FEBRUARY, 1953

Radio-Television SERVICE DEALER

The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

When there are new worlds to conquer, JFD will do it!
Now our engineers have combined the famous JFD VHF Jetenna and UHF bowtie antenna into a miracle performer that pulls in all channels—from 2 to 83. Use it with the especially developed filter network* for perfect reception, completely free of inter-spectrum interference. Pre-assembled construction, all aluminum, even to solid aluminum dowels.

Write for the new 1953 JFD dealer almanac on your letterhead—35 pages of the widest TV antenna and accessory line in the industry.

*optional

JFD
UHF - VHF

it's out of this world!

new, VHF-UHF All-Channel Antenna —the Jet 283

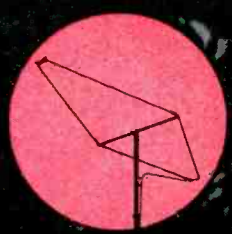
one antenna—one transmission line for all channels from 2 to 83

Corner Reflector No. UHF400

"Bowtie-Flector" No. UHF600

Ultra V-Beam No. UHF500

YAGIS No. UHF300 Series for Channels 14 to 83



Rhombic No. UHF 200

"Double-Vee" No. UHF100

JFD MFG. CO., Brooklyn 4, N. Y., Bensonhurst 6-9200
world's largest manufacturer of tv antennas and accessories

Burton browne advertising

NEW! FREE!

CARTRIDGE DISPENSER

PLUS

THESE E-V SALES AIDS

1 COLORFUL DISPENSER

2 UNIQUE DECAL

3 SET MODEL REPLACEMENT GUIDE

USE this handsome, all-metal dispenser in your store or shop. It catches the eye and makes your customers want to buy!

This modern merchandiser is the *new way*, the *positive way* to cash in on the $70,000,000.00 phono-cartridge modernization-replacement market.

Not only does it sell cartridges, but the handy Cartridge Interchangeability Chart on each side makes your replacement service quick and easy.

In addition, the unique colorful, transparent Decal and the complete Manufacturers Set Model Replacement Guide make *you* the authority on Phono Service in your community.

All three are Free, without extra cost, from your E-V Distributor with *every* purchase of *any* 6 E-V Phono Cartridges. (The 6 basic Preferred E-V Models shown here, of course, enable you to make over 92% of all replacements.)

Use this profit key to '53! Open up the treasure that holds 10,000,000 Phonograph Modernization Sales. *Make money selling Cartridge replacements now the E-V way.*

Handsome All-Metal Maroon, Yellow and White Dispenser. Holds any 6 E-V Cartridges in their New Jewel-Like Golden Yellow Plastic Boxes.

Hang it on a Wall or Shelf. Cartridge Boxes Easily Removed from Bottom or Top.

Complete Cartridge Interchangeability Chart on Both Sides of Dispenser

Electro-Voice

Send Now For
FREE BOOKLET SCP 1-2
"YOUR PROFIT KEY TO '53"

ELECTRO-VOICE, INC.
412 Carroll St., Buchanan, Mich.
Send Free Booklet SCP 1-2
"YOUR PROFIT KEY TO '53"

NAME _____

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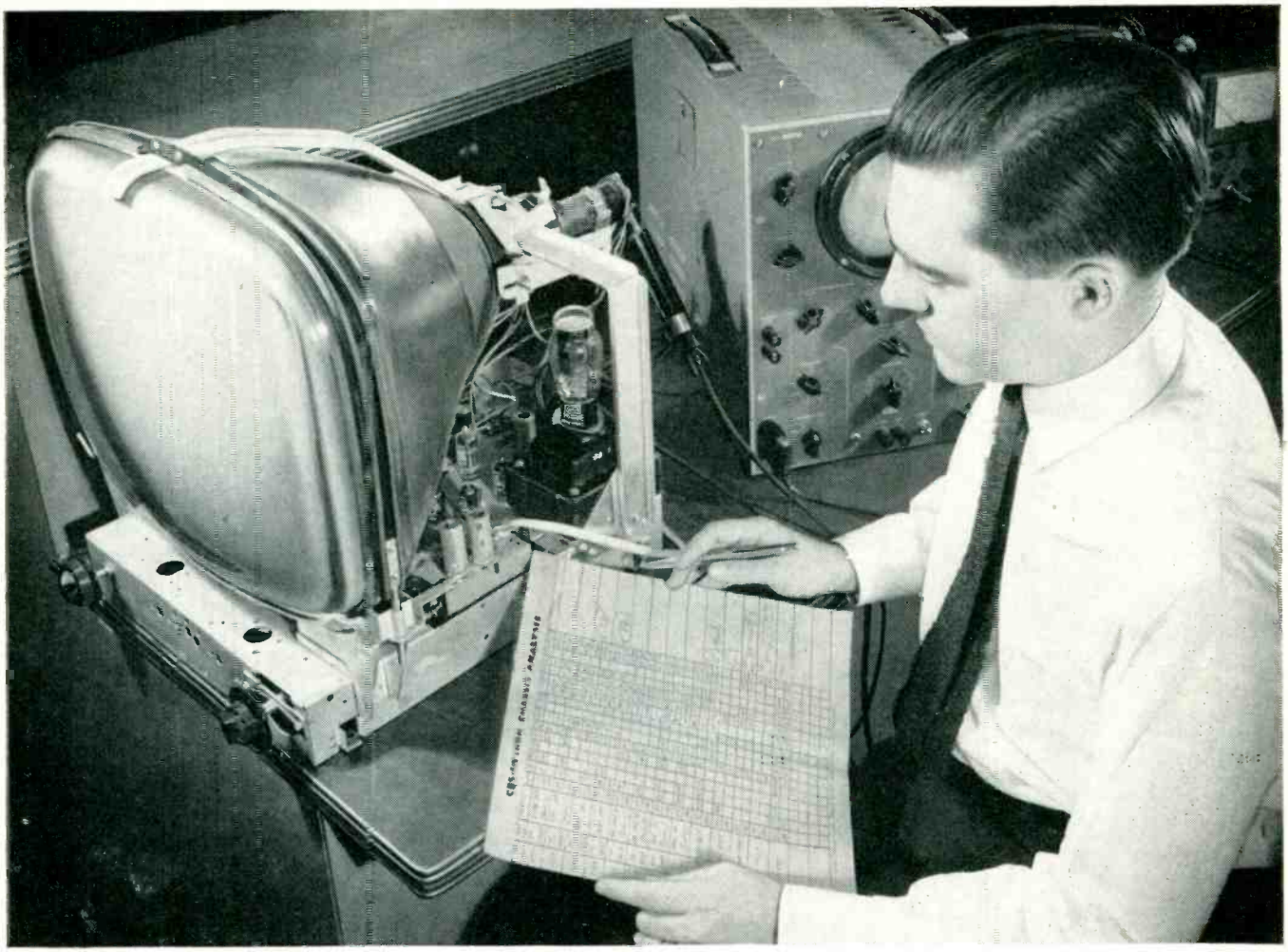
CITY _____ ZONE ___ STATE _____

Export: 13 E. 40th St., N. Y. 16, U. S. A. Cables: Arlab



Bring back that New-Set Sparkle with Performance-Tested Tubes

Meet John Cunningham, a CBS-Hytron Commercial Engineer. John is beginning at the beginning for you. Socket by socket, he is analyzing the tube requirements of a brand-new TV set design.

John knows the superior performance demanded. He concentrates his know-how on insuring top tube operation within standard specification limits. He tests sample tubes . . . checks analysis data. Working hand-in-glove with the set designer . . . and with CBS-Hytron engineers . . . he assures control of the characteristics of all tubes for this new chassis. Finally he achieves . . . from rectifiers to picture tube . . . the perfect performance all of this engineering team (and you) seek.

Constantly CBS-Hytron carries on teamwork like this. Socket by socket analysis. Day in, day out — with 9 out of 10 leading TV set makers. Both tube and set engineers pool their specialized skills. Scores of the nation's foremost TV set engineers help make endless CBS-Hytron improvements. Help assure you of unsurpassed performance in virtually *all* leading TV sets.

Small wonder that your CBS-Hytron replacement tubes recapture that new-set sparkle. Please *your* customers. Cut *your* call-backs. Profit more. Take advantage of CBS-Hytron engineering. Demand CBS-Hytron . . . your logical replacement tube, because it is performance-tested all the way . . . from original to replacement.

CBS HYTRON RADIO TUBES

MANUFACTURERS OF RECEIVING TUBES SINCE 1921

HYTRON RADIO AND ELECTRONICS CO.

A Division of Columbia Broadcasting System, Inc.

Main Office: Danvers, Massachusetts

NEW . . . BIGGER . . . BETTER

FREE!

6th Edition

CBS-HYTRON Reference Guide for Miniature Electron Tubes

- A CBS-Hytron original . . . it's unique.
- *All* miniatures, regardless of make.
- 250 miniature types . . . 87 new.
- 111 basing diagrams . . . 34 new.
- Similar larger prototypes indicated.
- 8 packed pages of data you need daily.
- And it's FREE!

Get your copy of this old friend brought up to date now. Ask your CBS-Hytron jobber or write direct . . . today!

EDITORIAL

by S. B. COWAN

Video Speed Service Systems— Soon Available As a Complete Book

So many thousands of our subscribers have written us that they find VSSS (which is an exclusive feature published only in SERVICE DEALER) so valuable as time-savers and for quick reliable answers to tricky TV service problems that we are acceding to the demand for the immediate issuance of a complete VSSS book, to be released in April.

It will be in loose-leaf form and will contain about 600 video service data references only a few of which have been given prior release. Our regular subscribers can add their own additional VSSS reference pages as they appear monthly in this magazine, so the book itself is self-perpetuating, for each issue of SERVICE DEALER carries at least 24 new VSSS data references. Yes, the VSSS book containing over 224 pages plus an expansion-type semi-hard cover binder with alphabetical index and about 600 references in Volume I alone is something to look forward to. Every technician will want his own personal volume. We expect to ship out first copies in April at approximately $4.95 net to technicians, postage paid by us.

Our original opinion that technicians would find that a file of VSSS is worth more than $50 still holds, but we are happy that mass production methods allow for a much more nominal price—less than 1 cent per Reference Data. By the way, as the print run of Edition I is limited to 20,000 copies, we suggest that you refer to page 42 in this issue and get your reservation in accordingly.

This Issue Breaks Record

In three respects this issue of SERVICE DEALER breaks all records since the publication's inception over 13 years ago. First, as our paid circulation and gross distribution this month hits a new all-time high, we know that more technicians and service dealers will read this issue than any other. Second, more advertisers have spent more money for their space in this issue than ever before although this is not, in any way, a special issue, nor have we increased our advertising rates since 1950. Third, more pages of text material expressly prepared for our exclusive use are contained in this issue, giving our subscribers better value than heretofore. It's nice to know that we can distribute dividends to you, the fellows who have made those earnings possible.

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ADOLPH SUCHY
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67 WEST 44TH ST.
NEW YORK 36, N. Y.

Member Audit Bureau of Circulations

Vol. 14, No. 2 **FEBRUARY, 1953**

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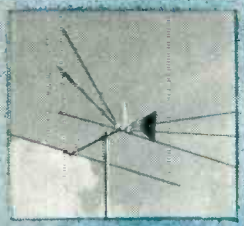
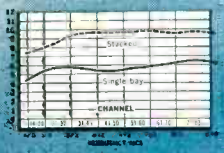
TED E. SCHELL, 2700 West 3rd St., Los Angeles 5, Calif., Dunkirk 2-4889
RADIO-TELEVISION SERVICE DEALER is published Monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $2 per year in the United States, U.S. Poss. & Canada: elsewhere $3. Single Copies 25c. Reentered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

ULTRA FAN series — Complete VHF-UHF coverage



single bay — model no. 4133

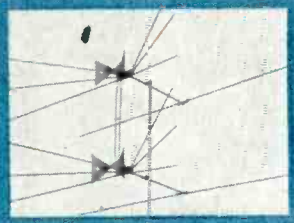


Today's most sensitive All-VU* antennas! The Ultra Fans actually operate on three separate electronic principles — automatically:

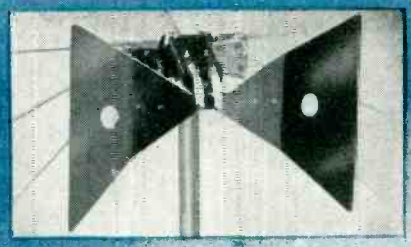
1. Low Band VHF (Channels 2-6) . . . Conical antenna with parasitic reflector
2. High Band VHF (Channels 7-13) . . . Large diameter V antenna
3. UHF (Channels 14-83) . . . Triangular dipole with sheet reflector

One set of All-VU* stacking rods provides highest VHF and UHF gain. Each Ultra Fan has its own 2-stage inter-action filter, so that only one transmission line to the set is required.

*All VHF, all UHF



stacked — model no. 4132



ULTRA DAPTER

model no. 414

Instantly converts all Channel Master Super Fans into high gain, all-channel, VHF-UHF antennas. Features a built-in inter-action filter.

Your best bet for UHF!

CHANNEL MASTER Ultra-Tennas

America's most complete — most effective — UHF antenna line.

Channel Master's advanced engineering pays off again! While rain caused hundreds of UHF antennas to FAIL recently in Portland, *not one Channel Master antenna dimmed or started out a picture!* The facts speak for themselves: Rain or shine, Channel Master antennas outperform all others.

Only Channel Master Antennas are designed to eliminate the "TWIN TERRORS" OF UHF RECEPTION:

- **Vibration, which causes picture flicker.**

  Eliminated by Channel Master's Ultra-Rigid construction and advanced mechanical design.

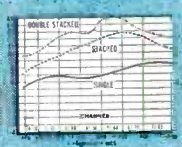
- **The accumulation of dirt or moisture around the antenna terminals, which dims and eventually shorts out the TV picture.**

  Eliminated by Channel Master's sensational "free-space" terminals which prevent the accumulation of foreign deposits at the feed points.

ULTRA BOW

model no. 401

The basic UHF antenna for primary signal areas, and the outstanding member of the bow-type antenna family.

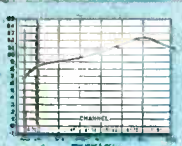


ULTRA BOW

with SCREEN REFLECTOR

model no. 403

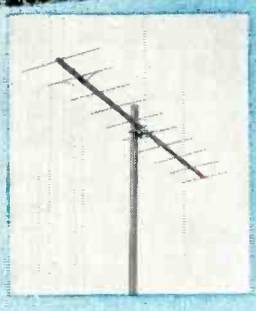
Can be stacked in 1, 2, and 4 bays. High, all-channel UHF gain, excellent front-to-back ratio.



ULTRA VEE

model no. 404

- Good UHF gain
- Low VHF gain
- The most rigid UHF antenna of its type and size.

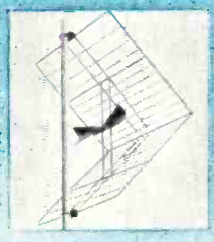


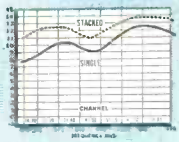
Gain: 11 DB, single
14 DB, stacked

DELTA WELD

Wide Band 10 Element UHF Yagi

Custom-designed for full coverage of your specific area! Brilliant high gain performance across as many as 23 different channels.





CORNER REFLECTOR

model no. 405

The outstanding all-channel UHF FRINGE antenna. Now — can be stacked for even greater gain.

MEMBER ANTENNA MANUFACTURERS ASSOCIATION

TRUST IN PREASSEMBLED ANTENNAS

Sold through the nation's leading distributors

CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

Write for complete technical literature

ULTRA-TIE model no. 9034

Electronic Inter-Action Filter

JOINS separate antennas into a single VHF-UHF antenna system, for use with a single transmission line.

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

The only filter with "free-space" terminals.

NOW—read this true story of

UHF ANTENNA FAILURE IN PORTLAND!

GARRETSON RADIO SUPPLY, INC.
INDUSTRIAL DIVISION
2416 SECOND AVENUE
SEATTLE 1, WASHINGTON
SE. 0640 • MU. 0422

January 22, 1953

Channel Master Corporation
Napanoch Road
Ellenville, New York

Attn: Harold Harris

Dear Harold:

Now that the UHF station, KPTV in Portland, Oregon has been on the air for a few months, it may interest you to know some of the results of antenna performance.

Antennas of all descriptions, both multi-channel and single channel UHF have been installed in the Portland area. The results in most cases were fair, however in some instances certain types of antennas specifically for the UHF channels failed completely to perform. Several of the so called "all channel" antennas performed in strong signal areas, but failed completely where gain was needed, or ghost problems were encountered. These results were obtained while the weather in Portland was good.

For the past few weeks it has been raining consistently in the Portland area and the antenna failures have been numerous, due to the shorting out of the terminal connection at the antenna. The result -- antenna crew men have been out drilling small holes in the terminal blocks trying to provide as much air insulation as possible. Certain types of antennas, which used an isolation filter at the antenna also had their troubles. In many cases this filter broke down and moisture leaked into the filter, causing it to short out at the terminal.

Many of the Channel Master UHF antennas have been sold and installed by our dealers in Portland, with no complaints whatsoever. In all cases, the antennas have given excellent performance and provided clean pictures, regardless of weather conditions. This, we feel, is the result of research and engineering, and the foresight to foresee the many problems which would confront the UHF antenna.

The use of your free-space terminals has forestalled any problems of signal loss due to moisture conditions and in all cases, our dealers tell us that the Channel Master antennas live up to the published catalog information.

May we offer our congratulations on an excellent unit - and let's keep them rolling!

Very truly yours,

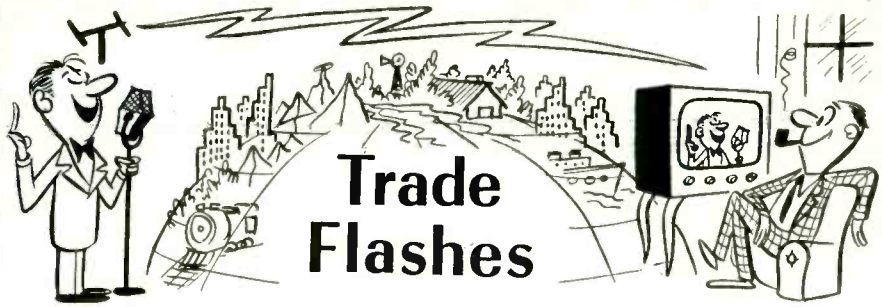
GARRETSON RADIO SUPPLY, INC.

Paige C Lundberg

By: Paige C. Lundberg

VMH/pl

Look to Channel Master for UHF— IT PAYS OFF!



Trade Flashes

NPA Releases Antennas

Recent removal of TV and automobile receiving antennas from the civilian-type items list paves the way for larger allocations of controlled materials to makers of the two products, the National Production Authority, Department of Commerce, said recently.

Richards W. Cotton, Director of NPA's Electronics Division, explained the action was necessary to avert a growing shortage of TV and automobile receiving antennas.

IRE Convention

More than 30,000 radio engineers and scientists from all parts of the world will convene on March 23-26 at the Waldorf-Astoria Hotel and Grand Central Palace in New York City for the most important technical meeting of the year—the 1953 IRE National Convention. The comprehensive program of 220 technical papers and 400 engineering exhibits will be keynoted by the theme "Radio-Electronics, A Preview of Progress."

The opening meeting of the Convention will be the Annual Meeting of the IRE, to be held at 10:30 A.M., March 23, in the Grand Ballroom of the Waldorf. The principal speaker will be William R. Hewlett, Vice President of Hewlett Packard Co. Added features of special interest will be ceremonies honoring incoming President J. W. McRae and none Charter Members of the IRE.

Electronic Components Symposium

The American Institute of Electrical Engineers, Institute of Radio Engineers, Radio-Television Manufacturers' Association, and West Coast Electronic Manufacturers Association are cooperating in the presentation of the 1953 Electronic Components Symposium to be held in the Los Angeles area. This Symposium is one of a series of national meetings on electronic component parts being held annually; the last one occurring in Washington, D. C. in the spring of 1952. The purpose of this meeting is to bring together all those who share an interest in the development, design, performance, and future of electronic component parts.

The Symposium will take place on April 29, 30, and May 1, 1953, at the Shakespeare Club in Pasadena, California.

Chicago Audio Fair News

The Audio Fair in Chicago will be combined with the 1953 International Sight and Sound Exposition to be held at the Palmer House here September 1, 2 and 3, according to a joint announcement made by Harry N. Reizes, Audio Fairs manager, and S. I. Neiman, president of the Exposition.

The combined International Sight and Sound Exposition and Audio Fair, the only public high-fidelity audio-video Show to be held in the midwest in 1953, is expected to attract more than 20,000 persons during its three-day public and trade display of leading American and foreign equipment.

TV Shipments For 11 Months Top 5 Million

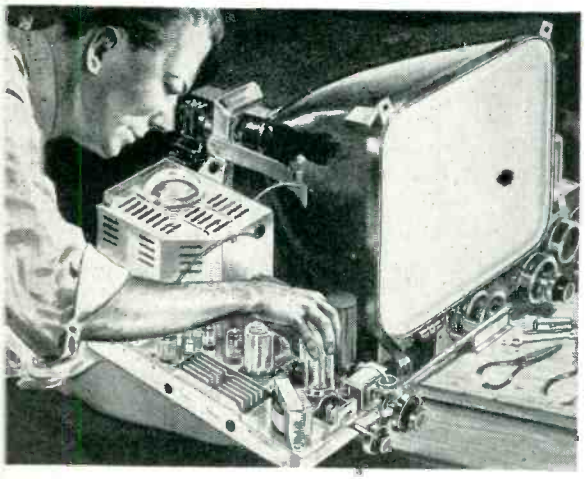
During the first 11 months of 1952 a total of 5,208,614 television sets were shipped to dealers, the Radio-Television Manufacturers Association announced. This compares with 4,415,422 sets shipped to dealers during the same 1951 period.

For the month of November, RTMA estimated that 756,855 TV sets were shipped to dealers compared with 409,681 sets shipped in the same 1951 month.

Sylvania TV Service School Opens 1953 Season

Mr. E. W. Merriam, Service Manager of the Radio and Television Division, Sylvania Electric Products Inc., announced recently that the first 1953 class of the Sylvania Television

Depend on Mallory
for
Approved Precision Quality



There'll Be No Call-Back On This Job!

You can be sure there will be no time-wasting call-backs to cut down your profits when you use Mallory Capacitors. Mallory Capacitors are engineered to meet the electrical requirements of any TV or radio set. You can depend on them to give long-lasting performance that's equal to . . . and often better than . . . any original equipment component.

Rating-for-rating, Mallory FP Capacitors give longer life at higher temperatures and greater ripple currents. They'll give trouble-free performance at 185° F. (85° C.). They are the only fabricated plate capacitors on the replacement market.

For all plastic tubular replacements you can count on Mallory Plascaps® the same way you do on FP's. They eliminate problems of shorting, leakage, unsoldered leads and off-center cartridges.

Nothing will lose a customer faster than a set that won't stay repaired. That's why it is always good business to specify *brand* as well as rating when you order parts. And if you depend on Mallory you can put an end to call-backs, get precision quality, yet pay no more.

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

Service School got under way January 5th, in Buffalo.

The Sylvania TV Service School, which first started in the Fall of 1952, offers a comprehensive course in the latest and most efficient techniques of television servicing. Every two weeks, normally during the Fall, Winter and Spring months, a new 12-man class meets for 10 days of concentrated practical instruction made up of 25% lecture time and 75% actual trouble shooting, analyzing defects by using the latest in television service equipment.

Due to special service clinics to be conducted in newly opened TV markets, the next class will not be held until February 16, 1953.

No charge is made for the Sylvania course. Its sole purpose is to give instructions to service personnel of Sylvania television distributors, dealers and service contractors whose only cost in sending their technicians is the travel, plus living expenses for two weeks.

According To Admiral — —

Nearly 20 per cent of all the television and radio receivers made in the United States are produced in the Chicago area, reports Admiral Corporation. Philadelphia ranks second in TV and radio production, followed by New York and Syracuse.

In 1950, when nearly 7,500,000 television receivers valued at $2,235,000,000 were sold, the TV industry achieved the largest dollar volume in the entire electrical field.

More than 175,000 television receivers were sold in 1947, the first full year of commercial television. These receivers had a retail value of $83,500,000—a greater dollar volume than was achieved by the automotive industry in the first 10 years of its operation.

Wartime electronics research speeded the development of television for civilian use by at least five years.

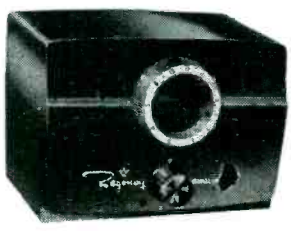
Approximately 9,000,000 of the over 19,000,000 television receivers now in use in the United States are at least four years old and have smaller than 16-inch screens.

The television replacement demand is estimated to reach 5,000,000 sets a year when TV is available nationally.

New Community Antenna Developed

Many whole communities now partially or completely blacked out from television reception due to terrain conditions can soon experience excellent televiewing as a result of a special antenna developed by two staff mem-

Thomas A. White
president: Jensen Manufacturing Company, Chicago, Illinois
says: "In every field there's one leader
---- in boosters it's Regency"
the largest selling booster at any price



Burton browne advertising

bers of the Denver Research Institute of the University of Denver.

Better still, materials needed to build the antenna, which is extremely simple in design, cost only a few dollars and can be bought on the open market. With proper instruction, a man handy with tools can often make the installation by himself.

Responsible for creation of the device, known as a "double rhombic antenna," are Dr. Richard C. Webb, electronics engineer, and Col. Victor C. Huffsmith, assistant director of the Denver Research Institute.

Baker Urges Educational TV In New York State

Dr. Walter R. G. Baker, General Electric Company vice president, urged adoption of a system of educational television in New York State as an economic necessity vital to the security of the United States.

Dr. Baker, general manager of the G-E Electronics Division at Syracuse, N.Y., told the state commission on educational television that "if the great state of New York does not take the leadership in setting an example for the other 47 states, the benefits of effective educational television may be lost to the nation for all time."

"To my mind," he said, "it is not a question of whether we can afford educational television in New York state. Instead, I believe we cannot afford, if we have the least concern for our country's future and for the future of our children, to pass up the opportunity that has been offered us.

RCA Ships First Commercial UHF Transmitters

Four *uhf* (ultra-high-frequency) television transmitters—the first to come from commercial production assembly at the RCA Victor plant here—were shipped recently to holders of high-priority orders, it was announced by the RCA Engineering Products Department. Additional *uhf* transmitter equipment is in production, the company stated, and units will be shipped against existing orders as soon as production and testing can be completed.

The transmitters, new 1-kilowatt models capable of providing up to 27-kw effective radiated power in the 470-890 megacycle frequencies, are the first commercial equipments to be delivered for telecasting in the new channels 14 to 83.

Station WSBA-TV (channel 43) York, Pa., owned by the Susquehanna Broadcasting Company;

Station WBRE-TV (channel 28), Wilkes-Barre, Pa., owned by Louis G. Baltimore;

Station WFPG-TV (channel 46), Atlantic City, N.J., owned by the Neptune Broadcasting Corporation;

Station WSBT-TV (channel 34), South Bend, Ind., owned by the South Bend Tribune.

Two other new *uhf* (ultra-high-frequency) television transmitters were shipped more recently to Stations WKBN-TV (channel 27) and WFMJ-TV (channel 73), both in Youngstown, Ohio.

RMTA Acts To Curb Spurious Radiations

Calling on all television manufacturers for cooperation, Dr. W. R. G. Baker, Director of the RTMA Engineering Department, presented an RTMA plan for implementing and accelerating the reduction of spurious oscillator radiation in TV transmission and reception at an all-industry engineering conference in the Biltmore Hotel, New York City.

UHF In Peoria, Ill.

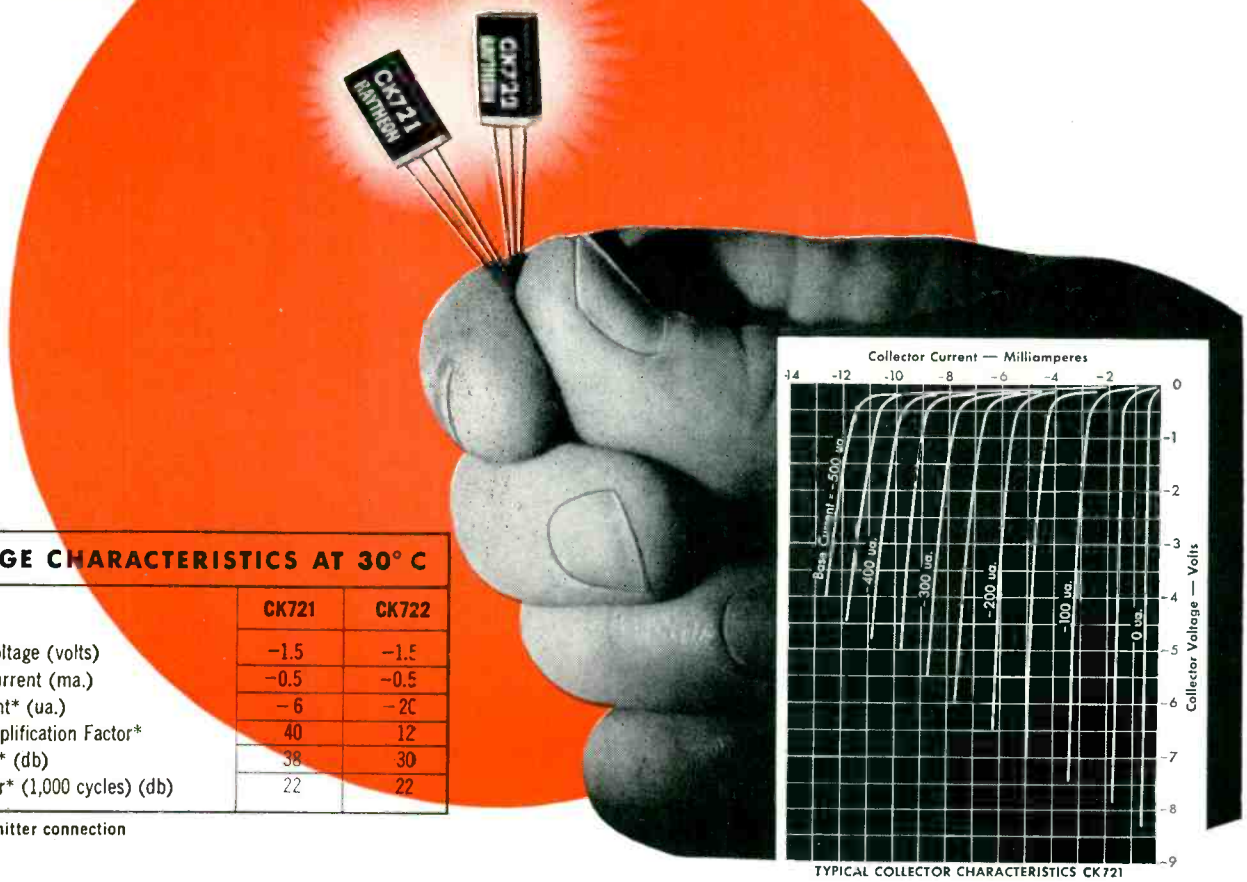
The General Electric Company today shipped a UHF television trans-

[*Continued on page 16*]

NOW AVAILABLE!

PNP GERMANIUM JUNCTION

RAYTHEON TRANSISTORS



AVERAGE CHARACTERISTICS AT 30° C	CK721	CK722
Collector Voltage (volts)	−1.5	−1.5
Collector Current (ma.)	−0.5	−0.5
Base Current* (ua.)	−6	−20
Current Amplification Factor*	40	12
Power Gain* (db)	38	30
Noise Factor* (1,000 cycles) (db)	22	22

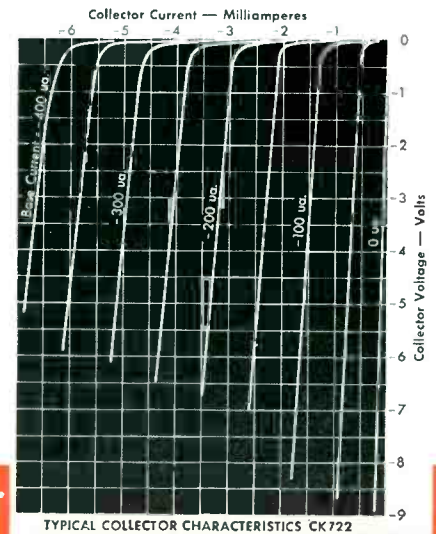
*Grounded Emitter connection

TYPICAL COLLECTOR CHARACTERISTICS CK721

For the first time in history, Germanium Junction Transistors are commercially available, Raytheon Junction Transistors, types CK721 and CK722 can now be obtained for your experimental and developmental use.

Here's another first for Raytheon! Leaders in the development and production of Electron Tubes and Germanium Products, Raytheon now leads the way in production of this important new electronic development.

For price and delivery information of Raytheon Germanium Junction Transistors, write, phone or wire your Raytheon Tube distributor.



TYPICAL COLLECTOR CHARACTERISTICS CK722

RAYTHEON®

Excellence in Electronics

RAYTHEON MANUFACTURING CO.

Receiving Tube Division

Newton, Massachusetts • Chicago, Illinois • Atlanta, Georgia • Los Angeles, California

RAYTHEON MAKES ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

SYNC PULSES

by San D'Arcy

New Homes Bonanza for TVmen— It seems that many buyers and builders of new houses (especially private dwellings), want to provide TV antenna outlets in most of the rooms to eliminate having unsightly transmission flopping about. Cognizant of that desire TVmen have approached the builders and owners with the suggestion that while the house frame is going up and before the lathes are applied or walls are enclosed is the proper time to have the TV wiring installed. Both builders and homeowners generally accept the proposal, giving the TVman a profitable installation order. Some of these antenna installation authorizations have subsequently resulted in making such good friends of the home owners that they have followed up by buying additional TVsets for use in rooms that otherwise might not have been given TV treatment.

Multicouplers for two or three TVsets to work off a single antenna, and highly efficient transmission lines are now available. It is a simple matter to make antenna installations inside the house frames, and it's an easy service to sell. Get on the bandwagon!

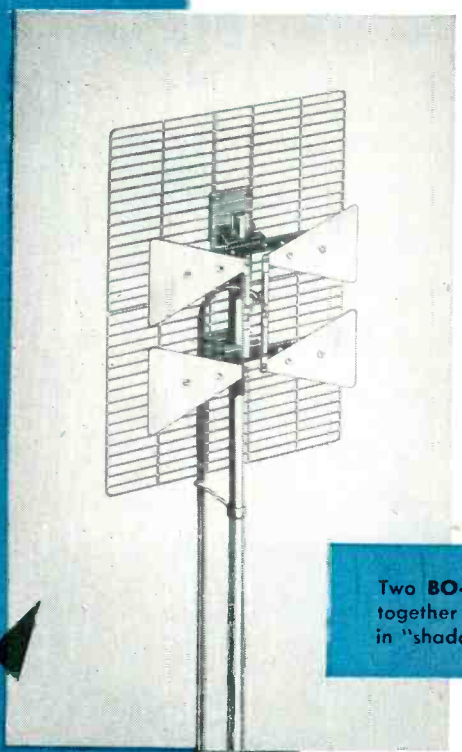
About TV Tube Implosions—Our recent sync pulse item —showing a wrecked room resulting when the set owner fixed his own set, which later exploded, brought many letters citing similar, but unpublicized, happenings in other communities. Most correspondants conjectured on the cause of those blowups.

Probably the most logical letter came from F. W. Marble of Solon, Ohio. He opined that possibly a novice technician might have adjusted the TVset's focus coil to eliminate a neck shadow (meaning he put the focus coil too tightly up against the Pix tube's throat) when the set was hot. Then, as the set cooled off, the subsequent contraction and pressure on the brittle pix tube neck caused it to "let go." Said informant Marble: "I have serviced several sets and found this identical condition, and fortunately got to them before the tubes broke." Brother Marble, we think you've got a fine point there, you might have also added a warning that TVsets are much too dangerous for any except professional technicians to service.

The January 5th Issue of "Life"—was fine. Especially the article, "Where Do We Go From Here," and we recommend its reading by all TVmen. The article discusses our country's economy, past, present and probable future for a year or so, at least, evaluating whether or not we're headed for a boom or recession, and outlining the probable extent and effect of either.

We who derive our income from radio and TV, and the servicing of communications and industrial electronics apparatus, can look toward the future with much optimism. It is axiomatic that service trades boom during recessions. But more important is the fact that new vistas are constantly opening for technicians such as radio and TVmen who are "invited" into homes where there are such things as appliances, radios and record-players, which constantly need repairs or the addition of accessories (long-play needles, new pickups, fresh batteries, etc.). For example, many homes have electric ranges, the heating elements of which are subject to burn-out. It is logical that radio and TV technicians should be ready, willing, and able to replace any such defective range elements when the opportunity presents itself. Why not stock up on some electric range elements and install them at a profit? A simple question, "How's your electric range working?" can mean many extra dollars income for you, so start asking it.

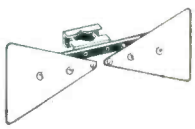
...and now UHF antennas by AMPHENOL



The magic words in television these days are Ultra High Frequency. That UHF television is a practical reality has been proved, not only by laboratory tests, but also by the success of the first commercial UHF station now operating in Portland, Oregon. Because of the high signal losses common to UHF, it is extremely important that the entire antenna system be of the finest quality and of a proved design. The choice of antenna and the availability of the proper accessories to adapt that antenna to the particular locale are factors that determine the success of any UHF installation. The entire Amphenol line of UHF antennas and accessories has been designed and approved by the Amphenol team of engineers that achieved industry-wide renown for the origination of the Inline VHF Antenna.

The BO-TY UHF Antenna is the first of a complete line of Amphenol UHF antennas. It is designed as a general purpose UHF antenna for all major signal areas. The Amphenol UHF Antennas previewed for you at the left have been designed to answer the varied installation requirements in major, fringe or "shadow" areas.

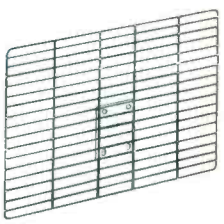
Two BO-TY 114-053 Antennas with Reflectors, 114-560, stacked together with Stacking Rods, 114-558, for increased signal strength in "shadow" areas or nearby fringe.



Model 114-053 *BO-TY Antenna is a bi-directional, all-channel UHF antenna. It is fastened to the mast with an integral universal clamp that accommodates masts from ¾" to 1½" O.D.*

Model 114-558 *Stacking Rods are designed for stacking BO-TY antennas one above the other. Stacking BO-TY antennas provides additional gain and the Stacking Rods maintain perfect impedance match.*

Model 114-560 *Reflector is designed for the BO-TY Antenna when a uni-directional pattern is desired. Addition of the 114-560 also helps somewhat in increasing the gain of the BO-TY.*



* Model 114-054 Yagi UHF Antenna for high gain on specific channels

* Model 114-057 "V" combination UHF and VHF Antenna

* Model 114-058 All-Channel UHF Corner Reflector Antenna

* Model 114-060 UHF Rhombic Antenna for high gain and rejection of reflected signals

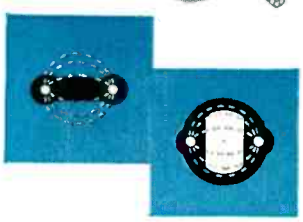
* These UHF antennas are currently in final laboratory tests and will shortly be released to production. When available they will meet the mechanical and electrical efficiency characteristic of all Amphenol antennas.

AMPHENOL Tubular TWIN-LEAD

Amphenol Tubular Twin-Lead has proved itself to be the best answer to the need for an economical lead-in for UHF television. Actual installations in Portland, Oregon have established the superiority of Tubular over all other existing types of twin-lead.

The tubular construction provides a constant impedance that is virtually unaffected by age, weather conditions, salt or dirt deposits on the line. The extremely low-loss of the Tubular Twin-Lead is one of the characteristics that is essential to a UHF lead-in.

The illustration at extreme left reveals the lack of protection that the dielectric of flat lead-in affords to the essential field of energy between the conductors in twin-lead. The illustration to the right demonstrates how this field of energy is protected within the tubular twin-lead and therefore is unaffected by external weather conditions or deposits on the line.



AMPHENOL

NOW—a dynamic new campaign to help you

Share in the Magic of the

Dealer Identification Program spotlights your service . . . builds prestige and profits

Now—you can make the most of the magic selling power in the famous RCA trademark. Here is a complete business-building program that includes everything from window displays to local and national advertising. Don't miss this great opportunity . . . see your *RCA Tube Distributor* today for full details.

1. "REGISTERED DEALER" DISPLAY SET. For your window, a three-dimensional display in full, rich colors . . . plus a set of 10 RCA dummy cartons . . . plus two companion easeled display cards.

Dynamic Promotions to help you sell your service to your prospects:—

3. DIRECT MAIL PROGRAM. Seven brand-new and unique mailing pieces that will stimulate your service business. Also, a Basic Mailing Kit to help you get started with your campaign.

4. ILLUMINATED "SPINNING MOTION" SIGN. Action-packed 15" sign that sells your service. Spinning wheel creates dancing shadows and colors. Nothing like it offered before.

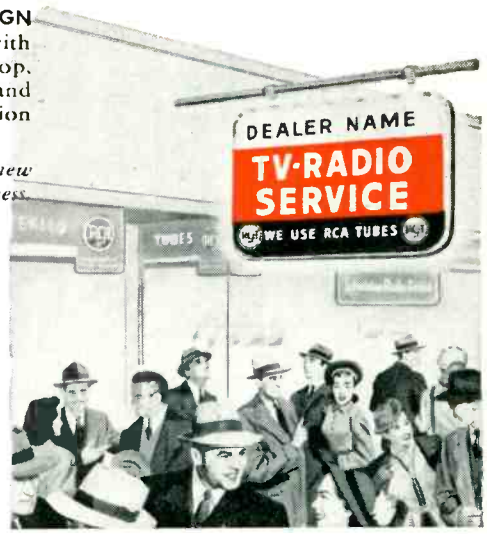
RCA

WE USE RCA TUBES

2. RCA TRADEMARK DECAL. For your door, window, or service truck.

5. OUTDOOR ILLUMINATED SIGN FOR DEALERS. Personalized with your own store name at the top, this brilliantly glowing plastic and steel sign will command attention up and down the street.

. . . and many other dynamic new plans to help you build your business.



GET THE STORY TODAY!

Ask your RCA Tube Distributor for your copy of the colorful 16-page booklet "A Magic Pass-Key to Customer Confidence." The complete campaign is outlined, illustrated, described in full detail. Be sure to get your copy as soon as possible. It's free!

TRADE FLASHES (contd.)

mitter to station WEEK-TV in Peoria, Illinois.

The transmitter, second UHF unit to be shipped by G.E., operates at low power (100 watts). Aspecial antenna, which will be delivered later this month by G.E., will provide an effective power of about 2000 watts.

Precision 1953 Television Servicing Lectures Begin

Precision Apparatus Co., Inc., Elmhurst, N. Y., manufacturers of radio and television test equipment, opened its 1953 "Precision" Lecture Series on Television Circuitry and Servicing, Tuesday night, January 6, at the Engineering Societies Building, New York City. The session, conducted by R. G. (Bob) Middleton, senior field engineer of the company, dealt with *uhf* and *vhf* Television Receiver Circuitry and Trouble-Shooting. In attendance at the meeting were radio and television service technicians from metropolitan New York.

According to Mr. S. M. Weingast, "Precision" President, these Lecture-Discussions and Live Demonstrations are scheduled to be presented in approximately 110 cities throughout the United States and Canada during 1953 with special concentration in those areas that are just receiving, or are soon to receive their first TV stations UHF and VHF.

Du Mont Ships TV Transmitters

As part of its "On Schedule" equipment delivery program for TV broadcasters anxious to get on the air quickly in 1953, shipments of more than half a million dollars worth of television equipment were made recently by the Television Transmitter Division of Allen B. Du Mont Laboratories, Inc.

Among the shipments of equipment made from the Transmitter Division's headquarters at Clifton, New Jersey, were the following:

Old Pueblo Broadcasting Co. (KOPO), Tucson, Arizona. A 5 KW VHF television transmitter for Channel 13 and complete associated station and studio equipment. Lynchburg Broadcasting Corp., (WLVA), Lynchburg, Virginia. A 5 KW VHF transmitter for Channel 13 and complete associated station and studio equipment. Cornhusker Radio & Television Corp., (KOLN-TV), Lincoln, Nebraska. A 5 KW VHF transmitter for Channel 12 and complete associated station and studio equipment. Pueblo

[*Continued on page 20*]

Sylvania's New 1954 Calendar for Service Dealers . . . . sells all through the Year!

They'll read your super-service story every month!

Filled with ideas and recipes your prospects will want to keep

It's your personal Christmas greeting, too

Don't miss this Dramatically Different Business Builder!

Here's the hardest-selling, custom-made Home Calendar ever offered to Radio-TV Service Dealers! It's tailor-made just for you! Features an appealing illustration painted exclusively for Sylvania by a famous cover artist. Reproduced in full color and imprinted with your name and address.

Your prospects simply can't overlook this calendar. It's filled with timely hints and valuable household suggestions they'll want to keep handy. And, every time they turn the page they'll be reminded of your dependable service, skill, and experience.

Order now . . . supply limited! At only 1½¢ per customer per month (in lots of one hundred or more), this calendar is truly the smartest advertising buy ever offered. But don't delay, the supply is limited! Order a couple of hundred from your regular Sylvania distributor . . . TODAY! If he is out of stock, write to: Sylvania Electric Products Inc. Dept. 3R-2202, 1740 Broadway, N. Y. 19, N. Y.

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

FAR BETTER RECEPTION

IN EVERY LOCATION

with Sensational New

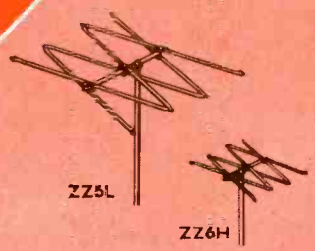
TRIO ZIG-ZAG

Patent Pending

TV ANTENNAS

SUBURBAN MODELS

Models ZZ4A and ZZ6A give you all-channel (2 thru 13) reception in ONE SINGLE BAY ANTENNA. The Model ZZ4A has excellent gain and is designed for suburban areas. Model ZZ6A has even greater gain and provides excellent all-channel reception in near fringe areas.



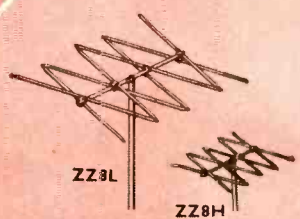
NEAR FRINGE MODELS

For near fringe area reception, the Models ZZ6L and ZZ6H are recommended. Model ZZ6L covers Channels 2 thru 6, Model ZZ6H is for Channels 7 thru 13. Both antennas offer high gain with patterns and front-to-back ratios similar to cut-to-channel yagis.

From ultra-ultra fringe to metropolitan areas, the sensational new TRIO ZIG-ZAG TV Antennas are providing clear, enjoyable TV pictures.

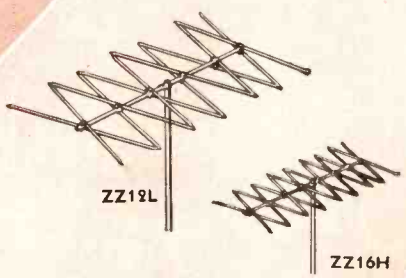
Enthusiastic reports are pouring in from across the nation, testifying to the high efficiency of the new, exclusive TRIO ZIG-ZAG TV Antenna design.

Yes, results — not mere claims — have made the TRIO ZIG-ZAG America's most wanted TV antenna!



FRINGE MODELS

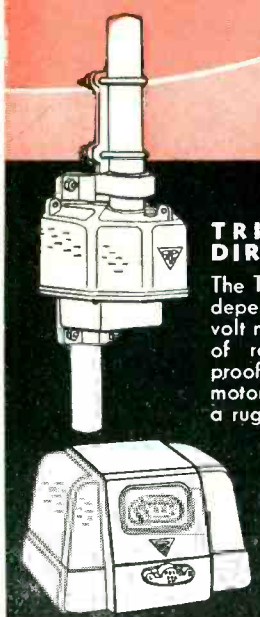
Models ZZ8L and ZZ8H were designed for normal fringe area reception and provide clear, snow-free pictures. Forward lobe patterns and front-to-back ratios are similar to a good single channel, multi-element yagi.



ULTRA FRINGE MODELS

The extremely high gains of the ZZ12L and the ZZ16H models provide unequalled reception in ultra-fringe areas. Model ZZ12L covers Channels 2 thru 6 and Model ZZ16H, Channels 7 thru 13. These two models when stacked, are fed with only one 300 ohm line and provide ALL VHF CHANNEL RECEPTION. Line match is excellent and front-to-back ratios are unusually high.

ZZ12L and ZZ16H are stacked for all VHF Channel Reception



TRIO ROTATOR AND DIRECTION INDICATOR

The TRIO Rotator is America's most dependable — has two powerful 24 volt motors — one for each direction of rotation. Absolutely weatherproof, permanently lubricated. All motors, shafts and gears mounted on a rugged, one-piece casting for true alignment, strength and longer life. Every TRIO Rotator fully guaranteed for two years! Beautiful Direction Indicator has "finger tip" control — no need to hold knob for rotation. A touch of the finger starts it — a touch stops it!

* *To provide even greater strength, TRIO Antennas now have stamped steel element clamps.*

TRIO

TRIO MANUFACTURING COMPANY • GRIGGSVILLE, ILLINOIS

TRADE FLASHES (contd.)

Radio Co., Inc. (KDZA), Pueblo, Colorado. A 5 KW VHF television transmitter for Channel 3 and complete associated station and studio equipment.

Carpenter Establishes New Firm

Douglas H. Carpenter, nationally-known authority in the electronics field, has established the Summit Engineering Company, it was announced recently. Principal products will be newly designed, highly improved television antennas, particularly for UHF-TV, and other electronic equipment. Main office and factory (now in full production) are at 3324 Main Street, Hartford.

Erie's English Director Honored

Word has been received from Erie Resistor's subsidiary in England, that A. A. Dyson, Managing Director of Erie Resistor Ltd., has been included in Queen Elizabeth's New Year's Honor's List to receive the Order of British Empire.

William J. Doyle Becomes Mfrs' Rep.

William J. Doyle, whose resignation as vice president in charge of sales of The Astatic Corporation, Conneaut, Ohio, became effective January 1, will begin operations as a manufacturers' representative in mid-January, with offices at 333 N. Michigan Blvd., Chicago.

Obituary

Carl H. Dicke, of New Bremen, Ohio, for years a leader in the electrical industry, died December 18, at Old Mill Lodge, Medix Run, Pa. He was 50 years of age.

Mr. Dicke was board chairman of Crown Controls Co., Inc., manufacturer of Pioneer and Tempmaster temperature controls and Crown Television Antenna Rotators.

His death of a heart ailment which had curtailed his active business career in later years, will be a great loss to his many friends throughout the industry.

IRC Opens Chicago Sales Office

The International Resistance Company, Philadelphia, continues to expand its facilities. In order to serve its customers in the Metropolitan Chicago area, and surrounding territory, IRC announces the opening of a Chicago Sales Office, located at 4013 North Milwaukee Avenue, Chicago 41, Illinois.

Long Life—Low Maintenance
No Comebacks with the

New 300 OHM TRANSMISSION CABLE by BELDEN

FOR 50 YEARS Wiremaker for Industry

To You, Belden's Golden Anniversary Means

—product performance that can come only from a "know-how" that has grown through actual service since the inception of Radio.

—an ability to co-operate in pioneering new wires to meet or anticipate industry's growing needs.

In the years that follow

This Belden Program Is—

— TO BE CONTINUED

No. 8230

COPPER-SHEATHED 20-GAUGE STRANDED STEEL WIRE

Brown Polyethylene-Resists Weather and Oxidation

The new Belden Weldohm, 300-ohm Transmission Cable is the greatest advancement in television installation since television began.

Reducing TV lead-in conductor breakage to a minimum is easy. The new Belden Weldohm Cable has overcome the breakage point by 162%, that's 1½ times the strength of pure copper wire.

In actual test, Belden Weldohm Cable will withstand 254% more whipping or severe flexing than the average installation of 300-ohm copper lead-in wire.

There is no difference in the electrical characteristics between an all-copper conductor and the Belden Weldohm copper-coated steel wire. The web is 72 mils of 100% virgin polyethylene.

NEW
FOR U.H.F. INSTALLATION
BELDEN ULTRA-WELDOHM — 8235

BELDEN MANUFACTURING CO., 4639 W. Van Buren St., Chicago 44, Illinois

Belden Radio WIRE

IMPEDANCE MEASUREMENTS

by **RUFUS P. TUNER**

(Author—Basic Electronic Test Instruments)

A practical article showing the service man how to do a job that has frequently been a source of trouble to him. This treats a theoretical problem on "how to do" level enabling the reader to make many basic measurements.

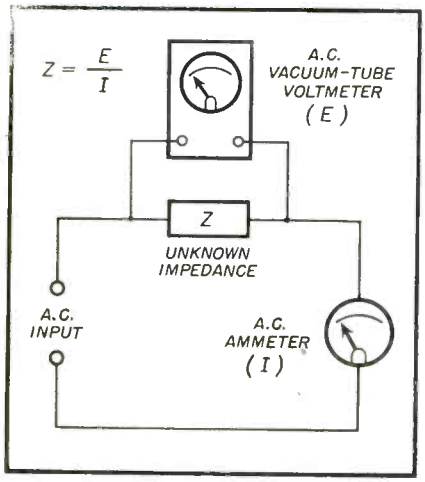


Fig. 2—Connections for the Volt-Ammeter method oz Z measurement.

IMPEDANCE is one of the most important properties of electrical circuits. Like resistance, impedance is directly proportional to the voltage drop across a component and inversely proportional to the current flowing through it. Impedance is the total opposition offered to the flow of alternating current by a circuit or component. It may consist of resistance (R) only, or may be some combination of resistance and reactance, capacitive or inductive or both. When reactance is present in combination with resistance, impedance (Z) is the vector sum of resistance (R) and reactance (X). Thus; $Z=R\pm jX$. The presence of reactance makes impedance frequency-dependent.

Some of the components and devices ordinarily checked for impedance include capacitors, choke coils, transformer windings, relay coils, *rf* coils, loudspeaker fields and voice coils, motors, solenoids, and occasionally combinations of these various elements.

Impedance measurements are similar to resistance measurements; except that simple resistance measurements usually, but not always, are made with direct current, while impedance *always* must be checked with *ac*. In fact, the similarity is so great that an ohmmeter specially designed to operate with an applied *ac*, rather than the usually *dc* voltage, might be used under some circumstances as an *impedance meter*.

Volmeter-Ammeter Method

Several methods of impedance measurement are available to the service technician. The simplest scheme offering good accuracy is the *voltmeter-ammeter method*. This is illustrated in *Fig. 2*. The voltage drop across the unknown impedance is measured with *ac* vacuum-tube voltmeter, and the current through it with an *ac* ammeter. For highest accuracy, the voltmeter resistance must be high and the ammeter resistance low. Impedance (Z) is calculated from the voltage (E), in volts, and the current (I), in amperes: $Z=E/I$.

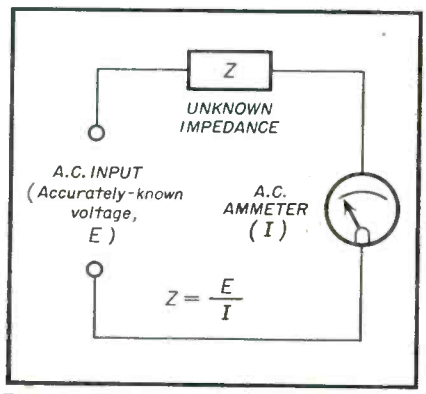


Fig. 3—Connections for Ammeter method of Z measurement.

Example: A coil is checked by the voltmeter-ammeter method. The ammeter reads 500 milliamperes (0.5 ampere), and the v.t. voltmeter 0.3 volt. What is the impedance value? Here, $Z=E/I=0.5/0.3=1.66$ ohm.

The applied *ac* test voltage may be

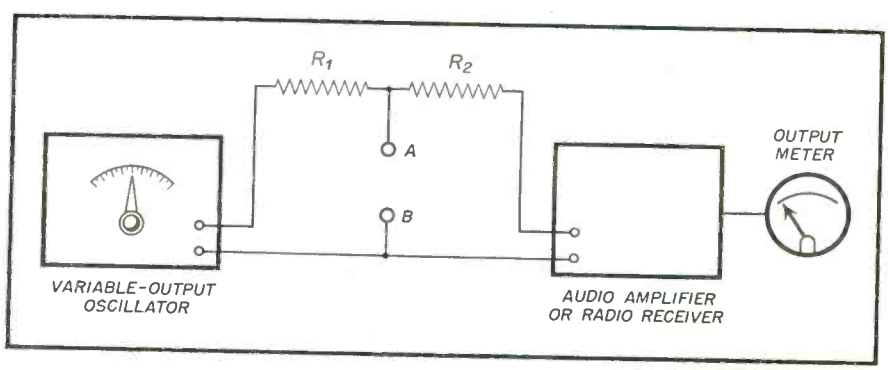


Fig. 4—Set up for measuring Z by the Network method.

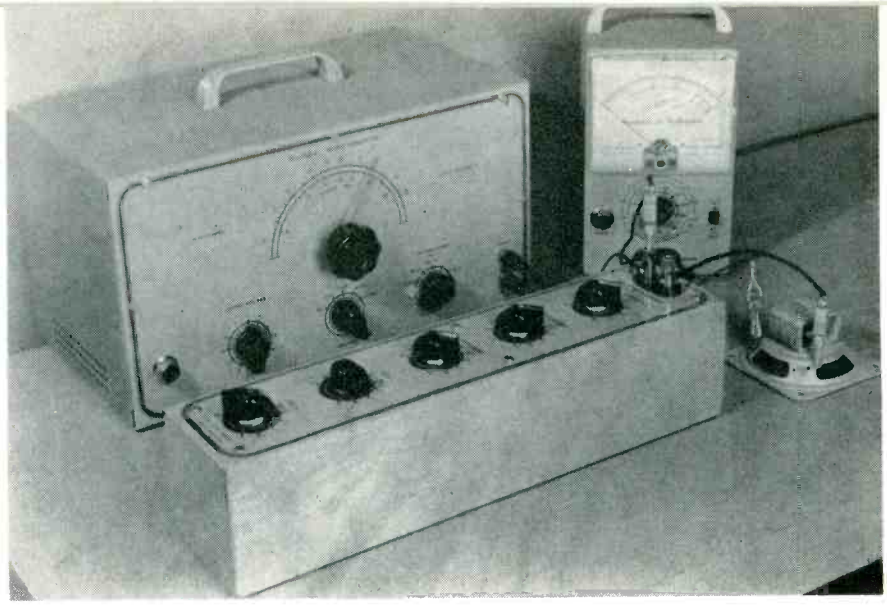


Fig. 1—A typical, inexpensive commercial set up for accurately determining impedance. Refer to schematic in Fig. 5.

of any frequency required for the measurement. But frequencies higher than about 3000 cycles seldom are practical in this method because of errors caused by high-frequency leakage in the circuit and instruments. If impedance is to be checked at several frequencies, the response and accuracy of the two meters must be good throughout the desired frequency range. The voltage source itself must have a low impedance, to prevent error due to the impedance in series with the unknown. Otherwise, the source impedance value must be subtracted from the calculated value of the unknown.

The voltmeter-ammeter method of measuring impedance has the advantage of relative simplicity. It makes use of standard instruments which can be found in the average shop and small laboratory, and these instruments need not be tied up beyond the length of time required for the test. It has the disadvantage, however, of being unsuitable at high frequencies because of "feedthrough" of the test signal by stray capacitances. This stray coupling can be minimized to some extent by the use of elaborate shielded between the parts of the setup. At the common test frequencies of 60, 100, 400, and 1000 cycles, no trouble due to this cause need be expected.

Ammeter Method

A variation of the scheme just described is the *ammeter method* (See *Fig. 3*), so called because an ammeter or milliammeter usually is the only instrument required. Here, the voltmeter is omitted, the test voltage being supplied by a source of accurately-known *ac* voltage. Impedance is determined from the known voltage and the measured current, as in the previous method: $Z=E/I$.

Example: A choke is checked by the ammeter method, using as the test-voltage source an audio oscillator rated at constant 2 volts output. The ammeter reads 100 microamperes (0.0001 amp.). What is the impedance value?

$Z=E/I=2/0.0001=20{,}000$ ohms.

This scheme has the advantage that only one meter is needed. Its accuracy is dependent, however, upon the closeness with which the test-voltage value is known and may suffer considerably from hidden voltage fluctuations.

Both the voltmeter-ammeter and ammeter methods are used frequently by audio technicians having occasional need to check voice coils, chokes, capacitors, and resistors at audio frequencies.

T-Network Method

Fig. 4 illustrates a substitution method of impedance measurement with a simple T-network. This method is applicable to both audio and radio frequencies.

In this scheme, a T-network is formed by non-inductive resistors *R1* and *R2* and the component which is connected to terminals *A* and *B*. The signal source is an audio oscillator for *af* impedance measurements, or an *rf* oscillator or signal generator for *rf* measurements. The signal source must have continuously-variable output voltage and must have some method of output voltage indication such as an output meter or calibrated attenuator. The detector may be any convenient small audio amplifier for *af* measurements, or a small radio receiver for *rf* measurements. This detector must be provided with an output meter, as shown in *Fig. 4*.

Resistors *R1* and *R2* must be non-inductive. They can be ordinary 1-watt carbon units. For impedance measurements up to about 100 ohms, they can be 1000 ohms each. Their value should be increased when checking higher impedances. It is advisable that *R1* and *R2* each have a resistance equal to approximately 10 times the highest impedance to be measured.

The following procedure is followed in checking impedance by the T-network method. (1) Connect a 10-ohm non-inductive resistor temporarily to terminals *A* and *B*. (2) Adjust the

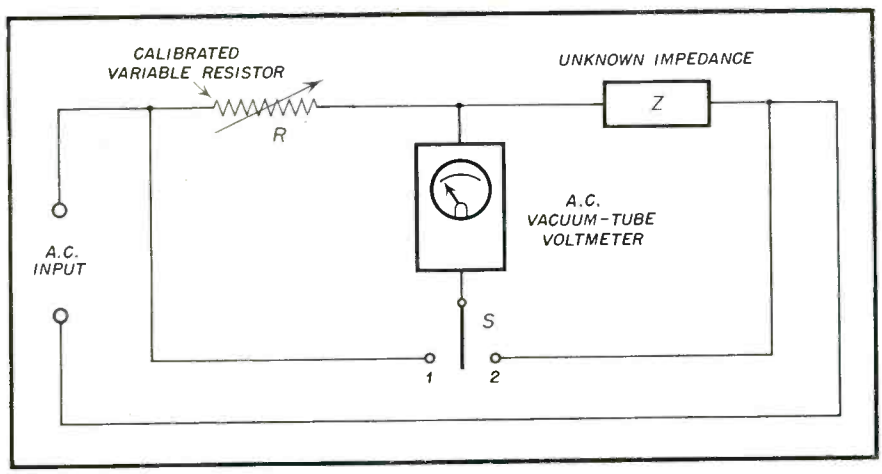


Fig. 5—Series-Resistance method—Set up pictured in Fig. 1.

oscillator output to obtain a convenient reading of the output meter of the amplifier or receiver. The best reading will be in the upper third of the meter scale. (3) Record the corresponding reading of the output meter or attenuator in the oscillator as *E1*. (4) Remove the 10 ohm resistor from the T-network and connect the unknown impedance, in its place, to terminals *A* and *B*. (5) Reset the oscillator output carefully until the same reading as before is obtained on the output meter of the amplifier or receiver. (6) Record the new reading of the output meter or attenuator in the oscillator as *E2*. (7) Determine the unknown impedance (Z, in ohms) by means of the equation $Z=10\ E1/E2$. *Example*: A capacitor is checked by the T-network substitution method. The circuit is set up with a 10-ohm resistor and the oscillator output is adjusted to 15 volts (E1 for a suitable reference deflection of the detector output meter. The capacitor then is connected in place of the 10-ohm resistor, and the oscillator voltage must be reduced to 0.5 volt (E2) to restore the detector output meter deflection to its initial value. What is the impedance of the capacitor? $Z=E1/E2 \times 10 = 15/0.5 \times 10 = 30 \times 10 = 300$ ohms.

When using the T-network method, connect the network to the oscillator and detector (amplifier or receiver) by means of the shortest possible leads. When checking impedance higher than 100 ohms, it may be convenient to employ a "setup" resistor having some value higher than 10 ohms. This new value (which need not be an even number of ohms) must be substituted for 10 in the equation for impedance calculation.

Series-Resistance Method

The series-resistance method, or some variation of it, is the scheme usually employed in electronic laboratories for the accurate measurement of impedance at audio frequencies. This method is illustrated in *Fig. 5*. A typical setup employing the scheme also is shown in *Fig. 1*.

The series-resistance method requires an accurately-calibrated variable resistor (R) which may be a resistance decade box, as shown in *Fig. 1*, or may be a rheostat provided with a direct-reading *ohms* dial. The variable resistor is connected in series with the unknown impedance (Z) and a source of *ac* test voltage at the desired frequency. The voltage source may be an audio oscillator, as shown in *Fig. 1*. An *ac* vacuum-tube voltmeter is arranged with a single-pole, double-throw switch (S) for reading at will the voltage drop across either the resistance or the impedance.

To check an impedance by the series-resistance method: (1) Throw switch *S* to its position *1*, and adjust the *ac* test voltage to give a good deflection of the *vtvm*. This deflection shows the voltage drop (E_r) across the resistor. (2) Throw switch *S* to position *2*, now observing the voltage drop (E_z) across the unknown impedance. Note the difference between the values of E_r and E_z. (3) While throwing switch *S* back and forth between its two positions, slowly adjust resistance *R* until there is *no* change in the v. t. voltmeter reading as the switch setting is shifted. (4) At this point; the voltage drop E_r equals the voltage drop E_z, and the unknown impedance (Z) is equal to the setting (R) of the calibrated variable resistor. The impedance value thus is read directly from the setting of the resistance dial or scales. Impedance values can be measured as accurately as the calibration of the variable resistance.

It is desirable to keep the test voltage as low as possible when using the series-resistance method, in order to prevent excessive current flow through the resistance and impedance in series. If a vacuum-tube millivoltmeter is available, the signal may be reduced to a few millivolts and there will be no danger of damaging either the calibrated resistance or the impedance under measurement. An inexpensive Heathkit Model AV-2 audio vacuum tube millivoltmeter, Model DR-1 resistance decade, and Model AG-8 audio generator are shown in the series-resistance setup in *Fig. 1*. This arrangement permits the measurement of impedance from 1 ohm to 99,999 ohms in accurate 1-ohm steps and at frequencies from 20 cycles to 1 megacycle.

If a resistance decade box or direct-reading rheostat is not available, an uncalibrated rheostat may be used in the following manner: After the circuit is "balanced", remove the rheostat carefully from the circuit without disturbing its setting and read its resistance with an accurate ohmmeter. The unknown impedance then is indicated by the ohmmeter reading.

The series-resistance method of impedance measurement has the advantage of simplicity and high accuracy. Balancing the circuit is the easy operation of adjusting the resistive element only for equal voltage drops, and determining the impedance is reduced to merely reading the resistance setting.

Example: In a series-resistance impedance-checking setup employing a resistance decade box, the *vtvm* deflection is stabilized when the decades of the box are set to the following values: 1 thousand, 8 hundreds, 5 tens, and 4 units. What is the unknown impedance value? Ans. 1854 ohms.

In the series-resistance method, unlike several other methods of impedance checking, the accuracy of measurement is independent of the impedance of the test-voltage source.

No article on impedance measurement for the service technician would be complete without some remark concerning the mistaken idea that a *dc* ohmmeter, such as is incorporated in radio test meters, can be used to check impedance. There are service dealers who feel quite positive that a resistance check will indicate true impedance if the ohmmeter reading is multiplied by some factor. Furthermore, they contend that they have had it "come out okay" and often can perform an almost convincing demonstration, the results of which we hasten to assure you are due strictly to coincidence.

The instances of this so-called proof are happy coincidences of a chance relationship between the *dc* resistance of a transformer winding checked and its inductance. This fallacy can be understood readily when we consider that the same value of inductance can be obtained with a high-resistance and a low-resistance coil; but, due to the difference in resistance values, the impedance of these two coils would be different. Also, different values of inductance (and therefore impedance) might be obtained with coils having the same *dc* resistance!

In the normal servicing of electronic equipment, it often becomes necessary to measure impedance and you will want a check of good accuracy. When this occasion arises, use one of the methods described in this article, the selected method depending upon which instruments you own and can detail to the job.

TV SYMPOSIUM SERIES— No. 2 (Cont'd)

This is a continuation of the Symposium article featured in the January issue. Specific application of the principles discussed previously is shown in the various commercial units described here.

UHF CONVERTERS

by ALLEN LYTEL

PART 2

General Electric Translator

Designed to cover the UHF-TV band in its entirety as with most UHF-TV converters, the General Electric translator Model 101 is shown with its inter-connection in *Figure 10*. The existing VHF antenna is tied to the VHF antenna terminals on the UHF translator. A separate UHF antenna and transmission line-lead-in (assuming a separate antenna is needed) is tied in to separate UHF antenna terminals on the translator. A short section of transmission line connects the standard antenna terminals of the VHF receiver to a third set of terminals on the translator. There is a power outlet on the back of the translator into which the power line of the VHF receiver is attached. The converter power cord is plugged in to a standard wall outlet and its supplies AC power for both the translator and the standard television receiver.

There are two controls on the translator; one is the tuning control and the other is the selector switch. In the "Off" position of the selector switch, no power is supplied to either unit, in the "VHF" position, the standard television receiver is supplied with power and the VHF antenna lead-in passes through the translator to the antenna terminals of the standard receiver. Filament power alone is applied to the UHF translator while the switch is in this position (so as to allow warm-up and minimize drift when the translator is turned on.) In the "UHF" position, filament and plate supply to the translator are both on and the standard television receiver is operating. The UHF antenna is now connected with

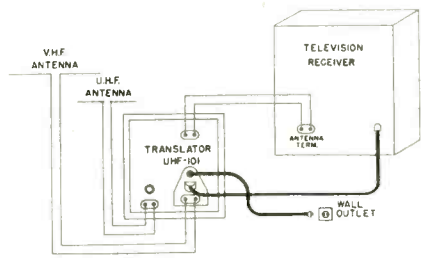


Fig. 10—Connections for wiring GE U-H-F converter to TV receiver.

the translator and the output from the translator on the appropriate VHF channel is supplied to the VHF tuner. Thus in this position the UHF signal passes through the translator where it is converted to a VHF signal and then passed to the VHF television receiver. A fourth or "light" position of the selector switch turns on the pilot light for the translator allowing for accurate tuning. So that the pilot light will not be a distracting element to the viewer, it is on only in this position, allowing the station to be tuned in after which the selector switch is turned back to the "UHF" position.

A schematic diagram of this translator is shown in *Figure 11;* the antenna terminals discussed above may be identified from the schematic. Parallel wire transmission lines are used for frequency adjustments; one tunes the oscillator circuit and the second tunes the input. These are capacitively loaded transmission lines whose turning is accomplished by means of sliding shorting bars. There are adjustments, which are *C-5* and *C-21,* for tracking purposes. It will be seen from the schematic that rather than directly going to ground, the short circuited ends of the transmission line tuning elements are resistively loaded using two resistors whose junction is grounded. This prevents the unused portion of the transmission line tuning element from being resonant. A resonant condition here would "suck" energy from the desired resonant circuit; the resistive loading acts to damp out any oscillation which would be present in the "unused" portion of the transmission line tuning element.

A self-contained power supply is used with this unit which prevents loading the power supply of the existing television receiver. A 6AF4 is used for the local oscillator with a IN72 crystal mixer. In common with

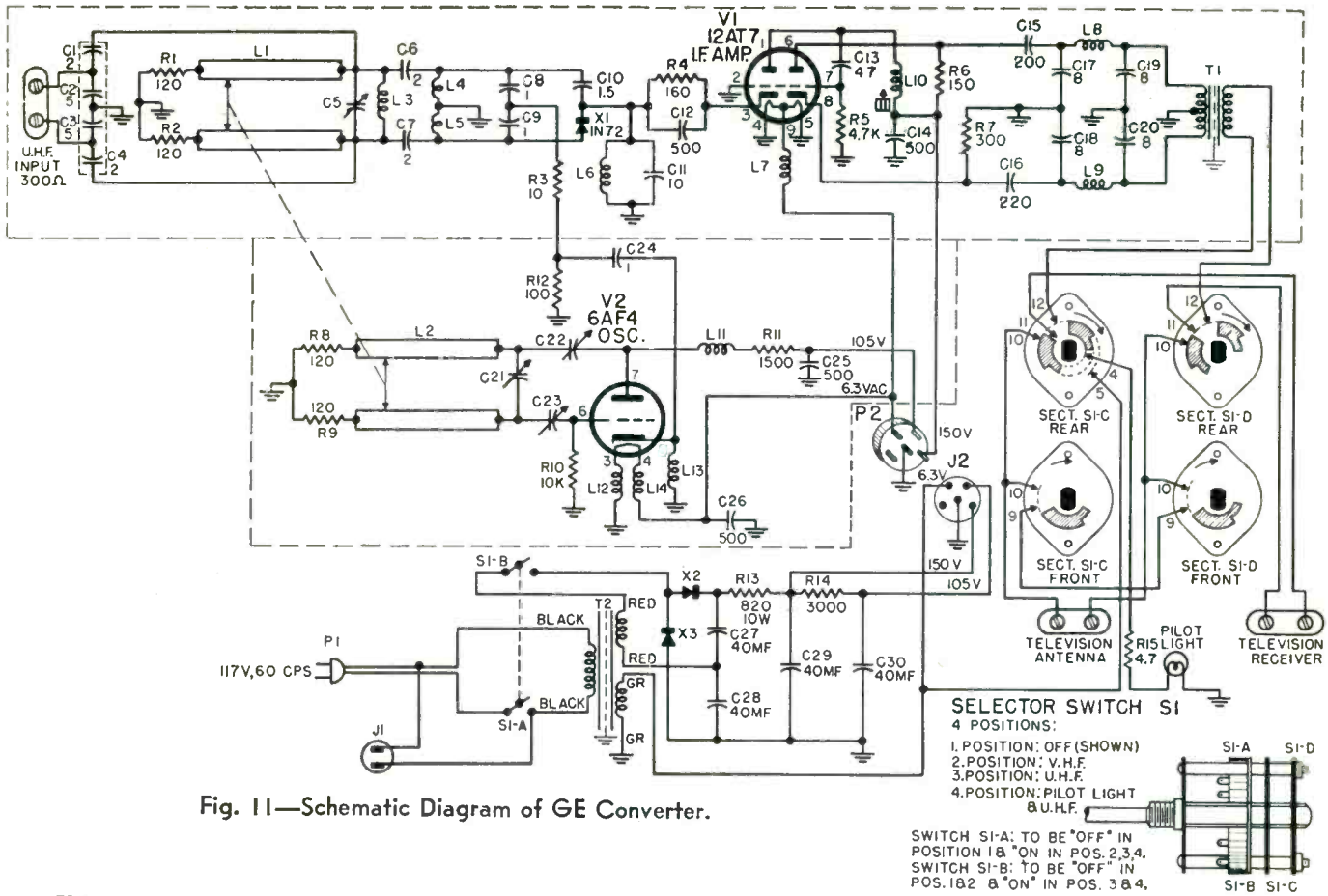


Fig. 11—Schematic Diagram of GE Converter.

most UHF conversion systems, there is no rf amplifier. A 12AT7 is used as the if amplifier: the input is to the cathode on pin 3. The grid of this section is at ground potential and it operates as a grounded grid amplifier. The plate output is capacitively coupled to the grid of the second amplifier on pin 7. Output is taken between plate and cathode and inductively coupled to the 300 ohm output going to the standard television receiver.

Figure 12 illustrates the location of parts on this translator. The drive screw for the transmission line tuning elements is shown to the left and the trimmer adjustments for tracking mentioned above are also indicated. The coupling adjustment *L-10* adjusts the coupling between the if amplifier stages.

Kingston Products Converter

A simple and complete basic tuner manufactured by the Kingston Products Corporation is shown in *Figure 13*. The three controls are: 1. Station selector, 2. Fine Tuning and 3. Off-On Power and antenna conversion switch. The over-all cabinet dimensions are 8⅛th inches wide, 5¾ inches high and 4½ in. deep. The schematic of this unit which does not have its own power supply is shown in *Figure 14*. There are two tuned transmission lines, one for the local oscillator and one for the pre-selector. The transmission lines are shaped in a radius and tuning is accomplished with silver plated sliders. The entire tuner shown in *Figure 15* without the cover and in *Figure 16* with the cover may be used as a self-contained unit with its built-in power supply allowing it to be used with any television receiver. Taken alone, the tuner unit may be added to an existing television receiver utilizing the already present receiver power supply.

The oscillator and pre-selector lines are made from ¼ inch wide curved parallel strips of silver plated brass. Tuning principles are the same as those discussed earlier in the article. The tracking problem is made simple by using two trimmer condensers one for the high frequency end and the other for the low frequency end. These

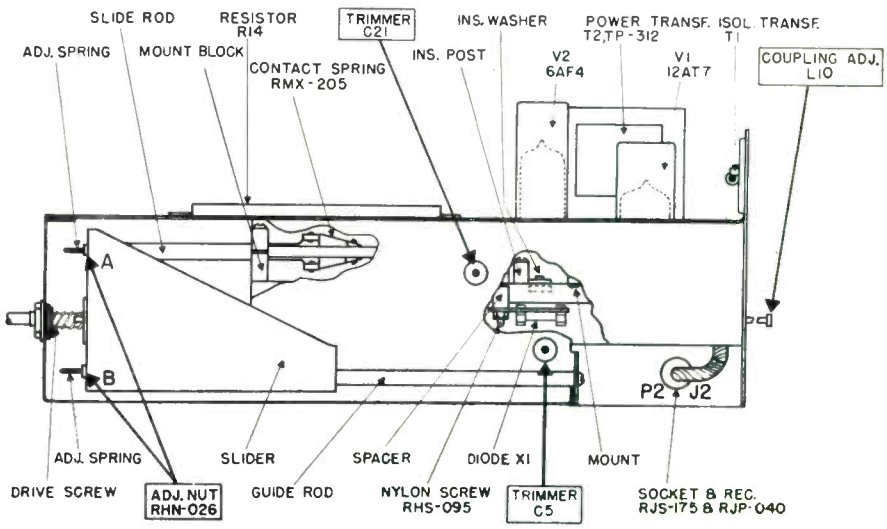


Fig. 12—Tube, trimmer and component location of GE Converter.

Fig. 13—Kingston U-H-F Converter in cabinet.

trimmers are virtually independent. The pre-selector circuit uses a half-wave transmission line with a crystal mixer directly coupled to the shorted output end and the antenna mutually coupled to the input end of the lines. The oscillator uses a 6AF4 vacuum tube, capacitively coupled to a quarter wave short circuited line.

When the VHF receiver is tuned to Channel 10 the local oscillator tunes from 275 to 695 megacycles. Plate voltage is shunt fed through series chokes with by-pass condensers used. Warm up drift is stablized after approximately five minutes of operation.

A cascode IF amplifier is used with its inherent low noise; the double triode is a 6BK7 which amplifies the output of the mixer and provides additional selectivity. The band width of this IF amplifier is great enough to allow mixed tuning and drift while preventing any serious amplitude distortion since the band width is approximately 7 megacycles. A 300 ohm output is supplied to the standard VHF antenna terminals of the existing receiver.

Zenith UHF-TV System

It is possible to obtain UHF-TV reception with the standard VHF receiver through the use of a channel strip provided the VHF television receiver uses a turret tuner. This type of reception pioneered by Zenith, among others, has been successfully demonstrated. The receiver local oscillator operates below the high channels and above the low channels reducing the range required of the oscillator. A symmetrical band pass is necessarily used because the relative positions of the sound and picture carrier are inverted.

In *Figure 17* a block diagram of the VHF conversion system is shown in part A; a block diagram of the UHF conversion system is shown in part B of the same figure. In the first case, the 6CB6 is used as an RF amplifier, the 6AG5 is the mixer and the 6C4 is the local oscillator. As the tuner is turned from channel to channel, different channel strips are used and fine tuning adjusts the oscillator frequency over a small range.

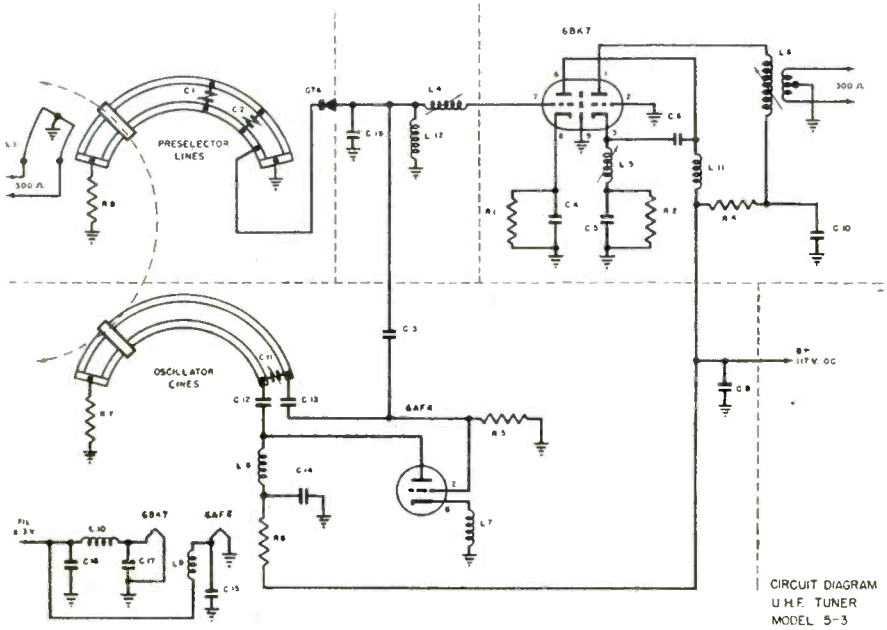


Fig. 14—Schematic of Kingston Converter.

In the case of UHF operation, a special channel strip is inserted on an unused local channel. Only the oscillator functions as it did originally. A crystal mixer is used whose input frequency for mixing is obtained from a second crystal which acts as a frequency multiplier. This means the 6C4 local oscillator signal passes through a stage of frequency multiplication then through the mixer. The original RF amplifier tube, the 6CB6, is changed to an IF amplifier as is the 6AG5 which formerly functioned as the mixer. In this way, there are effectively two amplifier stages after mixing. All of the parts necessary to convert part *A* in the figure to part *B* in the figure are contained in the compact UHF channel strip. Since there are no additional vacuum tubes used, there is no additional drain on the power supply.

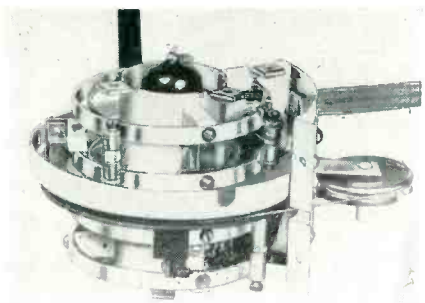


Fig. 15—Kingston Converter with cover plate removed.

Fig. 16—Kingston Converter with cover plate in place.

RCA-UHF-TV Converter

The Radio Corporation of America is one of the pioneers in UHF-TV and as a part of the National Broadcasting System experimental UHF television program, several different models of converters have come into use. *Figure 18* is a schematic of a special experimental converter designed to be used as a part of the experimental program at Bridgeport, Connecticut. Input to the tuner is by means of 75 ohm coaxial line coming from the antenna; output of the tuner is at 21 megacycles so that the output signal can be applied directly to the I-F frequency remains constant, the receiver. A high-pass filter which is a printed circuit is used as a part of the input with a cut-off at approximately 500 megacycles. The use of such a filter as in *Figure 19* prevents interfering signals below this frequency from interacting with the TV signals. This filter feeds a 6J4 triode acting as a grounded grid RF amplifier. This tuner which operates on a double superheterodyne principal has a 6J6 as the first oscillator and mixer. The output of this stage is a 135 megacycle signal.

Two 6AG5's are used for the first or

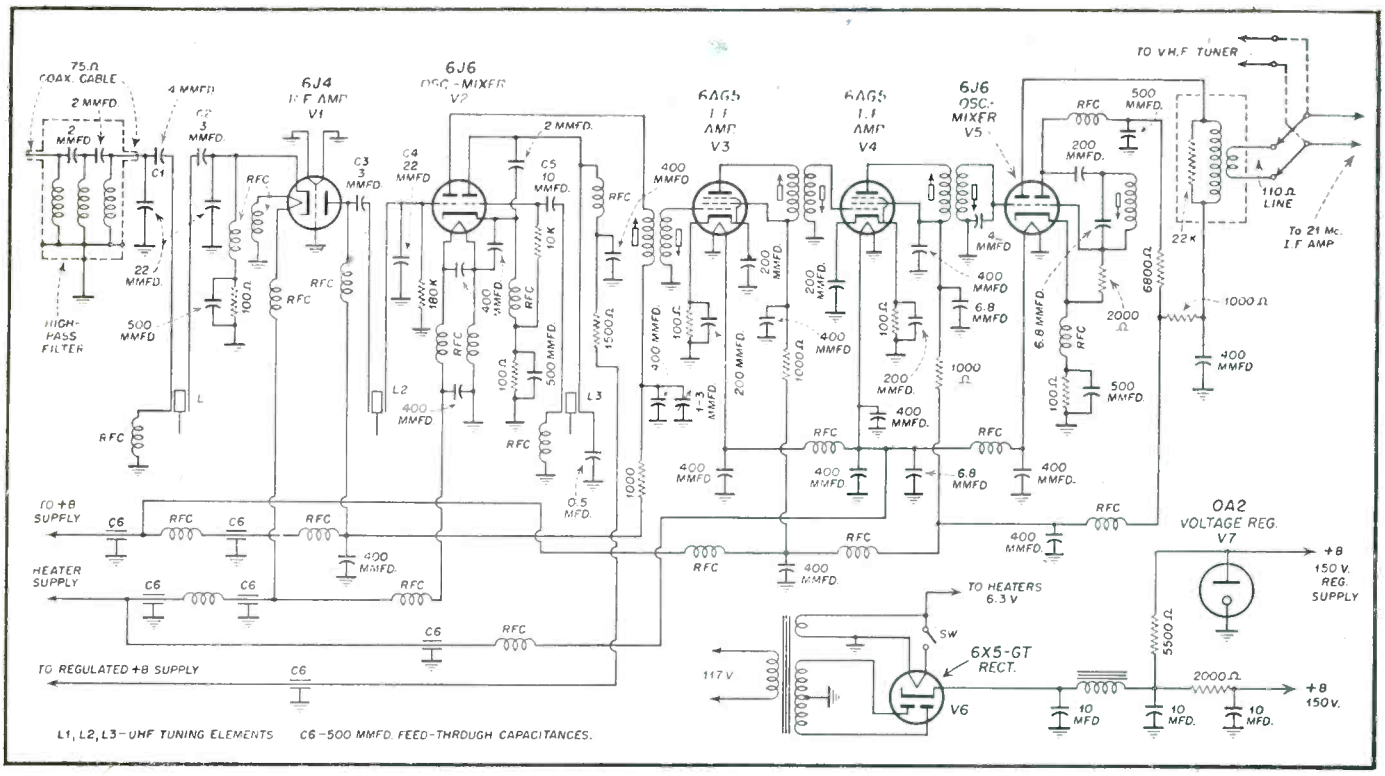


Fig. 18—RCA U-H-F Tuner schematic.

high frequency I-F amplifier. As this IF frequency remains constant, the second oscillator need not be tuned. This second oscillator mixer, again a 6J6, heterodynes the incoming signal and produces a standard 21 megacycle IF output.

As shown in the schematic drawing, the I-F amplifier of the VHF receiver may be connected to either the VHF tuner or the UHF tuner with this in mind: a converter of this type could be mounted on the television chassis so that there would be two tuners; one for the UHF band and one for the VHF band. This would, of course, be a transitory stage since eventually receivers covering both bands will be needed.

Tuning elements of this converter do not operate over the entire range although it is apparent with slight changes in design, they could. However, it appears that these tubes would not give adequate performance as RF amplifier over the entire band.

The tuning strips in *Figure 20* which are used are very thin strips of copper foil mounted on bakelite tubes. This piece of copper represents something less than a full turn and its shape is tapered in this manner in order to provide proper tracking. The frequency is varied as the slug is moved in or out by the attached threaded screw. Since even a short section of straight wire has appreciable reactance at UHF, these coils act as inductances and their electrical equivalent is a slugged tuned coil having a number of turns.

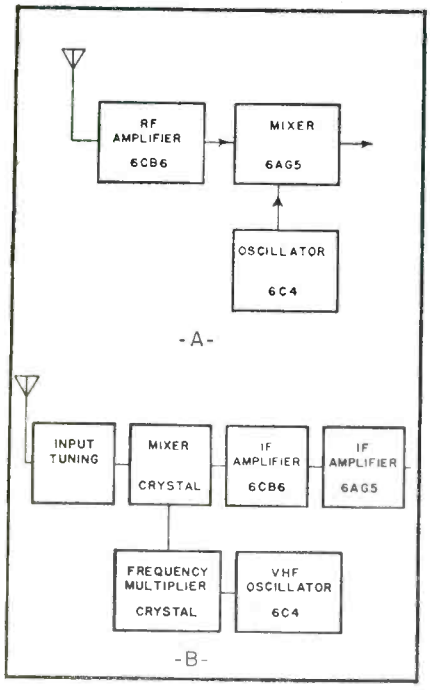


Fig. 17—Block diagram of Zenith System.

A. V-H-F conversion system
B. U-H-F conversion system

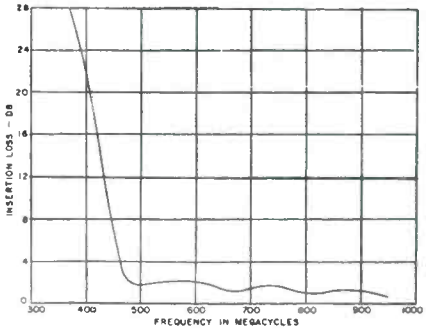


Fig. 19—High pass filter characteristics of RCA tuner.

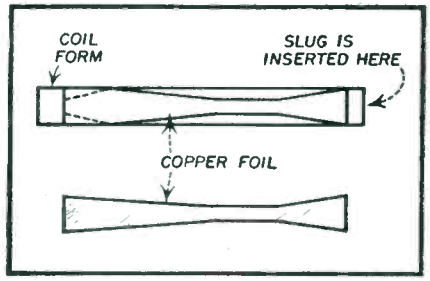


Fig. 20—Detail of U-H-F- tuning element used in RCA tuner.

This concludes the Symposium article on Ultra High Frequency Converters. Another Symposium articles will appear in the March Issue.

LOOKING *for* TROUBLE?

No. 11

by Cyrus Glickstein

SEE if you can find the trouble in a defective TV receiver which is being serviced on the bench by taking part in this trouble-shooting quiz. Answer each question before going on to the next one. If there is more than one correct answer, designate each one.

TYPE OF RECEIVER: RCA Chassis KCS47B, transformer low voltage power supply, flyback high voltage system, split sound (sound taken off after the second video i-f stage).

TROUBLE: Low and distorted sound; complete loss of sync both horizontally and vertically; the jumbled pix information (contrast level) appears normal.

1. As usual, controls are manipulated to determine the effect on the trouble. The volume control at maximum cannot increase the sound level to normal. Both hold controls have no effect on synchronizing the picture. The brightness control cannot blank out the picture even at maximum counter-clockwise rotation. The action of the contrast control appears normal—although the picture is not synced, the pix information evidently becomes darker and lighter as the contrast control is rotated in either direction. These indications are noted on all active channels.

On the basis of the information on the screen, from the speaker, and from rotating the controls, the defective section(s) probably is (are):

a. Low voltage power supply
b. Video strip (video i-f amplifiers, video detector, video amplifiers)
c. Sound strip (sound i-f amplifiers, discriminator, audio amplifiers)
d. Front end (r-f amplifier, oscillator, mixer)
e. Sync circuit (sync amplifier, sync separator)

2. Although there are several different troubles, it is reasonable to assume, until proved otherwise, that there is one common cause. The section most likely to be defective is the low voltage power supply. The trouble may be either in the power supply proper or in one of the voltage feed lines connected to the power supply.

Since a defective tube may sometimes short out part of the supply voltage, it is advisable to substitute tubes in the affected sections before proceeding with further trouble-shooting. Tubes are substituted in all the

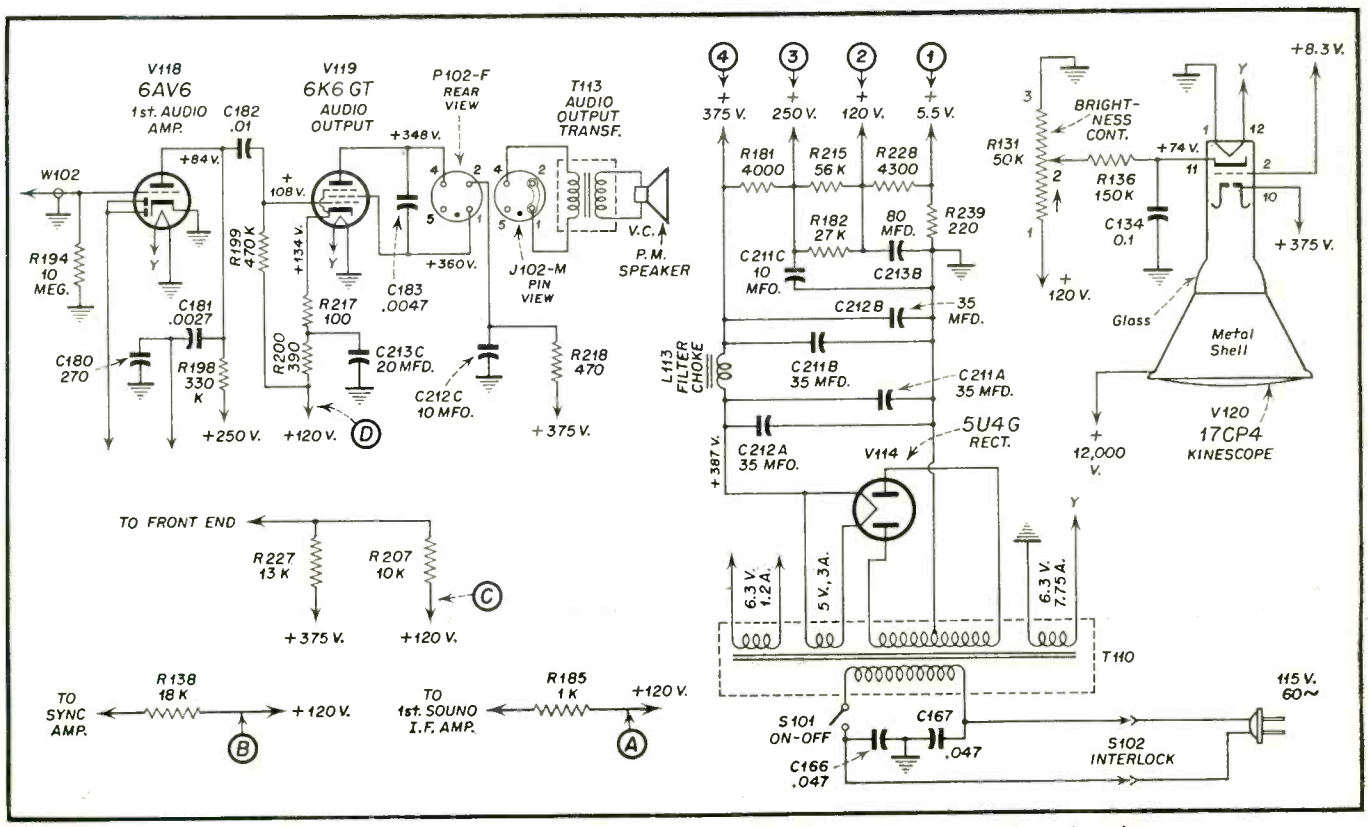


Fig. 1—Partial schematic of RCA chassis No. KCS47B, l.v. power supply and audio.

circuits which might be faulty—low voltage rectifier, audio strip, video strip, sync circuit. No improvement is noted.

At this point, the most helpful methods for localizing the trouble further are:

a. Scope check to find the defective stage
b. Disturbance tests
c. Signal injection (signal generator)
d. Voltage checks
e. Resistance checks

3. Voltage checks at key points in the circuit help determine whether the trouble is in the low voltage system. The following voltages are read at the indicated points of the voltage divider across the low voltage supply, *Fig. 1*:

Designated Point	*Schematic Value*	*Measured Value*
#1	+ 5.5 v	+ 1.5 v
#2	+120 v	+ 45 v
#3	+250 v	+218 v
#4	+375 x	+335 v

The most likely point to check further for the defect is:

a. + 5.5 v line
b. +120 v line
c. +250 v line
d. +375 v line
e. Transformer and rectifier circuit of low voltage supply

4. The trouble seems to be localized on the +120 V line. This is indicated by the greatest difference between the normal and actual voltage values. The trouble may be in the filter condenser at the +120 V junction of the voltage divider or in one of the stages feeding off this line. To localize the point at which the defect is located, the condenser at the +120 V junction (C213B), and the connections at A, B, C, and D, *Fig. 1*, are unsoldered one at a time. After each connection is unsoldered, the voltage at the +120 V point on the divider is remeasured. No marked change is noted and each line is reconnected until D is unsoldered. The voltage reading rises considerably closer to the normal value, indicating trouble along this line.

Power is turned off and resistance readings are taken along this line. Resistance measurements are normal. The line is resoldered to the +120 V point and further voltage measurements are made at the cathode and grid of the 6K6, audio output stage, since this circuit is returned to the +120 V line (*Fig. 1*). The following readings are obtained:

Control grid 6K6	—	42 v
Cathode 6K6	—	49 v
Junction of *R200* and *R217*	—	40 v
+120 v point	—	45 v

On the basis of these readings, the fault most likely is:

a. Leaky coupling condenser *C182*
b. Filament-to-cathode short in 6K6, audio output tube
c. Grid return resistor *R199* decreased in value
d. Leaky cathode bypass condenser *C213C*
e. Open cathode resistor *R200*

1. a

In cases of multiple troubles, it is usual to suspect the low voltage power supply—the power supply proper or one of the bus lines feeding off the supply. A low voltage defect is likely to affect more than one section of the receiver, though this is not always true. This discussion applies particularly to receivers with transformer-type low voltage power supplies. Some older TV receivers with series filaments also give rise to multiple troubles when one filament opens up. In these receivers, however, a glance inside the cabinet discloses several tubes with unlit filaments and the cause of the multiple symptoms is evident.

The most obvious case of trouble in the low voltage supply is no pix, no raster, and no sound although all of the tube filaments light up. However, there are many trouble symptoms—showing up singly or in combination—which are due to defects in the B+ supply. The symptoms from a given trouble depend on the receiver model and the circuitry.

A small drop in B+ voltage may cause merely a somewhat narrow picture which is too small to fill the mask horizontally or may cause both insufficient width and height. This small decrease in B+ voltage may be due to low emission in a rectifier tube or high internal resistance in a selenium rectifier. The same effects can

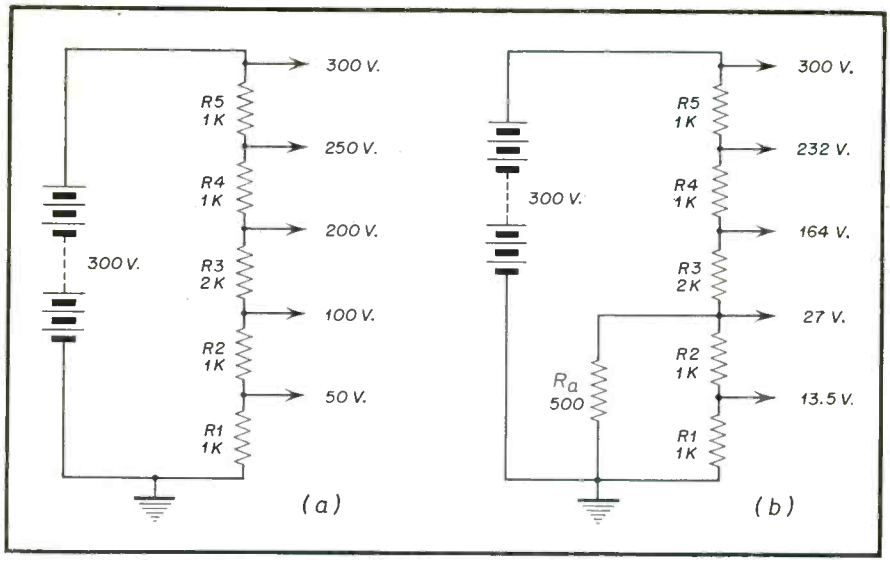


Fig. 2—(a) Simplified series voltage divider circuit. (b) Restribution of voltages caused by partial short.

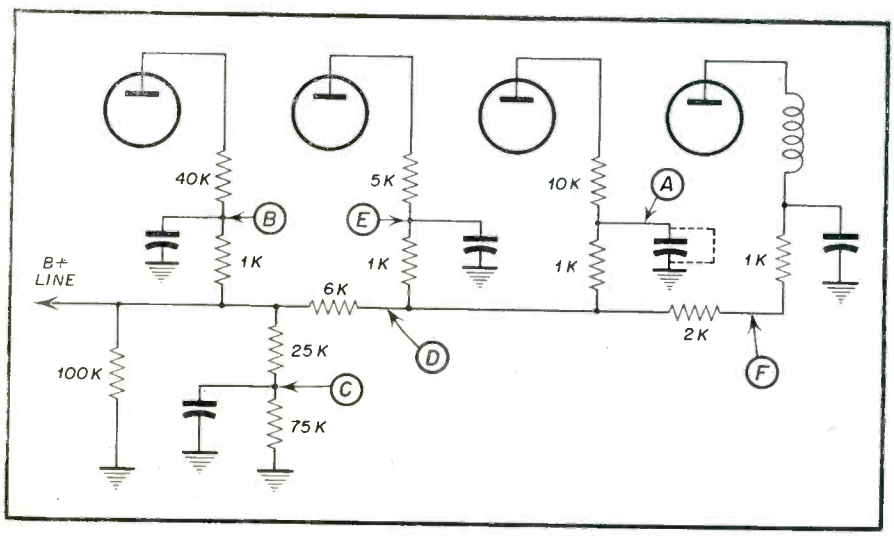


Fig. 3—Resistance readings are: (B+)-7K, (B)-8K, (C)-23K, (D)-1K, (E)-2K, (F)-3K, and (A)-150 ohms.

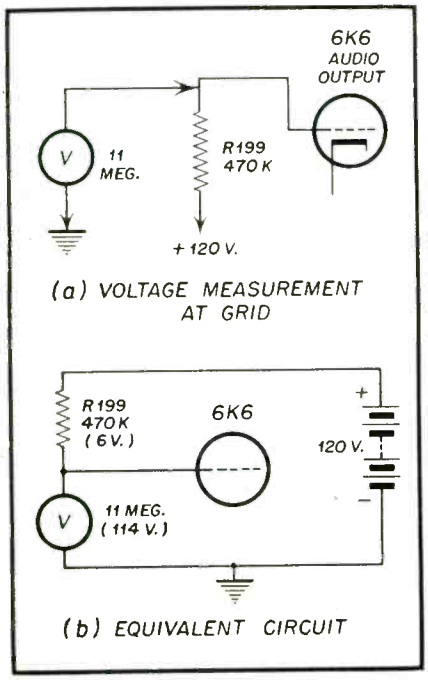


Fig. 4—Effect of meter on R.

be produced by a drop in line voltage. Before any trouble-shooting is done in a home because of these symptoms, the line voltage should be checked.

Other troubles which may be caused by a defective low voltage power supply are:

a. Tearing and pulling in the center of the pix plus a large loss in contrast (open power supply filter condenser);
b. Horizontal and vertical jittering (defective power supply filter condenser);
c. Vertical foldover (weak rectifier tube);
d. Insufficient brightness (low B+).

All of the troubles listed above can, of course, be caused by defects in other circuits. In all cases where the power supply may be at fault, it is advisable to change the rectifier tube as one of the first steps in trouble-shooting. This is to guard against spending a good deal of time hunting trouble in other parts of the receiver then finding that a defective rectifier tube is the cause.

Since a defective tube in another part of the receiver may cause a short or partial short on one of the B+ feed lines, it is advisable to change tubes in all of the affected stages before proceeding with further trouble-shooting.

In the receiver being serviced, the video information, though jumbled because of loss of sync, is contrastly, not snowy. This indicates the signal amplitude is normal and there is no visible loss of signal strength through the video strip. This in turn indicates the defect is not in the front end or the video strip. A defective front end or first or second video i-f stage might cause a weak signal, giving low sound and weak video. A weak video signal might in turn account for poor synchronization. However, since the video level appears normal and there is, in addition, still another trouble—loss of control over brightness—a defect in the front end or video i-f stages is not a likely possibility.

2. d, e

To check troubles along a complex voltage divider and the associated feed lines of the low voltage power supply, voltage and resistance checks are most valuable. Scope checks are most useful in signal tracing video signals in the video detector and video amplifier circuits, sync signals in the sync circuits, and sawtooth voltages in the sweep circuits. Signal injection can be used to check the front end, video and audio strips. Disturbance tests are most useful for localizing dead stages, especially in the signal circuits. The problem in this receiver is not to find a dead stage but the one which is functioning incorrectly.

3. b

The readings indicate trouble at the +120 v point, since the output at this point is off much more percentagewise than at any *higher* point on the divider. A useful working rule for finding the defective point along a voltage divider is to note the points which are furthest off from the correct readings. Select the highest reading in this group and check the line where this reading was made. This procedure is recommended on the assumption that a short or partial short at any intermediate point along a divider usually throws off the voltage at that point and at all points below more than it does the voltage readings higher on the divider.

The Circuit Simplified

This is illustrated in *Fig. 2*, showing a simplified example—a series voltage divider across a 300 v battery. (In TV low voltage power supplies, the voltage divider and stages form a complex series-parallel circuit.) The original voltage distribution in the simple series divider is shown in *Fig. 2a*. Now suppose a partial short of 500 ohms, represented by *Ra*, is placed from the +100 v point to ground. This value of resistance now parallels the two low resistors on the divider, *R1* and *R2*.

The voltage along the divider is redistributed, based on the new values of resistance in the circuit. The new voltages which would be measured are shown in *Fig. 2b*. Note that the highest point on the divider where the readings are off the most is the point

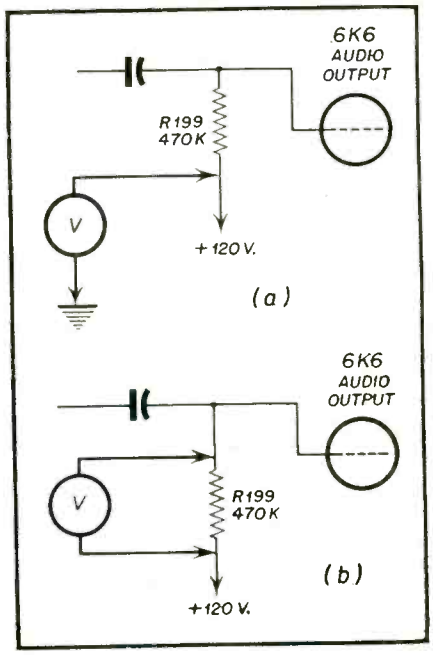


Fig. 5—Measuring grid voltage with low resistance meter.

at which the partial short (*Ra* to ground) is connected.

This example assumes the full B+ output of the supply remains unchanged. Under practical operating conditions, the B+ output drops when a heavier load (a short or partial short) is placed anywhere on a power supply. This drop is reflected all along the divider. However, the rule still holds. In addition to the general drop, there is a further redistribution of voltage because of the change in resistance relationships. The highest point on the divider at which the greatest voltage change is measured is the point to check first.

When the output of the whole B+ system is low and each point on the divider is equally low in direct proportion, then the trouble is probably either in the power supply proper or along the feed line connected to the top (most positive output) of the B+ supply. If there is some difficulty in determining where the trouble is originating, it is a good practice to separate the power supply from the load —stages feeding off the supply—and to measure the output of the supply. However, to get a valid check, it is necessary to place an equivalent load across the supply—a 5K, 20 watt resistor, for example. Normally, any power supply voltage goes up when the load is removed and a no-load check will not indicate clearly whether the voltage output of the power supply is normal. Furthermore, if the power supply is good and the load is removed, the output voltage may go high enough

[*Continued on page 68*]

SOUND SYSTEMS IN TV

by **LEONARD LIEBERMAN**

PART I

A discussion of the theory of Intercarrier Sound in the modern TV receiver, its advantages and its shortcomings. A comparison of former methods of sound take-off with a complete technical analysis of the factors involved.

THE sound system in the American Television System consists of a frequency modulated carrier which is 4.5 mcs higher than the amplitude modulated video carrier. After it is received and converted in the receiver into an I-F signal (*Fig. 1*), it is amplified. In the earlier model TV sets and in some of the current ones, this signal is taken off after the convertor or one of the composite I-F amplifiers. It is then fed to a separate sound I-F system.

Since 1948, this split sound system has declined in favor of the intercarrier sound system. In this system, both the video and sound I-F are amplified in one i.f. string. These are applied to the video detector. The video detector is a non-linear device. It can, therefore, be used as a mixer and second converter. The resulting output is fed to an I-F strip tuned to a 4.5 mcs.

After the sound i.f. signal is amplified, it is fed to a detector. The detected output is then taken off into an audio-frequency amplifier and then fed to an audio output tube.

Some F.M. Theory

In order to more clearly understand the problems which arise in the receiver sound system, a review of basic F.M. theory is now in order. The foundation of an F.M. system consists of an oscillator whose tuned circuit is so set up that the oscillator frequency or phase can be varied by an amplitude modulated system. This device is applied not only to radio transmission, but is the basis of some of the serviceman's equipment. The video sweep generator for instance, is an F.M. device. So are the sweep systems used in most oscilloscopes. As a matter of fact, the sweep generator is an excellent model for examining how an F.M. system works.

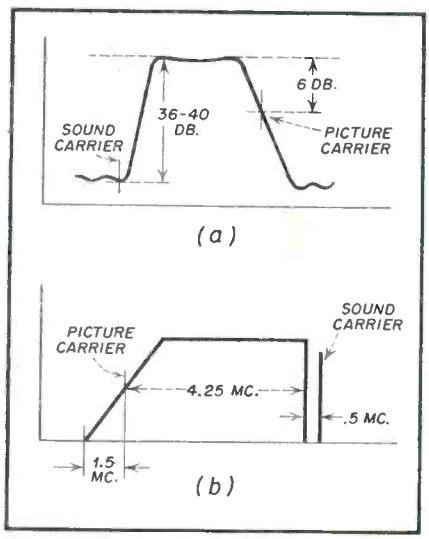


Fig. 1—a. Actual I-F curve. b. Ideal I-F composite curve.

Most of the common types of sweep generators, consist fundamentally of the following: an oscillator tube and associated circuits, a frequency varying device an amplifier section and an output section (*Fig. 2*). The oscillator section is generally a standard oscillator with a tuning condenser across the tuned circuit. In addition, another condenser is connected in parallel with the tuned circuit. The second condenser is mounted on a device which can vary the condenser's capacity.

The frequency varying device is usually a sweeper or a driver unit. The condenser is very likely to be a plunger device so arranged that as it is pushed or pulled past the rest point the capacity changes. As a sine-wave signal of 60 cycles is applied to the driver voice coil, the diaphragm and the connecting rod to the plunger will move in and out.

The oscillator's frequency will then increase and decrease in equal amount as the plunger moves in and out from its center position. The maximum deviation will occur, of course, as the peaks (positive and negative) of the sine-wave. By increasing the amount of signal fed to the speaker voice coil, the amount of deviation can be set. The rate at which the frequency is, of course, a function of the frequency of the driving sine-wave.

There, in a nutshell, are the basic elements of an F.M. signal. The amount of center frequency variation (usually called deviation) is a function of the input amplitude. The rate at which this frequency varies is a function of the input frequency. The last basic item of note is that the oscillator output is of a constant amplitude.

It is obvious that the driving voltage does not have to be a sine-wave but can be an audio signal. It is also obvious that the frequency varying device does not have to be mechanical. As a matter of fact, in broadcast transmissions it is never mechanical, but entirely electronic.

Intercarrier System

Before going into the sound I-F and detection stages in detail, let us examine the method of intercarrier

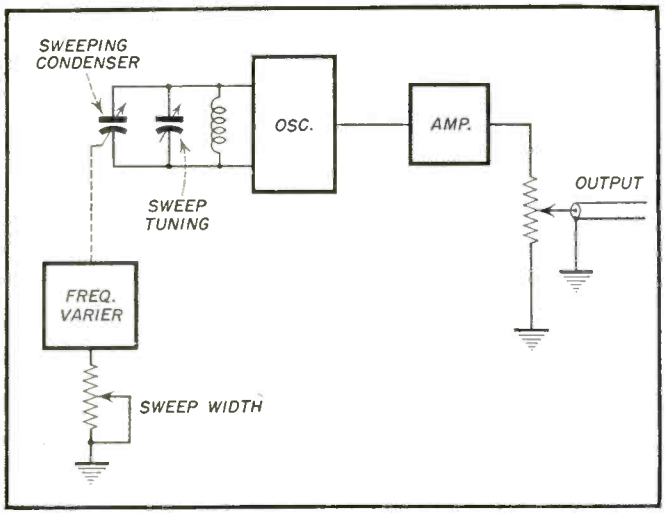


Fig. 2—Sweep Generator block diagram showing Oscillator, Sweep, Amplifier and Output.

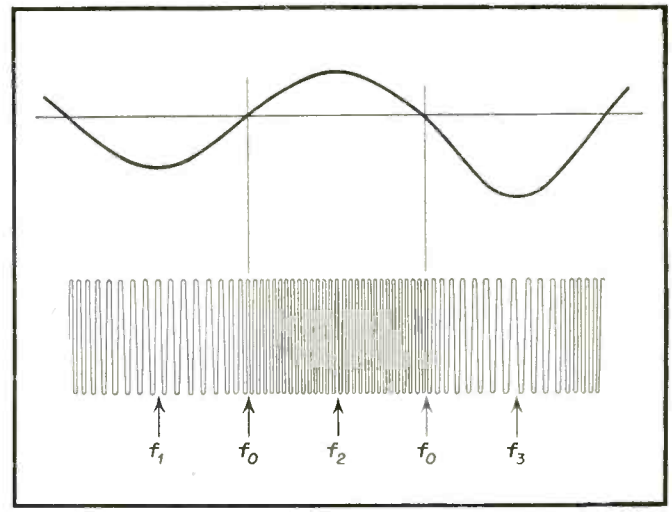


Fig. 3—Relation between Sine Wave modulating signal and F.M. output signal.

operation. In this type of operation a fixed frequency is heterodyned with a varying frequency in a non-linear device. The output will consist of the original fixed frequency plus the sum and difference frequencies. In the intercarrier system, the video carrier frequency is fixed. The sound frequencies vary around the sound carrier. When the two signals arrive at the video detector the output is the demodulated video signal and two F.M. signals one of which is the sum of the video and sound carriers. The other is 4.5 mc difference frequency (*Fig. 4* indicates in block form what happens).

Intercarrier Advantages

There are a number of reasons why the intercarrier system has superseded the split sound receivers in numbers produced. Some of these reasons are for better operation and others for manufacturing economy. (Some of us who worked on the earlier model intercarrier sets would have sworn that it would be impossible to find a good word for the system.)

To understand one of the main reasons for the intercarrier system benefits examine *Fig. 5*. In the earlier days of TV with most set sales in strong primary receiving areas the set was tuned for the picture with the best resolution. When this occurred, the converter output was correctly tuned and the best audio output occurred. This of course, was the optimum condition and it assumed that the local oscillator would not drift. Unfortunately, the oscillator *does* have a tendency to drift. If this occurred, and the oscillator drifted only 300 kcs. the sound would disappear even though the picture remained.

In addition, with the opening of the fringe market, it often became advisable to sacrifice picture resolution for picture gain. This could be done by

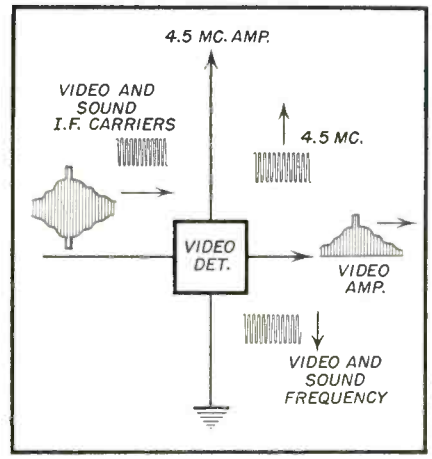


Fig. 4—Block diagram of intercarrier video detector inputs and outputs. As a result of the detector action the incoming video and sound carriers beat against each other, producing a separate 4.5 mc FM sound signal and a demodulated video signal.

detuning the oscillator approximately ¼ to ½ mcs and thereby increasing the picture strength by a factor of 2. If, however, the sound I-F was fixed, this would result in the sound being tuned out.

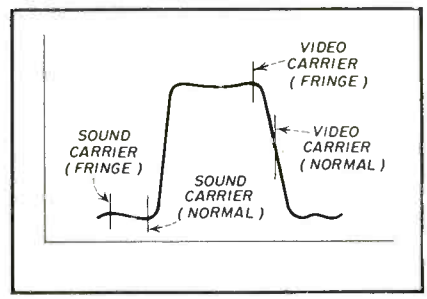


Fig. 5—I.F. signal showing the drift and fringe limits.
In split-sound receivers sound drift results as the local ascillator drifts in frequency.

The sound in the intercarrier system, however, is not fixed in the I-F amplifiers, but remains the constant 4.5 mcs. away from the video carrier. Therefore, if the oscillator is detuned either intentionally or by drift, as long as the picture remains, there is sound present. Another minor split sound annoyance which the intercarrier set eliminated was the microphonic front end. Since there isn't a separate sound I.F., the microphonic front end does not have anything to cross modulate.

The intercarrier system also, it seemed, had the potential for great manufacturing economy. The reason for that lies in the fact that the sound signal could be amplified through the regular i.f. stages and then be further amplified in the video amplifier as a 4.5 mcs. signal. After the video amplifier it could then be directly applied to the limiter stage. This would save one, or possibly two sound i.f. stages. For reasons which will be discussed later, these economies were misleading and today a good intercarrier system will cost almost as much to manufacture as a split sound set. The system advantages, however, remain.

The Limiter

After the sound I-F signal is amplified, it is applied to the grid of a limiter tube. The need for the limiter arises from the fact that the F.M. detector should have a constant amplitude voltage applied to it. The limiter also serves to clip any noise pulses which may be superimposed on the signal envelope. This ability to discriminate against and clip noise is one of the strongest features of F.M. transmissions. In order to accomplish this function the limiter stage which clips in the grid and limits in

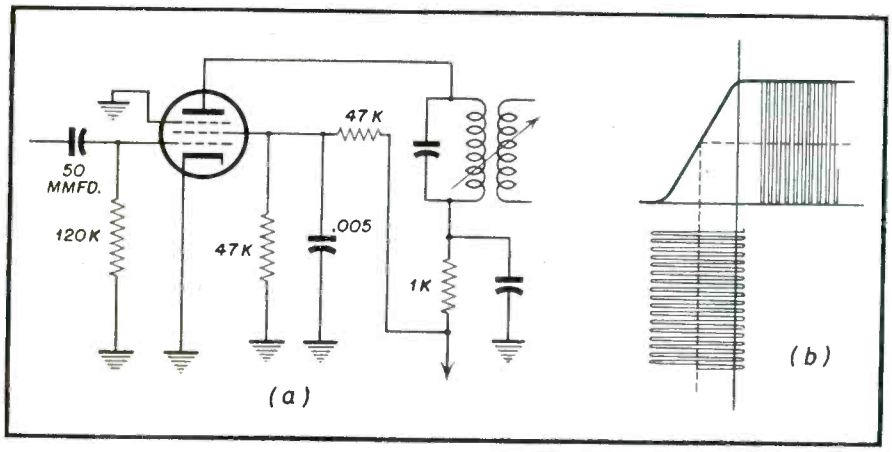


Fig. 6—Limiter action and schematic.

Fig. 6—(a) Typical limiter schematic found in many TV receivers. (b) Limiter action. Observe that large amplitude signals result in grid current, and drives the tube to plate current saturation, thereby clipping (leveling) the signal amplitudes above a certain value and at the same time attenuating noise pulses.

the plate, must be fed a signal of a large enough amplitude to drive it to grid current and plate saturation. (*Fig. 6B*). Since the frequency sensitive stage sees only variation in frequency and its rate of change, the distorted wave form of *Fig. 6B* does not result in sound distortion.

The frequency sensitive devices commonly used fall into three categories. The discriminator, the ratio detector and the quadrature detector. Taking these devices in that order, below is a brief description of how they function. Before going into details, it would be advisable again to see *Fig. 3* on how an F.M. signal is created.

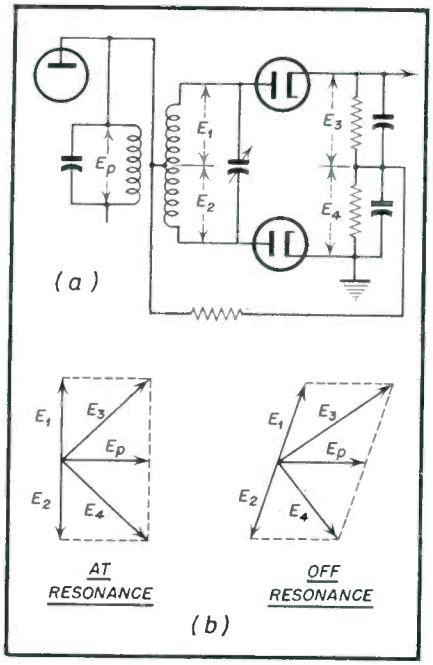


Fig. 7—Discriminator diagram with vector analysis of action.

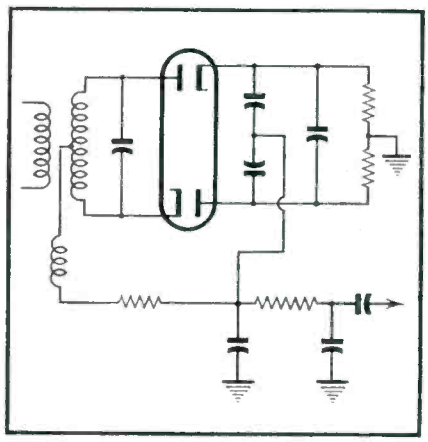


Fig. 8—Ratio detector schematic.

The Discriminator (Fig. 7)

In the discriminator we have a double tuned coupled transformer. The primary of the transformer is condenser coupled to a center tap in the secondary. The voltages at the end of the secondary without the coupling condenser are 180° out of phase with each other. The low end of the secondary is in phase with the top of the transformer. As a result of the coupling condenser, the ends of the transformer are 90° leading and 90° lagging the primary at the center tap. The ends of the transformer are connected to two diodes. The center tap is connected to the center of the two diode resistors.

Referring to *Fig. 3*, when the amplitude modulation equals zero, the F.M. frequency equals the center frequency. If the tuned circuits are at the center frequency, when that frequency is applied to the transformer primary, the resultant voltage at the secondary would be equal and 180° out of phase when applied to the diodes. The result would be that they would cancel each other out at the center tap. If the applied frequency is either greater or less than the center frequency, the phase angle of the resulting signal would cause the vector sums of the secondaries plus the primary to be greater for one diode or another. The outcome is an A.M. signal whose amplitude varies directly with input frequency (*Fig. 7B*). The difference in the load resistor voltages appears at the cathode of *V1*.

Ratio Detector (Fig. 8)

In the ratio detector, the vector analysis is the same as the discriminator with the following differences in operation. A third winding is connected from the midpoint of the secondary and it is brought back to the midpoint of two condensers which are located across the two diodes. The diodes are connected so that the plate of one diode and the cathode of the other one are at either ends of the transformer secondary. The difference voltage due to the variation in the amount the two diodes conduct appears as the demodulated audio signal at the low end of the third winding. By putting a large electrolytic condenser across the diode load resistors variations in input voltage can be compensated for. This action makes it possible in strong signal areas to eliminate the limiter stage. Due to the fact that the same current flows in both tubes, the output of a ratio detector is ½ that of a discriminator for equal input voltages. This means that the ratio detector must be driven harder.

[*To be concluded*]

YOUR *hi-fi* MARKET

by CHARLES B. GRAHAM

(Engineering Dep't, Rocke International)

PART 5

Fig. 2—This H. H. Scott amplifier shows a typical group of controls for a top grade audio amplifier.

IN preceding installments we have examined power amplifiers, tone controls, phono compensation and preamps. This month we will delve into the front end of the high-quality audio amplifying system and explore some of the circuitry not yet touched on. All are part of the front end, or control unit section of the amplifier.

Various ways of minimizing record scratch and other noise will be examined; loudness controls and channel selection facilities will be discussed; and special features such as low impedance outputs will be discussed. When we have finished we should have a good idea of all the elements that go into the electronics of today's modern high-fidelity set-up.

In the old days a selector chose either radio or phonograph, and that was that. A two-way single pole switch in front of the first a-f grid did the job and no questions asked. Now it's a little more complicated. We often have four or even five signal sources, with three the absolute minimum which must be provided for in any system. Too, due to differences in level of various program material sources, plus the widespread use of loudness controls, it is imperative that we employ level setting potentiometers.

Selector Switches

The selector switch must provide for selection of either the output of the phono preamp or the tuner input(s), another input or two such as TV audio or tape recorder (output of tape preamp), and in some cases for selection of the preamp with bass compensation removed, so that a low level, high-quality mike can be used. This means that the selector switch cannot simply have each input receptacle wired to one switch contact. This is true of the tuner position, and the crystal phono, TV, and recorder inputs, *if* no level setting pots are used. (Their use is strongly recommended, as discussed below.) However, the phono input actually feeds into the grid of a bass-compensated and amplifying phonograph preamp, whose plate feeds to a switch contact through a blocking condenser. If the preamp is to be used as a mike amplifier, the bass compensation needed for magnetic phono must be removed at the same time that the selector switch arm goes into the mike position. Examine *Fig. 1* and you will see a typical selector switch for a hi-fi amplifier. Note that the switch is preceded by level-setting pots.

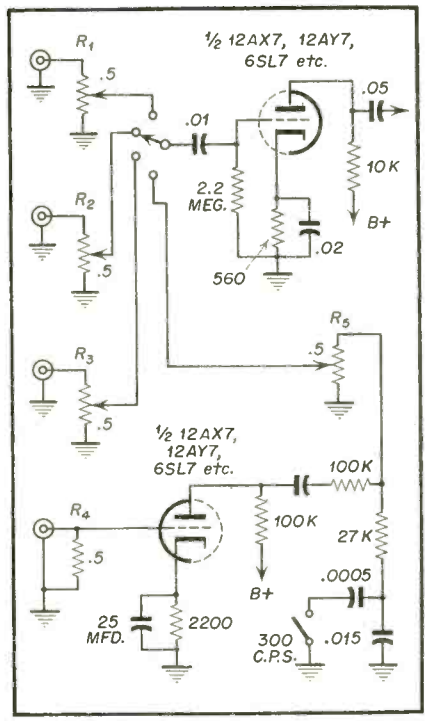


Fig. 1—Shown above is the input-selector section of a high-quality amplifier. The switch at lower left marked "300 cps" changes the turnover point (bass boost) of the phono preamp. Selector switch is shorting type to prevent loud switching noises in speaker.

These switches must be of the "shorting" type, to eliminate loud switching transients (which, with the high gains involved might easily damage the speaker) when switching from one position to another. Finally, the selector switch must short all signals to ground except the one which it is intended to amplify at any particular time. This may easily be seen by considering what would happen if a one volt tuner signal is present at a floating contact point ⅛th of an inch away from another contact which carries a signal being amplified, during a moment when the channel in use has a very low signal, say, .03 volts, at that point. Naturally, there would be a very audible tuner signal leaking into the desired channel.

Loudness Controls

Another reason for employing level sets, in addition to the differences in volume of one type of program source from another, is the variation in volume from one tuner to another, or one make of pickup to another. Many present day tuners are capable of delivering an output of 3 or 4 volts from their detectors, which can easily overload the first or second stage of a good amplifier. This can only be prevented by the use of a level-setting potentiometer ("level-set"). In practice, when all the program sources are plugged into the control unit correctly, the main volume control is set about midpoint, a typical radio station is tuned in, an average loud record, etc., and all input level-sets are adjusted so as to give approximate equal volume from the loudspeaker. This should be somewhere near the normal maximum expected volume at which the set will be used.

In most cases a two position switch is at first, adequate, but a large per-

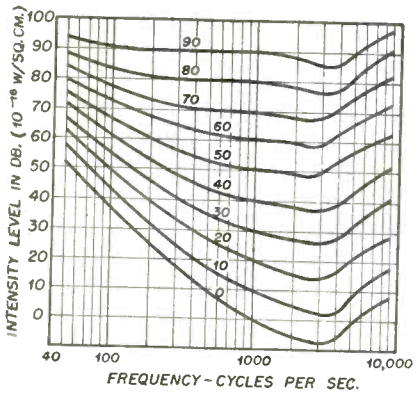


Fig. 3—Fletcher-Munson curves indicate the amount of boost needed at various listening levels to give the same apparent strength to different frequencies as would be heard (by the average ear) if the sounds were played at concert-hall levels.

centage of people who have high-fidelity sets assembled plan to add another input or two. Often it is the TV set or a tape recorder. But much of the time it is another tuner (it may be a separate AM tuner) or a mike channel. Thus, it is wise to have an absolute minimum of three channels available on every system, with the preference being for at least four.

Last, but not, least there is the obvious necessity for level sets so that the volume will not change abruptly when going from one input channel to another.

One of the additional reasons for individual channel level-set pots is the use, in many high-quality systems, of the "loudness control," in place of the regular main volume control. From the following paragraphs we will see that the levels of various program sources fed into the amplifier should be approximately even so that the frequency-discriminating effects of the loudness control will be equally effective on all signal sources.

Why Bass Boost is Necessary

The loudness control differs from the ordinary volume control in that it boosts the bass progressively more and more as the level is reduced. Stated another way, the loudness control provides considerable bass boost at low volume settings, and this boost is gradually reduced as the level is increased. It has long been recognized that the human ear hears best at the mid-frequencies, around 2000 to 4000 cycles. It has been noted that as the volume of music (any sounds) is reduced, or as the listener is removed farther from the source of sound, he hears less and less of the bass. This is called the Fletcher-Munson effect, after the two researchers who compiled the statistics documenting the phenomenon. They checked the response of a large number of people's ears to frequencies throughout the audio range and produced the "Fletcher-Munson Curves", shown in *Fig. 3.*

It will be seen from examination of these curves that the average human ear responds about equally to loud sounds of all frequencies, at about 90 db (above 10-16 watts/sq.cm.). At volume levels lower than this the ear starts losing frequencies below 1000 cycles, with the lowest frequencies fading most rapidly. This means that for the ear to hear music at a relative level of 55 db with just as much apparent bass as it would if the music were played back at full concert level there must be about 25 db of boost at 50 cycles, almost 20 db at 100 cycles, and none at 1000 cycles.

There are several ways of obtaining the necessary bass boost for playback of music at low levels. In home systems it would be inconvenient to do this with a separate bass control, although for many years that was the only way to do it. This meant that a change in volume level required a change of the tone control setting (also using up some or all of the bass control rotation).

How Bass Boost is Accomplished

For many years some of the better radio sets have used a very simple loudness control, and at least one manufacturer has used it in almost all of his models. The widely used 630 TV chassis also has this circuit in the various versions of that set made by many different manufacturers. This control is an ordinary *.5* or *1* megohm pot with a tap at about 200,000 ohms and a small condenser and resistor (usually about .01 μf and 100,000 ohms) to ground. It is better than no loudness control, but does not provide proper compensation when the arm of the pot is at any point on the control except at the tap. See *Fig. 4a.*

Considerably superior results are obtained with a tapped volume control which has two taps, and consequently two *R-C* networks off the taps to

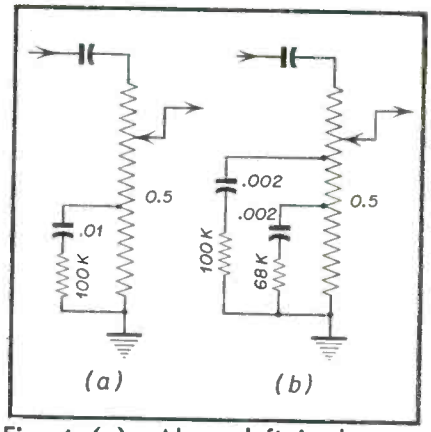


Fig. 4 (a)—Above left is shown a volume control employed by RCA for many years on most of its radios. Actually a simplified "loudness control," it was surprisingly effective. 4 (b) is the same sort of circuit, and is employed by present-day makers of many high-quality audio amplifiers to provide superior Fletcher-Munson compensation.

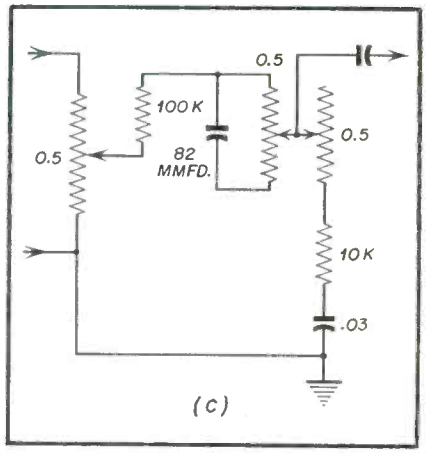


Fig. 4 (c)—This is the schematic of a continuously-variable loudness control which may be purchased in kit form (IRC) at most jobbers. It is easy to construct and very effective.

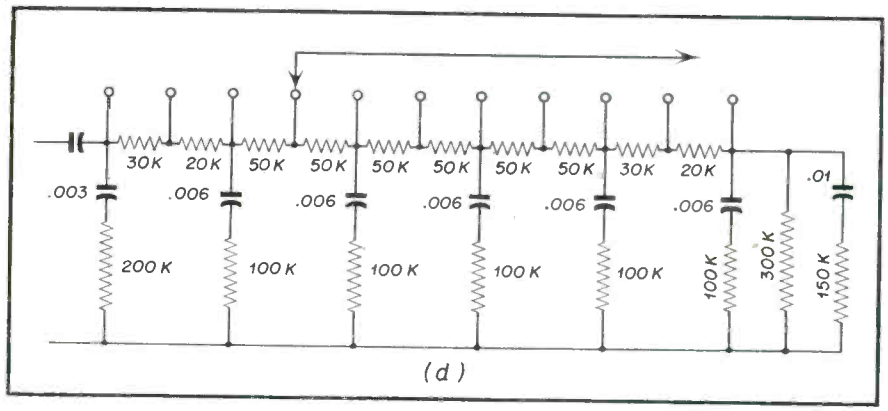


Fig. 4 (d)—This is the most elaborate sort of loudness control. It provides rather complete compensation for ear-loss at lower volume-lower frequencies. Its advantages are cost (many parts) and the fact that it has steps instead of smooth variation.

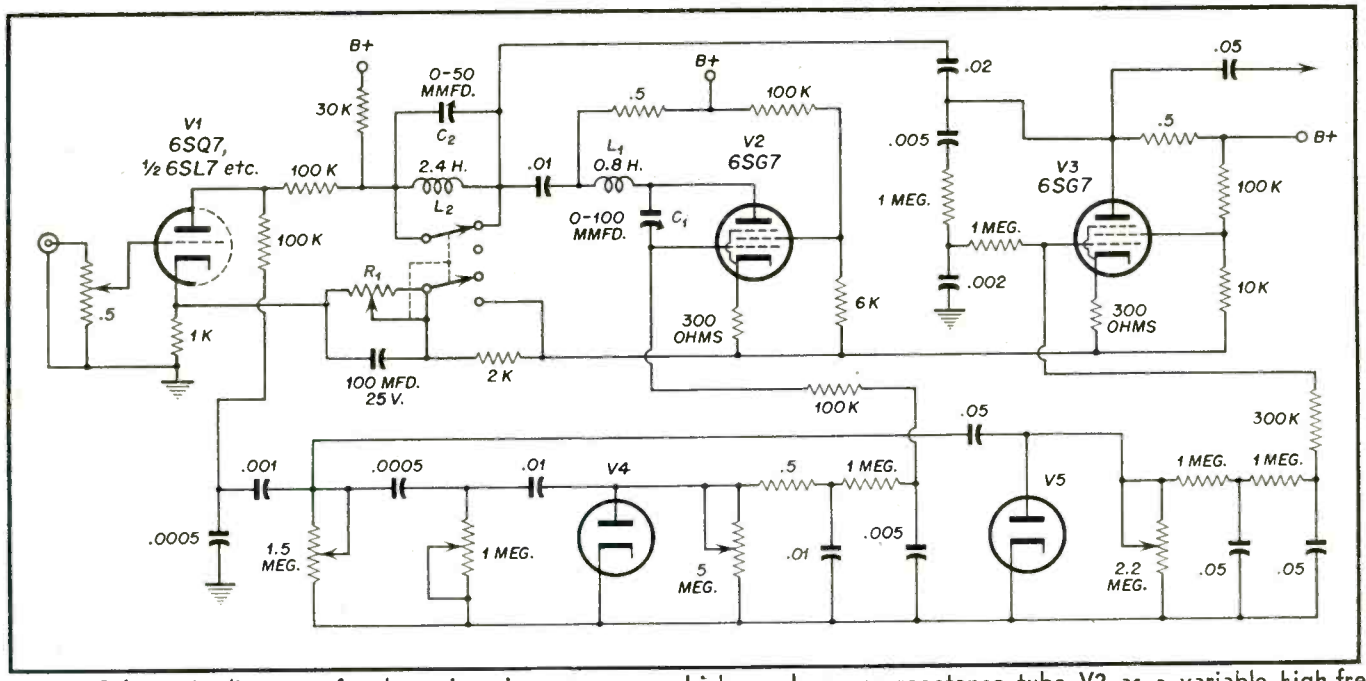


Fig. 5 Schematic diagram of a dynamic noise suppressor which employs one reactance tube V2 as a variable high-frequency gate (filter) and another, V3, as a low frequency gate. Present practice is more often to incorporate two high-frequency gates along with the one for lows. The diodes V4 and V5 may be included in the tube envelopes of other tubes. See text for explanation of how the circuit works.

ground. This type of loudness control is now employed in a number of top grade, and even some medium quality amplifiers. This is shown in *Fig. 4b*.

There is a continuously variable loudness control which employs three potentiometers, 2 resistors and 2 condensers. It may be purchased as a kit for under $3.00 from most jobbers, and can be installed in most amplifiers. Its disadvantages are its cost, and in some chassis, its overall length—about 2¾ inches. This type is shown in *Fig. 4c*.

Another loudness control is the stepped type which employs a two deck switch with twenty or so steps. This provides really excellent compensation for the Fletcher Munson effect, but is considerably more expensive to incorporate into manufacturing, and it also has, to many consumers, the undesirable steps of volume control, instead of smooth continuous control of the other types. See *Fig. 4d* for this method.

Some manufacturers do not provide a loudness control and two have furnished it with a switch which disables it at the option of the listener. Most music-lovers, however, prefer it once its necessity and use are explained.

Noise Controls

There is a growing list of what we must call, for lack of more adequate terminology, noise controls. These are all the circuits which allow variable control (or which *attempt* it) of scratch, rumble, hiss, heterodyne whistles, static, modulation noise, and all other undesired noises which are extraneous to the program material. We do *not* here include fixed circuits such as deemphasis networks or phono compensation circuits. We are concerned with sharp cut-off filters, range switches, and dynamic noise suppressors.

It has been increasingly recognized in the past three years that better signal-to-noise ratios can be achieved by the use of these special filter circuits than just with tone controls. This is because undesired noise most often is present in greater amounts in the upper portions of the audio frequency spectrum than in the lower parts. Thus it is often possible to eliminate much of the noise (undesired sound) without losing a great deal of the music (desired sound). To do this requires the use of filters which slope more sharply than do conventional single-section R-C circuits.

True "sharp cut-off" filters have slopes ranging from about 12 db per octave to about 18 or more. When a fairly rapid rate of attenuation like this is attained it is possible to perceptibly increase the (signal-to-noise) music-to-scratch ratio. And this can often be done without materially impairing the apparent fidelity of the music.

The easiest, although it is also the most expensive, way to make a sharp cut-off filter for audio is to use a trap (tuned to the frequency at which the cut-off is desired to start) consisting of a condenser and a choke. It may be either a parallel-resonant circuit placed across the signal or it may be a series trap placed in series with the high side of the circuit. Since condensers for audio circuits tend to become unwieldy in this sort of use, the condenser is kept small and the choke usually ends up being of the order of a henry or two. This becomes rather expensive in any but professional equipment, so another solution is usually sought.

The multi-section R-C circuit can be constructed so that it approaches the steepness of slope of an L-C filter. More recently a circuit has been introduced[1] which gives cutoff as sharp as the use of inductances will permit in conventional circuitry, but which involves only a simple R-C feedback loop.

It is generally desirable that the sharp treble cut-off be a variable control for the music listener. That is, the listener will sometimes wish to use a sharp cut-off which takes effect at a lower frequency. Thus common sharp cut-off filters (frequently called scratch, hiss, or noise filters) customarily have at least three and often four or five positions.

Typical is the sharp cut-off filter in *Fig. 2*, which is called the "range switch." You will note that it provides for nominal cutoffs at 6, 12, and 22 kc. These points are approximately one octave apart each.*

The recent innovation mentioned above[1] makes it possible to inexpensively provide a variable sharp

[*Continued on page 62*]

*In electronics, just as in music, the difference between a note or frequency and its double, or its half, is exactly an octave.

1. IRE Convention 1952—"A New Electronic Filter"—Sterling.

GOOD SERVICE PAYS OFF

by **HARRY J. MILLER**

Crowd gathered in front of Eastern window to watch Walcott-Charles fight.

WHEN it was announced that the fight between Walcott and Charles in the Quaker City would leave local video receivers blacked out for a distance of 75 miles from the city, Ben Lacca, Eastern's sparkplug, and several of his enterprising force of technicians announced they'd bring the fight to their store for the benefit of their customers, and they did.

They gave Philadelphians a free show of the heavyweight battle right in their window.

For weeks prior to the fight Lacca planned. He erected a 36-foot tower for his specially designed antenna, hooked up a pre-amplifier booster and wired it up to a hot converted tuner with a 24-inch screen. The night of the fight he parked the set in his prominent show window, switched to Channel 4 to get the weak New York signal, turned the antenna towards a large hospital building in the vicinity.

Amid the delighted shouts of the viewers, the reflected signal bounced back, outlining the fight on the screen sharply and clearly.

You'd have thought Philadelphia was having another Mummer's Day parade. Hordes of people lined both sides of Broad Street, widest street in town, and a squadron of police appeared to handle the crowd that overflowed out of the store and into the pavements and streets. Traffic was halted; people brought boxes and step ladders. When the fight was over, one leather-lunged man in the crowd voiced the viewers' appreciation.

"You've done a service to the community," he thundered, and the people yelled and clapped their approbation of the dealer's action.

The newspapers picked it up and the next day Lacca received editorial ovations for his entertainment of the capacity crowds. Obviously this kind of publicity reacts not only to the credit of this particular serviceman, but to that of the entire field of video sales and service.

This isn't the first time that Lacca has come up with an extra-curricular service idea. For example, whenever a customer shows up with a set that requires major repair like a burned out power supply or a new picture tube, Lacca takes the patron to the back of his shop, to a tiny office he's equipped where he and the customer is away from the store's traffic areas.

"If the customer has a small picture tube, then I talk to him about converting it to a larger viewing screen and a larger picture tube so he can get a bigger picture.

Suppose the repair job is going to run $35 or $40. I show him that I can convert his set into the biggest screen his cabinet will allow—for $69—that being the price I've found most attractive. But he may doubt my cabinet-making ability.

At first he may demur, so I take him over to the part of the store where I keep on hand a number of conversions we've done. They're nicely polished and we keep them that way so they'll make a good impression.

Then I take him back to the garage behind our store. We've been so successful in capturing re-conversion jobs that we equipped the garage with power saws, sanders, and spray painting machinery so we can really turn out a good job.

Ben Lacca trims the frame for one of his conversion jobs.

By this time the customer is fairly well convinced that we won't butcher up his cabinet. For a clincher, I offer to take him around to any one of a number of customers, even in his own style set, for whom we've made conversions that they are happy with.

This usually decides the matter, and we've got a $69 job instead of a $35 one, and I know the customer will be well pleased with our work. And what helps better his impression of us is that he'll have a bigger picture, and he'll probably credit the total pleasing effect of his reception to us!"

Even with a professional cabinet maker converting the receivers, Lacca figures the $69 job nets him $25.

In sending out reply postals to customers on his mailing list, Lacca makes an effort to contact first the folks whose sets have been giving them trouble, or who have the 10 or 12-inch size. He finds these easier to convert to the 17-inch picture.

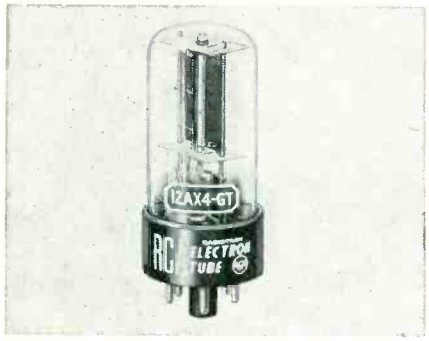
"It works out this way," added Lacca. "Let's say I quote a figure of $32 on a bad picture tube or repair job. I show our customer that for another $37 he'll have a 17-inch instead of a 10 or 12-incher. Nine out of 10 people go for it!"

"We send out about 5,000 mailing pieces a month to customers on our live mailing list," said this serviceman. "And we've found that some people are waiting for color television, so they don't bother having their sets repaired, since they think color viewing is just around the corner.

Our message advises them that if they don't repair the minor troubles

[*Continued on page 68*]

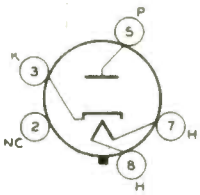
NEW TUBES



RCA 12AX4—GT

Recently announced by the RCA Tube Department is the 12AX4-GT, a half-wave vacuum rectifier tube of the heater-cathode type. It is intended particularly for use as a damper tube in horizontal deflection circuits of television receivers utilizing series-heater strings.

Designed to withstand negative peak pulses between heater and cathode of as much as 4000 volts with a d-c component up to 900 volts, the 12AX4-GT provides flexibility in choice of deflection circuits.



Electrical

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.6	amp
Direct Interelectrode Capacitances (with no external shield):		
Heater to Cathode	7.5	μμf

Mechanical:

Mounting Position	Any
Maximum Overall Length	3-5/16"
Maximum Seated Length	2-3/4"
Maximum Diameter	1-9/32"
Bulb	T-9
Base	Short Intermediate-Shell Octal 5-Pin

DAMPER SERVICE

Maximum Ratings, *Design-Center Values:*

PEAK INVERSE PLATE VOLTAGE	4000* max.	volts
PEAK PLATE CURRENT	600 max.	ma
NOT-SWITCHING TRANSIENT PLATE CURRENT For duration of 0.2 second maximum.	3.0 max.	amp
DC PLATE CURRENT	125 max.	ma
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to Cathode	4000▲ max.	volts
Heater positive with respect to Cathode	100 max.	volts

* This rating is applicable when the duty cycle of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

▲ The dc component must not exceed 900 volts.

Tube Basing & Characteristics —12X4GT

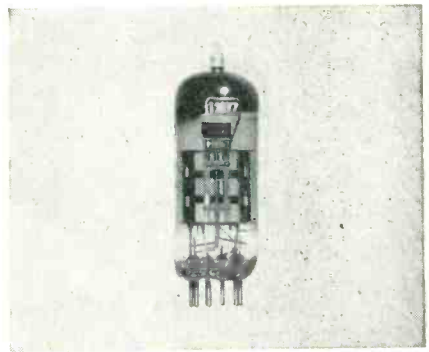
Sylvania 12BY7

A new television pentode, the 12BY7, is now in production at the Radio Tube Division of Sylvania.

The 12BY7 is a high transconductance, sharp cut-off video pentode designed for service in television receivers. The tube features miniature T-6 1/2 construction, and will furnish large output voltages across low values of load resistance and supply voltage. The separate suppressor grid connection allows the Sylvania Type 12BY7 to be used for more diversified applications. The heater may be operated from either 6.3 or 12.6 volts.

HEATER CHARACTERISTICS		
Heater Voltage Series/Parallel	12.6/6.3	Volts
Heater Current Series/Parallel	300/600	Ma
CHARACTERISTICS AND TYPICAL OPERATION		
Class A1 Amplifier		
Plate Voltage	250	Volts
Screen Voltage	150	Volts
Cathode Bias Resistor	68	Ohms
Plate Current	25	Ma
Screen Current	6.0	Ma
Transconductance	12,000	umhos
Plate Resistance	110,000	Ohms
Grid Voltage for I_b 20 ua	-10	Volts
Amplification Factor (Triode Connected)	28	

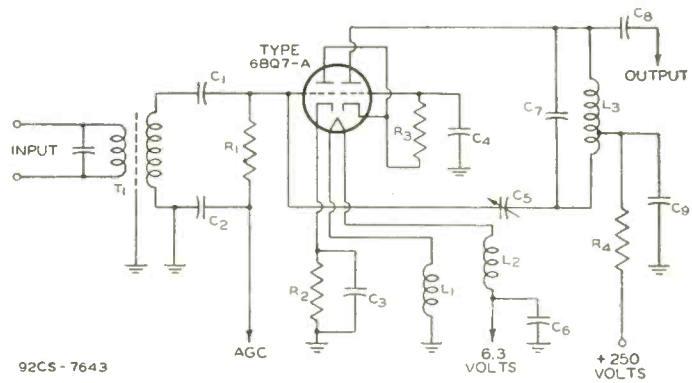
Characteristics of Sylvania 12BY7



RCA-6BQ7-A

The 6BQ7-A is a medium-mu twin triode of the miniature type designed for use at the first rf amplifier tube in vhf television-receiver tuners or as a low-noise if pre-amplifier tube in uhf television receivers employing a crystal mixer.

In comparison with the older superseded RCA type 6BQ7, the 6BQ7-A features somewhat higher transconductance while retaining the same low input capacitance, low input loading, and low plate-to-cathode capacitance. These features make the 6BQ7-A particularly useful in the direct-coupled rf stage of television receivers utilizing a driven rf-grounded-grid am-

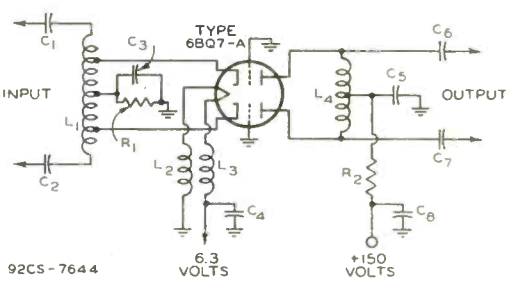


C1: 33 μμf, 400 volts
C2: 1000 μμf, 400 volts
C3: 1000 μμf, 400 volts
C4: 1000 μμf, 400 volts
C5: 0.5 to 1.5 μμf, 400 volts
C6: 1000 μμf, 400 volts
C7: 2 μμf, 400 volts
C8: 33 μμf, 400 volts
C9: 1000 μμf, 400 volts

L1, L2: Bifilar chokes, each 10 turns No. 18 enamel wire, 1/4" coil form
L3: Tuned circuit element of tuner. Value depends on distributed circuit capacitances. To determine tap point, tap down to 80 to 90% of total number of turns

R1: 10000 ohms, 0.5 watt
R2: 100 ohms, 0.5 watt
R3: 500000 ohms, 0.5 watt
R4: 100 ohms, 0.5 watt
T1: Tuned circuit element of tuner. Value depends on distributed circuit capacitances.

Fig. 1 - RCA-6BQ7-A in Driven RF-Grounded-Grid Amplifier Circuit with Direct-Coupled Drive.



C1 C2 C3 C4 C5: 1000 μμf, 400 volts
C6 C7: 100 μμf, 400 volts
C8: 1000 μμf, 400 volts

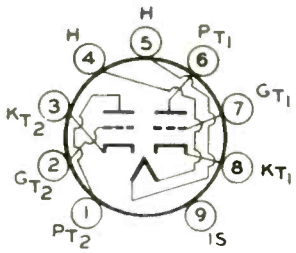
L1 L4: Tuned circuit elements of tuner. Values depend on distributed circuit capacitances.

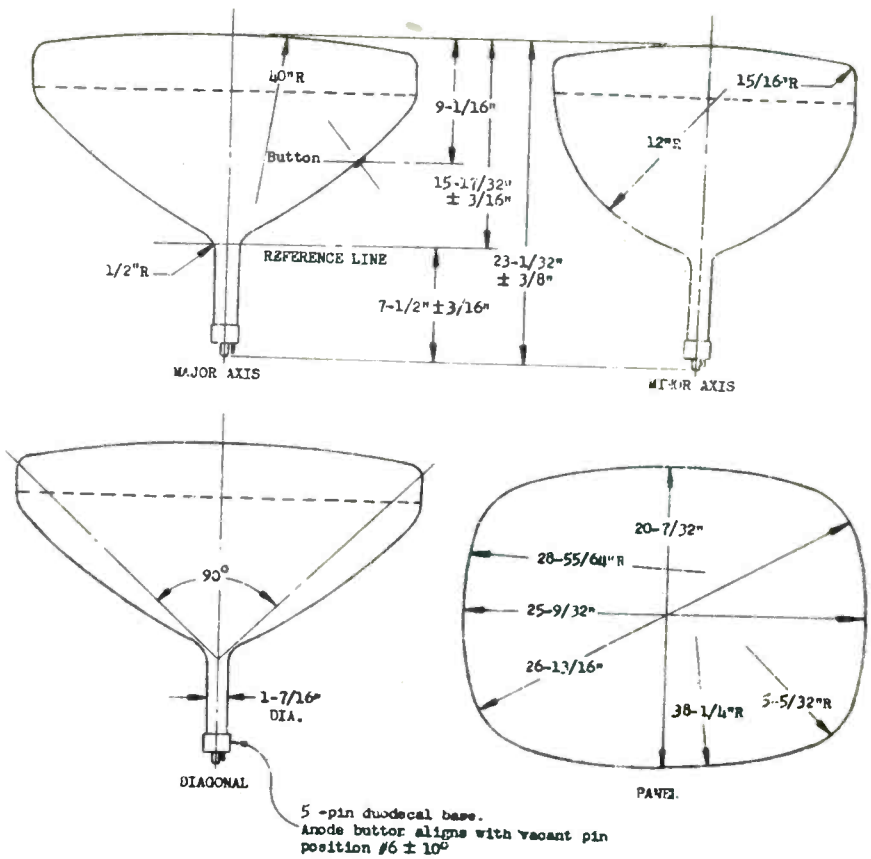
L2 L3: Bifilar chokes, each 10 turns of No. 18 enamel wire, 1/4" coil form.
R1 R2: 100 ohms, 0.5 watt

Fig. 2 - RCA-6BQ7-A in Push-Pull RF-Grounded-Grid Circuit.

plifier circuit or in the cascode type of circuit. Use of the 6BQ7-A in such circuits provides a reduction in noise with resultant improved receiver sensitivity.

SOCKET CONNECTIONS
Bottom View





Physical dimensions of Hytron's new 27EP4 CRT.

AMPLIFIER - Class A

Values are for Each Unit

Maximum Ratings, Design-Center Values:			
PLATE VOLTAGE	250▲	max.	volts
PLATE DISSIPATION	2	max.	watts
CATHODE CURRENT	20	max.	ma
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200▲	max.	volts
Heater positive with respect to cathode	200	max.	volts
Characteristics:			
Plate Voltage	150		volts
Cathode-Bias Resistor	270		ohms
Amplification Factor	39		
Plate Resistance	6100		ohms
Transconductance	6400		μmhos
Plate Current	9		ma
Grid Volts (approx.) for plate current of 10 μamp	-10		volts

Typical Operation in Push-Pull RF-Grounded-Grid Circuit:

Values are for Each Unit

Plate Voltage	150	volts
Grid Voltage*	-2	volts
Cathode Resistor (Common to both units)	100	ohms
Plate Current	10	ma

Typical Operation in RF-Grounded-Grid Circuit with Direct-Coupled Drive:

Unit No.1 (driver tube) is directly coupled to Unit No.2 (driven rf-grounded-grid amplifier tube) as shown in accompanying circuit

	Unit No.1	Unit No.2	
Plate Supply Voltage	250	250	volts
Plate Voltage	135	115	volts
Grid Voltage	-1	-	volt
Grid Resistor	-	0.5	megohm
Plate Current	10	10	ma
Grid Current	0	0	ma
Grid Voltage (Approx.) for plate current of 10 μamp	-14	-	volts
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	1	250	volts

Maximum Circuit Values (Each Unit):

Grid-Circuit Resistance	0.5 max.	megohm

▲ Under cutoff conditions, in rf-grounded-grid circuits with direct-coupled drive, it is permissible for this voltage to be as high as 300 volts.

* Obtained from cathode resistor.

† According to RTMA Standard ET-109-A with external shield No.315.

Tube basing and characteristics of 6BQ7-A

The very high transconductance—6400 micromhos obtained at a plate current of only 9 milliamperes—permits high gain and reduced equivalent noise resistance. The low input loading minimizes induced grid noise and makes practical a high input-circuit gain even in high-frequency channels. Furthermore, variation of the gain-control bias voltage produces a relatively small change in input loading so that antenna termination is substantially constant. The low plate-to-cathode capacitance contributes to stability in rf-grounded-grid circuits.

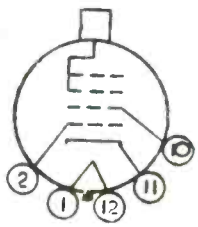
Each of the triode units of the 6BQ7-A is effectively shielded from the other. Consequently, either unit will give stable performance when used in high-frequency applications such as push-pull rf-grounded-grid amplifiers, driven rf-grounded-grid circuits, and counter circuits.

Hytron Type 27EP4

The Hytron type 27EP4 is a 27" rectangular, 90°, all-glass, magnetically focused, picture tube providing an effective area of over 400 square inches. The tube also incorporates a spherical face plate and an aluminized screen.

Other features of the tube are:

1. Single ion-trap gun design.
2. Neutral density face plate.



GENERAL DATA

Heater voltage	6.3±10%	volts
Heater current	0.6	ampere
Average direct interelectrode capacitances		
Grid No. 1 to all other electrodes	6	mmf
Cathode to all other electrodes	5	mmf
Phosphor		No. 4
Fluorescence		white
Persistence		medium
Focusing method		magnetic
Deflection method		magnetic
Deflection angle (approx.)*		diagonal 90°
Face plate light transmission (neutral density filter) (approx.)		66%

MECHANICAL DATA

Overall length	23 1/32" ± 3/8"
Outside diagonal	28 13/16"
Outside width	25 9/32"
Outside height	20 7/32"
Cap	Recessed small cavity (21-24)
Base	Small shell duodecal 5-pin (JES. 57)
Basing	JETEC designation 12D
Mounting	any

ELECTRICAL DATA

Maximum Ratings (Design-Center Values)

Anode voltage	20,000 d-c max. volts
Grid-No. 2 voltage	500 d-c max. volts
Grid-No. 1 voltage:	
Negative bias value	125 d-c max. volts
Positive bias value	0 d-c max. volts
Positive peak value	2 d-c max. volts
Peak heater cathode voltage:	
Heater negative with respect to cathode (Note A)	180 max. volts
Heater positive with respect to cathode	180 max. volts
Grid-No. 1-circuit resistance	1.5 max. meg

JETEC Test Conditions

Anode voltage	14,000 d-c	volts
Grid No. 2 voltage	300 d-c	volts
Grid No. 1 voltage (Note B)	-33 to -77 d-c	volts
Focus Coil Current (approx.) (Note C)	110±10 d-c	ma
Ion-trap current (Note D) (approx.)	85± 50% d-c	ma

* It is recommended that a deflection yoke of 1/2" flare radius be used.

Note A: A value of 410 max. volts is allowed during equipment warm-up period not to exceed 15 seconds.

Note B: Visual extinction of undeflected focused spot.

Note C: JETEC #109 focus coil.

Note D: As measured with single-field beam bender, JETEC #111

Tube basing and characteristics of 27EP4

VIDEO SPEED SERVICING SYSTEMS

5th INSTALLMENT

INDEX FOR THIS ISSUE

Mfr. Capehart **Chassis No.** CX-33

Card No. C-1

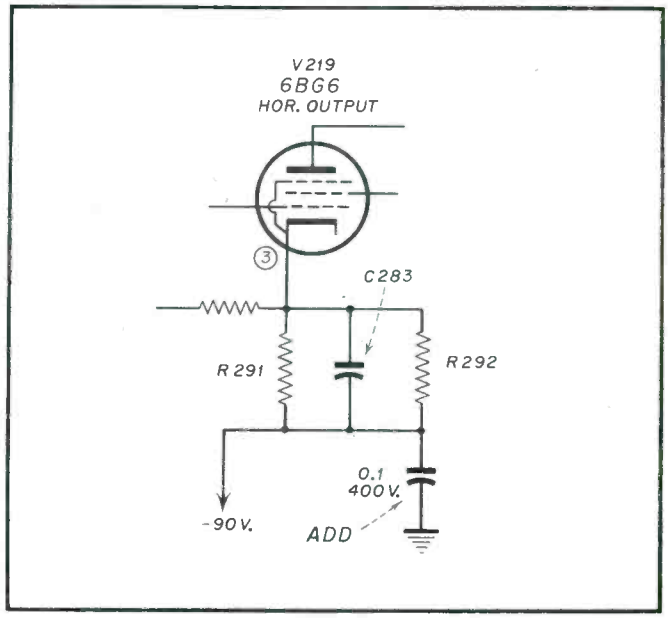
Section Affected: Sound & Pix

Symptom: Whistle in sound and lines in pix.

Cause: 15.75 kc horizontal spraying

What To Do:

Add: .1 μf-400V condenser from ground to junction of *R291* (220 ohms), *R292* (220 ohms) and -90 V.



Mfr. Capehart **Chassis No.** CX-33

Card No. C-2

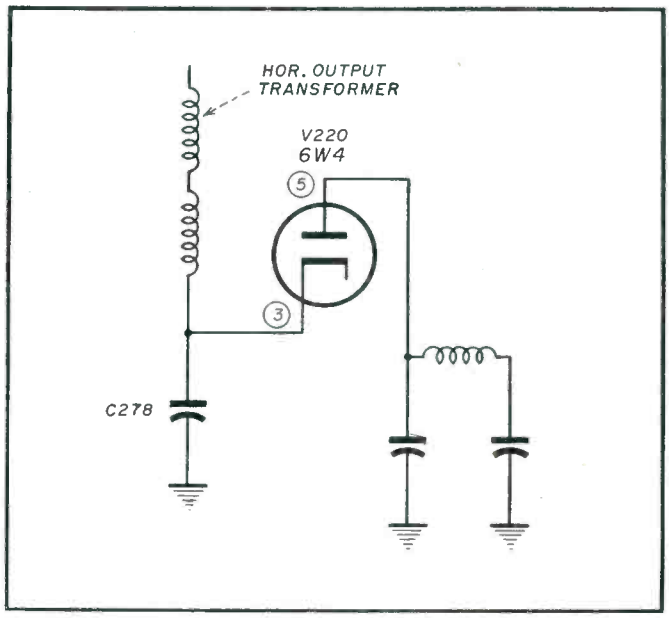
Section Affected: Pix

Symptom: Small section of pix displaced horizontally.

Cause: Component defect.

What To Do:

Replace: *C28* (30 μμf—6 kv).



Mfr. Capehart **Chassis No.** CX-33

Card No. C-3

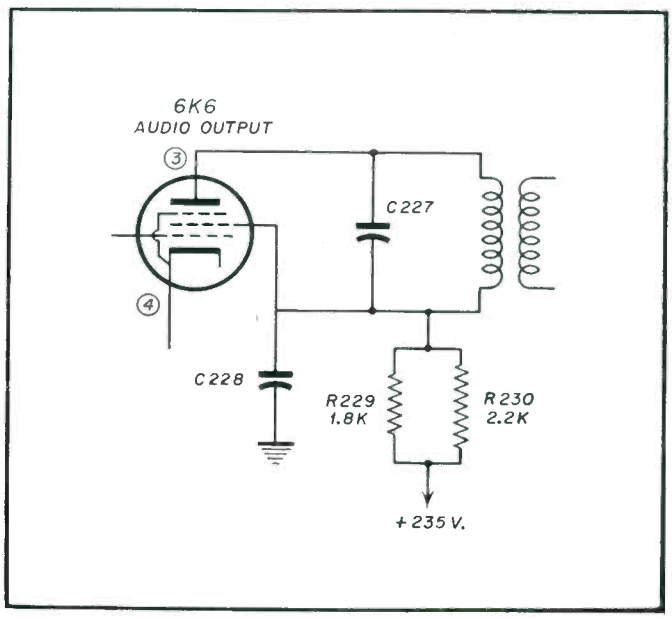
Section Affected: Picture

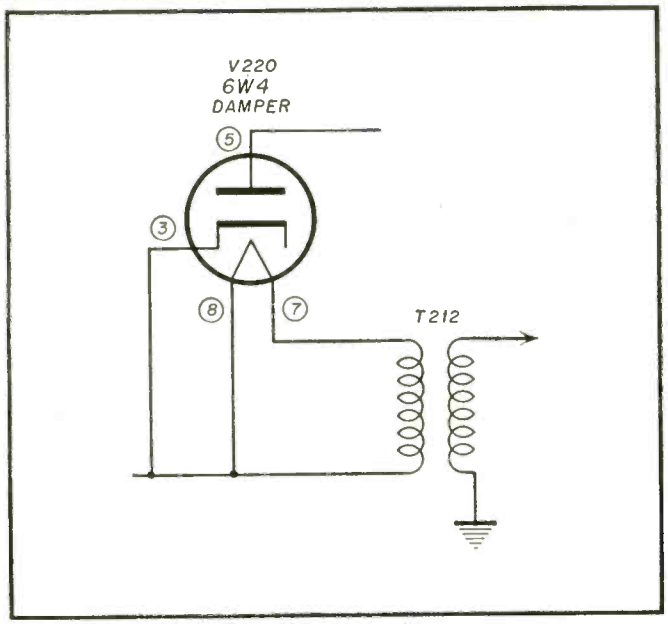
Symptom: Picture tears in step with audio.

Cause: Component defect.

What To Do:

Check: *C228* (20 μf—450 V) for leakage.
R229 (1.8K) for change in value.





Mfr. Capehart **Chassis No.** CX-33

Card No. C-4

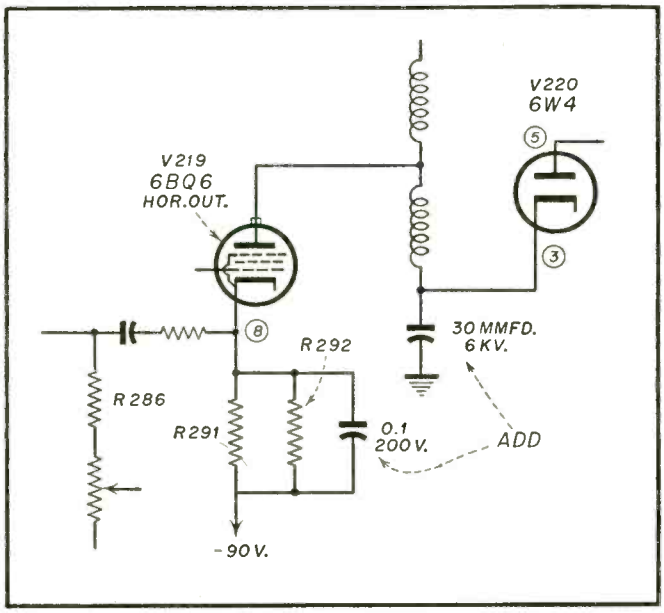
Section Affected: Raster

Symptom: Intermittent reduction of width.

Cause: Excessive transformer winding capacity.

What To Do:

Replace: *T212* damper tube filament isolation transformer.



Mfr. Capehart **Chassis No.** CX-33

Card No. C-5

Section Affected: Raster

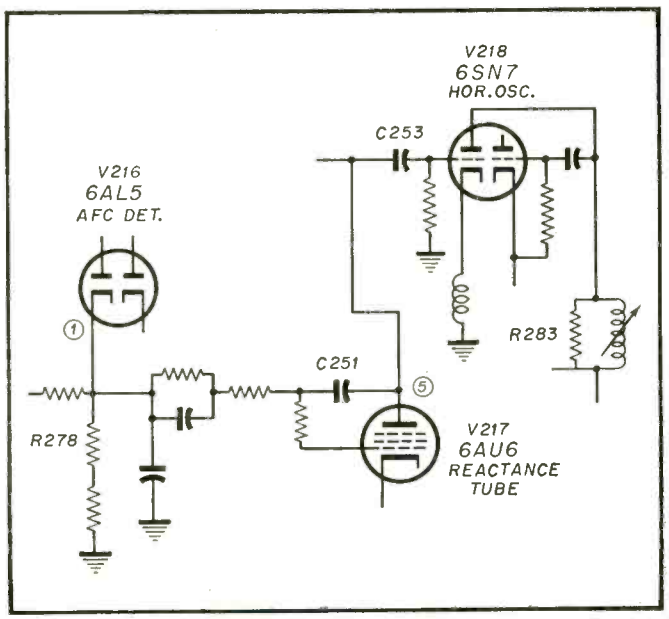
Symptom: Insufficient width.

Reason For Change: Circuit improvement.

What To Do:

Add: .1 μf-200 V in parallel with *R291*. Also, 30 μμf-6kv. from pin #3 of 6W4 to ground.

Change: *R286* (150K) to 47K.



Mfr. Capehart **Chassis No.** CX-33

Card No. C-6

Section Affected: Pix

Symptom: Poor picture phasing.

Cause: Circuit requirements.

What To Do:

Change: *C253* (.0047 μf) to .001 μf.
R283 (560K) to 100K.

Check: *C251* (100 μμf) for leakage.
R278 (470K) for change in value.

Mfr: Olympic **Chassis No.** TA

Card No. C-1

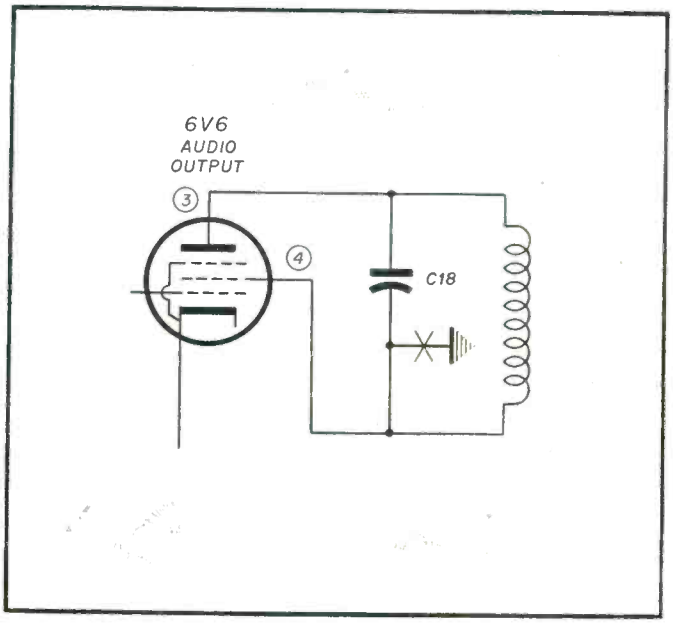
Section Affected: Sound

Symptom: Sound stops.

Cause: Component failure (C18)

What To Do:

Connect *C18* to pin #4 of 6V6 instead of ground.



Mfr: Olympic **Chassis No.** TA

Card No. C-2

Section Affected: Raster

Symptom: Excessive blow-out due to hi-voltage surges.

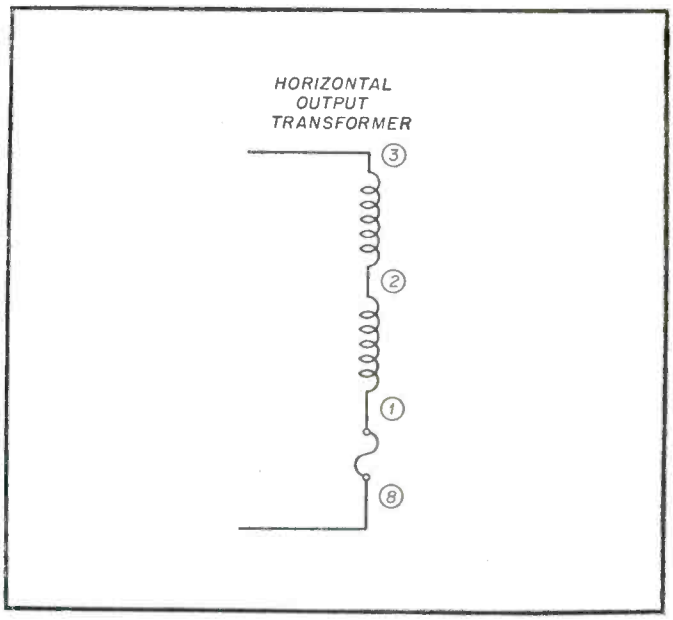
Cause: Line voltage surges.

What To Do:

Rewire: Green wire from terminal #1 to terminal #8 on horizontal output transformer.

Connect: Fuse from terminal #8 to terminal #1.

Rewire: Yellow wire from terminal #8 to terminal #7.



Mfr: Olympic **Chassis No.** TA

Card No. C-3

Section Affected: Pix and Raster.

Symptom: Vertical fold over and non-linearity.

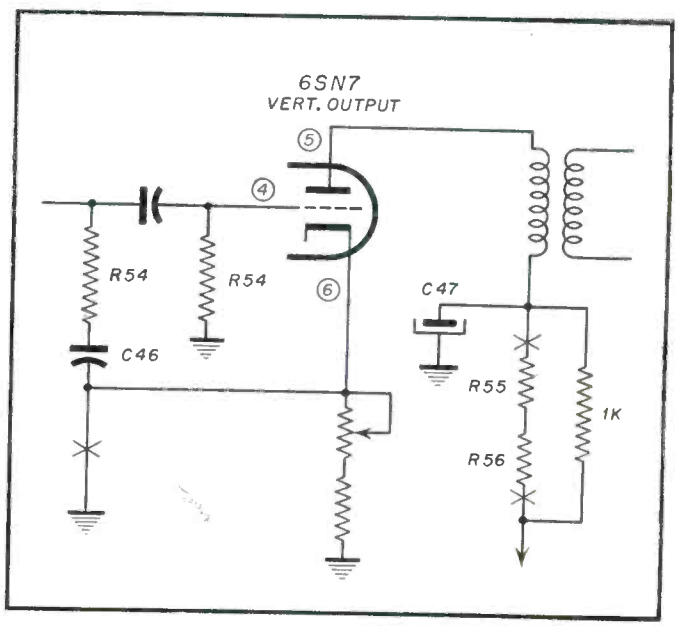
Cause: Non-linear tube operation.

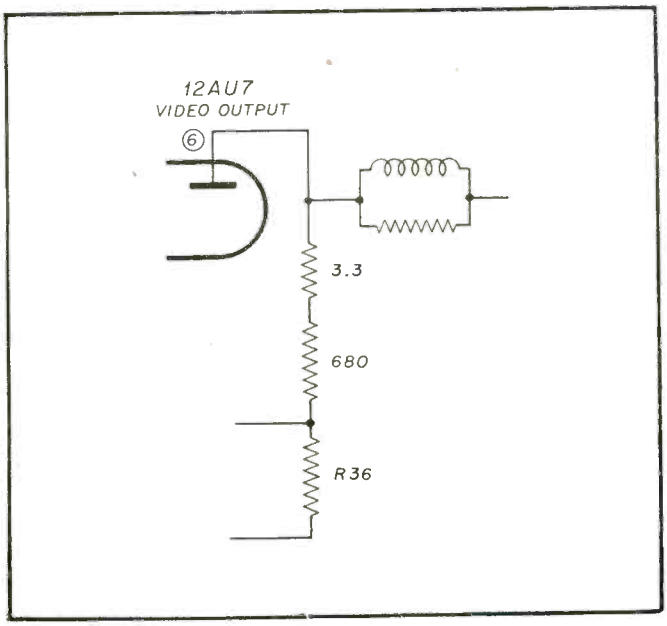
What To Do:

Change: *C47* from 4 μf-450 V to 20 μf-450 V. Also, *R55* and *R56* from 6.6K to 1K, and *R53* from 2.2 meg to 1 meg.

Note: *R54* shown connected to pin #4 of 6SN7 on diagram should be *R53*.

Rewire: Ground connection of *R54* and *C46* network to cathode side of vertical linearity control.





Mfr: Olympic **Chassis No.** TA

Card No. C-4

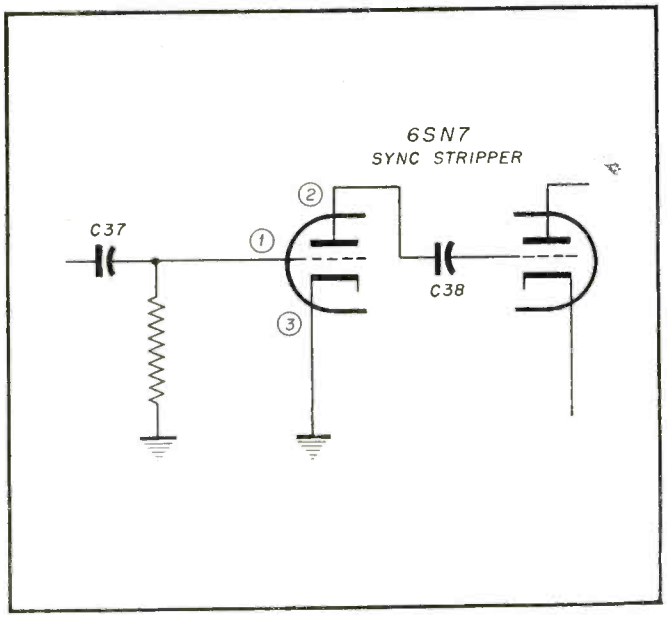
Section Affected: Pix

Symptom: Pix tears at either high or low setting of contrast control.

Cause: Either too much or too little sync being taken off video amplifier output.

What To Do:

If tearing occurs at high contrast control setting, change *R36* from 1000 ohms to 680 ohms. If tearing occurs at low contrast control setting change *R36* from 1000 ohms to 1200 ohms.



Mfr: Olympic **Chassis No.** TA

Card No. C-5

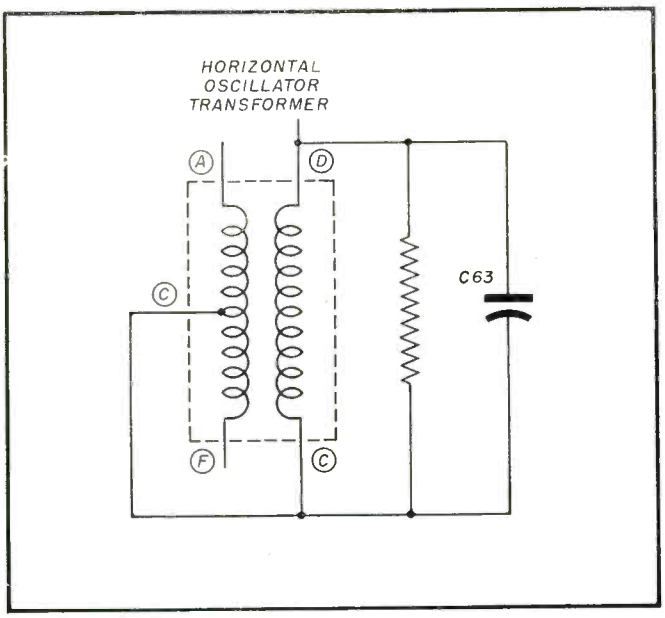
Section Affected: Pix

Symptom: Horizontal tearing.

Cause: Component failure.

What To Do:

Check: *C37*—.05 μf-400V for leakage.
C38—220 μμf-mica for low value.



Mfr: Olympic **Chassis No.** TA

Card No. C-6

Section Affected: Pix

Symptom: Horizontal Drift.

Cause: Leaking *C63*

What To Do:

Replace with molded .01 μf-600V condenser.

Mfr. Philco **Model No.** 49-1040

Card No. 49-B-1

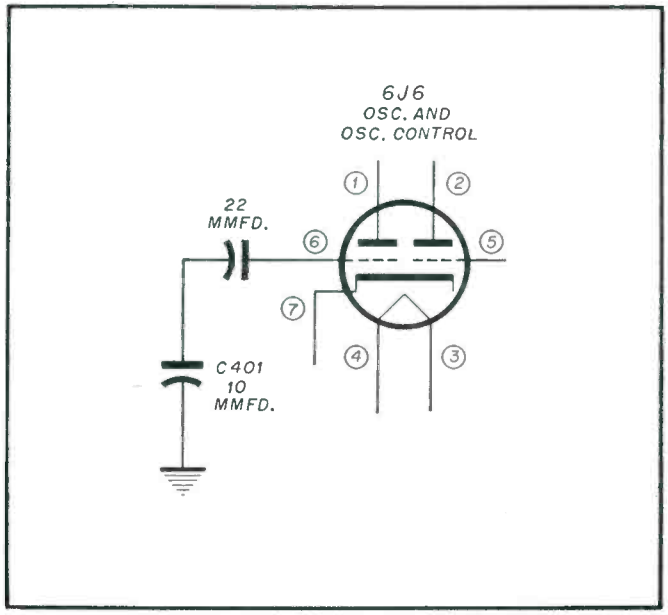
Section Affected: Sound

Symptom: No sound.

Cause: Local oscillator drift.

What To Do:

Change: *C401* to a special temperature-compensated condenser (Part No. 30-1224-51).



Mfr. Philco **Model No.** 1240

Card No. 49-B-2 **Code No.** 124

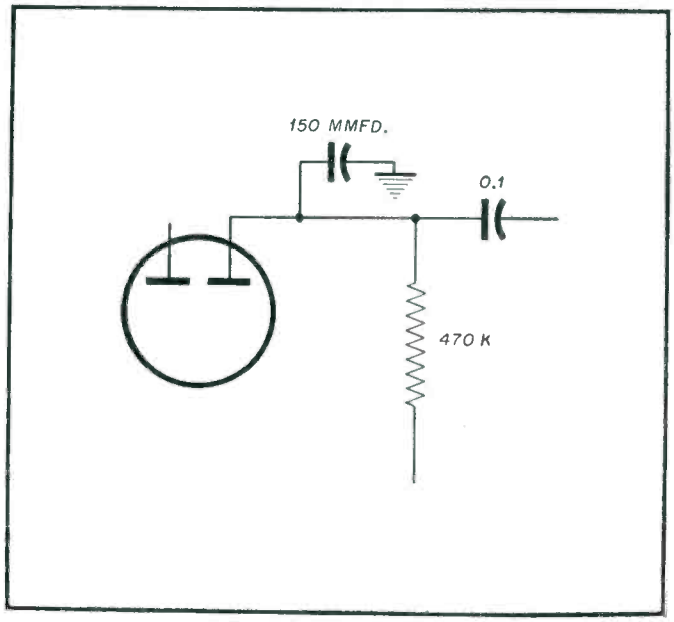
Section Affected: Pix and sound.

Symptom: Sync buzz and sound bars in pix.

Reason for Change: To reduce hum radiation.

What To Do:

Connect: 150 $\mu\mu$f condenser between pin #6 of vertical blocking oscillator and ground.



Mfr. Philco **Model No.** 49-1240

Card No. 49-B-3 **Code No.** 124

Section Affected: Pix

Symptom: Inadequate vertical linearity.

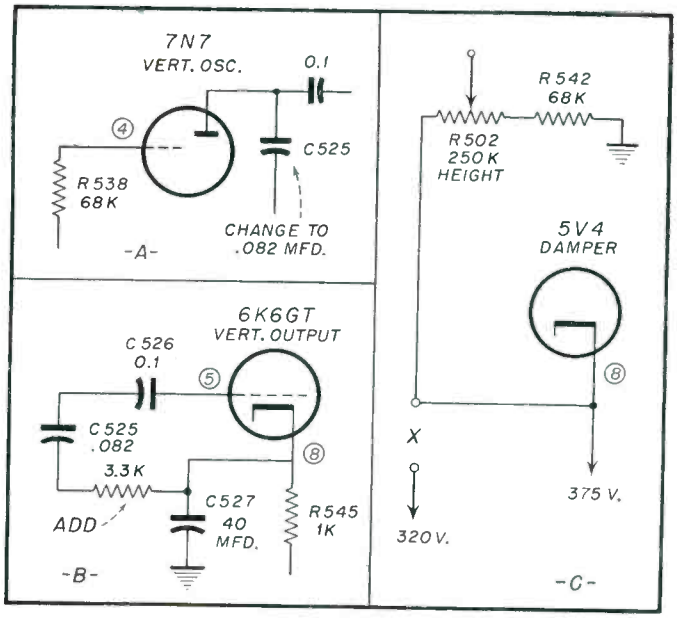
Reason For Change: To improve vertical linearity.

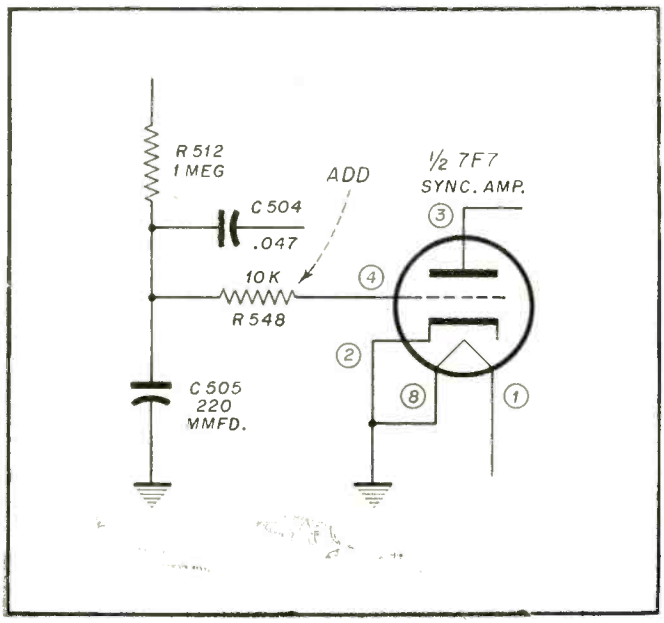
What To Do:

Change: *R538* from 10K to 68K. Also *C525* from .05 μf to .082 μf. *(Fig. A)*

Add: A 3.3K resistor in the lead between *C525* and the junction of *C527* and *R545*. *(Fig. B)*

Disconnect: *R502* from 320-volt supply and connect to pin #8 of damper tube. *(Fig. C)*





Mfr. Philco **Model No.** 49-1040

Card No. 49-B-4

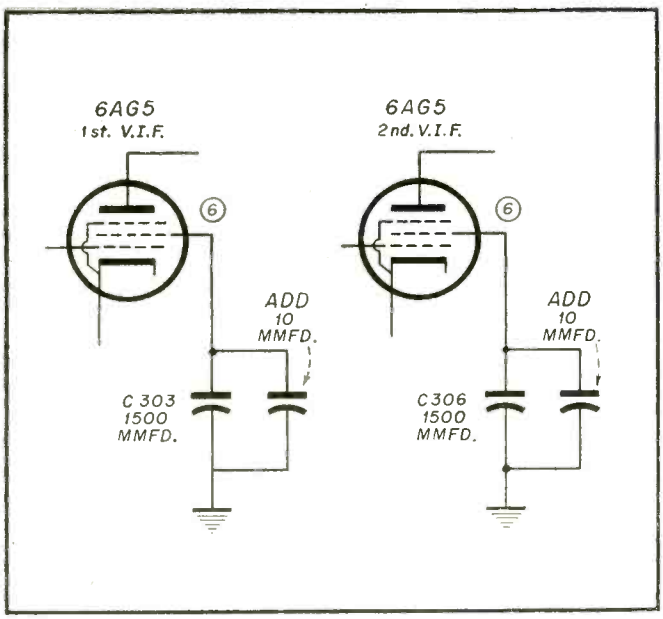
Section Affected: Sync

Symptom: Unstable sync.

Cause: Video signal in sync.

What To Do:

Add: 10K resistor (*R548*) in series with grid of 7F7 sync amplifier between pin #4 and junction of *C504*, *C505*, and *R512*.



Mfr. Philco **Model No.** 49-1040

Card No. 49-B-5 **Code No.** 123

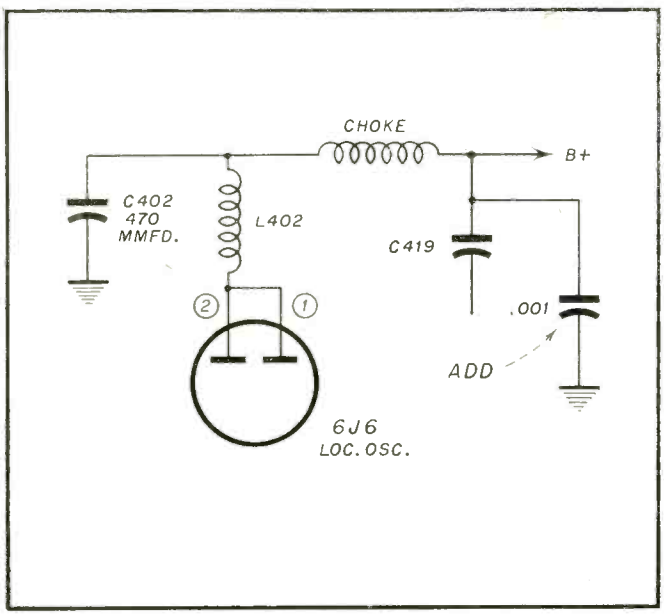
Section Affected: Pix

Symptom: Unstable pix (oscillation).

Cause: or Reason for Change: To prevent oscillation of video *if* stage.

What To Do:

Add: A 10 $\mu\mu$f condenser in parallel with *C303*. Also a 10 $\mu\mu$f condenser in parallel with *C306*.



Mfr. Philco **Model No.** 49-1040

Card No. 49-B-6

Section Affected: Sound

Symptom: Sync Buzz.

Cause: Video modulation in local oscillator.

What To Do:

Add: Choke (Philco Part No. 32-4112-11) in series with the B plus lead to the local oscillator between ungrounded end of *C419* and junction of *L402* and *C402*.

Connect: .001 μf condenser in parallel with *C419*.

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

Card No. 412-7

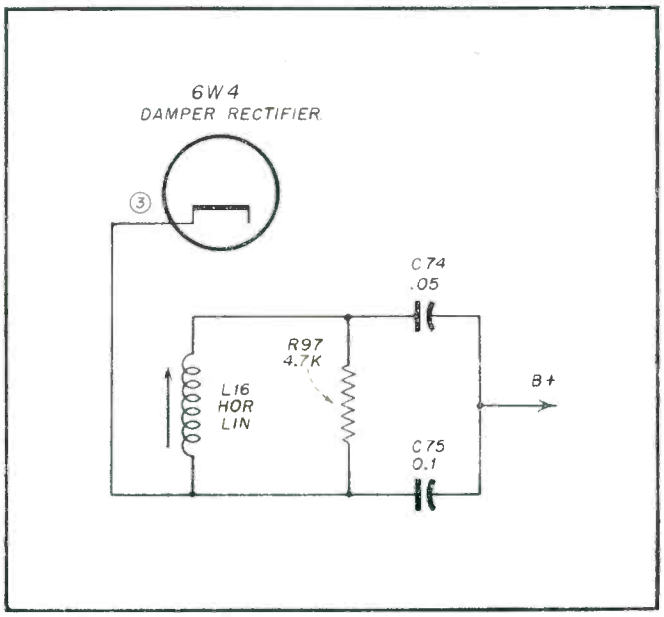
Section Affected: Raster

Symptom: Horizontal raster is too small, with low brilliance and fold over on left hand side of pix.

Cause: Shorted *C74* (.05 μf).

What To Do:

Replace: *C74* (.05 μf).



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

Card No. 412-8

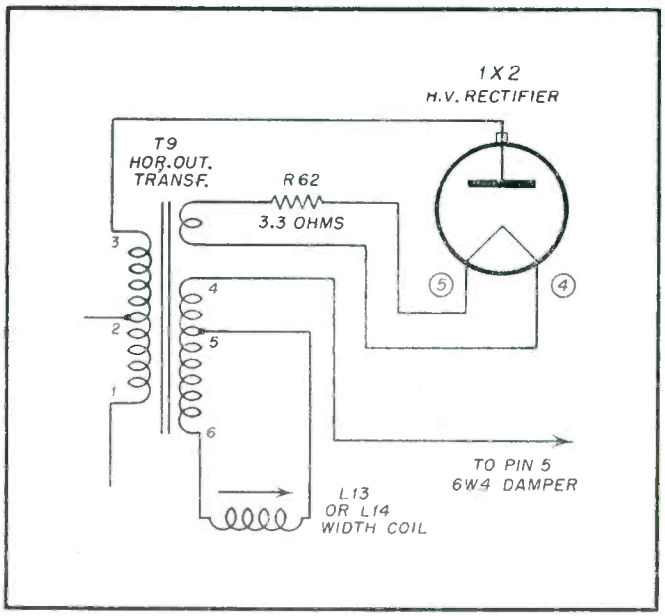
Section Affected: Raster

Symptom: Horizontal raster is too large.

Cause: Component failure.

What To Do:

Check: *L13* or *L14* for open.



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

Card No. 412-9

Section Affected: Raster

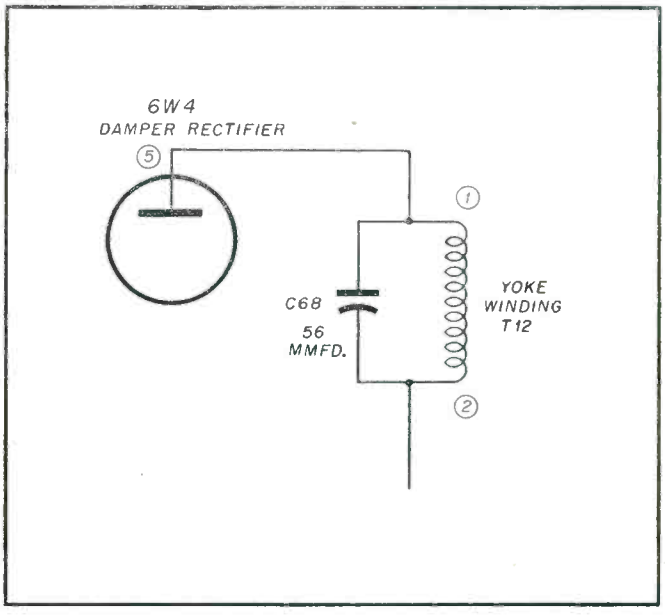
Symptom: Keystoning—top of raster smaller than bottom.

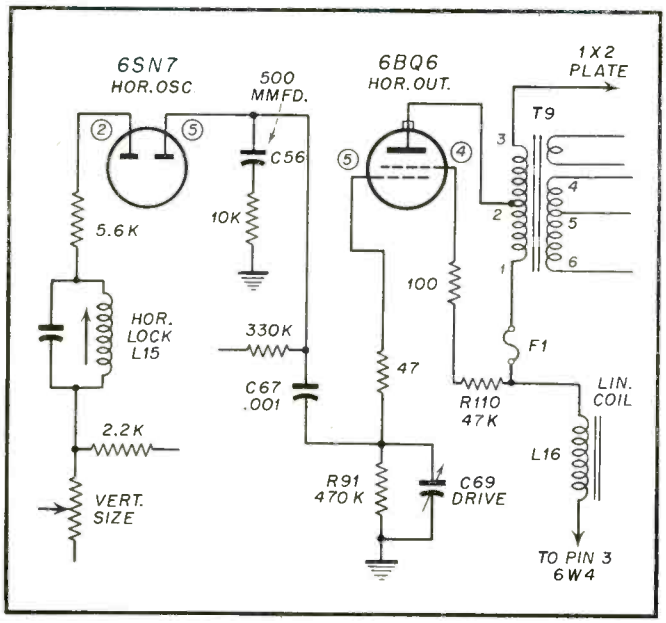
Cause: Shorted horizontal components.

What To Do:

Replace: *C68* (56 μμf) located inside of deflection yoke.

Check: Deflection yoke *T-12*. May have shorted turns.





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

Card No. 412-10

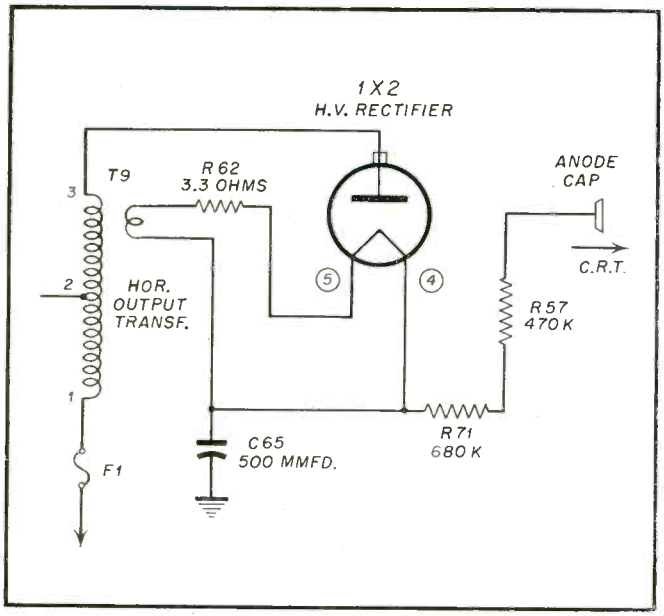
Section Affected: Raster

Symptom: No raster—normal sound

Cause: Defective horizontal components

What To Do:

Check: *R110* (47K) for open. *L15* for open; *C69* for short; *C67* (.001 μf) for open or short; *C56* (500 μμf) for short; *T9* for open or partially shorted windings. A defective *T9* results in the waveform appearing as a ripple instead of a sawtooth when scope is connected across *L16* (linearity coil).



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

Card No. 412-11

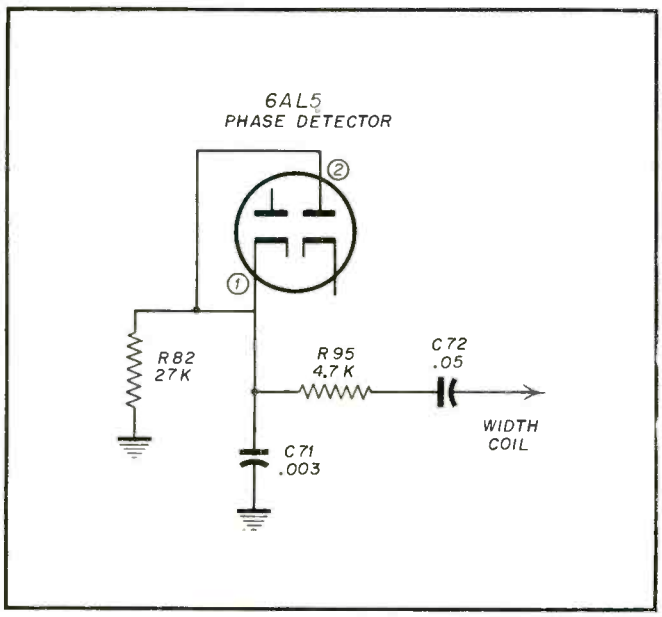
Section Affected: Raster

Symptom: No raster—normal sound.

Cause: Shorted high voltage condenser located in filter compartment, or open fuse (F-1) located at 6BQ6 socket.

What To Do:

Replace: *C-65* (500 μμf) high voltage filter. Also, F-1 with Slo-Blo Type fuse only.



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

Card No. 412-12

Section Affected: Raster

Symptom: No raster, sound normal. Normal raster appears if 6AL5 phase detector is removed from socket.

Cause: Shorted feedback condenser to 6AL5 phase detector tube.

What To Do:

Replace *C72* (.05 μf)

ASSOCIATION

• NEWS •

Local, State and National Associations are urgently requested to send in news of their activities so that we may print them in these columns.

PRSMA

P.R.S.M.A. held its last open meeting at the Franklin Institute on December 2nd, 1952, featuring Mr. C. E. Walter, field supervisor of the RCA Service Co., who spoke on *uhf* and presented RCA's new *uhf* tuners and adapters. Slides and movies were used with his lecture to bring out the fine points of his lecture. He also reported on the *uhf* station now operating in Portland, Oregon. Mr. McDonald, engineer of WHUM-TV in Reading, Pa., was also present with his assistant and spoke on the new station being put into operation sometime near the end of December this year.

Radio & Television Technicians Guild of Florida Inc.

It is quite obvious that a great many servicemen have fallen into the category of misinformed salesmen.

This fact is quite evident in Dade County.

The reason for this statement is the obvious neglect of TV Antennas. For maximum efficiency we know that all sets should be operated on an Out-door Antenna.

Antennas are designed as an integral part of the Tuning Unit of the TV receiver.

The mis-leading Ads that read "set delivered and completely installed" is as phony as a $3.00 bill, unless they completely install an outside Antenna.

Starting with the built-in Antenna and going to a properly installed outdoor Antenna, Field strength will increase anywhere's from 30 to 95%. Taking into consideration the fact that Miami will be fringe Area in respect to Ft. Lauderdale in the UHF Band — UHF Antenna installations will be very critical—so from here on out let's try and do a better job with VHF installations.

In Dec. Mr. Neil Hunter, Field Engineer for Sprague was in town. His appearance here was through the efforts and co-operation of East Coast Radio & TV Co. and Herman Radio Supply Co. Mr. Hunter gave an excellent lecture and demonstration on Capacitors. All those who attended the entire lecture had a far better insight on Capacitor construction and application.

Joint Electronics & Radio Committee On Service, Philadelphia Radio Servicemen's Association, and Television Contractors' Association

The JERCS—Joint Electronics & Radio Committee on Service—in cooperation with the Philadelphia Radio Servicemen's Association and Television Contractors' Association, is continuing its year long program of progressive education in the latest information and methods for TV servicemen in this area by presenting another in its current series of lectures.

James Robertson, *uhf* engineer for Capehart-Farnsworth Corporation of Ft. Wayne, Ind., will report on experience in the active *uhf* Bridgeport and Portland areas and on *uhf* market research on January 22nd at the Franklin Institute at 8:00 p.m. His lecture will also cover the available information on standard coil conversion to 20 & 40 mc *if* strips, and future circuit developments on all TV sets. Mr. Robertson is in this area through the courtesy of Trilling & Montague. This program was arranged by the Technical Educational Advisory Panel, the JERCS' subcommittee organized to handle the electronics servicemen's educational program.

By presenting this lecture, the Joint Electronics & Radio Comittee on Service is energetically following through on the program for which it was organized a year ago. At that time complaints against the electronics industry were piling up at a fantastic rate. In order to bring harmony and mutual understanding to its various elements and to develop educational programs for both the serviceman and the consumer, five well-known men in the electronics industry in Philadelphia banded together to form the nucleous of the JERCS. The five men, Albert D. Steinberg of Albert D. Steinberg & Co.; Albert M. Haas of Albert M. Haas Co.; Harry Ehle, Vice-president of International Resistance Co.; Thomas Joyce, president of Raymond Rosen & Co. and Morris Green of Almo Radio Co. drew together representatives of all segments of the electronics industry to put on a program of self-policing and internal education that has become a model for other communities in the country.

Under the sponsorship of the JERCS, a wide range public relations program has been instituted and carried out, including reports on the electronics industry in trade journals and daily press, television and radio shows, talks before civic and industrial groups and a year long program of educational lectures.

These lectures are open to all servicemen in this area, and include a question and answer period.

San Antonio Radio and TV Association, Inc.

Our association met Jan. 13, 1952, for their regular Annual Meeting to elect a board of Directors and Officers for the coming year. To bring you up to date on our activities we are enclosing a brief history of our association.

The annual meeting was preceded by a banquet at the St. Anthony Hotel. Officers are: President—Al Niehaus, Vice-President — A. B. O'Keefe, Secretary—Forrest L. Baker, and Treasurer—Tom Boyd.

[*Continued on page 66*]

CIRCUIT COURT

C.B.S. Columbia Models No. 817,820 Sync Amplifying System

The C.B.S. Columbia Models #817, 820 (*Fig. 1*), in order to give as stable sync as possible, uses separate amplifiers for the horizontal and vertical sync pulses. The reason for this lies in the fact that circuit values in sync amplifiers which amplify a composite sync, have to be a compromise. The compromise is between the response to the broad 60 cycle vertical pulse and the narrower 15.75 kcs horizontal pulse.

These compromise values result in a degradation of the pulse wave form. This degradation, in turn, leads to the vertical being more susceptible to noise pulses. In order to correct this situation, C.B.S. Columbia in their models #817, 820, as mentioned previously, amplify the horizontal and vertical pulses separately.

This is accomplished by feeding the grid of Tube "A" (*Fig. 2*) with the complete signal across a differentiator network consisting of *C207* and *R206*. The RC time of these components is such that the vertical pulse results in a spiked form that is of a great enough amplitude and width to permit tube *A* to conduct. The reason for this is that with the cathode grounded, the high value of *R206* causes the grid leak current to bias the tube to cut

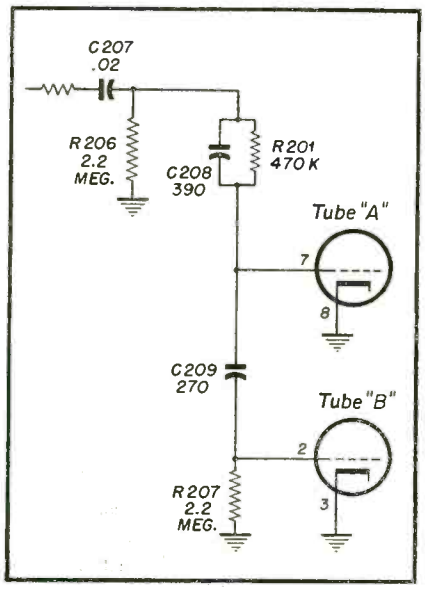


Fig 2—Partial schematic showing method of sync voltage distribution.

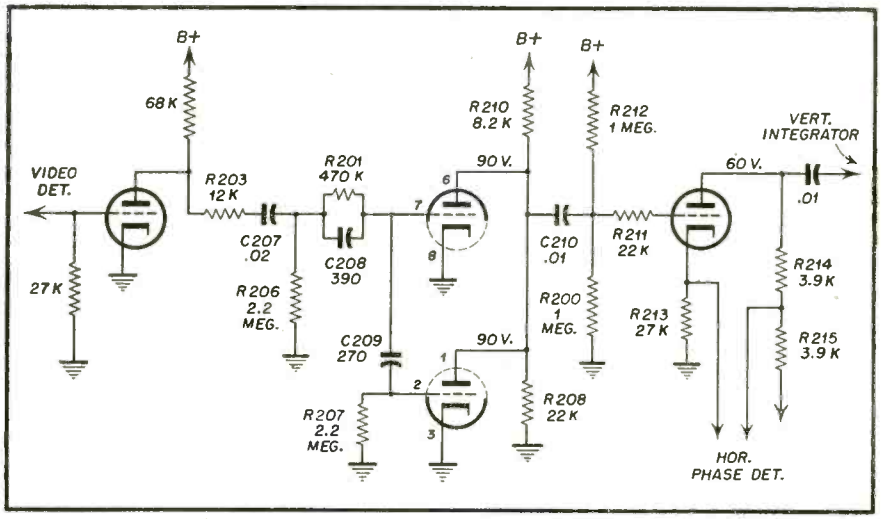


Fig. 1—Separate sync. amplifiers used in C.B.S. Columbia Models 817, 820.

off. The horizontal pulses being of a much narrower width do not bring the tube out of conduction. Tube *B* is also biased to cut off by grid leak biasing through *R207*. The *RC* time of *C209* and *R207* permits tube *B* to conduct only on the horizontal pulses. The vertical pulse develops most of its voltage across *C209* and the horizontal pulse develops most of its voltage across *R207* which is between grid and ground.

The plates of both tubes are tied together and the combined signals are developed across the common load resistor *R210*. This signal is then fed across *C210* and *R209* into another amplifier. The horizontal pulses are taken off the cathode and plate through resistors *R213* and *R215*. They then feed a horizontal phase detector diode. The vertical sync pulse is taken off through *C211* into the integrator.

Both tube *A* and tube *B* in addition to their pulse amplifying functions also act as sync strippers and limiters. The signal is fed sync phase positive from the video detector. Both tubes are cut off and only conduct on the sync pulses. This strips the video portion of the signal.

As a result of the value of the voltage divider, *R210* and *R208*, the plate voltage is approximately 90 volts. A condition of rapid plate saturation is thereby produced. Tube *V13* also is a limiter with a plate voltage in the order of 60 volts. This serves to clip any video information which might not have been stripped in the previous stage.

Conrac Model 61, 64—Detection and Sync Stripping

These two models (*Fig. 3*) are examples of the new trend towards making use of multiple element tubes for video detectors and heptodes for sync strippers. Let us examine briefly how these circuits operate.

Let us start with the signal at the plate of the fourth i-f amplifier, the *ac* load for this tube is *L7*. *L7* is in the cathode circuit of *V6*. *DC* wise this coil is a short. The plate of the detector tube goes to ground through *R20*. As the negative half of the *i-f* envelope appears across *L7*, it drives the cathode negative with respect to ground and also with respect to the plate. Since on this portion of the signal, the plate is positive with respect to cathode, plate current flows. This current flow is toward ground and, therefore, the voltage at the junction of *R20, R21, C31* and *C32* is negative. Due to the time constants of the components, this network filters the *i-f* component out via *C32* and the video component by means of *C31*. The result is a peak-type *agc* system. This voltage is applied to the grids of

[*Continued on page 64*]

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Push-Pull "V" and "H" amplifiers • 1 MC Band Width • High impedance, compensated "V" input Step Attenuator • Z axis modulation • 12 tubes incl. V.R. and 2 rect. • Light Shield and Mask • Heavy Steel Case. 8¼x14½x18".

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True Zero-Center VTVM—MEGOHMMETER with large 7" meter.

58 ranges to 6000 Volts, 2000 Megs, +70DB, 12 Amps • Direct Reading R.F. VTVM scales via optional RF-10A High Freq. probe • Voltage Regulated bridge type circuit • Constant 13⅓ Megs input resistance to 600 V., 133⅓ Megs at 6000V • Complete with test cables • In matched steel cabinet 10½ x 12 x 6".

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SERIES 612
Modern Free-point TUBE TESTER, and dynamic A-B-C Battery Tester.

Incorporates RTMA recommended circuit principles • 10 lever free-point element selection • Built-in roller chart • Dual short-check sensitivity • Noise, Ballast and Pilat Tests • Free replacement tube test data chart service • Complete, ready to operate • In matched heavy gauge steel cabinet 10½ x 12 x 6".

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The instruments shown above illustrate one of many possible MATCHED COMBINATIONS of *PRECISION* Test Equipment for the modern TV-FM-AM service bench. Each combination provides a selected, basic and efficient Laboratory at moderate cost.

SERIES TV-4—Super-High Voltage Safety Test Probe.

Extends range of Series EV-10A (above) to 60 KV direct reading, with full safety to operator and equipment. Multiplier cartridges also available to match most VTVM's and 20,000 ohms per volt test sets.

Series TV-4: — Complete, for use with EV-10A.

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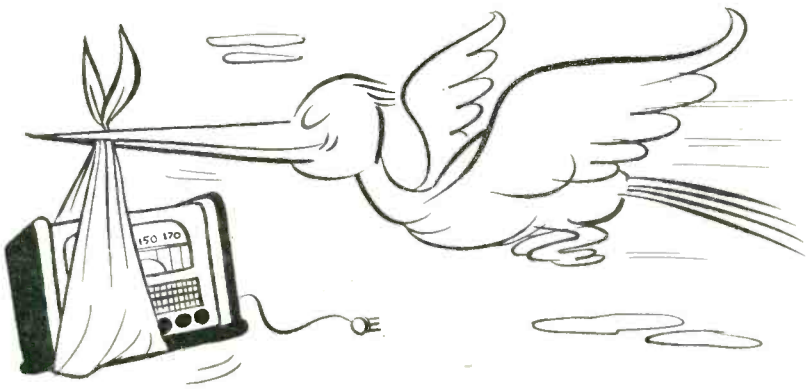
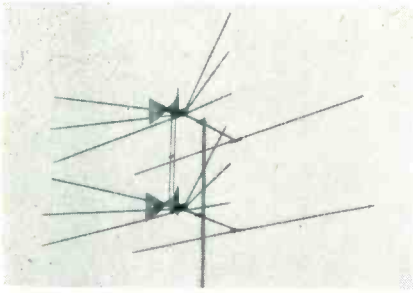


New Products

UHF-VHF ANTENNA

Channel Master Corporation, Ellenville, New York, has announced the development of the stacked Ultra Fan, Model 4132.

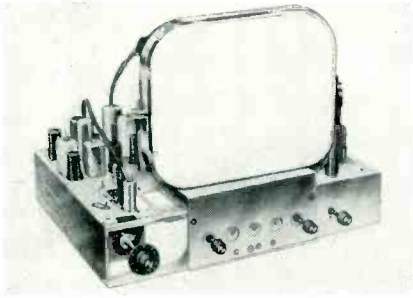
The Stacked Ultra Fan utilizes two interaction filters, one at each antenna, which electronically separate the VHF and UHF bands. This permits the antennas to be used with only one transmission line, and complete vhf-uhf reception is accomplished without switching. New "All-Vu" stacking rods have also been developed which provide highest gain on both vhf and uhf.



The Stacked Ultra Fan was designed to eliminate the "Twin Terrors" of UHF: vibration, and the accumulation of dirt and moisture at the terminals. The terminals of this antenna are isolated in free space, preventing the accumulation of dirt and moisture which can dim or short out the picture completely. The filters also have "free space" terminals.

TV RECEIVER KIT

Transvision, Inc., New Rochelle, New York, announces the release of the 1953 Television Kits for home assembly. The new A-4 design, this series of 6 models features afc, agc, choice of several tuners, optional remote control, retrace-elimination, ready addition of uhf channel strips without converters, optional power of 60 cycles, 50 cycles and 25 cycles.



These kits accommodate both American system of 525 lines and European system of 625 lines.

The instructions, prepared under the direction of David Gnessin, long known in experimental electronic work through his articles on television in technical trade journals, fill a 70 page plastic-bound book (with an additional dozen full-size drawings and photographs).

A free brochure on the 1953 kits is available from Transvision gratis.

UHF ANTENNA

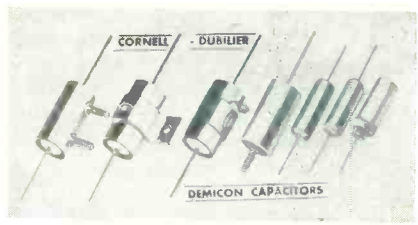
Over 10,000,000 antenna installations are prospects for the recently announced Ward Jazz Trombone uhf antenna, Model TV-180. Specifically designed to convert existing VHF antenna installations to also cover uhf, it is easily mounted on the same mast as the present antenna. Its market is every area with a uhf station either on the air or due to come.

Jazz Trombone is a companion piece to the extremely popular Trombone, announced by Ward several months ago and now widely used around the country. The Trombone is a combination uhf-vhf antenna designed for installation with new sets, while Jazz Trombone is to convert old installations to uhf.

Coverage of all uhf channels, uniform gain of 8 db across the band, low vswr and 300 ohm impedance are electrical features. It has a sharp directional pattern, too, to cut down the critical uhf ghost problem. Small—about two feet by two feet; light weight—less than two pounds; and completely preassembled, it is all aluminum construction. Two and four stack models are also available.

CAPACITORS

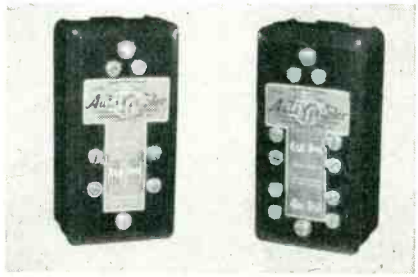
The expansion to twelve types in the "Demicon" series of miniaturized, tubular metal-cased paper capacitors is announced by Cornell-Dubilier Electric Corporation of South Plainfield, New Jersey.



Cornell-Dubilier "Demicons" are hermetically sealed in metal cases, with glass-to-metal seal terminals, and are available in seven mounting and container styles. Impregnants, tolerances and internal constructions are provided to meet the most popular applications encountered in present day engineering practice.

TV ANTENNA COUPLERS

Industrial Television, Inc., announced initial deliveries of their new IT-117A and IT-118A AutoCouplers.



The AutoCoupler permits the operation of two or four TV receivers from a single antenna. Attractively housed, the AutoCoupler features micro-loss, interaction suppressing distribution, and is suitable for twin lead or open-wire line.

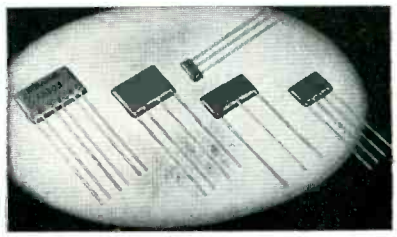
The AutoCoupler may be used in conjunction with ITI AutoBoosters for multiple installations in secondary signal areas.

The AutoCoupler is the latest addition to ITI's expanding line of jobber products which now include the IT-105R Battery-operable Field Strength Meter, the IT-90AB Cascode AutoBooster, the IT-102A Super AutoBooster, and the Tenna-Clip.

PRINTED CIRCUITS

Five new printed circuits for TV and Radio sets have been added to the replacement parts stocks of distributors for The Sprague Products Company. All of the new items are resistor-capacitor networks screen printed on high dielectric constant ceramic bodies. The resistor elements are highly stable, another new Sprague development in this field. A moisture-resistant insulating resin is used to thoroughly protect the complete plate assemblies.

The addition of these new R-C networks to Sprague's already large R-C line is part of the company's continuous program of making available to service technicians new developments in printed circuits and ceramic capacitors as soon as field needs arise.



Circuit diagrams of these new units are available from the Technical Service Section, Sprague Products Company, 71 Marshall Street, North Adams, Mass.

for the new 12 volt auto circuit

RADIART announces its 6300 series... an addition to the full line of

RED SEAL **Seal-Vent VIBRATORS**

Faster Starting

The exclusive RADIART design permits the briefest possible "Warm-up" period, thereby making the RADIART vibrators practically instantaneous starting. This added feature means greater performance.

Longer Life

There's more for your money in every RADIART vibrator-they last longer! Precision manufacture, using only the finest materials, assures long lasting, trouble-free performance.

Complete Replacement Line

RADIART has a CORRECT replacement vibrator for every original equipment vibrator. 12 Radiart vibrator types serve over 89% of all popular replacements. NOW..THE NEW 6300 SERIES IS READY FOR THE NEW '53 car MODELS with radios having 12 volt circuits.

Seal-Vented

Sealed at the factory to prevent the formation of an insulating film on the points while the vibrator is on the shelf...the sealed vent automatically opens when put in use to allow the vibrator to "breathe".

preferred by Servicemen Everywhere

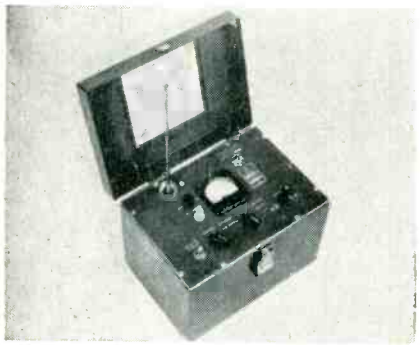
SUBSIDIARY OF CORNELL-DUBILIER ELECTRIC CORP.

THE RADIART CORPORATION CLEVELAND 13, OHIO

VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTORS • POWER SUPPLIES

PORTABLE FREQUENCY AND DEVIATION METER

A new portable frequency and deviation meter for readily checking radiated carrier frequency, undulation deviation, and other performance data of mobile two-way radio systems is announced by the Engineering Products Department of the RCA Victor Division, Radio Corporation of America.

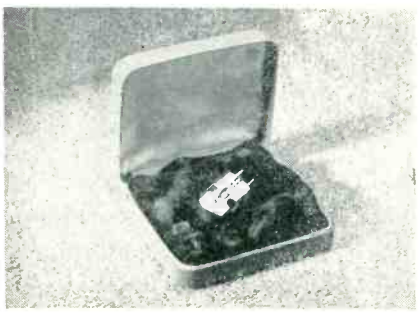


The new meter, RCA Type CX-8A, is a self-contained, highly accurate, direct-reading test instrument which provides facilities for checking the radiated carrier frequency of mobile and station radio transmitters to comply with regulations of mobile and station radio transmitters to comply with regulations of the Federal Communications Commission. It can also be used both as a field strength meter, to determine relative power output of a transmitter, and as a precise signal source for accurately aligning radio receivers.

The new instrument is designed to operate at one or two specified frequencies in the 25-50 or 152-174 megacycle range, or in other frequencies on special request. The center frequency indicator range is within plus or minus 15-kc of the internal crystal standard. The reading accuracy of the meter is plus or minus 200 cycles, and the accuracy of the reference to the crystal oscillator is better than plus or minus .002 per cent.

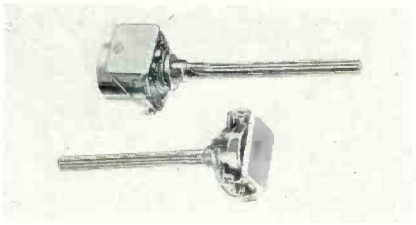
HI-FI RELUCTANCE PICK-UP CARTRIDGES

Three new General Electric 15,000 cycle variable reluctance phonograph cartridges are being displayed for the first time at the New York Audio Fair. As additions to the company's "Golden Treasure" line, dual stylus RPX 053 bears a suggested list price of $57.90 and RPX 061 and RPX 063, both single stylus cartridges, are listed at $33.95. All three feature diamond styli.



G-E's audio engineers believe these wide range cartridges are the answer to the question of how to obtain the best possible record reproduction with the least possible wear and distortion on favorite records.

The decision to adopt the diamond stylus for playing all three popular record speeds was based on the result of tests which showed that after running hundreds of hours, the diamond stylus produced no audible distortion.



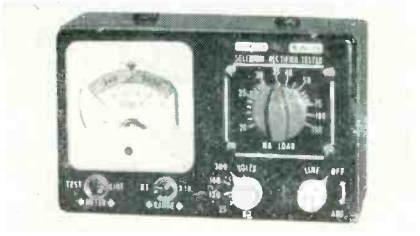
COMPENSATED CONTROLS FOR HI-FI

Compentrol is the new compensated loudness control being manufactured by the Centralab Division of Globe-Union. The unit is a combination dual-tapped control and Printed Electronic Circuit plate combining the compensating network. The use of the PEC plate makes possible a size practically no larger than an ordinary volume control together with close control over the output of the entire network Since all components in the "Compentrol" network are in shunt, there is no insertion loss, and no additional amplification is required.

Two styles of Compentrol are now available ½ meg and 1 meg values, in both switch and non-switch types. The units are completely assembled and ready for installation by a service engineer or audio enthusiast. Complete description and directions are enclosed with each unit. Prices for Compentrol are $2.50 plain type audio net, $3.00 switch type audio net. A booklet describing "compensation" and the Compentrol unit is available free of charge at Centralab distributors, or by writing the company: Centralab, 900 East Keefe Ave., Milwaukee 1, Wisconsin.

SELENIUM RECTIFIER TESTER

The Jackson Electrical Instrument Co., 18-40 S. Patterson Blvd., Dayton 2, Ohio, announces the new Model 710 instrument for testing all radio and television selenium rectifiers rated



from 20 to 650 ma. It operates on 110 to 125 volts ac and has a variable indicated voltage range of 25 to 300 volts ac. Use of the instrument is said to be extremely simple. After the load and volt indicators are set and the line voltage is adjusted, the test lead clips are placed on the rectifier terminals, next the correct meter range is selected and the test switch is pressed. Then the GOOD-BAD dial shows the condition of the rectifier and also indicates life expectancy. A bulletin giving complete information on the Model 710 tester will be sent upon request.

DEFLECTION YOKES

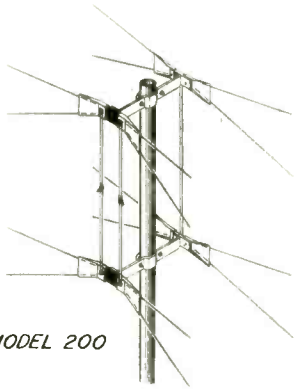
Standard Transformer Corporation, Chicago, today announced that four Stancor deflection yokes are now available with or without leads and networks.

To simplify installation work and to do away with the necessity for removal and replacement of the network components in applications where they cannot be used, yet supplying them ready-installed where needed, Stancor Nos. DY-1 DY-8; DY-9 and DY-10 are now available also as DY-1A; DY-8A; DY-9A and DY-10A respectively, with leads and networks added. This provides the right yoke for any specific installation, it was pointed out. In many applications the standard networks cannot be used, and removal and replacement of the networks components doubles the work of the service technician.

By supplying deflection yokes with or without leads and networks, Stancor does away with the necessity for paying for networks which cannot be used, yet provides yokes with leads and networks already installed where they are needed.

UHF ANTENNA

Telrex, Inc., Asbury Park, N. J., announces that production has been started on their new uhf "Ultra" "Conical-V-Beam"—a unit completely factory assembled, made of sturdy construction capable of withstanding gale winds on high towers. It is a broadband unit, and the stacked "Conical-V-Beam" dipoles



insure flat hi-gain response with full video and tone fidelity at any uhf channel plus freedom from flicker or flutter. This compacted array covers full UHF range at highest signal-to-noise ratio—at low cost. List price $10.75. Write for literature.

4-WATT RESISTOR

A new power resistor, type PW4 rated at four watts, has been enthusiastically received as a recent addition to the IRC line Completely insulated with an inorganic core material molded in a high temperature plastic, this unit will not support combustion. Wire element is uniformly and tightly wound on glass fibre core with axial leads 1½" long; .036" diameter. Body dimensions: 1¾" long 1 ohm to 8200 ohms in ±5% and ±10% tolerance. Units prominently stamped with IRC trademark, type and rating, ohm range and tolerance. This four watt resistor particularly recommended for television circuits requiring 2 to 3 watts actual dissipation at high ambient temperature, resistance element of resistance capacitance filter in automobile receiving sets where operation is at high ambient temperature, and all other circuits where a stable resistor is required, with wattage dissipation of 1 watts and less. For further information, write International Resistance Company, 401 North Broad Street, Philadelphia 8, Pa., for catalog bulletin P-1.

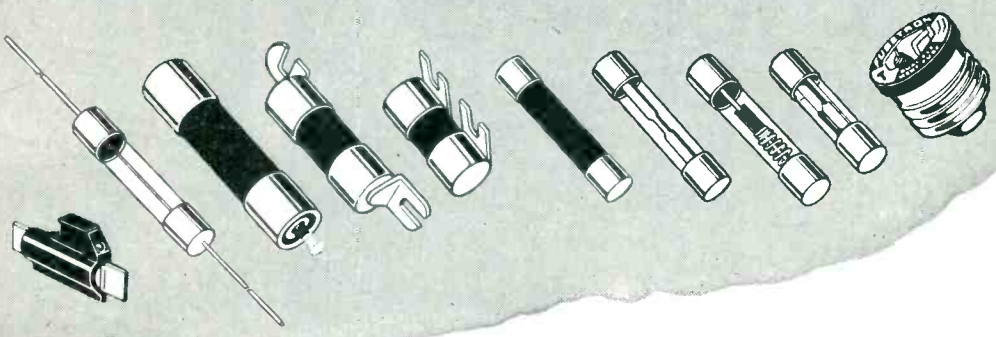
TOOLS FOR INSTALLING NEEDLES

The Duotone Company, Inc., Keyport, N. J., has announced that it is now including installation tools with every precious metal, sapphire and diamond tip replacement needle Duotone produces for RCA's #74068 Cartridge. Installation directions are printed on the package's reverse side together with the list price, needle tip material and size, and Duotone's catalogue number for the needle as listed in the Duotone Replacement Needle Chart. This same information is repeated on a small detachable inventory tag.

WHATEVER YOUR FUSE NEEDS THIS ONE SOURCE SAVES TIME AND TROUBLE

BUSS FUSES

for TELEVISION...RADIO...RADAR INSTRUMENTS...CONTROLS...AVIONICS



From fractional amperage types to huge industrial fuses, BUSS has specialized in a complete fuse line for the past 39 years. Whatever your circuit protection problem, you can choose from this complete line not only with convenience but with confidence in the unequalled BUSS reputation for quality and dependability.

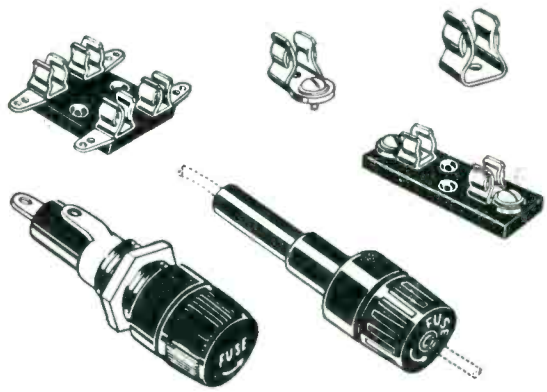
Evidence of BUSS dependability is the rigid electronic testing every fuse must undergo before leaving the factory. Ultra-sensitive electronic devices check it to exacting standards of construction, calibration and physical dimension.

BUSS Fuses Are Best For Your Business.

When you install BUSS Fuses, you can forget about troublesome "callbacks" caused by unnecessary blowing... and yet you can be certain of positive protection. In addition, your customers will appreciate the BUSS name... famous in home, farm and industry for 39 years. They'll know you've used the best.

...Plus

A COMPLETE LINE OF FUSE CLIPS, BLOCKS AND HOLDERS



USE THE HANDY COUPON — *It's just good business to rely on BUSS FUSES*

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me bulletin SFB containing facts on BUSS small dimension fuses and fuse holders.

*Name*_____

*Title*_____

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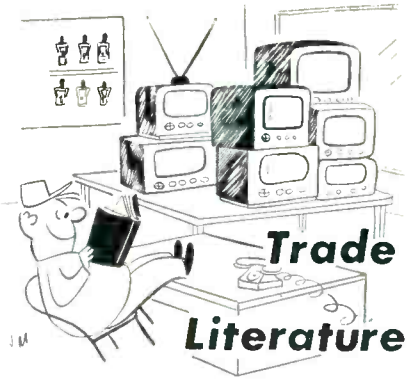
*Address*_____

*City & Zone*_____ *State*_____ 252



Du Mont Service News, the official Du Mont Servicing publication for the past two years, is a monthly publication replete with interesting and valuable servicing articles and field service data on Du Mont receivers. Many of the articles are of a general nature, but are of immediate concern to the servicing technician.

With contributions by such capable writers as Harold J. Schulman, service manager, Carl J. Quirk, technical supervisor, and Joseph J. Roche, editor, this publication becomes a "must" in trade literature the serviceman should receive. The January issue will be devoted to circuit descriptions and troubleshooting tips on a brand new Du Mont chassis.

For further information see your Du Mont parts distributor, or write: Du Mont Service News, Allen B. Du Mont Laboratories, Inc., Allwood, New Jersey.

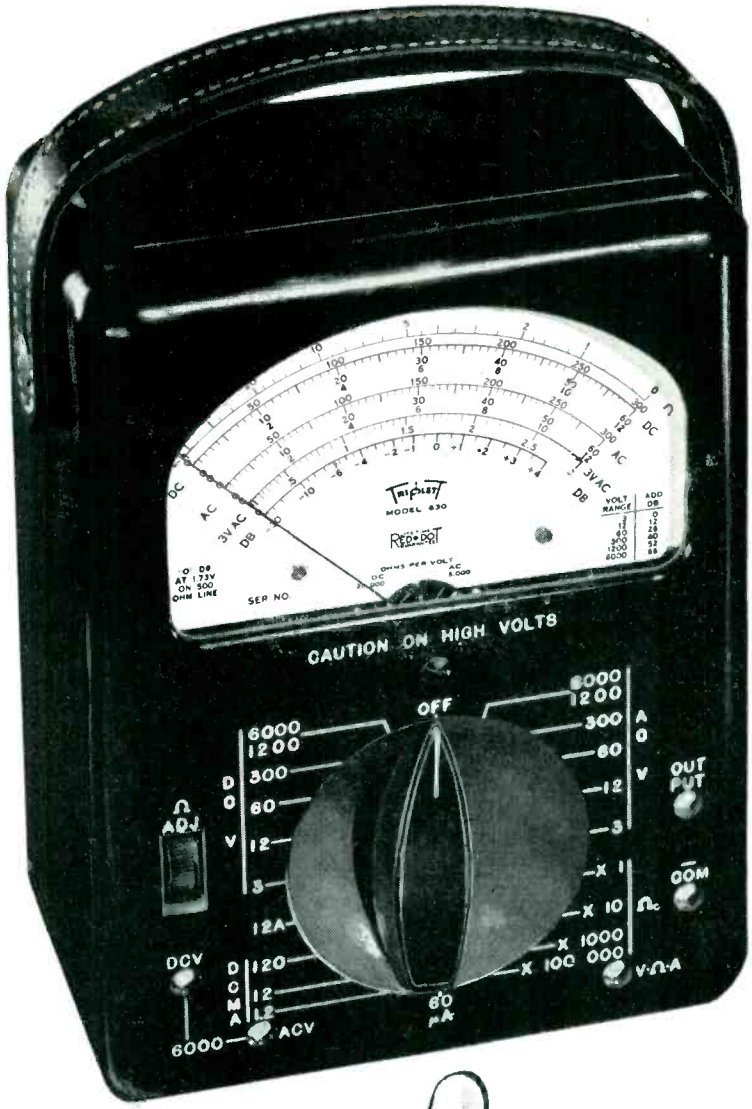
* * *

Radio's Master, a completely cross-indexed, fully illustrated buying guide and reference book containing 80,000 items of current electronic products, is now ready for the entire parts and equipment industry. Published by United Catalog Publishers, Inc., this hard covered, permanent edition containing 1220 pages, gives accurate, authentic descriptions of all items as approved by each manufacturer.

Radio's Masters is the official buying guide used by engineers, purchasing agents, dealers, recording studios, broadcast stations, laboratories, industrial plants, government agencies, experimenters—in fact, by all who buy, sell or specify. Available through local electronic parts distributors or write to United Catalog Publishers, Inc., 110 Lafayette St., New York 13.

* * *

Electro-Voice, Inc., Buchanan, Michigan, has just issued two 8-page Bulletins No. 185 and No. 189, on the E-V Aristocrat and Regency Klipsch-



ALL RANGES WITH THIS ONE CONTROL

Model 630

Just *one* knob—extra large—easy to turn—flush with the panel, controls all ranges. This one knob saves your time—minimizes the chances of "burn-outs" because you don't have to remember to set another control. You can work fast with Model 630 with your eyes as well as your hands. Look at that scale—wide open—easy to read, accurately. Yes, this is a *smooth TV* tester. Fast, safe, no projecting knobs, or jacks, or meter case. Get your hand on that single control and you'll see why thousands of "Model 630's" are already in use in almost every kind of electrical testing

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FOR THE MAN WHO TAKES PRIDE IN HIS WORK

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TRIPLETT ELECTRICAL INSTRUMENT COMPANY · BLUFFTON, OHIO, U.S.A.

Licensed Folded Horn Corner Enclosures, with complementary 12-inch and 15-inch full range and separate 2-way loudspeaker systems. E-V Baronet with complementary 8" speaker, and E-V Peerage sound equipment console.

The authentically styled, acoustically correct enclosures in Mahogany and Korina Blonde finishes are fully illustrated and described. Detailed data is given on the individual E-V Coaxial Speakers, High Frequency and Low Frequency Drivers, Diffraction Horns and Crossovers, and on complete E-V Speaker Systems for these cabinets. Important information on response, impedance, efficiency and distortion data is included. Comprehensive table shows various changer, amplifier, and tuner combinations compatible with the E-V Peerage Console.

* * *

With an expanding and widening market for Hi-Fi audio equipments rising to many millions of dollars, it is natural that the consumer-purchaser will soon need the help of servicemen well versed in and trained to handle audio Hi-Fi problems.

High Fidelity Simplified, another excellent and timely Rider publication, amply illustrated, should be read by the servicing profession for the understanding of what Hi-Fi really is. This should give the serviceman or service-dealer a talking acquaintance with a new art, an interesting hobby and a fast growing industry. (Note the multiple Audio Fairs.)

It may also be suggested that when too many time-consuming questions are thrown at the busy serviceman, he can recommend that the book—understandable to the technically uninitiated—be purchased and read by his consumer-service client. Available at parts distributors, audio salons or at John F. Rider Publishers Inc.

* * *

A "one-a-month" information kit describing permanent magnet application ideas for industry has been announced by the Carboloy Department of General Electric Company, Detroit.

The basic "kit" consists of a heavy permanent binder with six application ideas, each described on a separate loose leaf page. Each month, the Department plans to issue a new magnet application sheet which will be distributed automatically to those who request the basic information kit.

The first six ideas presented are: use of magnets on conveyors to transport ferrous parts, sheet steel separators, floor sweepers to pick up ferrous objects, plant layouts, tool racks, and shear tables for cutting sheet metal.

Each idea sheet contains complete technical information and diagrams regarding the particular application described.

* * *

Because of the vastly increased use of electronics in industry, Hudson Radio & Television Corp., New York Distributor, has published a complete new 196-Page Catalog of Electronic Equipment. This 7" x 10" book is so prepared that it can also serve as a reference manual for Industrial, Laboratory, Broadcast and other users of electronic equipment. It includes an elaborate cross-reference and guide to JAN (Joint Army-Navy) components of the world's outstanding manufacturers. Practically every standard make of Radio and TV Replacement Parts and accessories is listed at Distributor Prices!

* * *

Special needs of the practical designer are met in "Filter Design Data for Communication Engineers" by John H. Mole, a new book published this month by John Wiley & Sons.

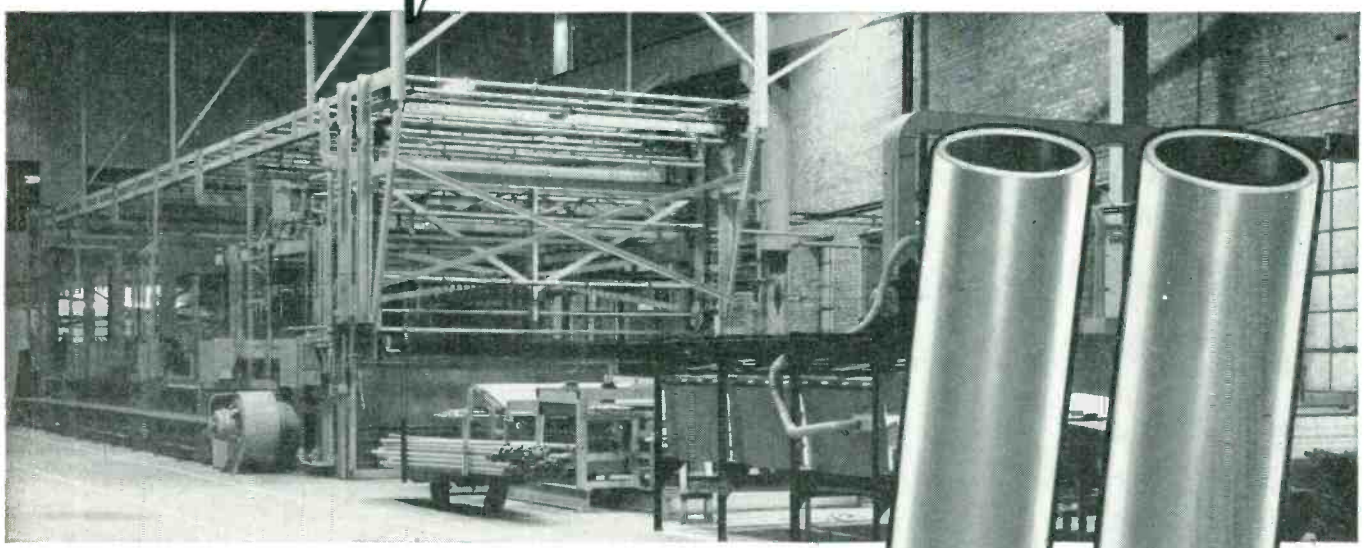
Concentrating on the Zobel methods of synthesizing filters, the author provides a clear exposition of design methods and their results. He discusses in turn: low-pass, high-pass, symmetrical band-pass and band-stop

5 ft. and 10 ft. self-coupling

immediate delivery from your Admiral distributor

MASTS

Television



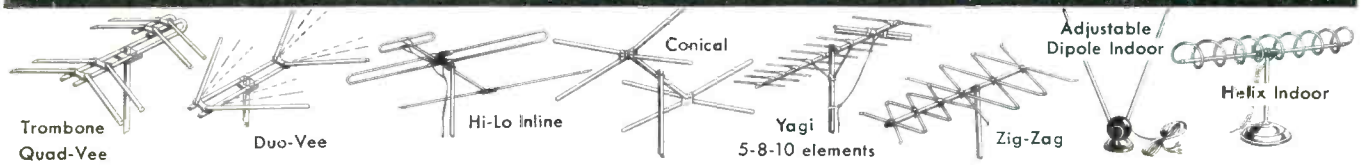
The greatly increased need for outside antennas in new station areas has just about soaked up the supply of masts. Now Admiral is ready to help you meet the demand with these new 5 and 10 foot masts . . . *available at once* from your Admiral Distributor.

Admiral's huge production brings you these masts at the industry's lowest prices. Finest quality, too . . . made of cold-rolled seamless steel tubing, heavily electrogalvanized for utmost rust resistance. Both 5 and 10 foot masts are available with one end flared to take extensions . . . eliminates the need for separate mast couplers. Order from your Admiral Distributor by part number:

	20 gauge	*18 gauge*	*16 gauge*
5 ft. plain end	M 40		
5 ft. flared end	M 40A		
10 ft. plain end	M 41	M 42	M 43
10 ft. flared end	M 41A	M 42A	M 43A

Admiral Corporation, Accessories and Equipment Division, Chicago 47, Ill.

A COMPLETE LINE OF ADMIRAL TV ANTENNAS . . . NOW AVAILABLE FROM YOUR ADMIRAL DISTRIBUTOR



sections; dissymmetrical band-pass filters; impedance transformation; junction losses and calculation of effective loss; and the design of terminal sections.

Tchebycheff behavior of stop-band attenuation; the effects of dissipation; tolerances on element values; and simpler filters with Tchebycheff behavior of pass-band loss are covered as well. In addition, a notable collection of charts, tables, and formulas have been selected or especially prepared for this volume in order to save time-consuming calculations.

"Filter Design Data for Communication Engineers" contains 252 pages and is priced at $7.50.

* * *

"Your Road to Better FM" titles a new pamphlet describing WARD FM antennas.

The pamphlet is designed both as a catalog and as an envelope stuffer, and is being used by many distributors and dealers in their sound rooms.

Entitled Form 54-187, "Your Road to Better FM" is now available from Ward distributors or direct from Ward Products Corp., Division of The Gabriel Co., 1523 East 45th Street, Cleveland 3, Ohio.

HI-FI

[*from page 38*]

cutoff filter which is continuously variable. It uses no steps, but instead has the same smooth action that a potentiometer has. In this arrangement a normal variable tuning condenser is employed as part of a feedback loop.

In this kind of circuitry, the most successful filters are the ones which provide the greatest amount of noise reduction with the least amount of loss of music. This is of course always a compromise—not all the scratch, hiss, or other undesirable noise is gotten rid of, and not all the music is left in. But if the compromise is a good one, there will be definite improvement in the sound.

Dynamic Noise Suppressor

The most complex of the noise controls is the dynamic noise suppressor. This is a means for providing fairly sharp cutoffs at constantly-changing (dynamic) points. The sharp cutoff filter is used, but instead of being set by the listener for the particular record being played, it changes its own setting rapidly, whenever the frequencies (upper) of the music change.

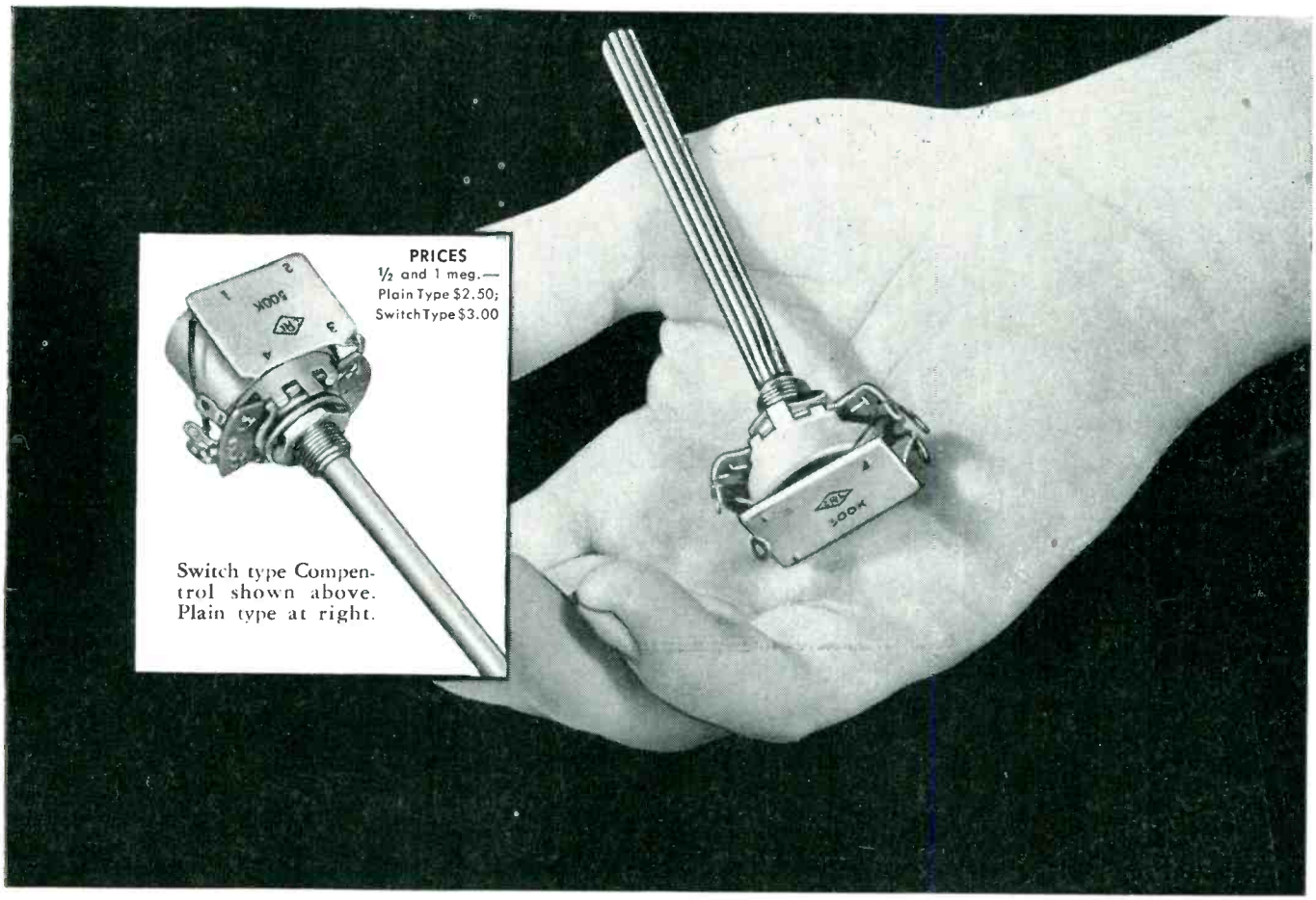
This is accomplished by using a tube as a variable inductance or variable capacitance in tuned circuits to produce sharp, constantly changing filters. A reactance tube circuit is employed in which the mutual conductance of the tube (*V2* in *Fig. 5*) is controlled by changes in its grid d-c voltage, which in turn depend on the signal which *V4* rectifies after its amplification by *V1*.

When the mutual conductance of the tube changes, the value of effective inductance which the tube represents changes, and this changes the resonant frequency of the sharp cutoff filter of which the tube is part.

In *Fig. 5* we have one high frequency dynamic filter, of which *V2* is the center, and one low frequency filter (to reduce rumble, which becomes more apparent once the treble is cleaned up) of which *V3* is the center. Most fairly elaborate home-type dynamic noise suppressors have two high frequency filters ("gates") and one low frequency gate. The diodes *V4* and *V5* are used to rectify a portion, respectively, of the high-frequency content of the signal and the low frequencies. The d-c control voltages thus obtained are then fed to the grids of the reactance tubes where they affect the G^m of the tubes as they pass (and filter) the signal.

Controls for adjusting the time constants of the rectifying diodes are

For faithful tone reproduction . . . high fidelity at low volume level — use Centralab's Compentrol



Centralab components are safest for guaranteed servicing

YOU can stake your service reputation on the Centralab Compentrol. That's because this combination volume control and Printed Electronic Circuit faithfully reproduces the high-pitched tones of the operatic soprano — or the deep bass notes of the boogie woogie beat . . . when volume is set at low level.

In fact, Compentrol was especially developed to better reproduce the apparent bass and treble response of radios, audio amplifiers, phonograph combinations and television sets. Use it as a business builder as well as for replacement service. It actually improves original performance! What's more, its low price will fit any pocketbook.

Because of its design CRL's Compentrol needs *no additional amplification*. There is no insertion loss when you use Compentrol.

The Centralab Compentrol is furnished in ½ or 1 meg. —plain or switch types. Switch is SPST, and an insulated switch shield is furnished for a-c shielding. Most amplifiers use a plain type. For complete details, ask your Centralab distributor, or use the coupon.

Make your Centralab distributor headquarters for exact electronic replacements

Centralab

A Division of Globe-Union Inc.
Milwaukee 1, Wisconsin
In Canada, 635 Queen Street East, Toronto, Ontario

The Centralab Compentrol is only one of the more than 470 *new* items listed in Centralab's new Catalog 28. Get your copy of this 32-page index to the latest developments in the fast-changing electronic field, plus a 16-page booklet telling the whole Compentrol story. See your distributor or use the coupon.

CENTRALAB, A Division of Globe-Union Inc.
944 E. Keefe Ave., Milwaukee 1, Wis.

Please send me my copy of the new Compentrol Booklet as well as Centralab Catalog 28 at once and without charge.

Name..... Position.....

Company.....

Address.....

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

shown next to each diode. They regulate the charge and discharge times, and therefore control the "attack" and "recover" intervals of the circuit. (They decide how fast the circuit should act to limit the high frequency amplification once there is no high-frequency music present.)

In this particular circuit *C2* and *L2* constitute a trap for the region between 10 kc and 16 kc. If there were another high frequency gate employed in this circuit it would take over in this part of the frequency spectrum, and we might use another adjustable trap similar to *C2-L2* for the frequencies above 16 kc.

Output Impedance Matching

Finally, we come to the last feature with which we will concern ourselves in the amplifier for a while—the output impedance of the control unit. This was never a problem so long as audio amplifiers were single, self-contained units. The rule was to use careful layout and short leads and forget about the impedances from one stage to the next—they were all high.

But today, with remote control units on almost every high quality amplifier (and even some not-so-high ones!) we have to be concerned with having low impedance output from the control unit so that the highs do not get lost while going across the room to the power amplifier. One way to solve this is through the use of broadcast-type step-down transformers. But this means using another transformer at the power transformer to step the signal voltage back up again, and that means money.

Another way to do it is to use a triode as a cathode follower and end up with an impedance out of perhaps 1000 ohms. This solution has been adopted by several manufacturers. Still others simply work the last tube as a straight voltage amplifier into a rather small load, and thus end up with a bit less voltage but a rather low enough source impedance (say 10,000 ohms) to handle most installations with no perceptible treble attenuation. Finally, we have the designers who quite frankly make no attempt to deal with the situation. They have a fairly high source impedance and admit it.

CIRCUIT COURT

[*from page 52*]

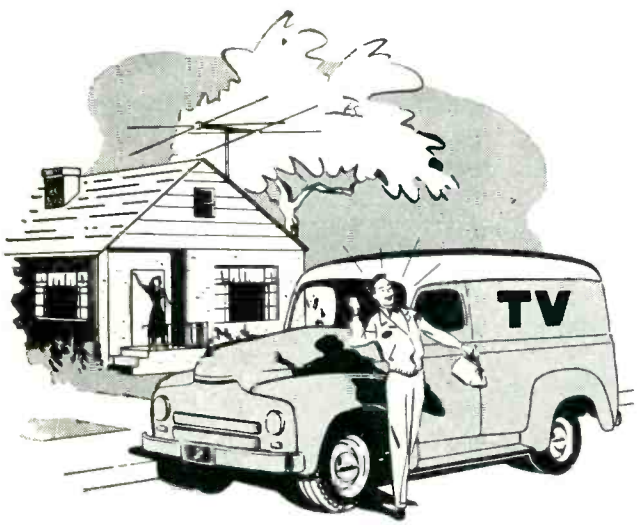
the *r-f* amplifier and the first two *i-f* amplifiers.

While this *agc* action is occurring the grid to cathode voltage is also changing. This change in grid to cathode bias appears across *C33* through *R23* and *L9*. While the neg-

ASTRON

SAFETY MARGIN

CAPACITORS



Cut Callbacks!

When you install ASTRON Capacitors, you're insuring against call-backs, building your reputation for *reliable* service.

Through the use of an improved electrolyte, and an exceptionally high-purity anode foil—plus rigid quality control and exhaustive multiple testing techniques—ASTRON electrolytic SAFETY-MARGIN capacitors mean longer life and maximum performance under every condition. Unexpected surges of voltage, undue heat or moisture—conditions that might spell failure in an ordinary capacitor—rarely affect an ASTRON.

So next time ask for ASTRON—the capacitor with the "safety margin" that protects your service reputation. And ask for Astron Type AM molded paper tubular capacitors to complete your service job. *Individually tested — individually guaranteed.*

Depend On—*Insist On*

ASTRON CORPORATION

Write for Catalog AC-3 and Name of Jobber Nearest You

ASTRON
CORPORATION

255 Grant Avenue, E. Newark, N. J.

active half of the *i-f* envelope appears across *L7, C33* discharges through *R23* and *L9*. When the positive half appears, the tube is cut off by the plate and *C33* charges again. We, therefore, have the triode acting as a detector and *agc* rectifier.

The detected signal appears at the grid of V7, the video amplifier through *L8, L10, R24,* and *R25*. *L8* is a tuned parallel circuit whose resonant frequency is 4.5 *mc*. This presents a high impedance to the 4.5 *mc* intercarrier sound frequency. As a result, this signal appears across *R23* and *L9* and is taken off between *L9* and ground by *C34*. It is then applied to the grid of the first sound amplifier stage.

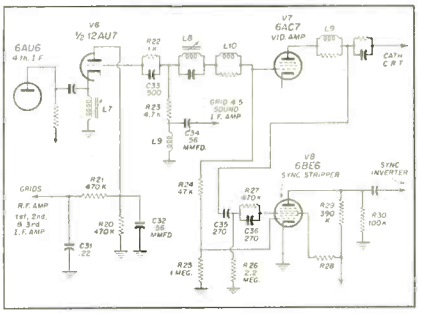


Fig. 3—Conrac video detector, agc, and sync stripper.

The 6BE6 sync stripper operates on the principle that while both grids #1 and #3 can control the plate current, the grid #1 is the more sensitive in this respect. The circuit is set up in the following manner. The major signal is applied to grid #3 from the plate circuit of the video amplifier. This signal is in the order of 35 volts *p-p*. The signal off the plate of the video amplifier has been limited. As a result, all noise pulses on the sync pulse have clipped. In addition, all other noise pulses are no higher than the top of the sync pulse. This is conventional video amplifier design and in noisy areas, if used as is, would result in the noise pulses triggering the oscillators prematurely.

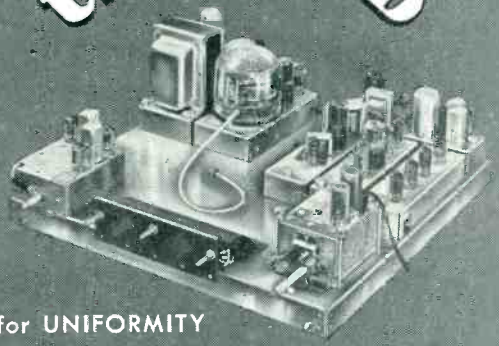
ASSOCIATIONS

[*from page 51*]

Following is a Brief History of This Organization:

In 1949, a small group of Radio and Television service-dealers met for the purpose of getting better acquainted with each other and discussing their mutual problems. Several meetings were held and other service-dealers invited in until it was decided to make

UNIT-IZED
TRADE MARK



• for UNIFORMITY
• for MODERNIZATION
• for MAINTENANCE

SETCHELL CARLSON TELEVISION

. . an engineering masterpiece
. . . a coveted dealership

B. T. SETCHELL
President and
Chief Electronic Engineer

SETCHELL CARLSON "UNIT-IZED" TELEVISION, the receiver that is electrifying the industry . . . bringing order and simplicity to a host of production and service problems.

The compact chassis consists of a hase and 8 plug-in units, each performing its separate and distinct yet perfectly synchronized function, producing picture and tonal quality that defies comparison.

This new and exclusive type of chassis construction provides maintenance of peak quality by individually testing each unit, provides the possibility of modernizing at the lowest possible expense and provides an ease of service unequalled in the television industry.

In addition to the features that have proven to be valuable, such as, models with radio and phono, 4 stages of I. F. amplification, simplified adaptation to U. H. F., variable tone control, front panel adjustment, removable safety glass, luminous dials, and distinctive cabinet designs, SETCHELL CARLSON television contains many more basic *exclusive* features that make it television's best buy.

—Herm-A-Dome; (patent applied for) a hi-voltage unit hermetically sealed against humidity and dust, preventing arcing and corona thus prolonging its life.

—A unique circuit (patent No. 2,589,299) that protects major parts in case of oscillator drive failure.

It is truly the dream set of the customer, the dealer and his serviceman.

SETCHELL CARLSON television is custom designed in a limited production schedule and equipped with powerful sales tools that make every dealership a valuable and coveted one.

Interested dealers are requested to write:

one of the several models . . . Blonde 5301 with Radio and Phono compartment

SETCHELL CARLSON, INC.

"Leaders in Electronics for a Better Life"

NEW BRIGHTON, MINNESOTA

a permanent organization. The name chosen was San Antonio Radio and Television Association. More or less regular meetings were held and a set of by-laws was drawn up and a State charter was applied for and granted on June 13, 1951.

From the start it was apparent that our organization would not follow conventional lines. We of course could not be expected to insure ethical practices of non-members but we could insure ethical practices of our members. We examined Codes of Ethics of other similar organizations in other cities and finally adopted a Code of Ethics which has been accepted by our members, and we believe, insures our customers of the utmost in Service.

It is also necessary that our members be identified prominently so that prospective customers will know where to have their receivers repaired. The present emblem of the association was adopted Sept. 27, 1951. It is displayed on shop windows, on our code of ethics, on cars and trucks of members and on all advertising of the association, as well as on membership cards and certificates and identification cards of members and their employees.

We were instrumental in organizing the state organization which was organized on Jan. 28, 1951, under the name of Texas Electronics Association and has regular meetings four times a year at Austin, Texas. Mr. Baker of Radio Service Company is now T.E.A. president and we are members of T.E.A. which is composed of Associations similar to ours. Present members are Dallas, Ft. Worth, Austin, Houston and San Antonio associations.

We are at present holding three regular meetings a month. Two technical sessions (TV course) are being held the second and fourth Tuesdays of each month. These are attended largely by associate members, who are shop technicians, students and other persons interested in Radio and TV. We are holding one business meeting each month on the first Tuesday of each month. This meeting is attended by the shop owners or legal representative of the member firms who is usually the Service Manager of the firm. This session is largely devoted to business problems arising out of the service business. Method of advertising and customer relations are some of the subjects discussed. A pamphlet entitled "Interesting Facts about your TV set" is one of the results of these meetings.

GOOD SERVICE

[*from page 39*]

in their sets, these may lead to major ones with correspondingly larger expense.

This works with most of them; we pull the set out to give an estimate, and if the customer is satisfied we work on it the next day. We never keep a set for more than three days because this results in loss of goodwill. Neither do we loan sets, for we've found that if these develop trouble, especially through the customer's inadequacy or unfamiliarity with the controls, the resulting service calls are profitless and demoralizing to our servicemen."

Presently it takes 14 men and three trucks to service Eastern's thriving business.

TROUBLE?

[*from page 32*]

to cause a breakdown of the filter condensers.

Voltage Divider Precaution

Care must be exercised in detaching lines from the low voltage system when making checks along a voltage divider. Even more care must be

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used when disconnecting lines in receivers using tube voltage dividers. There are two important circuit variations in TV low voltage supplies:

1. Resistive voltage dividers across the low voltage supply, from which voltages are tapped off for various circuits. A typical example is shown in *Fig. 1*.
2. Tube voltage dividers. A common example of a simple tube voltage divider is a parallel combination of three video i-f stages and the sync amplifier in series with the audio P-A stage across the B+ supply. In some models, more complex tube voltage dividers are used. Various stages of the receiver are placed in a series—parallel network across the low voltage power supply.

Tube voltage dividers are used to tap off the desired voltages from the low voltage system without having to use large wattage resistors as in the resistive voltage divider circuits. This results in a saving of parts and reduces heat and power dissipation.

Disconnecting a line to check a short or partial short in a complex network may throw off the operation of several stages and upset the voltage distribution even more than the original fault. In such circuits, opening a connection should be done only after checking the schematic to determine the possible effect on overall operation. Complex circuit arrangements can often be checked by measuring voltage and resistance at key points in the circuit as described in the following paragraph.

Trouble Shooting Methods

In tracking down trouble in a complex power supply, voltage and/or resistance checks are generally most useful in finding the trouble. Once the defective bus is found, generally by a voltage check as described above, further checks are made along the bus at various points to determine where on the bus the reading is off the most. By checking along the bus, it is simple to determine whether you are getting closer to or further away from the trouble.

As an example, assume there is a short at point A, *Fig. 3*. Trouble-shooting is being performed by resistance measurements. The normal reading from B+ to ground is 50K, but the actual reading is found to be 7K. As the ohmmeter prod is placed at various points along the defective line, the reading may get greater than 7K. This indicates you are going further away from the trouble, from a resistance standpoint, instead of getting closer. That is, an additional resistor (or resistors) is between the shorted point and the meter prod. On the other hand, if the reading is smaller than 7K at a given point, then you are coming closer to the short. This is evident in *Fig. 3*. The short is at point *A*. If the measurement is taken at points *B* and *C*, the reading is higher than 7K, since these points are electrically further away from the short. If the measurement is taken at point *D*, the reading is lower, since this point is electrically closer to the short. As further readings are taken at *E* and *F*, the readings again become higher, showing that these points in the circuit are further away from the short. When the reading is taken at *A*, the lowest possible reading is obtained. The lowest reading indicates the location of the trouble.

There may be times when the short is connected directly to a line rather

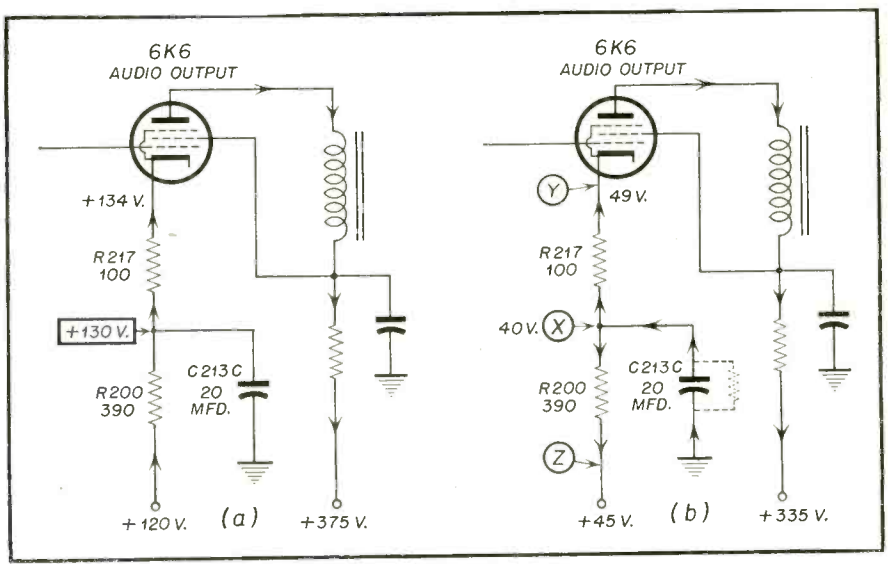


Fig. 6—(a) Normal path for current flow. (b) Current flow through cathode resistors with C213C leaky.

than on the other side of a resistor. In such cases, the lowest resistance reading would be made right on the line. To check where the short is, it may be necessary to open the line by unsoldering at various points and to remeasure the resistance until the shorted point is found.

Resistance measurements are made, of course, on this basis only after an initial measurement shows one of the B+ lines has an incorrect resistance reading.

The same general procedure can be followed by taking voltage measurements along a bus and noting where the main voltage difference is found.

4. d

The readings show cathode bypass condenser C213C is leaky. Normally, the current for the P-A stage goes from the +120 v point through cathode resistors *R200* and *R217* through the tube. Voltage at the cathode of the P-A is higher than +120 v by the amount of the drop across the two series cathode resistors. Normally, the junction of the two resistors (connection point between *R200* and *R217*) is more positive than +120 v but less positive than the cathode voltage.

Note that the control grid voltage of the P-A stage should read +120 v but always reads less because of the high value of grid return resistance. Because of the positive voltage (+120 v) to which the grid resistor is returned, any voltmeter measurement from grid to ground forms a voltage divider made up of the meter and the grid resistor, *R199*, as shown in *Fig. 4*. Even a VTVM with an internal resistance of 11 megohms will read several volts less than the actual voltage which appears at the grid when no meter is there. With a 20,000 ohms per volt meter or one with a lower internal resistance, there will be an even smaller reading at the grid when the voltage is measured from grid to ground. When using a meter other than a VTVM, the grid reading may be off considerably and it may be somewhat difficult to determine if there is a defect in the grid circuit. A mental computation can be made of the internal resistance of the meter and the value of grid return resistance in series across the supply voltage and the expected voltage which should be measured at the grid. Or a reading can be made as shown in *Fig. 5*. First, measure the voltage at the +120 v point; then measure the voltage across *R199*. If there is no voltage reading across this resistor, there is no voltage drop and the voltage therefore must be the same at both ends of the resistor, or +120 v at the grid. A voltage will be measured across the grid return only when there is a d-c current flow through it due to some defect in the circuit—a leaky coupling condenser or a gassy tube.

Because *C213C*, cathode bypass condenser, is leaky, current goes through this condenser and takes two paths—through *R217* and the P-A tube; and through *R200* to the +120 v point. *Fig. 6*. As a result, the junction of *R217* and *R200*, instead of having the normal reading intermediate between +120 v and the higher cathode voltage, is lower than either point. Because of the leaky condenser, the junction point (*X, Fig 6*) is less positive than the other two points (Y and Z *Fig. 6*); that is, current goes from the junction to the other two points. Current goes from a point less positive to a more positive point in the circuit.

The low reading of the junction point, therefore, is a tip-off on the nature of the trouble. The low equivalent resistance of a leaky *C213* acted as a partial short across the +120 V point in the low voltage supply and caused a redistribution of voltage across the voltage divider. The voltage shift also reduced the bias on the P-A stage (cathode-to-grid potential) and caused

more current through the P-A stage, heavier loading on the entire low voltage system, and therefore some additional reduction in the total B+ voltage. Apparently, the condenser broke down only under load, since the resistance readings were normal.

A leaky coupling condenser *C182* could not account for the observed voltage readings. If *C182* were leaky, a d-c current would probably flow through the condenser opposite to the usual direction because of the original voltage distribution in the circuit. Contrary to the usual situation, the normal voltage on the plate side of *C182* is *less* than on the grid side (*Fig. 1*). With a leaky coupling condenser, grid voltage therefore would very likely be less positive than normal while the cathode voltage would be + 120 v or perhaps more. Since the grid voltage would be less positive, current through the P-A tube would either be less or cut off entirely because of this increased bias. If anything, voltage at the +120 v point and full B+ would be higher rather than lower, because of the decrease of current through the P-A stage and the smaller load across the power supply. In addition, the junction of the two cathode resistors would not have a lower voltage such as was measured.

A decrease in the value of *R199* would have practically no effect on the normal voltage readings. An open *R200* would not cause the observed drop in voltage at the +120 v point. Also, with *R200* open, voltages measured at the P-A cathode and at the junction of *R200* and *R217* would be higher than normal rather than lower.

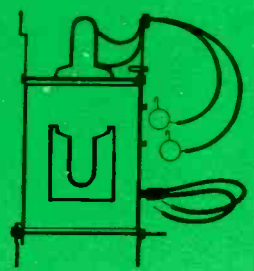
A cathode-filament short in the P-A stage is ruled out for at least two reasons—the tube was charged and there would not be a lower voltage at the junction of *R200-R217* compared to the cathode or the +120 v point. A cathode-filament short in the P-A stage is a fairly common trouble in current receivers because of the large cathode-to-filament potential. When such a short develops in the P-A tube, in sets having a resistor low voltage divider, symptoms similar to those described in this receiver may appear. A cathode-filament short can also cause a redistribution of voltage in the low voltage system. In some receivers using a tube voltage divider arrangement, a P-A cathode-filament short may result in no pix, normal raster, and no sound except a loud 60-cycle hum.

It should be noted that a fault in any stage can be considered basically a trouble affecting the low voltage power supply when it causes a considerable voltage change in part or all of the supply.

AD INDEX

take the kick out of TV

CORONA **FREE** HVO-X7 FLYBACK TRANSFORMER



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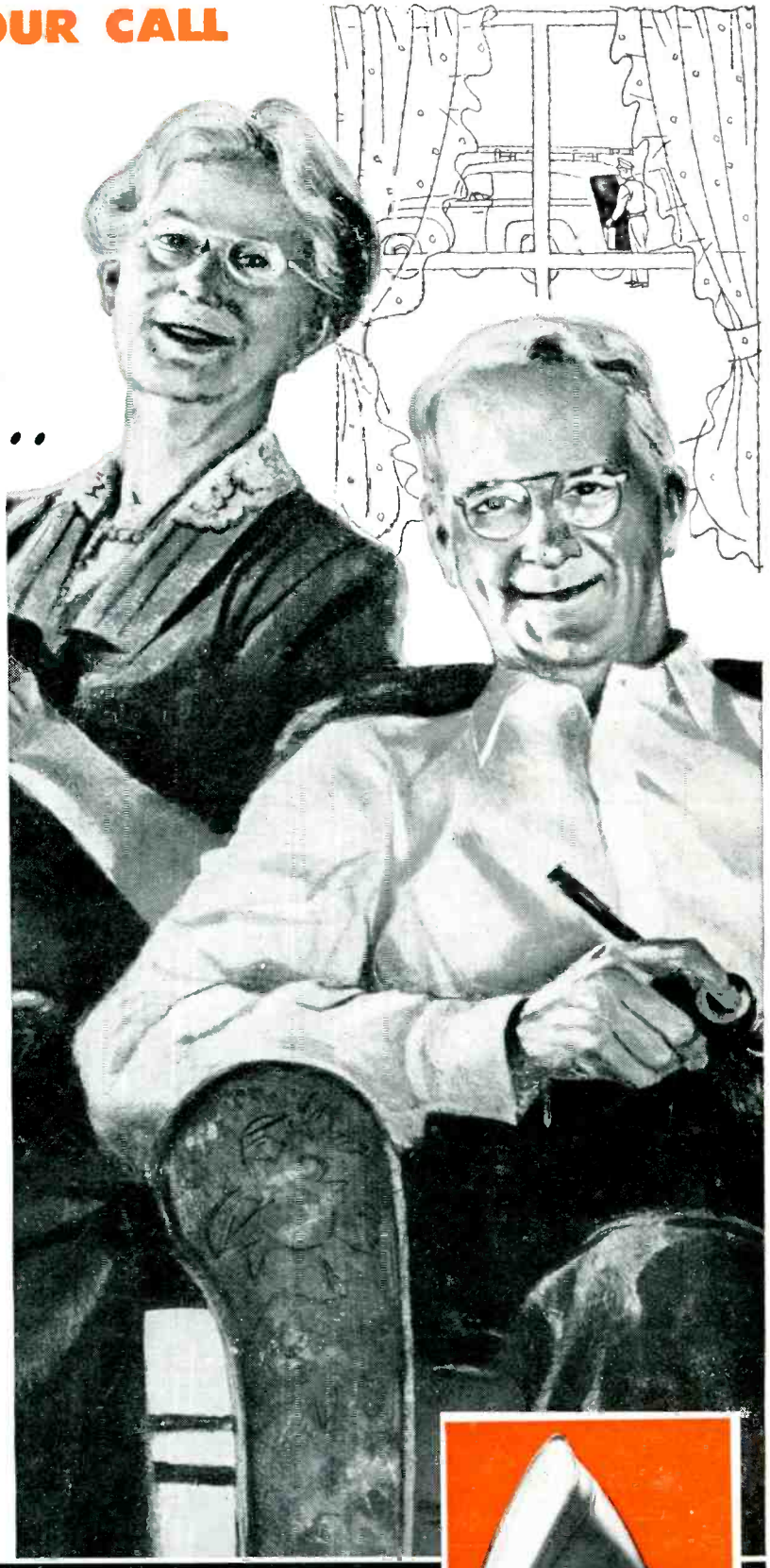

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