MAY, 1954

Radio-Television SERVICE DEALER

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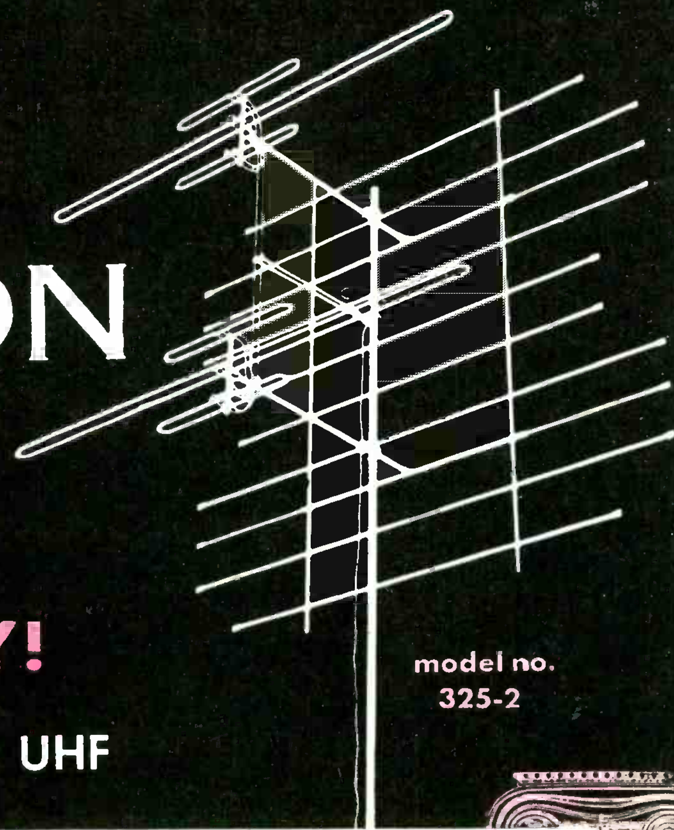

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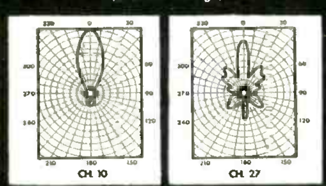

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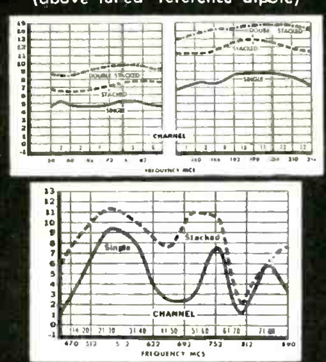

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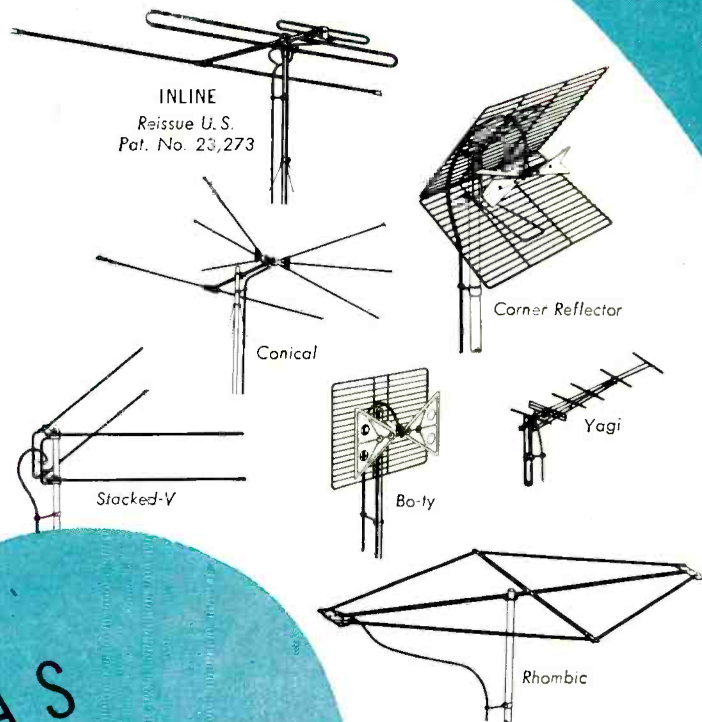

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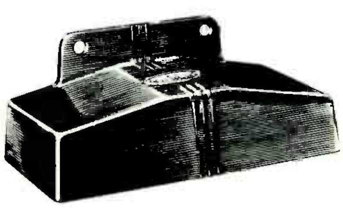

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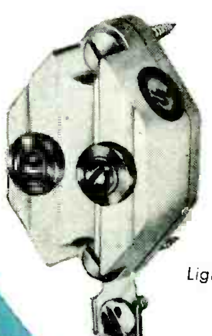

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VOL. 15, NO. 5 MAY, 1954

FEATURE ARTICLES

CHARTS

CIRCUIT & SERVICE FORUM

DEPARTMENTS

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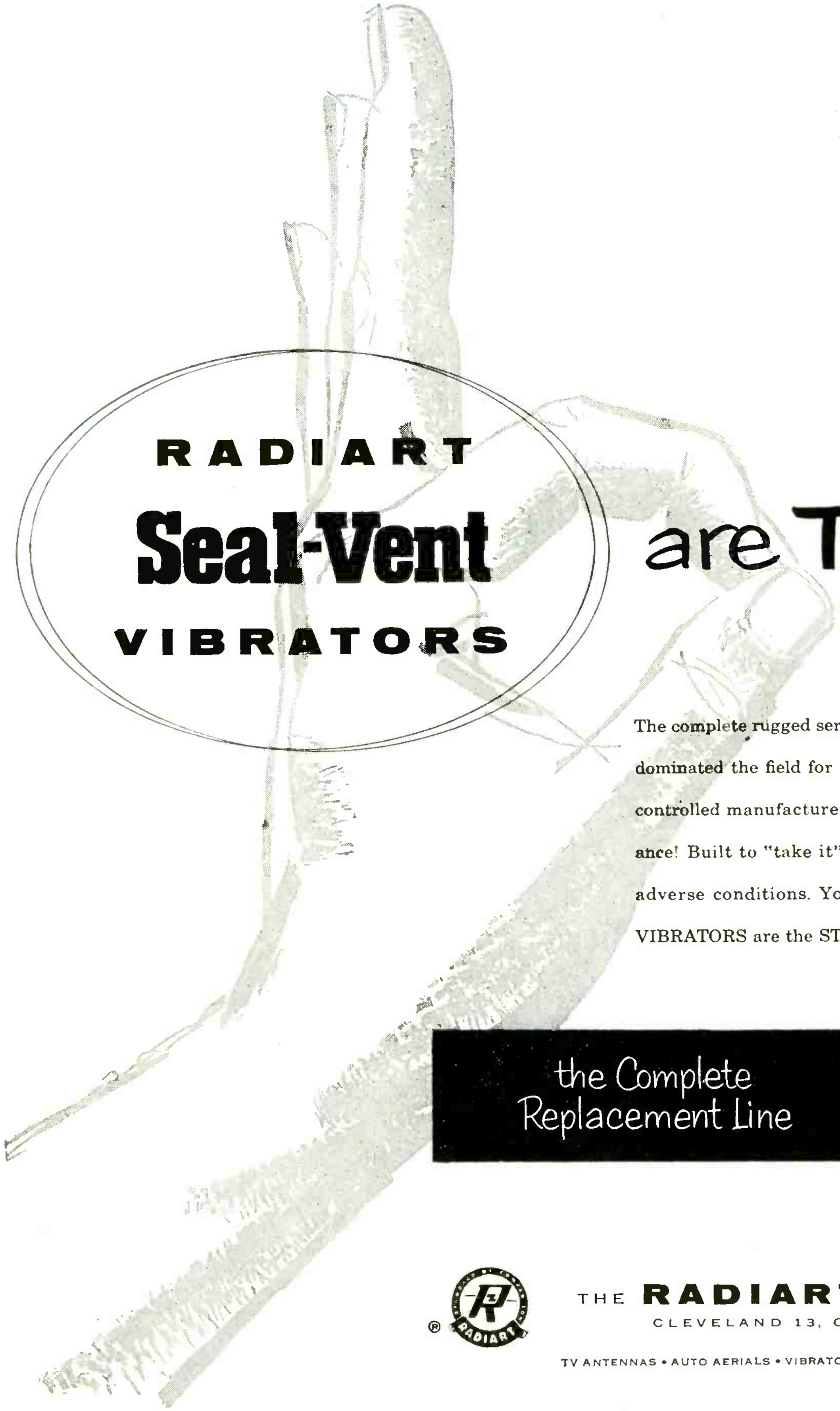

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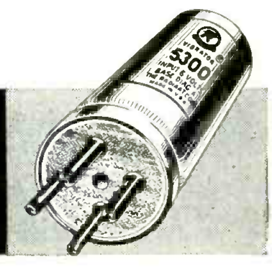

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EDITORIAL...

by S. R. COWAN
PUBLISHER

OUR NEW DEPARTMENTS

Since our "TV Field Service" department began to appear as a regular monthly feature hundreds of our readers have written us to say how valuable it is to them. This department's basic purpose is to help technicians so they may do as much minor TVset repairing as possible while in the customer's home, thus saving much travel time, and allowing more time for other service jobs.

But one reader, although praising the section itself, said that he does not favor doing any under-the-chassis TVset repair work while the customer is about to watch the operation, because, as he puts it, if only a minor component needs replacing, the customer might object to a high charge — or at least a charge that could be gotten without quibbling had the set been repaired out-of-sight at the shop.

This points up a pricing factor that has always been the bane of the service profession. It is our opinion that customer charges should be predicated upon the time AND know-how factor. Every second—travel time; take-out-of-the-console time; trouble-shooting time, etc.—put into any set is time that a customer should pay for. And in addition, the customer must pay for the technician's years of training, his investment in tools, etc. These are part of the over-all package that must be paid for by someone—and that someone must be the customer.

WORTHWHILE INCOME BOOSTER IDEAS

The men who prosper most in the service business always try to sell more than their mere know-how and skill as servicemen. Think! You can easily round out and amplify your income and avoid a drop in take-home pay during certain seasons like summertime by using ideas that have been successfully tried by other servicemen.

For example—during summer many battery sets go into use again. So, go after your customers now. Get your share of profitable replacement battery business. Sell 'em flashlights too! Always look for "plus sales" such as long-play phono needles, picture tube brightening devices, etc. Sell customers on replacing obsolete and worn out antennas while they're away this summer. Make auto-radio service checkup campaigns now before your customers start their summertime trips. Tell your customers that auto and battery radios should be kept in good working order *at all times* not merely because of the pleasure they give—but more important—because if there were an atom bomb attack anywhere that put power lines out of use, such self-powered radios would be the sole means of communication still available.

Our article, in last month's issue, on how easy it is to sell and install Remote TV Tuners, showed that timely merchandising can be very profitable indeed. Several service shops that we know of have been averaging better than $500.00 a month net profit on Remote Tuner sales alone.

And don't forget, air conditioners are simple to service. Only one or two minor adjustments, or a replaced defective relay, are needed in 99% of the jobs that you'll come across. Why not get some manufacturers' service notes? What applies to one brand applies to most others. Then, a low-cost direct-mail advertising campaign to your regular customers, telling them to have their radio-TV-appliance summerizing done by you, will pay nice dividends.

YOU ASK FOR IT

Our sole editorial aim is to provide you with facts and data which will enable you to do your work more easily, more efficiently, in less time and at greater profit. Knowing that most of you are old-timers, pioneer servicemen who cut your eyeteeth on theory many years ago, we stick to text of practical nature and we only delve into theoretical matters on rare occasion. Note for the record that we alone of the serviceman's magazines have opined that color TV is still many months away. But take careful notice—that which we have published and will publish on color TV has been and will be of true value to you.

Time is one of your most precious assets. Our text is geared to help you utilize it to the greatest advantage. Our four exclusive, regular departments, "Video Speed Servicing Systems"—"TV Field Servicing"—"TV Instrument Clinic" and "The Answer Man" are, we sincerely believe (and this has been confirmed by thousands of complimentary letters saying so), the most valuable monthly features available to servicemen.

However, as this is your magazine, you should feel free to guide its editors in selecting subject matter that you'd like to have covered. Write any time.

SHOP EFFICIENCY

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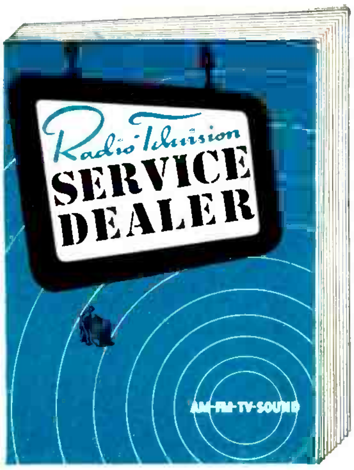

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A TYPICAL ISSUE COVERS

- Video Speed Servicing Systems
- Rider's "TV Field Service Manual" data sheets
- Latest TV Installation and Maintenance Techniques for VHF and UHF
- Auto Radio Installation and Service
- Advanced Data on New Circuitry
- Production Changes and field service data on receivers
- New Tubes
- New Test Equipment, operation and application
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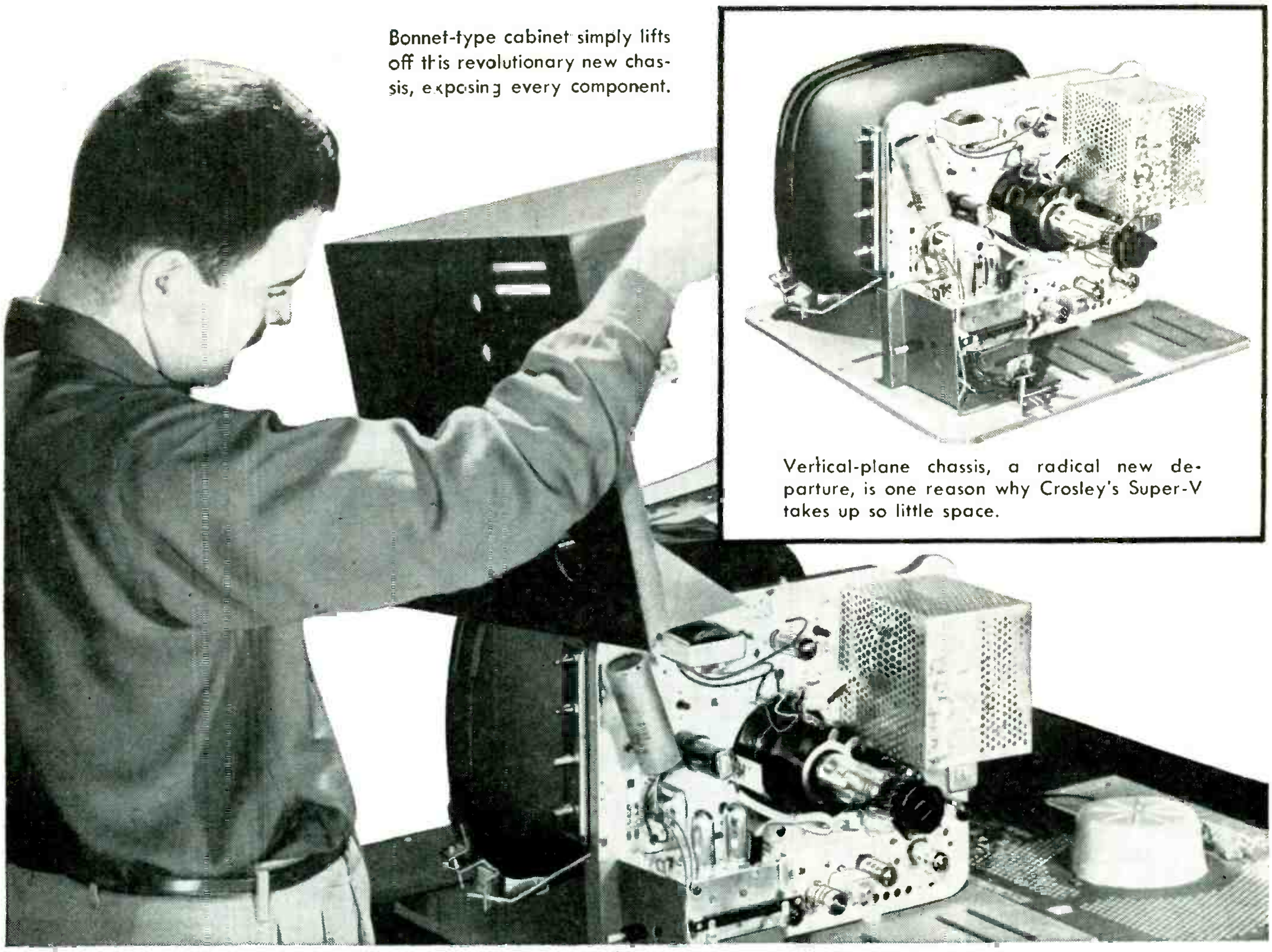

Vertical-plane chassis, a radical new departure, is one reason why Crosley's Super-V takes up so little space.

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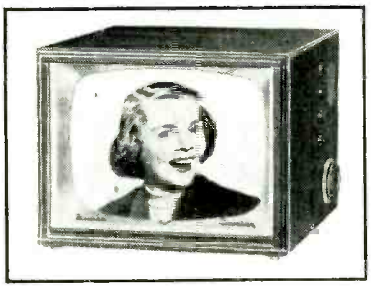

Removing the back of the Super-V plainly exposes all secondary controls and every tube in the set. For any other service job, it's as simple as opening the hood of your car—no chassis to pull, just slide the entire cabinet up off the chassis.

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UHF & COLOR TV Making New Boom

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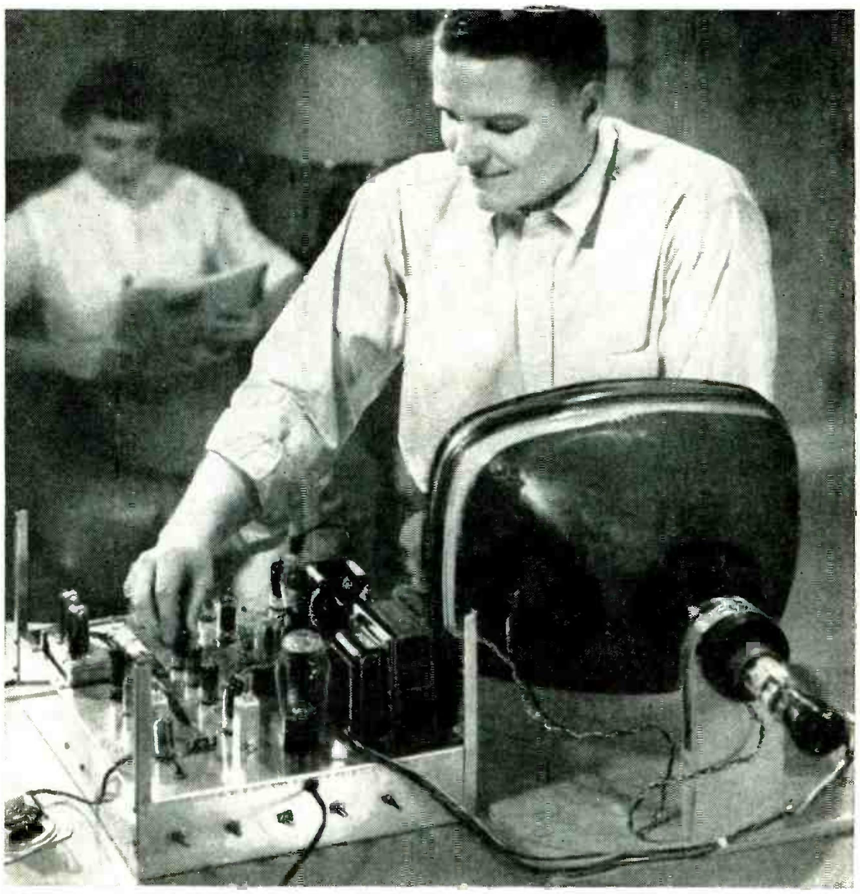

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HORIZONTAL AND HIGH VOLTAGE Color-Set Circuitry

PART I

by Bob Dargan and Sam Marshall

Part 1 deals with horizontal oscillator and output circuits now used in color sets

From a forthcoming book entitled "FUNDAMENTALS OF COLOR TELEVISION"

THE high voltage supply for a three-gun color TV receiver differs from the conventional high voltage supply in many ways. These are primarily a result of the new circuits that have been added because of the increased power requirements and voltage regulation of the color picture tube.

A three gun color picture tube fires three electron beams which simultaneously bombard three color phosphor materials. In general, approximately five times more current is drawn by a color tube than by a B & W picture tube. Also, a color picture tube requires a much higher accelerating voltage so that the phosphor material when bombarded with the electron beam may provide a brightness comparable to that available with B & W picture tubes. For this reason most color receivers apply 19.5 to 20 KV to the high voltage ultor.

The color picture tube generally draws between 500 and 600 microamperes. The present color tube is rated for a maximum current of 750 microamperes which should not be exceeded. The power drawn by the picture tube is about 15 watts maximum (20KV X .00075 amps). This is many times the power used in a typcial black and white picture tube.

In the color TV receiver using the tri-gun picture tube high voltage is obtained by the rectification of the flyback pulse developed by a horizontal deflection auto-transformer. This method is similar to the one used in B & W TV receivers except for the increased power requirements.

An examination of the color receiver deflection and high voltage block diagram, *Fig. 1* shows that the blocks which are the same as those found in a B & W

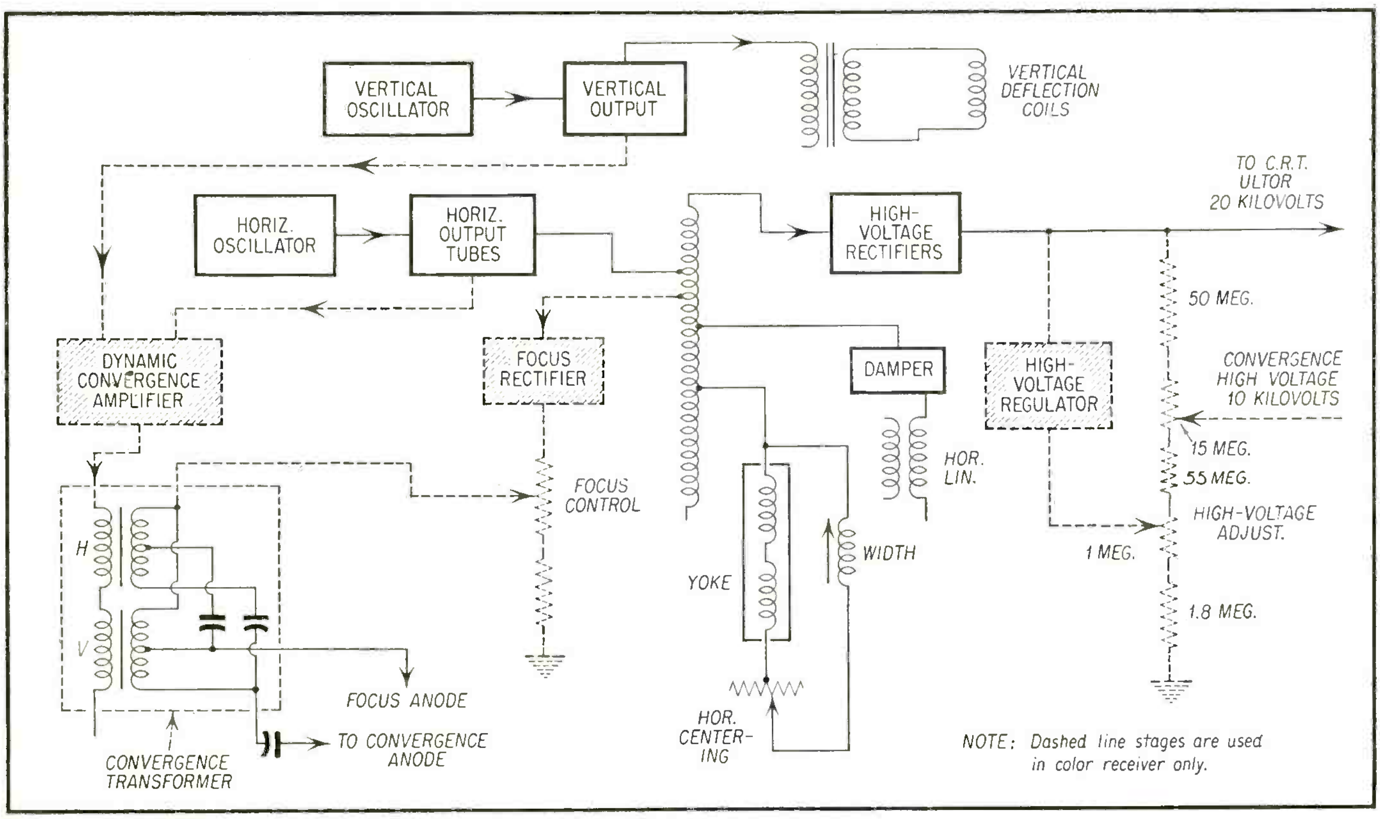

Fig. 1—Block diagram of a color deflection system. High-voltage regulation, focus, and convergence systems shown.

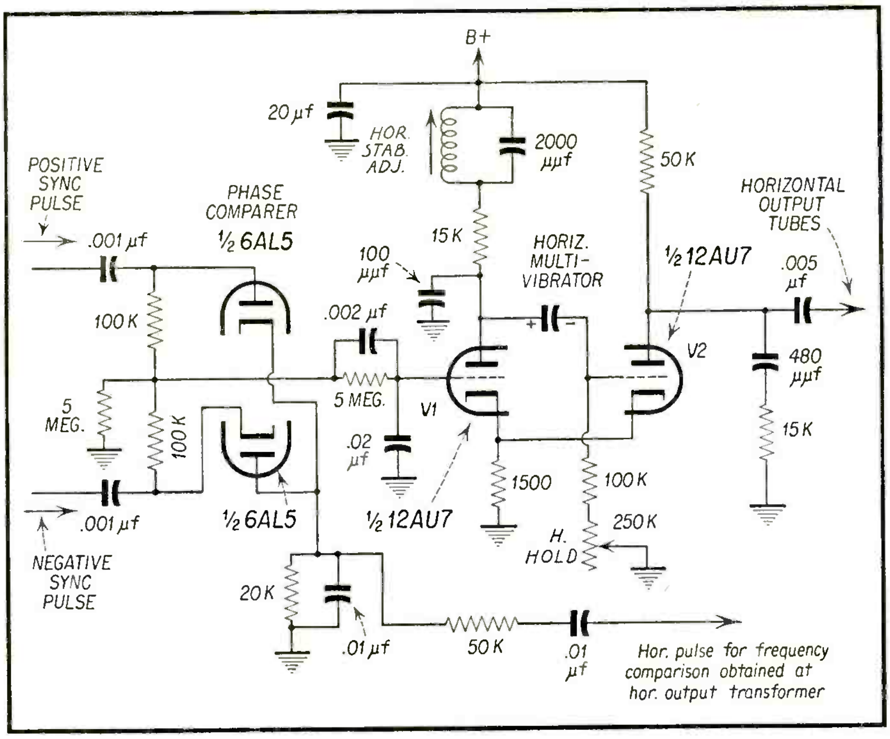

Fig. 2—Horizontal comparing and multivibrator circuits used in several color TV receivers. Note many pulse take-off points.

receiver are drawn in solid lines. The additional blocks necessary to achieve proper operation of a color picture tube are shown in the dashed lines.

Horizontal Oscillator Circuits

Two types of horizontal oscillator circuits are presently employed in color TV circuity. These are the multivibrator and blocking oscillators which are described in the following paragraphs. Their purpose is to produce a sawtooth waveform of correct frequency for providing correct trace and retrace of the electron beam across the face of the picture tube.

Multivibrators

The horizontal multivibrator circuit as shown in *Fig.* 2 is usually described as two resistance coupled amplifiers connected to each other so that the output of each is coupled to the input of the other.

In a cathrode coupled multivibrator circuit the conduction of V2 in *Fig.* 2 causes a positive voltage to be developed across the common cathode resistor due to the current flow through tube V2. The voltage developed across the common cathode resistor is applied at the same time to tube V1. Since this voltage is positive at the cathode side of the resistor it causes plate current in the tube to be reduced. The reduction in plate current through V1 causes the plate voltage to increase in a positive direction, the waveshape of this voltage being the same as the waveshape of the spike applied at the cathode. This positive pulse is coupled to the grid of the tube V2 through the 420 *uuf* coupling condenser where it causes the grid to draw current. The grid current charges up the coupling condenser with the polarity shown, negative at the grid side of the coupling condenser and positive at the plate side. The negative charge cuts off the tube V2 until the charge leaks off through the grid leak resistors, 100K and 250K ohms. When the tube V2 is no longer biased to cut-off the tube conducts heavily and discharges a sawtooth voltage waveform that has been building up across the 420 *uuf* condenser in series with a 15K resistor. Once the tube V2 begins to conduct the cycle starts over again. It is this sawtooth voltage that is used to eventually affect the horizontal sweep across the picture tube.

Frequency control of this tube is achieved by comparing the phase of a pulse fed back from the horizontal output transformer with the incoming sync pulse. If the multivibrator speeds up or slows down with respect to the incoming sync pulse a correction voltage is developed in the phase comparer circuit. This voltage, applied to the grid of V1, brings the multivibrator back to the proper frequency determined by the incoming horizontal sync pulse.

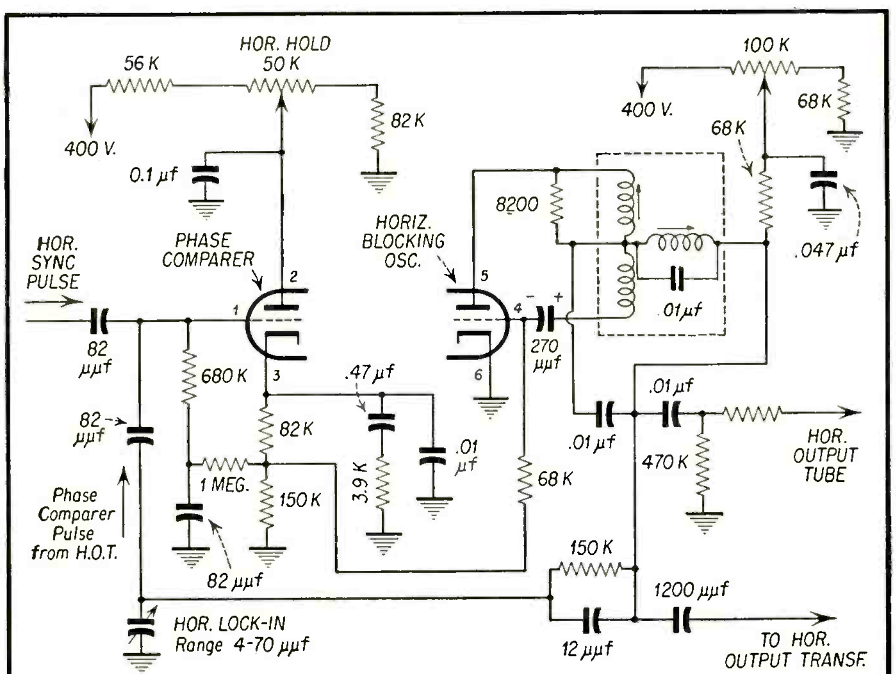

Fig. 3—Horizontal blocking oscillator circuit used in color TV.

Horizontal Blocking Oscillators

A blocking oscillator circuit used in color TV receivers is shown in *Fig.* 3. When the blocking oscillator tube conducts, the current flows with increasing amplitude through the transformer until tube saturation is reached. The increasing plate current flow through the transformer couples a positive voltage to the grid of the tube. This causes the grid to draw electrons from the tube which charges up the grid side of the coupling condenser. The long time constant of the condenser-resistor network establishes a negative bias at the grid of the tube. This bias blocks the tube which remains in the cut-off state until the electron charge on the condenser discharges through the grid resistor. With the bias removed from the grid circuit the tube conducts once more and the cycle starts all over again.

Tube cut-off is controlled primarily

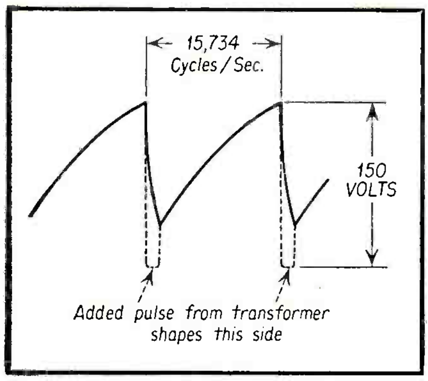

Fig. 4—Grid waveform is modified by the pulse from the horizontal output transformer. By straightening the edge of the waveform a sharper and faster cutoff of the tube conduction is achieved with greater resulting efficiency.

by its grid bias. Therefore, if this bias is reduced the oscillator action will speed up and if increased it will slow down. This property is made use of in controlling the frequency of the blocking oscillator.

An automatic frequency control circuit is provided in conjunction with the blocking oscillator to correct for conditions which might cause the incoming sync pulse to lose control. The system shown is generally called a "pulse width" *afc* circuit. It uses a phase comparer circuit that compares the phase of the horizontal oscillator with the phase of the reference sync pulse. The two pulses are fed into the grid circuit, and when the sync pulse sits on top of the sawtooth voltage the phase comparer tube conducts, developing a positive voltage at the cathode of the phase comparer. This positive voltage is fed to the grid of the blocking oscillator through a voltage dividing network where it adds with the self-generated bias at the oscillator grid.

If the oscillator speeds up or slows down, the resultant pulse width due to the positioning of the sync pulse on the oscillator sawtooth voltage causes conduction of the tube. The tube will conduct more or less current depending upon whether the pulse width is wider or narrower than the normal width. The result is more or less current flow in the phase comparer tube which causes a corresponding variation of voltage supplied by the cathode of the phase comparer to the grid of the oscillator. This voltage is in a direction which corrects the oscillator phase so that it eventually comes into exact sync with the sync pulse.

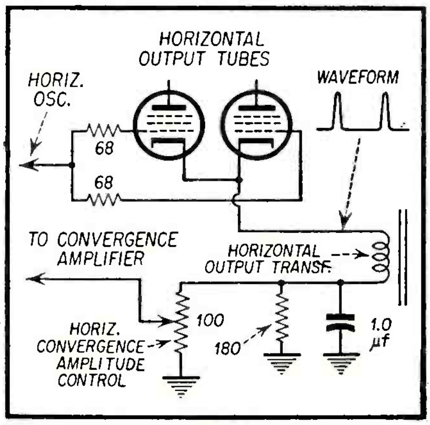

Fig. 5—One of the windings on the horizontal output transformer supplies shaping waveform to cathode.

Horizontal Output Circuits

The horizontal oscillator circuits used in TV color receivers generally requires that the output signal voltages be a little higher than in conventional B & W receivers. To drive the horizontal output tubes of present color circuits a peak-to-peak voltage of about 150 volts is employed.

To maintain horizontal output circuit efficiency the plate current in the horizontal output tube during the retrace time must be cut-off rapidly and kept cut off during the entire retrace period. It must be realized that pulses as high as 6000 volts are at the horizontal output tube plates during retrace time. To prevent these pulses from drawing plate current in the output tube special shaping of the grid signal voltage is necessary.

To effect this shaping a pulse is usually obtained from a special winding on the horizontal output transformer which, depending upon the polarity of the connections, can be applied to the grid or cathode of the horizontal output tube. This pulse, as shown in *Fig. 4* shapes the driving signal so that cut-off of the horizontal output tube will definitely be assured during the retrace interval. *Fig. 5* shows the manner in which the pulse is inserted in one type of color receiver. Here the cathode circuit is used. *Fig. 6* shows how the pulse shaping voltage can be supplied to the horizontal output tube grid to achieve the same kind of shaping.

This shaping accomplishes an important purpose in the deflection system. All the energy must be built up in the auto-transformer windings for the high voltage circuit so that the maximum possible positive spike voltage can be applied to the high voltage rectifiers. If current is drawn by the horizontal output tube during the retrace time less voltage will be available to the high voltage rectifiers. Also the "Q" of the circuit will be reduced because of the loading effect if the output tube conducts.

Horizontal Output Transformers

Horizontal output tubes used in color TV are usually two 6CD6's, 6BG6's or 6BQ6's connected in parallel. New, single tubes are presently being designed to handle this high current deflection job. Horizontal output tubes drive a horizontal output transformer as with black and white receivers. However, the transformer used in color work is larger. It is also considerably more complicated, containing many more windings than its black and white prototype. The output transformer shown schematically in *Fig. 7* is of the auto-transformer type with taps on the main windings for the following circuits. The letters associated with each tap correspond to the lettered taps shown on the schematic of *Fig. 7*.

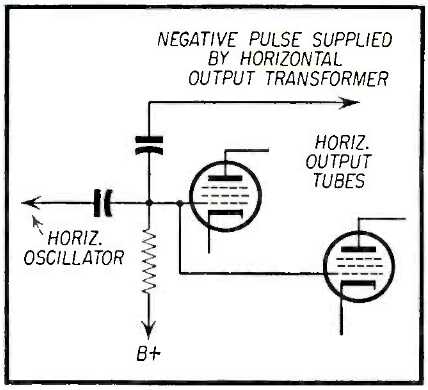

Fig. 6—The shaping voltage waveform is supplied to the grids of the horizontal output tubes above.

It can also be noted that further taps or separate windings are provided for the following functions:

1. Four filament windings are provided for the high voltage and focus rectifiers. The high voltage doubler tube filament uses only a single turn.
2. *AGC* gate windings are usually provided. This may be just a tap

[*Continued on page 57*]

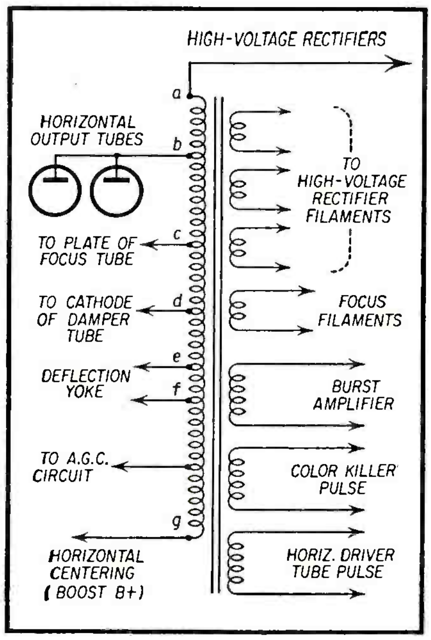

Fig. 7 — Horizontal output transformer and its associated circuit windings are shown in figure above.

"The Answer Man"

by BOB DARGAN

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

Vertical Retrace Suppression

Dear Answer Man:

I have an Emerson Model 600 TV receiver in which I would like to incorporate vertical retrace suppression.

B.E.H.
Nampa, Idaho

Dear B.E.H.:

The incorporation of vertical retrace suppression is easily accomplished and is particularly effective in those areas where the received signal is weak and the resulting picture tube signal is also weak.

In most TV receivers the changes incorporate a relatively simple circuit which feeds a positive pulse from the vertical output circuit to the picture tube cathode. Since the pulse is positive the picture tube is cut off during the vertical retrace periods.

In other types of receivers where the video signal is supplied to the cathode a negative pulse can be applied to the picture tube grid to cut off the tube current during vertical retrace periods.

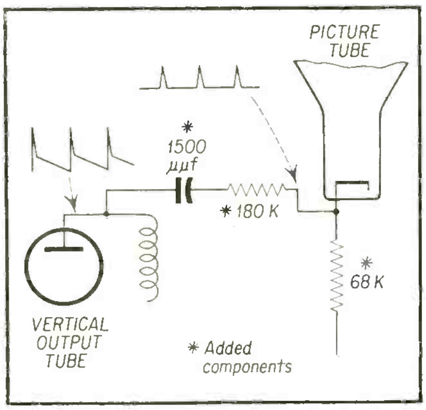

Fig. 1—Typical vertical suppression circuit showing correct waveforms.

Referring to *Fig. 1* the incorporation of vertical retrace suppression involves the addition of three components, two resistors and one condenser. The condenser is used for *dc* blocking purposes and ranges in value from a .0015 to a .003 *uf* depending upon the tolerable loading of the vertical output cicuit and the amplitude of the pulse necessary to accomplish the retrace suppression.

In series with the condenser is connected a resistor of about 180K to 220K ohms. The purpose of the resistor is to drop some of the voltage across it and to help prevent loading the vertical output stage. If the stage is loaded it will cause the vertical height and linearity to be affected beyond correction with the adjustment controls.

The series condenser-resistor network is usually connected to the plate of the vertical output tube where a positive going pulse is obtained that can be integrated in the condenser-resistor network. The waveshape at the plate of the vertical output tube is reduced in amplitude and shape so that a proper waveform is available for the picture tube as shown schematically in *Fig. 1.*

The third component used in the suppression circuit is a resistor of about 68K ohms. This resistor is inserted in series with the cathode circuit of the picture tube if the cathode is grounded or a large bypass condenser between the cathode and ground or B plus places the cathode effectively at *rf* ground potential. The purpose of the resistor is to have a circuit component in the picture tube circuit across which the suppression voltage can be developed. Since the resistor is inserted in the cathode circuit of the picture tube the integrated vertical deflection voltage will cause the picture tube to be biased beyond cut-off by the integrated vertical pulses and the electron beam is thereby prevented from flowing during the vertical retrace periods.

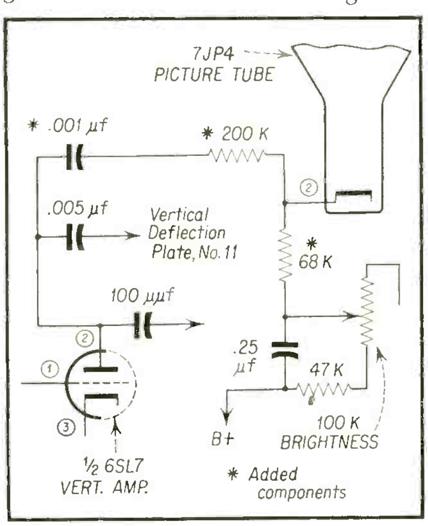

Fig. 2—Vertical retrace suppression circuit in the Emerson Model 600.

The circuit for vertical suppression in the Emerson Model 600 receiver is shown in *Fig. 2*.

Bias Box

Dear Answer Man:

In the series of articles titled "Troubleshooting TV With Key Test Points," a bias box is mentioned in troubleshooting Automatic Gain Control (*agc*) systems.

Since I have had a lot of *agc* trouble I would like to know more about it.

J.J.S.
Worcester, Mass.

Dear J.J.S.:

With the use of more complex *agc* systems in current TV receivers it is very desirable to be able to determine immediately and quickly whether the difficulty in a receiver is due to *agc* trouble or not. Also in alignment work a fixed negative source should be supplied in most cases to the *agc* negative voltage line as specified by the manufacturers of the particular TV receiver.

A battery with a potentiometer connected across it so that the desired negative voltage can be tapped off is the most common method of obtaining a negative voltage but this is cumbersome and the battery does not last too long.

A more convenient method of obtaining a negative voltage is an arrangement as shown in *Fig. 3*.

The components necessary are:

1) two 5 *ma* selenium rectifiers

[*Continued on page 15*]

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350 WEST FOURTH STREET, NEW YORK 14, N.Y.

ANSWER MAN

[from page 12]

2) three 20 *uf*, 50 volt, electrolytic condensers
3) one 2000 ohm, ¼ watt resistor
4) one .01 *uf* condenser
5) three alligator clips.

These eight components can be easily mounted on a flat plate of insulation material or in a small box. All components can be obtained at the local electronic distributor and can be assembled in relatively no time at all. *Fig. 4* shows a possible arrangement of these components on the insulation panel.

If it is desired a small recitfier tube such as a 6AL5 duo-diode tube can be employed in place of the selenium rec-

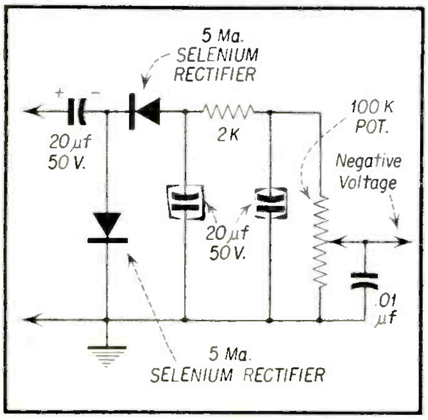


Fig. 3—Convenient way of obtaining negative voltage for test purposes.

tifiers but this necessitates the use of a tube socket which makes for a slightly more bulky item.

If alligator clips are connected to the three leads from the bias box it can easily be fastened into the chassis under test. The ground lead is connected to the ground side of the filament and the other alligator clip is connected at the 6.3 volt filament supply. This supply

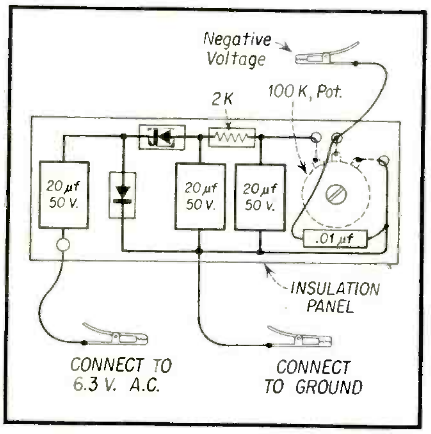


Fig. 4—Possible arrangement of the parts shown in schematic of Fig. 3. This may be used as the "bias box."

point can be either at the filament transformer or at the filament pin of one of the tubes supplied with 6.3 volts *ac*.

The 6.3 volts which is an *rms* value has a peak voltage of 1.4 times this value or 8.8 volts. The voltage doubling circuit of the bias box permits the obtaining of almost twice this amount of negative voltage.

GE 17T103: Vertical Hold

Dear Answer Man:

I have a G.E. 17T103 on which the vertical hold is very touchy. Just by touching the control it will roll one way; and then when you try to stop it, it will roll the other way slowly. I have checked the sync and vertical circuits. The voltages check with the manufacturer's print. I have replaced tubes, but this does not correct the trouble. Could you give me any information as to what could cause this set to drift vertically?

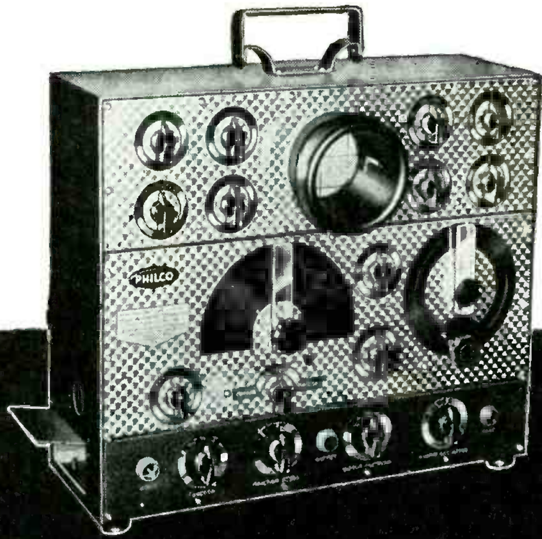
P.S. I get voice on Channel 7 but no picture. What do I adjust to get the picture in? Is there an adjustment on the tuner?

J.K.
Wellsville, Ohio

Dear J.K.

From your letter it appears that the troubles are only associated with the

[Continued on page 18]



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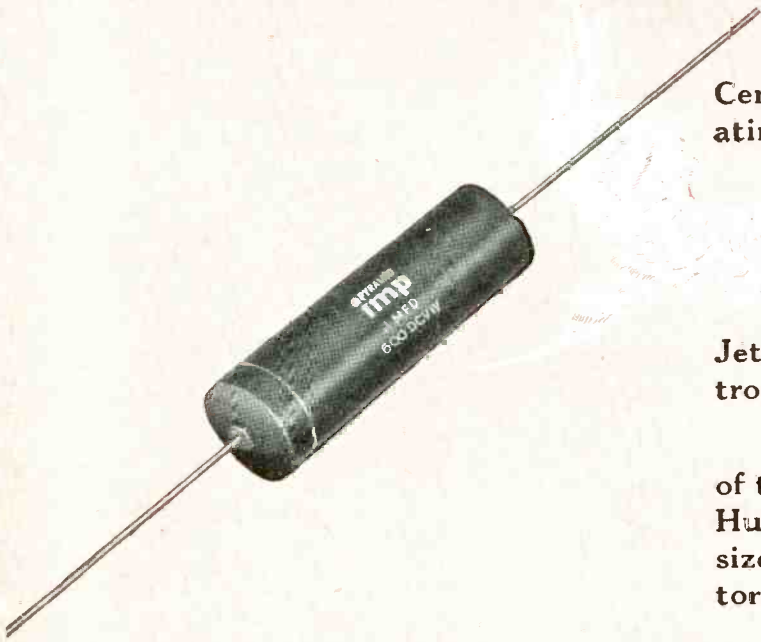

Jet Imps are designed to operate at 100° Centigrade (212° F.—boiling point) 15° higher operating temperature than most molded capacitors available today. This means that Jet Imps not only withstand emergency conditions but also under normal operating temperatures, such as the high temperatures under a TV chassis, Jet Imps have a real safety margin for long trouble-free service.

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ANSWER MAN

[*from page 15*]

vertical circuit and the picture is normal in that the low frequency response and vertical blanking bar appear to be proper.

On the basis that the horizontal oscillator lock-in action is also normal, more than likely a component in the integrating circuit is defective. The vertical sync pulse is not triggering and locking in the vertical oscillator. Examination of the schematic for the integrating network reveals five components in the circuit, one of which is undoubtedly defective. See *Fig. 5.*

The .002 μf condenser is the most common component that has failed in this model receiver with respect to this trouble. It usually opens up. However, there is also a 470 $\mu\mu$f condenser that could be open, causing the same effect. If either of the two resistors from the sync amplifier stage (82K and 39K) has increased in value the same effect would result. One other component that could introduce vertical trouble is the .001 μf condenser in the integrating network. A thorough check of these five components will more than likely reveal the source of the trouble.

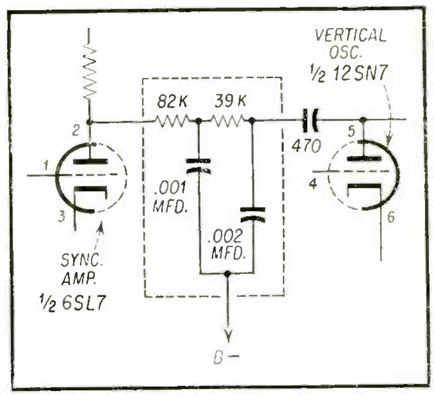

Fig. 5—Partial schematic of G.E. 17T103 indicating various components in integrator circuit that might give rise to troubles outlined in communication received.

In response to your inquiry concerning the adjustment of Channel 7, the tuner does not have a separate oscillator adjustment. A screw adjustment is provided for Channel 13 which will align the channels below to Channel 7. For Channel 6 and below there are separate oscillator screws. If the Channel 13 oscillator slug is adjusted to bring in Channel 7 the adjustment will also affect the channels below Channel 7 and they may have to be touched up. This is because the tuner is of the incremental type with each channel starting with Channel 13 add-

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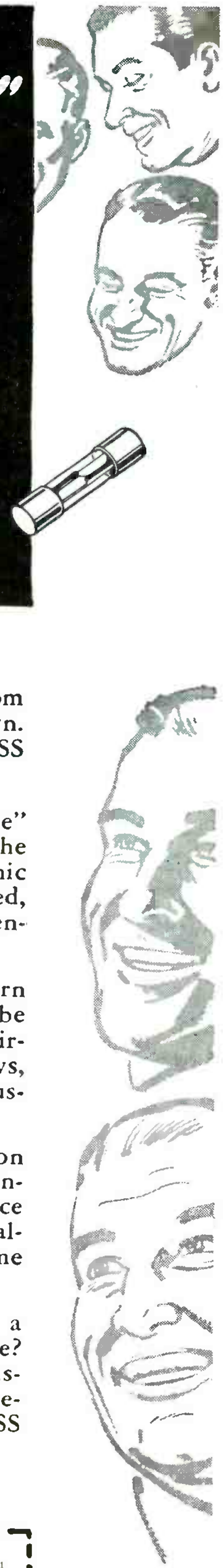

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ing a small amount of series inductance to the oscillator circuit.

Concerning General Electric receivers a very informative bimonthly publication is available from the General Electric Company which will be of great use. Just address a letter to them at the Electronics Department, Schenectady 5, N.Y. and ask to be included in their mailing list to receive "Techni-Talk."

Proper Servicing Techniques

Note: We recently received a letter addressed to the Editor, the essence of which is contained below. We could not resist the temptation of including it in our Answer Man column with the Answer Man's thoughts on the subject.

Dear Editor:

I have recently serviced a TV receiver in which a number of condensers had been "clipped" for a fast resistance check, and stuck back with a thread of solder—which any service technician can tell you is exceedingly poor practice. In this particular chassis, as might be expected, several of the connections had come loose—making the cure worse than the disease.

For the benefit of some few of your readers who might not know better it should be pointed out that a good workman does not clip leads: he unsolders them carefully. Most sets don't have leads long enough to allow them to be clipped and then put back with the proper mechanical joint before soldering. And if the mechanical joint of the lead is not made the lead will work loose in short order.

Dear Sir:

The point of unsoldering condensers versus cutting the pigtails has been a topic of discussion with many electronic technicians. There are those electronic technicians who are neat and thorough and every time they check a condenser they unsolder the connection and then resolder the pigtail after the check. These technicians are certainly to be commended for their high quality workmanship, their carefulness, their neatness and all around technical ability.

However, from other standpoints, speed in making repairs is actually the essence of a profitable service organization. Speed is a result of "Know How," and is attained through training and experience. In essence the measure of a serviceman's worth is his practice of the following rules:

1. Inspect the TV receiver to determine which section is faulty, and if possible at this time, which stage is affected.
2. Substitute a known good tube for every tube that can possibly be the cause of the receiver difficulty.
3. Inspect the chassis visually for burnt, broken or leaky components.
4. Check the condenser, particularly the paper type, used for such purposes as coupling and bypassing.

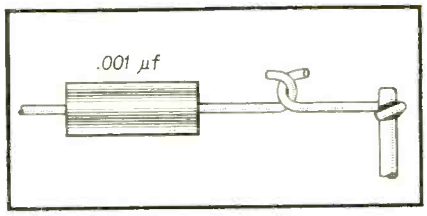

Fig. 6—If pigtail length permits, this hook splice adds strength.

Now, the great majority of electronic troubles are found in the first step. The second step is very useful and reveals a great portion of the troubles that are not tubes. The third item includes a great portion of the troubles that are encountered after the first two steps do not locate the difficulty. Under the fourth step a great many troubles will be corrected. That is, when the coupling condensers of the stages which are not operating properly are investigated, defective condensers will be found to be a great cause and source of TV troubles.

If crackerjack shop technicians are observed in action, it will be found that they pretty much follow these preliminary servicing procedures. Naturally there is more to servicing TV receivers than just these four steps. They are only the beginning steps in a complex operation but they will locate about 98% of the troubles in TV receivers.

Notice, now, that for a profitmaking operation speed is essential; speed particularly in the completion of these first four steps.

The fourth step which is the checking of condensers, should also be conducted with a degree of speed. Electronics servicing men have been clipping condensers for many years. Some have been checking in this manner long before the advent of TV, and have not experienced any misfortunes or recalls because of it. It must certainly be understood and accepted that these fellow can solder two wires together and have them stay together without resorting to a preliminary mechanical joint. In most cases a mechanical joint is nice but not absolutely essential.

Usually, if two pigtail leads have been properly soldered together and stress is applied, the wire will pull out of the condenser before the soldered joint will part.

Naturally, if the pigtail length permits the hook splice it should be used. The hook splice, shown in *Fig. 6*,

[*Continued on page* 57]

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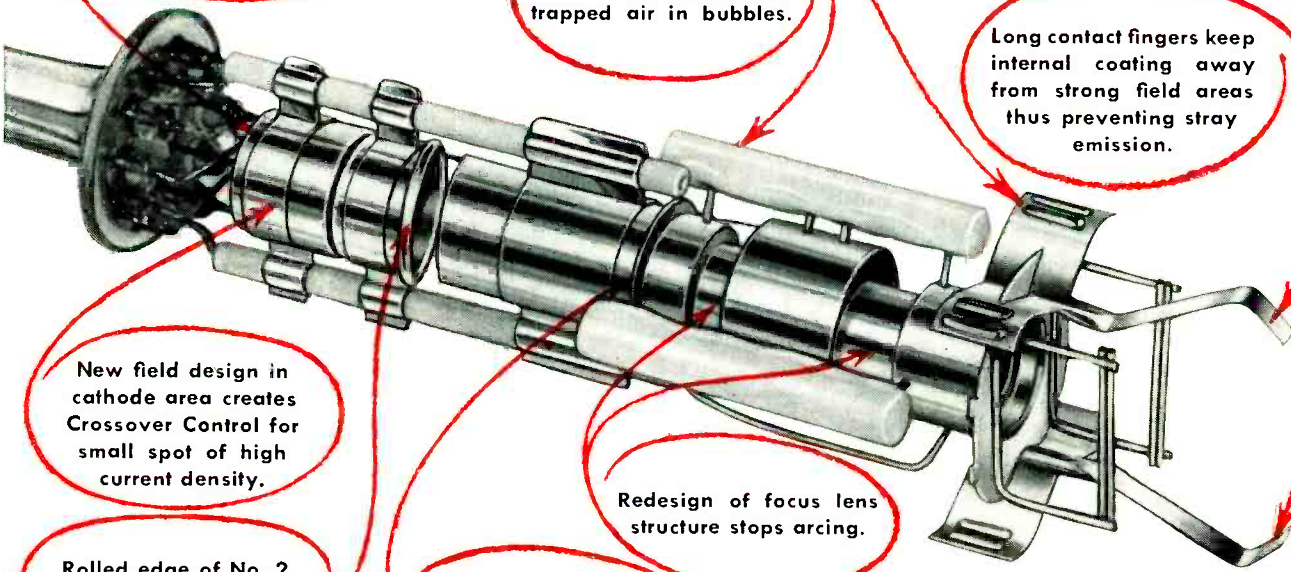

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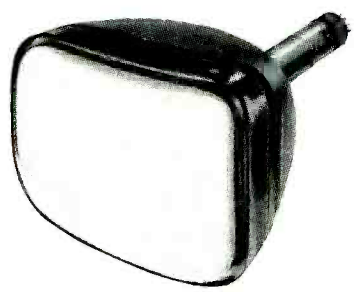

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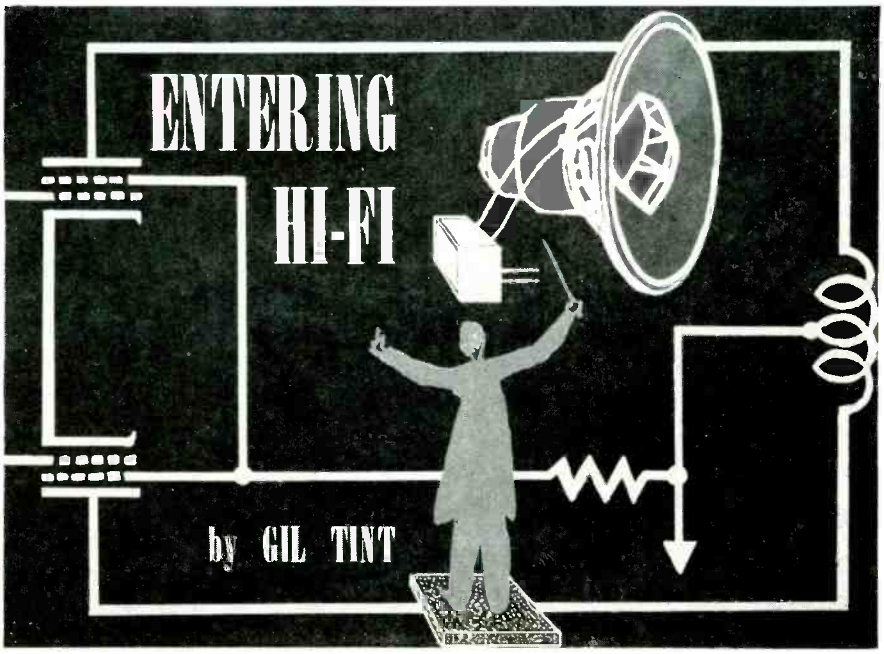

Servicemen Can Profit by Entering the Field of Custom Sound Installations.

ABOUT twenty years ago, an enthusiastic group composed mostly of radio engineers, experimenters and musicians started making noises about the possibilities of greater fidelity in sound reproduction. For many years they were treated by the industry with an attitude lying somewhere between outright ridicule and amused indulgence. Today, however, they are treated with respect. Interest in high fidelity has reached such a feverish pitch that it threatens to become the "tail that wags the donkey" of the radio industry. So great has the public's demand become for better audio reproduction that several of the nation's largest producers of console radios and TV receivers have come out with their own versions of radio tuners, amplifiers, speakers and other units that comprise a high fidelity system.

All this hubbub is of interest to the serviceman and technician insofar as it means a tremendous new potential market for his services. His can take on a four-fold role in this field—consultant, seller, installer, and repairman.

Consultation

The consultant should consider three factors when advising a potential customer what sort of audio system he should purchase: the size and decor of the listening room, the response of the client's ear and the amount of money he is prepared to spend.

The dimensions of the room are important in determining the power handling capacity of the system. There would be little point in installing a 25 watt amplifier and speaker system in a 12 x 15 foot living room. If played at full level, it might result in the eventual eviction of the tenant from his apartment and the loss of a client. As a matter of fact, a system is never used at its

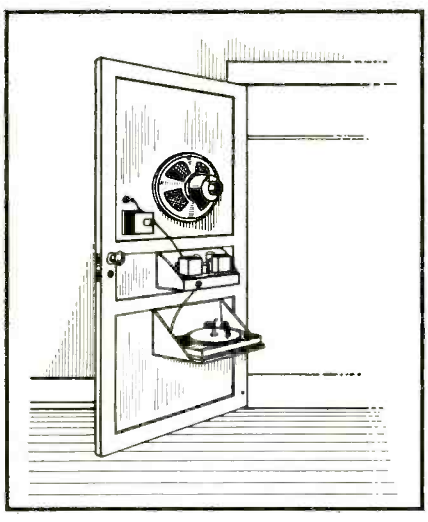

Fig. 1—Closet door installation. This is cheapest if closet contains clothes and door faces into long dimension of the room. See text for details.

maximum rating. This figure is only an indication of the amount of reserve available in the unit. The largest home rarely requires more than five or six watts of audio. However, the amount of harmonic distortion present at a given listening level is considerably less in a 25 watt system than in one with a 5 watt maximum rating. The power capacity of the system should therefore be no larger than necessary.

For an entirely different reason, the decor of the room on which the equipment is to be installed is also important. This aspect of the situation is often better discussed with the feminine member of the family. She may be more con-

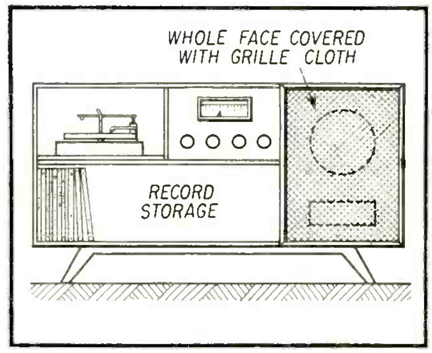

Fig. 2—Typical layout of units in commercial hi-fi cabinets. Amplifier sits behind tuner containing controls.

cerned with the style and finish of the cabinets to be used and where they are to be located. Nevertheless, because of the possibility of acoustical feedback and unwanted needle vibrations, the speaker should be housed separately and located remotely from the rest of the system. There are several ways of fitting the speaker enclosure gracefully into the room. It can be used as an end table, or placed in a dummy fireplace, etc. Since no two rooms are furnished

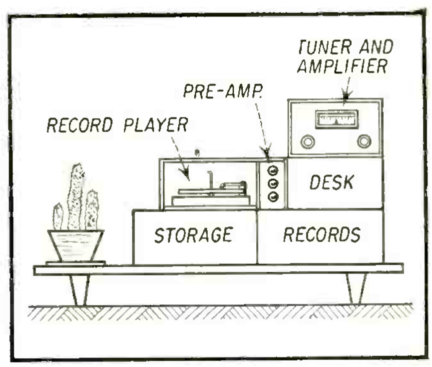

Fig. 3—Modular units may also be used to house the hi-fi components.

alike, this problem can be handled *only after inspecting the client's home.*

The second point of consideration, the customer's hearing range, is important in determining the scope of the installation. One has to be careful here, however, as no one likes to be told that he has 20 *db* holes in his head; that's almost as bad as accusing him of having no sense of humor. In this business, however, honesty pays off more than flattery. A satisfied purchaser can

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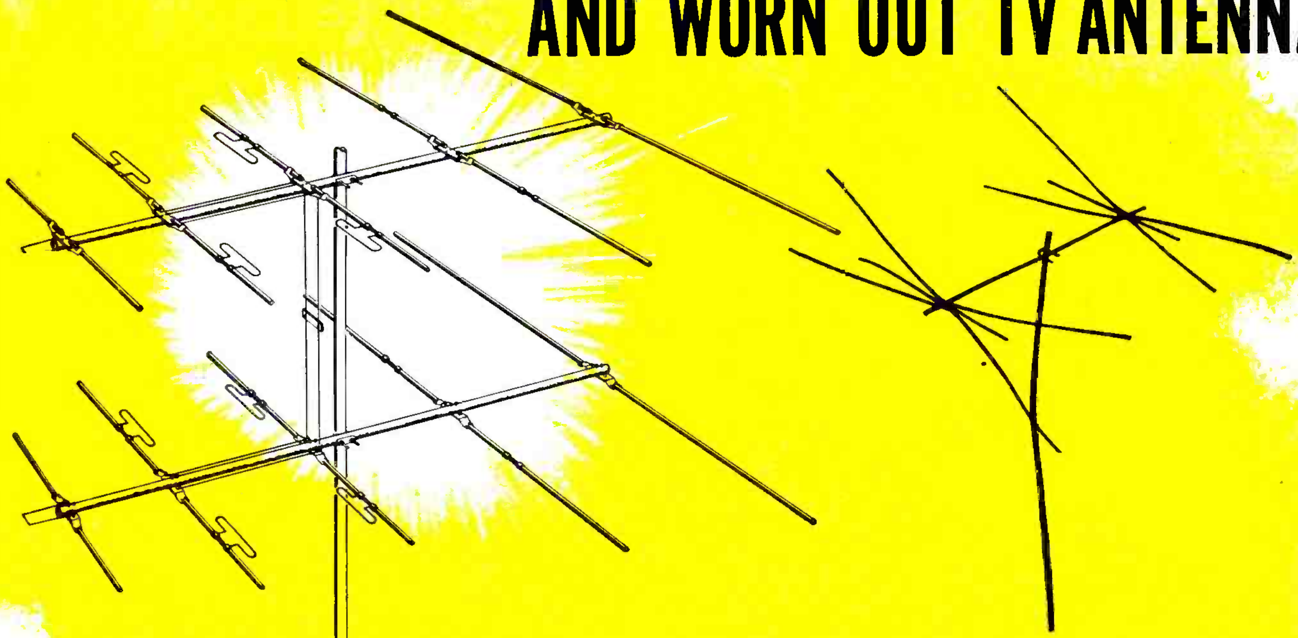

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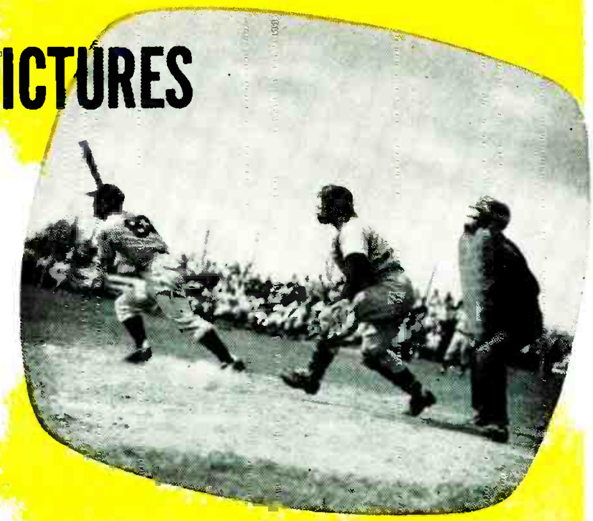

Provide your customer with greater enjoyment with his present TV receiver—put new life into the pictures on the screen—supply him with the equipment necessary to bring in **all** the available channels better, clearer...with the installation of a new Taco antenna.

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Technical Appliance Corporation, Sherburne, N. Y.

In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ontario

—*Courtesy, Sultan Laboratories*

Fig. 4—Custom installation houses record-changer, tuner, amplifier, speaker. Note ample storage area.

—*Courtesy Webster-Chicago Corp. and Voice and Vision, Inc.*

Fig. 5—This installation includes TV and features a desk surface adjacent to the record-changer.

start a pyramid of recommendations worth much more than the income derived from misinforming a few naive customers. They don't stay naive long.

However, if a person is found whose high frequency response is somewhat below average (and this is easily determined by the use of an audio oscillator and speaker—a good publicity stunt by the way), he can be told that a wide range system can increase his listening pleasure nevertheless. Improvements such as overtone enrichment of music, reduced distortion, bass and treble control, cleaner transient response (sometimes referred to as overhang), static-free FM reception and the ease of AFC tuning are sufficient to win over a potential customer. As a matter of fact, he will be able to detect a wider range of frequencies on a good system in spite of his limited hearing. This can be explained by the fact that his old radio attenuated even those frequencies within his range to such an extent that he never heard them. The best way to clinch a situation like this is to let him listen and judge for himself.

Thirdly, it is wise never to recommend equipment beyond the customer's financial means. There are enough commercially available components to choose from in all price ranges to fit almost any budget. Strangely enough, the purchaser's confidence can be gained in this manner at no sacrifice in profit. The reason is that a very small, (if any) percentage of the returns from an installation comes from the mark-up on components, but more of that later.

Installation

Assuming the customer has been sold, the next job is to install the system. The two major considerations of this phase of the operation are the type of housing to be used for the installation, and the interconnection of the equipment. Several methods of enclosing the equipment will now be discussed in their order of increasing complexity.

The easiest and also the most impractical way of setting up the system is to place it on a shelf or table in the open. This suggestion is likely to come from the customer. The chances are that he either has a bachelor friend who threw it together that way or he attended the Audio Fair and thought that that's the way it's done. Nevertheless, such factors as shock hazard, dust collection, nagging wives and tube burns make this method highly unfeasible.

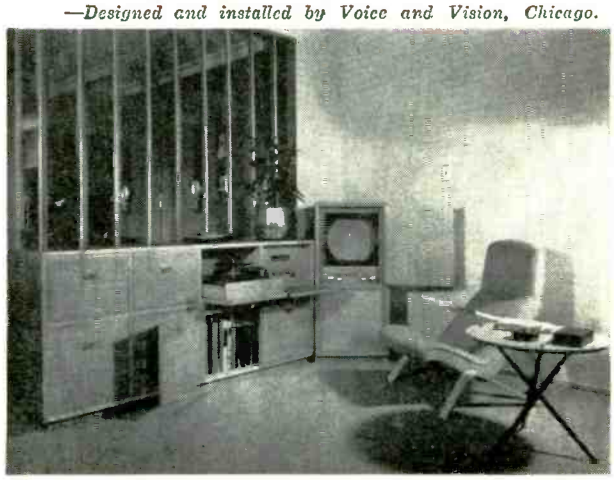
For small apartments, or for rooms which cannot take much more furniture, a closet installation is recommended (see *Fig. 1*). If space permits, the speaker alone may be mounted in the door, and the other units placed on shelves. This method, if workable, has certain advantages over other methods discussed here. The only cabinetry needed here is a new closet door. Rather than cut up the closet door in use, it is wise to buy an extra one for this purpose; the old one can be stored somewhere. Customers in rented homes or apartments will appreciate this suggestion since they usually have to pay for such damages. Ventilation is no problem since the large volume of a closet will keep the ambient temperature well below the critical value. If the speaker is installed in the door, no

Fig. 6—Here the hi-fi equipment becomes part of the room's wall. Note large speaker area.

—*Designed and installed by Voice and Vision, Chicago.*

Fig. 7—This installation provides ample and correct housing for all units; is also room divider.

—*Designed and installed by Voice and Vision, Chicago.*



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A member of the CBS family: CBS Radio • CBS Television Columbia Records, Inc. • CBS Laboratories • CBS-Columbia • and CBS-Hytron damping or absorbent material need be used to line the closet walls. The clothes or linens themselves make excellent sound absorbers. Naturally, no speaker should be installed in a china or dish closet. The cabinet work necessary for the various cut-outs can usually be done by the installer himself.

For those who want one or two large cabinets for a prominent place in the room, there are commercial items available which are ready-made for the more popular hi-fi components (see *Fig.* 2). The equipment need only be mounted and connected. A study of any hi-fi catalog will show that the cabinets come in several styles and finishes, and even unfinished if desired. When ordering them, it is necessary to list the make and model of each component so that the proper cut-outs will be made.

There is another type of installation, similar to the above, which makes use of the new modular type of units on the market (see *Fig.* 3). Here, the system is integrated with bookshelves, a drop-leaf type of desk and secretary, storage cabinets, knick-knack shelves and record storage compartments. Since these units are put out for the most part by furniture manufacturers, they are not geared for the audio trade. Hence, these units might require a fair amount of modification and carpentry to adapt them to the installation. A record changer drawer must be added, matching front panels for the various components must be supplied and cut out, and the back panels must be removed in part to provide adequate ventilation. In any case, it is only fair to point out to the customer that an added TV unit necessitates a larger installation.

Finally, there is the custom-built installation, such as the wall unit, recommended for the home owner and the customer with a specific design in mind. (Examples of this type of installation are shown in *Figs.* 4 through 7). This is the most expensive type of installation and can bring in a nice return. However, it is important to make sure that every detail of the design and wood finish is carefully discussed with the customer and cabinet-maker before going ahead with the job. Otherwise, some dimensions might be off, the finish might not match the other wood pieces in the room, or some other overlooked detail might cause trouble. This only results in strained relations, a dispute over the bill and a bad recommendation —no matter whose fault it is.

Interconnection of Components

The interconnection of the components, in spite of what the manufacturers say, does require some thought to suit individual needs and tastes. A few important considerations on this subject will be discussed here.

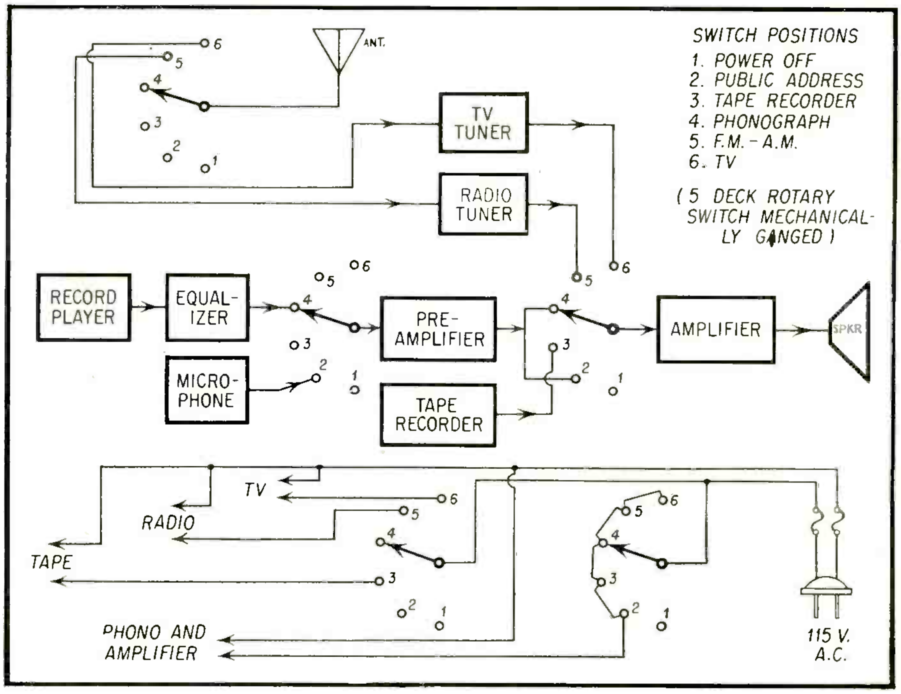

Fig. 8—External switching arrangement for single control selection of desired unit. Other controls for volume, treble, bass, record equalization, tape-record, etc., must be used as provided in set.

First of all, a switching system could be arranged which requires the operation of only one control for power and selection. A system with a separate off-on switch for each component may not be practical. Neither, on the other hand, is it desirable to turn all of the equipment on when only part of the system is being used since this is a waste of power and money. There is enough of a choice of components available to meet most requirements, under average conditions. However, certain set-ups may require some interconnection modifications. *Fig.* 8 illustrates a method of switching which requires only one control and permits power to reach only those units in use. Almost every component used in home systems is included in the block diagram. For simplicity, the tape recorder is shown

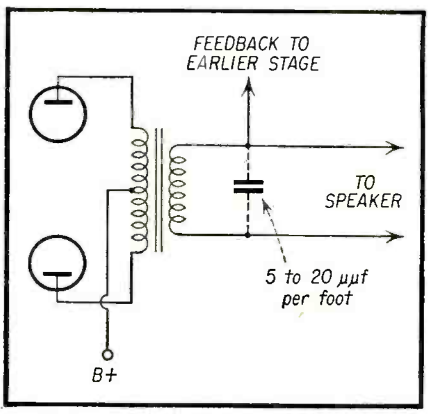

Fig. 9—Unwanted capacitance may be introduced if long speaker leads are used with feedback amplifier.

connected for play-back. The individual instruction sheets of the various manufacturers should be consulted when setting up the system for tape-recording from the various sound sources. Notice that antenna switching, if necessary, can be provided. If a balanced 300 ohm line is used, an extra wafer must be added. The other side of the twin lead should then be connected to corresponding positions on the added wafer. Both sides of the line should be adequately fused since some amplifiers and tuners are not individually fused.

Secondly, an attempt should be made to avoid the duplication of volume and tone controls. With two bass, treble and volume controls to play with plus an equalizer, even Job would give up and go to a concert. Also, the less units with controls, the fewer front panel cutouts needed. If there are volume controls on both the radio tuner and on one of the other components (which is usually the case), the control at the highest sound level point in the chain should be replaced with a fixed resistor equal to the maximum value of the control. Both noise level and harmonic distortion can be reduced somewhat in this way.

Thirdly, adequate provisions for the ventilation of the high-powered units in the system should be provided. This first rule, in this connection, is to keep the cabinets at least four inches away from the wall, where possible. Also, when it doesn't interfere with the appearance of the installation, no back

[*Continued on page 60*]

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YOUR HI-FI EQUIPMENT GUIDE

Based on information from THE AUDIO FAIR DIRECTORY

Manufacturers	FM-AM Tuners	Amplifiers	Phono Pickups & Styli	Tone Arms	Turntables & Motors	Record Players	Tape Recorders	Loudspeakers	Enclosures & Cabinets	Special Items (transformers, etc.)
ACRO PRODUCTS CO., Philadelphia, Pa.										*
ALPHA WIRE CORP., N. Y., N. Y.										*
ALTEC LANSING CORP., N. Y., N. Y.	*	*						*	*	*
AMPEX ELEC. CORP., Redwood City, Cal.		*					*			
AMPLIFIER CORP OF AMERICA, N. Y., N. Y.		*					*			
AMPRO CORP., Chicago, Ill.							*	*		
ANGLE GENESEE CORP., Rochester, N. Y.									*	
ARGOS PRODUCTS, Genoa, Ill.									*	
AUDAK COMPANY, N. Y., N. Y.			*	*						*
AUDIO DEVICES, INC., N. Y., N. Y.			*				*			*
AUDIO EXCHANGE, INC., Jamaica, N. Y.										*
AUDIO & VIDEO PRODUCTS CORP., N. Y., N. Y.							*			*
AVCO MFG. CORP., Cincinnati, Ohio										*
BEAM INSTRUMENTS CORP., N. Y., N. Y.		*						*	*	*
BELDEN MFG. CO., Chicago, Ill.										*
BELL SOUND SYSTEMS, INC., Columbus, Ohio		*					*	*		
BERLANT ASSOCIATES, Los Angeles, Cal.							*			*
DAVID BOGEN CO., INC., N. Y., N. Y.	*	*				*			*	*
R. T. BOZAK CO., Stamford, Conn.								*		
BRITISH INDUSTRIES CORP., N. Y., N. Y.		*				*		*	*	*
BROCINER ELECTRONICS LAB., N. Y., N. Y.		*						*	*	
BROOK ELECTRONICS, INC., Elizabeth, N. J.		*								
BROWNING LABS., INC., Winchester, Mass.	*									
COLLARO RECORD CHANGERS (see ROCKBAR CORP.)						*				
COLLINS AUDIO PRODUCTS, Westfield, N. J. (Kits)		*								
COLUMBIA RECORDS, INC., N. Y., N. Y.					*					*
CONRAC, INC., Glendora, Cal.										*
COOK LABORATORIES, INC., Stamford, Conn.		*								*
DAYSTROM ELEC CORP., Crestwood Recorder Div., Poughkeepsie, NY							*			
DuKANE CORP., St. Charles, Ill.							*			
DUOTONE CO., INC., Keyport, N. J.			*					*		*
ELECTRO-VOICE, INC., Buchanan, Mich.			*					*	*	*
ESPEY MFG. CO., INC., Englewood, N. J.	*	*								
FAIRCHILD RECORDING INSTRUMENT CORP., Whitestone, NY		*	*	*	*					*
FERRANTI ELECTRIC, INC., N. Y., N. Y.			*	*						*
FISHER RADIO CORP., Long Island City, N. Y.	*	*								
FREED-EISEMANN RADIO CO., N. Y., N. Y.	*	*								
GARRARD RECORD PLAYERS (see BRITISH INDUSTRIES)						*				
GATELY DEVELOPMENT LAB., Barrington, N. J.								*	*	
G & H WOOD PRODUCTS CO., (Cabinart) Bklyn, N. Y.									*	
GENERAL ELECTRIC CO., Syracuse, N. Y.		*	*	*				*		*
GOODMAN INDUSTRIES (Willgold Elec Sales Corp.) N. Y., N. Y.								*		
GRAY RESEARCH & DEVELOPMENT CO., Manchester, Conn.		*		*						
GROMMES AMPLIFIERS (see PRECISION ELECTRONICS)		*								
H. A. HARTLEY CO., INC., N. Y., N. Y.	*					*		*	*	
THE HALLICRAFTERS CO., Chicago, Ill.	*	*								
HARVEY-WELLS ELECTRONICS, INC., Southbridge, Mass.	*					*				*
HEATH COMPANY, Benton Harbor, Mich. (Kits)	*	*				*				*
JENSEN MFG. CO., Chicago, Ill.			*					*	*	*
HARMON KARDON, N. Y., N. Y.		*								
KARLSON ASSOCIATES, INC., Bklyn, N. Y.									*	
THE KELTON CO., INC., Cambridge, Mass.	*	*	*			*			*	
KINGDOM PRODUCTS, LTD., N. Y., N. Y.						*		*	*	*
KLIPSCH EASTERN, INC., N. Y., N. Y.								*	*	*
KLOSS INDUSTRIES, Cambridge, Mass.								*	*	
LANGEVIN MFG. CORP., N. Y., N. Y.		*								*

Manufacturers	FM-AM Tuners	Amplifiers	Phono Pickups & Styli	Tone Arms	Turntables & Motors	Record Players	Tape Recorders	Loudspeakers	Enclosures & Cabinets	Special Items (transformers, etc.)
JAMES B. LANSING SOUND, INC., Los Angeles, Cal.								*	*	
LEAK POINT ONE AMPLIFIERS (see BRITISH INDUSTRIES)		*								
LIVINGSTON ELECTRONICS CORP., Livingston, N. J.				*						*
MADISON RADIO SOUND, Madison, N. J.		*								
MAGNECORD, INC., Chicago, Ill.							*			*
JEFF MARKEL ASSOCIATES, N. Y., N. Y.									*	
H. S. MARTIN & CO., Evanston, Ill.	*	*								
McINTOSH LAB., INC., Binghamton, N. Y.		*								
MEASUREMENTS CORP., Boonton, N. J.										*
MINNESOTA MINING & MFG. CO., St. Paul, Minn.										*
MOTOROLA, INC., Chicago, Ill.	*					*				
THE NATIONAL COMPANY, Malden, Mass.	*	*								
NEWCOMB AUDIO PRODUCTS CO., Hollywood, Cal.		*			*	*				
ORRADIO INDUSTRIES, Opelika, Ala.										*
PENTRON CORP., Chicago, Ill.	*	*					*	*		*
PERMOFLUX CORP., Chicago, Ill.								*	*	*
PICKARD & BURNS, INC., Needham, Mass.								*	*	*
PICKERING & CO., INC., Oceanside, N. Y.		*	*	*						
PILOT RADIO CORP., Long Island City, N. Y.	*	*								*
PORTABLE GRAMAPHONE CO., INC., N. Y., N. Y.								*		*
PRECISION ELECTRONICS, INC., Franklin Park, Ill.		*								*
PRESTO RECORDING CORP., Paramus, N. J.					*		*			*
RADIO CORP OF AMERICA (RCA Victor Div.) Camden, N. J.	*	*				*	*	*	*	*
THE RADIO CRAFTSMEN, INC., Chicago, Ill.	*	*				*		*		
RADIO ENGINEERING LABS., INC., Long Island City, N. Y.	*									
RADIO WIRE TELEVISION INC., (LAFAYETTE) N. Y., N. Y.										*
REEVES SOUNDCRAFT CORP., N. Y., N. Y.			*							*
REGENCY DIVISION, (I. D. E. A., INC.) Indianapolis, Ind.		*								
REK-O-KUT CO., Long Island City, N. Y.					*	*				*
REVERE CAMERA CO., Chicago, Ill.							*			
RIVER EDGE INDUSTRIES, River Edge, N. J.									*	
R-J ENCLOSURES (see BRITISH INDUSTRIES)									*	
ROCKBAR CORP., N. Y., N. Y.			*		*	*			*	
HERMAN HOSMER SCOTT, INC., Cambridge, Mass.		*								*
SHIELDS LABS., INC., Pittsburgh, Pa.		*							*	*
MARK SIMPSON MFG. CO., Long Island City, N. Y.		*					*			*
SONEX, INC., Upper Darby, Pa.		*								
SONOTONE CORP., Elmsford, N. Y.			*							
STEPHENS MFG. CORP., Culver City, Cal.		*						*	*	*
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TANNOY CANADA LTD., London, England								*		*
TECHMASTER CORP., N. Y., N. Y. (Kits)		*								
TELECTRO INDUSTRIES CORP., N. Y., N. Y.							*			
THE TETRAD COMPANY, Yonkers, N. Y.			*							
THORENS CO., New Hyde Park, N. Y.	*					*				*
ULTRASONIC CORP., Cambridge, Mass.		*				*		*	*	
UNITED TRANSFORMER CO. (UTC), N. Y., N. Y. (Kits)		*								*
UNIVERSITY LOUDSPEAKERS, INC., White Plains, N. Y.								*	*	*
UTAH RADIO PRODUCTS CO., INC., Huntington, Ind.								*	*	
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V-M CORP., Benton Harbor, Mich.						*				
WEATHERS INDUSTRIES, Barrington, N. J.			*							*
WEBSTER-CHICAGO CORP., Chicago, Ill.						*	*			
WHARFEDALE LOUDSPEAKERS (see BRITISH INDUSTRIES)								*		
WHITE SOUND, INC., Chicago, Ill. (Kits		*						*		*
ZENITH RADIO CORP., Chicago, Ill.						*				

This chart has been prepared as a service to the trade by the editors of RTSD. Note: some tuners include preamplifiers; some do not. Consult manufacturer's specifications before setting up the entire system. Column headed "amplifiers" includes record-equalizers, preamps, and power amps. Column headed "record players" includes manual (single-play) assemblies as well as automatic changers. Some tape recorders do not contain their own power amp and loudspeaker, but rather use the same amplifier and speaker that the tuner and record-player use. Again, to avoid waste of money, time, and labor, do not purchase and begin putting together the components of a system before you have thoroughly checked the specifications and discussed them with your client.

Color Stripe Signal

Provides Color Signal Check on Black and White Transmissions

Fig. 2—Color stripe appears as light green bar. On black and white sets bar is almost invisible.

THE new color stripe generator developed by the Radio Corporation of America for use by television stations is a major step toward solving the problem of satisfactorily installing color TV receivers in homes despite the relatively few hours of color programming presently being aired. The new unit, which is of relatively simple design and can be installed by a television station for approximately $500, will add a narrow color stripe to the station's regular black and white television signal during station breaks. The color stripe, practically unnoticeable on black-and-white receivers, will enable the receiver serviceman who is making a color television receiver installation to determine whether the station's color signal is reaching the receiver.

The RCA Color Test Generator is designed to be inserted in the video line feeding the television transmitter in such a way that the normal system operation is not changed in any way. The normal signal at this point in the system is a composite (video and sync) monochrome signal such as that shown in (a) of *Fig. 1*. The inserted Color Test Generator does not change this basic signal at all but simply adds to it a small amount of color information. This information consists of (1) a color sync "burst" signal which appears on the "back porch" of the regular monochrome sync pulse and (2) a short test "burst" of color signal which is superimposed on the monochrome video signal at the right side of the raster as shown in (b) of *Fig. 1*.

Monochrome receivers are relatively "blind" to these added signal components because most receivers have relatively low response at 3.6 *mc*. In a *color* receiver, however, the color sync signal and color test burst signal operate to generate a single greenish-yellow bar (¼ to ⅜" wide) at the extreme righthand side of the picture on a 15" Kinescope.

On a color receiver, this bar will appear with the color gain control advanced as for a normal color picture. With the color control turned down, a normal black/white picture will result. Naturally, during a color transmission the color bar will be deleted. On a monochrome transmission however—even for such brief periods as station breaks (5—15 seconds)—this color bar will provide a color test signal of inestimable value to the service technician. Here, within a few seconds, he will have a signal that will provide a complete system check. If the color bar is not apparent in its true color and intensity, it will be an indication that additional work is needed at that location, apart from the receiver. This work (antenna change, relocation or reorientation, distribution check, termination, etc.) could well be scheduled before the next transmission of the color bar. In any event, this simple color test signal would provide a conclusive check on the over-all receiving system at any customer's location. Likewise, the customer, too, would have this same "tool" available to him to determine whether service was needed well in advance of a scheduled color program transmission.

Description of the RCA Color Stripe Generator

A block diagram of the RCA Type WA-8A Color Stripe Generator is shown at the right in *Fig. 1*. Referring to this diagram the operation is as follows:

The input video signal is fed to a "sync separator" which amplifies the signal, then strips off the picture part of the signal, leaving only the sync signal to be passed on.

The "pulse width discriminator", to which the signal is next fed, blocks off the equalizing and vertical sync pulses, leaving only the horizontal sync pulses.

The separated horizontal sync pulses are used in two ways. First, they are fed to a "burst keyer amplifier and shaper" which amplifies and shapes these pulses and passes them on to a "gate" circuit. Here these pulses allow bursts of subcarrier frequency to go through to the output amplifier at just the right time for these bursts to appear on the back porch of the standard monochrome horizontal sync signals. Thus positioned they provide color sync signals of the type specified by the new FCC Color TV Standards.

The second use made of the separated horizontal pulses is to trigger a "delay" circuit which in turn triggers a "pic-

[*Continued on page* 56]

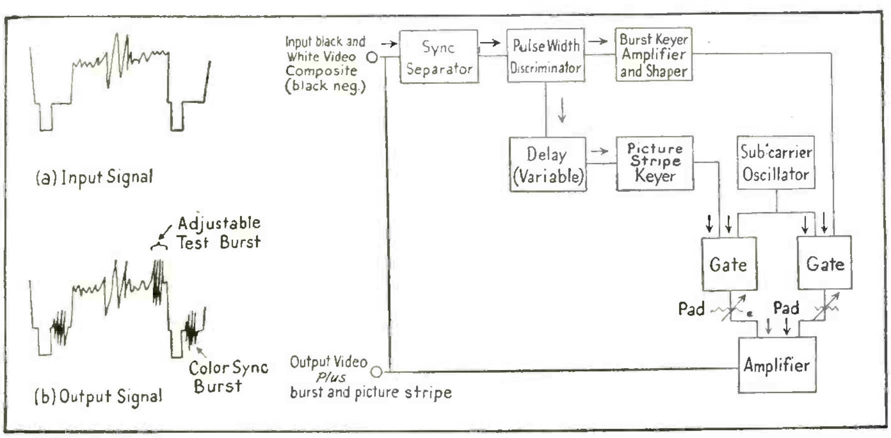


Fig. 1—Signal input and output to color stripe generator is shown at left. Block diagram of generator at right.

The Work Bench

by Paul Goldberg

ORDINARILY, sound troubles in the television receiver don't seem to give the serviceman too much trouble. However, occasionally the serviceman comes across an audio problem which can give him more than a few new grey hairs. The following case histories are typical examples.

Admiral 20V1: Buzz

The first problem dealt with an Admiral 20V1. When the set was turned on it played normally. However, after about 20 minutes a loud buzz was heard. It sounded like trouble in the ratio detecter. See *Fig. 1*

First, a few preliminary checks were made. Varying the vertical hold control had no effect on the pitch of the buzz. Thus, the vertical section was eliminated as a source of the trouble. Varying the fine tuner caused the buzz to come and go. On station, however, the picture quality was good while the buzz remained.

The 6AL5 was replaced and the ratio detecter transformer secondary slug was adjusted for minimum buzz. The set now seemed to play properly.

About 20 minutes later, the buzz returned. The trouble was definitely in the ratio detecter. But what was causing the drift? Looking at the diagram it seems logical to suspect *C204*-180 *uuf*. And so it was replaced together with the old 6AL5. Naturally, with a new capacitor the ratio detecter transformer had to be realigned for minimum buzz.

After this was done the set was again left to cook. Imagine our dismay when a half hour later the buzz came back as usual. From previous experience it was known that this particular Admiral 20V1 had a few modifications that were recommended. We looked them up and found that a 20 *uuf* minus 750 temperature coefficient ceramic condenser placed in parallel with *C204* was recommended for a drifting ratio detecter.

The 20 *uuf* condenser was installed and again the ratio detecter transformer had to be realigned, both primary and secondary, for minimum buzz. The set played well for about two hours when the buzz came back again.

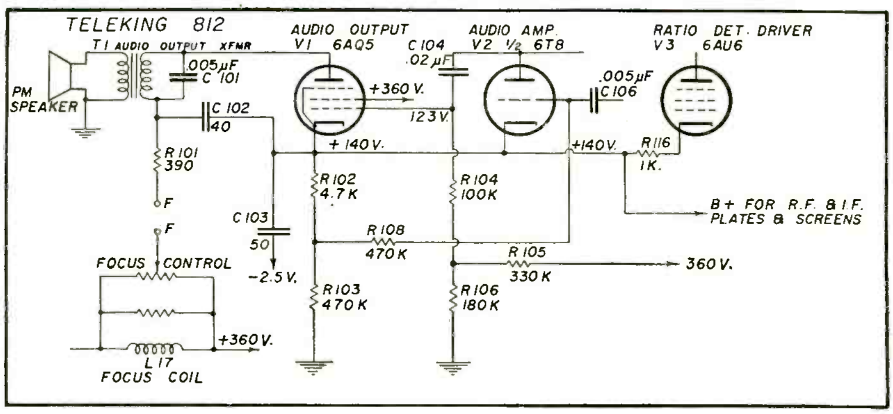


Fig. 2—Partial schematic of sound section of Tele-King Model 812. Note that +140 volt connection is obtained at cathodes of tubes.

We were about to commit suicide but before doing so, we got the idea that the ratio detecter transformer (T201) could be the cause of this trouble. So, without further hesitancy, the part number of T201 was looked up. While doing this, an important bit of information was noticed, namely, that C204 was also a minus temperature coefficient capacitor.

It then dawned on us that the *replacement* condenser 180 *uuf* (C204) which was still in the set was not a temperature compensated condenser. The original condenser was then installed and again the ratio detecter transformer was realigned for minimum buzz. The television set played all that day and the next without drifting. The writer then gave due thanks, made out the bill, and returned the set to the customer.

Tele-King 812: Distortion

The second problem involved a Tele-King 812. After the TV receiver had played a few minutes the sound became distorted. We first varied the fine tuner to see if the sound would clear up. As the sound remained distorted and as there was no buzz at the "on station" setting of the fine tuner, it was assumed that the trouble was in the audio section of the receiver. See *Fig. 2*

The diagram showed that V1, V2, V3 in the sound section were the tubes whose cathodes were connected in series with the 360V B+ supply. Thus a 140 volts B+ source was made available at the cathodes for the plates and screens of the *rf* and *if* tubes.

We also saw that *R106* and *R105* formed a bleeder network to bias the grid of the 6AQ5 (V-1) at about 17 volts negative with respect to cathode, or at about 123 volts positive to ground. Moreover, the 6AQ5 acts as a voltage regulator by keeping the 140 volts *rf-if*

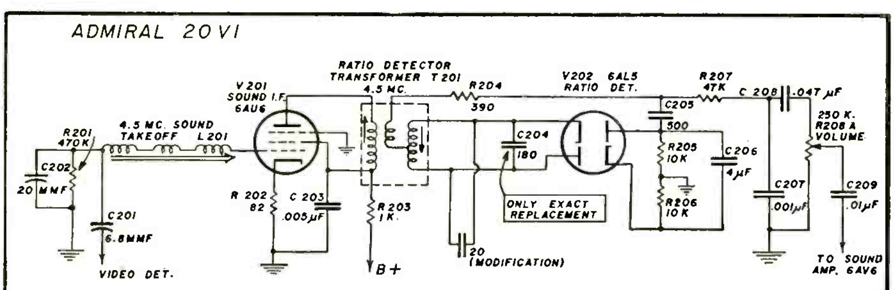
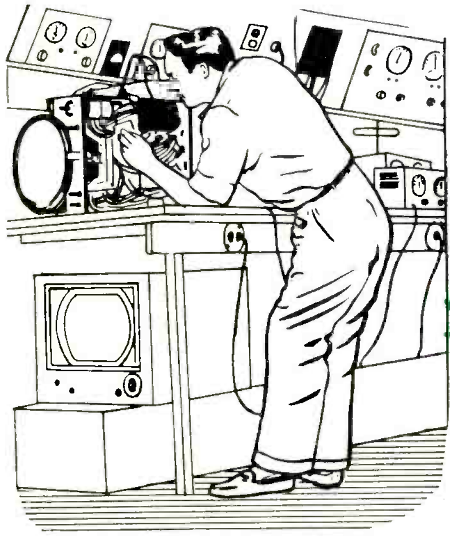


Fig. 1—Partial schematic of sound section of Admiral Model 20V1. Note modification insertion and Exact Replacement Only indication.



This Month:

SOUND PROBLEMS

supply constant. It does this through *R102* and *R103*. For example, if the 140 volts happens to increase, this automatically makes the 6AQ5 cathode more positive with respect to the grid, thus decreasing the cathode current flow. This in turn decreases the voltage drop across the cathode load *R102* and *R103*. This decrease in voltage will now be just enough to offset the previous increase in cathode voltage.

We have discussed this series cathode voltage dropping method because it is used similarly in so many other television receivers. Now with all this in mind we first replaced V1 and V2 individually but this did not solve the situation. We then measured the grid to cathode voltage of the audio output tube V1 (6AQ5). It measured about 40 volts positive.

Here was an irregularity. As was stated before, the voltage should have measured about 17 volts negative to cathode. First we checked *C104*, .02 *uf* for leakage. It checked satisfactorily. Next we checked the voltage divider network *R105* and *R106*. *R105* checked accurately at about 330K, but *R106* which was supposed to be 180K measured about 350K. It now can be seen why the 6AQ5 grid-to-cathode measured 40 volts positive. The voltage developed across *R106* was now at about half of the 360 volt B+ supply or 180 volts, and the cathode was at 140 volts. Thus the grid was 40 volts positive. *R106* was then replaced with a new 180K resistor and the sound was no longer distorted.

Motorola TS95: Sound distorted at high volume control setting

The third problem concerned a Motorola TS95. The set came into the shop with the complaint that when the volume control would be turned up toward maximum, the sound would distort. However, at a normal setting the sound was fine. This condition had existed since the day the set was installed.

First, a new speaker was connected in place of the old one. (As you probably have experienced, a defective voice coil can operate properly at normal volume but at maximum volume will tend to rub and give a nasal quality.) However, the same condition prevailed.

The 6J5 and 6V6 were replaced individually but this too did not solve the situation. The volume control *R31B* was then checked for any defects but none were found. The coupling condenser (*C54*) to VII was then checked for leakage. See *Fig.* 3

Occasionally, condensers leak only at maximum input. But *C54* checked okay. We now decided to check *C53*, the coupling condenser to the 6J5, but alas, this condenser was missing. *R44*, the grid resistor (4.7 meg) was also missing. It was observed that the center arm of the volume control fed the 6J5 grid directly.

We immediately installed *R44*, and *C53* and turned the set on. The volume control now varied from minimum to maximum without any distortion.

R44 and *C53* are not only the coupling network but also provide grid bias. With *R44* and *C53* out of the circuit, the voltage across the volume control, *R31B*, when at a maximum, would drive the 6J5 to draw grid current, thus causing sound distortion.

In rechecking the operation of the volume control it was observed that at a minimum setting there was a pronounced buzz which we had not noticed before. However, at normal and maximum volume control settings there was no buzz. The vertical hold control was varied, which varied the pitch of the buzz. Naturally, we concluded this to be vertical buzz.

From experience, we remembered that a glass 6J5 (V10) was not called for in this receiver. It was then replaced with a metal 6J5 *the shield of which is grounded*. This change put an end to the vertical buzz problem.

In this receiver, the audio circuits run extremely close to the vertical circuits. This is the reason for the metal tube. We believe it very important to *replace the original tubes with the exact duplicate; even with regard to whether it is glass or metal*. In audio circuits hum and buzz pick-up are very probable if this is neglected.

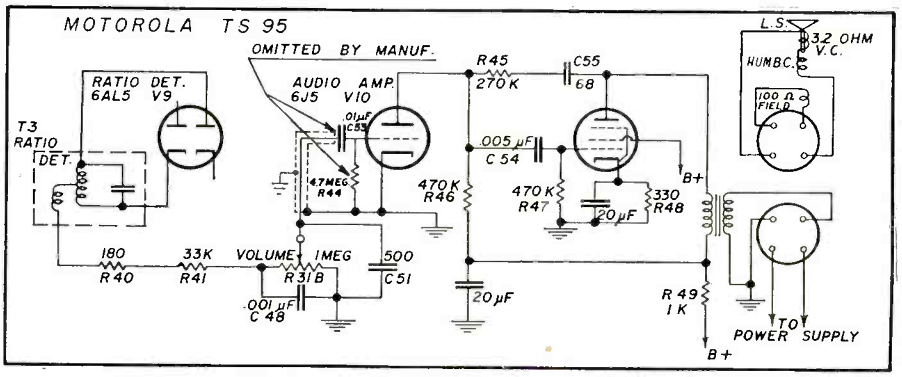
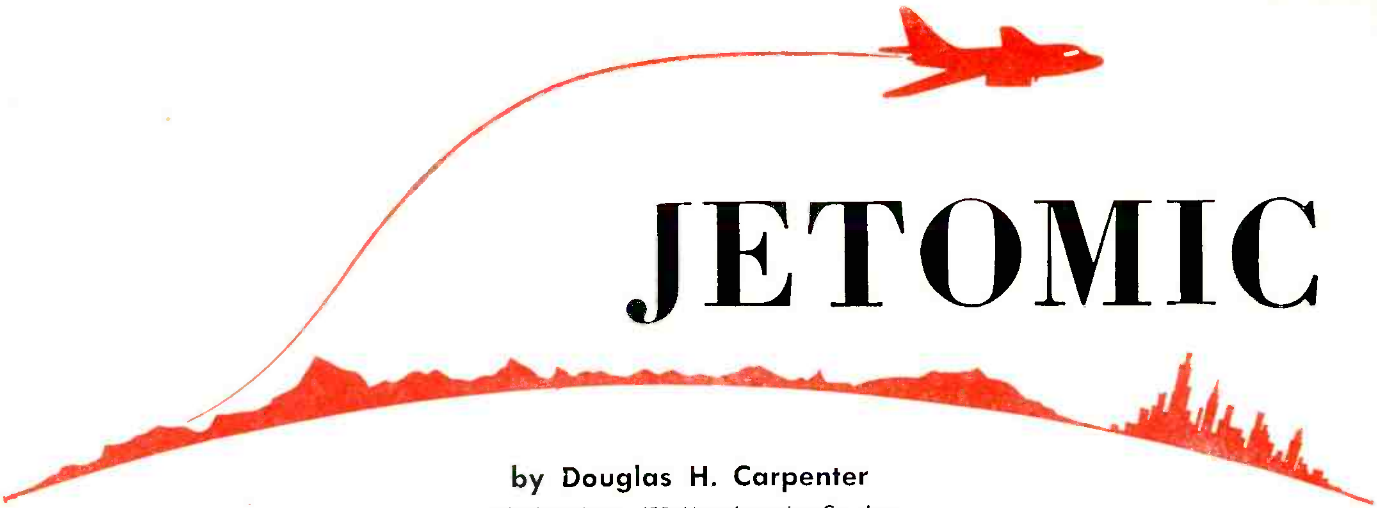


Fig. 3—Partial schematic of sound section of Motorola TS 95. Observe where components were omitted. Use metal or shielded 6J5.



JETOMIC

by Douglas H. Carpenter

Chief Engineer, JFD Manufacturing Co., Inc.

ULTRA high frequency telecasting has created many new installation problems for the television service technician. Basically, every dealer must make a choice between two different types of conversion techniques. A good percentage of existing consumer receivers employ turret tuners, where a *uhf* strip can be inserted for reception of the new ultra high frequency channel. The alternative to this procedure is of course to use a separate converter in conjunction with the TV set, permitting reception of all channels in this new *uhf* range. I can appreciate that this is fairly common knowledge to the reader, but

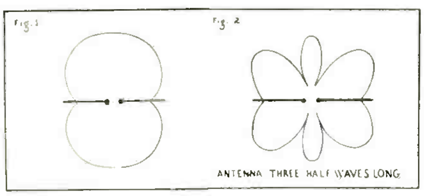


Fig. 1—(left)—Simple dipole antenna and its radiation pattern.
Fig. 2—(right)—3/2 wavelength ant. and its radiation pattern.

it is emphasized because at this point the dealer has made a decision as to the type of outside receiving installation he is going to make to get the best possible television pictures for his customer.

Other factors that will affect this selection include future *uhf* assignments; the possibility of *vhf* channel changes, and new *vhf* channels coming on the air. The procedure of adding a separate *uhf* antenna requires the use of an additional transmission line. In the interests of economy the new *uhf* antenna is almost invariably mounted below the existing *vhf* array, in the worst possible signal location. Of course additional stand-offs and associated hardware must be used, and we still have two leads for one set of receiver terminals. The problem of connecting these two leads to the receiver can be solved by installing a switch or separation filter at the antenna input terminals of the TV set. If a low loss separation filter were available, this would be an ideal solution as it would allow automatic operation of the individual antenna systems.

It is this author's opinion that there is no filter yet developed that will efficiently isolate a *vhf* and *uhf* antenna without excessive loss, particularly in the *uhf* range. The filter could of course be installed at the antenna and a single lead line brought down to the receiver. The saving through such practice is questionable however, as a new low loss line must be used for *uhf*. This new transmission line will carry both *vhf* and *uhf* signals, and the original flat ribbon line removed. The filter type *vhf-uhf* installation is restricted to areas of high signal from the *uhf* transmitter where the inherent losses of the filter can be tolerated.

It might be interesting at this point to resolve some of the factors involved in the strip tuner *vs* the converter type installation. In the case of the strip tuner the set sensitivity is just as good as a *uhf* converter placed between the antenna and receiver. The strip tuner TV set has only one set of antenna

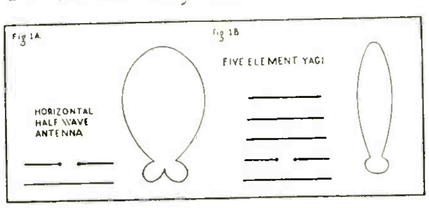


Fig. 1a—(left)—Reflector added to simple dipole antenna above.
Fig. 1b—(right)—Directors added.

terminals necessitating the use of a separation filter at the antenna or receiver. The fixed loss of the filter will cut down the amount of *uhf* signal arriving at the set. Whether this is serious or not from an operational standpoint depends again upon the original amount of *uhf* signal available. The converter on the other hand has two sets of terminals and the *uhf* and *vhf* antennas may be connected independently without filter loss. This in turn explains why in many cases converters have been used on sets that were designed to take *uhf* channel strips. The net result is a more costly installation; the requirement of tuning and switching the converter, and the natural objection of having an additional piece of equipment on top of the television set.

The ideal solution would be to have the entire range of signals from Channels 2-83 available on a single transmission line without resorting to the use of lossy filters, or the need of an entirely individual *uhf* installation. In the past the basic limitation has been in the television antenna system. At-

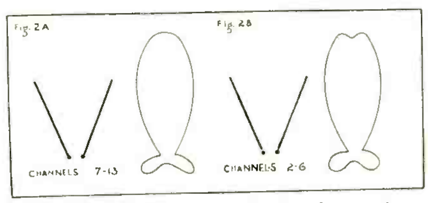


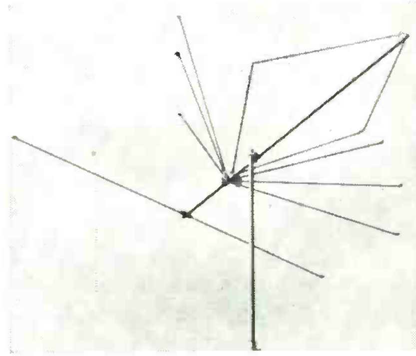
Fig. 2a—(left)—Tilted dipole and its radiation pattern.
Fig. 2b—(right)—Response characteristics of antenna for Ch. 2-6.

tempts at designing a single array for this wide range of frequencies were not very successful because of the problems involved in maintaining a constant unidirectional radiation pattern. It is the purpose of this article to describe a successful *uhf-vhf* antenna, and the engineering reasoning that went into its design.

Before describing the JFD Model 454 I would like to review the operation of the dipole antenna at its fundamental and harmonic frequencies. Although I can appreciate that this is probably common knowledge to the reader, it will serve to illustrate how the long wire or V type antennas are developed.

In *Fig. 1* we have a simple dipole antenna and its characteristic radiation pattern at resonance. It will be noted that the pattern is bi-directional with the plane of maximum radiation (or signal pick-up) at right angles to the axis of

ANTENNA



Basic Jetomic Antenna. Details of this unusual antenna illustrated in text.

Evolution and description of new All-Channel (2 to 83) High Gain Antenna

the antenna proper. Minimum signal will of course be received at the antenna ends. This condition will be true for only one frequency, and restricts the use of the dipole antenna for a maximum of one television channel.

If we wished to raise the gain of the dipole at this frequency and to cut off one lobe a reflector may be placed behind the dipole. As illustrated in *Fig. 1a* the response is now uni-directional and the response from the back of the antenna is eliminated. To further narrow the beam width and increase gain directors may be added. The response now becomes that of *Fig. 1b*.

Although we have a high gain uni-directional antenna its use is restricted to the basic frequency range of the simple dipole. In the design of a broad band antenna the use of any type of straight dipole is impractical because of this limitation.

Figure 2 shows the same dipole (of *Fig. 1*) at three times its resonant frequency. The reader will note that the polar pattern now consists of four major lobes located at roughly 45 degree points in relation to the antenna axis.

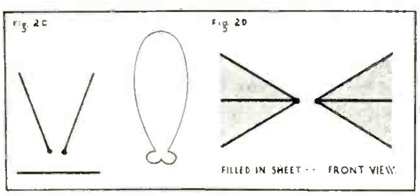


Fig. 2c—(left)—Tilted dipole with reflector showing pattern. Fig. 2d—(right) — Four additional elements added to "V" antenna.

This pattern would be of course unusable, as the antenna gain is distributed and not additive as in the resonant condition. To place some practical values on these two conditions let us assume that the resonant response of *Fig. 1* occurs at Channel 3, and the third harmonic condition at television Channel 9.

In the drawing of *Fig. 2a* we have the same dipole in a different mechanical form. Here the dipole elements have been tilted forward to form a V. As we shift the mechanical elements of the dipole we have shifted the polar response. If we consider first the operation on the third harmonic it will be noted that we no longer have four major lobes, but rather a single lobe polar pattern (*Fig. 2a*). The effect of tilting the dipole elements forward has been to superimpose the forward dipole lobes into a single pattern. It must be remembered that although the dipole was one half wave length long at its funda-

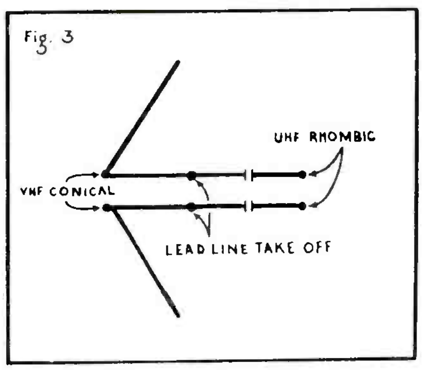


Fig. 3—Filter employed in Jetomic.

mental resonant frequency it is three half wavelengths long at the third harmonic frequency or in our case Channel 9. Since we have an extended wavelength antenna we automatically have power gain, as the signal collecting area has been increased as compared to a dipole cut for this same frequency.

The third harmonic condition is simply a matter of design angles, and not difficult to accomplish for the frequencies under consideration. When we alter the polar response at the third harmonic we have of course changed the pattern at the resonant condition. Reference to the drawing of *Fig. 2b* indicates much the same response as we had in the original resonant condition of *Fig. 1*. The major difference being that now there is a slight dip in the forward portion of the curve.

To review exactly what has happened the reader must visualize the right hand side of the original dipole response being moved to the left and the left hand side of the curve to the right. To satisfy the angle requirements of the third harmonic operation, the polar pattern at the half wave resonant condition is altered. In much the same manner as the gain and pattern response of the simple dipole was improved in *Fig. 1a*, a reflector is added and our resonant pattern becomes that of *Fig. 2c*. Here, the dip in the forward portion of the pattern has disappeared, the lobe has been narrowed and the back lobes have been minimized.

Although it might seem at this point that we have satisfied the requirements of a broad band antenna for channels 2-13 there is still another consideration that must be met for extended frequency operation. The operation of a broad band antenna requires a uni-directional response on all channels between 2 and 13; gain considerably above that of the simple dipole, and a close match to a standard 300 ohm line. The antenna of *Fig. 2c* consists of a single

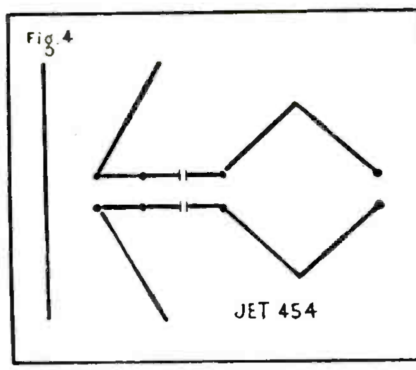


Fig. 4—Filter incorporated in complete Jetomic antenna assembly.

V and reflector, and has a variable impedance at the lead line connecting points. The Q of this antenna particularly of channels 7-13 is very high with a resulting impedance much higher than the required 300 ohm line.

In order to lower the Q of any antenna the easiest method is to raise the diameter of the elements. To cover the entire range between Channels 2 and

[*Continued on page* 54]

RC CIRCUITS

by Cyrus Glickstein

This third installment examines the time-constant, differentiating action, and other characteristics of series-parallel resistor-condenser networks.

EVERY basic type of series-parallel RC circuit acts differently from a simple series RC circuit—and differently from each other. The first series-parallel RC circuit we will examine *(Fig. 13)* illustrates this. To compare the action better, let's summarize briefly the action in the simple circuit show in *Fig. 14*.

In a simple series RC circuit, *Fig. 14*, there is no voltage across the condenser and the full battery voltage appears across the resistor at the instant the switch is closed. Maximum current flows. Then, as the condenser charges, the voltage across the condenser builds up and the voltage across the resistor drops. Current flow becomes smaller and smaller. After 5 RC, current in the circuit stops. The condenser has charged up to the full battery voltage and is equal to and opposite to (bucking) the battery voltage. There is no longer any voltage across the resistor.

The circuit in *Fig. 13* acts similarly in some respects but quite differently in others. At the instant the switch is closed in this circuit, the uncharged condenser *C1* acts like a *short circuit* across *R1*. At this instant, there is zero voltage across *R1*, *C1* and the full battery voltage is across *R2*. The initial current which flows depends only on the battery voltage and the value of *R2*. Then the condenser starts to charge. As *C1* charges, the voltage across the condenser, and therefore across *R1* in parallel, rises—while the voltage across series resistor *R2* drops. If the switch is kept closed, the condenser charges up to a certain voltage, which is *less* than the battery voltage. The amount of voltage to which the condenser charges depends on the value of *R1* and *R2*. The two resistors act as a voltage divider. If *R1* is one-half of the *total* resistance *(R1 = R2)*, then *C1* charges up to *half* of the battery voltage. If *R1* is two-thirds of the total resistance *(R1 twice as large as R2)*, then *C1* charges up to two-thirds of the battery voltage, and so on. With the values of resistance shown in *Fig. 13*, the condenser charges up exponentially in the usual way to 40V, then stops charging, while the voltage across *R2* drops from full battery voltage to 80V. At this point, there is twice as much voltage across *R2* as across *R1*, since *R2* has twice the resistance of *R1*. Thereafter, a *steady current* flows through both resistors and there is a constant voltage across the condenser.

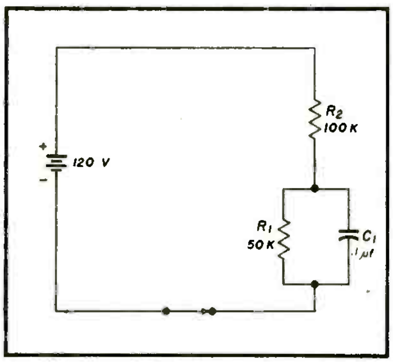


Fig. 13—Simple series-parallel r-c circuit for studying basic RC action.

The exact operation can be better understood by describing the action from the standpoint of current in the circuit. As in the simple series circuit, maximum current flows at the first instant. The amount of current depends on the source voltage and the resistance of series resistor *R2*. *R1* is effectively shorted by *C1*. This total initial current flows through *R2* and *C1*. Then *C1* starts to charge, and the current through both *C1* and *R2* drops.

However, since the voltage across the parallel resistor *R1* is rising (*C1* is charging), the current through *R1* must increase. *Whenever voltage across a resistor increases, the current through it increases.* Obviously, the current through *C1* must be falling faster than the current through *R1* is increasing. This must be true since the combined currents through *C1* and *R1* form the total circuit current which flows through *R2*. The total current through *R2* is falling since the voltage across *R2* is dropping. The condenser stops charging when the rising current through *R1* becomes equal to the falling current through *R2*. A steady current then flows through the resistors. This occurs when the voltage drops across the resistors become exactly proportional to the resistance.

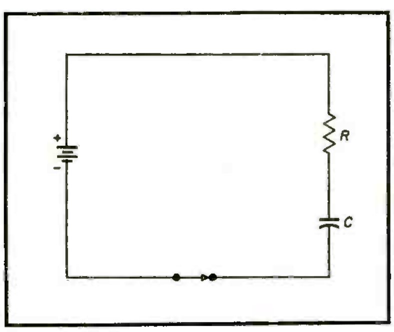


Fig 14—Simple series r-c circuit for comparing with that shown in Fig. 13.

Calculating Time Constant

To understand the operation clearly in terms of time constant, it is a simple matter to reduce the series-parallel circuit to an *equivalent* series RC circuit. On the basis of this analysis, we will see that a parallel resistor across the condenser has a simple effect on the time constant of the circuit, but a more complex effect on the output waveforms.

In the circuit, of *Fig. 15a*, maximum current flows through *C1* and *R2* at the instant the switch is closed. This current depends on the battery voltage and the resistance of *R2*.

$$I_{MAX} = E/R2 = 120/100{,}000 = 1.2 \text{ ma}$$

Also, after a certain period, *C1* charges up to 40V, then stops charging. No more current flows through *C1*, even though a steady current flows through the two resistors. From the standpoint of the condenser action, therefore, it is easy to figure out a series RC circuit which gives the same results. All we need is a 40V battery and a value of resistance that, with a 40V battery, gives 1.2 ma at the first instant. By simple Ohm's law ($R = E/I$) this is found to be a resistor of approximately 33,000 ohms. *Figure 15b* shows the series circuit which is the *equivalent* of the original series-parallel circuit considering *condenser action only*. In this equivalent circuit, the same initial current flows when the switch is closed (1.2 ma) and the condenser charges up to the same maximum voltage (40V) *in the same period of time.*

The equivalent circuit has a definite mathematical relationship to the original circuit. In the original series-parallel circuit, the voltage to which *C1* charges depends on the values of *R1* and *R2* and how they divide the source voltage. The resistors act as a voltage divider. Therefore, E_C (the *equivalent* source voltage across the condenser) is equal to:

$$E_C = R1/R_T \times E_T$$
$$= 50{,}000/150{,}000 \times 120 = 40V$$

It is interesting to note that the one resistor in the equivalent circuit is equal to the parallel value of the two resistors in the original circuit. (This will be discussed in greater detail shortly.) That is, 50K in parallel with 100K is equal to 33K. The equivalent resistance (R_{EQ}), that is, the single resistor in the equivalent circuit, is therefore equal to:

$$R_{EQ} = R_1 \times R_2/R_1 + R_2$$

This, of course, is the formula for the equivalent resistance of two resistors in parallel. To be very clear, these equations are useful simply to find an equivalent series RC circuit which has the same condenser-charging action, *which means the same time constant.* The time constant of the original series-parallel circuit therefore is:

$$T = R1 \times R2 \times C1/R1 + R2$$
$$= 33{,}000 \times .1 \times 10^{-6}$$
$$= 3300\ \mu sec$$

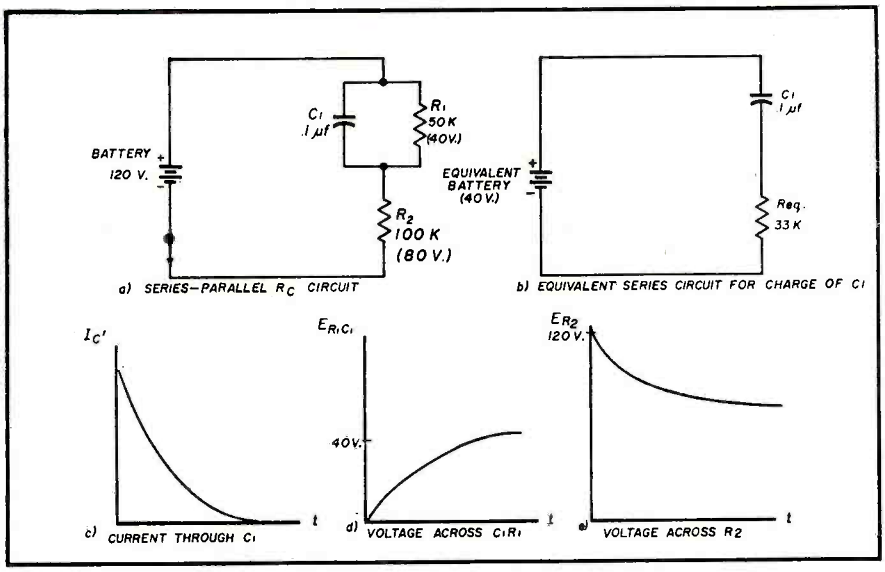


Fig. 15—Series-parallel r-c circuit of Fig. 13 reduced to equivalent series r-c circuit to show the charging action and time-constant waveforms.

This is exactly the same as the time constant of the equivalent series circuit ($T_{EQ} = R_{EQ} \times C1$).

Figure 15c shows the curve representing the change of current through *C1*, from maximum to zero, as the condenser charges to its final voltage. *Figure 15d* shows the voltage across *R1, C1* rising to its maximum value (40V) and remaining at that value. From the standpoint of current and voltage across *C1*, this action is very much like the action in a series circuit, except that the parallel resistor *R1* modifies (reduces) the time constant. The voltage across *R2* will be discussed shortly.

Let us assume now that *C1* in *Fig. 16a* has been charged to 40V while *S1* was closed and *S2* open. Then *S1* is opened and *S2* is closed. *C1* now discharges. Note that *C1* discharges through *two* paths, *R1* and *R2*, as shown by the dotted lines in *Fig. 16a.* This is equivalent to *C1* discharging through the two resistors in parallel as shown more clearly in *Fig. 16b.*

Analysis of Two Positions of R

It is interesting to note that *both for the charge and discharge period,* the two resistors act—as far as the time constant of the circuit goes—*as if they are in parallel.* In the discharge circuit, they definitely are in parallel. In the charge circuit, they are effectively in parallel. Let's see why. We know in a simple series RC circuit, the time constant is equal to $R \times C$. If we put a second resistor in parallel to the first one *(Fig. 17a)*, then the time constant is still $R \times C$ but now R is the parallel

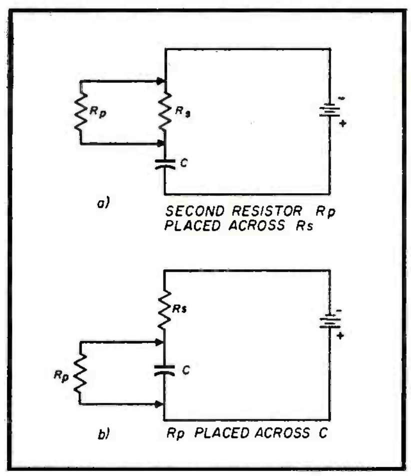


Fig. 17—R_p has same effect on time constant whether put across C or R_s.

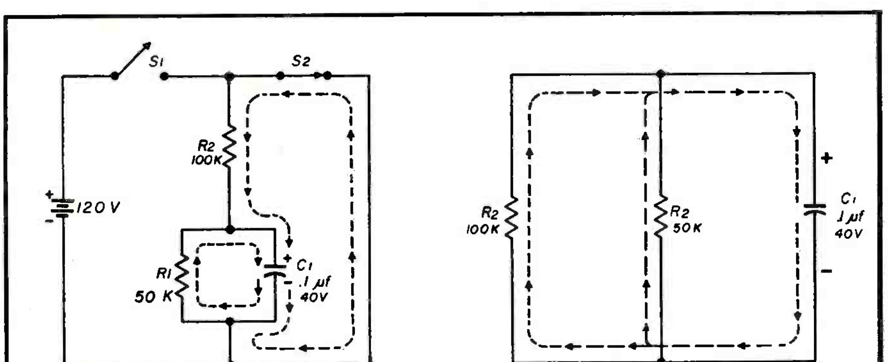


Fig. 16—Discharge action in series-parallel r-c circuit; (b) is equivalent circuit of (a). This circuit is same as shown in Fig. 13.

value of the two resistors—a smaller value than before.

Yet our formula above tells us that if we put the second resistor in parallel with the *condenser,* it has exactly the same effect on the time constant of the circuit as when we put it in parallel with the resistor. This becomes clear on a closer analysis of what happens in both cases.

Let's place a second resistor *Rp* across the condenser *C1 (Fig. 17b). Rp* is equal to *Rs* in this example. We don't change the *initial* charging current but we *reduce* by one-half the value of voltage to which the condenser can charge as compared to the original series circuit. The condenser therefore reaches 63% of full charge (and full charge) faster—to be exact, in one-half the time. The time constant of the circuit has been effectively cut in half.

If the equal resistor *Rp* is placed across *Rs (Fig. 17a),* then the initial charging current is *doubled,* since the total value of resistance is cut in half. The condenser charges up to the *same* source voltage. The condenser therefore charges twice as fast, and the time constant is again one-half of the simple series circuit value. Note that the same result is obtained, as regards time constant, by placing the second resistor in parallel with either the condenser or the first resistor.

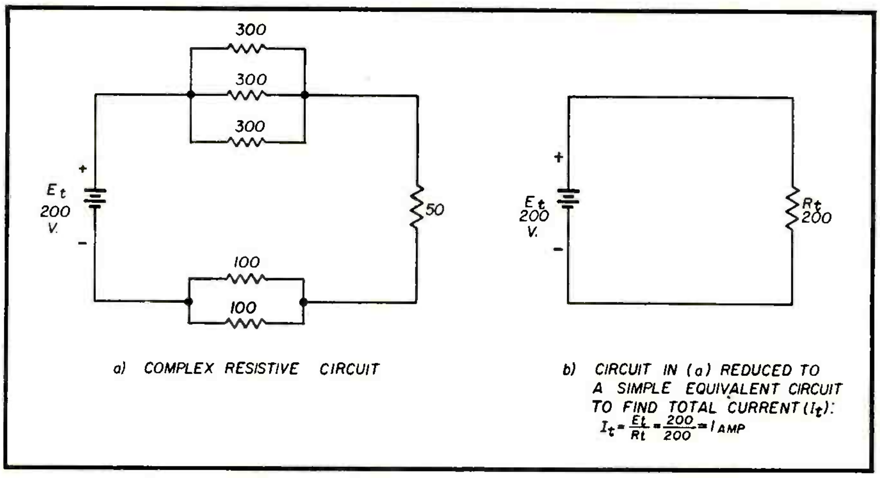


Fig. 18—Limitations of using "equivalent circuit": circuit n (b) gves total current, but no info on branches of circuit in (a).

Limitations of Using an "Equivalent Circuit"

In reducing a relatively complex circuit to a simple equivalent circuit, to follow the action more clearly, we have followed a common practice in radio and TV. However, when we use an equivalent circuit to find out one particular point, we don't thereby do away with the fact that the original circuit is a complex one. The simplified equivalent circuit does not provide *all* the answers. For the complex circuit of *Fig. 18a,* for example, the simple equivalent circuit of *Fig. 18b* can be used to find the total circuit current, but *not* the voltage drops across each individual resistor or the current in each branch of the original circuit.

In the same way, the equivalent series RC circuit clarifies the time constant of the more complex network as well as the condenser action but it does not clarify the entire action. We have seen that the parallel resistor in the series-parallel RC circuit we have examined has the same effect on the time constant whether it is placed in parallel with the condenser or the series resistor. We will now see that the parallel resistor has a noticeably different effect on the output waveform when it is in parallel with the condenser.

This occurs essentially because the voltage change across the series resistor *R2 (Fig. 15a)* in a series-parallel circuit is different as compared to the voltage across the resistor in a simple series circuit. In the simple series RC circuit, the voltage across the resistor drops to zero when the condenser is fully charged. On the other hand, in the series-parallel circuit, the voltage across *R2* drops from the battery voltage at the instant the switch is closed to some value of voltage depending on the voltage division between the two resistors. This is shown in *Fig. 15e.*

This action has very marked effects in *ac* circuits— especially differentiating and to a lesser extent, integrating circuits. For example, assume the time constant of a series-parallel RC circuit (like that in *Fig. 19a*) is short compared to one cycle of an incoming square wave signal. The signal is being taken off *R2* and is therefore being differentiated. (The circuit can have a short-time constant if *either* resistor is small enough, since the two resistors together are equivalent to parallel resistors in their effect on the charging of the condenser. However, if the parallel resistor *R1* is very large compared to the series resistor *R2,* the condenser *C1* would charge up to practically all of the source voltage. The voltage across *R2* drops to practically zero. The waveform across *R2* would be very close to a normal differentiated wave, *Fig. 19b.* On the other hand, if the values are reversed, and *R1* is small compared to the series resistor *R2,* then a differentiated waveform would *not* appear across *R2.* In this case, most of the voltage remains across *R2* as the condenser completes charging, and the output waveform across this resistor would be as in *Fig. 19c.*

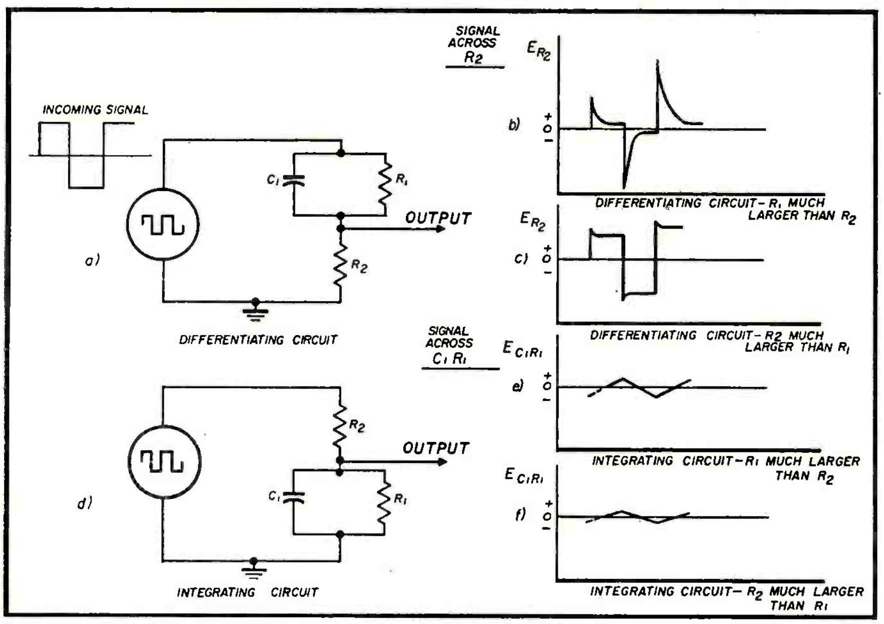


Fig. 19—Differentiating and integrating action in a series-parallel r-c circuit (parallel RC shown in series with R). Note different "output" points.

[To Be Continued]

TV INSTRUMENT CLINIC

PART 2

Based on CHALLENGE CLINIC demonstrations, this new series discusses many measurement and test problems raised by service technicians.

by ROBERT G. MIDDLETON
Field Engineer,
Simpson Electric Co.

WAVEFORM interpretations concerned with various conditions in TV receivers are the gist of the questions and answers in this month's installment of TV instrument Clinic. Dealt with are: ringing in horizontal output circuits, dot generators, hum in video amplifiers, and variations in the appearance of various types of waveforms.

Q. When I test current waveform through the horizontal deflection coils, a wiggle sometimes appears at the beginning of the sawtooth. What is the meaning of this wiggle?
A. The ringing condition noted is shown in *Fig. 1*. The ringing voltage is a damped sine wave which is caused by shock excitation of stray reactances in the sweep circuit. Shock excitation results from the abrupt rise of the sawtooth flyback. The frequency of this ringing is often in the vicinity of ½ *mc*, and can be trapped out by use of a suitable ringing trap in series with the deflection coil. It is desirable to trap out the ringing wave, because it produces vertical gray bars on the left-hand side of the picture.

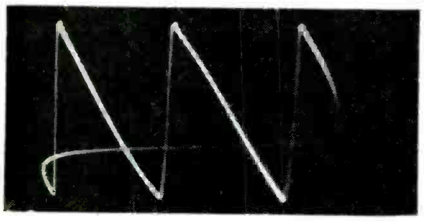


Fig. 1—High frequency ringing effect in Hor. Output circuit.

Q. Does ringing in the sweep circuit always take place at about 0.5 *mc*?
A. No. As shown in *Fig. 2*, situations may arise in which the ringing frequency is much lower.

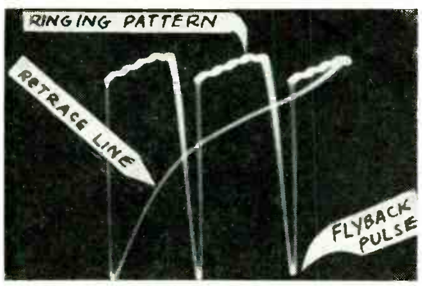


Fig. 2—Low frequency ringing effect in Hor. Output circuit.

Q. What is the difference between a linearity dot generator, and a white dot generator?
A. The patterns are the same, but the polarity of the pattern voltage is reversible in the case of a white dot generator. Typical pattern is shown in *Fig. 3*.

Fig. 3—Pattern obtained using typical white dot generator.

The white dot generator is used in setting up color television picture tubes.

Q. When testing deflection linearity with an audio oscillator, I often find that the width of the bars varies from top to bottom of the screen on the picture tube. What would cause this condition?

Fig. 4—Bar width variations indicates hum in video amplifier.

A. This situation is shown in *Fig. 4*. It is caused by the presence of hum voltage in the video amplifier, which causes the resultant peak voltage of the testing voltage to vary from top to bottom of the screen. When this condition is present, you will also note that the picture changes in shading from top to bottom.

Q. When making square-wave tests of the video amplifier, I often obtain a pattern in which the horizontal portion of the wave appears clearly, but the vertical portion is invisible. What is the cause of this variation?
A. A typical situation of this kind is illustrated in *Fig. 5*. The invisibility of the vertical portions of the waveform is due to the rapid travel of the beam in the vertical direction. There is no simple method of making all portions of the pattern equally bright.

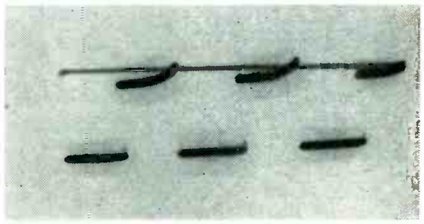


Fig. 5—Vertical waveform is relatively invisible as shown above.

Q. What is the meaning of *flatness* in the output from a sweep generator?
A. Flatness refers to the uniformity of output voltage from the generator over the swept band. A sweep generator is usually tested with a crystal probe of the demodulator type, to make a flatness check. The pattern shown in *Fig. 6* shows the output from a flat generator; the pattern shown in *Fig. 7* shows the output from a generator which is not flat. In various cases, the amount of departure from flatness in terms of percentage cannot be determined unless a *dc* scope is used, since the true zero-volt reference level may be otherwise unknown.

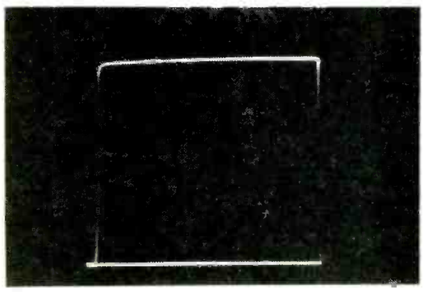
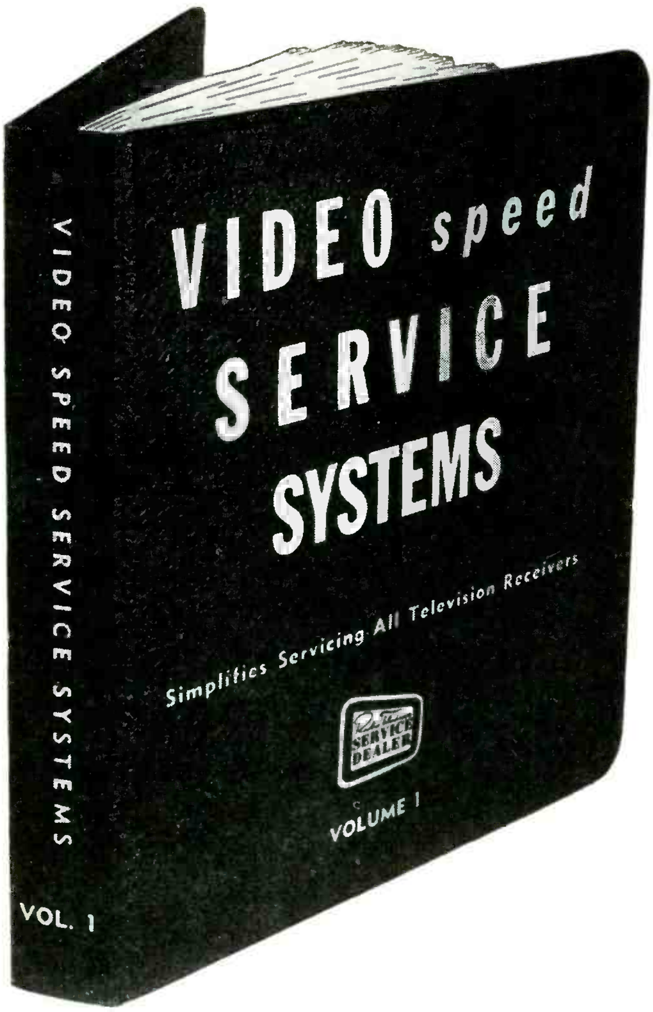


Fig. 6—This response curve was obtained with a flat amplifier.

[*Continued on page 62*]

FOR GREATER PROFITS



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

ARVIN

(9200 SERIES)

MODELS: 9210, 9212, 9216, 9218, 9219, 9240

CHASSIS TE-358, TE-359, TE-363, TE-364

TUBE COMPLEMENT

SYMBOL	TYPE	FUNCTION
V1	6AU6	Intercarrier Sound Amp.
V2	6BN6	Sound Limiter—Detector
V3	6BK5	Audio Output
V4	6CB6	First Picture IF
V5	6CB6	Sound Picture IF
V6	6CB6	Third Picture IF
V7	6CB6	Fourth Picture IF
V8	6CL6	Video Amplifier
V9	6AU6	AGC Tube
V10	6BE6	Sync Separator
V11A	6SN7GTA	Sync Splitter
V11B		Vertical Oscillator
V12	6AH4GT	Vertical Output
V13	6AL5	Horizontal Discr.
V14	6SN7GTA	Horizontal Oscillator
V15	6BQ6GT or 6CD6G	Horizontal Output
V16	1B3GT	Hi-V Rect.
V17	6AX4GT	Damper
V18	5U4G	Power Rectifier
V19	5U4G	Power Rectifier
V20	21EP4B or 24CP4	Picture Tube
V21	6BZ7	RF Amplifier
V22	6J6 or 6X8	VHF Osc.-Mixer
V23	6AF4	UHF Oscillator
V24	6BZ7	UHF IF

KEY VOLTAGES

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

B+ Output of Filter Choke	300 VDC
Boosted B+, terminal "T" on Hor. Output Transformer	560 VDC
Plate of Vert. Osc., V11 pin 2	170 VDC
Plate of Vert. Out., V12 pin 5	260 VDC
Plates of Hor. Osc., V14 pin 2	170 VDC
pin 5	250 VDC
Grid of Hor. Out., V15 pin 5	—5.0 VDC

ADJUSTMENTS

VERTICAL HOLD

This control is adjusted to prevent the picture from rolling up and down. By rotating the control in both directions its action will be self evident—and it should be set in the position that leaves the picture most stable.

HORIZONTAL HOLD

This control is adjusted to prevent the picture from breaking up into horizontal black bars. Usually its most stable position will be near the center of its rotation.

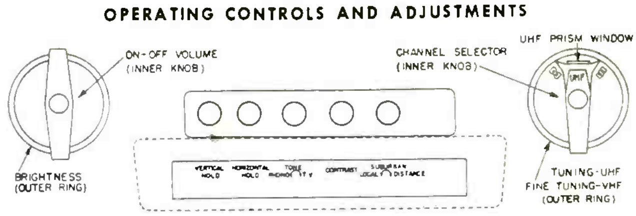
TONE

This control permits choice of bass-treble tone balance on TV and phono. Also, when rotated maximum to the left until the switch clicks, it will allow a phonograph attachment to play through the television receiver. For TV reception this switch must be turned maximum to the right.

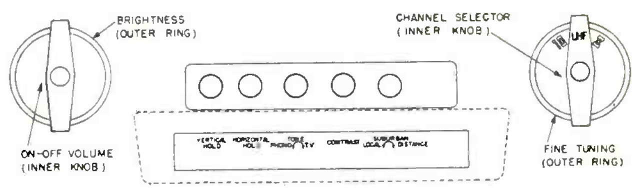
CONTRAST CONTROL

Adjust the CONTRAST CONTROL so that the picture

OPERATING CONTROLS AND ADJUSTMENTS



OPERATING CONTROLS UHF-VHF MODELS



OPERATING CONTROLS VHF MODELS ONLY

has the desired tones in shading. This control varies the ratio of black to white in the picture.

TRIPLE-POWER SWITCH

The normal position of the switch is in the "distance" position (maximum to the right) and should be moved to the "suburban" position (center) if picture shows evidence of overloading or distortion. In extreme cases where the receiver is operated in close proximity to television station, it may be necessary to turn this switch to the "local" position (maximum to the left) to prevent this overloading.

TWEET ADJUSTMENT (UHF MODELS ONLY)

This adjustment is made accessible by removing chan-

[*Continued on page* 46]

ARVIN TROUBLESHOOTING CHART

RASTER BLOOMING
Hor. drive con.
V15, V16, V17, V18, V19, V20
Check 3-220kΩ Res. connected in series with second anode lead.
Check HV filter cap

INSUFFICIENT BRIGHTNESS
Ion trap
Brightness and hor. drive con.
V15, V16, V17, V18, V19, V20
Low line voltage

EXCESSIVE RASTER (PIX SIZE)
Hor. drive, width and height con.
V15, V16, V17, V20

INSUFFICIENT RASTER WIDTH
Hor. drive and width con.
V15, V17, V18, V19, V20
Check 2-18kΩ Res. and 0.1 MFD cap connected to pin 4 of V15
Check 270 MMFD cap connected to pin 2 of V14
Low line voltage
H.O.T.

INSUFFICIENT RASTER HEIGHT
Height and vert. lin. con.
V11, V12, V18, V19
Check 0.047 and 0.1 MFD caps connected to red lead of Vert. osc. transformer
V.O.T.
Low line voltage

NO VERT. DEFL.
V11, V12
Check 0.047 and 0.1 MFD caps connected to red lead of Vert. osc. transformer
Vert. Defl. yoke
V. O. T. and Vert. osc. transformer

NO VERT. SYNC.—HOR. SYNC. OK
Vert. hold and electronic stabilizer con.
Vert. Int. network
V10, V11, V12

NO HOR. OR VERT. SNC.—PIX SIGNAL OK
Electronic Stabilizer con.
V9, V10, V11

NO HOR. SYNC.—VERT. SYNC. OK
Hor. hold and lock con.
V13, V14, V15
Check 330 MMFD cap connected to pin 1 of V14.

NO SOUND—NO RASTER
Power input circuit
V18, V19

NO RASTER—SOUND OK
Brightness con.
Ion Trap
HV Fuse (0.25 Amp. Slo-Blow)
HV xformer Hor. yoke CRT connections

PIX JITTER UP & DOWN
Vert. hold, electronic stabilizer con.
V9, V10, V11

WEAK PIX—SOUND AND RASTER OK
Tuner fine tuning
Contrast con.
Sub., dist. and local selector switch
V4, V5, V6, V7, V8, V9

POOR HOR. LIN.
Hor lin. and drive con.
V15, V17
Check 2-0.047 MFD caps connected to Hor. lin. coil
H.O.T.

POOR VERT. LIN.
Vert. lin. and height con.
V11, V12
Check 0.047 and 0.1 MFD cap connected to red lead of vert. osc. transformer
Check 100 MFD EL. cap connected to pin 8 of V12
V.O.T.

PIX JITTER SIDEWAYS
Hor. hold, lock and electronic stabilizer con.
V10, V13, V14
Check 0.01 MFD cap and 22kΩ Res. connected to pins 5 and 7 of V13

SMEARED PIX
Tuner fine tuning
Sub., loc. dist. selector switch V4, V5, V6, V7, V8
Check vid. det. xstal 1N64 (part of T-206)
Check vid. det. and amp. peaking coils
IF and RF alignment

POOR PIX DETAIL
Tuner fine tuning
V4, V5, V6, V7
Check vid. det. and amp. peaking coils
IF and RF alignment

SOUND BARS IN PIX
Tuner fine tuning
V4, V5, V6, V7, V21, V22
Check alignment of L-201
IF and RF alignment

SNOW IN PIX
V4, V5, V6, V7, V21, V22
Antenna and transmission line

AC IN PIX (DARK HOR. BAR)
V4, V5, V6, V7, V8, V9, V21, V22

ENGRAVED EFFECT IN PIX
Tuner fine tuning
Contrast con.
Sub., loc., dist. selector switch
V4, V5, V6, V7, V8, V9, V22
Check vid. det. xstal 1N64 (Part of T-206)

VERT. BARS
Hor. drive con.
V15, V17
Check 56 MMFD cap and 1kΩ
Check 56 MMFD cap and 1kΩ Res. connected to terminals 3 and 7 of yoke
Defl. yoke ringing

PIX BENDING
Hor. hold, lock and electronic stabilizer con.
V11, V13, V14, V15
Hor. drive con.

AUDIO HUM IN SOUND
V1, V2, V3

DISTORTED SOUND
Tuner fine tuning
V1, V2, V3, V22
Tone con.
Check vid. det. xstal 1N64 (Part of T-206)
Sound and vid. IF alignment L-201, T-101
Det. alignment T-101, L-101

NO SOUND—PIX OK
Tuner fine tuning
Vol. con.
V1, V2, V3
Speaker (open voice coil or defective connection)
Sound and vid. IF alignment L-201, T-101
Det. alignment T-101, L-101

WEAK SOUND—PIX OK
Tuner fine tuning
Vol. and buzz con.
V1, V2, V3, V22
Check vid. det. xstal 1N64 (Part of T-206)
Sound and vid. IF alignment L-201, T-101
Det. alignment T-101, L-101

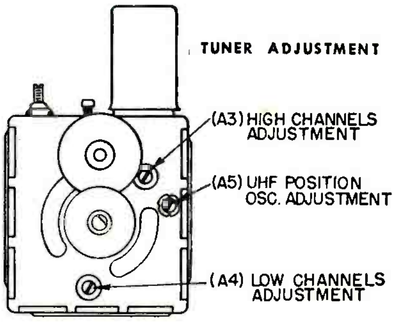
NOISY SOUND—PIX OK
Vol. and tone con.
V1, V2, V3
Check sound system for loose connections
Buzz con.
Speaker
Sound IF and det. alignment L-101, L-201 and T-101

SYNC. BUZZ IN SOUND
Tuner fine tuning
Buzz con.
V1, V2, V22
Check vid. det. xstal 1N64 (Part of T-206)
Sound IF and det. alignment, L-101, L-201 and T-101

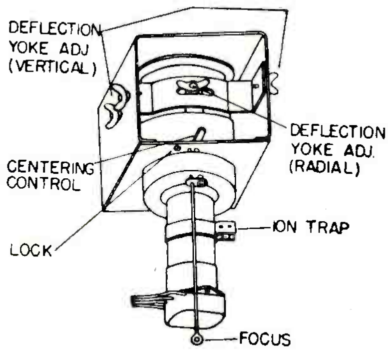
INTERMITTENT SOUND—PIX OK
V1, V2, V3
Poor connections in sound system

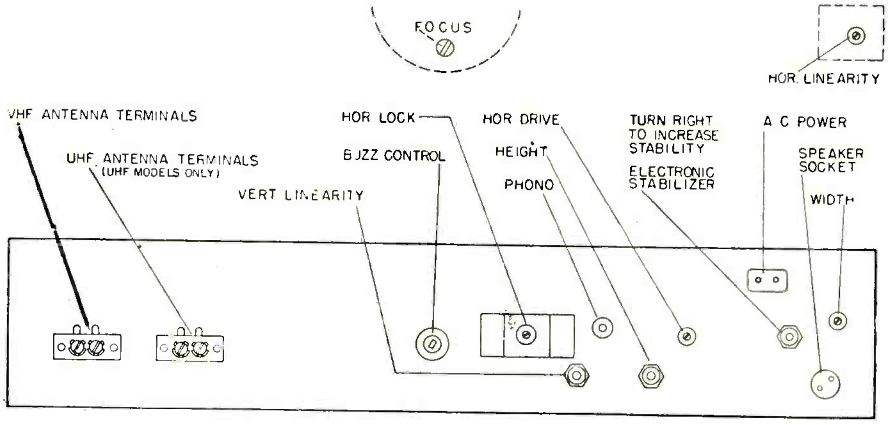
WEAK OR NO PIX—SOUND WEAK—RASTER OK
Tuner fine tuning
Contrast con.
Sub. loc. dist. selector switch
V4, V5, V6, V7, V21, V22
Check vid. det. xstal 1N64 (Part of T-206)
RF and IF alignment

INTERMITTENT RASTER—SOUND OK
Brightness con.
V14, V15, V16, V17, V20
HV xformer



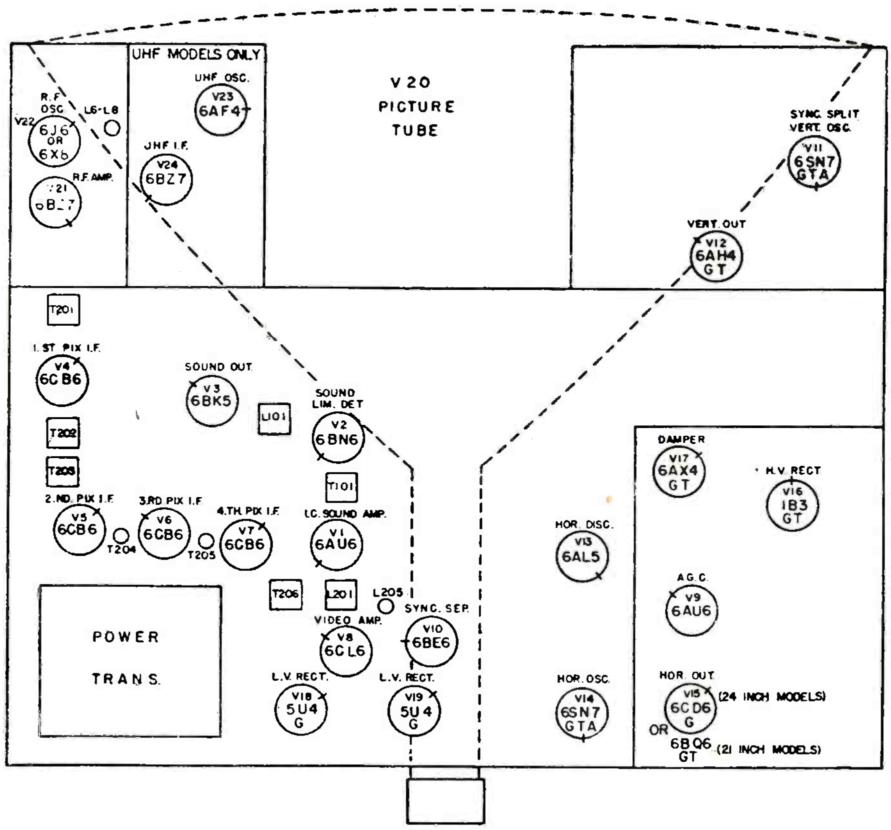
VHF TUNER (FRONT)





REAR CONTROLS

TUBE LAYOUT



[*from page* 43]

nel selector and fine tuning knobs. This adjustment is the center of the three screw driver adjustments and is the furthest to the right. This UHF position oscillator trimmer should not be adjusted unless some type of interference is present at the 127 megacycle frequency.

REAR ADJUSTMENTS

1. CABINET ANTENNA (UHF-VHF)

This receiver has separate built-in antenna for UHF and VHF. This receiver is normally shipped with these built-in antennae connected. If an outdoor antenna is required, the built-in antenna which is being replaced with an outdoor antenna, must be disconnected.

NOTE: If an all-channel (UHF-VHF) antenna is satisfactory for use in your area, it is possible to connect both the UHF and VHF terminals on the back of the television set to the antenna lead-in by the use of a MM 30 Mighty Match (Vee-D-X) or equivalent.

2. BUZZ CONTROL

This control is provided to adjust the AM rejection characteristics of the sound system (sync buzz, noise, or hiss). Since this control has been adjusted for an optimum setting at the factory, do not attempt to make this adjustment unless sync buzz noise or hiss is present. Caution: Turn this control slowly from the present preset position—usually not more than 30 degrees rotation in either direction will be necessary.

3. HORIZONTAL LOCK

For best adjustments turn horizontal control maximum counter clockwise and set the horizontal lock coil so that the pattern will break on 3 to 4 bars at this point.

4. VERTICAL LINEARITY

This control affects the linearity of the top of the picture —for instance, improper setting of this control will cause a person being televised to have a stretched or flat head.

5. PHONO

Phono jack is on rear panel. Switch on tone control must be turned when using this receiver as a phono amplifier.

6. HEIGHT CONTROL

This control affects the picture height and also controls the stretching or shrinking of the bottom of the picture —for instance, causing long or short legs on a person being televised.

7. HORIZONTAL DRIVE

Adjust HORIZONTAL DRIVE TRIMMER to the right to the point where "overdrive" lines just disappear. "Overdrive" lines appear as a vertical white line in the left portion of the picture. The Horizontal Drive Trimmer is located in the control grid circuit of the Horizontal Output Tube controlling the operating characteristics of the tube. Turning the HORIZONTAL DRIVE TRIMMER to the right reduces the Horizontal Drive.

8. AUTOMATIC ELECTRONIC STABILIZER CONTROL

This control provides a means of stabilizing the sync circuit against electrical interference (such as automobile ignition and other impulse type noises). This control is set at the factory for best overall results. When electrical interference makes the picture unstable tune in strongest station available and turn control clockwise until picture shifts or distorts. Then turn control counter clockwise until picture shifting or distorting disappears. If a strong signal is not available turn control until picture becomes most stable. (Usually about one-half of full rotation.)

9. WIDTH

Adjust WIDTH CONTROL to obtain a picture with sufficient width to just fill the picture frame. Maximum width occurs when the screw is maximum clockwise. This adjustment regulates the amount of deflection current flowing in the horizontal deflection coils controlling the horizontal dimension or width of the picture.

10. HORIZONTAL LINEARITY

Adjust for uniform linearity across face of tube. Should one or two horizontal white bars appear on the right side of the picture with the horizontal drive, width and HORIZONTAL LINEARITY CONTROLS set properly, turn the HORIZONTAL LINEARITY CONTROL clockwise until these bars disappear.

11. FOCUS CONTROL

This control is operated by a plastic rod with a loop end which protrudes from an opening near the center of the rear cover. Rotate this plastic rod for the sharpest detail.

12. CENTERING

Loosen lock screw move CENTERING CONTROL until picture is properly centered.

SOUND AND 4.5 MC TRAP ALIGNMENT

1. Tune in available TV station and reduce signal into set until hiss is heard with sound. This can be done by inserting an attenuator in the antenna lead-in or by removing antenna lead-in from the set and stray feeding in signal by placing lead-in in close proximity of the set.

2. Set buzz control in the middle of its range. Adjust take off coil L201, top and bottom T101, Quadrature coil (L101) and buzz control for cleanest sound and minimum buzz. If any adjustment causes hiss to disappear reduce signal into set until hiss reappears and continue with adjustments.

FADA

MODELS 17C2, 17C4, 17C6, 17T9

TV FIELD SERVICE

Pre-published from Rider "TV Field Service Manuals"

by Rider & Alsberg

TUBE COMPLEMENT

SYMBOL	TUBE USED	FUNCTION
V1	6BQ7 or 6BK7	Cascode RF Amplifier
V3	6J6	Osc. Mixer
V4	6CB6	1st IF
V5	6CB6	2nd IF
V6	6CB6	3rd IF
V7A	½ 6AL5	Video Detector
V7B	½ 6AL5	A.G.C.
V8	6AG7 or 12BY7	Video Output
V9A	½ 12AU7	Sync. Separator
V9B	½ 12AU7	Sync. Clipper
V10	6AL5	Hor. Phase Detector
V11	6SN7-GT	Hor. Osc. & Discharge
V12	6CD6-G	Hor. Output
V13	6W4-GT	Damper
V14	1B3-GT	High Voltage Rectifier
V15	6S4	Vertical Output
V16	5U4-G	Low Voltage Rectifier
V17	5U4-G	Low Voltage Rectifier
V18A	½ 6SN7	Vertical Osc.
V18B	½ 6SN7	Sync. Inverter
V19	6K6-GT	Audio Output
V20A	½ 6T8	Audio Amplifier
V20B	½ 6T8	Ratio Detector
V21	6AU6	Ratio Det. Driver
V22	17BP4 or 17RP4	Picture Tube

Key Voltages

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

B+, plate of damper, V13 pin 5	340VDC
Boosted B+, cath. of damper, V13 pin 3	520 "
Plate of Vert. Osc. V18 pin 5	180 "
Plate of Vert. Out. V15 pin 9	415 "
Plates of Hor. Osc. VII pin 2	335 "
pin 5	170 "
Grid of Hor. Out. V12 pin 5	-19 "

OPERATING INSTRUCTIONS

(1) Turn OFF-ON SOUND volume control clockwise about a half turn. This turns the receiver on and sets the sound volume to a reasonable level.

(2) Allow a brief warm-up period.

(3) Set Station Selector to desired channel.

(4) Adjust the Fine Tuning control to where music or speech is heard, assuming that the station is broadcasting.

(5) Turn picture control fully counter clockwise.

(6) Turn the brightness control fully clockwise and then slowly counter clockwise until light is just visible on the screen.

(7) Turn the picture control clockwise until activity or a definite form is just noted on the screen. Do not advance control any further until steps 8, 9, and 10 are completed.

(8) If the pattern is moving up or down adjust Vertical control until pattern is stationary in vertical direction.

(9) If picture appears as black and white diagonal lines or seems to be moving sideways, adjust Horizontal control until a proper picture is obtained.

(10) Readjust Fine Tuning control for best picture.

(11) Adjust Picture control until picture is suitable for brightness and contrast. If the control is advanced to maximum clockwise position, overloading of the picture will occur on strong signals. This will be noted by excessive contrast, bending of picture and raspy noise in the sound output. When this occurs rotate the picture control slowly in a counter clockwise direction until the picture and sound distortion disappears. The brightness and details of a picture are controlled by the Brightness and Picture knobs. Adjust Tone Control for desired quality of sound.

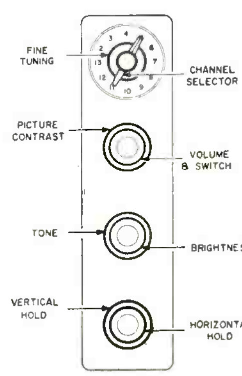
(12) Recheck the Fine Tuning control for best picture.

NOTE: If any difficulty is experienced with steps number 8 or 9, turn the PICTURE control ¼ turn counter clockwise, readjust the Fine Tuning control and then repeat these adjustments.

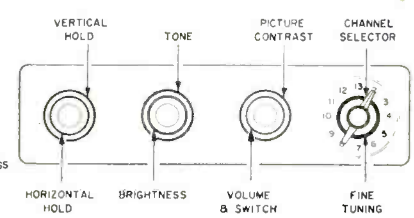
If the receiver has been in previous operation and no controls disturbed except for turning the on-off knob to "off" position, then subsequent operation should require the previous steps 1 through 3 and, if necessary, steps 13 and 14 as follows:

(13) Adjust the FINE TUNING control for best picture quality. Readjust the SOUND volume control to desired level.

(14) Adjust PICTURE and BRIGHTNESS controls to obtain desired level of contrast and brightness.



FRONT CONTROLS FOR MODELS 17C2; 17C4



FRONT CONTROLS FOR MODELS 17T6; 17T9

ADJUSTMENTS

Ion Trap, Focuser and Deflection Yoke Adjustments

Before any adjustments can be made the back of the cabinet will have to be removed. Remove all screws holding back cover to cabinet, and pull cover away from cabinet. Since the power cord circuit is broken by the interlock when the cabinet back is removed, an extra television

[Continued on page 50]

FADA TROUBLE SHOOTING CHART

DISTORTED SOUND

Tuner fine tuning
V3, V19, V20, V21
Check 0.02 MFD cap connected to pin 5 of V19
Sound and Vid. IF alignment L-12, L-13
Det. alignment L-16, L-17

NO SOUND—PIX OK

Tuner fine tuning
Vol. con.
V19, V20, V21
Speaker (open voice coil or defective connection)
Sound and Vid. IF alignment L-12, L-13
Det. ailgnment L-16, L-17

WEAK SOUND—PIX OK

Tuner fine tuning
Vol. con.
V3, V19, V20, V21
Sound and Vid. IF alignment L-12, L-13
Det. alignment L-16, L-17

NOISY SOUND—PIX OK

Vol. con.
V19, V20, V21
Check Sound system for loose connections
Speaker
Sound IF and Det. alignment L-12, L-13, L-16, and L-17

SYNC. BUZZ IN SOUND

Tuner fine tuning
Contrast con.
V7, V8, V19, V20
Sound IF and Det. alignment L-12, L-13, L-16, L-17

INTERMITTENT SOUND—PIX OK

V19, V20, V21
Poor connections in sound system

WEAK OR NO PIX—SOUND WEAK—RASTER OK

Tuner fine tuning
Contrast con.
V1 ,V3, V4, V5, V6, V7, V8
RF and IF alignment

INTERMITTENT RASTER—SOUND OK

Brightness con.
V11, V12, V13, V14, V22
HV xformer

RASTER BLOOMING

Hor. Drive con.
V12, V13, V14, V16, V17, V22
Check HV Filter cap and 100kΩ
Res. connected to i.f.

INSUFFICIENT BRIGHTNESS

Ion trap
Brightness and Hor. Drive con.
V12, V13, V14, V16, V17, V22
Low line voltage.

EXCESSIVE RASTER (PIX SIZE)

Hor. Drive, Width and Height con.
V12, V14

INSUFFICIENT RASTER WIDTH

Hor. Drive and Width con.
V12, V13, V16, V17
Check 270 and 390 MMFD cap. connected to pin 5 of V11
H.O.T.
Low line voltage

INSUFFICIENT RASTER HEIGHT

Height and Vert. Lin. con.
V15, V16, V17, V18
Check 0.1 and 0.05 MFD caps connected to red lead of Vert. Osc. Transformer
V.O.T.
Low line voltage

NO VERT. DEFL.

V15, V18
Check 0.1 and 0.05 MFD caps connected to red lead of Vert. Osc. Transformer
Vert. Defl. yoke
Vert. Osc. Transformer

NO VERT. SYNC.—HOR. SYNC. OK

Vert. Hold con.
Vert. Int. Network
V15, V18
Check 0.005 MFD cap. connected to yellow lead of Vert. Osc. Transformer

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK

V9, V18

NO HOR. SYNC.—VERT. SYNC. OK

Hor. Hold and Freq. con.
V10, V11, V12
Check 330 MMFD cap. connected to pins 2 and 4 of V11

SOUND BARS IN PIX

Tuner fine tuning
V3, V4, V5, V6
Check Alignment of L-12
IF and RF alignment

SNOW IN PIX

V1, V3, V4, V5, V6, V7
Antenna and transmission line

AC IN PIX (DARK HOR. BAR)

V1, V3, V4, V5, V6, V7, V8

ENGRAVED EFFECT IN PIX

Tuner fine tuning
Contrast con.
V3, V4, V5, V7, V8, V22
Check Vid. Det. and Amp. peaking coils

VERT. BARS
Hor. Drive and Lin. con.
V12, V13
Check 56 MMFD cap connected to yoke terminals 1 and 2
Defl. yoke ringing

PIX JITTER UP & DOWN
Vert. Hold and Contrast con.
V9, V15, V18

PIX BENDING
Hor. Hold and Freq. con.
V9, V10, V11, V12, V18

AUDIO HUM IN SOUND
V19, V20, V21

NO SOUND NO RASTER
Power input circuit
V16, V17

NO RASTER—SOUND OK
Brightness con.
HV Fuse F1 (0.25 Amp)
Ion trap
V11, V12, V13, V14, V22
HV xformer Hor. yoke CRT connections

WEAK PIX—SOUND AND RASTER OK
Tuner fine tuning
Contrast con.
V3, V4, V5, V6, V7, V8

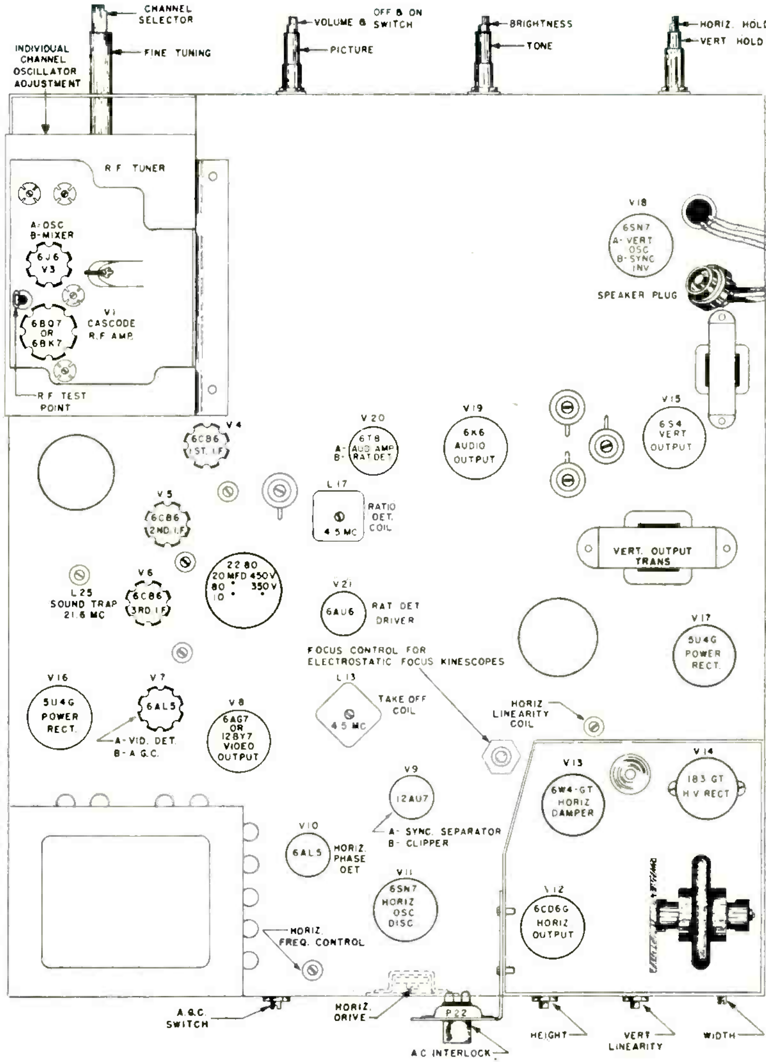
POOR HOR. LIN.
Hor. Lin. and Drive con.
V12, V13
Check 0.25, 0.05 and 0.033 MFD caps connected to Hor. Lin coil

POOR VERT. LIN.
Vert. Lin. and Height con.
V15, V18
Check 100 MFD cap. connected to pin 2 of V15
Check 0.1 and 0.05 MFD caps connected to red lead of Vert. Osc. Transformer

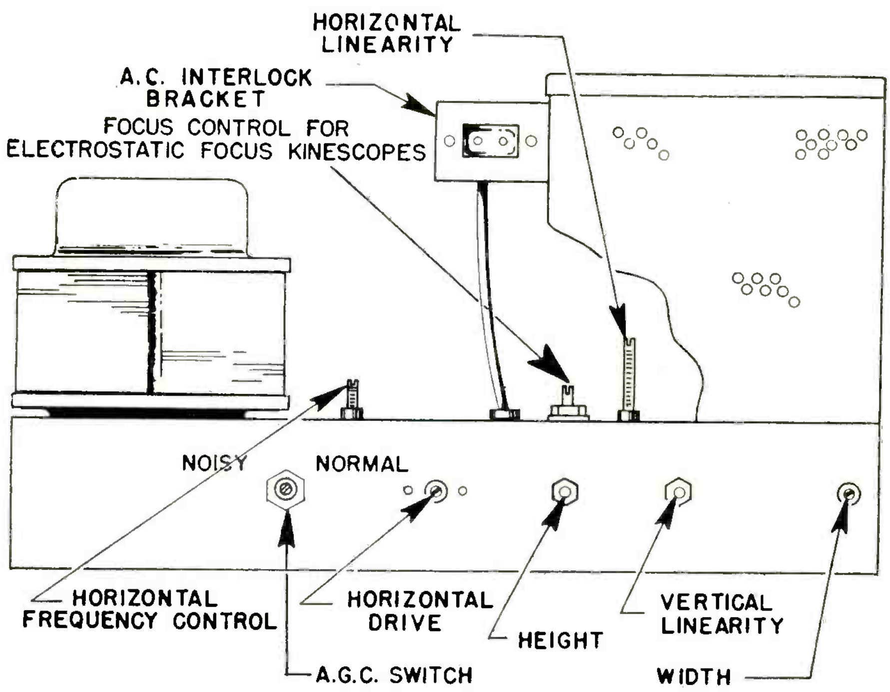
PIX JITTER SIDEWAYS
Hor. Hold and Freq. con.
V10, V11
Check 0.01 MFD and 6.8 k Res connected to pins 5 and 7 of V10

SMEARED PIX
Tuner fine tuning
Contrast con.
V3, V4, V5, V6, V7, V8
Check Vid. Det. and Amp. peaking coils
IF and RF alignment

POOR PIX DETAIL
Tuner fine tuning
V4, V5, V6
Check Vid. Det. and Amp. peaking coils
IF and RF alignment



TOP VIEW OF CHASSIS



SERVICE ADJUSTMENTS

[*from page* 47]

power cord will be necessary to make a power connection to the receiver. A mirror placed in front of the receiver will help in making the adjustments.

For Magnetic Focus Kinescopes: Ion Trap Adjustments

Turn on the receiver and switch to one of the television channels not in use in your area. With the brightness control in the maximum clockwise position and the picture control fully counter-clockwise adjust the ion trap by moving it forward or backward at the base of the tube, at the same time rotating it slightly around the neck of the cathode ray tube for the brightest raster on the screen. Reduce the brightness control setting until the raster is just visible on the screen, readjust the ion trap for maximum brilliance. Adjust the focuser adjustment control until the line structure of the raster is clearly visible. Readjust the ion trap for maximum raster brilliance. The final touches of the adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

Focuser Magnet Adjustment

The focuser magnet should be adjusted so that there is approximately one-eighth inch of space between the rear shell of the deflection yoke and the front face of the focuser magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the focuser magnet should be parallel with the axis of the cathode ray tube neck.

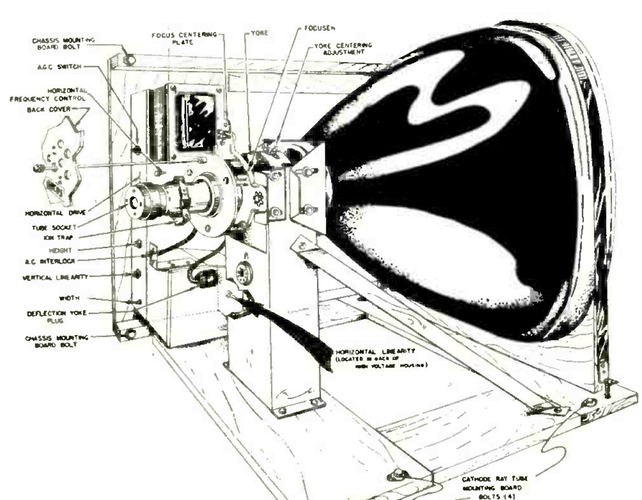
NOTE: The cardboard insert between the focuser magnet and the neck of the cathode ray tube must not be removed.

Deflection Yoke Adjustment

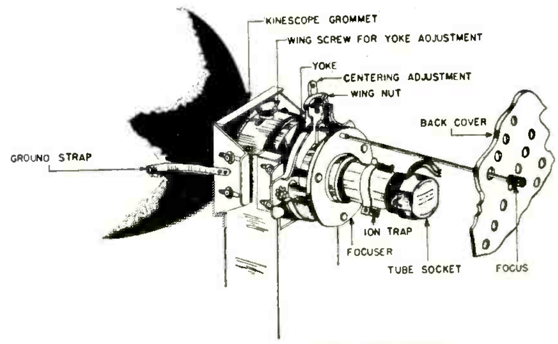
If the lines of the raster are not horizontal or squared with the picture mask, loosen the yoke centering wing screw and rotate the yoke until this condition is obtained. Tighten the wing screw making sure the deflection yoke is as far forward on the neck of the cathode ray tube as possible.

Centering Adjustments

No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet as shown. The centering plate has a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

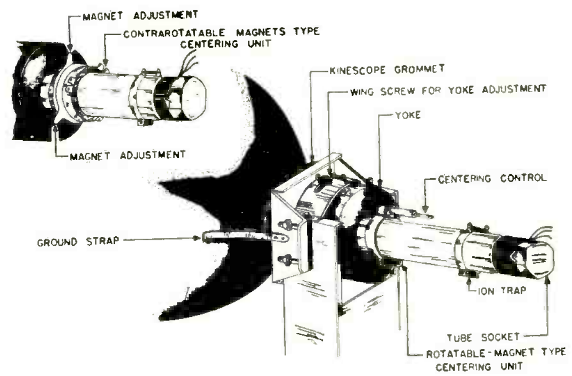


SERVICE ADJUSTMENTS AND CONTROLS
ELECTROMAGNETIC FOCUS KINESCOPES
17C2 —17C4



SERVICE ADJUSTMENT AND CONTROLS
ELECTROMAGNETIC FOCUS KINESCOPES
17T6 – 17T9

If a corner of the raster is shadowed, check the position of the ion trap. Reposition the ion trap within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus centering plate. In no case should the ion trap be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the cathode ray tube. In some cases it may be necessary to shift the position of the focuser magnet in order to eliminate a corner shadow.



SERVICE ADJUSTMENTS AND CONTROLS
ELECTROSTATIC FOCUS KINESCOPES
17T6 - 17T9 - 17C2 - 17C4

For Electrostatic Focus Kinescopes: Ion Trap Adjustments

Turn on the receiver and switch to one of the television channels not in use in your area. With the brightness control in the maximum clockwise position and the picture control fully counter-clockwise adjust the ion trap by moving it forwards or backwards at the base of the kinescope, at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen.

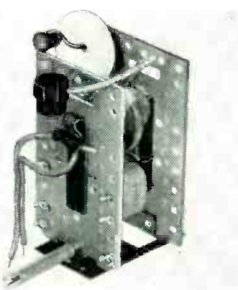
Deflection Yoke Adjustment

If the lines of the raster are not horizontal or squared with the picture mask, loosen the yoke centering wing screw (shown in figure 4) and rotate the yoke until this condition is obtained. Tighten the wing screw making sure that the deflection yoke is as far forward on the neck of the cathode ray tube as possible.

New Products

I.T.I. UHF Generator

I.T.I. announces a unique UHF TV Generator which is particularly useful where no **UHF** signal is yet available. Called the IT-13OR UHF Generator, this device uses the signal from any VHF station and translates it to a UHF signal on any channel. In addition, VHF test equipment can be adapted to UHF by this unit. Complete details are available from **Industrial Television, Inc., Clifton, N. J.**



Halldorson Flyback Transformer

Halldorson's new FB412 flyback transformer is an exact replacement for Part No. C-201-21025-1 used in AIRLINE, RAYTHEON, and TRUETONE television sets. It features a variable-gap width control, tapped AGC winding, special mounting base, etc. Bulletin 116 describing this item, and listing all TV models and chassis in which it is an exact replacement, can be obtained from **Halldorson Transformer Company, 4500 Ravenswood Avenue, Chicago 40, Illinois.**

No-Noise in Spill-proof Can

Introduction of a new spill-proof, easy-to-use 6 oz. spray can has been announced by **Electronic Chemical Corp., 813 Communipaw Ave., Jersey City 4, N. J.,** manufacturers of No Noise, the formula for contacts. The new spray can has been proved more economical because of its easy-to-handle, easy-to-use spill-proof construction.

Superex Adapter for Tube Testers

Superex announces an adapter that can be used with any make tube tester and all picture tubes. Without removing the pix tube from the TV cabinet, any tube from 10" to 30" can be checked for electrostatic or magnetic shorts. Overall length, 49½". For details, write to **Superex Electronics Corp., 23 Atherton St., Yonkers, N. Y.**

TACO's "Trapper"

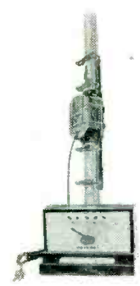
The TACO "Trapper," catalog no. 1880, provides yagi performance and gain on all VHF channels 2 through 13. It comprises a forward director with auto-match stubs, two tuned driven elements with auto-match stubs, one tuned **high-band** reflector and one low-band reflector. Installation is facilitated by use of TACO's Jiffy-rig assembly method. Details are available from **Technical Appliance Corp., Sherburne, N. Y.**

RMS NevaTip Indoor Antenna

Model K-38, a new UHF-VHF indoor antenna with a criss-cross phasing element, features a six-position switch for tuning the proper pair of poles for best reception of channels 2 through 83. The RMS K-38 is equipped with the NevaTip base, 5 feet of twin lead and instructions. For data, write to **Advertising Dept. RMS, 2016 Riverdale Ave., New York 62, N. Y.**

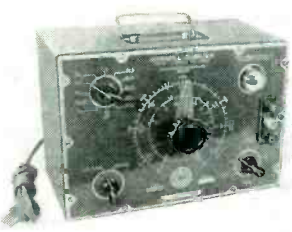
Haydon Mast Kits

Haydon announces new improved models of their zip-up mast kits. These are furnished with markers to prevent pulling out. Each length is 10 feet long and is precision made to telescope into each other snugly. Accessories, guy rings, bolts are furnished. Heavy duty 16 gauge and economy models are available. **(Haydon Products Corp., 1801 Eighth Ave., Bklyn 15, N. Y.)**



JFD Announces "Rotenna"

Five main features of the "Rotenna" are said to be: (1) Stop-Watch tuning accuracy, (2) Cartridge type removable drive unit, (3) "Inline" mast collar construction, (4) 390 degree traverse and (5) Finger-tip piano control console. The "Rotenna" housing is constructed of die-cast aluminum, as is the drive unit's housing. For further details, write **JFD Manufacturing Co., Inc., Bklyn, N.Y.**



New Capacitor—Resistor Bridge

Capacitor-Resistor Bridge BF-60 quickly measures the important characteristics of substantially all types of condensers and resistors and determines their quality. It detects opens, shorts and intermittents; the capacity between wires and shieldings, transformer windings, wires in cables, etc. For further information write to Mr. E. J. Maginot, Sales Promotion Manager, **Cornell - Dubilier Electric Corporation, South Plainfield, N. J.**

Imperial Ground Rod

Imperial Radar & Wire Corp., of New York City introduces a new ground rod which features a heavy steel rod ⅜" in diameter with a heavy double plating, and finished off with a hand rubbed oil coating to insure extra long life. This ground rod comes in 4 ft. lengths, and has a fine turned down point which makes it easy to drive into any type of soil. Imperial Radar also manufactures open line, ground wire and guy wire.

TRADE FLASHES

• • •

The Radio-Electronics-Television Manufacturers Association reports these production totals during the first two months of 1954: TV sets, 847,504; radios, 504,099; portables, 144,846; auto radios, 726,403; clock radios, 265,865. This represents some decline from 1953's level.

RETMA's PLAN FOR CURBING *TV receiver interference has been submitted to the industry. The gist of the proposal involves adherance to a recommended intermediate frequency of 41.25 mc for TV receivers. Other aspects of the plan call for radiation limits for TV and FM sets, and voluntary submission of sets for testing and certification to an independent laboratory. The F.C.C. appears to be in general agreement with the plan.*

ALFRED A. GHIRARDI, famous in the radio text-book industry for more than thirty years, will co-author a new series of books on radio and TV test equipment with Robert G. (Bob) Middleton, the well-known lecturer and writer, whose series on the "TV Instrument Clinic" is currently running in SERVICE DEALER. The first book in the new series by Ghirardi and Middleton will be published by John F. Rider, Publisher, N.Y., and is scheduled to appear this summer.

In line with the "do-it-yourself" trend, Admiral Corporation today announced the addition of outdoor TV antenna kits to its accessories line. There are nine kits in all, each with a choice of four different mounts covering all types of TV reception—UHF, VHF and combined UHF-VHF. They are designed for color as well as black and white reception.

Each outfit contains everything the set owner needs, down to the last screw-eye, for his outdoor antenna installation—antenna, mast, mast mount, guy wires, insulators and lead-in, plus a step-by-step instruction booklet.

MORE THAN 27,000 TELEVISION SERVICEMEN *have attended the first 35 sessions in a nationwide series of technical clinics on installation and maintenance of color television receivers sponsored by the Radio Corporation of*

America and its distributors, it was announced recently.

Similar clinics in a total of 65 major cities are scheduled in the series presented by RCA for servicemen-dealer customers of RCA Tube and RCA Victor Home Instrument distributors. These distributors sponsor the meetings locally.

Over 800 service dealers attended RAYTHEON "Service Saver" and Color TV meetings held recently in Toledo, Columbus, Cleveland, Cincinnati, and Lima, Ohio. Approximately 500 service dealers attended RAYTHEON "Service Saver" and Color TV meetings held recently in Fargo, North Dakota and Minneapolis, Minnesota.

At the "instruction clinics," Bill Ashby, RAYTHEON TV's popular staff lecturer, gave a slide-illustrated presentation of the RAYTHEON "Service Saver" plan developed around the RAYTHEON TV Owner's Guide and dealer "Service Saver" Manual and Wall Chart. Mr. Ashby further developed the practical aspects of color TV servicing.

A HORIZONTAL CONVERGENCE COIL *for color TV sets, said to withstand high voltage to an unusual degree, has been announced by General Instrument Corporation. Another unusual item being produced by G.I. is a half-inch-square IF transformer, one-third smaller than those currently in use, for pocket radios and equipment using transistors.*

A NEW PLAN FOR "FIELD-ASSEMBLED" replacement controls and switches has been announced by Clarostat. The system is said to replace the numerous types of shafts and various electrical values with relatively few types and values that can be assembled in the field to meet any requirement. For details, contact Clarostat Mfg. Co., Inc., Dover, N. H.

Parts distributors from all over the country will show their latest components at the 1954 Electronics Parts Show, to be held in Chicago's Conrad Hilton Hotel May 17 through 20.

COLOR BLINDNESS DOES NOT SEEM *to affect a serviceman's ability to adjust a good color TV picture, according to Carl Finzer, an instructor in Motorola Inc's color television school for distributor service personnel.*

Finzer based his opinion after observing 75 service managers perform the same experiment in the laboratory of the factory service school in Chicago.

The experiment is to set up a color set to receive black and white pictures.

Reception of a good black and white picture lies in the technician's ability to focus all three of the primary colors (red, blue and green) with equal intensity.

"If a man can adjust a color set to receive a clear black and white picture, he can be sure of getting a good color picture since the intensities of color are already focused," Finzer explained.

Announcement was made jointly by Jerry B. Minter (Components Corporation), president of the Audio Engineering Society and Harry N. Reizes, Managing Director of Audio Fairs, that there has been a renewal of the Sponsorship Agreement wherein A E S will continue to sponsor the Audio Fair for the years 1954 and 1955. The sponsorship covers the periods for the Sixth and Seventh annual conventions of the Society.

For five successive years the Audio Fair has provided the forum, meeting rooms, society headquarters, convention facilities, banquet arrangements and contributed the cash sponsorship honoraria to assist the Society in the conduct and support of Society functions.

The Sixth Annual Convention of the A E S will again be held in conjunction with and at the same time as The Audio Fair—October 14, 15, 16 and 17, 1954 at the Hotel New Yorker, 34th St., and 8th Avenue, New York City.

Simpson Electric Company of Chicago will incorporate a new utility handle on their Model 260 volt-ohm-milliammeter. The new "Adjust-A-Vue Handle" permits the technician to set his tester at any convenient viewing angle right while he is servicing.

The tube division of RCA *has developed three types of equipment for servicing home color TV sets. These include a color-bar generator for facilitating adjustment of color circuitry in the receiver; a portable dot-bar generator for making convergence adjustments in the receiver; and a 5-inch dual-band width oscilloscope for observing the color-burst signal and for checking the color-burst circuit.*

Precision Apparatus Co., Inc., manufacturers of radio, television and electronic test equipment, presently located in Elmhurst, Long Island, announces that it will move to a new plant in Glendale, Long Island, by mid-summer of 1954. The new plant will provide expanded facilities for the PRECISION concern as well as for the PACE Electrical Instruments Co., Inc., their wholly owned meter manufacturing subsidiary.

A training school, in which the passing requirement is the ability to repair a color television receiver, is being held in Chicago by Admiral Corporation.

JETOMIC ANTENNA

[*from page 33*]

13 the diameter requirement would be roughly 26 inches. This of course would be impractical so an alternative method is used to accomplish the same result.

In *Fig. 2d* four additional elements are added to the V section of the antenna. An angle is chosen so that the separation at the flared ends of the V elements is less than ¼ wavelength at the highest desired frequency. The three elements on each side of the V become electrically intercoupled, and the result is the same as if we had used the larger diameter tubing or a flat sheet as illustrated in *Fig. 2d*.

The reader is probably aware at this point that we have been describing a form of the familiar conical antenna. The conical because of its inherent electrical configuration is a frequency compensated antenna. The gain of the con-

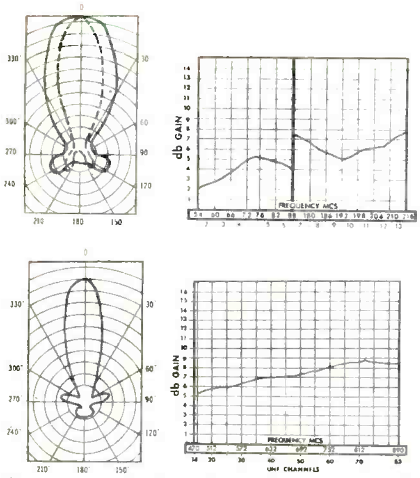


Fig. 5 — Gain of single stack unit.

ical on Channels 2-6 is less than the gain on Channels 7-13. This in the greatest majority of cases becomes an advantage, as propagation characteristics, tuner sensitivity and transmission line losses become greater as the frequency is increased. Economy of manufacture, ease of assembly and established acceptance were other factors that influenced the selection of the conical for the *vhf* section of the All Channel Model 454.

Before thought was given to the problems of electrical combination of two dissimilar antennas for all channel operation, a complete review of all *uhf* antenna types was undertaken to determine the best possible high gain broad band type. Standard models such as the corner reflector, and extended V seemed

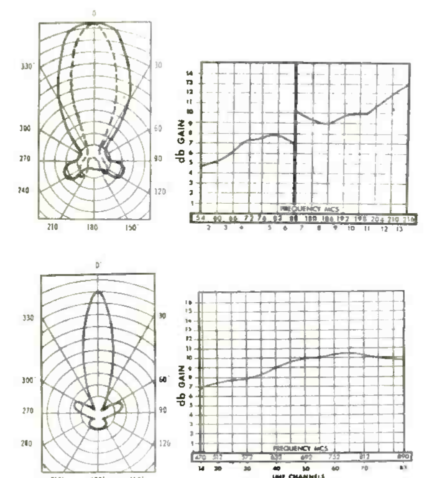


Fig. 6 — Gain of double stack unit.

to give best gain results, but had the disadvantage that it was necessary in many cases to probe for the best location at *uhf*.

At ultra high frequency the reader is probably aware that signal scattering occurs to a much more marked degree than on Channels 2-13. This means that multiple signal paths are available at the receiving location. The situation is further aggravated at *uhf* by the extremely short physical length of the transmitted wave. As the reflected signals arrive with the original ground wave at the receiving location, the in and out of phase components add and cancel resulting in high and low signal points both in the horizontal and vertical planes. This means that any small antenna must be moved to a position where maximum signal occurs if best results are to be expected.

The disadvantage of the smaller antennas can be overcome by employing an antenna that is physically long enough to cover several signal maximums. The reasoning behind the selection of the rhombic for the uhf section of the JFD 454 was twofold. First the gain of the rhombic exceeded that of any other broad band *uhf* type tested. Second the annoyance of spending valuable installation time in probing for a maximum signal location was completely eliminated. The rhombic has additionally the sharpest directional response of any *uhf* antenna, and can discriminate between closely spaced reflections and the major desired signal.

The selection of the two antenna types for coverage of Channels 2-83 was the first step in the development of Model 454. The problem of combining these two inherently different antennas without loss or electrical interaction was quite a different matter. Standard printed circuit isolation filters had dielectric losses in addition to off resonance insertion loss which would have cut the efficiency of our rhombic section in half. The problem of a perfect hermetic seal for this type of filter had never been satisfactorily solved. In the component type filters high and low pass circuitry relied upon perfect termination for best performance. Voltage losses in the order of 35 to 45 percent were not uncommon in the commercial versions tested.

At this point JFD engineers designed a simplified form of isolation filter to solve this specific problem. The filter had to have less than .5 db loss as viewed from either end. It additionally must completely separate both antennas at their individual frequency ranges. The filter had to be air mounted to eliminate dielectric loss encountered in the potted or printed circuit types.

Figure 3 is a schematic of the filter employed in the JFD Model 454. Here we have in essence a frequency discriminating electronic switch. In the case of the conical operation on Channels 2-13 the following occurs. The short piece of transmission line connecting the conical terminals to the transmission line take off points is only a fraction of a wavelength at these frequencies, and its net effect is to act as an extension of the down lead. The rhombic antenna on the other hand is connected to these same transmission line take off points through a capacitor network. The capacitor values are chosen to present a very high impedance to the passage of *vhf* signals. These capacitors follow a considerably higher impedance curve than their nominal value plotted against frequency. The reason for this is the variation in terminating impedances involved at the rhombic and the lead line take off points. The conical, therefore, can operate as a completely independent antenna on Channels 2-13.

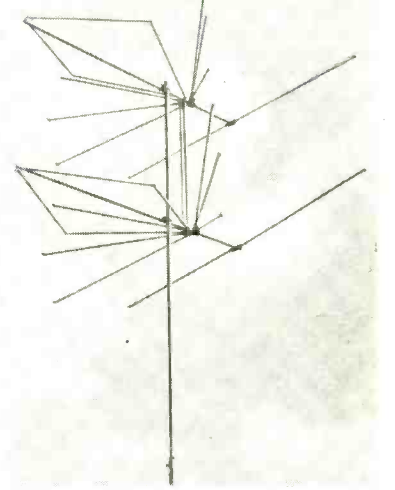


Fig. 7 — Double stack Jetomic antenna.

COLOR STRIPE SIGNAL

[*from page 29*]

ture stripe keyer". The amount of delay determines the position of the color stripe on the picture. The "picture stripe keyer" is also variable so that the width of the stripe also may be varied.

The output of this keyer goes to a "gate" which allows bursts of sub-carrier frequency to be passed to the output amplifier. The timing and duration of these bursts depends on the setting of the delay and the keyer. Ordinarily these bursts are of very short duration and appear at the end of the raster as shown in (b) of *Fig. 1*. So positioned they cause a green-yellow line about ¼" wide to appear in the picture as shown in *Fig. 2*.

The sub-carrier oscillator which is the heart of the WA-8A Generator is a crystal-controlled oscillator which is not locked to the picture sync signals. However, it is mounted in a heat-controlled chamber so that it maintains its frequency of 3.58 megacycles within sufficient limits for the purpose.

The output of the two "gate" circuits are fed into an amplifier, the output of which is loosely coupled to the signal line.

It will be noted that there is a straight-through circuit from input to output. Thus a failure in this unit will not interrupt regular monochrome operation. The switch from normal black and white to black and white *plus* color stripe is effected simply by applying B+ voltage to the output amplifier and oscillator.

ANSWER MAN

[*from page 20*]

is used to increase the strength of the joint.

Most pieces of electronic gear such as television receivers are not going to have to withstand shock or vibration as an aircraft receiver must stand up under. Therefore, the solder connection in practically every case will be sufficient without the mechanical connection.

Also consider this most important fact. In the process of unsoldering a paper condenser, which has had its pigtail wound around a terminal, several times as many of them have, the heat applied in first unsoldering and then reconnecting can and often does damage the condenser. Aside from the heat, the pulling and tugging on the pigtail can also loosen the connection of the pigtail internally in the condenser and cause it to pull right out, so that the technician is left standing with a pigtail in his hand and a big question in his mind. He must replace the condenser and if the trouble in the receiver was in any manner an intermittent it will probably necessitate at least a half hour of inspection to feel sure that this condenser was the culprit responsible for the difficulty.

The conclusion that many fully experienced electronic technicians have come to is that:

1) clipping of condenser leads is fast and easy, less tiring on the technician so that he can accomplish more repairs.
2) It does not damage the component as might be done due to heating and bending of the pigtail.
3) safe and reliable connections can be made if the pigtails are cleaned and soldered without forming a resin joint.
4) many years of experience has proved that this type of disconnecting of components is practical and does not result in future troubles.

COLOR [*from page 11*]

on the horizontal deflection coil winding on some color receivers.

3. A color burst gating voltage is usually employed necessitating a separate winding or a tap on the transformer.
4. A horizontal output tube grid pulse shaping voltage is provided with a separate winding. This voltage permits shaping the horizontal oscillator voltage which drives the output tube grid.
5. A color killer winding which prevents video information from passing through the color circuits unless a color broadcast is being received.

Deflection Yokes

By passing current in the form of a sawtooth through the horizontal coils the electron beams can be linearly deflected from one side of the picture tube to the other. Vertical deflection is accomplished in a similar manner; that is, by passing a sawtooth of current through the vertical deflection coils at the vertical deflection rate.

Deflection yokes used with color picture tubes have a horizontal deflection angle of 45 degrees for the 15 inch tube and 59 degrees for the 19 inch tube. The horizontal output transformer is designed to properly deflect the three electron beams over the color tube face with a uniformity of focus, high sensitivity and optimum convergence.

The vertical and horizontal coils are specially designed to develop uniform magnetic fields for deflection. The physical construction of the windings are such that the forward portion of the yoke is flared to minimize convergence errors due to fringe field effects.

The core of the yoke is made of eight sections, fitted together to produce a single ring of ferrite iron, a high efficiency core material. The core sections are champhered at the front edge permitting the core to fit close up to the flare of the coil windings.

The yoke is not designed to be used as a support for the color picture tube. The picture tube is supported by a Mumetal shield, as a consequence the yoke can be positioned easily on the neck of the tube. Proper operation of

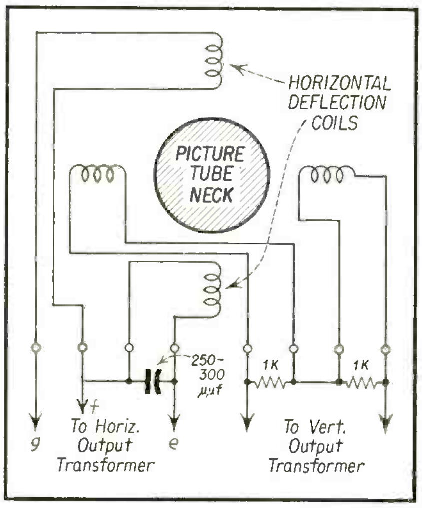


Fig. 8—Typical color receiver yoke circuit, showing horizontal and vertical deflection coils.

the picture tube requires the following yoke adjustments:

1. Positioning of the yoke along the picture tube neck. When positioning the yoke on the neck of the tube place it about 3/8 of an inch from the funnel of the picture tube as the preliminary point to start the adjustments from.
2. Rotating the yoke permits lining up the raster horizontally to coincide with the horizontal edge of the receiver mask.
3. By adjusting the yoke at a slight angle with respect to the neck of the picture tube or radially on the neck, the center of deflection of the magnetic field of the yoke can

be made to coincide with the deflection center of the picture tube. Purity at the center of the picture can be accomplished by moving the yoke axially on the mount. In the color receiver the positioning of the yoke is part of the adjustment procedure for color purity.

The deflection yoke is much larger in overall size than the one used with black and white receivers, measuring about 7¾ inches in outside diameter. The inside diameter is about 2¼ inches. With reference to the inside diameter an axial movement of about one inch is necessary to facilitate yoke adjustments for color purity.

Coils in a color yoke must be more accurately wound than B & W coils so that the magnetic fields are very uniform. The requirements of the deflection magnetic fields for the three beams are more stringent than that for the single beam black and white picture tube. The yoke is specially wound and designed to achieve simultaneous deflection of the three beams without defocusing the beam at the sides of the picture tube. This improved focus characteristic results in pin-cushioning in excess of that usually present in B & W tubes. For this reason the color tube is usually overscanned to make conceal this effect. Any dispersion of the three electron beams during deflection will make convergence more difficult.

The angle of horizontal deflection is either 45 or 59 degrees. Inductance values used to date are 12 to 15 millihenrys, for the horizontal cores and 80 to 120 millihenrys for the vertical deflection coils. These coils are located on the neck of the picture tube diametrically opposite each other as shown in *Fig.* 8, with the horizontal coils located vertically with respect to the neck axis. The *dc* resistance of the horizontal coils is about 10 ohms, and of the vertical coils about 60 ohms.

A 250 to 300 *uuf* condenser is used for neutralization purposes. If this condenser is not provided, or is open, vertical bars will appear on the left side of the picture. Improper neutralization in a color picture tube yoke will result in more serious effects because the three color electron beams will be distorted differently with the result that convergence of the three beams at the left side of the picture will be impossible.

As may be noted in *Fig.* 9 a series .02 *uf* condenser and a 4700 ohm resistor

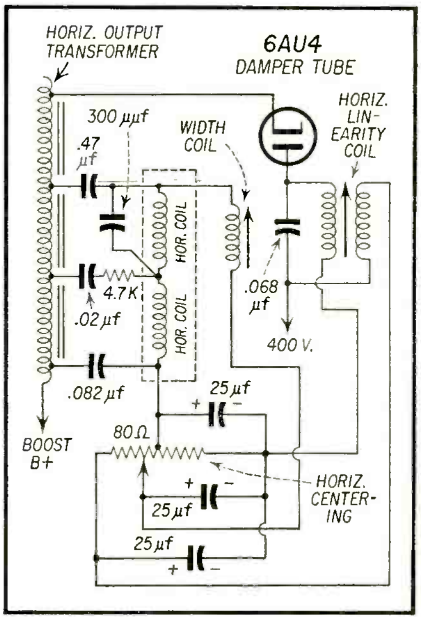


Fig. 9 — Controls in the horizontal output stage of color receiver for adjustment of width, horizontal linearity and horizontal centering.

connect the tap on the horizontal output transformer to the junction of the two horizontal deflection coils. This network also functions to effect neutralization of the horizontal windings.

(*To Be Continued*)

ENTERING HI-FI

[*from page 26*]

panels should be used. Where this isn't practical, the rearboards can be decoratively perforated. To protect the wood and also to prevent the finish from changing due to heat, the underside of the shelves can be lined with single layers of aluminum foil, face down. The grocery store variety is fine for this purpose. In cases where there is either insufficient circulation of air or an extremely high-powered system is being installed, a blower can be mounted in an appropriate place. Interference from the motor presents no problem on FM or phonograph reception—and what audiophile bothers with AM?

A word about wiring between a remotely located speaker and the rest of the system might be included here. The shortest and most invisible method of connection is preferred. Normally, the length of speaker lead would not be critical. Most quality amplifiers of today, however, employ a feedback system which includes the secondary winding of the output transformer. Any capacity introduced by the connecting wire is therefore effectively in parallel with the feedback (see Fig. 7). If a critical length (usually above fifteen feet) is reached, high frequency oscillations are introduced. A trick used more than once by the author in situations where wall to wall carpeting is used is to gradually shove a sufficiently large steel measuring tape under the rug and padding until it comes out the other end. One end of connecting wire can then be tied to the steel tape, and the whole works can be pulled back under the carpet. TV twin lead is ideal for this purpose since it lies flat and cannot be seen or felt through the rug.

Servicing

If all of the above advice is faithfully followed, there should be no need for further contact between the installer and the purchaser. But some part of the system is going to fail or wear out sooner or later and the customer will need a serviceman. The installer will usually get first crack at the job since he knows most about the particular system and the customer has confidence in him. A discussion of some important phases of this situation might be in order here.

There is the question of whether to handle service on a contractual or a per call basis. At first, it might seem wiser to choose the service contract arrangement. There are two good reasons against this choice. One is that, expensive as they are, a great many of the hi-fi components on the market are just border designed. Power transformers run awfully hot, output tubes are pushed to the limit, power resistors are not sufficiently de-rated and condensers are occasionally caught leaking wax all over the place. This is not true of a few of the better units, but enough of them fall into this category to warrant an objection to service contracts. Another reason is that, no matter how well the system performs, there is always a critical listener who "hears" things and is calling his serviceman to hear them with him. The end result is that the contractor becomes a slave. Charging for service on a per call basis is clearly the wiser choice.

Like most television sets, almost all audio components are supplied with parts lists, schematics, adjustments and alignment procedures. This is a great help in tracking down symptoms. Guarantee periods are usually longer on these units than on TV sets. And many manufacturers have authorized service agencies in various large cities so that if the trouble occurs within the guarantee period the offending member need not be touched at all.

Most important of all, there are very few really tough repair jobs. Most of them involve worn-out needles, faulty output tubes, noisy volume controls, intermittent cable connections, open filaments and the like. After several of these calls, the complicated ones come as a relief.

Profit

Now that the field has been covered from three major viewpoints—consulting, installing, repairing—it might be a good idea to analyze the source of profit available to the technician or serviceman who enters the audio field.

To start with, little if any profit is derived strictly from over-the-counter sales of components unless the seller is a franchised distributor. True, there is a nominal list price on most of the units which is about 30% or 40% above net. This figure is highly inflated, however, and is rarely charged. Besides, it would be quite embarrassing to have customers discover at a later date that they can buy the equipment for considerably less than they were quoted. Here again, it pays to level with the customer rather than risk a valued reputation. It may be possible, however, to obtain a professional or service discount from the local electronic distributor amounting to as much as 20% off the net price on some items. Another source worth investigating is the possibility of becoming a franchised distributor for a couple of audio firms. There are several newer and lesser-known outfits who put out quality items that easily compete with the nationally advertised units. These small manufacturers would be more likely to offer a distributorship to a dealer who is in a position to push their line.

The largest percentage of profit from audio work, however, comes from the services performed in the installation. On custom cabinet jobs, an arrangement can be made with a good local cabinet maker and the net profit shared equitably. Then, there are many extra services which the purchaser might want, such as extra speakers, earphones, remote switching, integration of his TV set with the system and other such items which require extra parts and a great deal of labor time. And of course, there is always that intangible quantity known as "professional services rendered" which should not be overlooked. Good advice is worth a lot of money and the customer will be the first to realize that when he listens to his hi-fi system and compares it with his neighbor's over-priced console combination. Finally, as was previously discussed, there is the revenue from service calls, which can be as remunerative as TV calls. The average audio system costs much more than the average TV set today and repair costs are roughly proportional.

After weighing both the advantages and disadvantages of adding audio work to the serviceman's business, the author has come to the conclusion that it would be a shame to neglect this lucrative field. In spite of its almost unbelievable increase in popularity in the past few years, it is relatively wide open in all areas except those in and around some of the largest cities. National magazines and radio networks have climbed on the bandwagon and can serve as a free source of advertising. And finally, the idea of hi-fi is so attractive that just setting up a demonstration unit is sufficient to bring in customers.

TV CLINIC *(from page 41)*

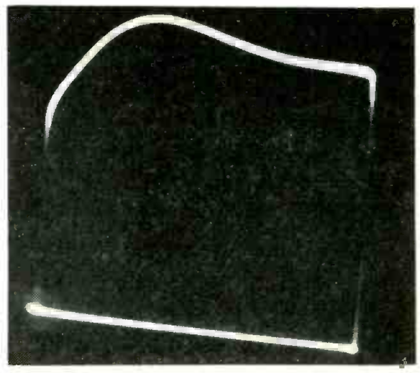


Fig. 7—Response curve obtained using a non-linear amplifier.

Q. What causes a pattern to appear very blurred and fuzzy during signal-tracing procedures?

A. This situation is shown in *Fig. 8.* It

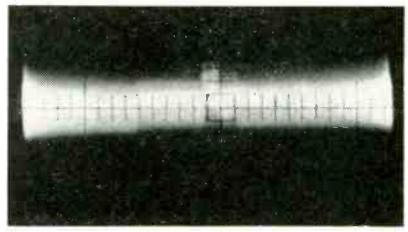


Fig. 8—Fuzzy pattern obtained with receiver gain set very high.

is usually the result of operating the receiver at high gain, so that the noise voltages appear prominently in the pattern.

Q. Upon occasion interference appears in the pattern which is not ragged, like noise, but which tends to blur the display. What is the source of such interference?

A. A typical situation of this kind is shown in *Fig. 9.* It is caused by stray

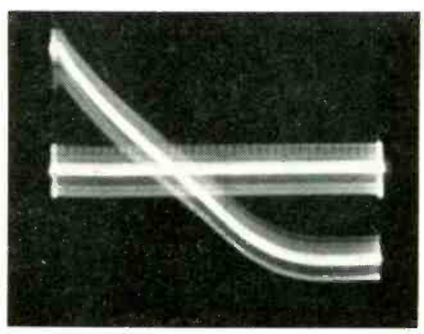


Fig. 9 — Stray pulse interference causing blurred scope display.

pulse voltages from the horizontal sweep circuit or from the picture tube. Better shielding should be used in the test setup, or, the horizontal sweep circuit of the receiver can be disabled during test.

TRADE LIT *Check List*

✓ ✓ ✓ ✓

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

LITERATURE AVAILABLE	SOURCE
Microphones, accessories, phono pickups, wire and tape recording heads are described in new **Catalog #44A.**	**Shure Bros., Inc. 225 W. Huron St. Chicago, Ill.**
Antennas, masts, towers, hardware, installation equipment shown in **Catalog** available with distributor's imprint.	**Admiral Corp. Accessories Div. Chicago 47, Ill.**
Type 301-A miniaturized wide-band, quantitative CRT oscillograph described in new **Bulletin.** Also, **Techniques of Photo-Recording from Cathode Ray Tubes, 3rd ed.**	**Du Mont Laboratories, Inc. Tech Sales Dept. 760 Bloomfield Ave. Clifton, N. J.**
How to Modernize Your Materials Handling Operations, 6-page illustrated booklet depicts use of two-way communication in industry. Includes resume of F.C.C. license regulations.	**General Electric Co. Advertising Inquiry Electronics Park Syracuse, N. Y.**
TV antennas and accessories described in **Catalog #55,** a 32-page multi-colored booklet, which includes Gain Reference Chart. 3-hole punched.	**R M S 2016 Bronxdale Ave. N. Y. 62, N. Y.**
Electro-welded TV antenna masts and butt and lock seam tubing are shown in new **Catalog** issued by this affiliate of the Snyder Mfg. Co.	**Bellevue Tube Mill, Inc. P. O. Box 4465, Phila., Pa. Attn: Dick Morris**
TV Replacement Transformer Popularity Tables, Stancor Bulletin no. 469 lists TV models using each Stancor replacement transformer. Separate tables for 55 major TV set manufacturers.	**Chicago Standard Transformer Corp., Standard Div., Addison and Elston Chicago 18, Ill.**
Catalog DE lists almost 300 new dry electrolytic capacitors as well as data on new type TDL, hermetically sealed dry electrolytic.	**Pyramid Electric Co. North Bergen, N. J.**
Bulletin describing eight new TV accessory items including TV filter, UHF-VHF crossover, 2-receiver TV coupler, calibrated variable L kit, Klipzons, clip and plug adapters.	**United Technical Labs Morristown, N. J.**
Two-color, 8½" x 11" **Catalog Sheet** on Telex Earset, listing specifications and related information.	**Dept KP, Telex, Inc. Telex Park St. Paul, Minn.**
Products for maintenance and storage of materials described in **Catalog R-1200-R.**	**Red Tiger Products, Inc. 20 North Wacker Chicago 6, Ill.**
Turbo tubings, sleevings, and wire described in illustrated **Brochure.**	**William Brand & Co., Inc. North & Valley Sts. Willimantic, Conn.**
Promotion Kit containing display material, mailing stuffers, newspaper mats, TV slides, commercial announcements describing Televanes.	**Ward Products Corp. 1148 Euclid Ave. Cleveland 15, Ohio**
Brochure on antenna package merchandising available to parts jobbers and service dealers. Also, 24-page **Radio Parts Catalog no. 538/1929** showing essential parts used daily available to all servicemen.	**JFD Manufacturing Co., Inc. 6101 Sixteenth Avenue Brooklyn 4, N. Y.**
Switches listed and illustrated in new **Catalog.** Twenty-five item numbers are catalogued.	**Erie Resistor Corp. Disc Dept. Erie, Pa.**
Complete characteristics and data on IRC molded boron-carbon resistors, type MBC are given in new **Catalog Bulletin B-8.**	**Int'l. Resistor Co. 401 N. Broad St. Philadelphia 8, Pa.**
Sample Card with different sizes wire manufactured showing gauge, weight per 1000 feet, breaking strength, diameter, etc.	**Imperial Radar & Wire Corp. 820 East 233rd St. Bronx 66, N. Y.**

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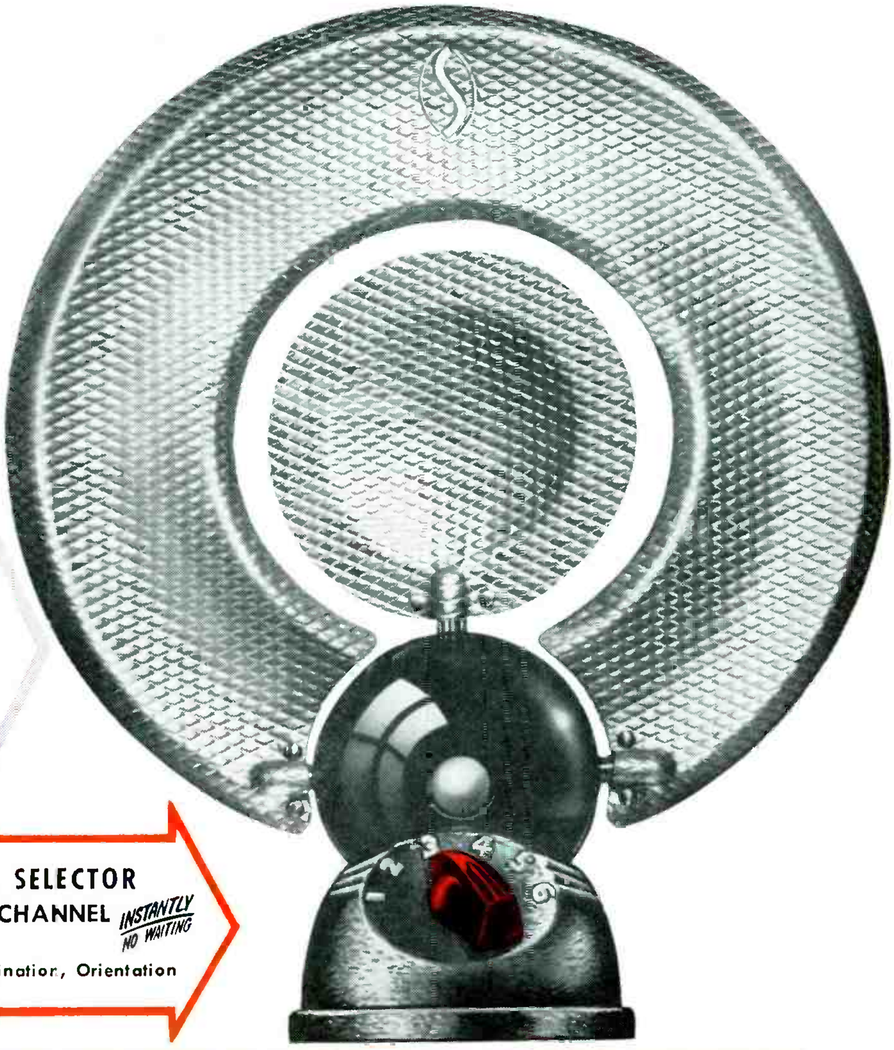

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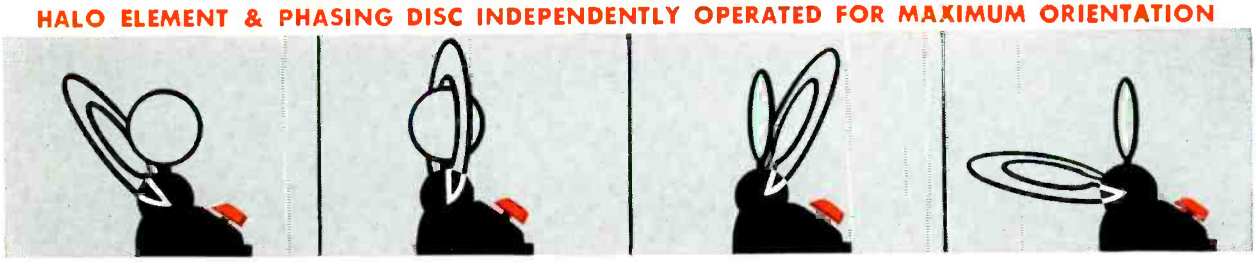

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