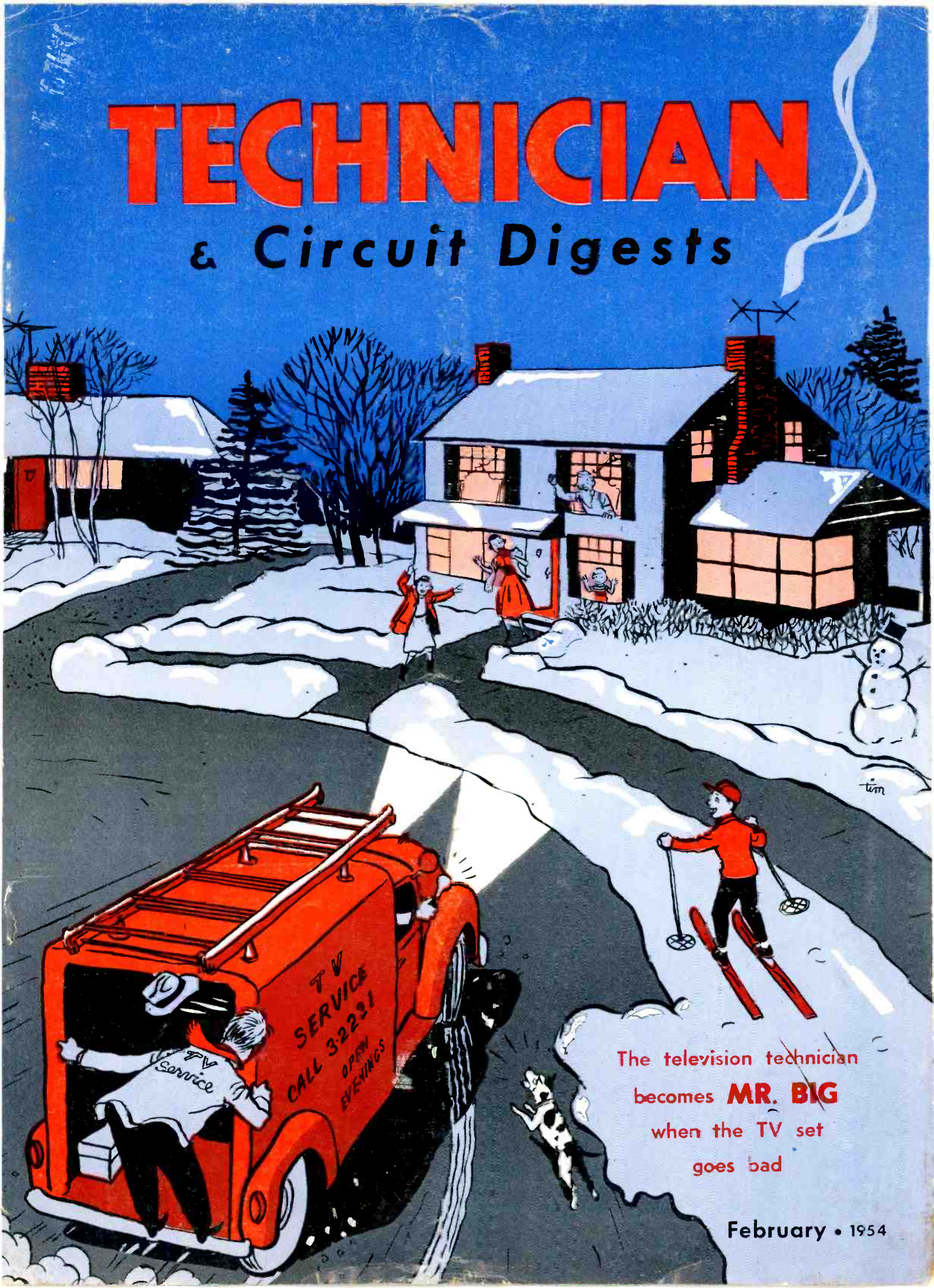
TECHNICIAN

& Circuit Digests



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February • 1954

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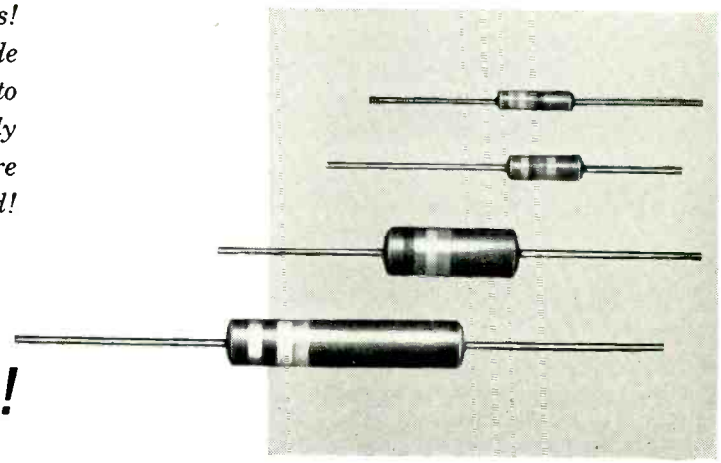

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FEBRUARY, 1954

*CIRCUIT DIGESTS (See pages following p. 72)

ADMIRAL: Chassis 20A2, 20A2Z, 20D2
GENERAL ELECTRIC: "EE" Chassis
MAGNAVOX: Chassis 108A Series
RAYTHEON: Chassis 21T11
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1 Merit devotes their undivided attention to service requirements for transformers and coils. THERE is no competition for the time and effort of Merit engineers and production, whose sole responsibility is to design and produce what the service field wants and needs when it is needed

Merit--exclusively for service.

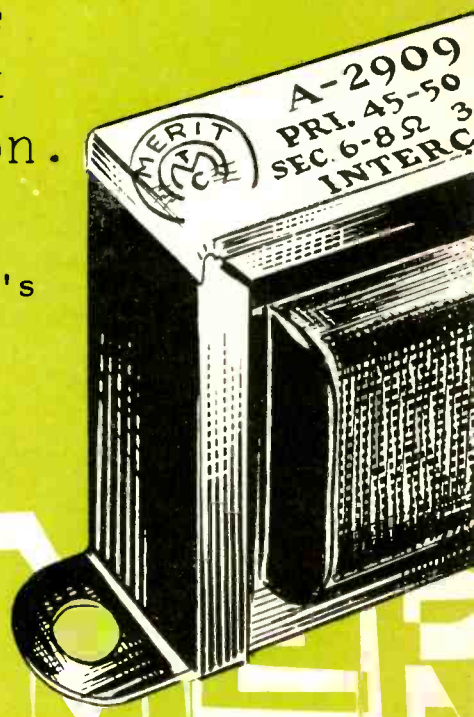
MER

4 POINT

2 Merit actively aids in service. Merit transformers and yokes retain actual operating characteristics of the original components but design improvements simplify replacement installation. Merit installation instructions are more complete than any others available.

Merit's is the most complete replacement catalog and the Merit replacement guide is ahead of service requirements.

Merit transformers are tape marked* for quick positive identification.



Find Merit's complete line listed in John Rider's Tek-File and Howard Sam's Photofacts and Counter Facts.

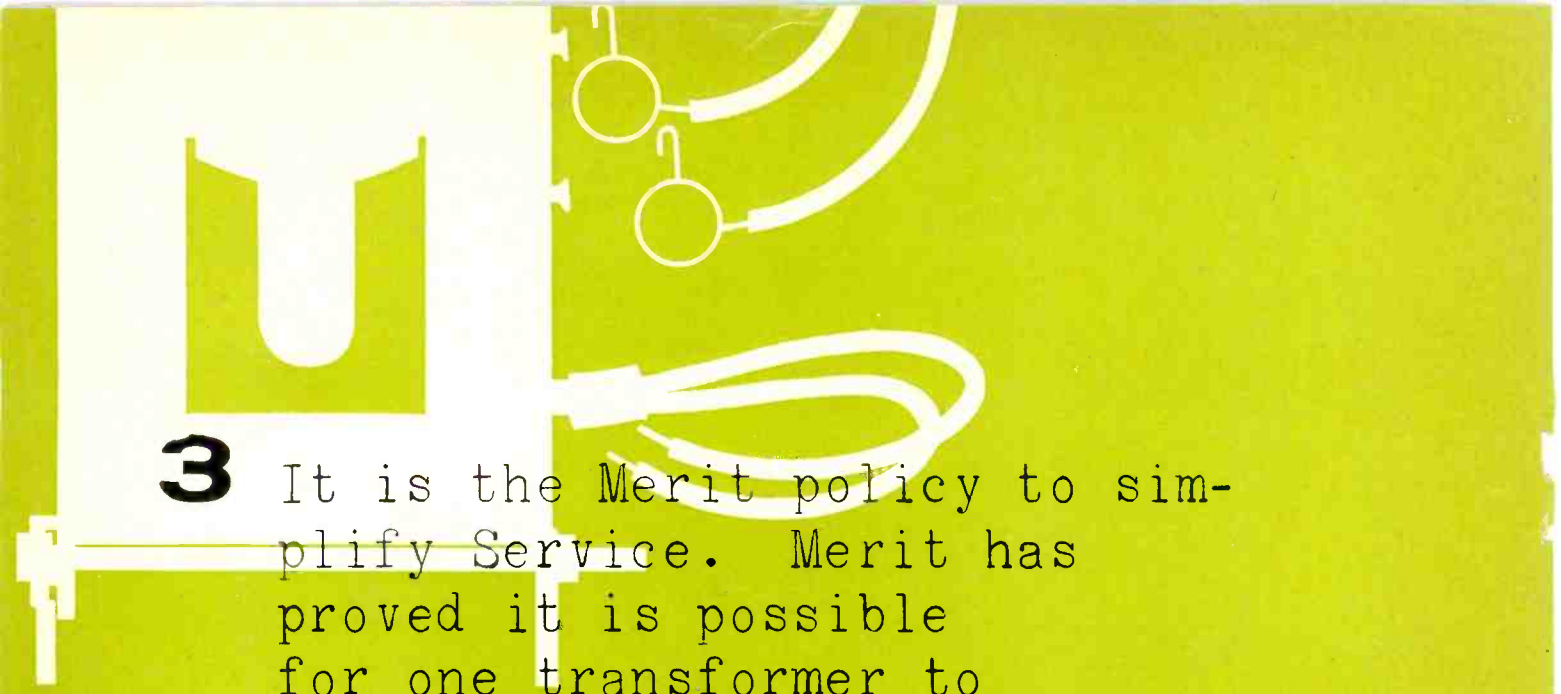
*originated by Merit.

TV "REPL"

MERIT TRANSFORME
4427 North Clark Street

MERIT

PROGRAM 4 POINT PROGRAM



3 It is the Merit policy to simplify Service. Merit has proved it is possible for one transformer to serve a multiple purpose -- that is replace more than one particular unit without sacrificing the essential operating efficiency of any of the various original components. Exact replacements are included in the Merit line only when substitution would complicate replacement labor. A stock of Merit replacements is always live -- there are no dust-catchers in the Merit line.

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4 POINT PROGRAM 4 POINT P

4 Chicago, ✓
Hollywood, ✓
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3 modern plants
prove Merit
means: Service needs service.

Wherever the customer
is located there is a
Merit plant dedicated to
turning out service requirements
fast for his area.

The whole country is Merit's
backyard and <u>all</u> customers
are preferred.

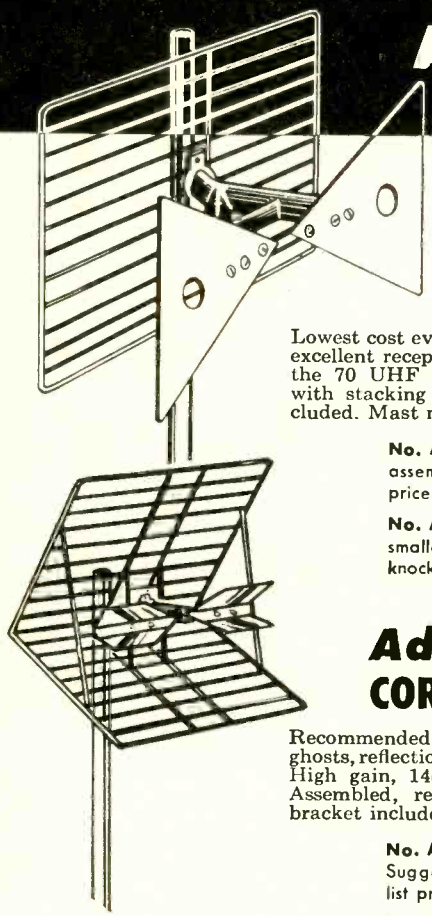
MERIT MER

ROGRAM 4 POINT PROGRAM

Admiral

ALL-CHANNEL UHF ANTENNAS

HIGH GAIN LOW COST



Admiral BOW TIE

Lowest cost ever for a quality UHF antenna. Gets excellent reception in good signal areas on any of the 70 UHF channels. Each antenna furnished with stacking bar. Mast mounting brackets included. Mast not included.

No. AN65A—Deluxe—Shipped completely assembled. Suggested list price..... **$5.95**

No. AN65B—Standard—Similar to above, smaller reflector screen. Shipped knocked-down. Sug. list price.. **$3.95**

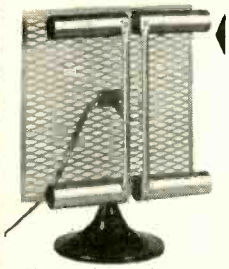
Admiral CORNER REFLECTOR

Recommended for troublesome locations where ghosts, reflections and interference are encountered. High gain, 14db. Front to back ratio 15 to 1. Assembled, ready to put up. Mast mounting bracket included. Mast not included.

No. AN56A—One bracket mounting. Suggested list price..... **$11.25**

No. AN56B—Same as above, front mounting. Suggested list price..... **$11.25**

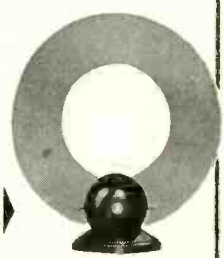
INDOOR UHF ANTENNAS



Admiral Super

Recommended for troublesome locations. Exceptionally high gain . . . over 7 db. . . . excellent ghost suppression. Only 12 inches wide. Weighted and felt padded base.

No. 94A10-6—Complete with lead-in. Suggested list price.. **$12.95**



Admiral Target

Smartly styled in rose-gold colored anodized aluminum with mahogany phenolic base. Stands only 10 inches high. Base is weighted and felt padded . . . can be placed on top of receiver . . . picks up all UHF channels.

No. 94A10-7—Complete with lead-in. Suggested list price. **$4.95**

You'll make an *extra profit* on every installation using these high gain UHF antennas. Ask your Admiral distributor about the *extra large discounts* from the list prices quoted here.

You'll be giving your customer extra value, too! All these antennas are finest quality . . . made with aircraft aluminum antenna elements and vibration-proof reflectors. "A-frame" insulators provide plenty of free air space around elements. The units have high mechanical strength and low resistance. They are *double* plated for extra resistance to weathering . . . first zinc plated, then dipped in zinc dichromate which gives them a beautiful gold finish. These antennas can be easily fastened to existing masts and towers. Order by part number from your Admiral distributor.

Ask your ***Admiral*** distributor for

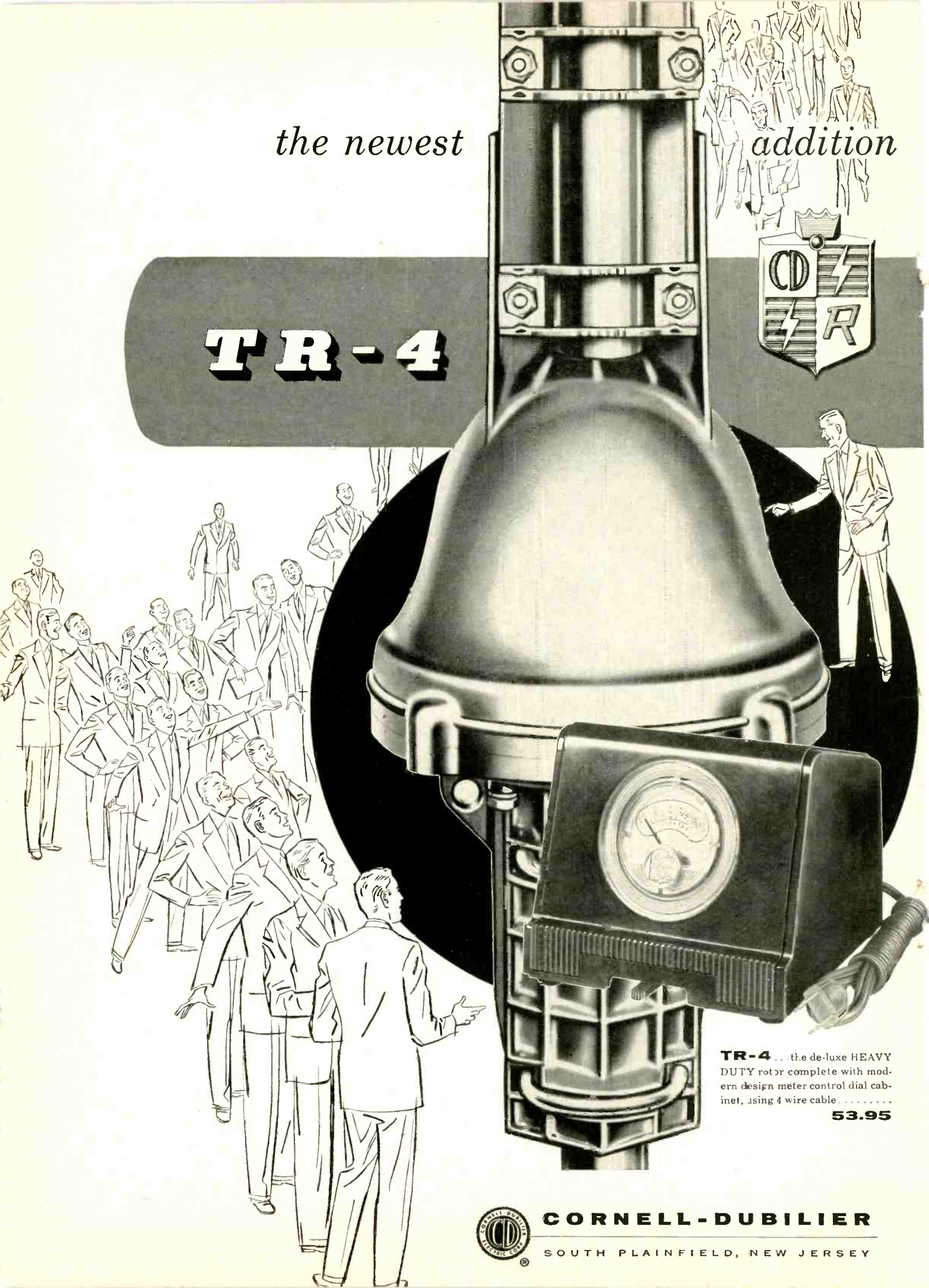
FREE CATALOG

with complete line of ***Admiral*** TV antennas and accessories

Admiral Corporation
Accessories and Equipment Division,
Chicago 47, Illinois

the newest *addition*

TR-4



TR-4 . . . the de-luxe HEAVY DUTY rotor complete with modern design meter control dial cabinet, using 4 wire cable **53.95**

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SOUTH PLAINFIELD, NEW JERSEY

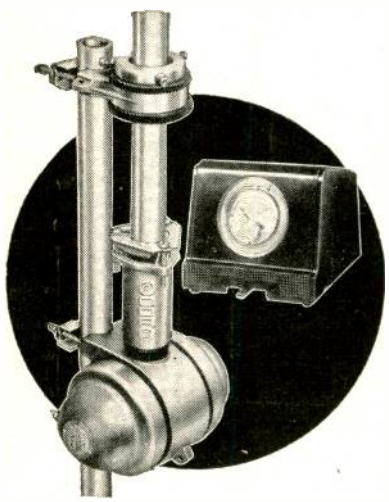
to the family of C·D·R Rotors

C·D·R ROTOR

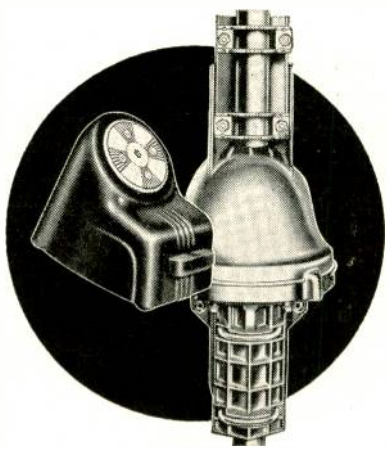
the ultimate in heavy duty Rotors

incorporating all the fine features
that have made the TR-2 outstanding
plus these fine features:

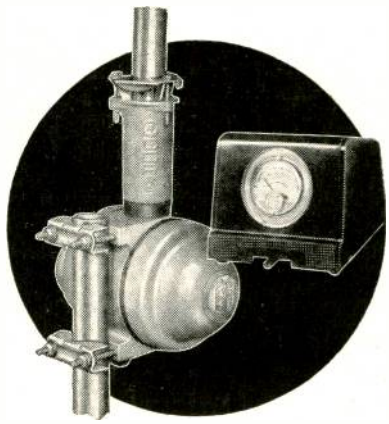
★ **Handsome Meter Dial Cabinet** ★ **Uses 4 Wire Cable**



TR-12 . . . a special combination value consisting of complete rotor, including thrust bearing . . . handsome modern design cabinet with meter control dial, 4 wire cable
47.95



TR-2 . . . . the Heavy-Duty rotor, complete with "Compass Control" cabinet having illuminated "perfect pattern" dial . . .
49.95



TR-11 . . . the all-purpose rotor with handsome modern design cabinet with meter control dial, uses 4 wire cable . . . . . .
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CLEVELAND 13, OHIO

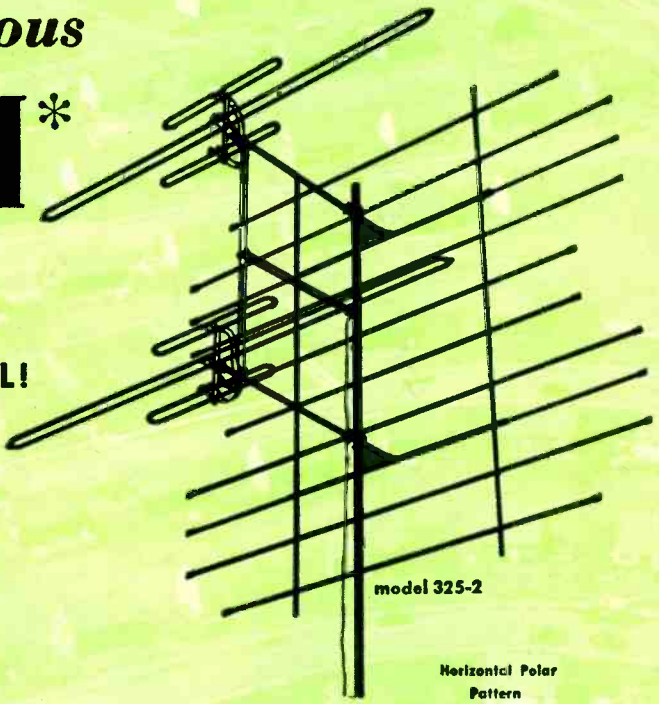
over 100,000 already installed!


model 325-4


model 325

CHANNEL MASTER'S *fabulous*

CHAMPION*


model 325-2

the world's most powerful all-channel VHF antenna —OUT-PERFORMS AND OUT-SELLS THEM ALL!

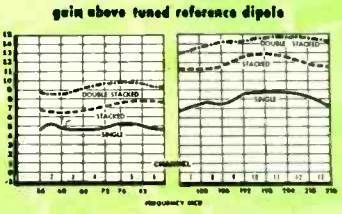
Never before in the history of television has an antenna received such an overwhelming reception. Channel Master's CHAMPION — in a few short months — has rocketed to the top as the nation's most-wanted, best-selling, best-performing VHF antenna!

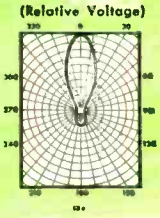
CHAMPIONSHIP Performance: Only the CHAMPION has the unique new "Tri-Pole", a *triple-powered dipole system* in which the Low Band dipole also functions as *three* dipoles tied together, in phase, on the High Band.

All-aluminum. Assembles faster than a 5-element Yagi! The CHAMPION is *another* great contribution of the Channel Master Antenna Development Laboratories.

CHAMPIONSHIP Promotion: The CHAMPION is the antenna America knows best!

• Publicized in leading magazines! • Outstanding dealer Cooperative Advertising Program! • Free newspaper mats, window streamers and TV film commercials!





THE STACKED CHAMPION PROVIDES:

11-13 DB High Band gain

6½-7½ DB Low Band gain

THE STACKED CHAMPION OUT-PERFORMS


this . . .


this . . .


this . . .


or this

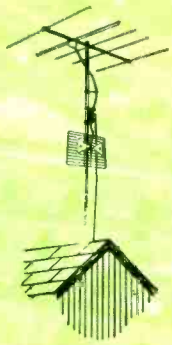
Model No.		List Price
325	Single Bay	$20.83
325-2	2-Bay	$42.36
325-4	4-Bay	$88.89
Separate Stacking Harness		
325-3	2-Bay Harness	$ 2.08
325-5	4-Bay Harness	$ 4.17

CHANNEL MASTER CORP.

ELLENVILLE, N. Y. WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

*pat. pending

TIE SEPARATE ANTENNAS TO ONLY ONE TRANSMISSION LINE



CHANNEL MASTER inter-action filters

Only *Channel Master* filters are permanently sealed in a block of moisture-proof, high melting-point electrical wax, locked in an attractive styrene case.

- Single lead
- No switching
- No signal loss
- No inter-action, effective isolation.

VHF only

New!

TENNA-TIE

model no. 9033-A

Use with leads of any length!

New, specially designed High and Low Pass filters entirely eliminate the need for critical lead lengths! This new, extremely effective circuit makes the TENNA-TIE the most effective filter of its type now available.

— *only* $3.50

VHF-UHF

ULTRA-TIE

model no. 9034

JOINS — separate VHF and UHF antennas for use with a single lead.

SEPARATES — VHF and UHF signals at the set or converter where separate terminals are provided.

"Free-space" terminals.

new low price — $3.75

VHF-UHF

TRIPLE-TIE

model no. 9035

Ties together all *three* TV reception bands:

1. *Low Band VHF*
2. *High Band VHF*
3. *All UHF*

High and Low Pass filters enable the Triple-Tie to adapt all Hi-Lo VHF installations to UHF — quickly and effectively. "Free-Space" terminals for perfect all-weather UHF reception.

new low price — $4.86

THE ANTENNA IN COLOR TELEVISION

by Harold Harris, *Vice President, Sales and Engineering*

Now that color telecasting is a reality, we will see an ever-increasing flow of color sets to the consumer. Although much is being said and written on the subject of color sets, many unanswered questions remain about the role of the television receiving antenna in color television.

Will present antennas work on color?

Will a special antenna be needed?

The results of thorough laboratory and field tests made by engineers of the Channel Master Antenna Development Laboratories show that practically all present TV antenna types will perform satisfactorily on color. Gain variations as high as 3 DB across one channel can be tolerated. When this figure is exceeded blurring or smearing of the picture may occur. Although there are certain antennas on the market which do have excessive gain variation, this is not the case of the vast majority of present installations.

There are also indications that fringe area color reception may be more critical. This may necessitate the use of fringe area antennas in areas closer to the TV station.

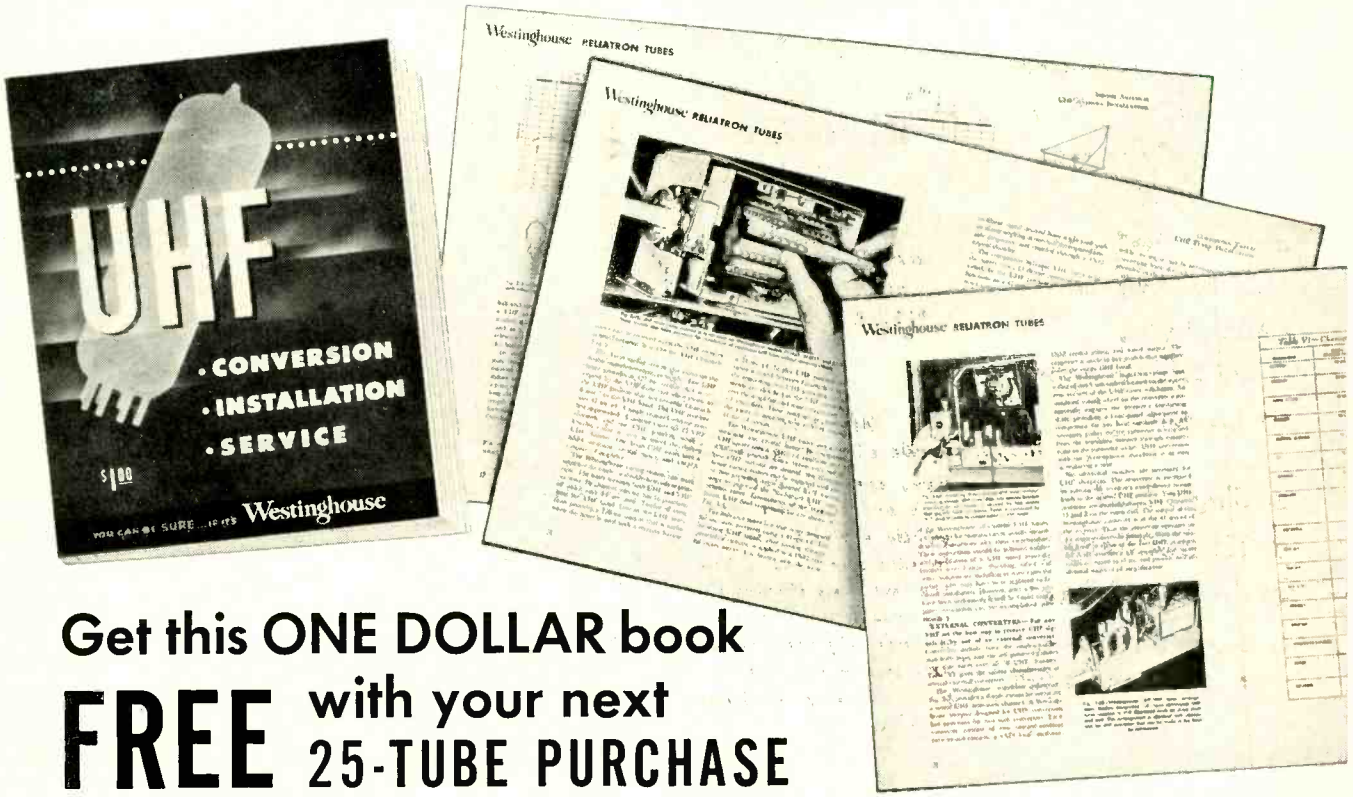
In the nation's most advanced television research laboratory, Channel Master antennas have always been designed for full band width and minimum variation in gain on any one channel.

For this reason, every Channel Master antenna which you have installed in the past, as well as the ones you install today, will provide reception of outstanding quality when color TV comes to your area.

Channel Master antennas were the antennas selected for the tests which led to the F.C.C.'s approval of the National Television Standards Committee color system.

THIS BOOK HELPS YOU

Make Increased Profits



Get this ONE DOLLAR book FREE with your next 25-TUBE PURCHASE

This newest, most helpful book on UHF conversions is yours free when you buy 25 RELIATRON receiving tubes or one picture tube from your Westinghouse Distributor.

This vital handbook covers conversion data, tuners and converters, antenna installations, channel frequency charts, station coverage, and many other necessary, conveniently arranged facts you will need.

There's a gold mine in UHF conversions. And this book will help you make the most out of the biggest profit opportunity since television came alive.

Get this dollar value for no extra charge with your next order of 25 tubes! See your nearest Westinghouse RELIATRON Tube Distributor for your copy of this new "how to do it" book that will build your profits.

Act Now for **UHF PROFITS**

See Westinghouse Tube Listings in 1954 Photofact Folders.

U3024

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WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.

PROVED from coast to coast

In every UHF area, Mallory Converters bring clear, trouble-free all-channel reception to thousands and thousands of families. Make sure your customers get this PROVED PERFORMANCE.

Mallory UHF Converter

Prove to yourself that the Mallory Converter can be a profit-maker for you. Ask your Mallory distributor for details on the Mallory 88 Converter. It's a fast-seller . . . easy to install . . . and performance is outstanding.

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CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
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LETTERS
To the Editors

Author In Error, He Says

EDITORS, TECHNICIAN:

We would like to call your attention to considerable misinformation which appeared in the article *V.H.F. Antenna Installation Problems*, in your December issue.

(1) The author describes at length "oscillating lines." It is well known that two conditions are necessary for sustained oscillation—a feed-back path and energy amplification. Since there is no amplification of energy in an antenna or its transmission line, oscillation cannot exist outside of the television set. One should not confuse the "gain" of an antenna with amplification, or the *reflections* in a transmission line due to mismatch with oscillation. In Channel Master's wide experience with TV antenna installation problems, we have never heard of "oscillating lines."

(2) In the second paragraph, the author advocates the use of an *open*-ended stub across the antenna. The stub is cut to an effective quarter-wave length at the channel frequency which is to be improved. It is well known that a quarter-wave length open-ended stub is almost exactly equivalent to a short-circuit. It is obvious, then, that placing this stub across the antenna as described will almost completely eliminate reception for the channel one is trying to improve.

(3) In the third paragraph, the author suggests using an attenuating pad to eliminate "ghosts." When "ghosts" are due to reflections in the transmission line, due to mismatch at its ends, the use of a pad will help. However, in the case of "ghosts" due to multipath reception, the ratio of the direct signal to the reflected signal is not changed by a pad. Therefore a pad will not help at all to reduce "ghosts" due to multipath reception. Furthermore, the formula given in this paragraph will not give the straight line distance to the reflecting obstacle; it will give the difference in total path lengths of the direct and reflected signals.

We hope this clears up the errors in your otherwise excellent periodical.

JULIUS GREEN
Antenna Laboratory
Channel Master Corporation
Ellenville, New York

Free Tube Checking Again

EDITORS, TECHNICIAN:

I have been an ardent reader of your magazine and still regard it as one of the top magazines in our profession. In the November edition, I read several articles on charging for tube checking. I realize that this is a pro and con affair, but the following is one technician's view point:

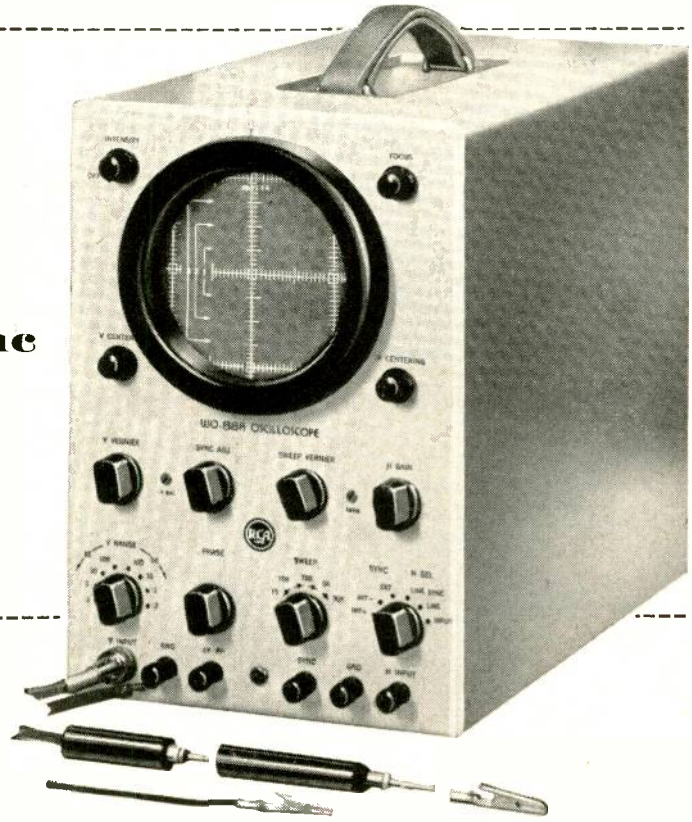
One of the most imperative qualities

(*Continued on page* 18)

Now... only $149.50 Suggested User Price the popular RCA WO-88A

featuring . . .

- ✓ **Voltage-Measuring Facilities**
- ✓ **"Plus" and "Minus" Sync**
- ✓ **High-Input Resistance**
- ✓ **Low-Input Capacitance**



Check these "extra" features

- Direct-coupled vertical amplifier
- 5" Cathode-ray tube with magnetic shield
- 60-cycle sweep with wide-angle phasing control
- Frequency-compensated attenuators
- "Voltmeter-type" vertical attenuator
- "Voltmeter-scale" type graph screen
- 1-volt peak-to-peak calibrating voltage
- 'Scope is completely stable—even at maximum sensitivity of 25 millivolt-per-inch
- Quick "recovery" time, freedom from line "bounce"
- Completely shielded input cable eliminates hum and noise pickup

Specifications—

- **Deflection Sensitivity:** (vertical amplifier) 25 rms millivolts or better per inch.
- **Vertical-Amplifier Frequency Response:** Flat from dc to 100 Kc; within —3 db at 500 Kc; within —10 db at 1 Mc.
- **Input Resistance and Capacitance:** 10 megohms and 9.5 uuf with WG-216B Low-Capacitance Probe.
- **Sweep-Circuit Frequency (four ranges):** 15 cps to 30 Kc.
- **Square-Wave Response:** Negligible tilt and overshoot.
- **Average Rise Time** (Vert. Amp.): 0.5 microsec.
- **Power Supply:** 105-125 volts, 50-60 cycles.
- Size 13½" high, 9" wide, 16½" deep. Weight only 25 lbs. (net).

The WO-88A has *built-in* voltage calibrating facilities which permit *simultaneous* waveshape display and peak-to-peak voltage measurements. Frequently, the *shape* of the TV waveform under observation will be correct but its *amplitude* will be low and, consequently, cause improper operation. Therefore, a TV 'scope is complete only if it can measure the peak-to-peak voltage of the displayed waveform. *Check this feature on the "88"!*

On the WO-88A, sync polarity may be reversed instantly by simply clicking a front-panel switch. This feature is important because TV pulses may be either positive or negative, depending upon where the 'scope is connected. To avoid waveshape "jitter" or distortion, use a 'scope which will "lock in" readily on all types of TV waveforms. *Check this feature on the "88"!*

When you use the low-capacitance probe supplied with the WO-88A, the over-all input resistance is raised to 10 megohms! Because many TV circuits are extremely sensitive to resistive loading, normal circuit operation may be seriously disrupted by loading of the average 'scope. With the low-capacitance probe, however, loading problems are minimized. *Check this feature on the "88"!*

In addition, the low-capacitance probe supplied with the WO-88A decreases the over-all input capacitance to less than 10 uuf! Excessive capacitance loading can cause the horizontal oscillator to change frequency or stop oscillating. When the WO-88A is connected, the low over-all input capacitance leaves receiver operation essentially unaffected. *Check this feature on the "88"!*

Get full details today from your RCA Distributor or clip coupon and mail to:

RCA Commercial Engineering
Section B46W, Harrison, N. J.
Please send me your new folder on the RCA WO-88A Oscilloscope.

NAME _____
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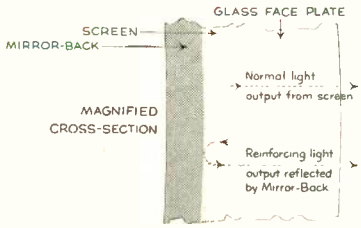
RADIO CORPORATION of AMERICA
TEST EQUIPMENT **HARRISON, N.J.**

Arthur Godfrey, famous CBS-TV star

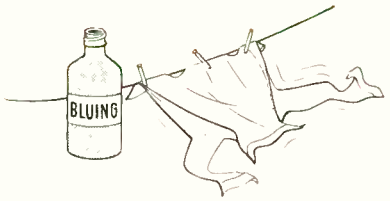
GET BETTER THAN NEW-SET PERFORMANCE

WITH CBS-HYTRON MIRROR-BACK SCREEN



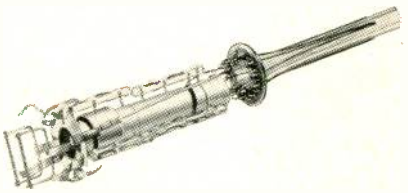
Mirror-Back (aluminized) screen mirrors *all* the light output to the viewer. Offers: Brighter pictures. Greater contrast. Better resolution. Reduced strain on other components. Full effective anode potential. Prevention of cross-burns. And longer life. For greater customer satisfaction . . . more profit, replace with original CBS-Hytron Mirror-Back tubes. Many types now available.

WITH CBS-HYTRON BLUE-WHITE SCREEN



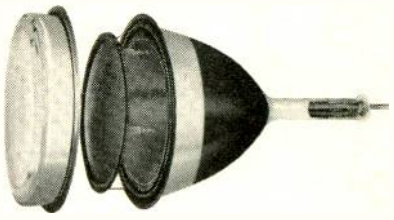
Ever notice how a shirt laundered with bluing appears whiter? With the CBS-Hytron Blue-White screen, whites are whiter; blacks, blacker. Expanded gray scale gives noticeably sharper pictures in fringe areas. No wonder CBS-Hytron's original Blue-White screen has become the universally preferred standard. Your customers, too, will prefer Blue-White screens.

WITH CBS-HYTRON SMALL-SPOT GUN



Smaller the spot produced by electron beam, sharper the picture. New lens focusing system of CBS-Hytron Small-Spot Gun reduces spot size 30 per cent. Prove it. Replace with a new CBS-Hytron Small-Spot tube. *See*, yourself, the superior resolution. Profit more. Combine all three: CBS-Hytron Mirror-Back . . . Blue-White Screen . . . Small-Spot Gun. Get and give that better-than-new-set thrill!

LOOK TO CBS-HYTRON FOR COLOR, TOO!



New CBS-Colortron stresses simplicity. Offers many advantages: Simpler construction. Fool-proof assembly. Lower cost. Lighter weight. Adaptability to mass production in large sizes. Improved contrast. Simplified focusing . . . circuitry . . . adjustment. Resistance to overload. Greater stability. All stemming from unique spherical mask and face plate. You'll appreciate these advantages when *you* start servicing color TV.

FREE CATALOG . . . CBS-HYTRON BUSINESS BUILDERS

Describes all CBS-Hytron Business Builders to date: *Certified* Quality Service tags, streamers, decals, illuminated and flange signs, clocks, postal cards, and ad mats. The famous CBS-Hytron service tools. Technical literature. Price lists. Special offers. Get your Business Builders Catalog, PA-37, today . . . from your distributor, or direct.

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For a look into the future, get complete advance data on the new, revolutionary CBS-Colortron: Construction . . . operation . . . application . . . installation and adjustment . . . electrical and mechanical data. FREE . . . from your CBS-Hytron distributor . . . or direct.

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CBS-HYTRON Main Office: Danvers, Mass.

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RECEIVING • TRANSMITTING • SPECIAL-PURPOSE • TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

(*Continued from page 14*)

in my estimation for a successful technician, is the love of the business and also not to be too arrogant in helping the average customer. I honestly believe that this article regarding charging for testing tubes will tend to make some of the servicemen a little too independent, in charging for everything they do for a customer. There are things that come up daily in our profession that have to be handled discreetly, such as replacing a male plug on a lamp or fixing a lady's iron. All these little things tend to obtain good will, something that would normally cost you a good sum in advertising.

I have been in business for over fifteen years, never made a fortune, but have always been busy and have made a good living. I believe in the old creed, when a customer asks you to do anything you should be honored that he asked you, also . . . charge according to the job.

I hope that in one of your editorials you will try to educate the newcomers in our profession to follow this creed a little. I still think that, with a customer's respect . . . and good workmanship, a serviceman can charge a little more and still be well ahead of the fellow who is arrogant and charges for even a washer or maybe to just dust off a chassis.

GEORGE E. FOGLEMAN
Fogleman Radio & TV Service
1721 Fort Davis Street, S.E.
Washington 20, D. C.

Likes Price Editorial

EDITORS, TECHNICIAN:

Your article in the December issue, "Don't Be Afraid to Charge a Good Price!" was wonderful. I am conceited enough to say that that has been my exact feeling and policy.

L. WALTON
Broadway Radio Service
7 East 19th Avenue
Gary, Indiana

Cut-Throat Competition

EDITORS, TECHNICIAN:

I receive TECHNICIAN magazine every month, and look forward to every edition, for it has given me so much help.

There has opened up a wholesale house in Washington, Pa. They have been running ads in all the papers describing the wholesale prices of all our parts, and at the bottom of these ads they state this—*Wholesale to All.* It makes me have a red face when a customer of mine prices an antenna from me and I tell him the list price for it; then he comes right back with the newspaper ad showing me the same antenna at half the cost. Some of the prices are even lower than I can buy for wholesale. What is the solution to this problem?

LARRY J. STULL
Stull's Radio & TV
Marianna, Penna.

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with SYLVANIA!

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Early photo of Ball Radio Service Shop.

Showing modern, efficient repair booths in Ball Television and Radio today.

Says Mr. Ball: *"My men are as skilled and experienced as any you'll find anywhere, and each is instructed to do the best job possible with the best of parts... and that, of course, includes Sylvania Tubes."*

Ted Ball is another important Radio-TV Service Manager that appreciates the quality performance, dependability, and the nation-wide high reputation of Sylvania products.

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LIGHTING · RADIO · ELECTRONICS · TELEVISION

TECHNICIAN
& Circuit Digests

CALDWELL-CLEMENTS, INC., 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Problems Ahead, Outlook Good

As we go into the second month of the new year, we get a clearer picture of what's ahead for the technician during the remaining months.

In taking this look ahead we can foresee a phenomenal growth for the service industry, as pointed out in last month's editorial. Color-TV is on the way. Hi-Fi is growing by leaps and bounds, and maintenance of a record number of B & W sets, radios, phonos and recorders spells big business in anybody's language.

Year by year servicing revenue will grow in this restless industry which is always bringing out something new, exciting and different to challenge the ingenuity, skill and know-how of the technician.

Yes, '54 looks like another busy year for the men who keep the home folk happy, maintaining the equipment so many millions depend upon for daily entertainment, education and enlightenment. '54 can be a year of greater profits and expansion for the technician-dealer who wisely meets the challenges that lie ahead.

But there will be problems which the service department must face.

Tight Money Will Affect Service Operations

Many of such problems will come about as the result of a more or less tough market in retail selling, which is likely to be reflected in tighter money conditions at the service business level.

For instance, folk are hanging onto their money for dear life, and this will cause more haggling over service bills. Then, too, the gyps will intensify their efforts to increase their take, and more of them may be operating. Customers may be a little slower in paying bills, and there may be a rise in the number of dead-beats.

Safe Method to Build Profits and Good-Will

All of the foregoing doesn't mean that service revenue will be down. *On the contrary, 1954 bids fair to be the biggest year the industry has ever had.* But '54 also looks like a year when the service department must watch its financial step every inch of the way. It must guard against accumulating bad accounts, it must fight to sell good, honest service at honest prices, and it must maintain prestige, profits and customer good will. Also, advertising should be kept up or initiated, in this rather slippery period, to retain old business and add new trade. Never was there a time more suited to advertising your service business.

The profit-minded technician-dealer needs to sell faith in the country to his customers these days, when all too many self-appointed dispensers of gloom are predicting financial chaos in the midst of the greatest prosperity the nation has ever known.

The future of the service business was never brighter, but smart owners and managers realize that '54 isn't a year for coasting or resting on one's laurels. It's a year for hard work, hard-boiled supervision and the will to meet and lick the problems which appear to be in the offing.

Tuning In the

GREATEST ERA AHEAD FOR SERVICE BUSINESS, and we're not fooling! Never before in the history of this industry has the opportunity for increasing service volume been so promising. Color TV, of course, leads this opportunity parade, with Hi-Fi following closely on its heels. By the end of this year, more than 100,000 (perhaps many more) color sets will be in consumers' homes, and their installation and maintenance, while posing many a problem, will be a stimulating (and profitable) challenge to the technician.

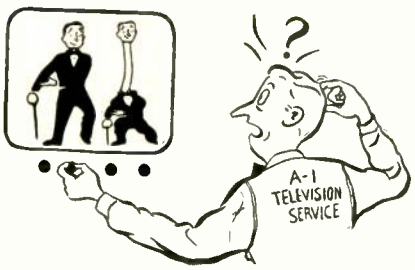
AND THIS 100,000 OR MORE COLOR SETS is nothing but a trickle preceding the production deluge on the way, because in 1955 several million color receivers will in all likelihood be in use by consumers, with total TV sets in homes and public places probably reaching a figure of 40,000,000!

HI-FI IS ON THE WAY, TOO, and it's moving fast toward the high places, presenting hundreds of opportunity angles for the service industry to capitalize on. Service and installation will involve components, complete instruments, phonos, tape recorders, phono needles and a wide variety of accessories. The sale of custom-installed Hi-Fi units alone may well ring up a total of $220,000,000 this year.

"How many volts you figure that was, Perkins?"

ON THE BUSINESS FRONT: Repair business fell off sharply after Xmas in the metropolitan New York area for reasons no one can accurately pinpoint, though one large service outfit says people are hanging onto their money for dear life, and are willing to tolerate poor reception until they've recovered from holiday expenditures. . . . Small-town dealers loaded with accounts receivable in many sections of country had better get out and collect their dough. Big-city service organizations carrying only small number of charge accounts, because of C.O.D. policy most insist upon. . . . Dealer credit situation has improved in most localities over last Summer, distributors in large cities report.

SOME TECHNICIANS IN CERTAIN UHF AREAS are selling plenty of converters by simply demonstrating the units in the home. Where good reception is obtained, such demos result in speedy sales. Converter "price-war" which broke out in Milwaukee has ended.



HIGH UHF CONVERSION FEES in some areas are drawing grumbles from set owners and managers of new UHF stations alike. Consumer complaints to the stations state that some servicers ask $75 or more for adjusting or adapting a set to receive a new UHF channel. This practice hurts both the technician and the station, UHF station operators claim. Some directors of new UHF stations are cooperating with service dealers and technicians in planning inexpensive conversion techniques, and in bringing this information to the public. Checking with the UHF station in your area re its recommendations as to the best and cheapest technique would be a good idea before going ahead with conversions.

TRENDS IN THE OFFING as we go into the second month of the new year: More and more customers will ask YOU about Color-TV, and for the sake of good public relationship you must have intelligent answers on the tip of your tongue. . . . Plenty will ask about Hi-Fi, too, and while this subject is a bit complicated for the layman to understand, try to explain in simple language. . . . '54 promises to be a year of stiffer competition for the service dollar. TECHNICIAN editors predict a slight increase in the number of servicing outlets.

SEVERAL DEPARTMENT STORE service set-ups have been making headway in some of the large cities, gaining business chiefly through reputation, and solicitation of large customer lists. Trend could spread this year, offering the independents some very real competition.

MANPOWER SITUATION EASING in some heavy industrial centers, but still very tight in New York, parts of California and in most of the South. Some suburban New York shops paying $100 a week to TV servicers with very little experience.

DIPLOMACY by servicers is becoming more important than ever, field reports say. With the trend away from service contracts toward individually-billed service calls, set owners are less critical of secondary deterioration in receiver performance. They usually wait for major breakdowns before hollering "Uncle." As a result, more calls than ever involve multiple troubles. Complete overhauls bring squawks over high bills. Repair of major defect alone raises complaints of incompetent work. Either way, the technician is left holding the bag. Getting to be like the radio days when more than half the sets in use were in need of repair.

Picture.....

PIX TUBE OUTLOOK FOR '54. Almost one in every seven TV sets in use today will require a new picture tube in 1954, according to J. Milton Lang, general manager of the G-E Tube Department. Market research indicates a need for over four million replacement picture tubes. Over 27 million sets are now in use throughout the country. Lang said the high replacement tube figure represents a normal development, with so many sets growing older. The four-million plus figure is the highest of any year to date, and is expected to top the 1953 requirement by about 50 per cent. Despite the advent of color TV, the industry should produce about 5,200,000 additional picture tubes for new black-and-white sets, Lang estimated. The need for initial equipment monochrome tubes will come in large measure from opening up of new market areas, and from continuing consumer demand for the larger picture sizes and lower prices of high-quality black-and-white receivers. Lang believes color picture tubes should make up about two per cent of the industry's total CRT output in '54.

REMEMBER 'WAY BACK WHEN pre-war TV antennas were of the "pitchfork" type? . . . When, during the transmission-line shortage some of you fellows had to use solid-conductor cable which came from abroad? . . . And those days when the predecessors of the present dollar-a-call boys charged a half a buck? . . . Can you recall, too, the ion "spots" on many pix tubes? the "diathermy-interference" craze? The era of magnifiers and filters?

SALES RESISTANCE TO B & W TV, on part of consumers adopting a "wait and see" attitude on color, is in for a major assault by manufacturers. Most top set producers are announcing 21-in. black and white sets to sell below $200, representing drastic price cuts in their former lines. Other leaders are expected to follow. Confidential sources say these new lines, streamlined in design for low pricing, have been on paper for some time. Seems the industry—or at least part of it—anticipated B & W resistance with advent of color, and is all ready to meet the challenge.

YOU MUST HAVE SOMETHING ON THE BALL to stay in business. Motorola's Service Dep't. calls attention to a recent government report that vividly illustrates the need for good management and good business control. The report states that only twenty eight concerns out of every hundred started were going concerns after five years of operation. The following shows the average trend per hundred business ventures:

Year of Operation	*Failures*	*Remaining*
1st	32	68
2nd	18	50
3rd	12	38
4th	6	32
5th	4	28

These statistics deserve your serious thought. Are you taking steps to insure that YOU will still be in business five years from now?

SAME OLD CHASSIS!—The doctor complained bitterly about the $18.75 charge for repairing his TV set. "My TV is certainly not as complicated as a human being. I spent six years in college," he said to the technician, "and two years as an interne before I practiced any medicine. But I can't get any fees like that for my work." "In TV," replied the TV technician, "we have a couple of thousand models to deal with. Every year each manufacturer brings out at least one new model. We've got to have a big library of technical information and attend many meetings to keep up to date. But you, doctor, still work on the same model you studied in school."—Sterling Intercom, Houston, Tex.

"Must be something wrong with this set . . . all we can get is people."

WHEN A TECHNICIAN BUILDS UP A REP AS A GENIUS in his community, whether he's the owner or the service manager, he finds himself in a tough spot as the business expands because everybody and his brother wants this particular "wizard" to PERSONALLY service the ailing sets. Naturally, this just can't be done when there's a big volume of work. Best thing to do in such situation is to "build up" other good technicians in the organization, "selling" them to the customers via direct-mail, over the phone and in personal contacts.

HARD-BOILED SIGNS, such as "Not Responsible for Sets Left After 30 Days," "All Work Strictly Cash," and the like, do more harm than good, since they antagonize customers, and don't mean anything legally anyway. Better put up some reading, "All Work Guaranteed," "We Use Finest Parts," "Best Test Equipment," "Our Technicians Are Highly Skilled Specialists," etc., to build good-will and inspire confidence in your service department.

SOME RANDOM THOUGHTS IN THE FIELD: TV antenna makers are more competitive-minded than any other folk in the business. . . . There's been a definite decline in number of people bringing tubes into shops for testing. This activity was at its height during the Depression. . . . Even if they can't understand 'em, people like to get itemized bills for service.

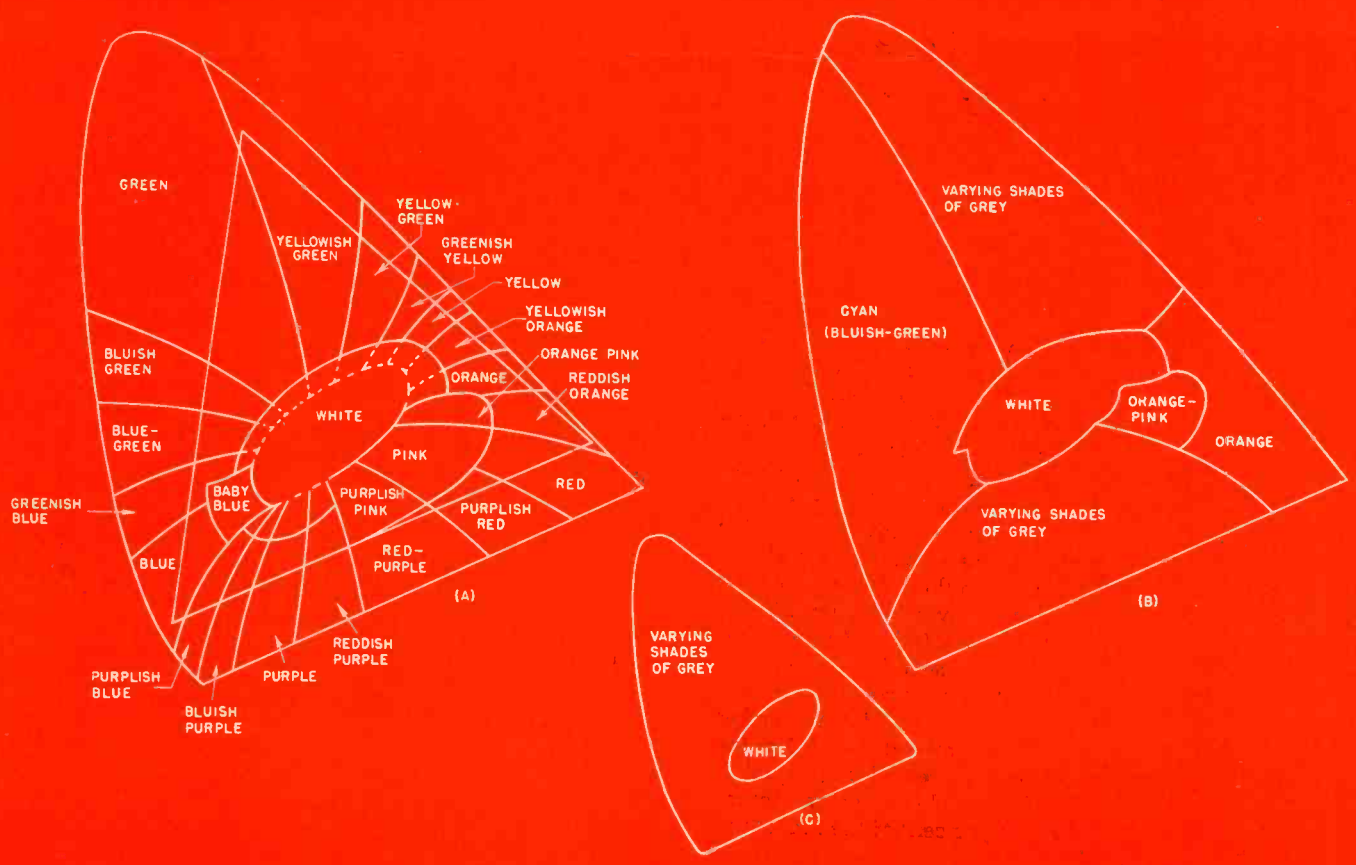


Fig. 1A—The horseshoe comprises all the visible colors; the triangle includes all colors reproducible in color TV. Colors shown in this triangle are recognizable to the eye when they cover large areas. B—When medium-small areas are viewed, blues and yellows appear gray, and only cyan and orange are clearly distinct. Two areas rather than one are shown as gray. This is so because yellow and purple—the colors really present in these areas—will look gray if the observer's distance from them is great enough. C—The eye cannot distinguish between colors and black-and-white when small objects are viewed; only intensity variations——referred to as *varying shades of gray*—are visible.

More About

Color TV Fundamentals

How the Eye Sees Color. What "Q," "Y" and "I" Signals Are. Sub-carrier Modulation Explained

By Peter Orne
and
Sol Heller
Managing Editor, TECHNICIAN

• Last month, we tried to clarify how room was found in the black-and-white spectrum for color signals. In this month's article, we will review the next problem surmounted by NTSC researchers—i.e., their determination of the minimum information required to obtain a satisfactory color picture. The problem was briefly discussed in the Oct. '53 issue of TECHNICIAN (*Serviceman's Analysis of the New TV Color System*), and will be considered in greater detail in this piece.

The less information that has to be transmitted in addition to the luminance information (luminance refers to the color signal component that corresponds to the black-and-white video signal) the less chance there will be of interaction taking place among the different signals sent out. In order to determine the minimum bandwidths to which color signals could be reduced, many investigations were made into how well the eye sees small areas of color. The result of these investigations may be summed up as follows:

The eye cannot see color—i.e., distinguish between colors or black-and-white—when the object inspected is very small (see Fig. 1C). The eye has "three-color" vision, on the other hand, for large objects (Fig. 1A). "Three-color vision" means that we can, by mixing lights of three colors in the proper amount, cause the eye to see practically any color. This duplication is called color matching.

There are many ways of obtaining a color match. Almost any three widely-separated colors may be used (as we shall see later). In the

color picture tube, red, green and blue lights (given off by phosphors on the screen) are employed for this purpose.

How about cases that fall in between the extremes of no color and three-color vision—i.e., the instances when medium-small objects are being viewed? What the average person sees in these instances may be reproduced by the mixture of *two* colors (see Fig. 1B). Some color-blind people, incidentally, see both large and medium-sized objects in this way.

In viewing medium-small objects, most of us readily differentiate between cyan (a bluish green) and orange. Blues and greens, however, look like cyan, and reds and yellows look like orange. We can experience this effect if we try to match a single fine strand of colored thread to a correspondingly-colored spool of thread.

It appears, therefore, that we need three components of information to get proper coloring for large areas; two pieces of information are required to get satisfactory color on "medium-small" areas; we only need to know the luminance for very small areas.

"Q", "Y" and "I" Signals

The way we see small detail, in monochrome that is, and the fact that we want a compatible system, makes it necessary that one of the components be the luminance or "Y" signal. From the fact that we can distinguish cyan and orange best in medium-small areas, it would be an advantage to choose as one of the other components of information a signal that distinguishes between these colors. This signal is called the "I" signal.

For large areas, where the eye can distinguish between all colors, another piece of intelligence must be added which is called the "Q" signal. This signal distinguishes between green and purple. If the information present in the "I," "Q" and "Y" signals is combined, any visible color can be effectively reproduced, thus permitting "three-color" viewing.

Summing up: "Y" is the luminance information; it is transmitted for the full 4 mc. "I" is the information that can tell cyan from orange, and is transmitted to 1.5 mc. "Q" is the information that, in conjunction with the "I" and "Y" signals, provides the three components for "three-color" vision; it is transmitted for only .5 mc (see Fig. 2).

Readers may wonder why the colors in Fig. 1 are grouped in a horse-shoe form. The theory behind this may be summarized as follows:

Any color can be reproduced by mixing three colors together. The three colors used are known as the *primaries* of the system. The only restriction regarding the choice of colors is that a primary color must not be reproducible by any mixture of the other two primaries.

Color Designation Systems

Visible colors can be represented in different ways. Most readers are probably familiar with the fact that colors can be designated by their wavelength. Scientists concerned with the study of color have found it convenient to use another method of representing visible colors. They (arbitrarily) choose three colors that are *supersaturated*—i.e., unmixed with white—and define any other color by giving the amount of each supersaturated color necessary to reproduce it.

The supersaturated or reference colors are non-existent in nature and cannot be seen by the eye. They provide arbitrary standards for comparing colors.

One of the reference colors is so chosen that its amount affects only the brightness (not the hue or saturation) of the color to be defined. The other two colors are capable of representing any definite color (except with respect to brightness). The system is essentially the same as the one used in color TV, in which two signals—"Q" and "I"—determine the color, while the third one—"Y"—reports on its brightness.

When the two supersaturated or reference colors are used as axes (vertical and horizontal axes, of course) any color visible to the eye may be plotted as a point on this diagram. The height of the point (or its distance above the *X* axis) indicates the amount of one reference color present; the distance of the point from the *Y* axis indicates how much there is of the other reference color.

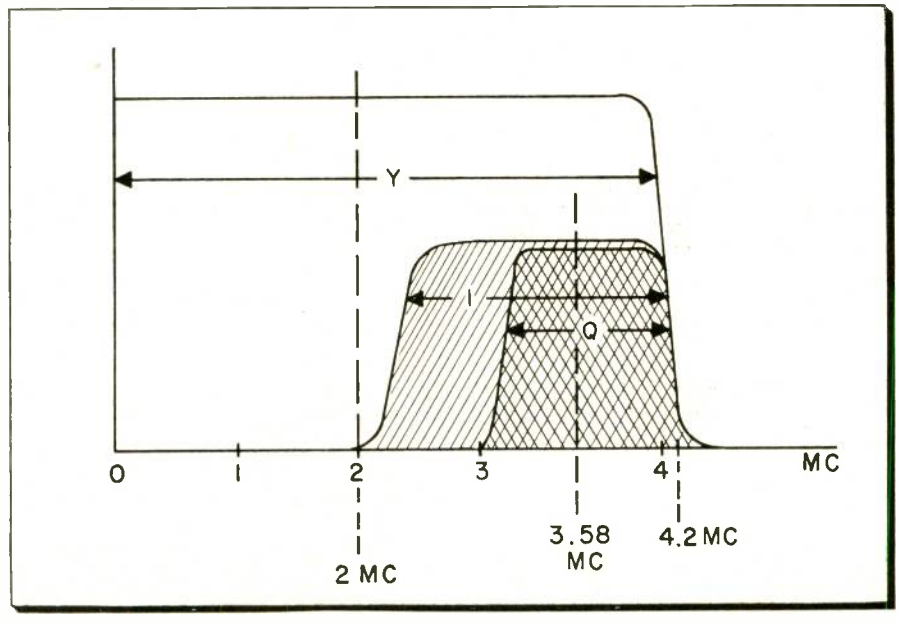
When such a diagram is made, it is found that visible colors fall into an area that looks like an inverted horse-shoe. The nearer we come to the center of the horse-shoe, the less saturated the colors get—i.e., the whiter they get. The area at the center is what most people consider white.

Subjective Aspects of Color

Color is subjective—that is, different people give different names to the same shade of color. In addition, colors look different when their surrounding color is changed. White is a wide area (in Fig. 1) because desaturated shades of any color (i.e., color mixed with white) will look white if looked at for some time without comparison. This is the reason, incidentally, that the shade of white used on a black-and-white crt screen turned out to be much less important than originally expected; only when a number of b & w sets are put next to each other does the difference in screen whiteness become apparent.

A final note on the horse-shoe patterns of Fig. 1: There are actually no sharp divisions between colors, such as those that seem to be present in these sketches. Different

Fig. 2—Bandpass requirements for "Q," "Y" and "I" signal components.



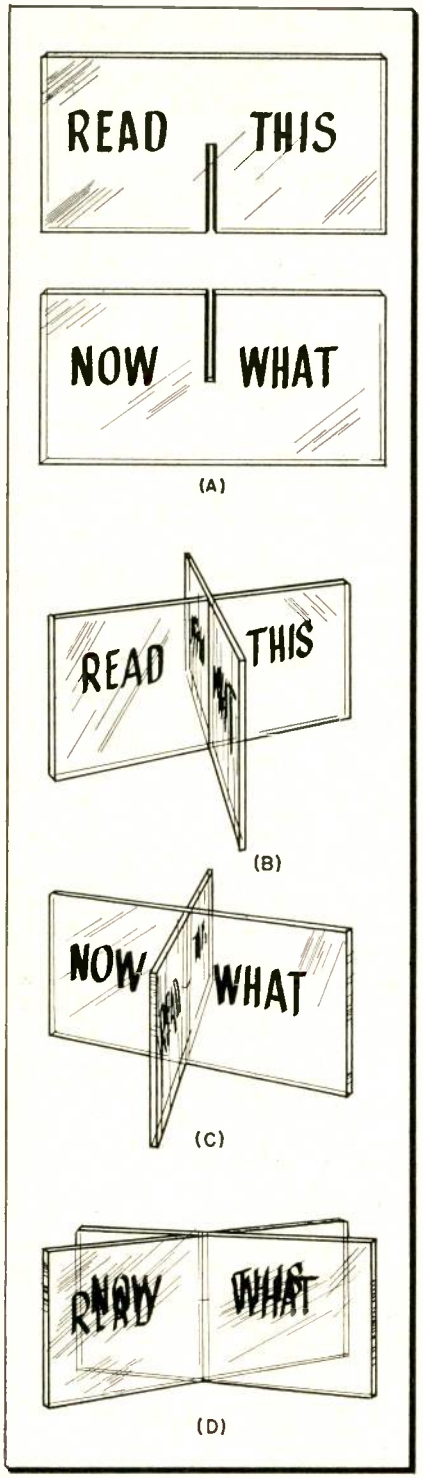


Fig.3—Mechanical analogy to phase-shifting of color subcarrier. Two signs, painted on glass and mounted at right angles, represent subcarrier at 0 and 90 degrees.

people will place the dividing lines between colors at different points. The colors in Fig. 1A are most saturated (i.e., intense) on the rim of the horse-shoe; these intensities are largely beyond the range of the present-day TV color system. The dotted-line area in the white section will be seen as white, or white with a hue of the adjacent color added, depending on the vision characteristic of the viewer.

With the problem of how much color information to transmit surmounted, the next difficulty that arises is how to transmit two different pieces of color information, "Q" and "I," on *one* subcarrier. If we could use two different subcarriers, "Q" could be modulated on one and "I" on the other. This is effectively done, but *the two carriers are at the same frequency.* Since this may sound like double talk, let's see whether we can clear it up.

Mechanical Analogy

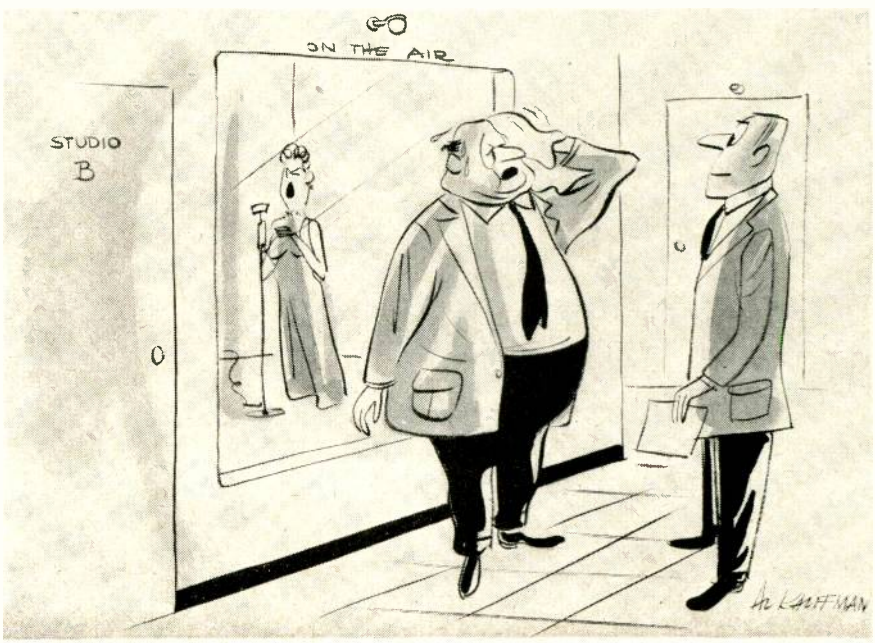
Assume that two transparent sections of glass are available (Fig. 3A). On one of them are printed the words READ THIS; on the other, NOW WHAT. Suppose we get our favorite glasscutter to join these two pieces of glass at right angles, as shown in Fig. 3B. If we look at this combination from one angle (Fig. 3B), we can see the words READ THIS. If we look at it from another angle (Fig. 3C), we can read the words NOW WHAT. If we look at the unit from the angle shown in Fig. 3D, however, we can decipher neither phrase, since one set of words falls over the other, obscuring both groups of words.

An analogous situation is present with respect to the use of the color subcarrier. The "Q" signal (similar to READ THIS) is modulated on the color subcarrier (equivalent to one glass section); the "I" signal (similar to NOW WHAT) is modulated onto the subcarrier after the latter has been shifted in phase 90° (or *quadrature*-shifted). The second glass section, which makes an angle of 90° with the first one, may be compared to the phase-shifted color subcarrier.

If the exact phase of the carrier when the signal was modulated onto it is known, the modulation can be removed or detected (just as the glass sections can be read, if we know the angle to read them by). This type of detection is known as *synchronous detection.* It requires exact knowledge of the subcarrier phase; a subcarrier sync burst is transmitted after each regular horizontal sync pulse as a phase reference for the receiver, to provide this desired phase information.

AND WAS HIS FACE RED! Technician we know was asked to install an outdoor antenna on the roof of a fourteen-story building in New York. Job took almost all day because the superintendent insisted on lead-in being fastened to outside wall at each floor. This necessitated going into each apartment from top to second floor (and finding the super each time another floor was reached.) New antenna set-up provided a mediocre picture, which owner didn't squawk about since most tenants on his particular side of the building got poor reception also. The pay-off: A few weeks later the owner called the TV man and said that an outdoor aerial which he'd purchased solved his problem, bringing in an acceptable picture.

"For years I broadcast my morning setting up exercises—did fine—then they put me on TV"



Servicing AC-DC Radios

Part 3. Odd Fading Case. Locating Intermittent Filaments Quickly

By M. G. Goldberg

• An intermittent in any receiver is somewhat of a headache, but a periodic fading or cut-out in an ac-dc receiver is even worse, because these receivers cost the customer comparatively little; service charges must therefore be kept low, and any job which consumes a lot of bench time means money lost. Let's consider a case in point.

The output of this 5-tube set dropped just enough to be annoying several times during a program, cutting in and out with a volume change of 15 or 20%. After trying all new tubes and making other tests, the trouble was finally narrowed down to the second i-f and detector circuits illustrated in Fig. 1.

During the fading period, the frequency of the received station remained constant (the oscillator didn't shift); the tone was not appreciably affected, and there was no click when the set cut in and out. Connecting the scope input cable to points *A*, *B*, and *C* in turn showed no change in response during the fading; *with the scope connected from point* D *to chassis ground, however, the set did not cut out.* The connection just cited was made several times, with the same result.

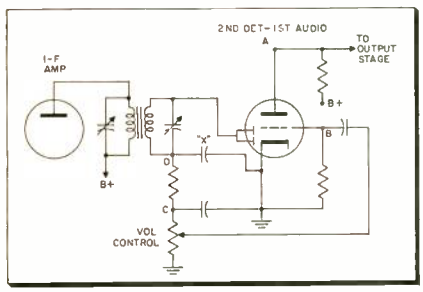


Fig. 1—I-f and second-detector circuit of 5-tube ac-dc receiver. Intermittent open-circuiting of condenser "X" resulted in fading.

The writer finally concluded that the small capacitor marked "X" in Fig. 1 (a 50 mmfd unit) was opening and closing periodically. With the scope disconnected and the capacitor open, the i-f signal was not sufficiently bypassed, causing the audio output to drop. With the scope connected, however, the 75 mmfd capacitance of the latter's input cable was more than sufficient to substitute for capacitor "X" in the circuit, and no fading was therefore noticeable.

Intermittent heaters in ac-dc receivers are often troublesome. An undue amount of time may be wasted in determining which tube in the series string is opening up. This applies especially to receivers in which the trouble occurs only spasmodically, and then for only a few seconds at a time. Naturally, the technician can't spend an hour or two on one of these low-priced sets, waiting around for a heater to open. The writer has worked out a simple and speedy system for locating the defective tube in such cases, without spending more than a few minutes of bench time on the job.

Let's refer to Fig. 2A. Here we have a conventional 5-tube heater string in which an intermitent filament is present—one which won't stay open long enough for a routine check, and which cuts out perhaps only three or four times during an hour's program. Note the two ac voltmeter connections. One meter (VM-1) is attached across the two higher voltage heaters; the other connects across the three lower voltage filaments.

Place the meters where they can be readily seen and turn the set on, then go to work on another bench job. As long as the continuity of the heater circuit is intact, VM-1 will read approximately 85 volts; VM-2 will read about 35 volts. When the cutout occurs, attracting the serviceman's attention, a glance at the meters will reveal that one meter is now indicating practically full line voltage, while the other has dropped to zero.

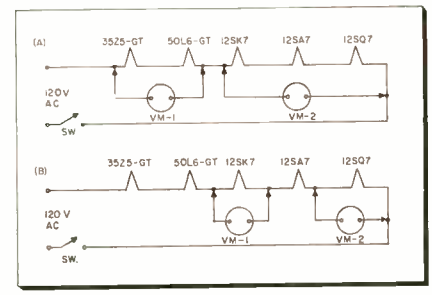
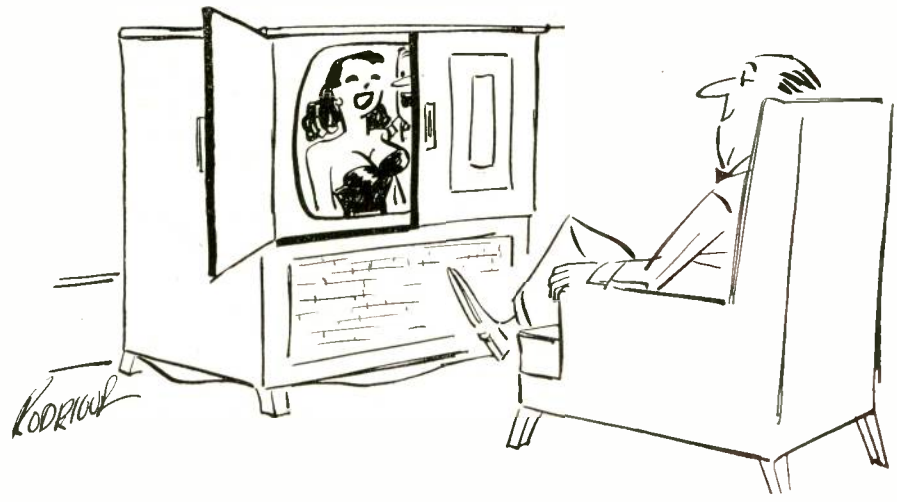


Fig. 2A—Connection of 2 ac voltmeters across tube filaments for first fading check. B—Voltmeter connections for the second fading check.

Assume that VM-1 has gone to zero and VM-2 to full line voltage, on the first fade. This means that the intermittent is in one of the 12-volt heaters. Now connect the meters as shown in Fig. 2B. If, on the next fade, *both* meters go to zero, it will prove that the 12SA7 is the bad tube. On the other hand, if one of the meters goes to zero, while the other reads full line voltage, the defective tube will be the one across which full line voltage is measured. This simple arrangement checks *all* five tubes in only *two* fades, and almost makes child's play out of what could be a time-consuming headache.

If, on the first fade, VM-1 goes to full line voltage (Fig. 2A) while the VM-2 reading drops to zero, connect one meter across each of the two higher voltage heaters for the 2nd test.



Hi Fi Guide to Pickup

Tracking Problems, Phono Arm Location and Weight,

By Harry Mileaf

• This article deals with the installation, service and replacement of the arm and the pickup cartridge, and also considers the part these units play in the overall operation of a Hi Fi system. Information useful in setting up an installation, or checking and improving an installation in use, will be presented.

The pickup arm and cartridge determine, in part, the fidelity of record reproduction and longevity of records; they should be periodically checked to insure proper operation of the Hi Fi system. Outlined below

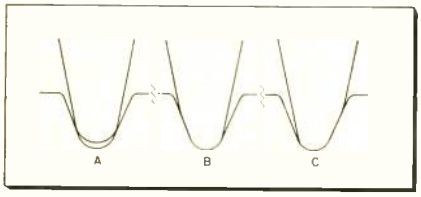


Fig. 1A—Stylus properly seated in groove, providing good tracking. B, C—Improper seating.

are the pickup arm and cartridge characteristics we are going to discuss in this piece.

Pickup Arm: 1. Tracking. 2. Weight. 3. Resonance.

Pickup Cartridge: 1. Weight. 2. Frequency response and output. 3. Stylus (needle).

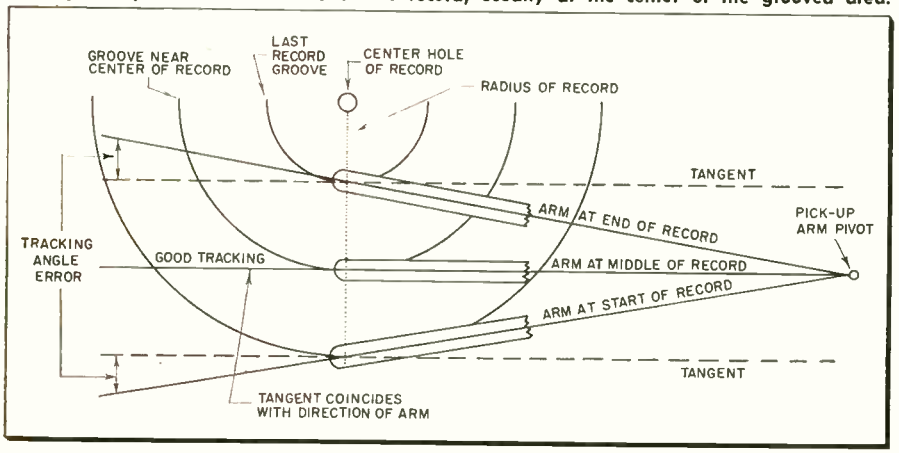
Pickup Arm Tracking. This is a little-understood cause of distortion and wear in a record player. Tracking is the term applied to the manner in which the pickup needle rides in the record's grooves. Fig. 1 illustrates proper and improper tracking. Fig. 1A shows the needle properly tracking the groove; it is seated firmly, applying equal pressure to both sidewalls of the groove, and follows the lateral deviation of the groove with fidelity. Providing that the stylus itself is in good condition, poor tracking, as shown in B and C of Fig. 1, can be caused by poor tangency, binding, and improper turntable leveling.

Tangency. The needle shown in Fig. 1A is properly seated only when it is in line with the tangent of the groove in which it is riding. In other words, if a line is drawn from the pivot point at the base of the tone arm to the stylus tip (see Fig. 2), the needle is properly seated only when this imaginary line is at right angles to a radius of the record.

Due to design of the pivoted pickup arm, the needle travels along an arc across the record; because of this, the arm cannot maintain true tangency on all of the grooves, as indicated in Fig. 2. The difference between the needle direction and the tangent line is called the *tracking error angle.*

Good tracking is provided for at the center portion of the record's grooves, to keep the overall error angle at a minimum. For example: If the pickup arm produced a total tracking angle change of 8 degrees across a record, and was set for perfect tracking at the starting grooves, it would produce an 8-degree tracking error at the end of the record. To prevent such a large tracking error angle, the arm is set for perfect tracking at the center of the record. The error now introduced is app. −4 degrees at the beginning of the record, and +4 degrees at its end.

Fig. 2—Tracking angle error due to use of pivoted pickup arm. True tangency is possible at only one point on the surface of the record, usually at the center of the grooved area.



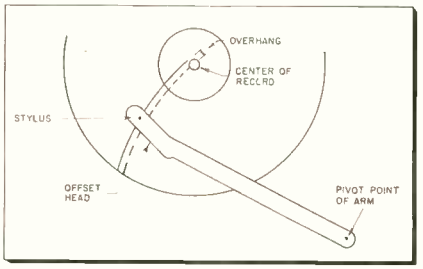


Fig. 3—Use of an offset head (one not in line with the arm) and proper location of the pivot, cause the needle to finish its travel at a point above the center of the record. This "overhang" reduces the tracking error.

The total tracking angle variation is still 8 degrees, but the maximum error is brought down to 4 degrees.

Methods used to minimize this problem include use of a longer arm, use of an offset arm, and location of the arm's pivot point so that tracking error is minimized. With a longer arm, the arc traveled by the pickup is reduced; the overall tracking angle variation is, as a result, reduced too. Reduction of the travel arc, and consequently the tracking error, is also achieved by offsetting the head, and locating the pickup arm pivot in such a way as to produce an "overhang" (see Fig. 3).

Record players nowadays use varied combinations of phono arm length, overhang, and offset to improve tracking. When a phono installation is being made, or an arm is replaced, careful attention should be given to the location of the pivot point, to prevent introduction of an incorrect overhang. The average amount of overhang is about ⅜ inch.

When improper tangency is introduced, the needle and the walls of the record's grooves will wear prematurely; excessive needle-talk and distortion will also be heard.

Binding. It is very important for the pickup arm to ride freely across the record. The pickup needle will track poorly and ride the walls of

Arms and Cartridges

Types of Pickups; Installation and Service Considerations

the grooves if it resists the lateral pressure of the grooves due to a bind (see Fig. 1C). Besides introducing excessive needle-talk and distortion, this condition causes premature record wear. Lubricate the pickup arm pivot shaft regularly so that it can ride freely, and check to make sure that no mechanical obstructions are preventing a free side-to-side movement.

Turntable Leveling. If the turntable is not level, the downward pressure of the needle will not be applied perpendicular to the plane of the turntable. Instead, the pressure will be applied to the sidewall

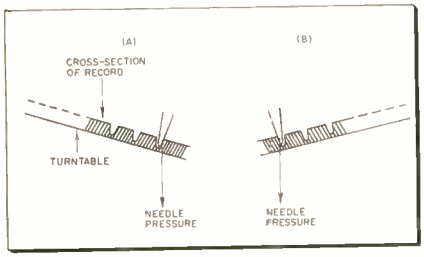


Fig. 4—The needle may ride along either sidewall when the turntable has not been leveled.

of the groove in the direction of the turntable angle, as shown in Fig. 4. This condition will produce the poor seating shown in B and C of Fig. 1, and cause wear and distortion. It is wise for this reason to check that the turntable or its mounting board, and the surface the record player will sit upon, are level. It is important to note that the needle must be perpendicular to the earth's surface to seat properly. Check the pickup arm or cartridge mountings, to make certain they maintain the needle in this position.

(Such a test may often be made by placing a pocket mirror, whose thickness approximates that of a record, on the turntable, and allowing the stylus to rest on the mirror. If the needle is truly perpendicular at the point of contact, it will appear to be in line with its reflected image from any angle. Any angular deviation present will become obvious, since such a deviation appears exaggerated when the needle's reflection is compared with the needle.—Ed.)

Weight. The weight of the pickup arm is a critical factor for the following three important reasons:

Vertical Compliance. Proper vertical compliance requires that the pickup needle follow the vertical modulations present in the record's grooves without reproducing any unwanted signals. The biggest vertical modulation problem is the result of "pinch effect." A consideration of how this effect develops will help to explain it.

The width of a groove in the record depends on the width of the cutting stylus making the groove. Since the cutting stylus (unlike the playback stylus) has a flat face, the groove it makes will be as wide as the stylus *only when the stylus is cutting in the same direction the groove is traveling (Fig. 5A).* When modulation is applied to the cutting stylus, it swings back and forth, and the angle it makes to the direction of groove travel changes. The effective width of the stylus thus decreases, and the width of the groove it makes is reduced (Fig. 5B).

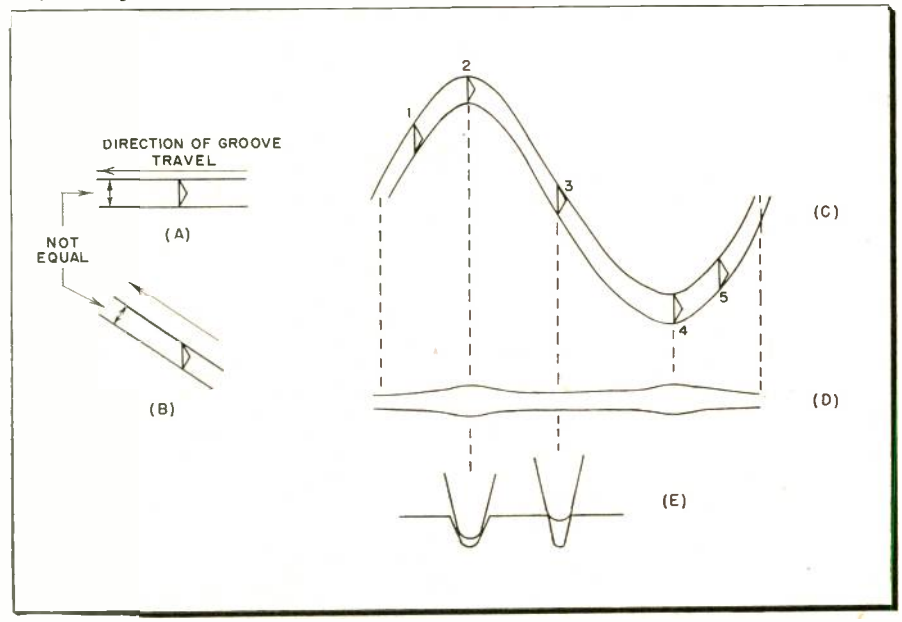
Note in C and D of Fig. 5 that when one sine wave is cut laterally, the groove develops two cycles of width change. This change in width causes the pickup needle to rise and fall as it rides the record's grooves (5E). If the pickup arm is too light, it will jump and skip grooves as the pickup needle contacts the pinched portions of the grooves. If the pickup arm is too heavy, the cartridge will tend to move excessively up and down when it rides in the pinched portions of a groove, causing appreciable second harmonic distortion.

Cartridge Output vs Pickup Arm Weight. If the pickup arm is too light, there will not be enough lateral pressure applied to the cartridge, and the output level will be lower than normal. If the arm is too heavy, too much pressure is applied, and considerable amplitude distortion will result (since the arm has too much inertia to follow lateral groove deviations faithfully).

Record Wear. If the pickup arm is too heavy, the needle will apply too much pressure to the grooves' walls and wear them prematurely. Conversely, if the arm is too light, it will bob up and down and also cause unnecessary wear.

As we can see, the weight of, or the pressure adjustment on, the

Fig. 5A—When flat cutting stylus is moving in line with the direction of groove travel (as it does at points 2 and 4 in sketch C), the groove it cuts is widest. B—When the flat cutting stylus is moving at an angle to the direction of groove travel (as at points 1, 3 and 5 in sketch C) its reduced effective width causes the groove it cuts to become narrower. C—Magnified top view of disc surface, showing groove make by recorded sine wave. D—Sine wave of (C) pulled out straight, to show width variation (pinch effect). E—Cross-section of a record, showing the rise and fall of playback stylus as the width of the groove it rides in changes.



pickup arm, is an important factor when its replacement is necessary. The required stylus pressure depends on the type of cartridge being used. Information regarding this characteristic is supplied by the manufacturer.

It is advisable to check the weight carried by the pickup needle periodically, or when a replacement is made, to be sure that the proper pressure is being applied. Needle pressure gauges for this purpose can be obtained for a dollar or two. If the pressure being applied is not in accordance with cartridge specifications, it should be suitably adjusted. The better grade pickup arms provide counter-balance springs or sliding weights that are adjustable; some provide thumbscrew or screwdriver adjustments that are easily accessible.

The average amount of pressure required for the LP cartridge is 5 grams; it is between 10 and 15 grams for standard cartridges. Dual-speed arms with only one pickup needle should strike a happy medium. It is always better to have two pickups for this reason.

Pickup Arm Resonance. Since the pickup arm has mass, it also has, unfortunately, a physical resonant frequency. In many of the arms on the market, this resonant frequency falls within the audible range. The longer the arm, the lower the resonant frequency. The type of material the arm is made of also determines its resonant frequency.

In the majority of pickup arms, the cartridge is securely attached to the arm. Thus, any motion of the pickup needle is indirectly coupled to the arm, and physical oscillation of the arm occurs. If such arm vibration is objectionable, the arm can be replaced with one that resonates outside the audio range, or with an arm that provides for damping of the resonant oscillations. It is important to note that some manufacturers use arm resonance to boost the bass response.

Cartridge Weight. The weight of the pickup cartridge is important because of the same considerations presented during our discussion of pickup arm weight. It is recommended that the pressure of the pickup arm assembly be suitably adjusted when the weight of the replacement cartridge requires more or less pressure than the original.

Cartridge Frequency Response and Output. These are the two most important factors determining the value of a pickup cartridge. Unfortunately, these characteristics are usually inversely proportional. If we change a cartridge to obtain more gain, the frequency response range narrows, and vice versa.

The crystal cartridge has the highest level of output, but also the poorest high-frequency response. The average crystal cartridge delivers about one volt, but its treble response may only extend to a few thousand cycles.

Some cartridges have frequency capabilities well beyond the audio range, but their output is measured in millivolts. The newer ceramic cartridges can deliver between .1 to .5 v at 10 to 15 kc, which is considerably better than a happy medium.

Two other types of pickups sometimes employed are the *frequency-modulation* and *strain-sensitive pickups*. These pickups have desirable characteristics, but their major disadvantage is that they require auxiliary circuits for their operation. Where economy is a factor, they are not often considered, despite their marked advantages.

If the response of a crystal cartridge is considered inadequate, a switch can be made to a ceramic or magnetic-type pickup. A preamplifier is required when a magnetic pickup is substituted for a crystal type, unless the amplifier present provides a low impedance input for use with a magnetic cartridge, and can deliver enough gain to compensate for the magnetic cartridge's low output. A ceramic cartridge is a high-impedance device, and can be substituted for a crystal cartridge without the necessity of adding a preamplifier.

The cheapest method of improving the frequency response of a crystal cartridge is by way of frequency compensation. Compensation controls and networks are sold for this purpose, and are comparatively cheap. Fig. 6 shows one compensation network that can be made up and used with a crystal cartridge to improve performance. (The components incorporated in such a network will depend on the frequency characteristic of the uncompensated crystal. The manufacturer of the cartridge will generally provide a response curve and/or recommend a compensating network. It should be noted that there are practical limits with respect to how much compensation can be provided.—Ed.)

Other Cartridge Characteristics. Crystal cartridges are affected by variations in temperature and humidity. Magnetic and ceramic types,

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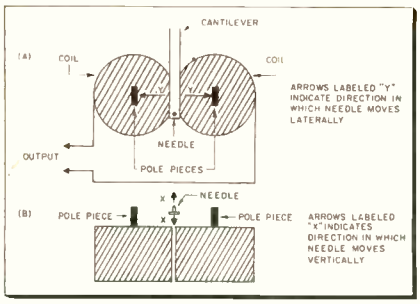


Fig. 7—Details of magnetic pickup. Bottom view is shown in (A), cross section in (B).

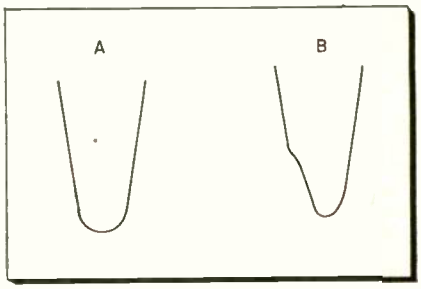
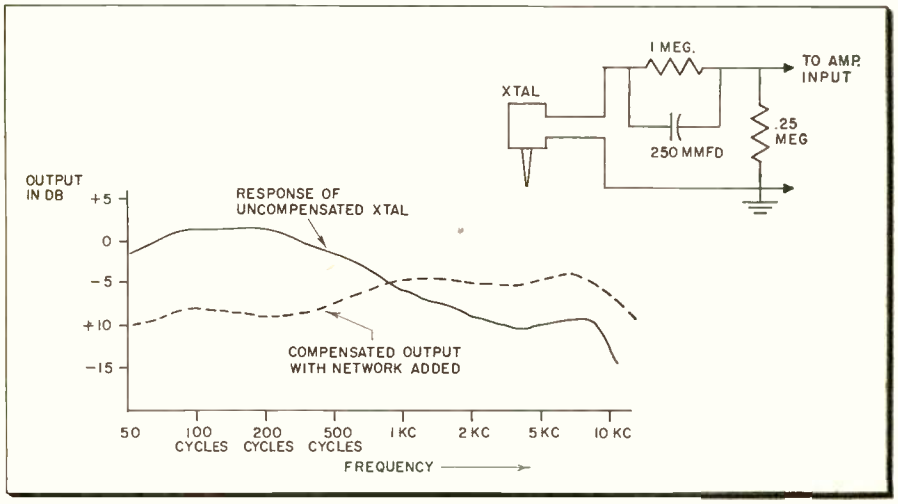


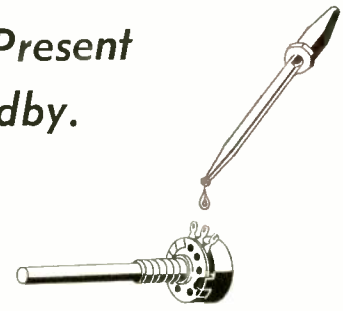
Fig. 8A—A properly shaped stylus tip. B—A needle point that has been worn out of shape.

Fig. 6A—Compensating network for a crystal cartridge. B—Response curves for crystal cartridge before and after compensation. Note smaller amplitude variations in dotted-line response.



What's Wrong with Carbon Tet?

An Engineer and a Chemical Consultant Present the Case Against an Old Service Standby.



BY HARRY E. SHULMAN
AND MURRAY JELLING, PH. D.

• Several articles have been written during the past two years on the use of carbon tetrachloride as a cleaner for controls and tuners. Having devoted a considerable amount of time to this subject, we believe it would be enlightening to the serviceman to explain what happens when carbon tetrachloride is used, and to list its disadvantages. Also, as improved cleaners have been developed, an explanation of their action and the methods by which they should be applied should be valuable to the serviceman.

Under no circumstances should carbon tetrachloride be used on electronic parts. Controls are usually lubricated, and carbon tetrachloride is such an excellent solvent that the lubricant is completely removed. The part may be in working order for a day or two, but the removal of the lubricant leads to frictional wear, and the trouble will appear and remain thereafter.

In addition, carbon tetrachloride causes corrosion. Even traces of this solvent will react with moisture and produce hydrochloric acid. Moisture is present in the air, and the cooling effect of the carbon tetrachloride as it evaporates will cause condensation on the metal surface. The absence of the lubricant, and the presence of the moisture and the acid, will cause corrosion of the metal, leaving a white film. This is probably zinc oxychloride, as the metals present are generally zinc alloys. This film and the corrosion will effect the characteristics of the control, and lead to more trouble than existed before the part was cleaned.

Cleaners have recently been developed which eliminate these difficulties. Essentially these are based on several ingredients.

1. A solvent is used which is an excellent cleaner, but is non-corrosive in contrast to carbon tetrachloride. The evaporation rate is slower, which reduces the tendency for cooling and condensation of moisture on the metal surface.

2. A lubricant is incorporated. This is left as a thin film to replace the original lubricant, which has been removed during the cleaning. It should be noted that gradual removal of lubrication and consequent deterioration has been going on during the years the control has been in operation.

3. A corrosion preventative is present to insure the protection of the unit after the servicing.

4. A conductor is incorporated to counteract any resistance introduced by the lubricant. This ingredient should not, of course, affect the characteristics of the component part. One manufacturer uses a material known as "Metacote" to impart this property to his product (Mute-Tone).

An efficient product should contain ingredients to perform all of the above functions in an expedient manner for the serviceman. The product should be supplied with a dropper attachment, and the serviceman should be equipped with a small brush, a cloth, a pipe cleaner, and a toothbrush, so that all types of controls may be cleaned easily and properly.

Cleaning Controls

In applying the cleaner to controls, such as volume, horizontal hold and contrast potentiometers, a few drops from a dropper are permitted to fall on the spaces around the pot terminals; the knob is then turned back and forth several times. This procedure will usually clean the dirty control effectively. In most cases the control may be cleaned without removing the chassis from the cabinet. This is done by tilting the cabinet, and allowing a few drops to run down the control shaft into the control. After a few turns of the knob, the control is cleaned.

Cautions on Cleaning Tuners

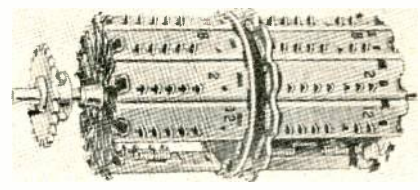
Greater care must be exercised in cleaning tuners. When cleaning wafer-type tuners, an excessive amount of the cleaner must not be permitted to be absorbed by the wafer material, as this may cause the tuner to drift. This caution is especially applicable in the case of some RCA tuners.

The proper method is to use an artist-type paint brush or a pipe cleaner, and only apply the cleaner to the contact areas of the wafer switch. This procedure is effective, and permits use of the unit for a considerable length of time before servicing is again required. Application of the cleaner by spraying should be avoided, as this method cannot be restricted to the contact areas alone, and a definite drift is apt to follow such improper cleaning.

On the Standard Coil type tuner, the use of a cloth was found effective. A small quantity of the cleaner was placed on the cloth, and the contact areas were rubbed. After a few complete revolutions of the tuner, the contacts were cleaned and lubricated.

On the Zenith type tuner it was found that the use of a toothbrush was the most efficient method of servicing the contact areas.

Regardless of the method of application, carbon tetrachloride was found to be a detriment to servicing controls and tuners. This cleaner may eliminate the trouble for a short time, usually a day or two, but the trouble returns and servicing is required again. This type of servicing is of course unsatisfactory, as it is time-consuming and causes a loss of confidence in the serviceman. Since improved cleaners are now readily available, servicemen should make use of them.



Drum of Zenith turret tuner. Stationary contact surfaces may be cleaned with toothbrush.

Troubleshooting Drift

Tests and Remedies for a Tough

By Philip Thier

• One of the most difficult TV service jobs, perhaps, is the correction of frequency drift in tuners. The simplest cases of drift are caused by faulty oscillator tubes. These may have loose elements, causing the inter-electrode capacitance to change periodically just enough to shift the tuner all over the selected channel. A quick tube replacement, followed, if necessary, by a slight realignment, will clear up the problem in such a case. The more difficult cases, those which drive the serviceman to distraction or into a defense job, will be considered in this article.

Let's consider first the complaint which was made to the serviceman as follows:

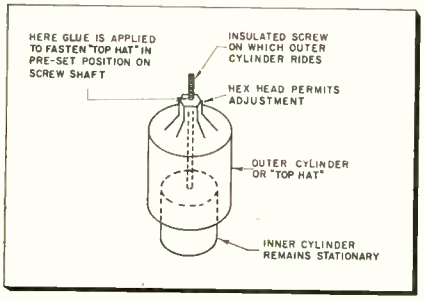


Fig. 1—"Top-hat" type of tubular trimmer.

"I was peacefully sipping an after-dinner highball and watching the news on Channel 4. Suddenly both picture and sound faded out. By the time I got to the set to see what was wrong, the picture and sound began to come back on. But you better come on over quick. It wasn't 4 that came up—it was 5. Either that set is changing channels by itself or else I'll have to change my brand of liquor."

Well, he didn't have to change his brand. There was enough drift in the tuner to shift the reception clear over to another channel. When he made the home call, the serviceman found the tuner set on Channel 4; Channel 5 sound was coming through strong, but the (Channel 5) picture was weak and snowy.

At first inspection, the technician reasoned that the oscillator tube was at fault. Its replacement, however, brought no improvement. The chassis was then taken into the shop. The set, it was found, used a turret tuner with structural features peculiar to this particular make of receiver. In electrical design, however, it was similar to the general run of commercial turret tuners.

Bench tests on the receiver revealed only front-end misalignment. After realigning the set, it was kept in operation for a few hours to see if the drift recurred. It did not, so the set was returned to the customer.

The following day, the set was back in the shop with the original complaint. This time the tuner was cleaned thoroughly before being realigned. The set was operated on the bench for three hours, but no drifting occurred. A cardboard box was then placed around the chassis, to simulate the poor ventilation present when the set was in its cabinet. In a few minutes, the tuner began to drift all over the band.

Following Up Clue

An important clue had been discovered. What particular component, however, was at fault? One lead that seemed worthy of follow-up was the fact that in each alignment, the same two trimmer condensers required the major adjustment. These were in the oscillator and mixer circuits. A detailed test and inspection of the trimmers and all other components in the two circuits resulted in the conclusion that there must be an easier way to make a living. All parts tested good. The mechanical assembly of the tuner next received careful inspection. The close, detailed scrutiny paid off by revealing the trouble.

All trimmers used in the tuner were of the "top-hat" or tubular type (see Fig. 1); after adjustment, such units are covered with glue to hold them in place. It was previously indicated that a rise in temperature was linked with the oscillator drift. Normal expansion of the condenser material (due to heat) could not cause so drastic a change of frequency. What about *abnormal* expansion, however? To check on this phase of the matter, the "top-hat" position with respect to the center body of all the trimmer capacitors was marked; the chassis was then operated inside the cardboard box. After the drift had occurred, a definite change of position of the "top-hat" was observed on the two trimmers previously referred to.

It now became apparent that the

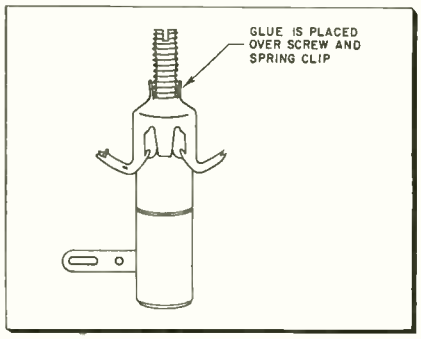


Fig. 2—Tubular trimmer capacitor.

glue holding these two "top-hats" in position was at fault. Most likely the trimmers had been adjusted in some previous repair, and the serviceman had been careless in his choice of a proper bonding agent. (It is very important that the bonding agent used in tuners be of such composition that it will not expand or contract to any considerable degree with temperature changes. The compound must also be an excellent insulator at high frequencies, as well as for fairly high dc potentials.) The old glue on the tuner was removed; after alignment, a good quality polystyrene-base coil dope was used to lock the trimmers in place. The trouble was now cured to the satisfaction of all concerned.

This case history has been presented in detail to illustrate just how obscure tuner troubles can be. It also was intended to demonstrate a useful method for locating the trouble.

Tubular Capacitors

The "top-hat" trimmer used in the tuner we have been discussing is just a special form of tubular capacitor. Another kind of tubular capacitor is illustrated in Fig. 2. Because they can be made to cover a wide capacitance range from a frac-

in Television Tuners

Service Problem. Case Histories

tion of a micro-microfarad on up, tubular trimmers are being incorporated in TV tuner design more frequently, now that UHF is here.

In the "top-hat," the outside case is movable and the center is used for mounting. The other type of tubular trimmer is supported by the spring clip at the top; the center slug is movable. The usual practice with both types is to cement the movable part at the adjusting screw, after appropriately setting the screw. Hence, many tuners besides the one previously described may be caused to drift by tubular trimmers that have been "gummed up" with a poor grade of glue.

Widespread use is now being made of insulated terminals as tie-points or feed-throughs to facilitate wiring. In tuners, the feed-throughs (see Fig. 3) are used to bring connections through shield plates and cans. A one-sided terminal may be used when a tie-point is needed and it is inconvenient to use a spare lug

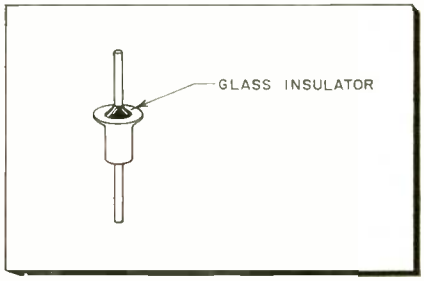


Fig. 3—A feed-through terminal.

on a tube socket, or when no such spare lug is available.

The glass insulator on such terminals may break, with the terminal shorting to chassis, but this is rare (as well as obvious). More often, the glass will *crack*, due to the application of excessive heat in soldering, or because of over-energetic tapping during a search for loose connections.

Similar in appearance to the feed-through terminal is the feed-through capacitor (see Fig. 4). This unit is used in TV tuners to bring the B+ lead through the tuner shield, or through shield plates between stages. It serves the dual purpose of feed-through terminal and bypass capacitor. The insulating material employed is a ceramic which also serves as the dielectric material of the capacitor.

As in the case of the feed-through terminals, the ceramic can be damaged by excessive heat or mistreatment. Breaking the ceramic will result in a short; the defect is readily apparent to the eye. In both the terminal and the capacitor, the main source of trouble lies in cracked insulation.

Dust and Dirt Troubles

These cracks, which usually extend from center post to the mounting ring or screw, as the case may be, become filled with dust and dirt in a very short time. Now, dust in a TV receiver is composed largely of metallic particles. Although these particles are bunched together loosely and provide a poor or, at best a varying resistance path for dc, they will act as a series-connected string of capacitors to ground, causing loss of r-f, oscillator or i-f signal voltage.

If the terminal is carrying i-f signal, the capacitance introduced by the metallic particles may affect the plate circuit of the mixer stage or the grid circuit of the first i-f stage (see Figs. 4, 5). Since this stray capacitance does not remain constant, its detuning effects on the mixer and i-f stages will not be constant either, and fading or drift will become evident. A loss of synchronization may be present as well. Incidentally, a cracked tube socket in the tuner can produce the same adverse affects on reception.

A varying resistance path instead of a varying capacitance to ground may be the problem encountered when a feed-through capacitor is cracked and the crack becomes filled with dirt. Since the feed-through capacitor is used to bring B+ voltage through the shield, the varying leakage path introduced in the case just cited will tend to cause the plate voltage of the oscillator tube to vary. This may cause undesired changes in oscillator frequency, and the receiver will, in consequence, exhibit drift.

To locate cracks, brush the insulation with carbon tetrachloride. If any cracks exist, they will show up as dark streaks, while the rest of the insulation will remain clear.

It is extremely important to replace any resistor in the front end which may have become even slightly overheated due to a short circuit. Any excess heat will cause the insulating material around the resistive element to crack. This, in effect, places another resistor in parallel with the overheated one. Since this "effective resistance" is usually of a varying nature, tuner stability will be seriously affected.

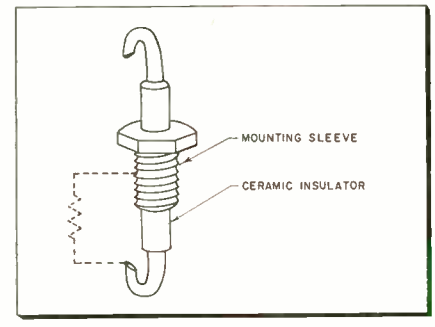
A cracked resistor will also exhibit varying capacitance characteristics. (Carbon and composition resistors have an appreciable distributed capacitance whose shunting effect varies with frequency—Ed.) The instability thus caused becomes more pronounced as the frequency increases. A defective resistor of the kind just described is one of the things to look for when a set drifts on the higher channels (7 to 13) but not on the lower ones.

Some servicemen may replace a shorted condenser and make no tests for further damage, to get the set out of the shop quickly. Such haste is not good business practice. A little extra care and time spent on the repair will prevent a costly call-back later on.

Replacement Cautions

Whenever any part replacement is made in a tuner, the new part should be placed electrically and mechanically exactly as the set designer intended. An effective

Fig. 4—Feed-through capacitor. The ceramic insulator, when cracked, creates a low-resistance shunt path (indicated by dotted lines).



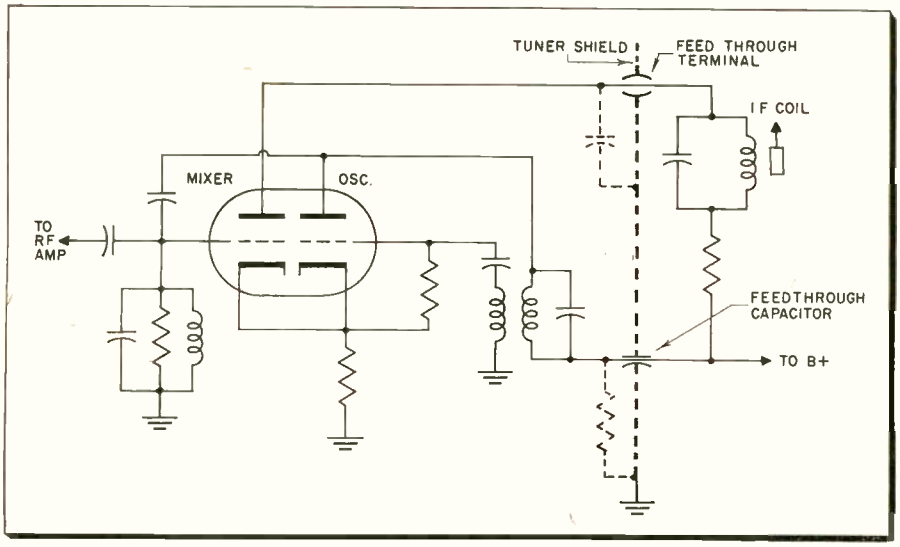


Fig. 5—Typical mixer-oscillator front-end circuit. The condenser in dotted lines illustrates the effective shunt capacitance introduced by a cracked feed-through terminal; the dotted-line resistor illustrates the possible effect of a cracked feed-through capacitor.

method of doing this is to sketch the exact placement of the defective part before removal. Lead length and dress must be kept the same. A straight wire 0.04 inch in diameter and four inches long has an inductance of 0.1 microhenry. At standard broadcast frequencies, this inductance is negligible; at 100 mc, however, it represents an impedance of about 65 ohms. The choking effect of such an impedance is obvious.

Under certain circumstances, a TV receiver will exhibit symptoms of tuner drift, yet no defect can be found in the tuner. This is especially common in receivers using selenium rectifier power supplies. These rectifiers are often sectioned, to supply different voltages to various parts of the set. A common fault in selenium rectifiers is that the output voltage will vary if the oxide element is slightly defective.

Plate Voltage Changes

Should this occur in the rectifier section supplying the tuner, the varying oscillator plate voltage that results will tend to produce corresponding variations of local oscillator frequency. Other stages, of course, will also be affected, but the oscillator-caused symptoms will generally be the most noticeable. A vacuum-tube voltmeter connected to the tuner B+ supply line will indicate any voltage fluctuations, helping identify this kind of trouble when present.

Poor power supply regulation may cause the set to be unstable or drift during the first fifteen minutes or half-hour after it is turned on, with receiver stabilization occurring afterward. This source of drift, incidentally, is an often overlooked one. Monitoring the B+ line with a voltmeter, as in the preceding case, will help localize the trouble. Replacing the rectifier or filter condensers (when tests confirm that they are defective) will eliminate drift caused by such component defects.

To avoid introducing drift into a tuner when it is being serviced, observe the following precautions (in addition to others previously cited):

When making soldered connections, use as little solder as possible. At high frequencies, a glob of solder may act as a capacitor. A cold-soldered joint may become intermittent, and will always add resistance to the circuit. Keep the soldering iron hot and use a high silver content solder (if obtainable). Any rosin flux present must always be removed from the connection, as it introduces a very low resistance shunt path at very-high and ultra-high frequencies.

The most valuable commodities the service technician has to sell are his time and knowledge. To make better use of both when trouble-shooting drift, the following pointers should be kept in mind:

1. In searching for the cause of trouble, remember that defects in receiver sections other than the tuner can cause drift.

2. Since even a tube replacement in the tuner may necessitate realignment, it is recommended that all tuner repairs be done in the shop.

3. A very thorough mechanical inspection of the entire tuner assembly should be made when trouble-shooting drift.

4. Careful and precise electrical tests of all circuits in tuner are also recommended.

5. Replace defective parts with exact duplicates, maintaining the original physical placement and lead dress.

6. Precision alignment is advisable. Obtain the set manufacturer's recommended alignment procedure, if possible.

7. Before returning set to customer, keep it in operation on the bench for a few hours. This will help prevent costly callbacks.

"Conditions of Repair" Card

One of the novel ideas of Bonded TV Service, Inc., of Belmont, Mass., is a printed "conditions of repair-service" card which has been widely copied throughout the Massachusetts area. The card is printed on both sides. It reads:

"Conditions of this repair service. Be certain that your set has been adjusted to *your* satisfaction before our serviceman leaves. Recalls will not be allowed for adjustments.

"Since many circuits and tubes combine to make up the picture and sound, we cannot assume responsibility for future breakdowns, even immediately after repair is made.

"Parts and tubes used in the repair are guaranteed for one year and will be replaced without charge, except for service, provided Bonded TV Service Co. is called to re-service set at regular charges.

"It will be assumed that the repair has been properly made, unless our main office is notified to the contrary within two days."

Another "first" by Bonded was the origination of service advertising on the TV page of Boston newspapers, and visual advertising over TV Station WBZ-TV once a week.

Bonded operates on a strictly cash basis. "Credit does not work in this business," manager Widisky said.

My Competitor

My competitor does more for me than my friends will do.
My friends are too polite to tell me what I ought to know.
My competitor makes me efficient, diligent and attentive.
He makes me work and search for new ways to improve my service.
My competitor would take my business away from me, if he could.
This keeps me constantly alert to protect what I have.
If I had no competitor, I would be lazy, incompetent and independent.
I need discipline. I like my competitors. They have been so good to me.

—Sales Story

Eliminating Tweet Interference

Part 2 of a Series on Lead Dress Troubles

By Cyrus Glickstein

The most important video defect which can be caused by lead dress is *tweet*—an r-f interference pattern generated internally in the receiver. The tweet frequency is a harmonic of the video or sound i-f carrier. This harmonic is fed from the video detector back to the tuner, beats with the incoming picture or sound r-f carrier, and causes an interference pattern to be visible on the screen.

The tweet pattern is usually a continuously changing one. It can generally be distinguished from external interference by a simple test. Vary the fine tuning control. If the TVI pattern seen changes from thin diagonal or vertical lines, to broad horizontal lines, and back to diagonal lines, as the fine tuning is slowly varied (see photos), the interference pattern is probably due to an internally-generated tweet.

To verify this, figure out whether any harmonic of either the sound or picture i-f is close in frequency to either the sound or video r-f carrier, on the channel(s) where the interference is present. If it is, a tweet is probably the cause of the TVI.

In most cases, the tweet is caused by pickup of the i-f harmonic in the section of transmission line between the antenna terminals and the tuner. The trouble may be due to the insufficient spacing of this antenna lead-in from audio or video i-f stages, particularly the video detector. If moving the lead-in reduces the tweet symptoms seen on the screen, it is advisable to staple the lead-in along the top of the cabinet, as far from the video i-f section as possible. It may be necessary to lengthen the lead-in, to obtain the maximum reduction in interference.

If the tweet is not caused by pickup in the antenna lead-in, it is advisable to determine whether it is originating in the sound or video i-f section. This can be done, as described previously, by simply checking mathematically — determining whether the sound or video i-f harmonic falls in the channel tuned in. Another check consists of removing the first sound i-f tube and noting if the tweet effect disappears. If it does, it is originating in the sound i-f section.

Possible procedures for clearing up tweet interference originating in the sound i-f section include the following:

a) Check sound i-f and discriminator transformer shield cans and wiring. The cans should be tight in place and well grounded to the chassis.

b) Lead dress in the discriminator stage, especially that of discriminator transformer wiring, should be short and direct.

c) All bypass capacitors in the sound i-f section should have leads as short as possible; the capacitors themselves should be dressed close to the chassis.

For clearing tweet interference originating in the video i-f section, the following is recommended:

a) Try shielding the 4th video i-f, video detector, and video amplifier stages, when such shielding is absent.

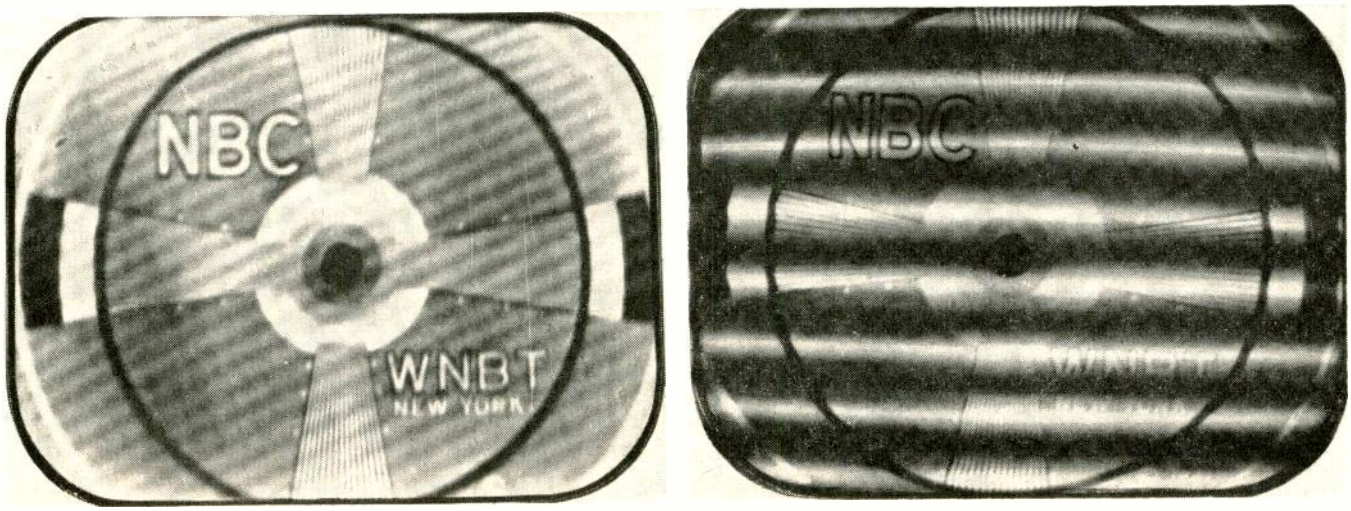
b) Wires from the video detector circuit should be short, dressed close to the chassis, and away from other wiring.

c) Determine, by bridging and resistance tests, whether bypass condensers in the 4th picture i-f plate circuit, the r-f bias circuit, and the video i-f plate and screen circuits are in good condition.

d) An outdoor antenna should be tried on receivers using built-in antennas, since the outdoor unit provides a better signal, less susceptible to interference. A built-in antenna is apt to pick up more tweet interference than an outdoor one.

In the case of particular receiver models, where the tweet problem is present in aggravated form, service bulletins of the set manufacturer should be consulted.

TVI caused by tweet varies from narrow diagonal lines (left) to broad horizontal lines (right), as fine tuning control is rotated slowly.

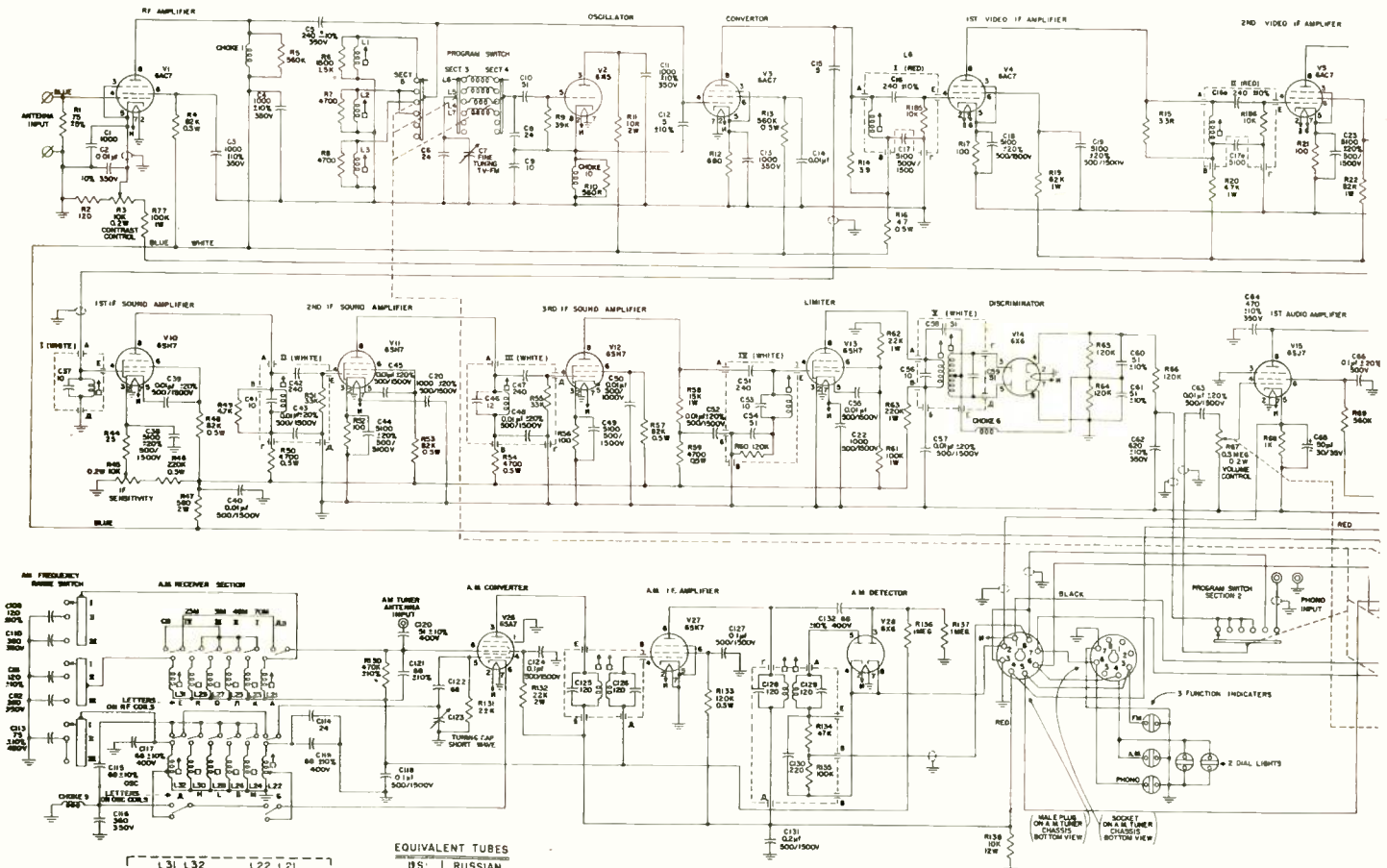


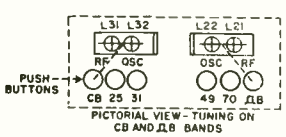
Modern Russian TV Receiver

Diagram and chassis photos provided by U. S. Air Force offer American technicians opportunity to compare Soviet and American designs.

The late-model Russian TV set whose schematic is shown on this page is known as the "Leningrad" T-2. It is a single-channel job using 32 tubes. Set would sell for about $400 in the United States. Picture tube has an 8-in. screen which emits a green light. A. C. Omberg, Engineering Director of Bendix Radio Division, Baltimore, Md., recently demonstrated this set during the course of an interview with T. White of WBAL-TV.

Separate power supply and AM tuner chassis are used in the T-2. Sound system present is a split-carrier; sound take-off point is at the plate of the converter. Circuitry seems very similar to that present in American bourgeois receivers. (Note *Equivalent Tubes* chart, bottom of this page.)



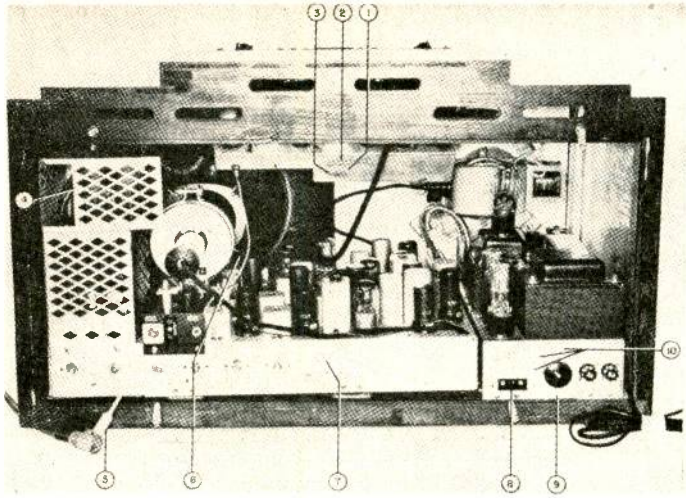


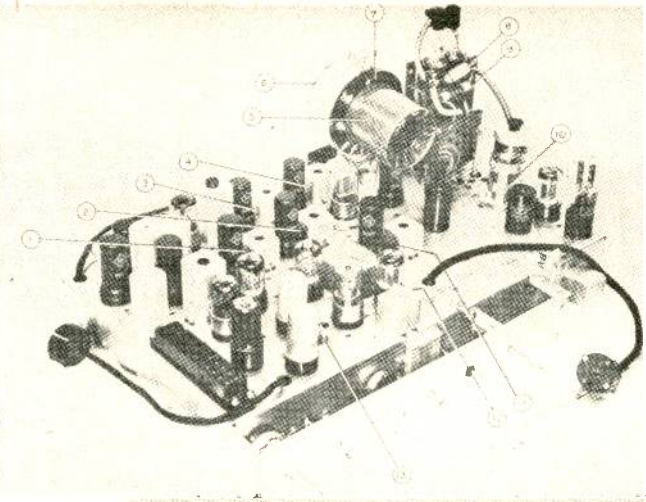
PICTORIAL VIEW - TUNING ON CB AND ДБ BANDS

EQUIVALENT TUBES

US	RUSSIAN
6AC7	6AC7, 6Ж4
6H6	6X6
6J5	6Ж5, 6C2C
6SN7	6H8M
6F6	6Ф6
1Z1	1Ц1
5Z4	5Ц4C
23LK1B	23ЛК1Б
6AG7	6AG7, 6Л9
6SH7	6SH7, 6Ж3
6V6	6V6, 6ПГ6C
6SA7	6SA7, 6A7
—	Гр-50, LS50
—	Гг-50, Гу-50

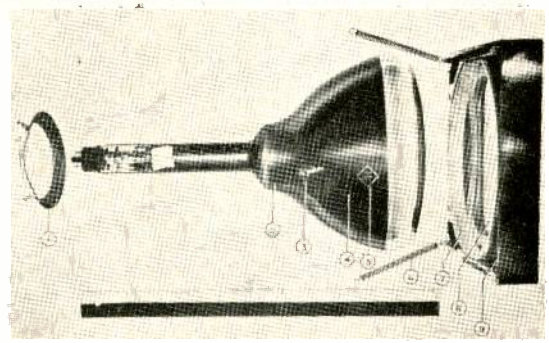
NOTES
UNLESS OTHERWISE SPECIFIED
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
K INDICATES THOUSANDS OF OHMS
MEG INDICATES MILLIONS OF OHMS
μF INDICATES MICROFARADS
W INDICATES WATTAGE
WW INDICATES WIREWOUND
ALL RESISTORS ARE ±10% TOL AND 0.25 W
PROGRAM SWITCH SECTION ONE IS NEAREST TO KNOB



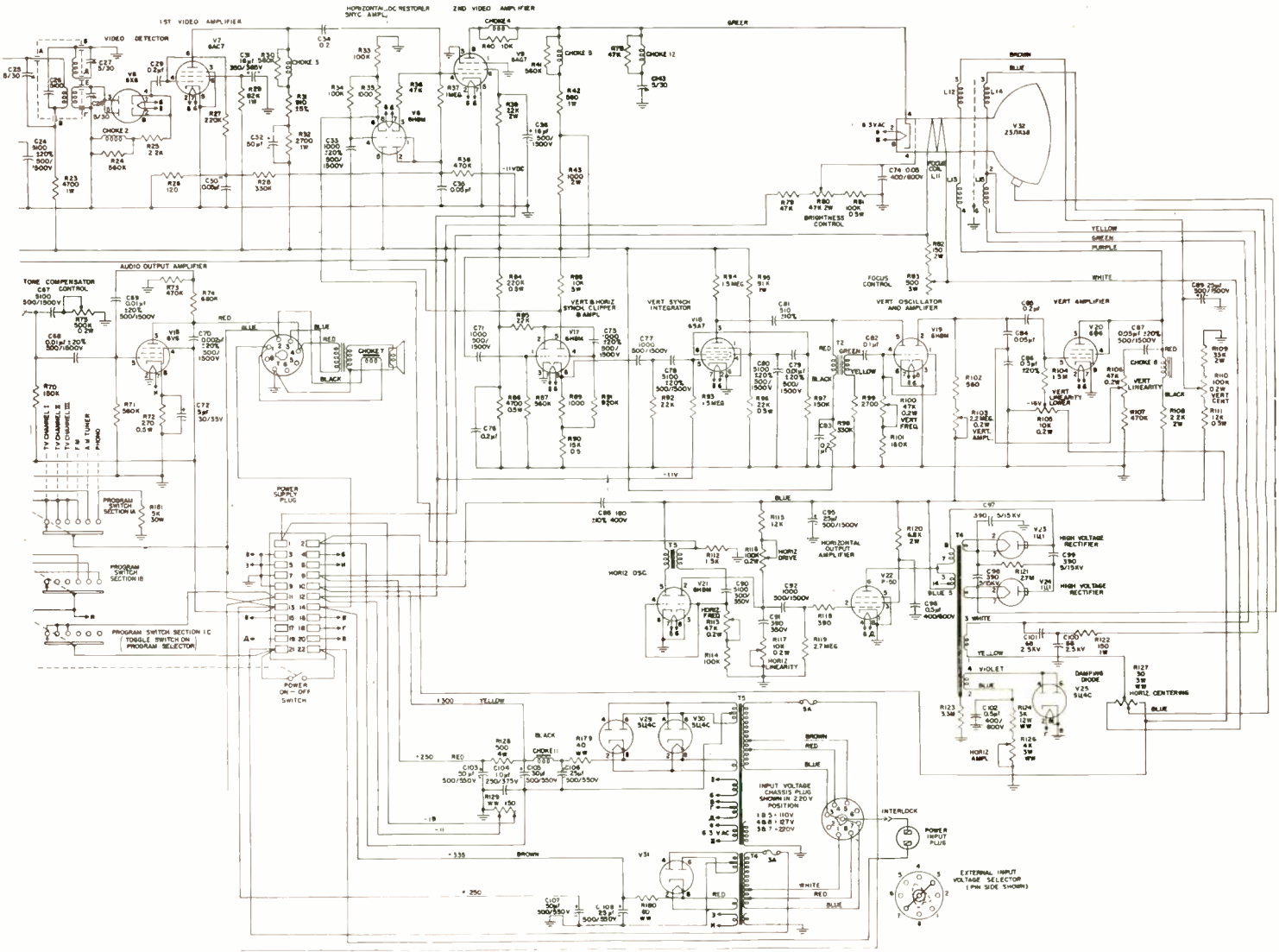


(Above) Rear view of Russian receiver's interior
1. & 2. Manufacturing mark
3. AM tuner Serial No.
4. Hi-V Diode Access Door
5. 90° Antenna Connector
6. Manufacturer's mark
7. TV chassis serial No.
8. Interlock, Female Conn.
9. Power supply serial No.
10. Source voltage selections

(Above Right) Front quarter view of the te'e-vision chassis
1. to 4. Manufacturing mark
5. Focus coil
6. Deflection coils
7. Manufacturing mark
8. 15KV clear plastic cap.
9. Sleeved resistor, R121
10-12. Manufacturing mark
13. Vert. Lin. (upper) control



(Right) Exploded view of CRT assembly
1. Retaining Ring
2. Manufacturing Mark
3. High Voltage Contact
4. Tube Type
5. Manufacturing Mark
6. Retaining Spring
7. Hair Felt Pad
8. Safety Glass
9. Molded End Plate



Rx for Ailing CRTs

Soldering Cure for CRT

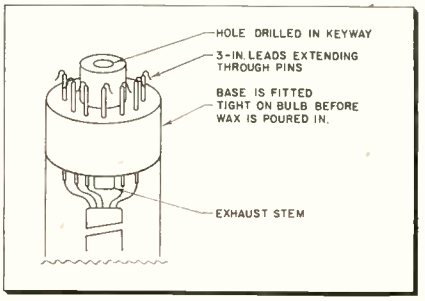
When a picture tube filament seems open, many servicemen will replace the crt with a new one. A wiser procedure is to first use a very hot soldering iron on the prongs of the picture tube itself. A high resistance joint, or oxidation on these filament prongs, may be the cause of the crt filament not lighting. Heating up the prongs will return the tube and set back to normal in such a case.—*Gelman's TV, Philadelphia, Penna.*

Socket Replacement

Here is a hint which may be of value in servicing early 1951 RCA models, such as 6T53 through 6T87 sets. Customer's complaint: sound but no raster. I find no glow at the crt filament. After a slight movement of the crt socket, the tube lights and the set works ok for a day, a week, or sometimes a month. Then another call. The rear of the socket is removed, the leads are resoldered, and the pin contacts are tightened. A few days later the same trouble occurs. I repeat the same procedure. Then I run a little Lubriplate or Walscolube in the socket contacts, hold a hot iron against the tube pins to make sure contact here is ok and reassemble the socket. A month goes by and the same thing happens. In disgust, I replace the socket. I tell the customer if the same thing happens it is undoubtedly the pix tube and leave. No more calls. This, of course, happened only on the first job of this type. Since then I have replaced almost a dozen sockets on the first visit, with no callbacks. Seems that, regardless of how tight the contacts are around the heater socket contacts, a microscopic layer of corrosion develops, and a slight rise in resistance prevents full current flow to the heater. One jobber here has run out of sockets lately, pointing up the prevalence of this trouble.—*M. G. Goldberg, St. Paul, Minnesota.*

Rebasing Technique

Ever have a picture tube base come off in your hand when removing the socket? There is a solution to this problem that will probably result in a better connection than the original bond between the glass bulb and the tube base. Carefully remove any remaining leads from the socket and clean them as close to the bulb as is possible, then solder three-inch tinned no. 18 wire leads to the original ones. Clean all residual glue from the base, and remove solder from the pins. Drill a ⅜-in. hole in the flat portion of the keyway of the base, and thread the tinned leads through the proper pins, pulling the base down tight on the bulb. Then bend wires over the pins, as shown in the figure, to hold the base in that position. Place tube on floor, face down, and pour hot sealing wax in the hole drilled in the keyway, until it completely fills the interior of the base. Then solder pins, and clip off excess wire. When the sealing wax is hard, the tube base should be able to support the entire weight of the picture tube, the strain now being on the exhaust tube in the center of the base.—*Walter C. Souders, Ambler, Penna.*

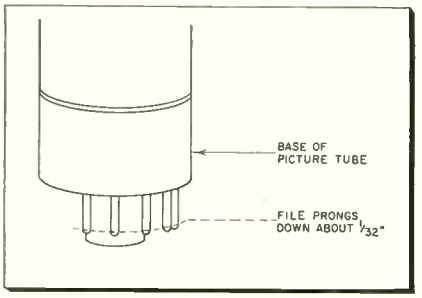


Technique for rebasing picture tubes by adding lead lengths and cementing with sealing wax.

More on Rebasing

Many technicians of my acquaintance go about rebasing a picture tube with trepidation and lack of proper technique. The tube usually belongs to a customer. When the base inadvertently comes off during handling, the shop owner is responsible for an expensive component. It must be remembered that the five leads coming out of the crt are fairly tender copper-oxide coated leads. To feed these through the pins of the base, the average technician first heats the prongs of the base and shakes off the solder. Then he tries to thread the five leads thru the five prongs. In many cases these wires are so short that one can't be quite sure that they are actually through the base pins. In such a case, file these base pins down a little, as indicated in the sketch. When the crt leads are finally threaded through the proper base pins they will now be actually seen protruding. You can believe me that this is quite reassuring. I have shown several of my friends just how I do it and the invariable comment is: "Boy, this sure is a swell way of doing it. It takes me twice as long the other way and I am never sure that all the leads are actually in the proper base pins and firmly soldered. This way you can see what you are doing."

Here are details on the procedure: File down the base prongs about $\frac{1}{32}$ of an inch. That will effectively remove all of the solder from the hollow prongs. Carefully clean the leads with fine sandpaper. Remove all excess dried cement from the inside of the base. Now carefully thread the leads through the prongs of the base. They will not only show but will actually come out of the prongs about $\frac{1}{32}$ of an inch.



Rebasing may be facilitated by filing crt prongs down to make them 1/32 in. shorter.

Pull the base back just a trifle. Apply service cement both to the base and the glass sparingly. Allow it to stay for about two or three minutes. Then push the base up snugly against the glass. Allow about half an hour to dry. Solder leads to prongs. With a fine file, remove excess solder.—*B. O. Riis, Miami, Florida.*

Prescriptions for C-R Tube Service Problems. Removing Faults, Replacement, Reactivation

Arcing Remedy

If corona or arcing is experienced at the anode button, it is probably due to an accumulation of dirt, or the effect of a corroded rubber suction cover. The following procedure is recommended to eliminate the trouble.

1. Disconnect the anode lead from the tube. 2. Clean the area around the anode button with carbon tetrachloride or a scouring compound. 3. Add a protective coating. It has been found that the use of Crosley Appliance Polish (part number 81527) after the surface has been cleaned will give this protection.

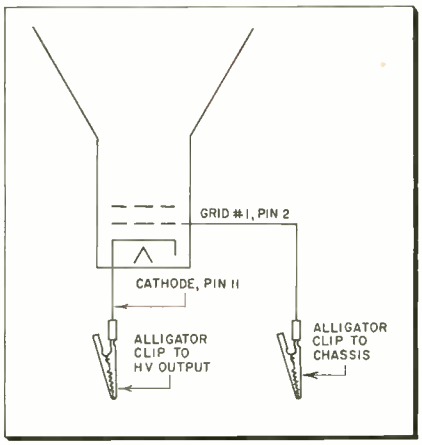
As an added precaution: If the original anode connector is without a suction cover, thus permitting free accumulation of dirt, or if it has a rubber cover, which could be the source of present or future trouble, a new anode connector and lead assembly should be used to replace the original assembly. This new assembly should have a neoprene suction cover which will resist corrosion and prevent accumulation of dirt around the anode button. If this procedure is followed, re-occurrence of problems of this kind will be held to a minimum.—(*courtesy Crosley Service Dep't.*)

Rapid CRT Replacement

This technique, which I have used often, may be of help to other technicians who service RCA 21-in. receivers. We have had many 21AP4 picture tubes go negative or lose emission, thus making replacement necessary within the first few months after the set was sold. Ordinarily the chassis has to be pulled to replace the tube, but the method I use is faster and easier. After disconnecting the high voltage cable, crt socket and ion trap, remove the two ¼-in. screws holding the supporting bracket for the deflection yoke to the top of the cabinet. You can then remove the supporting bracket by tilting it to the left just enough to clear the top of the cabinet; then you slip it off over the neck of the tube. After this is done, you can remove the picture tube by turning its face or front to the left (away from the high voltage cage). The new tube can then be installed in a matter of minutes, without removing the chassis. Usually the only adjustment that need be made after reinstalling the yoke assembly is the correct placement of the ion trap.—*Wallace Cantoni, Landisville, N.J.*

Removing Internal Shorts

A cathode-ray tube occasionally develops a grid-to-cathode short; such a short may be intermittent. This trouble may be hard to locate, and it is often solved by replacing a costly picture tube. I have found that



Set-up for removing grid-cathode short in crt.

many tubes can be saved by *flashing*, which separates the shorted elements. Simply remove the tube socket and the hv connector; then, using two clip leads having good quality insulation, ground pin no. 2, the grid. Now connect pin no. 11, the cathode, to the high-voltage lead. Turn on the set and lightly tap the neck of the tube. (We would recommend leaving the set on for no more than a second or two at a time, to prevent damage to hv components. The high-voltage arc between grid and cathode will often force these elements apart, clearing up the short and saving a costly picture tube.—*Walter C. Souders, Ambler, Penna.*

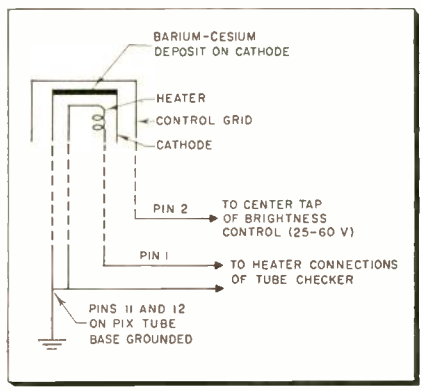
Pix Tube Reactivation

Normally, if the pix tube is weak it is best to sell the customer a new one. However, it is sometimes possible to restore satisfactory emission in the old one. In the manufacture of the crt's electron gun, the cathode is coated with a cesium-barium powder. This coating (.003 to .005 in. thick) is rarely activated to full depth. It is possible for the serviceman to take advantage of this fact by reactivating the remaining powder on the cathode. Some manufacturers of equipment built especially for this purpose claim that 90%

of all low-emission picture tubes can be restored. I can't confirm or deny this statement but, with my method (no special equipment required), we can settle for a 30% figure.

Only two items are required: An ordinary tube checker, to supply a variable source of heater voltages; and a TV chassis, to supply a dc source of from 25 to 60 volts. (Some receivers provide a variable dc voltage on their brightness controls, ranging from zero to 120 v or more. On Philco 50T1401 and similar sets, for instance, 0 to 155 volts is available at the brightness control.)

Consider the grid-cathode assembly of the electron gun to be a diode. Tie one heater leg to the cathode; then tie this junction to



Set-up for reactivating crt's with low emission.

ground. Impress 25 to 60 volts on the grid. Keep this voltage as close to 25 volts as possible, because ion bombardment of the cathode may occur at higher voltages, if the vacuum is not tight. Connect the heater leads to any convenient pair of heater pins in the tube checker, but make sure the ungrounded heater lead is not grounded internally in the tube checker. Then use following procedure:

(*Continued on page* 64)

COLOR SHORTS

INSTALLATION procedure for color-TV receiver was demonstrated by RCA personnel at conference called shortly after FCC announcement on NTSC standards. Color pix tube was not mounted on chassis, as is usual with B & W sets. The tube, packed in a separate carton, had to be mounted in the cabinet. Unlike conventional crt, the color tube must be oriented for a single correct position; the built-in mask must be aligned with the cabinet opening and the blue gun in the neck of the tube must be uppermost with respect to red and green guns.

THE HI-VOLTAGE regulation adjustment will have to be made (screw-driver control) with a meter when the receiver is installed, as correct hv value is important to proper beam convergence and color registry. A good B & W pix is the next thing the receiver is set up for. Carried out with a linearity or dot generator, or special convergence checker, this procedure prevents B & W pix from being marred by color ghosts.

COLOR PURITY ADJUSTMENTS are then separately made for the individual primary colors, to insure uniform saturation for each across the entire crt screen. Then the balancing controls for each primary are manipulated, so that all three together give a uniformly grey raster. Saturation adjustments, made next, may depend on individual judgment. If they are set too high, however, the excessive signal present may overdrive the crt, causing color distortion as well as possible tube damage.

RECEIVERS may be hinged on top to facilitate picture tube installation and access to controls. The front panel of one proposed commercial model features more than 20 controls. No octopus should have any trouble learning how to adjust his color receiver! The fine tuning knob, an often neglected control with modern tuners, will become more important. Relatively minor deviations in receiver tuning may suppress the 3.58 mc color subcarrier, seriously affecting color reproduction. In switching from one channel showing a color program to another, the set owner may have to readjust fine tuning regularly. Chroma and phasing controls may also have to be readjusted with every switch-over to another channel, to compensate for minor differences in transmission. Improper phasing may result in wrong-color reproduction (red for blue, blue for green, etc.).

SERVICE CONTRACTS, informed sources say, are expected to cost about three or four times more for color sets than for B & W receivers. First-year contracts should fall between $170 and $300, app. These figures, of course, represent an early condition. Contract charges should fall in a year or two, as was the case with initially high B & W contract costs.

THE LAWRENCE COLOR TUBE, employing a single electron gun, may get a bigger play in '54. A step-up in output of this crt was foreshadowed with the addition of new grid-producing facilities by the Chromatic Television Laboratories of California. Grids have been a principal bottleneck in the production of Lawrence tubes. An annual total output of more than 25,000 grids was forecast for the new facilities, with production starting by the end of March. The grids will be used in the manufacture of 21- and 24-in. color pix tubes. The Lawrence design is said to pave the way for these large-screen tubes. Thomas Electronics of Passaic, New Jersey, manufacturer of conventional B & W crts, will handle the fabrication of the color tubes themselves, under a recent licensing agreement.

COLOR SERVICE SCHOOLS and clinics have already been started by at least three manufacturers. Westinghouse claims the first service school (December) at its plant in Metuchen, N.J. All of the Westinghouse key field service personnel took part in classroom and laboratory sessions. Subjects covered included: the study of color; composite color signals and their function; transmitter requirements and variables; basic receiver design; and adjustment of color receivers.

BUFFALO was chosen by Sylvania for its first color service school in January. Field clinics to train Sylvania dealer-servicemen are now in the works. The first RCA color clinics, each consisting of four days of intensive instruction and demonstration, were held for the benefit of receiving set licensees. New York and Chicago were the sites for the first two such clinics in January. The Los Angeles clinic begins on February 8. Similar clinics for service groups will be held in 65 key cities throughout the country, starting early this month.

RETMA is now working on a color-TV lecture program for technicians. The program, as now proposed, will be offered to sponsoring organizations as a package deal. The package will include: a lecture text; an illustrated booklet, on which the lecture is based, to be distributed to audiences at the time of the lecture as a study guide and reference text; a series of 35 mm strip films to supplement and illustrate the lectures; and a lecturer's guide pamphlet recommending procedures and techniques for most effective use of the lecture material.

DR ALLEN B. DU MONT foresees 21-in. color sets at $500 each, but does not believe this point will be reached for at least three years. He anticipates limited-quantity production of color-TV in general until 1956. He believes cost factors will block an immediate swing to color. Full integration may take 10 to 20 years.

HOME STUDY COURSE IN COLOR TV for technicians already versed in B & W circuitry and service will be offered by RCA Institutes of New York City. Consisting of nine lessons, the course will cover the following subjects: Introduction to Color TV; Principles of Light and Color; The Color TV System; Receiver Principles; Color Picture Tubes; Receiver Circuitry; Set-up and Adjustment Procedures; Alignment and Servicing; and Special Test Equipment. For a bulletin describing the course, write to Home Study Department, RCA Institutes, 350 West 4th Street, New York 14, N.Y.

COLOR ISN'T ALL—A recent Comedy Hour show was telecast in color. A follow-up of New York TV columnists who viewed the program on color sets produced interesting results. When the show lagged, bored reviewers tuned *out* the picture—in favor of B & W programs that held greater interest.

SHOP HINTS

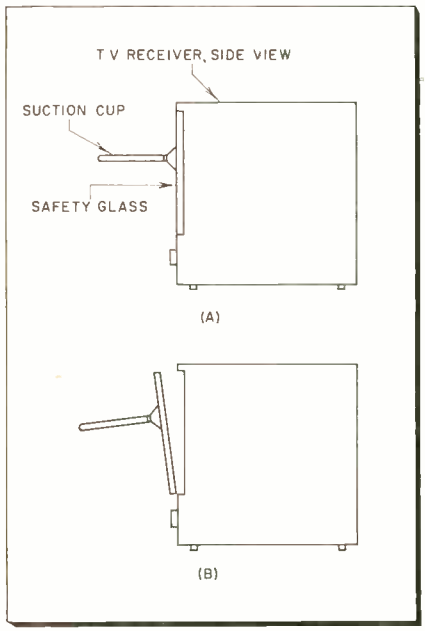
Minimizing Damage; Accident Prevention; Dynamic Condenser Check; Deodorizing Sets; Painless Chassis Carry.

Preventing Instrument Damage

Plastic or wood cases of various test meters are so smooth that the instruments are easily pulled from the bench during use. A few layers of adhesive tape placed on the bottom of the case will often remedy this kind of trouble. Tape also may be installed in a criss-cross manner to further prevent slipping. —*H. Leeper, Canton, Ohio.*

Safety Glass Removal

If you have ever had to take out a safety glass to clean a dirty picture tube, and found to your horror you had chipped or broken the glass with a screw-driver, you will appreciate this time and money saver. I use a suction-cup dart from a child's toy gun. Simply moisten the rubber (after removing screws which hold the glass) and press the cup onto the top center of the glass (see illustration). Pull outward, at the same time holding the bottom of the glass with your free hand.

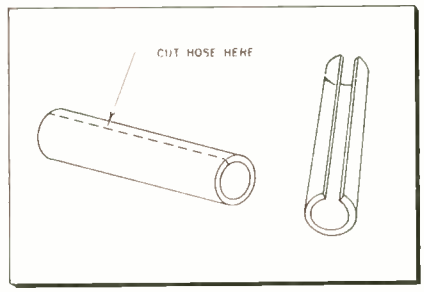


Simple method for removing crt safety glass.

Note: This works equally well with safety glasses that swing out from the bottom. On these press the rubber onto the *bottom* center, and hold the *top* with the free hand, pulling outward on the suction cup. —*J. L. Mancini, Winthrop, Mass.*

Gimmick for Chassis Carry

Sometimes the edges of a heavy TV chassis dig into the hands when the chassis must be carried any great distance. I got around this by making two cushions for my hands.



Grips made from an old rubber hose help take the pain out of carrying a heavy TV chassis.

These were made by cutting two 5-in. pieces from a rubber garden hose. The units were sliced lengthwise down the middle on one side. When slipped over the bottom edge of a chassis on either side, they tend to make good soft grips. They take very little room in the service kit and can be slipped off and on in a second.—*H. A. Wahl, Redondo Beach, Calif.*

Truck Accident Prevention

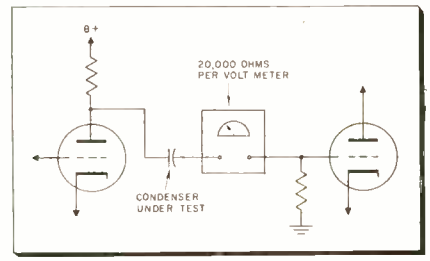
Several of our men were involved in accidents as they opened the doors of their service cars or trucks. This happened when approaching motorists ran into the truck doors in the dark. We solved this problem by attaching narrow strips of reflecting tape just inside each door along the edge. When the doors are opened at night, the tape is visible to oncoming autoists, and accidents are thus avoided.—*H. J. Müller, Sarasota, Florida.*

Deodorizing Receivers

It may sound strange, but some receivers have to be deodorized. This writer had to replace a burned-out power transformer. The job turned out quite well, except that the customer objected to the burnt odor that persisted despite a thorough clean-up attempt. Finally I hit on a very simple method that really worked. Reasoning that even a perfume does not smell when properly corked, I corked the burned areas by spraying two coats of plastic spray (Krylon) over the discolored areas. The smell disappeared. Do you have a customer allergic to odors of burned transformers, resistors, and selenium rectifiers? Try this method, it works!—*B. O. Riis, Miami, Florida.*

Dynamic Condenser Check

In many instances, condensers short only under load, and check ok when out of the circuit. When such a condition seems to be present, I use a voltmeter in series with the suspect part, as shown in the illustration. If the capacitor is shorted, a dc current flows through it and through the resistance of the meter.

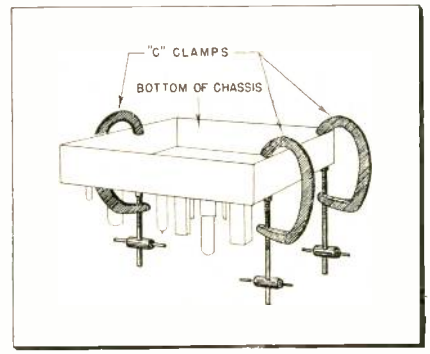


Checking capacitor dynamically with voltmeter.

This sets up an IR drop, and the meter needle will swing up, verifying the existence of the short.—*J. L. Mancini, Winthrop, Mass.*

Chassis Supports

Large C clamps make ideal chassis supports. They take up little room, adjust to many sizes of chassis, are inexpensive, and they may often be used where other chassis supports cannot be employed. Much time can be saved by their use, and needless damage avoided.—*Joseph Amorose, Richmond, Va.*

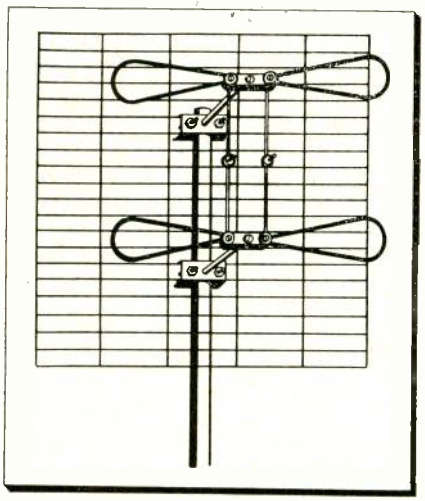


New Antennas and

UHF, VHF and Combination Units; Mounting Aids

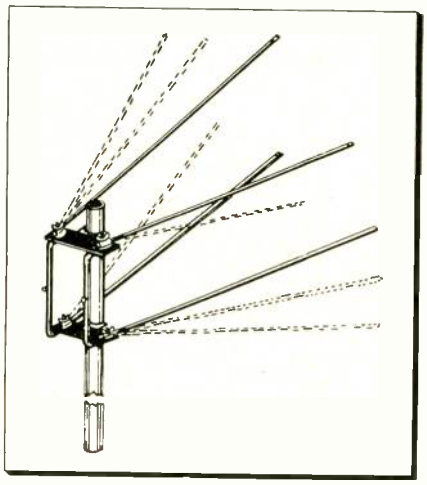
Fretco UHF-VHF ANTENNA

The Mi Tee Ray Screen, model MR S, is said to have high gain from Channels 2 to 83. A 50:1 front-to-back ratio provides discrimination against ghosts. Insulators of high dielectric strength prevent signal loss. Construction withstands wind and ice. Antenna comes pre-assembled but collapsed. List price, $7.25. Fretco, Inc., 406 N. Craig St., Pittsburgh 13, Pennsylvania.—TECHNICIAN



Telco UHF-VHF DOUBLE V

This stack-type antenna, cat. no. 9010, can be used for UHF, VHF or both in primary and secondary signal areas. Adjusts to angle spacings of 50, 70, or 90 degrees, and has high directivity. Ruggedly constructed to withstand wind, ice and snow, the antenna is said to install easily. List price, $6.95. Television Hardware Mfg. Co., Rockford, Ill.—TECHNICIAN



Bogen UHF ANTENNA WIRE

This single-wire transmission line is said to have low loss, low interference susceptibility, all-weather performance characteristics, and low radiation. Since swinging of line does not affect signal, only two standoffs with no intermediate supports are necessary. Two matching units ("Launchers") are required per installation, one each at antenna and receiver, to match to the short lengths of 300-ohm line used at these ends. The wire, called G-Line, is available in 150-ft. length, in kit with 2 launchers and 2 standoffs; list, $38.25. Wire alone available on 500-ft. reel for $32.50. David Bogen Co., 29 Ninth Ave., New York 14, NY—TECHNICIAN

Telkor UHF ANTENNA

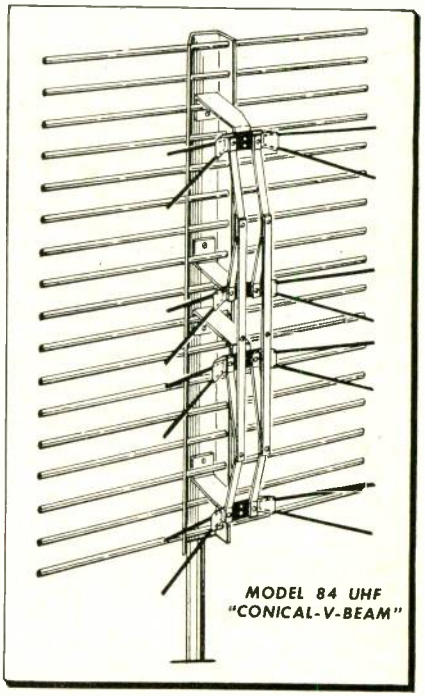
Engineered for high gain on all UHF channels, model 14283 discriminates against ghosts and interference, has a high front-to-back ratio, and is recommended for all-weather use. Terminals are located in free space to reduce leakage. Shipped pre-assembled. Suggested list price, $8.50. For extreme fringe locations, order stacking kit 14283K. Telkor, Inc., Elyria, Ohio.—TECHNICIAN

Safety LADDER BELT

Dangerous falls from ladders during antenna installation are said to be averted by this climber's safety device. One end of chain fastens to climber; the other end slides along rail fastened to ladder as climber goes up. If climber slips, device is said to lock against rail within 7 in. of spot where fall begins. Unit designed to be jam-proof, operate in all weather, and adapt to all types of ladders. Safety Tower Ladder Company, P.O. Box 1052, Burbank, Calif.—TECHNICIAN

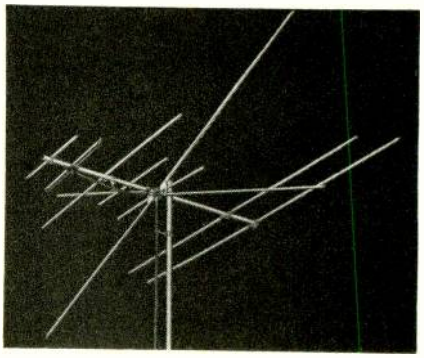
Telrex UHF ANTENNA

Model 84 UHF, a single-unit, conical-V beam, 4-bay array, is said to give 2 to 6 db more gain than conventional 2-bay units. Designed for fringe-area UHF use, the array is pre-assembled for rapid installation and may be easily added to existing VHF antennas. Light weight, rugged construction and negligible wind resistance are also featured. Telrex, Inc., Asbury Park, N.J.—TECHNICIAN



Falcon VHF ANTENNA

The Falcon 88, a conical-yagi type antenna for all-channel VHF use, is said to provide good line match, sharp directivity, high forward gain and absence of minor lobe response. The array feeds into a single 300-ohm line. Quick assembly, sturdy construction and low cost are also featured. Phasing bars available for stacking. Falcon Electronics Co., Quincy, Illinois.—TECHNICIAN



Related Products

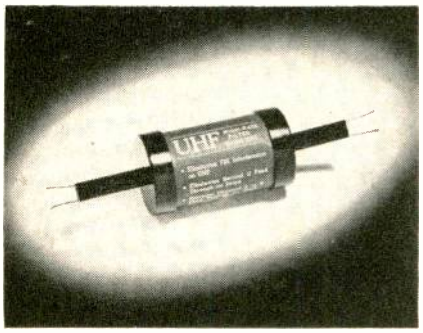
and Hardware; Boosters, Tuners and Filters

Drake UHF TVI FILTER

Designed especially for use in UHF reception, the UHF-300-HP high-pass filter attenuates interference caused by images and spurious signals from VHF stations, oscillators of other television receivers and UHF converters, signals at intermediate frequencies, and others in the region below 450 mc. List price $3.25. R. L. Drake Co., 11 Longworth Street, Dayton 2, Ohio. —TECHNICIAN

SIC TVI FILTER

High-pass filter model HP2 is made to pass all UHF channels from antenna to receiver with less than 1 db attenuation, but to provide 45 to 50 db of rejection for VHF signals. Eliminates many types of TVI peculiar to the UHF range, including interference from Channel 5 or



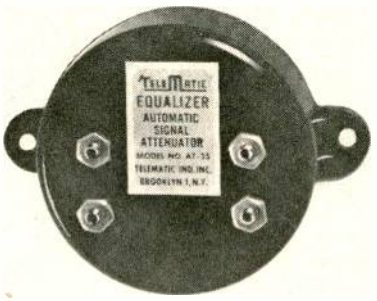
6 signals on double-conversion UHF systems. Service Instruments Co., 422 S. Dearborn St., Chicago, Ill.—TECHNICIAN

Bogen UHF BOOSTER

Model UHB booster provides gain of 8 to 13½ db across UHF band, channels 14 to 83 inclusive. Noise figure varies from 11 to 15 db. The tuning knob is the only control, as the booster is turned on and off by a relay operated by the TV receiver. List price, $41. David Bogen Co., 29 Ninth Avenue, New York 14, N.Y. —TECHNICIAN

TeleMatic SIGNAL EQUALIZER

The Automatic Signal Equalizer, model AT-25, is intended for locations where low-frequency VHF channels may be strong enough to overload the receiver, whereas high frequency channels are not strong enough to permit constant attenuation at the antenna input. Maximum attenuation is provided on the low band, minimum on the high band, without upsetting antenna-receiver impedance match. No con-



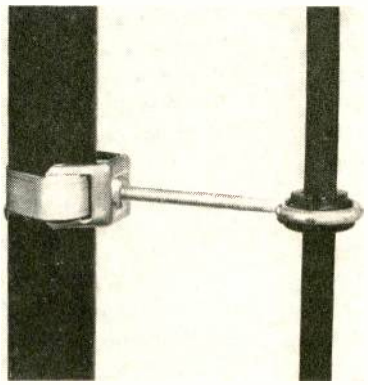
trols or switches need be manipulated. List price, $4.95. Tele-Matic Industries, Inc., One Joralemon St., Brooklyn, N.Y.—TECHNICIAN

HP TELESCOPIC MASTS

Zip Up telescoping mast kits are available in heavy-duty sets (16-gauge) or economy sets, to make masts in sizes of 20, 30, 40 and 50 feet. Individual mast sections are 10 in. long. Snug fit prevents wobble. Kits furnished with accessories including guy rings and bolts. Haydon Products Corp., 1801 Eighth Ave., Brooklyn 15, N.Y.—TECHNICIAN

Insuline STAND-OFF

Made to accommodate all types of standard TV transmission lines, this strap-type stand-off uses a low-loss polyethylene grommet and features an adjustable strap to mount on any pipe diameter from ¾ in. to 1½ in.



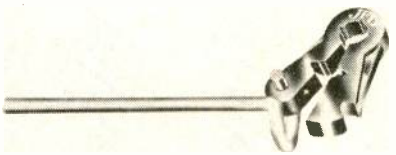
It is quickly tightened in place with a captive tension nut. Insuline Corp. of America, Long Island City, New York.—TECHNICIAN

Anchor UHF-VHF TUNER

The TV 900 tuner is a 12-position turret tuner for which individual channel segments are available separately. Any group of 1 to 12 channels, UHF, VHF or a combination of both, may be installed in any sequence to meet the needs of a particular location. Original installation or replacement of channel segments is said to be rapid and to require no special procedures or test equipment. No extra crystals or converter strips needed on UHF. Single conversion principle is used on Channels 2 to 83. Anchor Radio Corp., 2215 South St. Louis Ave., Chicago 23, Ill.—TECHNICIAN

JFD ANTENNA ACCESSORIES

The Pal stand-off, for all types of antenna wires, avoids the use of a metal ring surrounding the lead-in. This measure prevents development of standing waves, which may interfere with TV reception in sensitive installations. Lightning arrestor model AT120, the Lightning Sentry,



includes a resistor network and two replaceable fuses. The network bypasses interfering static charges as well as lightning. The replaceable fuses protect the arrestor itself against damage by strong lightning charges. List price, $4.75. JFD Mfg. Co., 6101 16th Ave., Brooklyn 4, N. Y.—TECHNICIAN

Imperial GUY WIRE

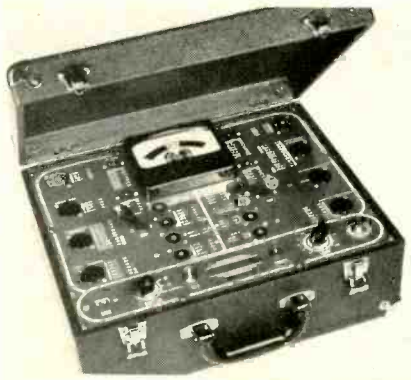
This guy wire is made of 7 strands of 18-gauge pure aluminum and uses a closely-knit twist for added strength. Wire is guaranteed against rust, tarnish and salt-air deterioration. Stretch yield is approx. 3%. Packaged in 100-ft. continuous coils, 1000-ft. cartons and 1000-ft. metal spools. Imperial Radar & Wire Corp., 820 E. 233rd Street, Bronx 66, N.Y. —TECHNICIAN

TV Technician

Test Instruments and Accessories; Storage Equipment

ASD TUBE CHECKER

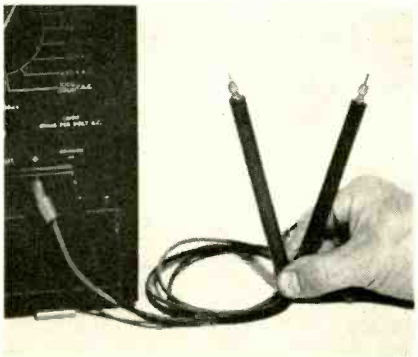
Model TV-20, a time-saving tube checker, uses 20 connected sockets to facilitate testing. Developed particularly for TV servicers, the checker needs no roll chart, minimizes



set-up procedure and features portability. Other characteristics: automatic line compensation, high sensitivity to leakage, positive gas detection circuit. Net price, $124.50. American Scientific Development Co., P.O. Box 104, Fort Atkinson, Wisconsin.—TECHNICIAN

Insuline TEST LEADS

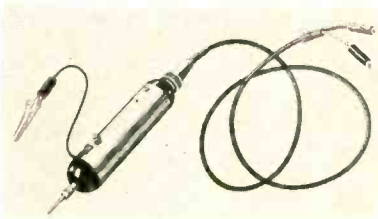
This pair of leads, intended for use with standard test instruments, has heavy lucite handles 5 in. long and ⅜-in. in diameter. The leads furnish protection against high ac and dc voltages. The ends are fitted with small chucks which take phonograph-needle test tips, useful for probing crowded connections and piercing insulation of wires without damage. Handles are colored red and black, respectively,



and carry 45-in. lengths of flexible leads with molded right-angle phone-tip plugs. Catalog number, 304; price, $1.65. Insuline Corporation of America, 3602 35th Ave., Long Island City, N. Y.—TECHNICIAN

Scala DEMODULATOR PROBE

A voltage-doubling crystal demodulator probe for use with scope or vtvm in TV alignment and troubleshooting, the BZ-4 probe provides increased utility in signal tracing low-level i-f stages, and in calibrating generators against crystal-oscillator harmonics. A high degree of 60-cycle hum rejection permits effective tests in heater, agc, and dc supply lines for the presence of spurious high-frequency voltages. Can be used to localize dead or weak i-f stages, calibrate the base line of a scope, demodulate a video-amplifier sweep response curve, check the output of a sweep generator, and to test for sync-buzz pulses in a 4.5-mc.



sound channel. Useful to 150 mc. Priced at $10.75, complete with coaxial lead and instruction book. Scala Radio Co., 2814 19th St., San Francisco, Calif.—TECHNICIAN

Superex CRT TEST ADAPTER

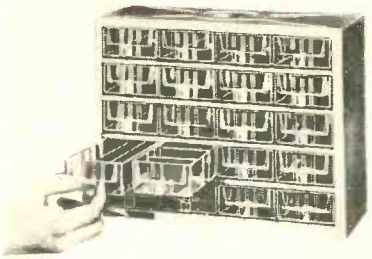
Designed for use with any make tube tester and all picture tubes, this adapter features simplicity of operation. One end plugs into the tube checker. The other end connects to the crt, which need not be removed from cabinet. Price, $3.95. Superex Electron. Corp., 23 Atherton St., Yonkers, N.Y.—TECHNICIAN

RCP HV PROBE

The HVMP-2 high-voltage multiplier probe lead extends the range of the manufacturer's model 655 peak-to-peak vtvm on dc volts. Meter scale readings are multiplied by 100 with the probe. Complete with multiplier resistor and terminations, the probe is of the heavy-duty type with a safety barrier. Priced at $8.95. Radio City Products Co., Inc., 152 West 25 St., New York, N.Y.—TECHNICIAN

GI SMALL PARTS CABINETS

The line of See-Thru drawer cabinets has been developed for visible filing and storage of small parts in service shops and home workshops. The spill-proof drawers are made of clear guaranteed plastic; welded all-steel cabinets are



used. Adjustable drawer dividers and identification labels are provided. Models available with from 8 to 128 drawers, with extra-size or metal drawers, and with carrying handles for portability. Over 750 combinations can be supplied to suit user's requirements. General Industrial Co., 5738 N. Elston Ave., Chicago 30, Ill.—TECHNICIAN

Windsor TUBE CADDY

Although this fold-out caddy, the Carry-All, is built for portability, it provides space for meters and other tools necessary in on-the-spot home servicing, as well as for tubes. The caddy may be obtained free on a

tube purchase deal, or bought outright ($14.95). Further details from Windsor Electronic Tube Co., 1515 Sheepshead Bay Road, Brooklyn 35, New York.—TECHNICIAN

New Components

Parts for Initial Use and Replacement; Shop Aids

IRC POWER RESISTORS

Type PW-7 and PW-10 power resistors, rated at 7 and 10 watts respectively, are useful in many radio and TV applications. Type PW-7 available from .51 to 5100 ohms, PW-10 available from 1 to 8200 ohms; tolerances, 5% and 10%. Manufacturer's ratings show favorable performance with respect to humidity, load life, overload and effects of soldering. International Resistance Co., 401 N. Broad St., Philadelphia 8, Penna.—TECHNICIAN

GE SOCKET WRENCH SET

This space-saving socket wrench set has been developed for radio-TV service technicians. The two tools, each with four heads mounted in the shape of a cross, replace 8

individual hex-head wrenches. Made of chrome-plated hardened steel; sizes clearly marked. Available through GE tube distributors. Tube Dept., General Electric Co., Syracuse, N.Y.—TECHNICIAN

Daven ATTENUATORS

Series 154 fixed attenuator pads are available in either T or balanced H networks. Units are available in losses up to 100 db with a wide range of input or output impedances. Maximum power dissipation, 1 watt; Accuracy, ±2%. Common applications: to equalize incoming signal levels, to change impedance, to combine 2 or more incoming lines into a single line, or to equalize the outputs of several speakers connected to a common source. Daven Co., 191, Central Ave., Newark, N. J.—TECHNICIAN

Halldorson FLYBACK

Flyback transformer FB412 is designed as an exact replacement for Part No. C-201-21025-1 in 84 models and chassis of Airline, Raytheon and Truetone TV receivers. The unit features a variable-gap width control, tapped agc winding and a special mounting base. Halldorson Transformer Co., 4500 Ravenswood Ave., Chicago 40, Ill.—TECHNICIAN

Stancor FLYBACKS

These four flyback transformers for Philco receivers are exact replacements, according to the manufacturer. A-8220 replaces Philco part 32-8565, used in 14 models and chassis; A-8221 replaces 32-8555 in 29 models and chassis; A-8222 replaces 32-8533 and 32-8534 in 38 sets; and A-8223 replaces 32-8572 in 15 sets. All chassis involved were manufactured in 1952 and 1953. The replacement units have choke coils, resistors, and capacitors wired to the terminal boards.

Three exact-replacement flyback transformers cover 91 Motorola models using 52 chassis. Stancor part number A-8224 replaces Motorola flybacks 24C711265, 24C711265-A, and 24C721290 in 56 models. A-8225 replaces 24K712193 in 15 models. A-8226 replaces 24K721301C and 24K271517C in 20 models. Each unit has a horizontal centering pot, variable gap width control and a socket for a 1B3 rectifier. Added to the original design are a corona ring on the tube socket and a reinforced terminal board to withstand the strain of inserting or removing the 1B3 tube. Chicago Standard Transformer Corporation, Standard Division, Addison and Elston, Chicago 18, Illinois.—TECHNICIAN

Jet PRECISION CONTROLS

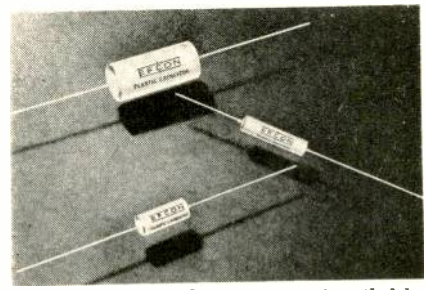
Jet D-100 precision potentiometers are available with rotation up to 360 degrees, and in resistance ranges up to 50,000 ohms, ±1%. Units are rated at 1 watt. Other features: light weight, long life, high ambient temperature rating. Anticipated life is said to be in excess of 1 million cycles of noise-free operation. Jet Electronics, Inc., 93 Mass. Ave., Boston, Mass.—TECHNICIAN

Int'l SELENIUM RECTIFIERS

Special-type selenium stacks, designed for the anticipated power supply requirements of color TV receivers, are available for capacitive loads of 600, 700 and 750 ma. Maximum input voltage ratings are 130, 172 and 195 volts rms. Special construction affords lower forward drop, lower temperature rise and longer life. International Rectifier Corp., El Segundo, Calif.—TECHNICIAN

EFCON CAPACITORS

Type MH plastic film capacitors feature special design for close tolerance, miniature size, moisture resistance, high insulation resistance and



low dielectric absorption. Available in tolerances of ±1%, ±2%, ±5% and voltage ratings of 200, 400 and 600 v dc in any value from .01 to 1 mfd. Hermetically sealed in metal tubular cases. Electronic Fabricators, Inc., 682 Broadway, New York 12, N.Y.—TECHNICIAN

Sprague CAPACITORS, PC's

Replacement ceramic capacitors and Bulplate printed circuits are being furnished in clear molded polystyrene boxes. The re-usable containers reveal both contents and ratings of units at a glance. Snap locks on the hinged lids eliminate spilling. These compact boxes are space savers for storing small parts. Sprague Products Co., Marshall St., North Adams, Mass.—TECHNICIAN

No-Noise CONTACT SPRAYER

No-Noise contact and volume control cleaner is now being made available in spill-proof 6-oz. pressure spray cans, for service technicians who find this type of container more convenient. The cleaner is also available in 2-oz. and 8-oz. bottles, and quart cans. Electronic Chemical Corp., 813 Communipaw Ave., Jersey City 4, N.J.—TECHNICIAN

Tubes and Tube Equivalents

Radio and TV Types; CRT's, Crystal Diodes and Transistors

Sylvania 12-VOLT CAR RADIO TUBES

In line with the trend toward 12-volt automobile batteries, a full complement of 12-volt tubes is available for use in parallel-heater circuits in automobile radios. Except for filament ratings, they are equivalent to their 6-volt prototypes; e.g., the 12BA6 is similar to the 6BA6, r-f or i-f amplifier. Others in the line: 12BD6, r-f amplifier; 12BE6, converter; 12AV6, 2nd detector and audio amplifier; 12X4, rectifier. Audio output tubes include the 12AQ5 and 12V6GT. Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.—TECHNICIAN

Sylvania POWER AMPLIFIER

Beam power amplifier 6CM6, intended for use as a vertical deflection amplifier in tv receivers, and also as a class A_1 audio output tube. This 9-pin miniature type has pin connections as follows: pin 1, screen grid; pin 2, no connection; pins 3 and 6, control grid; pins 4 and 5, heaters; pin 7, cathode; pin 8, no connection; pin 9, plate. Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.—TECHNICIAN

Sylvania 6AM8

This 9-pin miniature type is a combined diode and pentode. Pentode section is similar to 6CB6; diode section similar to one half of 6AL5. May be used as final i-f amplifier and video detector to reduce tube complement. Sylvania Electric Products Inc., 1740 Broadway, New York 19, N.Y.—TECHNICIAN

Raytheon TUBES, GERMANIUMS

The following miniature tubes have been designed primarily for TV applications: 6CF6—sharp cutoff pentode for use in gain-controlled i-f stages or as UHF r-f amplifier; 6CS6—dual-control heptode for use as sync clipper.

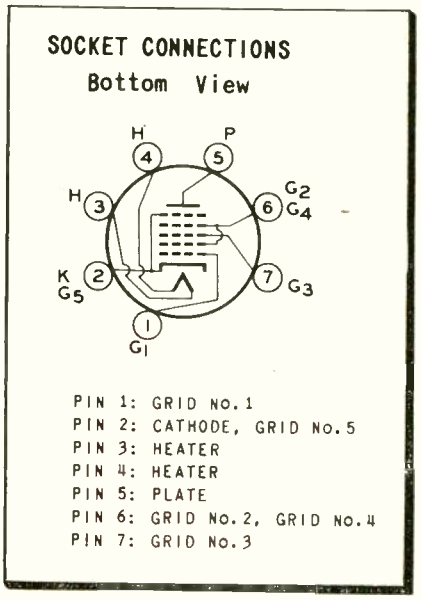
Germanium diodes are now available in hermetically-sealed types, with optional plug-in construction. Ruggedly built for shock resistance.

Low-noise PNP junction transistor, type CK727, has an average noise factor of 13 db, and an average power amplification of 37 db. Raytheon Mfg. Co., Receiving Tube Div., 55 Chapel St., Newton 58, Mass.—TECHNICIAN

RCA 6BY6, CRYSTAL DIODES

The 6BY6 is a 7-pin miniature pentagrid amplifier for use as a gated amplifier in TV receivers, especially as a combined sync separator and clipper.

Six types of crystal diodes, germanium point-contact type, are of sealed-in-glass construction: 1N34-A



—general-purpose type intended for low-power rectification as in isolating, clipping, and switching circuits. 1N38-A—large-signal type useful in clamping circuits. 1N54-A—high-back-resistance type intended for clipping circuits, high-impedance hv probes, dc restorers, and high-impedance detectors. 1N55-A—large-signal type with high peak inverse voltage rating. Especially useful in clamping circuits, dc restorers and hv probes. 1N56-A—high-conduction type useful as limiter in FM circuits. 1N58-A—similar to 1N55-A but with a lower peak inverse rating. Tube Department, Radio Corp., of America, Harrison, N.J.—TECHNICIAN

RCA CRT and DAMPER

Type 6AU4-GT, a half-wave rectifier, is designed for use as a damper diode in receivers using larger picture tubes with 90-degree deflection angles. Glass shell type; socket and basing arrangement identical to that of 6W4-GT damper. The all-glass 12ZP4-A rectangular crt is designed for magnetic focus and deflection. Features filterglass faceplate, takes single-field magnet ion trap. RCA Tube Department, Harrison, N. J.—TECHNICIAN

CBS 21FP4C

This aluminum-backed, all-glass, rectangular crt uses low-voltage electrostatic focus, electromagnetic deflection, a grey-glass cylindrical faceplate and a single-field ion-trap magnet. Outer conductive coating, when grounded, may be used as hv filter capacitor. Typical hv value, 14kv. CBS-Hytron, Danvers, Mass.—TECHNICIAN

CBS BEAM-POWER AMPLIFIER

A direct replacement for the 6BQ6-GT, said to be more ruggedly designed for longer life and operation beyond the limits of the 6BQ6, is the 6CU6. Intended for use in horizontal output stages, as well as in audio-amplifier and class C r-f applications. Socket, plate cap and basing arrangement follow the 6BQ6. CBS-Hytron, Danvers, Mass.—TECHNICIAN

GE 6BJ7, CRT's

Type 6BJ7 is a miniature triple-diode, designed for use in color TV receivers to reduce tube complements. May be used as dc restorer for three signal channels. Each diode section is similar to diode section of conventional 6AL5.

21ACP4 and 21ACP4-A (aluminized) are all-glass rectangular crt types using 90-degree horizontal deflection angles. Wider angle makes possible reduction of overall length to 20 in., reducing size of cabinet required for receiver. Typical 2nd anode voltage: 16kv. General Electric Tube Department, Schenectady 5, N.Y.—TECHNICIAN

CORRECTION

Author Kesgen writes in to say that P-1, in his article, *Audible Alarm for Servicing Intermittents* (Jan. '54 TECHNICIAN), should have been listed as 10 meg, not 1 meg.

Audio and Hi-Fi Items

Speakers, Enclosures, Amplifiers and Allied Units

W-Z TV HEARING AID

This auxiliary speaker, specially designed for the hard-of-hearing, permits TV viewing at normal distances from the receiver without loss of sound. Leads from the auxiliary speaker clip to the leads from main speaker. Auxiliary unit may be hooked over shoulder of listener or back of chair. Price, $13. Wright-Zimmerman, New Brighton, Minnesota.—TECHNICIAN

Cabinart SPEAKER HORN KITS

Kits incorporating the Klipsch corner-horn enclosure design are available in unfinished birch. The compact cabinets achieve large-enclosure performance on low frequencies by using back-loading to increase path length. Kits K-12 and K-15, for 12-in. and 15-in. speakers, respectively, each provide an extra port for mounting a tweeter or other auxiliary speaker. Kits include hardware, pre-cut baffle, and instructions for assembly and finishing. G. & H Wood Products Co., 75 North 11th N. Y.—TECHNICIAN

Kloss SPEAKER SYSTEM

This small-size complete speaker system makes high-fidelity performance possible at a low cost; based on the original Baruch-Lang design. Employing four 5-in. speakers in a wedge-shaped housing little more than a foot high and less than 20 in. wide, the system may be mounted anywhere on the floor or ceiling or in the corner between two walls. Corner-mounting is not essential for wide range and low distortion. Available in output impedance of 4 or 16 ohms. May be obtained direct from manufacturer for $19.95. Kloss Industries, 10 Arrow Street, Cambridge, Mass.—TECHNICIAN

Utah HI FI SPEAKER SYSTEMS

One single-speaker and several multiple-speaker systems are available as follows: model HF100, 12-in. speaker and cabinet, response from 30 to 10,000 CPS; model HF300, 10-in. woofer plus tweeters in cabinet, response from 30 to 15,000 CPS; Quartet model, 12-in. woofer plus tweeters in corner enclosure, response from 30 to 15,500 CPS: Chordette model, 8-in. woofer plus tweeter in bookshelf or end-table enclosure. Utah Radio Products Co., Inc., Huntington, Ind.—TECHNICIAN

Masco TAPE RECORDERS

Models 53 and 53R (with and without radio) are dual speed, dual track tape recorders featuring fast forward and rewind speeds and two-motor drive. Response at 7.5 in. per second: 80 to 8500 cps, with wow and flutter less thon 0.3%; response at 3.75 ips, 80 to 5000 cps. Inputs for mike, radio, and phono; outputs for external amplifier or speaker. Timing indicators, push-button operation and monitoring switch are also provided. Mark Simpson Mfg. Co., 32-28 49th Street, Long Island City 3, N. Y.—TECHNICIAN

Lorenz WOOFER and TWEETER

The Lorenz woofer and tweeter are designed to be used in combination for a wide-range speaker system. Also available are a high-pass filter to match the two speaker units and a choice of cabinets to house the three components comprising the system. Kingdom Products Ltd., 23 Park Place, New York 7, N.Y.—TECHNICIAN

Craftsmen HI FI FM TUNER

An FM tuner said to meet the highest Hi Fi requirements, model C900 features high sensitivity and stability with low distortion. Some features: sensitivity of 1 microvolt for 20 db quieting; amplified, continuously variable AFC for optimum control of strong and weak signals; less than .05% intermodulation distortion through entire receiver. Three controls are provided: AFC, off-on-volume, and tuning. Net price, $99.00. The Radio Craftsmen, Inc., 4401 N. Ravenswood, Chicago 40, Ill.—TECHNICIAN

Webcor TAPE RECORDER

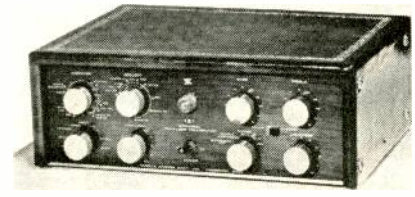
Following the success of its 3-speaker phonograph, Webstor-Chicago is producing a 3-speaker tape recorder, model 2030, to give wide-angle dispersion of sound throughout the listening area. One 4-in. and two 6-in. speakers are used to disperse sound so that high-frequency dead spots are avoided. Construction of one-half inch wood veneers lowers cabinet resonance, thus improving bass response. List, $143.70. Webster-Chicago, 5610 W. Bloomingdale Ave., Chicago 39, Ill.—TECHNICIAN

Brook HI-FI AMPLIFIER

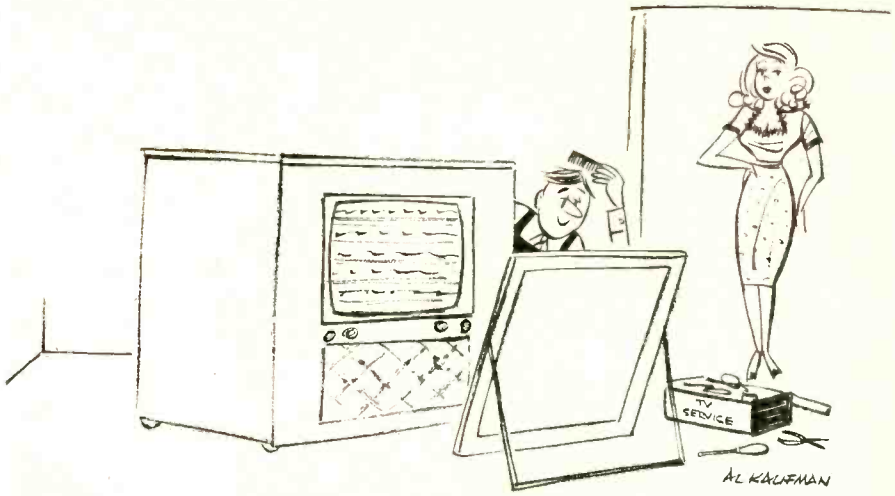
A small-size single-chassis amplifier and control unit, model 22A provides response within 1 db from 20 to 20,000 cps with 10 watt output at negligible distortion. Five input channels are featured for tuners, TV, recorder and phono cartridge; four output impedances from 2 to 16 ohms. Controls: channel selector, record equalizer (6 positions), bass, treble, compensated loudness, and on-off power. Brook Electronics, Inc., 34 DeHart Place, Elizabeth, N.J.—TECHNICIAN

Scott HI-FI CONTROL UNIT

Model 121-A Dynaural Equalizer-Preamplifier is a self-powered remote control unit for broadcast or home sound systems. Record compensation is provided by separate, continuously-variable bass turnover and treble roll-off controls. Built-in Dynaural Noise Suppressor dynamically discriminates against turntable rumble and record scratch with minimum effect on musical frequencies. Also featured: Variable high-frequency cut-off filters, separate bass and treble tone controls, 8-position input selector, and separate input level controls. Compensated loudness control may be switched to operate as flat volume control. H. H. Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.—TECHNICIAN



Technician's Lighter Side



Obscure Threat Dept.

Joe Thomas, one of our service friends, was telling us how he collected some long overdue bills. Customers to whom Joe had mailed strings of letters, some gentle and others stern and purposeful, had blandly ignored the requests for immediate payment. Several hundred dollars was involved, and Joe was not disposed to overlook the matter.

One day a man came around and offered to collect the sums due, in return for a percentage of the take. "Fine," said Joe. "You collect, and I'll pay you 20% of the total you bring in."

Within 3 days, checks adding up to $280, or about 90% of the money owed Joe Thomas, were received in the mail.

Joe was curious about his collector's technique.

"Tell me, whatever did you do that made that money roll in so fast?" he asked, when he had paid the man his $56.

"Just wrote 'em a letter," replied the collector.

"One letter?" asked Joe. "I wrote them at least *five* letters! What did your letter say?"

"I'll read ya one," said the collector. He took a piece of paper out of his pocket and read:

Dear Mr. Best:

You owe the Joe Thomas Radio Service $15. If you don't send in a check for this sum in 48 hours, you'll be surprised at what'll happen.

Yours truly, etc.

We don't recommend the technique, but it does point up the value of a fresh approach to one's problems . . .

Reward of Virtue (180 Degrees Out of Phase)

A small-town radio shop owner—let's call him Mac—called one of his technicians into his little office for a heart-to-heart talk the other day.

"You know, the customers like you very much," said Mac.

"Thank you," beamed the technician.

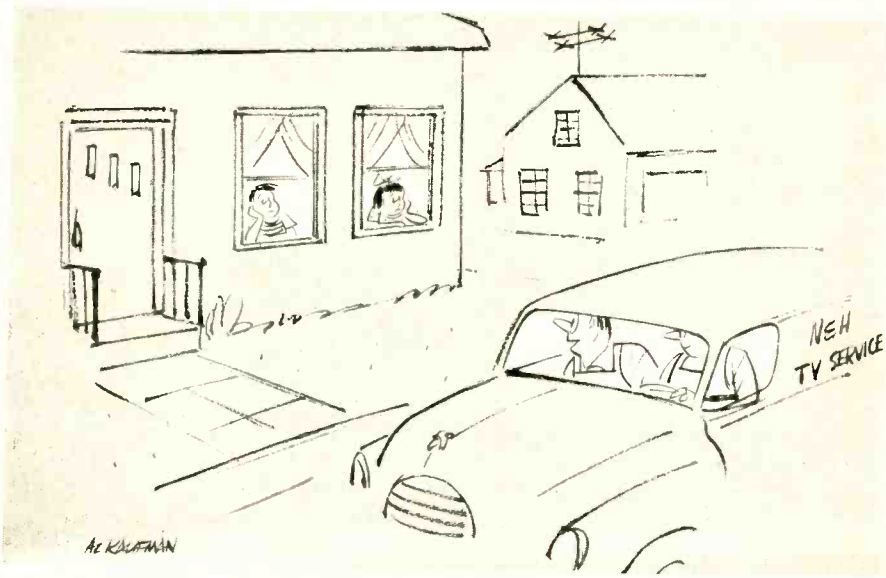
"Practically every customer you've visited in the month you've been here has had glowing things to say about you."

The technician's beam became beam-powered.

"They say you do wonderful work. You're courteous, competent, and thoroughly reliable."

The serviceman's smile expanded further. Thoughts of the raise that seemed imminent weaved through his mind like 60-cycle hum.

"In fact," concluded the boss, "you're getting so popular with the customers, in a few months you might be able to start a business of your own, and take them all away . . . so I'm forced to fire you."



"This must be the house."

Think and Grow Poor

You probably never heard about the owner of a large TV-radio shop who was much impressed with the numerous signs marked THINK that he saw in the plush front offices of a factory he was visiting. Some time later, the merchant decided to install similar signs in his own establishment. Several days after the signs had been posted in prominent parts of the store, a friend came in to visit.

"How'd that plan of yours work out?" asked the friend. "You know, that idea of sticking up THINK signs all over?"

"Not so good," sighed the shop owner. "The first day they were up, three people who walked in with small radios they wanted fixed looked at the signs, thought a moment, then walked out again. The second day my chief serviceman told me that after thinking it over, he would like a partnership in the business. To top it all off, my landlord came in today, and after glancing at the signs, told me it was about time he raised my rent."

Have you had any amusing experiences during the course of your servicing work? Why not write them down and send them in? TECHNICIAN will pay $5 for acceptable anecdotes of this kind. Address Editor, Technician's Lighter Side, *TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., N.Y. 17, N.Y.*

NEW

WALSCO *Imperial*

INTRODUCING the greatest advance in Conical antennas . . . it's the *all-new* WALSCO *Imperial*. Featuring a new "barrier disc" insulator with 2 inches of air space between the terminals to prevent *shorts*. Soot deposits, dirt, moisture, salt, etc., *cannot* affect this insulator. The WALSCO *Imperial* will therefore maintain *lasting* high gain performance *anywhere*, regardless of weather conditions. Contact surfaces and terminals will never rust or oxidize. Front end hardware is *stainless steel* to prevent corrosion losses *permanently*. Front end elements are pre-assembled to holding plates which are fastened to the insulator with one wing nut. Less than 2 minutes to assemble.

MOST REVOLUTIONARY CONICAL ANTENNA IN 4 YEARS

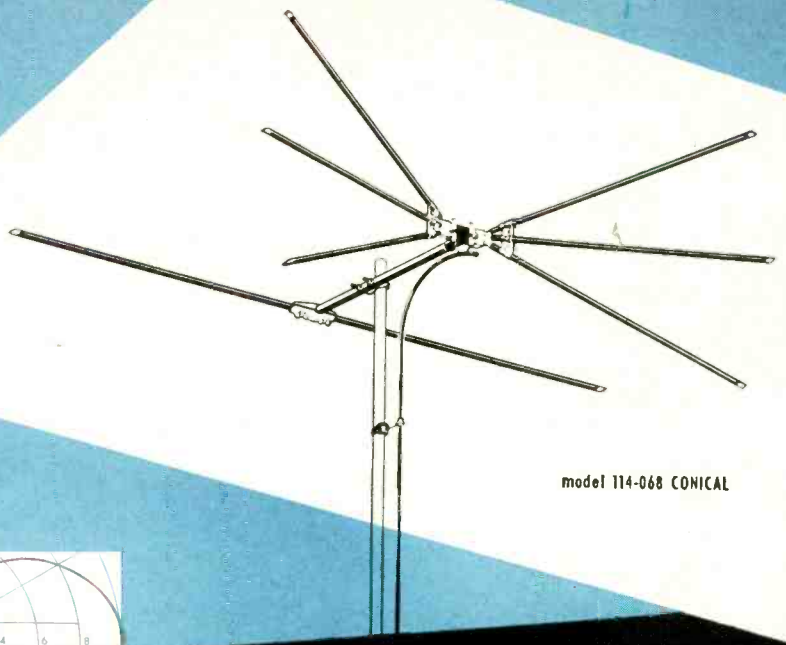
3 year unconditional guarantee!

Guaranteed lasting high gain on all VHF channels

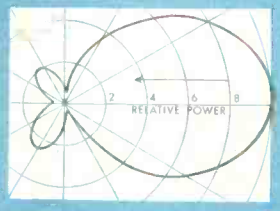
WALSCO ELECTRONICS CORPORATION

3602 Crenshaw Blvd., Los Angeles 16, Calif.

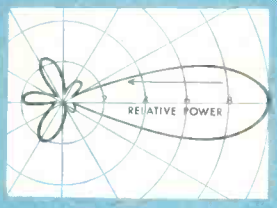
now!



model 114-068 CONICAL



69 mc—channel 4



195 mc—channel 10

Directivity patterns of the CONICAL are exceptionally clean. The strong major lobe indicates fine directivity.

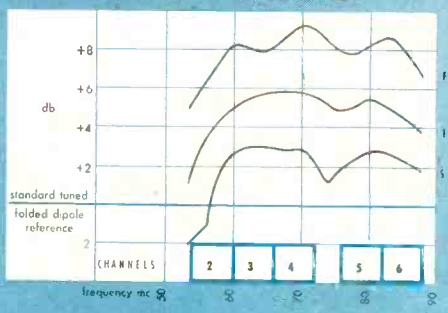
a VHF CONICAL antenna built to the Quality Standards of AMPHENOL

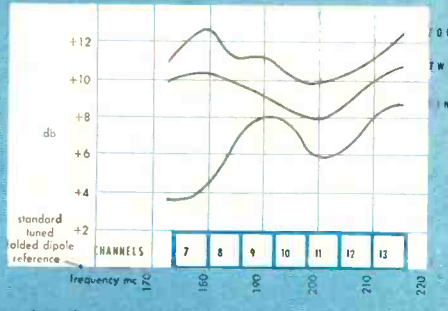
Now ready to join the fastest-growing and fastest-selling antenna line in the United States is a new AMPHENOL VHF antenna. Designed to supplement the fabulous INLINE* for VHF reception, the new CONICAL antenna will give true-picture reception in *every VHF signal area:* major, fringe and long-distance. Gain and directivity have been engineered to the high AMPHENOL standards that have set the quality goal for the entire industry. craftsmanship attention to the small but important details make the CONICAL another example of AMPHENOL's fine antenna work.

AMPHENOL CONICALs are available in single, two and four bay models. The stacked models use unique phasing harnesses for extra gain. The CONICAL may be obtained in packaging that contains all the necessary stacking equipment or else the individual antenna may be purchased one or two to a carton. In addition, the single bay CONICAL is available in a complete antenna installation kit.

All elements of the CONICAL are constructed of sturdy, long-lasting seamless aluminum tubing — assuring rust-free years of top performance.

*Reissue U. S. Patent 23,273





High gain of the CONICAL is illustrated in the gain charts for single, two bay and four bay models. Measured in accordance with proposed RETMA standards, the charts also show the desirable flatness of the gain.

AMPHENOL

AMERICAN PHENOLIC CORPORATION • *chicago 50, illinois*

Now's the Time to Make the Service Department Pay

Too many dealers are willing to operate their businesses on the premise that the service department is merely a feeder for sales, and shouldn't be expected to show a profit.

Here and there, because of certain unusual conditions, the premise just mentioned may be sound to the extent that a few dealers find it impossible to rack up profits on service work, some going in the red with still others managing to operate on a break-even basis.

But it's a truly unusual case where an owner is justified in resigning himself to this state of affairs before he has explored every avenue of possible profitable operation in his service department.

TECHNICIAN'S editors have prepared this article with a view toward pointing out a number of reasons why profits get devoured in many service departments. The editors are also suggesting some remedies to help those owners and managers who want to eagle-eye their operations in an all-out endeavor to make money.

Do these conditions prevail in *your* service department?

Inadequate Charges: A most common reason for in-the-red operation. *Remedy:* Review your charging formula. Don't be afraid to ask fair prices for your work.

Overboard Overhead: Do you have shirkers or time-wasters on your payroll? Do you have *too much* help? How do you keep men busy during slack periods—when the overhead continues to roll along? Does someone in authority assign the bench work and outside calls? Are outside calls routed efficiently in order to save time and cut down vehicle expense? *Remedy:* Fire the hopeless drones, "re-sell" the good men, who may have fallen into bad habits, on the necessity for doing a full day's work. Have someone lay out each man's job for the day, and plan outside call routes carefully. Be sure to keep men busy when things are slow. They can clean up the shop, rearrange stock etc., during these intervals.

Sketchy Estimating: Almost all shops are called on to estimate a great many of the repair jobs that come in. Do you have a realistic, profit-slanted method for quoting? If you use a hit-and-miss technique you'll get plenty of headaches. If you "forget" how much you told Mrs. Jones that job would be, you may wind up behind the eight-ball. If, for instance, you bill her for more than quoted, you may lose her as a customer. On the other hand, "forgetting" may result in a loss to you. *Remedy:* Make out a simple "estimating slip" on every job, or fill in the amount on a service order. Spend a little extra time trying to make an *accurate* estimate. It'll pay off.

Inefficient Record-Keeping: Do you lose money through failure to include *all* labor and parts on some jobs? Does the department lose money through failure of employees to *charge out* all tubes, components or time on some repairs? Do your bills go out *promptly*? Are collections followed up efficiently, or are accounts receivable allowed to die of old age in the ledgers? *Remedy:* If some or all of the foregoing conditions exist in your department, *do something about it!* For instance, hire an accountant (part time) to set up a good system, and insist that every man in your employ keep an account of time, tubes and other components. (Many shops charge parts and material against those employees who "draw" such supplies out of inventory.)

Sloppy Buying: This can be put into two categories: 1. *Overbuying,* and 2. *Underbuying.* In the first instance, carelessness is usually to blame for buying too much stock, or going overboard in ordering too many slow-moving items. In the second case, hand-to-mouth purchasing is usually alibied with the excuse that the person responsible for this important chore of buying is too busy. Obviously, buying too heavily ties up good money in inventory, while buying in inadequate supply ties up too many jobs and discourages technicians. *Remedy:* Resolve to buy more carefully, making "need" lists which should be checked against stock on shelves and in servicers' hands.

Not Enough Customers: No service department head should be satisfied with the amount of business it's presently doing. The objective should be to expand, to keep adding new customers in order to prevent lulls in work, and to compete with what may be an increased number of service set-ups coming into the field this year. *Remedy:* Advertise consistently, even if small space is used in directories and in newspapers. Use direct-mail pieces to solicit new customers, and to keep your name before the old ones. The profit-minded dealer not only *renders* service—he *sells* it, too.

Start a clean slate, in this second month of the new year, and a firm resolution to show profits from your service and installation. Many dealers are making fine livings because they watch every penny, and chop out the dead wood. It can be done in almost every shop. Why not try to make more money in *your* business?

$5,000 IN PRIZES

...easy to win

503 PRIZES!

$2000 - 1st prize

$500 - 2nd prize, $100 - 3rd prize
100 - $10 prizes, 400 - $5 prizes

HOW TO WIN

To win one of these 503 prizes all you have to do is complete in 25 words or less "I like Pyramid capacitors because_____" You fill in this statement on a Pyramid contest entry blank which can be obtained from any electronic parts jobber selling Pyramid capacitors. You have this entry blank countersigned by your jobber or one of his salesmen and forward it to us attached to a Pyramid Dry Electrolytic Capacitor box top —the top being the part which carries the description of the item. There is no limit to the number of entries which you may make in this contest but each entry must be accompanied by a box top. Full rules for the contest appear on the entry blank.

It's so easy. Here is the kind of statement that might win:

"I like Pyramid capacitors because they always check out perfectly and don't deteriorate and so I know I won't have to call back at my expense."

"I like Pyramid capacitors because the line is so complete that I can always get what I need and don't have to worry about an off-brand capacitor."

PYRAMID

PYRAMID FEATURES:

1. Only one quality—the best at no premium. All Pyramid capacitors are made of materials commanded by rigid military specifications.
2. All Pyramid capacitors are non-hygroscopic.
3. Highest quality insulator material used in all production results in low leakage factor.
4. Exclusive non-contamination technique guarantees close tolerances and no deterioration. Peak performances for life.
5. Pyramid capacitors operate unchanged at ambient temperature of 85° centigrade.
6. Designed by service technicians across the country for their requirements.
7. Individually packaged for protection.
8. Permanently legible, high visibility ratings on each item.
9. 100% absolute electronic inspection before shipment.

Pyramid is in its 10th year as a leading manufacturer of high-quality capacitors.

PYRAMID ELECTRIC COMPANY
1445 HUDSON BOULEVARD
NORTH BERGEN, N. J.

SERVICE ASS'N REPORTS

Calendar of Coming Events

Feb. 4-6: The Audio Fair, Alexandria Hotel, Los Angeles, Calif.

Feb. 8-12: Western Winter Radio-Television & Appliance Market, Western Mart, San Francisco, Calif.

Mar. 22-25: Institute of Radio Engineers National Convention, Waldorf-Astoria Hotel, New York. Exhibits, Kingsbridge Armory, Bronx, New York.

May 17-20: Electronic Parts Show, sponsored by Association of Electronic Parts & Equipment Manufacturers; West Coast Electronic Manufacturers Association; Radio-Electronic-Television Manufacturers Association and National Electronic Distributors Association and Sales Managers Club (Eastern Group), Conrad Hilton Hotel, Chicago, Ill.

June 15-17: Radio - Electronic - Television Manufacturers Association Convention, Palmer House, Chicago, Ill.

Sept. 30-Oct. 2: High Fidelity Show, International Sight and Sound Exposition, Palmer House, Chicago, Ill.

Oct. 13-16: The Audio Fair, Hotel New Yorker, New York.

NATESA Award to GE

The National Alliance of Television and Electronic Service Associations, 5908 S. Troy St., Chicago, Ill., presented a fifth award to the GE Tube Department for its public relations program in behalf of the TV service industry. Bertram L. Lewis, eastern vice-president of NATESA, made the presentation of the "Friends of Service Management" plaque to John T. Thompson, sales manager of the GE Tube Department. Frank J. Moch, Chicago president of NATESA, was present. The award cited GE for "outstanding service to TV service management in creating better customer relations." Other GE awards came from Associated Radio and Television Service Dealers of Columbus, Ohio; Federation of Radio Servicemen's Associations of Philadelphia; and Radio Technicians Guild of Boston.

ARTSNY Fetes Liebowitz

Officers and directors of Associated Radio-TV Servicemen of New York, 165 E. Broadway, their wives and some friends surprised Max Liebowitz, ARTSNY president, with a testimonial dinner. Speakers extolled Liebowitz' judgment in evaluating proposed licensing laws, his reputation for fair dealing and his role as "emancipator of the radio-TV service profession." After the testimonials, the president was presented with a gift.

In his own speech, Liebowitz asked for greater active support of the association by its members. He said, "You cannot continuously help people who will not help themselves." The president-founder was encouraged by the fact that he was getting more cooperation from more people in 1953 than in the two preceding years. With the growth of associations, he found the outlook for the service profession becoming brighter.

NEDA Grows

According to the national office of the National Electronic Distributors Association, the following parts distributors recently joined the organization. Members are listed with respective chapter affiliation:

Burton S. Phillips, Electronic Center, Inc., Minneapolis, Minn. (Minnesota); Henry Lynch, Friday-Lynch Radio Co., Ottumwa, Ia.; W. B. Smith, Sidles Co., Omaha, Neb.; Norman "Scotty" Cameron, the Cameron Co., Rock Island, Ill. (all three in the Iowa-Nebraska Chapter); Dennis J. Hightower, H&L Radio Supply Co., Fort Worth, Tex. (North Texas); and Albert J. Kernerman, Glendale Electronic Supply Co., Detroit, Mich., as well as Joseph F. Keese, Radio Supply & Engineering Co., Inc., Detroit, Mich.

The organization also reports that it is currently engaged in revising the 1953 NEDA Battery Index, with the new edition expected early in 1954. Over 6500 copies of the index have been mailed out on past requests, confirming a need for such a cross-reference work. An increasing number of battery manufacurers are cooperating by including NEDA battery numbers on charts, labels, and cartons. Copies of the 1953 index are still available, in the meantime, on request. Address National Electronic Distributors Assoc., 228 N. La Salle Street, Chicago 1, Ill.

(*Continued on page* 67)

GE's J. T. Thompson accepts plaque from B. L. Lewis, NATESA V.P., as pres. F. Moch watches.

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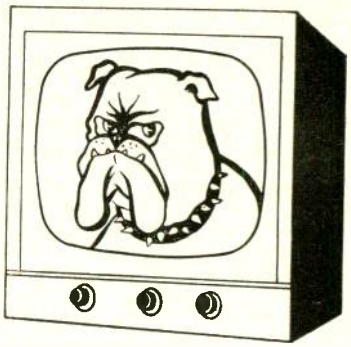


Intermittent Pix Pulling

The complaint was "picture snaking" and increased contrast after the set was on for about forty-five minutes. The symptoms seemed to indicate an agc defect. First, I checked all i-f, tuner, and agc tubes. They checked ok. Next I pulled the chassis on the floor and left the set on for what seemed like a long time, but it played ok. I did not care to wait too long in the customer's home with the chassis on the floor, so I brought it to the shop. I set it up on the bench with a meter on the agc line. The set played all right for two days!

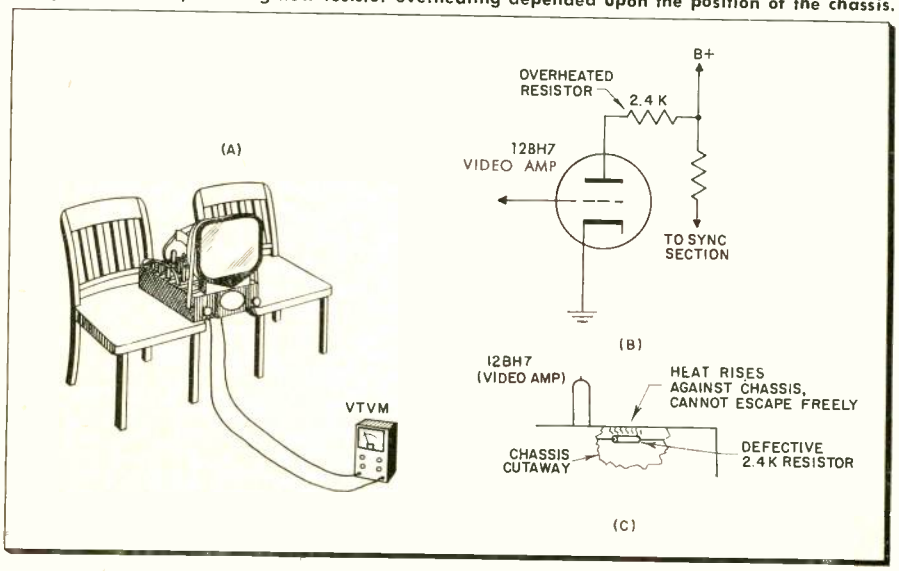
I called the customer and explained that the set was working normally in the shop, and that I had not found anything wrong with it. The customer requested that the set be brought back to her home. About forty-five minutes after I returned the set, the customer called and complained of the same trouble. I told her to leave the set on, and I would be right over.

When I arrived, the set was pulling horizontally, although not very badly. "The longer it is on, the worse it gets," the set owner commented. I shut off the set in order to pull the chassis out of the cabinet to check voltages. Then I put the set on the floor and turned it on. It played fine. No pulling—just a darned good picture. It seemed impossible that the TV cabinet should cause the picture to pull, yet the picture "snaked" only when the set was in the cabinet.

I decided to leave the set on the floor for a while. The customer, who fortunately was a very understanding person, asked if I could set the TV receiver right side up for a while, so her son could see a program he was interested in. Upon turning the set in a right-side-up position—heretofore I had always had it on its side so that I could check voltages—the set started to pull. At first it was pulling just a little, but within an hour the set was pulling badly and contrast had increased noticeably.

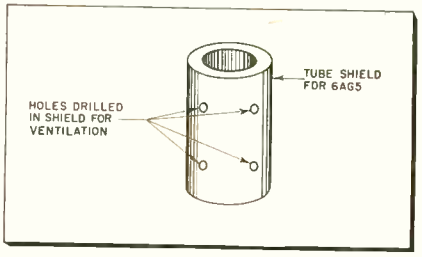
I tipped the set sideways for just an instant, in order to clip my vtvm on the agc line. The agc voltage was normal! Next I placed the chassis between two chairs (see sketch A). This enabled me to check voltages while the set was in an upright position. After a considerable amount of checking I found that the trouble was caused by a 2.4k video plate load resistor (see sketch B). The resistor was badly charred, but only on one side—the side that was facing the chassis. When the set was in the normal upright position, the heat would rise up against the chassis, causing the resistor to over-heat and go up in value (sketch C). With the increase in resistance of the video plate load resistor, the contrast would increase, and some of the video voltage would get into the sync, causing the picture to pull horizontally.—*F. Mattioli, Madison, Wisconsin.*

A—Set-up for checking the chassis in an upright position while horizontal pulling occurred. B—Schematic location of the overheating resistor in the video amplifier plate circuit. C—Cutaway chassis view, showing how resistor overheating depended upon the position of the chassis.



The Mysterious 6AG5

When I was called in to service this set in the owner's home, she informed me that she had previously called several technicians in to repair the receiver. About a week or so after they fixed it, the set would go bad again. The raster was ok, but there was no video. The owner informed me that a tube in the back of the set with a metal shield around it (6AG5, 4th video i-f) had been found broken, and required replacement several times. Nobody, it seems, had been able to discover why the tube was breaking repeatedly. I looked, and sure enough the 6AG5 was broken again.



Holes punched in this tube shield prevented repeated tube breakage due to excessive heat.

I took the shield off and made small holes in it for air ventilation (see sketch); then I replaced it over a new tube. My reasoning was as follows: the ventilation would prevent the tube from getting too hot, expanding and finally breaking. The diagnosis was apparently correct, since the set has been working for two months now without a complaint.—*Gelman's TV, Philadelphia, Penna.*

Executive ability is deciding quickly and getting somebody else to do the work. —J. C. Pollard

Hi Fi Guide to Pickup Arms & Cartridges

(*Continued from page 30*)

on the other hand, can withstand wide variations without any ill effects. This is the main reason that magnetic and ceramic units have longer lives.

Another characteristic worth considering is the cartridge's response to vertical modulation. Such modulation is the result of the cartridge translating the vertical movements of the stylus into electrical signals. Vertical modulation should be kept at a minimum for high-fidelity reproduction.

Some pickups, such as the variable-reluctance and other magnetic types, are relatively insensitive to vertical stylus movements. These cartridges depend for their output voltages on the transfer of flux from the pickup cantilever (see Fig. 7) to the pole pieces of the coils. When the cantilever moves laterally, getting closer to one pole piece than the other, proportional currents are induced in each coil, and an output voltage is developed. When the cantilever moves vertically, however, the distance between the cantilever and the pole pieces does not change, and no output voltage develops.

Choosing a Cartridge. As we can see, the various types of cartridges have their advantages as well as their disadvantages. The type of cartridge used is determined by the budget. It does not pay, of course, to choose a cartridge that has a wider frequency response than the amplifier with which it is used.

Before a cartridge is replaced in a Hi Fi system, check its characteristics to see that it will give performance equal to, or better than, the original cartridge. (When a change-over is being made from one type of pickup to another, anything in the amplifier's input circuit that is intended for specific use with the original type of cartridge may have to be altered or removed to match the new unit. This applies to input impedance, as well as to preamplifiers, equalizers and compensating networks.—Ed.)

The Stylus. Some of the information provided on needle selection

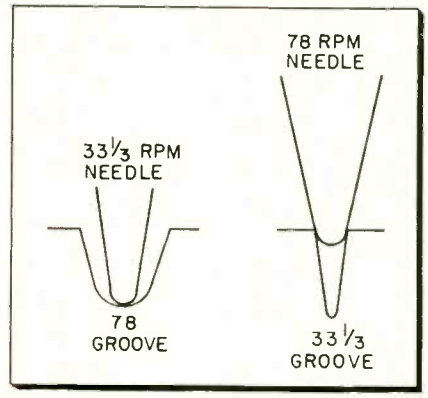


Fig. 9—Improper tracking results when the stylus diameter does not have the correct size with respect to the record grooves it rides on.

may seem to concern the set owner more than the serviceman; the data presented should, however, help the technician answer questions he may be asked.

The prime function of the pickup needle (or *stylus*, as it is more accurately called) is the transfer of the lateral movement of the record's grooves to the pickup cartridge. Diamond-point needles are probably the best investment from the user's standpoint. Even though they cost more initially, they are good for a couple of thousand playings on fine-groove discs, whereas the saphire-tipped needle is good only for a few hundred. Less distortion and less record wear is produced by the diamond-point needle, and its life is also longer.

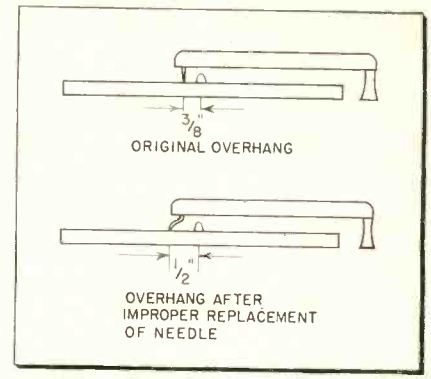


Fig. 10—Overhang may be changed when a stylus replacement is of the wrong type.

Needles should be checked periodically to see whether wear has developed. Fig. 8B shows a worn needle point that will not track the grooves properly, thus introducing record wear. A worn needle also introduces excessive needle-talk and distortion. Magnifying lenses made for this purpose should be used to thoroughly inspect the needle tip.

An unfortunate mistake to be avoided by servicemen is the interchanging of standard and LP needles. The LP needle has a 1-mil point; the standard needle has a 3-mil point. Fig. 9 illustrates the poor seating that is produced when these needles are interchanged. The LP needle rests at the bottom of the standard groove and does not follow lateral motion properly. This causes an excessive amount of surface noise and distortion. The standard needle, on the other hand, rides too high in the LP groove and has, in consequence, a tendency to skip and wear the walls of the grooves.

Another important factor in the replacement of a pickup needle that may be overlooked is its shape. If the wrong type of needle is used as a replacement, the pickup arm overhang may be changed considerably (see Fig. 10).

Pickup Assembly Replacement Cautions. The various parts of the pickup arm assembly have definite requirements. When any part replacement is necessary, or an improvement in operation is desired, check the overall characteristics of the replacement against the characteristics of the associated elements in the system.

"It's intended to give the set owner a more intimate view of favorite performers."

Du Mont Unveils New Dual-View TV Set

A television receiver which shows two TV programs on one screen while permitting two audiences to view their choices simultaneously was introduced by Allen B. Du Mont Laboratories, Inc. The receiver is known as the "Du Mont Duoscopic." The receiver can tune in any two TV programs from any stations within range. This means a husband may view one program, while his wife watches another.

A press gathering at the preview demonstration, using polaroid glasses, saw a particular program at one moment and then, by merely reversing the glasses, became observers of a different telecast. With personalized ear pieces and convenient remote control audio units, the press group heard and saw any of two programs they desired. Whenever an individual wishes, he can independently switch to another channel. The remote-control sound system makes possible audio synchronization with the channel change. Audio volume can be lowered or raised to accommodate the listener's preference.

New Fields for Webcor

Webcor, manufacturer of phonographs and magnetic recorders, today entered two new industries with the announcement of its first radio and the first of a series of musical recordings on tape. The new Webcor radio is a five-purpose clock-radio called the "Quintet." It features a plug for attaching a tape recorder to make recordings of radio shows. It will also permit plug-in of a record changer and will turn appliances on or off automatically.

Pyramid Prize Contest

A contest for servicemen that offers $5600 in cash prizes has been announced by the Pyramid Electric Company of North Bergen, N.J. The contest will begin Feb. 1 and will continue until the end of April. First prize will be $2,000. The second and third prizes are $500 and $100, respectively. In addition, there will be 500 other cash awards.

The contest entails completing the sentence, "I like Pyramid capacitors because . . ." in 25 words or less. Entry blanks for the contest will be available through jobbers, who will countersign each one submitted. Duplicate awards will be granted to the lucky jobbers whose servicemen win prizes. Each entry in the competition must be accompanied by the top of a box from a Pyramid dry electrolytic capacitor.

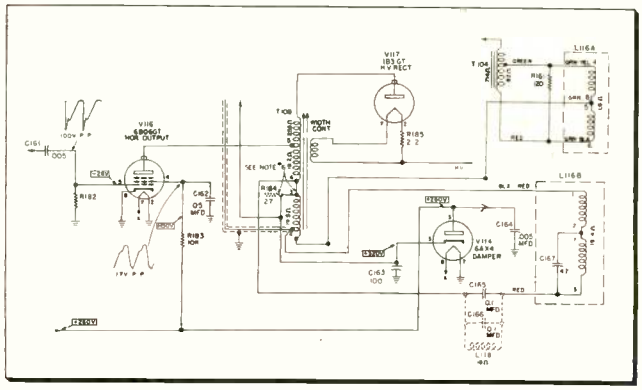
Mfrs. Changes

Recent Design Alterations

Linearity Improvement in '54 Crosley Sets

Several of the changes that have been made in Crosley's custom and deluxe line of 17 in. and 21 in. television receivers to improve horizontal linearity are described below (see schematic). The code letters used on chassis incorporating this change are also given. Chassis with earlier code letters do not have the change.

402	CODE E	404-1	CODE C
402-1	CODE F	404-5	CODE B
402-4	CODE B	405	CODE D
402-5	CODE A	405-1	CODE D
403	CODE E	410-1	CODE B
403-1	CODE D		



Although the published parts lists still apply to early production chassis, the following list gives the new parts used in the chassis incorporating this change. The symbol numbers are given in two columns to permit quick reference to the schematic in either bulletin.

SYMBOL NUMBER		PRIOR TO CHANGE		INCORPORATED IN CHANGE	
Bulletin No. 459	Bulletin No. 465	Part No.	Description	Part No.	Description
C159	C161	137499-34	Capacitor, 560 mmf., 10%, 500 v., Mica	144675-2	Capacitor, .005 mmf., 500 v., Disc Ceramic
C162	C163	154988	Capacitor, 120 mmf., 10%, 3KV., Disc Ceramic	157046-1	Capacitor, 100 mmf., 10%, 3KV., Disc Ceramic
R172	R182	39374-55	Resistor, 300,000 ohm, 10%, ½ watt	39374-57	Resistor, 470,000 ohm, 10%, ½ watt

Horizontal Instability in Stewart-Warner Sets

If you encounter critical horizontal hold action on any current Stewart-Warner TV receivers, it is suggested that you specifically follow the procedure we are going to outline. By so doing, you will be able to obtain horizontal holding action that remains within the range of the front panel hold control. 1. Check to see that condenser 131 is a silver mica unit, 820 mmfd, ±5% tolerance. This condenser is Stewart-Warner part No. 512,-547. It is already incorporated in all receivers except those 9300 series sets that do not include the letter "H" in the series coding at the rear of the chassis. 2. Check to see that condenser 130 is other than a Sangamo type

in TV Sets

in Television Receivers

(red body). This .01 mfd condenser should be the type supplied under Stewart-Warner part No. 512311—do not use a substitute. The correct type is already incorporated in all (except the 9300 series) that do not include the letter "R" in the series coding on the rear of the chassis. 3. If the receiver has a "horizontal range" trimmer condenser, it should be screwed closed. 4. If a 6SN7GTA tube is used as the horizontal afc-blocking oscillator, replace it with a 6SN7GT. 5. Turn the receiver on and allow it to operate for fifteen minutes. 6. Set the horizontal hold control on the front of the receiver to its counter-clockwise position. 7. Remove the 6BE6 gated sync separator tube from its socket. This will cause the receiver to lose both horizontal and vertical sync. 8. If it was necessary to replace the No. 130 .01 condenser (step 2) you will probably find the receiver to be pretty far off horizontal frequency. This should be corrected by adjusting the *bottom* slug of the Synchroguide transformer until the picture "hunts" horizontally. In other words, the picture will remain intact and slide from side to side across the screen, but will not break into diagonal lines. If you did not replace the .01 condenser, the bottom slug of the Synchroguide transformer should not be adjusted. In this case, only the top slug need be adjusted until the hunting condition is obtained. 9. Plug the 6BE6 tube back into the socket and set the front control of the receiver to the center of its range. The picture should now remain in horizontal sync when switching channels and also remain within the range of the horizontal hold control.

Sentinel TV Receiver Changes

To eliminate possibility of drive lines appearing on picture, and to reduce effect on size of horizontal hold coil adjustments, make the following change (in Models 454, 455, 456, 457, 464, 465, 466, 500, 511, 512, 513, 515, 520, 521, 522, 523 and 525):

Replace C-58 (a 680 mmfd fixed mica capacitor, at plate of horizontal oscillator) with a 470 mmfd fixed mica capacitor, ±10%, part no. 23E3500-40.

To increase vertical size and vertical linearity control range in models 532, 542, 554, 562 and 564:

If R-106 (a 270-ohm 1 watt resistor) is connected to the output side of the filter choke, connect it to the input side of the filter choke instead. This can be done simply by removing the 270 ohm 1 watt resistor from its physical position on the tie lug located in center of chassis, and connecting this resistor across the C-84 input filter condenser sections—40 mfd (half moon) and 40 mfd (square).

Vertical Line in Emerson 27-in. Sets

A vertical white line may appear in the picture on some 27-in. sets (chassis 120179-B, 120205-B) due to overdrive of the horizontal output tube. In the event that readjustment of the horizontal width coil, changing the 6BQ6 horizontal output tube or changing the 6W4GT damper tube does not eliminate this overdrive bar, change the value of R-74 from 330k ½ watt to 390k ½ watt. This resistor is connected to pin no. 5 of the 6SN7 horizontal oscillator. 120179-B chassis incorporating this change are coded Triangle C; 120205-B chassis, Triangle B.

MFRS' Catalogs & Bulletins

Hi-Fi, Audio Catalogs

Five recently published catalogs present comprehensive listings of audio and Hi-Fi equipment and components for use in the home and on the professional level. Amplifiers, speakers, tape recorders, equipment housings and enclosures, microphones, record players, pickups, tuners, audio test equipment and binaural gear are some of the types of items covered. *Audio Guide, Catalog T-54,* 128 pages, is available from Terminal Radio Corporation, 85 Cortlandt Street, New York 7, N. Y. *High Fidelity Sound Equipment 1954,* 58 pages, is available from Hudson Radio and Television Corp., 48 West 48th Street, New York 36, N. Y. *1954 High Fidelity, Audio Equipment,* 96 pages, is available from Sun Radio & Electronics Co., 650 Sixth Avenue, New York 11, N. Y. *High Fidelity Music System Components, Catalog No. 454,* 48 pages, is available from Lafayette Radio, 100 Sixth Avenue, New York 13, N. Y. *1954 Audio Handbook,* 104 pages, is available from Arrow Audio Center, 65 Cortlandt Street, New York 7, N. Y.

Understanding High Fidelity is a two-part, 50-page booklet the first part of which attempts to explain the how and why of quality reproduction in the home. The roles of the various parts of the system are discussed. The second part is a guide to the selection and installation of components. An appendix includes a glossary of Hi-Fi terms and a bibliography. Price, 25 cents. Available from David Bogen Co., 29 Ninth Ave., New York 14, N. Y.

Mail Order Catalogs

Recently published mail order catalogs listing electronic equipment and components, replacement parts and associated gear are available from Radio Shack Corporation and Newark Electric Company. Both catalogs are fully indexed and illustrated, and cover test equipment, audio and amateur gear, batteries, tubes, relays, books, connectors, wires, switches, power supplies, replacement resistors, inductors and capacitors. In addition to the main product index, the Radio Shack book has a manufacturer's index. Both catalogs include order forms and instructions for ordering. *Radio*

Shack Catalog 54, 226 pages, is available from Radio Shack Corporation, 167 Washington Street, Boston 8, Mass. *Newark Catalog No. 56*, 194 pages, available from Newark Electric Company, 223 West Madison Street, Chicago 6, Ill.

Federal Selenium Handbook

Design, application, specifications and circuitry are covered in the second edition of Federal's *Selenium Rectifier Handbook*. The 80-page booklet lists selenium rectifiers for radio and TV applications, and also covers rectifier designs and power supply circuits for use with audio amplifier, radio, and intercom systems, as well as other dc power supplies. Servicing information includes troubleshooting tables to help the technician in checking selenium rectifiers for specific troubles, as well as diagrams for setting up rectifier tests in the repair shop. Price, 50 cents. Available through distributors, or write to Federal Telephone and Radio Company, 100 Kingsland Road, Clifton, New Jersey.

Jerrold Folder on Community TV Antennas

A catalog folder has been issued by Jerrold Electronics Corporation, 26th & Dickinson Streets, Philadelphia, Pa., covering their new five-channel community antenna system This new engineering development uses the present Jerrold series W equipment which distributes TV signals from three stations. New K series equipment is added to distribute two extra channels. The new catalog folder, titled "Jerrold's Five-Channel Community Antenna System," is available upon request.

Miller Coil Replacement Guide

The latest Miller TV Technician's Coil Replacement Guide, No. 154, is available through leading parts distributors throughout the country. This 20-page catalog lists, by set manufacturer and part number, equivalent Miller replacements for chokes, coils and transformers used in video and sound i-f, r-f, discriminator, sync and sweep circuits; also listed are peaking coils, ion traps and adjustable inductive controls. J. W. Miller Co., 5917 South Main Street, Los Angeles 3, Calif.

CRT Comparison Wall Chart

The TV Picture Tube Division of Sylvania Electric Products Inc. has released a new version of its handy

(*Continued on page 62*)

Catalogs & Bulletins

(*Continued from page 61*)

"TV Picture Tube Comparison Chart." The new free wall chart, brought up to date, can be obtained from the Sylvania Advertising Distribution Department, 1100 Main Street, Buffalo, N. Y. Data on more than 160 different crt types is available at a glance. Added informational features in this new chart include ion trap listings and base diagrams. Face, body, focus, deflection angles, basings, and length-in-inches data on all tubes are also included.

B-T TV Calculator

Blonder-Tongue Labs is offering a free "TV Calculator" to TV service dealers and TV technicians. The calculator contains a scale for instant conversion of decibels to voltage gain; charts and diagrams describing various strengths of attenuator pads; a convenient channel-megacycle scale, and a table to compute TV transmission line losses at VHF and UHF channel frequencies. Available on request from Blonder-Tongue Laboratories, Inc., 526-536 North Avenue, Westfield, New Jersey.

RMS UHF Antenna Bulletin

Indoor and outdoor UHF antennas including yagis, bow ties and corner reflectors, are described in a six-page bulletin. Also covered are lightning arrestors and other accessories for UHF installations. Obtain copies direct from Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., New York 62, N.Y.

EICO Instrument Catalog

The *1954 EICO Catalog* lists and illustrates the complete line of EICO instruments obtainable in kit form (30 items) or factory-wired (33 items). The 12-page booklet, in addition to showing each item, breaks data down into *features, specifications* and *applications* for every listing, thus providing easy reference. Available free to TECHNICIAN readers from Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, New York.

RMS Antenna Catalog

Catalog No. 55, 32 pages, describes the manufacturer's complete line of antennas and accessories. Fully indexed by product groupings, the catalog includes information on packaging and shipping weights. A gain reference chart is also present. The booklet is 3-hole punched for easy filing in binders. It can be obtained from RMS, 2016 Bronxdale Ave., New York 62, N. Y. Say you saw it in TECHNICIAN.

CBS Advertising Aids

Four new business builders are being offered by CBS-Hytron to service-dealers to help them tie in with the nationally advertised Certified Quality Service program. These CQS sales aids are: An illuminated plexiglass sign for indoor use, a metal flange sign, direct-mail postal cards, and ad mats. All four sales aids are available through CBS-Hytron distributors. The illuminated sign is intended to serve as a night light, as well as a display for daytime use.

The postal cards offer copy tying in with the *Life-Post* advertising on Certified Quality Service. They are printed on government postals, with the dealer's own three-line imprint, and are available at a nominal cost. The ad mats are purposely small, so that a service-dealer can afford to use them over and over. The mats may be obtained free.

NEW BOOKS

PRACTICAL COLOR TELEVISION FOR THE SERVICE INDUSTRY. Published by RCA Service Company, Inc., Camden, New Jersey. 64 pages; $2.00, paper bound.

This profusely illustrated "first" in color-TV books (100 illustrations, many in full color) covers its subject in three sections. Section I begins with color principles, and includes definitions of many new terms the service technician will be confronted with. The visible color spectrum is also analyzed and broken down with respect to primary colors. The development of the transmitted color signal is next examined in detail. An overall consideration of the compatible TV color system is then presented, followed by a study of the three-gun color tube. Section II begins with a basic circuit description of a typical color receiver, and follows up with a detailed section-by-section analysis.

The third section, largest in the book, offers practical information for service and installation. Information on test equipment and alignment is presented, as well as instructions to be given to the customer. Appendices to the book include a glossary of the many new terms that will enter the technician's vocabulary, a bibliography, and a complete schematic (fold-out insert) of the receiver on which the book is based. Full-color photographs of pictures seen on the crt screen during various conditions of defective operation and misadjustment are very striking, and should prove most helpful to the technician.

HOW TO TROUBLESHOOT A TV RECEIVER, by J. Richard Johnson. Published by John F. Rider, Inc., 480 Canal Street, New York 13, N.Y. 128 pages; $1.80, paper bound.

Some of the topics considered in this book are: getting the most out of TV service data; preliminary observations and checks—the troubleshooting approach; use of test patterns in troubleshooting; and interpretation of distortion in the picture or raster. Tubes, tools, equipment and accessories are dealt with from a practical viewpoint. Tables in these sections are intended to guide the novice technician in assembling

(*Continued on page 65*)

Be Sure to See Page 73 CIRCUIT DIGESTS

Rx for Ailing CRTs

(*Continued from page 39*)

1. Flash heater at 12.5 volts for 20 seconds.
2. Age heaters at 7.5 volts for 5 minutes.
3. Repeat steps 1 and 2 three times.
4. Age for two hours at 6.3 volts, continuing to maintain B+ voltage on the grid.
5. Test the picture tube; repeat steps 1 to 4 if necessary.

If emission is satisfactory after the fourth step, do *not* repeat to get "just a little more" because, during oxidation of the cathode powder several microns of gas are released. On old tubes, the amount of getter material remaining may not be sufficient to absorb all the released gas.—*Paul Leichter, Philadelphia, Penna.*

Focusing Electrostatic CRT's

The quality of the picture on any television receiver is to a large degree determined by the sharpness of focus of the electron beam. What can be done to improve this focus—particularly on the self-focusing (electrostatic) tubes, such as we use in the 9300 series of Stewart-Warner receivers? On these sets, no external focus control of any kind is present. The focus of the tube is, however, very much affected by the setting of the ion magnet—and there is only *one* correct setting for this magnet. First, it should be adjusted for maximum brightness. Within this range of maximum brightness, there is only *one* point of optimum focus. To obtain this point of best focus, adjust the brightness level to normal with the brightness control, and set the tuner off channel. Observe the line structure of the raster on the screen while making slight adjustments of the ion trap. You will find that there is one point at which the scanning lines appear most sharp. In obtaining this point of best focus, be sure that you do not reduce brightness. In the event that good sharp focus cannot be obtained even after careful ion trap adjustment, it is suggested that the ion trap be reversed. To do this, slide it off of the tube, turn it over and slip it back on. The magnet should be placed diametrically opposite its original position. By careful readjustment, you should now be able to obtain good, sharp focus.—(*courtesy Stewart-Warner*)

Intermittent Pix

The complaint was an intermittent picture on an Emerson Model 690B. Upon loss of picture, symptoms of poor ac filtering appeared—i.e., a dark screen except for a 3-in. band of white across it was present. By checking with a scope, I found video at the grid of the 6AC7 video amplifier, but none at the plate. Pulling the socket off the picture tube made the signal appear at the video amplifier plate. The trouble was a cathode to filament short in the 19AP4 picture tube.—(*courtesy Sylvania News*)

Servicer Runs for Congress

Carroll S. Shaw, TV specialist, 5814 Hallandale Beach Boulevard, Hollywood, Fla., whose TV repair shop on wheels was described in Nov. TECHNICIAN, writes us that he has announced his candidacy for Representative in Congress from Florida. (Two years ago Mr. Shaw was a candidate for the Florida state legislature.) Mr. Shaw also adds: "I am starting a weekly paper here in Hollywood, and only hope I can make as much on it as I do in TV service. As I spend so much time doing service, I will not have time to campaign, so I am going to sell my TV business. I hope I will not be sorry."

New Books

(*Continued from page 63*)

equipment and parts stock for various needs. Minimum essentials and optional additions appear in these lists.

GUIDE TO AUDIO REPRODUCTION, by David Fidelman. Published by John F. Rider, Inc., 480 Canal Street, New York 13, N. Y. 240 pages; $3.50, paper bound.

For those who wish to acquire a background in the principles and techniques of sound reproduction, but who are not and do not wish to be audio specialists, this introductory book should be of considerable help. Not a layman's tract on Hi-Fi, the volume requires basic familiarity with the principles and components of electronic circuits. Beginning with the theory of sound and musical instruments, the author proceeds to the design and construction of components of quality sound systems, and the assembly of complete systems. Theory of operation, practical circuits and networks, and enclosure construction are considered. Measurement techniques and servicing procedures are also included. Mathematical considerations are simplified and kept to a minimum.

"Greatest Show on Earth"

Yes, the industry's greatest TV-electronic parts show will be held in two places simultaneously.

— **In CHICAGO, May 17-20, when parts, accessories and test equipment will have the spotlight at the Conrad Hilton Hotel.**

— **In TECHNICIAN, May issue, destined to be the Greatest TV-Electronic Show on Paper.**

Why the Greatest Show on Paper? Because the many exclusive features planned for the May issue will surpass anything that has been done by O. H. Caldwell and M. Clements over the past 30 years.

The Caldwell-Clements directories, color charts and special issues have always eclipsed anything attempted by publishers in this industry.

In several respects, this TECHNICIAN Show on Paper will be more helpful than the show in Chicago, because:

1—Many key men among the busy parts distributors will not be able to see the Chicago show, and can only READ about it.

2—TECHNICIAN serves the CUSTOMERS of the parts distributors (the technicians and service managers) as well as the distributors themselves. These technicians and service managers are also vitally interested in new developments but cannot attend the show.

3—TECHNICIAN'S 50,000 circulation includes more professional servicemen and service managers than any other service trade publication—actually over 45,000.

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Alphabetical listing of all manufacturers of radio-TV-electronic products

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Complete list of service associations

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Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N.Y.

Yes, TECHNICIAN's May Issue will be the GREATEST SHOW ON PAPER

Ass'n. Reports

(*Continued from page 53*)

LIETA Annual Report

The Long Island Electronic Technicians Association, 88 Fourth St., Oceanside, N.Y., organized in June of 1953, has published its first annual report. Included in the paper are the program and policies of the association, which incorporates a code of ethics subscribed to by all LIETA members. The code covers employment of qualified personnel for servicing, avoidance of false claims and false advertising, standard guarantees, use of quality replacement parts in servicing, prompt and efficient servicing and treatment of customers in an equitable manner.

In reporting on its other activities, LIETA discusses public service and public relations programs, monthly technical forums sponsored by the association, its own employment exchange, and its own technical library. On the agenda for future programs are liability insurance and hospitalization benefits for members, and education of the public to the technician's role in the community.

Complete Index of

ALL "CIRCUIT DIGESTS" TO DATE

Including Current Issue. CIRCUIT DIGEST NOS. 111 to 115 will be found in this issue of TECHNICIAN

All Units Are TV Receivers Unless Otherwise Noted

ADMIRAL

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ADVERTISERS INDEX

FEBRUARY, 1954

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

NOW! Use Your Present Signal Generator for UHF!

NEW! PHILCO Signal Generator Adapter

(VHF to UHF)

Individually Calibrated For Extreme Accuracy

Now produce UHF signals for TV receiver tests at a fraction of the cost of a UHF generator. Individual calibration guarantees extreme accuracy of UHF frequency. Any VHF signal generator output at 60 MC is converted by the PHILCO Model G-8000-C to UHF. The VHF sweep or marker signal beats against the UHF oscillator, producing UHF signals with the same characteristics as the VHF input signal. It's economical . . . *it's a PHILCO exclusive!*

Look at These Philco Features . . .

1. The VHF signal generator output attenuator controls the UHF output signal level.
2. Precision Vernier Dial for accurate re-settings.
3. Each unit is hand calibrated.
4. Functions as an external UHF converter by connecting UHF antenna transmission line to generator's output terminal and connecting lead to TV receiver tuned to 60 MC Channel 3.
5. High UHF levels, excellent stability, no drift.

5" High Gain Oscilloscope Model S-8202.

Gives rugged, general purpose performance. 60 CPS phasing of sweep generator presentations. Wide sweep range (up to 100KC) gives extreme flexibility in sweep circuit trouble shooting.

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February • 1954

TECHNICIAN CIRCUIT DIGESTS

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with CONTRAST control set fully to the right, all other controls set for normal picture (in sync), DX Range Finder control set fully to the left (at "0" position). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

FUSE LOCATION

The horizontal output circuit is fused with a 3/8 amp., 250 volt fuse, part number 84A4-3 which is located on the top side of the chassis.

NOTE: To read schematic for 20A2 and 20A2Z chassis, use sections in heavy solid lines; to read schematic for 20D2 chassis, use sections in heavy dotted lines and connect appropriate points indicated by dots coded B1 B2 etc.

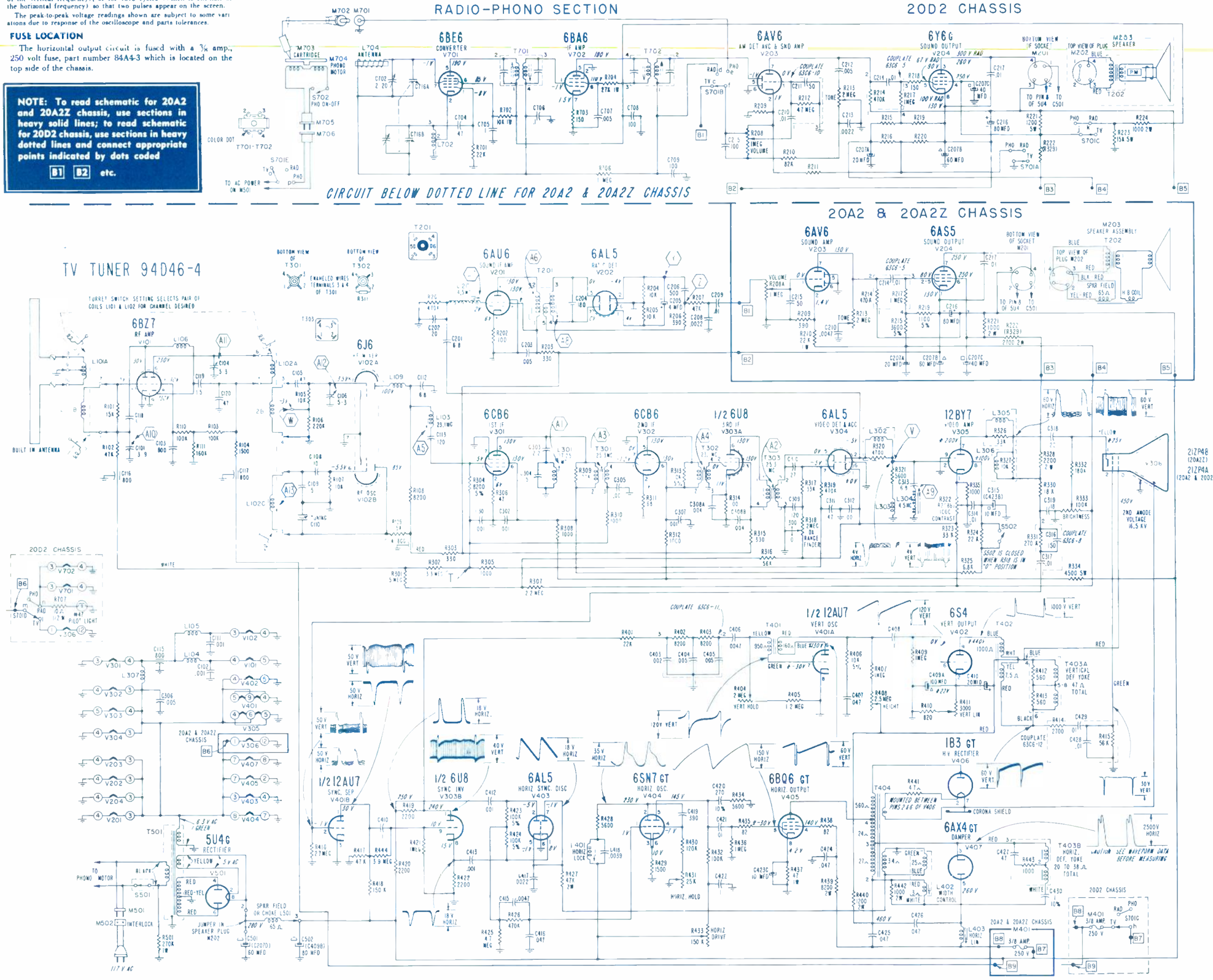
Control Panel in 20A2 & 20A2Z; CHANNEL Knob Removed.

Control Panel in 20D2; CHANNEL Knob Removed.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),.....(Y), (Z), etc. indicate alignment points and alignment connections.



ADMIRAL ANTENNAS AND TRANSMISSION LINES

The input impedance of this receiver is 300 ohms balanced (between antenna terminals). When connecting an external antenna for VHF reception only, 300 ohm flat transmission line, part number 95A22-1 is satisfactory. For VHF and UHF reception, use 300 ohm tubular transmission line, part number 95A22-32. For best VHF and/or UHF reception in areas of high humidity or high salt content, use 270 ohm foam transmission line, part number 95A22-34. In VHF installations where the transmission lines passes through areas of heavy electrical interference, the use of 75 ohm large diameter coaxial transmission line may reduce the interference. When using 75 ohm coaxial transmission line, connect the outer conductor to the chassis and the inner conductor to either antenna terminal; use the terminal which gives the most satisfactory picture on the weakest station. In weak signal areas, the use of coaxial cable should be avoided.

For outdoor television installations, we recommend any of the following antennas which may be obtained from your Admiral distributor. Antenna kit AN5 (zig-zag) or AN3B (conical) provides excellent all-channel reception for VHF channels in most metropolitan or suburban locations. Antenna kit AN1 (duo-vee) or AN2 (trombone) provides excellent all-channel reception for VHF and UHF channels if the stations are in the same general direction. For all-channel UHF reception only, within 20 miles, use antenna kit AN65A (bow-tie and reflector); for long range reception up to 65 miles, use antenna kit AN56A (corner reflector). Each kit contains detailed installation instructions. Complete data on antennas, (recommended types for particular areas, radiation patterns, etc.) is given in the "Admiral Antenna Catalog".

ADJUST VHF CHANNEL SLUGS

For purposes of simplicity in these instructions, the VHF receiver's **Channel Selector** will be called **Low-Channel Selector** and the VHF **Fine Tuning** control will be called **Fine Tuning** tab.

VHF Sets. VHF-UHF Sets.

Channel Selecting Controls.

Individual VHF channel slug adjustment for each VHF station received should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one VHF station to another by turning the **Low-Channel Selector** only. With correct channel slug adjustment, best picture and adequate sound will be located at the approximate center (half rotation) of the range of the **Fine Tuning** tab.

VHF channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the **Low-Channel Selector** for a station; set other controls for normal picture and sound.
c. Set the ***Fine Tuning*** tab at center of its range by rotating it approximately half-way.
d. Remove the **Channel** knobs and **Fine Tuning** tab.
e. Insert a 1/8" blade, ***non-metallic*** tool in the hole adjacent to the channel tuning shaft (see front panel illustration). For each VHF channel in operation, carefully adjust the channel slug for best picture. (Note that this may not be the point at which the sound is loudest.) Be sure that the **Fine Tuning** tab is set at the center of its range before adjusting each channel slug. Caution: Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the chassis from the cabinet and remove the coil from the tuner drum. Move the slug retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace and reset slug retaining spring.)

ADMIRAL
Chassis 20A2, 20A2Z, 20D2

Technician CIRCUIT DIGEST 111

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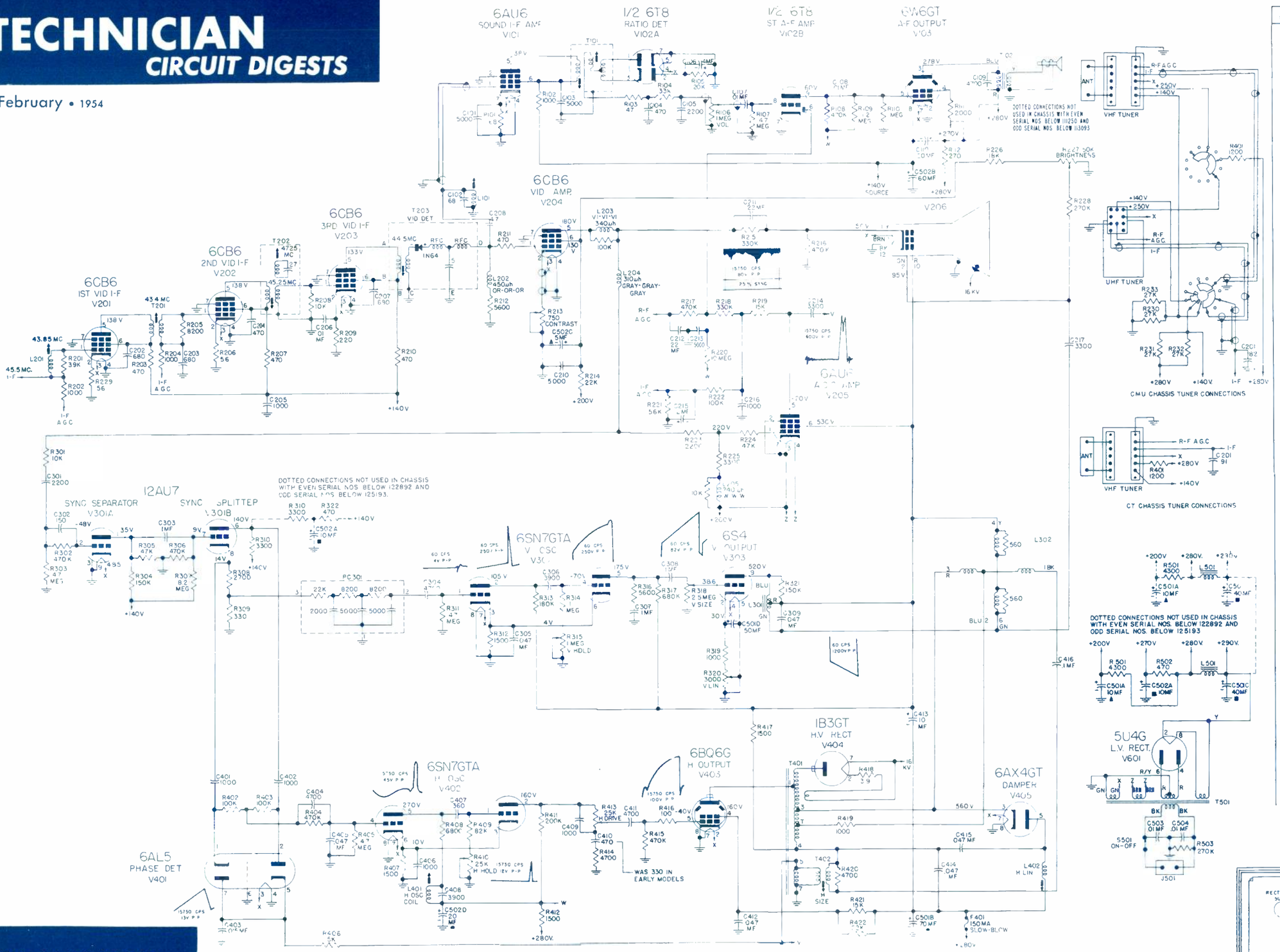
TECHNICIAN
CIRCUIT DIGESTS
February • 1954



SYMBOL	DESCRIPTION	PART NO
C 208	Capacitor, Molded, 4.7 mmf., 500 V.	280209-123
C 210	Capacitor, Ceramic Disc, .005 mfd., 500 V.	280178-1
C 211	Capacitor, Paper, .22 mfd., 200 V.	280202-18
C 212	Capacitor, Paper, .22 mfd., 200 V.	280202-15
C 213	Capacitor, Ceramic Disc, .005 mfd., 500 V.	280178-1
C 214	Capacitor, Paper, .0033 mfd., 600 V.	280201-4
C 215	Capacitor, Electrolytic, 2 mfd., 50 V.	270027-22
C 216	Capacitor, Ceramic Disc, .001 mfd., 500 V.	280178-14
C 217	Capacitor, Paper, .0033 mfd., 600 V.	280201-4
C 301	Capacitor, Paper, .0022 mfd., 400 V.	280211-3
C 302	Capacitor, Mica, 150 mmf., 500 V.	280189-99
C 303	Capacitor, Paper, 1 mfd., 200 V.	280202-13
C 304	Capacitor, Paper, .0047 mfd., 400 V.	280211-8
C 305	Capacitor, Paper, .047 mfd., 200 V.	280202-11
C 306	Capacitor, Silver Mica, 3900 mmf., 500 V.	280161-3041
C 307	Capacitor, Paper, 1 mfd., 400 V.	280212-6
C 308	Capacitor, Paper, 1 mfd., 400 V.	280211-13
C 309	Capacitor, Paper, .047 mfd., 400 V.	280211-11
C 401	Capacitor, Paper, .001 mfd., 400 V.	280212-2
C 402	Capacitor, Paper, .001 mfd., 400 V.	280212-2
C 403	Capacitor, Paper, .015 mfd., 200 V.	280212-1
C 404	Capacitor, Paper, .0047 mfd., 400 V.	280212-4
C 408	Capacitor, Paper, .047 mfd., 200 V.	280212-5
C 409	Capacitor, Mica, 1000 mmf., 500 V.	280159-133
C 407	Capacitor, Silver Mica, 360 mmf., ± 5%, 500 V.	280159-3060
C 408	Capacitor, Silver Mica, 3900 mmf., ± 5%, 500 V.	280161-3041
C 409	Capacitor, Paper, .001 mfd., 400 V.	280211-1
C 410	Capacitor, Silver Mica, 470 mmf., ± 5%, 500 V.	280189-3061
C 411	Capacitor, Paper, .0047 mfd., 400 V.	280211-5
C 412	Capacitor, Paper, .047 mfd., 400 V.	280211-11
C 413	Capacitor, Electrolytic, 10/380 Semi Polarized	270027-23
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C 416	Capacitor, Paper, .047 mfd., 400 V.	280211-11
C 414	Capacitor, Paper, .1 mfd., 600 V.	280202-13
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C 502	Capacitor, Electrolytic, 20-10-8/350 V., 60/300 V.	270021-51
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C 504	Capacitor, Ceramic, Disc, .01 mfd.	280219-2
R 101	Resistor, Carbon, 68 ohms, ½ W.	230104-49
R 102	Resistor, Carbon, 1000 ohms, ½ W.	230104-62
R 103	Resistor, Carbon, 47 ohms, ½ W.	230104-46
R 104	Resistor, Carbon, 33,000 ohms, ½ W.	230104-80
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R 107	Resistor, Carbon, 4.7 megohm, ½ W.	230104-106
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R 206	Resistor, Carbon, 56 ohms, ½ W.	230104-47
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R 210	Resistor, Carbon, 470 ohms, ½ W.	230104-58
R 211	Resistor, Carbon, 470 ohms, ½ W.	230104-58
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R 225	Resistor, Carbon, 3300 ohms, ± 5%, 1 W.	230095-171
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R 227	Potentiometer, Brightness Control, 50,000 ohms, ½ W.	220126-27
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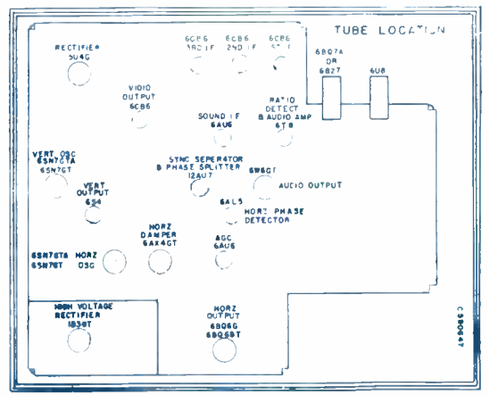
R 306	Resistor, Carbon, 470,000 ohms, ½ W.	230104-94
R 307	Resistor, Carbon, 8.2 megohm, ½ W.	230104-109
R 308	Resistor, Carbon, 2700 ohms, ± 5%, ½ W.	230094-169
R 309	Resistor, Carbon, 330 ohms, ½ W.	230104-56
R 310	Resistor, Carbon, 3300 ohms, ± 5%, ½ W.	230094-171
R 311	Resistor, Carbon, 4.7 megohm, ½ W.	230104-106
R 312	Resistor, Carbon, 1800 ohms, ½ W.	230104-66
R 313	Resistor, Carbon, 180,000 ohms, 1 W.	230106-89
R 314	Resistor, Carbon, 1 megohm, ½ W.	230104-98
R 315	Potentiometer, Vertical Hold, 1 megohm, ½ W.	230126-39
R 316	Resistor, Carbon, 5600 ohms, ½ W.	230104-71
R 317	Resistor, Carbon, 680,000 ohms, 1 W.	230108-96
R 318	Potentiometer, Vertical Height, 2.5 megohm, ½ W.	230126-40
R 319	Resistor, Carbon, 1000 ohms, ½ W.	230104-62
R 320	Potentiometer, Vertical Linearity, 3000 ohms, 14 W.	220130-3
R 321	Resistor, Carbon, 180,000 ohms, 1 W.	230106-88
R 322	Resistor, Carbon, 470 ohms, 1 W.	230106-58
R 401	Resistor, Carbon, 1200 ohms, 1 W.	230108-63
R 402	Resistor, Carbon, 100,000 ohms ± 5%, ½ W.	230094-207
R 403	Resistor, Carbon, 100,000 ohms, ± 5%, ½ W.	230094-207
R 404	Resistor, Carbon, 470,000 ohms, ½ W.	230104-94
R 405	Resistor, Carbon, 4.7 megohm, ½ W.	230104-106
R 406	Resistor, Carbon, 18,000 ohms, 2 W.	230106-76
R 407	Resistor, Carbon, 1500 ohms, ± 5%, ½ W.	230094-163
R 408	Resistor, Carbon, 6800 ohms, ± 5%, ½ W.	230094-179
R 409	Resistor, Carbon, 82,000 ohms, ½ W.	230104-88
R 410	Potentiometer, Horizontal Hold, 25,000 ohms, ½ W.	220126-38
R 411	Resistor, Carbon, 200,000 ohms, ± 5%, ½ W.	230094-214
R 412	Resistor, Carbon, 1500 ohms, ½ W.	230104-66
R 413	Potentiometer, Horizontal Drive, 25,000 ohms, ½ W.	220126-41
R 414	Resistor, Carbon, 4700 ohms, ½ W.	230104-70
R 415	Resistor, Carbon, 470,000 ohms, ½ W.	230104-94
R 416	Resistor, Carbon, 100 ohms, ½ W.	230104-80
R 417	Resistor, Carbon, 1500 ohms, 1 W.	230108-66
R 418	Resistor, Carbon, 3.9 ohms, 1 W.	230104-3
R 419	Resistor, Carbon, 1000 ohms, 2 W.	230106-82
R 420	Resistor, Carbon, 4700 ohms, 2 W.	230106-70
R 421	Resistor, Carbon, 15,000 ohms, 2 W.	230106-76
R 422	Resistor, Carbon, 22,000 ohms, 1 W.	230108-78
R 501	Resistor, Wire Wound, 4300 ohms, 5 W.	260071-1
R 502	Resistor, Carbon, 470 ohms, 1 W.	230106-58
R 503	Resistor, Carbon, 270,000 ohms, ½ W.	230104-91
PC 301	Printed Circuit	250126-1
S 301	Switch, UHF-VHF	140938-1
F 401	Fuse, 150 MA, Slow-Blow	180187-24
J 501	Socket, Speaker	180804-11
J 502	Socket, A C	180476-1
	Focus Unit & Centering Device	340849-1
	Ion Trap	340493-2



MAGNAVOX
Chassis 108A series

Technician
CIRCUIT DIGEST
112

Models: CT, CU & CMU 401A; CT, CU & CMU 402A; CT, CU & CMU 403A; CT, CU & CMU 404A

PARTS LIST FOR THE 108A SERIES TELEVISION CHASSIS, CT, CU & CMU 401A; CT, CU & CMU 402A; CT, CU & CMU 403A; CT, CU & CMU 404A

SYMBOL	DESCRIPTION	PART NO.
T 101	Ratio Detector	360588-1
T 102	Transformer, Audio Output	350046-1
T 201	Coil, 1st I.F.	360581-1
T 202	Coil, 2nd I.F. & Trap	360582-1
T 203	Coil, 3rd I.F. & Det.	360583-1
T 401	Transformer, H.V.	360880-1
T 402	Control, Horizontal Width	360588-1
T 501	Transformer, Power	300072-1
L 101	Sound Take-off, 4.5 M.C.	360584-1
L 201	Coil, Input, 1st I.F.	360840-1
L 202	Coil, Peaking, Orange-Orange-Orange	360443-28
L 203	Coil, Peaking, Violet-Violet-Violet	360443-31
L 204	Coil, Peaking, Gray-Gray-Gray	360443-30
L 205	Coil, Peaking, White-White-White	360443-29
L 301	Transformer, Vertical Output	390067-1
L 302	Coil, Deflection	360587-1
L 401	Coil, Horizontal Oscillator	360879-1
L 402	Control, Horizontal Linearity	360886-1
L 501	Reactor & Filter	320088-1
C 101	Capacitor, Ceramic Disc, .008 mfd., 500 V.	280178-1
C 102	Capacitor, Ceramic Disc, 68 mmf., 500 V.	280218-7
C 103	Capacitor, Ceramic Disc, .008 mfd., 500 V.	280178-1
C 104	Capacitor, Ceramic, Disc, 470 mmf., 500 V.	280088-117
C 105	Capacitor, Paper, .0022 mfd., ±10%, 400 V.	280212-3
C 106	Capacitor, Electrolytic, 4 mfd., 50 V.	270027-10
C 107	Capacitor, Paper, .01 mfd., 600 V.	280211-7
C 108	Capacitor, Paper, .01 mfd., 600 V.	280211-7
C 109	Capacitor, Paper, .0047 mfd., 600 V.	280201-5
C 110	Capacitor, Electrolytic, 20 mfd., 380 V.	270027-30
C 201	Capacitor, Silver Mica, 82 mmf., 500 V. (CMU Version)	280189-3046
	Capacitor, Silver Mica, 91 mmf., 500 V. (CT Version)	280189-46
C 202	Capacitor, Ceramic Disc, 680 mmf., 500 V.	280218-4
C 203	Capacitor, Ceramic Disc, 680 mmf., 500 V.	280218-4
C 204	Capacitor, Ceramic Disc, 470 mmf., 500 V.	280218-6
C 205	Capacitor, Ceramic Disc, .001 mfd., 500 V.	280178-14
C 206	Capacitor, Ceramic, Disc, .01 mfd., 500 V.	280178-2
C 207	Capacitor, Ceramic, Disc, 680 mmf., 500 V.	280218-4

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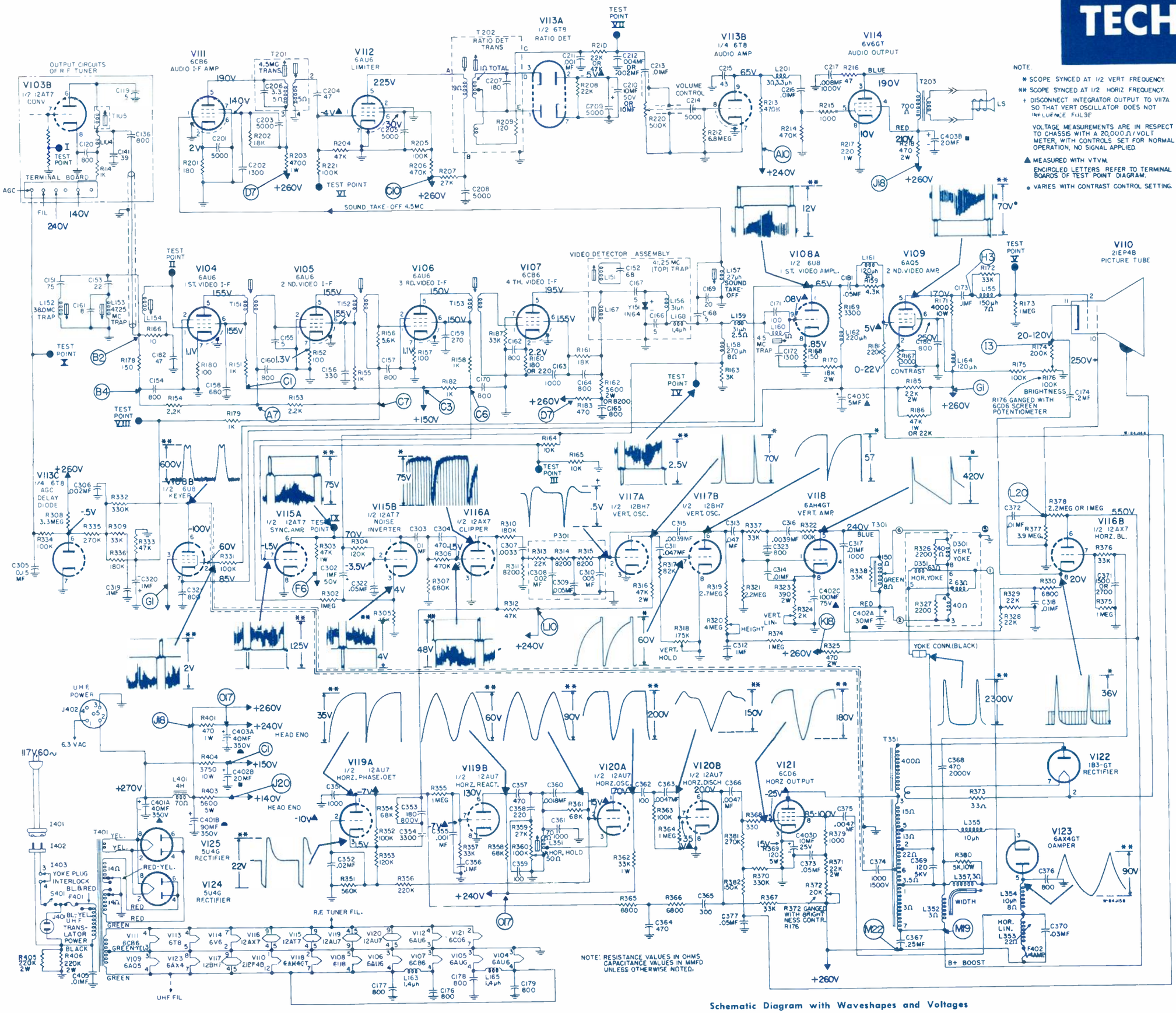
TECHNICIAN
CIRCUIT DIGESTS

February • 1954



Schematic Diagram with Waveshapes and Voltages

GENERAL INFORMATION

The Model 21T7 television receiver is designed for operation on channels 2 through 13, with provision for UHF adaptation.

This receiver bears UNDERWRITERS LABORATORIES approval and incorporates a 21-inch rectangular picture tube. The Model 21T7 utilizes 22 tubes and 4 rectifiers, and features the following:

Two r-f amplifiers, four video i-f stages, automatic noise cancellation, horizontal and vertical retrace blanking, automatic horizontal frequency control and keyed delayed automatic gain control.

The r-f tuner unit is similar to tuners used in other recent General Electric television receivers, the essential difference being the method of i-f output coupling (refer to the accompanying schematic diagrams). An adjustable i-f interference trap is incorporated in the tuner unit which may be tuned to reject offending signals in the 40 to 50 mc i-f range.

SPECIFICATIONS

POWER INPUT RATING:	Frequency ..... 60 cycles Voltage ..... 115 volts Wattage ..... 275 watts
R-F FREQ. RANGE:	Channels ..... No. 2 thru No. 13 Frequencies .... 54-88 mc, 174-216 mc with provision for UHF
OPERATIONAL FREQUENCIES:	Picture I-F carrier ..... 45.75 mc Adjacent channel audio trap ..... 47.25 mc Sound I-F carrier ..... 41.25 mc Adjacent channel video trap ..... 38.00 mc Intercarrier sound take-off ..... 4.5 mc
AUDIO POWER OUTPUT:	Undistorted ..... 1.5 watts Maximum ..... 2.5 watts
LOUDSPEAKER:	Type ..... Alnico PM Cone Diameter ..... 6 1/2 inches Voice Coil Impedance @ 400 cycles ..... 3.2 ohms
ANTENNA INPUT:	Built-in antenna provided External antenna terminals Impedance - 300 ohms balanced ground

Models: 21T7, 21T8, 21T20, 21T21, 21C225, 21C226, 21C227, 21C228, 21C229, 21C230, 21C231, 21C232, 21C233

GENERAL ELECTRIC "EE" Chassis

Technician CIRCUIT DIGEST 113

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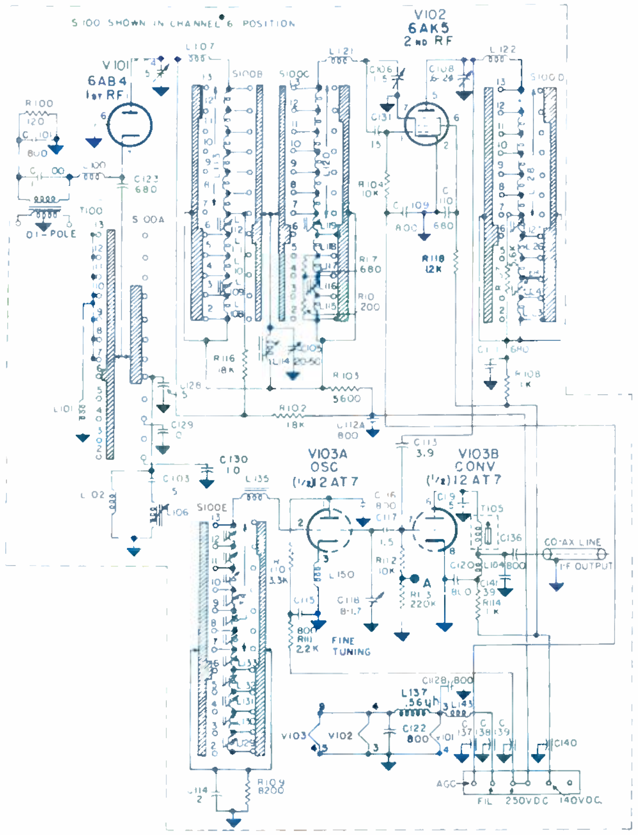
GENERAL ELECTRIC
"EE" Chassis
Technician CIRCUIT DIGEST
113

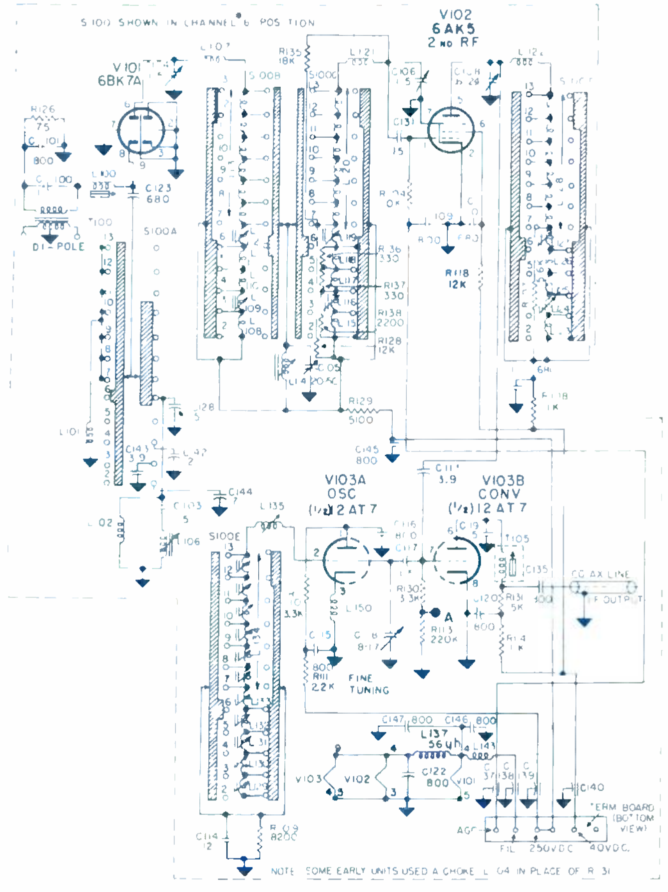
CAUTION NOTICE

THE REGULAR B+ VOLTAGES ARE DANGEROUS AND PRECAUTION SHOULD BE TAKEN WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE. THE HIGH VOLTAGE SUPPLY (16,000 VOLTS) AT THE PICTURE TUBE ANODE WILL GIVE AN UNPLEASANT SHOCK BUT DOES NOT SUPPLY ENOUGH CURRENT TO GIVE A FATAL BURN OR SHOCK. HOWEVER, SECONDARY HUMAN REACTIONS TO OTHERWISE HARMLESS SHOCKS HAVE BEEN KNOWN TO CAUSE INJURY. ALWAYS DISCHARGE THE PICTURE TUBE ANODE TO THE RECEIVER CHASSIS BEFORE HANDLING THE TUBE. SINCE THE HIGH VOLTAGE IS OBTAINED FROM THE B+ VOLTAGE CERTAIN PORTIONS OF THE HIGH VOLTAGE GENERATING CIRCUIT ARE DANGEROUS AND EXTREME CAUTION SHOULD BE OBSERVED.

THE PICTURE TUBE IS HIGHLY EVACUATED AND IF BROKEN, GLASS FRAGMENTS WILL BE VIOLENTLY EXPELLED. WHEN HANDLING THE PICTURE TUBE ALWAYS WEAR GOGGLES.



R-F Tuner, Schematic Diagram



REVISED "RK" VERSION TUNER SCHEMATIC

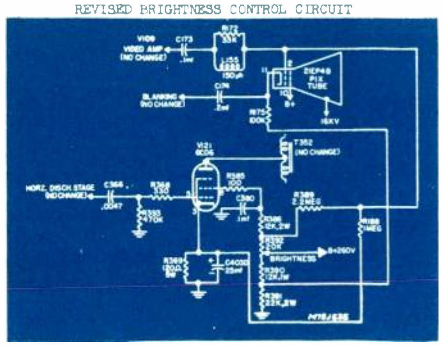
PRODUCTION CHANGES

1) Reduction of I-F Interference: - In order to assist in the reduction of i-f interference an adjacent channel trap shield can, RHS-11? and a chassis bottom plate RHS-11? was added to the chassis.

2) Video Amplifier: -The video amplifier tube was changed from 6AQ5 to a 6CL? type. The complete video amplifier circuitry has been modified slightly using the following components: C4??, L166, L16?, R1?3, R1?4, R1?5 and R1?6.

3) Brightness Circuit:- This change was made to provide greater consistancy of raster size with respect to changes in the brightness level. Receivers incorporating this circuit may be identified by the fact that a single unit brightness control potentiometer is used rather than a dual type of the earlier production chassis

REVISED BRIGHTNESS CONTROL CIRCUIT



RECEIVER ALIGNMENT

R-F TUNER UNIT

Although this tuner unit (Cat. No. RJX-051 is quite similar to tuner units used in recent receivers it is not interchangeable with previous production tuner units because of changes in its i-f output coupling method. However, the r-f and oscillator alignment procedure is exactly the same as used on the Model 17T10 r-f tuner unit.

AUDIO I-F ALIGNMENT

NOTES:-

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio alignment. Keep the Volume control turned down unless the speaker is connected.

2. Figure 2 shows a simple resistor network needed for the alignment of T202 secondary. These two 100K resistors should be chosen as accurately as possible, for equal resistance. Be sure to remove these resistors after completing the alignment. Align as follows:-

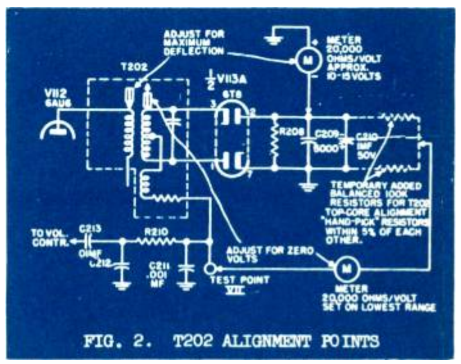


FIG. 2. T202 ALIGNMENT POINTS

AUDIO I-F ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLTMETER	ADJUST	METER INDICATION	REMARKS
1	To test point #6 and chassis.	L15? and T201 (top and bottom cores)	Adjust for maximum deflection	Voltage to be read is negative with respect to chassis
2	V113A, pin 2 and chassis.	T202 primary, (bottom core)		
3	Test Point #7 and center of two 100K resistors. See Figure 2.	T202 secondary, (top core).	Adjust for zero volts d-c output	Repeat steps 1, 2 and 3 to assure proper final adjustment.

VIDEO I-F ALIGNMENT

INTRODUCTION:-

The following alignment data is divided into two separate procedures. Because of the extremely high adjacent channel trap attenuation, the conventional method of sweep observation of these traps becomes difficult. Hence all traps shall be pre-tuned by applying an amplitude-modulated signal and adjusted for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure, observe the usual precautions regarding warm-up time, equipment cable lead dress and generator output cable termination.

TRAP ALIGNMENT

GENERAL:-

As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available It should cover the range of 37 to 48 megacycles at fundamental frequency, with available internal 400-cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400-cycle signal as observed on the oscilloscope.

Owners of General Electric sweep alignment equipment may obtain the required amplitude-modulated carrier frequencies by a simple manipulation of the equipment controls as noted below.

Those technicians who do not have either of the above equipment available are advised to omit the trap alignment procedure. With the exception of the video amplifier 4.5 mc trap L160, the traps will not become seriously mis-aligned due to tube changes. The above-mentioned 4.5 mc trap may be sweep-aligned, if desired, in which case a 4.5 mc sweep signal should be used in step 3, below. The trap may then be tuned to minimum response at 4.5 mc which should be crystal marker calibrated.

Obtaining AM Output from G-E Sweep Equipment

The General Electric ST-4A Sweep Generator will provide 60-cycle square-wave amplitude-modulated signal. To obtain this signal proceed as follows:

1. Turn the sweep generator sweep width control fully counter-clockwise. This will provide a steady (zero sweep) carrier.

2. Turn the sweep generator blanking switch "on". This will square-wave-modulate the carrier at a 60-cycle rate.

3. The next step is to calibrate the frequency of this AM carrier.

a). Turn the marker generator "on" and set the dial to the desired frequency (4.5 mc, 38.0 mc, 41.25 mc or 47.25 mc).

b.) Slowly tune the sweep generator through the desired frequency. As the desired frequency is approached, a strong beat signal will be observed on the oscilloscope. At exact resonance, a zero beat condition will be noticed, on each side of which will appear a beat pattern. Minor sweep generator back-and-forth frequency drift may be noted. However, this drift is insignificant and may be disregarded.

c.) Turn off the marker output.

4. Apply this AM signal according to the instructions in the chart below.

5. The signal observed on the oscilloscope appears as two parallel lines. When the traps are properly tuned the distance between these lines will be at a minimum. NOTE: It may be necessary to use full output of the sweep generator and near maximum oscilloscope gain to observe proper trap tuning.

NOTES:-

1. Remove V121 plate cap. Temporarily connect a 2500-ohm, 25-watt resistor from B+ 260 V to chassis.

2. Remove V115 from its socket.

3. Turn the Volume control to minimum and the Picture Contrast control to maximum. Turn the Brightness control fully counter-clockwise.

4. Set Channel Selector to channel 11 position. Set the Fine Tuning control to its maximum counter-clockwise position.

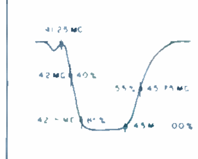
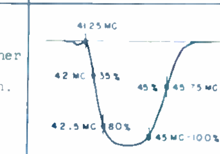
5. Connect oscilloscope to test point #5 (picture tube grid).

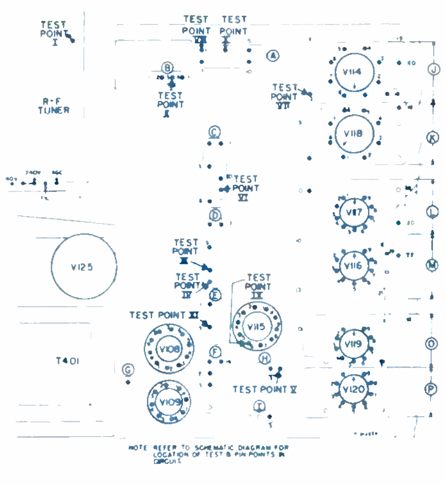
6. Allow receiver and test equipment to warm up for 20 minutes. Refer to figure 4 for trimmer location. Align as follows:-

TRAP ALIGNMENT CHART

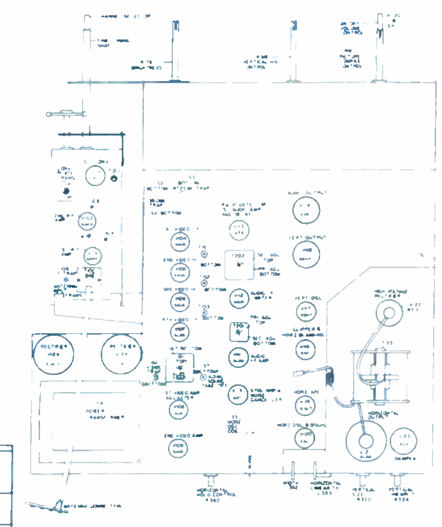
STEP	AM - GENERATOR INPUT POINT	AM - GENERATOR FREQUENCY	ADJUST FOR MINIMUM OUTPUT	REMARKS
1	Test Point #1 (R-F Tuner Unit)	41.25 mc	L151	
		47.25 mc	L153	May require maximum oscilloscope vertical gain
2		38.0 mc	L152	May require maximum oscilloscope vertical gain. If insufficient "null" is observed, turn core of L154 2 or 3 turns into coil.
3	Test Point #4 (Diode Load)	4.5 mc	L160	Connect detector network between oscilloscope input and receiver test point #5 as shown in figure 3. Remove V107 during this step.

ALIGNMENT CHART

STEP	CONNECT SWEEP GENERATOR	ADJUST	DESIRED RESPONSE	REMARKS
1	Into Test Point #2 and chassis thru .001 mf. Center sweep frequency approx. 44.0 mc. Sweep width approx. 10 mc.	T151 for proper 42.0 mc response. T153 for proper 45.75 mc response. T152 & L16? for zero "tilt" and maximum gain without "saddle-back".		Make indicated adjustments to obtain maximum gain consistent with proper curve. Corners of curve peak must show slight rounding. Peak of curve may extend 10 % (max. beyond 45.0 mc marker.
2	Into Test Point #1 and chassis thru .001 mf. Center sweep frequency approx. 44.0 mc. Sweep width approx. 10 mc.	L154 and T105 (R-F Tuner for maximum gain and proper marker position.		Obtain maximum gain and proper marker positions. Peak of curve should extend 15% beyond 45.0 mc marker, with slight rounding.
3	Into R-F Tuner input thru balanced adapter and 300-ohm pad and line. Sweep channels 2-13. Sweep width approx. 10 mc.	C108 (R-F Tuner	Align for zero "tilt" on ch. 12. Check chs. 7-13 and make further compromise adjustment so that each channel will have no more than ±20% "tilt" with the Fine Tuning adjusted to provide the proper sound and picture i-f markers.	
4		L124 & L127 (R-F Tuner	Align for zero "tilt" on channels 3 & 6. Check chs. 2-6 and make further compromise adjustment, so that each channel will have no more than ±20% "tilt" with the Fine Tuning adjusted to provide the proper sound and picture i-f markers.	

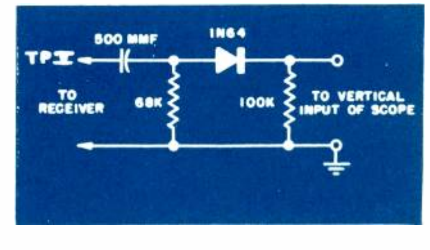


Test Point Diagram



Tube and Trimmer Location

FIG. 3. I-F TEST R NETWK



I-F SYSTEM SWEEP ALIGNMENT

GENERAL:-

Now that the traps have been set at their proper frequencies the i-f curve may be shaped.

NOTES:-

1. Turn Picture Contrast control to minimum

2. Connect oscilloscope to test point #3 (junction of R164 and R165). This was shown in error as test point #7 in publication S-21T7.

3. Apply a negative 6-volt battery bias voltage to test point #8. Connect positive lead of battery to chassis.

4. Calibrate the vertical gain of the oscilloscope to provide a 2-inch deflection with applied signal, 1 3 4 volts peak-to-peak.

5. Note that the following procedure uses 45.0mc as the 100% reference point. Maintain the sweep generator output so that the baseline-to-45.0 mc-marker amplitude equals 2 inches. Align as follows:-

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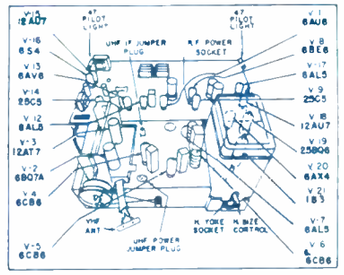
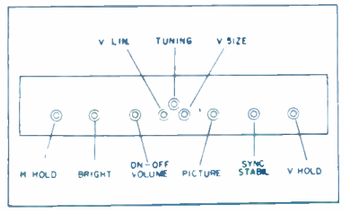
WARNING

At all times during operation the chassis is at 125 volts DC potential above ground and it also may be at the line voltage potential depending on how the line cord plug is inserted in the power receptacle.

Extreme caution must be observed when working with the chassis outside the cabinet and when power is applied to the receiver with the cabinet back removed. SEVERE SHOCK may result from contact with chassis.

An isolation transformer between the line plug and power receptacle must be used when service is required. This removes AC line shock hazards. Damage to the receiver and test equipment may result without the use of an isolation transformer.





RESISTORS RESISTOR WATTAGE IS REPRESENTED IN 1/2 WATT UNLESS OTHERWISE INDICATED 'K' DENOTES X 1,000 & 'M' DENOTES X 1,000,000

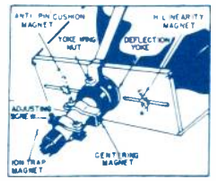
SWITCHES ALL SWITCHES ARE SHOWN IN THE POSITION FOR VHF OPERATION

VOLTAGE READINGS THE VOLTAGE READINGS INDICATED AT THE VARIOUS TUBE SOCKET PINS WERE MEASURED WITH A 20,000 OHM PER VOLT VOLTMETER. NORMAL OPERATION, NO SIGNAL INPUT AND LINE VOLTAGE AT 115V AC WHERE CONTROL SETTINGS AFFECT VOLTAGE READINGS THE MINIMUM AND MAXIMUM ARE INDICATED (SEE WARNING BELOW)

HIGH VOLTAGE HIGH VOLTAGE ON PLATE CAPS OF THE 1B3 HIGH VOLTAGE RECTIFIER AND 25BQ6 HORIZONTAL PULSE AMPLIFIER DO NOT MEASURE THIS VOLTAGE. MEASURE CRT 2nd ANODE VOLTAGE WITH H.V. PROBE

COIL DC RESISTANCE THE DC RESISTANCE READING INDICATED NEAR THE TRANSFORMERS AND COILS HAVE BEEN TAKEN WITH AN OHMMETER DIRECTLY ACROSS THE COIL BEING MEASURED. COILS SHOWN WITHOUT A RESISTANCE READING HAVE A DC RESISTANCE OF LESS THAN ONE OHM. A TOLERANCE OF ± 10% IS PERMISSIBLE. DO NOT MEASURE WITH SET TURNED ON.

WAVE FORMS THE WAVE FORMS ILLUSTRATED ARE EXACT COPIES OF THAT SHOWN ON A LABORATORY OSCILLOSCOPE. THE WAVE FORMS WERE TAKEN UNDER NORMAL OPERATING CONDITIONS, WITH A TRANSMITTED SIGNAL AND THE PICTURE IN SYNC AT ALL TIMES. WITH EACH WAVE FORM IS THE PEAK-TO-PEAK VOLTAGE AND A HORIZONTAL OR A VERTICAL NOTATION (REPRESENTING VERTICAL (60 CYCLES) OR HORIZONTAL (15,750 CYCLES) SCOPE FREQ.). THE WAVE FORM AND PEAK TO PEAK VOLTAGE READINGS MAY VARY SOMEWHAT DEPENDING ON THE STRENGTH OF THE SIGNAL, THE PICTURE INFORMATION BEING TRANSMITTED, AND THE ADJUSTMENT OF THE VARIOUS CONTROLS. WHEN OBTAINING WAVE FORMS, CONNECT THE GROUND LEAD FROM THE OSCILLOSCOPE TO THE CHASSIS AND THE HOT LEAD TO THE POSITION INDICATED BY THE ARROW



REPLACEMENT PARTS LIST

20MC VHF TUNER

Capacitors

Ref No	Part No	Description
C200	8G-11892	22 mmf, ceramic
C201 A B	8E-17142	5-20 mmf, dual trimmer
C202	8G 16045	220 mmf ceramic
C203	8G 20890	6 mmf, ceramic feed thru
C204	8G 22612	5000 mmf ceramic
C205	8G 12495 8	1.5 mmf ceramic
C206	8G-21747	1000 mmf ceramic
C207	201 22333	Trimmer condenser
C208	8G 13201	1000 mmf, ceramic
C209	8G 12495 2	1.0 mmf ceramic
C210	8G-13201	1000 mmf ceramic
C211	8G-13017	15 mmf ceramic
C212	201-15142	Trimmer condenser
C213	8G 12495-2	1.0 mmf ceramic
C214	201 22333	Trimmer condenser
C215	8G 13201	1000 mmf, ceramic
C216	8G-19314	4 mmf ceramic
C217	201 22333	Trimmer condenser
C218	8G-20878	1000 mmf feed thru
C219 220	8G 13201	1000 mmf ceramic
C221	8G 12495 2	1.0 mmf ceramic
C222	8G-19568	2.5 mmf, ceramic
C223	8G 11891	51 mmf ceramic
C224	201-22333	Trimmer condenser
C225 226	8G-20878	1000 mmf, ceramic feed thru
C227	8G-15224	7 mmf ceramic
C228	201 22333	Trimmer condenser
C229	8G-13201	1000 mmf, ceramic
C230	8G-20879	6 mmf ceramic feed thru
C231	8G 20878	1000 mmf ceramic feed thru

Resistors

Ref No	Part No	Description
R200	981 94	470K ohm, ½ watt, 10%
R201	981-62	1000 ohm, ½ watt, 10%
R202	981 74	10K ohm, ½ watt, 10%
R203	981 38	10 ohm, ½ watt, 10%
R204	981-78	22K ohm, ½ watt, 10%
R205	981 27	220K ohm, ½ watt, 20%
R206	981-66	2200 ohm, ½ watt, 10%
R207	981-74	10K ohm, ½ watt, 10%
R208	981 13	1000 ohm, ½ watt, 20%
R209	981-50	100 ohm, ½ watt, 10%

Chokes, Transformers, Coils

Ref No	Part No	Description
T200	13E 22082	H.B. Antenna transformer
T201	13E 21673	L.B. Antenna transformer
L200	13M 20781	Cascode coil
L201	13M 20780	Cascode coil
L202	13E 17046	L.B. RF primary coil
L203	13E 17140	H.B. RF primary coil
L204	13E 12046	L.B. RF secondary coil
L205	13E 17140	H.B. RF secondary coil
L206	16A 20777	Filament coil
L207	16A 17128	RF choke coil
L208	13D 12155	L.B. Oscillator coil
L209	13E 17140	H.B. Oscillator coil

Miscellaneous

Ref No	Part No	Description
S200 201 202 203	2J 16310	Sliding switch contact
	201 22081	Antenna transformer assembly (Includes C200 C201A B C204 R200 T200 and T201)
	200 20772	Antenna shield assembly
	201 20766	Coil alignment strip
	SF 16311	Switch contact holder
	200 20779	Switch lever assembly
	2D 20893	Switch lever bracket
	200 18824	Rear cam
	200 22803	Shaft and front cam
	200 20881	Bottom cover
	201 20769	Capacitor plate assembly (Includes C218 225 226 230 231)
	49A 20763	Main cam spring
	5M 18807	Treadle bar
	2M 16276	Core mounting clips
	43A2 5444	Hex nut 2-56x3-16
	51A 15713	Iron core (white) for L209
	51A 17162	Iron core (brown) for L203 205
	51A 21200	Iron core (pink) for L208
	51A-15715	Iron core (blue) for L202
	51A-17161	Iron core (orange) for L204
	2C 18804 1	Front end plate
	2C 18805 1	Rear end plate
	49A 18799	Link spring
	2M 18800	Front link
	2M-21278	Rear link
	2M-19150 1	Flat spring
	2B-19323	Tube shield
	7B 13050	Antenna terminal board

20MC IF AMPLIFIER

Capacitors

Ref No	Part No	Description
C300	8G-19502	10 mmf, ceramic
C301	8G-13962	5000 mmf, ceramic disk
C302	8F3-8	100 mmf, mica
C303	8G-13201	1000 mmf, ceramic
C304 305		Included with L304
C306	8G-19522	2000 mmf, ceramic
C307	8G-13201	1000 mmf, ceramic
C308	8G-13962	5000 mmf, ceramic disk
C309 310	8G-13201	1000 mmf, ceramic
C311	8G-21105	680 mmf, ceramic
C312-313		Included with L309
C314	8G-13962	5000 mmf, ceramic disk
C315	8G-13201	1000 mmf, ceramic
C316	8G-13962	5000 mmf, ceramic disk
C317	8G-13201	1000 mmf, ceramic
C318 319	8G-12166	5 mmf, ceramic
C320	8G-12495-5	3.3 mmf, ceramic

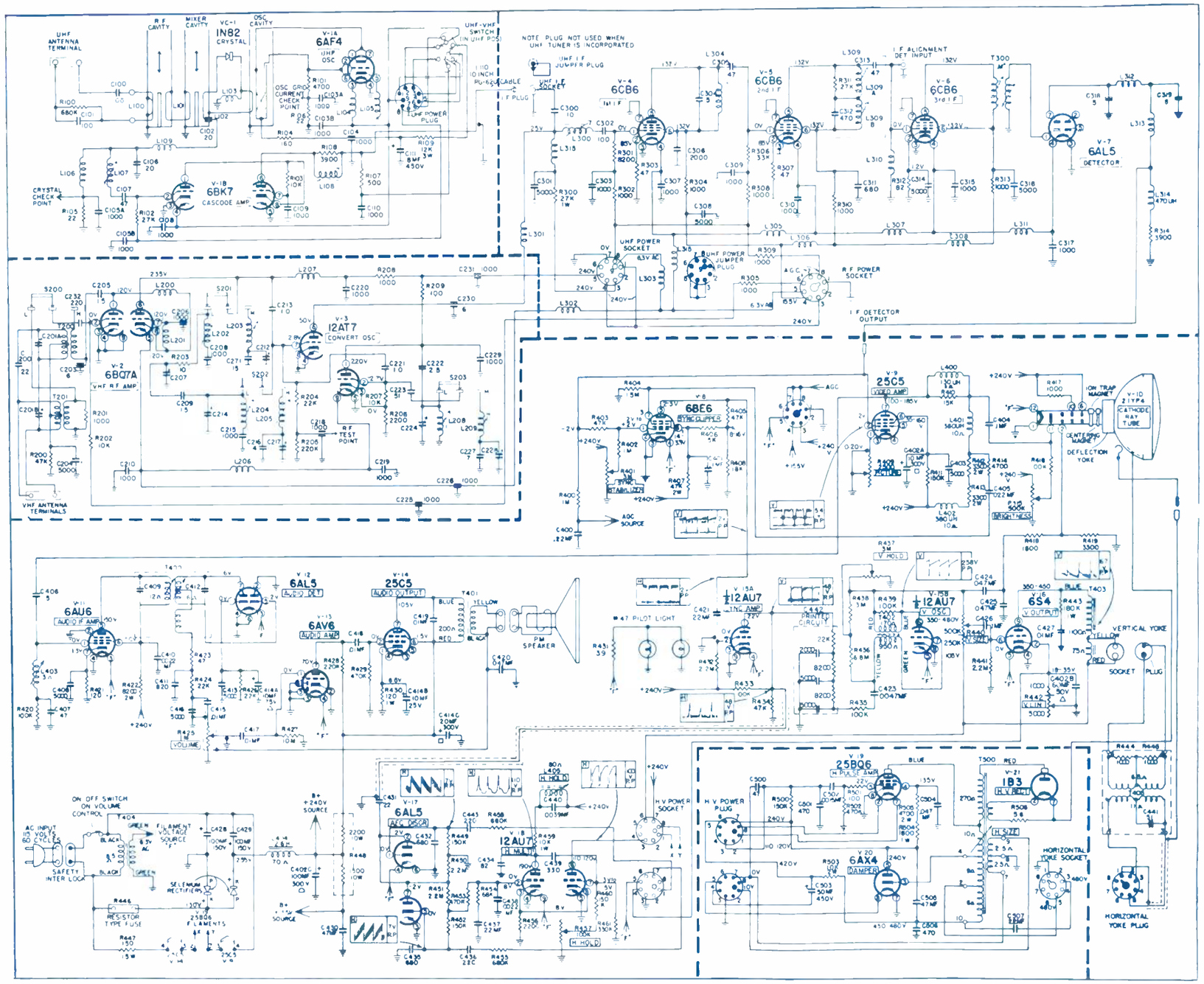
Resistors

Ref No	Part No	Description
R300	982-39	27K ohm, 1 watt, 10%
R301	981-73	8200 ohm, ½ watt, 10%
R302	981-62	1000 ohm, ½ watt, 10%
R303	981-46	47 ohm, ½ watt, 10%
R304 305	981-62	1000 ohm, ½ watt, 10%
R306	981-80	33K ohm, ½ watt, 10%
R307	981-46	47 ohm, ½ watt, 10%
R308 309 310	981-62	1000 ohm, ½ watt, 10%
R311		Included with L309
R312	981-49	82 ohm, ½ watt, 10%
R313	981-62	1000 ohm, ½ watt, 10%
R314	981 69	3900 ohm, ½ watt, 10%
R315	981 80	33K ohm, ½ watt, 10%

Chokes, Transformers, Coils

Ref No	Part No	Description
T300	13B-22939	Output IF transformer
L300	201 22924	Converter coil

SCHEMATIC DIAGRAM



Ref No	Part No	Description
L301	16A-21656	RF choke coil
L302 303	16A-17937	Filament choke coil
L304	201-22927	IF coil assembly
L305	16A-17937	Filament choke coil
L306	16A-18676	RF choke coil
L307	16A-17937	Filament choke coil
L308	16A-18676	RF choke coil
L309	201-22929	IF coil assembly
L310	201-15608	RF choke coil
L311	16A 17937	Filament choke coil
L312 313	16A 22923	Peaking coil
L314	16A-19365	Peaking coil
L315	201 20765	Peaking coil

Miscellaneous

Ref No	Part No	Description
	2D-22253	Chassis bolt bracket
	39A-22252	Bracket insulator
	15C-16007	7 pin, tube socket
	2M-17589	Shield base
	15R-10440	RF power socket

Ref No.	Part No	Description
	198-19922	UHF IF socket and IF alignment input socket
	201-21657	UHF IF jumper plug
	198-11920	UHF Tuner power socket
	19A-21244	UHF Power jumper plug
	2D 22811	AC mounting board bracket
	2D 22809	Tuning shaft bracket
	3A-22812	Tuning shaft
	200-22930	Follower plate and spring
	3M-22389	Drive lok pin (3 used)
	29C-22395	Ring E retainer (2 used)
	200 22933	Drive pulley and bushing
	200 22934	Drive cord and spring assembly
	29M 23108	Circular retaining ring
	200 22922	Shield can for L304 309
	38A 23028	Cardboard insulator for above
	43D 19967	Coil fastener for L300 304 309
	2B 22925	6AL5 bottom socket shield
	2C 22921	IF socket shield plate
	201 22940	F Output lead assembly
	2H 17588	Tube shield

Models: M-2131A, C-2137A & C-2138A

RAYTHEON
Chassis 21T11

Technician
CIRCUIT DIGEST
114

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REPLACEMENT PARTS LIST (cont'd)

Ref. No.	Part No	Description
		21" DEFLECTION CHASSIS
		Capacitors
C400	8J 16082	.22 mfd 200 volt molded
C401	8J 16085	.1 mfd 200 volt molded
C402 A B C	8C 22523	10 mfd 300 volt 60 mfd 50 volt 100 mfd 300 volt lytic
C403	8G 13962	5000 mmf ceramic disk
C404	8J 16083	.1 mfd 400 volt molded
C405	8J 19757	.022 mfd 400 volt molded
C406	8G-12166	5 mmf. ceramic
C407	8G 12198	47 mmf ceramic
C408	8G 13962	5000 mmf ceramic Included with T400
C410	8J 20634	.0022 mfd 400 volt molded
C411	8F3 124	820 mmf 300 volt mica Included with T400
C412		
C413	8G 13962	5000 mmf ceramic
C414 A B C	8C 22524	10 mfd 75 volt 10 mfd 15 volt 20 mfd. 300 volt lytic
C415	8J 20582	.01 mfd 200 volt molded
C416	8G 22132	5000 mmf ceramic
C417	8J 20582	.01 mfd 200 volt molded
C418	8J 16084	.01 mfd 400 volt molded
C419	8G 21208	.01 mfd ceramic
C420	8J 16081	.047 mfd 400 volt molded
C421	8J 16095	.22 mfd 400 volt molded
C422	17A 22376	Printed circuit
C423	8J 20580	.0047 mfd 200 volt molded
C424	8J 16081	.047 mfd 400 volt molded
C425	8J 16096	.047 mfd 200 volt molded
C426	8J 16083	.1 mfd 400 volt molded
C427	8J 16097	.01 mfd 600 volt molded
C428	8C 22285	100 mfd 150 volt lytic
C429	8C 22286	100 mfd 150 volt lytic
C430	8J 21505	.47 mfd 400 volt molded
C431	8G 11892	.22 mmf ceramic
C432	8F3 123	680 mmf 300 volt mica
C433	8F3 117	270 mmf 500 volt mica
C434	8F3 112	82 mmf 500 volt mica
C435	8F3 123	680 mmf 300 volt mica
C436	8F3 117	270 mmf 500 volt mica
C437	8J 16082	.22 mfd 200 volt molded
C438	8J 20578	.002 mfd 200 volt molded
C439	8F3 119	330 mmf mica
C440	8J 20613	.0039 mfd 600 volt molded Included with T405
C441		
C442	17A 22376	Printed circuit
		Resistors
R400	981 98	1 megohm ½ watt 10
R401	10B 17318	Sync Stabilizer control 3 meg
R402	981 92	330K ohm ½ watt 10
R403	981 82	47K ohm, ½ watt 10
R404	981 100	1.5 megohm ½ watt 10
R405	981-82	47K ohm ½ watt, 10
R406	981 76	15K ohm ½ watt 10
R407	984 82	47K ohm 2 watt 10
R408	981-77	18K ohm, ½ watt 10
R409	10B-22311	Picture control 2500 ohm
R410	981 76	15K ohm ½ watt 10
R411	981 88	150K ohm ½ watt 10
R412-413	984 68	3300 ohm 2 watt 10
R414	981 70	4700 ohm ½ watt 10
R415	10B-21456	Brightness control 500K ohm
R416	981 90	220K ohm ½ watt 10
R417	981-62	1000 ohm ½ watt 10
R418	981 65	1800 ohm ½ watt 10
R419	981 68	3300 ohm ½ watt 10
R420	981 86	100 K ohm ½ watt 10
R421	981 51	120 ohm ½ watt 10
R422	984 73	8200 ohm 2 watt 10
R423	981 46	47 ohm ½ watt 10
R424	981 78	22K ohm ½ watt, 10
R425	10A 22305	On Off Volume control 1 meg
R426	981 78	22K ohm ½ watt 10
R427	981 110	10 megohm ½ watt 10
R428	981 90	220K ohm ½ watt 10
R429	981 94	470K ohm ½ watt 10
R430	982 51	120 ohm 1 watt 10
R431	9C1 1070	3.9 ohm ½ watt 10
R432	981 102	2.2 megohm ½ watt 10
R433 434	981 82	47K ohm ½ watt 10
R435	981 86	100K ohm ½ watt 10
R436	981 108	6.8 megohm ½ watt 10
R437	10B 17318	Vertical Hold control 3 meg
R438	981 102	2.2 megohm ½ watt 10
R439	981 86	100K ohm ½ watt 10
R440	10B 22307	Vertical Size control 750K ohm
R441	981 102	2.2 megohm ½ watt 10
R442	10B 22304	Vertical linearity control 6000 ohm
R443	982 89	18K ohm 1 watt 10
R444 445	981 62	1000 ohm ½ watt 10
R446	16M 22301	Resistor type fusi
R447	9M 22837	150 ohm 15 watt 10
R448	9M 22275	2700 ohm 10 watt 10 1500 ohm 10 watt 10
R449	981 88	150K ohm ½ watt 10
R450 451	981 102	2.2 megohm ½ watt 10
R452	981 88	150K ohm ½ watt 10
R453	981 94	470K ohm ½ watt 10
R454	981 84	68K ohm ½ watt 10
R455	981 96	680K ohm ½ watt 10
R456	981 84	1500 ohm ½ watt 10
R457	10B 17275	Horizontal Hold control 100K ohm
R458	981 96	680K ohm ½ watt 10
R459	982 74	10K ohm 1 watt 10
R460	981 90	220K ohm ½ watt 10
		Chokes, Transformers, Coils
T400	13M 22303	Ratio Detector transformer
T401	12C 22508	Audio Output transformer
T402	12M 18241	Vertical Oscillator transformer
T403	12C 20761 2	Vertical Output transformer
T404	12D 22586	Filament transformer
T405 (Incl R444 445 & C441)	20I 22697	Deflection yoke assembly

Ref. No	Part No.	Description
		21" DEFLECTION CHASSIS (cont'd)
L400	16A 20021	Peaking coil (130UH)
L401-402	16A 19486	Peaking coil (380UH)
L403 (Incl C406 407 & R420	20I 22581	Video Trap Coil assm
L404	16A 21714	Filter choke (2.6 H)
L405 (Incl C440	20I 22302	H. Hold coil assm
		Miscellaneous
	2D 22253	Chassis bolt bracket
	19A 22252	Bracket insulator
	41M-22446	Front control insulator
	15C 16007	7 pin tube socket
	2M-17589	7 pin tube shield base
	2H 17588	Tube shield
	15B 21968	6S4 tube socket
	16C-22595	9 pin socket and spring assm
	20D 22737	9 pin socket and adapter plate
	19A 22525	Speaker socket
	19B 22672	Vertical yoke socket
	15B 21186	Lytic mounting plate for C429
	19B 22541	H. V. power socket
	7M 22266	R44& terminal board
	7M 22267	Video input terminal board
	2D 22564	Pilot light mounting bracket
	37A-22512	Pilot light shield
	47A 22513	L. H. Pilot light socket bracket
	47A 22592	R. H. Pilot light socket bracket
	2D 11002	Mounting clip for C430
	2D-12053	Mounting clip for C400 421 437
	21J 20097	Selenium rectifier
	43F 15390	Control mounting nut (8 used)
	51A 21740	Iron core for L405
	43D-11666 1	Speed clip for L405
	20I 22551	AC Line cable assm (Includes 3 items below)
	41M 22434	Mounting plate
	19A 19446	AC receptacle
	55A 19819	8 inch sleeving
	15B 17278 9	CRT socket and cable
	20I 22441	RF power plug and cable
	51A 22370	Iron core for L403
	43D 19967	Coil tube fastener for L403
	46A 10793	Pilot light bulb
	14B-20283	Shielded wire

Ref. No.	Part No.	Description
		21" H.V. SUPPLY
		Capacitors
C500	8G 19863	.47 mmf ceramic
C501	8F3 121	470 mmf 500 volt mica
C502	8J-20589	.0015 mfd 400 volt molded
C503	8C 22544	50 mfd 450 volt lytic
C504	8J 16081	.047 mfd 400 volt molded
C505	8J 21505	.47 mfd 400 volt molded
C506	8G 21440	470 mmf 1000 volt ceramic
C507	8J-16082	.22 mfd 200 volt molded
		Resistors
R500	981 88	150K ohm ½ watt 10 %
R501	981 50	100 ohm ½ watt 10%
R502	981 94	470K ohm ½ watt 10 %
R503	984 74	10K ohm 2 watt 10%
R504	982 65	1800 ohm 1 watt 10 %
R505	984 70	4700 ohm 2 watt 10 %
R506	9C1 1070	3.9 ohm ½ watt 10%
		Chokes, Transformers, Coils
T500	20I 22196	H. V. Deflection transformer
	2D 22253	Chassis bolt bracket
		Miscellaneous
	39A 22252	Bracket insulator
	15B 22335	Yoke socket
	15B 10440	25B06 tube socket
	15B 20860	6AX4 tube socket
	19A 22540	Dual H.V. power plug
	20I 20817 1	1B3 Socket assembly
	14C 22282 1	H.V. Cable assembly
	2B 22263	Shield can
	2B 22264	Shield can cover
	38A 19991	Insulator strap
	49A 22633	Ring (2 used)
	2D 11490	Mounting clip for C503
	2D 12053	Mounting clip for C507
	2D 11002	Mounting clip for C505

Ref. No.	Part No.	Description
		21" C.R.T. MOUNTING ASSEMBLY
T405	20I 22697	Deflection yoke assembly
	2M 22664	Tube strap
	2D 22666	Tube strap bracket
	2D 22660	Tube mounting bracket
	23M 22706	Carriage bolt (2 used)
	43A14-22707	Carriage bolt nut
	2D-22658	Tube support bracket
	2D 22662	Yoke mounting bracket
	25M 22653	Retainer ring
	3M 22659	Tie rod
	16M 22602	Linearity magnet
	16M 22607	Ant. pin cushion magnet
	16M 20697	Centering magnet
	16M 19906	Ion trap magnet
	43E 15569	Linearity & pin cushion wing nut
	32T8-20807	Yoke wing nut
	20I 22489	H. Yoke cable and plug
	20I 22690	V. Yoke cable and plug

Ref. No.	Part No.	Description
		21 SUBURBAN CABINET PARTS
	24D-22818	Cabinet (M 2131)
	24D-22892	Cabinet (C 2137)
	24D 22893	Cabinet (C 2138)
	30M-21485	Safety glass
	25M-20821	Rubber cushion (3 used)
	2M-22755	Back support
	2D-21257 A136	Glass support channel
	2D 21257-A135	Glass support (C 2138 only)
	25H 21507	Gasket
	32D6-21460 F101	Channel phillips screws
	32D6 21460 F133	Channel phillips screws (C 2138 only)
	25M-22756-1A129	Mask
	25M-22756-A135	Mask (C 2138 only)
	200-22559	Escutcheon assembly (Includes 10 items below)
	5C 22535	Escutcheon
	200 22600	Dial plate and pulley assembly
	43D 22611	Push on fastener (2 used)
	6D 22589	VHF dial scale
	6D 22590	UHF dial scale
	5C 22397	Raytheon crest
	2M 22517	Retainer spring
	23M 22511	Bead chain
	200 22603	Pointer pad and link

Ref. No.	Part No	Description
		21" SUBURBAN CABINET PARTS (cont'd)
	5M 22281	Pointer
	32D6 23034 F101	Escutcheon screws
	14M 22510	Speaker cable (2131 only)
	14M-22846	Speaker cable
	18A 21216	5" PM speaker (2131) only
	18A 19927	8" PM speaker
	5B-22637	Tuning knob
	5B 22613	Picture and volume knob
	5B 20755 29	Star knob
	5B 23047	Sync stabilizer knob
	20I 20237	VHF built in antenna
	200-22918	Cabinet back assembly (Includes 3 items below)
	23J 22762	Cabinet back
	2D-22710	Line cord mounting bracket
	14M 17395	Line cord and plugs
	5M-22948	Plastic emblem
	25M 22758	CRT shield
	13D-22967	Push on fastener

VIDEO IF ALIGNMENT

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	23.9 26.3	25	IF alignment input	Scope at IF detector output	Connect short between pin 5 and 6 of tube 5	T300 pri. (top) T300 sec. (bot.) Coupling rod	
2	Markers should fall 10% down. If response curve is not as shown., readjust coupling rod (bottom T300) for proper bandwidth and T300 primary and secondary for flat response and maximum gain.						
3	21.2	——	Converter grid	VTVM at IF detector output	Remove short. Adjust generator for output of approx. 2 volts DC.	L309B (bottom core)	Maximum reading
4	26.5	——	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L309A (top core)	Maximum reading
5	21.2	——	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L309B (bottom core)	Maximum reading
6	24.0	——	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L304	Maximum reading
7	25.0	——	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L300	Maximum reading
8	——	25	Converter grid	Scope at IF detector output	——	T300 pri. (top)	Rock for flat response
9	23.8 26.65	25	Converter grid	Scope at IF detector output	Markers should be 50° down and response curve should be as shown. If not, repeat alignment	Check point only	

Picture IF frequency 26.75 MC — Sound IF frequency 22.25MC.

NOTE: A very short lead from the generator must be used to prevent regeneration.

VIDEO TRAP COIL (L-403) ADJUSTMENT

1. Tune in a station.
2. Adjust the tuner until sound bars just appear.
3. Turn L-403 slug all the way out (counter-clockwise).
4. Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous.

SOUND IF ALIGNMENT

Short antenna to ground

1	4.5	——	IF Detector Output	VTVM across C-416	——	T400 Primary (Botom of can)	Maximum Reading on V.T.V.M.
2	——	4.5	IF Detector Output	Scope across C-416	Sweep approx. 100 KC. Adjust for maximum linearity	T400 Secondary (Top of can)	
3	——	4.5	IF Detector Output	Scope across C-416	Sweep approx. 100 KC. Adjust for maximum linearity	T400 Primary (Botom of can)	

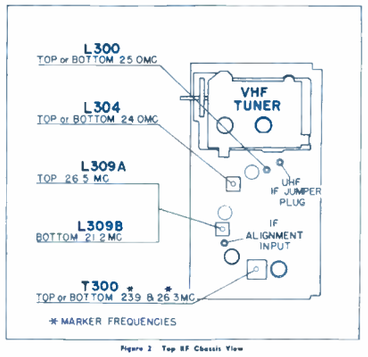


Figure 2 Top RF Chassis View

PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. When aligning the IF Amplifier be sure tuner is set approximately to channel 11.

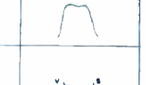
TUNER ALIGNMENT

1. Preset trimmer screws C-212-217-207-214-228-224 to dimensions shown, Figure 3.
2. Preset coil cores L-203-202-205-204-209-208 in the following manner.
   (a) In low band position, turn tuner to top of stroke (cores furthest out of coil).
   (b) Switch will be in low band position.
   (c) Adjust coil cores 1 6 inch from core to end of coil form (use core aligning tool if available).

V-video
S-sound

LOW BAND RF TRACKING Turn Tuner to Channel 6.

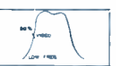
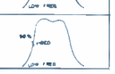
NOTE Low Band must be aligned before High Band.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V—83.25 S—87.75	Channel 6	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-201B	
2	V—83.25 S—87.75	Channel 6	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-207 C-214	
3	V—77.25 S—81.75 V—67.25 S—71.75 V—61.25 S—65.75 V—55.25 S—59.75	Channel 5 Channel 4 Channel 3 Channel 2	Antenna Terminals	R. F. Test Point	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-207 C-214	

HIGH BAND RF TRACKING Turn Tuner to Channel 13.

1	V—211.25 S—215.75	Channel 13	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-201-A	
2	V—211.25 S—215.75	Channel 13	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-212 C-217	
3	V—205.25 S—209.75 V—199.25 S—203.75 V—193.25 S—197.75 V—187.25 S—191.75 V—181.25 S—185.75 V—175.25 S—179.75	Channel 12 Channel 11 Channel 10 Channel 9 Channel 8 Channel 7	Antenna Terminals	R. F. Test Point	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-212 C-217	

LOW BAND OSCILLATOR TRACKING Turn Tuner to Channel 6.

1	83.25	Channel 6	Antenna Terminals	Scope at IF Detector Output	Adjust until marker is 50% down on low frequency slope	C-224	
2	67.25 55.25	Channel 4 Channel 2	Antenna Terminals	Scope at IF Detector Output	Marker should be 50% down on low frequency slope	——	

HIGH BAND OSCILLATOR TRACKING Turn Tuner to Channel 13.

1	211.25	Channel 13	Antenna Terminals	Scope at IF Detector Output	Adjust until marker is 50% down on low frequency slope	C-228	
2	193.25 175.25	Channel 10 Channel 7	Antenna Terminals	Scope at IF Detector Output	Marker should be 50% down on low frequency slope	——	

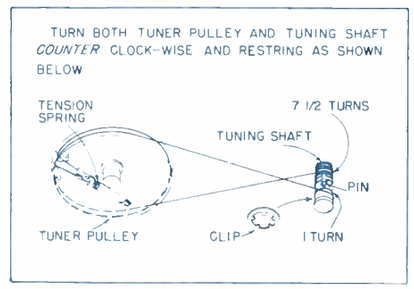


Figure 1. Dial Stringing

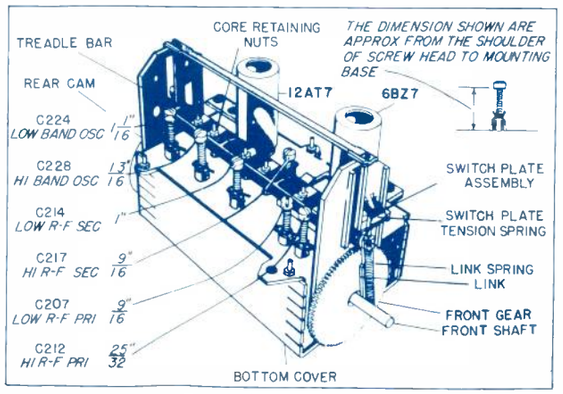


Figure 3. Top VHF Tuner View

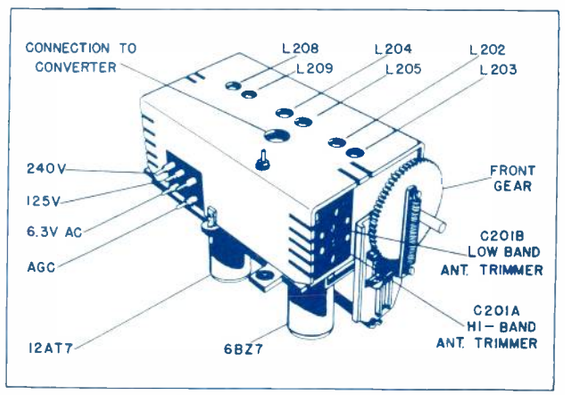


Figure 4. Bottom VHF Tuner View

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February • 1954

TECHNICIAN CIRCUIT DIGESTS

HORIZONTAL RINGING COIL

The horizontal ringing coil (L100) should be adjusted as follows:

1. Short out the ringing coil with a short jumper wire.

2. Set the horizontal hold control to the middle of its range, and leave it in this position during the steps that follow.

3. Connect a VTVM to the pin No. 2 grid circuit of the horizontal multivibrator, so as to measure the DC voltage between this point and ground.

4. With the receiver tuned to a TV station, adjust C421 (located on the rear of the chassis) for + 1 volt on the meter. If a reading of + 1 volt can be approached but not quite reached at one extreme of the C421 adjustment, it may be necessary to set the horizontal hold control slightly to one side of mid-position to obtain one volt reading.

5. Remove the jumper from across the ringing coil.

Adjust the ringing coil for + 1 volt on the meter, and check the adjustment by switching to another channel and then back again. The receiver should pull into horizontal synchronization on all channels

ALIGNMENT

ALIGNMENT TOOL

To adjust the slugs in the common I-F transformers a special tool is required. This tool must fit into the .035" x .093" slot in the slug. An incorrectly designed tool will cause chipping of the slug. A suitable tool is stocked under Westinghouse part number V-8345.

COMMON I-F ALIGNMENT PROCEDURE

The common I-F system uses over-coupled I-F transformers to obtain the required band width. In the alignment of this type system, the visual method of stage-by-stage alignment is used. A sweep generator is used to develop the I-F response curve on the oscilloscope, and an unmodulated signal generator (marker) is used to provide spot frequency indications on the curve.

With some of the I-F transformers, peaks may be obtained at two positions of the adjustment slugs. If a transformer is badly out of adjustment, it is advisable to turn the slug out (counterclockwise) as far as possible before beginning alignment. Then turn the slug clockwise until the first peak is reached. This procedure is recommended to obtain the correct peak rather than an undesired second peak which is sometimes obtained when the slug is turned farther clockwise.

Fig. 5 – Oscilloscope Connections

THE ALIGNMENT PROCEDURE TO BE USED IS GIVEN IN THE FOLLOWING STEPS:

1. To avoid undesirable beat response during alignment, remove the R-F amplifier tube from its socket and rotate the channel selector to channel 13.

2. Connect the vertical input of the oscilloscope to the video test terminal (point "B" on Fig. 3) through the decoupling network shown in Fig. 5. The oscilloscope horizontal input should be connected to the sweep (synchronizing) output from the sweep generator THROUGH WELL SHIELDED LEADS. Turn the sweep control on the oscilloscope to the "x" or "off" position.

3. Connect the negative terminal of a 9 volt bias battery to the AGC line (point "A"), and connect the positive terminal to chassis ground.

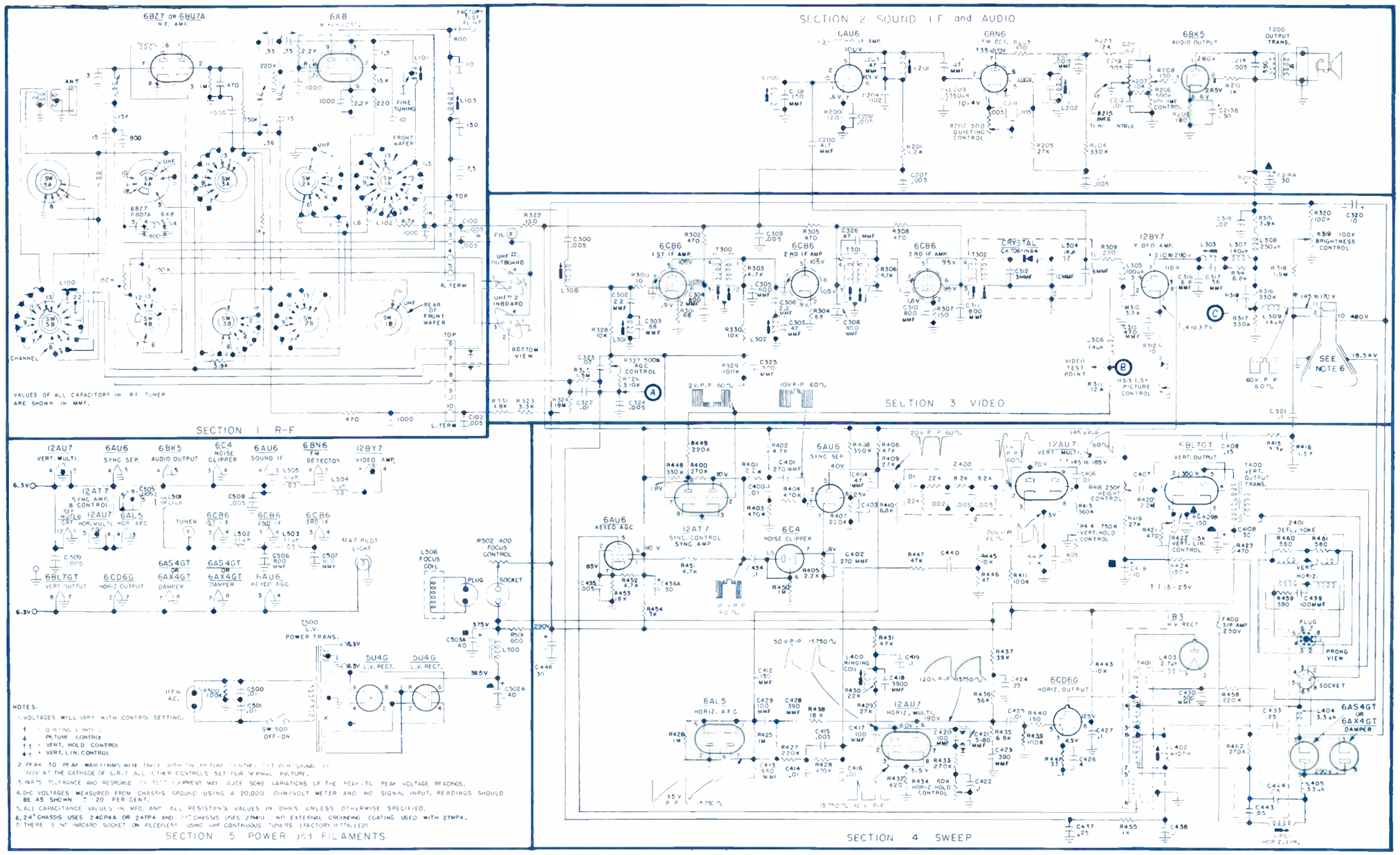
4. Couple the marker generator output to the sweep generator output so that the two signals are applied together to the points specified in the steps that follow. Some sweep generators have facilities for connecting the marker output directly into the sweep generator. With other sweep generators, the marker can be coupled to the sweep by wrapping a few turns of insulated wire around the center conductor of the sweep generator output cable and connecting the marker generator to this wire. The loose coupling obtained in this manner is desirable because EXCESSIVE MARKER SIGNAL INJECTION WILL DISTORT THE RESPONSE CURVE.

5. Adjust the sweep generator for a center frequency of 44 mc. with a sweep deviation of 10 mc.

6. Connect the high side of the sweep generator output cable directly to the control grid of the 3rd I-F amplifier, and connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 3rd I-F amplifier tube. Keep the leads from the cable as short as possible.

MODELS CONTAINING ALL CHANNEL UHF TUNERS

When the letter "U" appears in the model number, the receiver contains an all channel UHF tuner in addition to its VHF facilities.



Models: H-815T24 and H-817K24

7. Detune the plate circuits of the 1st and 2nd IF amplifiers by attaching alligator or similar type clips to pin #5 of the 6CB6 1st and 2nd IF amplifier tubes. USE CARE TO AVOID SHOCK. This step is necessary to avoid absorption of the signal that is applied to the 3rd IF grid.

8. Adjust the oscilloscope vertical gain and the sweep generator output level to obtain a curve on the oscilloscope. To avoid a distorted curve, the recommended practice is to use maximum oscilloscope vertical gain and only enough sweep signal amplitude to obtain a good curve.

9. Set the marker generator to 44 mc. with the output attenuated until the marker pip is barely visible on the curve, and adjust the primary of the 3rd common I-F transformer, T302, until the 44 mc. marker pip is at the highest point on the response curve.

10. Adjust the secondary of T302 to make the top of the response curve symmetrical.

11. Make certain that the response curve coincides with Fig. 8A, using the marker to check at the appropriate frequencies. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must be at equal heights. Re-adjust the primary and secondary of T302 if necessary to obtain these conditions.

12. Remove the detuning clips that were attached in step 7.

13. Disconnect the sweep generator from the grid of the 3rd IF amplifier.

14. Connect a signal generator that has an output of .02 volt or higher to the grid of the 1st IF amplifier, "high" side to the grid and ground side to the chassis. Adjust the signal generator to 47.25 mc. amplitude modulated, and increase the output until a sine wave response is visible on the oscilloscope.

15. Adjust the adjacent channel sound trap, L302, for minimum response on the oscilloscope.

NOTE: IF A SIGNAL GENERATOR IS NOT AVAILABLE AND THE RECEIVER IS LOCATED IN A STRONG SIGNAL AREA WHERE ADJACENT CHANNEL SOUND INTERFERENCE OCCURS, L302 CAN BE ADJUSTED BY TUNING THE RECEIVER TO THE CHANNEL ON WHICH THE ADJACENT CHANNEL INTERFERENCE OCCURS, CAREFULLY ADJUSTING THE FINE TUNING CONTROL TO ITS CORRECT SETTING, AND ADJUSTING L302 TO THE POSITION WHERE THE ADJACENT CHANNEL SOUND INTERFERENCE IS ELIMINATED.

16. Attach a detuning clip to the plate of the 1st IF amplifier tube, and remove the amplitude modulated signal generator connections.

17. Connect the high side of the sweep generator output cable directly to the control grid of the 2nd IF amplifier. Connect the ground side of the cable to the chassis partition as close as possible to the ground point of the 2nd IF amplifier tube.

18. Adjust the primary of the 2nd common I-F transformer, T301, for maximum height of the response curve at 44 mc., and adjust the secondary of T301 to make the top of the curve symmetrical.

19. Make certain that the curve corresponds to Fig. 8B. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal heights, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T301 if necessary.

20. Remove the detuning clip from plate of the 1st I-F amplifier.

21. Move the sweep output connection from the grid of the 2nd I-F amplifier to the grid of the 1st I-F amplifier, and connect the ground side of the cable as close as possible to the ground point for the 1st I-F amplifier tube.

22. Detune L103 located on the tuner by rotating it several turns counterclockwise. Otherwise, the setting of L103 will affect the waveshape in the following step.

(Continued on reverse side)

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WESTINGHOUSE
Chassis Assembly V-2250-1

Technician
CIRCUIT DIGEST
115

February • 1954

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CIRCUIT DIGESTS

18

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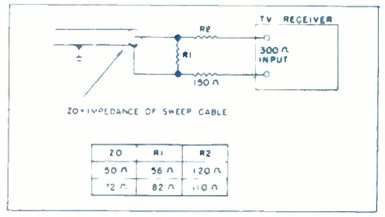
For complete Index to all earlier Circuit Digests, see main section of magazine



ZO	R1	R2
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω

Fig. 6 – Impedance Matching Network

(Continued from reverse side)

23. Adjust the primary of the 1st common IF transformer, T300, for maximum height of the response curve at 44 mc., and adjust the secondary of T300 to make the top of the curve symmetrical.

24. Adjust L103 so that the dip or "suck-out" which it produces on the response curve is at 44 mc. (center of curve).

25. Make certain that the curve corresponds to Fig. 8C. If the marker frequencies fall at the correct points, no transformer re-adjustments are required.

26. Remove the sweep output connection from the grid of the 1st IF amplifier.

27. Replace the RF amplifier tube which was removed in step 1.

28. Adjust the sweep generator to channel 13 (210 to 216 mc.), and connect its output cable to the receiver antenna terminals through the impedance matching network shown in Fig. 6. Keep the leads as short as possible.

When working with very high frequencies, the impedance matching network is required because response curves are of no value unless the sweep generator output cable is terminated in its characteristic impedance. Any mis-match present results in standing waves which may seriously affect the observed waveform depending upon the amount of mis-match.

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Chassis Assembly V-2250-1
Technician CIRCUIT DIGEST 115

29. Couple the marker generator output to the sweep generator output by using the loose capacitive coupling provided by a one turn loop, or connect both the high side and the ground side of the marker generator cable to the receiver chassis. Loose coupling between the marker generator and the receiver is desirable to avoid distortion of the response curve.

30. Set the channel selector to channel 13 and the fine tuning control to the middle of its range.

31. Adjust the sweep generator output to the lowest level that provides a usable response curve on the oscilloscope, and adjust the marker output so that the marker pip is barely visible.

32. Adjust the 1st IF reactor, L300 for a symmetrical response curve.

33. Set the marker generator to 41.25 mc., and adjust the 41.25 mc. sound trap, L301, to minimize the amplitude of the marker pip.

34. Using the marker generator at 41.25 mc., 42.25 mc., 43 mc., 44 mc., 45.75 mc., and 47.25 mc., see that the marker pips fall as indicated on Fig. 8D. If the curve is satisfactory on channel 13, all other channels should also be satisfactory.

4.5 MC. TRAP ALIGNMENT PROCEDURE

1. Connect the high side of the signal generator to the video test terminal (point "B" on Fig. 3) through a .001 mfd mica capacitor, and ground the low side to the chassis.

2. Adjust the signal generator to 4.5 mc. (unmodulated). The accuracy of this frequency is very important. If a crystal controlled signal generator is not available, the frequency should be checked with an accurate frequency meter.

3. Connect the common lead from the VTVM to the chassis, and connect the R-F probe from the VTVM to the cathode of the CRT. This point is shown as point "C". Note that this point is above ground potential and, therefore, the R-F probe must contain a blocking capacitor.

4. Using a strong 4.5 mc. signal, adjust the 4.5 mc. trap, L303 for minimum indication on the meter.

SOUND ALIGNMENT PROCEDURE

The sound system can be aligned using either locally generated signals or a received TV signal. Since the latter method does not require signal generating equipment, it will be described first and will be followed by the procedure using locally generated signals.

To use an "air" signal for alignment:

1. Tune the receiver to a TV station and connect an attenuator between the receiver and the antenna so that the strength of the signal can be varied from weak to strong.

2. Set the quieting control (R202) located on the back of the chassis approximately to its mid-position.

3. Apply a strong signal to the receiver, and adjust the quadrature coil (L202) for maximum program sound. If peaks occur at two different positions that are widely separated, use the one that occurs when the slug is farthest counterclockwise. If two peaks occur within a narrow range of adjustment, sufficient signal is not being applied to the receiver and/or the quieting control is not set at the proper position.

4. Reduce the signal to its lowest useable level and adjust the 4.5 mc. IF slugs (L200 and L201) and the quadrature coil (L202) again for maximum program sound. If peaks occur at two different settings of the slug, use the peak that occurs when the slug is farthest counterclockwise. Recheck adjustments at the lowest useable signal level.

5. Apply a very weak signal that allows noise to be heard and adjust the quieting control (R202) for minimum noise. The position at which the noise is minimized depends on the strength of the signal; therefore, the weakest useable station in the area should be used for this adjustment. This control determines the AM rejection characteristics of the sound system, and its correct setting is normally about mid-position. DO NOT LEAVE THE QUIETING CONTROL SET AT ITS MAXIMUM COUNTERCLOCKWISE POSITION.

Fig. 7 – Oscillator Adjustment Tool

To use locally generated signals for alignment:

1. Connect an oscilloscope or an AC voltmeter across the volume control for use as an indicator.

2. Apply a 4.5 mc. FM signal (deviation approximately 7.5 kc.) to the video test point (B on Fig. 3).

3. Using a strong signal, adjust L202 for maximum output.

4. Reduce the signal to the lowest level that will produce an indication and adjust L200, L201 and L202 again for maximum output.

5. Apply a 4.5 mc. AM signal (modulated approximately 30 percent) to the video test point.

6. Beginning with a very low signal level, increase the generator output, while rotating the quieting control back and forth, until the signal level is such that the AM output across the volume control dips to ZERO with a rise on each side as the quieting control is rotated. Set the quieting control for zero output at this signal level.

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H. F. OSCILLATOR ALIGNMENT PROCEDURE

If the 6X8 oscillator tube is replaced, the different inter-electrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator.

Alignment of the oscillator on the high band is accomplished by adjusting the brass slug located adjacent to the vernier drive wheel on the front of the tuner. Alignment of the oscillator on the low band is accomplished by adjusting the brass slug on the lower front of the tuner. These slugs can be adjusted from the front of the receiver without removing the chassis from the cabinet if a non-metallic tool similar to that shown in Fig. 7 is used. The guide on the end of the tool is helpful in seating the tool in the screw slot. The adjustment procedure is as follows:

1. Set the fine tuning control to the middle of its range by rotating it until the arrow near the edge of the fine tuning drive wheel is straight up, and keep it in this position during the following adjustments.

2. Set the channel selector to the highest of the low band (channels 2 through 6) stations operating in your vicinity.

3. Peak the low band adjustment slug (L102) for the best picture detail.

4. Set the channel selector to the highest of the high band (channels 7 through 13) stations operating in your vicinity.

5. Peak the high band adjustment slug (L101) for the best picture detail.

6. Check the previously made low band adjustment, and if the tuning has changed repeat steps 2 and 3.

SECOND DETECTOR LOCATION

The second detector (1N64 or CK706 crystal) and its associated components are located in the 3rd IF transformer shield can. The crystal, L304 and C312 can be replaced without installing an entire new 3rd IF transformer assembly. The replacement should be exactly the same as the original part. This applied to both its electrical characteristics and physical dimensions. In the event that the smaller crystal is not available and the larger size 1N64 is used as a replacement, the 1N64 must be mounted vertically so that the shield can be replaced.

ALIGNMENT CHARTS

The information in these charts is condensed from the foregoing detailed information as a convenience to the service technician. It is recommended that the detailed information be studied before using the charts.

COMMON I-F SECTION

Rotate the channel selector to channel 13.

Connect the oscilloscope to the video test terminal, point "B" on Fig. 3, through the decoupling network shown in Fig. 5.

Connect a 9 volt bias battery to the AGC line, point "A" on Fig. 9.

Couple the marker generator output to the sweep generator output. In the steps that follow, use the marker to check the response curve at the frequencies indicated on Fig. 8.

Step	Alignment Signal	Remarks	Adjust –
1.	Remove the RF amplifier tube.		
2.	44 mc. sweep to 3rd IF grid	Connect detuning clips to 1st & 2nd IF plates	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 8A.
3.	47.25 mc. amplitude modulated to 1st IF grid	Use sufficient signal to produce sine wave response on oscilloscope.	L302 for min. response
4.	44 mc. sweep to 2nd IF grid	Connect detuning clip to 1st IF plate	Pri. of T301 for max. response and sec. of T301 for symmetrical curve shown in Fig. 8B.
5.	44 mc. sweep to 1st IF grid	Detune L103 before adjusting T300	Pri. of T300 for max. response and sec. of T300 for symmetrical curve
6.	44 mc. sweep to 1st IF grid		L103 for "suck-out" at 44 mc. (center of curve). See Fig. 8C.
7.	Replace the RF amplifier tube		
8.	213 mc. sweep to antenna terminals through network.	Fine tuning set to mid-range	L300 for symmetrical curve and L301 for min. 41.25 mc. marker amplitude. See Fig. 8D

Fig. 8 – Response Curves at Various Stages of Alignment

SOUND I-F SECTION AND 4.5 MC. TRAP

Connect the signal generator to the video test terminal (point "B" on Fig. 3) through a .001 mfd. capacitor.

Step	Signal Gen. Frequency	VTVM Connections	Remarks	Adjust –
1.	4.5 mc. unmodulated	RF probe to point "C" (see Fig. 9) and common lead to chassis.	Use strong signal from generator	L303 for minimum voltage
2.	4.5 Mc. FM 7.5 Kc. Dev.	Across volume control	Use strong signal from generator	L202 for maximum output
3.	Same as step 2	Same as step 2	Use weakest signal from generator.	L200, L201 and L202 for maximum output
4.	4.5 Mc. AM 30% Mod.	Same as step 2	Start with weak signal increase as adjustment is made.	Quieting control for dip to zero.

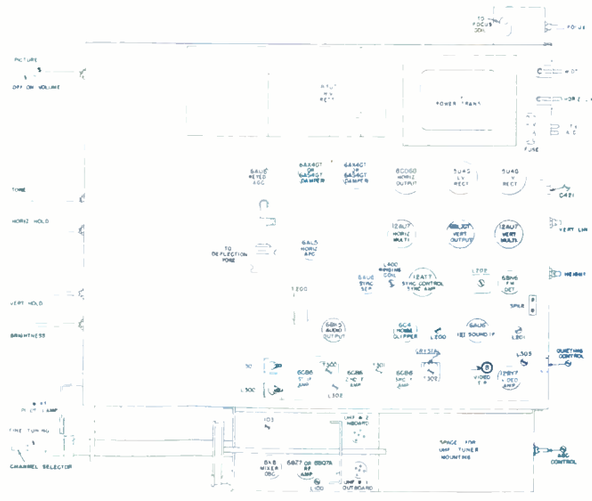

Fig. 3 – Top View of Chassis

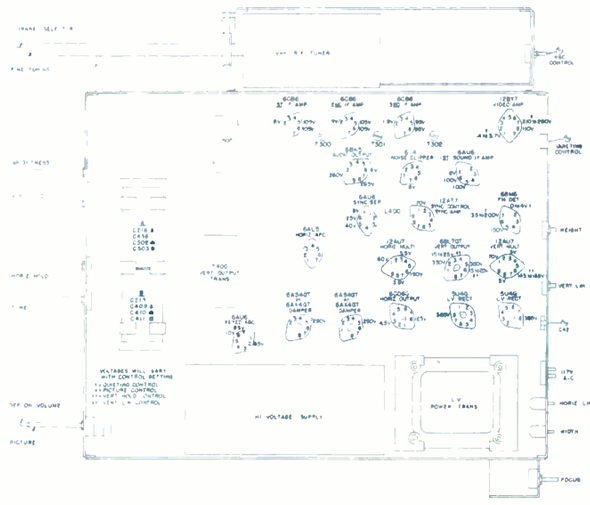

Fig. 4 – Bottom View of Chassis

capacitor replacements

FOR SETS OF THE MONTH

ADMIRAL CHASSIS 20A2, 20A2Z, 20D2

Symbol No.	Rating Mf @ WVDC	Admiral Part No.	Sprague Replacement
C205	4 @ 50	67A4-9	TVA-1303
C207	60+40 @ 350/60 @ 200/20 @ 150	67C15-23	TVL-4609
C409	80 @ 350/100 @ 50	67C15-22	TVL-3722
C410	20 @ 475	67A21-1	TVA-1804

MAGNAVOX MODELS CT401A, ETC.

Symbol No.	Rating Mf @ WVDC	Magnavox Part No.	Sprague Replacement
C106	4 @ 50	270027-10	TVA-1303
C110	20 @ 350	270027-20	TVA-1608
C215	2 @ 50	270027-22	TVA-1301
C413	10 @ 350 SP.	270027-23	R-1468
C501	70+40+10 @ 350/50 @ 50	270021-52	TVL-4659 / TVA-1308
C502	20+10+5 @ 350/60 @ 200	270021-51	TVL-4620 / TVA-1613
PC301	Integrator Plate	250186-1	101C1

GENERAL ELECTRIC "E E" Chassis

Symbol No.	Rating Mf @ WVDC	G. E. Part No.	Sprague Replacement
C210	1 @ 50	RCE-090	TVA-1300
C302	1 @ 50	RCE-090	TVA-1300
C320	1 @ 50	RCE-090	TVA-1300
C401	90+40 @ 350	RCE-154	TVL-2637
C402	30+20 @ 350/100 @ 75	RCE-155	TVL-3629
C403	40+20+5 @ 350/10 @ 25	RCE-156	TVL-4621

Note: C210 may also be 10Mf50V (G.E. #RCE-169). Use Sprague TVA-1304 to replace.

RAYTHEON CHASSIS 21T11

Symbol No.	Rating Mf @ WVDC	Raytheon Part No.	Sprague Replacement
C402	100+10 @ 300/60 @ 50	8C-22523	TVL-3574
C414	20 @ 300/10 @ 75/10 @ 15	8C-22524	R-1487
C428	100 @ 150	8C-22285	TVA-1420
C429	100 @ 150	8C-22286	TVL-1423
C503	50 @ 450	8C-22544	TVA-1713
C442	Integrator Plate	17A-22376	101C1

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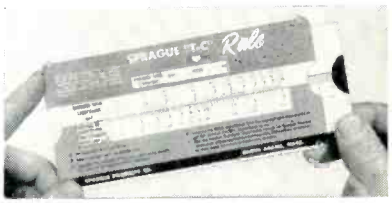
WESTINGHOUSE CHASSIS V-2250-1

Symbol No.	Rating Mf @ WVDC	Westinghouse Part No.	Sprague Replacement
C213B, C409B, C410B, C411B	30 @ 500/10 @ 450/150+30 @ 50	V-11535-1	R-1488
C216A, C436A, C502A, C503A	40+40 @ 450/30+30 @ 350	V-9891	TVL-4720
C320	10 @ 450	V-10293-1	TVA-1705
C426	4 @ 50	V-4637	TVA-1303
C446	30 @ 450	V-6570	TVA-1711
Z400	Integrator Plate	V-11192-1	105C1

NEW!

SPRAGUE "T-C" RULE



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Complete charts for color codes on all types of ceramic capacitors are on the back face of this rule.

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1954 Dodge DeLuxe ½-Ton Panel Truck—complete with "Truck-o-matic transmission," radio, heater and accessories . . . *plus a full set of RCA Test Equipment*, aluminum ladder, and winner's business name and address on truck panel.

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* * *

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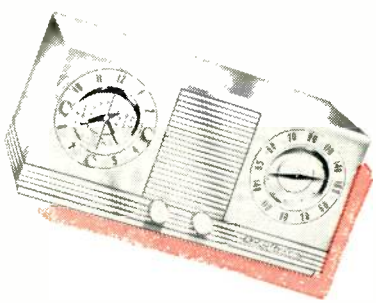
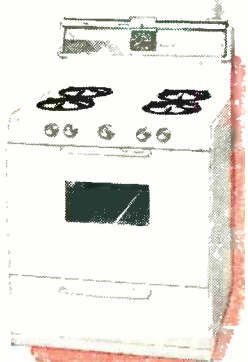
*Your RCA Distributor Salesman will be glad to help you . . . because if you win, he wins a duplicate prize!





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