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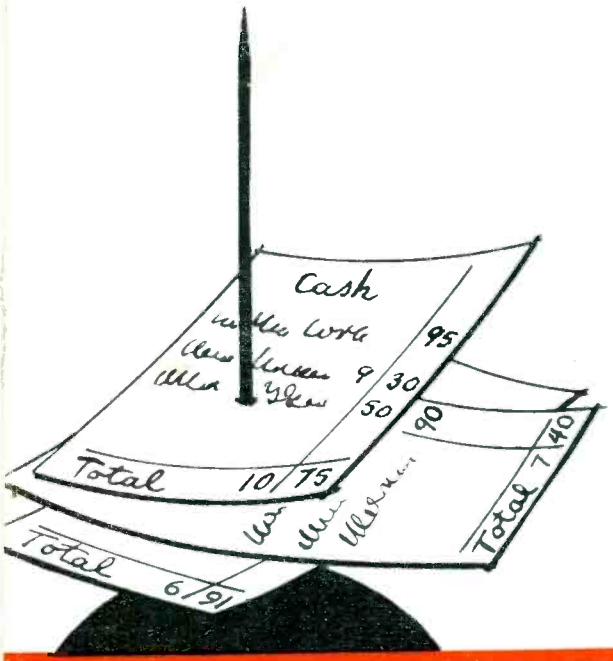

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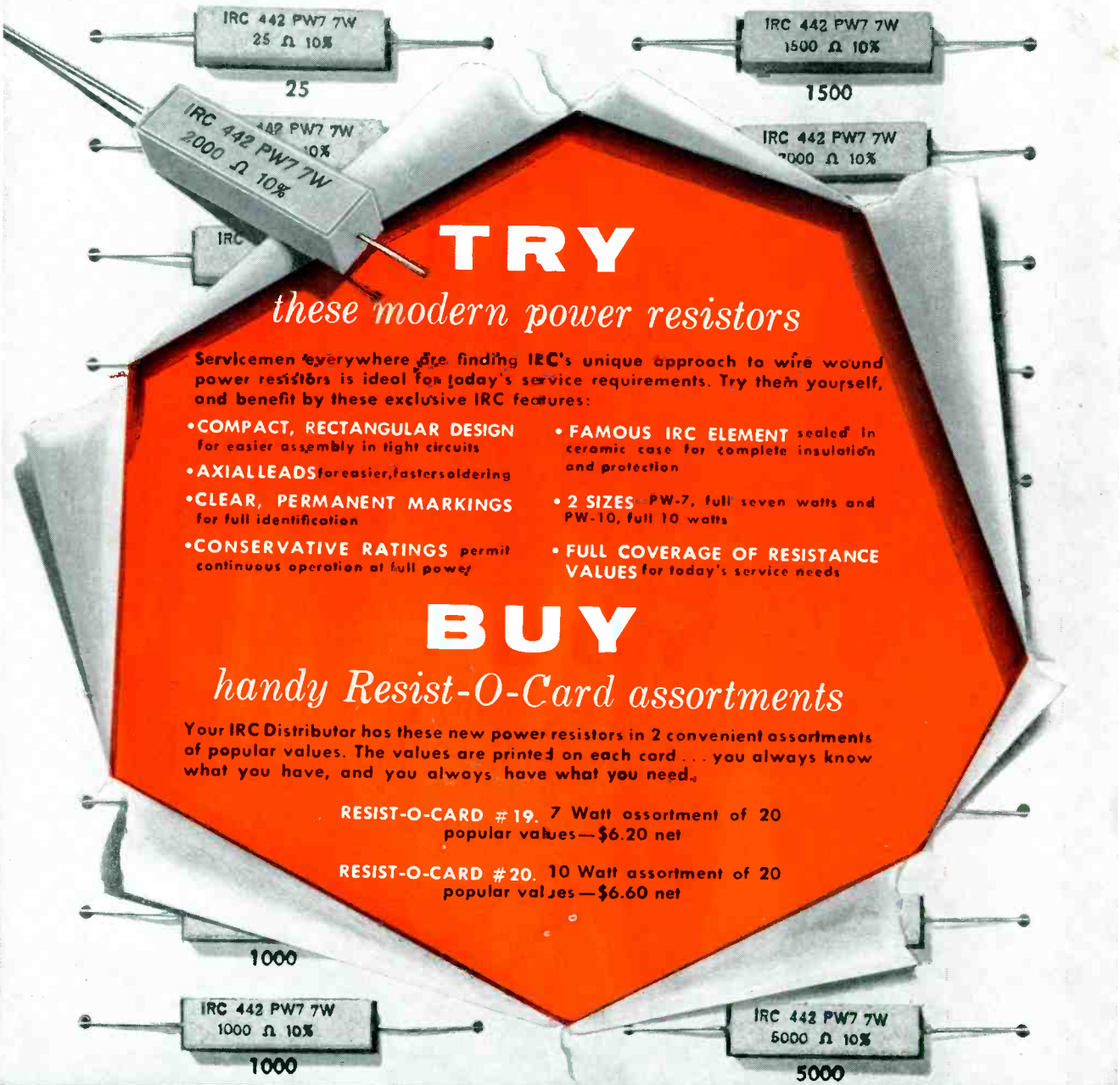

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VOL. 16, NO. 9 SEPTEMBER, 1955

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

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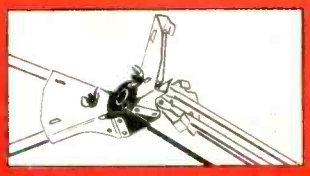
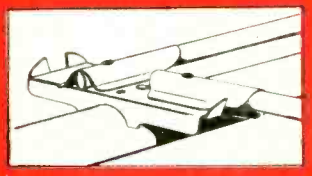


Insta-Lok Head—216% more resistance to vibration and breakage. Flip out elements—they're locked in place.



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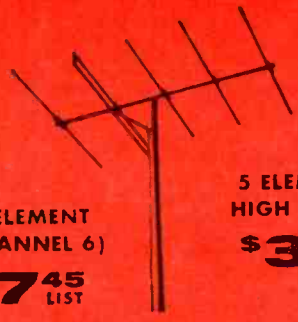

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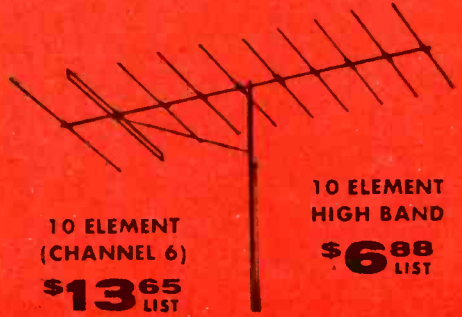

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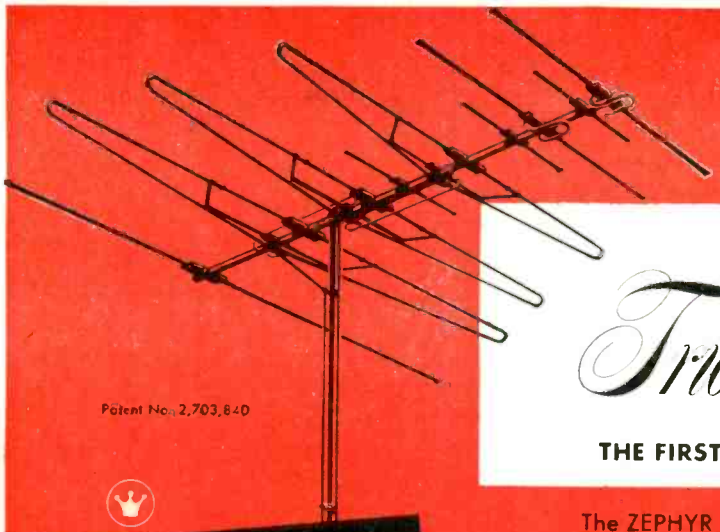

Patent No. 2,703,840

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THE FIRST STAGGER-TUNED TELEVISION ANTENNA

What Hi-Fi brings to Audio
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brings to TV Antennas!

The ZEPHYR ROYAL employs three "wing" dipoles, stagger-tuned, to provide even higher and more uniform gain, absolute flat response on all channels 2–13—a necessity for color TV. It is tuned on six predetermined frequencies in the same way that stagger-tuned circuits are used in I.F. stages in TV receivers.

The ZEPHYR ROYAL is not just an addition to the famous TRIO ZEPHYR, but is a completely new electrical design. Parasitic elements are used ONLY where they contribute to the efficiency of the antenna's electrical design—not just for promotional purposes.

A new phasing method provides increased directivity—and functions equally well on the highs as well as the lows.

The elimination of minor lobes, to an extent never before realized in an all-channel antenna, finally banishes all co-channel interference. All of the gain is packed into one efficient forward lobe.

Try a new TRIO ZEPHYR ROYAL. You'll find that in gain and directivity it's the best all-channel TV antenna ever produced for color or black and white.

Pre-Assembled—Uses TRIO's famous Insta-Lok Clamps. Sturdy—Rugged—Compact and it's patented too!

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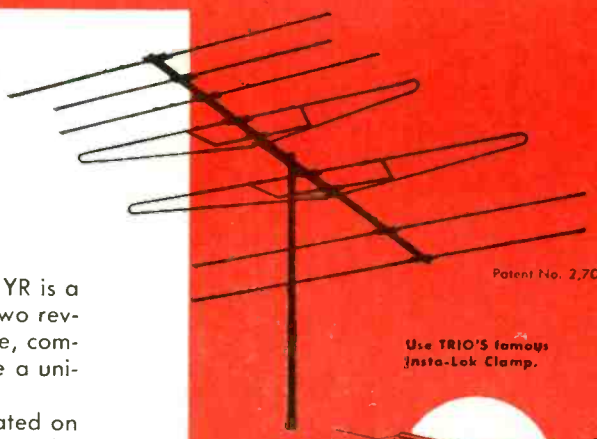
the Trio Zephyr



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Use TRIO'S famous Insta-Lok Clamp.

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There's sharp directivity too, on all channels—comparable to a yagi.

TRIO believes that with the introduction of the ZEPHYR and the ZEPHYR ROYAL, the need for stacked arrays is eliminated.

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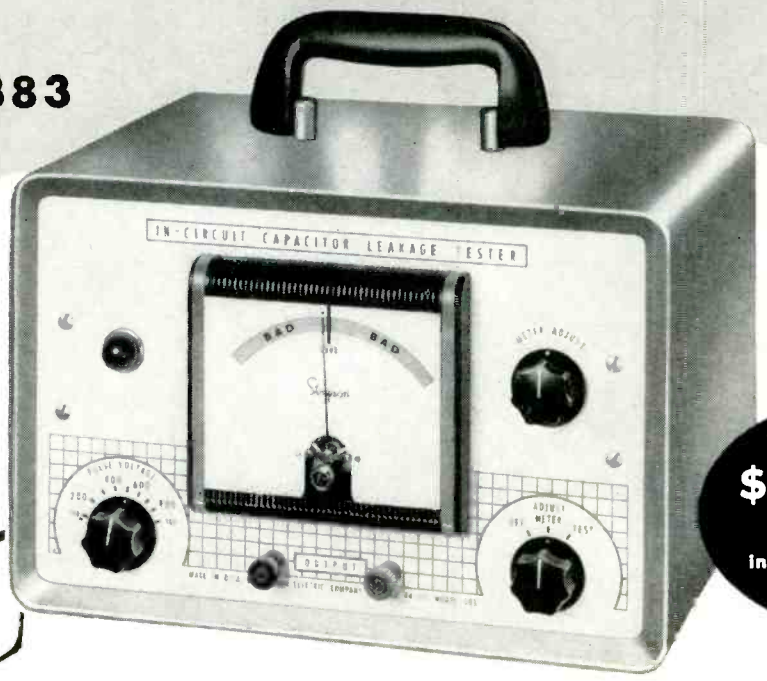
model 383



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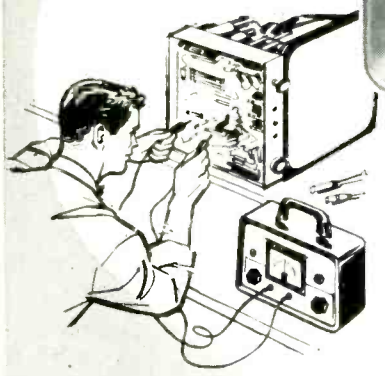

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Only two simple test leads to apply. Indication is on a "Good-Bad" scale—your customer can see *why* new capacitors are needed. Tests capacitors from 1 uuf to 0.25 uf in a jiffy. Indicates leakage resistance from "shorts" to hundreds of megohms. Also detects the presence of unstable *resistors* right in the circuit.

Be the first technician in your area to cash in on this fabulous Simpson tester. Sell *preventive* maintenance . . . fix "dog" sets in one-tenth the usual time. Double . . . yes, even triple your service income.

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TUNG-SOL "Magic Mirror" ALUMINIZED PICTURE TUBE

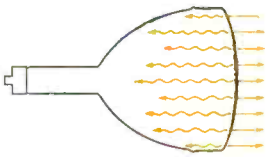
BRIGHTER-SHARPER
MORE DETAIL
MORE CONTRAST

The "Magic-Mirror" Aluminized Picture Tube creates the brightest, most realistic TV picture you can bring into the homes of your customers. The "Magic-Mirror" tube effectively utilizes *all* the light generated by the phosphor screen.

Tung-Sol has developed a unique "fogging" method of backing up the phosphor screen with a mirror-like aluminum reflector. This reflector prevents light radiating uselessly back into the tube. It brings out all the detail of which the receiver circuit is capable. So smooth and true is the Tung-Sol aluminum reflector that mottling, streaks, swirls, "blue-edge", "yellow-center" and other objectionable irregularities are eliminated.

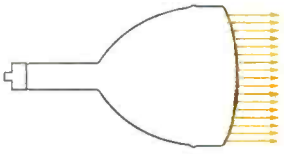
Tung-Sol pin-point-focused electron gun assures a steady, brilliant picture—free from alternate fading and overlighting. Tung-Sol's exacting standards of quality control, manufacture and testing further guarantee the high uniformity and maximum performance of the "Magic-Mirror" TV Picture Tube.

For further details, including Tung-Sol's sales aids and advertising support, call your Tung-Sol supplier today.



ORDINARY TUBE—Only *half* the light produced by the phosphor screen is utilized in the picture. Other half radiates wastefully back into tube.

RESULT—A light background within the tube which reduces picture contrast.



MAGIC-MIRROR ALUMINIZED TUBE — Aluminized reflector allows electron beam through. Blocks wasted light from backing up into tube. Reflects *all* the light into picture.

RESULT—Pronounced increase in contrast to make a bright, clear, more realistic picture.

TUNG-SOL ELECTRIC INC., Newark 4, N. J.

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12. Complete, detailed alignment data is standard and uniformly presented in all Folders.

13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.

15. Blank pin or locating key on each tube is shown on placement chart.

16. Tube charts include fuse location for quick service reference.

TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.

18. Series filament strings are schematically presented for quick reference.

COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver.

20. Proper replacement parts are listed, together with installation notes where required.

21. All parts are keyed to the photos and schematics for quick reference.

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22. Each Folder includes time-saving tips for servicing in the customer's home.

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TROUBLE-SHOOTING AIDS

25. Includes advice for localizing commonly recurring troubles.

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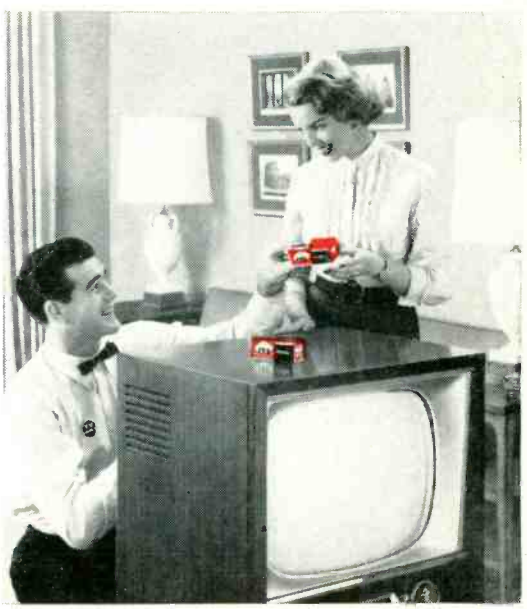


CBS-HYTRON, Danvers, Massachusetts

A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

EDITORIAL...

by S. R. COWAN
PUBLISHER

Free Enterprise

Recently several test equipment manufacturers marketed tube checkers, simple in design, suitable for laymen to use to check their tubes with. Many service dealers and service shop owners bought these checkers, put them into use in their own stores, and report they are happy with the investment and resulting tube sales. However, from mail we have received, it is apparent that others besides radio dealers (such as drug stores, super-markets, hardware dealers, etc.) have also bought these test-it-yourself checkers and are selling replacement tubes—these sales "being stolen away from us" according to the complaining radio service dealers.

The service dealers who wrote us and objected to the story we ran about the test-it-yourself checkers forgot that this magazine goes solely to professional radio-TV service shop owners, and not to super-markets or drug stores, and certainly not to laymen. The complainers also forgot that we would be remiss were we to fail to report the release of new products that can make money for our readers. Some of the objectors go so far as to condemn the tube manufacturers who are selling their tubes to drug stores and super-markets. They have forgotten that in this country free enterprise contributes to and abets prosperity. Tube makers want to sell tubes—as many tubes as possible. They don't care whether the tubes are bought by set-owners at drug stores or radio dealers' stores. *Our livelihood* comes from the success of professional radio service dealers and servicemen so we'd prefer to have them get all replacement tube business.

So, instead of "griping" and threatening to boycott tube manufacturers who sell to super-markets, may we suggest a counter-measure for service dealers to use. Fight fire with fire! Stated another way—outsell, and outmerchandise the super-markets! The way to do this is to EDUCATE your customers that the mere replacement of a tube that a checker calls "weak" or "bad" is NOT usually the only reason why a receiver is inoperative.

As a matter of fact, here is where history is repeating itself from the "fix-it-yourself craze" wherein, in due time, professional service dealers will benefit from the current loss of a few replacement tube sales. You'll get repair jobs that otherwise might not have come to you.

Now, the tubes sold by various outfits such as drug stores and super-markets may divert profits from service dealers for a while, but in time set-owners will find that they "goofed" when they tried to bypass the professional service dealers. But getting back to fundamentals—we still believe that professional service shops can buy for their own use and profit such items as "test-your-own" tube checkers. Let your customers use the checkers, paying you a nominal fee for the privilege, and you'll sell more tubes. Work more closely with your customers, and get more respect and business from them.

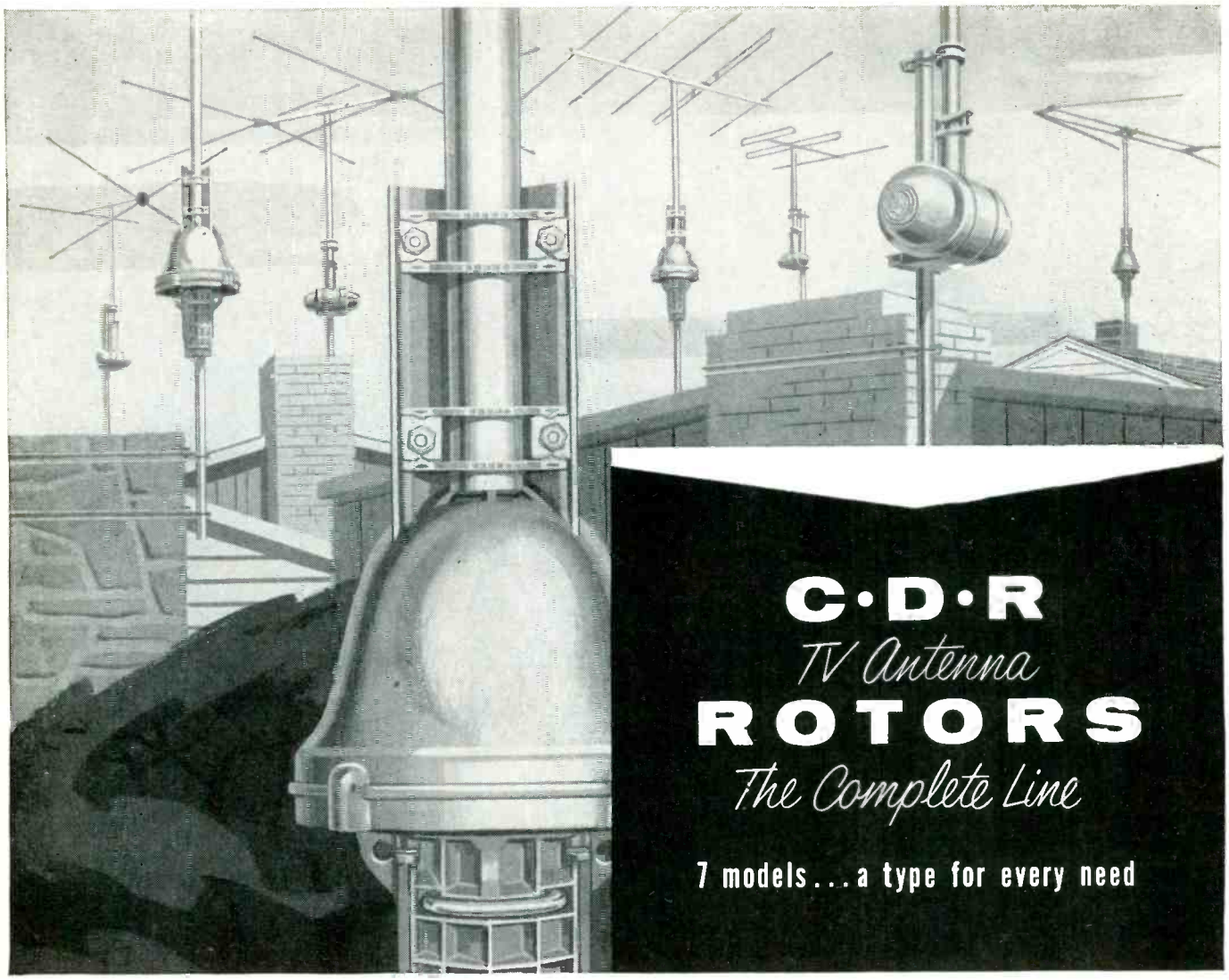
$15,000 Per Year Servicemen

This is a dynamic age! All manufacturers are extremely sales and merchandising conscious. To increase profits all are upping production, thus lowering unit costs. Retailers are also merchandising to the hilt, moving more units at lower-per-unit profit. Radio-TV service dealers and service firms can and should follow that pattern. Reflect for a moment! Are you "selling" your services more aggressively than heretofore or are you complacently going along, taking what you consider to be "your share," as the Fates decree? This question is asked because within the past few weeks I have spoken to many servicemen who candidly admit they are now in the $15,000 a year income bracket.

I asked these high-wage earners to disclose the "secret" that brought them such substantial incomes. In each case the "secret" was no secret at all. They merely adopted a policy that paid off well. What was that policy? A simple one! Each man first decided that he was truly a very competent serviceman and a dignified businessman. Then each decided that he would charge a minimum of $6 per service call for labor, with needed parts and tubes to be sold at list price. Each of these men has all necessary instruments and a substantial stock of tubes, etc., in the luggage compartment of his car. Seldom do these men "pull" a chassis from the customer's house.

Summarized—these successful servicemen have merchandised their time and ability. Their businesses are solidly founded and their satisfied customers, by recommendation, are steering more and more business to them daily. These men tell me they not only finish the TV repair job that they were basically called for quickly, but they also say to each customer something to the effect: "as long as I'm here, I'll fix any other TV set, radio, or phono-record player that needs looking at." And, from that simple extra "selling suggestion"—these men tell me that they get extra jobs in 3 homes out of 5.

Herein lies the so-called "secret" whereby many good, competent, business-like servicemen can and are earning better than $15,000 a year. Think this over! Are you desirous of getting into the $15,000 a year bracket or are you willing to go along, working 80 hours a week, for a piddling $3.50 per job "take"—hoping that you'll make a decent living this particular week?



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TR-12 Complete rotor INCLUDING thrust bearing. Handsome modern cabinet with meter control dial, uses 4 wire cable.

TR-4 The heavy duty rotor complete with handsome new, modern cabinet with METER control dial, uses 4 wire cable.

TR-11 Same as model TR-12 without thrust bearing.

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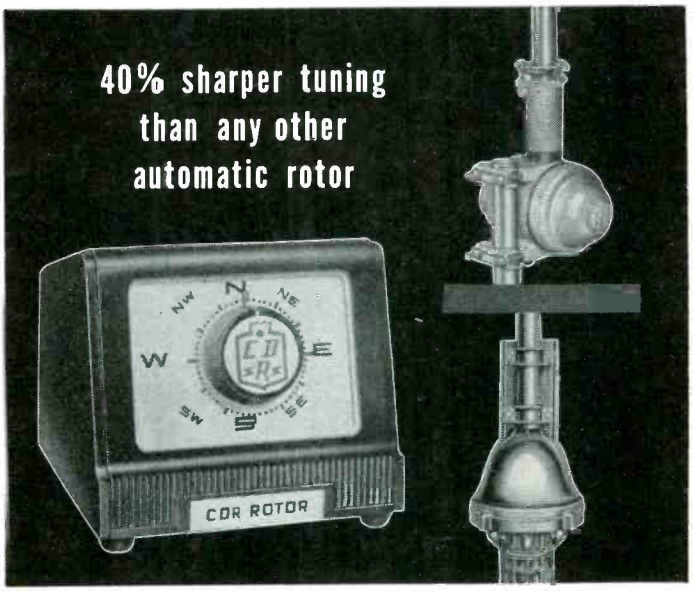

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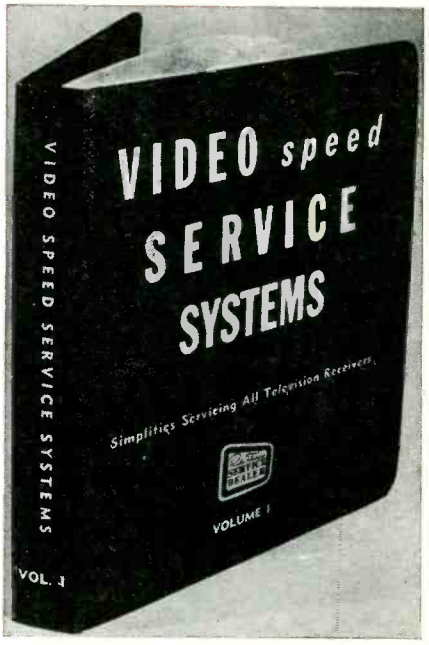

Facts About Video *speed* Service Systems:

CONTENTS:

A compilation of specific receiver service repairs, "bugs", chronic troubles, field circuit changes, manufacturers' production revisions, etc. The compilation enables the service technician to pin-point what is wrong with any given TV set and to correct the fault in the shortest possible time.

SOURCES:

The material was obtained directly from manufacturers, distributors' service departments, TV service organizations, and top TV Service-dealers throughout the country. Furthermore — all material has been checked carefully to assure dependability and accuracy.

USES:

The VSSS data sheet for any particular TVset maker's model or chassis number gives: 1—the *section* of the set affected; 2—the *symptom;* 3—the *cause* of complaint; 4—the *solution,* in simple, understandable and usable form.

Video Speed Service Systems is guaranteed to simplify servicing all TV sets. Contains over 600 service items representing over 2500 of the most serviced TV models now in use. Over 25 different manufacturers' lines are covered. Almost 15,000 copies of VSSS have been sold at $4.95. Every technician needs a copy.

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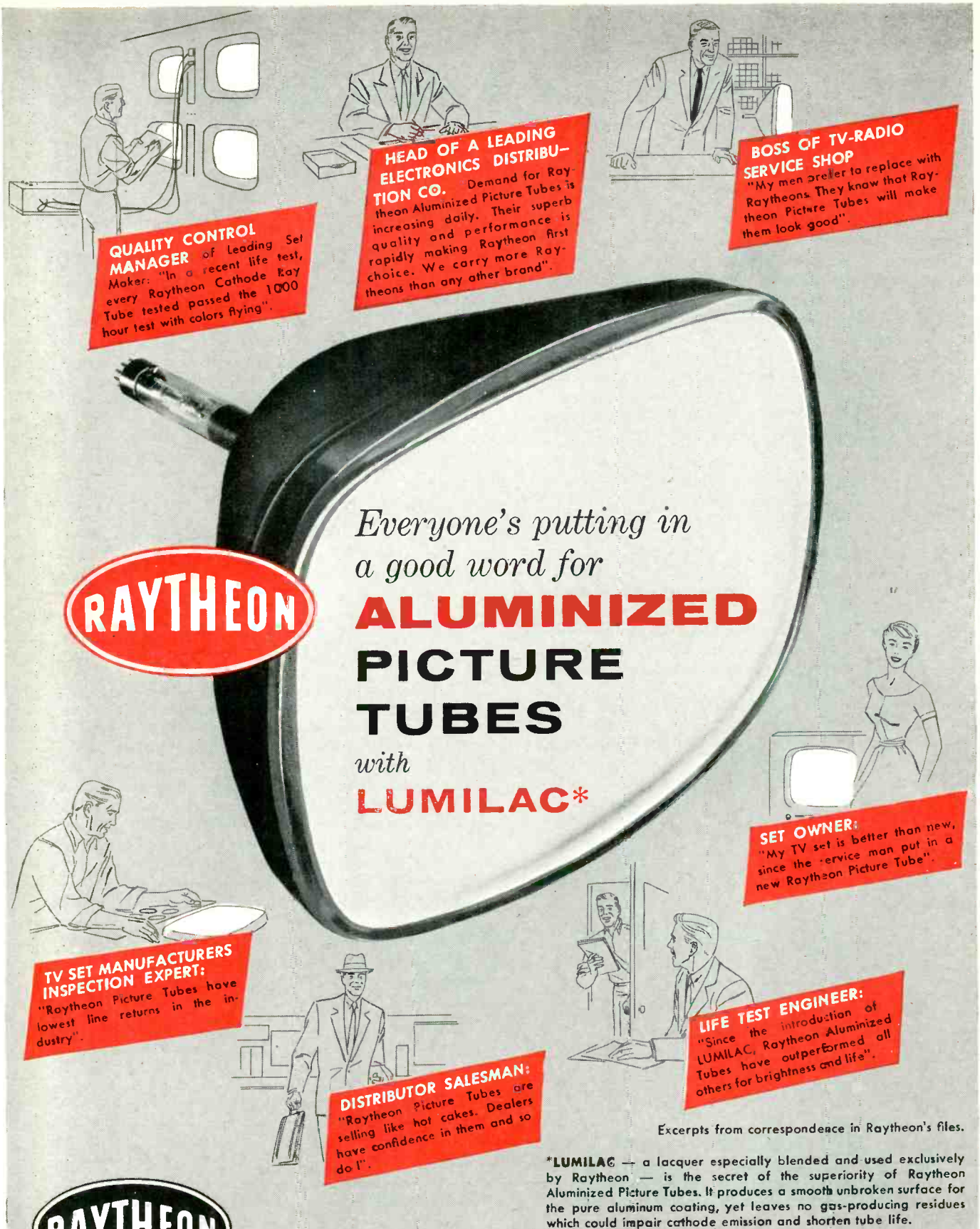

Excerpts from correspondence in Raytheon's files.

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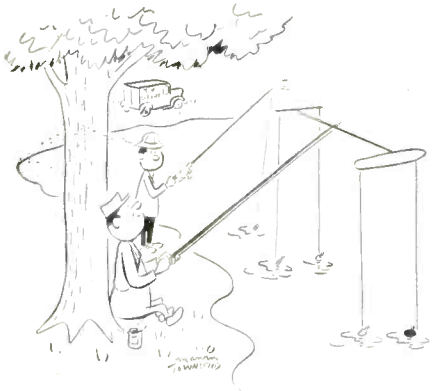
Service Industry Meets For Unity was the keynote of the meeting held by representatives of various Radio-TV service associations throughout the country in Pittsburgh, Pa. on August 7, 1955. At this meeting the groundwork was established for the type of organization that would best be suited for tying together in a closely knit group the various independent groups now in operation. An invitation is again extended to all delegates of national, state, and local groups to participate in another meeting to be held at Indianapolis, Indiana on October 9, 1955. For details write to J. H. Boyer, P. O. Box 204, Ephrata, Pa.

A UNIQUE SUMMER ANTENNA INSTALLATION promotion by TACO has been in progress these last few months with gratifying results. Features of this promotion have been attractive posters and mailing cards with the dealer's name prominently imprinted.

G. R. Day, a N. Y. serviceman *who combines Radio-TV Service and Burglar Alarm Systems comes up with an interesting observation regarding the loss of tool and tube kits from servicemen's cars. To quote Mr. Day: "The reason for this condition is generally a lack of precaution on the part of the serviceman in that he leaves the door of his car unlocked or leaves his bags unguarded on the sidewalk. If a theft occurs the first thing to do is to notify the police giving a full description of the contents. It would surprise you to know how much is recovered this way. All 'Buy and Sell' stores make regular police reports, and if your property is recovered in one of these places you can recover it for their cost which is usually very little."*



A TWIN-SPEAKER "SUPER-T" TRANSISTORIZED PORTABLE *radio that plays 2,500 hours, or for two years normal use, on a single battery, and a 21-inch color television set designed for the first practical mass production of color TV, were the stars of a new line of radios and television products unveiled in New York City (August 18) by the Raytheon Manufacturing Company. The color set has 24 tubes and 3 rectifiers. According to Henry F. Argento, vice president and general manager of the company's television and radio operations: "This set makes color TV practical. It is Raytheon designed, engineered and built. It is the size, no larger than a regular black and white TV console. It is not built like a baby grand piano. It can be mass-produced, and it has features such as top tuning, vertical chassis mounting, window-viewing of channel selection, great dependability, and extremely simple servicing."*

Victor H. Meyer Co., *distributor* of Sylvania products in the New York area, recently wound up a 3-day show for dealers which attracted 2400 persons at the Bayside Plant of Sylvania. The firm combined an exhibit of new Sylvania television, radio and high fidelity phonograph sets with a guided tour of the Sylvania research center here, where much of the basic research is carried out on developments in electronics and other fields, including atomic science.

MORE THAN SIX TIMES AS MANY HOUSEHOLDS had television sets in June 1955 than in April 1950, according to the results of a survey of the United States recently conducted by the Bureau of the Census. About 32 million, or 67 percent of the households enumerated in June had one or more television sets, whereas in 1950, the first time that a question on television was included in a census of housing, there were about 5 million households with television sets, or 12 percent of the total.

A campaign to break the *multi-million dollar racket in television and radio tubes was announced by Philco Corporation. Worn-out and discarded receiving tubes are being resold by unscrupulous concerns to the public, servicemen and dealers at tremendous profits, the Company said. The racket is estimated to cost television and radio users $100,000,000 annually. In many instances, it was said, these tubes are completely worthless, although they look like new tubes after being "cleaned up." Philco announced that its distributors throughout the Country will give all radio and television technicians and servicemen a credit of five cents for each old tube turned in, and that the old tube will be smashed in the presence of the serviceman. Industry-wide adoption of this tube smashing program would keep up to 30,000,000 old tubes a year out of the hands of the racketeers, Philco estimated.*

THE VITASCAN COLOR TELEVISION studio, developed after years of research by Allen B. Du Mont Laboratories, Inc., was opened to visitors at Gimbels, N. Y., on August 14, 1955. Vitascan projects light from a cathode-ray tube, instead of receiving light as the conventional color television camera does. In this Du Mont system, the projected beam of light travels over the scene, and then its reflection is picked up and converted by filtered Multiplier Phototubes into an electrical signal which can be transmitted with superb fidelity onto a standard color television system.

South River Metal Products Co., Inc., *holder of U. S. Patent No. 2482575 and Canadian Patent No. 463261 on the Chimney Mount Antenna Base, announced that Haydon Products of Brooklyn, N. Y., has settled the Patent Suit brought by South River against the subject firm. The settlement consisted of an agreement to discontinue the manufacture and sale of Chimney Mount Antenna Bases and a cash settlement for damages.*

OVER 3.2 MILLION TELEVISION RECEIVERS *were sold at retail during the first six months of this year to establish a new sales record for the period, the Radio-Electronics-Television Manufacturers Association announced. Retail sales of radios, except automobile sets, in the January-June period also were higher than last year, the Association noted. Retail sales of radios, excluding auto sets, were 2,429,018 compared with 2,410,893 sets sold in the first half of 1954. Automobile radios are not included in RETMA's report on retail sales of radios because most of them are made for inclusion at the factory in new automobiles. The Association had reported earlier that 3,661,416 auto radios were manufactured during the first half of this year, including 584,567 sets made in June.*

J. H. Craft, Jr., of Stromberg-Carlson has been appointed chairman of the Service Committee of the Radio-Electronics-Television Manufacturers Association for fiscal year 1955-56, President H. L. Hoffman announced. Mr. Craft succeeds H. J. Schulman of CBS-Columbia. The committee directs Association activities in the field of radio and television set servicing.

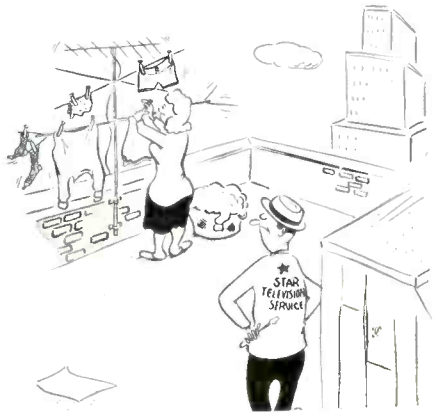
OVER 100,000 TV ANTENNAS ON homes along the Atlantic coast will be knocked down by hurricanes this year, it was predicted by Harold Harris, Vice President in Charge of Engineering of the Channel Master Corp., Ellenville, N. Y. Mr. Harris based his estimate on statistics compiled after last year's hurricanes. He offered the following advice compiled by Channel Master distributors to antenna owners in the areas likely to be affected: Call your insurance man to check immediately on antenna coverage. Is your TV antenna included in your present personal and property liability policies or do you need special coverage? Call your television serviceman to check your antenna installation. In addition to the antenna, the mechanical condition of the masting, guying, and lead-in wires should be carefully examined.

Two all-transistor portable radios—one in the miniature size with six transistors and the other featuring a larger loudspeaker and case with seven transistors—were announced by the RCA Victor Radio and "Victrola" Division, Radio Corporation of America, for introduction during the fourth quarter.

TELEVISION SERVICE DEALERS CAN NOW *sell G-E picture tube installations on an easy credit plan and be reimbursed in full immediately by their G-E tube distributors, according to an announcement by J. T. Thompson, manager of distributor sales for the General Electric Tube Department. The new finance plan covers the cost of a G-E picture tube, any G-E receiving tubes or parts needed to complete the installation, the service dealer's labor charges, and even a complete TV overhaul. The customer pays as little as five dollars down and has six months to pay the balance.*

Officials of the Astron Corporation, 255 Grant Avenue, East Newark, N. J., leading manufacturers of precision capacitors and RF filters, have just announced the opening of new expanded distribution facilities to service the West Coast area. The Company has contracted for large scale warehousing facilities in Los Angeles, Cal., in which have been placed a very large stock of all standard styles and types of Astron products. This significant new distribution move was further described as an integral part of the Company's recently announced over-all expansion program.

ERIE ELECTRONICS DISTRIBUTOR *Division, Erie Resistor Corporation, Erie, Pa. announces a new addition to their line of kits. This new kit consists of an assortment of 62 Erie General Purpose High Voltage and By-Pass Disc Ceramicons; Temperature Compensating Tubular Ceramicons; Printed Circuits; and High Voltage Filter Ceramicons packed in a handy convenient 18 section Plastic Case. The capacitors selected are those the serviceman encounters for replacement most often.*



Xcelite, Incorporated, of Orchard Park, N. Y., has completed a plant expansion program which increases the firm's output of hand tools by 25%. The expansion consists of a new building housing machinery for production of Xcelite nut drivers, screwdrivers, reamers and tool kits.

BETTY FURNESS WILL SPEARHEAD *a program advising 93.8 per cent of television set owners in 99 cities across the nation to rely on their servicemen for set repairs, it was announced by the Westinghouse Electronic Tube Division. The "Don't do it yourself!" campaign will be implemented by life-size store display of Betty Furness holding a Westinghouse Reliatron tube carton. Dealers are also provided with "Don't do it yourself!" booklets pointing out the hazards of amateur tinkering. The booklets are to be distributed to set owners by Westinghouse service dealers.*

Todd has brought out two new catalog sheets on R.C.A. and Motorola replacements. These catalog sheets feature a full and completely exact replacement line of deflection yokes, flybacks, vertical and power transformers for these two makes of TV sets. Leading Parts Jobbers throughout the country are now carrying these TODD . . . R.C.A. and Motorola replacements.

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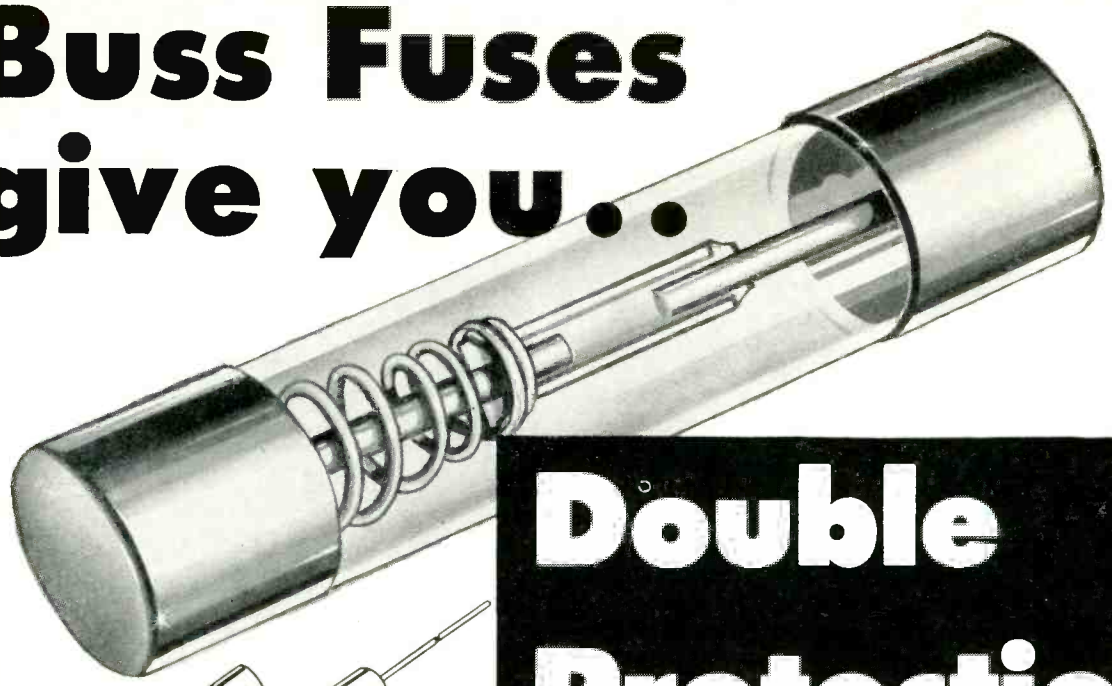

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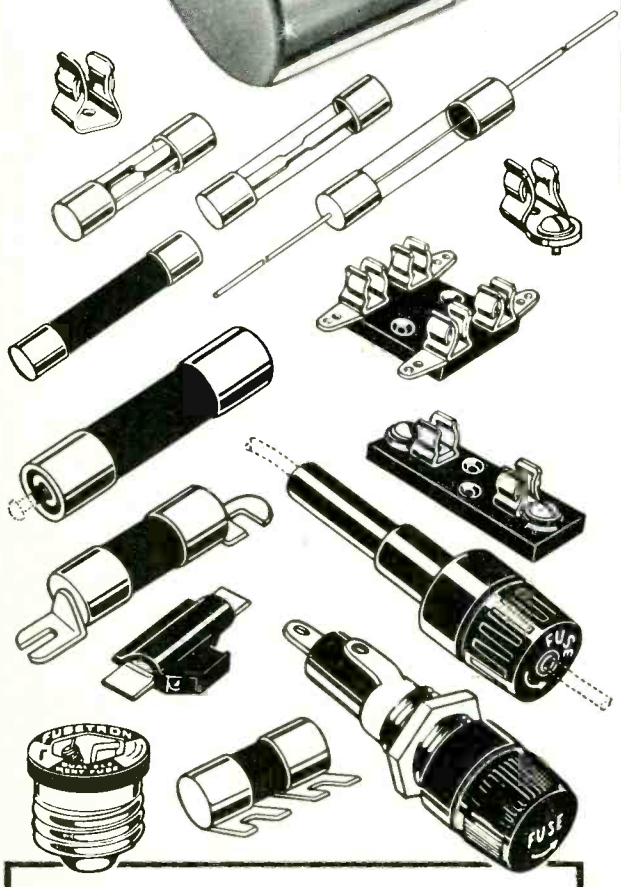

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CONVERGENCE

In Part 1 Of This Series On Convergence The Principles Of A 3-Gun Tube Are Reviewed, As Well As The Theory Behind Static And Dynamic Convergence.

by **Bob Dargan and Sam Marshall**

Part 1

from a forthcoming book entitled "Fundamentals of Color Television"

UNDERSTANDING convergence from the standpoint of theory and adjustment requires a basic understanding of the operation of the electron gun of the 3-gun color tube. For this reason we will devote a few paragraphs to a treatment of some of the essential principles of this tube. To some it may serve as a review and to others as an introduction. In any event it is a logical introduction to the subject of Convergence.

Review of Principles of 3-Gun Electron Gun

The 3-gun color tube has, as its name implies, three separate electron guns for controlling the three separate beams directed toward the red, green, and blue phosphors. The individual electron beams must be made to fall exclusively on their respective phosphor dots if correct color rendition is to be effected. The means by which we insure the latter comes under the heading of "Convergence."

The electron gun structure of a typical 3-gun tube is shown in *Fig. 1*. It consists essentially of three guns which are symmetrically arranged within the neck of the tube. This symmetrical arrangement is illustrated in *Fig. 2*. Each gun contains a cylindrical control grid (G1), screen grid (G2), focus electrode (G3), and a high voltage anode sometimes designated as G4. The electron beam from each cathode makes its way through these cylinders to the phosphor dots deposited on the glass faceplate of the tube. Four sets of internal pole pieces are included in the gun structure. One pair is located directly in line with an externally mounted "Blue Beam Lateral Corrector Magnet," and the other three pair are located in line with a set of externally mounted "Convergence Coil Magnets." The purpose and function of these magnets will shortly be explained. The pole pieces within the tube neck are designed to concentrate the magnetic fields of the externally mounted magnets on the desired electron beams.

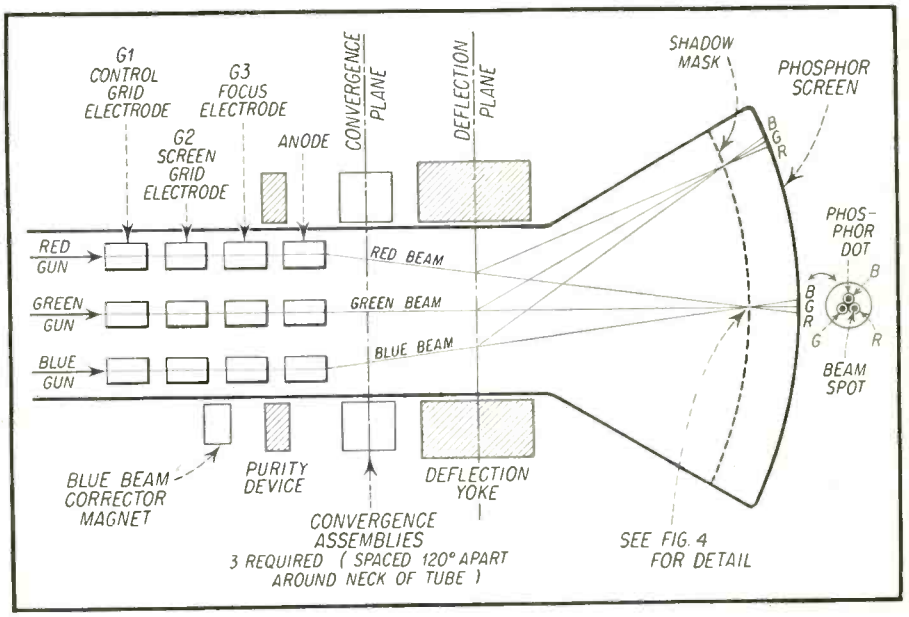


Fig. 1—Cross-sectional view of a 3-gun tube along its axis showing the electron beam paths and external beam control components.

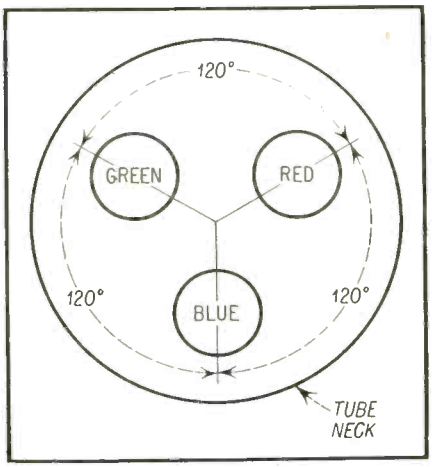


Fig. 2—Cross-sectional view of 3-gun color tube showing placement of the electron guns. Tube may be mounted with blue gun on bottom, as shown in figure, or blue gun on top.

The manner in which the three electron beams travel through the tube is shown in *Fig. 1*. Notice that each beam is controlled separately by a single gun. Observe also, that on leaving the high voltage anode the beams are shown to converge toward the shadow mask. Actually this convergence is effective along the entire axis of each gun. This condition is brought about by the fact that the guns are symmetrically tilted about one degree along the entire length of their axes, the object being to effect a meeting of the three beams at an aperture in the *approximate* center of the shadow mask under conditions of zero horizontal and vertical sweep. The operations performed in making the three beams fall *exactly* on this aperture are called "Static Center Convergence" adjustments. The plane across the neck of the tube directly in the center of the convergence assembly is called "The Convergence Plane."

A little ahead of the convergence

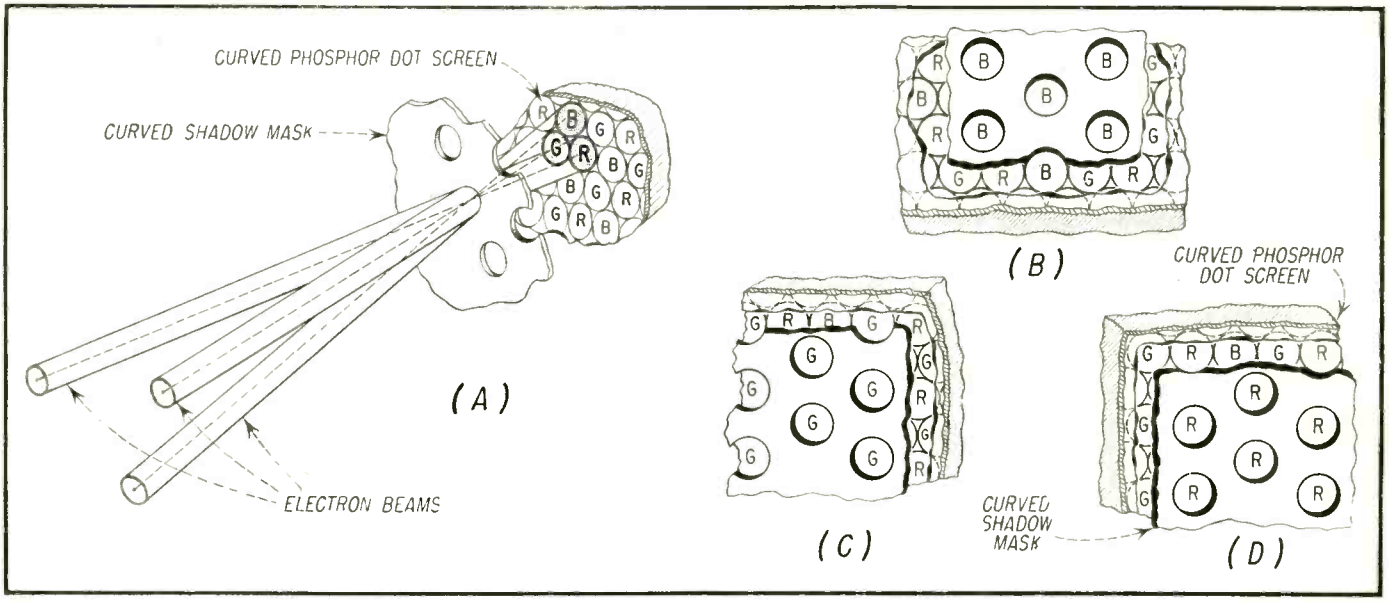


Fig. 3—Two views showing how properly converged electron beams fall on their respective color phosphor dots. In (A) all three beams are shown as they enter the aperture mask. In (B), (C), and (D) each beam is viewed from its own particular deflection point.

plane the three beams fall under the influence of the horizontal and vertical deflection fields. These fields sweep the beams across the face of the tube, and may be considered to begin beam deflection in a plane called "The Deflection Plane." The beams then continue on to the various apertures in the shadow mask.

On leaving an aperture each beam falls on a phosphor dot which lights up in a color corresponding to the color the beam is supposed to produce. *Fig.* 3 shows two popular methods used to illustrate this principle. Both illustrations are meant to convey the same explanation of how the three beams, though entering the same aperture simultaneously, reach different phosphors on the screen. In (A) the three beams are shown entering an aperture

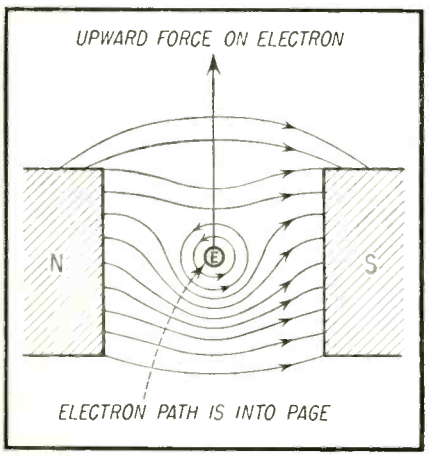


Fig. 4—An electron proceeding in a direction into the page is acted on by an upward force as shown. This force is the resultant of the magnetic fields of the electron and the magnet.

at different angles in accordance with the principles of mechanical convergence and magnetic deflection just discussed. Because their exits are at different angles they will naturally fall

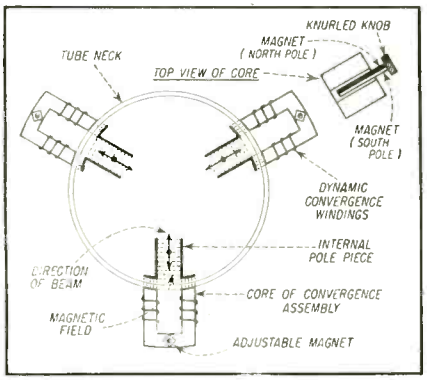


Fig. 5—Convergence structure mounted on neck of tube. Adjustable magnet mounted on top of core provides variable magnetic field of reversible polarity.

on three red, green and blue adjacent phosphors if the tube is properly constructed. In (B), (C) and (D) each beam is analyzed individually. Thus (B) shows us how the shadow mask and phosphor screen appear to a blue beam in its path from the deflecting field to the phosphor screen. The same applies to (C) for the green beam and (D) for the red beam. Therefore, it can be seen that the *angle of approach* determines which colored phosphor a beam will strike. This angle of approach is controlled by the mechanical tilt of the three guns as well as the various electrostatic and electromagnetic fields set up within the tube.

In a tube free of production inaccuracies each electron beam will fall only on its corresponding phosphor dot. If the center of the beam falls exactly on the center of the phosphor dot perfect "Register" results; if not, color contamination and fringing will be observed.

Magnetic Control of Convergence

Up to this point we have not discussed the various external magnetic devices which are used to insure *perfect* convergence both at the center and at other points of the screen. It will shortly be apparent that convergence across the entire face of the screen, that is during horizontal and vertical deflection, involves two sets of magnetic controls.

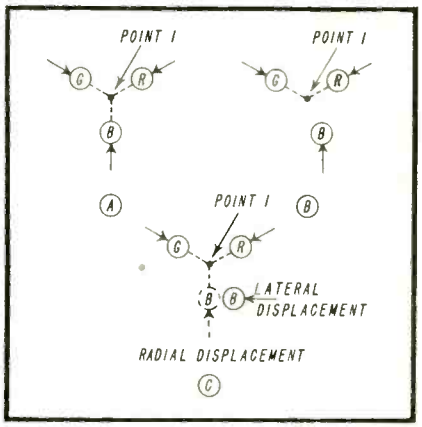
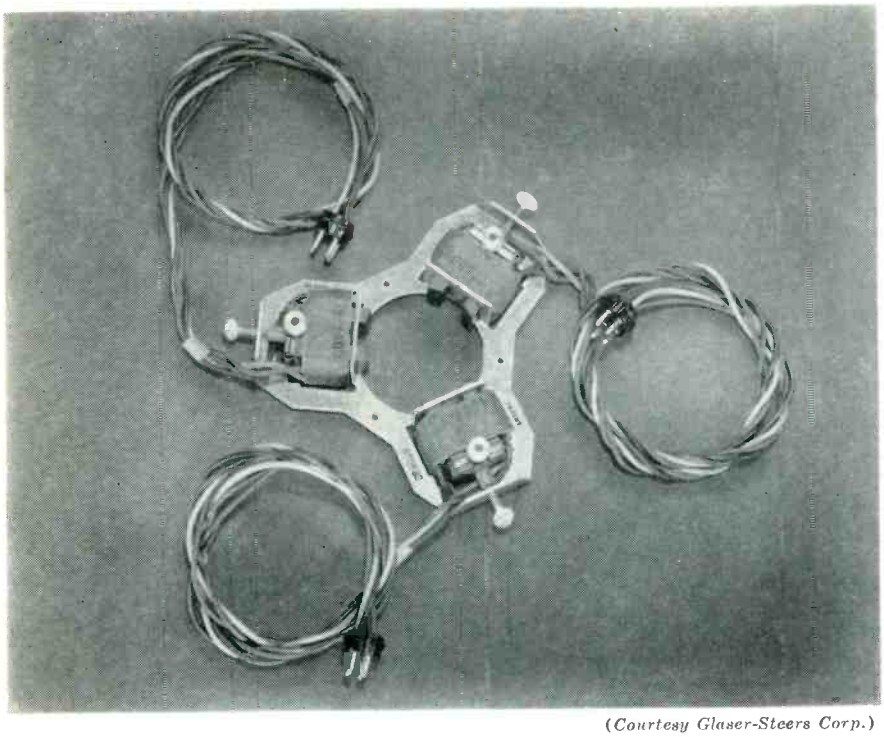


Fig. 7—In (A) phosphor dots are symmetrically disposed around point I, and may be converged radially. In (B), only green and red dots may be converged radially. In (C), addition of lateral adjustment permits convergence of all dots.



(*Courtesy Glaser-Steers Corp.*)

Fig. 6—Typical commercial static and dynamic convergence assembly. Cylindrical knobs for magnetic control are shown in center area.

The first is a set of adjustable permanent magnets, and the second a set of electromagnets. All are located on the neck of the tube. Exact convergence *at the center* of the screen may be obtained by adjustment of the permanent magnets only.

Center Screen Convergence

We are now ready to see how this exact convergence at the center of the screen may be obtained. Referring to *Fig. 1* again, let us assume that the deflection power is temporarily removed from the yoke on the neck of the tube. In this case the electron beams will tend to converge toward the center aperture of the shadow mask. If convergence is perfect each beam will result in its corresponding color phosphor dot being produced at the center of the screen. These dots in turn, because of the limited resolution of the eye, will appear as a white spot to the observer.

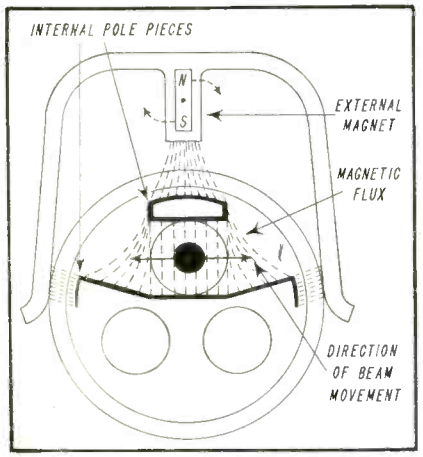
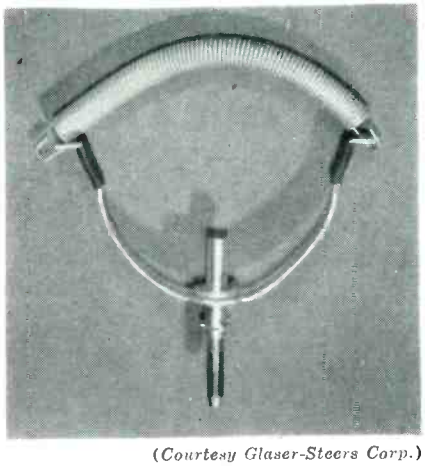


Fig. 9—Magnetic field set up by Blue Beam Corrector Magnet.



(*Courtesy Glaser-Steers Corp.*)

Fig. 8—Commercial Blue Beam Lateral Corrector Assembly.

However, perfect convergence at the outset is not a likely circumstance due to production inaccuracies, and the individual beam paths will invariably have to be adjusted so that they fall on their proper phosphor dots. A simple means of influencing an electron beam is by the use of a magnetic field at right angles to the direction of the beam and having an adjustable intensity.

An electron beam moving in a magnetic field behaves like a wire carrying current in a motor, that is, it is deflected at right angles to the magnetic lines of force as shown in *Fig. 4*. In this figure we will assume that the direction of motion of the electron is into the page and perpendicular to it. Then, according to elementary electrical principles, the electron beam will produce a magnetic field of its own which will react with the assumed direction of the magnetic lines of force produced by a fixed magnet. This reaction is such that at the bottom of the electron both fields will be the same and a repulsion between the fields will take place. On the top of the electron both fields will be opposite and an attraction will take place. The net result will be an upward deflection of the electron beam. If the direction of the magnetic lines of flux were reversed the beam would be deflected downward. Thus, a magnet capable of producing variable and reversible magnetic fields can cause an electron beam to be moved up or down by any amount as shown in the figure.

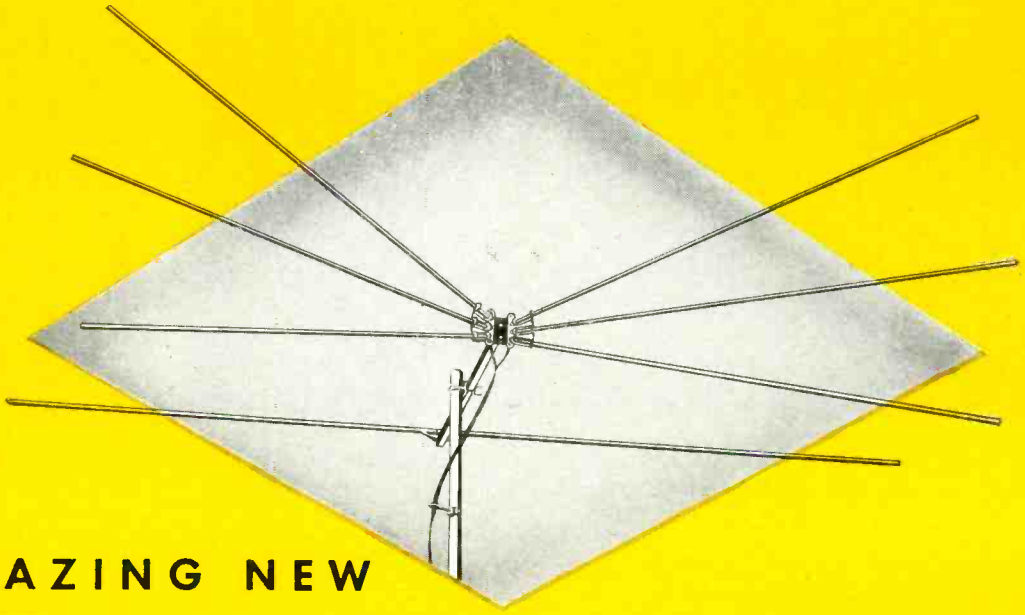
Magnetic devices of this nature may be mounted on the core of the convergence structure in the manner shown in *Figs. 5* and *6*. The split longitudinal permanent magnet as shown in *Fig. 5* provides an increase or decrease of magnetic flux as it is rotated as well as a reversal of the magnetic field if required. The net result is a movement of the electron beam above and below a neutral point corresponding to the point where the magnetic field is zero and exercises no control of the beam. This adjustment is made by the knurled nuts in the assembly shown in *Fig. 6*.

The entire convergence structure is mounted on the neck of the tube directly behind the yoke and provides the required radial displacement of each of the electron beams. It is customary to indicate this displacement in the manner shown in *Fig. 7A*. Here we see how the phosphor dots appear at the front of the picture tube. If the beams are symmetrically located one merely converges the green and the red beams together so that they are superimposed on each other at *point 1*. Following this the blue beam is positioned upward so that it also falls on *point 1*.

However, as shown in *Fig. 7B* this beam symmetry seldom exists. More often we find that the blue dot is either to the left or right of *point 1* when the red and green dots are converged. Therefore, some additional means must be provided to adjust the blue beam *laterally* as well as *radially*. To this end an additional magnet structure previously referred to as the "Blue Beam Corrector Magnet" (*Fig. 8*) is mounted on the lower neck of the tube as shown in *Fig. 1*. The magnetic influence of this magnet on the blue beam is shown in

[*Continued on page* 53]

PHILCO® *Announces*



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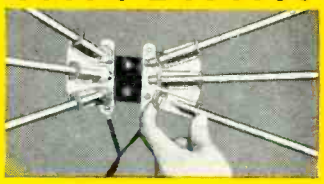

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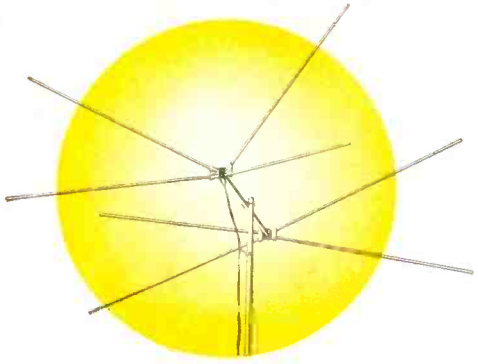

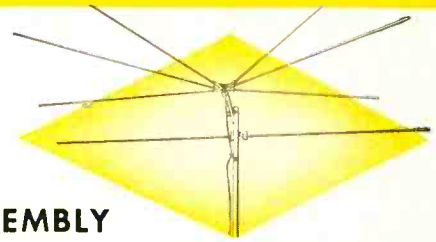

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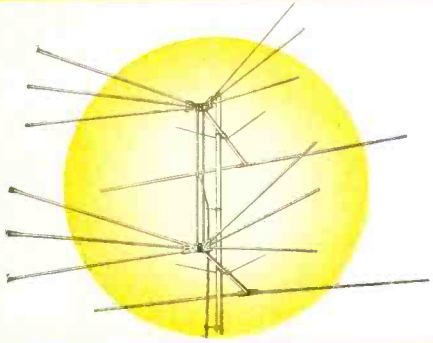

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GEIGER

This First Installment Deals With

Part 1

by **Oscar Fisch**

THE serviceman who doesn't like to let grass grow under his feet would do well to acquaint himself with the problem of servicing radiation detectors. Thousands of these devices are in use at the present time by amateur and professional prospectors in an endless search for uranium bearing ore. This has opened up a new field for both sales and service which falls quite naturally into the lap of the serviceman. The circuits and components used in radiation detectors are, with very few exceptions, very similar to those found in radio and TV receivers. It is the purpose of this series to provide the serviceman with the basic information necessary for understanding and servicing these instruments.

The Makeup of Matter

To begin with, a brief discussion of radioactivity is in order. As you probably know, all matter is composed of atoms. An atom in turn is made up of a central nucleus surrounded by one or more electrons. These electrons travel around the nucleus in elliptical orbits, so that the atom resembles a miniature solar system with the nucleus corresponding to the sun, while the electrons correspond to planets. The nucleus of the atom contains protons and neutrons. Electrons have a negative charge, protons have a positive charge, and neutrons, as their name indicates, have no charge.

There are only ninety-two different kinds of atoms occurring naturally on the earth. A few more have been made by man by a process with which we need not concern ourselves here. All of the millions of different substances we know of are made up of different combinations of these atoms.

Fig. 1—Two typical Geiger-Mueller tubes. The one on the left is the Type 75NB3 manufactured by Amperex Electronic Corp. The one on the right is a Tracerlab TCG-8.

Radioactivity

Nearly all of the different atoms are naturally stable. By this we mean that the number of protons and neutrons in the nucleus, and the number of planetary electrons remain unchanged. Thus an atom of copper remains an atom of copper. An atom of oxygen remains an atom of oxygen. There are a few atoms however, which are unstable. Without the application of any outside force, the nucleus of such an atom splits into two parts, each of which forms a new nucleus. Some of the planetary electrons of the original atom go with one of these two *daughter* nuclei while others go with the second newly formed nucleus. The most familiar of these unstable atoms are radium and uranium. Along with the splitting process, there occurs another interesting and most important phenomenon, namely, the shooting out of three distinct types of rays. They have been named, alpha, beta, and gamma rays. The alpha and beta rays consist of streams of charged particles, the alpha being positive (1) and the beta negative (2). The gamma rays are electromagnetic waves of very short wave length. This entire process is called *Radioactivity* and the rays given off are called *Radioactive Emanations, Radioactive Radiation,* or *Radioactive Rays.*

The Geiger Counter

In prospecting for radioactive ore as well as in research work involving radio-

COUNTERS

The Basic Theory Of Geiger Counters

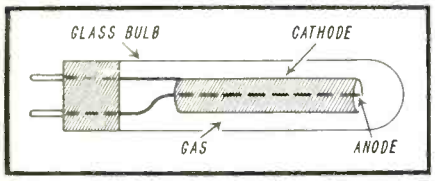


Fig. 2—Internal construction of a Geiger-Mueller tube.

activity, a number of different types of instruments may be used to detect the presence of the radioactive material. For all practical purposes, the serviceman need concern himself with only two types. These are the "Geiger-Counter" and the "Scintillation Detector".

The heart of a Geiger Counter is the Geiger-Mueller tube or more simply, the Geiger tube. They are also called GM tubes. *Fig. 1* is a photograph of a number of such tubes. Actually, its construction and operation are simpler than most tubes used in radio and TV circuits. *Fig. 2* shows the construction of a typical GM tube. It consists of a glass tube containing two elements and filled with a gas under low pressure. The cylindrical metallic element serves as the cathode, or the element to which a negative potential will be applied. The central wire is the anode which is connected to the positive side of the voltage source.

Ionization

To understand the operation of the GM tube it is first necessary to understand the process of ionization. It has already been pointed out that atoms contain positive charges in the form of protons in the nucleus, and negative charges in the form of planetary electrons. Under normal conditions an atom of any kind is electrically neutral. The electron and proton have charges of equal strength, but of opposite polarity. Thus, the normal atom, being neutral, must have as many electrons outside the nucleus as there are protons within. There are ways, however, of forcing one or more electrons to leave an atom. When this happens, the remaining "partial atom" acquires a positive charge and is now called positive *ion*. The process of knocking off these electrons is called ionization. (Atoms may also form negative ions by picking up electrons, but we are not concerned with this at the moment.)

In a GM tube, one method which could be used to ionize the gas within the tube would be to apply a sufficiently high voltage between anode and cathode. Under this condition the positive voltage on the anode is strong enough to tear electrons away from their atoms. We shall see later that a GM tube must always be operated at a voltage *below* this "breakdown" voltage. Another and much more important method for producing ionization is to allow radioactive rays to strike the tube. All three types of radioactive rays, alpha, beta, and gamma, are capable of producing ionization.

GM Tube Operation

When radioactive rays enter a GM tube, ionization of the gas within the tube may occur in two different ways. First, the gas may be ionized directly by the ejection of one or more electrons from the gas atoms. Frequently however, the ionization is indirect. The gamma rays, striking the glass wall of the tube ejects electrons from some of the atoms of which the glass is composed. The rapidly moving electrons in turn, knock electrons out of the gas atoms within the tube, thus ionizing the gas. *Fig. 3* is a simple schematic indicating the action taking place. Suppose that one of the gas atoms in the space between the anode and cathode becomes ionized. We then have what is called an "ion pair," that is, an electron with a negative charge, and the remainder of the atom with a positive charge. If there were no voltage applied between anode and cathode, the positive ion would attract

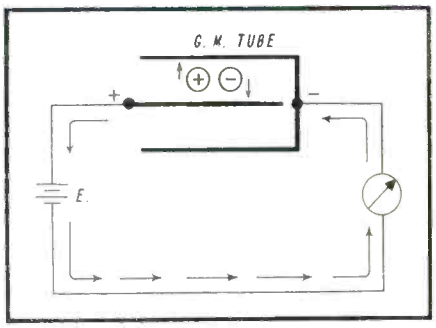
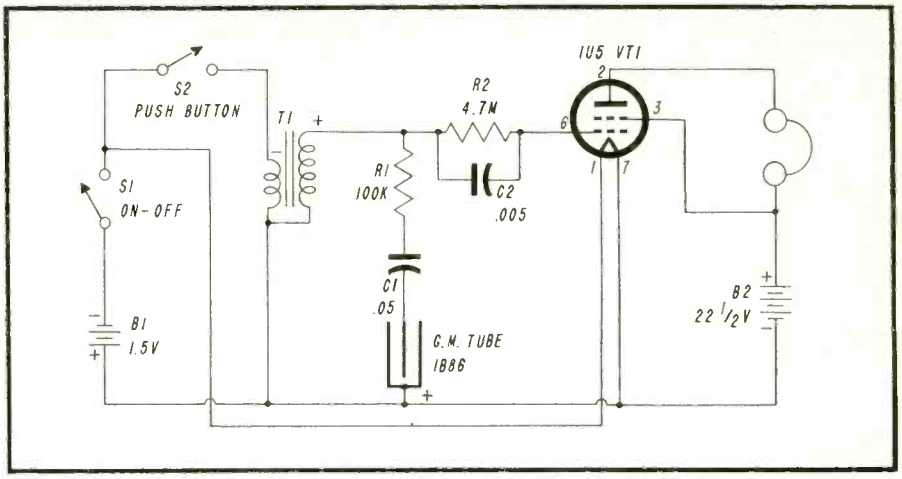


Fig. 3—Current flow through a Geiger-Mueller tube when ionization takes palce.



(Courtesy Precision Radiation Instruments)

Fig. 4—Schematic of a simple form of Geiger Counter.

the negative electron, the two would recombine, and we would then have the original normal atom. Suppose now, that we make the anode positive with respect to the cathode by means of E. A number of different results are possible, depending on the magnitude of E. The tendency of such a voltage, of course, would be to cause the electrons to move toward the anode and the positive ions toward the cathode. If the voltage E is too small, however, the ion pair will recombine as explained above, and there will be no noticeable result in the external circuit. If the voltage E is increased, a point will be reached where the force of attraction tending to re-unite the ion pair is overcome by this externally applied *emf*. At this point, the electron will move to the anode, then through the external circuit around to the cathode. At the same time the positive ion is attracted to cathode within the tube. The two then recombine and the gas atom is once more complete. A similar action takes place for all other atoms between cathode and anode which may have become ionized. As a result a small current flows in the external circuit. The strength of the current of course will depend on the number of ion pairs formed or in other words, on the strength of the ionizing rays.

If the voltage is increased still further, the ions travel faster until the point is reached where the ions attain sufficient speed to ionize other atoms by collision. At this voltage a larger pulse of current flows for each original ion pair formed. In this voltage range, the tube can distinguish betwen alpha, beta, and gamma rays, since the alpha produce the greatest ionization and therefore the largest pulse of current. Next in order of their ability to ionize are the beta rays and finally the gamma rays.

If we increase the voltage once more, a point is reached where a kind of chain reaction takes place. If only a single ion pair is formed, the electrons (negative ions) and positive ions move with such speed that they produce additional ions by collision with the gas atoms as before. These secondary ions have enough energy to ionize still other atoms. This process continues, so that a weak ionizing ray is capable of producing a large pulse of current. In this range of voltage, every ionizing particle, or ray, which enters the tube produces an equally large pulse of current. This action takes place over a range of a few hundred volts, and it is in this range that GM tube is used in a Geiger Counter. Raising the voltage above this range brings us to the point where breakdown occurs. At this point, ionizaion takes place and current flows due to the high voltage alone. Any reading would be meaningless and operation at this voltage is harmful to the tube.

The actual value and range of the voltages which will produce the effect described above will depend of course on the construction of the tube. Its physical dimensions and the gas pressure are the important factors. A typical value of voltage used in Geiger Counters is about 900 volts, although some of the smaller models go down to about 300 volts.

In prospecting, a primary consideration in design is portability. This has led to the development of some novel circuitry for the production of high voltage from small batteries.

Circuit Analysis

Figure 4 is a schematic of a Model 108 Geiger Counter manufactured by Precision Radiation Instruments. Because of its simplicity it serves as a good starting point to illustrate the

[*Continued on page 52*]

EXCLUSIVE "PHASE-REVERSER" GUARANTEES

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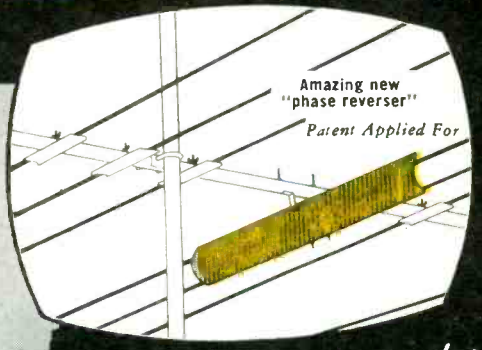

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Actual comparison of fringe antenna performance

Channels	Gain (db) Single Bay 2	4	6	7	9	11	13
Walsco Wizard Imperial	6.1	6.9	8.2	11.9	11.6	10.8	12.6
Antenna "A" With 3 Phase Reversing Dipoles	6.3	6.6	8.1	10.5	10.2	10.6	12.4
Antenna "B"— Yagi Type with Phasing Loops	5.1	5.5	6.8	7.5	9.6	8.8	11.2
Antenna "C"— Yagi Type with Loading Coils	5.9	6.9	8.6	9.1	8.6	9.6	7.8

The new Walsco **Wizard** performs as 3 separate antennas combined in **one** to give the **very finest**, all-channel picture reception ever seen on any television screen. Extra dipoles, complicated harnesses, or phasing stubs are **completely** eliminated. And the Wizard is the easiest to assemble and install.

Walsco guarantees the Wizard for 3 years.

Model	Price
Wizardette #4110	$14.90 list
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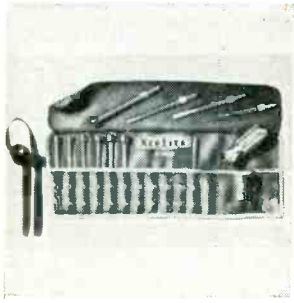
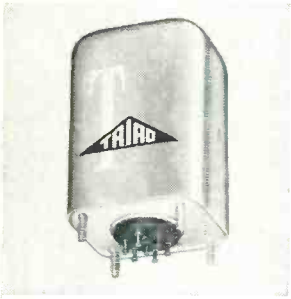
NEW COMPONENTS

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 50, and send it, along with your company letterhead or business card, to New Products Dept., Radio Service Dealer, Suite 510, 67 West 44th St., New York 36, N.Y.



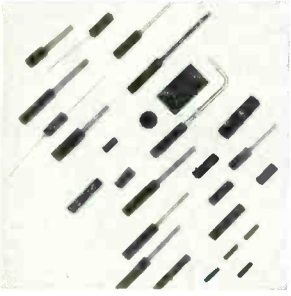
Xcelite Pocket Roll Kit

Called the "99 Junior," a new plastic roll kit that contains eleven tool bits plus a combination handle, and which rolls up to pocket size, has been introduced by Xcelite, Incorporated. The kit's pockets hold the seven smaller size nut driver shafts (3/16" thru ⅜"), 3/16" and ¼" slotted screwdriver bits and Nos. 1 and 2 Phillips. Two extra pockets are provided for extra tools such as reamers. For information, CHECK C95.



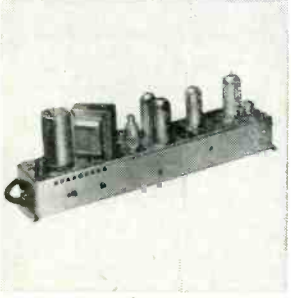
Triad Hi-Fi Line

New to the Triad line this year are hi-fidelity output transformers with screen taps in the primary, providing extended range and increased power for the more modern audio amplifier circuits. Specifically, these items are the HS-181 and HS-186, and S-142 and S-146. Complete specifications on these new items are shown in the new Triad Catalog TR-55, copies of which may be had by CHECKING C91.



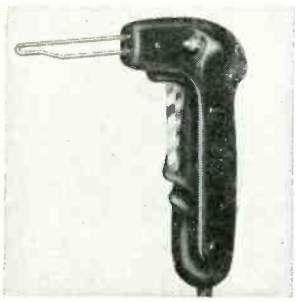
New Merit Transformers

Merit Coil and Transformer Corp. has announced the introduction of several additional exact replacement horizontal and high voltage output transformers. Newly introduced are the HVO-38 (illustrated) and the HVO-54 exact replacements for Admiral, the HVO-40, a replacement transformer for Silvertone and the HVO-37, a replacement transformer for Silvertone, Sentinel, Hallicrafters and the Crosley "Super V". For information, CHECK C96.



Blonder-Tongue Amplifiers

High power single channel TV amplifiers with automatic gain control are now available from Blonder-Tongue Labs. These Model MCS units are used by installers to amplify, mix and equalize individual VHF channels at the antenna site or in TV distribution lines. Any number of units may be mixed without loss and channels may be cascaded for increased gain. Model MCS can be added to any existing amplifier system. For information, CHECK C97.

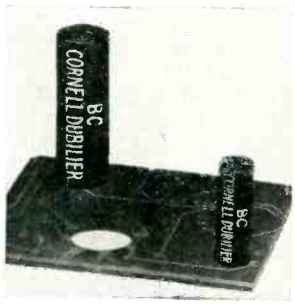


ESICO Soldering Gun

This compact soldering gun with the lightweight Luger grip and fast-heating tip is manufactured by The Electric Soldering Iron Co., Inc. The Esico Luger handle is molded to fit the hand naturally. Perfect balance lessens fatigue and speeds soldering. Available with dual or single heat, with twin lights to illuminate the work. No stand needed; the Luger rests on its side when not in use. For information, CHECK C92.

C-D Plug-In Tubulars

Cornell-Dubilier announces their "Type BC" phenolic-cased plug-in paper tubular capacitors designed for use with printed circuits, and encased in molded phenolic shells with two parallel lead wire terminals. These terminals are brought out from the end of the capacitor through a thermo setting plastic end fill compound, and are spaced a fixed distance so that they may be plugged directly into printed circuits and dip soldered. For information, CHECK C90.

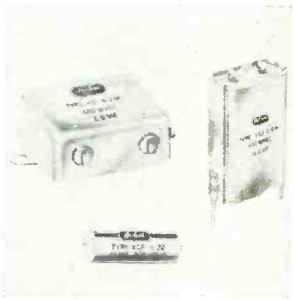


The "Illini 300"

The Illinois Condenser Co. has recently announced the new "Illini 300" Electronic Photo Flash Kit featuring the latest developments in high efficiency tubes, capacitors and reflectors. It will be merchandised through electronics parts distributors. The "Illini 300," with a 1/600 flash duration, is economical to build and operate; uses standard battery types and provides highest quality 100 watt second output from its 300 volt operation range. Unit less standard batteries sells at $59.50. For information, CHECK C94.

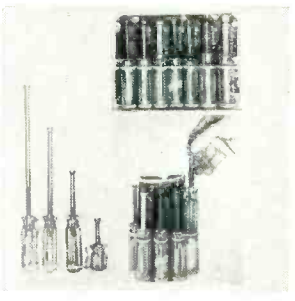
Astron Series X Capacitors

Astron Corporation has recently announced *new* Series "X" Capacitors. Available in a wide selection of hermetically sealed tubular, "Squeeze Seam" and Bathtub cases with glass-to-metal closures for positive environmental protection, these units offer dependable operation over a wide temperature range, from −65° C to 150° C *without derating*; they exhibit high insulation resistance, good capacitance stability, excellent R. F. and retrace characteristics. For information, CHECK C99.



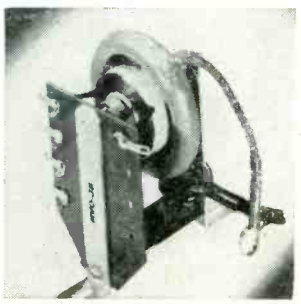
Vaco Nut-Drivers

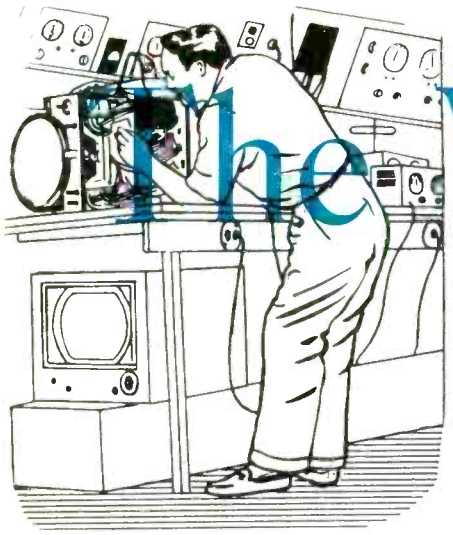
Vaco's new line of color-keyed nut-drivers introduce several developments. The entire shaft is insulated from handle clear to the tip. The shafts are hollow the entire length, making the tool lighter, perfectly balanced and easy to use. The handles are extra large, deep fluted for sure grip. The sockets are extra hard, long wearing, which assures low over-all cost. Available in four popular lengths. For information, CHECK C98.



Superex Core Kit

Replacements for almost 90% of TV cores are available in a new Ferrite Core Kit, from Superex Electronics Corporation. Containing 27 pieces and priced at only $2.25 net, this core kit will often enable servicemen to save the cost and effort of replacing coils and transformers in the horizontal deflection, sound and video portions of most TV receivers. For information, CHECK C93.





The Work Bench

by PAUL GOLDBERG

This Month:

HORIZONTAL FREQUENCY PROBLEMS

This month's installment is devoted to horizontal frequency problems. To obtain speedy repair a thorough knowledge of the horizontal oscillator circuitry is necessary.

Kent "7" Series

The receiver was turned on and it was immediately seen that the picture was far out of horizontal frequency range. The horizontal oscillator slug was first adjusted and although this had some effect, the picture still remained far out of horizontal frequency. The horizontal hold also had effect, but did not aid the situation to any great degree. The 6SN7, horizontal oscillator was next replaced but had no effect. See *Fig. 1.*

At this point the diagram was studied. This receiver utilizes a synchroguide type horizontal oscillator circuit. This circuit eliminates the use of a sync discriminator such as the 6AL5, dual diode tube. In this circuit one 6SN7 type tube does the entire job. The horizontal oscillator may be called a free running blocking oscillator. The coils of T205R1 *A* to *C* and *C* to *F* make up the blocking oscillator transformer section. The stabilizing tuned circuit between *C* and *D* is shock excited into sine wave oscillation by pulses of plate current.

After observing these facts voltage measurements were taken at 6SN7 pins #6, 4 and 5, but all were found to be correct. Voltage measurements at pins 2, 1 and 3 were taken but no clue could be obtained from these measurements either. The oscillator grid leak condenser *C75* was checked for voltage leakage and was found to be OK.

We noticed at this point that the width of the picture was insufficient also. The drive control *C81* was therefore adjusted. To our amazement adjusting *C81*, not only increased the width but had a tremendous effect on the horizontal oscillator frequency. However, adjusting the drive control would not bring the picture into horizontal sync. Condenser *C81* was next checked for voltage leakage but showed none.

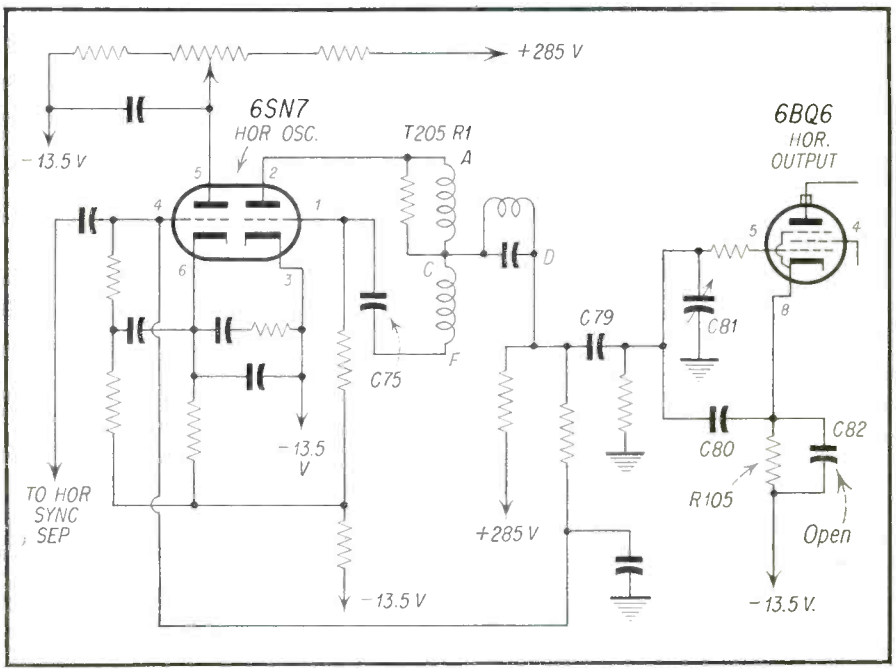


Fig. 1—Partial schematic of Kent "7" Series.

It was believed at this point that there was a defective component in the vicinity of the 6BQ6 grid circuit. The grid coupling condenser *C79* was next checked for voltage leakage, but it checked OK. The shaping condenser *C80*, if defective, would have a tremendous effect on the width of the raster. Therefore, though it seemed an unlikely prospect, it was nevertheless voltage leakage checked. However it was found to be functioning properly with no leakage.

It seemed that our only clue was the amazing effect that *C81* the drive control had on the horizontal oscillator frequency. The diagram was studied again. T205R1, the horizontal oscillator transformer could not in our estimation cause *C81* to act in this way. However, something peculiar was noticed. The shaping condenser *C80* was tied to the cathode of the 6BQ6 instead of to "B" minus as it is in most receivers. Just as an experiment, *C80* was unsoldered from the 6BQ6 cathode and grounded instead. Immediately the width spread out and the horizontal frequency came back into range. Now, because we had found *C80* to be functioning properly previously, we resoldered it to the cathode and examined the 6BQ6 cathode circuit further. The cathode resistor *R105* was next resistance checked but was found to check properly at 220 ohms. The cathode condenser *C82* was then replaced wtih a new 4 μf condenser and

[*Continued on page 48*]

A NEW WHITE-DOT

Discussion Of White-Dot Generators, And A Description Of The Circuitry Of

by **Robert G. Middleton**
Field Engineer
Simpson Electric Co.

THE new Simpson Model 434 White-Dot (Varidot) Generator, provides some interesting operating facilities. As shown in *Fig. 1*, which illustrates the external appearance of the instrument, controls are provided for varying the number of dots horizontally and vertically in the pattern, and also for varying the size of the dots. In addition, a hum check is provided, as will be explained.

The number and size of dots is made variable in this generator, to meet the varied instructions specified by color receiver manufacturers for convergence of various brands of color-TV sets. Some manufacturers specify eight horizontal dots, with a corresponding number of vertical dots for standard aspect ratio, while other manufacturers specify as many as twenty horizontal dots, with corresponding ratio of vertical dots. Some manufacturers specify very small dots, while others specify very large dots. The Simpson generator meets all of thse requirements.

Figure 2 shows one of the faults commonly encountered with white-dot generators which are unsychronized—information appears on retrace, causing an objectionable smear in the white-dot pattern. Moreover, an unsynchronized pattern does not lock in tightly, which is a continuing nuisance to the operator. Hence, *sync and blanking should be provided by a white-dot generator, to lock the pattern and to blank out the information on retrace.*

Another fault which appears in the white-dot pattern is in the form of lines joining the dots, as shown in *Fig. 3*; this fault is caused by insufficient depth of modulation of the r-f carrier. Greater modulation percentages are required for color-TV receiver servicing because the color-video *dc* restorers clip the dot pulses, and reduce the effective percentage of modulation originally present in the signal.

It is interesting to analyze the operation of the white-dot generator circuit shown in *Fig. 4*. Two free-running oscillators, a vertical synchronizing oscillator, and a horizontal synchronizing oscillator, operate at approximately 60 cps and 15,750 cps, respectively.

The vertical synchronizing oscillator is locked harmonically with the horizontal synchronizing oscillator. Two free-running multivibrators, the vertical dot multivibrator, and the horizontal dot multivibrator, are locked in with the vertical and horizontal sync oscillators, respectively. The signals from these two multivibrators are differentiated, and the differentiated pulses are fed into two clippers: the vertical dot clipper and the horizontal dot clipper, respectively.

The pulses from these clippers are then applied to the dot gate, which operates to pass the horizontal dot pulses through the gate only during the intervals when vertical pulses are applied to the gate. These gated dot pulses are then applied to the input of the modulator.

Pulses from the vertical sync oscillator and horizontal sync oscillator are shaped and added in the sync clipper, and then applied to the modulator. The resulting composite output from the modulator is applied to the *rf* oscillator to develop a modulated *rf* output which is suitable for application to the input teriminals of a color-TV receiver.

This modulation of the *rf* oscillator occurs when the function switch is in the *rf* position. But when the function

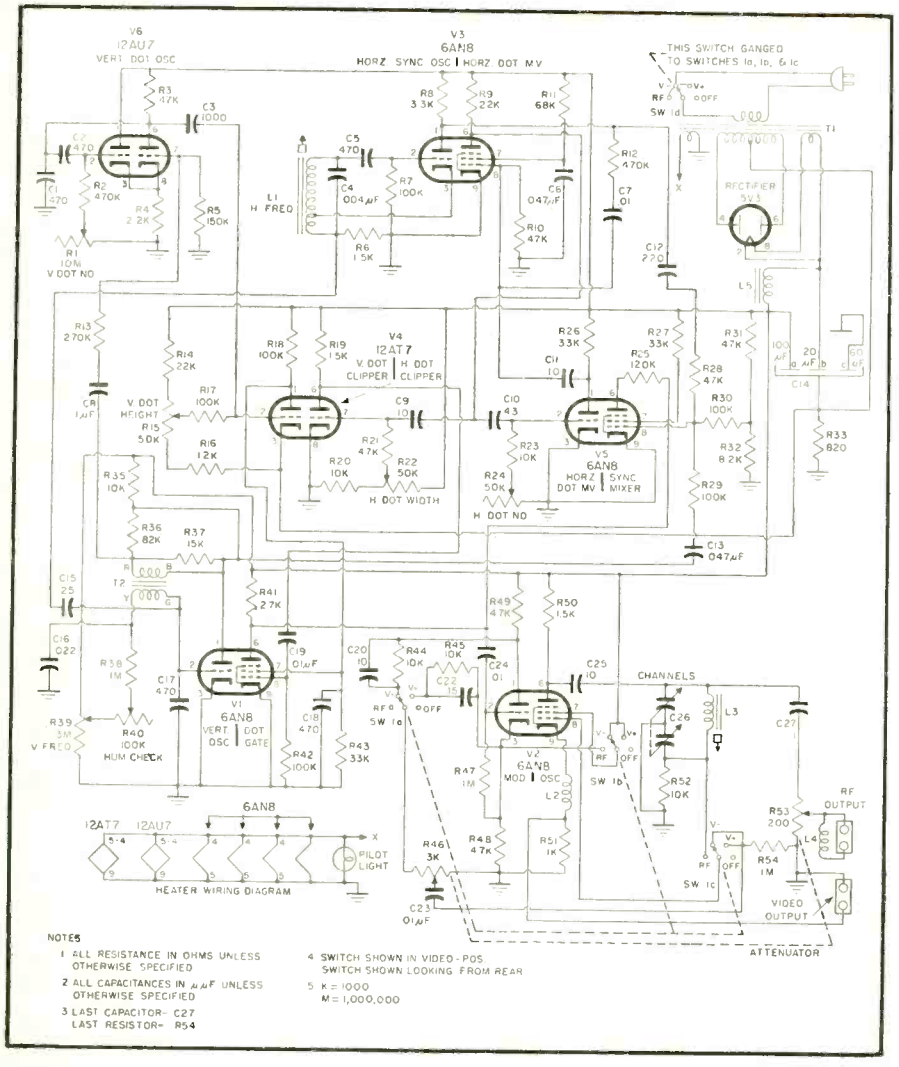


Fig. 4 — Circuit diagram of Simpson Model 434 White Dot (Varidot) Generator.

GENERATOR

The Varidot Generator.

Fig. 1—Simpson Model 434 White Dot Generator

switch is set to one of the video-output positions, the modulator operates as a phase splitter, providing either desired polarity of video signal, through the *rf* oscillator tube, which is now disabled and operates as a cathode-follower video-output tube. Troubleshooting of video-amplifier circuits in color-TV receivers may require either positive-going output, or negative-going output, depending upon the particular application.

The triode portion of a 6AN8 tube is utilized for the horizontal sync oscillator circuit. The frequency of oscillation is determined by the resonant frequency of *L2* and *C4*. Inductor *L2* is a slug-tuned coil which can be adjusted by means of a screwdriver from a rear access port of the generator case. A synchronizing signal which drops across *R6* is applied by capacitor *C14* to the grid of the vertical sync oscillator. This is a blocking type oscillator, which utilizes transformer *L3* and the triode section of the 6AN8 tube. The frequency of oscillation is controlled by *R31* and *R33*. Control *R31* is adjusted so that the oscillator operates at 60 cycles per second when *R33* is in the center of its range. *R31* is mounted on the chassis inside the generator case.

The vertical dot oscillator, utilizing the two sections of the 12AU7, is of the multivibrator type. The frequency of oscillation is controlled by the setting of control *R1*, which determines the number of horizontal rows of dots in the pattern, counting from top to bottom of the pattern. The signal appearing at the plate terminal of this tube is differentiated by capacitor C3 and resistor *R15*. The negative pulse which is thereby obtained is applied to the grid of the vertical dot clipper.

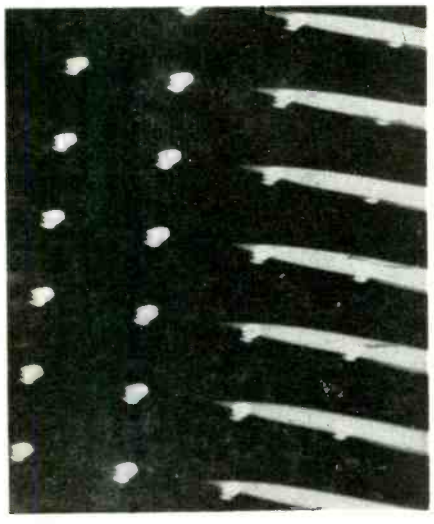


Fig. 2—Retrace lines appear on face of tube due to inadequate sync or blanking.

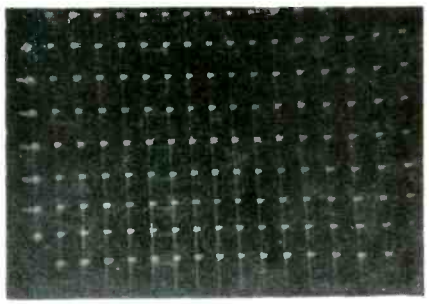


Fig. 3—Inadequate depth of modulation causes lines to appear.

This negative pulse, after inversion and amplification by the vertical dot clipper, is applied to the screen grid of the dot gate. A positive voltage, determined by the setting of the vertical dot height control, *R13*, is applied to the left-hand terminal of *R15*. The duration of time through which the grid of the vertical dot clipper is negative with respect to the cathode constitutes the period through which the negative pulse exceeds in amplitude the positive voltage applied to the left-hand terminal of *R15*. The setting of *R13* thereby determines the width of the positive-going pulse which is applied to the screen grid of the dot-gate tube.

The horizontal dot multivibrator utilizes the pentode section of a 6AN8 tube, and the triode section of a second 6AN8 tube. This multivibrator is synchronized with the horizontal sync oscillator. The synchronizing signal, which appears at the plate of the horizontal sync oscillator, is applied to the grid of the pentode section of the horizontal dot multivibrator by the series combination of resistor *R53* and capacitor *R25*. The signal appearing at the plate of the pentode section of the horizontal dot multivibrator is differentiated by capacitor *C9* and resistor *R20* and the differentiated pulses are applied to the grid of the horizontal dot clipper.

The grid of the horizontal dot clipper is biased positively, in the same manner as the vertical dot clipper. *R19* controls the value of positive voltage which is applied to the lower terminal of *R20*, and accordingly controls the width of the negative-going pulse at the grid of the horizontal dot clipper. The resulting positive-going pulse which appears at the plate of the horizontal dot clipper is applied by *C16* to the control grid of the dot-gate tube.

The dot gate utilizes the pentode section of a 6AN8 tube. The screen voltage of this tube is negative with respect to the cathode, except when a positive-going pulse appears at the plate of the vertical dot clipper. The dot gate pentode accordingly amplifies only during the period of these positive-going vertical dot pulses. Negative-going pulses appear at the plate of the dot gate only when the vertical and horizontal dot pulses appear *simultaneously* at the screen grid and control grid, respectively, of the dot gate. Horizontal synchronizing pulses appearing at the plate of the horizontal sync oscillator are applied to the grid of the sync mixer by means of the series combination of *C7* and *R26*. Vertical synchronizing pulses appearing at the junction of resistors *R35* and *R36* in the vertical-oscillator circuit are applied to the grid of the sync mixer by *C12* and *R25*. The sync mixer and dot gate have a common plate load *R38*, and accordingly, the voltage waveform across *R38* consists of nega-

[*Continued on page 48*]

THE FUTURE *of the* ANTENNA INDUSTRY

by **J. L. Wade**
General Manager TRIO Manufacturing Company

NO industry in America has seen a more rapid change in manufacturing and sales technique, electrical design, mechanical engineering than has the TV antenna field. Consider the modern, pre-assembled conical with instant flip-out elements. Today it sells at $3.95 list. In 1947, when it had to be completely assembled by the installer, it cost $27.50. One of the very best all-band modern arrays today lists at $34.95, in 1947 a four bay colinear cost approximately $125.00. Let's go back and see how these events transpired and from these facts if we can predict what will happen to antenna sales in the years ahead and how these changes will affect dealers, distributors and manufacturers.

"Hams" Turn Manufacturers

For the humble beginnings of the TV antenna industry, we must give credit to the radio amateur or "ham" as he is better known. Forced by federal regulations to carry on his hobby at these unknown, higher frequencies, considered useless at the time, he went to work on equipment and antennas that would produce results.

It was no accident that such antennas as the colinear arrays, yagis, conicals and Vees as well as various methods of feed and impedance step-up were developed by hams. Two things favored the hams; their clannish cooperation and their very numbers. Several thousand hams could accomplish in days all the experimentation and development that would take commercial laboratories years to perform.

The rapid advance of television and the necessity for high gain antennas caught the industry off guard so to speak, and it was only natural that the radio "ham" to whom such antennas were "old stuff," should step into the manufacturing picture.

Not accustomed to mass producing things, the pioneers in this new industry did the best they could—every antenna produced was strictly a hand-made model. Labor saving equipment was likely to consist only of a single spindle drill press and a cut-off saw. Raw materials were hard to get and expensive, for the young industry was too small to get much attention from the large manufacturers of tubing, castings and phenolic materials.

The finished product was strictly a knocked-down affair, requiring the installer to assemble the antenna from a multitude of drilled elements and a sack full of bolts, nuts, clamps, insulators and other small parts.

In spite of all this, business—and profits—were good. The ever increasing demand for TV antennas kept every manufacturer busy. There was virtually no competition because a manufacturer was most likely to stay in his own backyard expending most of his efforts to supply the demands of his particular area.

The Picture Changes

The transition to multiple drills and other equipment, although still requiring much hand operation, nevertheless helped reduce costs and make for more uniformity of product.

As more and more TV stations came on the air and more areas received multiple channel coverage, the trend in TV antennas began to shift away from single, dual or three channel reception and towards broadbanding or all-channel operation. The engineering department, which had for a time been sitting on the side lines, suddenly found a need for its talents. It has been said that there is nothing new in basic antenna theory, but some of the new improvements and variations that have come out of the engineering laboratories makes one wonder.

Along with broadbanded operation came the demand for pre-assembled flip-out construction. In other words, with profit margins down as compared with the old days, the fellow who sold and installed the antenna refused to spend even fifteen minutes time putting one together from a package of loose parts —and you can't blame him.

End of Basement Operations

Although new antenna manufacturers continued to spring up like mushrooms, others dropped by the wayside.

It is estimated that approximately 125 such basement operations were begun and prospered until they failed to meet the competition of mass production methods and especially advanced mechanical engineering which enables one to build an antenna with rapid element fan-out assembly features, now demanded by the installer. The days were gone when an assembler-manufacturer could purchase tubing, castings, nuts, bolts, washers, insulators, etc. and dump these into a huge carton, along with elements, boom, etc. enclose assembly instructions numbering pages—and send the conglomeration to a customer as a finished antenna. Such archaic production methods could only mean one thing—an inferior product at a high price. Such operations were at variance with the very principles that have given America the highest standard of living in the world and permit the worker to produce the most for his efforts, at the same time increasing quality, production, wages and profits, while giving the public an antenna that their pocketbook can afford. Neither could the small operator adhere to rapid production schedules, prompt shipment, advertise nationally, supply the sales and promotion aids, literature, newspaper mats, radio and TV spot announcements that the distributor and dealer required. As a consequence, only those prospered who were willing or could make a tremendous investment

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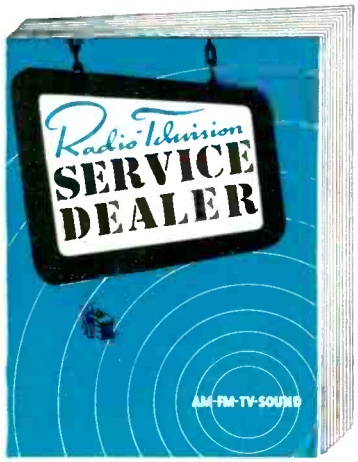

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in modern plant facilities, modern machines, well staffed tool rooms, time study engineers, complete design and testing laboratories adequately well integrated sales and advertising promotion departments, fleets of trailer trucks to supply prompt delivery to practically any point in the country.

Automation Cuts Costs

In keeping with these advances, the actual manufacturing process has been so far improved that costs have dropped to but a fraction of what they were. Modern tube mills, such as installed by TRIO, were the first automatic machines to fabricate finished antenna elements from giant rolls of aluminum, in one operation, with the holes punched and the ends formed. Multiple punch presses or press brakes using hopper load and automatic feed have replaced the old multiple drill press operation in making the booms. These modern machines punch all holes from two directions in one operation, turning out 6000 finished booms per hour. Production costs are slashed and quality greatly improved as a result of precision spacing and alignment and absolute uniformity. An excellent example of the savings in cost of these modern production methods is a TRIO Conical that lists at $3.95. This conical sells to the distributor at a price that is lower than the cost of the tubing alone, if it were purchased in carload lots from an aluminum supplier. Yet to be added would be cost of fabrication, clamps, insulators, etc. Little wonder that automation is an absolute ncessity in these days of keen competition.

Increased Profits For Distributor and Dealer

Competitively priced conicals are as standard today for most jobbers and Service Dealers as sugar, soap powder and cigarettes are at the corner grocery store. Undeniably they are good buys, with their quality construction and rapid assembly features. But just as the grocer can't make money on sugar and soap powder, so the Service Dealer jobber can't make a significant profit with these antennas. This group, therefore, has need for a broad line—one that comprises these inexpensive standards plus the new higher priced arrays that embody the latest engineering advancements and combine extremely high gain over *all* channels, yet are compact and sturdy.

Taking the Slump Out Of Summer Antenna Sales

An example of the sales and promotion aid a progressive manufacturer can give the Service Dealer and distributor, is the unique and successful plan that raised TRIO antenna sales 500% during the slack summer months. Service Dealers and jobbers who participated in the novel plan likewise raised their summer sales correspondingly. The plan tied an unseasonable item, TV antennas, to a very seasonable item, a new rose trellis of tubular aluminum construction. The plan offered a free rose trellis with the purchase of each new ZEPHYR antenna, a startling innovation in the electronics industry to stimulate off-season business.

First launched at the Chicago Parts Show, the plan was so successful with dealers and distributors alike that by August 1, sales continued at an approximate 500% increase over the corresponding previous summer months, with every indication that ZEPHYR and the new ZEPHYR ROYAL sales would be correspondingly increased during the fall and winter months.

A Look Into the Future

It is our belief that the 1955-1956 season will see slightly less dollar volume than last year, due largely to the ever shrinking fringe areas and the better sensitivity of the new TV receivers. However, industries that have modernized their operations and have a broad

[*Continued on page 55*]

NEW TUBES & SEMI-CONDUCTORS

Tung-Sol

Tung-Sol Electric Inc. announces the development of the first audio power amplifier designed specifically for car radio service. The new tube, the 12AB5, is intended to be used either singly or in push-pull for power output stage use. The design and the ratings are specifically directed toward use in the 12-volt automotive systems adopted by every large automobile manufacturer. Using the nine-pin all glass miniature envelope, the 12AB5 provides a wider margin of safety than previously found in the smaller seven-pin types 6AQ5 and 12AQ5. Because there is no compromise with household radio or TV needs, the 12AB5 will therefore provide greater reliability and service life.

General Electric

Large size television picture tubes which require no external ion traps now are commercially available. This has been made possible by a newly-designed straight electron gun and a special aluminization control process developed by the General Electric Tube Department. The new gun is being built into four new 21-inch tubes (21BAP4, 21BCP4, 21BDP4, and 21BNP4) and a new 24-inch tube (24ZP4).

Operation of high-voltage anode tubes without the use of external magnets is made possible by the new straight gun and an improved processing technique controlling the thickness of the aluminum coating inside the tube face. The aluminum must be thin enough to permit the electrons to penetrate and activate the phosphor, while at the same time thick enough to stop the heavier ions and thus prevent phosphor burn.

Sylvania

Three new 21-inch, aluminized, electrostatic focus, all-glass, rectangular, television picture tubes, rated for 20 kv operation, have been announced.

The three new tubes have been offered in line with the higher operating voltages now required to produce higher contrast and brighter television pictures. Double-type designations are used in each case: 21ALP4A/B; 21AUP4A/B; and 21AVP4A/B. The tubes will thus meet all specifications for previously registered 18 kv tube types. Diagonal deflection angles and external

conductive coating capacitance ratings are as follows:

21ALP4A/B ..90°, 500-750 μμf
21AUP4A/B ..72°, 500-750 μμf
21AVP4A/B ..72°, 1200-1500 μμf

Tube type 6CS7 is a miniature 9-pin, medium mu, dual triode with dissimilar sections and is suitable for vertical deflection and oscillator applications using conventional transformer supply voltages. The other triode section of this dual purpose tube is intended for service as an oscillator, detector or amplifier. The tube is also designed for series string or conventional parallel operation.

The 25DN6 is a beam power pentode rated for television service as a horizontal deflection amplifier and was designed particularly for use in "off-the-line" series string sets utilizing low B+ voltages.

Raytheon

The 3CF6 is a heater-cathode type sharp-cutoff pentode of miniature construction designed for use in gain-controlled video IF stages and as an RF amplifier in VHF television tuners. The 3CF6 is the "Series String" counterpart for the 6CF6, having a 600-milliampere heater rating and a controlled heater warm-up characteristic.

The 5V6GT is a heater-cathode type pentode designed for use as a power amplifier in a.c. and battery operated equipment or as a vertical deflection amplifier in television receivers. The 5V6GT is the "Series String" counterpart for the 6V6GT having a 600-milliampere heater rating and a controlled heater warm-up characteristic.

The 5X8 is a heater-cathode type, combined medium-mu triode and sharp-cutoff pentode of miniature construction designed especially for use in "transformerless" AM/FM receivers. The 5X8 is the "Series String" counterpart for the 6X8 having a 600-milliampere heater rating and a controlled heater warm-up characteristic.

CBS-Hytron

A new matched pair of CBS transistors is now being used in the audio output stage of portable radios. The pair of P-N-P. junction transistors, known collectively as the type 2N108, is employed in a Class B push-pull circuit. Inherent efficiency of these transistors combines with that of their Class B circuit to give nearly doubled battery life.

The paired transistors are capable of at least 35 milliwatts of power output with a total harmonic distortion not exceeding 10% at 400 cycles per second and with an efficiency of over 50% from a 3.5 volt battery.

Construction of the CBS 2N108 pair

[*Continued on page 43*]

the answer man

Dear Sir:

I have an Admiral chassis 19K1 in which the horizontal sync becomes unstable after a period of operation. It can take from 10 minutes to ½ hour before the instability develops. Everything has been checked, tubes, voltages, resistors, etc. and there does not seem to be anything wrong that I can put my finger on.

K.M.
Dallas, Texas

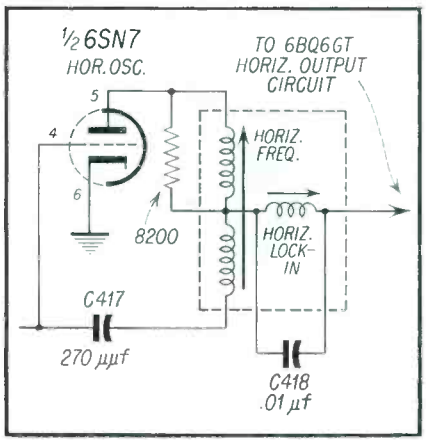


Fig. 1—Horizontal oscillator circuit of Admiral 19K1 chassis.

This difficulty can be due to a change in capacitance of the .01 *μf* condenser across the horizontal locking coil (stabilizer coil) as shown in *Fig 1*. The increase in temperature after the receiver has been in operation for a short period of time can cause a change in capacitance of this .01 *μf* condenser with a resultant detuning of the stabilizer or locking coil.

It is suggested that this condenser, *C418*, .01 *μf* be replaced with a molded type of 400 volt, 10% tolerance. After this is done it may be necessary to adjust the horizontal oscillator frequency and stabilizer coils for best operation.

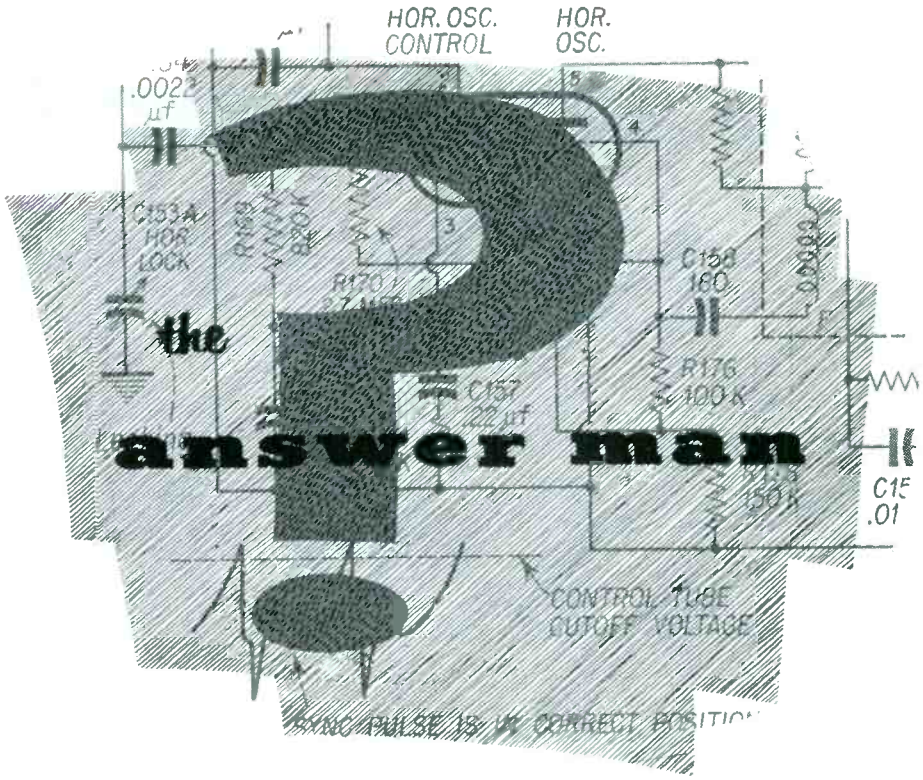
Of course, there is always the possibility that condenser *C417*, 270 *μμf*, is changing capacitance or leaking as this will bring about the same erratic action or drifting. This condenser, *C417*, 270 *μμf*, should preferably have a 1000 volt rating.

Mr. Answerman:

I recently encountered a 24 inch Westinghouse TV receiver that seemed to have a little background noise in the sound. The receiver played very well otherwise and I don't think the customer was aware of this slight hiss in the audio as they didn't say anything.

However, I'm curious to know what it might have been due to. Should I have touched up the alignment of the FM circuits. The chassis number of this Westinghouse receiver is V-2318.

T.J.
Chicago, Ill.



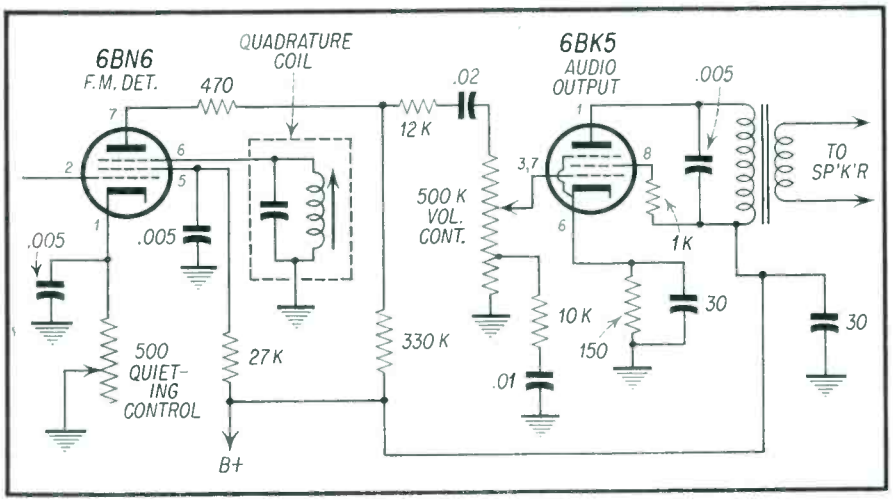


Fig. 2—Partial schematic of Westinghouse V2318 chassis showing FM detector and audio output circuits.

The Westinghouse chassis V-2318 receiver employs a control specifically for the purpose of permitting adjustment to remove noise or hiss in the audio. This control is called a quieting control and is positioned on the back apron of the chassis. A small hole is made available in the back panel for easy access with a screwdriver blade.

Ordinarily, the control does not require adjustment except possibly in those areas where the received signal is weak and this should be done at the time of installation. Under weak signal conditions all that is necessary is to slightly readjust the potentiometer to reduce the accompanying noise in the audio.

As shown in *Fig. 2* this quieting control is located in the cathode circuit of the 6BN6 FM detector circuit. Its action is to adjust the AM rejection characteristics of the system. Normally the correct position is the mid range of the control. It is most desirable to use the weakest channel to be received in that area for this rejection of noise adjustment.

Dear Mr. Answerman:

In a Model 21TQ Stromberg-Carlson TV receiver I have noticed that the focus of the 21XP4 picture tube is not as sharp as might be desired. I was wondering if there is anything that can be done to increase the sharpness of focus on this picture tube.

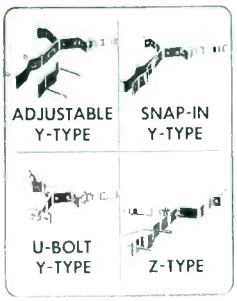
G.A.
Madison, Wisc.

The focus on the 21XP4 (low volt-

[*Continued on page 47*]

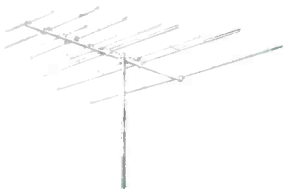
NEW ANTENNAS AND ACCESSORIES

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 50, and send it, along with your company letterhead or business card, to New Products Dept., Radio Service Dealer, Suite 510, 67 West 44th St., New York 36, N.Y.



Channel Master Chimney Mounts

A complete line of chimney mounts for every possible type of chimney installation has been introduced by Channel Master Corp. There are eight different models, including a Z-Type, Snap-in Y-Type, Adjustable Y-Type, and U-Bolt Y-Type. Available with either galvanized or stainless steel strapping. Mounts are made of heavy-gauge steel, heavily zinc-coated to resist corrosion. For further information, CHECK A96.

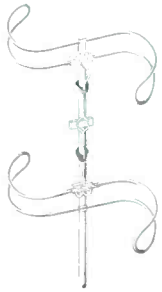


Winegard Colored Antennas

Literature is now available on the new colored Winegard Interceptor and Super 'Ceptor TV antennas, which feature anodized aluminum coloring in seven beautiful colors that add sales appeal. However, the bright metallic colors are more than a sales novelty. The patented Lumalite anodizing process makes the antenna completely resistant to corrosion by salt air, dampness, dust and natural atmospheric gasses that cause ordinary aluminum to oxidize and deteriorate rapidly. For further information, CHECK A94.

Federal Coupler

Federal Electronics Sales announces their manufacture of a new product the "Bi-Fi 2-Set Antenna Coupler" for TV or FM. The unit, featuring new printed circuit bifilar coils, is designed to effectively operate two TV or FM sets from a single antenna. The Bi-Fi can also be used to operate simultaneously one TV and one FM set from the same antenna. For further information, CHECK A97.



Taco Hi-Fi FM Antenna

An Omni-directional S-type antenna providing a nearly perfect circular directivity pattern, this antenna has a broad-band folded dipole tuned to cover the entire FM band. Matching the conventional 300-ohm transmission line, the antenna delivers maximum signal to the receiver terminals. By having the driven element at ground potential, a simple and effective lightning protection feature is provided automatically. For further information, CHECK A91.

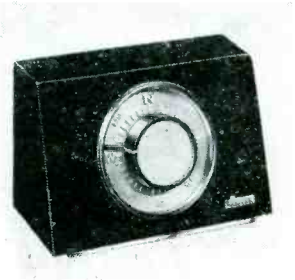
MODEL K-29

4 New Indoor Antennas by RMS

A series of 4 Varioscopic indoor antennas has just been made available by Radio Merchandise Sales Inc. featuring the advanced Tune-A-Slide adjustment bar which assures perfect impedance matching for sharper, ghost-free pictures. The complete Varioscopic series feature 3-section telescoping brass dipoles, brown crackletone base with felt cushioning and 5 feet of twin lead. For further information, CHECK A98.

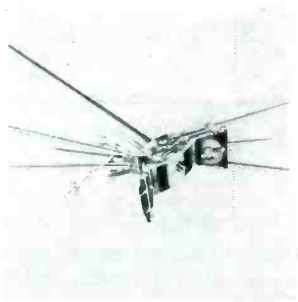
New Alliance Tenna-Rotor

Alliance Manufacturing Company has announced the introduction of two new Tenna-Rotors: Model U-98 (illustrated) is the deluxe, fully automatic rotator which replaces the popular Model U-83. Along with the new Model T-12, which is the indicator control, this unit features more perfect synchronization and alignment; faster, more positive, rotation without swinging or drifting, and magnetic breaking. For further information, CHECK A92.



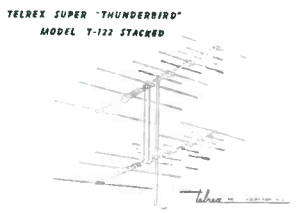
JFD Zip-Assembled Conicals

JFD Manufacturing Co. announces a new line of 12 Zip-assembled deluxe conicals. The new Zip dipole-head zips the preassembled dipole elements into place and locks them there. Absolutely no tools are required. Perfect, unbroken electrical continuity from the dipole element through the dipole-head to the lead-in assures maximum energy transfer. With the Zips there is no "friction" contact between the feed points, and no accumulation of dust or moisture which ordinarily dims and shorts out the picture. For further information, CHECK A93.



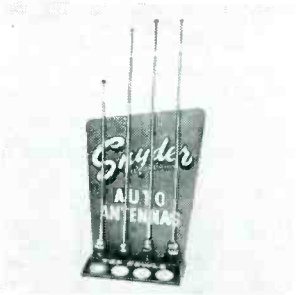
Telrex Arrays

The Telrex Super Thunder Bird is now available in two models of two bay arrays. The basic single bay Super Thunder Bird, Model T-120 can be supplied in a 2 bay array, ¼-wave stacked, model T-122 for gain increases averaging 3db on all channels. A ½-wave stacked two bay array, Model T-122-S is also offered where LO channel emphasis is especially required. Model T-122-S provides gain increases over a single bay unit of up to 4.5db on channels 2-6. For further information, CHECK A90.



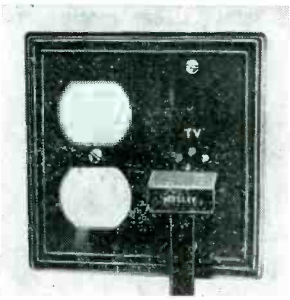
Snyder Antenna Display

A new Top Cowl Auto Antenna Display Board, decorated in blue, black, fluorescent green and white for counter and window display, is now being distributed by Snyder Mfg. Co. to its dealers throughout the United States and Canada. The display board fits Snyder's TC 3, TC 3B, TC 8 and TC 9 models, all 1955 designs. For further information, CHECK A95.



Mosley *ac*-TV Wall Plate

Mosley Electronics, Inc., has just announced a new series of *ac*-TV wall-plate sockets as a result of the demand of the building industry for combination AC outlets and TV line-rotator cable outlets. The wall plates fit standard double type electrical outlet boxes and provide for a dual *ac* outlet plus any of nine combinations of TV line outlets and rotator cable outlets. For further information, CHECK A99.



Mfr. Majestic **Model No.** 21C31

Card No. MAJ 21C31-1 **Chassis No.** 110

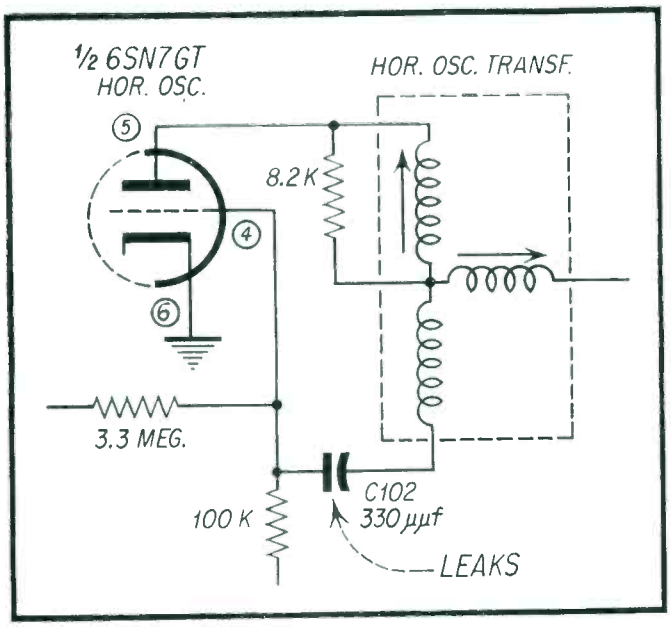
Section Affected: Sync

Symptoms: Horizontal oscillator drifts out of locked-in frequency

Cause: Leaky condenser

What to Do:

Replace: *C102*, 330 *μμf* condenser.



Mfr. Majestic **Model No.** 21C31

Card No. MAJ 21C31-2 **Chassis No.** 110

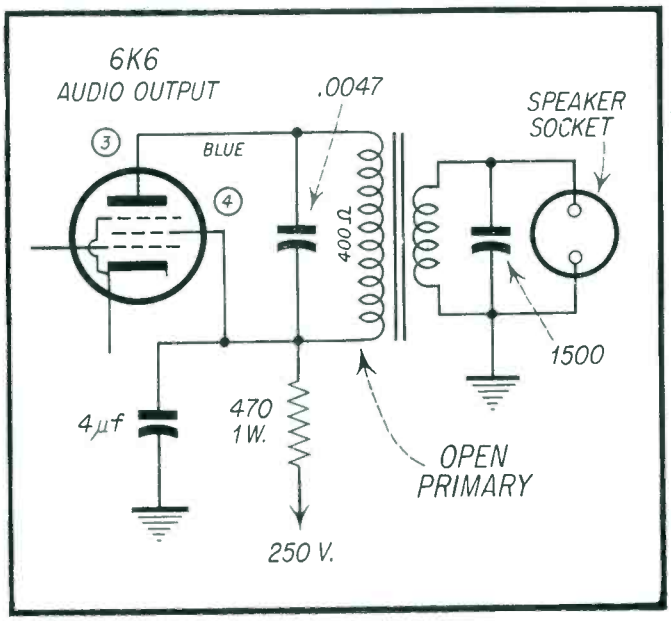
Section Affected: Audio

Symptoms: No sound

Cause: Audio output transformer primary, open

What to Do:

Replace: Audio output transformer, *T11*



Mfr. Majestic **Model No.** 21C31

Card No. MAJ 21C31-3 **Chassis No.** 110

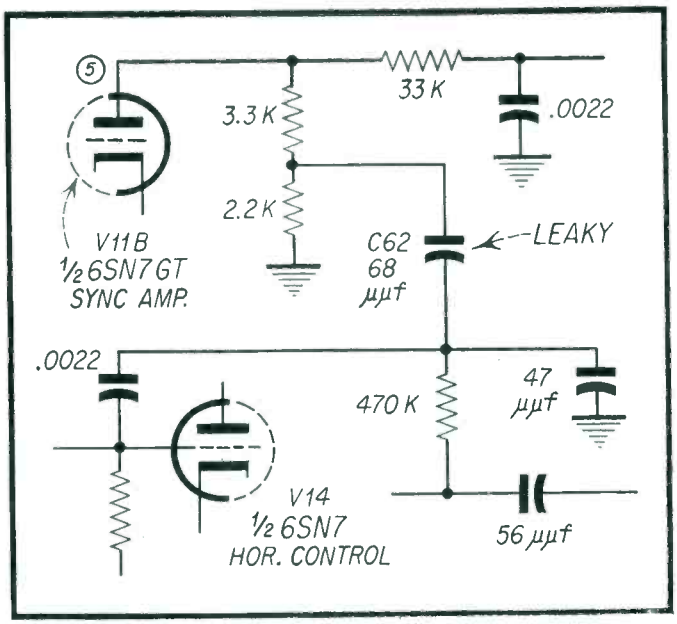
Section Affected: Sync

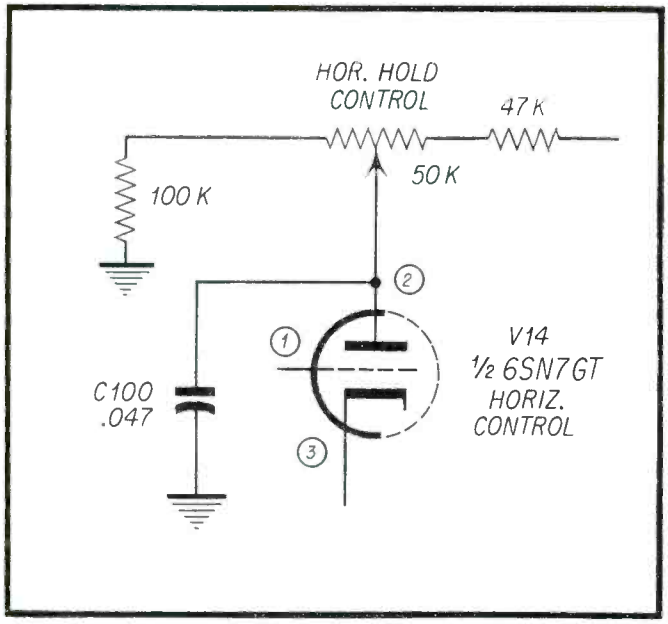
Symptoms: Critical horizontal lock-in action

Cause: Leaky condenser

What to Do:

Replace: Condenser *C62*, 68 *μμf*





Mfr. Majestic **Model No.** 21C31

Card No. MAJ 21C31-4 **Chassis No.** 110

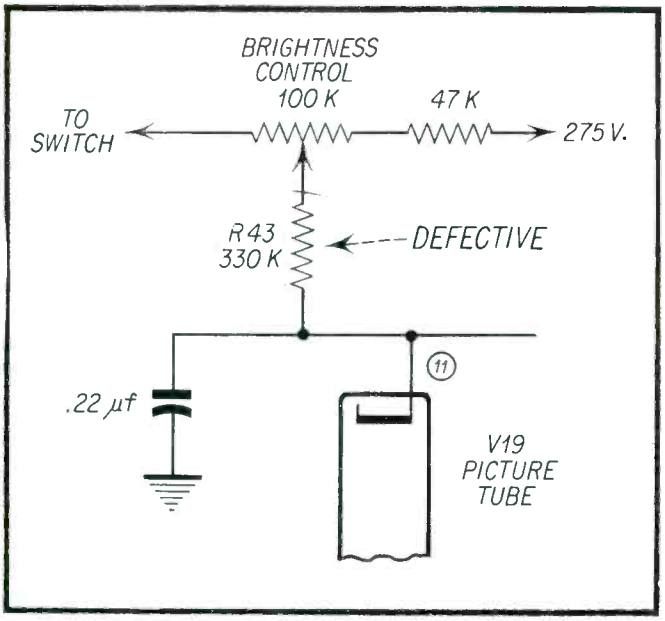
Section Affected: Raster and Picture

Symptoms: No high voltage

Cause: Shorted condenser

What to Do:

Replace: *C100*, .047 *μf* condenser



Mfr. Majestic **Model No.** 21C31

Card No. MAJ 21C31-5 **Chassis No.** 110

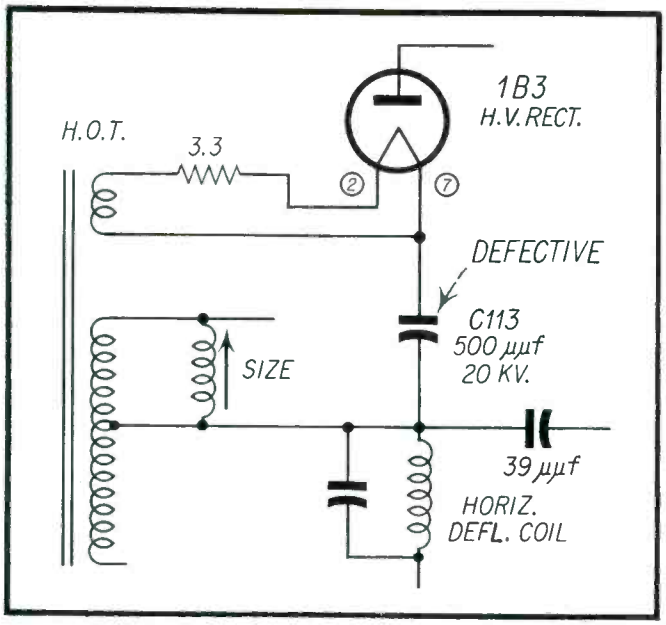
Section Affected: Pix and Raster

Symptoms: Not able to cut off raster and picture

Cause: Resistor changed in value

What to Do:

Replace: *R43*, 330K resistor



Mfr. Majestic **Model No.** 21C31

Card No. MAJ 21C31-6 **Chassis No.** 110

Section Affected: Raster and Pix

Symptoms: Flashing and tearing in raster and picture

Cause: High voltage filter condenser breaking down

What to Do:

Replace: C113, 500 *μμf* 20KV condenser

Mfr. Olympic **Model No.** 17K41

Card No. OLTK-1 **Chassis No.** TK

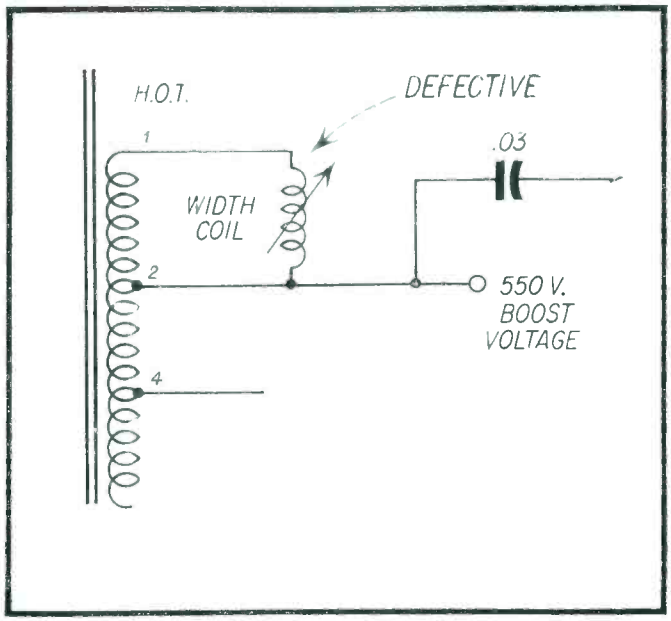
Section Affected: Raster

Symptoms: No high voltage

Cause: Width coil internally shorted

What to Do:

Replace: Width coil, *L19*



Mfr. Olympic **Model No.** 17K41

Card No. OLTK-2 **Chassis No.** TK

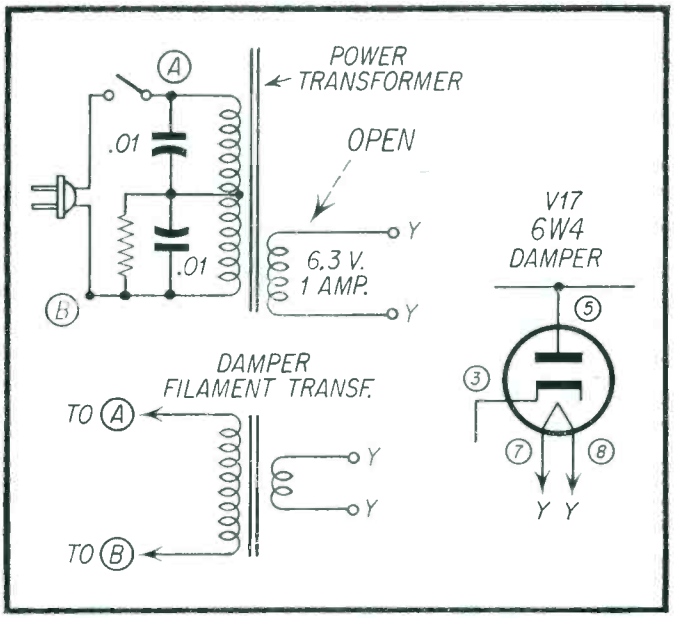
Section Affected: Raster

Symptoms: No high voltage

Cause: Open 6W4 Filament winding on power transformer

What to Do:

Add: 115 volt 6.3 volt filament transformer to operate the 6W4 tube



Mfr. Olympic **Model No.** 17K41

Card No. OLTK-3 **Chassis No.** TK

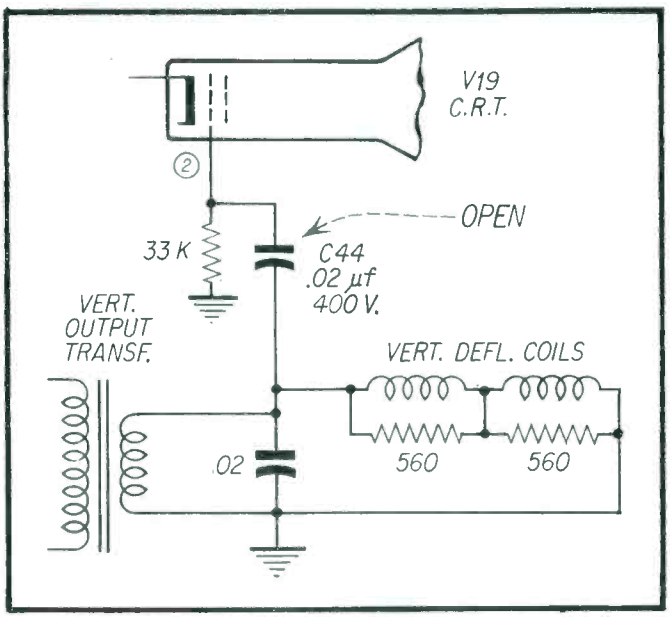
Section Affected: Raster and Picture

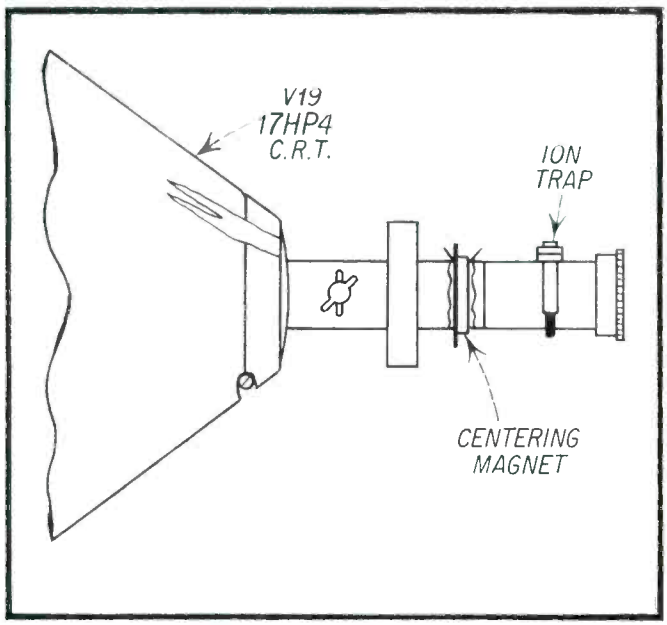
Symptoms: Visible retrace lines

Cause: Open condenser

What to Do:

Replace: *C44, .02 μf* condenser





Mfr. Olympic **Model No.** 17K41

Card No. OLTK-4 **Chassis No.** TK

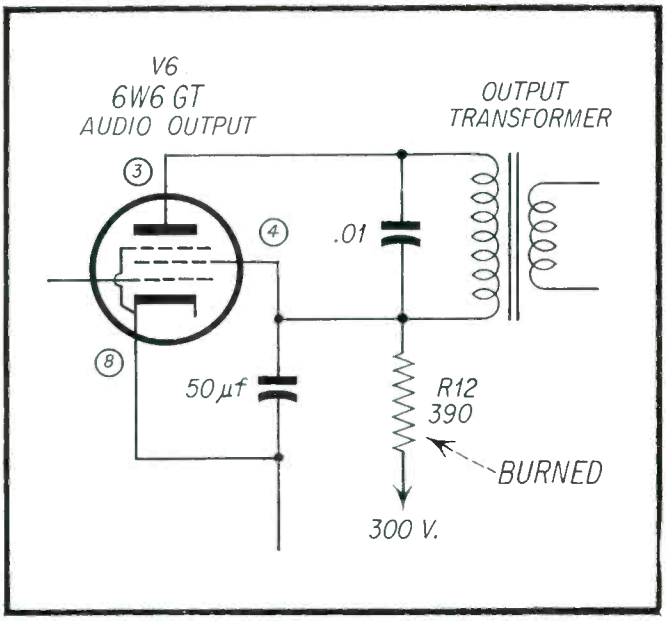
Section Affected: Picture and raster

Symptoms: Inability to center raster without corner shadows.

Cause: Defective raster centering assembly

What to Do:

Replace: Raster centering Assembly



Mfr. Olympic **Model No.** 17K41

Card No. OLTK-5 **Chassis No.** TK

Section Affected: Audio

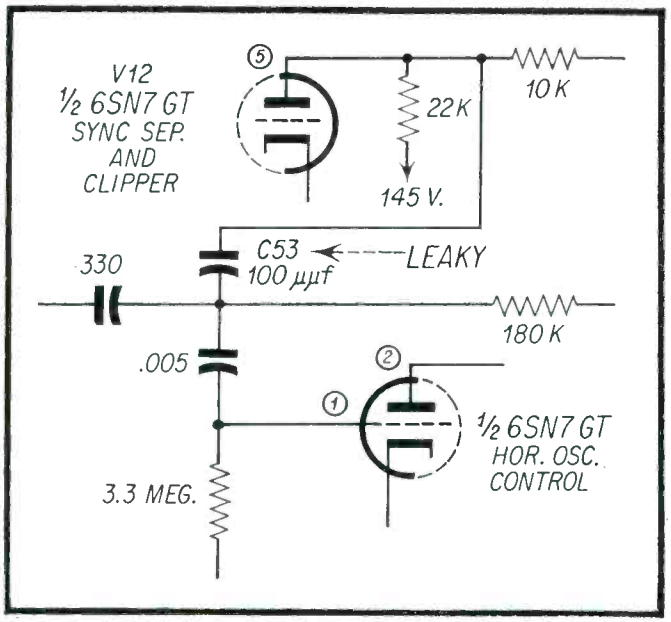
Symptoms: Frying noise in sound

Cause: Resistor burning

What to Do:

Replace: *R12*, 390 ohm resistor

Check: *C11*—50 *μf* for short



Mfr. Olympic **Model No.** 17K41

Card No. OLTK-6 **Chassis No.** TK

Section Affected: Sync

Symptoms: Very unstable horizontal hold

Cause: Leaky condenser

What to Do:

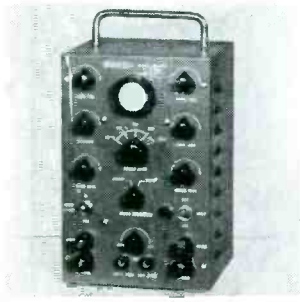
Replace: *C53*, 100 *μμf* condenser

NEW TEST EQUIPMENT

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 50, and send it, along with your company letterhead or business card, to New Products Dept., Radio Service Dealer, Suite 510, 67 West 44th St., New York 36, N.Y.

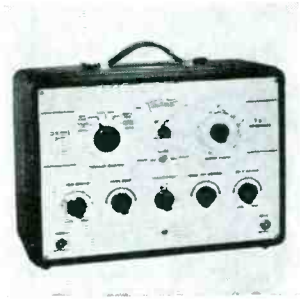
C-D BF70 Bridge

Cornell-Dubilier announces their BF-70 Capacitance-Resistance Analyzer. This portable instrument locates capacitor opens, shorts and intermittents; high and low capacities, detects high leakage and high power-factor in electrolytic capacitors, as well as low insulation resistance in paper, mica, and ceramic dielectric capacitors. Sensitive capacitance measurements between wires and shieldings, transformer windings, cable wire and other similar conditions are also possible. For further information, CHECK T99.



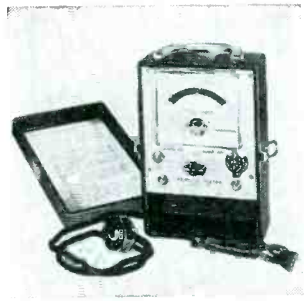
Probescope Oscilloscope

A new portable miniature oscilloscope has been designed by The Probescope Company. One of the smallest complete oscilloscopes on the market, weighing only 8½ pounds and taking up less than ¼ sq. ft. on the bench. Features: An input impedance of 2 megohms shunted by 15 mmfd; a ten to one attenuator; Vertical sensitivity of 100 MV full scale; Sweep rate of 20 cycles to 30 kilocycles in 5 steps. For further information, CHECK T95.



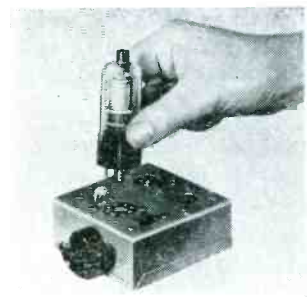
Triplett Dot Generator

The Triplett Electrical Instrument Co. presents a new Dot Generator, Model 3438, which checks video, *rf*, *if*., sync and color circuits with modulated *rf* (Channels 2 to 6) and *if* (20 to 55 *mc*) outputs available. Horizontal sync pulses (15,750 cycles) and vertical sync pulses (60 cycles) available for checking sync circuits. Other features: Horizontal bars (480 cycles to 600 cycles) and vertical bars (crystal controlled at 189 KC) for checking linearity on b/w and color sets. For information, CHECK T93.



Anchor Reacto Tester

The Anchor Products Co. has recently marketed their Reacto Tester which tests for open connections and elements, useful life, shorted elements, cathode emission, gaseous tubes, and repairs open elements, corrects shorts, and reactivates low emission tubes. Instructions are permanently fixed to unit. The unit will purportedly displace more expensive bench equipment. For further information, CHECK T97.



Bava Fil-A-Test

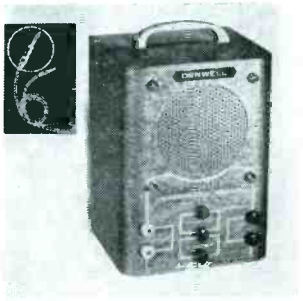
Fil-A-Test locates faulty tubes in an entirely new way. Place tube in the appropriate socket and pilot bulb will light if tube filament is good. Operates with built-in pocket flashlight batteries furnished with each unit. Batteries and bulbs are replaceable at any drug or hardware store. Tests every standard type tube. All metal construction. Aluminum Hammerloid finished in Baked Synthetic Enamel. Weighs only 8 ounces. For further information, CHECK T94.

Hycon Color Bar/Dot Generator

Hycon Mfg. Co. has introduced the new Model 616 Color Bar/Dot Generator. Every color sequence and linearity adjustment necessary for optimum receiver performance is available in this one compact instrument. Three color sequences are offered, each graphically portrayed on the instrument's front panel for ease in identification. Color Band "A" is the complete NTSC sequence. Band "B" has 4 bars: G-Y at 90°, R-Y, B-Y and black. Band "C" consists of black, I, Q, black. Quadrature signals are held within 1°. For further information, CHECK T96.

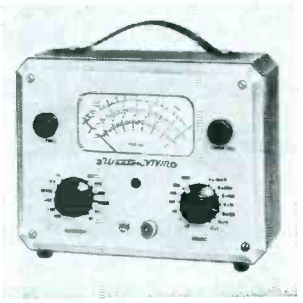
Dunwell Test Speaker

New portable low priced Universal Test Speaker, Model A6, equipped with specially designed universal test leads. Produced by the Dunwell Manufacturing Company. Model A6, provides servicemen with a fast, audio test for any TV radio receiver or phonograph. Tip jacks connect to sturdy 4" PM speaker, universal output transformer, 60 ohm field and 90 ohm field. For further information, CHECK T91.



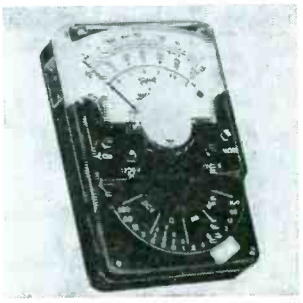
Weston VTVM

A self-contained, battery operated Vacuum Tube Voltmeter. This instrument makes possible quantitative measurement of all complex wave form voltages utilized in video, sync and deflection circuits with no a-c line interference in critical measurements. Battery operation affords complete isolation from spurious response due to stray a-c fields and circulating ground currents. For further information, CHECK T92.



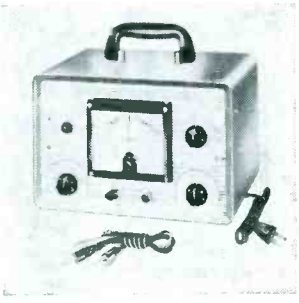
Triplett "Mighty Mite"

A highly compact miniature VOM, the "Mighty Mite," Model 310, is now being produced at the Triplett Electrical Instrument Co. It is a complete miniature 20,000 ohms per volt VOM available for the technician who wants a pocket-size unit suitable for wide-range testing. Self-shielded for checking in strong, magnetic fields, it has a sturdy plastic meter window and boasts interchangeable test prod tips that fit in top of the unit to become the common probe. A selector switch speeds circuit and range settings. For further information, CHECK T98.



Simpson Leakage Tester

The Simpson Model 383 In-Circuit Capacitor Leakage Tester operates on a new patented principle which distinguishes between ordinary circuit resistance and leakage resistance in paper, mica, and ceramic capacitors. Both metered *dc* voltage and adjustable *ac* pulse voltage are applied to capacitor under test. The Model 383 applies full rated working voltage across the capacitor, right in the receiver circuit, without disconnecting either end of the capacitor. For further information, CHECK T90.



CIRCUIT ANALYSIS

Theory And Adjustment Of The DuMont Narrow Band Sync Amplifier Circuit

by **RTSD Technical Staff**

THE Narrow Band Sync Amplifier (NBSA) is a circuit used to some extent by Dumont. It was first incorporated in model RA105B and used up to model RA147. It was designed to provide a high degree of noise immunity for the sync circuits by maintaining stable sync during periods of heavy noise bursts.

NBSA circuitry is quite different from circuits performing similar functions in other receivers. It becomes necessary, therefore, to apply different servicing techniques for troubles in receivers using NBSA. This article covers the theory of operation and the practical problems of adjustment and servicing.

Theory of Operation

In most receivers the composite video signal is applied to the sync circuits for processing, which entails the elimination of the pix portion video signal and the building up of the sync portion. NBSA selects, through the use of tuned circuits, only the low video *if* frequencies containing the sync signals. A typical video *if* curve is shown in *Fig 1*. Below that is the response curve of the NBSA. By comparison it may be seen that the response curve of the NBSA is much narrower than that of the video *if* stages. Only the frequencies grouped around the carrier will enter the NBSA, these being the low frequency video signals which include the sync pulses.

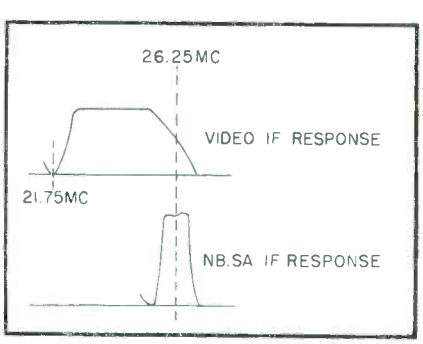


Fig. 1—NBSA response curve.

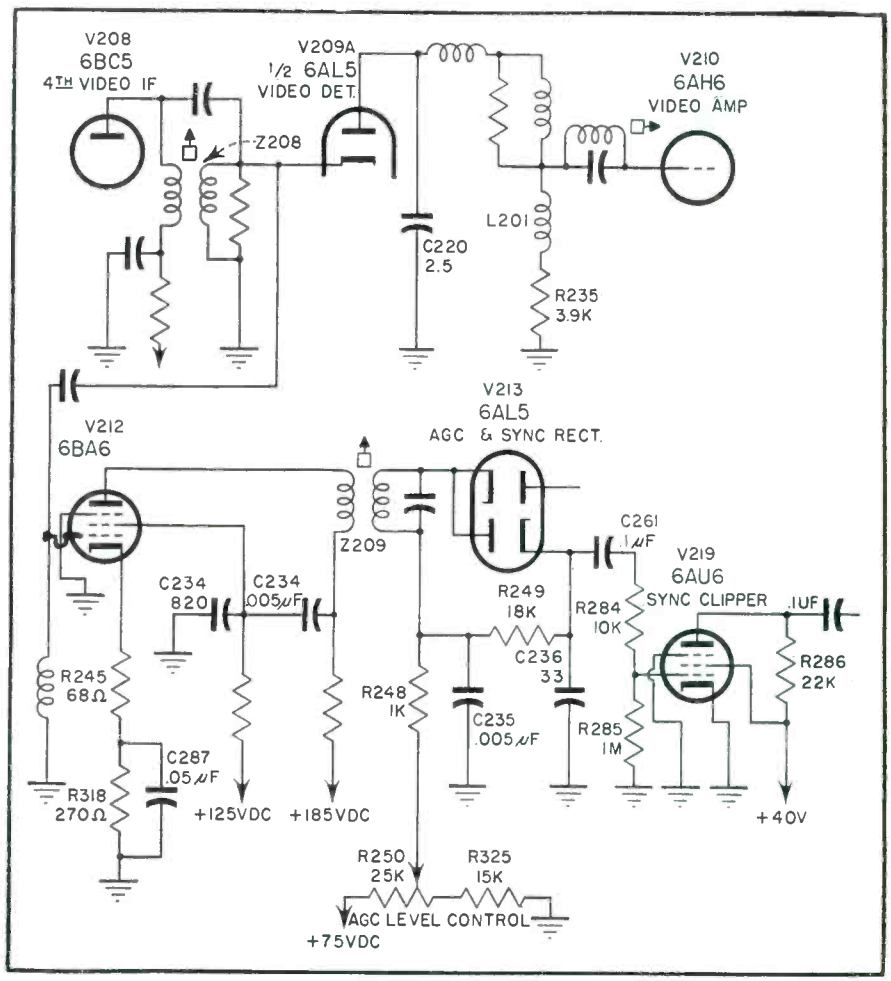


Fig. 2—Narrow Band Sync Amplifier circuit used in DuMont RA 113.

Referring to *Fig.* 2, the output of V208, the composite video *if* signal is fed to the video detector V213 via the input to V212, the NBSA. *Z209* located in the plate circuit of V212 determines the frequency and band width of the stage. The output of *Z209* is fed to V213 the 6AL5. The upper half of V213 is employed as the *agc* rectifier while the lower half is the sync detector. The sync signal is developed across *R249* and coupled to the grid of V219, the first sync clipper. A variable voltage is applied through *R248* for setting the *agc* level. The *dc* voltage does not bias the sync rectifier because the cathode returns to the junction of *Z209* and *R248*. The *agc* rectifier returns to ground and is therefore controlled by this voltage.

Circuit Adjustments

There are several methods for adjusting the NBSA circuit. The simplest method is as follows:

(1) Tune in strongest channel.

(2) Raise brightness control until re-

DEPARTMENT OF COMMERCE
BUSINESS AND DEFENSE SERVICES ADMINISTRATION
WASHINGTON 25

AUG 1 1 1955

Mr. George Eannarino
Director, Rectifier Division
Sarkes-Tarzian, Incorporated
415 North College Avenue
Bloomington, Indiana

Dear Mr. Eannarino:

The current work stoppages in the copper industry have very seriously affected the production of selenium. A survey made by the Business and Defense Services Administration has found that there is sufficient high-purity selenium available for less than a month's average production of rectifiers.

In view of the seriousness of the situation, I am asking you to help yourself, the rectifier industry as a whole, and those industries to which you supply vital components by making every effort to recover all discarded selenium rectifiers. The program I suggest is as follows:

(a) Immediately contact all your distribution outlets to request their customers to return discarded rectifiers to them.

(b) Immediately request your distribution outlets to collect and return to you all discarded rectifiers of your brand.

(c) You have the selenium in the discarded rectifiers reclaimed for your account.

Such a program should result in an annual reclamation of approximately 20 per cent of the total amount of high-purity selenium used. This will somewhat ease the seriousness of the shortage which we face.

Your wholehearted cooperation in this recovery program is of importance to the national economy.

Very truly yours,

H. B. McCoy
Deputy Administrator

SARKES TARZIAN INC.
RECTIFIER DIVISION
AUG 15 1956

trace lines appear.

(3) Adjust primary and secondary of Z209 for minimum video and brightest retrace lines.

(4) Readjust the brightness control for normal operation.

(5) Adjust the *agc* for normal operation in the following manner: Rotate *R250*, the *agc* level control until bending occurs. Reverse the direction of rotation and turn until the bending occurs again. Set the control somewhere between these two points.

If any extreme sensitivity is shown by the horizontal hold control, readjust the top slug of *Z209* for improved stability. The procedure outlined is generally found suitable for most cases of misadjustment. If Z209 is badly misaligned a signal generator may be used for realignment. Connect the generator to pin No. 1 of V212. Set the generator at 26.25 *mc* modulated *rf*. A *vtvm* may be connected across *R249* or a scope across *R285* for output indicators. The primary

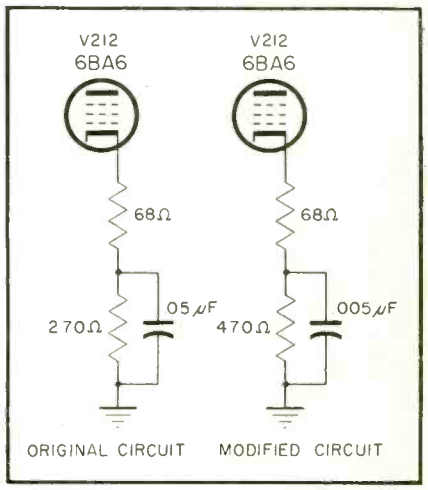


Fig. 3—Modification to improve horizontal stability.

and secondary of Z209 are then adjusted for maximum output. When this is completed, check the horizontal hold control. If it shows signs of sensitivity readjust the top slug of Z209.

Circuit Modifications

The most common difficulty encountered in this series is unstable horizontal hold. Dumont issued several modifications for the improvement of this condition. *Fig 3* shows the modifications for the cathode circuit of the 6BA6, V212. This modification was later incorporated as a production change and may be in many receivers already.

A second recommendation was to short out the 10K resistor *R284*. This permits better clipping and elimination of the video content but lowers the circuit immunity to noise bursts.

The third modification is shown in

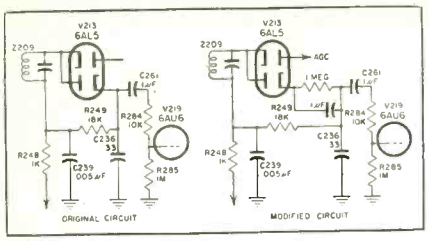


Fig. 4—Modification to improve horizontal stability.

Fig. 4. This consists of the addition of a 1 megohm resistor and a .1 *uf* condenser in the sync diode circuit. In a noisy area this modification is not too satisfactory as it lowers the circuit opposition to noise pulses.

NEW TUBES

[*from page 32*]

features hermetic sealing in nickel-silver cans each measuring 0.350 inch long by 0.225 inch in diameter.

The CBS-Hytron type 17ATP4 is an electrostatically-focused, magnetically-deflected, direct-view picture tube designed for use in television receivers. The all-glass rectangular construction of the 17ATP4 contains a gray-glass, spherical face plate that provides greater contrast under high ambient-light conditions. The 17ATP4 incorporates a 90-degree deflection bulb design that facilitates cabinet economy by providing a shorter over-all bulb length. The 17ATP4 contains an electron gun designed for use with a single-field external ion-trap magnet. The CBS-Hytron 17ATP4 also contains an outer conductive coating that, when grounded, serves as a high-voltage filter capacitor.

The CBS-Hytron type 17AVP4 is an electrostatically-focused, magnetically-deflected, direct-view picture tube designed for use in television receivers. The all-glass rectangular construction of the 17AVP4 contains a gray-glass, spherical face plate that provides greater contrast under high ambient-light conditions. The 17AVP4 incorporates a 90-degree-deflection bulb design that facilitates cabinet economy by providing a shorter over-all bulb length. The 17AVP4 contains an electron gun designed for use with a single-field, external ion-trap magnet. The CBS-Hytron 17AVP4 also contains an outer conductive coating that, when grounded, serves as a high-voltage filter capacitor.

RCA

RCA-21AXP22 is a directly viewed picture tube of the metal-shell type for use in color television receivers. It is capable of producing either a full-color

or a black-and-white picture measuring 19 5/16" x 15¼" with rounded sides and having a projected area of 260 square inches. The 21AXP22 utilizes three electrostatic-focus guns spaced 120° apart with axes tilted toward the tube axis to facilitate convergence of the three beams at the shadow mask; individual convergence control of each beam radially by internal magnetic poles and supplemental control of the blue beam tangentially by internal magnetic poles; and an assembly consisting of a spherical metal shadow mask with uniform holes and a metalized, tricolor, phosphor-dot screen on the inner surface of the spherical Filterglass faceplate. The tricolor, phosphor-dot screen is composed of an orderly array of small, closely spaced, phosphor dots arranged in triangular groups. Each group consists of a green-emitting dot, a red-emitting dot, and a blue-emitting dot, and is aligned with a corresponding hole in the shadow mask.

The 6CB5 is a high-perveance beam power tube of the glass-octal type designed especially for use as a horizontal-deflection amplifier tube in color television receivers. The 6CB5 has a maximum plate-dissipation rating of 23 watts and a maximum grid-No. 2 input of 3.6 watts. These ratings in addition to a peak positive-pulse plate-voltage rating of 6800 volts and a peak negative-pulse plate-voltage rating of 15 volts, enable a single 6CB5 to provide full deflection for the RCA-21AXP22 color picture tube. Other electrical features which contribute to the overall performance of this tube in deflection circuits are low mu-factor, high plate current at low plate voltage, and a high operating ratio of plate current to grid-No. 2 current.

The 6BK4 is a low-current beam triode of the sharp-cutoff type designed specifically for the voltage regulation of high-voltage, low-current dc power supplies in color television receivers. It has a maximum dc plate-voltage rating of 25,000 volts, a maximum dc plate-current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 25 watts. The high-voltage insulation in the 6BK4 for its intended service is obtained by the use of a double-ended structure utilizing a suitably designed electron gun which consists of a thermionic cathode and one grid. The plate connection is made to a small cap at the end of the bulb.

The half-wave vacuum rectifier tube 6BL4 of the glass-octal type is particularly suited for use as a damper diode in color television receivers. Rated to withstand a maximum peak inverse plate voltage of 4500 volts (absolute), the 6BL4 can supply a maximum peak plate current of 1200 milliamperes and a maximum dc plate current of 200 ma.

ASSOCIATION NEWS

by Samuel L. Marshall

National Alliance of TV and Electronic Service Associations

A very important step has been taken by RETMA when a plan to accredit TV-radio service people was released. Under this plan not only is it proposed to accredit those service people who satisfactorily complete the RETMA advanced TV course but also those practicing service people who submit to an examination based upon the course. The examination would be in part a written multiple choice type test and in part actual service of sets in which at least two troubles have been created.

NATESA has, since its inception, and NATESA officers even before that, have championed accreditation, especially in cooperation with RETMA. We find one serious flaw in the RETMA plan, and that is the limitation of accreditation to cities in which the RETMA course has been set up. At present, this would mean about four cities, mostly out east. To speed the benefits of accreditation it is our sincere belief that accreditation boards consisting of all segments of the industry, be set up *immediately* in *every* city where sufficient interest is shown. It is our firm belief that accreditation *will* solve the great majority of problems facing the service industry, the solutions.

Texas Electronics Association, Inc.

The Texas Radio & TV Service Clinic and Electronics Fair held in San Antonio, Texas, August 26-27-28 was proclaimed a huge success. T.E.A. along with manufacturers, representatives, and distributors spared no expense in bringing a bang-up clinic and fair to this region. Among the feature speakers and the companies they represented were, Charles Golenpaul of Aerovox, Ray Nugent of Philco, Frank Hadrick of Admiral, W. A. Adcock of Texas Instruments, Al Coumont of R.E.T.M.A., Clint E. Walter of RCA, and Dan Halpern of Westinghouse.

Associated Radio & TV Servicemen (Chicago, Ill.)

The Executive Committee of the Associated Radio & Television Servicemen, Illinois, submitted the following resolution to its members:

"The individual members of ARTS, Illinois who are independent radio and television service shop owners and dealers have long known of and suffered from the practice of indiscriminate selling at wholesale prices to any and all of the consuming public by the radio and electronics parts jobbers and/or wholesalers.

"They are also aware of the indiscriminate distribution by these same jobbers or/wholesalers of catalogs containing wholesale prices of electronic parts and supplies.

"Therefore the members of ARTS, Illinois have expresssed themselves in opposition to these unfair trade practices.

"Further, the members of ARTS, Illinois requested their Officers and Executive Committee to make known the feeling and the position of the members regarding this 'Back Door Sales Policy.'"

Radio & TV Association (Springfield, Ohio)

From the Springfield, Ohio Daily News of Wednesday, July 20th, we note:

"Incorporation of Radio and Television Association of Springfield and Vicinity was announced by Ted W. Brown, Secretary of State. His Columbus office granted a non-profit corporation charter to the local group.

"Marvin Miller, president of the association, said that the incorporation was made to protect individuals in enforcing or suggesting reforms in practices among television dealers and servicemen. The organization is made up of some 40 Springfield and area men who represent about 60 per cent of the dealers and servicers about the community."

Long Beach (Calif.) Radio Technicians Assoc. Inc.

The ninth Chapter of Radio Television Technicians Association was installed at the Green Hotel, Pasadena, California, on Tuesday evening, July 26th, 1955. President Lee Johnson, and General Chairman Public Relations Harry E. Ward, of Long Beach Chapter presided and installed the following officers:

Pres., John Dunner, Jr.; 1st Vice-Pres., Ford Wilson; 2nd Vice-Pres., Wayne B. Hartwell; Secy., Frank W. Fisher, Jr.; Treas., Harold Rupp; Public Relations, Keith L. Herb.

Guests included: Clarence H. Morris, Pasadena Police Chief; Ed Thornburg, Deputy L.A. Sheriffs Dept.; Ben Sewell, Pasadena STAR NEWS; E. E. Kirkbride, L.A. Better Business Bureau.

Radio-TV Technicians Association of Orange County, Calif.

The above organization observes that the super-markets are taking over. Your customer can now take his TV and radio tubes to the market with him when he goes grocery shopping and by plugging them into a crude but flashy tube checker find out which ones might be bad. Then he asks the attendant to sell him what he thinks he needs in RCA, GE, or Sylvania.

RTA is going to bat on this thing in as forceful a way as possible and has the force from Long Beach to Santa Barbara including the Pomona and San Fernando Valleys; in short Southern California.

ANSWER MAN

[*from page* 33]

age electrostatic focus) picture tube can be noticeably changed and improved in many cases through adjustments of the ion trap. As in all cases, the ion trap is adjusted for maximum brightness but at the same time it should be positioned for best focus, also.

In models of the 21TQ series a focus socket is provided on the top of the chassis which can be used to select the voltage that will provide the optimum focus. In other words, the focus lead from pin #6, the electrostatic focus anode, on the CRT can be plugged

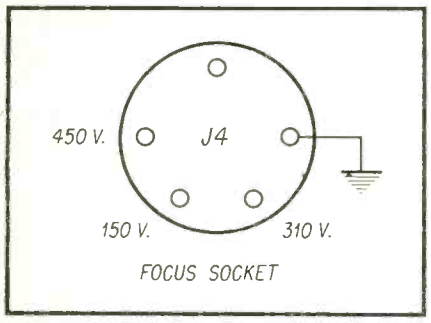


Fig. 3—View of focus socket in Stromberg-Carlson 21TQ Series.

into any of the positions shown in *Fig.* 3. Some of the first chassis in this series did not make available the 450 volt potential and had that socket hole grounded. If the chassis does not provide this voltage it can be obtained by running a lead from the boost voltage provided to the vertical output transformer to the grounded socket hole. Naturally, the ground connection at this hole in the socket must be disconnected.

The use of one of these focus anode potentials plus careful adjustment of the ion trap will provide proper focus in almost all cases.

VARI-DOT GEN.

[from page 27]

tive-going dot pulses and positive-going sync pulses.

The video signal at the plate of the dot gate is applied to the grid of the modulator triode by capacitor *C20*. When the function switch is in the *rf* position, the modulator triode operates as a cathode follower, and the video signal developed at the cathode is applied to the screen grid of the *rf* oscillator tube. This *rf* oscillator has an operating frequency determined by *L5* and *C22*. The *rf* output from this oscillator is modulated by the video signal, which is applied to the screen of the pentode oscillator. The amplitude of modulated *rf* output from this circuit is adjustable by means of potentiometer *R51*.

When the function switch is set to either the + video or to the − video positions, the modulator tube operates as a phase splitter, with one polarity appearing at the cathode, and the opposite polarity appearing at the plate. When the function switch is set to the − video position, the signal at the plate of the modulator is applied through the attenuating network *C17* and *R41* to the left-hand terminal of *R40*. This potentiometer *R40* operates as the video output attentuator, and permits a selected level of video signal to be applied to the control grid of the pentode oscillator.

This pentode oscillator operates as a cathode follower when the function switch is set to either of the two video positions, the video output from the cathode being applied to the video-output connector on the front panel of the instrument. The operator will observe that the small-sized dots appear sharper when signal is applied directly to the grid of the video amplifier in the color-TV receiver under test, as compared with the broader appearance of the dots when modulated *rf* output is applied to the antenna-input terminals of the receiver under test. This difference is the result of the relatively limited bandwidth of the signal circuits in the receiver, as well as by the bandwidth and transient response of the modulator in the instrument.

Variable vertical sync-pulse rate is provided so that the operator can check the sync action of the color-TV receiver both under conditions of studio transmission locally, and under conditions of network reception in which the vertical sync-pulse rate is not locked in with the power-line frequency.

WORKBENCH

[from page 25]

immediately the horizontal frequency came back into range and the width spread out to normal. The old 4 *μf* condenser was checked and found to be open. The receiver was then played for two days and functioned properly.

With *C82* open there was no separate path for the horizontal oscillator current, thus *R105* was now directly in series with the shaping condenser, *C80* and therefore was an integral part of the horizontal oscillator circuit. Thus any change in the 6BQ6 cathode current would affect the horizontal oscillator frequency. This accounts for the effect of the drive control condenser (*C81*) on the horizontal oscillator frequency.

Admiral 18XP4BZ

The receiver was turned on and the horizontal frequency immediately drifted out of range. The 12AU7 horizontal oscillator was replaced but had no effect. Next the 6AL5 was removed from its socket. As soon as this was done the horizontal oscillator frequency, although out of sync, came back into range. The 6AL5 was next replaced but had no effect.

At this point, the diagram was studied. Because the trouble seemed to

be located in the horizontal sync discriminator (6AL5) circuit, closest attention was paid to this area. This receiver utilizes a cathode coupled multi-vibrator for its horizontal oscillator. Balanced sync pulse voltage from the sync inverter is supplied through an RC coupling network to the sync discriminator. The sync discriminator then develops a *dc* voltage across *R429* which is proportional to the phase difference between the transmitter sync pulse and the horizontal sweep reference voltage. When the frequency and phase relationship between these two voltages is correct, the sync discriminator supplies normal operating bias to the first triode section of the horizontal oscillator (12AU7).

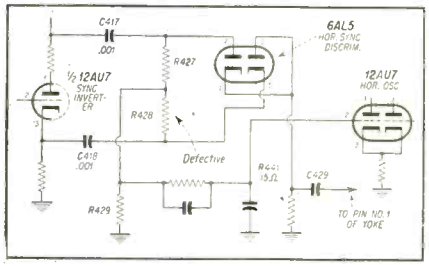


Fig. 2—Partial schematic of Admiral 18XP4BZ.

Knowing these facts and as this was strictly a horizontal frequency range problem, a voltage measurement was taken across *R429*, the sync discriminator load resistor. The meter measured about 4 volts positive instead of less than 1 volt positive. Condensers, *C417* and *C418* were then clipped out of the circuit and measured for leakage individually. Both condensers however, checked okay. Capacitor *C429*-.047 *μf*, the condenser that feeds the horizontal reference voltage from the horizontal output circuit was next checked for leakage but was found to be functioning properly. Finally a resistance check was made across *R427* and *R428*, both 100K resistors. *R427* measured properly but *R428* measured 400K. Resistor *R428* was next replaced with a new 100K

MOVING?

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resistor and the receiver was turned on. The horizontal frequency was now correctly in range and the receiver functioned properly. Since no other cause could be found for the defective *R428*, the 6AL5 was replaced as a positive action to avoid a recurrence of the same problem.

GEIGER COUNTERS

[*from page* 22]

principles previously discussed. The GM tube used here is a 1B86, a 300 volt tube. As might be expected its simplicity makes its use rather limited. The manufacturer points out that it will not measure the exact quantity of radiation, but it does indicate whether radiation is present or not.

The 1½ volt dry cell, *B1* in conjunction with the transformer *T1* is used to charge *C1* to about 300 volts in the following way. The push button switch *S2* is depressed and released quickly 3 or 4 times. Each time that *S2* closes the circuit, a magnetic field builds up around the primary and secondary of the transformer. When *S2* opens, this field collapses rapidly. In so doing it induces a large back *emf* across the high impedance secondary. This back *emf* charges *C1* to about 300 volts. It is important to note that the charge path of *C1* is *through* the GM tube. This means that the charging voltage must be large enough to cause ionization by breakdown as previously described. Each time that breakdown occurs, a click will be heard in the earphones, since the sudden flow of current through *R1*, *C1*, and the GM tube develops a voltage which is applied to the grid circuit of the 1U5. This is then amplified and current pulse through the phones produces the click.

Once *C1* becomes charged it serves as the voltage source for the GM tube. In this condition, if radioactive rays of sufficient intensity enter the tube, ionization takes place resulting in clicks in the earphones. Each time this happens, *C1* loses a small portion of its charge, so that as the instrument is used, the voltage applied to the GM tube gradually decreases, and the sound gradually gets weaker. When this happens *S2* should be depressed and released once or twice to recharge *C1*. Once the clicks are heard when *S2* is operated, it should not be depressed any more, since this means that the tube is operating in the breakdown range and such operation shortens the life of the tube.

In succeeding installments, more elaborate Geiger Counters and Scintillation Detectors will be discussed.

CONVERGENCE

[*from page 17*]

Fig. 9. Now on convergence of the red and green beams, the blue beam may be moved laterally then radially as shown in *Fig. 7C*, to effect convergence of all three beams. It might be pointed out that the blue beam corrector magnet fits directly under the blue electron gun where the gun has an accommodating set of pole faces designed to effect maximum transfer of the magnetic field set up in the corrector magnet.

Dynamic Convergence

The operations discussed in the previous paragraphs are often referred to as "Static Center Convergence" adjustments. We make the point to introduce the need for *additional* convergence correction when the beam is deflected across the face of the tube. Under these conditions new convergence errors appear because of "geometric" distortion which we will explain presently.

Up to this point we have been examining the three beams in the absence of deflection power and have arrived at a converged condition at the center of the screen. The application of deflection power now will cause the three beams to traverse the entire screen. *Fig. 10* indicates a set of two conditions that correspond to the center and one of the limits of the phosphor screen. Note that although the three beams are still converged at the center, at the limit of deflection the beams would ordinarily arrive at a point of convergence prior to striking the shadow mask. This point falls approximately on a portion of a sphere the center of which is the inter-

section of the tube axis and the deflection plane. The radius of curvature of this sphere is equal to the distance between the center of the sphere and the center of the shadow mask. A shadow mask having this radius of curvature would coincide with the point of dynamic convergence referred to above. However, because the mask and faceplate do not have this special curvature the points of convergence will not fall on the shadow mask and a large convergence error will be produced at the screen limits. In light of the above this

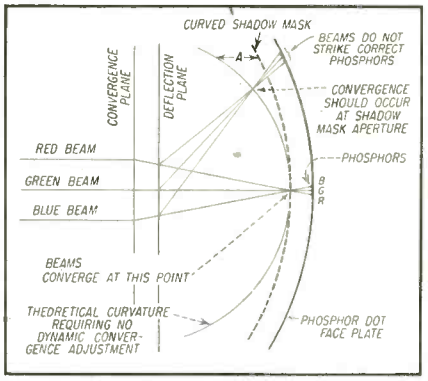

Fig. 10 — Geometric convergence error is indicated by "A".

error may be considered as being entirely attributable to the geometry of the picture tube. It is obvious that to correct this condition the mask and faceplate of the tube should theoretically have a greater curvature. However, the public does not take well to images produced on screens with too round a surface, and as a concession to consumer taste this curvature is flattened. Therefore, other means must be resorted to to correct that error. It might be added that early color tube designs

using a *perfectly flat* face-plate suffered from extremely severe convergence errors for this very same reason.

Having observed the nature of the error at the tube limits, that is, convergence occurs before the beams strike the shadow mask, it is obvious that convergence at the screen limits is possible by simply *reducing the strength of the convergence magnetic fields as the deflection angle is increased.* Reducing the convergence field strength opens up the relative angles between the three beams and results in convergence at the shadow mask aperture. Referring again to *Figs.* 5 and 6 we observe that the dynamic convergence coils are mounted on the same structures that house the permanent magnets previously adjusted under Static Center Convergence.

Taking each beam individually, studies of the deviation of the beam trace from a straight line as the beam passes from left to right across the face of the tube indicate that the uncorrected beam is parabolic in nature. Thus, the beam trace is high in the middle and low at the end. From this we deduce that the correcting field would have to have an inverse parabolic variation equal and opposite to the uncorrected deviation. Circuits are made available in receivers to permit application of variable parabolic voltages and currents fo this purpose. The next installment will deal with these circuits.

ANTENNAS

[from page 30]

line plus new high gain arrays that are compact and not bulky, will see even greater sales due to the inability of the assembler-manufacturer to compete in today's market.

In the field of new antenna design, there has been tremendous progress which will doubtless continue at an accelerated rate in the years ahead.

No one can accurately predict what will eventually happen to TV antenna sales although the general trend now seems well established. If F.C.C. Commissioner John C. Doerfer's recent plan to have all major cities convert to UHF were adopted, the conversion cost to the set owners in just nine major cities would amount to $1.7 billion dollar outlay! A significant share of this would go for new antennas. In addition, there would have to be new antennas for urban and rural communities. Whatever the merits of Commissioner Doerfer's plan, however, it seems doubtful that it will be adopted, although ten years ago it would unquestionably have resulted in better coverage for the entire nation.

Advertising Index

Sears Meteor

Chassis 637.12420

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PARTS LIST

CAPACITORS

SYMBOL	Part No.	DESCRIPTION	TYPE
C1-C21	Part of Tuner	Cascode E-36.151-2	
C21A, C21B	B-4.125-1	5000 MMF	Dual disc
C22A, C22B	B-4.125-1	5000 MMF	Dual disc
C23A, C23B	B-4.125-1	5000 MMF	Dual disc
C24	D-3.100-30	.25 MFD 200 V	Paper Tub
C25A, C25B	B-4.125-1	5000 MMF	Dual disc
C26	B-4.115-1	5000 MMF	Ceramic disc
C27	C-4.109-11	220 MMF	Ceramic
C28	C-4.111-5	3.3 MMF	Ceramic
C30	D-3.105-23	.22 MFD 400 V	Molded Tub
C31, C63, C29, C106	C-5.435-3	40/40/4/4 MFD-450 WV	Elect.
C32	D-3.105-21	.1 MFD—400 V	Molded Tub
C35	B-4.115-1	5000 MMF	Ceramic disc
C39	D-3.105-23	.22 MFD 400 V	Molded Tub
C40	C-4.109-11	220 MMF	Ceramic
C41	D-3.105-12	.0022 MFD	Molded Tub
C42	D-3.105-17	.022 MFD	Molded Tub
C43	D-4.104-93	68 MMF ± 5%	Silver Mica
C44	Part of	2000 MMF	
C45	B-10.101	5000 MMF	Vert. Int. Network
C46		5000 MMF	
C47	D-4.105-24	4700 MMF ± 10%	Mica
C48	D-3.105-59	.047 MFD 600 V ± 10%	Molded Tub
C49	D-3.105-21	.1 MFD—400 V	Molded Tub
C50, C102	C-5.429-2	100/25 MFD-50 WV	Elect.
C52	D-3.105-21	.1 MFD—400 V	Molded Tub
C53	D-3.105-19	.047 MFD—400 V	Molded Tub
C59	C-4.109-14	47 MMF ± 5%	Ceramic
C61	B-4.138	5000 MMF, Heavy Duty	Ceramic disc
C62, C64, C72, C104	C-5.435-3	40/40/4/4 MFD-450 WV	Elect.
C65	D-3.105-26	.0022 MFD—600 V	Molded Tub
C66	D-3.105-19	.047 MFD—400 V	Molded Tub
C67	D-3.105-17	.022 MFD—400 V	Molded Tub
C68	D-3.100-30	.25 MFD—200 V	Paper Tub
C69	D-4.104-59	330 MMF ± 10%	Mica
C70	D-3.106-1	.01 MFD—600 V	Stab. type—Molded Tub
C71	D-4.105-9	1200 MMF ± 10%	Mica
C73	D-4.104-70	560 MMF ± 10%	Mica
C74	B-4.119-2	Trimmer with Bracket	
C75	C-4.109-14	47 MMF ± 5%	Ceramic
C76	D-3.105-34	.047 MFD 600 V	Molded Tub
C78	D-3.100-30	.25 MFD—200 V	Paper Tub
C79	B-4.128	H.V. 500 MMF—20KV	
C80	B-4.129-2	39 MMF ± 10% 2KV	Ceramic
C81	D-3.105-59	.047 MFD ± 10%—600 V	Molded Tub
C82	D-3.100-46	.035 MFD ± 10%—600 V	Paper Tub
C83	B-4.129-4	68 MMF ± 10%—2KV	Ceramic
C91	D-4.104-38	100 MMF ± 10%	Mica
C92	D-4.104-21	39 MMF ± 10%	Mica
C93A, C93B	B-4.125-1	5000 MMF	Dual disc
C95	D-4.108-12	1500 MMF	Ceramic
C97	C-5.430-1	4 MFD—50 WV	Elect.
C98	B-4.115-1	5000 MMF	Ceramic disc
C99	B-4.115-1	5000 MMF	Ceramic disc
C101	Part of B-10.103	.01 MFD	Printed Circuit
C103	D-3.105-28	.0047 MFD—600 V	Molded Tub
C105	D-108-12	1500 MMF	Ceramic

RESISTORS

R1-R14	Part of Tuner	Cascode E-36.151-2	
R15	D-7.103-132	12K ± 10%	2 W. carbon
R16	D-7.101-44	4.7K ± 10%	½ W. carbon
R17	D-7.101-250	47 ± 10%	½ W. carbon
R18	D-7.101-237	330 ± 20%	½ W. carbon
R19	D-7.101-55	8.2K ± 10%	½ W. carbon
R20	D-7.101-250	47 ± 10%	½ W. carbon
R21	D-7.101-226	100 ± 20%	½ W. carbon
R22	D-7.101-62	12K ± 10%	½ W. carbon
R23	D-7.101-248	150 ± 10%	½ W. carbon
R24	D-7.101-114	220K ± 10%	½ W. carbon
R25	D-7.101-226	100 ± 20%	½ W. carbon
R27	D-7.101-226	100 ± 20%	½ W. carbon
R28	D-7.101-62	12K ± 10%	½ W. carbon
R29	D-7.101-44	4.7K ± 10%	½ W. carbon
R30, R108	C-8.230-1	Control, dual, Contrast 1.5K, Vol. 1M	
R31	D-7.101-37	3.3K ± 10%	½ W. carbon
R33	D-7.101-79	33K ± 10%	½ W. carbon
R34	D-7.101-83	39K ± 10%	½ W. carbon
R36	D-7.101-55	8.2K ± 10%	½ W. carbon
R38	D-7.103-104	2.7K ± 10%	2 W. carbon
R39	D-7.103-104	2.7K ± 10%	2 W. carbon
R40	D-7.101-17	1K ± 20%	½ W. carbon
R41	C-8.229-9	100K Pot.	
R42	D-7.101-86	47K ± 10%	½ W. carbon
R43	D-7.101-114	220K ± 10%	½ W. carbon
R44	D-7.101-100	100K ± 10%	½ W. carbon
R45	D-7.103-97	1800 ± 10%	2 W. carbon
R46	C-8.221	2250 Pot.	4 W. Wire Wound
R47	B-6.211-4	2750	10 W. Wire Wound
R48	D-7.101-148	1.5M ± 10%	½ W. carbon
R49	D-7.101-121	330K ± 10%	½ W. carbon
R50	D-7.101-90	56K ± 10%	½ W. carbon
R51	D-7.101-48	5.6K ± 10%	½ W. carbon
R52	D-7.101-30	2.2K ± 10%	½ W. carbon
R53	D-7.101-37	3.3K ± 10%	½ W. carbon
R54	Part of	22K ± 20%	Vert.
R55	B-10.101	8.2K ± 20%	Int.
R56		8.2K ± 20%	Net.
R57	D-7.101-148	1.5M ± 10%	½ W. carbon
R58	C-8.229-10	1.5M Pot.	
R60	D-7.101-129	470K ± 20%	½ W. carbon
R61	C-8.219-5	2.5M Pot.	
R62	D-7.101-185	6.8M ± 20%	½ W. carbon
R64	C-8.207-8	5K Pot.	
R68	C-6.215-5	470K ± 10%	7 W. Wire Wound
R69	D-7.102-38	2.2K ± 20%	1 W. carbon
R70	D-7.101-122	330K ± 20%	½ W. carbon
R71	D-7.101-65	15K ± 10%	½ W. carbon
R72	D-7.101-129	470K ± 20%	½ W. carbon
R74	D-7.101-100	100K ± 10%	½ W. carbon
R77	D-7.102-108	100K ± 10%	1 W. carbon
R78	C-8.229-7	50K Pot.	
R79	D-7.101-171	3.3M ± 10%	½ W. carbon
R80	D-7.101-138	820K ± 10%	½ W. carbon
R81	D-7.101-55	8.2K ± 10%	½ W. carbon
R82	D-7.101-107	150K ± 10%	½ W. carbon
R83	D-7.101-99	100K ± 5%	½ W. carbon
R84	D-7.101-111	180K ± 10%	½ W. carbon
R85	D-7.102-94	47K ± 10%	1 W. carbon
R86	D-7.101-55	8.2K ± 10%	½ W. carbon
R87	D-7.102-44	3.3K ± 10%	1 W. carbon
R88	D-7.102-94	47K ± 10%	1 W. carbon
R89	D-7.101-129	470K ± 20%	½ W. carbon
R90	D-7.101-142	1 M ± 20%	½ W. carbon
R91	D-7.101-226	100 ± 20%	½ W. carbon
R92	D-7.103-118	5.6K ± 10%	2 W. carbon
R93	C-6.212-1	3.3 ± 20%	½ W. Wire Wound
R94	D-7.102-137	470K ± 20%	1 W. carbon
R95	D-7.101-128	470K ± 10%	½ W. carbon
R96	D-7.102-214	150 ± 20%	1 W. carbon
R100	D-7.101-87	47K ± 20%	½ W. carbon
R101	D-7.101-226	100 ± 20%	½ W. carbon
R104	D-7.101-17	1K ± 20%	½ W. carbon
R106	D-7.101-66	15K ± 20%	½ W. carbon
R107	D-7.101-69	18K ± 10%	½ W. carbon
R109	D-7.101-192	10M ± 20%	½ W. carbon
R110	Part of	470K ± 20%	Printed Circuit
R111	B-10.103	470K ± 20%	
R112	D-7.102-13	560 ± 10%	1 W. carbon
R113	D-7.102-10	470 ± 20%	1 W. carbon
R115	D-7.101-93	68K ± 10%	½ W. carbon

TRANSFORMERS, COILS AND CHOKES

SYMBOL	Part No.	DESCRIPTION	TYPE
L1-L10	Part of tuner	Cascode E-36.151-2	
L11	C-1.522-4	Video Peaking Coil	Yellow Dot
L12	C-1.522-3	Video Peaking Coil	Blue Dot
L14	C-1.522-4	Video Peaking Coil	Yellow Dot
L15	C-1.522-4	Video Peaking Coil	Yellow Dot
L16A, L16B	C-9.254-3	Deflection Yoke	Short 70° Cosine
L17	C-9.237-3	Filter choke	
L19	C-9.234-4	Focus Coil	
L18	B-1.533-1	Horiz. Size Coil	
L20	B-1.531	Horiz. Lin. Coil	
L22	C-1.554	Sound take-off Coil	
T1	Part of tuner	Cascode E-36.151-2	
T2	C-1.553	1-F Transformer	
T3	C-1.553	1-F Transformer	
T4	C-1.553	1-F Transformer	
T5	C-9.230-4	Vert. Blkg. Osc. Trans.	
T6	C-9.228-5	Vert. Output Trans.	
T7	D-9.260	Power Trans.	
T8	C-1.549	Horiz. A.F.C. Coil	
T9	D-9.259-1	Horiz. Output Trans.	
T10	C-1.552-1	Ratio Detector Trans.	
T11	C-9.225-4	Audio Output Trans.	

CABINET PARTS

PART No.	DESCRIPTION
E-12.703	Cabinet, Table Model 21"
B-13.201	Knob & Spring — Fine Tuning
B-13.202	Knob & Spring — Contrast
B-13.203	Knob & Spring — Volume
B-13.211	Knob & Spring — Channel Selector
D-14.368-1	Mask — 21"
B-24.206	Plug (Speaker)
C-26.645	Nameplate — Contrast, volume

PART No.	DESCRIPTION
C-26.646	Nameplate & Channel Indicator
C-26.779	Safety Glass
D-29.441	Cover, Vent (Cabinet Bottom)
C-30.447	Speaker, P.M. 4"
L-35.904	Control Cover Plate & Spring Assembly
L-35.905	Line Cord Assembly
L-35.907	Cabinet Back Assembly
L-35.909	Control Door Assembly

Sears Meteor

Chassis 637.12420

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TV I-F ALIGNMENT

1. Tune receiver to quiet portion of TV High Band.
2. Set contrast control fully counterclockwise.
3. Apply 3 v. negative bias between the A.G.C. bus (at C22A) and ground. (Use 2—1½ v. cells.)
4. Connect TV I-F Signal Generator through a 1500 MMF condenser to Test Point (A) of tuner unit; low side to ground. (See schematic diagram.)
5. Connect negative lead of V.T.V.M. (or meter of 20,000 ohms-per-volt, or better) to 4.7K diode load resistor TEST POINT (B); positive lead to ground. (See schematic diagram.)
6. Feed 23.2 MC [23.3]* (±.05 MC) from Signal Generator, and adjust T4 for maximum deflection on meter. Maintain Signal Generator output so low that meter reads no more than 1.5 volts at peak.
7. Feed 21.8 MC [21.8]* (±.05 MC) from Signal Generator, and adjust T3 as above.
8. Feed 24.0 MC [23.9]* (±.05 MC) from Signal Generator, and adjust T2 as above.
9. Feed 24.7 MC [24.5]* (±.05 MC) from Signal Generator, and adjust T1 as above.
10. Replace the meter with the vertical input of an Oscilloscope through a 10K isolating resistor, low side to ground.
11. Remove Signal Generator. Feed a video I-F Sweep Generator (20 to 28 MC) through loosely coupled shield of 6J6 converter tube, making sure shield is not grounded. (Refer to Fig. 13.)
12. Loosely couple high side of a TV I-F Marker Generator to the high Sweep Generator Lead; low side to ground.
13. Feed I-F Sweep, and observe response on 'scope. (See Fig. 15.) Use marker frequencies 20.25, 21.75 and 24.75 MC.
14. If response does not approximate that shown in Fig. 15, repeat steps 4 to 9, making sure that frequencies are precise, and that the Signal Generator output voltage is kept low. Continue with steps 10 to 13. A slight touch-up of individual slugs may be required to approximate the recommended curve of Fig. 15.

*NOTE: If 3v fixed bias is unavailable and zero fixed bias is used, set signal generator at [ ] bracketed frequencies values.

IMPORTANT: Keep the sweep generator and marker generator outputs at minimum to avoid curve distortion. Marker pips should be kept barely visible.

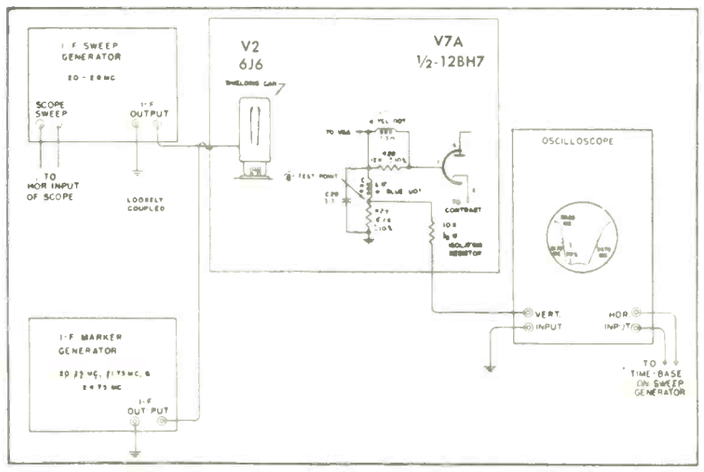


FIG. 13. IF ALIGNMENT BLOCK DIAGRAM

TV SOUND ALIGNMENT

1. Connect a 4.5 MC Signal Generator (±.01 MC) through a 1500 MMF condenser to the grid, Pin 7 of V7, 12BH7; low side to ground. See schematic diagram.
2. Obtain two resistors of approximately 100,000 ohms each, whose resistances have been matched accurately with an ohmmeter. Connect them in series across the 18K resistor (R107) at the 6T8 tube socket (V9A).
3. Connect negative lead of V.T.V.M. to junction of matched resistors of step 2; positive lead to ground.
4. Feed 4.5 MC (±.01 MC) from signal generator, and adjust L22, sound take-off coil, for maximum deflection on V.T.V.M.
5. Adjust the bottom slug of T10 for maximum deflection on V.T.V.M.
6. Connect positive lead of V.T.V.M. to junction of C98, and R106 TEST POINT (C), leaving negative lead of V.T.V.M. connected as in step 3. See schematic diagram.
7. Adjust top slug of T10 for zero output on V.T.V.M. between two opposite polarity peaks.

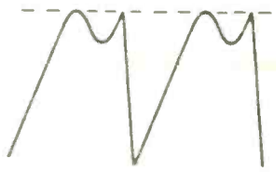
TABLE I RF ALIGNMENT FREQUENCIES

CHANNEL NUMBER	SWEEP GEN. CENTER FREQ. (10MC. SWEEP)	MARKER GENERATOR FREQUENCIES	
		VIDEO CARRIER	SOUND CARRIER
2	57 MC.	55.25 MC	59.75 MC
3	63 MC	61.25 MC.	65.75 MC.
4	69 MC.	67.25 MC.	71.75 MC.
5	79 MC.	77.25 MC.	81.75 MC.
6	85 MC.	83.25 MC	87.75 MC.
7	177 MC.	175.25 MC.	179.75 MC.
8	183 MC.	181.25 MC.	185.75 MC.
9	189 MC.	187.25 MC	191.75 MC.
10	195 MC.	193.25 MC.	197.75 MC.
11	201 MC.	199.25 MC.	203.75 MC.
12	207 MC	205.25 MC	209.75 MC.
13	213 MC.	211.25 MC	215.75 MC.

FIG. 14.

HORIZ. OSCILLATOR TRANS. ALIGN.

1. Tune in a TV station, preferably one that is transmitting a test pattern.
2. If after attempting the Horizontal A.F.C. Service Adjustment, described above, the picture cannot be made to sync. pre-set the Horizontal Stabilizing adjustment (inner slug of T8, beneath chassis) 5 turns in from its maximum out position.
3. Set the Horizontal Hold control to the center of its range and adjust the Horizontal A.F.C. adjustment until the picture is in sync.
4. Connect a low capacity probe of an oscilloscope to terminal "C" of the Horizontal oscillator transformer, T8; low side to ground. Set horizontal sweep to 7875 C.P.S. If a low capacity probe is unavailable, connect a 10K resistor in series with the vertical scope lead.
5. Adjust the Horizontal Stabilizing brass slotted screw until the broad and narrow peaks of the pattern on the oscilloscope are of equal height. (See illustration.) During Horizontal Stab. adjustment, picture must be kept in sync. by adjusting the Horizontal A.F.C. adjustment, if necessary.
6. Disconnect oscilloscope and follow Service Adjustment "E" above



R.F. ALIGNMENT

1. Connect TV Sweep Generator to Antenna Terminals.
2. Connect R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope through a 10,000 ohm ½w. resistor to Test Point (A) fig. 16.
4. Short A.G.C. Bus to ground on TV chassis (across C22A 5000 MMF Discap condenser).
5. Set Station Selector switch to Channel 12.
6. Feed 207 mc at 10 mc sweep from Sweep Generator, and 205.25 mc and 209.75 mc fixed frequencies from R.F. Marker Generator.
7. Observe response curve on Scope. If necessary adjust C3, C6, or C13 (See fig. 16) so that response curve corresponds approximately to that shown in fig. 15 and has maximum gain.
8. Check markers on response curve of all remaining channels, setting Sweep and Marker Generators at corresponding frequencies for each channel. See Table I for convenient tabulation of proper frequencies. If the R.F. Markers do not fall in automatically in their proper places on all channels, a compromise must be made by slight readjustment of C3, C6, C13.

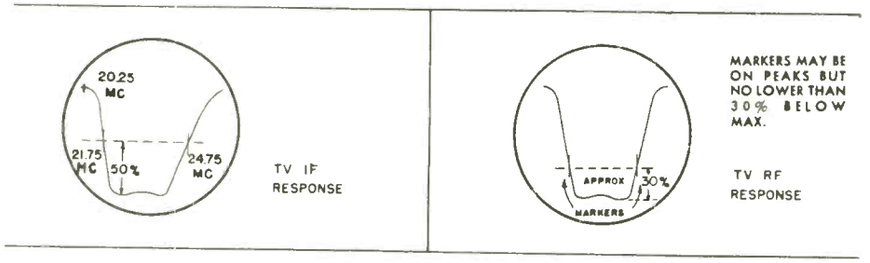


FIG. 15. RECOMMENDED RESPONSE CURVES

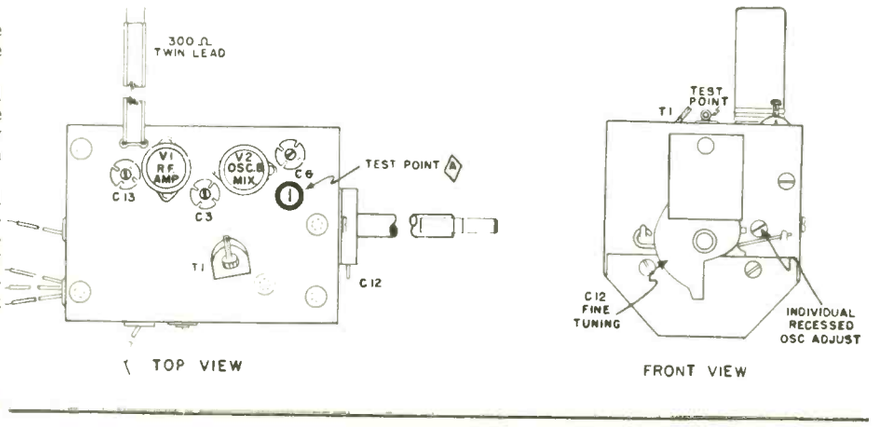


FIG. 16. R.F. TUNER ADJUSTMENT POINTS (STANDARD COIL CASCODE TUNER)

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OSCILLATOR ALIGNMENT

1. Connect TV R.F. Sweep Generator to Antenna Terminals.
2. Couple R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope to R29, 4.7K diode load resistor Test Point (B).
4. Couple 24.75 mc video I.F. Marker Generator loosely to first I.F. grid (Pin 1 of 6CB6, V3).
5. Rotate Fine Tuning control to center of range.
6. Set Station Selector switch to Channel 12.
7. Set Sweep Generator to 207 mc at 10 mc sweep and Marker Generator to 205.25 mc (video carrier).
8. Observe response curve and adjust C12 (Fine Tuning, see fig. 16) for Zero-beat with 24.75 marker. Zero-beat is indicated by an unmistakable break-up of the observed response curve.

   NOTE: Quality of response curve does not affect accuracy of oscillator alignment, so long as a zero-beat is obtained.
9. Check for zero-beat on all channels in this manner, setting the Station Selector, Sweep Generator and Marker Generator at corresponding frequencies. (See Table I.) It is not usually necessary to make any further adjustments. However, if the individual oscillator coils must be touched-up, the following procedure should be employed:

   a) Rotate Fine Tuning control to center of range.

   b) Set Station Selector to desired channel, Sweep Generator to its center frequency with 10 mc sweep, R.F. Marker Generator to the corresponding video carrier frequency (See Table I), and I.F. Marker Generator at 24.75 mc.

   c) Place a non-metallic screwdriver through the opening marked 'Individual Recessed Osc. Adjustment', fig. 16, and adjust oscillator coil zero-beat with 24.75 mc marker on response curve.

   d) This adjustment can be repeated on any single channel, or, if necessary, on all channels.

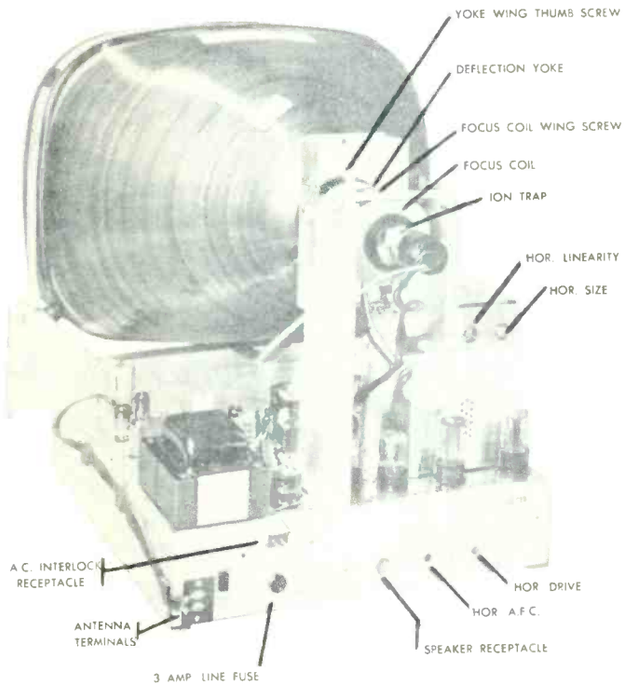
TUBE COMPLEMENT AND VOLTAGE CHART

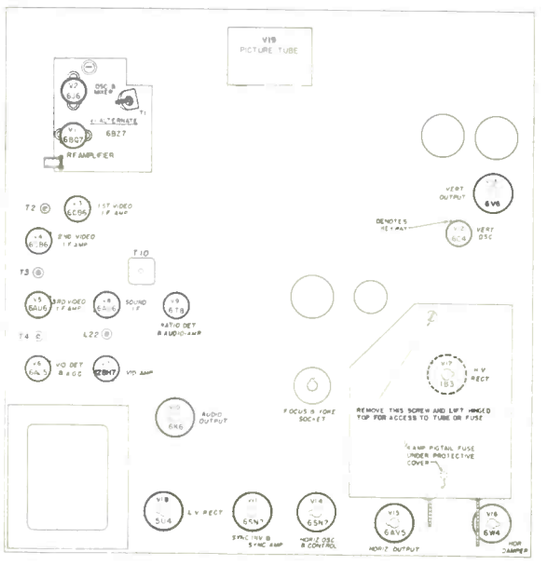
Symbol	Tube Type	Pin No. 1	Pin No. 2	Pin No. 3	Pin No. 4	Pin No. 5	Pin No. 6	Pin No. 7	Pin No. 8	Pin No. 9
V1	6BQ7	165	−1	0	6.3AC	0	265	160	165	0
V2	6J6	75	135	6.3VAC	0	−3 to −5	−4 to −9	0	—	—
V3	6CB6	−1	.55	0	6.3AC	100	100	0	—	—
V4	6CB6	−1	.55	0	6.3AC	101	101	0	—	—
V5	6AU6	0	0	0	6.3AC	102	102	1	—	—
V6	6AL5	0	−.75	6.3AC	0	0	0	−.35	—	—
V7	12BH7	152	0	0	6.3AC	6.3AC	57	−.35	0	—
V8	6AU6	0	0	0	6.3AC	105	105	.9	—	—
V9	6T8	−.35	−1.7	−.35	6.3AC	0	0	0	−.35	40
V10	6K6	NC	0	210	219	0	N.C.	6.3AC	14	—
V11	6SN7	0	28	2.4	28	74	28	6.3AC	0	—
V12	6C4	144	0	0	6.3AC	144	−34	0	—	—
V13	6V6	NC	6.3AC	275	275	−24	—	0	5	—
V14	6SN7	−3.5	175	12	−65	188	0	0	6.3AC	
V15	6AV5	−25	6.3AC	0	—	Do Not Measure	—	0	145	
V16	6W4	NC	NC	470	—	225	—	290	290† / 6.3AC†	
V17	1B3	13.5KV*	13.5KV*	13.5KV*	—	13.5KV*	—	13.5KV*	13.5KV*	
V18	5U4	NC	310** / 5.0AC	NC	305AC	290	305AC	290	310	
V19	CRT	0	5	Pin 10 / 365		Pin 11 / 33		Pin 12 / 6.3AC		

NOTES FOR VOLTAGE CHART

1. Tune receiver to unused chan. — no signal applied.
2. All front panel controls at maximum clockwise position.
3. Screwdriver service adjustments — adjusted for normal raster.
4. Maintain line voltage at 117 volts A.C.
5. All voltage measured with V.T.V.M. unless otherwise specified.
6. Values shown are D.C. voltages measured from socket to ground unless otherwise specified.
7. N.C. designates no connection.
8. A dash designates the non existence of socket connections.
9. "Local distance" switch in "local" position.

* Use high voltage insulated probe only.
† Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 7 and 8.
** Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 2 and 8.





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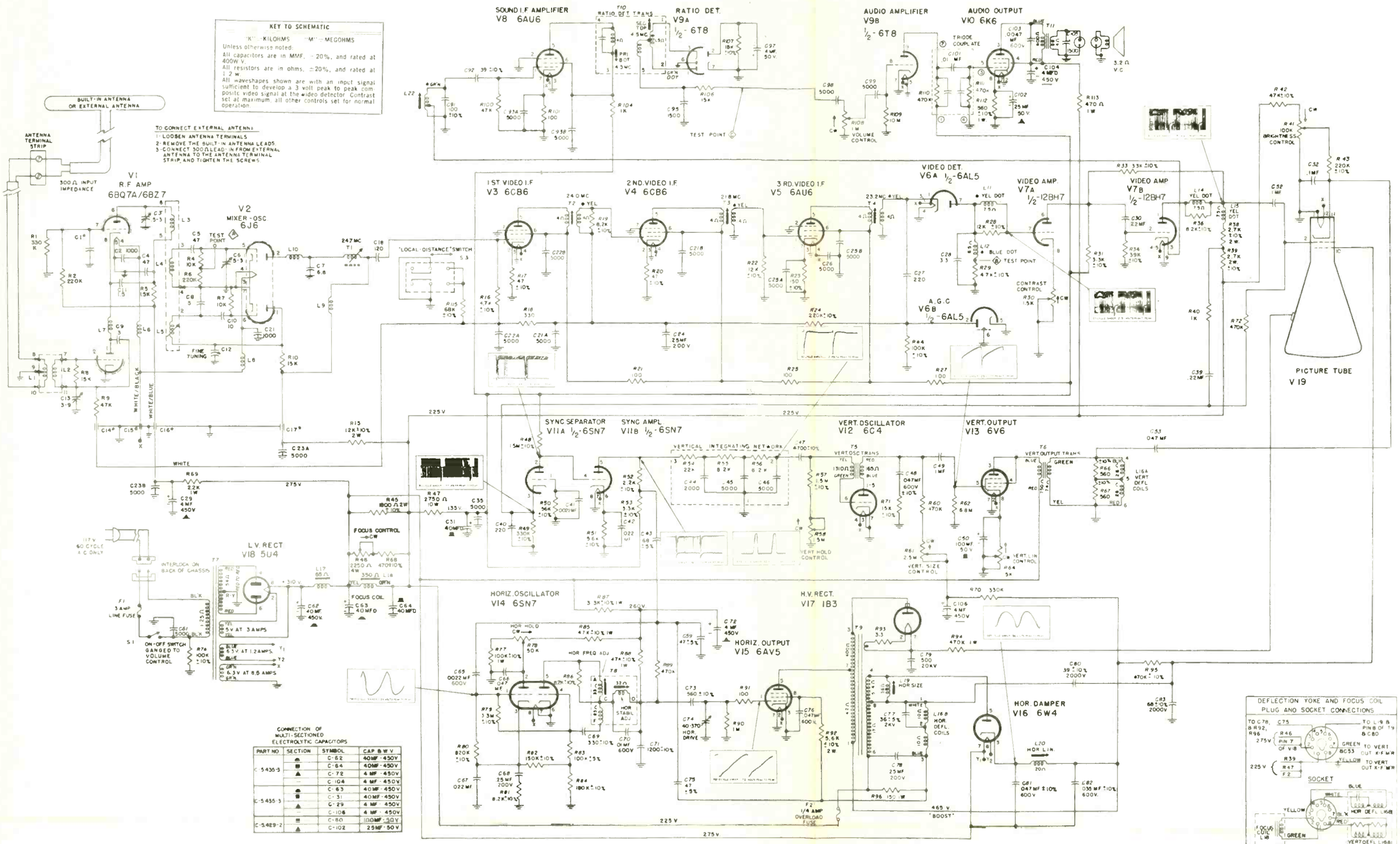

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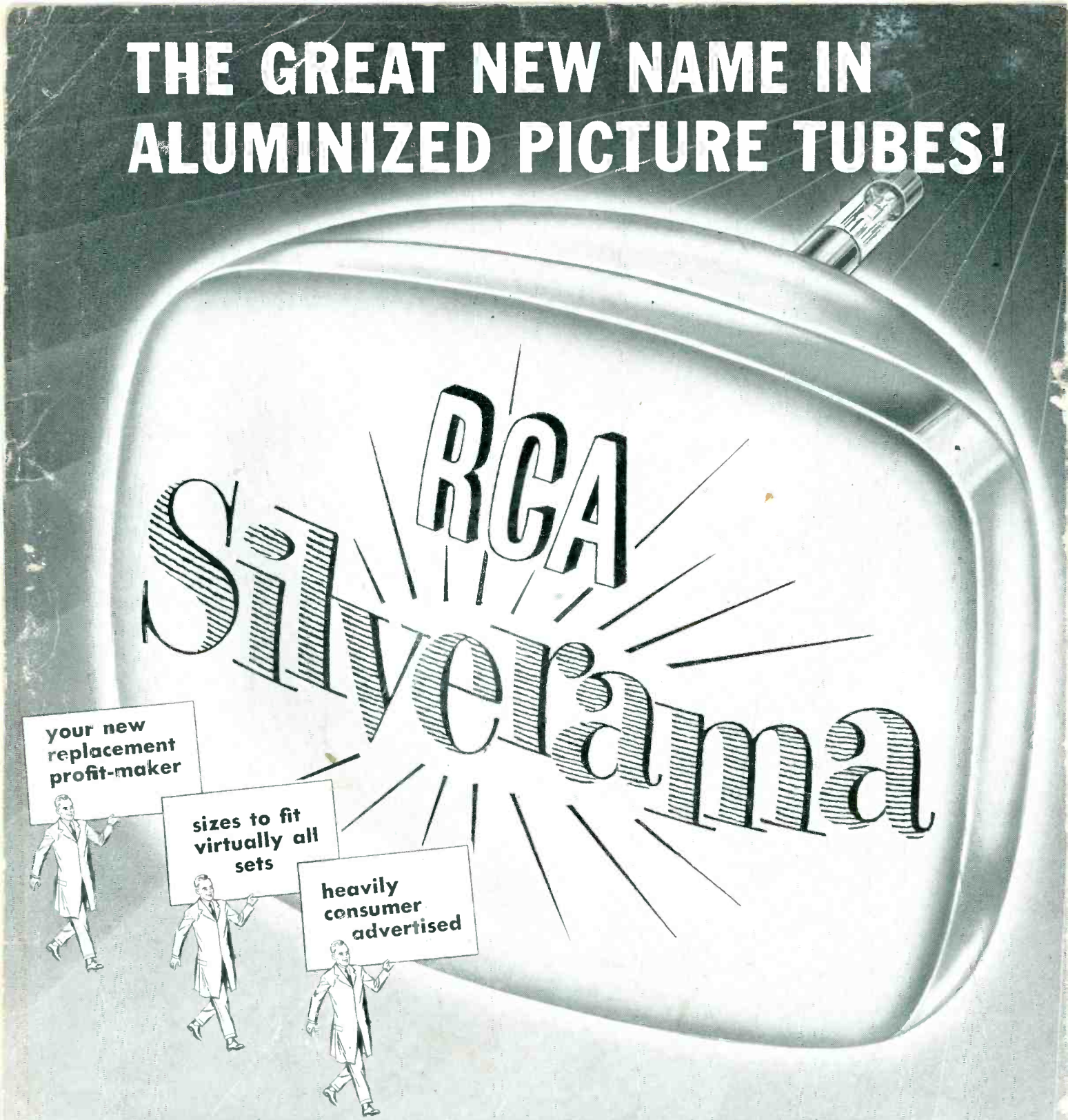

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