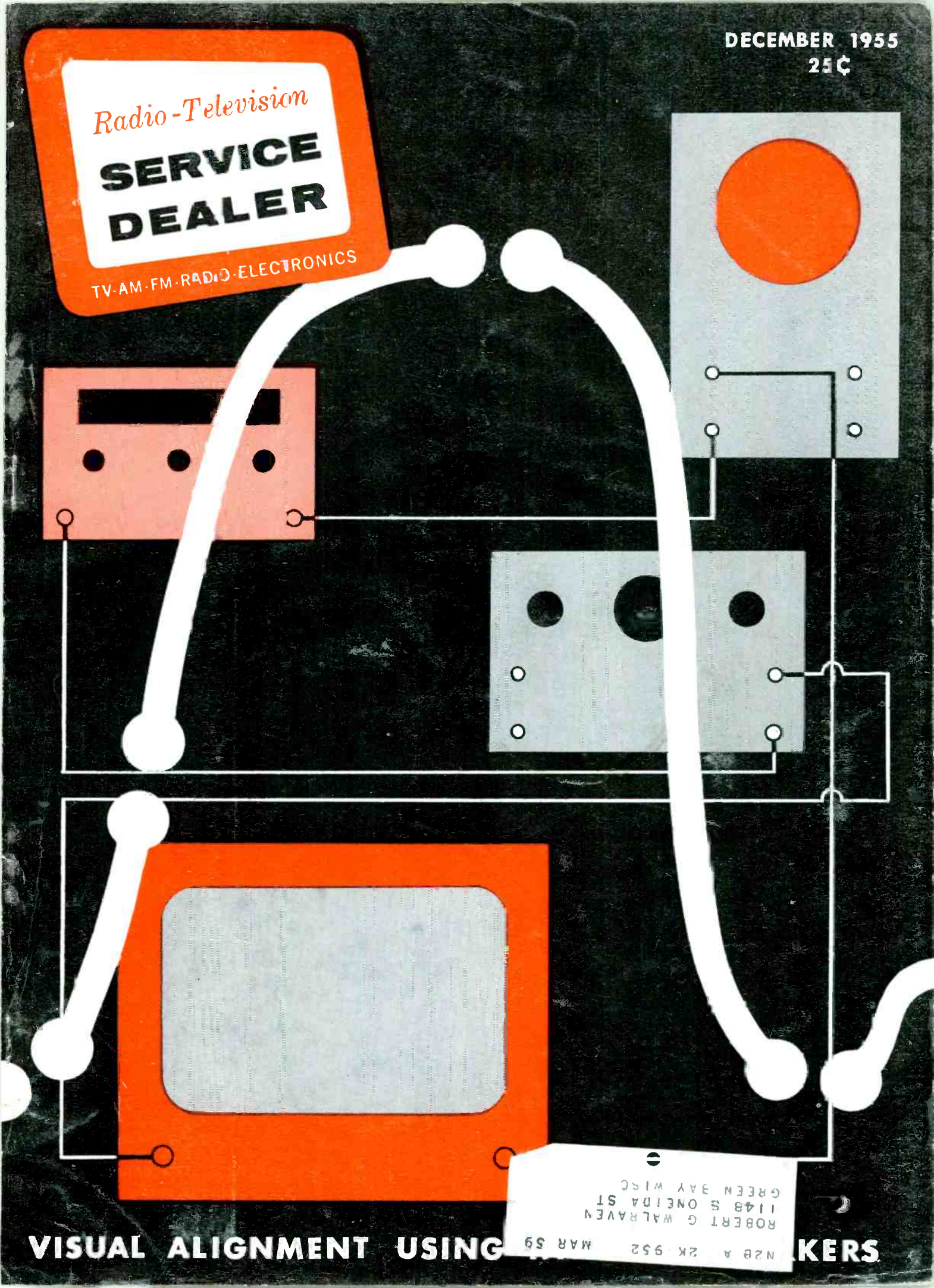
DECEMBER 1955
25¢

Radio-Television SERVICE DEALER

TV-AM-FM-RADIO-ELECTRONICS



VISUAL ALIGNMENT USING [illegible]KERS

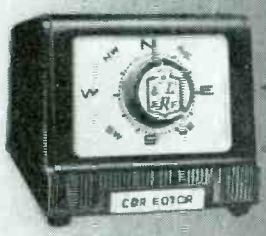
setting new selling records everywhere

C·D·R TV antenna ROTORS

the COMPLETE line
A Model for Every Need

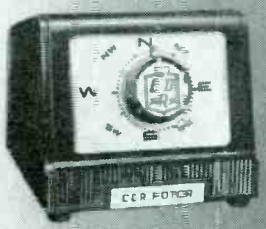
AR-1

The completely AUTOMATIC rotor, powerful and dependable, with a modern design cabinet. Uses 4 wire cable.



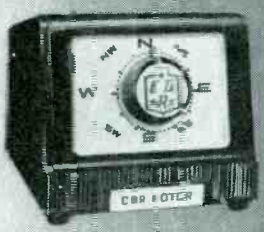
AR-2

Completely AUTOMATIC rotor with thrust bearing. Handsome cabinet, uses 4 wire cable.



AR-22

Here is the completely AUTOMATIC version of the famous TR-2 with all the powerful features that made it so famous.



TR-2

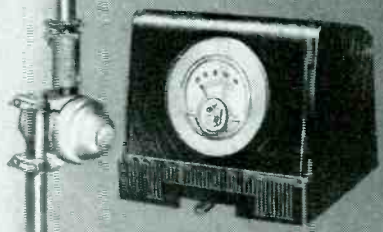
The heavy-duty rotor with plastic cabinet featuring "compass control" illuminated perfect pattern dial. Uses 8 wire cable.

TR-4

The heavy-duty rotor complete with modern cabinet with METER control dial. Uses 4 wire cable.

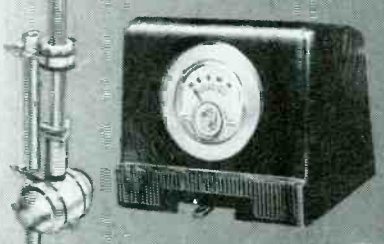
TR-11

The ideal budget all-purpose rotor with new, modern cabinet featuring meter control dial. Uses 4 wire cable.



TR-12

A special combination value consisting of complete rotor with thrust bearing. Handsome modern cabinet with meter control dial, uses 4 wire cable.

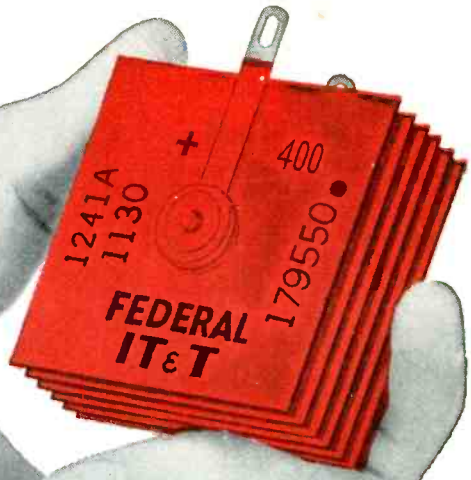


CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

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

Federal

...America's pioneer selenium rectifier



FIRST IN PREFERENCE!

with MORE Manufacturers **with MORE Distributors** **with MORE Servicemen**

More radio and TV manufacturers—through their design and component engineers—have placed their OK on Federal Selenium Rectifiers than any other make! Consequently, *more* distributors stock Federal to take care of *more* calls from servicemen for "replacement by Federal." Literally tens of millions of Federal types have been factory-installed. Federal is OK with manufacturers because Federal means *dependable* receiver performance . . . OK with distributors because Federal is in such high favor and big demand . . . OK with servicemen because Federal is profitable and customer-satisfying. Whatever *your* rectifier requirements you can meet them with Federal's *Universal* and *Regular* Lines . . . one source of supply for the radio-TV industry! Write today to Dept. F-185.

Here are the clinching reasons behind Federal's coast-to-coast leadership:

- Longer life
- Higher output voltage
- Lower temperature rise
- Superior humidity resistance
- More uniform quality
- Proven mechanical construction
- 85° C. UL acceptance
- Conservative ratings
- Largest plant capacity
- More engineering know-how

Federal Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

COMPONENTS DIVISION • 100 KINGSLAND ROAD • CLIFTON, N. J.

In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., New York

Federal

FEDERAL TELEPHONE & RADIO FTR

A DIVISION OF IT&T

VOL. 16, NO. 12 DECEMBER, 1955

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

RADIO-TELEVISION SERVICE DEALER is published monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $1.00 per year in the United States, & U.S. Poss. Elsewhere $1 per year additional. Single Copies 25c. Second Class mail privileges authorized at New York, N.Y. Tel.: MU 7-2080.

POSTMASTER: SEND FORM 3579 TO RADIO-TELEVISION SERVICE DEALER, 67 WEST 44th ST., NEW YORK 36, N. Y.

Centralab Type MD Molded Disc

New, completely insulated ceramic disc capacitor

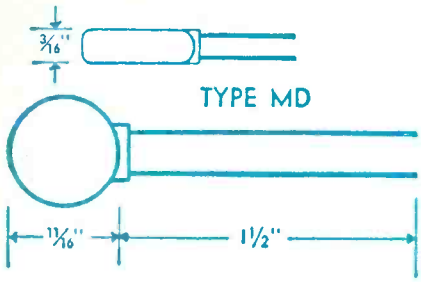
Nine ways better than an ordinary disc

Highest Leakage Resistance

Initial, 10,000 megohms. After 100-hour, 95%-humidity test, 1000 megohms. Returns to initial rating upon drying. Insulation resistance of molding, 300,000 megohms. This guarantees longer life, safer operation.

Highest Dependability

Wholly produced in Centralab's own plants, under strict control of ceramic, as well as capacitor, engineers. Centralab makes only ceramic capacitors—thus is interested first, last, and always in ceramic capacitors.



The only ceramic disc of its kind—there's nothing else like it! It took four years to build—and an investment of over $100,000.00 in production equipment.

No matter how you look at it, the Centralab Type MD Disc gives you more for *your* money—gives *your customer* more for his.

No, sir, when it comes to high quality and high standards of performance, you just simply cannot beat Centralab MD's. See for yourself — try them as replacements on your next few jobs.

Highest Moisture Resistance

The capacitor body itself has moisture absorption of only .007% or less. The molded casing has moisture absorption of .005% or less. This is less than the china dishes you use for food.

Easy Identification

Clearly labeled to avoid confusion and mistakes. Coded in accordance with JAN specifications. Each unit labeled with capacity and voltage rating.

Highest Mechanical Strength

Will not chip, crack, or break under rough handling or dropping. One-piece construction is unaffected by extremes of vibration.

Molded Insulation

Completely insulated with Centrathene. 2500 V.D.C. breakdown to ground. You can place an MD next to a chassis or high-voltage leads without flashover or breakdown through the case. Fungus proof. Unaffected by ozone, salt water, or any known acid or solvent at room temperature. Will not become brittle at −55°C.

Highest Lead Strength

You'll need a pair of pliers and a vise to strip these leads. MD's have the highest lead strength of any ceramic disc on the market—greater than the breaking strength of the wire itself.

Complete Range of Values

52 values from 5 mmf. to .01 mfd. Voltage rating, 1,000 V.D.C.W. to 4000 mmf.; 600 V.D.C.W. over 4,000 mmf. Tolerance, ±10%, 5 mmf. through 680 mmf.; ±20%, 750 mmf. through .005 mfd. GMV (guaranteed minimum value), .0056 mfd. through .01 mfd.

Conservatively Rated

100% flash-tested at double-rated voltage. Periodically spot-checked at 1000-hour load life at test voltage.

Send coupon for Centralab Catalog No. 29, for further facts on MD's and other products.

Centralab

Package of **5** only **75c**

Suggested net price

Centralab

A Division of Globe-Union Inc.

944L E. Keefe Avenue, Milwaukee 1, Wisconsin

Send me Centralab Catalog No. 29

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

The "K.O." is Fantastic!

Features the highest front-to-back ratios ever recorded for any TV antenna:

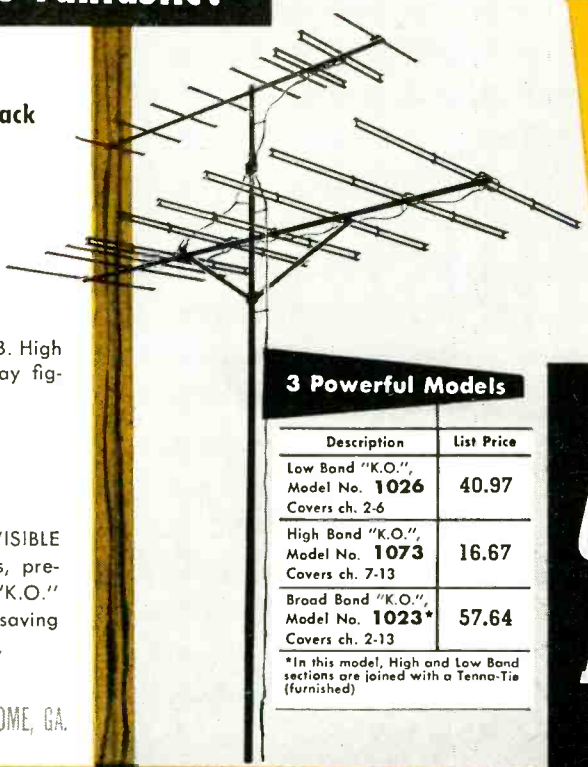
- **Low band:** from 20:1 to 50:1 relative VOLTAGE.
- **High band:** Up to 13:1 relative VOLTAGE.

High gain: Low band, 7 to 9 DB. High band, 8.5 to 10.5 DB. (Single bay figures). Balanced for COLOR.

Ends co-channel interference! Knocks out "Venetian Blinds"!

Channel Masters "K.O." puts an INVISIBLE BARRIER in the path of rear signals, preventing co-channel interference. The "K.O." is completely preassembled with time-saving "Snap-Lock" Action. 100% aluminum.

LICENSED BY KAY-TOWNES ANTENNA CO., ROME, GA.



3 Powerful Models

Description	List Price
Low Band "K.O.", Model No. **1026** Covers ch. 2-6	40.97
High Band "K.O.", Model No. **1073** Covers ch. 7-13	16.67
Broad Band "K.O.", Model No. **1023*** Covers ch. 2-13	57.64

*In this model, High and Low Band sections are joined with a Tenna-Tie (furnished)

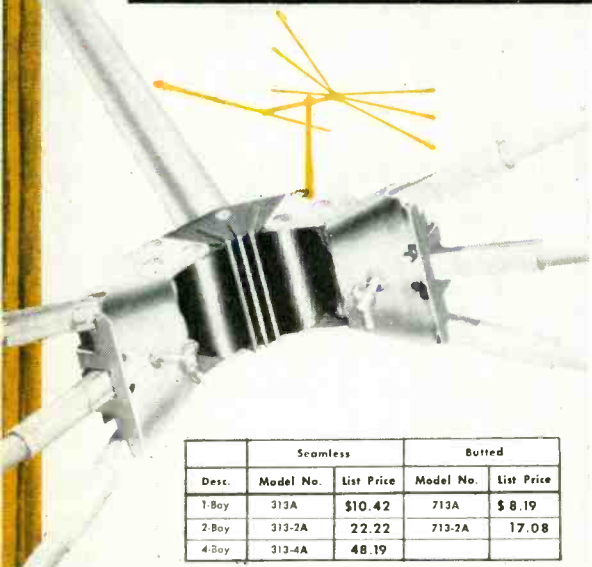
New Antennas!

New Accessories!

CHANNEL MASTER now provides you

New expanded ACCESSORIES program! Channel Master now becomes the first and only manufacturer in the industry that can supply you with every-*thing* you need for an antenna

new The Super Fan



- *"Super-Sembled"!*
- *Re-designed!*
- *Better than ever!*

Channel Master's Super Fan is the original fan antenna. Famous for its superb quality, it has been in continuous demand for six years. *Millions* are in current use.

- Assembles with NO HARDWARE or tightening.
- Massive, heavy-duty, molded fan head. Unaffected by moisture and extreme temperatures.
- Reinforced elements. External sleeves prevent breakage.

	Seamless		Butted	
Desc.	Model No.	List Price	Model No.	List Price
1-Bay	313A	$10.42	713A	$ 8.19
2-Bay	313-2A	22.22	713-2A	17.08
4-Bay	313-4A	48.19		

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

the world's largest manufacturer of television antennas and accessories

CHANNEL MASTER'S

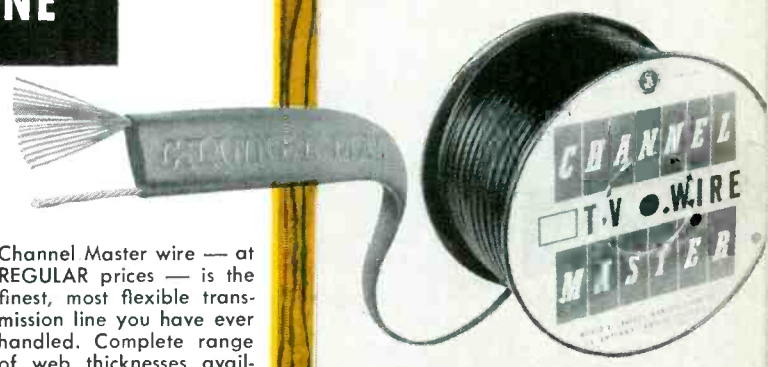
new

TV TRANSMISSION LINE

it's got

FLEX-APPEAL!

The first TV wire to give you the benefits of **20** strands per conductor (20/33 pure copper).



Channel Master wire — at REGULAR prices — is the finest, most flexible transmission line you have ever handled. Complete range of web thicknesses available. Colorful display packaging.

Two outstanding lines:
(both featuring exclusive 20-strand conductor):

"TWIN TWENTY"

Marked every 10 feet. Saves time, ends waste.

- Full width.
- Available in silver or brown.
- Pure VIRGIN polyethylene.

"CHALLENGER"

Fine quality transmission line at today's VERY LOWEST PRICES.

with

EVERYTHING but the roof!

installation. From now on, guarantee customer satisfaction with a *COMPLETE CHANNEL MASTER INSTALLATION — FROM TOP TO BOTTOM.*

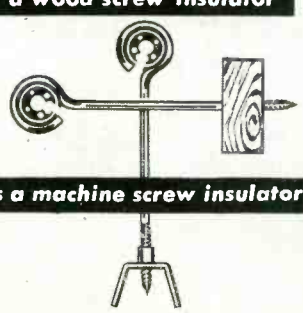
new

STANDOUT *insulators*

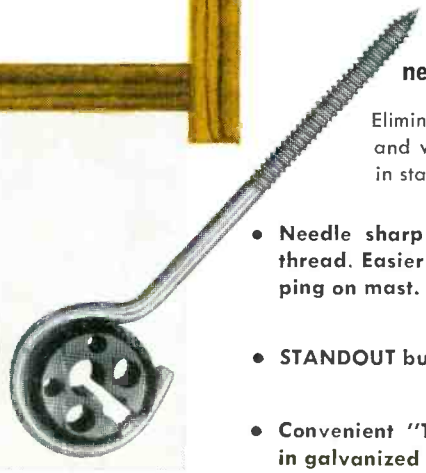
Featuring this revolutionary new 2 in 1 screw thread design!

Eliminates the need for stocking separate machine and wood screws. Cuts your inventory investment in standoffs by more than 65%.

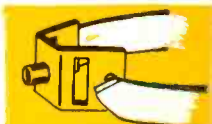
It's a wood screw insulator



It's a machine screw insulator



- Needle sharp point, made possible by finer thread. Easier to work in wood. Prevents slipping on mast.
- STANDOUT buckle has **8** machined threads.
- Convenient "Taper-Tip" strapping, available in galvanized or stainless steel.



All popular types and sizes available, including full assortment of specialized hardware. See your Channel Master distributor

EDITORIAL...

by S. R. COWAN, PUBLISHER

The Verdict Is In

The question: "Are you service shop owners influenced by manufacturers' advertising as to what products and brands you will buy—or are you greatly influenced by the recommendations of your distributors and their salesmen?"—as posed in our October editorial, brought a gratifying response.

Of all the letters received from service firm owners only a single one conceded that the shop owner was influenced by distributors. Every other serviceman said in effect, "I make my own decisions, and advertising in magazines like SERVICE DEALER definitely influenced those decisions."

Some of the letters received were so interesting and informative that we have taken the liberty of quoting from them on page 45 in this issue.

Our reason for publicizing these frank views from service shop owners is two-fold. (1) Although we know distributors have problems of their own we want them to have a better understanding of servicemen's problems. Only in this way can they work together on a more intelligent basis with their customers. And, (2) we want manufacturers to re-evaluate their distribution setup so that in time all distributors will cease to be outright competitors of the service shops which are their customers. Stated another way—distributors who sell at retail sundry replacement tubes, parts and instruments to any Tom, Dick and Harry, and who do not give professional service firms the preferential treatment and discounts to which they are entitled as common trade practice—such distributors are nothing more than "glorified dealers" and if they fall into this category we believe they are not entitled to distributor rating and distributor preferential discounts from manufacturers.

The average service shop owner has 4 basic gripes against the distributors who serve him.

1) Most distributors do not maintain a suitable inventory and they seldom stock the newer products being offered by manufacturers until they are literally forced to do so by a big demand that has accumulated. In fact, it seems that at best most distributors only have fair stocks of gilt-edged items like the most popular tube types, condensers and resistors.

2) Few distributors carry a broad line of modern test equipment—and apparently their countermen know so little about the various lines of instruments, new instruments especially, their technical characteristics and applications, that the counterman's opinions and recommendations are most often taken with "tongues in cheeks."

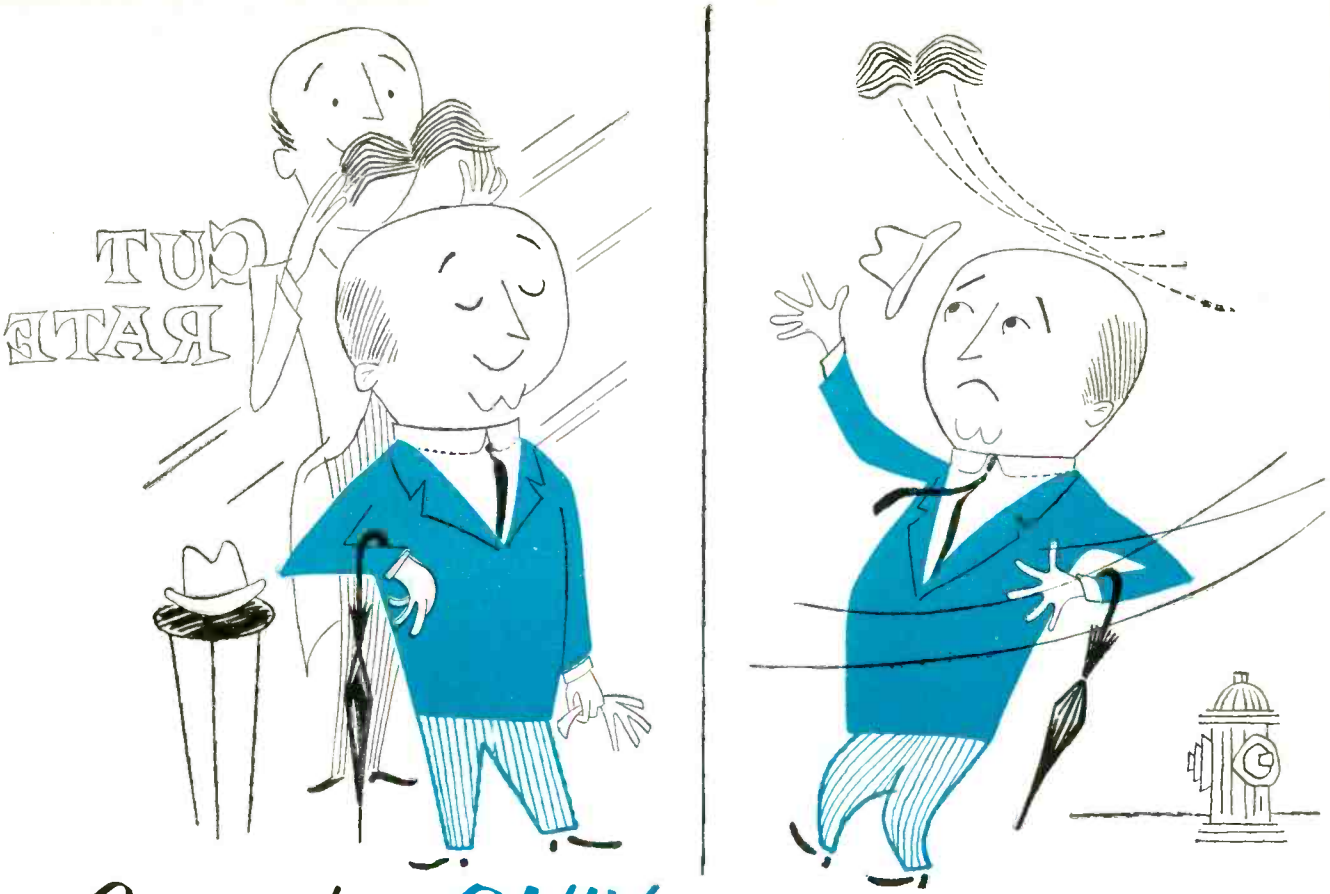
3) Many distributors are retail competitors to their servicemen customers, and many distributors even have the temerity to operate service departments in open competition to their service firm customers.

4) Many distributors, working on a "fast buck basis" carry excessive inventories and prefer to push "no name" items, that is, unadvertised and usually inferior products, which provide a better profit margin for the distributor even though these products sell for less than the advertised and fully warranted brands.

The average service shop owner has some gripes about manufacturers too. Servicemen believe that most manufacturers, in their advertising, fail to give sufficient technical details about their products. For example, size, specifications, mounting bracket data, electrical characteristics, substitution and interchangeable features, load limits and optimum operational data about various items are wanted badly by servicemen but are too seldom given in manufacturers' trade paper advertisements. Servicemen do not want to waste their valuable time looking up facts in manufacturers' catalog sheets especially when most of these catalogs are available only to distributors for use in their own files. Test equipment manufacturers, it seems, could do themselves and service shop owners much good if they would really school distributors (and their salesmen) on the broader aspects of their lines, showing their instruments' adaptability, ranges, versatility, etc.

For example, all tube testers test tubes but some testers are more adaptable and accurate than others, and consequently are better buys for professional servicemen. In contrast, less expensive and less complex tube testers generally serve the purpose of the average part-time serviceman.

Probably the best way to learn all there is to know about a scope is by actual practice on the bench. The same may be said about square wave and dot generators. However, servicemen say that they want instrument manufacturers to point out in their advertisements more technical information than heretofore and they suggest that manufacturers use a "point by point" explanation of their line's merit, ranges, adaptability, etc.



Consider ONLY a

PERFECT REPLACEMENT

when original quality disappears

When the *original* goes, the substitute should be a *Perfect Replacement.* Ordinarily there is only one perfect replacement—something that looks and works as good as the original when new—*or better.* When the original picture tube goes, the *perfect* replacement is a Du Mont Twin-Screen Hi-Lite* The set will sparkle with new picture life . . . you'll have "new set" quality—*or better.* A Du Mont Twin-Screen Hi-Lite picture tube *replaces* age with "like new" performance.

**the ultimate in aluminized picture tubes.*

DU MONT®

CATHODE-RAY TUBE DIVISION, ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, N. J.

TV TUNER REPAIRS

Tuner Repairs Are Easy With The Correct Approach And Equipment

by **Donald Quaranta**
Supervisor
Tuner Department
CBS Columbia Division
Columbia Broadcasting Co.

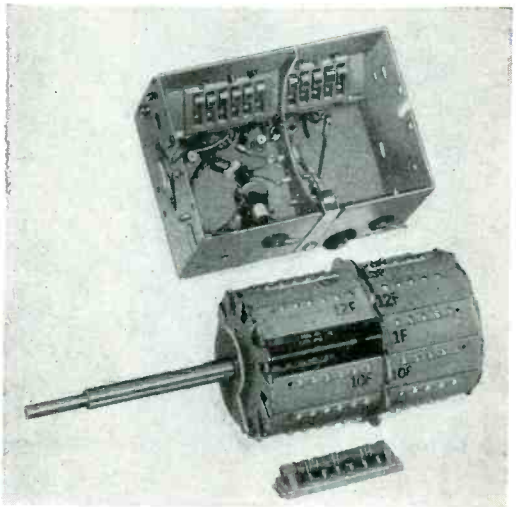


Fig. 1 — Exposed view of typical turret-tuned cascode tuner. Channel 11 oscillator section is shown removed from clips.

REPAIR of tuners in television sets is not as tricky or complex as you may believe if you approach the problem in a sensible way as you do other circuits in the television receiver. If you have a television receiver that exhibits picture troubles and it is not the fault of the associated *if* strip or video amplifier the tuner can be the troublesome spot.

Some frequent and familiar picture troubles such as intermittant picture on one or more channels, or weak or poor picture quality on a known good reception channel are troubles which can be caused by a defective tuner. If you are doubtful of the source of picture trouble at times there are ways you can look into the *rf* section of the tuner to see if trouble lies here or in the adjacent picture sections which affect the picture quality. The tuner is the spot where a lot of television servicemen get confused because there are adjustments on the tuner with which they are not familiar and don't want to touch.

Required Equipment

First of all, in the servicing of tuners, it is necessary to have the proper equipment to do an accurate check. This includes an *rf* sweep generator, a source of video and sound markers which cover all 12 VHF channels, a scope and an external bias supply. The sweep generator can either have built-in video and sound markers or a separate generator can be used for the markers. The important factor is that whatever markers are used they should be accurate. The sweeper must also be accurate in the sense that it displays a reasonably flat response for all 12 channels. This does not mean it must be perfectly flat from one end to the other, but it is necessary that the ouput be steady over the required bandwidth to be swept. In general a good sweep generator will have a flat 12 *mc* response.

If poor equipment is used erroneous responses will be viewed on the scope; in which case the adjustments made on the tuner will be of no value. If in doubt about the accuracy of any equipment, or if a method of testing using this equipment is not known, every effort should be made to correct these conditions. It is always best to use equipment that is known from past experience to be reasonably reliable.

In this article the alignment procedure of a cascode turret tuner which is used in the majority of present day receivers will be presented. This pro-

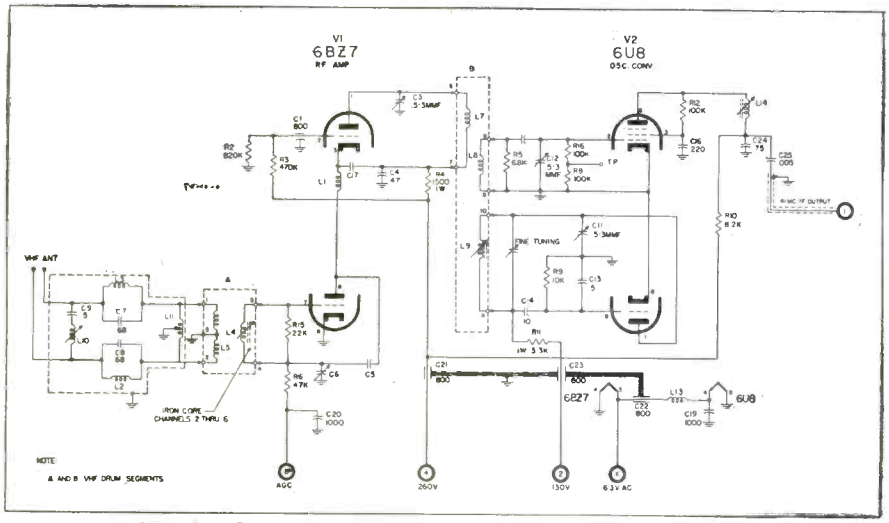
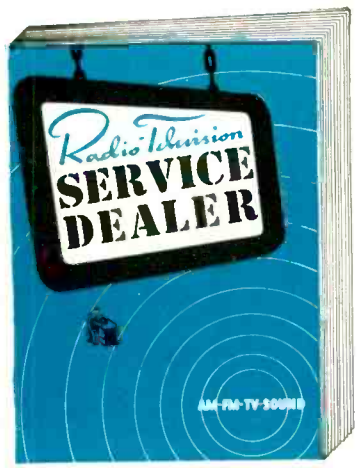


Fig. 2—Circuit diagram of turret-type cascode tuner.

More Professional Servicemen Subscribe To "SERVICE DEALER" Than Any Other Technical Magazine Because Its Feature Articles and Regular Departments Have Proven To Be The Most Helpful, Accurate and Timely. 24 Issues Cost Only $2.



You may subscribe if you are a:

- Serviceman employed by a Service Organization.
- Serviceman employed by a radio/TV Dealer.
- Serviceman employed in industrial electronic service firms.
- Independent serviceman who does not have a business establishment.
- Employee of a Distributor.
- Student enrolled in accredited Radio/TV Schools, Colleges, etc.
- Hobbyists or experimenter.

A TYPICAL ISSUE COVERS

- Video Speed Servicing Systems
- Rider's "TV Field Service Manual" data sheets
- Latest TV Installation and Maintenance Techniques for VHF and UHF
- Auto Radio Installation and Service
- Advanced Data on New Circuitry
- Production Changes and field service data on receivers
- New Tubes
- New Test Equipment, operation and application
- Hi-Fi Installation and service
- New developments, such as transistors, color, UHF, etc.
- News of the trade
- Service Short Cuts & Shop Notes
- Explanation of difficult circuits

"Service Dealer" does not have field subscription salesmen calling on the trade.

You must order your subscription direct from us or from your magazine agency.

Subscription rates: $2.00 for 2 years $1.00 for 1 year

RADIO-TV SERVICE DEALER
67 W. 44 St., New York 36, N.Y.

☐ NEW ☐ RENEWAL

Gentlemen: Here is $2.00 for which enter my 2 year subscription. (This rate applies in USA only. Elsewhere add $1 per year)

Name .....

Address .....

City ..... Zone ..... State .....

Name of firm ..... ☐ Owner ..... ☐ Employee .....

Firm's business address .....

City ..... Zone ..... State .....

Your Position or Title .....

Check whether firm is: ☐ Service Organization or ☐ Dealer having Service Dept.

If some other type of company describe: .....

IF STUDENT, Name of School .....

cedure can be followed in most tuners.

Most present day cascode turret tuners employ separate *rf*, oscillator and mixer tuning coils for each channel. These coils are mounted on separate strips and are assembled on the tuner barrel. Two strips are mounted edge to edge to form a pair of strips for each channel. In all there are 12 pairs of strips for all 12 channels. (*Fig 1*) Note: Some latest type turret tuners employ a single strip for each channel but electrically these tuners are similar to the double strip type. The strips when revolved to a pre-selected channel, make contact with stationary spring contacts in the tuner and pick out the desired channel.

Electrically, this is what takes place (*Fig.* 2 schematic). The back tuning strip which is the *rf* section, picks up the selected signal on the tuned circuit across terminals 1 and 2. This coil in turn, through mutual inductance transfers a signal voltage to the coil across terminals 4 and 5 (*L4*). This *rf* signal is then amplified through the cascode arrangement and its load is seen across terminals 6 and 7 (*L7*) on the front strip. On the other end of the same strip across terminals 10 and 11 (*L9*) is the locally generated oscillator signal. In the center of the same strip connected to terminals 8 and 9 (*L8*) is the mixer coil. Both *rf* and oscillator signals are mixed and the difference frequency signal is passed on to the tuned plate circuit at *if*.

Alignment Check

The first step in going through the alignment is to hook up the equipment. Connect the sweep generator to the antenna terminals with correct matching. In most cases it is 300 ohms. Next, calibrate the oscilloscope vertical input to 0.1 volts P-P as output for 100% reference level. *Example:* If graph is used on scope, set 100% level for 20 boxes and adjust vertical input to 0.1 volt P-P with a scope calibrator.

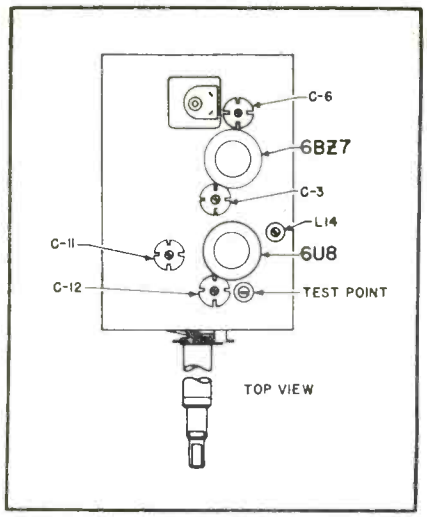


Fig. 3—Trimmer locations and test point of tuner described in this article.

Hook the scope to the test point of the tuner (*Fig.* 3 and schematic). The small lead coming through an opening on top of the tuner is usually the test point. Connect an external bias supply of –3 volts to the *agc* terminal on the tuner.

Turn the receiver on and set sweep generator and receiver for Channel 10. Adjust sweep generator to produce 0.1 volts P to P signal. After *rf* response is observed on scope, set markers to 193.25 *mc* for video carrier and 197.75 *mc* for sound carrier. (See table for complete listing of carriers for all channels.) The carrier markers should fall on top of respective carrier peaks. If they are built in markers with the sweep generator they will fall in automatically, but if markers are externally used adjust for accuracy and make them appear as tiny birdies on scope.

Next go through all 12 channels and get an overall picture of the *rf* curves. You can consider the tuner properly adjusted if you observe the following patterns on all channels.

1. Tilts do not exceed 30% between peaks (*Fig. 4a*).
2. Valleys do not exceed 30% from maximum peak to valley (*Fig. 4b*).
3. No response outside the carriers should exceed 120% of the set up reference level (*Fig. 4c*).
4. Carriers should fall on top or on the high frequency side of its respective peak; no more than 10% down from peak on video side and no more than 30% down from peak on sound side. (*Fig. 4d*).

The bandwidth should not exceed 11 *mc* on Channels 2 to 6 and 13 *mc* on Channels 7 to 13 when measured at the 6*db* point. (50% down on curve).

If certain channels fall out of these limits, (which may be due to age of tuner or the changing of tuner tubes) adjustments can be made on the tuner to compensate for these errors.

Alignment of Tuner

It is best to make preliminary adjustments on Channel 10. This is usually recommended by tuner manufacturers because it is mid-band for high channels and compensating trimmers have the most effect on high channels.

When starting to align, adjust trimmers *C6*, *C3* and *C12*, for best curve (*Fig.* 3 & *4e*). Condenser *C6* usually has the most effect on gain while *C3* and *C12* do most on tilts. Again go through all channels and if any one channel is still out of maximum limits compensate a little with the trimmers and go back through all channels again. Some turret tuners feature an adjustable slug from Channels 2 to 6 in the antenna coil strip. These slugs should be adjusted for best response with maximum gain. (*Fig. 4e*). Schematic (*Fig.* 2) shows such a tuner with the adjustable coil (*L4*).

Tuner Repairs

If there is still a bad *rf* response or no response on any one channel, take out the individual strip from the barrel and examine for poor contacts, cold soldered coil or possible breaks in the coil. Repair if possible, otherwise individual strips can be purchased.

In some tuners, due to wear and age, the strips make intermittent contact and this shows up as a noisy and intermittent picture. This trouble can be repaired by first cleaning the strip with a solvent and then slightly lubricating with Lubriplate or equivalent.

If the tuner is completely inoperative on all channels, the fault is usually not due to the strips on the barrel. This type of trouble is usually associated with the circuitry under the barrel. The barrel can easily be removed as one complete unit from the stationary

[*Continued on page 51*]

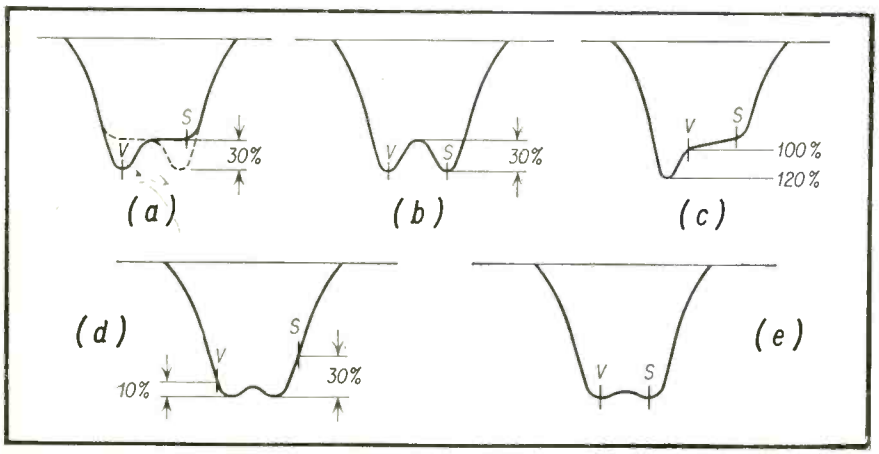


Fig. 4—Typical curve limits obtained in aligning tuner.

ASSOCIATION NEWS

by Samuel L. Marshall

Philadelphia Radio Servicemen's Association

Awarded a plaque to the Radio Corp. of America in recognition of its co-operation with the entire radio and TV service industry. The award was made by Richard G. Devaney, President and was accepted in behalf of RCA by Charles M. Odorizzi, Executive Vice

President of RCA. In accepting the award, Mr. Odorizzi cited RCA's close association and cooperation with independent service organizations and asserted that RCA would continue to work closely with independent technicians as a means of improving service standards for the benefit of the public.

RTA of Santa Clara Valley, Calif.

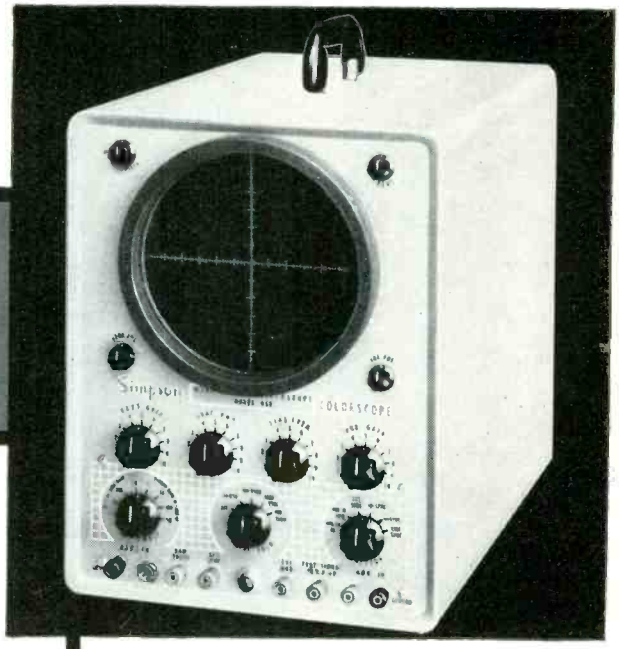
Congratulations are in order on the Volume I No. 1 official publication of this enterprising service organization. It is really a smart-looking periodical and smacks of tasteful and professional makeup. Editor is Chet Spink. President of the association is H. Lawrence Schmitt. Included in this periodical are newsy items of interest to all servicemen of the community and the RTASCV standards of practice. Keep up the good work RTASCV.

Southwest, Mo. TV Technicians

Newly elected officers of the Southwest Missouri TV Technicians Association, Inc., an affiliate of NATESA are Chas. Neeley, Eldorado Springs, Mo., Pres.; L. E. Fawver, Cassville, Mo., V. Pres.; V. S. Banes, Monett, Mo., Secy.; Ray Richardson, Mt. Vernon, Mo., Treas., and Carrol King, Lamar, Mo., Publicity Director. This association is unusual in that the members are scattered over a large area and

new!

Simpson 7" COLORSCOPE



MODEL 458

$229.95 complete with shielded input cable and manual

100% response at 3.58 mc colorburst!

DUAL BANDWIDTH—NARROW OR WIDE

Compare the new Simpson Colorscope Model 458 with any oscilloscope on the market. It is an advanced, seven-inch, high-gain, wide-band scope especially designed for color-TV service. (Ideal for black and white, too.) A big feature of the Model 458 is its *flat* frequency response—within 1 db to 4.5 mc! With its accessory probes, Model 458 can do more color-TV testing jobs than any scope in its price range.

ADDITIONAL FEATURES

- Dual bandwidth provides extra testing versatility.
- Properly compensated wide band vertical amplifier stages.
- High sensitivity and very good transient response.
- Compensated step attenuator.
- Vernier vertical attenuator for *continuous control* of the signal voltage.
- CRT balanced deflection.
- Excellent square wave response.
- Very small loading of circuit being checked.
- "Tilt" and "Overshoot" carefully checked and minimized.
- Very stable sweep and synchronizing circuits.

ACCESSORY PROBES

Voltage Doubler, No. 740 . . $10.95

Low Capacitance (input impedance of 10 megohms shunted by only 14 mmf), No. 741 . . $9.95

100:1 Voltage Divider, No. 742 . . . . . $9.95

Direct-Resistive Dual Purpose, No. 743 . . . . . $9.95

See Your Electronics Parts Distributor, or write

SIMPSON ELECTRIC COMPANY
WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT
5200 W. Kinzie St., Chicago 44, Illinois
Phone: EStebrook 9-1121
In Canada: Bach-Simpson Ltd., London, Ontario

SPECIFICATIONS

VERTICAL AMPLIFIER FREQUENCY RESPONSE—Wide band position: *Flat* within ± 1 db from 20 c/sec to 4.5 mc/sec; *flat* within ± 2 db from 10 c/sec to 5.0 mc/sec.

Narrow band position: *Flat* within ± 1 db from 20 c/sec to 200 kc/sec; *flat* within ± 2 db from 10 c/sec to 300 kc/sec.

RISE TIME—Less than 0.05 microsecond (wide band position).

VERTICAL DEFLECTION SENSITIVITY—Wide band: 40 mv R.M.S./inch minimum. Narrow band: 15 mv R.M.S./inch minimum.

HORIZONTAL AMPLIFIER FREQUENCY RESPONSE—*Flat* within ± 1 db from 20 cycles/sec to 200 kc/sec.

HORIZONTAL DEFLECTION SENSITIVITY—Horizontal input "Hi", 115 millivolts R.M.S./inch minimum. Horizontal input "Low", 1.4 volts R.M.S./inch minimum.

VERTICAL INPUT IMPEDANCE—3.3 Megohms shunted by 20 mmf.

HORIZONTAL INPUT IMPEDANCE 1.1 Meg.

LINEAR SWEEP OSCILLATOR—Saw tooth wave from 14 cycles/sec to 250 kc/sec. Sixty-cycle sine wave also provided.

INPUT CALIBRATION—18 Volt P-P test voltage available on panel.

INTENSITY MODULATION—Provision for internal, external and 60 cycles.

some drive over 100 miles to the monthly meetings, yet attendance will run near 80% of the membership. It has been in existence for over three successful years. Lectures each month on servicing techniques by some of the best service engineers in the country make the meetings interesting to all. The members strongly believe in one strong national organization with one standard name and insignia which the public the nation over will recognize as the guide to honest, dependable service.

TV Association of Oklahoma

The Television Association of Oklahoma has embarked on a 3 point program as the initial step in their formation of the association which:

1) Will endeavor to establish a standard of operation so that the public will know what to expect in the way of its business dealings with the members of the association.
2) Select members who can conform to the standards set up by the association.
3) Educate the public as to its members and the advantages of doing business with association members.

California State Association

The California State Association had its first meeting in the city of San Jose on October 15, 1955. Delegates from service guilds and associations in both the northern and southern areas of the state met for the first time. Tom Lawson presided as Chairman. This column wishes this new association the best of luck and a long and successful existence.

NATESA

NATESA headquarters reports that it has been asked to submit the names of qualified members to take over the installation and maintenance of electronic equipment in various cities. If interested, please apply directly to headquarters. NATESA points out that its actions are controlled by Federal Law and as such it cannot engage in price fixing and regulations in restraint of trade. It warns affiliates not to place NATESA in jeopardy on this score and that all matters containing the NATESA name be referred to and approved by the officer and president of NATESA.

Long Island Television & Radio Technicians Guild

Murray Barlow, who attended the unity meeting for this organization in Indianapolis on October 9th voices his

[Continued on page 50]

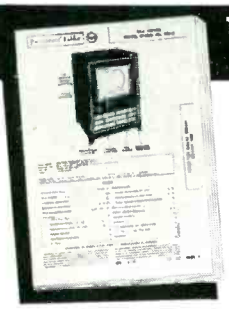
BLACK AND WHITE TV
TRANSISTOR RADIOS
AMPLIFIERS AND TUNERS
COLOR TV
AM RADIOS
AUTO RADIOS
FM RADIOS
RECORD CHANGERS

WHAT'S YOUR SERVICE PROBLEM?

PHOTOFACT HELPS YOU SOLVE IT

FASTER, EASIER, BETTER, MORE PROFITABLY!

THE WORLD'S FINEST SERVICE DATA



THESE GREAT FEATURES ARE EXCLUSIVE IN PHOTOFACT—THEY HELP YOU EARN MORE DAILY, HELP INSURE CUSTOMER SATISFACTION

PHOTOFACT Service Data is the *only* service information based upon first-hand examination of the actual production-run receivers and equipment. It is authentic, uniform data developed through actual study and analysis by service engineers in the Howard W. Sams Laboratories. PHOTOFACT is the *only data* prepared from the practical point of view of the Service Technician.

Thousands of Service Technicians use PHOTOFACT daily for time-saving, profit-boosting service operations. If you've never used PHOTOFACT, you've never realized your full earning power—you've never given such complete customer satisfaction. So get the proof for yourself. Try PHOTOFACT—use it on any job. Your Parts Distributor has the Folder Sets you need for any of the 17,000 TV and radio receivers, changers, recorders, etc., covered in PHOTOFACT. Once you use this great service, we know you'll want the complete PHOTOFACT Library.

FULL SCHEMATIC COVERAGE

1. Famous "Standard Notation" uniform symbols are used in every schematic.
2. The same standard, uniform layout is used for each schematic.
3. Diagroms are clear, large, easy to read, easy to handle.
4. Wave forms are shown right on the TV schematics for quick analysis by 'scope.
5. Voltages appear on the schematics for speedy voltage analysis.
6. Transformer lead color-coding is indicated on the schematic.
7. Transformer winding resistances appear on the schematic.
8. Schematics are keyed to photos and parts lists.

FULL PHOTOGRAPHIC COVERAGE

9. Exclusive photo coverage of all chassis views is provided for each receiver.
10. All parts are numbered and keyed to the schematic and parts lists.
11. Photo coverage provides quicker parts identifications and location.

ALIGNMENT INSTRUCTIONS

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.

FIELD SERVICE NOTES

22. Each Folder includes time-saving tips for servicing in the customer's home.
23. Valuable hints are given for quick access to pertinent adjustments.
24. Tips on safety glass removal and cleaning.

TROUBLE-SHOOTING AIDS

25. Includes advice for localizing commonly recurring troubles.
26. Gives useful description of any new or unusual circuits employed in the receiver.
27. Includes hints and advice for each specific chassis.

OUTSTANDING GENERAL FEATURES

28. Each and every PHOTOFACT Folder, regardless of receiver manufacturer, is presented in a standard, uniform layout.
29. PHOTOFACT is a *current* service—you don't have to wait a year or longer for the data you need. PHOTOFACT keeps right up with receiver production.
30. PHOTOFACT gives you *complete* coverage on TV, Radio, Amplifiers, Tuners, Phonos, Changers.
31. PHOTOFACT maintains an inquiry service bureau for the benefit of its customers.

FREE Send for the PHOTOFACT CUMULATIVE INDEX

IT'S VALUABLE!

Send for it! Your guide to virtually any model ever to come into your shop; helps you locate the proper PHOTOFACT Folder you need to solve any service problem on any model. Once you have the make and chassis number, it takes just 60 seconds to find the applicable PHOTOFACT Folder. Send coupon now for your FREE copy of the valuable Cumulative Index to all the PHOTOFACT Folders you need.

FREE

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc., Dept. 4-M5
2201 E. 46th St., Indianapolis 5, Ind.

☐ Send FREE Photofact Cumulative Index.

Name.....

Address.....

City.....Zone...State.....

EASY-PAY PLAN TO FIT YOUR BUDGET

Ask your PHOTOFACT Distributor . . . he'll show you how you can now own the PHOTOFACT Library through a unique Easy-Pay Plan that exactly fits your needs. Pays for itself as you EARN MORE.

HELPS YOU EARN MORE DAILY

EXPO PRESENTS I.R.

INFINITE REJECTION

world's first fundamental and complete

*THE SENSATIONAL I.R.I.S.

gives infinite rejection of the interfering signal regardless of direction or channel or whether the interference is co-channel, adjacent channel or ghosts.

The rejection of the interfering signal is accomplished by opposing the interfering signal with a signal of equal amplitude but of opposite phase, thus producing complete cancellation. Simply rotate the upper section of the antenna to a position where the interference disappears.

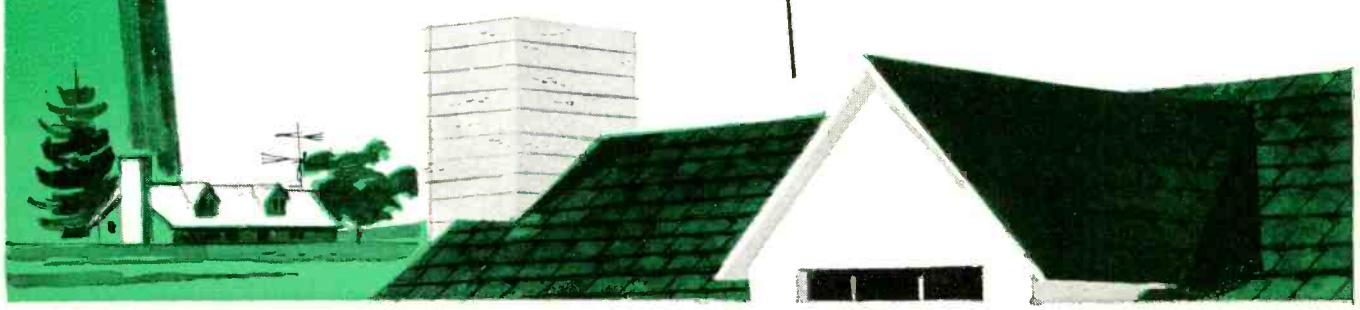
Can be used either in a fixed installation or with rotor. All accessories and harness furnished for quick, easy installation.

THE FAMOUS EXPO ANTENNA

is used in I.R.I.S. with its fundamental unlimited bandwidth characteristic, thus insuring excellent performance throughout the 82 channels.

No more Venetian blinds, or ghosts or distortion from an interfering co-channel signal or "splatter" from a strong local station.

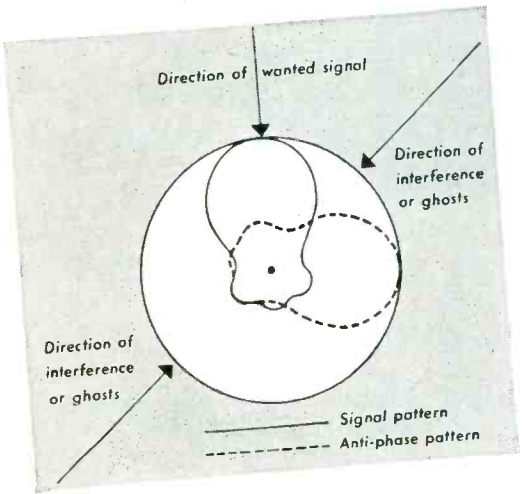
The combination of the principle of the exponential curve and the proved performance of I.R.I.S. offers an exceptional sales potential, both in antennas and TV sets. Now is the time to cash in on this exclusive opportunity.



I.S.*

INTERFERENCE SYSTEM

answer to the interference problem

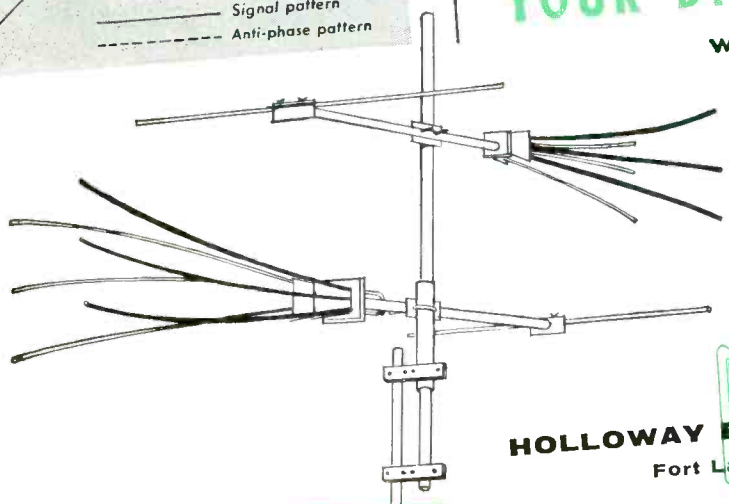


EXPO-I.R.I.S. comes in the following models:

XO2R6	2-bay, 6 element EXPO-I.R.I.S.	List $20.95
XO2R8	2-bay, 8 element EXPO-I.R.I.S.	List $25.50
XO4CR6	4-bay, 6 element colinear EXPO-I.R.I.S.	List $53.25
XO4CR8	4-bay, 8 element colinear EXPO-I.R.I.S.	List $61.75

ORDER TODAY FROM YOUR DISTRIBUTOR

whom we will supply until official distributors are designated in your locality



EXPO

HOLLOWAY ELECTRONICS CORP.
Fort Lauderdale, Florida

*Pat. applied for

BUILD YOUR OWN JENSEN HI-FI SPEAKER SYSTEM

IT'S EASY WITH JENSEN'S NEW COMPLETE SPEAKER KITS AND DETAILED CABINET CONSTRUCTION AND ASSEMBLY MANUAL!

KT-31 IMPERIAL KIT
3-way system. The ultimate in performance. Specially designed 15" "woofer", compression type mid-range and "supertweeter" units. 600- and 4000-cycle crossover networks, intrarange equalizer, special controls, brackets, cables. Recommended enclosure 25 cu. ft. in back-loading folded-horn. 16 ohms. 35 watts. $184.50

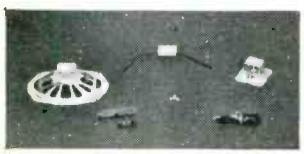
KT-32 TRI-PLEX KIT
3-way system. Superlative performance in moderate space; approx. 10 cu. ft. suggested. 15" "woofer", compression type mid-range and "supertweeter" units. 600- and 4000-cycle crossover networks intrarange equalizer, controls, brackets, cables. 16 ohms. 35 watts.....$169.50

KT-21 CONCERTO-15 KIT
2-way system. An outstanding system with 15" "woofer" and compression type "tweeter", 2000-cycle crossover network and balance control, bracket and cables. 10 cu. ft. enclosure suggested. 16 ohms. 30 watts $99.50

KT-22 CONCERTO-12 KIT
2-way system. Excellent performance in scaled-down size (recommended enclosure as small as 6 cu. ft.). Like KT-21 except 12" "woofer". 16 ohms. 25 watts.....$73.00

KDU-10 TREASURE CHEST DUETTE KIT
2-way system. Special 8" "woofer", compression driver "tweeter" and frequency division for compact reproducer (1½ cu. ft. Duette enclosure or 2½ cu. ft. Bass-Ultraflex type.) Includes wiring materials. 8 ohms. 20 watts.....$24.75

KDU-11 TABLE DUETTE KIT
2-way system. Specially designed for chair side or table TV use. May also be used in 1½ cu. ft. Duette enclosure. Heavy duty 6" x 9" "woofer", compression driver "tweeter", frequency division unit and wiring materials. 3-4 ohms. 20 watts.....$23.75



KDU-12 BUDGET DUETTE KIT
2-way system. For maximum results at lowest cost. May be installed in table or 1½ cu. ft. regular Duette or in 2½ cu. ft. Bass-Ultraflex enclosures. 6" x 9" "woofer" direct radiator "tweeter" frequency dividing unit plus wiring materials. 3-4 ohms. 15 watts.....$10.50

KTX-1 RANGE EXTENDER SUPERTWEETER KIT
Adds smooth, clean highs from 4000-cycles to limits of audibility to any single unit, coaxial or 2-way system. Complete with crossover network, balance control and cable. For systems rated up to 35 watts.....$43.75

Cabinart (G & H Wood Products) utility enclosures are available for all except KT-31 and KTX-1 Kits.

BIG 36 PAGE BOOK WITH 18 ENCLOSURE DESIGNS

Complete instructions for building self-contained or built-in single speaker and 2-way and 3-way speaker systems: "Duette", Bass-Ultraflex and Back-loading Folded Horn cabinets. Includes parts lists and speaker data for all types of enclosures.

Get Your Copy Now For Only 50c

If you want a hi-fi system with the stand-out performance for which Jensen speakers are famous . . . plus the fun and saving of "do it yourself" . . . and the advantage of being able to adapt each basic design to your exact needs for a built-in or free standing speaker enclosure, then be sure to get your copy of Jensen's big new 36 page Manual 1060 now!

Explains fully the advantages and relative performance of 18 different speaker systems you can build or build-in with Jensen hi-fi speaker kits. Tells you how to start in high fidelity on a low budget with a real 2-way speaker system that can cost under $20 complete! Shows how to build a hi-fi speaker in table form to improve your TV or to use as an attractive useful furniture piece.

Manual 1060 gives you complete drawings for cabinet work plus easy to follow instructions for woodwork, speaker installation and connecting up. Tells how to make the latest in "Bass-Ultraflex" and back-loading folded horn enclosures. You can build any of Jensen's fine reproducers from the incomparable Imperial to a low cost Duette. Manual 1060 is priced, postpaid at only 50¢.

The JENSEN *authentic high fidelity* speaker system kits give you the same high-quality matched loudspeaker components used in JENSEN'S factory assembled complete reproducers: you "do it yourself" and save. It's easy to select and order the kit you want. Send in the coupon TODAY. Get your copy of Manual 1060 NOW!

JENSEN MANUFACTURING COMPANY
6601 SOUTH LARAMIE, CHICAGO 38, ILL., DEPT. (D)

Please send me the Jensen *Authentic* High Fidelity Manual 1060 "You Can Build Your Own Hi-Fi Loudspeaker System." I am enclosing 50c in coins.

Name_____

Address_____

City_____ Zone_____ State_____

Jensen MANUFACTURING COMPANY

6601 South Laramie, Chicago 38 • Division of The Muter Co., in Canada, Copper Wire Products, Ltd., Licensee

Intensity Markers

For Sweep Alignment

Description Of A Unique Method Of Utilizing Markers For Alignment

by **Oscar Fisch**

MOST servicemen are familiar with the method of using marker "pips" for the purpose of precisely locating certain specific frequencies on a response curve during alignment procedures. The most commonly used method employs an accurately calibrated signal generator (marker generator) in conjunction with a sweep frequency generator to produce these marker pips.

A new system for frequency marking has recently been made available to the serviceman, and makes use of "intensity modulated" markers. These markers appear as bright spots on the response curve as seen in *Fig. 1*, or they may be made to appear as "breaks" in the curve, as shown in *Fig. 2*. There are several very desirable features to be found in this method among which are the clear visibility of the markers in the trap regions of the response curve, the absence of distortion in the response curve due to the high marker signal intensities, and the elimination of oscillation which may be caused by the marker.

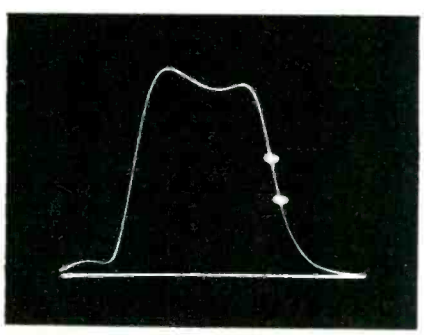


Fig. 1—Marked frequency is midway between bright spots.

Fig. 3 — Weston Model 985 VHF Calibrator with Z axis output.

It is the purpose of this article to explain the operation and the use of the test instruments involved with this type of frequency marking.

Principle Of Operation

Figure 3 is a photograph of the Weston Model 985 Calibrator. This instrument is an accurate, crystal calibrated signal generator which may be used to provide the conventional type of marker, but also has provision for the production of intensity modulated markers. It might be asked at this point, "Why both?" One answer lies in the fact that intensity modulated markers require the use of an oscilloscope with a "Z" axis input. This will be explained in detail later. It will also be shown how a "Z" axis input may easily be added to an oscilloscope which does not have one. At any rate, by providing both types of markers, the instrument may be used with any scope.

On the assumption that the reader is familiar with the conventional type of marker display, we shall limit our treatment to a study of only the intensity modulation aspects of this instrument.

Figure 4 is a block diagram to help explain the production of these intensity modulated or "Z-axis" markers. Referring to this figure, note that the sweep generator, in addition to feeding its signal to the receiver being aligned, also feeds a similar signal into the mixer stage of the calibrator. The variable oscillator within the calibrator also feeds a signal to the mixer stage.

Suppose for example it is desired to produce a marker on the response curve at 45.75 *mc*. Suppose also that the sweep generator is delivering a signal which is sweeping back and forth between 40 and 50 mc. The tuning knob on the calibrator would then be adjusted to 45.75 *mc*, the desired marker frequency. The output of the mixer stage will then contain the usual "difference" frequency. In this case however, since one of the input frequencies is continually changing, the difference frequency at the output will continually change. For example, at the beginning of the sweep, the difference would be 45.75-40 or 5.75 *mc*. As the swept frequency gets closer and closer to the oscillator frequency, this difference frequency at the output gets smaller and smaller until zero beat is reached.

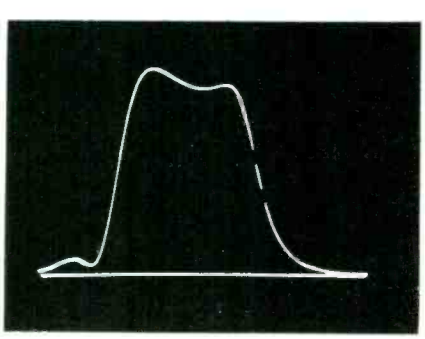


Fig. 2—Marked frequency is midway between the two breaks.

This of course occurs when the swept frequency reaches 45.75 *mc*. As the swept frequency continues on, the difference frequency at the mixer output increases reaching a value of 50-45.75 or 4.25 *mc* at the end of the sweep.

It is important to note at this point, that the plate load of the mixer stage contains a resonant circuit which is *fix tuned* to 75 *kc*. As a result, the only time that the *rf* amplifier recevies an appreciable signal is when the difference between the swept frequency and the oscillator frequency is 75 *kc*. This will occur at two points, one just below and the other just above zero beat. In the illustration we have taken, these would occur 75 *kc* below and 75 *kc* above 45. 75 *mc*.

The 75 *kc* output is then amplified by the *rf* amplifier and demodulated by a crystal detector. Two pulses of *dc* voltage therefore appear at the detector output. These are then amplified and emerge at the "Z" axis output terminal on the panel. A switch is provided by means of which a crystal of reversed polarity is substituted in the detector circuit. This permits the production of either a positive or a negative pulse at the output.

To summarize, we now have at the Z axis output terminal, two pulses of voltage one of which occurs just before the frequency to be marked, and the other just after.

Z Axis on Oscilloscope

The X axis on the oscilloscope refers to horizontal direction of deflection of the electron beam. It is more commonly called the H axis. The Y axis, similarly, refers to deflection in a vertical direction and is more commonly called the V axis. The Z axis is less familiar but not at all complicated. It simply refers to the control of the intensity of the beam by means of a signal fed to the grid or the cathode of the cathode ray tube. Thus a positive voltage applied to the Z axis terminal of the scope causes the spot on the screen to become brighter if the internal circuit feeds the grid of the CRT or dimmer if the connection is made to the cathode.

Most of the oscilloscopes now in use are not provided with a Z axis terminal. Since a Z axis is necessary for the display of intensity modulated markers, it will be necessary to add a Z axis terminal to the scope if it does not already have one. This is done very easily. Simply mount a terminal post at a convenient position on the panel, and connect this terminal to the grid of the CRT through a .05 *μf* condenser. Shielded wire should be used. A 500K resistor is then connected between the Z axis input and ground and the job is done.

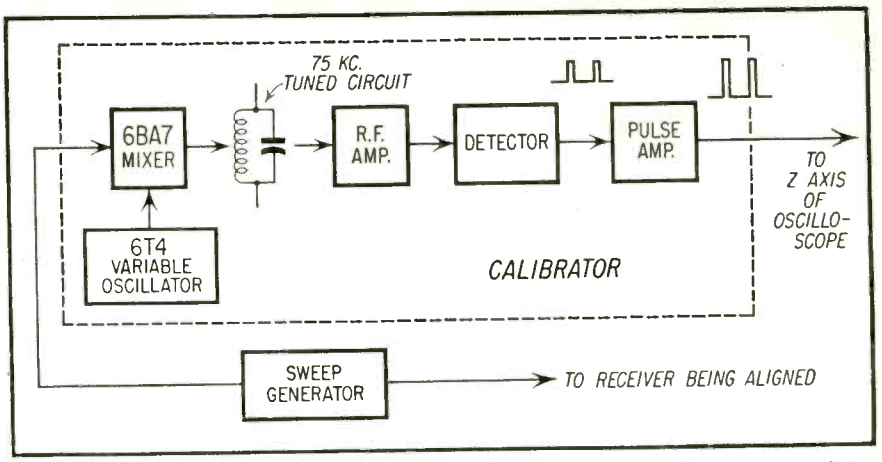


Fig. 4—Partial block diagram of Weston Model 985 Calibrator to show formation of intensity modulated markers.

Bench Set Up

We are now in a position to understand the functioning of the entire system. Fig. 5 illustrates a typical bench set up. Notice that it resembles the conventional arrangement in many respects. The important differences are as follows:

1. In the conventional system, the sweep frequency generator supplies a sweep frequency signal to the receiver being aligned and a synchronized sweep voltage to the horizontal deflection terminals of the oscilloscope. In this system, both of these signals are still used in the same way but a third signal is fed to the calibrator or marker generator. This third signal is identical to the sweep frequency fed to the receiver in all respects except amplitude. It is of fixed amplitude and is fed to the mixer stage of the calibrator as previously described.

2. The output of the conventional marker generator is fed into the receiver being aligned and the marker signal must therefore pass through the receiver circuits. In this system, the output of the calibrator is fed to the Z axis terminal of the scope. *It is important to note that this signal does not pass through any portion of the receiver.*

Figure 1 shows the appearance of the markers on the response curve. Following the illustration we selected previously, the marked frequency of 45. 75 *mc* would be midway between the two bright spots. In the light of our previous analysis, the reason for this type of display becomes clear. When the swept frequency reaches 45.675 *mc*, which is 75 *kc* below the frequency to be marked, (45.75 *mc* in this case) the calibrator delivers a positive pulse of voltage to the grid of the CRT via the Z axis input terminal and causes a bright spot on the trace at this point. Immediately thereafter the pulse to the Z axis disappears, since, as we have seen, the beat frequency output of the mixer falls below the 75 *kc* to which the plate is tuned. The trace now returns to normal brightness. Following this another pulse is delivered to the Z axis when the swept frequency reaches 45.825 *mc*, or 75 *kc* above the frequency to be marked. Once more a bright spot appears on the trace. These spots are therefore 150 *kc* apart and the point on the response curve midway between them will correspond to the frequency at which the calibrator has been set.

[*Continued on page 54*]

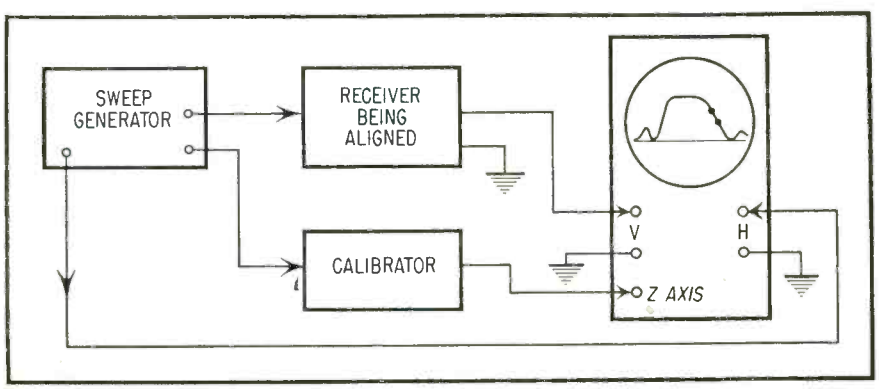
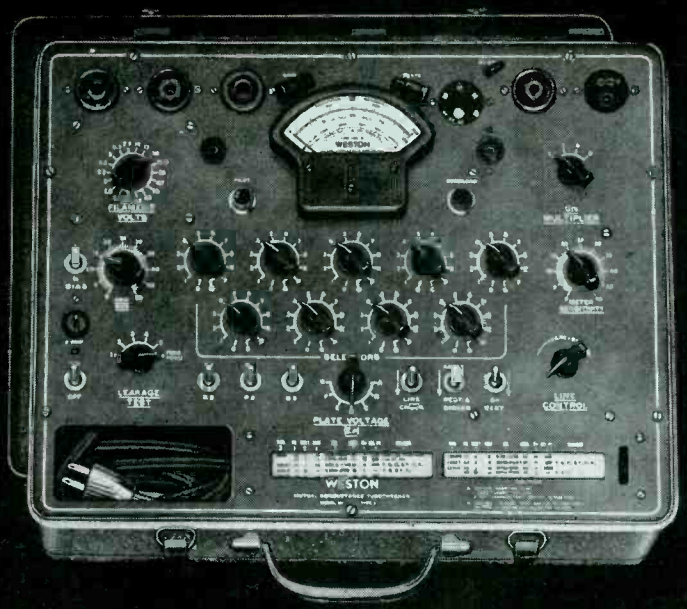


Fig. 5—Bench set up for alignment using intensity modulated markers.



Weston Model 981
Proportional Mutual Conductance Tubechecker

FILTERED D-C POTENTIALS

for accurate G_m measurements

OUTSTANDING FEATURES:

G_m MEASUREMENTS—G_m measurements are made more accurately by using filtered d-c plate, screen grid and control grid potentials. A precision voltage divider network and selector switch allows a proportionate value of signal voltage to be chosen *for testing tubes having transconductances up to 30,000 micromhos*. Signal voltages of 5.2, 2.6, 1.3, and 0.65 volts peak-to-peak having a frequency of 5000 cycles are provided.

GRID BIAS, SCREEN GRID AND PLATE VOLTAGE: Filtered d-c potentials of 90, 130, and 220 volts are available for plate and screen potentials. A variable filtered d-c voltage in two ranges of 0-5 and 0-20 volts are used to obtain better resolution of Grid Bias settings. *Far greater accuracy is obtainable with filtered d-c potentials than previously possible in portable tubecheckers.*

METER MEASUREMENT OF HIGH LEAKAGE RESISTANCE—Since tube leakage as high as several megohms can cause poor performance in TV Receivers, this tubechecker is designed to provide an accurate meter measurement of leakage resistance as high as 5 megohms between tube elements, thus being particularly useful for TV servicing and TV line production assembly.

TWIN SECTION TUBES—Three toggle switches make it possible to rapidly check and compare the respective sections of twin section tubes at only one setting of the selector switches.

WESTON *980 LINE TEST EQUIPMENT*

THE 980 LINE

PROPORTIONAL MUTUAL CONDUCTANCE TUBECHECKER

SEND COUPON TODAY FOR COMPLETE DESCRIPTION AND PRICES

Weston Electrical Instrument Corporation
614 Frelinghuysen Avenue
Newark 5, New Jersey

Please send literature on the new 981 Tubechecker.

NAME_____

ADDRESS_____

SD

for "no call back" performance in flybacks

LOOK FOR THE NEW MERIT GREEN TIRE!

BURTON BROWNE ADVERTISING

A Merit first . . . the new *Merit Green* flyback tire is the latest in the many Merit services to streamline your profit. Made of a new miracle material unaffected by temperatures from −40°F to +200°F., the Merit Green tire eliminates practically all of the faults that have beset flybacks and have made for costly profit-cutting call-backs.

The only manufacturer with a complete line of transformers, yokes and coils made entirely in its own plants. Merit parts are listed in Sams' Photofact Folders for your convenience.

MERIT

MERIT COIL & TRANSFORMER CORPORATION
4425 North Clark Street, Chicago 40, Illinois

COLOR SYNC ANALYSIS

Discussion Of The Operation Of The Color Sync Section

by **Bob Dargan and Sam Marshall**

from a forthcoming book entitled "Fundamentals of Color Television"

THE color sync section of a color TV receiver has two primary functions. First, it must develop a pair of locally generated 3.58 *mc* signals 90° out of phase with each other, or to use an equivalent expression, in quadrature with each other as shown in *Fig. 1A*. The second function is to establish definite phase angles of these locally generated 3.58 *mc* quadrature signals relative to the fixed phase of the transmitted 3.58 *mc* burst. In an I/Q receiver Signal A and Signal B as shown in *Fig. 1. (B)* must lag the subcarrier phase by 57° and 147° respectively. In an R-Y/B-Y Signal A and Signal B as shown in *Fig. 1. (C)* must lag the subcarrier phase by 90° and 180° respectively. These locally generated 3.58 *mc* signals, if properly phased with reference to the subcarrier, will demodulate the chroma signal along properly phased I and Q axes in an I/Q receiver, and R-Y and B-Y axes in an R-Y/B-Y receiver.

It will be recalled that the I and Q axes are initially fixed with reference to the 3.58 *mc* subcarrier phase at the transmitter. These axes and their relative phases must be re-established again at the receiver if the original color signals are to be reproduced.

As an example, let us consider a chroma signal, such as the one shown in *Fig. 2*, which is made up of the signals I′ and Q′. Notice that because of the fixed angles of the I and Q axes the amplitudes of the color signals I′ and Q′ determine both the amplitude and phase angle (A) of the resultant chroma signal with respect to the reference phase of the 3.58 *mc* burst.

It is this angle (A) which determines the hue of the chroma signal; and if at the receiver, this angle is not re-established between the chroma signal and the transmitted burst, the demodulated color signals will be anything but correct.

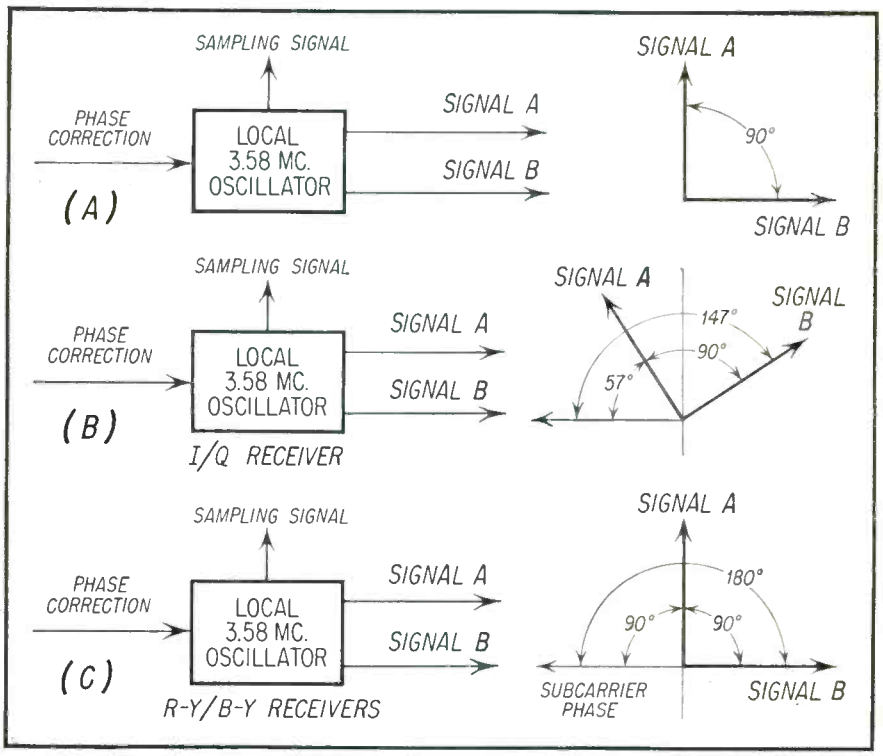


Fig. 1—(A) shows how the local 3.58 mc oscillator must develop a pair of signals 90° out of phase with each other. (B) shows phase angles of local 3.58 mc oscillator signals relative to subcarrier reference phase in an I/Q receiver. (C) shows phase angles of local 3.58 mc oscillator signals relative to subcarrier reference phase in an R-Y/B-Y receiver.

Observe that the transmitted 3.58 *mc* signal is referred to as the "burst" and the 3.58 *mc* signals developed in the receiver are referred to as "local 3.58 *mc* oscillator" signals. This distinction is employed in order to prevent confusing one with the other, both being different signals of different phase and having different functions.

Transmitter Color Sync Signal Development

It is evident that the station burst signal must be transmitted along with the other video and sync signals if the subcarrier reference phase is to be re-established in the receiver. The burst signal thus transmitted is referred to as the "Color Burst," and consists of between 8 to 11 cycles of the 3.58 *mc* subcarrier during each horizontal sync pulse interval. A review of the manner in which this signal is generated and transmitted will be helpful in understanding how it is utilized in the receiver.

Referring to *Fig. 3A* we observe that the I modulator receives two signals, an I signal which has no characteristics of phase, and a 3.58 *mc* subcarrier signal delayed 57° from its original reference phase. In this manner the I signal itself is given a phase delay of 57°. Examination of the Q modulator reveals that the Q signal undergoes a similar processing, except that the phase of the subcarrier in this case is delayed an additional 90°

giving the Q signal a phase delay of 57° + 90° = 147°. The relative phase angles of these signals are shown with respect to the subcarrier reference phase in *Fig. 3B*.

The color burst signal referred to previously is derived from the 3.58 *mc* subcarrier generator by feeding a branch of the latter into a Keyer stage into which are also fed the horizontal sync pulses. The action of the Keyer results in an output waveform in which 8 to 11 cycles of the subcarrier are superimposed on the back porch of each horizontal sync pulse as shown in the figure. The combination of the horizontal sync pulse and the color burst signal is then fed into a Combiner stage which adds this portion of the signal to the composite video signal.

Receiver Color Sync Section (I/Q)

In general, the manner in which the color sync signal is functionally utilized differs very little in the various types of color receivers. This will become evident as we analyze the block diagrams of the color sync sections of both an I/Q and an R-Y/B-Y receiver.

In the I/Q block diagram shown in *Fig. 4*, we observe that a portion of the composite video signal is taken off the video amplifier and fed into a 3.58 *mc* resonant circuit. Here the lower video frequencies as well as the horizontal and vertical sync pulses are removed from the signal, the output signal now consisting of the color burst and the chroma sideband signals centered around 3.58 *mc*.

By slightly detuning the 3.58 *mc* resonant circuit in one direction a *phase advance* of the output subcarrier signal may be obtained. Provisions for detuning this circuit are made in receivers by providing a small variable condenser across a slug-tuned coil. This condenser is referred to as the "Hue Control." When the latter is correctly adjusted the color burst signal is advanced 33° from the subcarrier burst phase. Correct adjustment of this control is evident to the operator when he observes color hues such as flesh tones, etc.

It will be observed that the chroma signal is present at the output of the 3.58 *mc* resonant circuit in addition to the color burst. Inasmuch as the chroma signal can effectively interfere with the function of the color burst signal in its control of the phase of the local 3.58 *mc* oscillator, the entire signal is fed into a "Burst Gate" circuit simultaneously with a flyback pulse from a tap on the horizontal output transformer. This pulse permits the Burst Gate to conduct only during the flyback pulse interval, thereby excluding all other signals from its output but the color burst signal (it will be recalled that the color burst occurs during the back porch of horizontal blanking). Observe that the relative phase of the color burst at the output of the Burst Gate stage is still +33°.

From the output of the Burst Gate the color burst signal is fed into an automatic phase control (APC) network which consists of the familiar combination of a balanced phase detector, a reactance tube, and an oscillator. In this case the oscillator is tuned to 3.58 *mc*. In this network the quadrature phase of the oscillator is compared with the color burst phase in the phase detector. Any difference in quadrature phase between the two is converted into a correction voltage out of the phase detector. This correction voltage is then applied to a reactance tube which converts the correction voltage into an equivalent capacitance. This capacitance is in parallel with the tuned circuit of the oscillator and can be increased or decreased depending on the correction voltage. If the local oscillator is in quadrature with the burst signal, zero correction voltage is developed. If it is not, a correction voltage is developed which brings the oscillator back in quadrature phase with burst.

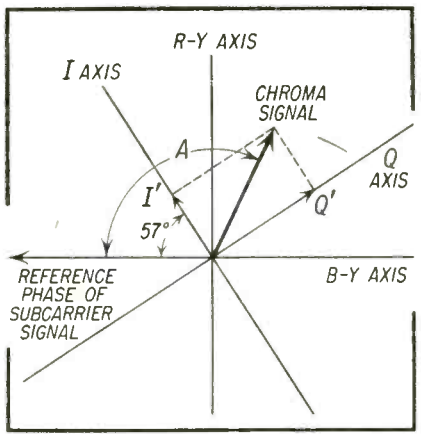


Fig. 2—Color of chroma signal is determined by angle between reference phase of subcarrier and phase of chroma signal.

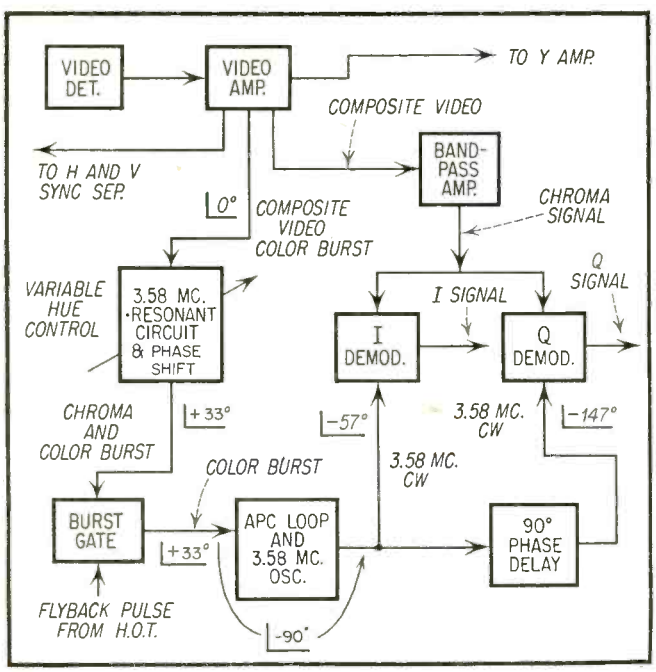


Fig. 4—Block diagram of color sync section in an I/Q receiver. Video detector, video amplifier, and bandpass amplifier are not considered part of the color sync section.

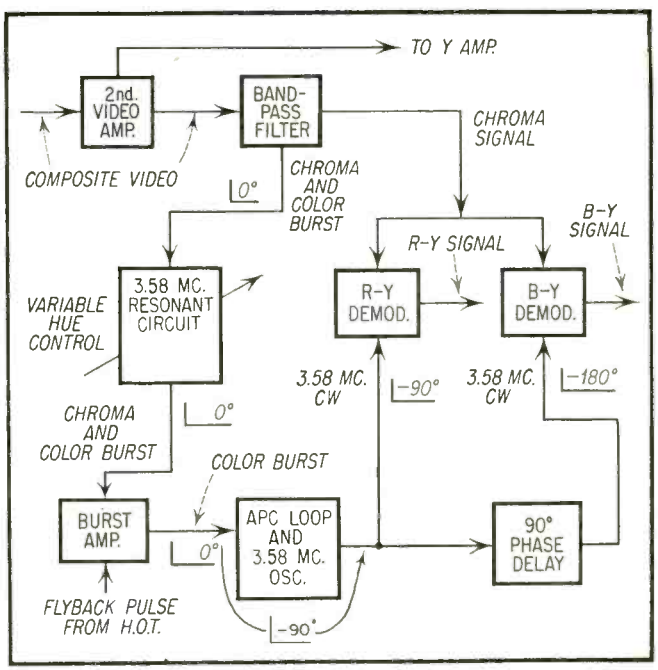


Fig. 5—Block diagram of color sync section in an R-Y/B-Y receiver. Color sync units are 3.58 mc resonant circuit, burst amplifier, APC loop and 3.58 mc oscillator, and 90° phase delay.

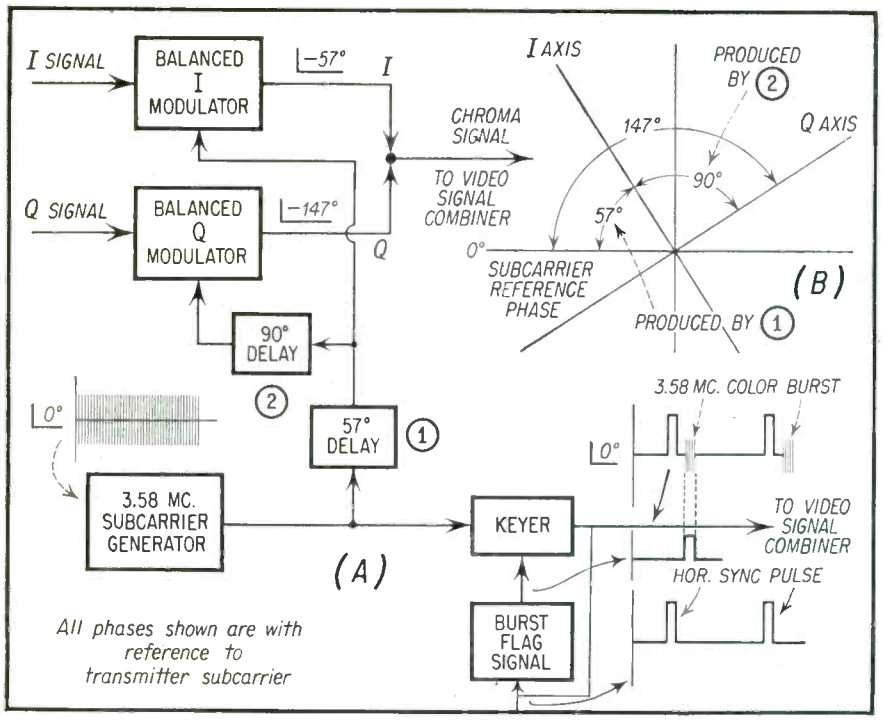


Fig. 3—(A) Subcarrier signal is utilized to impart properties of phase to I and Q signals, and to provide transmitted signal with fixed reference axis. (B) Phase relations of subcarrier, I, and Q axis.

The output of the local oscillator is split into two paths. One path feeds the local 3.58 *mc* signal (delayed 57° with reference to the subcarrier) into the I demodulator, and the other path feeds this signal into a circuit which provides an additional phase delay of 90°. The output of this latter circuit is then fed into the Q demodulator.

Observe that the phases of the quadrature signals fed into the two demodulators (57° and 147°) are in exact correspondence with the phases of the I and Q axes at the transmitter. Under these conditions the chroma signal fed into both demodulators will be demodulated along the I axis (−57°) in the I demodulator and along the Q axis (−147°) in the Q demodulator. The filtered outputs of these demodulators will then be the original I and Q signals.

Color TV receivers, particularly of the R-Y/B-Y variety, employ many circuit variations of the system just described. These variations and their many refinements will be discussed subsequently. At this point in our discussion it would be well to review that the color sync section of an I/Q receiver consists essentially of the following:

1) A 33° advance phase network which advances the incoming color burst subcarrier signal 33° before being applied to a Burst Gate.
2) A Burst Gate stage which provides only the color burst signal to the phase detector input of an APC loop.
3) An APC network which compares the incoming color burst phase against a local oscillator, and provides a net 57° delayed 3.58 signal from the local oscillator to the I demodulator, and a net 147° delayed signal (also from the local oscillator) to the Q demodulator.

R-Y/B-Y Color Sync Section

The block diagram of a color sync section employed in a typical R-Y/B-Y receiver is shown in *Fig.* 5. Although in *Fig.* 5 the color sync signal is taken off the output of the Band Pass amplifier, this feature is not a unique characteristic of an R-Y/B-Y receiver and may be also employed in an I/Q receiver. By this arrangement increased gain is provided to the color sync signal before it enters the Burst Gate stage. Also, the low video components of the composite signal which contain the Y and the horizontal and vertical sync pulses are removed from the signal before entering the 3.58 resonant circuit.

The important difference in this type of receiver is that there is no phase advance given the color burst signal in the 3.58 *mc* resonant circuit (Hue Control) following the Band Pass Amplifier since the output of the local 3.58 *mc* oscillator is delayed 90° with respect to the transmitted burst, the phase delay of the quadrature signal of the local 3.58 *mc* oscillator will be delayed 90° + 90° = 180°. Thus, the chroma signal will be demodulated along the R-Y (−90°) and B-Y (−180°) axes which correspond to these phase angles.

TUBES, RECTIFIERS and SEMI-CONDUCTORS

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., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

La Salle "Pic-Testube"

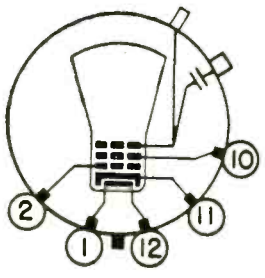
The "PIC-TESTUBE" has become available through La Salle Tube Mfg. Co. Complete with carrying case. It checks all picture tubes more dependably than any ordinary tube or emission checker. Gives consumers a visual test of how their set will work with a new CRT, without removing the old tube. It eliminates ion trap and focus coil at the start. Will indicate bad or defective damper tubes, high voltage rectifiers, vertical output and vertical oscillators, all sync and video amplifier tubes. For data, check G124.

GIC Silicon Rectifier

New silicon power rectifier, is being marketed by the Semi-Conductor Department of Automatic Manufacturing Corporation, subsidiary of General Instrument Corp. Designed for equipment where miniaturization and high temperature reliability are of utmost importance, rectifiers take up only 3/100 of a cubic inch and weigh 7/100 of an ounce, operate at temperatures as high as 200 degrees Centigrade and in many instances are directly interchangeable with vacuum tubes, selenium rectifiers or germanium junction rectifiers. For data, check G125.

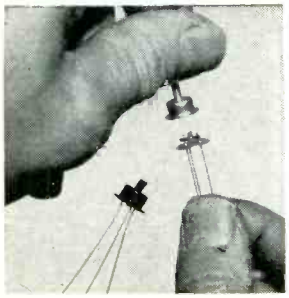
Westinghouse Color Tube

Contrast of new and old color CRT's illustrates advantages of new 22-inch, all-glass, rectangular shadow mask color tube (right) announced by Westinghouse. Metal flange on the old tube (left), necessitated costly insulation, eliminated in the new Westinghouse tube (right). The new color tube is built like a black and white tube and has no flanges, requires standard insulation of a black and white TV set and uses standard high voltage contact buttons. For details, check G-123.



Raytheon CRT

The 21AMP4A is a direct view magnetic focus and magnetic deflection picture tube for television receivers. It employs a spherical rectangular filter-glass face plate for elimination of reflection and an aluminized screen for increased picture brightness. It is designed to be used with an external ion-trap magnet of the single field type to prevent ion-spot blemishes. The external conductive coating, when grounded, serves as a filter capacitor. For data, check G-129.

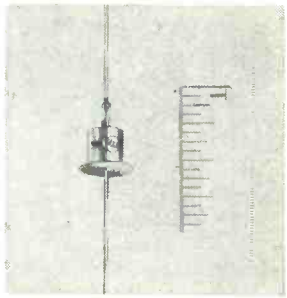


GE Transistor

A new transistor, designed to meet the demands of radio amateurs, hobbyists and experimenters for a stable, inexpensive transistor, has been placed on the market by the General Electric Co. The 2N107 has the same physical appearance and dimensional specifications as the USAF 2N43a transistor which was designed by G-E engineers and is being specified by the Air Force for their electronic equipment. It has an all-metal case and is hermetically sealed for the maximum in reliability. For data, check G121.

Federal Germanium Rectifiers

A new series of germanium diffused junction power rectifiers now available in production quantities for general industrial use, has been announced by Federal Telephone and Radio Co. The rectifiers — 1N91, 1N92 and 1N93—have a reverse current at least 20 per cent lower than RETMA specifications for the type, and are particularly recommended for blocking, magnetic amplifier and magnetic control applications. They can replace thermionic diodes in computers, and, in addition, their low capacitance permits the passage of frequencies up to 50 kilocycles. For data, check G120.

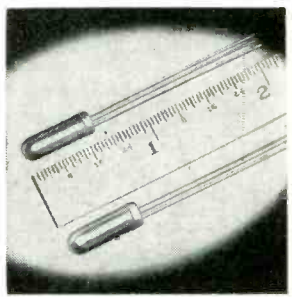


CBS 6792

A versatile high-voltage control tube has been announced by CBS-Hytron. Known as the CBS 6792, it is a multi-purpose beam tetrode for voltage stabilization service from 3000 to 25,000 volts. The tube may also be triode connected in several different ways. The wide range of input connections thus available offers a choice of many operating characteristics. The 6792 can solve high-voltage control problems as a regulator, gating tube, variable resistor, or amplifier. For further information, check G127.

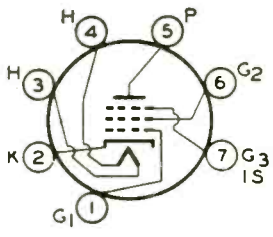
Amperex Junction Transistors

Latest addition to the Amperex line of high-current low-voltage power transistors is the matched-pair type 2-OC72. The efficiency of these transistors is unusually high, so that particularly suited to applications requiring up to 200 milliwatts output. The high-efficiency emitter which gives unusual performance to the Amperex type 2N115 transistor is incorporated in these push-pull units. They offer the advantage of high current gain at low supply voltages as well as high-power output for the low drive power required. For details, check G122.



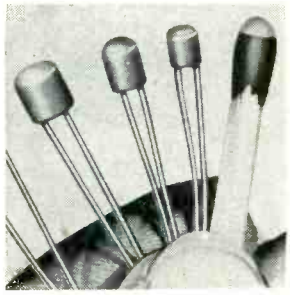
RCA Semiremote-Cutoff Pentode

The 3BZ6—a semiremote-cutoff pentode of the 7-pin miniature type—is intended for use particularly in the gain controlled picture-if stages of television receivers. It is designed with a 600-milliampere heater having a controlled warm-up time to insure dependable performance in television receivers employing series-heater-string arrangement. It reduces cross-modulation effects in the picture-if stages, and minimizes distortion resulting from high signal levels and age time delay. For data, check G126.



International Selenium Diodes

Newly developed sub-miniature selenium diodes Types 6U1, 7U1 and 8U1, are being produced by International Rectifier Corp. to provide bias for tubes in equipment that must withstand severe environmental conditions. Type 6U1 is rated for a maximum input of 156 v rms, type 7U1, 182 v rms and type 8U1, 203 v rms at 1.5 ma. They are designed for stable operation in an ambient temperature range of minus 50°C to plus 100°C. For further information, check G128.



THE WORK BENCH

Unusual Service Problems And Their Solutions

by **Paul Goldberg**

This Month's Problem:
Peculiar symptoms due to defective tubes.

THIS month's installment is devoted to odd tube troubles. A thorough knowledge of the receiver's circuitry is necessary in order to obtain speedy repair.

630 Type Chassis

When the receiver was turned on it was noted that there was no control of brightness or contrast. Both were always at maximum no matter how the controls were varied. There was also an "S" shaped bend in the picture. After studying the diagrams, it was decided that solving the brightness problem might hasten the solution of all the problems.

Contemplating of course that one defective component was the cause of all of the trouble a voltage measurement was first taken at the control grid of the C.R.T. pin #2. The meter read zero volts. Varying the brightness control, which should have produced a minus 100-to-zero volts reading had no effect on the voltage reading. Next a voltage measurement was taken at the minus 100 volt arm of the brightness control to ground.

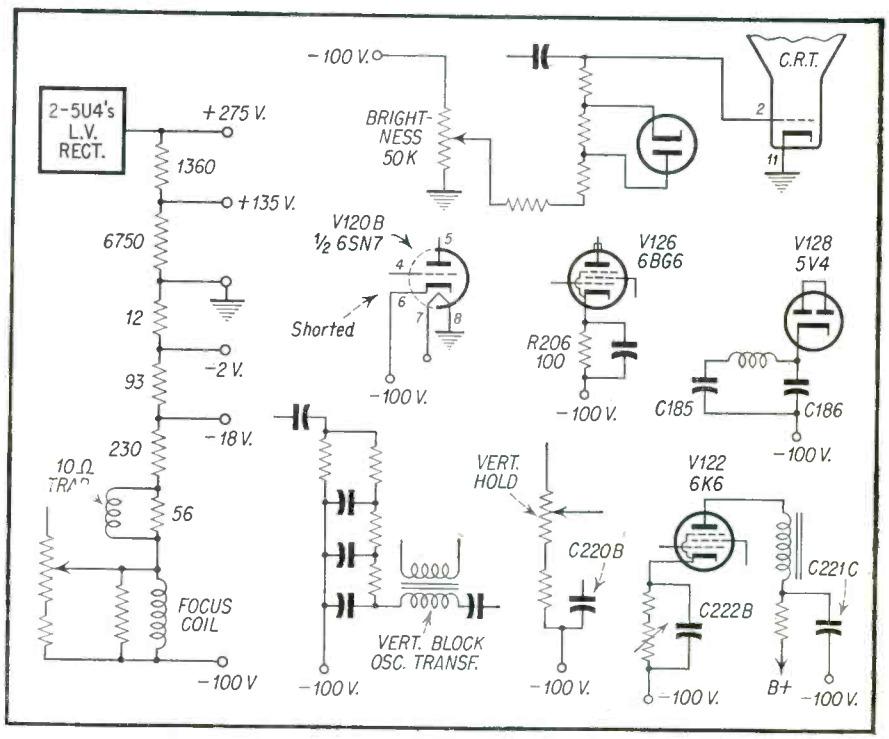


Fig. 1—Partial schematic of 630 type chassis.

The meter measured zero ohms. Thus the -100 volt buss was shorted to ground. The brightness control was resistance checked and was found OK.

The diagram was studied again. It was observed that the -100 volt buss connected to the cathode of the 6SN7, V120B, pin #6, directly to the cathode resistor, *R206* 100 ohms, of the 6BG6 (V126); to the horizontal linearity condensers *C185* and *C186*, to the vertical condensers *C220B* and *C221C*, and to the cathode condenser *C222B* of the vertical output tube 6K6 (V122). Now, out of all of these components the best possibility seemed to be V120B, 6SN7.

The others might not possibly cause the zero ohms resistance reading off the -100 volt buss. If the cathode of the 6SN7 (V120B) pin #6 shorted to the filament pins #7 and #8, of which pin #8 is grounded, then we would have the solution. With the ohmmeter connected from pin #6 of V120B to ground, this

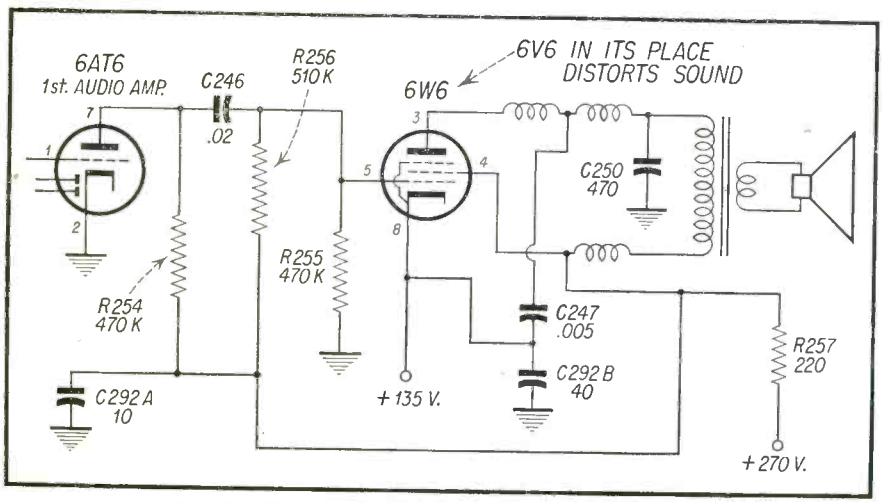


Fig. 2—Partial schematic of Du Mont RA 164.

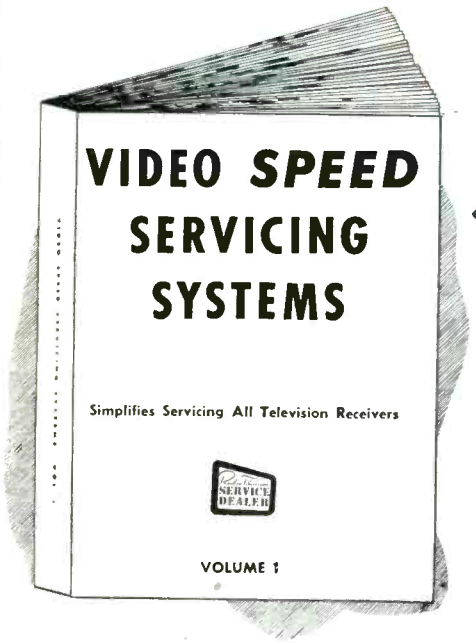
6SN7 was pulled out of its socket. Immediately the meter went up to 500 ohms. The 6SN7 was then resistance checked from pins 6 to 7. The tube was found to be shorted (zero ohms.) A new 6SN7 was installed and all of the troubles disappeared. The receiver then functioned normally.

It can be seen that if the −100 volt buss is grounded then the −2 and −18 volt lines are also grounded to zero volts. This accounts for the absence of contrast control as this circuit uses the −18 volt buss. The "S" shaped bend is caused by effectively grounding the −2 and −18 volt buss which is also utilized for the sync circuit bias voltage.

Du Mont RA164

When the receiver was turned on the sound was found to be distorted. First, the first audio amplifier, 6AT6 and the audio output tube 6V6 were replaced, but the trouble remained. C246, the grid coupling condenser was next voltage leakage checked but was also found to be OK. The diagram was then consulted and it was noted that the audio output tube was used as a voltage dropping device. The cathode pin #8 was used as the 135 volt B+ source. In this circuit a grid bias voltage is developed by the bleeder network R256 and R255. This sets the control grid at 115 volts positive to ground or 20 volts negative with respect to cathode, thus, normally operating the audio output tube as an undistorted class A amplifier. Knowing these facts a voltage measurement was first made at the control grid (pin #5) of the audio output tube. The meter read a little more than +115 volts. The cathode voltage was next measured at a little less than +135 volts. The filters C292A and C292B were next bridged with new filters but had no effect. The plate and screen voltages were approximately correct nevertheless the compensating condensers C247 and C250 were voltage leakage checked but were found to be OK. The plate voltage of the 6AT6, first audio amp., was found to be approximately correct. R254 the plate load was resistance checked properly at 470K. At this point we were rather puzzled. Studying the diagram once more it was observed amazingly enough that the audio output tube should be a 6W6 and not a 6V6. A new 6W6 was therefore installed and the audio cleared up immediately. This was a case of pure carelessness. Because of the interest this problem had developed the tube characteristics of the 6V6 were referred to in the tube manual. It was found that the 6V6 could not possibly operate undistorted class A with 250 volts on the plate and screen and −20 volts bias on the grid. To operate undistorted class A the maximum 6V6 grid bias quoted was −12.5 volts.

By popular demand, the serviceman's most-wanted book, Video *speed* Service Systems Vol. 1. is now also available in a low cost PAPER BOUND COVER EDITION



Has the identical contents of the Ring Binder Edition but the price is only $2.95

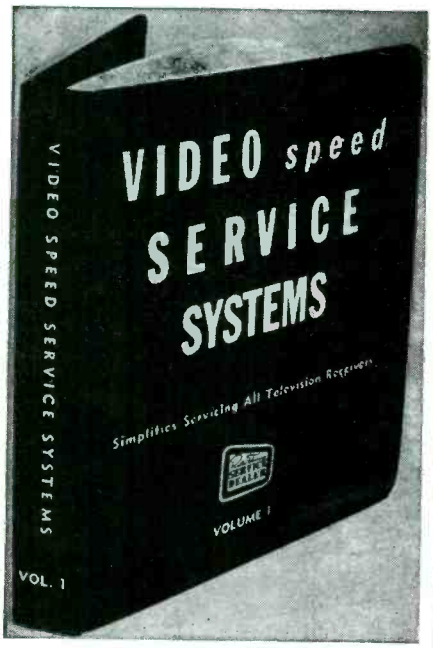
TAKE YOUR CHOICE

←New Hard Paper Cover Bound Edition $2.95 Postpaid

Cloth-Covered Ring Binder Edition $4.95 Postpaid →

(New York City Residents, add 3% to cover city sales tax)

Distributors — Order your supply now. Service Dealers, order from your distributor. If he can't supply you, order direct by mail from us.



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 cnd 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.

CUT OUT AND MAIL

COWAN PUBLISHING CORP., 67 WEST 44TH STREET, NEW YORK 36, N. Y.

Please send me postpaid Video speed Service Systems Vol. 1 in ☐ Paper Bound Edition for $2.95 . . . or ☐ Hard Cover Ring-Binder Edition for $4.95. My check for $ ..... is enclosed. (If you reside in New York City add 3% to cover city sales tax.)

Name .....

Address .....

City ..... Zone..... State.....

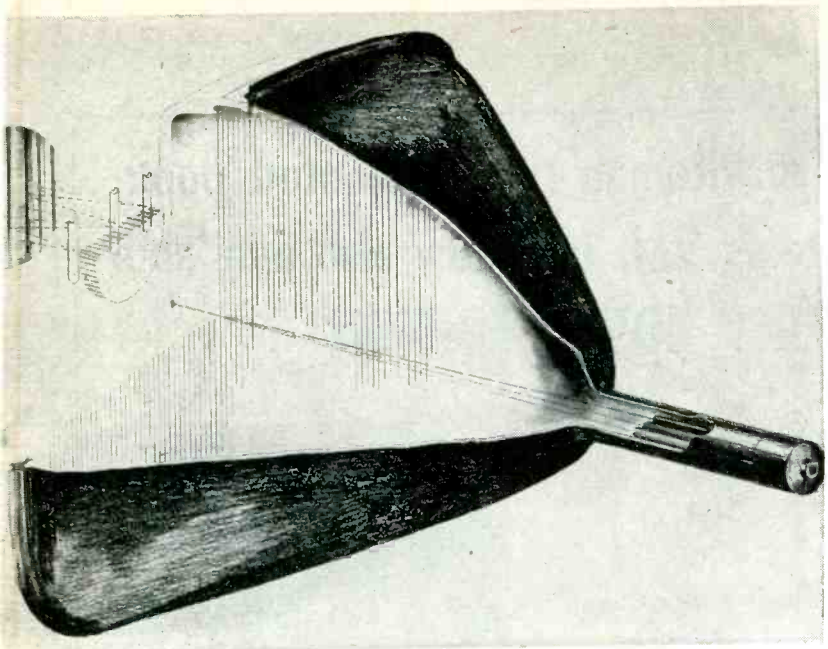


Fig. 1—Cutaway view of G.E.'s new "Post-Acceleration" color picture tube. Observe that three guns are in a single horizontal plane. Color selection is obtained by means of parallel array of wires in front of tube referred to as the "Grille."

The COLOR

Employing A New Principle, This

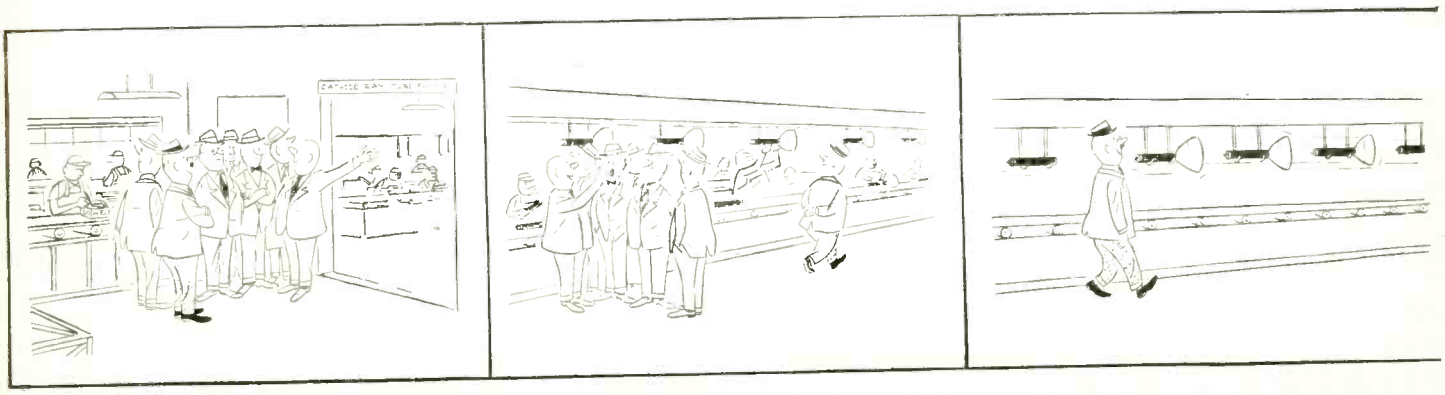
A NEW type of color picture tube called a "Post-Acceleration" type to differentiate it from the "Shadow-Mask" type has been developed by G.E. While still not ready for production, nor will it be for another year or so, its imminence merits a description of its construction and contribution to the Color TV art.

The tube shown in *Fig. 1,* is basically a three-gun type which uses direction selection at the front end to cause each of the three beams to strike the proper array of phosphors with which it is associated. The front end of the tube consists first of an array of parallel wires which in unison form the color selection electrode. In close proximity to this array is the phosphor screen containing an array of phosphor lines for each of the primary colors to be excited. Because "electron optical" masking is used instead of the conventional shadow masking, the color selecting electrode, which is called the grille, has an extremely high transparency. In this case it is claimed that the grille transparency is greater than 90%, meaning that more than 90% of the electrons ejected from the gun strike the phosphor screen and contribute to picture brightness. In the conventional shadow mask tube about 12-14% of the beam electrons find their way to the shadow mask. Thus, it is claimed that for equal high voltage power input, this tube is theoretically more than six times as bright as the shadow mask type tube. However, G.E. engineers have decided to derate the tube to a beam current of about 1/3 of the current used in present shadow mask tubes. This fact combined with the use of a faceplate glass with a neutral density filter having only a 50% transmission rating will give the tube an apparent brightness gain of about twice the shadow mask type as claimed by G.E. If this is true it will mean a decided improvement in ambient light degradation plus the need for high voltage power supplies of considerably reduced power requirements.

Considering the neck end, three electrostatic guns will be observed which lie in a plane instead of in a triangular array as in the shadow mask tube. The grille consists of a parallel array of wires fastened to the envelope itself. The front envelope is the glass surface on which the phosphor stripes are printed. In normal operation the final gun electrode potential and cone potential are held at about 6½KV, the grille is held at a potential approximately 200 volts lower than the gun and cone potential, and the phosphor screen is run at approximately 25KV.

Figure 2 shows, in rather simplified terms, the theoretical operation of the front end. Observe that the electron beams enter the grille with a slight angular separation. The angle is exaggerated since in the actual tube it is less than 1°. As the electron beam enters the grille region two effects occur. First, the central ray of a particular beam no longer travels in a straight line but assumes a parabolic path, and the strong electrostatic field between the screen and the grille accelerates the electrons to the high screen potential.

A second action which occurs as the beam enters the grille region is a focus-



New G.E. TUBE

Tube Shows Great Promise

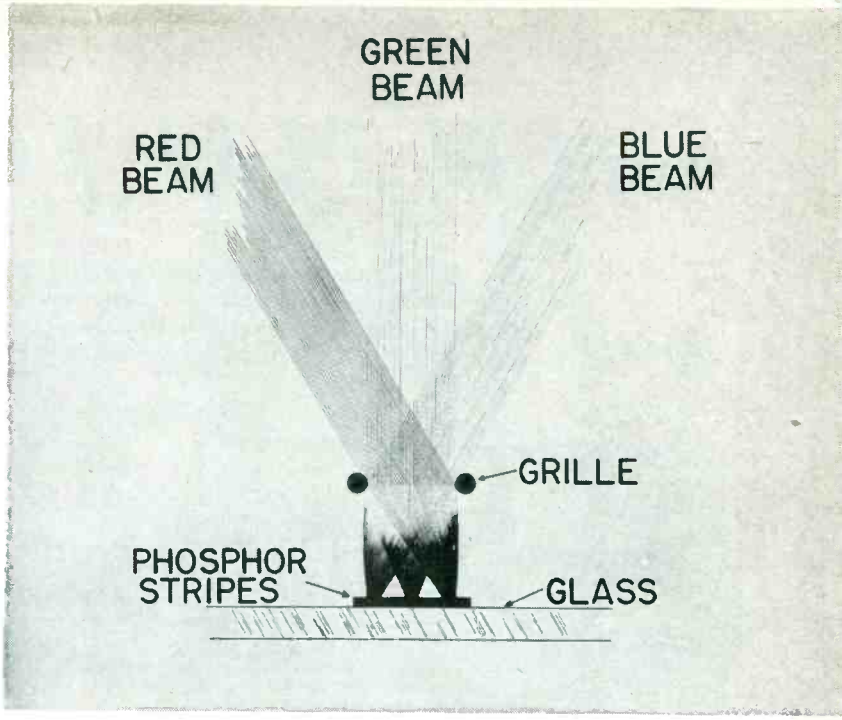


Fig. 2—Electron beams enter grille of tube with an angular separation of less than 1 degree. This is greatly exaggerated in the artist's sketch shown above.

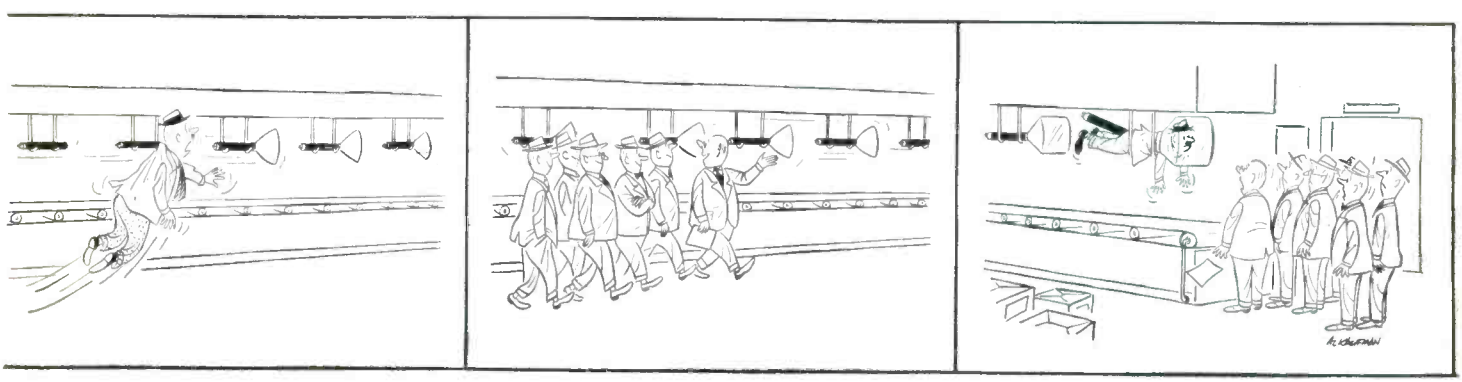
ing phenomenon. With properly-applied potentials, each pair of grille wires forms an excellent electron optical cylindrical lens. This lens reduces the size of the beam in the horizontal dimension from its initial diameter of let's say 35 mils down to only 5 mils. Because the beam width is so small in comparison with the phosphor stripe width, a guard band is formed on either side of the beam landing area allowing the beam to move about on a particular stripe without striking an adjacent stripe and hence effecting color purity. This wide guard band allows considerably large mechanical tolerances in manufacture and electrical tolerances in operation.

As claimed by G.E., a gun assembly which places three beams in essentially the same plane—in this case the horizontal plane—has decided theoretical and practical advantages as far as convergence is concerned. It is, of course, necessary to apply convergence dynamically at both the horizontal and vertical rates, but a complete separation of functions is possible with the one plane construction. Furthermore, the number of convergence controls can be reduced considerably.

Another advantage of this tube is that the deflection requirements are relaxed. Because post acceleration is fundamental to its operation, the "phosphor-on-face" tube requires deflection of only a 6½KV beam, resulting in the need for less deflection power.

It might be pointed out that because of the post acceleration principles involved, and because, for simplicity, only a single grille is used, secondary electrons hit the screen in a random manner and cause the excitation of a white background. The result here is a loss in contrast. However, this loss is indeed small, fading into insignificance when compared with the overall advantages to be derived by a tube of this design.

Another operation feature of any color tube which is important to the set manufacturer is its behavior in external magnetic fields. The earth's magnetic field changes the electron trajectories, and hence, the angle of entry of the beam into the grille region. This will cause the beam to strike a different portion of the screen than in the absence of an external magnetic field. On first thought, one would say that the post acceleration tube is more sensitive than the shadow mask tube to the magnetic fields since the beam travels at a lower velocity. This is true. In the vertical direction, however, color purity can easily be maintained due to the use of vertical continuous stripes of the same color. Therefore, any field which would cause a shift in this direction can be neglected. An axial field would cause rotation in the center of the picture coinciding with the center of rotation. Finally, the major cause of color impurity is then due to the vertical component of any stray fields because this will give a horizontal shift. This includes the earth's magnetic field. In present design this field is compensated for. Different set manufacturers will undoubtedly have different ideas but G.E. claims to have obtained this compensation without the use of expensive shields.



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., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

Telematic Tele-Check

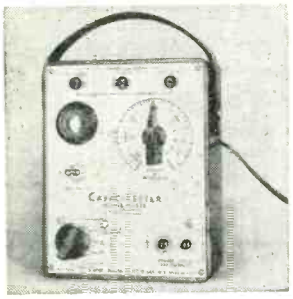
Telematic Industries, Inc., announces the production of Tele-Check, a portable picture test tube and yoke assembly, which consists of an all-purpose 5AXP4 CRT tube, a Universal yoke, and 6-foot extension leads for extending CRT socket, anode, and yoke connections. It is housed in a lightweight, leatherette case, and will work on all TV sets regardless of make, model, or size, and eliminates the necessity for carting fragile, cumbersome picture tubes back to the shop. For details, check T121.

Jackson Tube Tester

A tube tester, designated Model 49, has just been announced by Jackson Electrical Instrument Co., which features a number of plug-in accessories, all using the basic meter and power supply to perform additional tube and component tests. Accessories may be added at any time, and do not interfere with basic tube test procedures. Accessories include a high-resistance shorts tester, which measures interelement leakage to 2 megohms, a heater current tester, and a selenium rectifier checker. Accessories soon to be available include a signal tracer, RF oscillator, and condenser tester. For details, check T120.

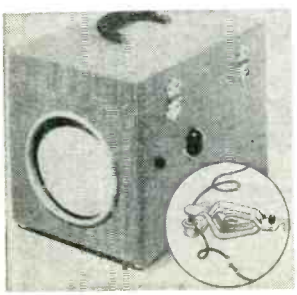
U-Test-M

Customers can test their own tubes and make an on-the-spot purchase of needed replacements when a Radio-TV Service Dealer has a "U-Test-M". In addition to being a tube-tester the unit stocks 300 tubes in handy drawers beneath the tester. After determining which tube is defective, the customer simply helps himself to a replacement and pays the store owner the price of the tube. The instrument requires 2 square feet of floor space. Some Distributors are working with Service Dealers on a percentage basis. For more data, check T128.



Teletest Capacitester

A new piece of test equipment that measures capacitance and permits coupling condensers to be tested for leakage without disconnecting them from their circuits, called the *CapaciTester*, is manufactured by the TeleTest Instrument Corp. Grid current effects that make voltage tests of leaky couplers hard to interpret are avoided (since the receiver is *off* when the tests are made). This is an advantage the CapaciTester enjoys over a voltmeter. In checking for a leaky coupler, voltages similar to those present in normal receiver operation are applied to the condenser under test. For data, check T-127.



Sel-Son CRT Tester

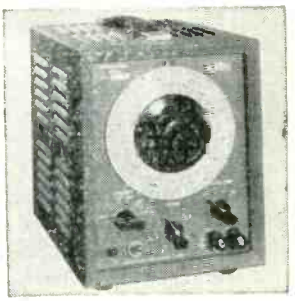
An all-purpose tester for picture tubes has been developed by the Sel-Son Electronic Tube Corp. Their CRT Substituter enables servicemen to determine at a glance whether the trouble is in the CRT or the chassis, without removing the tube, yoke, focus arrangement or ion trap. The unit includes the necessary extensions for HV connection, tube socket, and yoke supply. In use, the HV lead and tube socket are hooked up as usual. The yoke supply extension has four leads with "insulation piercing" clips. For details, check T124.

EMC Volometer

Electronic Measurements Corp. is now marketing its Model 102 Volometer, which features a 3½", accurate to within 2%—800 microamperes D'arsonval-type meter. The pocket-size model 102 combines 5 AC voltage ranges: 0 to 3000v., 5 DC Voltage ranges: 0 to 3000v., 3 AC ranges: 0 to 600 ma.; 4 DC ranges: 0 to 130 max, 0 to 1.2 amps.; and 2 Resistance ranges: 0 to 1000 ohms, 0 to 1 megohms. The Model 102 can be used to evaluate all types of electronic circuits as well as electrical circuits. For further information, check T126.

Du Mont Sine-Wave Generator

A new sine-wave generator for magnetic amplifier, servomechanism, and computer development, for laboratory testing or field maintenance of telephone equipment, and for measurements of frequency response, bandwidth or distortion has been introducel by Du Mont Laboratories, Inc. Designated as the Type 348 Sine-Wave Generator, it features extended low frequency range, high output power, low distortion, and calibrated output control including a four-step decade attenuator. Five decade tuning ranges and an additional band-spread high frequency range are provided. For details, check T129.

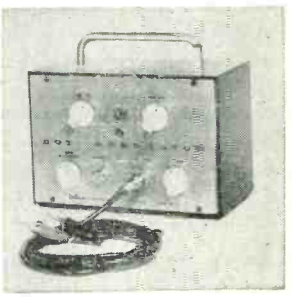


ETI Volta-Chek

Electronic Test Instrument Corp., announces the Volta-Chek, an instrument designed to check voltages applied to the cathode ray tube. It checks bias, enabling servicemen to check whether brightness or contrast control is working, checks 1st anode and filament, sets with low magnitude focus voltage from 400v. to 1,000v., sets with high magnitude focus voltages from 1,000v. to 3,000v., localizes the faulty circuit elements and determines whether it is the tube which is at fault or a chassis component. For data, check T123.

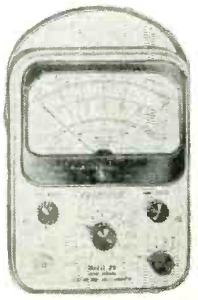
Hoffman Dot Generator Kit

A White Dot Generator in kit form was announced today by Hoffman Electronics Corp. Designated Model CD it has been designed for maximum ease of asembly by the service technician. Sockets and terminals are pre-riveted on the chassis to simplify assembly of the unit. Dots can be fed directly to the antenna terminals of the color receiver, eliminating the necessity of hooking the actual circuitry of the receiver chassis to effect the convergence operation. The unit weighs only 6½ pounds. For details, check T122.



Precision VTVM

Precision Apparatus Co., Inc., is now producing its Model 78, a new moderately priced, battery-operated vacuum tube volt-ohmmeter. It is equipped with a 5¼" wide-angle Pace meter of ±2% accuracy and 1% multipliers and shunts of both wire and deposited film types. It has a deep-etched heavy-guage, satin-brushed aluminum panel is encased in a rugged, blue-grey, ripple-finished steel cabinet, and uses standardly available commercial batteries. For details, check T125.



Mfr: Capehart **Chassis No.** CX-38S

Card No: CA 38-1

Section Affected: Sync

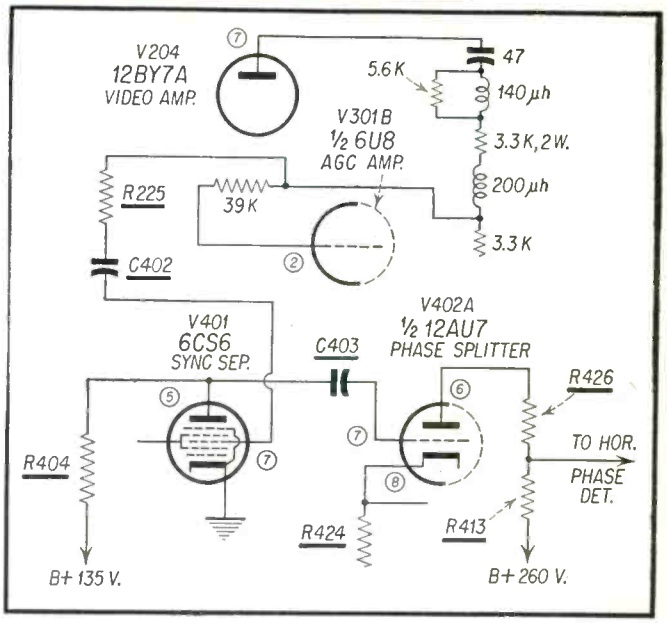
Symptom: No horizontal or vertical sync

Cause: Defective sync component

What to Do:

1—Check by substitution: 6CS6 (V401) sync separator; also, 12AU7 (402) phase splitter; also, *C402* (1500 $\mu\mu f$) ceramic and *C403* (.047 μf—600 V tubular)

2—Check by measurement: *R225* (10K), *R404* (560K), *R424* (3.9K), *R426* (10K), *R413* (3.9K)



Mfr: Capehart **Chassis No.** CX-38S

Card No: CA 38-2

Section Affected: Sync

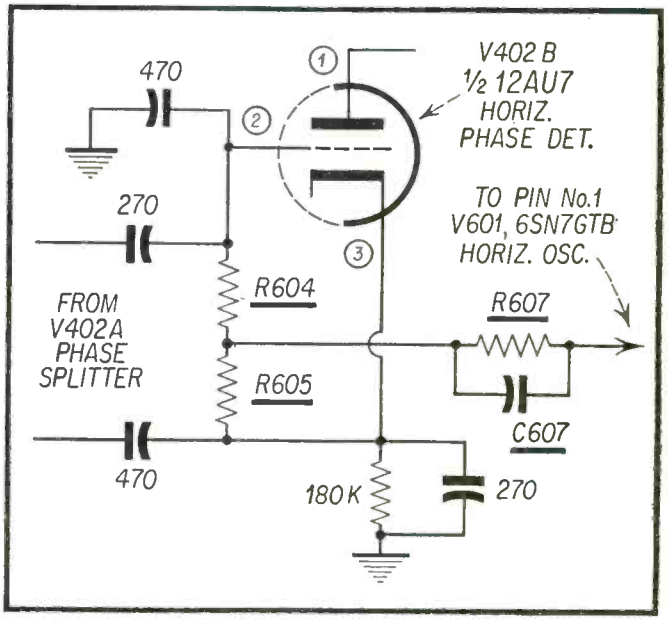
Symptom: Jittery horizontal sync

Cause: Defective phase detector component

What to Do:

Check by substitution: 12AU7 (V402B) phase detector; also, *C607* (.0022μf—200 V)

Check by measurement: *R604* (82K), *R605* (82K), *R607* (2.2 meg)



Mfr: Capehart **Chassis No.** CX-38S

Card No: CA 38-3

Section Affected: Sync

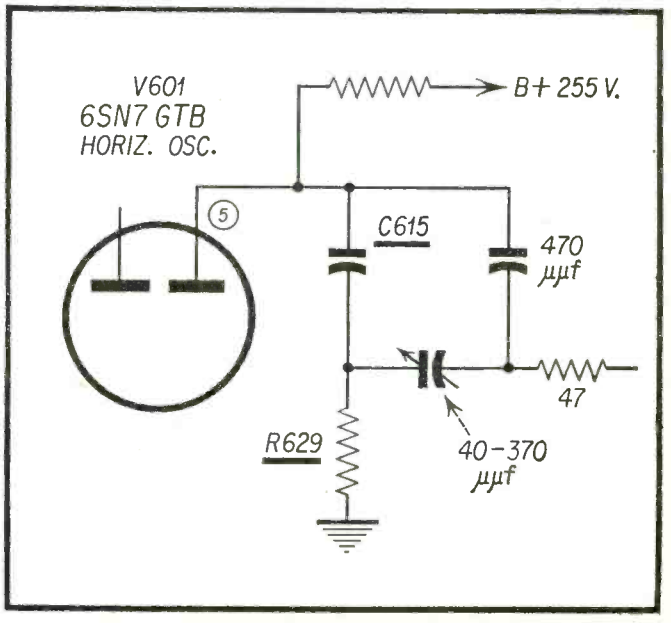
Symptom: Three overlapping pictures (horizontal oscillator frequency too high)

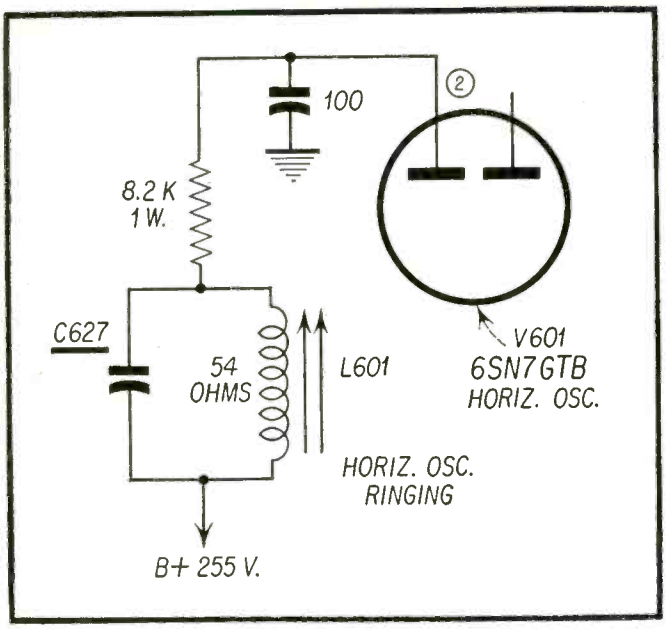
Cause: Defective horizontal oscillator circuit component

What to Do:

Check by substitution: 6SN7 (V601) horizontal oscillator; also *C615* (330 $\mu\mu f$)

Check by measurement: *R629* (10K)





Mfr: Capehart **Chassis No.** CX-38S

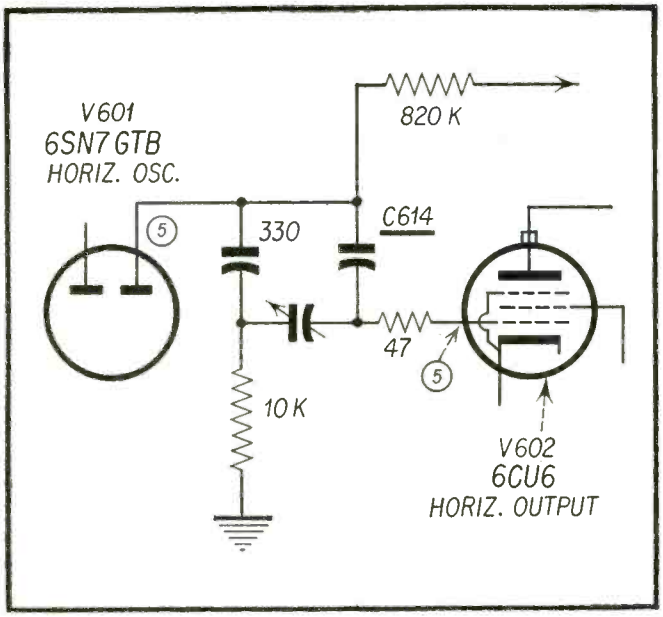
Card No: CA 38-4

Section Affected: Sync

Symptom: Tearing at top of pix

Cause: Open capacitor or misadjustment of Horizontal Osc., AGC or Pix Lock Control

What to Do:
Check adjustment of: Horizontal Oscillator, AGC and Pix Lock Control
Check by substitution: *C627* (4700 $\mu\mu f$)



Mfr: Capehart **Chassis No.** CX-38S

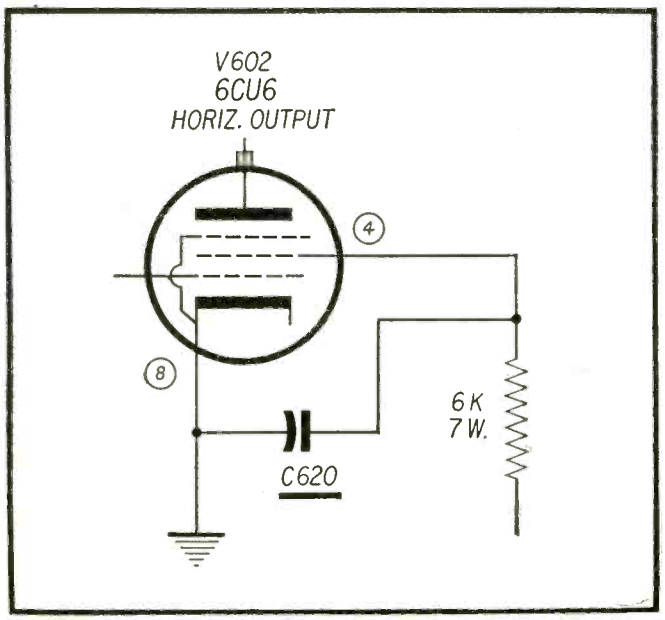
Card No: CA 38-5

Section Affected: Pix

Symptom: Insufficient horizontal sweep with foldover on right side

Cause: Leaky condenser

What to Do:
Replace: *C614* (470 $\mu\mu f$)



Mfr: Capehart **Chassis No.** CX-38S

Card No: CA 38-6

Section Affected: Pix

Symptom: Horizontal foldover in center of pix

Cause: Leaky condenser

What to Do:
Replace: *C620* (.047 μf—400 V tubular cond)

Mfr: Crosley **Chassis No.** 431-3, 432-3

Card No: CR 431-3-1

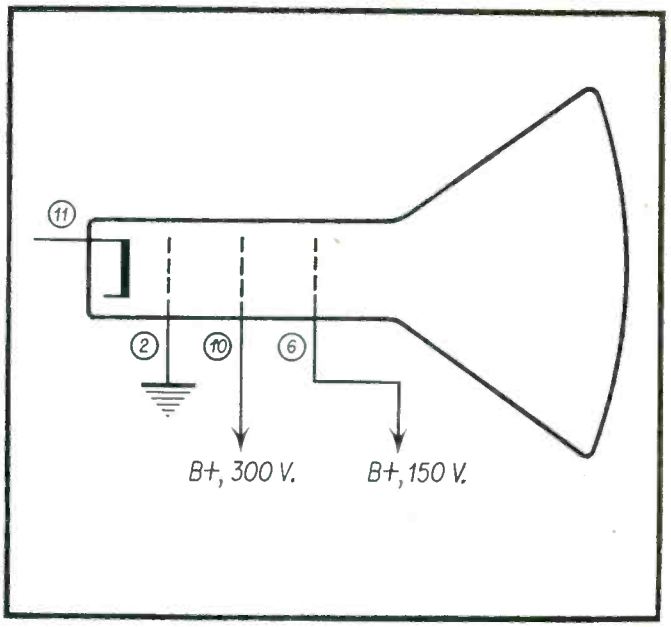
Section Affected: Pix

Symptom: Unsatisfactory focus

Possible Cause: Incorrect focus anode voltage

What to Do:

Try connecting Focus Anode (pin 6 of CRT) to various points other than B+ 150 V such as: chassis ground, B+ 260 V (pin 5 of damper VIII—12AX4GTA), B+ 300 V (pin 10 of picture tube), and B+ 495 V (B+ Boost-Term. #2 of horizontal output transformer)



Mfr: Crosley **Chassis No.** 431-3, 432-3

Card No: CR 431-3-2

Section Affected: Pix

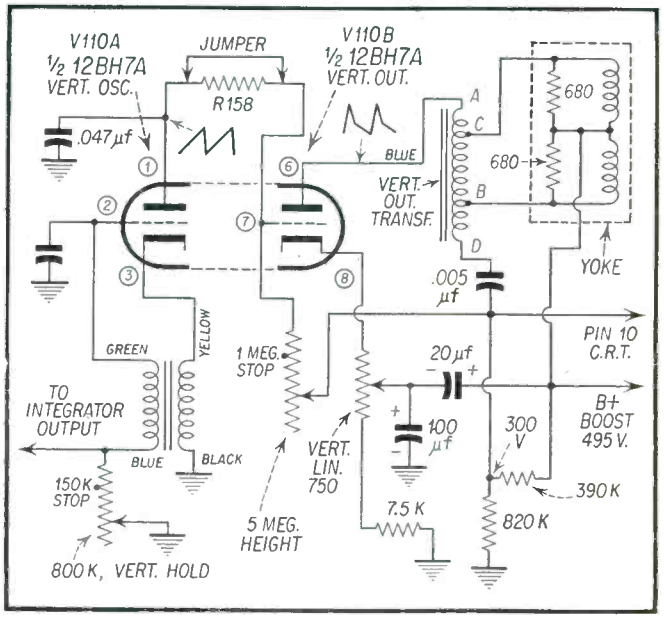
Symptom: Slight compression at top of pix out of range of linearity and height controls

Cause: Combination of characteristic of V110B —½ 12BH7A vertical output tube and T107 (vertical output transformer) affects waveshape in vertical output circuit. See Card No. CR 431-3-3.

What to Do:

Try connecting in or out of circuit *R158* (68K) by clipping off jumper across this resistor

Note: This operation alters waveshape of voltage applied to grid of V110B thereby introducing a slight amount of compensating spread in the output



Mfr: Crosley **Chassis No.** 431-3, 432-3

Card No: CR 431-3-3

Section Affected: Pix

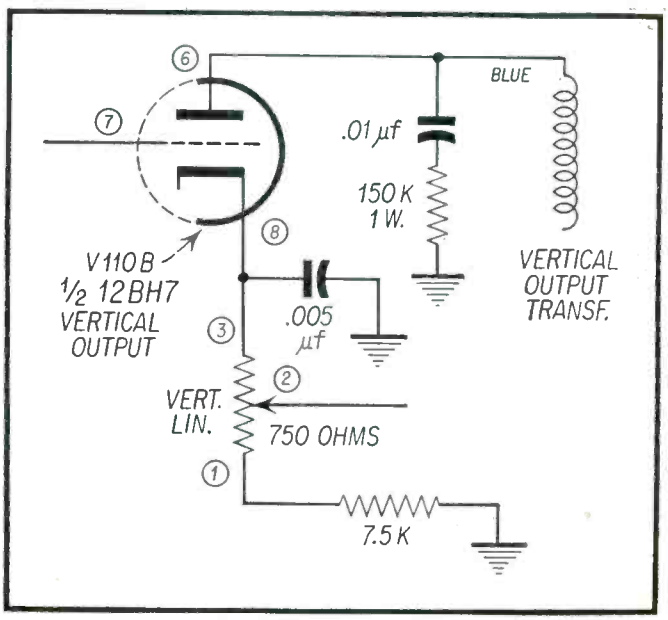
Symptom: Vertical spreading out of range of linearity and height controls.

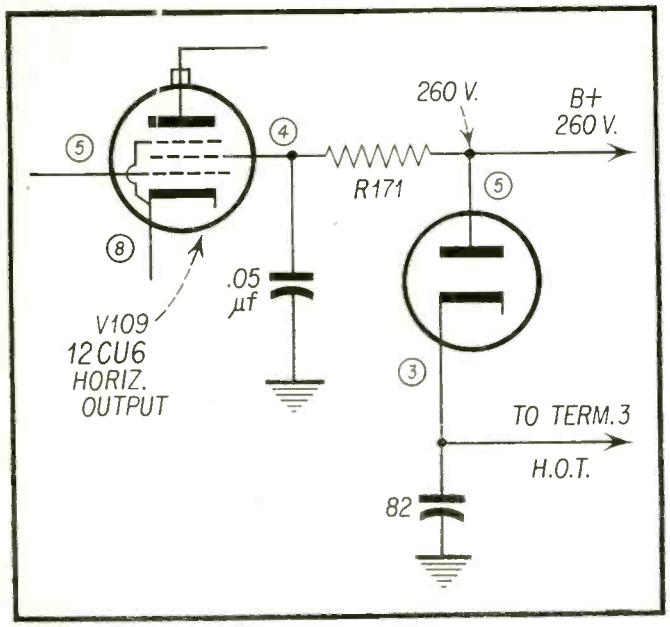
Cause: Combination of characteristics of V110B —½ BH7A vertical output tube and T107 (vertical output transformer) affects waveshape in vertical output circuit. See Card No. CR 431-3-2.

What to Do:

Connect: .01 μf—600 V condenser in series with 150K—1W (10%) resistor from plate to ground in vertical output stage

Note: These changes are designed to introduce a slight amount of negative peaking and affect the current waveshape in the yoke in a manner designed to introduce a slight amount of compression





Mfr: Crosley **Chassis No.** 431-3, 432-3

Card No: CR 431-3-4

Section Affected: Raster

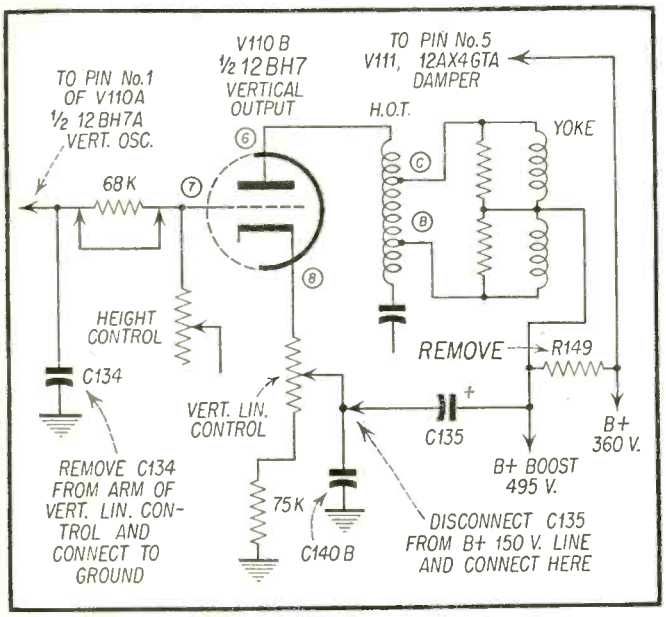
Symptom: Insufficient width

Reason for Change: Provide increased horizontal output tube gain.

Note: This change was included in chassis 431-3 Code D and 432-3 Code E, and continued in later chassis

What to Do:

Change: *R171* (12K) to 8.2K



Mfr: Crosley **Chassis No.** 431-3, 432-3

Card No: CR 431-3-5

Section Affected: Pix

Symptom: Picture stability could be improved

Reason for Change: To improve picture stability

Note: This change was begun in chassis 431-3 Code F and 432-3 Code H.

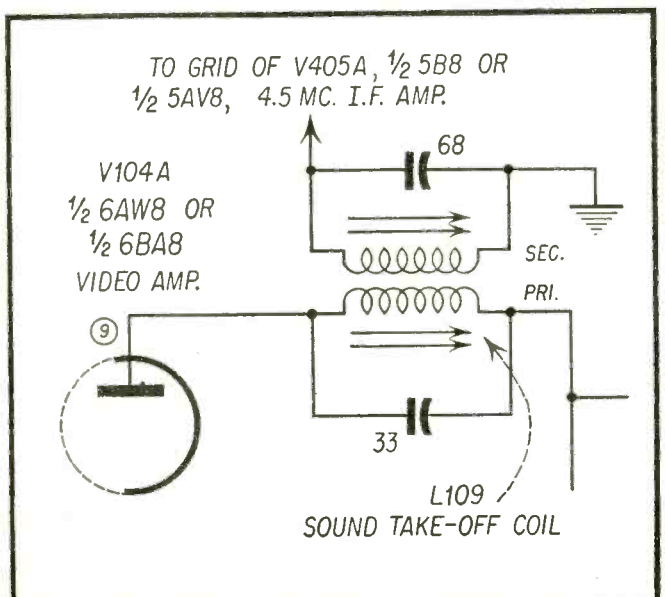
What to Do:

Change: *C140B* from 30 μf—150 V to 100 μf—150 V by shunting with 70 μf—150 V condenser (observe polarity)

Remove: Low side of *C135* (20 μf—500 V) from B+ 150 and connect to arm of vertical linearity control

Remove: Low side of *C134* (.047 μf—600 V) from arm of vertical linearity control and connect to chassis ground

Remove: *R149* (470K)



Mfr: Crosley **Chassis No.** 431-3, 432-3

Card No: CR 431-3-6

Section Affected: Sound

Symptom: Buzz or distortion that cannot be corrected by realignment. Peaks and nulls when realigning sound may be hard to find.

Possible Cause: Reversed connections on primary of *L109* (sound take-off coil)

What to Do:

Reverse: Connections on the primary of *L109*

VOLTAGE REGULATING TRANSFORMERS

Operation And Applications Of Voltage Regulating Transformers

by **Larry Stineman**
Chief Engineer, Merit Coil & Transformer Corp.

IN operating electrical equipment, including TV sets, it is usually desirable to operate at rated input voltages. In some instances, however, it is sometimes necessary to operate at higher or lower than rated voltages. The Voltage Regulating or Voltage Changer transformer is a device designed to do just this. Interposed between the line voltage supply and the TV set, it performs the function of enabling manual boosting or lowering of the input voltage to the device to be regulated.

Referring to *Fig. 1*, the Voltage Changer unit consists of an auto transformer having primary taps spaced in the range from 65 to 145 volts. The secondary or output tap connection is for a nominal 117 volts. A rotary switch permits selection of any primary tap. The voltmeter, which reads output volts, is one having a 0 to 15 volt movement with a 0-150 volt scale connected across a section of the output winding. With this arrangement any change in primary voltage or change in tap position will show a proportional change in the voltmeter reading. With a true 117 volts applied to the 117 volt primary tap, the voltmeter will read 117 volts. The unit is also provided with a six foot cord and plug for connection to the line supply circuit and a receptacle into which the electrical device to be regulated can be plugged. An additional component is a neon type indicator bulb to show when the unit is in operation.

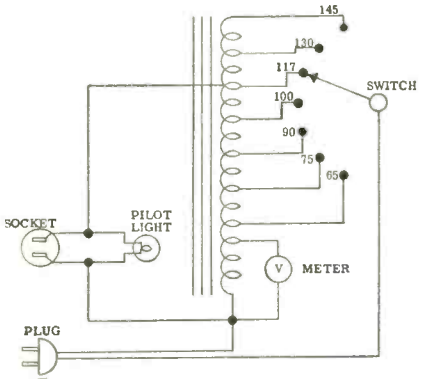


Fig. 1 — Circuit diagram of Merit Model P3139 V.R. Transformer.

Function

As mentioned above, the Voltage Changer achieves its function by means of a tapped autotransformer. Referring to *Fig. 1*, the output is tapped at a nominal 117 volts. The input is tapped at 65-75-90-100-117-130-145 volts. Input or line voltages can be applied to any tap by means of the rotating switch. If the line voltage is low, say 100 volts, the switch would be rotated to the 100 volt position. Due to autotransformer action, the line voltage would then be boosted in the ratio of 117 to 100, providing an output of 117 volts. This would hold true whenever the line voltage is applied to the equivalent rated tap. However, if a line voltage of say 110 volts were applied to the 100 volt tap, an increased output voltage of

$$110 \times \frac{117}{100} = 129 \text{ volts}$$

would be obtained. Decreased outputs can be obtained in the same way by applying lower values of line voltage to a higher rated tap. In this manner either rated voltages or higher or lower voltage values can be obtained from the unit by adjusting the switch position. It is not advisable however to apply more than 25% rated voltage to any given tap because of danger of running the voltmeter off scale, or of overheating the unit in continuous operation. If a wide range of output voltages are desired, the unit should be connected and operated in reverse. That is, referring to *Fig. 1*, with normal line voltage of approximately 117 V. fed into the receptacle, output voltages from 65 volts to 145 volts may be obtained at the plug up to full rated output by varying switch settings. In this case the meter, of course, would read input or line voltage and the output voltage would be identified by referring to switch position markings.

Fig. 2—View of transformer showing meter and switch.

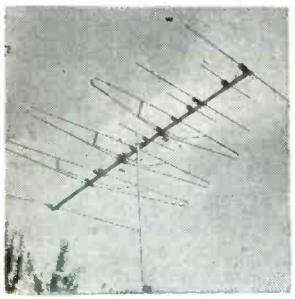
For The TV Viewer

The Voltage Changer is useful to the TV viewer in boosting low line voltages encountered particularly in rural areas where the line voltage may drop as low as 80 or 90 volts. In metropolitan districts, during certain periods, the combination of line voltage drop due to increased neighborhood loads and increased overloads on the house wiring system may drop the supply voltage at the TV set to 110 or 105 volts or lower. By keeping the Voltage Changer permanently connected to the set, the TV viewer can simply switch to a lower tap during these periods to maintain constant voltage input. Because of its conservative design and autotransformer construction, the Voltage Changer has comparatively low losses. The no-load losses on a reputable unit rated at 350 Watt capacity, is in the neighborhood of 5 Watts. This means that the unit could be left permanently connected or "floating" in the line at a cost of only a fraction of a cent per day. The TV set can then be turned off or on in the usual manner without changing switch

[*Continued on page 53*]

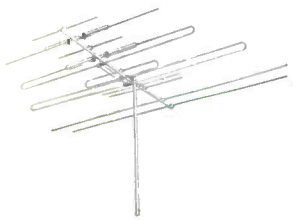
NEW ANTENNAS AND ACCESSORIES

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



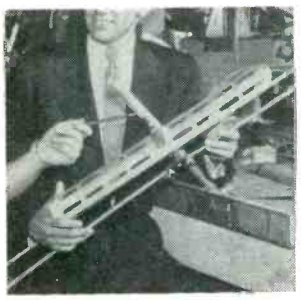
Trio Zephyr Royal

Trio Mfg. Co. recently introduced the Zephyr Royal, said to be the best performing antenna the company has ever offered. Stagger-tuning, with the antenna tuned to 6 pre-determined frequencies gives the flat response necessary for good performances throughout the entire VHF band. The Zephyr Royal has a total of eleven parasitic and nine active elements stagger-tuned to give flat response on channels 7-13. For further data, check A126.



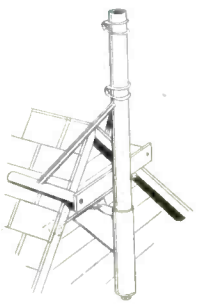
Welco Zee-Beam Line

The Welco Mfg. Co. has introduced their ZEE-BEAM TV antennas, in which one ZEE-X element functions with full efficiency on both the high and low TV bands. There are 3 models in the ZEE-BEAM line. Model 110 is the economy all channel VHF fringe antenna, model 220, the queen of all fringe, all channel VHF antenna designs, and the Welco Super ZEE-BEAM, an all-channel VHF design featuring ZEE-X elements in multiples for remote area reception. For further information, check A122.



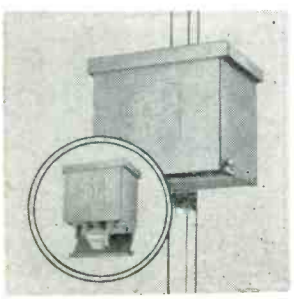
Walsco Phase Reverser

Offering higher gain and sharper directivity on all VHF channels, the Walsco Wizard incorporates a parasitic phase reversing principle. A specially shaped metal shield is mounted in front of the receiving element, and is claimed to increase the antenna's efficiency, while cutting down installation time. Extra dipoles, complex harnesses, and phasing stubs are eliminated. For details, check A127.



Rohn Gable Mount

This gable mount, recently introduced by the Rohn Mfg. Co., is designed to quickly attach to any gable roof for a secure, durable antenna mounting. Simply loosen bottom bolt, slip mount into place, and then tighten bolt. Accommodates tubing up to 1½" in diameter. For further information, check A120.

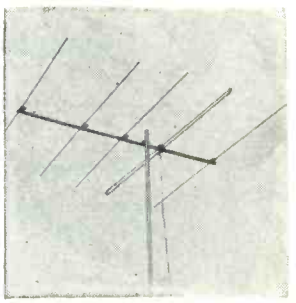


B-T Antenna-Mounted Booster

A broadband VHF amplifier featuring a low-noise circuit, multi-voltage power supply and weatherproof housing is now available from Blonder-Tongue Labs. The Model AB Booster provides more than 25 db gain on all VHF channels; operates automatically thru its power unit near the TV set. 300 ohm line carries AC power up to the remote unit and amplified TV signals down to the receiver. Gain is sufficient to overcome line loss of 2200 feet on the LO band and 1400 feet on the HI band. For details, check A123.

Channel Master Array

Channel Master Corp. has announced a new line of 5- and 10-element single-channel Yagis to its "Maverick" antenna series. The Low Band Yagis do not require hardware, tools or tightening. High Band models require tightening on only two elements. All Mavericks feature an entirely new, specially-designed "Snap-Lock" bracket that locks and nests the elements, providing rigid, secure support. The Low Band 10-element models are boom-braced. For details, check A128.



Clear Beam Yagi

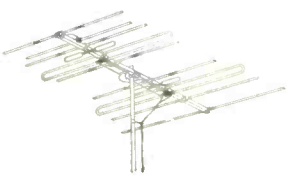
Clear Beam Antenna Corp. is now producing an all channel Yagi TV antenna, "Sky Sweep" Model MYS-SO. It is of completely modern Yagi design, having all elements, parasitic and driven, in the same plane to afford performance equallled only by ten element Yagis cut, tuned and peaked for single channel performance. Incorporated into the Sky Sweep's is "Focal-Sharp" tuning, wherein the manufacturer claims each director element is cut, phased and insulated to magnify the signal directly on the driven element. For further details, check A124.

Snyder "Torque Tenna"

The "Torque-Tenna" model AX-100, is now on the production line at Snyder Mfg. Co. It is half the size of a regular conical-type roof TV antenna. Because of this and the fact that it occupies only one-fifth of the square footage of a traditional type of roof antenna, the Torque-Tenna eliminates much roof reflection and helps wipe out the problem of ghosts and "snow" on the TV screen. It weighs only 27 ounces and is highly resistant to strong wind blasts, thus helping to cut down the rate of blown-down roof antennas. For details, check A129.

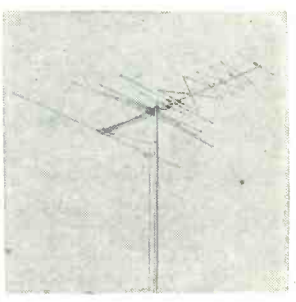
Finco B-8

This Finco broad-band antenna is said to achieve absolute maximum Front-to-Back ratio for the elimination of venetian blinds, back ghosts, etc. with no sacrifice of gain on either low-band or high-band. This is accomplished by twin-driving of Two Fidelity Phased elements, true quadrature twin-drive on low-band and tri-quadrature twin-drive on high-band, and parasitic elements, interleaved in the space-wave pattern between two driven elements. For details, check A125.



JFD Power Helix!

A new all-channel fringe-area antenna, the Power Helix, has been announced by JFD Manufacturing Co. The array features microwave helical design, used in conjunction with a flat-plane dipole system. This dipole system features one long element, measuring one-half wavelength on Channel 2, which receives both Channels 2 and 3. The next element is one-half wavelength on Channel 5, for Channels 4 and 5. Excellent gain and directivity are obtained on Channel 6 by combining the back section of the Helix with a specially-designed harness, to form a closed loop. For information, check A121.



JOHN F.

RIDER SPEAKS

AS we write these lines we are looking at the underside of a modern television receiver. The *if* strip consisting of the *if* amplifiers and the crystal detector has printed circuit board wiring. The components are mounted on top of the board and all the connections are dip-soldered on the bottom. Another board contains the video amplifier and output tube, the sound detector, the sync separator, and the vertical and horizontal sweep generators. The remainder of the receiver is arranged in a normal manner.

But, dealing with the printed circuit board alone, the technique is being applied to a variety of devices—radio receivers, record player amplifiers, high-fidelity tuners, tape recorders, and test equipment. Within a year examples of printed circuit board techniques will become commonplace in virtually every kind of equipment that service technicians work on and with.

We are looking at an illustration of the bottom view of the aforementioned television receiver; showing the printed wiring on top of which appear the symbolizations of the various components of the receiver. As far as component location identification is concerned, illustrations of this kind are very much more helpful than photographs with callouts. Adoption by all equipment manufacturers will make circuit tracing and tests of individual components very much more rapid than heretofore. Of course, it is going to make the isolation of a component by unsoldering much more difficult. Location of check points and access to check points are aided greatly, although having the components on one side of the board and the connections on the other may complicate things. It will be a long time before anyone develops the ability to read any sense into the circuit organization of the components. For this there will still be a need for the conventional schematic.

At the moment, the majority of the printed wiring arrangements used in home electronic equipment employs similar techniques—namely, a deposit of copper forming the circuit wiring on a baseboard. These conductive surfaces remain after an etching process removes all of the unused conductive material which is laminated on to the board originally.

As far as techniques for producing printed circuits are concerned, there are quite a variety. The most widely used is

the etched wiring method that we have described. Then there is the embossed wiring method wherein the wiring pattern to be used for interconnection is pressed into the board. The copper foil surface, which is later removed, is at a higher level than that which is to be used, thus making it relatively simple to remove the undesired copper foil.

Pressed powder wiring, painted wiring, plated wiring, and stamped wiring are other processes used. Space does not permit a description of each of these at this time. Of far more importance is the effect of such techniques on servicing activity.

We realize that attempting to forecast things in an art that is comparatively new in the practical sense is a dangerous thing, but we will do so anyway. Coming events cast their shadows before them, and enough experiences have been chronicled to permit some sort of prognostication.

We do not think any of these developments is going to eliminate the servicing industry, even in the light of having seen a device that is being designed to have a trouble-free life of 40 years. (The figure "40" in the previous sentence is not a typographical error.) But we also want to mention that the device we referred to is not intended for the commercial market.

A printed wiring board technique, regardless of how it is going to be used, will have to lead to a gradual decrease in the dimensions of the devices, although it also will lead to very much more orderly arrangement of the components. This is an immediate result, at the same time, it is going to call for a somewhat more refined technique in the actual repair of a defect. The removal of components will have to be done more carefully, with lower wattage soldering iron; 100W and 500W irons will no doubt be replaced by 25W irons, if not even lower. The application of heat to junctions will have to be done with much more care in order to avoid evaporation of the materials used as conductors.

The identification of a repair will be easier. Changes made in the field will be instantly discernible. The printed wiring board technique will produce more stable equipments and eliminate the danger of having a defect appear after a repair job as the result of a shift of the connecting wires, a frequent occurrence in the years past.

There is every reason to believe that the printed wiring board technique of manufacturing is going to produce a more rugged device, something that is going to remain trouble-free much longer than heretofore. This may not be the case at the outset of the employment of the technique. Much experimentation and proving have gone on over the years past, but even so, many of the problems native to the production of these units on a scale such as that found in the radio and television equipment manufacturing industry have yet to be solved.

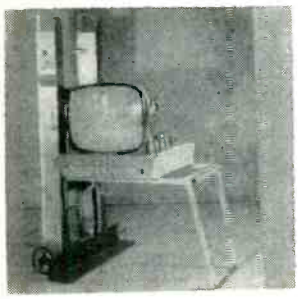
Numerous tests have shown a high stability factor in printed circuits, and this can lead to reduced servicing. In this respect there is every reason to believe that the use of printed wiring board techniques is going to demand replacement parts which are generally categorized by the words "exact replacement." Much room for development still remains; for example, these techniques are not yet being applied to power circuits. However, now that the trend has started, it will not be long before almost all parts of the equipment will be wired in this manner.

The likelihood exists that television receivers produced in this fashion may be less free from "bugs" when they see daylight in the hands of the public. Because of the way in which the printed boards are produced, changes in components and circuits will probably be less frequent than in the past. Of course there will be some need for corrections after receivers hit the field, but it is a fairly safe bet that they will be less numerous than in the past.

The printed wiring board technique effects economies. In time these economies will be reflected in the list price of the product sold to the public as well as in the designs of new equipment for use by the public. It is reasonable to assume therefore that the reduction of servicing activity that may come to pass in the next few years because of these new techniques will be offset by the increase in the number of units of all kinds being placed in the hands of the public.

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., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.



Yeats Platform Attachment

A folding platform attachment designed to adapt the handling conveniences of Yeats appliance dollies for carrying TV table models and chassis has been marketed by the Yeats Company. Helpful to TV repairmen when removing TV chassis from second story dwellings, or in delivering and installing window air-conditioning units, the attachment enables the user to take advantage of the Yeats endless belt step glide, and strap ratchet fastener. For details, check C121.

G-C Test Kit

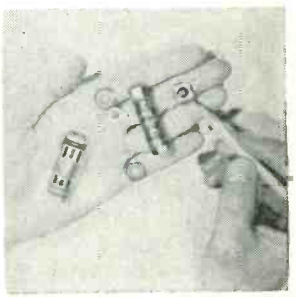
A complete set of test socket adapters, designed to make quick electronic measurements on any TV set chassis, has been developed by General Cement Mfg. Co. Four adapters are included in this kit, which is packaged in a convenient form for use in a serviceman's kit as well as on his bench. The kit facilitates the measurement of voltage and resistance, audio and video, from the top of the chassis or the base of the picture tube. There is also included a seven-pin and a nine-pin miniature test socket adapter and an eight-pin octal socket adapter. For details, check C120.

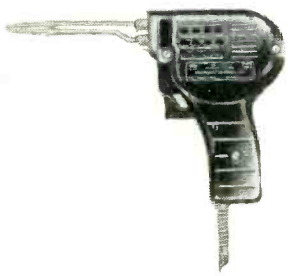
C-D Royal Cub

Cornell-Dubilier announces its Royal Cub paper-dielectric capacitor which features high temperature and high stability operation, exceptional mechanical toughness, and long-life characteristics achieved by the use of Polykane—a solid thermosetting compound developed by C-D. The Royal Cub withstands rough handling, severe vibration and shock, climatic extremes of heat and cold, moisture and humidity, and soldering iron heat without damage. For details, check C126

Burgess "Wafer Cell"

The "wafer cell" announced by Burgess Battery Co., is shown in this close-up. The cell itself, smaller than a fingertip yet a third more powerful than conventional flat cells, is made entirely by machine and sealed in an airtight pliofilm envelope. 13 such cells in a column wrapped tightly with transparent plastic and capping it in a leak-proof tube produces this 22½ volt battery for pocket radios, hearing aids, Geiger counters, and other small electronic devices. For further data, check G125.



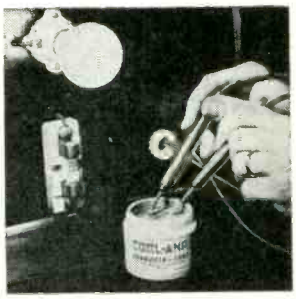


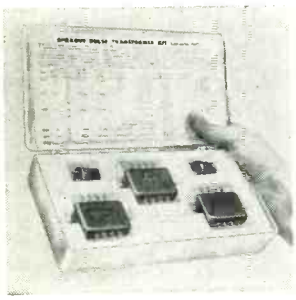
Wen Soldering Gun

The Wen soldering gun is a 200-watt, heavy duty gun that comes up to working heat in less than 5 seconds. Features include: silver-plated tip and connectors for sure and positive electrical contact, an extra-rigid (but removable) tip, a heavy-gauge steel nose, and a built-in spotlight angled to throw shadowless light on the work area. Weight: 2¼ lbs. While the gun is properly classified as a heavy-duty unit, the design of the housing for the gun is made of high-impact shatter-proof plastic that has a high luster, ebony-black finish. For data, check C128.

Conducto-Lube

Conducto-Lube is a highly conductive top-grade lubricant designed for use in conducting hinge joint switches. This illustration shows conductivity by a low voltage test in a jar of Conducto-Lube, with the current illuminating the globe. This product's lubricative qualities can be used on knife blade switches to prevent their "balling up" and "freezing". Conducto-Lube's conductivity will reduce resistance and heating. For further data, check C129.



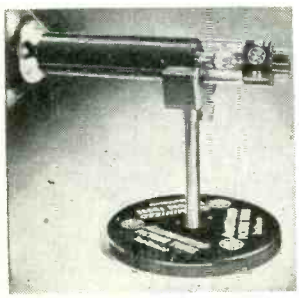


Sprague Pulse Transformer Kit

Engineering development assistance for pulse circuit designers is provided by a new Pulse Transformer Kit by Sprague Electric Co. It contains five Sprague pulse transformers chosen to cover a wide range of practical applications, with primary inductance from 0.5mH to 50mH, and turns ratios as high as 8:1. Each miniature transformer has multiple windings, permitting the engineer to easily select the characteristics best suited to his application. For details, check C127.

RCA Remote TV Control

A remote control unit that operates all important television receiver adjustments from up to 30 feet away can now be installed on most RCA Victor black-and-white VHF sets. "Small enough to fit in a hand, the control unit measures 2¼ inches in width, 2 inches in height and 5½ inches in length. The plastic unit contains three separate control knobs for fine tuning, picture control and on-off and volume as well as a dial for all VHF channels. For details, check C123.

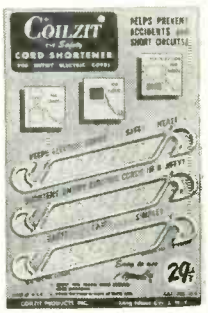


GE "Nek-Rest"

A time-saving aid for servicemen available through General Electric tube distributors, which eliminates fumbling for the right size prop to hold neck of a television picture tube. The "Nek-Rest" is easily-adjusted to hold a picture tube neck firmly at just the right height on the service bench. Rubber wedges are supplied to hold round tubes from rolling. For details, check C-122.

Coilzit Package

A new three dimensional 5 x 8 counter card featuring 3 clear plastic Coilzit Safety Cord Shorteners has been introduced by Coilzit Products, Inc. Designed for quick self-service, Coilzit shortens untidy electric cords on radios, lamps, clocks and television sets. It will hold as much as 3 feet of cord, thus eliminating unflattering, hazardous loose wires which are directly responsible for many accidents and short circuits. For details, check C124.



School for Service

National School's 50th Anniversary Deserves A Hearty "Well Done"

MOST of the men now engaged in some phase of the electronics industry are enjoying a measure of success and a living standard far higher than that of any other industry. But there still exists a serious need for more trained technicians on all levels and leaders within the industry now recognize that this acute shortage of specialists is an imminent danger that could stunt future growth. As a matter of fact, experts estimate that at present the home radio-TV servicing field could utilize at least 50,000 more men than are engaged in it and with the advent of color TV late this year the manpower shortage will rise acutely.

The advantages of education are apparent in the "Want Ads" urgently calling for men to fill the gaps in a rapidly growing industry. The more complex electronic processes become the more knowledge and skill are essential. More education and training are required for a man to service television receivers as compared to radios, and further training is required before a technician is competent to service industrial electronics installations, 2-way radio communications apparatus or commercial aircraft electric devices such as ILS or radar.

As said before, a goal in mind together with the determination to see it through, is the passkey for any man to open the way to increased income. The fascinating and productive careers open in electronics now and in days ahead are too numerous to mention.

The "hitch" to this promising picture of a better, more secure future in electronics is that the more attractive the opportunity the more thorough is the preparation necessary. Jobs that require no special knowledge are plentiful; and applicants for them are equally numerous. When more training is demanded, fewer men seem to qualify. Thus, the coveted positions and salaries are directly related to the specific background and developed skills of a man.

The majority of this country's top technicians, the ones who command the most money and prestige, planned and prepared for their careers in one of the many fine technical training schools. One of the pioneers and present leaders in this trade education field is National Schools of Los Angeles, now celebrating its 50th year of instructive service. The occasion of a "Golden Anniversary" alone would not entitle the organization to mention, in a technical publication such as this. But, because of its great contribution to electronics (such as training 8,500 specialists in electronics for the Government during World War II), we feel that we can waive formalities and review in brief the school's modus operandi.

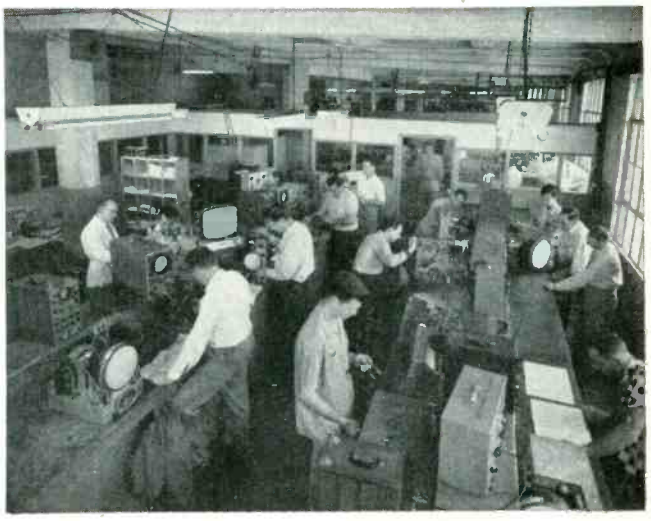
National Schools was established in 1905. At present, Dr. L. J. Rosenkranz directs the policies of this world famous institution. Today, upwards of 130,000 students are currently enrolled in either the resident center or in its world-wide correspondence department. Instruction is given in three languages—English, Spanish and Portuguese.

The "home study" courses cover all adjuncts of radio, TV, and fundamental electronics. Over 100 lessons are involved with the beginner performing many down-to-earth experiments—continuously progressive in scope. Periodically the students are given examinations to measure their ability and these tests also serve as an indication pointing to the strong points of the student's capacity—whether it be for radio-TV servicing or broadcast engineering.

The resident courses are many, and each is divided into two categories, first of which is the basic 12 month course covering the study of TV, radio and electronics. Graduates of this course may elect then to pursue the 6-month indoctrination course covering advanced TV techniques. The advanced resident courses, for example, require six hours a day—five day-a-week instruction. Training in the lab, studios and classrooms consists of mastering complete camera chains, monitoring scopes, monitors for video and audio, power supplies, transmitters and all the auxiliary equipment to be found in a modern TV studio or a network member.

Men already having sufficient background, training, and practical experience in radio-TV servicing, if they so qualify, may enroll only in the advanced TV course. And these men may also take advanced courses by mail to qualify them for obtaining an FCC general class ticket so they can then service the vast number of industrial electronic radio installations there are all through the country.

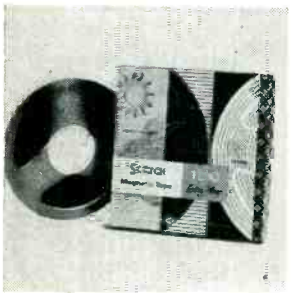
Broadcast training in one of the laboratories.



TV repair training in one of the shops.

HI-FI PA SOUND

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., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

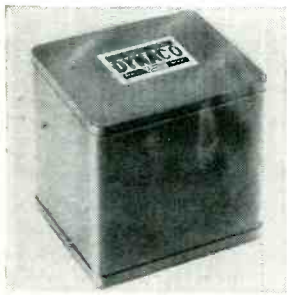


"Scotch" Magnetic Tape

A new "weather-balanced" magnetic tape offering 50% more recording time than conventional tapes has been announced by Minnesota Mining and Manufacturing Co. A major feature of the new No. 150 tape is its one-mil polyester "weather-balanced" backing made from Du-Pont "Mylar" film for resistance to changes in temperature and humidity, and for greater strength. As a result, it is recommended for all critical recording applications where long-play is also a requirement. For details, check S127.

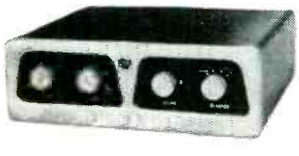
Telectrosonic Tape Recorder

A new Hi Fi tape recorder unit for custom installation that is supplied with tape transport, recording amplifier, playback preamplifier and erase oscillator, has been announced by the Telectrosonic Corp. The unit has been designed to provide simplified control of rapid switching from "record" to "play" with protection against tape breakage by means of a novel wind-rewind interlock. High quality recording results are obtained utilizing a magic-eye recording level indicator. The unit may be mounted either horizontally or vertically. For further data, check S122.



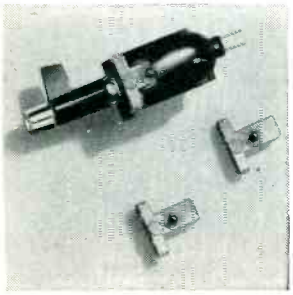
Dyna Output Transformers

Dyna Co. has introduced the first of its new line of high fidelity audio output transformers, the Dynaco A-430, which utilizes new design principles on which patents are pending. The A-430 matches 6550's or 6CA7/EL-34's, and has a guaranteed frequency response plus or minus 1 db from 6 cps to 60,000 cps. Its undistorted power handling capability is 50 watts from 20 cps to 20,000 cps and 100 watts from 30 cps to 15,000 cps. Featuring good TF square wave transmission, its phase characteristics permit substantial feedback without amplifier instability. For details, check S126.



Munston Hi Fi Amplifier

A 10 watt Hi Fi amplifier, the Munston Maestro, of compact design featuring continuously variable equalization for matching original program or individual tone preferences, has been announced by Munston Mfg. Co. The amplifier features Munston's "Dynamic B-T" including calibrated tone controls and a circuit of special design for dynamic control of base-treble response. Frequency response can be adjusted for the establishment of reciprocal curves as a compensation to original recording characteristics. For details, check S128.



Pickering Fluxvalve

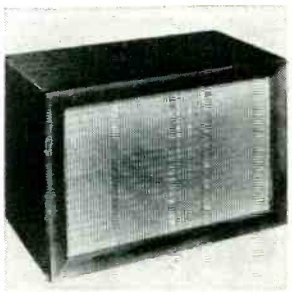
The "Fluxvalve", a new wide-range magnetic turnover pickup with replaceable styli has been introduced by Pickering & Company, Inc. It has extremely high compliance for low tracking force (2-5 grams). The vibratory mass has been reduced to an amount so low that pickup response is flat at 30kc on ordinary vinyl. It is said to be completely free of mechanical resonances in the operating range, and will purportedly make a radical improvement in the way records hold up in use. For data, check S121.

RCA "Mark VII"

A portable 3-speed Hi-Fi phonograph, featuring a frequency range of 70 to 20,000 cycles, has been announced by RCA. The Mark VII contains a 6-inch loudspeaker for low and mid-range frequencies and two 3½-inch loudspeakers for high frequencies. It has an output of three watts undistorted with a maximum of four watts. Its 3-speed record changer has a ceramic flip-over pickup with twin styli, and features a slip-on "45" spindle, one-speed control, automatic last record stop, stabilizer-arm and muting switch. For details, check S129.

Karlson 8" Enclosure

A line of high fidelity loudspeaker enclosures designed for 8" speakers, and utilizing the Karlson principle, has been introduced by Karlson Associates, Inc., making it possible to get definitive bass and tone in a unit which will fit in a bookcase. There are five different models of this new Karlson 8 enclosure. The basic unit of the new line is an easy to assemble kit. Delux models are finished in Blonde or Mahogany plastic. With several generally available speakers the bass range can be extended to below 40 cycles. For further information check S125.



Audiogersh Player

Audiogersh Corp. announces delivery of the 1956 Miraphon Manual Record player, the XM-110A. In this model, due to a special method of motor mounting by means of isomodes, transmission of any vibration to the chassis is completely eliminated. The table moves in a special double row of ball bearings, as does the tonearm; the plug in head accommodates the user's cartridge. It is started by moving the tonearm to the right; at the end of the record it automatically shuts off. For further information check S124.

AFM Suspended Cabinets

Suspended, re-arrangeable TV and hi-fi cabinets, assembled in an "open look" room divider type furniture piece, are rapidly becoming the popular mode of equipment cabinetry. Walnut plywood cabinets with sliding wood doors include housing for TV and complete Hi-Fi equipment, and storage space for records, tapes and films. Natural caning was used for the fronts of the speaker cabinet and the tape storage below the TV unit. All cabinets are independently hung, and the structure may be re-assembled in various arrangements. For details, check S120.

Remler Phone Aid

A new 3-ounce transistorized telephone amplifier powered by dime-sized batteries is now available for those who use telephones in noisy locations and for the hard of hearing. Manufactured by the Remler Co., this phone aid clips over any style telephone receiver. For people with normal hearing the "Scottie" phone aid increases the loudness of overseas and long distance phone calls and improves connections on rural telephones. It is said to increase the acoustic output by 49 DB. For data check S123.

LETTERS From Readers

This Month's Lot Is Devoted To Answers To October's Editorial

Sir: I agree with you, manufacturers should advertise on the serviceman's level because we are his customers and the jobbers are merely the middlemen. After all servicemen are the ones who use the parts, instruments and equipment necessary to service electronic installations and jobbers seem to be more interested in pushing the old lines on hand rather than get the newer ones being offered.

L. B., Robbinsdale, Minn.

Sir: Magazines such as RTSD are the sources from which I get information pertaining to test equipment, new products and anything else about the TV industry. I could not hope to get such information from any of the distributors or their salesmen around here.

W. W. W., Clarkton, N. C.

Sir: Believe me, I have yet to meet the jobber's salesman who could show me and demonstrate a new product or instrument properly. Generally I have to ask my jobbers if they have what I want in stock, what the price is, and then I have to sweat it out waiting for them to get it so they can make delivery. If it were not for the advertising and articles on new test equipment in magazines like yours—and the fact that Service Dealer describes all the new products—we servicemen would probably never know that they were available, because our distributors never take the trouble to keep us informed. Recently an advertisement saying "This instrument does the job better, quicker and more accurately", impressed me. I asked my distributor to demonstrate it. Neither he nor his counterman knew how to go about it so I gave up in disgust and got all the facts direct from the manufacturer. Another thing, distributors around here have been selling retail customers at the same prices they want from us professionals. These money hungry, short-sighted distributors actually steal our customers away from us and then wonder why we prefer to deal with mail order houses or other distributors located in other cities.

R. G. D., Phila., Pa.

Sir: Servicemen usually work pretty long hours and are reluctant to write more letters than necessary but I feel this letter is very necessary. Your statement to manufacturers that we servicemen make up our minds is 100% on the ball. My attitude is typical. I read from cover to cover every page of every magazine I take. Recently I saw an advertisement on a new solder gun and tips and it appealed to me so I phoned my jobber. He said he didn't handle this item but did have another brand like it. I then phoned jobber #2 and got the same reply. So I phoned jobber #3 and he said that although he didn't have the gun that I wanted in stock he would soon have them if I gave him an order. The result is that I at least gave this jobber the order and am now waiting for my new solder gun. I know that jobbers can't carry a stock of all items but the point I want to bring out is this: 2 of the 3 local jobbers didn't even know enough about good business practice to offer to get me what I wanted —or if you want to look at it another way—2 of the 3 jobbers here work on the premise that servicemen should buy what they want to sell them. So sir, you can tell the solder gun maker who advertised in Service Dealer that I bought his gun because his advertisement sold me on it and the distributors around here couldn't switch me into buying the other gun that they wanted to sell, maybe because they make more profit on that brand.

R. E., Vancouver, B. C.

Sir: The answer here is that we take what the jobbers carry in stock except in cases where we are displeased with a product or its maker. The idea being that standard makes are all about the same.

N. S., Los Angeles, California

Sir: It seems to me that we servicemen tend to reject the lines most highly recommended by jobbers. We are a skeptical breed and have learned "the hard way" that we are right in following our own instincts. In this area there is no serviceman's group or association and there's no unity. Woe to him who does not cut his competitor's throat—and, believe it or not, the distributors around here are our worst competitors. Is it any wonder that we are looked down on by the public?

B. R. C., Robert Lee, Tex.

Sir: Many Manufacturers issue catalogs of exact replacement parts but it takes us servicemen a long time to get them and then they quickly become obsolete. My suggestion is that Manufacturers should advertise their replacement parts and the set model numbers they are intended for in Service Dealer. Then I would save time when buying from my distributors. As matters stand, very often they give me the wrong items.

A. P., Clark Twsp., N. J.

Sir: I strive to purchase good merchandise regardless of the distributor. I patronize the ethical distributors and not those who are my competitors.

J. D., Lynwood, California

Sir: Let's all get together and patronize manufacturers who respect the intelligence of servicemen and advertise to them.

R. C., Weymouth, Mass.

Sir: This is my 25th year in electronics and I conduct a very successful business because never, do I listen to a jobber. I make decisions from ads I read and after I have requested Manufacturers' own pamphlets and data sheets.

E. C., St. Johnsbury, Vt.

Sir: You are absolutely right about the power of advertising. I always read ads carefully in search of new and improved equipment. Then I check the specifications claimed for them. It's hard to decide what to buy if you discuss your problems with distributors because, and it's logical—for several reasons their opinions differ widely. I'd prefer to accept the claims of Manufacturers over their own names in their ads.

H. A. C., Asbury Park, N. J.

The ANSWERMAN

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

by **RTSD Technical Staff**

Dear Mr. Answerman:

A large number of foreign automobiles imported to this country use 12 volt electrical systems as well as many of the new American built cars. I would like to know if there is a convenient means of operating 6 volt car radios from these 12 volt systems.

J. D.
Washburn, Ill.

The conversion to 12 volt operation of 6 volt car radios can be done in three different ways. One method is to connect up the radio to one half of the 12 volt battery thus being provided with the desired 6 volts. However, this may

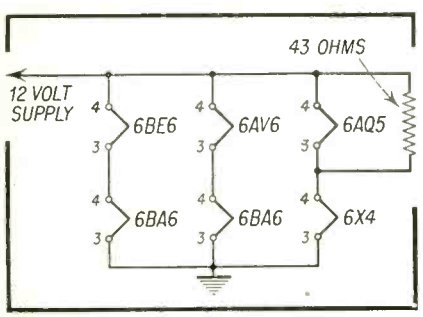


Fig. 1—Connecting 6 volt filament tubes in a car radio for 12 volt battery operation.

prove detrimental to the battery. The 12 volt batteries are constructed with the plates smaller than those used in 6 volt batteries.

The next possibility is to employ a series resistor across which half of the voltage can be dropped thus making available 6 volts to the car radio. Consider that the current flow through this resistor must be in the order of 8 amps, the amount that generally flows in most 6 volt car radios, the power loss in this series resistor is *voltage times current* or 48 watts. This wattage rating should be increased to 100 watts to provide a safety factor. The Clarostat resistor, K-100W, is made especially for this purpose. It is a 100 watt, 1 ohm resistor and is by necessity quite large in physical size.

It can be easily seen that to have a resistor dissipating 48 watts hanging around the car is not only undesirable but wasteful. If it is decided to use this method to obtain the 6 volts the 12 volt source is generally picked up at the ignition switch rather than attempting to connect into the battery itself. The resistor is then suspended at a convenient point on the firewall under the dash.

Another solution to the problem and perhaps the best is to convert the set to operate with 12 volts. This is not as complex as it may at first be thought. Before it is physically attempted, however, it should be determined that the tubes employed will permit 12 volt operation by pairing them without too much difficulty. The filament current will have to be investigated to enable the connecting of tubes in series that draw the same amount of filament current. If one tube used in the radio, such as a 6AQ5 tube is different from as an example the 6X4 tube, it is necessary to connect a shunt resistor of 43 ohms across the tube conducting the least filament current thus bypassing the extra current through the resistor. This can be noted in *Fig. 1.*

In addition to the above another change involves making the B plus obtained from the power supply to the radio the same as that available under 6 volt operation. This necessitates changing the power transformer and vibrator to the 12 volt variety. The proper choice of these items can be determined easily by examining some of the schematics for 12 volt auto radios and choosing items of proper physical dimensions.

Answerman:

I have a condition in an RCA chassis KCS47 series where I have no control over the brightness with the brightness control. Also, there is no sync lock-in action of the horizontal and vertical oscillator circuits.

I suspected that the trouble was in the picture tube, as sometimes a high resistance short exists between grid and cathode of the picture tube do cause difficulties similar to this; but changing or rather substituting a new picture tube did not correct the trouble.

I believe that my trouble is in the 12AU7 *dc* restorer and sync separator circuit but I haven't been able to put my finger on it.

H. C.
Miami, Fla.

You are most probably correct in your belief that the trouble is in the

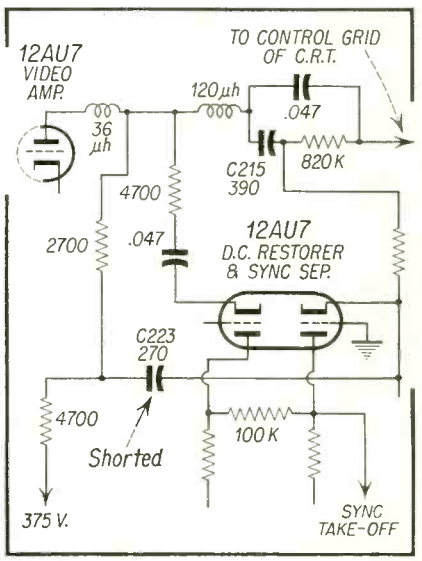


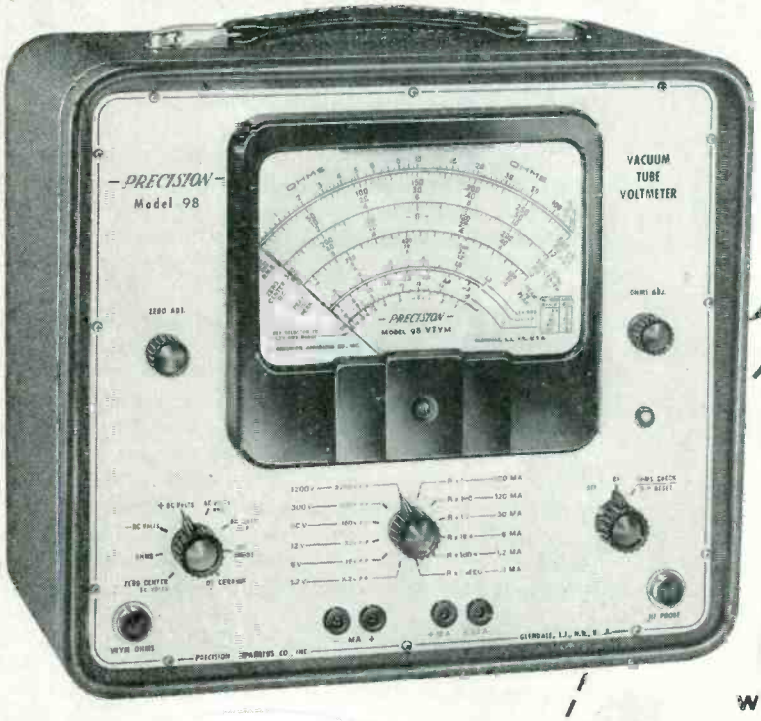
Fig. 2—If C223, 270 μμf shorts it causes no control over brightness, and no sync lock-in action.

12AU7 *dc* restorer and sync separator circuits. If you conduct a close re-examination of the 12AU7 circuit you will probably find that pin #8, the cathode of that triode side, has a high positive voltage, at least higher than the corresponding plate, pin #6. This will cause the tube to be unable to conduct the sync pulses. If the cathode voltage is very highly positive very little sync pulse voltage will be able to overcome the voltage and cause conduction through the tube. This, then, is undoubtedly the cause of the poor sync action.

[*Continued on page 53*]

NOW...MORE RELIABLE ELECTRONIC MEASUREMENTS

including Peak-to-Peak Voltage Ranges to 3200 Volts



VACUUM TUBE VOLTMETERS by PRECISION

The Models 88 and 98 are wide-range, high-impedance, electronic test sets with specially engineered peak-to-peak voltage ranges for exceptionally accurate response to pulsed wave-forms encountered in color and monochrome TV and similar electronic equipment.

PRECISION MODEL 98

WITH 7" FULL-VIEW PACE METER

9 Distinctly Separate Functions
55 Convenient Wide-Spread Ranges

- ☆ **6 True-Zero-Center DC Voltage Ranges.** 26⅔ Megohms input. 0 ±1.2 ±6 ±12 ±60 ±300 ±1200 volts.
- ★ **6 Electronic Ohmmeter Ranges.** 0—1000—100,000 ohms. 0—1—10—100—1000 Megohms.
- ★ **6 Minus and 6 Plus DC Voltage Ranges:** (Left-Hand-Zero) Constant 13⅓ Megohms input resistance. 0—1.2—6—12—60—300—1200 volts.
- ★ **6 High Impedance RMS AC Voltage Ranges:** 0—1.2—6—12—60—300—1200 volts.
- ★ **6 High Impedance Peak-to-Peak AC Voltage Ranges:** 0—3.2—16—32—160—800—3200 volts.
- ★ **5 Special High Frequency Probe Ranges:** Extends AC RMS reading facility to 300 Mc. 0—1.2—6—12—60—300 volts RMS. (Requires optional PRECISION RF-10A HF Probe.)
- ★ **8 DC Current Ranges:** 0—300 microamperes. 0—1.2—6—30—120—600 MA. 0—1.2—12 Amperes.
- ★ **6 Decibel-Output-Meter Ranges:** —20 to +63 DB
- ☆ **One Universal, Coaxial AC-DC VTVM Probe** serves all electronic functions other than high frequency probe ranges.
- ★ **1% Multipliers and Shunts:** wire and deposited-film types.

Model 98-MCP Deluxe: (illustrated) In custom-styled, hooded cabinet and two-color satin-brushed aluminum panel. Case dimensions 11½ x 13 x 6⅝ inches. Complete with 3-way VTVM probe and manual. **Net Price: $109.50**

Model 98-MCP Standard: Complete as above except with black anodized panel in standard black ripple finished cabinet, 10½ x 12 x 6 inches. **Net Price: $104.50**

PRECISION MODEL 88

With Wide-Angle 5¼" PACE Meter

Offers maximum compactness and portability.

Electronically similar to the Model 98, but does not include db and DC current ranges.

Model 88: Complete with detachable AC line cord, internal ohmmeter battery, 3-way coaxial VTVM probe and detailed operating manual. In custom-molded phenolic case and panel, 5⅜ x 7 x 3⅛". **Net Price $69.75**

ACCESSORIES AVAILABLE

Model TV-8: Super-High Voltage Safety Test Probe with X100 Cartridge for DC voltage ranges to 60 kilovolts. **Net Price: $14.75**

Model RF-10A: High-Frequency Vacuum Tube Probe. For direct measurements up to 300 volts and 300 MC. **Net Price: $14.40**

Part No. ST-1: (For Model 88 only) Retractable snap-on stand permits convenient 45° table mounting. **Net Price: $1.00**

PRECISION TEST EQUIPMENT — Standard of Accuracy

PACE — THE METER OF PRECISION

PRECISION Apparatus Company, Inc.

70-31 84th Street, Glendale 27, L. I., N. Y.

Export Division: Morhan Exporting Corp., 458 Broadway, New York 13, U.S.A.
In Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 10, Ontario

trade

An expansion of national service facilities to handle the increased number of Du Mont instruments in the field was announced by Dr. P. S. Christaldi, manager of the Technical Products Division of Allen B. Du Mont Laboratories, Inc. "We plan to expand our national service facilities to insure the most exacting customer service for the ever-increasing number of Du Mont instruments in the field. We will set up separate executive administration for the parts sales and service departments of Technical Sales, which formerly were under a single administrative control."

A specially-designed optical lens that permits the precise location of over 1,000,000 tiny color phosphor dots on the face of a color television picture tube is now being used by the Radio Corporation of America to simplify and speed production of high-quality 21-inch color tubes.

A 40-hour course in color TV, designed to train 20,000 color television servicemen throughout the country, has been inaugurated by Philco Corporation. As the initial step in the Philco Color Television School, service technicians representing all Philco distributors are being brought to Philadelphia factory headquarters in groups of not more than twenty. After these distributor representatives have been fully trained in color television servicing and methods of teaching, they will return to their respective areas to conduct local color TV schools for qualified technicians through the Philco Factory Supervised Service program.

The Cornell-Dubilier Electric Corporation announces the most complete modernization and expansion of its famous "POWERCON" line of vibrator-powered converters in over 20 years. Hitherto limited markets have been expanded to include manifold applications in the marine, aircraft, business office, "ham," appliance, mobile and industrial fields. The new "POWERCON" line, most extensive made by any manufacturer, covers a range of DC-to-AC power outputs from the 2-watt "SHAVER PAK" unit to a 350-watt SUPER HEAVY DUTY model.

Harry R. Ashley, President and founder of Electronic Instrument Co., was recently toasted at a commemoratory luncheon held at the EICO executive offices. Members of the trade press were shown all the ingredients that make up a typical precision EICO Kit (instructions, components, etc.). Especially interesting was the story and explanation of how an EICO Kit is born. As Mr. Ashley stated, the procedure comprises five steps. First, field reports of a market need are gathered and studied. Second, an analysis is made of what similar instruments might exist. Third comes the actual design of the prototype kit. The fourth step consists in testing the prototype kit. Writing instructions is the fifth step.

Capacity crowds of TV dealers and servicemen from all sections of Los Angeles, Long Beach and Orange County are turning out for the four Hoffman Color TV Schools presented by the Hoffman Sales Division of Los Angeles. Complete story on the installation and service of Hoffman 21-inch Colorcasters is presented in the 6-hour training course, which is held on two consecutive evenings from 7:30-10:30 p.m. Schematics and written instructions on set-up procedure for Hoffman color TV sets are distributed

flashes

to everyone attending the schools. Hoffman factory field service engineers Leonard Mathys and Bill Kapler conduct the school, assisted by Jim Sullivan, Hoffman Service of Los Angeles.

A facilities program of over $1,000,000 to implement production of the new Westinghouse all-glass color television picture tube in the Elmira, N. Y. plant was announced by R. T. Orth, vice president of Westinghousie electronic tube division. "Our expanded facilities program is prompted by our confidence that the new Westinghouse rectangular shadow mask picture tube will be ready for commercial production early in 1956," Mr. Orth said. "Our engineers have made such significant progress working with laboratory models in the past two months that we feel sure our color tube will be ready for the market next spring."

Gaily colored auto radio antennas to match the bright modern color schemes of the modern automobile mark a new glamorous era in this once drab-looking product. The new Snyder Fiberglas auto antenna line in color is now being manufactured by Snyder Mfg. Co., 2218 W. Ontario St., here, one of the nation's largest producers of auto radio and television antennas, Bumper Jax and auto accessories.

With the announcement yesterday that a Chicago television station will be the first all-color station in the world, Henry F. Argento, vice president and general manager of Raytheon's television and radio operations today predicted the "log jam" in color TV production will be broken within a "very short time."

Harold Harris, Vice President in charge of Sales and Engineering, of Channel Master Corp., has announced the appointment of Marty Bettan as District Sales Manager for the five boroughs of New York City and Westchester County. Mr. Bettan, widely known throughout the industry, has for the past year headed his own manufacturers' representative firm, servicing parts distributors in the Metropolitan New York market. During the past five years, he has travelled over 450,000 miles in the course of delivering hundreds of technical lectures on the subject of TV antennas.

Over a million more television receivers were produced during the first nine months of this year than during the similar 1954 period, the Radio-Electronics-Television Manufacturers Association reported. Radio production during the same period nearly totaled the entire output for 1954, the Association added. January through September output totaled 5,760,506 TV sets, RETMA reported, compared with 4,733,315 produced during the same 1954 period. In the first nine months, RETMA reported that 10,027,362 radios were manufactured compared with 7,042,442 turned out during that period of 1954. Total 1954 radio production had been 10,400,530.

The Magnavox Color TV Service Training Program which was inaugurated in San Francisco early this month was opened in New York City, Monday, October 31. Week-long classes will be conducted at the New York Trade School for Magnavox Eastern Division dealers and authorized service agencies according to General Service Manager, R. J.

[Continued on page 50]

ASSOCIATIONS

[from page 16]

apprehensions of the proceedings that took place. To quote Mr. Barlow:

"Out of the meeting came a resolution adopted by voice vote that the delegates ask their associations to join NATESA. Most of the delegates (considering the late hour and the turn that the meeting had taken) went along with the resolution as an act of resignation, rather than the enthusiasm that would have greeted a more positive step.

"It is my feeling that very few of the associations represented at the meeting will go along with the resolution, but will adopt a 'wait and see' attitude. Fortunately, the Electronic Service Council for Unity was not disbanded and it is likely that a more 'experienced' group of delegates may once more meet, and that the desires of the majority of the independent service associations to form a truly representative American Television Association will not be frustrated again!"

TELSA—Connecticut

New officers of the Hartford Chapter are as follows:

Peter Lukawicz, President; Harold Mann, Vice President; Jerry Ottenberg, Recording Secretary; J. R. Britney, Sr., Corresponding Secretary; I. Sherry, Treasurer; B. Cohen, Publicity & Advertising Director.

TRADE FLASHES

[from page 49]

Yeranko. Company field service engineers under the direction of Service Training Director, Charles Kayhart, will instruct students in a course which stresses practical set-up and trouble-shooting procedures. The Magnavox 35-hour service course will be repeated until all service technicians who qualify have received this training.

CBS-Hytron, a Division of Columbia Broadcasting System, Inc., has introduced a new Fiberglas Drop Cloth to protect floors and rugs while the service technician repairs radio and television sets. The cloth is being made available to service-dealers through CBS tube distributors. Unlike others being used, this blue and white Drop Cloth, which is 37 by 48 inches, is fire-resistant and protects against drops of hot solder. It can be used to cover a chassis carried in the rain, is easy to clean, and folds compactly into a tube caddy.

Jobbers evidently recognize a good "deal" when they see one. Recently the Finney Company sent 423 Distributors a bonus-gift offer on their new line of Finco Geometric TV Antennas. A personalized zipper case contained the material. Within a short period of time 257 different jobbers ordered the maxi-

mum quantity of antennas offered in the two-for-one proposition; and we hear that many passed on a part of their savings to their Service Dealer customers.

A transistor radio that derives its power from the sun, requires no tubes or replaceable batteries, and which conceivably could last a lifetime without repair, was announced by Admiral Corporation. But before anybody rushes out to buy one it should be explained that while the receiver works satisfactorily, it is still entirely experimental. Developed in the company's research and development laboratories, the solar receiver resembles a conventional table radio, contains volume and station selector knobs, and a loudspeaker. On one end is a control knob for turning the radio on or off and changing it from solar operation to a flashlight-size standby battery which is recharged by the sun's rays. The standby cell is capable of continuous operation for 50 hours without re-charging.

Three leading manufacturers have joined together to create a product which will make eight TV channels available to every Ark-La-Tex area TV set owner. The product, the Finco Ark-La-Tex Geomatic Unit, comprised of tower, rotator, and antenna, is custom-designed to bring in with perfect clarity Channels 6 in Texarkana, 7 in Tyler, 5 in Alexandria, 8 in Monroe, 9 in Lufkin, 10 in Eldorado, 12 in Shreveport, and the new Channel 3 in Shreveport. The components of the Finco Ark-La-Tex Geomatic Unit are each produced by a foremost manufacturer in his field: the television tower by Spaulding Products Company; the antenna rotator by Crown Controls Company, Inc.; the TV antenna by The Finney Company.

TUNERS

[*from page 13*]

section of the tuner by releasing the spring clips at both ends of the barrel shaft. With the barrel removed, take voltage and resistance measurements at B+ points (*Fig. 2*). Examine the stationary spring contacts for breaks, poor contacts or possible broken connecting leads to the contacts. Look for burnt resistors or broken feed-through condensers. (*Fig. 2—C21, C23*).

If the trouble is found, the replacement parts should be similar in all respects. For example, if a 47 $\mu\mu f$, 200 WV ceramic condenser is defective, it should be replaced with a 47 $\mu\mu f$ 200 WV ceramic condenser.

These alignment and repairing hints can be useful only if considerable care

SPECIAL OFFER TO OUR READERS!

By special arrangement with John F. Rider Publisher, Inc., RADIO-TV SERVICE DEALER now brings you a COMPLETE diagram service to help you do a faster, easier servicing job!

ALL COMPLETE! ALL FACTORY PREPARED! ALL FACTORY AUTHORIZED!

- ✓ **Just $1.25 for COMPLETE SERVICING INFORMATION on any TV receiver . . . any year, any make, any model . . . from 1946 on!**
- ✓ **Just 75¢ for COMPLETE SERVICING INFORMATION on any radio . . . any year, any make, any model . . . from 1941 on!**

TAKE ADVANTAGE OF THIS SPECIAL OFFER . . . MAIL THE COUPON TODAY!

Radio-TV Service Dealer, 67 W. 44 Street, New York 36, N. Y.
Please RUSH me the following diagrams:

RADIO DIAGRAMS @ 75¢ EACH		
CHASSIS #	MAKE	MODEL #

TV DIAGRAMS @ $1.25 EACH		
CHASSIS #	MAKE	MODEL #

MAKE ALL CHECKS & MONEY ORDERS PAYABLE TO Radio-TV Service Dealer
(For all New York City orders, please submit additional 3% sales tax.)

Name .....

Address .....

City ..... State .....

is followed in the alignment and handling of the tuner. These tuners are built for long wear, so try repairing it before any attempt is made to replace it.

TABLE FOR VIDEO AND SOUND CARRIERS

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

ANSWERMAN

[*from page 46*]

Now, if pin #8 has a positive voltage on it so will the grid of the picture tube, that is, higher than normal or what the schematic calls for. This will result in the grid of the picture tube being more positive than the cathode, thereby resulting in the tube not being cutoff by the brightness control voltage in the cathode circuit of the picture tube. The reason for this is that the cathode can't be made more positive than the grid which is the same as saying that the grid can't be made more negative than the cathode which will bias the tube to cut off or reduce the tube current.

Now, what component failure can bring about these voltage changes. Either of two condensers shorting will do it. If condensers *C215* or *C223* shorts it will place positive voltages at the points mentioned above resulting in the complete disruption of the proper circuit action, as can be seen in *Fig. 2*.

VOLTAGE REGULATING TRANSFORMERS

[*from page 39*]

setting of the Voltage Changer. Under full rated load conditions, the losses or power consumed by the Voltage Changer itself amounts to approximately 20 Watts. This is about 5% increase over the power consumed by the TV set operating alone.

As A Tube Brightener

In addition to the above, the unit may often be used to restore near normal brilliance to old TV sets by applying line voltage to a lower value tap. The resulting slight increase in input voltage to the set will provide a sharper and brighter picture without usually appreciably affecting other adjustments.

Serviceman's Shop Use

The serviceman can find use for the Voltage Changer in the shop as a source for a varied range of supply voltages. Besides its use to compensate for line voltage drop in providing exact rated voltages for checking purposes, it can be used to apply a 20 to 30% overvoltage to TV or radio equipment in checking for a suspected weak component by switching line voltage to a lower rated tap, thus placing a correspondingly higher voltage on the equipment. By connecting the unit in reverse, the serviceman has available voltages from 65 to 145 volts for a variety of purposes, such as operating soldering irons at half power when not in immediate use, connecting to battery charging equipment for accelerating or decelerating rate of charge, varying speed of motors, drills, and a variety of other uses.

INTENSITY MOD. MARKERS

[from page 22]

It was noted previously that with this system of intensity modulated markers the marking signal does not pass through any portion of the receiver being aligned. It is precisely for this reason that intensity modulated markers are just as clearly visible in the trap portions of a response curve as they are on the upper portions. Since the marker signal doesn't pass through the receiver, it cannot be attenuated by the various trap circuits. See *Fig. 6*.

For the same reason, it is impossible for the marker signal to cause distortion of the response curve by overloading any of the receiver stages, or to cause oscillation.

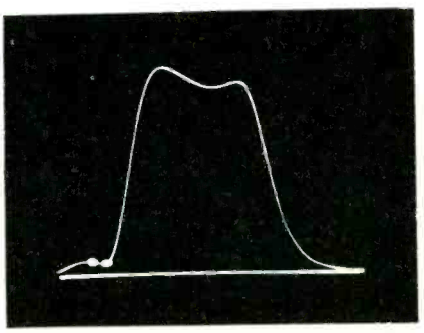


Fig. 6—Intensity modulated marker is visible in trap portion of swept curve of receiver.

It will be noted from *Fig. 5* and from the previous discussion, that the Calibrator must receive a signal from the sweep generator similar to that fed to the receiver being aligned. If the Weston Model 984 Sweep Generator is used in conjunction with the Model 985 Calibrator, provision for this connection is made on the Sweep Generator panel. If however a different manufacturer's sweep generator is used, the sweep signal for the calibrator may be taken from the regular sweep output using coaxial cable and a series decoupling resistor of about 500 ohms. If this should be done it is important to check the output of the generator to make certain that it delivers a flat output. It might be necessary to experiment with the size of the decoupling resistor to produce this flat output.

It was mentioned previously that the calibrator can deliver negative as well as positive pulses to the Z axis, by reversing the crystal detector polarity. When this is done the trace is extinguished rather than brightened, and the appearance of the response curve is as shown in *Fig. 2*. Notice that the markers are now indicated as breaks

in the curve. Either method may be used.

Another very useful feature of the calibrator is the ability to display markers at the sound carrier and the video carrier simultaneously as shown in *Fig.* 7. This is accomplished in the following way. The crystal selector switch is set to select the 4.5 *mc* crystal. The mixer in the calibrator now receives three signals, namely the sweep frequency signal from the sweep generator; 4.5 *mc* from the internal crystal, and the frequency to be marked from the internal variable oscillator. Suppose we wish to display markers simultaneously at 45.75 *mc* and 41.25 *mc*. If the calibrator dial is set at 45.75, the mixing action between the internal oscillator and the crystal will produce sum and difference frequencies. There will not be present at the mixer output four signals having frequencies of 4.5

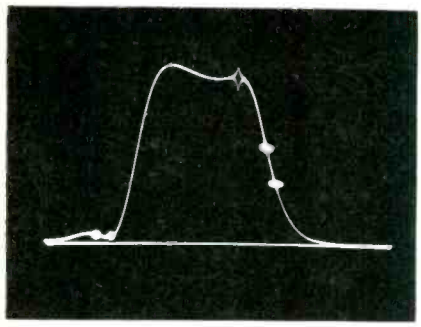


Fig. 7 — Simultaneaus display of markers at sound and video carriers of swept portion of curve.

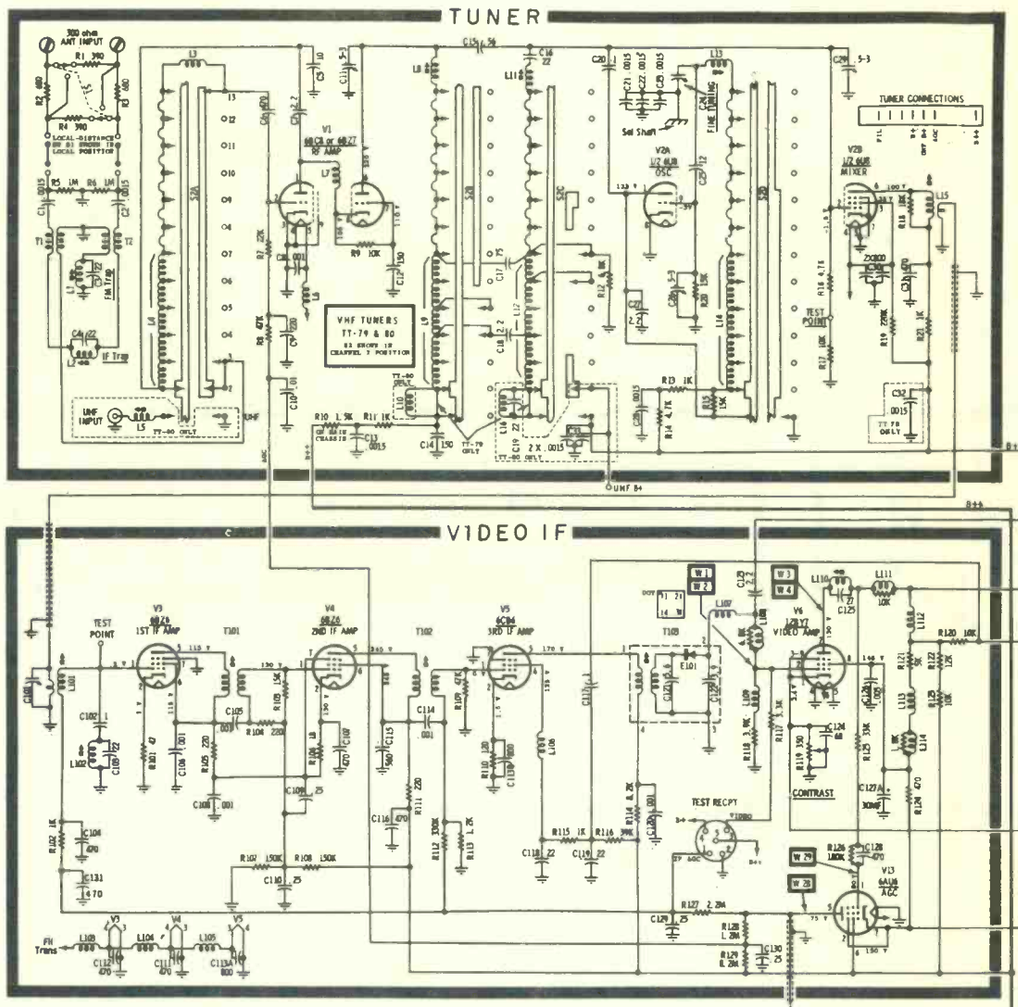
mc, 45.75 *mc*, 41.25 *mc* and 50.25 *mc*. The first two of course are the original frequencies, the third is the difference frequency and the fourth is the sum frequency.

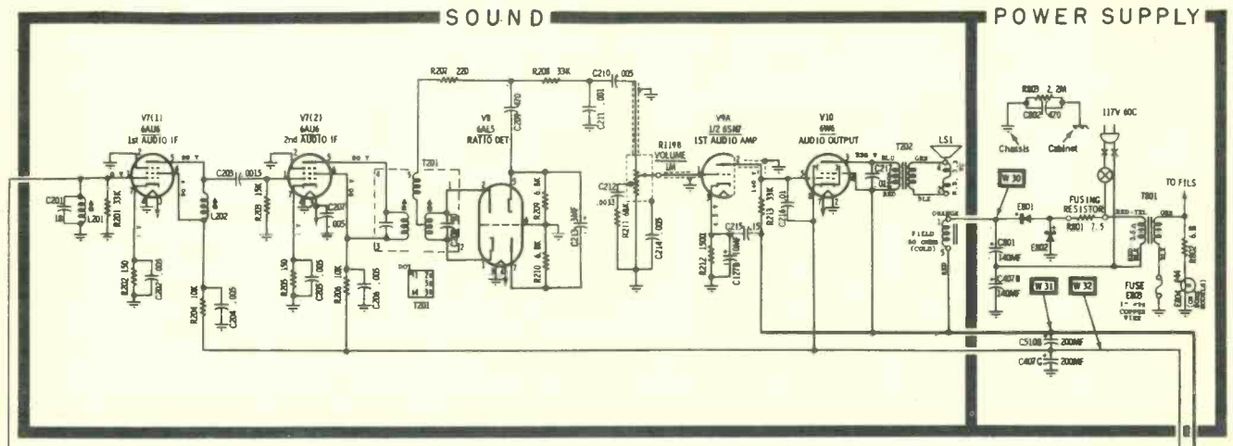
As before, the swept frequency is also fed into the mixer stage. The action which takes place now is similar to that described previously. Each of these four frequencies beats with the swept frequency and when beat frequency is 75 *kc*, a pulse of voltage is delivered to the 2 axes. In this case there are four points at which the markers would appear. Since the sweep range was from 40 to 50 *mc*, only two points on the curve would be marked, namely the 41.25 and the 45.75 *mc* points. The 4.5 *mc* and the 50.25 *mc* points would be outside this particular swept band.

If the tuning on the calibrator is changed the markers move simultaneously, but always maintaining a separation of 4.5 mc.

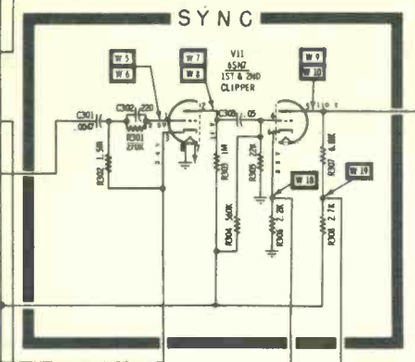
An interesting point to notice in *Fig.* 7 is the presence of a spurious marker pip. This presents no problem here. It is simply disregarded, since only the intensity modulated pips have any significance in this type of alignment.

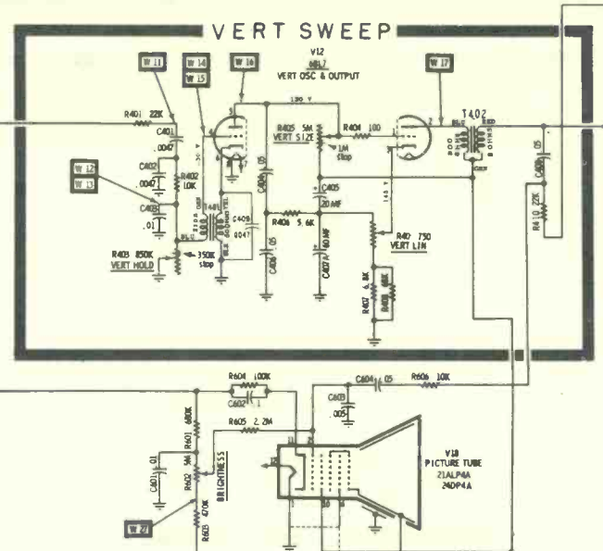
Advertising Index

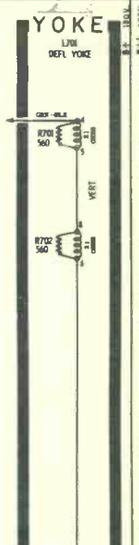

TUNER
VHF TUNERS TT-79 & 80
TUNER CONNECTIONS
UHF B+

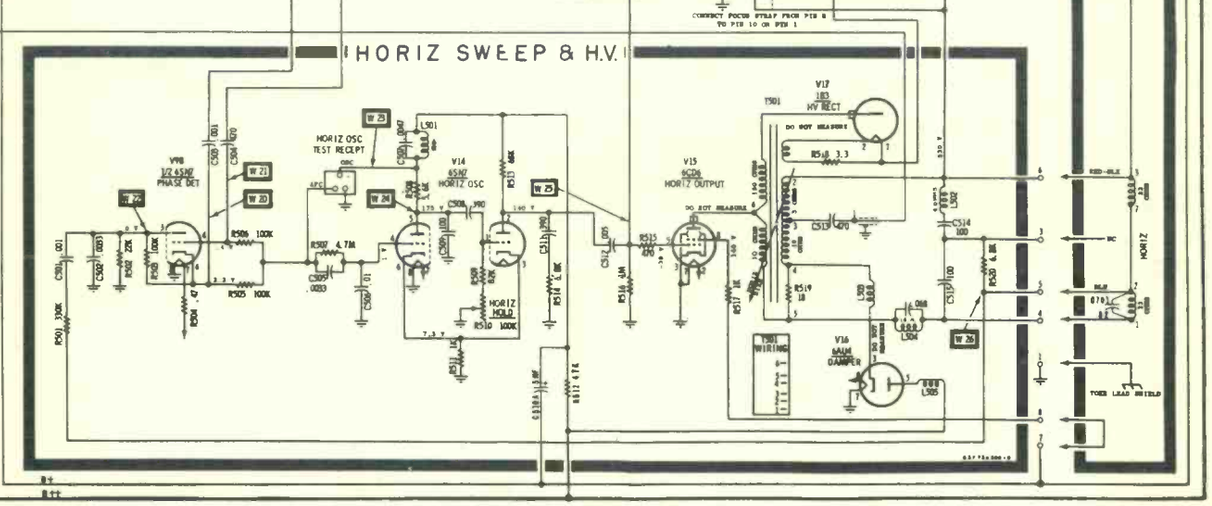

SOUND
POWER SUPPLY
1st AUDIO IF
2nd AUDIO IF
RATIO DET
1ST AUDIO AMP
AUDIO OUTPUT
VOLUME
FUSE

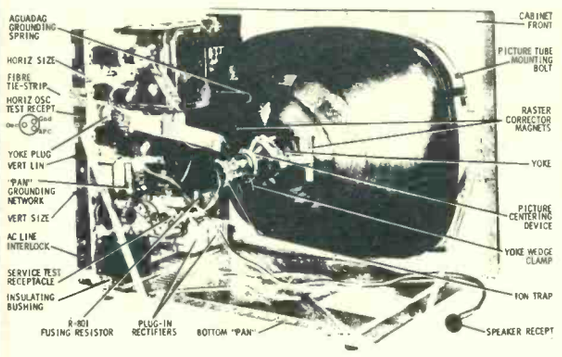
VIDEO IF
1ST IF AMP
2ND IF AMP
3RD IF AMP
VIDEO AMP
TEST RECPT
CONTRAST

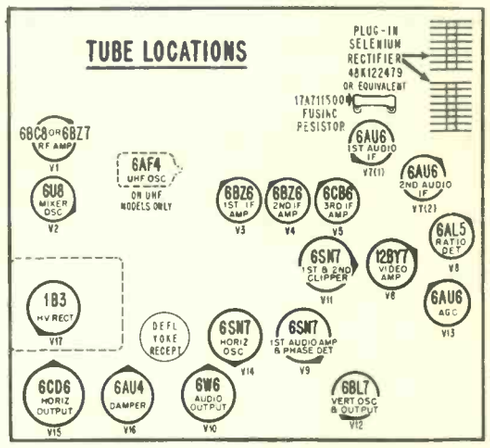

SYNC
CLIPPER


VERT SWEEP
VERT OSC & OUTPUT
VERT SIZE
VERT LIN
VERT HOLD


YOKE
DEFL YOKE


HORIZ SWEEP & H.V.
HORIZ OSC TEST RECPT
PHASE DET
HORIZ OSC
HORIZ OUTPUT
HV RECT
DAMPER


AQUADAG GROUNDING SPRING
HORIZ SIZE
FIBRE TIE-STRIP
HORIZ OSC TEST RECEPT
YOKE PLUG
VERT LIN
"PAN" GROUNDING NETWORK
VERT SIZE
AC LINE INTERLOCK
SERVICE TEST RECEPTACLE
INSULATING BUSHING
R-801 FUSING RESISTOR
PLUG-IN RECTIFIERS
BOTTOM "PAN"
CABINET FRONT
PICTURE TUBE MOUNTING BOLT
RASTER CORRECTOR MAGNETS
YOKE
PICTURE CENTERING DEVICE
YOKE WEDGE CLAMP
ION TRAP
SPEAKER RECEPT


TUBE LOCATIONS
PLUG-IN SELENIUM RECTIFIER 48K122479 OR EQUIVALENT
17A7115000 FUSINC RESISTOR
6BC8 OR 6BZ7 RF AMP V1
6AF4 UHF OSC ON UHF MODELS ONLY
6U8 MIXER OSC V2
6BZ6 1ST IF AMP V3
6BZ6 2ND IF AMP V4
6CB6 3RD IF AMP V5
6AU6 1ST AUDIO IF V7(1)
6AU6 2ND AUDIO IF V7(2)
6AL5 RATIO DET V8
6SN7 1ST & 2ND CLIPPER V11
12BY7 VIDEO AMP V6
6AU6 AGC V13
1B3 HV RECT V17
DEFL YOKE RECEPT
6SN7 HORIZ OSC V14
6SN7 1ST AUDIO AMP & PHASE DET V9
6CD6 HORIZ OUTPUT V15
6AU4 DAMPER V16
6W6 AUDIO OUTPUT V10
6BL7 VERT OSC & OUTPUT V12

TUNER

SOUND

POWER SUPPLY

SYNC

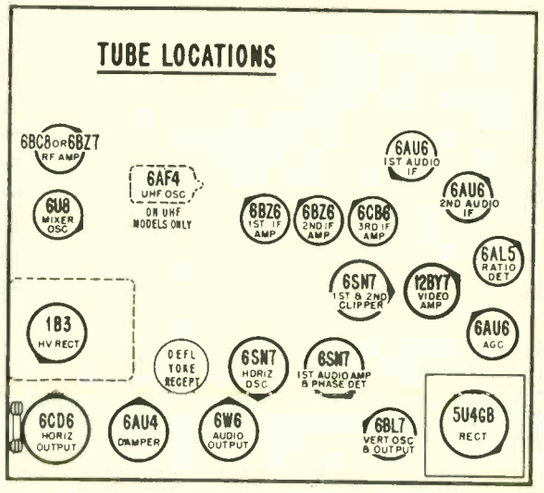
VERT SWEEP

YOKE

VIDEO IF

HORIZ SWEEP & H.V.

TUBE LOCATIONS



CAPACITOR VALUES UNDER 1000 ARE IN MMF. ALL OTHERS IN MF UNLESS OTHERWISE SPECIFIED.

NOTES

VOLTAGE MEASUREMENTS

1. Made with a VTVM from point indicated to chassis.
2. Line voltage - 117 volts
3. Antenna disconnected and input shorted across.
4. Channel selector switch on channel which develops least noise at pin #3 of test receptacle.
5. Contrast control "off", maximum counterclockwise position.
6. All other controls in normal operating position.
7. Voltages associated with variable-control circuitry will vary with control setting.

WAVEFORMS

1. Designated by "W" prefix and numerical reference.
2. Photographs of waveforms are on pages preceding the schematic.
3. Required circuit conditions are given with each waveform.
4. Waveforms observed on wide-band oscilloscope.

TUNER

SOUND

POWER SUPPLY

SYNC

VERT SWEEP

YOKE

VIDEO IF

HORIZ SWEEP & H.V.

CAPACITOR VALUES UNDER 1000 ARE IN MMF.
ALL OTHERS IN MF UNLESS OTHERWISE SPECIFIED.

NOTES

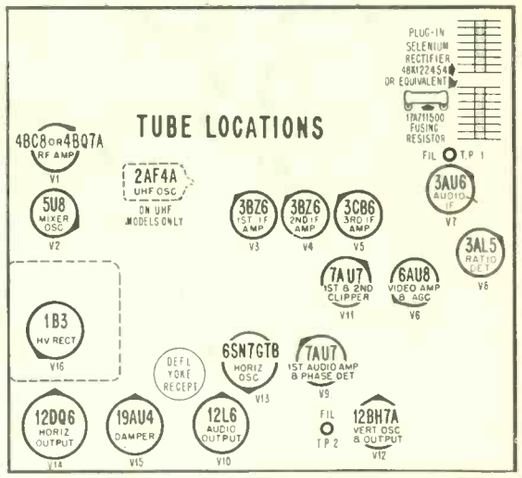
VOLTAGE MEASUREMENTS

1. Made with a VTVM from point indicated to chassis.
2. Line voltage - 117 volts (use Isolation Transformer).
3. Antenna disconnected and input shorted across.
4. Channel selector switch on channel which develops least noise at pin #3 of test receptacle.
5. Contrast control "off", maximum counterclockwise position.
6. All other controls in normal operating position.
7. Voltages associated with variable-control circuitry will vary with control setting.

WAVEFORMS

1. Designated by "W" prefix and numerical reference.
2. Photographs of waveforms are on pages preceding the schematic.
3. Required circuit conditions are given with each waveform.
4. Waveforms observed on wide-band oscilloscope.

TUBE LOCATIONS



HORIZONTAL OSCILLATOR ADJUSTMENT

The HORIZONTAL HOLD control should have a sync range of approximately 30°. If the control is too critical, adjust as follows:

1. Set all controls for normal picture.

2. Short AFC voltage to ground and shunt HORIZONTAL OSCILLATOR coil, L-501. to ground with a .1 mfd 400 volt capacitor. This may be done with the chassis in the cabinet by using the HORIZONTAL OSCILLATOR TEST RECEPTACLE.

3. Adjust HORIZONTAL HOLD control to the point where the picture almost remains stationary...as far as horizontal sync is concerned.

4. Remove the .1 mfd capacitor shunting the HORIZONTAL OSCILLATOR coil and without turning horizontal hold control, adjust HORIZONTAL OSCILLATOR coil to the center of the range in which the picture almost remains in sync horizontally.

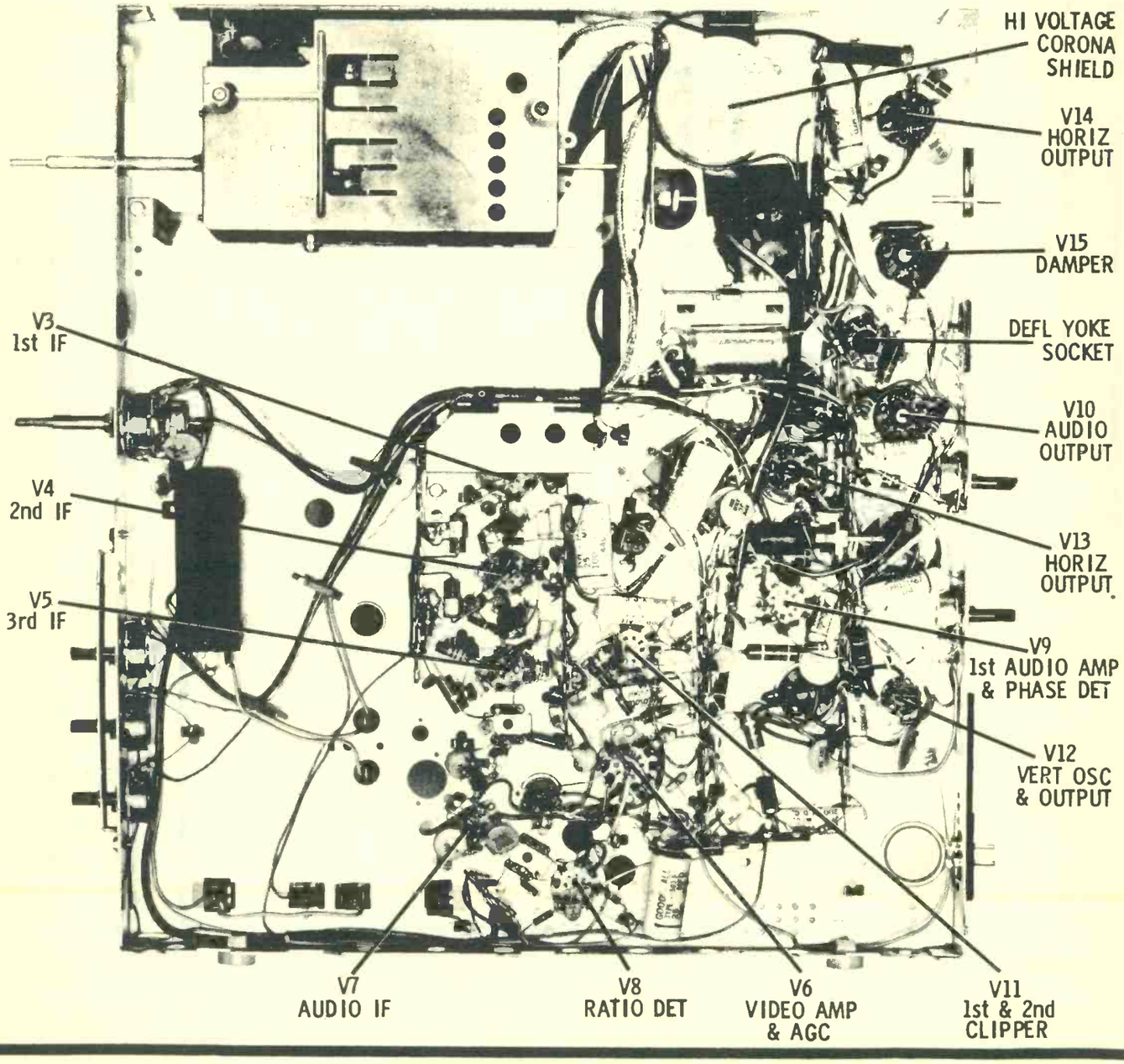
5. Remove short from AFC voltage to ground and adjust HORIZONTAL HOLD control so that no fold-over appears on either side of the raster.

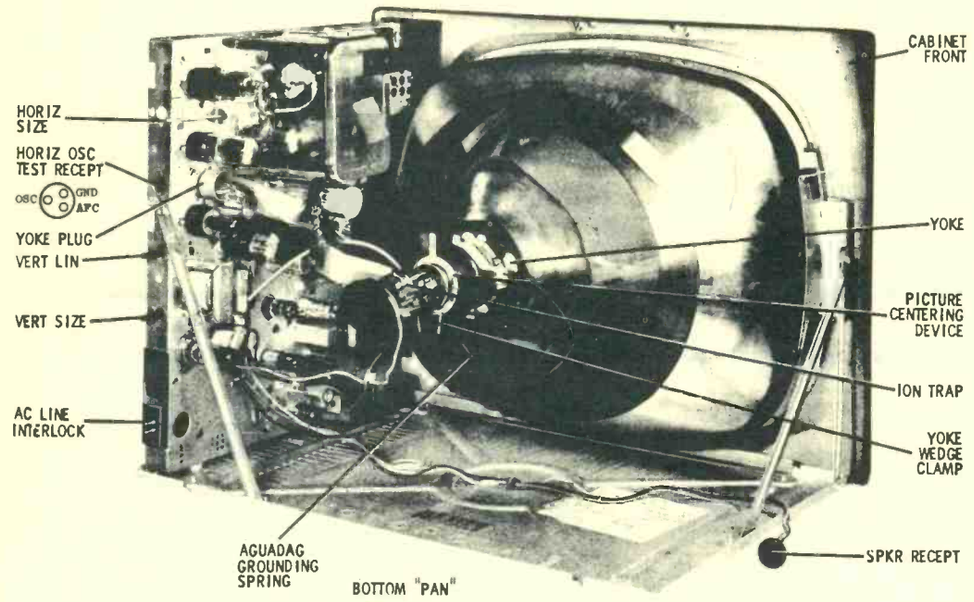
SERVICE TEST RECEPTACLE

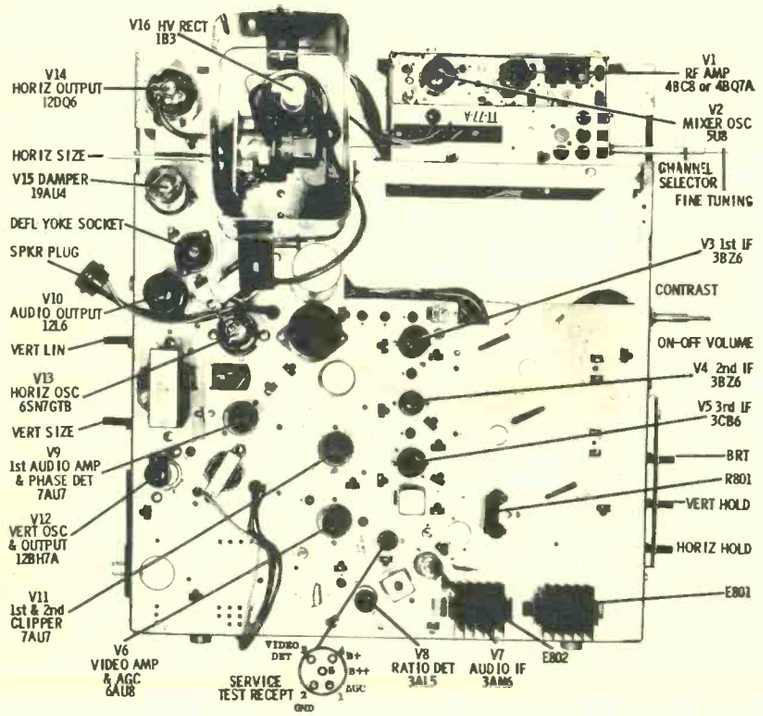
A SERVICE TEST RECEPTACLE. accessible from the rear of the cabinet after the back has been removed. provides the following test points (see Figure 5).

Pin	Connection to
1	AGC
2	Ground
3	Video detector output
4	B+
5	B++

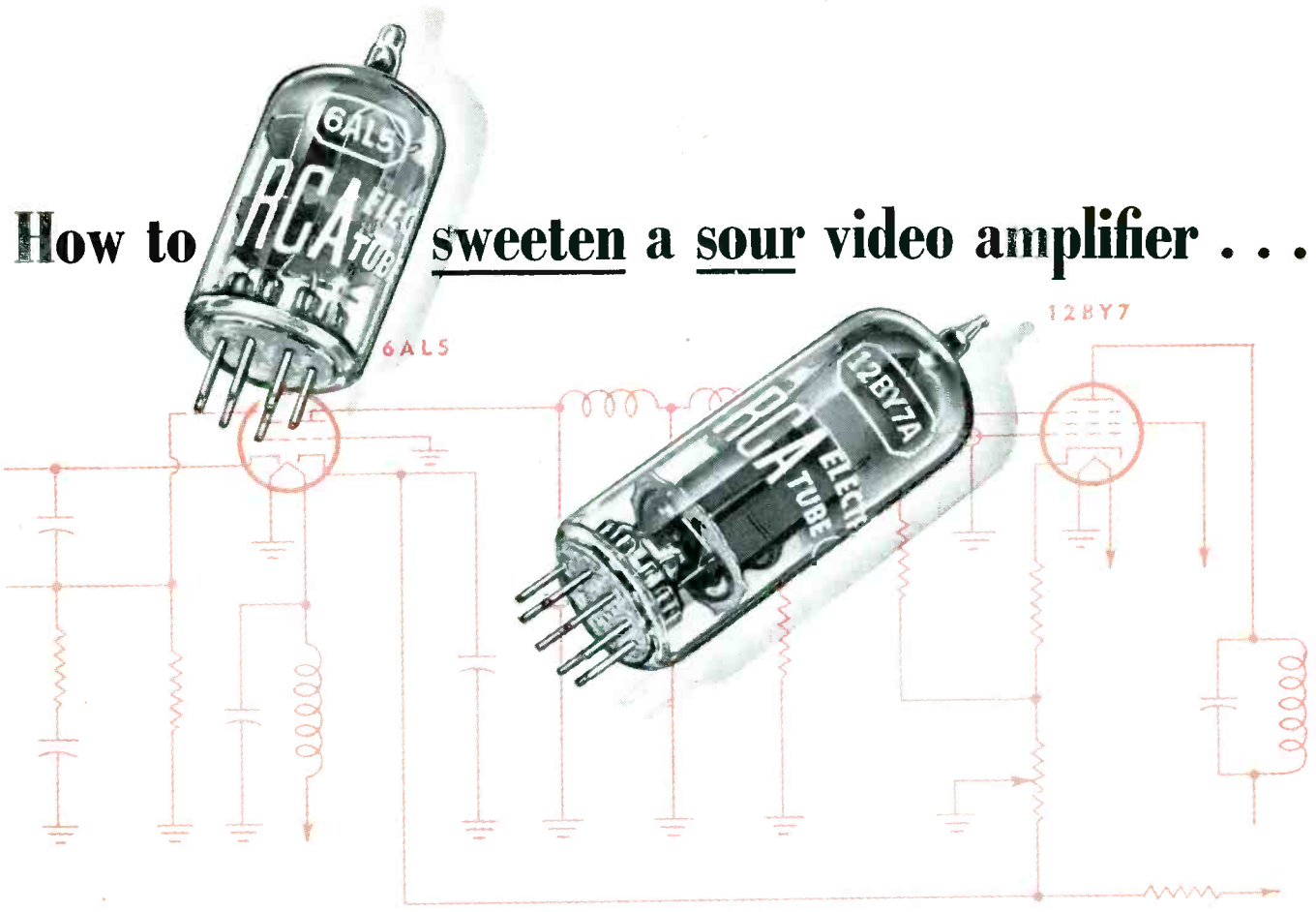
These test points provide rapid checking of the power supply voltages--giving the approximate condition of the selenium rectifiers and the line voltage. Operation of the receiver from the antenna to the detector may be checked by the use of pin #3 (detector output). Pin #1 allows rapid checking of the AGC voltage. It is suggested that this voltage be checked and recorded at the first opportunity by the service technician using a receiver in normal operating condition. Such AGC voltage information may be invaluable when checking sets in which the AGC action is doubtful. This voltage varies according to the signal strength and may range from a very low value (zero) to about 9 volts minus.







How to sweeten a sour video amplifier . . .



Use RCA Tubes with Built-In Quality!

In 2nd picture detectors and video amplifiers, a "sour" 12BY7-A or 6AL5 can *wash out* or *smear* a picture and make a.g.c. ineffective. In video amplifiers with critical requirements, fine performance *depends* on good tubes in the sockets. Strict quality control and selected materials used in the manufacture of RCA tubes give you replacement tubes conforming to TV set manufacturers' requirements for top performance—your assurance of better picture and sound fidelity.

In circuits so vital to clear, sharp pictures—use only long-lasting top-quality tubes—that means RCA TUBES. Your customers will see and hear the differences.

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

First choice for TV circuits . . . dependable RCA Tubes.

SMASH THE

"distance barrier"

—WITH telrex

THUNDERBIRDS

- Duplexed Elements for Maximum Gain
- Compensated "Trombone" Matching Sections for Maximum Efficiency
- Full Video and Audio Bandwidth for Maximum Black and White and Color Fidelity
- Hi-Strength Aluminum, Quick-Rig Construction

new! Telrex Hi-Frequency Yagis for Dual Channel Reception

Precision tuned and matched for super-performance. Featuring famous Telrex ruggedized all-aluminum construction and quick-rig design that saves you time and money on every installation!

Model Y7X1 (7-8-9) for channels 7, 8, and 9.

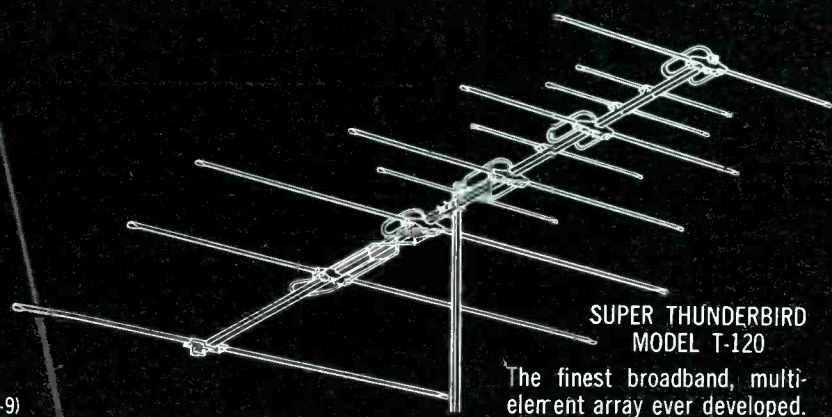
Model Y8X1 (10-11) for channels 10 and 11.

Model Y8X1 (12-13) for channels 12 and 13.

Producers of famous "BEAMED-POWER" Communication Rotaries. Call or write for new catalogs on TV Antennas, Commercial Arrays or Amateur Rotaries.

•

"Conical-V-Beams" are produced under U.S. Patent No. 23,346, Canadian Patent No. 500,436 and British Patent No. 691,485—other patents pending. Sold only through authorized distributors.

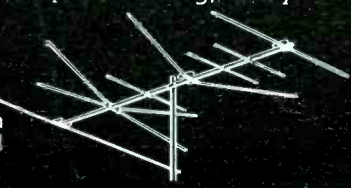


SUPER THUNDERBIRD MODEL T-120

The finest broadband, multi-element array ever developed.

New Distance Smashers for All-Channel TV!

These new multi-element, Broadband "Beamed-Power" Arrays are Telrex-designed especially for fringe and sub-fringe area reception, wherever exceptional sensitivity and maximum directivity are required. For extra performance at low cost, install Telrex "Thunderbirds"—the "hurricane-designed" arrays that provide lasting installations! Call or write for complete catalog, today!



TELREX THUNDERBIRD Model T-130 features Conical Dipole and "V" Beam elements for maximum results per dollar!

telrex INC.

"CONICAL-V-BEAMS"

AMERICA'S STANDARD OF COMPARISON!

ASBURY PARK 5
NEW JERSEY, U.S.A.
Tel. PRospect 5-7252

•

Canadian Distributor:
DELHI METAL PRODUCTS, LTD., Delhi, Ontario