IN THIS ISSUE:
RAISE THE SERVICE PROFESSION'S PRESTIGE
HIGH SPEED SERVICING
VISUAL ALIGNMENT
INCOME TAX DEDUCTIONS
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.

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.

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.

<table>
<thead>
<tr>
<th>At Start of Test</th>
<th>After 2,000 Hours</th>
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<tbody>
<tr>
<td>Capacity</td>
<td>Resistance</td>
</tr>
<tr>
<td>20.9 mmf</td>
<td>6.16 ohms</td>
</tr>
<tr>
<td>20.1 mmf</td>
<td>6.5 ohms</td>
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*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:

BUY MALLORY ASSURED QUALITY AT REGULAR PRICE LEVELS

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

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!

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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 meet all your actual needs!

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☐ Send HOWARD W. SAMS' 1947 AUTOMATIC RECORD CHANGER MANUAL(S) at $4.95 each.
☐ Send HOWARD W. SAMS' DIAL CORD STRINGING GUIDE(S) at $0.75 per copy.
☐ Send FREE PHOTOFACT Cumulative Index.
☐ Send details of your Special Trade-In Offer.
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!
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 mfg’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

[Continued on page 322]
Match up the people and the horns

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 PHONOGRAPH

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 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.
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 Council 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-5; 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, 484 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 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:


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 retailer'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 ex-quiite the thing with the exc... 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 MEC phonograph and a high fidelity amplifier. The results of this installation are so... I would like to congratulate you on this development."

"I have installed one of your DL. IRM 6C Variable Reluctance type pickup cartridges in my record changer and am feeding it through a preamplifier made by you. The dia-gram of which is descriptive... I have obtained the results that I have heard from this pickup are better than anything I have heard before."

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

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

RESEARCH AND DEVELOPMENT COMPANY

"The combination of... of radio... of radio... National radio networks... on all of their transcription tables."

"The release for public sale of your Variable Reluctance... pickup cartridge has meant to a large number of people in this neighborhood... Listening compared with other... it 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

"Not so long ago I bought one of your DL. IRM 6C Variable... more than lived up to my ex- pectations."

FROM A LEADING STATION

"Rete. Nov. 27-ordered 30 G-E pickups because tests indicated that they were superior... that they were superior... that... station is going to in- clude G-E pickups in all transcrip-
tion equipment."

FROM A LEADING UTILITY LABORATORY

"I have been using for the last several months a... pair of your variable reluctance pickups... with eminent satisfaction. I would in fact so far as to say that the results when first put to use were astonishing."

"We are rapidly approaching the day on which G-E Variable Reluctance Pickups may be a standard com-

RADIO SERVICE DEALER * FEBRUARY, 1948
"... 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. Tennies, Manager Radio Dept. of Kay's Department Stores, Los Angeles, Calif.

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

**You need all 17—order today**

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<tr>
<th>Volume</th>
<th>Price</th>
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<td>Xvi</td>
<td>$15.00</td>
<td>Record Changers and Recorders</td>
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<tr>
<td>Xv</td>
<td>$8.40</td>
<td>Master Index (covering Manuals, Vols. I to XV)</td>
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<td>Xvi to XvIII</td>
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John F. Rider Publisher, Inc., 404 Fourth Avenue, N.Y. 16
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VOL. XVII
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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

RADIO SERVICE DEALER * FEBRUARY, 1948
A NATURAL Combination for SERVICING by SIGNAL SUBSTITUTION

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

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

Combination Master Electronic 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.
★ Employs standard tube basing numbering system on all element selectors, permitting most simplified operation and comprehension of test results.

CIRCUIT AND BATTERY TESTING HIGHLIGHTS
★ 35 A.C. and D.C. ranges to 6000 volts, 60 microamperes, 12 amperes, 70 DB, 60 megohms.
★ 20,000 ohms per volt D.C., 1,000 ohms per volt A.C.
★ High speed, positive, double-wiping contact, push-button selection of ranges.
★ All standard ranges at Only Two polarized tip jacks.
★ Tests all standard radio A, B and C batteries under dynamic load conditions, simulating actual performance.

A Stable, Accurate Source of R.F. Signals such as the NEW Precision Series E-200-C Wide Range Signal Generator
★ Direct Reading Frequency coverage 88 KC to 120 MC for A.M., F.M. and T.V. alignment (absolute fundamentals to 30 MC).
★ 1% Accuracy on all bands. Precision “Unit-Oscillator” construction.
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RADIO SERVICE DEALER • FEBRUARY, 1948
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.

NEARLY 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 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 Committee. 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 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 delinquent 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 malpractices 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, 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-increasing 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
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, the same corrective in one hour, while the other might decide upon a manner that requires two hours, often cannot be avoided.

A physician that at one time or another some ethical medical profession must admit inevitably so, a $4 per hour labor charge, for instance, the 2-hour man, might be working at a 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 service workers. 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.

One might elect to repair the trouble in a manner that requires two hours, and parts to 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

**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.

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*See Editorial this issue

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*Continued on page 30*
"TIME 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 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 obtained for 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.

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

by Arthur Liebscher*

Fig. 2—Using the probe

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
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

<table>
<thead>
<tr>
<th>TEST METHOD</th>
<th>INOPERATIVE</th>
<th>INTERMITTENT</th>
<th>LOW OUTPUT</th>
<th>POOR QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEARING</td>
<td>Listen for signal or other sound</td>
<td>Listen for interruptions or noise when tapped</td>
<td>Note loss of volume or frequency range—possibly when adjusting control</td>
<td>Listen for poor tone, hum, whistle, noise—possibly when adjusting controls</td>
</tr>
<tr>
<td>OBSERVATION</td>
<td>Look for damaged parts—short circuits—broken wire—tubular or displeased</td>
<td>Look for loose parts, loose wires or connections</td>
<td>Look for tubes out of place—open or shorted parts or wires—no glow in tube or cold tube</td>
<td>Look for damaged parts, poor connections, broken wires, tubes cold or out of place</td>
</tr>
<tr>
<td>SIGNAL TRACING</td>
<td>Follow signal to point of disappearance</td>
<td>Follow signal to point of interruption—possibly when tapped</td>
<td>Monitor for signal change—monitor for socket voltage change—possibly due to moisture or temperature variation</td>
<td>Follow signal to point where distortion or oscillation occurs</td>
</tr>
<tr>
<td>SIGNAL TEST (MONITORING)</td>
<td></td>
<td></td>
<td>Measure signal at point of suspected loss</td>
<td>Follow signal to point where hum or interference enters path</td>
</tr>
<tr>
<td>SIGNAL TEST (GAIN-CHECK)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIGNAL TEST (FREQUENCY CHECK)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>VOLTAGE INDICATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESISTANCE—CAPACITY TEST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

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The 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 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 difference (desired) frequency in this case would be 10.7 mc. 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-
developed 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 "pip" which may be moved throughout 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 service man 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 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 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, 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 µf condenser is connected to rectifier cathode ground 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

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Fig. 1.—Sinc modulation, "mirror image," mistuned i.f.

Fig. 2.—Saw tooth modulation—single i-f trace.
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 stages (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

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 oscilloscope 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 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 38}


**INCOME TAX DEDUCTIONS YOU MAY TAKE**

Are 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—which is 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 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 Dedications**

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).

[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 60, 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 new 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 return), 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 $2250.

**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—using the cheapest one. Prepare your records for at least five years.

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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 converter, 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 µuf 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 µuf) these serve to effectively confine the 10.7 mc signals to the transformers and tubes.

In series with the plate coil of each 10.7 mc transformer is a tuned circuit consisting of a .002 µf 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 455 kc voltages are coupled between stages by 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 converter stage.

Airline Model 74BR-1812A

This two band receiver operates on the standard broadcast and 88-108 mc 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 development and a stage of audio amplification. The output tube is a 6V6, along with the 5Y3G tube being the only ones not miniatures. A 9" 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 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 converter schematic is the use of an LP 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.

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)
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 milliamperes. 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 ke band. Also available in Blonde Moderne as Model 51T116.

Triplett 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. Triplett 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...

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 casings. 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
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 Sound men have recognized and specified them because of dependability, efficiency and low-cost, and because the reproducers are trouble proof.

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

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

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

Write for free catalog
RACON ELECTRIC CO., INC.
52 East 19th St. New York 3, N. Y.
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 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.

ESPEY
The Custom Built Chassis

Yes sir! In producing the ESPEY line of custom built chassis we have kept in mind the physical dimensions necessary for chassis units which could be easily adapted to custom-built work, or as replacements for existing inferior units. Carefully engineered and manufactured to give absolute satisfaction in any type of installation. The Model 7-B can serve as an ideal 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.
528 EAST 72nd STREET—NEW YORK 21, N.Y.

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 FLASHERS
(from page 8)
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 lath, 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 immediate 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

AVAILABLE IN 5 SIZES
3 ohm Voice Coil
4 ohm Field Coil
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Utah Auto Replacement Speakers are designed and built as original equipment to the manufacturer's specifications. They're rugged, made to last . . . made to perform better for your customers. Ask your jobber for Utah Speakers today. He carries a complete line of more than seventy EM and PM models.

Utah's new home in Huntington

RADIO SERVICE DEALER * FEBRUARY, 1948
RADIO SERVICE DEALER  FEBRUARY, 1948

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 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.

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

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12 issues $2—24 issues $3 in U.S.A. & Canada. Elsewhere $3 per year.

26

RADIO SERVICE DEALER  FEBRUARY, 1948
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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- Adjustable mounts make your Service work easier.
- Sealing under Vacuum means 100% Protection.
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Halldorson offers a complete line of replacement and amateur transformers ... all vacuum sealed. More than 300 different types including new high fidelity. See your parts jobber and select the type best suited for your needs. Get the best. Get Halldorson Vacuum Sealed Transformers.

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Available Only Through OHMITE Distributors

Every unit is not only color-coded but individually marked for quick, positive identification. Millions used in critical war equipment. Standard RMA values from 10 ohms to 22 megohms, in %, 1, and 2-watt sizes.

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 1½ volt flashlight cell is usually satisfactory. The reason for using the battery is the fact that the bias circuit of the ratio detector load circuit is such that small discharges will occur at lower 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 bias 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 (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.
HIGH SPEED SERVICING
[from page 16]

taking the trouble to remove a chassis. The latest of these handy gadgets is a 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,
For those higher working voltages—particularly television receivers, oscillographs and other latter-day electronic circuits—with high capacitance values for filtering or by-passing—Aerovox has the answer:

Popular Aerovox Type PRS Dandees are now available in extended D. C. working voltages of 500, 600 and 700 D. C. W., or 650, 750 and 850 surge. Capacitance values are 8, 10, 12 and 16 mid.

And of course the tried-test-proven Dande construction: hermetically-sealed aluminum can; waxed paper jacket; spun-over ends eliminating "shorts"; bare pigtail leads that won't work loose.

See Our Jobber...

These extended-voltage Dandees are being stocked. Our jobber can supply them. Order your requirements NOW.

---

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 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.

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.
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 ones fails 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 predeterminated 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 arrangement he would see to it that he 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 breakdowns before they even occur. In practicality 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.**
SIGNAL - TRACER GENERATOR

- Two Instruments in one
- Simple to operate
- A Remarkable Instrument
- Cuts Servicing Time ½
- Pencil Thin Probe
- A.C., D.C.

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This instrument permits following the signal " audibly " through the receiver from the antenna to the speaker, a new method of hearing the cause of trouble. It is a signal generator that delivers a strong A.F., I.F. and D.C. signal, permitting the serviceman to align each stage of the receiver under test. General Frequency 1000 cycles to 25 megacycles. Easy a multiwavelength network.

A few faults that can be traced and isolated with instrument

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* A.C. - D.C. Ready to operate, with instructions, $16.50

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EDITORIAL

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[elaborated text]

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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