



# radio service dealer



FEBRUARY, 1948

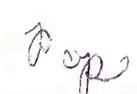
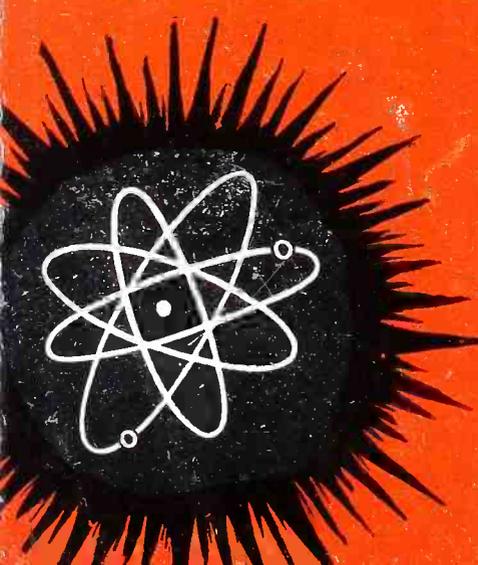
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RAISE THE SERVICE PROFESSION'S PRESTIGE

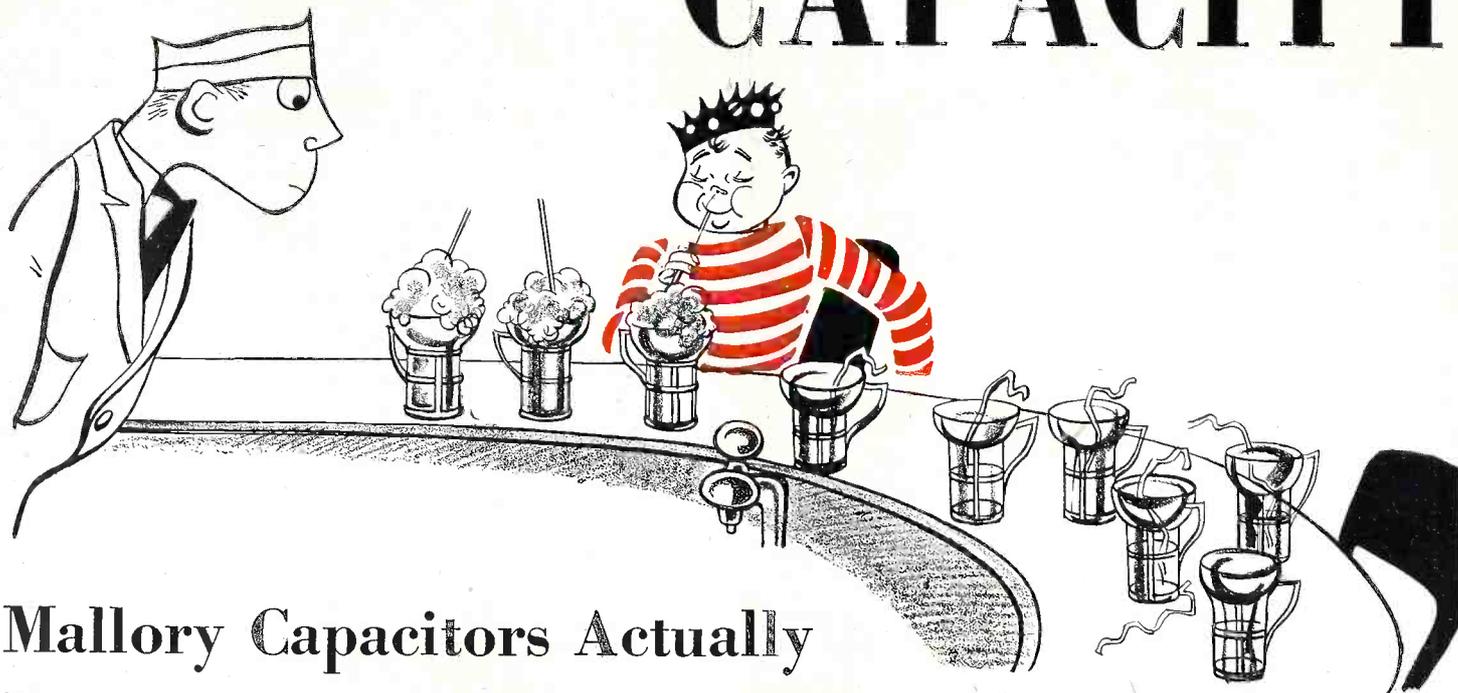
HIGH SPEED SERVICING

VISUAL ALIGNMENT

INCOME TAX DEDUCTIONS



# Sustained CAPACITY



## Mallory Capacitors Actually Increase in Capacity After 2,000\* Hours

Install Mallory FP Capacitors with the knowledge that they will last in a "hot set" with temperatures up around 185° F.—they will last on the shelf or in an inactive set without needing reaging—and they will last without loss of capacity.

Their RF impedance—their ability to withstand ripple current, are other plus values that make Mallory capacitors popular with radio service men, as well as with manufacturers of radio equipment.

### THE MALLORY "GOOD SERVICE FOR GOOD BUSINESS" PLAN

will increase business and profits in your shop.

A unique follow-up file makes it easy to keep customers.

You tie in with Mallory acceptance to develop new business—ask your distributor about it.

Mallory is never satisfied to produce parts that just get by. In all Mallory Parts you will find a generous margin in *your* favor. Mallory capacitors will operate at 185° F.—that's 35° hotter than R. M. A. requirements.

### \*2,000 HOURS OF OPERATION

An actual test of Mallory capacitors operated in an oven at 185°F. and 450 volts DC, plus 10 volts of 120 cycle ripple, showed them still going strong and with increased capacity at the end of 2,000 hours. Typical results:

At Start of Test		After 2,000 Hours	
Capacity	Resistance	Capacity	Resistance
20.9 mmf	6.16 ohms	23.5 mmf	6.5 ohms
20.1 mmf	6.5 ohms	23.4 mmf	6.55 ohms

BUY MALLORY ASSURED QUALITY AT REGULAR PRICE LEVELS

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

Thousands of Servicemen asked us:  
**"Why Don't You Publish a Tube Placement Guide?"**



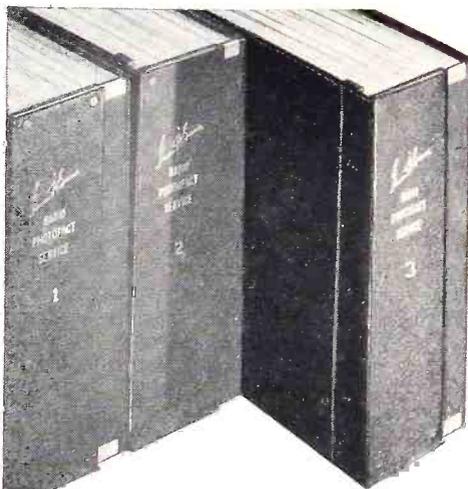
**SO WE DID!**  
**AND HERE IT IS:**  
**THE NEW PRACTICAL HOWARD W. SAMS**  
**"RADIO RECEIVER**  
**TUBE PLACEMENT GUIDE"**

It's the book you'll use every single day—in the handy pocket-size you like—that shows you exactly where to replace each tube in almost 4500 models! Covers receivers from 1938 to 1947. Each tube layout is illustrated by a clear, accurate diagram, with tubes identified by large, easy-to-read type numbers. Saves you valuable time identifying tube placement, especially where the customer has removed the tubes from the set. Eliminates irritating hit-and-miss methods and risky guessing—helps you work faster, more profitably. Completely indexed for quick, accurate reference. Handy on service calls—a big help on every job—outside or in the shop. You'll want several copies for bench and outside calls. They'll pay for themselves over and over again. Order today!

**NOTHING LIKE IT!**

*Practical*—like all SAMS Manuals! *Complete*—the only single source for tube placement data on almost 4500 models. *Accurate*—correct information on every model. You get 192 pages of invaluable data in a handy, sturdily-bound pocket-size book. Say goodbye to tube placement identification problems—save time—get more work done faster! Now at your local job-ber for **ONLY \$1.25**.....

**The World's Most Practical Radio Service Manuals!**



PHOTOFACT Volume 3 is ready for you—brings your post-war service data right up to January, 1948! Companion to Volumes 1 and 2—the most *practical, accurate and complete* Radio Data ever compiled. Here is everything you need for fast, efficient, profitable servicing of all post-war models—bound in easy-to-use volumes. Order your PHOTOFACT Volumes now—the Radio Service Data with the *exclusive* features that meets all your actual needs!

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**PHOTOFACT SERVICE**

*"The Service that pays for itself over and over, again"*



Says the service expert who values his good reputation and the repeat business that goes with it—

**"I SELL  
KEN-RAD  
RADIO  
TUBES  
BECAUSE  
THEY'RE  
BUILT  
RIGHT"**

**"...AND  
BECAUSE  
THEY  
PLAY  
RIGHT  
I BUY  
THEM!"**



—asserts the tone-conscious radio owner who appreciates the superior quality of Ken-Rad tubes.

# KEN-RAD DOUBLE ACCEPTANCE

**puts profits in the repairman's pocket**

● You're glad to install Ken-Rad tubes because their reputation stands high with you, as well as with other service experts. And Ken-Rad tubes reward this enthusiasm by helping you secure a bigger repeat business—based on clients' faith in your standards of work as shown by the quality tubes and parts you use.

DOUBLY ACCEPTED . . . by you and your customers! That's why Ken-Rad tubes hold a coast-to-coast margin of popularity. Radio owners endorse their finer tone, their long-

playing life. You prefer to sell Ken-Rad tubes—customers want to buy them! It's a favorable meeting of minds, creating more sales and greater profits.

NOW is the time to impress your name and high-grade repair facilities on your neighborhood! Radio-set production is large; owners' service needs will grow. Ken-Rad tubes can help you gain wider, friendlier local recognition, with the increased business "take" that will result. Install and sell Ken-Rad *doubly-accepted* radio tubes!

● "ESSENTIAL CHARACTERISTICS" Ken-Rad's Booklet ETR-16—is a "must" for the dealer or service-man who wants a convenient, concise, and comprehensive guide to the selection of radio tube types. Your free copy will be mailed you promptly on request. Write for it today!

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**KEN-RAD** *Radio Tubes*  
PRODUCT OF GENERAL ELECTRIC COMPANY  
Schenectady 5, New York

# EDITORIAL

by S. R. COWAN

## Tube Price Gripe By Jobbers

The Jobber's Assn. (NEDA) has publicly announced its opposition to the present trade practice of tube makers who permit radio set manufacturers to buy tubes at prices lower than Jobbers pay and then resell the tubes at the same prices that Jobbers must charge. Says NEDA: "Tubes which they (set mf'g'rs) purchase and earmark for sale to subsidiary or private distribution channels should be sold to them at prevailing replacement distributor prices."

We agree with Jobbers as their gripe is well founded. Now, let us gripe about some Jobber tactics that are unreasonable. How much longer are some "Jobbers" going to operate their own retail radio service departments in unfair competition with legitimate Servicemen and Service Dealers? And, how much longer are some "Jobbers" going to sell replacement tubes, parts, etc. over-the-counter at big discounts to any Tom, Dick and Harry who wants to buy same? We believe Jobbers should sell replacements at wholesale and give established trade discounts only to recognized, legitimate radio Servicemen and Service Dealers.

## Technician Apprenticeship Proposed

Members of the Vocational Teachers Assn., (radio teachers in the New York City public schools), have been actively engaged in trying to find a counter-proposal to the Bill for Licensing Radio Technicians which is now under consideration. One teacher offers a suggestion that in our opinion has great merit. He proposes that the men of the radio servicing profession should get a good Association organized, and then:

1—Set up suitable trade standards and a code of ethics comparable with those of other recognized trades;

2—Set up standards of technical training, apprentice training and trade experience required by journeymen mechanics on a basis comparable with other recognized trades;

3—Set up coordinating committees composed of manufacturers, technicians, educators, related industry representatives and others who will plan and administer the above recommendations.

The highlight is the proposal that, in effect, no one shall be allowed to engage in or do any radio service work as an independent until he has taken an accredited course in radio training, passed an examination, served for a period of years (say three to five) as an apprentice technician in some accredited service shop, and then after passing another examination, plus subscribing to the radio service profession's code of ethics . . . then only will such an individual be

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Member of the  
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Circulations

radio  
service  
dealer

VOL.  
9  
NO.  
2

SANFORD R. COWAN, Editor & Publisher

SAMUEL L. MARSHALL, Technical Editor

FEBRUARY, 1948

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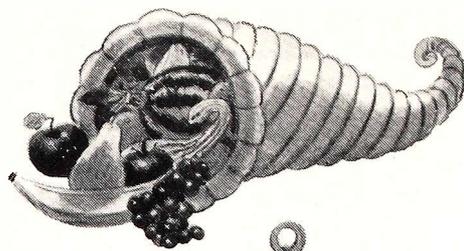
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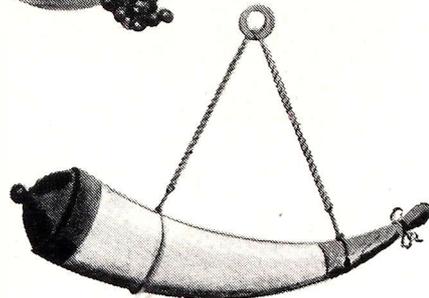
4.



1.



2.



3.



4.



## Match up the people and the horns

*(It may mean money to you!)*

THE FIRST THREE, of course, are very easy.

The sea captain (1) goes with Cape Horn (3); the musician (2) with the French horn (4); and the pioneer (3) with the powder horn (2).

That leaves the Average American (4) matched up with the Horn of Plenty (1).

As such an American, you'd like that

to be true, wouldn't you?

**It can be—and will be**—for millions of Americans who, today, are putting money regularly into U. S. Savings Bonds.

In ten years, as the Bonds mature, these millions will find that they have truly created a Horn of Plenty for themselves!

For they'll get back \$4.00 for every

\$3.00 they're putting in today!

There are now *two* easy, automatic ways to buy U. S. Savings Bonds regularly. The Payroll Savings Plan for men and women on payrolls; the Bond-A-Month Plan for those not on payrolls but who have a bank checking account.

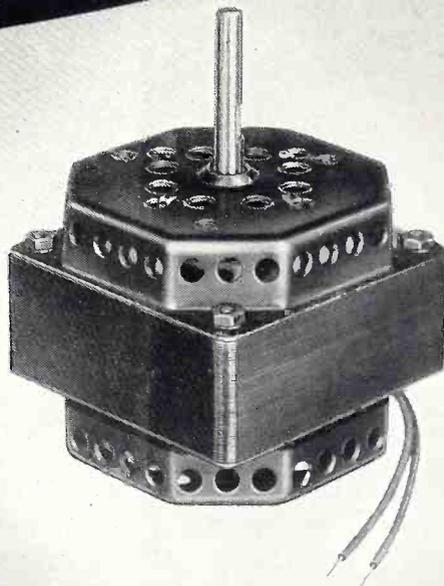
**Let U. S. Savings Bonds fill up** your personal Horn of Plenty . . . for the years to come!

### Automatic saving is sure saving—U. S. Savings Bonds

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*Announcing...*



WIRE RECORDERS



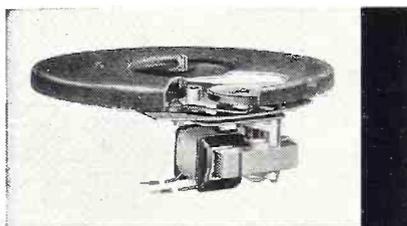
TAPE RECORDERS



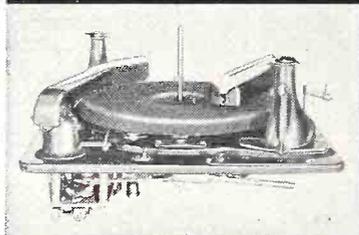
DISC RECORDERS



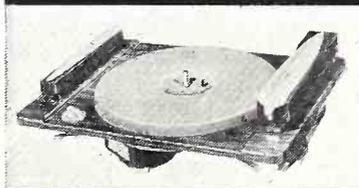
COIN-OPERATED PHONOGRAPHS



Model MX Rim Drive, Constant Speed Electric Phonograph Motor



Model RC-130 Combination Record-Changer Recorder



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

## a bigger, better measure of famous **GI** Smooth Power

It's the General Industries RM-4 Smooth Power phono-recorder motor—long a popular favorite for disc recorders and heavy duty phonograph units—*now* redesigned and improved to meet the power requirements of wire and tape recorders.

New features include special locating and locking means for new top and bottom covers which assures high accuracy in alignment of rotor within the stator bore... dual aluminum cooling fans and scientific air intakes for maximum cooling effectiveness.

Its advantages: Greater power . . . longer motor life . . . quieter operation . . . less vibration . . . cooler running characteristics . . . minimum magnetic field radiation. And, like all GI motor units, it affords split-second pick up to full constant speed—true Smooth Power performance.

*Complete information and performance data upon request. Write today.*



**The GENERAL INDUSTRIES Co.**

DEPT. K, ELYRIA, OHIO

# TRADE FLASHES

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

## G-E Executives Hear New Pickup

The Electronic Reproducer, General Electric's exclusive development for "noiseless" record playing, is explained by Paul L. Chamberlain (right) manager of sales for the G. E. Receiver Division. Listening are (left to right) E. P. Toal, sales manager of the stand-



ard line of receivers; W. M. Boland, Electronics district manager from San Francisco; H. W. Mandernach, Electronics District Manager from New York; and W. M. Skillman, Electronics District Manager from Dallas, Tex.

## RMA Service Committee Maps Industry Set Servicing Plan

An industry plan to improve radio set receiving and to eliminate abuses will be considered by the RMA Service Committee. Various proposals for directing the public to reputable service shops will be discussed. The Service Committee, under Chairman W. L. Parkinson, expects to prepare an industry program for submission to the RMA Board of Directors at the mid-winter RMA Conclave in Chicago on Jan. 22.

The RMA Board of Directors recently opposed proposed municipal legislation to license radio technicians and servicemen in New York, and sponsors of the legislation agreed to defer action to permit the industry to set up a plan for self-regulation.

## New Test Equipment Catalog

A new 18-page catalog which lists the specifications of nine new instruments in the G-E line of test equipment: Tube Checker, Type YTW-1; Signal Generator, YGS-3; Oscilloscopes, Types CRO-3A and CRO-5A; Capacitance Resistance Bridge, Type YCW-1; Unimeters, Types YMW-1A and UM-3; Sine or Square Wave Generator, Type YGA-2; High Voltage Multiplier, YYW-1 may be obtained from G-E Specialty

Division, Electronics Park, Syracuse, N. Y. Ask for catalog ESD-129.

## Garod Videos

Garod Electronics Corp. is initiating delivery of its "Royal" five-in-one Television Combination this month, according to Lou Silver, vice president in charge of sales. The new television instrument includes a 12" direct viewing tube, AM, FM, shortwave, and automatic record changer in a mahogany finish 18th Century cabinet.

First deliveries will be made in cities where television stations are in operation, and where television facilities will soon be available. Every receiver in production has already been sold.

## New Walsco Representatives

WALSCO has appointed the following new representatives in the territories indicated:

Southeast Territory—Hopper & McCoy, 454 Marietta St., N. W., Atlanta, Ga.

Missouri Valley Territory—Fred H. Larrabee, 6033 Main St., Kansas City, Mo.

Pacific Northwest Territory—Frank Wedel, 8113 Latona, Seattle, Wash.

Northern California—J. W. Marsh Co. (Charlie Meyer), 65 Ninth St., San Francisco, Calif.

## G. E. Making Hard-to-Get Tube Types

General Electric Company is making available 52 additional types of tubes to solve the radio servicemen's problem of incomplete radio set repair because of the lack of key tubes to install in receivers.

"The 52 types are those which represent less than 20 per cent of the replacement demand. Manufacturers concentrate on producing these types in greatest demand which represent about 80 per cent of the replacement market, and thus thousands of servicemen are holding sets on their shelves for the want of one tube which they can't obtain or which is not being manufactured," according to Russell W. Metzner, G. E. replacement tube sales manager.

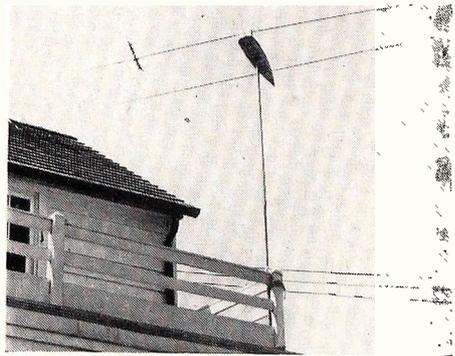
The tubes, which are needed for repair of a wide range of sets dating back to 1933 or 1934, are being shipped to Ken Rad and G. E. distributors throughout the country. It is expected that additional such types will be added in February.

## Appointed Rep. by Snyder

Martin Friedman has been appointed Snyder Mfg. Co. representative for Eastern Pennsylvania, New Jersey, Maryland, District of Columbia and Virginia it was announced recently by Ben Snyder, president of the Philadelphia concern, which specializes in the production of auto antennas and mike stands.

## Antenna Rods Available

Step-drawn monel tubing suitable for use in FM and Video dipoles is being made available by Superior Tube Co. of Norristown, Pa.



## New Air King Distributors

Five new distributors have been added to the Air King list. They are:

Chief Electronics, Poughkeepsie, N. Y., Cumberland Wholesalers % Fay Dist. Radio Co., Connellsville, Pa., David White Radio Supply Co., Little Rock, Ark.

## RCA Victor Offers Suggestions To Builders Planning Homes equipped For Television

Camden, N. J.—The speed with which television is becoming accepted as a basic part of the modern home in television broadcasting areas makes planning for the new medium an important part of the realtor's thinking today, Dan Halpin, RCA Victor Television Receiver Sales Manager, said in a statement issued recently. Inclusion of wiring for television gives the builder an important new selling point and serves as reassurance to the prospective buyer against added expense later, he said.

Describing the work necessary to make such an installation, Mr. Halpin recommended the incorporation of standard 300 ohm transmission line from the living room (or other room where the television receiver will be used) to the

[Continued on page 25]

**FROM A LEADING RECORD MANUFACTURER**  
 "The pickups are proving quite the thing with the engineers here. If you ever get to New York, I'd like very much to let you hear how fine they sound."

"Recently I purchased one of the Variable Reluctance Pickups manufactured by your company. I have installed it in a . . . in conjunction with your MSC phono preamplifier and a high fidelity amplifier. The results of this installation to date have been excellent and I would like to congratulate you on this development."

**FROM A LEADING UTILITY LABORATORY**  
 "I have been using for the last several months a pair of your variable reluctance pickups in connection with a high fidelity play-back system with eminent satisfaction. I would in fact go so far as to say that the results when first put to use were astonishing."

"I have installed one of your DL 1RM 6C Variable Reluctance type pickup cartridges in my record changer and am feeding it through a preamplifier made by you, the diagram of which is given in figure 2 of the descriptive sheet belonging to the above mentioned pickup. I find that the results I have obtained from this pickup are better than anything I have heard before."

**FROM A LEADING SET MANUFACTURER**  
 "We are rapidly approaching the day on which the G. E. Variable Reluctance Pickup will be a standard component in our instruments. May I say that I continue to enjoy immensely the results from the sample pick-ups you were kind enough to send some weeks ago. I have yet to hear their superior even at considerably higher price levels."

"I have been using a General Electric Reluctance Phonograph Pickup for the past few weeks, and am greatly impressed by the cleanness of its reproduction."

"I recently heard a demonstration of the G-E Variable Reluctance Reproducer Model DL 1RM 6C, which was very impressive."

**RESEARCH AND DEVELOPMENT COMPANY**  
 "The combination of . . . . . G. E. cartridge, and . . . . . is being adopted with enthusiasm by radio stations throughout the country. . . . . are placing them on all of their transcription tables."

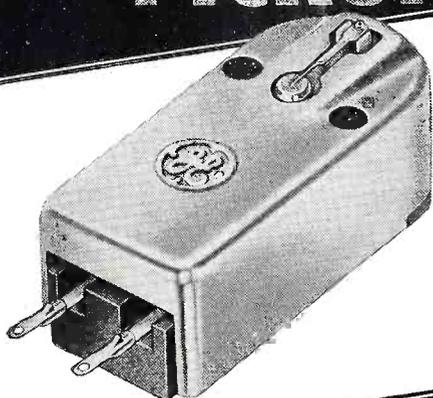
"The release for public sale of your Variable Reluctance pickup Cartridge has made a large number of people in this neighborhood happy. Listening comparisons with other types of cartridges lead only to the conclusion that the G-E is perhaps the biggest improvement in record reproduction for the poor man in the last ten years."

*They're all talking about the*

**VARIABLE RELUCTANCE PICKUP**



**Have you sent in your order?**



General Electric Company, Electronics Department, Electronics Park, Syracuse, New York.

**GENERAL  ELECTRIC**

"Not so long ago I bought one of your DL 1RM 6C variable reluctance pickups. I am completely satisfied with it. It has more than lived up to my expectations."

**FROM A LEADING STATION**  
 "Retel Nov. 27 ordered 30 G-E pickups because tests indicated that they were superior. . . . . and station is going to include G-E pickups in all transcription equipment."

**RIDER MANUALS**  
*Mean*  
**SUCCESSFUL**  
**SERVICING**

**KAY HAS ALL 16**

(AND VOL. XVII ON ORDER)



**NOWHERE**  
nowhere but in Rider Manuals  
will you find:

- so many single band receivers • so many multi band receivers • so many manufacturers • so many models • wire recorders and record players when part of a set • "How It Works" book explaining the theory of complexities in new receivers • "clarified - schematics" with their time-saving breakdowns of multi-band jobs—all the data you need for fast diagnosis of troubles

**RIDER MANUALS OFFER**  
**OFFICIAL, AUTHORIZED**  
**SERVICING DATA**  
Direct from the service departments of the set manufacturers come the makers' own recommendations for **PROPER SERVICING PROCEDURES**

"... up-to-date ... latest information."

"Rider manuals bring us the authentic, accurate, dependable servicing data every shop must have to operate profitably. They give us this material in a systematic form, and are up to date with the latest information needed. That's why we have all Sixteen," says T. F. Tennes, Manager Radio Dept. of Kay's Department Stores, Los Angeles, Calif.

find all sixteen volumes of Rider Manuals. These complete sets are there for a reason. The most fundamental reason. They enable the technician to work more productively, make more money.

If that is what you want, then benefit from the findings of experienced, successful men in the servicing industry. Keep a complete set of all 17 Rider Manuals at your fingertips. Give your shop the Sign of Successful Servicing.

So it is with successful servicemen in towns from coast to coast, over whose servicing benches you will

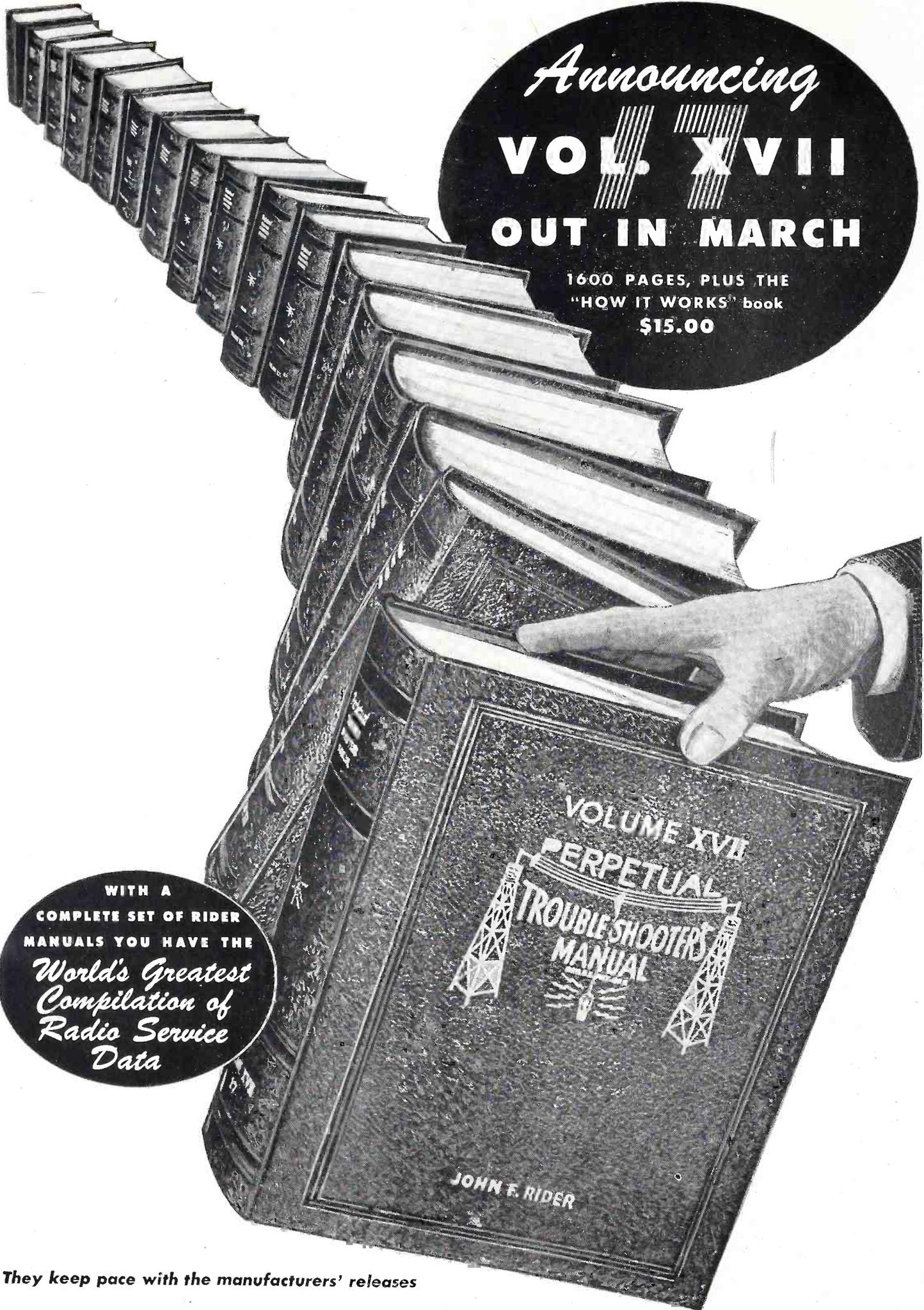
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VOLUME XVII.....	\$15.00	Record Changers and Recorders .	9.00
Volume XVI . . . . .	8.40	Master Index, (covering Manuals,	
Volume XV . . . . .	18.00	Vols. I to XV) . . . . .	1.50
Volumes XIV to VII (ea. vol.) . . .	15.00		
Volume VI . . . . .	11.00	NOTE: Individual Volumes VI, VII and VIII	
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**24 HOUR DATA SERVICE.** For 10c you receive schematic, voltage data parts list (everything that will fit on two 8 x 11 inch sheets) on any new or old receivers. Additional material 5c a sheet. Send 20c with order.

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**Give Your Shop The Sign**  
**of Successful Servicing**  
**RIDER MANUALS**



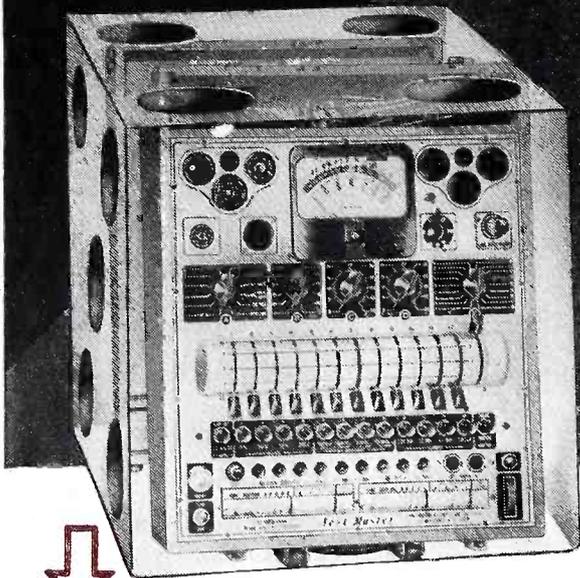
*Announcing*  
**VOL. XVII**  
**OUT IN MARCH**  
1600 PAGES, PLUS THE  
"HOW IT WORKS" book  
**\$15.00**

WITH A  
COMPLETE SET OF RIDER  
MANUALS YOU HAVE THE  
*World's Greatest  
Compilation of  
Radio Service  
Data*

**They keep pace with the manufacturers' releases**

# ... A **NATURAL** Combination for **SERVICING** by **SIGNAL SUBSTITUTION**

The Modern, **DYNAMIC**, Speed Approach to radio receiver alignment and adjustment problems.



Net Price  
\$123.40

## A Reliable Tube Tester . . . A High Sensitivity Circuit Tester such as the **NEW** Precision Series 10-54 *Electronamic Test Master\**

Combination Master Electronamic Tube Performance Tester, Battery Tester and 35 Range, Push-Button Operated, Supersensitive Set Tester.

### TUBE TESTING HIGHLIGHTS

- ★ Features the Precision "Electronamic" circuit — the all-inclusive, single-operation, positive, vacuum-tube Performance Test.
- ★ 12 Element Central Lever Selector System affords highest practical order of obsolescence insurance.
- ★ Absolute Free-Point element short-check and performance test selection regardless of varying or multiple pin and cap terminations.
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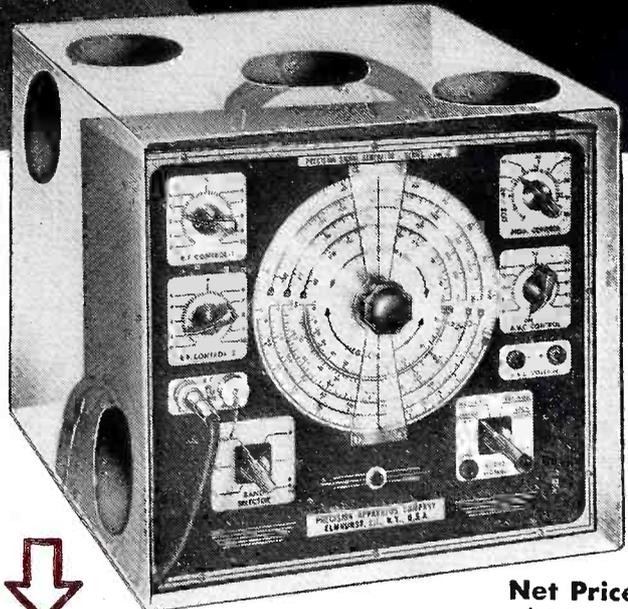
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# RAISE THE RADIO SERVICING PROFESSION'S PRESTIGE AND YOU WILL RAISE ITS EARNING POWER

by Sanford R. Cowan

**Organization of and membership in accredited Associations of Radio-Electronic Technicians is solution . . . but many other constructive ideas are presented herein.**

**N**EARLY a thousand radiomen, (independent and employed radio technicians and Service Dealers), attended the sessions of the Philadelphia "Town Meeting of Radio Technicians" held January 11th-13th under the joint auspices of the RMA, Sales Managers Club, NEDA, The Representatives, the Philadelphia Radio Service Men's Association and the Federation of Radio Servicemen's Association of Pennsylvania.

The underlying reason for the clinic, as the "Town Meeting" might be called, was for the manufacturing and distributing branches of the radio industry to afford radio technicians with expert advice on various phases of small-business management in addition to some practical technical data, particularly with regard to FM and television servicing. In this and subsequent issues we will reprint excerpts from and digests of the several speeches and papers presented.

#### **Association Reps Hold Forum**

A sideline of the clinic itself was the fact that it afforded an opportunity for delegates from many radio technicians' Associations to get together, discuss their mutual problems, and agree upon proposed ways and means of overcoming them.

It is a fact, although the writer dislikes admitting it, that the radio servicing profession as a whole is not held in high regard by the radio set-owning public. By the same token, it is a known fact that the radio-electronic servicing profession, on the

whole, is not enjoying as high an earning power and income as we, who comprise the field, believe we deserve.

#### **Code of Ethics**

It was the consensus of the technicians' Association delegates that by adopting certain procedures, not only would the stigma against the servicing profession be removed but also its earning capacity would be increased. Delegates from 19 different Associations, representing an active membership of almost 4,000 technicians, drafted a proposed Code of Ethics for the profession. The complete text of the proposed Code is reprinted herewith.

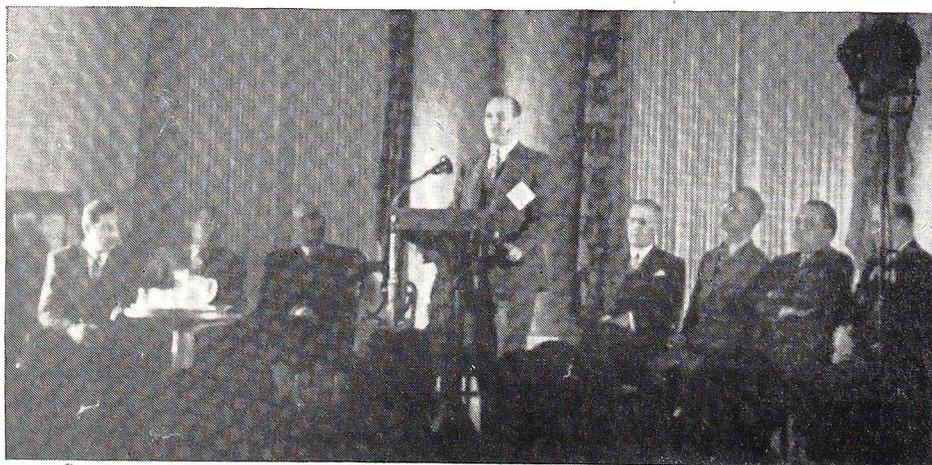
#### **Enforcing Ethics—Penalties]**

The author urges every radio technician, whether an independent, employer or employee, full or part-time, to attest to his integrity by signing

such a Code—and more important—to abide by its stipulations without qualification.

There are radio technicians' Associations of one type or another in many major cities throughout the U.S.A. Where there now is no association, we advocate that one should be organized as quickly as possible. Technicians who reside in places that are quite distant from where there is an association should make it their business to affiliate with the one nearest to them. And, to qualify for membership, besides subscribing to a Code of Ethics, it should be mandatory that each and every member should prove his technical competence. About this phase, the writer offers several suggestions in the Editorial, page 3 this issue.

Every Association should have as a part of its basic organizational setup



Don Fink, editor of "Electronics" addresses Town Meeting audience. On platform with him are shown, seated, representatives of the various sponsoring groups.

Grievance and Enforcement Committees. The enforcement bureau should be established to police the membership's adherence to the Code and to take corrective measures when it is violated. The Grievance Committee should function in any case where a set-owner has a disagreement with a technician. In cases where a set-owner and technician who is an Association member have a disagreement, the Grievance Committee should weigh all the facts and render an impartial and fair decision. If the set-owner's complaint is found to be unjustified or unreasonable, the reasons therefore should be frankly and thoroughly explained. If, on the other hand the technician Association member is found guilty he should be directed to take whatever corrective measures are necessary. Failure to make full and complete reparation on the part of such an Association member would warrant his expulsion from the organization and public notification to such effect. In such case it would be incumbent upon the Association itself to see to it that the set-owner is given full redress and satisfaction.

In the event a complaint is lodged against a technician who is not an Association member, the Grievance Committee should judge the case purely and without bias on its merits, and then, if the technician is found guilty, it should recommend to him in clear and friendly terms, what the Association believes would be the proper adjustment to be made for the set-owner. If the derelict technician elects to disregard the friendly advice thus given by his fellow technicians (through their Grievance Committee) and if he refuses to make amends to the dissatisfied set-owner, then the Association's Grievance Committee should act as co-complainant and complaining witness in a Court of Law against the culprit.

Such industry and profession-policing tactics would without doubt be the greatest deterrent towards malpractitioners possible; but more important, such highly ethical practices by technicians themselves on behalf of the set-owning public would bring tremendous prestige to the profession. The subject of lost prestige, and the method of regaining the public's confidence in radio technicians is so important that we reiterate with all the force at our command the opinion that *only by sincerely and honestly policing itself so the public becomes aware of it can and will the radio servicing profession earn the respect and cooperation of the set-owning public.* It is axiomatic that when a profession enjoys popularity and prestige it can charge prices that will afford it with the living standards to which it is entitled.

As we have stated before many times,

## RADIO-ELECTRONIC TECHNICIANS

### Code of Ethics

In order that I identify myself and my business as a member of the radio-electronic technicians' profession, and in order that I may assist in maintaining the radio-electronic industry upon the highest possible level—thus insuring public confidence—I hereby subscribe to the following Code of Ethics:

1. I will at all times, without any exceptions, perform my work to the very best of my knowledge and ability. In addition, I will make a sincere effort to improve my knowledge of the technical and business requirements of my profession, thereby enabling me to render still better radio-electronic service.
2. I will conduct myself and my business in an honest and straightforward manner, meriting and inspiring the confidence of my customers.
3. I will, whenever practicable and desirable, prefer to use original factory replacement parts. In other cases, I will use replacement parts known to be of equal or better quality, thus insuring satisfactory performance.
4. I propose to charge a just and fair price for all professional services rendered.
5. I will exercise all reasonable care in handling my customers' property.
6. I will guarantee all radio-electronic service performed which has been authorized and for which payment has been received, for a period of ninety (90) days.
7. I will engage only in fair and ethical practices recommended and approved by the radio-electronic technicians' profession as being conducive to public confidence.

(Name of Technician or Establishment)

our own and other reliable surveys show conclusively that the radio servicing profession enjoys somewhat greater prestige in smaller communities while just the inverse is true, and in direct proportion, where populations are greater. Perhaps such "indications of good will" in the smaller towns is justified; perhaps it is not. One "gyp" serviceman in a town where there are ten (for a 10% "bad" score) is no balm to an industry that is cleaning house when compared to a city having 1,000 technicians, of which 50 may engage in malpractice (for a score of 5% "bad"). There is no reason why there should be any "bad boys" in our profession, despite Pope's adage, "To err is human, to forgive divine."

#### **Integrity and Its Rewards**

Suffice to say, the radio-electronic servicing profession simply **MUST** enhance its prestige EVERYWHERE if only to fend off the ever-impending threat of municipal, state or federal control such as licensing.

Within the past few weeks several radio commentators have taken the liberty of stating, in effect, that the entire radio servicing profession should be looked upon disdainfully and with suspicion because of rife overcharges, incompetence and downright dishonesty. We have pointed out ways and means

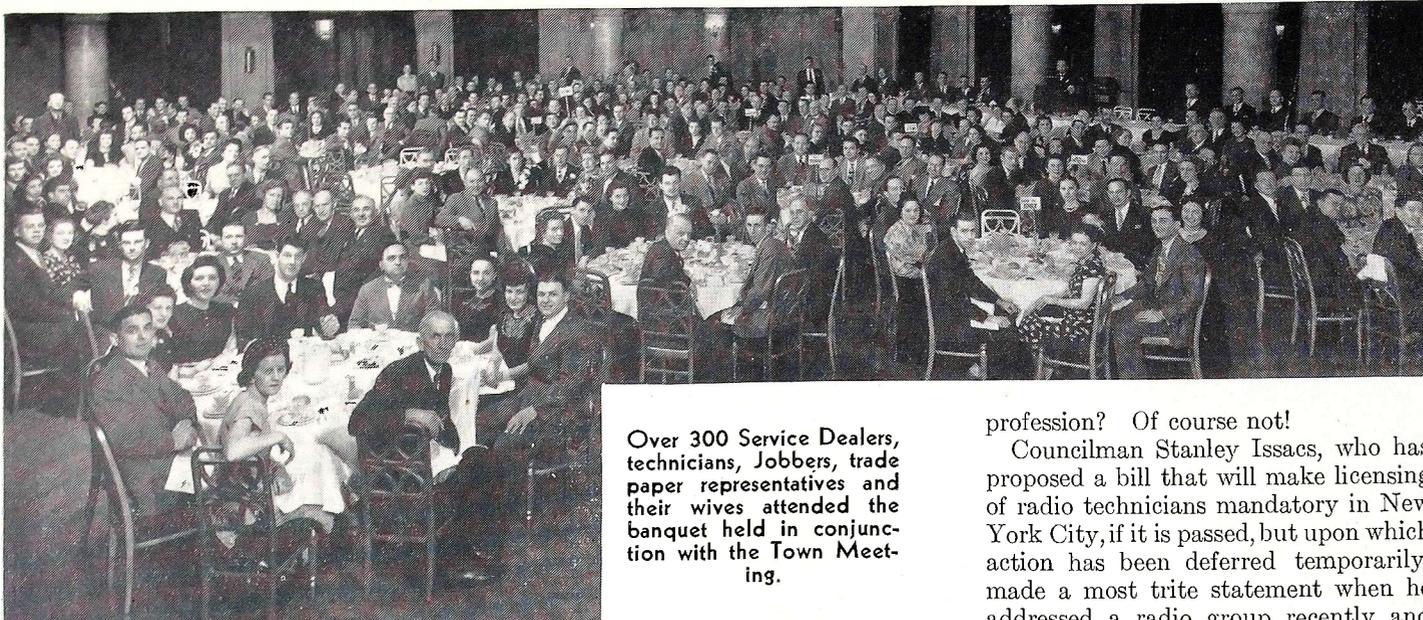
of getting rid of the majority of "gyps" in the foregoing paragraphs. The matter of incompetence, whether intentional or inadvertent, is more complex and must be treated accordingly. This will be covered later on in this treatise.

Meanwhile, as the servicing profession has already undertaken the first steps in the huge project of "cleaning its own house," *now while the project is under way*, we of the profession have the right to, and we should ask all broadcasters and stations to refrain from making any derogatory statements about us and our integrity.

In fact, those communities that are at present favored by associations of radio technicians who have and abide by a Code of Ethics, and who police their membership, in our opinion should be told by their local radio outlets of the present availability of such competent and ethical radio repairers. By endorsing those technicians who are trying to conduct their business on a highly ethical plane the radio stations themselves would render a service to their audiences and at the same time do much toward forcing the less ethical radio technicians to improve their standards.

#### **The Profession's Inherent Faults**

Even the most sincere and ethical



Over 300 Service Dealers, technicians, Jobbers, trade paper representatives and their wives attended the banquet held in conjunction with the Town Meeting.

practitioner in the so-called highly ethical medical profession must admit that at one time or another some physician has made erroneous and faulty diagnoses. Error of judgement often cannot be avoided. Two different technicians, given a defective radio set, might immediately discern the fault. One might elect to repair the trouble in a manner that requires two hours while the other might decide upon a method that would permit him to do the same corrective in one hour. Yet, when it comes to a question of ethics, no hard and fast rule can be applied to either of the above cases, for one technician feels he has earned a 2-hour service fee while the other knows he has only earned a 1-hour labor charge. Yet, because of circumstance, location, experience or other variables, the 1-hour repairman might have established, and justly so, a \$4 per hour labor charge rate for himself while his counterpart, the 2-hour man, might be working at a fair rate of only \$2 per hour. The question then, is a case such as this, resolves itself to the basic one: was the 2-hour technician less technically skillful, or did the 1-hour man just happen to guess right—or, did the 2-hour technician, because of inexperience, overcharge the set-owner by 1 hour as it took him "a wasted extra hour" to make the given repair?

Since 1930 the writer has been continuously associated with magazines that cater to radio servicemen. Determining the magazines' policies and selecting the articles for publication is a problem. A publisher must not only endeavor to "please" his subscribers by giving them the kind of articles they evince an interest in, but in addition a publisher is false to his trust as an educator if he fails to also publish (as inoffensively as possible) some purely educational data—such as articles on good business management practices—

despite the known fact that this type of text material is not generally liked by technical magazine readers. Yet every technician, to be an all-round *good technician*, simply *must* have a certain amount of non-technical knowledge or his entire basis of conducting himself and his business is founded on a quicksand into which he must surely sink and disappear, to the detriment of others in the same profession.

Yes, it is the writer's opinion that the radio servicing profession has done itself a great disservice by not paying as much attention to the management side of its business, in comparison to its rapid technical progress, as it should have. For example, if a large service organization (or even if a small independent radio serviceman) fails to keep the proper types of books and business records neither can possibly function efficiently. Failure to keep proper records might result in failure to take all allowable exemptions at tax report time thus resulting in an overpayment of taxes. This would leave a smaller amount of working capital on hand which might rightfully have been spent on the purchase of more modern and efficient tools and test equipment, the ownership of which would have resulted in rendering better service, in less time, at lower prices, and at greater net profit to the technician himself.

In the same vein, failure to know how to conduct a business in a business-like manner can only bring to the offender the scorn of his customers and result in the lowering of the prestige of the entire profession of which he is a part. Believe me, abortionists and ambulance chasers, when caught and convicted, cast great reflection upon the prestige of the entire medical profession which as a whole strives mightily to cast them out and keep them out. Should we do less to eliminate the quacks from our

\* See Editorial this issue

profession? Of course not!

Councilman Stanley Issacs, who has proposed a bill that will make licensing of radio technicians mandatory in New York City, if it is passed, but upon which action has been deferred temporarily, made a most trite statement when he addressed a radio group recently and stated: "Perhaps my Bill requiring licensing of New York's radio technicians will never have to be submitted for vote because the radio servicing industry has "cleaned its own house" and eliminated all the offenses charged against it, but Gentlemen, I believe, and you yourselves realize and undoubtedly concur, that it took *no less than the threat of drastic action*, such as my Bill, in order to get you to work up enough energy to make an attempt to clean up your own mess." Mr. Issacs is right!

#### Offenders Against Technicians

Although the servicing profession is not without fault, certain untenable factors have contributed to the bad over-all picture. During the war period many radio parts jobbers, without justification whatever, opened their own service departments and went into unfair competition with the legitimate servicing fraternity.\* When scarce tubes and parts were allotted for civilian radio repairs these unscrupulous jobbers diverted their civilian allocated tubes and parts to their own service departments, or to priority-holding buyers who could pay extraordinary high prices, and as a result were able to literally take the bread out of the mouths of technicians who had no recourse whatever.

The set-owning public itself can be blamed for some of the faults it ascribed to the radio servicing profession. For example, the set-owner who can buy a radio for \$9.95 at retail despite the fact that the list price of the tube complement alone is just about that much yells with malicious and unjustified indignation when a technician who finds it necessary to replace four or five tubes asks as much as \$7 for them although they list at \$8.25. Yes, the public has to be educated that service fees are not based upon the original cost prices of sets but rather upon the

[Continued on page 30]

# HIGH SPEED SERVICING

**T**IME is money—at least that is the way a radio service dealer should look at it. As each new week begins he has a credit of 40 to 70 hours of negotiable time. This time multiplied by his hourly earning rate represents his anticipated income from service work for the week.

The number of hours per week a man works, the amount he earns, and how tired he gets are personal problems which vary with individuals. There is one factor however, which is commonly experienced by all, and that is a desire for increased earning power.

If a service dealer buys equipment which will enable him to do a given amount of work in a shorter time he is taking a definite step to improve his position and increase his earning power. This is true, provided the initial cost of the equipment does not exceed the value of the time saved when liquidated over a reasonable period of time.

New time-saving features have become the key to new designs in test equipment, for leading manufacturers know that the more built in "minute savers" they have to offer, the more their customers will prosper. Manufacturers also know that prosperous customers will in turn be back for additional income-producing features.

## RCA's New Test Oscillator

An example of what can be done in designing new time saving devices is demonstrated in the recently introduced RCA Test Oscillator, type WR-67A, which includes three cardinal features developed for high-speed servicing. (See Fig. 1). The range switch on this oscillator includes fixed frequency positions for the most commonly used

## Describing a brand new instrument and suggesting a better and faster step-by-step method of trouble shooting

by Arthur Liebscher\*

alignment frequencies. This means that the time usually required to adjust the dial to 455 kc for i-f alignment and then switching it back and forth several times between 600 kc and 1500 kc, can be reduced to instantaneous switching. Just think what this means in terms of all the alignment jobs you do! From a different viewpoint, this feature alone makes a once-over alignment of each midget radio repaired such a quick, low cost job that it is worth including for the advertising value of customer satisfaction alone.

The second super-service point claimed for this oscillator is a signal injection probe. The design of the probe itself is borrowed from that commonly used with signal tracing equipment such as the Chanalyst. It makes possible safe contact with any grid, plate or other tube element connection. From this we see that a signal supplied by the Test Oscillator can be quickly injected into any point where such action may be of value in determining whether or not the receiver is capable of handling that signal properly. In other words, we can apply a technique which is actually the reverse of signal tracing. This, incidentally, does not obsolete signal tracing for both methods can be used together when the case warrants it.

The flexibility of a probe that can "squirt" i-f, r-f and audio signals into any desired portion of a radio circuit lends itself well to signal injection and quick alignment.

## Faster Alignment

Suppose we have a receiver with a defect near the second detector. Audio signal injection can be used to work backwards from the loudspeaker to the defective detector circuit, which would then stop the progress of signal injection prior to that point. Augmenting this with signal tracing from the antenna to the second detector would prove that

the r-f and i-f section of the receiver was working properly. We would, therefore, have a logical method of closing in on the defect from both ends of the signal path.

The third feature in this new Test Oscillator is double attenuator control which provides four steps of attenuation plus a variable fine control, a combination which covers the extremes of signal level requirements for servicing. Signal amplitudes up to one volt are available for "pumping through" a completely misaligned set, and signals down to approximately one micro-volt can be obtained at the turn of these two controls for final alignment of very sensitive receivers. You will note that it is not necessary to change cable connectors from high to low output and that a signal can be progressively weakened when the injection technique is used in working backward from the sound detector toward the antenna connectors of a receiver. Without lost time the signal level can be reduced by an amount equal to the gain of each stage in progressive injection points. This gives the desirable net result of an even signal level at the second detector regardless of the stage where the signal is injected.

It can now be seen that the big time saving features are centered between switching operations and touch contact, which permit extreme flexibility in rapid change of frequency, desired adjustment of signal level and quick transfer from one signal injection point to another.

## Testpoint Adapters

In appraising various time savers we should also consider the use of Testpoint Adapters for contacting tube elements above the chassis. (See Fig. 2). Their use agrees with the foregoing procedure in that they can be applied to further

\* Test and Meas. Equip. Div., RCA-VICTOR

Fig. 2.—Using the probe



advantage in injecting signals into any stage without removing the chassis from the cabinet. When contact is made with adapter testing points bearing plate voltage, it is worth recalling that the blocking capacitor type of probe, previously mentioned, removes all worry of the hazard of damaging the Test Oscillator.

Testpoint Adapters are great time

savers in that they serve as well for voltage measurements as they do for signal injection or signal tracing. They can also be conveniently used to make temporary tests for by-passing when unwanted oscillation is present and signal tracing is otherwise impossible. In such a case, a by-pass condenser need only be connected between the adapter contact and the chassis.

A series of Testpoint Adapters will often enable *stage-by-stage* signal and voltage contacts in cases where the socket connections are not easily available from the underside of the chassis. Considerable time can be saved in making estimates when these adapters enable the service man to discover what portion of a radio is defective, without

[Continued on page 29]

### Step-by-Step Trouble Shooting Procedure—Recommended for use at Service Bench

## TROUBLE SHOOTING CHART

TEST METHOD	NATURE OF TROUBLE			
	INOPERATIVE	INTERMITTENT	LOW OUTPUT	POOR QUALITY
HEARING	Listen for signal or other sound.	Listen for interruptions or noise when tapped.	Note loss of volume or frequency range—possibly when adjusting control.	Listen for poor tone, hum, whistle, noise—possibly when adjusting controls.
OBSERVATION	Look for damaged parts—short circuits—broken wire—tube or dial lights out.	Look for loose parts, loose wires or connections.	Look for tubes out of place—open or shorted parts or wires—no glow in tube or cold tube.	Look for damaged parts, poor connections, broken wires, tubes cold or out of place.
SIGNAL TRACING	Follow signal to point of disappearance.	Follow signal to point of interruption—possibly when tapped.	Follow signal to point of loss or where gain is not normal.	Follow signal to point where distortion or oscillation occurs. Follow signal to point where hum or interference enters path.
SIGNAL TEST (MONITORING)		Monitor for signal change. Monitor for socket voltage change—possibly due to moisture or temperature variation.		
SIGNAL TEST (GAIN CHECK)			Measure signal at point of suspected loss.	
SIGNAL TEST (FREQUENCY CHECK)	Check band selection. Check power line frequency. Check oscillator frequency.	Check oscillator frequency for change. Check I-F for change.	Check oscillator frequency. Check A-F range.	Check I-F oscillator tuning. Check line frequency. Check phasing of hum bucking coil. Check phasing of inverse feedback.
VOLTAGE INDICATION	Check for presence of required voltage at point of signal disappearance.	Check for voltage change near point of signal interruption—possibly when tapped.	Check for incorrect voltage at point of signal loss.	Check for incorrect voltage at point of signal quality deterioration.
RESISTANCE—CAPACITY TEST	Check for short circuits, open circuits or resistance to ground.	Test for resistance or capacity change—possibly when tapped.	Check for incorrect R-C Values. Check for leakage.	Test for poor contacts—incorrect R or C values.

For quick interpretation of the chart—Read across to find nature of trouble. Then follow column down for required test. Skip items previously eliminated.

The main purpose of the trouble shooting chart is to help servicemen to run down defects by the most direct approach. Adherence to the chart will save time often wasted in jumping from one category to another in following hunches on a possible source of trouble.

In some cases, more than one "nature of trouble" may be evident. When this happens it is wise to trouble shoot one completely before attacking the second. Here again, time is saved by avoiding misleading suspicions and approaching the defective part by the most direct path.

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# VISUAL ALIGNMENT

**T**HE MODERN sweep signal generator and oscilloscope are today a must for the serviceman who expects to keep up with the advanced service market. They are prime requisites to the visual alignment of FM and TV intermediate frequency and discriminator circuits—in turn essential to rapid and satisfactory receiver alignment. Regeneration, lack of symmetry and bandwidth are just a few of the common troubles that are shown up at a glance by the visual system. It is the purpose of this article to take some of the mystery out of broad-band alignment, and to explain as far as is here practicable the electrical functioning of FM sweep generators.

There are two ways of producing a frequency modulated wave useful for service purposes. The first and most popular way is to use a reactance modulator tube, the plate circuit of which is common to an r-f oscillator. If a sine wave is applied to the grid of the modulator it will cause the frequency of the oscillator to vary above and below its "center" frequency. The reason for this is a linear phase displacement of the oscillator plate current. The rate of this phase displacement is the rate of the modulating voltage. The amount of modulating voltage used determines the amount of frequency swing obtainable within the limits of the straight portion of the modulator tube characteristic. It is necessary to operate this oscillator at a relatively high frequency in order to obtain enough sweep for FM work—even higher to get enough sweep for TV.

The second way of obtaining the FM wave is by the use of what is called a vibrating capacitor. This capacitor is electrically shunted across the oscillator tank circuit and its mechanical amplitude controlled by the magnitude of the modulating voltage. The rate of sweep is again the rate of the modulating voltage. The advantage of this type of device is that it can usually be operated at a lower radio frequency than in the first case. The disadvantages of this system are inevitable mechanical failure of the capacitor, and the time element and cost involved in replacement. This writer prefers the electronic system both from the standpoint of durability and sweep linearity. This is a personal preference, but based upon considerable design experience and application in commercial sweep generators.

It has been standard design practice

## Analysis of modern sweep generator visual alignment as applicable to FM receivers and TV sound channels

by Douglas Carpenter

not to use the basic oscillator frequency as the desired output frequency. The first consideration is the great frequency range required. In FM for instance, a sweep generator should be capable of providing frequencies throughout the range of roughly 2-108 mc. The range between i.f. and r.f. is not necessary for straight FM, but includes all the popular television sound channels. Television sound channels are nothing more than the circuits to be discussed, and the systems to be described are directly applicable to these units. Another reason for not using the basic oscillator frequency is the fact that if the reactance modulator effect is inductive or capacitive, tuning the oscillator would result in this effect being a variable percentage of the circuit constants involved. In other words, it would not be possible to obtain the same amount of sweep for various settings of the oscillator frequency.

These and other considerations have led design engineers to obtain the desired frequency through a beat method. The frequency modulated oscillator is left at a fixed frequency, and a separate variable frequency oscillator beats with it to produce either a sum or difference output frequency. These two oscillator frequencies of unlike character (one unmodulated and one frequency modulated) are fed to a mixer tube where the

sum and difference (usable) frequencies are generated. It is a well-known fact that when two frequencies of unlike character are mixed that the product frequencies will retain the characteristics of both. It is in this manner that the final usable output is produced.

There is one other system that develops the final frequency without the use of a mixer tube. In this arrangement the two oscillators are mechanically arranged so that their fields interlace and mixing takes place in one of the oscillators. This novel arrangement is called "proximity mixing" and is used by one manufacturer of better-than-average sweep generator equipment.

It has been stated that it is necessary to operate the fixed FM oscillator at a relatively high frequency to obtain the required sweep. To elaborate on this, consider the case of the FM oscillator frequency being 40 mc and the variable oscillator frequency being 29.3 mc. The difference (desired) frequency in this case would be 10.7 mc, a popular FM i.f. It is obvious that with standard tubes and components that slow drift and settling drift will be factors at the frequencies involved. These may be small percentages of the high frequencies but show up as large displacements of the product frequency, which is a much lower frequency. One leading manufacturer makes use of a newly de-



The author at his bench

veloped dual triode of extremely low inter-electrode capacity. This special u-h-f tube coupled with specialized circuit design holds these inherent drifts to practically zero.

With less accurate equipment the problem of calibration inaccuracy may be solved in two ways. The first method simply consists of allowing a fifteen minute "warm up" period for the generator, and then rechecking the dial calibration against known frequency sources (such as FM or short wave stations), with correct dial readings then noted for future use. The second method of rechecking dial calibration is by the use of marker signals.

The marker signal is essentially an accurate unmodulated low frequency source which is variable throughout the range of the sweep generators FM product frequency. The result of feeding the marker output in parallel with the sweep generator is an amplitude response or "pip" which may be moved across the receiver's intermediate frequency response curve as seen on the 'scope screen, as the marker oscillator's frequency is varied throughout this range. The marker signal finds more application in production testing and design where bandwidth, slope ratio, and zero response must be accurately determined. If the serviceman has access to an AM signal generator of known calibration accuracy this may be used as a source of marker "pips," and as a recheck of dial reliability. He may use his regular AM test oscillator or signal generator as the marker oscillator, once he has carefully checked its dial calibration at required frequencies.

#### Use and Function of the Service Oscilloscope

The service oscilloscope is essentially a voltmeter which interprets amplitude and frequency in terms of time. It consists of a cathode ray tube, the beam of which may be simultaneously varied vertically and horizontally by the applied voltage. The character of the wave form that controls the horizontal displacement of the beam is saw tooth. In other words the beam travels across the screen at a rate set up by the "coarse" and "fine" frequency controls of the 'scope (or external horizontal saw tooth horizontal sweep control voltage), and then snaps back to its starting point in theoretically zero time. The purpose of using a saw tooth voltage for horizontal control is to eliminate the retrace line or pattern that would result if the beam took as much time to return to its original starting point as it did to travel across the screen initially. The position of the beam vertically at any instant during its horizontal displacement is determined by the amplitude at that instant of the voltage fed to the vertical input terminals of the 'scope. The "time base" of the oscilloscope is

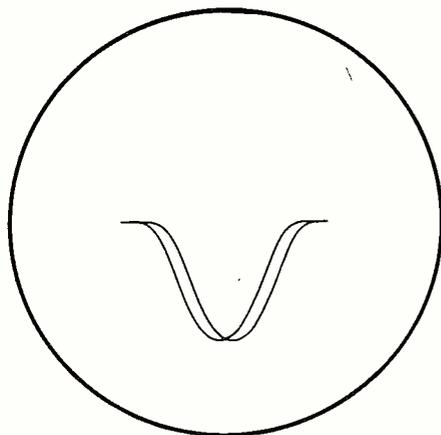


Fig. 1.—Sinc modulation, "mirror image," mistuned I.F.

simply a means of controlling the number of times per second the beam will travel across the screen. The "coarse" frequency control selects the frequency range, and the "fine" frequency control acts as a vernier of this control, and is used to stop the desired pattern on the screen. If the correct internal saw tooth sweep of the 'scope is selected any number of adjoining patterns may be stopped on the screen. To obtain 3 cycles of a 60 cycle sine wave, for instance, it would be necessary to set the internal sweep of the scope at a 20 cycle rate. It is apparent that if three complete cycles of vertical displacement occur during the same time period that the beam travels across the screen once, then three adjoining sine waves will be observed. The same will be true for FM selectivity or discriminator S-curve patterns. If, for instance, the 'scope beam travels across the screen once while the FM carrier is swept through the intermediate frequency pass band three times, three adjoining selectivity curves will be observed. This relationship holds for any ratio of horizontal to vertical displacement frequency, and it is possible to obtain any number of i-f or discriminator patterns (within practical limits) or the "mirror image" superimposed patterns by adjustment of the 'scope frequency controls.

#### FM Generator Sweep Rates and Synchronizing Circuits

The sweep rate of the signal generator,

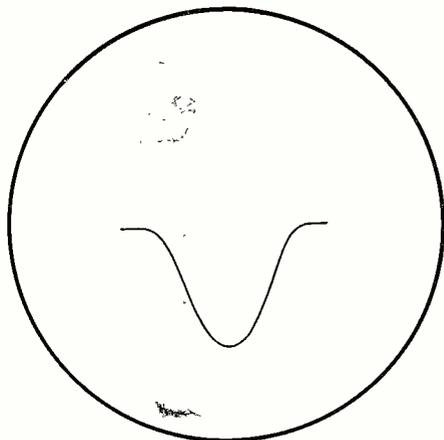


Fig. 2.—Saw tooth modulation—single I-F trace.

or the number of times per second that the carrier frequency is varied through a given point is rapidly becoming standardized at 120 cycles. If a 60 cycle sine wave is used as the modulating source the FM carrier is swept through the pass band once on the positive and once on the negative excursion. Although the modulating voltage is actually 60 cycles, the sweep rate is 120 cycles. The basic 60 cycle frequency so required is easily obtainable from the power transformer, and it is easier to design a modulator circuit that is free of phase displacement when a low modulating frequency is used. There is no valid objection to using this particular sweep rate, and today it is practically standard.

The phasing or horizontal synchronizing circuit which is incorporated in some sweep generators is intended to replace the time base of the scope. It is a specialized circuit utilizing the proper time-constant to produce a saw tooth wave that is in exact phase with the voltage applied to the reactance modulator. The minor disadvantage of using the scope time base to stop the pattern is that any phase variation between the modulating voltage and the horizontal control voltage will cause the pattern to "drift" across the screen. In other words these two voltages may not occur in exactly the same time interval. This effect may be observed even after the "fine" frequency control of the 'scope has been set to stop a pattern on the screen. It is created for one thing by a slight change in line frequency affecting the 'scope and sweep generator in slightly different manners. If the generator is provided with a synchronizing circuit the "coarse" frequency control of the 'scope is turned to "off." The synchronizing leads of the generator are then connected to the horizontal binding posts of the 'scope. If the generator is not provided with such a circuit and the generator employs a full-wave power supply with condenser input an in-phase voltage may be obtained. The discharge voltage of the first filter condenser is of a saw-tooth character and is at a 120 cycle rate. If a .02  $\mu$ f condenser is connected to rectifier cathode prior to the power supply filter, enough "sync" voltage can be obtained between the free terminal of this condenser and ground for horizontal control. No separate ground lead need be brought out with this connection as a common ground is made when the vertical binding posts of the scope are connected to the sweep generator. The time constant of the above system is not fast enough to "erase" a slight retrace base line, but this provides an advantageous constant reference line in the case of the superimposed discriminator patterns to be described. It will be assumed in the following explanations that either

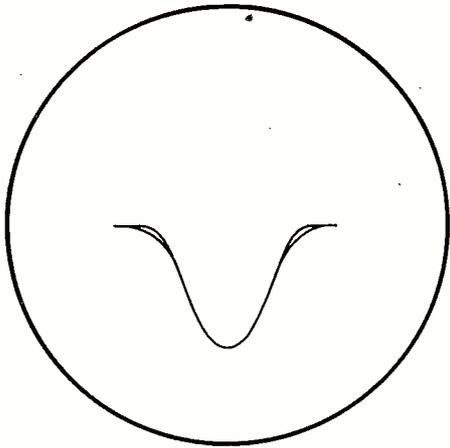


Fig. 3. Showing how Fig. 1 would appear if properly aligned.

the above system, or the 'scope-provided system of horizontal control is employed.

#### Differences Between AM and FM Receivers

There is no difference between the r-f-mixer circuits of an FM or AM receiver except that the FM circuits operate at much higher frequency. The first difference lies in the intermediate frequency amplifiers. These amplifiers are designed to pass about 150 kc without significant amplitude variation. In other words the selectivity response is broad, and amplitude response should not be more than 2:1 down at points 75 kc either side of the center frequency. After the i.f. there are two systems of FM rectification generally employed. The first system uses one or two limiter stages followed by a Foster-Seeley discriminator. The second system employs a Seeley ratio detector directly after the i.f. The limiter stage (s) in the first system are simply amplifier stage (s) run at low screen and plate voltages so that the tube (s) will saturate and allow no further variation in plate current past a predetermined limit of grid signal drive. The limiter, therefore, will not pass any amplitude variations in excess of the signal, provided the signal is strong enough to saturate the tube and start limiting action. The Foster-Seeley discriminator which follows the limiter converts the FM signal into an amplitude variation. This signal

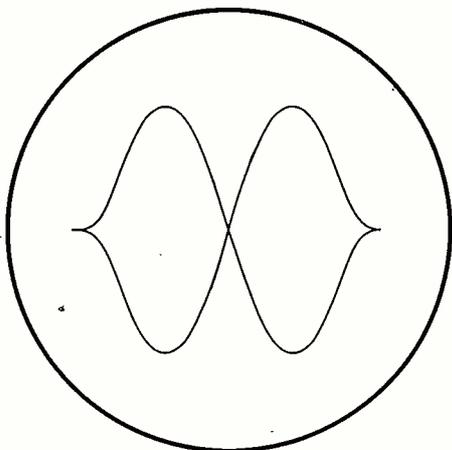


Fig. 4. Sinc modulation, discriminator "mirror image" trace.

is passed through a de-emphasis network and then fed to a high-quality audio system. The de-emphasis and audio curves should be reasonably flat to 15,000 cycles for proper reproduction. The Seeley ratio detector performs the dual functions of limiter and discriminator, and is followed by the same de-emphasis and high-quality audio circuits.

#### Alignment of Receivers Using Foster-Seeley Discriminators

The first step in alignment of an FM receiver is to temporarily short the receiver oscillator and AVC. Connect the sweep generator output between the converter grid and ground. Connect the synchronizing lead from the generator to the horizontal binding posts of the 'scope, and turn the "coarse" frequency control of the 'scope to "off." Connect the oscillo-scope vertical binding posts across the first limiter grid resistor, "high" side to the above-ground point of the resistor, and "ground" post to the receiver chassis. The limiter grid resistor will be located between the associated i-f transformer secondary and ground. The sweep generator is set to the proper i-f frequency, and suitable sweep applied. If the reactance modulator is modulated with a 60 cycle sine wave, 'scope swept at 120 cycles, two images will appear extending downward from the base line (Fig. 1). If the modulating voltage is saw tooth only one image will appear (Fig. 2). In the first case the i-f transformers are adjusted so that both of these images coincide or nearly coincide (Fig. 3). At the same time be careful not to try to adjust for maximum amplitude through sacrificing symmetry of the sides of the pattern or by contraction of top response. If the sweep generator is saw tooth modulated and the single pattern (Fig. 2) appears simply adjust for maximum symmetry, amplitude, and flat top response. The sweep calibration of the generator may be used to determine the total pass bandwidth and the flat-top response may be compared to this by a visual inspection of the pattern.

Without changing the frequency setting of the sweep generator, connect the vertical binding post (high side) to the ungrounded cathode of the discriminator. As in case 1 or 2 above the pattern of either Figs. 4 or 5 will appear. Adjust primary trimmer of discriminator transformer for maximum amplitude, and secondary trimmer for symmetrical displacement above and below the base line.

Remove the shorting lead from the receiver oscillator, and connect the high side of the 'scope again to the limiter grid resistor. Connect the sweep generator to the antenna binding posts and set input circuits to appropriate r-f

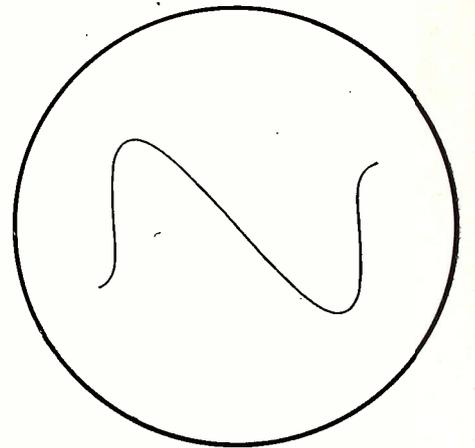


Fig. 5. Sinc modulation, ratio detector (I. F.) "mirror image" trace misaligned.

frequency (per set manufacturer's instructions). Adjust oscillator and r-f trimmers for maximum amplitude of i-f pattern response at specified dial calibration points.

#### Alignment of Receivers Incorporating Ratio Detectors

The ratio detector previously mentioned performs the dual functions of both limiter and discriminator. Alignment and pattern resolution are exactly the same as in the case of the Foster-Seeley discriminator type of receiver. Connections of the sweep generator remain the same as in the previous case. The essential difference lies in the connection of the 'scope and a special bias battery.

This type of detector employs a stabilizing condenser of high capacity across the detector load resistor. This large condenser must be disconnected, and the scope connected from the "audio take off" point (high side prior to the de-emphasis circuit) and ground to the receiver chassis. The sweep generator is connected between the converter grid and ground, and the receiver oscillator temporarily shorted. One or two traces of the i-f selectivity response will be observed depending on the character of the modulating voltage. In this case the i-f traces will extend upward from the base line. To obtain a

[Continued on page 28]

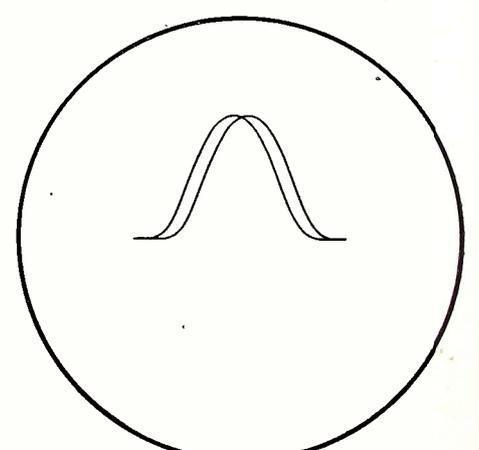


Fig. 6. Saw tooth modulation, single discriminator trace.

# INCOME TAX DEDUCTIONS YOU MAY TAKE

**A**RE taxes going to be cut this year?

As this is being written a bill cutting taxes has been introduced in Congress. The President's attitude is known, but the final decision is still in doubt. We have a seven billion dollar budget surplus, but the demands for foreign aid are great.

Whatever Congress and the President do, it is quite likely that the tax you will pay of March 15th will be at the same rate as you paid last year. On the whole business was pretty good in 1947, but with the increased cost of living, our interest is in paying as little tax as possible.

The law says that you may take advantage of every opportunity to keep your tax to a minimum. This can be done legally by taking advantage of all permissible deductions. It has been shown many times that a great many people overpay their income taxes due principally to careless preparation of returns and lack of information.

Our purpose is to point out some of the many deductions which can and should be taken. There are several points you should watch carefully.

The first is that of your inventory. The wise radio service dealer will take an inventory at the end of every calendar (or fiscal) year. This will give you a good indication of your real profit.

## Losses and Depreciation

You may price the inventory at either the cost of the items to you—or the market price—whichever is the lower. You will probably find some items which were lost, stolen or damaged. For these you are entitled to take a loss. Radio tubes are sometimes broken, some things you carry in stock become defective or obsolete and are not saleable. Those which are destroyed are marked down as complete losses; obsolete or worn items which are not saleable at normal prices are given a reduced figure. As to these, you secure the real inventory value by computing what you can sell them at, then deduct the cost of selling. Be careful though—if you set a reduced value on something, you must offer it for sale at that price thereafter.

Shortages are always cropping up in an inventory. Since you have paid for

**Expert advice outlining tax deductions that are allowable to all businessmen when they compile their income tax report**

**by Elliott H. Marrus**  
(Attorney at Law)

the articles, you are entitled to take credit for the loss so far as your taxes are concerned.

What are you going to do about your equipment? You know that small, inexpensive tools, soldering irons and those items which have a useful life of less than one year may be written off as business expenses. More costly and longer lasting pieces such as test equipment and fixtures depreciate in value. So you figure the estimated useful life of the items and then deduct a percentage of their original cost (based on the number of usable years) each year. For example, the furniture and fixtures in your store have an estimated useful life of ten years. Thus each year you may take 10% of the original cost as depreciation. If you bought the fixtures second hand, then the estimated useful life may well be less than ten years. However, if you neglected to take a depreciation allowance for something in your last tax return, you may not take two year's depreciation this tax-report time. It is advisable to carefully examine all your equipment to see that you are taking full depreciation on everything permitted by the law.

If any item of equipment has become obsolete or useless you may take a loss

on its *book value*. Book value is the original cost, less the amount you have previously taken in depreciation plus what you can sell it for as salvage or junk.

## Operating Expense Deductions

Do you use your car for both business and pleasure? Are you claiming the deduction for that portion of the use which can be attributed to business? You are entitled to do so. For example, if during 1947, the vehicle was driven 8,000 miles and if you compute that 4,000 of those miles were for business purposes, then you may deduct one-half of the total expense and depreciation. Driving to and from work and home is not considered a business use.

Car expenses include gas, oil, anti-freeze, parts, repairs, garage, maintenance, washing, insurance, etc. It is generally figured that a new car used for business has a useful life of five years (no depreciation is allowed on vehicles used for non-business purposes). Thus each year 20% of the cost may be depreciated. In the example given above, you may take one-half of 20% of the cost as allowable depreciation, and one-half of the cost of operation.

Business expenses are a large item in your deduction picture. If your books are complete (but they probably are not), you will have no trouble securing a full allowance for this item. The trouble is that so many dealers pay some bills out of their pocket or from the till and not get an invoice or make a record of it. Among the expenses which you may deduct are:

Cost of small tools and supplies.

Business insurance—theft, fire, hold-up, public liability, workmen's compensation, etc.

Legal and accounting fees.

Wages, salaries, commissions, bonuses, tips (including temporary help).



"Aw Pop!-I think I can fix it."

[Continued on next page]

Janitorial services and supplies.

Rent; or upkeep depreciation and taxes of your property if you own it.

Repairs to your premises. If it is a major alteration, you must depreciate the cost each year rather than taking one lump deduction.

Interest of business loans.

Transportation and warehouse charges.

Entertainment and traveling expenses (for business purposes).

Certain types of advertising.

Business taxes.

Stationery, postage and miscellaneous office expenses.

Service car expenses—if you don't use your personal vehicle.

If you have not in the past kept complete records of these expenses (and any others you may have), now would be a good time to start such a system.

Since many dealers do not operate as corporations, they generally report their business income on the same form as personal income. That's perfectly all right so long as you are sure to take *all* the deductions permitted. Here are some major points to be considered in the individual's tax return.

#### **Exemptions**

You may take a \$500 exemption for each of your dependents. According to the tax law, a dependent is a close relation by blood, marriage or adoption who had less than \$500 income in 1947 and to whom you furnished more than half his support. "Support" includes not only cash, but also the value of lodging, board, clothing, medical expense, etc. The age of the dependent does not matter. He may be 6, 30 or 76 years old. Some people fail to take the full \$500 exemption because support was not given for the full year. That's wrong. If the other conditions we mentioned are present, even if you supported the dependent for only a portion of the year, you would be entitled to take the full exemption. A good example of this is a child born in November.

#### **Contributions**

We all know that we are entitled to take a deduction up to 15% of our adjusted gross income (the amount entered on line 1 of page 3 of the Tax return) for gifts to charitable organizations. It is also true that you may deduct contributions to religious, literary, scientific, educational and certain other non-profit American organizations. Gifts to individuals are not deductible, no matter how worthy the cause. Remember that your contribution need not be in cash, you may count such things as food, clothing, etc.

Both business and personal interest payments are deductible—personal on page 3, business on Schedule C. You may count interest paid to a private party as well as a bank.

#### **Taxes**

During the course of a year we all pay many taxes, most of which are deductible from your income tax. The one which are excluded are Federal income and excise taxes; inheritance, estate, legacy and gift taxes. The excise taxes which are levied on you as a retailer are deducted on Schedule C. On page 3, you deduct the sales taxes (such as those on clothes, cigarettes, etc.) which are levied on you as a consumer.

You may also deduct real property taxes (except those assessments which improve the value of your property, such as for the building of a new sewer), and fees for recording deeds and mortgages. Water taxes are usually not deductible because they are usually fees for supplying water, rather than taxes.

Other deductible taxes are motor vehicle licenses, gasoline taxes (varying in different states from 2c to 7c per gallon, poll taxes, occupational, stock transfer and use taxes and other local taxes on admissions, tobacco, liquor, etc.

#### **Losses**

Not only are losses in business deductible (on Schedule C), but the ones in your personal life are likewise. If your camera was stolen, you would be entitled to set down the value of it. Generally we may say that any loss due to fire, theft, storm, casualty or shipwreck for which you were not reimbursed by insurance or otherwise is a deductible item. For example, if your automobile was damaged in an accident not due to your negligence, then the amount of the damages (for which you were not reimbursed) may be entered as a deductible loss.

#### **"Medical" Expenses**

This is one of the more human aspects of the tax law. It provides that you may take a deduction for part of the money you spend to maintain and repair your health and that of your dependents.

Not only doctors' bills are deductible, but also practically anything necessary in connection with your health. These include payments to optometrists, dentists, nurses, hospitals, and laboratories. You should count money spent on medical supplies and equipment (such as eye glasses, wheel chairs, arches, etc.), medicines (also tonics, vitamins, toothpaste, etc.) and even the cost of travel and vacation when taken under the direction of a physician for the benefit of health. Don't forget to include premiums on your hospitalization, accident and medical policies.

After you arrive at the total amount of these "medical" expenses, you subtract from it 5% of your adjusted gross income (item 6, page 1 of the tax re-

turn), and the net is the amount of deduction to which you are entitled.

There is a limit to the amount you may deduct for medical expenses. If you are filing a return for yourself alone, without dependents, the total is \$1250. If you take credit for one or more dependents, or if yours is a joint return with your wife, then the total allowable deduction is \$2500.

#### **Miscellaneous Deductions**

Alimony payments made under order of court or under a written agreement for the support of your wife after a separation or divorce may be deducted from your income before paying the tax. The payments must be periodic—and strangely enough, there is no deduction for support payments for children if the amount is separately stated.

You may also deduct your share of the interest and real estate taxes paid by a cooperative apartment corporation in which you a tenant-stockholder.

The question which frequently is asked is: "Shall I file a joint return with my wife?" Of course, each man's situation is different, but the general answer is "No" if she has a net income of more than \$500, or if her deductions are less than her income. The reason is that ordinarily a joint return (when the wife has income) will put you into a higher bracket and result in a larger tax. You can best answer your own question by computing your tax both ways—with joint and individual returns—and using the cheapest one.

Preparing an income tax return is an unpleasant task—almost as unpleasant as paying the tax itself. Whether you prepare it yourself, or engage an attorney or accountant to do the task, your tax bill will be less if you gather all pertinent information in advance, taking into consideration the points we have mentioned in these pages. Remember that you may have to prove a claimed deduction at some time in the future, so it is a good idea to keep your records for at least five years.

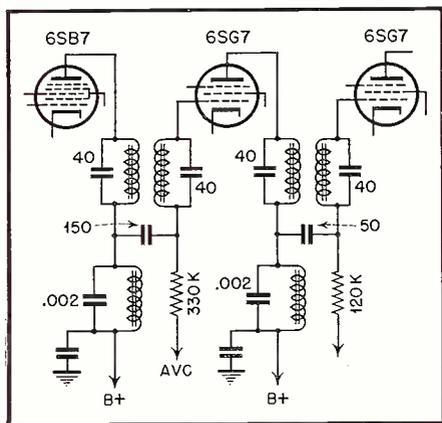
#### **Noisy House Wiring**

Instead of taking off plates of wall receptacles, canopies, and sockets to find faulty house wiring connections, use an electric heater that draws about 6 amperes.

Connect it to each outlet, with an a-c voltmeter plugged across the line, watching any fluctuation on the meter. In this way many joints will be found that should have been soldered, but were not, joints of this type corrode very quickly, thus causing all sorts of noise in the line. This method will show up cold soldered joints, so if in doubt on any joint, make sure by placing your hot soldering iron under the joint till the solder flows freely around the wires, thus assuring a perfect bonded joint free of any noise.

**Pilot T-521**

An unusual combination i-f stage is used in the Pilot T-521 AM-FM receiver. A partial diagram shows the first i-f stage and its associated circuits. The convertor, a 6SB7, has a 10.7 mc transformer between its plate and the grid of the 6SG7 i-f tube. In the plate of the i-f stage a similar transformer couples it to the next 6SG7 stage. The transformers have fixed 40  $\mu\mu\text{f}$  condensers and movable iron cores for tuning. Note the fixed capacitors between primary and secondary of each transformer at the low potential ends. Though small (50 and 150 uuf) these serve to effectively confine the 10.7 mc signals to the transformers and tubes.



1st i-f stage of Pilot model T-521.

In series with the plate coil of each 10.7 mc transformer is a tuned circuit consisting of a .002  $\mu\text{f}$  condenser and an iron core coil. This combination is tuned to resonate the entire plate load to 455 kc. Thus, on AM position, the set develops a signal of this frequency in the i-f stage. The grid circuits of the 6SG7 stages are completed by resistors of 330K and 120K ohms. The 455kc voltages are coupled between stages by both the inductive and capacitive relationship of the 10.7 mc coils and the fixed coupling capacitors between coils. This form of coupling is commonly termed impedance coupling.

With the arrangement described a single i-f stage can amplify either 455kc or 10.7 mc signals, depending on the output of the convertor stage.

**Airline Model 74BR-1812A**

This two band receiver operates on the standard broadcast and 88-108 mc

# CIRCUIT COURT

FM band. Eight tubes plus rectifier are utilized. Built-in antennas are provided for both bands, but terminals are provided for external connection.

Block diagrams are shown of the tubes and circuits employed in the performance of each type of operation. A simplified schematic of the mixer and oscillator circuits are also shown.

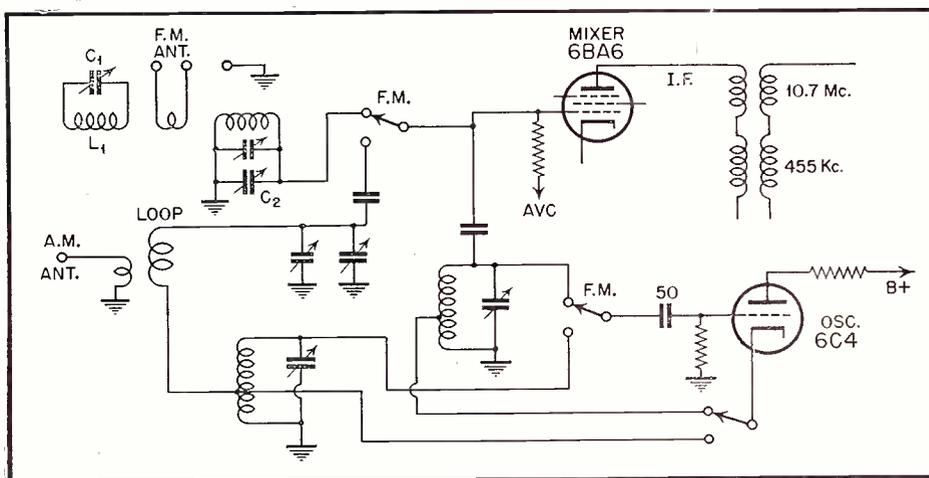
When AM reception is desired the operation involves the use of the 6BA6 mixer and 6C4 oscillator to develop the 455 kc I. F. The oscillator circuit makes use of a tapped coil Hartley circuit.

The 455 kc is amplified in another 6BA6 tube and fed to a 6AT6 stage which provides detection, AVC devel-

insensitive to amplitude variations of a short period. The audio output of the tube, a 6AL6, is built up to normal volume in the 6AT6 and 6V6 stages, as on AM.

An interesting feature of the convertor schematic is the use of an L.F trap to eliminate interference from 10.7 mc signals riding through to the grid of the mixer. This function is performed by C1 and L1, in parallel, coupled to the antenna and mixer grid coils. When sharply tuned to 10.7 mc this trap will effectively absorb the unwanted signals.

Note also that different methods are employed to inject the oscillator voltage into the mixer. On AM the loop returns to a tap on the oscillator coil.



Simplified schematic of Airline 74 BR mixer and oscillator circuits.

opment and a stage of audio amplification. The output tube is a 6V6, along with the 5Y3G tube being the only ones not miniatures. A 6" by 9" oval speaker puts out a maximum of 7 watts.

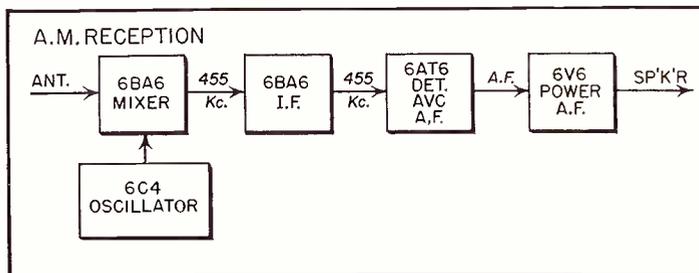
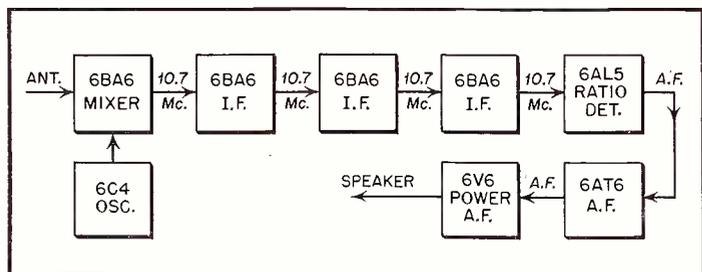
The FM circuits start out with the same mixer and oscillator tubes. Switching takes place in the mixer grid and both grid and cathode of the oscillator. The I. F., this time 10.7 mc is first amplified in the same 6BA6 which served on AM. Series transformers are used. Further gain is provided by two more stages at 10.7 mc, both using 6BA6 tubes.

The second detector uses a ratio detector circuit. This type of circuit needs no limiter preceding it, being relatively

On FM, however, a small capacity is connected between the two grids and provides coupling. Note that separate tuning condensers are used for the two bands, mounted on a common shaft for simplification of tuning.

**FLASH—it WAS Intra Video!**

Many readers have asked us whether the Master Antenna System manufactured by Intra Video Corp. is referred to in the article "Master TV Antennas vs Indoor Antennas for Multi-set Applications," by Ira Kamen, which appeared in our January, 1948 issue. The answer is, "Yes." (Editor)

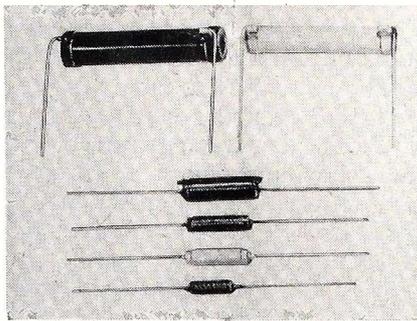


Airline 74 BR. Block diagram of FM circuit, left, and AM circuit, right.

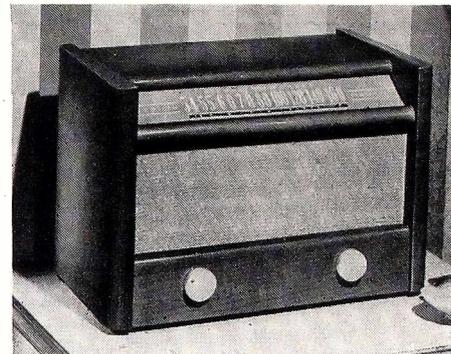
# NEW PRODUCTS

## Ohmite Announces New Radio Frequency Plate Chokes

To cover the higher frequencies now in use Ohmite Mfg. Co., 4954 Flournoy Street, Chicago, has developed six new radio frequency chokes. The recommended operating ranges are as follows: Stock No. Z-14, 7 to 35 megacycles; Z-28, 20 to 60 mc; Z-50, 35 to 110 mc; Z-144, 75 to 190 mc; Z-235, 160 to 350 mc; and Z-460, 320 to



520 mc. The first two units are rated at 600 milliampères. The other four at 1000 ma. These new chokes are more fully described in Bulletin 133 which will be sent upon request.



### Stewart-Warner Model 51T56

An ac/dc table model housed in early American maple cabinet. Has 4 tubes plus rectifier. Covers 540-1600 kc band. Also available in Blonde Moderne as Model 51T116.

### Triplet 3413 Tube Tester

Conclusive tube tests for value, inter-element shorts and leakage. Standard RMA Recommended circuit; with accurately calibrated values for all makes of tubes—more than an emission test in the special switching flexibility. Triplet switching makes possible an exclusive combination of tube testing advantages including maximum circuit flexibility, simplicity of operation and anti-

**Get brilliant,  
ghost-free reception  
on all channels  
of Both bands...**

*install this new*  
**AMPHENOL**  
**TELEVISION Array**

Today, in most communities, a single 54-88 mc folded dipole television antenna is all you need.

Tomorrow, with two television bands in use, an ordinary TV antenna designed for service on either the 54-88 mc, or the 174-216 mc band will not satisfactorily receive the other. So, if you want brilliant reception on *all* channels, in *both* bands, and don't want to buy two antennas, this new Amphenol Television Array is the one to buy.

This antenna array is unique. Its two broadband folded dipoles and reflectors have a common transmission line. This permits the large folded dipole to also serve as a reflector for the small folded dipole.

Amazing as it seems, this arrangement produces more gain than a dipole. This is true over the whole high frequency band, and also over most of the low. In areas of low signal strength, this array delivers brighter, clearer pictures. Also, its highly directional pattern virtually eliminates "ghosts."

Antenna elements and supports are of sandblasted aluminum tubing and aluminum alloy castings. The five foot mast is of cadmium plated steel tubing. Designed to withstand high winds and ice loading, the antenna is easily assembled with ordinary tools. No element length adjustment is required.

Swivel mounting plate and guy clamp permit installation on every type roof. Seventy-five feet of low-loss Amphenol 300 ohm Twin-Lead, which matches the input of most television receivers, is included. A good impedance match is achieved on both bands.

See your jobber, or write direct, for prices and complete technical data.

## AMERICAN PHENOLIC CORPORATION

1830 SOUTH 54TH AVENUE, CHICAGO 50, ILLINOIS  
COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT •  
ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS



obsolescence design. The new lever switches give individual control for each tube element. Tests all receiving tubes, gaseous rectifiers, resistor and ballast tube continuity and pilot lamps. Only one socket used for each tube base type eliminating possibility of plugging into the wrong socket. New tubes can be calibrated without manufacturers' data. "Speed Roll" Tube Chart conveniently located simplifies testing.

Counter-Portable type case has detachable, hinged cover and strap handle. Power supply: 115 Volt, 50-60 cycle A.C. For literature write Triplet Electrical Instrument Co., Bluffton, Ohio.

[Continued on page 24]

# 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	Straight Trumpets, 21 types
Re-entrant Trumpets, 7 types	Re-entrant Phone Speakers, 7 types
Tweeter & High Frequency Speakers, 3 types	Flat bell straight trumpets, 2 types
Radial Horns and Speakers, 3 types	Armored Cone Projectors, 7 types

In addition there are cellular and auditorium horns, inter-com, 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.**

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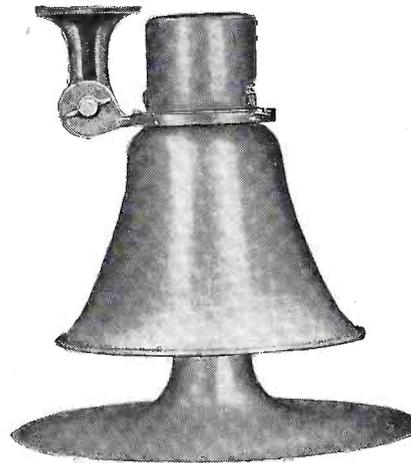
# RACON



**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.



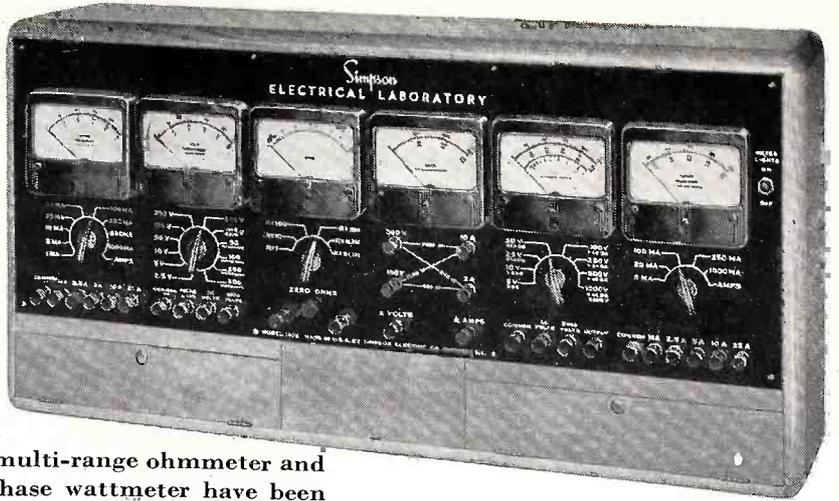
**NEW RADIAL RE-ENTRANT SPEAKER**, excellent for all types of industrial sound installations. Provides superlative and complete 360° speech intelligibility by efficiently over-riding factory high noise levels. Frequency response 300-6000 cps. Handling capacity 25 watts continuous, 35 w. peak. Has mounting bracket. Size 12" wide by 12 5/8" high.

**New Simpson Instrument Combines Functions of Sixty Others**

Just announced by Simpson Electric Company, Chicago, is Model 1005 Electrical Laboratory, a new multiple purpose test instrument. Designated by its makers as a complete test unit for use by radio, electronic and electrical technicians in laboratories, shops or service departments, the Laboratory is said to combine the functions of over sixty separate instruments. It consists of six individual 4½" rectangular instruments, each with a complete set of ranges.

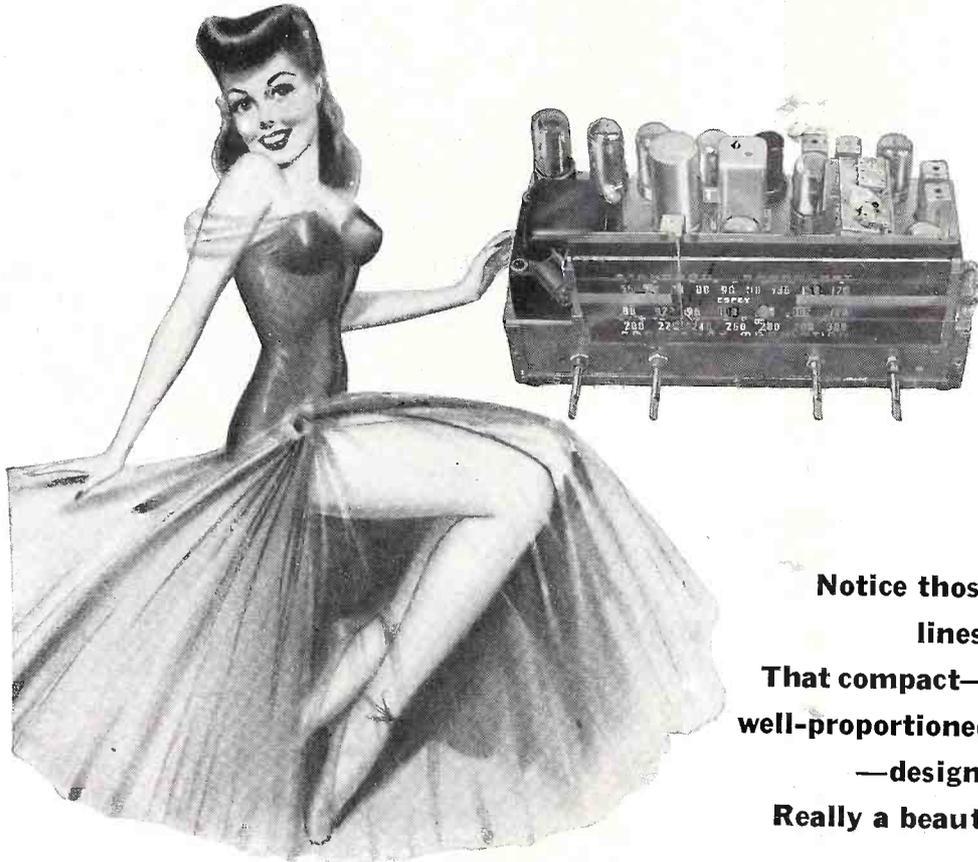
In addition to the wide variety of A.C. and D.C. voltage and current

ranges, a multi-range ohmmeter and a single phase wattmeter have been



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replacement for AM sets housed in highly-thought-of cabinets.

The **ESPEY** Model 7-B is an AM/FM superheterodyne receiver with 10 tubes plus a rectifier tube, operating on 105/125 volts AC, 50/60 cycle. Wired for phone operation, this superbly engineered receiver is supplied, ready to operate, with 10" speaker with Alnico No. 5 magnet, antennas, and all necessary hardware.

**For further details about this—and the rest of the ESPEY line—write today to Department M.**

**ESPEY MANUFACTURING COMPANY, INC.**  
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incorporated. Also, to meet the need for extreme sensitivity required in testing circuits where only a small amount of current is available, an instrument is provided with a sensitivity of 50 microamperes, providing 20,000 ohms per volt on all D.C. voltage ranges. The Electrical Laboratory incorporates a rectifier type instrument for measuring A.C. voltage with a resistance of 1,000 ohms per volt on all ranges. This latter instrument also has in combination a complete coverage of DB ranges from minus 10 to plus 55 for volume indications.

The Electrical Laboratory is adaptable for testing all electrical appliances, small motors, circuits, radio sets, etc. All of the instruments are indirectly illuminated, and all lights are controlled by one switch located at the right side of the panel. The panel is of lustrous, long-wearing anodized aluminum. Cabinet is natural finish birch, with lock-joint construction. Two compartments for accessories and instructions, with hinged doors, are located at the base of the cabinet. All connections are made to binding posts located on the panel. Test leads and Break-in plug are furnished. Size is approximately 34" x 17" x 9", weight 37 lbs.

**Spool Wire Dispenser**

The new line of dial cords and cables by **JFD Mfg. Co.**, is packaged in a display rack holding 50 and 100 foot spools as shown.



## TRADE FLASHES

[from page 6]

attic or upper portion of the building. This transmission line can be terminated in a standard electrical outlet box at the receiving point, and run through the partitions in a manner similar to bell wire, requiring no conduits nor sheath. A length of approximately twenty feet of this line should be left coiled in the attic or near the top of the building for future connection to the particular antenna selected and later installed.

The line should be covered with standard loom or other insulating tubing where it enters the standard electrical single outlet box at the receiving location. The line may be tacked to the studding and other framework of the house by means of standard fibre head telephone tacks. Both the wire and the tacks are available as RCA stock items.

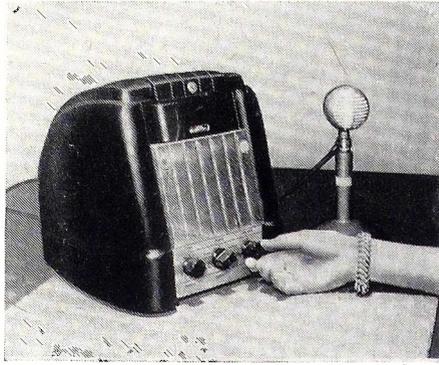
The wire cannot be run nearer than three inches to metal laths, pipe, or other conducting material. It should be kept clear of other electrical wiring, maintaining a maximum of separation therefrom and avoiding parallel runs. The television antenna transmission system, being of "low tension" character, will not fall under the wiring codes, except for proper workmanship. The terminating outlet for the television antenna transmission line should be adjacent to a power outlet capable of furnishing 120 volts, alternating current, 60-cycle, 400-500 watts. About 100 feet of transmission line will be required for the average residence. This line now sells at a price of 5 cents per foot retail. Thus for a modest investment a builder can feature new homes "equipped for Television."

### Plug-in Cartridge Recorder

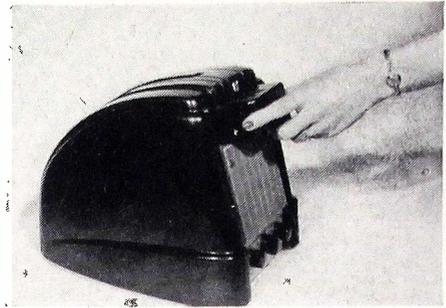
A radically designed, lightweight wire recorder, which for the first time completely eliminates the complicated handling of wire by utilizing a simple "plug-in" cartridge, has been developed and is now being marketed by RCA.

The new wire recorder weighs less than 25 pounds with cartridge and microphone. It has only three simple controls, operates on 110-volt AC power source, and has an indicator light to show correct recording volume.

The "plug-in" cartridge records a half-hour of speech or music and may be operated to permit immediate playback without rewinding. The "immediate playback" feature is possible by the unique design of the cartridge, which contains not one, but two lengths of permanent wire, wound on four spools. Untouched by human hands, the wires wind, unwind, and rewind themselves,



permitting the operator to record a speech or musical selection of any length up to 30 minutes, and returning to the exact starting point on the wire for im-



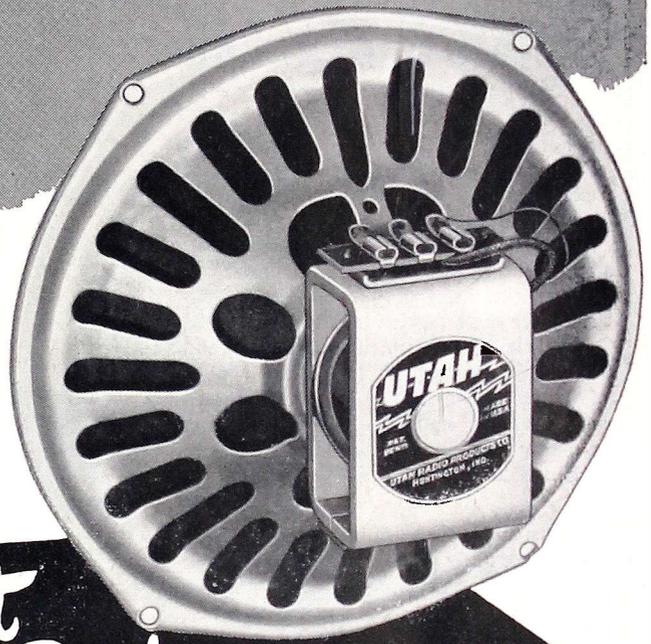
mediate playback.

Another innovation is a timing device calibrated in minutes and fractions of minutes which permits the user to determine the exact locations of recordings on the wire and permits several

## AUTO REPLACEMENT SPEAKERS

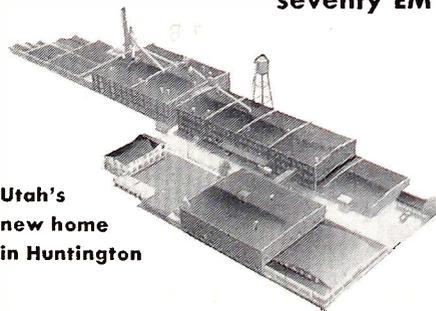
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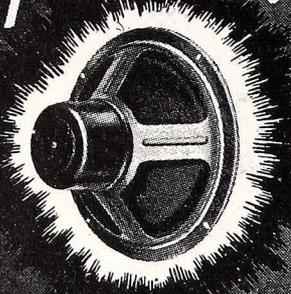
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# LOOK AHEAD



short recordings to be made without the danger of overlapping.

Still another advance in the RCA wire recorder is its automatic "erasing" feature. Without requiring a separate operation to "clean" previous material off the wire, the recorder automatically erases previous sounds as a new recording is being made.

The new RCA recorder is being offered as a "complete package," with all equipment for both recording and instantaneous playback included.

### Admiral Offers Unique TV Set Line

Admiral Corporation introduced on Jan. 2nd a "completely different" system of home television. The innovation, referred to as "television optional," offers matching television consoles, radio-phonograph combinations, and record cabinets, which may be bought separately and matched at any time.

The television console section—a complete full-size unit—will retail for approximately \$299.95. It has a full 10-inch screen and a more sensitive 28-tube circuit.

This set, together with the radio-phonograph combination, including FM, priced at \$299.95, will bring the total cost of the complete ensemble to less than \$600.

The innovation has these advantages the manufacturer claims:

1. The family with moderate income can plan on both a radio-phonograph and a television set by buying them one at a time to distribute the over-all cost and still have matched units.

2. Families that have hesitated about buying a three-way set for fear that future developments in television might make that part of the set obsolete, can now protect their investment by buying the radio-phonograph and television units separately.

3. The radio-phonograph and the television receiver may be used together, separately, or even in different rooms.

4. The television receiver will be easily portable so that it can be moved to the most suitable spot for viewing whenever desirable.

5. The units are styled to fit the sectional trend in furniture designing so they will fit into many room-furnishing schemes. Cabinet designs are simple and conservative to permit their use with the majority of furniture styles.

6. Since both units have separate speakers, the audience may watch a news or sports event on the television screen and listen to the standard radio description of it by turning the television sound down to an inaudible level. The units will use separate speakers.

Buyers of any unit of the ensemble

will be able to match one or both of the others at any time during a period of several years. At any time, he will get the most up-to-date features of any unit.

### Mallory Service Plan

A far-reaching program of cooperation with radio servicemen to help them expand and improve their service—the Mallory “Good Service for Good Business” plan—has been launched by P. R. Mallory & Co., Inc., Indianapolis, Ind. Mallory distributors are now holding meetings of servicemen all over the country to introduce the plan. The company is offering a number of practical, easy-to-use selling tools expressly designed to simplify the serviceman’s business building job and to make his operations more profitable. A feature of the meetings being held is a showing of the new Mallory sound slide-film, “Good for You.”

Servicemen who take advantage of the plan enter into a three-way Agreement with P. R. Mallory & Co., Inc., and the Mallory distributor for their territory. The Agreement does not require purchase of any Mallory parts. At the time the Agreement is signed, \$2.50 is paid to the distributor and copies of the Agreement are furnished



to both the service man and the distributor. The plan is available only through Mallory distributors.

Among the tools supplied to the

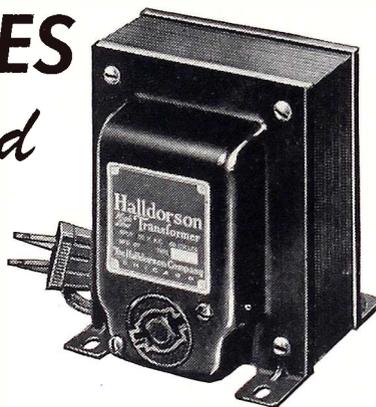
service man is a unique customer follow-up file box complete with alphabetical and monthly index cards. With this attractive blue and orange file goes a set of 250 special triple postcards which Mallory imprints with the serviceman’s name and address. One part of this card is a “Record of Work Done,” which is filed alphabetically by the customer’s last name. The remaining double card is designed to be mailed to old customers who have not had their radios inspected or repaired in six months.

These double cards are filed under a monthly heading six months from the time the set was last checked. When that month comes around, the serviceman takes the double card out of the file and mails it to his customer. One-half of the double card contains a reminder message to the customer that his set should be examined. Mallory supplies these cards with the name of the serviceman and his address imprinted at the end of this message. The other half of the card is for the customer to tear off and mail back to the serviceman, specifying a time for him to call. This unit also is imprinted with the serviceman’s name and address so customers need only sign it and drop it in the mail.

A handsome four-color electric sign

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# OHMITE

for use either in the window or on the counter is another feature of the Mallory "Good Service for Good Business" plan. A handsome metal Certificate is supplied to the serviceman which states that he has pledged to do careful work at fair prices, use only the finest quality parts, and earn a reasonable profit. The Certificate is signed and sealed by Mallory and bears the serviceman's name in hand-lettering. The Certificate and the signs already described identify the serviceman with the Mallory name and help to enhance his reputation in the community.

The company includes in the plan free use of the Mallory Consultation Service on business problems and the Mallory Technical Service on radio problems. There is no restriction on the kind of requests made, or the number. These inquiries are handled by correspondence directly between the Mallory Service account and P. R. Mallory & Co., Inc.

## VISUAL ALIGNMENT

[from page 18]

trace of the ratio detector itself (discriminator patterns *Figs. 4, 5*) a constant bias source must be substituted for the disconnected condenser. A 1 1/2 volt flashlight cell is usually satisfactory. The reason for using the battery is the fact that the time constant (R/C) of the ratio detector load circuit is such that small discharges will occur at lower modulating frequencies. These discharges although not detrimental to sound reproduction show up as small amplitude variations in the discriminator pattern. For r-f-mixer alignment disconnect the bias battery and oscillator shorting lead, and proceed as above.

### Explanation of Double Traces, and Inverted Traces

It has probably been noticed that when the 'scope was connected across the limiter grid resistor that the 'scope pattern extended downward from the base line; or in what is referred to as a

"negative" direction. The reason for this is that the grid of the limiter is drawing current under signal application, and so the voltage applied to the 'scope's vertical amplifier is negative in respect to ground. The 'scope simply traces out the amplitude variation of this voltage—which is the selectivity response of the i-f amplifier system. In the case of the ratio detector the voltage reaching the vertical amplifier is positive with respect to ground. In this case the selectivity response is "positive," and so extends upward from the base line.

It was stated that the reason for a double or single image was due to the character of the modulating voltage. *Fig. 6* shows two images which represent a mistuned i-f system. *Fig. 7* shows one cycle of the sine wave modulating voltage which frequency modulates the signal generator, plotted from positive to negative to positive (*points 1, 2, 3*). The center line may be considered the "resting" (center) frequency of the FM generator. As the sine wave varies from *points 1 to 2* the oscillator changes from its lowest to highest frequency. In this same space of time the beam has swept across the screen once, and traced out one image of the pass band. This is true because its vertical amplifier is under control of a voltage of varying amplitude, and its horizontal amplifier under control of a saw tooth 120 cycle voltage. The beam now snaps back to its starting point while the oscillator is at its highest frequency (*point 2*). As the sine wave varies from *point 2 to 3* the oscillator changes from its highest to lowest frequency and the beam superimposes a second image over the first trace. An inspection of *Fig. 6* reveals that the physically adjacent sides of the two traces are actually opposite sides, and the composite image is actually two selectivity traces, one a "mirror image" of the other. By varying the sweep generator's output frequency these two traces may be made to "slide" one over the other and the "mirror image" effect better observed. It should be remembered that for correct alignment the sweep generator must be left at the receiver's center i-f frequency, and pattern coincidence obtained by successive adjustment of i-f, and then of discriminator transformer trimmers.

In the case of saw tooth modulating voltage only one pattern may be obtained because the modulating voltage snaps back to zero at the same time the beam returns to its starting point. The sweep, therefore, is always in one direction during the beam trace interval. The preference of one system over another is still a matter of some small dispute, but with advanced design favoring the "mirror image" system for purposes of symmetrical comparison.

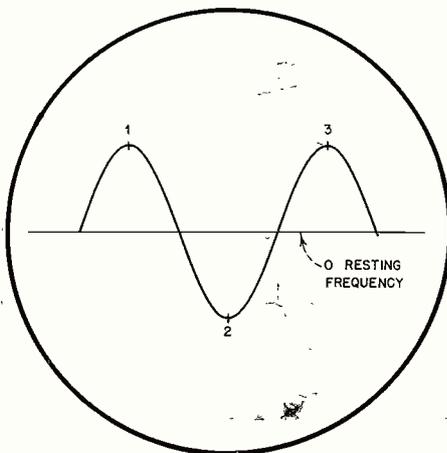


Fig. 7. One complete cycle of the sound wave.

## HIGH SPEED SERVICING

[from page 15]

taking the trouble to remove a chassis. The latest of these handy gadgets is a



Fig. 1—RCA Test Osc. WR 67A

miniature Testpoint Adapter especially designed to fit into the tight places in new FM and television receivers.

### Using The Chart

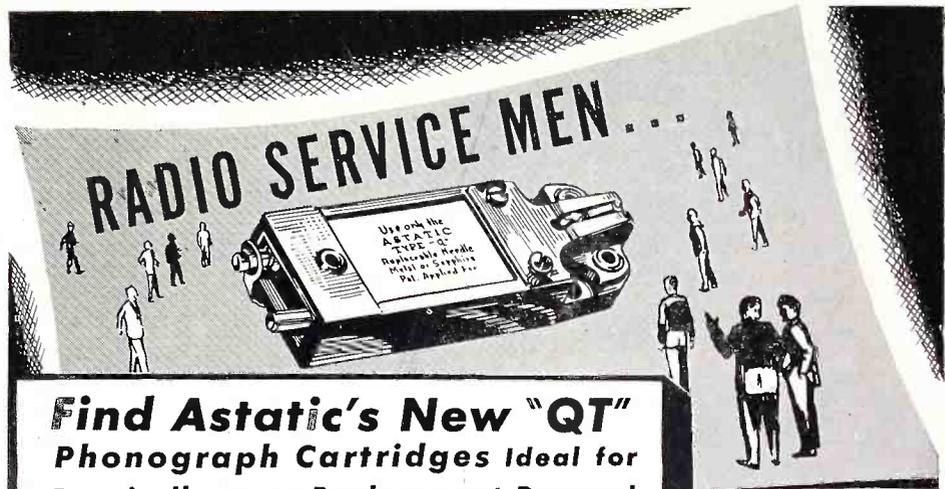
The accompanying chart is intended to help the serviceman resolve his trouble-shooting problems by a procedure based on logical thinking and as direct an approach to the source of trouble as possible. Although the plan of the chart exhibits certain suggested possible cures for defects, which fall in the categories listed, it is not intended to indicate a comprehensive coverage of those listings. Being fundamental in nature, it avoids the usual listing of symptoms, causes and cures.

The first test method mentioned is "hearing." Through using his hearing alone, the serviceman can usually detect which of the four "nature of trouble" classifications exist.

Applying the second test method of "observation," it is found, that which can be seen to be wrong with a radio receiver usually endorses what was heard to be wrong with it. Often these two test methods, which are no more than the serviceman's own natural facilities, are enough to locate certain troubles within a defective receiver.

Beyond the above, it is necessary to add the facilities of test equipment to extend one's range of hearing or observation, just as the telescope makes it possible to see things not normally visible. To continue with a logical approach toward locating an invisible cause of trouble, it is advisable to employ signal tracing as a test method. The simplicity of signal tracing procedure, or that of signal injection, as the case may be, helps to locate trouble quickly in any of the four categories mentioned as "nature of trouble."

It may be noted from the chart that only in cases of intermittent conditions or low output, is it necessary to make special signal tests for monitoring and gain-checking respectively. Similarly,



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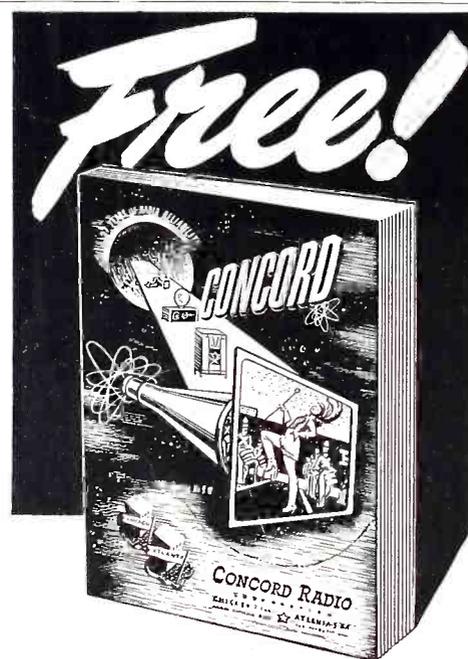
• For quiet, faithful reproduction, freedom from needle talk, relatively high output, and excellent tone range, the "QT" Cartridge is a modern replacement favorite. In addition, this new Cartridge is reasonably priced, simple to mount and connect, and designed for long life and record protection. Special literature is available.



Type "Q" Matched Replaceable Needles used with Model "QT" Cartridges

Precious Metal Tip

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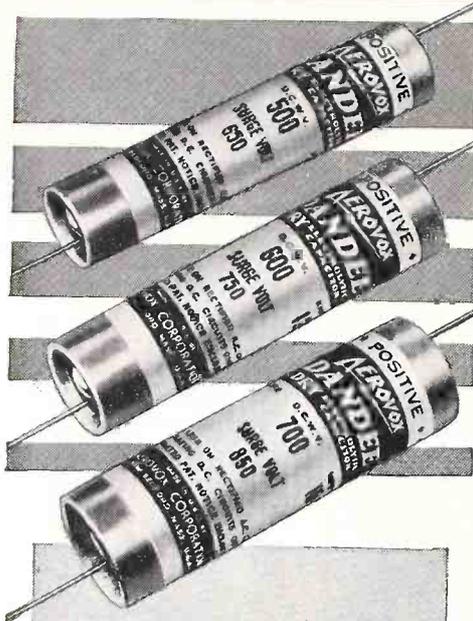
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signal tests involving frequency are only required occasionally as verification of suspected frequency defects noticed in the foregoing tests.

In following any column down the chart, it is seen that "voltage indication" is intended to prove, through lack of proper voltages, why something is wrong with the signal handling capability of the receiver.

As a final proof of the source of trouble in any category, resistance or capacity test can be made to determine exactly what part or parts are defective.

When evidence warrants, it is perfectly reasonable to skip any of the tests listed in a column. For instance, a crack appearing on a resistor, as noted by observation, might be good cause to make a resistance test before reverting to the balance of the procedure outlined above.

## RAISE PRESTIGE

[from page 13]

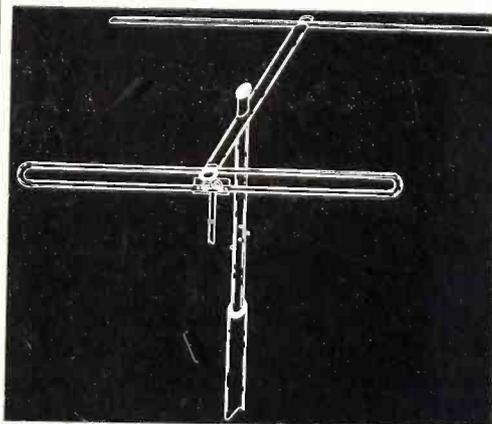
actual fault and the required corrective measures that must be taken to overcome same. And as for free tube examinations, or free estimates or free diagnoses, the public must be trained to expect just as much such free service from radio technicians as it (the public) gets from electrical engineers, doctors, lawyers and the like who do very little of anything free, except in clinics that are supported by public funds as a general rule.

Radio set manufacturers also have a part in the condemnation proceedings for, as a whole, they have completely neglected the radio servicing profession except in such cases as where they believed they could make a profit therefrom. For years it has been the policy of the "largest set manufacturer of them all" to refuse to give or sell any circuit data or service notes on its line of sets except to such dealers as carried their franchise, or to those technicians who agree to buy their private brand of exact replacement parts, on which they made nice profits.

Even as this is being drafted, we find on our desk a gripe from jobbers who oppose the competition for replacement tube and parts sales that set manufacturers now give them. See this issue's Editorial.

Then, with the advent of Television, came the so-called "exclusive manufacturer's service-installation contract" deal. To that policy we could subscribe for the initial first year period of television sales, allowing "specialists" to handle work while others acquired the necessary technical training—but when it comes to the following year and the manufacturers offer a "renewal service contract" which restricts competition, then we must openly oppose the practice

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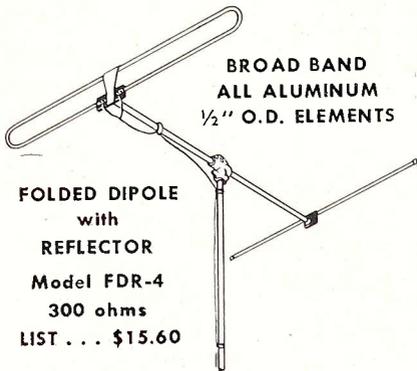
## \$1.00 to \$5.00 PAID for "SHOP NOTES"

Write up any "kinks" or "tricks-of-the-trade" in radio servicing that you have discovered. We will pay from \$1 to \$5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor," RADIO SERVICE DEALER, 342 Madison Ave., New York 17, N. Y. Unused manuscripts cannot be returned unless accompanied by stamped and addressed return envelope.

# Rig-Fast

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ALL ALUMINUM  
1/2" O.D. ELEMENTS

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Model FDR-4  
300 ohms  
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"Rig-Fast" quality means greater turnover . . . more profit. New Model 4 line elements are pressure sealed, reinforced at terminal ends. Alignment assured with Key Slot Ring. "Rig-Fast" models interchangeable. Rig complete with accessories. Inquiries invited.

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## COMBINATION "DYNOPTIMUM" TUBE and SET TESTER

Model  
802-N

High Quality in a low-priced instrument for greater profits

ONLY  
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Multiply your productive service time with this completely modern, accurate tube and multi-tester. It provides maximum test operations with minimum switch settings—speeds your service checks for field and counter work. Order from your local jobber. Write direct for catalog.

Check these features:

- Simple to operate as a tube tester or set tester—only 3 selector switches.
- Usual AC voltage errors due to frequency and temperature virtually eliminated with germanium crystal rectifier.
- Tests paper, mica and electrolytic condensers for leakage.
- Resistance measurements through a 200 million to 1 range.
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- Set tester includes AC—DC voltmeter—output meter—decibel meter—ammeter—milli-ammeter—ohmmeter—all multirange.

R.C.P. INSTRUMENTS—BEST FOR EVERY TEST

**RADIO CITY PRODUCTS CO., INC.**

152 West 25th Street,  New York 1, N. Y.

as not being in the best interests of the servicing profession as a whole. One excuse given by set manufacturers for the "exclusive" service arrangement was that not enough proper test equipment is available for television repairing. If that is the case, it is incumbent upon the set maker to either provide the necessary test equipment or withhold delivery and installation of their sets until enough technicians and test instruments are available to handle service on same. Even now, some "manufacturer's exclusive TV service agencies" are so far behind in their work that the TV set owners are fast becoming a disgruntled lot—and naturally, the onus falls upon *all* men in the radio servicing profession despite the complete innocence of the great majority who don't even have a chance to do any work on TV models.

The broadcast stations, too, can be blamed to some extent for the bad grace in which technicians are held. However, if they will in future support the efforts of accredited radio technicians in their area they will derive great benefit by increasing their audience and at the same time steer repair work away from less competent technicians whose ethical standards may be below par.

### Steady Income for Technicians Possible by Preventive Maintenance Contracts

One basic weakness in the field of radio servicing is the fact that an assured and steady income cannot be predetermined by the average technician, especially if he depends upon home radio repair work exclusively. Technicians, notoriously adverse to being "sales minded," should not hesitate to arrange to sell their technical ability on a regular predetermined contract fee basis, and they can do so, as we shall explain.

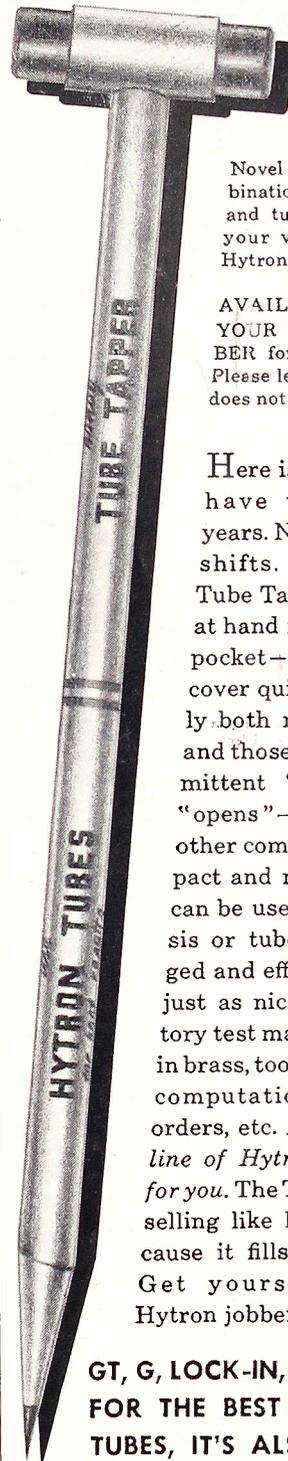
One type of potential but steady income that the average radio-electronic technician has completely overlooked is that which might be derived from industrial users of radio-electronic and sound equipment. Most technicians work on the theory that when an electronic device breaks down someone will be called upon to repair it, and the chances are fair that they might get the job. Instead, an aggressive technician will attempt to sign up the job before there is a break-down, and by the very nature of his working arrangement he would see to it that he got paid a fixed fee for preventing break-downs before they even occur. In practically every locale there is some store, factory, school or church that uses some type of sound or electronic system. The breakdown of such apparatus causes the owner much hardship. *Preventive maintenance is the answer!* The paper "Electronics Through The Crystal Ball" given at the

# HYTRON

## Handy TUBE TAPPER

## Much-needed TOOL

## Locates Intermittents



Novel and useful combination pencil, eraser, and tube tapper. Fits your vest pocket. A Hytron exclusive.

AVAILABLE FROM YOUR HYTRON JOBBER for only a nickel. Please let us know, if he does not have it in stock.

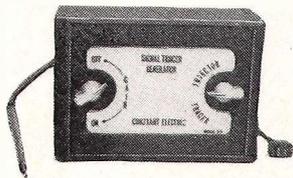
Here is the tool you have wanted for years. No more make-shifts. The Hytron Tube Tapper—always at hand in your breast pocket—helps you discover quickly and easily both microphonism and those elusive intermittent "shorts" and "opens"—in tubes or other components. Compact and nonmetallic, it can be used on set chassis or tube tester. Rugged and effective, it does just as nice a job as factory test mallets. Doubles in brass, too, when making computations, writing orders, etc. *First of a new line of Hytron tube tools for you.* The Tube Tapper is selling like hot cakes, because it fills a real need. Get yours from your Hytron jobber today.

GT, G, LOCK-IN, MINIATURE —  
FOR THE BEST IN RECEIVING  
TUBES, IT'S ALSO HYTRON.

# HYTRON

RADIO AND ELECTRONICS CORP.  
Salem, Massachusetts

## SIGNAL - TRACER - GENERATOR



- ★ Two Instruments in one
- ★ Simple to operate
- ★ A Remarkable Instrument
- ★ Cuts Servicing Time 1/2
- ★ Pencil Thin Probe
- ★ A.C. - D.C. Operated

This instrument permits following the signal audibly through the receiver from the antenna to the speaker, a sure method of locating the cause of trouble. PLUS a signal generator that delivers a strong A.F., I.F. AND R.F. signal, permitting the serviceman to align and trace any portion of receiver under test. Generator frequency 1000 cycles to 25 megacycles. Uses a multivibrator network.

A few faults that can be traced and isolated with instrument

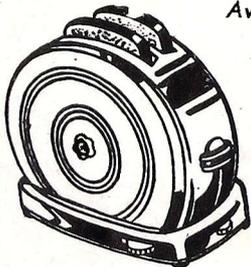
- ★ Distortion
- ★ Fading
- ★ Loss of Gain
- ★ Oscillation
- ★ Intermitting Operation
- ★ Open Coils
- ★ Weak or Shorted Tubes
- ★ Hum and Noise

A.C.-D.C. Ready to operate, with instructions, \$16.50  
See Your Local Jobber  
If he can't supply you write us direct  
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Automatic release  
... no burning ...  
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The Ideal Hotel for Rest and Relaxation. Beautiful Rooms. Salt Water Baths. Glass inclosed Sun Porches. Open Sun Decks atop. Delightful Cuisine. Garage on premises. Open all year.

Fiesta Cocktail Lounge  
Favorite Rendezvous of the Elite  
Exclusive Pennsylvania Avenue  
and Boardwalk

Town Meeting by D. G. Fink, Editor of *Electronics*, and which we will reprint in an early issue of "RSD" covers this subject admirably.

### Increasing Service Prices

In foregoing paragraphs we have stressed the need for the radio servicing profession to erase the stigma attached to it by eliminating shoddy work and below-par ethical practices. Even while the "house-cleaning" process is going on, it would be advisable for all technicians and service dealers to re-examine their price structures and make any necessary revisions as soon as possible. In a subsequent issue of "RSD" we will carry the paper "Cost Accounting and The Computation of Charges for Radio Technicians" which Mr. P. G. Zink, Jr., C. P. A. delivered at the Town Meeting. It should enlighten all radio technicians.

### Need for Modern Test Equipment

In conclusion, a word is in order regarding test equipment, the prime tool, aside from knowledge, of the average technician. Modern electronic circuits are more complex and critical than ever before. Close tolerance measurements, quickly obtained, are a *must* if peak efficiency work is to result. By spending less time troubleshooting and by putting "saved" time to use in performing additional service work, greater efficiency, and of course greater earning capacity results. Discard obsolete test equipment and replace it with the most modern available as quickly as possible. The investment, for it is merely that and not an outright expense, will more than pay dividends. In fact, the radio technician who makes it known that he has and uses the most modern test equipment available can from that one fact alone get for himself a vast amount of prestige.

### EDITORIAL

[from page 3]

eligible to go into business or do servicing work for himself, whether full or part-time makes no difference.

The recognized trades and professions, electrical and medical alike, which have in effect that type of required apprenticeship and proven training enjoy the high regard of the general public. The radio servicing profession might do well to follow:

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## VERIFIED SPEAKERS

"They Glorify The Tone"

**WRIGHT  
Inc.**

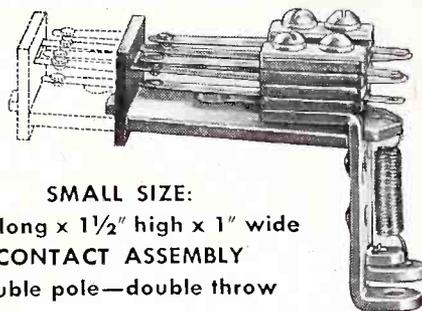
2235 University Avenue

St. Paul 4, Minnesota

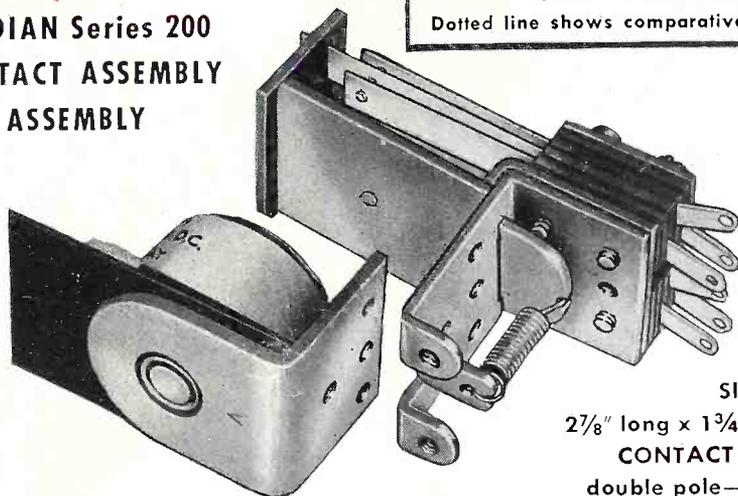
# GUARDIAN

presents...

a new **MIDGET**  
CONTACT ASSEMBLY  
*Interchangeable*  
with the **GUARDIAN Series 200**  
STANDARD CONTACT ASSEMBLY  
AND COIL ASSEMBLY

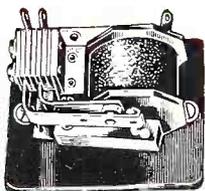


**SMALL SIZE:**  
1 5/8" long x 1 1/2" high x 1" wide  
**CONTACT ASSEMBLY**  
double pole—double throw  
Dotted line shows comparative size



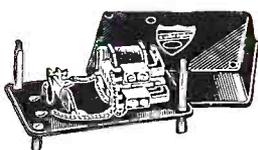
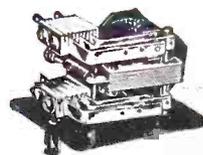
**SIZE**  
2 7/8" long x 1 3/4" high x 1" wide  
**CONTACT ASSEMBLY**  
double pole—double throw

## Popular RADIO RELAYS in the GUARDIAN line:



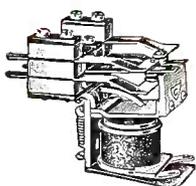
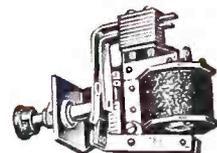
**K-100 Keying Relay** For low voltage control of high voltage transmission. Guardian Series K-100 Relay will follow key or bug at highest WPM rate attainable. High speed response, strong magnet and return spring give clean make and break, produce best CW note. Coils: 5 to 16 v., A.C.; coils for other voltages on specifications.

**B-100 Break-in Relay** For break-in operation on amateur transmitters. The Guardian B-100 Relay has laminated field piece and armature. Fine 1/4" silver DPDT contacts, capacity to 1500 watts, 60 c., non-inductive A.C., and in A.C. primary circuit of any inductive power supply delivering up to 1 KW, inclusively.



**T-100 Time Delay Relay** In radio transmitter circuits, Guardian's T-100 Time Delay Relay prevents damage of rectifiers and tube filaments by preventing plate current before filaments are sufficiently heated. Laminated field piece and armature. Mounted in dust-proof metal box.

**L-250 Overload Relay** Provides accurate, fixed overload protection against current surges and continuous overloads. Guardian's L-250 Relay replaces expensive, time-wasting fuses. Attracts armature on 250 mils. Max. drop across coil—10 v. Guardian's L-500 Relay attracts armature at 500 mils. Max. drop across coil—5 volts. Ideal for experimenters on new circuits.



**A-100 Antenna Relay** A low loss AISiMag insulated relay. For single wire fed installations specify the A-100-C, SPDT unit. Two A-100-C in place of one A-100 in open wire line systems will avoid possible impedance mismatch. A very popular relay with radio amateurs.

SEE THESE AND OTHER GUARDIAN RELAYS AT  
BOOTH 51, MAY 12-16, STEVENS HOTEL, CHICAGO, ILL.

Ask your jobber for the new midget contact switch assembly which is interchangeable with the Guardian's Series 200 coil assembly. Your jobber carries a complete line of Guardian radio relays.

# GUARDIAN



# ELECTRIC

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*Sell more service . . . sell more RCA tubes . . . by displaying this dramatic 8-color, 22" x 28" girl poster.*

## **In miniatures . . . it's RCA!**

THE TREND IS TO MORE MINIATURES . . . in midget and auto sets . . . FM and TV receivers . . . commercial and industrial equipment.

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THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA



**TUBE DEPARTMENT**

**RADIO CORPORATION of AMERICA**

**HARRISON, N. J.**