OCTOBER, 1954

Radio-Television SERVICE DEALER

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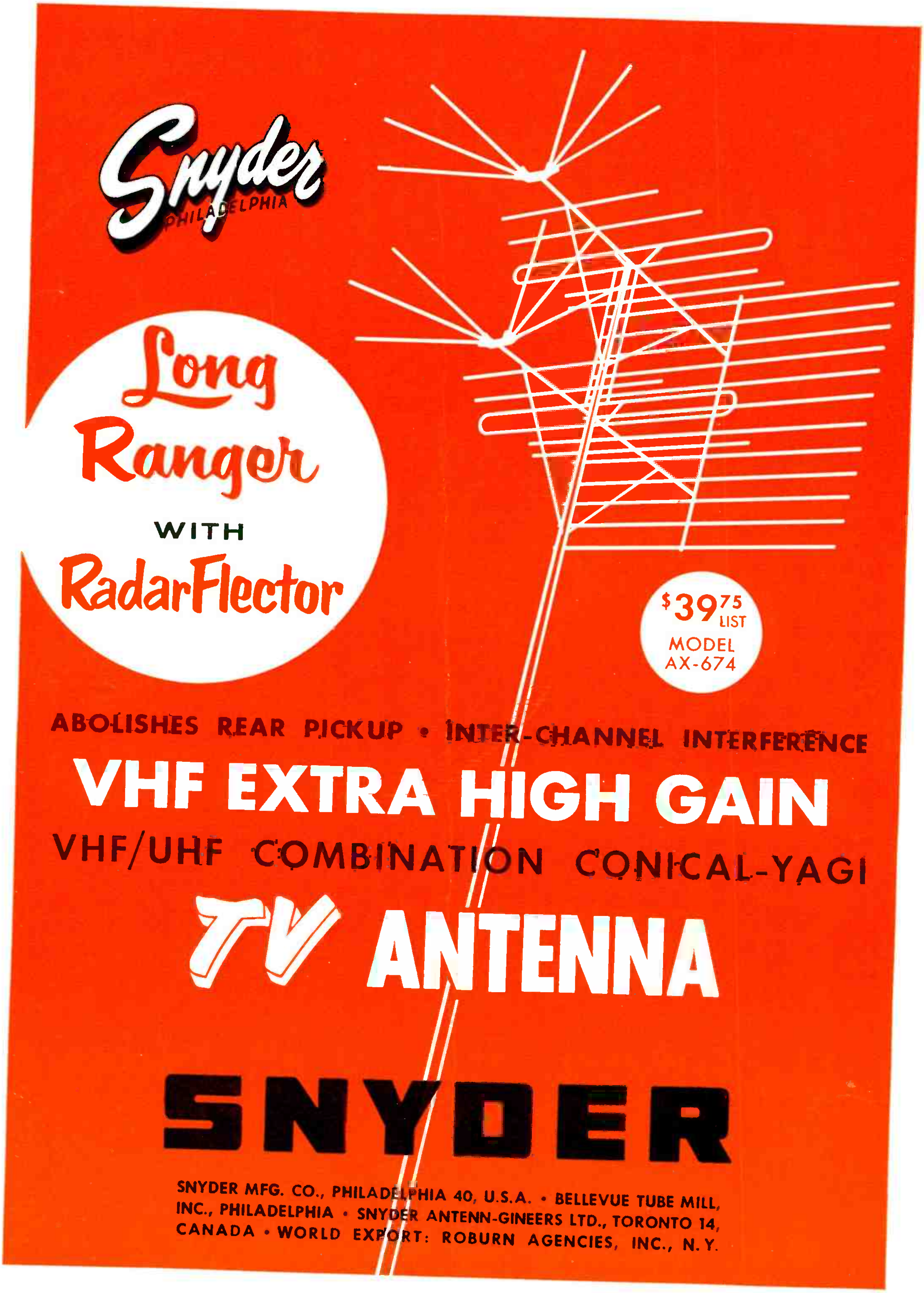
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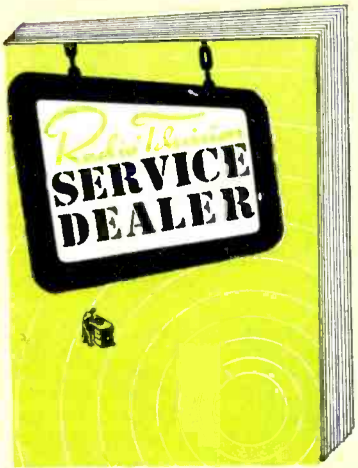

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VOL. 15, NO. 10 OCTOBER, 1954

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

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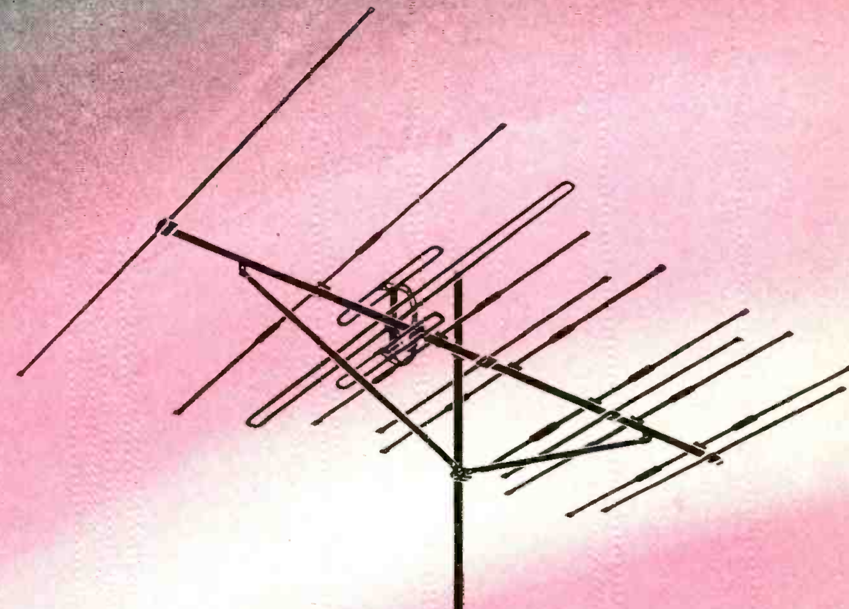

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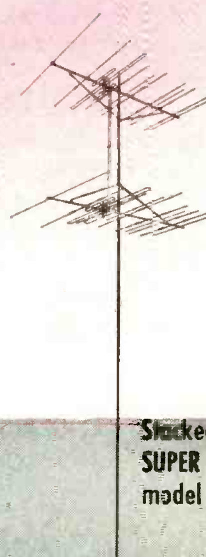

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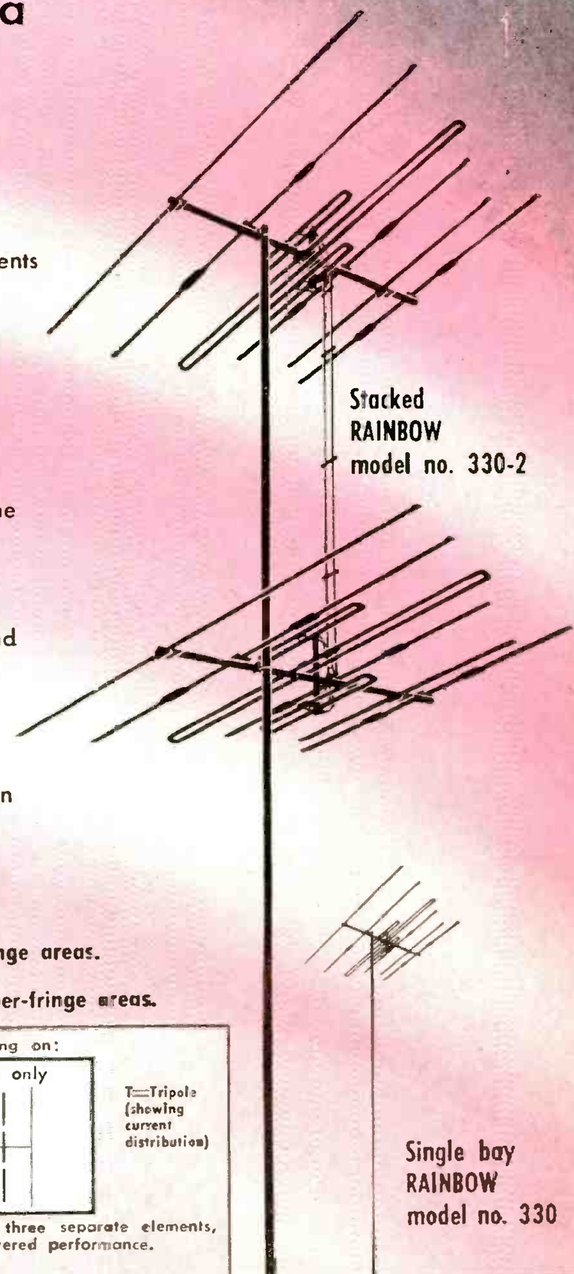

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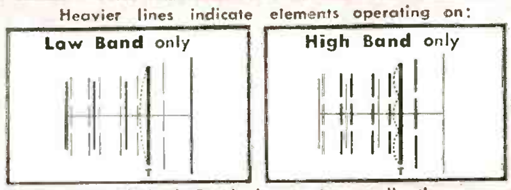

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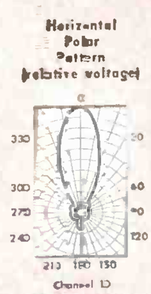
	1-Bay SUPER RAINBOW	+1 DB	+1 DB	-1.5 DB	+2.5 DB	-3.5 DB	+3.5 DB	+3 DB	+2 DB	+1.5 DB	+2 DB	+3.5 DB	+4.5 DB
	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over Stacked Champion	Stacked RAINBOW	+1.5 DB	+2 DB	+1.5 DB	+1.5 DB	+2 DB	+.5 DB	+.5 DB	+0 DB	+0 DB	+0 DB	+1 DB	+1.5 DB
	Stacked SUPER RAINBOW	+2 DB	+2.5 DB	-3 DB	+3 DB	+4 DB	+.5 DB	+[illegible] DB	+1 DB	+2 DB	+2 DB	+2.5 DB	+3.5 DB



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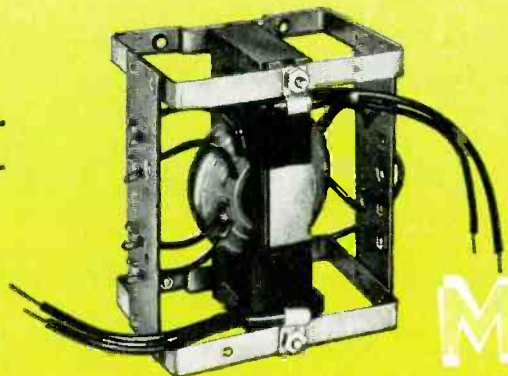

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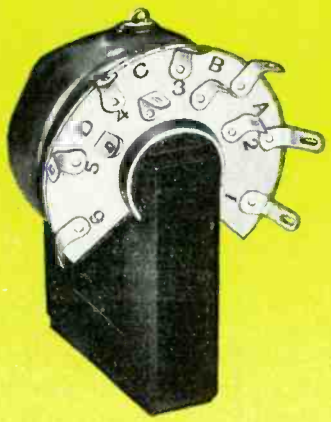

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EDITORIAL... by S. R. COWAN PUBLISHER

A Publisher Hurts Servicemen

In yesteryear it was common practice and considered good business for competing publications, particularly newspapers, to blast away at one another at the slightest excuse. Of late this practice has not been indulged in because modern publishers are supposed to be more polite than their forebears. Well—because we are both old fashioned and because we have the interests and welfare of the radio-TV servicing profession at heart, we now find it necessary to blast away, with all the power we command, at a contemporary publishing firm whom we sincerely believe is doing professional radio-TV servicemen a rank inexcusable injustice. We refer to Ziff-Davis Pub. Co. (who for years has published *"Radio News"*—which is supposed to be published for the benefit of radio-TV servicemen). Ziff-Davis has just launched another monthly magazine titled *"Popular Electronics."* Both *"Popular Electronics"* and *"Radio News"* have the same Editor, a fine fellow personally, by name of Oliver (Ollie) Read.

Scanning *"Popular Electronics"* first issue we find in it articles titled: "How To Test and Replace Radio & Television Controls"—"How To Align Receivers"—"How To Fix Home Radios"—"Adjusting Your TV Height Control"—and others of passing interest.

As *"Popular Electronics"* like *"Radio News"* is sold on newsstands, copies can get into the hands of laymen, set owners and others besides professional servicemen. These laymen, then, are being advised and told how to do their own radio-TV repair jobs—jobs that, under normal circumstances, without *"Popular Electronics"* interference, might be relegated to professional servicemen.

Isn't this a ludicrous and intolerable situation? Here we find that a magazine publisher who *claims* to be the serviceman's friend is actually taking jobs away from those servicemen, worsening their already too-competitive position. Ziff-Davis, in this age of free and unrestricted enterprise, has, by launching *"Popular Electronics"* with its "service-your-own-set" type of articles, bitten the hands that feed them. The companion magazine *"Radio News"* with the same Editor as *"Popular Electronics"* will probably find itself loved much less henceforth by professional servicemen who naturally do not want their income or profession undermined.

Our Prediction Is Upheld

Just five years ago RCA introduced the first 45 rpm record. We then predicted that "45's" along with 33 1/3 rpm recordings, would revitalize the phonograph business and eventually force 78 rpm records into obsolescence. That prediction is being borne out. In 1949 record industry sales totalled 160 million dollars. This year the total may exceed 225 million. And this despite the tremendous impact and competition of TV, which was in its infancy in 1949. Think of it! In the past five years 200 million "45" records and 13 million "45" turntables have been sold. Think of all the needles and cartridges that can be sold in the years ahead!

Mr. Frank Folsom, President of RCA, is now of the opinion that in another five years the "45" will account for more than 75% of the total record volume. We don't care about that—but we do hope that with each coming year more and more electronically actuated phonograph record players will be sold and used. They can be and are a wonderful influence upon the nation's adolescents who in time may be taught to appreciate good music and truer fidelity of phono reproduction.

In this connection may we voice our objection to the rampant and frequently misused term "High Fidelity." When the writer founded and became the first publisher of the magazine "Audio Engineering" in 1944 it was his thought, and that of his associates, that the term "High Fidelity" meant truly faithful wide frequency-range reproduction of the better class music or artistic rendition. Today some manufacturers put one or two tiny speakers, each having a 300 to 3000 cps range, into an oblong cabinet and call that sort of garbage "Hi-Fi." Something in the way of standards is needed to differentiate between genuine and quasi High Fidelity. Possibly the Audio Engineering Society and the Institute of Radio Engineers could get together on a standards project of that kind.

Being close to the matter, we realize that for various reasons, some valid, others selfish, many manufacturers would not wish to have such "standards" established. This group might stymie any action that IRE or AES might undertake. At least, an attempt to define High Fidelity minimums should be made, otherwise many avoidable misunderstandings between the public and the sellers of audio reproducers are bound to arise.

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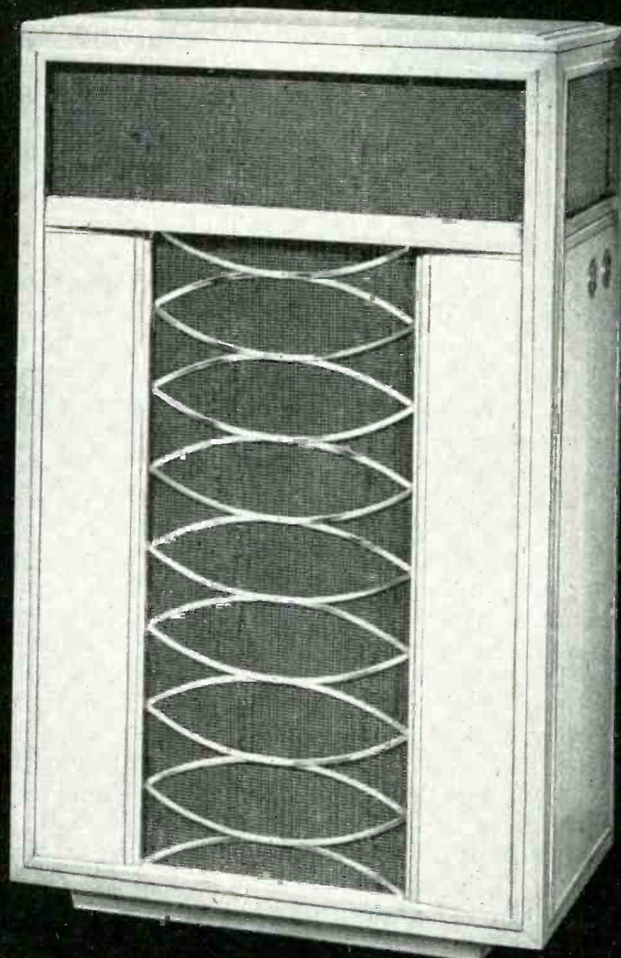

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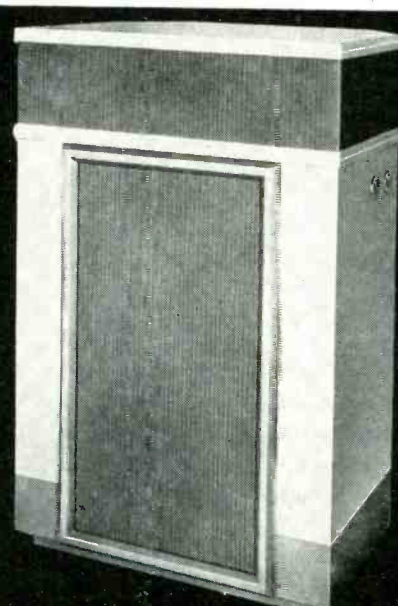

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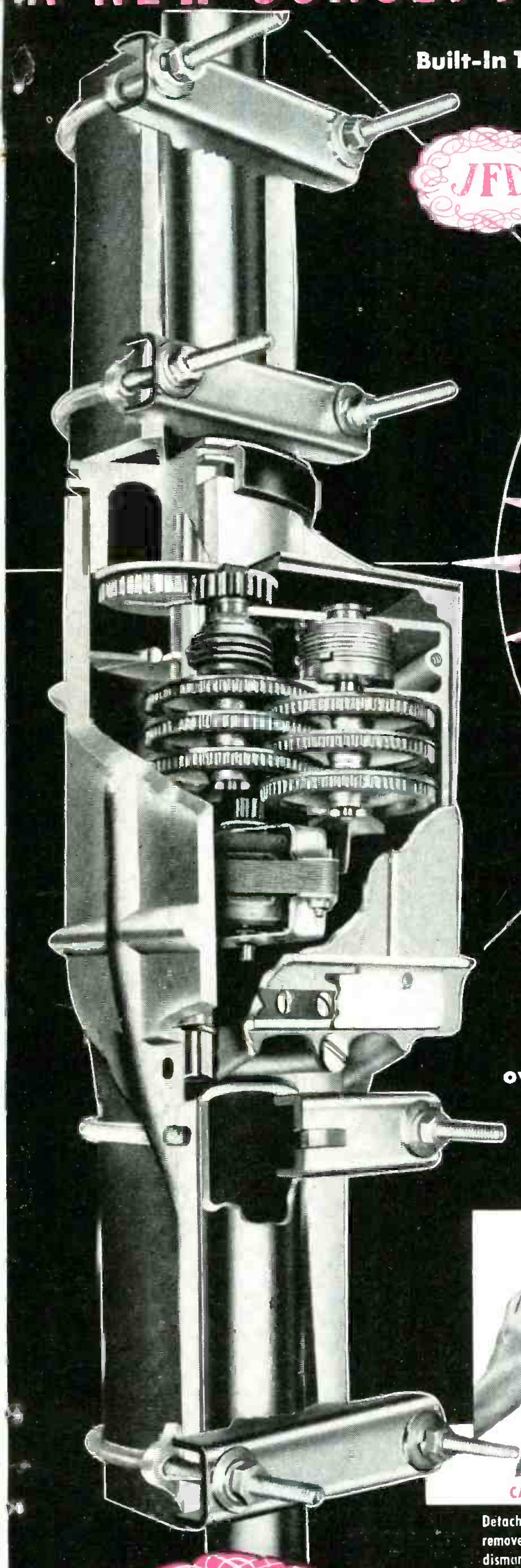

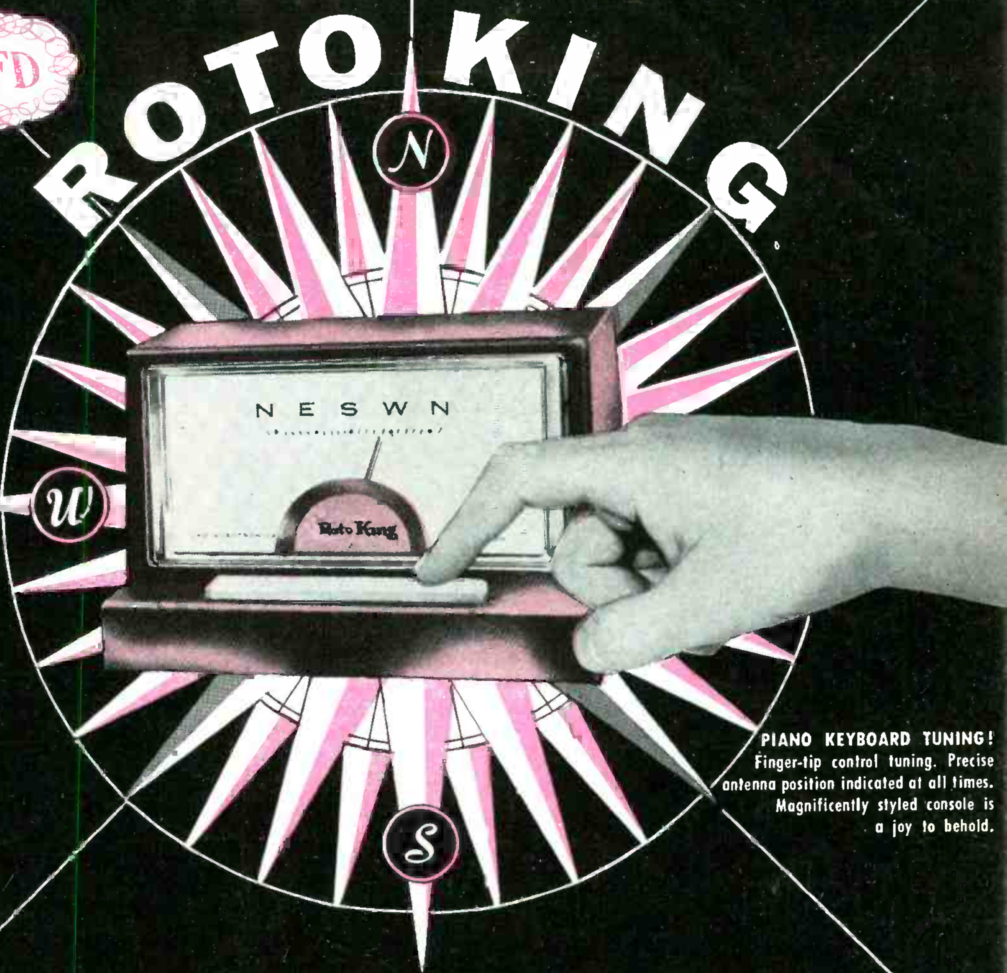

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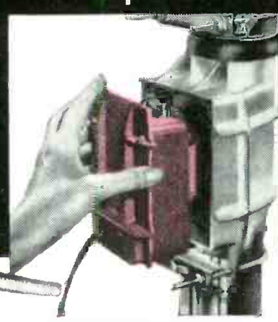

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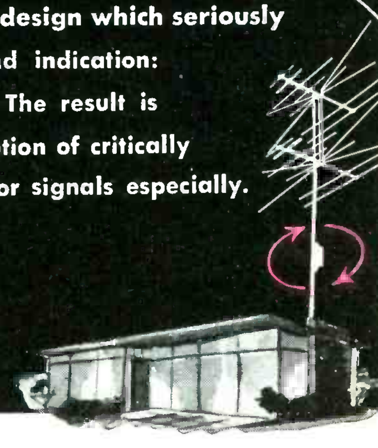

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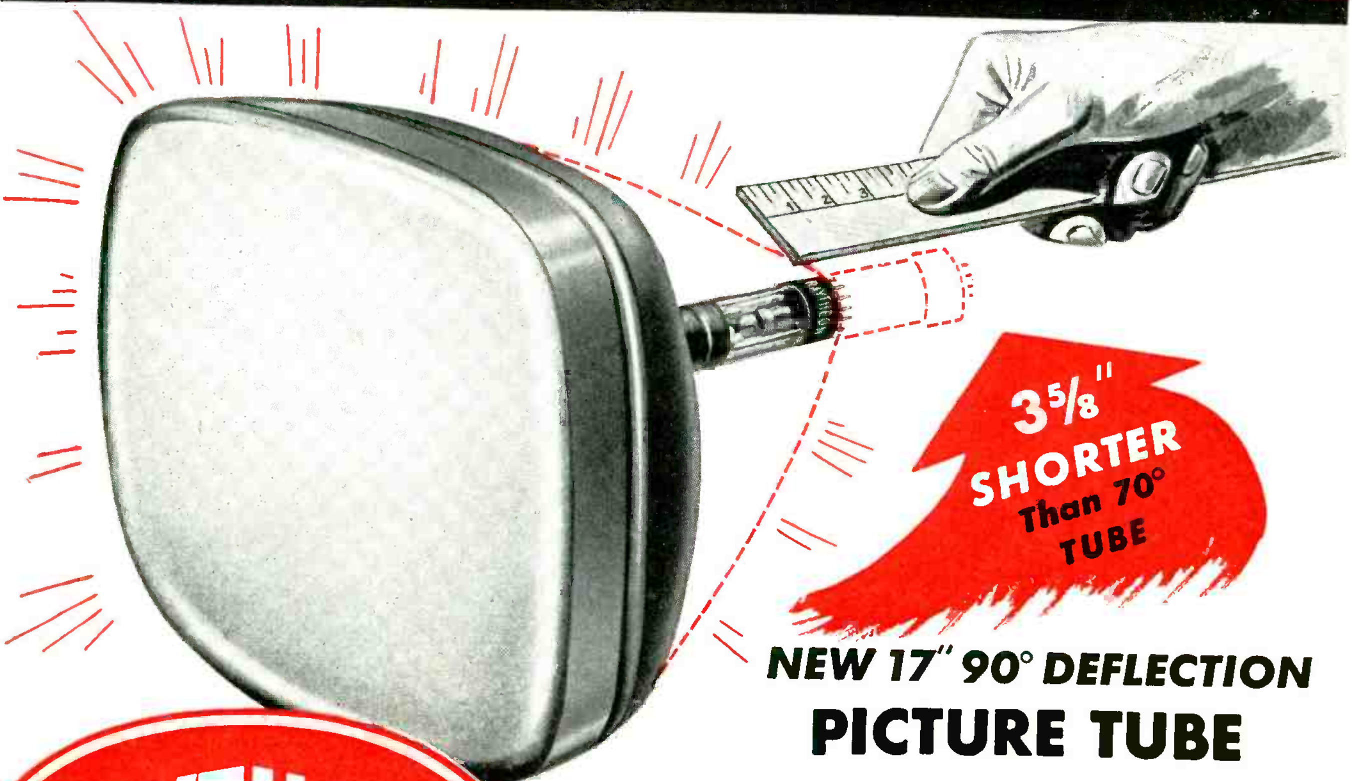

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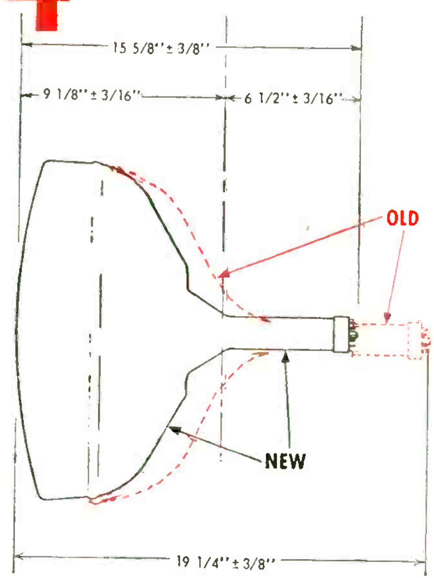

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SWEEP GENERATOR by RCP

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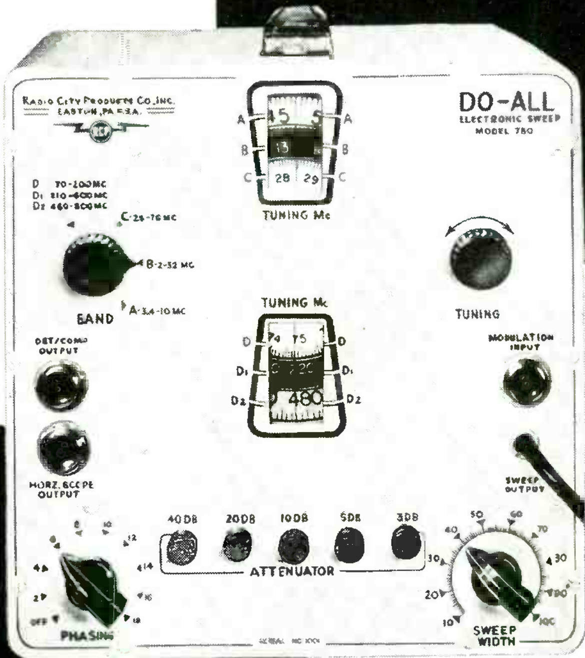

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Sweep Linearity: Exceptional high degree of linearity not possibly obtainable in mechanical sweeps.

Band	Linearity Sweep Width Within 2 DB	Linearity Sweep Width Within 4 DB
A	0- 8 mc	Max. 15 mc
B	0-10 mc	Max. 25 mc
C	0-10 mc	Max. 22 mc
D	0- 8 mc @ 70 mc	Max. 25 mc
	0- 20 mc @ 200 mc	Max. 30 mc

RCP

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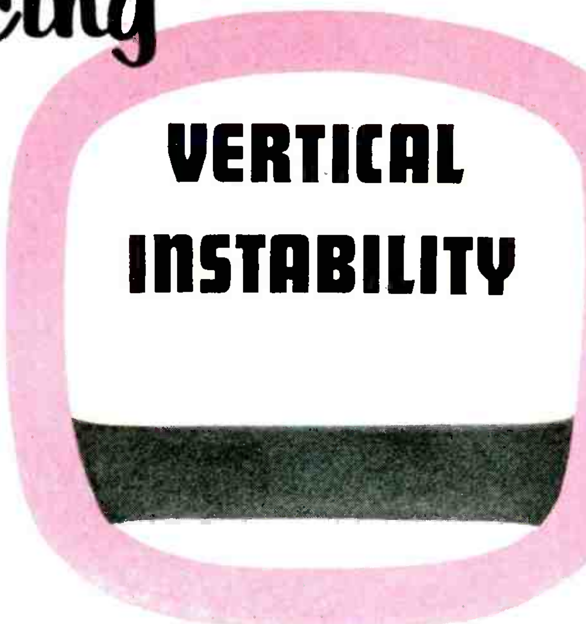
Servicing VERTICAL INSTABILITY



by **Steve Travis**

ONE of the compensations of television servicing is that the symptom shown in the picture tube most often reveals the defective circuit. However this premise may be a faulty one if followed blindly. This is particularly true in the case of vertical instability which generally takes on the following forms:

1—Picture locks but is very touchy
2—Picture locks but is out of frame
3—Vertical jitter
4—Any of the above plus excessive contrast

It is very tempting to interpret the above symptoms as being caused by a defect in the vertical oscillator circuit. However, it will be generally found that most vertical sync troubles do not originate in the vertical oscillator circuit proper, but rather in the many circuits that precede the oscillator.

Sync Compression

The most common cause of vertical instability is sync compression which may be better understood from the following discussion. When the composite video signal is formed at the transmitter, the sync pulses occupy 25% of the upper portion of the signal as shown in *Fig. 1*.

When the composite video signal is reproduced at the receiver it must be a complete duplicate, in every way, of the signal formed at the transmitter. In certain types of troubles that may occur in the receiver, the amplitude of the sync pulse will be reduced while the video signal amplitude will remain constant or may even become greater. A reduced sync pulse is shown in *Fig. 2*. From this figure it can be seen that the video signal now occupies 90% of the amplitude and the sync only 10%. The lowered sync level is referred to as sync compression.

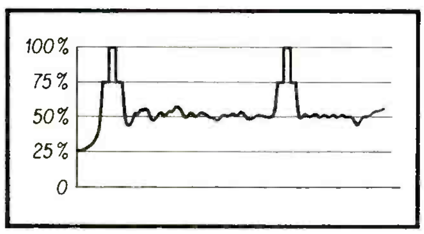


Fig. 1 — Normal signal

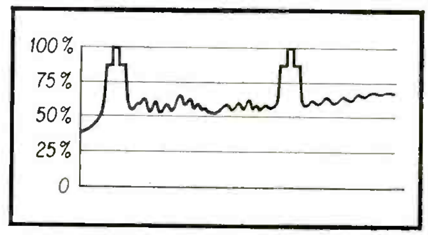


Fig. 2 — Sync. compressed.

Sync compression can occur in any stage through which the composite video signal passes. This includes the:

1—*RF* stage
2—*IF* stage
3—Video detector
4—Video amplifier

Sync compression in these stages may be caused by any of the following:

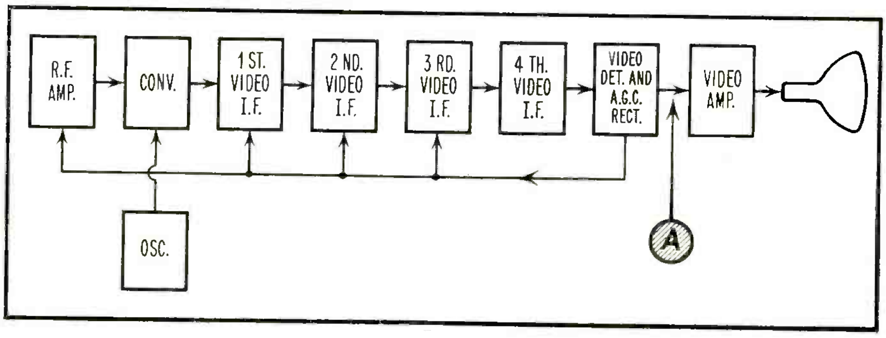


Fig. 3 — Block diagram of sync check at video detector output.

1—Defective tubes
2—Defective *agc* system
3—Defective components causing non-linear amplification

Except for excessive contrast the same symptoms indicated in the first paragraph may develop from defects in the sync circuits themselves. Although not referred to in the category of sync compression we will cover service procedures for these conditions as well.

Since the sync pulses affected are both horizontal and vertical it may be asked why sync compression does not generally result in severe horizontal instability. This is because of the stabilizing effect of the horizontal *afc* circuit. In most cases, if horizontal instability does occur due to sync compression, it may appear as a horizontal pull.

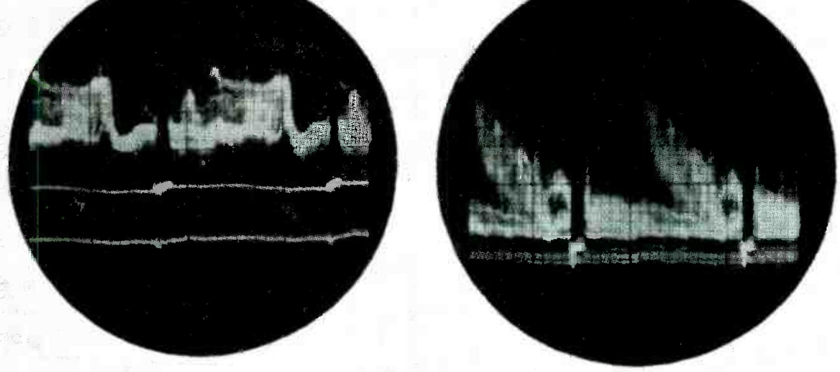


Fig. 4 — (A) Proper and (B) Improper waveforms at video detector output. (B) indicates sync compression in video signal.

Service Procedure

The prime objective in trouble shooting is first to isolate the defective stage and then to isolate the defective part within that stage. The first component that should be checked is the tube, and that by substitution only. Care must be taken in this procedure to change *all* the tubes of the complete section suspected. If, for example, more than one *if* amplifier tube is gassy it may be overlooked in a substitution process in which only *one* tube at a time is replaced. When the tubes of a particular section have been eliminated as the possible source of trouble, we can then proceed to eliminate other components in the suspected stage.

Key Test Points

A key test point for checking sync operation is the video detector output designated as point *A* in *Figs.* 3 and 5. By using an oscilloscope we can observe the composite video signal at this point. If there is no sign of sync compression at this point we may then proceed to check the video amplifier and sync circuits. Proper and improper wave forms are shown in *Fig. 4A* and *B*, *Fig. 4B* indicating compression. The oscilloscope should be adjusted to show at least two vertical fields. If there is any indication of sync compression shown on the scope then the cause must be located somewhere between point *A* and the *rf* amplifier.

Faults may be isolated by two methods. If the serviceman owns a crystal detector probe, he should connect it to the vertical input terminals of the oscilloscope. This now enables him to check the composite video waveform at any point on the *if* strip. The test procedure is from the last *if* amplifier back to the *rf* stage. If the waveform at the plate of any stage shows compression, and the input does not, the stage being checked is defective. A voltage or resistance analysis will most often show up the offending part.

If the equipment mentioned in the previous paragraph is not available a second method of attack may be employed. This is a straight voltage analysis from the last *if* amplifier to the antenna. When making this voltage analysis special attention should be paid to the control grid readings. The actual value of voltage to be read at the control grid is determined by the strength of the incoming signal and the condition of the *agc* circuit. Therefore the value of control grid voltage obtained may vary somewhat from published figures. A rule of the thumb range is between −2 to −6 volts.

Grid Current

Voltage is not the only quantity to be checked. Of equal importance is the absence or presence of grid current. If grid current flows in the *rf* or *if* tubes an inevitable result will be sync compression. This can be checked by measuring the output voltage of the *agc* rectifier at point *B* in Fig. 5.

This voltage will normally be pro-

[Continued on page 61]

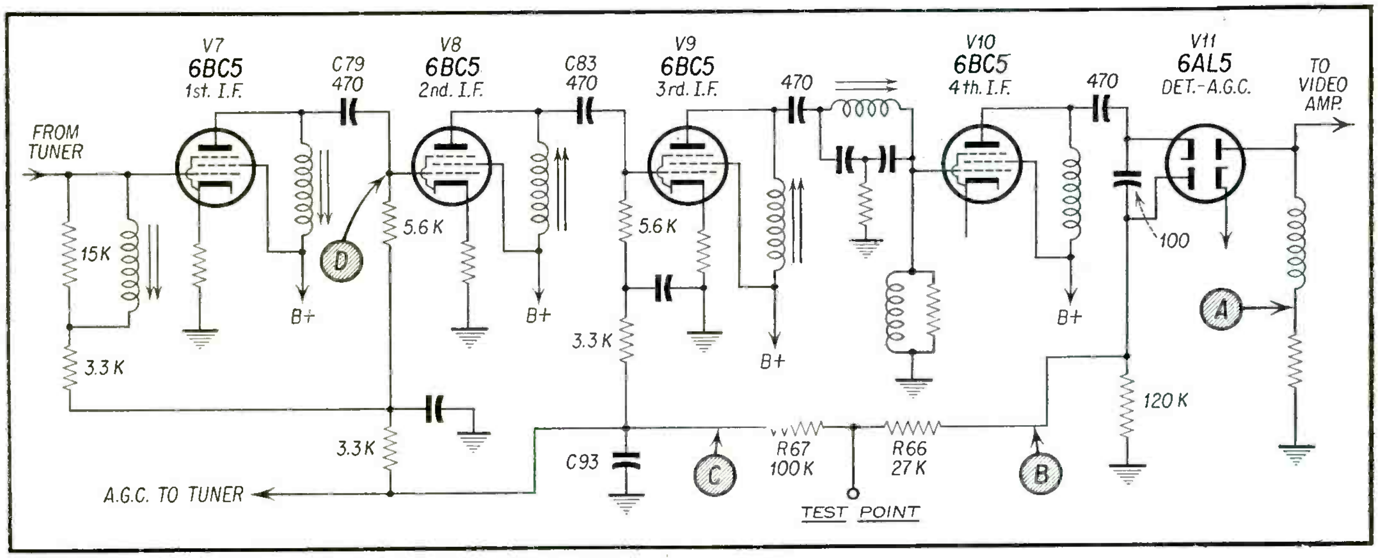


Fig. 5 — Typical video detector, *agc* rectifier and vertical instability distribution circuit.

HEAR THE DIFFERENCE!

Based on the famous University model WLC Theater System used so successfully and extensively in deluxe stadium and outdoor theater installations . . . auditoriums, expositions, concert malls and other important applications where only the highest quality equipment is acceptable—University engineers now bring you a smaller, compact version—the BLC—for general application in public address work. The BLC is the New standard for both voice and music, indoors and outdoors. The BLC is now yours, at the low *low* price of

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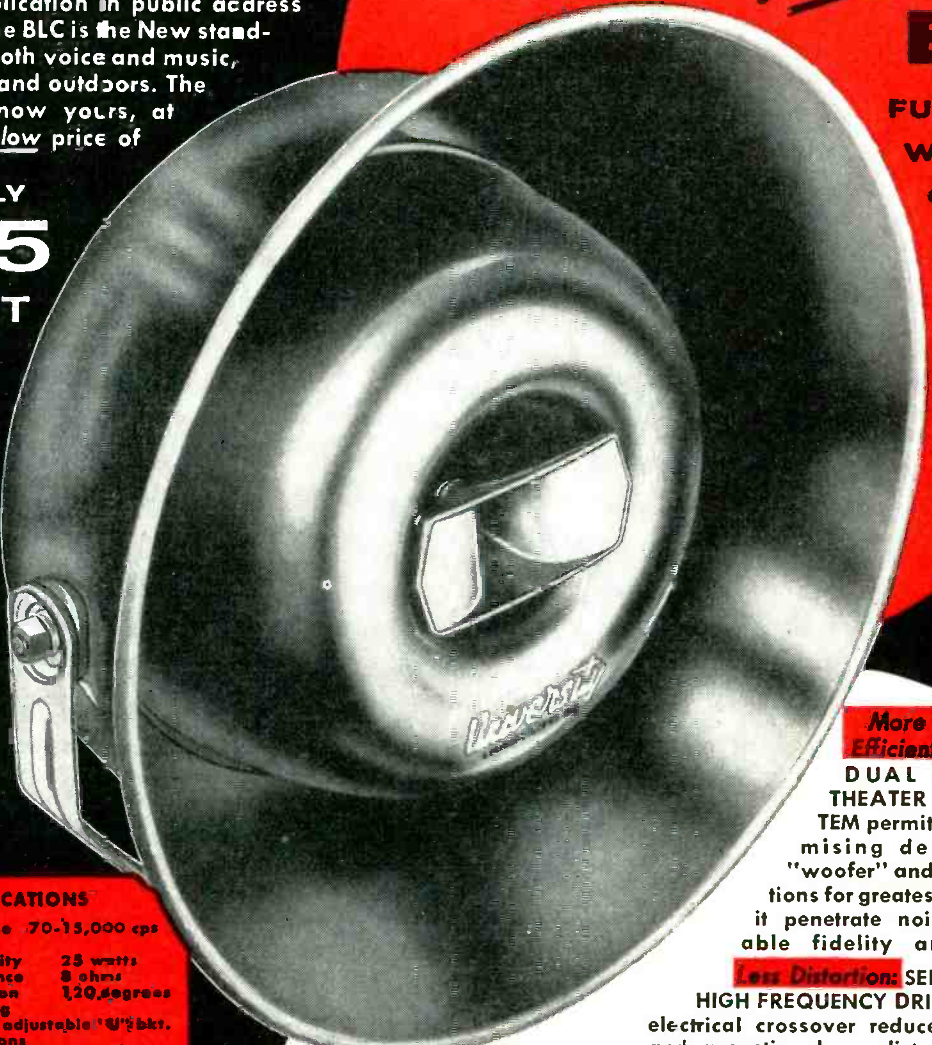
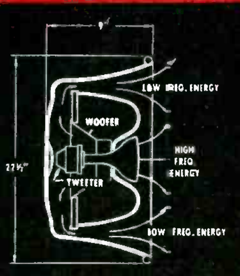
MAKE *Every* P.A. A HI-FI INSTALLATION WITH THE *New* MODEL BLC

FULL RANGE WEATHERPROOF COAXIAL SPEAKER



SPECIFICATIONS

Response	70-15,000 cps
Power Capacity	25 watts
Impedance	8 ohms
Dispersion	120 degrees
Mounting	180° adjustable "U" bkt.
Dimensions	22½" diameter, 9" depth



Ask your distributor for a convincing demonstration, and HEAR THE DIFFERENCE!

More Efficient: DUAL RANGE THEATER TYPE SYSTEM permits uncompromising design of the "woofer" and "tweeter" sections for greatest efficiency. Hear it penetrate noise with remarkable fidelity and intelligibility.

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Better Lows: BALANCED "COMPRESSION" TYPE FOLDED HORN, starting with eight inch throat and energized by top quality low frequency "woofer" driver provides more lows than other bulky designs.

Better Highs: DRIVER UNIT TWEETER with exclusive patented "reciprocating flares" wide angle horn transmits more highs with greater uniformity . . . high frequency response that you can *hear!*

More Compact: EXCLUSIVE WEATHERPROOF DUAL RANGE COAXIAL DESIGN eliminates wasted space. Depth of BLC is only 9"; can be mounted anywhere, even flush with wall or ceiling.

More Dependable: EXPERIENCED MECHANICAL ENGINEERING AND CAREFUL ELECTRICAL DESIGN meet the challenge of diversified application and environmental hazards. Rugged, and conservatively rated—you can *rely* on the BLC.

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is a service man's dream!

"No more groping and twisting"

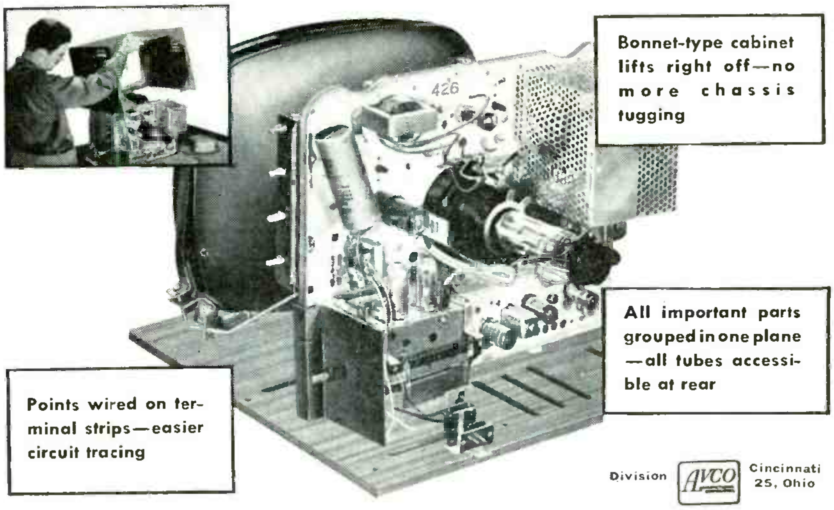
"Entire chassis accessible for service"

Just look at what service men say!

"By removing the cabinet back, every tube is right in front of one's eyes. No more groping and twisting to relocate tube-socket pins. The separate diagram showing the actual filament wiring makes the search for an open filament a matter of seconds."
L. B. Hallberg, *Hardware Products Co., Sterling, Ill.*

"The Crosley Super-V is a service man's dream; the new vertical chassis allows the changing of tubes in a few minutes. When service of a more complicated nature is required, the cabinet can be removed by loosening 6 screws; this leaves the entire chassis accessible for service."
Roy R. Thompson, *Saginaw Distributors, Inc., Saginaw, Mich.*

Just look inside a Super-V!



Division AVCO Cincinnati 25, Ohio

Crosley gives you more for your money!

Block Diagram Analysis of COLOR TRANSMISSION and RECEPTION

by **BOB DARGAN and SAM MARSHALL**

From a forthcoming book entitled *"Fundamentals of Color Television."*

Part 2

AT this point it would be advisable to discuss the luminance signal, E_Y in somewhat greater detail. The maximum luminance signal of a television scene corresponds to the brightest white area in the field of vision of an observer. The minimum luminance signal corresponds to black.

As indicated in Chapter I, the luminance signal is made up of definite proportions or percentages of the red, green, and blue signals, these being:

$E_Y = .3\ E_R + .59\ E_G + .11\ E_B$ (II-1)

These percentages describe the manner in which the individual colors give rise to the sensation of brightness. Thus, green contributes 59%, to the brightness sensation, red 30%, and blue 11%. Mixing these colors in the percentages stated above results in the sensation of colorless light ranging from a bright white to dark gray depending on how much light is present.

As an example, let us consider the case where a color camera is scanning a peak white scene. According to NTSC specifications equal and maximum primary color signal values appear at the outputs of the three color camera tubes. For a black and white tube to reproduce this sensation of white, the signals would have to be connected to a signal mixing network, called a "matrix," so that the final color signal outputs are produced in the following ratio:

30% red, 59% green, 11% blue.

This is illustrated in *Fig. 8A* where a maximum white signal produces amplitude as well as percentage ratios of 30, 59 and 11.

Now, if a darker scene is scanned, such as 50% gray, as in *Fig. 8B*, the camera voltage outputs will be reduced in each case to ½ the original value; but the same *ratio* of color signals will appear at the output of the matrix, that is:

30% red, 59% green, 11% blue.

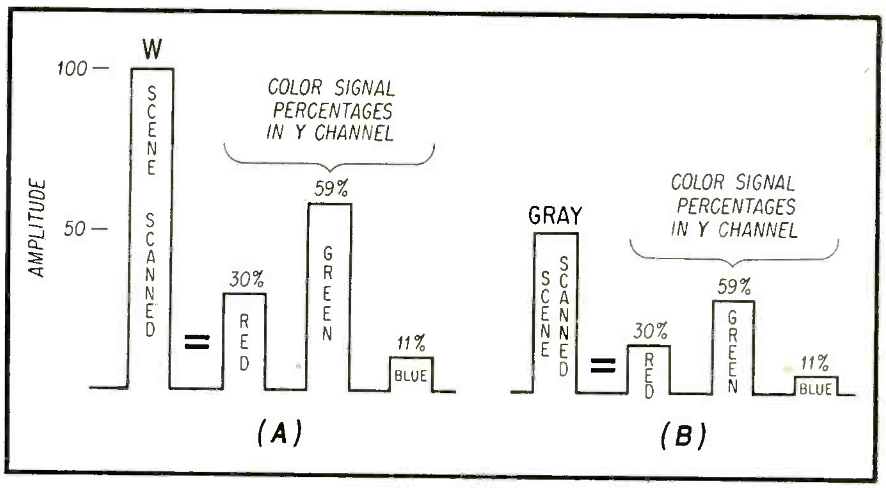


Fig. 8—In (A) 100% white signal scene produces following color signal amplitudes and percentages in Y channel:
Amplitudes: Red-30, Green-59, Blue-11.
Percentages: Red-30%, Green-59%, Blue-11%.
In (B) 50% luminance or gray signal produces following color signal amplitudes and percentages in Y channel:
Amplitudes: Red-15, Green-29.5, Blue-5.05.
Percentages: Red-30%, Green-59%, Blue-11%.
Thus it should be evident that the color signal percentages in a monochrome (white or gray) scene remain constant; what differentiates one monochrome scene from another, that is, white from gray, are the relative amplitudes of the component colors in both scenes.

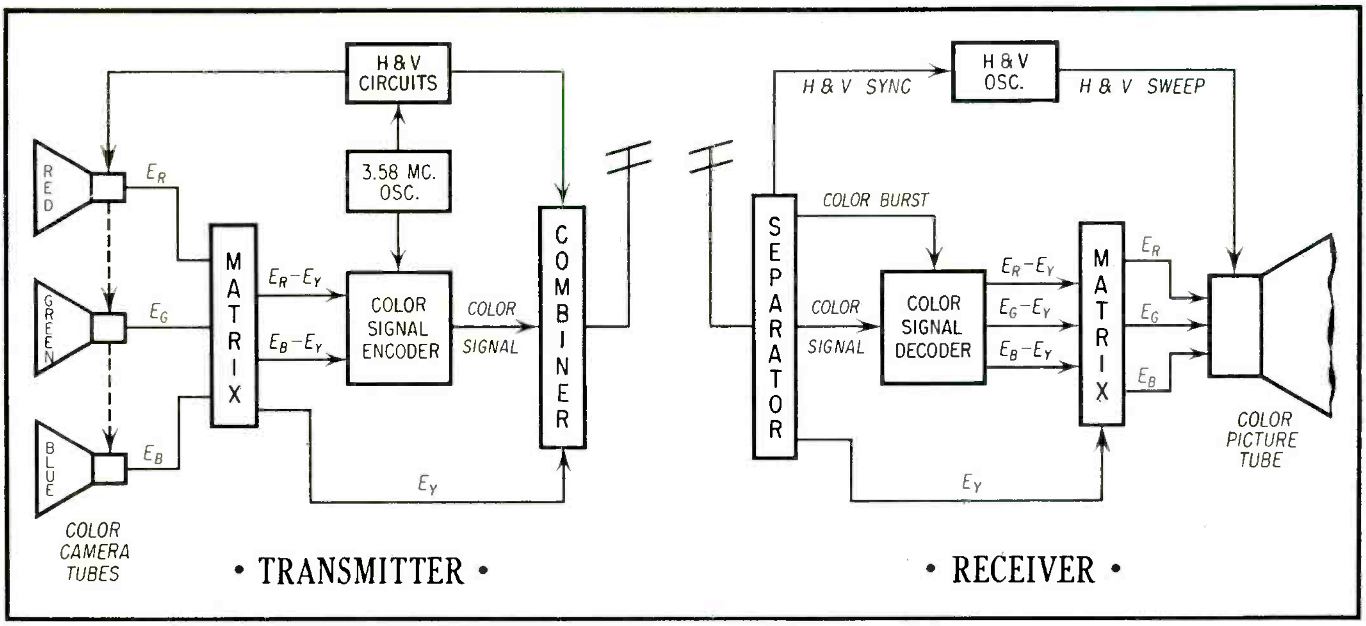


Fig. 9—Block diagram of color TV system with color-difference signals added.

Color-Difference Signals

We are now ready to find out how the primary color signals leaving the outputs of the color camera tubes are processed so that ultimately two signals are made available for transmission. These are a brightness signal containing the luminance information; and a color signal containing information relative to the hue and saturation of the spot being scanned.

Referring to *Fig. 9* we will observe that the three color voltage outputs of the camera tubes are fed into a matrix in the first color signal processing operation we are concerned with. This signal processing involves subtracting E_Y or the luminance signal from the red color signal and the blue color signal.

Symbolically, by subtracting the Y signal from the red color signal, we obtain:

$$E_{RED} - E_Y \text{ or } E_R - E_Y$$

This expression is referred to as the red "color-difference" signal. Similarly, the blue color-difference signal can be represented as:

$$E_B - E_Y$$

Notice that E_Y is brought out as a separate signal from one point on the matrix, $E_R - E_Y$ from another point, and $E_B - E_Y$ from a third point, By properly proportioning the matrix values, the E_Y signal may be made to have the percentages shown in equation II-1.

The red color-difference signal, $E_R - E_Y$, therefore is made up as follows:

$$E_R - E_Y = E_R - (.3E_R + .59E_G + .11E_B)$$
$$= .7E_R - .59E_G - .11E_B \qquad \text{(II-2)}$$

Notice that negative signal values are indicated in equation II-2. These negative values simply mean that the polarity of the color signal referred to is inverted. Negative signals may be obtained by suitable phase inverting circuits about which additional details will be given in another chapter.

The blue color-difference signal developed at the output of the matrix is shown as $E_B - E_Y$, and has the following color signal makeup:

$$E_B - E_Y = E_B - (.3E_R + .59E_G + .11E_B)$$
$$= .89E_B - .3E_R - .59E_G \qquad \text{(II-3)}$$

Thus, by proper matrixing we convert the three primary color signals into a luminance signal E_Y, and two color-difference signals $E_R - E_Y$ and $E_B - E_Y$.

A question that might be asked at this point is why isn't a green color-difference signal also developed. The answer is that it is not necessary to do so in the transmitter inasmuch as this signal may be derived at the receiver by suitable matrixing of the $E_R - E_Y$ and $E_B - E_Y$ signals. Since the latter signals already contain values of E_G as shown in equations II-1, II-2, and II-3 by suitable additions and subtractions the $E_G - E_Y$ signal is obtained. This operation will shortly be illustrated.

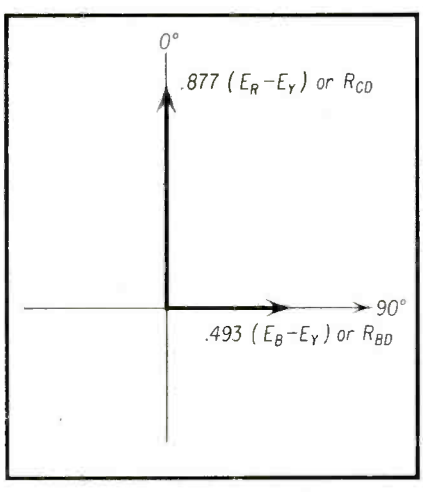


Fig. 10A—Phase relations between color difference signals after modulation of sub-carriers. Assume the E_R E_Y axis to be the zero degree reference axis.

The real significance of these new color signals is that we have reduced the *color* information to be transmitted from three primary color signals to a Y signal and two color-difference signals. Exactly how the color-difference signals are transmitted will shortly be explained. First let us see how the color-difference signals are processed at the transmitter, then at the receiver; and then how eventually the original red, green, and blue color signals are reestablished.

A comparison between the transmitter sections of *Figs. 6* and *9* will reveal that except for the creation of the color-difference signals, *Fig. 9* is the same as *Fig. 6*. Observe that E_R, E_G, and E_B enter a matrix where E_Y and the color-difference signals are formed. E_Y, the complete luminance signal enters the combiner preparatory to becoming part of the composite video signal. $E_R - E_Y$ and $E_B - E_Y$ enter a new color encoder where in combination with the 3.58 *mc* subcarrier a single color signal is formed. As in *Fig. 6*, this color signal combines with the Y signal and the sync signal to form the composite video signal.

At the receiver, (*Fig. 9*), the color-difference signals may be used to recover the original E_R, E_G and E_B signals. For instance, to recover E_R we simply add E_Y to the red color-difference signal in a suitable matrix and obtain:

$$(E_R - E_Y) + E_Y = E_R \qquad \text{(II-4)}$$

To recover E_B we simply add E_Y to

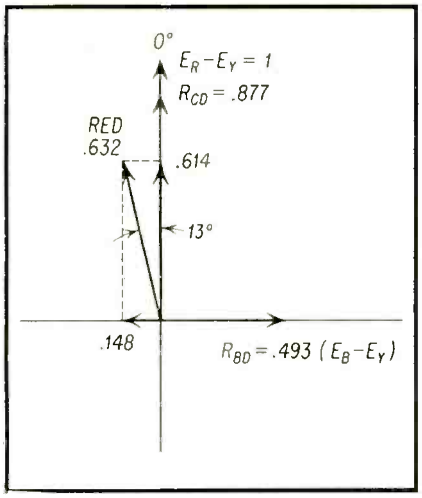


Fig. 10B—Relative values of color difference signals developed as a result of pure red signal. Phase displacement of red signal is 13°. Relative amplitude is .632.

the blue color-difference signal and obtain:

$$(E_B - E_Y) + E_Y = E_B \qquad \text{(II-5)}$$

To recover E_G we add E_Y to the green color difference signal and obtain:

$$(E_G - E_Y) + E_Y = E_G \qquad \text{(II-6)}$$

It was originally stated that E_G is obtained at the receiver, by combining $E_R - E_Y$ and $E_B - E_Y$. We will now see how this is done. It can be shown (See proof of Equation II-7 below) that:

$$E_G - E_Y = \frac{-30}{59}\left(E_R - E_Y\right)\frac{-11}{59}\left(E_B - E_Y\right) \qquad \text{(II-7)}$$

Thus, if in the decoder we adjust our circuit components to obtain the above negative signals in the fractions or percentages shown, $E_G - E_Y$ may be obtained.

To summarize this section up to this point, we have shown how the original color signals are converted at the transmitter matrix into a Y or luminance signal and two color-difference signals. At the receiver the color-difference signals are mixed in a matrix to reproduce the original E_R, E_G, and E_B color signals. Although the green color difference signal is not developed as a separate signal in the transmitter, in the receiver it may be obtained by proper matrixing of the $E_R - E_Y$ and $E_B - E_Y$ signals.

Comparing *Fig. 9* with *Fig. 6*, no change was made in the block diagram other than to remove the color-difference signals from the encoder and decoder and to treat them in separate sections.

Equation II-7 may be proved by expanding the right side as follows:

$$E_G - E_Y = \frac{-30}{59}(E_R - E_Y) - \frac{11}{59}(E_B - E_Y)$$

$$= -.51\,(E_R - E_Y) - .19\,(E_B - E_Y) \qquad (2)$$

$$= -.51\,E_R + .51\,E_Y - .19\,E_B + .19\,E_Y \qquad (3)$$

Collecting terms

$$= -.51\,E_R - .19\,E_B + .70\,E_Y \qquad (4)$$

Expanding E_Y

$$= -.51\,E_R - .19\,E_B + .7\,(.3\,E_R + .59\,E_G + .11\,E_B) \qquad (5)$$

$$= -.51\,E_R - .19\,E_B + .21\,E_R + .413\,E_G + .077\,E_B \qquad (6)$$

Collecting terms

$$= -.3\,E_R - .11\,E_B + .41\,E_G \qquad (7)$$

$.41\,E_G$ may be written as:

$$.41\,E_G = -.59\,E_G + E_G \qquad (8)$$

Substituting: (8) in (7)

$$= -.3\,E_R - .11\,E_B - .59\,E_G + E_G \qquad (9)$$

(The first three terms above are equal to −Y, therefore)

$$E_G - E_Y = E_G - E_Y$$

Thus, the right side of equation II-7 is identical with the left side, and equation II-7 is proved correct.

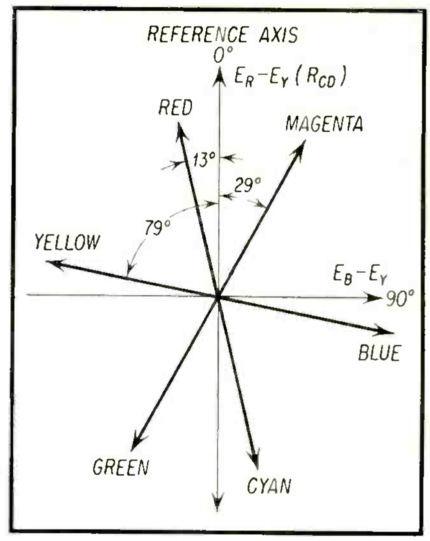


Fig. 11—Phase displacements of various color signals with respect to E_R-E_Y axis.

Reduced Color Difference Signals

We are now ready to go one step further in our analysis of the color system, that is, the development of a new set of color signals directly related to the previous color-difference signals. These new color signals are necessary to the operation of the NTSC color system.

Ordinarily the original color-difference signals as developed could be used to modulate the color subcarrier. However, it has been found that the color portion of the composite signal may cause overmodulation at certain color signals on maximum signal amplitudes. To prevent this overmodulation the color-difference signals are attenuated so that the new value of the red color difference signal which we shall call R_{CD} is:

$$R_{CD} = .877\,(E_R - E_Y) \qquad \text{(11-8)}$$

In like fashion the new value of the blue color difference signal which we shall call B_{CD} is:

$$B_{CD} = .493\,(E_B - E_Y) \qquad \text{(11-9)}$$

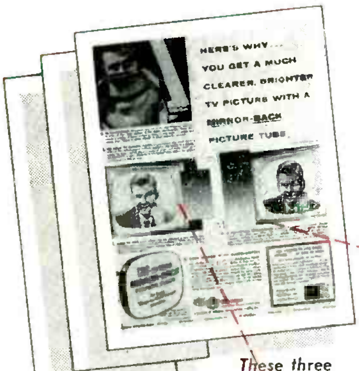
It might be pointed out that even with the above reduced color-difference signal values a certain amount of overmodulation could be produced if the scene scanned contains highly-saturated colors. This possibility is so unlikely that it can safely be assumed that no trouble will arise from over-modulation of this type. Of course the color-difference signal could be further compressed to eliminate the possibility of any overmodulation. However, doing this would result in a serious reduction of the signal to noise performance of the color channel.

Color Signal Phase Relations

The new color-difference signals R_{CD}

[*Continued on page 62*]

Now, TV set owners can understand benefits of Aluminized Tubes!

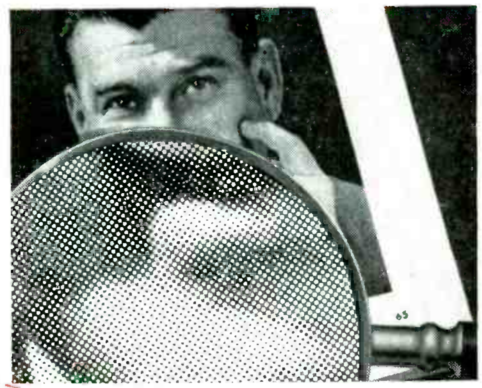


These three advertisements will appear in POST this fall.

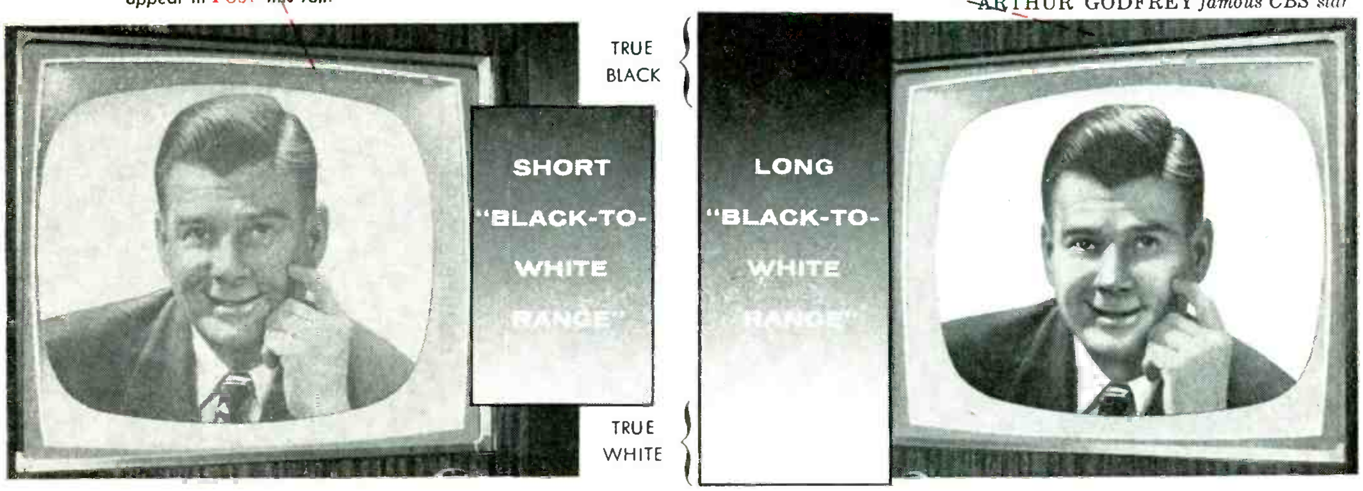
THESE ADVERTISEMENTS IN POST EXPLAIN THAT:

1. **IN MAGAZINES,** *the pictures* you see (when magnified) are made by a series of tiny dots applied to the paper *mechanically*.

ON YOUR TV SCREEN, *the pictures* are also made by a series of dots (which appear as lines) applied *electronically*. These dots, in both cases, create a variety of tones including black, a range of grays, and white. BUT, it is the LENGTH of this "Black-to-White Range" (the gray scale) that makes the picture excellent, good, fair, or poor.



ARTHUR GODFREY *famous CBS star*



2. **ORDINARY PICTURE TUBES** used in most TV sets made before 1953 produce a *short* "Black-to-White Range." While the picture is good, the picture tube cannot develop enough *light output* for a *long* "Black-to-White Range."

3. **CBS-HYTRON MIRROR-BACK TUBES** produce up to *twice the light output* of ordinary picture tubes. Like the silver backing on a mirror, the *shiny* aluminum backing on a Mirror-Back tube reflects to the viewer *all the light* on the screen. The resulting increased brightness and reduced halation (unwanted spreading of light from one dot to another) is *essential* to give you a *long* "Black-to-White Range." The full range you *must* have for the clearest, sharpest, brightest pictures that are a joy to watch.

TALK LONG "BLACK-TO-WHITE RANGE" PICTURES ...SELL BIGGER-PROFIT

CBS-HYTRON MIRROR-BACK PICTURE TUBES

Talk . . . demonstrate . . . and sell "Long-Black-to-White-Range" clearer, sharper, brighter pictures. It's easier to sell premium-grade, brand-new CBS-Hytron Mirror-Backs . . . with their controlled quality and dependable full-year guarantee. Profit more. Tie in with POST. Get this Mirror-Back Promotion Kit . . . from your CBS-Hytron distributor, or mail coupon.

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I enclose 25¢ for postage and handling.

I want ...... more consumer self-mailers at 1¢ each, for which I enclose an additional $........

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City .... State ....

ASSOCIATION NEWS

NETSDA—New York

Activity for the fall season was initiated by delegates representing Radio and TV Service Dealers and Technicians Associations from Pennsylvania, New Jersey and New York, at a meeting Aug. 29 of the National Electronic Technicians and Service Dealers Associations, in New York. Provisions were made for incorporation as a non profit Corporation and officers were elected to hold office until the annual meeting in January. Committees were appointed to work on and develop the scope and activity of NETSDA. A definite program toward exchange of ideas and liaison between all associations was an important committee activity.

ARTS—Chicago

A series of nine talks on Color Television to be given by experts in the field of TV manufacturing and servicing is to be sponsored by the Associated Radio and TV Servicemen. The schedule, from October through January, will cover Color transmission, construction and development of tube, the CBS planar mask tube, and colorimetry. The second phase of lecture will begin at the end of January, 1955, and will involve circuitry, design problems, repair problems, and color vs. B&W operation.

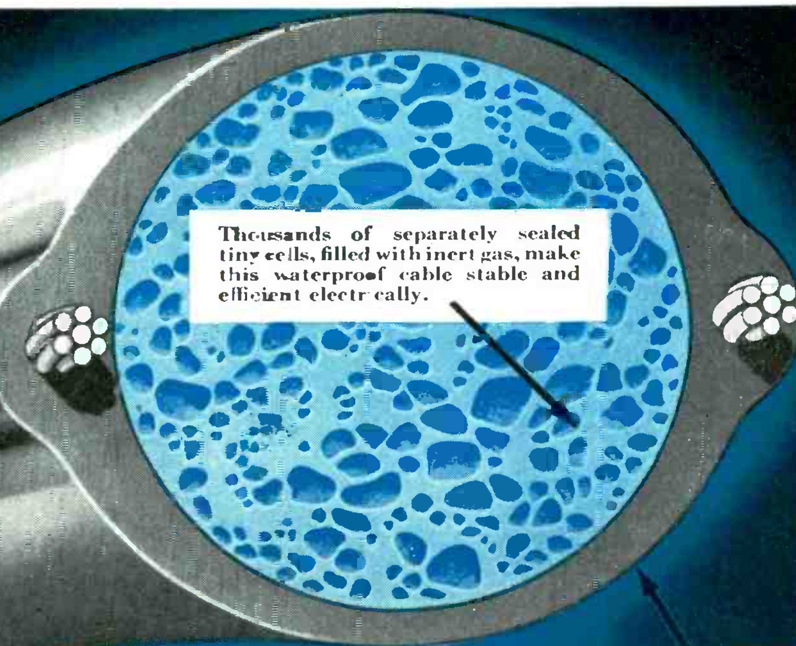
TEA—Fort Worth, Texas

The Radio and Television Service Clinic and Electronics Fair, held annually under the sponsorship of the Texas Electronics Assn., Inc., was presented at the Adolphus hotel in Dallas, during August 27-29, and featured clinical discussions of all facets of the servicing industry—B&W and color servicing techniques, service cost analysis, collections, small claims courts, TVI, public relations, merchandising, service-management relations, and a special comprehensive lecture on color theory. Factories, representatives, and distributors were well represented.

SORRY—Wrong Association

We offer our sincere apologies for the confusion caused by our unfortunate reference in last month's "Association News" to the LIETA "Guild" News. The "Guild" News is not published by LIETA, but by the Radio Television Guild of Long Island, the group which has taken an exemplary step by instituting their effective Public Relations Program.

New UHF & VHF LEAD-IN



ADVANTAGES:

1. Lowest losses at UHF and VHF frequencies.
2. Great abrasion resistance and mechanical strength.
3. No time-consuming end seal required; easy to install.
4. No internal moisture to cause signal loss.
5. No kinking when used with antenna rotors.
6. Resistant to snow, ice, rain, and wind.
7. Resistant to ultraviolet rays from the sun.
8. Uses Belden Weldohm conductor for long conductor life.
9. Can be clamped tightly in stand-off insulators without crushing. No special fittings required.
10. Conductor spacing is constant even when the lead-in is transposed.
11. No stripping problem for attaching the conductor.

...*Cuts* SIGNAL LOSS

This completely new 300-ohm line results from the development of a new cellular plastic core where each separate cell is filled with an inert gas to make an efficient cable with the lowest possible losses at both UHF and VHF frequencies. With this absolutely waterproof cable, no sealing of the ends is necessary. Celluline cable can be fixed in stand-off insulators without crushing. The thick outer wall of polyethylene serves to protect the cable from abrasion and sun damage.

By fusing *only* virgin polyethylene, the wall can be made smooth—absolutely free from rough spots—to prevent the adherence of dust and other impurities which would increase the losses.

The copper-covered steel strands, which make up the conductors, assure 49% greater resistance to breaking from flexing or stretching than any all-copper conductor.

8275 CELLULINE®

TRANSMISSION LINE

by **Belden**

WIREMAKER FOR INDUSTRY

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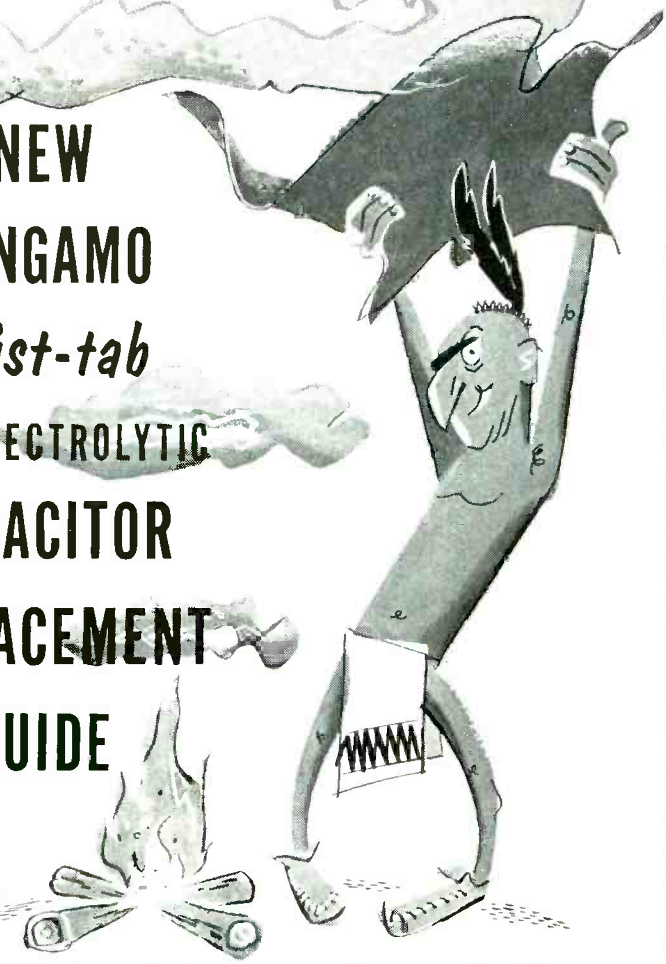

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FROM COAST TO COAST

B-T LABS 'Add-A-Unit'

MODEL CA-1

AUTOMATIC ALL-CHANNEL COMMERCIAL ANTENSIFIER

The Model CA-1 is probably the most popular VHF signal amplifier in the field. In use since 1951, it has weathered every conceivable test of performance and endurance.

The fact is that there are more B-T CA-1 line amplifiers in use today, than any other single make. The reasons are clear. The Model CA-1 performs effectively and reliably. It is economical, and is amazingly simple to install.

These are the important features:

GAIN — 27db (22x)

IMPEDANCE — 75 ohms and 300 ohms at input and output terminals.

CONTROLS — Screw-driver gain control.

TUNING — None . . . automatic all-channel transmission.

INSTALLATION — Ordinary screw terminals. No special tools required.

TUBES — (2) 6J6 and (2) 6BQ7 in cascaded, push-pull circuit.

CABINET — Hammertone gray metal. 8 x 4½ x 5". Weighs 5 lbs.

List Price **$77.50**

. . . and for no-loss distribution of amplified TV signals in multi-set installations, see the

B-T LABS Models DA-2 and DA-8 Distribution Amplifiers.

For Complete Data on VHF-UHF Distribution, write to Dept. YK-7

BLONDER-TONGUE LABORATORIES, INC.
Westfield, New Jersey

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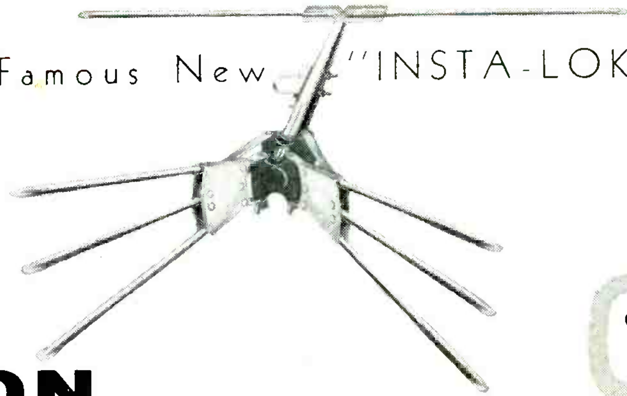
Uses Famous New "INSTA-LOK" Clamp



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2 thru 83

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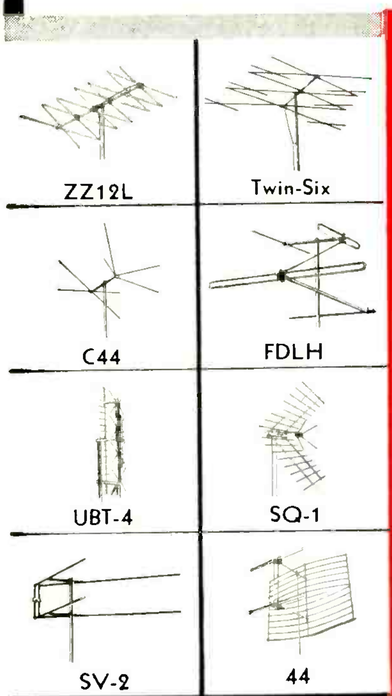

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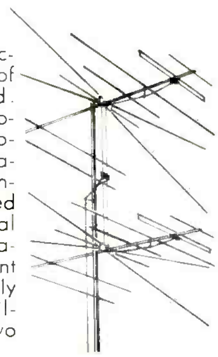

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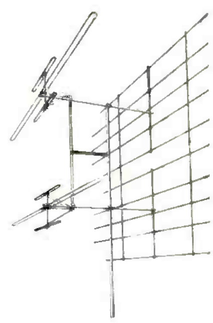

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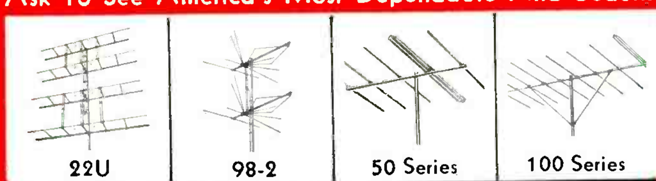

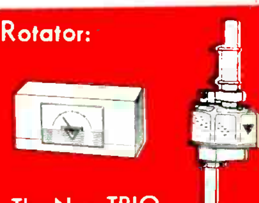

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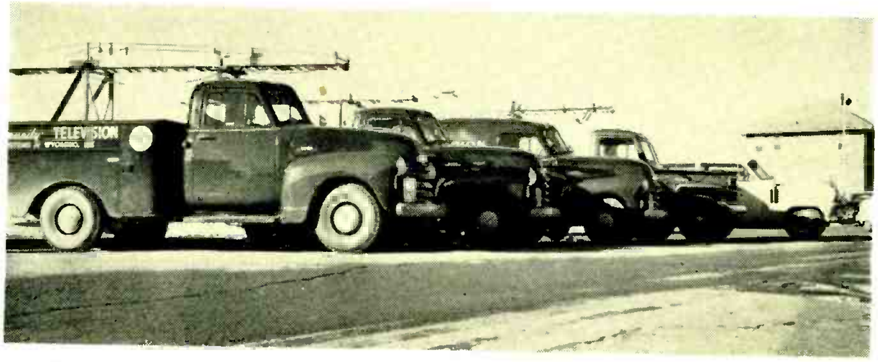


TELEVISION is no longer a stranger in Casper, Wyoming. It will not remain a stranger in many other cities if they follow the example of Casper. How pictures were brought to this prairie city from Denver, Colorado is a study of free-enterprise in operation. The clear, stable picture enjoyed here (almost 300 miles from Denver) is a result of well-planned local investment plus engineering skill and cooperation. Through the enthusiasm and efforts of Bill Daniels, president of the Community Television Systems of Wyoming, Inc. the citizens can receive entertainment from the four major networks carried by Denver television stations.

Mr. Daniels conceived the idea, and with the guidance of T. G. Morrissey, a Denver consultant engineer, presented the plan that was accepted by some thirty local investors. Approximately one year, and a half-million dollars later Casper had television (beginning December 1953). In less than a year there have been 900 subscribers and an anticipated 3000 by January 1955. Equipment and line installations have been made to serve a potential 9000 subscribers.

Management and engineering for Community Television Systems of Wyoming (C.T.S.) are under the capable directions of two brothers, Gene and Richard Schneider. Gene takes care of the business administration and enrollment of new subscribers while Dick supervises the installations and maintains the equipment in peak operating condition. They also were responsible for the installation of the distribution system that carries the signal to all parts of the city.

The Casper signal originates at a mountain location, Crow Creek Hill in Wyoming, some 100 miles from Denver. Here each station (Channels 2, 4, 7, and 9) are picked up and prepared for transmission via microwave link to Casper. An operator is on duty at this location at all times that the Casper viewers are receiving signal. One of his duties is to make the change-over from one station to another in accordance with a program schedule distributed to Casper viewers. Only a single-channel link is employed, consequently, Casper viewers receive a program from only one of the Denver stations. The station to be chosen at Crow Creek Hill for each quarter-hour period is determined by local popularity polls. Viewers set their receivers to Channel 4 while the actual program choice is made at Crow Creek Hill. A typical day's program would be as follows:

Channel numbers indicate the Denver station distributed during time period indicated. Casper receivers are set to Channel 4 for all programs.

The composite video signal from the chosen station at Crow Creek is next supplied to the A.T.&T. Co. This signal (approximately 6000 megacycles) is the mircowaved over a 200-mile path from Crow Creek to Casper. Actually the line of sight distance is only 122 miles but relay link follows an arc path because of terrain conditions (mountains north of Laramie), Fig. 1. Five intermediate booster links are required with the signal finally terminating at the telephone building in Casper. From here the composite video signal is sent via coaxial cable to the control room and offices of the C.T.S. of Wyoming.

Here the signal is amplified and prepared for modulation of a low-powered transmitter (tuned to Channel 4) which feeds the signal to a Jerrold community television distribution system. Program sound is also conveyed over the link and modulates another carrier displaced by 4.5 megacycles from the Channel 4 picture carrier.

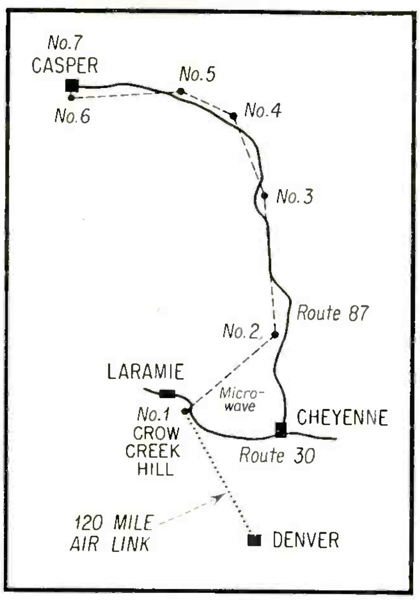
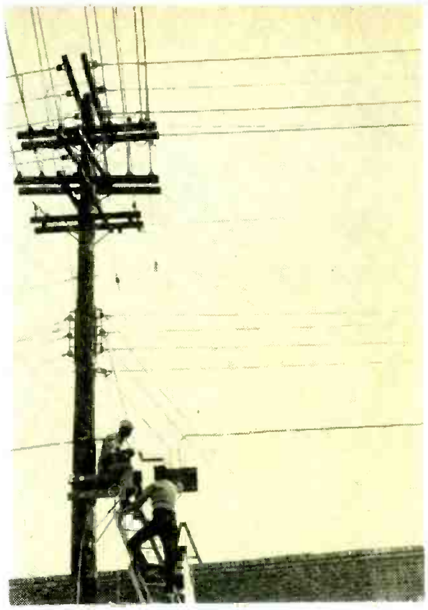


Fig. 1—Air and microwave link from Denver to Casper.

TV System



by **Edward M. Noll**

A well-planned local investment plus engineering skill and cooperation yield a clear, stable, community-wide reception. The complete story of the organization and operation of this service.

Master Receiver and Control Locations

The functional plan of the CTS equipment required at Crow Creek and at Casper is shown in Fig. 2. The Denver stations are picked up on individual Yagi antennas and applied to four quality receivers (individual receiver for each station). Each receiver can be switched to other channels in case of failures or desire to pick up additional channels as they come on the air.

The sound and picture outputs of each receiver are supplied to a switching system that permits a choice of the station signal to be sent to Casper. The video channel through which the signal passes contains a stabilizing amplifier for proper cleaning and shaping of the synchronizing information while the audio channel has gain and limiter circuits for proper setting of program sound levels and peaks.

Elaborate dual monitoring facilities are provided for checking sound levels, picture quality, and waveform fidelity for both the station now "on air" up in Casper as well as to preview the next station to be switched over to the link. An operator is on duty at this location during the 12-hour program period for each day.

At the Casper control center of CTS, video and audio are monitored again before application to Channel 4 signal generator. Sound is passed through another limiter-amplifier and level indicator. A second stabilizing amplifier can also be switched into the video channel when necessary. Picture and sound signals are used to modulate the Channel 4 signal generator that has facilities for proper adjustment of contrast, brightness, and white level of the composite video modulation.

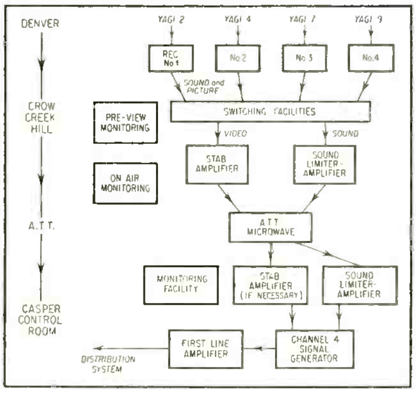


Fig. 2—Community Television system equipment at Crow Creek Hill and Casper.

Distribution System

The Casper distribution system has been installed over the entire city. Main feeder lines fan out from the central location of CTI offices with secondary lines running down the front or back of most every street. Thus, this system can already serve 9000 potential users. Only the drop-offs into individual houses need to be made as new subscribers are obtained.

The central location of the control point permits an efficient arrangement of the main feeder lines so that no single line has more than 11 amplifiers in cascade. When the signal enters the edge of a city (as it does with many community antenna systems) it is more difficult to obtain an ideal feeder arrangement. All lines in the Casper installation are double-shielded, minimizing greatly the radiation problems encountered with the earlier community antenna systems. In fact there has been only one known case of "signal stealing" in the area and that was via a needle pierced through the line.

The Casper subscriber pays $150 to be attached to the line and a rental of $7.50 per month (plus 8% federal tax) to receive his television. We who receive so much television for so little should take note. We are too prone to forget that television affords so much entertainment for so little. Our bouquets should go to the subscribers of Casper who pay more for television, appreciate it more, and realize they still are obtaining an entertainment bargain.

Distribution amplifiers are spaced along the main feeder lines to compensate for cable attenuation, permitting the development of a constant amplitude signal at all points along the distribution system. In fact every third amplifier along each main feeder is a Jerrold automatic gain control amplifier—this type of amplifier retains a constant output despite signal variations, voltage changes, and changes in loading conditions along the feeders. It is the operation of these units that ensures uniformity of performance throughout the system.

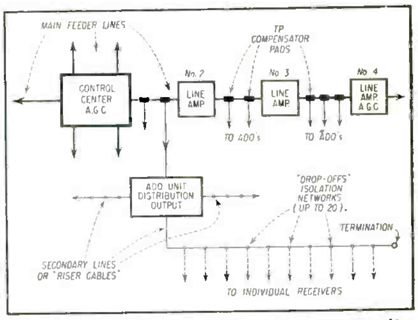


Fig. 3—Basic plan of community distribution system.

At various points along the main feeder lines distribution outlets can be attached via special compensator pads. These compensating pads, *Fig. 3*, prevent interaction between tap-off points along the main feeder and permit application of a constant amplitude signal

[*Continued on page* 56]

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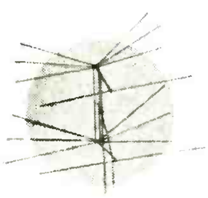

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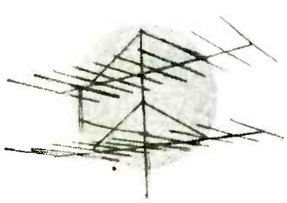
Strong signal pickup on VHF channels 2 through 13 . . . UHF channels 14 through 83 . . . ideal for fringe area reception . . . all-aluminum construction with dowelled elements: Part No. 45-3096-2. Rugged single bay design: Part No. 45-3096.



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10 elements . . . all-aluminum . . . factory pre-assembled. Top performance on channels 2 through 6 . . . 13 db to 15 db gain on various channels. Single bay Part No. 45-3112-2 through 6. Stacked version harness Part No. 45-3267.

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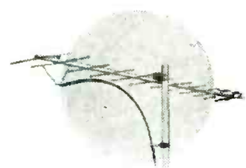

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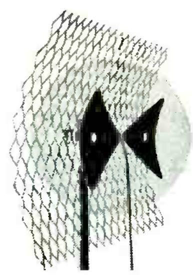

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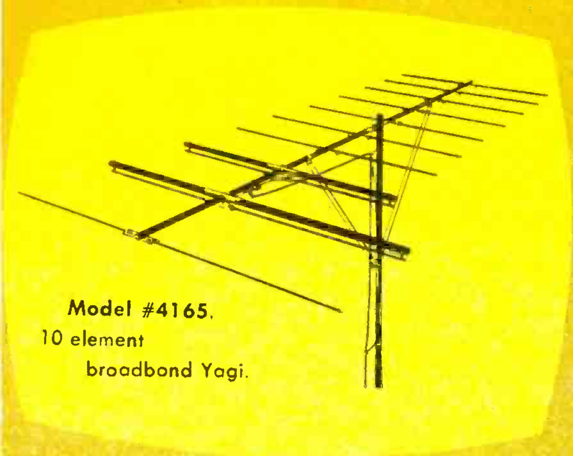

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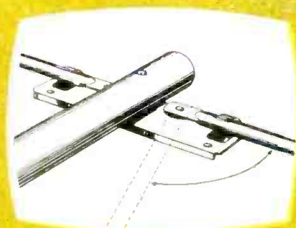

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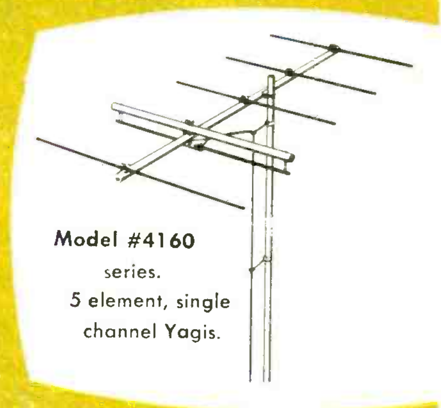

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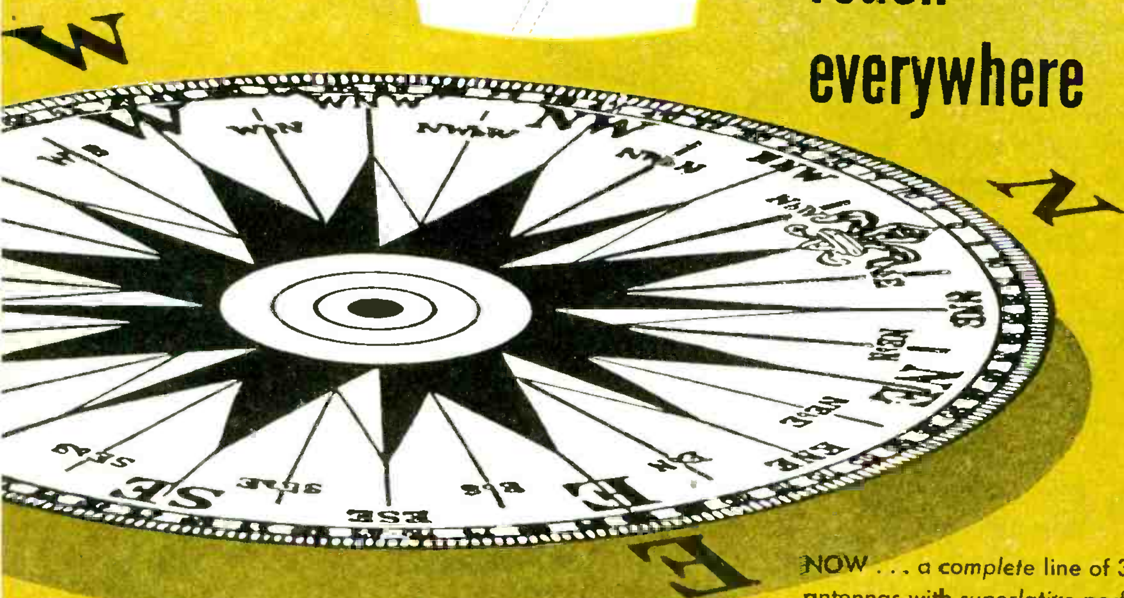

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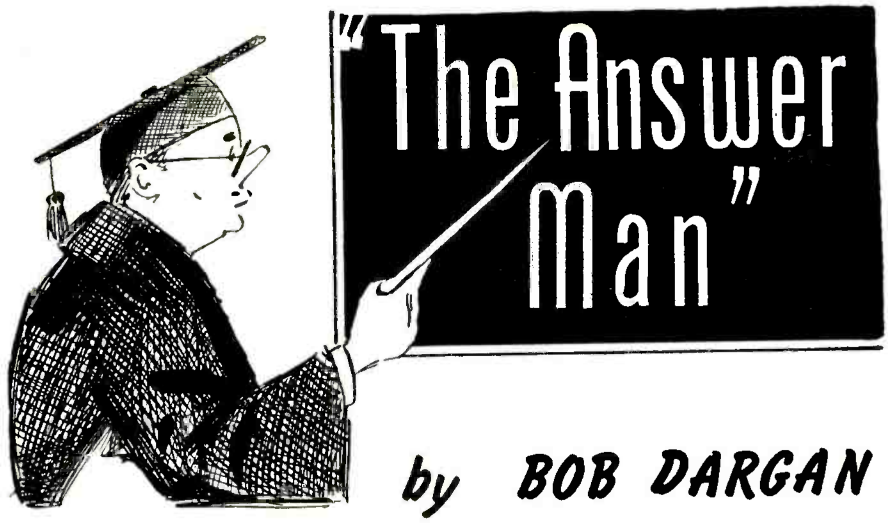


"The Answer Man"

by **BOB DARGAN**

Do you have a vexing problem on the repair of some radio or TV set? If so, send it in to the Answer Man, care of this magazine. All inquiries acknowledged and answered.

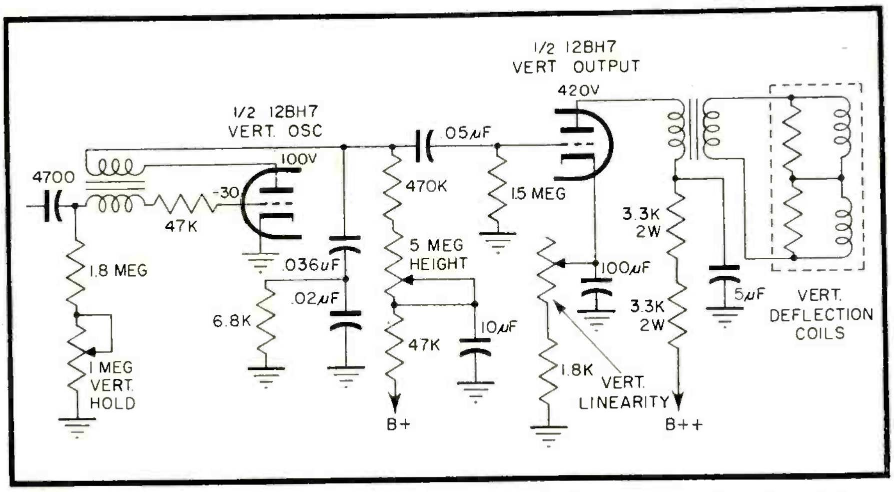


Fig. 1 — Vertical deflection section of the CBS-Columbia Chassis 750-3.

**CBS Columbia Ch. 750-3—
Height Shrinks**

Dear Mr. Answerman:

I have encountered on several occasions vertical deflection troubles that have caused me considerable difficulty in locating. The present case I have in mind, a CBS-Columbia chassis 750-3, is a problem where the height shrinks after a period of about ten to fifteen minutes. The shrinkage amounts to about one inch on the top and bottom and occurs very slowly.

What do you suggest as a recommended procedure in servicing this type of deflection trouble?

N.E.
New Haven, Conn.

Naturally the first step is to substitute the tubes concerned, the vertical oscillator and output tubes. In this receiver these functions are combined into one envelope and the tube is the 12BH7 dual triode. The circuit for the CBS-Columbia 750-3 chassis is shown in *Fig. 1.*

After checking the tubes a record should be made of the vertical oscillator grid and plate voltages as well as the vertical output grid and plate voltages. These should be taken under the two conditions, normal operation and when the picture shrinks. If a marked change occurs it usually is an indication of which stage the trouble will be located in.

At the same time a scope can be placed at the grid of the vertical output tube and the peak to peak voltage measured when the deflection is normal. After the height shrinks any change in waveform shape or amplitude can be noted for this input grid circuit.

If the waveform changes at the grid of the output tube it is fair to assume that the trouble is in the vertical oscillator circuit. Since there is no change in the vertical oscillator frequency, the change in waveform is probably due to a change in B voltage supplied to the circuit. The 470K resistor, the height control and the 47K resistor feeding the B voltage should be checked while hot after the shrinkage occurs. With the receiver switched off the resistors can be measured immediately to see if they have increased from their normal value.

There are other components that can cause this type of trouble in the circuit. If the .036 μf charging condenser develops a leak as the circuit warms up the waveform at the grid will be reduced in amplitude and the shrinkage will result.

Consider now that the grid waveform remains constant when the shrinkage occurs. If the scope is connected to the plate of the vertical output stage the waveform at his point will probably shrink in amplitude along with the height of the picture. Another check that can be made at this point is the peak to peak voltage at the plate of the

[Continued on page 52]

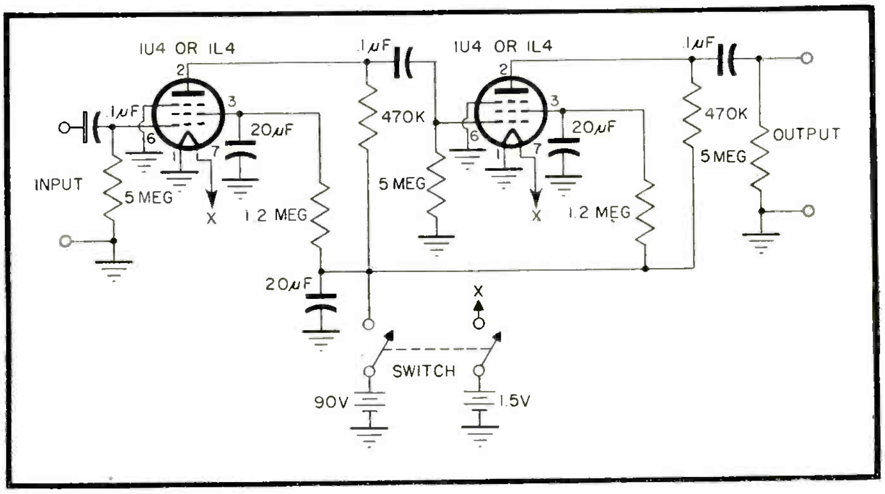


Fig. 2—Schematic for battery operated scope pre-amplifier.

Key Test Points

by Steve Travis

Methods of systematic stage isolation and defective component pinpointing as applied to TV deflection, vertical and horizontal oscillator systems.

The Deflection System

The picture and raster is impressed on the tube by deflecting the beam from the electron gun both vertically and horizontally. It therefore requires two deflection systems to accomplish this. The vertical deflection system uses a 60 cycle oscillator which moves the electron beam slowly down the picture tube face at this frequency rate. The horizontal oscillator develops a sawtooth of voltage which causes the beam to be deflected horizontally at 15,750 cycles per second. Both oscillators are locked in with the station sync signals.

The deflection system is the section in a TV receiver that generally requires more servicing than any other section. This is due primarily to the high voltages and circuit complexities found in the deflection system. However, it is only necessary to observe ordinary troubleshooting procedures to properly service the deflection section, as for that matter any other sections. The difficulty is isolated first in its section, then to a particular stage of that section, and finally to the defective component.

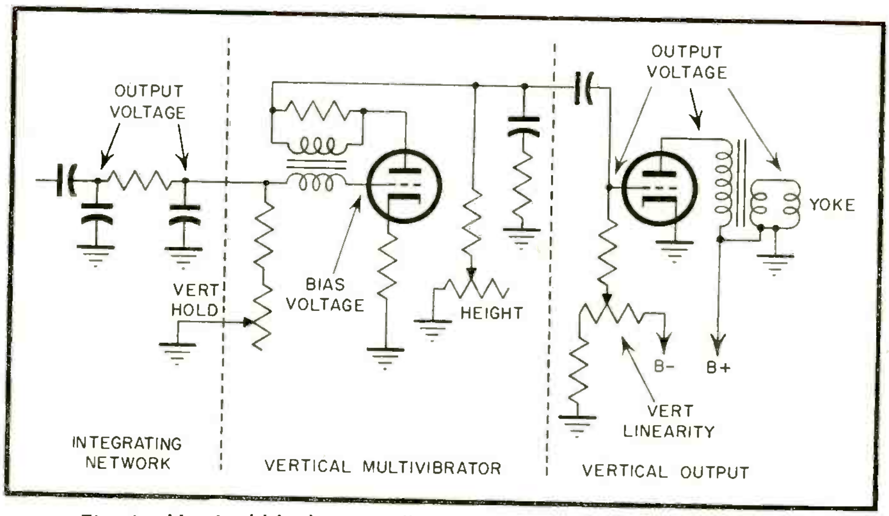


Fig. 1—Vertical blocking oscillator and conventional output stages.

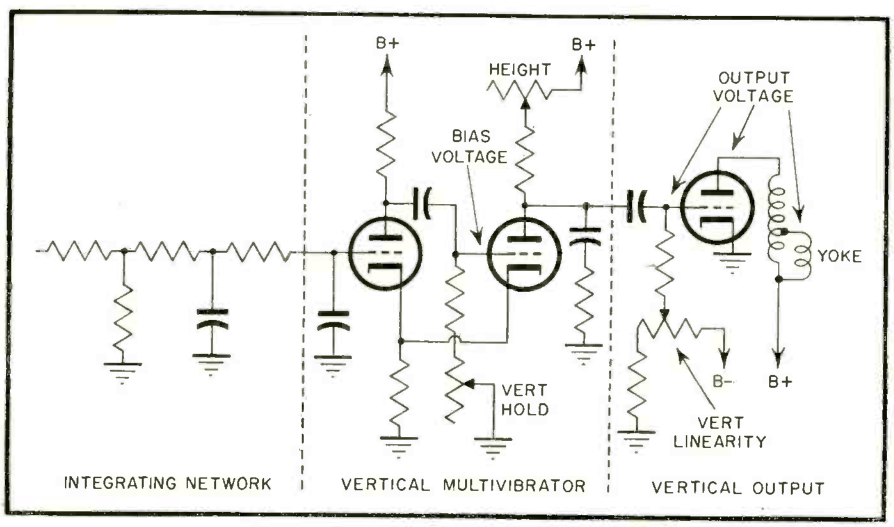
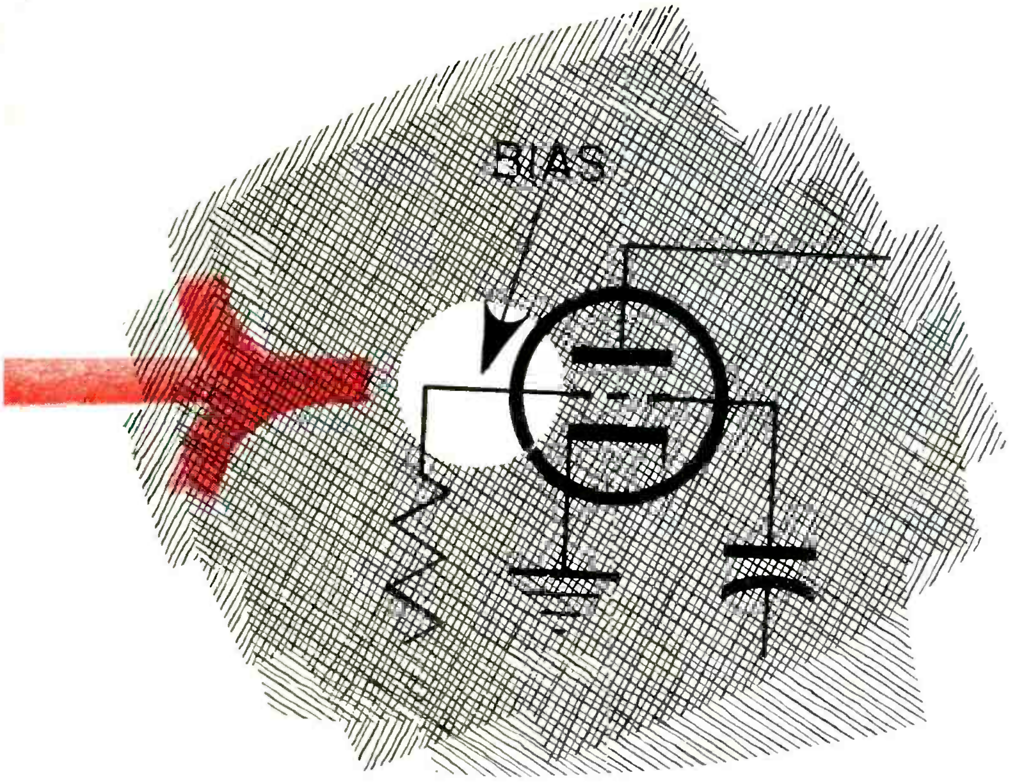


Fig. 2—Vertical multivibrator and autotransformer output stage.

The Vertical Oscillator

In troubleshooting the vertical oscillator the technician is concerned with the same approach as servicing other oscillator circuits. The key test point is the grid of the oscillator tube. Here the negative grid voltage is the key test point. As explained previously, whether the oscillator circuit is of the multivibrator or blocking type, if the stage is operating as it should a negative voltage will be generated at the grid circuit a negative voltage. See *Fig. 1*. If the oscillator is operating, a negative grid voltage will be present. The important point is that the negative voltage is generated in the normal development of the oscillator frequency, and therefore indicates that is the oscillator operating whether of the blocking or multivibrator type. These two generally



used vertical deflection systems are shown in *Figs. 1* and 2.

A method of trouble shooting the vertical deflection system is to connect the vertical stages through a .1 *uf* condenser to the top of the volume control and use the speaker as an indication of whether the oscillator signal is being developed and being passed through the different stages to the vertical deflection yoke. The vertical buzz will be heard from the speaker as the condenser is connected to the different stages of the Vertical system indicating that the signal is present at those locations. In this manner the signal can be traced from the oscillator to the deflection yoke. Varying the vertical hold control should change the pitch of the buzz from the speaker confirming that vertical deflection pulses are being heard. Of course, the voltage observed on an output meter can be used as an indication of the presence of vertical oscillator pulses in the vertical oscillator or output sections, as in *Fig. 1* and 2.

The Horizontal Deflection System

The horizontal section can also use either a multivibrator or blocking type of oscillator to produce horizontal deflection. The developed sawtooth of voltage from the oscillator is coupled to the horizontal output section where it is changed to a current sawtooth and applied to the horizontal deflection yoke to magnetically deflect the electron beam.

In each stage of the horizontal deflection system check points exist which can be quickly used to isolate the difficulty to a particular stage. Once the stage has been isolated, voltage and resistance checks will locate the defective component.

The Horizontal Oscillator

The grid bias at the horizontal blocking oscillator or multivibrater is a definite check as to whether the horizontal oscillator is functioning. At the grid of the oscillator a negative bias of 30 volts or more indicates that the oscillator is working. This voltage depends upon the type of circuit and can be as high as 70 volts in a horizontal blocking oscillator. As with other types of oscillator circuits the only way the negative voltage can appear at the grid of the oscillator tube is for the circuit to be developing oscillations. Therefore this test point is an excellent, quick check on the circuit. The numerical value of the negative voltage is not important. It is the presence of the negative voltage that indicates that the circuit is functioning. Two generally used horizontal oscillator circuit are shown in *Fig.* 3 and 4.

[To be continued]

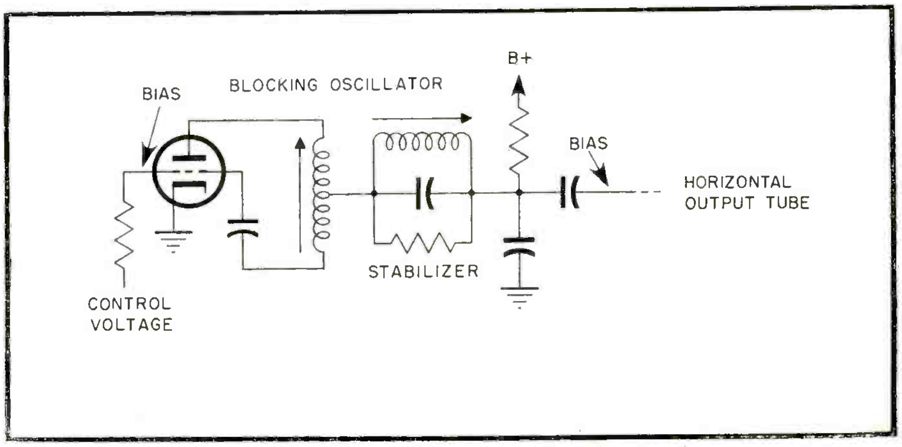


Fig. 3—Horizontal blocking oscillator circuit indicating key test points.

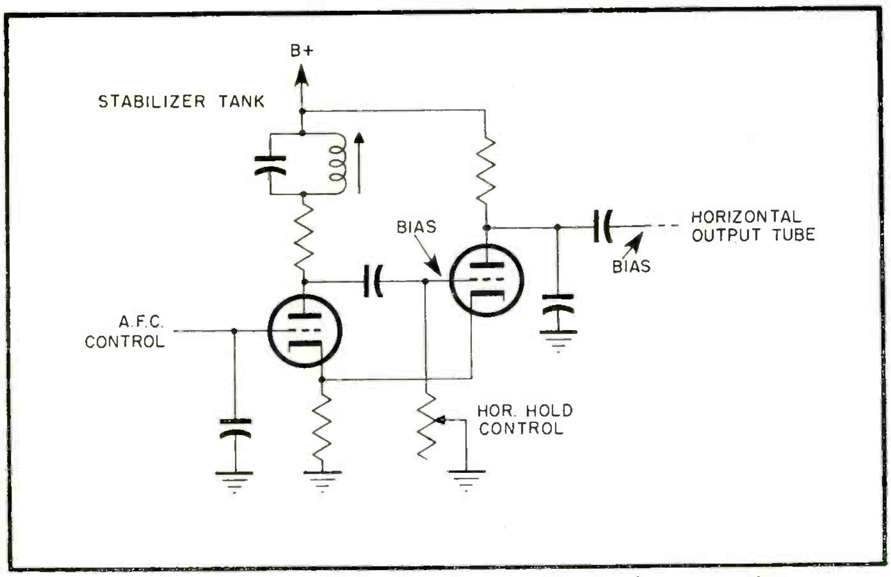


Fig. 4—Horizontal multivibrator circuit indicating key test points.

RC CIRCUITS

by Cyrus Glickstein

This fifth installment discusses the functional characteristics of complex RC circuits with series parallel elements, and their application to TV sync circuits.

WE have previously analyzed complex RC circuits with one condenser and two resistors. We will now find that complex RC circuits with two condensers, one series and one parallel, have some unsuspected behavior quirks.

Basic Action of Series Condensers

As an introduction to these circuits, let's review the action of two condensers in series across a battery, Fig. 23. When the switch is closed, current flows only for an instant. The condensers charge up immediately and current flow stops. The voltages across the condensers add up to the battery voltage, since the battery voltage divides across the two condensers in *inverse* proportion to capacity. That is, there is less voltage across the larger condenser. For example, if *C1* is .1 *uf* and C2 is half the size—.05 *uf*—in *Fig.* 23, then the battery voltage (180V) divides inversely across the two condensers — 60V across *C1* (.1 *uf*) and double the voltage, or 120 V across C2 (.05 *uf*).

Series-Parallel Circuit Action

When the switch is closed in the series-parallel circuit with two condensers shown in *Fig. 24a,* the battery voltage instantaneously divides across the two condensers in inverse ratio to their capacity, just as in the previous case. At this first instant, *R1* has no effect on the action. However, immediately after this first surge, *R1* provides a *discharge* path for parallel condenser *C1* while series condenser C2 continues to *charge*. *C1* discharges to zero through *R1* while C2, the series condenser, charges to battery voltage through *R1*. Arrowheads show the direction of current flow in Fig. 24a. The curves illustrating the voltages across each condenser are shown in Fig. 24b and c.

Time constant for C2 is defined as the time it takes this condenser to charge to 63% of the *exponential portion* of the curve (Fig. 24c), disregarding the initial surge. That is, after the first instantaneous charge, C2 then charges in the usual exponential way

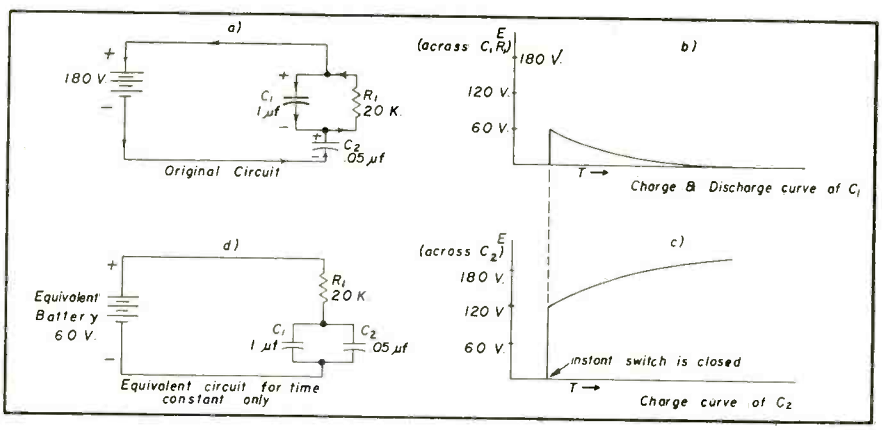


Fig. 24—Charging action which takes place in series parallel circuits. Parallel RC in series with C.

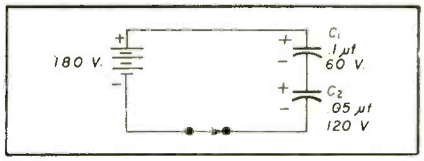


Fig. 23 — Two condensers across a battery divide the voltage in inverse ratio to capacity.

from 120 v to 180 v. For C1, time constant is the time it takes C1 to discharge to 37% of the initial surge voltage. Since the circuit has one overall time constant, both events take place at the same instant.

Whether a condenser charges or discharges, the *current* through the circuit decreases. The current curve in either case is an exponential curve of decay. Therefore, the decreasing current through *R1* divides—part goes to *C1* which is discharging and part goes to C2 which is charging, *Fig. 24a.* This has exactly the same effect on the time constant of the circuit as if both condensers are in parallel and charging through *R1,* as shown in the equivalent circuit, *Fig. 24d.* In the equivalent circuit, the decreasing current through *R1* also divides between the two condensers.

Effectively, the two condensers are in *parallel* and the time constant of the entire circuit of *Fig. 24a* (or *24d*) is:

$T = (C1 + C2) \times R$

$= (.05\ uf + .1\ uf) \times 20{,}000$

$= .15 \times 10^{-6} \times 20{,}000 = 3{,}000\ usec$

The fact that the two condensers in *Fig. 24a* divide the battery voltage during the first surge may seem at first glance to reduce the time constant of the circuit. This however is not the case. A simple example will clarify the situation. Assume we have a simple series RC circuit across a battery. This circuit has a certain time constant based on the value of R and C. Now before the switch is closed, another condenser of *equal* value is placed across the resistor—a circuit similar to *Fig. 24a.* When the switch is closed, the series condenser C2 instantaneously charges to *half* the voltage, then more slowly charges to the other half of the voltage. Current for the initial, instantaneous charge of the two condensers does not flow through the resistor at all, but through the condensers only. Therefore, series condenser C2 has to charge slowly *through the resistor* to only one-half the amount of voltage as compared to a simple series circuit. However, in this series-parallel circuit, initial current through the resistor, after the first surge, is also one-half compared to the initial current in a simple series circuit. This is true since only one-half the source voltage appears across *C1,* which is in parallel with *R1.* Note that

[*Continued on page 57*]

Simpson

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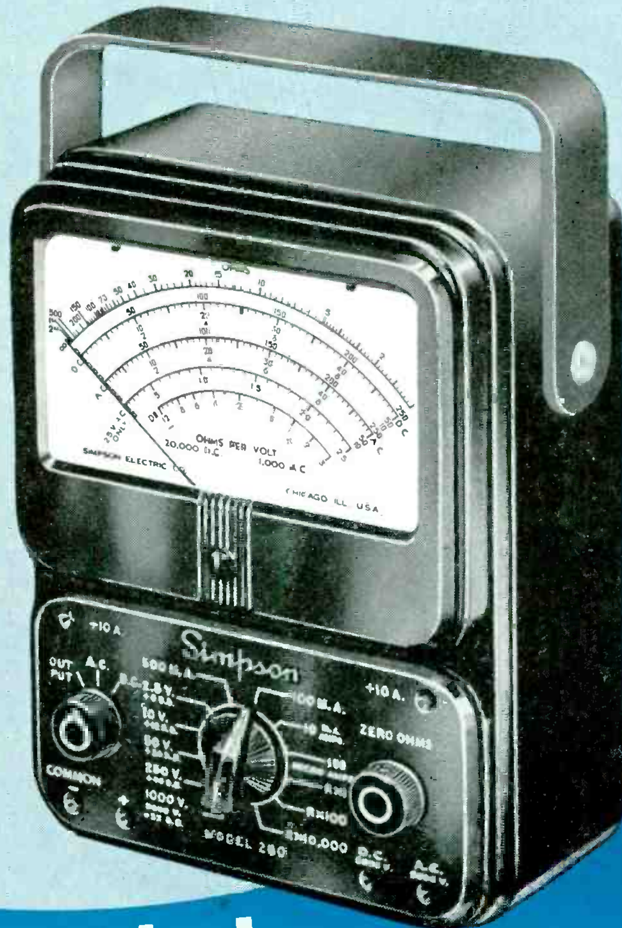
MULTI-TESTER



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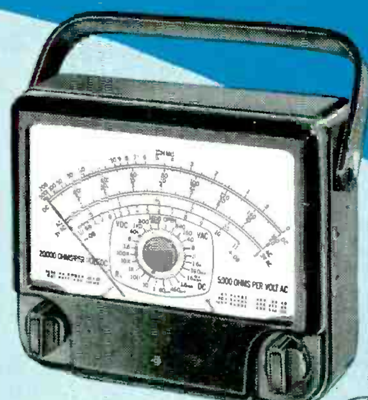

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AC VOLTAGE: 0-3, 0-8, 0-40, 0-160, 0-800 volts (5,000 ohms per volt sensitivity)
AF OUTPUT VOLTAGE: 0-3, 0-8, 0-40, 0-160 volts (0.1 microfarad internal series capacitor)
VOLUME LEVEL IN DECIBELS: −12 to +45.5 DB in 4 ranges.
Zero DB Power Level, .001 watt in 600 ohms.
DC RESISTANCE: 0-500 ohms (4.5 ohms center); 0-5,000 ohms (45 ohms center); 0-50,000 ohms (450 ohms center); 0-500,000 ohms (4,500 ohms center); 0-5 megohms (45,000 ohms center); 0-50 megohms (450,000 ohms center)
DC CURRENT: 0-80, 0-160 microamperes, 0-1.6, 0-16, 0-160 milliamperes, 0-1.6, 0-16 amperes (267 millivolts maximum drop)
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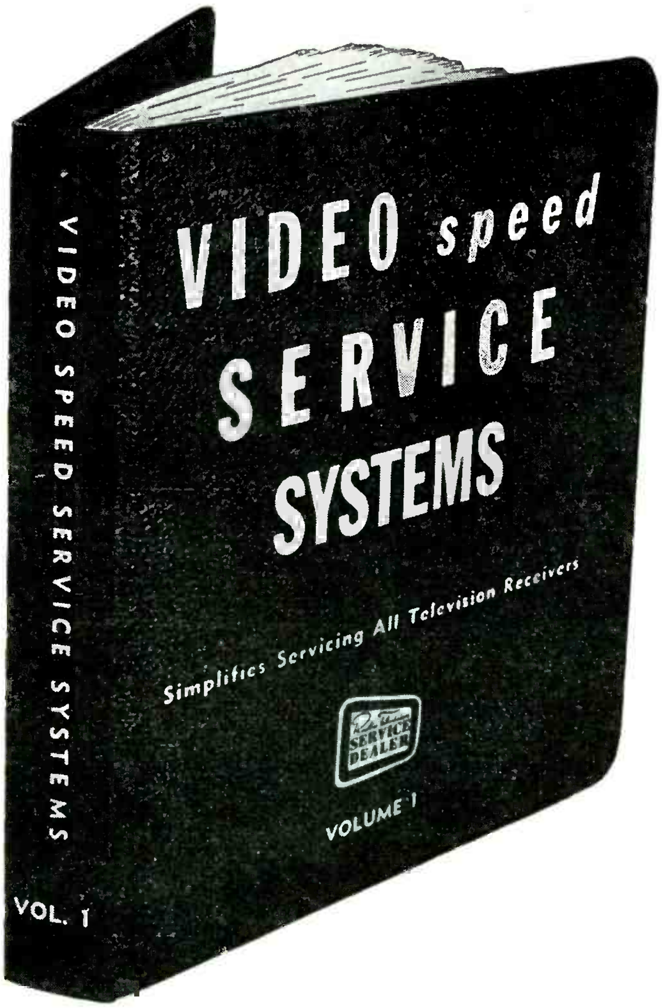

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- Low Glass Electrolysis
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The Work Bench

by PAUL GOLDBERG

THIS installment is devoted to three sync amplifier problems. The use of the oscilloscope is extremely important in hunting down these faults. Equally important is the manufacturer's service data which usually contains the correct waveforms at the important places.

RCA KCS82—Horizontal Pull

The receiver was turned on and immediately it was noticed that a horizontal pulling condition took place at the top of the raster. The picture could not be straightened out. The top of the picture would either pull to the right or the left.

A check was then made to see if there was any hum in the picture. Hum in the picture is a well known cause of horizontal pulling. Two black bars in the picture is indicative of 120 cycle hum. This is caused by a bad filtering condition in the "B" supply. One black bar in the picture is the result of 60 cycle hum. This is caused usually by cathode to filament leakage in one of the video or *rf* tubes. If the cathode of a tube is grounded the hum leakage is also grounded. Thus, a cathode-grounded tube usually will not be the cause of this type of trouble.

In this case there was no hum in the picture; however, another symptom was observed: The contrast could not be lowered to a point that could be considered normal. It was therefore supposed that a slight case of *agc* trouble was also present.

Checking the tubes, all the video *if* and *rf* amplifiers were replaced individually but with no effect. Next, all sync tubes (V109, V111, V112) were replaced individually but with no effect. The horizontal oscillator (V114) was also replaced but also without effect.

At this point the manufacturer's service notes were consulted. Immediately it was seen that the cathode voltage of the horizontal sync separater, V111B, was being fed to the *agc* amplifier, V111A. Here was a possible trouble spot.

The scope was next set up to view horizontal pulses, and a waveform check was made at pin #7, grid of V111B. This waveform checked okay against the service data. (Ref. to *Fig. 1A.*) Next, a waveform check was made at pin #6 of V111B. (Ref. to *Fig. 1B.*) Here it was obvious that there was something wrong. The horizontal sync pulse was not being amplified. The purpose of V111B is to amplify the horizontal sync pulse and also separate this pulse from the video and blanking information. This is accomplished by biasing the cathode at 70 volts positive with respect to grid. This tube will then only conduct on the horizontal sync pulses.

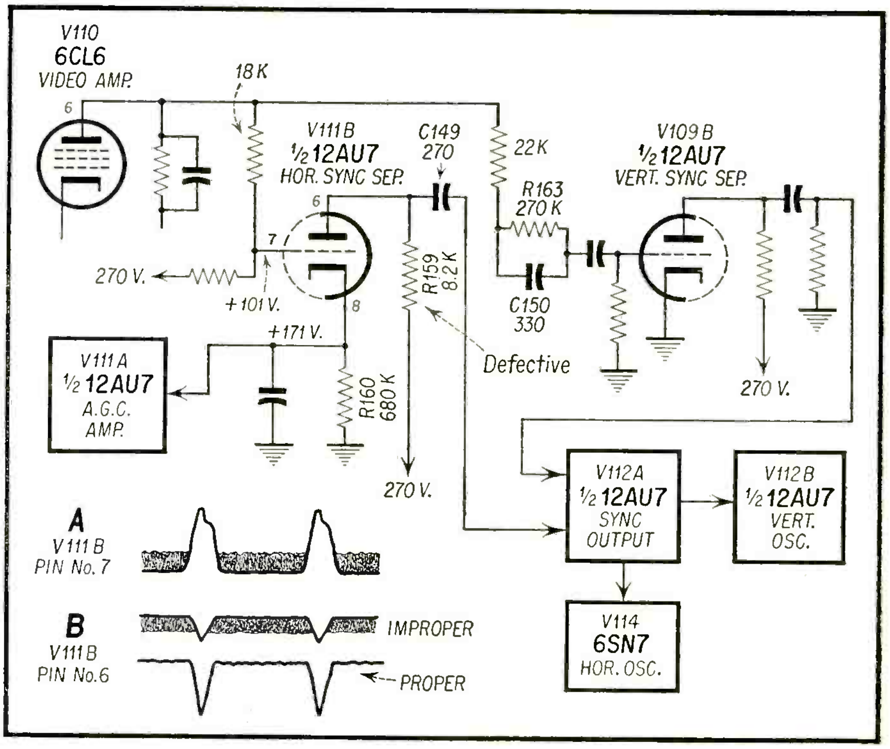
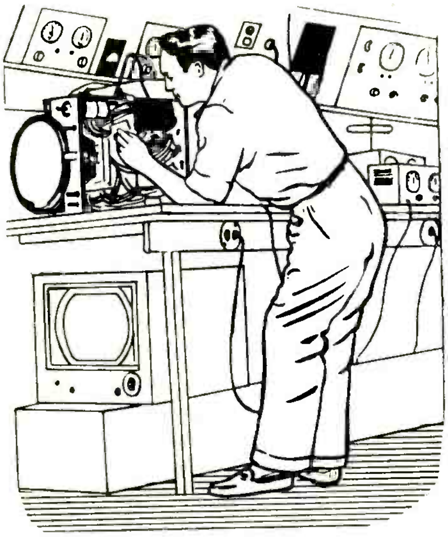


Fig. 1 — Partial schematic, RCA KCS82.

Knowing these facts, a voltage check was attempted at pin #6 of V111B. But before doing so, it was noticed that *R159*, 8.2K, the plate load resistor, was severely burned. Seeing this, a resistance measurement was taken and it was found to measure only 125 ohms. The resistor was then replaced. Because no reason could be found for *R159* burning up, V111, 12AU7 was replaced as the only possible cause. The receiver now functioned properly.

Emerson Chassis 120162A—Horizontal Pull and Vertical Roll

The receiver was turned on and it immediately started to pull horizontally and roll vertically. This was evidently both a horizontal and vertical sync problem. V11B, ½12AU7, was the only composite sync amplifier. Thus V11 was immediately replaced but without effect. A search was then made for hum in the picture but there was none. V12 was next replaced but without effect. The oscilloscope was then set up and a waveform was taken at pin #7 of V11B. This waveform checked correctly with the manufacturers data. (*Fig. 2A*). A waveform was then taken at pin #2 of V12A. This waveform seemed also to check correctly. (Ref. to *Fig. 3B*). A waveform was then taken at pin #7 of V12B and here was the trouble. (Ref. to *Fig. 2C*). A study of the sync circuitry was made. The composite sync pulses enter V11B and are amplified. After being amplified the



This Month:

SYNC AMPLIFIER PROBLEMS

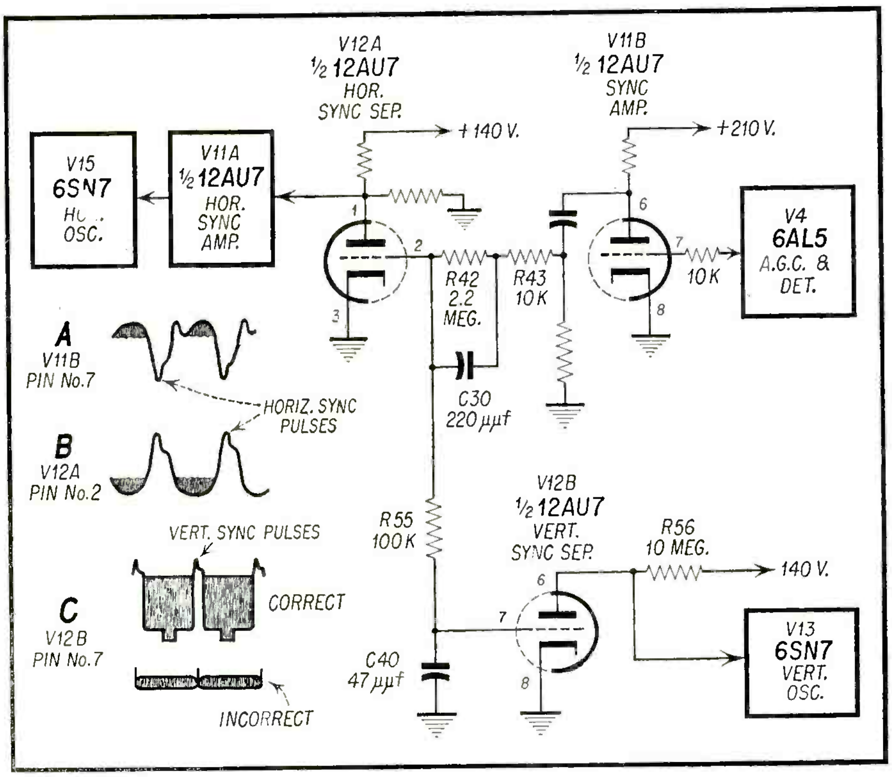


Fig 2. — Partial schematic, Emerson 120162-A.

composite sync signal enters a network (R42, 2.2 meg and C30, 220 *mmf*) at pin #2 of V12A. This network has an excellent horizontal sync pulse to noise ratio. However, it attenuates the vertical sync pulses. To improve on this situation a low pass filter (R55, 100K and C40, 47 *mmf*) is employed which increases the vertical sync pulse to noise ratio at pin #7 of V12B. Thus, due to these networks, only the horizonal sync pulses will be amplified by V12A, and only the vertical sync pulses will be amplified by V12B. To get back to the trouble now and referring to the incorrect waveform in *Fig. 2C*, it is evident that very little vertical sync pulse was getting to the grid of V12B. A resistance measurement was then made from Pin #7 of V12B to ground. The meter read about 500K. *C40*, 47 *mmf*, was next clipped from the grid, pin #7, and measured. It measured about 750K ohms leakage. *C40* was then replaced with a new condenser and the receiver functioned properly.

Because *C40* was leaking, horizontal as well as vertical sync pulses were being amplified by both V12A and V12B. *C40*, normally would kill all horizontal sync pulses arriving at pin #7 of V12B. Moreover, the vertical sync pulses no longer had the easy path of *R55* and *C40* and so they divided themselves between the grids of V12A and V12B. Thus, the diminished vertical sync pulse caused the intermittent vertical roll and the vertical sync pulse being allowed to trigger the horizontal oscillator caused the horizontal pulling.

Motorola TS114—Intermittent Horizontal Pulling and Vertical Jitter

The receiver was turned on and it was observed after a time that the horizontal began to pull intermittently and that the vertical had a bad jitter. Inasmuch as there was no sign of *agc* trouble, we decided to check the clipper circuits. V12, the clipper, was replaced but had no effect. Next the scope was set up and a waveform check was made at Pin #1 of V12A, the first clipper. The waveform however checked correctly with the manufacturer's service data. (Ref. to *Fig. 3A*.) A waveform check was next taken at Pin #2 of V12A. Here the waveform was not correct. (Ref. to *Fig. 3B*.) The purpose of V12A, the first clipper is to remove the blanking end video information and

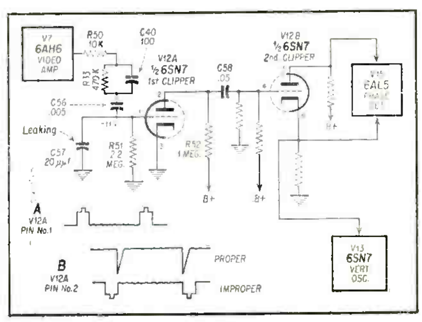


Fig. 3 — Partial schematic, Motorola TS 114.

amplify only the sync pulses. *C57* and *R51* form the cutoff grid leak bias for V12A. Because of this grid leak action, V12A will only conduct on the sync pulses thus eliminating the blanking and video information. Now the waveform taken at Pin #2 of V12A, you will notice, contains all the video and blanking information. This should not be. Refer to *Fig. 3B* and the correct and incorrect waveforms can be seen.

[*Continued on page* 56]

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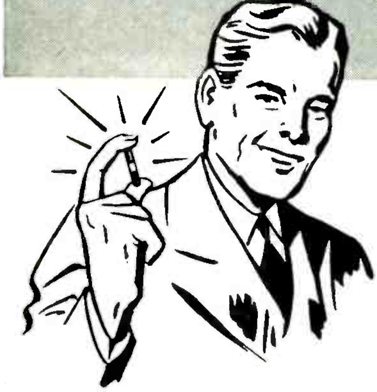

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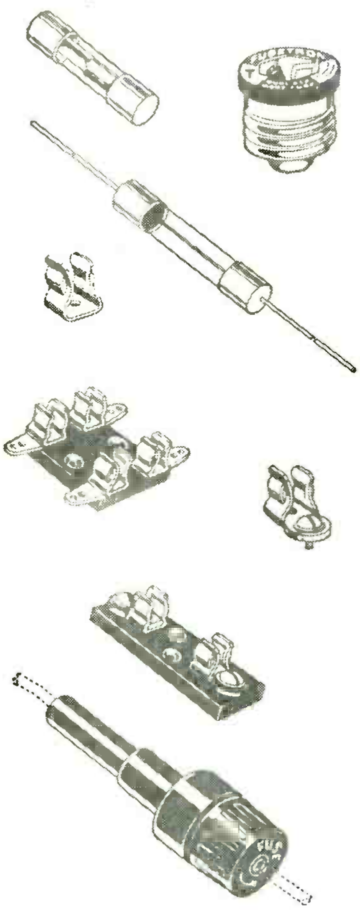

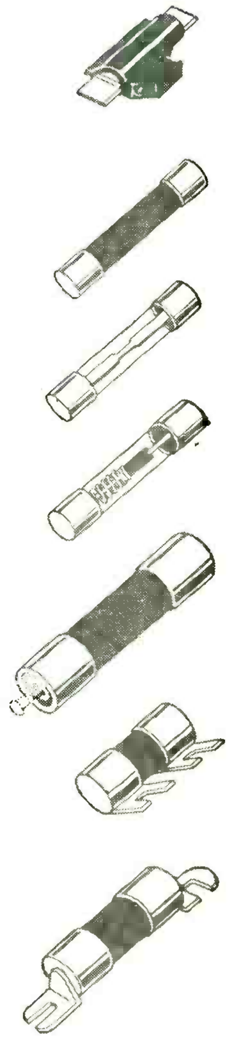

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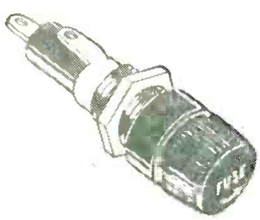

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TUBE LIST

SYMBOL	TYPE	CIRCUIT FUNCTION
VHF Tuner	6J6	R-F Osc., Mixer
*VHF Tuner	6BQ7	R-F Amp.
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer
V-1	6CB6	1st I-F Amp.
V-2	6CB6	2nd I-F Amp.
V-3	6CB6	3rd I-F Amp.
V-4 A & B	6AL5	Det., DC Restorer
V-5 A & B	12AT7	1st Video Amp., Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vert. Osc. & Vert. Output
V-9	6AU6	Automatic Gain Cont.
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amp.
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Hor. Oscillator
V-17	6BQ6-GT	Hor. Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	H.V. Rect.
V-20 & V-22	5U4-G	L.V. Rect.
V-21	21MP4	Pix Tube 21" Metal Rect. (Electrostatic)

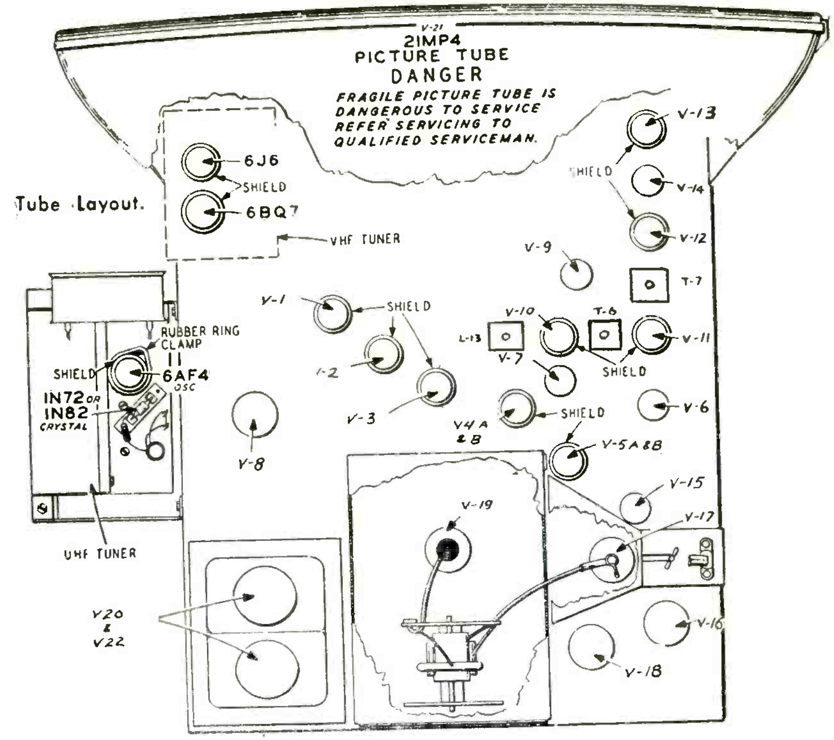
*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7.

KEY VOLTAGES

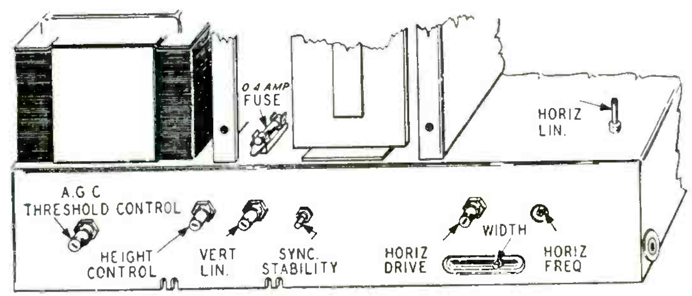
B+, plate of damper, V18 pin 5	300	VDC
Boosted B+, cath. of damper, V18 pin 3	520	"
Plate of Vert. Osc., V8 pin 2	75 to 200*	"
Plate of Vert. Out., V8 pin 5	500	"
Plates of Hor. Osc., V16 pin 2	175 to 200*	"
pin 5	260	"
Grid of Hor. Out., V17 pin 5	—26 to —35	"

*Voltage is a function of control settings.

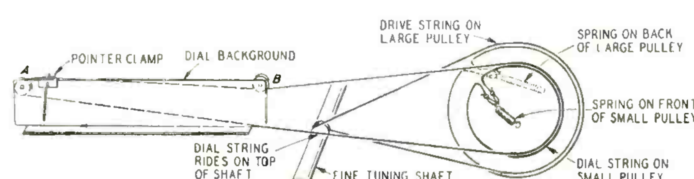
All voltages are measured with a VTVM connected between the tube pins and chassis.



Tube Layout.



Adjustments Rear of Chassis



Drive Cord Stringing.

ADJUSTMENTS

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS

While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control up so that the picture appears washed out. Adjust width control until the picture fills the mask. Turn the horizontal drive control clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control for best linearity. If adjustment of the horizontal drive or horizontal linearity is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control is required, readjustment of the horizontal drive control will be necessary. Adjust the picture centering device to align the picture with the mask.

CENTERING ADJUSTMENT

If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

ADJUSTMENT OF AGC THRESHOLD CONTROL

Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL

When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT

Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT

With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control until the picture pulls into sync.

ION TRAP MAGNET ADJUSTMENT

The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

PICTURE TUBE SAFETY GLASS

It will be necessary to clean the picture tube safety glass and the face of the picture tube occasionally. Remove the screws and cleat. Insert your fingers into the opening at the center of the frame and carefully lift up and pull out the safety glass. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

For models that have the cleat and screws at the top of the cabinet the following caution must be observed:

CAUTION—UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS MAY FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET.

FIRESTONE TROUBLE SHOOTING CHART

No Sound—No Raster
Power input circuit
V20, V22
Check B+ fuse F-1 (0.4 Amps)

No Raster—Sound OK
Brightness control
V4, V16, V17, V18, V19, V21
Ion trap
HV xformer Hor. yoke CRT connections

Weak Pix—Sound and Raster OK
Tuner fine tuning
Contrast and AGC Threshold controls
Check Tuner tubes
V1, V2, V3, V4, V5, V6

Poor Hor. Lin.
Hor. Lin and Hor. Drive controls
V17, V18
Check 0.047 and 0.1 mf caps. connected to Hor. Lin. coil
Hor. Out. Trans.

Poor Vert. Lin.
Vert. Lin. and Height controls
V8
Check 0.1 mf cap. connected to Vert. Out. Trans.
Check 100 mf cap. connected to pin 6 of V8
Check 0.1 mf cap. connected to pin 4 of V8
Vert. Out. Trans.

Pix Jitter Sideways
Hor. Hold and Freq. controls
AGC Threshold control
V9, V15, V16, V17
Check 0.01 mf cap. and 27K and 6.8K res. connected to pin 5 of V15
Sync Stability control

Smeared Pix
Tuner fine tuning
Contrast and AGC Threshold control
V1, V2, V3, V4, V5, V6, V9
Check Tuner tubes
Check Vid. Det. and Amp. peaking coils
Check 0.047 mf cap. connected to pin 1 of V6
IF and RF alignment

Poor Pix Detail
Tuner fine tuning
V1, V2, V3, V4, V21
AGC Threshold control
IF and RF alignment

Sound Bars in Pix
Tuner fine tuning
Check Tuner tubes
V1, V2, V3, V4, V9
AGC Threshold control
Check alignment of L-7
IF and RF alignment

Snow in Pix
Check Tuner tubes
V1, V2, V3, V4
AGC Threshold control
Antenna and transmission line

Engraved Effect in Pix
Tuner fine tuning
Contrast and AGC Threshold controls
Check Tuner tubes
V1, V2, V3, V4, V5, V6, V21
Check Vid. Det. and Amp. peaking coils
Check 0.047 mf cap. connected to pin 1 of V6

Vert. Bars
Hor. Drive control
V17, V18
Check 56 mmf cap. connected to terminals of defl. yoke
Defl. yoke ringing

Pix Jitter Up and Down
Vert. Hold and Sync. Stability controls
AGC Threshold and Contrast controls
V4, V5, V7, V8

Pix Bending
Hor. Hold and Freq. controls
AGC Threshold and Sync Stability controls
V5, V7, V9, V15, V16, V17
Check 0.047 mf cap. connected to pin 4 of V16

Distorted Sound
Tuner fine tuning
AGC Threshold and Tone controls
Check Tuner tubes
V10, V11, V12, V13, V14
Check audio coupling network connected to pin 7 of V14
Sound and Vid. IF alignment L-13, T-6
Det. alignment T-7

Weak Sound—Pix OK
Tuner fine tuning
Volume and AGC Threshold controls
Check Tuner tubes
V10, V11, V12, V13, V14
Sound and Vid. IF alignment L-13, T-6
Det. alignment T-7

Noisy Sound—Pix OK
Volume and Tone controls
V10, V11, V12, V13, V14
Check sound system of loose connections
Speaker
Sound IF and Det. alignment L-13, T-6 and T-7

Sync. Buzz in Sound
Tuner fine tuning
V4, V10, V11, V12
Sound IF and Det. alignment L-13, T-6, T-7

PACIFIC MERCURY

Chassis 200—1, 2, 3, 4, 5, 11, 12, 13, 14, 15

TUBE LIST

SYMBOL	TUBE	CIRCUIT FUNCTION
V1	6CB6	1st Vid. IF Amp.
V2	6CB6	2nd Vid. IF Amp.
V3	6CB6	3rd Vid. IF Amp.
V4	12AX7	Vid. Det. Noise Balance
V5	6CB6	Vid. Amp.
V6	6AU6	Sound IF Amp.
V7	6AL5	Rat. Det.
V8	6AV6	Audio Out.
V9	6AQ5	Audio Out.
V10	12AU7	Sync. Sep.
V11	6AU6	AGC Amp.
V12	6AV6	Vert.Osc.—Noise Balance
V13	12BH7	Vert. Out.
V14	6SN7GT	Hor. Osc.
V15	6AU5	Hor. Out .
V16	6W4	Damper
V17	1B3GT	HV Rect.
V18	5U4G	LV Rect.
V19	17HP4 21MP4	Picture Tube
V20	6X8	Osc.-Mixer
V21	6BZ7	RF Amp.
V22	6J6	UHF Osc.

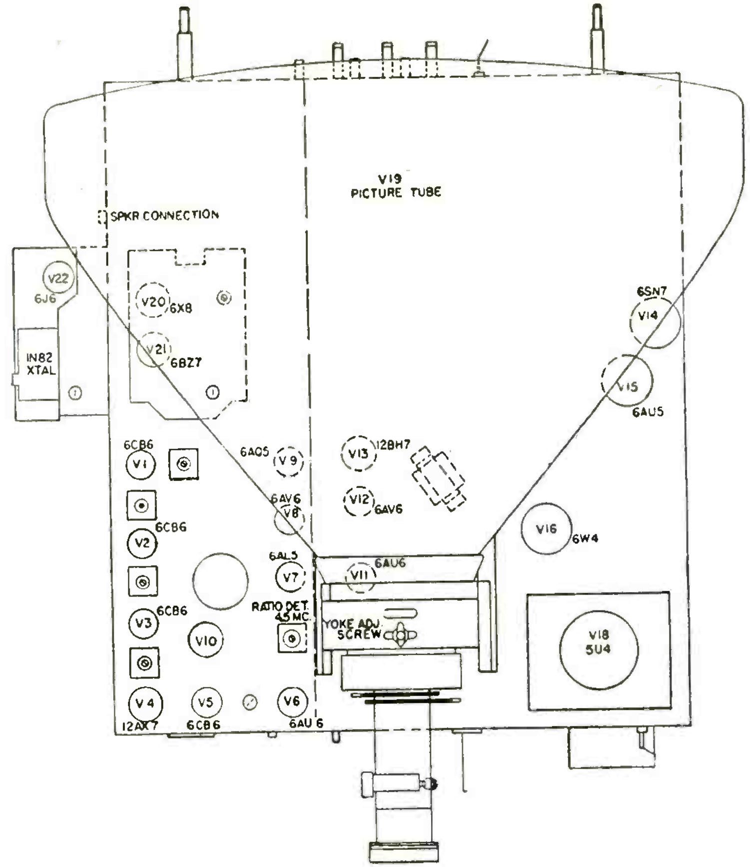
KEY VOLTAGES

B+, plate of damper, V16 pin 5	290 vdc
Boosted B+, cath. of damper, V16 pin 3	450 vdc
Plate of VERT. OSC., V12 pin 7	240 vdc
Plate of Vert. Out., V13 pin 1	450 vdc
Plate(s) of Hor. Osc., V14 pin 2	180 vdc
pin 5	180 vdc
Grid of Hor. Out., V15 pin 1	—12.5 vdc

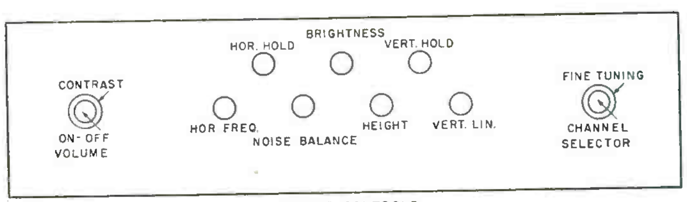
(All voltages are measured with a VTVM connected between the tube pins and chassis.)

CHASSIS IDENTIFICATION CHART

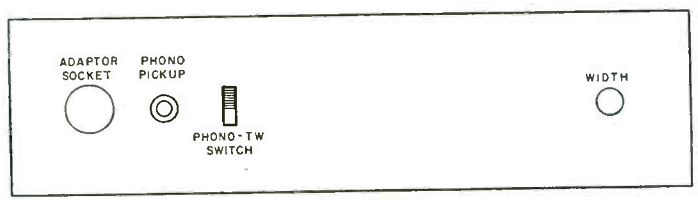
CHASSIS NUMBER	PICTURE TUBE TYPE	TUNERS VHF	TUNERS UHF
200-1	17HP4	PMC-57006	PMC-57007
200-2	17HP4	PMC-57006	PMC-57008
200-3	17HP4	PMC-57006	PMC-57009
200-4	17HP4	PMC-57006	None
200-5	17HP4	PMC-57011	None
200-11	21MP4	PMC-57006	PMC-57007
200-12	21MP4	PMC-57006	PMC-57008
200-13	21MP4	PMC-57006	PMC-57009
200-14	21MP4	PMC-57006	None
200-15	21MP4	PMC-57011	None



TUBE LOCATION CHART



FRONT CONTROLS



REAR CONTROLS

TV FIELD SERVICE
Pre-published from Rider "TV Field Service Manuals"
by Rider & Alsberg

ADJUSTMENTS

Warning—Operation of the receiver chassis outside of the cabinet involves the danger of working with high voltages. Extreme caution should be exercised at all times.

Occasional minor adjustments will be needed if any circuit work or tube replacement is required. A test pattern, generated locally or from a broadcast station, is recommended for best results. The operating and auxiliary controls, located on the front panel and rear apron, should be set for as good a pattern as possible before making the following adjustments:

CENTERING

Rotate each of the Centering Rings separately until the picture is properly centered.

HEIGHT AND WIDTH

Adjust the Height and Width Controls, so that the picture fills out the dimensions of the screen. A slight re-adjustment of the centering control may be necessary.

HORIZONTAL DRIVE CONTROL

The Horizontal Drive Control is adjusted by backing off the control until a vertical white bar appears in the middle of the picture, and then going in one full turn from this point. This adjustment may be reached from the underside of the chassis mounting board. See below for detailed description of Horizontal Oscillator Sync Adjustment.

VERTICAL LINEARITY CONTROL

Set the Vertical Linearity Adjustments for a symmetrical pattern. A slight re-adjustment of the Height and Width Controls may then be necessary.

Note: The sequence of adjustments outlined above is suggested as a convenient method of approach and not an arbitrary procedure. The procedure used to obtain the final results may be varied to fit the circumstances.

NOISE BALANCE CONTROL

Turn the Channel Selector to the strongest station signal on the air. Slowly turn the Noise Balance Control from full clockwise position counterclockwise until the picture just starts to show a distorted shape. Then turn the control slightly in the opposite direction so that the picture shape is normal. Check all channels. If the picture shape is distorted on any channel, advance the control slightly clockwise to restore normal shape. (Note: Whenever the picture is distorted, or slanting bars are encountered which cannot be adjusted correctly with the horizontal lock or fine tuning controls, always set the noise balance control fully clockwise before making any other adjustment.)

PICTURE TUBE ADJUSTMENTS

Warning: The picture tube envelope encloses a high vacuum. Any accidental blow or rough handling may cause the tube to implode with dangerous and destructive force. The wearing of heavy gloves and shatter-proof goggles is advised when handling the picture tube.

1. Turn the Brightness Control to maximum (clockwise) and the Picture Control to minimum (Counterclockwise).
2. Rotate the Ion Trap Magnet and at the same time move it backward and forward to obtain the brightest raster.
3. Reduce the Brightness Control so that the raster is slightly over normal brilliance and re-adjust the Ion Trap Magnet for maximum brightness.
4. Loosen the Deflection Yoke adjusting screws and rotate the Deflection Yoke so that the top and bottom edges of the raster are parallel to the top of the chassis. When this adjustment is made, tighten screws.
5. Adjust the Centering Control until the entire raster is visible, centered within the opening of the mask, with no shadowed corners.
6. Move the Ion Trap Magnet as in step 2 for final adjustment.

PACIFIC MERCURY TROUBLE SHOOTING CHART

NO RASTER—SOUND OK
- Brightness con.
- Check HV Fuse F1 (0.25 Amps)
- Ion trap
- V14, V15, V16, V17, V19
- HV trans. Hor. yoke CRT connections

WEAK PIX—SOUND AND RASTER OK
- Tuner fine tuning
- Contrast con.
- V1, V2, V3, V4, V5, V11, V20

POOR HOR. LIN.
- Hor. Drive con.
- V15, V16
- Check 0.05 μf cap. connected to pin 5 of V16
- Hor. Out trans.

POOR VERT. LIN.
- Vert. Size and Lin. con.
- V12, V13
- Check 0.05 and 0.1 μf caps. connected to red lead of Vert. Osc. trans.
- Check 100 μf Elec. cap. connected to pin 3 of V13
- Vert. Out. trans.

PIX JITTER SIDEWAYS
- Hor. Hold, req. Locking-Range and Waveform con.
- V14, V15
- Check 2200 μμf cap. connected to pin 1 of V14

PIX JITTER UP & DOWN
- Vert. Hold and Contrast con.
- Noise Balance con.
- V10, V11, V12, V13
- Check 4700 μμf cap. connected to yellow Lead of Vert. Osc. trans.

ENGRAVED EFFECT IN PIX
- Tuner fine tuning
- Contrast con.
- V1, V2, V3, V4, V5, V11, V19, V20
- Check 0.1 μf cap. connected to cath. of V19 (No. 11)
- Check Vid. Det. and Amp. peaking coils

VERT. BARS
- Hor. Drive con.
- V15, V16
- Check 47 μμf cap. connected to yoke terminals
- Defl. yoke ringing

PIX BENDING
- Hor. Hold, Freq, Locking-Range and Waveform con.
- V10, V11, V14, V15
- Check 0.02 μf cap. connected to pin 3 of V14
- Noise Balance con.

EXCESSIVE RASTER (PIX SIZE)
- Hor. Drive con.
- Hor. and Vert. Size con.
- V15, V17, V19
- Check 0.025 μf cap. connected to pin 8 of V15

RASTER BLOOMING
- Hor. Drive con.
- V15, V16, V17, V18, V19
- Check HV Filter cap.
- Check 470k Ω Res. connected to HV Filter cap.

INSUFFICIENT RASTER WIDTH
- Hor. Drive and Size con.
- V15, V16, V18
- Check 2-1000 μμf caps. connected to terminal "D" of Hor. Osc. trans.
- Hor. Out. trans.
- Low line voltage

INSUFFICIENT RASTER HEIGHT
- Vert. Size and Lin. con.
- V12, V13, V18
- Check 0.05 and 0.1 μf caps. connected to red lead of Vert. Osc. trans.
- Vert. Out. trans.
- Low line voltage

NO VERT. DEFL.
- V12, V13
- Check 0.05 and 0.1 μf caps. connected to red lead of Vert. Osc. trans.
- Vert Defl. coils (yoke)
- Vert. Out. and Osc. trans.

NO VERT. SYNC.—HOR. SYNC. OK
- Vert. Hold con.
- Vert. Int. network
- V11, V12, V13
- Check 4700 μμf cap. connected to yellow lead of Vert. Osc. trans.

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK
- V10, V11
- Noise Balance con.

NO HOR. SYNC.—VERT. SYNC. OK
- Hor. Hold, Freq., Locking-Range and Waveform con.
- V10, V14, V15
- Check 390 μμf cap. connected to pin 4 of V14

NO SOUND—PIX OK
- Tuner fine tuning
- Vol. con.
- V6, V7, V8, V9
- Speaker (open voice coil or defective connection)
- Sound and Vid. IF alignment L9
- Det. alignment T3

TV FIELD SERVICE

Pre-published from Rider "TV Field Service Manuals"

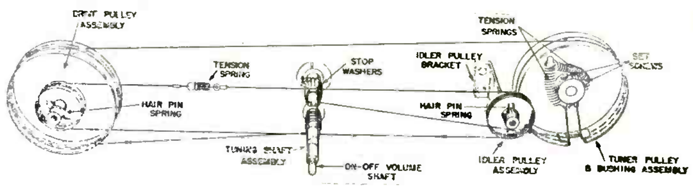
by Rider & Alsberg

WESTERN AUTO

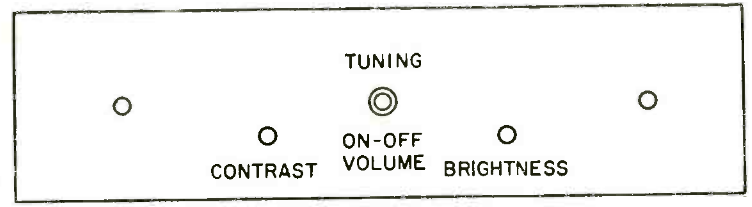
Model 2D-1315A, 2D-1325A, 2D-2312A,** 2D-2314A, 2D-2321A, 2D-2322A*

Chassis 21T1A, 21T1A, 17T1B, 21T1A, 21T1A, 21T2A

*UHF Tuner Incorporated **17-inch Receiver



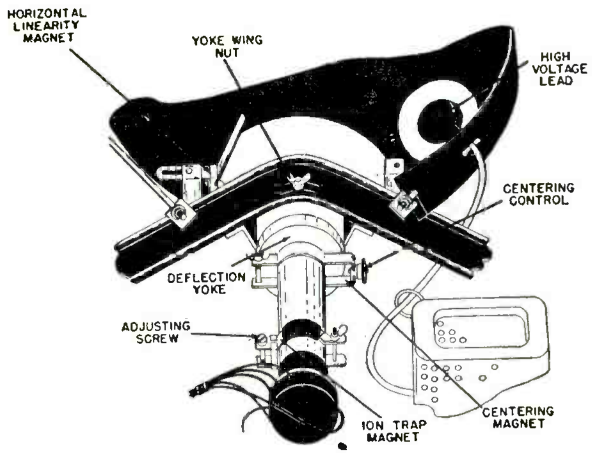
Dial Stringing.



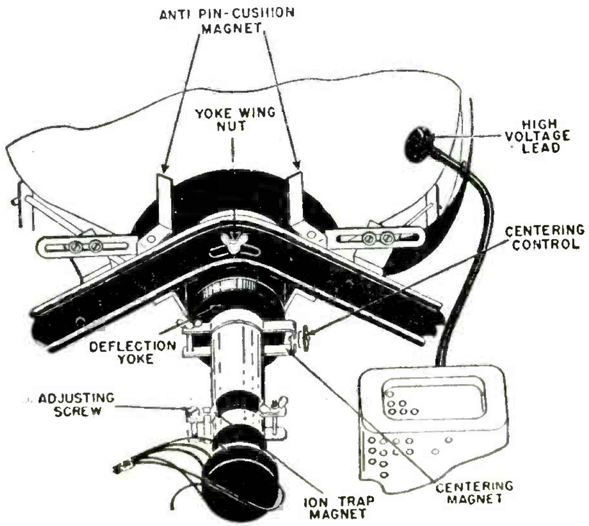
FRONT CONTROL VIEW

TUBE LIST

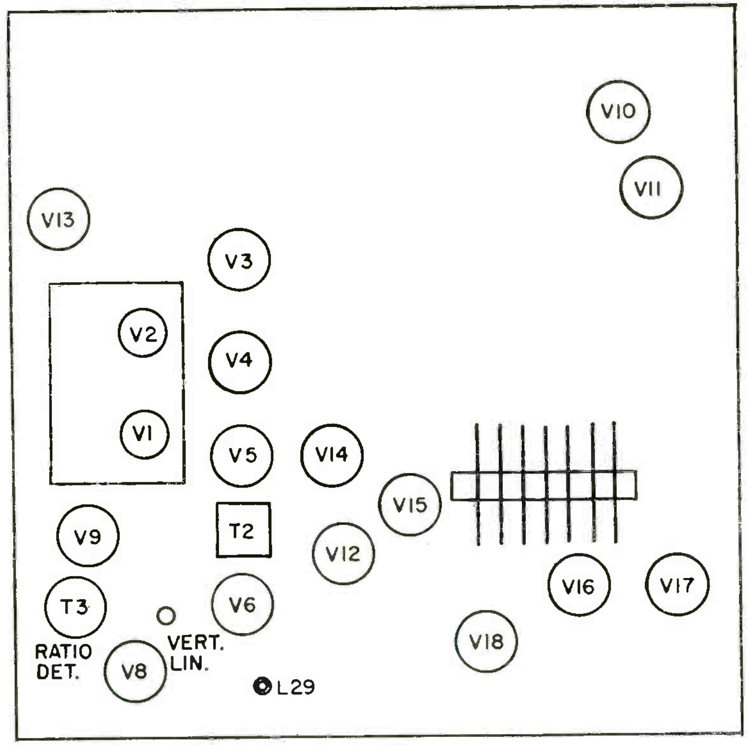
SYMBOL	TUBE	CIRCUIT FUNCTION
V1	6BK7	VHF, RF Amp.
V2	12AT7	VHF Osc.-Converter
V3-4-5	6CB6	IF Amps.
V6	6AH6V	Video Amp.
V7	17HP4	Picture Tube
V7	21FP4A	Picture Tube
V8	6AU6	Audio IF Amp.
V9	6AL5	Audio Detector
V10	6AV6	Audio Amp.
V11	25L6GT	Audio Output
V12	6BE6	Sync Clipper
V13	12SN7GT	Vert. Blocking Osc., Output
V14	6AL5	A.F.C. Discriminator
V15	6SN7GT	Hor. Multivibrator
V16	25BQ6GT	Hor. Output
V17	6AX4GT	Damper
V18	1X2A	H. V. Rectifier
V19	6AF4	UHF Oscillator
V20	6BK7	UHF Pre-IF Amp.



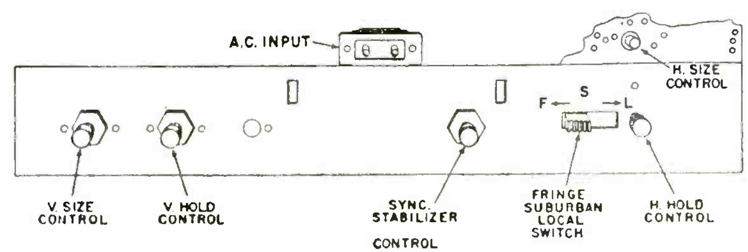
17-inch Tube Assembly.



21-inch Tube Assembly.



CHASSIS TOP VIEW



Rear Controls.

KEY VOLTAGES

B+, plate of damper,	V17 pin 5	240 vdc
Boosted B+, cath of damper,	V17 pin 3	450 vdc
Plate of VERT. OSC.,	V13 pin 6	245 vdc
Plate of Vert. Out.,	V13 pin 1	450 vdc
Plate(s) of Hor. Osc.	V15 pin 2	88 vdc
	pin 5	150 vdc
Grid of Hor. Out.,	V16 pin 5	−24 vdc

(All voltages are measured with a VTVM connected between the tube pins and chassis.)

ADJUSTMENTS

VERTICAL SIZE AND VERTICAL LINEARITY CONTROL

The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.

CAUTION:

The vertical linearity control is on the top chassis plate, therefore, severe shock may result from contact. If an isolation transformer is unavailable, use an insulated screwdriver for the adjustment to reduce shock hazards. The adjustment can be made from either the top or bottom of the chassis.

FRINGE-SUBURBAN-LOCAL SWITCH

The three position switch selects the proper operational characteristics of the receiver for the signal strength area in which located. The position of the switch is governed by the signal strength available.

In the Fringe position the A.G.C. voltage is reduced to a bare minimum and the sync stabilizer adjust control affects the sync clipping level to reduce noise affects.

In the Suburban position full A.G.C. is applied and the sync stabilizer adjust control functions as in the fringe position.

In the Local position full A.G.C. is applied and sync stabilizer adjust control disabled.

SYNC STABILIZER ADJUST CONTROL

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

ION TRAP MAGNET

The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip). If the adjustment is necessary, loosen the wing nut and rotate until the position which gives maximum illumination is found. Adjust the screw for maximum illumination. Repeat the above two steps. Rotate and slide magnet until the best focus position is found. Tighten wing nut. Adjustment should be made with brightness and picture controls set for normal viewing.

HORIZONTAL SIZE CONTROL

The horizontal size control should be adjusted until the picture fills the entire screen horizontally. A clockwise rotation will decrease size. To some extent the vertical size control setting may be affected by a major horizontal size adjustment.

HORIZONTAL HOLD CONTROL

The horizontal hold control is located on the rear flange of the chassis and should be adjusted in the following manner.

Set the picture control to its normal operating position. Turn the thumb screw clockwise until it reaches its stop. Turn two complete turns counter-clockwise. The thumb screw is a vernier adjustment and will then be in the center of its range.

Turn the iron core with a small screwdriver or adjusting tool until the picture is steady (no horizontal movement). Set the core to the middle of its range.

After the iron core has been properly adjusted the thumb screw should then be used as a vernier adjustment to control synchronization when necessary.

CENTERING MAGNET

The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

DEFLECTION YOKE

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a positioning adjustment is necessary, loosen the yoke nut located at the top of the picture tube assembly.

HORIZONTAL LINEARITY MAGNET—17" ONLY

The horizontal linearity magnet affects the linearity of the right side of the picture only. The magnet pulls or stretches the right side and has a greater effect closer to the picture tube.

ANTI-PIN CUSHION MAGNET—21" ONLY

Adjust centering until an edge of the raster is visible. Loosen the positioning screws and slide the magnet backward or forward until the edge of the raster is vertically straight. If keystoning is noticed adjust magnets in vertical plane.

WESTERN AUTO TROUBLE SHOOTING CHART

NO VERT. SYNC.—HOR. SYNC. OK

Vert. Hold con.
V12, V13
Sync. stabilizer con.
Check 0.0047 and 0.022 µf caps. connected to pin 3 of V13

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK

V12
Check 0.0022 µf cap. connected to pin 7 of V12
Sync. Stabilizer con.
Fringe switch

NO HOR. SYNC.—VERT. SYNC. OK

Hor. Hold con.
V14, V15, V16
Check 330 µµf cap. connected to pin 5 of V15

DISTORTED SOUND

Tuner fine tuning
V2, V8, V9, V10, V11
Check Vid. Det. xtal. CK706 (Part of T2)
Check 0.01 µf cap. connected to pin 5 of V11
Sound and Vid. IF alignment
Det. alignment

WEAK SOUND—PIX OK (8C)

Tuner fine tuning
Vol. con.
V2, V8, V9, V10, V11, V12
Sound and Vid. IF alignment
Det. alignment

SYNC. BUZZ IN SOUND

Tuner fine tuning
V2, V6, V8, V9
Check Vid. Det. xtal CK 706 (Part of T2)
Sound IF and Det. alignment

WEAK PIX—SOUND AND RASTER OK

Tuner fine tuning
Contrast con.
V2, V3, V4, V5, V6, V12
Fringe switch

POOR HOR. LIN.

V16, V17
Check 50 µf El. cap. connected to terminal 1 of Hor. Out. trans.
Hor. Out. trans.

ENGRAVED EFFECT IN PIX

Tuner fine tuning
Contrast con.
V2, V3, V4, V5, V6
Check 0.1 µf cap. connected to pin 1 of V6
Check Vid. Det. and Amp. peaking coils

VERT. BARS

V16, V17
Check 47 µµf cap. connected to yoke terminals
Defl. yoke ringing

PIX BENDING

Hor. Hold con.
Sync. Stabilizer con.
V12, V14, V15
Check 0.047 µf cap. connected to pin 4 of V15

WEAK OR NO PIX—SOUND WEAK—RASTER OK

Tuner fine tuning
V1, V2, V3, V4, V5, V6
RF and IF alignment

EXCESSIVE RASTER (PIX SIZE)

Hor. Drive con.
Hor. and Vert. Size con.
V7, V16, V18
Check 8.2K Ω res. and 0.047 µf cap. to pin 4 of V16

INSUFFICIENT RASTER WIDTH (23)

Hor. Size con.
V16, V17
Check 560 µµf and 0.01 uf caps. connected to pin 2 of V15
Hor. Out. trans.
Low line voltage

INSUFFICIENT RASTER HEIGHT

Vert. Size and Lin. con.
V13
Check 0.47 µf cap. connected to pin 4 of V13
Check B+ supply voltage
Vert. Out. trans.
Low line voltage

NO VERT. DEFL.

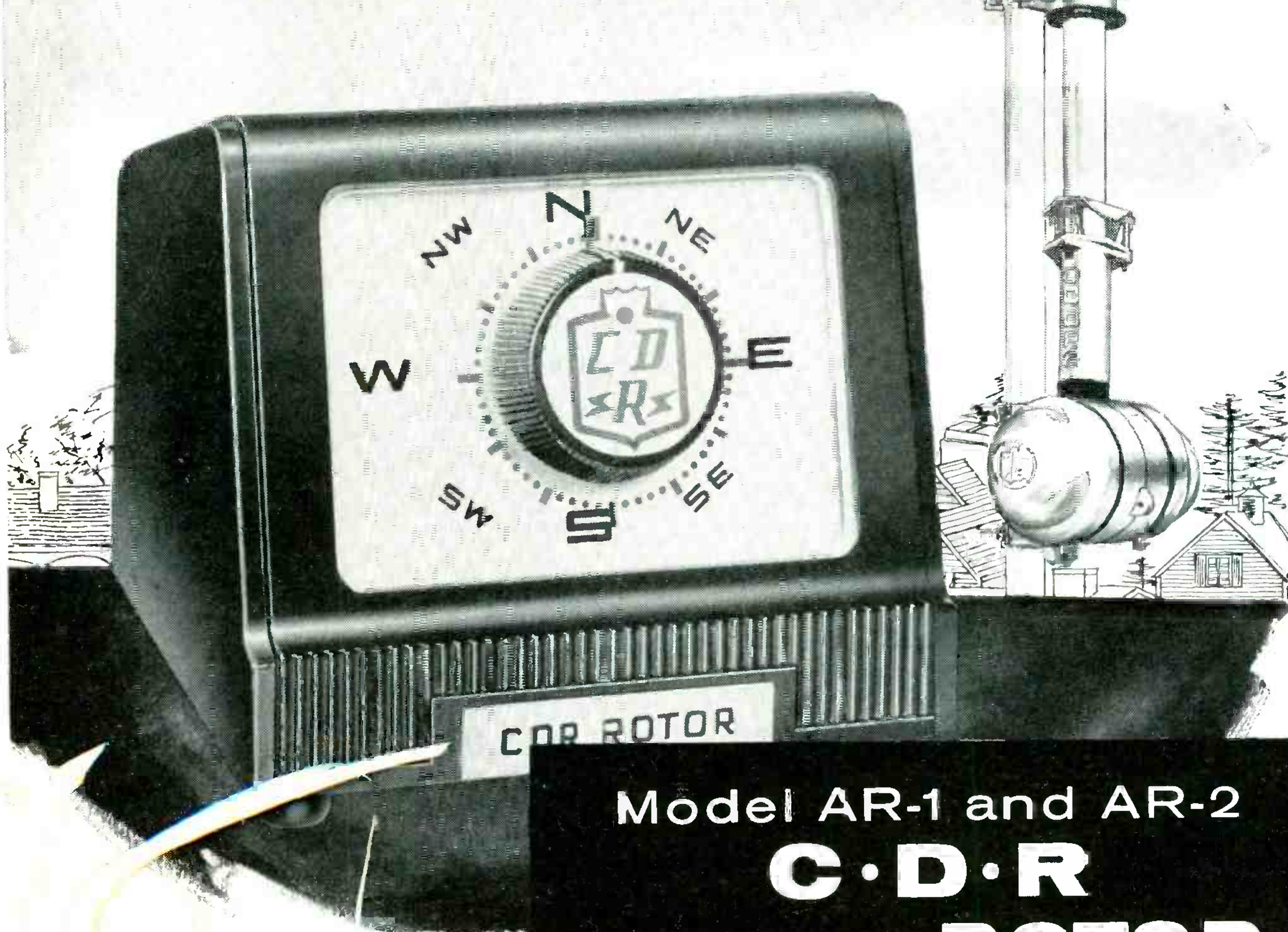
V13
Check 0.01 and 0.047 µf caps. connected to red Lead of Vert. Osc. trans.
Check 0.47 µf cap. connected to pin 4 of V13
Vert. Defl. coils (yoke)
V.O.T. and Vert. Osc. trans.

POOR VERT. LIN.

Vert. Size and Lin. con.
V13
Check 0.47 µf cap. connected to pin 4 of V13
Check 100 µf Elec. cap. connected to pin 6 of V13
Vert. Out. trans.

40% Sharper Tuning

than any other AUTOMATIC ROTOR



Model AR-1 and AR-2
C·D·R
automatic ROTOR

Here is EVERYTHING that ANYONE could ask for in a rotor! Powerful enough to turn any TV antenna . . . sturdy construction . . . and a handsome modern design plastic cabinet that AUTOMATICALLY turns the antenna to any position . . . AND ACCURACY that presents 40% SHARPER TUNING than any other automatic rotor!

. . . AND THEY ARE PRE-SOLD to consumers in every leading rotor market area with saturation TV SPOT ANNOUNCEMENTS!

Model AR-2 . . complete AUTOMATIC rotor with thrust bearing . . . and handsome modern design cabinet, uses 4 wire cable

Model AR-1 . . same as AR-2 without thrust bearing

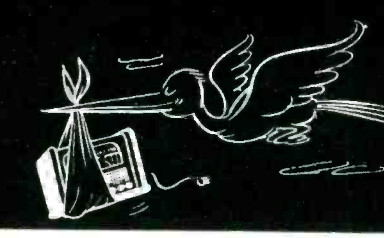
Field Tested
For Years

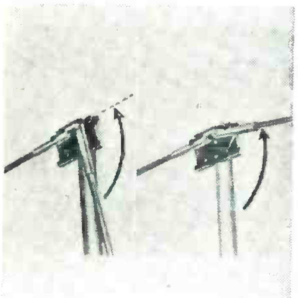
& Tried
& Tested
& Proven

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

THE **RADIART** CORP.
CLEVELAND 13, OHIO

New Products



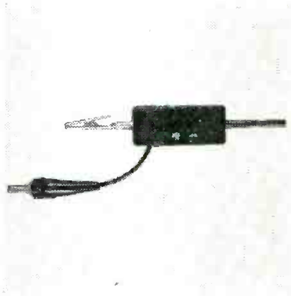


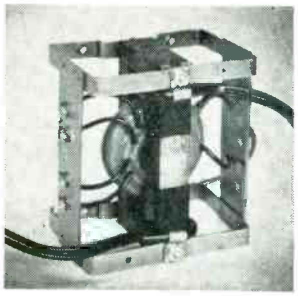
Snap-Lock Antenas

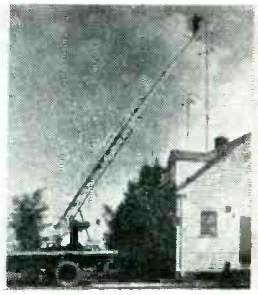
Channel Master Corporation, Ellenville, N. Y., has announced that its complete line of preassembled antennas will incorporate "Snap-Lock" action. This new design eliminates the need for wing nuts and all other hardware requiring manual tightening. At the same time it provides for a stronger, more rigid assembly than has heretofore been possible for dipoles, directors, and reflectors.

Simpson HF Probe

Many of the service scopes now in use have relatively low sensitivity, which may place the technician at a disadvantage in checking certain low-gain circuits in the color TV chassis: however, by use of a suitable video voltage-doubler probe, it is observed that a scope having a sensitivity of 0.05 volt-per-inch, e.g., provides an effective sensitivity of 0.025 volt-per-inch.





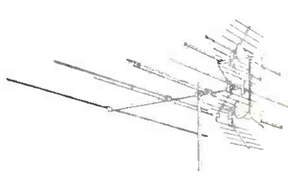


Merit Replacement Transformers

Seven high voltage, horizontal deflection transformers, models HVO-15 through HVO-21, designed as exact replacements for Philco units are now being manufactured by the **Merit Coil and Transformer Corp.**, 4427 North Clark Street, Chicago. According to the manufacturer, these seven transformers cover 90 per cent of all Philco chassis and models produced prior to and during 1953.

Memco Aerial Ladders

Aerial ladders such as these, manufactured by **Memco**, of Oklahoma City, have become very popular with the fringe-area serviceman, who simplifies his antenna service and installation technique, saves a great deal of time, and perhaps his life, because of the ladder's safety features. For info. write: Memco, 1007 NW 36 St., Oklahoma City 3, Okla.

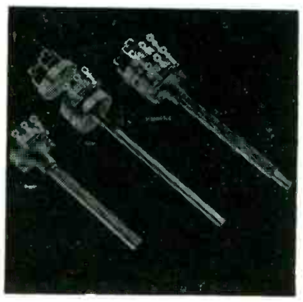


Vokar Vibrator Line

A specially built line of replacement vibrators has been made available by **Vokar Corporation**, Dexter, Michigan. The new vibrator, known as the Imperial, is reported to have unlimited shelf-life, and quiet, unexcelled performance. Packaged in a distinctive golden can, the Imperial carries an unconditional full-year warranty. Contact points are coated with anti-oxidizing agent and each point carefully cleaned by hand rather than mechanically.

Vee-D-X Antenna

The new "Chief Series" of antennas by **LaPointe Electronics** is designed around the phasing technique known as "Dyna-phase" which effects unity coupling of all three TV bands for a perfect impedance match through a single lead in line to the set. Dispensing with filters, auxiliary stubs and couplers, this antenna has an average gain for uhf that closely approximates stacked arrays with a high front-to-back rejection ratio.

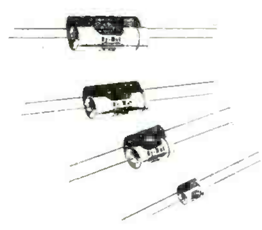


Centralab Dual Control Replacements

Centralab's "Fastatch" system of dual-concentric control replacements eliminates the problem of finding a "Special" control. **Centralab** has separated the rear unit, complete with inner shaft from the front unit, complete with outer shaft, so that shafts can be cut to the proper length and then the units "snapped" together in one motion. The Fastatch switch, if required, is "snapped" on to the rear unit.

Picture Clear UHF Antenna

The uhf section of the antenna consists of two stacked dipoles together with a reflector. These are designed to be broad-banded and to cover the entire uhf spectrum with minimum standing wave ratio when matched to the standard 300-ohm load. The reflector of the uhf section has been designed in such a manner that it also served as a good antenna for vhf reception in primary service areas. Address inquiries to RTSD.



RCA Loudspeakers

Two new **RCA** loudspeakers which feature larger-than-usual Alnico V magnets are now available to radio-television service dealers for replacement applications. The speakers are a 6½-inch permanent-magnet type (RCA-220S1), for replacement service in table model radio and television receivers and in centralized sound systems; and a 6-by-9-inch permanent-magnet type (RCA-218S1), for use in automobile radios and home music systems.

Astron Paper Capacitors

Astron "Hy-Met," high temperature "Metalite" metallized paper capacitors, are the smallest paper capacitors available for their given ratings and operating temperatures according to **Astron Corporation**, East Newark, New Jersey. Hy-Met is designed for operation over a wide temperature range of −55° C to +125° C. It features the unique self-healing characteristics of metallized paper capacitors, and has good capacitance vs. temperature stability.

THE 980 LINE

Model 985 Calibrator—$199.50

Model 983 Oscilloscope—$329.50

Model 984 Sweep Generator—$199.50

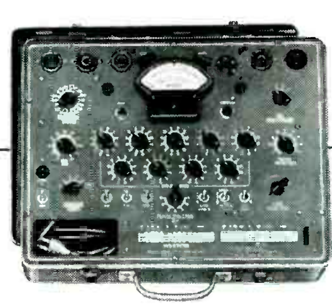
Representing an entirely new approach in test equipment design and operation, the 980 Line instruments have brought new *simplicity* and new *time-saving facility* to TV receiver alignment and servicing. Now available to TV technicians through leading distributors. Literature giving complete information on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.

8420

Model 982 Vacuum Tube Voltmeter—$69.50

WESTON

TEST EQUIPMENT



Model 981 Tubechecker—$199.50

Model 980 Analyzer—$52.50

ANSWERMAN

[*from page* 27]

vertical output tube which should be 1600 volts.

Shrinkage can be caused by an increase in the resistor values in the cathode or plate circuit of the vertical output tube. The 3000 ohm vertical linearity control and the series 1800 ohm resistor should be checked to determine if they are increasing in resistance.

If the cathode resistor checks good, the next point to examine is the two 3.3K resistors feeding B plus to the vertical output transformer. These resistors may be increasing in value reducing the plate voltage. This should also show in the *dc* plate voltage reading as a voltage change.

If the plate voltage does not change appreciably and the series resistors are found to be good the next step is to substitute a new vertical output transformer. Of course the vertical deflection coils can be at fault but this is not as likely as the transformer.

If the core material of the deflection coils should separate or is badly cracked so that a space develops when the current flows through the deflection coils the yoke can be responsible for this type of trouble.

Increasing Scope Gain

Dear Sir:

I have an oscilloscope that doesn't have enough vertical gain for certain TV troubleshooting purposes. Could you furnish me with a wiring diagram of a battery operated pre-amplifier that will permit me to use my scope with smaller voltages such as those present in the *if* stages of a television receiver.

J.K.D.
Greencastle, Ind.

Many technicians are finally getting to know their test equipment. An oscilloscope is no longer a piece of equipment that gathers dust on a shelf above the service bench, but in many shops is employed to quickly locate troubles. Along with the scope there are two pieces of auxiliary equipment that are very useful. These two attachments are the voltage calibrator and the pre-amplifier.

Older scopes and even some newer ones may have sufficient bandpass but the gain may not be as high as desired. Also some scope kits can be greatly improved with the addition of a pre-amplifier.

[*Continued on page* 56]

The largest assembly of high-fidelity enthusiasts ever to gather for a single event will attend the 1954 Audio Fair, according to Harry N. Reizes, Fair manager. Scheduled for four days beginning October 14 at the Hotel New Yorker, the Fair will play host to an estimated 30,000 visitors.

A retail sales contest, open to its thousands of dealers throughout the country, has been announced by the General Electric radio and television department. The contest will be of twenty weeks duration ending on Dec. 31 with the award of a 17-day all-expense paid cruise of the Caribbean to winning dealers and their wives. Every G-E radio and TV dealer in the country will have an opportunity to come out on top in the contest, regardless of the size of his business. Standing in the contest will be based on a point system and all dealers will be classified according to average volume of sales during a predetermined period.

Dallas, Texas, is getting ready a "Texas-style" welcome for the Electronic Parts Distributors' 3rd Regional seminar to be held at the Baker Hotel, October 22 and 23, 1954. This educational program, financed jointly by National Electronic Distributors Association and Radio Parts & Electronic Equipment Shows, Inc., will present Elmer Wheeler, Dallas' "super salesman" who will give visiting distributors tips on effective selling. There will also be two panels composed of distributors. One will discuss "Inventory Control," a subject shown to be at the top of jobbers' problems lists; the other will cover a variety of subjects, including methods of checking freight rates; how to help a dealer be a better businessman; ways to cut down on paper work, etc., Insurance, Business Management and possibly the new tax law. A movie on Credit & Collections, entitled "Of Time and Salesmen" produced by Dun & Bradstreet will also be shown as part of this broad program. Entertainment will include refreshments, a cocktail party and a prize award.

More than two million dollars will be spent in all media this fall to advertise CBS-Columbia color and black-and-white television receivers and radio sets. Advertising and promotion of CBS-Columbia's new color receivers will be highlighted by a two-page four color insertion in Life Magazine, to be followed up by an extensive factory saturation newspaper schedule in key cities, and expanded radio and television spots, plus full dealer cooperative schedules.

Blonder-Tongue Laboratories, Inc. of Westfield, N. J., manufacturer of master TV systems and uhf converters has expanded production capacity with the opening of a second plant nearby. This provides a total of over 50,000 square feet. Supplementing the remodeled assembly lines are a modern machine shop, enlarged service department and excellent shipping and receiving facilities. Additional floor space is available for the production of new Blonder-Tongue products, as soon as designs are released.

The Vokar Corporation, of Dexter, Michigan, manufacturers of Imperial vibrators, has announced recently that they plan to merchandise their Imperial line through their nationwide distribution setup of jobbers.

An attractive point of sale display is being offered to all distributors free of charge by Radio City Products Company, Inc., Easton, Pennsylvania. This impressive display is in four colors and acts as a silent salesman and at the same time it practically displays their new Model #480 Universal Multitester. Any distributor who orders four or more units automatically receives one of these displays without requesting it. The display features the "world's best multitester value."

The Battery Committee of National Electronic Distributors Association met with manufacturers of batteries on September 28, in Chicago. A letter to manufacturers explaining the purpose of the session, stated: "The NEDA Battery Index is serving an excellent cross-reference purpose as it now stands. However, there are a number of dry batteries that are not directly interchangeable, and on which electrical specifications and size are not exact. To start work on a clarification project, we invite you to send one of your engineers to attend a meeting in Chicago for the purpose of determining insofar as is possible, directly replaceable *numbers in competitive lines."*

Manufacturing companies represented include General Dry Batteries, Inc., Cleveland, Ohio; Burgess Battery Company, Freeport, Ill.; National Carbon Company, New York City; Olin Industreis, Inc., New Haven, Conn.; Ray-O-Vac Company, Madison, Wis.; Radio Corporation of America, Harrison, New Jersey; Marathon Battery Company, Wausau, Wisconsin, and Bright Star Industries, Clifton, New Jersey.

Quam-Nichols Company has announced that effective September 1, 1954, the Wes Alderson Co., 10430 National Blvd., Los Angeles 34, California, will represent our company in the sales of its products to jobbers and manufacturers in Southern California.

Sylvania Electric Products, Inc. announced the availability to electronics distributors in the west of a new promotional program intended to help service dealers to drastically cut callbacks. Essentially, the program involves the construction and development of new tube types which will help the serviceman at the point of chassis, when he is being harassed by having to return to a customer's home after barely having left there to service a set.

Mr. Julius Finkel, president and founder of JFD Manufacturing Company, 6101-16th Avenue, Brooklyn, New York, accepts the 5-Millionth Indoor Antenna from Miss Joan Adler, who presents it to him on behalf of the JFD Production Department. This special gold-plated model is offered to Mr. Finkel, who is approaching his 25th year in business, in recognition of his high principles, and successful products.

ANSWERMAN

[*from page* 52]

Examples of where the scope pre-amplifier is desirable is in the alignment of *vhf* tuners. In this case the pre-amplifier permits aligning without overdriving the tuner to obtain an output waveform that can be observed on the scope tube.

This is even more important in *uhf* tuner trouble shooting and alignment where the input and output levels are so small that the average scope will reveal nothing.

The scope pre-amplifier presented in *Fig.* 2 is a voltage amplifier employing conventional tubes, either the 1U4 or the 1L4, and is built with standard parts that service shops may easily obtain. The circuit is straightforward and can easily be assembled.

The pre-amplifier employs a 90-volt battery for the B plus and a 1.5-volt battery to provide the filament voltage. A battery operated unit is less apt to develop hum and bounce problems that would be possible with other types of power supplies. To further eliminate hum it is desirable to use coax cable for the input and output signals and the outside shield of the cable should be fastened to the metal container rather than to terminals protruding from the metal container. Best results can be obtained if the batteries are also enclosed in the case.

The 1U4 or 1L4 tube is employed because of the low filament current drain. The 1U4 tube is preferable because of its high gain and low B plus current drain.

In the chassis layout, maintain the input and output leads and circuit resistors and condensers as far as possible from each other so that feedback possibilities are reduced.

The use of a scope pre-amplifier with an *rf* probe will permit the serviceman to go right up to the front end of a TV receiver and view the signals that otherwise would not be discernible. Also he can more easily perform stage by stage alignment in high gain, low level equipment.

WORKBENCH

[*from page* 35]

A voltage check was then taken at Pin #1 of V12A. Instead of the meter reading 11 volts negative, it read about one volt negative. A resistance check was next made from Pin #1, grid of V12A, to ground. The reading was about 200K instead of 2.2 meg. ohms. C57 (20 *μμf*) was then clipped from the circuit and on checking its resistance it read 300K ohms. We replaced C57 and the receiver now functioned properly. The point to remember here is that because there was no bias on V12A due to a defective C57, the video and blanking information was not eliminated and was therefore allowed to trigger the vertical and horizontal oscillators.

COMMUNITY TV SYSTEM

[*from page* 23]

to each distribution outlet or ADO unit regardless of its separation from the line amplifiers.

The distribution outlets or ADO units are used to feed three separate secondary lines or riser cables. Individual receivers are connected to the riser cables, each cable handling 20 receivers. The ADO units are minimum loss bridging amplifiers that provide a high degree of decoupling between amplifiers and the individual riser cables. They have a minimum forward loss and a very high backward attenuation.

From the secondary lines the individual drop-offs are made to receivers via isolation networks. As many as 60 receivers can be supplied with signal from the three riser cables attached to an ADO unit. Other ADO units are available that permit feeding of 200 receivers.

The special drop-off isolation networks link the cable that runs into an individual receiver with the riser cable. These drop-off networks must be positioned along the riser cable according to a color code. They have varying degrees of attenuation according to their separation from the ADO unit. With this arrangement the same amplitude signal is applied to each receiver along the riser whether the drop-off is made near the ADO unit or at the far end of the line. At the same time they permit optimum isolation between all receivers along the cable.

According to Gene Schneider, performance reliability of the system depends on a rigid preventive maintenance schedule. A chief technician and two assistants handle the maintenance and installation chores. Each amplifier location is seen once each five weeks and its signal level measured. Every ten weeks a replacement amplifier is substituted at each location. The removed amplifier is taken to the shop to be inspected, adjusted, and aligned. It then can be inserted at another location along the system.

The maintenance schedule is arranged so that level checks are being taken in one part of the city while amplifier substitutions are made in another part. Such a schedule affords a good indication of the overall system almost each week because of the interlocking arrangements with the main feeders.

The technical crew also makes the individual drop-offs to new subscribers and many other chores such as re-routing lines when pole changes are made, for building construction and, yes, even for house movings.

The story of television in Casper is an inspiring one because it is a direct result of local community activity—hopes, pioneering spirit, effort, and results. No dole or grants are involved. This is the answer for obtaining first rate television in many cities of comparable size and location.

RC CIRCUITS

[*from page* 30]

in a simple series circuit, *full* source voltage appears across the resistor at the first instant. The effect on time constant so far is zero—since a modified RC circuit where the condenser effectively charges up to one-half the battery voltage, starting with one-half the original initial current, would have the same time constant as before if no other factor is involved. The third factor which makes the difference is the fact that the current for both condensers goes through *R1*, even though one condenser is discharging and the other is charging. Effectively, this is the same as if both were charging or both discharging through *R1*.

Immediately after the first surge, the voltage across parallel condenser *C1* can be considered the battery voltage in an equivalent circuit, *Fig. 24d*-60v. The parallel condenser C1 discharges by this amount of voltage and the series condenser charges by exactly the same amount. The current for both condensers flows through R1. The time constant of a simple series RC circuit is changed in exactly the same degree by placing a second condenser across *either the resistor or the original condenser*. However, the effect on circuit operation and on the output waveform will be different, as shown in the voltage curves of *Fig. 24*, when the condenser is across the resistor.

One important characteristic of this

[*Continued on page* 59]

Trade Literature Check List

Catalog: installation practices, and types of accessories available for a multiplicity of installations, including splicers, HV probes, custom TV, outlet wall plates, combination and polarized connectors, terminals, etc.	**Javex** **P.O. Box 646** **Redlands, Calif.**
150,000 **cross-reference listings** of TV sweep components for every TV set mfd. to date, plus servicing data and theory of sweep circuits.	**Ram Electronics Sales Co.** **Irvington, N. Y.**
1954 Catalog of stock transformers for Radio, TV, amateur, communications, etc. applications. Electrical and physical specs for over 500 units. Also write for bulletin #469, for Flyback replacements.	**Chicago Standard Transformer Co.** **Addison and Elston,** **Chicago 18, Ill.**
New **Tung-Sol Tube Characteristics Manual,** 200 pages listing data on 600 receiving tubes, 110 premium types, 170 CRT's, 85 diodes plus tube base diagrams, color codes, dial lamps and numbering codes.	**Tung-Sol Electric Co.** **95 8th Ave.,** **Newark 4, N. J.**
Jensen Catalog #1040, covers their line of general purpose and commercial loudspeakers, projectors, cabinets, volume controls and transformers.	**Jensen Manufacturing Co.** **6601 South Laramie Ave.,** **Chicago 38, Ill.**
Electro-Voice Catalog #119 illustrates and describes mikes, HI FI speakers, components, enclosures, phono cartidges, PA components, FM and TV boosters, and RME products.	**Electro-Voice, Inc.** **Buchanan, Mich.**
Complete **products catalog** featuring the Astatic line of phono pickups, needles, recording heads, mike stands, TV uhf converters and boosters.	**Astatic Corporation** **Conneaut, Ohio**
Allied Catalog #140 listing a highly comprehensive line of electronic equipment for domestic consumption. You name it. It's here.	**Allied Radio Corporation** **100 N. Western Ave.,** **Chicago 80, Ill.**
The **CBS-Hytron Reference Guide** for Miniature Electron Tubes, containing all miniature tubes, regardless of make. 329 types.	**CBS-Hytron** **Danvers, Mass.**
A **Catalog** of **Chester Wires and Cables** for every electronic purpose, and for every installation technique.	**Chester Cable Corp.** **Chester, New York**
JFD's Brochure with charts, diagrams, and photos of development of their new Jet-Helix antenna.	**JFD Manufacturing Co.** **6101 16th Ave.** **Brooklyn 4, N. Y.**
GE's Brochure, illustrating in diagrams the fundamentals of the GE Chromacoder TV B'casting system.	**General Electric** **Electronics Park** **Syracuse, N. Y.**

Aside from the books reviewed in our Trade Literature columns, many valuable bulletins, catalogs, guides, etc. are made available by manufacturers, etc. at no cost, or in some cases, nominal cost, to the servicing profession. As an aid to the busy technician, RTSD publishes this Check List. To the best of our ability, the items are listed in the order in which we learned about them. This, we feel, is the fairest and most sensible way to help the serviceman keep up with things. Items that couldn't make the list this month because of space limitations will ride at the head next issue. Unless otherwise specified, all literature pieces in the Check List are free for the asking. Simply write to the organization listed in the Source column, and mention you saw it in *Service Dealer*.

RC CIRCUITS

[*from page 57*]

circuit should be noted and remembered. After the first surge, the parallel condenser discharges while the series condenser continues to charge. With some modifications, we will find the same thing happening in many other types of complex RC circuits.

The basic action of any of the RC networks we have discussed may be modified to some extent in a radio or TV stage because of the way the circuit is connected. For example, connecting the grid of a tube to a certain point in the RC circuit may effectively short out one resistor when the grid draws current on positive signal peaks. However, during the rest of the signal cycle, the resistor functions as part of the network.

Sync Circuit Application

This happens in a common circuit in current TV receivers, *Fig.* 25. The RC network is used between the output video amplifier and the first sync clipper stage. Our previous analysis makes it simple to understand the general action of the RC circuit. Before that is discussed, it will be helpful to review briefly how this type of clipper stage operates.

Grid leak bias and low plate voltage are used in the sync clipper stage, VI. The amount of grid leak bias is determined by the positive peak voltage of the incoming signal—the sync pulses. As a result of the low plate voltage and the bias, the tube cuts off at a comparatively small negative signal. Therefore, only the most positive part of the incoming composite video signal—the sync pulses—appears in the output at the plate. All the rest of the video signal is negative enough to cause the tube to cut off.

The combination *C1R1* in *Fig.* 25 acts as a "noise filter" to reduce the harmful effect of short-duration, high-amplitude noise pulses on the sync clipper stage. *Without C1R1,* the grid leak condenser C2 would charge up instantaneously to the peak amplitude of the noise pulse. On the peaks of the positive signals the time constant is short, since the grid draws current. At this instant, the effective grid-to-cathode resistance of V1 is very much smaller than *R2* which is in parallel, and acts to short out *R2*. After the noise pulse passes, C2 discharges through *R2*, a long time constant path. This causes a large increase in grid leak bias. When sync pulses come in for the next few lines, the clipper stage will remain cut off because of the heavy bias and no sync pulses appear in the output. This

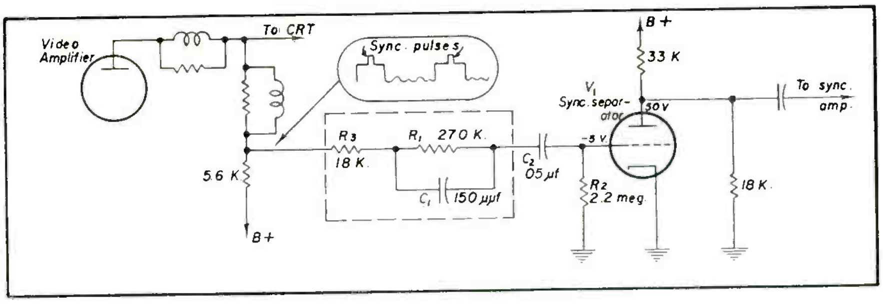


Fig. 25—Series parallel RC input circuit to sync separator stage.

can easily upset synchronization.

However, with *C1R1* in the circuit, a large noise pulse as before causes the grid of the clipper to draw current, just as an incoming sync pulse does. However, the voltage divides instantaneously between $C1$ and $C2$ in inverse proportion to the capacity. Practically all of the voltage therefore appears across $C1$. This is similar to the first surge when the switch is closed in *Fig. 24a*. As a result, there is practically no increase of voltage across grid leak condenser C2 and no change of bias. Since the time constant for the discharge of $C1$ through $R1$ is short, $C1$ can discharge rapidly.

When signals with a longer duration come in—such as vertical sync pulses—the initial voltage is also practically all across $C1$. However, these sync pulses last long enough for grid leak condenser C2 to charge to a substantial portion of the applied signal voltage, while at the same time C1 discharges. When the transmission of these sync pulses is completed, C2 then discharges through $R2$ to provide grid leak bias. $C1R1$ act to keep the grid leak bias level fixed by the sync pulse amplitude rather than by random noise pulses. Obviously, this noise filter is not a complete solution to all noise problems since large noise bursts may duplicate the effect of vertical sync pulses. Most current models use in addition noise cancellation stages.

$R3$, 18K, is added in series with the network to act as a decoupling resistor. $R3$ prevents V1 from loading down the video amplifier stage, especially when the grid of V1 draws current, $R3$ is large enough to decouple V1 from the video amplifier stage output circuit but still small enough to allow $C1$ to charge up quickly to the positive peaks of applied signals.

A drop in the value of $R3$ can cause picture fuzziness and/or sync instability. Strictly speaking, the RC circuit of Fig. 25 falls in the category of a more complex network which will be discussed in the next installment. However, the small value of $R3$ compared to $R1$ makes the circuit function substantially as described above.

[To Be Continued]

VERTICAL INSTABILITY

[from page 11]

portional to the strength of the incoming signal. However, the presence of grid current alters the situation considerably. Thus, referring to the diagram, we observe that resistors $R66$, $R67$ and condenser $C93$ form the filter network for the *agc* line. Since the grid circuit should draw no current there should be no voltage drop across $R66$ and $R67$. The voltage at point C in *Fig. 5* should equal the voltage at point B if no current flows.

[Continued on next page]

Under normal conditions the control grids connected to the *agc* line will measure the same as at point C of *Fig.* 5. If a grid is drawing current the grid voltage will measure less negative than the *agc* line (point C). For example, in *Fig.* 5, if point C in the *agc* line measures –5V and a check at point *D* reveals a potential of –2.9V we can conclude that current flows in the grid circuit of V8.

This could come from two sources only: One is V8 itself, and the other is a defective *C79*. If V8 is gassy the grid will develop a positive potential permitting current to flow in the circuit. This may be checked by removing V8 from the socket and rechecking the voltage. Since the removal of V8 kills the signal, the *agc* line voltage will drop to a very low value, probably less than –1 volt. If the grid pin at the socket of V8, with V8 removed now measures the same value as the *agc* line, V8 is defective. If the grid pin of V8 still reads some positive value, the second possibility, that is, a leaky or shorted 470 *μμf C79* is the cause of the trouble.

If the scope test at point *A* of *Fig.* 3 does not show sync compression, the video amplifier should be checked. Wave form checks should be made at the input and output points of each stage in the video circuit. Tube voltages and resistance checks should be made at any stage that shows incorrect waveforms.

Sync Circuit Check

If the video amplifier stages check OK the sync circuit is checked next. Again two methods may be employed, waveform analysis or voltage analysis. Waveforms of the sync stages may be made with a scope. Unfortunately, unless the exact waveforms are known, it is very difficult to determine whether or not an observed waveform is correct. It is therefore best to supplement the scope test with a voltage analysis.

One invaluable test that can be made with the scope is a check for the presence of undesired signals. The writer has frequently found unstable sync in receivers resulting from spurious signals in the sync circuit with no channel tuned in. These spurious signals, tracked down with the scope invariably show up an open filter somewhere. It is almost impossible to pin point this type of trouble by voltage measurements.

When making a voltage analysis of the sync circuit, receiver check points are invaluable as points of reference. *Fig.* 6 shows a typical sync circuit. It must be kept in mind that the sync signals will affect the voltage readings to some extent. Under normal operating conditions the presence of sync pulses will produce a negative voltage at the

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 RADIO-TELEVISION SERVICE DEALER, published monthly at New York, N. Y. for October 1, 1954.

1. The names and addresses of the publisher, editor, and business managers are: Publisher, Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y.; Editor, Samuel L. Marshall, 262 Sullivan Place, Brooklyn, N. Y.; 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.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

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 20th day of August, 1954.

HARRY N. REIZES, Notary Public

grids of the stages that are grid leak biased.

Referring to *Fig.* 6 we find our check points are *A* at V1, *B* at V2, and *C* at V3. At points *A* and *B* the voltage should read negative if a sync pulse is present. If *C1* or *C2* are leaky the reading may change to a lower value or may even go positive. In order to check this, it is necessary to switch off the channel and recheck the grid voltages.

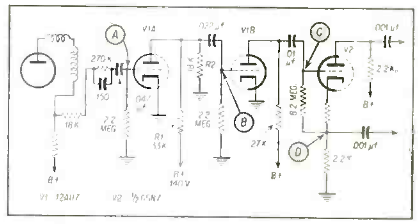


Fig. 6 — Typical sync circuit.

In the event of positive grid voltage the sync pulse shape and amplitude will be materially changed. The extent of the waveshape change determines how badly the sync is upset. Sometimes loss of both horizontal and vertical hold are observed. Reference to *Fig.* 6 will indicate that point *D* is normally positive with respect to ground. Therefore, the grid of V2 will read positive. However, its positive value should never exceed the reading from point *D* to ground.

Careful plate voltage readings should be made in sync circuits. V1 should have a low plate voltage due to the voltage divider action of *R1* and *R2*. Should the plate voltage rise the separating action of this stage will alter and video information will enter the sync, causing instability. In comparison, V2 has a higher plate voltage. Sync instability will occur if the 27K plate resistor should rise in value, thereby lowering the plate voltage; or should the source voltage drop.

The foregoing, in general, outlines the underlying principles of vertical sync instability. Of course, certain peculiar circuit designs will give rise to concomittant peculiar effects. However, if the serviceman understands the basic causes and symptoms relating to these troubles, the overall servicing operation becomes quicker and that much more profitable.

COLOR TV

[*from page* 16]

and B_{CD} could now be utilized to modulate the color subcarrier to produce the single color signal shown in *Fig.* 9. The manner in which this would be done is explained in detail in the next section; at this point all that we must know about the process is that two artificially produced carriers of the same frequency (3.58 *mc*) but displaced in phase by 90° may be modulated by the color-difference signals. This process permits two separate and distinct sets of AM sidebands to be transmitted on the same carrier frequency without interfering with each other.

Since the individual color-difference signals modulate two carriers displaced in phase by 90° the phase relations between the resulting signals are as shown in *Fig. 10A*. Observe that the new red and blue color-difference signals now take up definite right angle positions with respect to each other. Just as the red and blue color difference signals take up a definite angle with respect to each other, it can be shown that *all* color signals assume certain phase angles with respect to each other depending on the color or hue of the signal. In this manner, any color may be identified by the phase it has compared to a reference color signal to which we may arbitrarily assign zero reference phase. In *Fig. 10A* zero phase corresponds to $E_R - E_Y$.

As an example of the above let us assume that a saturated red bar is being scanned. Then, E_G and $E_B = O$; and assuming relative values, E_R and E_Y become:

$E_R = 1$

$E_Y = .3$ (recalling that the matrix is set so that $E_Y = .3E_R + .59E_G + .11E_B$). Under these conditions the relative color-difference signal amplitudes become equal to:

$$E_B - E_Y = -.3$$
$$E_R - E_Y = \ .7$$

For these values (referring to *Fig. 10A* and *10B*) the new color-difference signal amplitudes are:

$$R_{CD} = .877\ (E_R - E_Y) = .877 \times .7 = .614$$
$$B_{CD} = .493\ (E_B - E_Y) = .493 \times -.3 = -.148$$

The resultant of these two values shown in *Fig. 10B* corresponds to a pure red signal of maximum brightness. Notice that the phase displacement of the red signal is 13° to the left of the red color-difference signal zero phase position.

By a similar analysis all of the other colors may be shown to have definite positions with reference to $E_R - E_Y$. This is illustrated in *Fig. 11* for some of the major colors. Thus, a red signal is displaced 13° from the reference axis: a green signal 180° − 29° = 151°; and a blue signal 180° − 79° = 101°. Notice that the colors red, blue and green and magenta are displaced 180° from their complementary colors, cyan, yellow and magenta.

[To be continued]

Advertising Index

CBS-COLUMBIA

Models 17M06, 22C06, 22C38
Chassis 750-3, 751-3

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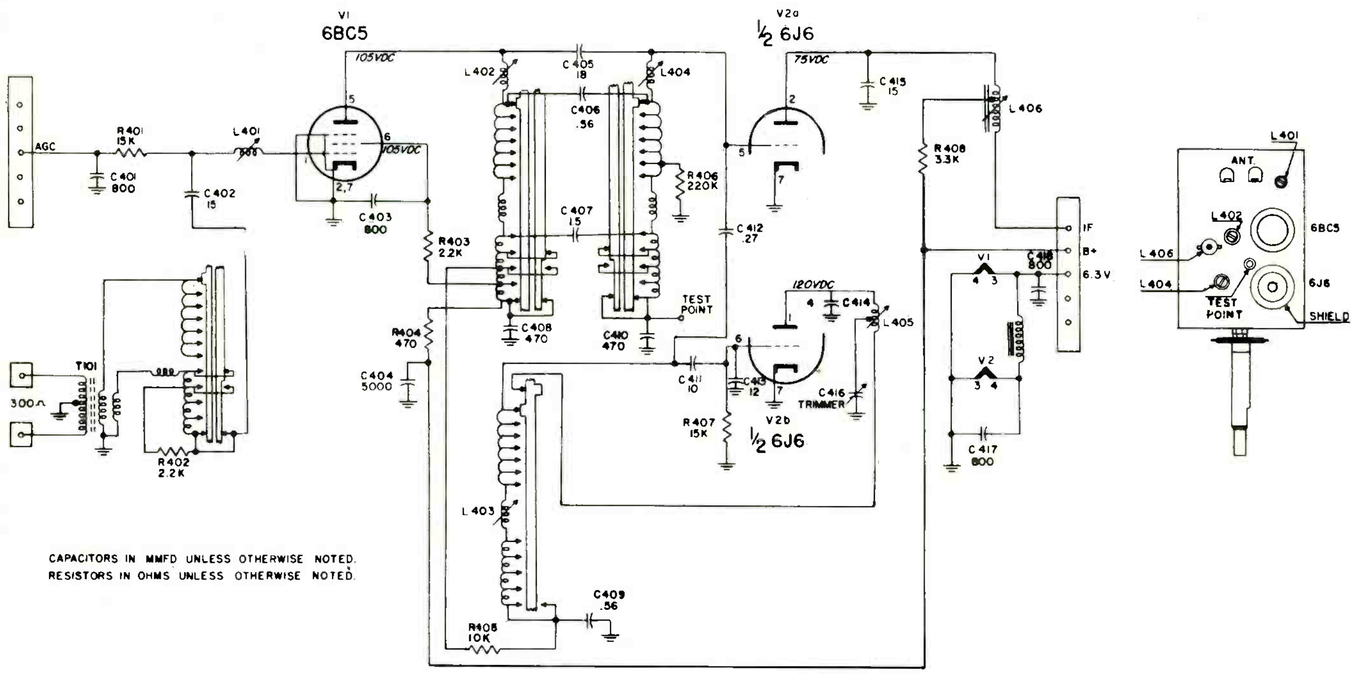
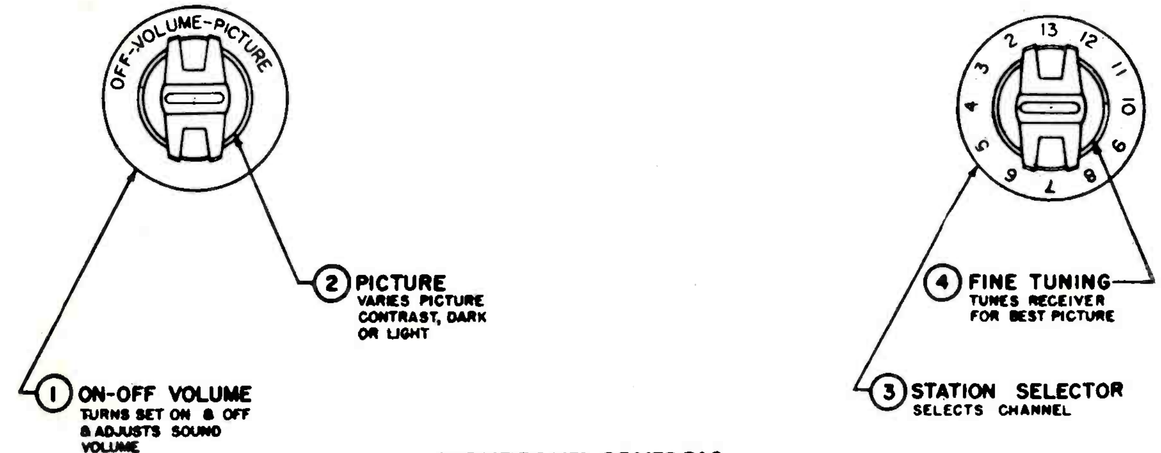
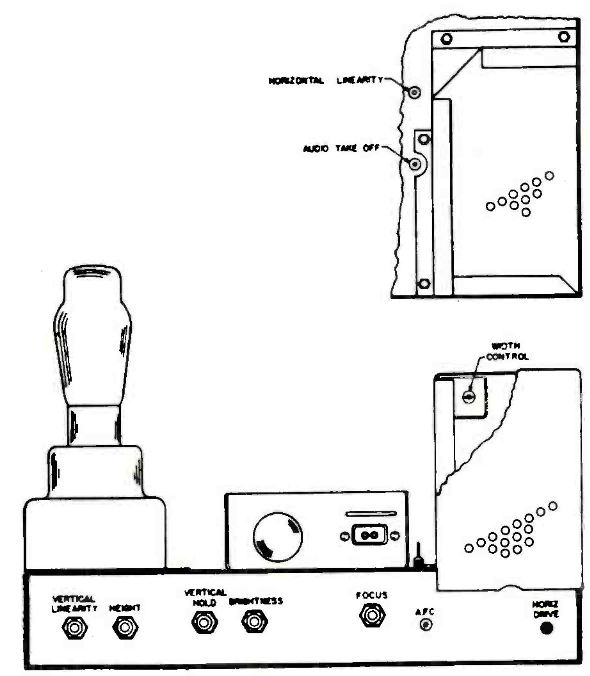


CAPACITORS IN MMFD UNLESS OTHERWISE NOTED.
RESISTORS IN OHMS UNLESS OTHERWISE NOTED.

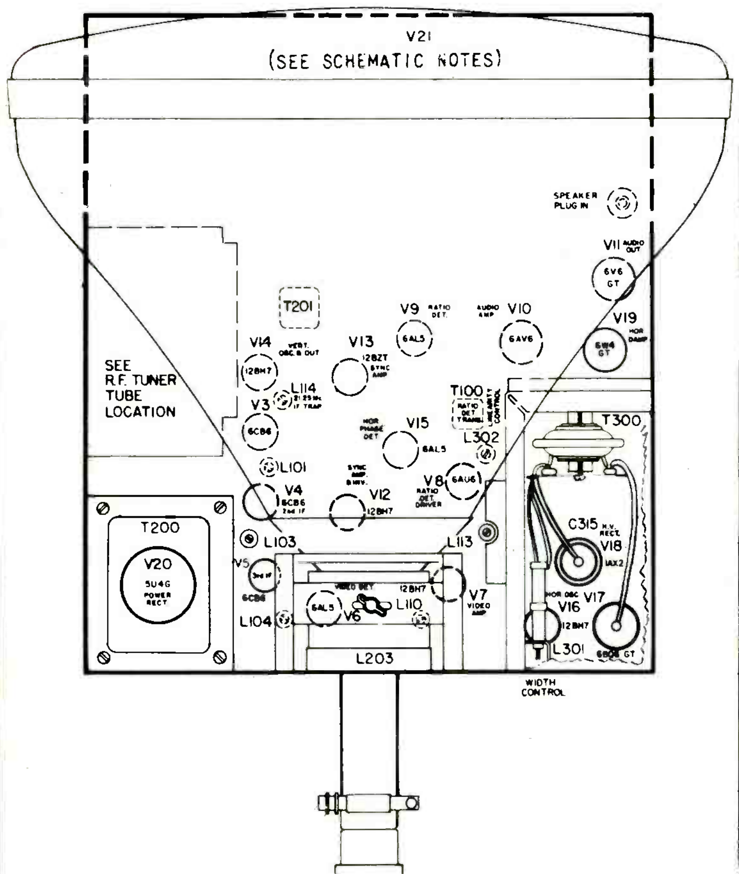
TUNER SCHEMATIC & TUBE LOCATION



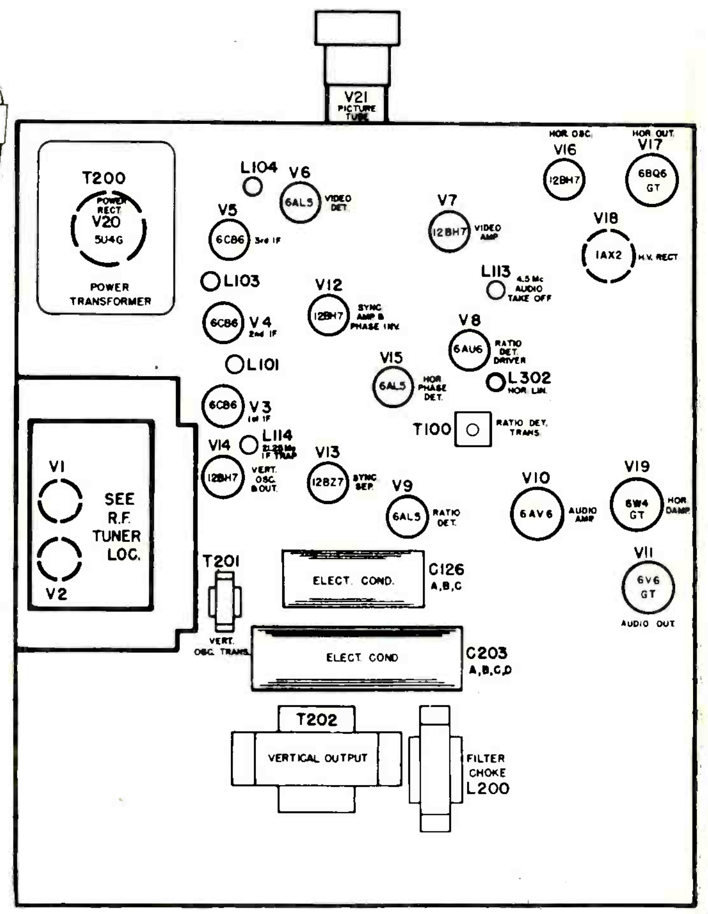
FRONT PANEL CONTROLS



REAR CONTROLS



TUBE & TRIMMER LOCATION



BOTTOM VIEW

	MODEL 17M06	MODEL 22C06	MODEL 22C38
CABINET	A60215	A60201	A60201
SAFETY GLASS	A62457-23	A62457-25	A62457-25
GLASS RET. CLIP	A62466 or A6205	A –	–
RET. CLIP LOCKING SPRING	A541440 or w/ A62466	–	–
MASK	A62470	A62481	A62481
BACK COVER	A62329	A62483-2	A62495
SPEAKER	A5866 – 5" PM	A5124 – 8" PM	A58124 – 8" PM
KNOB, CHANNEL SELECTOR (VHF)	A39281-2	A39281-2	A39281-2
KNOB, CHANNEL SELECTOR (VHF & UHF)	A39277-2	A39277-2	A39277-2
KNOB, ON-OFF-VOLUME	A39280-2	A39280-2	A39280-2
KNOB, PIX CONTROL	A39279	A39279	A39279
KNOB VERNIER	A39278	A39278	A39278
INDICATOR DISC (UHF)	A40152	A40152	A40152

CBS-COLUMBIA

Models 17M06, 22C06, 22C38
Chassis 750-3, 751-3

An exclusive service of Cowan Publishing Corp. by special arrangement with John F. Rider, Publisher

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picutre tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a– 4.5 megacycles

b– 22.8 megacycles

c– 25.4 megacycles

d– 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (± 1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.

3 – Cathode Ray Oscilloscope with good low frequency response.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE HORIZONTAL OUTPUT TUBE FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L406, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.

8 – Adjust L114 for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7 diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope verticel settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

5 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.

6 – Check all channels as above.

SOUND ALIGNMENT

1 – Connect 4.5 megacycle signal generator to pin 2 of 12BH7 (V7) video amplifier.

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V9) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K(± 1%) resistors across R126 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).

6 – Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

When necessary, the video amplifier 4.5 mc trap (L110) should be adjusted as follows:

1 – Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.

2 – Connect DC V.T.V.M. to pin 7 of 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.

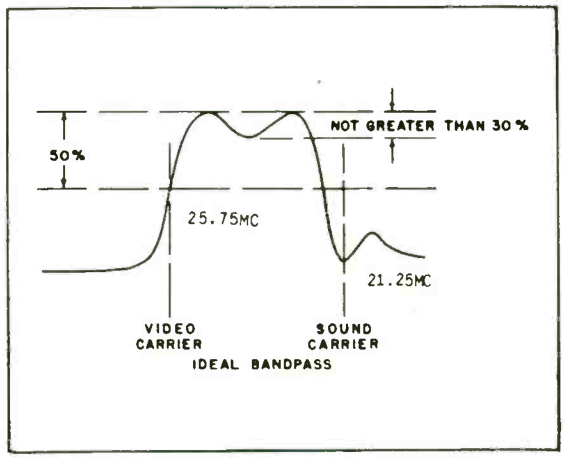
3 – Adjust L110 for minimum deflection on V.T.V.M.

R-F OSCILLATOR

If all channels are not within range of FINE TUNING control, adjust two screws located in front of r-f tuner unit for adjustment of either low or high band. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L404, during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.



DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

PICTURE TUBE HANDLING PRECAUTIONS

The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.

CBS-COLUMBIA

Models 17M06, 22C06, 22C38
Chassis 750-3, 751-3

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RESISTORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
R100		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R101		PE231-1113	Carbon, 33 Ohm 1/2W ±10%
R102		PE231-1137	Carbon, 330 Ohm 1/2W ±10%
R103		PE231-1179	Carbon, 18K ohm 1/2w ±10%
R104		PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R105		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R106		PE231-1167	Carbon, 5600 ohm 1/2w ±10%
R107		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R108		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R109		PE231-1129	Carbon, 150 Ohm 1/2W ±10%
R110		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R111		PE231-1177	Carbon, 15k Ohm 1/2W ±10%
R112			
R113		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R114		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R115		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R116		PE232-1161	Carbon, 3300 Ohm 1W ±10%
R117		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R118		PE231-1131	Carbon, 180 Ohm 1/2W ±10%
R119			
R120		PE233-74	Carbon, 11k Ohm 2W ±5%
R121		PE233-1179	Carbon, 18k Ohm 2W ±10%
R122		PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R123		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R124		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R125		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R126		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R127		PE231-1245	Carbon, 10 Megohm 1/2W ±10%
R128		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R129		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R130		PE232-1137	Carbon, 330 Ohm 1W ±10%
R131		PC21134-4	Wirewound, 3250 Ohm 7W ±10%
R136		PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R139		PE231-1215	Carbon, 560K ohm 1/2w ±10%
R140		PE231-1187	Carbon, 39K ohm 1/2w ±10%
R200		PE23151	Wirewound, 1.2 Ohm 1W ±10%
R201		PC21134-2	Wirewound, 60 Ohm 10W ±10%
R202		PE231-1183	Carbon, 27k Ohm 1/2W ±10%
R203		PE231-1175	Carbon, 12k Ohm 1/2W ±10%
R204		PE231-1193	Carbon, 68k Ohm 1/2W ±10%
R205		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R206		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R207		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R208		PE232-1181	Carbon, 22k Ohm 1W ±10%
R209		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R210		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R211		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R212		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R213		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R214		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R215		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R217		PE231-1169	Carbon, 6800 Ohm 1/2W ±10%
R218		PE232-127	Carbon, 1.8 Megohm 1W ±5%
R219		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R220		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R221		PE231-1225	Carbon, 1.5 Megohm 1/2W ±10%
R222		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R225		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R226		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R227		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R228		PE231-1185	Carbon, 33k Ohm 1/2W ±10%
R229		PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R230		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R231		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R232		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R233		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R234		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R236		PE232-1205	Carbon, 220K ohm 1w ±10%
R300		PC21134-16	Wirewound, 2250 Ohm 15W ±10%
R301		PE233-1165	Carbon, 4700 Ohm 2W ±10%
R302		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R303		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R304		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R305		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R306		PE231-1233	Carbon, 3.3 Megohm 1/2W ±10%
R307		PE232-1181	Carbon, 22k Ohm 1W ±10%
R308		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R309		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R310		PE231-1205	Carbon, 220k Ohm 1/2W ±10%
R311		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R312		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R313		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R314		PE233-1133	Carbon, 220 Ohm 2W ±10%
R315		PE23163	Carbon, 0.56 Ohm 1/2W ±10%
R316	751-3	PE233-2321	Carbon, 1.0 Megohm 2W ±20% (Allen Bradley)
R317	750-3	PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R318		PE232-1177	Carbon, 15k Ohm 1W ±10%
R319	750-3	PE231-1109	Carbon, 22 Ohm 1/2W ±10%
R319	751-3	PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R320	751-3	PE233-1165	Carbon, 4700 Ohm 2W ±10%

CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C100		PE190-133	Mica, 270mmf 500V ±10%
C101		PA19147	Ceramic, Shielded Dual Disc, 1500mmf GMV
C102		PE556-234	Ceramic Tubular, 680mmf 350V ±10% (Insul.)
C103		PE190-133	Mica, 270mmf 500V ±10%
C104		PE190-133	Mica, 270mmf 500V ±10%
C105		PA19148	Ceramic, Single Disc 1500mmf GMV
C106		PA20138	Electrolytic, 1mfd 50V
C107		PP19163	Ceramic, Shielded Dual Disc 5000mmf GMV
C108		PE190-140	Mica, 510mmf 500V ±10%
C109		PE190-107	Mica, 22mmf 500V ±10%
C110		PE555-101	Ceramic Tubular 10mmf. 500V ±20% (Unins.)
C111		PE555-136	Ceramic Tubular 1000mmf 350V ±20% (Unins.)
C112		PE194-160	Paper, .05mfd 600V ±20%
C113		PP19201	Ceramic Tubular, 820mmf 350V ±10% (Unins.)
C114		PE555-100	Ceramic Tubular, 5mmf 500V ±10% (Unins.)
C115		PE555-113-2	Ceramic Tubular, 47mmf 500V ±20% NPO
C116		PE197-160	Molded Tubular .05mfd 600V ±20%
C117		PE194-151	Paper, .005mfd 600V ±20%
C118		PA19148	Ceramic Single Disc 1500mmf GMV
C119		PE556-236	Ceramic Tubular, 1000mmf 350V ±10% (Insul.)
C120		PE194-160	Paper, .05mfd 600V ±20%
C121		PA620181	Electrolytic, 1mfd 100V
C122		PE194-156	Paper, .02mfd 600V ±20%
C123		PE194-160	Paper, .05mfd 600V ±20%
C124		PE194-145	Paper, .001mfd 600V ±20%
C125		PE194-151	Paper, .005mfd 600V ±20%
C126		PA20135	Electrolytic, 10-10-10 mfd 450V
C127		PE194-145	Paper, .001mfd 600V ±20%
C128		PE555-100	Ceramic, 5.0mmf 500V ±10% (Uninsul.)
C129		PA20182	Electrolytic, 50mfd 25V
C132		PE194-145	Paper, .001mfd 600V ±20%
C133		PE556-136	Ceramic Tubular, 1500mmf 350V ±20% (insul.)
C201			
C202		PA19109	Ceramic, Single Disc 5000mmf GMV
C203		PA20144	Electrolytic, 40-40-20-20-mfd 450V
C204		PA19109	Ceramic, Single Disc 5000mmf GMV
C205		PA19109	Ceramic, Single Disc 5000mmf GMV
C206		PA19109	Ceramic, Single Disc 5000mmf GMV
C207		PE194-156	Paper, .02mfd 600V ±20%
C208		PE190-137	Mica, 390mmf 500V ±10%
C209		PE190-133	Mica, 270mmf 500V ±10%
C210		PE194-155	Paper, .01mfd 600V ±20%
C211		PE194-155	Paper, .01mfd 600V ±20%
C212		PE192-163	Mica, 4700mmf 500V ±10%
C213		PE194-159	Paper, .035mfd 600V ±20%
C214		PE194-156	Paper, .02mfd 600V ±20%
C215		PE194-160	Paper, .05mfd 600V ±20%
C216		PA20174	Electrolytic, 5mfd 350V (Non-Polarized)
C218		PE194-160	Paper, .05mfd 600V ±20%
C219		PE194-160	Paper, .05mfd 600V ±20%
C220		PE194-155	Paper, .01mfd 600V ±20%
C221		PE194-151	Paper, .005mfd 600V ±20%
C222		PE194-151	Paper, .005mfd 600V ±20%
C223		PE194-155	Paper, .01mfd 600V ±20%
C227		PA19109	Ceramic, Single Disc 5000mmf GMV
C300		PE194-145	Paper, .001mfd 600V ±20%
C301		PE194-145	Paper, .001mfd 600V ±20%
C302		PE197-151	Molded Tubular .005mfd 600V ±20%
C303		PE197-151	Molded Tubular .005mfd 600V ±20%
C304		PE194-160	Paper, .05mfd 600V ±20%
C305		PE195-261	Mica, Silver, 3900mmf 500V ±5%

CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C306		PE190-137	Mica, 390mmf 500V ±10%
C307		PE190-133	Mica, 270mmf 500V ±10%
C308	750-3	PE190-125	Mica, 120mmf 500V ±10%
C308	751-3	PE190-137	Mica, 390mmf 500V ±10%
C309		PA1772	Trimmer, 25-280mmf
C310		PA20137	Electrolytic, 10mfd 25V
C311	751-3	PP19145	Mica, 5mmf 2500V GMV
C312		PE197-160	Molded Tubular .05mfd 600V ±20%
C313	751-3	PP19146	Mica, 10mmf 2500V GMV
C314		PE197-160	Molded Tubular .05mfd 600V ±20%
C315	751-3	PA1998-3	Ceramic, 500mmf 20kv
C316		PE197-162	Molded Tubular .1mfd 600V ±20%
C317		PA20147	Electrolytic 25mfd 12V
C318		PP19180	Mica, 220mmf 1000V ±10%
C320	750-3	PE190-133	Mica, 270mmf 500V ±10%

CHOKES & COILS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
L101		A3392	Coil, Pix IF
L102		A28253	Choke, RF
L103		A3392	Coil, Pix IF
L104		A3392	Coil, Pix IF
L105		A28253	Choke, RF
L106		A28255-2	Coil, Peaking (White)
L107		A28255-1	Coil, Peaking (Red)
L108		A28255-2	Coil, Peaking (White)
L109		A28255-1	Coil, Peaking (Red)
L110		A28286	Coil, 4.5 MC. Trap
L111		A28255-1	Coil, Peaking (Red)
L112		A28255-4	Coil, Peaking (Green)
L113		A28286	Coil, 4.5 MC Audio Takeoff
L114		A28314	Coil, 21.25 MC IF Trap
L200		A1406	Coil, Filter Choke
L201		A28276	Choke, Filament
L202		A28276	Choke, Filament
L203	750-3	A28328	Coil, Deflection Yoke
L203	751-3	A28330	Coil, Deflection Yoke
L300		A28263	Coil, Horiz. Freq. Control
L301	750-3	A28279-1	Coil, Width Control
L301	751-3	A28318-1	Coil, Width Control
L302		A28292	Coil, Horiz. Linearity
		A28331	Deflection Yoke Cover w/Centering Device

TRANSFORMERS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
T100		A1201 or 1202	Ratio Detector
T200		A10109	Power
T201		A10106	Vertical Oscillator
T202		A10152-1	Vertical Output
T300		A10136 or A10137	Horizontal Output

CONTROLS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
P100		A24142	Contrast-Volume, 5K-250K ohm
P200		A24112	Vertical Hold, 1.0 Megohm
P201		A24111	Vertical Size, 5.0 Megohm
P202		A24114	Vertical Linearity, 3K ohm Wirewound
P204		A24110	Brightness, 100K ohm
P206		A24112	Focus Control, 1.0 Megohm

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

MISC. CHASSIS ACCESS. & PARTS — ALL CHASSIS

PART NO.	DESCRIPTION
A65100K	Chassis
A5355	Shield, H.V. Supply
A5356	Cover, H.V. Supply Shield
A54609	Bracket, Horiz. Freq. Control Coil
A541059	Bracket, Interlock
A541242	Grounding Spring CRT Coating
A540-62	Terminal Strip, AAEAAAEAA
A540-67	Terminal-Strip, AAAEAA
A540-44	Terminal Strip, AAEAA
A540-19	Terminal Strip, AEA
A540-34	Terminal Strip, AAEA
A18155	Socket, Octal Moulded
A18210	Socket, Octal Moulded Bakelite Saddle
A18173	Socket, 9 Pin Moulded
A18171	Socket, 9 Pin Moulded No Saddle
A18157	Socket, 9 Pin Wafer
A18147	Socket, 7 Pin Wafer
A18101	Socket, Speaker-Plug
A541131	Socket, H.V. Cond.
A562-6	Capacitor Clips; 1-3/8
A562-3	Capacitor Clips; 3/4
A54618-1	Tube Shield
A3206	Ion Trap
A541341	Anode Lead Holder

MISC. CHASSIS ACCESS. & PARTS — 17" TUBE

PART NO.	DESCRIPTION
A54851	Bracket, Yoke Hood & Support
A541084-1	Channel, CRT Front Support; Left
A541084-2	Channel, CRT Front Support; Right
A54827	Strap, CRT; Right
A54828	Strap, CRT; Left
A541086	Bracket, CRT Stop
A55141-1	Anode Connector Assembly
A541085	Cushion, Rubber; CRT Channel
A541110-2	Cushion, Sponge Rubber; CRT Strap, Right
A541110-1	Cushion, Sponge Rubber; CRT Strap, Left
A54971-18	Cushion, Cork; CRT Stop Bkt.
A18197-3	Socket, Kinescope

MISC. CHASSIS ACCESS. & PARTS — 21" CHASSIS

PART NO.	DESCRIPTION
A541251	Bracket, Interlock
A541248-1	Bracket, CRT Rear Support (Left)
A541248-2	Bracket, CRT Rear Support (Right)
A541000	CRT Rubber Grommet
A541246	Bracket, Yoke Hood and CRT Grommet
A541250-1	Bracket, Yoke Hood Support (Left)
A541250-2	Bracket, Yoke Hood Support (Right)
A541383	Bracket, CRT Front Support and Stop
A541249	Bracket, Tie Rod
A541254	CRT Strap Assembly
A541261-1	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541261-2	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541102-6	Rubber Cushion (CRT Strap)

CBS-COLUMBIA

Models 17M06, 22C06, 22C38
Chassis 750-3, 751-3

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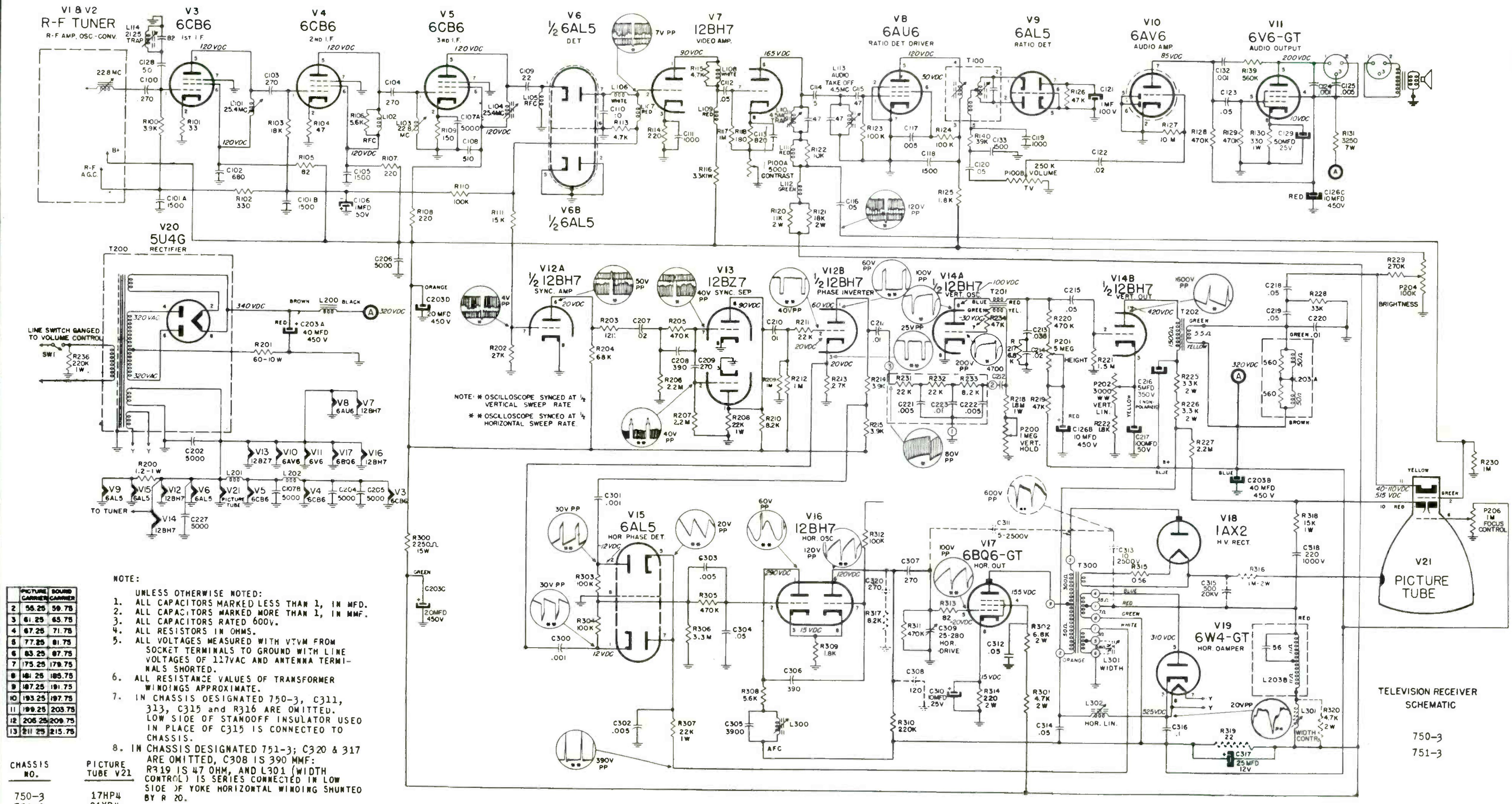

	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

NOTE:

UNLESS OTHERWISE NOTED:

1. ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
2. ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
3. ALL CAPACITORS RATED 600V.
4. ALL RESISTORS IN OHMS.
5. ALL VOLTAGES MEASURED WITH VTVM FROM SOCKET TERMINALS TO GROUND WITH LINE VOLTAGES OF 117VAC AND ANTENNA TERMINALS SHORTED.
6. ALL RESISTANCE VALUES OF TRANSFORMER WINDINGS APPROXIMATE.
7. IN CHASSIS DESIGNATED 750-3, C311, 313, C315 and R316 ARE OMITTED. LOW SIDE OF STANDOFF INSULATOR USED IN PLACE OF C315 IS CONNECTED TO CHASSIS.
8. IN CHASSIS DESIGNATED 751-3; C320 & 317 ARE OMITTED, C308 IS 390 MMF: R319 IS 47 OHM, AND L301 (WIDTH CONTROL) IS SERIES CONNECTED IN LOW SIDE OF YOKE HORIZONTAL WINDING SHUNTED BY R 20.

CHASSIS NO.	PICTURE TUBE V21
750-3	17HP4
751-3	21YP4

TELEVISION RECEIVER SCHEMATIC

750-3
751-3

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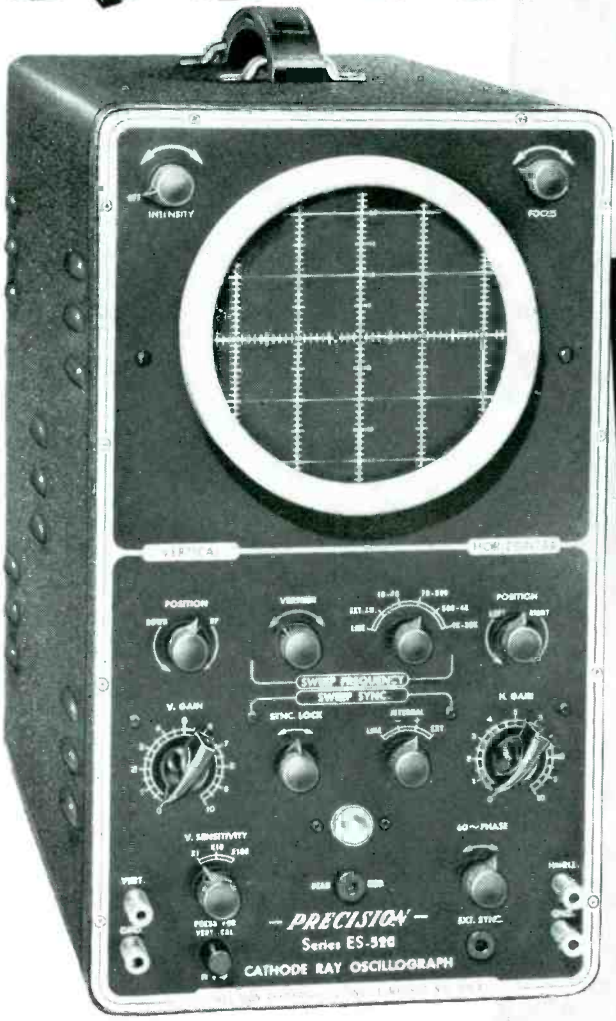

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- ★ Push-Pull vertical drive. 20 millivolts per inch sensitivity.
- ★ 3-Step, frequency-compensated, vertical input attenuator.
- ★ Vertical frequency response 20 cycles to 500 KC within 2 DB
- ★ 1 volt, peak-to-peak, built-in vertical voltage calibrator.
- ★ Excellent vertical square wave response from 20 cycles to 50 KC.
- ★ Push-pull horizontal drive. 50 millivolts per inch sensitivity.
- ★ 'H' frequency response 20 cps to 200 KC within 3 DB (at full gain).
- ★ Internal linear sweep 10 cycles to 30 KC. Neg. and pos. sweep synch.
- ★ Tube Complement: 12AU7 'V' cathode follower and amplifier, 6C4 phase-splitter, 12AZ7 push-pull 'V' drive. 6AB4 'H' amplifier, 12AZ7 push-pull 'H' drive. 12AU7 sweep oscillator. 6X4 rectifier, 1V2 high potential rectifier, NE-51 calibration regulator, 5UP1 CR tube.
- ★ Built-in 60 cycle sine-sweep phasing control.
- ★ Beam modulation input terminal at front of panel.
- ★ All 4 deflection plates directly accessible at rear.
- ★ Filter-type, removable, calibrated graph-screen.
- ★ Etched, anodized, heavy gauge aluminum panel.

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