

radio service dealer

APRIL, 1948

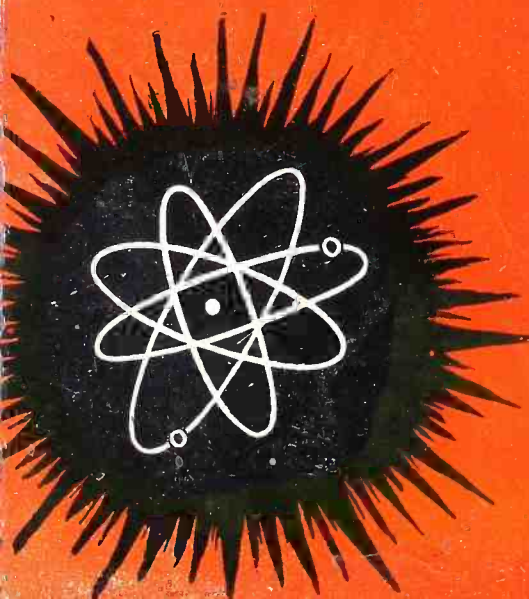
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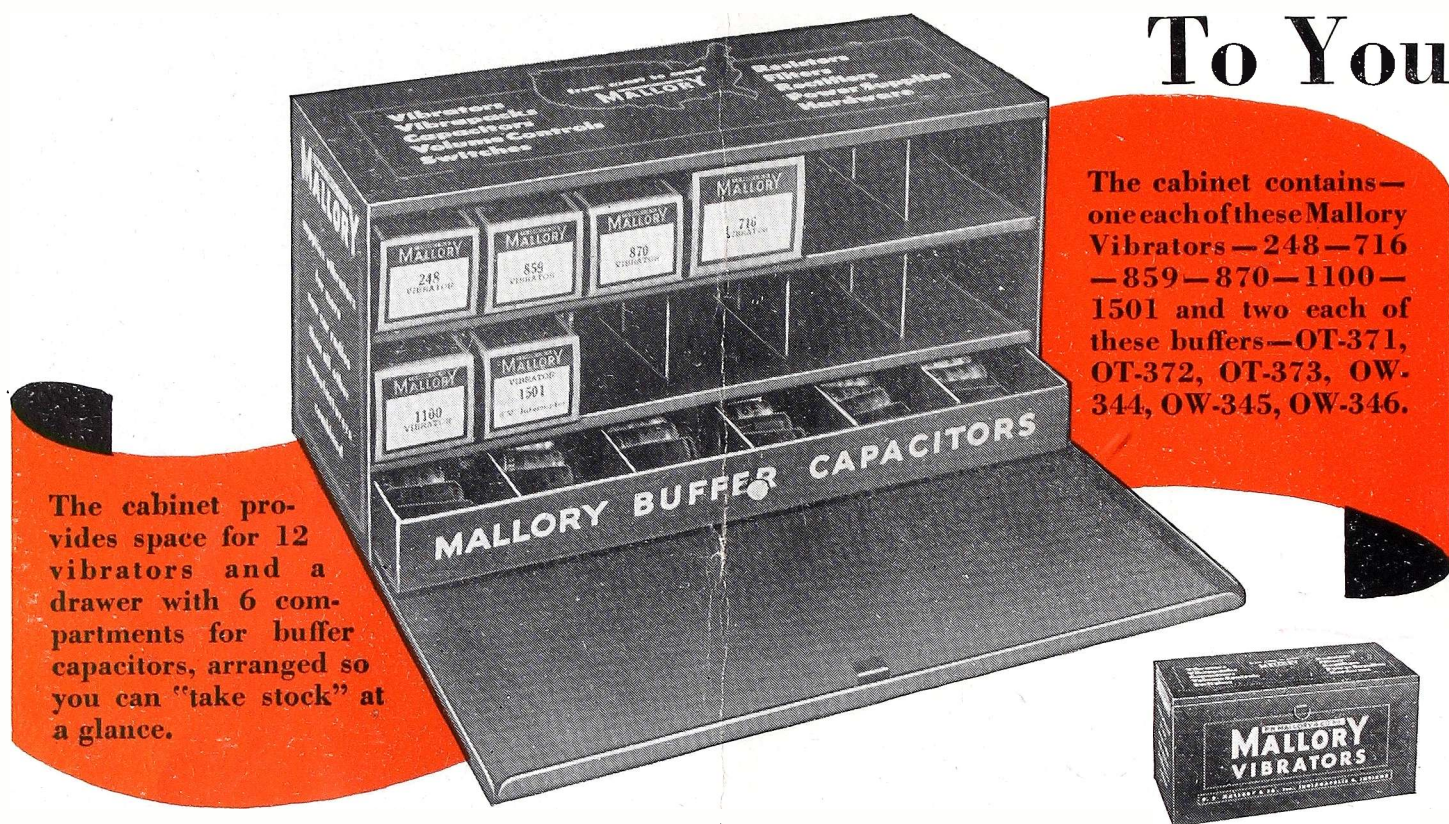
HOW TO COMPUTE WHAT PRICES TO CHARGE

HIGH RESISTANCE, HIGH SENSITIVITY VOLT-
MILLIAMMETER

USING 'SCOPES IN RADIO SERVICING
MOBILE RADIO



Another Good Deal—From Mallory To You



The cabinet provides space for 12 vibrators and a drawer with 6 compartments for buffer capacitors, arranged so you can "take stock" at a glance.

The cabinet contains—
one each of these Mallory
Vibrators — 248—716
— 859—870—1100—
1501 and two each of
these buffers—OT-371,
OT-372, OT-373, OW-
344, OW-345, OW-346.

The Fastest Selling Vibrators in the Finest Line Made— The Mallory "2448 Vibrator Deal"

Mallory, first producer of the vibrator, builder of the sturdiest, most reliable vibrators made, offers you an attractive deal on this important replacement part. A fast moving selection of 6 vibrators, that will cover 75% of your requirements, together with an assortment of 12 buffer capacitors (2 each of 6 ratings), in an attractive metal cabinet at a net price of \$24.48 to the serviceman.

This is the serviceman's regular price for these parts; no charge is made for the cabinet. You sell the parts for \$40.80—make your full \$16.32 profit.

Your Mallory Distributor has them in stock for immediate delivery. Place your order now, and get this handsome, convenient cabinet for *your* shop.

More Mallory Vibrators are in Use Than All Other Makes Combined

WHAT WILL
MALLORY
DO NEXT?

See Us at
the Radio
Parts Show

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

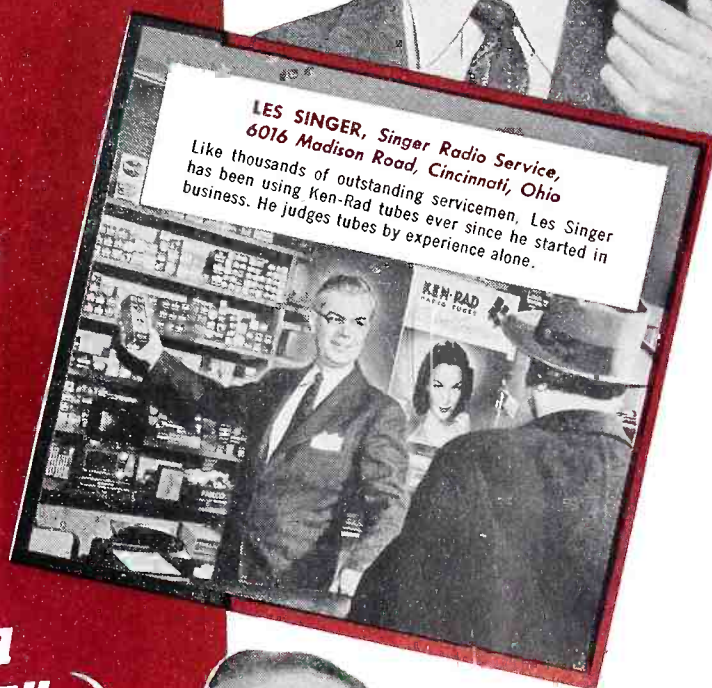
**"REACH FOR KEN-RAD--
You'll never find a better tube!"**



Ken-Rad tubes have been built for 26 years on the idea that when you please the serviceman—you please everybody!

By actual tube experience, servicemen know Ken-Rad research and engineering are outstanding. They know Ken-Rad production is painstaking—with test after test to make doubly sure there's no higher standard of performance.

Dependability, above everything else, is why servicemen everywhere say, "Reach for Ken-Rad—you'll never find a better tube."



**LES SINGER, Singer Radio Service,
6016 Madison Road, Cincinnati, Ohio**
Like thousands of outstanding servicemen, Les Singer has been using Ken-Rad tubes ever since he started in business. He judges tubes by experience alone.

**"We build tubes to build
YOUR REPUTATION"**

Practically every radio serviceman knows Ken-Rad tubes. He depends on them.

And there's plenty of reason for this confidence. Ken-Rads are made exclusively to meet the exacting demands of servicemen. They're *quality* tubes, with *stamina* and *endurance*.

This is important. Because it takes more than good service to build repeat business. It takes good tubes, too. Ken-Rad tubes.

Use them and you can count on customers coming back, satisfied.



**C. A. MEGUIAR, Shop Foreman,
Metal Mounting Dept.,** where grid turns are accurately aligned in beam type mounts. (Below) Aligning grid turns in special jig before welding to supports.



KEN-RAD *Radio Tubes*

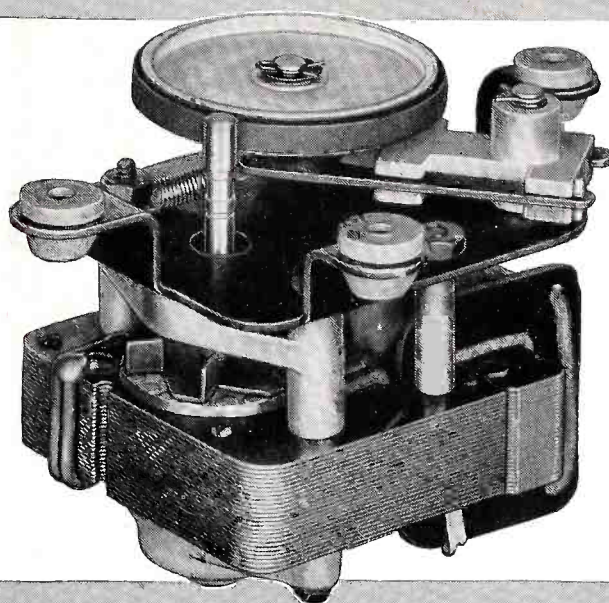
PRODUCT OF GENERAL ELECTRIC COMPANY

Schenectady 5, New York

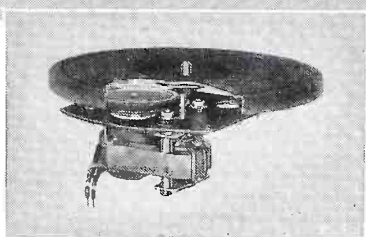
**The
Serviceman's
Tube**



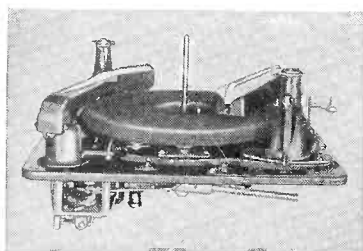
HERE'S
*Smooth
 Power*
**TO PLEASE YOUR
 CUSTOMERS**



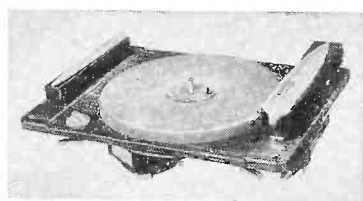
**QUIETER...
 MORE COMPACT...
 LONGER LASTING...**



**Model LX Rim Drive Constant Speed
 Electric Phonograph Motor**



**Model RC-130 Combination Record-
 Changer Recorder**



**Model R-90 Dual-Speed, Home
 Recording and Phonograph Assembly**

• Yes, it's your customers who will appreciate the plus features of General Industries' Model MX Phonomotor—*split-second pickup to full constant speed . . . dependable, quiet operation . . . and a full measure of famous GI Smooth Power.*

In this up-to-date motor, no detail which could contribute to increased customer satisfaction has been overlooked. Scientific noise elimination through accurate balancing and improved cushioning . . . superior idler arrangement which positively eliminates vertical wobble . . . anti-friction bearing construction for long trouble-free service . . . are but some of the reasons why the MX stands out as the top-quality value for top-quality phonographs and record-changers.

From the drawing board to the final inspection line, the MX has been designed, engineered and built to be the finest phonomotor of its type available. Plan NOW to give your customers the extra quality that's inherent in every General Industries' phonomotor, recorder and combination record-changer recorder. Complete information is available upon request.



The GENERAL INDUSTRIES Co.

DEPARTMENT K • ELYRIA, OHIO

EDITORIAL

by S. R. COWAN

Know Your Television Techniques

Many "RSD" subscribers reside in sections of the country where at present no television broadcasts emanate. Some technician-subscribers who live where there is no likelihood of television for a year or two have written to us complaining that we devote too much of our text content to TV subjects, regarding which they have no immediate interest. In contrast, many others who also reside in away-from TV areas have recently expressed the view that they are delighted with our pioneering efforts and they want all the data possible on TV because they know that eventually telecasting will reach their section.

Realizing that it is practically impossible to keep every subscriber 100% happy with your selection of technical articles, this Journal's editor has proceeded upon the premise that technicians may as well face the inevitable, ... TV is coming along fast, much faster than most people realize, and those technicians who choose to delay their education in this highly involved subject are treading on treacherous ground, and by being lackadaisical, leave themselves vulnerable to having the new age pass them by.

Television's Progress

There are about 1,800 AM and 260 FM stations in the U. S. A. Eighteen TV stations are now on the air and reliable sources estimate that more than 60, and possibly 80, TV stations will be functioning before Jan. 1st, 1949.

During 1947 almost 18 million radio sets of all kinds were manufactured. Of this total 1,175,000 were FM-AM models and 178,570 were television sets. In addition several thousand TV kits were sold. Production schedules for 1948 call for a much greater percentage of FM and TV sets than ever before, leading one to appreciate the soundness of the claims of some authorities that within the next few years TV set sales will hit the \$600 million a year mark and the 40 million people residing in the principal 140 U. S. markets will receive TV programs regularly.

Over a quarter-million TV sets are already installed in American homes.

From the astute technician's point of view, it is grand to contemplate that in the not too distant future, a large percentage of all radios subject to installation and servicing will represent high-priced sets that, when serviced, allow for a high and profitable service fee. The \$9.95 type of receiver was always the serviceman's worst enemy. Television and FM, representing \$150 to \$750 cost units, are probably the greatest boon to Service Dealers since radio's inception. Ponder this carefully for it is the Utopia we've dreamed of.

Trade Show-Chicago, May 11-14

All eyes are on the industry's big event. Only Jobbers and RMA members may attend the first 3 days while the final day will be open to all who wish to attend.

It is expected that much in the way of new equipment and parts, postwar developed and kept "under wraps" until now, will be shown.



Member of the
Audit Bureau of
Circulations



VOL.
9
NO.
4

SANFORD R. COWAN, Editor & Publisher

SAMUEL L. MARSHALL, Technical Editor

APRIL, 1948

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SANFORD L. CAHN
National Advertising Sales Manager

HARRY N. REIZES
Advertising Manager

BRANCH: J. C. GALLOWAY, 816 W. 5th St., Los Angeles 13, Calif., Mutual 8335

Jean M. Wheeler
Circulation Manager

David Saltman
Adv. Production Manager

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AIR KING

Pockette



PORTABLE

For profits that bloom in the spring
...Here's the newest from AIR KING

The "Pockette" portable. So tiny it fits in the palm of your hand... so excitingly new and different that you'll agree it's made-to-order for the present competitive market. Yet the "Pockette" portable maintains the same rigid engineering specifications you have found invaluable in all AIR KING radios, radio combinations and wire recorders.

Features designed for selling!

Loop antenna in cover... 4 miniature tubes... uses 1 standard flashlight battery and 1 standard 45-volt "B" battery... vinylite carrying strap... polystyrene case... snap-lock cover... sturdy metal grill to withstand outdoor elements. Batteries easily changed! When the lid's open, "Pockette" is "on"... close it, and "Pockette" is "off." Net weight: 1 lb., 11 oz. Measurements: 3" x 5 3/4" x 3 3/8".

READY FOR IMMEDIATE DELIVERY

- Model A-425—Ebony with Nickel trim.....*\$19.95
 - Model A-426—Ivory with Gold trim.....*\$24.95
 - Model A-427—Maroon with Gold trim.....*\$22.95
- *Less batteries. Slightly higher in Zone 2.



MODEL A-425

\$19.95
Less batteries

Slightly higher in Zone 2.



So tiny it fits in the palm of your hand.

AIR KING PRODUCTS CO., INC., BROOKLYN 32, NEW YORK • Export Address: Air King International, 75 West Street, New York 6, N. Y.

AIR KING RADIO

Division of HYTRON RADIO & ELECTRONICS CORP.

The Royalty of Radio Since 1920



RADIO SERVICEMEN!

19 PRIZES FOR 18 IDEAS

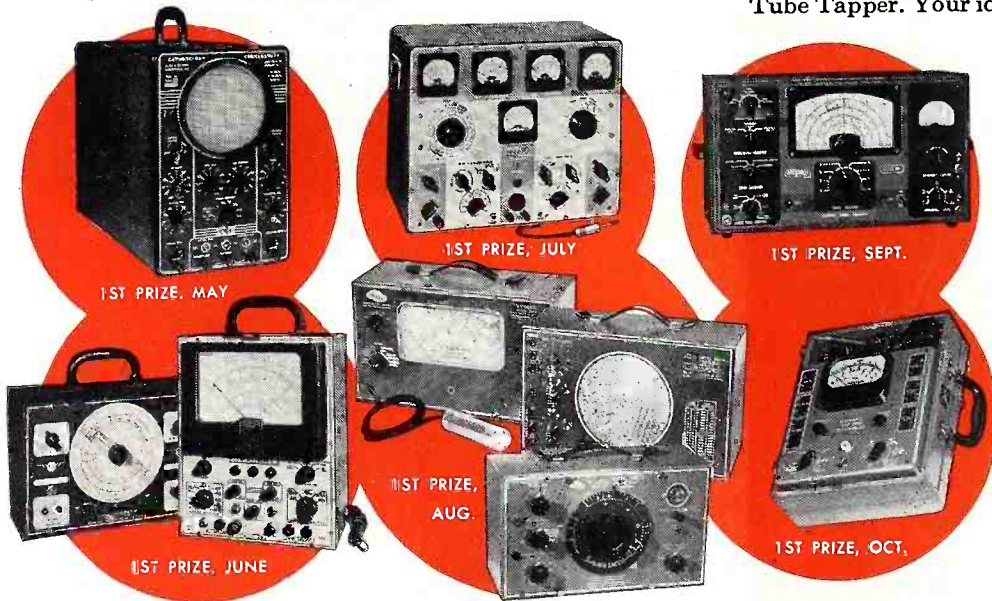
HERE'S HOW EASY IT IS TO WIN

Right now, you may have a winning idea at work in your shop. An idea for a simple service tool which makes your work easier, faster, more profitable. Hytron wants to help make such needed tools available to all servicemen — at cost. You can cash in on your idea easily — and also help the other fellow.

Simply obtain an official entry blank from your Hytron jobber — or write us. Answer a few simple questions on the blank. Then include a sketch with constructional details — or a photograph — or a model of your proposed tool. Mail

to Hytron Contest Editor. The tool should be simple, practicable, durable, compact, easy and economical to manufacture. Examples: Hytron Tube Tapper and Miniature Pin Straightener.

That's all there is to it. Nothing to buy. Nothing difficult. No fancy writing. And could you use one of those beautiful deluxe test equipments — or one of those crisp new Savings Bonds! Check the easy rules. Get an official entry blank today for full details on how to win. Send in as many entries as you wish — in any or all six contests. Everyone wins a Tube Tapper. Your idea may hit the jackpot. Let's go!



HERE ARE SOME EXAMPLES



Hytron's Tube Tapper and Miniature Pin Straightener show you the kind of tool you want. Check off the qualities. Simple? Yes. Practicable? Usable time-savers. Durable? Built to last. Compact? Carry them in your pocket. Easy and economical to manufacture? Adapted to mass production. Tube Tapper a nickel; Pin Straightener 49¢ — both under 50¢. Tools associated with tubes preferred, but other original service tools also acceptable.

HERE ARE THE PRIZES

First Prizes

- MAY DuMont Type 274 Five-Inch Oscillograph.
- JUNE Radio City Products Model 665-A, the "Billionaire", V-T Volt-Ohm-Capacity Meter, Insulation Tester; and Model 705-A Signal Generator.
- JULY Hickok Model 156A Indicating Traceometer.
- AUG. McMurdo Silver Model 900A "Vomax" Electronic Volt-Ohm-Milliammeter; Model 904 Condenser/Resistor Tester; and Model 905A "Sparx" Dynamic Signal Tracer/Test Speaker.
- SEPT. Jackson Model 641 Universal Signal Generator.
- OCT. Weston Model 769 High Frequency Electronic Analyzer.

Second Prize — Each Month \$50 U. S. Savings Bond
Third Prize — Each Month \$25 U. S. Savings Bond

Grand Prizes

\$200 U. S. Savings Bond — to contestant whose idea is judged to be best of the 6 winning monthly first prizes.
\$200 U. S. Savings Bond — to Hytron jobber indicated on entry blank as serving grand prize winner.

HERE ARE THE EASY RULES

WHO . . . Any bona fide radio serviceman who repairs radios for the general public and who lives in continental United States is eligible for these contests, except employees of Hytron, their advertising agencies, and their families.

HOW . . . Get official entry blank from your Hytron jobber, or write us. Describe on blank your idea for a shop tool for radio servicemen. Include sketch and constructional details — a photo — or model. Make your proposed tool simple, practicable, durable, compact, easy and economical to manufacture (preferably to sell without profit at 50¢ or less) — like the Tube Tapper or Miniature Pin Straightener.

WHERE . . . Mail to CONTEST EDITOR, HYTRON RADIO & ELECTRONICS CORP., SALEM, MASS.

WHEN . . . There are six monthly contests. Opening and closing dates for each contest are the first and last days of each of the months from May through October, 1948, inclusive. The postmark date determines month of entry. Entries for final month's contest must be postmarked before midnight, October 31, 1948, and received by November 15th. At judges' discretion, unsuccessful entries in any month's contest may be re-considered among following months' entries. You may submit as many different ideas as you wish in any or all six monthly contests. Use separate blank for each entry.

PRIZES . . . See special listing of prizes.

JUDGES . . . Entries will be judged on originality, simplicity, practicability, durability, compactness, and ease and economy of manufacture. Judges will be: Sanford Cowan, Editor & Publisher of *Radio Service Dealer*; W. W. MacDonald, Managing Editor of *Electronics*; Oliver Read, Chief Editor of *Radio News*; Joseph Roche, Editor of *Radio Maintenance*; J. L. Stoutenburgh, Executive Editor of *Radio & Television Retailing*; Lewis Winner, Chief Editor of *Service*.

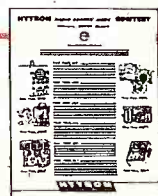
Judges' decisions final. Duplicate prizes in case of ties. No entries returned. Entries become property of Hytron, who may, at its option and by special arrangement with the entrant, pay the cost of a patent application (if the tool is patentable) with the understanding that Hytron is to have a non-exclusive license to manufacture, distribute, and sell the tool without royalties. Contests subject to all Federal and State regulations. Winners will be notified by mail. Grand prize winner will be announced in radio service trade papers shortly after close of final contest. Prize winner list available approximately one month after close of last contest.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS



Now Available...

New, important additions to the most complete line of Speakers and Driving Units made

To the more than 60 different type and size speakers and horn units that already comprise the RACON line—these new models have been added. There is a RACON speaker and horn unit ideal for every conceivable sound system application.

RACON has not only the most complete line, but also the most preferred line. For over 20 years leading Soundmen have recognized and specified them because of dependability, efficiency and low-cost, and because the reproducers are trouble proof.

Here is a partial list of the various types of RACON products now available:

PM Horn Driving Units, 10 types
Re-entrant Trumpets, 7 types
Tweeter & High Frequency Speakers, 3 types
Radial Horns and Speakers, 3 types

Straight Trumpets, 21 types
Re-entrant Fone Speakers, 7 types
Flat bell straight trumpets, 2 types
Armored Cone Projectors, 7 types

In addition there are cellular and auditorium horns, intercom, paging, monitor, and dwarf speakers, cone speaker housings, etc., besides all basic accessories such as swivel brackets, mounting units, cone housings, multiple horn throat combinations, etc.

Write for free catalog

RACON ELECTRIC CO., INC.

52 East 19th St.

New York 3, N. Y.

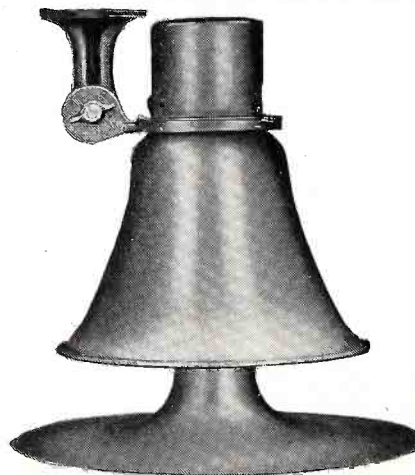
RACON



NEW SPECIAL PM HORN UNIT, having Alnico V magnet ring, completely watertight, housed in a heavy aluminum spinning. Provides extremely high efficiency reproduction with minimum input. Handling capacity 35 watts continuous, 60 w. peak.



NEW SMALL RE-ENTRANT HORNS, extremely efficient for factory inter-com and paging systems; for sound trucks, R.R. yards and all other industrial installations where high noise levels are prevalent. Watertight, corrosion-proof, easily installed. Two new models — type RE-1 1/2, complete with Baby Unit, handles 25 watts, covers 300-6000 cps; type RE-12, complete with Dwarf Unit, handles 10 watts, freq. response of 400-8000 cps.



NEW RADIAL RE-ENTRANT SPEAKER, excellent for all types of industrial sound installations. Provides superlative and complete 360° speech intelligibility by efficiently over-riding factory high noise levels. Frequency response 300-6000 cps. Handling capacity 25 watts continuous, 35 w. peak. Has mounting bracket. Size 12" wide by 12 3/4" high.

PROSPECTING FOR *Extra* SALES?



Let This Ward 1-2-3 Plan Help
You Cash in on the Huge
Auto Aerial Replacement Market



FAULTY AERIALS CAUSE 2 OUT OF 3 CAR RADIO TROUBLES

Thousands of auto aerials in use today have become so badly damaged by weather, vibration and abuse that they might as well be junked!

To help you sell the two out of three who only need a replacement aerial to make their radios work like new again, Ward offers you a special package deal backed by a powerful barrage of national consumer advertising in the Saturday Evening Post, Collier's and the American Weekly! It includes: (1) A striking sign that catches customer interest, (2) A handy aerial tester that spots trouble in a jiffy, and (3) A smart display of four replacement aerials, a model for every make and model car.

Your profit is at least \$2.00 on every aerial, PLUS installation charge. The signs and display are free, you pay only for the aerials! Write today for details. Also, please send name of your parts jobber!

THE WARD PRODUCTS CORPORATION

1526 EAST 45th STREET, CLEVELAND 3, OHIO
DIVISION OF THE GABRIEL COMPANY

IN CANADA: Atlas Radio Corp., 560 West King Street, Toronto, Ontario
EXPORT DEPT.: C. O. Brandes, Mgr., 4900 Euclid Avenue, Cleveland 3, Ohio



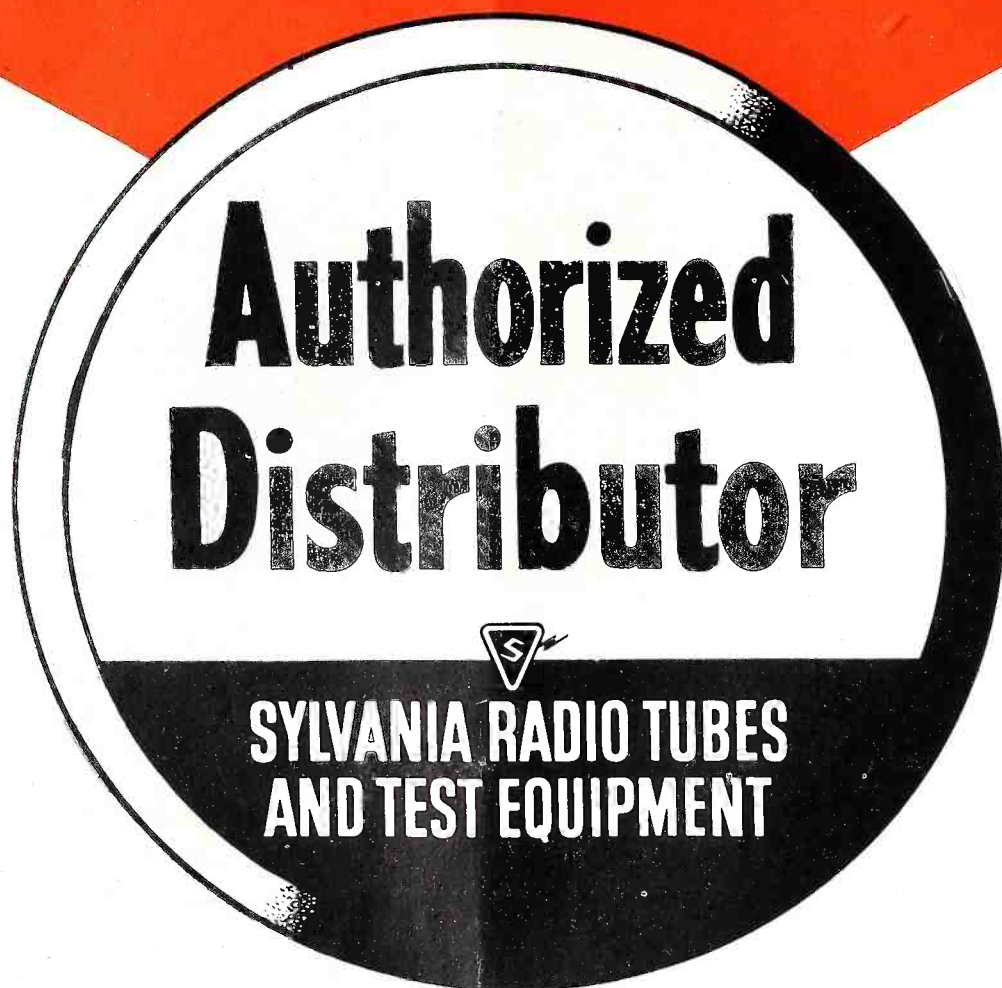
Nationally advertised in
The Saturday Evening Post
Collier's • The American Weekly

WARD

Aerials

WORLD'S LARGEST PRODUCER OF AERIALS FOR CAR AND HOME

**Look for the distributor
who displays this sign!**



As a part of its 1948 program, Sylvania Electric will supply each of its authorized distributors with this new decal, printed in red, yellow, black and three shades of green. It's worth your while to look for this sign on

his windows, doors and trucks — it is your assurance that this distributor will supply you with genuine Sylvania radio tubes and top-quality test equipment — and that you can count on prompt, courteous service as well!

Sylvania Electric Products Inc., Radio Tube Division, Emporium, Pa.

SYLVANIA  ELECTRIC

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS. FIXTURES. WIRING DEVICES; ELECTRIC LIGHT BULBS

TRADE FLASHES

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

"Town Meeting" Voted Success

The Town Meeting of Radio Technicians held in Philadelphia in January will be followed by other similar meetings this year as the radio industry pushes toward a pattern of helping the radio technician help himself to become a better craftsman and businessman, H. W. Clough, chairman of the Radio Parts Industry Coordinating Committee, announced

"The next meetings will also be experimental," Mr. Clough said. "We are seeking a sound, constructive pattern which may eventually entail meetings alone, or meetings plus other efforts, or even, conceivably, the abandonment of meetings in favor of other efforts we find more effective. We are feeling our way in a project immediately important to the entire industry and of paramount importance to the television and FM manufacturers, who must have a pool of stable, competent technicians for maintenance and servicing if television and FM are to realize their potentials."

A recommendation to proceed with the program launched in Philadelphia was made at a recent meeting of the Coordinating Committee in New York. Selection of cities and dates for the future meetings was left in the hands of Harry A. Ehle, of Philadelphia, Chairman of the Town Meeting committee.

"Only major change in the program foreseeable at present—and it should be remembered that other changes will be made from meeting to meeting—is one requested by technicians themselves. This is the exhibit of test equipment, in action. Mr. Ehle has been directed to work out a non-commercial means of providing such exhibits of test equipment in the future."

Mr. Clough released a summary of Mr. Ehle's report to the Coordinating Committee concerning the Philadelphia meeting.

Mr. Ehle said he saw these results from the first Town Meeting:

"Radio technicians like and probably prefer non-commercial meetings.

"The Industry demonstrated its interest in the radio technician and indicated its recognition of the necessity of clearing up criticisms of radio technicians by state and local authorities.

"Through the cooperation necessary to put across a successful meeting, the

local distributors learned more about each other and more about their collective ability to cooperate on their problems.

"The local meeting definitely indicated the need on the part of the radio technician and industry for quick education on television and FM problems in order to assure effective installation and servicing of these more complicated devices."



Mr. Wm. J. Doyle (left), Sales Manager of Astatic Corporation wishes Ray T. Schottenberg (center), now Astatic's representative in the Philadelphia area, "Good Luck!" while Harold A. Moyer (right), Astatic's new assistant sales manager joins in extending best wishes to his predecessor.

Old Timers to Meet

Radio's Old Timers—"ROT" to you—is preparing for its annual round-up at the Trade Show in May, according to word from John Olsen, President, who announces, "The Second Annual 'ROT' Cocktail Party will be held in Private Dining Room No. 2, at the Stevens Hotel, from 5:00 to 7:00 P. M. on Monday, May 10, just ahead of the Radio Industry Banquet; only paid-up members of 'ROT' can attend."

"ROT" was created in prewar days as a common meeting ground for those who have been in Radio in a commercial way for a long period of years. Anyone who believes he is eligible for membership in this "honorary" society is urged to communicate with John O. Olsen, President, Radio's Old Timers, 1456 Waterbury Road, Lakewood, Cleveland, Ohio.

Jordan Upper by Bendix

Horace H. Silliman, who joined Bendix Radio as district manager for New England and up-state New York four years ago, moves up from manager of distribution to merchandising manager. He will superintend liaison oper-

ations for the factory among national distributing organizations and retail outlets.

New manager of distribution is Arthur C. Jordan.

Hytron Offers Second Serviceman's Tool

Hytron Radio & Electronics Corp., Salem, Mass. offers the Miniature Pin Straightener as its second in a series of specially designed servicemen's shop tools.

The Pin Straightener is being made available to radio servicemen at less than the cost of manufacture. It can be obtained from Hytron jobbers for 49c.

This precision tool is built of special stainless steel and aluminum turned



out in an automatic screw machine. Observe the mounting holes for bench use and the comfortable shape and knurling for hand use.

It pays to always use a Pin Straightener before plugging in miniatures. Prevention of only one broken pin can pay for the Straightener twice over. Each serviceman needs three—one for the bench, one for the tool kit and one for the counter near the tube tester. You can get your Miniature Pin Straightener from your Hytron jobber.

Utah Adds Two Reps.

Utah Radio Products, Huntington, Indiana, has added two new representatives to its nation-wide replacement speaker sales staff.

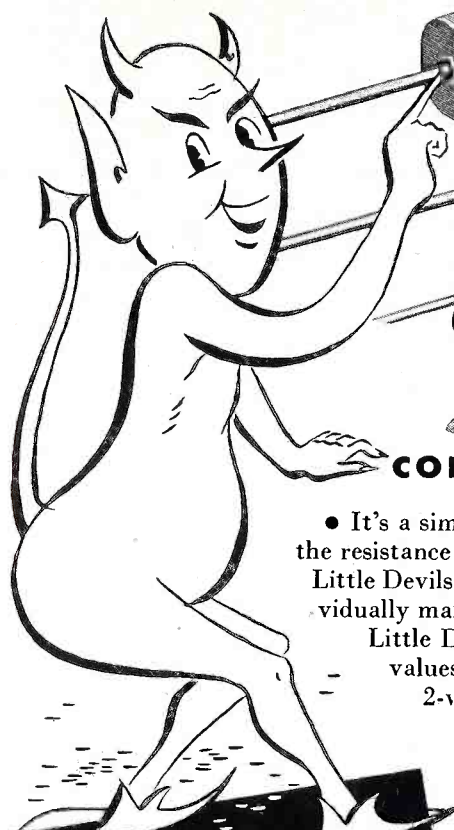
Ray Hutmacher of Ray Hutmacher & Associates, Chicago, is the company's new representative in Illinois, Wisconsin and St. Louis County, Missouri. William S. Lee, Detroit, now covers the entire state of Michigan for Utah.

Booklet Describes Point-to-Point Communication Equipment

New point-to-point radio communication equipment is described in a new

RESISTANCE and WATTAGE

marked on every unit!



OHMITE

Little Devils

composition resistors

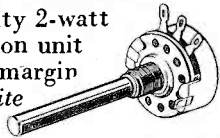
• It's a simple matter, now, to make sure you're getting the resistance and wattage you want. Just ask for Ohmite Little Devils. Every unit is not only color-coded but individually marked for quick positive identification. Ohmite Little Devil resistors are available in standard RMA values from 10 ohms to 22 Megohms, in 1/2, 1, and 2-watt sizes. Tol. $\pm 10\%$. Also $\pm 5\%$ in 1/2 and 1-watt sizes.

Available Only Through Ohmite Distributors

Other
**OHMITE
ITEMS...**

TYPE AB POTENTIOMETER

New high quality 2-watt molded composition unit with good safety margin
Sold only by Ohmite distributors.



SEE THE OHMITE DISPLAY
Booth No. 43

Radio Parts Show
Stevens Hotel, Chicago
May 11-14

BROWN DEVIL RESISTORS



Rugged, dependable, wire-wound, vitreous-enameled. Easily mounted by tinned wire leads. Tol. $\pm 10\%$. Five, 10, 20-w sizes.

DIVIDOHM ADJUSTABLE RESISTORS

Used as multi-tap resistors or voltage dividers. Provides odd resistance values quickly. Vitreous-enameled.



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G.E. Division Changes

Transfer of the Parts Section from the Specialty Division to the Receiver Division of the General Electric Company's Electronics Department has been announced by L. K. Alexander, assistant manager of the Receiver Division at Electronics Park, Syracuse, N. Y. Russell S. Fenton, who was sales manager of the section while it was incorporated in the Specialty Division, will continue in that capacity.



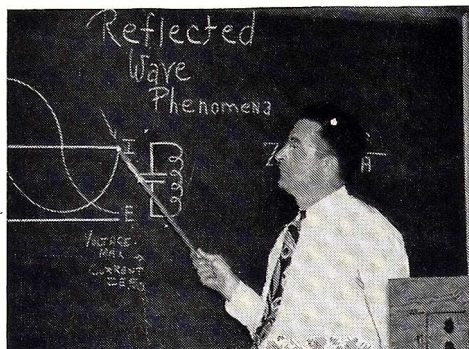
Russell S. Fenton
New Sales Manager, G-E Co. Component Parts section of Receiver Div.

Product lines of the Parts Section include replacement parts for General Electric receivers; universal radio parts; initial manufacturing radio equipment, featuring a full line of permanent magnet Alnico 5 loudspeakers and the variable reluctance pickup; and a line of accessories, such as automobile, FM and television antennae and General Electric soldering irons.

Headquarters for the Section is now in the new Receiver Division building in Electronics Park, here.

[Continued on next page]

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Packard-Bell Appoints

Packard-Bell Company, Los Angeles manufacturer of radios, radio-phonographs, and home-recording instruments, new appointments include William H. Cies as Sales Manager, Kenneth Johnson as Assistant Sales Manager, and Frank E. Ware as Field Sales Manager.

Belle Handles Garod in N. Y.

Belle Electronics Corp., exclusive metropolitan New York distributors of Garod radio and television products, opened offices and showrooms at 385 Fourth Avenue, New York City.

Max Weintraub, president of the organization, announced that dealers will be able to take advantage of a factory service station manned by factory trained technicians.

RCA Offers Trade-mark Electroplates

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The electros are illustrated in a catalog of proof sheets which is available from the Advertising Section of the Tube Department. Distributors and dealers who use offset printing for their

[Continued on page 32]

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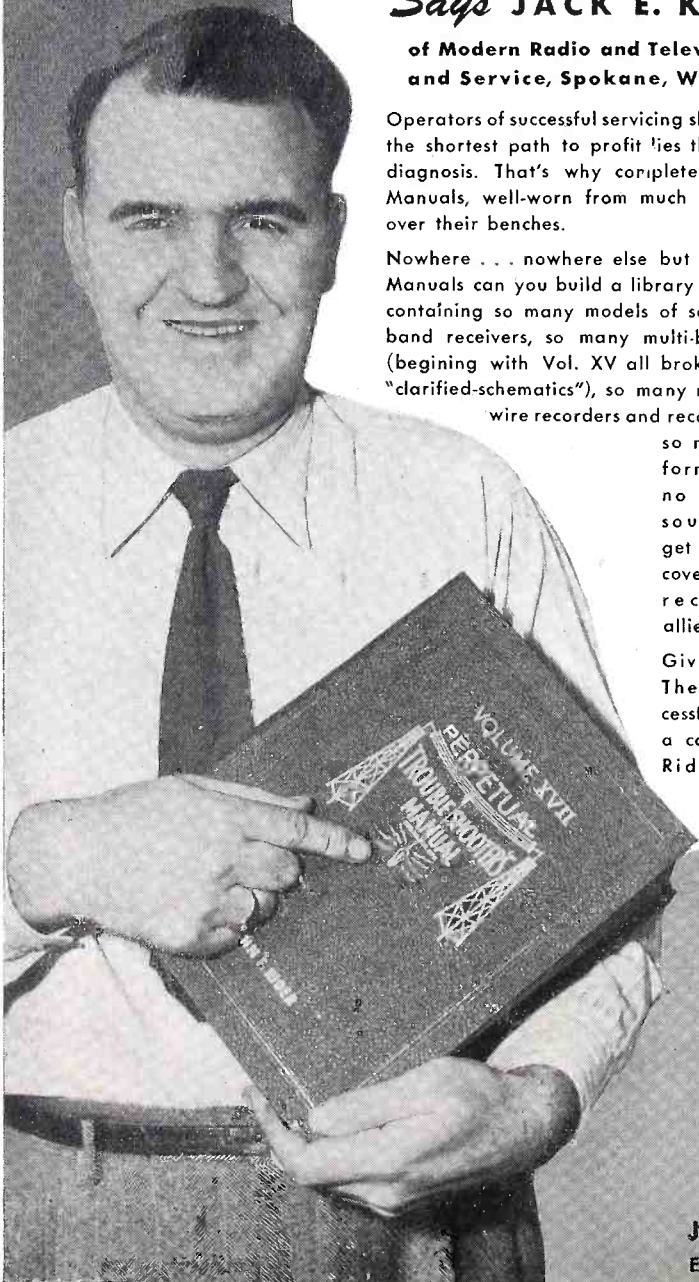
of Modern Radio and Television Sales and Service, Spokane, Washington

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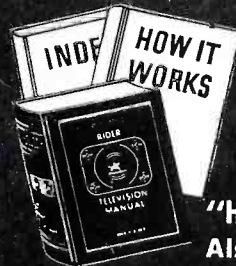
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VIDEO I-F CIRCUITS & APPLICATIONS

by S. L. MARSHALL

TELEVISION receivers, in general, contain two separate i-f channels, one for the audio carrier and the other for the video. In Fig. 1 we show the block diagram of a typical television receiver, and illustrate the manner in which the i-f carriers are separated from the composite r-f signal. This separation might take place in the plate circuit of the mixer, or in the first, second, or third stage following the mixer. In the figure, separation takes place in the first stage following the mixer.

In this article the basic requirements of fundamental TV video i-f circuits are discussed, together with the manner in which these requirements are met in typical television receivers.

| CHANNEL | FUNCTION | R.F. VIDEO CARRIER | R.F. AUDIO CARRIER | I.F. VIDEO CARRIER | I.F. AUDIO CARRIER |
|---------|------------------|--------------------|--------------------|--------------------|--------------------|
| 3 | STATION DESIRED | 61.25 Mc. | 65.75 Mc. | 25.75 Mc. | 21.25 Mc. ⊗ |
| 2 | ADJACENT CHANNEL | 55.25 Mc. | 59.75 Mc. | 31.75 Mc. | 27.25 Mc. ⊗ |
| 4 | ADJACENT CHANNEL | 67.25 Mc. | 71.75 Mc. | 19.75 Mc. ⊗ | 15.25 Mc. |

⊗ Indicates possible trap.

Chart 1—Table of relative frequencies obtained in TV receiver with video i-f's tuned to 25.75 mc.

Stages containing both the video and audio i-f signals must be able to pass a wide band of frequencies encompassing the modulation frequencies contained in both carriers. This means a band-pass of approximately 6 mc.

It is interesting to note that the frequency relations of the respective video and audio carriers are reversed in the i-f sections. Thus, in the case illustrated above, the video r-f carrier is 61.25 mc., and the audio carrier is 65.75 mc. After conversion, the video i-f carrier is 25.75 mc., and the audio i-f carrier is 21.25 mc. This can be easily calculated by subtracting the video and audio r-f carrier frequencies from the oscillator frequency which beats against these two carriers. So we see that although in the r-f section the audio carrier is higher than the video carrier, in the i-f section this relationship is reversed, and the audio carrier is lower than the video carrier.

Basic Requirements

One of the fundamental requirements of the video i-f section of a television receiver is its ability to amplify, with complete band pass the wide range of video modulating frequencies. The highest video modulating frequency broadcast by a transmitter is 4.0 mc. This value is determined by the number

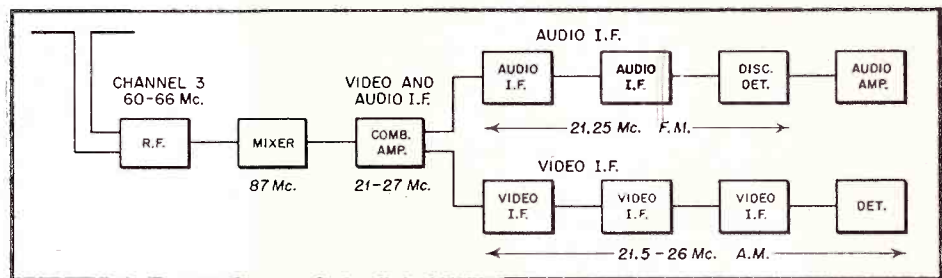


Fig. 1—Block diagram of r-f and i-f sections of typical television receiver.

of horizontal lines scanned, 525; the aspect ratio, 4/3; and the combined effects of horizontal and vertical resolution. Commercial receivers capable of this frequency range have superior definition as compared to receivers with lower video band-pass characteristics.

Figs. 2a and 2b illustrate comparative patterns obtained with two receivers, one with a 4 mc. band-pass or better, and the other with a 2.4 mc. band-pass. Notice that in the high band-pass receiver, the vertical wedges are clearly defined. On the other hand, in the low band-pass receiver, the vertical wedges are hardly distinguishable from each other.

Three popular methods employed to obtain a wide band-pass are:

1. Overcoupling between the primary and secondary of the i-f transformer.
2. Damping the tuned circuit of the i-f transformer with resistors.
3. Stagger-tuning the various i-f stages at different frequencies.

A second requirement of i-f amplifier is that the amplitudes of the overall video response curve have definite values at certain frequencies. This is illustrated in Fig. 3. On the assumption that we are tuned to Channel 3, notice that the video i-f response is zero at the audio carrier and 50% of the maximum at the video i-f carrier.

The reason for the 50% attenuation level of the response envelope at the video carrier frequency is due to the manner in which the transmitter transmits vestigial-sideband energy. Recalling that in this type of transmission most of the lower side band energy is not transmitted, but that double side-band transmission does take place at the

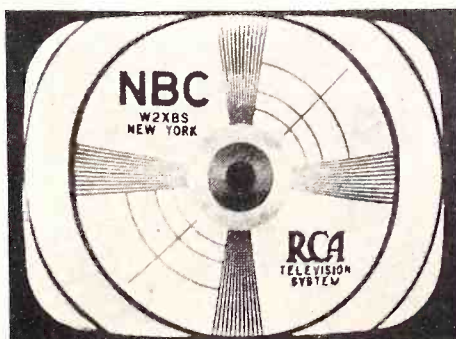


Fig. 2a—Normal test pattern.



Fig. 2b—Pattern with H.F. distortion.

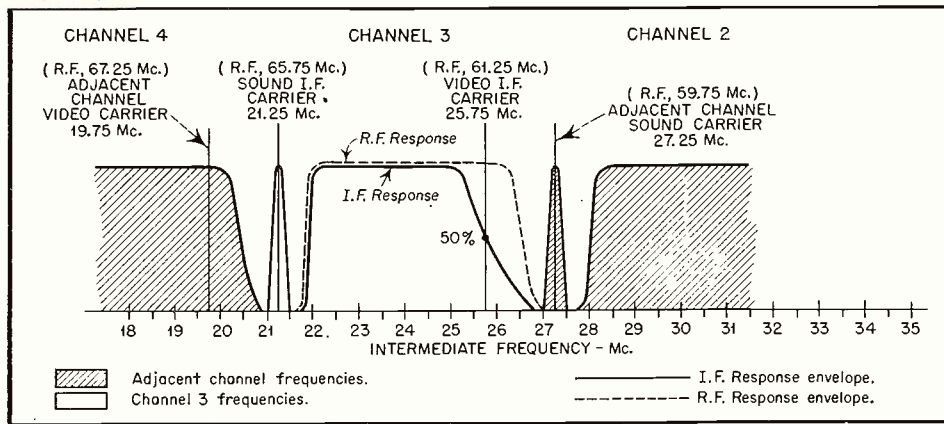


Figure 3.

lower modulating frequencies, it becomes apparent that the low-frequency modulation content is greater than high-frequency modulation content. Therefore, by reducing the relative low-frequency modulation energy content at the receiver, equalization of the various side-band amplitudes is obtained. It is standard practice to effect this equalization in the i-f stages. This is done by aligning these stages so that the amplitude response of the video carrier is 50% of the amplitude response at the higher modulating frequencies.

A third requirement is that the video i-f response characteristic be such as to prevent any sound energy from the station's own carrier, or interference from any other channels from entering the video i-f section. Interference of this nature produces constantly moving bars across the face of the CRT in synchronism with the interfering sound.

Associated sound channel interference might enter the video i-f amplifier through leakage and mutual impedance paths; or because of mistuning; or because of poor cut-off at the ends of the response curve. Proper wiring and layout design usually takes care of the first source of interference. As for the second, the inclusion of sound i-f traps at various points in the i-f amplifier produces a sharply descending response curve (see Fig. 3) which prevents any interfering frequencies from entering the video detector.

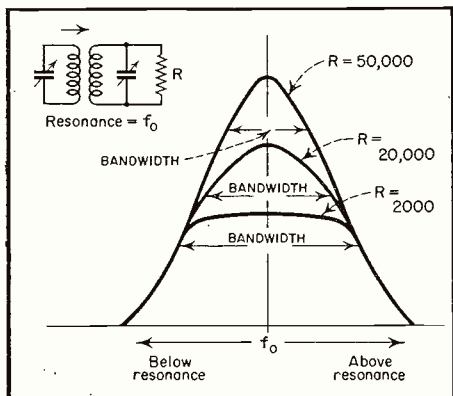


Fig. 5—Effect of damping resistance, R , on i-f band width.

Adjacent channel interference can readily be understood by reference to Fig. 3. Consider, for example, a receiver tuned to Channel 3, with its video i-f carrier at 25.75 mc. and its corresponding sound i-f carrier at 21.25 mc. Interference from Channel 2 centers around the audio carrier of the

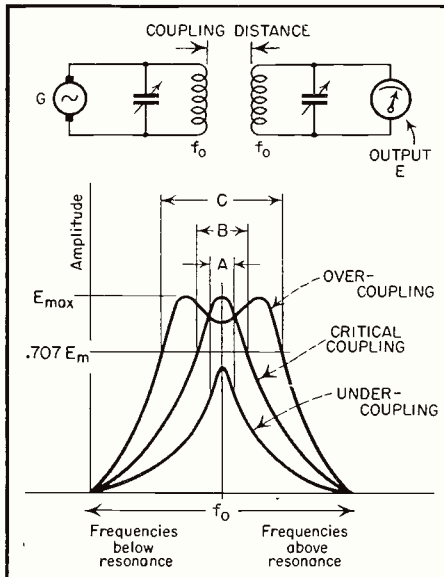


Fig. 4—Effect of coupling on output, E , for frequencies above and below the resonant frequency, f_0 .

station in this channel. After conversion, the frequency of this carrier is 27.25 mc. A suitable trap, at this frequency, inserted in the video i-f amplifier will effectively eliminate interference from this source. Interference of a similar nature from Channel 4 centers around the video carrier of the station in this channel, which after conversion has an i-f frequency of 19.75 mc. Insertion of a trap tuned to

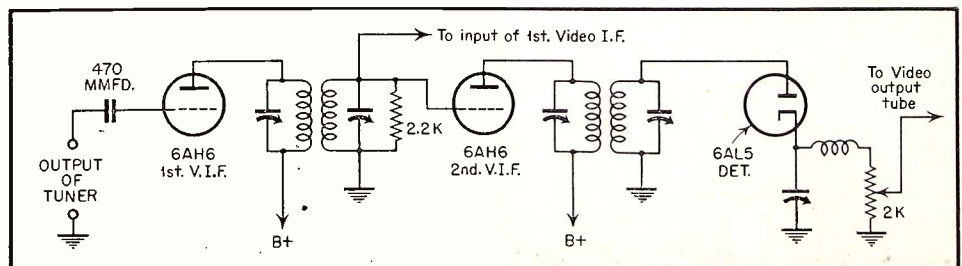


Fig. 6—Video i-f amplifier, simplified schematic of Belmont 21A21.

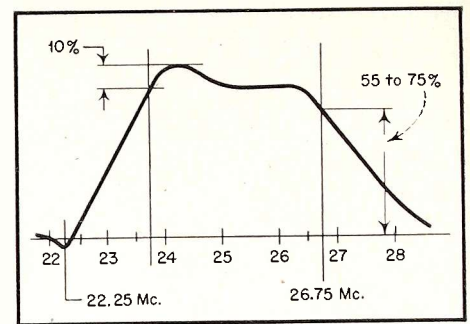


Fig. 7—Overall response curve of Belmont 21A21.

this frequency will take care of any interference from this source, although little interference of this nature is generally encountered.

Interference from other stations, aside from those located in the adjacent channels, is generally due to image frequency response. Modern television receivers employ intermediate frequencies, however, which are high enough to result in a minimum of interference of this nature.

Overcoupled I. F. Transformer Characteristics

A well-known principle connected with i-f transformers is that frequency response is connected with the degree of coupling between primary and secondary. This is illustrated in Fig. 4. In this figure an i-f transformer tuned to a frequency, f_0 , is connected at its input to a signal generator, G , and at its output to a suitable output indicator, E . As the distance between primary and secondary is reduced from an undercoupled to an overcoupled position, its bandwidth increases from A to C . This bandwidth is determined by the intersection of the curves with the line which crosses these curves at an amplitude .707 times the maximum amplitude

Thus, increasing the coupling between primary and secondary of an i-f transformer increases its bandwidth. In TV receivers using i-f transformers of this type the coils are overcoupled to the point where a bandwidth such as C is obtained.

Damping Resistor Method of Obtaining Wide Bandpass

Shunting a tuned circuit with a resistor will reduce the circuit Q , thereby

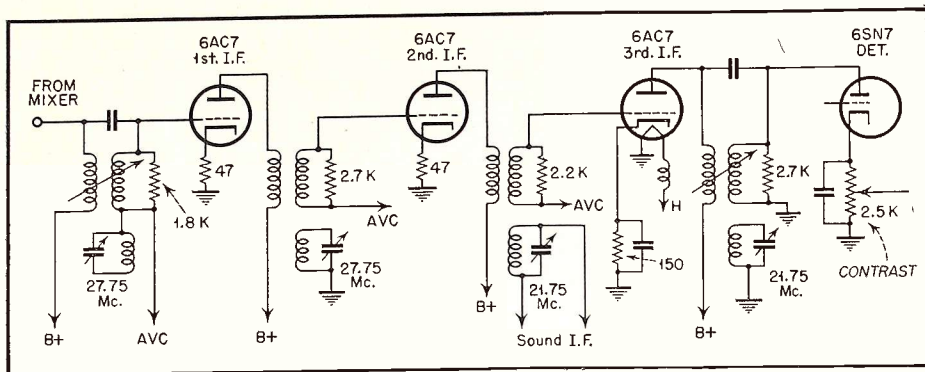


Fig. 8—Farnsworth models 6V220-240. Simplified schematic of video i-f amplifiers.

Broadening the overall bandwidth response. Although this method results in a reduction in gain the advantages derived from a wider bandpass compensates sufficiently for this loss in gain to make its application almost universal. Fig. 5 illustrates the effect of a loading resistor on the bandwidth of a typical transformer. In order to make up for the low stage gain of a circuit using this method tubes with higher figures of merit have been developed. Furthermore, where certain overall i-f amplifier gain is required additional stages are included.

It is generally found that a combination of overcoupling and damping resistors is employed. This produces a response curve of excellent bandwidth characteristics. In Fig. 6 we see a modern application of this method as employed in the Belmont 21A21 receiver. The center video i-f frequency in this receiver is 26.75 mc., and the corresponding audio i.f. is 22.25 mc. An overall response curve of the complete unit is shown in Fig. 7. Observe that in Fig. 6 the primaries are not damped. Notice also that the last video i-f secondary contains a damping resistance of 2,000 ohms which in this case is the contrast control.

An interesting variation of an overcoupled transformer and resistance damped i-f circuit is shown in Fig. 8. This is the simplified schematic circuit diagram of the Farnsworth Models GV 220-240 i-f amplifier. Rather unique

is the fact that fixed tuning is provided for in the second and third i-f stages. In circuits of this type individual stage resonance is made possible by the overall effects of the capacities contained in the coil winding, the circuit wiring, and the tube input capacitance. For this reason lead dress is of great importance.

Another innovation employed in this receiver is the use of r-f chokes in the high side of the filament supply. This practice is finding increasingly wider acceptance among manufacturers of TV receivers, since by its application undesirable inter-coupling between i-f components and the filament line is eliminated.

Notice that the cathode resistors are unby-passed. This provides improved frequency and amplitude response by injecting a small amount of degeneration in the individual stages. Notice also, that a coupling capacitor is employed between the primary and secondary of the first i-f transformer. Improved high frequency response results from this measure. Finally, it might be observed that the sound i-f is taken off the third i-f transformer. This is rather unusual, and requires an extremely wide bandpass response in the first three i-f stages.

Damping resistors seldom require replacement. However, should the occasion arise when such replacement is necessary, it is imperative that the exact resistor replacement value be used. The reason for this is that the

overall waveshape of the response curve is directly dependent on the value of damping resistor employed.

Stagger-tuning Methods of Obtaining Wide Band-Pass

A very efficient method of obtaining broad band-pass response in TV receivers is to employ a number of i-f stages, each one tuned to a different frequency contained within the required frequency limits of the bandwidth. The overall response of all the stages combined then becomes considerably wider than that which is achieved with each stage tuned to the same frequency. By this method it is also possible to obtain gain characteristics comparable with that obtained in single frequency i-f amplifiers.

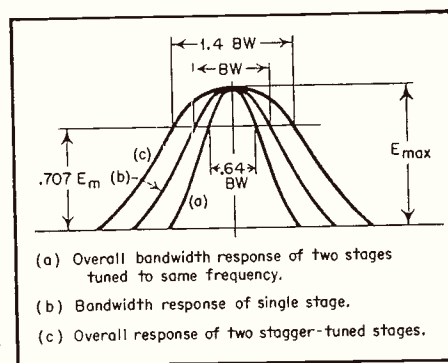


Figure 9

The advantages to be gained by stagger-tuning are greater ease of alignment, and less regeneration between stages. Comparative response curves of two two-stage cascade amplifiers, one, single-frequency tuned, and the other, stagger-tuned, are shown in Fig. 9. The overall bandwidth response is measured between the points on the curves which intersect the $.7 E_{max}$ line, which is the customary height at which bandwidth is measured. Observe that the bandwidth of curve a, is .64 times the bandwidth of a single stage. On the other hand, the bandwidth of curve c, corresponding to the two stagger-tuned stages is 1.4 times the bandwidth of a single stage.

A typical commercial application of the stagger-tuned principle is shown in Fig. 10 in which a simplified schematic of the i-f amplifier of the R.C.A. 648 PTK projection TV receiver is given. Four stages of i-f amplification are employed in this receiver, each coil being effectively shunted by a suitable damping resistor. The individual response curves of these stages are shown in Fig. 11 together with the overall response curve indicated in dashed lines.

One of the features of stagger-tuning is that slight variations in gm of in-

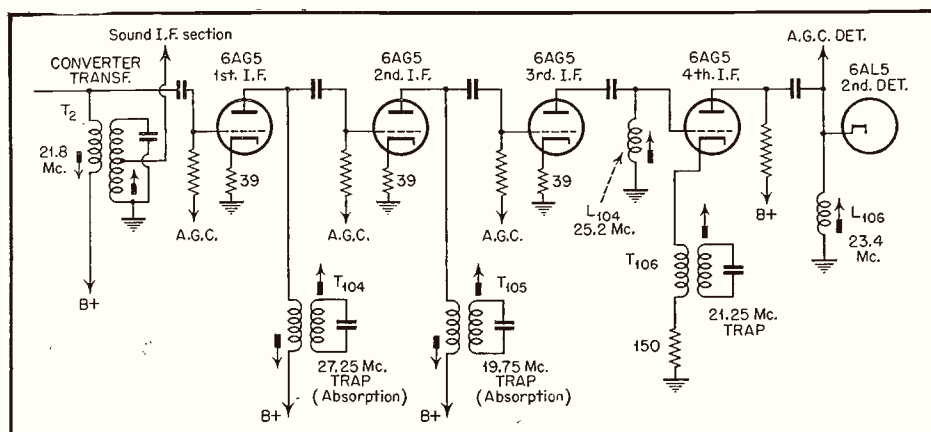


Fig. 10—I-F amplifier simplified schematic of RCA projection TV transmitter, RCA 648 PTK.

[Continued on page 37]

HOW TO COMPUTE THE PRICE

To successfully operate a business, management must know how to properly predetermine what prices must be charged customers for all services rendered. This treatise, read by the author under the title "Cost Accounting and Computation of Charges for Radio Technicians" at the recent Philadelphia Town Meeting, fully covers the subject.

YOU ARE acquainted with the adage, "A small leak will sink a great ship." The managements of large and small businesses have learned by experience that many of the leaks that would eventually sink their enterprises are detected and corrected by the application of sound cost-accounting principles. With this thought in mind the following cost-accounting information is submitted to assist radio technicians in the management of your respective businesses.

In order to understand clearly the various phases of cost accounting, it is necessary to become familiar with the meaning of the terms "material," "labor" and "overhead." "Material" represents purchases, such as parts, which are applicable to a certain job. "Labor" is the cost of time spent processing and completing the job. A simplified definition of "overhead" would be all the costs of doing business which are not directly chargeable to a given job, such as rent, heat, light, depreciation, etc.

With a brief understanding of the cost accounting terms, it might be well to make a case study of an average shop of a radio technician in order to illustrate the methods of arriving at the cost of doing business from which equitable charges to customers may be determined. The case we will study consists of an owner operating a small shop with two employees. Exhibits "A," "B," "C" and "D" refer to this study. Exhibit "A" concerns the determination of a rate to be used for the allocation of labor costs to various jobs. Column (1) indicates the rates per hour that the employees are being paid. The proprietor of the business is also listed, and the top rate of \$1.50 is considered to be an equitable rate for his services to the business. The average number of working hours per month for each in-

EXHIBIT "A"

| Column No. | DETERMINATION OF LABOR RATE | | | | |
|------------------|------------------------------------|---------------------------------------------------------------------|------------------------------------------|-----------------------------------------|------------------------------------------------------|
| | (1) Payroll Rate Per Hour | (2) Estimated Hours (Pro- ductive & Non-Produ- ctive | (3) Estimated Payroll For Month | (4) Estimated Productive Hours | (5) Rate Charge- able Per Pro- ductive Hour |
| Proprietor | \$1.50 | 200 | \$300.00 | 150 | \$2.00 |
| Technician No. 1 | 1.50 | 160 | 240.00 | 120 | 2.00 |
| Technician No. 2 | 1.00 | 160 | 160.00 | 100 | 1.60 |
| | | 520 | \$700.00 | 370 | |

dividual should be estimated in order to compute the payroll charges for the month. Column (2) of Exhibit "A" indicates the total estimated hours for the month, and Column (3) sets forth the estimated payroll for a given month. In addition to estimating the total number of hours, it is necessary to segregate the total into what is known as "productive" and "non-productive" hours. Productive hours are directly chargeable to a certain job. Non-productive hours represent time consumed for business reasons not directly chargeable to any one job. It is necessary in order to recover all of the payroll costs to spread the non-productive or idle time over the productive hours. This

process is easily done when a reasonable estimate is made of the productive hours for a given month. A rate is obtained which is chargeable to each productive hour by dividing the estimated productive hours into the estimated payroll cost for each individual. In Exhibit "A" we note that Column (3) indicates the payroll costs for the month, and Column (4) lists the estimated productive hours. The rate indicated in Column (5) should be used in charging customers for the time spent on the various jobs. The use of this rate will recover the total payroll costs for the month if the number of estimated productive hours is reasonably correct.

EXHIBIT "B"

| Column No. | DETERMINATION OF OVERHEAD RATE | | |
|-----------------------|--------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | (1) Per Annual Budget | (2) Per Month | |
| OVERHEAD ITEMS | | | |
| Rent | \$360.00 | \$30.00 | The monthly overhead of \$92.50 divided by the 370 estimated productive hours for the month results in an overhead rate of 25c per productive hour. This rate is chargeable to the productive hours of each job. |
| Heat | 96.00 | 8.00 | |
| Electric | 60.00 | 5.00 | |
| Shop Supplies | 120.00 | 10.00 | |
| Depreciation | 180.00 | 15.00 | |
| Office Supplies | 120.00 | 10.00 | |
| Telephone | 60.00 | 5.00 | |
| Sundry Expenses | 114.00 | 9.50 | |
| | \$1,110.00 | \$92.50 | |

TO CHARGE FOR REPAIRS

by **PHILIP G. ZINK, JR.**
 Certified Public Accountant

The proprietor should prepare a budget which will reflect the amounts, or the estimated amounts, to be expanded for the items comprising the overhead of the business. If you will refer to *Exhibit "B,"* you will note that many of the various overhead items applicable to the business of radio technicians are listed. The figures in Column (1) are amounts as per the budget for the year based on past experience as well as any additional information which was available at the time the budget was prepared. Column (2) places the annual budget figures on a monthly basis. The monthly overhead figure of \$92.50 is divided by the estimated productive hours for the month, thereby resulting in an overhead rate of 25c per productive hour. This rate is applied to the number of productive hours for each job. It can readily be seen that this method will allocate the overhead of the business to the various jobs on a fair and equitable basis.

With the labor and overhead rates adequately determined, we are now in a position to apply those rates to jobs coming into the shop throughout the month. The costs for each job should be accumulated on a "job ticket." The term "job ticket" is really a misnomer because a ticket form need not necessarily be used. The so-called "ticket" is merely a sheet or card, such as *Exhibit "C,"* which is assigned to each job on which the various elements of cost applicable thereto are recorded. The upper portion of the ticket should be reserved for all information pertaining to the job such as the name and address of the customer, the job number, etc. Below this information adequate space should be provided for the accumulation of the various materials which were used, with columns for the insertion of the costs and selling prices of the mate-

rials. Below the material section, the labor charges should be assembled. The name of the individual working on the assignment should appear as well as his starting and stopping time while performing the job. A space should also be provided for the insertion of the employee's rate which was determined earlier in our discussion of *Exhibit "A"* as being chargeable for each productive hour. The total number of productive hours spent by the employee or employees can be obtained from the recorded data and by multiplying these hours by the determined rate or rates, the charge for labor is acquired. The overhead to be charged to the job is obtained by merely multiplying the total chargeable hours by the overhead rate which was established at the beginning of the month. The labor and overhead charges are added together and a certain percentage for profit is applied to the total. For example, if the labor and overhead charges applicable to a certain job totaled \$10.00, then a certain percentage of this figure should be added to provide the proprietor with a reasonable profit for management responsibilities and a return on his investment.

I am not in a position to state what this percentage should be because it will vary based on different conditions and circumstances. In the example cited, if 20% is used, the amount of \$2.00 would be added to the total labor and overhead charges for the proprietor's

profit on the job. Due to the fact that materials are usually charged to the job at an amount higher than cost, thereby resulting in a profit on the sale of parts, the profit of 20% was only applied to the total of labor and overhead charges. In this particular case, (see *Exhibit "C"*), a part costing the proprietor 50c was charged to the job for 75c, which indicates a profit of 25c on the sale of the part. Technician No. 1 spent three hours on the assignment, and by applying his rate of \$2.00 per hour, which was determined in *Exhibit "A,"* the labor costs chargeable to this job are \$6.00. The overhead rate of 25c per chargeable hour is likewise applied to the Technician's time, resulting in an amount of 75c. Twenty percent of the total labor and overhead charges is added to the job to supply a reasonable profit to the proprietor. The total charge to the customer for this job is \$8.85, which includes the following: first, a partial absorption of the non-productive labor time; second, a partial absorption of the business overhead; third, a profit on the sale of a part used for the job; and, fourth, a reasonable profit to the proprietor for the responsibilities and the risk of doing business.

If all of the job tickets for any one month could be assembled into one over-all ticket, we would have a picture somewhat like that shown in *Exhibit "D."* Materials costing \$100.00 were

[Continued on page 36]

EXHIBIT "C"

| SAMPLE FORM OF "JOB TICKET" | | | | | |
|----------------------------------|--|-------------|--------------------|--------|---------------|
| CUSTOMER..... | | JOB NO..... | | | |
| ADDRESS..... | | | | | |
| DATE STARTED..... | | | DATE FINISHED..... | | |
| MATERIAL: | | | | | |
| 1 Tube | | Cost | | | |
| | | \$.50 | \$.75 | | |
| LABOR: | | | | | |
| | | Time | Hours | Rate | |
| Technician | | Start | Stop | | |
| No. 1 | | 1 P.M. | 4 P.M. | 3 | \$2.00 |
| | | | | | \$6.00 |
| OVERHEAD: | | | | | |
| | | | Hours | Rate | |
| | | | 3 | \$.25 | \$.75 |
| TOTAL LABOR AND OVERHEAD CHARGES | | | | | \$6.75 |
| ADD 20% FOR PROFIT | | | | | 1.35 |
| | | | | | \$8.10 |
| TOTAL CHARGE FOR JOB | | | | | \$8.85 |

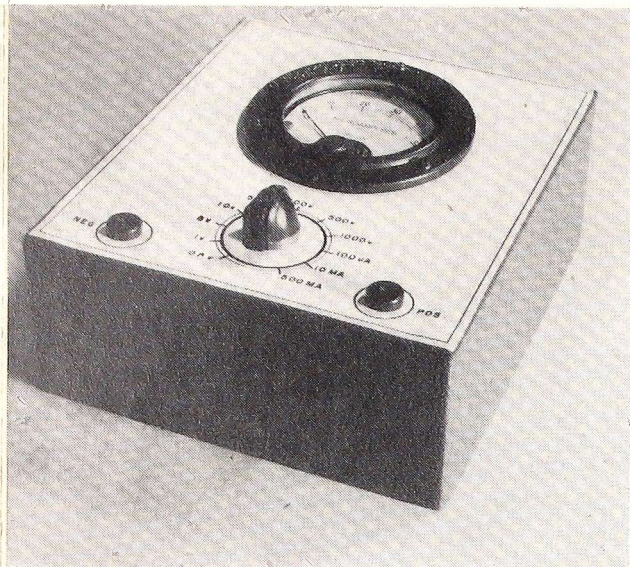


Fig. 1—External View of the Completed Instrument. Note simple arrangement of the entire unit.

ALTHOUGH the electronic type of d-c voltmeter offers wide utility and consequently enjoys deservedly great popularity, there are numerous radio service operations which demand a non-electronic instrument for current and voltage measurements. Two important instances are (1) measurements made at locations remote from power lines, and (2) measurements and tests in certain "above ground" circuits (a v. c., a. f. c., high-gain audio, etc.) where a power-line-operated instrument might introduce hum interference. But in order to be fully useful in modern radio testing, a non-electronic voltmeter must have high input resistance, so as to give accurate voltage readings across high-value plate load resistors, grid resistors, signal voltage dividers, etc. The common 1000 ohms-per-volt rating is not good enough.

A satisfactory high-resistance voltmeter and low-resistance milliammeter combination is easy to build and should be standard equipment in every service shop and experimental laboratory. It need not be expensive or fragile. This article gives constructional data for a small, simple instrument of this type which has 20,000 ohms-per-volt sensitivity.

Meter Features

Figure 1 is an external view of the high-sensitivity, high-resistance d-c volt milliammeter. Built around a 3-inch 0-50 d-c microammeter, this instrument is housed in a 7" x 6" x 2½" leatherette-covered wooden box provided with a white plastic panel. Shielding is not essential. An individual builder may employ any sort of housing, other than that used by the author, which suits his fancy. For example, a steel radio chassis might be used, or a moulded box of bakelite or other plastic.

A High Resistance, High Sensitivity Volt-Milliammeter

By Rufus P. Turner

Constructional Details of An Extremely Useful Non-Electronic Instrument Having 8 Voltage Ranges, 3 Current Ranges, and a Constant Sensitivity of 20,000 Ohms-Per-Volt. Inexpensive and Easy to Build.

The voltage ranges are 0-0.5, 0-1, 0-10, 0-50, 0-100, 0-500, and 0-1000. This unusual assortment of ranges adapts the instrument excellently to all forms of servicing and experimental work. The lowest accurately detectable voltage value (first meter division on the 0-0.5-volt scale) is 10 millivolts. Sensitivity is 20,000 ohms per volt on each voltage range. The total instrument resistance on voltage ranges "looking in" from the input terminals is 10,000 ohms on the 0-0.5 v. range, 20,000 ohms on 0-1 volt, 100,000 ohms on 0-5 volts, 200,000 ohms on 0-10 volts, 1 megohm on 0-50 volts, 2 megohms on 0-100 volts, 10 megohms on 0-500 volts, and 20 megohms on 0-1000 volts. On the latter four voltage ranges; the resistances actually are slightly higher than given above, since the relatively slight total of microammeter internal resistance and meter rheostat resistance (total 2000 ohms) has not been included in the resistance values stated for these four ranges. The resistance of the meter circuit is not important except on the first four voltage ranges, where it has been compensated for in the selection of the multiplier resistor values.

The three current ranges selected by the author are those which survey indicates to be the most used in ordinary service measurements—0-100 microamperes, 0-10 milliamperes, and 0-500

milliamperes. The total instrument resistance on current ranges "looking in" from the input terminals is 1000 ohms for 100 microamperes, 9.95 ohms for 0-10 milliamperes, and 0.199 ohms for 0-500 milliamperes.

The 0-0.5, 0-5, 0-50, and 0-500-volt ranges and the 0-500-milliampere range are read directly on the 0-50 scale of the microammeter, taking care to place the decimal point mentally in the right place. The 0-1, 0-10, 0-100, and 0-1000-volt ranges, as well as the 0-100-microampere and 0-10-milliampere ranges, are read by mentally multiplying the 0-50 meter scale by 2, and placing the decimal point in the right place. Thus, on the 50-volt range, a 20-microampere meter reading means 20 volts, while the same deflection is 400 volts on the 1000-volt range. Similarly, a 35-microampere deflection is read as 7 milliamperes on the 0-10 milliampere range.

Complete Circuit

The complete circuit diagram is given in Figure 2. Here, *M* is a Weston Model 301 0-50 d-c microammeter. This meter has an approximate internal resistance of 1140 ohms. *R*₁ is a miniature, screwdriver-adjusted, wire-wound rheostat set experimentally to bring the total meter circuit resistance up to 2000 ohms, a more convenient value than 1140 ohms for proper pro-

[Continued on page 35]

USING 'SCOPES

FOR RADIO SERVICING

by Douglas Carpenter

Fundamentals about what could be the serviceman's most valuable instrument.

DURING the past few months this author has had the opportunity to interview a number of radio technicians, and has been amazed at their seemingly small degree of knowledge concerning the service oscilloscope. This versatile instrument is without a doubt the most valuable tool manufactured for the servicing profession; and a complete knowledge of its basic function is imperative if the serviceman hopes to complete in the FM/Television market just around the corner. Intelligent analysis of patterns obtained on the 'scope screen will guarantee rapid evaluation of the trouble. Wave form analysis instantly shows up troubles that cannot be located by other means. The oscilloscope may be used as a signal tracer/voltmeter to interpret variations in phase, amplitude, or symmetry, to mention a few. The 'scope finds application in every type of electronic equipment, and it is a *must* for the shop that hopes to keep up with the competitive service field.

The cathode ray tube is the screen or window of the modern oscilloscope. An electron beam of finite weight is generated within this tube and its motion simultaneously controlled by applied horizontal and vertical voltages. If we turn the oscilloscope to "on," a tiny dot will appear at the center of the screen. If the horizontal amplifier gain control is turned clockwise, a line will appear across the 'scope screen. The beam is actually "sweeping" between the end limits of the line observed; but due to the phosphor coating of the screen, and the persistence of vision of the human eye, the effect observed is a straight line. Two controls are provided for centering the pattern. The vertical positioning control governs the up and down movement of the pattern, while the horizontal positioning control adjusts the pattern left and right. This is done by variation of voltages on the respective control

plates of the cathode ray tube itself. The focus control determines the crossover point of the beam in the tube and is used to accomplish pattern clarity.

If the focus control is not set properly the pattern would appear "fuzzy," and definition would be lost. The intensity control controls the average brightness of the pattern, and is related to the focus control. A change in the setting of one requires a resetting of the other to obtain best definition.

The linear time base of the 'scope is the means of generating the saw-tooth horizontal control voltage for the cathode ray beam. The unknown voltage (vertical) is always compared to this when the 'scope time base is used, and a complete understanding of this circuit is necessary for intelligent usage.

Fig. 1 shows the fundamental circuit required to produce a saw-tooth horizontal control voltage. The control voltage is generated by a gaseous triode relaxation oscillator. The voltage source charges the selected condenser through the variable resistance until the plate voltage is high enough to cause the triode to ionize and conduct. The condenser then discharges rapidly through the tube which is a low resistance in this condition. The plate voltage drops because of this low resistance, and ionization is suspended.

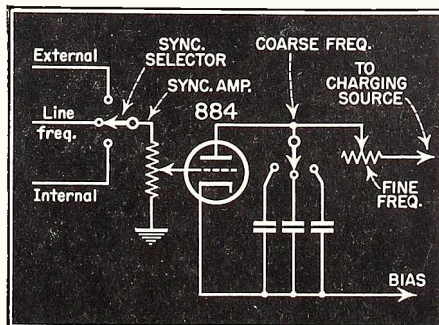


Fig. 1. Relaxation oscillator

The tube is again a high resistance and the condenser recharges. This periodic slow charge and rapid discharge constitutes a saw-tooth wave, the frequency of which is determined by the R/C constant of the plate circuit. It is obvious, therefore, that within limits any saw-tooth frequency may be generated by selection of the proper condenser and resistor. The resistor being variable produces a frequency selection within the limits of its R change. In the modern oscilloscope the condensers are arranged so that when selected one after the other they will provide a continuous frequency range as the variable resistance is rotated through its extreme limits. The control that selects the condenser is known as the "coarse frequency control," and the variable resistance as the "fine frequency control."

If the amplified voltage generated by this circuit is used to control the horizontal displacement of the electron beam, we may preset the number of sweeps per second by selection of the proper R/C constant. If the relaxation oscillator is generating, for example, a 60-cycle saw-tooth voltage the beam will be swept from left to right across the screen in 1/60 of a second. This is controlled by the charging of the condenser. The relaxation oscillator now discharges in almost zero-time, and the beam is returned to its original starting point. The time period involved for the beam to return from the extreme limit of its horizontal displacement to its original starting point is extremely small, and no retrace line is visible.

The voltage generated by the saw-tooth relaxation oscillator is in itself of insufficient magnitude to be applied directly to the horizontal deflecting plates. For this reason horizontal amplification is employed between this oscillator and the respective control plates. These amplifiers are usually resistance coupled or direct coupled

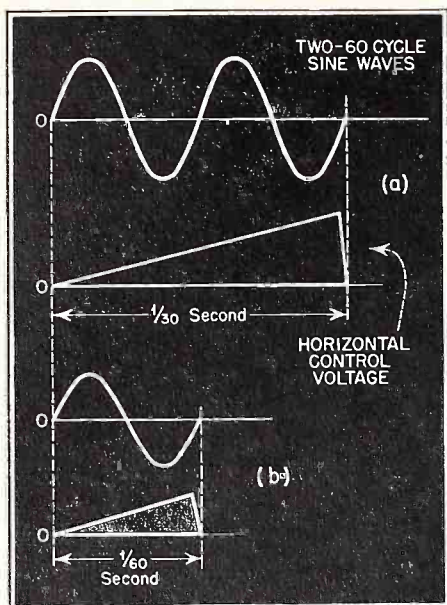


Fig. 2a (above)—2b (below)

devices that present a relatively flat response over the frequency range required. The top limit of these amplifiers is ordinarily about 150 kc and the lower end roughly 10 cycles. Although the end limit that may be selected by the coarse and fine frequency controls may be only 50 kc, two or three cycles of a higher frequency voltage may be observed without too much attenuation. The vertical amplifier incorporated in the oscilloscope is similar in design to the horizontal amplifier. It is to this amplifier that we apply the voltage to be observed. If the horizontal control voltage is set to a 30 cycle rate and a 60 cycle sine wave applied to the vertical amplifier the following would occur. The beam in this case would be swept across the screen in $1/30$ of a second. As the voltage applied to the vertical deflection plates through the vertical amplifiers occurs twice in this same time period, two adjoining 60-cycle sine waves would be traced out (Fig. 2a). This is because the vertical positioning of the beam is being controlled at any instant in time by the applied vertical voltage as referenced against the beam transit time controlled by the relaxation oscillator horizontal voltage. If we set the relaxation oscillator to a 60 cycle rate one sine wave would be observed because the vertical cycle only occurs once during the beam sweep time. This is illustrated in Fig. 2b. These are simple examples but hold true for any ratio of horizontal to vertical frequency.

As mentioned above, the amplifiers are restricted to low frequencies because of the nature of their circuit conformation. If it is desired to observe a frequency outside the limits of the vertical amplifier, this frequency may be applied directly to the vertical amplifier deflection plates. In this instance there is, of course, no ampli-

fication, and the applied voltage must be of sufficient magnitude to give proper vertical deflection. The deflection sensitivity of a normal scope used for service work may vary from about .21 volt through the amplifiers to 18 volts (peak) direct. These figures are based upon one inch of peak deflection. Laboratory scopes such as the Dumont 208-B have a deflection factor of .01 r.m.s. volts/inch through the vertical system. Selection of an oscilloscope will depend upon application as the extremely sensitive types are, of course, more expensive.

Another advantage of the oscilloscope is the extremely small loading effect. Usually a vacuum tube is used as an impedance transforming device and the attenuator located remote from the input circuit. This is done to provide a constant impedance to the circuit as the gain controls are varied. Input impedances in the order of $25 \mu\mu\text{f}$ at .5 megohm are realized. As the current requirements of the scope are practically zero negligible loading occurs when the scope is shunted across even a resonant circuit.

There are in addition to the discussed two additional controls labeled "sync." selector, and "sync." amplitude. These are extremely valuable in the case of visual alignment. If we consider the case of a frequency modulated sweep generator employed to produce a selectivity curve of an FM receiver i-f response, the advantage is apparent. (The process of producing the above has been covered by several authors in recent issues of trade magazines, and will not be repeated here). If the sweep rate of the FM generator is 120 cycles and we wish to observe 2, 3, 4 adjoining patterns of the selectivity response of the receiver or the "mirror image" superimposed pattern traces, utilization of the sync. circuit of the scope is necessary to hold the pattern steady on the screen. The horizontal synchronizing cable of the FM generator (Fig. 3) in this case would be attached to the "external" binding post of the scope, and the sync. selector turned to external. It is a phenomenon of the relaxation oscillator that if a small voltage is applied to its grid circuit it will tend to be controlled at the fundamental/harmonic, and sub-multiple frequencies of this voltage. Thus, in the case of the FM sweep generator the horizontal synchronizing voltage provided by the generator is in exact phase with the FM modulating voltage, and this is applied to the grid of the relaxation oscillator. The relaxation oscillator in this case tends readily to lock in at harmonic and sub-multiple frequencies and gives a holding effect upon the patterns observed. The amount of control voltage applied to the relaxation oscillator grid is con-

trolled by the sync. amplitude control. This control should be set to minimum requirement as excessive control will result in pattern distortion.

The other two positions of the sync. selector are internal and line frequency. If the sync. selector is set to internal a small portion of the voltage applied to the vertical amplifier system is in turn applied to the grid of the relaxation oscillator, and some control is realized. If the selector is set to the line frequency position a small portion of the available mains frequency voltage is applied to the oscillator. In both of these settings the amount of applied voltage is controlled by the sync. amplitude setting. In any of the above cases the sync. amplitude control should be set to the minimum required, as pattern displacement (distortion) can occur due to alteration of the tube's plate voltage/current characteristic due to curvature caused by overloading. This results in a phase change which will distort the pattern observed.

In the above discussion it is hoped that the basic working functions of the service oscilloscope have been explained. The examples used related only to simple sine wave combinations for purpose of simplicity. Complex waves may also be analyzed on the scope screen, and almost every day new applications are being found for this versatile instrument. Audio amplifiers may be instantly qualified by application of square waves eliminating the tedious plotting system. FM and television broad band amplifiers may only be properly aligned by use of the oscilloscope. It is safe to say that only the serviceman who can apply the oscilloscope in combination with related equipment will find himself still in business in the lucrative FM/television service field which is much nearer than most of us realize.

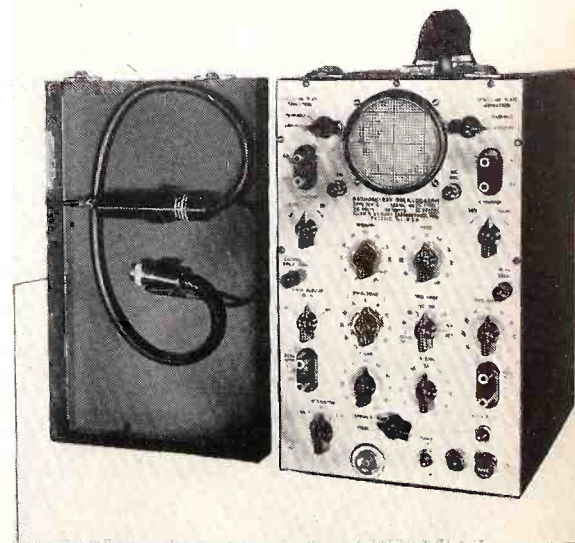


Fig. 3. A DuMont C-R Scope

MOBILE RADIO

A new field, mobile 2-way communications, opens to Radio Service Dealers.

by Gerald R. Fuller

THE phenomenal success of the experimental radio dispatched taxi cabs has opened a new field of income to progressive radio service dealers in the smaller cities. To be sure the larger taxi fleet owners will undoubtedly operate their own radio service departments when sufficient channels are made available to them to allow for the operation of mobile units running well into the hundreds. However, the majority of the companies in smaller cities operating up to a hundred cabs will undoubtedly follow the pioneers in the field and make arrangements with a local established service dealer or service organization for the required supervision and routine servicing. This spells open sesame for the service dealer looking for new fields to exploit.

How One Service Dealer Did It

Madison, Wisconsin, as an example, already has three cab companies out of four now radio equipped, with the fourth waiting on equipment. Richard Evans of that city had an eye to the future and the required FCC license when the Yellow Cab Company became interested in Radio Dispatch. He took time out from his busy Evans Radio Service to assist with the "equipment test" and, ten days later, the "service tests" for this company. Today he services two firms and is assisting with the tests for the last of the four . . . "found" income in the highly competitive business of servicing radio-communications equipment. Mr. Evans' pioneering in this



Fig. 1—A Motorola remote control unit operates the 50 watt FM transmitter of Madison's Yellow Cab Co. The transmitter is located two miles away on top of one of Madison's highest buildings. The dispatcher is Harold Hussy.

field should serve to cue the entrance of other well established service dealers into this lucrative branch of two-way industrial communications.

Richard Evans' first interest in Radio Dispatched Cabs came as a direct result of his inborn personal philosophy of life which he has unconsciously expanded into a very successful business philosophy. He has never been one to refuse a bit of friendly help or advice to anyone in need. Never an exponent of high-pressure selling, he has built up one of the busiest radio service organizations in Madison in the relatively short period of four years by the simple, friendly expedient of making a friend of everyone who comes into contact with him by doing this person a small favor. In Evans' own words, "A small favor, perhaps a bit of advice given without thought of the dollar sign, or the soldering of a loose wire, will do more good than a year of back-slapping talk." So it is only natural that he should someday come to the aid of a taxi fleet owner perplexed over the complexities of the FCC Rules and Regulations and end up with a Service Contract.

Taxi Radio Dispatch

On a recent cross country trek the author interviewed over a half a hundred cab companies. The signs were encouraging for the many operating with radio were high in their praise of this money-saving method of keeping all of

their drivers within finger-tip reach. And the non-operating companies conceded reluctantly that Radio Dispatch was the only thing new that had happened to the industry in twenty-five years and that they would have to turn modern and jump on the bandwagon or bow to the inevitable—competition.

Radio Dispatch's more obvious advantage is the drastic cutting down of the dead-head miles. A radio-cab stands about a seventy percent chance of picking up a return fare from a long haul to the outlying residential districts due to the dispatcher's ability to broadcast these "in" calls and that is like found money to a taxi operator



Fig. 2—A typical 25 watt FM mobile transmitter and receiver as installed in a taxi luggage compartment.

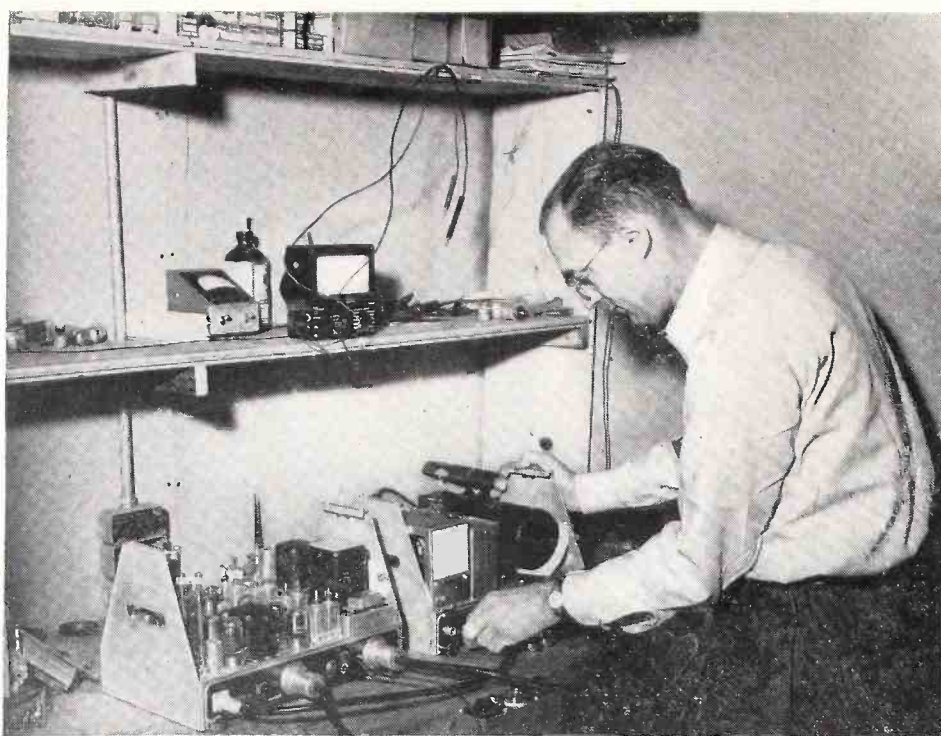


Fig. 3—Mr. R. K. Evans, of Evan's radio Service, Madison, Wisc., sets up mobile unit in the easy-to-construct mock-up he built in his shop to facilitate the servicing of mobile communications units. Technicians planning to handle mobile equipment repairs will find such a mock-up makes for faster, easier repairing.

plagued with the increasingly high cost of gasoline and maintenance.

Another advantage of equal importance in the faster, better service offered by Radio Dispatch. Where, in the past, a customer requesting a taxi usually had to wait from ten to fifteen minutes he now replaces the receiver and in many cases glances out the window to see his cab pulling over to the curb. The public has always been quick to recognize efficient service. So Radio Dispatch will soon be an American institution along side self-service super markets and the gas station attendant who cleans your windshield.

There are two factors holding up the general landslide at this writing. One, the slowness of equipment deliveries, speaks for itself. However, the bugs have been worked out of present-day equipment and manufacturers are promising better designed, cheaper equipment for the future. At the present there are only two channels of the Urban Mobile Service's 152-162 mc band assigned to taxis. This is a definite bottleneck.

Other Type 2-way Radio Users

The Urban Mobile Service band was set aside to afford two-way communication between fixed stations and such mobile units as pick-up and delivery trucks, doctor's vehicles, armored cars, railway express trucks, oil trucks, taxi cabs, boats in adjacent harbors and a one-way signaling service to indicate to the vehicle operator that he should

call his home office. However, taxi cabs have been the only ones making extensive use of this band to date.

Radio Dispatch utilizes a duplex circuit with 152.27 mc assigned to the fixed land station and 157.53 mc given to the mobile units. All cab companies have to share these frequencies and in cities having more than one radio-cab company the channel is unable to handle all of the traffic. However, the FCC held a hearing on the subject and, due to the success of Radio Dispatch, additional channels are expected. Enough,

it is hoped, to handle the traffic of the 1000-1500 radio-cabs planned for such cities as New York, Chicago, San Francisco and Los Angeles.

It is the practice of the majority of the equipment manufacturers to initiate the procurement of the station license after selling the cab company, supervise the installation of equipment and assist the buyer in obtaining the services of a competent radioman. The past record has shown that there is a great variation in the extent of the supervision, leaving the field open to interested local radiomen. For, although each manufacturer is well represented with field engineers, the cab company has to employ a full time service engineer in compliance with the FCC Rules and Regulations governing this type of station with the service engineer "on call" rather than on duty. Therefore the cab companies prefer to farm out the responsibility to an established service organization, providing the FCC license requirements are met, rather than go to the greater expense of adding another man to their payroll. In the larger cities, of course, where the operating companies will have several hundred units to service it probably will be to their advantage to set up their own service organizations.

In brief, the licensing schedule follows this pattern: The taxi company applies for a station construction permit in the same manner as the larger broadcast stations. Then within a period of time the equipment is ordered, delivered and installed. Within two days of the date the transmitter is scheduled to be fired up the Service Engineer must file application for the Equipment Test. This

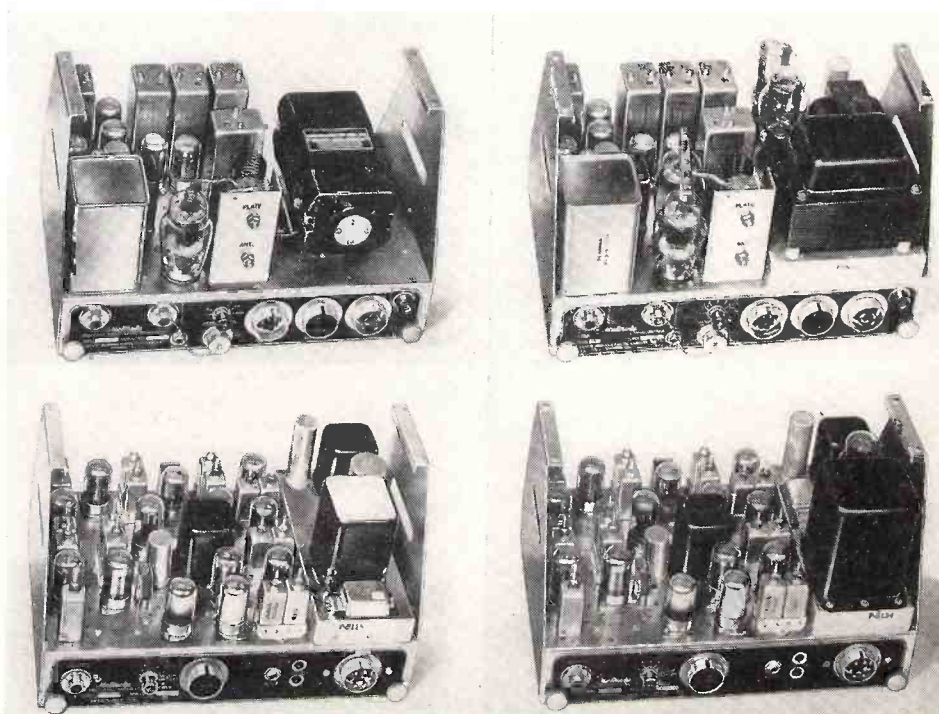


Fig. 4—(Top left), Motorola PA-8026 transmitter chassis with DC power supply; (top right) same transmitter with AC power supply; (bottom left) Motorola 8119 receiver chassis with DC power supply; (bottom right) same receiver with AC supply.

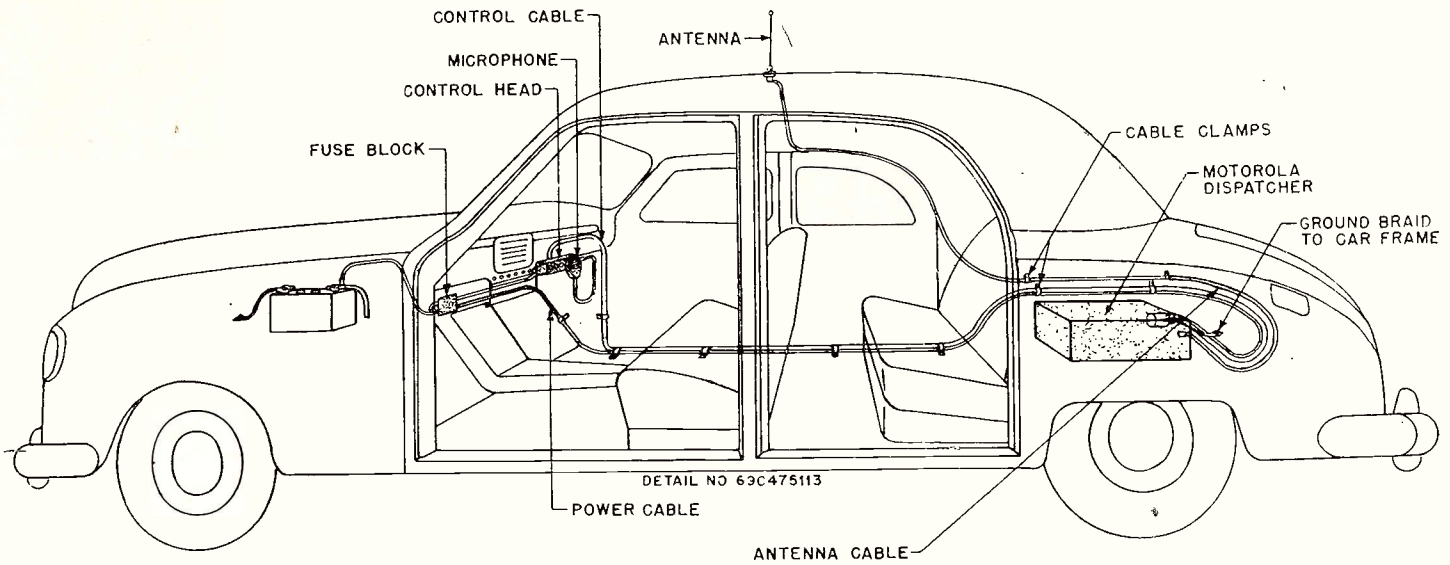


Fig. 5—Installation of Radiotelephone equipment in the average automobile is relatively simple.

period of actually checking the equipment and getting on the air is limited to ten days. However, before the eighth day the FCC must be notified of the beginning of the Service Test and application made for the license. The Service Test has a thirty day limit, with extensions of the time limit possible. And the time is devoted to checks for interference coverage and serviceability of the equipment. With the issuance of the license the duties of the Service Engineer become rather routine, consisting mainly of maintenance, orienting the taxi company's dispatcher and cab drivers to the ways of two-way radio communication, and seeing to it that the proper logs are maintained.

The Use of "Q" Calls

It may be that the Service Engineer will have to familiarize himself with the popularly adopted communication calls for Radio Dispatch which differ somewhat from the "Q" calls of the commercial communications networks and the Ham Operators. Most taxi companies use the following numerical code:

- 10-1 Standby
- 10-2 Yes
- 10-3 No
- 10-4 Acknowledge (d)

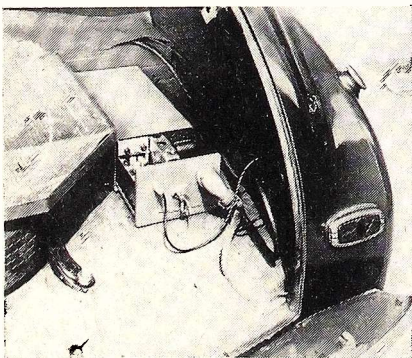


Fig. 6—New FM radiotelephone dispatcher in trunk compartment of a Doctor's car. Note compactness, small degree of space used.

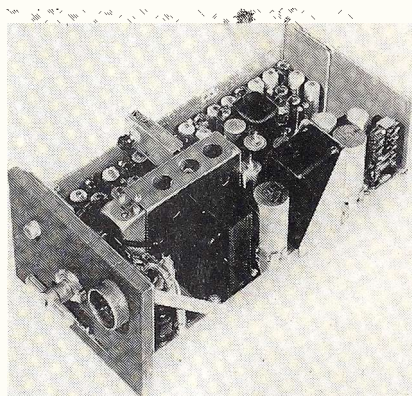


Fig. 8—View of FM radiotelephone dispatch unit withdrawn from its regular case.

- 10-5 Location?
- 10-6 Passengers?
- 10-7 Out
- 10-8 In
- 10-9 Repeat
- 10-10 Destination
- 10-11 Time signal
- 10-12 Empty
- 10-13 Emergency

The troubles that the newly indoctrinated Service Engineer will run into are the usual routine component part failures, flat tubes, relay and power supply failures. The majority of the equipment installed at the present was designed by engineers with police communications background. This has resulted in rather efficient transmitters and receivers on the whole but it is noted that the control circuits are not standing up under the heavy load of Radio Dispatch. A taxi driver uses

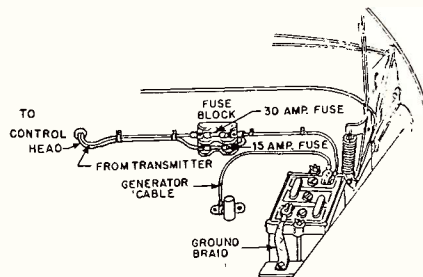


Fig. 9—Close up of fuse-block wiring.

his unit about three to four times more than the average police officer.

With one known exception the equipment is narrow band FM. The exception is one firm reconverting surplus Army SCR 522s to taxi use.

Test Equipment Needed

A considerable sum of money could easily be tied up in VHF test equipment. However, a practical service dealer could get by readily with the ordinary test equipment his shop already contains plus the tuning meter normally supplied with the units by the manufacturer. A permanent mock-up consisting of a hi-amperage six volt power source plus the junction and control boxes and the various inter-connecting cables peculiar to the make of equipment he will service should prove invaluable and can be constructed with the minimum outlay of cash. Additions can be added by imaginative individuals to meet personal whims and tastes.

To avert the possibilities of the lean years of the "30's" being repeated after the present boom subsides the radio serviceman-dealer of today should give serious thought to branching out into all phases of electronics, particularly selling and servicing radio-communications systems.

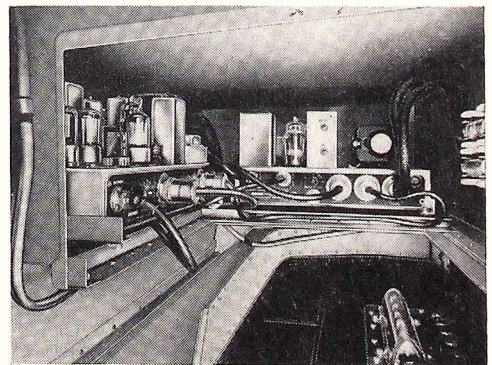


Fig. 7—Two-way radiotelephone receiver, (left), and transmitter, (right), housed in space over rear left wheel of modern Greyhound bus.

CIRCUIT COURT

Airline Model 74WG-2505A

An interesting variation in the way of convertor stages is to be found in the Airline set illustrated. A miniature type of dual triode, 6J6, is employed. This tube has a common cathode.

Output of the 6BA6 tuned r-f stage (used only on the FM band) is capacitively coupled to the tuned grid coil of the mixer section of the 6J6. Signal bias is developed across a .1 meg. leak.

Oscillator voltage appearing on the mixer plate is by-passed by a 47 μf condenser. A series choke in the plate lead to the first 10.7 mc. i-f transformer aids in the action.

The oscillator portion of the tube is biased by the drop developed across the 10K-ohm leak. The grid is effectively at ground potential for signal voltage. The cathode is tapped part way up on the coil element of the tuned circuit. Plate voltage is supplied to the oscillator portion via an r-f choke. The plate is coupled nearer the top of the coil than the cathode, by a 47 μf unit. The conditions for generation of oscillations thus being provided, and coupling to the mixer section obtaining by virtue of the common cathode element, efficient performance is possible with a minimum of components and complication.

Hoffman Model B503

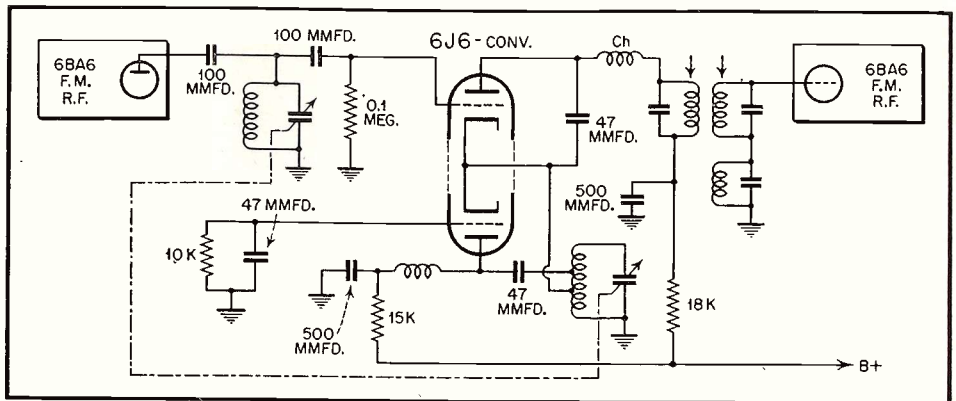
The Hoffman model B503 provides several interesting circuit functions. A block diagram is shown to simplify our explanation of it.

The instrument provides for radio reception or recording, record playback or microphone recording. Broadcast and two short wave bands are available.

The r-f i-f section is conventional, using 6SK7 tubes as amplifiers and a 6SA7 as a convertor. A 6SQ7 tube performs the functions of detector, AVC rectifier and first audio amplifier for radio. The following stage, using a 6J5 triode, operates as a tone compensating network. Separate bass and treble boost or attenuation are provided. It is interesting to note that all compensation is switched out when the recording feature is switched in. This insures maximum fidelity impressed on the record, to be compensated as reproduced.

The next stage operates as a phase inverter and feeds the push-pull 6V6 output tubes. One 6V6 grid is fed from the 6J5 inverter plate—the other from the cathode.

Output of the 6V6 stage can be



Converter stages of Airline model 74WG—2505A

switched to either the speaker or the cutter. For recording from a microphone, two additional audio stages are inserted to bring the level up to a normal value. A 6SJ7 pentode and 6SQ7 triode section provide the gain. Output of the 6SQ7 feeds the grid of the 6J5 inverter. A gain control for the mike stages is included. Radio and mike outputs can be mixed for recording.

The diodes of the 6SQ7 in the mike amplifier are used to rectify a portion of the 6V6 output and the voltage thus developed causes a 6U5 eye tube to indicate the volume level. This feature permits accurate setting of gain for best record cutting.

Output of the phone pickup is connected to the triode elements of the 6SQ7 first audio stage.

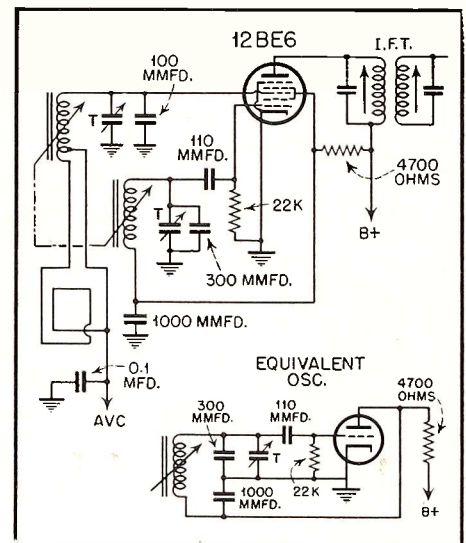
Emerson Model 540A

In the Emerson 540A receiver, using miniature tubes throughout, is an unusual mixer-oscillator circuit. The tube employed is a 12BE6. Variable inductance tuning is used, with gauged sliding cores.

One variation from the normal is the use of a loop tapped across a portion of the mixer grid coil. This permits pickup and coil tuning without mismatch due to capacitance coupling.

Note that the inductance is shunted by a 100 μf fixed unit and a trimmer condenser.

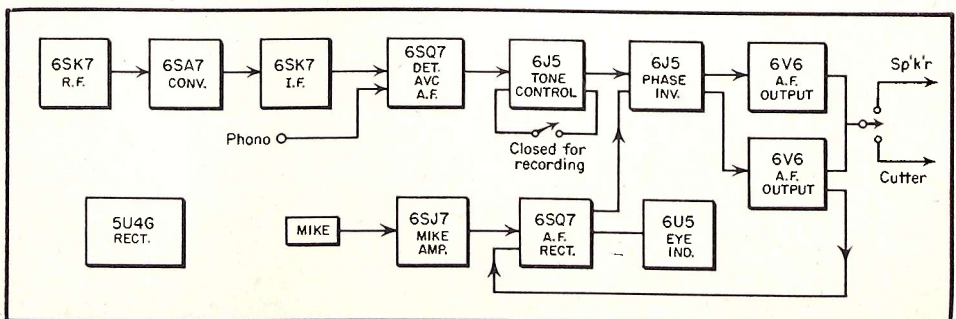
The oscillator circuit is of the Colpitts type rather than the Hartley usually employed. The cathode is



Oscillator—mixer circuit of Emerson model 540A

grounded directly instead of being tapped up on the coil. One end of the coil connects to the oscillator grid through 110 μf , while the grid returns to ground via 22K ohms. The second

[Continued on page 34]



Block diagram of Hoffman model B503

SHOP NOTES

Write up any "tricks-of-the-trade" in radio servicing that you have discovered. We pay from \$1 to \$5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor".

Arvin Model 665—Eliminating Hum and Improving Tone Quality

To eliminate modulation hum frequently encountered in this 6 tube a.c. phono-combination, replace the 1 meg resistor in the grid circuit of the converter tube, (formerly *R13*) in manufacturer's schematic) with a 100,000 ohm resistor shown in the accompanying illustration as *R15*.

As illustrated *R15* is connected from grid to floating ground, contrasted with *R13* which was connected from grid to AVC line.

This set's tone quality may be improved by replacing condensers *C5*, .0005 μf across the volume control *C14*, .0002f μf , and *C7*, .002 μf on the tone control with *C13*, .005 μf .

Submitted by Albert Loisch, Darby, Pa.

Trick for Replacing Speaker Cones

When making speaker cone installations or repairs to same, a half-dozen spring-type clothespins can be helpful. Use them around the speaker rim to hold the cone edges down while the cement dries.

Submitted by Richard Preston, Oxford, N. Y.

Records and Needles

Webster has come up with a few record maintenance hints, and needle facts which are well worth the serviceman's consideration. They, also may well be incorporated on the back of a suitable card for advertising purposes. Here they are:

Records

1. Do not buy (or use)* warped records, or those showing obvious wear.
2. Keep records in their envelopes and albums, preferably laid flat to prevent warping.
3. Do not keep near heat as this will warp the records.
4. Keep records clean with a soft brush (do not use cloth)* to avoid grinding dust and lint into the grooves.
5. Do not leave records on posts on conventional stack up type or record changer. The limited support, plus heat of the changer compartment, will surely cause warping.

Note:

* Editor's addition

** These needles give satisfactory service up to ten playings.

6. Use a good needle and replace when wear becomes apparent.

Needles

So many different types of phonograph needles are on the market that there is often confusion as to which is most suitable. The following brief summary lists the different types and sets forth the qualifications of each.

Steel

These are full tone, half tone and various odd shapes made of steel only. Usually give *greatest volume*. Should not be used to play more than one record.** Standard types give greatest high frequency response with resultant higher noise, scratch, and hiss level. Points wear rapidly, depositing material in grooves and damaging records.

Chrome Point

These are steel needles with chrome plating and have about the same qualifications as a full tone steel needle, except that the chrome plating greatly increases the life. May be used for twenty-five to fifty plays, depending on the pick-up pressure.

Bamboo, Cactus, Thorn, Etc.

These are used primarily to reduce high frequency response, noise and record wear. Distortion and low quality are usually apparent. Unsuitable for record changers.

Metal Alloy Points

Come in many shapes and sizes and may be used for 1,000 to 5,000 plays without change. Properly alloyed points polish to a high degree, increasing record life. Should be left in pick-up undisturbed as point wears to fit record groove and changing may result in severe record damage. Recommended for record changers.

Sapphires

These needles have a correspondingly longer life. Same precautions against dropping and changing position should be observed. Recommended for changers and wide range reproduction.

Antenna Connections

Should the occasion arise where it becomes necessary to replace the connections to antennas it is necessary to see that the flat twin parallel con-

ductor is *not* twisted. The rear parallel conductor should be connected to the rear terminal screw on each loop antenna. The front parallel conductor should be connected to the front terminal screw on each loop antenna.

Substituting a 42 for 6B5

In some of the older models of Crosleys and Beverlys or any set using the unobtainable 6B5 tube in the output stage, it is possible, with only a slight change, to substitute a 42.

Disregarding the complicated internal connections of the 6B5, a look at the socket connections will show that it is all ready for a 42 except for the grid bias. Heater connections go on pins 1 and 6. Number 2 pin is the plate, No. 3 pin the screen grid, No. 4 pin the control grid, and No. 5 pin the cathode. In the Crosley model 515 it is only necessary to remove the grounded cathode and insert a 300-400 ohm 5-watt resistor by-passed by a 10 μf 50 volt condenser.

Since sets using the 6B5 usually require a driver tube as the 76, it will be conventionally coupled to the following grid. The only caution is to make sure of the bias on the 42.

Contributed by R. S. Thompson, Springfield, Mass.

Philco "Mystery" Set—Failure to Tune

Philco model 40-216 "Mystery" sets sometimes fail to respond to the remote control unit when a change of station or volume is desired. If you dial a station or try to increase volume and the automatic mechanism just chatters but does not function properly, check the 16 μf 200 volt electrolytic capacitor No. 95 (per Philco's schematic), which is in series with resistor No. 94 across relay solenoids. Conds. No. 95 has probably lost its capacity.

Submitted by F. A. Rand, Winthrop, Maine.

Sentinel 286-PR—Weak Reception

When reception is either mushy or weak, nine times out of ten the trouble is due to an open 4.7 meg. $\frac{1}{4}$ watt B plus dropping resistor in grid No. 2 of the 1S5 tube.

Submitted by Pedro S. Trueba, San Benito, Tex.

NEW PRODUCTS

Precision Series 85

A new High Sensitivity Test Set has been announced by Precision Apparatus Company, Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.

The Series 85 is bakelite cased, lightweight, portable and compact. Affording a sensitivity of 20,000 ohms per volt D.C. and 1,000 ohms per volt A.C.; 34 self-contained ranged are provided to 6,000 volts, 120 microamperes, 12 amperes, +70 DB and 60



megohms. It has a 4-5/8" wide angle 50 microampere meter with 2-color scale-plate and large easy-reading numerals. Panel is of heavy gauge, anodized etched aluminum. Unit supplied complete with self-contained ohmmeter batteries and test leads.

Ranges: Voltage Ranges: 0-3-12-60-300-1200-6000 volts A.C. and D.C. Current Ranges: 0-120 microamps, 0-1.2-12-120 MA. 0-1.2-12 Amperes D.C. Resistance Ranges: 0-6000 ohms (35 ohms at center scale) 0-600K-6 Meg-60 Megohms. Decibel Ranges: From -26 to +70 DB.

New RCA Crystal Phono Replacement

A new "Silent Sapphire Crystal Pickup" which may be used as a replacement for any of 70 different crystals employed in the pickup arms of a wide variety of different makes and models of phonographs, is now being marketed by the Renewal Sales Section of the RCA Tube Department.

New Webster-Chicago Recorder

A new wire recorder, especially designed for easy connection to existing amplifier circuits, is announced

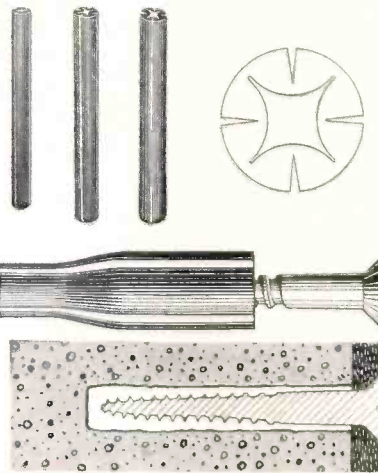


by Webster-Chicago Corporation.

The new unit, Model 78, utilizes push-button controls for greater flexibility of operation in any of four "record" or "listen" positions. It consists of a wire transporting mechanism, a pre-amplifier, interstage amplifier, oscillator and built-in power supply. Accurately calibrated recording level meter assures correct recording volume. The Model 78 is mounted in an attractive metal case 11 3/8" x 11" x 5 5/8". List price will be \$153, east of the Rockies. For more information contact: S. T. Seaman, Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 39, Ill.

Plastic Expanding Screw Anchor

"Hi" plastic screw anchors are offered by Holub Industries, Inc., box 409, DeKalb Ave., Sycamore, Ill. These units, which come in all sizes for screws sized 5 through 20 are simply inserted in the hole and as the



screw is driven home it automatically locks itself in. Ideal for use in concrete, plaster, and similar instances where it would be otherwise impossible to obtain a strong anchorage under normal procedure. Present day antenna installations are typical cases where such anchors fill a need. For literature write to the manufacturer. The anchors are very inexpensive and should be in every radio serviceman's tool kit.

Converters for TV Sets in DC Areas

A long-needed line of converters that permits operating TV sets, wire recorders and other office appliances in D.C. areas is put on the market by Electronic Laboratories, Inc., Indianapolis, Ind. The two new units now available are:

MODEL 110R15

INPUT: 110 volt DC (Commercial power line).

OUTPUT: 110 volt AC 60 cycles. 15 to 150 watts at 80-100% power factor.

VIBRATOR REPLACEMENT: Model 1315.

Filtering: Converter is radio frequency filtered completely for broadcast, short wave and FM bands.

Regulation: Variation of voltage

over output power range is so slight that no external regulation control is necessary.

Dimensions: 12 1/4" long, 6 1/4" wide, 7 1/2" high.

Weight: 15 pounds.

Finish: Hammered dark blue baked enamel with chrome handle.

Starting: Autostart with connection of load.*

Fuse: 5 ampere 3 AG type (spare provided).

MODEL 110R30

INPUT: 110 volt DC (Commercial power line).

OUTPUT: 30 to 300 watts at 80-100% power factor.

VIBRATOR REPLACEMENT: Model 3051.

Filtering: Converter is radio frequency filtered completely for broadcast, short wave and FM bands.

Regulation: Variation of voltage over output power range is so slight that no external regulation control is necessary.

Dimensions: 18" long, 8" wide, 9" high.

Weight: 55 pounds.

Finish: Hammered dark blue baked enamel.

Starting: Autostart with connection of load.*

Fuse: 5 ampere 3 AG type (spare provided).

*AUTOSTART provides remote operation of converters eliminating wiring and installation costs - provides instantaneous starting - appliances operate just as when connected to 110 volt AC line.

New Astatic Crystal Mike

Described as the "Velvet Voice" Beauty, a new, convertible type Crystal Microphone has just been introduced by The Astatic Corporation, Conneaut, Ohio. Made with a detachable "quick-lock" base, this microphone may be used as a hand or desk mike or mounted on floor stand.



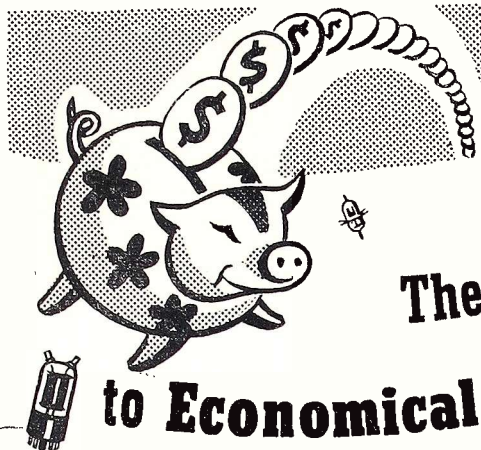
It is made with bright chrome grille, gold finish housing and handle, and dark brown baked enamel base.

It is supplied in two models: No. 200, with smooth, even frequency response characteristics from 30 to 10,000 c.p.s. No. 241, with similar range but with rising characteristics between 1500 and 5500 c.p.s. for added brilliance in the speech range. Either model supplied with or without switch as illustrated.

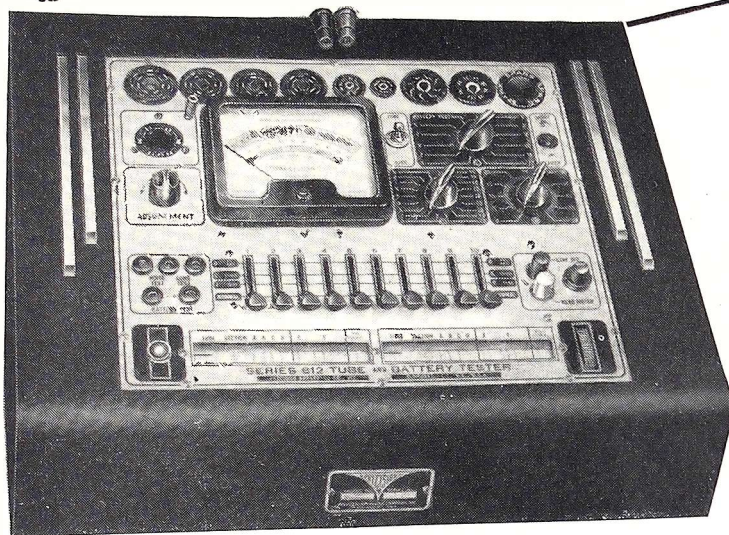
New Recorder

A new home recording unit with professional features has been an-

[Continued on page 32]



The New PRECISION "612" is your answer to Economical, Positive, Tube and Battery Testing



- ★ Positive Free-Point Tube Testing
- PLUS ★ Highest Practical Obsolescence Insurance
- PLUS ★ Utmost Simplicity of Operation
- PLUS ★ "Precision" Quality and Workmanship
- PLUS ★ Moderate Cost . . . Impressive Design

The new Series 612 is a modern, **free-point, lever-operated Cathode Conductance Tube Tester** representing the culmination of extended and intensive development in the field of modern tube checking requirements. It answers the ever-present need for **positive tube testing results at moderate cost**, with full conformity to "Precision's" high standards of workmanship, performance and quality components.

The new "600" line affords tube testing parameters based upon the time-proven emission testing principles as recommended by both tube manufacturers and R.M.A.; plus innumerable circuit features which render it incomparable amongst instruments in its category.

612-C (illustrated). In modern chrome-trimmed, Counter type cabinet. Dull black ripple finish on heavy gauge steel. 16 x 13 1/2 x 7", sloping to 3" at front. Complete: — \$63.95

612-P—In hardwood, Portable case with tool compartment. Size 12 x 13 x 6" Complete: — \$61.95

612-MCP—Open style Metal Case Portable, fine dull black ripple finish on heavy gauge steel. Size 10 1/2 x 12 x 6". Complete: — \$59.95

612-PM—In standard size Panel Mount 12 1/4 x 19" with dust cover. For rack cabinet or wall mounting. Complete: — \$61.95

TUBE AND BATTERY TESTING FEATURES

- ★ Tests all modern tube types including 7 pin Acorns, button 7 and Noval 9 pin types, dual-capped H.F. tubes, FM and TV amplifiers, etc.
- ★ Filament voltages from 3/4 to 117 volts.
- ★ Absolute Free-Point 10 element lever selection for both short and merit tests.
- ★ 4 1/2" wide vision meter. 2% Accuracy.
- ★ Dual HI-LO short-check sensitivity.
- ★ Individual Tests of Multi-Section Tubes including tuning indicators, gas rectifiers, oscillator-converters, etc.
- ★ Ballast Unit Tests.
- ★ Micro-Line adjustment — continuously variable.
- ★ Pilot and signal light tests.
- ★ Noise and Condenser test pin jacks.
- ★ Dynamic "under-load" test for all popular radio A, B, and C dry batteries.
- ★ Built-in, brass geared roll chart.
- ★ Anodized, deep-etched, heavy gauge aluminum panel.
- ★ Panel-mounted Fuse extractor Post.
- ★ Telephone type cabled wiring using plastic-insulated moisture resistant hook-up wire.

SERIES 620 TUBE, BATTERY AND SET TESTER RANGES TO 3000 VOLTS, 12 AMPERES, + 64DB, 10 MEGOHMS

A COMPLETE, PORTABLE, SERVICE LABORATORY providing every essential feature for general purpose test and check of modern radio and electronic equipment.

Incorporates the identical tube test circuit and battery testing features of the Series 612. (described above) PLUS a complete A.C.—D.C. Multi-Range Circuit Tester of 1000 ohms per volt sensitivity.

CIRCUIT TESTING FEATURES

- ★ 5 A.C.—D.C.—Output Voltage Ranges: to 3000 volts.
- ★ 5 D.C. Current Ranges: to 12 Amperes
- ★ 3 Resistance Ranges: self-contained: to 10 Megohms.
- ★ 5 Decibel Ranges from —12 to +64 DB.
- ★ Full rotary Range and Function Selection.
- ★ 2 pin jacks serve all standard ranges.
- ★ 1% Wire-wound and Metallized Resistors.
- ★ 400 microampere 4 1/2" Meter. 2% accuracy.
- ★ All Circuits Insulated from power line.

The Series 620 is available in the same four model types as described for the series 612 (above)

620-C — Counter Cabinet.....Net Price \$84.30
 620-P — Portable Case.....Net Price \$82.30
 620-MCP — Metal Case Port.....Net Price \$80.30
 620-PM — Panel Mount.....Net Price \$82.30

SEE these new "Precision" Test Instruments now on display at all leading radio parts and equipment distributors, or write directly for the Precision 1948 catalog describing the full Precision line of quality Electronic Test Instruments.

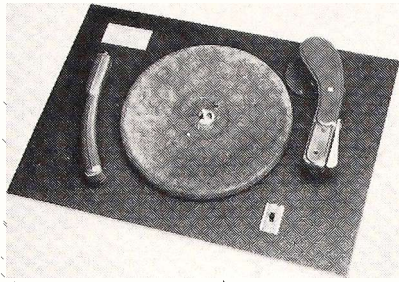
PRECISION TEST EQUIPMENT

Standard of Accuracy

PRECISION

APPARATUS COMPANY INC.

92-27 HORACE HARDING BOULEVARD
ELMHURST 8, NEW YORK



nounced by the Universal Microphone Company.

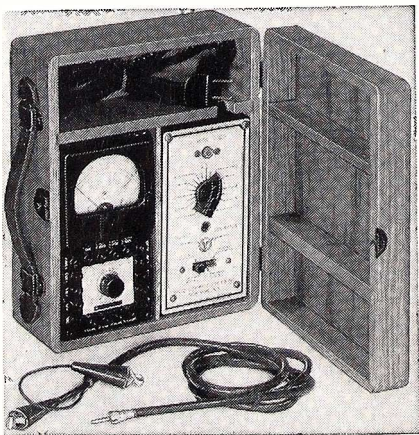
Called the Universal RC Recording Chassis, this new unit is said to have these features:

- (1) Recording extremely close tangency.
- (2) Patented pantographic movement makes possible equally spaced cutting over the entire record.
- (3) Groove depth adjustment is visible and adjustment can be made in recording position.
- (4) Pantographic action keeps guide shoe at correct angle in lead screw thread—records inside to outside.
- (5) A lift lever at side of head allows the operator to locate the stylus in the exact groove location after the lead screw has been engaged.
- (6) New RC Recording Chassis records music and voice at commercial levels and loudness.
- (7) Recording head is automatically lifted at the end of a 10" record.

Using a 10" turntable the heavy duty, 110 volt, 60 cycle 78 RPM motor is complete with crystal pick-up to play back 12" records. Further information can be had by writing to Universal Microphone Company, Centinela at Warren Lane, Inglewood, California.

Compact Servicettes

Designed to accommodate several essential service instruments, which can be removed for bench operation. In addition, compartments are provided for test leads and tools.



Servicette Model 4410—Pocket multimeter Model 449A with pocket signal generator Model 710, plus test leads, output lead, and carrying case.

Servicette Model 4420—same as Model 4410 except that FM pocket signal generator Model 720 is included instead of Model 710.

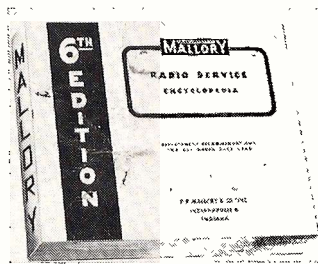
For further information, write to

BOOK REVIEWS

6th Edition Mallory Encyclopedia

The 6th Edition of the Mallory Radio Service Encyclopedia has been announced by P. R. Mallory & Co., Inc., Indianapolis, Ind.™

The latest edition, which provides helpful service information on all prewar and postwar receivers in one volume, contains 25% more listings than the 5th Edition.



The Encyclopedia includes detailed replacement information on volume and tone controls, capacitors, and vibrators . . . circuit information, service hints, installation notes, I.F. peaks, tube complements and number of tubes . . . and in addition, shows a reference to Rider's Manual, volume and page number for each receiver. The 6th Edition will be available at a net price of \$2.00 on April 1st through all Mallory distributors.

FM Transmission and Reception,

by John F. Rider and Seymour D. Uslan; Published by John F. Rider Publisher, Inc.

An up-to-the-minute 416-page book covers the principles underlying the operation of the complete FM transmitter and receiver. The first section discusses both the narrow-band and wide-band transmitters manufactured today for service in television—in ham, aviation, marine, police, point-to-point, and mobile radio communication systems. Both direct and indirect FM transmitter theory is explained as well as a complete coverage of both trans-

mitting and receiving antennas.

The second section of the book explains each stage of an FM receiver, comparing them with their counterparts in AM sets, and with special attention being given to the four different types of FM detectors as well as the FM tuners that are marketed today. In the chapter on alignment of receivers, both the meter method, visual method and a combination of the two are thoroughly discussed. Such servicing problems as relocation of antennas, image response, noise and oscillator troubles, cathode lead inductances, etc. are contained in the last chapter. A comprehensive bibliography and index are included.

"FM Transmission and Reception" is now available at jobbers in either paper or cloth binding.

Broadcast Operators Handbook,

by Harold E. Ennes, published by John F. Rider Publisher, Inc.

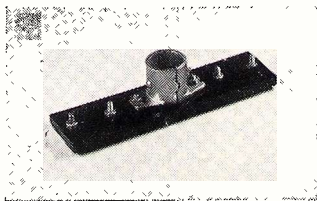
This 288-page book fills the gap in the literature covering the engineering development of broadcast equipment and its practical operation. The first four parts of the Handbook cover operating practice in control rooms, the master control, remote controls, and the transmitter. The fifth and sixth sections discuss technical data for operators and technicians, including comprehensive preventive maintenance instructions; operational data for transmitter meters and indicators are included in the appendix, which is followed by a bibliography and index.

"Broadcast Operators Handbook," which is now available at jobbers, is written in operators' language. It is intended not only for the newcomer to the field, but for the old timers as well, who will find many ideas in it that will furnish new and refreshing slants on many phases of putting programs on the air in the best possible way.

Radio City Products Company, Inc., 152 West 25th Street, New York 1, N. Y.

Oak Ridge Develops Collar Clamp

Oak Ridge Antennas, manufacturers of the "Rig-Fast" line, announces a new all aluminum collar clamp which holds antenna and



reflector elements in place on the mast or cross arm stronger and more permanently. The new clamps assure quick, accurate alignment and prevent the elements from twisting or slipping out of position. This means the elements last longer and the receiver always gets the strongest possible signal.

ADDRESS CHANGES . . .

Subscribers to RADIO SERVICE DEALER should notify our Circulation Dept. at least 3 weeks in advance regarding any change in address. We cannot duplicate copies of RADIO SERVICE DEALER sent to your old address. Old and new addresses MUST be given.

Circulation Dept.
RADIO SERVICE DEALER
342 Madison Ave., New York 17, N. Y.



TO YOUNG WORKING GIRLS — WHETHER IN LOVE OR NOT

When a young girl goes to work, she is apt to look on her job pretty much as a fill-in between maturity and marriage.

Whether in love or not, she's confident that a handsome breadwinner will come along... to provide her with a nice combination of bliss and security.

"So why," she may ask, "should I save money out of what I make?"

There are a number of reasons why—all good ones. For example:

(A) The right man might not happen along for some time.

(B) He might not be able to provide her with quite all the little luxuries a

young married woman would like to have.

(C) Having money of her own is a comfort to *any* woman, no matter how successfully she marries.

So we urge all working girls—if you're not buying U. S. Savings Bonds on a Payroll Plan, *get started now.*

It's an easy, painless, and automatic way to set aside money for the future. In ten years, you'll get back \$4 for every \$3 you put in—and a welcome \$4 you'll find it!

Remember, girls—having money of your own may not make you *more* attractive, but it certainly won't make you *less*!

P. S.

Women not on payrolls, but who have a checking account in a bank, should buy their Bonds on the simple, automatic Bond-A-Month Plan.

AUTOMATIC SAVING IS SURE SAVING — U. S. SAVINGS BONDS



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Electronic

LABORATORIES, INC.



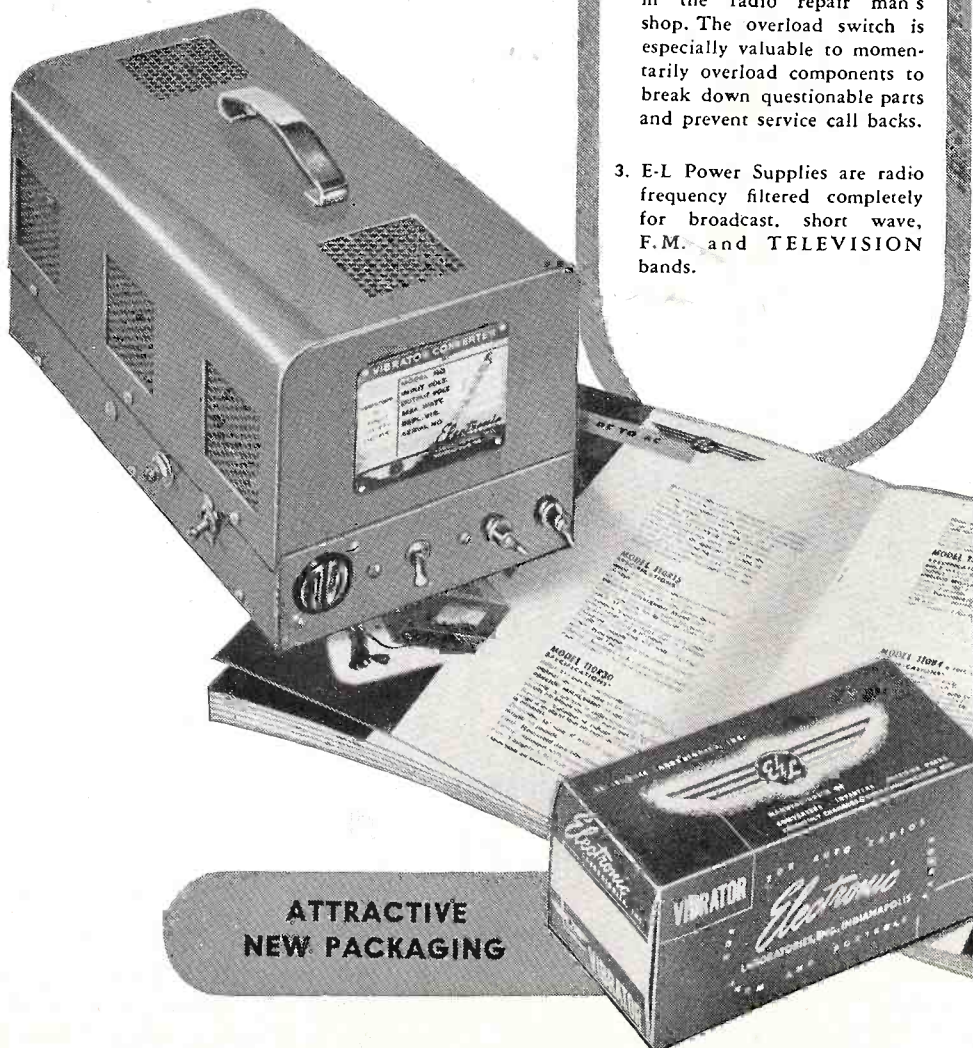
**NEW 1948
LINE WITH
Exclusive features**

The outstanding line
of converters with
new engineering ...
new design ...

TELEVISION

for Wire Recorders . . .
Radio Phonograph Combination . . . Small
Power Tools (1/10th H.P. maximum) . . .
Public Address Systems . . . Amplifiers . . .
Communication Receivers and Transmitters
. . . Small Appliances (mixers, Vacuum
cleaners, etc.) . . . Laboratory Test Equip-
ment . . . Sound On Film Amplifiers . . .
Intercommunication Systems . . . Movie
Projector Motors . . . Razors . . . Other
electrical devices.

1. The 110 volt and 32 volt converters are equipped with AUTOSTART . . . the automatic start and stop feature. This provides remote operation of converters, eliminating wiring and installation costs . . . provides instantaneous starting with no warming up.
2. E-L Battery Eliminators are the only units on the market that can simulate actual year 'round operating conditions in the radio repair man's shop. The overload switch is especially valuable to momentarily overload components to break down questionable parts and prevent service call backs.
3. E-L Power Supplies are radio frequency filtered completely for broadcast, short wave, F.M. and TELEVISION bands.



ATTRACTIVE
NEW PACKAGING

ELECTRONIC LABORATORIES, INC. INDIANAPOLIS,
INDIANA, U.S.A.

TRADE FLASHES

[from page 12]

advertising material can lift the illustrations directly from the proof sheets for printing.

Rep. & Distributor Appointments

Rodney Young Co. is now Cincinnati distributor for U. S. Television Mfg. Co.

Corwin Company now distributes Arvin radios and electrical appliances in the Los Angeles area.

Rowles Sales Co. in San Antonio; Appliance Distributors, Inc. in Louisville and Lincoln Sales Corp. in Baltimore now handle the Bendix Radio line as distributors.

Hyland Elec. Supply Co. of Chicago now distributes the Sentinel Radio line.

Newell B. Parsons is now manufacturer's representative for Webster-Chicago in the Chicago and Milwaukee areas.

J. E. Redmond Supply Co. of Phoenix now distributes the Packard-Bell line of radios.

Stromberg-Carlson appoints distributors the following: Mid-Atlantic Appliances of Washington, D. C., and Baltimore for D. C., parts of Virginia and W. Va.; Graybar Elec. of Syracuse to serve central and western N. Y.; Stubbs Elec. of Portland, Ore. in several counties of Oregon and Washington State; Graybar Elec. of Cincinnati to cover sections of Indiana and Kentucky.

Seven new distributors are announced by Stewart-Warner. They are Anderson-Young Electric Co., Lubbock, Texas; Elcon Products Co., Minneapolis, Minn.; A. H. Marshall Co., Inc., Plattsburg, N. Y.; Wilkins Distributing Co., Salt Lake City, Utah; Scott Sales Co., Toledo, Ohio; Graybar Electric Co., Eugene, Oregon, and Looboyle Refining Co., Tulsa, Okla. All are exclusive distributors in their cities.

Phono Crystal Replacement Guide

A new guide to phonograph crystal replacement, which shows clearly the exact replacement crystal to use in the different models of RCA Victor phonographs, has been prepared by the RCA Tube Department and is now available to radio servicemen and dealers through RCA Parts Distributors.

Air King Adds Distributors

Air King Products Co., Inc., Brooklyn, N. Y., manufacturers of radios, combinations and wire recorders announced the following distributor appointments:

They are: Mission Radio, San Antonio, Texas; Whitehead Radio Co., Columbus 15, Ohio; D. & R. Radio

Supply, Steubenville, Ohio; Eagle Sales Co., Providence, R. I.; A. C. McClurg Co., Chicago, Ill.; Toledo Radio Specialties, Toledo 2, Ohio; Barno Radio Co., McKeesport, Pa.; Thompson Radio Supplies, Zanesville, Ohio; Hicks Radio Supply, West Va.; Fall Radio Supply Co., Canton, Ohio; Electronic Distributors, Lexington, Kentucky, A. W. Mayer Company, Boston 15, Mass.

Illinois Cond. Catalog Supplement

Illinois Condenser Co., 1616 N. Throop Street, Chicago 22, Illinois announces a supplement to their catalog of September 2, 1947. This supplement lists new additions to the "Illini" line of Electrolytic Condensers. Included are types especially designed for use in voltage doubling circuits. Also several new high voltage, high capacity types are listed for the first time.

Copies of this supplement may be obtained by writing the company.

New Vol-Control Kit

The Han-D-Kit No. 5 just released by Clarostat Mfg. Co., Inc., 130 Clinton St., Brooklyn, N. Y. contains 12 of the most popular values of plain, tapped and slip-drive controls, together with a selection of 12 attachable shafts and 4 as-a-switches; 6 ballast tubes most generally called for; five Green-ohms or 10-watt wire-wound power resistors; plus a double-ended wrench, authorized service plaque, copy of latest catalog, and a registration card calling for a free copy of the new 50c Clarostat Service Manual—all packed in a green-finished steel cabinet with hinged cover and entirely free of any advertising matter, so that it can be used later as a filing cabinet or handy box. Representing a total value of \$30.15, the dealer's net is only \$15.07. But the main thing about this kit is that it's good to the last item. It contains no "duds."

Shure Introduces New Wire-Recording Heads

A new line of wire-recording heads has been announced by Shure Brothers, Inc. of Chicago. The manufacturers state that the new heads are unusual in the versatility of their mechanical and electrical adaptations. Recording, play-back, and erasing features have been combined into one small compact unit. Mechanical construction also permits a variety of shielding and mounting arrangements.

Impedances and internal connections may be varied to suit individual needs. Other features are: uniform performance, excellent wear characteristics, reduced hum pickup, and a controlled groove contour. Complete information is available to firms writing on company letterhead.

A GREAT **TRANSVISION** FIRST!

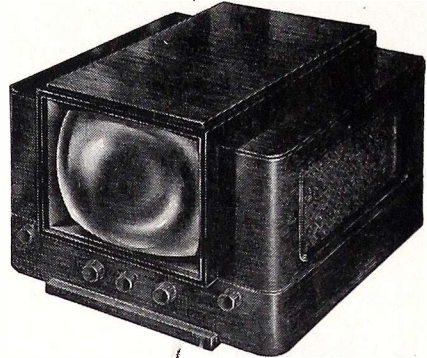
NEW... Sensational **TRANSVISION** Development now offers **LARGE-IMAGE DIRECT-VIEW TELEVISION** at low cost!

BIGGEST VALUE in TELEVISION!

Model 10BL TELEVISION KIT with FM Radio . . . Features Beautiful CABINET with BUILT-IN LENS. Gives LARGE 120 Sq. In. Picture

Roto-picture effect: Picture "rotates," giving the appearance of being in focus and clearly visible from every angle! Uses 10" Electromagnetic Direct-view Picture Tube.

Features new-type cabinet with built-in lens which magnifies, clarifies and heightens contrast of the picture. The lens also creates the effect of apparent rotation of the picture, so that when the observer moves, the picture still seems to be in focus and clearly visible from any angle.



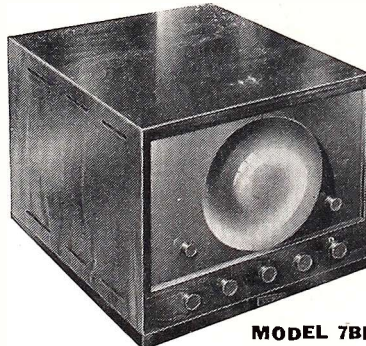
MODEL 10BL

ECONOMICAL KIT, EASY TO ASSEMBLE. In point of value, this Television Kit provides the opportunity of acquiring a **LARGE-IMAGE** direct-view television set at a **VERY LOW PRICE**; also very economical from a tube replacement angle. This model is available in **KIT FORM**, for easy assembly; no technical knowledge required. Simple step-by-step instructions are included. Saves as much as 50% over the cost of receivers with similar picture magnitude.

TECHNICAL DATA: Model 10BL uses a 10" Electromagnetic Direct-view Picture Tube; has complete F.M. Radio which comes completely factory-wired; receives all channels in any area; supplied complete with antenna and lead-in wire. The **LENS** is 15" x 11", giving a picture size of approx. 10" x 12" or 120 sq. in.; the highly-styled cabinet measures 26" wide x 17" high x 19" deep, available in Mahogany, Walnut, or Blonde finishes.

PRICES: Transvision **MODEL 10BL Television Kit**, with FM, 10" tube, cabinet with built-in lens, antenna, 60 ft. lead-in wire. LIST \$359.00
MODEL 12BL, same as 10BL except that it uses 12" tube, giving picture area of 130 sq. in. LIST \$389.00

Scoop! New Revolutionary **MODEL 7BL** Television Kit with Specially Designed **CABINET** with **BUILT-IN LENS**



MODEL 7BL

- Uses 7" Electrostatic Picture Tube
- Gives 50 square inch picture of superior quality

FEATURES: Though it has a 7" tube, the effect is equivalent to a 10" set because the built-in lens magnifies the picture. Also picture performance is superior because the lens clarifies and heightens contrast of the image. Picture "rotates" apparently, as the observer moves, giving the effect of always facing the observer. This is effective to a very wide angle. Pre-tuned for 5 channels.

PRICE: Including cabinet with built-in lens, antenna, 60 ft. of lead-in wire. **NET \$189.00.**

TRANSVISION "SERVICE NOTES" The Key to Successful Television Servicing

Transvision's "Service Notes" is a compilation of confidential Television Notes and Information, the product of experience with over 20,000 television receivers, now made available to the public.

The "Service Notes" is a most valuable compilation of instructions and data on Magnetic and Electrostatic Television Receivers. Though compiled in the course of servicing Transvision Kits, the information is applicable to any type of television receiver.

"Service Notes" is complete with photographs and diagrams. The information is worth a small fortune. The cost is low. **LIST \$2.95.**



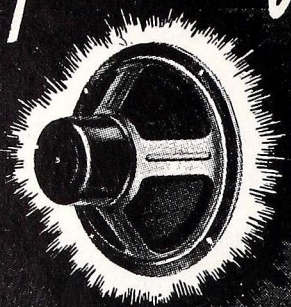
All prices 5% higher west of Mississippi; all prices fair traded.

For further information see your distributor, or write to:

TRANSVISION, INC. Dept. S.D., NEW ROCHELLE, N. Y.

See **TRANSVISION** at the **PARTS SHOW!** There will be a **SPECIAL TRANSVISION EXHIBIT** from May 10th through the 14th at the **SHERMAN HOTEL** (Chicago) in the **GOVERNOR'S SUITE!** Be sure to see the interesting new Transvision Developments in Television and FM.

Permoflux SPEAKERS



YOUR JOBBER CAN SUPPLY YOU!

Permoflux quality and dependability—the same as supplied to the major set manufacturers—is your assurance of complete customer satisfaction. You'll find Permoflux Speakers easy to install and readily available in both PM and Electro-dynamic types. You'll find too, that it pays to give your customers "tops in tone" with a Permoflux Replacement Speaker.

TWO COMPLETE
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PIONEER MANUFACTURERS OF PERMANENT MAGNET DYNAMIC TRANSDUCERS

PERMOFLUX CORPORATION

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236 SOUTH VERDUGO ROAD, GLENDALE 5, CALIFORNIA

SERVICE DEALERS

For 8 consecutive years "Radio Service Dealer" has consistently published more exclusive and authentic articles on: (1) new radio servicing methods and techniques; (2) new test equipment and its applications; (3) new and unusual receiver circuits; (4) P-A and sound installation and service methods; (5) FM and Television circuits, installation and servicing techniques; (6) Shop Notes; (7) practical bookkeeping and business management methods—than any other monthly magazine purporting to cater to radio technicians.

From an editorial point of view "RSD" has vigorously fought to improve the standards and earning capacity of the Nation's legitimate Service Dealers and Technicians, as opposed to those "experimenters and novices" who profess to be radio technicians although they are not so qualified by experience or ethical practices.

"RSD" accepts subscriptions only from legitimate and recognized radio Service Dealers and Technicians and from students in accredited radio training schools. Be sure you are an "RSD" subscriber, and be sure to tell your bona-fide competitors that they should subscribe too. The low cost of a 2-year subscription (\$3 in U. S. A. and Canada) makes "RSD" the best business investment possible, only 12½¢ per issue. Use the order form below to extend your present subscription, or give it to a friend in the radio service business so he may use it.

USE THIS COUPON—FILL IN—RETURN IT TO US AT ONCE WITH YOUR REMITTANCE ATTACHED

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342 Madison Ave., New York 17, N. Y.

Gentlemen: Please send the next issues of RADIO SERVICE DEALER. Our remittance in the sum of \$ is enclosed.

Name

Address

City Zone State

Firm Employed By:

Position or Title

LOOK AHEAD



CIRCUIT COURT

[from page 26]

and fourth grids are tied together in the tube and serve as a plate for the triode oscillator. D. C. reacts the grids through 4700 ohms, which also places them at a high r-f potential. This effective plate then connects to the tuned coil at the end opposite to the grid end. The capacity branch of the tank circuit is formed by 1000 $\mu\mu\text{f}$ from plate end to ground and 300 $\mu\mu\text{f}$ from grid end to ground. A trimmer is shunted across the 300 $\mu\mu\text{f}$ section.

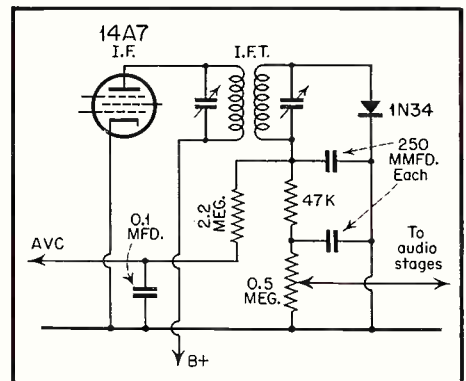
Conditions for oscillation (and variable inductance tuning) are thus provided with the grid and plate of a triode 180° out of phase and the cathode at an appropriate tap in between.

Electronic Laboratories Model 76RU

This six tube instrument, a combined radio receiver and inter-communication master station employs a novel second detector and AVC circuit.

Following a 14A7 r-f stage, 14Q7 convertor and 14A7 i-f stage we find a crystal rectifier of the 1N34 variety. This rectifier takes the place of the diode element found in most receivers.

In the partial schematic illustration are shown the crystal and its associated components. The last i-f transformer secondary has the crystal from one



Novel AVC Circuit

side to ground and the other side connects to the usual i-f filter, with a 47K-ohm resistor and two 250 $\mu\mu\text{f}$ condensers, thence to the .5 meg. volume control as a load. Audio is taken from this control to the subsequent stages (a 14F7 and 50A5) as in the ordinary circuit.

AVC voltage is also developed across the lead and, after passing through the 2.2 meg. resistor, is applied to the r-f, convertor and i-f tubes.

It should be noted that the polarity of the crystal is important and if replacement is made it should be so connected that a negative voltage is developed on the AVC bus.

HIGH SENSITIVITY VOLT-MILLIAMMETER

[from page 18]

portioning of the shunt and multiplier resistors. This rheostat is installed inside the voltmeter case, since it normally will not need readjustment once it has been set to the proper value.

The voltmeter multiplier resistors are R_2 to R_9 inclusive. These resistors may be 1-watt carbon units or metalized resistors, but must be selected individually from dealer's stock for exact ohmic values. A good ohmmeter usually will be satisfactory for making this selection, but a first-class bridge will permit much closer selection. If cost is no object, precision wirewound meter resistors may be employed. R_3 must be made up of one 15,000-ohm and one 3000-ohm resistor connected in series. R_4 may be selected from a lot of 100,000-ohm resistors which run on the low side of their rated value. Similarly, R_5 may be selected from a lot of low-running 200,000-ohm resistors.

The current-meter shunt resistors are R_{10} to R_{12} inclusive. These components also must be selected for exact ohmic values. Resistor R_{12} will have to be made from a straight length of heavy Nichrome, or similar resistance wire, cut (with the aid of a low-range ohmmeter) exactly to 0.2 ohm, and then soldered directly between the switch contact and the NEG input terminal.

The selector switch, S , is a 2-pole, 11-position, NON-SHORTING, rotary selector switch. Either bakelite or ceramic insulation may be used, although the ceramic is an unnecessary refinement.

The eight voltage ranges and three current ranges take all eleven terminals of the selector switch. However, by employing a switch having additional contact positions, an individual builder may, if he desires, provide additional milliampere and microampere ranges. The ohmic value of required shunt resistors for the new ranges may be calculated from the formula $R = 2000 / F - 1$, where F is the factor by which the basic 50-microampere scale of the meter is to be multiplied. Thus, F is 20 if a 0-1-milliampere scale is desired, because 1 milliampere is 20 times 50 microamperes.

The positive and negative input terminals, marked POS and NEG, are respectively red and black tip jacks or banana jacks—depending upon whether the builder's meter test leads have phone tips or banana plugs on their ends.

Adjustment

In the multiplier resistors (R_2 to R_9) and the shunt resistors (R_{10} to R_{12})

[Continued on page 37]

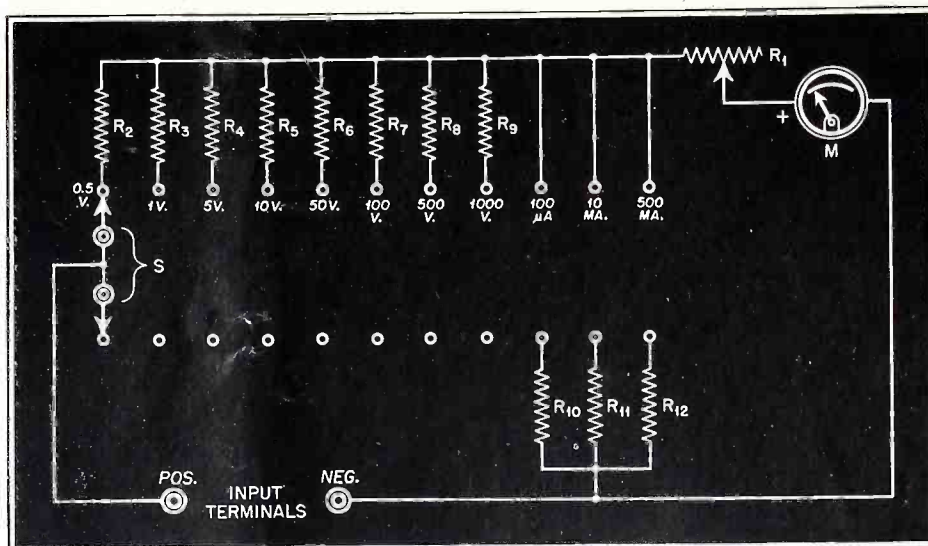


Fig. 2. M—0-50 d-c Microammeter (Res. = 1140 ohms) Weston Mod. 301; R_1 —Miniature 1000 ohm w.w. rheostat, screwdriver adjusted; R_2 —8000 ohms, 1 watt; R_3 —18,000 ohms 1 w. (15,000 and 3,000 ohms in series); R_4 —98,000 ohms, 1 w. (see text); R_5 —198,000 ohms 1 w. (see text); R_6 —1 meg, 1 w.; R_7 —2 megs, 1 w.; R_8 —10 megs, 1 w.; R_9 —20 megs, 1 w.; R_{10} —2,000 ohms, 1 w.; R_{11} —10 ohms, 1 w.; R_{12} —0.2 ohm, 1 w. (see text); S —2-pole, 11 position, NON SHORTING, rotary selector switch.

Utah
RADIO PRODUCTS

SPEAKER

MODEL SE1210

**Booth One
Stevens Hotel
May 11-14, 1948**

Utah

**Utah's new
factory in
Huntington**

**VISIT OUR BOOTH
at the RADIO SHOW**

**UTAH RADIO PRODUCTS
HUNTINGTON, INDIANA**

DIVISION OF INTERNATIONAL DETROLA CORP.

COMPUTING THE PRICE TO CHARGE

[from page 19]

charged to all the jobs at \$120.00, indicating a profit of \$20.00 on the sale of the materials. The actual productive hours spent on the various assignments by Technician No. 1, Technician No. 2 and the proprietor were exactly in accordance with the estimate made at the beginning of the month as shown in Exhibit "A." This, of course, would not be true in actual practice because there would be a variance between the estimated productive hours and the actual productive hours. However, if the estimates are carefully made, the variances either above or below the actual number of productive hours will not be great. The overhead rate of 25c per productive hour has been applied to all such hours for the month. Twenty percent of the total direct labor and overhead charges has been added for profit. The Profit and Loss Statement below gives a resume of the transactions which are reflected in the over-all job ticket. The sales for the month total \$1,071.00, from which are deducted the cost of parts purchased, the payroll expenses for the two technicians, and the overhead charges. This leaves a profit for the proprietor in the amount of \$478.50, which can be accounted for as follows:

| | |
|--------------------------------------------------------------------------------|----------------|
| Profit on the sale of parts | \$20.00 |
| Proprietor's compensation for services rendered | 300.00 |
| Proprietor's profit for managerial responsibilities and risk of doing business | 158.50 |
| | Total \$478.50 |

Please note that the profit to the proprietor for the risk and responsibilities involved is actually 20% of the total labor and overhead charges of \$792.50.

In conclusion we should reconsider the basis for our charges; that is, the productive hours. There are many time-saving methods which may be

used, thereby resulting in an increased number of productive hours during a given period. It is essential in this type of business that you radio technicians build up the number of productive hours so that the base over which the many costs are pro-rated will be as large as possible. Many hours are consumed as

EXHIBIT "D"

| | |
|--------------------------------------------------------------------------------|------------------------------------------------|
| OVER-ALL "JOB TICKET" | |
| CUSTOMER..... | JOB NO..... |
| ADDRESS..... | |
| DATE STARTED..... DATE FINISHED..... | |
| MATERIAL: | |
| Various Parts | Cost \$100.00 \$120.00 |
| LABOR: | |
| Technician | Time |
| Proprietor | Start Stop Hours Rate |
| No. 1 | XX XX 150 \$2.00 \$300.00 |
| No. 2 | XX XX 120 2.00 240.00 |
| | XX XX 100 1.60 160.00 |
| | 370 \$700.00 |
| OVERHEAD: | |
| | Hours Rate |
| | 370 \$.25 \$ 92.50 |
| TOTAL LABOR AND OVERHEAD CHARGES | |
| | \$792.50 |
| ADD 20% FOR PROFIT | |
| | 158.50 \$951.00 |
| TOTAL CHARGES FOR JOBS | |
| | \$1071.00 |
| PROFIT AND LOSS STATEMENT | |
| Sales for the Month | |
| | \$1071.00 |
| Less: | |
| Cost of Parts Purchased | \$100.00 |
| Payroll Expense | 400.00 |
| Overhead Expenses | 92.50 |
| | 592.50 |
| PROFIT—Accounted for as follows: | |
| | \$478.50 |
| Profit on sale of parts | \$ 20.00 |
| Proprietor's compensation for services rendered | 300.00 |
| Proprietor's profit for managerial responsibilities and risk of doing business | 158.50 |
| | \$478.50 |

Sightmaster Leads Again

WITH THE BEST VALUE IN QUALITY TELEVISION!

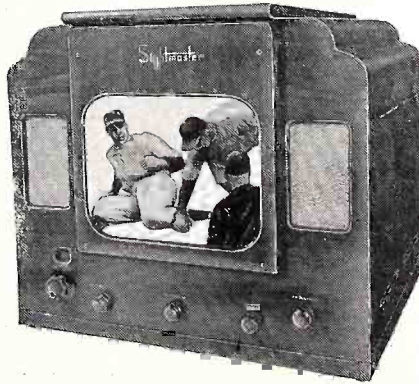
The New
SIGHTMASTER 15
with FM RADIO
\$595.00

In Mahogany or Walnut; plus installation and Fed. Excise Tax
One of the LARGEST DIRECT-VIEW TABLE MODELS AVAILABLE, featuring the brilliant 15" picture-tube.

Only Sightmaster GIVES YOU THESE ADVANTAGES: A 15" Table Model with 120 sq. in. direct view picture... Built-in F.M. Radio Receiver... Twin speakers... A CHOICE of CABINETS in beautiful hand-rubbed Mahogany, Walnut, or Blonde (at slight additional cost) to suit every taste... One Year Sightmaster Warranty... Exclusive Franchises. Expanding Manufacturing Facilities Enable us to Invite Participation of an Additional Number of Dealers on a Protected Franchise Basis.

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220 Fifth Ave., New York 1, N. Y. MURRAY HILL 9-0174

Philadelphia Office: 1500 Walnut Street



a result of poor planning on the part of the proprietor. Hours which should be productive are non-productive, all because of lack of good judgment and careful planning. There are many times when each of you have devoted at least half a day to the procurement of certain parts for a job. Of course, this time is not chargeable to the customer; however, the labor and overhead costs of operation continue. Good management will consider the time lost in procuring the various parts and will provide means whereby the items are obtained without effecting a loss in productive hours. The more productive hours you have, the less will be the overhead rate chargeable to each productive hour and the less the labor cost per hour. The reduction of the labor and overhead rates per productive hour will result in lesser charges to the customers for services rendered. This condition will attract many more customers to have their radios repaired who otherwise would not consider such services because of high charges.

[Continued from page 35]

are accurately selected "on the nose," no adjustment nor calibration need be made to standardize the instrument. However, rheostat R_1 must be set accurately to bring the total resistance of R_1 plus the internal microammeter resistance to 2000 ohms. This is done in the following simple manner, if resistor R_3 has been selected exactly on the nose:

(1) Set range switch S to its 1-volt position. (2) Advance rheostat R_1 to its maximum resistance setting. (3) Connect an accurately-known 1-volt d-c source to the INPUT TERMINALS of the instrument. (This voltage may be obtained from a single dry cell through a 10,000-ohm wire-wound potentiometer, and measured by means of an accurate low-range d-c voltmeter). (4) Adjust rheostat R_1 carefully until microammeter M reads exactly 50 microamperes. Fasten rheostat R_1 at this setting by applying a drop of old fashioned sealing wax carefully to the rheostat shaft and bushing. The instrument then will be ready for use.

Conclusion

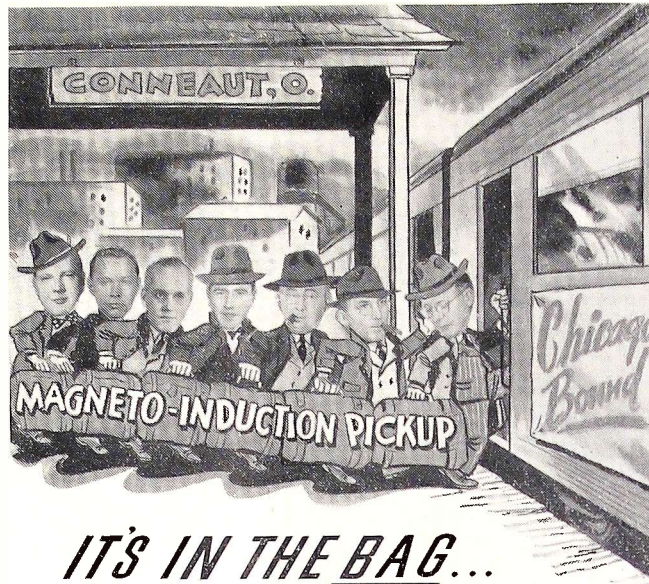
Advantages of the instrument are self-evident. By employing high input resistance values, voltages may be checked readily in critical high-resistance and low-resistance electronic circuits. The standard panel-type microammeter keeps cost low. By employing low-resistance input on the current ranges, microamperes and milliamperes may be read directly in series circuits without encountering objectionable voltage drop across the instrument itself. By choosing a convenient meter range, such as the 50-microampere setup shown here, there is no need to draw curves, make charts, or prepare a special meter card. Any builder who is even moderately handy with a pen can make the range scale for volts and milliamperes. The complete project of building the meter can be completed easily in a morning or afternoon between service rushes.

VIDEO I-F CIRCUITS

[from page 17]

dividual i-f tubes do not affect the resonant circuit conditions as a result of variations in input capacitance. Because of this, tube replacement, when necessary, does not raise a problem of realignment.

Alignment of these receivers is relatively simple. The first operation is to align each stage at its own frequency for maximum response. Following this, the overall response curve is observed on a CRO. If slight variations of this



IT'S IN THE BAG...

As we catch the train for the Annual Electronic Parts Show at Chicago, we are very anxious to see you. We have something extra special to show you this year. And you'll certainly be interested in this outstanding new development, too. We have it "in the bag"—the Astatic Magneto-Induction Phonograph Pickup. It is new, it is different.

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23 pgs. Radio and Television Sets • 62 pgs. Radio Parts
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9 pgs. Electronic Test Equipment

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Address.....

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

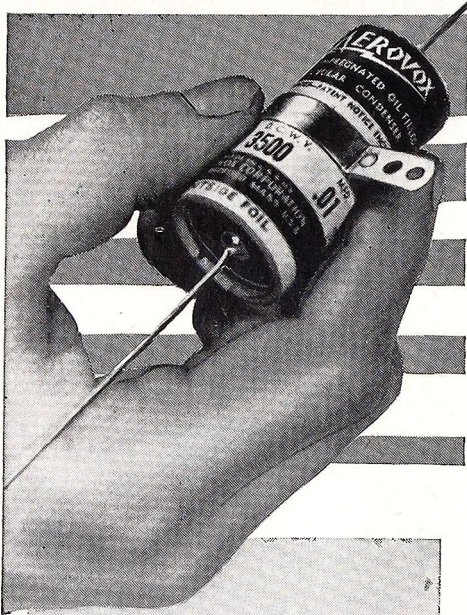
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Previously in 400, 600, 1000 and 2000 v. D.C.W. ratings, but now extended to 2500, 3000, 3500 and 4000 v. for television and other higher-voltage applications.

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response curve are desired, these may be made by slightly shifting the center frequencies of the individual stages to conform with the waveshape desired.

Traps

As pointed out previously, adjacent and associated channel interference can be eliminated by employing suitable traps. These traps are tuned at or near three definite frequencies. These frequencies correspond to the associated channel sound carrier, the adjacent channel video carrier, and the adjacent

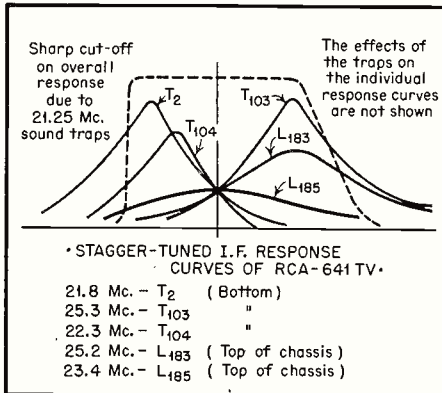


Figure 11

channel audio carrier, the latter two being the channels higher and lower, respectively, than the channel being received.

Referring again to Fig. 3, we have prepared a table, as shown in Chart A, which outlines the various interfering r-f frequencies and the corresponding i-f trap frequencies. In a receiver in which the i-f transformers are tuned to 25.75 mc the associated sound trap would be tuned to 21.25 mc, the adjacent channel sound trap to 27.25 mc, and the adjacent channel video signal trap to 19.75 mc. A commercial application of this is given in the 648 PTK R.C.A. receiver.

Trap circuits are generally of four types, these being:

1. Absorption.
2. Rejection.
3. Negative Resistance.
4. Cathode Degenerative.

Fig. 12 illustrates a simple absorption trap circuit. It consists, essentially, of a tuned circuit coupled inductively or directly to the portion of the i-f circuit in which both the video and interfering signals appear. The tuned trap circuit is in series resonance only to the interfering signal, so that, it offers a short-circuit path to this signal only. Commercial applications of absorption traps are shown in Figs. 8 and 10.

A rejection trap is illustrated in Fig. 13. This consists of a tuned parallel circuit which is generally connected in the high side of an i-f stage. Since a tuned parallel circuit offers a high impedance path to the frequency

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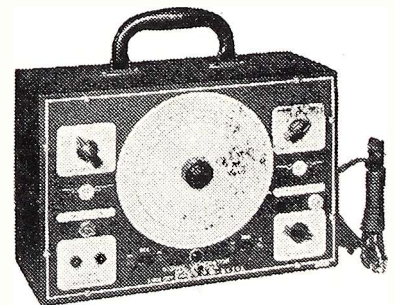
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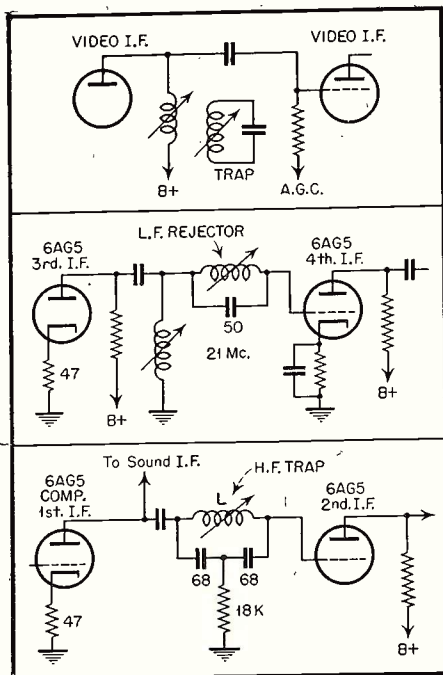


Fig. 12—(top) Simple absorption trap.

Fig. 13—(center) Motorola VT 101 receiver, showing low-freq. rejection trap circuit.

Fig. 14—(bottom) the same set's negative resistance trap circuit.

at which it is resonant, it will reject unwanted signals at this frequency only.

A third type of trap circuit is the negative resistance trap shown in Fig. 14. The Motorola Model VT-101 re-

ceiver makes use of this circuit in two of the i-f stages. By tuning this trap to the frequency of the unwanted signal a negative resistance is produced in the trap circuit which cancels the effect of the indicated 18,000 ohm resistor. In this manner the circuit resistance between points A and ground is zero at the trap frequency. When aligning, choke L, is adjusted to minimum response at the frequency it is desired to attenuate. Low frequency as well as high frequency rejection may be accomplished by this type of trap.

In Fig. 15, we illustrate a fourth type of trap circuit. Employed by R.C.A. in their current TV receivers, this trap makes use of cathode degeneration in the following manner. The primary

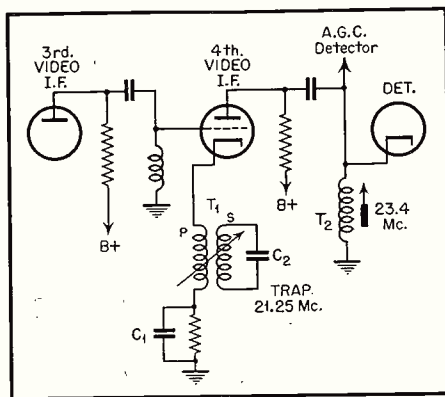
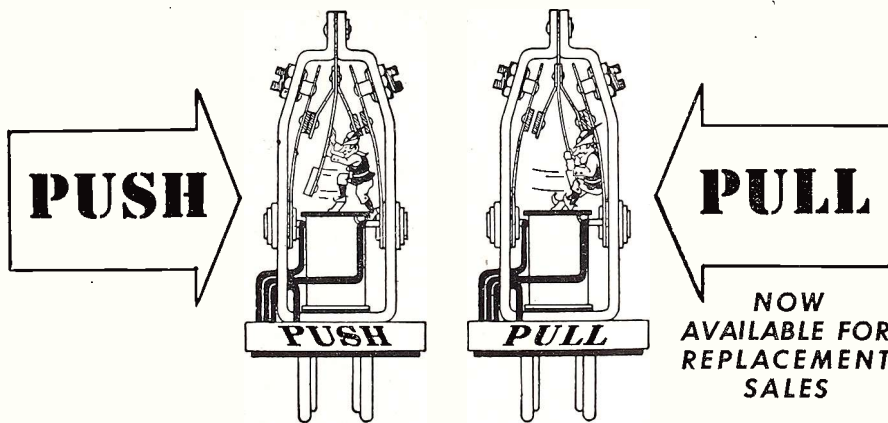


Fig. 15—Cathode degeneration trap circuit used in RCA model 648PT8.

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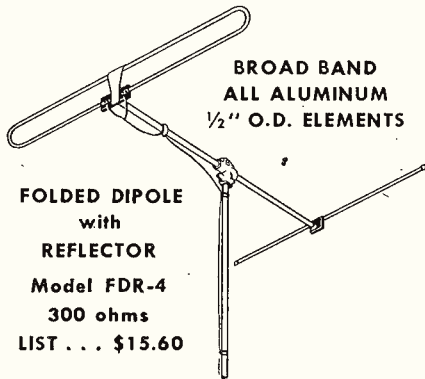
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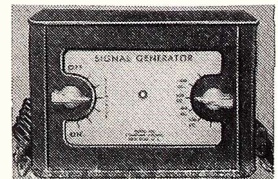
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