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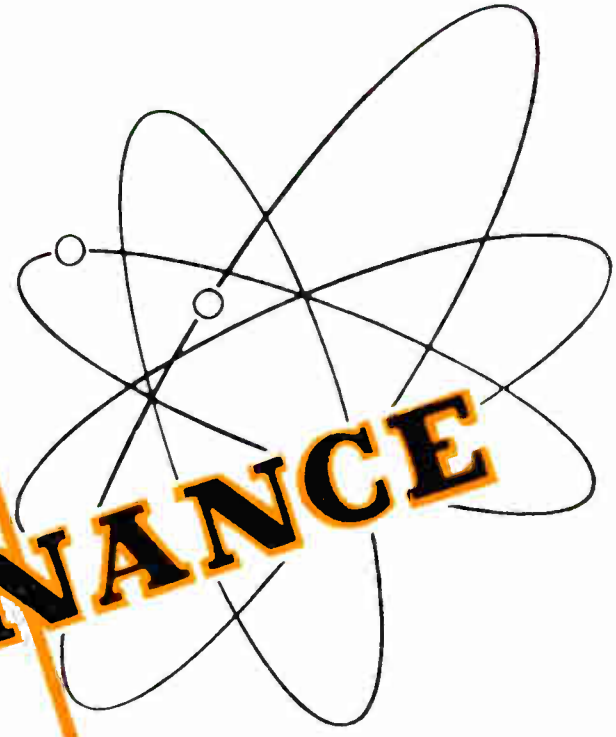

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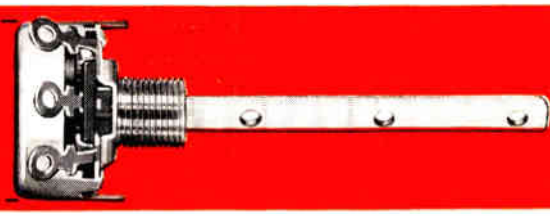
The First 15/16" Replacement Control Line



Quietest and Smoothest . . . by Test!

THE SIZE IS . . . . . NEW
Only 15/16" in diameter, it easily services the increasingly popular small sets where ordinary controls will not fit.

THE SWITCH IS . . . . . NEW
No chance of failure—it's Mallory engineered and Mallory manufactured. Pushes on—stays on—and *works*.

THE DESIGN IS . . . . . NEW
Brand new shaft style saves valuable time in installation—reduces inventory since one shaft fits all knobs.

THE ELEMENT IS . . . . . NEW
More accurate over-all resistance, smoother tapers, ample power dissipation.

THE CONSTRUCTION IS . . NEW
Extra quiet—no metal-to-metal contact between shaft and cover or bushing. Special Mallory contact material.

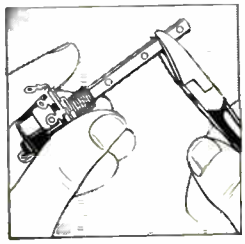
THE CONTACT IS . . . . NEW
Laboratory tests prove that the Mallory Midgetrol is the quietest control on the market.

THE SHAFT IS . . . . . NEW
Unique—two simple fittings—for all type knobs. No need for extra controls for different knobs.

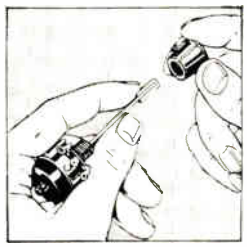
THE TERMINAL IS . . . . NEW
Won't break—twist 'em all you want in close working space. Away from panel to avoid shorting.

THE EXTENSION IS . . . . NEW
Easy to apply with self-tapping screws. Supplementary shafts available for installations which require them.

THE SUSPENSION IS . . . NEW
Two-point—insures even contact pressure at all points of rotation. Larger bushing area—added support—no wobble.

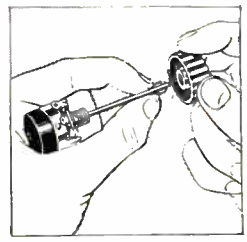


Side snips neatly cut shaft to length desired.

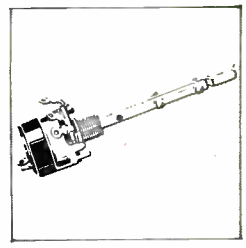


U-clip furnished to slide over end of shaft—holds set-screw knobs.

Use half the U-clip to hold push-on type knobs.



Spring steel clip included for use with knurled knobs.



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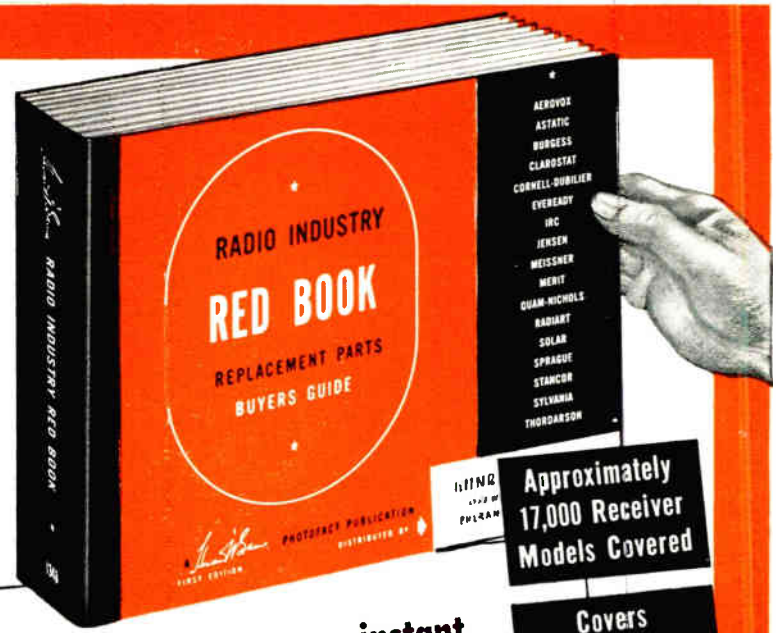

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RADIO MAINTENANCE

INCLUDING ELECTRONIC MAINTENANCE

Volume 4 SEPTEMBER 1948 Number 9

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Copyright 1948, Boland & Boyce, Inc.

Radio Maintenance is published monthly by Boland & Boyce, Inc., at 34 No. Crystal St., East Stroudsburg, Pa., U.S.A.; Executive and Editorial Office, 460 Bloomfield Ave., Montclair, N. J. Subscription Rates: In U. S., Mexico, South and Central America, and U. S. possessions, $3.00 for 1 year, $5.00 for two years, single copies 40 cents; in Canada, $3.50 for 1 year, $6.00 for 2 years, single copies 45 cents; in British Empire, $4.00 for 1 year, $7.00 for 2 years, single copies 60 cents; all other foreign countries, $5.00 for 1 year.

Entered as Second Class matter July 13, 1946, at Post Office, East Stroudsburg, Pa., under the Act of March 3, 1879.

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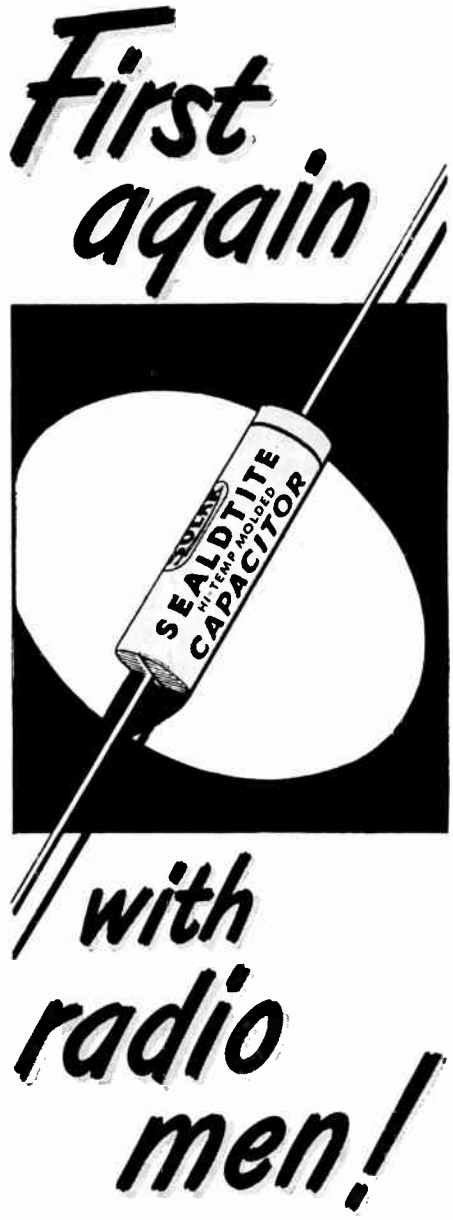

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Meet Sangamo Electrolytics, the newest family to become linked with the Sangamo Tribe. Introducing, from left to right on the opposite page, are illustrations of the "Chieftain", "Tomahawk", "Warrior", "Apache", and "Mohican". These newcomers now join the established tribe of Sangamo Micas, Silver Buttons, Papers, and Plastic Tubulars. Their heritage of dependability and long-life performance stems from being built in a factory which was constructed *especially* and *exclusively* for the manufacture of contamination-free electrolytics. Their performance will meet and exceed the most stringent requirements of electronic applications. Yet, these new, high-quality capacitors are competitive in every respect from a standpoint of design, construction, and price.

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Here is the only multiple scale test instrument of its kind in the world. It definitely reduces the possibility of errors by providing a single scale for each range of this finest of volt-ohm-milliammeters. As the selector switch is moved to the range desired, an ingenious gearing mechanism rotates a drum, bringing into place behind the meter window the proper scale for that range. Here is the equivalent of 25 separate instruments combined in one sturdy and compact unit. (18 scales; 7 additional direct reading ranges through use of high voltage and output jacks.) The patented Roto-Ranger principle eliminates the confusion of numerous readings on one scale, and the multiplying factors common to ordinary multi-range testers, by providing a separate scale for each range. There are no cramped calibrations in these full sized Roto-Ranger scales. Each is designed as it would be for a separate instrument.

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Milliamperes, D.C.: 10, 100, 500
Microamperes, D.C.: 100
Amperes, D.C.: 10
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INSTRUMENTS THAT STAY ACCURATE

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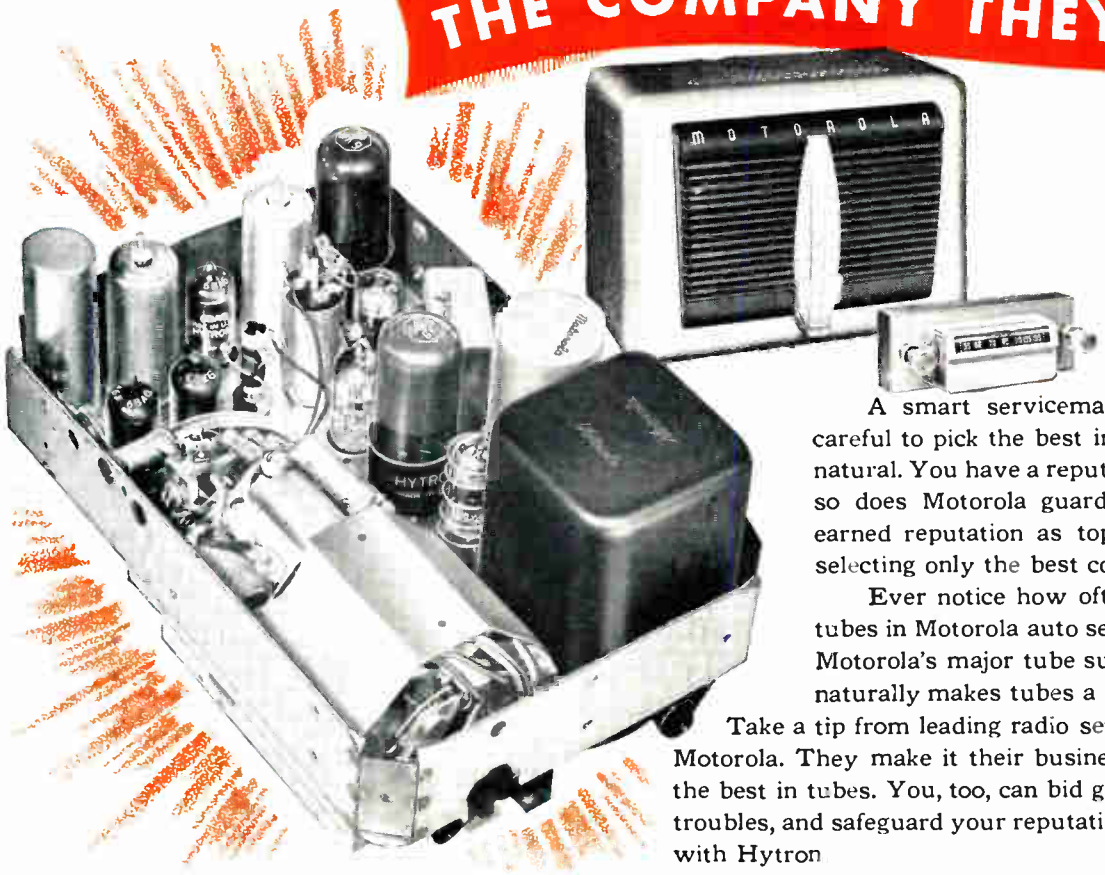
TUBES ARE KNOWN BY THE COMPANY THEY KEEP



A smart serviceman, you are mighty careful to pick the best in tubes. That's only natural. You have a reputation to protect. Just so does Motorola guard jealously its well-earned reputation as tops in auto radio by selecting only the best components.

Ever notice how often you find Hytron tubes in Motorola auto sets? To rate as one of Motorola's major tube suppliers, Hytron just naturally makes tubes a lot better than good. Take a tip from leading radio set manufacturers like Motorola. They make it their business to know and use the best in tubes. You, too, can bid goodbye to your tube troubles, and safeguard your reputation by "going steady" with Hytron

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Jackson 641 Universal Signal Generator.

FIRST PRIZE, OCT.
Weston 769 H-F Electronic Analyzer.

Want one of these deluxe first prizes? Perhaps a $200 U. S. Savings Bond grand prize? Or one of three $50 and three $25 U. S. Savings Bond second and third prizes? Try your hand at any or all of Hytron's monthly contests exclusively for radio servicemen. It's easy. Here's how. Get entry blank with complete details from your Hytron jobber, or write us. Describe your proposal for a simple, economical shop tool like the Hytron Tube Tapper or Miniature Pin Straighteners. Mail entry to Hytron Contest Editor. Then hold your breath. The finger of the judges may point at you.

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Only 49¢ at Hytron jobbers

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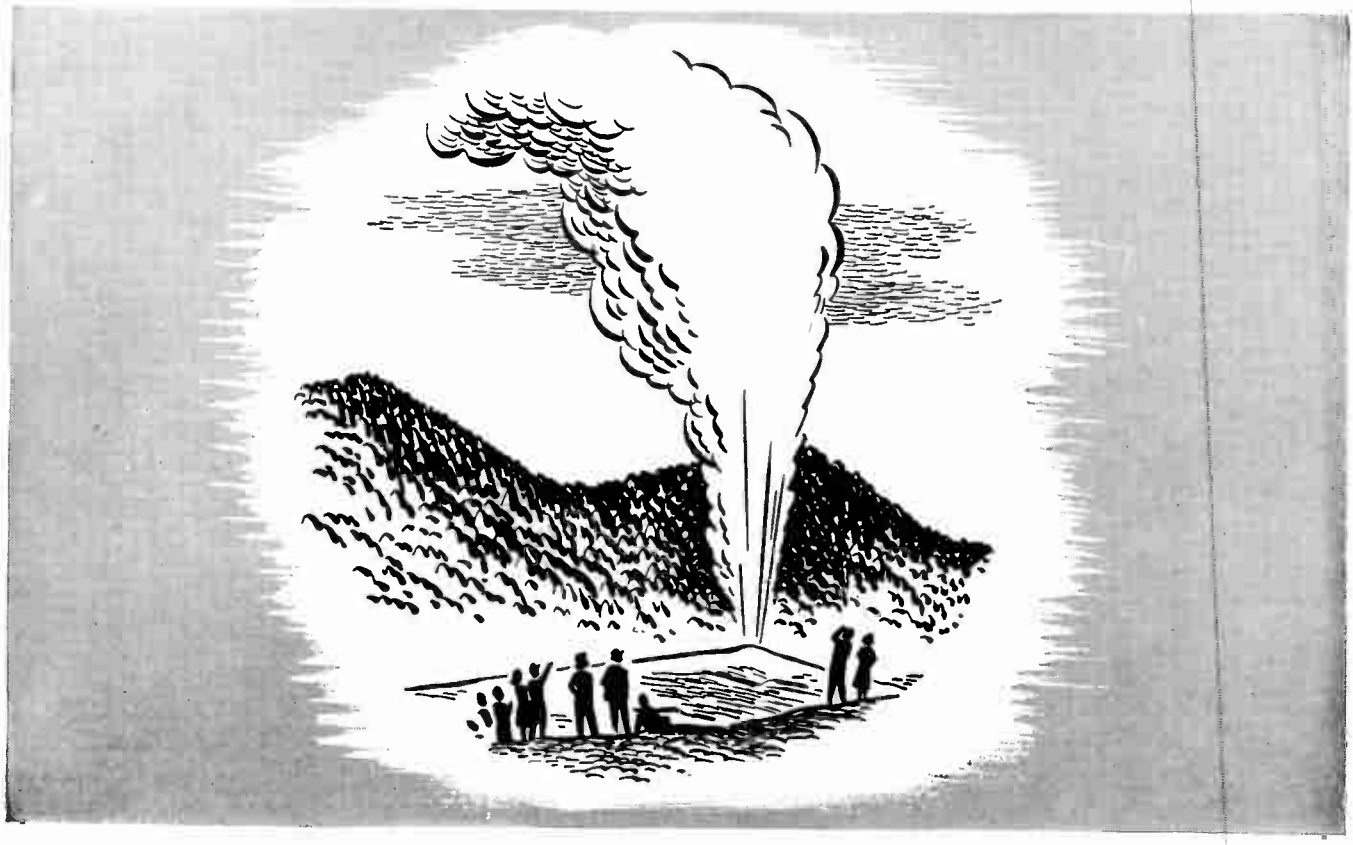
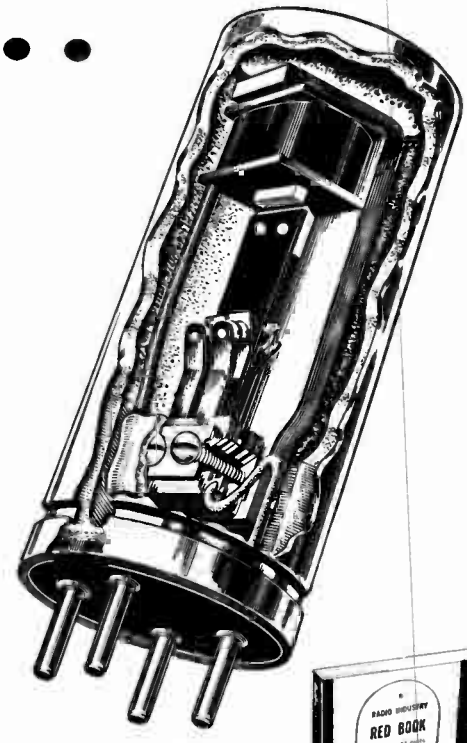


Dependable . . .

The regularity with which "Old Faithful" sends its towering spray skyward has been a glowing symbol of dependability. And so it follows that the regularity of "Old Faithful" best typifies the dependability of RADIART VIBRATORS. Because they're built better . . . because they're engineered faultlessly, servicemen everywhere prefer Radiart everytime because they know that their customers receive greatest value consistently. They start . . . and start quickly! Their performance is dependable and above reproach. Just another feature in the long list of factors why Radiart is the preferred and fastest selling vibrator.



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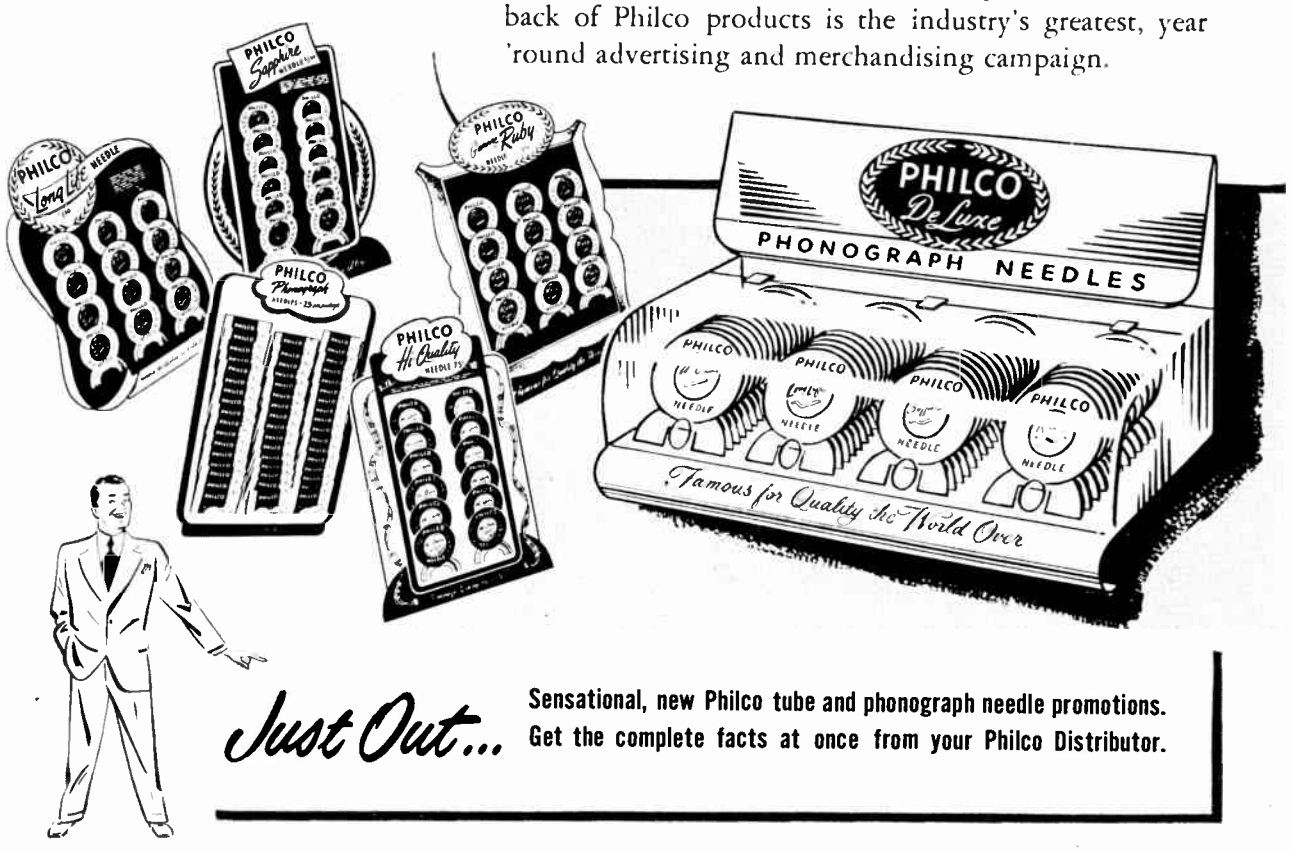

Just Out... **Sensational, new Philco tube and phonograph needle promotions. Get the complete facts at once from your Philco Distributor.**

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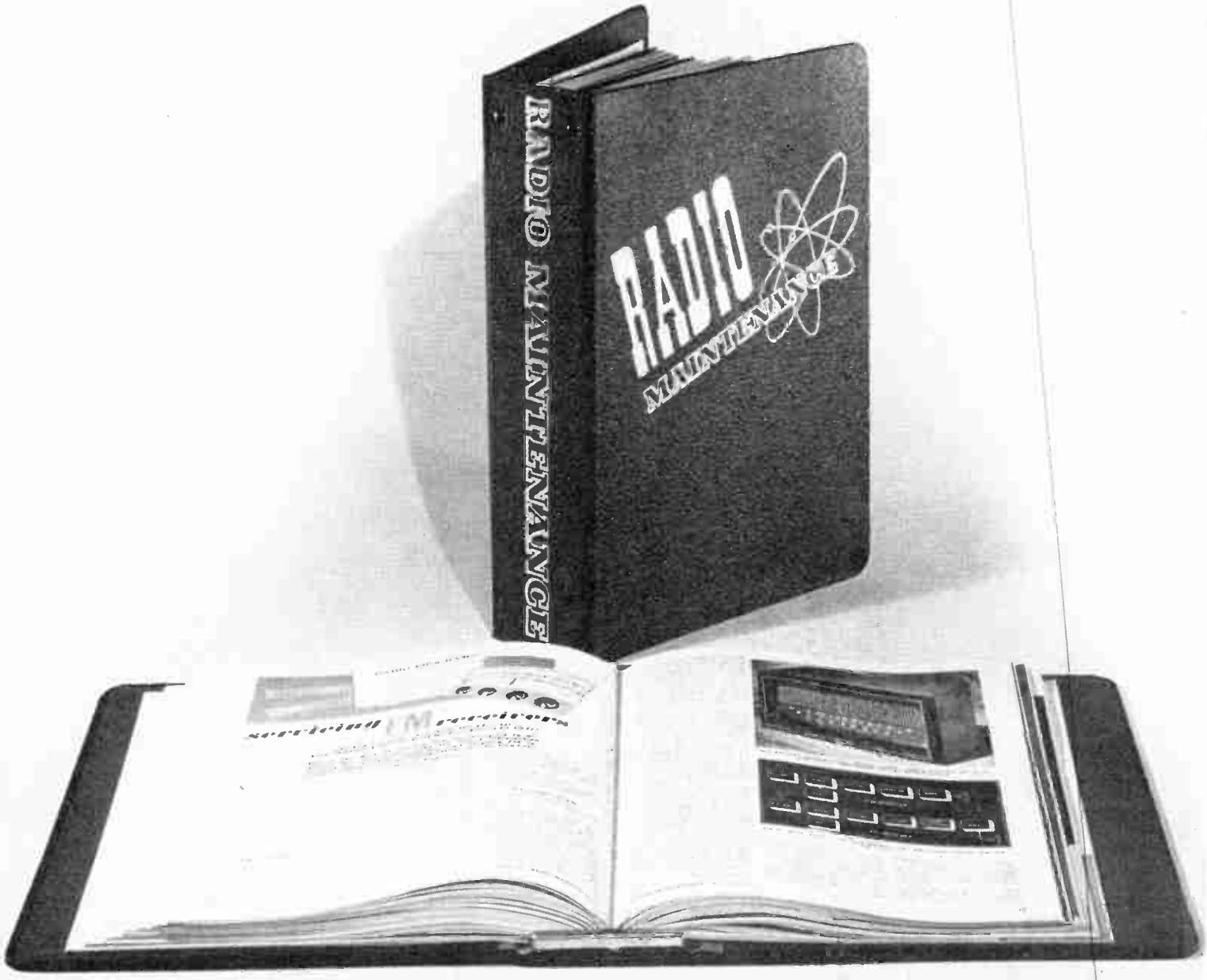

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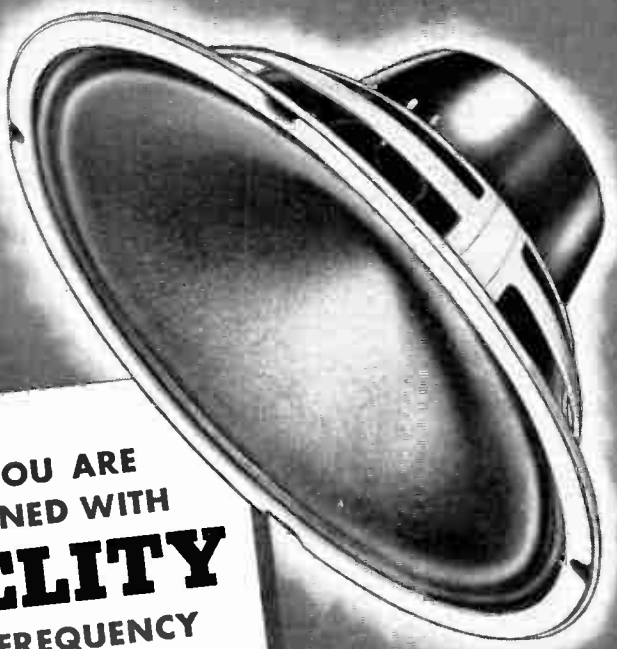

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25 WATTS POWER HANDLING CAPACITY

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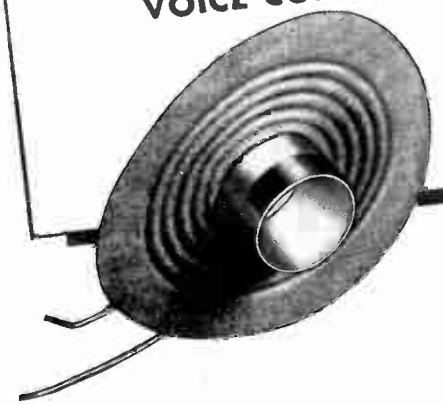
EQUIPPED WITH THE FAMOUS GENERAL ELECTRIC ALUMINUM FOIL BASE VOICE COIL



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Note: Frequency response 50—13,000 cycles.

For complete information on this outstanding speaker write: *General Electric Company, Electronics Park, Syracuse, New York.*

GENERAL ELECTRIC

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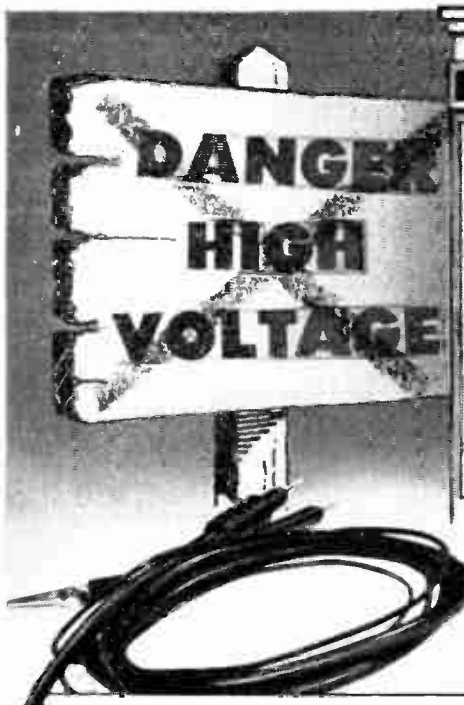

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WITH THE NEW

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Super High Voltage Safety Test Probes

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- ★ All critical high potential and ground connections within the probe are positively accomplished via high compression contact springs.
- ★ Special helical film-type cartridge multiplier, developed specifically for very high potentials.
- ★ Custom molded polystyrene probe head, bakelite handle and barrier. Specially machined and tooled lucite internal components.
- ★ "Application Engineered" to meet the exacting requirements demanded by its intended field of usage.

NOW . . . the TV high voltage test problem solved with safety and operational confidence. A super high voltage test probe, "Application Engineered" for the job . . . tested on the job . . . approved for the job. Custom designed for YOUR safety FIRST, and providing the accuracy, dependability and reliability you expect from products bearing the "Precision" name.

★ Convenient (Tool-less) means for rapid removal and interchange of the special cartridge style high voltage tubular multiplier permits a single TV probe to be employed with more than one, high sensitivity, multi-range test set, via purchase of the appropriate cartridge.

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High Voltage Test Probe LESS multiplier cartridge.
Net Price $12.35

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★ **Series TV-2**
Model TVP WITH cartridge for Precision (or any) 20,000 ohms per volt test sets having a built-in 6000 volt DC range.
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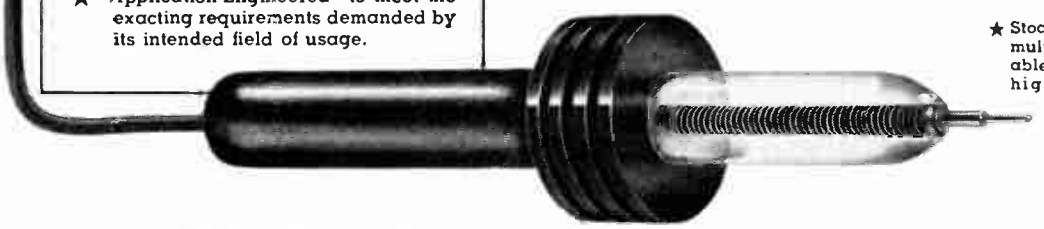
★ Stock value and special value multiplier cartridges are available to match most popular high sensitivity test sets.



Series TV High Voltage Test Probes provide direct kilovoltmeter facilities with your present high sensitivity test set, and vacuum tube voltmeter such as the "Precision" instruments illustrated below.

♦ See them on display at all leading radio equipment distributors along with the complete Precision line of modern electronic test instruments for all phases of AM-FM-TV service and maintenance. ♦

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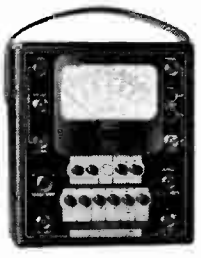
Laboratory Type 20,000 ohms per volt AC-DC test set. Full rotary range and function selection. 34 self-contained ranges to 6000 volts, 60 megohms, 12 amperes, + 70 DB. 4½" full vision meter.
Net Price $38.75



Model 858-L
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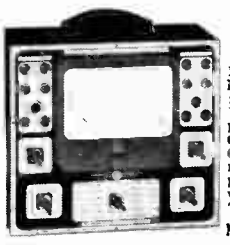
Net Price $54.10



Model EV-10 MCP
Multi-range, high sensitivity, zero-center VTVM plus complete AC-DC V-O-M facilities to 6000 volts, 2000 megohms, 12 amperes, + 70 DB with extra large 7" meter.
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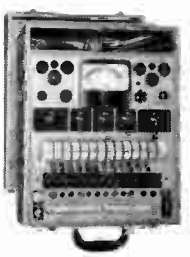

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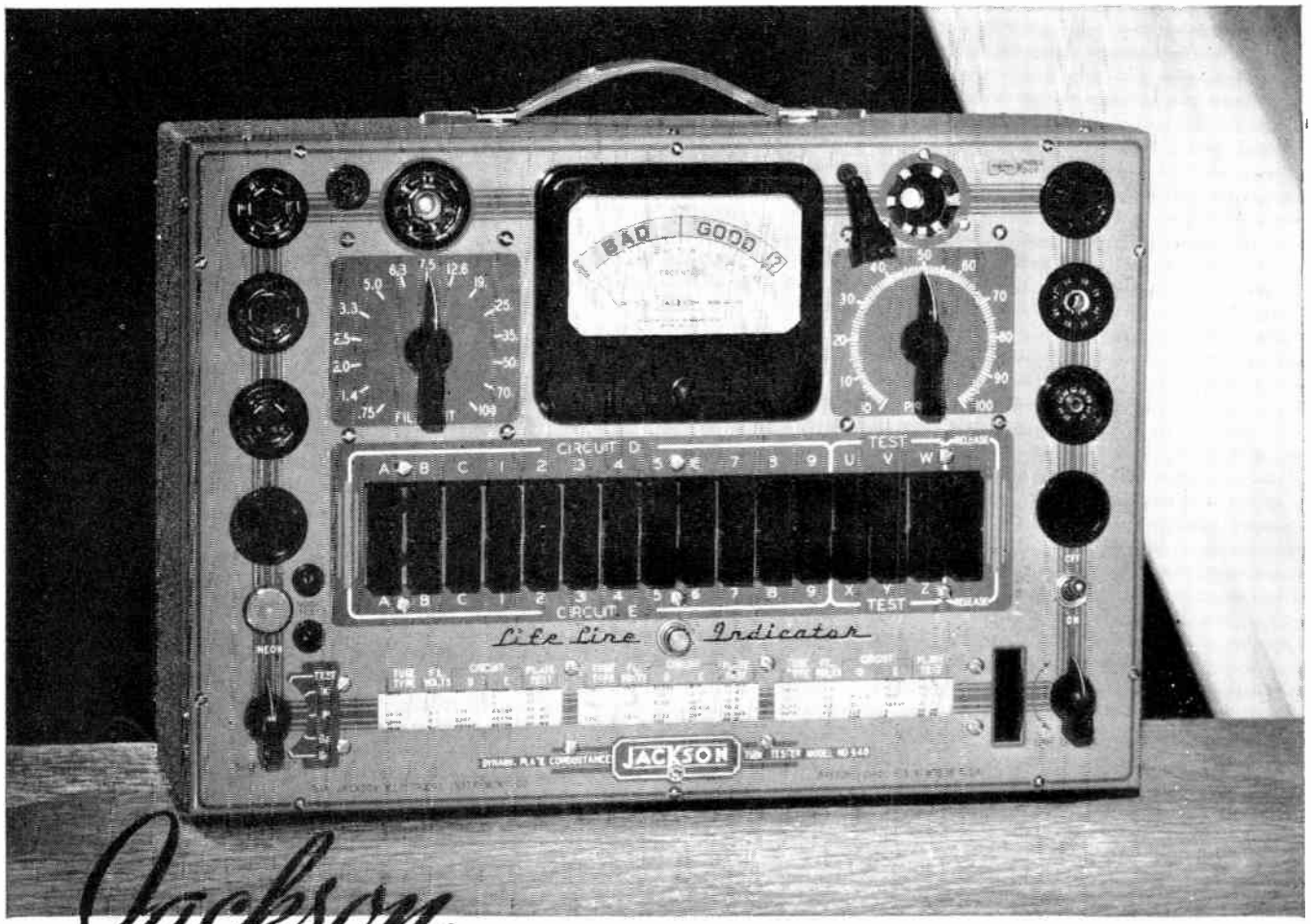

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RECEPTION UNLIMITED

by Max Alth

Concentrating entirely on television servicing and installation, this company has found that specialization pays.

THE public's surprise buying of television receivers has left the students of television servicing so far behind that the current demand for it far exceeds the supply.

The men who had the foresight to prepare for this contingency are finding it to their financial advantage to spend all of their time at television, and many of them are setting up specialized businesses of their own.

"Reception Unlimited," in New Rochelle, N. Y. is an example of this new ramification of the radio service business: specialization in television and FM installation, and service; no sales or other types of radio repair.

The business and its name were conceived by William Cipperly on March 1, 1947. Mr. Cipperly is a member of the class of '33, R.P.I. He has held a ham license since way back when there were no W.'s His call at that time being 2BMX. He has held a Radio 1st. 18 years. He has worked for the New York Telephone Company, and the New York Power Company, as well as for the Link Radio Corp. He designed and installed the New York State Police 2-way radio system (Niagara Falls to Montauk Point, L. I.,) when he was with them in their radio department for eight years. All of which is to say that Mr. Cipperly is no newcomer to radio.

Getting Started

His first step in starting "Reception Unlimited" was to rent a small store off the main stem in New Rochelle. He erected a thirty foot tower atop the shop for both advertising and test purposes. He placed a large sign over his window, and then went out and personally contacted all the sellers of television receivers in the area.

He promised the dealers twenty four hour service, six days a week (New York State Law prohibits seven days of work a week). Charges were based on a definite, flat rate, protected price schedule: The customer would be charged more than the dealer. He guaranteed all his antenna installations, come what may, for one year. Almost all of the dealers agreed to give him their work.

He placed a small ad in the classified section of the local paper, and a small display ad in the phone directory. So far, the ads have produced comparatively little results. Most of Mr. Cipperly's work is being furnished by his dealer contacts.

The ads, however, have resulted in a number of evening and emergency calls. The deduction is that most of the television service work being done today is installation. Most of the sets sold by dealers, other than those connected with Reception Unlimited, are still in their contract service period, so that their owners call Reception Unlimited only when they are unable to secure their contract service.

These calls will increase when these contracts run out, and the good will engendered by the emergency repairs will help build the company.

Twenty-four Hour Service

Mr. Cipperly receives four or five of these evening calls a week, which would make it seem that he and his staff work around the clock. Actually it is not so. He advertises twenty-four hour service, but no one calls him after the stations have gone off the air. Usually the call is shortly in advance of a program important to the set owner.

Again it would seem that he ties himself up evenings for a paltry four or five calls a week, a rather low return on time invested.

Mr. Cipperly does not believe that this is so. He believes that his twenty-four hours service is a terrific selling point; and if it were not for this extra service, customers would as likely sign up with better known, company-service organizations. In other words, since they don't know him, they would rather have their set repaired by RCA, Dumont, or other factory repair men, if the time elapsed is going to be the same.

Here are some of his prices:

Labor Charges	Customer	Dealer
2 men, first half hour,	$3.50	$2.50
1 man, after 6 PM		
first half hour	7.50	5.00
each add. hour	7.50	5.00
Antenna, any type ...	20.00	20.00

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Material	Customer	Dealer
Di-pole	$10.00	$6.00
Folded Di-pole	12.00	7.00
All band H	32.00	20.00
30′ tower, material and labor	100.00	80.00

Billing

All repair work is done on a cash basis. Bills are mailed on the fifteenth of each month, and cash is expected within thirty days after mailing. If the money is not forthcoming, a second bill is sent. Fifteen days later, a third bill marked "please." Ten days later a note to the effect that the bill is long overdue, and that payment is expected within ten days, or action will be taken. This action consists of turning the collection over to an agency which handles the work for fifteen percent of the face sum.

Previewing

In addition to twenty-four hour service, Reception Unlimited offers a preview of television reception at any location in the country.

This preview permits the prospective set purchaser to learn just what quality picture he may expect at his location, with any particular antenna arrangement. In many cases the preview has clinched the sale by convincing a customer that good reception was possible at his home. In other cases it has sold a set owner on the need for a bigger and better antenna array.

The television survey is accomplished by erecting a temporary antenna, and viewing the picture on a Hallicrafter 7" receiver. The comparatively small size of this set makes it convenient to tote about.

Mr. Cipperly's service bench is small because he tries to do as much of the repair work as possible in the customer's home.

Wherever possible, Mr. Clipperly brings his survey receiver right up on the roof, so that the men erecting the antenna can see the picture. When this is impossible, he uses phones or walki-talkies.

Mr. Cipperly believes in doing as much repair work as possible right in the customer's home; and he feels that good tools are half the battle. When he goes out on a call he carries over $4,000.00 worth of tools with him, exclusive of the value of his station wagon. He also firmly believes that two men are a must, especially on antenna jobs.

This point was driven home the other day when he attempted an installation all by himself on a gabled roof. He brought the mast up on the roof and was placing it in its step when a gust of wind tilted it, and he

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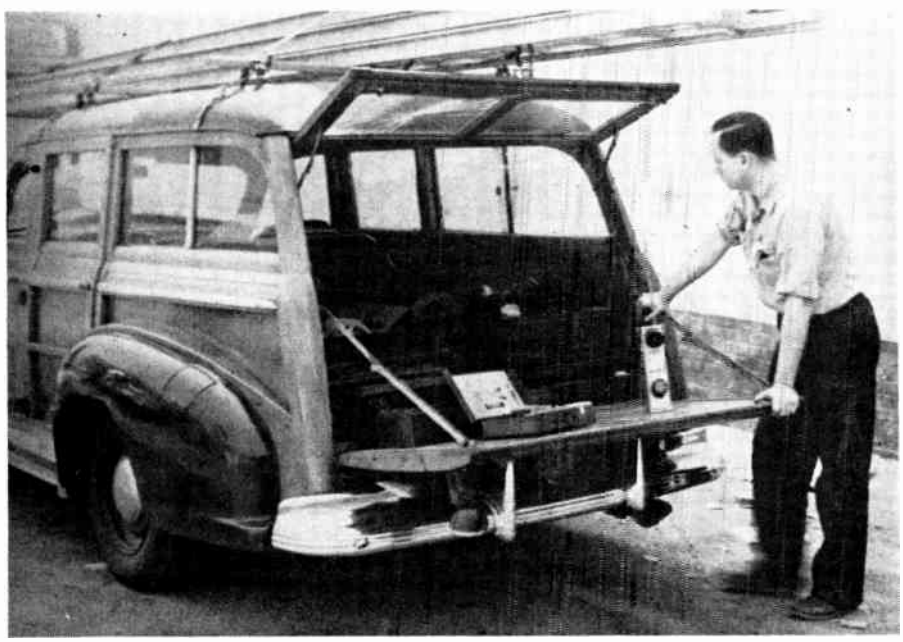

There is nothing like having the right tool for the right job at the right time. "Reception Unlimited" goes on the job with some $4,000 warth.

Mr. Cipperly believes that two heads are always better than one.

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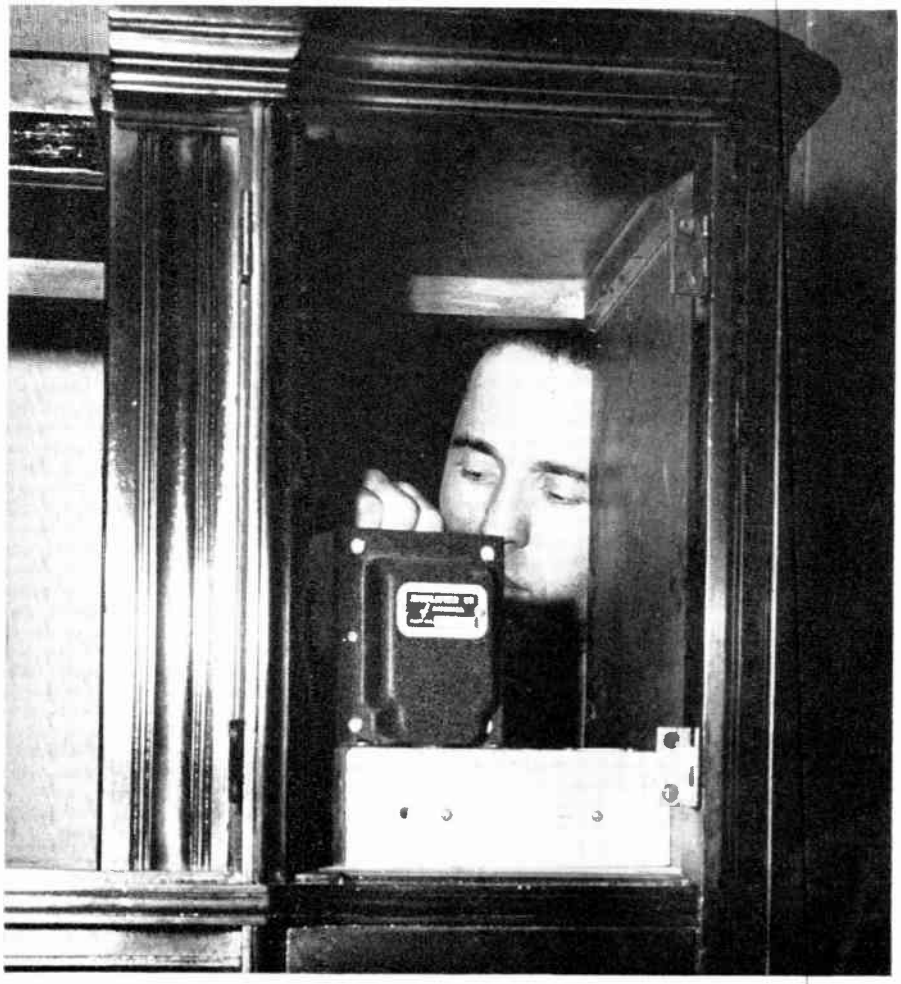
HOW TO MODERNIZE OLD RADIO-PHONOGRAPHS

by Walter I. Fischman

This is the second article in our series on custom building for added profits.



Robert Isacman, of Vertech Radio, is shown here starting preliminary work of fitting a revamped amplifier and timing unit back into a Capehart Cabinet.

SENTIMENT plays a large part in the fact that among customers many will prefer extensive reconditioning of an old radio-phonograph to junking it and investing in an entirely new one. A good modernization, however, can often bring a set up to current perforance and add thereby a practical factor. It has been the experience of both Vertech Radio and Danby Corporation of Philadelphia, that this phase of remodeling can be of definite service to the customer while providing a lucrative market.

Many sets of several years back were sturdily enough constructed to make it well worth while adding FM, and perhaps television, and bringing the tonal reproduction efficiency up to par. The two firms have found that the higher priced sets usually work out best in modernizing. Because they originally cost more, usually better parts and construction were used. For the most part, a low priced set is not worth working on. To spend $75 or $100 (even more with television) in order to bring an old $700 to $1,200 set up to date, makes sense. Spending that much on a set that originally sold many years ago for $150, is definitely foolish.

Dual tone controls, introducing some negative feed back, changing the speaker compliment and adding FM and television will often make a good but ancient Capehart or Stromberg Carlson the equal of a good modern radio.

The experience of both Danby and Vertech has shown that, in general, sets dating back beyond 1935 aren't worth putting too much work on and the same goes for those that do not have push-pull output.

Replacements

At Vertech, in reconditioning, paper condensers are looked upon with suspicion. If they show ony sign of leakage, they are replaced with new ones of more recent manufacture. These are usually the weakest components in a set. Tubes are checked and borderline ones replaced along with the bad ones.

Danby has also found that almost all electrolytics have to be replaced. Tubes are uncertain. Occasionally, an old one will be found that will check and perform better than a new tube. Noise controls are changed. If the set is of push-pull output and has a cheap and small driver transformer, it is replaced with a phase inverter for improved frequency response. Most old type speakers are pulled out and new PM with output transformer substituted.

Specifically, the changes most often made in modernizing old sets are as follows:

1. *Phonograph pick up.* Both firms lighten the pick-up by the substitution of a new crystal or one of the new variable reluctance cartridges plus the necessary pre-amp. Sometimes it is necessary to counterbalance the arm to get the correct

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mass at the needle point. At this stage, Vertech always checks with the customer to ascertain the correct resister-condenser loading combination to bring the tonal values up to the personal preferences of the customer.

2. *Record Changer.* Danby will sometimes leave the original record changer if there is no sign of wear in the motor or mechanism and if the unit has no rumble or wows. According to their experience, the older changers were often built with stronger motors than come with present day mechanisms. Vertech follows the same idea but finds that it often pays to substitute a modern changer and know that one source of service calls has been virtually eliminated.

3. *Amplifier.* Danby has found that it is almost impossible to make a single-end stage over into push-pull because the power transformer usually won't take the extra load. They reduce distortion by changing another stage of amplification, using higher RC and introducing negative feedback to flatten the response. Vertech checks through and balances the control grids and, if necessary, selects a new oupput transformer of a larger size for greater efficiency in lower frequencies.

4. *Tuning section.* Vertech first realigns the set, and then checks the tubes and the blocking condensers of the AVC circuit for leakage as a high resistance is necessary. The company feels that it is of little use to change a circuit, as it is usually far too involved for the return on time, materials and performance. Danby finds that a TRF is usually worth saving and it is essentially left alone. For tonal values, they broaden one or two of the IF stages with resistance. In this manner, although gain is lost, quality is increased. The same effect can be obtained by slightly staggering the IF stages. But this is far more critical and considerable care must be exercised.

5. *Speaker.* Sometimes, in the experience of Vertech Radio, a new cone on an old speaker will be sufficient to take away any rasp present and bring the unit up to good tonal reproduction. If this is not enough, a good PM speaker is substituted, filter capacitors are added to compensate for increased hum level, and resisters are inserted in the circuit in place of the field coil. Danby feels that the speaker is the single place where the greatest improvement can be made. A good speaker and accompanying output transformer can give greater efficiency and better quality without the use of more power. In addition to giving more power at low frequencies and better highs, a good output transformer can also improve the transfer characteristics of the output tube.

Adding FM

The addition of FM is a simple matter. As far as the circuit is concerned, the only change is another input tap on the top of the volume control. Any one of the numerous tuners available on the market can be used. If the FM tuner is going to be mounted outside of the existing cabinet, then its size will probably not be an item to be considered. However, if it must go in the cabinet, then the selection of a unit will probably be based upon physical proportions.

There are currently enough tuners on the market for one of sufficiently correct size to be squeezed in. If need be, a record storage compartment can be sacrificed and a panel can be mounted there, cut out for the tuner dial and controls. A good trick, although it requires considerable mechanical adaptation, is to gang the FM tuner in back of the AM section and through the use of dial cords or connectors, have both tuners rotate in the same control. A new dial plate is necessary calibrated for the new scale. It is a great deal of trouble, but if the tuner *must* go in the cabinet and there is no other spare space, it is sometimes the only possible solution.

Adding Television

The addition of television, likewise, has been found by both companies to be relatively simple. The audio of the television is simply fed into the amplifier of the set. In some rare cases the entire set can be incorporated into the cabinet, but this is quite rare, especially since the screen must be at a convenient height. Usually the television unit is placed either on top of or along-side the existing set, with the audio lines connecting them. A standard television set is used.

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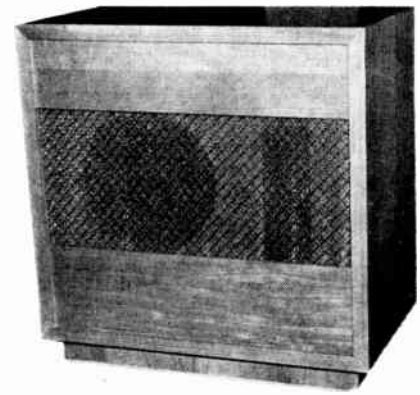
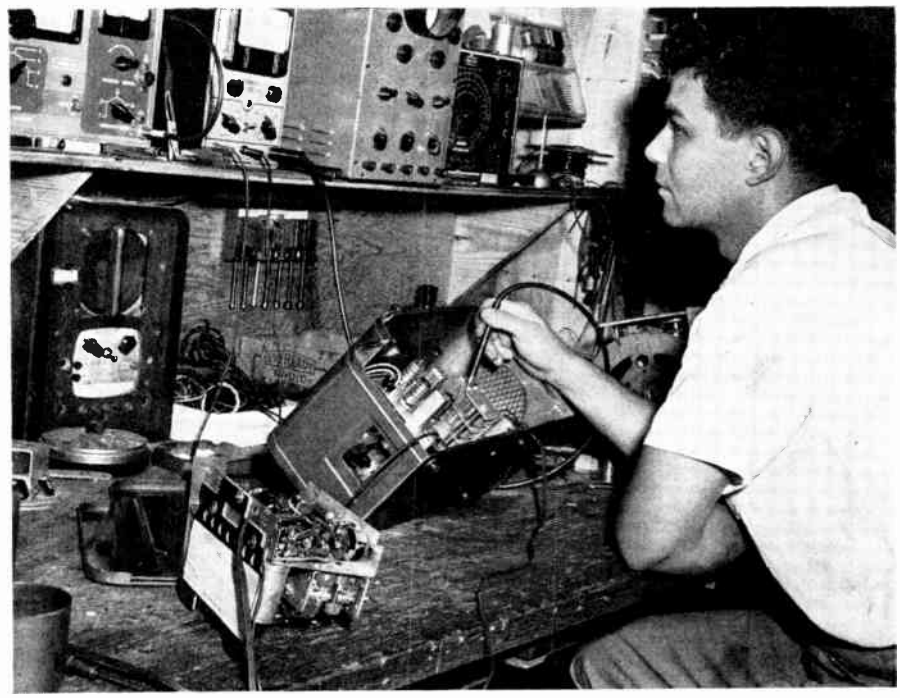


Many people prefer putting new insides in their old cabinets to getting an entirely new job like this one, that may not match the rest of their furniture.



All components should be carefully checked when revamping an old set.

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SERVICING WITH THE VACUUM TUBE VOLTMETER

The Vacuum Tube Voltmeter is an excellent instrument for tracing, d.c. voltage measurements, and many other purposes.

by J. E. Cunningham

ONE of the most versatile test instruments available to the serviceman is the modern electronic or vacuum tube voltmeter, and yet a surprising number of servicemen do not use it to its best advantage. Many servicemen, remembering the disadvantages of its earlier prototypes, such as the slideback VTVM, still look upon it as a laboratory instrument too time-consuming to be used except in cases where more commonplace instruments will not suffice.

Actually, the modern electronic volt-ohmeter is capable of making almost all measurements needed in routine radio servicing quickly and efficiently. It is generally equipped with a probe type of rectifier that will permit RF voltages to be measured without appreciably loading the circuit under test. It has resistance scales which will measure resistances from a fraction of an ohm to several hundred megohms. This article will outline the simplicity with which these measurements can be made.

Signal Tracing

The system of locating a defective stage in a radio receiver by signal tracing has proven its worth as a time saver and is highly regarded by most servicemen. This system consists of measuring the signal level at various points in the receiver circuit until a point is located where the signal disappears due to the malfunction of one or more components.

Several different types of instruments have been designed for this purpose. Some utilize magic eye tubes to indicate the signal level, others use meters, and still others allow the serviceman to judge the strength of the signal as it is heard in headphones or speaker. The VTVM which is equipped with an RF probe is capable of measuring signal voltages and may easily be used as a signal tracer.

There are two chief limitations to this type of signal tracing as compared to that done with a tuned signal tracing instrument: (1) There is no speaker on the VTVM and, consequently, no way to determine the quality of the signal. (2) The VTVM is not tuned and gives no indication of the frequency of the signal. However, if the customary signal tracing procedure is modified slightly, the VTVM can be used quite effectively. The important thing is to remember the limitations and not expect too much of the instrument.

In Fig. 1 is shown a typical five tube superhet. The points at which the signal voltage is customarily measured, when servicing by the signal tracing method, are marked by the letters A to S inclusive. When using the vacuum tube voltmeter as a signal tracer it is rather impractical to make a measurement at A, unless the signal generator has a very high output, since the output of most signal generators is too low to give a reading. At B, the signal voltage can be measured, and after a little practice with a particular signal generator, the serviceman will be able to judge whether or not the gain of the antenna coil is normal. At point C, the signal voltage should be very low as it is by-passed through C-1 to ground. If any appreciable amount of signal voltage is present here, the by-pass condenser, C-1, is inefficient and should be replaced. This same method may be used to check all by-pass condensers; if there is a large signal voltage across them, they are either open or their capacity is too low.

Perhaps the best point to measure the signal next is G, for if a signal is present there, the mixer and oscillator stages may be considered as working properly. If there is no signal voltage at G, other checks may be made at D and E, but they are not as useful as when they are made by a tuned signal tracer, because there is no indication that the voltages found are of the proper frequency. Absence of a signal at point E indicates that the oscillator is not functioning, but even if there is a signal at E, the oscillator may not be operating at the proper frequency. Although this is definitely a limitation, the trouble is isolated to one state which, after all, is the aim of the signal tracing system.

There should be no appreciable sig-

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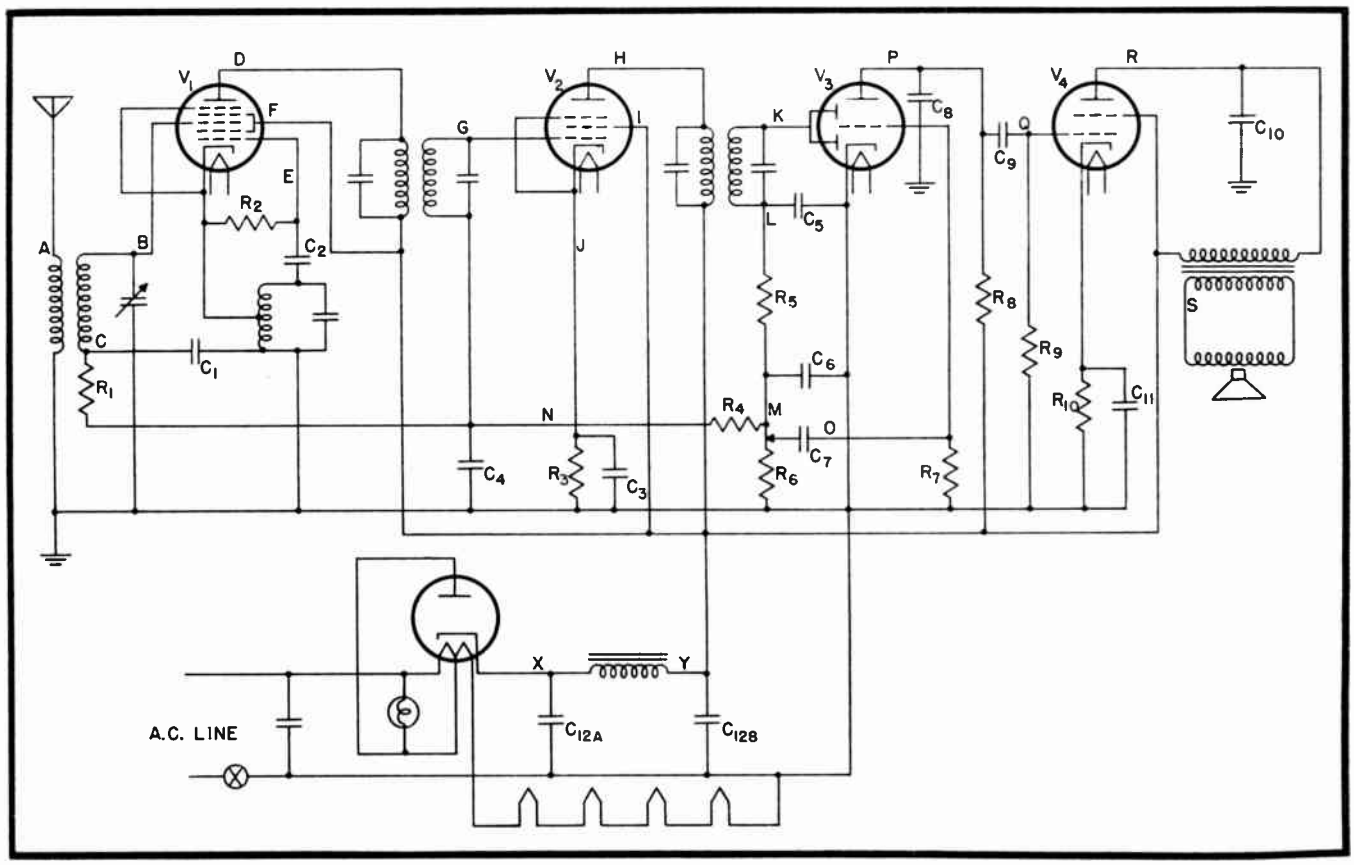

Fig. 1. Typical 5 Tube Superhet showing Points where signal voltage is measured.

nal on the screen grids of V-1 or V-2, that is, at F or I. In sets having screen grid by-pass condensers, a signal at F orI would indicate that these condensers were open, but in circuits like the one shown where a filter condenser also serves as a by-pass condenser, it often indicates that the filter is inefficient at radio frequencies, even though it has not lost any of its capacity.

This is a common weakness of electrolytic condensers. Operation can generally be improved by installing a paper by-pass condenser direct from the screen grid to ground. The signal at H should be considerably stronger than at G due to the gain of the stage. A measurement made at J will check the efficiency of the cathode by-pass condenser in the customary manner.

In the next stage of the receiver, the signal is demodulated and the audio voltage follows a different path from that of the carrier. Since the VTVM will not discriminate between these two signals, the input to the receiver from the signal generator must be *unmodulated* while checking the IF voltage. The output IF transformer has a step-down turns ratio, therefore the signal at K will be

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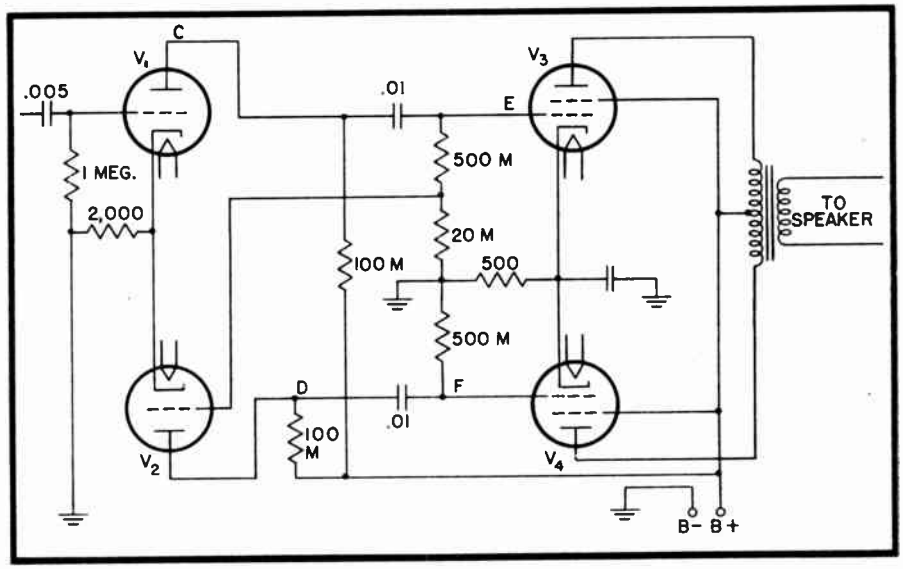

Fig. 2—Push-Pull output stage with phase inverter.

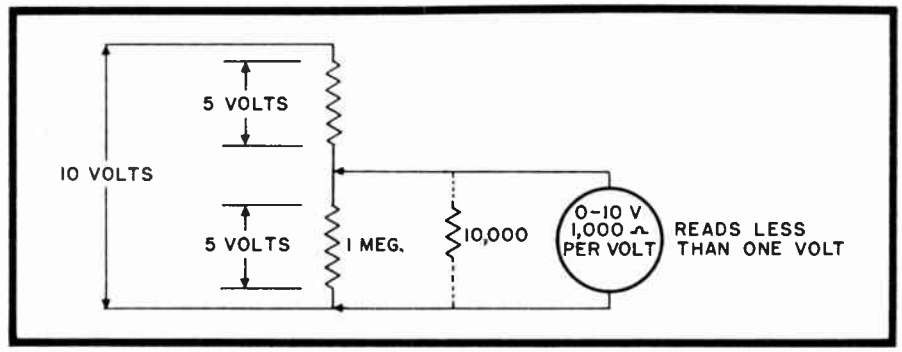

Fig. 3 Showing how low resistance voltmeter adds its own resistance in parallel with resistor in circuit.

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TRANSMISSION LINE PROBLEMS

by Morris Gottlieb

WITH the increasing use of FM and television receivers, it has been necessary to use specially designed antennas, because these signals are transmitted on higher frequencies than hitherto used for public entertainment and listening. The use of higher frequencies brings with it new problems previously disregarded on consideration of the broadcast band frequencies. At these higher frequencies the waves propagated by the transmitter act more like light wave in so far as they travel in line-of-sight directions. The use of special antennas is necessary to pick up as much of the desired signal as possible.

Special high-gain antennas have been designed to do this job, but the amount of signal voltage picked up by any antenna is necessarily small. After the signal has been picked up, it is then necessary to couple it to a transmission line in order to feed it to the receiver. Special consideration must be given to the transmission line installation in order to get the signal from antenna to receiver with the least possible loss.

These losses fall into the two general classifications:

1. Losses due to the impedance in the wires.

2. Losses due to mismatching of impedances.

Advances made in radar and other high frequency electronic devices during the war have led to the present high state of perfection in low loss lines. Therefore, the problems involved in loss of power in the line itself are of little consideration to the technician. When a line is to be installed, the technician should realize

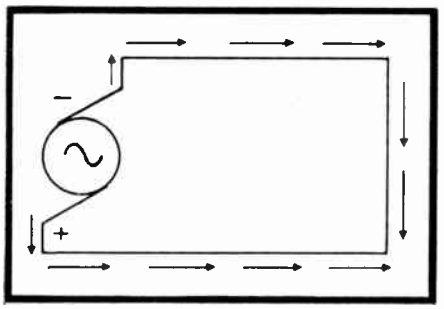

Fig. 1 Showing the instantaneous polarity of a generator, and the direction of electron flow in a line of less than half-wave length.

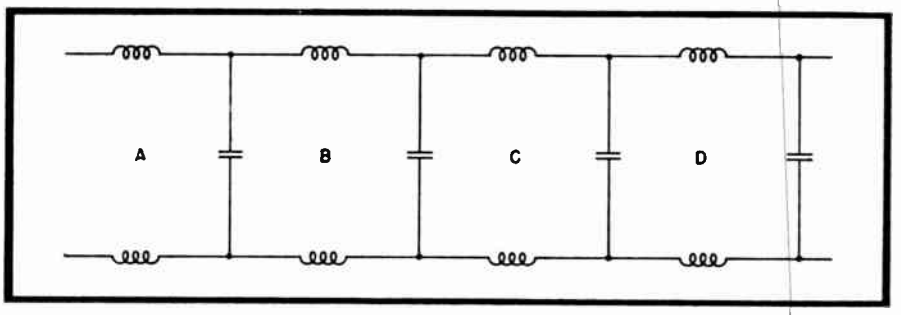

Fig. 2 Transmission lines can be broken down to series inductances and shunt capacitance.

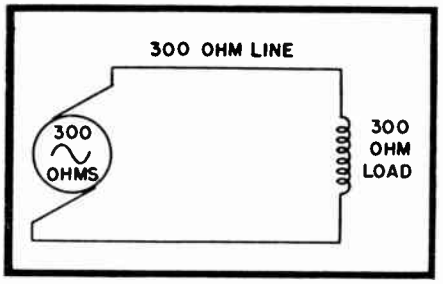

Fig. 3 A 300 ohm generator with a 300 ohm line terminating into a 300 ohm load.

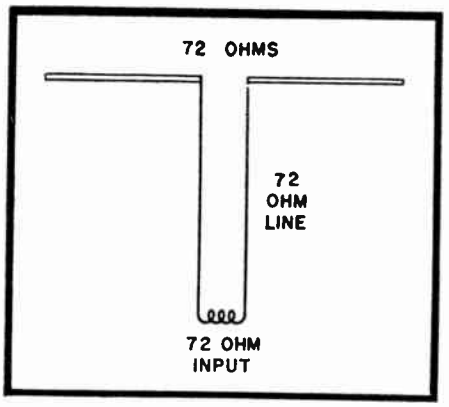

Fig. 4 A 72 ohm line connecting a 72 ohm input transformer to an antenna at a point of 72 ohms impedance.

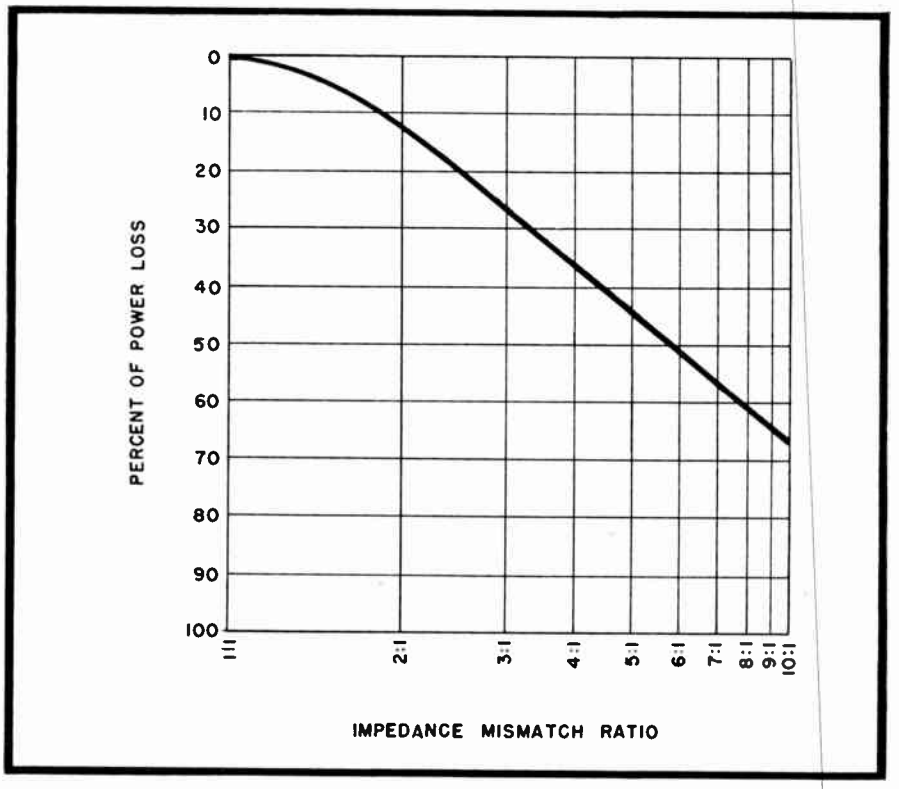

Fig. 5 Power losses incurred by antenna mismatching.

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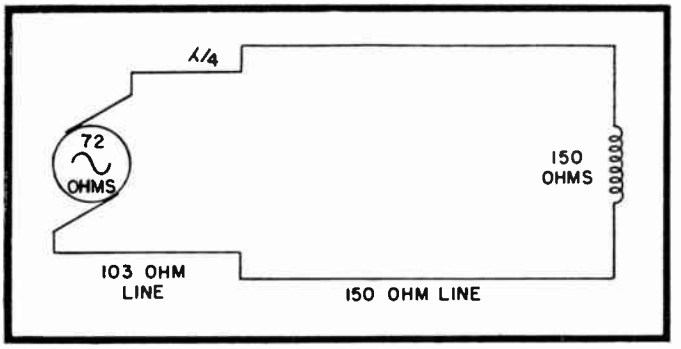

Fig. 6a Matching a 72 ohm generator to a 150 ohm line through a matching section, 1/4 wavelength of 103 ohms.

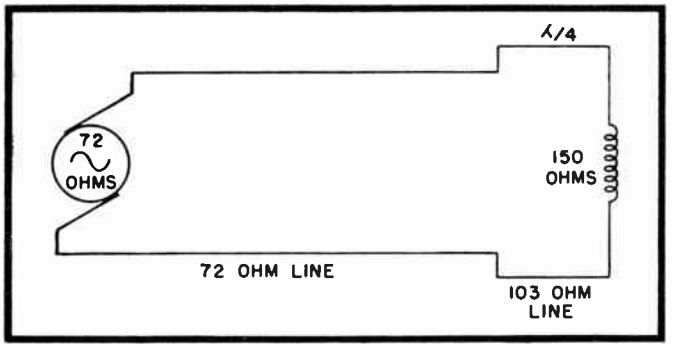

Fig. 6b Matching a 72 ohm line to a 150 ohm load through a matching section, one quarter wavelength of 103 ohms.

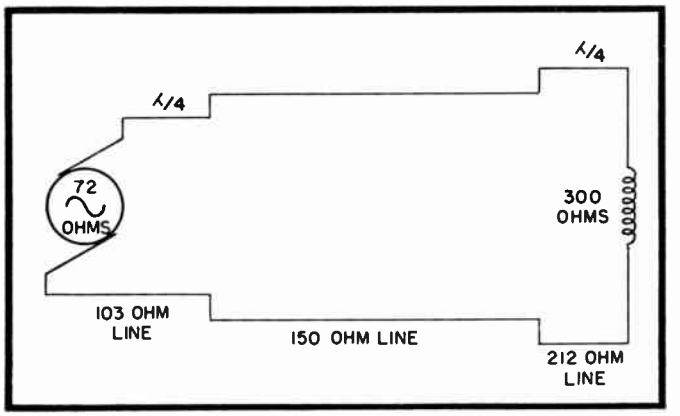

Fig. 7 (Left) Matching a 72 ohm generator to a 300 ohm load, using a 150 ohm transmission line. The λ/4, 103 ohm line matches the generator to the 150 ohm line, which is matched to the load by a λ/4, 212 ohm line.

CHANNEL	150 ohm MATCHING SECTION
1- 44-50 Mc	48.5 Inches
2- 54-60 Mc	40.5 Inches
3- 60-66 Mc	36 Inches
4- 66-72 Mc	33 Inches
5- 76-82 Mc	28.5 Inches
6- 82-88 Mc	26.5 Inches

To cover all channels, cut to 37 Inches

Fig 8 Table showing length of matching section recommended to match 72 ohms to 300 ohms for television receivers.

that there are available to him lines with various amounts of losses. Here the problem of expense will usually govern the choice of line to be installed.

Before the principles of impedance matching of transmission lines are examined, it would be proper to define a transmission line, and to understand why it presents a problem. A transmission line is any line equal to or greater than one half wavelength of the operating frequency.

Fig. 1 shows a circuit consisting of an a.c. generator and a line of less than half wavelength. The top of the generator is marked —, and the bottom +, indicating that as electrons leave the top of the generator, they flow around the circuit and reenter the generator at the bottom. If the line were more than one half wavelength long, by the time the energy emanating from the top of the generator came around the circuit and was about to enter the bottom, the cycle would have reversed itself, and electrons would be flowing out of the bottom, thereby upsetting the cycle.

Lines may be looked at, as if they were composed of series inductances and shunt capacitances as shown in Fig. 2. The amount of series inductance depends upon the dimensions of the wire itself, whereas the shunt capacitances depend upon the spacing of the two wires with regard to one another. If definite values of inductance and capacitance were assigned to each of the sections in Fig. 2, and the impedance of section "A" were computed, a definite number of ohms could be designated as the impedance for this section. If the combined impedance of sections "A" and "B" were now computed, it would be found that this is less than the impedance for section "A" alone. If sections "A", "B" and "C" were taken into consideration, the computed impedance would be even less.

By further calculation, adding an additional section each time, the impedance would be found to decrease rapidly at first, then more and more slowly, until a point is reached where the impedance remains constant, no matter how many more sections of inductance and capacitance are added. The final value of impedance of the transmission line is called the characteristic or surge impedance of the line. This is the impedance of a line of infinite length.

If a line of infinite length were attached to a generator, the energy sent forth from the minus terminal would never return to the plus terminal, and would thus present no problem. Since it is not possible to use lines of infinite length, the same purpose can be accomplished by terminating a line in its characteristic impedance.

In a manner of speaking, it can be said that by terminating a line in its characteristic impedance, we fool the generator into thinking that it is dealing with a line of infinite length, for in both cases the impedance to the generator is the same.

Fig. 3 shows a 300 ohm line emanating from a generator and terminating in an impedance of 300 ohms. The energy sent out from the generator is entirely absorbed by the load. This being the case, there is no problem encountered with current finding itself out of phase at the terminal to which it is traveling, and therefore there is no bucking action of the two out-of-phase currents. The presence of bucking action, when it occurs, causes a phenomenon called "Standing Wave." Such standing waves are the algebraic sum of the energies sent out from the generator, and the energies sent back out of phase by the terminating impedance.

If we consider the antenna as a

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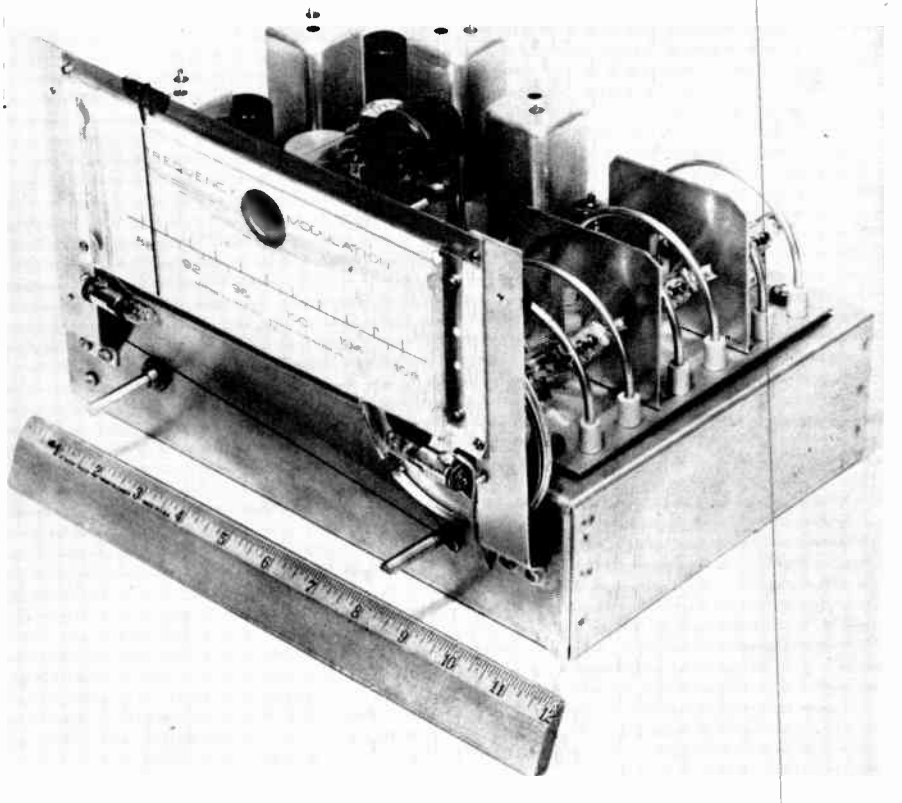
FRONT END TUNING SYSTEMS IN FM RECEIVERS



by J. Richard Johnson

This article continues our series intended to aid our readers with their servicing of FM sets.

SINCE the most frequently used types of FM receivers are really special forms of the familiar superheterodyne circuit, the serviceman is particularly interested in those features which are different, in theory or practice, from those in the more familiar AM broadcast receivers.

Fig. 1 shows the block diagrams of several circuit types now in use. Type A is the most elaborate and brings out most fully the benefits to be derived from the FM system. Circuit B is the same as circuit A except that a ratio detector has replaced the limiter and the discriminator. The ratio detector provides both limiting and detection of the FM wave. Circuit C is the simplest type yet developed. The supergenerative detector not only limits and detects the *RF wave*, but also produces a higher audio power output than other FM detectors.

The merits of various detection systems will be considered in a subsequent article. At present we are interested in the "front end" section of the receivers used for FM reception. Some RF amplifiers and converters in FM receivers differ from those used in AM receivers in both circuit design and physical appear-

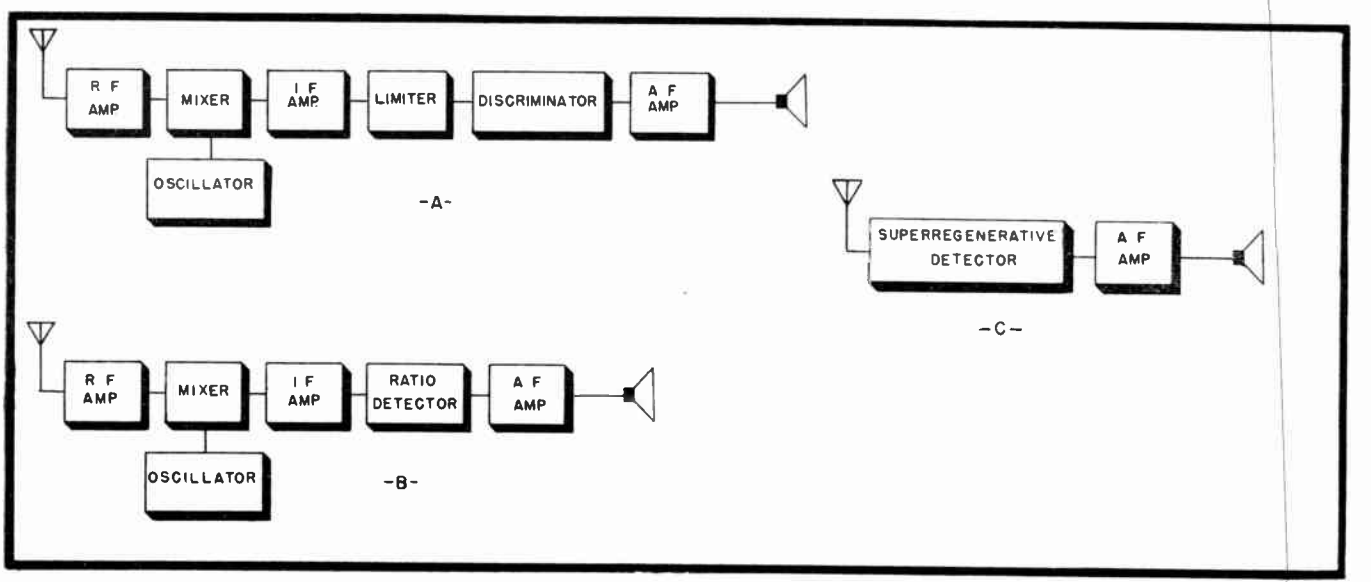


Fig. 1 Block diagram showing principal arrangements used in FM receivers. (A) The most elaborate type, using a limiter (single or cascade) and a Foster-Seeley or other discriminator. (B) In this arrangement, the separate limiter is eliminated because the ratio detector produces a limiting effect of its own. (C) New superregenerative detector, which does its own limiting and detecting in one tube.

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ance. Let us consider physical appearance first.

Coil Design

In the range of carrier frequencies used for FM broadcasting, the size of the coils which will resonate properly is approaching the size of the leads by which these coils are connected to the remainder of the circuit. The Q of helical coils useful for the FM range is low compared to the Q of the same type at much lower frequencies. For this reason, many FM set manufacturers have favored the use of special inductor designs which have a higher Q and thus are more efficient. Moreover, these special inductors are often of greater physical dimensions (at least in length) and are thus less critical to manufacture in large quantity.

One substitute for coils at FM RF frequencies is the resonant line. A piece of transmission line has *distributed constants,* i.e. it has a certain number of microhenrys of inductance per foot and a certain number of micromicrofarads of capacitance per foot. This inductance and capacitance adds up and causes the line to "resonate" in the same way as a tuned circuit. The resonant frequency depends on the length of the line, and can be varied by moving a shorting element along its length. Resonant circuits of this nature have an extremely high Q and are efficient to much higher frequencies than the helical type.

Each of the three pairs of semicircular pieces of tubing constitutes a tuned circuit. A shorting wiper travels over the inside surface of each pair of pieces of tubing. This wiper is connected mechanically to the tuning shaft so that changes in rotation vary the amount of inductance in the circuit. A schematic diagram of this type of tuner is shown in Fig. 2.

Other Types

Other types of resonant line tuning systems feature straight lines placed in a vertical position.

An unconventional coil design is the "guillotine" tuner. To understand how the guillotine tuner works, refer to Fig. 3. The stationary portion of the tuner is a flat piece of metal fashioned into the shape of two turn coil. The ends x and y are connected into the circuit as the ends of any tuning coil. The moving portion B is a flat sheet which is inserted between the two turns of the stationary portion A. This insertion reduces the inductance of part A; first by acting as a shield and reflecting capacitance into the circuit (like a shorted turn secondary) and, second, by reducing the magnetic coupling between the two turns. The further the moving section is inserted, the lower is the inductance, and, the higher the frequency to which the circuit tunes. A guillotine type of tuner is used in General Electric FM receivers.

Another RF tuning system, found in Motorola receivers, is the tuned coaxial line type. The principle of this system is illustrated in Fig. 4. A concentric line forms the resonant circuit; its resonant frequency is varied by moving an iron dust core in and out of the space between the inner and outer conductors of the line. Ganging is very conveniently accomplished by connecting all the dust core shafts to a common piece of material. Tracking is adjusted by small silver mica condensers at the end of each inductor and by variation of the relative position of each slug.

Permeability tuning is also used

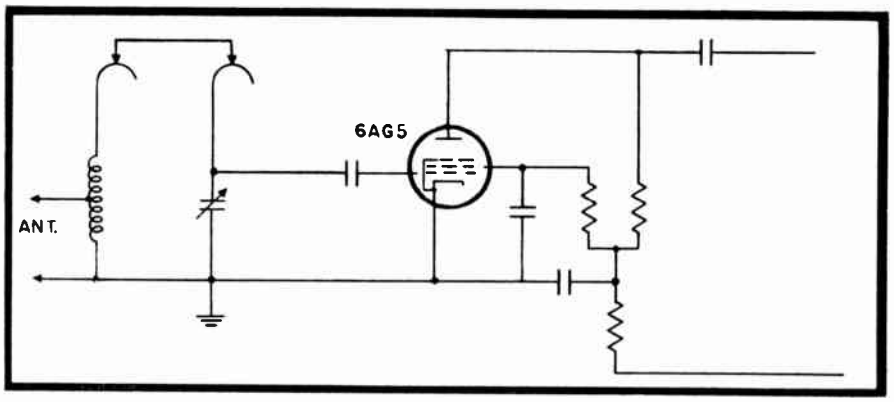

Fig. 2 Schematic diagram of the resonant line type tuner.

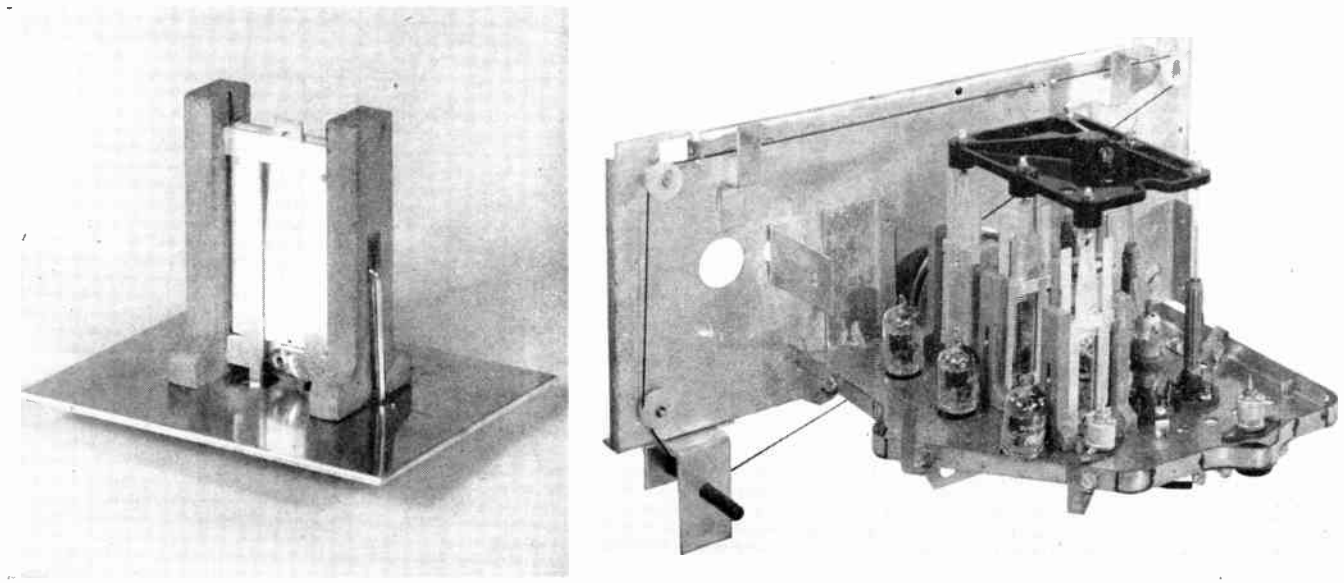

Fig. 3 The two photographs above show the "guillotine" tuner and how it works.

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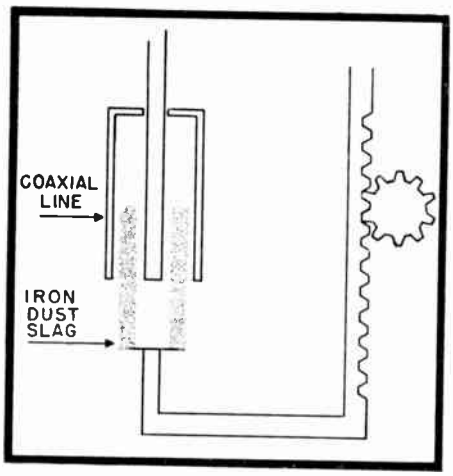

Fig. 4 The principle of operation of the coaxial tuner.

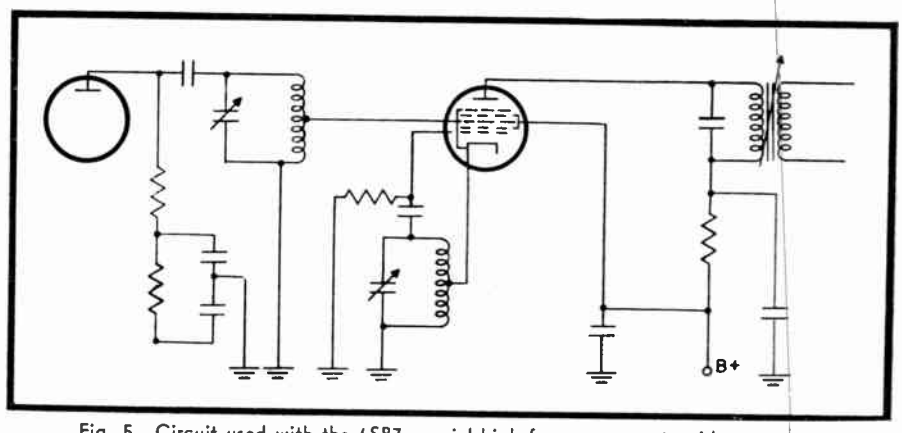

Fig. 5 Circuit used with the 6SB7 special high frequency pentagrid converter.

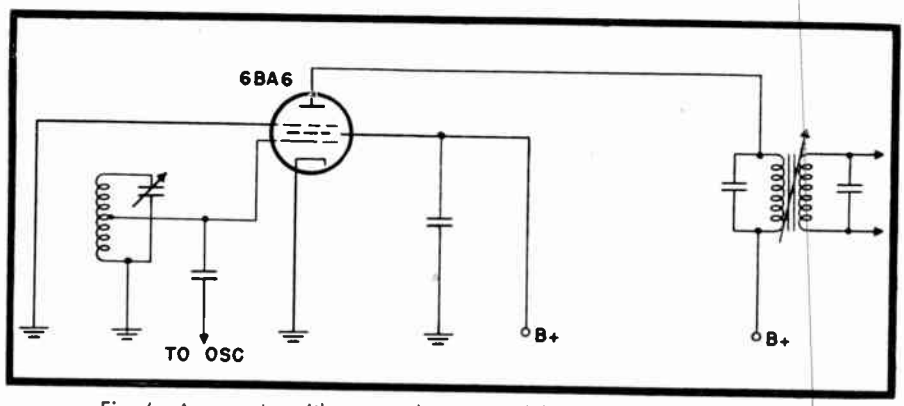

Fig. 6 A converter with a pentode mixer and fed by a separate oscillator.

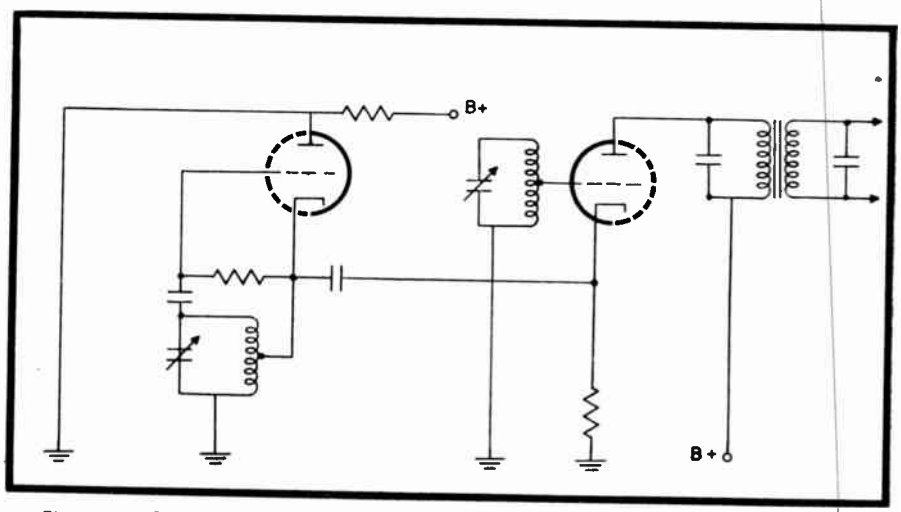

Fig. 7 A Converter section using triodes (sections of a dual triode) for the mixer and the oscillator. Cathode coupling between the circuits is also used.

in FM receivers. The mechanism is quite similar to that used in similarly tuned AM receivers.

Besides the high Q and efficiency afforded by these special systems of tuning, the increased tuning range made possible is very important a feature. At low frequencies (such as AM broadcast) the maximum feasible frequency change for condenser tuning is about 3 to 1. At high frequencies (such as FM) the irreducible minimum circuit and tube capacitances become relatively large and the maximum tuning range is even further decreased. For example, if we have a tuning condenser with a maximum capacitance of 50 mmf and a minimum capacitance of 10 mmf and connect it in a circuit with wiring and tube capacitances of 20 mmf, we'll have a situation like this:

Max. total cap.—80 mmf; min. total cap.—30; cap. ratio—2.67 to 1.

Since the frequency shift ratio is proportional to the *square root* of the capacity change, the frequency shift ratio in this case would be about 1.6 to 1. On the other hand, special tuning devices described above, have frequency shift ratios as high as 5 to 1.

Just for tuning the *FM band alone* a high frequency shift ratio is not needed because the 88-108 Mc range only represents a shift of about 1.25 to 1. But many receivers were designed to cover both the old and the new FM bands. To do this requires a shift of almost 3 to 1. Other receivers cover both the television and the FM bands, requiring a 5 to 1 shift.

Such a device is the Mallory Inductuner. This tuner uses helical coils, but they are all wound on forms mechanically connected to a common shaft. As the shaft is rotated (during tuning) small wiper contacts move along the coils, shorting out a portion of the coil. The amount of the coil shorted depends on the degrees of rotation of the shaft. Three coils are provided for tuning the RF stage, the mixer and the oscilator respectively. The mechanical arrangement is such that all the coil inductances vary in the same way, facilitating tracking.

It should not be construed from the above discussion of special tuning coil designs, that ordinary fixed helical coils are not used. A number of receivers for FM make use of that type with very good results. However, even when fixed helical coils are used, their appearance is quite different from that of the "RF coils" used for AM broadcast reception. One or two turns are usually sufficient, and heavy wire is used. The coil is usually self-supporting, to

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TIME SAVERS

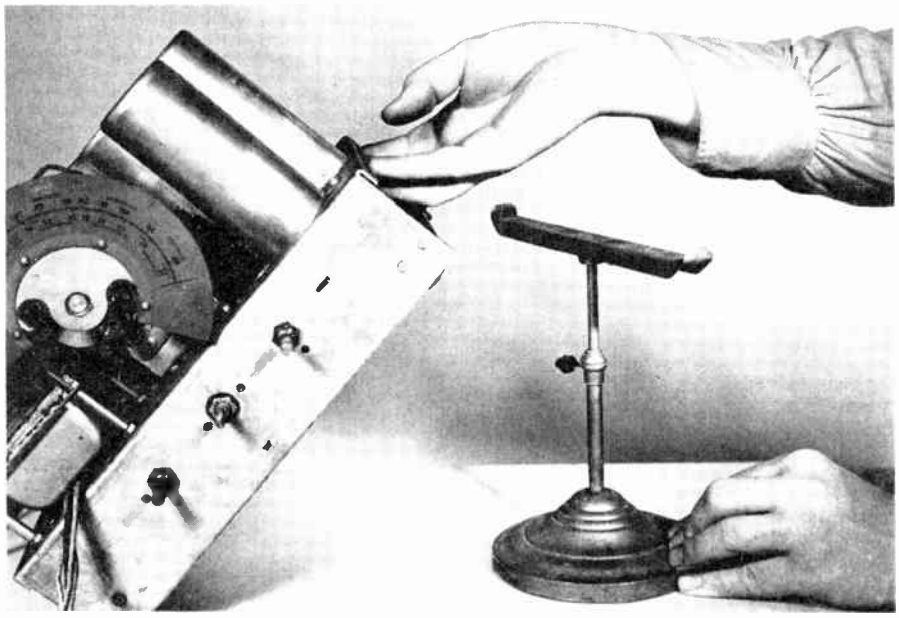
by H. Leeper

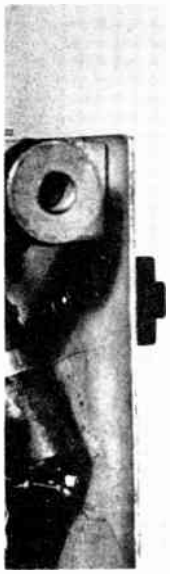
CONVENIENT RADIO CHASSIS SUPPORT

Adjustable display holders as shown may be used to advantage for supporting the radio chassis.

One or two of these holders will prevent damage to the radio tubes or coils by keeping the weight of the chassis off such parts.

The top section of such holders may be insulated with pieces of an old inner tube if desired.





MAGNIFYING GLASS

A magnifying glass is needed in many cases to check values marked on condensers and other parts. A convenient method of using such a glass is illustrated. The glass has been removed from a holder which used a swivel mount.

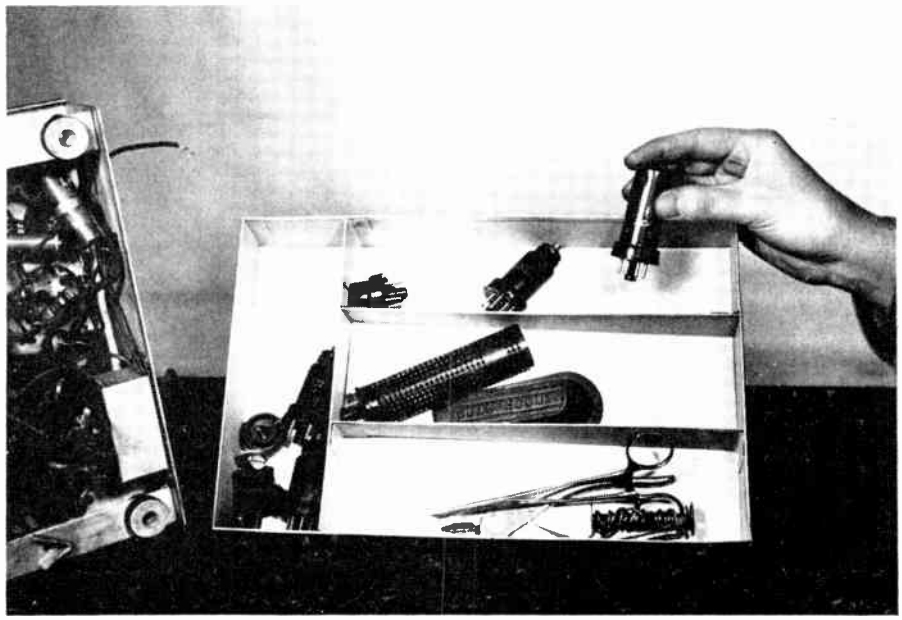
The glass with attaching straps and bolt is carried easily in a vest pocket until needed. Then it is attached to the pencil eraser as shown. The eraser becomes the second part of the swivel arrangement and permits the use of the glass at various angles.

CONTAINER FOR PARTS AND TOOLS

Metal cutlery trays of the type illustrated are available at the dime stores, and will save time and lost parts when used to keep knobs, screws and tubes from any certain radio all together.

Tools may also be placed in the divided sections of the tray.

The tray shown is 13 inches long, 8½ inches wide and 2 inches deep. It is made from light metal and is low in cost. Several of these trays could well be used when a number of radios are being worked on—with gummed labels carrying the model and customer's name if desired.



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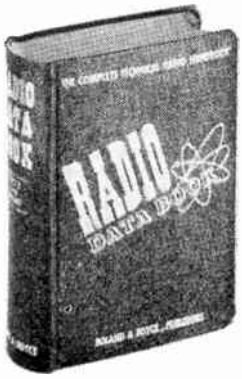

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Cliffside—Nidisco Radio Store
East Orange—International Sound Eng. Co.
Jersey City—Nidisco Radio Parts Dist.
Newark—Radio Wire Television, Inc.
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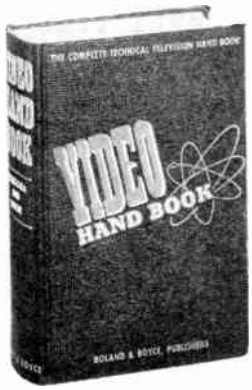

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Salem—Morrow Radio Co.

PENNSYLVANIA
Allentown—Radio Elec. Serv. Co. of Pa.
Altoona—Hollenback's Radio Supply
Easton—Radio Elec. Serv. Co.
Emporium—Sylvania Electric Prod., Inc.
Erie—J. V. Duncombe Co.
Harrisburg—D & H Dist. Co., Inc.
Radio Distributing Co.
Lancaster—Eshelman Supply Co.
Morristown—Kratz Brothers
Philadelphia—AC Radio Supply Co.
Almo Radio Co.
A. G. Radio Parts Co.
Air Tone Sound & Rec. Co.
Herbach & Rademan Co.
Radio Elec. Serv. Co.
Radio 437 Store
Electric Warehouse, Inc.
Pittsburgh—Radio Parts Co.
Tydings Co.
Scranton—Broome Dist. Co.
Fred P. Pursell
Scranton Radio & Tel. Supply Co.
Sharon—Heiges Bros., Inc.
York—J. R. S. Distributors
Wilkes-Barre—Radio Service Co.
Williamsport—Williamsport Radio Supply

RHODE ISLAND
Providence—W. H. Edwards Co.
Wm. Dandreta & Co.

SOUTH CAROLINA
Charleston—Radio Laboratories
Columbia—Dixie Radio Supply Co.
Radio Warehouse
Greenville—Gillian Radio Co.
Spartanburg—McElhenney Radio Supply House

TENNESSEE
Memphis—Bluff City Dist. Co.
Knoxville—Chemcity Radio & Elec. Co.

TEXAS
Amarillo—R & R Electronic Co.
West Texas Radio Supply Co.
Austin—The Hargis Co.
Corpus Christi—Electronic Equip. & Eng. Co.
Dallas—Crabtree's Wholesale Radio
Dennison—Dennison Radio Supply
San Antonio—Mission Radio
Tyler—Lavender Radio Supply Co.

VIRGINIA
Bristol—Bristol Radio Supply Co.
Norfolk—Radio Equipment Co.
Radio Supply Co.
Radio Parts Dist. Co.
Roanoke—H. C. Baker Sales Co.

WEST VIRGINIA
Huntington—King & Irwin, Inc.
Wheeling—Gee Electric Co.

WASHINGTON
Bellingham—Waitkus Supply Co.
Seattle—General Electric Supply Co.
General Radio, Inc.
Marshall James
Radio Products Sales Co.
Radio Telev. & Appl., Inc.
Seattle Radio Supply Co.
Western Electronic Sup. Co.
Spokane—Columbia Elec. & Mfg. Co.
Tacoma—C & G Radio Supply Co.
Wible Radio Supply
Walla Walla—Kar Radio & Electric Co.

DISTRICT OF COLUMBIA
Washington—Capitol Radio Wholesalers
Electronic Wholesalers, Inc.
Kenyon Radio Wholesalers
Rucker Radio Wholesalers
Silberne Radio & Elec. Co.
Star Radio Co.

WISCONSIN
Appleton—Valley Radio Dist.
La Crosse—Stark Radio Supply Co.
Madison—Satterfield Radio Supply, Inc.
Milwaukee—Acme Radio Supply Corp.
Central Radio Parts Co.
Radio Parts Company, Inc.
Taylor Electric Co.
Racine—Standard Radio Parts

CANADA
Winnipeg (Manitoba)—Hudson's Bay Co.
Lee-Burn Company
Montreal—Payette & Co., Ltd.
Edmonton (Alberta)—Radio Supply Co., Ltd.
Toronto (Ontario)—Radio Trade Supply

BOLAND & BOYCE INC., PUBLISHERS

World Radio History

➔**A Sensational Announcement to the Top "1/3" in Servicing . . .**

After 2 Years of Preparation CREI Introduces Its New Home Study Course in

TELEVISION AND FM SERVICING

G. E. PHOTO

PREPARE FOR A BETTER JOB WITH THIS 100% PRACTICAL "ON-THE-JOB" TRAINING

This new course was prepared by CREI at the request of several large manufacturers, distributors and dealers who said, "We must have more servicemen trained to handle the approximately 800,000 television sets and 4,000,000 FM sets to be produced this year alone! CREI knows exactly what you need and every effort has been made to keep this course practical and to the point. If you are now in service work you will be able to thoroughly understand and apply each lesson. It has been reviewed and checked by qualified service experts who know what you must know to get ahead in this booming field.

Start your training now and you start applying your new-found knowledge immediately. Every lesson in this course can be helpful in your daily work. As you progress in your training you will find yourself equipped to handle complicated Television and FM work that only a few months ago looked "impossible". The time to start is now.

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Please send me complete details of your new home study course in Television and FM servicing. I am attaching a brief resume of my experience, education and present position.

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☐ I am entitled to training under G. I. Bill

OVER THE BENCH

by John T. Frye

YOU will not be in the radio service game too long before you run into a deadbeat who will try to get out of paying his bill. Fortunately, there are not very many of these people, but it seems there are always enough to go around so that every serviceman meets up with two or three of them each year.

It strikes me that a description of a recent encounter with one of this ilk might be of interest to newcomers to the service game, and it should arouse a sympathetic grin from you oldtimers.

Mr. D. (for "deadbeat") brought his radio to the shop with a complaint about a bad hum. Outside of this condition, which appeared very suddenly, he stated that the set had been operating perfectly. Investigation revealed that the output filter condenser was open. The input condenser had apparently been replaced in the not very distant past.

A new condenser was installed; tubes were checked; the alignment was touched up. The set was allowed to run for a couple of hours without any further trouble showing up; so the customer was told it was ready, as he had requested.

Mr. D. called for the set in person, and it was only when he was going out the door with it that he mentioned that he would be in and pay for it Saturday. There seemed so little doubt in his mind but that this arrangement would be quite satisfactory with me, that, like a fool, I said, "Well, okay."

Four Saturdays sailed past without my hearing a word from Mr. D. At the end of that time, I made it a point to meet him and mention that he had not paid the bill.

"That job was no good," he informed me. "That radio sounds worse than when I took it to you."

"You should have brought it back, then," I pointed out. "I'll have it picked up in the morning."

"All right, but I hope you fix it right this time," Mr. D. snarled.

The radio was picked up and turned on. Not a thing was out of order. Just to make sure, though, it was taken out of the cabinet and gone over with extreme care, especial attention being paid to the possibility of some intermittent condition. Finally it was restored to the cabinet and let run for two six-hour stretches without a single thing being noticed as being out of order.

Mr. D. was called in, and he was urged to see if he could find anything wrong with the set. He twisted all the knobs, listened with his head first on one side and then on the other, and finally said grudgingly, "Well, it sounds pretty good. Maybe you have it fixed right this time. If it holds up, I'll be in and pay you Saturday."

When the set was installed in Mr. D.'s house, it sounded just as good as it had in the shop—but Mr. D. did not come in Saturday or the next Saturday or the one after that!

In the meantime, a little inquiry among the fraternity revealed that Mr. D. had pulled this same stunt on two other servicemen in town and that he had never paid them. They were very tickled to welcome me to the dubious honor of being one of Mr. D.'s dupes, and they offered some small wagers that I would "never get any blood out of that turnip".

By this time, I was becoming pretty annoyed with Mr. D.; so I had no hesitancy about calling on him and asking for payment.

"That radio is still no good," he

World Radio History

said. "It may work all right in your shop, but it is no good here. Our favorite program is the barn-dance, and we have not been able to get a bit of it since you worked on the set."

It so happened that the barn-dance was on that very night; so I quickly said, "I'll drop in tonight and see if I can find out why you cannot get your program."

I did just that. I sat there in Mr. D.'s living room and listened to the barn-dance. I never heard better reception. There was no noise, no fading; and every note was crystal-clear.

At the end of that period, Mr. D. mumbled, "It surely is funny. When you are here it sounds fine. I guess it is all right after all. Now next Saturday—"

"Whoa there, my friend!" I interrupted him. "*This* is Saturday, you know. Suppose you pay me right here and now for the job I did two months ago. Then, if you are not satisfied with the set, take it to any radio shop in town and tell them what you are complaining about. Tell them to repair anything they find with it and to send me the itemized bill together with any defective parts they remove. I'll pay that bill."

"Well, I'd be willing to do that, but all I have is a twenty dollar bill—"

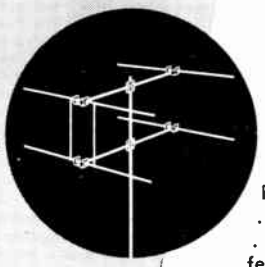
"Fine, fine!" I quickly said, "I happen to have change."

And so at last I was paid, and I was able to crow over my hard-won victory to my fellow servicemen; but I did not fool myself: I lost a lot of money on that job. While I was going over that set for the second time, and while I was sitting there listening to the barn-dance, I could have been making several more dollars, or I could have been doing something that gave me pleasure.

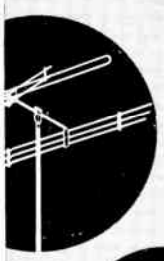
I have not told this as a model for how to handle deadbeats, for there are probably much better ways of taking care of the situation than I followed. The point I want to make is that the serviceman should follow a hard-and-fast system that does not allow characters of this nature to get their foot in the door. You will not lose any worthwhile business by insisting on cash-on-the-barrelhead for radio service, the barrelhead for radio service.

Flexibility makes BRACH

"the Service Man's Line"

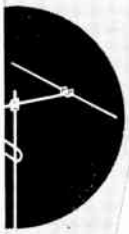


Brach antennas . . . long known for dependability . . . maximum reception . . . trouble-free operation . . . durability and ease of installation . . . now feature an added extra . . . Flexibility. Unique construction features aid the service man in making a more rapid installation to which future additions or modifications can be easily made.



1. FLEXIBILITY A complete line designed with basic antenna parts which are convertible to more complex arrays as required by location and reception problems.

2. COMPLETE KITS Each antenna model is independently designed and furnished in a completely packaged kit containing all necessary hardware, downlead (when desired) and the Universal Base Mount . . . ready for installation.



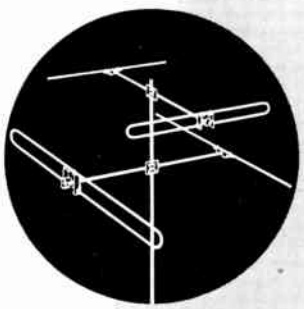
3. PRE-ASSEMBLY Each antenna is factory pre-assembled as far as possible, ready to erect. Complete and simple installation instructions. Saves valuable man-hours on the roof.

4. MECHANICAL STRENGTH Weather - tested for durability, Brach Antennas feature a husky steel mast, rigid connections, sturdy base mount, neat appearance. All parts corrosion resistant.

5. SUPERIOR RECEPTION Designed with engineering "know-how". All Brach antennas are factory pre-tuned, matched for 300 ohm transmission line with large diameter aluminum elements for better signal pick-up. Directivity patterns and standing wave ratios available upon request.

New! Tops in TV!

HI-LO ROTATABLE Antenna



Here it is! A ratatable antenna ta pravide peak performance with any statian at any time. Brach intraduces the new "Superview" Ratatable, caverıng bath high (174 MC ta 216 MC) and law (88 MC ta 108 MC) TV bands. High band extensian available far easy additian ta standard dipale array far separate arientatian. Na mare multiple images. No more "weak" stations. Brach's Superview HI-LO assures televisian receptian that's taps. Make sure and investigate the new Superview line taday.

Write far Free Brach catalag shawing camplete line af TV and FM antennas and accessaries.

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WORLD'S OLDEST AND LARGEST MANUFACTURERS OF RADIO ANTENNAS AND ACCESSORIES

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Features You Can Talk About

Presenting the most Complete Line of

Nylon Needles with Knee Action

The Swing is towards Nylon—because Nylon Needles by Webster-Chicago eliminate surface noise . . . groove hopping . . . filter but not dampen surface noise and preserve records. Show . . . suggest . . . and sell these 4 profit building needles!

Red Nylon with Knee Action. New! Genuine sapphire tip. Plays longer—reproduces highs and lows perfectly. None finer! $500

Ivory Nylon with Knee Action. Precious jewel tip, reproduces the full diatonic scale. $350

Black Nylon with Knee Action. An old standby for sales and profits with precious metal, osmium alloy tip. $250

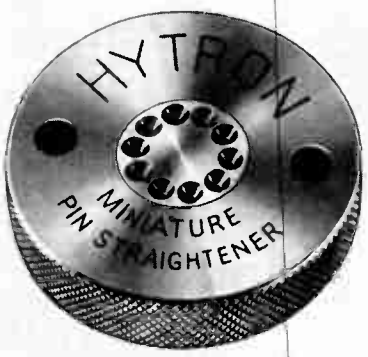
The NEW Tear drop all Nylon with highly polished rose jewel tip. Softens scratch without losing reproduction brilliance. $175

WEBSTER-CHICAGO
5610 Bloomingdale, Chicago 39, Ill.

THE INDUSTRY PRESENTS

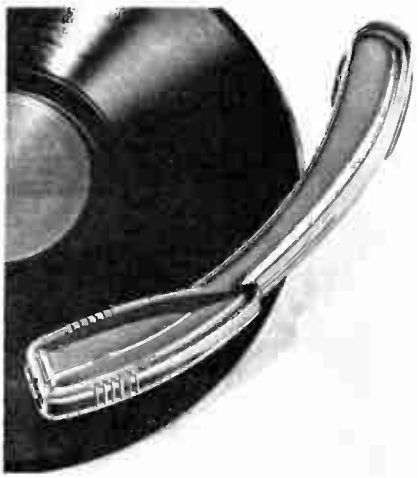
MICROGROOVE RECORD CHANGER

The new Webster-Chicago Model 133 automatic microgroove Record Changer is in production now and will be ready for distribution as soon as microgroove records become available. The change from standard groove 78 rpm to microgroove 33 rpm has been a relatively simple conversion, continues Mr. Hartford, because the well-known Webster-Chicago record changer design is universal in principle. A new carefully balanced tone arm which applies no lateral pressure on the thin walls carries the approved Nylon Knee Action Needle easily and precisely along the groove with superlative reproduction quality and minimum drag. The drive on Model 133 has been easily reduced to 33 rpm with the same single-speed torque characteristics and wow-less performance of the standard Webster-Chicago record changer models. The changer unit is mounted in an all metal base which is finished to blend with home furnishings and may be used on table top or in radio console compartment for amplification through radio. Microgroove records provide magnificent tone in the entire hi-lo range, further states Mr. Hartford, and Model 133 reproduces every shade and degree with startling fidelity.



MINIATURE PIN STRAIGHTENER

Hytron Radio & Electric Corp., Salem, Mass., announces hte Hytron 9-Pin Miniature Straightener, third in a series of shop tools specially designed for servicemen's use. Continuing a brand new kind of offering—Hytron's new 9-Pin Miniature Pin Straightener, like the Tube Tapper and 7-Pin Straightener, is distinctly apart from the usual offered sales and technical aids. Designed with an eye to making the serviceman's job easier and more profitable, this precision tool is built of special stainless steel and aluminum.



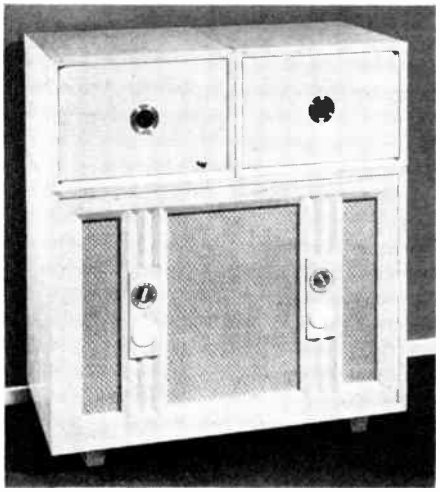
MICRO-GROOVE PICKUP

Shure Brothers, Inc., 255 W. Huron St., Chicago, Ill., have introduced their new "900 MG" crystal phonograph pickup for Micro-Groove records. The long playing micro-groove records are selling fast, but a new pickup is needed to play them. The Shure "900 MG" is an answer to this need. It tracks at 7 grams—has a needle force of 9 grams as an added safetly factor. It uses a special offset osmium-tipped needle with a point radius of only .001 inch, and has an output of one volt.

CONDENSERS

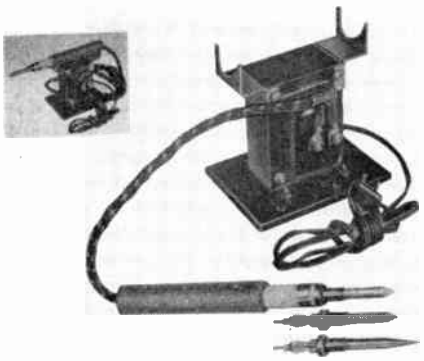
In order to service the new radios properly, especially FM and television receivers, Olson Radio Warehouse, Inc. has added high voltage condensers to its line. New values include: 20 mf 450 volts; 30 mf 450 volts; 40 mf 450 volts, as well as the new handy small size —50-30 mf 150 volts tubular. "Akrad" Condensers are available from Olson Radio Warehouse, Inc., 73 E. Mill Street, Akron 8, Ohio, and are attractively packaged in handy steel kitainers, ten condensers to a carton.

World Radio History



CUSTOMADE UNITS

The Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill., is beginning to market four basic Customode units: a medium utility cabinet, for large equipment, small television sets, etc.; a small utility cabinet, for tuner, amplifier, recorder, record changer, etc.; a reproducer cabinet, bass reflex design for a 15-inch coaxial speaker, the last word in acoustical correctness; and a record cabinet, holding more than 200 records. The units are finished in finely textured blonde mahogany or cordovan mahogany. Flush satin-finish brass door pulls with dark green plexiglas window add dignified decorative touches.



SOLDERING IRON

A new featherweight soldering iron called "Soldetron", which weighs only 3 ozs. is being manufactured by Transvision, Inc., New Rochelle, N. Y. The following new features are incorporated in this iron: Interchangeable tip-heads, no cleaning or filing. Fingertip control permits long soldering periods without fatigue. High working output, low current drain. Ideal for fine precision work in "hard-to-reach" places. Efficient on assembly line.

The iron heats up within 20 seconds from a cold start; cools upon release of the button; quickly reheats when button is pressed.

→ To page 37

Provides Vast New Sales Fields For Dealers and Servicemen

The long-playing micro-groove records have opened a vast new sales field for Servicemen and Dealers. Hundreds of thousands of record enthusiasts are ready to buy the new records, but they must have a new pickup to play them. This is your big opportunity to "adapt" their present sets with the Shure "900MG." It is a tremendous market—an immediate, anxious, impatient market. Here are opportunities, sales, PROFITS! Think of the hundreds of phonograph users in your immediate area. You will render an outstanding service by using a Shure "900MG." It is unsurpassed for the most brilliant reproduction of music you have ever heard.

AVAILABLE AT SHURE DISTRIBUTORS NOW!

Model 900MG Code: RUZUZ List Price — $12.50

(Shure Patents Issued and Pending. Licensed under Patents of Brush Development Co.)

SHURE

SHURE BROTHERS, INC.

Microphones and Acoustic Devices

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New Book makes AUTO RADIO REPAIR *twice* as easy!

Covers all auto Radio types from mid-1930's to present, including mobile FM.

Just Out!

SERVICING THE MODERN CAR RADIO, by A. L. Hurlbut

Second edition, 702 pages, 8½ x 11, 222 illus., over 500 circuit diagrams $7.50

Here—written by a practical auto radio expert of 20 years' standing—is everything to help the beginner or experienced serviceman gain profitable skill in the fast-growing field of car radio servicing. A complete guide to the work. Book not only describes installation, testing, and repair methods fully, but also gives needed special facts of car radio circuits, differences between car and home radio servicing problems, shop set-up and business-getting ideas, etc. And invaluable for all jobs is the big gallery of circuit diagrams on hundreds of models, old and new.

Practical facts and methods on:

—getting into the car radio business	—antenna installation
—differences between mobile and home radios	—loudspeaker installation
—antennas and input circuits	—remedying interference
—power supplies	—servicing procedure
—circuit features	—vibrator maintenance
—auto electrical systems	—loudspeaker servicing
—setting up shop	—car-radio alignment
—car set installations	—push-button tuning, etc.

OPPORTUNITY OF A LIFETIME

for alert servicemen, says A. A. Ghirardi author of famous radio servicing books and articles

"SERVICING THE MODERN CAR RADIO represents an opportunity no wide awake serviceman can afford to miss. There are over 9,000,000 car radios—approximately 16 out of every 100 radio receivers in use — a wonderful field for increasing business; stepping ahead of competition! Good auto radio men are scarce, and this book gives you a gold mine of information you need to cash in on this profitable, fast-growing business."

ALFRED A. GHIRARDI

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Send me Hurlbut's Servicing the Modern Car Radio for 10 days' examination on approval. In 10 days I will send $7.50, plus few cents postage, or return book postpaid. Postage paid on cash orders; same return privilege. (Books sent on approval in U. S. only. Price outside U. S., $8.00, postpaid.)

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Occupation .....

ELECTRONICALLY SPEAKING

Since the announcement in April of the unique Hytron Radio & Electronics Corp. contest for radio servicemen, hundreds of contestants have been awaiting news of the winner of the first month's prize. The winner whose serviceman's tool suggestion was voted to be the best entry was Mr. Harry L. Smith of 25-26 Steinway Street, Long Island City, N. Y. In the accompanying photograph Mr. Smith is shown being congratulated and presented with the prize by Mr. Everett B. Boise, Hytron's commercial engineer in the New York area, while Bill Harrison of the Harrison Radio Corp., 12 West Broadway, New York City, waits to add his congratulations. The first prize for May was a DuMont Type 274 five-inch Oscillograph.

The board of Judges consists of:

Joseph J. Roche, Editor
Radio Maintenance

Sanford Cowan, Editor & Publisher
Radio Service Dealer

W. W. MacDonald, Managing Editor
Electronics

Oliver Read, Chief Editor
Radio News,

J. L. Stoutenburgh, Exec. Editor

Lewis Winner, Chief Editor
Radio & Television Retailing
Service

There are still many worth-while deluxe first prizes to be won and a $200 U. S. Savings Bond is the grand prize in the Hytron Servicemen's Contest. Not to be overlooked are the $50 and $25 U. S. Savings Bonds, second and third prizes. You can get an entry blank with complete details from your Hytron jobber or write Hytron direct. Describe your pro-

Everett B. Boise of Hytron presents First Prize in Hytron Contest to Harry L. Smith, while Bill Harrison of the Harrison Radio Corporation looks on.

World Radio History

posal for a simple, economical shop tool like the Hytron tube tapper or miniature pin straighteners.

First of a series of five educational meetings for radio technicians in the next twelvemonth will be held in the Hotel Astor on September 27, 28 and 29, Harry A. Ehle, Chairman of the Town Meetings Committee of the Radio Parts Industry Coordinating Committee, has announced. The New York meeting will be followed by one in Boston at the Hotel Bradford, November 15, 16 and 17, and by others in Atlanta (January), Los Angeles (March) and Chicago (April), Ehle said. All will be adaptations of the program worked out for the first Town Meeting of Radio Technicians, held in Philadelphia last January as the first attempt on the part of the radio industry to extend a helping hand to the radio Serviceman.

As in Philadelphia, each of the meetings will be completely non-commercial. Programs will bring the technician constantly revised, up to date information on television servicing, as well as a balanced program designed to make his life easier as an independent businessman.

On September 20, 1948, the FCC will hold a hearing, docket 8976, on the utilization of the band of 475-890 megacycles for television broadcasting. The issues tto be considered are as follows:

1. To obtain full information concerning interference to the reception of television stations operating on channels 2 through 13 resulting from adjacent channel operation of other services, from harmonic radiations, and from man-made noise.

2. To receive such additional data as may be available since the close of previous hearings (Dockets 6651 and 7896) concerning the propagation characteristics of the band 475 to 890 megacycles.

3. To obtain full information concerning the state of development of transmitting and receiving equipment for either monochrome or color television broadcasting, or both, capable of operating in the band 475 to 890 megacycles.

4. To obtain full information concerning any proposals for the utilization of the band 475 to 890 megacycles or any part thereof, for tele-

→ to page 41

Tailor-made

for WIRE RECORDER-RADIO combinations

MODEL 78 with push-button control

Webster-Chicago WIRE RECORDER

is a top quality, precision unit designed for installation in radio console or for use in semi-portable applications with radio or high fidelity amplifier. Model 78 provides all combinations... recording from radio or microphone; playback through headphones, radio or external amplifier, with simple push-button control of electrical circuits. A sensitive meter provides accurate recording level indication and the wire transport mechanism is positive acting and foolproof.

Easy to install... Model 78 is easy to install, and makes an ideal combination. Contained in an attractive metal case which mounts as a complete unit, Model 78 is furnished complete with microphone, one spool of wire and all necessary plugs, cords and instructions for neat installation.

■

The radio-listening public is demanding auxiliary equipment for more complete enjoyment of their radio programs, record music and home entertainment.

■

DEMONSTRATE and install Webster-Chicago Model 78 Wire Recorder.

■

Ask your Webster-Chicago Distributor

WEBSTER-CHICAGO

famous, too, for Webster-Chicago Record Changers and Magic Nylon Phonograph Needles

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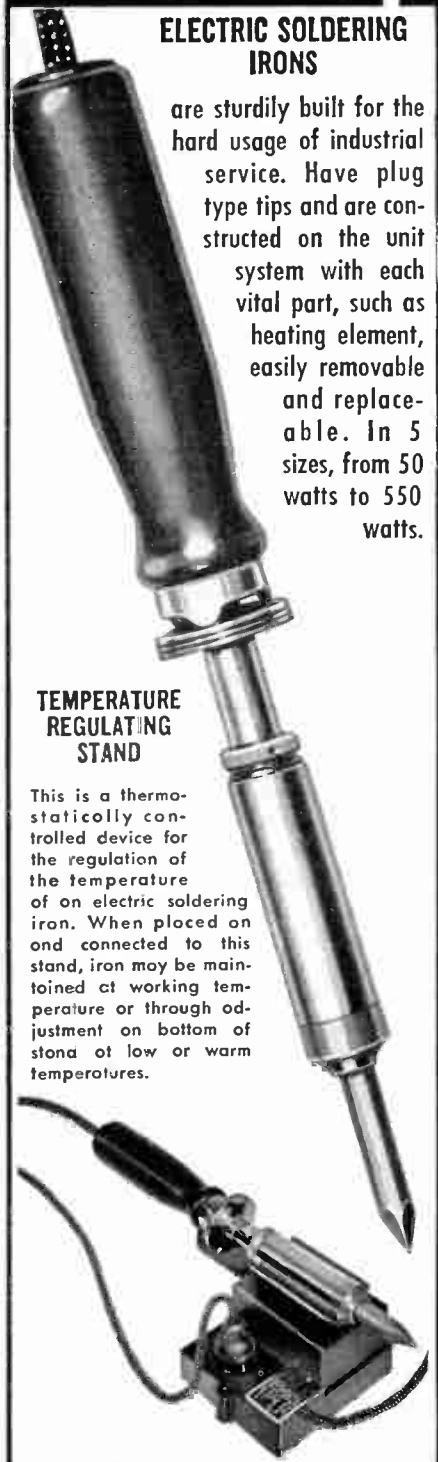
American Beauty

ELECTRIC SOLDERING IRONS

are sturdily built for the hard usage of industrial service. Have plug type tips and are constructed on the unit system with each vital part, such as heating element, easily removable and replaceable. In 5 sizes, from 50 watts to 550 watts.

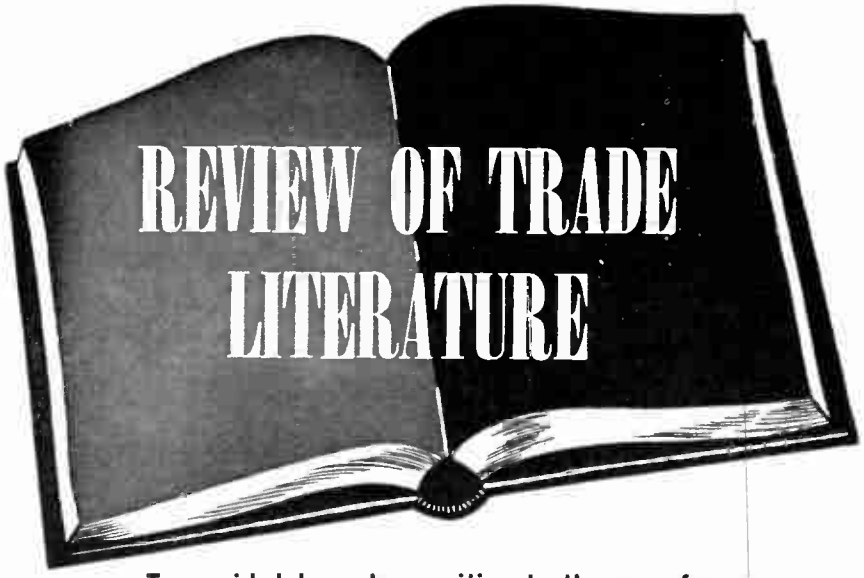


TEMPERATURE REGULATING STAND

This is a thermostatically controlled device for the regulation of the temperature of an electric soldering iron. When placed on and connected to this stand, iron may be maintained at working temperature or through adjustment on bottom of stand at low or warm temperatures.

For descriptive literature write 110-1

AMERICAN ELECTRICAL HEATER COMPANY
DETROIT 2, MICH., U. S. A.



To avoid delay when writing to the manufacturer give issue and page number

How to Use Diagrams in Radio Servicing—This six page booklet precedes a twenty-six page "Complete Index to Radio Diagrams" manual published by Supreme Publications. The booklet presents some ideas on the use of diagrams, briefly, aided by a few illustrations. The index should prove of value to radio service technicians.

This literature can be obtained free, by writing directly to Supreme Publications, 9 South Kedzie Ave., Chicago 12, Ill., and sending a two-cent stamp for postage.

Products that Help the Radio Man—This fifteen page catalog lists the Walsco products: Radio parts, hardware and chemicals. Most of these products are pictured in photographs or sketches, and described, numbered and priced for list and dealer. An index at the back of the booklet makes it easy to locate the type of part you want.

You can get a copy of this catalog from Walter L. Schott Co., 9306 Santa Monica Blvd., Beverly Hills, Calif.

Radio Industry Red Book— Howard W. Sams & Co., Inc. announces publication of the Radio Industry Red Book, a cooperative effort, representing the first and only complete radio receiver replacement parts guide ever published. This single authoritative volume provides accurate, easy to use listings on all 9 major replacement components for approximately 17,000 models made during the ten year period 1938 to 1948. It lists original parts, together with numbers for proper replacement parts made by 17 leading manufacturers, covering Capacitors, Transformers, Controls, IF Coils (including Peak Frequencies), Speakers, Vibrators, Phono Cartridges, Tubes and Dial Lights, Batteries—plus a wealth of valuable installation notes.

The 17 parts manufacturers represented in the Red Book include Aerovox, Astatic, Burgess, Clarostat, Cornell-Dubilier, Eveready, IRC, Jensen, Meissner, Merit, Quam-Nichols, Radiart, Solar, Sprague, Stancor, Sylvania and Thordarson. The Red Book is the first cooperative industry effort for the radio service technician. All data is arranged alphabetically and by model numbers for quick reference. The Red Book contains almost 500 clearly printed 8½ x 11 pages. Binding is Smythe-sewed, opens flat for easy use.

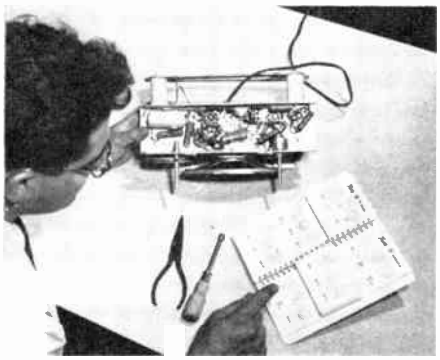
Price, $3.95. From Howard W. Sams & Co., Inc., 2924 East Washington Street, Indianapolis 6, Indiana.

Triple Pindex—An valuable new tool for quick identification of electron tube connections designed to permit radio servicemen to locate instantly and study simultaneously any two or three tube base diagrams out of over 475 types, is now available in a unique booklet known as the RCA Triple Pindex, prepared by the RCA Tube De-

World Radio History

partment.

The RCA Triple Pindex, so-called because of its design, provides three complete and separate base-diagram booklets, joined in a single cover with a spiral wire binding. To locate the base diagram of a particular tube, the serviceman need only flip over the pages of one of the booklets. If a second base diagram is desired, it



may be as quickly located in the second booklet without disturbing the first. A third diagram may also be independently located in the same way. All three diagrams are thus available on the same three-in-one "page" for quick and easy checking, without the necessity of continual back-and-forth thumbing of pages.

Ideally suited for work-bench operations, the new booklet measures a handy 4 x 8 inches. It is printed on heavy stock to withstand wear in continual use, and is yellow in color, both for easy finding on a cluttered bench and because black diagrams on yellow are easily read under artificial light. Diagrams are large and clear, and a complete legend explaining the symbols used appears inside the front cover.

The new RCA Triple Pindex is now available from RCA Tube Distributors at a price of 75 cents.

Electronics Reference Book — A reference book to help the electrical engineer understand and apply new electronic equipment in industry has just been published by John Wiley & Sons. Prepared by electronics and research engineers of the Westinghouse Electric Corporation, the 680-page Industrial Electronics Reference Book contains 36 chapters on the basic theory of electrons and the design, application and maintenance of electronic equipment in industry. This handbook includes within one cover all the technical data needed to understand the scope and limitations of electronic equipment as used in industry. It will be useful to engineers faced with the problems of approving or rejecting industrial electronic equipment.

Besides presenting underlying theories and design factors, the book brings the electrical engineer up to date on developments in electronic instruments, motor control, dielectric heating of woods and plastics, resistance welding, X-ray and photo-electric devices and many other fields of electronics.

The Industrial Electronics Reference Book, measuring 9 x 11 inches, can be obtained from John Wiley & Sons, 440 Fourth Ave, New York 16, N. Y. $7.50.

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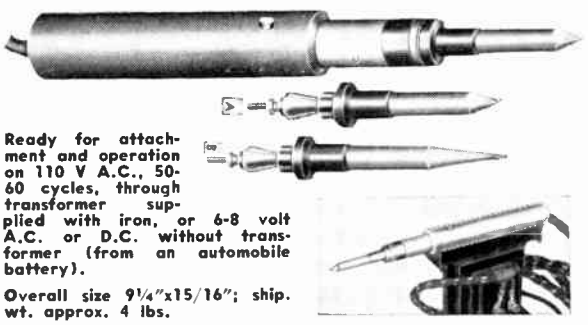

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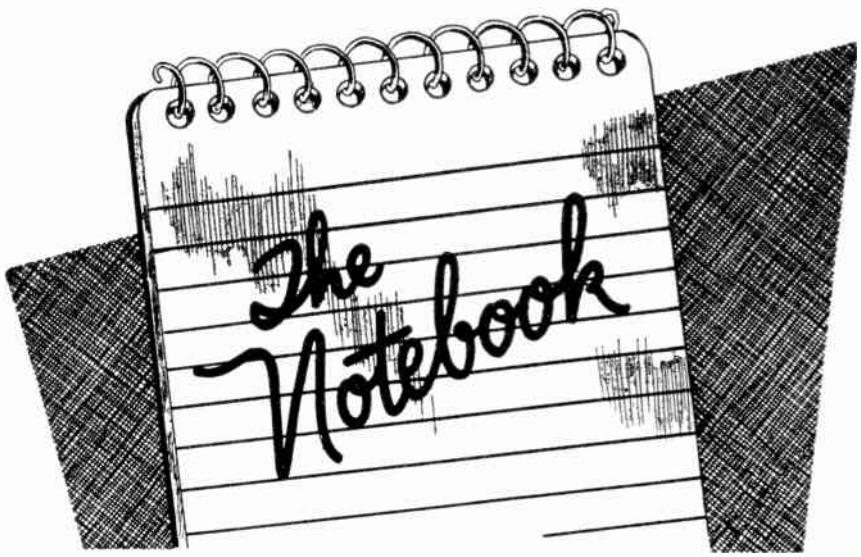


The Notebook combines with *Case Histories* to form one department. This department will consist of readers' ideas and suggestions for kinks and gadgets which have proved helpful to them, plus case histories of some of the tough ones we have all come across. Tell us about the problems you have encountered with certain sets and how you have solved them. With the case histories give us a clear and brief an explanation as possible stating the symptoms, the cause, and remedy; give the make, model number, and if possible, the year. Of particular interest are those receivers manufactured from 1937 to the present. Keep your suggestions for useful gadgets and twists both simple and practical. Radio Maintenance will pay $2.00 for each item published in this department.

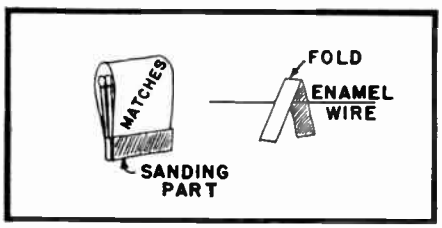
MAJESTIC MODEL GI-426

The HL6 goes bad about every six months; there is squeal and noise when volume control is adjusted. This was a new set, and the volume control tested good. Replacement remedied the squeal and noise. 100 volts on plate of HL6 caused short tube life. Installing a 15,000 ohm, one watt resistor between B+ and the IF transformer reduced voltage down to proper value.

Charles R. Hood
Ashland, Ky.

EMERGENCY SANDPAPER

Here is a good way to save time, when looking for fine sandpaper to clean small size enamel wire, etc.

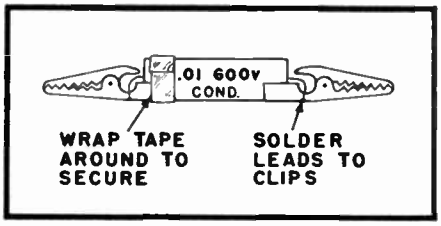


Use the sanding part of a book of matches. Remove the sanding part from the book matches. Then fold it so that it can be used to clean off the enamel from the wire before soldering.

Charles Teresi
Chicago, Ill.

CONDENSER LEADS

It often becomes necessary to use a condenser in series with a signal generator or scope. The leads soon break off after being used a few



times. To prevent this, use two alligator clips opened up and fitted over the condenser as shown. Solder leads and taps to make it serviceable.

Walter A. Civenar
Philadelphia, Pa.

WORN BACK

Quite often a small set comes into the shop with the holes in the card board back so worn and torn that the snap-in trimounts cannot hold the back in place. Gummed "reinforcements" such as are intended to reinforce the retaining holes of the paper in looseleaf notebooks, can be used to correct this condition neatly and efficiently. Two or three reinforcements can be used to repair each hole for added strength.

John T. Frye
Logansport, Indiana

HEAT CONTROLLER

A good heat controller for the soldering iron may be made from an old tapped primary power transformer connected to operate as an auto transformer. The line is connected to the outside of the winding. One "iron" lead is connected directly to one side of the line. The other through a switch to one of the taps and if desired to the other side of the line. The transformer riding on the line this way draws very little current. If the line voltage in the neighborhood is low, or if quick heating is desired, move the line in one or two taps and switch the iron out to the end of the winding for more than line voltage. A pilot bulb can be hooked up to the filament winding for on-off indication.

Max Alth
Yonkers, New York

SPEAKER MOUNTING

If you are called on to install a radio in an old type car and the speaker has to be installed separately from the radio, it is best to mount the speaker on the fiberboard liner on the inside of the side cowl. Just cut a hole in the liner and mount the speaker between the liner and the cowl. If possible, use a finished grill. If not available, try using a fine copper screen wire. The enclosed space surrounding the speaker, gives wonderful tone quality.

Albert Loisch
Darby, Pa.

USING OLD VIBRATORS

Defective vibrators from battery-operated radios may be used for many purposes around a radio shop. The bottom of the unit is removed by inserting a screw driver under the rolled edge and bending it outward so that the "works" may be removed. The sponge rubber lining may often be inserted between tube shields to prevent annoying rattles caused by vibration. The smaller disc will prove useful in replacing worn or misplaced chassis shock absorbers. The "can" may be used as a container for small bolts and screws by removing the handle. If angle brackets or spade lugs are attached, the can may then be used as a coil shield.

Marion L. Rhodes
Knightstown, Ind.

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Industry Presents

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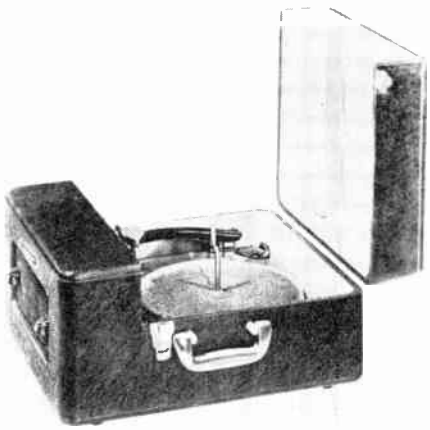
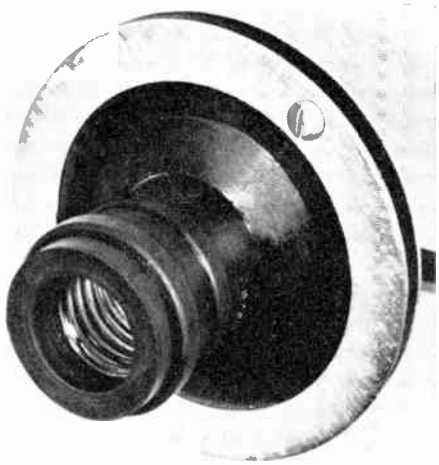
CUSTOM-BUILT CONSOLE CABINETS

Jackson Industries, Inc., 1708 South State St., Chicago, Ill., announces the manufacture of a new line of quality cabinets for console model radio-phonographs. These cabinets come in walnut, mahogany and blonde, and are available in five different models. One of the models (illustrated) is adaptable for currently produced 7" and 10" television sets and kits. The cabinets will accommodate all standard record changers and most current radio chassis. Full details can be obtained by writing Jackson for their new catalogue.



PORTABLE PHONOGRAPH

Webster-Chicago, manufacturers of record changers, wire recorders, and phonograph needles, announced today a new portable automatic phonograph. The Model 161 is a fully portable automatic phonograph, housed in an all wood case covered with attractive burgundy leatherette. The Model 161 will play a full stack of records with cover closed. Volume and tone controls are on the outside, which permit changes in volume and tone without lifting the cover.



VIBRATION DAMPING SOCKET

Mines Equipment Company ot St. Louis, has introduced a Molded (Neoprene) Edison base lamp socket that will prolong the life of electric lamps by protecting bulb filaments from surrounding vibration. Molded as a unit to a resilient rubber mounting diaphragm that fits a standard four inch wall outlet box, all necessary metal parts such as female socket, wires, connections, etc. are protectively encased in Neoprene, DuPont's oil, acid, heat and wear-resistant rubber-like compound. In addition, a rubber bead on sockets mouth fits bulb's neck snugly. This seals "socket-lamp" assembly protecting its electrical connections against water, dust, oil, etc.

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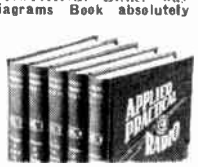

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Industry Presents

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STABILIZED HEAT

Designed to accommodate crystals from 80 to 10,000 kc and recommended for broadcast and frequency standard applications. Large 7-pin base. Will accommodate most JK holders besides accommodating more than one small holder. Heater 6.3v, others on special order. Operating temperature 50° C ± 1° others also on special order. Available as double oven on special order. Crystals electrostatically shielded. Better thermal insulation results in lower heater current consumption and shorter warm-up time. May be mounted in any position. Entire unit is ruggedly built for long, dependable service.

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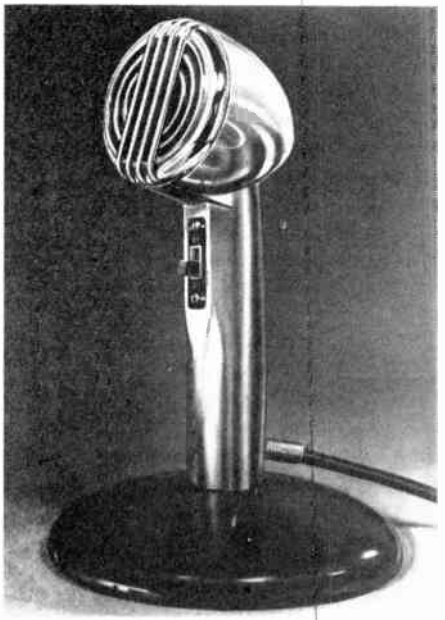

CERAMIC ELEMENTS

Two of its most popular microphone models and an especially developed phonograph pickup cartridge now are available with ceramic elements, it has been announced by The Asiatic Corporation, Conneaut, Ohio. Manufacturing the first ceramic devcies represents hte second time in its history that The Asiatic Corporation has taken such a pioneer step. The company also produced the first crystal products in its field. A broad variety of applications now have given final proof ot the extensive advantages previously anticipated for microphones and pickups employing ceramic elements, according to an Asiatic spokesman. The transcription quality reproduction of the devices has been completely unaffected by exposure to extreme climatic and artificial heat, it was declared. The widest possible humidity range has left the ceramic products similarly unchanged in performance and physical condition. Comparatively low impedance of the microphones has permitted their use under many circumstances where, previously, only costly, heavy units were suitable. The ceramic pickup cartridges have been adapted successfully to standard circuits without making additional changes.

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ELECTRONIC VOLT-OHM-MILLIAMMETER

Operational simplicity, broad test facilities and new engineering developments are embodied in Triplett's new Electronic Volt-Ohm-Milliammeter Model 2451. Embodying many new developments assuring simplified operation, it speeds up servicing; yet gives everything needed for the job. Model 2451 eliminates the cumbersome operation of switching back and forth from range to range to balance the circuit. With Triplett's exclusive new approach just zero the meter on the range to be used and proceed with the test.

CAPACITOR ANALYZER

A small, light-weight capacitor analyzer, especially designed for the radio and appliance service industry, is now available from Solar Manufacturing Corporation, 1445 Hudson Blvd., North Bergen, N. J. The new Solar Model CBC analyzer measures capacitances from 10 mmf to 800 mf, using a "quick-as-a-wink magic eye" indicator for capacitance bridge balancing. Power factor measurements on electrolytic capacitors are made by the bridge method. It also incorporates simplified neon lamp test circuits for visual checks of the insulation resistance of paper and mica capacitors and of the leakage current of electrolytic capacitors. The instrument has a line frequency resistance bridge covering a range of 100 ohms to 7 megohms.

TACKER

Fastener Corporation, Chicago, has a new automatic gun tacker perfectly adapted to the job of tacking down television transmission cables. This tacker drives a narrow crown staple (1/8" wide) so that it can be driven through the center of the cable with no danger of touching either of the outer wires. This gun tacker is operated by simply squeezing the handle, thereby tacking the cable securely. Only one hand is needed. The tacker holds 86 staples in either 1/4" or 3/8" lengths. It is just what the television service man needs for fastening the television transmission cable.

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533 DM (illustrated above)
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World Radio History

Transmission Line

→ from page 21

generator, and the input transformer in our receiver as the terminating impedance, then it can readily be seen that if the impedance of the transmission line is equal to the impedance of the input transformer, then the maximum amount of energy will be transferred to the receiver. This may simply be looked upon as a problem in impedance matching.

One of the basic principles of radio is that in transferring maximum amounts of energy, the load impedance must equal the impedance of the generator. It is likewise true that in order to get the greatest amount of energy transferred from the antenna to the transmission line, the impedances here too must be equal. Fig. 4 shows a 72 ohm line coupled to an antenna at a point where the impedance of the antenna is 72 ohms, to an input transformer of 72 ohms. In this case, maximum amounts of energy will be coupled from the antenna to the input.

It might be necessary to connect an antenna of 72 ohms to the input of a receiver having an impedance of 150 ohms. Impedance matching must be adhered to if optimum results are to be achieved, if there is to be a maximum transfer of energy and absence of standing waves. Fig. 5 shows how much of a power loss can be expected in cases of mismatching. This table shows that if the impedance mismatch were 2 to 1, or if a 75 ohm antenna were directly connected to a 150 ohm input, 11% of the energy would be lost because of mismatch.

In our problem of connecting a 72 ohm antenna to 150 ohm input, the ratio of mismatch is a little greater than 2 to 1, therefore the loss incurred would be a bit more than 11%. For greater ratios of mismatch, increasingly greater amounts of energy will be lost. In order to match 72 ohms to 150 ohms without this 11% loss, two procedures are open.

The first is to attach a tuned line, which is actually a line of exactly one half wave length, or a multiple of one half wave length, at the operating frequency. This length is critical, and can only be adjusted at one frequency. Therefore this method is impractical for receivers which cover a band of frequencies.

The most common method of matching is with the use of quarter-wave matching sections. Fig. 6 shows a 72 ohm generator connected to a 150 ohm line through a quarter wavelength section of line, which in this case is 103 ohms. In actual practice, 103 ohm lines are not available, so 100 ohm lines would be used. The formula used in finding the value of impedance of the matching section is: $Z\ (\text{matching}) = \sqrt{Z\ (\text{antenna}) \times Z\ (\text{input})}$. If a large amount of 72 ohm line is available, and it is desired to use this for the transmission line, then the quarter wave section of 103 ohms would connect the 72 ohm line to the 150 ohm input as shown in Fig. 6b.

The next problem is to connect a 72 ohm antenna to a 300 ohm input. The connecting distance is several hundred feet, and looking around the shop, we find that the only line on hand of this length is a 150 ohm line. But we have many short pieces of line of all other commercial impedances. The procedure to be followed here is to use the given formula to find the value of line needed to match 72 ohms to 150, and then to find the value to use in matching 150 to 300. Fig. 7 shows the setup in such a case. The 72 ohm generator is connected through a quarter wavelength line of 103 ohms to the 150 ohm transmission line, which in turn is connected to the input transformer through a quarter wavelength section of 212 ohms.

It should be remembered that in cutting a quarter wavelength matching section to a certain frequency, excellent results can be expected at both this frequency, and those frequencies nearby which will also be used.

Most modern television receivers have either 72 or 300 ohm inputs, and most modern antennas designed for television receivers are also made in 72 or 300 ohm impedances. Because of the fact that differently designed antennas give different results, such as uni-directional, bi-directional or non-directional reception, it may be necessary to choose a specific type of antenna for a designated location which does not match the receiver input, such as a 72 ohm antenna for a receiver with a 300 ohm input, or a 300 ohm antenna for a set with a 72 ohm input.

In such cases it is essential to use a matching section. Because antennas are cut to length at each location to favor either one or two specific stations in the television band, the matching section should be of such length as to also bring up the signal strength of a desired station. By using arbitrary frequencies in order to achieve best results, matching sections should be cut to proper length as shown in Fig. 8. With the given formula, the impedance of the matching section is computed to be 150 ohms. ✓ ✓ ✓

Notice to Service Organizations!

RADIO MAINTENANCE Magazine Special Group Plan

Radio Servicemen enrolled in service trade organizations may subscribe to RADIO MAINTENANCE at the special Group Plan price of $2.00 for one year—a saving of one-third regular price. Here's how it's done:

1. Offer open to members of Radio Servicemen's Associations, societies or organizations.

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4. Payment must accompany each order.

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RADIO MAINTENANCE Magazine, 460 Bloomfield Ave., Montclair, N. J.

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vision broadcasting and the standards to be proposed therefor.

Any information related to these questions should be communicated directly to the Secretary of the Joint Technical Advisory Committee, Mr. L. G. Cumming, Institute of Radio Engineers, 1 East 79th Street, New York 21, N. Y.

Ross D. Siragusa, president of Admiral Corporation, announced today the highlight of the Admiral exhibit at the American Furniture Mart for the Furniture Show opening July 5, would be console model Admiral radio-phonograph combinations equipped to play records at both 33⅓ rpm and the standard 78 rpm speed. Several recording companies are already manufacturing records at the slower speed, providing 22½ minutes of music to the side instead of the usual three minutes, Mr. Sirgusa explained. The new record players with two tone arms have a capacity of twelve ten-inch records or ten twelve-inch records, providing four hours of continuous entertainment without changing records, he said.

A. C. W. Saunders, of the Saunders Radio & Electronics School of Newton, Mass., whose Television training program is the basis for the Howard W. Sams's Photofact course in Television principles, recently talked to large groups of Radio Service Technicians in Bethlehem and Philadelphia, Pa., and in New York City, on the fundamentals of television receiver servicing. Backed by a wealth of practical experience in the radio service business, Mr. Saunders employs an interesting series of analogical diagrams to explain television circuit functions with remarkable clarity. Experienced radio technicians glean a new concept of television receiver fundamentals from Mr. Saunders' presentation. These meetings of radio servicemen are the first of a series to be sponsored by Howard W. Sams & Co., Inc. to alert experienced radio technicians to the splendid opportunities in television for the trained radio technician. Mr. Saunders' lecture schedule under Howard Sams' sponsorship will take him to every major section of the country during the balance of this year.

At the recent NAMM convention in Chicago, television receivers proved to be of primary interest to the majority of Music Merchants who attended it.

Pointing out the growing need of the Television industry for the independent service technician, Mr. Saunders gave a graphic account of how twenty experienced radio servicemen, after taking a sixteen hour orientation course in television installation and servicing, had organized a television installation and service company in Boston, which is today the largest independent concern of its kind in the New England States.

Television reception interference caused by automobile ignitions can be corrected or minimized if motor car manufacturers equip their autos with proper suppressors on spark plugs, distributors, etc., according to the most recent of a series of tests conducted by the RMA Engineering Department in cooperation with the Society of Automotive Engineers. These tests, made by a subcommittee of the RMA Committee on Vehicle Radio Interference, demonstrated that automobile ignition systems must not exceed 35 microvolts per meter if they are not to interfere with normal television reception. Tests, using cars equipped with proper suppressors indicated that interference can be reduced to a minimum, if not eliminated, by the use of such safeguards. The tests were conducted near Camden, N. J., and were intended to check earlier tests in the light of recent developments in television receiver design and construction.

Life-size television pictures for hotels, clubs, amusement places, hospitals, churches, schools and industry became available recently with RCA Victor's announcement of the first commercial equipment designed specifically throughout for presentation of television programs to large audiences. Possessed of the added brilliance and clarity obtained with reflective optical systems, as compared with those employing refractive optics, the pictures produced by

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Servicemen's choice! in...

ARKANSAS

● Arkansans know that it takes a tall lot of traveling to find a better tube than Cunningham. That's because Cunningham tubes are built to deliver long life and top performance in any radio. That's why, if *you* campaign for Cunninghams whenever new tubes are called for . . . you'll harvest an *extra* crop of customers as dependable as Cunninghams themselves!

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World Radio History

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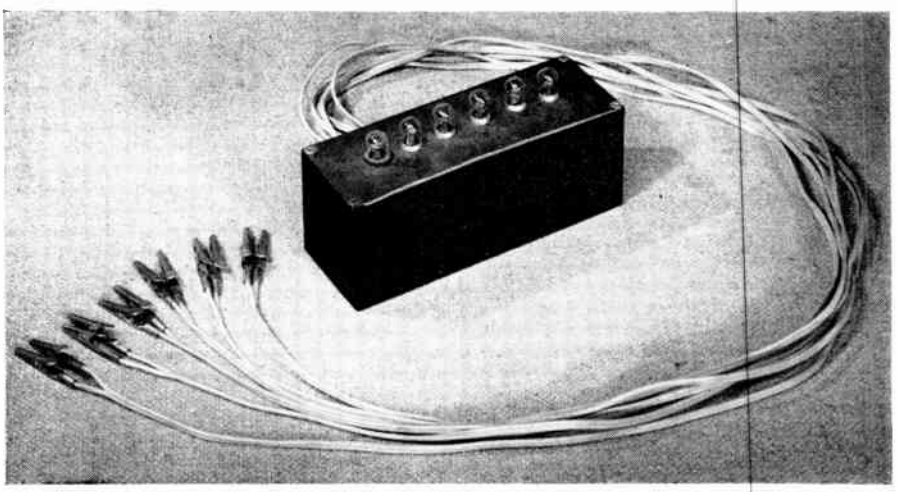
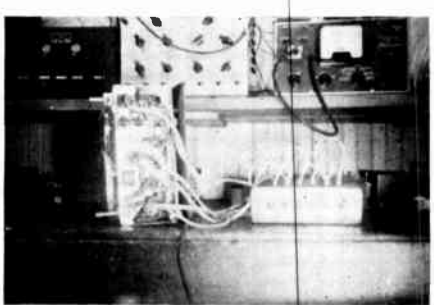
BUILD THIS INEXPENSIVE "BLINKER-DETECTOR"



by Edward W. Kesgen

THE instrument depicted has been found to be very useful in locating tubes with intermittently thermostatic, or "blinking," filaments. AC-DC (series-filament) receivers having such tubes in their complement may operate normally for hours or days, and then suddenly become intermittent. This type of intermittent condition, as distinguished from the type caused by defective condensers or other components, is accompanied by a blinking pilot light. Usually, before an AC voltmeter can be utilized to check for an open filament, the set once more operates normally and the serviceman has a few more gray hairs.

The "Blinker-Detector" consists merely of six (or more, as the builder desires) 110 volt neon lamps of miniature size. The lamps should have self-contained resistors; if they don't, they will have to be wired in series with one lead to each lamp. Any type of case may be used; if it is metallic, grommets must be used to insulate the lamps. Six holes are drilled on the top of the instrument to accommodate the lamps, and six more holes in one of the sides, in line with the top holes. I used two-conductor cord to each lamp, thus isolating each lamp circuit and preventing a confusing maze of wires from accumulating. Alligator clips with rubber sleeves were used to connect to the set being tested.



All that is necessary to operate the "Blinker-Detector" is to connect two wires from each lamp across each tube filament, being careful not to touch adjacent pins or components. Turn set on and attend to other shop routines. When the set becomes intermittent, merely glance in its direction. The neon lamp which is lit or blinking will be found to be the one connected to the filament of the defective tube.

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BACK ISSUES

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the new projectors may be tailored to suit screen sizes ranging from 3 x 4 feet to approximately 7 x 9 feet.

Simultaneous preview demonstrations of this auditorium or lobby-type projector were given in New York, Boston, Philadelphia and Washington in connection with the Republican National Convention and the world's championship Louis-Walcott fight, RCA revealed in its announcement. Developed by the RCA Engineering Product Department, the projector (Model TLS-86) is now in quantity production, and initial distribution has begun in areas served by the television networks.

RCA Victor's Berkshire Series of deluxe, high-fidelity radio-phonograph instruments—some with television—was introduced to the market at an invitation preview and demonstration for business and civic leaders, musicians, and music dealers at Lyon and Healy's main Chicago store, at 243 S. Wabash Avenue.

The ceremony marked the formal opening of the store's new Berkshire Salon, where all of the five luxuriously-styled models in the series were on display. Lyon and Healy will be the exclusive dealer for the Berkshire instruments in Chicago.

Acclaimed by Serge Koussevitsky, and other eminant musicians since it was first unveiled at the Berkshire Music Festival at Tanglewood, near Lenox, Mass., the new instruments utilize wartime and postwar advances in electronics and acoustics to provide high-fidelity reproduction of music over a range unattained in any previous instrument.

The development of the Berkshire Series instruments was described by Frank M. Folsom, Executive Vice President of RCA, who was a guest of Lyon and Healy, as "an adventurous departure" from established business and engineering practice, in that the usual—and usually necessary—restrictions of component and manufacturing costs were discarded.

Colleges, universities, city school systems and other non-commercial educational groups soon will be able to establish FM broadcast stations at comparatively low cost, it has been indicated by a Federal Communications Commission announcement.

General Electric Electronics Department executives pointed out that the FCC announcement of proposed rule making under which a license would be granted to Syracuse University at Syracuse, N. Y., for operation of its G-E two and one-half watt FM transmitter, would open the door for the first time in the nation's broadcasting history to FM radio stations of less than 250 watts. The ruling cannot become final until after an approval period.

The FCC decision promises to permit broadcasting of educational, religious or entertainment programs by countless colleges, universities, schools and other non-commercial groups at low budget cost. The small unit is about one-quarter the cost of the smallest power unit authorized previously by the FCC.

R. J. Brown, commercial engineer of G. E.'s transmitter division, said the diminutive transmitter was designed especially for the field by General Electric at Electronics Park, Syracuse, N. Y., and has been studied by University and Company officials. Application for a license was made after use of the transmitter was judged a success by the Syracuse University's Radio Workshop.

For more than a year, the transmitter, about the size of a floor-model radio receiver with power requirement equal to that of a three-way floor lamp, has been beaming radio signals directed at about 10,000 people on the University campus. Policy of the station has been to train students for radio careers and widen the educational service of the University.

The FCC ruling also supported a General Electric plan submitted over a year ago to eliminate the cost barrier to non-commercial educational broadcasting. It is expected that the decision will permit filling within a short time the available radio channels which have been unused because "getting on the air" was a costly procedure. There are 20 FM non-commercial educational radio frequencies available for colleges, schools, and religious organizations, G-E executives explained.

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IOWA

• Iowa does more than furnish fine food for American homes . . . and Cunningham tubes do more than furnish top performance. Cunninghams are *first-line* tubes . . . built for long life and trouble-free service. That's why you should elect to replace with Cunninghams when new tubes are called for.

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Radio Trade Supply . . . . . Des Moines

Cunningham Tubes

A product of
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somewhat weaker than that at H.

Little or no signal should be found at L and M, for the RC filter formed by R-5 C-5 is designed to remove the IF signal. With a *molulated* signal fed to the receiver, the voltage should again be checked at points K and M. This time a signal should be present, for the audio component of the signal will be passed without any appreciable loss. The AVC system is by-passed by C-4 for all frequencies and there should be no signal at point N.

The audio signal at O should vary with the setting of the volume contro, R-7. The signal should be several times stronger at P andQ, and amplified even more at R. Due to the step-down turns ratio of the output transformer, the signal at S will be much weaker.

The circuit of a typical push-pull output stage with a phase inverter is shown in Fig. 2. The purpose of the phase inverter, V-2, is to furnish a signal 180 degrees out of phase with that at point E to the grid of V-4 at F. This phase shift comes about by the well known fact that the phase is changed by 180 degrees when a signal passes through a vacuum tube, which in this case is V-2. It is imperative that the signal voltages applied to the grids of V-3 and V-4 be approximately equal. If these voltages are within 10% of each other, the difference will be balanced out in the output transformer.

Greater differences than this will result in distortion. The component or tube responsible for any great difference between the voltages at E and F may be located by checking signal voltages at A, B, C and D. The voltage at A should equal that at B and the voltage at C should egual that at D. A resistance check of that part of the circuit where the trouble originates will disclose the defective component.

Tracing Hum

Hum and other noises generated within the receiver can be traced to their source by shorting the antenna of the receiver so that no signal is present and measuring the hum level on the VTVM. The most usual source of hum in receivers is defective filter condensers which may easily be checked by measuring the hum voltage across them, at points X andY in Fig. 1.

d.c. Voltage Measurements

The superiority of the VTVM over low resistance instruments in making measurements of d. c. voltage across high resistance networks, can be easily appreciated when we consider the example in Fig. 3. Here, a potential of ten volts is evenly divided across a pair of one megohm resistors, five volts across either resistor. When a 1,000 ohms per volt meter on the ten volt scale is applied across one resistor, its own resistance is effectively in parallel with the resistor itself.

Since the resistance of the meter on this scale is about 10,000 ohms, the combined resistance of resistor and meter is slightly less than this amount. This makes the ratio between the two resistances about one to ten and the reading on the meter will be less than one volt, which is, of course, meaningless. On the other hand, the input resistance of a modern VTVM is in the order of ten megohms and if applied to this same resistor in Fig. 3, the reading will be over 4 volts, which is an error of less than 10%. This is a considerable improvement over the error of 90% in the previous case.

Referring again to Fig. 1, the AVC network formed by resistors R-1 and R-4 has a resistance of over 2 megohms and the low resistance meter will not show any reading of this voltage at all. The electronic voltmeter will measure the voltage at all points in this network without disturbing the loading of the circuit.

When connected across the AVC load resistor, R-6, the VTVM makes an excellent output indicator for alignment as the volume control may be turned down to reduce objectionable noise that would otherwise be heard in the speaker. Furthermore, when using this type of output meter it is not necessary to kill the AVC action as is the case when using an audio output meter.

A very accurate measurement of leakage of the audio blocking condenser may be made by placing the VTVM at point Q in Fig. 1. If resistor R-9 has a resistance of one half megohm, a leakage of only two microamperes through the blocking condenser, C-9, will cause a voltage drop of one volt which will be shown on the VTVM. Another cause of positive voltage at point Q is grid emission in V-4, or the presence of gas in the tube. To prevent grid emission it is important that the grid resistor R-9, does not exceed the maximum recommended value specfied by the manufacturer in the tube manuals.

It was stated in the discussion of the VTVM as a signal tracer that it was not possible to tell the quality of the signal from the indications on the VTVM. This is true. But there is some compensation in the ability of the VTVM to reveal obscure causes of distortion.

For example, the peak value of a signal applied to a tube, such as V-4, should never exceed the value of the negative grid bias. The VTVM will measure both of these voltages accurately and will instantly indicate when the grid is driven positive with respect to the cathode. This same measurement may be made on other tubes in the receiver when the signal is distorted.

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Very often the cause of distortion, which by any other method may have remained undiscovered for hours, will be located in a matter of minutes.

Although it must be conceded that the VTVM does not replace all other instruments in the service bench and has several limitations, it is amazing how many useful measurements may be made when the serviceman becomes familiar with it. In fact, it seems that the usefulness of the instrument is limited only by the ingenuity of its owner.

Industry Presents

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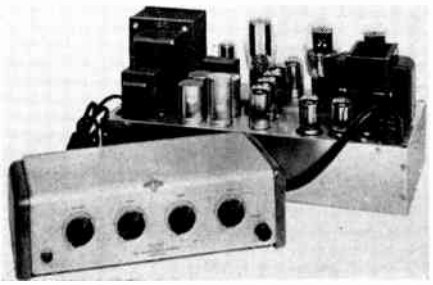
AUDIO OSCILLATOR

A new Audio Oscillator, beat frequency, Type YGA-4, developed for the serviceman, has been announced by the Specialty Division of the General Electric Company's Electronics Department. The new device, designed for use in testing radio receiver audio channels, public address systems, intercoms, and other audio work, features a low distortion output in one band over the audio spectrum from 25 to 16,000 cycles. The large illuminated dial facilitates rapid checks of audio circuits and equipment for frequency response, distortion, gain, power output and phase shift.

A stable BFO circuit enables the YGA-4 to deliver a low distortion output voltage which remains constant within plus or minus one decibel over the frequency range 50 to 15,000 cycles. The suitcase type device weighs only 21 pounds, and operated on standard power of 50-60 cycles, 105-125 volts.

MOBILE AMPLIFIER

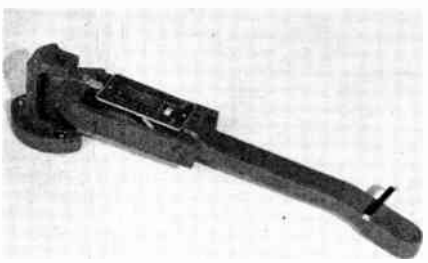
Audar, Inc., of Argos, Indiana, announce the Telvar Mobile Amplifier, designed for 6-V. Battery and 110-V. a-c operation. It comes equipped with or without the phonograph top.



HIGH QUALITY AMPLIFIER

A new remote-control model of the Brook High Quality Amplifier, designed essentially for custom-built radio-phonographs, has recently been introduced by Brook Electronics, Inc., 34 DeHart Place, Elizabeth 2, New Jersey. Designated Model 10C3, the new amplifier is built primarily for use in the home by music lovers and serious high-quality-audio enthusiasts. However, its audio characteristics are such that it is equally well-suited for application where highest engineering standards prevail. In designing the new model, attractiveness and flexibility were given equal consideration with electrical performance.

As may be seen in the illustration, Model 10C3 consists of two separate units and is designed for remote operation with all controls conveniently removed from the basic amplifier. The smaller of the two chassis shown contains the pre-amplifier stages, input jacks, and all operating controls. It is housed in a compact metal cabinet which is designed and finished to fit in with even the most tastefully-decorated surroundings. The larger chassis contains the 30-watt power amplifier and power supply, and may be placed in any location dictated by expediency and convenience. Four input channels are provided, one of which is high-gain with internal equalization for use with low-level magnetic-type pickups.



TONE AND TRANSCRIPTION ARMS

A new tone arm, equipped with the G-E variable reluctance cartridge, for playback of 10 and 12 inch records, and a new transcription arm for professional use, are now available from the Receiver Division of the General Electric Company's Electronics Department. Designed specifically as a companion unit for the G-E variable reluctance cartridge, the new tone arm provides the best compromise between minimum tracking error and over-all dimensions.

Servicemen's choice! in...

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• Since 1915, thousands of set owners in Maryland have voted for Cunningham tubes... because they're good for long terms of public service. That's why Cunninghams enjoy such a high reputation today. Cast *your* vote for Cunninghams when new tubes are called for, and *more* customers will vote for you!

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Front-End Tuners

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eliminate the losses inherent in forms at these frequencies.

Tuner Circuit Frequencies

Most of the FM RF amplifiers now in use employ an impedance coupled circuit. The grid of the RM amplifier is tuned, the plate circuit is resistance coupled to the tuned grid circuit of the mixer. Although there are wide variations in the physical design of tuning coils (as described) the RF amplifier circuit doesn't vary much from the basic impedance coupled version. Sometimes an RF choke is used in the plate circuit instead of a resistor.

There are several types of mixer circuits. Pentagrid converters common in AM receivers, such as the 6SA7, 6A8, etc, have too much capacitance and "pulling" effect on the FM frequencies and are therefore not used. However, two specially designed high frequency pentagrid converter tubes are widely used, particularly in the small, less expensive models. These are the 6BE6 and the 6SB7. A typical circuit using the 6SB7 is shown in Fig. 5. It will be noted that it is practically identical to those used at lower frequencies, the type of tube used being the important difference.

In spite of special design features incorporated in the 6SB7, pentagrid converters are a compromise for simplicity. Random receiver noise generated in these tubes is much greater than in converter arrangements using a separate oscillator. This is because each additional element added to a tube increases random noise. Although much of this random noise (due to thermal agitation of electrons in the electron stream) is "swamped" out in the limiter stage, some of it frequency modulates the received signal and can be heard as interference on the received signal.

Therefore, in spite of the presence of limiting action, minimizing random receiver noise is important in FM receiver design.

Noise effects are minimized by the use of a separate oscilator in the converter section. Fig. 6 shows a converter section using a pentode mixer and Fig. 7 shows one using a triode mixer, both with separate oscilator. These circuits both use capacitive coupling between oscillator and mixer.

Circuit B emplys inductive coupling between oscilator and mixer.

Circuit B emplys inductive coupling directly between the oscillator and mixer coils. This is accomplished by the simple expedient of not letting any shielding material get between the two coils. Circuit C couples oscillator voltage into the cathode as in Fig. 7, except that an RF choke or a small coil is used instead of a resistor.

Servicing RF Sections

All the conventional RF section troubles will be encountered in FM receivers with a few extras thrown in. Some low frequency troubles are accentuated. For instance, FM receiver pentagrid converters are subject to conditions not detectable on tube testers. Often a tube which tests ok on the checker *will not oscillate*. This is a fault already familiar to the serviceman from his low frequency work, but he will find it much more often in FM receivers. Component aging can have the same effect. Grid resistors which have changed value can prevent oscilation or cause intermittend operation.

When a tube is replaced in this section, realignment will nearly always be necessary. This is true because even though the designer attempts to make the effect of tube capacitance small, this capacitance is so large compared to the tuning capacitance that the variation from tube to tube will often seriously change alignment adjustment.

Alignment adjustments are similar *in principle* to those made on low frequency AM receivers. But the novel tuning systems sometimes used make the physical manupulations often radically different. These alignment operations will be considered in detail in a subsequent article. ✓ ✓ ✓

Electro
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Announcement

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6K7GT	12BA6	25Z6GT	1T4	6AC5	6X7	6U5
6Q7GT	12BE6	35W4	1U4	6AQ5	25Z5	43
6SA7GT	12K7GT	45	1S5	6BE6	6C6	70L7
6SK7GT	12Q7GT	46	3S4	6BA6	6D6	84
6SQ7GT	12SA7	47	3Q4	6AU6	75	117L7
6V6GT	12SK7	50B5	3V4	6BJ6	117Z3	32L7
12A8GT	12SQ7	50L6				

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GREYLOCK ELECTRONIC SUPPLY CO.
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Modernizing Radios

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As far as changes in the cabinet are concerned, few will have to be made other than the alterations already covered. The only exception to this is where the speaker has to be changed and the chamber is not accoustically large enough to accomodate the new unit. In this case, in sets built with a record storage space on one or both sides of the speaker chamber, it is sometimes possible to remove the partitions and have the entire area for the speaker.

The reverse of this is to entirely discard the speaker space in the cabinet, make a matching outboard speaker cabinet, and convert the space in the cabinet into record storage. This, of course, involves the construction of an entirelyl new and matching housing plus connecting cables, which can be troublesome. However, at times it is far superior to have the speaker mounted outside of the cabinet, or in a wall, in a panel of a bookcase, or in another piece of furniture, instead of having muffled tones as a result of too small a speaker space.

Where shrillness exists, the entire chamber can be lined with rock wool of fiberglass. Experiment also with either opening or enclosing the back to determine which gives the best results.

Final check procedure is virtually the same as that which would be applied to any set in for an overhaul, but requirements are considerably more rigid. Danby makes it a point to check both before and after modernization for frequency repsonse and for distortion at medium, high and low levels. Standard procedure at Vertech is to put an audio oscillator on the set to check the audio circuit and hook in a scope to ascertain the quality of the frequency response.

After all of this, the question naturally comes up, "just how good a performance can be expected form a modernized set?" Of course, the answer to this depends a great deal upon the quality of the original. But in general, a good radio-phonograps, although long in years, can be made the tonal equal of anything currently on the street selling for seven to fifteen hundred dollars. ✓ ✓ ✓

Reception Unlimited

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lost control. It was either the mast, or both the mast and he. The mast went, and it crashed onto the ground in the courtyard. Fortunately, no one was nearby.

In addition to the usual fire, theft and auto liability insurance carried by most service men, Mr. Cipperly carries $50,000 to $100,000 worth of general liability insurance; $1 to $10,000 worth of property damage insurance, and a similar amount of product insurance. He also has workingman's compensation insurance. He believes that the protection is well worth the comparatively slight cost.

Mr. Cipperly has discovered that tubes are just about the biggest trouble makers in television and FM receivers, and so carries as many as he believes he will need when he goes out on a call, which is the complete complement for the set he is going to service.

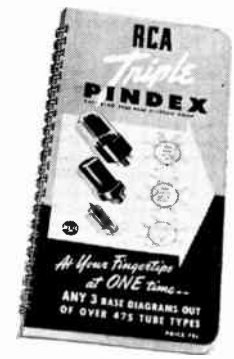
To the customers who desire it, he offers a flat yearly maintenance, parts extra, rate. This fee is based upon the size of the picture tube and the type of set. The average amount is about $30.00 per year per set.

Since the entire business is so very new, sufficient facts have not as yet been compiled, and no definite yearly breakdown figures can be found. Mr. Cipperly does not know whether his fee for a year's television set upkeep is going to make or lose money for him. Judging by his experience to date he expects on the average three calls per set per year. Whether or not this will be so, and wether or not this will be so after a set has aged a year or more, he does not know.

However, so far only five customers have signed up, and it seems that most people will try and outlive the insurance company the same way they do with their AM receivers, believing that it will cost them less in the long run on a per job basis.

Which seems to indicate that the service technician's dream of business stability based on a sort of socialized radio repair is still a long way off. ✓ ✓ ✓

Servicemen's choice!



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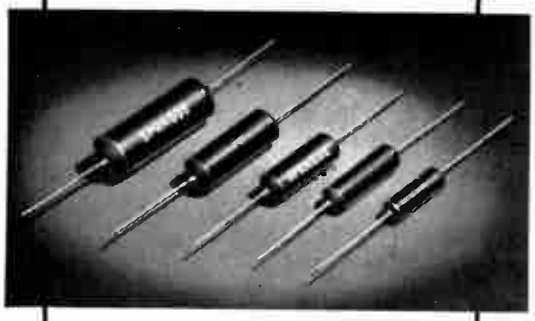

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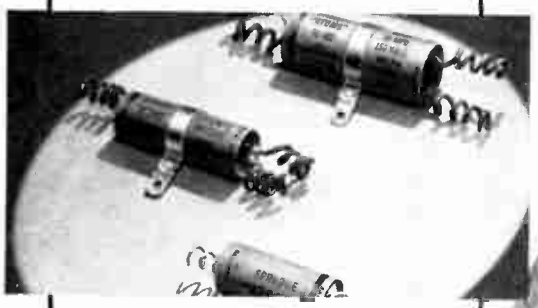

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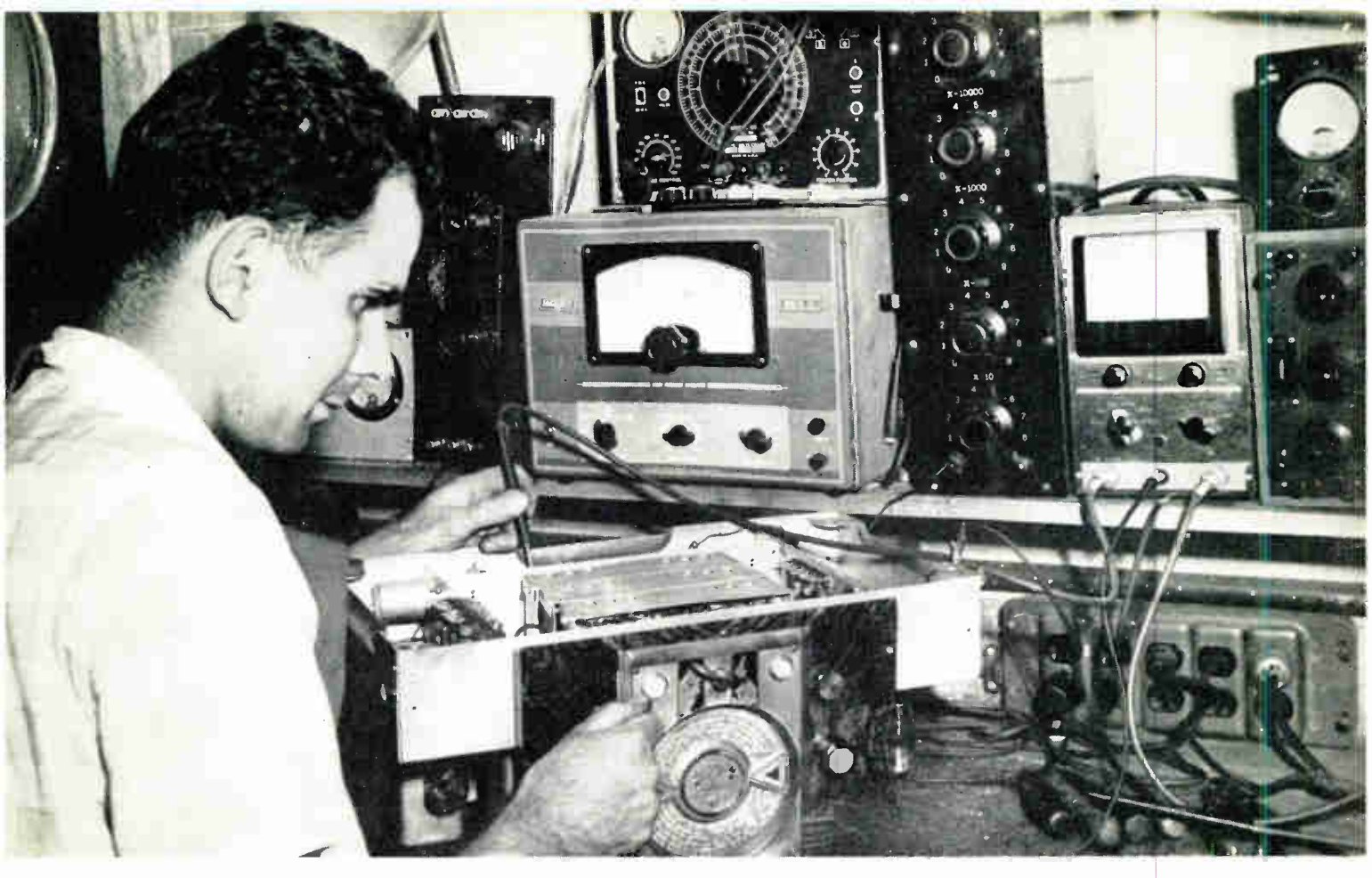

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