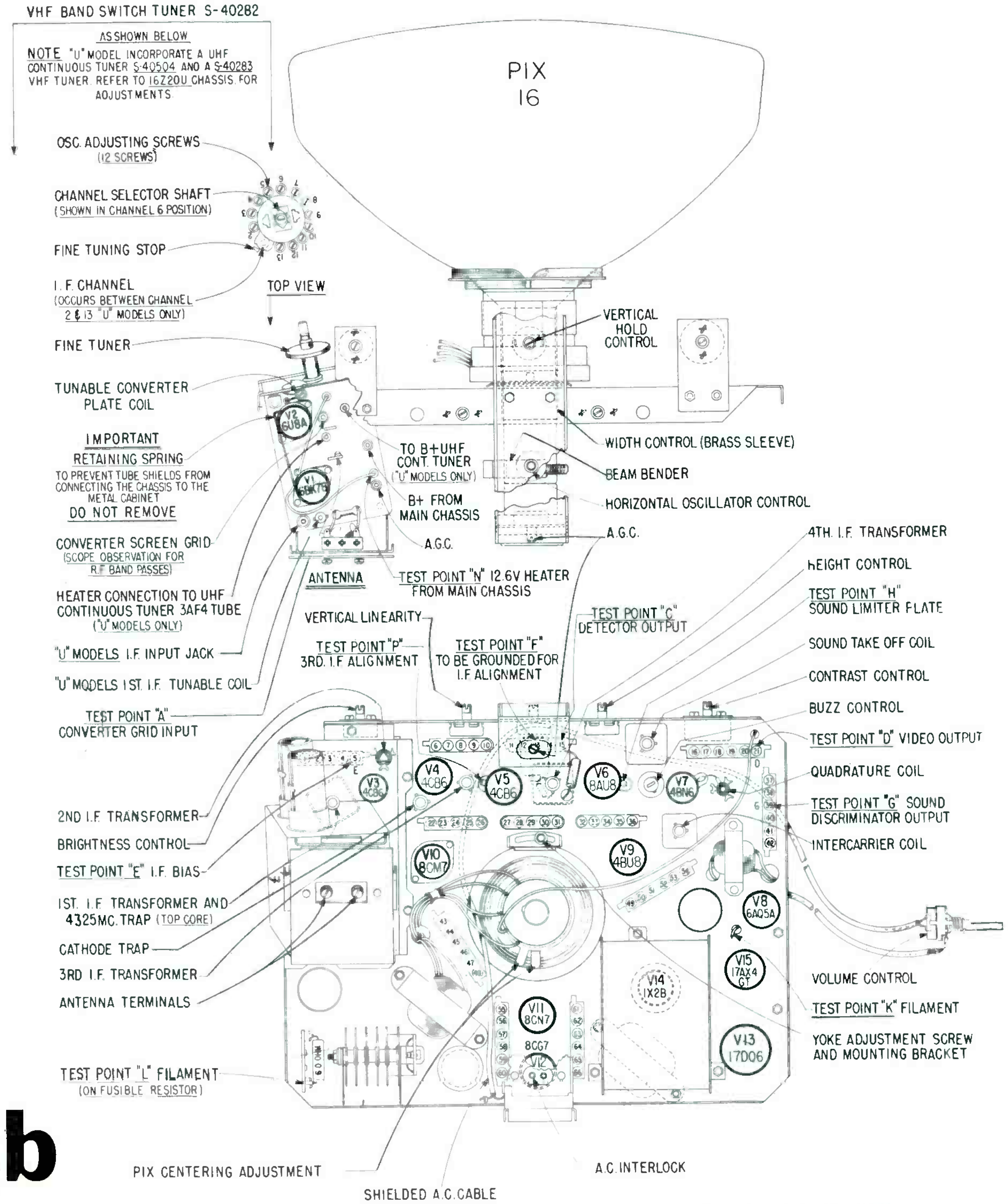


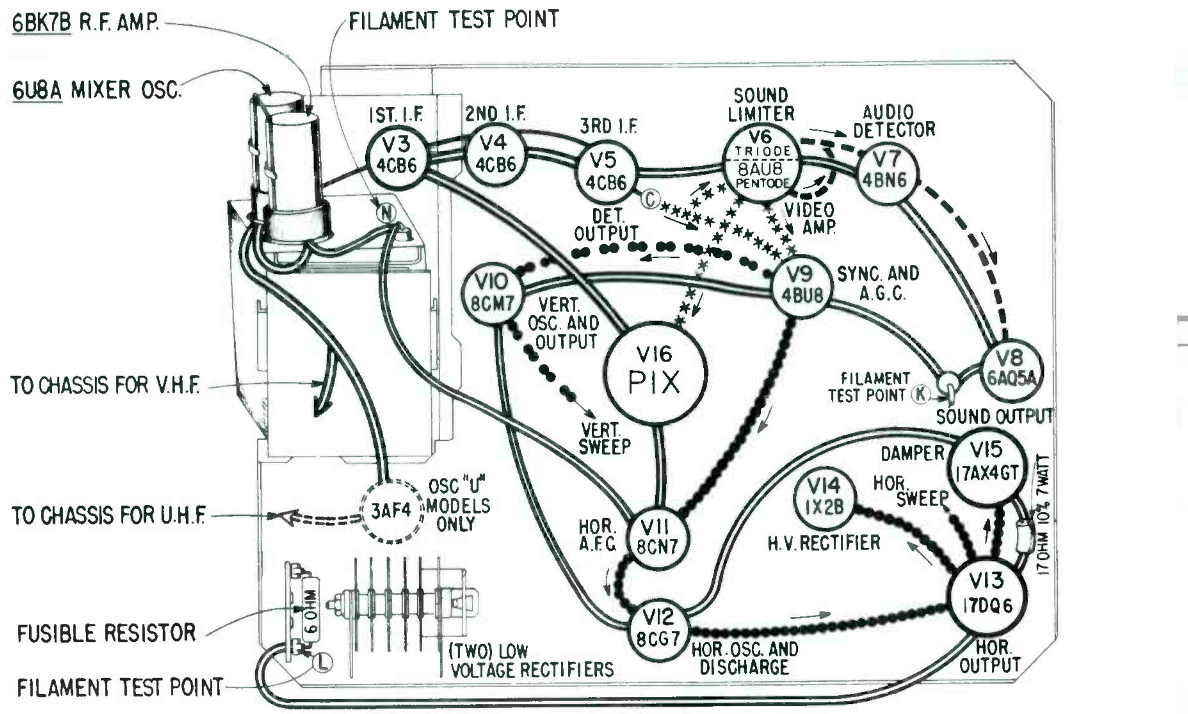
Schematic Diagram 16Z25 Chassis

ZENITH

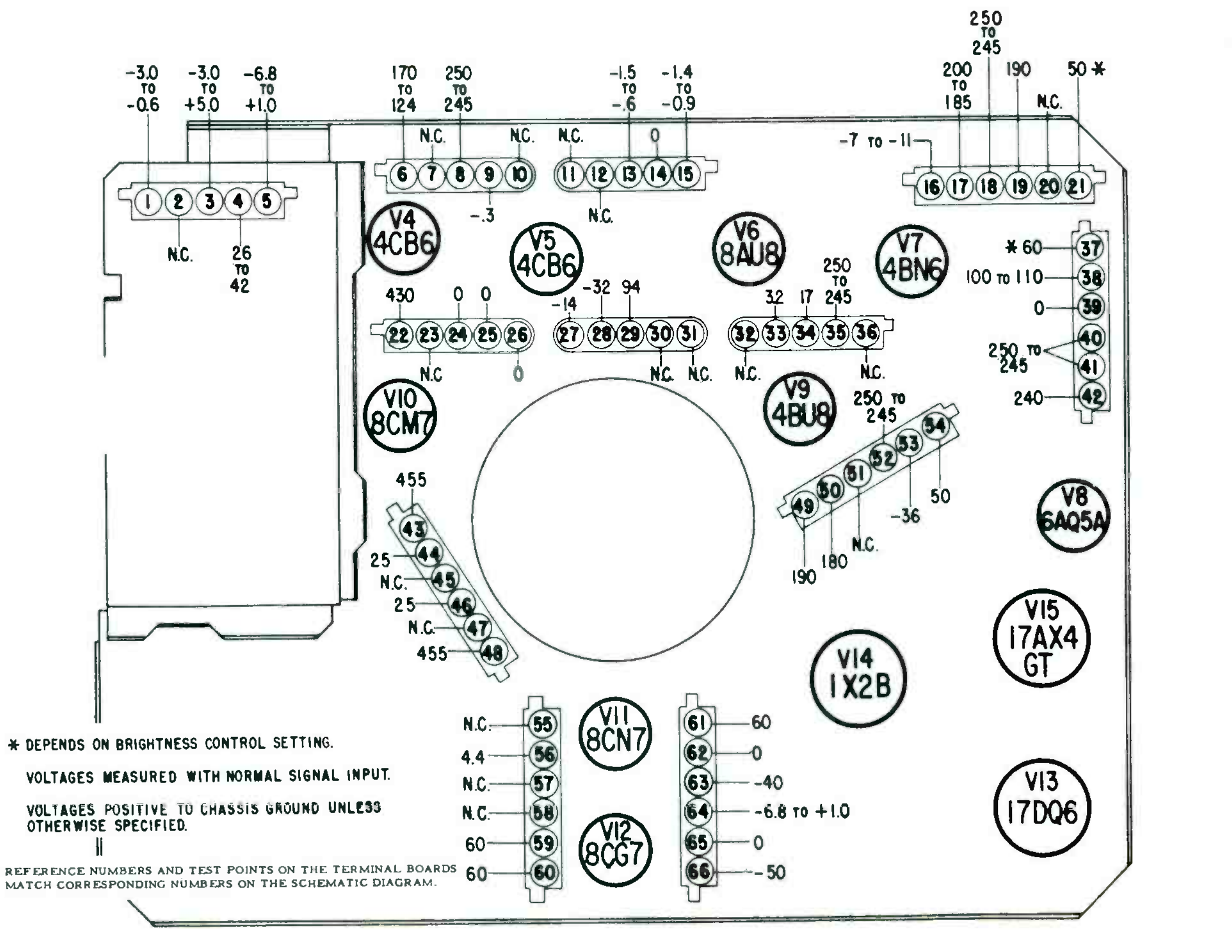
TV CHASSIS 16Z25
Models Z1510L
Z1511B
Z1512J

Item No.	Part No.		
A1	87-5	Integrator	
A2	87-4	Integrator	
X1	103-18	Diode Crystal	
R3	63-3609	7K Ohm Contrast Control	
R4	63-3264	500K Ohm Brightness Control	
R5	63-3284	750 Ohm Buzz Control	
R9	63-3625	350K Ohm Potentiometer A.G.C.	
R10	63-3263	7.5 Megohm Vertical Size Control	
R11	63-3262	750K Ohm Vertical Hold Control	
R12	63-3266	3.5K Ohm Vertical Linearity Control	
R14	63-3680	17 Ohm I.R.C. ± 10%	7 W
R15	63-3644	6 Ohm Fuse Type ± 10%	5 W
R16	63-1194	47K Ohm ± 10%	1 W
R17	63-2145	10K Ohm	2 W
R18	63-2313	180K Ohm ± 10%	1 W
R19	63-3623	10K Ohm ± 10%	4 W
R20	63-3631	2.7 Ohm WW	1/2 W
R23	63-3696	1 Megohm Volume Control	
T6	95-1534	Audio Output Transformer	
T7	95-1535	Vertical Output Transformer	
T8	95-1527	Deflection Coil	
T10	S-40284	Horizontal Sweep Transf.	
T11	95-1543	Filter Choke	
SE1	212-19	Selenium Rectifier	
SE1	212-14	Selenium Rectifier (Alt)	
SE2	212-19	Selenium Rectifier	
SE2	212-14	Selenium Rectifier (Alt)	





FILAMENTS
SOUND CIRCUIT
COMPOSITE VIDEO
60 CYCLES
VOLTS 117 AC
VERTICAL CIRCUIT
HORIZONTAL CIRCUIT
INTERMEDIATE FREQUENCY
WATTS 160



* DEPENDS ON BRIGHTNESS CONTROL SETTING.

VOLTAGES MEASURED WITH NORMAL SIGNAL INPUT.

VOLTAGES POSITIVE TO CHASSIS GROUND UNLESS OTHERWISE SPECIFIED.

REFERENCE NUMBERS AND TEST POINTS ON THE TERMINAL BOARDS MATCH CORRESPONDING NUMBERS ON THE SCHEMATIC DIAGRAM.

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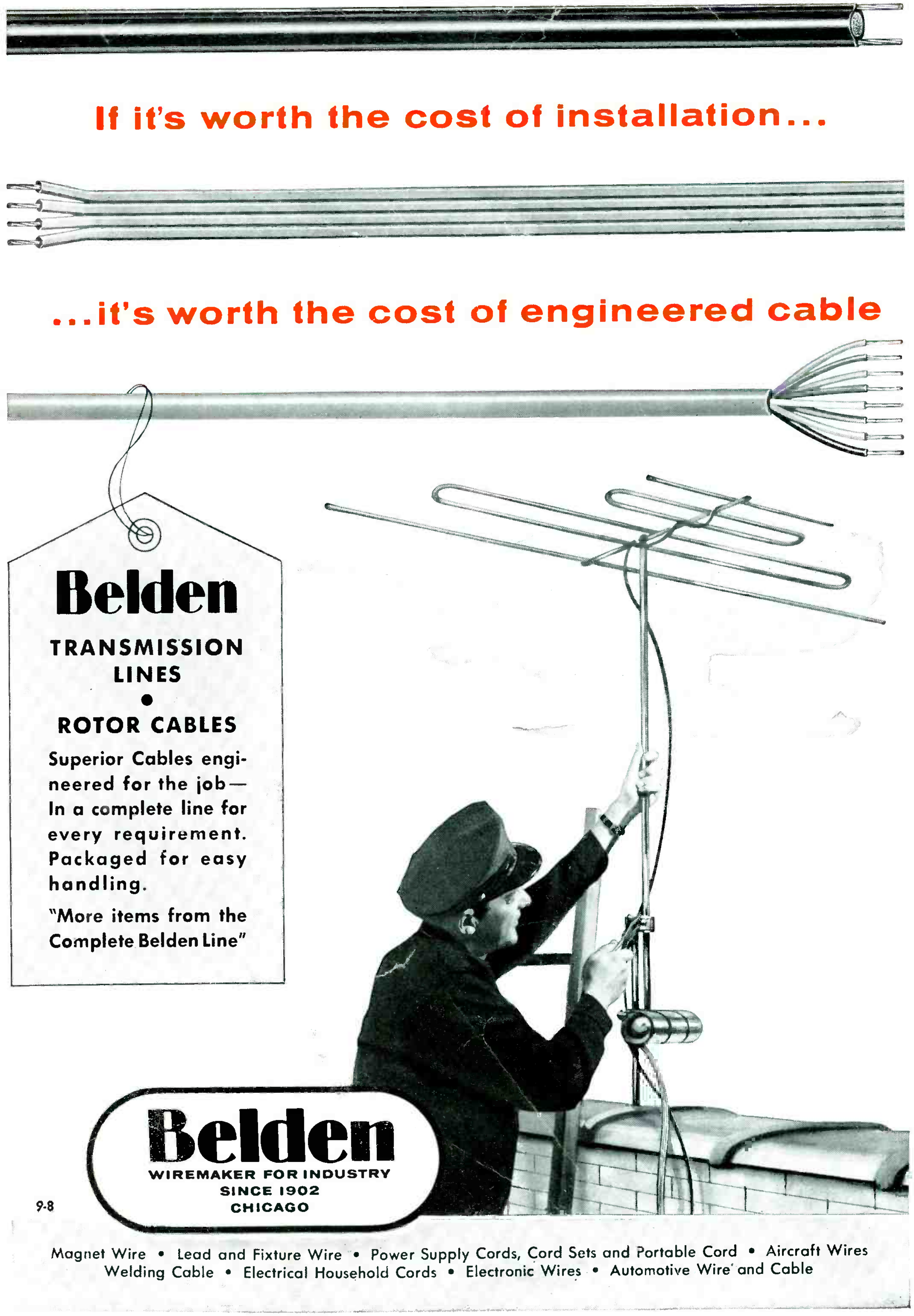

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