

Radio **SERVICE DEALER**



MARCH, 1949

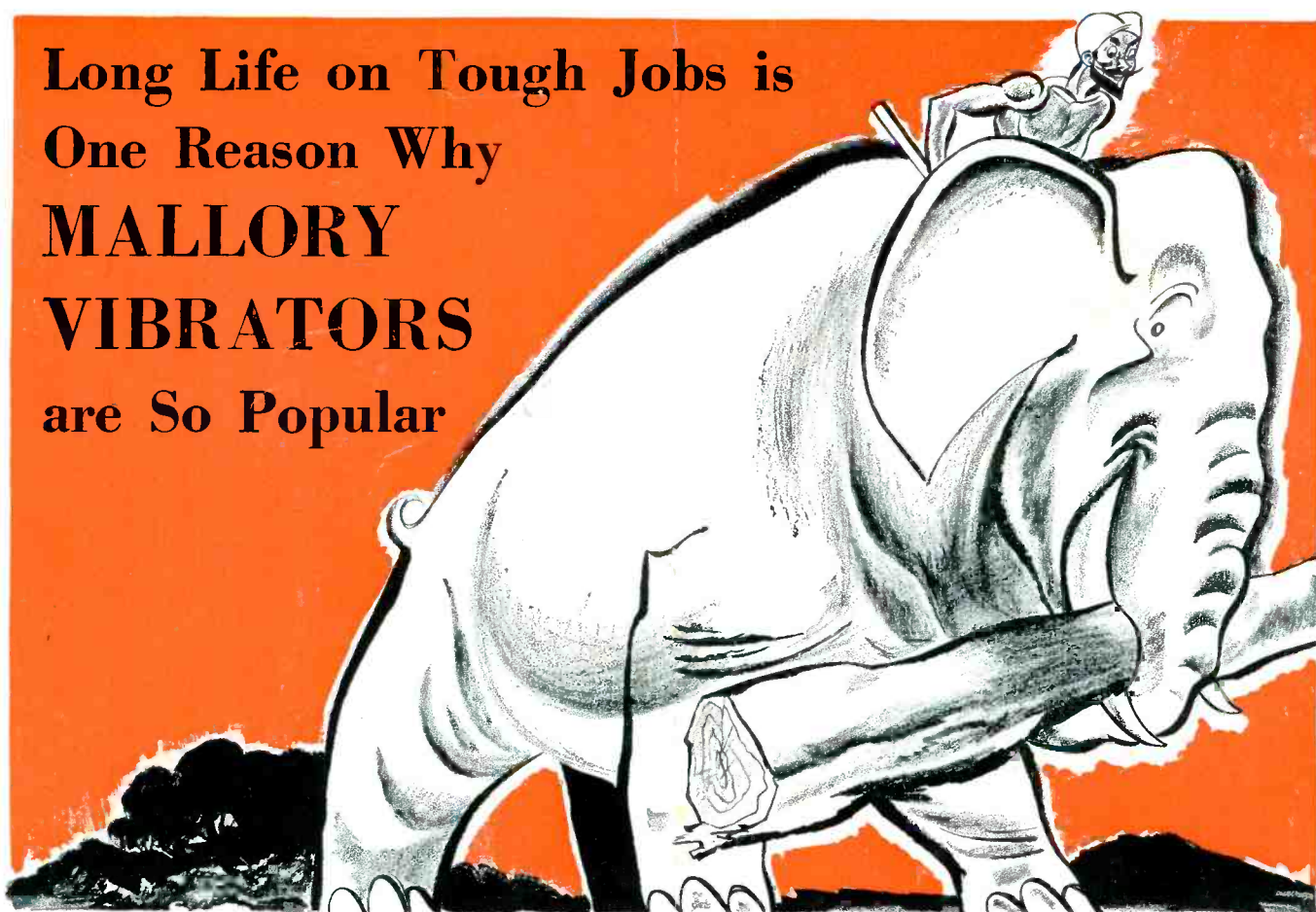
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AM-FM-TV-SOUND

The Professional Radioman's Magazine

Long Life on Tough Jobs is
 One Reason Why
MALLORY
VIBRATORS
 are So Popular



Long life in a vibrator results from a combination of good design and careful production.

The design of Mallory Vibrators is a product of an unusual combination of engineering talent

and resources in electronics, electrochemistry and metallurgy.

For example, the contacts in Mallory Vibrators are Mallory-specified and Mallory-made. And a patented Mallory design insures a perfectly balanced mechanism.

Convincing proof that Mallory maintains careful production is the fact that more Mallory Vibrators are in use as original equipment than all other makes combined.

You get not only *long life*, but *dependable starting*, and *high output efficiency* from Mallory Vibrators. No wonder they are so popular with radio service men everywhere—Mallory Vibrators are best for replacements. See your Mallory Distributor.

Mallory "2448" Vibrator Deal

This deal gives you a handsome storage and display cabinet for your stock of vibrators, together with a selection of vibrators and buffer capacitors that will answer 75% of your requirements.



You pay only the service man's net price for the six vibrators and twelve buffer capacitors. There is no charge for the attractive, convenient cabinet. Your Mallory distributor has them in stock for immediate delivery.

MORE MALLORY VIBRATORS ARE USED IN ORIGINAL EQUIPMENT THAN ALL OTHER MAKES COMBINED

P. R. MALLORY & CO. Inc.
MALLORY

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

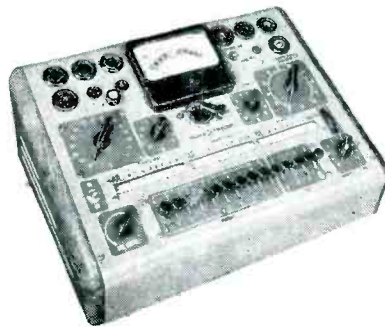
*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

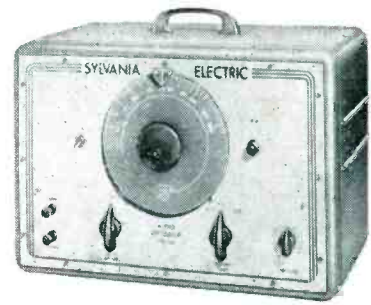
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA



Modern, efficient, Sylvania Oscilloscopes, Type 132 (7-inch screen) above and Type 131 (3-inch screen), are ac operated general purpose cathode ray instruments used to study waveforms, measure voltages and currents in various types of circuits. Excellent for audio circuit analysis, transmitter checking, filter and hum analysis, vibrator waveform checking. Type 132 price: \$144.50; Type 131 price: \$89.50.



The last word in tube testers: Types 139 (Counter Type, shown), and 140 (Portable Type)—smartly styled, scientifically designed. Features: *Shorts Test* at voltage low enough to prevent tube damage, high enough for full brilliancy on indicator; all tube elements tested under dynamic conditions; *Fingertip Controls*: tests all tube types; *Provision for Noise Test*; large 4½-inch meter; 8-foot cord. Each model: \$79.50.



This Audio Oscillator Type 145 is one of the most versatile and convenient test instruments made. Its powerful signal of known frequency provides an accurate tone source for checking radio receivers. It is ideal for response and distortion testing of audio amplifiers, public address systems, juke boxes, wired music installations and individual speaker cones. An exceptionally valuable test instrument. Price: \$129.50.



The Sylvania Poly (MULTI-PURPOSE) Meter Type 134Z provides, in a single compact instrument, the means of making a multitude of electrical measurements and tests. Electrical values measured include audio, ac and rf voltages (up to 300 mc); dc voltages from 0.1 to 1,000; direct currents from .05 milliamperes to 10 amperes; resistances from ½ ohm to 1,000 megohms. Instrument is compactly built, attractively styled, includes all essential accessories. Priced at only \$89.50.



With this new DC Voltage Multiplier, the 1,000 vdc range setting on your Sylvania Polymeter will read 10,000 vdc full scale! The 300 vdc range setting will read 3,000 vdc full scale! Add this accessory to your Polymeter and you have a Kilovoltmeter for testing TV circuits and other high dc voltage applications. Only \$9.95!

GOOD SERVICING STARTS WITH...

Fine test equipment

Now, in addition to selling the best in tubes, you can simplify your testing and trouble-shooting job with the latest and finest in test equipment! For full details about these carefully engineered Sylvania instruments, mail handy coupon today!

**SYLVANIA
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ELECTRONIC DEVICES; RADIO TUBES; CATHODE RAY TUBES; FLUORESCENT LAMPS,
FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; PHOTOLAMPS

RADIO SERVICE DEALER • MARCH, 1949

Sylvania Electric Products Inc.
Radio Tube Division, Dept. R-1803
Emporium, Pa.

Gentlemen:

Kindly forward detailed information about instruments checked below:

- Oscilloscopes Audio Oscillator
 Tube Testers Polymeter
 DC Voltage Multiplier

Name _____

Address _____

City _____

State _____ Zone _____

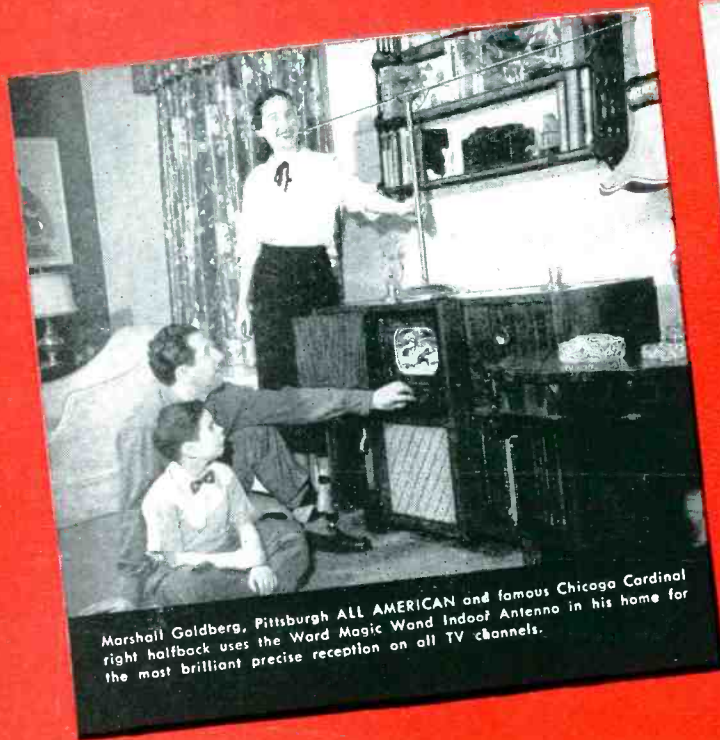
Announcing 2 SENSATIONAL

Only the very best indoor antenna is sufficient for excellent reception. WARD'S new TVI-43 and TVI-49 are the FINEST INDOOR ANTENNAS AVAILABLE TODAY FOR METROPOLITAN MULTI-STATION AREAS.

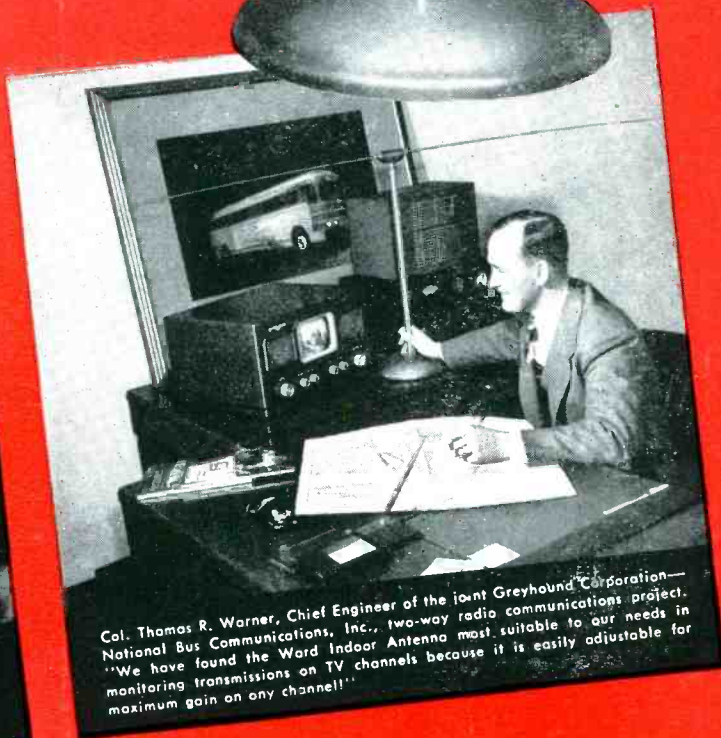
Ward is the largest exclusive manufacturer of the finest and fastest selling antennas in the world. Behind the Ward name and symbol stands a company, known and respected for a quarter of a century for exceptional quality. These antennas are creative masterpieces, superb in their performance, into which Ward has poured a host of new design and construction features.

WARD'S NEW TVI-43

The TVI-43 is the finest indoor antenna that modern skill and technology can produce—far superior, by any standard, than anything else on the market. It brings in all channels precisely and brilliantly. Most attractive—chrome-plated brass telescopic dipoles, satin beige brown finish—blends perfectly with the most exacting interior. List \$17.95



Marshall Goldberg, Pittsburgh ALL AMERICAN and famous Chicago Cardinal right halfback uses the Ward Magic Wand Indoor Antenna in his home for the most brilliant precise reception on all TV channels.



Col. Thomas R. Warner, Chief Engineer of the joint Greyhound Corporation-National Bus Communications, Inc., two-way radio communications project. "We have found the Ward Indoor Antenna most suitable to our needs in monitoring transmissions on TV channels because it is easily adjustable for maximum gain on any channel!"

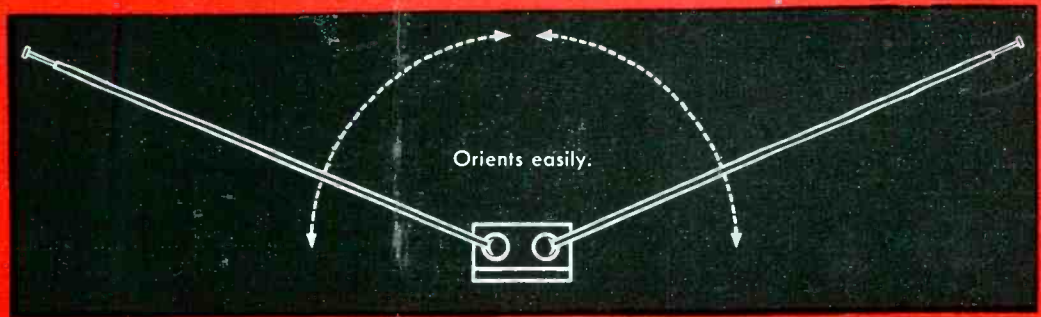
NEW INDOOR ANTENNAS

By **WARD**

WARD'S NEW TVI 49

And here is Ward's portable TVI-49. It will give excellent reception on all channels—orients easily in all directions. Chrome-plated brass telescopic dipoles. The TVI-49 is sturdily constructed and weighted perfectly—it will not tip over—designed to harmonize beautifully with living room decor. List \$7.50.

Manufactured by Ward, a company that stresses utmost perfection. You owe it to yourself and your customers to see and inspect Ward's unique indoor antennas. See any leading parts distributors or write for catalog today.



WARD
Magic Wand
ANTENNAS



WARD PRODUCTS CORPORATION
1523 E. 45TH ST., CLEVELAND 3, OHIO
DIVISION OF THE GABRIEL CO.

EDITORIAL

FLASH! TV On Roof Law Proposed!

A Bill has just been introduced in the Legislature of New York State which if passed will require landlords to allow tenants to install TV antennae on roofs if they wish to. Will keep you advised. What a boom for TV sales that law would be!

About TV Antennas

During December the country was plagued by high wind, sleet and snow storms. This was the first opportunity TV set owners were afforded to ascertain how good an antenna installation was made for them. We have made a rather comprehensive survey with these findings: In the East, where severe snow storms, but very little high winds prevailed, less than 3% of the TV antenna installations were knocked down. However, in the Midwest and Northeast sections where sleet and high winds did prevail, havoc was wrought, resulting in almost 10% of the TV antennas either falling, or being thrown out of orientation. A lesson was learned. Do it right the first time and leave a sufficient safety margin every time you install an antenna.

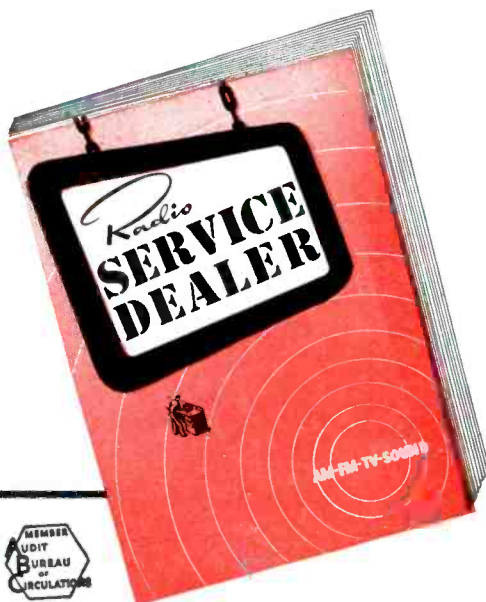
Signs of Prosperity

The year 1948 was exceptionally good for most radio service dealers and technicians. Firms engaged primarily in retailing did not fare quite so well. Now, it becomes apparent that general business conditions are leveling off to a more normal plane, seemingly a prosperous plane!

The prospects for radio service dealers and general business, as we see it, are better than ever before. We should be entering a long period of genuine prosperity. An indication of this is the fact that savings banks throughout the country are increasing their interest rates on savings accounts. Reflect backward and you'll recall that during this country's boom period, from 1925 through 1929, savings banks paid interest rates ranging upwards from 2½% to a peak of 4½%. Then came the depression and interest rates dwindled, and during the most lush years of artificial prosperity—the war years 1941 through 1946—banks paid as little as 1% interest, and in some cases less. Now banks are upping their interest rates, and this ups our enthusiasm.

Is An Index Wanted?

At the outset in every December issue of RADIO SERVICE DEALER we carried a complete Index of material we published during that year. The practice was discontinued because of the paper shortage during the war years, and has not been resumed as we were of the opinion that our subscribers would rather have us devote the three or four pages to a timely technical article rather than to a recapitulation of what had already been published. What is your view on this subject? Do you want an Annual Index. We will abide by the wishes of the majority, so write!



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Samuel L. Marshall
MANAGING EDITOR

COWAN PUBLISHING Corp.
342 MADISON AVENUE
NEW YORK 17, N. Y.

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Every Type for Every Service

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* Design Patented

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A "press-time" digest of production, distribution & merchandising activities

Town Meetings

The recent Town Meeting of Radio Technicians in Atlanta sponsored by the Radio Parts Industry Coordinating Committee, reveals that the new program first presented there was the most successful of the three held in the current season. In the meantime, by the time this issue is received the next meeting scheduled to be held at the Rodger Young Auditorium, Los Angeles, on Feb. 28, March 1st and 2nd will be over. The final meeting in Chicago on April 11, 12, and 13 will be virtually identical with the previous two meetings.

Hytron Grand Prize Winner

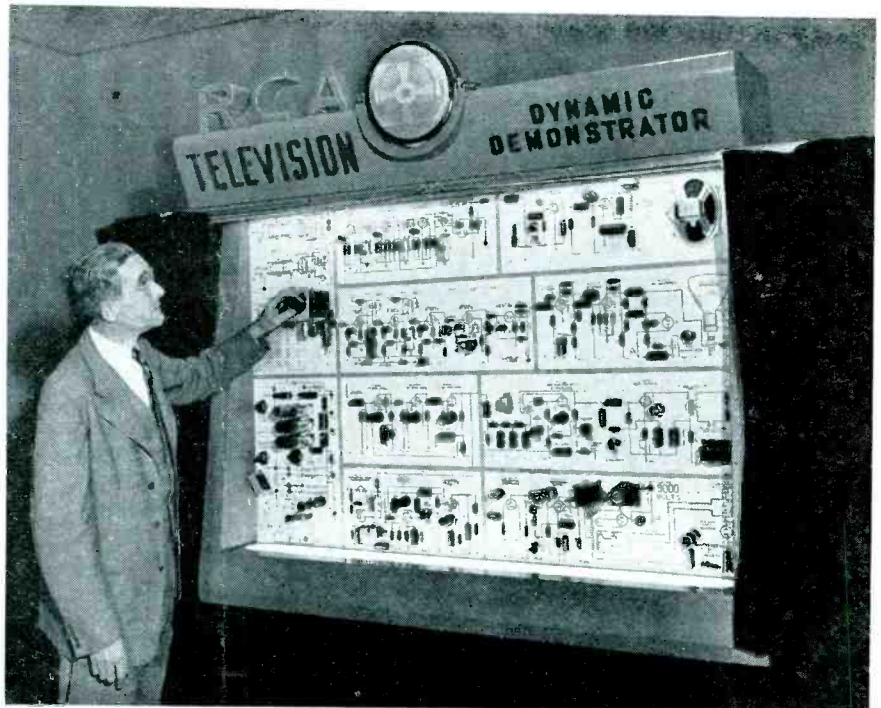
For the past several months, radio servicemen from coast to coast have been vying with each other for top honors each month in the Hytron Radio & Electronics Corporation contest.

With the contest completed, Hytron announces the \$400.00 U.S. Savings Bonds, grand prize winner, as selected by the judges, Mr. Harry L. Smith of 25-26 Steinway Street, Long Island City, New York, who won the first prize also at the start of the contest in May. In the accompanying photograph, Mr. Smith is shown be-



ing presented the Savings Bonds by Mr. Bruce A. Coffin, President of Hytron Radio & Electronics Corporation, while Mr. Everett Boise, Hytron's commercial engineer in the New York area, looks on.

Interest during this contest has been at a fever pitch and Hytron wishes to thank the judges and all the servicemen who did so much to make this contest the success it was.



New RCA TV Dynamic Demonstrator recently displayed at a showing in New York. This piece of equipment should prove of interest to schools.

Their thanks will be expressed in a more tangible way when a series of service tools will be offered to servicemen at cost. Be on the lookout for their announcement in trade papers very shortly. Several tools are now in production and will be available any day now, with others to follow as soon as design and production details are ironed out.

N.Y.C. Contested on Sound Ban

A suit contesting the validity of a New York City ordinance which in effect bans radio and sound equipment in public places was filed last Friday, Feb. 4, in the New York Supreme Court by two RMA members and other parties with the approval of RMA General Counsel John W. Van Allen. The Supreme Court was asked to issue preliminary and permanent injunctions and to declare the ordinance null and void.

I.T. & T. Acquires Farnsworth

International Telephone and Telegraph Corporation and Farnsworth Television and Radio Corporation an-

nounced today that an agreement in principle had been reached for the acquisition by I. T. & T. of the Farnsworth Company. In announcing this entry of I. T. & T. into the television receiver field it was stated that if the sale is consummated the I. T. & T. expects to continue manufacturing operations at Fort Wayne and the national Capehart Distributor and Dealer organizations which have been built up over many years.

G.E. Engineer To Advise S.A.

R. S. Yeandle, General Electric television engineer will leave this country on February 10, for a six-week tour of South America, to encourage the adoption of U. S. television standards in Latin American countries, it was announced by the G-E Transmitter Division at Electronics Park, Syracuse, N. Y.

I.R.E. Phila. Meeting

Some of the newest technical developments in the radio-television industry will be discussed at the annual spring meeting of the RMA Engineer-



Electronic
TUBES

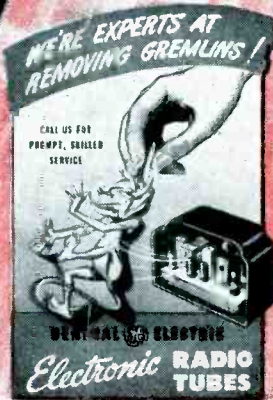
IN RADIO AND TELEVISION TUBE SALES

1949 IS A G-E YEAR!

A big campaign of selling aids paves your path to profits. Something new—and hot—every 60 days!



You can't beat this shop-garment offer. It proves the point when we say G-E dealer helps are "hot." You make no investment! Shirts, trousers, jackets, coats—in attractive powder blue, with the G-E pocket emblem in orange and dark blue—come to you each week freshly laundered. You rent, not buy! And the low rent is roughly equal to what you might pay for cleaning only.



Amusing—and great little business-builders! Two of the cleverest new counter cards the trade has seen! Cut-outs feature the gremlin in one case, the "sour notes" in another. They give a lifelike three-dimension effect. The cards come in full colors, varnished for brilliancy, with built-in easel mounts.



THIS is the year you'll shake hands with yourself because you're retailing G-E tubes. If you haven't any on your shelves, it will be smart to put your order in . . . fast!

G-E tubes are a fast-moving, profitable item because General Electric works with you to widen your customer list. This page shows a few of the aids-to-sales furnished you for promotion. There are plenty of others—and brand-new items will join the parade at frequent intervals.

Better tubes aren't built! G-E quality

backs up your promotion, makes friends of tube buyers. When you install a General Electric tube, you're selling others later on—to the same satisfied customer, or to persons he refers to you for tubes, parts, or radio-TV service.

Get aboard the tube-profits train! Your nearby General Electric tube distributor will be glad to show you how. Phone or write him today. Or address *Electronics Department, General Electric Company, Schenectady 5, New York.*

You can put your confidence in—

GENERAL ELECTRIC



181-MA3-0850

VEE-D-X

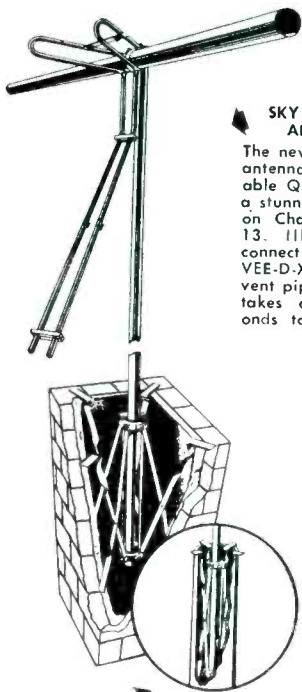
provides everything you need

SINGLE SOURCE

ANTENNAS • MASTS • TOWERS • CHIMNEY & VENT-PIPE MOUNTS • GUY CABLE • LIGHTNING ARRESTORS • TRANSMISSION LINE

FOR BETTER TV & FM INSTALLATIONS

Costs go up and profits vanish with poorly designed, hard-to-erect antenna equipment. Why gamble with profits and customer good will when you can be sure of all-around satisfaction with VEE-D-X—the complete single source quality line. Every VEE-D-X product is skillfully engineered for your entire range of technical requirements and problems. Fast, low cost installation insures full profit margin for you on every TV sale.



SKY MONITOR ANTENNA

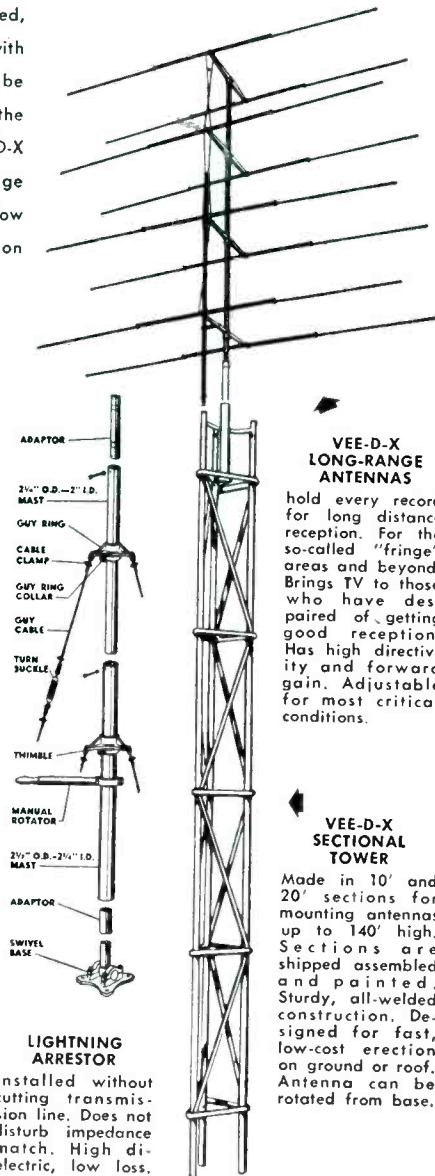
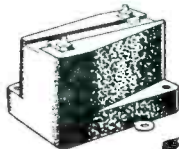
The new broad-band antenna with tunable Q section. Also a stunning performer on Channels 7 thru 13. Illustrated in connection with new VEE-D-X chimney and vent pipe mount that takes only 60 seconds to install.

NEW LIGHT WEIGHT MAST

Extremely light (a 20' section weighs only 11 lbs.) without sacrifice of strength. Permits rotation even after guy wires have been installed. Good-looking and unsurpassed for speed in erection.

CHIMNEY MOUNT

The finest chimney mount on the market. Fits any opening—round, square or rectangular from 4" to 22" for 1", 1 1/8", and 1 1/4" masts.



VEE-D-X LONG-RANGE ANTENNAS

hold every record for long distance reception. For the so-called "fringe" areas and beyond. Brings TV to those who have despaired of getting good reception. Has high directivity and forward gain. Adjustable for most critical conditions.

VEE-D-X SECTIONAL TOWER

Made in 10' and 20' sections for mounting antennas up to 140' high. Sections are shipped assembled and painted. Sturdy, all-welded construction. Designed for fast, low-cost erection on ground or roof. Antenna can be rotated from base.

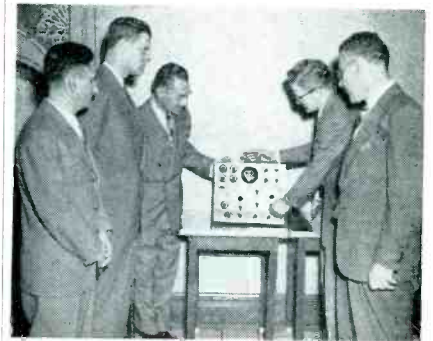
LIGHTNING ARRESTOR

Installed without cutting transmission line. Does not disturb impedance match. High dielectric, low loss.

ing Department and the Institute of Radio Engineers April 25-27 at the Benjamin Franklin Hotel in Philadelphia.

Philco Receives FRSSMA Award

Philco Corporation received the 1948 award of the FRSSMA for outstanding contributions to the progress of the radio service industry. The award was presented to James M. Skinner, Jr., vice-president—sales and parts, Philco Corp. by Leonard Helk, president of the Lackawanna Radio Technicians' Association. Other speakers at the luncheon, which was attended by about 100 leading service technicians and representatives of the radio press from six states, included David Krantz, chairman of the FRSS-



MA and president of the Philadelphia association (PRSSMA), and Thomas L. Clarkson, president of the Mid-state Radio Servicemen's Association of Pennsylvania.

Appearing in the photo, from left to right are: Ed Phillips—John A. Blessing Co.; James Skinner, Jr.—V. P., Philco; Sanford R. Cowan, publisher—Radio Service Dealer Magazine; John Pell, manager of TV Service, Philco; Kenneth Kenyon, general manager—service division, Philco.

New Duotone Sapphire

The Duotone Company, New York announces a microgroove cutting sapphire needle constructed solely for use in equipment especially constructed for microgroove cutting. Available through all regular Duotone distributors.

Permoflux Adds To Line

Permoflux Corporation announces four new model speakers for television replacement purposes in addition to their very complete line of replacement speakers. These new models are 4 x 6, 5" and 6" with 62 ohm field and 4 ohm voice coil, and a 4 x 6 with 100 ohm field coil and 4 ohm voice coil.

The addition of these new models, together with the other models available, means that Permoflux now has

Send Coupon Today

VEE-D-X brings you the best things first in TV antenna equipment. Watch for VEE-D-X every month in this publication. Write today for literature and prices!

VEE-D-X

means video distance

LaPOINTE-PLASCOMOLD CORP. Unionville, Conn.

Please send complete information on the following:

VEE-D-X Single Source Plan VEE-D-X Tower

VEE-D-X Chimney Mount VEE-D-X Antennas

VEE-D-X Mast Lightning Arrestors

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COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

Test Pointers

ON VISUAL ALIGNMENT

Always a useful service instrument, the oscilloscope has become indispensable since the advent of FM and television. Technicians who have familiarized themselves with oscilloscope operation are now able to capitalize on opportunities for present-day servicing requiring visual-alignment facilities.

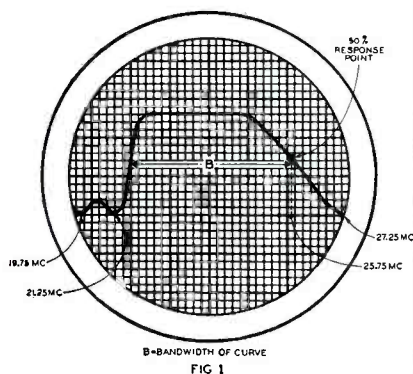
Visual alignment is a technique which presents the frequency response curve of an amplifier upon the screen of an oscilloscope. A representative video-if response curve is shown in Fig. 1. In some cases, this curve will appear "upside down" or "left to right"; however, the position of the curve is of no consequence.

A response curve shows the selectivity characteristic of an amplifier in terms of output voltage versus frequency. Each point along the base line corresponds to a certain frequency, and the height of the curve above each base-line point indicates the output voltage at that frequency. A transparent graph screen is placed over the face of the cathode-ray tube to determine relative output voltage values. If the scope is calibrated in terms of volts/inch deflection, absolute voltage values can also be measured.

An over-all video-if curve, as shown in Fig. 1, should rise rapidly at the low-frequency end, while the high-frequency end should drop gradually. In this figure, the dip at 21.25 Mc is caused by a sound trap. Another dip at 19.75 Mc is caused by an adjacent-channel picture-carrier trap. The 4-Mc bandwidth of this curve is the frequency span from 21.75 Mc to 25.75 Mc. Note that the picture carrier frequency (25.75 Mc) is placed approximately 50% up the curve; this requirement arises from the single-sideband system used in television transmission.

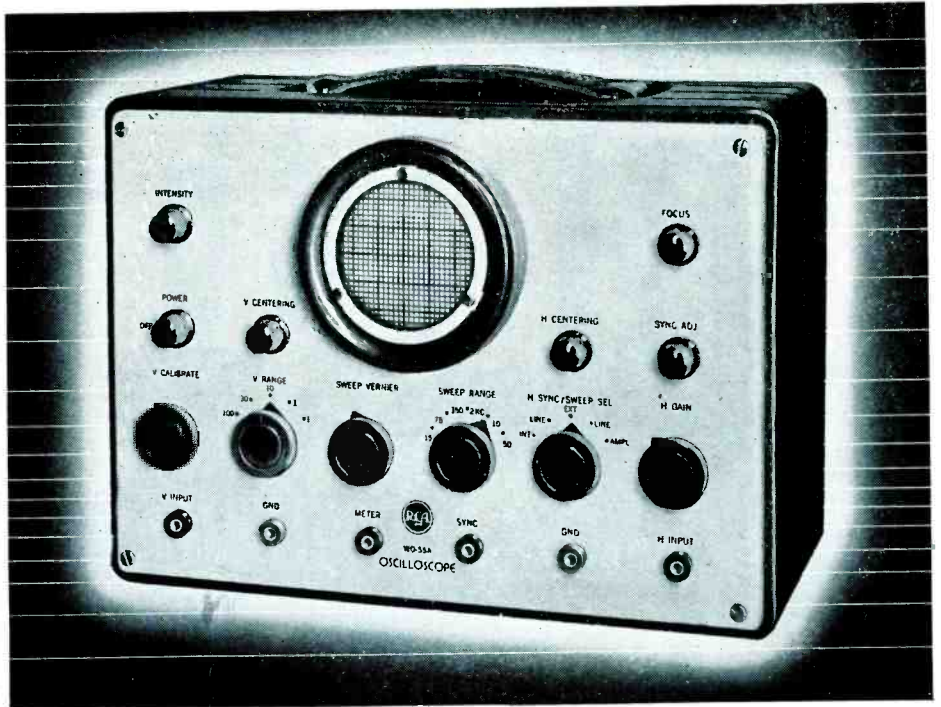
Such a visual-alignment curve presents all necessary alignment information at a glance, and makes the over-all effect of a trimmer adjustment immediately apparent. Even when stagger-tuned if stages are individually peaked an over-all rf-if response measurement must be made to insure proper alignment. (The frequency at any point along the curve is determined by means of a "marker," as will be explained in another Test Pointers article.)

When the response curve is incorrectly shaped, various picture defects result. Insufficient bandwidth causes inadequate horizontal resolution which shows up as a blurred picture. If the curve does not dip properly at the trap frequencies, interference frequencies will enter the video channel and cause bars to appear in the picture. If the carrier is placed too far down on the curve, the low video frequencies are attenuated, which results in poor picture quality, unstable sync, and poor blanking. Numerous other difficulties arise from improper alignment, which are beyond the scope of this article.



B-BANDWIDTH OF CURVE
FIG 1

Contrary to popular opinion, an oscilloscope used for television alignment or for video-amplifier adjustment need not have a wide frequency response range. However, the vertical amplifier should have good linearity in order to obtain accurate voltage measurements. A crystal probe is used in combination with the oscilloscope to observe video-amplifier frequency-response curves. Additional operating convenience is afforded by a built-in calibrating voltage source, and a VTVM-type vertical range switch.



For TV, FM and AM...

Servicing's most modern alignment tool—

THE RCA WO-55A OSCILLOSCOPE

• For TV and FM in particular—where precise, wide-band alignment is vital—the RCA WO-55A Oscilloscope does the job better because it gives an indication of the result of an adjustment the instant it is made . . . and provides a true curve of the over-all frequency response. In addition, the WO-55A is ideal for tracing audio distortion and hum, locating audio parasitics, checking phase shift, measuring frequency, determining percentage of modulation, and measuring peak-to-peak voltages in high-impedance circuits.

The voltage at any point on a waveform can be read directly on the clip-on graph screen. A built-in voltage source is provided for calibration in rms or peak-to-peak values.

A self-synchronized line-frequency sweep is provided for visual alignment, dispensing with the necessity of external sync. connections. Linearity of the trace is unusually good, with accurate indication of the 50% and 70% points on television rf or if response curves.

Push-pull vertical and horizontal amplifiers provide full screen deflection

without overload, and allow the trace to be enlarged beyond the tube face for observation of pattern detail.

The use of RCA miniature tubes . . . plus a new, short-neck, 3-inch cathode-ray tube . . . make the WO-55A equally useful in shop or field.

The RCA WO-55A Oscilloscope is one of seven *matched test units* engineered for modern AM, FM, and TV servicing. Get further details on the WO-55A from your RCA Test Equipment Distributor—or write RCA, Commercial Engineering, Section 55CX, Harrison, N. J.

SPECIFICATIONS

Deflection Factor:	
Vertical Amplifier	0.47 RMS volts/inch* (1.33 peak-to-peak volts/inch)
Horizontal Amplifier	0.53 RMS volts/inch* (1.5 peak-to-peak volts/inch)
Sine-Wave Frequency Response, Both Amplifiers: Flat Within $\pm 20\%$ From 7 to 70 000 cps. Useful up to 200 kc.	
Sweep-Oscillator Frequency Range 15 to 50,000 cps.	
Power Supply	105/125 volts, 50/60 cycles
Power Consumption	50 watts
Dimensions	w. 13½"; h. 10"; d. 8½"
Weight	15 lbs.
*For Sine Waves.	

Always keep in touch with your RCA Distributor



RADIO CORPORATION of AMERICA

TEST AND MEASURING EQUIPMENT

HARRISON, N. J.

MAKE MORE PROFIT

Replace Phono Pickup Cartridges



- Makes Cartridges Easier to Sell and Install
- Saves Ordering-Time and Servicing-Time
- Improves Record Playing
- Turns Prospects into Satisfied Customers
- Builds Cartridge and Needle Business



Greatest Merchandising Opportunity in Cartridge History!

YOU CAN MAKE the replacement of phono pickup cartridges a *profitable* side of your servicing. No longer is it necessary to order one cartridge for each repair job. With the 3 basic models in the TORQUE DRIVE KIT, you can immediately replace any one of over 150 types in common use. Furthermore, the revolutionary TORQUE DRIVE Crystal Cartridge modernizes your customer's player, greatly improves reproduction, prolongs record life. Has replaceable Osmium-Tip or Sapphire-Tip needle.

HANDY SALES AND SERVICE KIT

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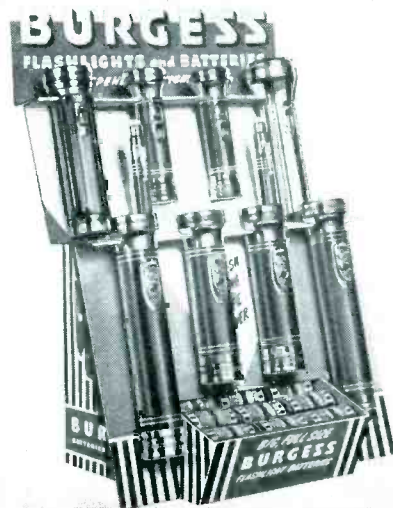
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Merchandising Display

An attractive battery and flashlight merchandising display, as shown below, has been made available by the Burgess Battery Company for its dealers. The kit consists of ten flashlights and a convenient battery counter, as well as a storage rack for additional batteries in the rear.



New Colored Records

Translucent, plastic phonograph records in gay, cheerful rainbow colors to identify all categories of music will soon make their first appearance in the 50-year-old record industry when RCA Victor introduces its completely new 45-rpm system for reproducing recorded music in the home. It was revealed today by J. G. Wilson Executive Vice President of the Radio Corporation of America in charge of the RCA Victor Division.

45 RPM Adapter

On the heels of the recent introduction of a new 45 rpm disc with large spindle hole and 7-inch overall diameter, comes a Webster-Chicago announcement that Company has available an inexpensive adapter kit which will quickly convert any of its dual speed record changers to include playing the new record.

New G.E. Periodical

Techni-Talk, a bi-monthly illustrated publication for radio and television servicemen and dealers, has been announced by the Tube Division of the General Electric Company.

Available through G-E and Ken-Rad Distributors *only*, the magazine is designed to keep servicemen and

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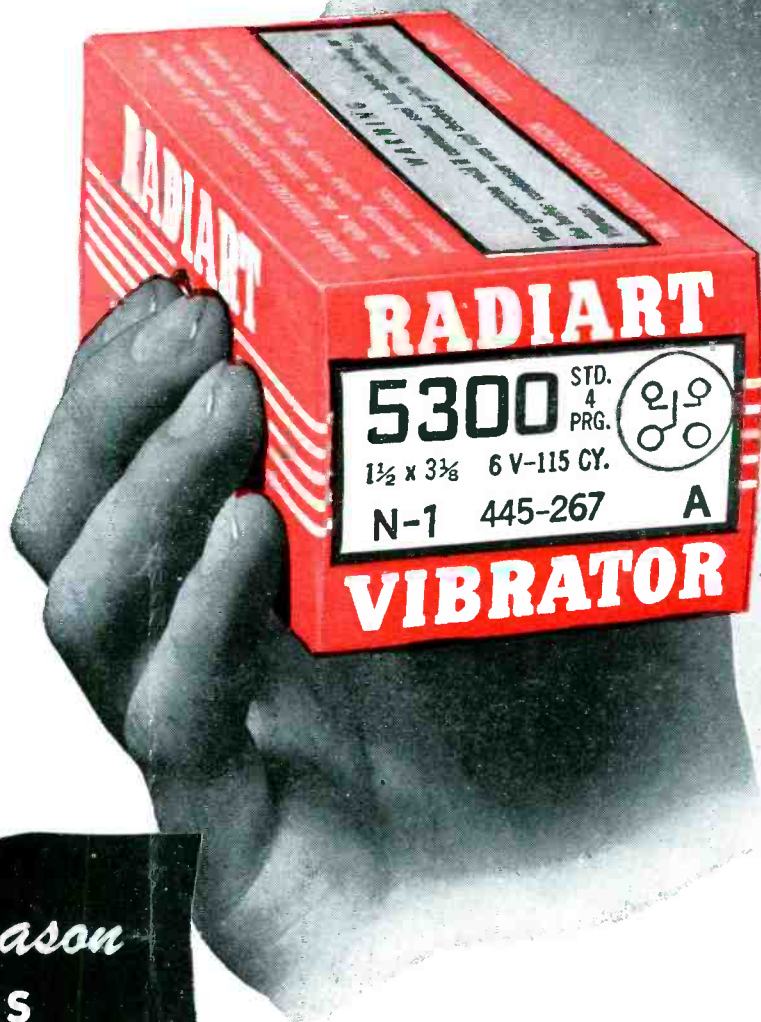
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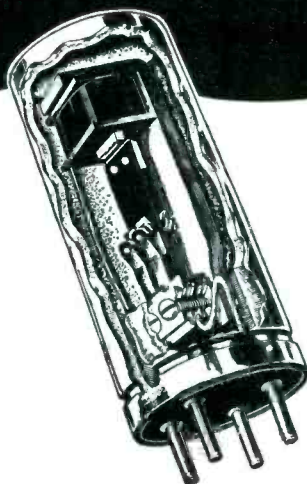
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Field Findings

A resume of Industry happenings here, there and everywhere

I owe RCA an apology for having expressed in my January editorial the opinion that they weren't "doing right" in launching their new line of 45 rpm records and record-players. Since then I have seen and heard the new 45 rpm player and more important I have had explained to me the reasons underlying its development. Now I can say that I believe the 45 rpm type record changer is *here to stay* purely because of its merit and not merely because RCA is big enough to win out in what Columbia chooses to call "a record war".

Many technical details about RCA's new 45 rpm player and records have not yet been released for publication, but when available will appear in this magazine. Meanwhile, here is a picture of the new unit, and a few high-lights about the advantages it affords; to wit: wider range of reproduced frequencies and higher fidelity, less flutter and "wow", faster record-changing — (the change-over cycle being about 2 seconds), lower delivery costs because the unit and records weigh less, greater record storage savings because the records are so small and thin, greater record life as the records have thick labels which prevent the playing surfaces from touching one another, a changing mechanism that is simple and practically fool-proof and very small in size—and also, the 1½ inch spindle hole which simplifies loading as compared with the conventional records having ½ inch holes.

Radio servicemen never found it profitable to repair the old type changers. Even the simplest were "tough babes" to work on. On the other hand, service dealers did enjoy a substantial amount of business replacing defective units or adding changers to receivers not originally equipped to play phonographs. However, with the advent of 33 1/3 rpm types and then the announcement of the impending 45 rpm models, replacement and sales business dropped sharply as the public became wary

by S. R. COWAN



RCA 45-RPM phono and record

and decided to buy nothing for a while until the confusion clears up a bit. I am for anything that will keep business moving along on an even keel and now I feel the time is fast approaching when this whole record-speed mixup will be straightened away once and for all.

TV Installation Losses

An about face has been made recently by Eastern Service Dealers who went in for TV installation contracts without knowing in advance how to determine their charges. For example, one firm simply figured that if RCA or DuMont can get a Service Contract fee of \$65 they should be able to do so too, and make a profit on the deal. So, after taking on several such contracts this Service Dealer found himself behind a great big black 8-ball. He learned to his chagrin that he had taken a bad financial loss on every job. The time element licked him for his installers were spending far too many hours making an installation.

For example, figuring a two-man installation team could make an ordinary installation in less than 3 hours, and paying each man \$3 per hour, this Service Dealer expected to have a labor outlay of about \$18 per installation. Subsequently he found that installations were taking 5 and 6 hours each when not too many difficulties were encountered, and some

of the jobs required 10 hours. It didn't take long to realize that something was wrong . . . and that the thing that was wrong was the Service Dealer's idea that he could get away with flat fee charges. In fact, in desperation, this Service Dealer did what others have found it necessary to do, spend money on rotary motors such as the new Tenna Rotor jobs that Alliance is delivering (with orders exceeding supply), paying for the motors out of his own pocket rather than pay for hours of labor required for orienting antennas.

It seems that a Tenna Rotor costs the Service Dealer about \$20 net. Or figured another way, each motor represents what it would cost for a two-man team working 3 hours to orient a rig. So, in order to speed up installations, for there is profit in volume business, it was worth-while paying for the motors himself, making the installation more efficient, and keeping men almost abreast of the heavy schedule of piled up work. (Incidentally fellows, I bought and paid for my own Tenna Rotor and it's terrific. Naturally one must expect optimum results from rotary TV antennas, and that's what I'm getting. Wonder if I can get Alliance to pay me for this free advertisement. I never gave a client such a "break" before).

Without doubt Service Dealers are getting more and more chances to take on TV antenna installations. The dealers, especially those who do not operate their own service departments, try to keep their customers happy by holding prices to a minimum, so they, the non-service minded dealers, won't advocate that a customer buy a rotor. Service Dealers and Service Organizations that do handle TV work would be wise if they did advocate that TV set buyers should spend the extra few dollars required for a rotor. To begin with, it will allow a profit margin on the sale of the rotor and in addition it will speed up the antenna installation

[Continued on page 41]



Service Dealers

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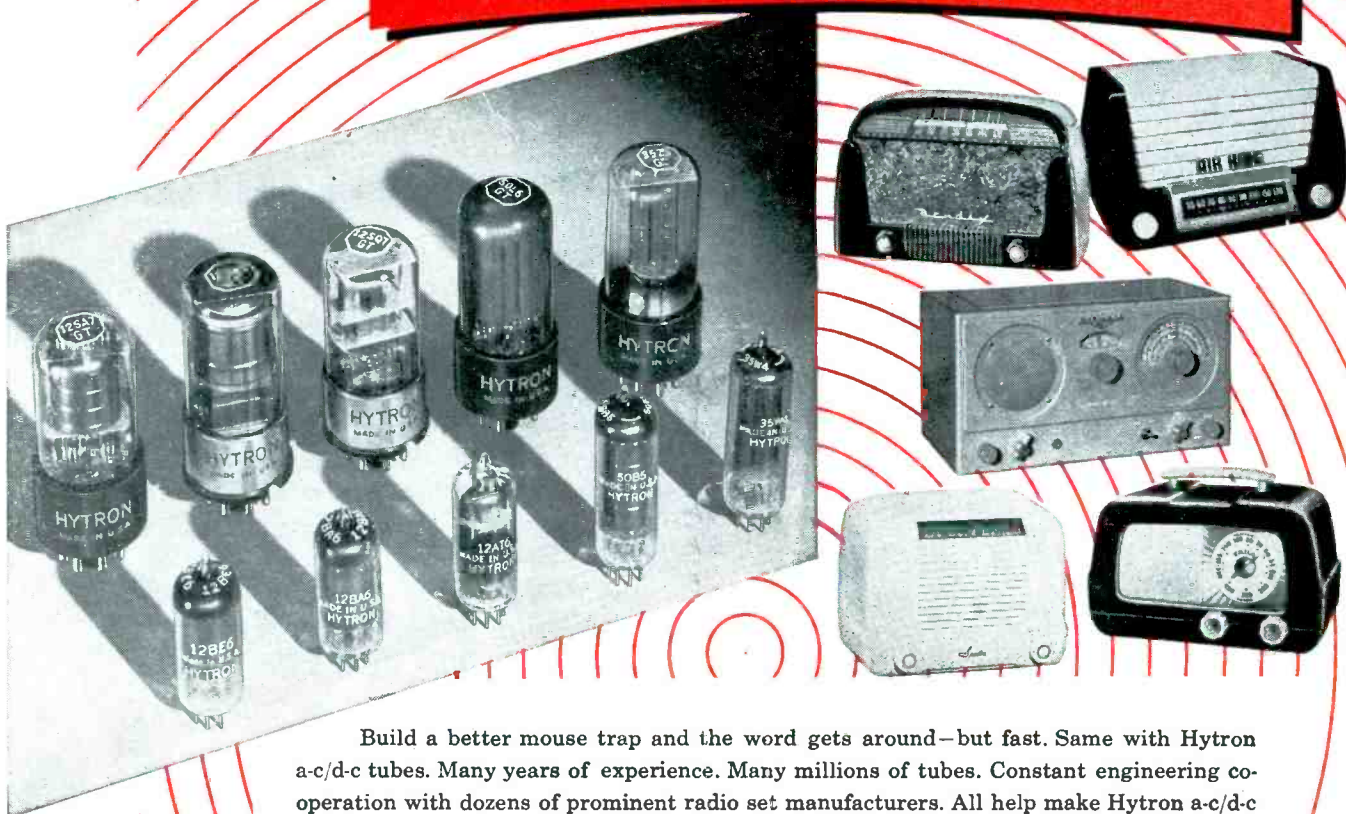
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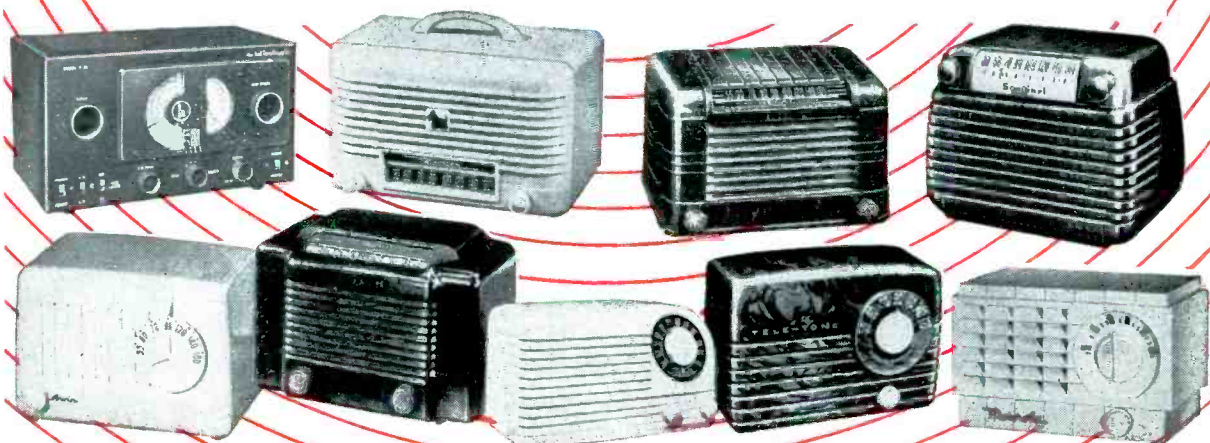
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PROJECTION TELEVISION

by ALLAN LYTELL

PART 3

This is the third and final article in the series of articles on Projection TV, and describes the system employed in the RCA projection receiver.



Fig. 1—RCA 8PCS-41 projection television receiver.

THE Radio Corporation of America has pioneered in the development of projection model television receiver for home and theatre use. This article is concerned only with the home type receivers. One early model RCA uses a system with a plane mirror to change the position of the image as seen by the audience, but this TRK model is not a true projection system for the image is viewed as it is on the tube screen without being made larger.

Figure 1 is an illustration of the 8PCS-41 which uses the Schmidt projection principle to provide an image 15" x 20". An earlier model by the same company, the 648PTK uses the same optical system and presents the same size image. The 8PCS-41 uses a retractable screen, but the optical function of both models is the same. The instrument described in this article is the 648PTK or the 8PCS-41, the newer model, since the description and operation are the same in both.

Basic Optical System

The Schmidt system is used in both of these television receivers, and in Fig. 2 the basic optical components are illustrated. A 5TP4 Kinescope is mounted facing a concave spherical mirror whose center portion is blacked out. The picture tube is mounted

between the focus and center of curvature of the mirror which will allow barrel several times to prevent acetate mirror to throw an enlarged image upon the screen. Again, as is common with Schmidt system projectors, a correcting lens is mounted around the neck of the picture tube for the purpose of correcting spherical aberration. Without the use of the correcting lens the concave mirror itself would produce an image which would lack sharpness. A plane mirror is used to fold the optical path and allow the use of a smaller cabinet. This image is projected upon the back of the screen and viewed from the front. The RCA system has a resolution of 1,500 lines which exceeds the demands of the television presentation.

In Fig. 3 the Kinescope holder is shown together with the thumb screws which are used for adjustment. An anode high voltage clip is made a part of the Kinescope holder. One innovation of the RCA alignment procedure is the use of a special optical test lamp, but one precautionary measure should be made standard with this receiver. Since the Kinescope holder is a part of the high voltage anode contact, this holder unit

should be shorted out to the optical incidental discharge of the high voltage capacitors. Normally these capacitors will not be charged in a new receiver, but the precaution of discharging them will prevent unnecessary discomfort. The corrector lens is mounted in the optical barrel and should be removed by loosening the three screws which hold the clamp springs as shown in Fig. 4. Be sure not to remove the screws which hold the correcting lens mounting plate. Extreme care should be given to the correcting lens to prevent scratches or other damage.

The spherical mirror, the back of the screen, and the plane mirror may be dusted with a small, very soft brush. Any contact between fingers and the mirror front surface is to be avoided since this will cause corrosion. RCA recommends that the screen and mirrors be cleaned with a solution of "Dreft" and water. The test lamp is placed in the Kinescope holder and adjusted to the proper center position. An ordinary line cord is used to apply 110 volts a.c. to the lamp after which the corrector lens is replaced. There is an indicating arrow on the edge of the lens which must be pointed toward the rear of the unit. If the image on

the screen is not aligned properly the lamp may be rotated to produce a well-centered picture. The center opening of the corrector lens may be covered with a piece of black paper which will facilitate proper adjustment by preventing light from being sent to the screen through this hole. The cloth dust cover should be drawn in place around the optical barrel.

Adjustments

For the best possible adjustments the service man should be able to view the screen from the front while working on the rear of the set. This may be accomplished through the use of an ordinary plane mirror placed in front of the set. Optical focus may be adjusted by the use of the adjustment lock screws illustrated in *Fig. 4*. The best possible overall definition is desired and the manufacturer says that 900 line definition should be obtained. Optical focus adjustment is turned until the vertical and horizontal lines of the optical lamp pattern, become double. These lines are parallel only if the test lamp is properly centered.

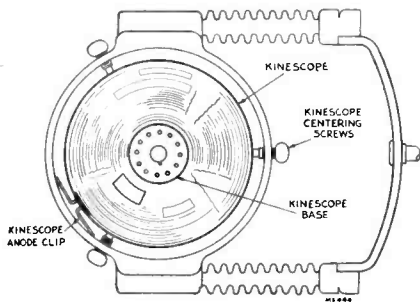


Fig. 3—Kinescope holder.

Should these lines not be parallel, Horizontal or Lateral adjustments should be made. See *Fig. 5*.

When the vertical lines are not parallel, lateral adjustment is indicated. Loosen the lateral adjustment lock screws and turn the lateral adjustment screws until a parallel condition is obtained for the vertical lines. Exactly the same adjustment is made for the horizontal lines except that the Horizontal adjustment lock screws and centering adjustments are used. After both vertical and horizontal lines are in correct adjustment the lock screws should be tightened. The corrector lens may be adjusted by first moving the optical focus adjustment to obtain a halo around the dot which appears in the center of the test lamp. The optical focus adjustment lock screws should first be loosened to permit manipulation of the optical focus.

The halo about the center of the test lamp is made to appear symmetrical by loosening the corrector lens lock screws and shifting the lens. After this adjustment has been obtained the lens centering lock screws should be tightened to maintain this position. A check may be obtained on the alignment of the entire optical barrel through use of the focus adjustment. This optical focus adjustment is loosened and then varied throughout the focus range. If the optical barrel is in the proper position the picture will come into focus overall at the same time. When one portion of the picture comes into focus before the rest, the optical barrel horizontal tilt jack nuts are changed. Should any adjustment be required of these three nuts the Horizontal and Lateral optical adjustments should again be checked. These adjustments should only be necessary, if at all, when this receiver has been moved or handled roughly. After the proper corrections have been made, the test lamp may be removed by turning the Kinescope mounting wing nuts, all the same amount, and only enough to remove the lamp.

Precautions

The ordinary precautions involved in handling any picture tubes apply to the installation of the Kinescope. One unusual feature of the service manual is their notation to handle the tube by the neck and avoid covering the envelope of the tube with fingermarks to prevent a high voltage leakage source. Carbon tetrachloride may be used to remove fingermarks. Since the tube must be handled by its neck, extra precautions must be taken to prevent breakage. A special brass clip is placed in the Kinescope anode

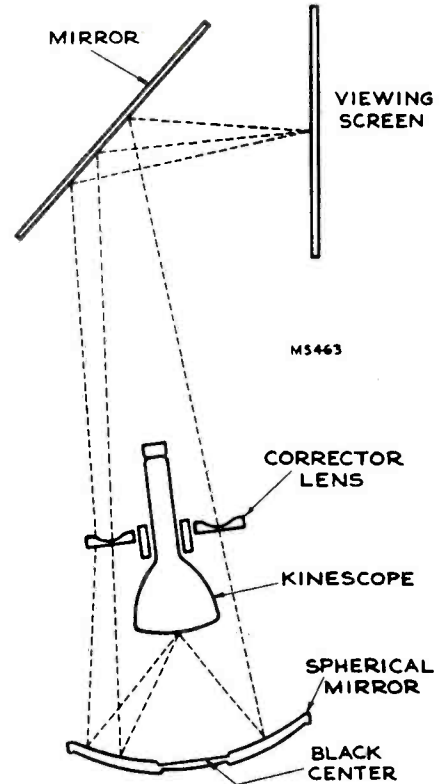


Fig. 2—Reflective optical system.

connector and the tube is inserted in its holder. The CRT is mounted so that the socket keyway is pointing toward the television chassis and the anode clip is not tightened holding the tube in place. Replace the correcting lens, which must be removed to install the Kinescope and tighten the lens in position.

Place the deflection yoke with the slotted end of the bakelite center tube in the up position. Attach the Kinescope socket and turn the yoke so that the leads come out the rear, and place the cables according to *Fig. 6*. A test pattern will now be needed

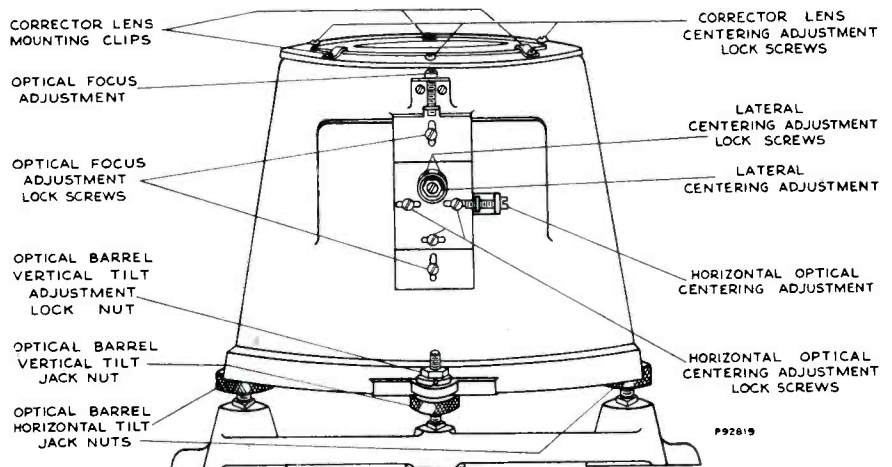


Fig. 4—Optical barrel adjustments.

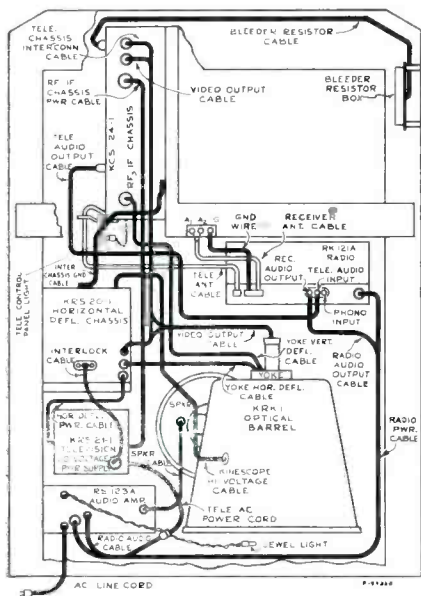


Fig. 6—Interconnecting cables.

for any further adjustments and the optical portions of the receiver should not have to be corrected any further. A feature of the use of the Optical test lamp makes this procedure unique; the alignment of the optical portions of the receiver may be made without reference to the electrical controls. Thus optical electrical focus, and centering, may be made after the entire optical system has been set up with the test lamp. Electrical adjustments must then be made with the use of the test pattern. A special design for public places is the RCA 741 PCS which is not illustrated. This model has a panel which pulls down from under the top to protect the screen. In the home receiver the screen folds down into the set. This larger model has the same size picture

and a special locking panel to protect the front adjustments.

Besides the unique test lamp procedure and the optical adjustments, there are several other features of interest. A high voltage of 27 Kv is used for the CRT anode and this voltage is obtained from the energy stored in the deflection coils during the horizontal scanning. These inductive kicks are built up by an autotransformer and a voltage-tripler circuit; Three 8016 tubes are used for this purpose.

CRT & Screen Details

Magnetic deflection and electrostatic focusing are used by the CRT which also has a screen with an aluminum backing. This backing coating is very thin and allows electrons but not light to penetrate. Since the light from the image is not wasted in the backward direction the picture is made more bright. This increase is about the ratio of 1:2, and is of assistance in obtaining the required degree of picture contrast.

The viewing screen is of special construction, made of two sheets of Lucite with a partially diffusing layer between them. Vertical lines are a part of the front surface and the rear surface has molded fresnel lenses which have the ability to concentrate the light into the best vertical viewing position. The fresnel lens is quite like those used in lighthouses to form a concentrated beam of light. The horizontal viewing angle is increased by the use of the vertical lines of the front face. A diffusing layer is needed to prevent the fresnel lens of the rear and the vertical lines of the front

from interfering with each other. There is an illumination increase of about 5 due to the lens of the rear, the vertical lines of the front, and the layer in between. This increase means that the viewing angle is concentrated, as with the Philco 2500, but the picture as viewed from the side is unsatisfactory to most viewers and is not used in any case.

Some of these features of the projection system and its components may seem a bit remote from the proper field of the retailer or the serviceman but this is not true for either one. Many consumers desire information about their receivers and the person owning an expensive projection receiver will be more satisfied if the working of the parts is explained. More important, perhaps, is this; proper knowledge of the function of the various parts is needed to prevent a useless search for trouble in the electrical parts when it is to be found in the optical sections.

In line with this, the most frequently asked question in projection is this: "Why don't the leads to the CRT interfere with the light going to the screen?". This is explained only by the principle of optics which shows that the light from any given point of the CRT image is reflected from many parts of the concave mirror and passes through all parts of the lens. Thus where the leads to the CRT obscure only a small part of these total light rays of any point there is a decrease in light due to the leads but this is too small to be noticeable. Small opaque objects have been placed in the concave mirror without seeming to decrease the brightness of the projected image. But to have the best results the smallest possible amount of light should be interfered with and this means proper leads dress and clean lenses and mirrors.

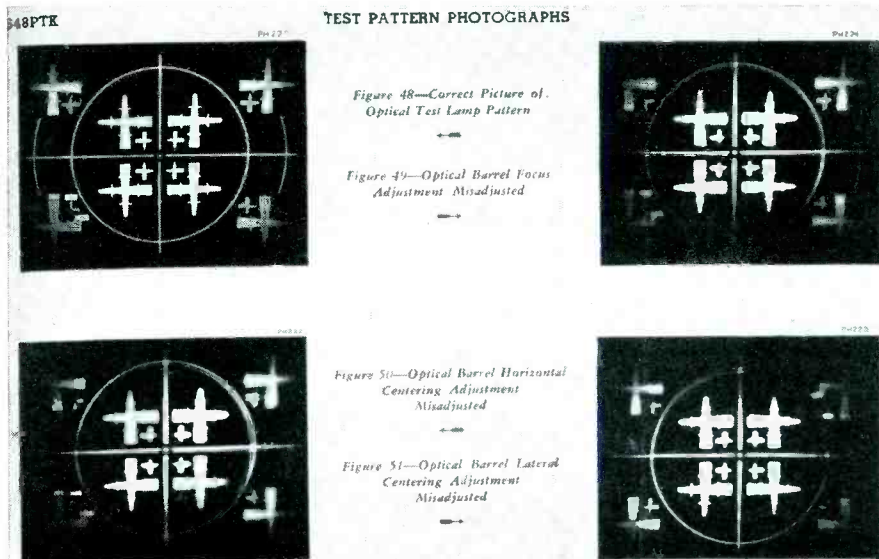


Fig. 5—Adjustment patterns using optical test lamp.

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VOLT - OHM -

MOST service men are aware, of course, that the volt-ohm-milliammeter is basically a current measuring instrument which has been equipped with suitable multipliers and shunts and has been calibrated to indicate volts, ohms, milliamperes, etc. Modern volt-ohm-milliammeters or multimeters are highly developed and are arranged so that values of d-c voltages, d-c milliamperes (sometimes amperes also) resistance, a-c voltages, decibels, and in at least one type of instrument a-c amperes may be measured. Changes from one function to another and from range to range are accomplished through the medium of a more or less simple switching arrangement, or in some cases by a combination of switches and pin jacks.

D-C Current Measurement

The sensitivity of the meter (the amount of current required to give a full scale deflection) determines the accuracy of the multimeter. This is especially true in taking readings across a high value of resistance. This point is illustrated in *Figs. 1A* and *1B*. In *1A* the meter is one which requires one milliampere to give a full scale deflection. The voltage across the 250,000 ohm plate resistance is to be measured, and since the maximum voltage to be encountered is 250, a multiplier has been connected in series with the instrument. A simple Ohm's Law calculation will show that in order to limit the current through the meter to one milliampere with an impressed voltage of 250, the series resistor, or multiplier, must have a value of 250,000 ohms.

Note that in this instance the internal resistance of the meter has been disregarded, because in the case of a one milliampere movement it will be negligible compared to the 250,000 ohm multiplier. However, in the case of a much more sensitive instrument (which will have a higher internal resistance) the meter resist-

Describing the basic circuits that make up the complete volt-ohm-milliammeter, so that the serviceman can evaluate the individual merits of such instruments and their limits.

ance must be subtracted from the total series resistance needed to give the actual value of the multiplier. We now have an instrument which will measure a maximum value of 250 volts and which has a total resistance of 250,000 ohms; in other words, for each scale volt the resistance is 1,000. The sensitivity of the instrument is, therefore, 1,000 ohms per volt.

When we attempt to measure the voltage across the 250,000 ohm plate resistor, we have two parallel paths, each having a resistance of 250,000 ohms. It is obvious that the currents through these paths will be equal, and that the total current will be twice as great with the meter connected as it was before. This additional drain on the source will result in a drop in voltage, and instead of measuring the actual value our reading will be somewhat lower.

This undesirable condition may be minimized by using an instrument having a higher resistance, and of course this means that the sensitivity of the meter must be greater. If a 100-microampere meter is used in place of the 1-milliampere movement, it will be necessary to connect a multiplier having a value of 2.5 megohms in series with the meter, as shown in *Fig. 1B*. When this voltmeter is connected across the 250,000 ohm plate resistor, there will still be a slight voltage drop, but not nearly so great as in the first case.

From the above discussion, we have learned that a meter with a high resistance (high ohms-per-volt rating) is desirable; in fact, it is essential in many operations. A few modern multimeters use meters hav-

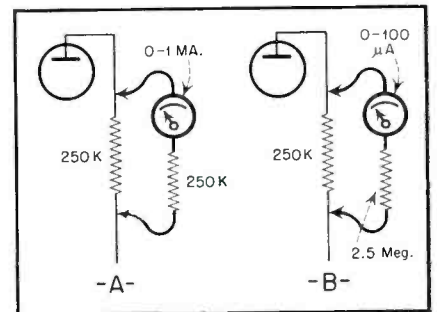


Fig. 1—Relative loading effects of 1 ma and 100 μ a instruments.

ing a sensitivity as high as 20,000 ohms per volt (50-microampere movement); the majority are 5,000 ohms per volt (200-microampere movement) or better. In at least one type of instrument (Weston Model 779) the sensitivity may be changed from 1,000 ohms per volt to 20,000 ohms per volt as required.

The d-c voltage measuring circuits of most multimeters are extremely simple. In the average case, a simple

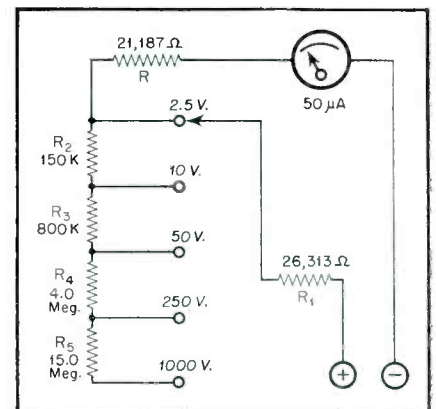


Fig. 2—D.C. voltage measuring circuit of Weston Model 779.

MILLIAMMETERS

by WILLIAM R. WELLMAN

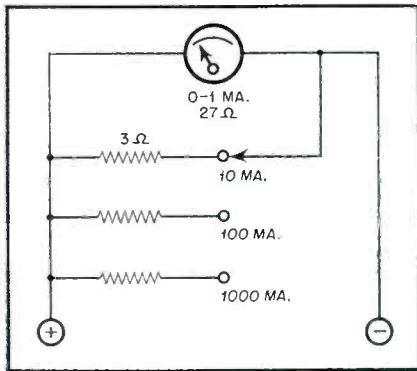


Fig. 3—Basic current measuring circuit used in volt-ohm-mils.

single-pole multi-contact switch is used to connect the required multiplier resistor in series with the meter. A typical circuit, used in the Weston Model 779, is illustrated in Fig. 2. The meter used in this instrument has a full scale deflection of 50 microamperes. With the range switch in the 2.5 volt position, as shown in the drawing, the two re-

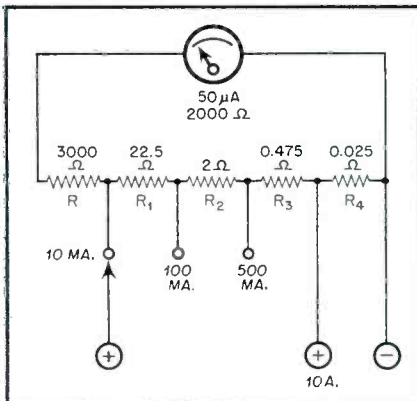


Fig. 4—D.C. current measuring circuit of Simpson Model 260.

sistors, R (21,187 ohms) and R_1 (26,313 ohms) are in series with the meter. These, together with the internal resistance of the meter make up a total of 50,000 ohms. When the switch is advanced to the next position (10 volts), R and R_1 remain in the circuit, and the 150,000 ohm resistor R_2 is added, making the total, including the meter resistance, 200,000 ohms. On each succeeding range additional resistance is added so that the total, together with that already in the circuit, is correct for the range in use. In some types of instruments this procedure is varied by using a multiplier of the full value needed without adding the multiplier used on the previous ranges to it.

As anyone who has attempted to design and build his own multi-meter is aware, the problem of accurate measurement of current is more difficult than that involved in voltage measurement. As an example of the problems to be encountered, suppose we consider Fig. 3. A 1-milliampere meter is to be provided with ranges of 10, 100 and 1000 milliamperes. We have here three separate calculations. In no case must the total current through the meter exceed 1.0 milliampere. Therefore, when the instrument is to be used to read 10 milliamperes full scale, the additional 9 milliamperes must pass through the shunt resistor, which means that the shunt must have only 1/9th the resistance of the instrument. The 1.0 milliampere meter has a resistance of 27 ohms and the shunt for the 10 milliampere range will then have a resistance of 3 ohms. For the 100 milliampere range the shunt resistance will be 1/99th that

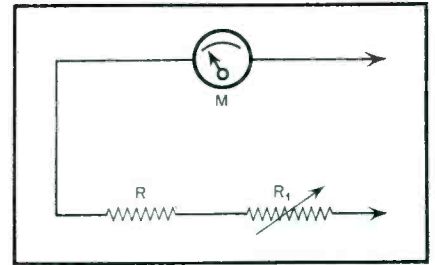


Fig. 5—Basic ohmmeter circuit used in volt-ohm-milliammeters.

of the meter and for the 1000 milliampere range it will be 1/999th of the meter resistance. Obviously, the shunts for the higher current ranges will have very low values and if the readings are to be at all accurate they must have accurate resistance values. Of course, when a more sensitive meter is used, the meter resistance will be higher and the problem will be somewhat simplified. Needless to say, in any case the exact resistance of the meter must be known.

While the circuit of Fig. 3 is workable, it is not generally used in commercial instruments for a variety of reasons. One of these is the possibility that a shunt may open or a switch point may fail to make contact due to dirt or corrosion, in which case the meter is left unshunted and, of course, unprotected from overload. A much better arrangement is the so-called "ring" (Universal Shunt) type circuit, shown in Fig. 4. This is a simplified version of the current measuring circuit used in the Simpson Model 260. Note that in this type of circuit the meter is always protected, regardless of whether the switch makes good contact or not.

With the switch in the "10 MA" position, R is in series with the meter; R_1 , R_2 , R_3 and R_4 (all in series) are connected across the instrument. When the switch is advanced to the next range (100 MA) R and R_1 are in series with the meter while R_2 , R_3

and R_4 comprise the shunt. The total shunt value has now been reduced so that it is correct for the 100 MA range. Thus on each range the series and shunt resistor values are adjusted so that the total resistances of the two parallel paths formed are correct, and each passes the required amount of current.

Resistance Measurement

A basic ohmmeter circuit is illustrated in Fig. 5. When the test leads are shorted, a current will flow through the meter and the series resistors; the value of the current will depend upon the battery voltage and the resistor values. As the battery voltage decreases due to use, R_1 is adjusted to maintain a full scale reading with the test leads shorted. If a resistor is now placed between the test leads, the current reading will be lower; as the value of the resistor is increased the current becomes progressively lower, and the milliammeter may be calibrated in terms of ohms.

While the circuit just described is useful under certain circumstances, it will be understood that the maximum and minimum values of resistance that may be read will depend upon the sensitivity of the meter and the battery voltage. Increasing the battery voltage or the sensitivity of the meter will raise the upper limit of the resistance range; using a meter of lower sensitivity will enable the user to measure very low resistance values. For service work, the ohmmeter must be capable of measurement over a very wide range. Many coil and transformer windings have resistances of 1 ohm or less, and in some tests it is necessary to measure values running up to hundreds of megohms. To accomplish the desired result, circuit arrangements are used in which meter sensitivity is changed as needed, and in addition, the battery voltage may also be changed. The

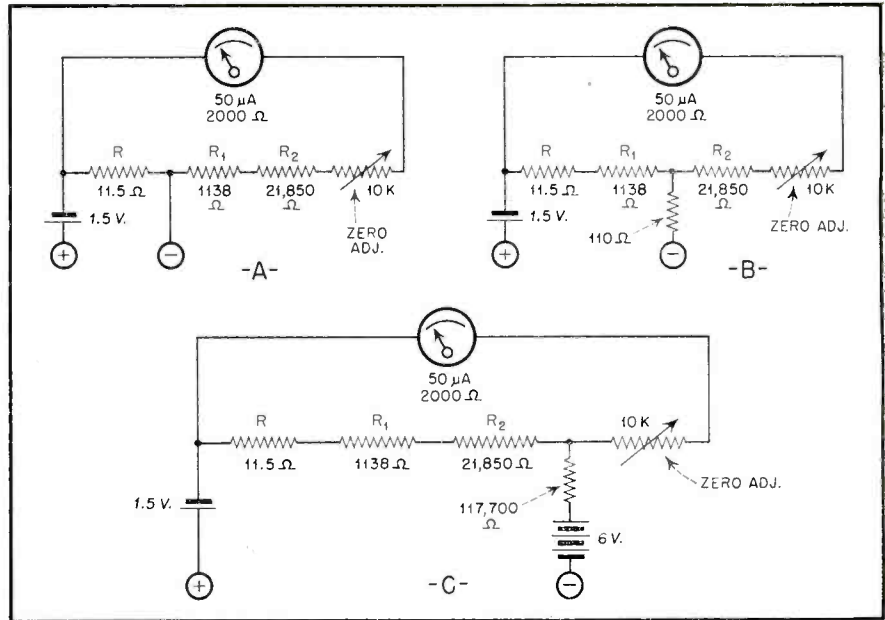


Fig. 6A—Ohmmeter circuit, Simpson Model 221, selector switch in this figure is set for the two thousand ohm range. Fig. 6B—Ohmmeter circuit, Simpson Model 221, selector switch in this figure is set for the two hundred thousand ohm range. Fig. 6C—Ohmmeter circuit, Simpson Model 221, selector switch in this figure is set for the 20 megohm range.

circuit provisions for making these changes are illustrated in the Figs. 6A, 6B and 6C, which are simplified versions of the ohmmeter circuit used in the Simpson Model 221.

Figure 6A shows the set up for the 2000 ohm range. The meter, a 50-microampere movement, is shunted by 11.5 ohms, while R_1 , R_2 and 10,000 ohm zero adjuster are in series with the meter. The battery used for this range is 1.5 volts. For the next range, 200,000 ohms, the meter sensitivity is increased by raising the shunt resistor value to 1149.5 ohms. Resistor R_2 and the zero adjuster are now connected in series with the meter. When the switch is set for the 20 megohm range, as in Fig. 6C, and additional 6-volt battery is cut into the circuit and the shunt resistor value is in-

creased to 22,999.5 ohms. Only the zero adjuster potentiometer remains in series with the instrument.

A-C Measurements

Some type of rectifier must be used in order to enable a d-c meter to read a-c values. Diodes and small copper oxide rectifiers have both been used for this purpose, but at the present time tube rectifiers are almost non-existent. The rectifier, in some cases, is mounted inside the meter case. Fig. 7 shows the circuit (simplified) used in the Precision Series 85 for measurement of a-c voltages. The solid arrows represent the flow of current through the instrument on one half cycle and the dotted arrows show the current flow around the meter on the opposite half cycle. The adjustable resistors R_1 and R_2 are units which are calibrated for the individual rectifier and sealed after calibration. As a general rule, for any given type of instrument the sensitivity for the a-c ranges is lower than that obtainable on d-c ranges. In this particular case, the a-c sensitivity is 1,000 ohms per volt.

Most of the medium and high priced instruments are calibrated to indicate decibels; the circuits used are quite similar to those employed for a-c voltages, except that a condenser (usually 0.1 μ f.) is connected in series with the jacks or binding posts.

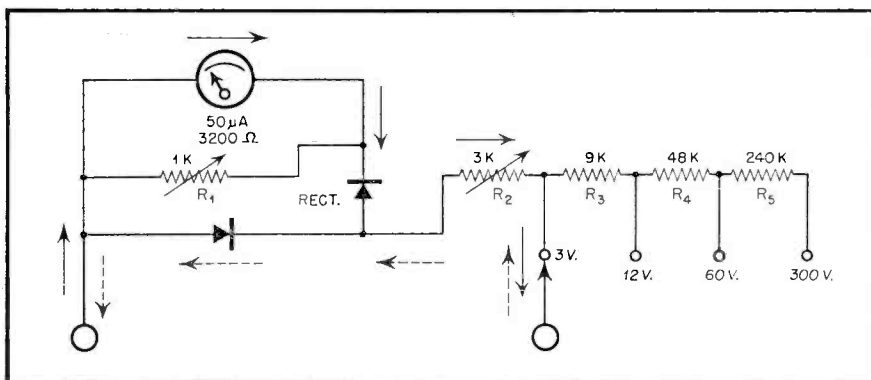


Fig. 7—A-C voltmeter circuit used in Precision series 85.

SIGNAL GENERATORS

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Mfgr.	Model	Frequency Range (Mc)	Output R-F Volts	Other Features	Wt. Lbs.	Size Inches
Approved	A 200	.1-25 on fundamentals to 75 on harm.		Colored scale Percentage of A-F mod. variable to 100%	16	8 x 10 x 12
Bradshaw	300	Fixed Freq. .456, .465, .600, 1.5		Socket for crystal control		
ECA		.1-25			19	8 x 10 x 12
EICO	315	.075-50 on fundamentals to 150 on harm.		Microcycle vernier tuning with which FM receivers may be aligned. Accuracy .02%	22	12½ x 12 x 5
Ferret FM-AM	701	.17-220 Fund. to 110		9 inch scale 3 color	10	10¼ x 10¼ x 5½
Hickok (crystal controlled in 277X and 288X) (db meter in 288X)	277 277X 288X	.1-110 AM .1-110 FM .1-160 FM		Fundamentals through entire range. Audio output 0-15 kc available. Crystal controlled. Wide and narrow band sweeps	28	11 x 16½ x 8
	191X	.125-120 on fund. to 240 on harmonics	.1	Calibrated output from ½ μ volt—.1 volts Db meter available. When used with Model 305 CRO an FM R.F. up to 170 mc may be had.	29	14 x 16½ x 8
Jackson	641	.1-120 AM .1-160 FM		Independent variable audio oscillator Output reads directly in microvolts	32	16¾ x 9½ x 7
McMurdo Silver	906	.09-170 AM .09-210 FM	1.0	Built in VTVM to measure output voltage FM beat osc. variable from 0 to 1000 kc	8	12¾ x 7¾ x 5¾
Precision	E-200-C	.088-30 on fundamentals to 120 on harm.		Supplies own A.V.C. voltage Panel mounted model E-200-C FM	17	10½ x 12 x 6
Radio City Products	705 A	.4-30 on fundamentals to 100 on harm.	1 volt on fund.	2 separate percentages of modulation High harmonic content	11	8 x 11¾ x 5
	710	Fixed freq. .5, 1.5 .456, .465		Pocket meter Operates	2	3 x 6 x 2¾
	720	Fixed freq. 88, 108 9.1, 10.7		Pocket meter Operates A.C. or D.C. Chassis isolated from line	2	3 x 6 x 2¾
R. C. A. FM Sweep Gen.	53 A	8.3-10.7 FM 85-110 FM	.1-1.0 to 0.1	Adjustable i-f width Phasing control	15	13½ x 9¾ x 7½
R. C. A.	WR 67 A	.1-30 on fundamentals	1.0	Drum dial Suitable for R. C. A. rack mount	15	13½ x 9¾ x 7½
Simpson	340	.075-30 on fundamentals to 120 on harm.		9 inch meter dial	20	16 x 10 x 6
	415 A	.075-130 AM Fund. to 60 2-115 FM	1.0	Amount of FM continuously variable 0-1 mc	18½	15½ x 11¾ x 5¾
Supreme	661	.065-20.5 on fundamentals to 82 on harm.		No isolating condenser required		
	666	.065-20.5 on fundamentals to 60 on harm.		Contains separate A-F, R-F, and FM oscillators Provides visual alignment of AM i.f. amp.	33	15½ x 11½ x 8¾
	670	Fixed 10.7 FM Fixed 50 FM Fixed 100 FM		Provides narrow and wide FM mod. signals 3 Fixed carriers	15	9½ x 8 ¹¹ / ₁₆ x 7¾
Tel-Instrument Co.	1900	17-40	.5	10-freq. 400 cps. mod. crystal controlled oscillator for TV i-fs. Accuracy .05%.		12½ x 9½ x 8
Triplett	3432	.165-40 on fundamentals to 120 on harm.		Percentage of A-F mod. variable to 100%	17	15 ¹¹ / ₁₆ x 11½ x 6¼
	3433	.1-120 AM fund. 2-170 FM		Contains crystal oscillator Output attenuator and metering calib. in R.F. units Contains calibrated deviation control	30	15 ¹¹ / ₁₆ x 11½ x 8¼

TUBE TESTERS

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NAME	MODEL	TYPE	FEATURES	WEIGHT LBS.	SIZE INCHES
Hickok P—Portable C—Counter DM—Merchandiser	533 P	Mutual	Tests new h-f and TV tubes Scale directly in mhos	31	17 x 18 x 8½
	533 C 533 DM	Conductance	Gas test Noise test		
	534 B	Mutual Conductance	Same as above Contains multimeter	31	17 x 18 x 8½
	536	Mutual Conductance	Tests new TV tubes	31	17 x 18 x 8½
	538	Mutual Conductance	Same as above Contains multimeter		17 x 18 x 8½
Precision P—Portable C—Counter PM—Panel mount MCP—Metal case portable	10-12	Electronic	Battery tester Ballast tube tests	P-23 PM-33 C-32	C-17 x 17½ x 7½ sloping to 3 inches
	10-15	Electronic	Noise test Leakage test TV & new tube tests 9 inch meter	45 PM-37	P-13¾ x 17¼ x 6¾ sloping to 4 inches
	10-20	Electronic	Same as above without 9 inch meter A-C/D-C multimeter	P-25 PM-35 C-34	P-13¾ x 17¼ x 6¾
	10-22	Electronic	Same as 10-15 9 inch meter	49 PM-41	PM-22¾ x 19
	10-54	Electronic	Tests new h-f and TV tubes Noise tests Ballast tube tests 20,000 ohm/volt A-C/D-C multimeter	P-25 PM-35 C-34	P-13¾ x 17¼ x 6¾
	612	Emission	Battery tests Ballast tube tests Noise test	MCP-17 P-19 PM-20 C-23	P-12 x 13 x 6
	614	Emission	7 inch meter Leakage test Noise test Meter raised for full-view	27	16 x 13½ x 7
	620	Emission	Battery test Noise test Ballast test A-C/D-C multimeter	MCP-19 P-20 PM-20 C-23	
	654	Emission	Ballast test Leakage test 20,000 ohm/volt A-C/D-C multimeter	MCP-19 P-20 PM-20 C-23	
Radio City Products DL—Double meter M—Merchandizer P—Portable	316	Emission	Available in DL & M models Noise test	13	16½ x 13¾ x 5¼
	322	Emission	Available in P model Noise test	11	5¼ x 12¼ x 7
	802 N	Emission	A-C/D-C multimeter	13	5 x 13 x 9½

TUBE TESTERS (continued)

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NAME	MODEL	TYPE	FEATURES	WEIGHT LBS.	SIZE INCHES
Radio City Products	805 B	Emission	Battery test A-C/D-C multimeter	16	16½ x 12¾ x 5¼
Simpson	330	Percentage of Mutual Inductance	Test new h-f and TV tubes	16	15½ x 9½ x 6¼
	335	Percentage of Plate Conductance	Test new h-f and TV tubes	19	15½ x 9½ x 6¼
	555	Emission	Test new h-f and TV tubes	13½	16¾ x 12½ x 6
Star	TE-1	Emission	Test new series tubes	6	9 x 7 x 3½
	MT-12	Emission	Noise test Leakage test Test new series tubes	10	14 x 12 x 6
Supreme PM—Panel mount P— Portable	504-B	Emission	A-C/D-C multimeter	20	11 x 15 x 6¾
	589 A	Emission	Leakage test Open circuit test Noise test Battery test	10	11⅞ x 8⅞ x 5⅞
	600	Emission	A-C/D-C multimeter	20	11 x 15 x 16¾
	616	Emission	7 inch meter Ballast tube test Battery test	19	PM-15 x 11½ P-15¼ x 12¼ x 7¾
	620	Dynamic	Noise test Leakage test	20	11 x 15 x 6¾
Sylvania	139	Dynamic	Noise test	16½	16¼ x 11⅜ x 5½
	140	Dynamic	Noise test	18	15 x 14⅞ x 5¼
Test Craft	TC-50	Emission	Test new h-f & TV tubes Test thyratrons A-C/D-C multimeter		8 x 10½ x 5
Triplet	3413	Emission	Open element test		
	3480	Emission	Open element test Ballast test A-C/D-C multimeter		
Weston	686 Type 9A	True Mutual Conductance	Laboratory instrument giving com- prehensive check of mutual conduc- tance at all values of tube potentials.	105	19 x 26 x 7.3
	798 Type 5	Proportional Mutual Conductance	Tests new h-f and TV tubes Tests VR, cold cathode rectifiers, and Thyratrons	23	17¾ x 11⅞ x 6¾

Television

KILOVOLT METERS

by RUFUS P. TURNER

THE necessity for checking the high anode voltage of a television picture tube introduces a new testing problem for servicemen. This article will attempt to reduce some of the present confusion by explaining how kilovolts can be measured with commercial kilovoltmeters, and how to construct simple kilovoltmeters.

Danger. High Voltage!

Before discussing the technical aspects of high voltage measurement, we want to stress most emphatically that *all* high voltages are dangerous to the operator. We mean every word of this. Every high-voltage power supply must be recognized as a potential killer orcrippler of human beings and must be respected as such. The operator must exercise extraordinary precaution when making high-voltage measurements and must follow closely every rule listed later in this article under *Precautions and Techniques*.

The fact that the output of a high-voltage television power supply is limited to a few milliamperes is no excuse for carelessness on the part of the serviceman. In spite of low current capacity and relatively poor voltage regulation, a television power pack is no plaything. A good rule is to trust *no* high-voltage source.

Kilovoltmeter Construction

A kilovoltmeter suitable for television testing must have high input resistance in order to prevent overloading of the high-voltage, low-current power supply.

Figure 1 shows the circuit of a high-resistance d-c kilovoltmeter which may be built by the serviceman. If the builder uses a 0-50 d-c microammeter at *M*, the instrument will have a resistance of 20,000 ohms per volt. If a 0-100 d-c microammeter is

Details on the construction of kilovoltmeters and high voltage probes suitable for use with your low voltage VOM

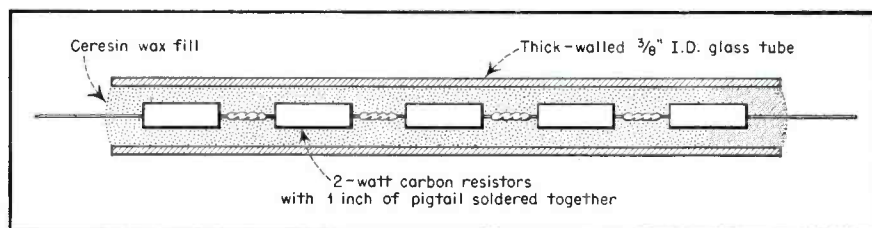


Fig. 2—Construction of R_1 .

employed, the resistance will be 10,000 ohms per volt. Both of these resistances are satisfactory for television testing. Circuit constants for both microammeters are given in Fig. 1, since we expect that servicemen might have either one or the other size of meter available.

The kilovoltmeter has two ranges: 0-5000 and 0-50,000 volts. A particular advantage of the 50-microampere meter is the fact that its regular scale can be read directly in volts simply

by adding mentally the proper number of zeros.

Multiplier resistor R_1 is made by series-connecting the proper number of long-length 2-watt carbon resistors to obtain one of the R_1 values given in Fig. 1, enclosing them in a thick-walled glass tube, and filling the tube with ceresin wax. By using a number of long resistors connected in series, a long leakage path is provided for the high voltage. This protects the microammeter and reduces the danger of flashover. The 2-watt resistor has a higher power rating than is required in the kilovoltmeter multiplier but it provides the desirable 1-3/4 inch length for each component resistor.

In order to obtain an R_1 resistance value of 100 megohms for the 50-microampere meter, four 22-megohm resistors and one 12-megohm resistor must be connected in series, with 1 inch of pigtail between each two adjacent resistors. This series string then must be slipped into a 13-inch length of 3/8" i.d. glass tube which afterward is poured full of ceresin wax. For an R_1 resistance value of 50 megohms for the 100-microampere meter, five 10-megohm resistors must

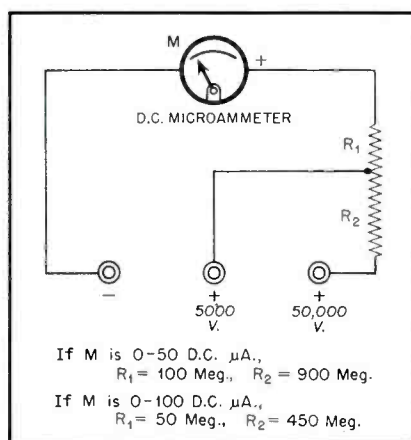


Fig. 1—D-C kilovoltmeter.

be connected in series, with 1 inch of pigtail between each two adjacent resistors. The 50-megohm string also will require a 13-inch length of enclosing glass tubing.

All resistors must be selected carefully for *exact* resistance values. An accurate high-resistance bridge or good ohmmeter will be satisfactory for making the selection. The pigtails of adjacent resistors in the R_1 multiplier assembly must be twisted together tightly and soldered. Do not use any form of corrosive flux for soldering. The melted wax should be poured carefully into the glass tube so as to surround the resistors completely. *Figure 2* shows construction of resistor R_1 .

Resistor R_2 in each case (See *Fig. 1*) is a special factory-made, high-voltage, ultra-high-resistance component. When the 50-microampere meter is used, R_2 must be 900 megohms. For the 100-microampere meter, R_2 must be 450 megohms. The resistor recommended for R_2 in each case is I. R. C. Type MVO. This component is rated at 50,000 volts. It is 10½ inches long and 1-⅛ inch in diameter, and is supplied with lug-type terminals. The Type MVO is not a stock resistor which ordinarily can be bought over the counter, but must be ordered from the manufacturer, International Resistance Co.

Mechanical construction of the kilovoltmeter is very important. There are several particular points to pay attention to. For example; for reasons of safety, a range switch is not recommended. Instead, one negative and two positive input jacks are used. The three input jacks must be mounted on a subpanel set back of the main panel of the kilovoltmeter (See *Fig. 3*). A clearance hole drilled through the main panel just above each jack permits the insertion of a long-stemmed plug into the recessed jack without danger of coming in finger contact with the latter. Either banana- or pin-type jacks may be employed. The jack sub-panel must be made of polystyrene or high-grade bakelite. The center-to-center spacing between jacks and also from the end jacks to the subpanel mounting screws must be not less than 2 inches. The subpanel must be clean of grease, moisture, and fingerprints. After mounting the subpanel, clean it thoroughly with carbon tetrachloride applied with a cotton swab and coat it with a thin layer of ceresin wax especially between the jacks.

The main panel of the instrument

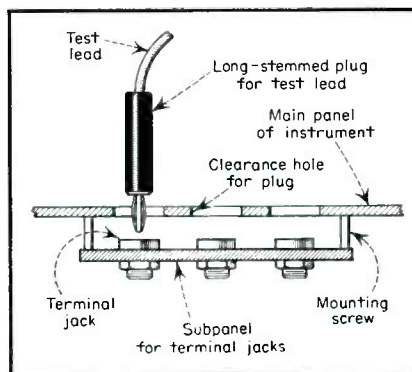


Fig. 3—Construction of input terminal arrangement for high voltage testing.

must be non-metallic. Use bakelite or other plastic, or a good-grade well-dried wood which has been heavily coated with shellac. Use only a bakelite-encased microammeter—and avoid meters with “hot” metallic zero-adjuster screws. It is advisable also to use plastic or wood for the instrument cabinet.

Do not employ close, compact construction in this instrument. On the other hand, keep all leads well separated and use rigid wire. Allow ample “breathing space” inside the cabinet. Because of the length of the multiplier resistors and the requirement for separation between components and wiring, it will be necessary to use a larger-sized cabinet than is common for non-electronic multimeters. Assuming a “3-inch” microammeter to be used, the minimum cabinet dimensions recommended are 14” long, 10” wide, and 2½” deep. Sloping front panel construction may be employed, if desired.

Resistors R_1 and R_2 must be mounted by means of brackets made preferably of some non-conducting material. They must not be mounted closer than 1 inch to the meter or to the input jacks.

The flexible wire of the test leads must have high-tension insulation. No test prods should be used on the business end of the test leads, since it is not safe for the operator to hold prods or probes in his hands when checking voltages higher than about 1000 (See *Precautions and Techniques*). Instead, insulated clips should be installed on the ends of the leads to be fastened to test points in the circuit before switching-on the television receiver.

Multipliers and Probes

A few servicemen have asked us how to build multipliers to convert their present factory-built electronic d-c voltmeters into kilovoltmeters. The

simplest way to extend the range of such instruments is to employ an external multiplier in conjunction with the 1000-volt d-c range of the instrument.

For television testing, the most useful extended range will be 0-50,000 volts. This calls for an external multiplier with a resistance value equal to 49 times the input resistance of the instrument. The multiplier must be rated to withstand a voltage drop of 49 kv across itself. The two most common total input resistances of electronic d-c voltmeters are 11 megohms and 16 megohms. This means that a 539-megohm multiplier will be required for an 11-megohm instrument (such as RCA VoltOhmyst) and a 784-megohm multiplier will be required with a 16-megohm instrument (such as Sylvania Polymeter). If your instrument has some other value of input resistance, simply multiply that value by 49 to obtain the required external multiplier resistance.

The job of constructing an external multiplier for the d-c vacuum-tube voltmeter is not so simple. For one thing; if the resistors needed to total the multiplier value are used, the multiplier will be rather large-sized. For example, 20-megohm carbon resistors (highest integral stock value) connected end-to-end to obtain either of the above ultra-high-resistance values might make the multiplier as long as 5 feet! Furthermore, the maximum voltage drop allowed across individual resistors by the resistor manufacturer will be exceeded. This would eliminate all ordinary small carbon resistors (rated at a maximum voltage drop of 500 v.) and even the much more expensive small-sized ultra-high-range metallized resistors (rated at 1000 volts drop) unless cost and size are inconsequential and the builder is prepared to use at least 100 series-connected 2-watt carbon resistors. A 100-resistor multiplier can be made with 10 cards (such as shown in *Fig. 4-A*) stacked one above the other. Each card would hold 10 resistors mounted side by side and so chosen that the total resistance of the 100 resistors will equal 49 times the input resistance of the electronic voltmeter. Each resistor can be tied separately to the card by means of one or more pieces of fabric cord passed through small holes drilled through the card on each side of each resistor, as shown in *Fig. 4-A*. Ten cards then may be stacked by means

of four long screws or threaded rods passed through the corners of each card, as shown in Fig. 4-B.

Allowing $\frac{3}{4}$ inch separation between cards, a box measuring inside 15" long, 4" wide, and 8" high would be needed to enclose the completed multiplier resistor assembly. The box would have to be made of insulating material, such as bakelite or dried and impregnated wood, and should be poured full of ceresin wax after the multiplier is placed into position.

An I. R. C. Type MVO resistor makes a more compact external multiplier if size is a consideration. This special resistor can be ordered to the exact required resistance and is rated to handle a voltage drop of 50 k v. It can be mounted conveniently in a slender box or case, ceresin wax-filled, with inside dimensions of 11" long, $1\frac{1}{2}$ " high, and $1\frac{1}{2}$ " wide.

The same safety precautions applicable to other types of kilovoltmeters apply fully also to the electronic d. c. voltmeter used with an external kilovolt multiplier. (*Many multipliers and probes are now available commercially. See Test Equipment Chart in the Feb. issue of Radio Service Dealer.* Ed.)

Voltage Divider for A.C.

High a-c voltages encountered in television receivers are also of high frequency (30 kilocycles being a common frequency). The high input-impedance type of a-c vacuum-tube voltmeter (rectifier-amplifier variety) is especially satisfactory for checking high-frequency voltages, but the maximum voltage which may be checked continuously without damage to the diode rectifier is about 100 volts r. m. s.

In order to use the electronic a-c voltmeter for high-voltage TV measurements, an external voltage divider of the capacitive type is recommended. Such a divider must be capable of reducing 50,000 volts r. m. s. to 100 volts (a ratio of 1 to 500) for presentation to the meter, and must have a low value of total capacitance.

Figure 5 shows a capacitive voltage divider answering these specifications. The 1-to-500 reactance ratio is provided by 4 μf and 2000 μf in series. If a 50,000-volt potential is impressed across the series combination, 100 volts will appear across the 2000 μf unit. Maximum voltage will appear across the 4- μf capacitor. This component accordingly must have the highest voltage rating.

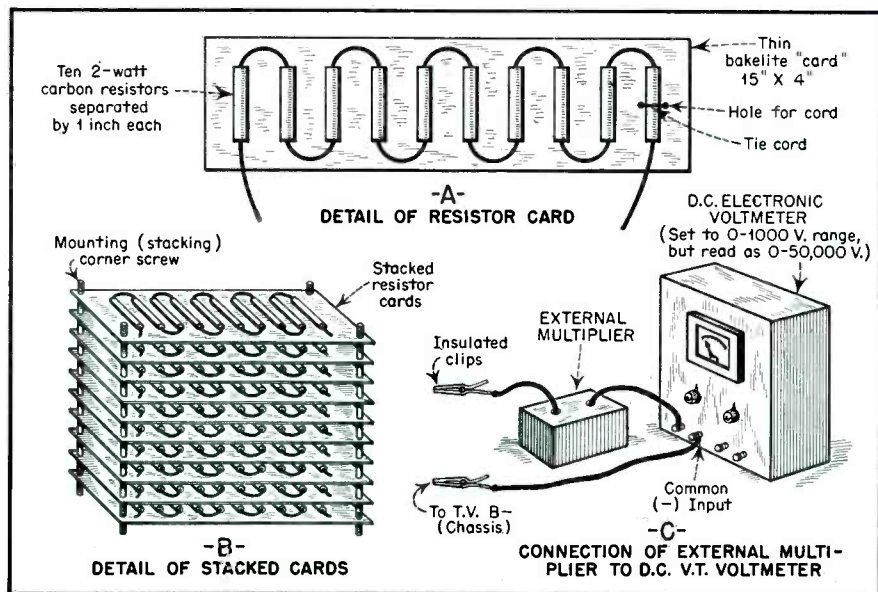


Fig. 4—Details of external multiplier construction.

The 4- μf high-voltage section in Fig. 5 is obtained by series-connecting three 12- μf Eimac (or equivalent) vacuum capacitors. This 4- μf combination has a voltage rating of approximately 68 kilovolts r. m. s.

The total capacitance of this external voltage divider is approximately 3.99 μf , a low value which has minimum detuning and loading effect upon the high-frequency TV power supply, provided short leads

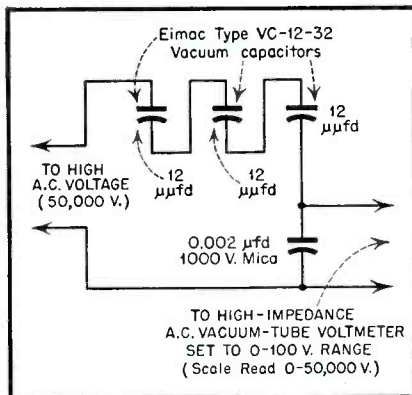


Fig. 5—Capacitive voltage divider for high voltage a-c measurements with low voltage a-c VTVM.

are employed between the power supply, voltage divider, and VTVM, and provided the divider components are mounted far enough apart to minimize stray shunt capacitance.

Ordinary meter rectifiers, such as the oxide type, are not satisfactory for this type of a-c measurement because of their poor high-frequency response. Crystal rectifiers, while possessing excellent frequency characteristics at the frequencies employed

in TV power supplies, are unable to withstand the high peak inverse voltages encountered. The vacuum tube instrument accordingly is indispensable for such measurement.

Precautions and Techniques

So much has been printed in recent years regarding safety precautions in handling high voltage equipment that every operator would be expected by now to be on the alert at all times and to be well versed in rules of procedure. But there still remains such an appalling lack of regard for safety that we are compelled to recapitulate here the precautions and techniques applicable to high voltage testing.

Following are a dozen of the most important points:

- (1) Do not use test prods with a high-voltage meter. Instead, connect the meter leads to the high-voltage points by means of insulated clips while the power supply is cold. Then switch-on the power supply and take a reading. Switch-off the power supply before disconnecting the leads.
- (2) Do not permit any portion of the body to come into contact with the power supply, voltmeter, or test leads.
- (3) Keep the test leads well separated even when they are well-insulated. Do not allow the test leads to rest on metallic objects.
- (4) After switching-off a high-voltage power supply, short-circuit the filter capacitors with a screwdriver or similar tool with an extra long thickly-insulated handle, in order to

[Continued on page 45]

MARKERS for VISUAL ALIGNMENT

by **WALTER H. BUCHSBAUM**

WHEN aligning an amplifier whose response curve has a particular shape or where the bandwidth is important, the response curve must either be plotted graphically or must be made visible on an oscilloscope. By using a special sweep frequency signal generator in conjunction with the 'scope it is possible to actually see the frequency response curve on the 'scope. This generator generates a mean frequency which is varied both above and below this value at a constant rate. Most such instruments vary the frequency at a 60 cycle, sinusoidal rate. We say that they furnish a signal, frequency modulated with a 60 cycle sine wave.

The signals pass through the amplifier and are amplified according to the frequency response of the unit under test. If just a single frequency would pass through, a DC voltage would result at the detector, and this DC voltage would be a measure of the gain of the signal in the amplifier. When a sweep frequency generator is used, a number of d-c voltages like that, varying according to the gain at each particular frequency appear at the second detector.

Since the frequency of the generator output changes according to a 60 cycle motion, the d-c voltage at the detector will also change in 60 cycle variation, and produce an exact replica of the actual frequency response curve of the amplifier. The signal on the 'scope then has a 60 cycle frequency, and the horizontal sweep must be of the same form as the sweeping action of the sweep fre-

A timely article on the types and requirements of marker generators as applied to TV servicing and alignment.

quency generator. Most generators use a 60 cycle sine wave for sweeping, and since the 'scope uses a sawtooth sweep, this latter has to be turned off and the sine wave horizontal sweep voltage from the generator

it will blank out all or a portion of the response curve or it may change not satisfactory without some means of a frequency reference. The curve in *Fig. 1* shows a video i-f response curve, without any marking indications. How would you know that the bandwidth is 4 mc between half power points? How would you know where the sound and where the picture i-f carriers are? The only way to tell is to introduce an additional signal or a wavetrap (dip) which makes a mark on the response curve and permits reading off its frequency on a suitable scale.

An ordinary signal generator can be used to provide marker signals if it covers the range of the frequencies under alignment. The signal from the regular signal generator is amplified just as the various frequencies from the sweep generator and would normally result in a d-c voltage at the second detector. This d-c voltage would appear as a raising of the d-c level of the trace on the 'scope at a point corresponding to the frequency of the marker signal. Since the trace of the 'scope forms the frequency response curve, the small d-c voltage due to the marker signal appears as a "pip" or small wiggle on the response curve.

If the marker signal is too strong the appearance of part of the re-

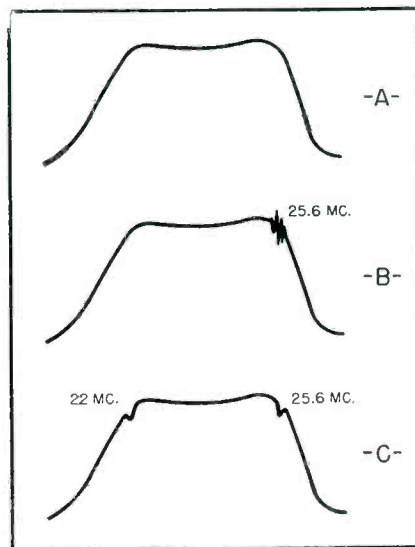


Fig. 1—Video response curves with and without markers.

connected to the horizontal input terminals of the 'scope.

Need For Marker "Pips"

While the method outlined above gives a good idea as to the shape of the frequency response curve, it is



Fig. 2—Hickok Model 610 TV sweep frequency signal generator.

sponse curve. Since the output of most signal generators is adjustable, simply reduce the marker generator output.

It is not enough to just see a marker signal at one point of the response curve and know that this corresponds to a certain frequency, because in order to check bandwidth, peak separation or trap alignment, the difference between at least two points on the frequency response curve must be known. Some marker systems feature fixed crystal controlled markers appearing every few megacycles. In this system it is necessary to interpolate between markers to find the exact spot you want.

Many sweep frequency signal generators incorporate a marker generator, like the Hickok Model 610 shown in Fig. 2. Here the marker can be varied from 20 to 30 mc which is just sufficient to cover the most frequently used television i-f band. Only two controls deal with the marker, the frequency adjustment and the control marked "Marker Injection" which controls the amplitude of the marker signal. When a sweep generator is used that does not have an internal marker generator or where the marker signal does not cover the required range, it becomes necessary to use external marker signals.

Method for Obtaining Marker "Pips"

Any signal generator covering the desired frequency range can be utilized to provide a marker signal. Depending on the amount of amplification of the amplifier under alignment and the output level of the sweep generator, the marker signal can either be connected directly in parallel with the output of the sweep generator, or else some other method can be used.

Often, when the output probe of the marker generator is connected in the same places as the output probe from the sweep generator, it may be impossible to reduce the marker output enough so that the curve is not distorted or blanked out by the marker signal. In that event the strength of the marker signal can often be reduced by using a resistance pad or a low capacity series condenser, if the frequency is low enough. It is found frequently that it is sufficient to just connect the "high" side of the marker output probe to the amplifier chassis, leaving the grounded side unconnected.

Some sweep generators, like the Hickok model 610, contain provisions for connecting up additional marker signals, when, for instance, the RF amplifier of a television receiver is

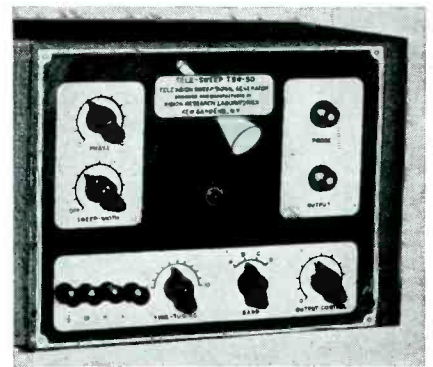


Fig. 3—Vision Telesweep TSW 50.

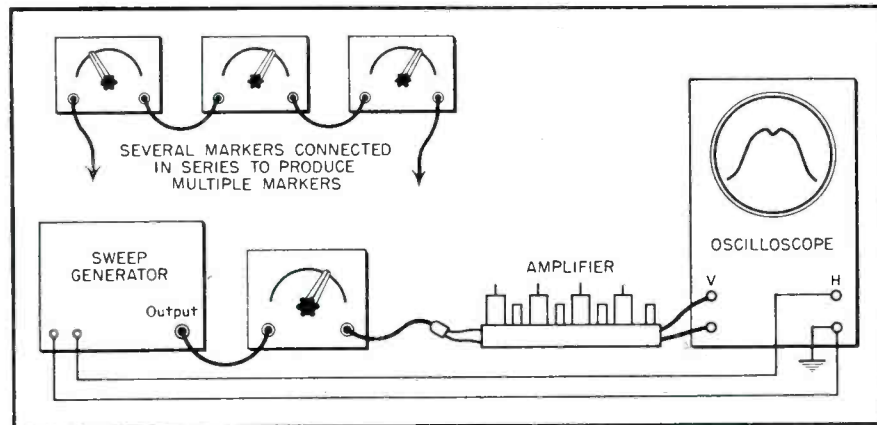


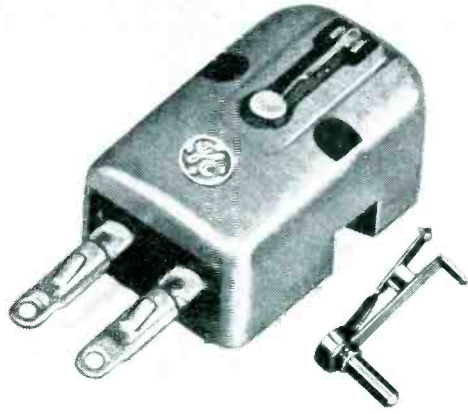
Fig. 5—Connecting marker, signal generator, and 'scope.

aligned. In that case the internal marker has to be turned off and the external marker source is connected to the marker terminal; or if a crystal is used, through the crystal terminals.

The Vision Telesweep TSW 50, shown in Fig. 3 has a special terminal where any marker signal is connected. This terminal leads through a coupling condenser to the potentiometer controlling the output of the sweep generator. No additional connection from the marker generator is then necessary and the sweep signal already contains the marker sig-

[Continued on page 44]

NEW!



G-E VARIABLE RELUCTANCE CARTRIDGE


*with the replaceable stylus for
Conventional and Long Playing Records*

NOW—in one small unit—all the sales and performance advantages of the G-E Variable Reluctance Cartridge plus this additional consumer economy feature—the Replaceable Stylus.

Negligible needle scratch and needle talk, minimum record wear, wide frequency response, freedom from resonance peaks, realistic reproduction—these are maintained at all times, simply, easily, economically with the Replaceable Stylus.

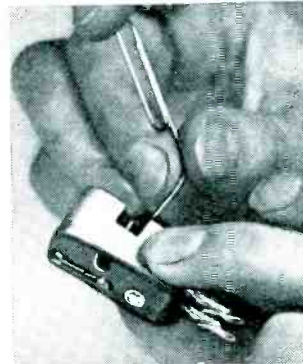
No more changing of the entire cartridge means more frequent replacement of stylus by the consumer because he can do it himself so easily.

Four simple steps—and presto! The worn stylus is replaced and maximum high quality performance is restored for the critical listener.

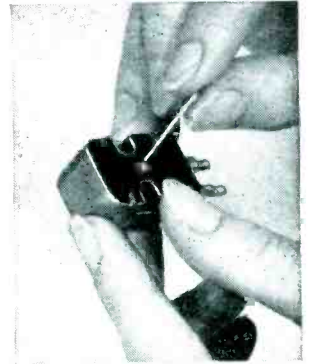
Note, too, these additional features: 

- **New notched design . . . one-third smaller . . . improved shape . . . more generally adaptable to various tone arms.**
- **More clearance for record changers.**
- **Higher lateral compliance for more faithful tracking.**
- **More economical for the customer—more sales for the dealer.**
- **Cartridges available for LP records with 1 mil stylus; for conventional records with 3 mil stylus.**

For complete information on the new Variable Reluctance Cartridge write: *General Electric Company, Electronics Park, Syracuse, New York.*



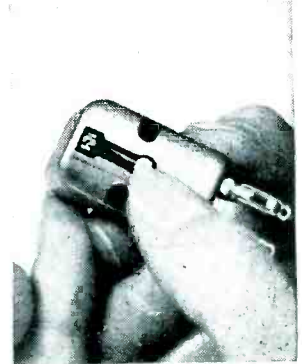
1 Simply remove cartridge from tone arm.



2 Use paper clip or wire to force stylus out of the cartridge.



3 Insert new stylus into cartridge with fingers.



4 Press firmly into position with thumb nail.

You can put your confidence in—

GENERAL  ELECTRIC

178-H1

CIRCUIT COURT

Majestic Model 8FM775

One tube which is finding increasing favor among designers of combination AM-FM receivers is the 6S8GT, and deservedly so, for it was developed for just the purpose for which it is being employed.

One version of the use to which this special tube is put is illustrated by the circuit of the Majestic Model 8FM775. This seven tube instrument is of the series-filament type, and but for the phono motor could operate on d.c. as well as a.c.

A portion of the schematic, illustrating the limiter, detector and first audio stages, is shown. The tube under discussion will be seen to consist of a duo-diode-triode and an extra diode, in one envelope. Note that the extra diode has its own cathode brought out to a socket terminal.

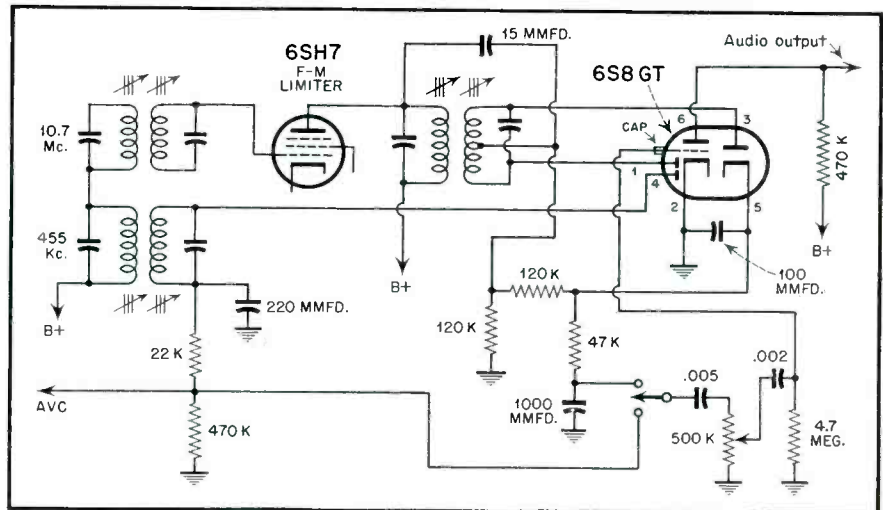
The i-f stages not shown are of the usual dual variety, ending up with series primaries in the last stage. The secondaries have no connection, going to their separate circuits. The AM secondary feeds the 455 kc. signal to one of the diode plates in the common portion of the tube. A.V.C. and audio voltages appear at the other end of the coil. The function switch passes the audio on to the triode section of the 6S8 where it is amplified.

In the FM position, the discriminator transformer has one end of its secondary connected to the remaining diode plate of the common section and the other end to the plate of the extra diode. The cathode of the latter section of the tube develops AM across its load, subsequently de-emphasizing it in an RC filter and supplying output to the volume control and triode section, via the function switch. Note that the triode grid comes out the top of the tube.

The triode section is signal-biased, via the 4.7 meg. resistor, and has plate voltage limited by the large 470 K ohm plate resistor.

Woolaroc Model 3-71A

This seven tube chassis covers the standard broadcast and FM bands, has series-connected heaters and em-



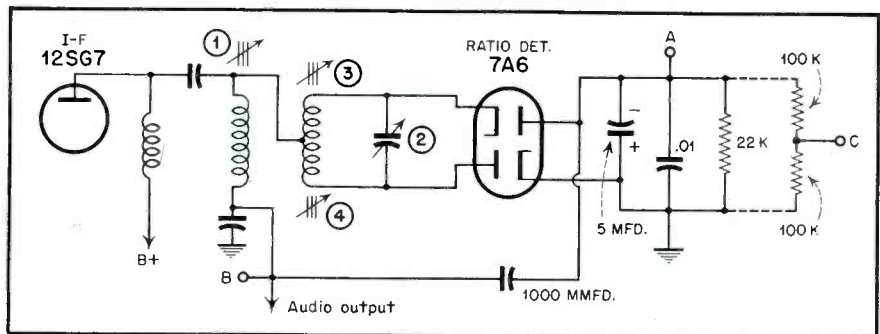
Application of the 6S8GT tube in the Majestic Model 8FM775.

loys a dry-disc type of rectifier. A 6SB7 converter is followed by two stages if i.f. on both 455 kc and 10.7 mc using type 12SQ7 tubes. FM detection takes place in a 7A6 dual-diode. Details of this stage are shown in the partial schematic. AM detection and audio amplification take place in a 12SQ7 and two 35L6 tubes.

The last i-f stage is shunt-fed and the plate load at 10.7 mc is provided

quality, from a ratio detector hinges on the condition of balance between the two halves of the transformer secondary. Some designers depend on accurate winding of the coil. Others supply a core which can be adjusted after installation to balance the voltage at the ends of the coil.

This design makes use of two cores, in addition to the trimmer capacitor. With these adjustments it is possible to adjust the resonant



FM detector stage in the Woolaroc Model 3-71A receiver.

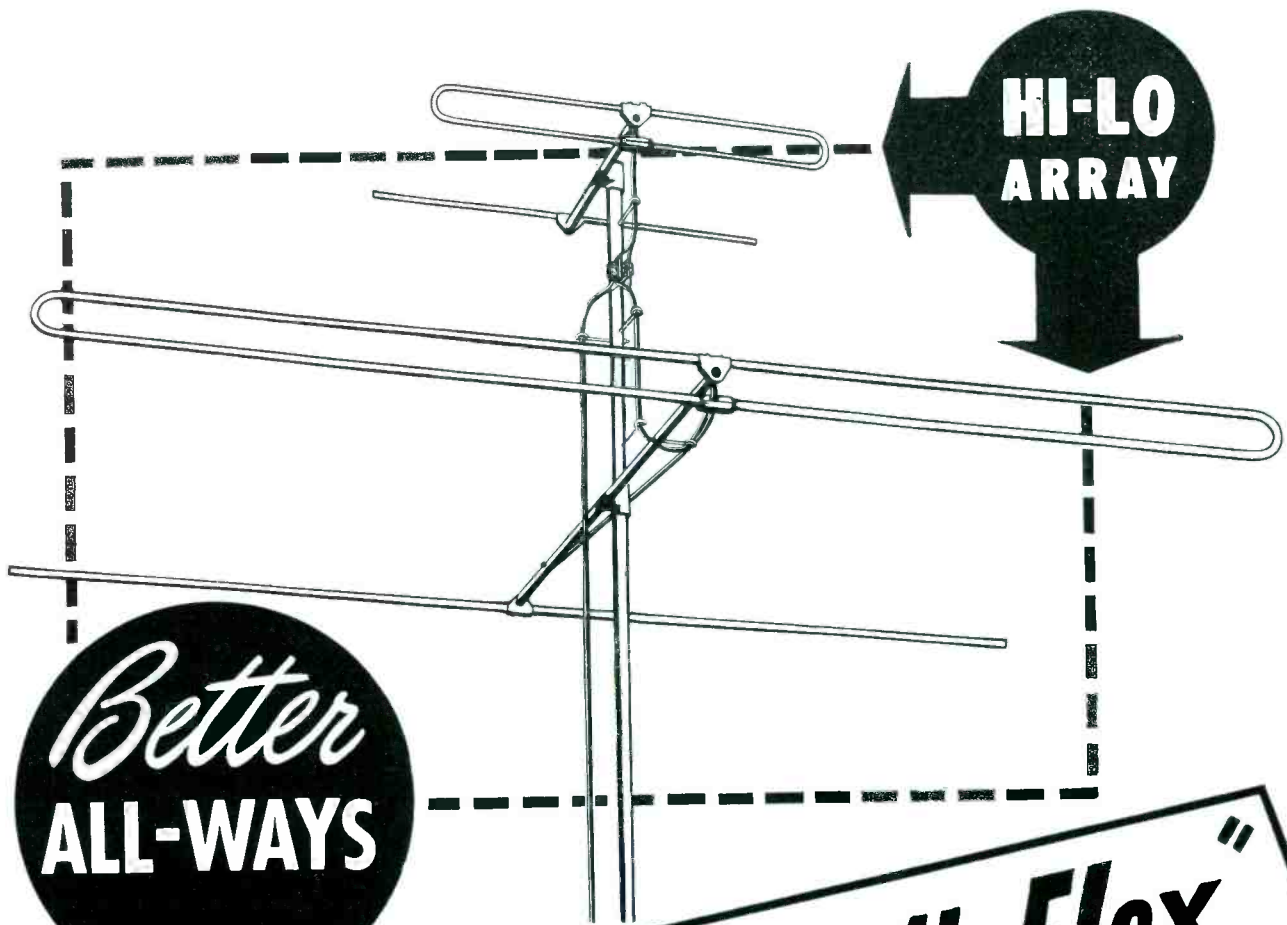
by a slug-tuned primary in the coupling transformer between it and the ratio detector. The usual connection from the high impedance end of the primary to the center of the secondary is made. The secondary is resonated by a trimmer capacitor. This much of the circuit is conventional.

The problem of getting adequate noise reduction, and incidently symmetrical tuning and optimum tone

frequency, the balance and the bandwidth. This can be best explained by briefly going over the adjustment procedure.

With a signal of 10.7 mc applied to the i-f stage shown, and a VTVM connected between point A and ground, the primary slug is adjusted for maximum indication. With two equal resistors in series across the

[Continued on page 42]

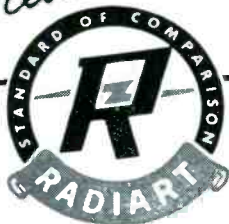


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TELEVISION and FM ANTENNAS
THE QUALITY ANTENNA LINE

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Electrically **OUTPERFORMS ALL OTHERS**

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 • **MADE TO STAND UP!**



IT'S RIGHT WHEN IT'S RADIART!

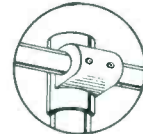
THE RADIART CORPORATION

CLEVELAND 2, OHIO

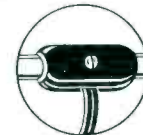
MANUFACTURERS OF THE FAMOUS RED SEAL VIBRATORS



No "assembly puzzles" with Radiart's "SIMPLI-FLEX" design. No degree in engineering or truck-load of tools needed — absolutely no loose hardware. One minute assembly, one man installation!



High strength, well engineered design of more than ample safety factor, with simple, sturdy all aluminum castings, elements, and heat-treated support masts for PERMANENT installations.



"WEATHER-SHIELD" polystyrene terminal block encloses lead-in connections and protects from all weather conditions! Keeps electrical performance at maximum.

NEW PRODUCTS

TV INDOOR ANTENNA

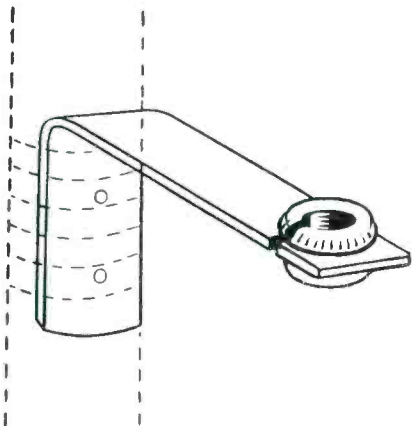
Radion, the portable, indoor T-V antenna manufactured by Radion Corp., 1137 Milwaukee Ave., Chicago, Ill., has passed the 100,000 sales mark. Now original equipment for most T-V manufacturers Radion antennas are also sold by dealers from coast to coast, and production facilities are now being extended to handle the increased demand.



The Radion antenna is versatile both in installation and in use. It can be placed on the T-V set, on the floor, or on a window sill, and it can be turned in any direction. The arms can be extended to 92 inches for channeling. It comes in black bakelite or mahogany base, with polished nickel arms and will be available in a variety of base colors at an early date. An extensive advertising program is in preparation for trade papers and newspapers in telecasting centers.

DOWNLEAD ACCESSORY

A new accessory designed to prevent excessive wear and strain on exposed downleads is the Stand-Off #376, manufactured by the L. S. Brach Mfg. Corp., 200 Central

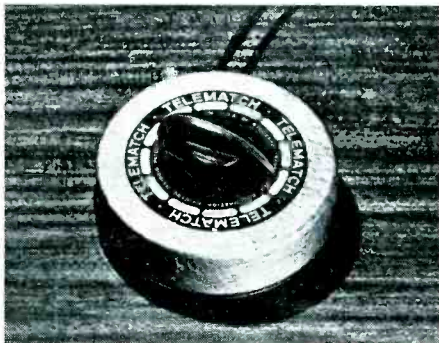


Avenue, Newark, N. J., pioneers in the development of radio and TV antennas and accessories. The Stand-Off may be mounted with screws to a side wall, with self-tapping screws directly to the antenna mast, or taped securely onto the mast. Improved reception resulting from a three-inch minimum spacing of the downlead from the mast is assured, and the downlead is adequately protected at the same time.

The Stand-Off may be used with either twin lead-in or coaxial cable, and is available in two sizes: #376, with a 3-inch arm; and #377, with a 6-inch arm.

TV ANTENNA MATCHING DEVICE

Elimination of the electrical mismatch existing between antenna and receiver in nearly all television receiver installations is made possible by a new device, tradenamed Telematch, according to the manufacturer, Standard Transformer Corporation, Chicago.

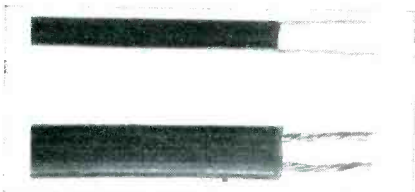


Correcting this mismatch enables the full broadcast signal picked up by the antenna to be delivered, with minimum loss, to the receiver for greatly improved reception.

The Telematch is quickly installed by attaching two cable lugs to the receiver antenna input terminals. No tubes or electricity are used. Unit may be mounted behind receiver or used on top of cabinet. Finished in rich brown and hammertone gold with plastic control knob.

TWO HUNDRED OHM LINE

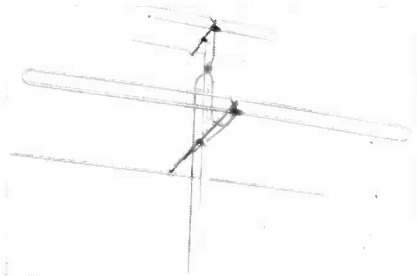
The La-Pointe-Plascomold Corp., Unionville, Conn., manufacturers of the VEE-D-X line of TV accessories announce a new transmission



line, X 200 A. Shown below in comparison with ordinary 300 ohm line, (the 200 ohm line is on bottom) the X 200 A Transmission line has a physical dimension of .650" x .300". It contains 2 strands of wire of which each strand is composed of 7 strands of #21 wire. Its nominal impedance is 200 ohms. The attenuation in db per 100 feet at 30 megacycles is 0.6 and at 100 megacycles is 1.1. The X 200 A Transmission line has low losses and is not affected by moisture.

NEW TV ANTENNA

Radiart Corporation, Cleveland, Ohio, manufacturers of vibrators, vibrator power supplies and auto radio aerials, announces a new line of "Simpli-Flex" antennas. These antennas may be built up from simple dipole to multiple-stacked, all channel arrays as required, and may be obtained in complete packages of simple or complex arrays. Conversion kits are available to add to original bas. in-

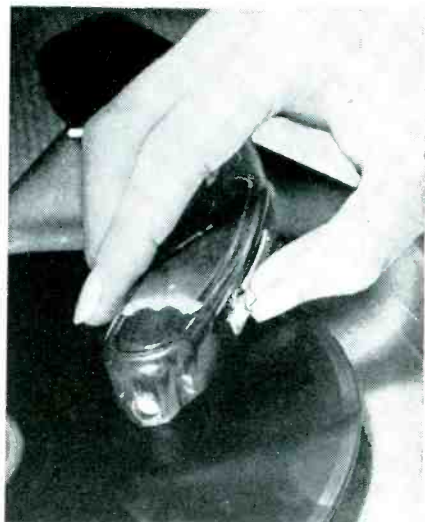


stallations where changing conditions make it desirable to increase utility and effectiveness.

Streamlined aluminum elements plus rugged support brackets and large diameter high-strength masts, assure ample safety factor and permanent installations. Top electrical performance is maintained by a "Weather-Shield" terminal block made of polystyrene, which encloses lead-in connections. For further information, see your jobber or write the Radiart Corporation, 3571 W. 62, Cleveland 2, Ohio.

NEW PICKUP

The mere flip of this switch shifts Sonotone Corporation's new "Titone" pickup from one needle point playing the standard 78 rpm. record to another point which will play either



of the new 33 1/3 rpm. or 45 rpm. discs. This all-in-one pickup for all types of records is the latest development of the original ceramic device previously announced by Sonotone, manufacturer of hearing aids.

ELECTRIC HAMMER

A highly efficient adaptor tool for drilling into cement, stone, brick, tile, etc., has been placed on the market by the Roto-Power Corp., 283 Greene Ave., B'klyn, 5, N. Y. Called "Pow'r Ham'r," it converts an electric drill into a powerful hammer.

Built small for ease of operation, its size is 6-7/16" x 1-3/8". Self contained lubrication is provided, and it comes complete with two holders to fit 10 sizes of Rawplug drill bits,

Have ALL THE FUN
SAVE 2/3 THE COST

Build YOUR OWN TEST EQUIPMENT

1 Heathkit VACUUM TUBE VOLTMETER KIT

Everything you want in a VTVM. Shatterproof solid plastic meter face, automatic meter protection in burn-out proof circuit, push pull electronic voltmeter circuit assuring maximum stability. Linear DC and AC scales. AC and DC full scale ranges of 3V-10V-30V-100V-300V-1000V. A total of 24 ranges. Isolated DC test prod for signal tracing and measurements of voltage while instrument is in operation. An ohmmeter section accurately measuring resistance of 1/10 ohm to one billion ohms with internal battery. Extremely high input resistance 11 megohms on all ranges DC and 6.5 megohms on AC. All these features and many more are the reasons hundreds of radio and television schools are using Heathkit VTVM's and recommending them to all students. Like all Heathkits, the VTVM kit is complete, 110V. 60 cycle power transformer, 200 microamp meter, tubes, grey crackle cabinet, panel, test leads, 1% ceramic precision divider resistors and all other parts. Complete instruction manual. Better start your laboratory now.

Shipping weight 8 lbs. **\$24.50**

2 Heathkit SINE AND SQUARE WAVE AUDIO GENERATOR KIT

The ideal instrument for checking audio amplifiers, television response, distortion, etc. Supplies excellent sine wave 20 cycles to 20 000 cycles and in addition supplies square wave over same range. Extremely low distortion, less than 1%, large calibrated dial, beautiful 2 color panel, 1% precision calibrating resistors, 110V. 60 cycle power transformer, 5 tubes, detailed blueprints and instructions. R.C. type circuit with excellent stability.

Shipping weight 15 lbs. **\$34.50**

3 Heathkit CONDENSER CHECKER KIT

Checks all types of condensers, paper mica — electrolytic — ceramic over a range of .00001 MFD. to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage of 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill.

Shipping weight 7 lbs. **\$19.50**

4 Heathkit SIGNAL TRACER KIT

Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V. 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions. Small portable 9" x 6" x 4 3/4".

Shipping Wt. 10 lbs. **\$19.50**

Heathkits are beautiful factory engineered test equipment kits supplied complete but unassembled with all parts — tubes, grey aluminum cabinets, punched, formed and plated chassis, calibrated panels, ready wound coils and complete detailed instruction manuals for assembly and use. With costs zooming up, Heathkits save the labor cost of assembly enabling thousands to have equipment which they otherwise could not afford.

5 The NEW 1949 HEATHKIT 5-INCH OSCILLOSCOPE KIT

New improved model of the famous Heathkit Oscilloscope. Building an oscilloscope is the finest training for television and newer servicing technique and you save two-thirds the cost. All the features and quality of instruments selling for \$100.00 or more. Supplied complete with cabinet, two color panel, 5B1 tube, 2 5Y3 tubes, 2 6SJ7 tubes and 884 generator tube. Power transformer supplies 1000 volt negative and 350 volt positive. Sweep generator 15 cycles to 30 M. cycles. Has vertical and horizontal amplifiers. Oil filled filter condensers for long life. Complete blueprints and instructions included.

Shipping weight 25 pounds. **\$39.50**

6 Heathkit FM AND TELEVISION SWEEP GENERATOR KIT

A necessity for television and FM. This Heathkit completely covers the entire FM and TV bands 2 megacycles or 230 megacycles. The unit is 110V. 60 cycle transformer operated. Uses two 6J6 tubes, two 6C4 tubes and a 6X5 rectifier. An electronic sweep circuit is incorporated allowing a range of 0 to 10 MC. A sawtooth horizontal sweeping voltage and phase control are provided for the oscilloscope.

The coils are ready assembled and precision adjusted to exact frequency. As in all Heathkits, the best of parts are supplied, Mallory filter condenser, zero coef. ceramic condensers, all punched and formed parts, grey crackle cabinet, 5 tubes, test leads, etc. Better get it built now and be ready for the FM and TV business. Shipping Wt. 6 lbs. **\$24.50**

7 Heathkit SIGNAL GENERATOR KIT

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V. 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4 3/4". Ship. Wt. 7 lbs. **\$19.50**

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Anchor drill bits and others from No. 6 wood-screws size to $\frac{5}{8}$ ". A chuck for other manufacturers, drill bits available, as well as special attachments for riveting, peening, caulking, chipping, scaling, paint removing, body and fender work, etc.

NEW ASTATIC PICKUPS

A complete line of newly engineered phonograph playing arms, cartridges and related equipment, for use with the new long-playing

records, now is being produced by The Astatic Corporation, Conneaut, Ohio.

Seventeen different pickup models are included in the new array of Astatic products, offering wide range of price, choice of crystal or magnetic type units, additional broad choice such as cartridges with diamond, sapphire or precious metal needles.

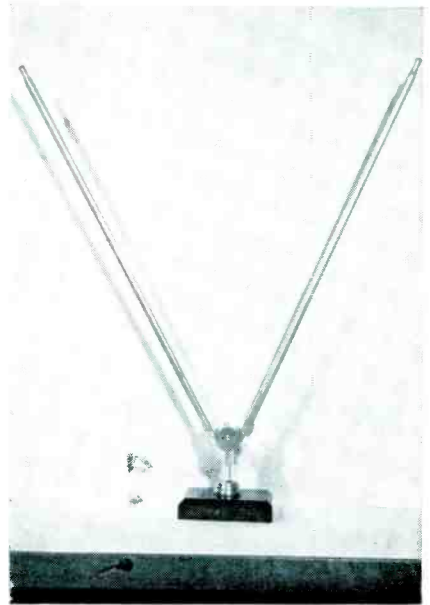


Included in this new line is the FLC-33 long playing crystal pickup; the 510-QT-33 crystal

pickup, another long playing unit containing the "Quiet Talk" series cartridge which is employed here with a special one mil tip radius precious metal or jewelled stylus: the Model 510-MI-2M-33 magneto-induction pickup, and many others, the complete details and specifications of which may be had on request by writing the manufacturer directly.

NEW INDOOR TV ANTENNA

Public Operating Corp., 100 W. 42 St., N. Y. C. announces production of a new portable, indoor TV antenna, Model Gyro-tenna type V-1.

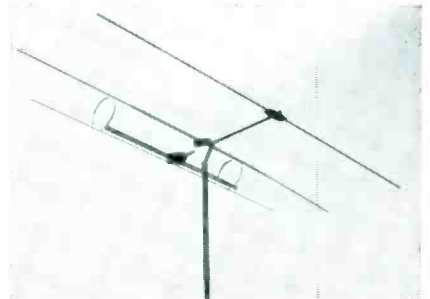


The V-1 will be sold nationally through distributors in all televised territories. This is an entirely new type of indoor television and FM antenna, mounted on a catalin base and lucite rod, consisting of two extendable dipole elements which can be extended out to a total of 35" on each element. Likewise each element can be raised or lowered and the entire antenna may be rotated for the best antenna location.

The Gyro-tenna type V-1 is designed for broad band coverage for channels 1 through 13 on television and all standard FM frequencies.

MULTIPLE REFLECTOR ANTENNA

Tricraft Products Co., 1535 N. Ashland Ave., Chicago, Ill., announces their new Model 1000



antenna for TV-FM. A gain of 10 db over a half wave dipole in the high band and $5\frac{1}{2}$ db in the low is claimed, as well as a low standing wave ratio. Wing nuts are supplied for all bolts. No tools are needed to assemble the antenna which comes complete with all hardware and 65 feet of 300 ohm twin lead wire.

NEW TV FRONT END

Vision Research Laboratories Inc. announce their new TV front end tuner Model TF 701, featuring a combination of inductance and

TeleFILTER

MAKES YOUR TV SELLING

Easier



BECAUSE IT:

- Eliminates Eyestrain
- Sharpens Contrast
- Reduces Glare



Notice, when demonstrating TV, the pleased expression on customers' faces. They'll beam when the picture becomes clearer and sharper as you place a TeleFILTER over the screen. For TeleFILTER, like magic, brings the picture to life. *There's no easier way to sell television!*

TeleFILTER, a House of Television original, is made of highest grade optical plexiglass in all sizes to fit every screen. Blue tint actually heightens contrast and eliminates eyestrain due to glare. Attaches in 15 seconds with self-backed adhesive strips. Liberal discounts.

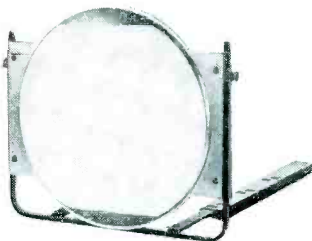


The original and genuine TeleFilter

MULTIVISION SCREEN

MAGNIFYING LENS: "Featherweight!" Extra-wide angle... no distortion at viewing angle of even 100°. Low convexity gives unusual clarity. Ideal for all table and console models... fits 7" or 10" screen. Comes in gold finish; lens in clear or glare-reducing blue. Guaranteed by *The House of Television!*

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Manufacturers of the TeleFILTER, MULTIVISION SCREEN, and SIGNAL KLEER accessories: Antennas, Indoor Antennas, Mounting Hardware, Wave Traps, Attenuator and Matching Pads, Matching Transformers, Plasticlean Cleaner.

STARRETT-LEHIGH BUILDING NEW YORK 1, N. Y.



RIDER MANUALS..

the world's most
comprehensive compilation of servicing data
—AM-FM-Television... and Allied Fields!

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The first industry-wide public address equipment Manual, incorporating the amplifier production of 147 manufacturers from 1938 to 1948. 2024 Pages plus "How It Works" Book which explains theory of various PA circuits and method of rapidly locating faults. Index also included. \$18.00 complete.



The RADIO AMATEUR'S BEAM POINTER GUIDE

... by John F. Rider (W2RID)

By merely consulting the charts of this book you can accurately point your beam to any country or island in the world containing amateur prefix listing. The book contains a country-prefix list, a cross index of prefixes and countries... also gives complete explanation of great circle maps, magnetic compass variations, etc.

32 pages. 8 1/2" x 11"..... \$1.00

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Servicing by Signal Tracing, 360 pages illustrated.....	\$4.00
Understanding Vectors and Phase, 160 pages, paper binding, 99¢.....	\$1.89
Vacuum Tube Voltmeters, 180 pages, illustrated.....	\$2.50
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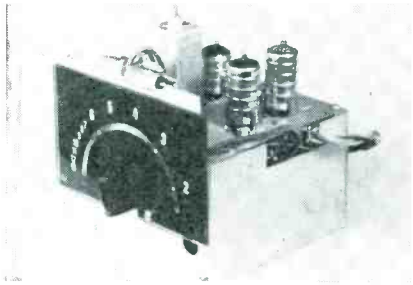
Your Jobber Carries a Full Line of RIDER MANUALS
RIDER MANUALS mean SUCCESSFUL SERVICING

NOTE: The Malory Radio Service Encyclopedia, 6th edition, makes reference to only one source of all radio receiver schematics — Rider Manuals. ANOTHER NOTE: The C-D Capacitor Manual for Radio Servicing, 1948 edition No. 4, makes reference to only one source of receiver schematics — Rider Manuals.

Any book which is not available at your Jobber may be ordered direct from

JOHN F. RIDER, PUBLISHER, Inc., 480 Canal St., New York 13, N. Y.

Export Agent: Rocke International Corp., 13 East 40th Street, N. Y. C., Cables, ARLAB



capacity variation this unit tunes continuously over all 12 channels with substantially constant bandwidth.

Frequency gaps between channels, as from 6 to 7, are bridged in one smooth motion, so that a 180° rotation of the tuning device covers

all channels making tuning as simple as in a broadcast receiver.

Compactly designed it measures 3 x 4 x 4 1/2 inches and contains conventional r-f amplifier, oscillator and mixer circuits. This unit is available to manufacturers and dealers and comes complete with lighted lucite dial and planetary reduction drive.

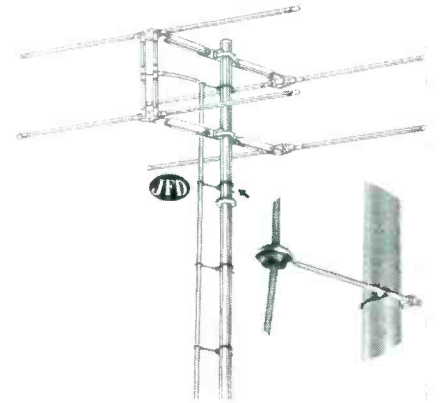
For complete details contact manufacturer at 87-50 Lefferts Blvd., Richmond Hill 18, N.Y.

DOWNLEAD STANDOFFS

The JFD Manufacturing Co., Inc., 4117 Ft. Hamilton Parkway, B'klyn 19, N. Y., announces the manufacture of a complete assortment of Mast-Clamp Screw Eye Stand-Offs for use in securing Twin Lead or RG type lines to any size mast or element from 1/2" to 2" in diameter.

Made with polyethylene, JFD Mast-Clamp Screw Eye Stand-Offs assure efficient high

frequency transmission and unchanged impedance from antenna to receiver. By anchoring Lead-In wire in place, these stand-offs pre-

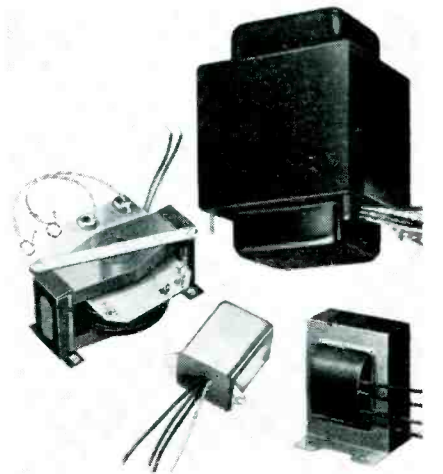


vent line damage due to slackening and twisting—thus helping improve TV/FM reception.

A folder describing the entire JFD Mast-Clamp Stand-Off line is available upon request from the manufacturer.

NEW TV TRANSFORMERS

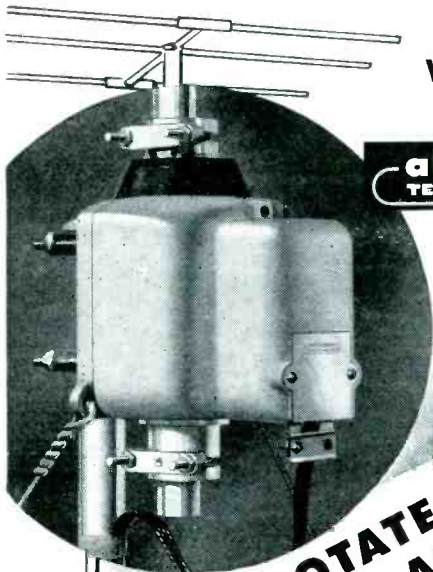
Now available from stock is a complete line of television transformers, designed to fit the circuits of leading TV receiver manufacturers. Made by Chicago Transformer Division, 3501 W. Addison St., Chicago 18, Illinois, this new line provides the serviceman with the convenience of exactly matched replacements. To small set manufacturers and producers of television kits, etc., the line offers proven design and top quality.



Included in the line are television power transformers, vertical blocking oscillator transformers, vertical scanning output transformers, and a horizontal scanning output transformer. A four-page, illustrated catalog with complete descriptions, dimensions, and replacement guide is available.

Television is "Tops"

WITH TENNA·ROTOR



alliance
TENNA·ROTOR

GETS **STRONGER SIGNALS**

ROTATES TV AND FM ANTENNA

LIST PRICE **\$39.95**



CONTROL BOX
Size of box 5" x 5"

Operates in any weather.
Fits most types of antenna.

Alliance Tenna-Rotor is an electric antenna rotator. It assures correct antenna "beaming"—gives positive control of antenna rotation to select the exact position for "peaked" reception! Tenna-Rotor is quick and easy to install—the electric powered rotor unit resists corrosion—is enclosed in a split zinc, die-cast housing, and is operated from a plastic control box which plugs into any 110 volt, 60-cycle house circuit. A 3-position switch rotates antenna clockwise or counter clockwise and stops it at the right point. Four-conductor inter-connecting cable from rotor to control box is made available at 5 1/2¢ per foot.

TV and FM service dealers, and users, will find that the Alliance Tenna-Rotor simplifies and improves new and existing installations!

Write for catalog sheet and illustrated folder.

alliance motors

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO
Export Department; 401 Broadway, New York, N. Y., U. S. A.

Model
ATR
Size of
rotor
unit
7 3/4"
x 5 1/4" x
8"

Shipping
Weight
12 lbs.

Takes
Max
Antenna
O.D.
of
1 3/8"

BUY
U.S.
SECURITY
BONDS
NOW!

TRADE FLASHES

[from page 10]

dealers abreast of the latest developments in radio and television, and to assist them with technical problems encountered in the field.

New Transvision Plan

Transvision, Inc. of New Rochelle, N. Y., announces the introduction of a new 3-point plan whereby Radio or Electrical Servicemen can become television dealers. Details of the Transvision 3-point Dealer Set-Up are as follows:

The serviceman can make money by assembling Transvision Television Kits and re-selling them with standard Transvision cabinets as completed receivers.

The serviceman can make money through the sale of Transvision's "Custom-Art" line, exclusively designed by Charles Allenbrook, noted artist and designer.

The serviceman can make money through the resale of the nationally advertised line of Transvision Television Kits, Cabinets, Antennas, Components and Accessories.

For further information write to Transvision direct.

Belden FM Ant Sales Kit

To assist dealers and servicemen in the promotion of better FM reception in their areas, Belden Manufacturing Company is including a complete promotion Kit with standard packages of the new Belden Poly-Point FM Antenna.

The Kit includes posters, literature, and newspaper ad mats featuring the Belden Antenna.

R.M.A. Reports

More than 975,000 television receivers were produced during 1948, bringing the postwar total TV set production to at least 1,160,000, the Radio Manufacturers Association reported today. An additional 25,000 to 30,000 unassembled TV set kits were reported to have been manufactured last year.

More than 200 million radio receiving tubes were sold in 1948 by RMA member-companies, the Radio Manufacturers Association reported today. Tube sales during last year totalled 204,720,378, an increase of more than five million over the 199,533,827 tubes sold in 1947.

Following is a month-by-month table on television and radio set production by RMA member-companies for the year 1948:

	TV	FM-AM	AM	All Sets
January	30,001	136,015	1,173,240	1,339,256
February	35,889	140,629	1,203,087	1,379,605
March	52,137	161,185	1,420,113	1,633,435
April	46,339	90,635	1,045,499	1,182,473
May	50,177	76,435	970,168	1,096,780
June	64,353	90,414	959,103	1,113,870
July	56,089	74,988	552,361	683,438
August	64,953	110,879	759,165	934,997
September	88,195	171,753	1,020,498	1,280,446
October	95,216	170,086	869,076	1,134,378
November	122,304	166,701	827,122	1,116,127
December	161,179	200,326	876,315	1,237,820
Totals	866,832	1,590,046	11,675,747	14,132,625

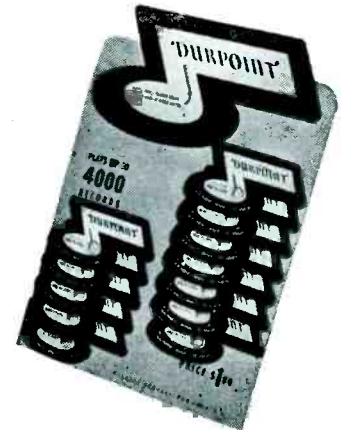
Month-by-month table on television and radio set production for 1948.

DEALERS' CHOICE

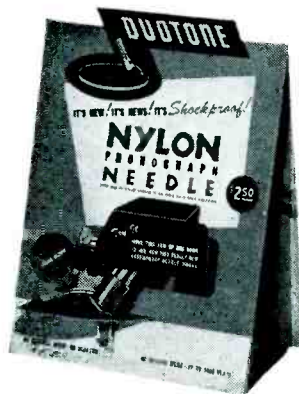
THREE DUOTONE NEEDLES PUT PEP IN ACCESSORY SALES



THE "STAR"—A top-quality sapphire-tipped needle, the Duotone "Star" has rolled up sales records in stores across the country. Entirely hand made, long-wearing, individually tested and inspected. Packed in individual transparent lucite containers. Free display cards and national advertising boost sales. List price \$5.00.



THE DURPOINT—The Duotone Durpoint answers the steady demand for a good, permanent needle at low cost. Plays thousands of records without changing. Takes additional polish from record groove, reducing surface noise and record wear. Twelve needles on an eye-catching display, each packed on individual card. List price each needle, \$1.00.



THE SHOCKPROOF NYLON—The Duotone Shockproof Nylon needle is really shockproof, will absorb shock when whole tone arm is bounced on record. Twelve needles in individual transparent plastic containers on three-dimensional self-demonstrating display. Free demonstration needle and two counter signs with each card. List price each needle, \$2.50.

THE **DUOTONE** COMPANY, INC.

799 Broadway New York 3, N. Y.

Rochester TV

Rochester can expect television by June 1, Dr. Ray H. Manson, Stromberg-Carlson president stated recently. The company's video station WHTM is scheduled to be on the air with a test pattern in April, affording ample time for final adjustments before inaugural ceremonies.

E-V Sales & Service Kit

A combination sales and service kit of Electro-Voice "Torque Drive" Crystal Pickup Cartridges offers service-dealers and distributors a unique merchandising opportunity.

With the 3 models in a single Kit, a serviceman can immediately replace any one of over 150 standard type cartridges in common use. Each Torque Drive Kit contains 6 assorted cartridges with replaceable needles, 4 extra needles and needle holders, and consumer pamphlet. For further information, write for Kit Bulletin to Electro-Voice, Inc., Buchanan, Michigan.

ASSOCIATION

NEWS

Philadelphia Radio Servicemen's Association, Philadelphia, Pa.

Television Industries of B'klyn, N.Y., presented a program on their 20" x 26" projection TV kit. The arrangements were made by Almo Radio of Philadelphia, and Sam Marshall, managing editor of Radio Service Dealer Magazine delivered a technical analysis of the unit, accompanying his talk with slides. Among those who attended were men from Delaware, Maryland, New Jersey, and many of the Eastern parts of Pennsylvania. The Franklin Institute Auditorium, in which the meeting was held, was filled to capacity.

Associated Radio Service Dealers, Columbus, Ohio.

Newly elected officers for the coming year are: Ray Horney, Pres.; George Dykes, Vice-Pres.; Olin Payne, Sec.; Gordon Barber, Treasurer. The Board of Directors are: Danna Young, Chas. Hildreth, Wm. Whiting, Dave Sears, John Graham, and A. Brown of Appliance Distributing Co., representing the Associate Jobbers.

The Association celebrated its 5th birthday at the December meeting. The ARSD Weekly TV school is giving its members a thorough training in TV from the ground up.

Lackawanna Radio Technicians' Association of Pennsylvania.

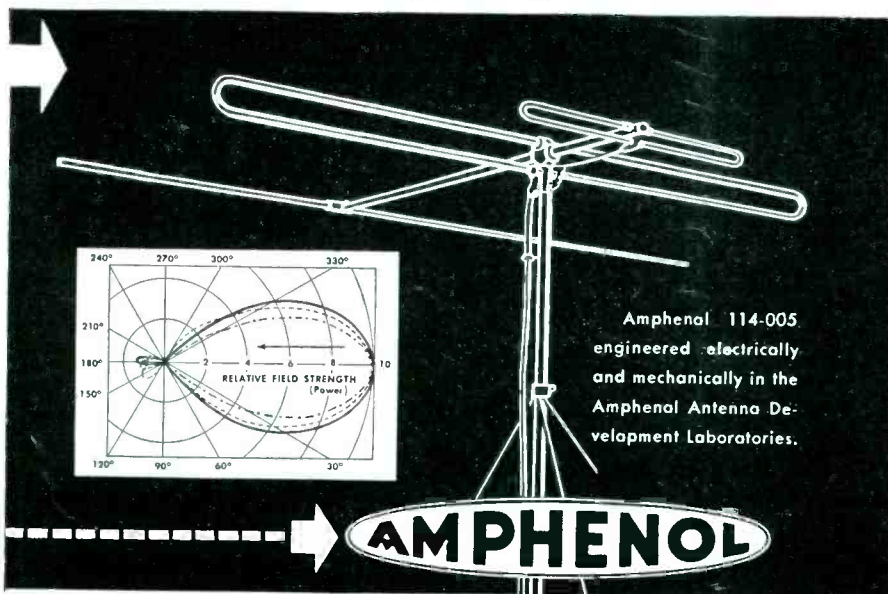
Leon Helk, Chairman, writes us—"As Chairman of the group, I shall make at our next meeting the entertainment for motion, that we adopt Radio Service Dealer as our official publication"—

The Scranton Tribune reports that complaints of dissatisfied customers of local radio repair shops have diminished considerably since organization of IRTA.

The Middle Tennessee Radio and Television Servicemen's Association.

A new organization with the following officers: Ed Klugman, Pres.; Ed McGavock, Vice-Pres.; Tom Borchert, Sec.; E. B. Newkirk, Treas.— Best wishes for a long and successful Association, men.

AMPHENOL TV ANTENNA



ADDED GAIN MEANS BRILLIANT RECEPTION ON ALL BANDS

Streamlined and scientifically engineered for best reception and optimum gain, the Amphenol 114-005 Television Antenna incorporates two broadbanded folded dipoles and a low band reflector, with a common transmission line. Top performance is provided over all channels in both the high and low bands.

The radiation patterns as diagrammed are substantially unidirectional and maintain high front-to-back and front-to-side ratios over both bands.

The 114-005 is ideal for use with rotators.

MORE SIGNAL STRENGTH BRIGHTER PICTURES

Standard Amphenol TV Antenna in stacked array (Model 114-301 or 114-302) provides additional high-gain for fringe areas. Each bay of the antenna may also be individually oriented in areas requiring reception from different directions.



AMERICAN PHENOLIC CORPORATION
1830 SO. 54th AVE. • CHICAGO 50, ILLINOIS

Associated Radio-Television Servicemen of New York City.

The 8th meeting of the TV Training Program arranged by the ARSNY was attended by more than 450 servicemen who came from all parts of the metropolitan and surrounding areas. The meeting, sponsored by Hickok Elec. Instrument Co., was on "Alignment and Associated Test Equipment." On March 2, Sylvania Electric Products presents a lecture on "Servicing and Associated Test Equipment." The three remaining lectures of the series will be given on March 16, April 6, and May 4, by prominent manufacturers. In addition a final lecture on Cathode Ray Tubes and Circuits is scheduled for an undetermined date in the future, to be given by Transvision, Inc.

Kingston Radio Servicemen's Association of Kingston, N. Y.

H. E. Matthews, Sec. of the KRSA writes us that we had listed the address of this organization incorrectly in our January listing of associations throughout the country. The correct address is as follows: Kingston Rad. Ser. Men's Assn. % Matthews' Radio Service, 6 Furnace St., Kingston, N.Y.

Federation of Radio Servicemen's Association of Pennsylvania.

The picture you see below was taken on the occasion of the presentation of a plaque to James M. Skinner representing Philco Corporation at a recent expressed the appreciation of the Federation for Philco's TV training program for servicemen.



To All Associations:

Radio Service Dealer Magazine, your mouthpiece, urgently requests all associations throughout the country to send in regularly, news of their activities and doings. If we can serve as the medium for the interchange of ideas between organizations so that all can benefit by incorporating those procedures which are of obvious benefit to them, we will be more than repaid for our efforts.

BACK NUMBERS of "RSD"

Order them now - the supply is low.

- JANUARY 1946**
Applying Neg. Feedback in Audio Amps.
New Philco FM Circuit
RMA Resist. & Conds. Chart
- FEBRUARY 1946**
Applying Neg. Feedback in Audio Amps.
Service Market in Industrial Electronics
Ballast Tube & Plug-in Resistor Chart
- APRIL 1946**
Modern Tube Testing, Part 1, Methods
Servicing Sound Systems
Short-cuts on Intermittants by use of "Substitution Block"
- JUNE 1946**
Modern Tube Testing, Part 2, Instruments
Short-cuts in Trouble-Shooting
Ohmmet., Cond-Testers, Cap-Met., Part 2
- JULY 1946**
Distortion—Determining the Cause, Part 1
Ohmmeters, Cond-Testers, Cap-Met. Part 2
Multivibrators
- AUGUST 1946**
How Is Your Grid Biased? Part 1
Distortion—Determining the Cause, Part 2
Sound Distribution Systems
- SEPTEMBER 1946**
Transconductance-Reading Tube Tests
How Is Your Grid Biased, Part 2
Centralized Radio Servicing
- NOVEMBER 1946**
The TV Opportunity—Installing & Servicing
Don't Miss "Hidden" Profits, Part 1
Service Market in Industrial Electronics
- DECEMBER 1946**
Modernizing Sets by Using New Rectifiers
Deflection Generators in TV
Guide for Miniature Electron Tubes
Answers to FM Servicing Problems
- FEBRUARY 1947**
Simple Methods to Determine Impedances
Servicing Record-Changers
How To Block Interference
- MARCH 1947**
Antenna Multicouplers
Servicing P-A Installations
Trade Standards for TV Installations
Industrial Maintenance
- APRIL 1947**
Using Your Scope in Radio Servicing
Analysis of Coil Checkers
"Sparx" At Work
Trouble-Shooting in P-A Installations
- MAY 1947**
Oscillator & Power Supply Troubles
Ion-Trap in C-R Tubes
P-A System Design & Applications, Part 1
- JUNE 1947**
Simplified Set Checking
P-A System Design & Applications, Part 2
TV Installing Is A Specialty Business
Servicing 3-Way Portables

- JULY 1947**
Frequency Modulation, Part 1, antenna fundamentals & signal shifting effects
Automatic Gain Control Circs. in TV Sets
Using Conventional Sig. Gen. for FM Align.
- AUGUST 1947**
TV R-F Circuits Described
FM, Part 2, receiver circuit fundamentals
TV Antenna Installation Problems
- SEPTEMBER 1947**
Substitution Boxes Lick Service Problems
TV Antennas for Multi-Unit Dwellings
FM, Part 3, Discrim. & Deaccentuation Nets.
- OCTOBER 1947**
Add Record-players to Modernize Old Sets
P-A Fundamentals & Complexities
Modern TV Kits
- NOVEMBER 1947**
TV Antennas—Their Characteristics & Applications
Bookkeeping Simplified
Make A Universal Test Speaker
Eliminating Cathode Heater Hum from Audio Amplifiers
- DECEMBER 1947**
A New TV Set Servicing Technique
Ratio Detection & Its Applications
External Cross Modulation—Its Cause & Cure
- JANUARY 1948**
Master vs Indoor TV Antennas
Audio Extractor for Signal Generators
TV Kit Alignment Procedures
70 Volt Speaker Distribution Line
- FEBRUARY 1948**
High Speed Servicing
Visual Alignment
Income Tax Deductions
- MARCH 1948**
Know Your Tube Tester
TV Power Supplies
A-C/D-C Battery Set Circuits
- APRIL 1948**
Video I-F Circuits & Applications
Computing What Price to Charge
Using Scopes For Radio Servicing
- MAY 1948**
FM Set Alignment Procedure
Video Detectors
How Vectors Simplify Servicing
Significance of Power Factor and Q
- JUNE 1948**
Amplifier Checking by Signal Injection
Applications of Gas Type Tubes
Modern TV Kits
- JULY 1948**
Television's Service Outlook
Video Amplifiers
Bad Acoustics Cured Electrically
- SEPTEMBER 1948**
De-emphasis In FM Set Circuits
Video Amplifiers, D-C Restorers
Simple Wattmeter

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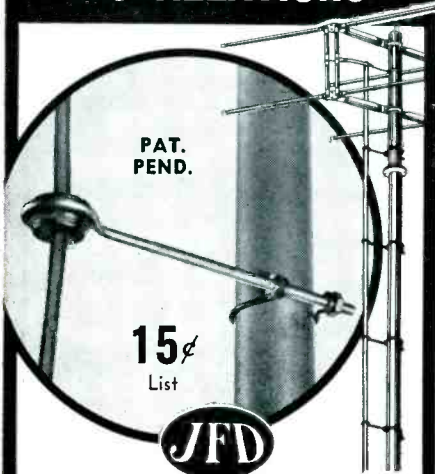
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FOUND!

the "MISSING LINK" to
GOOD TV ANTENNA
INSTALLATIONS



MAST CLAMP LEAD-IN SUPPORTS

Made with POLYETHYLENE
(the ultra-low loss insulation material)

Now you can make any old or new TV installation last longer, look neater, perform better with the unique JFD Mast-Clamp Lead-In Supports. These new Screw Eye Insulators are JFD-engineered to anchor lead-ins firmly in place and assure better TV/FM reception.



TL100-350
1" Clamp with 3/2" Screw Eye for Twin Lead.
Standard Ctn. 100
15c
List



RG100-350
1" Clamp with 3/2" Screw Eye for Coaxial Cable.
Standard Ctn. 100
15c
List



DTL100-350
1" Clamp with 3/2" Screw Eye for two Twin Leads.
Standard Ctn. 50
35c List



DBR18TL3
3/2" Screw Eye with wood-screw thread, for two Twin Leads.
Standard Ctn. 50
28c List

Most Clamps are made in all sizes for all applications, individually designed to fit masts from 1/2" to 2" O.D. Screw Eyes range from 3/2" to 12" in length.

Visit JFD Booth at Chicago Parts Show

JFD MANUFACTURING CO. Int.

6113 16th Avenue B'klyn 4, N. Y.

WRITE TODAY
for Valuable 4-page Bulletin #DBR

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FIRST In Television Antennas and Accessories

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TRADE LITERATURE

Miniature Tube Data . . . Raytheon Mfg. Co., 55 Chapel St., Newton 58, Mass. Contains a listing of over 70 receiving type miniature tubes and their characteristics in chart form. Included in the four-page folder are all pertinent characteristics, applications, terminal connection diagrams, and outline drawings for every miniature receiving type tube now announced and produced by all tube manufacturers. This chart should prove of great value and usefulness. Available free on request.

Socket and Mounting Notes Raytheon Flat Press Subminiature Tubes . . . Raytheon Mfg. Co., 55 Chapel St., Newton 58, Mass. Contains information about subminiature tube sockets, and explains methods of connecting to the tube, shielding it, and potting it. Very well illustrated. Available free on request.

Amphenol Engineering News Vol. 1, No. 11 . . . American Phenolic Corp., 1830 South 54th Ave., Chicago 50, Ill. Of interest to the Radio Service Dealer is an illustration and description of the Amphenol TV stacked array. Available free on request.

Sylvania News Vol. 15, No. 11 . . . Sylvania Electric Products Inc., P.O. Box 431, Emporium, Pa. TV Video I-F Amplifiers, by Franklin L. Burroughs. Gain and Bandwidth Requirements, gain control, tube characteristics, circuits, and traps are discussed. Included in this issue is a technical section index. Available free on request.

TV Receiving Antenna . . . Crosley Division, Avco Mfg. Corp. This booklet describes various types of antennas, transmission lines, matching systems, and installation techniques. Also contains charts and design factors.

Radio and TV Service Policy . . . Bendix Radio, Baltimore 4, Maryland. Contains information pertaining to Bendix Radio and TV warranties and sales-service policy; operating procedures; forms and printed material; part designation and coding system; coding; and personnel directory.

NEW . . . All Aluminum SELF-SUPPORTING TOWER

FOR HIGH GAIN
ARRAYS

Roof Mounted

Easy to Erect
Easy to Climb

The new, all aluminum RADIO-DYNE* Tower and Top Mast offers you the best in TV reception for home or store. This 44 ft. structure of graceful curves and shining beauty accommodates up to 4 arrays . . . holds antennas high up in the blue, where signals are stronger — and where interference is weaker. Ideal for operation in "fringe areas." The roof-mounted Radiodyne — easy to erect and easy to climb — exerts less pressure on the roof than would the weight of a child!

Gale-Proof
Weather-Proof

The sturdy Radiodyne ignores both high winds and heavy weather. All angle pieces are made of strong, heat-treated corrosion-resisting aluminum alloys possessing great strength. Forged steel fastening bolts and two-piece "universal-joint" feet are heavily zinc plated to withstand long outdoor service.

"Eiffel Tower"
Construction

The "Eiffel Tower" effect of the Radiodyne "44" makes it especially pleasing to the eye. The actual purpose of the design, however, is to give a pre-load to vital structural members . . . thus making the whole tower considerably stronger.

RADIODYNE TV TOWER MODEL 44

(ILLUSTRATED)

- Overall Height (To Top of Mast) 44'
- Height (Tower Only) 35'
- Mast Height (Above Tower) 9'
- Mast Length (Inside Tower) 3'
- Mast Outside Diameter 2"
- Number of Tower Sections 3
- Length of Tower Sections 12'
- Base 4'6" x 4'6"
- Top of Framework 8" x 8"

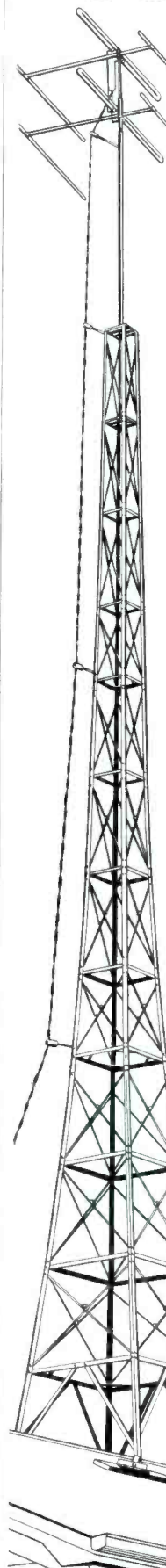
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For complete information on Radiodyne Towers for Amateur Radio, TV and FM — send a card to:

**WESTERN COIL &
ELECTRICAL CO.**

(Established 1915)
215 STATE ST.
RACINE, WIS.

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Basic Information Sources . . . Inquiry Reference Service, U.S. Dept. of Commerce. A listing of publications dealing primarily with trade and other general aspects of radio and TV. Those wishing references to technical material may consult the releases of the National Bureau of Standards, and the Office of Technical Services, listed on page 2, and the magazines listed on pages 8, 9, and 10. Available on request.

Advances in Printed Circuits

U. S. Dept. of Commerce, National Bureau of Standards, Miscellaneous Publication 192. Printed circuits have emerged from purely laboratory experiments to become one of the most practical new ideas in mass production of electronic devices. Although many of the new techniques were known and used long ago, printed circuits as we understand them today represent a comparatively recent accomplishment. The scope of the book is indicated by the following chapters: Painting, Spraying, Chemical Depositions, Vacuum Processes, Die-Stamping, Dusting, Performance, and Applications. The book consists of 10 chapters, totaling 43 large, two-column pages. It is adequately illustrated with 21 half-tones, 18 line cuts, and 5 tables. Available from the Supt. of Documents, U.S. Govt. Printing Office, Wash. 25, D.C. Price 40 cents.

FIELD FINDINGS

[from page 12]

by eliminating need for critical orientation, and finally it will give the set owner maximum satisfaction and results. A selling point is that a fine TV antenna installation with the best possible array is a good investment for it will not need to be replaced even when the set owner decides that he wants to buy a bigger screen or better TV set than the one originally purchased.

Legal Aspects of P-A

SEVERAL times we have mentioned here that the Supreme Court has affirmed that municipalities *must* permit the use of public address systems as a Constitutional privilege. There are no qualifications about this ruling as the Court stated that to deny one the use of a sound distribution system was in effect denying one the right of free speech. However, there are times and circumstances when the use of a P-A

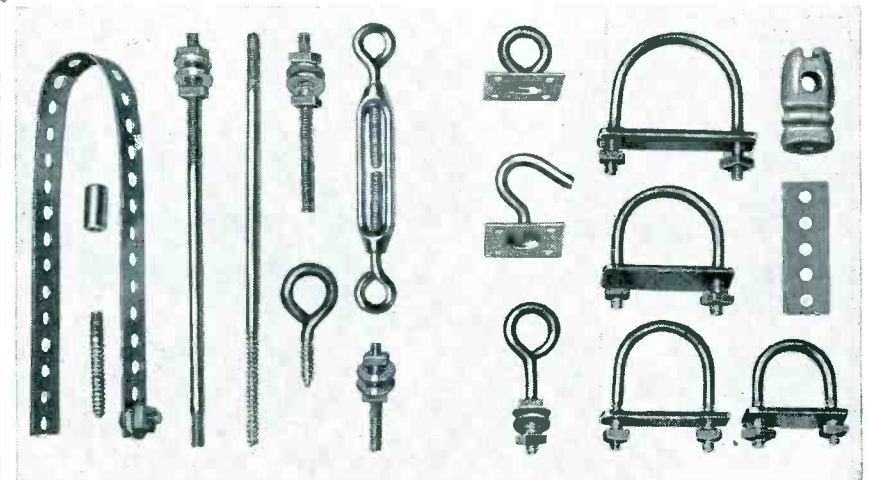
system can be limited or stopped by authorities, and rightfully so. For example, it is perfectly legal for law enforcement authorities to ban the use of P-A systems: At unreasonable hours of the night when such use might interfere with the sleep of private citizens; or, if the degree of loudness is such that it can cause harm or annoyance to listeners; or, if the character of sound distributed is of such nature as to detract from people engaged in normal occupations or pleasures.

It is a normal part of a Radio Service Dealer's routine business to rent out P-A systems when possible. When a P-A rental is arranged for, simply make sure that you don't use it too loudly or offensively. For example don't do what one chap did. He there making announcements that people should go to see the show playing at another theatre down the block. Another P-A renter got into trouble when the user of his equipment drove down the highways using

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insulators that embody actual insulating qualities even in rain or sleet; all hardware is heavily zinc plated to withstand long outdoor service (passes 100 hr. salt test); all small woodscrews are case-hardened. Radiodyne hardware is designed by and expressly for experienced radio and television servicemen. Ask your Radio Parts Jobber to show you the complete Radiodyne line.

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derisive language to people driving old cars, telling them to buy new cars at a certain auto sales agency. Still another P-A renter got in trouble with the law when he allowed the user to exhort people to go to a church of a certain denomination, hinting that if they didn't do so, they would wind up in Hell. That's a Hell of a note, but it proves that when properly used no one can prevent you from renting out your P-A equipment.

CIRCUIT COURT

[from page 30]

detector load resistor to obtain a center tap, the trimmer capacitor is then adjusted for minimum indication between the tap and point B. The tap is marked point C.

Then, with the signal generator set for 10.4 mc, slug 3 is set to give maximum indication between ground and point A. At 11 mc the maximum indication is reached by adjusting slug 4. The repetition of adjustments 2, 3 and 4 till no further improvement is obtained will result in optimum performance from the circuit.

Motorola Model 47B11

An interesting provision is made in the Motorola Model 47B11, a home-type battery operated instrument, for conserving battery life. A partial schematic, showing the 3Q5 output stage and battery supply, illustrates the details.

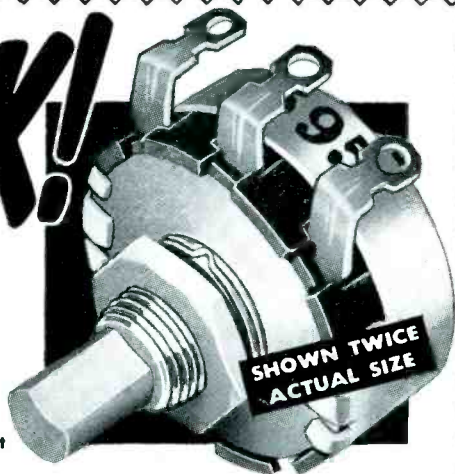
The 3Q5 tube has a dual filament, designed for operation on either 1.4 or 2.8 volts. The current drain of the separate sections of the filaments is 50 milliamperes each. Full filament emission can be obtained by either of two connections, series or parallel. In the latter case the drain is 100 ma.

The plate current of such a tube is naturally dependent on the grid bias. If provision is made to vary the bias it is possible to control the plate current. While only one bias value is correct for minimum distortion, it is true that at low volume levels the distortion will not be excessive if the bias is increased to a point where drain is sharply reduced.

Reference to the schematic will disclose two switches. The one indicated as S1 is the ON-OFF switch, and closes circuits to both A and B

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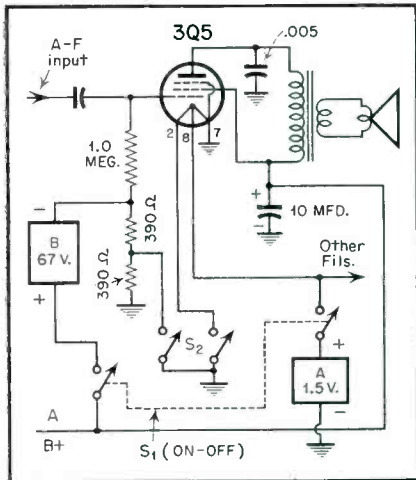


Controls and Resistors

CLAROSTAT MFG. CO., INC. • DOVER, NEW HAMPSHIRE • In Canada: CANADIAN MARCONI CO., LTD. Montreal, P. Q., and branches

batteries. Note that the *A* battery connects only to one half of the filament. The tube will operate satisfactorily at low levels with the low emission, and the total drain on the *A* battery is 200 ma. The other section of the switch connects the negative terminal of the *B* battery to ground via two 390 ohm resistors in series. The drop across these resistors is applied as bias to the output tube.

The second switch, marked *S*₂, is the battery saver switch in the position shown. When it is closed the other half of the 3Q5 is energized and one of the 390 ohm resistors is shorted out. Both *A* and *B* drain are increased, but full power is available from the tube.



Motorola 47B11 switching.

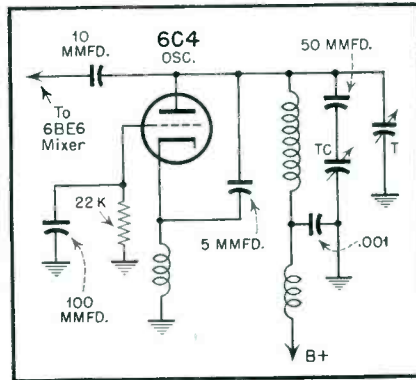
Monitor Model M-3070

The advent of FM bands on receivers for the home has brought to light many ingenious circuit details. Probably no circuit has received more attention, and produced more variations, than the high frequency oscillator. This is not surprising, since at the high frequencies now in use, it is not easy to achieve the required stability and uniformity of output.

The Monitor Model M-3070 attacks the problem from an angle which appeals to numerous designers, but with no more in common with other separate oscillator tube circuits than the use of a 6C4 miniature tube.

A portion of the complete schematic is shown to bring out the points to be explained. It might be well to point out that this set used separate front-ends for the AM and FM services. All coils and tuning condensers are used for one function only and no switching is done in signal frequency circuits.

The oscillator circuit is a variation of the time-tested Hartley circuit. It will be recalled that the conditions for oscillation to take place are that the grid of the tube connect to one end of the tank circuit, the plate to the other end and the cathode to be tapped somewhere along the coil.



Monitor M-3070 oscillator

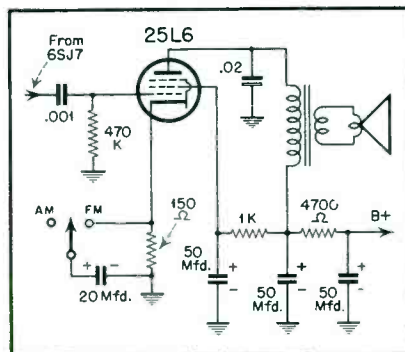
The conditions are fulfilled in the present case by the following method: the grid is at ground potential for r-f voltages by virtue of the 100 μ f capacitor to ground. D.C. bias is developed across the 22K ohm resistor. One end of the tank circuit, consisting of the coil and associated condensers, is also at ground potential by the path through the .001 μ f capacitor.

The tube plate connects directly to the opposite end of the coil and the cathode is effectively tapped up on the coil by having it return to ground through an r-f choke. Feedback is augmented by the 5 μ f capacitor from the plate to the cathode.

Crosley 88T Series

An unusual provision for increasing audio gain, and low frequency response, when the set is switched to FM operation is found in the Crosley 88T Series.

The output stage, employing a 25L6 tube, derives its bias from a 150 ohm

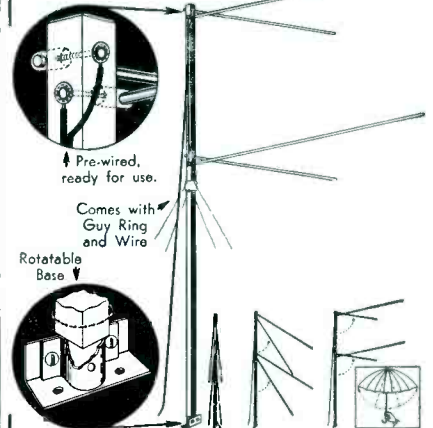


Crosley 88T output stage.

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 - Guy ring and guy wires provided for added rigidity.
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- and REMEMBER, "Flip-Up" COSTS ABOUT 1/2 the price of equivalent antennas!

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● SURE-FIRE IN HUMID CLIMATES! Utterly unaffected by climate, moisture, fungus! Booms sales, wins back customers.

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● RUGGED! PERMANENT! No crystals, magnets, filaments to fail! No pre-amplifiers. Ceramic TITONE performs perfectly for years!

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resistor in the cathode circuit. During AM reception there is no by-pass capacitor across this resistor. The result is degeneration and nominal gain.

In the FM position, a section of the range switch completes the circuit of a 20 μ f by-pass capacitor across the bias resistor. Degenerative action will be eliminated; gain, particularly at low audio frequencies will be increased. It is interesting to note that the coupling capacitor between audio stages is of only .001 μ f capacity, thus favoring high frequency response.

MARKERS

[from page 28]

nal by virtue of the internal design of the instrument.

A new and unique marker generator is the Vision Tele Marker TM-100 shown in Fig. 4. This unit can be used with any type sweep generator and the connections are shown in Fig. 5. Operating on the principle of an absorption type wave trap, it absorbs a small portion of that part of the sweep signal, which corresponds to the resonant frequency of the wave trap. The great advantage of this method which is employed in many marker generators, is that no matter how strong or weak the sweep signal is, the marker can never override or distort it, since only a small percentage of energy is absorbed. The "pip" created by this method is really a dip or indent in the frequency response curve, but since the Q of the wave trap is kept high this dip is quite sharp and distinct.



Fig. 4—Vision Tele Marker TM-100

Once a frequency response curve is obtained and the marker signal located, the alignment is very easy; especially when the marker is moved to the frequency under alignment in stagger-tuned i-f systems. Sometimes a number of markers are desired to appear at the same time, as for in-

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stance in production alignment of TV receivers. Several marker generators can be connected in parallel or if wave trap type markers are used, they are all connected in series with the output lead of the sweep generator.

While any standard AM signal generator can be used to supply marker "pips", a number of alert manufacturers are offering special marker generators. The most frequently seen in television laboratories are the type where a calibrated test oscillator supplies an unmodulated r-f signal for marking. The Mega-Marker, which is of this type, covers the television i-f bands and features an extra large, calibrated vernier dial.

Once the serviceman masters the method of visual alignment of FM and television circuits, he will find that marker operation presents no great problem and that a good marker generator not only speeds up the procedure, but it also assures accurate alignment, which is really important when the best in sensitivity and selectivity is required

Kilovoltmeters

[from page 26]

insure that the capacitors are completely discharged.

(5) Never probe into the wiring of a high-voltage equipment with an uninsulated tool or wire.

(6) Never make short-cut voltage tests by momentarily short-circuiting or grounding high-voltage points.

(7) Never work in any high-voltage equipment without first studying the circuit diagram thoroughly and carefully. If a diagram is not available, study the "cold" circuit. Do not stumble blindly through any piece of high-voltage apparatus.

(8) Do not use metal-cased microammeters, milliammeters, or voltmeters, nor meters with "live" metallic zero-adjuster screws, nor meters with the glass face missing.

(9) When making high voltage measurements, set the meter first to its highest range. Then, if deflection is too far downscale, switch successively to lower ranges. This simple rule often prevents meter burnout.

(10) Observe the one-hand rule. That is, keep one hand in your pocket when handling high voltages, and do your work with the other hand. A heavy electrical jolt received through one hand very likely will do less bodily damage than a shock received through both hands.



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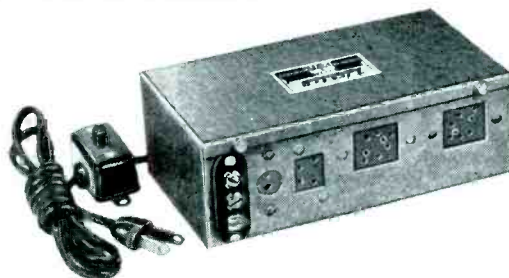


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(11) Keep the surfaces of all high-voltage test equipment free of moisture, oil, and dirt. Clean surfaces reduce the danger of flashover and minimize stray, high-order shunting resistance.

(12) In kilovoltmeters, make sure that the indicating meter is connected to the ground or B-minus end of the multiplier resistor. This reduces shock hazard which might be occasioned by a dangerous meter.

VOM

[from page 20]

Since the circuits are so similar, there seems to be no need for including a separate diagram. The use of the series condenser does introduce some error which diminishes as the frequency is increased, but at no time is this error at all serious. If it is known that no d.c. is present in the circuit under examination, the condenser need not be used; in many instruments this is accomplished by using the ordinary a-c voltage ranges for such work. Bear in mind that when using the output voltage ranges, zero DB corresponds to 1.73 volts and this is the voltage appearing across a 500 ohm load when 6 milliwatts is dissipated through the load. Most instruments calibrated to read decibels are arranged so that zero DB is located somewhere near the center of the meter scale.

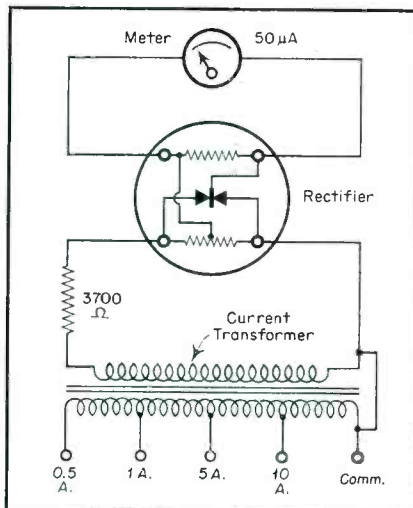


Fig. 8—A-C current measuring circuit, Triplet Model 2405-A

In some applications the ability to measure a-c amperes is very desirable as, for instance, in checking the primary current of a power transformer. At least one type of multimeter is equipped to measure values of altern-

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ating current and the simplified circuit (Triplet Model 2405-A) is shown in Fig. 8. Such measurements are accomplished through the use of a current transformer having a primary tapped for 0.5, 1.0, 5.0 and 10 amperes. When a section of this primary is connected in series with the circuit under test, current flowing through the primary induces a voltage in the secondary; the magnitude of the secondary voltage depends, of course, upon the current flow and the number of primary turns in use. The secondary voltage is applied to the meter rectifier and the rectified voltage is measured by the meter.

Additional Features

It should be borne in mind that changing from one function to another and from one range to another is accomplished through the medium of switches and, sometimes, pin jacks or binding posts. In the usual case, two switches are used; one for selecting the desired function, the second for selecting the desired range. To make operation as simple and as fool-proof as possible, some manufacturers have attempted to reduce complications in so far as possible. The Simpson Model 291 which employs a patented Roto-Ranger principle is an example of such design. A single switch performs all changes in function or range. In addition, the meter scales are changed as the switch is rotated so that there is an individual calibration for each range and the use of multiplying factors and the use of numerous scale calibrations is eliminated, since only one scale is visible at a time.

In many pocket-type instruments, the switching arrangements have been simplified as much as possible. For instance, the Weston Model 697 uses only two simple toggle switches. Supreme pocket-type meters are equipped with one switch which is operated simultaneously with the ohmmeter zero adjuster. Other instruments, notably the Precision Multi-Master line use push buttons for shifting ranges.

Large meters having easy to read scales are an important feature of many modern multimeters; this feature is often combined with the location of the most often used ranges at the top of the instrument scale, in order to afford the greatest scale length in such cases.

Finally, the provisions for measuring very high d-c voltages should be noted; an important feature, of course, in television servicing. The

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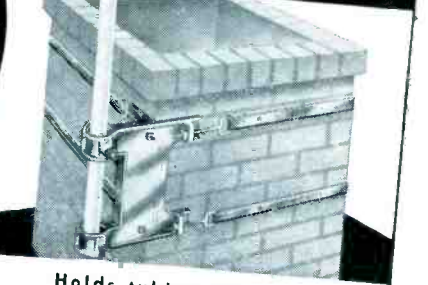
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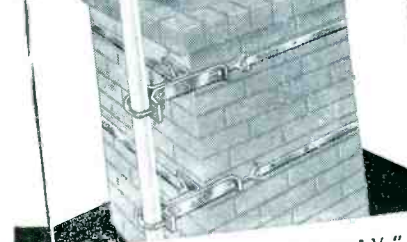
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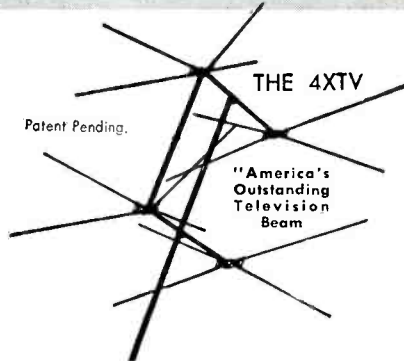
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