JANUARY 1953

Radio-TV SERVICE DEALER

The Professional Radio-TVman's Magazine

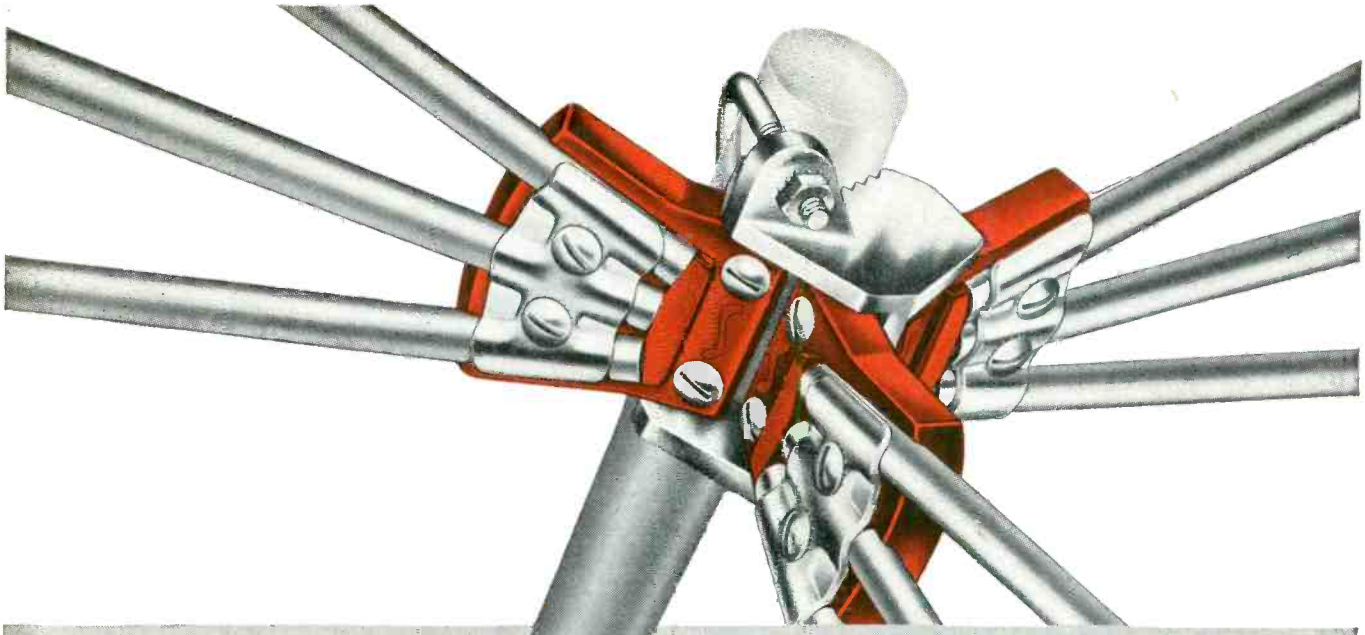
IN THIS ISSUE:

AM-FM-TV-SOUND

"In Arizona, my ranch is well beyond the fringe area—TV reception seemed out of reach, but I found that with a Regency Booster I got an excellent picture."

Edwin I. Guthman
President
Edwin I. Guthman & Co., Inc.
Chicago, Illinois and Attica, Indiana

burton browne advertising



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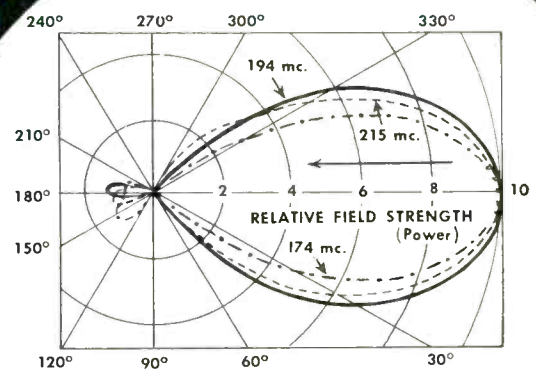
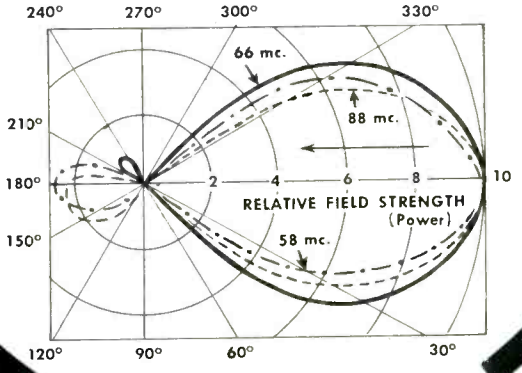
teamed together for Better TV Picture Quality



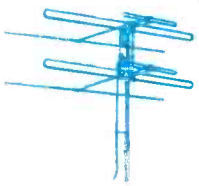
consider the evidence...

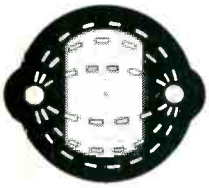


The combination of the famous Amphenol Inline Antenna with the extremely low-loss Amphenol Tubular Twin-Lead permits any TV set to present the best picture it possibly can.

In addition to a strong forward reception lobe, the Inline has uniform gain over the entire range of VHF channels—less variation than the 3 decibel change which causes "fuzziness." The Inline is also available in stacked array for those fringe or trouble areas which require additional signal strength.

The Amphenol Tubular Twin-Lead provides very low-loss and constant impedance. The tubular construction minimizes the effect of moisture and dirt deposits on the concentrated field of energy and ends weather interference. Because of these characteristics, Amphenol Tubular Twin-Lead has been recommended by leading TV manufacturers and authorities for any installation where UHF is, or will be available.





This illustration clearly shows that the concentrated field of energy between the two conductors, which are 7 strands of #28 copper weld wire, is contained by the tubular construction. This important field of energy is unaffected by any exterior conditions.

The test patterns on *both* high and low bands reveal the Amphenol Inline Antenna's superior uni-directional reception lobe. This single forward lobe intercepts the TV signal at its maximum available strength. It also rejects unwanted reflected signals or side interference that cause "ghosts" and unsteady pictures.

No other broadbanded antenna can present as favorable a reception pattern on *all* the VHF channels as does the Amphenol Inline Antenna.

Your free copy of this book is available from your Authorized Amphenol Distributor. It contains complete factual and test data on the factors which determine Better TV Picture Quality.

AMPHENOL

EDITORIAL

by S. B. COWAN

Video Speed Service Systems

When we introduced our exclusive new department in October we predicted it would be the most popular service-short-cut TVmen could find. Our appraisal was too conservative. From the thousands of laudatory letters that have come in to date we are convinced that VSSS is the finest servicing tool *ever* made available to any man engaged in TV service work.

To the more than 3,000 men who subscribed to "Service Dealer" in November, saying "Start my subscription with October" we offer our apologies. We simply ran out of October copies when the reserve 1,500 over-run was sold. To meet the unprecedented demand for VSSS we reprinted extra copies and these will be made available to all new subscribers while they last, and after that the VSSS series will be available in book form for about $2.00 per copy of 100 pages. (That's more than the subscription price to "Service-Dealer" so you can see why it pays to subscribe to the magazine itself when one department alone sells in reprint form for just as much as the entire issue.)

Our Blast On Price-Fixing

The mail bag this month was also loaded with pleas for help from subscribers who liked our November exposé of O.P.S. It seems that O.P.S. offices around the country decide arbitrarily what price ceilings should be imposed for their particular communities, and often they penalize the Service Dealers in a community. This is clearly brought to light by "The Northwest Electronic World," which is published by E. J. Wirtz, Jr. O.P.S. established prices in Spokane (where there is only VHF TV reception) and then in effect imposed the same price ceilings on Service Dealers situated in Portland. The latter city has UHF TV, and the problems there are as different as can possibly be, so the price limits should have been adjusted to compensate for the extra problems UHF entailed. In our next issue we will try to have an article covering the pricing situation more fully . . . and let it be recorded right now that it is our opinion that no TV service shop can afford to operate if it charges less than $6 per hour for labor.

Gyps Go To Jail

New York newspapers are again reporting how certain TV service shop operators were recently arrested and convicted of deliberately trying to gyp set owners. It seems that after the D.A. gets a few complaints about some shop he "tests 'em" by using a "check set" that is perfect except for a purposely created fault, such as a weak tube. We're 100% for that. If any TV shop owner is dishonest on purpose such a person should get a long jail sentence.

Sanford R. Cowan
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LEONARD LIEBERMAN
Contributing Editors

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

Vol. 14, No. 1 **JANUARY, 1953**

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TED E. SCHELL, 2700 West 3rd St., Los Angeles 5, Calif., Dunkirk 2-4889
RADIO-TELEVISION SERVICE DEALER is published Monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $2 per year in the United States, U.S. Poss. & Canada: elsewhere $3. Single Copies 25c. Reentered as second class matter Sept. 25, 1950 at the Post Office at New York, N. Y. under the Act of Mar. 3, 1879.

Trade Flashes

Program to Upgrade TV Servicemen by RTMA

A program designed to improve the technical proficiency and business technic of radio-TV service technicians is being launched by the Radio-Television Manufacturers Association with the institution of a "pilot" course in the New York Trade School.

The vocational training program, developed by the RTMA Service Committee, under Chairman R. J. Yeranko, of The Magnavox Co., has as its immediate objective the upgrading of television service technicians through existing vocational and trade schools. This is to be accomplished through the development and publication of manuals and teaching aids for schools and instructors which would reflect the recommendations of the radio-TV industry and be consistent with the rapidly changing designs and products of the industry.

Under the specific plan recommended by a subcommittee headed by W. L. Parkinson, of the General Electric Co., a model training program, under subsidy of the industry, will be developed with the guidance of an Industry Advisory Committee comprising the representatives of all segments of the radio-TV industry.

GE Ad Supports TV Serviceman

General Electric's Tube Department today announced that it will continue its consumer advertising program in support of television service dealers by placing a series of advertisements in Look Magazine during 1953.

G. A. Bradford, manager of advertising and sales promotion for the G-E Tube Department, said that the series in Look will continue a program inaugurated in September with full-page advertisements in Life and Collier's.

"Audio-Fair—Los Angeles"

Custom High-Fidelity Television, Home-Music Systems and associated, equipment with stereophonic (binaural) demonstrations, will occupy the high spots of an event which will be open to the public free of admission charge during the three (3) day Audio Fair—Los Angeles at the Alexandria Hotel, February 5th, 6th, and 7th, 1953. Approximately 100 exhibitors will demonstrate the latest products now being manufactured to meet the consumer demand for higher quality radio-phonograph reproduction and custom-built home entertainment centers.

High Fidelity music lovers and all music enthusiasts will hear recorded and broadcast programs reproduced covering not only the entire audible range, but also the new "Three Dimensional" Sound, similar to that used with the Cinerama motion picture recently shown in New York.

RCA Engineer Transmits First VHF Signals With Transistor Transmitter

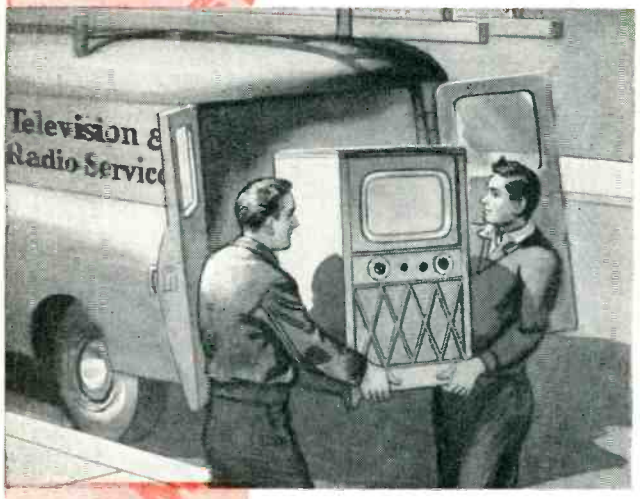
What is believed to be the first use of a transistor in VHF radio transmission was reported recently by the Tube Department of the RCA Victor Division, Radio Corporation of America. A transistor is a tiny amplifying device, built around a speck of germanium crystal, which performs some of the functions of an electron tube.

Although the historic radio communication was conducted on an experimental basis with home-made equipment, it was performed as a regular amateur transmission and enabled the transistor station to contact three licensed "ham" radio operators in the New Jersey area, the RCA Tube Dept. reported. One of the stations contacted was more than 25 miles away.

"Guess-Estimate" on TV Production Raised

Members of the Sales Managers Committee, under Chairman J. F. Walsh, meeting during the RTMA Industry Conference in Chicago, conducted an informal poll on the

Depend on Mallory
for
Approved Precision Quality



This Service Job Will Stay "Sold"!

For good reason, too. Mallory FP capacitors were used. They are engineered to duplicate the electrical characteristics of the original part in any TV or radio set that comes into your shop. They will give performance that's equal to . . . and often better than . . . the original equipment. You can count on Mallory FP's for precision quality . . . no call-backs.

Mallory FP's are the only fabricated plate capacitors available to the replacement market. They'll give you long lasting performance at high temperatures and greater ripple currents . . . even at 185° F. (85° C.).

When you use Mallory FP capacitors for all your service work, you can be sure that every job is right the first time. It just doesn't pay to take chances on capacitor performance. Always specify *brand* as well as rating when you order . . . ask for Mallory and watch your call-backs fall away to nothing. It costs no more to be sure with Mallory.

For plastic tubular replacements, ask your distributor for Mallory Plascaps®. They will put an end to premature shorts . . . leakage . . . off center cartridges . . . and unsoldered leads.

P R MALLORY & CO Inc.

MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
• RECTIFIERS • VIBRAPACK* POWER SUPPLIES • FILTERS

*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

expectations of television set production by the industry in 1953.

The average of these "guess-estimates" was 6.4 million compared with an earlier estimate of 5.7 million obtained in a similar poll last September. Individual guesses ranged from 5.7 million to 8 million sets at the Chicago meeting.

"Aerovox Research Worker" Celebrates Anniversary

Aimed at providing practical radio-electronic "know-how" for practical radio-electronic workers, the "Aerovox Research Worker" celebrates its first quarter-century of continuous publication. Edited by the Engineering Department of Aerovox Corporation, New Bedford, Mass., this unique monthly publication has grown from a few thousand copies in 1927 to a circulation of well over 25,000 copies distributed in the U. S. and throughout the world, even behind the Iron Curtain, on an absolutely free basis.

October TV Set Production Increased October TV Pix Tube Sales

Sales of both receiving tubes and cathode ray tubes increased substantially in October over the preceding month, according to estimates compiled by the Radio-Television Manufacturers Association.

Receiving tube sales totaled 41, 880,318 units valued at $28,379,-281.57 compared with 34,196,286 tubes valued at $24,432,747.60 in September. A breakdown of the sales showed 29,132,068 tubes sold for new equipment, 8,791,404 for renewal, 851,841 for export and 3,105,005 tubes were sold to government agencies. Receiving tubes sold during the first 10 months of 1952 totaled 287,569,947 units compared with 314,932,857 in the corresponding 1951 period.

October sales of cathode ray tubes to equipment manufacturers totaled 862,431 units valued at $19,761,300.59 compared with 640,793 picture tubes valued at $14,326,017.64 sold in September. The September report was the first time that picture tube sales were issued on an industry-estimated basis. Seventy-one per cent of the cathode ray tubes sold to set manufacturers in October were 18 inches and larger in size.

Total cathode ray tube sales for October were estimated at 1,045,286 units valued at $23,240,240.06 compared with 788,107 tubes valued at $17,232,438.98 sold in September.

National Union Announces Change In Address Of Home Office

In order to make available to the Research Division the entire building at 350 Scotland Road, Orange, N. J.,

and thus enable N.U.s Research Division to carry on an expanded research activity for the government in the interests of National Defense, N. U. has moved the administrative and home offices to Hatboro, Pa. on Monday, November 24th.

New address: National Union Radio Corporation, Jacksonville Road, Hatboro, Pennsylvania.

New Telephone: Hatboro 1791.

Symposium Sponsored by AIEE

The Executive Committee has announced that the 1953 Electronic Components Symposium will be held on April 29, 30, and May 1, 1953 at the Shakespeare Club in Pasadena, California.

This Symposium is one in a series of national yearly meetings on electronic component parts, and is expected to attract over 1,000 scientists, engineers, technical workers, and executives interested in future developments of the electronics industry.

The Symposium will be sponsored by the American Institute of Electrical Engineers. Institute of Radio Engineers, Radio-Television Manufacturers' Association and the West Coast Electronic Manufacturers' Association. Sessions will follow the general pattern of previous national meetings on electronic component parts held in Washington, D. C., and Los Angeles.

RCA Tube Department Reorganizes

The Tube Department of RCA Victor recently announced the creation of separate kinescope and receiving tube sales functions within its equipment sales organization in a move to streamline its service to manufacturers of a wide range of electronic communications, home entertainment, industrial, and military equipment.

R. H. Siemens has been appointed manager of kinescope equipment sales, and J. T. Wilson has been appointed manager of receiving tube equipment sales, according to M. J. Carroll, equipment sales manager. Heretofore sales of both kinescopes and receiving tubes had been administered by Mr. Siemens.

Allied Radio Starts Work on New Building

A. D. Davis, President of the Allied Radio Corporation, Chicago, leading national distributor of electronics parts and equipment, announced that rapid progress is being made on a new $2,000,000 building, expected to be ready for occupancy in the summer of 1953.

Allied's new site, with a total floor area of 150,000 square feet, will be in almost the exact geographical center of the city on Western Avenue and Washington Blvd.

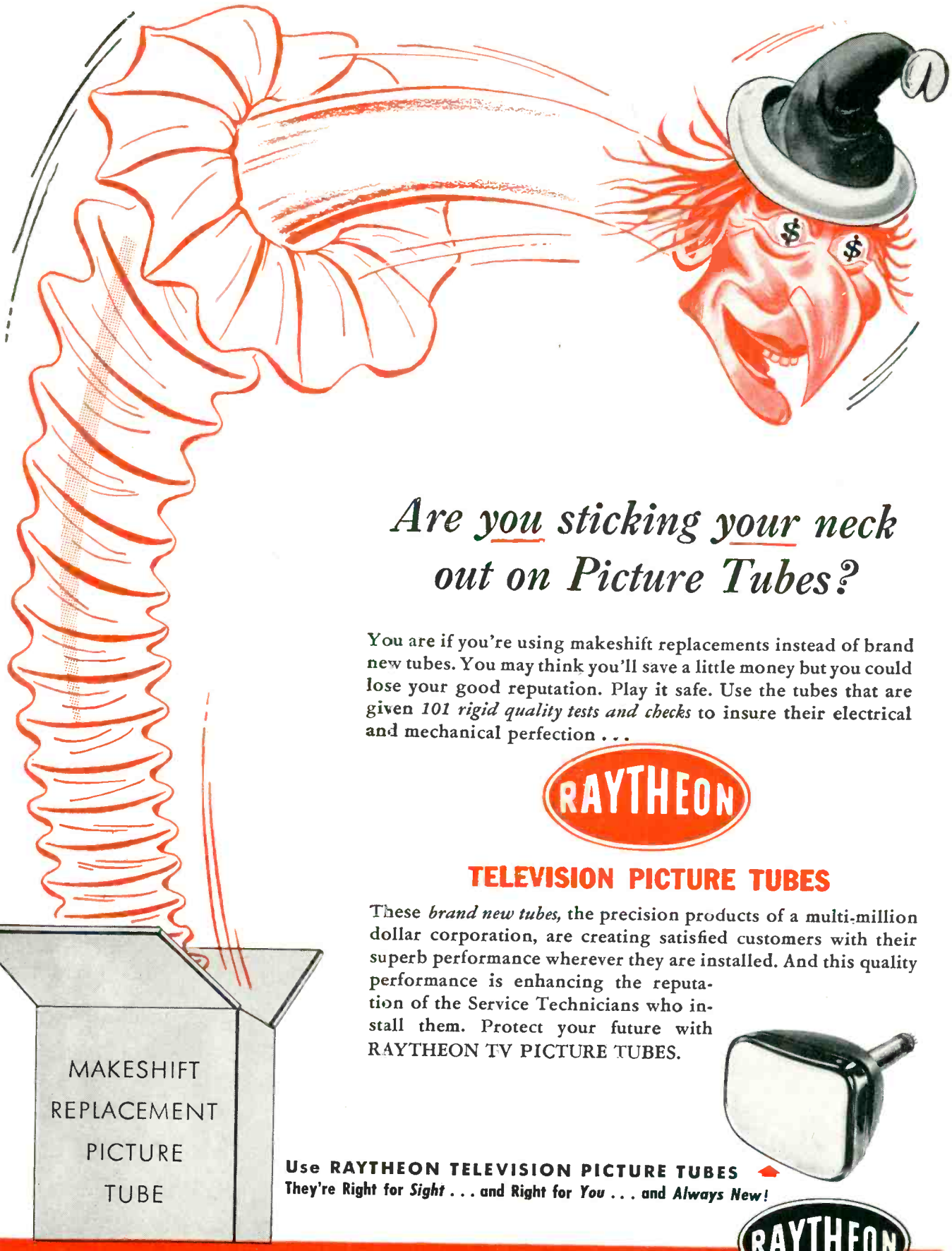
New York Reps Hosts At Annual Stag

Playing host to the largest group of Electronic Industry people in the history of their Annual Stags and Dinners, the New York Chapter of The Representatives held sway at the Woodstock Hotel in Times Square, New York.

Bill Gold, Chairman, and Wally Shulan, Secretary, of the Entertainment Committee ably assisted by Jules Bressler, Bob Breuer, Marty Camber, Cliff Landis, Paul Nichols and Sam Shaw, did a great job in seeing to it that the affair was a huge success and that everyone enjoyed himself.

October TV Set Production Increased

Production of television receivers in October was 75 per cent above the corresponding month in 1951, the Radio-Television Manufacturers Association reported today. The radio output, however, declined from the level of last year, according to RTMA's estimates.



Are you sticking your neck out on Picture Tubes?

You are if you're using makeshift replacements instead of brand new tubes. You may think you'll save a little money but you could lose your good reputation. Play it safe. Use the tubes that are given *101 rigid quality tests and checks* to insure their electrical and mechanical perfection . . .

RAYTHEON

TELEVISION PICTURE TUBES

These *brand new tubes,* the precision products of a multi-million dollar corporation, are creating satisfied customers with their superb performance wherever they are installed. And this quality performance is enhancing the reputation of the Service Technicians who install them. Protect your future with RAYTHEON TV PICTURE TUBES.

Use RAYTHEON TELEVISION PICTURE TUBES
They're Right for *Sight* . . . and Right for *You* . . . and *Always New!*

RAYTHEON

RAYTHEON MANUFACTURING COMPANY
Receiving Tube Division
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

Excellence in Electronics

RAYTHEON MAKES ALL THESE:
RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

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The more in a group the bigger the savings. 6 men in a group save $1.00 each; 4 men groups save 80c per man. Present "RTSD" subscribers may participate in or form a group with co-workers, or even competitors. Still active subscriptions are automatically extended 2 years. Start a Group today! The timely and exclusive technical data appearing in future issues of "RTSD" will make this the best investment you ever made. The special Group Rate offer may be withdrawn at any time—so hurry.

(The coupon below can be used for from 1 to 6 subscription orders. Use it today!)

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67 West 44th Street, New York 36, N. Y.

Please enter 2 years subscription orders for the names given below. Our remittance is enclosed.

NOTE: If you do not wish to tear this order blank out, just print or type the information on a single sheet of paper, following the style given. Each subscriber's occupation must be clearly described.

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☐ Two 2-year subscriptions each	2.50
☐ Three 2-year subscriptions, "	2.30
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Describe Title or Position and Type of Business ....
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Extra profits for servicemen!

NOW you can add UHF to the thousands of VHF Super Fans presently installed in your area, with Channel Master's exclusive new Ultra-Dapter, Model No. 414. In 5 minutes you can convert any Super Fan into an all-channel VHF-UHF antenna. See your distributor for details.

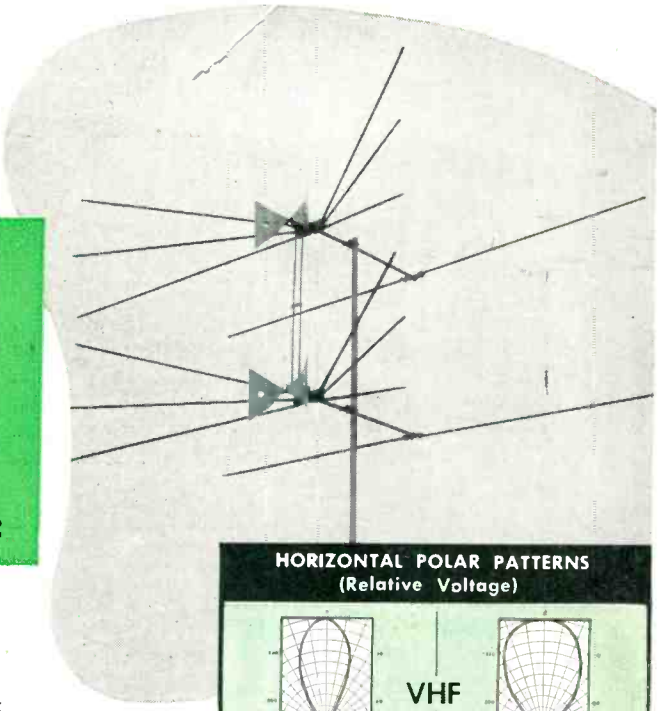
VHF *and* UHF

Now! Get all 82 channels with the *new*

CHANNEL MASTER ULTRA FAN

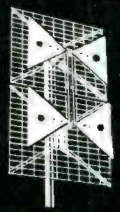
Single Bay model no. 413

Stacked model no. 4132



Write for literature on Channel Master's new complete line of UHF antennas including such models as these:

Ultra Bow
Model No. 401



Ultra Bow with screen reflector
Model No. 403

Ultra Vee
Model No. 404

FIRST IN PREASSEMBLED ANTENNAS

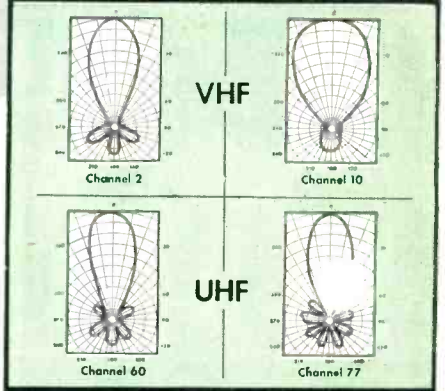
Today's most sensitive ALL-VU* antennas!

*All VHF, All UHF

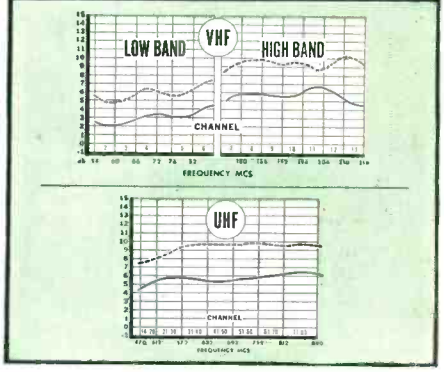
Featuring:

- **2 great antennas in 1 —** A genuine, high gain Super Fan on VHF, and an all-channel Triangular Dipole and reflector for peak UHF reception.
- **Electronic inter-action filter —** Automatically isolates VHF and UHF bands, eliminates inter-action. Ultra Fan operates with only a *single* transmission line to TV set.
- **"Free space" terminals —** Channel Master's *exclusive* UHF "free space" terminals prevent accumulation of dirt and moisture which gradually reduce picture quality in ordinary UHF installations.
- **Famous Channel Master engineering —** The Ultra Fan is an *integrated* VHF-UHF antenna that give uniformly high gain over *all* TV channels, from 2 through 83.

HORIZONTAL POLAR PATTERNS (Relative Voltage)



GAIN CURVES



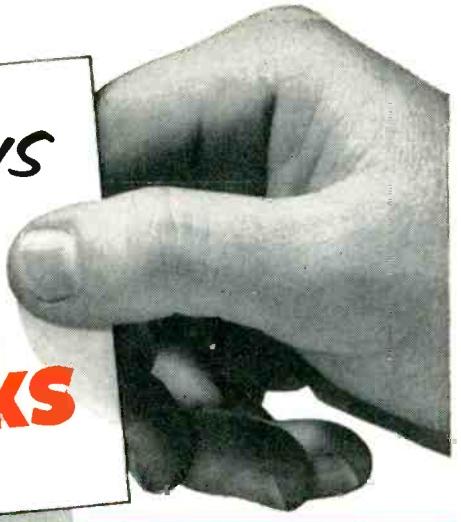
——— Single Bay
– – – – Stacked

MEMBER ANTENNA MANUFACTURERS ASSOCIATION

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

Let's forget the *"glittering generalities"* about quality.

Let's Check 4 specific ways CBS-HYTRON cuts your call-backs



1. BY MAKING CBS-HYTRON TV ORIGINALS BEST.

Longest experience with production . . . with applications . . . with improvements . . . all count. *CBS-Hytron-built* 1AX2, 1X2A, 6BQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, 16RP4, etc. *are* more trouble-free. Prove it to yourself.

2. BY ENDLESSLY IMPROVING STANDARD TV TYPES.

Close co-operation with leading set makers alerts CBS-Hytron daily to needed betterments. Take one of endless examples: the CBS-Hytron 6CB6. You will find its clear, non-carbonized bulb eliminates undesirable loading effects at vhf.

3. BY APPLYING "RELIABLE" TUBE TECHNIQUES.

CBS-Hytron 6AL5 is typical. Experience with the military 6AL5 family (JAN 6AL5, 6097/CT, 5726) is passed on to you. You profit by a commercial CBS-Hytron 6AL5 made truly reliable.

4. BY MATCHING EACH TUBE TO THE SET.

Daily, CBS-Hytron analyzes leading TV chassis. Dynamic socket-by-socket checks, plus continuous field experience, pay off. Give you CBS-Hytron matched-to-the-set performance . . . with the accent on trustworthy replacements.

Take advantage of CBS-Hytron extras like these. Keep your customers happy. Guarantee yourself against profit-slicing call-backs. Demand dependable CBS-Hytron tubes.

$1.45 net

NOW...TEST THE *EASY* TOPSIDE WAY!

Wish you could test a chassis topside? Without first pulling and wrestling with the heavy chassis? Without disturbing wiring and parts by digging underneath for buried sockets? How much faster, easier, safer you could work! New CBS-Hytron Test Adapter does the trick. Just replace a 7-pin miniature tube with the Test Adapter. Plug tube into Test Adapter. Presto, all socket connections are topside . . . within instant reach of your test prod or clip. Just one job pays for this new CBS-Hytron Test Adapter. Get yours today!

HERE'S HOW! With the CBS-Hytron Test Adapter, you quickly measure voltage, resistance, gain. You inject and trace signals . . . monitor intermittents. You check oscillating stages. Or the effect of adding a bypass condenser or shunt resistor.

With several CBS-Hytron Test Adapters you make stage-by-stage circuit checks . . . fast. You do all this dynamic testing the e-a-s-y way . . . topside. With no ill effects at a-f frequencies. And only slight capacitance and inductance effects at much higher frequencies.

You will like: The positive contact of the low-resistance, silver-plated base pins and test points. The plainly marked pin connections. The easy insertion and tight grip. CBS-Hytron Test Adapter is another designed-by-and-for-you "must" you must have. See your CBS-Hytron jobber today.

CBS HYTRON RADIO TUBES

MANUFACTURERS OF RECEIVING TUBES SINCE 1921
HYTRON
RADIO AND ELECTRONICS CO.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.
DANVERS, MASSACHUSETTS

TV SYMPOSIUM SERIES—No. 2

The second of a series of articles by well known writers which appears monthly as a regular feature. The following discussion of the fundamentals of U-H-F circuitry and design application is of immediate interest and should prove valuable to the service technician wishing to keep abreast of the art.

UHF CONVERTERS

by ALLAN LYTEL

(Author of UHF Principles)

PART 1

UHF Television Converters fundamentally are used to make a double superheterodyne out of the existing television receiver. The UHF signal is picked up, heterodyned against a local oscillator and a new lower frequency signal is produced. This lower frequency signal is usually on a frequency of one of the existing VHF stations. The television receiver is then tuned to this station and the signal passes through the entire standard television receiver.

New Tuning Elements

Circuit values, components and behaviors are all different for UHF and aside from tube differences, the biggest new element is in the circuit tuning device. Because of the distributed capacity, ordinary coils become quite useless at the UHF frequencies and other means are necessarily employed for tuning. *Figure 1* represents a fundamental method of tuning a coil used with some converter systems. A shield is inserted between the turns of the coil which changes the distribution of the magnetic flux within the inductor. When the shield is inserted as shown, the lines of force connecting one turn with the next are reduced, the inductance is reduced, and the inductive reactance is reduced. When the shield is removed, the magnetic lines of flux are the greatest, the inductance and the inductive reactance are higher.

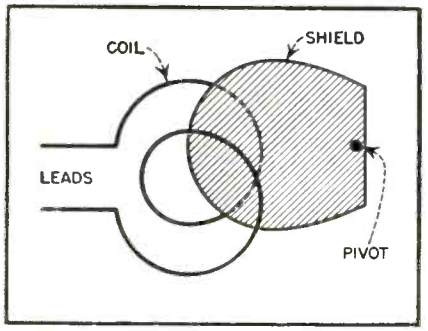


Fig. 1—Unique tuning system used at the ultra high frequencies.

An extension of this type of circuit is the butterfly tuner shown in *Figure 2*. Both the inductance and capacitance are integral parts of the mechanical arrangement as shown. The inductance marked L connects the two capacitive sections. The inductance is actually a half turn coil, while capacity is obtained between the large plate of the outer cylinder and the inner rotor. Lowest frequency is when the rotor is directly opposite the capacitive plates as shown; this condition provides maximum inductance and maximum capacity for the lowest possible frequency. High frequency is obtained by rotating the

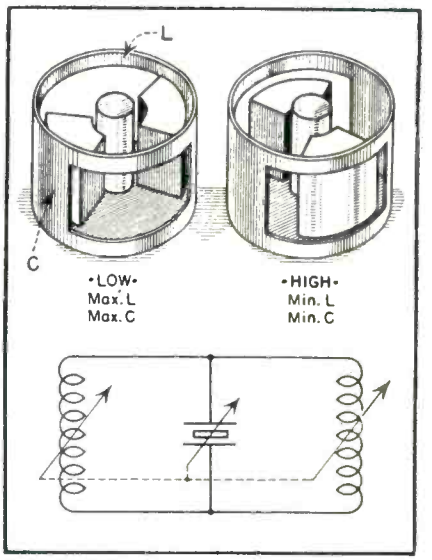


Fig. 2—Butterfly Tuner and its equivalent circuit.

rotor by 90 degrees so that the rotor acts as a shield between the inductive sections and simultaneously reduces the total capacity.

Transmission Line Tuner

By far the most popular tuning section in converters is the short circuited transmission line. *Figure 3.* Part A, shows quarter wave length line short circuited at the load end. Across the load there will be maximum current and minimum voltage: 90 degrees away from the load or at the sending end there will be maximum voltage and minimum current or a high impedance. Since the input impedance is infinitely high, at only the frequency for which the line is a quarter wave length, the circuit will act as a parallel resonant circuit. It can be shown mathematically that a 1/8th of a wave length or 45 degree long line short circuited is an inductive reactance equal to the characteristic impedance of the line. In the same manner, it can be shown that an 1/8th of a wave length line open circuited will have an input impedance which is capacitive reactance and again is numerically equal to the characteristic impedance of the line. This is shown in part B of the figure.

If the 1/8th wave length open-ended line and the 1/8th wave length short circuited line are tied together by jumpers, they will of course produce a quarter wave short circuited transmission line which is parallel resonant. A capacitive reactance equal to the characteristic impedance can be substituted for the 1/8 wave open section, hence as in part C of *Figure 3,* a 1/8th wave length section of shorted line, together with the appropriate capacity, provide parallel resonance. This capacity is made variable to allow for frequency adjustments. Gross changes in frequency are made by the movable shorting bar shown in part B of the figure by means of a mechanical arrangement. As the tuning dial is rotated, the shorting bar slider moves and changes the resonant frequency of the line. The trimmer capacitor is usually used to allow for proper tracking.

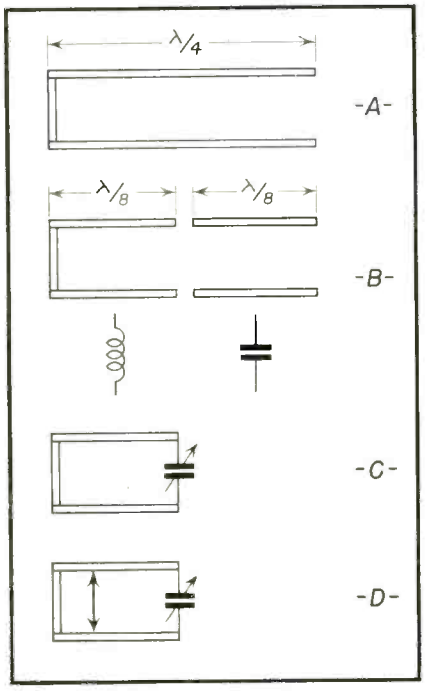


Fig. 3—Shorted Transmission Line Circuits.

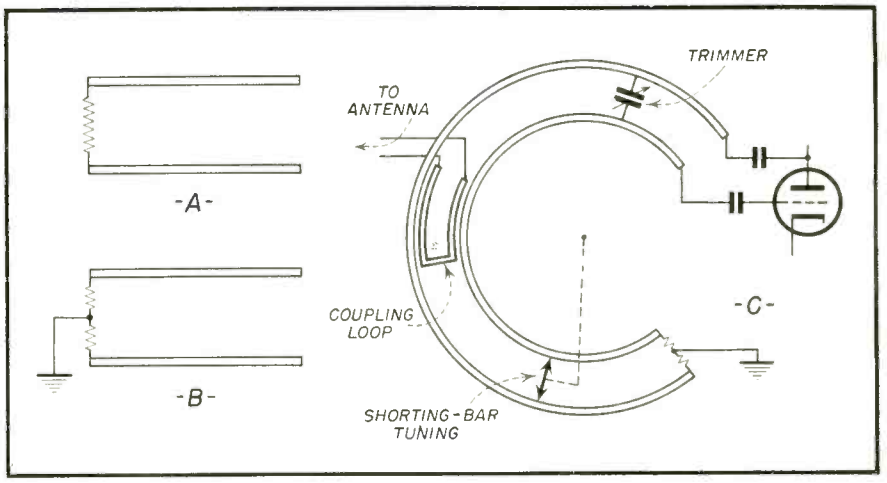


Fig. 4—Transmission Line Terminations.

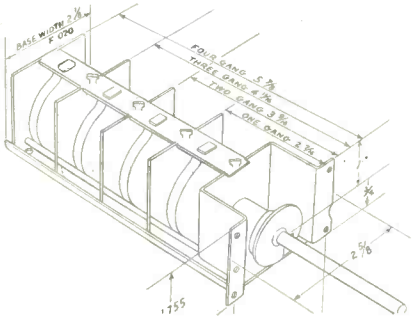


Fig. 5—Mallory U-H-F Tuner.

The section of line between a movable shorting and a fixed shorting bar may sometimes act as its own high frequency resonant circuit and suck energy from the desired circuit. It is known that any transmission line as in part A of *Figure 4* terminated by a resistive load, will reflect no energy. Thus, in transmission line tuned circuits, in addition to the movable shorting bar, the fixed end of the line has two resistors for a load and the center tap is at ground potential. This prevents the unused portion of the line from acting in a resonant condition.

A final version of a transmission line tuned circuit used widely in UHF conversion systems, is shown in part *C* of *Figure 4.* The resistive terminations and movable shorting bar are shown. As the tuning dial rotates the movable shorting bar mechanically is connected with it and also moves. A coupling loop going to the antenna is shown. The sending end of this tuned circuit transmission line is connected to the grid and plate of a triode acting as an oscillator. This is a very close representation of a local oscillator circuit used in UHF conversion systems.

Mallory Converter

A complete converter is manufactured by the P. R. Mallory and Co. which also manufactures the VHF Inductuner. This tuner utilizes a transmission line movable sliding bar type of tuning arrangement. The tuning required is done in 270 degrees of rotation, the tuned input elements are shaped differently from each other and the oscillator tuning elements are also different to provide adequate tracking. As the tuner arm rotates, an insulated bakelite shaft moves the shorting bar so that it makes contact to both conductors at all times. The tuning curve shown in *Figure 6* illustrates the tracking expected between the pre-selector and the oscillator. This unit covers the entire UHF range with continuous tuning. A tuned input is used with a 300 ohm input, a crystal mixer and local oscil-

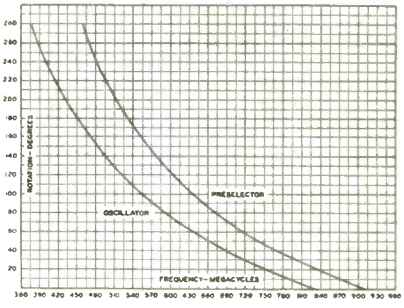


Fig. 6—Tuning curves for Mallory U-H-F Tuner.

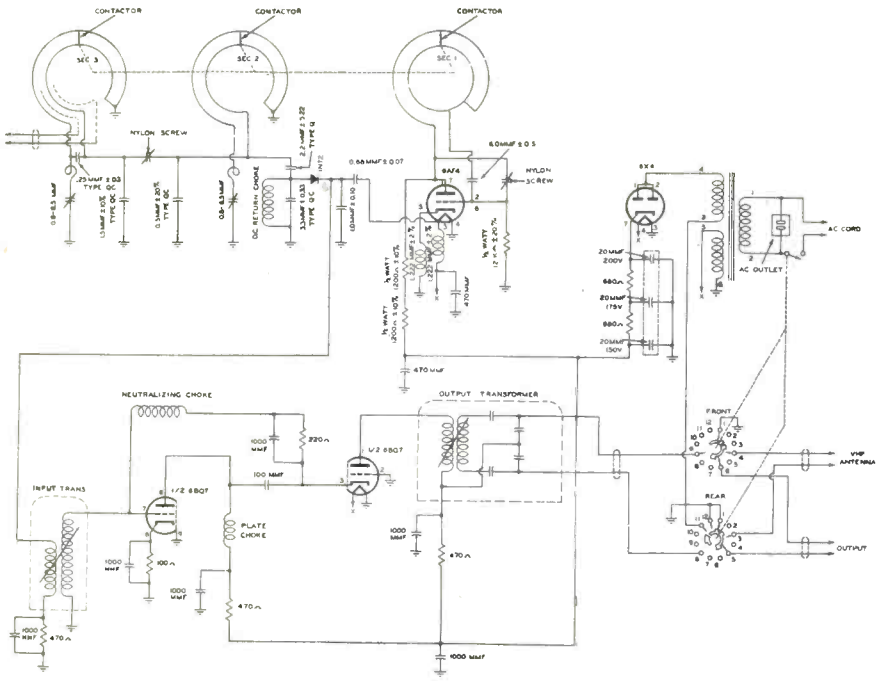


Fig. 7—Schematic of Mallory U-H-F Converter.

lator together provide the necessary IF signal.

As shown in *Figure 5* there are three tuning sections, one for the input, one for the mixer, and one for the oscillator. The i-f signal goes through two stages of amplification in a 6BQ7 shown in the schematic *Figure 7*. The i-f amplifier has a 12 megacycle output band width at a center frequency of 82 megacycles. Although this stage has a gain of 6, there is a conversion loss and an input loss so that the over-all gain of the unit is approximately unity. A self-contained power supply and a power outlet for the VHF television receiver on the back of the converter, allow this unit to be used with any existing television receiver.

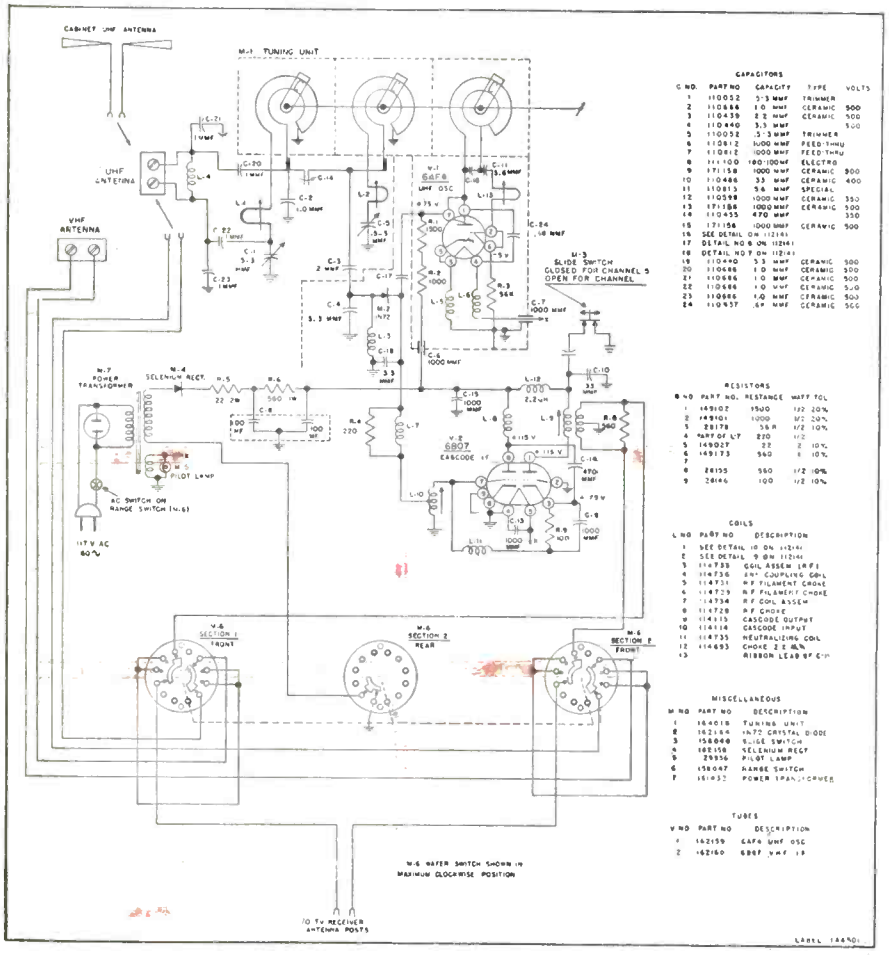


Fig. 8—Schematic of Stromberg-Carlson Converter.

Stromberg-Carlson Conventer

The Stromberg-Carlson converter covering the entire UHF range uses the Mallory 3-section tuner. A schematic diagram of the unit is shown in *Figure 8*. A crystal mixer and 6AF4 oscillator provides the frequency conversion. The 6AF4 is a miniature version of the 6F4 designed for UHF oscillator service. A 6BQ7 is used as a two stage IF amplifier: the block diagram is *Figure 9*.

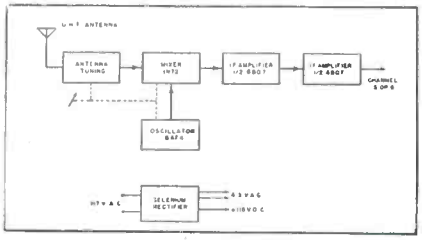


Fig. 9—Block diagram of Stromberg-Carlson U-H-F tuner. A selenium rectifier provides B plus power for the various stages in this unit. This unit may be used with any existing TV receiver.

Inductive padding is used with the tuning elements to allow for tracking. An amplifier tube is not used in the rf stage but the output from this tuned stage is applied to the tuned mixer stage. Oscillator high voltage is applied in shunt with the tuned circuit through *R-1* and *R-2* in series. Capacitor *C-7* is the feed through type used for the heater supply; self grid bias for the oscillator is obtained through resistor *R-3*. The normal bias is minus 5 volts. Mixer output at either the Channel 5 or Channel 6 frequency is fed in pin 7 of the i-f amplifier. Output from this stage is coupled to the cathode of the next section which acts as a grounded grid amplifier. Cathode return is through *L-11* and *L-10*. The switch *M-3* shifts the IF tuning 6 megacycles so that it may be either Channel 5 or 6. Since there is a band width of 12 megacycles, there is no loss of tracking with the switch in either position. Again, a self-contained power supply and power switching arrangement allow this unit to be used with any existing television receiver.

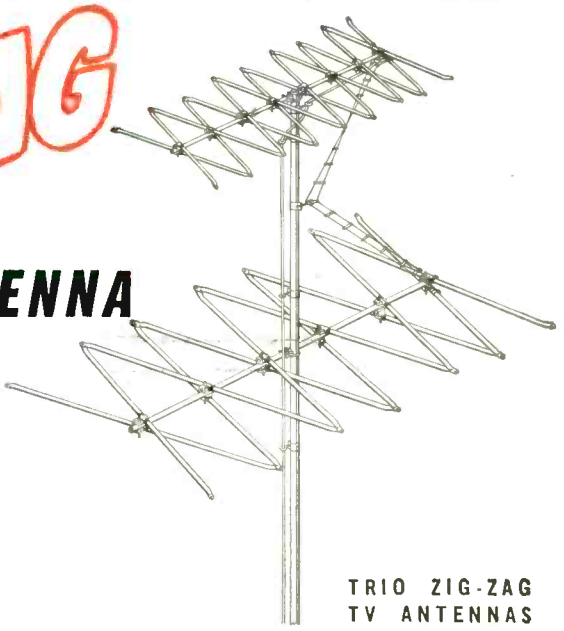
TERRIFIC ACCEPTANCE GREETS THE NEW

SMASH HIT!

TRIO ZIG-ZAG

(Patent Pending)

TV ANTENNA



TRIO ZIG-ZAG TV ANTENNAS

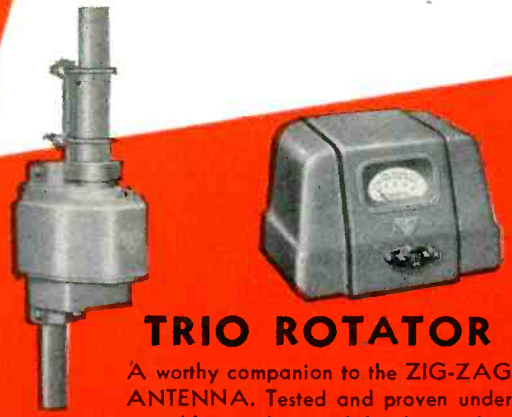
The sensational new TRIO ZIG-ZAG TV ANTENNA has already proven its superiority in the field. Thousands of installations have given a new high in TV reception, especially in ultra-fringe areas. Word of mouth has done the rest. TRIO'S plant capacity, taxed to the limit in an effort to supply the amazing demand for the ZIG-ZAG ANTENNA series, is being greatly expanded. Very soon now, your ZIG-ZAG ANTENNA will be supplied, and it's well worth waiting for.

ZIG-ZAG ANTENNAS have replaced every known type of installation and TRIO is proud to report that in EVERY instance the ZIG-ZAG ANTENNA has out-performed them all, even the tried and true TRIO dual-channel yagi.

TV listeners are finding that with a ZIG-ZAG ANTENNA they are no longer tied down to just one or two channels, but are getting excellent reception on channels never seen before. ZIG-ZAG ANTENNA is truly HOT on all VHF channels.

available in 8 different models, provide a new high in all-channel performance for any area, from metropolitan to ultra-fringe. Tremendous gain, sharp directivity, excellent match to 300 ohm line, sturdy vibration-proof construction and fast, easy installation tells the rest of the TRIO ZIG-ZAG ANTENNA story.

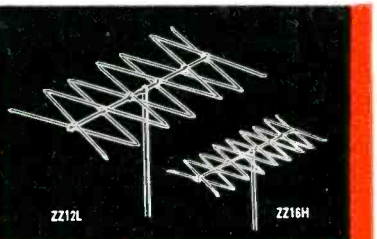
SEE THEM at your JOBBERS. WRITE for CATALOG.



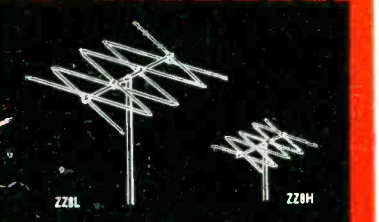
TRIO ROTATOR

A worthy companion to the ZIG-ZAG ANTENNA. Tested and proven under every conceivable condition of load, weather, strain and stress. Two motors, one for each rotation direction. Positive electrical stops prevent damage of over-rotation. Positive brake action, no drift even when supporting heavy arrays in 80 MPH winds. Precision built of finest materials and UNCONDITIONALLY GUARANTEED by TRIO for TWO YEARS. SMARTLY STYLED DIRECTION INDICATOR has easy to read dial face and easy to use finger touch control. A beautiful instrument you'll be proud to own.

These ZIG-ZAG ANTENNAS provide the ultimate in extreme fringe area reception. ZZ12L provides 12-14 db. gain on Channels 2 thru 6. ZZ16H has a gain of 14 db. on Channels 7 thru 13. These antennas have very narrow forward lobe, high front to back ratio, provide high rejection in areas with co-channel interference.

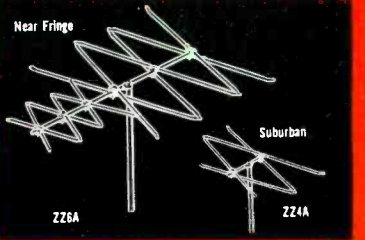


Where maximum gain is not necessary these normal fringe model ZIG-ZAG ANTENNAS are ideal. Model ZZ8L has a gain of 9 db. average on Channels 2 thru 6. The ZZ8H provides an 11 db. gain on Channels 7 thru 13. Forward lobe patterns comparable to good multi-element single channel yagi.



For near fringe area reception these ZIG-ZAG ANTENNA models provide 8-9 db. gains on all Channels 2 thru 13. ZZ6L covers Channels 2 thru 6 and Model ZZ6H covers Channels 7 thru 13. Both models have patterns similar to those of cut to channel yagis.

These ZIG-ZAG ANTENNAS provide ALL CHANNEL reception with only ONE antenna bay. Model ZZ6A is designed for near fringe area reception of all Channels 2 thru 13, with an average gain of 9 db. Model ZZ4A is for use in suburban areas, providing an average gain of 6 db. on all Channels 2 thru 13.



TRIO

TRIO MANUFACTURING COMPANY • GRIGGSVILLE, ILLINOIS

VERTICAL DEFLECTION SYSTEMS

by

LEONARD LIEBERMAN

A complete, comprehensive study of the vertical deflection system as currently used by leading manufacturers together with some practical hints about operation and servicing that can be applied to most TV sets.

The vertical sweep system is by and large standardized throughout the industry. Its circuitry is generally straightforward. It is, however, worth-while going into the operation of the vertical system to understand the causes of the troubles which occur in the system.

The FCC TV Standards call for the scene televised to be presented in 525 horizontal lines at the rate of 30 frames per second. In the interests of better optical and electrical operation, this is done at the rate of 262½ lines per field and 2 fields per frame. The lines operate interlaced. By this is meant that during the 1st field all the odd lines are scanned and during the second field the even lines are scanned. The vertical rate is 60 fields/sec. *(Fig. 1)*.

The function of the vertical system is to move the starting position of each horizontal line during each field 1/262.5 of the screen down from the preceding line. This is accomplished by varying the magnetic field created by the vertical deflection coil. The system must also be such that it can be kept in synchronism with the vertical sweep at the camera.

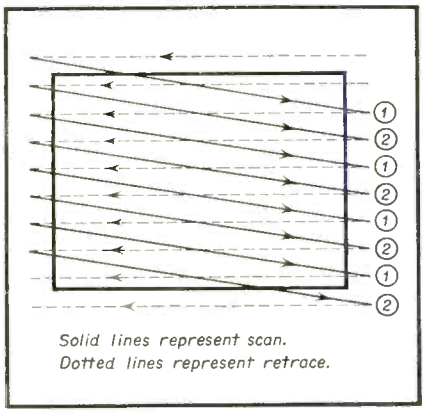


Fig. 1—Interlaced scanning of TV signal.

The component parts of the vertical system are:

1. Oscillator input
2. Oscillator
3. Oscillator output
4. Output amplifier
5. Deflection system.

Oscillator Input

The input to the vertical system generally consists of a cascaded low pass filter whose cut-off is approximately 7-8 kc. The cascading permits sharper discrimination of all frequencies above the cut-off and conversely increases the 60 cycle input. The function of this filter is to by-pass the 15.75 kcs horizontal pulses and to build the six equalizing pulses on the vertical blanking pulse into one 60 cycle waveform *(Fig. 2)*.

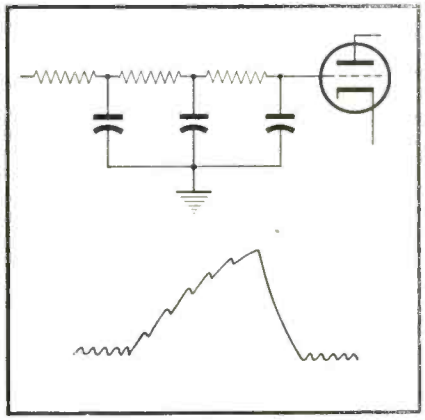


Fig. 2—Vertical oscillator input filter and equalizing pulses.

Oscillator

There are two general types of vertical oscillators. They are the blocking transformer oscillator and multivibrator. Let us first examine the blocking transformer oscillator. *Fig. 3* shows the generalized schematic of this type of oscillator. With the cathode grounded there is plate current flow through the transformer primary. The induced current in the secondary is, due to the transformer action, 180° out of phase. This current causes the coupling condenser to charge positively. This positive charge raises the grid voltage. The grid voltage in turn increases the plate current which causes the grid to go more positive.

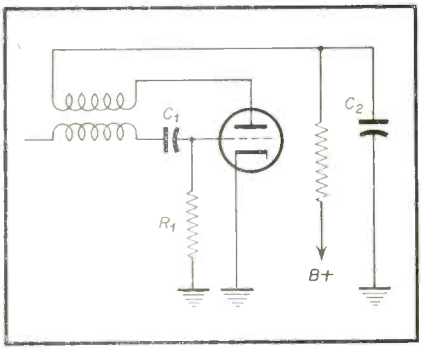


Fig. 3—Typical blocking type oscillator. Note use of feedback coil typical of conventional radio receiver oscillator.

The result is that within a very short time the plate reaches the current saturation point. As this point is being reached, the rate of current increases drops. With this drop in the rate of current change, the voltage induced in the secondary starts dropping. This, in its turn, reduces the grid voltage and the previous condition reverses. The grid is rapidly driven negative and then far beyond the tube cut-off point. The tube remains cut-off until *C1* charges through *R1* to the point where it starts conducting. In this manner, the free-running frequency of the system is a function of the *RC* time of *R1* and *C1*.

If this time is less than 60 cycles the pulse from the integrator will arrive just before the grid voltage gets to the threshold of conduction. It can, therefore, control the triggering of the oscillator. In this way the firing time of the oscillator is set by the incoming sync pulse and is in syncronism with the vertical system at the transmitter *(Fig. 4)*.

While the tube conducts *C2* discharges through the tube to the value of the plate voltage. When the tube is cut off *C2* charges to the supply voltage through *R2*. The length of time it takes to charge is a function of the values of *C2*, *R2* and the B+.

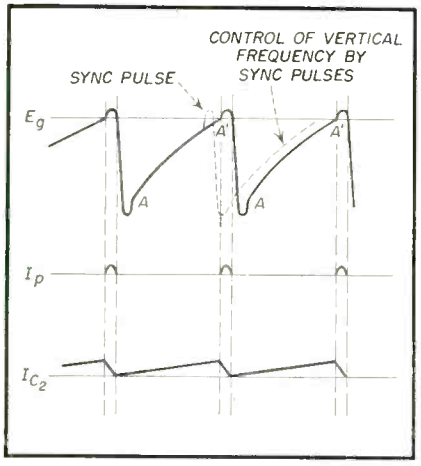


Fig. 4—Triggering of blocking oscillator by sync pulses.

Multivibrator

Many sets use a cathode coupled multivibrator instead of a blocking transformer type oscillator *(Fig. 5b)*. The reason this system is used is that it does not require the more costly components of the other type. This oscillator works as an R-C amplifier with the output of one tube being fedback to the other. In general, the multivibrator works as follows:

With no signal both tubes conduct. If a signal is applied to the grid of V1 *(Fig. 5a)*, the amplified output is applied in inverted phase to the grid of *V2*. The inverted output of *V2* is then fed back to *V1* through *C1*. This feedback is now in phase with the original signal. If this original signal is negative, *V1* is rapidly driven to cut-off. When this occurs, the plate voltage of *V1* rises to B+. This raises the grid of *V2*. *V2* then conducts fully.

C1 which is discharged at the negative potential of *V1* grid, charges through *R1*. The *R1C1* time determines when *V1* begins to conduct again. When this occurs, the signal on the grid is in the positive direction. The feedback system amplifies this signal to the point where the inverted signal fed *V2* drives this tube beyond cut-off.

The previous condition which applied to *V1*, now applies to *V2*. The RC time of *R2C2* determines when *V2* starts conducting. When *R1C1* equals *R2C2*, the wave shape is symmetrical, that is the width of *R1C1* pulse is the same as that of the *R2C2* pulse. The waveform illustrated in *Fig. 5C* is of an asymmetrical multivibrator.

The oscillator frequency is a function of *R1R2C1C2*. If this time content is slightly less than 60 cycles, the sync pulse will be superimposed on the *R1C1* exponential curve and would control the oscillator frequency.

In most TV sets, the variation of the basic multivibrator used is the common cathode or cathode coupled type. In this case, any signal on the grid of *V1* appears at the common cathode of *V1* and *V2* in the same phase. Thus a negative signal at the grid of *V2* appears as a negative signal at the common cathode. To the grid of *V1* this appears as a reduction in bias and *V1* conducts more current. This cathode current makes the grid of *V2* more negative. This action continues until *V2* is driven to cut-off.

This condition continues until *C1* discharges through *R1* and *R2*. When this occurs, the opposite condition prevails and a multivibrator pulse is taken off the output. While this type oscillator is less costly to manufacture than the blocking oscillator type, the values of the components are more critical and the tubes used should be well balanced.

Vertical Amplifier Input Peaking Network

In order for the current in the deflection yoke to have a sawtooth waveform, the waveform of voltage must be a complex one. This is due to the inductive characteristics of a coil. If a pure sawtooth of voltage were fed to it, the resultant current, due to the consant rate of change of voltage would tend to have an elliptical waveform. A squarewave in a pure inductance would give rise to an exponential current waveform which could be utilized for a sawtooth. In this case, however, the resistance of the coil which is comparatively large would cause the square wave to be superimposed on the exponential and again give rise to a distorted waveform.

If, however, a sharp-sided pulse with a sawtooth at the top could be introduced, the resultant current would have a sawooth characteristic. This can be understood by the following waveform analysis: The steep side of the waveform contains a large high frequency content. Therefore, the impedance of the coil is much larger than the resistor and the coil determines the current waveform. When the top of the pulse arrives, the impedance of the coil drops and the resistor determines the current waveform. If the top is a sawtooth, the result is a continuation of the coil sawtooth current

The waveform required is generated in a peaking network *(Fig. 6)*. This network is created by taking *C2* of the oscillator and bringing it to ground through *R3*. The reason for obtaining the required waveform lies in the following condenser characteristics: A condenser charging or discharging current is of an exponential nature, therefore, the initial current is very happy and decreases at an exponential rate.

The result is that as *C2* charges or discharges, the heavy current causes *R3* to develop most of the voltage and it is of a linear nature. As the current decreases, the slope voltage is developed across *C2*. The length of the straight line in the amount of slope are functions of the values of *C2*, *R3* and the B+ supply voltage *(Fig. 7)*. The slope *(A)* in *Fig. 7* can, in some sets, be a major cause of non-linearity.

Vertical Amplifier Output Circuit

The output tube is a pulse amplifier. Its bias is set so that when *C2* discharges, the tube is cut-off. This occurs during blanking when the electron

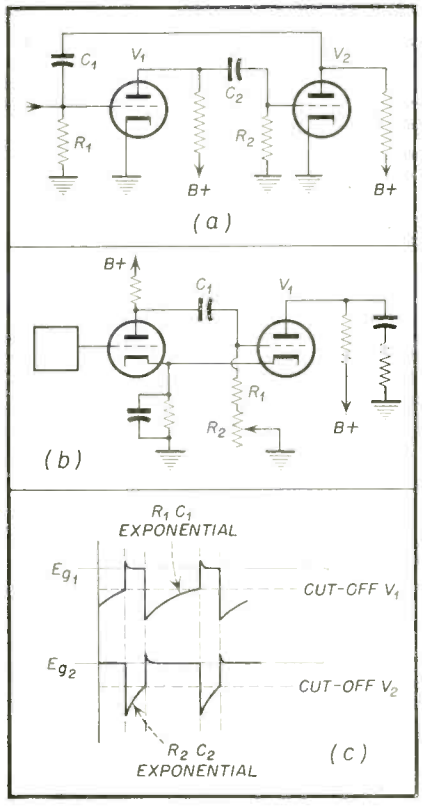
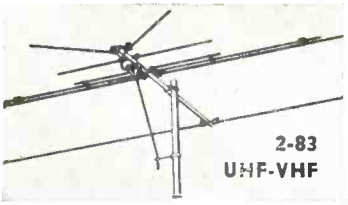
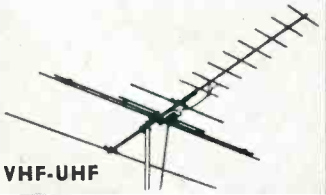


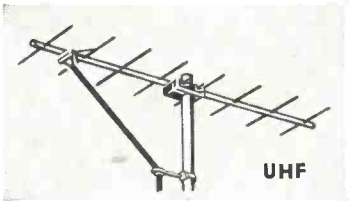
Fig. 5—Typical multivibrator oscillator with wave form caused by assymetry.



ULTRA Q-TEE
The sensational primary area all-channel UHF-VHF antenna that employs patented* printed circuit channel separators and uses only one transmission line.

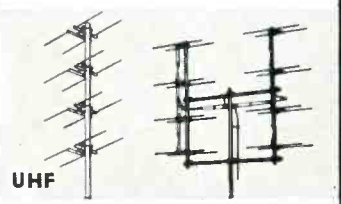
ULTRA Q-TEE Suburban
Operates similar to Ultra Q-Tee (above) but is designed for all-channel VHF and fringe area UHF.

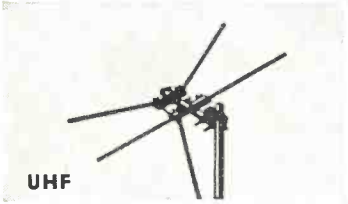




UHF LONG JOHN YAGI
Single channel eight-element yagi for both primary and fringe areas. Also available in twelve-element Long Long John with fiberglass boom.

UHF COLINEAR
High gain broad band fringe area UHF antenna. Four models cover entire UHF range. Also available in side-by-side array with special stacking kit.





UHF "V"
An all-channel primary area UHF antenna. Provided either plain or with Mighty Match for use in combination with present VHF antenna, using single transmission line.

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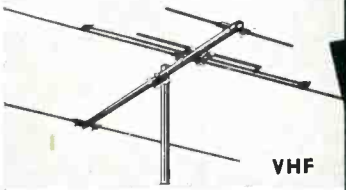

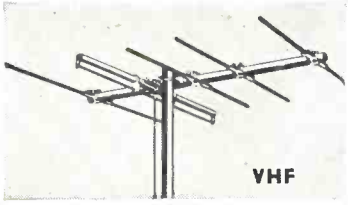

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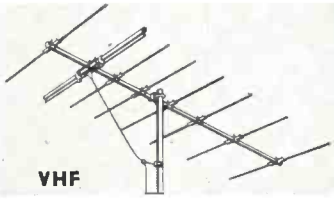

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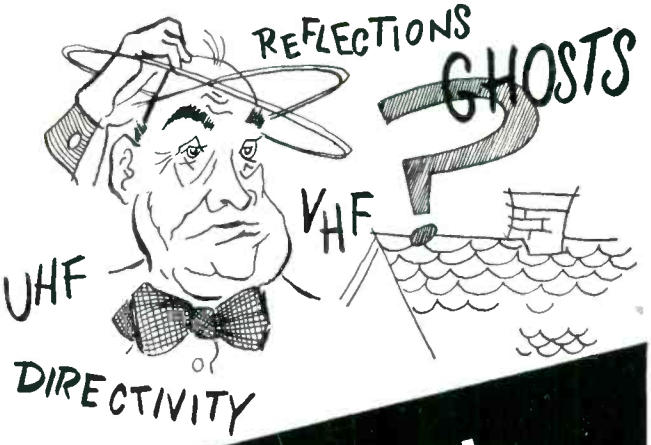

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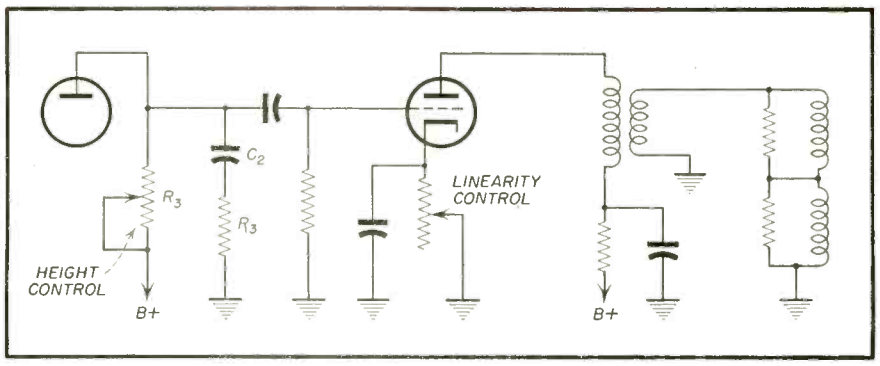

Fig. 6—Peaking network which aids linearity of required wave form.

beam is retracing. The bias is such that the pulse is amplified on the linear portion of the *EgIp* curve. A control is generally inserted in the cathode circuit for this purpose.

The a-c plate load is a step down transformer. The secondary of this transformer should match the impedance of the yoke back to the primary. This must be so as to give the maximum distortionless power transfer. The output tube can be a triode, a pentode or a pentode so connected that it is a pentode for d.c. and a triode for a.c. This is accomplished by connecting a large condenser from plate to screen.

Trouble Shooting the Vertical System

The troubles occurring in the vertical section can be listed as follows:

1. Height
2. Vertical linearity
3. Vertical frequency (hold)
4. Interlace
5. Foldover

Barring defective vertical oscillator and output amplifier tubes, the following are the probable sources of trouble.

1. INSUFFICIENT HEIGHT

A. check the B+. As the power rectifier ages, the B+ tends to drop. Many sets on the market especially 20" and 21" sets require virtually the maximum design B+. Thus, as the set ages, it becomes impossible to fill out the screen. If this is the case, the only solution is to try a number of rectifier tubes, until you hit a "hot tube" which will give you more than sufficient vertical sweep.

B. In many sets, in order to get a sufficiently high B+, the vertical system is brought back to the boost voltage. In this case, check the boost voltage and the damper tube. Also check the isolating resistor for an increase in value especially if it is less than 1 watt.

C. Check the height control for an open or intermittent point.

D. Check *C2* for leakage or short.

2. LINEARITY

A. If non-linearity occurs, at the time or shortly after a new vertical output tube has been installed, try

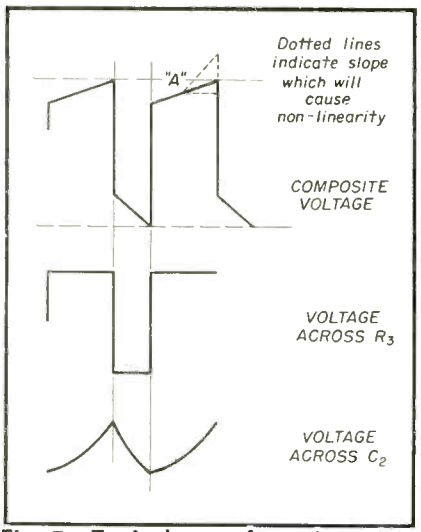

Fig. 7—Typical wave forms in various parts of circuit.

several other tubes. This may be due to operating conditions of the particular set, it may be difficult to get some tubes to operate on the linear portion of their *EgIp* curve.

B. Check the cathode by-pass condenser on the output tube for leakage. If this condenser leaks, the degenerative feedback will distort the waveform.

C. Check the resistor and condenser values in the "peaking network".

D. If a new yoke has been installed, make sure that it is an exact replacement for the original. The reason for this is that the values of L and R in the yoke, to a great extent, determine the other output circuit values. If an exact replacement coil is not available and non-linearity results, try the following: by means of an oscilloscope, a resistor and condenser substitution boxes, try various *R* and *C* combinations in the peaking network. Connect the oscilloscope and the boxes as shown in *Fig. 8*. Try various combinations until the slope *(a)* is linear.

3. HOLD

The vertical hold is a common source of service trouble. The causes of hold troubles are numerous. Some are outside the set, some outside the vertical system and some are in the vertical system itself. Most of the trouble not in the vertical system arises from the line *A-A'*, in the *Eg* curve in *Fig. 4*.

It can be seen that any pulses on this line whose amplitude is high enough can cause the vertical oscillator to be triggered. This is the reason that so much effort is made, circuit wise, to present nothing but the sync pulse to the integrator network. Since this article is on the vertical system and the other circuits have been discussed previously (RTSD September, October and November '52) we will discuss only those troubles which arise from defects in the vertical system itself.

(Continued on page 49)

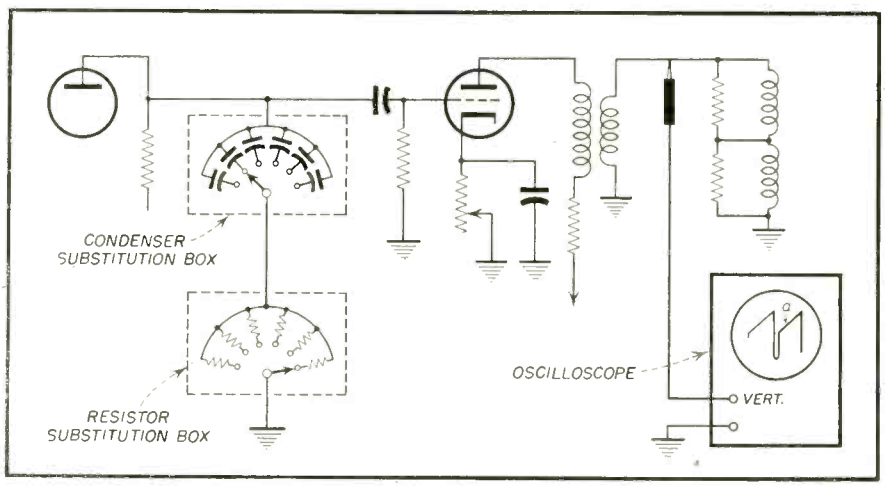

Fig. 8—Method of compensating for poor linearity if exact replacement yoke is not available.

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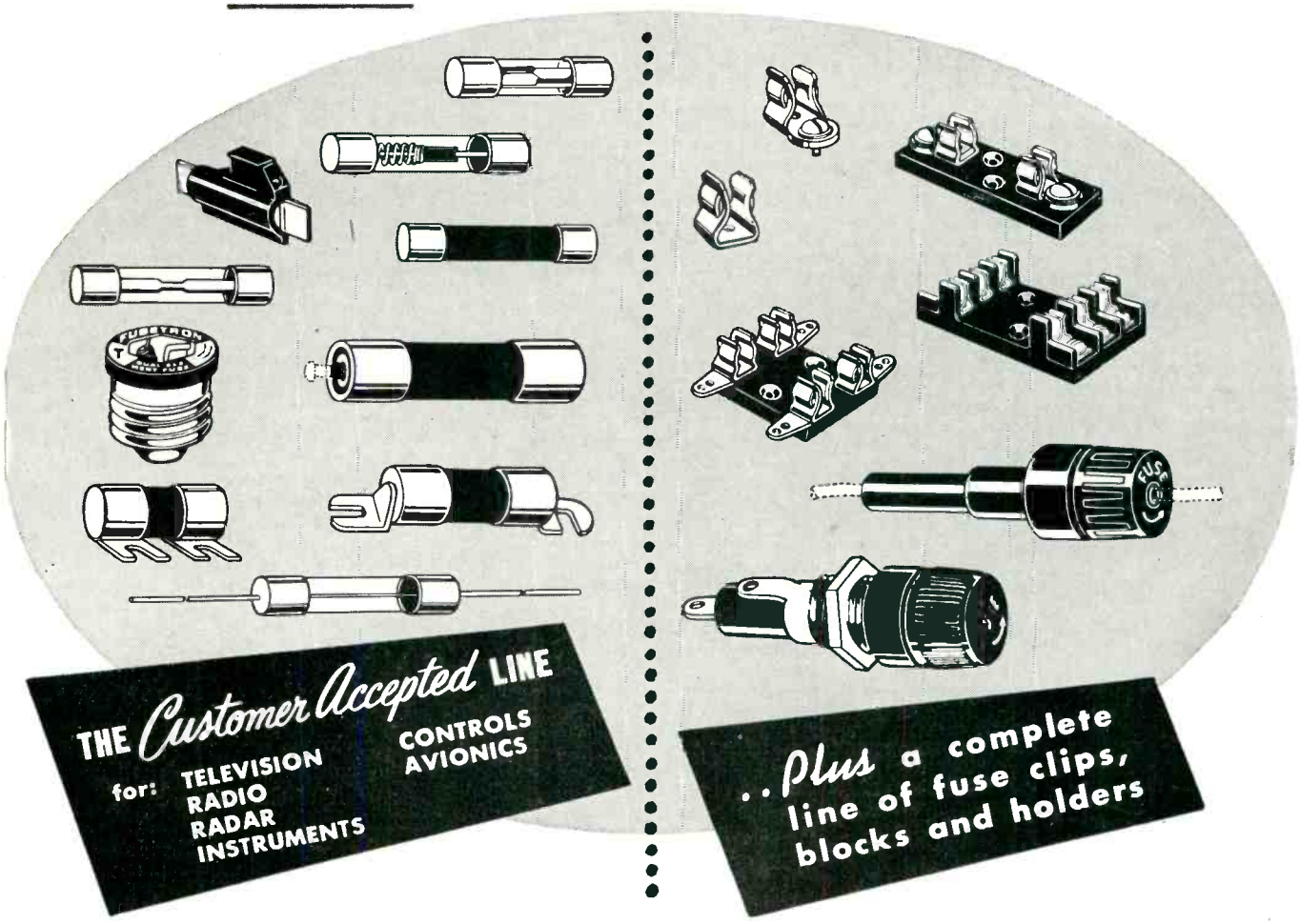

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YOUR Hi-Fi MARKET

PART 4

by CHARLES B. GRAHAM

In this installment we consider tone controls. The operation and theory of all types currently in use are completely discussed and evaluated.

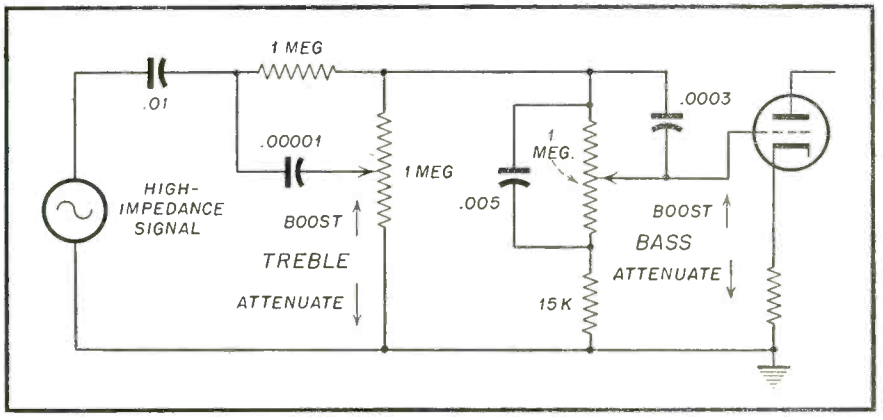

Fig. 1—An example of R-C network control used by many manufacturers of medium and low priced equipment.

Our examination of current theory and practice in the circuits which come in front of the power amplifier in high quality audio systems went into details of phono preamps and compensation in the last installment. This month we will take up tone controls. This arrangement follows the electrical path of the signal—after the program source or signal has been selected (and, if it's a low-level magnetic phono pickup, amplified and compensated), it is usually further modified by bass and/or treble controls.

Dual tone controls which allow either boost or cut, and which act independenetly, are standard facilities in almost all high-fidelity home systems today. It is true that there are some engineers who believe that, except for record compensation (see previous installment on the need for this, and how it's accomplished), the entire amplifying system should be as nearly flat over the whole audio frequency range as possible.

While this approach has some attractions, it assumes that there are no deficiencies in the associated equipment, and that playback conditions are perfect. It requires *flat* program material, and most program material just isn't flat. It ignores the fact that most rooms have their own frequency-selective characteristics. That is, the coefficients of absorption of listening rooms vary considerably, in addition to being much different from those of the concert hall. Finally, various listeners will want to hear more treble, less bass, etc., than other listeners. These and other considerations point to the need for variable bass-and treble boost-and-cut. Not to be overlooked is the simple fact that many people like to have plenty of dials to twist. Many high-fi addicts are gadgeteers, and will invariably choose the system with the most knobs.

Therefore high quality systems for sale to the public must have dual tone controls. Naturally, the amplifier whose controls seem to the customer to have the most flexibility—the greatest amount of effect on the sound—will usually be the amplifier purchased.

Treble Roll-off Controls

Until a few years ago most "tone controls" consisted simply of a potentiometer from the plate of a convenient voltage amplifier, with a condenser in series at the plate or ground end of the control. This provided a limited amount of control in the form of treble roll-off. Early sets were always deficient in bass response, so most radios and phonographs were usually operated with the tone control turned all the way down—maximum treble attenuation. This customarily decreased the overall volume level noticeably, so that the volume control had to be readjusted every time the "tone" control was reset.

These simple *R-C* networks could be designed to start the roll-off action at any place on the frequency response curve, depending on the size of various circuit constants including the control and the condenser, but the rate of slope was always less than *6 db*-per octave.

Gradually a few designers worked out circuits which varied the amount of feedback over two or more stages, to produce either treble cut or bass boost. These circuits were more satisfactory than previous simpler ones because they gave a wider range of control than did the simple variable *R-C* roll-off. But they reduced the overall amount of feedback available for other purposes, and often even introduced regeneration and serious transient and phase distortion, since almost always there were two or even more *R-C* networks included in the feedback loop.

The effect of the treble roll-off usually started at *1000* cycles, which has remained a popular midpoint. (Some engineers have favored lowering this point to *800* cycles, and a few even raise it.)

Degenerative Feedback Controls

For some years the most effective tone control circuit, and the one most widely employed, was one in which

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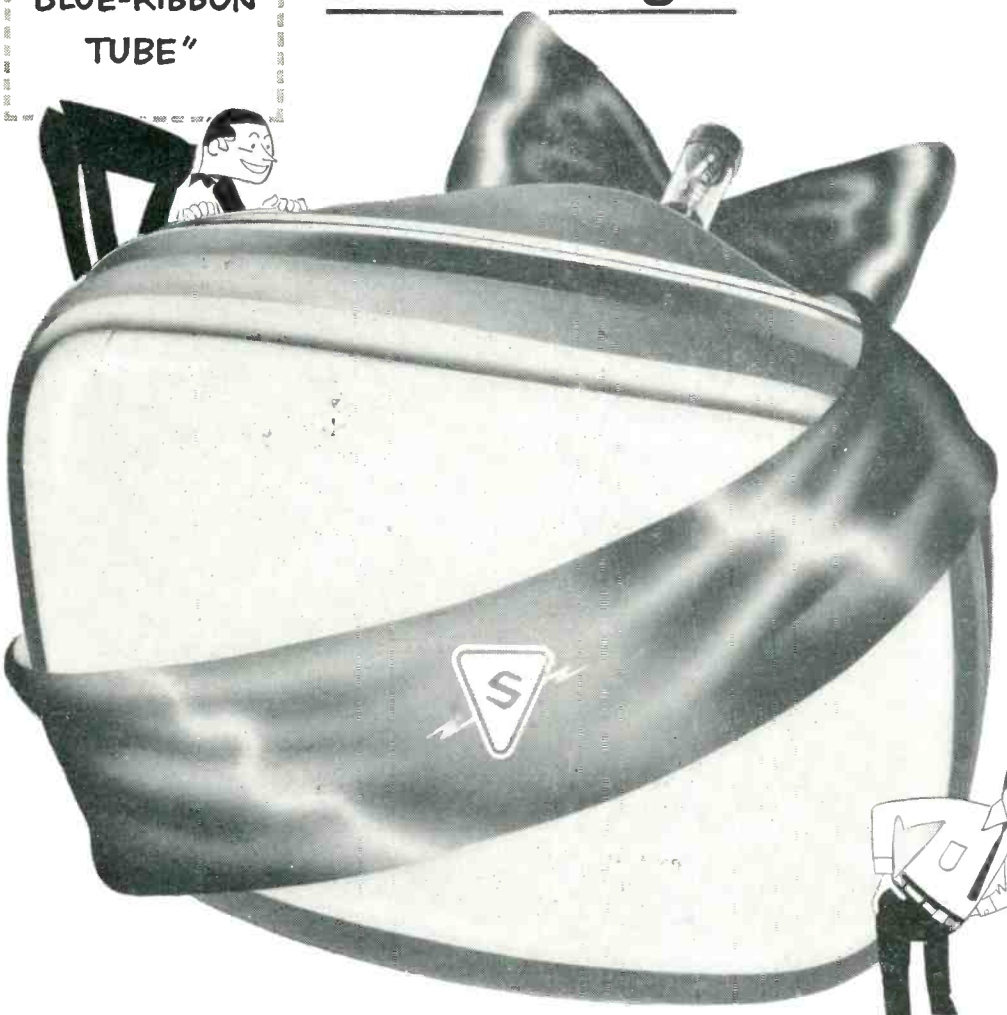

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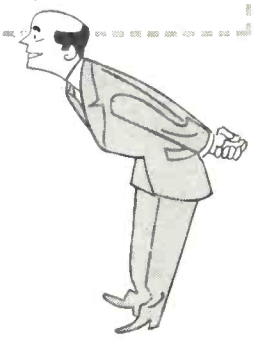

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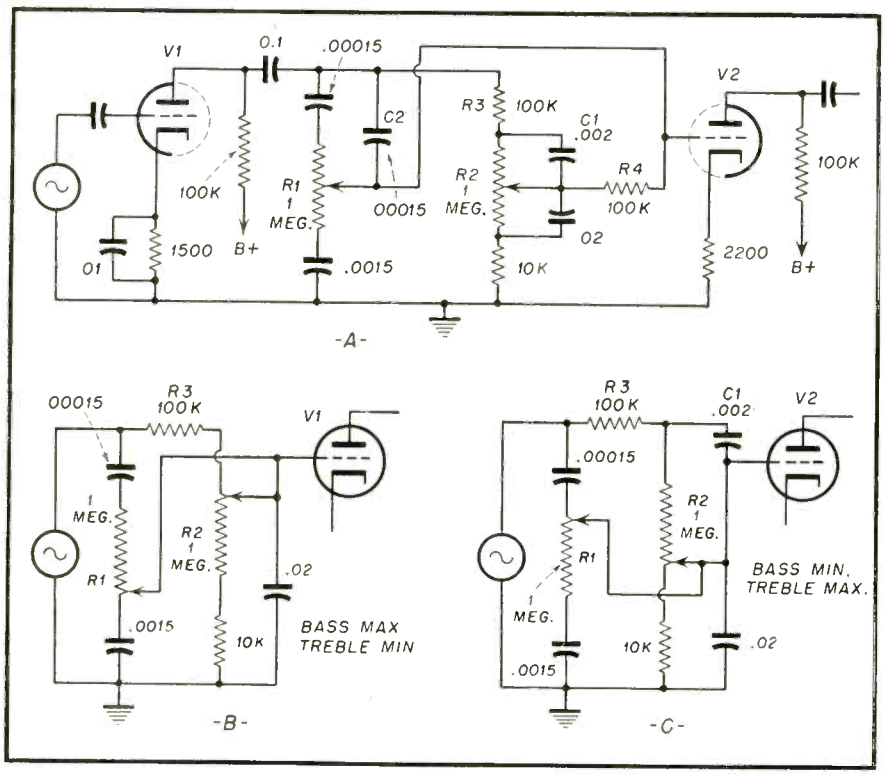


Fig. 2—Boost or attenuation losser networks. When controls are at mid or "flat" position gain is the same at all frequencies.

a resonant iron core choke was used with ganged dual potentiometers in a degenerative feedback circuit. The pots moved the inductance (and a matched capacitance) variously into either the plate circuit or into the cathode circuit of a voltage amplifier. This dual tone control circuit was widely enough used to draw attention to the consumer satisfaction inherent in using dual separate controls.

This circuit was too costly for incorporation into many commercial radio-phono consoles, and it was too sensitive to hum pickup for it to be successfully used by most amateur constructors. Thus, even though it is today available in improved packaged versions, it has given way to dual *R-C*, boost-cut controls.

There have been a great many circuit configurations designed which use *R-C* combinations to give the listener a choice of bass boost, bass attenuation, treble boost, or treble attenuation. All of these require that the amplifier have at least one added stage of voltage amplification. The amount of gain restored by the amplifying stage helps determine the maximum amount of boost afforded by the controls.

A comparatively effective circuit which is typical of the approach used by manufacturers of low and medium-priced equipment is shown in *Fig. 1*. Both boost and attenuation are provided for both treble and bass, but the amount of boost is about 10 db maximum.

R-C Controls

The most complex of the dual controls which employs only RC combinations (except the tapped, or step type controls, which are discussed below) is the separate channel, or three channel type. In this approach the signal is amplified to a medium level (most modern tone controls are inserted just before the gain control, which is at the front of the basic power amplifier, where the level is about .25 to 1.5 volts average) then split off into three separate channels.

One channel is fed straight through to a mixing point while each of the other two channels is fed through a separate variable *R-C* network, amplified, and then all three signals are combined at the mixing point. Sometimes the amplification takes place only after recombining the three signals, but this requires the use of more resistances to isolate the bass and treble channels from interaction. These isolation resistors cut the level down again, requiring more gain, so the best practice seems to be to amplify before mixing the three channels together again.

Probably the most widely employed dual tone control circuit in use today, in numerous variations, is one which was first publicly described four years ago.* This system had been used in a few amplifiers previous to that time, but since then it has been incorporated into all but a very few of the very best high-fidelity amplifiers on the market. Other top-quality amplifiers use the separate channel system, mentioned above, or the step-type controls, shown in *Fig. 5*, and described below.

L-C Resonant Controls

In addition to the types of tone controls which are diagramed and discussed here, there are certain ones employed largely in professional re-

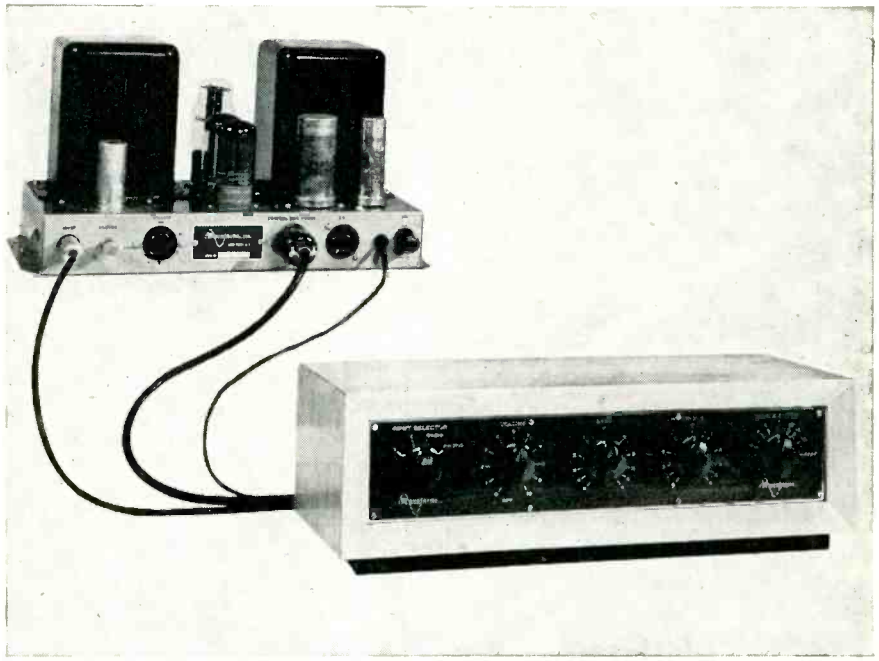


Fig. 3—A high quality amplifier incorporating dual tone controls. This is a typical Hi-Fi unit used in home installations.

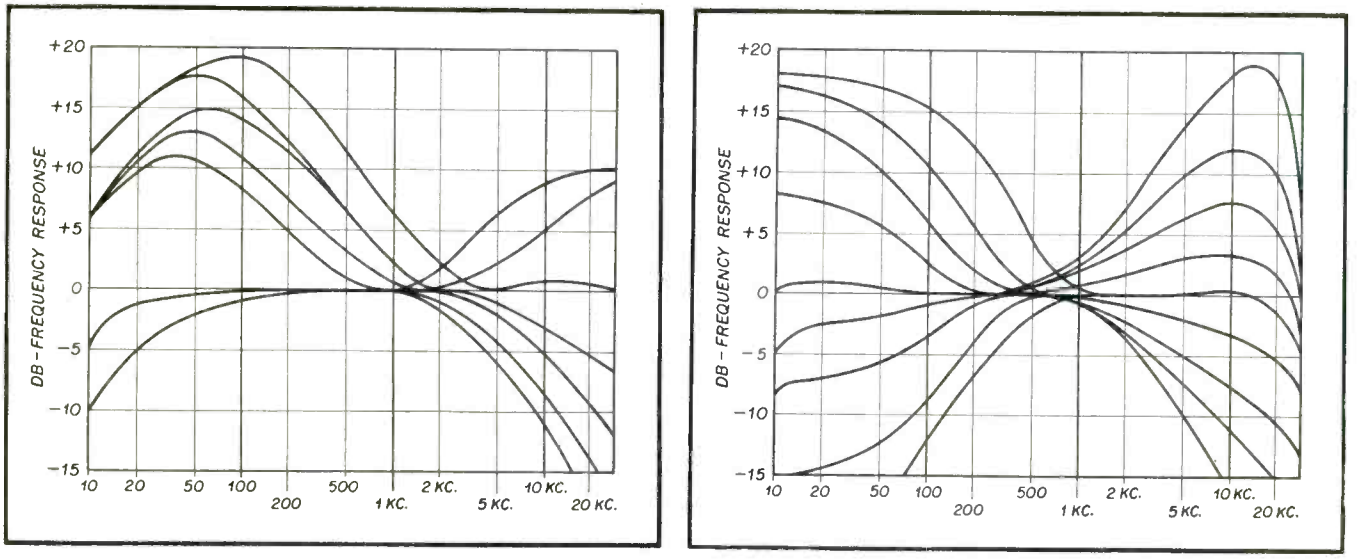


Fig. 4—Comparison of response curves for amplifier in Fig. 5 (right) and Fig. 2 (left).

cording and broadcast work which have resonant L-C circuits. These are very costly, and generally correspondingly effective. The most elaborate of them not only allow variable boost and cut, but allow the operator to choose the points where the maximum boost or attenuation in both treble and bass (remember that with resonant *L-C* circuits very definite "humps" and "dips" can be created in the response curves, instead of the more gradual *slopes* of *R-C* circuits).

R-C Networks

In the continuously variable dual tone control circuit which we are considering (as the prototype most commonly approximated in today's amplifiers) the boost or attenuation action is caused by the insertion of losser *R-C* networks. *(Fig. 2).* When the controls are in mid-position, or "flat", the gain of the tone control stage(s) is the same at all frequencies. When the bass control is at its maximum boost position the arm contacts the top of the pot. In this position *C1* is effectively shorted out, and the .02 condenser has its maximum effect on frequencies from about 800 cycles up, thus giving maximum bass. When the arm is turned downward the smaller condenser *C1* becomes effective and the network passes less and less of the bass to the grid of *V2* and more and more bass directly to ground. Treble boost is maximum when the arm of *R1* is at the top of the treble losser network. Note the capacitor *C2,* which is used to overcome the capacitive shunting effect (to chassis) of the entire treble network. This very small condenser feeds enough treble directly to the grid of *V2* to compensate somewhat for the shunt losses. *R4* is simply an isolating resistor which reduces the interaction of the two losser networks on each other to the point where it is unimportant. Many circuits omit it. Some designers separate the treble and bass networks from each other by placing

[*Continued on page 54*]

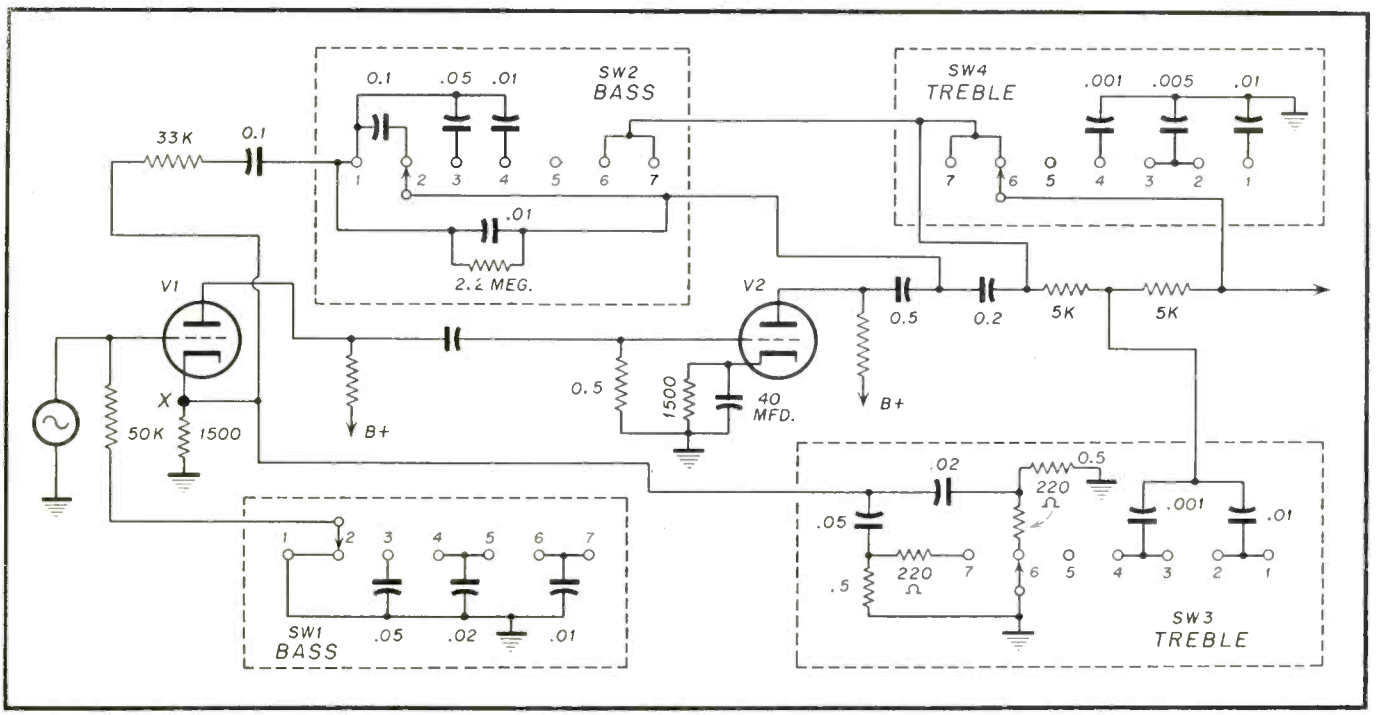


Fig. 5—Amplifier using "step" type of tone controls. Note two section losser network arranged in bridge T type filter. This type gives excellent results.

PUSH PULL AUDIO in TV RECEIVERS

by
MATTHEW MANDL
(Author of Mandl's Television Servicing)

The rebirth of Hi-Fi audio has made the TV listener audio conscious. The application of push-pull circuits is a must in the newer TV receivers. This discussion of push-pull audio is timely and reviews circuit details anew.

SEVERAL manufacturers have incorporated push-pull audio systems in their receivers during the past few years. In most instances, however, usage was confined to the larger console television receivers with TV, FM and phonograph combinations. With the current interest in high-fidelity audio, manufacturers generally have improved audio systems in their latest receivers and for this reason push-pull circuits will be found more often.

Older console radios in the higher price range usually incorporated push-pull audio output amplifiers but with the advent of television this excellent circuit was pushed into the background. Early television receivers were expensive and in order to keep costs down manufacturers sacrificed sound quality in favor of the picture. At the same time the small confines of the over-crowded table model television receivers prevented the use of large cone loudspeakers. Thus, the newcomer into the service field rarely encountered push-pull, while the old-timer found himself forgetting basic principles and also forgetting many of the short-cuts in push-pull servicing he once employed. The decline in sales of console radios in favor of television and the smaller table radio and FM combinations also meant fewer encounters with push-pull amplification. For this reason some of the basic factors of push-pull circuitry are reviewed here in conjunction with an analysis of common troubles and servicing procedures.

Advantages

In virtually all instances push-pull audio circuits in television, radio, or high-fidelity phonograph amplifiers are operated Class A. This means that there is d.c. flowing in the plate circuits of the tubes even without signal input. The tubes are operated on the flat (linear) portion of their characteristic curves to minimize harmonic

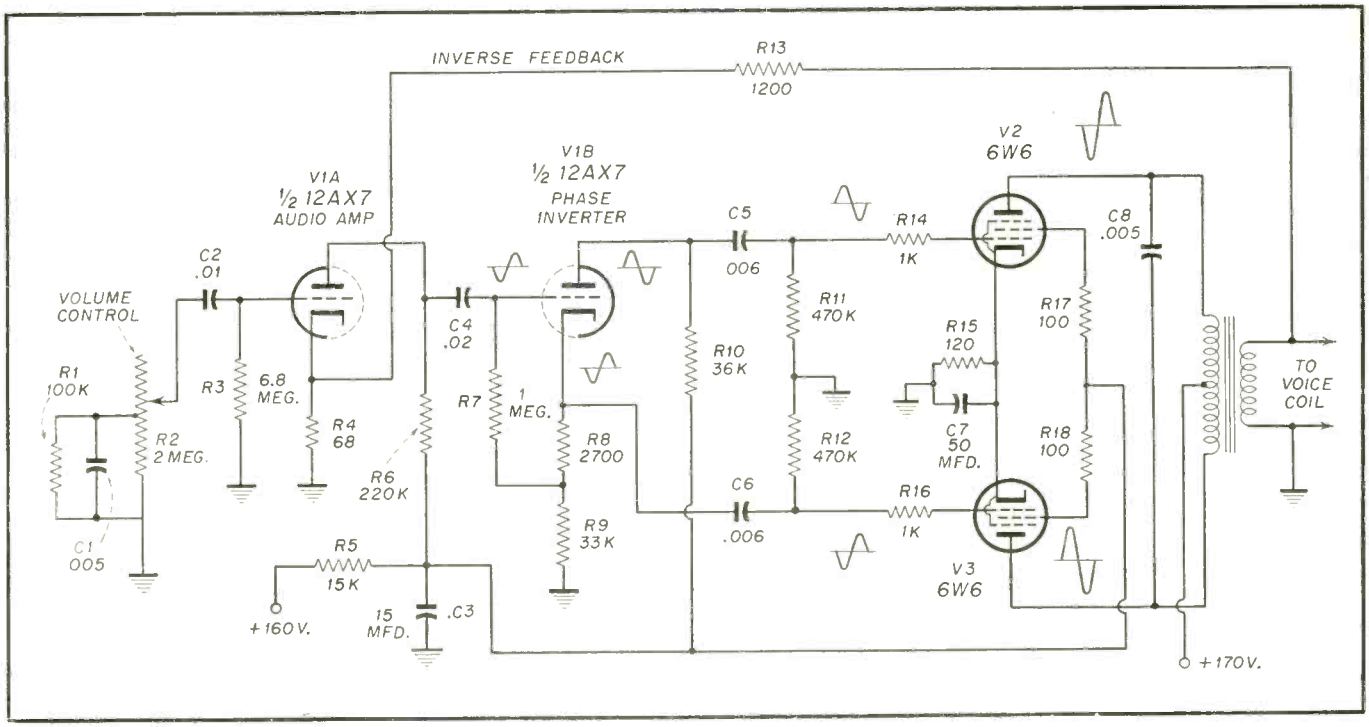


Fig. 1—GE Model 24C101 with push-pull audio and dual triode phase inverter.

distortion, and the input grid signals should not drive the grids positive. When the latter occurs, the grids draw current and distortion is developed.

The balanced arrangement of push-pull and the characteristics of its design are such that even harmonic distortion is reduced to a considerable extent over single-ended operation. For this reason the push-pull system delivers more than twice the *undistorted* power of a single tube of the same type. Besides this increases in audio quality, the opposing fields of each half of the output transformer primary tend to cancel and thus reduces core saturation.

Signal currents are opposite in phase in the two push-pull tubes, thus their combined effect cancels out from the center-tap of the output transformer primary. The current flow from this point on through the power supply and back to the cathodes is, therefore, relatively free of signal energy and thus feedback via power supply coupling to other stages is minimized. For the same reason hum currents caused by poor filtering in the power supply do not readily find their way into the push-pull circuit and less hum is heard from the speaker.

Commercial Types

A typical push-pull audio output amplifier system is shown in *Fig. 1.* This is used in the General Electric Model 24C101 series television receivers. The signal from the sound detector is impressed across the volume control, *R2.* The *R-C* network in the volume control, *R1* and *C1,* is the bass compensation circuit. This is an equivalent bass-boost for the lower settings of the volume control and compensates for the ear's decline in sensitivity to bass notes at low volume audio levels.

A dual-triode 12AX7 tube is used as a combination audio amplifier and phase inverter. The cathode of the first section (audio amplifier) is not by-passed to prevent loss of inverse feedback signal from the output transformer. Inverse feedback minimizes tube noises and distortion. By feeding back a portion of the output signal out of phase with the input signal a better quality audio output signal is produced. Such degenerative feedback can be from 5 to 25 per cent with greater benefits at the higher values. The greater the feedback, however, the lower the total power output. If the feedback resistor opens *(R13)* more audio output will be available, but quality will suffer by comparison.

Push-pull tubes require a well-balanced circuit for proper operation. This means that the plate voltages should be identical for each tube, and the resistors in the control grids and screen grids should be equal in value. Tolerances of *5 and 10* per cent are permitted, though the greater the difference the poorer the tonal quality produced by the amplification process.

he grid of one push-pull tube must receive its input signal *180* degrees out of phase with respect to the signal applied to the other. For this reason some form of phase inversion (phase splitting) must be employed. In *Fig. 1* this consists of a triode inverter, with the plate circuit furnishing the signal for *V2,* while the cathode circuit provides a signal to the grid of *V3* of opposite phase. (The signal voltage across the cathode is *180* degrees out of phase with that at the plate, but in phase with the input signal voltage at the grid of the phase inverter as shown.) Low value resistors are used at the control grids and screen grids to minimize parasitic oscillations *(R14, R16, R17,* and *R18).* The capacitor across the push-pull plates *(C8)* reduces undesirable high frequency signals which might produce squeals or whistles. It also serves to decrease the primary impedance for the upper tonal range of frequencies. At higher frequencies the reactance of the primary rises and this would tend to amplify the high frequency tones more than the low. The shunting capacitor has a decreasing reactance at higher frequencies and tends to compensate for the increasing reactance of the transformer primary. If this capacitor opens the sound output will be harsh and strident, with the tendency to produce high pitched whistles.

The 6W6 type tubes used in the push-pull circuit are beam power pentode type amplifiers. This type of tube is also found in the vertical sweep output amplifiers of television receivers.

Separate Phase Inverter Type

Fig. 2 shows another push-pull system used in television receivers (Admiral *20A1*) chassis with *4K1* radio tuner). Here, a separate tube is used for getting the necessary phase inversion for the push-pull grids. This has an advantage, because the gain of the first audio amplifier *(6SJ7)* is not diminished by the necessity for a high value cathode resistor with its consequent degenerative effect.

The phase inverter tube is a *6SQ7,* chosen for its high mu. The two diode plates are unused. The grid signal

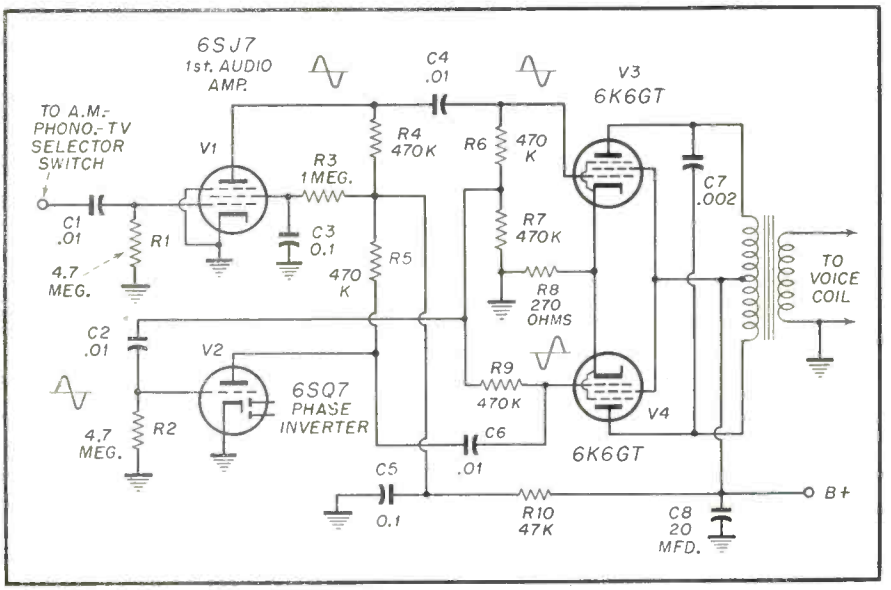


Fig. 2—Admiral Model 20A1 with separate tube inverter.

for the phase inverter is derived from the junction of three *470,000* ohm resistors. The output of the inverter feeds the grid of the lower push-pull tube via *C6,* the coupling capacitor. This is a self-balancing type of phase inversion which works exceptionally well and has been referred to as the "floating paraphase" phase inverter.

Inasmuch as the grid signals at *V3* and *V4* are opposite in phase, one might assume they cancel at the junction of *R6* and *R7* and thus produce no voltage for the grid of *V2,* the phase inverter. This cannot happen, however, for if no signal arrives at the grid of *V2,* the tube would produce no output and the grid of *V4* would receive no signal. If the grid of *V4* had no signal there would be no out of phase opposing voltage to cancel out the voltage at the junction of *R6* and *R7.* In such a case *V2* would get

[*Continued on page 51*]

Design of VACUUM TUBE VOLTMETERS USING THE NEW

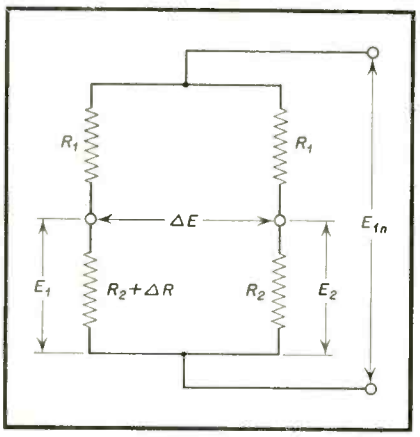


Fig. 1—Elementary bridge circuit of four resistors in parallel.

CONVENTIONAL VTVM's often do not utilize the full sensitivity possible from the tubes employed because of the unbalance, instability, and lack of linearity inherent in operating the tubes at high plate currents necessary for high sensitivity.

The elementary bridge circuit consists of four resistances arranged in series parallel as shown in *Fig. 1*. The potential difference across the bridge is expressed by the equation:

$$\Delta E = E_{in}\left(\frac{R_2+\Delta R}{R_1+R_2+\Delta R} - \frac{R_1}{R_1\ R_2}\right)$$

The curve E vs *R2* (*Fig. 2*) shows that as *R2* is increased, E approaches 0 volts asymtotically and maximum E occurs at $R2 = 0$. This indicates that in order to obtain high sensitivity in a bridge circuit which uses vacuum tubes for two of the arms, the tubes should have very low d-c resistance; i.e., low tube drop at their operating point, and, in addition, dissipation ratings sufficiently high to allow them to be operated with low resistance plate loads.

The conservatively designed Hytron type 12A4, while primarily intended as a vertical output tube in television receivers, is well suited to *VTVM* service because of its high perveance and uniformly small grid current. Sensitivities 15 to 20 times that of conventional tubes and circuits can be achieved with the simple arrangement shown in *Fig 3*.

The low value cathode resistors allow each tube to pass approximately 5 ma., a relatively high value for *VTVM* bridge tubes. The grid current which usually attends such operation of a vacuum tube is balanced out in the center-tapped divider network. High plate current operation of the Hytron 12A4 makes possible a sensitivity of 0.5V full scale on a 0-1 ma. meter, with stability comparable to that of less sensitive designs.

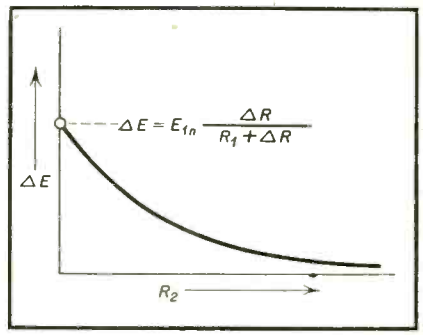


Fig. 2—Curve showing E vs. R2 indicating that as R2 increases E approaches O.

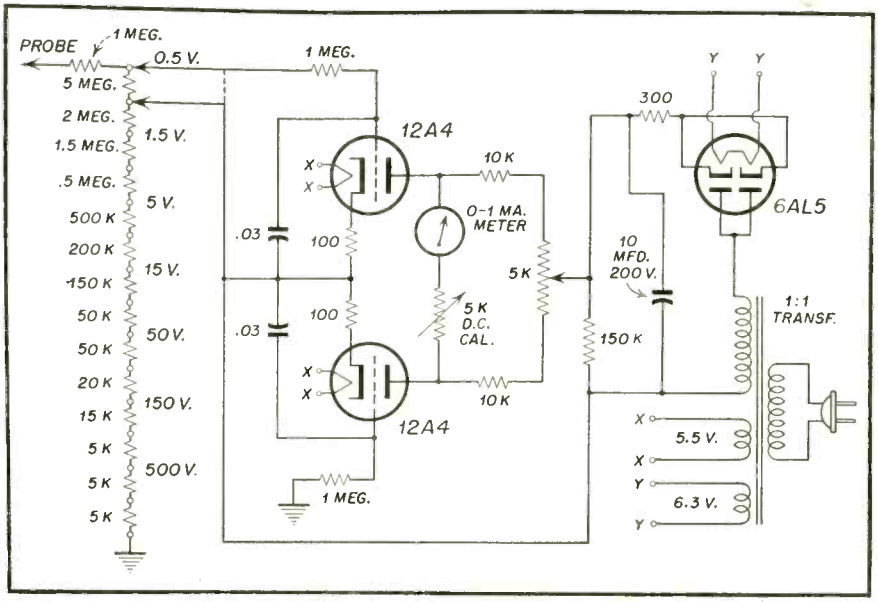


Fig. 3—Simple, sensitive VTVM using 12A4 tube. High sensitivity and simplicity make this an ideal instrument.

a Sensitive

VOLTMETER

HYTRON 12AH TUBE

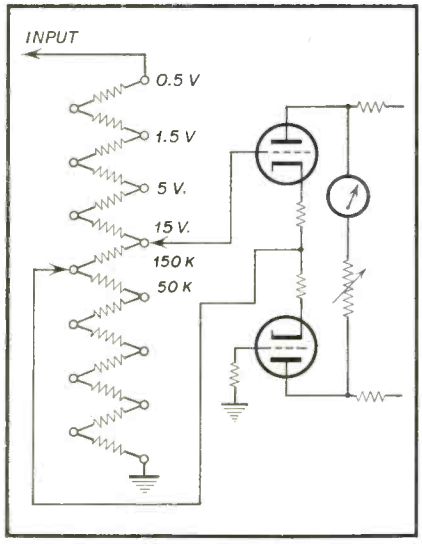


Fig. 5—Divider network with cathode and grid circuits switched together.

The resistance between grid and the common cathode return is kept equal by using an ordinary ganged switch with two wafers; one used for the cathode return and the other for the high grid input. The divider chain is somewhat unique in that it must be arranged to give the desired ranges; also, keep the common cathode return midway in resistance between the two grids. It can be accomplished for any divider network by using two resistances which total up to the value of each original divider resistance. The resistor nearest the high grid should have a value half that of the total remaining in the divider below the tap tied to the high grid. An example of such a divider is shown in *Fig. 5*.

The Hytron 12A4's operate very satisfactoriily with an heater supply of 5.5V. Use of this reduced heater voltage extends life considerably and increases the stability of the circuit in general.

Only the d-c bridge portion of the circuit is shown since this is the basic foundation of most vacuum tube voltmeters. Peak-to-peak or r.m.s. reading diodes for a-c scales and an additional divider for the ohmmeter scales could easily be added to the basic circuit.

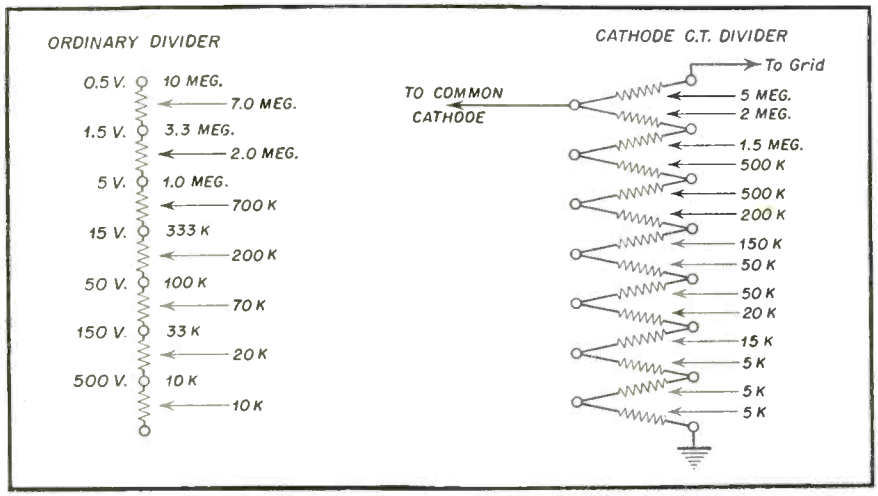
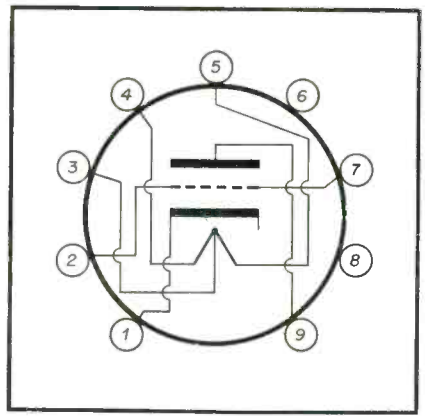


Fig. 4—Usual type VTVM divider and cathode type divider. Both are used in the present circuit.



Typical Characteristics:		
Heater voltage		12.6 or 6.3 volts
Heater current		300 or 600 ma.
Plate potential		250 volts
Grid potential		-9.0 volts
Amplification factor		20
Transconductance		7800 umho.
Plate current		21 ma.
Grid voltage for cutoff (E_b	500v)	-33 volts

Fig. 6—Base layout and operating characteristics of Hytron 12A4 tube.

A constant input resistance of 10 megohms can be maintained through all ranges and the source resistance of the voltage makes practically no difference in the reading obtained.

No difficulty was experienced from the use of the power supply above ground; ordinary power transformers have sufficient insulation resistance for this purpose.

The Hytron 12A4 is a high perveance medium-mu triode with the nine-pin miniature construction. Its tube base connections are shown in *Fig. 6*.

VIDEO SPEED SERVICING SYSTEMS

4th INSTALLMENT

Notes On Identification And Indexing

RCA uses the same cabinet model names for different types of chassis. To properly look up service information on RCA TV receivers it is suggested that the technician refer only to the chassis number stamped on the skirt of the chassis.

In its "21" series, Admiral uses two basic and similar chassis; one with, and one without keyed a.g.c. In the future, models using keyed a.g.c. will be designated as "21 series-kagc". The previous cumulative index does not differentiate between the two, however, the card title does.

INDEX FOR THIS ISSUE

Mfgr. Admiral **Chassis No.** 20A-1, 20B-1, 21A-1

Card No. 20-1

Section Affected: Pix

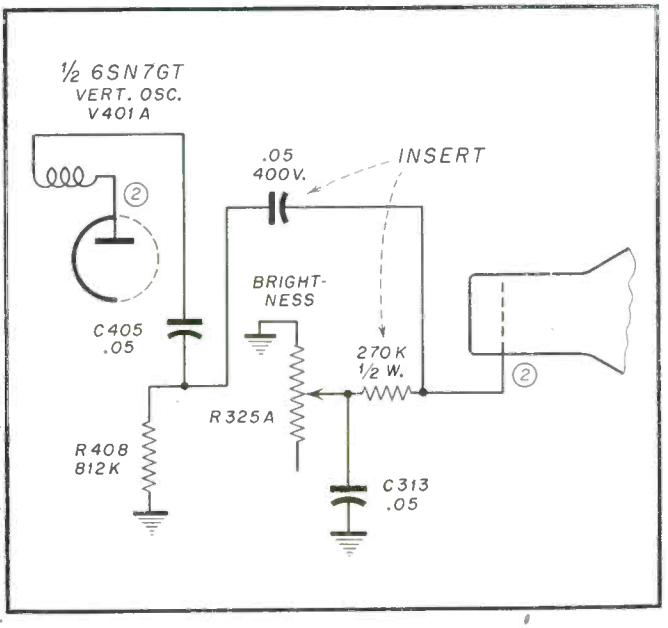
Symptom: Retrace lines visible in low signal areas with brightness control turned up.

Reason For Change: To remove retrace lines.

What To Do:

Install: 270K-½ watt resistor in series with pin *2* (grid) of CRT and junction of *C313* and *R327*.

.05 μf - 400 volt condenser between pin *2* (grid) of CRT and junction of *C405* and *R408*.



Mfgr. Admiral **Chassis No.** 20A-1, 20B-1, 21A-1

Card No. 20-2

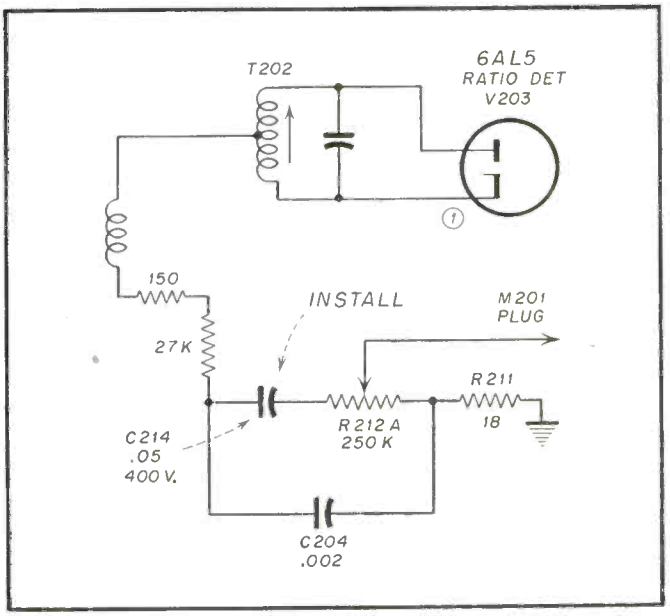
Section Affected: Sound

Symptom: Noise in volume control.

Reason For Change: To remove DC flowing through control.

What To Do:

Install: .05 μf - 600 volt coupling condenser (*C214*) in series between junction of *27K* resistor and *C204* and terminal of volume control *R212A*.



Mfgr. Admiral **Chassis No.** 20A-1, 20B-1, 21A-1

Card No. 20-3

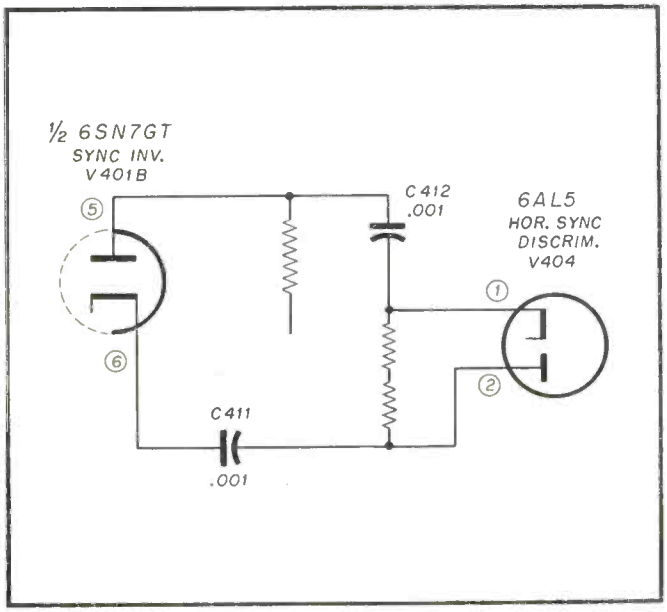
Section Affected: Sync

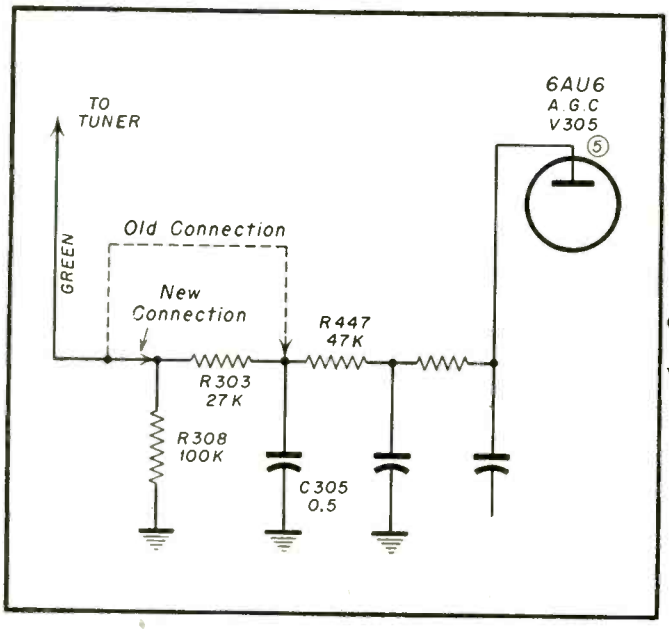
Symptom: Split framed pix—improper vertical sync.

Cause: Component failure.

What To Do:

Replace: *C411* and *C412*, .001 coupling condensers (leaky).





Mfgr. Admiral **Chassis No.** 20A-1, 20B-1, 21A-1

Card No. 20-4

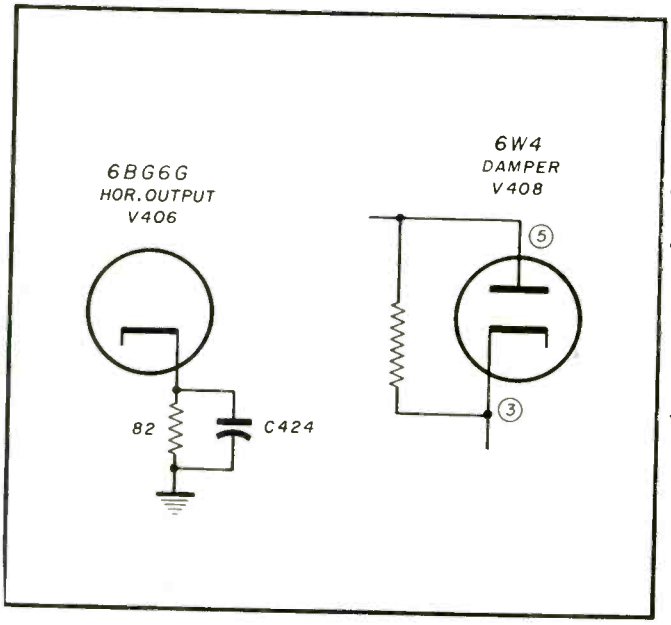
Section Affected: Sound

Symptom: Weak sound in high signal strength areas. All other possibilities of defective sound system checked.

Cause: Too much a-g-c.

What To Do:

Disconnect: Green wire (AGC) from tuner going to junction of *R447* and *R303* and connect this lead to junction of *R303* and *R308*.



Mfgr. Admiral **Chassis No.** 20A-1, 20B-1, 21A-1

Card No. 20-5

Section Affected: Raster

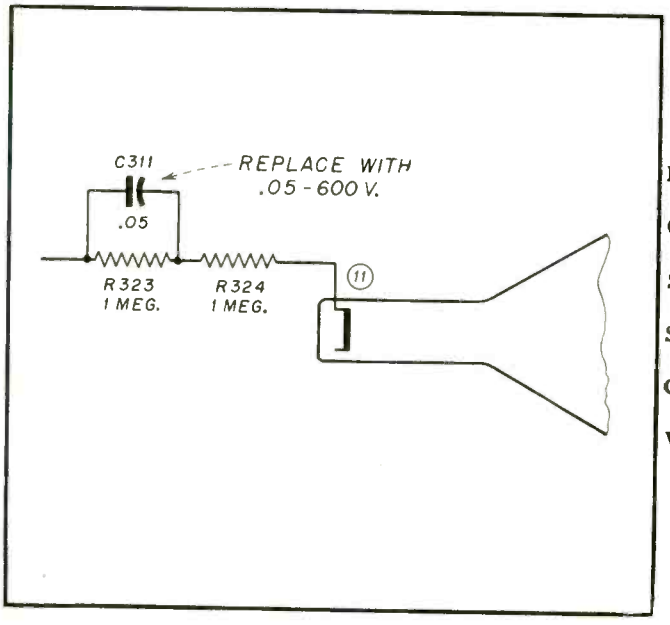
Symptom: Insufficient width.

Reason For Change: To increase sweep voltage.

(Later chassis contain these changes.)

What To Do:

Replace: 6300 ohm damping resistor (between pins 3 and 5 of 6 W4) with 7500 ohm 25 watt resistor.
C424 0.1 μf cathode by-pass condenser with 0.2 μf-200 V. condenser.



Mfgr. Admiral **Chassis No.** 20A-1, 20B-1, 21A-1

Card No. 20-6

Section Affected: Raster

Symptom: No raster, sound OK.

Cause: Component failure.

What To Do:

Replace: *C311* with .05 μf - 600V. condenser.

Mfgr. CBS **Chassis No.** 700-10

Card No. A-1

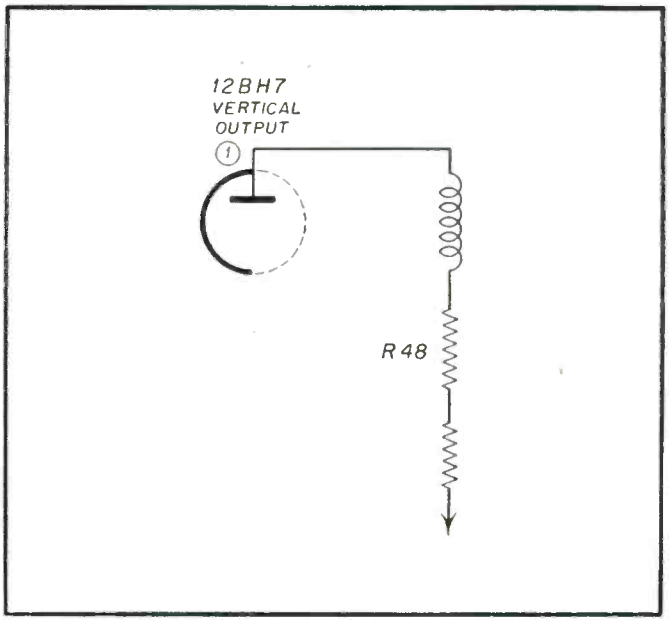
Section Affected: Raster

Symptom: No vertical sweep.

Cause: Component failure.

What To Do:

Replace: *R48* vertical output load resistor with a 3.3K-2 watt resistor.



Mfgr. CBS **Chassis No.** 700-10

Card No. A-2

Section Affected: Pix

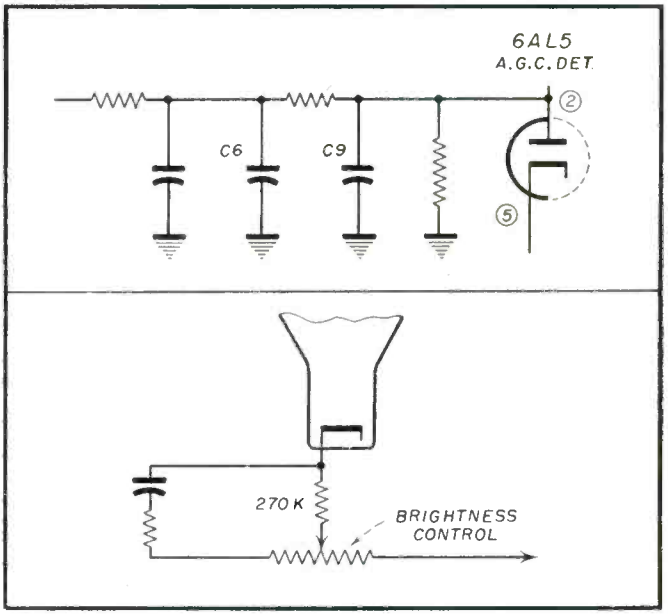
Symptom: Variations in pix gain with changes in pix or station.

Reason For Change: *AGC* modifications.

What To Do:

Change: *C6* from 0.1 μf to 0.25 μf (*Fig. 1*).
C9 from .005 μf to 22μμf. (*Fig. 1*).

Add: 270K-½ watt 10% resistor between the CRT cathode and the arm of the brightness control. (*Fig. 2*).



Mfgr. CBS **Chassis No.** 700-10

Card No. A-3

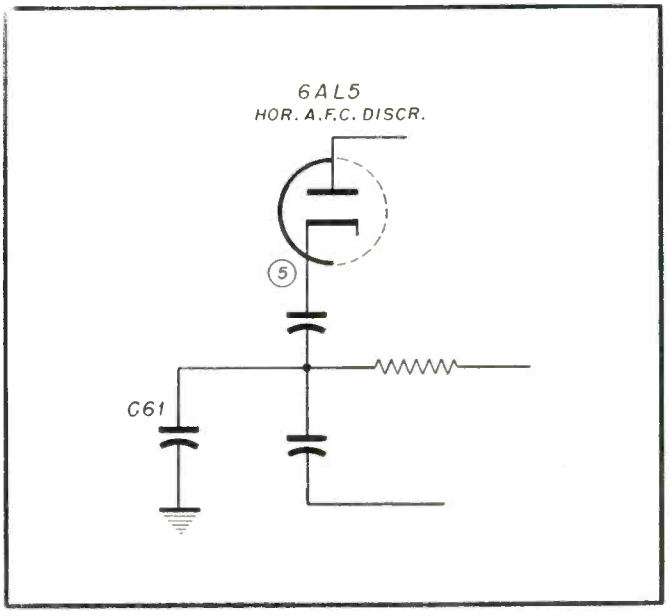
Section Affected: Pix

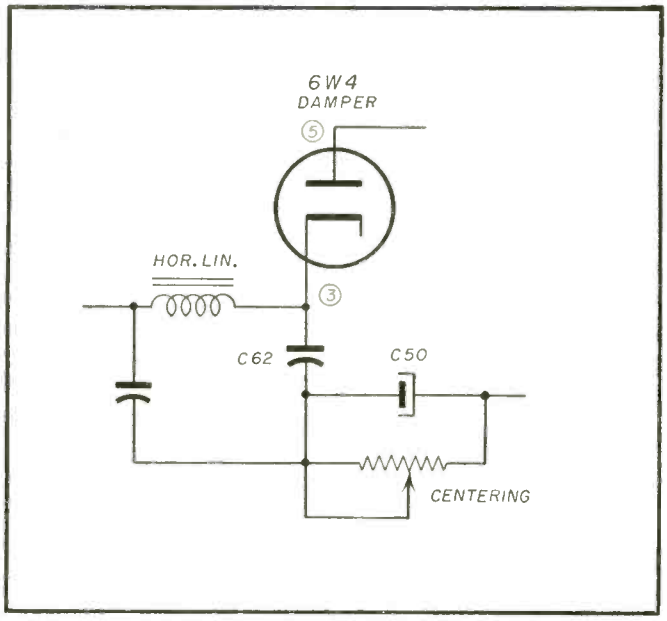
Symptom: Horizontal foldover.

Reason For Change: Improve time constants.

What To Do:

Change: *C61* from .005 μf 600 volt to .01 μf 600 volt.





Mfgr. CBS **Chassis No.** 700-10

Card No. A-4

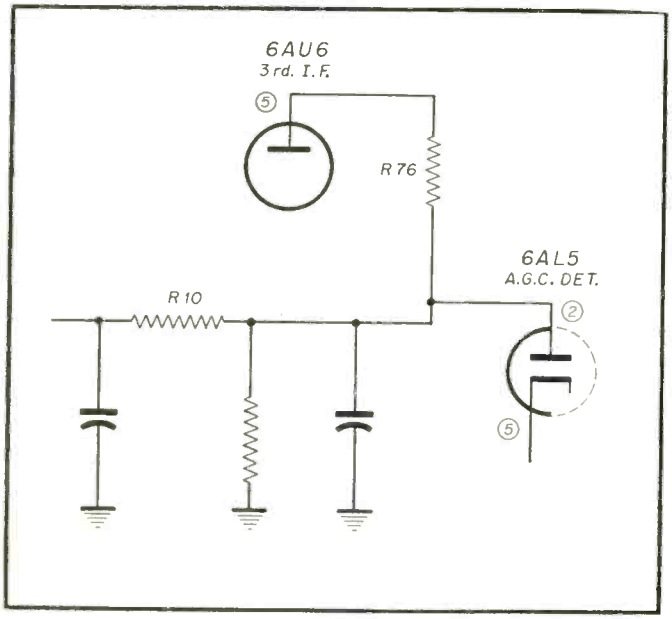
Section Affected: Pix

Symptom: Horizontal non-linearity.

Reason For Change: Improve horizontal linearity.

What To Do:

Change: *C62* from 0.1 μf. to .05 μf- 600 volt .
C50 from 0.25 μf. to 25 μf- 12 volt electrolytic.



Mfgr. CBS **Chassis No.** 700-10

Card No. A-5

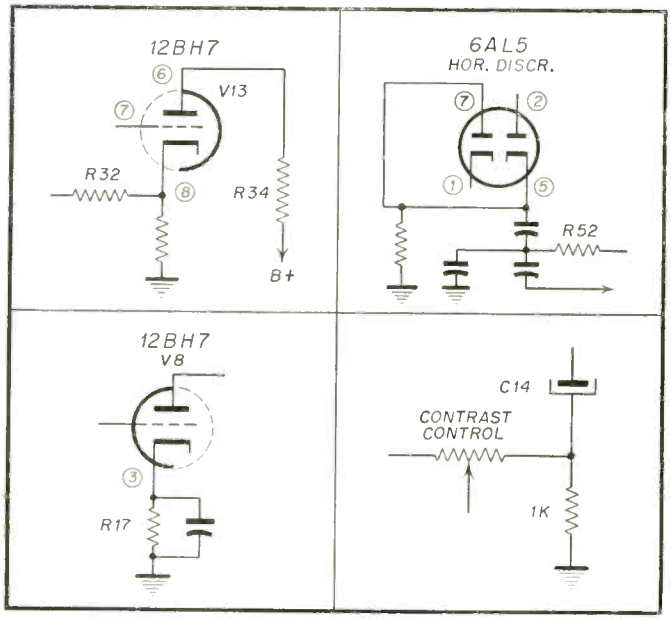
Section Affected: Pix

Symptom: Insufficient contrast range.

Reason For Change: Vary the amount of *a.g.c.* to the I-F's.

What To Do:

Change: *R10* from 2.2 meg. to 1 meg.
R76 from 1 meg. to 3.3 meg.



Mfgr. CBS **Chassis No.** 700-10

Card No. A-6

Section Affected: Sync.

Symptom: Sync instability; horizontal and vertical roll.

Reason For Change: To improve sync.

What To Do:

Change: *R32* from 3.9K to 1.8K (*Fig. 1*).
R34 from 3.3 meg. to 1 meg. (*Fig. 1*).
R52 from 6.8K to 2.7K (*Fig. 2*).
R17 from 560 ohms to 330 ohms (*Fig. 3*).

Add: 1K ½ watt resistor between *C14* and ground (*Fig. 4*).

Mfgr. Emerson **Chassis No.** 120118

Card No. E-1 **Code No.** △4

Section Affected: Pix

Symptom: Pix overloads.

Cause: Insufficient *A-G-C*.

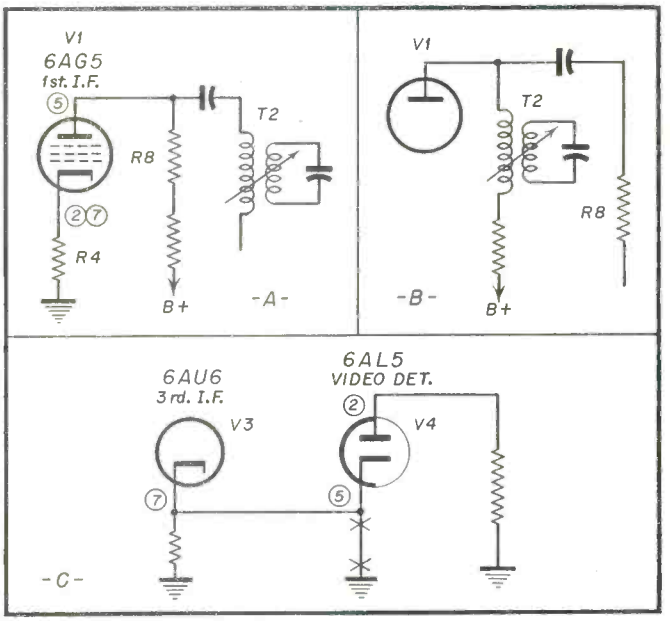
What To Do:

Change: *R4* from 68 ohms to 220 ohms (*Fig. A*).

Circuit Changes:

Switch connections of *R8 and T2* (*Figs A and B.*).

Disconnect pin 5 of *V4* from ground and connect to cathode of *V3* (*Fig. C*).



Mfgr. Emerson **Chassis No.** 120118

Card No. E-2 **Code No.** △2

Section Affected: Pix

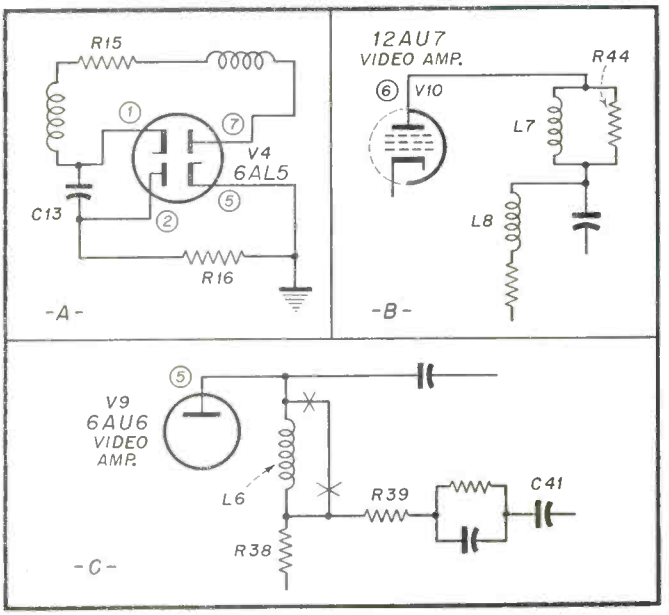
Symptom: Picture fuzzy.

Cause: Poor high frequency response of video amplifier.

What To Do:

Change: *C13* from 47 μμf to 24μμf (Fig. A).
R15 from 6.8K to 4.7K (Fig. A).
R16 from 33K to 68K (Fig. A).
L8 from 440 μh to 110 μh (Fig. B).
C41 from .05 μf to .01 μf (Fig. C).

Reconnect: *R39* from plate of *V9* to junction of *L6 and R38*.



Mfgr. Emerson **Chassis No.** 120118

Card No. E-3

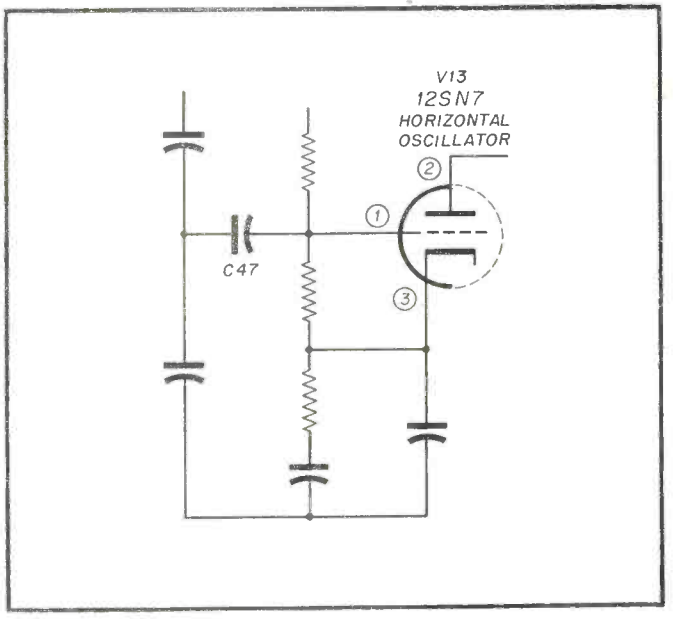
Section Affected: Pix

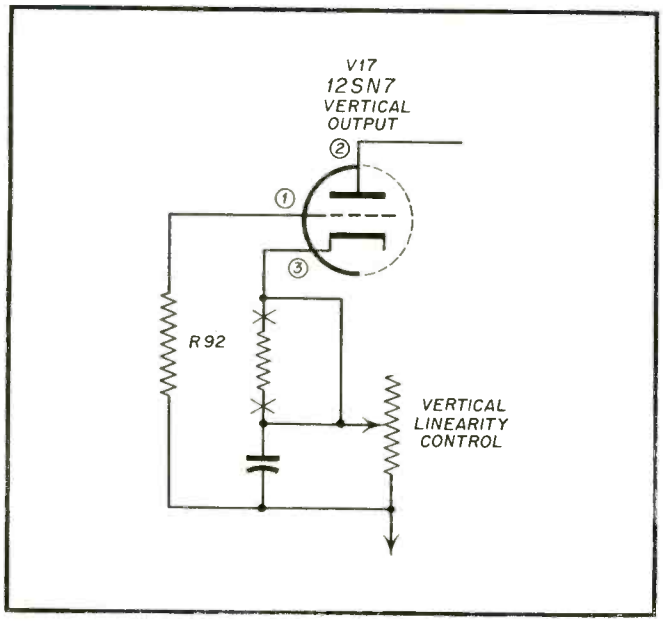
Symptom: Continuous horizontal oscillator drift.

Cause: Component failure.

What To Do:

Replace: *C47* -.002 μf 400 volt—with a .002 μf 600 volt condenser.





Mfgr. Emerson **Chassis No.** 120118

Card No. E-4 **Code No.** △5

Section Affected: Pix

Symptom: Vertical non-linearity

Cause: Non-linearity when using 12BH7 for vertical oscillator and output.

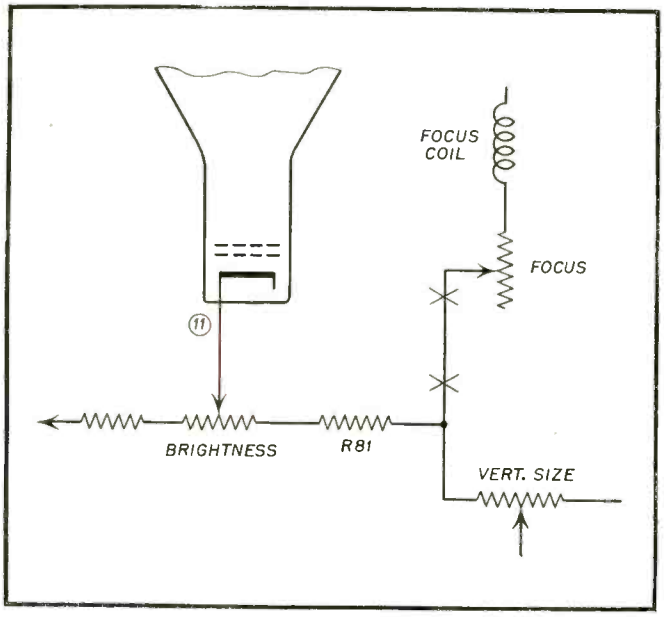
What To Do:

Replace: *12BH7* with *12SN7*.

Change: *R92* from 1 meg. to 4.7 meg.

Remove: 560 ohm resistor between cathode and linearity control

Reconnect: Linearity control directly to cathode.



Mfgr. Emerson **Chassis No.** 120118

Card No. E-5 **Code No.** △3

Section Affected: Pix

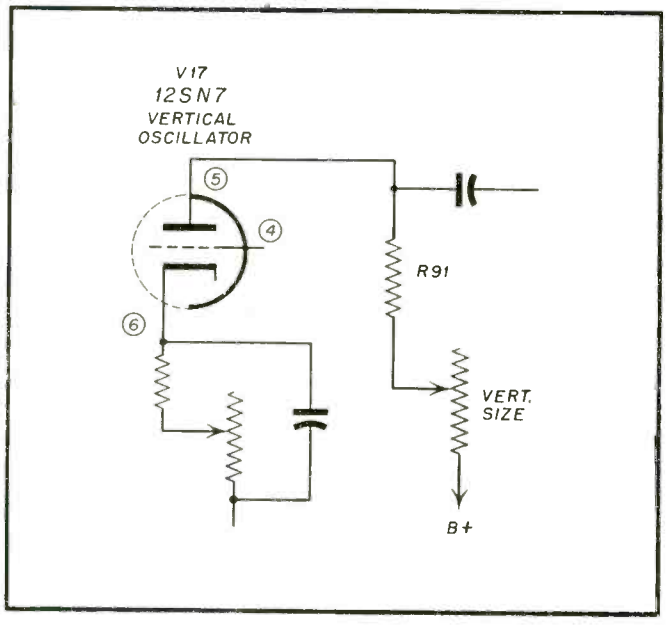
Symptom: Focus adjustments change brightness.

Cause: Interaction between focus and brightness controls.

What To Do:

Change: *R81* from 68K to 220K.

Reconnect: *R81* from focus control to B+ lug on vertical size control.



Mfgr. Emerson **Chassis No.** 120118

Card No. E-6 **Code No.** △7

Section Affected: Pix

Symptom: Insufficient height.

Cause: Low plate voltage on vertical oscillator.

What To Do:

Change: *R91* from 3.3 meg. to 2.2 meg.

Mfgr. Sentinel **Model No.** 412, 413, 414, 421, 422

Card No. 412-1

Section Affected: Raster

Symptom: No raster.

Cause: Component failure.

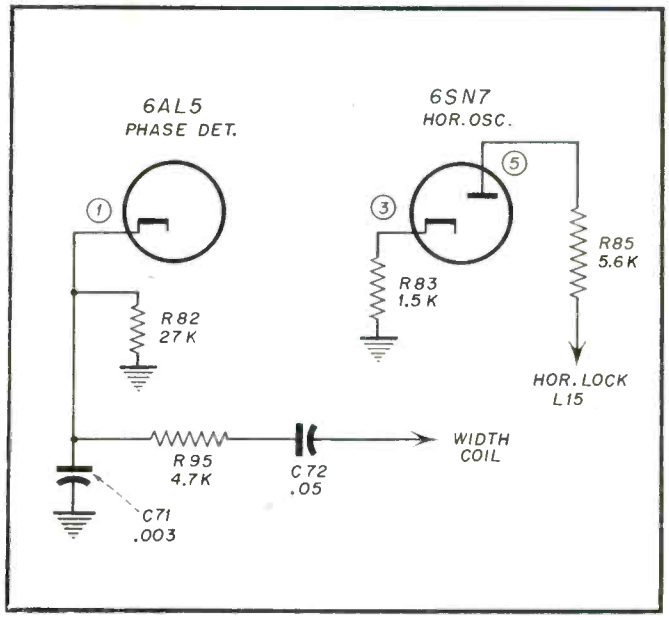
What To Do:

Check: *C72* for partial short or leakage. If raster is restored after 6AL5 phase detector is removed from socket, replace *C72* with .05 μf - 1000 volt condenser, then,

R82 - 27K for possible change in value.
R85 - 5.6K (5%) for possible change in value.

R95 - 4.7K for possible change in value.
R83 - 1.5K (5%) for possible change in value.

C71 - .003 μf - 200 volt for leakage or partial short.



Mfgr. Sentinel **Model No.** 412, 413, 415

Card No. 412-2

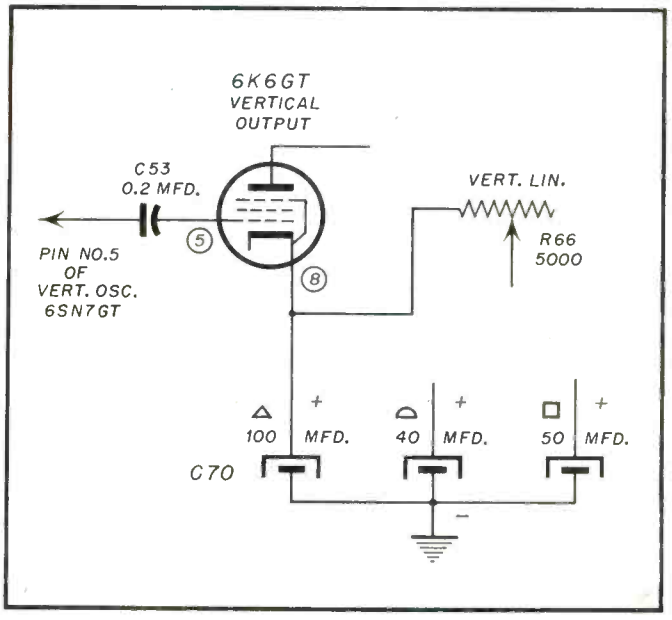
Section Affected: Raster and Pix

Symptom: Vertical raster small or vertical linearity very poor.

Cause: Component failure.

What To Do:

Replace: 100 μf cathode by-pass section of *C70* (marked △) *C53* - 0.2 μf.



Mfgr. Sentinel **Model No.** 412, 413, 415

Card No. 412-3

Section Affected: Raster

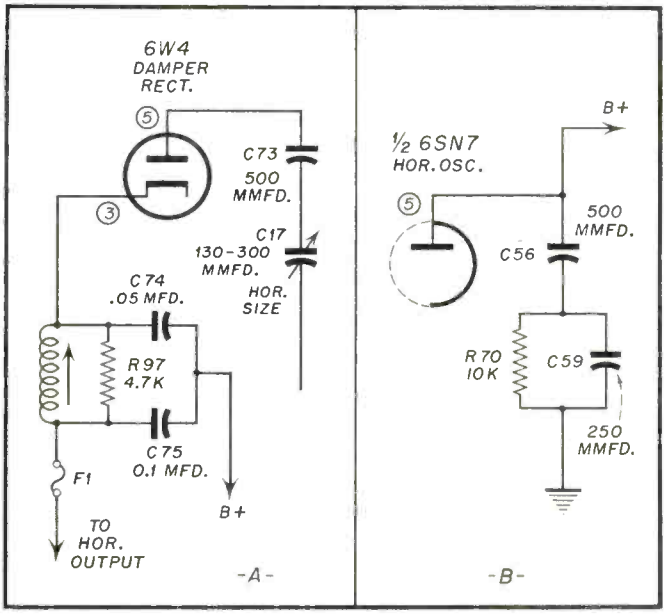
Symptom: Horizontal raster too small.

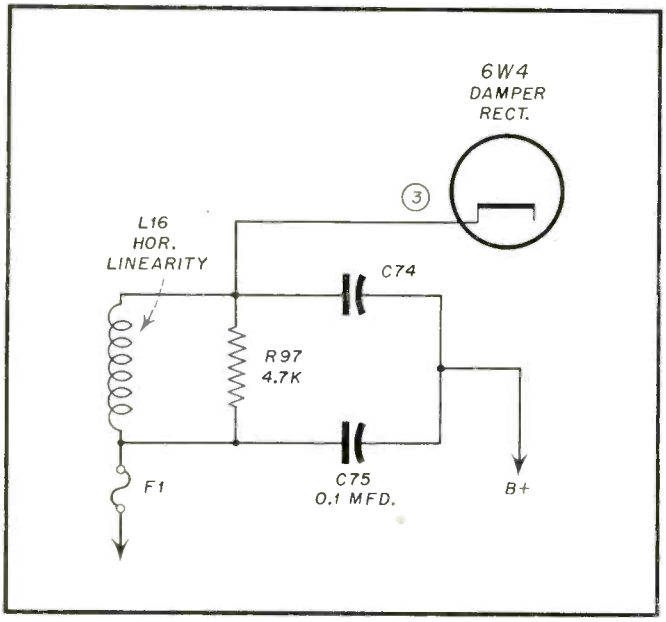
Cause: Component failure.

What To Do:

Check: *C73* (500 μμf) for open (Fig. A).
C74 (.05 μf) for leakage (Fig. A).
C75 (0.1 μf) for short (Fig. A).
C59 (250 μμf) for open (Fig. B).

Replace: *1X2* high voltage rectifier tube.
6W4 damper rectifier tube (Fig. A).





Mfgr. Sentinel **Model No.** 412, 413, 415

Card No. 412-4

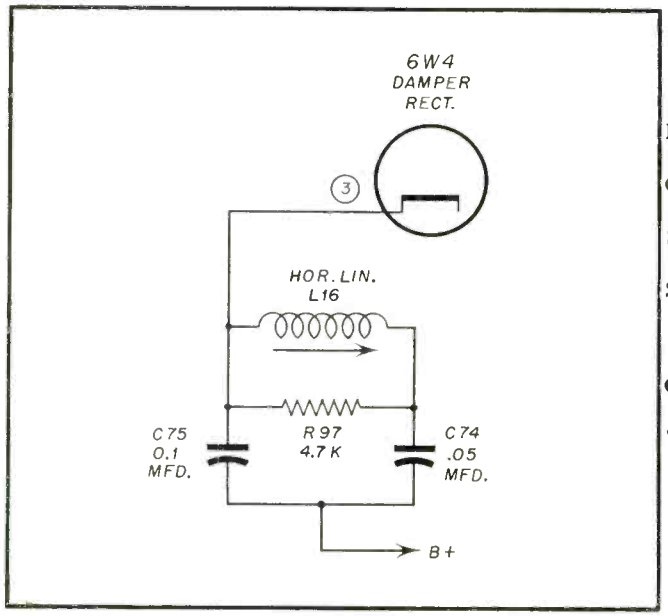
Section Affected: Pix

Symptom: Poor horizontal linearity. Horizontal linearity control has no effect.

Cause: Component failure.

What To Do:

Check: *C74* (.05 μf) for open.



Mfgr. Sentinel **Model No.** 412, 413, 415

Card No. 412-5

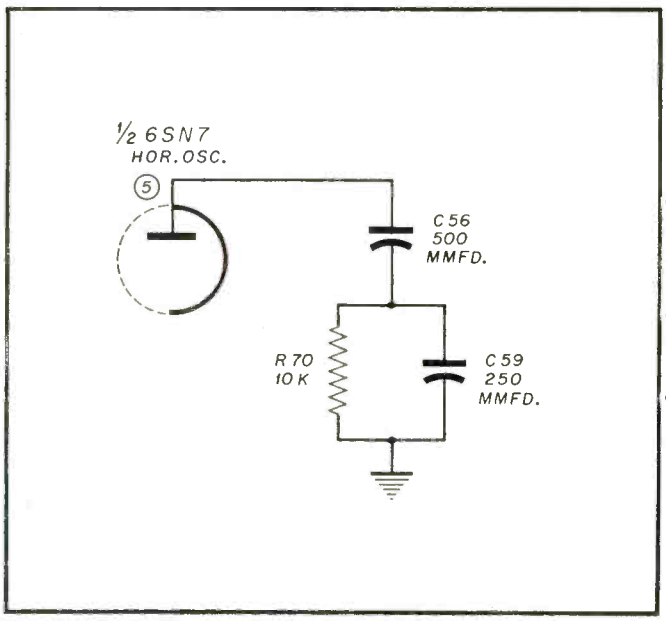
Section Affected: Raster

Symptom: Horizontal raster too small. Poor linearity. Vertical white line on left side of pix.

Cause: Component failure.

What To Do:

Replace: *C75* -0.1μf (open).



Mfgr. Sentinel **Model No.** 412, 413, 415

Card No. 412-6

Section Affected: Raster

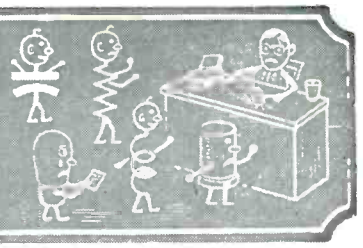
Symptom: Horizontal raster too small. Left side of pix cutting off or flattened out.

Cause: Component failure.

What To Do:

Replace: *C59* - 250 μμf (shorted).

CIRCUIT COURT



Emerson 120166-D

The Emerson 120166-D *(Fig. 1)* has several interesting circuit variations which tend to make for better fringe operation. *Figure 1a* shows the use of both average and peak *agc*. The peak *agc* developed is applied to the r-f amplifier. The average *agc* is applied to the *i-f*'s.

The reason for this division lies in the fact that in fringe areas, the noise content of the received signal is added to the desired signal in the average type *agc*. This is mainly due to the long time constants of this type of *agc* system.

This *a-g-c* if applied to the *r-f* amplifier will decrease its sensitivity. This sensitivity reduction decreases the signal to noise figure of the amplifier. This, in turn, further causes poor picture quality. The *i-f* amplifiers on the other hand require the greater *agc* to reduce the noise generated in the tubs.

The half of the *6AL5* containing pins *2* and *5* constitutes the peak *agc* rectifier. Pin 2 is coupled to the last if transformer through *C14*, a 22 $\mu\mu f$ condenser. As the i-f envelope starts in the positive direction the diode conducts. The plate current flows from pin *2* through *R15* to the cathode. *C15* discharges to the peak negative voltage through *R16*. When the tube stops

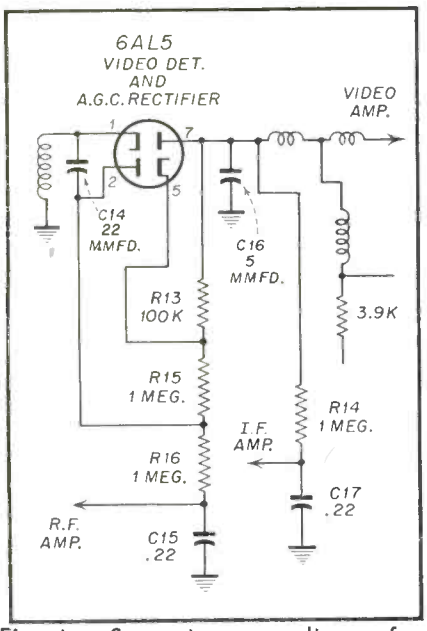


Fig. 1a—Separate agc voltages for r-f and i-f circuits in Emerson TV.

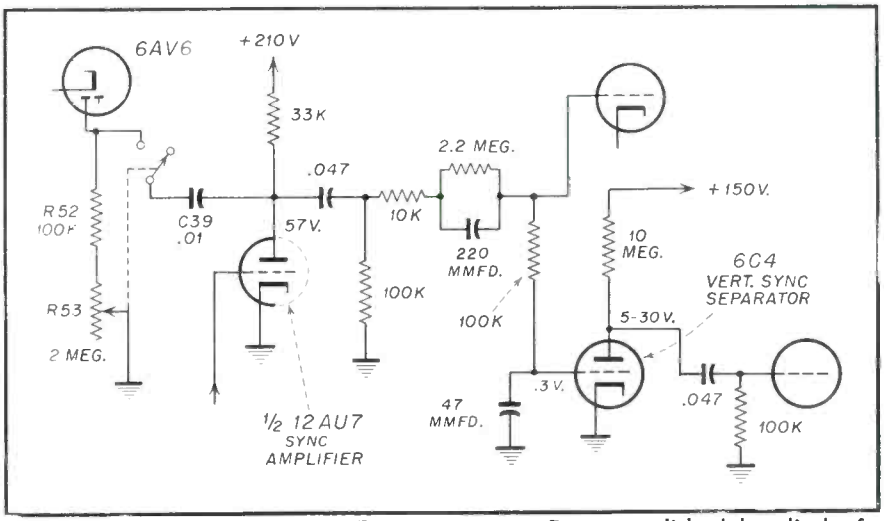


Fig. 1b—Noise suppression in Emerson 120166-D accomplished by diode for fringe area reception.

conducting *C15* charges through *R13, R14, R15*. The voltage on *C15* constitutes a bias on the diode. The *RC* time of the network is such that the diode is cut-off except on the peaks of the sync pulse. The voltage on *C15* is applied to the grid of the r-f amplifier. The other half of the *6AL5* is used as a video detector. The rectified signal is fed to the grid of the video amplifier. The signal is filtered through *R14* and *C17*. This average voltage is fed to the grids of the *i-f* amplifiers.

The circuit in *Fig. 1b* shows an attempt to meet the problem of noise pulses in fringe area reception. The first point of note is the noise suppressor diode in the sync amplifier plate circuit. The grid of this tube is fed from the sync take-off point in the video detector. The cathode is grounded.

The plate returns to +210 volts through *R53*. The average plate voltage is about 55 volts. In strong signal areas, the switch 52 on the "Fringe Compensating" control is open. In fringe locations, the plate circuit of one of the *6AV6* diodes is coupled to the amplifier plate by means of *C39*. The composite signal is fed to the grid sync phase negative. If the signal is weak, as it would be in fringe areas, there is likely to be strong noise pulses. The signal appearing at the plate will cause the diode to conduct. This diode current will apply a bucking negative voltage to the amplifier plate. This voltage will be greatest at the noise pulses. *R51* controls the amount of back bias developed.

The next method of preventing noise from disturbing the sync circuits is by having separate sync stripper and amplifier circuits for the horizontal and the vertical. When both sync pulses are amplified jointly, the circuit values of necessity must be compromises. The requirements for best operation of the 60 cycle vertical and the 15.75 kcs horizontal circuits are different. By designing each strip to its own optimum requirements, the vertical can present much better discrimination to all higher frequency pulses and can thus reject noise pulses better.

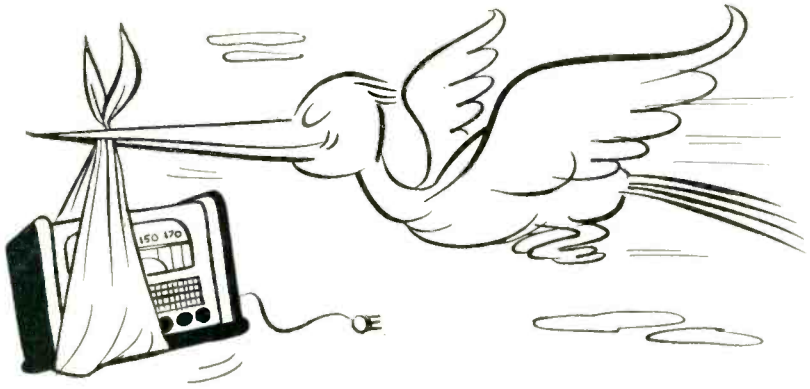
Stewart-Warner No. 21T-9211B

The model being analyzed (*Fig. 2*) utilizes the fact that the screen of a pentode can make the tube function as a limiter. In this case, the tube is made to act as a controlled noise limiter, in fringe areas. This is accomplished in the following manner:

The screen load resistor consists of two ganged potentiometers in series with a fixed resistor. In the maximum "distance" position of these controls, there is a maximum resistance. In the maximum "local' position, there is a minimum resistance. This to some extent controls the screen voltage and, thereby, the plate current.

In order to make this action less sporadic, a d-c amplifier is placed

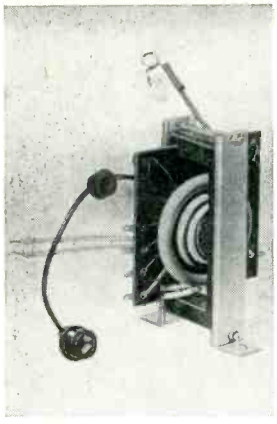
(Continued on page 51)



New Products

EXACT REPLACEMENT FLYBACK TRANSFORMERS

Model XO71, exact replacement for Admiral Part #79C30-1 and 79C30-3; and Model X072, exact replacement for Admiral Part #79C30-4 —are the latest in their complete line of horizontal output transformers just released by Ram Electronics Sales Co., South Buckhout Street, Irvington-on-Hudson, N. Y.



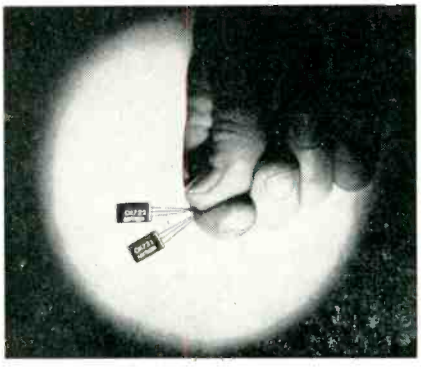
These 2 transformers are designed and constructed to the exact specifications of the set manufacturer and are guaranteed to equal or better the characteristics set up for them.

Both models are engineered for 66-70 degree horizontal deflection angle, utililize the new high-frequency Ferrite "E" core, and deliver up to 15 KV with excellent stability for optimum performance of the circuit.

TRANSISTORS

Culminating four years of intensive research in the field of semi-conductors Raytheon announced commercial availability of Germanium Junction Transistors.

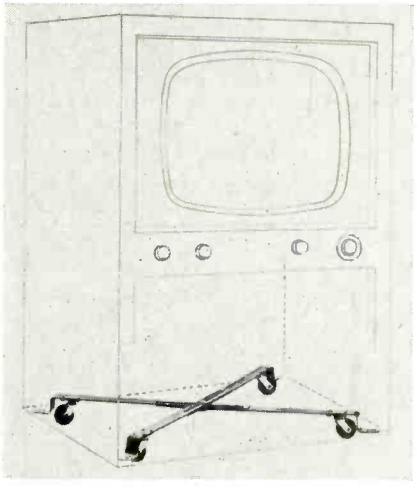
The new Raytheon transistors, types CK721 and CK722, are extremely compact and rugged units which will make possible a host of electronic devices previously considered fantastic. Commercial announcement of the new Raytheon junction transistor gives new impetus to development of desk size computers, electronic control devices for automatic manufacturing equipment, lightweight electronic control equipment for aircraft and guided missiles and other electronic applications of practically unlimited possibilities.



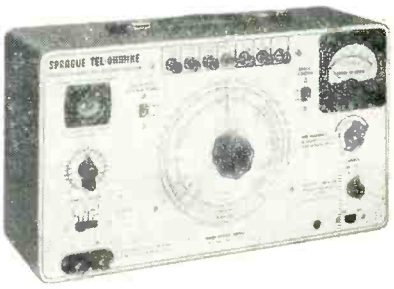
Although a portion of the initial output of the new Raytheon transistors will be channeled to top priority defense applications, Raytheon is now engaged in filling Distributor pipelines to accommodate the pent-up demand for this exciting and long-awaited announcement.

ROLLER-COASTER FOR MOVING TV CONSOLES

. . .A new caster assembly for television sets is rapidly finding its way to market through parts jobbers and service dealers. The Walter L. Schott Company is introducing its new Walsco **TV Rolabout**, an ingenious roller-coaster idea that fits almost any television console. Regardless of size, the **TV Rolabout** can be adjusted and installed in a matter of minutes.



With 4 ball bearing casters mounted on a heavy steel cross brace which is attached to the base of the cabinet, the **TV Rolabout** allows for simple movement of even the largest television console. The television set can be turned in any direction with very little effort. And the housewife finds this to be convenient, too, for cleaning under and behind the set. Servicing the chassis is likewise made easier for the repair man.



TEL-OHMIKE ANALYZER

Designed especially to meet needs of television servicemen for a fast, accurate capacitor-resistor analyzer, the new Sprague Model TO-4 Tel-Ohmike incorporates mny new features.

These include pushbutton range selection, extended capacitance ranges from 1 mmf to 20,000 mf with a special improved accuracy low range for checking small ceramic and molded "gimmick" capacitors, direct meter reading of insulation resistance up to 20,000 megohms for checking all types of electrostatic capacitors, direct leakage current readings of electrolytic capacitors at rated d-c working voltage, and a three-range power factor measurement of electrolytic capacitors for improved accuracy. All capacitors are automatically discharged for safety after test by simply releasing the range selector pushbuttons. A "magic eye" tube is used to simplify Wien bridge balance on capacitance and resistance measurements.

Resistance measurement range of the Model TO-4 is from 2½ ohms to 25 megohms at line frequency. A complete, step-by-step 16-page technical manual is furnished with the new Sprague TO-4. The instrument is housed in a sturdy two-color gray cabinet. Net weight is only 12½ pounds.

TV BOOSTER WITH LOW NOISE

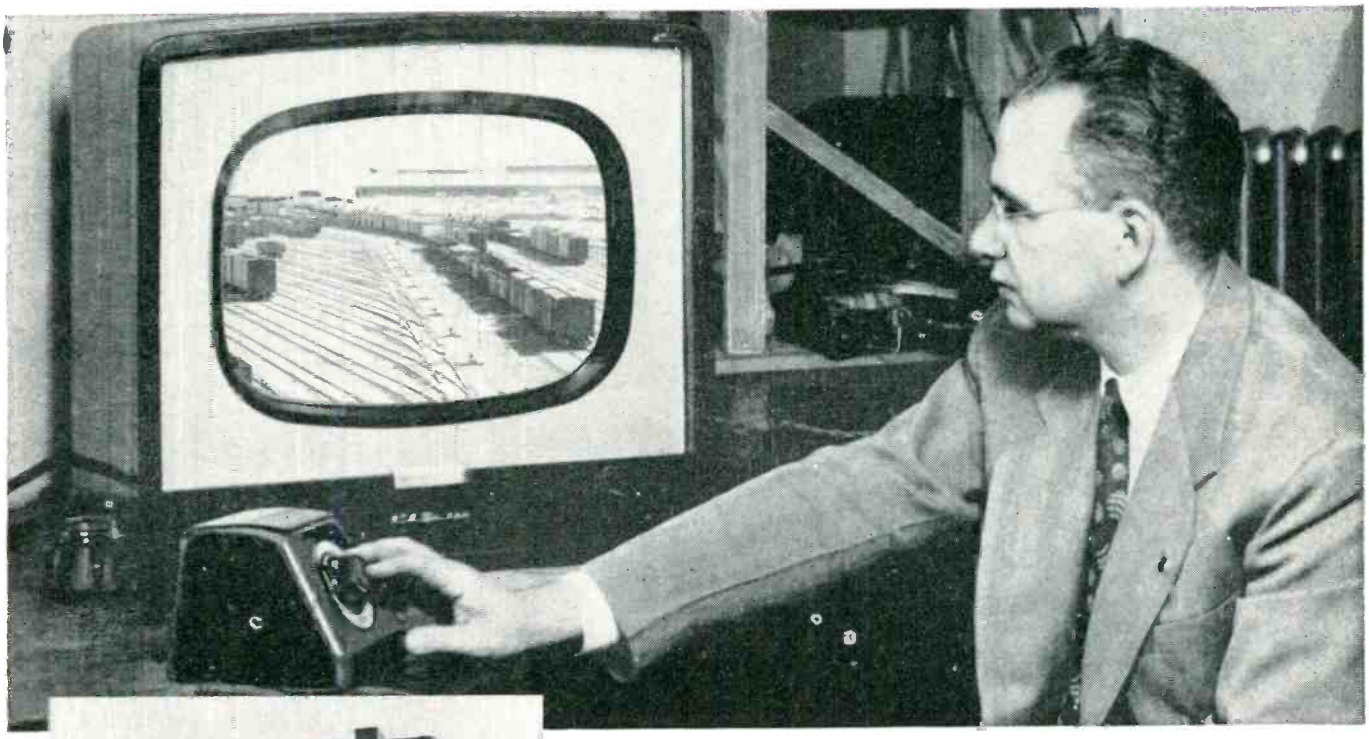
Channel Master Corp., has announced the introduction of Katy-B, a new kind of single channel TV booster, for which the company claims the highest gain and lowest Noise Figure ever achieved in any booster.

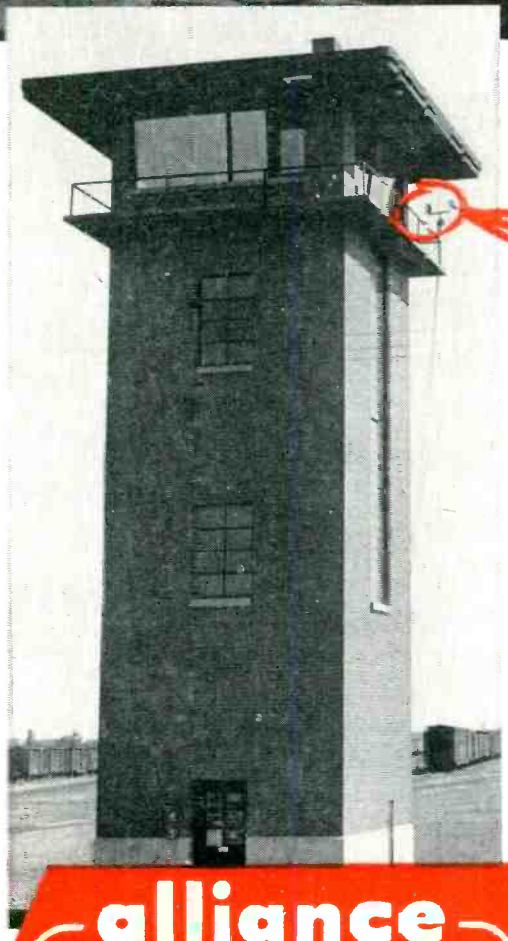
Katy-B was specifically designed to take advantage of the fact that booster performance depends primarily on Noise Figure. Gain alone is not enough. As a result, new design ideas were introduced to reduce noise while increasing gain.

To attain these goals, Katy-B incorporates the famous Low Noise 6BQ7 tube. In addition, it is the only single channel booster now made with a Cascode-type circuit.

It has a gain of 12 Times (22 DB) on the Low Band, and 8.5 Times (18.6 DB) on the High Band. Its Noise Figure is 4.5 DB on the Low Band, and 6.5 DB on the High Band.

ACCURACY, DEPENDABILITY, ALL-WEATHER OPERATION MAKE ALLIANCE TENNA-ROTOR VITAL IN RAILROAD TV!





Yardmaster now "watches" cars from desk as Alliance TENNA-ROTOR turns TV camera!

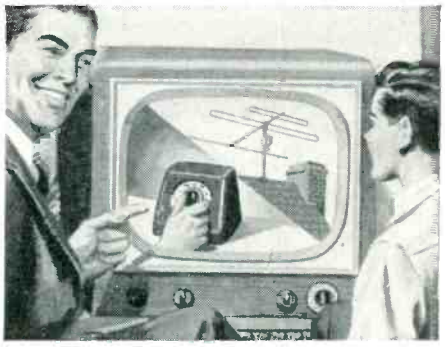
Alliance TENNA-ROTOR is "working on the railroad!"

Railroad yardmasters in the Baltimore & Ohio Chicago yards now speed their work. They use *television* to direct freight cars over the maze of switches and tracks. Small TV cameras mounted on Alliance TENNA-ROTORS rotate to scan any section of the yard. Yardmasters operate the TENNA-ROTOR control and observe the yard movements on the TV monitor screen, right at their desks!

Hundreds of thousands of TV viewers rely on TENNA-ROTOR's accuracy

New UHF stations are highly directional! Channels are changing on many stations . . . this makes many 'stay-put', single channel antennas obsolete! For accurate "on-the-beam" reception . . . UHF and VHF, Alliance Tenna-Rotor is the number one TV accessory!

Advertised on 60 TV stations. It pays to push the line that's pre-sold!



alliance
TENNA • ROTOR
TELEVISION ANTENNA ROTATOR

ALLIANCE MANUFACTURING CO. • ALLIANCE, OHIO

. . . sold the MOST because it's seen the MOST!

TV LINE SPLITTERS

Blonder-Tongue Laboratories, Inc. of Westfield, New Jersey presents a new group of TV accessories for dividing any TV transmission line into four branch lines. These units, called Line Splitters, are available in the following models:

Model LS4-1 Divides one 75 ohm line into four 75 ohm lines.
LS4-2 Divides one 300 ohm line into four 75 ohm lines.
LS4-3 Divides one 75 ohm line into four 300 ohm lines.
LS4-4 Divides one 300 ohm line into four 300 ohm lines.

B-T Line Splitters were designed to provide branch lines to Distribution Amplifiers in Master TV Systems. Requiring no power, they can be installed at remote locations. Precise impedance match and flat response over all VHF channels are unusual features in these low cost units.

B-T Line Splitters may also be used as an inexpensive means to provide reception for two to four TV sets, from one antenna. Interaction between TV sets, when present, can be eliminated by inserting attenuation pads between the Line Splitter and each TV set.

Each of the above Line Splitters is shipped wtih two resistors which provide proper termination of unused outlets. Spade lugs are included for convenience.

CAPACITOR CABINET & KIT

The Astron Corporation, E. Newark, N. J., has announced a new type plastic-metal capacitor storage kit. The cabinet, marketed under the name "Jiffy-Kit" conveniently stores by-pass and coupling capacitors in clear plastic drawers with identification labels all housed in steel. The "get-acquainted" campaign is aimed at the service man through authorized Astron distributors.

The capacitor kit features the Astron type AM, a molded paper tubular unit said to be highly resistant to humidity and designed for continuous operation at 85°C. The "Jiffy-Kit" contains 113 capacitors representing 26 different values claimed to be the most frequently replaced by service man.

SYLVANIA TEST CORD

Dealers demonstrating Sylvania Television with HaloLight now have a device which allows them to show the "Frame of Light" feature while standing as far as six feet from the television set.

A specially designed remote control cord attaches to the set allowing a dealer-salesmar to vary the intensity of HaloLight without having to divert his eyes from the prospect as he adjusts the HaloLight control on the front of the Sylvania TV receiver. Sylvania dealers may obtain the new remote-control HaloLight demonstrator cord from their distributors for a nominal cost.

NEW TESTER-REACTIVATOR-SPARKER FOR PICTURE TUBES

Transvision, Inc., of New Rochelle, N. Y., announces release to the television industry of its new CR Tube TEST-REACTIVATOR-SPARKER. Weighing only 6 lbs., this portable instrument is a complete testing and repair unit. It plugs into any convenient 110V receptacle. It is self-powered and completely self-contained and independent. Its three-fold function is as follows:-

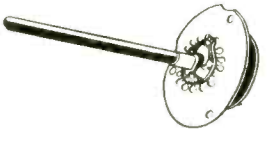
As a TESTER, this instrument measures Cathode emission, locates shorts between elements, and locates high resistance shorts or leakage as high as 3 megohms. It also indicates whether the tube has lost or is losing its vacuum.

As a REACTIVATOR, the unit can save many dim, worn-out tubes. **The reactivation can be done in the customer's home, without removing the picture tube from the TV set. As a SPARKER,** the unit sparks out electrical leakage which very often develops in picture tubes making them inoperative. The tube is saved and is as good as new instead of having to be discarded.

DETENT LINE COVERS REPLACEMENT NEEDS OF MANY TV SETS

Telematic Industries, 1 Joralemon Street, Brooklyn, New York, has broadened its line of Sturdy-Tune Detents so that it now includes eleven different detents to handle the replacement needs of nearly every brand TV receiver on the market.

The detents are available with or without a back plate. The availability of the Sturdy-Tune Detents without a back plate, if so desired by the serviceman, serves to cut the replacement cost.



NEW DISPLAY FOR "Q-T"

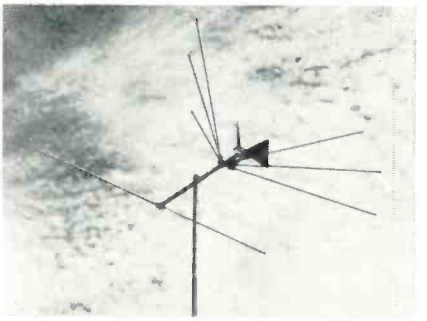
A small, compactly designed counter merchandiser highlights the packaging approach at the jobber's counter of "Q-T", a new solvent that quiets and preserves radio and television controls and contacts manufactured by Grayburne Corporation, 103 Lafayette Street, New York City. Sold to the jobber as a 12 bottle package, the yellow, blue and red container unfolds into a "silent salesman" at the point-of-sale.

VHF-UHF ANTENNA WITH ELECTRONIC FILTER

The JFD Manufacturing Company, Inc., of Brooklyn, New York is now rolling the heralded "JeT 283" off the production lines.

An unusual antenna designed for fine reception on Channels 2 through 83, in all but the far fringe areas, the "JeT 283" is a true combination of the famous JeTenna conical and the very practical triangular dipole for ultra high frequency reception. The latter is becoming better known as a "bow-tie" antenna.

To differentiate the UHF spectrum from the



VHF, a new electronic filter network has been designed for the "JeT 283." This system employs a unique high-pass and low-pass set-up, which isolates the VHF antenna from the transmission line—for the UHF antenna. This system operates in reverse for the VHF antenna.

GENERAL PURPOSE TEST METER SIMPLIFIES RADIO SERVICING FOR MOBILE TWO-WAY

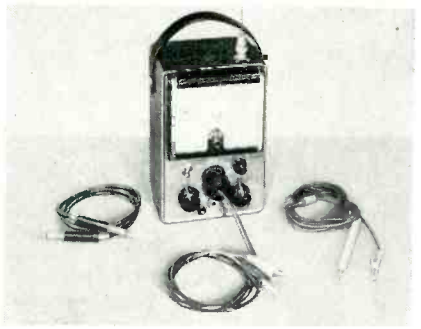
A new portable multi-range voltmeter and milliammeter, providing in one compact instrument the means for making all the electrical measurement necessary to install and service two-way radio communications systems, was announced this week by the Engineering Products Department of the RCA Victor Division, Radio Corporation of America.

The new general purpose test meter, RCA Type CX-7A, will measure current, voltage, and comparative radiated power. It is so designed that several related functions can be

When was the last time you were knocked on your

It won't happen again with the

MERIT



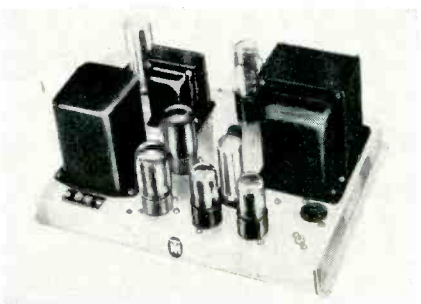
checked with a single arrangement of test leads, providing the equipment has built-in metering sockets or proper point-to-point checking facilities.

A typical application is the checking of the power amplifier loading of a mobile transmitter. This operation requires the measurement of grid drive, plate current, plate voltage, and the r-f output. In this case, one lead is connected to each of these circuits, and by simply operating the "function and circuit" switches, all the necessary readings and adjustments can be obtained to insure maxmum transmitter output at the rated plate power input.

HI-FI AMPLIFIER KITS

Tech-Master Products Co., long-established as the manufacturers of custom-built television circuit with unique modifications for true audio equipment with two amplifier kits. They are the Tech-Master Ultra Linear Williamson Type Amplifier Kit, Model TM-15A, and the Tech-Master Pre-Amplifier Kit, Model TM-15P.

The Tech-Master Ultra Linear Williamson-Type Amplifier Kit uses the famous Williamson circuit with unique modifications for true high fidelity reproduction at increased power output, 15 watts undistorted. It features a specially wound ALTEC LANSING Peerless audio output transformer. Frequency response is flat and smooth beyond the two extremes of the audible range, and distortion is less than .25% at normal listening levels, with excellent transient characteristics. The kit is furnished complete with punched chassis, transformers, tubes and all other components, and detailed wiring and assembly instructions.



NEW MINIATURE CIRCUIT BREAKER FITS STANDARD EDISON BASE FUSEHOLDERS

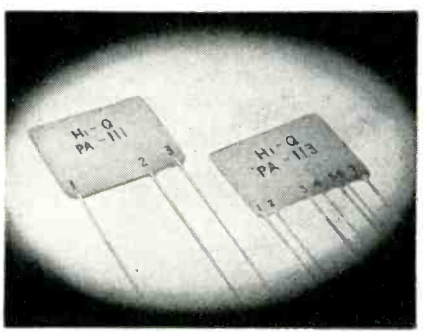
"MINI-BREAKER" is a new permanent type circuit protective device that fits like a fuse in any standard Edison base fuseholder delivering up to 125 volt A.C. service. It requires no additional equipment and no special wiring when applied to branch or main circuits of corresponding 15, 20, or 30

ampere ratings. Anyone can install it in a matter of seconds, and anyone can restore electrical service simply by pressing in and releasing its shock-proof reset button.

CERAMIC PRINTED CIRCUITS

Remarkably compact and convenient combinations of ceramic capacitors, resistors and printed conductors in units called plate assemblies, are offered by the Hi-Q Division of Aerovox Corporation, Olean, N. Y. Such units are now being used with distinct advantages for dependable miniaturization in TV, hearing aids, etc.

These plate assemblies are the most versatile of electronic components. The number and combination of capacitors/resistors which can be incorporated in a single unit is virtually endless or limited only by the K of the material and the physical size. Such units not only contribute to dependable miniaturization but also simplify assembly by reducing the number of soldered leads. The unit sizes are of the order of 1-1/16" long by 9/16" or 13/16" wide and by 5/32" thick.



Among the generally used Hi-Q plate assemblies are vertical integrators, vertical integrator and coupler units, audio plate-grid couplers, second detector and audio amplifier couplers, pentode second detector and audio amplifier units, and pentode plate coupler and screen supply units.

MINIATURE DC POWER PACK

The Jersey City Technical Laboratory announces the addition to its line two 'Mini-Pack" power supplies. The "Mini-Pack" is a small selenium rectifier source of instant power for the serviceman, technican, experimentor or ham who may need a handy convenient power source available at all times. The "Mini-Pack" is designed to plug into a standard AC female receptacle. Power is available at screw terminals which are extra long so that spade leads or alligator clips may be readily affixed.

Association News

National Alliance of Television & Electronic Service Associations (NATESA)

A meeting of NATESA was held at the Conrad Hilton Hotel in Chicago on Dec. 6 and 7, 1952.

Officers elected—Frank J. Moch, President; Bertram Lewis, Eastern Vice President; Fred Colton, East Central Vice President; Vincent Lutz, West Central Vice President; Jack McDowell, Secretary General; John Hemack, Treasurer; Harold Rhodes, Eastern Secretary; W. A. Rosenberg, West Central Secretary and Gerald Ratner, Legal Counsel.

A committee was set up to implement and put into force a definite plan for man-power training and qualification to create an immediate labor pool. A speakers bureau and training coordination plan will also be set-up.

A committee was set up to select the recipients of the NATESA "Friends of Service Management" awards from those nominated.

A committee was appointed to work out the details of a Seal of Acceptance plan. Under this plan, set manufacturers can earn the right to use the Acceptance Seal for any model which is designed so as to be simple to service. The manufacturers general attitude toward service will be a major determining factor in approval.

The spring NATESA meeting was changed to make it a "floating" meeting. Each NATESA affiliate will in turn host this meeting in their headquarters city. The next spring meet will be held in Kansas City, under the auspices of Television Service Engineers, Inc.

A plan was presented for the establ- Internal Revenue department, OPS, FTC local zoning boards and other governmental agencies to help clean up frauds within the industry.

A plan was presented for the various affiliates to "visit" each other

through the medium of tape recordings.

A plan was approved for consumer education through lectures and talks before various fraternal and other groups such as PTA and Rotaries.

Radio & TV Technicians Guild of Florida Inc.

REVIEW OF '52

The R&TTG had a full year of activity—with 12 general meetings and 12 Board meetings. The Guild, while still in the infant stage has accomplished more than appears on the surface.

Our first achievement was our banquet, which for the first time brought together at a social gathering, many of the electronic technicians with the Gal of his life. This was a great success and will be an annual affair and will be our Inaugural Dinner for newly elected officers.

The Guild joined the National Electronic Technician and Service Dealers Association. This association represents the Guild in all matters on a national scale — which we, by ourselves, could not afford to do. The record of achievement of NETSDA speaks for itself.

Next we formed an advertising committee, and for the first time in the history of Miami, the electronic technicians put across to the public a code of ethics by which we have all gained more respect from the general public.

Our next venture in serving our community was to make application for membership in the Miami Chamber of Commerce. The C. of C. after careful consideration of R&TTG saw fit to accept us as members.

Through the C. of C. we will, in the future, be able to serve Miami in heretofore undreamed of ways. The Guild has pledged to Miami through the C. of C. to do all in its power to give the public better service in an ethical manner never known before in this city in regards to radio and TV.

The Guild held its first annual picnic this past summer at Crandon Park. This was our second social affair of the year. All of the men, their wives and children who attended had a wonderful time.

As a public service feature and with the cooperation of all the local distributors and Eastern Air Lines, the Guild displayed at the Colonial Hotel on Biscayne Boulevard, a modern service shop. It described the uses of all the equipment necessary to efficient electronic servicing. Thousands of people viewed this display with an intense interest. TV service men in the Miami area were amazed

at the public reaction and interest.

Throughout the year, we have—as we shall continue to do in the future—fought to combat all unethical practices and advertising in regards to radio and TV service. This problem being so large in this city we could only take one case at a time. Our results—five investigations resulted in four cases, who, after being shown where they were hurting themselves, as well as the public, have changed to more ethical practices. The fifth case was out of business before we could conclude the investigation.

Happy holiday to ALL.

Editor.

Phila. Radio-Service-Men's Association (PRSMA)

On the evening of November 13, 1952, at the Broadwool Hotel a Sylvania service series meeting was held, sponsored by Radio Electric Service Co. and Albert Steinberg and Co., Sylvania Distributors, with P.R.S.-M.A., TCA and TEAP co-sponsors.

Bob Grow was the speaker and delivered a very fine lecture illustrated with slides, blackboard drawings of diagrams and demonstration equipment that included a typical television receiver and various test instruments.

RCA has just demonstrated a portable television receiver at its Princeton, N. J. research center. All tubes in this receiver are replaced with transistors except the 5 in picture tube. The complete set weighs only 27 pounds.

Looking over some of the radio and television trade papers you see news items about the large net profits of the set manufacturers that run up into the hundreds of thousands and some into the millions of dollars you would think that they would spend a little more to educate and help the service men who keep all these sets operating for the consumer. The service man needs help to do the right kind of work on these very complicated circuits used in television receivers.

Did you know that OPS price controls are back on tubes, parts and phonos? The control order is dated October 26 1952.

That much disliked advertisement on the air selling a book entitled "Fix your own television" should not be. Worst yet, they show a card where you can get a 40% discount on tubes. Why does this have to be?

Federation of Radio Servicemen's Associations of Pennsylvania

Each year the Federation's membership votes to present its annual award to the manufacturer, broadcaster, publisher or individual who contributes the most to the welfare of the electronic servicing dealer or technician.

This year the award will be presented to the General Electric Company in recognition for their initiative in providing a public relations program in behalf of the independent television technician. The presentation will be made on January 18, 1953 at 1 P.M. in the Hotel Harrisburger.

Officials of the General Electric Company will be present to accept this award. In addition to many other outstanding figures in the other segments of the industry, representatives of servicing dealers and technicians associations will also be present.

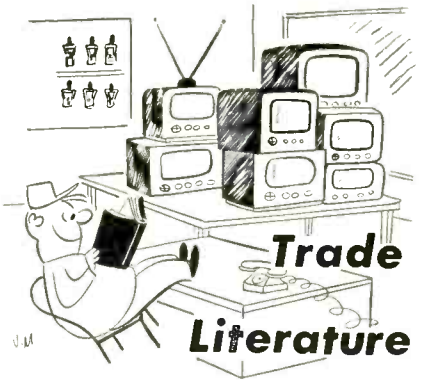
ASSOCIATIONS . . .
don't forget to send in news of your activities.

The transition of the Radio-TV service shop from a "hole in the wall" to a modern and inviting establishment has reached accelerated proportions in the last year. The Abington shop above is what we would like to show more of.

Abington Expands—Good Luck!

Abington Service Corporation has begun construction on its expanded headquarters at 107 Nassau Boulevard, Garden City South. At this address Abington will combine all its service facilities.

The shop will include a specially designed functional TV and radio service shop. Both indoor and outdoor drive-in facilities for automobile radio repairs will be incorporated and its present shop for service on Hotpoint major appliances which it does exclusively in Nassau County, Long Island, New York, will be enlarged.



* * *

Title: Television Engineering 2nd Edition
Author: Donald Fink
Publisher: McGraw-Hill
702 pages
512 illustrations + appendix & index

Mr. Fink's book, while formally labelled Second Edition is practically a new text. The reliable book which first appeared in 1944, has been completely revised and new sections added. The result is a must on the shelf of any person in the television field. The practicing serviceman will find it very convenient for referral of new circuitry to basic principles.

The manner of presentation is similar to the first edition except that the circuit diagrams and illustrations are of present day sets. An entirely new section on color has been added. This section covers the theoretical aspects of color itself, the application of color principles to television and an analysis of various proposed commercial systems. This analysis is as complete as could be expected with the time of publishing (1951) kept in mind.

A thorough explanation is given of the principles and operation of current sync systems, a.g.c., i.f., horizontal oscilators, high voltage and sweeps systems. This edition is a natural for schools as a text and for servicemen as a reference book. L. L.

* * *

One can get so much more out of television if one knows the basic facts —the simple, everyday, helpful details. Such is the aim of a new book, *"What You Should Know About Television,"* authored by Jacob H. Ruiter, Jr., long identified with the cathode-ray art and with its popular aspect called television.

Written for the layman, the book takes a very sensible approach and does not attempt to make a TV expert out of each reader.

Profusely illustrated, printed in

exceptionally readable type, and featuring a different but highly practical format, this book deals with every phase of everyday television from the buying of a set and its installation, to simple trouble-shooting hints, yet with the constant admonition to call a qualified serviceman when first-aid measures prove inadequate. The book also deals with programming and studio activities; how telecasting really works; what makes the TV set tick; the future of the TV art, including the meaning of UHF and eventual color; job opportunities in television; and finally, the latest FCC allocations in both the VHF and UHF ranges.

Published by J. H. Ruiter Publishing Co., Box 151, Somerville, N.J.
Price—$1.00

VERTICAL DEFLECTION

[*from page 20*]

A. While many manufacturers use printed circuits for the integrator, there are still many sets on the market which use individual components. Over a period of time, the capacitors show a tendency to leakage. It is advisable when other, more usual sources of trouble are checked and found to be in good working order, to remember that poor integrator components can cause vertical hold troubles.

B. Here again is would be advisable to check the B+. Since the B+ will determine the oscillator tube saturation point and also the amount of bias developed at the grid, any marked decrease in B+ will cause poor, critical, or intermittent vertical hold.

C. Check *R1* in the blocking oscillator type if after changing oscillator tubes, the hold suddenly becomes loose or intermittent. It may have changed value or may need to be increased or decreased 10% in value depending on whether the picture tends to "flop" up or down.

D. Be sure that if *C1* is changed, to replace it with a molded or oil-filled condenser of the *same voltage and tolerance rating*. Since this condenser is critical in determining the tube cut-off time, and oscillator frequency this requirement is self-evident.

4. INTERLACE

Poor interlace is like the "girl with the curl." When it is not important to by the customer, it is not important. *But* when you get a customer who objects to it, then you have quite a job on your hands. Most customers don't notice poor interlace, however,

since the advent of the 17" and larger tubes, the resulting larger black interline spaces has caused a great increase in complaints of "the black lines in the picture."

Let us examine what makes for interlace problems. To do this, we must go back to *Fig. 1*. As explained earlier, each frame is scanned twice. The first scanning field traces out the odd lines of the frame, and the second, the even lines. As a result, the second scan must start 1/525th of the raster below the start of the first scanning field.

This requirement means that the vertical oscillator must be triggered alternately, at two different times. The time difference should ideally be twice the horizontal frequency. The equalizing pulses determine the exact firing time.

The most common source of interlace problems is, unfortunately, built into a set. The serviceman can generally only try to work over something which is inherent to the set. This trouble source is the horizontal output pulse. This pulse, if sprayed into the vertical system, will cause the oscillator to trip at the same point every time. When this occurs, the condition known as "pairing" occurs. Often careful dress of the horizontal and vertical circuit leads will help the situation. This applies to the deflection yoke leads, as well.

One of the main sources of this spray is in the yoke, itself. This spray is fed back to the secondary of the vertical output transformer. This transformer, as we have seen, is step-down from primary to secondary. However, looking from secondary to primary, a signal originating in the secondary sees a step-up transformer. The pulse is thus amplified in the primary of the transformer.

Due to inter-electrode capacities, the signal appears at the grid of the output tube and is fed back to the plate of the oscillator. This feedback from plate to grid of the output tube is one of the main reasons for the use of pentodes as output amplifiers. When the yoke is the cause of poor interlace, it is sometimes possible to reduce the Q of the vertical output transformer. If the transformer is of the grounded secondary type, connect a 0.1μf-600 volt condenser across the secondary. Parallel the condenser with a resistor whose value would range from 330 to 1,000 ohms depending on the Q and Z of the circuit.

5. FOLDOVER

The most common sources of foldover are defects in the yoke, output transformer and vertical frequency timing circuits.

CIRCUIT COURT

[*From page 39*]

across the screen load resistors. The plate of the amplifier is connected to the same point as the screen of the video amplifier. Here is how the circuit operates—The cathode is grounded. The grid is returned to the agc buss. In this manner, the plate current which flows continuously is determined by the *agc* voltage. This plate current flowing through the screen load helps determine the screen voltage.

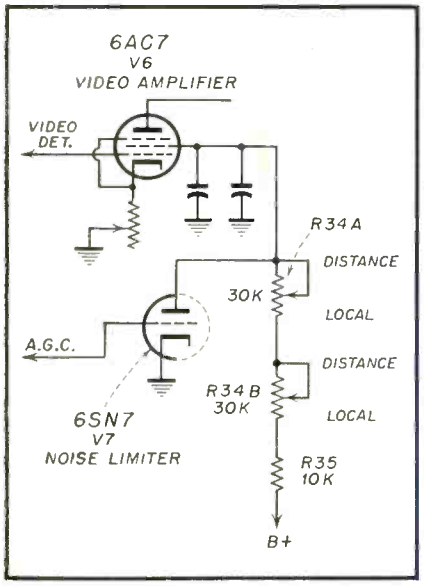


Fig. 2—Stewart-Warner video amp.

In a strong signal area, the ganged controls are shorted out. The bias on *V7* the d-c amplifier is high due to the high *a-g-c* developed in strong signal areas. The plate current of *V7* is, therefore, low. The result is that *R35* is the only load and the screen current plus the small V7 plate current do not cause any large drop across it.

In fringe areas, with *R34A* and *R34B* at maximum resistance, the screen load is now 70K instead of 10K. In addition, the weaker signal develops less *a.g.c.* This reduction is also a reduction in the bias of *V7*. *V7* therefore, conducts more heavily. This combination of increased load and increased current causes the screen voltage of *V7* to drop considerably.

The reduction of *V6* screen voltage results in *V6* clipping the tops of the signal in the plate circuit. We thereby have the plate circuit clipping in the fringe areas where noise pulses are most apt to exceed the amplitude of the sync pulse level. The composite signal is taken off the plate circuit of *V6* and is fed to the sync separator.

PUSH-PULL

[*from page 27*]

out the voltage at the junction of *R6* a large value of the signal present at the grid of *V3*. Thus, the system reaches an equilibrium wherein the phase inverter feeds the grid of *V4* with a signal having the same voltage as that appearing at the grid of *V3*.

Servicing Push Pull

As mentioned earlier, the advantages of the push-pull system are realized because of the balanced circuit arrangement. For this reason any unbalance which occurs can affect the quality of sound output. Thus, if one tube suffers a decline in emis-

sion, there will be an unbalance between the currents through the tubes and the tonal quality will suffer. The same holds true if one grid resistor becomes defective and its value increases beyond the identical resistor in the other tube.

An unbalance can be checked in several ways. One method is to insert a milliammeter in series with the cathode circuits of the individual tubes. In a well-balanced system, the currents through the individual tubes should be approximately equal. This method, however, necessitates unsoldering the cathode connections to the tube sockets unless test points are provided. A better method is to read the voltage between the plates of the push-pull tubes as shown in *Fig. 3*. A vacuum-tube voltmeter or multitester is placed between the test points designated *T5* and *T6* in the schematic, reversing the test prods to get a positive reading on the meter. A difference of more than five or ten volts indicates a proportionate current flow difference through the tubes. The greater the difference in voltage read between the plates, the higher the mismatch and in consequence the more the distortion that will be developed. Tube interchange can be tried, though the recommended procedure is to try several new tubes until two are found which have characteristics sufficiently similar to produce only a slight voltage difference between the plates. If this does not produce the necessary balance, a check should be made of the grid leaks and the transformer.

Distortion may also be produced by leaky coupling capacitors. In the absence of a capacitor checker, a vacuum-tube voltmeter can be placed between the grid and cathode of the tube as shown in *Fig. 3* (points *T1* and *T3*). In all instances the grid should show a negative polarity with respect to the cathode, whether or not a signal is present. If the voltage reading is *zero or positive*, the most likely trouble is a leaky coupling capacitor. The same test should, of course, be performed on the other tube using test points *T2* as against *T4*, or *T3*. If a new coupling capacitor does not improve performance, the tube may be gassy and thus cause a positive reading at the grid.

The relative balance of the primary of the transformer can be checked with a voltmeter. A reading between test point *T5* and *T7* should coincide with a reading between *T6* and *T7*. If a difference exists, shut off the receiver and use an ohmmeter between these two points to verify whether

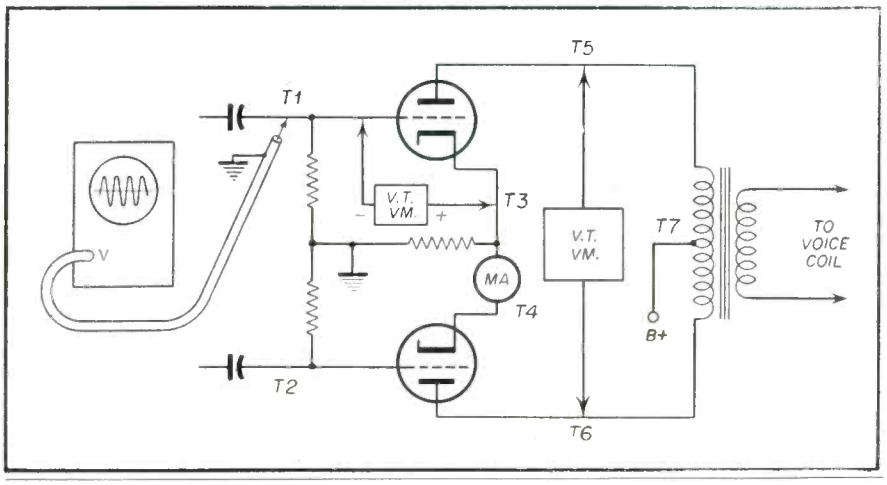


Fig. 3—Checking push-pull circuit with VTVM.

or not one half of the primary has shorted turns, or is otherwise defective.

Often a cathode capacitor is omitted from across the cathode resistor in push pull. If the system is well balanced the opposing signal currents through the resistor will cancel and no signal voltages will be present. Hence, a by-pass capacitor is unnecessary. Some manufacturers use one, however, to minimize degenerative effects across the cathode resistor should the system become slightly unbalanced. Thus, by temporarily shunting a cathode resistor with an 8 or 16 mfd filter capacitor, the degree of mismatch can be roughly ascertained. If a good balance exists, little difference in volume should be noticed. The same holds true for push-pull cathode circuits which already have a capacitor across the cathode resistor. Disconnecting the capacitor should make no difference in the volume of sound output. If an appreciable difference is present, the circuit should be checked for an unbalanced condition, starting with tube testing.

The proper function of the phase inverter circuit can be checked by using an oscilloscope. With the presence of an incoming signal (from an audio signal generator or detector output) the waveforms would show equal peak-to-peak values when the scope is placed at test point *T1* and *T2*.

Push-pull circuits in other television receivers are similar to the ones previously described and general servicing procedures apply in similar fashion. Major differences will be in the tube complement. Stromberg-Carlson, for instance, use a *6AU6* first audio in their *TS-124/15* television chassis. This is followed by a *6SC7* dual triode phase inverter and push-pull *6V6* output tubes. Tests for unbalance, leaky coupling capacitors, etc. are identical to those described for the other circuits.

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HI-FI MARKET

[*from page 25*]

the triode *V1* between them. The circuits of *Fig. 1* and *Fig. 2* both employ losser networks to accomplish the "boost" and "cut" actions. They simply allow the triode amplifiers to restore much of the lossed gain at either high or low ends of the frequency spectrum according to the positions of the slider arms of *R1* and *R2*.

Losser Networks Complex

More complex in design and construction, but even more effective, are the use of losser networks in two sections which approximate a bridged *T* filter (note that networks in *Figs. 1* and *2* are single section *R-C* filters) or which employ single section filters, not as losser networks, but instead as the frequency-selective portions of feedback loops.

Both of these approaches are used in the design of the step-type dual control system of *Fig. 5*. Although many engineers feel that the average consumer prefers the exact choice of setting afforded by continuously-variable controls, others believe that this convenience is more than offset by the advantages of the step-type.

Details of the particular circuit of *Fig. 5* are slightly simplified from the commercial version which has been most successful in its wide sale to home music enthusiasts. However, the principles are identical, and most of the details are the same. Bass control is effected by the two control switches *Sw1* and *Sw2*, on the left side of *Fig. 5*. Treble control is accomplished with *Sw3* and *Sw4*.

Practical Tone Control Consideration

It was felt by this designer that the customer more often wanted a fairly wide choice of bass boost, and less often required bass attenuation. Therefore the flat frequency position is not, as with the continuously cariable type of control, in the middle, but near one end. (Position *2* of *Sw1* and *Sw2*, which are ganged. Further, it was believed that the average music listener would more often need to attenuate the treble than to boost it. Therefore the flat response position of the treble control, ganged *Sw3* and *Sw4*, is position *5*. Comparison of the response curves in *Fig. 5* and *Fig. 6* will show the greater amount of bass boost and treble cut, the lesser amount of bass attenuation and treble boost available from the circuit of *Fig. 5*

than from the simpler, more frequently-employed type of circuits of which *Fig. 2* is typical.

In *Fig. 5* there is losser action of frequencies above *1* or *2 KC* (depending on the setting of *Sw1* and *Sw2)* resulting in the same bass boost. Further shaping of the bass curves of *Fig. 6* is obtained through the frequency-selective feedback circuit between the output of *V2* and the cathode of *V1*. The arm of the *Sw2* changes the amount of treble which is fed back to the cathode of *V1*, thus increasing the bass boost. (At this point the action is very similar to the manner in which bass boost is accomplished in the "Pickering-type" phono preamp described in the preceding chapter of this series.)

The resistor in the feedback loop coming off the cathode of *V1* limits the amount of signal feedback, while the .1 μf condenser next to it is merely a blocking condenser, which has no effective frequency-discriminating action. As *Sw2* is rotated clockwise it first inserts the .01 μf condenser (and paralleled 2.2 meg resistor) in series in the feedback loop, reducing the bass signal feedback, and thus boosting base. Then *Sw2* parallels the .01 μf condenser (shown near *V2* plate) with a smaller condenser (position *3*), further reducing bass feedback, increasing bass boost.

As the right-hand taps of *Sw2* are reached another action which has no direct relation to the feedback loop is introduced. The arm of the switch shorts out the .p μf condenser which is in series with the .5 μf plate coupling condenser. This increases the bass response at the extreme lower end of the curve.

Examining the action of the two treble tapped controls, we see that starting from flat position (position *5*, *Sw3* and going gradually *counter*-clockwise, increasing treble *attenuation, R-C* losser combinations by-pass treble frequencies to ground. Since positions *3* and *4* employ a smaller capacitor than positions *1* and *2*, there is more treble attenuation in positions 1 and 2. (This is exactly the same sort of treble reduction circuit used in the old-fashioned single "tone controls". But simultaneously with this action *Sw4* switches three progressively larger condensers across the output also. Taken together, these pairs of capacitors in each position form bridged-T R-C filters across the signal, giving steeper roll-offs than could be obtained with single section *RC* networks.

At the right hand end of the rotation, positions *7* and *8* of *Sw4* short

out two 5K resistors of the filter network, thus *increasing* the treble signal. At the same time these two positions of *Sw3* increase the treble contribution to the output by reducing the effective size of the cathode resistor of *V1*. Notice that in placing the 220 ohm resistors across the cathode bias *R* of *V1*, first in series with .02 μf and then with .05 μf capacitors, *Sw3* reduces the size of the cathode *R* only for *AC* feedback signal—it does not alter the DC bias, which is purely a function of the 1500 ohm cathode bias resistor.

In addition to the advantage of producing more bass boost or more treble cut than the simple types of tone control circuits, these step controls allow sharper curves, approaching almost the slope of resonant RC circuits, without their attendant disadvantages. Further, they give a choice of different *shape* curves.

Shaping the Control

Not all step, or switch type tone controls are as elaborate as the ones shown and discussed here. Therefore they are correspondingly less effective. It seems likely that the continuously-variably type will continue to be the most widely-used for some time. They give as much compensation as is usually desired, yet are relatively cheap to build, and are not space consuming nor difficult to service.

One variation which is becoming more popular is the use of bass controls which boost only, or of treble controls which have only roll-off. This conforms to the most generally-used positions from the point of view of the average music listener using the majority of available program material.

In addition to the preamplifier section and the tone control sections, modern high-quality amplifying systems must have switches to select phono, radio, TV, tape or other input material. In addition, the trend today is for them to have at least one additional of the following facilities: sharp cut-off filters or dynamic noise suppressors, built-in (automatic) *loudness* controls which boost the bass as the volume or gain control is reduced, cathode follower output, if the control unit may be used some distance away from the power amplifier, and a choice of record-characteristic curves. This last feature is usually part of, or precedes the preamp, as discussed in the previous installment.

Next month we will conclude examination of the circuits which precede the power amplifier.

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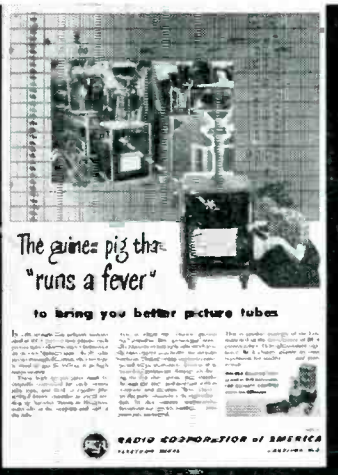

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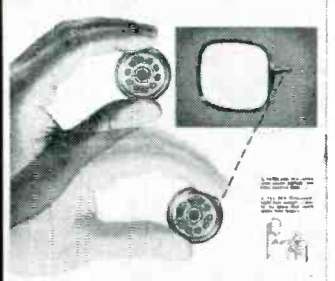

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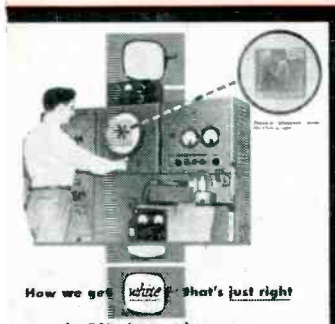

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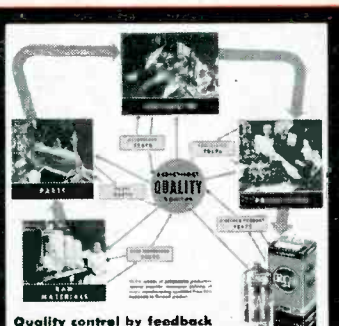

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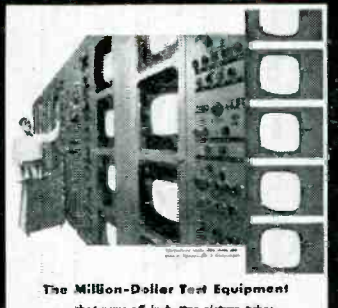

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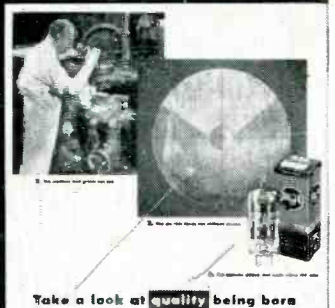

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