

DECEMBER, 1952

Radio-TVision SERVICE DEALER



The Professional Radio-TVman's Magazine

IN THIS ISSUE:

Automatic Frequency Control Circuits
Looking For Trouble? No. 11
A High Quality Amplifier
Transistors
Video Speed Servicing Systems

AM-FM-TV-SOUND

Booster performance depends on noise figure!

Gain alone is NOT enough!

CHANNEL MASTER

a new kind of SINGLE CHANNEL TV BOOSTER

with the

Highest gain Lowest noise
in booster history!

- **GAIN:** 12 Times (22 DB), low band; 8.5 Times (18.6 DB), high band.
- **NOISE:** 4.5 DB, low band; 6.5 DB, high band.
- The only single channel booster with **CASCADE**-type **CIRCUIT**
 - Uses famous, low-noise 6BQ7 tube.
- Double-tuned transformers for peaking both video and sound.
 - Antenna by-pass switch.

Actual Performance Figures prove that Katy-B tops 3 leading boosters!

	KATY-B	Booster A	Booster D	Booster C
Gain (high no. preferred)	8.5 Times	4.2 Times	5.9 Times	6.2 Times
Noise (low no. preferred)	6.5	14.3	8	9.1
VSWR (low ratio preferred)	1.5:1	9:1	2.6:1	3.8:1
Balance-to-Unbalance Ratio (high ratio preferred)	10:1	1.4:1	5.8:1	7.1:1

Typical Comparison on Channel 12

TV "snow" is noise generated by the set and booster. The amount of noise present depends primarily upon the first tube in the receiving system.

This means that where a booster is used, the amount of "snow" in the picture depends almost entirely upon the performance of the booster, and the tube(s) it uses. Most single channel boosters on the market today have poorer Noise Figures than modern TV front ends. Therefore, while these boosters may contribute gain, they actually deteriorate picture quality by adding noise.

Katy-B is the first modern single channel booster. It employs the famous, low-noise 6BQ7 tube in a Cascade-type circuit, which gives the lowest Noise Figure and highest gain ever obtained in a television booster.



list price \$24.40

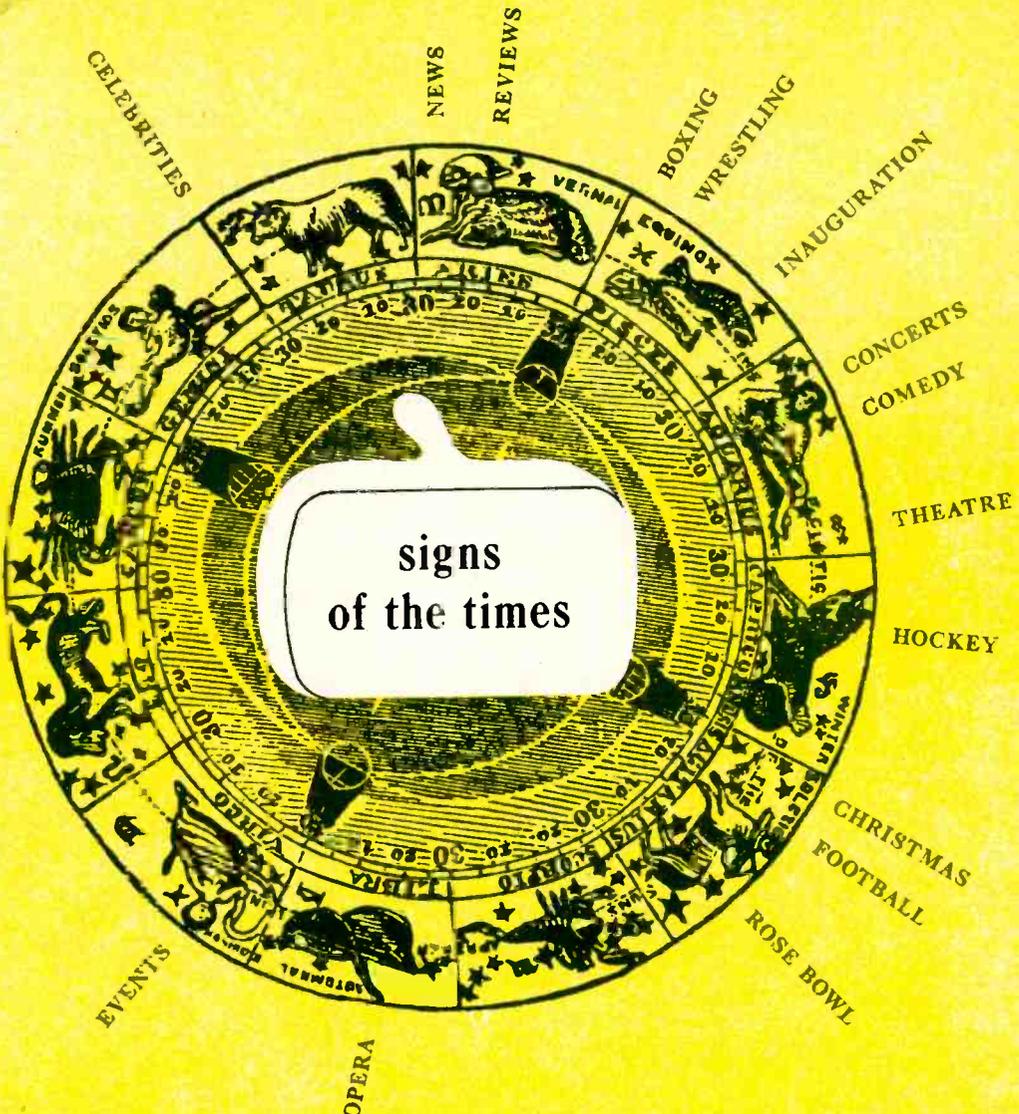
FREE: Educational new booklet—
"The 4 Standards of Booster Performance."

Ask your Channel Master distributor
for your copy.



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burton browne advertising

The stars show quality ascendant in the TV set owner's mind. *Follow your stars*—give the set owner the best picture tube replacement—Rauland. Your Rauland jobber anticipates your need today with a complete stock. The Rauland Corporation, 4245 N. Knox Avenue, Chicago 41, Illinois. MUlberry 5-5000.

RAULAND

PERFECTION THROUGH RESEARCH

PRECISION CR-30 CATHODE RAY TUBE TESTER

TESTS ALL TV PICTURE TUBES

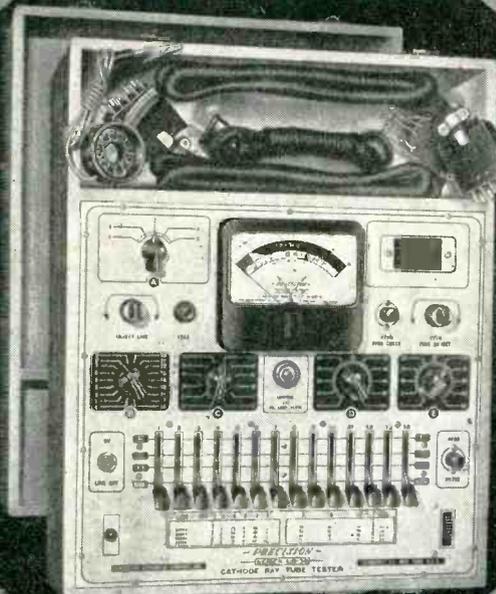
(MAGNETIC AND ELECTROSTATIC)

'SCOPE TUBES AND INDUSTRIAL CR TYPES

for True Beam Current (Proportionate Picture Brightness);
Tests ALL CR Tube Elements—Not Just a Limited Few

IN FIELD OR SHOP

Tests CR Picture Tubes
Without Removal from
TV Set or Carton!



The Precision CR-30 fills an obvious gap in the test equipment facilities employed by TV service and installation technicians.

Because of the absence of a reliable cathode ray tube tester, up to 50% of so-called "rejected tubes" are found to be fully serviceable and should rightfully never have been "pulled out."

Proven product of extended development, the CR-30 has been

specifically engineered to answer the question, "Is It the TV Set or is it the Picture Tube?"

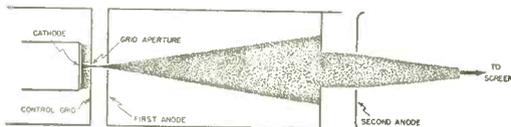
The Precision CR-30, a complete and self-contained Electronic Instrument, incorporates a TRUE BEAM CURRENT Test Circuit. The CR-30 checks overall electron-gun performance for proportionate picture brightness as well as additional direct testing facilities for accelerating anodes and deflection plate elements.

The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon-lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.

GENERAL AND TECHNICAL SPECIFICATIONS

- ★ Tests All Modern Cathode Ray Tubes:—Magnetic and Electrostatic, 'Scope Tubes and Industrial Types.
- ★ Tests All CR Tube Elements:—Not just a limited few.
- ★ Absolute Free-Point 14 Lever Element Selection System, independent of multiple base pin and floating element terminations, for Short-Check, Leakage Testing and Quality Tests. Affords maximum anti-obsolescence insurance.
- ★ True Beam Current Test Circuit checks all CR Tubes with Electron-gun in operation. It is the Electron Beam (and NOT total cathode emission) which traces the pictures or pattern on the face of the CR tube.
- ★ Voltage Regulated, Bridge Type VTVM provides the heart of the super-sensitive tube quality test circuit. Such high sensitivity is also required for positive check of very low current anodes and deflection plates.
- ★ Micro-Line Voltage Adjustment Meter-monitored at filament supply.
- ★ Accuracy of test circuits closely maintained by use of factory adjusted internal calibrating controls; plastic insulated, telephone type cabled wiring; highest quality, conservatively rated components.
- ★ Built In, High Speed, Roller Tube Chart.
- ★ Test Circuits Transformer Isolated from Power Line.
- ★ 4½" Full Vision Meter with scale-plate especially designed for CR tube testing requirements.
- ★ Heavy Gauge Aluminum Panel etched and anodized.
- ★ PLUS many other "PRECISION" details and features.

Total cathode emission can be very high and yet Beam Current (and picture brightness) unacceptably low. The CR-30 will reject such tubes because it is a true Beam Current tester. Conversely, total cathode emission can be low and yet Beam Current (and picture brightness) perfectly acceptable. The CR-30 will properly pass such tubes because it is a true Beam Current tester. The significance of the above rests in the fact that Beam Current (and picture brightness) is primarily associated with the condition of the center of the cathode surface and not the overall cathode area. (See illustration below)



SERIES CR-30—In hardwood, tapered portable case, with hinged removable cover. Extra-Wide Tool and Test Cable Compartment. Overall Dimensions 17¼ x 13¾ x 6¾". Complete with standard picture tube cable, universal CR Tube Test Cable and detailed Instruction Manual.

Shipping Weight:—22 lbs. Code: Daisy
NET PRICE:—\$99.75

See the CR-30 on display at leading electronic equipment distributors. Place your orders now to assure earliest possible delivery.



PRECISION APPARATUS CO., INC.

92-27 Horace Harding Boulevard, Elmhurst 8, New York

Export Division: 458 Broadway, New York, U.S.A. Cables—Morhanex
In Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

EDITORIAL

by S. B. COWAN

Prospects Brighter Than Ever!

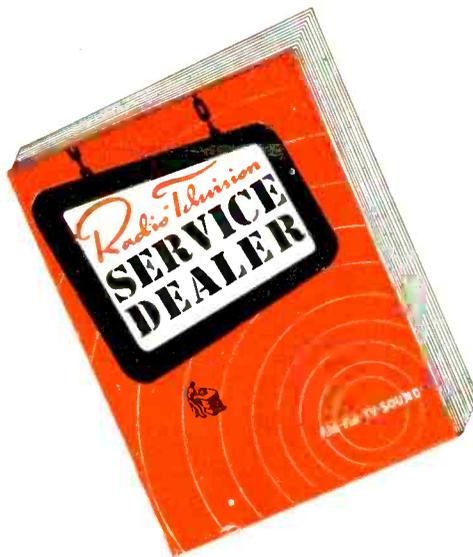
Your correspondent has just toured the Eastern Atlantic and Mid-Western States. Naturally we made spot checks, picking service shops at random, and in every instance the question: "How's Business?" was asked. Without exception the answers were the same, "We've got more business than we can handle!"

Making our survey just a bit more conclusive, we pinned down the shop owners on the question of their profit-earning status and learned that all of them earned more this year for themselves, paid more to their employees, and that their tax payments will exceed those of any previous year. In a word, Service Organizations and Service Dealers rate 1952 as their top year, and from all present indications 1953 will prove to be much better.

The big problems at present, and for the months ahead are two-fold; to wit, a shortage of competent technicians, and spotty bottlenecks on some replacement items or popular tube types. No two cities seemed to have the same shortage "complaint" for where we found a tube shortage in one town it seemed that in the next town tubes were plentiful but antennas were hard to get. It is our personal belief that the basic cause of the average serviceman's grief due to shortages can be traced directly to their parts jobbers, who seem to take fiendish delight in failing in their prime duty as jobbers, that of carrying stocks large enough to meet their customers' needs.

The primary function of a parts wholesaler is to warehouse items so they can be obtained over-the-counter immediately when wanted by professional technicians. Only a handful of the so-called parts jobbers attempt to follow that practice. Most of them carry token stocks of easily disposable merchandise and act as order-takers for the other items. That fact in itself explains why several large mail-order supply houses actually handle a larger volume of business with professional technicians than do the jobbers serving in the territory where the latter operate their businesses. More power to the mail-order houses! But, by the same token, there's no excuse for jobbers who fail to run their businesses in the manner that they should.

As the radio-TV service business during 1953 will undoubtedly break all past records, it is timely and proper for all who are engaged in servicing to examine their inventories and fill gaps that may exist. Prices are not going to break so any purchases made now will be sound, worthwhile investments.



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HOWARD W. SAMS & CO., INC.

TRADE FLASHES

A "press-time" digest of production, distribution, and merchandizing activities

Radio Set Shipments

Radio set shipments to dealers, excluding auto receivers, totaled 4,599,083 units in the first three quarters of this year, according to estimates released recently by the Radio-Television Manufacturers Association.

Set shipments in the third quarter totaled 1,719,377 units compared with 1,383,781 sets and 1,495,925 receivers shipped in the second and first quarters, respectively.

Audio Society Elects Officers

The following new officers have been elected by the membership of the Audio Engineering Society:

President—*F. Sumner Hall*, E. Sumner Hall, Inc.

Executive Vice President—*Jerry B. Minter*, Measurements Corp.

Central Vice-President—*Walter S. Pritchard*, Ohio Bell Telephone Co.

Western Vice President—*Richard L. Burgess*, Allied Recording Mfg. Co.

Secretary—*C. J. LeBel*, Audio Instruments Co., Inc.

Treasurer—*Ralph A. Schlegel*, WOR Recording Studios

Governors—*Price E. Fish*, Columbia Broadcasting System, *Jay H. Quinn*, Fairchild Recording Products Corp.; *Carleton H. Sawyer*, Bell Telephone Laboratories.

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Sylvania Inaugurates TV Service

School in Buffalo

Mr. E. W. Merriam, Service Manager of the Radio & Television Division, Sylvania Electric Products Inc., Buffalo, New York, has announced the establishment of a television service school offering a comprehensive course in the latest and most efficient techniques of television servicing. The newly formed school will be made up of two week long courses which start every other week. The school's sole purpose is to give instructions to service personnel of Sylvania television distributors, dealers and service contractors.

Mr. Merriam explained "the school was felt a necessity due to the fact



Students at work in new Sylvania service school.

that skillful and rapid diagnosis of television trouble, as well as speedy the correct service, makes for most efficient service unit operation and greater customer satisfaction." "These aims are accomplished," continued Mr. Merriam, "by providing Sylvania television distributors, dealers and service contractors with an inexpensive means of training their new technicians, as well as keeping their older TV service men abreast of the latest TV developments and repair techniques. The course will consist of 25 per cent lecture time, and 75 per cent actual trouble shooting and analyzing effects using the latest in television service equipment."

No charge is made for the training. Living and traveling expenses make up the only cost to the organization sending their technicians to Buffalo. Response thus far from distributors indicate that service personnel, in-

Greater than Ever!



THE RADIART *TV Booster*

with these added features:

- ★ Automatic On-Off Switch
- ★ Stand-By Position — eliminating "warm-up" time for booster
- ★ EXTRA 110 volt convenience outlet — plug in rotor or any appliance

and these too: *High Signal-to-Noise Ratio* ★ *Wide Band Amplification* ★ *Complete Neutralization for Stable Operation* ★ *Mahogany Grained Polished Finish* ★ *Completely Enclosed for Dust-Free Operation* ★ *15 Degree Tilt for Easier Visibility.*

Accepted as outstanding... now with the ADDED features this BOOSTER leads the field. The automatic switch makes it possible to shut off the TV set by switching off the booster... the stand-by position keeps the booster in readiness for use... and the extra outlet adds versatility to the booster.

It's the Perfect Partner to the CDR ROTOR... the TV TWINS



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..... **USED BY THE MILLIONS!**

You'll find Sprague Cera-mite disc ceramics in practically every major TV and radio set on the market today!

There's a good reason for their widespread use: Not only are Cera-mites *dependable*—the Cera-mite line is *complete!* These tiny capacitors are now made in a tremendous range of values from 1 to 30,000 mmf. This means that *one* line—the Cera-mite line—will handle *all* your ceramic replacement problems.

Write for Bulletin M-479 to Sprague Products Company, 71 Marshall St., North Adams, Massachusetts.

INSIST ON

Cera-mite * Capacitors

MADE BY



THE WORLD'S LARGEST CAPACITOR MANUFACTURER

cluding dealers from all parts of the country, will attend the two-week sessions. The first two classes consisted of men from twelve states and Honolulu.

Receiving Tube Shipments Rise

Shipments of receiving tubes by members of the Radio-Television Manufacturers Association increased in September over the previous month and the same month a year ago, it was reported recently. Total September shipments were 34,196,286 tubes valued at \$24,432,747. This included 31,482,740 tubes of the entertainment type and 2,713,546 of the allied receiving types.

In August, 30,141,536 tubes valued at \$20,827,635 were shipped by RTMA member-companies. For September 1951 shipments were 27,946,193 tubes.

During the first nine months of this year 245,689,629 tubes valued at \$176,938,899 were shipped compared to 280,795,338 tubes shipped during the same 1951 period.

Sarnoff Honored By I.R.E.

Brig. General David Sarnoff, chairman of the board of the Radio Corporation of America, has been named the first recipient of the newly established Founders Award by the Institute of Radio Engineers, a society of over 30,000 radio engineers and scientists here and abroad. The award was given "for outstanding contributions to the radio engineering profession through wise and courageous leadership in the planning and administration of technical developments which have greatly increased the impact of electronics on the public welfare."

The Founders Award, which will be given only on special occasions and not annually, was established today at a meeting of the Institute's board of directors to recognize an outstanding leader in the radio industry and to commemorate the three radio pioneers who founded the Institute of Radio Engineers forty years ago—Alfred N. Goldsmith, Editor of the Institute and consulting engineer; John V. L. Hogan, president of Hogan Laboratories, New York, N. Y.; and Robert H. Marriott, deceased.

Presentation of these awards will be made at the annual banquet to be held at the Waldorf-Astoria, New York City, on March 25, 1953, during the Institute's national convention.

New TV Station for York Pa. on UHF

Arrangements have been completed to equip WNOW-TV, York, Pa., with the new Du Mont 5 kilowatt ultra-high frequency television transmitter for Channel 49 and complete asso-

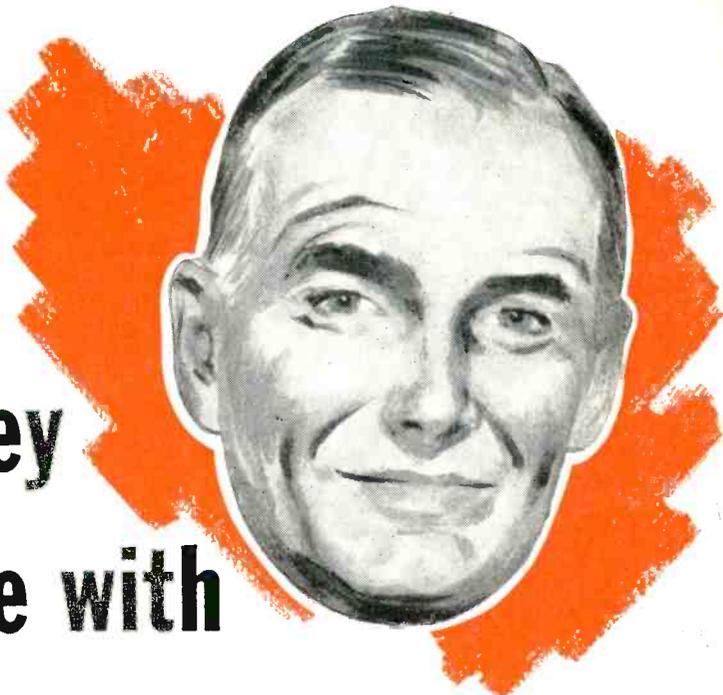
☆T.M.

YOU

make more money

when you replace with

RAYTHEON PICTURE TUBES



RAYTHEON PICTURE TUBES
GIVE YOU ALL THESE ADVANTAGES:

A brand new tube — Raytheon makes only new tubes of finest quality. Raytheon Picture Tubes have new glass, new guns, new screens.

Top quality — Raytheon Picture Tubes are the precision products of a multi-million dollar concern that has specialized in the design, development and manufacture of only top quality electron tubes for more than 26 years. During all this time RAYTHEON has never compromised with quality.

A thoroughly tested tube — Raytheon Picture Tubes and their components are given 101 rigid quality tests and checks to insure electrical and mechanical perfection.



Right...for Sight!

An established brand name — Raytheon Picture Tubes don't need to be "sold" to your customers — thanks to Raytheon's national advertising and reputation for making only the finest quality tubes.

Service — Raytheon Picture Tubes are readily available through your Raytheon Tube Distributor.

A 1-year warranty — Raytheon Picture Tubes are guaranteed for 1 year from date of installation — a warranty backed by Raytheon — one of America's leading tube manufacturers.

THESE RAYTHEON PICTURE TUBE
ADVANTAGES ADD UP TO:

Satisfied customers — Raytheon Picture Tubes will give your customers the finest picture, the finest performance possible. They'll build your reputation as a competent and thoroughly dependable Service Dealer — put you in line for repeat business and the business of your customers' friends.

More profit! — You'll save time on replacement jobs when you use Raytheon Picture Tubes because you work with complete confidence that their quality is uniform and will complement your skills. Saving time means more profit for you.

RAYTHEON MANUFACTURING COMPANY

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

RAYTHEON MAKES ALL THESE

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



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Your most valuable business asset is a **SATISFIED CUSTOMER!**



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RHEOSTATS • RESISTORS • TAP SWITCHES

ciated studio equipment, it was announced jointly today by Lowell Williams, general manager of WNOW-TV and the Television Transmitter Division of Allen B. Du Mont Laboratories, Inc.

The new station which received its construction permit in July of 1952 plans to go on the air on UHF Channel 49 in the Spring of 1953.

Complete camera equipment has already been delivered to the station which in recent weeks has conducted highly successful closed-circuit promotional demonstrations for local area retail television receiver dealers.

Sylvania Designs New TV

Tube Carton

The Television Picture Tube Division of Sylvania Electric Products Inc. announced that television tubes for renewal sales will be shipped in a new "factory-sealed" carton that permits easier and safer handling and that provides a distinctive appearance in dealers' shops and customers' homes. The carton will be used at present only for 16-, 17-, 20- and 21-inch tubes.

The modern carton has a de-luxe wood-grain finish, convenient hand holes for handling and was designed with proper weight distribution to permit high stacking and to eliminate shipping and storage damage. A semi-gloss finish on the carton resists dirt and scuffing.

RCA Tube Dep't Offers

Financial Guidance

The Tube Department of the RCA Victor Division, Radio Corporation of America, today announced the establishment of a business and financial consulting service for the company's distributors of electron tubes, parts, test equipment, and batteries.

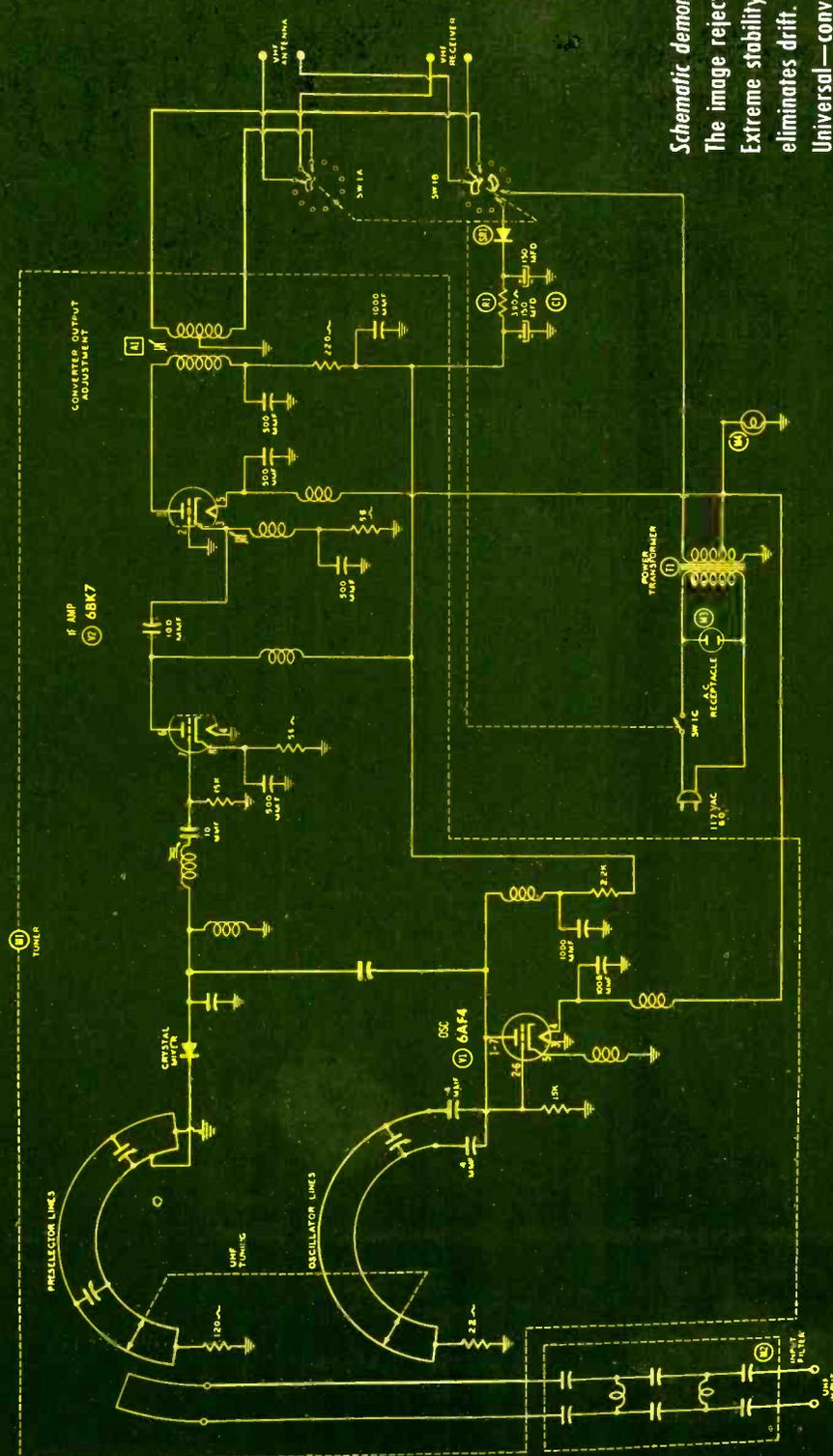
Robert B. Sampson, a veteran of 10 years of RCA Victor Division finance and business activities, has been appointed administrator of the new service, it was announced by Fred H. Troup, controller of the RCA Tube Department.

Designated by the company as its Distributors Financial Services activity, it will offer RCA distributors assistance on problems related to proposed expansion or improvement projects, inventory control, financing distribution, and over-all business activity, Mr. Troup explained.

Published statistical projections, he said, indicate that the market for renewal electron tubes, component parts, test equipment, and radio batteries, currently accounting for a national sales volume of approxi-

$Z = \frac{1}{a + j\beta} \tanh^{-1} \left(\frac{1}{\omega_0 c z_0} \right) = \text{Regency quality}$

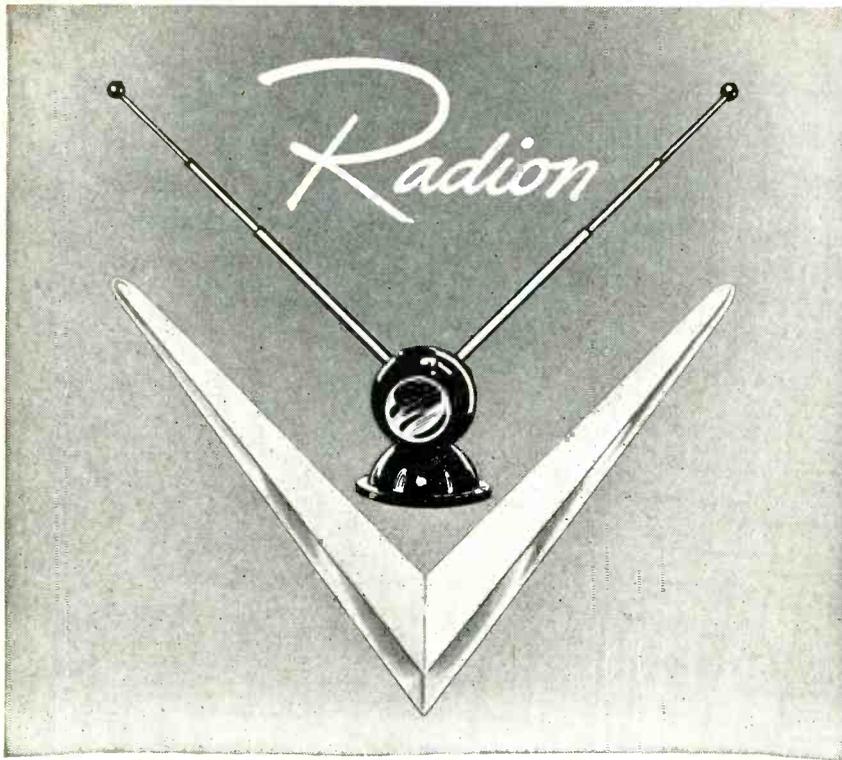
UHF CONVERSION



Schematic demonstrates — performance proves.
 The image rejection of VHF stations is down 50 to 60 db.
 Extreme stability—use of air dielectric in tuning element eliminates drift.
 Universal—converts all sets—the only converter recommended for the 5,000,000 split sound and video sets now in use.

Regency

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Because Radion is built better, easiest to install, simplest for customer to operate, Radion saves your profits. Deliveryman or customer installs it . . . service calls are minimized. Customers are pleased because Radion does the job . . . and keeps TV set price low.

Sell quality and you sell satisfaction . . . specify Radion, best selling because it's best!

Radion's New Lightning Arrester Fits All Twin Leads, Mounts Anywhere

Now, one arrester is all you need carry! Phenolic model at \$1 list; deluxe Porcelain is \$1.50 list. Counter-packaged low-priced to give you volume sales!



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mately \$600,000,000, will reach a volume of one billion dollars by 1955, and more than two billion dollars by 1960.

Tele-Mirror Promotion Program a Success

The conclusion of the Du Mont Tele-Mirror promotion, one of the most successful promotions yet undertaken by the Cathode-ray Tube Division of Allen B. Du Mont Laboratories, Inc., has been announced.

"The results have been extremely gratifying," declared Edwin B. Hinek, sales manager for the replacement sales department of the division. "Response from servicemen has been so great that we have given away thousands of Tele-Mirrors in only three months."

Du Mont's Tele-Mirror promotion followed the recent successful Tele-Lead program. Similar "service-to-servicemen" promotions will be forthcoming according to Hinek.

Home Hair Dryer Aids TV Repairs

Milady's home hair dryer has been pressed into service in a new and unique application—the repair of television receivers.

So reports "Techni-Talk," a publication for television servicemen published by General Electric's Tube Department, in its current issue.

The magazine quotes television serviceman James C. Houston of San Antonio, Texas, as reporting that many sets give trouble only when they reach a certain temperature. When the serviceman removes the television chassis from the cabinet to work on it, the set frequently does not warm up enough for the trouble to show up.

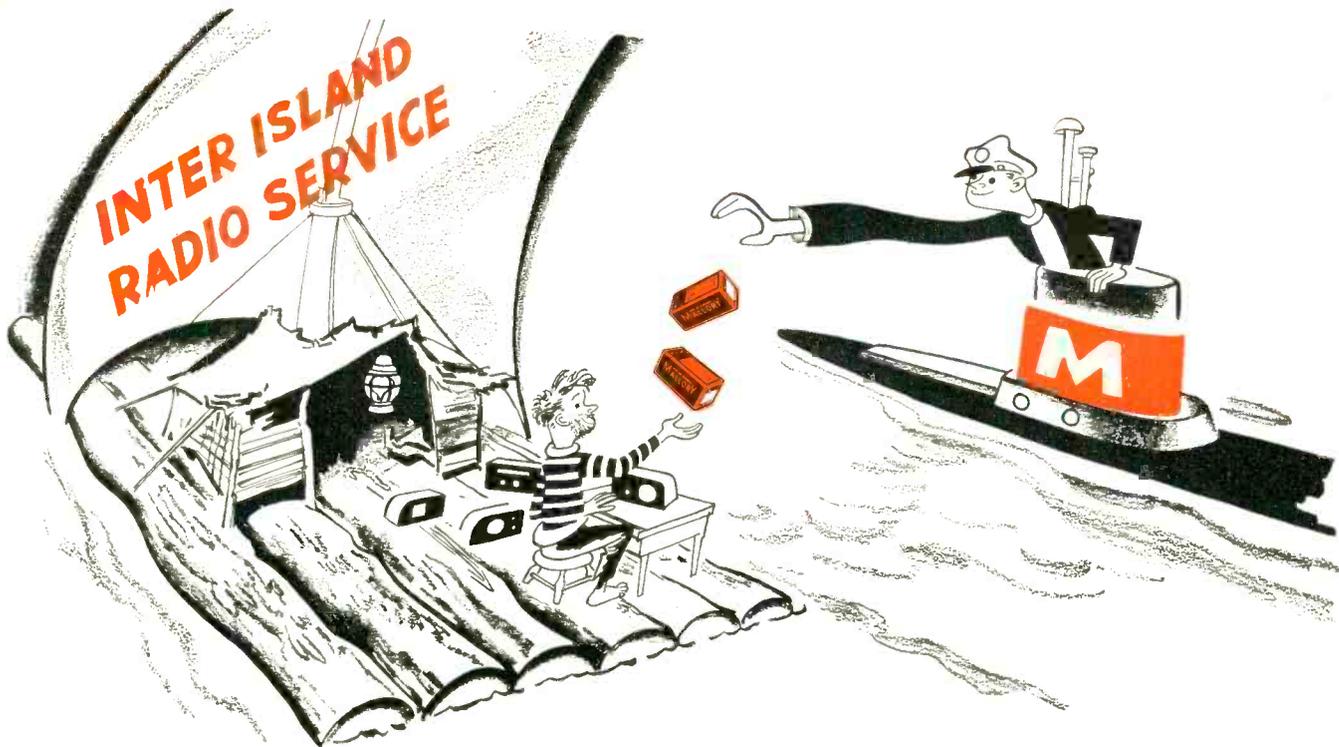
Mr. Houston says that an ordinary home hair dryer enables him to apply the necessary heat to any individual part in the set to determine where the fault lies.

Emerson Urges TV Dealers to Support Non-Commercial TV

The Emerson Radio and Phonograph Corporation recently called on 30,000 television dealers to take the lead in stimulating local community action in support of non-commercial educational television stations.

A message to dealers and members of the entire industry is contained in a pamphlet published by Emerson entitled "Educational Television, a New Market for TV Receiver Sales," headed by reproduction of a telegram from President Harry S. Truman reading: "Congratulations on your contribution and support to Education Television. The scientific marvel of

[Continued on page 16]



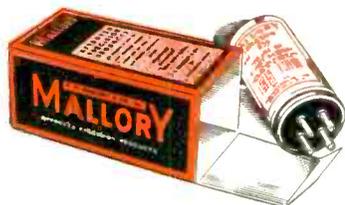
First Choice with Servicemen Everywhere . . .

MALLORY VIBRATORS

Servicemen know Mallory Vibrators give long, dependable performance—performance that keeps their customers happy. In fact, servicemen prefer Mallory Vibrators by a 2 to 1 margin, according to a recent survey. Mallory Vibrators give you . . .

- 1—Slow contact impact for minimum wear
- 2—High contact pressure for low resistance
- 3—Fast contact break for reduced arcing, pitting

Only from Mallory—with its patented, tuned vibrator mechanism—do you get this important three-way performance combination. It helps you beat the comeback problem. It's the reason manufacturers use more Mallory Vibrators as original equipment than all other brands combined. Follow their lead . . .



Mallory Vibrator Deals Help Keep Inventory Down . . . Include Parts Chest At No Additional Cost

You can service 47 different radio makes with the 6 vibrator types in these Mallory special deals. And you get a handy parts chest at no additional cost when you buy at your regular discount price. Ask your distributor for details today.

Make Sure! Make it Mallory!

P. R. MALLORY & CO. Inc.
MALLORY

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

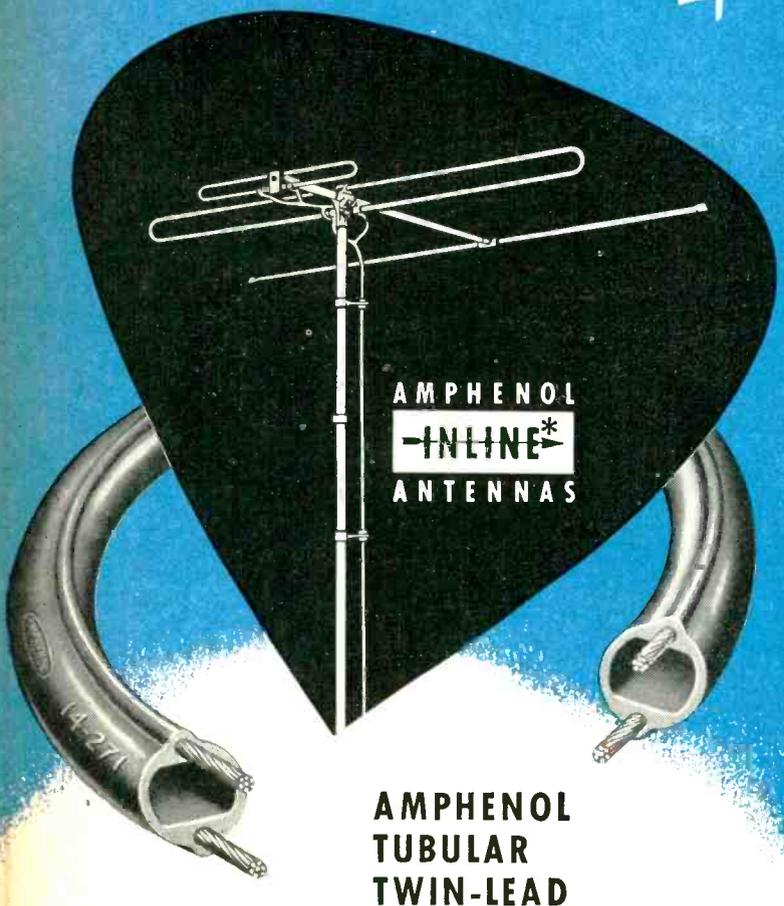
*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

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

teamed together for

Better TV Picture Quality



AMPHENOL TUBULAR TWIN-LEAD

This combination of the famous Amphenol In-Line Antenna and the extremely low-loss Amphenol Tubular Twin-Lead permits any TV set to present the best picture it possibly can.

The Amphenol In-Line is the superior all-channel antenna. The In-Line has uniform gain over the entire range of VHF channels—less variation than the 3 decibel change which determines “fuzziness.” Its strong forward reception lobe practically eliminates any pick-up of unwanted secondary or reflected signals.

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



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

Nominal Impedance	300 ohms
Velocity of Propagation	84%
Attenuation db/100 feet	
	30 mc — .63
	60 mc — .93
	100 mc — 1.25
	200 mc — 1.82
	400 mc — 2.7
	500 mc — 3.0
	700 mc — 3.6
	900 mc — 4.2

AMERICAN PHENOLIC CORPORATION
1030 SOUTH 54TH AVENUE • CHICAGO 50, ILLINOIS

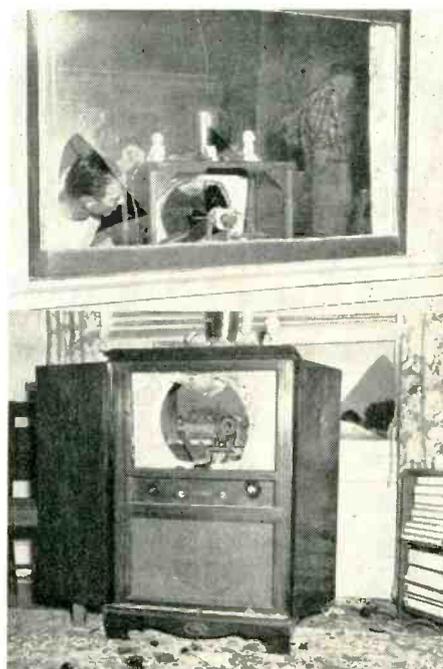


SYNC PULSES

by San D'Arcy

The Long Beach (Calif.) Radio Technicians Ass'n may be credited, through their Public Relations Chairman Harry E. Ward, for this issue's Sync Pulse column. That fact is mentioned because it establishes a precedent as we have never before dealt exclusively with one segment of the country's doings in writing this department, and never before has Sync Pulse been decorated with an illustration.

Look at the illustrations shown below, and if you don't mind mutilating this issue of "Service Dealer", display the item in your establishment so that your customers may see for themselves just how dangerous it is for all people other than professional servicemen to attempt to fix their own TV sets.



A 16 inch TVset owned by a Wilmington, Cal. family needed servicing. The owner tried to avoid paying a serviceman's fee, so he "fixed" the set himself. The family was asleep shortly thereafter, when at 5 A.M. there was a terrific explosion. See for yourself what happened. Damage was very high and not covered by insurance. The most fortunate thing that can be said is this: Luckily no one was in the room or watching the TVset when it exploded. Moral: Unless you are a competently trained TV technician don't try to fix any TVset or you may be seriously injured.

Every TVset is by the very nature of its construction a dangerous thing if handled carelessly. The cathode-ray tube (called the picture tube) is made with high vacuum and is ever a potential explosive power, though we call it implosion potential as the blast would be inward instead of outward. And inside all TVsets are high-voltage sections that carry from 9,000 to 20,000 volts, far more than that needed to electrocute adults.

Every home that can afford to own a TVset, even when bought on a time-payment basis, cannot afford to risk the family's lives by trying to save a few dollars that might be needed to pay a professional serviceman when the set becomes faulty. The caption under our illustration proves that point.

To restore
original performance
use *RCA VICTOR* "originals"



RCA Stock No. 74067 Crystal-Cartridge complete with sapphire and guard, for many 45-rpm players.

CASH IN ON "45"

For replacements . . . use
genuine *RCA VICTOR* crystals and styli

You can assure peak performance of RCA Victor 45 rpm's by using "original" RCA Victor crystals and styli.

Remember . . . RCA Victor originated the 45-rpm system—from stylus to record. And customers count on you to return their players to *original* high performance standards. By using *genuine* RCA Victor crystals and styli, you protect your servicing reputation and insure repeat business.

In addition to cartridges and styli for "45", there's a crystal cartridge and stylus specially designed for every model RCA Victor 78 or 78-33 rpm changer. Use them in your shop and avoid replacement problems.

Genuine RCA Victor crystals and styli are readily available from your local RCA Parts Distributor. SEE HIM TODAY.



New—Handy Stylus Dispenser and Utility Chest—Increase your stylus sales with this handsome, all-metal, 3-drawer chest—that doubles as counter dispenser and utility chest. Ask your *RCA Parts Distributor* today how you can get one, at no extra charge, with a model RCA Victor stylus inventory.



RADIO CORPORATION of AMERICA
ELECTRONIC COMPONENTS

HARRISON, N. J.

TMK. ©

ATR

AUTO RADIO VIBRATORS

have Ceramic Stack Spacers



A COMPLETE LINE OF VIBRATORS . . .

Designed for Use in Standard Vibrator-Operated Auto Radio Receivers. Built with Precision Construction, featuring Ceramic Stack Spacers for Longer Lasting Life. Backed by more than 20 years of experience in Vibrator Design, Development, and Manufacturing.

NEW MODELS
NEW DESIGNS
NEW LITERATURE

“A” Battery Eliminators, DC-AC Inverters
Auto Radio Vibrators

See your jobber or write factory

AMERICAN TELEVISION & RADIO CO.
Quality Products Since 1931
SAINT PAUL 1, MINNESOTA—U.S.A.

TRADE LIT.

[from page 18]

tions of klystrons, traveling-wave and multiple-stream tubes, magnetrons, and radar are also included. Electrical noise, microwave radio systems and measurements, relays, and the applications of microwaves in physical research are among the other subjects treated. "Essentials of Microwaves" contains 236 pages and is priced at \$4.50.

* * *

Merit Coil & Transformer Corp., Chicago, has prepared an eight-page replacement guide for auto radios which includes 4 pages on transformers and 4 pages on IF-RF coils. The Merit Auto Radio Replacement Guide can be obtained by requesting Form No. 3 from your jobber or writing Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40.

* * *

Erie Resistor Corporation of Erie, Pennsylvania has issued a new bulletin on Electronic Printed Circuits. The bulletin describes and illustrates their complete line of five types of Electronic Printed Circuits, each in a range of capacities: Diode Filters, Triode Plate Couplers, Vertical Integrators, Pentode Plate Couplers, and Audio Output Circuits.

* * *

The RCA Tube Department has recently issued a revised edition of its list of Preferred Tube Types for New Equipment Design. The revisions involve changes resulting from technological advances in tube design and application.

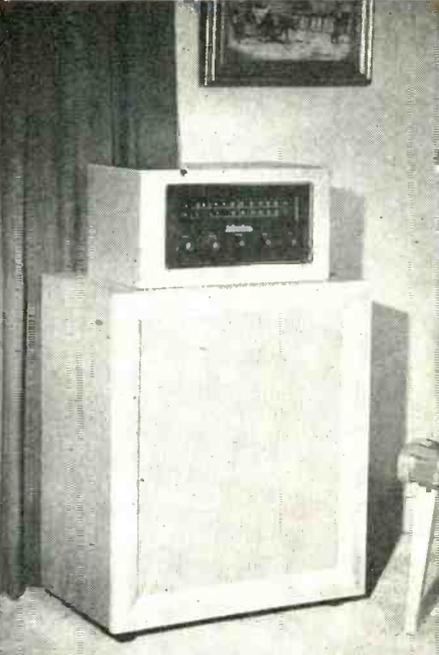
A copy of this latest issue of the RCA Preferred Tube Types list can be obtained on request from Commercial Engineering, RCA Tube Department, Harrison, N. J.

* * *

An eight-page catalog called "UHF Antenna Systems—How, What and Where for Every UHF Area" has been issued by VEE-D-X it was announced by Fred A. Hess, Sales Manager of The LaPointe Plascomold Corporation.

This brochure includes considerable important UHF data such as a page of "Questions and Answers" for the technician; a page on the VEE-D-X Mighty Match (MM-30) for separating VHF and UHF—a unit which is destined to play a mighty role in present and future television installations; two full pages on newly developed UHF

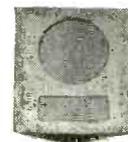
[Continued on page 56]



\$3900^{NET*}
15 or 12 in. Bass Reflex Cabinet

Craftsmanship in Cabinets

New—with more style and better tone at half the price.
Fits finest surroundings, yet economically engineered. ½-in. cellufoam acoustic lining.
Solid hardwood picture-frame front. Brahma-grain matching leatherette on top and sides.
Blonde or mahogany, same price. Ask your Parts Jobber or write for specification sheet.



NEW BASS REFLEX CORNER BAFFLE

Gives more effective coverage, looks better on wall. ½-inch cellufoam acoustic lining. Blonde or mahogany, same price.
12" spkr. \$8.55 Net*
8" spkr. \$5.10 Net*



WALL BAFFLES

Argos craftsmanship with resonant tone. Reinforced for extra strength. Blonde or mahogany, same price.
Up to 12" spkr. \$2.34 to \$4.65 Net*

*Slightly higher west of Rockies

Argos

PRODUCTS COMPANY

310 MAIN STREET • GENOA, ILLINOIS

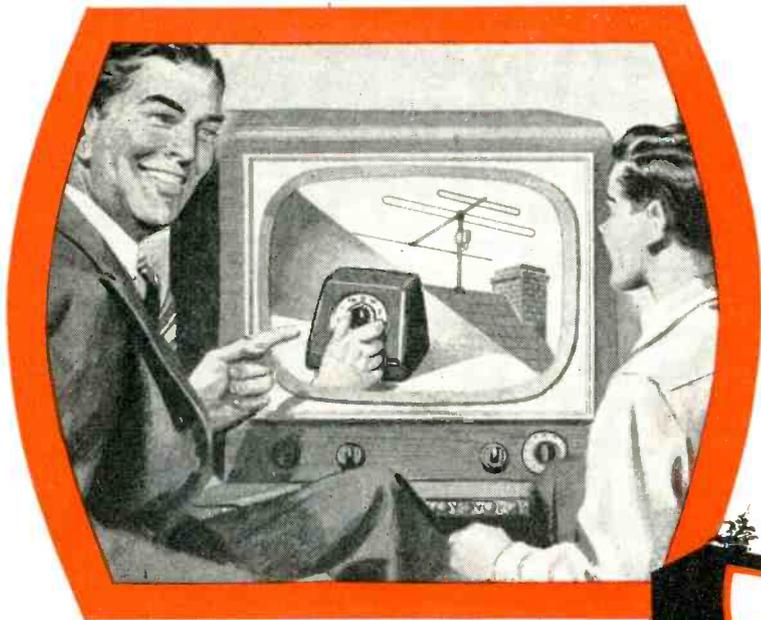
GET READY FOR **UHF!**

Join the Alliance Profit Parade!



SOLD THE MOST BECAUSE SEEN THE MOST!

BY 36 MILLION VIEWERS IN
13 MILLION HOMES



Alliance Tenna-Rotor, properly installed with a good directional, all-channel antenna (conical — in-line — colinear — or other conventional type) makes for perfect reception. Avoid frequent alterations—realignments—replacing of out-moded single-channel antennas, by turning one antenna to every station!

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

MEANS EXTRA PROFITS FOR YOU!

"Just set it and forget it"



PRE-SELLING Your Prospect **PAYS OFF!**

Alliance TV spots demonstrate, convince — **SELL!** They're packed with eye-compelling action! It pays to push the line with the *least* resistance — the *most* acceptance! *Sold by Television Dealers everywhere.*

FROM COAST TO COAST

New products join the Alliance Profit Parade! The Alliance Cascamatic, automatic TV Booster with the famous "California Circuit" is the latest profit maker added to the Alliance line.

Pre-tuned to all VHF channels, this 3-tube booster mounts on back of set.

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO



"WHY SHOULD I INSIST
ON **CBS-HYTRON**?"

"**YOU PROFIT MORE!**
HERE ARE
5 BIG REASONS WHY"



1. CBS-HYTRON IS FAMOUS... EASY TO SELL. The magic letters "CBS" are plugged for you on radio and TV station breaks . . . 102 BILLION times a year! CBS is known and respected by *all* your customers. CBS-Hytron is the profitable brand with endless sales assistance.



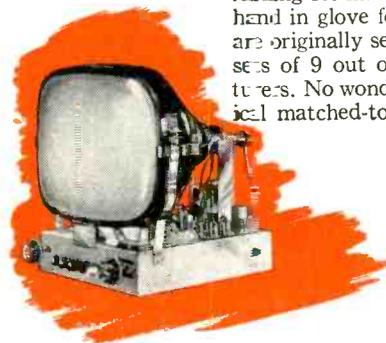
2. CBS-HYTRON SPECIALIZES IN RECEIVING TUBES. Since 1921, CBS-Hytron has concentrated on receiving types. Practice makes perfect. Put those years of know-how to work for you. Let time-proved CBS-Hytron dependability cut call-backs . . . make more money for you.



3. CBS-HYTRON LEADS IN TV TUBES. You know them. CBS-Hytron TV originals: 1AX2, 1X2A, 6BQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, and the original rectangular 16RP4. Even CBS-Hytron standard TV tubes are designed-for-TV . . . tested-for-TV . . . to give you peak performance and profit.



4. CBS-HYTRON IS ULTRAMODERN. CBS-Hytron is the tube of the future. Made in the world's most modern plants. On manufacturing equipment years ahead of the rest of the industry. CBS-Hytron advanced design and precision construction keep you always ahead. Give you tomorrow's trouble-free performance today.



5. CBS-HYTRON IS MATCHED-TO-THE-SET. Combined engineering skills of leading set makers and CBS-Hytron work hand in glove for you. CBS-Hytron tubes are originally set-engineered right into the sets of 9 out of 10 leading set manufacturers. No wonder CBS-Hytron is your logical matched-to-the-set replacement tube.

IT PAYS TO BE FUSSY! Just any standard brand won't do. If you want: Trouble-free, advanced performance. Maximum customer satisfaction. Minimum call-backs. More profit. Five big reasons point the way: Insist on CBS-Hytron!



CBS-HYTRON
Germanium Diodes

Complete data yours for the asking. Write CBS-Hytron, DANVERS, MASS., today.



TRADE FLASHES

[from page 10]

television has already proved its worth in the fields of entertainment news and sports events, and I hope will continue to grow in these fields. However, the basic element in American strength and progress has been its educational system. Therefore, I think it is important that an appropriation of our television facilities be devoted to education. This project is a source

of great hope for the future of our country. I wish success to the efforts to carry forward this hope to reality."

RMS Prexy Honored

Sidney Pariser, President, RMS (Radio Merchandise Sales, Inc.), was recently honored by his firm for his twenty-five year record of achievement in the radio and television parts industry.

Don't Waste valuable time waiting for a replacement—carry it in stock!

STANCOR CHOKES	C-2325 C-2326 C-2327	COVER 70% of your TV REPLACEMENTS*
STANCOR DEFLECTION YOKES	DY-1 DY-8 DY-9	COVER 70% of your TV REPLACEMENTS*
HORIZONTAL DEFLECTION OUTPUTS	A-8127 A-8128 A-8130	COVER 45% of your TV REPLACEMENTS*
VERTICAL DEFLECTION OUTPUTS	A-8112 A-8115 A-8123	COVER 70% of your TV REPLACEMENTS*
VERTICAL BLOCKING OSCILLATORS	A-8111 A-8121 A-8122	COVER 65% of your TV REPLACEMENTS*

* Based on a statistical analysis of all replacement recommendations in the Stancor TV Replacement Guide.

Stancor Transformers are listed in HOWARD W. SAMS' Photofact Folders and JOHN RIDER'S Tek-Files.

FREE!

Stancor's new 24-page catalog listing over 475 transformers and related components for all types of electronic applications. Includes over 100 TV units. Get your free copy from your Stancor distributor or write Stancor direct!



STANDARD TRANSFORMER CORPORATION

3586 ELSTON AVENUE, CHICAGO 18, ILLINOIS

TRADE LITERATURE

Transvision, Inc., New Rochelle, New York has just released a new Picture Tube Interchangeability Chart. This 4-page folder lists most Television Picture Tubes, giving the popular types which replace hard-to-get tubes. Where direct replacement is difficult, notes are included showing changes necessary. (Gratis)

"Report on Portland" is the title of a new pamphlet released by Ward Products, Division of The Gabriel Co. Since Portland was the first commercial UHF station, the report describes receiving antenna performance as a guide to future areas.

On-the-spot reports by distributors, newspaper comments, and specifications on the Ward "Trombone" and "U-Vee" antennas are included. Free copies of the report may be obtained from distributors or direct from Ward Products, Division of The Gabriel Co., 1523 E. 45th St., Cleveland 3, Ohio.

32-page booklet briefly describes electronic instruments providing direct-reading digital presentation of information, and their principal industrial applications. Covers high-speed counting, counting plus control, precise interval timing, measurement of rpm, pressure, temperature, flow, viscosity, velocity, frequency, distance, etc. Available without charge from Berkley Scientific division of Beekman Instruments, Inc., 2200 Wright Avenue, Richmond, California.

The new Turner Catalog has been released to the jobber and retailer trade.

Complete specifications for all microphones in the line are outlined in this new Catalog. Jobbers, retailers and consumers are invited to write for a free copy of the new 12 page Turner Catalog. Ask for the Turner Catalog No. 952. Address the Turner Company, 909 17th Street N.E., Cedar Rapids, Iowa.

Standard Transformer Corporation, Chicago, announced its new Stancor Simplified Television Transformer Catalog and Replacement Guide, list-



for that **NEW-SET** performance
INSIST ON GENUINE

DUMONT
*Original Television Parts and Teletrons**

Use the components designed, specified and insisted upon by Du Mont receiver engineers. They account for that universally acknowledged Du Mont quality. Now these same Du Mont Original Television Parts and Teletron picture tubes are made available through selected distributors for top-quality TV servicing.

Replacement Sales Cathode-Ray Tube Division
ALLEN B. DU MONT LABORATORIES, INC.
Clifton, New Jersey

*Trade Mark

ing replacement information on over 4400 (four thousand four hundred) TV models and chassis.

Presented in easy-to-read form, the guide makes it possible for the TV serviceman to find the correct Stancor transformer in a few seconds, according to R. J. Reigel, Distributor Sales Manager. With no complicated groups of numbers or columns to confuse him, all the serviceman has to do is look up the manufacturer's part number, conveniently listed in numerical order by type of transformer. The proper Stancor replacement will be found listed next to it.

Prepared according to suggestions of the Stancor Serviceman Advisory Board for the greatest ease and accuracy of use, the Guide also features a separate catalog section listing 117 Stancor TV replacement transformers with complete electrical and physical specifications.

* * *

Rider TEK-FILE, the monthly packaged service data of John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y., has added five new Packs of TV servicing information to its TEK-FILE list which now totals, 61 different Packs of TV serv-

icing data. It is expected that the publisher will release five new Packs every month until the complete servicing data of Rider Television Manual Volume 10 is made available in this handy packaged form. All data appearing in TEK-FILE is as complete as the Rider Television Manual data. It is not abridged to accommodate the different packaging.

Starting with TV TEK FILE Pack No. 57, dependable replacement parts listings are included. The publisher declares to the servicing trade that the parts listed conform with the physical and electrical specifications of the original parts used in the receiver. The following parts manufacturers are participating in the program: Aerovox, Clarostat, IRC, Jensen, Mallory, Ram, Sprague, Stancor and Triad. Others are being added.

* * *

Wide-spread future use of the transistor, potential successor to the vacuum tube in some applications, was strongly indicated when a leading engineering journal devoted an entire issue to 51 articles disclosing a multitude of advances in transistor research and development.

The 528-page journal, equivalent to a 750-page book, covered all phases of transistor progress, including a new technique for increasing the operating frequencies of transistors by as much as ten times through the use of four-element, or "tetrode" transistors. Many of the articles described new applications of transistors in amplifiers, oscillators, rectifiers, electronic computers and switching circuits.

The November issue of *Proceedings* is the largest issue ever published in the forty year history of the Institute of Radio Engineers, an international society of more than 30,000 radio engineers and scientists. Copies are available from the Institute, 1 East 79th Street, New York 21, N. Y., at \$3.00 per copy.

* * *

A new book on microwave apparatus and its functions, "Essentials of Microwaves" by Robert B. Muchmore, was published in October, by John Wiley & Sons.

In order to provide a broad understanding of the subject, the author stresses the physical principles that underlie the operation of microwave devices. His discussion covers the electromagnetic laws of Maxwell, characteristic waves, wave guides and antennas, cavity resonators and filters, typical microwave antennas, waves and electron streams, and grid-control tubes. The basic concepts and applica-

[Continued on page 22]

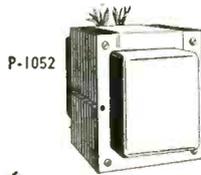
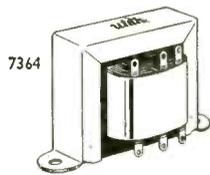
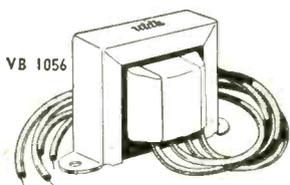


Yes, this Service Man knows his business—knows that he must be sure replacement transformers will perform superbly and reflect favorably his reputation as a highly skilled service technician.

He doesn't gamble with mediocre transformers, he installs the choice of leading set manufacturers—Utah. Don't hazard your reputation with unproven parts, specify "Utah" Transformers and be sure of a job well done.

POWER TRANSFORMERS • VERTICAL OUTPUT TRANSFORMERS • FILTER CHOKES
VERTICAL BLOCKING OSCILLATORS • AUDIO OUTPUTS

Free WRITE TODAY FOR Complete TRANSFORMER INFORMATION, UTAH TRANSFORMER DIVISION, CATALOG T-100



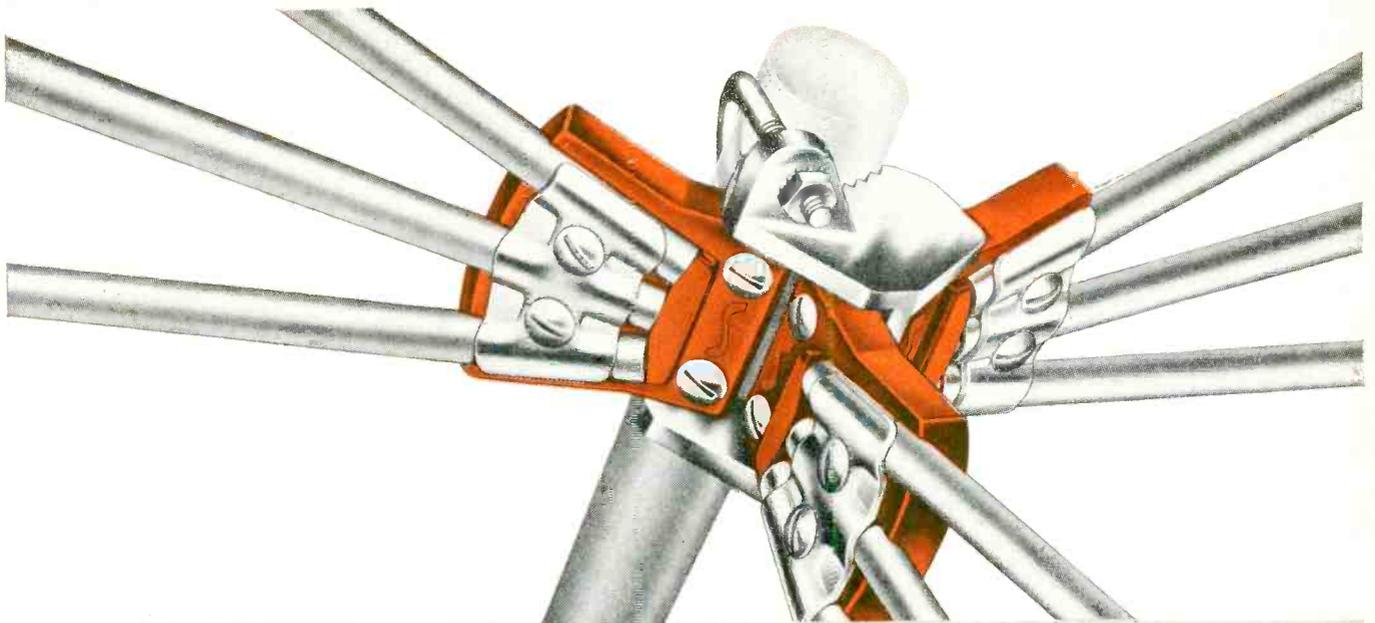
Speakers . . . Transformers

Export Dept. Rocke International Corporation, N. Y. C.

Utah

RADIO PRODUCTS CO., INC.
HUNTINGTON, INDIANA

A WHOLLY OWNED SUBSIDIARY OF NEWPORT STEEL CORPORATION



Snyder
PHILADELPHIA

Directronic

MOTORLESS TV AERIAL SYSTEMS

**TV's MONEY
MAKER**

EXCLUSIVELY YOURS

SNYDER MFG. CO.

ANTENNA ENGINEERS®

PHILADELPHIA

WORLD EXPORT: ROBURN AGENCIES, INC., NEW YORK 7, N. Y.

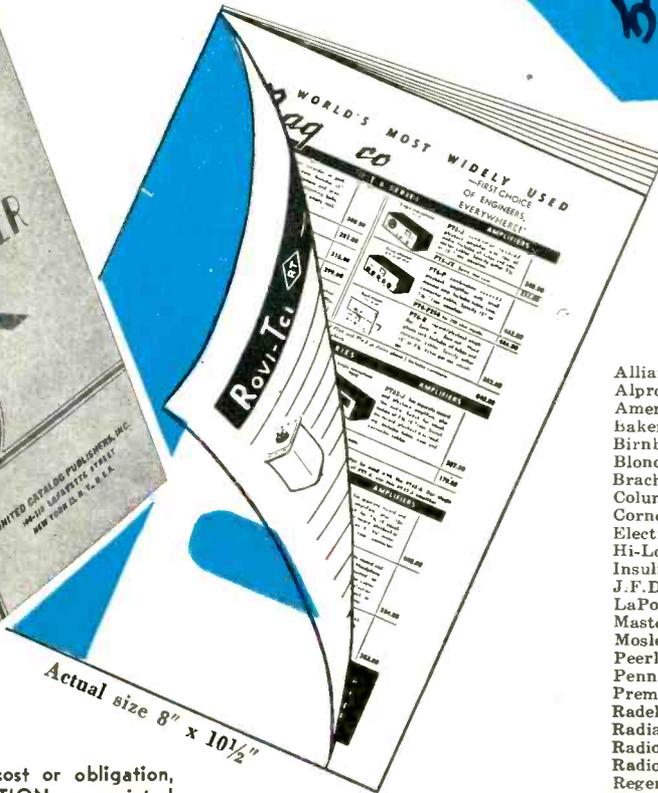
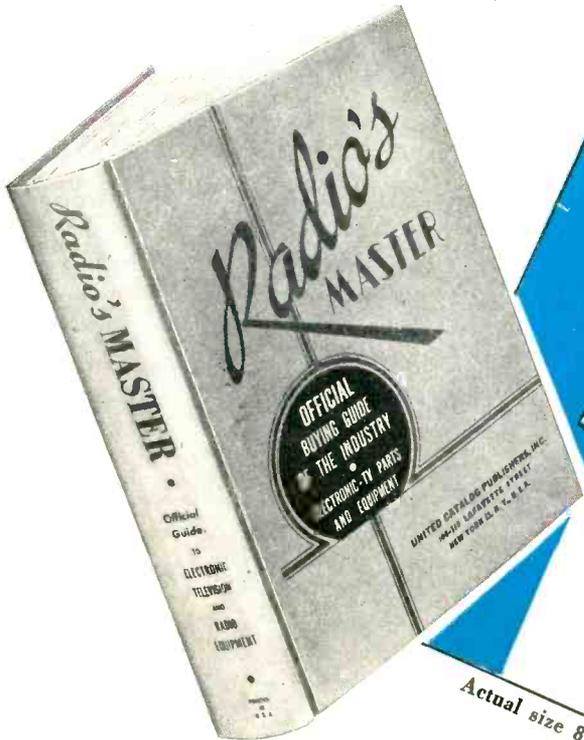
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ALMO RADIO PHILADELPHIA
WHOLESALE RADIO BALTIMORE
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CHAS. FRESHMAN CO. CLEVELAND
RADIO PARTS CHICAGO
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KAEMPER & BARRETT SAN FRANCISCO



FREE! **76 PAGE ANTENNA CATALOG SECTION**
 as reprinted from Radio's Master
ANTENNAS • BOOSTERS • ACCESSORIES
 Catalogs the products of the 32 leading
 Antenna and Accessory Manufacturers



Represented in RADIO'S MASTER 76 page ANTENNA and ACCESSORIES Section are the following manufacturers:

- Alliance Manufacturing Co.
- Alproco, Inc.
- American Phenolic Corp.
- baker Manufacturing Co.
- Birnbach Radio Co., Inc.
- Blonder-Tongue Labs., Inc.
- Brach Mfg. Corp.
- Columbia Products
- Cornell-Dubilier Elec. Corp.
- Electro-Voice, Inc.
- Hi-Lo TV Antenna Corp.
- Insuline Corporation of Amer.
- J.F.D. Manufacturing Co., Inc.
- LaPointe Plascemold Corp.
- Master Mobile Mounts, Inc.
- Mosley Electronics
- Peerless Products Industries
- Penn Television Products Co.
- Premax Products
- Radelco Manufacturing Co.
- Radiart Corporation
- Radio Corporation of Amer.
- Radio Merchandise Sales, Inc.
- Regency, Div. of I.D.E.A.
- Walter L. Schott Co.
- South River Metal Prod. Co.
- Spirling Products Co., Inc.
- Technical Appliance Corp.
- Tel-A-Ray Enterprises, Inc.
- Telrex, Inc.
- Tricraft Products
- Ward Products Corp.

Service-Dealer subscribers will receive without cost or obligation, a complete 76 page ANTENNA CATALOG SECTION as reprinted from the Industry's Official 1220 page Radio's Master, 17th edition.

Whether you buy, sell or specify, you will find this handy section extremely helpful for quick reference. It catalogs in detail the products of the leading Antenna and Accessory manufacturers with complete descriptions, specifications and illustrations.

This offer is made possible by a special arrangement between Service-Dealer and the publishers of RADIO'S MASTER. Fill in the coupon NOW and a copy will be sent you by return mail.

CLIP AND MAIL TODAY

RADIO-TELEVISION SERVICE DEALER
 67 West 44th Street, N. Y. 36 N. Y.

Please send me, without cost or obligation, the 76 page ANTENNA and ACCESSORY Section reprinted from Radio's Master.

Name

Address

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

Guard Your Good Name!

with Electronically-Tested
BUSS FUSES

Dependable Electrical Protection for:-
Television • Radio • Radar
Instruments • Controls • Avionics

Plus a companion line of Fuse Clips, Blocks and Fuse holders

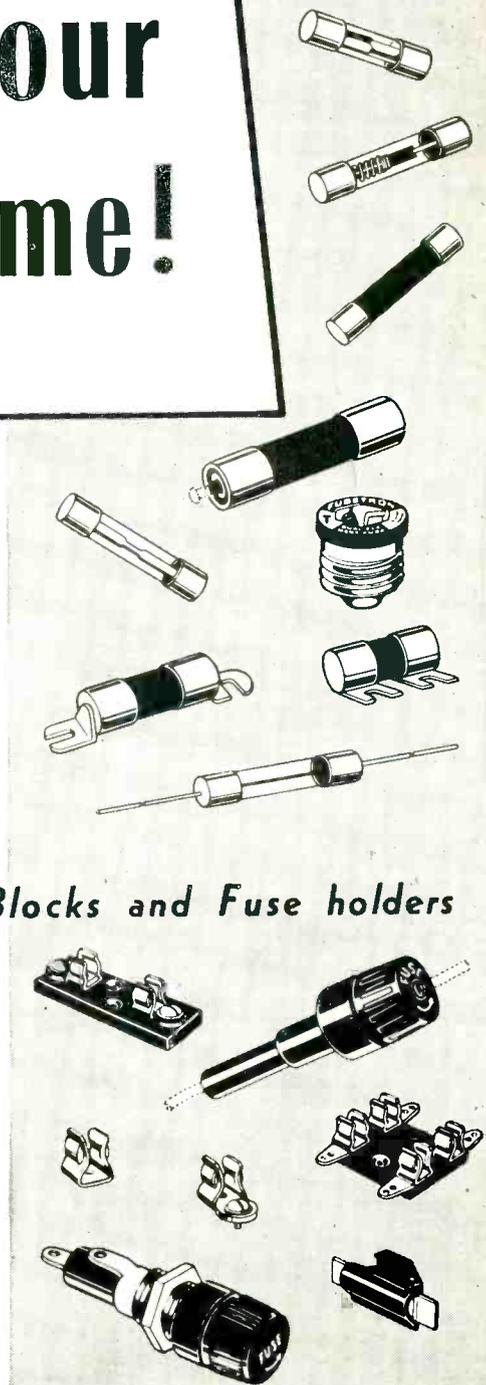
The cost of a fuse is small, compared to the value of the product it protects, — but the *customer influence* of a BUSS Fuse can be many times greater. The name BUSS is recognized as meaning fuses of unquestioned high quality. What better “silent salesmanship” could you ask for to complement your service?

To maintain this high standard each and every BUSS fuse is tested in a highly sensitive electronic device that rejects any fuse that is not correctly calibrated — properly constructed and right in physical dimensions.

The BUSS Trademark because it is KNOWN helps prevent people from blaming troubles they have on fuses you sold them — and so it does its little bit to prevent “complaints” and to protect your profits and goodwill.

This Coupon will bring you — facts on BUSS small dimension fuses, fuse clips, blocks and fuse holders.

BUSSMANN MFG. CO. Division of McGraw Electric Company
University at Jefferson St. Louis 7, Mo.



Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division of McGraw Electric Co.) SD 1252

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

Name _____

Title _____

Company _____

Address _____

City & Zone _____ State _____ 1252

TERRIFIC ACCEPTANCE GREETES THE NEW

TRIO
ZIG-ZAG
(Patent Pending)

TV ANTENNA



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

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



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<p>These ZIG-ZAG ANTENNAS provide the ultimate in extreme fringe area reception. ZZ12L provides 12-14 db. gain on Channels 2 thru 6. ZZ16H has a gain of 14 db. on Channels 7 thru 13. These antennas have very narrow forward lobe, high front to back ratio, provide high rejection in areas with co-channel interference.</p>	<p>ZZ12L ZZ16H</p>
<p>Where maximum gain is not necessary these normal fringe model ZIG-ZAG ANTENNAS are ideal. Model ZZ8L has a gain of 9 db. average on Channels 2 thru 6. The ZZ8H provides an 11 db. gain on Channels 7 thru 13. Forward lobe patterns comparable to good multi-element single channel yagi.</p>	<p>ZZ8L ZZ8H</p>
<p>For near fringe area reception these ZIG-ZAG ANTENNA models provide 8-9 db. gains on all Channels 2 thru 13. ZZ6L covers Channels 2 thru 6 and Model ZZ6H covers Channels 7 thru 13. Both models have patterns similar to those of cut to channel yagis.</p>	<p>ZZ6L ZZ6H</p>
<p>These ZIG-ZAG ANTENNAS provide ALL CHANNEL reception with only ONE antenna bay. Model ZZ6A is designed for near fringe area reception of all Channels 2 thru 13, with an average gain of 9 db. Model ZZ4A is for use in suburban areas, providing an average gain of 6 db. on all Channels 2 thru 13.</p>	<p>Near Fringe Suburban</p> <p>ZZ6A ZZ4A</p>



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TV SYMPOSIUM SERIES — No. 1

This is the first of a series of articles by well-known writers on the present state of the art relative to existing circuits in TV receivers. These articles will appear as a regular feature each month, and are designed to give the servicing technician a summary and solid working knowledge of TV circuitry.

AUTOMATIC FREQUENCY CONTROL

by **ROBERT B. GARY**

PERHAPS the most complex portion of the modern TV receiver is the horizontal oscillator and its control circuits. To maintain absolute synchronism of the horizontal sweep, all modern TV sets feature some type of automatic control which overcomes the effects of occasional noise pulses, oscillator drift and other disturbances. Understanding the operation of these circuits is a basic requirement for troubleshooting or adjusting them. In this article the theory, operation and adjustment of all major types of a-f-c systems are presented.

Basic A-F-C Circuits

The first a-f-c system in wide use was the Synchrolock circuit found in all RCA 630 type receivers. This circuit has long been considered the most satisfactory a-f-c system as regards performance. Its operation is really stable, its noise immunity excellent and its performance on weak signals very satisfactory. The adjustment of the synchrolock type of a-f-c circuit is not too complex and the range of the horizontal hold control is relative-

ly small. If the a-f-c is set properly, the picture will lock in automatically at any setting of the horizontal hold control, except on very weak signals.

The synchrolock circuit is used in all RCA 630 and 830 models as well as all 630 type chassis and is also employed in the Admiral 30A1, Zenith, Ansley, and most other 30 tube receivers. The advantages of the synchro lock could be summed up in its excellent performance and the disadvantages in its cost.

The second type of a-f-c is often referred to as phase detector because that is the principle on which it functions. There are many variations of this circuit in use today but they are all characterized by the presence of a double diode or a triode and the absence of a tapped oscillator transformer. This AFC system has good stability, good lock-in range on weak signals, but its noise immunity is only fair. The range of the horizontal hold control is not as limited as in the synchrolock. It is possible to let the picture lose synchronism at either or both ends of the hold control. This means that the customer might have

to readjust the horizontal hold control occasionally. This a-f-c system is used in the Admiral Model 20A1, Teleking, Motorola, Emerson and G.E. receivers. The last three manufacturers have modified the phase detector somewhat. The advantage of the phase detector can be summed up as economy and good performance and its drawbacks are critical adjustment and only fair noise immunity.

The third type of a.f.c. appears to be the most economical and stable a-f-c system to date. It is being used in all new RCA, Philco, Admiral, Olympic, Airing, Teletone and many other well-known receivers. The Synchroguide features stable operation, good noise immunity and fair lock-in at weak signals. If the control is set anywhere near the center the lock-in action will be satisfactory on weak and on strong stations. The entire circuit is contained in one tube, a 6SN7 double triode. The adjustment of the Synchroguide is best done with the aid of an oscilloscope. The advantages of this a-f-c system can be summed up as economy, good performance and stability and its draw-

backs lie mainly in the adjustment procedure.

Synchrolock

Figure 1 is basically a Hartley oscillator using a 6K6 with a cathode tap on the tank circuit. The tank capacity is made up of C_8 and C_9 as well as the tube capacity of the 6AC7. When the oscillator coil is adjusted the 6K6 oscillates in a sine wave fashion at a given frequency. This frequency can be changed either by adjusting the tuning slug in the coil or by varying the grid leak bias resistor R_4 which acts as the horizontal hold control. If the capacity of the 6AC7 varies it also affects the oscillator frequency. The tube capacity varies as the operating voltages, especially the grid bias, varies. The 6AC7 acts in this circuit as a variable reactance and is, therefore, often called the reactance tube.

The second coil acts as a transformer, coupling some of the oscillator signal to the 6AL5 frequency discriminator. We know that the FM discriminator transformer at center frequency will have zero voltage output at that frequency. R_1 and R_2 are connected to a minus 1.8 volt point and this means that at center frequency a d-c bias of minus 1.8 volts will be applied to the grid of the 6AC7 reactance tube. Consider R_7 , R_8 , C_5 and C_7 as parts of an RC filter keeping the grid voltage at a d-c value. If the oscillator frequency changes, d-c voltage in addition to the 1.8 volt bias is generated by the 6AL5 discriminator. This additional voltage can be either positive, reducing the negative bias, or it could be negative and make the bias higher. In both cases it will cause the 6AC7 tube capacity to either increase or decrease, and thereby vary the frequency of the oscillator.

The incoming synchronizing pulses are applied to the center tap of the discriminator through the windings to both plates of the 6AL5. The sine wave will cancel out the effect of the synchronizing pulses at both plates, if the oscillator is at the same frequency as the incoming pulses.

The left half of the synchrolock transformer and the 6AL5 in Fig. 1 are the frequency comparing section. The grid bias on the 6AC7 is the error voltage and the reactance tube itself the means for controlling the 6K6 sine wave oscillator. The half of a 6SN7 at the right of Fig. 1, is called the discharge tube because it changes the sine wave generated by the 6K6 into a sawtooth wave by passing it through a suitable RC network.

Adjustment of the synchrolock system is accomplished by tuning both

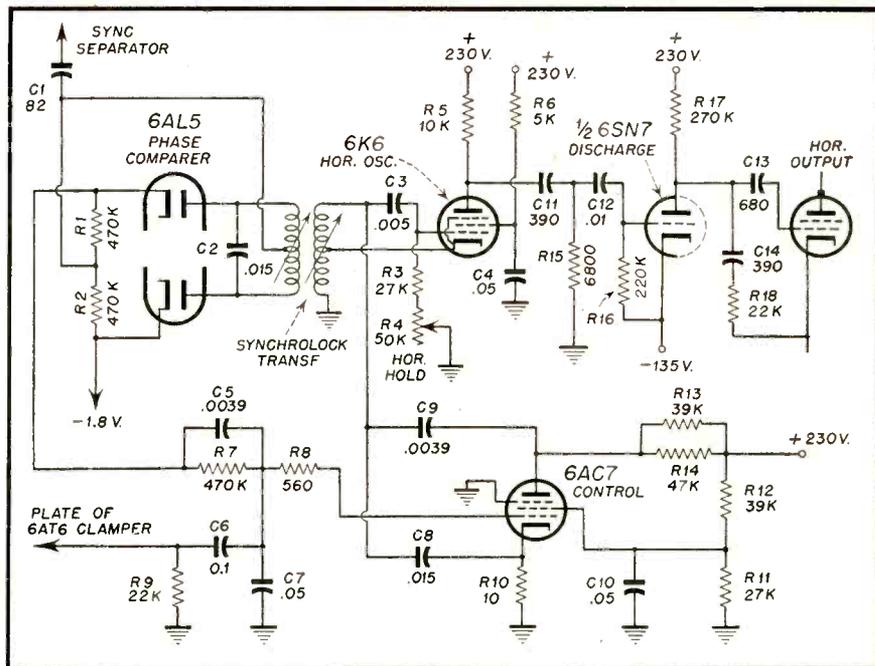


Fig. 1—Synchrolock type a.f.c.

windings of the discriminator transformer and by adjusting R_4 , the horizontal hold control. In most receivers using the synchrolock circuit the powdered iron slug tuning the oscillator winding is towards the back of the receiver. This slug is adjusted until the picture locks in. The discriminator slug usually has to be reached from the inside of the chassis and is adjusted for proper phasing of the picture. This phasing adjustment brings the picture into the center of the screen and eliminates foldover and jumping. After the phasing is set correctly, the oscillator slug is re-adjusted until the picture remains stable with the hold control set at either extreme. Switch channels several times to make sure the picture is locked in, regardless of

the hold control setting. Any re-adjustment of the frequency slug usually will also require a touch up of the phasing control slug.

The 6AC7, 6AL5 and the oscillator tube itself cause most frequent complaints. The synchrolock transformer C_8 , and C_9 , in Fig. 1, and the coupling condenser C_3 , are critical components. If nonlinearity appears on the screen which cannot be removed by adjustment of the linearity coil, the discharge tube may be at fault. The half of a 6SN7 shown at the right in Fig. 1, feeds a sine wave voltage into a charge and discharge network consisting of R_{17} , R_{18} , and C_{14} . This network determines the shape of the sawtooth voltage which is applied to the grid of the horizontal output amplifier.

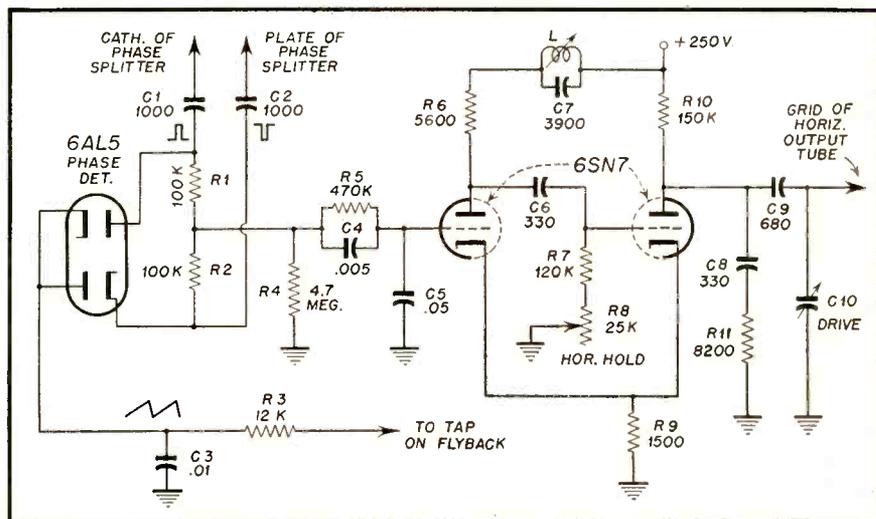


Fig. 2—Phase detector type a.f.c.

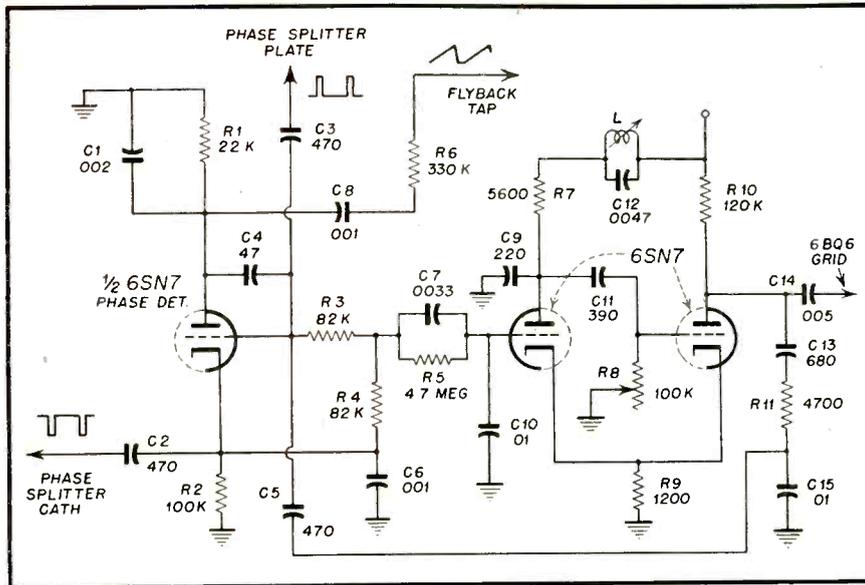


Fig. 3—Triode type phase detector.

If the curvature of the sawtooth is great, especially at the top, nonlinearity appears on the screen. The amplitude of this sawtooth may vary from about 50 to 80 volts peak to peak.

Phase Detector

The phase detector type of a.f.c. uses a combination multivibrator and sine wave oscillator as in Fig. 2. Without the tank circuit in the plate lead of one half of the 6SN7, this circuit appears like a cathode coupled multivibrator. R9 is the common cathode resistor and C6 couples the first plate to the second grid. These are typical multivibrator features. The grid resistor R8, the horizontal hold control, controls the discharge time of C6 and therefore the frequency of the multivibrator. To add the elements of a sine wave oscillator the tank circuit consisting of the coil L and C7 is inserted. Over one part of the cycle the tuned circuit controls the oscillation, producing the sine wave portion. During another part of the cycle the multivibrator takes over and causes a square wave to be superimposed on the sine wave. The RC network consisting of R11, C8 and R10, changes the square and sine wave combination into a sawtooth voltage.

The oscillator frequency is controlled by the horizontal hold control but the grid bias on the first grid also has a very great influence. This grid bias depends on the d-c voltage across R4, a 4.7 megohm resistor, and as this bias voltage varies, so will the oscillator frequency. The 6AL5 double diode is connected as a phase detector. The preceding phase splitter produces sync pulses of opposite polarity. The positive sync pulse goes to a diode

plate and the negative pulse to a cathode of the 6AL5. At the junction of R1 and R2 no voltage exists because the two pulses balance each other out. A sawtooth voltage is applied to the opposite parts of the 6AL5 from the horizontal output transformer. If the zero or center value of this sawtooth voltage coincides with the arrival of the sync pulses at the opposite plate or cathode, the 6AL5 cannot conduct. If the sawtooth phase differs from the pulses, either diode may conduct. The result of the two different diode currents will be an unbalance at the junction of R1 and R2. A voltage will therefore appear across R4, of such polarity that it will change the oscillator frequency back to the proper sync pulse speed.

The adjustment of the phase detector type of a.f.c. should be done very carefully and checked thoroughly. First the slug of the oscillator coil is adjusted for lock-in at the center position of the hold control potentiometer. Next the horizontal drive trimmer is adjusted for picture width, brightness and linearity. This adjustment usually affects the frequency of the oscillator somewhat and it may be necessary to reset the slug of the oscillator coil once more. Check the setting of this slug on the weakest as well as the strongest station and be sure it locks in.

The most frequent defect in the phase detector type of a.f.c. system will be tube failure. The most critical item is the oscillator condenser C7, which is usually a 3900 μf silver mica condenser. This condenser should be silver mica to prevent a capacity change with heat and excessive oscil-

lator drift. R6 and R9 should both be at least 10% resistors and R9 is usually the 1 watt size.

Triode Type Phase Detector

The most recent innovation in a-f.c. circuits is shown in Fig. 3 and is commonly called a triode type a.f.c. One half of a double triode is used here to perform the same functions as the double diode did in the regular phase detector. As shown in Fig. 3 the oscillator circuit is practically identical to the one shown in Fig. 2. The error voltage is applied to the grid of the oscillator tube through C7 and R5 and is essentially a d-c voltage. A combination sine wave oscillator and cathode coupled multivibrator generate a square wave which is changed into a sawtooth through the discharge network C13, R11 and C15.

The operation of the phase detector depends on four different waveforms three of which are shown in Fig. 3. Just like the diode in the preceding paragraphs the triode phase detector also requires sync pulses of opposite polarity applied at the plate and cathode. The sawtooth fed back from the flyback transformer goes to the triode plate through a wave shaping network consisting of C8, C1 and R1. A fourth voltage is coupled to the grid of the phase detector from the output network of the oscillator through C5 and C15. The principle of operation of the triode is dependent on the combination of these four waveforms so as to draw more or less current through R2, the cathode resistor. It is essentially this voltage which constitutes the error voltage and controls the frequency of the horizontal oscillator.

The most frequent complaint in this type of a.f.c. is due to defective 6SN7 tubes. The phase detector resistors and condensers are not as critical as might be supposed, but when replacing them only 10% resistors and condensers equivalent to the original should be used. In the oscillator circuit the same parts are critical as mentioned under "Phase Detector" above.

Adjustment of the triode type phase detector is identical to that of the diode type. It may be found that the coil must be tuned a little more accurately since the pull-in range of the triode a.f.c. is somewhat less than with the diode. The triode a.f.c. is used in several new models such as the new Motorola line, Scott and Traveler.

Synchroguide AFC

The Synchroguide circuit does not operate on the same principles as the Synchrolock or the phase detector

types, but because it depends on different pulse widths, it is often called a pulse width system. In the circuit of Fig. 4, the 6SN7 is both the oscillator and the control tube. One triode section is a blocking oscillator circuit, generating a square and sine wave combination which is converted into a sawtooth through the RC network, $R13$ and $C9$. $L1$ is a tapped coil and in some older receivers the winding from $C-D$ is lacking. The main function of this coil is to stabilize the circuit. The frequency of the oscillator depends mainly on the inductances in $L1$ and the grid bias across $R6$. The grid of the oscillator is returned to a tap on the cathode bias resistor of the control tube. At the same time a portion of the oscillator bias is applied to the grid of the control tube through $R7$. Since the oscillator grid bias is a large negative voltage this will keep the control tube cut-off for anything except strong positive pulses. Cathode bias on the control tube helps further to keep this triode section cut-off.

The frequency comparing action of the control triode depends on two different voltage waves. A sawtooth wave is coupled from point D on $L1$ through $R1$ to point (a). The synchronizing pulse comes from the sync clipper and amplifier through $C1$. The control tube is at a high bias so that only the small positive pip on top of the wave makes the tube conduct. If this pulse is broad, current passes for a longer time than if the pulse has a very sharp point. The control tube current determines the cathode bias across $R4$, $R5$, and filtered by $C4$. One half of the control tube cathode bias is applied to the grid of the oscillator and this is in effect the error voltage. Even a slight variation in bias will influence the frequency of the oscillator. The horizontal hold control $R9$ is part of a B plus voltage divider and sets the plate voltage for the control triode. The plate voltage determines the amount of current and thereby the cathode bias, which in turn is the error voltage. If the synchronizing pulse occurs just before the steep portion of the sawtooth, the pip on top will be broader. If the synchronizing pulse occurs slightly later this means a shorter current passing interval at the control tube. The appearance of the pulse is controlled by $C2$ usually labeled "lock-in" control. Once this adjustment is made it need not be touched unless major circuit changes are required. After the pulse width for normal operation is set through the adjustment of $C2$, the

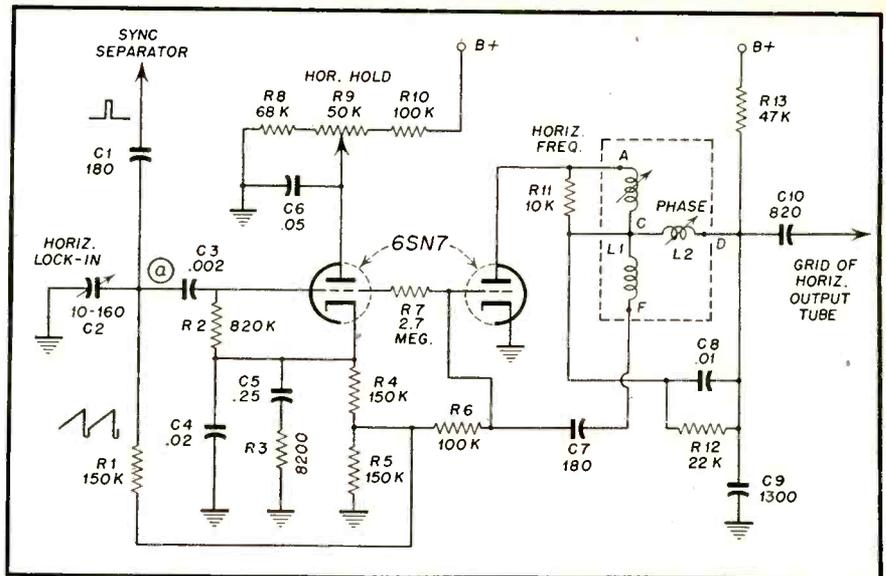


Fig. 4—Synchroguide type a.f.c.

two separate windings in $L1$ must be adjusted to oscillate at the proper frequency. If the frequency of the oscillator changes slightly, the width of the pip on top of the sawtooth wave appearing at point (a) will vary. A variation in pulse width at the grid of the control triode results in a variation of the cathode bias of this tube. This cathode bias is actually the error voltage which controls the speed of the oscillator through $R6$, the grid resistor of the oscillator triode.

The hold control $R9$ usually permits only a slight variation of the plate voltage of the control tube. At midpoint setting the synchroguide will lock in instantly when channels are switched. At either extreme setting the picture will not lose sync but when stations are changed synchronism may be lost.

Two different methods of adjustment are in use. The oscilloscope method is used when a major repair has been made and $L1$ must be completely re-adjusted. A 10,000 ohm decoupling resistor should be connected in series with the "hot" side of the scope to avoid detuning the circuit with the scope input capacity. If the correct setting for the horizontal hold control is not approximately at the midpoint, re-adjust the frequency controlling slug of $L1$. With the resistor connected to point C on the synchroguide coil and with no station coming in, adjust slug $C-D$ until a symmetrical sine wave appears superimposed on the sharp spikes. Then tune to a station and adjust the frequency controlling slug so that the picture just appears to lock in at either extremes of the hold control setting. Readjust the slug $C-D$ again for symmetrical pattern.

When no scope is available it may be necessary to juggle the relative positions of the two slugs until the picture locks in correctly with the hold control set at center, regardless of strong or weak signals. Fold-over or pulling are a good indication that the phasing slug $C-D$ is not set right. In some receivers a trimmer is used to control the frequency in addition to the slug $A-F$. Adjust the trimmer for approximately midpoint, then tune the slugs and use the trimmer again as a touch-up adjustment.

In addition to the 6SN7 tube and $L1$, the most critical parts are $R13$ and $R4$, usually a 5%, 1 watt resistor, and both $R5$ and $R6$. Most of the resistors used in the synchroguide circuit should be at least 10% types and all condensers 600 volt paper or molded types, with smaller values 500 or 1000 volt micas.

The most frequent defect in the synchroguide circuit is misadjustment or a substantial change in the value of a critical part. The 6SN7 is often defective and an open or shorted $L1$ or trimmer condenser are the next likely culprits. If none of these are at fault, a point by point voltage and scope check may be necessary.

Conclusion

The four types of AFC circuits shown here are the basic systems used in practically all modern TV receivers. Various manufacturers utilize slight variations of these basic circuits. Once the technician recognizes the type of a-f-c system and knows its critical parts, its shortcomings and advantages, it will make servicing much simpler. A thorough understanding of the operation of a circuit is always the prerequisite to speedy and efficient troubleshooting.

A DEFECTIVE TV receiver is on the bench for servicing. You can join in the step-by-step hunt for the trouble by answering the questions in the quiz. Answer each question before going on to the next. If there is more than one correct answer to a question, designate each correct choice. Answers and discussion follow.

Type of Set: Dumont, Model RA111A. Transformer low voltage supply, flyback high voltage supply, split sound.

Trouble: Pix normal, sound has hum in addition to usual audio output.

1. The first step in looking for audio hum is:

- (a) Change tubes in the audio section.
- (b) Change rectifier tube.
- (c) Vary volume control.
- (d) Vary channel selector setting.
- (e) Check filter condensers in the power supply.

2. The usual first steps in localizing audio hum are to check the indications on all channels, including blank ones, and to vary the volume control to see if the hum is heard with the volume control at minimum. In this case, the hum is heard on all channels, including blank ones. When the volume control is turned down to minimum, no hum is heard. These checks indicate:

- (a) Hum is probably originating in the power supply.
- (b) Hum is being picked up by the antenna.
- (c) Hum is originating in the front end (r-f amplifier, oscillator, mixer).

LOOKING for TROUBLE?

No. 11

by Cyrus Glickstein

(d) Hum is probably originating in the audio section after the volume control—audio amplifier stages, speaker.

(e) Hum is probably originating in the audio section before the volume control—discriminator, input circuit to volume control.

3. The hum seems to be located in the audio circuit immediately before or around the volume control. To check this further, the last sound i-f tube, V202, 6AU6 (Fig. 1) is removed. Hum is still heard. The combined discriminator—1st audio tube, V203, 6T8, is removed. Hum disappears. A

new 6T8 does not eliminate the hum. The hum therefore appears to be originating between the discriminator and the volume control. To localize the trouble further, the following test can be made:

- (a) Unsolder various leads to see the effect on the hum output.
- (b) Short screwdriver to chassis at various points in the circuit.
- (c) Use scope to check hum pick-up at different points in the circuit.
- (d) Use signal substitution (signal generator) to locate the defect.

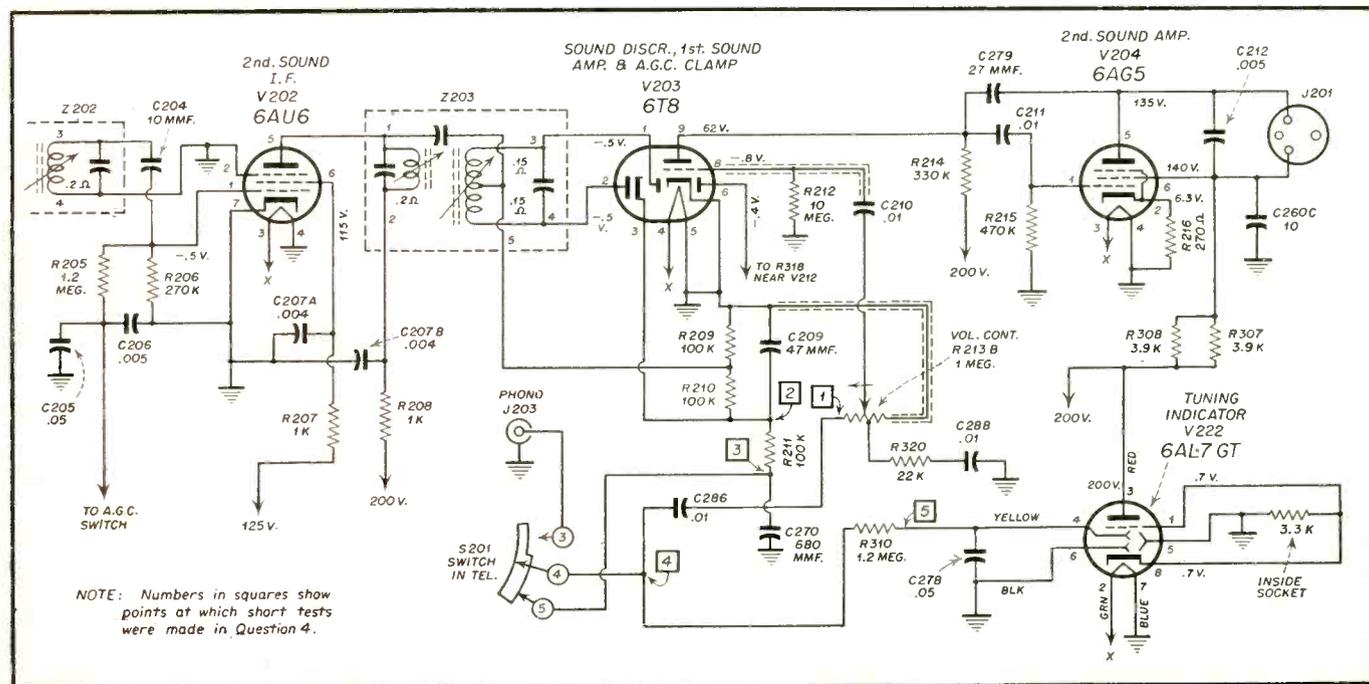


Fig. 1—Partial schematic of DuMont Model RA111A, portion of audio strip.

(e) Apply a large value capacitor (about 20 μ f-400 v) to B+ points to check filtering.

4. In this case, the screwdriver method is a simple way to find the point at which hum is being introduced into the circuit. The screwdriver was shorted to the chassis at the following circuit points (see Fig. 1) with the following results:

Point No.	Effect on Hum Output
1	Hum disappeared.
2	No effect, hum still heard.
3	Hum disappeared.
4	Hum disappeared.
5	Hum disappeared.

On the basis of these checks, the hum is due to:

- (a) Defective tuning indicator V222.
- (b) Hum pickup from switch S201.
- (c) Hum pickup from phono jack J203.
- (d) Leaky C270.
- (e) Open R320.

ANSWERS AND DISCUSSION

1. c, d

In trouble-shooting TV receivers, it is important to distinguish between hum and buzz. Buzz refers to either a mechanical vibration of one of the transformers in the receiver or to a harsh rasp coming from the speaker. Buzz from the speaker is caused by low frequency square waves (vertical sync pulses from the video signal) or by sawtooth waves originating in the vertical sweep circuit. Hum is generally a 60-cycle or 120-cycle sine wave output. In almost all cases, the causes of buzz differ from the causes of hum. Occasionally, a large hum voltage is amplified to a point where the tops and bottoms of the sine wave are flattened and the sound output is heard as a buzz. The two sounds are distinct and the first step in trouble-shooting is to decide which one is being heard.

In cases of buzz coming from the chassis rather than the speaker, the power transformer and the vertical output and blocking oscillator transformers are the primary suspects. Another cause may be poor contact between the grounding springs of the chassis and the outer aquadag coating of a glass CRT. Buzz coming from the speaker may be intercarrier buzz (in intercarrier sets) or may result from pickup in the audio circuits from the vertical sweep, sync, or video amplifier stages. To check whether the buzz is coming from the vertical sweep, rotate the vertical hold control to see if the sound is affected. If so, the buzz

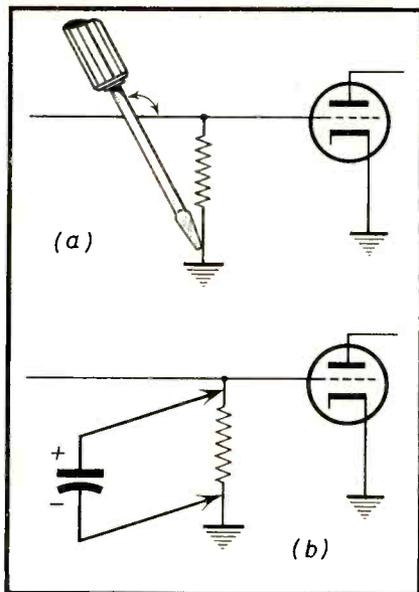


Fig. 2—Grid of a stage shorted to ground—(a) for both d-c and a-c with a screw driver; (b) for a-c only with a large condenser.

comes from the vertical circuit. The routing of audio leads away from the vertical circuit should be carefully checked. Additional steps for localizing hum, discussed in Answers 3 and 4 below.

With both buzz and hum troubles, preliminary steps in localizing the source are rotating the channel selector switch and varying the volume control. These checks determine where to look further for trouble.

2. E

If hum is heard on all channels, including unused ones, this indicates the hum is originating in the receiver and furthermore is originating at some point past the r-f and i-f circuits.

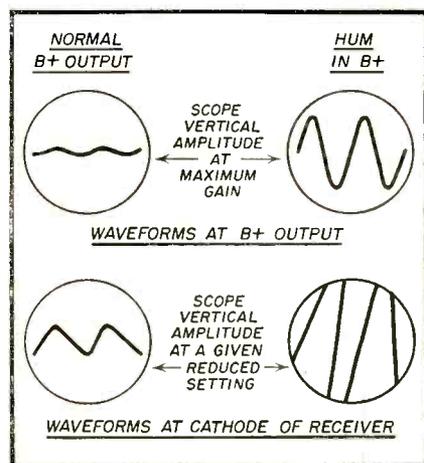


Fig. 3—Waveforms seen on service oscilloscope when checking B plus line for hum.

Hum which originates in the tuner, i-f, or a-g-c circuits cannot pass through the r-f and i-f circuits directly since these stages do not amplify audio (hum voltage) frequencies. These hum voltages must amplitude-modulate the r-f or i-f carrier of an incoming signal to be passed through these stages. Hum therefore which is heard only on active channels can be assumed to be riding through the r-f and i-f stages on a received signal. This hum must therefore be originating in the tuner, a-g-c circuit, or one of the video or sound i-f stages through which the sound signal must pass. In almost all cases, hum originating in an r-f or i-f stage common to both audio and pix signals is more evident in the video output than in the sound because of the limiting action in the f-m sound circuits. Occasionally, hum originating in one of these common stages may be more evident in the audio than in the picture.

By turning down the volume control, it is usually possible to check if the hum is coming to the volume control from a preceding stage or is originating after this point. If the volume control is down to minimum and the hum is cut out, then the hum is being fed to the volume control. There is one exception to this rule—cases where the hum is being picked up by the center-tap connection to the volume control. In such cases, turning the volume control to zero, which grounds the center-tap, also cuts out the hum. It is simple to determine if this is the case by a further check which is described under Answer 4.

If the hum is not cut out when the volume control is at minimum, then the hum is coming in after the volume control—in the audio amplifier stages, the B+ supply feeding these stages, or the speaker circuit.

In the receiver being serviced, the hum is heard on all channels. This indicates the hum is being picked up in the sound strip somewhere between the discriminator stage and the speaker. Since the hum is not heard when the volume control is turned down, this in turn means it must originate between the discriminator and the volume control. This is verified by (a) pulling out the last sound i-f stage, V202, Fig. 1, which does not affect the hum, thereby showing the hum is coming in after this point; and (b) pulling out the 6T8, discriminator—1st audio tube, which kills the hum. These two tests localize the origin of the hum to a small area of the receiver. In sets with series fila-

ments, it is not possible to make tube withdrawal checks, but the same effects can be obtained by shorting the grids of the stages involved, as explained under Answer 3.

3. b, c

A good, quick check in localizing hum in this area is using a screwdriver to short to the chassis at various points where there is no d-c potential. By shorting these check-points, it is often possible to determine where the hum is coming in. For example, if shorting a point to ground cancels the hum, the hum is originating in the signal circuit preceding that point. On the other hand, if the hum is still heard, the hum is originating after that point—between that point and the speaker.

Some of the other methods listed can be used in finding hum. A large condenser can be applied to various circuit check points just as a screwdriver is used, as shown in Fig. 2. When the condenser is applied to any point in the signal circuit, it acts as an a-c short, grounding out the hum signal if the hum is coming to that point from a preceding stage. Like the screwdriver, the condenser is useful in determining whether the hum is originating before or after the point being checked. The condenser has the advantage over the screwdriver in that it can be applied to plates, screen grids, and other points with a d-c potential without causing current overloads or knocking out the d-c operation completely as screwdriver shorting at some of these points may do. When the condenser is applied to B+ points, it adds to the filtering and gives useful information about possible breakdowns in the filter system. However, for making checks at points where there is no d-c potential as in the usual discriminator output-volume control input circuit, screwdriver shorting is simple and adequate. In receivers where the volume control and/or grid circuits of the audio amplifier stages are returned to a high d-c potential, screwdriver shorting to the chassis is not advisable. A condenser can be used instead.

An oscilloscope can be very useful in finding difficult cases of hum. Various bus lines can be checked to determine the amount of hum pickup—a-g-c line, B+ line, etc. Fig. 3 shows normal and abnormal waveshapes which appear on a scope when the B+ line is being checked for hum. Whenever an unusually large ripple is visible on the B+ line, there is either a defect in the power supply (open or leaky filter condenser, defective rectifier) or an excessive load (partial

short) across B+, overloading the filter system. It is often helpful to use the oscilloscope in conjunction with a screwdriver or condenser. The scope is connected to a point in the circuit where the hum can be seen on the scope screen (plate of the 1st audio stage, grid of the PA, plate of PA, etc.). The condenser is applied as described above, to various circuit check-points preceding the point where the scope is connected, while the effect on the hum is watched on the scope. The visible indications on

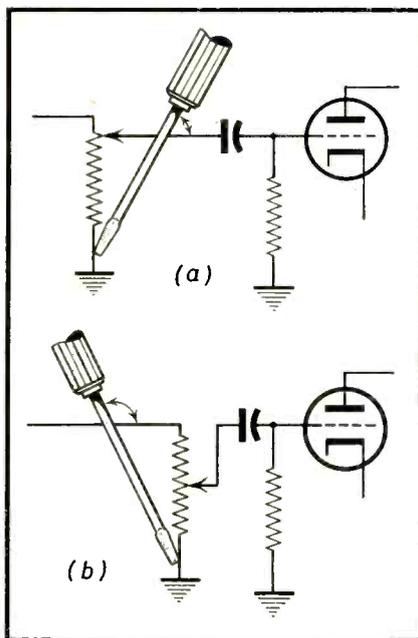


Fig. 4—Two steps in checking for hum pickup in center-tap line of volume control:

(a) with center-tap at maximum, short center-tap to ground. If hum disappears, then:

(b) set center-tap at center of rotation and short top of potentiometer to ground. If hum is heard, pickup is between center-tap and grid of 1st audio stage.

the scope are more definite than the audible hum from the speaker.

Unsoldering leads is not usually necessary to track down the sources of hum except in difficult cases.

4. a

Shorting at point No. 2, Fig. 1, shows the hum is not arriving from a preceding point (discriminator stage) since the hum is still heard. A frequent cause of hum pickup are the leads to the top and the center-tap of the volume control, even when these leads are shielded. The shields may be incomplete, ungrounded, or poorly grounded. If these leads are brought too close to the a-c power connections, the vertical sweep circuit, etc., hum may be introduced into the audio cir-

uits. If hum is being picked up by the center-tap lead, a somewhat misleading result is obtained when the volume control is rotated to see the effect on the hum output. As the volume control is turned to minimum, the center-tap is grounded, and the is knocked out, through the center-tap technically is after rather than before the input to the volume control. Usually, when hum disappears during this test it is assumed the hum is originating before the volume control. To rule out any possibility of confusion, one further check should be made. With the volume control at maximum, short the center-tap lug of the potentiometer to ground with a screwdriver. If no hum is heard, the hum is coming in at or before this point. If hum is still heard it is coming in after this point and the volume control leads are not the culprits. If no hum is heard when the center-tap is shorted, the next step is to short the (hot) lug of the volume control to ground and rotate the volume control knob (center-tap) to about one-half of maximum. In this position, the input to the volume control is grounded out but the center-tap is not grounded. If hum is heard now, then the pickup must be along the line from the center-tap to the grid of the 1st audio. This follows since in the first check, when the center-tap was grounded, no hum was heard; then hum was heard when the top of the volume control was grounded with the center-tap in the center of rotation, Fig. 4.

The last screwdriver shorting check, at point No. 5, indicated that the hum is originating in a stage preceding this point. The only possible input before this point is the tuning indicator, V222, 6AL7. An internal short of the filament to other elements of this tube caused the hum to be applied to the lead connecting this stage to the audio amplifier circuit. Normally, this lead feeds signals in the reverse direction—the detected audio voltage is applied to the tuning indicator to provide visual indication of the in-tune position. A new 6AL7 took out the hum.

A leaky C270 or open R320 (a) would not cause hum pickup and (b) had been ruled out by the short tests at points in the circuit beyond these two components. The last statement (b) is also true of S201. J203 cannot be the source of pickup because switch S201 is open and J203 is not connected to the audio circuit in this position. The possibility of a defective S201 and hum pickup from J203 is elimi-

[Continued on page 58]

ONE high quality audio amplifier worthy of study is the Model 50W-1 produced by the McIntosh Engineering Laboratories. Though not a new comer to the field, it is definitely of new design. The focal point of interest resolves to the unusual transformer coupling and circuitry of the pushpull output stage. Preliminary stages are also of interest but the output suffices for analysis. Constructional features are described later.

The kinetics of controlled and balanced electronic action between two halves of a mid-tapped and tightly coupled winding are proved, by this example, to be of equal significance with the balanced performance from two carefully selected vacuum tubes of identical type. But, balance is not all. Ingenious design around the bifilar winding principle has developed a new circuit which decimates leakage reactance between the two halves of a normally mid-tapped transformer primary. Design engineers have known for years that an ever-present distortion content existed in conventional pushpull output transformers and that its magnitude depended upon frequency and upon leakage reactance between the two halves of the transformer primary.

Problems of Balance

In any system where operation depends upon attainment of a satisfactorily balanced or bridge circuit, it follows that any reactionary or spurious effects introduce distortion and often these obnoxious reach troublesome proportions. Magnitude of unbalanced audio signal component may be directly dependent upon phase relationships and the ratio between primary and secondary voltages. Slightly fruitful corrective steps have been, variance of the effective center tap, and injection of primary voltage by means of a closely coupled and proportionately small tertiary winding.

When bifilar winding technic is used, balance may be bettered by employing a slightly different length of winding for one of the two tightly coupled coils. The ready solution for elimination of distortive leakage reactance is, according to this manufacturer, unity coupling with paired and balanced bifilar-wound audio transformers. McIntosh applies unity coupling to both driver and output stage as shown later in Fig. 3.

Problems of Distortion

For reasons of comparative study, a simplified and conventional pushpull audio output stage is shown in Fig. 1. Inherent leakage reactance between the two primary half-windings is represented by the single dotted loops between the half primaries and the plates, (Fig. 1). For frequencies above 2000 or 3000 cps, this leakage reactance has been responsible for a waveform distortion ranging between 2% and 10% dependent upon the extent of the malfunction.

A HIGH QUALITY AMPLIFIER

by C. A. TUTHILL

Circuit explanation and description of a popular high-quality amplifier of unusual design and performance.

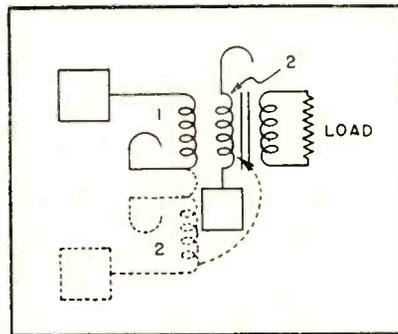


Fig. 1—Simplified and conventional push-pull audio output stage.

Various attempts at sectionalized construction of primary and secondary transformer windings have aided reduction of leakage inductance and distributed capacitance and thereby have somewhat reduced distortion of the higher frequencies. Reasonably

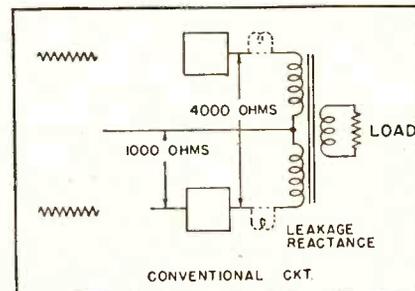


Fig. 2—First step in development of unity-coupled amplifier showing new coupling arrangement.

good low frequency reproduction from audio amplifiers usually required large core construction. It was found that smaller cores, constructed of materials having high permeability, were helpful toward better low frequency response from a transformer built to more reasonable physical dimension. However, when spectrum requirement is exacting, a shunt feed or bypass arrangement is necessary to avoid the saturation of high permeability cores. This will otherwise occur when high plate current is allowed to pass through the transformer primary. Such bypass circuits mean extra cost and complication.

Heretofore the requirement of considerable core material for satisfactory reproduction of low frequencies was great enough to challenge practicability in weight, size and cost. It is claimed that this new doubly-applied unity coupling performs better with an eleven pound core than did previous units with cores of ten times that weight. This proves again that design is not merely a function of theory but is critically subject to practicability.

Fundamental Circuit

In a limited space it is difficult to functionally analyze this somewhat radical circuit. Therefore basic facts and schematics are offered. Fig. 2 illustrates the first step in development of the unity coupled amplifier. The conventional dual primary winding is shown with the lower half in dotted lines. The actual position of the dotted-line half winding is shown in its new relationship (2) by solid lines. The two half-primaries are wound together in bifilar form as one winding. With this arrangement there

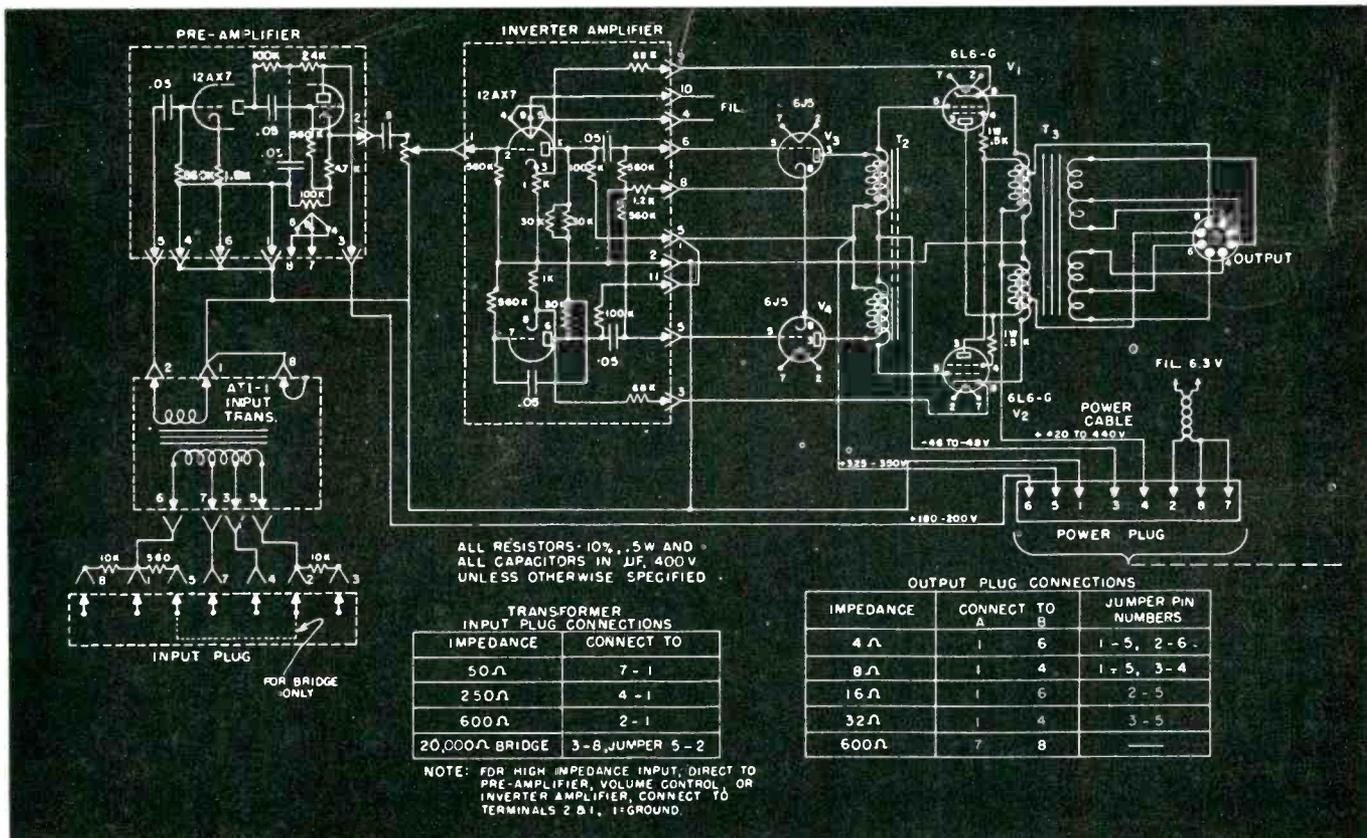


Fig. 3—Basic arrangement of circuitry employing bifilar windings for driver and output stage.

exists between the two half-primary windings a capacitance coupling, turn by turn, plus a magnetic coupling through the common core. The resultant extremely tight coupling achieves a ratio of primary inductance to leakage reactance which is greater than 2,000,000 to 1. At once leakage reactance is voided and the development of more highly efficient circuitry is made possible.

Basic Circuitry

Development and function of the

final amplifier, discussed in later paragraphs, is better understood if we consider the circuitry of Fig. 3. Immediately we see that the bifilar arrangement is also applied to the driver stage and that pentodes or triodes may be used in the final stage. In this example the screen grid is connected to take advantage of the efficient power conversion of pentodes. The suppressor grid effects higher power output for lower grid voltages than is possible with the use of triodes.

The screen grid is maintained at a constant d-c potential with respect to the cathode since the two transformer windings are coupled so tightly that no a-c potential can develop between the cathode of either tube and its corresponding screen. Note that the screen derives a constant d-c potential equal to that of the plate voltage. Before further analysis, it is well to study the a-c path through the primary of the output transformer.

Output Primary

The alternating current path traces upward through the upper quarter of one half-primary winding from the (+) mid-tapped plate supply, (Fig. 3). The upper end of that quarter-winding is connected directly to the plate of the lower tube. From this plate the signal travels across to the lower cathode, then upward through its quarter of the same half-winding and is thus returned to the plate supply mid-tap. Summarizing, the signal transit takes place through one plate winding and through one cathode winding, each of which is on opposite halves of the same coil and this coil actually is but one half of the bifilar-wound primary output winding. The same condition holds for the second half of the primary winding which serves the upper output tube, Fig. 3.

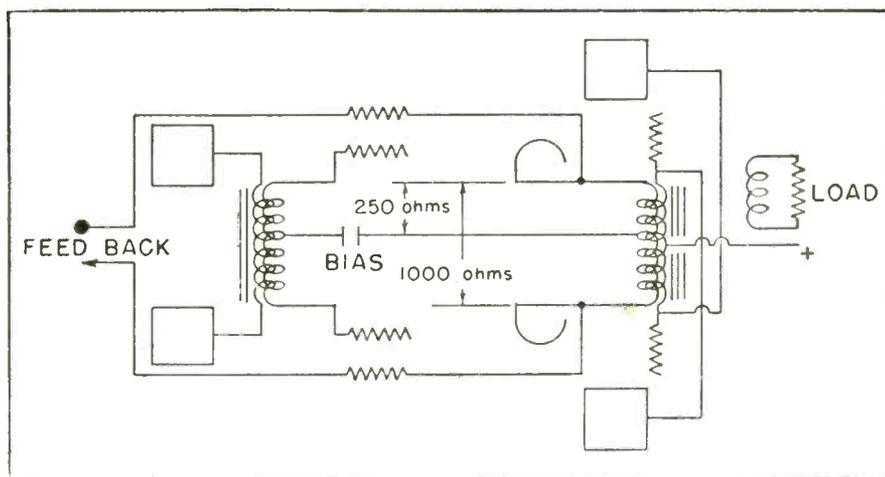


Fig. 4—Data and overall schematic of McIntosh Model 50W-1 50 watt audio amplifier, unity-coupled in driver and final stages with bifilar-wound transformers.

For each of the pushpull tubes, half of the primary output winding is in the cathode circuit and the other half-winding is in the plate circuit. Due to the extreme tightness of coupling, the two half-windings become as one or identical. From an *a-c* viewpoint this resolves into an output stage using one common primary winding. Obviously there is no leakage reactance between the coils for the two tubes. Distortion from that source is deleted.

Circuit Characteristics

In conventional pushpull amplifiers, customary values for 6L6s are an impedance of 4000 ohms between plates of the two tubes driving a mid-tapped primary of an output transformer. A resultant impedance of 1000 ohms exists between the midtap and either of the pushpull plates. In the closed loop unity coupled circuit employing two bifilar treatments, (one for driver and one for output) these two impedance values are greatly reduced and to considerable advantage. For the circuit of *Fig. 3*, the impedance between tubes becomes 1000 ohms while the impedance between either side and the midtap or ground is reduced to 250 ohms. Some of the claims for this 4 : 1 impedance reduction are: reduction of stray capacitance effects by a factor of 4; reduction of fundamental and harmonic phase shift; and a much wider spread of audio band pass.

A design engineer would say that the two tightly wound primary windings in each bifilar arrangement look like one winding to its secondary. Or, to put differently, the effective turns ratio between primary and secondary is reduced by a factor of 2 : 1. Over conventional pushpull arrangements a coupling advantage of 4 : 1 results. The designers claim an overall advantage of 16 : 1 for their circuit due to the shunting capacitance impedance advantage of 4 plus the simultaneous coupling advantage of 4. A considerable improvement in circuit characteristics has been developed which holds regardless of the class of operation of the output tubes, (*A* or *B*).

Feedback

Some directly coupled negative voltage feedback in the final stage is indicated schematically in *Fig. 4*. As stated earlier, under "Output Primary", half the output load is in the cathode winding and the other half load is in the plate winding. Because of this distribution of load, most of the gain of this final stage is lost through direct feedback. However,

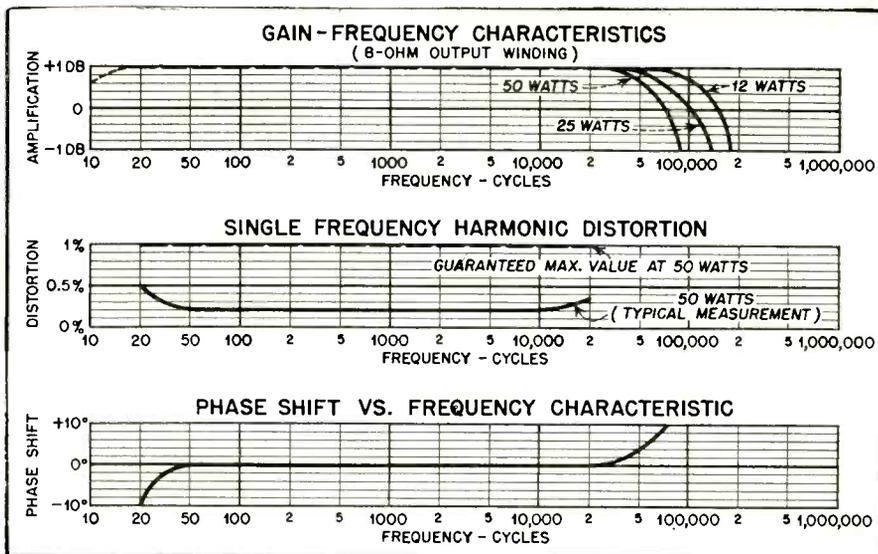


Fig. 5—Unequalized linear performance characteristics of McIntosh 50W-1 amplifier.

adequate overall gain overrides this feature.

A second component of feedback is derived through insertion of equally valued resistors between the output cathodes and the cathodes of the phase inversion stage. This second feedback improves amplifier linearity and reduces internal generator impedance for the amplifier to the extent that, looking back from the 8-ohm winding, the value is reduced to 8/10th of one ohm. The effect of final load upon effective amplification is fairly well isolated because of the final low value of internal generator impedance. In some cases it has been possible to reduce the internal generator impedance to 1/100th of the nominal impedance. In the case of the model 50W-1 amplifier, shown schematically in *Fig. 3*, outputs of 4, 8, 16, 32, and 600 ohms are provided. The first four values are available balanced or unbalanced while the 600 ohm output is balanced and is tapped from the output primary, connected to the cathodes and mid-tapped to ground. An isolated 600 ohm output is possible if ordered.

Performance Characteristics

Unequalized yet linear performance of this unit is shown by the curves of *Fig. 5*. The extensive gain-frequency spread results from direct intent to design an amplifier which would deliver a 50 watt output between 20 and 20,000 cps with less than 1% harmonic or intermodulation distortion. Note the extension of the gain-frequency curve for reduced power output. These wide bands were found necessary for control of phase shift so that feedback of higher fundamental frequencies and their harmonics would be in proper phase relationship to cancel out and

thus retain linearity. The importance of phase shift control is accentuated when we realize that a 45 degree phase may result in a 3 db change in frequency response. Stability pays off. Equalization facilities recommended for use with this amplifier are described under, "Constructional Features." Discreet selection of any other compensation is necessary to avoid introduction of distortion.

Constructional Features

Above the boxed-in and highly shielded transformers and amplifier sections, several sockets are provided for plug-in flexibility. For example; the plug-in pre-amplifier (*Fig. 4*) provides an extra gain of 34 db over a zero input otherwise plugged directly into the inverter stage. The volume control is a plug-in unit as is an input transformer. The latter may be connected for 30, 150, or 600 ohms, or for a high impedance bridging input. The phase inverter stage is a plug-in unit readily removable for servicing or replacement. Provision is made for inclusion of a remote console with tone control, additional preamplifiers, and switching for microphone, phono, or radio inputs.

An AE-2 amplifier-equalizer is available for use with the 50W-1 or other amplifiers. This unit has a self-contained power supply and employs four cathode-coupled stages, as well as four plate-loaded stages, to provide a four volt output with less than 0.3% distortion throughout the range of 20-20,000 cps. Five input channels accommodate : crystal pickup, FM-AM tuner, Pickering pickup, G.E. pickup, or low level microphone. A turnover at 300 or 500 cps is available at a 6 db per octave rate.

TRANSISTORS

by LEONARD LIEBERMAN

The imminence of the use of transistors in electronic circuits makes it mandatory for the serviceman to understand this new device. This article is a simple non-mathematical treatment of the subject.

THE use of transistors in commercial electronic circuits is, at present, "just a small cloud on the horizon, no larger than a man's hand." They may, if projects under development come through, suddenly spring up and envelop the entire electronics industry. At the present start of the art, they are not as good as Sunday supplement type articles imply, nor as miserable as the traditionalist states. They are not ready to turn out wrist-watch transceivers, but they can do much more than become good noise sources. The coming importance of transistors, is indicated by the fact that the Institute of Radio Engineers is devoting an entire issue of their publication to this subject.

Why is there a need for something which has taken fabulous amounts of money for research? Make no mistake about it, a vast amount of the industry's best minds and facilities have been devoted to just such research. In the first place, the vacuum tube is a very inefficient device, has a comparatively short lifetime and is a hog for power consumption. See Table 1 for comparative features.

This article has been prepared to give the practicing service man, a rough idea of how the transistor works. There will be little or no attempt to offer mathematical proofs, but there is a vast accumulation of articles on the transistor which can supply the intricate mathematics of semi-conductors for those service men who are inclined in that direction.

To understand the operation of transistors, it would be worth while to go over some high-school physics and chemistry. The reason for this is found in the fact that the operation of solid state semi-conductors depends on some elementary physical and chemical properties of this material. The basic building stone of the entire transistor branch of electronics is not merely the atom as such, as in the traditional branch, but its characteristics in crystal form and in the presence of other materials.

You are, no doubt, well aware that the atom consists of a nucleus with a positive charge given it by charged particles, called protons. Around the nucleus in mutually exclusive orbits

	POINT CONTACT TRANSISTOR	JUNCTION TRANSISTOR	VACUUM TUBE
GAIN	20-30 DB.	30-50 DB.	20-50 DB.
EFFICIENCY	30%	45%	.1-25%
LIFE	70,000 HRS.	90,000 HRS.	5000 HRS.
TEMPERATURE	70°C	70°C	500°C
NOISE FIGURE	45 DB.	15 DB.	10-30 DB.
POWER	100 MW.	1 WATT.	1 MEGAWATT

Table 1—Comparison of transistors to vacuum tubes.

are the electrons. The electrons are arranged in so-called valence rings. That is, the electrons are so arranged that the orbits of each electron in a valence ring are equi-distant from the nucleus. The elements whose valence is such that the outer ring is complete, have a very stable characteristic, both electrically and chemically. They are generally called inert.

Elements whose outer ring contain more or less than half the required

particles to complete the ring are chemically and electrically active. The elements whose rings are less than half full are non-conductive or insulating elements. That is to say, they would tend to absorb electrons to complete the ring. Those with more than half a complete ring, tend to become conductive.

The elements with which transistor theory is concerned with are those whose outer rings are exactly half filled. These elements like silicon and germanium will under some conditions act as insulators and under other conditions as conductors. This characteristic gives rise to their electrical name; semi-conductors.

The atoms of these elements in pure form align themselves into crystals whose structure is such that the half rings are shared. This creates a comparatively stable structure. The application of heat, however, will cause some of the electrons to break out of these rings. When this occurs, the element is in a conductive condition. By this is meant that the connection of a battery across the material will cause current flow.

Before going into a detailed examination let us first define some terms and examine some basic operational relations in a transistor. The descriptive convention calls the input or current source, an emitter, and the output side is called the collector.

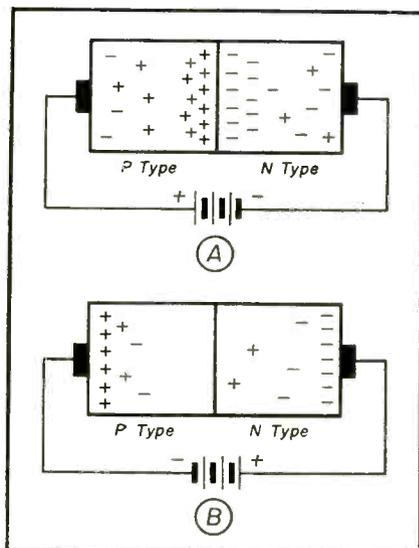


Fig. 1—Effect of bias voltages on P and N type transistors.

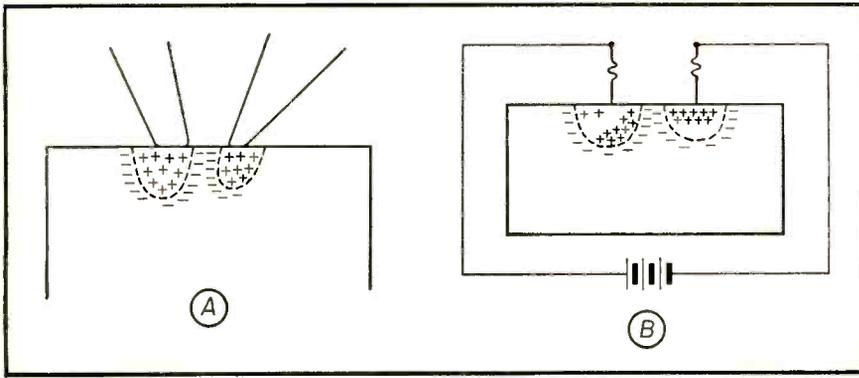


Fig. 2—Creation of P and N zones at fusion points in point contact transistors.

Any section of a transistor which is electron-deficient and thus has an overall positive charge is called a P element. The crystals which are short an electron are called holes. The holes have the property of taking an electron from neighboring crystals creating a hole there. This movement or shifting of the electron deficiency is termed hole movement or hole current. Crystals which have an excess of electrons are called N type elements. These excess electrons move in a random manner through the crystals and tend to knock established electrons out of crystals and replacing the knocked-out electron will in turn move through the material at random and will knock some other electron out of its crystal ring and so on. This movement is similar to random current in any conductor.

Figure 1 shows the action which occurs when a P type and an N type element are brought together, fused and a voltage source is supplied to them. Note that when the (+) side of the battery is connected to the P side of the material and the (-) side to the N side the electrons and the holes move to the center barrier and there is very little current flow. When the battery connections are reversed as in (B), then there is a heavy current flow.

It was found that when two wires were fused close together on a piece of germanium, something new was obtained. As a result of this fusion, the germanium permitted current to flow through the wires. This current flowed from one wire through the germanium to the other wire. Some very interesting side effects were noted. First, the current on the output side was greater than the current on the input side. Thus, the point contact transistor is a current gain device in contrast to the vacuum tube which is a voltage gain device. Second, it was noted that there was no phase

reversal of the signal. Finally, it was noted that the input or emitter side had to be biased with a positive voltage and the output side had to be biased with a negative voltage.

The reason for these effects can be seen in Fig. 2A. When the wires are fused to the germanium, the heat of fusion knocks some electrons off the

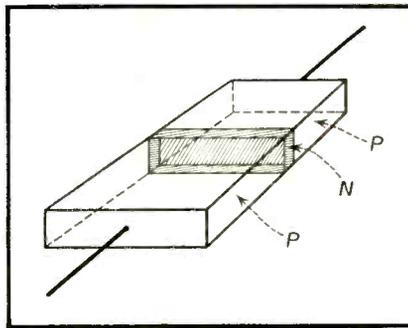


Fig. 3—Structure of a P-N-P junction transistor.

crystals. This creates a so-called "P-zone" under the wires. The P-zone is electron-deficient and as a result has an over-all positive charge. Between the two P-zones is an N-zone which has an electron surplus from the electrons which have left the P-zones.

If a battery is connected as shown in Fig. 2B the (+) side of the battery causes a movement of the positive "holes" from the fusion point towards the N-zone. There is some movement of electrons from the crystals near the fusion point through the wire to the battery. This is a measurable current flow. At the other end of the circuit, we find that the (-) end of the battery causes a heavy accumulation of "holes" near the fusion point. This causes a heavy flow of electrons from the battery into the junction point. In addition, the negative charge of the battery causes some of the holes from the input side to travel through the N-zone further increasing the output junction's positive charge. This

movement further increases the electron flow from the battery. The result is an output current which can be 4 to 5 times greater than the input current.

The input impedance of the joint contact transistor is approximately 40,000 ohms. The output impedance is about 400 ohms. This results in a system which shows the following characteristics. First, extreme instability in sine wave operation. Second, an exceedingly high noise figure originating at the contact fusion point. These two factors limit the use of point contact transistor in sine wave applications but do not stop its use in switching circuitry, flip-flop multivibrators where the device is strictly a one shot deal and does not require sustained continuous performance.

When these limitations of the point contact transistors became apparent, means were sought to utilize the inherently good characteristics of the semi-conductors. It was discovered that minute impurities from certain elements in the 3rd and 5th periodic valence tables could be introduced into pure germanium or pure silicon. It was further found that by the introduction of these elements from one or the other of these tables could create P or N type semi-conductors depending on which table the impurity came from.

Elements from the 3rd periodic table which have only three electrons in their outer ring create a situation of electron deficiency resulting in a P or "hole" material. Elements from the 5th table creates an N or electron excess material. These elements are not chemically bound to the base material in the form of a compound but are a mixture. The amount of impurity introduced is, as mentioned before, extremely small (approximately 1 part in 10^{18} parts of the base). The amount of impurity introduced is critical. This is one of the

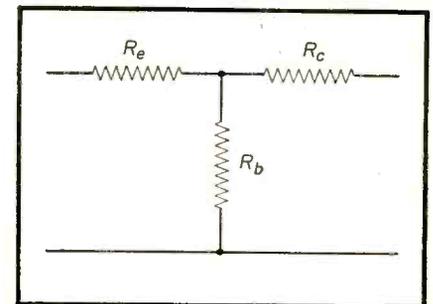


Fig. 4—Transistor equivalent circuit.

Re=Emitter resistance.
Rc=Collector resistance.
Rb=Base resistance.

main reasons for non-uniform production of transistors, at present.

Further investigation showed that if a thin layer of one type of element was sandwiched between two pieces of the opposite type (Fig. 3) a usable transistor is formed. The designations N-P-N and P-N-P literally denote which is the sandwiched-in element and which are the outside elements. These transistors were found to have several very useful properties. First, the crystals could be made to form or grow around the conductive lead. This eliminated the fusing of the wire to the crystal which we have seen is the major source of noise in the point contact transistor. The noise figure dropped from 94 db in the point contact type to about 20 db in the junction type. This last figure compares well with the noise figure of the average vacuum tube. Second, as a result of the barrier section the transistor becomes a voltage gain device with an exceedingly high efficiency. The junction type transistor will deliver to the output circuit as high as 50%-60% of the power put into it compared to the 20%-25% efficiency in a vacuum tube operated Class A.

By careful mixture of impurities in the various sections and controlling the thickness of the barrier layer, power gains in the order of 10,000 from input to output are possible. In the junction type of transistor in contrast to the point contact type, the output current is never as large as the input current. However, depending on the thickness of the barrier or base layer, it can be made to be as much as .99 of the input. Since the ratio of output impedance to input impedance is approximately 100:1 the

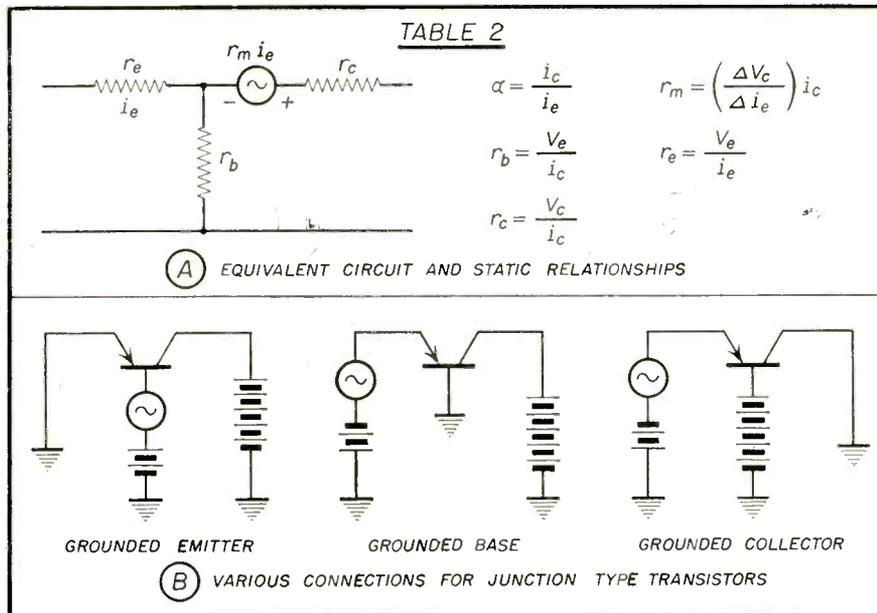


Table 2—Relationship of various static characteristics.

possibility of a tremendous power gain is evident. The difference between the current out and the current in is designated by the symbol, ∞ .

The elements in the transistors can be made roughly analogous to vacuum tube elements. The emitter can be compared to the cathode, the base can be compared to the grid and the collector is similar to the tube plate. It should be remembered that while these may correspond to the tube elements, depending on the type of junction transistor, the direction of current flow may be opposite to that in a tube. For the purposes of analytical presentation of the characteristics of a transistor, it can be drawn as in Fig. 4. R_e is the emitter resistance,

R_b is the base resistance and R_c is the collector resistance.

Figure 5 is a sample of the possible future design of r-f or i-f amplifiers in AM broadcast band receivers. As a result of the fixed input and output impedances, the stage couplings are of the series fed type rather than the traditional parallel shunt type. Note, also, the way that the biasing voltages are applied.

For general information and without going into the detailed derivations, Table 2 shows the relationship of the various static characteristics.

In conclusion, let us now examine more fully, the advantages and limitations of transistors. First, the advantages:

1. Their power and requirements are smaller than the vacuum tube.
2. They require no large power consuming filament supplies.
3. Since there are no filaments to burn up or open up, no cathodes to lose their coating, no grids to become contaminated and no fragile elements to shake loose, the life of a transistor is from 20 to 30 times that of a ruggedized tube.
4. The amount of signal required for linear operation is extremely small.
5. Constant research is bringing out significant major improvements and corrections of present limitations.

An example of this progress is the announcement of the development of a tetrode transistor. It is claimed that

(Continued on page 58)

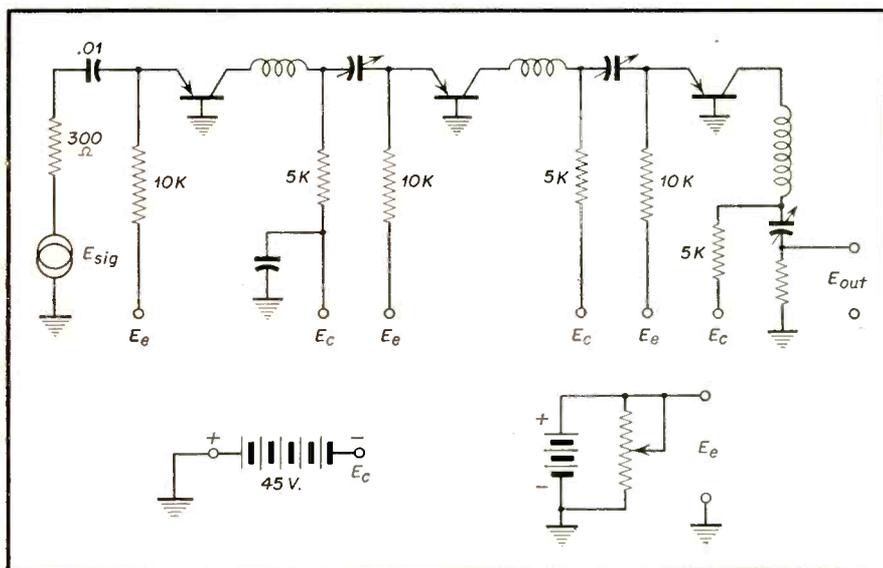


Fig. 5—Schematic of r-f amplifier using transistors.

VIDEO SPEED SERVICING SYSTEMS

3rd INSTALLMENT

CUMULATIVE INDEX

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Admiral	21 Series	Sync	November	28	21-12
Admiral	21 Series	Sound	December	38	21-13
Admiral	21 Series	Raster	December	39	21-14
Admiral	21 Series	Sync	December	39	21-15
Admiral	21 Series	Sync	December	40	21-16
Admiral	21 Series	Sync	December	40	21-17
Admiral	21 Series	Sync	December	40	21-18
Capehart	CX-33	Pix	December	41	B-1
Capehart	CX-33	Pix and Sound	December	41	B-2
Capehart	CX-33	Raster	December	41	B-3
Capehart	CX-33	Pix	December	42	B-4
Capehart	CX-33	Pix	December	42	B-5
Capehart	CX-33	Pix	December	42	B-6
Capehart	CX-33	Pix	December	42	H-1
Du Mont	RA 112-113	Pix and Sound	November	29	H-2
Du Mont	RA 112-113	Pix	November	29	H-3
Du Mont	RA 112-113	Pix	November	29	H-4
Du Mont	RA 112-113	Pix	November	30	H-4
Du Mont	RA 112-113	Pix	November	30	H-5
Du Mont	RA 112-113	Pix	November	30	H-6
Emerson	120129	Raster	November	30	H-6
Emerson	120129	Entire Set	December	43	I-1
Emerson	120129	Pix	December	43	I-2
Emerson	120129	Pix	December	43	I-3
Emerson	120129	Pix	December	43	I-4
Emerson	120129	Pix	December	44	I-5
Emerson	120129	Pix	December	44	I-6
Hoffman	170 Series	Pix	November	31	D-1
Hoffman	170 Series	Pix	November	31	D-2
Hoffman	170 Series	Pix	November	31	D-3
Hoffman	170 Series	Pix	November	31	D-4
Hoffman	170 Series	Raster	November	32	D-5
Hoffman	170 Series	Sound	November	32	D-6
Hoffman	170 Series	Pix	November	32	A-50-1
Philco	50-T1400	Pix	November	33	A-50-2
Philco	50-T1400	Pix	November	33	A-50-3
Philco	50-T1400	Sync	November	33	A-50-4
Philco	50-T1400	Pix	November	34	A-50-5
Philco	50-T1400	Sync	November	34	A-50-6
Philco	50-T1400	Pix	November	34	K-50-1
Philco	50-T1600	Raster	December	45	K-50-2
Philco	50-T1600	Raster	December	45	K-50-3
Philco	50-T1600	Raster	December	45	K-50-4
Philco	50-T1600	Pix	December	46	K-50-5
Philco	50-T1600	Sound and Pix	December	46	K-50-6
Philco	50-T1600	Sound	December	46	A-51-1
Philco	51-T1601	Sync	October	43	A-51-2
Philco	51-T1601	Raster	October	43	A-51-3
Philco	51-T1601	Pix	October	43	A-51-4
Philco	51-T1601	Pix	October	44	A-51-5
Philco	51-T1601	Sync	October	44	A-51-6
Philco	51-T1601	Sync	October	44	A-50-1
RCA	KCS-34	Raster	October	45	A-50-2
RCA	KCS-34	Sync	October	45	A-50-3
RCA	KCS-34	Sync	October	45	A-50-4
RCA	KCS-34	Sound	October	46	A-50-5
RCA	KCS-34	Pix	October	46	A-50-6
RCA	KCS-34	Pix	October	46	24-1
Stromberg-Carlson	24C,24RP	Pix	October	47	24-2
Stromberg-Carlson	24C,24RP	Pix	October	47	24-3
Stromberg-Carlson	24C,24RP	Pix	October	47	24-4
Stromberg-Carlson	24C,24RP	Sync	October	48	24-5
Stromberg-Carlson	24C,24RP	Pix	October	48	24-6
Stromberg-Carlson	24C,24RP	Pix	October	48	

Mfgr: Admiral Model No. 21 series

Card No. 21-13

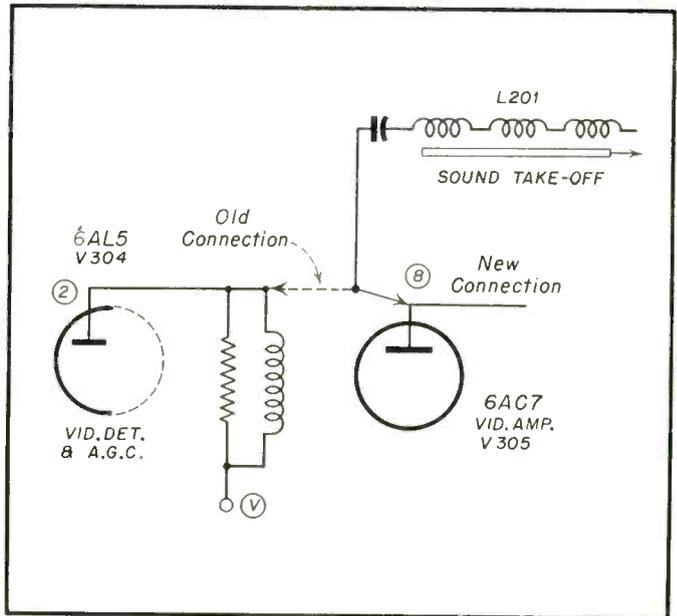
Section Affected: Sound

Symptom: Low audio in fringe areas.

Reason For Change: To increase audio gain in fringe areas

What To Do:

Disconnect audio lead from pin 2 of V304 and connect it to pin 8 of V305. Retune L201 sound take-off coil. Use station signal.



Mfgr: Admiral Model No. 21 series

Card No. 21-14

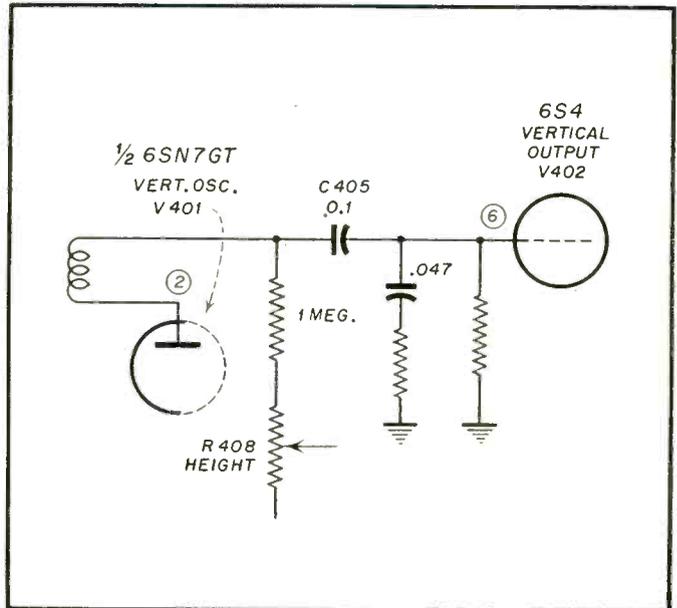
Section: Raster

Symptom: Several trace line appearing as white band across rasters, and/or insufficient height.

Cause: Leaky condenser C405 or defective 654

What To Do:

1. Check V402-6S4 vertical output.
2. Check C405 - 0.1 μ f



Mfgr: Admiral Model No. 21 series using gated (V304-6AU6) a.g.c.

Card No. 21-15

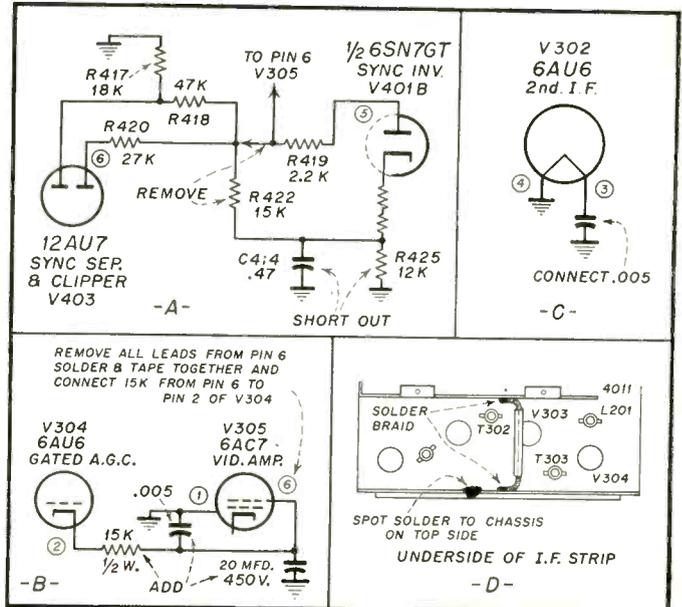
Section: Sync

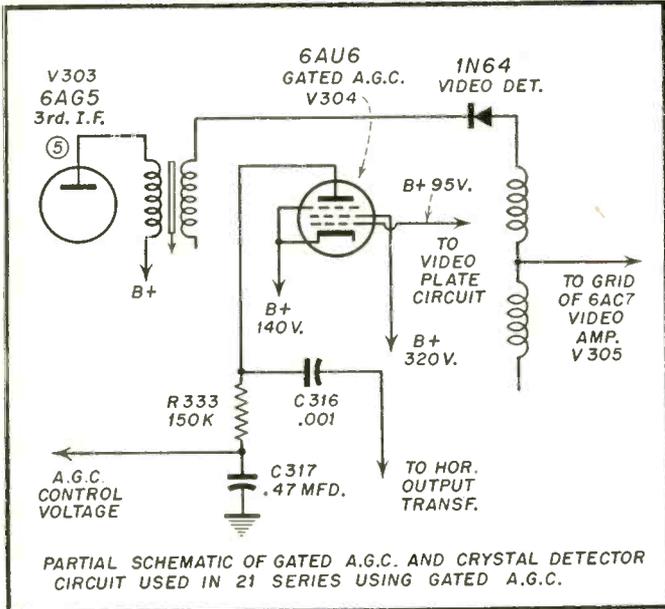
Symptom: Vertical roll and pix washout in weak signal areas.

Reason For Change: To improve sync.

What To Do:

- Remove: R422; short out C414 and R-452 (A); remove Leads from pin 6 of V305 (B).
- Connect: 15K between pin 2 (V304) and pin 6 (V305) (B); also .005 μ f between pin 1 and 6 of V305 (B); also 20 μ f from pin 6 of V305 to ground (B).
- Remove: R419 from junction of R418 and R420, reconnect to pin 6-V305 (A).
- Replace: R418 with 33K-1W resistor. Use 2 watt on phono-combos.
- Connect: .005 μ f from pin 3 of V302 to ground (C). A 3" length of 1/4" shielded braid as shown in (D). Insulate braid by slipping 2" piece of spaghetti over braid. On top side of chassis spot solder r-i sub-chassis to main chassis at point shown in (D).





Mfgr: Admiral Model No. 21 series using gated (V304-6AU6) a.g.c.

Card No. 21-16

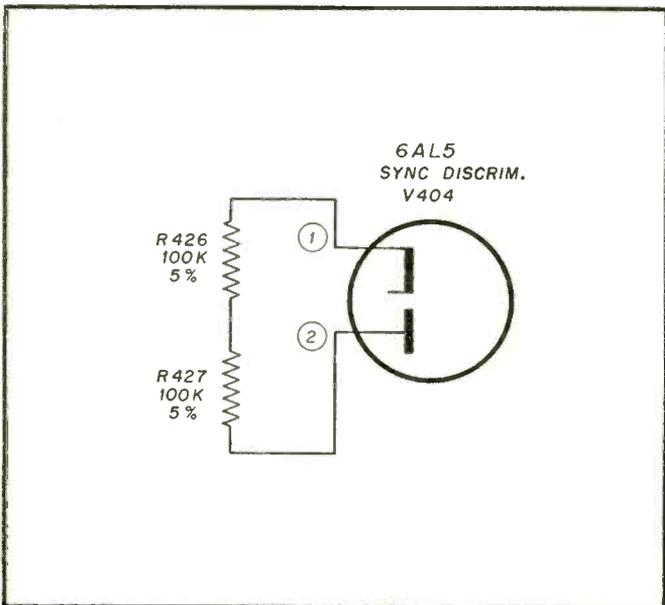
Section Affected: Sync

Symptom: Vertical roll and pix washout in weak signal areas.

Cause: Noise pulses. I-F regeneration. Defective germanium diode M 301. Low line voltage. Improper lead dress. Circuit changes required—see Card No. 21-15.

What To Do:

1. Check sync sep. and clipper V403 (12AU7).
2. Check r-f amp. in tuner V101 (6CB6, 6BC5, or 6AG5) for leakage between elements causing clipping of sync pulses due to incorrect A-G-C voltage.
3. Check video amp. V305 (6AC7). Excessive plate current results in clipping of sync pulses.
4. Check for faulty germanium diode.
5. Dress germanium diode away from pin 5 of a-g-c tube V304 (6AU6). Keep the white lead close to the chassis. Move the orange lead connected to pin 1 of a-g-c tube away from video amp tube V305 (6AC7).



Mfgr: Admiral Model No. 21 series

Card No. 21-17

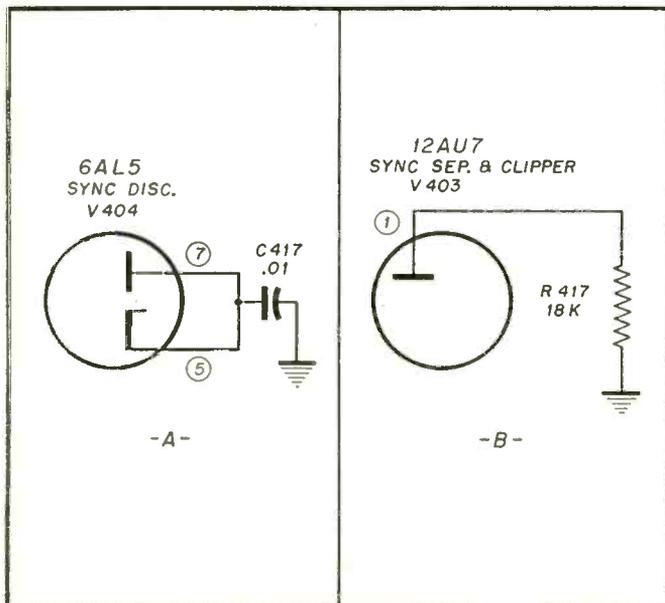
Section Affected: Sync

Symptom: Pix locks in only at center of Horizontal Hold control falls out on both sides.

Cause: R-426 or R-427 changed in value.

What To Do:

1. Check sync disc-tube V-404 and other circuit components.
2. Check R-426 and R-427 for changed values of resistance.



Mfgr: Admiral Model No. 21 series

Card No. 21-18

Section Affected: Sync

Symptom: Picture Bending.

Cause: Loss of sync pulse at video amplifier

What To Do:

1. Check 6BC5 and 6CB6 (leakage between elements).
2. Check hor. lock adj. L401.
3. Check C417 for defective operation (Fig. A).
4. Def. video tubes (high res. short) result in short of a-g-c voltage and overloading video amplifier.
5. Bending near the top of pix: defective V-403 (12AU7) sync sep and clipper. R 417 (18,000) changed in value (Fig. B).

Mfgr: Capehart Chassis No. CX-33

Card No. B-1

Section Affected: Picture

Symptom: Picture tube overloads on strong signal.

Cause: A.G.C. blocks on strong signal due to insufficient filtering.

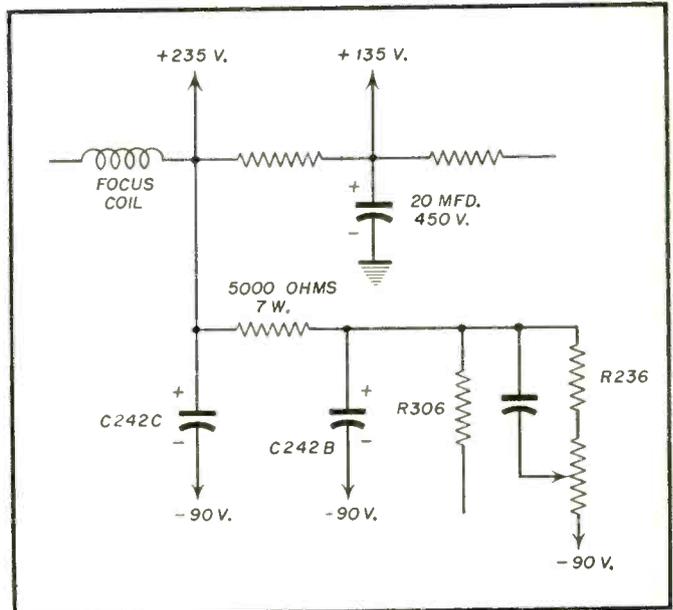
What To Do:

Remove: Present leads from C242b.

Add: 20 μ f-450V condenser. Connect positive side to where C242b was connected. Connect negative side to ground.

Add: 5000 ohm-7 watt wire wound resistor from positive side of C242c to positive side of 242b.

Reconnect: R236 and R306 from +135V to positive side of C242b.



Mfgr: Capehart Chassis No. CX-33

Card No. B-2

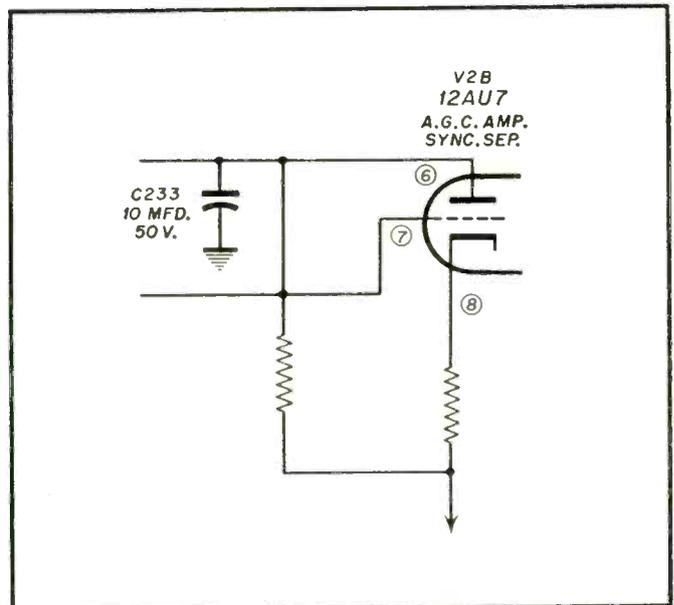
Section Affected: Picture and Sound

Symptom: "Frying" noise and multiple horizontal bars through raster.

Cause: By-pass condenser arcing internally.

What To Do:

Replace: C233.



Mfgr: Capehart Chassis No. CX-33

Card No. B-3

Section Affected: Raster

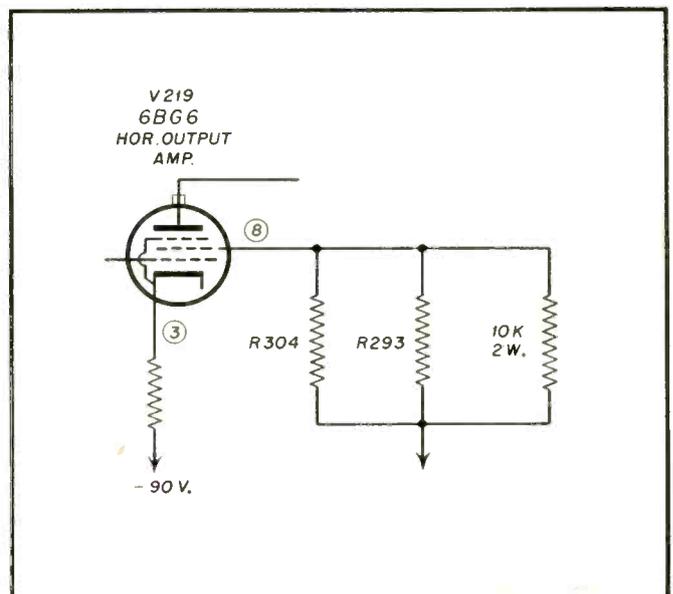
Symptom: Insufficient high voltage.

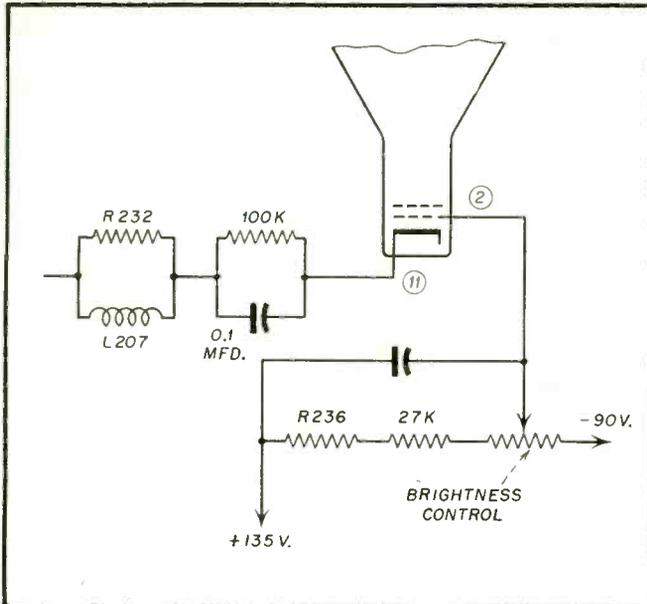
Cause: Low output from horizontal output amplifier.

What To Do:

Add: 10k-2w resistor in shunt with R293 & R304.

Connect:





Mfgr: Capehart Chassis No. CX-33

Card No. B-4

Section Affected: Picture

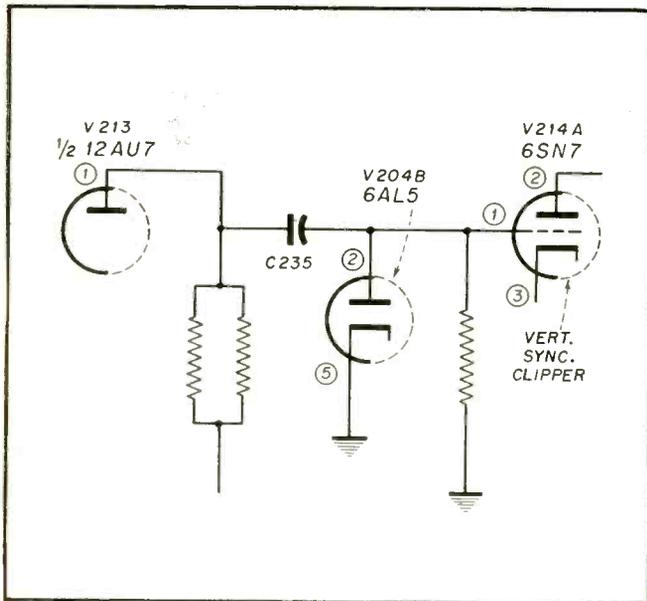
Symptom: Picture blooms.

Cause: Poor regulation of picture tube current.

What To Do:

Add: 100k resistor and .01 μ i condenser in parallel between cathode of V211 (CRT) and junction of R232 and L207.

Add: 27K resistor in series with R236.



Mfgr: Capehart Chassis No. CX-33

Card No. B-5

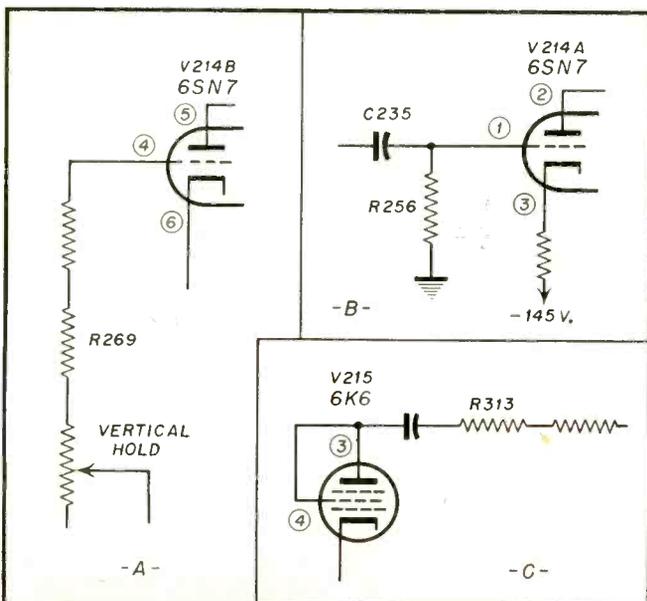
Section Affected: Picture

Symptom: Vertical jitter.

Cause: Leaky coupling condenser.

What To Do:

Replace: C235 (100 μ f).



Mfgr: Capehart Chassis No. CX-33

Card No. B-6

Section Affected: Picture

Symptom: Vertical instability.

Cause: Changes in component values.

What To Do:

Check: R269-38K (Fig. A).

R256-3.9 meg. (Fig. B).

R313-47K (Fig. C).

C235 for leakage (Fig. B).

Mfgr. Emerson Chassis No. 120129

Card No. I-1 Code No. $\Delta 3$

Section Affected: Entire set

Symptom Erratic operation.

Cause: Erratic Io-voltage

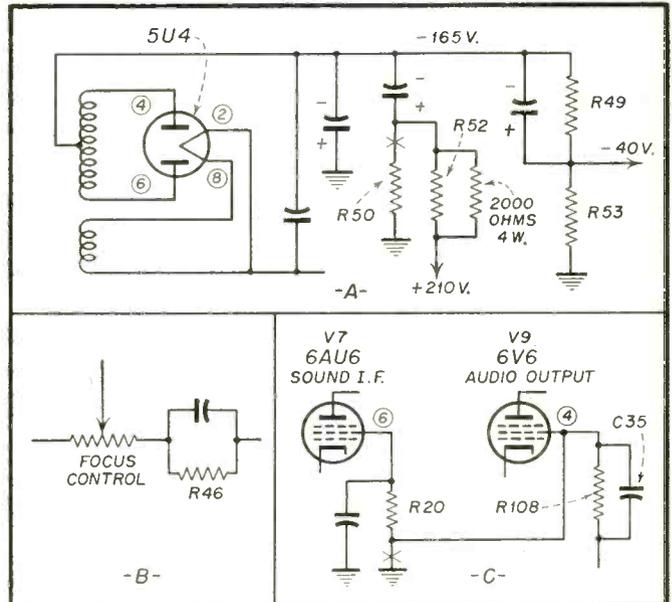
What To Do:

Change: R49 from 4K-10w to 9K-4w (Fig. A), and R53 from 1K-5W to 1.7K-4W (Fig. A), and R20 from 27K-1W to 39K-1W (Fig. C).

Remove: R50-8K-110W (Fig. A and R46-30K-5W (Fig. B).

Reconnect: R20 from ground to junction of R108, C36.

Add: 2K-4W resistor in parallel with R52 (Fig. A).



Mfgr. Emerson Chassis No. 120129

Card No. I-2 Code No. ΔB

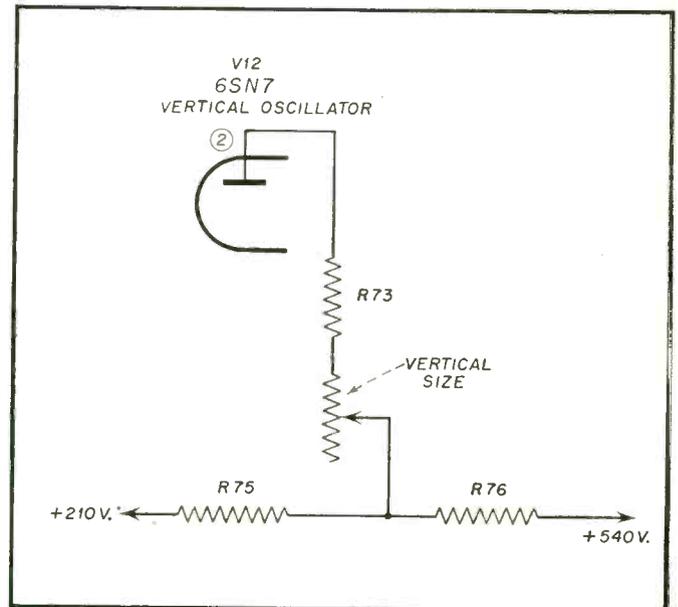
Section Affected: Picture

Symptom: Poor vertical size and linearity.

Reason For Change: Circuit improvement.

What To Do:

Change R75 from 220K to 150K $\frac{1}{2}$ W, and R76 from 150K to 220K $\frac{1}{2}$ W.



Mfgr. Emerson Chassis No. 120129

Card No. I-3 Code No. ΔD

Section Affected: Picture

Symptom: Unstable sync under noise conditions.

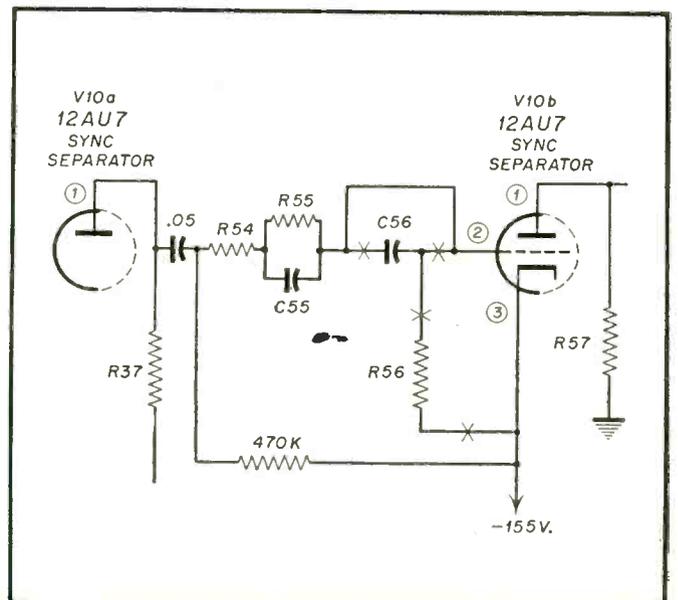
Cause: Sync time constants changed.

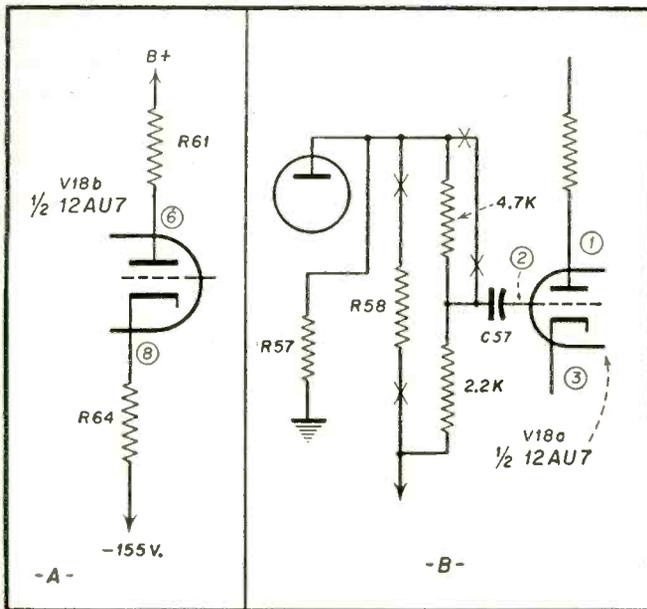
What To Do:

Change: R37 from 10K to 47K; R55 from 330K to 2.2K, and C55 from 220 μ f to 110 μ f.

Remove: R56 and C56.

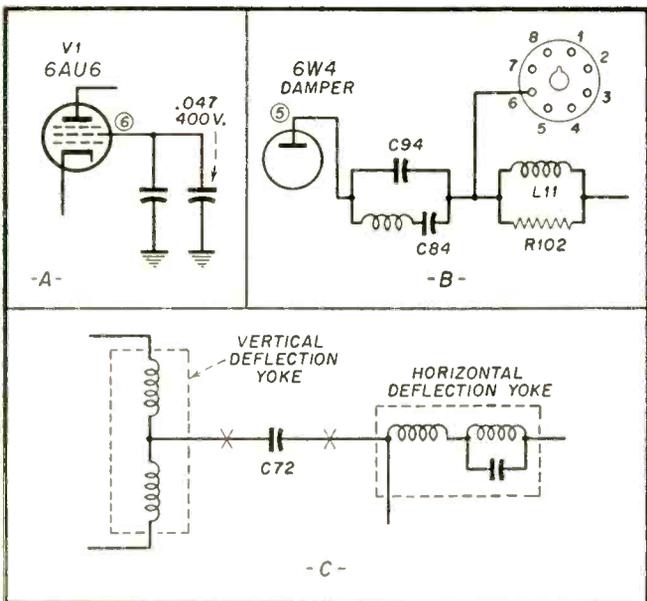
Add: .05 μ f/400 v condenser from pin 1-V10a to R54, and 470K $\frac{1}{2}$ W resistor from R54 to pin 3-V10b.





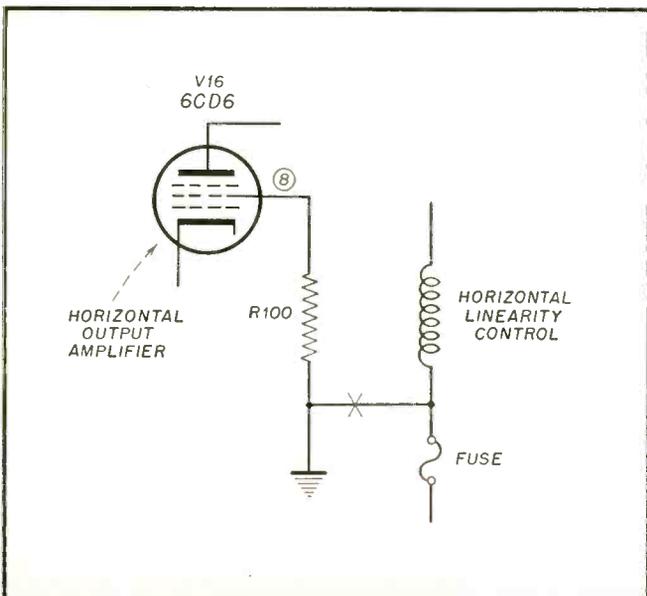
Mfgr. Emerson Chassis No. 120129
 Card No. I-4 Code No. ΔA
 Section Affected: Picture
 Symptom: "Jittery" sync.
 Reason For Change: Improve sync stability.

What To Do:
 Change: R64 from 1500 ohms to 1000 ohms (Fig. A); R61 from 220 ohms to 330 ohms (Fig. A).
 Remove: R58.
 Add: 4.7K resistor in series with a 2.2K in place of R58.
 Reconnect: C57 to midpoint of 4.7K and 2.2K resistors added.



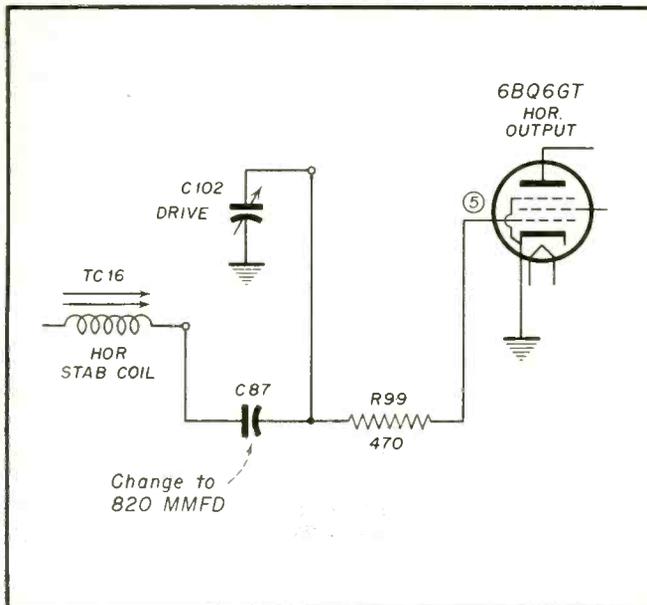
Mfgr. Emerson Chassis No. 120129
 Card No. I-5 Code No. ΔC
 Section Affected: Pix
 Symptom: Poor interlace.
 Cause: Horizontal pulses spraying into vertical system.

What To Do:
 Remove: C72 (270 μf) in deflection yoke (Fig. C).
 Add: .047 μf /400 V condenser from screen of V1 (pin 6) to ground (Fig. A). Add jumper from pin 5 of yoke plug to junction of C94, C83, L11 and R102 (Fig. B).



Mfgr. Emerson Chassis No. 120129
 Card No. I-6 Code No. $\Delta 8$
 Section Affected: Picture
 Symptom: Insufficient width.
 Cause: Insufficient horizontal amplifier output

What To Do:
 Change: R100 from 11K-1W to 2.7K-1W.
 Reconnect: Low end of R100 from junction of linearity coil and fuse to ground.



Mfgr: Philco Model No: 50-T1600

Card No. K-50-4

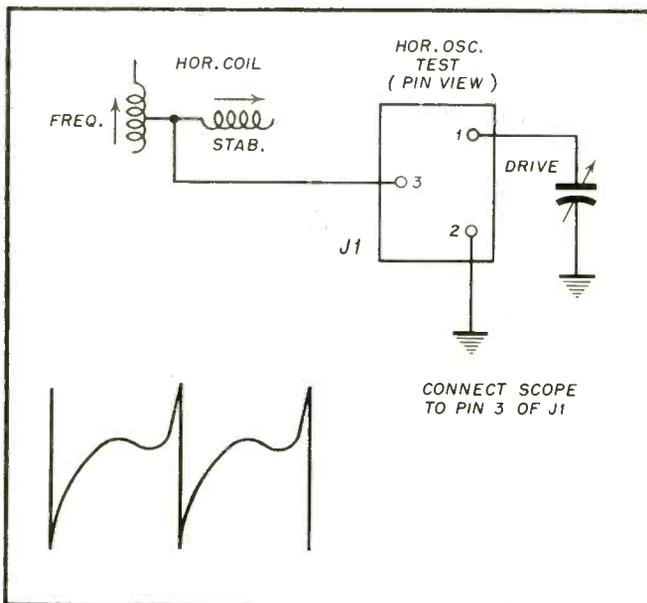
Section Affected: Pix

Symptom: Interaction between width and linearity coils.

Reason For Change: To reduce interaction between width and linearity adjustments.

What To Do:

1. C87 changed to 820 μ f.



Mfgr: Philco Model No: 50-T1600

Card No: K-50-5

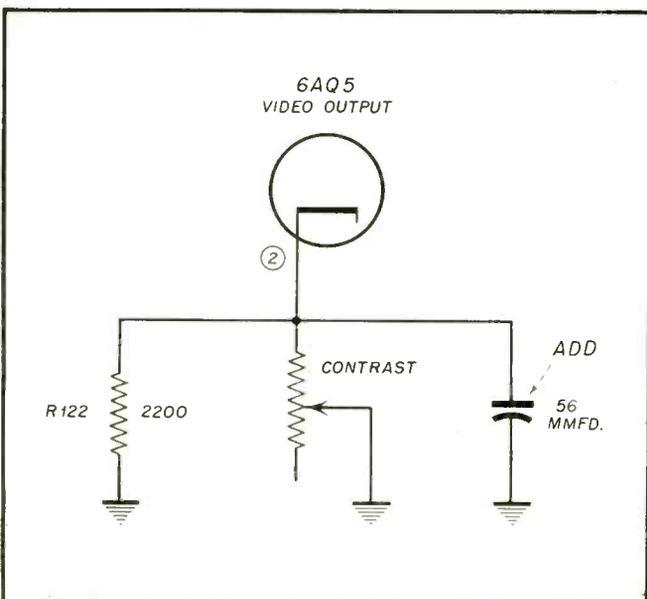
Section Affected: Sound & Pix

Symptom: Shrill sound accompanied by out-of-sync condition when Hor. Hold control is rotated in extreme clockwise or counter clockwise position—"Gunboating"

Cause: Adjustment of horizontal blocking oscillator core.

What To Do:

1. Turn Horizontal Hold control fully clockwise. Adjust frequency core of horizontal transformer to obtain 5 blanking bar sloping to right.
2. If gunboating persists; rotate horizontal hold control away from fully clockwise position momentarily; return to fully clockwise position and reset frequency core.
3. In strong-signal areas "gunboating" may be reduce by adjusting stabilizing core to obtain waveform shown in figure. Note that rounded positions are below peaks.



Mfgr: Philco Model No: 50-T1600

Card No: K-50-6

Section Affected: Sound

Symptom: Sync buzz

Reason For Change: Reduce lead radiation. (This change was started in chassis beginning with run No. 4)

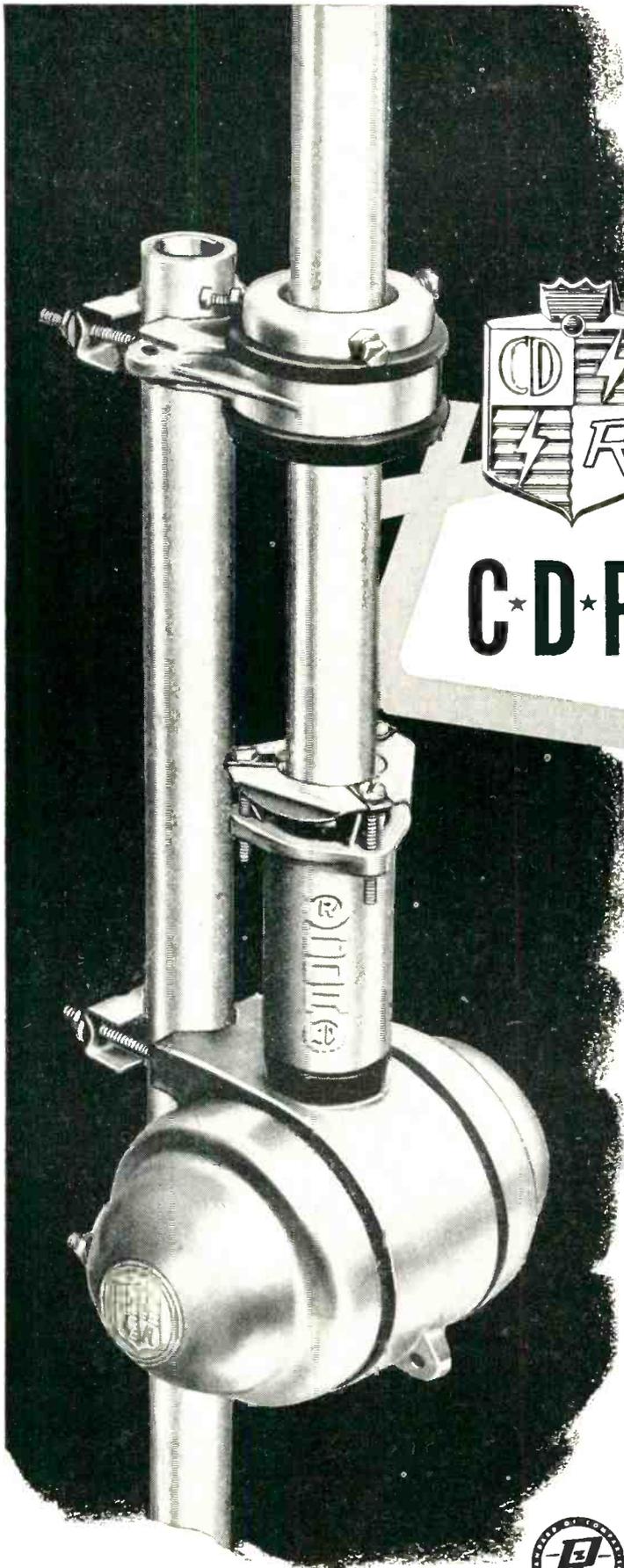
What To Do:

1. Add a 56 μ f condenser from Pin 2 video output tube (6AQ5) to ground.

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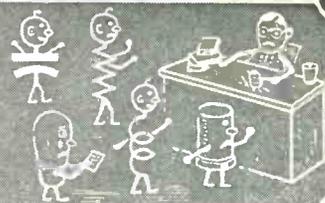
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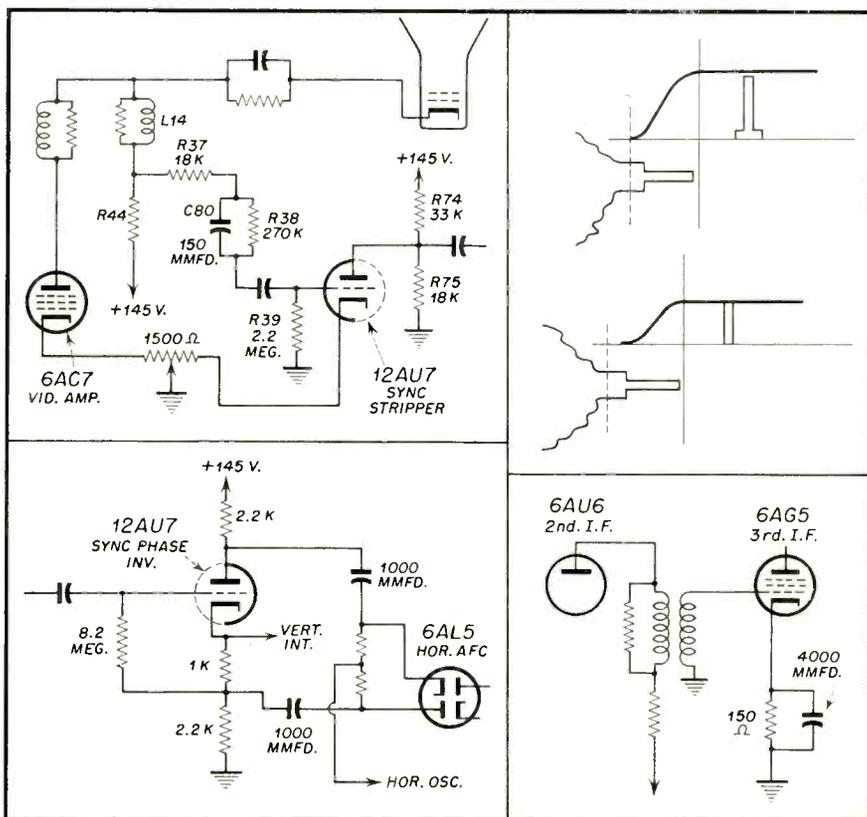
Admiral 21W1-Sync Noise Suppression

The Admiral 21W1 has several interesting circuits. Fig. 1 shows an unusual biasing arrangement for the sync stripper. The cathode of the video amplifier and the cathode of the sync stripper are both connected to opposite sides of the contrast control. The arm of the control is grounded. As the contrast control is varied, the bias on both the video amplifier and sync stripper are varied in opposite directions.

The grid of one half of a 12AU7 which is used as a sync stripper is connected to the plate of the video amplifier. The plate of the stripper tube has a potential +40 volts due to the voltage divider action of R74 and R75.

The video amplifier is a 6AC7 whose plate is d-c coupled to the CRT cathode. The sync is taken off the video amplifier plate load through the network consisting of L14 and R44. The signal is coupled to the grid of the sync stripper through R37 and R38 paralleled by C80 acting as a double time constant noise discriminating circuit. The plate voltage of the sync stripper is so low that its output will tend to compress the top of the sync pulse and also any noise pulses whose amplitude is greater than the sync pulse.

Now let us see how the control operates. In a weak signal area the contrast control is set for a minimum



Figs. 1 to 4—Admiral 21W1 sync noise suppression circuit. Fig. 1 (top left) sync biasing. Fig. 2 (top right) bias set by cathode resistor is shown in upper curve and bias set by grid leak detection is shown in lower curve. Fig. 3 (lower left) phase detection. Fig. 4 (lower right) 3rd i-f tube input circuit.

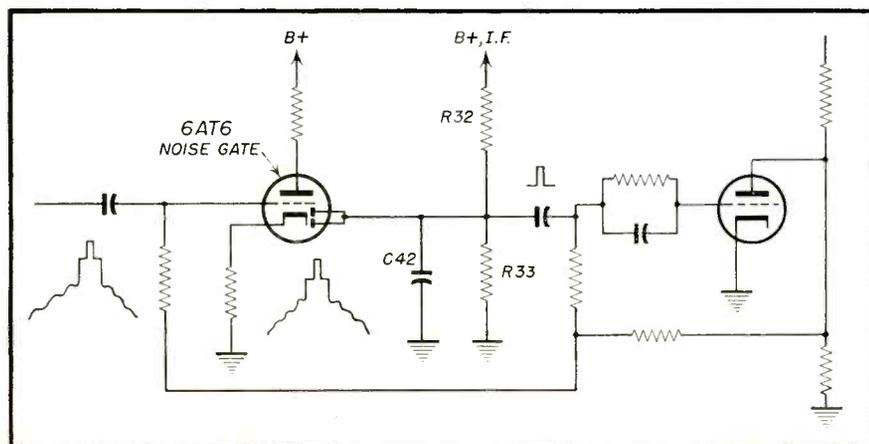


Fig. 5—Partial schematic of Philco Model 52-T2258.

bias. This sets the stripper tube cathode at a high bias. (Fig. 2-top). The signal input is set so the video information falls in the cut-off region and only the sync pulse is passed.

In a strong signal area the contrast control is set for a maximum resistance setting the cathode of the stripper tube at or about ground potential. Under these circumstances, the grid resistor (2.2 megs) draws grid current. This cuts the tube off. The RC time of the coupling condenser and grid resistor is such that the tube comes out of cut-off only during the sync pulses and in this way, the video information is stripped from the sync

[Continued on page 60]



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Most complete work on 'scopes! What they are, what they do, construction and capabilities. 992 pages 8½" x 11". 3,000 ill. Cloth cover \$9.00.

3. Vacuum Tube Voltmeters.

All the facts! Design, construction, testing, maintenance, application, etc., of all types of VTVM's. 432 pages 5½" x 8½". 210 ill. Cloth cover \$4.50.

4. Receiving Tube Substitution Guide Book.

Lists 2,500 radio, TV and electronic tube subs in numerical order. Gives ratings, wiring changes, tube base diagrams and characteristics chart. 224 pages. 8½" x 11". Paper cover \$3.00.

4a. First Supplement to Original Guide.

Lists 750 completely new and different tube substitutions. 48 pages 8½" x 11". Paper cover 5.99.

5. UHF Practices and Principles.

The complete, up-to-the-minute story on UHF told in a clear, down-to-earth style. Covers practical, working applications and equipment including brand-name converters. 400 pages. 5½" x 8½". Cloth cover \$6.60.

IT'S NEWS! TELL-A-FAULT

It's Rider's new monthly TV trouble-shooting service. Save countless hours of diagnosis time. Rider experts do your trouble-shooting for you... in pictures, charts, and symptom and cure sheets. Monthly bulletins. Send coupon for complete story—no obligation.

BE SMART... MAIL THIS COUPON TODAY!

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480 Canal Street, New York 13, N. Y.

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Send Free Data on Tell-A-Fault.

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(Please Print)

NEW PRODUCTS

BAR GENERATOR

RMS, manufacturers of television antennas, accessories, and electronic products, has introduced a new low-cost portable bar generator which permits accurate, on-the-spot linearity adjustment of the television receiver.

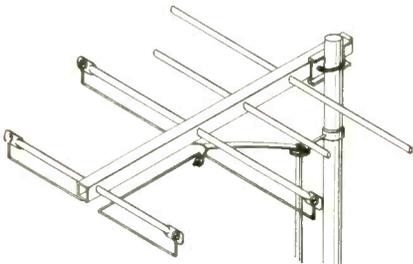


The new instrument, designated Model BAR-1, transmits a modulated carrier on channels: 4, 5, or 6, as predetermined by the service technician, producing both vertical and horizontal bars on the screen. A control is provided for adjusting the number of bars to suit the technician's convenience. By adjusting the linearity controls (and size controls when necessary) of the set so that the bars are properly proportioned across the screen, an accurate linearity adjustment can be quickly made, even when the station is not on the air.

UHF DUPLEX YAGI

Telrex, Inc., Asbury Park, N. J., announces that it is now in production on its new UHF "Duplex" Yagi, Model #300. Deliveries will start about mid November.

The UHF "Duplex" Yagi is a multi-element beam combining high gain with excellent directivity over the entire UHF-TV band, dimensioned specifically for UHF. This array is small in size, light in weight and readily installed above existing VHF antenna systems.



Field tests have demonstrated the extreme sensitivity of the UHF "Duplex" Yagi as well as its ability to suppress 'ghosts' and other interference. Since the unit is supplied fully pre-assembled, it can be installed speedily and without field adjustments.

Technical data on the UHF "Duplex" Yagi, Model 300, and other Telrex UHF antennas, is available on request.

LIGHTNING ARRESTOR

Universal application—plus UHF—are two big features of the new Ward Tri-Wire Lightning Arrestor.

The Tri-Wire can be used with flat 300 ohm line, open line, or UHF-recommended tubular line. It can be mounted on a flat wall or on the mast. Thus, only one arrestor is needed to cover every type of application.

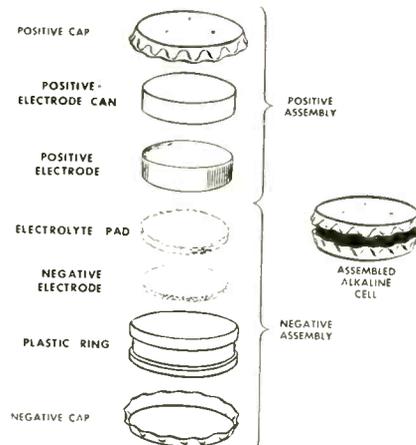
Actual UHF tests of the arrestor in Portland, and additional laboratory comparisons show the Ward Tri-Wire to have less loss than any other type tested.

Ward Tri-Wire Lightning Arrestors are in stock at parts distributors everywhere. They are packed both in bulk, Model TW-1, and a counter display carton, Model TW-2.

ALKALINE RADIO DRY BATTERY

More than a million dollars and three years of engineering research preceded the development of the revolutionary new alkaline "B" radio battery now being marketed by the Tube Department of RCA Victor Division.

Exploded View Of Alkaline Cell
Used in RCA VS 216



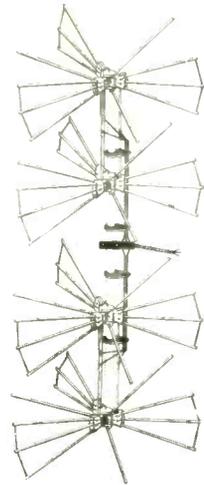
The new battery is nearly 25 per cent smaller than present comparable types, yet offers double "personal radio" playing capacity for the modern radio set designed around it.

The 67½-volt "B" battery (VS216), which is specifically designed for use in personal portable radios, is the first radio dry battery to utilize the alkaline-cell principle which heretofore had been applied successfully only to wet-type, non-portable batteries, according to an RCA spokesman.

NEW DIRECTRONIC ANTENNA

A brand new model in its line of Directronic TV Aerial Systems has been placed on the market by Snyder Manufacturing Company of Philadelphia. Designed by Ed Noll and Matt Mandl, Snyder engineers, the new model is named the Super-Directronic and carries the code AX-548.

As described by Dick Morris, company sales manager, the AX-548 is designed to give the finest reception in ultra-fringe areas where signals arrive from more than a single direction. It employs the Directronic principle of 360° electronically switched beam, giving the benefits of a motor-driven aerial without motors or moving parts. The AX-548 is a 4-bay, 48 element aerial. By means of a new six-position Directronic Beam Selector switch, which mounts on or near the set, remote

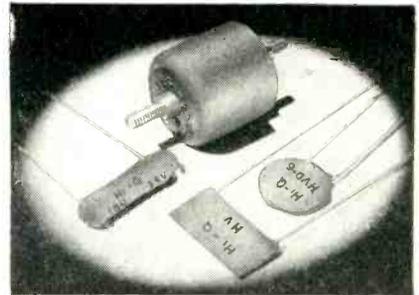


control of element combinations is obtained for perfect picture clarity on every channel.

Catalogs describing the AX-548 Super-Directronic may be obtained by writing to Dick Morris at Snyder Manufacturing Company, Philadelphia 40, Pa.

HIGH-VOLTAGE CERAMIC CAPACITORS

Voltage ratings of from 1 to 20 KV are now made available in Hi-Q ceramic capacitors of the slug, disk, plate and tubular types offered by the Hi-Q Division of Aerovox Corporation, Olean, N. Y.



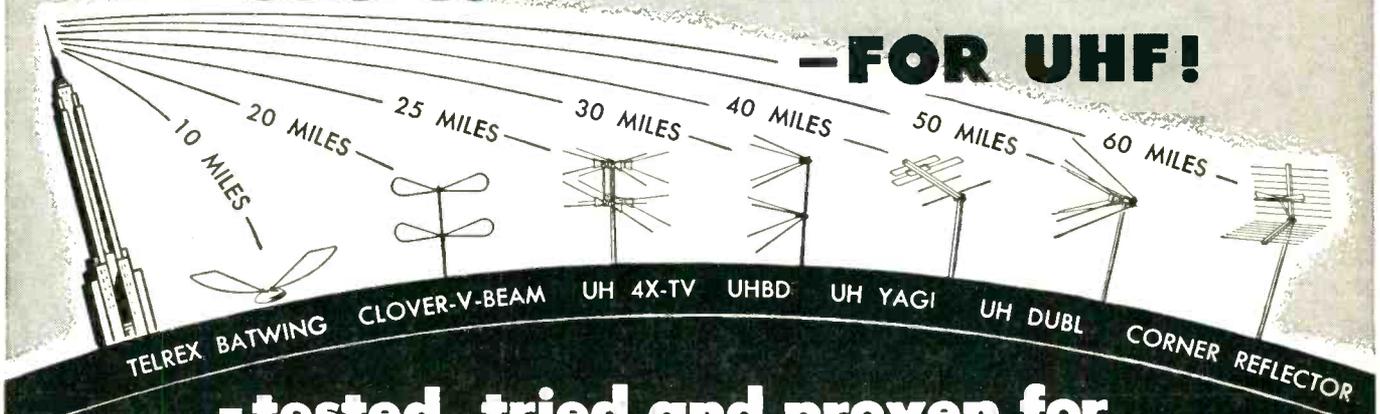
Hi-Q High-Voltage Disks are available in many capacities and voltage ratings. The high-voltage tubulars have been developed specifically for use in horizontal sweep and deflection sections of TV receivers, and come in standard capacitances from 4.7 to 1000 mmf., voltage pulse ratings of 1 to 7 KV and capacity tolerances of 5p%. Physical sizes are contingent on operational specifications or application requirements.

3-SPEED PHONO-GARD

The principle of the new Phono-Gard development is presented as follows: When a record is placed on the turntable, an automatic cycle is initiated by merely pressing a button. This sets the mechanism in motion. A transparent canopy moves forward and completely isolates the turntable and record. Simultaneously, the tone arm moves from its locked and inaccessible position at the rear of the cabinet and is properly positioned over



It's *Telrex* across the nation —FOR UHF!



—tested, tried and proven for every reception area, near or far!

You can depend on Telrex for all your UHF antenna requirements. The same sterling-quality construction featured in VHF models combined with reliable factory ratings assure antenna satisfaction of every UHF installation. The complete Telrex line for UHF

includes famous Conical-V-Beams, Fishbones, Yagis and Bat Wings. There's a Telrex UHF antenna for every area—city, suburban or remote-from-transmitter. When you think of UHF or VHF—think of Telrex!

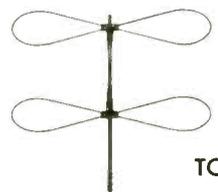


Bat Wing Model
FOR UHF AND VHF
RANGE—FROM 5 TO 10 MILES

Telrex
HURRICANE-BUILT
to survive bad weather!

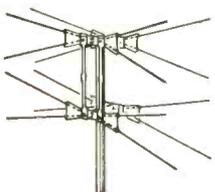
Weather durable materials and superb workmanship continue to make every genuine Telrex antenna super dependable under all climatic extremes. You can be sure of your antenna installation, if it's a Telrex!

Clover-V-Beam



UHF AND VHF ANTENNA
RANGE—FROM 10 TO 20 MILES

Model UH 4X-TV



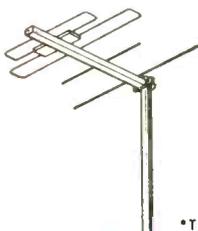
FOR UHF ONLY
RANGE—FROM 15 TO 25 MILES

Model UHBD



UHF AND VHF SERVICE
RANGE—FROM 10 TO 30 MILES

UH Duplex Yagi



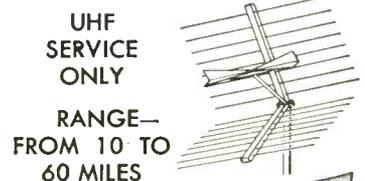
FOR UHF ONLY
RANGE—FROM 10 TO 40 MILES

UH DUBL Conical-V-Beam



FOR BOTH UHF AND VHF
RANGE—FROM 10 TO 50 MILES

Corner Reflector



UHF SERVICE ONLY
RANGE—FROM 10 TO 60 MILES

*TRADEMARK REGISTERED

WRITE FOR CATALOGS ON UHF, VHF AND FM ANTENNAS, NOW!

New illustrated literature contains complete specifications and technical data in addition to installation hints. Call or write Telrex today!

Telrex INC.
CONICAL-V-BEAMS®

AMERICA'S STANDARD OF COMPARISON

Originators and Manufacturers of "CONICAL-V-BEAMS"
—insist on *Telrex* the Original!

ASBURY PARK 5, N. J.

the recording. After the canopy completes its forward motion, the arm is gently lowered into playing position. When the record has been played in its entirety, this action is reversed.

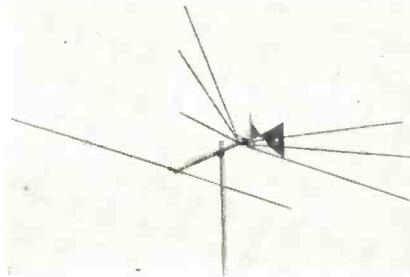
Descriptive Phono-Gard literature will be sent on request. Inquiries should be directed to Grayline Engineering Company, 12233 Avenue "O", Chicago 33, Illinois.

UHF-VHF ANTENNA

Channel Master Corp., Ellenville, N. Y., has announced its new 1953 Ultra-Tenna line, comprising a complete series of UHF TV antennas.

Featured in the line is the Ultra Fan, Model 413. This is an "All-VU" (all VHF, all UHF) antenna which combines Channel Master's well-known VHF Super Fan with a new high-gain, all-channel UHF antenna and reflector.

The UHF section features "free-space" terminals, an exclusive Channel Master development which prevents the accumulation of moisture, soot, ice, and dirt at the antenna feed points. Such accumulations, unavoidable in UHF antennas of standard design, are known to reduce picture quality and to



eventually "short out" the picture completely.

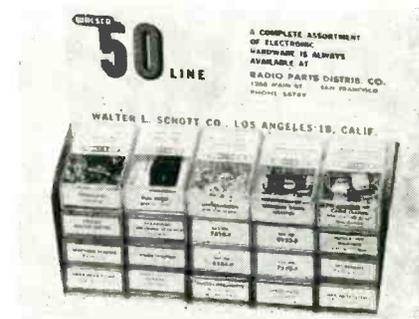
Vibration, another factor which seriously affects UHF reception, has been virtually eliminated in the Ultra Fan by the provision of two stamped holes in the Triangular Dipole. These holes minimize the wind resistance that is characteristic of this type of antenna.

A complete catalog of Channel Master Ultra-Tennas containing detailed information on all new models, such as the Ultra-Bow; the Ultra Bow with reflector; the Ultra Vee; the

Ultra Dapter; and the Ultra Tie; will be sent upon request.

NEW STORAGE TRAY

A new "storage tray" is now available to service men through Walsco jobbers. According to the Walter L. Schott Company, the sturdy metal tray is being offered to service men who purchase Walsco 50 Line packages.



These handy storage trays are designed to hold up to 20 sliding-lid plastic containers, and enable service men to keep small hardware items neatly stacked, easily available.

The descriptive label, showing the item and part number, appears on each plastic box for quick identification of all items stored in the tray. This useful Walsco tray can be mounted on the service man's wall or placed on a shelf or work table.

The new Walsco 50 Line, featuring hardware items in re-usable, plastic boxes, is now on display at jobbers everywhere.

TV MATCHING TRANSFORMER

Blonder-Tongue Labs of 526 North Ave., Westfield, N. J. introduces its 75-300 Ohm Matching Transformer. Designated as Model MT-1, it carries a list price of \$4.50 and is built into compact metal case no larger than a pack of cigarettes.



Precision impedance match at its 75 and 300 ohm screw terminals provide a means of eliminating standing waves and line reflections in individual installations, as well as master TV systems.

A Matching Transformer is needed to connect 75 ohm to 300 ohm lines, particularly where a 75 ohm line is installed to feed a 300 ohm TV set. This will reduce interference pickup as well as line ghosts.

JAN OCTAL SOCKETS

A new line of JAN octal sockets has been announced by the Parts Division of Sylvania Electric Products Inc. The sockets are available with several variations.

Designed to specifications JAN-5-28A, the new octal sockets are available with either Grade L-4B or better ceramic insulating base, or with Type MFE low loss phenolic plastic insulation. Mounting saddles are brass nickel-plated with four ground lugs hot tinned for solderability. Saddles are available with .156 diameter mounting holes or with threaded

FOR
perfection
IN
reception
IN
fringe areas

INSTALL

FINCO

20 in 1

T V A N T E N N A

- Clear pictures up to 120 miles and more from station!
- 8 driven elements on low band!
- 12 driven elements on high band!
- One antenna—one transmission line!
- High gain—low noise!
- Total weight only 8 lbs.!

The new patented FINCO Model #400 20-in-1 Co-Lateral Antenna is constructed on an entirely different principle than any other unit in the market today. Thousands of FINCO installations are giving TV owners perfect reception in fringe areas over 100 miles away from broadcasting stations. To provide complete TV satisfaction to customers in fringe areas, use FINCO every time!

THE FINNEY COMPANY
4612 ST. CLAIR AVE. • CLEVELAND 3, OHIO

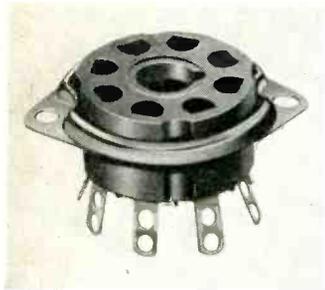
1902-1952



**ELECTRICAL AND ELECTRONIC
WIRES AND CABLES**

*—For the Automotive, Appliance, Motor,
Radio, and Television Industries*

**Belden Manufacturing Company
Chicago 80, Illinois**



extrusions for 6-32 screws. Contacts are available in either phosphor bronze or beryllium copper, silver plated. They are hot tin dipped after assembly for better solderability.

Sylvania engineers declared that these octal sockets were "especially designed for maximum strength, optimum electrical properties and great resistance to corrosion." Even

under severe vibrating conditions high tube retention and pin contact are assured. Contact tabs exhibit excellent flexibility and solderability. Highest quality is insured through the production application of all specified inspection tests of JAN-5-28A on approved equipment.

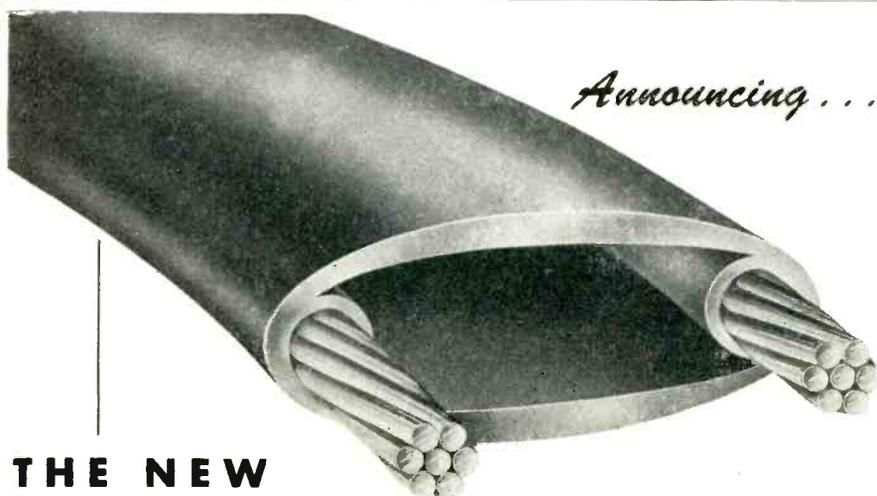
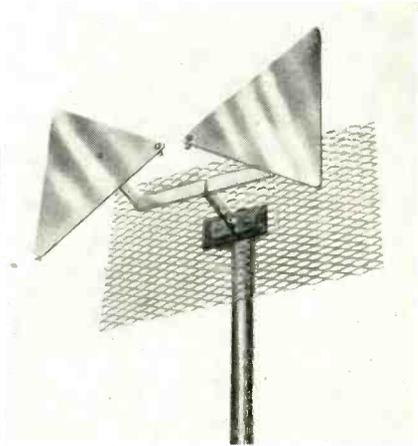
UHF ANTENNA

The JFD Manufacturing Company, Inc. of Brooklyn, New York announces that it has entered production of a straight bow-tie antenna with screen reflector for UHF. Delivering between four and six db in a single array, with gain climbing as frequency increases, this antenna will be strongly marketed in suburban areas.

The impedance of this antenna is such that it will match any UHF transmission line. It will be packaged and shipped to jobbers fully pre-assembled. Thus, installation can be prompt.

The construction of this antenna is such that no bolts must be tightened and no screws fixed prior to a set up. The all-aluminum bow-tie is riveted through to a powerful insulating block which in turn is riveted to a steel strip. This strip, about four inches in length is bent into a rectangular channel which connects to both reflector and profiled U-Bolt clamp. This clamp is behind the reflector which makes for simple installing.

A great ideal of additional information on this antenna, the JFD "UHF 600", can be obtained by writing directly to the JFD Manufacturing Company, Inc. at 6101 16th Avenue, Brooklyn 4, New York.



Announcing...

THE NEW

Synkote® "OVALTUBE"

*Low-loss tubular twin-lead
for better reception on VHF and UHF*

Here is a unique, *practical* down-lead that minimizes the effects of dirt, salt air and moisture on TV picture quality. Smooth, rounded exterior — no place for dirt to accumulate. Fits the same hardware and handles as easily as ordinary twin-lead, but gives excellent, trouble-free reception under *all* weather conditions!



SEAL THE ENDS IN 60 SECONDS

Simply heat with match or cigarette lighter, then squeeze ends together with pliers or knife blade.

USE YOUR REGULAR HARDWARE

Synkote OVALTUBE fits into the usual slotted stand-off insulator quickly and easily. No special threading, no special hardware required.

Ask your
jobber!

PLASTOID
Corporation

plant: HAMBURG, N. J. • offices: 42-61 24th St., Long Island City, N.Y.

TV TRANSMISSION LINE

ACCESSORIES

A new promotion, based on an assortment package of popular MOSLEY TV Antenna Transmission Line Accessories has been announced recently by Mosley Electronics, Overland, Missouri.

Containing an assortment of twenty-six lead-in entrances, wall sockets, plugs and other connectors of types suitable for use in every TV area, the new Mosley package, called the Sampler Special, is priced to provide an exceptionally good margin of profit for both jobber and dealer. In addition, for a limited time, an extra bonus consisting of



Mosley connectors valued at more than two dollars will be included in the Sampler Special as an added incentive for the dealer and installer to try the new Mosley line as a means of building customer good will and more TV business.

Attractively packed in a yellow and black counter-top display box with illustrations showing the purposes and advantages of each Mosley item, within, the Sampler Special will be available at most jobbers until December 31, 1952.

GROUND ROD

South River Metal Products Company announces a new Ground Rod with a special extruded aluminum Wire Clamp. This special aluminum Wire Clamp will accommodate all ground lead wire from #3 Gauge to #20 Gauge. Its aluminum body permits excellent electrical conductivity.

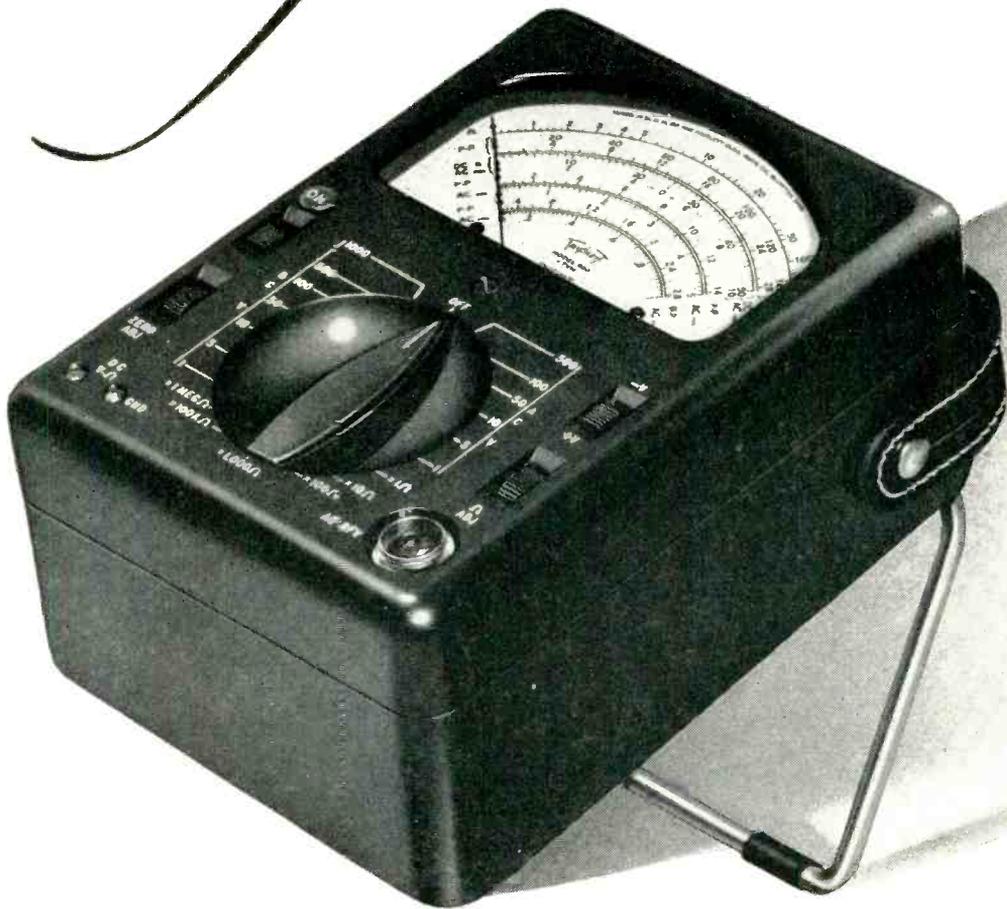


TRIPLETT

650 VTVM

There's Nothing finer for

Television



This combination of features explains why

- Complete frequency coverage with one probe, 20 cps to over 110-mc. Insulated and shielded RF tube probe, found usually only with laboratory instruments, is included.
- Peak to Peak ACV and RF with one probe.
- One volt full scale reading on AC & DC.
- One main selector switch, all ranges.
- ACrms—Peak to Peak
- 32 Ranges
- Zero center mark for FM discriminator alignment plus any other galvanometer measurements.
- High input impedance 11 megohms on DC.

Suggested U.S.A. Dealer Net \$6950 • Prices subject to change without notice.

TRIPLETT ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO

Triplett



THIS IS IT! THE RELAY

WITH *Interchangeable Coil*

FOR A WIDE RANGE OF RADIO APPLICATIONS

GUARDIAN Series 200

Interchangeable
COIL and CONTACT
Switch Assembly



Two basic parts—a coil assembly and a contact switch assembly—comprise this simple, yet versatile relay. The coil assembly consists of the coil and field piece. The contact assembly consists of switch blades, armature, return spring and mounting bracket. The new Guardian Midget Contact Assembly which is interchangeable with the Standard Series 200 coil assembly, is also available in either single pole, double throw; or double pole, double throw.

CONTACT SWITCH ASSEMBLIES

CAT. NO.	TYPE	COMBINATION	
		Single Pole	Double Throw
200-1	Standard	Single Pole	Double Throw
200-2	Standard	Double Pole	Double Throw
200-3	Contact Switch Parts Kit		
200-4	Standard	Double Pole	Double Throw
200-M1	Midget	Single Pole	Double Throw
200-M2	Midget	Double Pole	Double Throw
200-M3	Midget Contact Switch Parts Kit		

13 COIL ASSEMBLIES

A.C. COILS*		D.C. COILS	
CAT. NO.	VOLTS	CAT. NO.	VOLTS
200-6A	6 A.C.	200-6D	6 D.C.
200-12A	12 A.C.	200-12D	12 D.C.
200-24A	24 A.C.	200-24D	24 D.C.
200-115A	115 A.C.	200-32D	32 D.C.
		200-110D	110 D.C.

*All A.C. coils available in 25 and 60 cycles

GUARDIAN ELECTRIC

1606-P W. WALNUT STREET

CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING RADIO AMATEURS

NEW! MOSLEY WALL-THRU

For TV, FM and Amateur Transmission Line



Cat. No. 625
List Price \$1.95

Cat. No. 625-PK
WALL-THRU, complete with
MOSLEY Universal TV Lead-
in Socket and Plug.
List Price \$3.00

- Fits Any Wall Up To 13" Thick!
- Completely Weather-Proof!
- For Standard Flat 300 Ohm Line or RG-59/U Co-ax Cable!
- MOSLEY Lead-In Socket Can Be Mounted Direct To Inside Plate!
- Precision Molded Polystyrene End Plates!
- Easily, Quickly Installed!

MOSLEY ELECTRONICS

2125 LACKLAND ROAD OVERLAND 14, MISSOURI

MOVING?

When you change your address, please notify our circulation department as soon as possible. This is to your advantage, since it takes approximately 5 weeks to have your stencil changed and duplicate copies cannot be sent. Be sure to give your old as well as your new address.

RADIO-TELEVISION SERVICE DEALER

67 West 44th St.

New York 36 N. Y.

ASSOCIATIONS

Federation of Radio Servicemen's Associations of Pennsylvania

At a recent Federation meeting held in Harrisburg on Sunday, October 19th, the delegates voted to make its annual Plaque presentation at the January 18, 1953 meeting. In addition to this gala affair, it will also mark the presentation of the State Charter to the Federation of Radio Servicemen's Associations of Pennsylvania. In addition to the recipient of the Plaque, invitations will be extended to the friends of the Federation who are among the Manufacturers, Publishers and Distributors and to other associations in surrounding states. The officers and delegates of the Federation would desire to have present all representatives of the servicing organizations who would like to attend. Those interested in attending please contact Leon Helk, 67 South Main Street, Carbondale, Pa.

Associated Radio-TV Servicemen of New York

Chet Jur addressed the recent regular meeting of ARTSNY on Television High Voltage and Deflection Circuitry in one of the best attended sessions. Mr. Jur supplemented his address with projection slides, depicting various circuits and illustrating high voltage components and variations as well as deflection components and their variations.

He also illustrated various on-the-job improvisations using standard parts available from Jobber stock to replace proprietary or specially designed components. This proved to be great interest among the men, and resulted in a lengthy question and answer session after the meeting.

Bill Barron, Merit Sales Manager and Jules Bressler, local factory Rep. for Merit, also attended.

TRADE LIT

[from page 22]

antennas including the VEE-D-X UHF antenna Selector Map; a page describing the sensationally new VEE-D-X Universal Mounting Bracket, and its many uses; a page showing typical installations that combine both VHF and UHF.

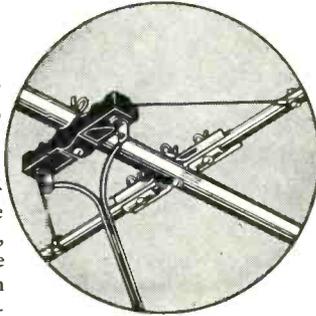
This new UHF catalog has been sent to all VEE-D-X jobbers, Mr. Hess stated, and is now available in large quantities for further distribution.

NEW LOW PRICES ON WORLD'S MOST POWERFUL YAGIS

New Delta Match

Perfected by Vee-D-X Engineers Makes Possible the New Low Prices on These Powerful Yagis

The new Vee-D-X Delta Match is an ingenious method of selecting the exact impedance point of the di-pole with any frequency, made possible by the unique tapered line principle. The Delta Match accomplishes an exact transformer action over an entire channel without loss of picture highlights or cutting of the audio portion of the TV signal. What's more, it permits lower cost with no sacrifice of either quality of performance or quality of the antenna. Except for the Delta Match section, the new Vee-D-X Delta Series have the same pre-assembled construction and powerful performance that have made Vee-D-X Yagis the Number One line of single channel antennas.

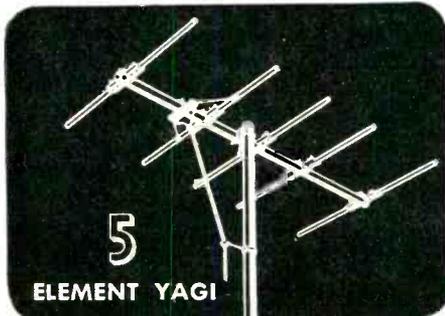


SAVINGS OF MORE THAN 30%

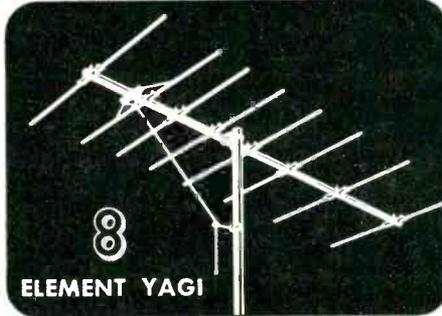
No Sacrifice of Quality or Performance

Here's good news to all Yagi users where low price is as important as the high gain that these powerful single channel antennas deliver. They are not cheaply made. In fact, they differ only from the famous standard Vee-D-X Yagis in their Delta Match section.

THREE MODELS FOR POWERFUL RECEPTION IN ANY SINGLE CHANNEL AREA



THE DC—Here is truly outstanding value in a quality five-element Yagi. The new DC delivers the power of the famous JC at lower cost. Its features include rugged pre-assembled all-aluminum construction; high gain on every channel; 6 megacycle band width; excellent front-to-back ratio. When ordering, be sure to specify channel. For example, for Channel 6, order DC-6. The DC may be stacked for extra gain. Special VEE-D-X phasing harnesses are available for double-stacking. When ordering for Channel 6, order DH-6. For complete prices on the DC see below. Channels 7-13 lists at only **\$5⁵⁵**



THE DELTA LONG JOHN—Here is the Delta Match version of the famous eight-element Long John that provides 41% more gain than a five-element Yagi, and gives equal gain to a double-stacked five-element Yagi array. High front-to-back ratio eliminates co-channel interference. Has rugged pre-assembled all-aluminum construction. When ordering, be sure to specify channel. For example, on Channel 6 order DLJ-6. The Delta Long John may also be stacked for additional gain. For complete prices, see below. Channels 7-13 lists at only **\$9⁷⁵**



THE DELTA LONG LONG JOHN—Where super high gain is required, you can't beat the Delta Long Long John either in performance or low price. It is the highest gain, single channel antenna ever developed and guaranteed to outperform any other Yagi except the standard Long Long John. Has rigidized boom bracing with pre-assembled, all-aluminum construction. High front-to-back ratio, full six megacycle band width. When ordering, be sure to specify channel. For example, when ordering Channel 6, order DLLJ-6. The DLLJ may be stacked for additional gain. See below for complete prices. Channels 7-13 lists at only **\$16⁰⁰**

COMPARE THESE LOW PRICES!

Channel	DC list	DLJ list	DLLJ list
7-13	5.55	9.75	16.00
6	9.75	18.05	26.40
4-5	11.15	21.55	31.95
3	11.85	23.65	37.75
2	12.50	23.65	37.75

It sure pays to buy 
VEE-D-X

The LaPointe-Plascomold Corporation
Rockville, Connecticut

Gentlemen:

Please send me information, at once, on your low cost Delta Series Yagis.

NAME

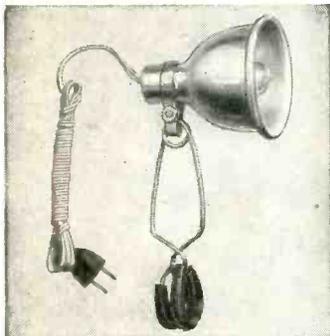
ADDRESS

CITY ZONE

STATE

Columbia 

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TROUBLE?

[from page 31]

nated by shorting tests No. 5. If the hum were originating on the other (switch) side of the large resistor, R310, it would continue to be heard when point No. 5 was shorted.

TRANSISTORS

[from page 37]

the tetrode type transistor overcomes a great many of the limitations of the junction type.

In listing the limitations of the transistor let us remember that most of them are not inherent. They can and will be corrected in the transistors that will be coming out in the near future. Some of the limitations are inherent in the present day transistors but there is no doubt that these limitations will be corrected by new designs just as the difficulties of the point contact were corrected in the junction type.

The present limitations are as follows:

1. The most serious is the non-uniformity in the characteristics of the manufactured product. The reject rate is extremely high. Transistors have to be hand-picked for good characteristics. This limits their present use to the laboratories.
2. The frequency limit of the junction type. Due to R_b and several internal capacities this limit is at the very best below 5 mcs.
3. Their sensitivity to heat.

Since thermal pressure causes electrons to break out of the shared ring crystals, heat variations can cause variations in the amount of free electrons in the N type elements. These changes will obviously change the characteristics of the element and the entire junction transistor. The small size of the transistor which is one of its advantages is in this case also a disadvantage. The reason for this is that although there is an extremely small power dissipation in the body of the transistor, there is an even smaller area for the resultant heat dissipation which in turn raises the temperature of the transistor body. Another limitation is the absence of available miniaturized components to match the wide variation between the output impedance of one stage to the input impedance of the second stage.

Thus, while wrist-watch receiver-transmitters for popular use are still

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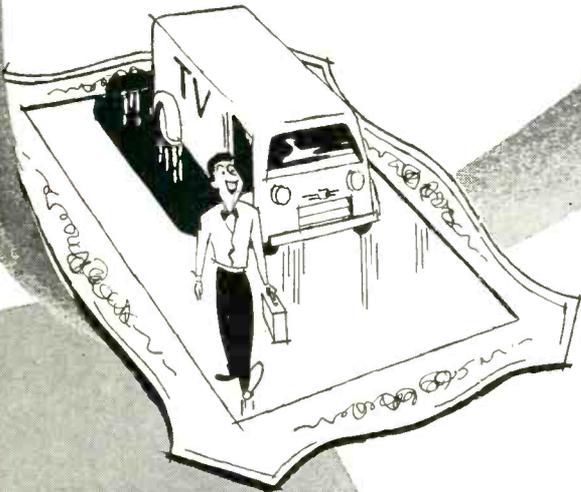
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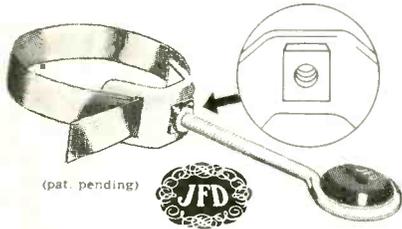


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comic book stuff, it will not be in the very distant future that vest pocket AM receivers and low power consumption TV sets start to appear on the market. It is the author's belief that the electronic tri-color TV system which will most likely be FCC approved will bring this day closer. This system with its vastly increased tube requirements in the auxiliary color circuits and resultant greater power transformer requirements will cause tremendous amount of laboratory and front office attention to be paid to any device which can cut the staggering power requirements down.

CIRCUIT COURT

[from page 48]

pulse. This stage is followed by another sync limiter stage. The plate voltage of this stage is at the saturation level. A result of this is the compression of any video information which might have been amplified by the previous stage. The cathode is grounded and as a result of grid leak bias the top of the sync pulse is cut-off and any noise pulses are cleaned out.

The sync stages have one other noteworthy circuit (Fig. 3). The horizontal a.f.c. is of the phase detector type. Both sides of the detector diode require that the signal be fed into it 180° out of phase. To get these two signals, the horizontal sync is taken off the plate and cathode of the phase converter. The vertical sync is also taken off the cathode. The thing to note is that the grid resistor return does not go to ground but to the junction of the horizontal and vertical take-off resistors.

Another interesting departure is in the third i.f. tube input (Fig. 4). Usually the coupling transformer load resistor is located in the grid of the input stage. In this set, the load resistor is in the output plate circuit. The grid impedance consists only of the transformer secondary. The purpose of this is to present a low impedance to noise which might be generated in previous stages. The stage does not go back to the a-g-c buss. The input impedance and the bias is derived from the cathode resistor which is by-passed for r.f.

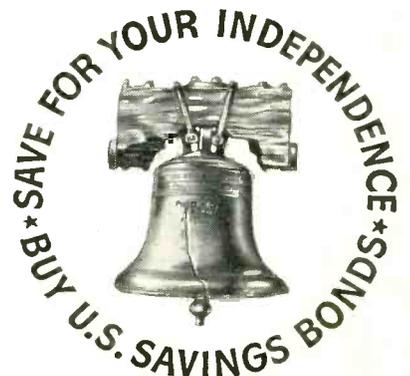
Philco Model No. 52-T2253

Sync Noise Suppression

The Philco Model #52-T2258 (Fig. 1) has a sync noise suppression and sync pulse gating system which is very novel. The functioning of the circuit depends on a circuit fact which is not often used, that is, sharp noise pulses have a very large high frequency content.

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In the circuit being examined, we find the following situation. The triode section of a 6AT6 is connected as a sync amplifier. The diode section plates are connected to a point on a B+ bleeder. The cathode of the tube is common to both sections. The diode plates conduct because their potential is B+. As a result the current through R32, the voltage at the diode plate is lower than the supply voltage.

The composite video signal is fed to the triode grid, its sync phase being positive. This signal, amplified, appears at the top of the cathode resistor still "sync-phase-positive." As the sync portion of the signal appears at the cathode its instantaneous voltage becomes higher than the plate voltage. This cuts the diode off.

When the diode is cut off, the voltage at the diode plate rises through R33 and becomes equal in value to the B+ supply voltage. This condition persists for the duration of the sync pulse until the signal drops instantaneously below the diode plate voltage. When this occurs the diode again starts conducting and the voltage at the diode plate again drops. The result of this action is a pulse which is identical with the sync pulse. This pulse is fed to the following stage by a coupling condenser where it is further clipped and compressed to present a clean pulse to the sweep oscillators.

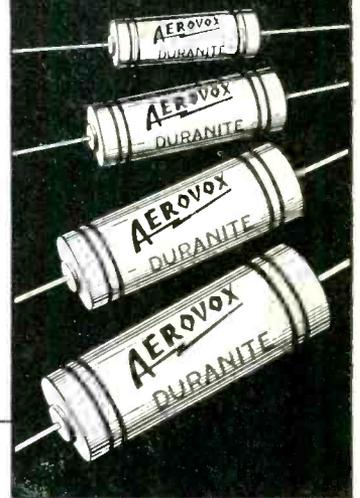
By operating in this manner, the circuit eliminates any noise pulses which might be riding on the sync pulse which would occur while the diode is at cut-off. To eliminate any noise pulses at other times, with amplitudes large enough to cut the diode off, a capacitor C42 (33 μ mf) is connected at the plate of the diode. The high frequency portion of the noise pulse sees this as a short and thus the tube continues to conduct.

In order to vary the diode sensitivity to allow for different signal strengths, the diode B+ source is the i-f B+. This B+ varies with signal strength. A strong signal will develop a high a-g-c bias for the i-f grids. This bias, reduces i-f plate current. The reduced plate current in turn causes the B+ voltage to rise. In strong signal areas, therefore, where the signal to noise ratio will be high, the diode plate voltage is high and the cathode has to go higher before the diode is cut-off.

In weak signal areas, the reverse condition occurs. The a-g-c is lower due to a smaller signal being developed across the second detector. This lower bias causes higher i-f plate current flow and a lower B+ supply voltage, the resulting lower diode voltage permitting earlier diode cut-off.

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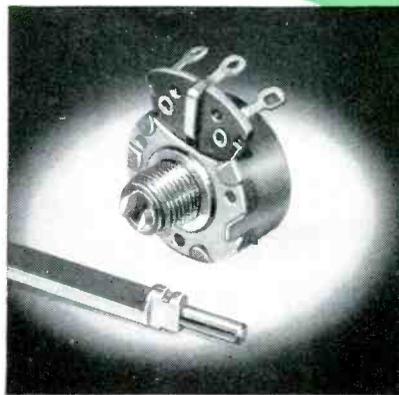
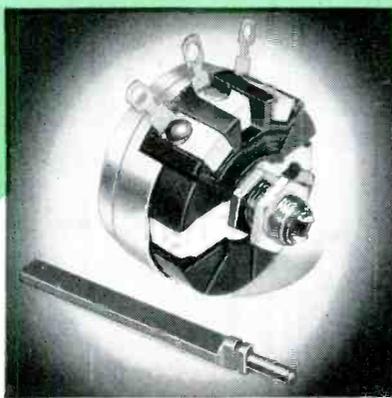
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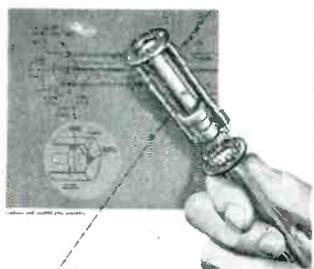
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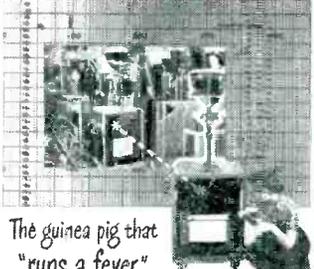
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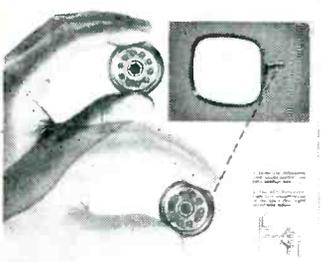
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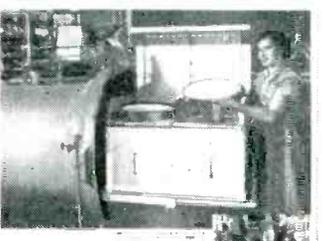
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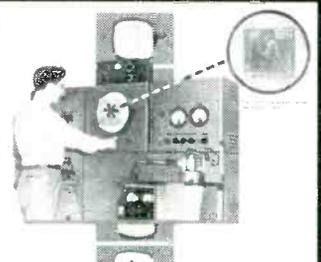
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The Torture Chamber that tests the strength of RCA Picture Tubes

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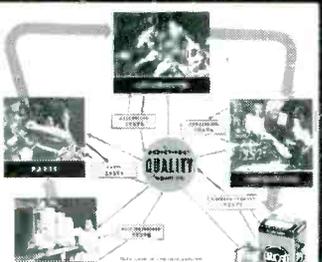
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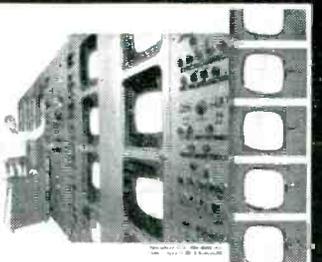
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Quality control by feedback ... the secret of RCA tube performance

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The Million-Dollar Test Equipment ... that pays off in better picture tubes

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Take a look at quality being bars

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