SEPTEMBER, 1953

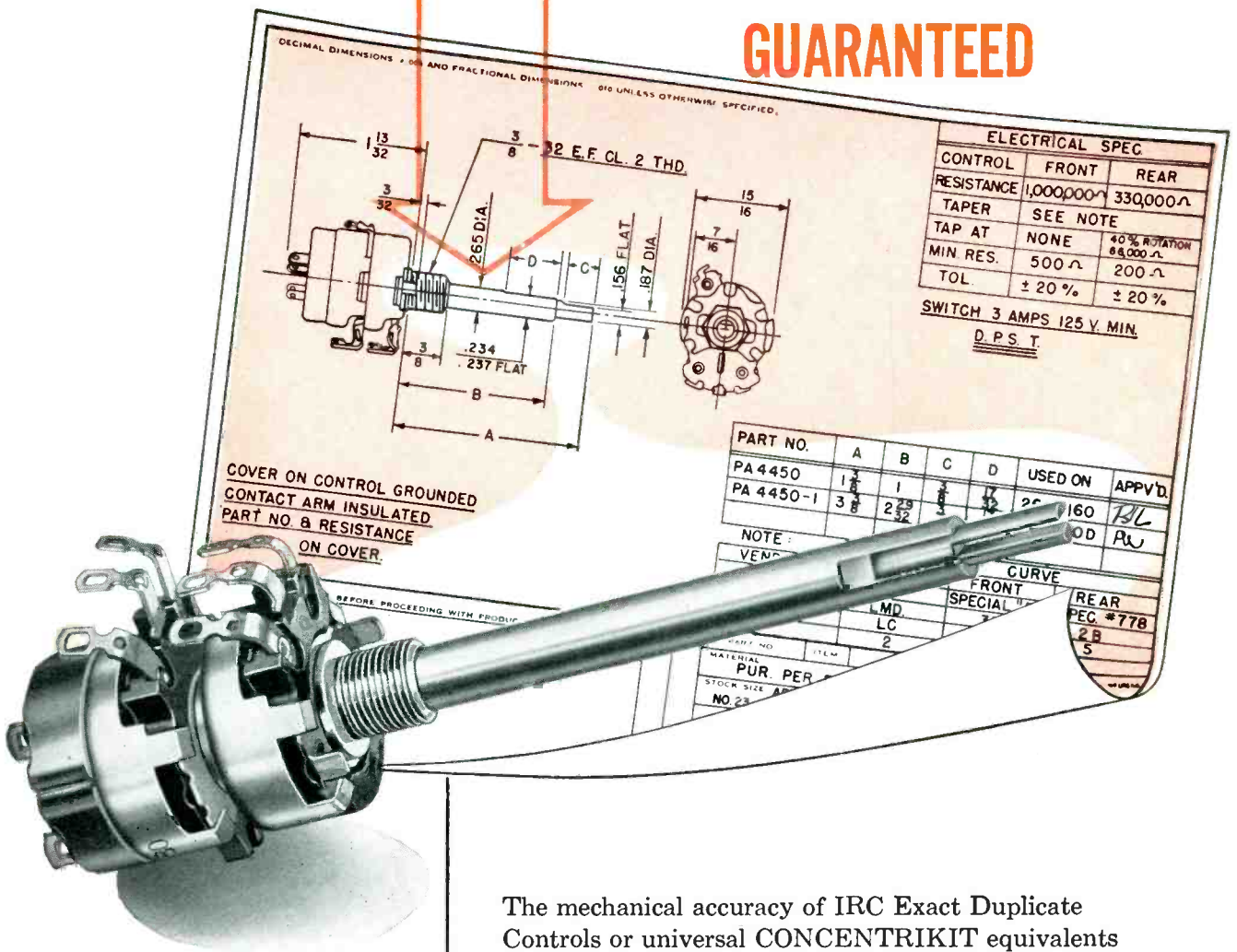
Radio-Television SERVICE DEALER

The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

HERE'S WHY IRC EXACT DUPLICATES ARE DOUBLE-MONEY-BACK GUARANTEED



ONLY IRC GUARANTEES SATISFACTORY MECHANICAL FIT AND ELECTRICAL OPERATION OR DOUBLE-YOUR-MONEY-BACK

The typical manufacturer's specifications shown here are exactly duplicated by IRC QJ-180 control. CONCENTRIKIT assembly includes P1-229 and R1-312 shafts with B11-137 and B18-132X Base Elements, and 76-2 Switch.

IRC

Wherever the Circuit Says

The mechanical accuracy of IRC Exact Duplicate Controls or universal CONCENTRIKIT equivalents is based on set manufacturers' procurement prints. Specifications on those prints are closely followed.

Shaft lengths are *never less* than the set manufacturer's nominal length—*never more* than 3/32" longer.

Shaft ends are precisely tooled for solid fit.

Inner shaft protrusion is accurately duplicated for perfect knob fit.

Alterations are never needed.

For Exact Duplicate Controls, specify IRC. Most Service Technicians do.

INTERNATIONAL RESISTANCE CO.

404 N. Broad Street, Philadelphia 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, Licensee

Depend on Mallory
for
Approved Precision Quality

"...and BE SURE

the VIBRATORS are MALLORY!"

That's the best way to be sure your service jobs stay "sold". You can depend on Mallory Vibrators to give more years of service. Their precision quality is the answer to time-wasting call backs. These are just two of the reasons why 5 out of 6 service men prefer Mallory for all their service work.

And the preference doesn't end there. They are more widely used as original equipment than all other makes combined. The patented, tuned mechanism in Mallory Vibrators gives better performance because:

Slow contact make . . .
means less wear

High contact pressure . . .
means low resistance

Fast clean break . . .
means reduced arcing

The next time you order vibrators . . . be sure to ask for Mallory. You'll get better vibrators, available in a complete line, meeting original equipment specifications . . . yet they cost no more. You can be sure that every service job is done right the first time.

P.R. MALLORY & CO. Inc.

MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES

APPROVED PRECISION PRODUCTS

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

the C·D·R Rotor

sells faster...sells easier

because.....

The best line of TV Rotors money can buy

It is the complete line of quality rotors, with a model and type to best serve 'most every type application.

TV Spot Campaign

To reach the buying public, an intensive campaign on Television in key markets pre-selling CDR ROTORS for you.

Newspaper Advertisements

Also directed at the consumer, a supporting campaign in key city newspapers exploiting the advantages of the CDR ROTOR.

Moving Displays

It's causing excitement everywhere, this display that is an eye and traffic stopper, a silent salesman for the CDR ROTOR.

Envelope Stuffers

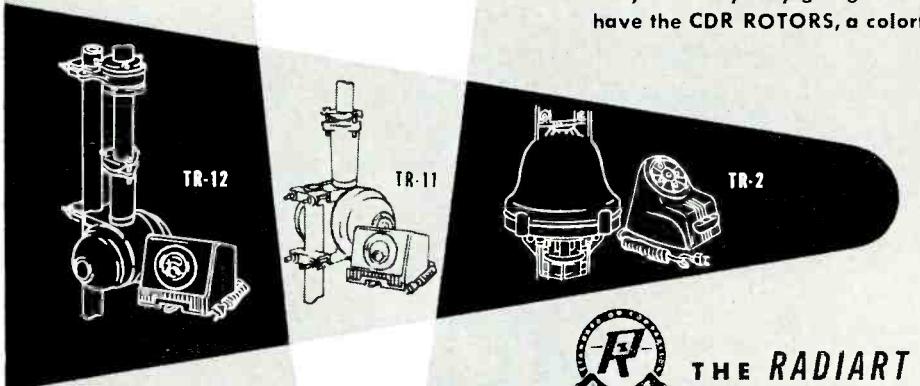
Here's another selling tool that may be mailed directly to your customers, selling them the CDR ROTOR in their home.

Newspaper Mats

A full set of completely prepared advertisements for dealers and distributors to capture extra CDR ROTOR business.

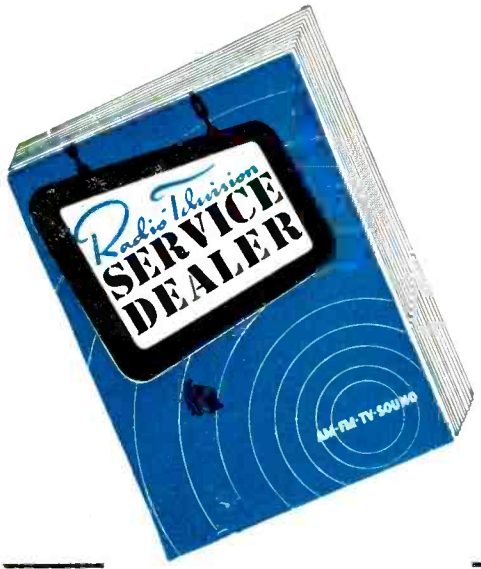
Window Streamers

They let everybody going into and by your store know that you have the CDR ROTORS, a colorful and eye-catching streamer.



THE *RADIART* CORPORATION
CLEVELAND 13, OHIO

CORNELL-DUBILIER ELEC. CORP.
SOUTH PLAINFIELD, NEW JERSEY



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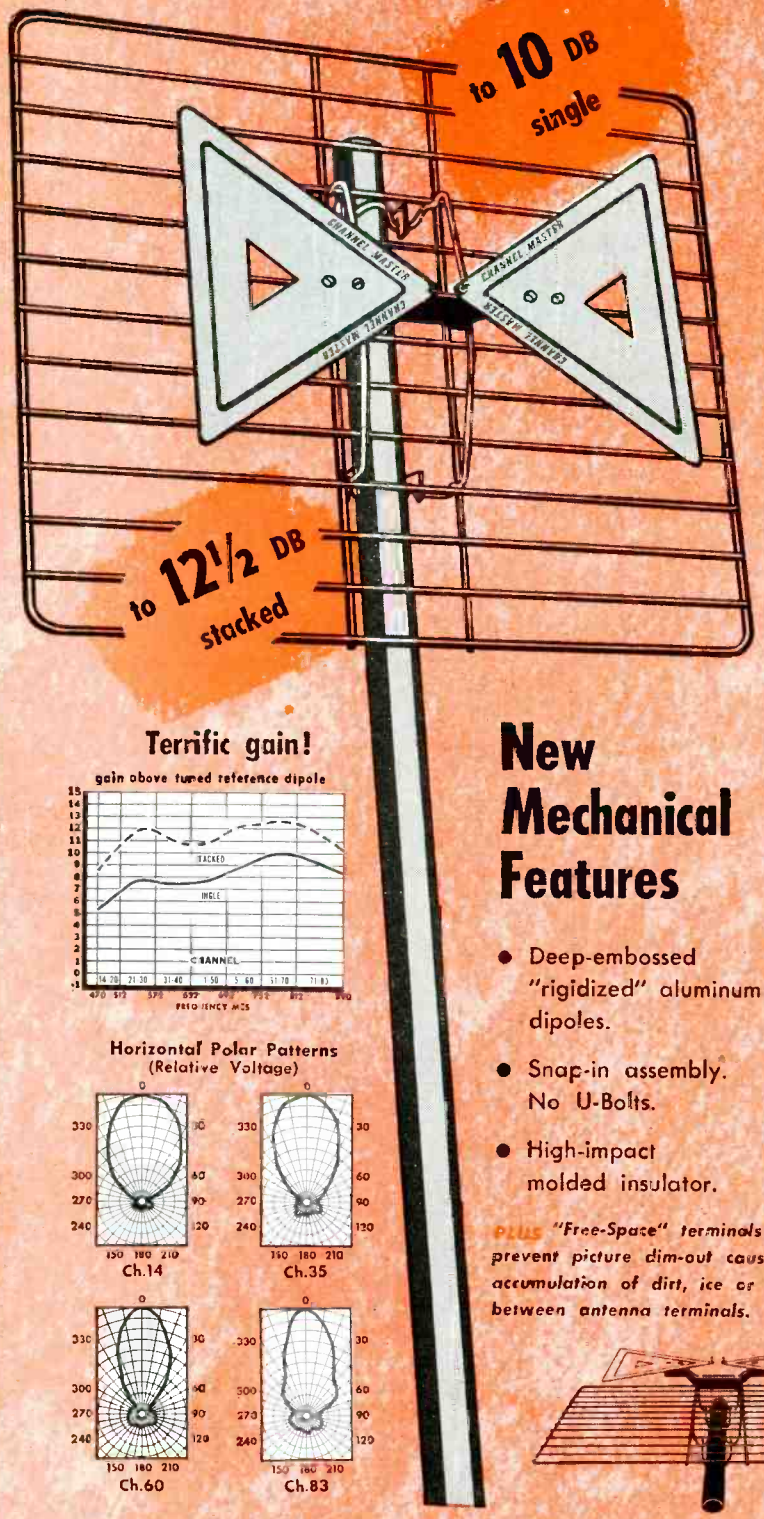
3 New Electrical Advances!



CHANNEL MASTER'S all-new UHF BOW-FLECTOR

model no. 408

The highest gain Bow and Screen antenna ever developed — single or stacked!

1. ***Enlarged Reflecting Screen.*** 53% more reflecting area — higher, flatter gain level.

2. ***Full-Wave Spacing*** of stacked antennas. Provides highest stacking gain ever obtained in an antenna of this type.

3. ***2-Stage Stacking Transformers*** for broad-band impedance match. Delivers high stacking gain ***over entire UHF band.***

Terrific gain!

gain above tuned reference dipole

Horizontal Polar Patterns
(Relative Voltage)

New Mechanical Features

- Deep-embossed "rigidized" aluminum dipoles.
- Snap-in assembly. No U-Bolts.
- High-impact molded insulator.

PLUS *"Free-Space" terminals that prevent picture dim-out caused by the accumulation of dirt, ice or rainwater between antenna terminals.*

Only 20 seconds to install!

Just snap Bow into Screen, then fasten entire assembly to mast with Channel Master's exclusive "SPEED-NUTS." The antenna cannot move, twist, flutter, or vibrate! The light-weight Bow Flector is the most rugged, fastest-installing antenna of its type.

Ask your Channel Master distributor for complete technical literature.

One of 5 Great New Channel Master Products For Fall!

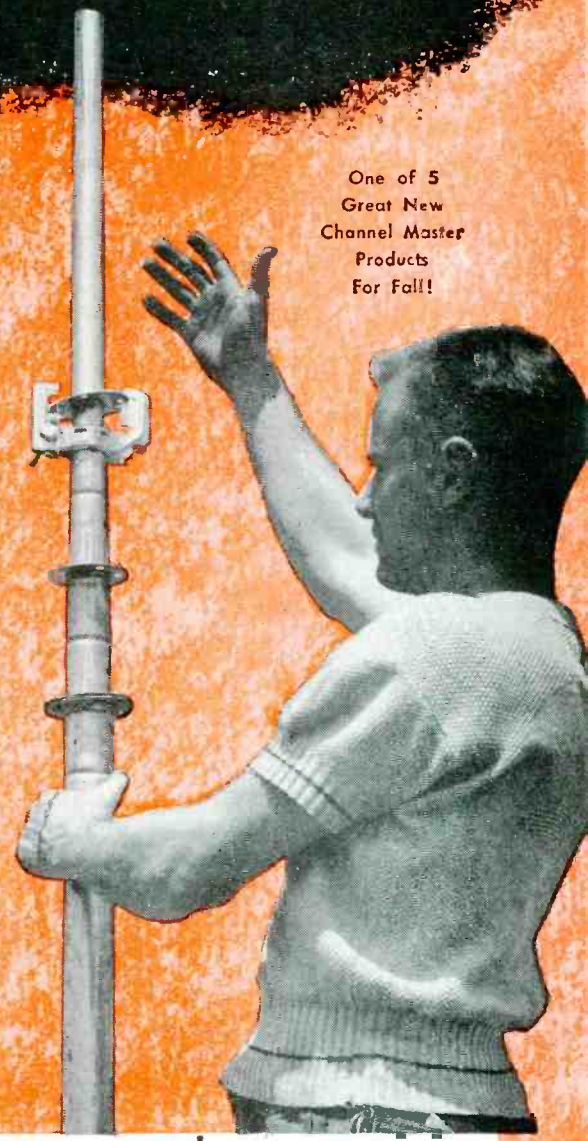
CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

FIRST IN PREASSEMBLED ANTENNAS

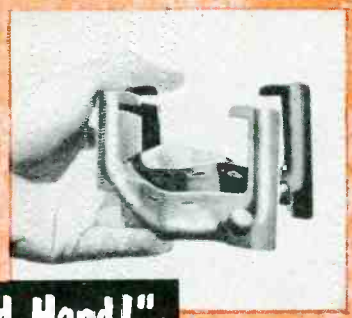
You've never seen a mast like it!

CHANNEL MASTER'S all-new STRATO-MATIC TELESCOPING MAST

One of 5 Great New Channel Master Products For Fall!

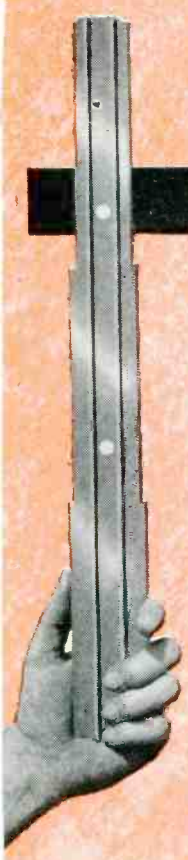


for antenna installations that are easier • faster • safer



Featuring the Amazing "Third Hand!"

— an automatic, removable locking device that actually acts as your "third hand," *holds* mast sections up when you let go! The Third Hand converts each guy ring, in turn, into a "safety lock." This permits you to raise sections freely, *using only one hand.* And . . . sections *cannot* slide down when you let go.



Automatic Mast Extension

The Step-Up Key, inserted through the bottom of the mast tubing, automatically extends each mast section 6 inches. Mast sections are kept partially extended even *after* mast is placed in vertical position — *without using hardware or locking bolts!*

World's Finest Mast Protection!

16-Gauge Masting HOT-DIP GALVANIZED

Most permanent type of mast corrosion protection available today. Sections are immersed in cauldron of molten zinc, until a thick layer of pure zinc is fused to inner and outer surfaces — so thick it actually adds to the weight of the mast; gives long-term protection!

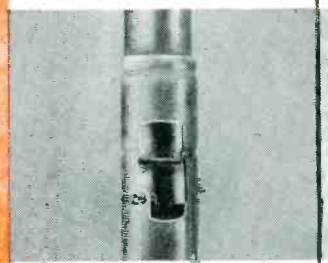
ZINC IS SELF-HEALING!

When the protective zinc coating is scratched or broken, the surrounding zinc actually goes to work to "heal" the wound. Thus, the base metal is automatically protected against damage due to installation or handling. The only coating with this ability.

18-Gauge Masting HEAVY ZINC ELECTRO-PLATING

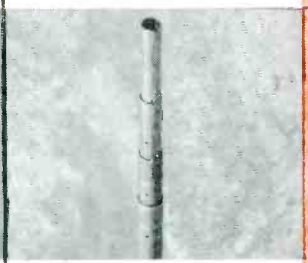
Heavy layer of bright zinc, exceeding Army-Navy specifications, provides effective long-lasting protection against elements. A chromate dip adds brightness; increases corrosion resistance. The strongest, most durable protection jacket of its type.

Inter-Locked Sections



Safety Rings prevent sections from pulling out of each other. Notches in sections engage bolt — no twisting.

No Hidden Holes



Step-Up Key automatically extends mast sections high enough to provide easy access to bolt holes. You don't have to pull up next section to insert bolt!

Model No. 16-Gauge	Model No. 18-Gauge	Sections	Lengths	Weights 16-Gauge	Weights 18-Gauge
1620	1820	A, B	20'	20 lb.	15 lb.
1630	1830	A, B, C	30'	32 lb.	25 lb.
1640	1840	A, B, C, D	40'	46 lb.	35 lb.
1650	1850	A, B, C, D, E	50'	61 lb.	47 lb.

FACTORY PRE-ASSEMBLED ANTENNAS

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

Ask your Channel Master distributor for complete technical literature.

Trade Flashes

Raytheon Announces The "Service-Saver" — A New Aid To Television Receiver Servicing

A new and unique method of helping television servicemen diagnose, and repair troubles with a television set was unveiled by Carrol W. Hoshaur, Director of Raytheon Sales Engineering at the Raytheon National Sales Conclave held at the Chicago Opera House. This new device consists of a booklet containing photographs of 40 possible troubles with a TV set's picture. Each picture is numbered for easy identification. When something goes wrong with the set, the owner calls his serviceman and tells him, "My picture looks like number seven or twenty-four as the case may be."

In the Raytheon Service manual that is distributed to all TV servicemen, there is also a "Service Saver" section that shows the same numbered 40 conditions, and gives schematic diagrams of the circuits and what causes the trouble, plus a complete list of parts and tubes that might be involved. It also contains hints and kinks for quick repair—what to test, what to change, what component might be causing the difficulty. This method of television service enables the serviceman to quickly diagnose and remedy the great majority of troubles and he will be able to effect a solution in ten to twenty per cent of the time he normally did without this unique approach."

Before introducing the "Raytheon Service Saver" to the public, Raytheon tested Mr. and Mrs. America's ability to describe correctly the picture condition they saw on their TV set. 92% of the subjects described the picture condition accurately.

RMS Conducts Servicemen's Forum

A half-hour telecast of a section of a servicemen's forum conducted by an official of Radio Merchandise Sales, Inc., was held at the studios of WHIZ-TV, Channel 50, Zanesville, Ohio. The combined RMS forum and WHIZ telecast is claimed to be one of the most unique presentations made by members of the TV industry. Martin Bettan, RMS engineering head, lead over 125 dealers at the studios of WHIZ in a technical discussion on *UHF*. In the latter 15 minutes of the program technical questions were then answered by the RMS technical chief.

At this early date, accurate results are not available, but immediate responses to the broadcast (phone calls and letters from the viewing public) and the enthusiasm of the local technicians, indicate that public interest "live" telecasts, when coupled with stimulation at the technical levels, is a most effective "hypo" for the TV business.

Television Interference Aids Distributed

RETMA, in cooperation with the Washington Television Interference Committee and the Electric Institute of Washington, has prepared two educational aids on the causes and cures of television interference for distribution to all TV service dealers and technicians in the greater Washington, D. C., area. It is pointed out in a pamphlet on the general subject of TVI that the radio amateur is actually involved in "only a small portion" of the television interference picture. A number of other causes of the complex TVI problem are detailed, leading to the conclusion that "the average television receiver owner is not trained either to diagnose or to understand his personal interference situation. He requires honest and intelligent advice from his service technician."

Niagara Frontier Gets UHF Techniques Preview

Television technicians of the Niagara area were given a preview on the techniques of *UHF* television reception recently in Buffalo, N. Y. The preview was another of the well-received Taco *UHF* Television Clinics presented in all parts of the country. Following talks by Taco and WBUF officials outlining the general theories of *UHF* and local conditions associated with television, a round table discussion was held during which the technicians enjoyed the opportunity of presenting their specific *UHF* problems.

Viewing Distances For Television

Experts at Emerson Radio and Phonograph Corporation report thousands

of observations revealing that the proper viewing distances for television range between four and eight times the size of the picture tube. For example, a 17-inch receiver gives the most satisfactory service when viewed from a distance of five to eleven feet. In a similar manner, a 21-inch TV set is best viewed from distances between seven and fourteen feet, while the 27-inch receiver's most satisfactory viewing range is nine to eighteen feet. One conclusion drawn from the Emerson survey is that the 27-inch video receiver is not too readily adaptable for home usage since a viewing range of such distance is rare in the average home.

Philco Test Equipment Line

The second double-page advertisement appearing in this issue culminates the first phase of the Philco campaign. Combining new circuits, accuracy and versatility with low cost, the advanced design Philco line of test equipment offers the service technician a great variety of units that, when combined, can form a complete service laboratory to meet every *VHF* and *UHF* servicing requirement. Among the Philco test equipments previewed are completely redesigned versions of standard Philco test units. Entirely new models, among them the Model G-8000 *vhf* to *uhf* Signal Generator Adapter and Model G-8002 Auto-Level Sweep Generator, lend a revolutionary approach to *uhf* servicing by providing the most modern tools for this newest advance in servicing.

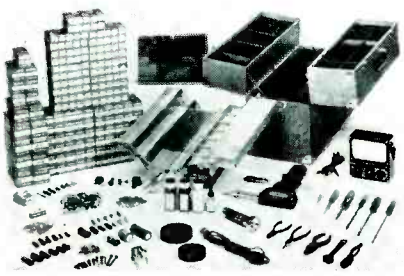
Availability for purchase of new model test equipments will be announced by Philco through the medium of advertising in this publication.

JFD Holds UHF-VHF Antenna Clinic

TV service-dealers in the Greenville, Spartanburg, Asheville areas of North and South Carolina attended a "JFD Antenna Clinic" sponsored jointly by Dixie Radio Supply Company and the JFD Manufacturing Company in Greenville, South Carolina's Poinsett Hotel. JFD's Mort Leslie discussed *UHF* and *VHF* antenna installation problems, pointing out individual antenna designs best adapted to various installation requirements. More than 600 attending service-dealers participated in the lively forum, which was preceded by a Buffet Supper.

Sylvania Offers "TNT Chest" For Servicemen

A handsome, new tube and tool carrying case, designed particularly to meet the needs of TV-radio servicemen, is being offered by Sylvania Electric Products Inc., in a premium promotional campaign, which will run through November 15. The sturdy, new Sylvania case, or "TNT Chest", will hold 187 tubes, meter, a complete set of tools, soldering guns, and a sufficient number of parts for any house call. A convenient feature of the case is its aluminum tool and parts tray, divided into 14 separate compartments, which holds all needed tools and parts. The case is light and roomy, measures only 9" wide, 15" high, and 20" long.



Sylvania "TNT" Chest

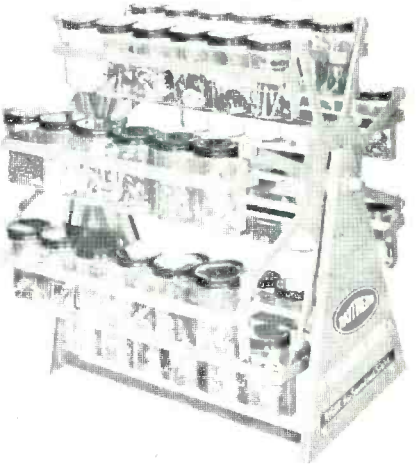
Boise Ordinance Passed

An ordinance was adopted by the Boise, Ida., City Council (July 13) amending the city building code to provide regulations and standards for the installation and maintenance of television antennas. Approved without any protests being heard, the ordi-

nance provides that any person installing or repairing any outside television or radio receiving antenna over 15 feet in height must obtain a permit from the city building inspector. The ordinance provides further that the city building inspector conduct inspections of television antennas and that metal mast structures supporting outside television or radio antennas be of non-corrodible material and effectively grounded. Use of chimneys or vents for supporting mounts is made illegal by the ordinance.

Raytheon Promotion For Service Dealers

Raytheon has recently announced a new tube promotion item. This item, the Raytheon Tele-Jar Rotor, is a most unique and necessary shop aid for dealers. Specially designed for service dealers, this exclusive promotion item will save them much time, space, and money in small parts storage. Approximately 17" high x 15" wide x 13" deep the Tele-Jar Rotor has 48 transparent plastic, unbreakable jars which are



ideal for storing transistors, crystal diodes, subminiature and miniature tubes, panel lamps, resistors, small condensors, insulators and hardware. Designed to give dealer shops a neat "professional" look, this versatile Tele-Jar Rotor has been manufactured so that it can be used on the bench or on the wall. The Rotor's ferris-wheel motion gives a constant, visible inventory check and facilitates small parts stocking.

Philco Releases New UHF Film

"When UHF Comes to Town" is the title of a new 15-minute film produced by Philco Corporation for release to distributors in areas through broadcasting stations are going on the out the country where new *UHF* air. It is available in 16mm sound for

[*Continued on page 13*]

NICE GUY... with an undeserved black eye

If you understood what your
RADIO AND TELEVISION SERVICE DEALER
is up against, you'd buy him a steak for his eye

WE'LL WAGER DOLLARS to doughnuts you approach a TV-Radio Service Dealer with apprehension — feeling sure he's scheming to "do" you out of an unfair portion of your hard-earned money. This mental black eye given the TV-Radio Service profession by the public is undeserved. When TV-Radio Service Dealers were swept into the spectacular growth of the nation's fastest developing new industry, some made mistakes, but the misguided were mighty few. The vast majority of Television and Radio Service Technicians are capable, efficient, thoroughly trustworthy businessmen doing a magnificent job of keeping pace with a rapidly expanding new industry.

And we know what we're talking about. Since 1945 — that's way back before nationwide TV — the Raytheon Manufacturing Company, through several of America's largest surety companies has been Bonding the repair work of Radio and Television Service Dealers. More than 30,000 Registered Bond Certificates have been issued to service dealers all over the United States, and of the millions of jobs these qualified Bonded dealers have handled *we've received less than 50 complaints.* We consider this amazing record a marvelous indication of the skill, integrity and ability of these selected service dealers.

The service dealers that are bonded through Raytheon are nationally known as *RAYTHEON BONDED ELECTRONIC TECHNICIANS.* They must be skilled technicians, have modern, efficient test equipment, and a wealth of experience to qualify for this coveted classification. They adhere to a strict 8-point Code of Ethics designed to protect you. Here it is:

1. Guarantee all Radio and Television repair work for 90 days.
2. Use only parts of recognized quality.
3. Charge not more than list price for parts installed.
4. Test customers' tubes as accurately as possible.
5. Keep labor charges at a reasonable level.
6. Perform only such work as is necessary.
7. Maintain proper equipment for good repair work.
8. Maintain the highest quality service.

Whatever the make and model of your radio or television sets, next time you need service we'd like to suggest you call a *Raytheon Bonded Electronic Technician.* Look for his seal. It's the symbol of a service man whose work, way of doing business, and integrity are above reproach. We're sure he'll satisfy you.

RAYTHEON
Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY, RECEIVING TUBE DIVISION
NEWTON · CHICAGO · ATLANTA · LOS ANGELES

RAYTHEON Bonded ELECTRONIC TECHNICIANS
CCC

RAYTHEON MANUFACTURES TELEVISION AND RADIO TUBES, INDUSTRIAL AND POWER TUBES, TELEVISION AND RADIO SETS, GERMANIUM PRODUCTS, DIATHERMY EQUIPMENT, ELECTRONIC COOKERS, ELECTRONIC MARINE EQUIPMENT, ELECTRONIC DUPLICATORS, INDUSTRIAL EQUIPMENT, ULTRASONIC MACHINE TOOLS AND ELECTRONIC TUBES, SONAR, RADAR AND COMMUNICATIONS EQUIPMENT FOR THE UNITED STATES GOVERNMENT

Raytheon Is Telling Your Side of the Story to over

25,000,000 Readers of LIFE

The September 21st issue of LIFE will carry the full page, two color advertisement pictured above, telling your side of the Radio-TV Service story to LIFE'S vast audience. We gladly run this advertisement to help you combat the unjust attacks that have been made on your profession and to give the public a true picture of the really good job you are doing. It's our way of saying "thank you" for your loyalty to *Raytheon Radio and Television Tubes.* We assure you their quality and performance will continue to meet your most exacting requirements.

RAYTHEON
Excellence in Electronics

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

EDITORIAL

by S. R. COWAN

UHF Conversion Problems

Many new *uhf* stations are nearing the operations stage, giving rise to many acute problems for service dealers and servicemen. Primarily, they must have or acquire the technical competency to make these conversions; then they must determine how much customers should be charged for such conversion service work. A very comprehensive story on this subject, a report on how Norfolk, Va. servicemen met the challenge, will appear in October "*Service Dealer*." Don't miss it!

Meanwhile, the happenings at Houston, Tex., where a new *uhf* station is nearing completion, warrant discussion. In Houston, recently, the Appliance Dealers Ass'n held a meeting at which there was present representatives of the Texas Electronics Technicians Ass'n, the BBB and the Retail Merchants Ass'n. It was brought out, from the serviceman's angle, that no pre-planned scale of rate charges for conversions should be decided upon. And rightly so! The general concensus that sets having turret-type front ends could be converted for a charge of $15 while non-turret-type sets could be converted for $50 is too low, to our way of thinking. Re-examine your cost figures, fellows!

That no antennas should be installed until a test pattern is actually on the air was decided upon. This is smart, as experience in other areas has shown. That a booklet designed to enlighten the public on set conversions, published by BBB and NAM, is to be offered to dealers and technicians, also meets with our favor . . . but even that book has some shortcoming in that it works more to the disadvantage of the serviceman, while favoring dealers. This is something that technicians should be forewarned about.

However, one point raised at the Houston meeting deserves special comment and criticism. The Appliance Dealers Ass'n stressed that there was "an ever-increasing number of 'unauthorized' and 'unscrupulous' repairmen operating in the area." It was mentioned that BBB was checking all servicemen listed in the telephone directory and technicians associations. We ask, "Who is qualified to judge as to who is an 'authorized' repairman?"

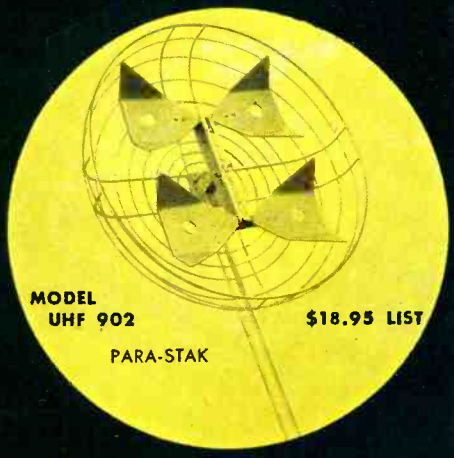
We advocate association membership for all technicians, even part-time independents and we strongly object to any group setting itself up to adjudge any independent servicemen as being "unauthorized" providing the man has the proper ability and integrity. We're for free enterprise as strongly as we are for unity and association membership. More important—we're for servicemen as such, and want to see them all enjoy higher living standards.

GOLD-COLORED ANTENNA... FULL-YEAR GUARANTEE AGAINST RUST AND CORROSION... ADVANCED HIGH-GAIN ANTI-VIBRATION DESIGN...

These revolutionary features are your identification of the new JFD "Gold Shield" UHF antennas—introducing to the TV antenna field an unprecedented consumer attraction.

JFD GOLD SHIELD GUARANTEE

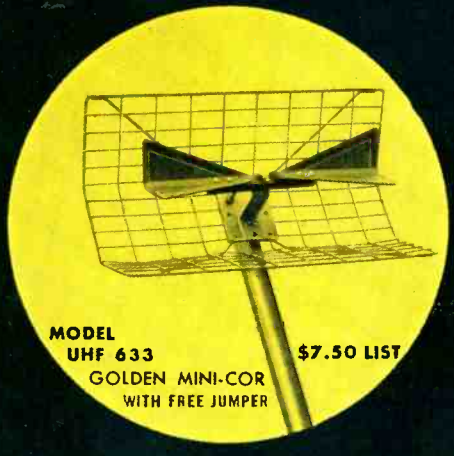
This JFD Gold-Shield Antenna is Guaranteed Against Rusting for 1 Year (normal use)



MODEL UHF 902 — $18.95 LIST
PARA-STAK

MODEL UHF 400 — $14.95 LIST
GOLDEN MAXI-COR

MODEL UHF 900 — $14.95 LIST
PARA-BOW



MODEL UHF 633 — $7.50 LIST
GOLDEN MINI-COR
WITH FREE JUMPER

MODEL UHF 411 — $11.75 LIST
GOLDEN BRIDGE

MODEL UHF 611 — $6.95 LIST
GOLDEN BOW-FLECTOR
WITH FREE JUMPER

Burton browne advertising

MODEL UHF 300 GOLDEN YAGI
WITH FREE JUMPER $5.50 LIST

JFD Electronics

Here's what the JFD "Gold Shield" UHF antennas offer you: An individual antenna for each installation requirement, ranging from the "Golden Para-stak" with 15 DB. gain and 20.5 DB. front-to-back ratio for fringe areas to the "Golden Bow-flector" with 6.5 DB. gain and 10 DB. front-to-back ratio for local signal areas. Add "Bronzidite" protective plating, and you have the antennas for greater UHF profits—without call-backs. See them at your jobber or write for Catalog No. 218.

BRONZIDITE

JFD MANUFACTURING CO., INC.
BROOKLYN 4, N.Y.
World's largest manufacturer of TV antennas and accessories

YOU'VE HEARD ABOUT THE Telechief®

It's HERE—Sangamo's new premium molded paper tubular capacitor that will outlast and outperform any other tubular . . . built for better TV performance.

NOW...

see your jobber for this

SPECIAL INTRODUCTORY OFFER!

Only $24.00

Slightly higher in Canada

Here's a deal you can't afford to miss. You get a basic balanced inventory of fast-moving "Telechiefs"—assortment based on national popularity—*PLUS* a heavy gauge steel chest with two extra drawers for small parts—*PLUS* 100 attractive folders of your choice to promote your business. You get all this for only $24.00—the dealer net price of the capacitors alone. (They list at $40.00.)

Get acquainted with the Telechief today—your Jobber has these kits in stock.

You can have 100 of any of these business-building folders without extra cost—a sample of each is enclosed in the kit.

Those who know...choose Sangamo

SC53-12

SANGAMO ELECTRIC COMPANY MARION ILLINOIS

TRADE FLASHES

[from page 8]

showing to television dealers and others interested in building up enthusiasm for new *UHF* television service.

NTSC Proposes New Color TV Standards

The National Television System Committee, an industry-wide group of scientists and engineers, announced it will ask the Federal Communications Commission to adopt new improved standards for commercial color television broadcasting. The standards proposed are an improvement over existing television standards in that they permit the broadcasting of color and simultaneously provide black and white sets with a high-quality black and white picture. No changes would be necessary in present sets to permit them to continue to receive a black and white picture from transmissions in color.

RTMA Changes Name to RETMA

Members of the Radio-Television Manufacturers Association voted to change their name to the Radio-Electronics-Television Manufacturers Association and approved a reorganization plan which will expand the Board of Directors and provide larger representation for new segments of the industry. The changes become effective immediately.

WNHC-TV Scheduled For Power Increase

The Elm City Broadcasting Corporation, owner of *VHF* television station WNHC-TV, has received permission from the FCC to increase its visual power output from 18,000 to 316,000 watts and to telecast on Channel 8. In changing from Channel 6 to Channel 8, WNHC-TV will provide stronger power which will eliminate any possible interference from other stations. The increase in telecasting power will enable WNHC-TV to penetrate, in a deeper and broader sense, the areas it now serves. The increase in power will, of course, bring about a further penetration of Southern New England and Eastern New York State. Target date for change is set for some time in November of this year.

January-June Television Production Record Set

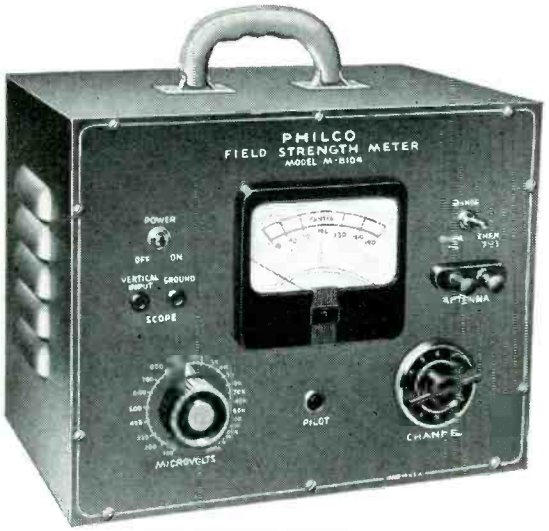
Television set production during the first six months of this year set a new record for the period, the Radio-Electronics-Television Manufacturers Association announced. At the same time, radio production topped the comparable 1952 period by over 1.8 million sets. For the first 26 weeks of this year, RETMA estimated that 3,834,236 TV receivers and 7,266,542 radios were manufactured. This compares with output of 2,318,235 television sets and 5,456,035 radio receivers in the same 1952 period. The previous January-June high in television production was set during 1951 when 3,457,519 sets were manufactured. For the month of June, RETMA reported that 524,479 television sets and 1,163,831 radios were produced compared with 361,152 TV receivers and 986,603 radios in the same 1952 month. Radios with FM circuits manufactured during June totaled 49,875 units. In addition, 1,384 television sets with FM facilities were produced.

RCA Features Hi-Fi Victrola Phonographs At NAMM Convention

Newly-developed high fidelity Victrola phonographs and new-type extended range phonograph records—both products of the RCA Victor Division were featured at the annual convention of the National Association of Music Merchants. The occasion marked the first demonstration to a large group of RCA Victor's new high fidelity Victrola phonographs, developed after

[Continued on page 60]

Servicemen!



Field Strength Meter

Model M-8104. More new features than any other unit at this popular price. Reads signal strength directly from the dial from 10 to 100,000 microvolts. A serviceman's time saver to measure actual TV picture signal strength.

CHECK THESE PHILCO TEST EQUIPMENT FEATURES

- ✓ New Low Prices
- ✓ New Ruggedness
- ✓ New Circuitry
- ✓ New Versatility
- ✓ New Styling
- ✓ New Accuracy

Cross Dot Linearity Pattern

Model G-8004. Philco's new unit for the finest possible linearity adjustments when a station pattern is not available. It provides extreme versatility of performance and design at amazing economy of operation. Light, rugged and portable it's the new leader in test equipment.

NOW YOURS ON NEW EASY PAYMENT PLAN

VHF to UHF Signal Generator Adapter

Model G-8000. The most economical system yet designed to produce UHF signals for TV receiver tests. Through a conversion process using any VHF meter this unit produces from an input VHF signal. UHF signals having the same characteristics as the VHF signal.

Mutual Conductance Tube Checker

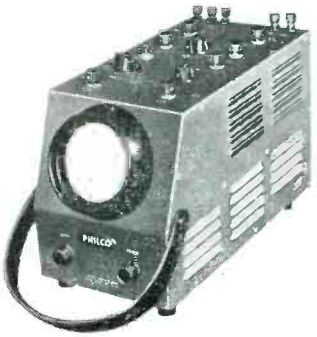
Model 7052. Tests more different type tubes than any unit on the market, from subminiature to acorn low power transmitting tubes. Shorts on tube elements can be easily determined, employs roll chart instead of cards, for use as a portable or counter top unit.

Dynamic Signal Tracer

Model 7031. An extremely versatile instrument . . . this unit is designed for fast diagnosis of radio trouble by audibly monitoring RF and AF circuits. Can be used to accurately check P.A. systems, microphones and phonograph pick-up circuits, also localizes distortion.

5-inch High Gain Oscilloscope

Model S-8202. This outstanding scope is built to the very highest standards of test instruments . . . It features the highest gain 10 millivolts/inch, and widest frequency range at its popular price. Wide sweep ranges allow extreme flexibility in sweep circuit trouble shooting.



3- nch TV Oscilloscope

Model S-8200. The most practical portable unit available for bench or field servicing. Preset horizontal and vertical sweep rates take the guesswork out of trouble shooting, aligning and measuring. Ideal for television because of its high sensitivity and wide response.

Philco Circuit Tester

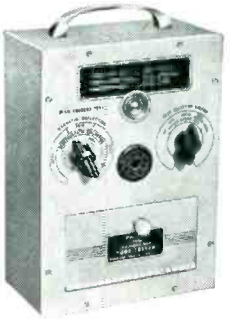
Model 8102. A general purpose volt-ohmeter that challenges comparison. Utilizes 1% resistors throughout to insure maximum accuracy. Tests AC voltage ranges of audio and high impedance AC circuits where a vacuum type voltmeter would normally be required.

Philco C rcuit Master

Model 8100 Designed to the most rigid of engineering specifications, this rugged metal-cased vacuum tube voltmeter is by far he finest in its price class. Provides unmatched accuracy for measuring and aligning where plus and minus indications are required.

UHF Auto-Level Sweep Generator

Model G-8002. The most modern, most inexpensive UHF sweep generator on the market. Checks sweep alignment with *any* test oscilloscope. Its output is controllable and leakage is negligible . . . makes possible over-all trouble shooting and testing of low level units.

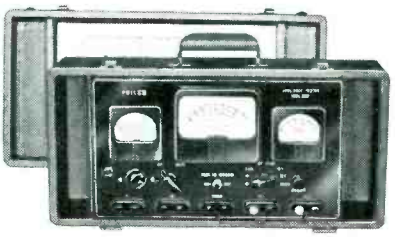


Cathode Ray Tube Checker

Model 7053. Will accurately test *all* picture tubes used in home TV receivers. Special cathode-ray tubes are easily checked by using plug-in adapters. Eliminates trouble shooting guesswork. Neon lamp indicates shorts and open elements in the electrodes of the gun.

Visual Alignment Generator

Model 7008. Combines in *one* economical instrument functions that can be approached only in a cumbersome collection of costly devices. No special scope connections are required for the most accurate visual alignment and calibration that is possible to achieve.



Appliance Tester

Model 5007. The ultimate in versatility. A one package, all purpose, portable appliance service unit. Permits over-all analysis of refrigerators, ranges, air conditioners and household appliances. With "pick-up" elements to determine temperature and built-in voltmeter.

MAIL THIS COUPON FOR NEW FREE BOOKLET
or see your Philco Distributor

PHILCO CORPORATION
Accessory Division
Allegheny Ave. & "A" St., Phila. 34, Pa.

☐ I am interested in the Philco Test Equipment shown here. Please send me details of your SPECIAL PURCHASE PLAN for obtaining these units.

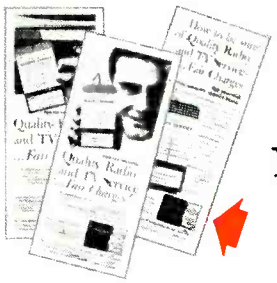
☐ Please send FREE copy of your new booklet on Philco Test Equipment.

NAME .....
ADDRESS .....
CITY ..... STATE .....

If *you* could advertise nationally, chances are *you'd* do just what CBS-Hytron is doing for *you*. *You'd* tell the world in LIFE and The Saturday Evening POST

Half-page advertisements will appear in LIFE Sept. 28, POST Oct. 3, LIFE Oct. 19, POST Oct. 31, LIFE Nov. 16, and POST Nov. 28. Reaching over 28,583,290 readers!

that *you* promise quality TV and Radio service, parts, and tubes . . . and at fair charges. And that's just what CBS-Hytron is doing for *you* with advertisements like these.



You'd identify *your* service repair shop as the *one* people are reading about in the magazines. *You'd* use this *Certified* **QUALITY SERVICE** decalcomania on *your* door.

These are just some of your *Certified* Quality Service advertisements. They sell *you* . . . and without a lot of sell for CBS-Hytron, although CBS-Hytron gladly pays the bill. Why? Because as we build *public confidence* in *Certified* Quality Service, we build greater faith *in you* and more business *for you* . . . our customers.

You'd use this *Certified* **QUALITY SERVICE** window streamer.

And

Let folks know *you Certify* the quality of your service, parts, and tubes . . . and at fair charges. Use all the *Certified* Quality Service sales material available to you. Be sure this window streamer is *up* during *your* consistent advertising campaign this Fall.

CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON, Danvers, Massachusetts

A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

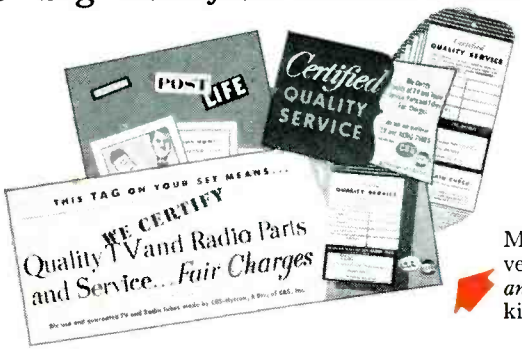
A member of the CBS family . . . CBS Radio • CBS Television • Columbia Records, Inc. • CBS Laboratories • CBS-Columbia, Inc. • and CBS-Hytron

above all *you'd* use these *Certified* **QUALITY SERVICE** tags.

They tell *your* customer he is getting more for his money when he calls *your* service repair shop . . . because *you Certify* the quality of service, parts, and tubes . . . and at fair charges. Yes, by using all this material, and more to come, *you* cash in on *your* big *Certified* **QUALITY SERVICE** advertising campaign.

This plan goes *all* the way to do the job. When *you* use these *Certified* Quality Service tags you're putting right into your customer's hands convincing *proof* . . . Proof that *Certified* Quality Service means *more for your customer's money.*

Get *your* kit.



It contains all the material *you* need to identify *you* as a *Certified* **QUALITY SERVICE** dealer. Ask your CBS-Hytron distributor for *special deal.* Or use coupon to order direct.

Make the most of *your* big *Certified* Quality Service advertising campaign. Be sure you have *all the facts* . . . *and all* the material you need. Get this *sales* promotion kit, today!

SEE YOUR CBS-HYTRON DISTRIBUTOR . . . OR MAIL COUPON TODAY!

CBS-HYTRON, Danvers, Mass.

Please rush me the *Certified* Quality Service promotion kit, containing:

1. 18- by 28-inch LIFE and POST easel display . . .
2. New *Certified* Quality Service decal . . .
3. 8- by 23-inch window streamer . . .
4. AND 250 *Certified* Quality Service tags imprinted with MY name and address.

HERE IS MY 3-LINE IMPRINT:

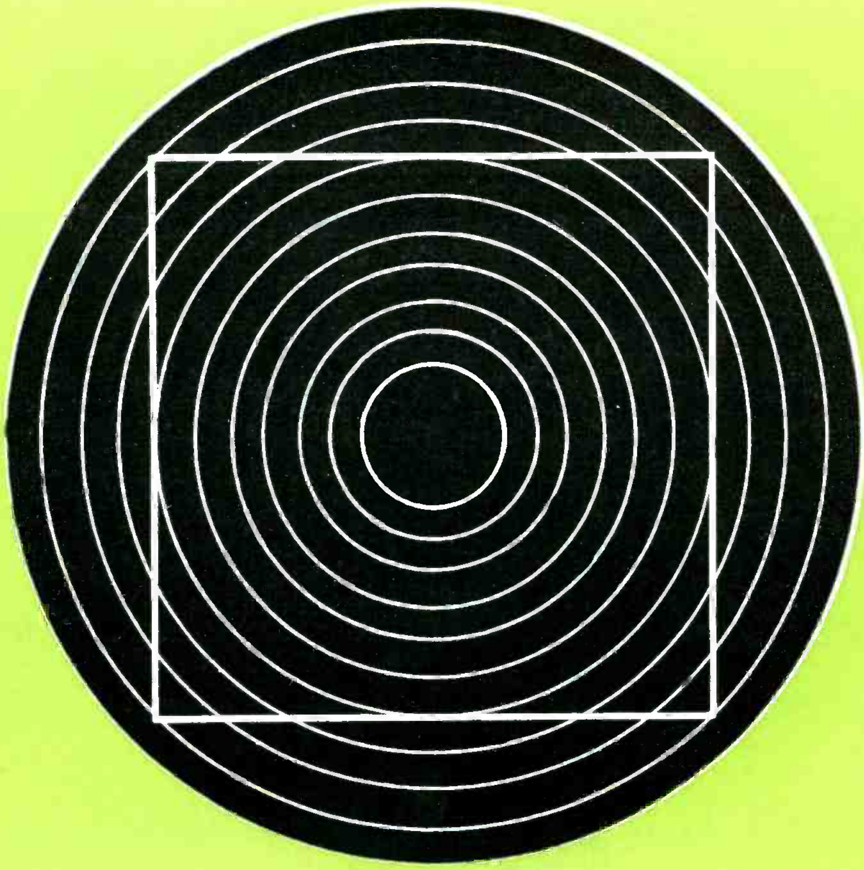
Name _____
(please print)

Street _____

City _____ *State* _____

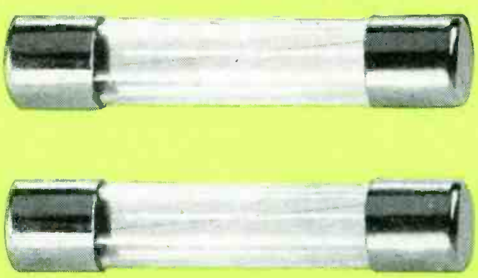
I enclose $2.00 to cover the cost of imprinting.

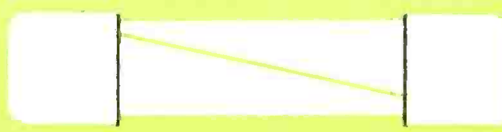
Signed: _____



things are NOT as they seem . . .

This is a perfect square within the circle
— it is an optical illusion that the sides bend.





This fuse may burn out anywhere along the length of the filament even in the cap—this blown fuse is impossible to detect visually.

Things are not as they seem . . .
These two fuses look alike . . .
But they are not.

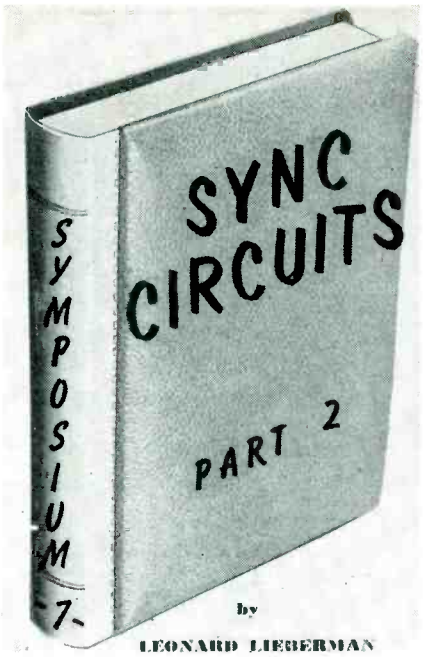
This Littelfuse has a controlled blowing point—the filament is plated throughout its length except in the very center—the fuse will always blow here. A blown Littelfuse can be detected immediately—a Littelfuse feature.

Littelfuse holds more design patents on fuses than all other manufacturers combined.

LITTELFUSE

DES PLAINES, ILLINOIS

This concluding installment on Sync Circuits gives a circuit analysis of various types used in commercial television receivers. An overall picture of the different types of sync circuits one may expect to service is thereby obtained.



Erratum: The first installment of "Sync Circuits" in the August, 1953 issue should be corrected as follows: Text matter (not illustrations) reading **Figs. 5, 6, 7, and 8** should read **Figs. 6, 7, 8, and 9** respectively. **Page 20,** 5th par., last line—**Fig. 5b** should read **Fig. 5.** Page 21, 5th par., 2nd line—delete **Fig. 9.**

Silvertone Model 1176-21

The Silvertone Model #1176-21 *(Fig. 11)* is an example of a cathode driven stage followed by a direct coupled stage. The composite video signal is fed to half of a 6SN7 through a double time constant network. It consists of a 270K resistor paralleled by a 270 $\mu\mu$f condenser which is in series with a .01 μf condenser and a 2 meg resistor to ground. The cathode is grounded and the 2 meg grid leak resistor develops a high bias. The plate voltage is kept low by means of a 68K resistor.

The signal is fed to the grid sync phase positive. As a result of the high bias, most of the video portion of the signal falls in the cut-off region. Due to the low plate voltage and resulting plate saturation, there is some compression of the top of the sync pulse. In this manner, noise on the sync pulse is compressed.

The signal is then fed through a .05 μf condenser to the cathode of the following stage, half of a 12AU7. This stage has the cathode at +125 volts, the grid is at +120 volts and the plate is at +145 volts. As a result of these voltage relationships, this stage cuts off part of the sync signal to flatten the top and also compresses the remaining video by plate saturation. The grid of the last stage is direct coupled to the plate of V2 in order to retain the original shape of the pulse. The output of this stage is fed to the horizontal and vertical sweep circuits.

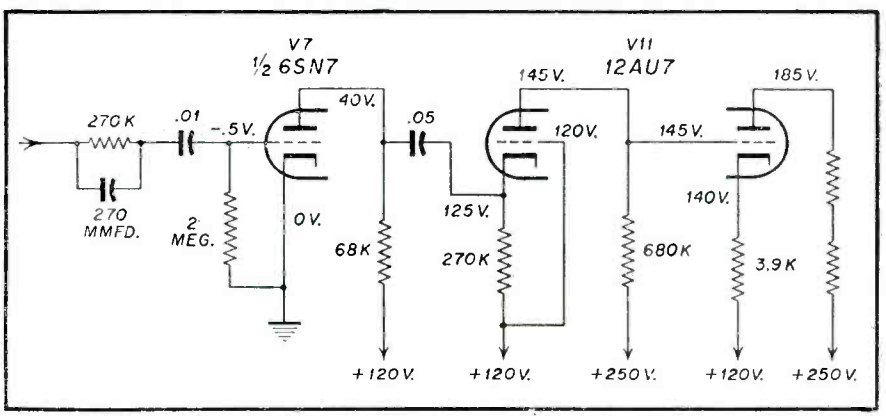


Fig. 11—Silvertone Model 1176-21. Note the cathode driven stage followed by a direct copuled stage. This method eliminates noise triggering of sweep oscillators.

Sparton Model 5212

The Sparton Model #5212 *(Fig. 12)* operates in a similar manner, with the following variations:

1. A pentode (6AU6) is used instead of the two triode sections for both clipping the top of the sync pulse and stripping the video information from the sync.
2. The grids of both stages are returned to positive points to present less of a charging impedance to noise pulses. The composite signal is fed sync phase positive to the grid of the 6AU6 through a double time constant circuit which discriminates against noise pulses.

The grid return resistor (2.2 meg) is returned to a tap between two 22K cathode resistors (See *Fig 12*, point A). Approximately 9 volts of grid to cathode bias is developed across the second resistor. The plate and screen are at 100 volts resulting in quick plate saturation.

The grid of the second stage is coupled to the plate of the first stage by means of a .1 μf condenser. The grid return of the second stage goes back to +110 volts through a 2.2 meg resistor. Grid current establishes a voltage in the order of 9 volts positive at this grid. Cathode current develops 12 volts at the cathode resulting in a -3 volts grid to cathode bias. The plate is at 70 volts positive. The horizontal phase detector is fed from both cathode and plate resistors and the vertical is taken off the top of the plate load.

RCA KCS 66C

The sync circuit of the RCA Model #KCS 66C *(Fig. 13)* uses 2½ tubes. It

has separate horizontal and sync pulse systems, has a noise limiting circuit and is also used to set the bias of the *agc* circuit. Therefore, it fulfills the initial requirements of increased efficiency and circuit reduction.

First, let us examine the noise suppression circuit. By means of this circuit, noise pulses whose amplitude exceeds the sync pulse are eliminated. This circuit works in the following manner:

One input to the vertical sync stripper is fed from the video amplifier in sync phase positive. The screen of the fourth video *if* amplifier is also connected to this grid. The video *if* amplifier is so biased that the normal sync pulses will not drive the tube to grid current. Any pulses of greater amplitude than the sync pulse will cause grid current. The screen is not fully by-passed, and this pulse will cause the screen voltage to drop. This, in turn, causes a negative going pulse to appear at the vertical separater grid at the same time as the pulse which was passed through the video amplifier. In this manner, a negative noise pulse and the same pulse phased positively appear simultaneously at the grid and cancel each other out.

The composite signal is taken off the video amplifier and is fed to 2 tubes both separated by a 56K isolating resistor. The upper tubes in *(Fig. 13)* are the vertical sync string, the lower set is the horizontal sync string.

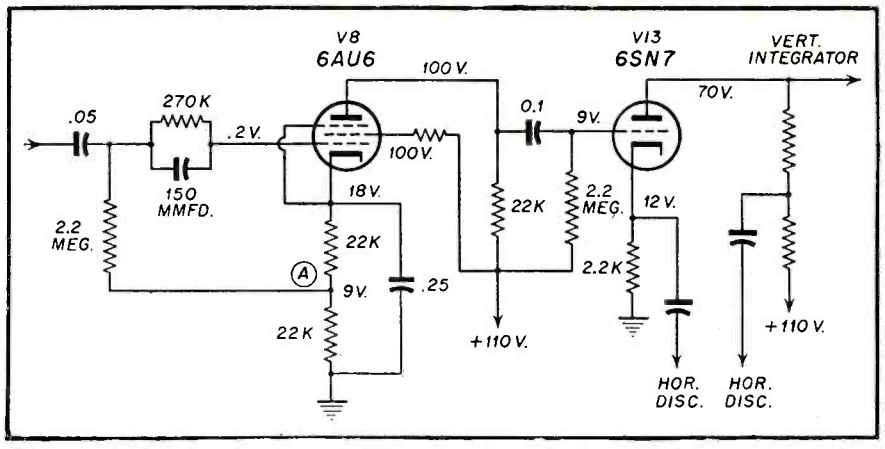


Fig. 12—Sparton Model 5212

The cathode of the vertical sync separater is connected by a 1.8 resistor to a tap on a bleeder from ground to +150 volts. The voltage at the cathode is approximately 95 volts. The grid is at +75 volts. The plate is connected to the boost voltage through a 120K and a 1 meg resistor and is nominally approximately 400 volts.

This stage, because of the heavy grid to cathode bias, tends to cut off all the video signal. The second stage, which has a very low plate voltage (+12 volts), compresses the video to the extent that only the vertical pulses are fed to the vertical integrator. Although, all the RC time constants in this circuit tend to discriminate against the horizontal pulse, the integrator network is featured by a differentiator circuit which shunts any higher frequency (horizontal) pulses to ground.

The horizontal circuit, in addition to its function of passing, amplifying, and shaping the horizontal sync pulses, also is the take-off point for the keyed *agc* system. In addition, it serves to set the *agc* bias level. The first sync stage is heavily biased (grid to cathode) by the insertion of a 150K cathode resistor. This brings the cathode voltage to +85 volts. The grid is at +75 volts. This results in the video portion of the composite signal being in the cut-off region. The second stage voltage, cuts off and clips the pulse fed to it. The third stage is also grid leak biased and is a cathode follower which feeds the signal to the horizontal *afc* tube.

The biased level for the *agc* is set in the following manner: The potentiometer *(agc* control) determines the bias level of the grid of the first horizontal sync stripper. The positive *dc* level of the *agc* tube grid is taken off the junction of the 150K and .01 μf condenser at the stripper tube's cathode. Since the level of tube conduction is determined by the grid to cathode voltage relationship, setting the grid level thus determines the voltage at the cathode. Once this level is set, the *agc* tube operates on the peaks of the sync pulse which is then fed to the grid of the *agc* tube.

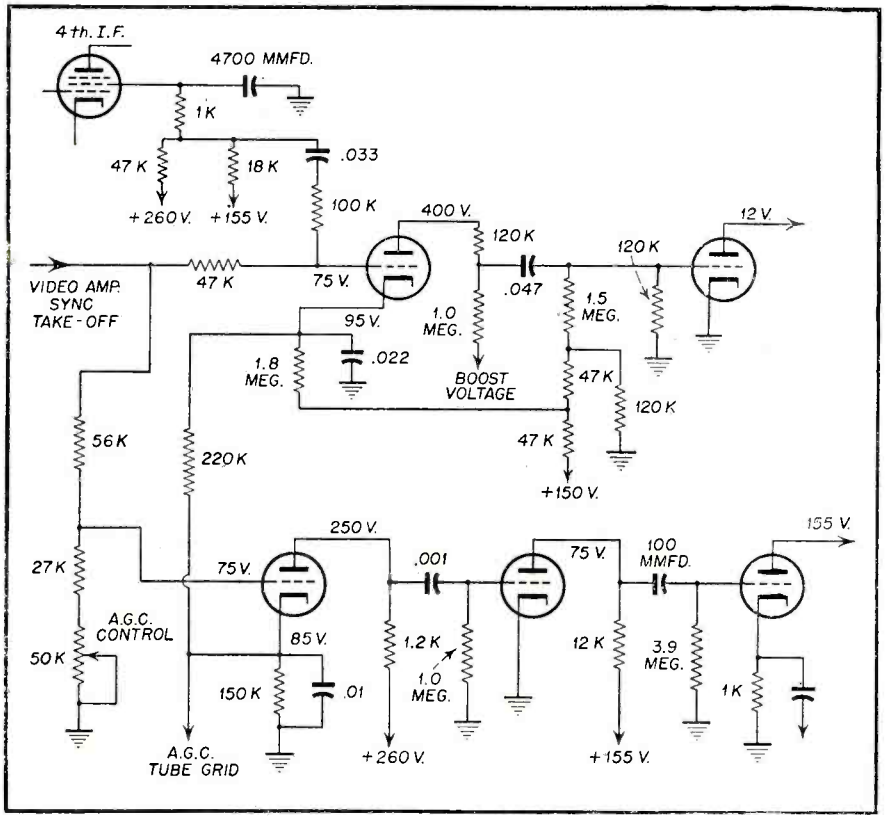


Fig. 13—RCA Model KCS66C

Philco Model 52T2110

The Philco Model #52T2110 *(Fig. 14)* is one of the most interesting examples of sync circuitry. The principle of operation depends on an action opposite to the usual diode action. Usually the portion of the signal appearing across the diode load resistor during conduction is the one used. In this case, it is the signal appearing across the load resistor during the

time that the tube is *not* conducting which is utilized.

This circuit works in the following manner: The composite signal is taken off the plate of the video amplifier sync phase positive. It is fed to half of a 12AU7. The cathodes of both halves of the tube have a common cathode resistor. The second section of the 12AU7 is diode connected. The plate resistor of the second section (180K) goes to+ 240 volts. It is large enough so that any plate current sends the plate voltage to approximately cathode potential. The plate also goes to ground through a 39K resistor.

The diode will only conduct during the negative (or video) portion of the composite signal. This conduction through the 39K resistor causes the .015 μf coupling condenser to discharge and sets up a heavy bias on the following grid. When the upper or sync portion of the signal appears on the common cathode resistor, the diode stops conducting. The 39K resistor acts as the charging resistor for the coupling condenser. This brings the grid of the following tube above cut-off and into conduction. The RC time of the diode load is such that recovery time is equal to approximately sync pulse time.

The output of the final stage is an amplified pulse equal to sync pulse. The feedback resistors from the plate of the final tube and the grid of the first tube sharpens and shapes the output pulses. The 270K resistor and 180 $\mu\mu$f condenser in the grid of the final stage presents a high impedance to noise pulses.

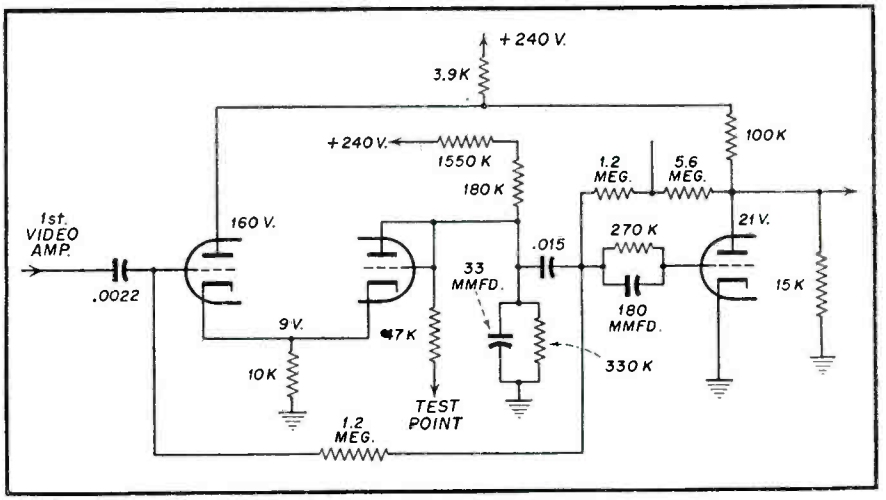


Fig. 14—Philco Model 52T2110

By constantly testing new models as they come into the shop, observing the voltage relationships with a meter and the sync signal by means of a scope, almost all sync circuits can be analysed. It might be advisable, when a receiver with a new and complex circuit comes into the shop and there are no voltage or scope measurements on the schematic, to note these items down so that the operation of the circuit can be studied and troubles in the sync located much more quickly.

Capehart CT52 & CT57—Heptode Sync Stripper

From the looks of the sets recently reaching the market, more and more of the manufacturers are hopping on the heptode sync stripper bandwagon. The Capehart CT52 *(Fig. 15)* is another in the parade. There are, some noteworthy features in this receiver.

In order to keep from loading the video amplifier output, and at the same time obtain better control of the two signals, the sync stripper signal is taken off the video detector. To obtain phase reversal and greater amplitude needed for the second control grid of V14 the sync stripper, the signal from the detector is fed to a 6BA6 sync amplifier, V13.

The cathode of V13 is grounded. The grid leak resistor *R52* (47K) with a signal across it causes the tube to cut off on the sync pulses. The plate is kept at approximately 25 volts due to the *dc* voltage across *R54* and *R55*. This results in a high plate voltage signal during cut-off. The output is a positive going sync pulse with accompanying video information. In addition to driving the 6BE6 sync stripper this signal also drives a keyed *agc* tube.

The 6BE6 first control grid is driven from the video detector with a 2-volt peak to peak negative sync signal. This will hold the tube close to cut-off except when the positive signal from the sync amplifier appears at the second control grid at an amplitude corresponding only to the sync pulses. The feature of this circuit is the presence of *R57* (4.7 meg) which goes back to 130 volts B+. The purpose of this resistor is to buck out the negative voltage which would appear across *R52* the 6BA6 grid resistor as a result of heavy noise pulses which would bias V14 to cut-off. This bucking voltage is applied in weak signal areas by means of the switch S. This action does not occur during an ordinary sync pulse because the network *R56, C55* does not discriminate against sharp noise pulses.

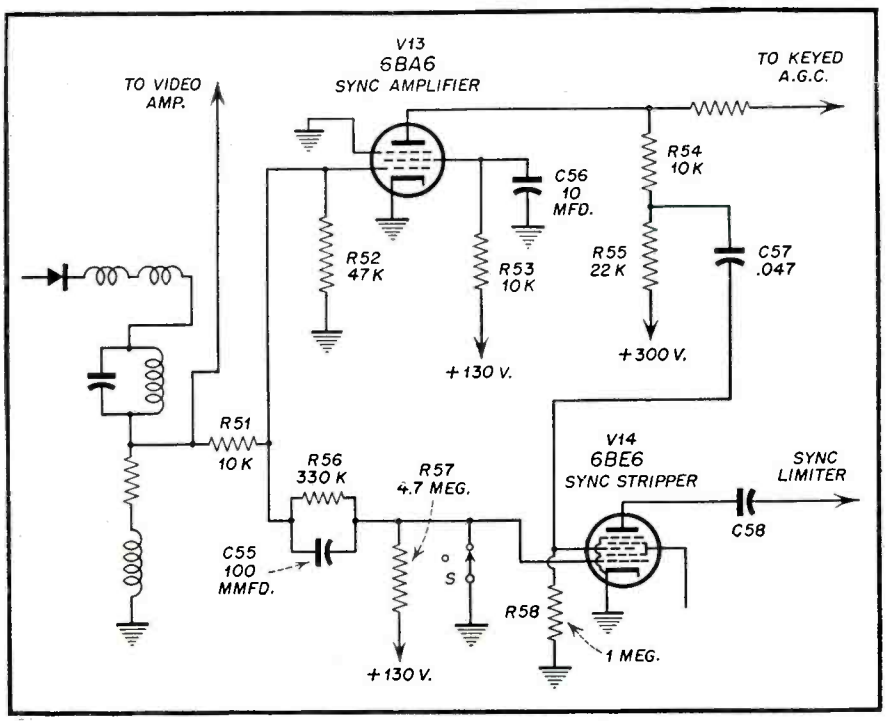


Fig. 15—Partial schematic Capehart CT52

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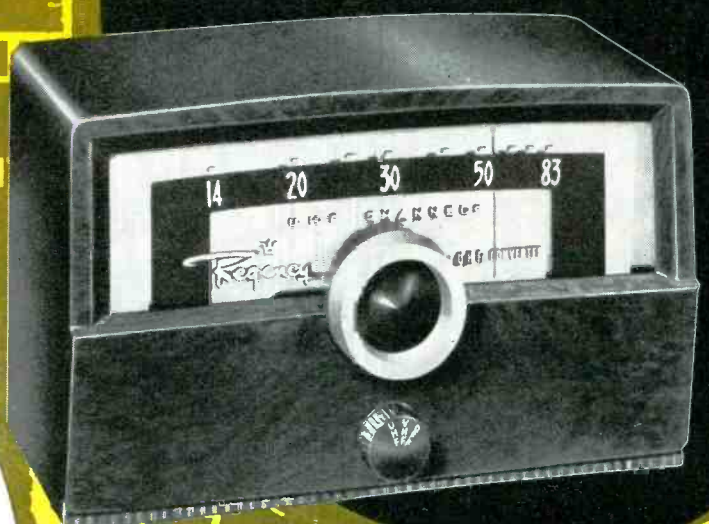
WE'LL TELL THE WORLD!

ONLY Regency HAS 5 WAY CONVERSION!

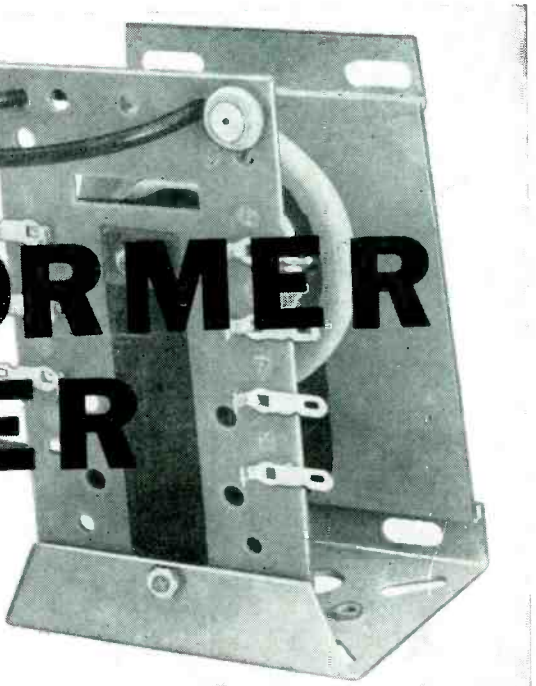
We'll tell them not to take chances with 2-way Conversion . . . that the Regency Quintuplet Converter, unlike *all* others, is designed to utilize any of 5 VHF channels in converting to UHF; other converters work only on 2 channels. Insure your customers against image interference, obsolescence! Sell them REGENCY'S Quintuplet Converter! . . . and at $49.95 list, there's greater profit for you!

Yes you'd better be ready for a big turnover this fall, because REGENCY'S promotional program is directing more traffic than ever *your* way!



Regency DIVISION OF I. D. E. A. INC.
Makers of VHF Boosters, FM Boosters, UHF Converters, Professional High Fidelity Equipment and Remote Control for Television

FLYBACK TRANSFORMER TESTER



by **HARRY CASEY**
(Chief Engineer, Kirby Products Corp.)

This article describes an effective piece of apparatus which simplifies horizontal output transformer testing.

AS any television serviceman will agree, the horizontal output section of a television receiver contains the circuits most likely to become defective much sooner and most often. Due to high peaks in operating voltages and other factors that subject circuit components and tubes to extreme operating conditions, marginal parts and tubes will break down faster.

Troubleshooting the horizontal sweep section of a TV receiver is fairly straightforward up to the flyback transformer. Some difficulty is presented in the horizontal sweep systems that employ regenerative types of B plus circuits. See *Fig. 1*. In these circuits the boosted B plus from the damper rectifier tube is used as B supply for all the tubes in the horizontal sweep system. This type of circuit can be successfully worked on in case of trouble by either feeding an external B plus to the horizontal oscillator plate load which causes it to oscillate if it is normal, or by removing the horizontal output tube from its socket. This decreases the B current drain enough to raise the B supply to a voltage high enough to permit the horizontal oscillator to operate.

If the trouble is not in the horizontal oscillator circuit, and after the horizontal output tube has been replaced and the circuit voltages checked, then the serviceman is generally up against a stone wall. From this point on he usually starts to check the flyback transformer for continuity and even if it appears satisfactory he removes it anyway and replaces it with one he thinks is good. This process is not only long drawn out, but does not always supply the answer. The author has had some very embarrassing experiences where a supposedly good replacement flyback transformer proved to be defective.

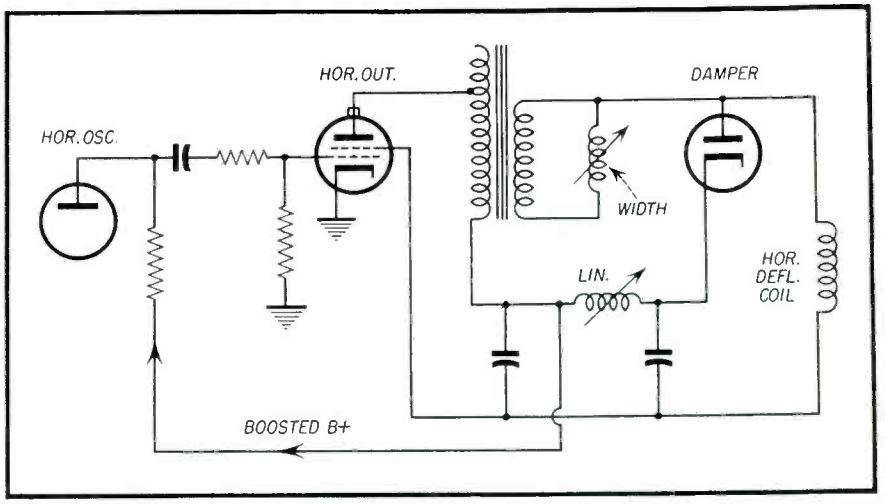


Fig. 1—Simplified schematic illustrating how the boost voltage from the horizontal output transformer feeds the plate circuit of the horizontal oscillator.

Recently a novel test instrument was developed which provides the answer to fast and sure horizontal output circuit troubleshooting. This instrument, called the Model 98, Flyback Transformer Tester, designed and produced by the Kirby Products Corporation of Philadelphia and New York, is a simple inexpensive test unit for checking the efficiency of flyback transformers. See *Fig 2*. This unit is so sensitive that it will actually detect the presence of one or two *shorted turns* in a flyback transformer. *Shorted turns* are the major reason for TV servicemen's headaches in flyback transformers, for they cause a large percentage of troubles and will not

Fig. 2—Flyback transformer tester.

show up with ordinary continuity tests made with an ohmmeter. For example see *Fig. 3*. Notice that any of the flyback transformer windings has a relatively low *dc* resistance. If just one or two of the turns were shorted as is shown in the figure the overall *dc* resistance would not decrease more than the barest percentage; a difference no ohmmeter could detect. However, the one or two shorted turns while not affecting the *dc* resistance to any degree have a considerable effect on the ac operating efficiency. They act the same as putting

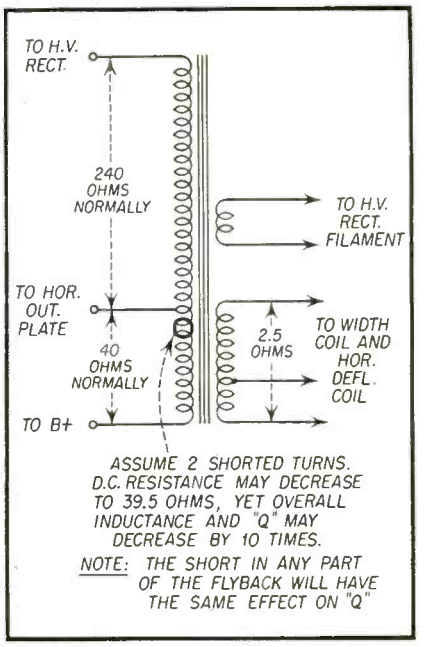


Fig. 3—Flyback resistance values.

a closed loop into a magnetic field. The energy in the field is shortcircuited, and the effective inductive reactance which determines the efficiency of the transformer is lowered tremendously. As a matter of fact, it is lowered to the point where the energy absorbed by the closed loop or shorted turn is so great that the horizontal output circuit fails to operate. This means a greatly decreased horizontal sweep width, a great reduction of subsequent high voltage or both.

The Model 98 contains very novel but simple circuitry. See *Fig 4*. A 6K6

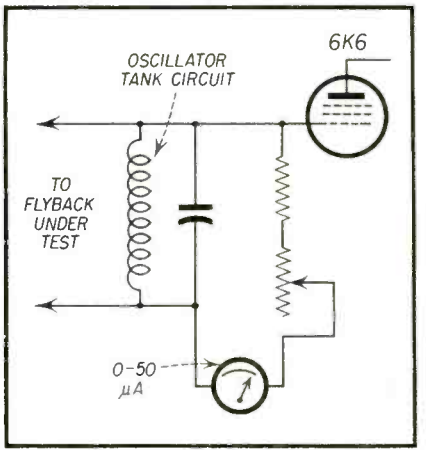


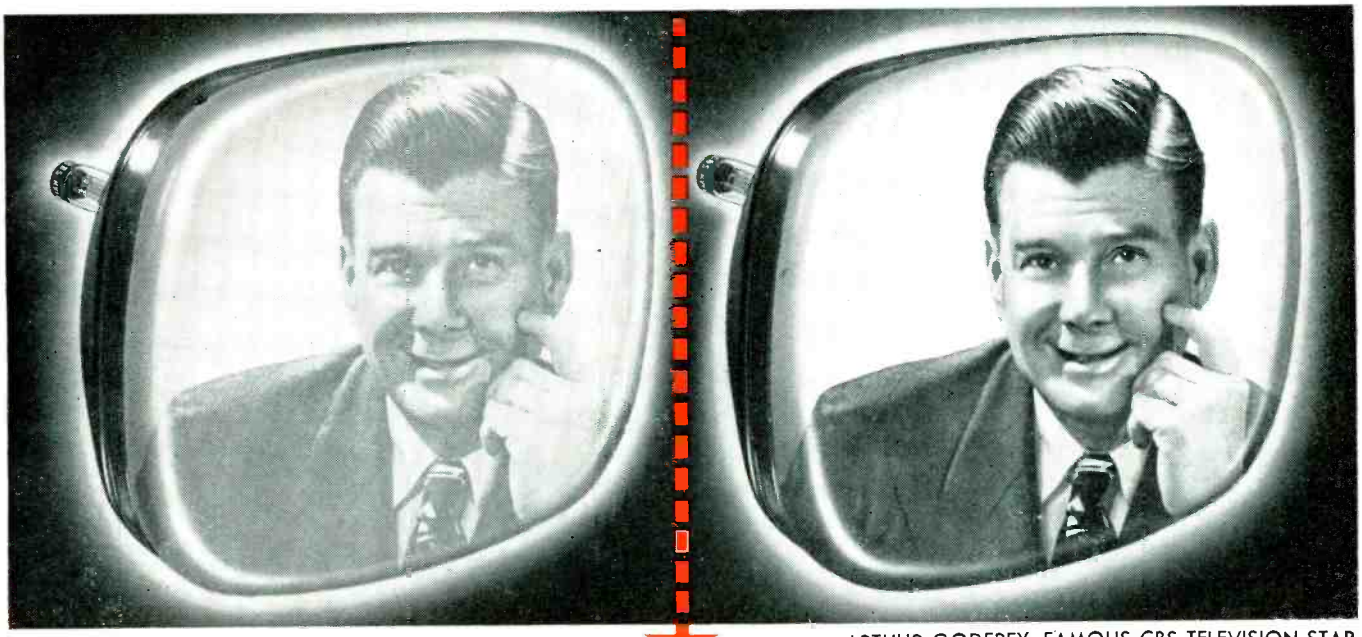
Fig. 4—Simplified schematic of flyback transformer tester.

tube is used as a special type of oscillator at a predetermined frequency and repetition rate.

A sensitive zero to fifty microampere meter is used as the indicating device. It is connected in the circuit to indi-

[*Continued on page 63*]

You can see the difference...



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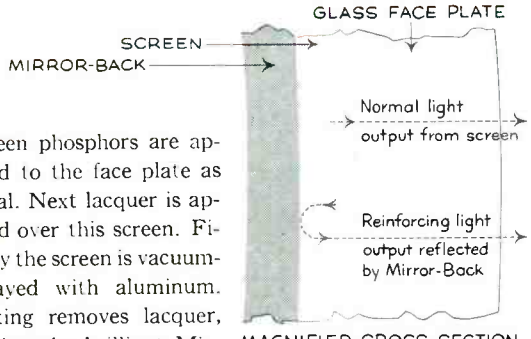

MAGNIFIED CROSS-SECTION

Screen phosphors are applied to the face plate as usual. Next lacquer is applied over this screen. Finally the screen is vacuum-sprayed with aluminum. Baking removes lacquer, leaving the brilliant Mirror-Back coating. Mirror-Back reflects light that would otherwise be lost to the rear of the screen. Boosts light output. Brightens picture.

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1. Stepped-up light output.
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3. Greater contrast.
4. Reduced strain on component parts.
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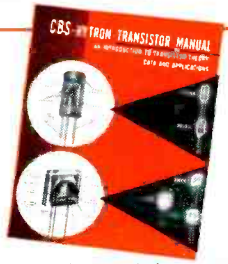
6. Longer life . . . drain on cathode materially reduced.

Leading TV set makers demand maximum brightness from their large-screen sets — without strain on component parts. For them, CBS-Hytron introduced its Mirror-Back 27EP4 and 24TP4 (both spherical, electromagnetic types). Mirror-like effect of their aluminum-backed screens reinforces light output. Gives brighter, sharper pictures.

You, too, will want CBS-Hytron Mirror-Back big-screen tubes for replacement. In 27- and 24-inch sizes, they are a must. Take a tip from leading TV set makers. Try the CBS-Hytron 27EP4 and 24TP4. See the difference for yourself. Let your customer see it too. Order performance-tested Mirror-Back tubes from your CBS-Hytron distributor.



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3 SPEED CHANGER CONVERSION

Valuable hints and procedures on the conversion of valuable phono cabinets to accommodate modern 3-speed changers.

by
L. C. BURDICK
(Sales Engineer, Webster-Chicago Corp.)

THE increasing demand of a growing "music conscious" public for complete and faithful reproduction of all types of records has made the record changer replacement business a profitable venture. Old consoles with single and dual speed changers represent a sufficient investment on the part of the owners to seek modernization with a good three speed diskchanger capable of playing all sizes of records. A follow up on a sale with an installation job makes the venture even more attractive. Any service organization can easily handle such an installation.

Basic Requirements

While variations of cabinet and circuit design exist, it is not difficult to adapt an old console to accept the modern 3-speed record changer. There are only two basic considerations in replacing the old unit and installing the new.

1. Space Requirements.
2. Electrical Requirements.

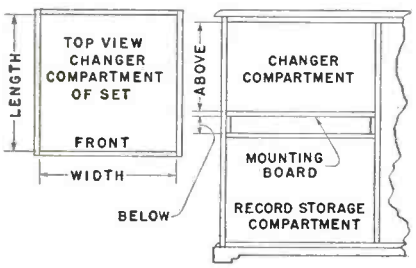
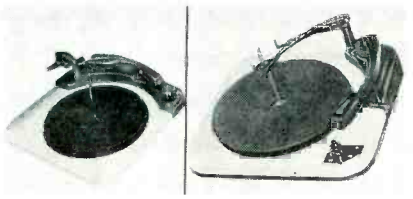


Fig. 1—Interior specifications of cabinet that should be carefully measured.



Diskchanger Chassis

MODEL	MIN. SPACE REQUIRED A	B	C	D	PICK-UP	CORD LENGTHS	MOUNTING BOARD NO.
121-1	14½"	13½"	2½"	5¼"	Crystal	3'	1909
121-270	14½"	13½"	2½"	5¼"	G.E. Triple Play	3'	1909
126-1 HF	15"	15"	2½"	6¼"	Crystal	3'	1910
126-27 HF	15"	15"	2½"	6¼"	Plug-in Heads for Magnetic Cartridge	3'	1910

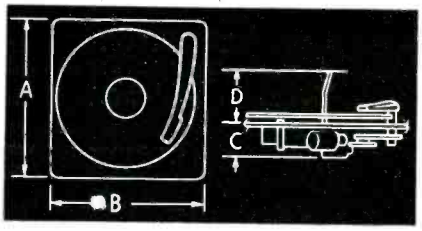


Fig. 2—Complete specifications of Webcor diskchangers. Measurements relating to space requirements are shown in center.

These considerations will determine the selection of the correct changer.

Webcor diskchangers are made with two different size mainplates (chassis) that will match the physical dimensions of virtually any type cabinet. Although the dimensions of the original changer plate are usually a good indication of the required size of the replacement unit, it is best to accurately measure the record changer compartment. These measurements take into consideration the length and width of the interior and, in addition, the space available above and below the mounting board or platform. See *Fig. 1*. Shown in *Fig. 2* are complete specifications of Webster-Chicago diskchangers. The minimum space requirements include the 12" record overlap and top parts overhang during manual or automatic operation.

The large majority of changers in older phono-radio combinations are equipped with crystal type cartridges. A modern 3-speed unit, using a similar cartridge, is electrically interchangeable with this type older changer. In some instances the customer may express a desire for the variable reluctance or magnetic cartridge. The installation will then require a pre-amplifier to compensate for low output and other characteris-

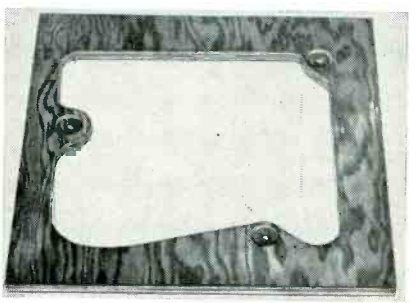


Fig. 3—Mounting board is provided to make installation easier.

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- Weather-resistant case
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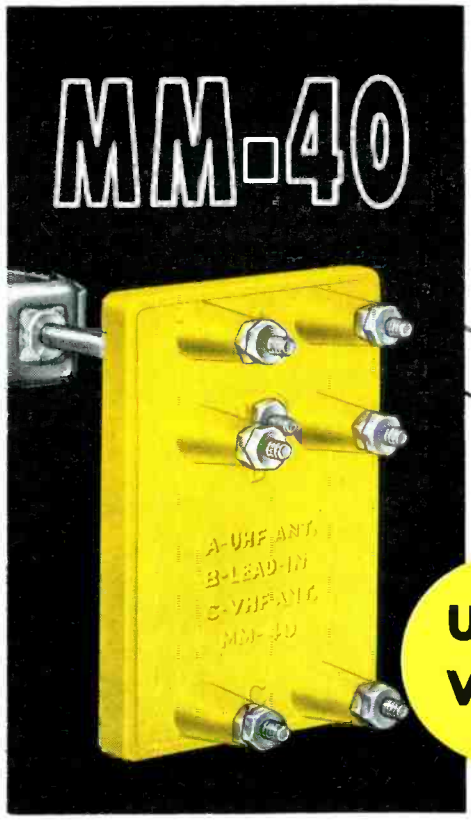
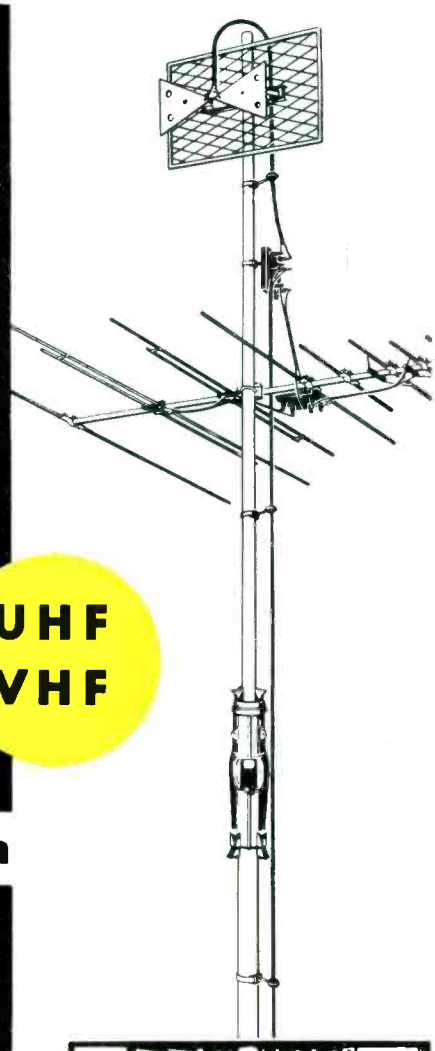
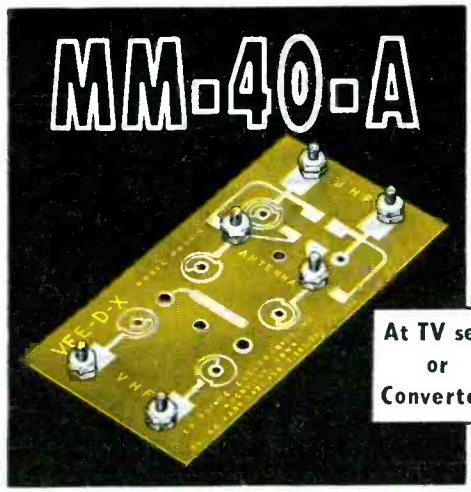
VEE-D-X was first to introduce the isolation filter (Mighty Match). Every Mighty Match is fully protected under*A.A.K. Pats. 2,422,458; 2,282,292; 2,611,086. The new models greatly minimize insertion loss, and are the result of constant research and engineering. Accept no substitute—insist on Mighty Match.

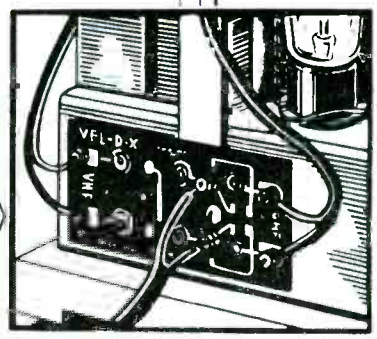




...and its companion



At TV set or Converter



SEVEN MODEL VARIATIONS FIT EVERY TYPE OF INSTALLATION.

also the new VHF MM-25

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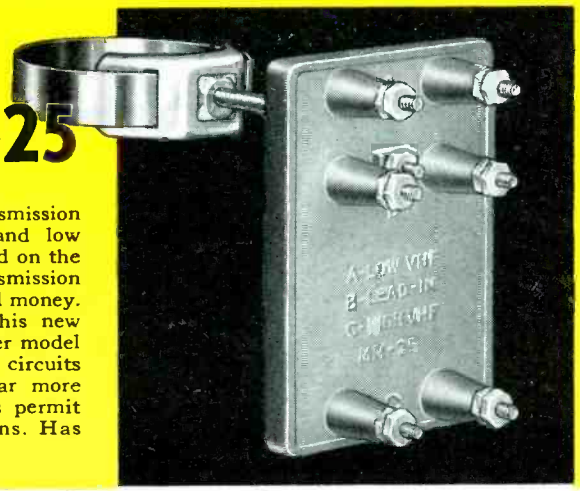

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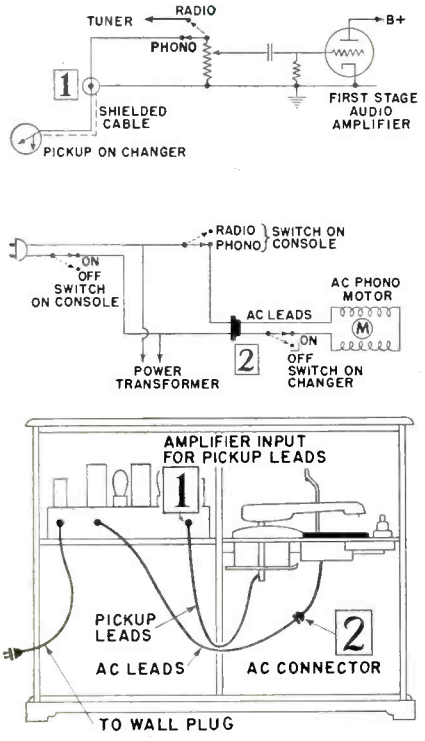


Fig. 4—(Top) Lead connection diagram—typical circuit.
(Center) AC lead connection diagram—typical circuit.
(Bottom) AC and pickup leads, changer chassis to radio chassis.

tics of this cartridge. Detailed electrical connections for both type cartridges will be treated later in this article.

Physical Installation

The physical and electrical basis for the diskchanger selection now established, removal of the old unit and actual installation of the new changer can be accomplished. (The *ac* cord should be disconnected from the wall socket while working on the installation). Almost all changers are secured to the mounting platform with removable bolts. If the unit is part of a slide-drawer assembly, removal of the entire drawer will facilitate the work. This can be done after first disconnecting the *ac* and pickup leads. Usually both sets of leads are connected to plugs that conveniently pull out from receptacles on the radio or amplifier chassis. Should the leads be soldered directly to the circuit, unsolder them but note the exact connections so that proper lead connections can be made when installing the replacement diskchanger. After the obsolete changer has been removed, the mounting platform (board) can be modified to properly mount the new unit. A template, supplied with the diskchanger, shows the correct cutout form. In the event a new board is needed the template provides a tracing for easy construction. ⅝" plywood is recommended for this purpose. Mounting boards, cut to fit the exact mounting requirements of Webcor diskchangers, are available. The photograph in *Fig. 3* shows a Webcor board that will serve as a replacement for the original and make the installation even more simple. The old board may be left in place, however, and most of the inside portion cut away. The new board can be placed on top of it and wood screws used to secure the mounting. If the cabinet will not permit the additional ⅝" vertical space required, removal of the old board and replacement with the new will be necessary. Alterations of the outside board dimension may be re-required in order to fit it properly into a particular cabinet. Sanding, staining, and otherwise finishing the board to match the cabinet interior can be accomplished to complete the physical installation.

Electrical Installation

As stated previously, a modern changer, equipped with a crystal tape cartridge, will be electrically interchangeable with an old unit using a crystal cartridge. The small problem involved then is that of making correct *ac* and pickup lead connections The *ac* leads, usually color coded, carry the

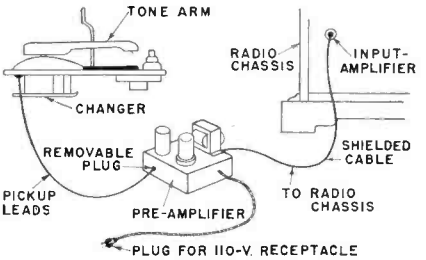


Fig. 5—Electrical position of typical pre-amp in a circuit comprising a changer and an input amplifier.

power to the motor of the diskchanger and the pickup leads deliver the electrical impulses, picked up by the cartridge, to the voltage amplifier (input) of the audio amplifier. The pickup leads are generally in cable form with the conductor insulated within a braided metal shield. Usually special plugs are used on

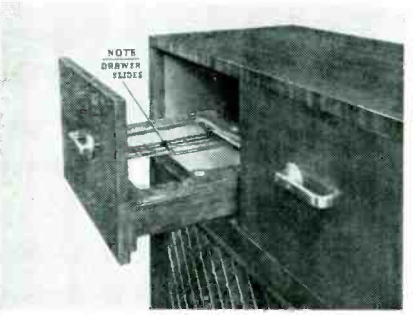
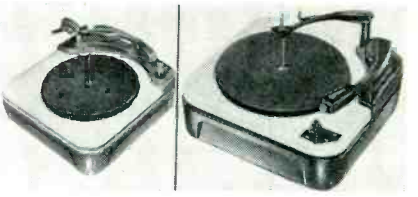


Fig. 6—Slide drawer type of mounting for changer mechanism.



Base-Mounted Fonografs

MODEL	MIN. SPACE REQUIRED A	B	C	PICK-UP	CORD LENGTHS
122-1	14½"	13½"	8¼"	Crystal	3'
122-270	14½"	13½"	8¼"	G.E. Triple Play	3'
127-1 HF	15"	15"	9½"	Crystal	6'
127-270 HF	15"	15"	9½"	G.E. Triple Play	6'
127-27 HF	15"	15"	9½"	Plug-in Heads for Magnetic Cartridge	6'

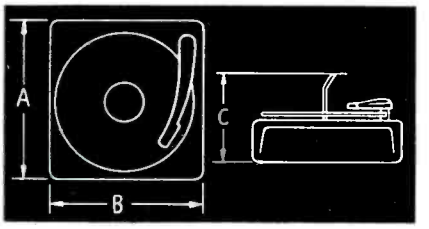


Fig. 7—Specifications for base pan models. Measurements relating to space requirements are shown in center.

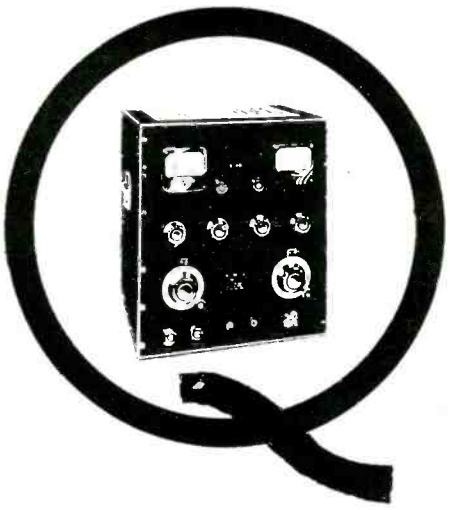
the leads that connect the old changer to the audio amplifier. The leads on both new and old changers must be identified and matched so that these plugs can be correctly used on the new diskchanger leads. The shield of the pickup cable is chassis grounded while the conductor will connect to the terminal of the plug that feeds the amplifier input. Quite often the bayonet plug on the end of the pickup cable of Webcor diskchangers will be the same type used on the original changer and will fit directly into the chassis receptacle. In *Fig. 4* the illustration and circuits shown are typical of those found in most consoles.

If a variable reluctance (magnetic) cartridge is used in a replacement unit, it will be necessary to install a pre-amplifier that will match the electrical characteristics of a particular magnetic cartridge. Several Webcor models are available equipped with either the General Electric triple-purpose cartridge or plug-in shells that will accept other magnetic cartridges. Cartridge manufacturers supply self-powered, matching pre-amps that can be easily mounted on the inside of the cabinet. The diagram in *Fig. 5* shows the electrical position of the pre-amp in the circuit.

Special Considerations

Cabinet Design: In a few instances the cabinet may be designed so that the record changer will come forward as the compartment door is pulled down. The redesign of this particular section of the cabinet may, in some cases, be easier than

[*Continued on page 71*]



MEASUREMENTS *and* METERS

PART 1

by **RUFUS P. TURNER**

The meaning of Q and various methods by which it may be measured is contained in this first installment. The subject matter is presented in a comparatively simple form.

INNUMERABLE coils and capacitors are employed in radio, television, and electronics. Efficient functioning of the circuits in which they operate depends upon the goodness of these components. The measurement of coil and capacitor quality therefore is as important as the measurement of inductance and capacitance. And often the quality is more important than absolute inductance and capacitance values.

There are several methods of checking the quality of these reactive components. But, when coils and capacitors are to be used at radio frequencies, the best test by far is the measurement of "Q."

What is "Q"?

The Q factor is the ratio of reactance (X) to resistance (R). It is expressed by the simple fraction X/R. The Q unit has no name comparable to the ohm for resistance, the ampere for current, and the cycle for frequency. It is merely numerical. The higher the Q, the better the grade of the component.

In either a coil or a capacitor, reactance is what we want (inductive reactance, X_L, in a coil; capacitive reactance, X_C, in a capacitor). But, we are forced to accept a certain amount of resistance also as an unavoidable by-product. Radio-frequency resistance results from characteristics of the wire with which a coil is wound; the metal plates, leads, terminals, and fittings of a capacitor; metal platings, corrosion, and presence of solder in circuit leads; skin effects; dielectric losses; moisture (surface, absorbed, and absorbed); proximity of shields and other metallic objects; and similar causes. *RF* resistance (which is what is meant by the term R in the Q fraction) can, under some conditions, be many times higher than any simple *dc* resistance present. It cannot be measured by any simple means, such as an ohmmeter.

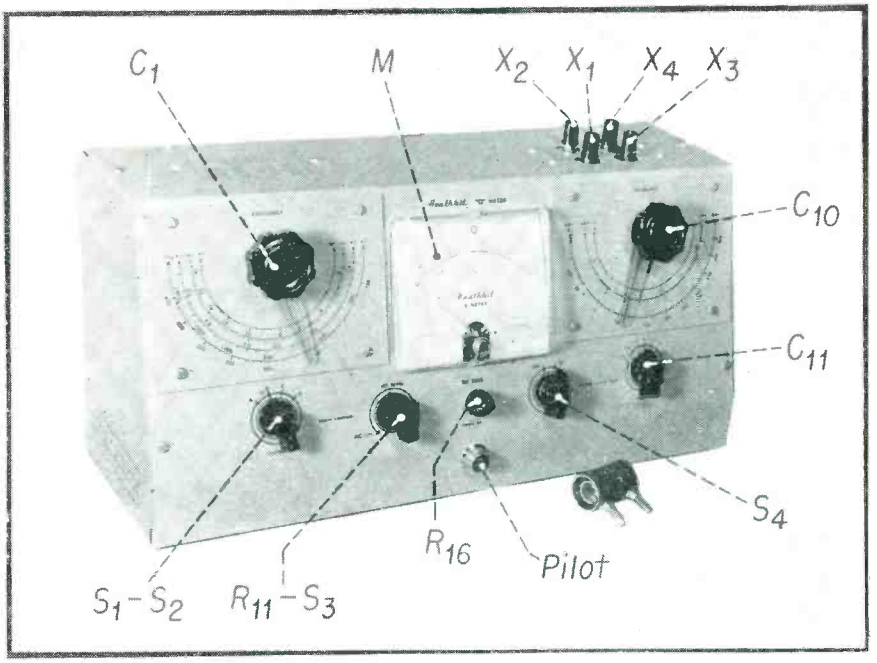


Fig. 1—Custom-Built Q-Meter. A description of this instrument will appear in the second installment next month.

If we expand the expression X/R, we obtain for a coil:

$$Q = 6.28fL/R$$

and for a capacitor:

$$Q = 1/6.28fCR$$

Frequency f is expressed in cycles, L in henries, R in ohms, and C in farads.

If we use the units more commonly employed in radio-frequency work (that is: f in megacycles, L in microhenries, and C in micromicrofarads), the Q equations become:

(1) $Q = 6.28fL/R$ for a coil

(2) $Q = 159.000/fCR$ for a capacitor

From the appearance of these equations, it would seem that all that is necessary is to calculate the reactance

from inductance or capacitance measurements at a known frequency, check the resistance in some simple manner, and divide the one by the other. Actually, the job is not that easy, since *rf* resistance is not measured in any simple way.

Conventional Q measurements at radio frequencies involve the checking of a test component in a resonant circuit. Several methods have evolved from laboratory techniques and have given rise to Q-meters as definite instruments.

The following paragraphs describe the most widely used methods of measuring Q, and the instrumentation required.

Susceptance Variation Method

Figure 2 illustrates a method of Q measurements employed occasionally in laboratories without standard Q-meters. While it usually consists of a temporary laboratory bench setup of signal generator, tuning capacitor, and v. t. voltmeter, the circuit has been incorporated into a permanent Q-meter by some experimenters.

In this arrangement (see *Fig. 2A*), a test coil, *L* for which the Q Value is required, is connected in series with a low-loss air-dielectric variable capacitor, *C*. A signal voltage, at the desired *rf* test frequency, is loosely-coupled into the circuit via the coil. A high-impedance *rf* vacuum-tube voltmeter then is connected across the tuning capacitor.

The circuit first is resonated to the test frequency by adjusting *C* for a peak deflection (E) of the v. t. voltmeter. The frequency at which this deflection is obtained is designated f_r in *Fig. 2B*. The signal generator then is detuned to a lower-frequency setting *(f1)* at which the meter deflection drops to 0.707E, being careful to keep the generator output constant. This is termed a half-power point The generator next is tuned to a point (f_2) higher in frequency than f_r, at which the meter deflection again drops to a half-power point (0.707E).

The spread (f_2-f_1) between the half-power points shows the selectivity of the *LC* circuit, being narrow for a sharp (highly-selective) combination, and widely-spaced for a broad circuit. This spread also is proportional to the Q of the circuit, since the selectivity is proportional to the ratio of reactance to resistance in the circuit. The Q of the circuit may be expressed in terms of the three test frequencies according to the following equation:

(3) $Q = f_r/(f_2-f_1)$

All f values are in the same units (cycles, *kc*, or *mc*, whichever is the most convenient to use)

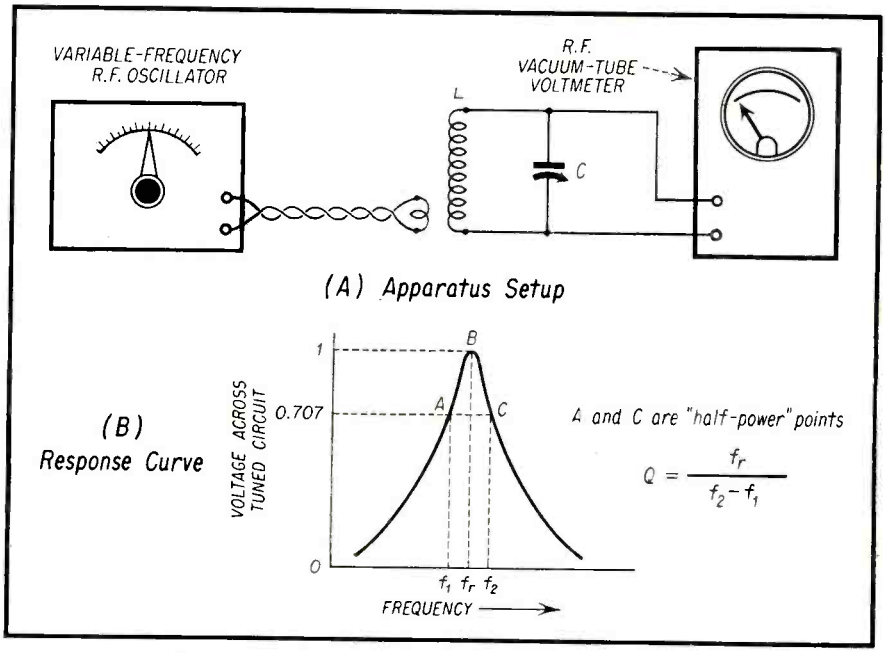


Fig. 2—Measuring Q without standard Q-Meter

A low-loss capacitor is employed at *C* in *Fig. 2A*. The capacitor Q therefore will be high. For this reason, the Q value obtained by means of Equation (3) may be assumed to be that of coil *L*.

Fixed Frequency Susceptance Method

An alternative scheme employing the susceptance variation method utilizes capacitance changes, instead of frequency changes, in checking Q values. The frequency is held to a fixed value. In this scheme, the same circuit arrangement (*Fig. 2A*) is used. However, capacitor *C* must be provided with a dial reading directly in micromicrofarads.

The signal generator is set to the desired test frequency, and the *LC* circuit is resonated by adjusting capacitor C for peak deflection (E) of the v. t. voltmeter. The dial reading of capacitor *C* then is recorded as C_r. Next, *C* is detuned to a capacitance setting lower than C_r to obtain a drop in meter deflection to 0.707E. This second capacitance setting is recorded as C_1. Finally, *C* is tuned to a capacitance setting higher than C_r again to obtain a meter deflection of 0.707E. This third capacitance setting is recorded as C_2. The circuit Q, which (because the losses in capacitor *C* are kept low) may be assumed to be the Q of coil *L*, may be determined from the successive capacitance settings, thus:

(4) $Q = 2C_r/(C_2-C_1)$

All C values are in the same units (μf or $\mu\mu f$ whichever is the more convenient to use)

When the maximum capacitance of the tuning unit, *C*, is very high, the increment C_2-C_1 may be so small that it cannot be read accurately on the tuning capacitor dial. In order to facilitate the measurement, a small calibrated trimmer capacitor often is operated in parallel with *C*, and the capacitance-shift values read on the dial of the trimmer, rather than on the main dial.

Measuring Q by Susceptance Method

When it is desired to use the susceptance variation method of measuring Q, a choice must be made between varying the frequency or varying the capacitance. Often, the decision will be governed upon which pieces of equipment are available. Some engineers favor the variable-frequency scheme because it allows a constant circuit capacitance. However, the frequency increments which must be read for high-Q values often are too small to be observed accurately on ordinary signal generator dials. The variable-capacitance scheme requires a dial-calibrated low-loss tuning capacitor and usually a dial-calibrated trimmer as well. For high and medium Q values, the same Q should be obtained with each scheme if provision is made for the close reading of capacitance or frequency increments. At low Q values, there may be some difference in final results because of the larger *f* and *C* increments which might not necessarily be in direct correspondence. In the latter case, the balance is tipped slightly in favor of the capacitance-variation scheme.

Measuring L and C

The Q circuit may be used addi-

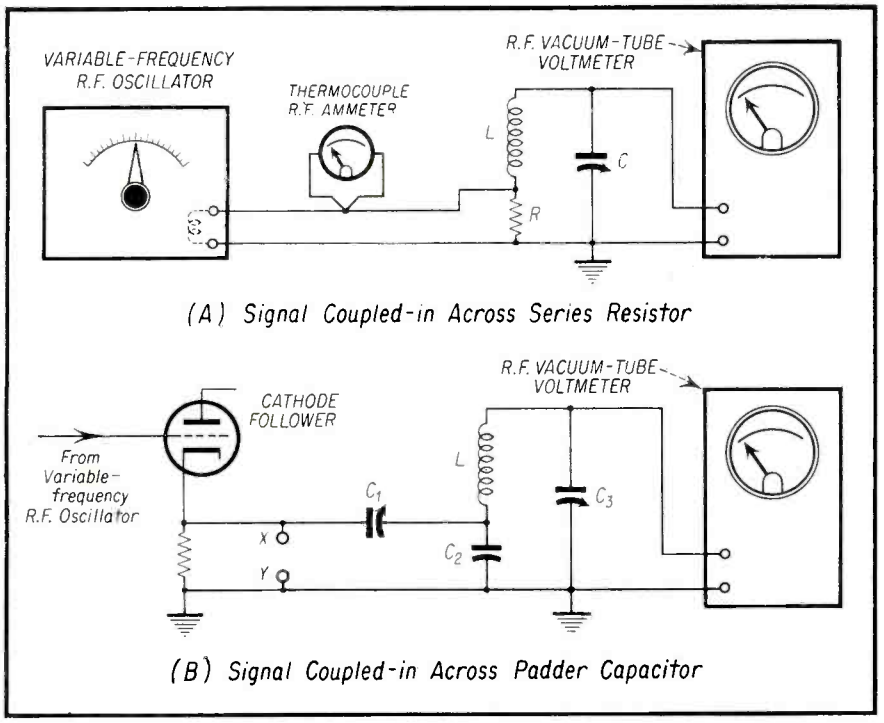


Fig. 3—Q-Voltmeter method of Q measurement.

tionally for the convenient measurement of capacitance and inductance at radio frequencies. If the capacitance value of C in *Fig. 2A* is known accurately, a coil of unknown inductance L_x may be connected at L. Either capacitor C or the signal generator frequency, f, then may be varied to obtain a peak deflection of the v. t. voltmeter. At this resonance, the unknown inductance may be determined in terms of the frequency and circuit capacitance:

(5) $L_x = 25{,}400/f^2C$

Where, L_x is in microhenrys
f is in megacycles
C is in micromicrofarads

As will be shown later in this article, the inductance value calculated by means of Equation (5) does not take into consideration the distribution capacitance of the coil. Further instructions will be given for increasing the accuracy of the measurement by checking the distributed capacitance.

For capacitance measurement, the unknown capacitance is connected into the Q circuit in place of C (*Fig. 2A*), and a coil of accurately-known inductance connected in position L. The signal generator then is tuned for resonance, as indicated by peak deflection of the meter. The unknown capacitance value then is calculated from the corresponding frequency and inductance values, as follows:

(6) $C_x = 25{,}400/f^2L$

Where, C_x is in $\mu\mu f$
L is in microhenrys
f is in megacycles

It should be borne in mind that this unavoidably is a measurement of the *total* circuit capacitance which includes circuit strays, lead capacitance, distributed capacitance of the coil, and input capacitance of the v. t. voltmeter, as well as the capacitance of the test unit. The accuracy of measurement can be high only when C_x is large compared to the total circuit capacitance due to other sources.

Measuring C by Substitution

Better accuracy of measurement is obtained when the substitution method is used. In this case, the circuit (*Fig. 2A*) is set up with a dial-calibrated variable capacitor at C. Coil L need not be an accurately-known standard inductor. Resonance is obtained first with only L and C in the circuit, by setting C to its maximum value (C_1) and tuning the signal generator for peak deflection of the v. t. voltmeter. The unknown capacitance, C_x, then is connected in parallel with tuning capacitor C and the latter detuned to a setting C_2 required to re-establish resonance. The unknown capacitance then is:

(7) $C_x = C_1 - C_2$

In order to minimize stray shunting capacitances, the shortest possible leads must be used in connecting the unknown capacitor into the circuit.

While possessing increased accuracy, the substitution method is limited to capacitance values which do not exceed the value equal to the difference between maximum and minimum capacitances possible with the calibrated capacitor, C. Thus, in the case of a tuning capacitor having a maximum setting of 500 and a minimum of 35 $\mu\mu$fd., the maximum unknown value which might be measured by the substitution method would be 500-35, or 465 $\mu\mu$fd.

Q-Voltmeter Method

The second method of Q measurement, which is becoming the more widely used in current practice, is termed the Q-voltmeter method. While based upon the same underlying relationships as the susceptance variation method involving series resonance at radio frequencies, the technique of the Q-voltmeter method differs somewhat from the other, especially in the method of arriving at final Q values.

Fig. 3 shows two schemes used in this method. In *Fig. 3A*, the *rf* test signal is injected into the Q test circuit (L and C in series) by means of a very low non-inductive resistor, R, across which the signal generator output voltage is developed. This resistor has an ohmic value of the order of a few hundreths of an ohm, so its presence will not lower the circuit Q drastically.

Capacitor C is adjusted to resonate the circuit at the test frequency, resonance being indicated as usual by peak deflection of the v. t. voltmeter. Since L and C are components of a series resonant circuit, both capacitive and inductive reactances are cancelled at resonance and only the small resistance of the coil and capacitor remains in the circuit to limit current flow. The circulating current accordingly is high, and the voltages E_{xc} (appearing across the capacitor) and E_{xl} (across the coil) are many times higher than the signal voltage e set up across the coupling resistor, R. Since at resonance the voltage across the coil equals the voltage across the capacitor, the v. t. voltmeter might be connected across either L or C. However, connection of the meter across the capacitor provides a common ground.

Since the voltage (E) across either the coil or capacitor will be proportional to the ratio of reactance to resistance, the meter deflection will be proportional to circuit Q. In fact, the following relationships exist:

(8) $E = Qe$, and $Q = E/e$

Where, E is the meter deflection, and e is the small voltage developed across coupling resistor, R

Thus, the v. t. voltmeter scale may be calibrated to read Q values directly,

[*Continued on page 71*]

LOOKING for TROUBLE?

NO. 13 –

by CYRUS GLICKSTEIN

YOU can join in the search for trouble in a TV receiver by answering the questions in this trouble-shooting quiz. Answer each question before going on to the next. If there is more than one correct answer to a question, give all correct answers.

Answers and discussion follow.

Complaint: The receiver, which is being serviced in a home visit, has diagonal black and white lines across the picture on Channel 5. Other channels and sound normal.

Model: Receiver is a split sound (not intercarrier); video *if* is 25.75 *mc*, sound *if* is 21.25 *mc*.

1. The black and white bars are evidently an interference pattern on the screen. Which of the following is the best way(s) to deal with interference:

(a) Advise owner to communicate with the FCC.
(b) Inform the owner the design of the receiver is defective.
(c) Determine the nature of the interference.
(d) Inquire if there are any Ham radio operators in the neighborhood.
(e) Check with the owner to determine at what times and on what channels the interference has been noticed.

2. The owner stated the interference was present whenever Channel 5 was tuned in. This was confirmed by observation. In general, this type of interference pattern is most likely caused by which of the following:

(a) Ignition noise.
(b) Diathermy.
(c) Local oscillator interference from a neighbor's set.
(d) A *tweet*.
(e) Other *rf* signal interference.

3. The observed pattern is most likely a tweet (internally generated interference), local oscillator interference from a neighbor's set, or some other type of steady *rf* interference. As a further check in determining the origin of the interference (internal or external), which of the following step(s) is helpful:

(a) Rotate the fine tuning control.
(b) Check the signal on each channel.
(c) Disconnect the antenna leadin from the antenna terminals.
(d) Take out the *rf* oscillator tube.
(e) Take out the last video *if* tube.

4. The channel selector was rotated through its range to check if the interference appeared on any other channel. It appeared only on Channel 5. The fine tuning control was rotated while tuned to Channel 5. The interference pattern superimposed on the picture changed from narrow slanting lines to broad horizontal stripes and back to narrow slanting lines as the fine tuning was rotated through its range. Toward the extremes of tuning rotation, the interference pattern disappeared. The broadcast horizontal stripes were noted at the point of best sound. this is characteristic of a tweet in this model.

To determine whether the tweet originates in the video or sound *if* strip, which of the following is done:

(a) Check the video and sound intermediate frequencies.
(b) Apply a scope to the video detector.
(c) Apply a scope to the discriminator output.
(d) Remove the video detector tube.
(e) Remove the first sound *if* tube.

5. The tweet originated in the video detector as could be verified by checking the video intermediate frequency (25.75 *mc*). The 3rd harmonic of this frequency (77.25 *mc*) beating with the video carrier of Channel 5 (77.25 *mc*) caused the beat-frequency interference

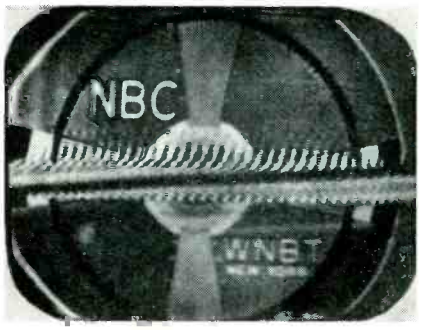


Fig. 1—Mild diathermy interference.

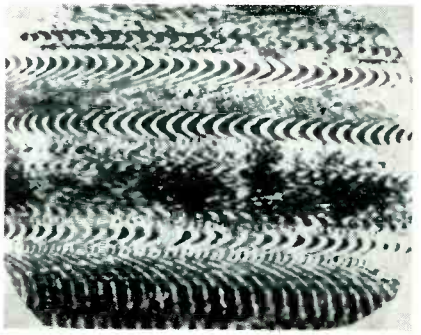


Fig. 2—Severe diathermy or FM interference.

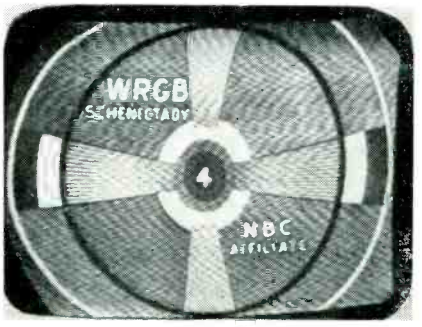


Fig. 3—One type of *rf* interference pattern (radio transmission, oscillator radiation, etc.).

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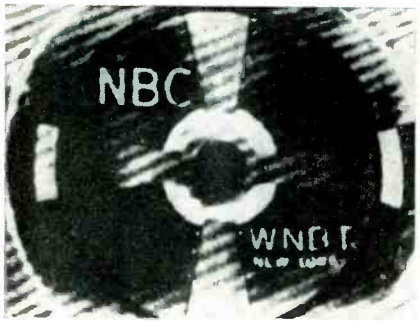

Fig. 4—Another type of *rf* interference.

noted on the screen. Which of the following method(s) can be used to eliminate the tweet:

(a) Shield *if* and detector tubes.
(b) Use a tweet trap.
(c) Reorient power supply leads in the chassis.
(d) Reorient antenna leadin to the tuner.
(e) Bypass filament line at the detector.

Answers and Discussion

1. c, e

The first step in servicing a TV receiver for an interference problem is to determine the nature of the interference by careful observation of the pattern. At the same time, it is helpful to secure from the owner information concerning the periods when the interference is seen (and possibly heard) and the channels affected.

A comparatively small proportion of TVI is caused by Ham operators. Where the interference does originate in a Ham transmitter, the fault is often in the TV receiver rather than the transmitter. Amateur operation is entirely legal on the regularly assigned frequencies. If interference is caused at the receiver due to poor selectivity or similar reasons, the correction must be made at the receiver. Only when the Ham is guilty of transmitting harmonics or other spurious signals can he be required to adjust his equipment.

Fig. 5—Enlarged section of picture showing 4.5 *mc* interference.

2. c, d, e

There are many kinds of interference which can affect a TV receiver. Interference can be external or internal, depending on the origin.

External interference, which comes into the receiver from an outside source, includes:

(1) Ignition and similar noise causing random flashes across the screen.

(2) Diathermy, *rf* (dielectric) heater, etc. Usually causing a herringbone pattern through a part of the picture. However, this interference may show up in other ways (depending on the strength of the signal), from a slight horizontal pulling at the top of the picture to a black and white marble-striped pattern covering the entire screen. *(Figs. 1* and *2)*

(3) Local oscillator interference from a neighbor's set—narrow vertical or diagonal black and white stripes. *(Figs. 3* and *4)*

(4) Amateur or other radio transmission—similar to local oscillator interference, but may be keyed on and off (code) or intermittent (voice broadcasting).

(5) FM interference—wavy vertical line pattern. *(Fig. 2)*

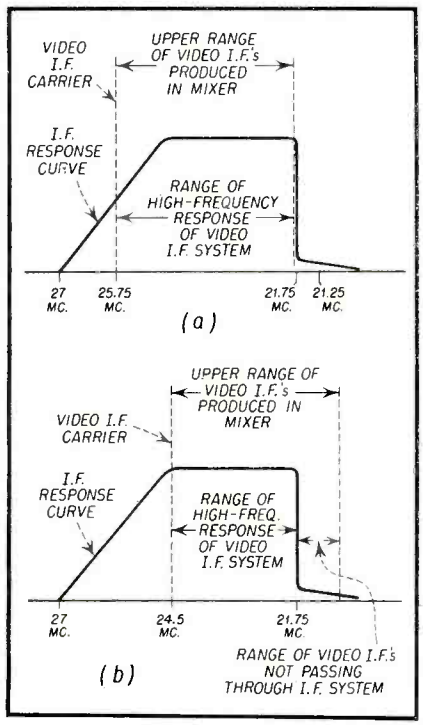

Fig. 6—High frequency response of video *if* system as affected by fine tuning.
(a) Full range of high frequencies pass through *if* stages with fine tuning at correct point.
(b) Higher video intermediate frequencies unable to pass through *if* system when fine tuning is rotated to minimize 4.5 *mc* interference.

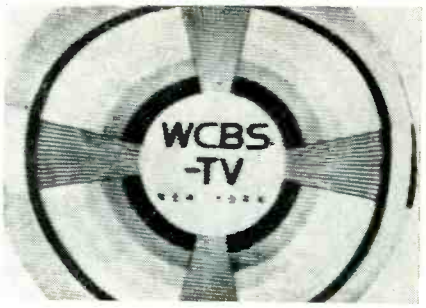

Fig. 7—Interference pattern caused by *rf* power supply.

(6) Adjacent channel interference—there are two types of interference caused by TV stations on adjacent channels. Interference from the adjacent lower channel is caused by the sound carrier and gives a herringbone pattern which varies according to the sound in the adjacent channel program. Interference from the adjacent higher channel is from the video carrier and results in a superimposed picture (stationary or slowly moving) or in a number of diagonal lines or in a vertical moving bar.

(7) Co-Channel interference—this results in a venetian blind effect, usually, with a superimposed picture.

Co-Channel and adjacent channel interference are generally problems only in fringe areas, which receive signals from widely separated stations.

F-M interference has a typical wavy or herringbone pattern. The instantaneous changes in the *rf* frequency from line to line cause the interference signal to shift slightly to the right and left from one line to the next. This wavy pattern is also typical of diathermy, dielectric heaters, and similar sources of interference since the frequency shifts somewhat with changes in load.

There are several types of interference patterns which are generated internally in a TV receiver. Internal interference has probably not received as much attention in technical litera-

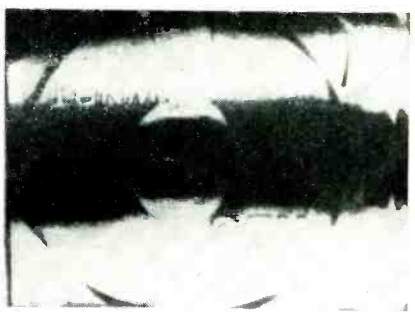

Fig. 8—120 cycle hum picked up in video stages.

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TELEVISION INTERFERENCE AIDS

TVI Causes, Effects and Solutions . . .

A

1. Diathermy, industrial heaters, etc.

Solution: High pass filter. AC line filter. If these measures are ineffective contact owner of interfering equipment and recommend manufacturer be advised.

2. Radiation from local oscillator of nearby TV and FM broadcast receivers.

Solution: Re-alignment of offending receiver.

3. Strong signals from nearby radio stations, including FM broadcast, amateur, police, taxi, government, airways and military services.

Solution: Install high pass filter, line filter, or in extreme cases install an absorbtion filter tuned to the interfering signal. If these measures ineffective locate and contact owner of equipment.

4. Cross modulation external to the receiver, but possibly including external rectification sources such as corroded antenna and transmission line connections.

Solution: Check lead-in or antenna for broken or corroded connections. Additional possibilities are poor connections in house wiring, plumbing, stovepipes, etc.

5. Multiple images.

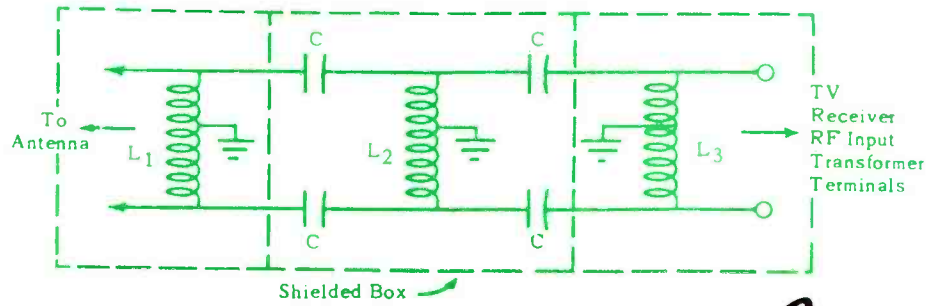
Solution 1: Reorient or relocate antenna and/or lead-in.

Solution 2: May be caused by standing waves due to an impedance mis-match between antenna, transmission line and receiver impedance. This condition can be detected by wrapping a piece of metalized paper around lead-in, watching for variations in reflections and signal strength while sliding metalized paper along lead-in.

6. Direct I. F. pickup.

Solution 1: Shield section responsible. (Shielding must be complete).

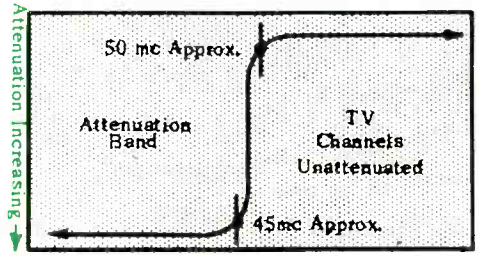
HIGH PASS FILTER FOR 300 OHM TELEVISION RECEIVER INPUT



C = 15 mmfd Ceramic

L_1, L_3 = 1.2 mh (21 Turns No. 24 Enamel Wire Close Wound on ⅛" Diameter Polystyrene Rod)

L_2 = 0.6 mh (15 Turns No.24 Enamel Wire Close Wound on ¼" Diameter Polystyrene Rod)



Caution!

No. 1 Be certain to supply a good electrical ground with an absolute minimum of lead, preferably to set ground. Where receiver has AC/DC chassis, ground through 0.001 mfd, 600 Volt mica condenser.

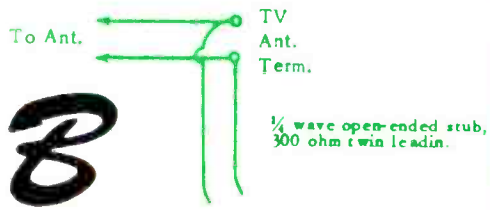
2. Place filter as close as possible to r.f. input transformer.

Commercial filters are available in the following ranges both fixed and tunable

0-30 Mc | 0-50 Mc | 20-30 Mc | 40-50 Mc | 88-174 Mc

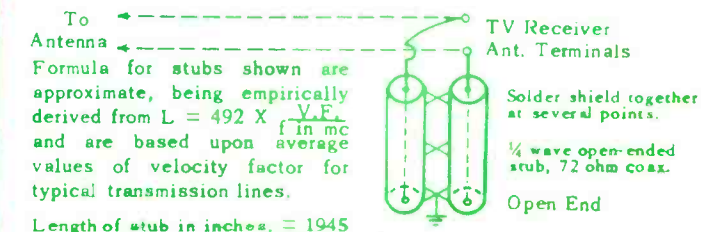
STUB WITH 300 OHM TWIN LEAD IN

B



Length of stub in inches = $\frac{2450}{f \text{ in mc}}$

¼ WAVE OPEN-ENDED STUB WITH 2 PARALLEL LENGTHS OF 72 OHM COAX FOR USE WITH 300 OHM INPUT



Formula for stubs shown are approximate, being empirically derived from $L = 492 \times \frac{V.F.}{f \text{ in mc}}$ and are based upon average values of velocity factor for typical transmission lines.

Length of stub in inches = $\frac{1945}{f \text{ in Mc.}}$

This type of stub has several advantages over 300 ohm tape:

* *Refer to Caution No. 1 on High Pass Filter (Above)*

Solution 2: Realign I.F. (See section C for more detailed information).

Solution 3: Check lead dress, particularly of long leads.

7. Image interference (This situation exists when a strong signal occurs at the oscillator frequency plus or minus the I.F.)

Solution: Use appropriate stub or tunable trap. (Refer to section B. High pass filter is ineffective in this specific application.

8. Signal operating in normal receiver pass band.

Solution: Find offending source and if unable to obtain cooperation, report to FCC.

9. Misadjustment of I. F. traps, I. F. tuned circuits, or misadjustment of TV receiver controls (traps may be faulty).

Solution: Correct misalignment or replace, or repair, defective component.

10. Faulty neutralization, particularly in triode or triode connected pentode cascode type tuners, may cause cross-hatch pattern on picture tube.

Solution: Locate defective component and replace.

11. Audio rectification characterized by audio from other than TV stations, such as police broadcast, taxi, utility, amateur stations, etc.

Solution: Since this rectification normally occurs at the grid of the first audio amplifier it can be eliminated by insertion of an RC filter placed as close as possible to the grid of the first audio tube (100 k resistor in series with the audio grid lead and 500 mmfd condenser *direct from grid to cathode*. It may be necessary to increase the value of the inserted by-pass condenser to as much as 1000 mmf and in the case where the manufacturer has used an extremely high value grid resistor in the order of 10 or more megohms, it may also be necessary to decrease this value. It is not usual for the audio signal to be degraded by changing the value of the grid resistor, for example, from 10 to 5 megohms).

12. Ignition (Pulse) type interference sources including electric motors and other power equipment, household appliances, thermostatic devices and florescent lighting and fixtures.

Solution: Line filters, change location of antenna, more directive antenna, use of coaxial in place of flat line. If these measures do not correct the condition locate the source and contact owner for his cooperation in eliminating the interference at the source.

EXAMPLE
For an interfering signal at 75.5 mc : $\frac{2450}{75.5}$ = 32.5 approx.

1. It can be moved or rolled up with negligible change in characteristics.

2. It is completely shielded, and it will not re-radiate, nor itself pick up signals.

Table of lengths of 1/4 wave open, 300 ohm line covering the FM band:

Frequency in Mcs	L in inches
88	27.8"
95	25.8"
108	22.7"

C

When a television receiver is in a strong field of r.f. close to the intermediate frequency of the receiver, *direct* pickup in one or more of the i.f. stages is likely. For example, a signal on 21.9 Mc would probably be picked up in the i.f. of a television receiver using a 21.9 audio i.f. channel. If a high pass filter is ineffective in eliminating the interference the i.f. should be re-aligned to a frequency different from the interfering signal by a few hundred Kc (As an example, in this case, to 22.2 Mc).

D

R.F. OSCILLATOR SETTINGS, NOMINAL FOR 20 to 30 Mc AND NOMINAL FOR 40 to 50 Mc.

Channel	Channel Frequency	Pix Carrier	Sound Carrier	Rcvr. rf Oscillator (21.9 mc I. F.) Low	Rcvr. rf Oscillator (21.9 mc I. F.) High	Rcvr. rf Oscillator (41.25 mc)
2	54-60	55.25	59.75	37.85	81.65	101
3	60-66	61.25	65.75	43.85	87.65	107
4	66-72	67.25	71.75	49.85	93.65	113
5	76-82	77.25	81.75	59.85	103.65	123
6	82-88	83.25	87.75	61.85	109.65	129
7	174-180	175.25	179.75	157.85	201.65	221
8	180-186	181.25	185.75	163.85	207.65	227
9	186-192	187.25	191.75	169.85	213.65	233
10	192-198	193.25	197.75	175.85	219.65	239
11	198-204	199.25	203.75	181.85	225.65	245
12	204-210	205.25	209.75	187.85	231.65	251
13	210-216	211.25	215.75	193.85	237.65	257

The Washington Television Interference Committee is an organization which has volunteered to act as a clearing house for television interference complaints involving radio amateurs.

The Committee maintains close liaison with industry, communication services, the FCC and others. This committee set-up gives both the amateur and the receiver owner a third party group of experts who will investigate the complaint promptly.

For assistance in resolving interference complaints involving amateur radio, call **RE 7-2000** or write to The Washington Television Interference Committee, 129 Joliet street, S.W., Washington (20) D.C.

This chart has been provided for your use through the coordinated efforts of the Washington Interference Committee, the Radio-Electronic-Television Manufacturers Association, and the Federal Communications Commission. It has been published as a public service by the Electric Institute of Washington, and is presented for wall chart use by Radio-TV Service Dealer Magazine.

VIDEO SPEED SERVICING SYSTEMS

12th INSTALLMENT

INDEX FOR JULY, AUGUST and SEPTEMBER ISSUES

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Admiral	19 Series	Sync	Sept.	39	AD19-2
Admiral	19 Series	Pix and Sound	Sept.	39	AD19-3
Admiral	19 Series	Sync and pix	Sept.	40	AD19-4
Admiral	19 Series	Pix	Sept.	40	AD19-5
Admiral	19 Series	Sound	Sept.	40	AD19-6
Belmont Raytheon	20AY21	Pix	July	27	BE-Y21-1
Belmont Raytheon	20AY21	Pix	July	27	BE-Y21-2
Belmont Raytheon	20AY21	Pix	July	27	BE-Y21-3
Belmont Raytheon	20AY21	Pix	July	28	BE-Y21-4
Belmont Raytheon	20AY21	Sync	July	28	BE-Y21-5
Belmont Raytheon	20AY21	Raster	July	28	BE-Y21-6
CBS-Columbia	2000-1	Pix	August	31	CB2000-1
CBS-Columbia	2000-1	Pix	August	31	CB2000-2
CBS-Columbia	2000-1	Pix	August	31	CB2000-3
CBS-Columbia	2000-1	Pix	August	32	CB2000-4
CBS-Columbia	2000-1	Pix	August	32	CB2000-5
CBS-Columbia	2000-1	Pix	August	32	CB2000-6
Capehart-Farnsworth	CX33	Pix	August	33	CA33-19
Capehart-Farnsworth	CX33	Pix	August	33	CA33-20
Capehart-Farnsworth	CX33	Pix	August	33	CA33-21
Capehart-Farnsworth	CX33	Pix	August	34	CA33-22
Capehart-Farnsworth	CX33	Pix	August	34	CA33-23
Capehart-Farnsworth	CX33	Pix	August	34	CA33-24
DuMont	RA117	Pix	July	29	DM-117-1
DuMont	RA117	Pix	July	29	DM-117-2
DuMont	RA117	Raster	July	29	DM-117-3
DuMont	RA117	Pix	July	30	DM-117-4
DuMont	RA117	Sync	July	30	DM-117-5
DuMont	RA117	Sync	July	30	DM-117-6
Emerson	120144	Pix	July	31	EM-144-1
Emerson	120144	Pix	July	31	EM-144-2
Emerson	120144	Sync	July	31	EM-144-3
Emerson	120144	Sync	July	32	EM-144-4
Emerson	120144	Pix	July	32	EM-144-5
Emerson	120144	Sync	July	32	EM-144-6
RCA	KCS34	Pix	August	35	RC34-7
RCA	KCS34	Pix	August	35	RC34-8
RCA	KCS34	Pix	August	35	RC34-9
RCA	KCS34	Sound	August	36	RC34-10
RCA	KCS34	Raster	August	36	RC34-11
RCA	KCS34	Pix	August	36	RC34-12
Sentinel	Model No. 454, 5, 6, 7	Sync	Sept.	41	SE454-1
Sentinel	Model No. 454, 5, 6, 7	Pix, or pix and sync	Sept.	41	SE454-2
Sentinel	Model No. 454, 5, 6, 7	Pix	Sept.	41	SE454-3
Sentinel	Model No. 454, 5, 6, 7	Pix	Sept.	42	SE454-4
Sentinel	Model No. 454, 5, 6, 7	Sound	Sept.	42	SE454-5
Sentinel	Model No. 454, 5, 6, 7	Sync	Sept.	42	SE454-6
Sylvania	1-274	Audio	Sept.	43	SY274-1
Sylvania	1-274	Pix	Sept.	43	SY274-2
Sylvania	1-274	Sync	Sept.	43	SY274-3
Sylvania	1-274	Pix	Sept.	44	SY274-4
Sylvania	1-274	Audio	Sept.	44	SY274-5
Sylvania	1-274	AM/FM Radio	Sept.	44	SY274-6
Sylvania	1-437	Pix	Sept.	45	SY437-1
Sylvania	1-437	Audio	Sept.	45	SY437-2
Sylvania	1-437	Pix	Sept.	45	SY437-3
Sylvania	1-437	Audio	Sept.	46	SY437-4
Sylvania	1-437	Pix	Sept.	46	SY437-5
Sylvania	1-437	Sound	Sept.	46	SY437-6
Stromberg-Carlson	17 Series	Pix	August	37	SC17-1
Stromberg-Carlson	17 Series	Pix	August	37	SC17-2
Stromberg-Carlson	17 Series	Pix	August	37	SC17-3
Stromberg-Carlson	17 Series	Pix	August	38	SC17-4
Stromberg-Carlson	17 Series	Pix	August	38	SC17-5
Stromberg-Carlson	17 Series	Pix	August	38	SC17-6
Transvision	"A" Series	Raster	July	33	TA-A-1
Transvision	"A" Series	Raster	July	33	TA-A-2
Transvision	"A" Series	Sync	July	33	TA-A-3
Transvision	"A" Series	Pix	July	34	TA-A-4
Transvision	"A" Series	Pix	July	34	TA-A-5
Transvision	"A" Series	Pix	July	34	TA-A-6

TROUBLE?

[from page 34]

ture as it deserves. Internally generated interference includes:

(1) Tweets.
(2) 4.5-*mc* interference.
(3) *RF* power supply pickup.
(4) 60-cycle and 120-cycle pickup.
(5) Arcing.
(6) Double conversion interference.

Tweets are harmonics of the video or sound *if* carrier which are fed back to the front end. These harmonics are in the tuning range of the incoming signals and therefore beat with the local oscillator producing a separate signal. For example, the video *if* carrier is 27.75 *mc*. The third harmonic is 77.25 *mc*. Channel 5 covers the range from 76-82 mc, with its video *rf* carrier at 77.25 *mc*. The third harmonic and the video *rf* signal beat with the local oscillator each producing a video *if* signal. The two video *if* signals beat in the video detector to form a beat output appearing on the screen in the form of black and white stripes. When the fine tuning control is not rotated, these stripes are usually continuously in motion and vary in number and position. They vary from a diagonal to a vertical position and sometimes become horizontal. This interference can only be seen when a station channel is tuned in (and usually on one channel only), since the *if* harmonic can only be generated if a signal comes in and first produces the fundamental video (or sound) *if*. A tweet can appear on almost any channel, depending on the intermediate frequencies used in the receiver and the harmonic relationship of these frequencies to the tuned-in channel. The tweet pattern is affected considerably by the rotation of the fine tuning control.

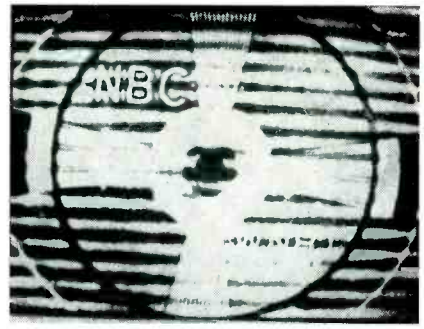


Fig. 9—Sound bars (audio frequencies) in picture.

Interference of the 4.5 *mc* variety consists of very fine black and white stripes, slanting or vertical *(Fig. 5)* which has an effect similar to poor focus. This type of interference is caused when the beat between the video and sound *if* carriers in the video detector (the two frequencies are always 4.5 *mc* apart) gets through the video amplifiers to the screen. 4.5 *mc* interference appears in both intercarrier and split sound receivers, is quite common, and may at times be overlooked.

In split sound sets, this interference often results in a smeared picture. To minimize 4.5 *mc* interference, the viewer usually turns the fine tuning control past the best sound (and best picture) point. At the position where the fine interference lines are no longer visible, the high frequency response has been considerably reduced. The resulting picture has little fine detail and is smeared. This occurs because by tuning past the correct point, the sound *if* carrier is no longer at the skirt of the video response curve but beyond the video *if* bandpass. Therefore no sound *if* signal goes through the video strip to beat with the video *if* carrier and practically no 4.5 *mc* interference is produced. The video carrier is up on the response curve, giving an accentuated low frequency response and a reduced high frequency response *(Fig. 6)*.

Another type of internally generated interference may occur in receivers having an *rf* type of high-voltage power supply. Diagonal or vertical black and white bars may be caused by leakage from this circuit. *(Fig. 7)* This type of interference is usually identified without difficulty by the frequency of the interference signal (approximately 300 *kc)* and by the knowledge that the receiver has this kind of supply.

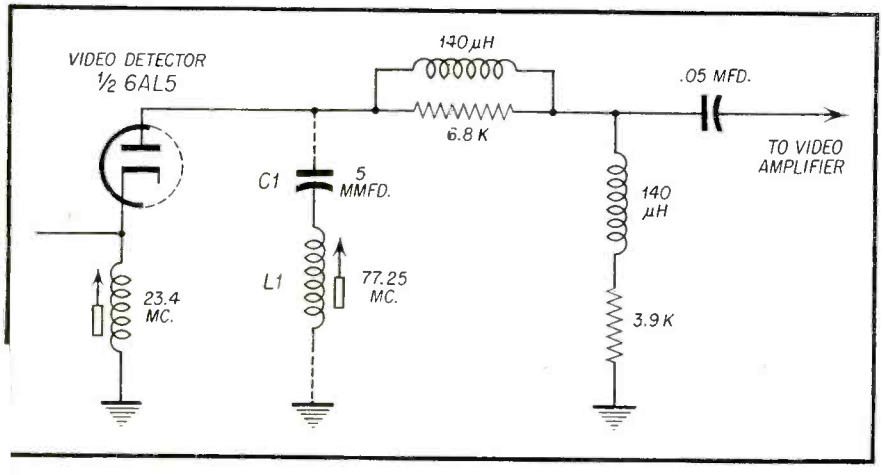
60-cycle and 120-cycle power supply interference is readily recognizable *(Fig. 8)*, and is generally caused by an internal defect—bad tube, hum in B+, etc.

Arcing in the high-voltage system appears like ignition interference on the screen but is usually heard in the sound also. It can easily be identified by being present when the antenna is disconnected. In addition, arcing can usually be seen and heard when examining the high-voltage cage with the set operating.

Double conversion interference is caused by a second TV channel being received when tuned to a desired channel. For example, a receiver is tuned to Channel 5 (76-82 *mc)*. In this receiver, the oscillator is at 103 *mc*. A small amount of oscillator voltage may appear at the grid of the *rf* amplifier tube. This beats with the incoming signal of Channel 7 (174-180 *mc)*, more specifically the sound *rf* carrier, 179.75 *mc*. The difference frequency between 103 and 179.75 *mc*, or 76.75 *mc*, appears at the mixer grid together with the desired signal from Channel 5. Both the desired signal from Channel 5 and the undesired beat from the Channel 7 sound carrier then beat with the oscillator frequency, are converted to *if* signals, and go through the video strip.

It is helpful in dealing with interference problems to know the approximate frequency of the interference pattern on the screen. Since the vertical sweep frequency is 60 cycles and the horizontal frequency is 15,750 cycles, it is simple to compute the frequency of any continuous *ac* signal on the screen. For example, a 60-cycle hum signal has one broad horizontal black and white bar (or one black and two white or one white and two black, depending on the phase of the hum signal). A 120-cycle signal *(Fig. 8)* has two black and two white horizontal bars, etc. All frequencies over 60 and less than 15,750 cycles give horizontal bars. Since 15,750 cycles is approximately the upper limit of human hearing, it can be said that any *audio* frequency

[Continued on page 63]



ig. 10—Circuit diagram showing how tweet trap is installed across video detector load (see text).

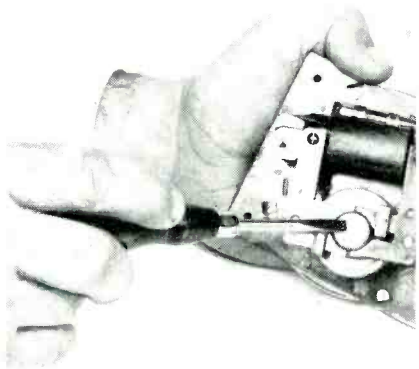
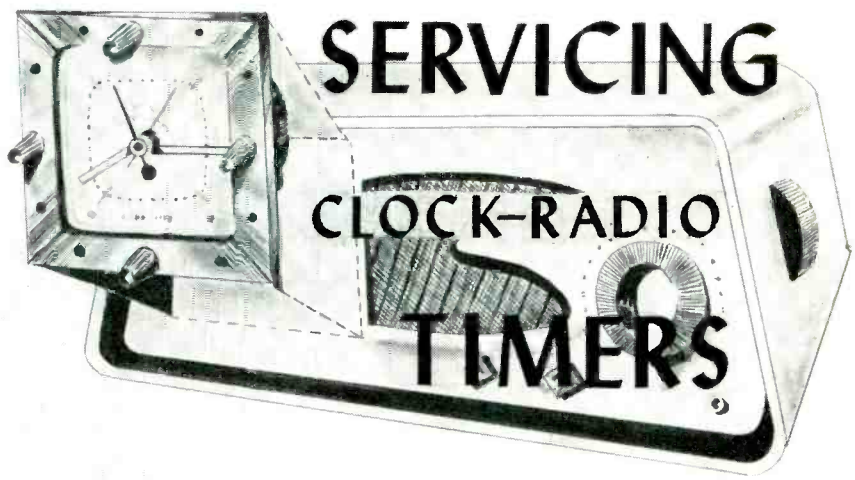


Fig. 1—The screwdriver in the workman's hands is pointing to the rotor, the motor which runs the timer.



By Telechron Dept., General Electric Co.

HOW does a dealer or distributor handle the servicing of Telechron clock-radio timers? That is becoming an increasingly important question as the number of clock-radios in use rapidly mounts.

There are between 6 million and 7 million clock-radios in use today, according to Russell T. Woodward, Manager of Marketing, Telechron Department, General Electric Company, and by the end of next year this figure will be up around the 10 million mark.

"It isn't the percentage of Telechron timer repairs that makes this subject of so much interest to service people," Mr. Woodward points out, "but rather the combination of two facts: (1) the number of clock-radios in use is large and fast becoming larger and (2) the clock-timer part of the clock-radio is unfamiliar to many radio repair specialists."

The question, "How does a dealer or distributor handle the servicing of Telechron clock-radio timers?" breaks down into two answers: one on in-warranty repairs; another on out-of-warranty repairs.

In-Warranty Repairs

Any Telechron clock-radio timer returned to a dealer or distributor with-

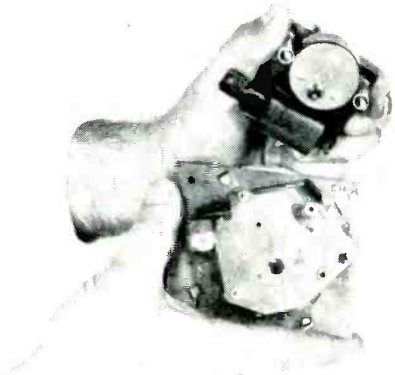
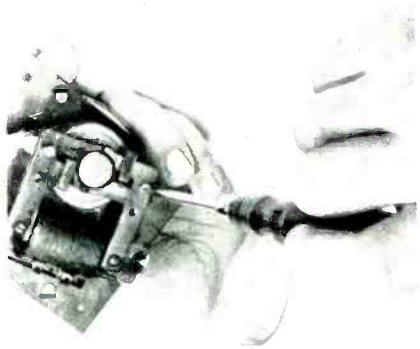


Fig. 3—The old rotor and field and coil assembly lifts out in one piece.

Fig. 4—Press with thumb on neck of rotor and it slips out smoothly and easily from the field.

Fig. 2—You need only to take out two screws in order to remove the rotor.



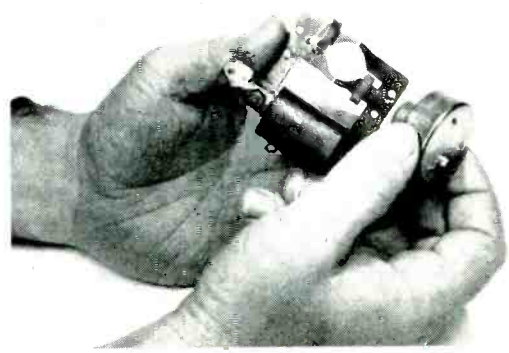


Fig. 5 — Disassembled the field and coil assembly is in the man's left hand, the rotor that runs the timer is in the right. Occasionally, the oil leaks out, or it wears and you have to replace it with a new one.

in the warranty period must be serviced by an authorized Telechron clock and timer service station. There are 121 of them located in principal cities all over the country. A list of these authorized service stations can be obtained by dealers and distributors by addressing a request to Product Service, Telechron Department, General Electric Company, Ashland, Mass.

Telechron timers are warranted for a period of one year.

If a customer, dealer or distributor tries to repair an in-warranty timer, he voids the warranty.

Out-of-Warranty Repairs

A different procedure is recommended for servicing of out-of-warranty timers. Recommended procedure is for the dealer or distributor to remove the timer from the clock-radio and send it to the nearest authorized service station, along with full information about its faulty behavior. Of course, if desirable, the complete clock-radio can be sent to the service station. In such cases, however, there is a nominal extra charge for removal and replacement of the timer.

The above procedure should always be followed when the timer has failed because of defective friction, switches or gears. Such repairs call for the highly specialized skill of the authorized service station.

Simple out-of-warranty repairs may be handled by the dealer or distributor. It's relatively easy to replace broken crystals, damaged bezels and knobs, inoperative rotors and open coils. Vibrators and alarms are also easy to adjust. Parts for simple repairs can be obtained from authorized service stations.

Some manufacturers of clock-radios supply their own appearance items: crystals, bezels and knobs. In such cases, these parts must be obtained directly from the clock-radio manufacturer or a representative. Authorized Telechron clock and timer service stations do not stock them for resale.

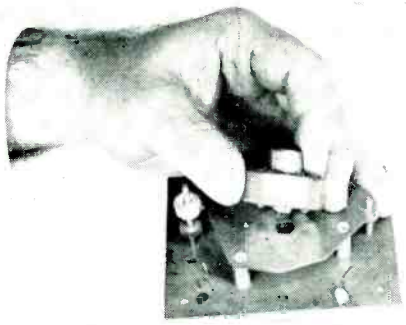


Fig. 6—The way to do it is to fit the rotor in position on the movement base plate. The gears must mesh first. If not done this way you are likely to fail to get your gears in mesh—they will jam up—the timer will fail to run.

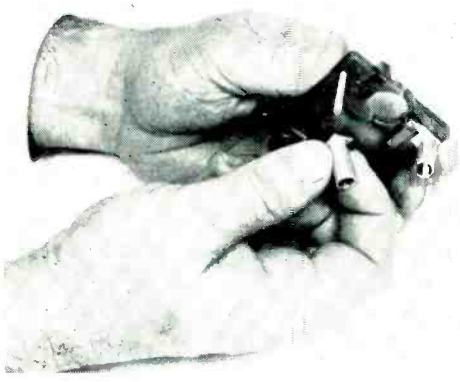


Fig. 7 — The aluminum spacers are used to hold the field in the correct position.

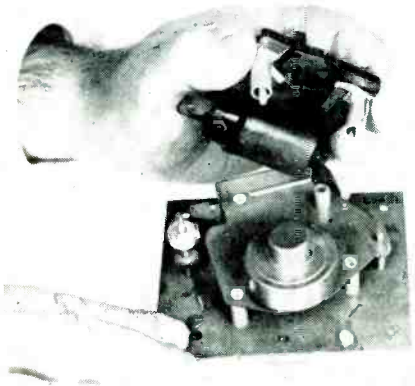


Fig. 8—Fit the field down over the rotor holding aluminum spacers with fingers so they won't slip off.

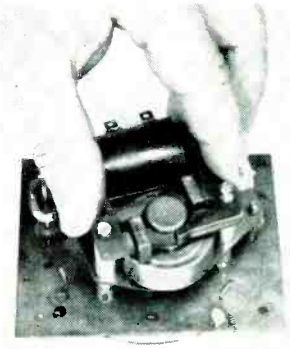


Fig. 9—Press into position, replace holding screws and the job is done.

How To Replace A Rotor Unit

1. Rotor Unit, heart of the timer's motor, is recognized by its small-nosed sealed case.

2. Motor is detached from base plate by removing two screws.

3. Rotor And Field Assembly, in left hand, lifts out in one piece.

4. To Remove Rotor from field, press neck of rotor with thumb. It slips out smoothly and easily.

5. Disassembled Motor shows rotor in right hand, field assembly in left.

6. New Rotor is fitted into position in base plate. Be sure gears mesh and rotor is pressed flat against base plate.

7. Aluminum Spacers make sure field assembly is in proper position.

8. Hold Spacers on screws with fingers while fitting field to rotor nose.

9. Press Field firmly over rotor nose and tighten screws. That's all.

10. Adjusting Alarm. a) Place long-nosed pliers on horizontal flat of vibrator. b) Energize field. c) Bend vibrator slightly up or down to make sound louder or softer.

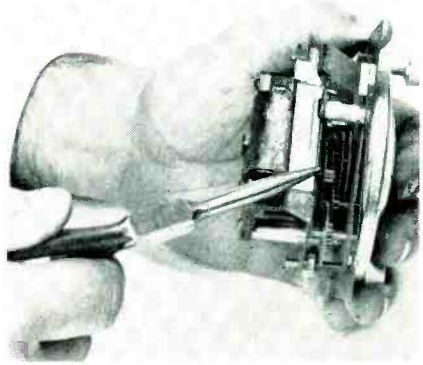


Fig. 10—Long nosed pliers are placed on the horizontal flat of the vibrator for adjustment. Energize the field. By bending the vibrator slightly up or down will increase or decrease the tone to the proper sound.

NEW TUBES

CBS-Hytron Type 24TP4

The CBS-Hytron type 24TP4 is a 24" rectangular, 90°, all-glass, magnetically focused, picture tube providing an effective screen area of over 370 square inches.

Other features of the tube are:

1. An aluminized screen for increased brightness.
2. Spherical filter-glass face plate.
3. Single ion-trap gun design.
4. External conductive coating which serves as a filter capacitor.

GENERAL DATA		
Heater voltage	6.3 10%	volts
Heater current	0.6	ampere
Average direct interelectrode capacitances:		
Grid No. 1 to all other electrodes	6	uuf
Cathode to all other electrodes	5	uuf
External coating capacitance(Note E)	250 min. 400 max.	
Phosphor		No. 4
Fluorescence		white
Persistence		medium
Focusing method		magnetic
Deflection method		magnetic
Deflection angle (approx.)*		diagonal 90°
Face plate light transmission (neutral density filter)(approx.)		72%
MECHANICAL DATA		
Overall length	21 1/8 3/8"	
Outside diagonal	24"	
Screen width (bogey)	21 7/16"	
Screen height (bogey)	17 1/16"	
Cap	Recessed small cavity (J1-21)	
Base	Small shell duodecal 5-pin(B5-57)	
Basing	JETEC designation 12N	
Mounting	any	
ELECTRICAL DATA		
Maximum Ratings (Design-Center Values)		
Anode voltage	20,000 d-c max.	volts
Grid-No. 2 voltage	500 d-c max.	volts
Grid-No. 1 voltage		
Negative bias value	125 d-c max.	volts
Positive bias value	0 d-c max.	volts
Positive peak value	2 a-c max.	volts
Peak heater cathode voltage:		
Heater negative with respect to cathode (Note A)	180 max.	volts
Heater positive with respect to cathode	180 max.	volts
Grid-No. 1 --circuit resistance	1.5 max.	volts
JETEC Test Conditions		
Anode voltage	14,000 d-c	volts
Grid No. 2 voltage	300 d-c	volts
Grid No. 1 voltage (Note B)	-33 to -77 d-c	volts
Focus Coil Current (approx.) (Note C)	110 10 d-c	ma
Ion-trap current (Note D) (approx.)	65 50% d-c	ma

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

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

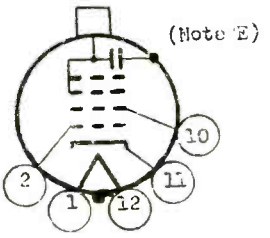
Note B: Visual extinction of undeflected focused spot.

Note C: JETEC #109 focus coil.

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

Note E: In the interest of reducing the number of potential types due to different external coating shapes, only the contact point is defined on the picture tube as shown in the drawing. The external coating may take any configuration above the reference line to produce the desired capacitance.

Characteristics chart of CBS-Hytron type 24TP4.

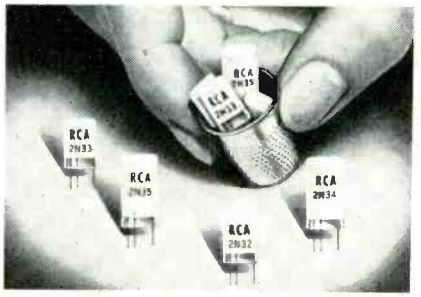


12N

Tube basing diagram of 24TP4.

RCA Transistors

RCA's commercial entry into the transistor field, after years of extensive research and development on semiconductors, is marked by the introduction of four types of germanium transistors —two point-contact and two junction.



RCA's new transistors.

Type 2N32 is a point-contact transistor intended for use in pulse or switching applications where an operating frequency for voltage-gain cutoff of 0.9 *mc*, an operating frequency for current-gain cutoff of 2.7*mc*, and a high current amplification factor are important design considerations.

Type 2N33 is a point-contact transistor intended for use in oscillator service at frequencies up to 50 *mc*.

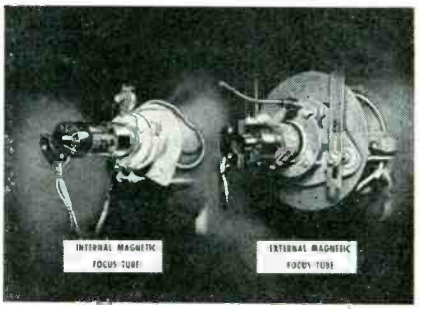
Types 2N34 and 2N35 are junction transistors of the p-n-p type and n-p-n type, respectively. Both types are intended for use in low-power, audio-frequency applications. These transistors operate at extremely low voltages, have a current amplification factor less than but approaching unity, and provide high operating power gain—features of primary importance in audio-frequency amplifier applications.

Each of the four types has a base with three small pins in line and spaced to provide mechanical indexing for socket insertion.

A copy of the 8-page booklet describing these new RCA Transistors may be obtained on request from Commercial Engineering, RCA Tube Department, Harrison, N. J.

GE Internal Magnetic Focus Tube

For the first time, permanent magnets are being built into new television picture tubes, thereby eliminating the need for external focusing controls

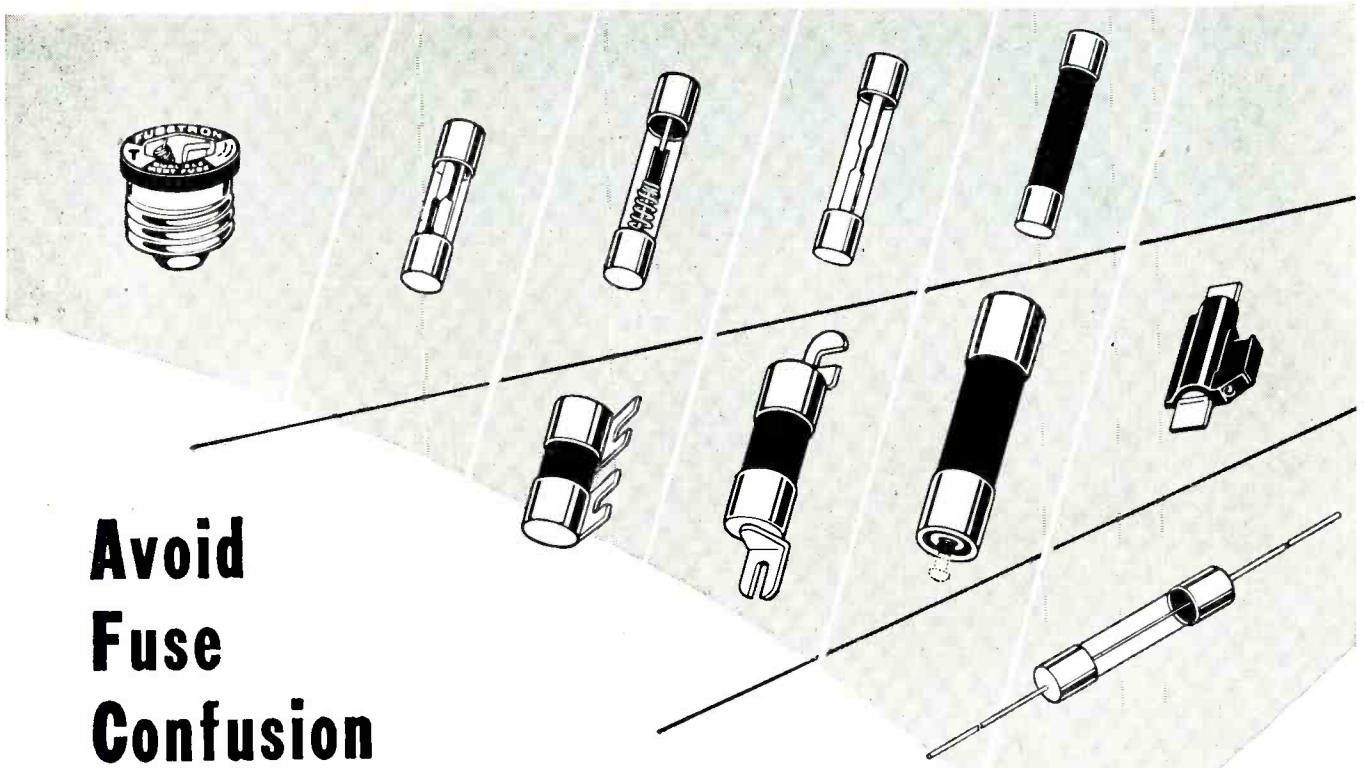


Comparison between new and old tube focus requirements.

and decreasing production costs by discarding three assembly units.

In a new General Electric TV 21JP4 tube displayed at the 1953 meeting of

[*Continued on page 61*]



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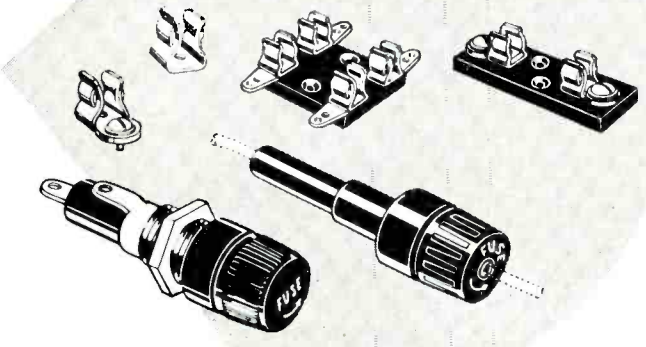

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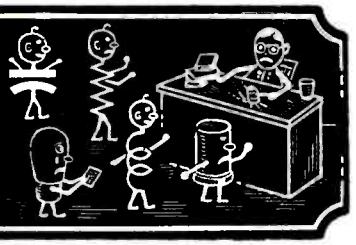


Capehart CX-37-AGC

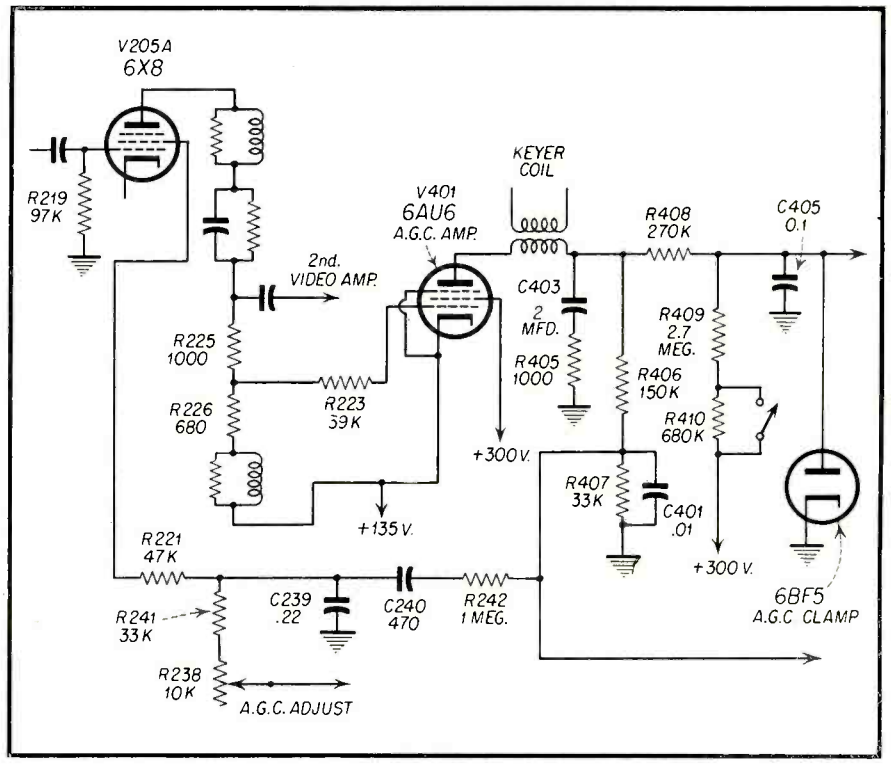
This *agc* system while containing many features common to all keyed *agc* systems also has some which are unique. The *agc* tube is a 6AU6. The grid of this tube is *dc*-coupled to the plate of the first video amplifier tube. The signal at this point is sync phase positive. The screen voltage of the first video amplifier is supplied from + 300 volts through *R241* and the *agc* control *R238*. By varying the screen voltage on the video amplifier, the amplification of that stage and therefore the amount of signal fed to the grid of the *agc* tube can be set.

The plate of the *agc* amplifier is pulsed with a 700 volt positive pulse through a winding on the width coil. The pulse width is that of the re-trace time of the horizontal deflection network. Since the horizontal pulse is so placed in time that it arrives during horizontal re-trace, the amplifier only operates during that portion of the video signal containing the horizontal sync pulse.

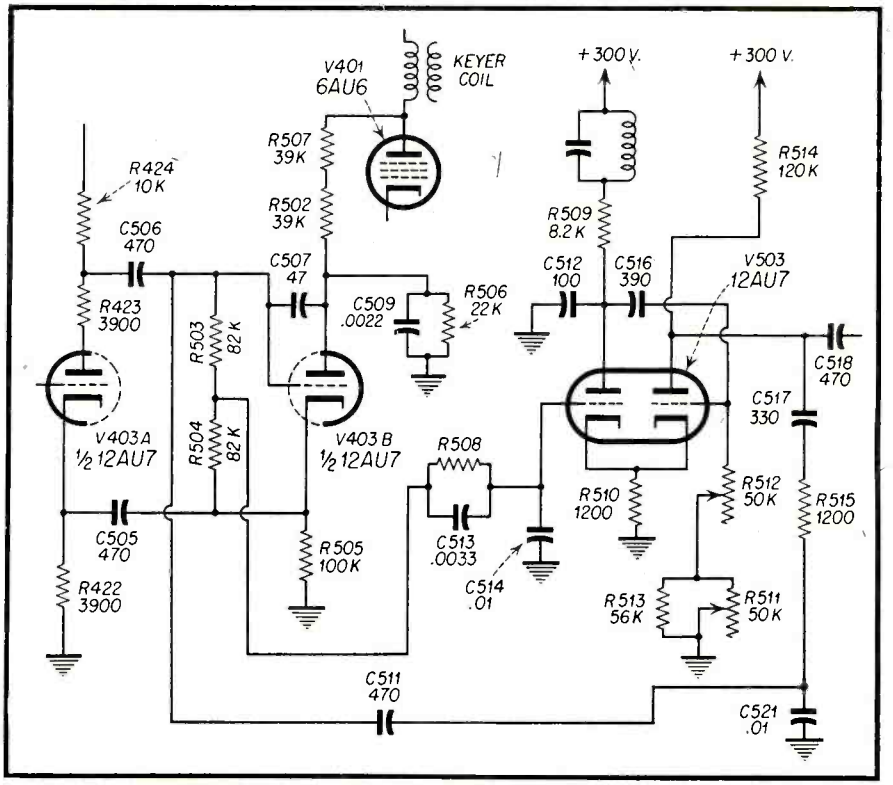
During the time this tube conducts, *C403* is charged negatively. When the pulse is over and the tube stops conducting *C403* discharges through *R406* and *R407*. This develops a voltage across these resistors which is negative with respect to ground and can be applied as bias to the *if* and *rf* tubes. The amount of charge on *C403* is determined by the amplitude of the sync signal and the resulting discharge voltage which is used for bias is therefore proportional to the received signal.

Bias for the *rf* amplifier is taken off the top of *R406* and *R409*. Bias for the *if* stage is taken off the junction of the two resistors. The diode section of a 6BF6 tube is used as an *agc* clamp. The plate of this diode is connected ot the *rf* bias point. It is also connected to *R409* and *R410* which return to +300 volts. With a weak signal input, this diode keeps the *rf* bias at or about zero volts. If the signal is large the voltage developed across *R406* and *R407* becomes sufficiently negative to cause the diode to be cut off. With the diode negative the full bias can be developed at the *rf* point and the *rf* amplifier is controlled by the *agc*. The

[*Continued on page 70*]



Partial schematic of CX-37 agc System



Partial schematic of CX-37 horiz. osc. and afc

12 reasons why it pays to replace with SYLVANIA PICTURE TUBES

Independent laboratory tests show these 12 outstanding qualities of Sylvania Picture Tubes

1. No tube failures (after 1500 hours).
2. No trend toward slumping emission or low light output.
3. No excessive leakage.
4. No excessive gas present.
5. Excellent grid control.
6. Excellent emission characteristics.
7. No stray emission.
8. Low electrical breakdown.
9. Very good color control.
10. Excellent spot centering.
11. Low screen burning (no rejections).
12. Excellent physical conditions.

Only Sylvania showed no tube failures

Here is proof that Sylvania Picture Tubes are *first* in long life and *finest* in all around performance of all tubes tested.

The above record was established in comparison tests of the tubes of 9 different manufacturers. All tests were conducted under identical conditions by an outside testing agency.

Set owners everywhere are being told again and again about Sylvania's superiority on the big, nation-wide TV show "Beat the Clock."

The Picture Tube for Reliable Replacement

Of course, the name Sylvania has always stood for highest quality. Now, more than ever before, Sylvania Picture Tubes mean better business for jobbers and service-dealers alike. If you would like the full story of these recent tests to show your customers how Sylvania Picture Tubes won over all others tested, simply mail the coupon now.

Send for this report

Sylvania Electric Products Inc.
Dept. 3R-2209, 1740 Broadway, N.Y. 19, N.Y.

Please send me the official report of the tests made on Sylvania Picture Tubes in competition with other makes.

Name_____

Company_____

Street_____

City_____ Zone_____ State_____

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In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg. St. Catherine St., Montreal, P. Q.

PERSONNEL NOTES

Meet the key men responsible for the manufacture and distribution of servicemen's products.

Appointment of **Edwin A. Freed** as Manager of Operations of General Instrument Corporation's headquarters plant in Elizabeth, N. J., was recently announced. Mr. Freed will continue to direct sales and will be in complete charge of all operations at the home plant. He joined General Instrument in 1951 as Sales Manager, after nine years with RCA where he was Manager of Sales of Component Parts.

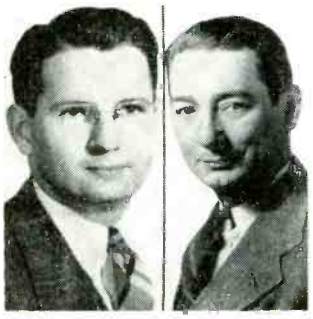
→

King Dendy, whose recent appointment to the research staff of the engineering division of the Edwin I. Guthman Company is shown (left), being welcomed to the department by chief engineer Frank A. Iverson. Mr. Dendy, who formerly was head of research and development for PCA Electronics, Inc., will specialize in delay lines and pulse transformers for the Guthman Company.

←

Grady L. Roark of Schenectady has been appointed Manager of Marketing for the General Electric Company's Tube Department, with headquarters here, it was recently announced. Mr. Roark has been manager of equipment tube sales for the department since last December, before which he was central regional sales manager for equipment tube sales with headquarters in Chicago. He joined G.E. on the company's test engineering program in 1933.

→



Sylvania Electric Products, Inc., announced recently the appointments of **Ralph R. Shields** (left), to the newly created post of Product Sales Manager of television picture tubes and **D. W. Gunn** (right), to the new post of Assistant General Sales Manager, Radio Tube and TV Picture Tube Sales. Mr. Gunn has been a member of Sylvania since 1931, and Mr. Shields joined in 1948. Both have worked successively at various engineering and supervisory capacities within the organization.

←

Robert L. Klabin, Controller of General Instrument Corp., major producers of television, radio and electronic products, has been elected by its management to manage the Company's new and expanding Sickles Division plant at Danielson, Conn. The new Division Manager has served General Instrument since 1935, progressing as Budget Director, Assistant to the President and Controller. Mr. Klabin is a member of several technical and management associations.

→

Karl W. Jensen, Vice President of Jensen Industries, Inc., Chicago, was elected Chairman of the Association of Electronics Parts & Equipment Manufacturers. Jensen also was named EP&EM representative on the Board of Directors of the Radio Parts & Electronic Equipment Shows, Inc., through which the association co-sponsors the annual Electronic Parts Show with four other trade groups.

→

I. M. J. Kaplan has been appointed Vice-President of Copperweld Steel Company with headquarters in Pittsburgh. Prior to his new assignment Mr. Kaplan was Manager of Sales—Special Products—of the Wire and Cable Division at Glassport, Pa. For over 12 years he has served in important capacities with the Wire and Cable Division as well as the Steel Division at Warren, Ohio.

→

Vinton K. Ulrich (right), has joined the David Bogen Company as General Sales Manager, it was announced by David Bogen, President, who also reports that **Mortimer Sumberg** (left), has been promoted to distributor Sales Manager. Mr. Ulrich, formerly renewal sales manager of the National Union Radio Corp., brings to his new position an unusual combination of sales and engineering experience. Mr. Sumberg has been identified with Bogen jobber sales for more than four years. He has been active in the electronics field for nearly twenty years.

→

Douglas Carpenter (left), has been appointed Chief Antenna Development Engineer of the JFD Manufacturing Company, Inc. Doug is inaugurating an expanded engineering program at JFD. He formerly served as Chief Engineer for the Vee-D-X Division of the La Pointe Plascomold Corp. **Jim Hall** (right), has been appointed Associate Antenna Test Engineer, assisting in development and field testing of antennas. Jim previously was associated with the CAA and Aviation Electronics operations of the Navy, both in the capacities of design and research engineer.

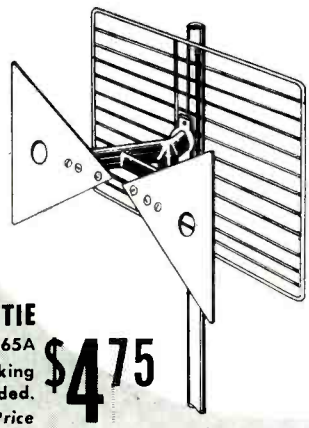
←

Les Wildberg, President of Leader Electronics, Inc., of Cleveland, Ohio, recently announced plans for his firm to enter into the manufacture and sale of TV equipment. It can be reported at this time, however, that the items will be primarily for consumer use, and that national sales are planned. Wildberg has been a well-known figure in the electronics field for over 30 years. He was the founder and former president of Radiart Corporation.

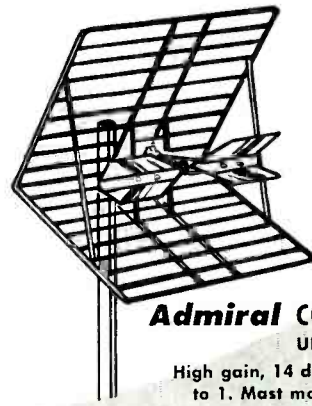
←

Announcement has been made by Snyder Manufacturing Company, of the appointment of **John Schweighauser** as a company Antenn-gineer. Among his duties, Mr. Schweighauser will call upon distributors and service dealers in the capacity of a sales engineer. He will acquaint the trade with new Snyder products and also do work on engineering problems. In addition, he will be engaged in field survey and sales promotion activities.

←



Admiral BOW TIE
UHF Antenna, No. AN65A
Each antenna furnished with stacking bar. Mast mounting bracket included. Mast not included. *Suggested List Price* **$4.75**



Admiral CORNER REFLECTOR
UHF Antenna No. ANS6A
High gain, 14 db. Front to back ratio 15 to 1. Mast mounting bracket included. Mast not included. *Suggested List Price* **$9.95**

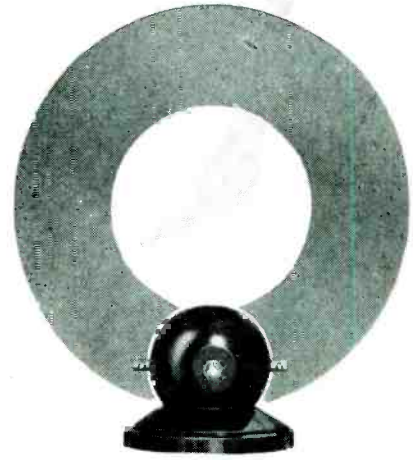
Admiral all-channel antennas

HIGH GAIN
LOW COST

Now you can make an extra profit on installations using these high gain UHF antennas. In good signal areas, the Admiral Bow-Tie No. AN65A gets excellent reception on any of the 70 UHF channels...*and lists for only $4.75!* For troublesome locations, where ghosts, reflections and interference are encountered, install the Admiral Corner Reflector Antenna No. AN56A. It lists for only $9.95.

Both these antennas are made with aircraft aluminum antenna elements and vibration-proof reflectors. Both come completely assembled, ready to mount. "A-frame" insulators provide plenty of free air space around elements. The units have high mechanical strength, low wind resistance, and are treated to resist weathering. They can be easily fastened to existing masts and towers.

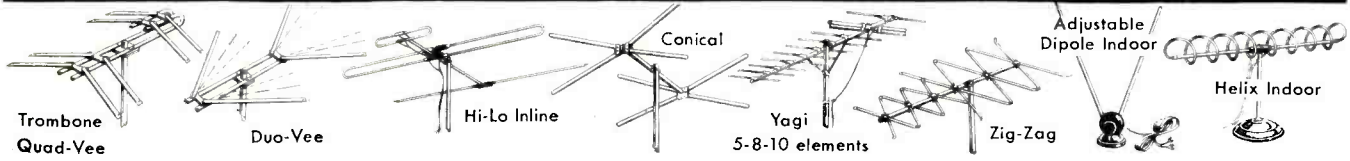
Where an indoor UHF antenna is needed, give your customer the Admiral Target No. 94A10-7. Smartly styled in rose-gold colored anodized aluminum with mahogany phenolic base, it stands only 10 inches high. The base is weighted and felt padded...can be placed on top of receiver...picks up all UHF channels. Order by part number from your Admiral distributor.



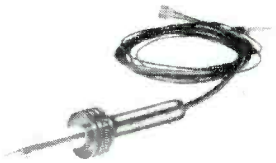
Admiral TARGET
Indoor Antenna No. 94A10-7
Complete with lead-in
Suggested List Price **$4.95**

Admiral Corporation
Accessories and Equipment Division • Chicago 47, Illinois

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

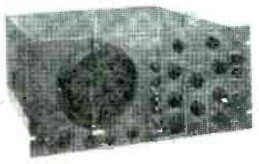


New Products



TV Safety Test Probe

Precision Apparatus Co., Inc., announces that a patent has been issued on the "Precision" Series TV High Voltage Safety Test Probe. The product was developed to afford convenient and direct measurement facilities up to 60,000 volts d.c., with complete safety to the operator, with utmost simplicity, speed and accuracy. These probes provide direct kilovoltmeter facilities for most high sensitivity test sets and vacuum tube voltmeters.

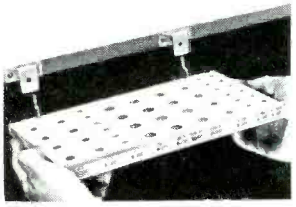


Rack-Mounted Oscillograph

Du Mont Laboratories, Inc., announces that the Du Mont Type 304-AR Cathode-Ray Oscillograph is now available as a rack-mounted unit. The unit features built-in voltage calibration. The illuminated screen is specially calibrated for reading any portion of the signal directly in volts by a push-button control on the operating panel. The rack-mounted oscillograph requires only 8¾" vertically in a standard relay-rack.

New HI-FI Speaker

The Oxford Electric Corporation announces a new, high-fidelity 15" speaker. Model #HF15LN has the following specifications and characteristics: Frequency range—50 to 10,000 C.P.S. Magnet Weight—14 oz. Alnico V; Power Rating—25 watts; Input Impedance 8 ohms; Voice Coil—1½" diameter. The unit is attractively finished with a silver "hammerloid" enamel and has a blue pot cover.



Vari-Board Shelf Brackets

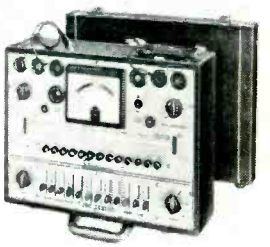
New brackets are announced by **Vaco Products Co.**, which permit mounting a Vari-Board shelf to regular shelf edges anywhere in the store, as desired, when regular Vari-Board punched panel is not used as a backboard. Made of wood, 11" x 5¾" x 7/16" thick, the brackets are simply attached by screws to the regular stock shelf edge, as illustrated, and the shelf hooks inserted into the front bracket holes for supporting the unit.

New Tube Britener

A universal TV tube britener has been developed by **Perma-Power Co.** Its isolation type transformer gives normal 6.3V to filament to relieve cathode short problems or 7.8V to increase cathode emission and restore lost brightness. Simple switch allows quick selection . . . unique design allows operation as constant voltage (parallel wired sets) or constant current (series wired sets) transformer.

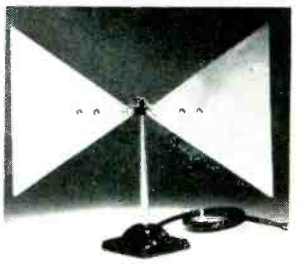
Tube Tester

Manufactured by the **Simpson Electric Company**, the new Model 1000, features fast testing with convenient ohms readings for leakage and shorts. The unit will test any receiving tube including 9 pin miniatures and subminiatures with base arrangements in line or circle. The Model 1000 tests plate conductance. The dial indicates percentage of rated plate conductance, which is closely related to mutual conductance.



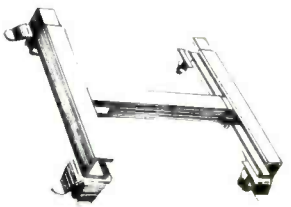
UHF Indoor Antenna

The Brach Manufacturing Corporation has announced the introduction of their new **uhf** Indoor Antenna, the #483 Bow-Tie. The same design that is used on outdoor **uhf** Bow-Tie antennas has been applied to the #483 in order to insure the highest possible gain. The Bow-Tie elements are mounted on an attractive black porcelain base that gives the entire unit a modernistic finish.



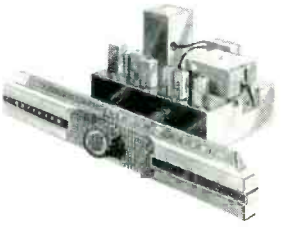
TV Set Roll-Around

Designed to add welcome mobility to present stationary television sets of the console variety is the new Telco TV Roll-Around, a product of **Television Hardware Mfg. Co.** The strong, rigid adjustable metal frame is equipped with heavy duty ball bearing casters that are smooth running and will not mar wood or composition floors. Constructed to fit under any floor model up to 30" x 24", the unit raises any set merely a half-inch from the floor.



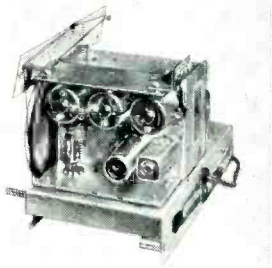
Vu-Matic Control Unit

The Vu-Matic Control Unit combines **Raytheon Manufacturing Company** latest tuning discoveries with recently developed chassis elements. Principal advantage of the feature is that one knob tunes all 82 vhf-uhf channels and switches in vhf-uhf antennas, circuits, and extra amplifiers—all automatically. The Vu-Matic chassis also shuts out picture interference and stops oscillator radiation.



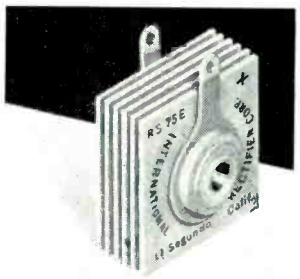
IF Signal Booster

Grayburne Manufacturing Co., Inc., announces the production of their Model TSB-1, an I.F. signal booster for **uhf** and **vhf**. The unit, provides an extra stage of I.F. to amplify both **uhf** and vhf signals without switching. The booster, which is supplied in adaptor form, is installed in an existing tube socket and requires but one wire connection to ground. It is said to increase picture brightness, amplify signals over 20%, and clear "snow" effects.



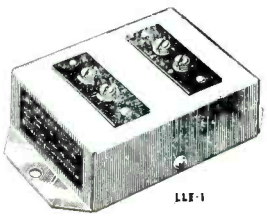
UHF Cavi-Tuner

The "Cavi-Tuner" is now available from the **Radio Receptor Co., Inc.** Field tests indicate superiority of the unit in overall noise figure, image rejection, oscillator radiation and gain. The unit has shown unusual sensitivity and gives excellent reception in fringe areas. Some of the outstanding features are as follows: no moving electrical contacts; completely shielded construction; excellent frequency stability and uniformly broad bandwidth and high selectivity over entire tuning range.



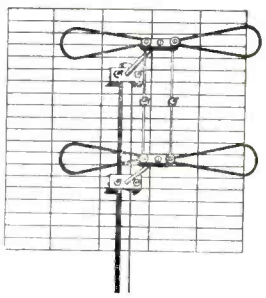
New Selenium Rectifiers

International Rectifier Corporation has developed a complete line of selenium rectifiers for use in Radio, Television, TV Boosters, and **uhf** Converters. The rectifier shown in the photograph is a Type RS75E and is rated as follows: maximum input, 130 volts RMS; maximum peak inverse, 380 volts; maximum output current, 75 MA. A series resistor of at least 22 ohms is recommended as a current limiter when used with a capacitive filter.



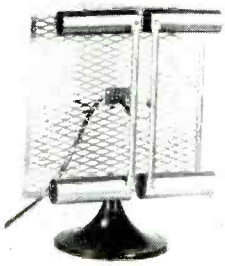
TV Line Loss Equalizer

A new TV accessory for equalizing high and low channel losses in transmission lines is now available from **Blonder-Tongue Laboratories.** Model LLE-1, Line Loss Equalizer, maintains balanced signal levels, and prevents over-loading and cross-modulation by offsetting high channel losses with attenuation varying from 17 db on Channel 2 to less than 1 db on Channel 13. May be inserted at any point in the transmission line.



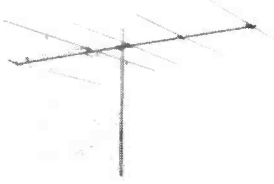
Mi-Tee-Ray Screen Antenna

Model MR-S, produced by **Fretco Inc.** designed for channel coverage 2 to 83 with ultra high gain. The front to back ratio is 50 to 1 and is also used in ghosty areas where others fail. A special ingredient is being used in the insulators to reduce any possibility of dielectric loss. The construction is wind and ice proof. This antenna needs no assembly, but comes collapsed.



UHF Indoor Antenna

Tricraft Products Co., now offers a new **uhf** indoor antenna consisting of a two element array with a reflector. The unit, measuring only 12 inches from side to side, considerably less than the size of most indoor **vhf** antennas, may be conveniently placed atop the T. V. receiver. The antenna covers all 70 **uhf** channels and provides excellent impedance match over the band.



2-Channel Twin-Tuned Yagi

Channel Master Corporation has announced the development of Model No. 525, an antenna peaked for both channels 2 and 5. The antenna, featuring a transformer-type dipole, has a gain of 6½ db on Channel 2 and almost 8 db on Channel 5, for a single bay. Stacking provides substantially higher gain. Directivity and rear rejection are excellent. Antenna operates with just a single transmission line, and there is no switching necessary.

TV Voltage Regulator.

Recently released by **Perma-Power Company**, this voltage regulator has been designed to **insure** maximum performance of any television set by returning full height and width of picture when low line voltage distorts picture. Features include . . . reduction of tube failures; increasing of set sensitivity and elimination of intermittent sync and oscillator drift caused by low line voltage.

UHF Converter

A completely new uhf converter is being introduced by the **Walsco Electronics Corporation.** The Walsco unit is said to be able to amplify the signal almost three times while it converts. Tests revealed that the unit will offer a lower noise level. Exclusive Turretune feature of this converter is the new turret-type band spread tuning unit with a double tuned pre-selector that has been labeled as an entirely new concept in **uhf** tuning. This tuning unit has a constant lc ratio. Walsco Imperial covers the entire **uhf** frequency spectrum.

3-D Phonograph Music

Webster-Chicago Corp., announce their new high-fidelity model. The Webcor three-dimensional "Musicale" provides a uniform audio response of from 50 to 12,500 cycles, in contrast to the average phonograph's reproduction of a maximum of 6,000 cycles. The unit has three speakers that provide what Webcor engineers describe as stereophonic sound—full reproduction of all frequency cycles in all parts of the room.

Miniature UHF Capacitor

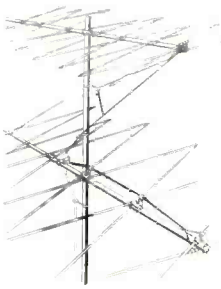
JFD Manufacturing Company, Inc., announces production of the "Mighty Midget" piston type variable trimmer capacitor for **uhf** television set manufacture and replacement parts requirements. Some features of the JFD model VC3-G are as follows: one inch overall length at maximum capacitance; capacitance range 1.0 to 8.0 mmf; universal mounting design fits any **uhf** receiver.

TV Lead-In Wall-Feed

Production of a new type weatherproof television transmission line wall entrance for house and trailer has been announced by **Mosley Electronics, Inc.** Product will accommodate either flat or tubular line and will completely seal out rain and snow. The new Wall-Feed permits the entrance of such wire directly under the eave into the attic.

Zig-Zag Re-Entrant Network

Improved performance of the Zig-Zag TV antennas has been announced by **Trio.** The Trio Re-Entrant Network shows no measurable loss when stacking for all channel —single feed-line operation. It is a method of broadening the impedance characteristics of a multi-channel antenna to the point where that impedance remains practically constant throughout the channels covered.



RCP VTVM Model 655

READS PEAK-TO-PEAK VOLTAGES DIRECTLY

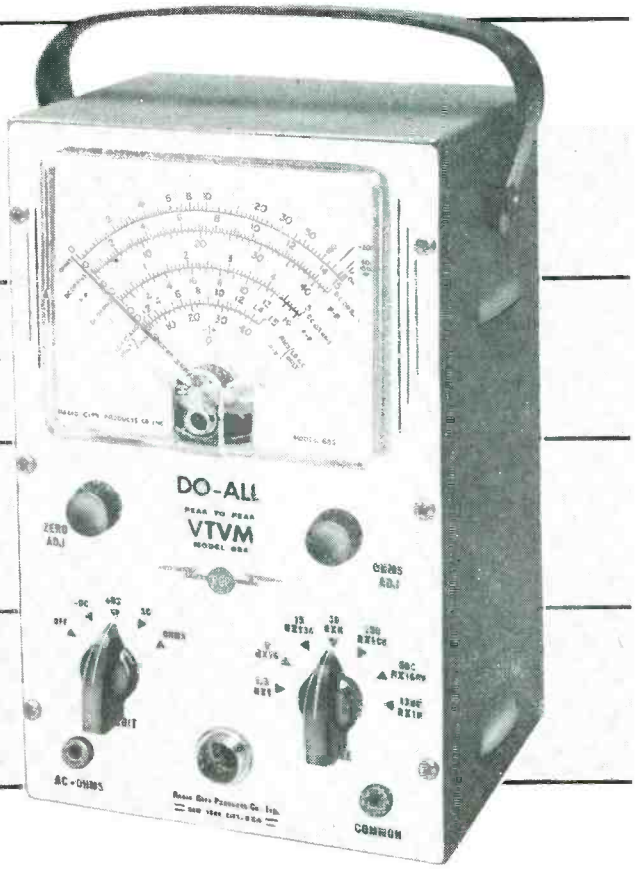
ACCURATE MEASUREMENT OF COMPLEX WAVESHAPES

SINE WAVE
RMS or Peak-To-Peak . . . Useful and Necessary—Read Directly With Model 655

PEAKED SAWTOOTH WAVE
TV Horizontal Signal . . . Peak-To-Peak Reading Required—Easily Done Directly with the Model 655.

PULSE WAVE
TV Horizontal Deflection . . . Peak-To-Peak Measurements Needed—Read It Directly on the Scale—Model 655.

COMPOSITE VIDEO WAVE
Video Amplifier . . . Peak-To-Peak Measurements A Must —Do It Directly With The Model 655.



Quickly . . . Accurately

DO-ALL Model 655. . .

ONLY $59.50

. . . gives a true reading measurement of complex and sinusoidal voltages with necessary peak-to-peak or RMS value read directly, for the analysis of waveforms in video, sync and deflection circuits.

Now TV efficiency is given greater effectiveness because sets can be serviced as the manufacturers say—the peak-to-peak way. The combination of this P. to P. meter and service notes to match, take the guesswork out of service and speed up your service operation.

Versatility of measurement, built into each Model 655, serves a variety of industrial applications in the service of vibrator power supplies, AC generators and all equipment utilizing any type of waveform or DC.

Match the Model 655 with any peak-to-peak VTVM—You will find that comparable performance can only be found in much higher priced instruments. Of high impedance design, the Model 655 makes use of an electronic balanced push-pull circuit and peak-to-peak rectification. The result is an absence of circuit loading, waveform error or frequency distortion.

This handsome looking unit has a brushed aluminum panel, etched for durability and uses an attractive clear plastic meter. Comes complete with our new "RCP SOLDERLESS TEST LEADS" for operation on 105 to 125 V AC.

FOR TELEVISION SERVICE AND INDUSTRIAL MAINTENANCE

- **PEAK-TO-PEAK AC measurements of from .2 V to 4200 V on 7 ranges.**
- **AC RMS measurements of .1 V to 1500 V on 7 ranges.**
- **DC measurements of from .02 V to 1500 V on 7 ranges.**
- **RESISTANCE measurements of from .2 ohms to 1000 Megohms on 7 ranges.**

Remember You can do more with a "DO-ALL".
See It at Your Parts Distributor. Write Dept. SD9 for RCP '53 Catalogue.

RADIO CITY PRODUCTS CO., INC.
152 WEST 25th STREET • NEW YORK 1, N. Y.

TRADE FLASHES

[from page 13]

years of research, in combination with RCA Victor's new Orthophonic Sound phonograph records, designed to achieve the utmost in wide range sound reproduction.

La Pointe Purchases Printed Circuit Company

LaPointe Electronics Inc. has purchased a 95 per cent interest in Circuitron, Inc., a New Jersey corporation which is engaged in the manufacture of printed circuits, it was announced by Jerome E. Respess, President. "By acquiring and managing Circuitron," Mr. Respess stated, "LaPointe is assured of a continuing supply of the printed circuits used in the Vee-D-X Mighty Match and other television accessory equipment. In addition," he said, "LaPointe will manufacture printed circuits for a wide variety of fields within the electronic industry.

Hallicrafters Builds New Plant

The Hallicrafters Company have announced that construction had begun on a new $400,000 plant in Toronto, Canada.

The new plant will be a one story brick building of modern design and is expected to be completed in October.

RCP Offers Special Purchase Plan

Radio City Products Company, Inc., has just introduced to their distributors a plan that makes it very easy to finance carrying an adequate stock of their products The new plan will permit the jobber to pay for stock over a period of 90 to 150 days without any interest. Trade Acceptances will be the medium to cover such purchases. In addition, the distributor has a guarantee of a liberal obsolescence protection.

NEDA Battery Index

National Electronic Distributors Association reports continued enthusiasm among radio-TV servicemen, distributors and others regarding the new NEDA Battery Index. Single copies are still available from National Electronic Distributors Association, 228 North La Salle Street, Chicago 1, Illinois.

General Instrument Meeting

General Instrument Corp., complete the first quarter, ended May 31, with record sales, Abraham Blumenkrantz, Chairman of the Board, told the annual meeting of stockholders. Net profit was the greatest for any initial quarter in the 30-year history of the company, he added. The company has broadened its activities in such fields as components for transistor application, printed circuits, color TV equip-

ment and electronic materials for the defense program, Mr. Blumenkrantz stated. In this connection, he emphasized: "G. I. is fully prepared right now to play an important role as a component manufacturer for the makers of color TV sets."

G.E. Ready For NTSC Color Signals

The General Electric Company has announced that its television transmitting equipment will satisfactorily rebroadcast network color TV programs under the compatible system now being recommended to the FCC by the National Television System Committee, without any additional equipment, provided the network signals arriving at the local station are of reasonable quality For color reception, only minor changes must be made to existing equipment.

TUBE NEWS

[from page 50]

the Institute of Radio Engineers, the external ion trap, focusing unit, and mechanical support have been replaced by a simplified ion trap and focusing unit, both built within the tube. Key to this new design are the tiny but powerful Carboloy permanent magnets now encased within the tube.

Size of the Carboloy Alnico 5 magnet used in the ion trap has been reduced to one-tenth that of the magnet previously employed. The new magnet is ⅛ inch in diameter and ⅛ inch in length. The former Carboloy magnet was rectangular, approximately ½ inch in length, ¼ inch thick and ⅜ inch wide.

The internal focusing device employs three Carboloy permanent magnets, measuring only ¼ inch in diameter and ⅝ inch long. Optimum clarity of focus is achieved through factory fixed focusing which eliminates the necessity for any external focusing control requiring adjustment by the set user.

Sylvania Type 40B2

A new horizontal deflection stabilizer tube, Type 40B2, has been released by the Radio Tube Division of Sylvania Electric Products Inc.

The Type 40B2 is similar in application to earlier released Sylvania Type 40A1. However, the new 40B2 has different voltage and current ratings, thus providing more versatile circuit design.

In circuits designed for its use, the 40B2 serves as the cathode bias resistor for the horizontal output tube. The non-linear resistance characteristic of the filament tends to hold the cathode current of the horizontal output tube relatively constant despite line voltage variations. The result is a stabilized horizontal deflection and second anode voltage. It also becomes possible, therefore, to operate the horizontal output tube near full scan capabilities at low line voltage without subjecting it to operating conditions which exceed the maximum ratings at high-line voltage. This insures greater reliability and trouble-free operation.

The Sylvania Type 40B2 is contained in a T-9 bulb. Average operating conditions are 40 volts at 150 ma.

Sylvania Type 40B2.

● ● ●

ASSOCIATION NEWS

FRSMAP

At a recent meeting at Lily Lake, Luzerne County, the Federation of Radio Service Men's Associations of Pennsylvania was informed by Milian J. Krupa, President that the State's proposed licensing bill for Radio-TV technicians has been tabled for this session of the legislature. Also announced were plans to hold an Eastern conference here in January, 1954, to discuss television-radio servicing and related industry problems. Representatives of similar servicing organizations from Maine to Florida are expected to attend.

William Morgan, President of FRSMAP's Wilkes-Barre chapter, was appointed editor of the organization's news bulletin, with immediate publication being planned. Cities represented at the meeting included Philadelphia, Pittsburgh, Scranton, Altoona, Harrisburg, Williamsport, Hollidaysburg, Carbondale, Reading, Chambersburg, Wilkes-Barre and Steelton.

TSDA

The Television Service Dealers Association of Philadelphia has launched a series of 18 newspaper advertisements promoting TSDA's members' facilities. The association headed by Louis J. Smith of Louis J. Smith Co., has voted unanimously to appropriate $1,200 from their advertisement fund for this advertising campaign in the Evening Bulletin. Ad copy will be of the institutional type, promoting TSDA services and explaining to the reader the advantages of using qualified radio and television service dealers. A grievance committee also has been appointed to investigate any consumer complaints that may arise concerning members' service work. The association has set up offices at 6021 Ogentz Ave., with a central telephone system to channel all requests for service to the nearest member. A standard rate charge for all calls cleared through the office only has been established. Dave Krantz has been named chairman of a new Industrial Relations Committee and Edward Strychowski, will head the association's Public Relations Committee.

Texas Electronic Association

TEA was the sponsor of the Texas radio and TV service clinic and electronic fair held recently at Fort Worth, it was reported by Leonard Smith, President. Talks by John F. Rider, President, Rider Publication and Al Robertson, Robertson's, Oklahoma City, opened the parley. Other talks given were by James D. Secrest, official of RETMA on "Let's Build Our Industry Together," William D. Renner, field technical sales director, and Howard W. Sams Co., who discussed *UHF* and color television. Advice to new television dealers was offered by Mort Farr, Upper Darby, Pa., and Hal Chase, President, Television Service Association of Detroit, Michigan. Russ Hansen, contract section manager, Motorola, Inc., and Ray Yeranko, radio and television service manager, The Magnavox Co., participated in a panel discussion on service.

Radio and Television Technicians Guild of Florida, Inc.

Suggested Charges for Television Service-Repairs

This schedule of suggested prices covers labor charges only, but includes all testing necessary to locate faulty part or circuit. Parts and tubes are extra.

	Pts	Labor	
Home Call			
1st 1/2 hour $5.00 minimum. After 1st 1/2 hour			$ 5.00
Pickup, delivery, pull, install and adjust			7.50
Projection			10.00
Warranty			
Parts exchange — minimum per set			1.00
Maximum per set			2.50
Call Backs			
All call backs regardless of trouble			2.00
Call back, other trouble			5.00
Bench			
Minimum $5.00 Hourly rate			5.00
Tube			
Replacement, locate and replace defective tube			1.00 minimum
Alignment			
Audio Section IF complete			4.50
RF tuner			Hourly rate
Video section			8.50
Capacitor and Resistor			
R.F. section			7.50
Audio			5.50
Sweep Section			7.50 maximum
Video section			5.50
Power section			5.00 maximum
Choke Coils			
Power section			3.50
Wave trap and adjustment			3.00
Audio section			4.00 minimum
Sweep section			4.50
Focus coil			4.50
Video section			5.50
Controls			
Clean controls			1.50
Connections			
Loose — Locate and repair			6.50
Modifications	Pts	Labor	
Modify to remove retrace	.65	2.50	3.15
Picture Tube			
Resolder ring			2.00
Install and adjust CRT up to 9"			3.00
10" to 17"			5.00
18" to 27"			8.50
Projection			Hourly rate
Rectifiers			
Selenium-replace			3.50
Short			
*All circuits — locate and clear (*except tuner)			6.50
Transformer			
AC-DC section			4.50
Power section — mounting charge $4.50 plus 25c per connection			8.00 minimum
Sweep section — output — horiz			6.50
oscillator, horiz			6.50
output, vertical			5.50
oscillator, vertical			5.50
IF transformer, video			6.00
Tuner			
Pull and install			12.50
Clean, lubricate and adjust contacts			3.50
Locate and replace defective capacitor or resistor			7.50
Locate and repair loose connection or short			Hourly rate
Yoke			4.50

The accompanying chart was made available by Thurow Distributors of Miami, Florida to the members of the Radio and Television Technicians Guild of Florida, Inc.

Radio and Television Association of Springfield, Ohio.

It was reported by Paul Boller, Secretary, that a vote taken at the last regular meeting resulted in a majority of members opposed to licensing, no matter in what manner, by this city. The association was born at a mass meeting held in the summer of 1949 which at that time had been organized to protest attempts of licensing and inspection of aerial installations by the city commission. Our violent opposition plus our proof of reliable workmanship without city inspection caused the city commission to drop the licensing matter entirely and has never since been brought up at a city commission meeting.

NATESA

Plans for the fourth annual convention of the National Alliance of Television and Electronic Service Associations, to be held at the Morrison Hotel, Chicago, October 9th, 10th and 11th, are nearing completion, according to Frank J. Moch, National President. More than one thousand members of the thirty-five affiliated state groups are expected to accompany the seventy delegates, with an additional five hundred persons representing Chicago area companies, John Cecich, Convention Chairman estimated. This year's plans call for both an industry convention and product display and an open forum, to which the public is invited, and where leading authorities on television maintenance and repair will give set owners an opportunity to air their comments on TV repair service.

Television and Radio Electronics Institute of Washington

Radio and television repairmen in Tacoma, Washington, have formed a unique trade association aimed at raising the standards of their field. Forty firms in Tacoma, have formed the Television and Radio Electronics Institute of Washington, the first in the Pacific Northwest and believed unique in organization nationally. Administrator of the Institute is R. E. Johnson, with headquarters in Tacoma. The Tacoma group is setting out on a program of tests for membership and a rigid code of ethics to follow.

Impetus for the organization came from the repairmen. After formation

of the institute they set up a 12-man board of governing executives. They adopted a seal of approval, which they will display and also attach to all repaired sets. Members agree to conform to the Minimum Classified Standards of Quality Products and Services of leading technicians and authoritative service bureaus.

Similar organizations have sprung into being since the advent of TV, but the Pacific Northwest group says that study shows that most of them are "mutual admiration societies" with no teeth in their organizational operation. Interest from Yakami and Seattle in a similar organization makes the Tacomans confident that in a short time they will have a statewide organization as new stations are assured for Seattle, Tacoma, Yakima, Bellingham, Spokane and Portland, Oregon.

FLYBACK TESTER

[from page 24]

cate oscillator efficiency.

When the unit is first turned on the 6K6 will oscillate. The flyback transformer under test is effectively connected by test leads across the oscillating tank circuit. If shorted turns are present in the flyback transformer under test the overall "Q" of the oscillating circuit will be lowered and the meter needle will indicate in the "BAD" region on the meter scale.

A flyback transformer may be checked in the TV receiver without disconnecting or removing it. In most cases it is only necessary to connect the two leads from the tester to the plate caps of the horizontal output tube and high voltage rectifier. To achieve greater accuracy in measurement the following procedure is used:

1. The TV receiver is turned off and disconnected from the *ac* line.
2. The HV RECT. and HOR. OUTPUT tube plate caps are removed.
3. The HV RECT. tube is removed from its socket.
4. The Deflection yoke assembly is unplugged.
5. One side of the WIDTH coil is disconnected.

The test leads from the Model 98 are connected across the two plate cap terminals on the flyback transformer. No polarity observation is necessary. If the meter needle indicates in the "BAD" region on the SHORT test scale the transformer has an internal short or low efficiency and should be replaced.

If the meter needle indicates in the "GOOD" region on the SHORT test scale then the trouble is not in the flyback. To quickly determine whether the trouble is in the deflection yoke reconnect it and notice the meter indication. A short in the yoke will reflect a short due to mutual inductance or reflected impedance and the meter will indicate in the "BAD" region. Thus by means of this unit the trouble can be quickly isolated.

The test described above specifically pertains to flyback transformers in a TV receiver under troubleshooting tests; however, the same procedure can be applied to transformers from stock to prevent installing a replacement transformer in a set only to find out that the replacement isn't any good.

TROUBLE?

[from page 47]

produces *horizontal* stripes or "sound bars" on the screen. *(Fig. 9)* shows sound bars of approximately 960 cycles.

A 15,750-cycle signal produces one

vertical black and one vertical white stripe on the screen (though one black and two white stripes or one white and two black stripes might be produced, depending on the phase of the signal). At twice the horizontal frequency, there would be two black vertical stripes and two white ones, etc. If the frequency on the screen is an exact multiple of 15,750 the lines are *vertical;* if not, they are *slanting.* To find the frequency of the interference signal on the screen, simply count the number of black (or white) stripes. If the bars are horizontal, multiply by 60; if vertical or diagonal, multiply by 15,750. While the frequency will not be exact, because of the blanking periods, it will be close enough for the purpose of estimating the approximate frequency.

3. a, b, c

The main steps in dealing with interference problems are:

(1) Identifying the type of interference (steady *rf, fm,* ignition, etc.);

(2) Identifying the origin of interference (internal or external);

(3) Checking on how the interference, if external, comes into the receiver.

(4) Applying the correct remedy.

The type of interference is identified by observing the pattern on the screen. The appearance of the main types of interference was listed in the preceding answer.

When there is any question whether the interference is being generated internally or externally, identification is most easily accomplished by a simple process of elimination. This can be done by first checking the possibilities of internal interference.

For example, a tweet pattern can be recognized by careful observation and by rotating the fine tuning control. The tweet pattern changes considerably when the fine tuning control is rotated. At the point where the tweet harmonic becomes equal to the video carrier, zero beat is approached (broadest horizontal black and white bars indicating the lowest frequency). The line pattern becomes diagonal and vertical with thinner stripes as the fine tuning is rotated further away from the zero-beat point.

In some receivers the tweet harmonic zero beats with the video carrier at the best sound point. In other cases, the zero beat occurs when the fine tuning is rotated away from the best sound point, while at the best sound point the stripes may be thin and diagonal. An example of this is a receiver with a sound *if* of 22.1 *mc.* The third harmonic of 22.1 *mc* (66.3 *mc*) beats with 67.25 *mc,* the video carrier of Channel 4. At the best sound point, an inter-

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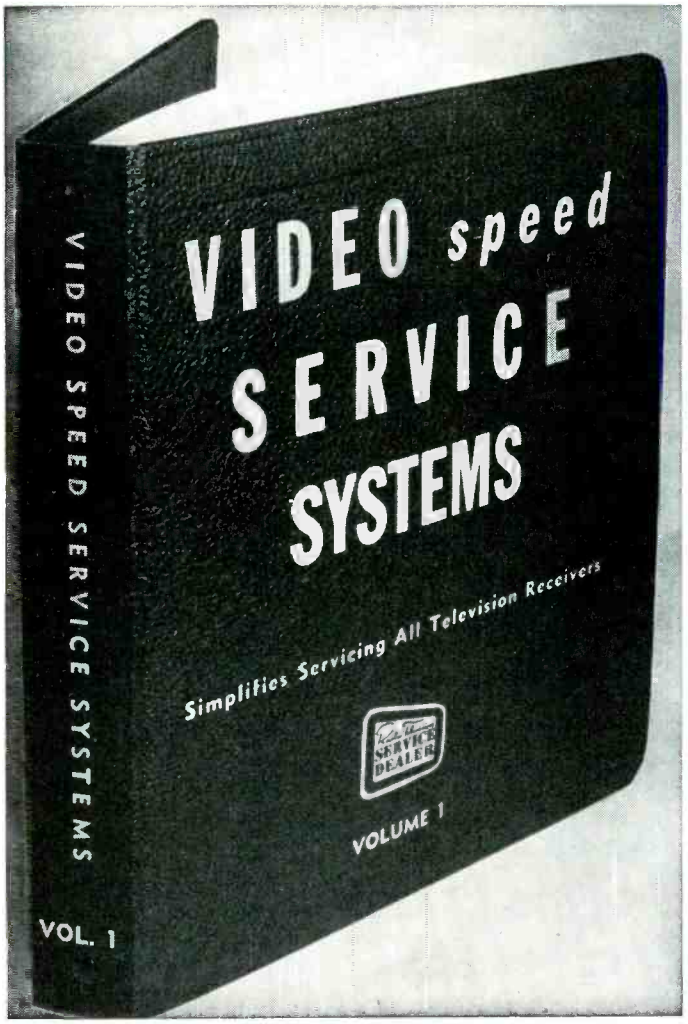

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ference frequency of approximately 1 *mc* is produced. A zero beat is generated when the fine tuning is rotated to one side of this point.

In all cases, rotation of the fine tuning gives a wide variation of the interference pattern which is typical of internally generated tweets.

Double conversion interference may resemble in appearance oscillator radiation from another TV receiver. However, local oscillator radiation is observed *only* when the interfering set is tuned to the channel capable of producing interference (the offending local oscillator must be at a frequency falling within the frequency range of the channel being tuned in at the receiver being serviced). Double conversion interference is always present as long as the interfering channel is on the air. A further check can be made by noting the intermediate frequency of the receiver and computing whether there is a channel capable of giving this type of interference.

When arcing or *rf* power supply interference is suspected, the antenna is disconnected from the antenna terminals. In both cases, the interference will still be seen. The other two types of internal interference—4.5 *mc* and 60-cycle or (120-cycle) interference are readily recognizable.

Disconnecting the antenna in itself does not automatically tell whether the interference is internally generated. Two types of internally generated interference, tweets and double conversion signals, do not appear unless the antenna is connected and TV signals are received. For the same reason, taking out the *rf* oscillator and video *if* tubes do not provide conclusive information whether interference is internally or externally generated. However, as previously indicated, disconnecting the antenna may be helpful in distinguishing between two similar types of interference, one external and one internal—like ignition noise (external) and arcing (internal).

Disconnecting the antenna is also helpful in the next step—determining by what path external interference is coming into the receiver.

External interference can come in by three paths: a) antenna-transmission line; b) line cord (power line); c) directly to the chassis.

Since the remedy for external interference depends on knowing how the interference is coming into the receiver, it is necessary to check the path of entry. The simplest way is to detach the antenna. If the interference is still seen, it is either coming from the power line or directly to the chassis. (Internal interference possibilities have been eliminated previously.)

The next step is to plug in a good low-pass filter (which should be in your kit when checking interference troubles) between the receiver and power line. If this attenuates the interference noticeably, then most or all of the interference is coming through the power line. If the interference is still visible, then direct pickup is indicated. On the other hand, if detaching the antenna reduces the interference, it is coming in by way of the antenna and/or transmission line. A high-pass filter and tuned stubs should then be tried. Interference remedies are listed in Answer 5.

4. a, e

When a tweet pattern is suspected as originating in the sound *if* on the basis of observation of the screen and checking the video and sound intermediate frequencies, further verification can be made by removing the first sound *if* tube. If the tweet disappears, it is originating in the sound detector. This will not work in the video strip, since removing the video detector, of course, kills both the picture and the interference.

5. a, b, c, d, e

The steps to take to eliminate tweets depend on the design and layout of components in individual receivers. Several manufacturers issue service bulletins on how to correct the problem in specific models. Generally, the first

step is to determine, by the methods noted above, whether the tweet is originating in the video or sound detector. One or more of the following remedies is then applied to the corresponding circuit:

1. Carefully check the lead dress—

(a) Keep the leadin from the antenna terminals to the front end as far from the affected *if* strip as possible. Move the lead while watching the effect on the screen.

(b) Keep the antenna leadin away from the 115-volt power line.

(c) Keep *ac* and *dc* power leads from the *if* and detector as far away from the front end and antenna leadin as possible. No soldered components—resistors, condensers, coil wires in the *if* strip should be moved since this may affect the tuning.

2. Make sure the *if* and detector tubes are shielded.

3. Bypass the hot filament line going to the last *if* and detector stage with a filament choke and bypass condenser.

4. For tweets originating in the video detector, a tweet trap has been found effective in some cases (*Fig. 10*). This is obtainable from the manufacturer and is a series-resonant circuit placed across the detector load, to short out the load for the tweet hamonic. While observing the screen pattern, the trap is tuned for minimum interference.

In a few instances, manufacturers have recommended an *if* and *rf* realignment at new frequencies.

Double conversion interference, which is most common in fringe areas is counteracted by one or more of the following: stubs and switches (see below); reorientation of the antenna; returning the *rf* amplifier grid to ground instead of to the *age* line.

4.5 *mc* interference can be caused by incorrect positioning of the fine tuning control in split sound sets, incorrect tuning of the sound takeoff coil in intercarrier sets, or incorrect tuning of 4.5 *mc* trap in the video amplifier stage (if the set has one). In some cases, it is necessary to install such a trap if the set has none.

Eliminating interference caused by 60-cycle (120-cycle) hum and arcing simply requires finding the defective component. *RF* power supply interference is caused by poor shielding or a defect in the supply.

The remedies for external interference depend on how it comes into the receiver. The following remedies are available:

1. For interference coming in from the power line—a low-pass filter between line cord and power outlet.

2. For interference coming directly to the chassis—a bottom pan on the chassis, and copper screening inside the cabinet well-grounded to the chassis and to external ground (provided the chassis is not "hot").

3. For interference coming in by way of the antenna-transmission line—

(a) At the *if* or other frequency below the TV spectrum—a high-pass filter;

(b) At TV or higher than TV frequencies—tuned traps (stubs);

(c) At all frequencies—reorientation and/or relocation of the antenna-transmission line.

For antenna-borne interference, it is desirable to know the frequency of the interfering signal. A mobile communications receiver is generally used both to check the frequency and to locate

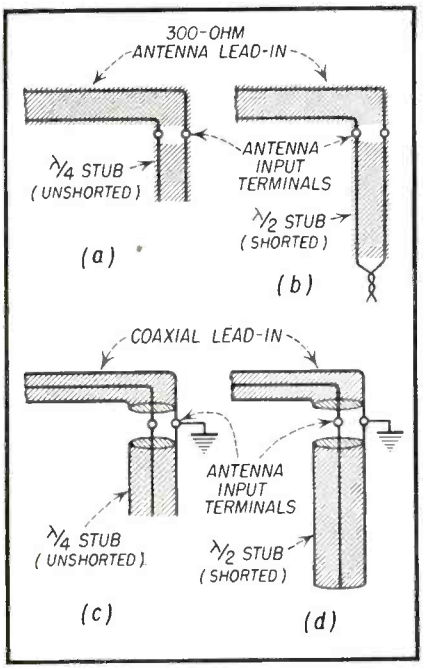

Fig. 11—300 ohm and coaxial cable stubs.

(a & c) Quarter wave unshorted.

(b & d) Half wave shorted.

the interference source by organizations specializing in interference problems. This is not generally available to a serviceman working on an occasional interference trouble. However, the problem can be solved on the basis of simple checks and general information. First, a high-pass filter is tried at the antenna terminals to determine the effect of the lower radio frequencies. Then tuned stubs are tried for frequencies in or above the TV bands.

Good low-pass and high-pass filters are commercially available or can be made by servicemen from data supplied in manuals.

Tuned traps can be easily constructed by the serviceman from lengths of transmission line, similar to the type already used in the receiver installa-

tion. Twin-lead or coax line is used, depending on the leadin to the receiver. The stubs act as tuned circuits which will attenuate a given frequency. Quarter-wave stubs are equivalent to series-resonant circuits and have open ends: half-wave stubs act like parallel resonant circuits and have shorted ends *(Fig. 11)*. A length is cut longer than needed according to the formulas:

300-ohm twin-lead:

Length of half-wave stub=4840/f *(mc)* (in inches)

Coax:

Length of half-wave stub=3880/f *(mc)* (in inches)

The stub is attached to the antenna terminals of the set. A razor blade or sharp knife is used to short across the end of the twin lead stub, without cutting the wire. This is done at approximately quarter-inch intervals until the interference is cut down the most. For coax stubs, a medium-size safety pin can be pressed into the wire until the inner conductor is shorted against the outer one. The transmission line is then cut. If the interference is not a TV station, the line can be cut and the leads shorted together. If the interference is from a TV channel, a switch is needed to disconnect the stub when that channel is tuned in.

To minimize the effect of the stub on desired channels, it is usually advisable to connect a small carbon resistor of from 20 to 150 ohms across the ends instead of shorting the stub. No smaller value of resistance should be used than necessary to cut down the interference. In all cases when traps are installed, all the active channels should be checked to make certain the signals have not been adversely affected.

When indicated, the antenna should be checked to make certain the maximum signal is being picked up compared to the interference. If necessary the antenna should be reoriented or relocated for maximum signal with minimum interference. In cases of ignition interference, the antenna leadin should be the maximum possible distance from the street where the noise is originating. The leadin should be twisted to cancel noise pickup—at least one twist every ½ feet. For difficult problems, coax may be necessary.

Oscillator radiation from another TV receiver can be reduced greatly by installing a booster at the offending receiver. This, however, requires the cooperation, financial and otherwise, of the owner and is not always a practical solution. At the receiver subjected to this interference, the usual solutions are antenna reorientation, a more directional antenna, and stubs.

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CIRCUIT COURT

[from page 52]

switch *S401* is used to determine the point at which the diode can be cut off.

Capehart-CX 37—

Horizontal Oscillator and AFC.

In the receiver under consideration automatic control of the horizontal oscillator is accomplished by a single triode phase detector circuit which uses ½ of a 12AU7. The plate of this tube is pulsed by a 15.75 *kc* pulse which is coupled from the plate of the *agc* amplifier. Before being applied to the plate of V403B, the pulse is fed to an RC network consisting of *R507, R502, C510* and *C509*. It is integrated and reduced in amplitude by this network and appears as a sawtooth pulse of approximately 20 volts peak to peak.

In the grid-cathode circuit we find two 82K resistors which act as a balanced network. When a positive going sync signal is applied to the grid, current flows through these resistors. The circuit time constants are so arranged that if the sync and sawtooth are in step the pulse arrives at the midpoint of the sawtooth and the voltage at the midpoint of the two resistors is zero.

If the oscillator should drift an out of phase situation occurs. As a result the potential difference between plate and grid causes changes in the plate current. This variation in turn causes the voltage at the mid-point of *R503* and *R504* to be less than or greater than zero. The voltage at this point is then applied to the oscillator.

The *dc* return for V403B is through *R506*. *C505* feeds a negative going pulse to the cathode of V403B. This provides a certain amount of noise immunity to the circuit. Another feature of this network is that in the event of a momentary interruption of the sync signal there will be no grid current flow and no spurious control voltage is applied to the horizontal oscillator.

The horizontal oscillator V503, is a sine-stabilized multi-vibrator of the cathode coupled multivibrator type. An LC circuit is in the plate circuit in series with *R509* the plate load resistor. The *dc* control voltage developed at the midpoint of *R503* and *R504* is applied to the grid of the first section of the multivibrator. Variations of bias on this grid determines the conduction time of the tube and this in turn determines the oscillator frequency.

● ● ●

3—SPEED CHANGER CONVERSION

[from page 28]

trying to replace the obsolete changer only. A drawer can be constructed using the cabinet door as its front and "drawer slides" utilized to provide smooth in and out movement of the entire drawer assembly which will mount the new unit. Such a drawer is illustrated in *Fig. 6*.

Pan Mounted Changers: This type of mounting is not common in older consoles. However, should it be necessary to consider a replacement of this type, two courses can be followed:

1. Modify the pan by relocating the mounting brackets or use new brackets. This is usually quite difficult and is time consuming.
2. The more practical method is to replace the entire assembly (space permitting) with a modern diskchanger incorporating a base pan mount. The matching units will make a more attractive installation in addition to simplifying the conversion. Specifications for Webcor base pan models are given in *Fig. 7*.

Hum Problems: Should initial test reveal the presence of a serious hum, reverse the leads to the diskchanger motor. If this does not help, the radio and changer chassis should be commonly grounded by a separate lead. The changer chassis is not originally grounded because of shock hazard involved in possible connection to *ac/dc* equipment. When straight *ac* equipment is used, the pickup cable shield terminal of the standoff on the underside of the changer can be grounded directly to the changer chassis. A separate ground lead from radio to changer chassis will be more effective, however. Often both connections will give best results. When a pre-amplifier is used, it may be necessary to find a mounting location in the cabinet that will provide a minimum of hum.

Q MEASUREMENTS & METERS

[from page 31]

and its calibration will hold, provided the signal generator output always is adjusted to a predetermined reference value. A thermocouple-type *rf* ammeter is provided for this purpose and is shown in the circuit in *Fig. 3A*.

Boonton "Q" Meters

The familiar Boonton Types 100-A and 160-A Q-meters employ the Q-voltmeter method, using the resistor method of injecting the test signal into the Q-measuring circuit.

In the complete Q-meter of this type utilizing the principles just explained, the signal source is a self-contained, self-powered, variable-frequency *rf* oscillator with adjustable output. A pair of binding post terminals is provided for plugging-in a coil at L. A similar pair of terminals is provided in parallel with tuning capacitor *C* (a dial-calibrated unit) for connecting a capacitor to be tested. Also connected in parallel with *C* is a small dial-calibrated air trimmer capacitor, usually reading from —3 to +3 micromicrofarads.

In the Boonton Type 160-A instrument, the dial for capacitor C is direct-reading in micromicrofarads from 30 to 450. The 100-megohm-input v. t. voltmeter (a 0-5 v. instrument) reads 0-250 Q on the basis of 0.02 volt developed across an 0.04-ohm coupling resistor—a radio-frequency current of ½ ampere flowing through the resistor. When the basic 0-250 Q range is used, the oscillator output is adjusted to deflect the pointer of the thermoammeter to its X1 reference point. Higher Q ranges are available by setting the ammeter to X1.5 (full-scale Q = 375) or to X2 (full-scale Q = 500). The internal oscillator supplies test voltages at frequencies from 50 *kc* to 75 *mc*.

Checking Q of Coils

When checking coil Q by the Q-voltmeter method, the coil under test is connected into the circuit in position L (see *Fig. 3A*). The oscillator is set to the desired test frequency, and capacitor *C* adjusted for resonance as indicated by peak deflection of the v. t. voltmeter. The oscillator output is adjusted to deflect the thermoammeter to its X1 reference point. The coil Q then is read directly from the meter scale. If the Q value is beyond the limit of the meter, the ref- X1.5 or X2 point and the indicated Q erence current meter may be set to its value multiplied accordingly.

When checking capacitor Q, the *LC* circuit is resonated at the desired test frequency first with a standard high-Q coil a position *L* and with only the tuning capacitor, *C*, in the circuit. Oscillator output is adjusted to bring the reference current meter deflection to its X1 point. The corresponding setting of the tuning capacitor is recorded at C_1, and the Q-voltmeter deflection at Q_1. The test capacitor next is connected to terminals in parallel with tuning capacitor *C*. The setting

of C now must be decreased in order to restore resonance. The new C and Q readings both are lower than before and are recorded as C_2 and Q_2. The true Q of the capacitor under test then is determined from the four readings, as follows:

$$(9)\quad Qx = \frac{C1\text{-}C2\ (Q1Q2)}{C1\ (Q1\text{-}Q2)}$$

Measuring Inductance with a Q Meter

A Q-meter using the Q-voltmeter scheme may be used to measure inductance by the method described in connection with Equation (5) and capacitance by the method described in connection with Equations (6) and (7).

Inductance (L_s), measured directly with the Q-meter is *apparent* inductance, which differs from true inductance (L_x) because of the effects of distributed capacitance in the coil under test. True inductance is:

$$(10)\quad Lx = Ls\left(\frac{C1}{C1 + Cd}\right)$$

Where, Lx and Ls are in microhenrys, and:

C1 and Cd are in $\mu\mu f$

C1 is the resonant setting of the Q-circuit tuning condenser, and Cd the distributed capacity of the coil.

Measuring Distributed Capacity

The following procedure should be followed in measuring distributed capacitance: (1) Resonate the Q-circuit containing the unknown coil. Have the tuning capacitor set to any convenient value C_1 between 50 and 100 $\mu\mu$fd. (2) Next, set the oscillator to ½ of the initial test frequency, and re-resonate the circuit by tuning the Q-circuit capacitor to a higher value, C_2. (3) Calculate the distributed capacitance by means of the following relationship:

$$(11)\quad Cd = \frac{C2\text{-}4C1}{3}$$

Another circuit for checking Q values by the Q-voltmeter method is illustrated in *Fig. 3*. Here, the input signal voltage is developed across a padder capacitor, C_2, instead of across a low-ohmage resistor. As in the previous example, inductor L and tuning capacitor C_3 in the Q-measuring circuit are in series with the input signal source, and a radio-frequency v. t. voltmeter shunts the tuning capacitor. The series trimmer, C_1, is set during the initial calibration of the instrument to give a predetermined voltage across C_2. The v. t. voltmeter may be switched temporarily to terminals X and Y for adjustment of the oscillator (generator section) output voltage to a reference value.

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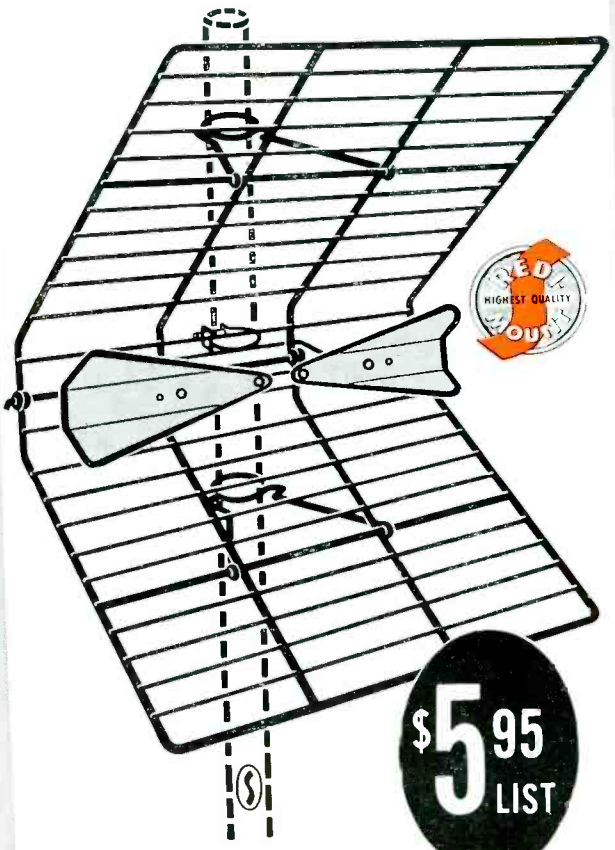

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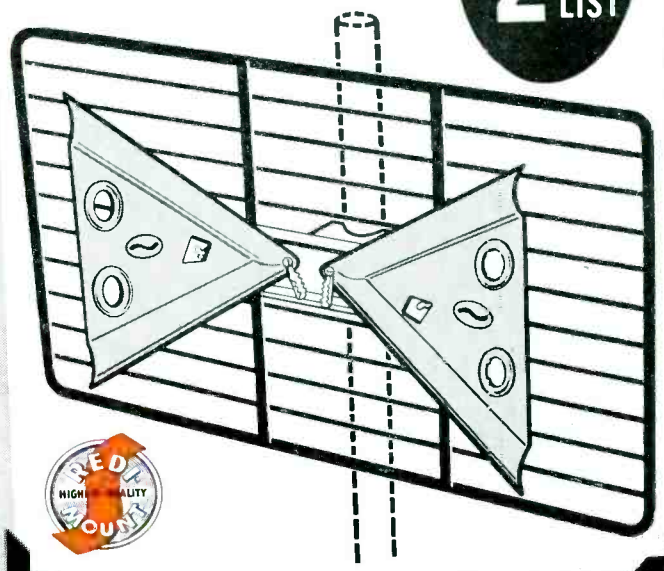

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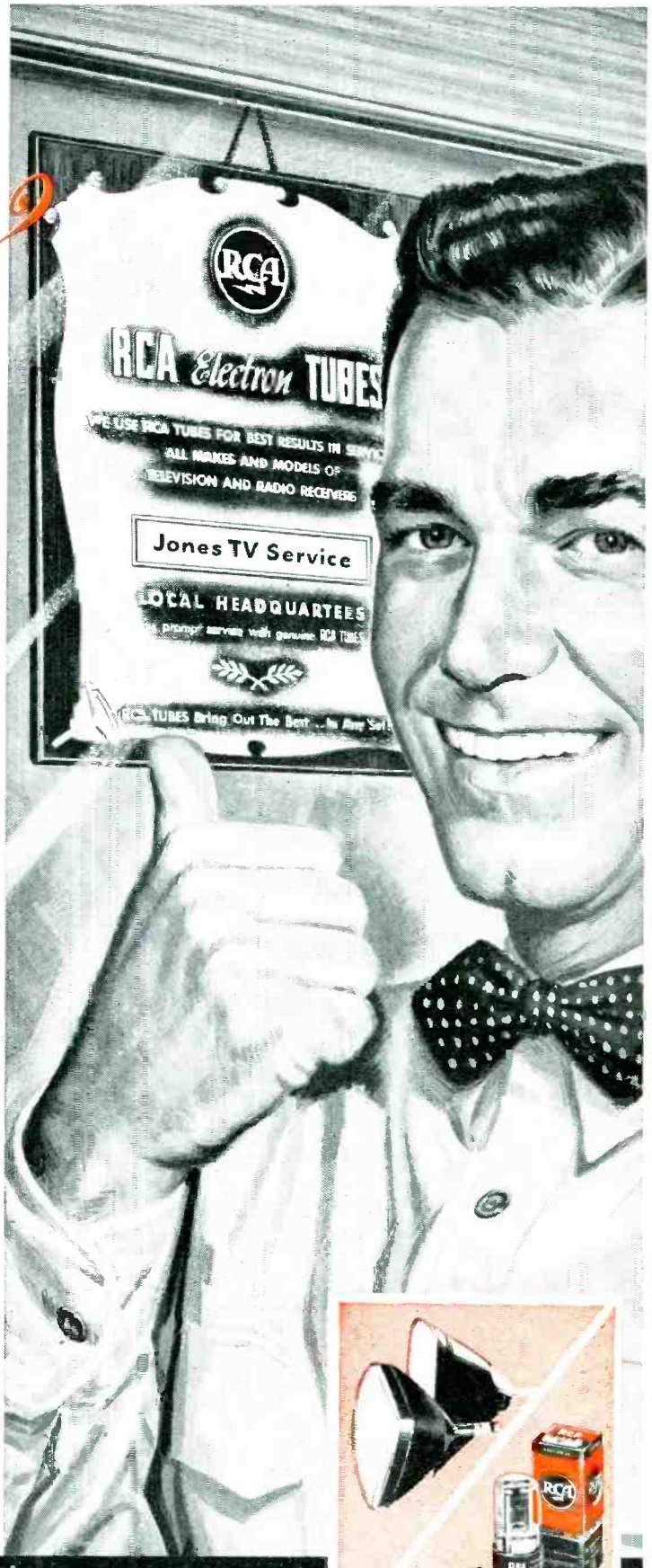

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