DECEMBER, 1950

Radio-Television SERVICE DEALER

The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

Paid Circulation Of This Issue: Over: 25,000
Total Distribution Of This Issue: Over: 30,000


Largest Selling Booster
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Jewels by Cartier
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EDITORIAL
by S. R. COWAN

Troublesome Days Are Ahead

An "emergency committee" of RTMA has asked National Production Authority to release at once sufficient quantities of materials now restricted, such as cobalt, nickel, copper and aluminum, to prevent imminent stoppage of all TV and radio set production. We commend James D. Secrest, RTMA's general manager, who clearly outlined the industry's position by reasoning that if the Government will want the services of radio plants in 90 days when war contracts are to be issued, unless the factories can be kept in operation in the interim, they face shutdown and the ir revocable loss of thier trained manpower to other industries.

The electronics industry committee that coordinates industry—Government war contract relations must also bear in mind that the general public's welfare—meaning the duty of keeping existing receivers in operable use—is of paramount importance too. That our Government is justified in producing radio-electronic equipment for all-out war use, plus the usual 5 to 1 stockpiling, is self-evident. But the fact also remains that now, more than ever before, is it necessary to keep America's home and amateur radios working. The day of atom bombing with its potential vast disruption of other types of communications is the basis for this contention.

Even if all-out war production strains our productive capacity, even if new receiver production must be curtailed to the vanishing point—it must be conceded that a small allocation to the replacement and maintenance fields must be considered worthwhile to the Nation's welfare and economy.

Color TV Held Back

As predicted, the Courts have enjoined CBS and the FCC from putting a non-compatible method of color videocasting into commercial use until the matter can be given further study. Upwards of 60 days, at least, will be required, and perhaps the matter may drag along in the courts for many months. That's fine! Meanwhile, the proponents of compatible methods can continue their developmental efforts and come up with an acceptable system. We hope so! We are 100% for color TV . . . but, only when it is the right kind of color, completely compatible, and perfected to the Nth degree. Let's have no half-way substitutes in the meanwhile. Of course, there's no reason for getting too excited about color TV right now because the industry itself, due to the war effort, is more than bogged down trying to get necessary tubes and parts needed for ordinary black and white models. As we have stated many times before, all this hubbub about color TV is silly. Anyone who wants a TVset should not hesitate to buy any good brand right now—or when he can get one, because they may become unobtainable or mighty scarce very soon.

Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

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342 MADISON AVENUE
NEW YORK 17, N. Y.

MEMBER AUDIT BUREAU OF CIRCULATIONS

Vol. 11, No. 12

DECEMBER, 1950

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RADIO-TELEVISION SERVICE DEALER is published Monthly by Cowan Pub. Corp., 342 Madison Ave., N. Y. 17, N. Y. Subscription price: $2 per year in the United States. U. S. Poss: & Canada: elsewhere $3. Single copies: 25c. Reentered as second class matter Sept. 25, 1950 at the Post Office at New York, N.Y. under the Act of Mar. 3, 1879. Copyright 1950 by Cowan Pub. Corp.

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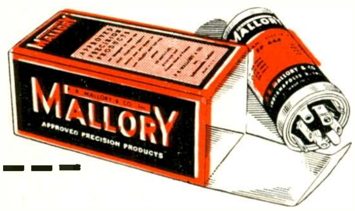

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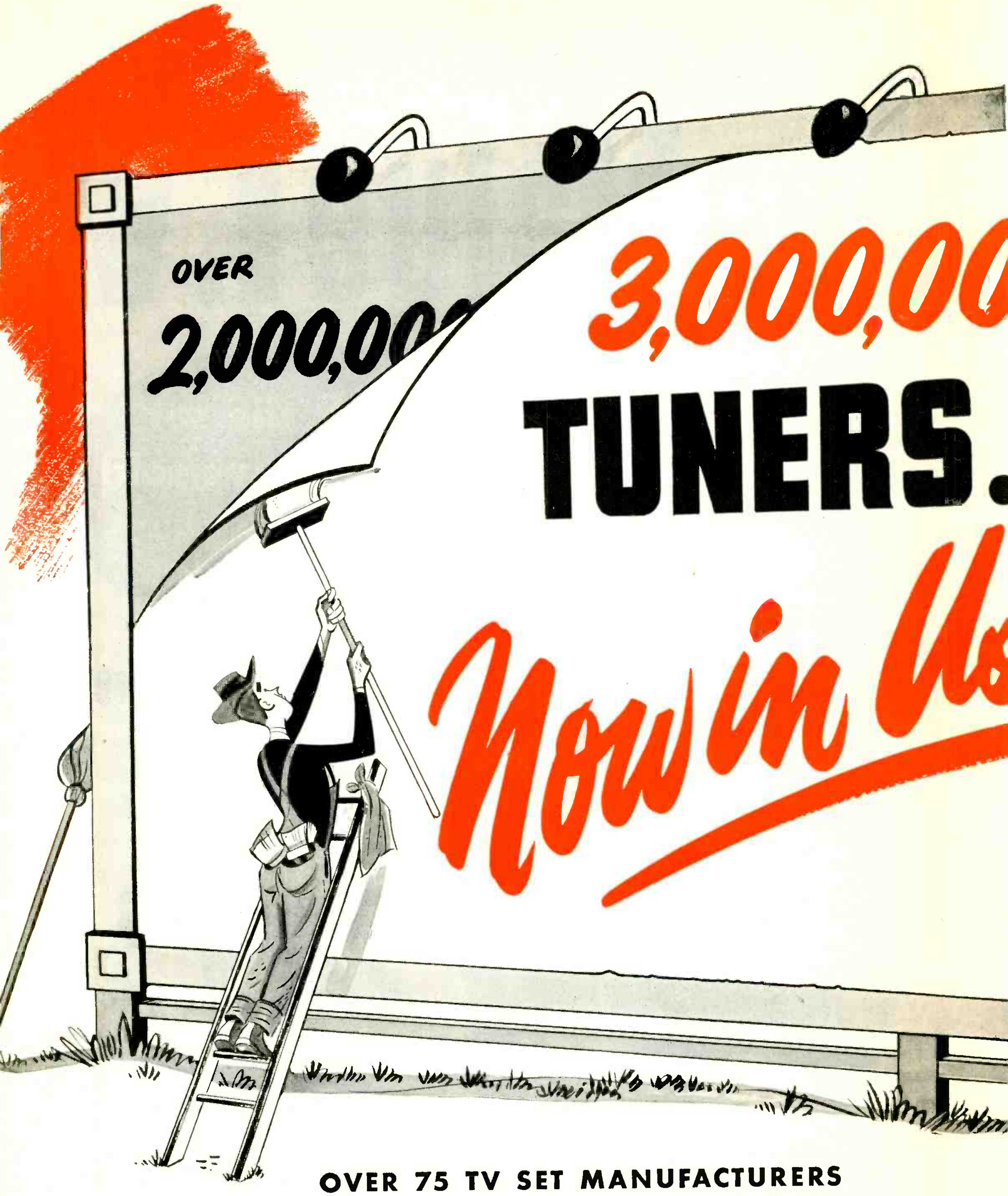

OVER 75 TV SET MANUFACTURERS USE "THE STANDARD TUNER"

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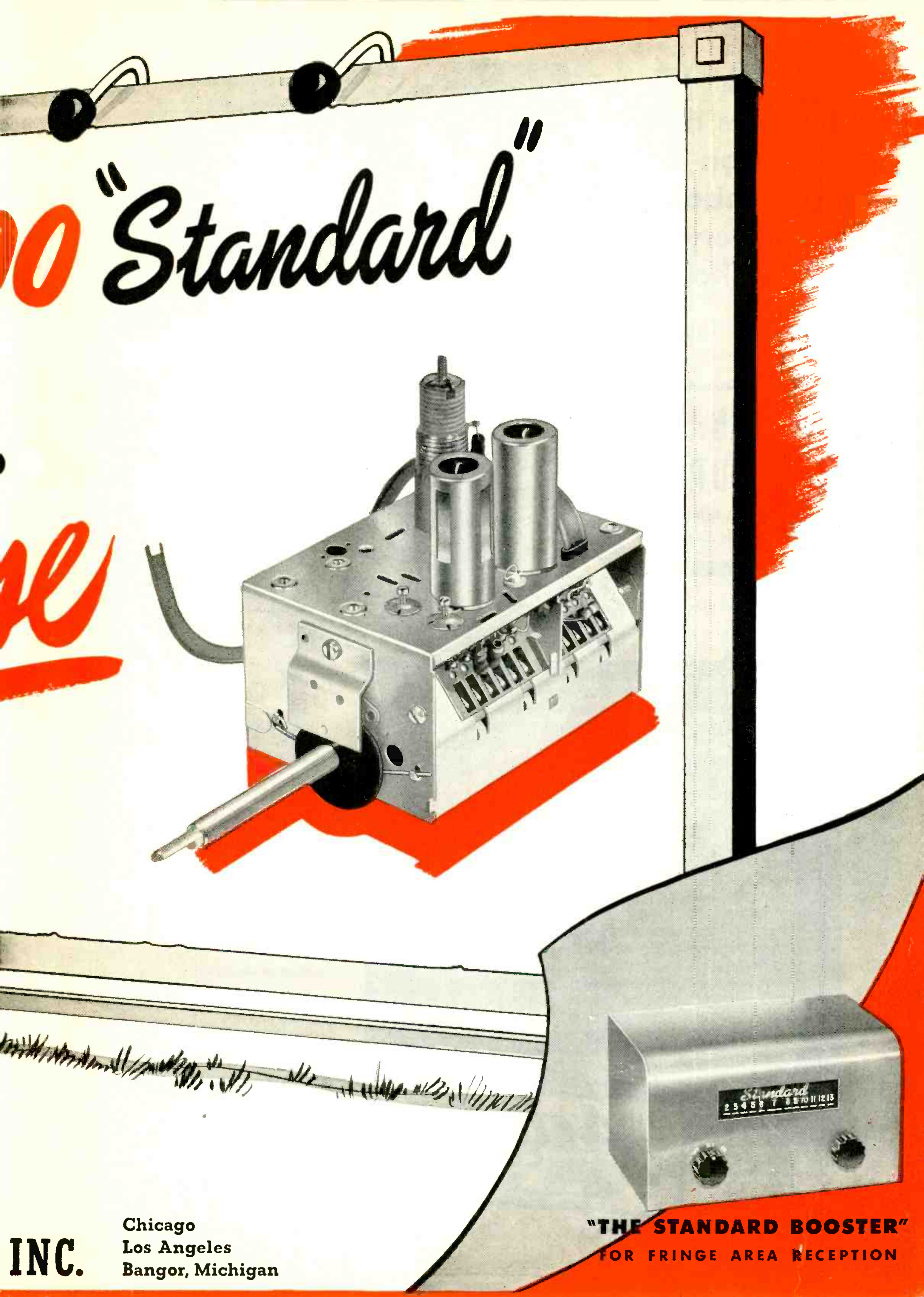
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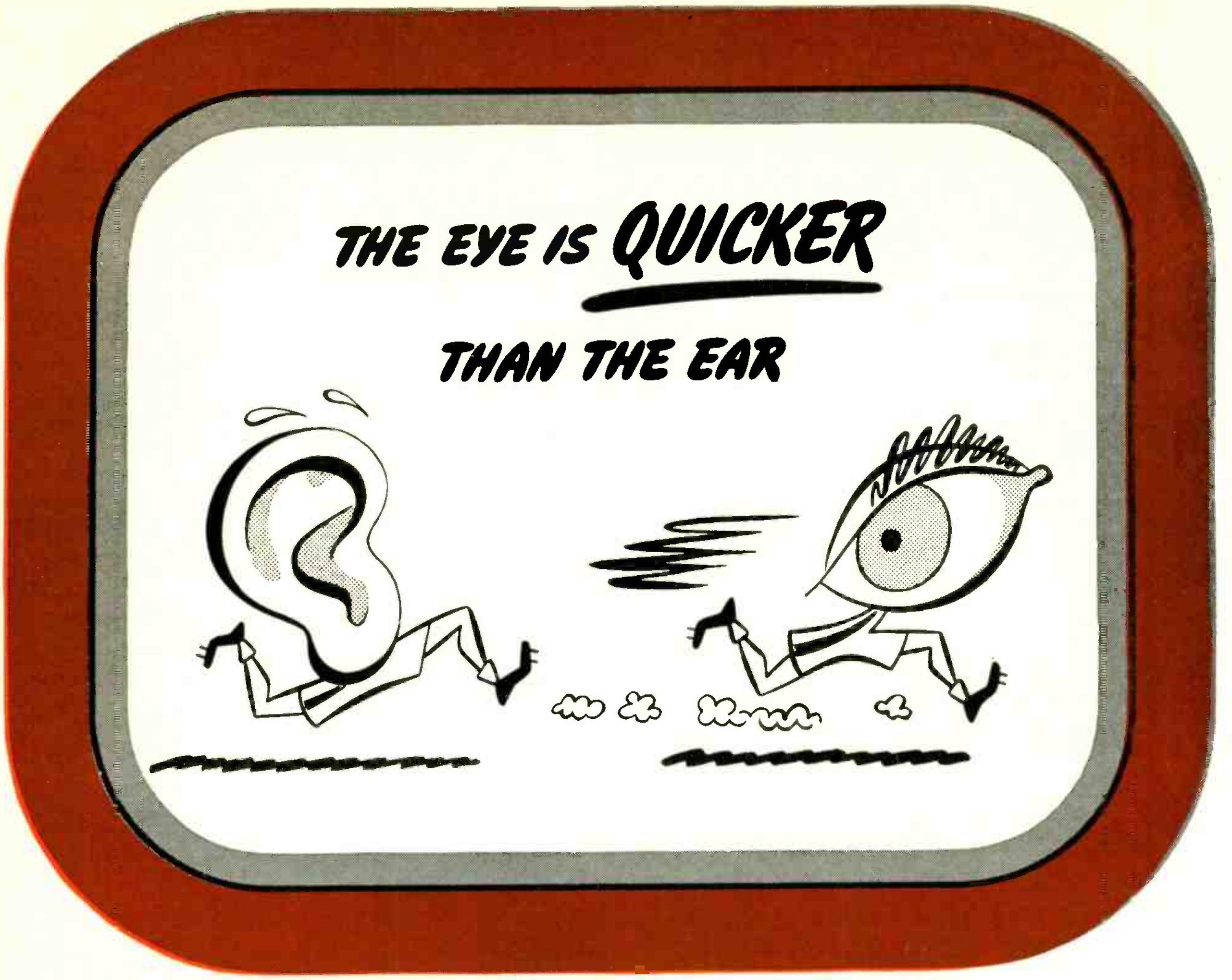


IF YOU SERVICE TV, YOU KNOW THIS!
Customers are quick to *see* imperfections. Much slower to *hear* them. Therefore *premium-quality* Hytron receiving tubes for the tougher TV jobs. *At no extra cost!* You gain also: Through fewer expensive service call-backs. Better customer satisfaction and confidence. More profits.

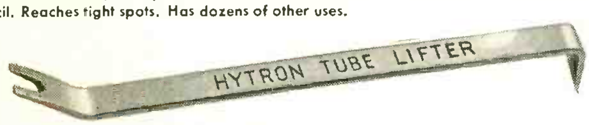
How does Hytron do it? By working closely with leading TV set manufacturers. By endless striving to better already superior performance. By improved design...processing...inspection...testing.

Try Hytron TV receiving tubes: 1X2A, 5U4G, 6AG5, 6AL5, 6AU6, 6BC5, 6BG6G, 6BQ6GT, 6CB6, 6SN7GT, 6V6GT, 6W4GT, 12BH7, 25BQ6GT, etc. Also Hytron rectangular picture tubes: 14BP4, 16RP4, 17BP4A, 20CP4. You pay no more for Hytron. But *see* the difference yourself...on the TV screen...on your cash register.

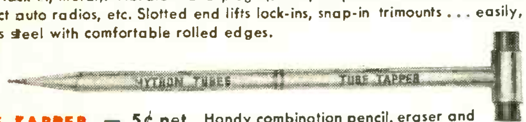
THEY COST PENNIES, BUT SAVE DOLLARS!

Order from your Hytron jobber today

HYTRON SOLDERING AID — **49¢ net.** Fork tip effortlessly, quickly unwraps "mechanically solid" joints. Straddles wire, grips, unwraps, pulls it free. Guides new wire; holds it firm while soldering. Spade tip reams solder from lug hole; pushes other wires aside. Tips are hardened, twist-proof, insulated, hard-chromed to shed solder. Tool handles like pencil. Reaches tight spots. Has dozens of other uses.



HYTRON TUBE LIFTER — **15¢ net.** *Lift* 'em all the e-a-s-y prybar way: Tubes (GT, G, standard, lock-in, metal). Vibrators and plugs (Jones, Amphenol) — and knobs. A natural for compact auto radios, etc. Slotted end lifts lock-ins, snap-in trimounts . . . easily, safely. Of stainless steel with comfortable rolled edges.



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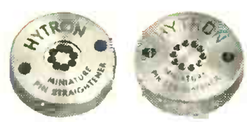
HYTRON TUBE PULLER — **75¢ net.** Pull or insert 7-pin miniatures the e-a-s-y way. Neoprene rubber puller works by suction and friction on top of tube. Positive grip. Reaches tight spots. Another Hytron time-temper-and-money saver.

HYTRON AUTO RADIO TOOL — **24¢ net.** Substitutes for control cables of universal auto radio. Quickly, precisely turns set on/off, tunes, adjusts volume and tone, re-aligns dial. Square also fits splines. Vee fits spade and other key fittings. Minimum backlash. Compact. Bright-zinc plated. Non-rolling large handle for fine adjustments.



HYTRON PIN STRAIGHTENERS, 7-Pin and 9-Pin — **55¢ net ea.** You merely press tube gently into Hytron Straightener until button base seats squarely. Presto, pins are straight! Fast . . . safe. Avoiding one broken tube pays for Straightener twice over. Precise, stainless-steel insertion die. Comfortable knurled aluminum holder. For hand, bench or tube tester use.

by SERVICEMEN A HYTRON TOOL for SERVICEMEN

OLDEST MANUFACTURER OF RECEIVING TUBES
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SALEM, MASSACHUSETTS

all we can say to you is

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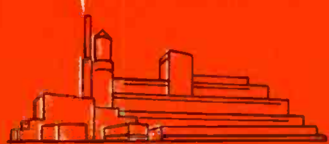

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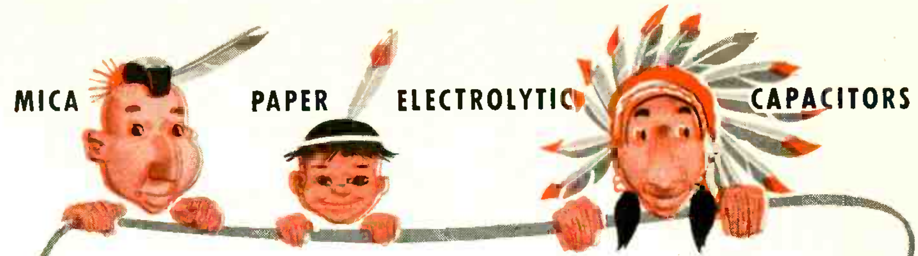

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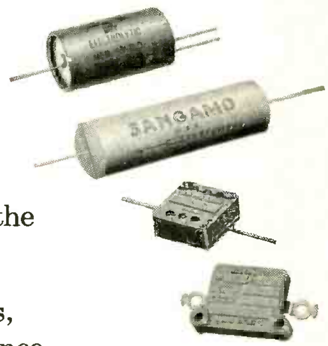
34 little Indians to fill your needs . . .



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Sangamo Capacitors are packaged in distinctively designed cartons that you can identify with ease and that make inventory simple.

A trial of Sangamo Capacitors will convince you. Stock up at your Jobber.

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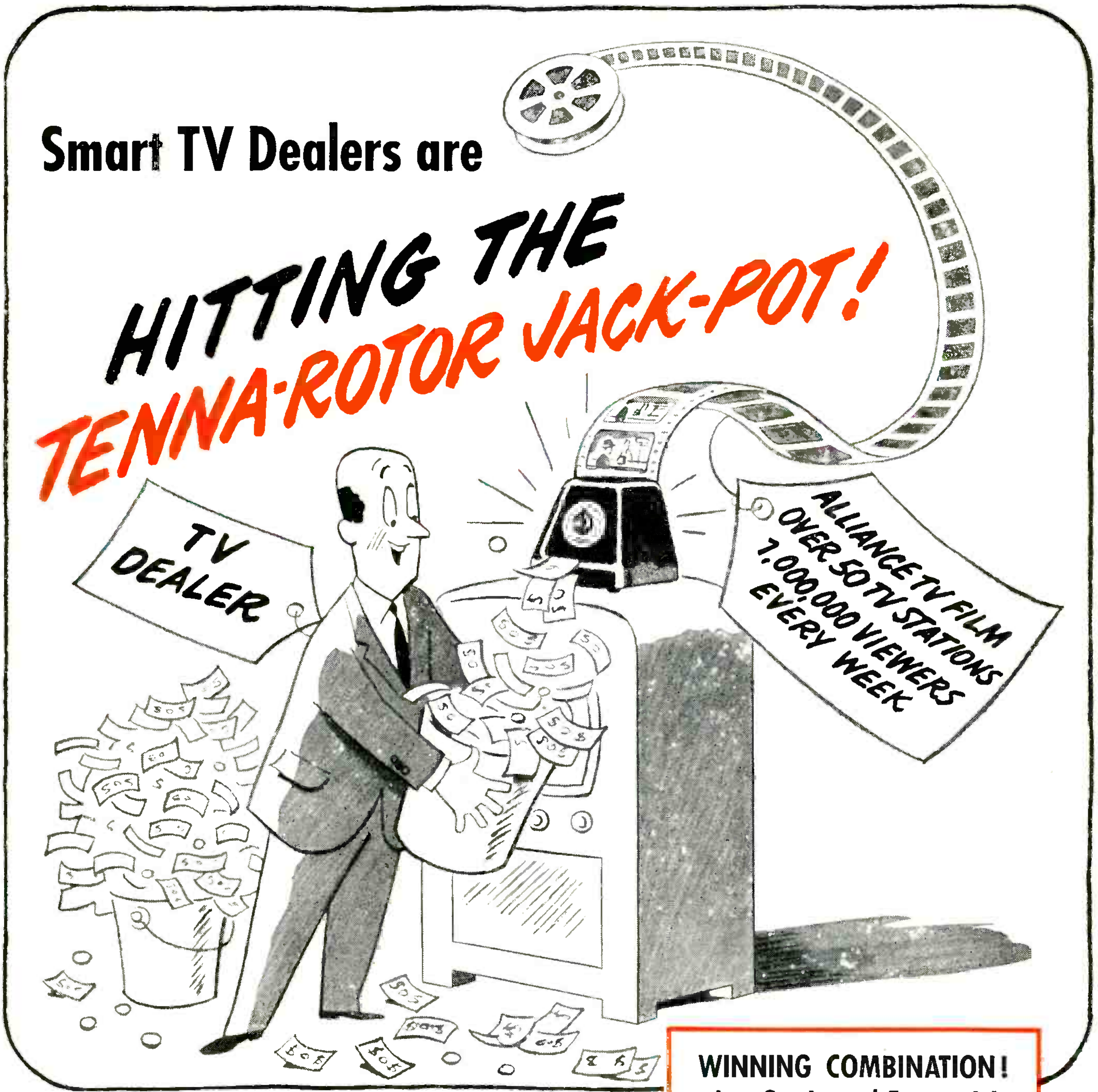

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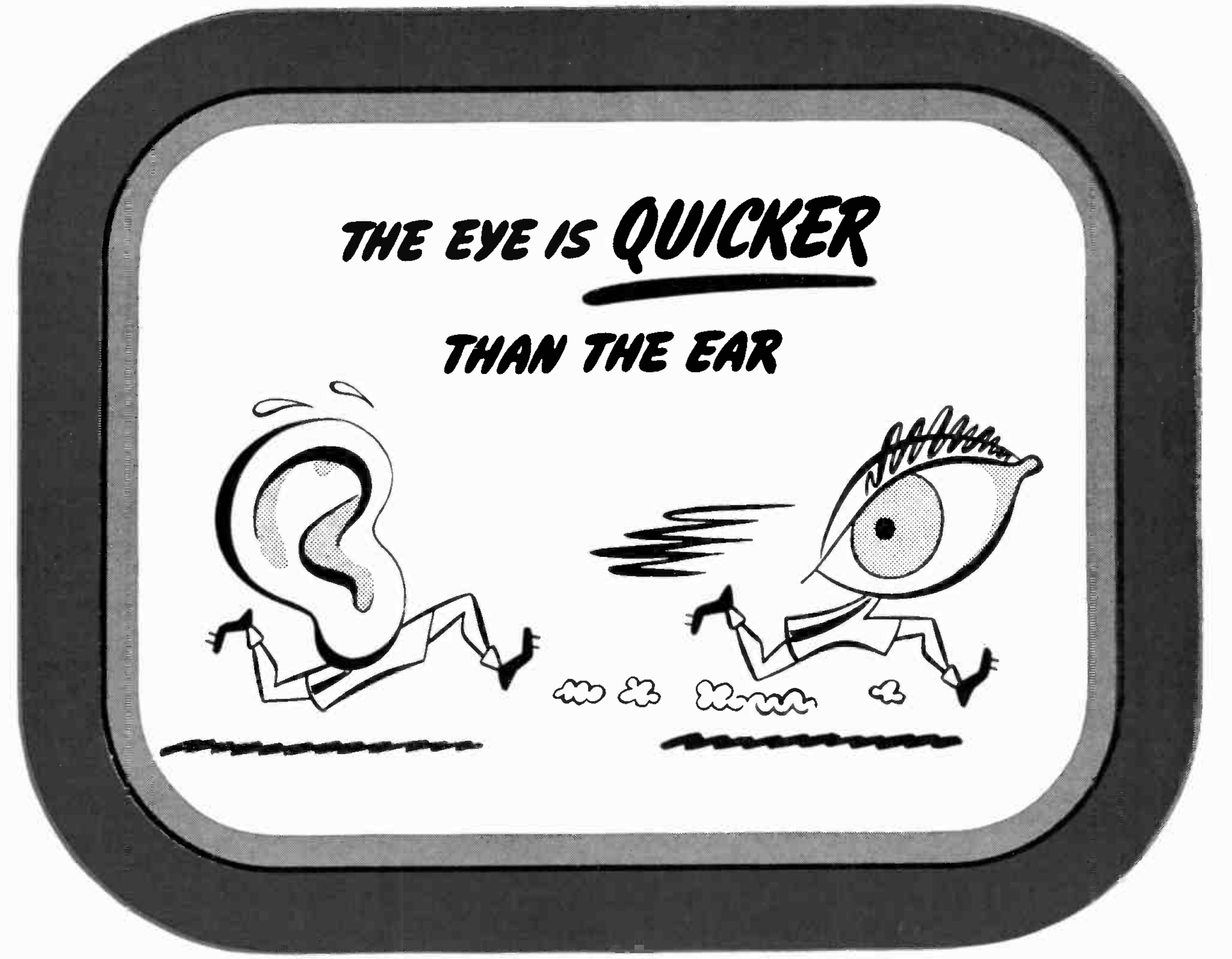
RCA's types are Best Sellers. There are more of them in actual use in TV receivers than any other brand. Industry choice of these high-volume types reflects to your advantage. Inventory and stocking problems are simplified . . . and you have the assurance of rapid, profitable turnover.

In addition, when you sell RCA kinescopes, you gain from customer confidence in the RCA brand . . . solidly established by the proved performance of RCA kinescopes in millions of television receivers.

Remember, too, that the quality and dependability of RCA kinescopes mean fewer service failures and fewer costly call-backs. There is, therefore, more profit in every RCA kinescope you sell.

Always keep in touch with your RCA Tube Distributor

RADIO CORPORATION of AMERICA
ELECTRON TUBES — HARRISON, N. J.



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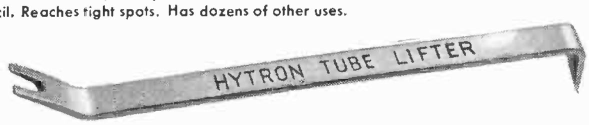

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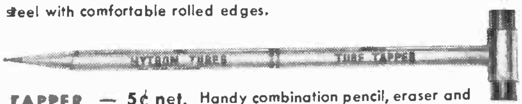

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OLDEST MANUFACTURER OF RECEIVING TUBES
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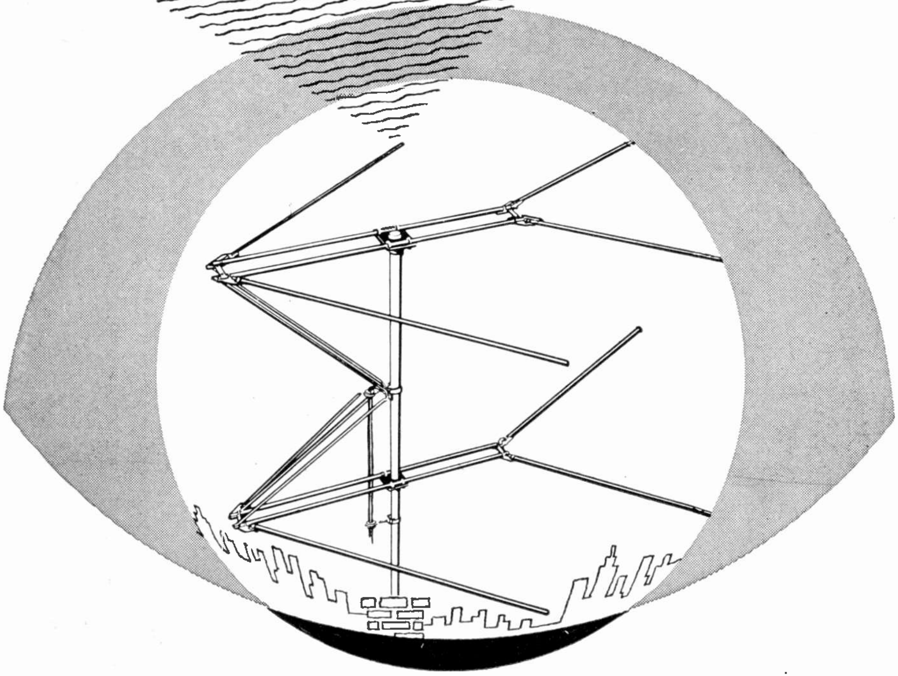

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By applying the proven "end-fire" principle to TV antennas the WORKSHOP DUBL-VEE set the pace for 1950. Its quick acceptance — over 80,000 *installed in three short months* — is a testimonial to WORKSHOP'S acknowledged leadership in antenna design and engineering.

The DUBL-VEE is typical of WORKSHOP antennas in other fields — commercial, amateur and aircraft. In every instance, advanced engineering and outstanding performance have established ready acceptance. You know when you specify the DUBL-VEE, or any other WORKSHOP antenna, that you are getting the best.

Write for Bulletin E

THE WORKSHOP ASSOCIATES, Inc.
135 CRESCENT ROAD, NEEDHAM 94, MASSACHUSETTS

any serviceman knowing he would be prosecuted for malpractice would cease and desist evildoings pronto. The only catch is that at present ARSNY's treasury is low and if many legal actions were required, it might fast become depleted. To prevent such an event from occuring, it would seem advisable for set distributors and manufacturers to contribute to the ARSNY legal fund, knowing that their money is merely being placed in care of ARSNY to be used only when and if such expenditure becomes necessary. Police action of the TV service industry *by the industry itself* is the surest and quickest way of accomplishing desired results. Manufacturers and dealers have done nothing to protect the public; now it is incumbent upon the servicemen to handle the matter themselves.

Injunction Stops Immediate Color TV-casts by Non-Compatible CBS Method

Judges Major, Sullivan and LaBuy, sitting in the Circuit Court in Chicago on November 14th and 15th, heard RCA and many other TV manufacturers request that FCC and CBS be restrained from beginning color transmission on Nov. 20th. Anyone not legally trained who heard both sides of the case would agree that the Judges' decision to issue a temporary restraining order favoring RCA *et als* was fitting and proper. For example, it seemed to us that FCC's main contention was merely to the effect that "we have studied this matter for a long time and now we want to wind it up, so, having decided in favor of the CBS system, why not let it go at that?" In contrast, RCA *et als* came up with some basically sound points in their argument, outstanding of which were these: 1) - a good, compatible color TV system is not yet available, so why try to foist upon a public (that doesn't care one way or the other about a system's technical makeup) something that will cost the present-day TVset owners 2½ billions of dollars. 2) — why accept a system that will not have for a very long period of time much of an audience, because it is generally conceded that none of the major set makers intended to swing their production from conventional black and white TV models to a mechanical system that would cost vastly more, have but limited sale, look atrocious, and most important, not be able to bring to people the worthwhile TV commercially sponsored programs. 3) — the trend is towards large size picture screens by popular demand,

[*Continued on page 40*]

12 Improvements IN NEW 1951

MODEL O-6 PUSH-PULL

Heathkit OSCILLOSCOPE KIT

Only $39.50

- ★ New AC and DC push-pull amplifier.
- ★ New step attenuator frequency compensated input.
- ★ New non frequency discriminating input control.
- ★ New heavy duty power transformer has 68% less magnetic field.
- ★ New filter condenser has separate vertical and horizontal sections.
- ★ New intensity circuit gives greater brilliance.
- ★ Improved amplifiers for better response useful to 2 megacycles.
- ★ High gain amplifiers .04 Volts RMS per inch deflection.
- ★ Improved Allegheny Ludlum magnetic metal CR tube shield.
- ★ New synchronization circuit works with either positive or negative peaks of signal.
- ★ New extended range sweep circuit 15 cycles to over 100,000 cycles.
- ★ Both vertical and horizontal amplifier use push-pull pentodes for maximum gain.

The new 1951 Heathkit Push-Pull Oscilloscope Kit is again the best buy. No other kit offers half the features — check them.

Measure either AC or DC on this new scope — the first oscilloscope under $100.00 with a DC amplifier.

The vertical amplifier has frequency compensated step attenuator input into a cathode follower stage. The gain control is of the non frequency discriminating type — accurate response at any setting. A push-pull pentode stage feeds the C.R. tube. New type positioning control has wide range for observing any portion of the trace.

The horizontal amplifiers are direct coupled to the C.R. tube and may be used as either AC or DC amplifiers. Separate binding posts are provided for AC or DC.

The multivibrator type sweep generator has new frequency compensation for the high range it covers; 15 cycles to cover 100,000 cycles

The new model 0-6 Scope uses 10 tubes in all — several more than any other. Only Heathkit Scopes have all the features.

New husky heavy duty power transformer has 50% more laminations. It runs cool and has the lowest possible magnetic field. A complete electrostatic shield covers primary and other necessary windings and has lead brought out for proper grounding.

The new filter condenser has separate filters for the vertical and horizontal screen grids and prevents interaction between them.

An improved intensity circuit provides almost double previous brilliance and better intensity modulation.

A new synchronization circuit allows the trace to be synchronized with either the positive or negative pulse, an important feature in observing the complex pulses encountered in television servicing.

The magnetic alloy shield supplied for the C.R. tube is of new design and uses a special metal developed by Allegheny Ludlum for such applications.

The Heathkit scope cabinet is of aluminum alloy for lightness of portability.

The kit is complete, all tubes, cabinet, transformer, controls, grid screen, tube shield, etc. The instruction manual has complete step-by-step assembly and pictorials of every section. Compare it with all others and you will buy a Heathkit. Model 0-6. Shipping Wt., 30 lbs.

New INEXPENSIVE MODEL S-2

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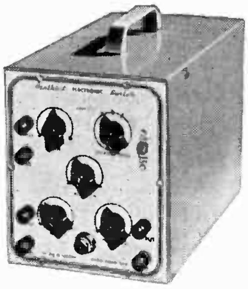

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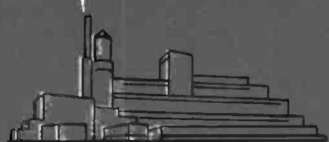

REDI-MOUNT HIGHEST QUALITY

HEAD-LINE ECONOMY BUILT

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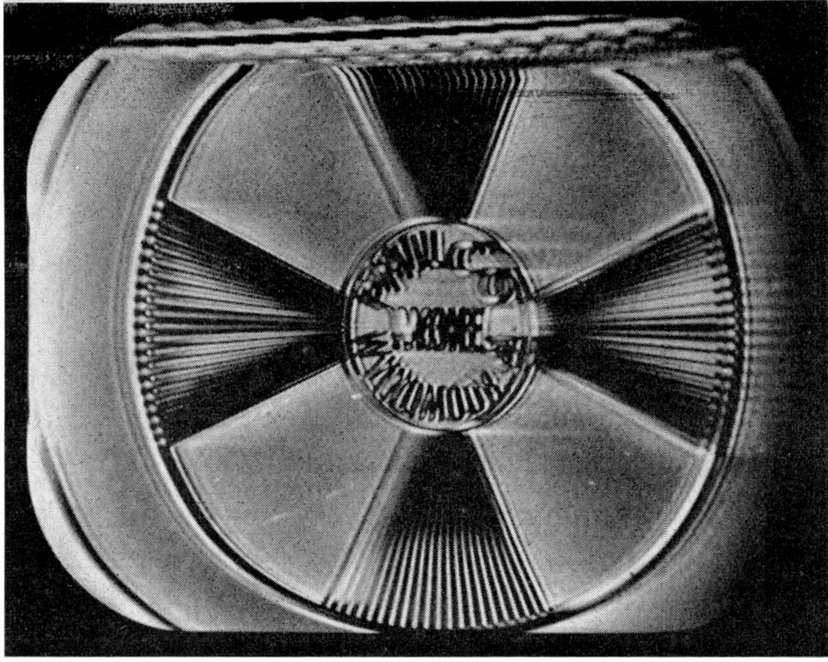
This article discusses the basic theory of keyed a.g.c. as well as various commercial circuits and their applications.



Inoperative a.g.c. can cause excessive contrast, weaving of picture and sync instability when a strong station is tuned in.

by Matthew Mandl

OPERATION & SERVICE of KEYED AGC SYSTEMS

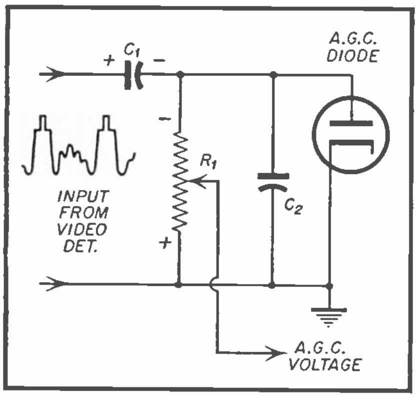


Fig. 1. Basic circuit of conventional a-g-c system.

IN their later model television receivers most manufacturers are using keyed AGC circuits instead of the older, more conventional type of automatic gain control. The reason for this is because of the superiority of keyed a.g.c. in terms of noise suppression and the reduction of airplane flutter. Since these advantages are achieved primarily by circuit design rather than by adding a number of extra tubes or parts to the conventional system, the manufacturer is enabled to improve his receiver without material increase in costs.

The keyed a.g.c. process is more easily understood by comparing it with the older, conventional method. The latter, in its basic form, is illustrated in *Fig. 1*. Here, the detected composite video signal is injected into the circuit in a positive-going polarity. This causes the a-g-c diode to conduct, charging *C1* to the peak value of the sync tips. The time constant of *R1* and *C2* is made quite long so that *C1* will remain charged to almost full value between sync tips. The charge across *C1* appears across *R1* and represents the a-g-c voltage which is used to establish the bias level on the r-f/i-f picture amplifier tubes of the receiver. Potentiometer *R1* can be adjusted to get the proper degree of bias control on the amplifier tubes.

While the amplitude of the picture signal varies during transmission, the level of the sync tips is held constant at the transmitter. The bias developed in the a-g-c system, therefore, will also be held at a fixed value unless the station fades. If this occurs, there will be less voltage available at the a-g-c tube and the charge across capacitor *C1* will decrease in proportion. This, in turn, decreases the negative bias applied to the amplifier tubes and thereby increases the gain of these stages to compensate for the fading.

Inasmuch as the vertical sync pulses (60 cps) are also present in the composite video signal applied to the a-g-c circuit, the long time constant is necessary to filter these out. Because of this long time constant, the a-g-c voltage is relatively unaffected for any changes in signal amplitude unless this change occurs over an appreciable time interval. Thus, this system does not respond to the rapid increase and decrease of signal caused by reflections from an airplane.

Besides this, if the signal to noise ratio in the area is poor, the noise impulses may add a sufficient voltage to the a-g-c system to materially decrease the gain of the amplifiers due to the excess bias which is developed. This proves of decided disadvantage, and cannot be corrected by the contrast control, for the latter is usually located in the video amplifier stages when a.g.c. is used.

In some of the earlier receivers an extra tube was employed for noise filtering, but this added to manufacturing costs and still left unsolved the case of airplane flutter. With the advent of *keyed a.g.c.*, however, both problems were solved with a circuit virtually as simple as the conventional a.g.c. but much more ingenious in design principles.

How Keyed AGC Functions

Figure 2 shows the basic keyed a-g-c circuit. Here, a small positive voltage is applied to the cathode which, in

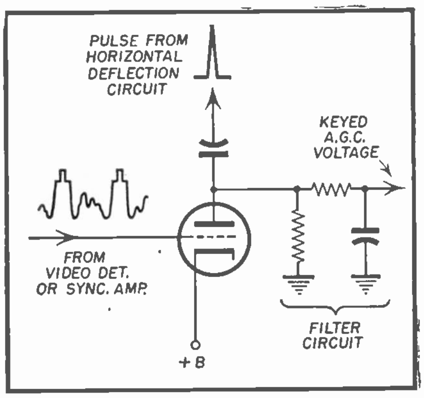


Fig. 2. Basic circuit of keyed a-g-c system.

turn, will make the plate negative with respect to this positive potential. The plate cannot conduct, therefore, unless this negative charge is overcome. A positive going, spike-appearing voltage is procured from the horizontal deflection circuits and applied to the plate of the a-g-c tube. This positive spike is of sufficient amplitude to overcome the negative charge on the plate and cause the tube to conduct. Tube conduction occurs, therefore, at the 15,750 rate of the horizontal sweep circuit, or once every 15,750th second.

The composite video signal from the detector, or the blanking and sync tips from the sync amplifier are applied to the grid of the a-g-c tube. The bias is so arranged that only the sync tips will allow the tube to conduct—that is, the bias is set so far negative that it takes virtually the entire amplitude of the positive blanking—sync tip signal to decrease bias sufficiently to allow current flow through the tube.

We have, therefore, a condition where neither the grid signal alone, or the spiked pulse on the plate alone, will cause conduction of the tube. *Both* must be present in order for the tube to function. Inasmuch as the sync tips are keeping the horizontal oscillator in proper frequency lock, both sync tips and horizontal pulse will occur at the same time. If the station fades, the sync tips will be lower in amplitude and cause less current flow through the tube, and thus develop less a-g-c bias voltage at the output. Less bias on the amplifier stages will increase their gain and compensate for the decreased signal due to fading.

Inasmuch as the a-g-c tube does not conduct between sync pulses, the video signals or any noise signals riding on them have no influence on the a-g-c voltage. At the same time the filter circuit at the plate need not have a long time constant, for it is only necessary to filter out the 15,750 ripple frequency. The relatively shorter time constant makes the system sensitive to the rapid changes of signal due to airplanes.

Typical Commercial Circuits

Figure 3 indicates the type of keyed a.g.c. employed by Westinghouse in various models of their receivers using the V-2150 series chassis. The similarity between this and *Fig. 2* is readily apparent, the only innovation being the use of a 150 ohm section of twin lead from the horizontal circuits to the plate of the 6BH6

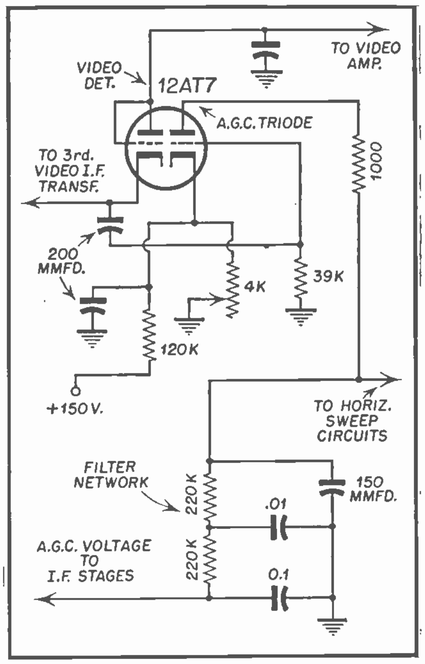


Fig. 4. Zenith a-g-c system.

a-g-c tube. The capacity existing between the two wires of the transmission line is used for coupling the spiked pulse to the plate of the a-g-c tube. The 130 volts screen potential is dropped down to 95 volts for the positive potential necessary at the cathode. Sync pulses from the first sync amplifier are applied to the grid of the 6BH6 and serve to key the system into operation.

The correct amount of bias for proper operation of the a.g.c. is established by the relationship of the plus voltage at the grid and that at the cathode. The voltage at the grid due to direct coupling from the 1st sync amplifier is approximately 70 volts. The positive potential of approximately 95 volts at the cathode, will make the grid negative with respect to the cathode by the diffference between the two voltags, or 25 volts.

Figure 4 shows the type of a-g-c circuit used by Zenith in their 24G20 series TV receivers. Zenith refers to their system as "Gated AGC" and its function is essentially the same as the keyed systems previously discussed. The a-g-c triode is one-half of the 12AT7 which also contains the video detector. The i-f signal from the secondary of the 3rd i-f transformer is applied to the grid of the a-g-c tube through a 200μμf coupling capacitor. During the positive half-cycles of this i-f voltage plate conduction occurs because of the presence of 15,750 cps pulses from the horizontal oscillator. Since the frequency of grid and plate signals coincide, the a.g.c. has an "open gate condition" only during the time duration of the applied sync pulses. During the interval between pulses the tube is non-conductive (gate closed) and therefore immune to noise signals present between horizontal sync time. The period of tube conduction can be changed by the potentiometer in the cathode circuit.

Some keyed a-g-c systems utilize more than one tube if additional refinements or greater a-g-c control is desired. An example of this may be found in the DuMont TV receivers and the one employed in their Model RA-105 is shown in *Fig. 5*.

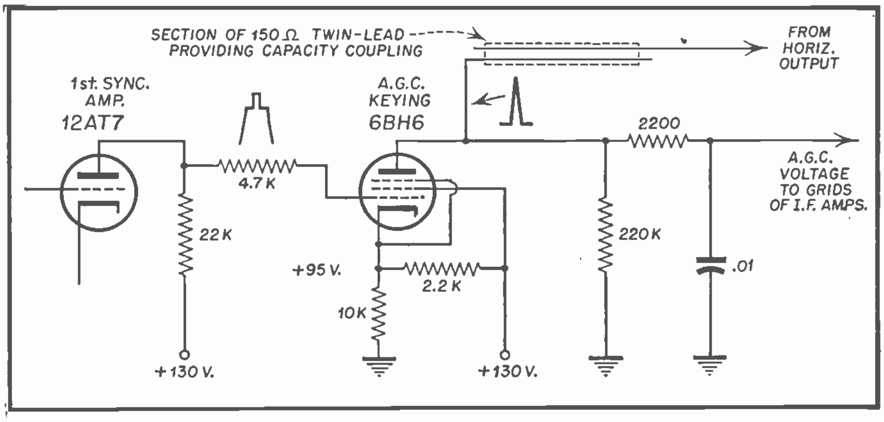


Fig. 3. Basic circuit of keyed a-g-c system used by Westinghouse.

The signal from the output of the video i-f stage is applied to the plate of the a-g-c diode 6AL5 tube. As with the Zenith previously discussed, this tube conducts on the positive half cycle of the input signal sync pulses. An RC filter is used to couple the voltage present in the cathode circuit to the grid of the 6AT6. This means that the grid receives a positive d-c voltage which has an amplitude depending on picture signal, and this d.c. controls the gain of the triode portion of the 6AT6 tube. A 15,750 signal which is primarily a square wave is also applied to the grid of *V209* and this is procured from the plate of the horizontal oscillator. This square wave signal is also amplified by the triode, though the gain depends on the d-c signal derived from the 6AL5 a-g-c diode.

The amplified signal appearing in the plate of the triode section is coupled to the upper of two diode plates in the same tube envelope. The diode rectifies this signal and thereby develops a negative potential which appears across *R246* and *R247*. The filter network (*R244* and *C226*) smooths out variations and assures substantially ripple free d.c. for a-g-c bias purposes at the grids of the picture i-f stages. When the incoming signal to the receiver changes in amplitude, the gain of the triode is altered and the resultant bias corrected to compensate for the changes in the received signal.

Circuit variations other than those shown in the foregoing examples will, of course, be encountered in the field. Essentially however, all keyed a-g-c systems function on the same basic principles—bias is developed during tube conduction, and the latter can only occur when both sync tips and horizontal sweep signal are applied to the a-g-c circuit simultaneously.

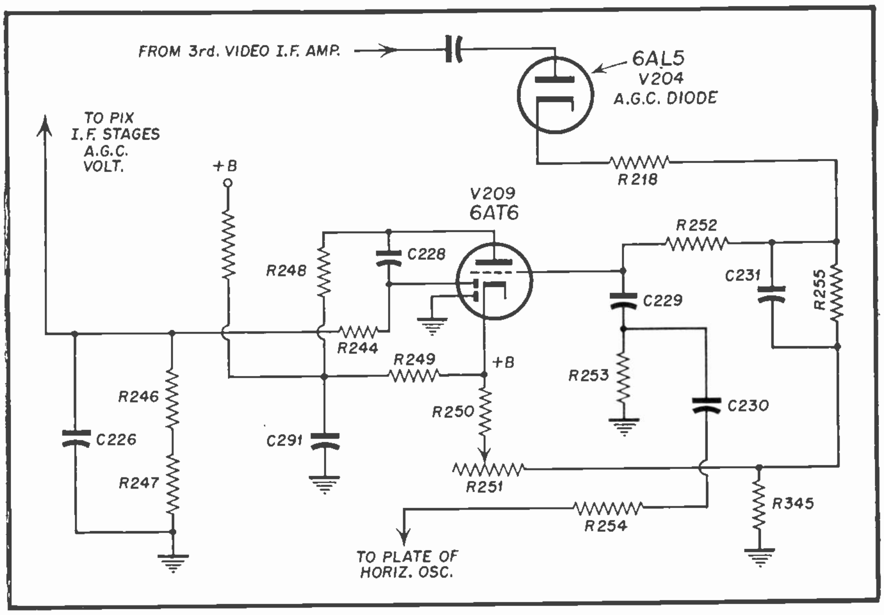


Fig. 5. DuMont a-g-c system.

Service Notes

Because the purpose of any a-g-c system is to maintain a constant picture signal level by controlling the bits applied to the r-f/i-f stages, the lack of such bias is a positive indication of a-g-c circuit failure. The best method for ascertaining the presence of the a-g-c bias is to tune the receiver to a station and measure the voltage existing at the grid of the first or second video i-f amplifiers. Use only a vacuum tube voltmeter so that the impedance of the measuring device will not materially effect the circuit. The bias should change when the receiver is tuned to other channels. A stronger station should develop greater bias, while a decrease in the a-g-c bias will be noticed for the weaker stations. *Figure 6* shows a typical a-g-c filter network usually found in the i-f stages, and method for measuring a-g-c voltage is also shown. The VTVM should be switched to read *minus* d-c voltage.

A change in tube characteristics or complete failure of the a-g-c tube is a common cause for faulty a-g-c operation. If tube conduction had decreased, sufficient bias will not be available for strong signal inputs, and in consequence the stages are overloaded. Bending and tearing of the signal appearing on the screen will result. This is identical to the condition set up in sets not having a.g.c., where the contrast control is set up too far on a strong local station.

An open circuit in the line feeding the pulse from the horizontal circuits to the plate of the a.g.c will also cause failure of a.g.c., because the tube will no longer conduct. The resutant zero bias will cause excessive gain, and this uncontrolled amplification will again result in picture instability and excess contrast.

Filter capacitors C_2 and C_3 in *Fig. 6* usually give little trouble because very little d-c voltage appears across them. When these give trouble, it is usually due to a capacitor which was defective or poorly constructed during manufacture. Occasionally these will be damaged by excessive heat generated by other components which have been placed too close. A shorted C_2 and C_3 will, of course, short out the a-g-c voltage and again the r-f or i-f amplifier tubes will be running with excess gain due to insufficient bias. Opening one side of these capacitors and checking with an ohmmeter will establish whether

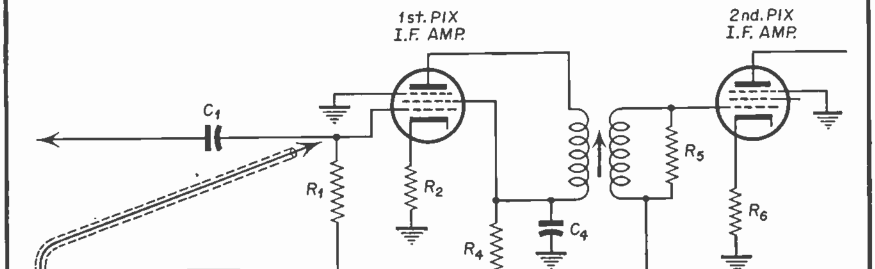


Fig. 6. Method for testing a-g-c voltages.

[*Continued on page 44*]

Sampling Techniques

APPLIED TO TELEVISION

by EDWARD M. NOLL

(Author of "Television for Radiomen")

In last month's article, sampling & multiplex techniques were introduced. Practical examples of sampling technique have been demonstrated by the RCA color television system and by the high defintion black and white experiments conducted by the Philco Corporation. The use of sampling has permitted RCA to produce a color picture with excellent resolution on only a six megacycle channel. Sampling in black and white systems has permitted monochrome resolution figures approximately double that which can be obtained by our present commercial system in a standard 6 megacycle spectrum.

IN our present black and white television system a possible maximum of 400 horizontal elements can be conveyed from transmitter to receiver. Frequency response of the system to convey these 400 elements must be in excess of 3¾ megacycles.

RCA Color TV System

Inasmuch as the frequency components in a video signal extend up to this high frequency, sampling rate must be exceptionally high. In the RCA system a sampling rate of 3.8 megacycles is recommended. This would at first seem to limit the high response to one-half of this frequency rate or 1.9 megacycles. However, in the RCA system a method of mixed highs is employed to obtain an equivalent resolution. Thus a sampling rate of 3.8 megacycles, use of mixed-high transmission, and a method of dot interlacing permit a high resolution color picture to be conveyed.

A color system, *Fig. 1*, uses three color interpretations—green, red and blue. Each of the color signals feed a low pass video amplifier which has a frequency range up to 2 megacycles. The output of these amplifiers are sampled at a 3.8 megacycle rate, breaking up the individual color video signals, up to a frequency limit of 2 megacycles (approximately one-half the sampling rate frequency). The frequencies in excess of 2 megacycles (from 2 to 4 megacycles) are mixed together in a mixer or added producing a composite signal from the three colors which is representative of the definition of the picture in form of half-tone levels. It has been found that the definition of the picture is represented in the higher frequencies and that they need not be broken up into individual color elements to reproduce a highly resolved picture. Frequencies below 2 megacycles are apportioned, sampled and broken up into color levels that are a function of the amplitude levels of the three basic colors in the object.

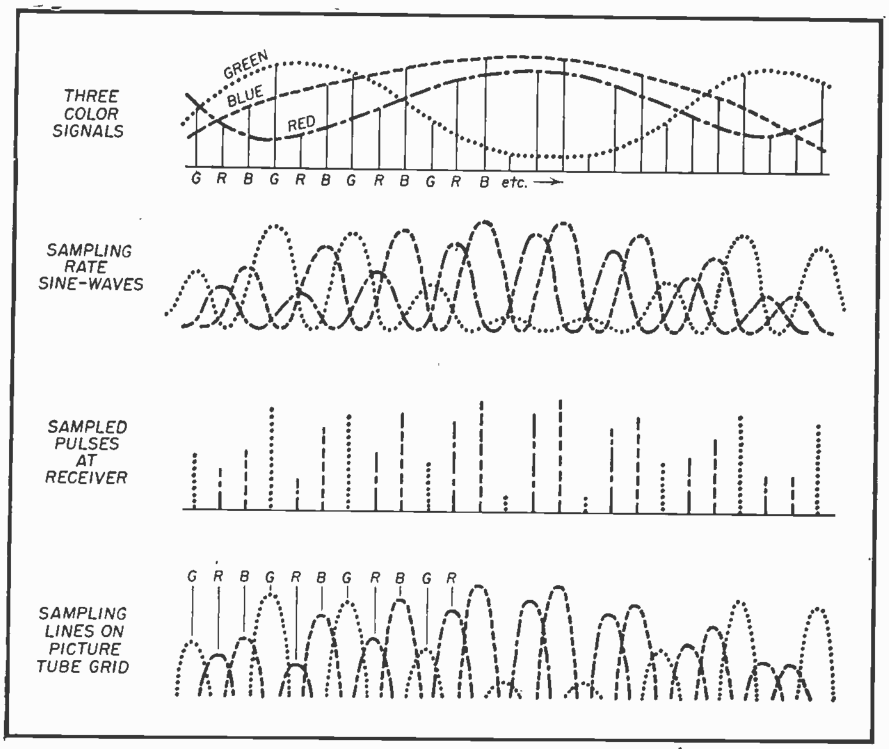


Fig. 2. Method of converting individual color signals into 3.8 mc sine waves. At the receiver a separate sampling circuit separates the colors and impresses them on the picture tube in their proper phase and amplitude relations.

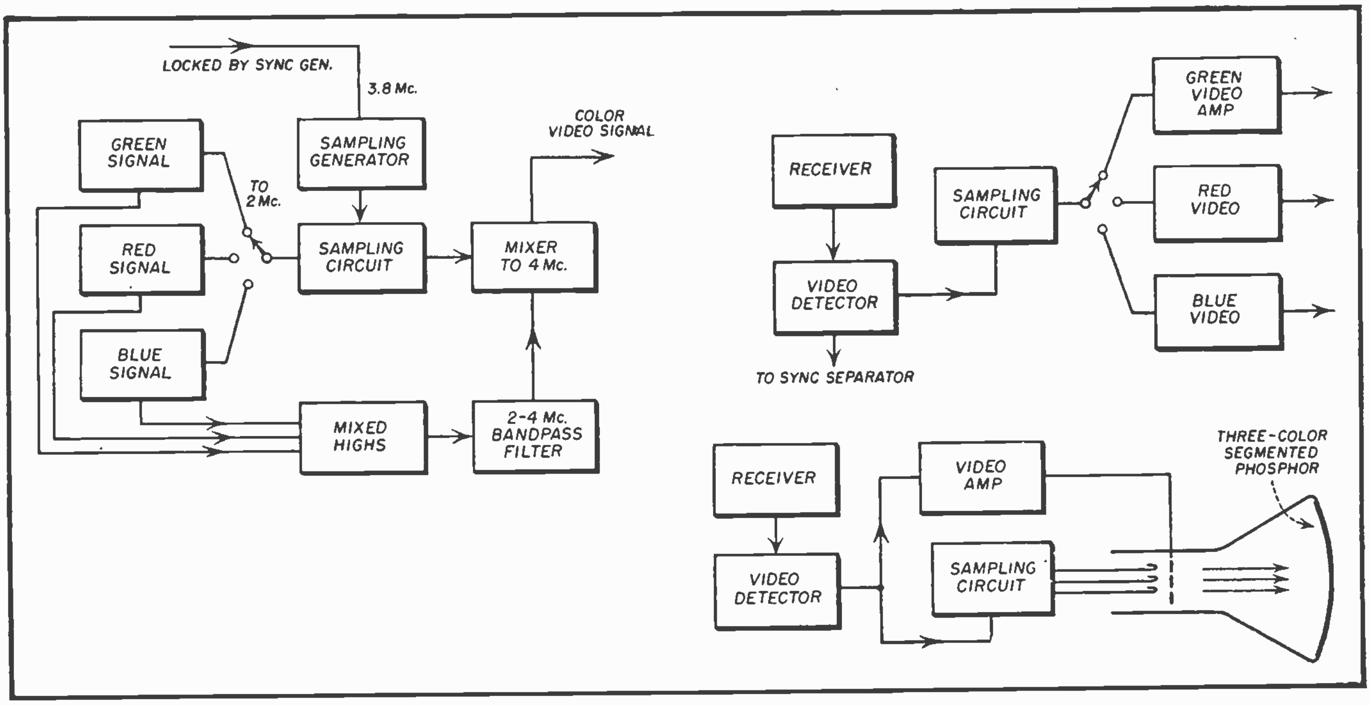


Fig. 1. Block diagrams of RCA color system for transmitter and receiver.

A standard scanning sequence is used for each camera and the output of the sync generator used must not be too different from that used in present commercial practice. A special pulse is used, however, to control the sampling generator which forms a pulse that keys the output of the three color video amplifiers at the proper instant permitting their signals to reach the output mixer video amplifier.

The action of the sampling system can be seen from the waveforms of *Fig. 2*. Each of the individual colors in accordance with their respective amplitudes and variations are sampled and produce corresponding pulses at the output of the sampling system. Again, the repetition rate of these pulses is the 3.8 megacycles interruption frequency, and as they are passed through the mixer video amplifier, which has a frequency response no higher than 4 megacycles, the pulses are converted into a 3.8 megacycle sine wave. Again the amplitude of this sine wave is a function of the amplitude of the pulse and, therefore, a function of the individual color intensities.

It is to be observed there is a separate train of 3.8 megacycle sine waves for each color. Relation between these respective sine waves is such that other two sine waves are passing through zero or below at the instant any one sine wave is at its crest value. Thus the crest of the sine wave represents the peak amplitude of the pulse from which it was derived. If these three sine waves are added, a composite sine wave of this same frequency is obtained, amplitude and phase of which is a function of the respective amplitudes of the three sine waves that form it. The average level of this composite is a function of the d-c components of brightness of these various color signals which make up the composite. As observed from the original color sine waves, the average level of each is a function of the average brightness of that color over a finite time. Thus the instantaneous variation and the average brightness level of each color is conveyed by the sampling system. The color composite video signal is combined with the mixed-highs output of the filter (which only passes the mixed-highs) to produce the complete video signal that is used to modulate (after proper amplification and insertion of pulses) the carrier of the color picture transmitter.

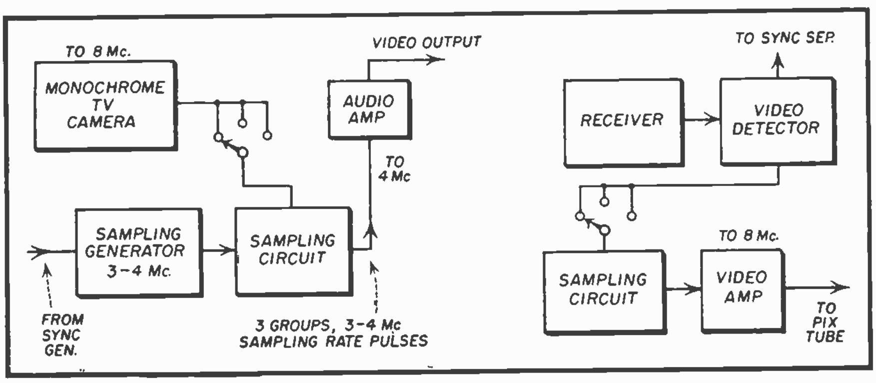


Fig. 3. Sampling principles applied to black and white transmission for high definition transmission and reception.

Color Receiver

At the receiver this information is picked up in a receiver using a conventional r-f and i-f section. The color video signal at the output of the video detector is applied to a sampler circuit which has been synchronized with the operation of the sampler at the transmitter. Thus the video signal is again broken up into 3.8 megacycle pulse components, one group of pulses for each basic color. The pulses are segregated into three separate color video amplifiers again and will be used to excite three separate picture tube grids. Frequency response of the individual video amplifiers is not much in excess of the 3.8 megacycle sampling rate. Nevertheless, each video amplifier is capable of passing the individual color samples in the form of a 3.8 megacycle sine wave and along

[*Continued on page 42*]

FRONT ENDS

by Samuel L. Marshall

(From a forthcoming book, "Television Installation Techniques")

Part 6

In this installment the basic principles of alignment are discussed together with necessary precautions to be followed to insure observation of the proper response curves. A typical alignment procedure is included.

THE alignment of TV Front Ends consists essentially of two sets of operations. The first is to obtain the required bandwidth and gain, this being accomplished by:

1. Adjusting suitable capacitance trimmers which control the response characteristics over certain frequency limits.

2. Adjusting the circuit inductances for optimum response. The second set of operations consists of adjusting the oscillator trimmers so that the correct i-f response is produced in the plate circuit of the mixer.

In general, Front Ends may be interchanged with slight alterations between split-sound and intercarrier receivers. Basically, all one has to do in order to adapt a Front End designed for split-sound use to intercarrier operation is to remove the sound trap. In some receivers the latter is used to partially attenuate the sound signal as required in intercarrier reception. For purposes of explanation, the block diagrams of intercarrier and split-sound systems are shown in *Fig. 3-45.*

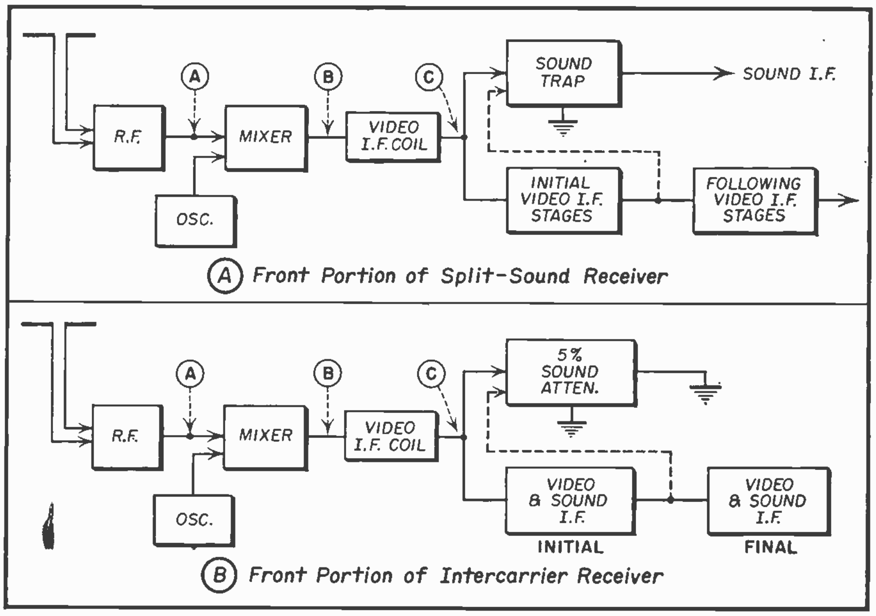
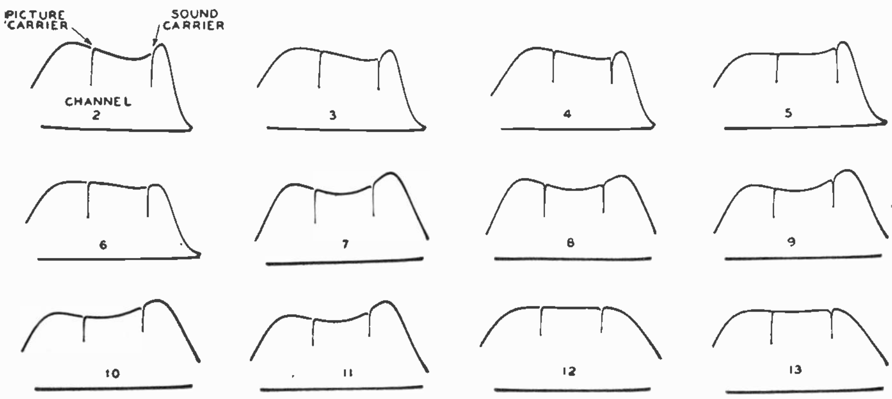


Fig. 3-45: Front portions of split-sound (A) receiver, and intercarrier (B) receiver.

Response Curves

A typical set of response curves corresponding to the output obtained at point *A* in both systems is shown in *Fig. 3-46.* This set of curves represents the r-f output for either type of receiver. Notice that in each curve the response is fairly symmetrical around the *center* frequency of each channel, no attempt being made at this point to favor the sound or video carriers at either end of the channels.



(Courtesy RCA)

Fig. 3-46: Typical set of r-f response curves obtained in a commercial receiver.

The response at the output of the mixer (point *B*) is also symmetrical; this time, however, the center frequency is at the center of the i-f band. In all types of receivers a converter transformer is connected at the output of the mixer tube so that the i-f response curve is first influenced by this component. Then, as

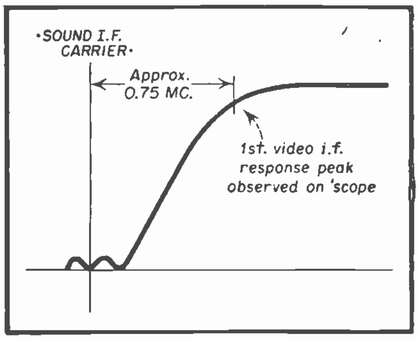


Fig. 3-47A: Correct partial i-f response curve—split sound.

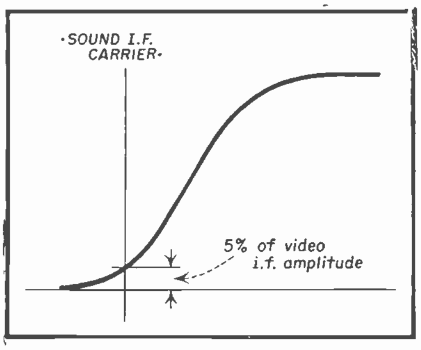


Fig. 3-47B: Correct partial i-f response curve—intercarrier.

the signal leaves the plate circuit of this transformer and enters the various video and sound i-f stages its response may be further influenced by other circuit components such as sound and adjacent channel traps.

Many split-sound receivers allow the sound signal to be amplified together with the video i-f signal for one or two stages of *overall* amplification before the sound is diverted to the sound i-f section. This is indicated by the dotted lines shown in *Fig. 3-45A*. The i-f response after adjustment of the sound trap appears as shown in *Fig. 3-47A*. This corresponds to the output at point *C* in *Fig. 3-45A*.

Proper intercarrier operation requires that the sound i-f carrier level be reduced to about 5% of the corresponding video i-f level. This reduction usually takes place in the converter output or in one of the earlier video i-f stages. *Figure 3-47B* illustrates the i-f response taken at point *C* of *Fig. 3-45B*.

Alignment

It will be recalled that symmetrical response curves around the center r-f frequency are called for when aligning r-f stages. Because of the wide frequency range of these response curves it is difficult to align these stages with a single frequency and an output meter as is the general practice in AM receivers. Instead, it becomes necessary to employ a sweep generator capable of inserting a wide band of frequencies into the r-f stages, and to adjust the various trimmers so that the required response curve as observed on an oscilloscope is obtained.

A typical test set-up of this type is illustrated in *Fig. 3-48*. Certain equipment must be used and basic rules observed in hook-ups of this type which apply to all alignments of this nature. These are as follows:

1. *Sweep*: The amount of sweep employed should be more than enough to encompass a complete r-f bandwidth. Because the r-f stage response is generally greater than 6 mc recommended r-f sweep settings are 15 mc.

2. *H-F Probe*: The type of signal at all r-f points except in the grid circuit of the mixer is a modulated r.f. Measurements made at these points, in order to be observed, require that the signal be demodulated. For this reason a h-f detector probe such as is used in an ordinary VTVM must be connected between the scope and the point at which the output signal is observed. A probe of this type is shown schematically in *Fig. 3-49.*

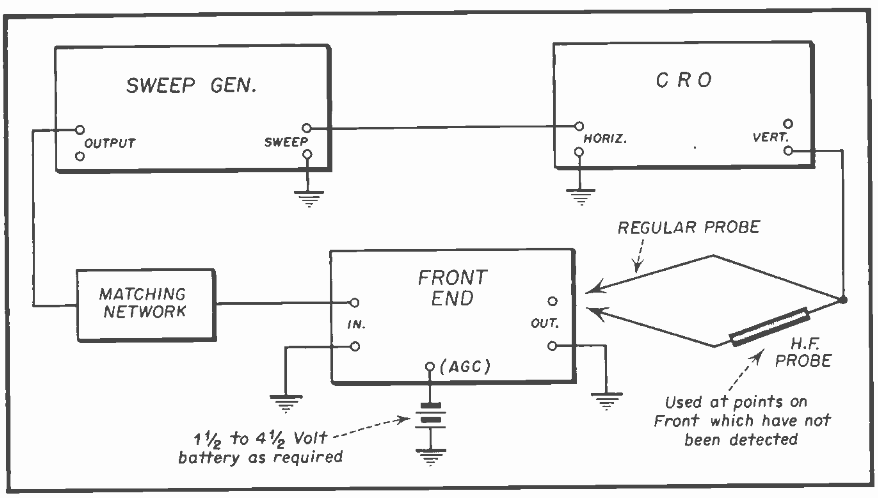
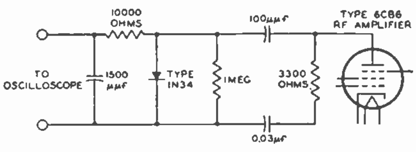


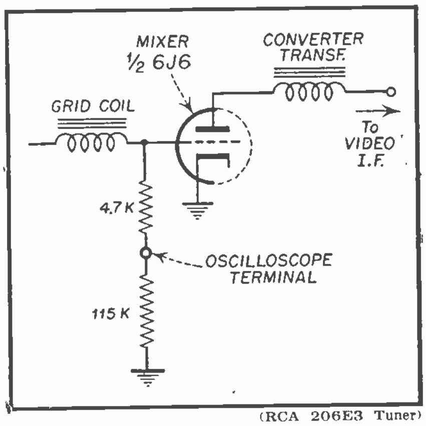
Fig. 3-48: Basic connections between sweep generator, CRO and Front End for observing r-f waveforms. Regular probe is used at grid circuit of mixer which is a point of detection. Crystal or h-f probe is used at other points. Matching network inserted between sweep generator and Front End is necessary to prevent distortion of waveform due to standing waves.

At the grid circuit of the mixer tube the signal is demodulated by virtue of the detector action of the tube. Therefore, no r-f probe is necessary at this point. However, it is customary to isolate the mixer grid from the probe by inserting a suitable resistor between the grid return and ground. A popular value of this resistor is 100K. The scope probe is then connected across this resistor and ground for measurements of the demodulated waveform present. Commercial Front Ends generally have this point readily accessible at some convenient position on the chassis, and it is referred to variously as a: tuner test point, looker point, oscilloscope point, etc. *Figure 3-50* illustrates the partial schematic of a typical mixer circuit showing this connection clearly.



(Courtesy RCA)

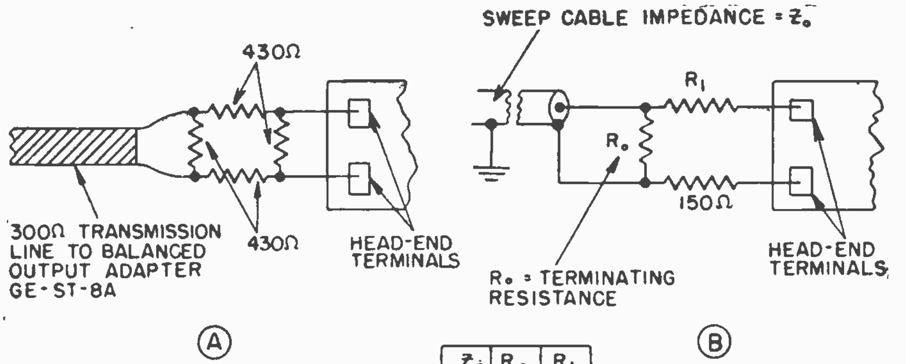
Fig. 3-49: Typical r-f probe circuit.



(RCA 206E3 Tuner)

Fig. 3-50: Partial schematic of mixer circuit.

3. *Marker*: It will be recalled that the r-f response curve observed on a 'scope represents the r-f response of the circuit to a wide range of frequencies, the latter being injected into the circuit by the sweep generator. During alignment it often becomes necessary to identify the *exact* frequency at certain points on the curve. An external oscillator or absorption circuit is therefore provided which in effect provides these exact frequencies, and when combined with the output of the sweep generator results in a slight break in the response curve



Z_o	R_o	R_1
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω
92Ω	110Ω	100Ω

(Courtesy G. E.)

Fig. 3-51: Networks for matching generators with impedances of 50, 75, and 92 ohm output to 300 receiver.

corresponding to the frequency of this oscillator or absorption circuit. The latter may be contained within the sweep generator or may be a separate and external piece of test equipment such as a signal generator. In any event, to be effective, it must have a high degree of accuracy—preferably crystal controlled.

The break in the curve may take on the appearance of a dip or a wiggle (birdie). The first is produced by an absorption device such as a wavemeter, the second by a c-w r-f oscillator. The output of the marker generator must be kept as low as possible; or, if an absorption circuit is used, the coupling must be as loose as possible, otherwise serious disruption of the waveform will result.

4. *Impedance Matching*: At very high frequencies, response curve measurements are valueless unless the sweep generator output terminals are properly terminated at the input terminals of the receiver. The reason for this is that at these frequencies a mismatch of this type results in standing waves which may or may not seriously affect the observed waveform, depending on the amount of mismatch present in the circuit. It is therefore advisable that some sort of matching network be employed between the generator and the input terminals of the Front End being aligned. Data for typical matching networks for connecting generators with 50, 75, and 92 ohm outputs to a 300 ohm input receiver is given in *Fig. 3-51.*

5. *Connections between units*: All connecting leads should be as short as possible. Shielded leads should be used in the r-f probe, in the 'scope output probe, in the sweep generator output probe, in the marker output probe, and in the connection between the sweep generator and the horizontal output terminal of the 'scope.

Ground connections should be made with care. Wherever, possible all grounds from the various units should be connected to a single point on the chassis. Sometimes peculiar waveshapes which change as the operator touches various units occur. This is indicative of improper grounding between units. Some manufacturers recommend a metal bench top when aligning Front Ends. While this practice lends itself to excellent grounding it is a little dangerous, being a potential source of high voltage shock.

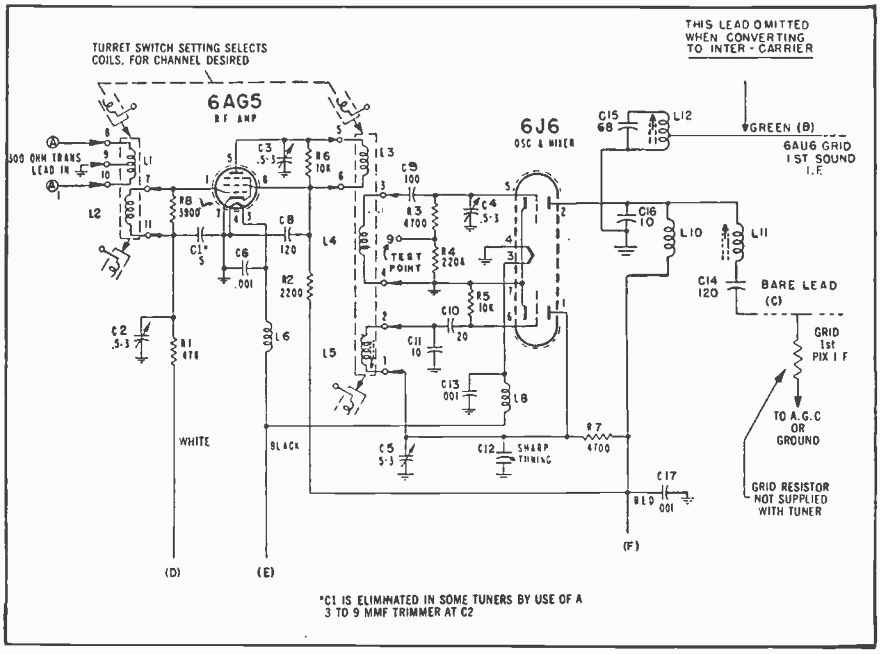
6. *Vertical Probe Pickup*: Without signal output from the sweep and marker generators the vertical amplitude on the 'scope should be zero. Be sure to make this check, otherwise the observed waveforms will be worthless. If any vertical signal does appear even though the sweep and marker generator outputs are set at zero, oscillation or hum is present in the tuner, or external energy is being picked up by the 'scope probe. At full 'scope sensitivity a slight vertical amplitude may be observed. This is permissible because during the actual alignment the 'scope sensitivity is invariably reduced from its full sensitivity range and this pickup will not appear in the final signal.

7. *Receiver Feedback*: To reduce possible feedback from the video i-f stages it is customary to remove the 1st or 2nd i-f tubes during the Front End allignment. Another possible source of disturbance is the vertical blocking oscillator, which can cause large variations in the "B" plus line. Removal of this tube in many cases will result in smoother alignment of the Front End.

As an example of the principles discussed in this and previous installments the following alignment procedure of the Standard Tuner Model TV 101 Front End is presented. For the convenience of the reader the schematic of this tuner which appeared originally in the Sept. issue, as *Fig. 3-24 is* presented again as *Fig. 3-52.*

I. F. and Trap Alignment

Connect VTVM in series with 10,000 ohm resistor to 2nd detector video output on main chassis. Remove tube shield on 6J6 on tuner. Capacity couple AM Signal Generator to 6J6



(Courtesy Standard Coil Prods. Co., Inc.)

Fig. 3-52: Circuit diagram of Standard Tuner Model TV 101.

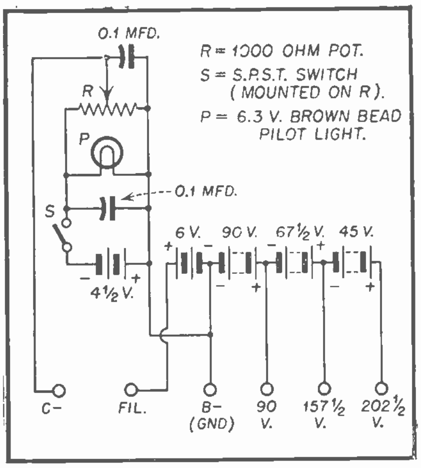


Fig. 3-53: Circuit details of battery box used to test TV Front Ends.

by slipping tight fitting ungrounded shield over 6J6 and connect generator to ungrounded shield. Set frequency of generator to 21.25 mc. Tune L_{12} for minimum voltage on VTVM. Set generator to 21.8 mc and tune L_{11} for maximum voltage VTVM. Use high output signal generator at 21.25 mc and low output on 21.8 mc for above alignment precedure.

R. F. and Mixer Alignment

1. Set station selector switch to channel 12.
2. Connect oscilloscope through 10,000 ohms to test point 9 (wire loop on top of tuner).
3. Set bias to 1.5 volts, (a 1.5 volt battery may be used). Set sharp tuning control at approximately midpoint of its tuning range.
4. Feed sweep generator into antenna terminals, sweeping channel 12.
5. Adjust C_2, C_3 and C_4 for flat-top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

Oscillator Alignment

1. Turn station selector switch to channel 12.
2. Connect calibrated crystal signal generator to one antenna terminal and ground. Set to sound carrier frequency 209.75 mc.
3. Connect vacuum tube voltmeter to d-c output of ratio detector or discriminator, whichever is used.
4. Adjust C_5 for zero reading on VTVM between a positive and negative peak.
5. Check all channels for zero reading on VTVM. It is usually not necessary to make any further adjustments. If necessary to touch up the oscillator coils, the following procedure is recommended:

Oscillator Re-check (not usually necessary)

a. Center sharp tuning control
b. Place a non-metalic screwdriver through opening, and adjust oscillator coil on channel 12.
c. This adjustment can be repeated for all channels or, if necessary, on any single channel.

Conversion From Split Sound To Inter-Carrier

1. Disconnect green lead from tap on L_{12}.
2. If a 21.25 mc trap is not required in first i-f transformer, remove C_{15} (68 mmf condenser). If a 19.75 mc trap is required, replace C_{15} with an 80 mmf condenser.
3. The 6AG5 then becomes the 1st inter-carrier i-f amplifier.

General Procedure

It must be remembered that there are many different types of Front Ends in use, each requiring an individual alignment sequence. For this reason the manufacturer's specifications and instructions should be followed in detail during the alignment of any one unit. However, it will be found that all alignments follow a general pattern, this being:

1. Adjusting the antenna and r-f stages for proper bandpass and gain.
2. Adjusting the oscillator to the exact frequency required to produce a required i-f bandpass.
3. Adjusting the converter i-f transformer to its required frequency.
4. Adjusting the sound or adjacent channel traps.

Aligning Front Ends Removed From Receiver

Very often it becomes necessary to remove the Front End from the receiver proper in order to align it properly or to check it for loose connections. To do this the video output terminals must be terminated in a load equivalent to the input of the succeeding i-f stage. An average value of this load is 10K ohms.

To make tests of this type an external power supply must be used. Such a supply employed by the writer, and utilizing batteries only, which has proven very satisfactory is illustrated in *Fig. 3-53* and *Fig. 3-54*. This battery supply may be used in many other applications such as testing portable receivers. It provides an "A" supply of 6 volts, a variable "C" supply of 4½ volts, and "B" voltage taps of approximately 90, 150 and 200 volts. The pilot light used in conjunction with the "C" supply indicates to the user that the potentiometer is connected across the "C" battery. When not in use the switch is turned off and the pilot light goes out.

Thus far, the writer has been able to test any Front End entirely disconnected from its chassis by connecting it up with this battery supply. Many intermittents and other defects almost impossible to locate with the Front End connected in the receiver have been detected in this manner. To those who have occasion to repair and align many Front Ends a unit of this type will prove invaluable.

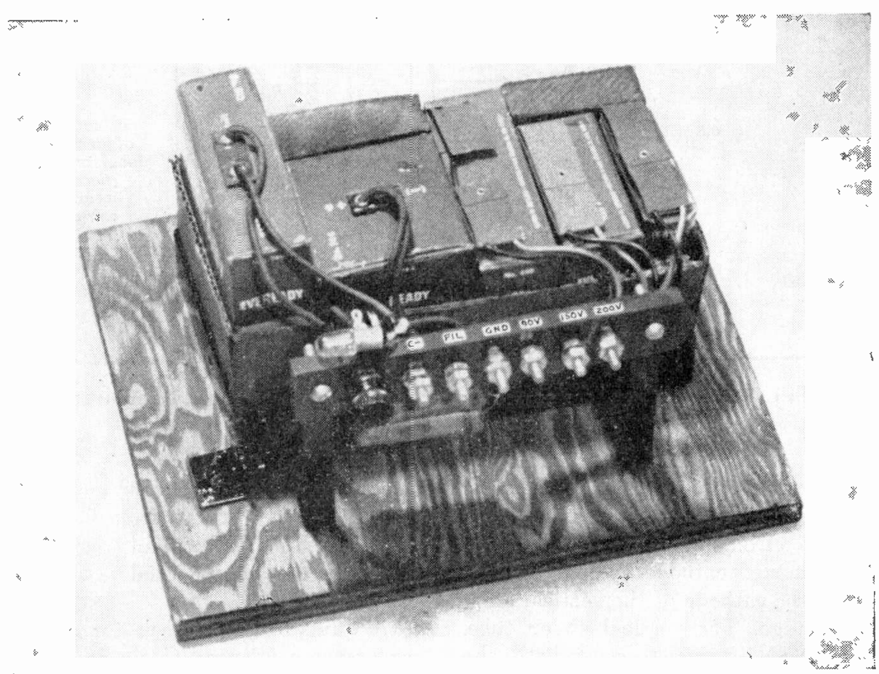


Fig. 3-54: Batteries used in battery box are Eveready #746-4½v, #744-6v, #490-90v, #467-67v, #455-45v, or their equivalents.

LOOKING FOR *Trouble?*

No. 2

by Cyrus Glickstein

(Instructor, American Radio Institute)

Continuing this unique type of trouble-shooting article which goes through the actual steps of servicing a TV receiver in quiz fashion. In this installment the Hallicrafter Model T-64 is analyzed for a particular symptom which any radio-TV service dealer might encounter.

HERE we go looking for trouble again—this time in Hallicrafter Model #T-64, using transformer low voltage supply, kickback high voltage supply, 10BP4 picture tube, and push-button channel selector. The sound was normal but the picture exhibited a marked foldover at the bottom.

The object of the game is to duplicate as far as possible the general steps in servicing a teleset as might be done on the bench or in the home until the trouble is found. The rules of the game are simple. Answer each question before going on to the next, since the answer is sometimes given in the following question.

1. The first step in trouble-shooting usually consists of checking appropriate controls to make sure there really is a trouble instead of only misadjusted controls. On the basis of the above picture on the screen:

(a) There is definite trouble in the vertical sweep circuit and there is no need wasting time to check vertical controls, since this type of trouble cannot be caused by misadjustment of controls.

(b) Same as (a) except that the trouble is indicated in the horizontal sweep circuit.

(c) Possibly can result from misadjustment of vertical linearity control.

(d) Possibly can result from misadjustment of horizontal drive control.

2. Varying the vertical linearity control varied somewhat the amount of foldover, but manipulating this control and the vertical size control could not take it out. This kind of trouble is caused most usually by a bad tube or a leaky coupling condenser or leaky saw-tooth condenser in the vertical sweep circuit, although there are other possibilities. In this type of circuit it can also be caused by a shorted cathode by-pass condenser in the cathode of the vertical amplifier stage. The vertical sweep tube, *V-14*, 6SN7, consisting of both the oscillator and amplifier stages, was changed. No improvement. The cathode voltage on the amplifier stage was measured with a voltmeter and found to be normal, varying from 0 to +16 v. as the linearity control was varied, showing that the cathode condenser was not shorted.

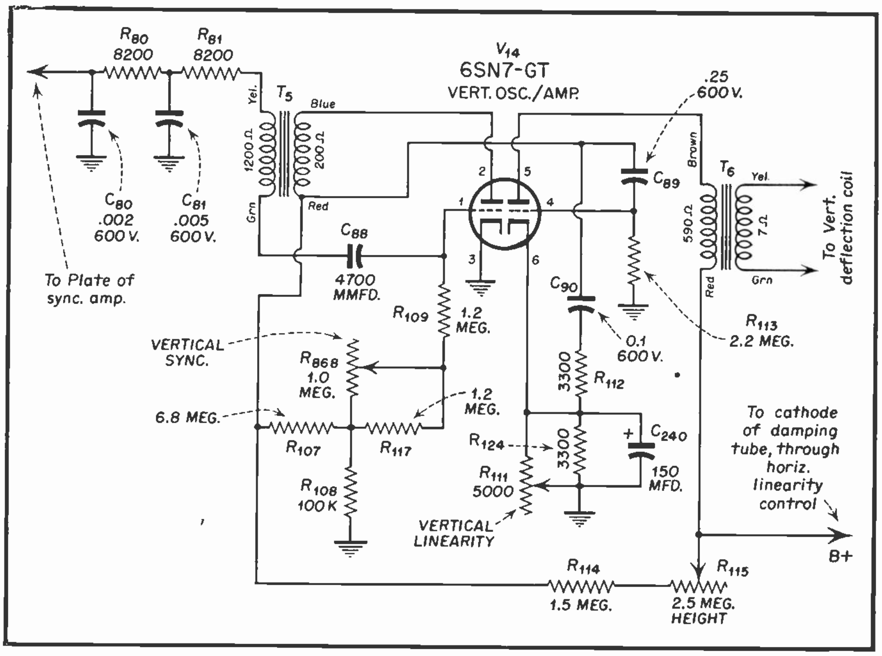


Fig. 1. Vertical sweep section of Hallicrafter Model T-64 receiver. (Partial Schematic).

A quick way to check for a leaky saw-tooth condenser, *C-90* (See *Fig. 1*) would be to turn set on and to:

(a) Check with VTVM to see if there is a positive voltage from top of *C-90* to ground with the vertical sweep tube out of socket.

(b) Put VTVM across *C-90* to check if there is a positive voltage with the vertical tube in.

(c) Bridge a known good condenser of the same value across *C-90* and watch picture tube to see if picture or raster returns to normal.

(d) Put VTVM across *R-112* to see if there is a positive voltage with the vertical tube out.

3. Saw-tooth condenser checked O.K. Next check made to see if the coupling condenser, *C-89,* was leaky. Quick check here is:

(a) Check for positive voltage on the grid of the amplifier stage with the set turned on and the the vertical tube in the socket.

(b) Same as (a) but with the tube out.

(c) Unsolder one end of the coupling condenser and check across it on the high range of the ohmmeter with the set turned off.

(d) All of the above methods are equally good.

4. Coupling condenser did not check leaky. Resistance check made around the tube socket and all resistance checked normal. Resistance readings of the vertical transformers and vertical section of the yoke were normal. On taking voltage readings, B+ was normal and plate and grid voltages of oscillator were about 20% off, but did not show any conclusive indication of where the trouble might be.

Since it is possible for the saw-tooth to be distorted even if the condensers are not leaky but simply decrease in capacity, the following condensers were changed: sawtooth (*C-90*), coupling (*C-89*) and grid leak (*C-88*). Set turned on. No change in the amount of foldover in picture. A scope was used to check wave-forms at the points shown in *Fig. 2.*

On the basis of the scope information and previous checks, trouble most likely is originating in:

(a) The plate circuit of the amplifier triode.

(b) Grid circuit of the amplifier triode.

(c) Plate section of the oscillator triode

(d) Either the plate section of the oscillator or the grid section of the amplifier.

5. Waveform was rechecked from top of *C-90* to ground after each of the following were done: Coupling condenser *C-89* unsoldered at one end; either side of *R-81* shorted to ground; bottom of *R-112* shorted to ground. Waveform did not change shape at any time and was the same as before (See *Fig. 2,* III) though shorting each side of *R-81* changed the frequency of the sawtooth somewhat. This indicates the trouble most likely is:

(a) Defective blocking oscillator transformer, *T-5.*

(b) Defective tube socket for vertical sweep tube, *V-14.*

(c) One of the resistors in the vertical oscillator stage must be changing value when voltage is applied.

(d) Shorted *C-81* in integrating network.

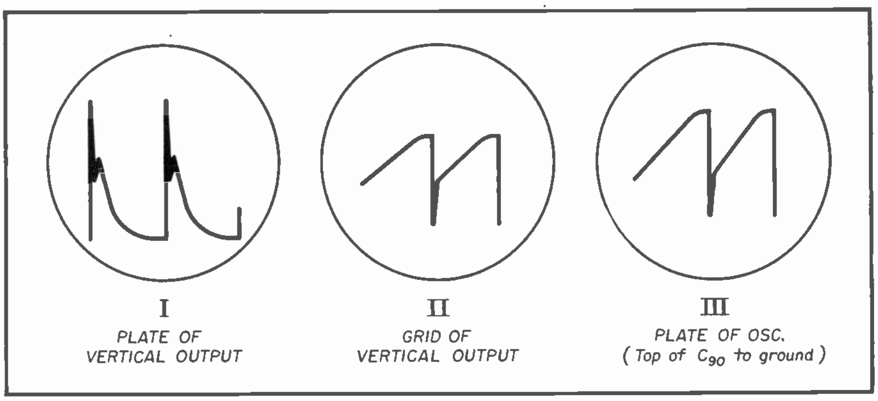


Fig. 2. Waveforms appearing at various points in vertical sweep circuit of a television receiver.

ANSWERS & DISCUSSION

Answer 1—c.

In some receivers, misadjustment of controls can cause vertical foldover. This is true in this receiver because linearity control can reduce vertical amplifier cathode resistance to zero. (See *Fig. 1*) As a result, lack of cathode bias on the amplifier stage will cause top of modified sawtooth wave to be flattened off and so cause foldover. In many sets there is a fixed resistor in series with the linearity potentiometer in the cathode of the vertical amplifier to limit the range the bias can be varied. In such cases, varying the vertical linearity control can correct for (or if set is too far off, cause) vertical non-linearity but not actually foldover.

Trouble definitely is indicated in the vertical rather than the horizontal circuit since it is a fault that is not common to all horizontal lines. Such a fault would be expressed in a vertical direction. That is, trouble in the horizontal sweep generally shows up in the vertical direction, and in the vertical sweep in the horizontal direction.

Answer 2—d.

When the tube is in, the oscillator operates and generates a modified sawtooth voltage. With a sawtooth voltage across *R-112* there may be some d-c reading, especially when the sawtooth is distorted even if the sawtooth condenser is not leaky.

While the sawtooth is an a-c voltage and should give a zero reading when measured with a d-c meter, this would be true only when the positive and negative halves of the signal are equal or symmetrical. When they are unequal, the d-c meter will give a reading in the direction of the larger half of the a-c voltage. However, if the tube is taken out and *C-90* is leaky, there will be a small d-c voltage across *R-112* due to the small amount of current through it and *C-90.* This could usually be measured by a VTVM across *R-112.* However, if the leakage current is very small, it may not show up very well across *R-112* because its low resistance value would give a small voltage drop. A more conclusive check would then be to unsolder one end of *C-90* and put the VTVM in series with it with the power in the set on and the vertical tube out of the socket. Even a small current flow through the VTVM will give a definite reading.

Since this is a transformer a-c set, it is perfectly feasible to take the tube out and the other circuits, including low voltage B+ would continue to operate. In sets where the filaments are in series, the same type of check would have to be made but without taking the tube out. Instead, the oscillator should be immobilized by grounding the grid, the idea being to prevent a sawtooth signal from masking any d-c voltage across the peaking resistor, *R-112.*

[*Continued on page 40*]

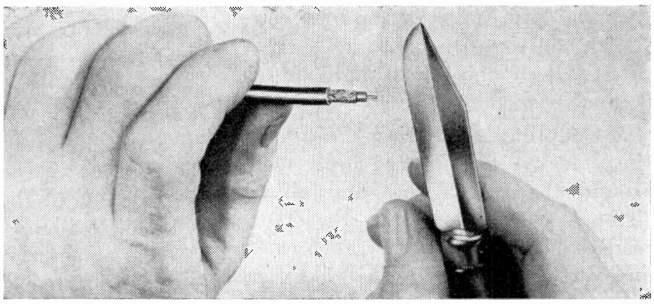
ASSEMBLING COAXIAL

Reprinted from Amphenol Engineering News, June

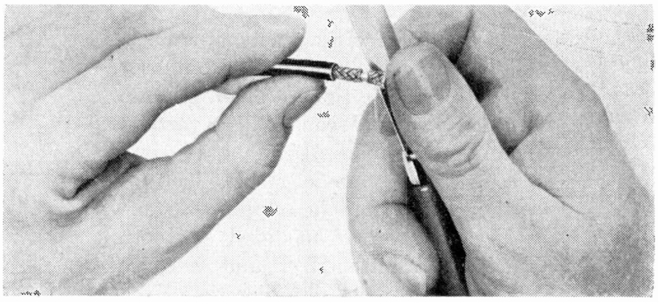
On these pages we show results of tested work procedures based on extensive experience in assembling connectors for use with RG 55/U, RG 58/U, RG 59/U, RG 62/U and RG 71/U cable. These methods have been adopted as standard on Amphenol assembly lines and are being passed on to our readers in the interest of building toward a higher degree of efficient workmanship. Shown to the right are the first three steps to be taken in processing either of the two assemblies. After these instructions have been followed either of the procedures shown in Figs. 4 to 8 or 9 to 13 may be continued according to the connector type being used.

OPERATIONS FOR RG 55/U AND 58/U CABLE

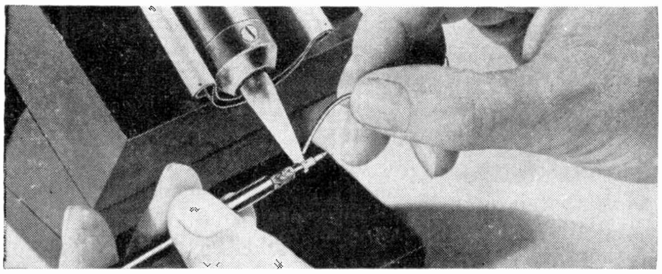
4. Dip exposed shield in rosin-alcohol flux to a depth of 1/8" (Apply a minimum amount of flux for a neat job.) Dip fluxed cable quickly into solder pot and immerse immediately into the alcohol. This cools the dielectric, prevents distortion and removes excess flux.



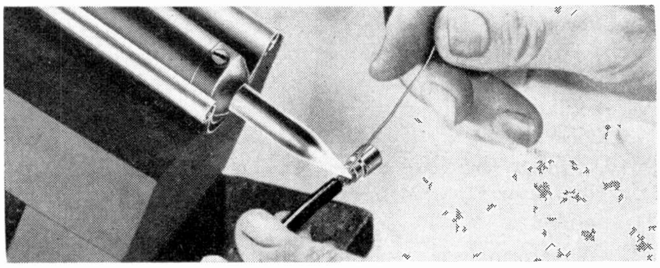
5. The tinned shield is then cut and removed to expose 1/4" of the dielectric.



6. The dielectric is then cut and removed to expose 1/8" of the center conductor.



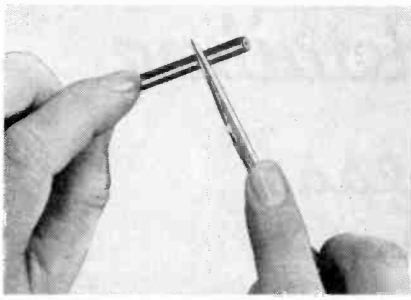
7. Tin the center conductor, slip on the contact and solder through the cross-drilled hole. The rubber or plastic sleeving which protects the external solder connection can now be slipped over the cable.



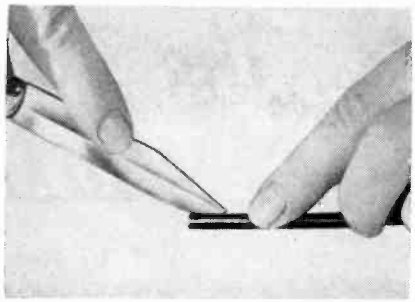
8. The connector shell is now slipped over the contact and shielding and soldered. Be certain the shell is properly located. It is in proper position when the tip of the contact is flush with dielectric and the end of the body shell.

CABLE CONNECTORS

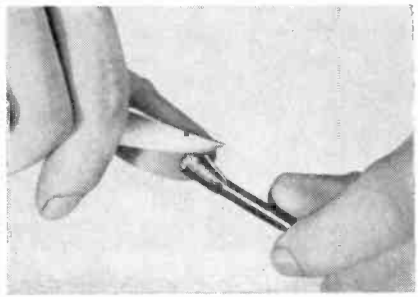
1950, by permission of the American Phenolic Corp.



1. After the cable is cut to required length, cut and remove vinyl jacket.

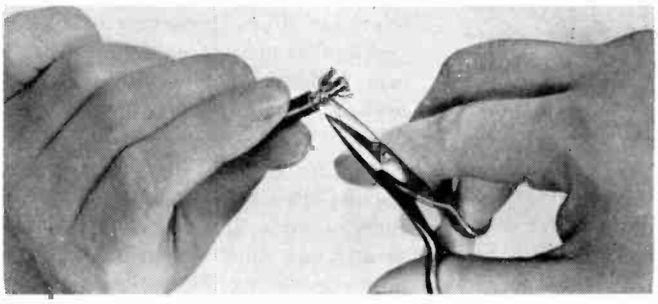


2. Slit vinyl jacket laterally to allow easy removal.

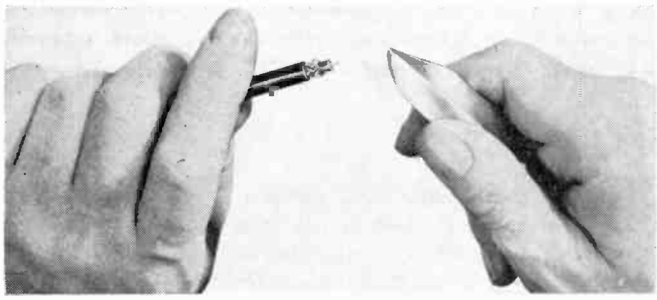


3. Remove vinyl jacket, exposing braid to 9/16" on the smaller and 7/16" on the larger cable.

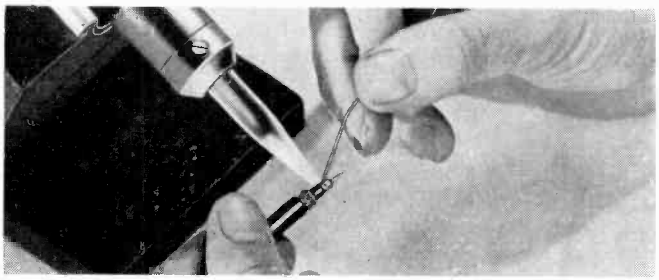
OPERATIONS FOR RG 59U, 62U AND 71U CABLE



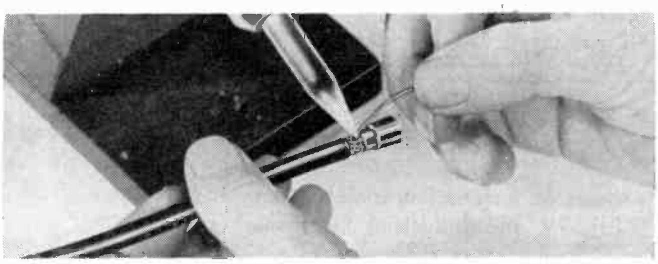
9. Slip the vinyl or rubber sleeving over the cable. Flare the braid slightly to permit trimming and remove 1/4" of shield, leaving 3/16".



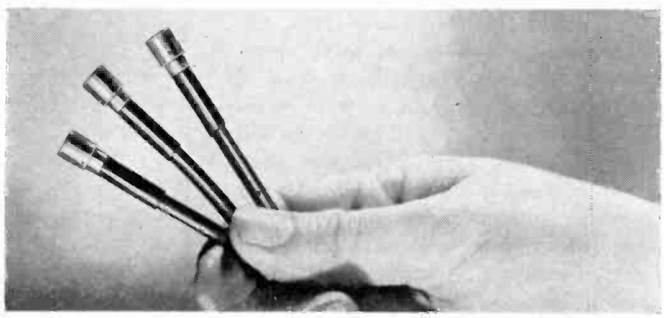
10. Cut the dielectric and remove to expose 1/8" of the center conductor.



11. The conductor is then tinned and the contact slipped in place and solder added through the cross-drilled hole.



12. Flare the braid slightly again and assemble connector shell to the cable. The shell should enter under the braid. The braid is squeezed into position over the shell body and soldered.



13. Slide rubber or plastic sleeving over the solder connection and the job is finished.

Roland D. Payne

"Does the Radio-TV Technician Belong In The TV Retailing Business?"

by **Roland D. Payne**
Sales Manager, Air King Prods. Co. Inc.

Your editor firmly believes that most servicemen can more than double their incomes by assuming an aggressive, rather than "hands-off" approach where potential sales of appliances, receivers, and accessories are concerned. Try it out--you'll be surprised at the results.

THE above captioned question has oft been asked by both the technician and the television manufacturer. To answer this question let us first establish the facts in the case.

On the negative side, first let us assume that in most cases franchises for the top brand lines of television will not be available to the technician.

Secondly, the main portion of the technician's business is technical know-how and the sale of replacement parts and not merchandising, as is needed to sell television sets.

Third: Most of the secondary television lines available carry very little and, in some cases, no consumer advertising, which makes them hard-to-sell items.

Fourth: Warehouse space being at a premium, most technicians do not have adequate facilities for handling large quantities of television receivers.

To offset the above negatives, the technician will have, in most cases, with a secondary television line, a larger margin of profit to work with. His dealer mark-up will be better and his list prices somewhat lower than those of the top name brands. Larger margins and lower list prices should certainly offset, somewhat, the fact of no consumer advertising. So let us assume for the moment that the selling of television receivers should be profitable.

From a physical equipment point of view, most technicians are amply prepared. Television must be demonstrated to be sold. Therefore, a display and demonstration corner or room is absolutely necessary. The receivers in this room or space must be in good working order and must be polished or dusted daily. Technicians know all of the idiosyncrasies of receivers and also all of their good qualities. This gives them a decided edge in demonstrating and selling TV receivers.

Most technicians are capable of buying at least one television receiver at a time. They may sell this sample and then immediately reorder. This is a nice lucrative business as the dollar profit is high. Besides, the installation and future servicing of these receivers will provide technicians with additional, regular services of income.

On the servicing side of the ledger, the technician is well equipped. He has oscilloscopes, signal generators and voltmeters; in fact, all of the equipment necessary for servicing television. Parts inventory creates no problem as most technicians already carry comprehensive inventory of needed standard television parts and tubes.

The technician, in most cases, is not expected by the manufacturer, to carry a large inventory of receivers at any one time. So, in buying what he needs, selling them quickly and reordering, the technician is never stuck with obsolete merchandise nor is he caught with a big inventory if and when prices decline.

I particularly emphasize the fact that the radio-TV technician has always been the receiver manufacturer's liason with the public and undoubtedly is the industry's greatest single factor in the molding of public opinion. Invariably, the serviceman's good or bad opinion of a receiver line is respected by the public, and influences its future purchases.

In conclusion, may I say that the technician definitely belongs in the television receiver business as the affirmative side of the question certainly outweighs the negative considerably.

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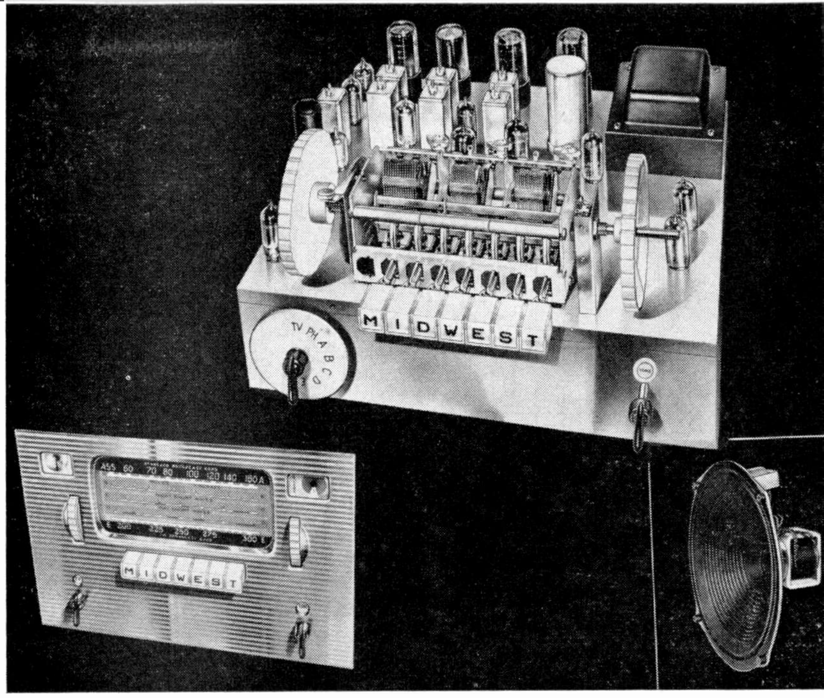


Fig. 1. Midwest Model JC-16 combination AM-FM receiver.

This is the sixth article on high quality tuners and receivers prepared by the author for our readers. Those who have followed this series are unamimous in their praise of the objective manner in which the various products were handled. In this installment the Midwest Model JC-16 is described.

IN the interest of high quality reproduction from a combination AM-FM tuner chassis, we find in this model JC-16 by Midwest Radio & Television Corp., *Fig.* 1, several worthy features. For example, instead of jamming quantitative functions within one envelope, this model provides an independent 6AL5 tube for AM detection while it includes another 6AL5 tube connected as ratio detector for FM translation. There is no shortage of tubes in the straight-forward circuits divulged in the schematic of *Fig. 2*. The block diagram of *Fig. 3* shows the assignment of all tubes.

To the lower left of the schematic (*Fig. 2*) are shown low capacity jacks and switching facilities for:

(a) inclusion of a video adapter unit which economically employs the contained audio amplifier.

(b) high quality phonograph pickup.

For reception of weaker FM and shortwave AM signals, a properly matched low-loss external dipole antenna should be connected across input terminals "A-A" which offer a 300 ohm balanced input. In many instances a built-in dipole serves adequately for local reception. Terminal "G" should be properly grounded. high impedance loop antenna, provided for this chassis, will answer most standard AM broadcast requirements.

Tuning Facilities

Simplified band-switching selects individual r-f, mixer and oscillator tuning coils for each of the five channels listed below. Short-cuts are held to a minimum, as proven by the schematic *Fig. 2*. Twenty-three inductances, twelve trimmer capacitors and sixteen tubes serve the channels below:

Band *A* - 540 kc to 1600 kc - AM broadcasts.

Band *B* - 1.6 mc to 4.7 mc. - AM shortwave.

Band C - 4.7 mc to 10.0 mc. - AM shortwave

Band D - 11.2 mc to 22.0 mc. - AM shortwave

Band E - 88.0 to 108 mc - FM broadcasts.

Note: Seven International bands are covered by *B*, *C* & *D* above.

Manual tuning control is spur-geared to six-gang capacitors. This control is augmented by seven pushbuttons, each of which may be set mechanically for a station at any point on the dial. These pushbuttons, however, are not recommended for the exacting requirements of shortwave tuning. To minimize noise, and distortion from the cutting of sidebands, a 6U5 tuning indicator is energized through a 1-megohm dropping resistor from the a-v-c bus which is in turn supplied by the detector tube in use. As a signal is properly tuned, the a-v-c voltage increases and deflection of the 6U5 is reduced to a minimum. This indicator is useful for stronger FM stations but not too accurate for the weaker ones. An auxiliary mechanical device just above the volume control shows visual indication numerically. It serves as a good reference for repeat tuning of a given station and allows volume to be accurately pre-set for local stations prior to *warmup*.

Since oscillator frequencies are changed with band switching the double-tuned i-f stages remain fixed at 10.7 megacycles for FM and at 456 kilocycles for AM reception. Good tracking alignment is accomplished through coil-core and trimmer capacitor adjustments detailed in servicemen's pamphlets.

Input and output r-f channels for all bands are switched to and from one miniature 6BA6 pentode whose high transconductance aids high signal-to-noise ratio.

Mixer-Oscillator

The 6BA7 pentagrid mixer offers separate grids to amplified r-f and local oscillator signals. Entrance interactions are thus minimized. A high conversion efficiency is derived from the selection of this tube which has a low internal noise content. However, since some hiss will be generated within any mixer tube, it is wise to take

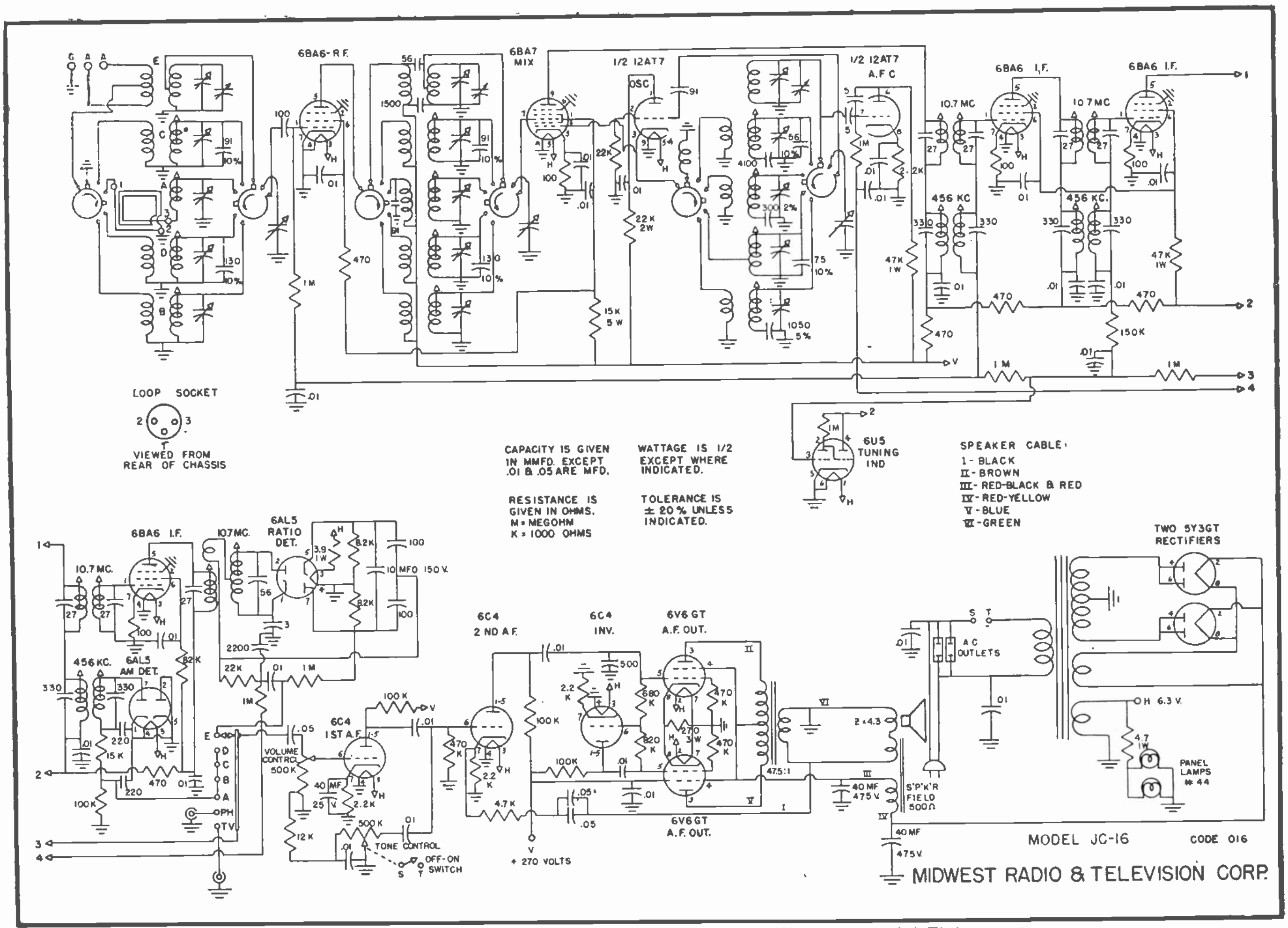


Fig. 2. Circuit diagram of Midwest Model JC-16 combination AM-FM receiver.

every possible step to obtain a healthy signal potential at the grid of the first r-f stage.

As modulated carrier and local oscillator potentials are combined within this tube, the first step in signal translation is effected. Incoming signals from the r-f stage are fed to grid #3 of the 6BA7 mixer via the selector switching system. Output from the 12AT7 oscillator tank is fed directly to its grid #1. Grid #2 screens off spurious interaction prior to desired mixing in the electronic plate stream. There results in the mixer output circuit a *new* modulated carrier whose *difference* frequency equals the interval between the incoming r-f signal and the r-f of the local oscillator.

Mechanically ganged, the oscillator tank tracks with the tuning of preceding r-f tanks. This results in a fairly constant difference frequency output from the mixer-oscillator. Even casual FM transmitter deviations from normal frequency must be tracked as must abberations within the tuner itself. Hence a means of automatic frequency control is applied to the FM channel.

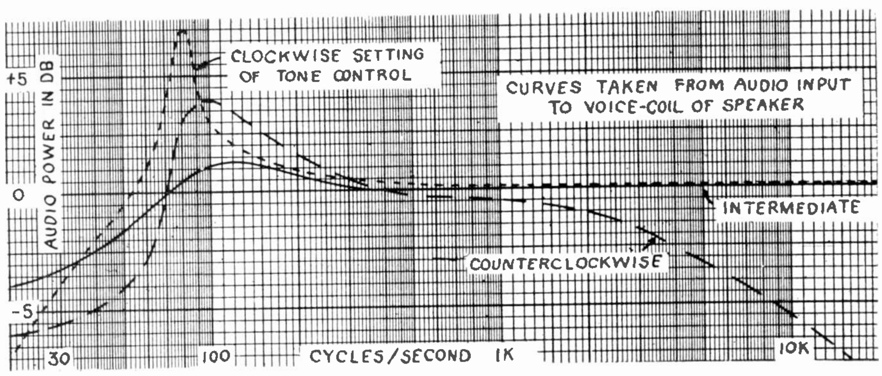


Fig. 4. Compensation effects of tone control at various positions of the latter. Audio output taken at voice coil.

AFC-(FM) [Reactance type]

Oscillator stability is highly necessary in high frequency channels. The second half of the 12AT7 (double triode) serves as a reactance-type a-f-c control tube. Plate current in it is made to lag almost 90 degrees behind its plate voltage changes. As witnessed from the schematic, *Fig. 2,* both the plate and grid of this *reactance* tube, coupled together by a 5 $\mu\mu f$ capacitor, receive signal from whichever oscillator circuit they are switched to.

An original FM control potential, tapped from the d-c output network of the 6AL5 ratio detector, is fed back through bus #4, (lower left corner of schematic), and through the 1-megohm resistor, directly to the grid of the reactance control tube (12AT7. The more positive this voltage the greater the plate current therein and vice-versa. Then since plate and cathode of this reactance tube are connected directly across the oscillator tank circuit, and since its plate current and plate voltage are

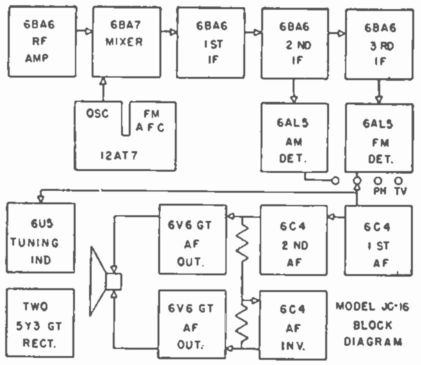


Fig. 3. Block diagram showing assignment of all tubes.

90 degrees out of phase, variations within the tube introduce reactive effects upon the oscillator output.

Should the oscillator frequency become higher than intended, the i-f frequency would naturally rise with it. Such action would indirectly raise the negative potential of the reactance tube grid thereby causing less plate current to flow therein. Resulting directly from this action, the inductive or reactance effect of the control tube adds to the normal inductance value of the oscillator tank circuit. From basic formulae we know that any increase of tank inductance will reduce oscillator frequency. Hence the reactance tube stabilizes oscillator frequency as it responds to plus or minus control potentials supplied to its grid from the ratio detector d-c output. Frequency drift or small tuning errors are therefore compensated.

Intermediate Stages

Adequate gain must be derived from the i-f section for proper operation of the individual AM diode and FM ratio detectors. This especially holds true for weaker signals and therefore we find a third i-f stage driving the FM detector. The average FM antenna input potential is lower than are those derived from AM transmitters of the standard broadcast band. Some limiting action is advisable prior to the final interpretation of the FM ratio detector. It will be noted from *Fig. 2* that the i-f plate and screen voltages are tapped from the supply bus successively lower as the FM detector is approached. The third 6BA6 i-f or driver stage, having low screen and plate voltage, becomes easily saturated and therefore does not respond to a variety of changes in signal amplitude, but, instead produces a fairly constant amplitude output. It remains a frequency-sensitive rather than an amplitude-sensitive device. Amplitude variations are thus smoothed out. They cannot be amplified beyond the saturation or limiting point of this third i-f tube as pre-determined by the values of its circuit components.

Due to the higher gain of this FM i-f section, regeneration must be guarded against. One of its effects is to peak the i-f response curve to such a degree that amplitude distortion attends higher levels of modulation. The four 10.7 megacycle i-f transformers are overcoupled thus passing the necessary band width and insuring good adjacent channel attenuation.

In the AM channel there are three 456 kc transformers used for intermediate stages. Their coefficient of coupling is adjusted to be slightly less than critical. When properly set there is only one peak.

Only the oscillator section of the 12AT7 serves the AM channels. AFC is applied only to the FM channel. Whereas a.v.c. is derived from the 6AL5 detector and supplied to all four AM channels through the selector switch and bus #3 as evidenced in the schematic of *Fig 2.*

FM Ratio Detector

The regulated plate signal output of the third i-f driving stage is supplied to the fixed-tuned primary of the ratio detector. The main center-tapped secondary winding connects to the plate of one diode and to the cathode of the other diode within the 6AL5 envelope, thus effectively connecting the two diodes in series; they conduct on the same i-f half cycle. The rectified voltage across the lower shunt capacitor in the 6AL5 output circuit is proportional to the voltage across the lower diode. The same holds for the upper capacitor and upper diode. Since the voltage across the two diodes differ according to instantaneous carrier frequency, then the voltages across the two capacitors differ proportionately. The voltage across one capacitor is the larger of the two capacitor voltages at carrier frequencies below to intermediate frequency, and the smaller of the two at frequencies above the intermediate. It follows, then, that the voltage across the two capacitors is additive.

Rectified signal current causes a d-c voltage drop across the two 82K shunt resistors. This charges the large 10 μf capacitor thus maintaining a steady state d-c value proportional to transmitted signal strength. The resultant stabilizing voltage keeps the summation voltage across the two smaller 100 $\mu\mu$f capacitors always constant thus minimizing any residual AM component in the detector output.

The tertiary winding, shown above the primary of the driving transformer, and common to both diodes, simplifies the signal transfer problem. The transfer from r-f to a-f is not simple. These few tightly coupled tertiary turns aid phase balanced elimination of any undesired AM hangover component. For greater understanding of this transfer problem the reader is referred to literature on ratio detectors.

Audio Amplifier

To the left of the first 6C4 audio amplifier stage in the schematic *Fig. 2* can be seen a multipole selector switch. Inputs of AM or FM radio, phonograph, or television adaptor are chosen and transmitted through the volume control to the grid of the first audio amplifier stage. Beneath this stage a graduated tone control may be seen mechanically linked to the "Off-On" switch. Compensating values derived from the latter are shown by the curves of *Fig. 4.* Personal tastes in tone are satisfied for any source of input.

The second 6C4 audio stage is connected for negative feedback from the secondary winding of the push-pull output stage. Thereby the amplifier becomes stabilized, distortion is minimized, and dynamic characteristics are made flexible. Expanded ranges of frequency response are amplified practically with equality throughout the workable FM range. The third 6C4 serves as the necessary phase inverter for driving of the lower 6V6 beam-power tube in the pushpull final stage. It must be remembered that no tuner is better than the amplifier and loudspeaker system to which it is connected. An undistorted 10 watt output is claimed for the amplifier.

Power Supply

Technically this power supply, employing a full wave rectifier, is not unusual despite its simplicity. A 500 ohm loudspeaker field serves as choke-coil in the rectifier output circuit. Initial high voltage is fed from the choke to the screen grids of the 6V6 beam power tubes while plate potential is supplied to these tubes through the mid-tap of the audio output transformer primary winding. Bleeders drop the initial voltage as required for all other potentials except heaters. Heaters are fed from their own 6.3 volt unrectified source.

Ventilation must be considered when this or any chassis is applied to custom-built or special installations. Dissipation of heat from all tubes is provided for in commercial models and must never be neglected elsewhere.

SHOP NOTES

Write up any "tricks-of-the-trade" in radio servicing that you have discovered. We pay from $1 to $5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor".

Philco Models 48-1000 1001-1050-Correcting loss of a-g-c action

An extremely black picture and difficult in synchronizing the picture may be caused by the loss of a-g-c action in the above models. Loss of a-g-c action may be due to the failure of the condenser which is connected between the triode plate and the diode plate of the a-g-c amplifier tube. If this condenser develops a short or a leak, a positive voltage is placed on the a-g-c bus and is fed to the grid of the r-f and i-f amplifiers.

Whenever the symptoms indicate loss of a-g-c action, this condenser should be checked. If it is found defective, replacement should be made with Philco Part No. 61-0120, which has a capacitance of .01 μf. and a working voltage of 600 volts, d.c.

Philco Model 49-702 Replacement of Tuner

The tuner available for replacement for Model 49-702, Code 121, is the one used in Model 50-702. Since there have been some circuit changes in both the latest tuner and the receiver, it will be necessary to make a slight modification to the new tuner to adapt it to Model 49-702, Code 121. This modification consists of removing one turn from the 1st v-i-f coil. The procedure for removing the turn and installing the new tuner is as follows:

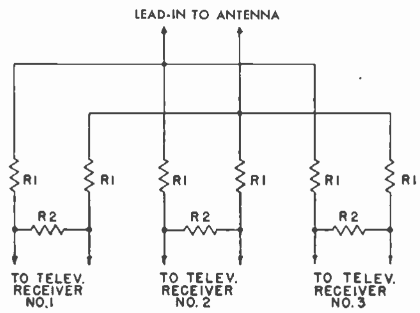
1. Remove the chassis from the cabinet, and the picture tube from the chassis.
2. Unsolder the tuner connecting wires, and record the connections.
3. Remove the perforated shield from the bottom of the tuner.
4. Locate the 1st v-i-f coil, which is connected to pin 3 of the 7F8 tube, and disengage the coil mounting clip from the chassis.
5. Unsolder the winding furthest from the chassis, and very carefully peel one turn off.
6. With fine sandpaper, remove the insulation from the wire and solder it to the coil terminal.
7. Secure the coil form.
8. Replace the perforated shield.
9. Install the new tuner in the chassis and rewire the same as the original tuner.
10. Align the i-f and r-f systems of the receiver as described in the service manual for Model 49-702, Code 121.

Philco Service Dep't.

Stromberg-Carlson-Pads for the purpose of connecting Multiple TV-12's to one antenna

To connect more than one television receiver to one antenna without the use of switches, resistor pads will be necessary to match the impedance of the lead-in to the impedance of the receiver.

Shown below is a chart of the resistors to use with each specified number of receivers. The figures are based on a 75 ohm impedance which is the input impedance of the TV-12 and also the characteristic impedance of coaxial lead-in (RG-59U or equivalent). Use Non-inductive carbon resistors and place the pads at the junction point and not at the receiver terminals.



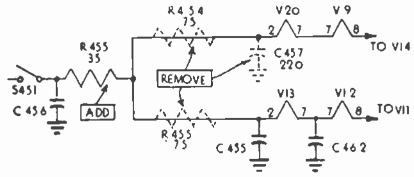
EXAMPLE FOR THREE RECEIVERS.

Number of Receivers	R_1	R_2
2	56	100
3	100	100
4	120	82
5	150	82
6	180	82
7	240	82
8	270	82

Stromberg-Carlson Svc. Dep't.

G.E.-Models 12T3, 12T4, 12C107, 12C108, 12C109-Filament Circuit Change

Late production receivers use a single 0.6 ampere Globar resistor in the filament circuit to give the same current regulation in this circuit during the warm-up period as was previously accomplished by the two - 0.3 ampere Globar resistors, *R454* and *R455*. The details of the circuit change are shown above.



The new Globar resistor is stocked as:

RRW-054-35 ohm, 0.6 ampere Globar resistor, (R455) $1.75

G. E. Increased Horizontal Sweep Width

Late production receivers incorporated the following changes to increase the horizontal sweep width.

1. Add a 220 $\mu\mu f$., 1500 v., capacitor (Stock RCU-295) between terminals #6 and #8 of the horizontal sweep output transformer, T351. Either two 390 $\mu\mu f$. capacitors (Stock UCU-1042) in series or two 470 $\mu\mu f$. capacitor (Stock UCU-1044) in series may be substituted for the 220 $\mu\mu f$. capacitor.

2. Change the termination of the high voltage capacitor, *C376, from* pin #6 *to* pin #5 of the 25W4GT damper tube, V15.

The above changes will be incorporated in all production receivers from this date.

G. E. Removal of 41.25 MC Video I-F Trap

Early production receivers made use of a 41.25 mc trap coupled to the 2nd video i-f coil. This caused "buzz" in audio on some receivers when the receiver was properly tuned for best picture detail at low contrast setting or when operating on a rather weak signal. This trap was removed on all late production receivers and was made less effective on receivers in process of fabrication, by shunting the trap by a 5100 ohm, 1/2 watt resistor by connecting it across the trap trimmer *C281*. If this change is desired in the field, the shunting of *C281* by the resistor does not require a realignment of the video i-f.

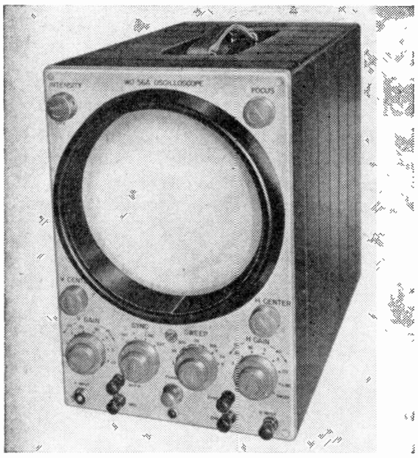
For replacement purposes the Stock No. RLI-123 2nd video i-f coil *with trap* will no longer be available. Replace this coil by Stock No. RLI-096. This latter i-f coil has a list price of $0.85.

General Electric Service Dep't.

NEW PRODUCTS

7- INCH OSCILLOSCOPE

A new, seven-inch oscilloscope, especially designed to meet the need for a high-quality instrument combining the advantages of large screen size, compactness, portability, and ease and convenience of operation, has been announced by the RCA Tube Department.



The new RCA WO-56A Cathode-Ray Oscilloscope is a precision-engineered instrument having wide application in service shop, laboratory, and factory. It features three push-pull stages of direct-coupled amplification. A wide frequency response, a high deflection sensitivity, and an excellent square-wave response provide waveform reproductions of unusual accuracy and clarity on its seven-inch screen.

NEW BEAM POWER TUBE

A beam-power amplifier tube, designed for use in the audio output stage of television and radio receivers, has been added to the production lines of the General Electric Tube Divisions.

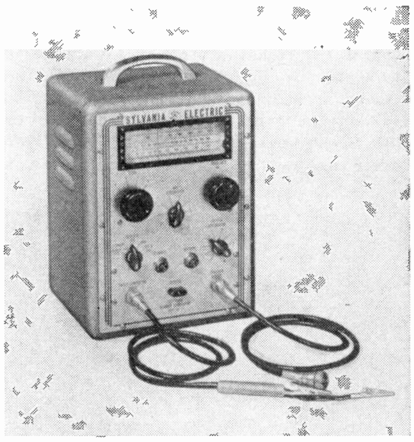
According to E. F. Peterson, Sales Manager of the Tube Divisions, the new tube (Type 6W6-GT) is capable of delivering relatively large power output and features high sensitivity. When connected as a triode, the tube may be used as a vertical deflection amplifier in television receivers.

Maximum ratings of the tube include: peak positive pulse plate voltage, 1000 volts; peak negative pulse grid No. 1 voltage 200 volts; plate dissipation, 10 watts. The tube has a heater voltage (A-C or D-C) of 6.3 volts; heater current, 1.2 amperes.

TV MARKER GENERATOR

A new television marker generator Type 501 designed particularly for use with TV sweep signal generators has been announced by the Radio Tube Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, New York.

The Sylvania Marker Generator Type 501 provides a means of accurately marking frequencies on the oscilloscope trace of response curves while testing a TV receiver during manufacture or during servicing. Through



the use of the marker generator, which is designed to cover the entire range of TV frequencies, accurate measurements of bandwidth and evaluation of dynamic response at any spot frequency may be made.

CRYSTAL CARTRIDGE

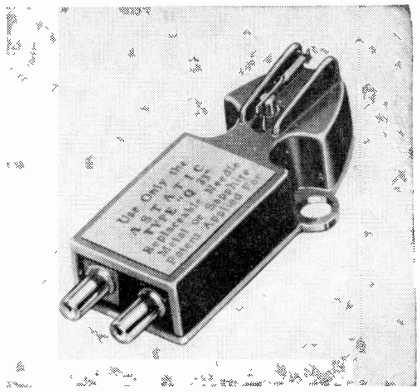
The Astatic Corporation, Conneaut, Ohio announces its tiny new CAC-J Crystal Cartridge designed for slow speed records.

Ability of the CAC-J to provide high quality performance is attributed to the fact that it is "internally equalized" to follow Columbia Records, Inc., ideal frequency response for the recording characteristics of LP records (30 to 11,000 cycles).

The new cartridge has a small, lightweight aluminum housing with standard 1/2-inch mounting holes to fit most tone arms. It is furnished with an adapter plate to permit mounting in RCA and similar 45 RPM record changers.

Output is listed at approximately six-tenths volt at 1,000 cycles per second on Columbia No. 103 test record and one volt on RCA 12-5-31-V test record.

The CAC-J is claimed to play both 33-1/3 and 45 RPM records with equal fidelity. Another model, the CAC-78-J, with three-mil needle tip radius for 78 RPM records, is



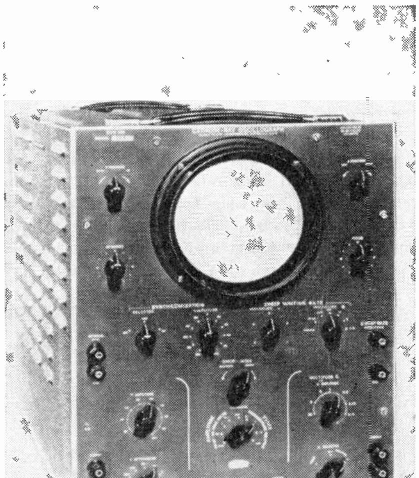
available.

Both models use the well known Astatic Type Sapphire tipped needle, the design of which, in itself, contributes to reduction of needle talk through high lateral and vertical compliance.

10 MC OSCILLOSCOPE

The Instrument Division of Allen B. Du Mont Laboratories, Inc., Clifton, N. J., recently announced a quantitative, 10-megacycle cathode-ray oscillograph, their Type 303. Time calibration is provided for the horizontal sweep of the instrument and regulated voltage calibration for vertical deflection. Both time and voltage calibration are accomplished by substituting a calibrating signal for the input signal.

The Y axis of the instrument, which includes a fixed, signal-delay line, provides a sensitivity of 0.1 volt peak-to-peak per inch. The frequency response of the Type 303 is down 3 db at 10 megacycles with no positive slope in the high-frequency range. Response

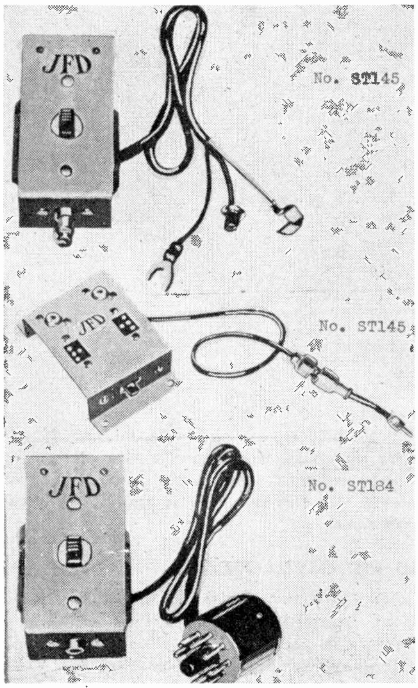


falls off slowly past the 10-megacycle point, so that the instrument is usable at frequencies considerably higher than 10 megacycles. The Type 303 will synchronize stably on signals higher than 15 megacycles.

PHONO-SWITCH ADAPTORS

The popular line of JFD Radio-Phono Switches is being readied for record-breaking sales volume during the fall and winter seasons, according to the JFD Manufacturing Co., Inc. Brooklyn.

The JFD Universal Record Player Selector No. ST144 permits use of a single sound sys-



tem or radio for any 78 rpm, 45 rpm and 33 1/3 rpm record player. Equipped with a special cable adapter, it fits either a 3-pin receptacle or coaxial phono-jack.

JFD Radio-Phono Switches No. ST145 and No. ST184 are designed to connect 78 rpm, 45 rpm and 33 1/3 rpm players to radios not equipped with phono-jacks.

Illustrated literature is available from the manufacturer.

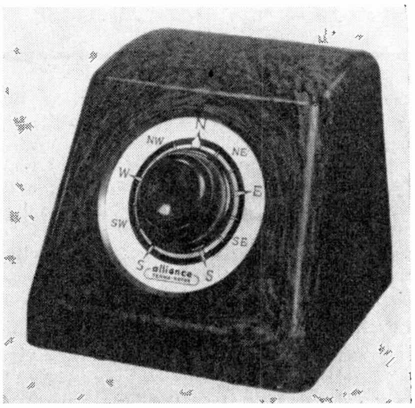
LOW R-F IMPEDANCE ELECTROLYTICS

Marked reduction in hum and "hash" often experienced in multi-section electrolytics because of interanode coupling and resultant internal cross-modulation, is claimed for currently produced Aerovox Type AFH or twist-prong-base multi-section electrolytics. A special internal construction provides low r.f. impedance and minimum coupling between sections. This desirable feature applies to the exceptionally large selection of capacitance and voltage combinations in the Type AFH electrolytics which are especially suited for

television applications and will withstand temperatures up to 85° C. Manufactured by Aerovox Corporation, New Bedford, Mass.

DIRECTIONAL DIAL INDICATOR

John Bentia, Sales Manager for The Alliance Manufacturing Company, Alliance, Ohio, announces that the original deluxe model Tenna-Rotor control case, which is fully automatic and which was announced at the NEDA

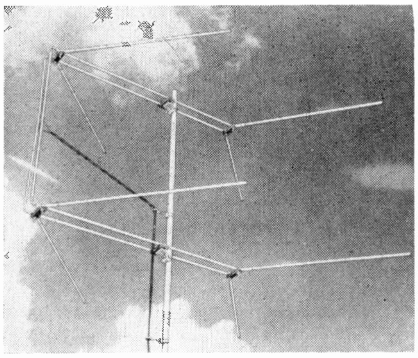


Show in Cleveland, will be supplied with a NORTH - EAST - SOUTH - WEST direction indicator dial.

The new Model HIR will be advertised in new television films over more than 50 TV stations throughout the country and is available for immediate delivery.

TV ANTENNA

A new all-driven-element antenna is announced by Technical Appliance Corporation, Sherburne, N. Y., manufacturers of Taco antenna systems for TV, FM, and AM. This new antenna type has been designed as the 1700 Series and is called the Twin-Driven Corner Antenna.

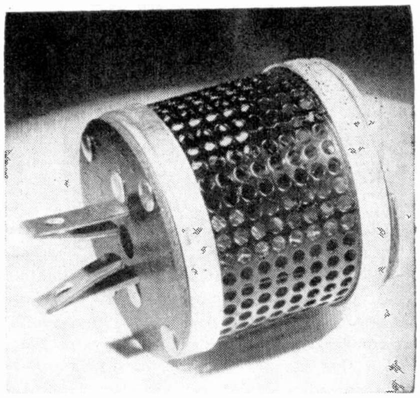


With all elements driven the directivity of reception has been narrowed, thus minimizing ghosts caused by reflected signals. The front-to-back ratio is extremely high adding to its fine performance. Both high- and low-band lobes coincide due to the phase relationship controlled through feeding.

The antenna elements are merely swung into place and wing nuts tightened to complete the antenna ready for installation. These new antennas are available in single or stacked models, depending upon the requirements of the installation.

TV LINE VOLTAGE REGULATOR

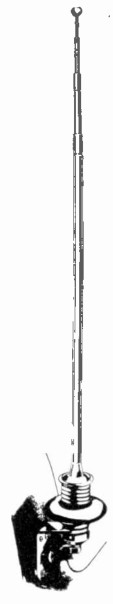
For steadier TV pictures regardless of line-voltage fluctuations, Clarostat Mfg. Co., Inc., Dover, N. H., now offers its Automatic Line-Voltage Regulator to and through its distributors. This aid to still better TV entertainment, particularly in rural districts or areas experiencing line-voltage fluctuations, is really a handy accessory. With male and female Edison connections at either end, it plugs in between the TV set's attachment plug and



the outlet. Two models are available: TV-A rated at 300 watts, for sets consuming 200 to 300 watts, and TV-B rated at 375 watts, for sets consuming 300 to 375 watts.

POLICE-TYPE AUTO ANTENNA

A new auto aerial, embodying police and army type construction and mounting features, has been announced by Snyder Manufacturing Company, Philadelphia television, radio and automotive accessory firm. Among its features



are an extra long four-section staff of chrome plated Admiralty brass, shock absorbing spring mount, red ceramic insulators and red tenite static ball.

Complete with 8 feet of UHF polyethylene cable and aircraft fittings, the HOT ROD is the latest addition to the complete line of Snyder Auto Aerials for all types of mounting. Catalog sheets on this aerial may be obtained by writing to Snyder Manufacturing Company, 22nd and Ontario Streets, Philadelphia 40, Pa.

CERAMIC DISC CAPACITORS

Centralab, Division of Globe-Union Inc. announces a new line of ceramic disc capacitors. The line includes single, dual and shielded dual capacitors with very high capacities in relation to size, some as small as 1/4 inch diameter. The third dimension— thickness — is virtually eliminated enabling disc capacitors to fit into very narrow spaces. These units are highly efficient as bypass and coupling capacitors in high frequency circuits and the shielded dual discs are especially valuable

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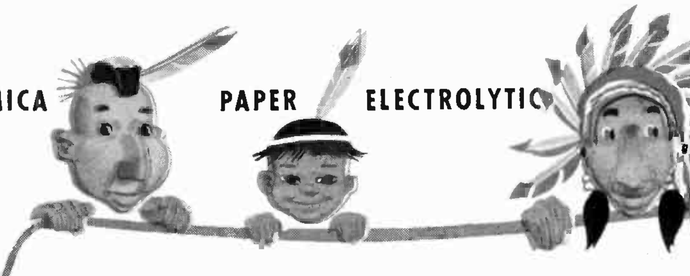
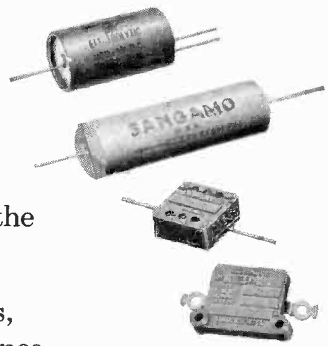


MICA PAPER ELECTROLYTIC CAPACITORS

The Sangamo Tribe means business

34 little Indians to fill your needs . . .



The Sangamo line offers 34 types of mica, paper, and electrolytic capacitors to take care of practically any replacement requirement in the radio and television field.

For example, the line includes Sangamo Micas, which have enjoyed a reputation for excellence throughout the radio and electronic industry since 1923. It includes the famous "Redskin" . . . the plastic molded paper tubular that is easy to work with because the flexible leads can't pull out. It includes a complete range of Electrolytics that will measure up to the toughest assignments in exacting applications where ordinary electrolytics might cause premature failure.

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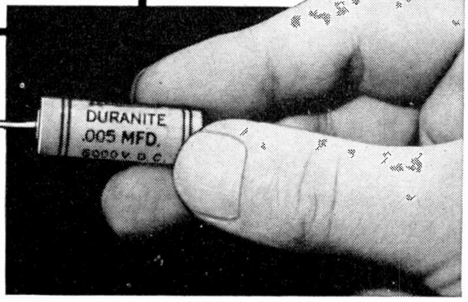

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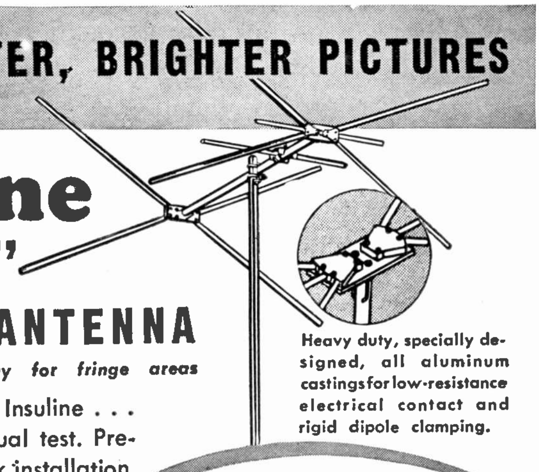

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Installed in a jiffy and quickly adjustable to all channels. Supplied complete with 300 ohm connecting lead and open-end mounting lugs.
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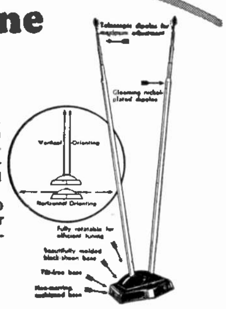

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BOOK REVIEWS

Encyclopedia on Cathode-Ray Oscilloscopes and Their Uses, by John F. Rider & Seymour D. Uslan, 992 pages, John F. Rider Publisher, Inc., New York 1950, Price $9.00.

This is the most complete book on cathode-ray oscilloscopes published to date and, although it covers the subject minutely and includes a vast array of information, every paragraph indicates a careful desire to explain the subject matter simply and clearly.

The first portion of the book deals with the electrical and mechanical theory and application of the 'scope. Also included in this section is an excellent treatment of electrostatic and electromagnetic deflection principles. We particularly enjoyed reading the chapter on Linear Time Bases which is a very complete treatment of this subject.

The second portion of the book deals with the basic oscilloscope and its modifications. This is a single chapter of 130 pages and discusses the various 'scope circuits, their variations and effects, as indicated in the different types of patterns that might be observed.

The third section concerns itself with measurements. This section is described in the chapter headings which are as follows: Phase and Frequency Measurement, Nonlinear Time Bases (measurements utilizing nonlinear sweep systems), Auxiliary Equipment (used in conjunction with measurement), Testing Audio Frequency Circuits, Visual Alignment of AM, FM and TV Receivers, Waveform Observation in TV Receivers, Transmitter Tests, and finally, Electrical Measurement, Scientific and Engineering Applications.

A fourth section (Chapter 20), is devoted to complex waveform patterns. Here we find 82 pages of patterns consisting of fundamentals and harmonics at various combinations of amplitude and phase.

In the fifth and final section, we are treated with a discussion of various special purpose C-R tubes, commercial 'scopes, and related equipment.

A tremendous amount of work and material was evidently entailed in the preparation of this encyclopedia, and any technician who has anything at all to do with the cathode-ray tube

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and its applications is depriving himself of time-saving and money-making information if he does not obtain this book at once. *S.L.M.*

Television Servicing by Walter H. Buchsbaum, 340 pages, Prentice-Hall, Inc., New York 1950, Price $5.35.

This text is divided into three sections. Part I analyzes receiver circuits, starting with the picture tube and its function and ending with front ends! Other material included in this section deals with the sound system, power supplies and projection units.

In Part II the author discusses alignment and installation. Procedures referring to video and sound alignment are given in the portion devoted to alignment. In the installation section, the author deals with physical location of the receiver, installation procedures and problems and, finally, receiver adjustment.

In the final section, Part III, which deals with trouble shooting, a breakdown of possible receiver symptoms is presented along with corresponding servicing procedures. Thus, inoperative receivers, loss of synchronization, defective deflection systems, poor picture quality, poor sound quality and poor CRT performance are individually analyzed according to effect and cause.

The book is well balanced textwise and is written in a clear and straightforward style. It abounds in illustrations, and coupled with its excellent mechanical makeup (printing, binding, size and layout), it will prove a worthy addition to libraries of those engaged in television servicing. *S.L.M.*

Second Edition of the Radio and TV Industry Red Book, A Replacement Parts Buyer's Guide, published by Howard W. Sams & Co., Indianapolis, Ind. Price $3.95.

This is a truly noteworthy contribution to the industry, providing as it does replacement data on all major receiver components, including AM, FM, TV and radio-phono combinations produced from 1938 to the present.

Replacement components for the receiver of 20 different manufacturers are made available. The manner in which a given part is identified is simple and straightforward; one merely refers to the receiver, and the various replacement components, as catalogued by different manufacturers, are easily identified in their appropriate columns.

The information provided has been divided into eight numerical sections which are as follows:

Section I - Component replace listings covering radios and amplifiers produced from 1938 through 1948 (components included are tubes, dial lights, electrolytic capacitors, transformers, chokes, phono-cartridges, IF coils, speakers and controls).
Section II - Same components as above covering the period between 1948 to 1950.
Section III - Component replacement listings covering postwar television receivers.
Section IV - Vibrator replacement listings for the vibrator-powered receivers produced from 1938 to 1950.
Section V - Battery replacement listings for battery-power receivers produced from 1938 to 1950.
Section VI - Selenium rectifier replacement listings for postwar radios, amplifiers and TV receivers.
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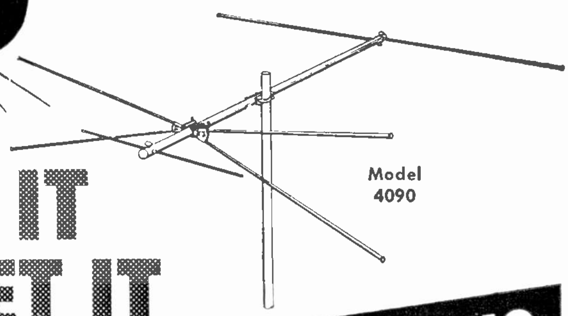

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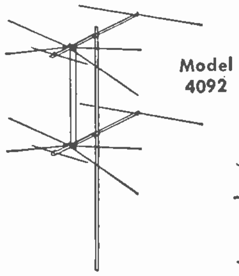

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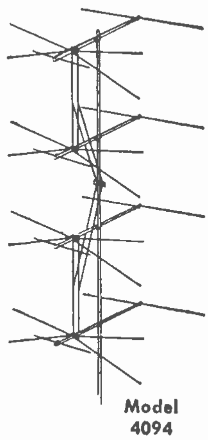

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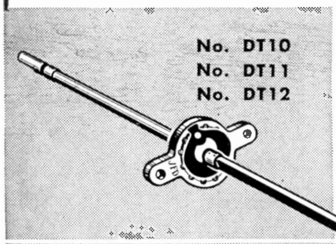

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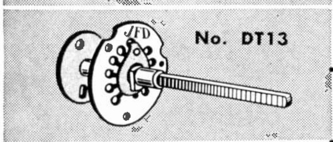

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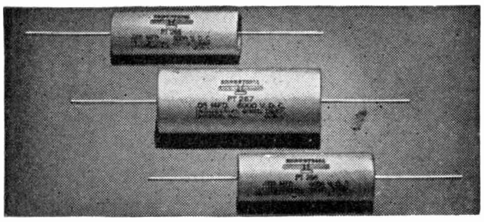

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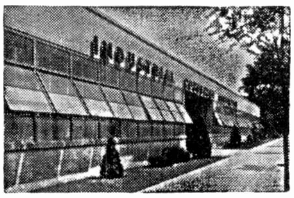

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his replacement part identified in a hurry, this book is a must. *S. L. M.*

SYNC PULSES

[*from page 12*]

so why try to impose upon the public a return to small size pictures. 4) — why was an FCC staff engineer who invented a device useable only in the CBS system allowed to influence the commission in favor of adopting a color method that requires use of his brainchild — at least he should have refrained from participating in the making of the decision.

LOOKING FOR TROUBLE

[*from page 25*]

The top of *C-90* would always have a positive voltage to ground since that is the side of the condenser going to the plate. In the same manner, a voltmeter across *C-90* would always be positive, whether the condenser is leaky or not. It would show no voltage only if *C-90* were shorted. Bridging a good condenser across a leaky one in this type of circuit would not give any clear-cut indication since it would immediately change the oscillator frequency and throw the picture out of synchronization.

Answer 3—b.

The tube is generally taken out when checking for a leaky coupling condenser and the grid checked for positive voltage because a gassy tube can also cause positive grid voltage. While this possibility was eliminated by changing tubes, it is also possible that a distorted waveform can affect the d-c reading on the grid, as outlined above. With the tube out, the oscillator is not operating and a leaky coupling condenser will give a positive voltage on the grid. This is best checked with a high resistance meter, preferably a VTVM on a low range. There usually is no trouble getting a readable voltage across a high value grid resistor when the coupling condenser is leaky. On the other hand, a low resistance meter is not too reliable for this type of check since it will reduce the total value of resistance in series with the leaky condenser as soon as it is put in parallel with the grid resistor. A small leakage current may not give a very large indication on such a meter.

An ohmmeter check across the condenser is not the best method for checking a leaky condenser since it is inconclusive and only shows up when the condenser is very leaky or shorted. On the other hand, the condenser may not check leaky with an ohmmeter and in fact may not become leaky until the voltage is applied and the condenser breaks down again. Besides, why unsolder any connection if there is a quicker and more reliable method which doesn't require unsoldering.

Answer: 4—c

Sawtooth is non-linear on both the plate of the oscillator and grid of the amplifier. Non-linearity is shown by the curve of the waveform along the upper right portion, instead of an angle being formed with straight sides. (See *Fig. 3*) Non-linearity can originate in the oscillator circuit and be passed on in that form, or the sawtooth can be linear when it is generated and become distorted in the amplifier or output circuits. Where non-linearity is seen at the plate of the oscillator, it may be caused by a fault in the oscillator stage, or the coupling or input to the amplifier stage, which is actually part of the oscillator stage load (leaky coupling condenser, gassy amplifier tube, etc.). However, these last possibilities were fairly well ruled out by the tube and condenser changes already made, unless one of the substituted components was defective.

Resistance values already checked O.K., indicating no resistor had changed value, and so caused the distortion. Condensers were not leaky but it was considered possible that the sawtooth condenser had decreased in value causing it to charge to too great

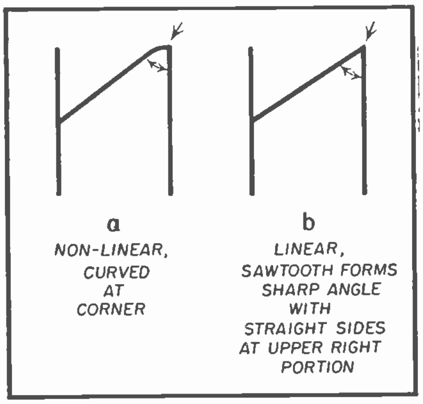

Fig. 3. Non-linear and linear waveforms.

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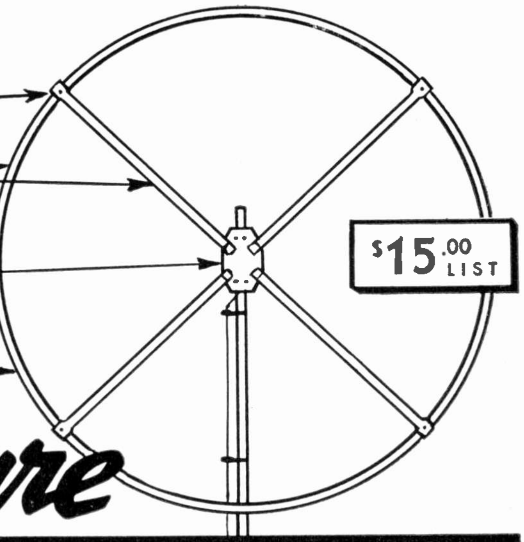

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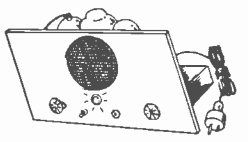

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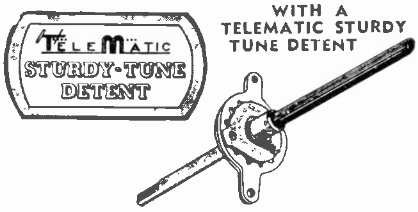

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a value and on the non-linear portion of the charge curve. This could cause foldover. In the same way, change of capacity in the grid leak or coupling condenser would not show up in checks for a leaky condenser but still could distort the waveform. There is no convenient way to check for change in condenser value although it can be done with a capacity checker. However, it is usually more feasible to change condensers for a quick check.

Answer 5—a.

Changing the blocking oscillator transformer eliminated the trouble. This is an unusual reason for foldover. Any possible defect in the integrating circuit or defective cathode condenser (in series with peaking resistor and sawtooth condenser) which could affect the waveform was eliminated from consideration when they were shorted out and the waveform didn't improve. Opening the coupling condenser with the waveform remaining distorted proved trouble was in oscillator circuit. All resistors and condensers in the oscillator circuit had been either checked or changed. Only component left that was likely to cause trouble was the transformer. Sometimes, in components like a transformer, resistance measurements are inconclusive, since faults like shorted turns may not show up in a resistance reading. However, it can often be found by the principle of exclusion—making certain all other components in the given stage are good, leaving only one component that could be causing the trouble—even though this component may not generally cause that kind of trouble.

Defective tube sockets usually cause intermittent operation rather than this type of distortion. If a resistor has changed value, it generally stays at the new value when the power is shut off. A shorted condenser in the integrating net would have no effect on the oscillator wave-shape but would have some effect on frequency, making it difficult or impossible to keep the picture from rolling vertically.

COLOR TV

[from page 19]

with this signal is the highest frequency component which is contributed by the mixed highs that are also sampled at the receiver but were not at the transmitter. However, the mixed-high components in each of the three video channels is approximately the same, but will, nevertheless, produce a high resolution picture. Color levels are, of course, set by the amplitudes of the indivual 3.8 megacycle sine waves in each channel and applied to the three grids in timed sequence.

It is interesting to observe that in our basic discussions of sound sampling systems in the previous article, the amplifier which followed the sampler at the receiver only passed information up to the highest frequency of audio to be passed and, therefore, the sampling rate frequency was also filtered, producing only an audio output. However, in the color system the sampling rate is permitted to pass through these receiver video amplifiers and, therefore, the signals as they appear on the grids are in the form of pulsating 3.8 megacycle sinewaves and by properly positioning them on the cut-off characteristics of the picture tube, each can be made to represent a specific group of elements on the television screen. For example, the green 3.8 megacycle sinewave can be at its maximum producing green

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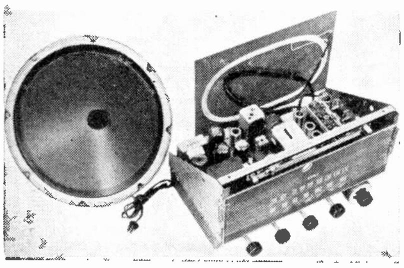

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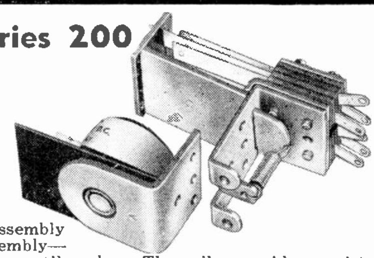

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200-M2	Midget	Double Pole	Double Throw
200-M3	Midget Contact Switch Parts Kit		

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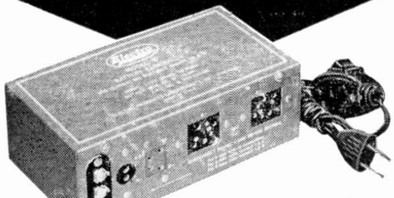

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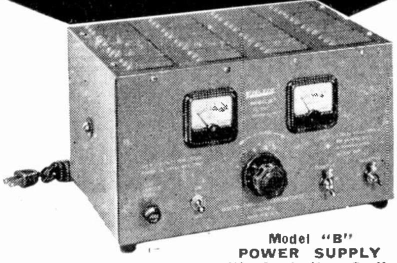

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element illumination. At the same instance, the other two sine waves are beyond cut-off on their respective picture tube grids and that similar elements on the other two grids remain un-illuminated. Just 120 degrees later the red 3.8 megacycle sinewave will reach its crest and light up next element while the other two sines will be below cut-off and the green and the blue grids will be biased off.

Thus, the information is arranging itself on the viewing screen as a series of individual elements, each representing a specific color. If this process continued throughout the individual color pick-up process there would be groups of elements set off on the viewing screen representing just one color. There would be individual groups of green, red and blue elements, each segregated from each other. Such a system, however, would limit the resolution per color and, therefore, the overall definition of the color picture. To improve color operating conditions, however, the sampling pulse circuit is shifted at regular intervals (generally after each frame) so the groups of element which represent one color for a given frame represent still another color for other fields. Thus, each element on a viewing screen is at one time or another representing the light level of each of the three basic colors. Method of transmission is referred to as dot interlace.

In the very latest RCA system using the new single or three-gun color tube only a single video amplifier is needed, video being applied simultaneously to the three grids of a single picture tube gun or to a single grid. In these type tubes there are three separate cathodes which are keyed by sampling pulses, turning on individual color beams in proper order. Each beam strikes its own elements of the three color phosphor and lights it in accordance with amplitude of signal present on the grid at that instant.

Sampling In Black And White TV

A similar sampling process can be used to obtain a black and white picture with more elements per line and, therefore, an improvement in apparent resolution. In such a system, the high resolution output of a camera (up to 8-10 mc) is sampled at a high frequency, *Fig. 3.* Information is again broken up into pulses and then into sampling rate sinewaves. The three sampling rate sinewaves (no frequency in excess of sampling rate) form a composite signal that is the video portion of the television signal which modulates the r-f carrier.

At the receiver this signal is again demodulated into pulses and then

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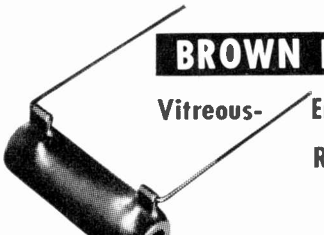

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back into three sampling pulsating sine waves. These variations (three sampling rate sine waves displaced by 120 degrees are applied to the grid of the picture tube. Each sine wave crest lights up an element on the screen in proportion to the original light intensity. Consequently, sampling forms three complete sets of elements displaced slightly from each other to form a television picture with more elements per line and an improvement in resolution.

Synchronizing Of Sampling Generator

A sampling circuit at the receiver must, of course, be synchronized with the sampling frequency and phase at the transmitter. One method of accomplishing synchronization is to utilize the back porch of the horizontal blanking period to transmit a sampling rate sine wave from the transmitter. At the receiver this sampling rate sine wave will be taken off the back borch of the blanking and used to synchronize the generator which forms the sampling rate pulse at the receiver.

To obtain dot interlace it is necessary to shift the sampling pulse in polarity at prescribed intervals. One method is to reverse the polarity of the sampling pulse at the end of each frame and, therefore, a different sequence of sampling will be set up for each frame and dots for element samples will become interlaced. Still another technique is the use of a sampling pulse frequency which is not an interval multiple of the line rate but has a frequency which is an interval and a half times the line frequency. Thus the flip-over of the sampling pulse becomes automatic at the end of each field.

Sampling and multiplex technique open new horizons in the electronic field and may some day, when frequency spectrum becomes too crowded, instigate a major revision of allocations. Possibilities appear unlimited and at present technique is just in its beginning experimental state.

KEYED AGC

[*from page 17*]

or not a short exists. If an ohmmeter gives no reading, and it is suspected that the capacitor is open, it may be bridged with another for a quick check.

With receivers having an adjustable control for proper setting of the a-g-c bias level, poor results may be due to improper adjustment. The

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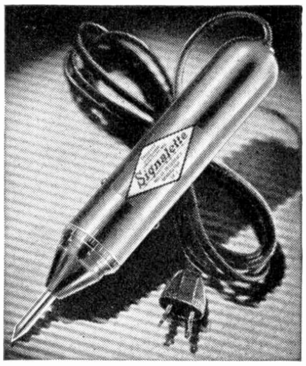

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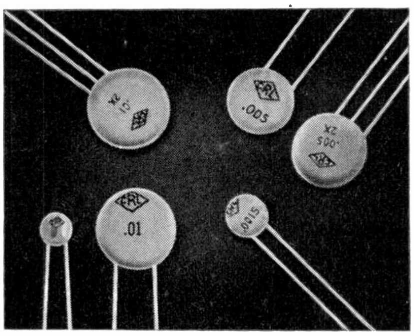
control should be set so that the picture is stable for the strongest station in the area. Adjustment should also, however, be made to give the best noise-free reception, and the snow effect on the screen should be studied while making corrections on the adjustable a-g-c control. Check for stability on the strongest station, and the best signal to noise ratio on the weaker stations.

An oscilloscope will facilitate trouble shooting by giving an indication of the composite video signal, blanking and sync tips on the grid of the a-g-c tube, and it will also show the absence or presence of the horizontal pulse on the plate circuit. Not only must both components be present in order for keyed AGC to function properly, but the receiver must be synchronized with the incoming signal so that the horizontal pulses will occur simultaneously with the applied sync tips to the a-g-c tube.

NEW PRODUCTS

[from page 34]



for bypassing in multiple stages because they will function with freedom from feed back.

The ceramic discs use No. 22 tinned soft copper wire radial leads which permit easy, close coupled connections and eliminate tricky bending and fitting. These discs have a low

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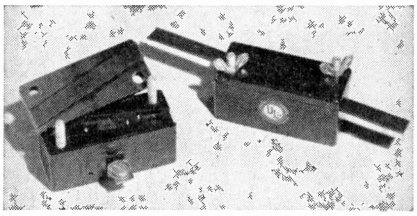
Jerome E. Respess, President of LaPointe-Plascomold Corporation (VEE-D-X) Unionville, Connecticut announced that the Vee-D-X 4-wire lightning arrester (RW-204) is now being constructed of high dielectric, double phenolic. This material, he stated, is for



installation in accordance with the National Electric Code and is also approved by Underwriter's Laboratories (UL). He further stated that it is the first and only arrester designed to accommodate 4-wire rotator line as well as regular 300 ohm transmission line.

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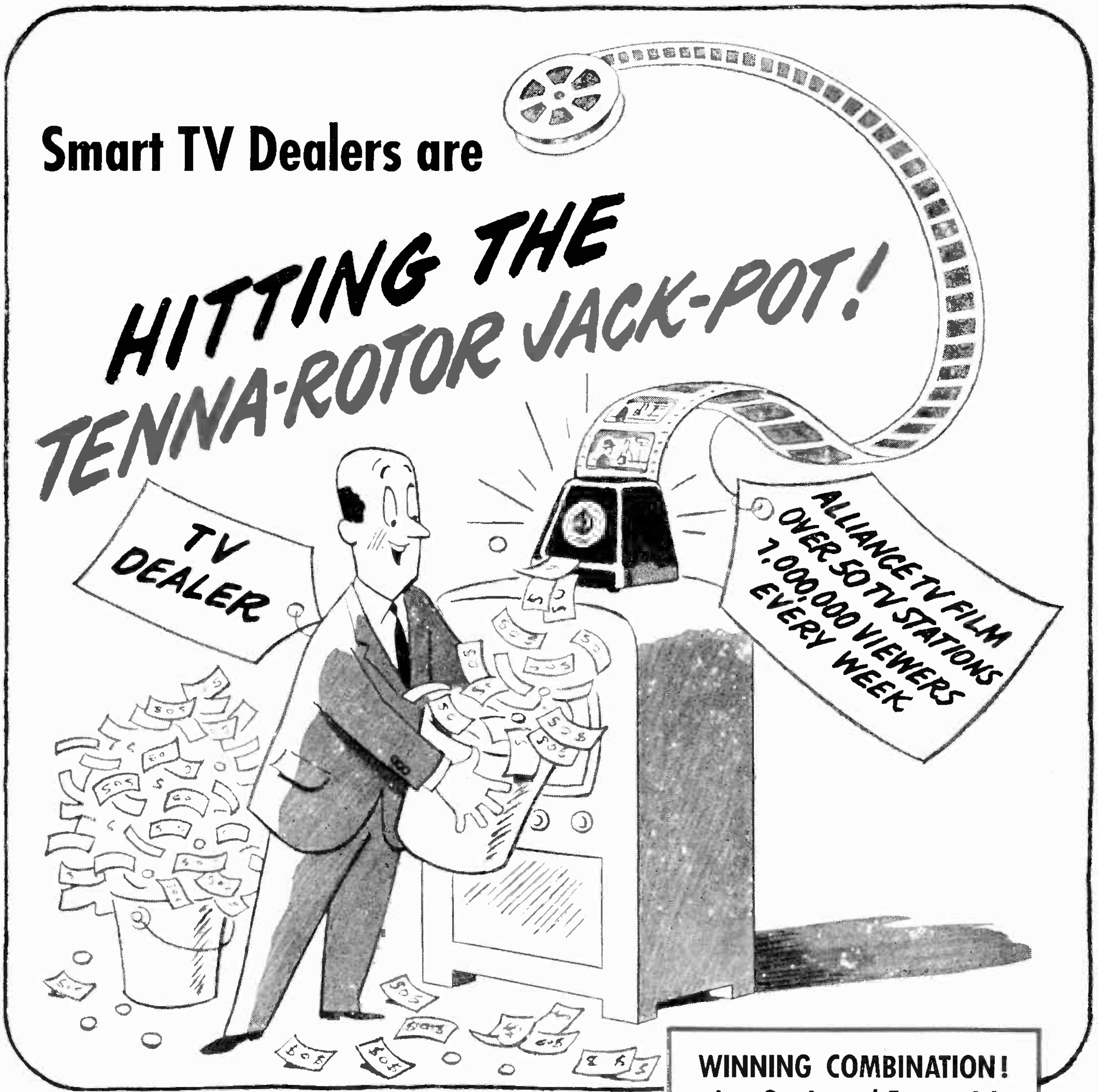

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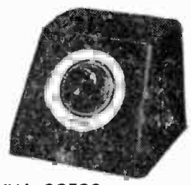

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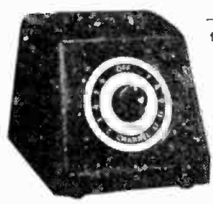

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