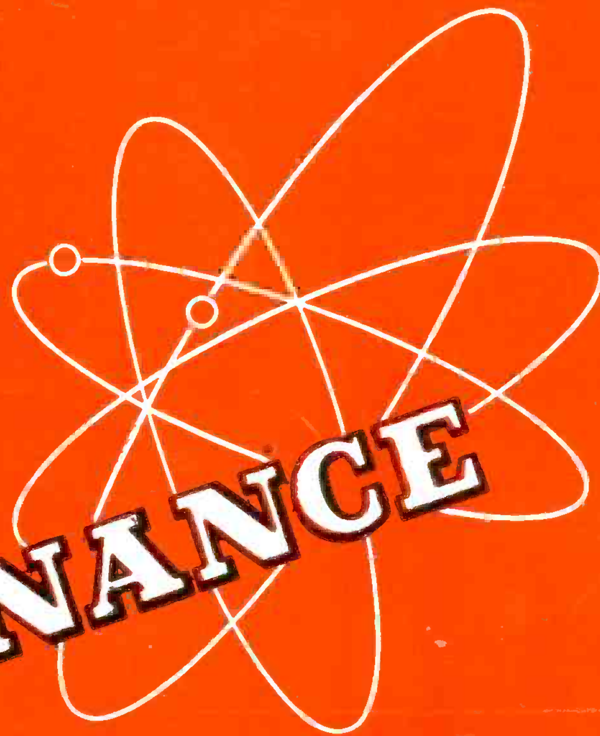
DEVOTED ENTIRELY TO THE

RADIO SERVICEMAN

25 CENTS

RADIO MAINTENANCE



JUNE 1947

TEST EQUIPMENT MAINTENANCE

CRYSTAL-CONTROLLED SIGNAL GENERATOR

WHEN THE CUSTOMER ISN'T RIGHT

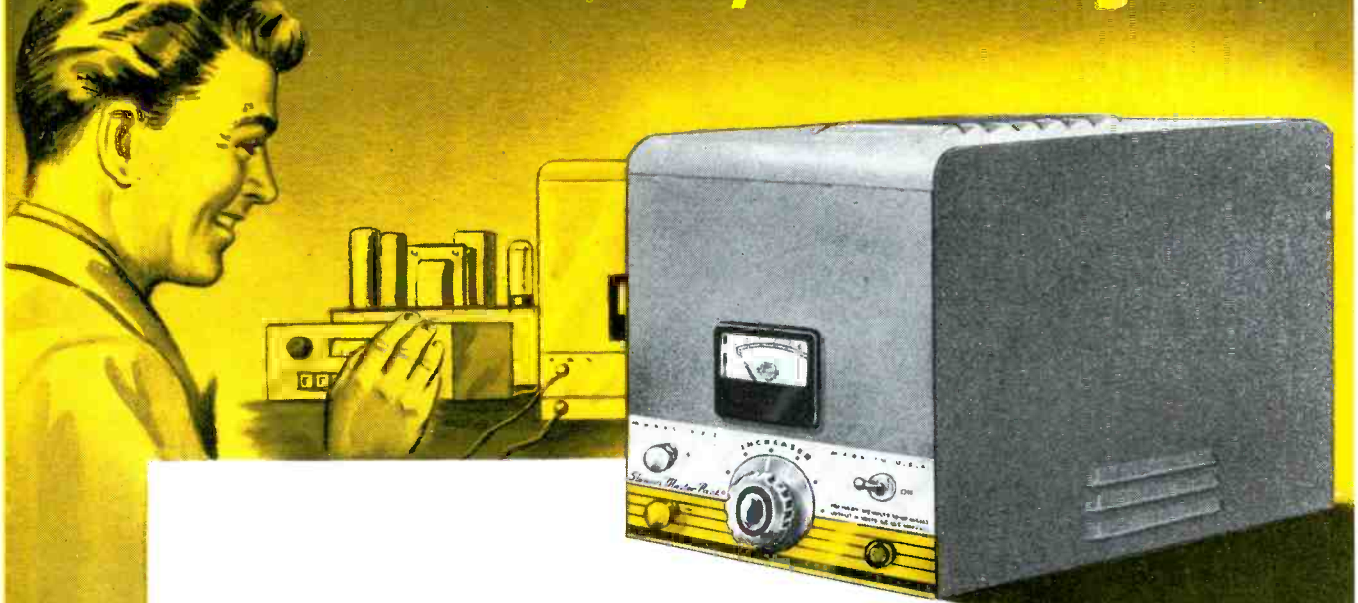
TELEVISION RECEIVERS—THE POWER SUPPLY

A BOLAND AND BOYCE PUBLICATION

STANCOR

really has something

to meet your servicing needs



POWER PACK • • • Model 752

The Model 752 power pack provides a well filtered 6 volt - 12.5 ampere D.C. supply from any standard 115 volt, 60 cycle source. Replacing messy and troublesome storage batteries for numerous types of service it is ideal for automobile radio sales demonstration or service test bench, effectively operating most push button tuning auto sets. Useful apparatus for industrial or laboratory testing. Best all purpose low voltage pack. All controls, knobs, voltmeter and terminals are visible and accessible on plainly marked escutcheon panel. Pack may also be used for auto accessories testing, battery charging, magnetic field exciting, electroplating, etc.

FOR DEMONSTRATING AND SERVICING

- AUTO RADIOS AND OTHER AUTO ACCESSORIES
- BATTERY CHARGING
- OPERATING RELAYS AND SOLENOIDS
- REPLACING STORAGE BATTERIES
- LABORATORY TESTING
- BRUSH PLATING

ask your jobber for the **STANCOR 752**

STANCOR

STANDARD TRANSFORMER CORPORATION

ELSTON, KEDZIE AND ADDISON • CHICAGO, ILLINOIS

A SIGN OF SUCCESSFUL SERVICING

Witte has all fifteen RIDER MANUALS

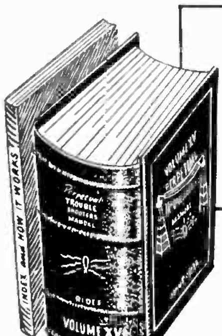
Anyone in Philadelphia's radio-service circles can tell you of the high reputation and efficiency of the servicing department of Witte Radio and Television Co. And, Witte has one thing in common with other successful shops; it recognizes the time-saving value of Rider Manuals, by maintaining a set of all fifteen volumes.

You, too, need this servicing data on American made receivers made between 1920 and 1947. You, too, need the facts to quickly diagnose troubles in any and all receivers that come to you for repair. You, too, need all fifteen Rider Manuals. For, from no other single source is this complete service available; receiver schematics, voltage data, alignment data, resistance values, chassis layouts and wiring, and trimmer connections. Dependable, authoritative information.

Volume XV, covering sets issued during 1946 and some unpublished pre-war models, is full of features resulting from "Sixteen Years of Continuing Service for the Radio Servicing Industry." For example, "clarified-schematics", which break down the composite diagrams of hundreds of complicated multiband receivers into *individual* schematics of each circuit as it exists with each turn of the wave band or equipment switch.

With each copy of Volume XV is the 181 page "How It Works" book, a guide to the theory of operation of the new technical features in the latest receivers. Volume XV, also includes all popular "Ham" communication receivers, Scott receivers, Magnavox RA combinations and record player combinations.

Rider Manuals are an investment which keeps pouring out profits for you. Those who bought Volume I, 17 years ago, are still benefitting from it. Be sure your shop has the Sign of Successful Servicing—be sure it has all fifteen Rider Manuals.



VOL. XV
JUST OUT!
2000 pages, plus 181 page "How It Works" Book.
$18.00 complete

Volumes XIV to VII (each volume)	$15.00
Volume VI	11.00
Abridged Manuals I to V (one volume)	17.50
Record Changers and Recorders	9.00

RIDER MANUALS
MEAN **SUCCESSFUL SERVICING**

ENTER THE

RIDER MANUAL CONTEST

224 OPPORTUNITIES TO WIN!

$4,325.00 WORTH OF CASH PRIZES

AND SERVICING EQUIPMENT

•

JUST TELL WHY
(in 100 Words or Less)

"RIDER MANUALS *MEAN* SUCCESSFUL SERVICING"

That's all you need do. Nothing to buy. Nothing difficult. No need for fancy writing. Write your entry on official blank, obtainable from your parts jobber, in plain everyday English. The first thing you write may win you one of the 224 valuable prizes.

DON'T PUT IT OFF.
WRITE IT DOWN!

Send in your entry *NOW!*

JOHN F. RIDER
Publisher, Inc.
404—4th AVE., N. Y. 16, N. Y.

Export Division,
Rocke International Corp.,
13 E. 40th St., New York City
Cable ARLAB

RADIO MAINTENANCE

INCLUDING

ELECTRONIC MAINTENANCE

Volume 3 JUNE, 1947 Number 6

Contents

Radio Maintenance is published monthly by Boland & Boyce, Inc., at 34 No. Crystal St., East Stroudsburg, Pa., U.S.A.; Executive and Edtiorial Office, 460 Bloomfield Ave., Montclair, N. J. Subscription Rates: In U. S., Mexico, South and Central America, and U. S. possessions, $2.50 for 1 year, $4.00 for two years, single copies 25 cents; in Canada, $3.00 for 1 year, $5.00 for 2 years, single copies 30 cents; in British Empire, $3.50 for 1 year, $6.00 for 2 years, single copies 40 cents; all other foreign countries, $4.00 for 1 year.

Change of address: Four weeks' notice required for change of address. When ordering a change, please furnish an address stencil impression from a recent issue if you can. Address changes cannot be made without the old stencil as well as the new one.

WHEN THE CUSTOMER *ISN'T* RIGHT

by Eugene A. Conklin
Cartoons by Vic Turner

The customer isn't always right, and when he isn't, he's hard to handle . . . But remember, he's your customer—right or wrong!

SUCCESS in the radio service business, as in any other where direct contact is made with the consumer, depends to a great extent on the manner in which the customer is treated. The average layman knows very little about his radio and when his receiver is in need of repair, he more often than not becomes very interested in what must be done to put it back in working order. He or she invariably asks questions of the serviceman. Because the consumer knows so little about radio and radio servicing, these questions are often difficult to answer. Good business practice tells us that they must be answered with an eye toward satisfying the customer and building confidence.

By anticipating the logical questions *before* they are asked, it is possible to develop a technique which will fulfill the above requirements. The writer went to a number of successful service shops to find out how they meet some of the more commonly encountered situations. The following are the questions and answers they gave.

What is the best procedure to follow when a customer calls on the phone and requests that a serviceman be sent to his or her home to repair a radio while the owner is absent?

Answer: Often a customer will call and state that "The key is in the mailbox, nobody will be home, but go right ahead and repair the radio." The serviceman who follows these instructions and enters an unoccupied house is taking the risk of being held responsible for any possessions lost, strayed or stolen from that home at any time during the day the radio is serviced. In fact, we heard of a case where a serviceman was accused of having taken something which later was found to have disappeared a week before the day he entered the house.

Ideal Radio Service of Dallas, Texas, has an excellent method of handling requests of this sort. When the customer calls, the following form is dictated over the phone: "I

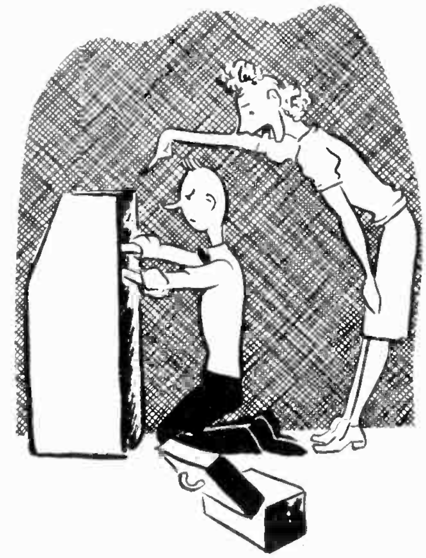
authorize . . . . to enter my home for the purpose of repairing my radio and hereby agree not to hold him responsible for any loss incurred as a result of his entrance." The customer is then asked to make out the form, sign it, and leave it with the key. It provides protection against unpleasant and costly lawsuits. In actual practice, the customer usually realizes that he is not being fair in asking the serviceman to assume responsibility for his property and will request that the serviceman call at a time when someone will be home. The customer almost always respects the business-like way in which the matter has been handled.

What is the best answer to give when a customer complains that a competitor down the street charges less both for components and hourly labor?

Answer: The Ruby Avenue Radio Service has its representatives inform the customer that its service rates are based on the work of skilled servicemen and the best of components from the standpoint of quality. They point out that service charges can only be lowered by using inexperienced help and parts of a poorer quality, and they remind the customer that either procedure often proves more costly in the final analysis. If handled tactfully, the customer will see the logic of the above answer without making it necessary to brand a competitor as unreliable.

What is the best thing to do when a customer insists on conversing with the serviceman when work is being done on a set in the home?

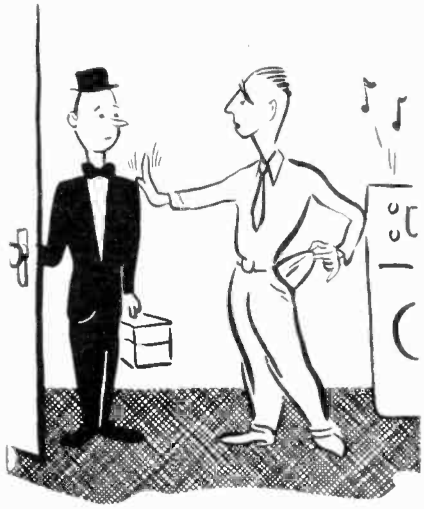
Answer: Jackson Radio Service of Jackson, Mississippi, has its representatives take a full five minutes to demonstrate their service tools and



explain as simply as possible the function of each. At the end of the explanation, the serviceman mentions that, while he welcomes a *silent* observer, conversation takes his mind off his work, lengthens the job, and increases the cost to the customer. The customer quickly realizes that he is is paying for the serviceman's time and will no longer interfere.

What is the best thing to do when a customer requests credit after repairs have been made?

Answer: The Ann Arbor Radio Sales and Service of Ann Arbor, Michigan, uses newspaper and radio advertising to explain to service patrons that it welcomes credit



service customers on the following basis: Two references must be provided and the firm allowed to check with the local Credit Bureau. If the results of the investigation are satisfactory, Ann Arbor Sales and Service extends credit for thirty days. If an account is not paid within five days of the termination of the credit period, no future service calls are made except on a strictly cash basis.

Granger Radio Service of Rochester, New York, has a plan whereby customers pay service charges amounting to more than ten dollars on the basis of one-third down and the balance within thirty days.

What can be done when a customer attempts to repair his own radio, succeeds in doing considerable damage, and then sends for the radio serviceman?

Answer: When an examination of the receiver shows that some inex-

→ To Page 20

Test Equipment MAINTENANCE

Test equipment which is always in tip top shape means dollars in the serviceman's pocket. Many a repair job results in double working time and expense because of instrument breakdown which a regular maintenance schedule could have prevented. This is the first of a series of three articles explaining how to increase the life and efficiency of your equipment.

by

John B. Ledbetter

MANY RADIO SERVICEMEN who daily encounter delicate and complex electronic equipment are reluctant to service their own test instruments. While it is sometimes desirable to return test equipment and meters to the factory, many items of maintenance may be successfully undertaken in the shop. Ability to service one's own equipment not only saves precious time and money, but usually improves efficiency and self-confidence.

Instrument and test equipment may be *preventive* or *corrective*. Preventive maintenance is that performed as a regular routine check-up, whereby abnormal conditions are found and corrected prior to breakdown. Corrective maintenance may be classified as that necessitated by equipment failure, and includes all measures required to restore normal operation.

The source of equipment failures is a defective part, damaged meter, or faulty tube, and can be traced and corrected without difficulty. Often suitable replacement parts may be obtained from a local radio distributor; special or precision parts should be obtained from the manufacturer. Orders for such parts should include the instrument serial and model number and an exact description and number of the defective part.

If the defect or breakdown requires return of the instrument to the manufacturer, a note should include: (1) The exact nature of the complaint, (2) any erratic behavior prior to failure, (3) whether trouble is intermittent, and (4) repairs or observations made by the serviceman. Such information provides the manufacturer's service department with a case history of the instrument. Without this information, the manufacturer might waste time in repeating operations already performed by the serviceman, with resultant increase in time and labor charges.

Preventive Maintenance

Equipment failures and depreciation may be minimized by proper care in handling, by precautions to prevent overload, and by making periodic check-ups on each instrument.

Most failures of meters, copper-oxide rectifiers, and other parts, are due to overload and incorrect scale settings. These are both almost entirely due to carelessness or "human error." Most of us have at one time or other become absent-minded just long enough to touch the test prods across a high voltage with the meter range set on the milliampere or ohms scale. Much time and trouble, to say nothing of service interruption, can be avoided simply by making sure the proper range or scale is being used for each test. When doubt exists as to the approximate value of the current or voltage under test, the highest meter range available should be used before switching to a lower scale. In this way, the meter and resistors are protected against overload. This system is also advantageous in checking low-voltage circuits since there is always the possibility that a shorted tube or component has placed excessive voltage across these points.

Maintenance Requirements

Proper care and operation, coupled with a definite maintenance schedule, will often decrease deterioration and breakdown *by as much as 90 per cent.*

The amount of maintenance required and the manner in which it is carried out depend largely on (1) the type of instrument, (2) the conditions of use, and (3) the care with which it is handled and operated. An instrument in regular operation naturally requires more frequent checking than one used occasionally. This does not mean that equipment used infrequently should *not* be checked at regular intervals. While moving parts of seldom used instruments may not suffer much wear, they *are* subject to oxidation and corrosion, collection of foreign matter, and exposure to moisture, heat, salt air, and other elements. Heat is responsible for carbonizing lubricants in bearings, shafts, and dial mechanisms. Exposed parts should be cleaned and lubricated regularly as recommended by the manufacturer.

Salt air, humidity, and chemical fumes in industrial areas, are injurious to metal parts, especially switch contacts, coils and wire-wound resistors. Condensers will dry out rapidly when exposed to heat. Although a number of modern test instruments are available with molded resistors, sealed meter cases, and impregnated components which aid in moisture-proofing, most parts are exposed and require occasional cleaning and lubrication. Recommended methods for cleaning and servicing test equipment are outlined in the following discussion.

Routine Maintenance

Preventive maintenance, more generally known as "routine" servicing, is equally important in all types of test equipment. The basic group, including tube tester, volt-ohm-milliammeter, and signal generator, require more attention than most of the others since they are in more constant use. It is to these instruments that first consideration is given.

Efficiency can be increased immensely by first setting up a definite maintenance schedule. In this way, there is less likelihood of overlooking a defect. The exact order in which the various steps are carried out is not important as long as *all* steps are included. Each serviceman has his own method of performing routine maintenance. It *is* recommended that, once the serviceman has chosen a desirable procedure, he list the steps in order *and follow that order in all tests.* By adopting a set method of performing maintenance duties, the serviceman memorizes each step, and, as a result, becomes more efficient and thorough.

Before proceeding with our discussion of maintenance routine, it may be well to review the operating characteristics of the parts which make up the modern tester and their more common failures.

Rectifiers

Common types of rectifiers used in tube testers, volt ohm-milliammeters, and other equipment employing DC meters to measure AC voltages, are (1) vacuum tube and (2) copper-oxide. The vacuum tube is usually a 30, 80, 6H6 or similar type connected as a diode or half-wave rectifier. Trouble with this type of rectifier is usually low emission or burned-out filaments. Internal shorts or leakage between the cathode and the heater sometimes occur; filament-to-plate shorts seldom are encountered except in cases of broken filaments. Indicative of rectifier trouble is an error or zero reading on all the AC scales. Low readings indicate a weak rectifier; *no* reading points to a burned-out tube, or, occasionally an open rectifier.

Rectifier tubes should be tested for shorts, leakage, and intermittent heaters or filaments, and replaced if necessary. Occasionally, it will be necessary to readjust the line rheostat to compensate for the difference in rectifier output. A small rheostat adjustable with a screwdriver will be found in most good tube testers. The line voltage should be checked with an accurate voltmeter and the rheostat adjusted to give the same reading on the tester meter. Some testers employ a shadowgraph or similar indicating device in conjunction with a rheostat controlled from the front panel. With these testers, it is not necessary to compensate for rectifier changes.

To avoid confusing rectifier trouble with other failures, check the meter action on DC voltage scales with a battery or other source of *known* voltage, or check meter

→ To Following Page

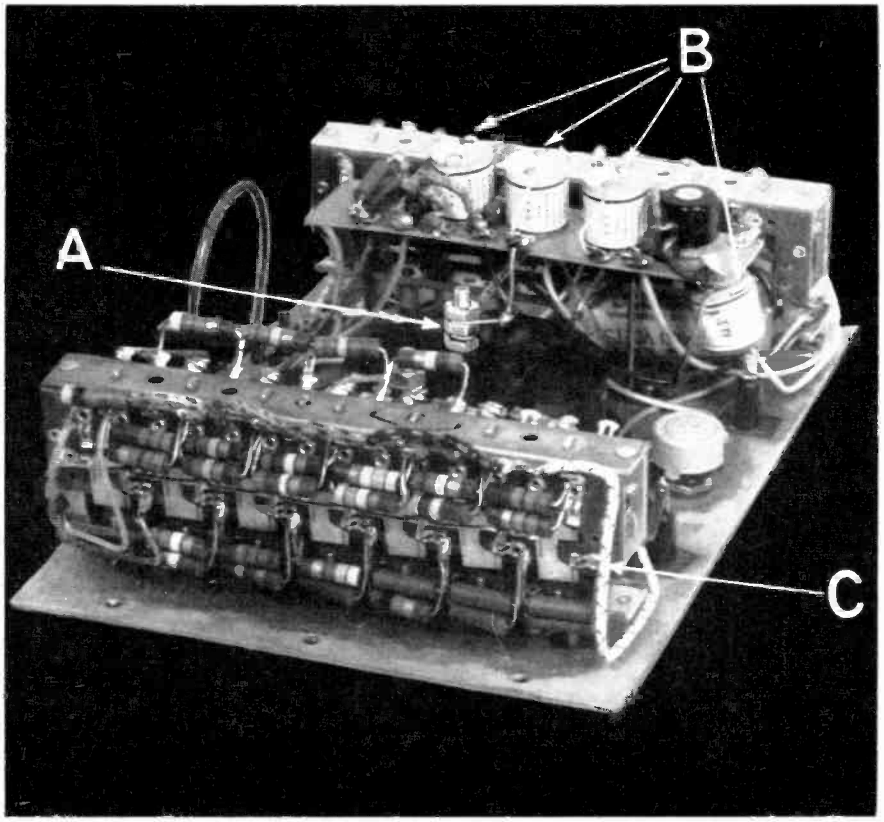


Fig. 1 Internal view of a typical volt-ohm-milliammeter, showing copper oxide rectifier (A,) precision resistors (B,) and push-button switch assembly (C.) Proper care of these and other parts is explained in the text.

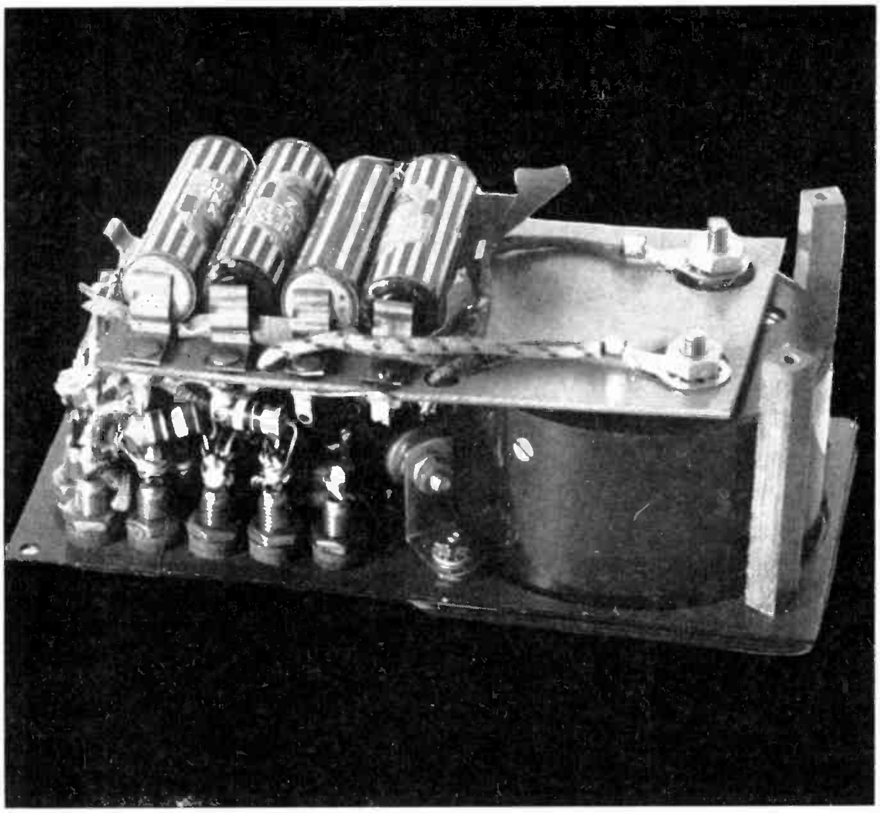


Fig. 2 Miniature type of multimeter especially useful for portable work. Switches are eliminated by the use of a large number of tip jacks.

readings on the ohmmeter scales. Low readings on all scales may be due to internally shorted turns on the meter coil, or to a low-resistance short in the range switch or test lead circuit.

Remember that most troubles are *simple*. Tracing the defect becomes difficult usually because the *obvious* causes are overlooked in the search for "complicated" failures. An example is offered from a recent experience in which the author was called upon to service a Hickok "Jumbo" volt-ohm-milliammeter which gave only a very slight indication on any scale. The meter was checked first by disconnecting it from the circuit and checking for resistance with an ohmmeter. (When using this method, an external resistor of several thousand ohms should be used in series to prevent "pegging" a sensitive meter.) The input and range circuits were then checked with the meter in the circuit, *but only for continuity*. The series resistors were checked. Then it was decided to check the circuit with a low-range ohmmeter for shorts. Immediately, the "C" battery was found to be shorted to the case by a sharp corner on the mounting strap which had punctured the battery insulation. Had the circuit been checked *first*, the trouble would have been found at once. The obvious was overlooked simply because the owner and several other servicemen had "checked" the instrument and assumed it presented a complicated service job.

A copper-oxide rectifier is composed of a series of oxide coated copper plates in which current will flow more easily from oxide to bare copper than in the opposite direction. While it has certain frequency and voltage limitations, it is useful for practical service work and is inexpensive, simple, and rugged. Common types are half-wave, double half-wave, and full-wave, examples of which are shown in Fig. 3. Types A and C are of the full-wave (bridge) type shown in schematic diagram 1. Type B is the double half-wave, shown in diagrams 2 and 3.

The following precautions should be observed when copper oxide rectifiers are installed or replaced:

1. Never expose the rectifier to temperatures above 45° C. Keep your soldering iron clear when making connections.
2. Avoid contact with acid or perspiration. When handled, the unit should be wrapped in tissue.
3. Only exact replacements or carefully checked substitutes should be installed.
4. Always mark all connecting wires as this will prevent mistakes such as wrong polarity.

Variable Controls

Potentiometers and rheostats found in tube testers and volt-ohm-milliammeters are usually wire-wound. A common fault is erratic operation, particularly on the low-ohms scale. Where erratic performance is due to dirty wiper arms and contacts, the control may be cleaned by flushing it with a mixture of half alcohol and half ether. Loose controls should be disassembled, the arm bent to provide better contact, and reassembled. After cleaning, contact surfaces of the arm and resistance element should be coated with a *very thin* film of vaseline, fine clock oil, or *Lubrico MD* (manufactured by Master Lubricants Company, Philadelphia, Pa.) Avoid applying an excess which will collect dirt, grease, and other foreign matter. Corrosion may be removed with a fine grade of sandpaper, brushing away the residue with a small brush or flushing with carbon tetrachloride and lubricating. Occasionally, a drop of oil should be applied to the bearings and shaft bushing.

In the majority of cases, the control as furnished by the manufacturer is built too lightly for rough use. The contact arm loses tension. The resistance element and the shaft and bearings become worn or loose, resulting in wobbly action and faulty operation. When space allows, worn controls should be replaced with 2-watt wire-wound units.

Switches

When operation of toggle switches becomes erratic, the logical solution is replacement. Wafer-type rotary switches may be cleaned by removing oxidation with very fine sandpaper and flushing with a mixture of ether and alcohol. Tension may be increased by disassembling and springing the contact jaws together with a pair of long-nose pliers.

Many test instruments are equipped with gang-type push button switches for selecting ranges and positions. Locking notches on shafts often become worn so that buttons will not stay in a locked position. In most cases, the edge of the notched side of the shaft is found to be rounded instead of straight. This can be remedied by filing. A broken contact blade can be repaired by cleaning, tinning and soldering at the break, applying enough solder over and around the broken area to hold the blade firmly without allowing a bend in the soldered area. Soldering is done with the push buttons in the release or "out" position to relieve strain and to allow tension when the button is pushed in. Cleaning of the contact surfaces is done in the same manner as outlined above.

Wiring

All connections should be checked for rosin joints, cold-soldered or loose connections, and broken leads. Corded cables are particularly subject to leakage effects due to moisture or fumes, and lacing should be removed when instrument is used in seaboard and industrial areas. The wires can then be spaced to prevent leakage effects.

Condensers

Capacitors used in test equipment are usually good for the life of the instrument. They are subject to the usual troubles, however, and should be checked when symptoms appear. If subjected to long periods of use or extreme heat and humidity, they may become leaky, dried-out, lose capacity, or become intermittent. Rarely is a shorted condenser found.

Faulty condensers are indicated by abnormal readings in one or more of the AC ranges, including the "output." The defective condenser is identified when only *one* AC range is incorrect and all others provide accurate readings. Where all ranges are inaccurate, the rectifier tube or unit should be inspected.

If replacement is necessary, a condenser whose value is near that of the original unit should be used. Values may be changed or several condensers connected in parallel or series-parallel until the meter readings correspond with a known voltage or with a calibrated instrument.

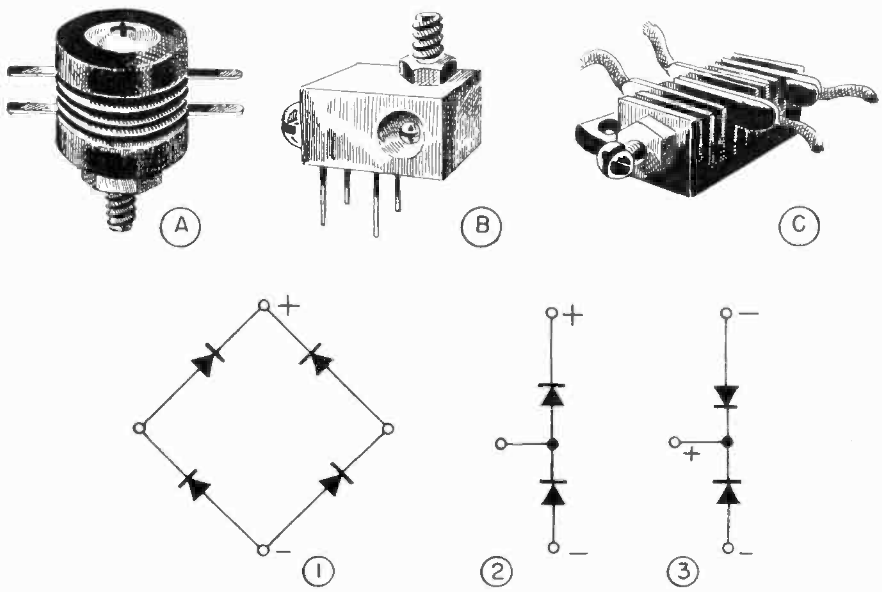


Fig. 3 Types of copper oxide rectifiers which the serviceman is likely to encounter in servicing his own test equipment. (See text.)

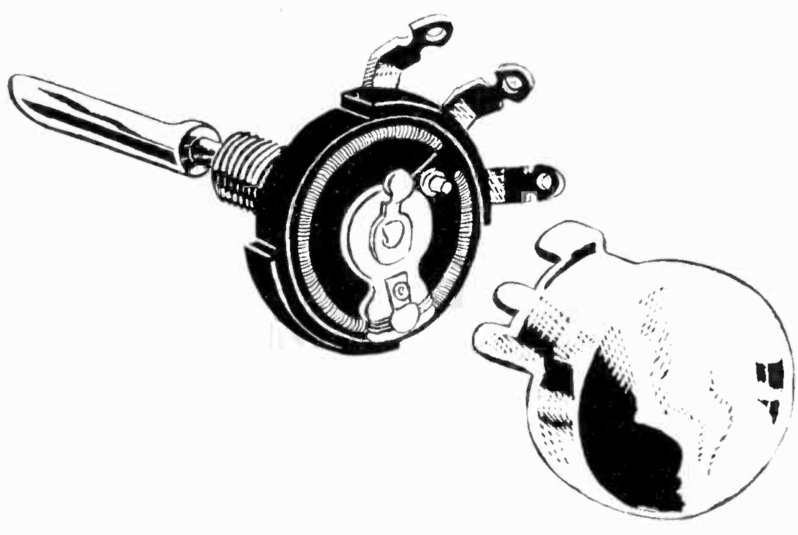


Fig. 4 View of wirewound volume control with back cover removed. This is typical of the controls often found in test equipment.

Resistors

Resistors, like condensers, rarely give trouble since most units are of the precision wire-wound type. The greatest strain to which they are subjected is accidental overload, and, in certain locations, corrosive effects from chemical fumes and humid or salt air.

In the cheaper test equipment, several carbon resistors may often be found in a cluster. An inaccurate range may be due to leakage between adjacent resistors. They should be spread apart slightly to avoid such possibility. *No* meter reading may be due to an open multiplier resistor. In like manner, an open or partially shorted shunt or series resistor will result in inaccurate readings of the range in whose circuit it is connected.

Replacement resistors should be checked for overall circuit accuracy by comparing meter readings with known values or checking against a laboratory standard. (Most high schools and university physics laboratories have precision voltmeters and ammeters; it is relatively easy to have a friend or faculty member check the instrument—usually they are glad to do so as a class demonstration or project.)

Part 2 will continue our discussion of routine maintenance procedure, meter repair, vacuum-tube voltmeters, oscillographs, and other shop equipment.

THE POWER SUPPLY

by Morton Scheraga
Allan B. DuMont Labs.

This article completes the discussion of the seven sections of the television receiver. Articles to follow will cover the new circuit designs and components.

TELEVISION RECEIVERS

Television receiver power supplies are more complex than those found in the usual radio receiver, for they must supply a multiple of voltages over a wide range. For example, in one commercial receiver now on the market, 400 volts are applied to the sweep circuits; 300 volts are applied to the RF, video, and sound circuits; a negative voltage of 10 volts supplies the beam positioning circuits; and the cathode-ray tube is driven at a potential of 12,000 volts.

Usually two separate supplies are employed as the most economical means of producing these voltages. Since the picture tube requires a very high voltage at low current, one of the supplies is used to perform only this function. The maximum beam current drawn by the picture tube is about 200 microamperes. On the other hand, the sweep circuits of a magnetically deflected tube draw as much as 200 ma at around 400 volts, while the rest of the receiver usually requires an additional 100 to 150 ma at about 300 volts. These currents and voltages are, therefore, drawn from a second supply, with the various voltages tapped from a bleeder.

The type of cathode-ray tube used in the receiver will determine the operating voltages of the power supply. Present day seven-inch, direct view tubes use from 3 to 6 kv accelerating potentials. Ten-inch tubes operate at 8 to 10 kv, and the large fifteen-inch and twenty-inch tubes are driven at voltages someimes as high as 15 and 18 kv, respectively. Another factor which affects the design of the supply is the focus and deflection system. Magnetically focused and deflected tubes require large currents, whereas electrostatic-

A complete power supply for a television receiver. This supply incorporates a number of new features which will be described in a later article.

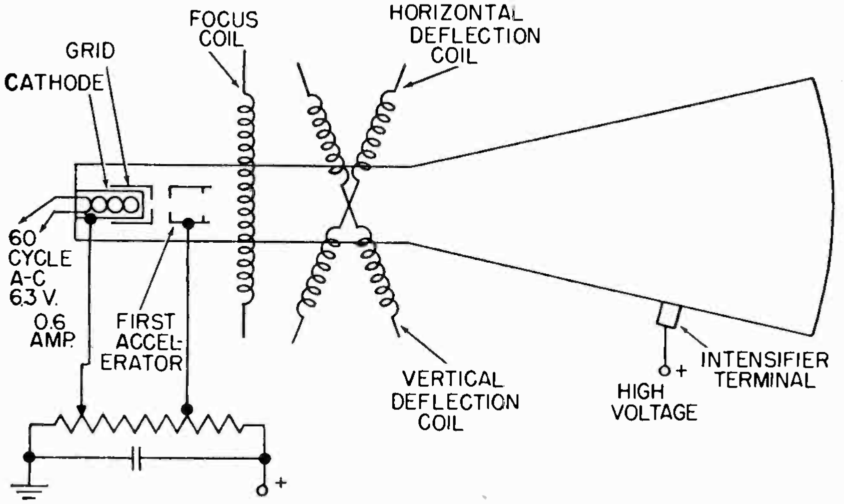


Fig. 1 The above illustration shows where the various power supply voltages are applied to a magnetically deflected and focused cathode-ray tube.

ally focused and deflected tubes operate at high voltages but low currents.

Magnetic Deflection

Let us consider first the television receiver supply designed around a magnetically deflected tube. Fig. 1 is a simplified diagram of the various voltages that control the tube's operation, while Fig. 2 shows a typical power supply in greater detail. The filament is heated from a 60 cycle low voltage source. The filament ratings in modern tubes are 6.3 volts at 600 ma. The tube shown in Fig. 1 is operated with a cathode at low potential so that the filament winding connected to it does not have to be insulated against high voltage breakdown. Sometimes, the cathode is run up to several thousand volts negative, in which case the filament winding is insulated accordingly.

It will be noted that a positive voltage is applied to the cathode. This is done in order to maintain the control grid at a negative potential with respect to the cathode, for in some circuits, the grid is directly connected to the plate of the video amplifier which is at positive potential. Thus, the cathode must be raised to a higher positive value than the grid in order to keep the latter negative with respect to ground. The cathode voltage is usually made variable to change the grid bias, and hence the beam current. This variable voltage is the *brightness control* of the receiver and is set by the user when tuning the set.

Following the grid in the order of elements in the tube is the first accelerating electrode. In magnetically deflected tubes it is operated at several hundred volts and is connected to a tap on the bleeder of the lower of the two power supplies.

The next element usually found in the gun structure is the focus electrode. However, manufacturers are now making most magnetically deflected television tubes for magnetic focusing which gives more uniform spot size and a sharper image than that obtained with electrostatic focusing. The tube in Fig. 1 lacks the focus electrode; instead, there is shown the focus coil, located over the tube neck and behind the deflection coil.

Two types of focus coils are found in receivers today: One of high resistance which draws about 30 ma, and another of low resistance requiring approximately 250 ma. In the first type, the current is low and the coil can be connected

→ To Page 22

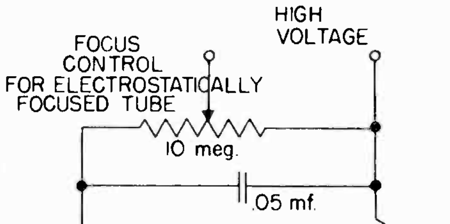
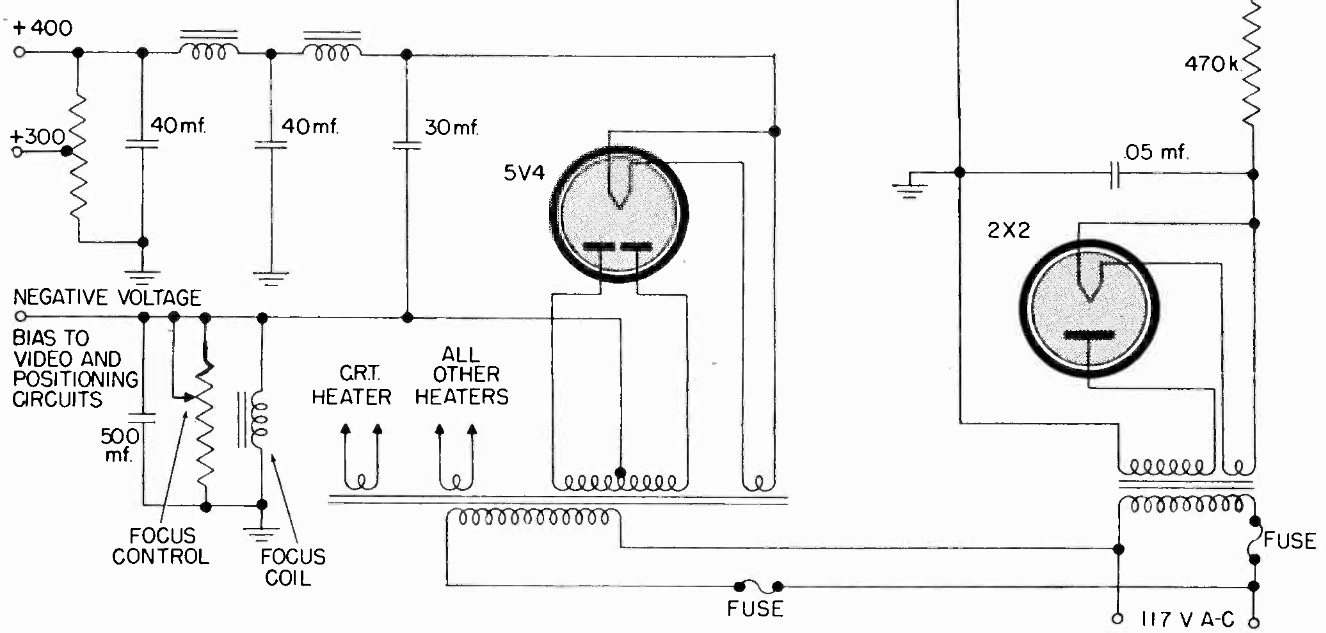
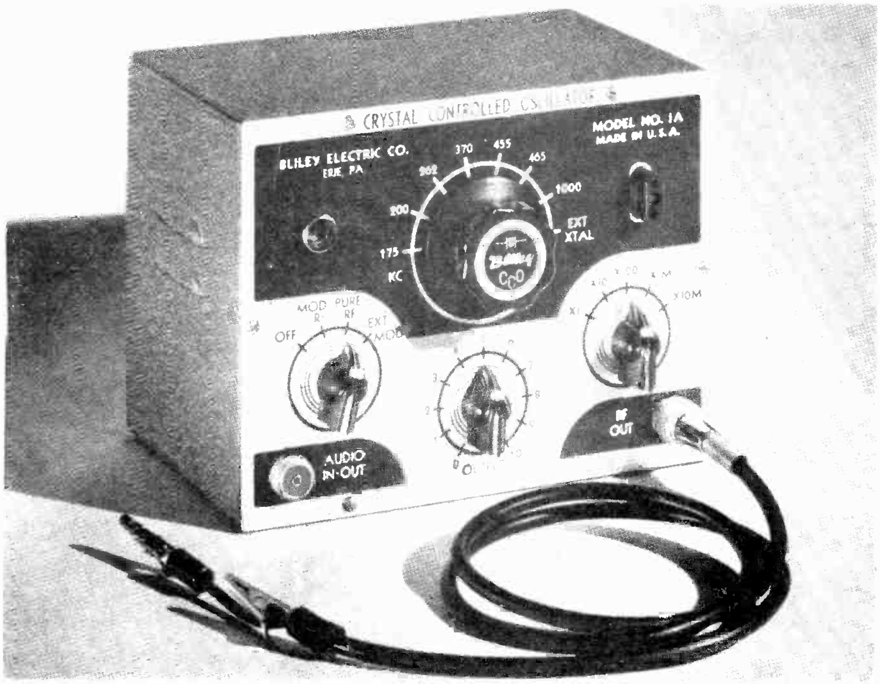



Fig. 2 A schematic diagram of a high voltage and low voltage supply for a television receiver which uses a magnetic cathode-ray tube.

Radio Maintenance is presenting a number of short articles describing various pieces of commercially available equipment. All of the units described will be put through their paces on the bench before being presented. It is hoped that the information given will prove helpful when choosing from the great variety of instruments available.



crystal controlled
SIGNAL GENERATOR

by J. R. James

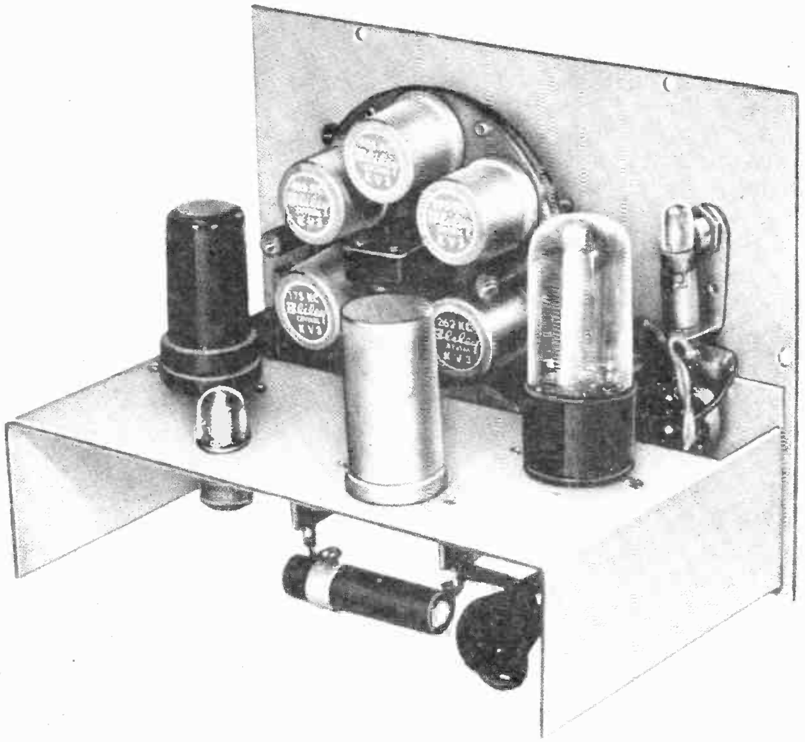


Fig. 1 The Bliley CCO with the case removed. The seven crystals are mounted around the rotary switch and held in place by the large round plate.

THE USE of a crystal controlled signal generator for alignment of receivers is becoming increasingly popular. We present the Bliley "CCO" as a good example of the several types of crystal controlled generators now available. There are two main advantages in the use of this type of equipment:

1. Instead of having to set a range switch and then carefully adjust a tuning dial to the frequency to be used, one must only turn the selector knob immediately to the desired frequency.

2. Since the frequencies are crystal controlled, they are very accurate and will remain so since such an oscillator cannot operate on any but its designated frequency.

As can be seen in the illustration, the unit is very compact. Controls and leads are all available from the front panel and calibrations are clear and distinct. The circuit is the AC-DC type; the B minus lead is kept above ground (chassis) potential, but a good RF ground is pro-

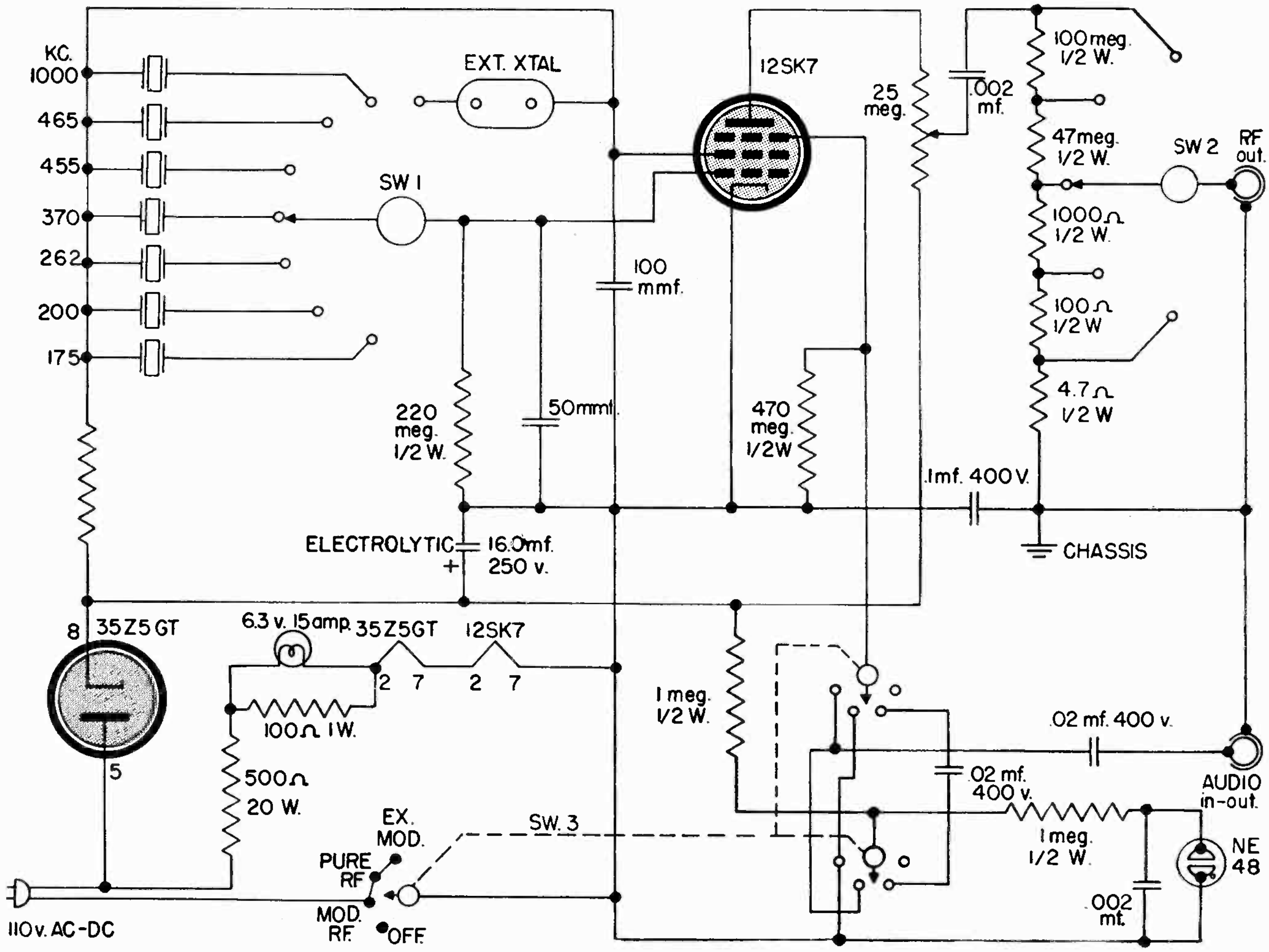


Fig. 2 Complete circuit diagram of the Bliley CCO.

vided by a 0.1 ufd condenser (C8). The chassis and cabinet are thus an effective shield and at the same time allow external grounding without danger of short circuiting the power line. A 35Z5GT tube is used for power rectification. The RF oscillator is a 12SK7 and audio modulation power is generated by means of a neon bulb. The circuit arrangement is given in Fig. 2.

A rather novel feature of this circuit is the use of a neon bulb as an audio oscillator, which provides the 400 cycle modulation voltage. The oscillator is the "Pierce" type which has the advantage of not requiring any tuned circuits. This means that frequency can be changed by simply switching from one crystal to another, and that external crystals can be used without any tuning adjustments.

Controls are as folows:

1. *Frequency Selector Knob* (center of panel). This control selects one of seven internal crystals or an external crystal.

2. *Operation Selector* (left center). This switch turns on the power and permits the selection of a pure RF signal, a 400 cycle modulated signal, or a signal modulated by an external audio signal.

3. *Attenuator* (center right). This is the decimal type of attenuator such as is usually found on signal generators.

4. *Output Control* (below Frequency Selector Knob). Provides smooth control of output voltage from zero to maximum for the particular attenuator setting being used.

As shown in the photograph, separate jacks are provided for RF and audio output signals. These are located at right and left sides respectively, near the bottom of the panel. The external crystal socket and pilot lights are located to the right and left of the frequency selector knob.

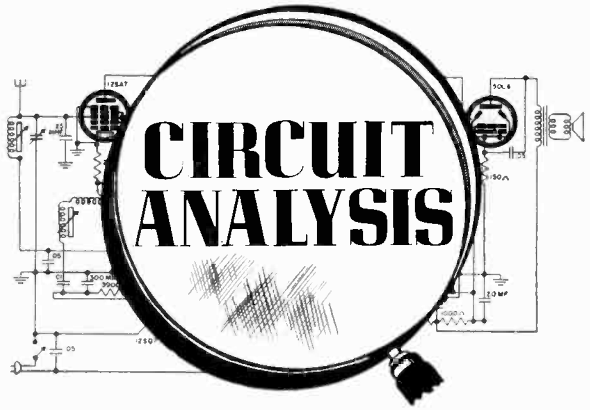
With ordinary broadcast receivers, alignment procedure is about the same as with conventional signal generators, except that harmonics of some of the crystal frequencies are used. We select the IF frequency with the knob in the center of the panel, feed the signal into the receiver in the usual way and align the IF section.

Since we now require the two tracking frequencies, 600 kc and 1400 kc, we make use of harmonics. We select the 200 kc crystal; the third harmonic will now be on 600 kc, and the seventh harmonic will appear at 1400 kc. There will, of course, be other harmonics at 800, 1000, 1200 and 1600 kilocycles. If we should have any trouble identifying these, we can select the 1000 kc crystal which has only one signal in the broadcast band. Once on 1000 kc, we can count harmonics from that point. When the set is aligned, dial readings at the harmonic points can be checked.

Short wave bands of receivers can be aligned by means of the 1000

→ To Page 33

CIRCUIT ANALYSIS



by
J. Richard Johnson

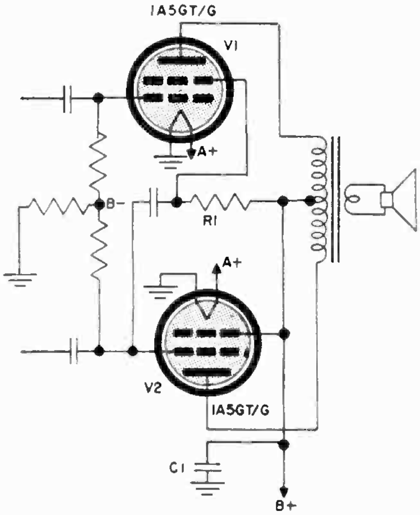


Fig. 1

Let us start this month's analysis of circuit diagrams with the Philco battery operated Model 46-132. This is a superheterodyne and uses a 1LA6 converter, ILN5 IF amplifier, 1LH4 detector AVC-AF amplifier, and two 1A5GT power output tubes. The power supplies are a 90 volt B battery and a 1.5 volt filament battery pack.

The phase inverter used in this circuit is rather unusual. Fig. 1 shows this portion of the circuit in simplified form. Notice that there is a resistor (R1) in series with the screen supply to output tube No. 1; whereas the screen of output tube No. 2 gets its DC directly from B plus. The screen of V1 is not by-passed, but decoupling condenser C1 by-passes the screen of V2. This means that the first screen has a signal voltage on it, built up across the resistor R1. This voltage is in phase with the voltage on the plate of this tube, which in turn is 180 degrees out of phase with the grid of V1. Signal voltage is coupled from this screen through C2 to the grid of V2 which is thus fed 180 degrees out of phase with the grid of V1. Phase inversion has thus taken place in the output stage itself.

Another interesting feature of this set is the tone compensator which is placed between the high side of the volume control and the grid coupling condenser as shown in Fig. 2. Condenser C3 and resistor R2 form a total impedance which varies with frequency due to the change in the reactance of C3. Since this impedance is lowest at the highest frequencies, it feeds more of the "highs" through to the grid of the first audio stage. It can be seen that this effect is greater when the volume control is in a low position since this compensator is shunted between the variable arm and the high side of the volume control.

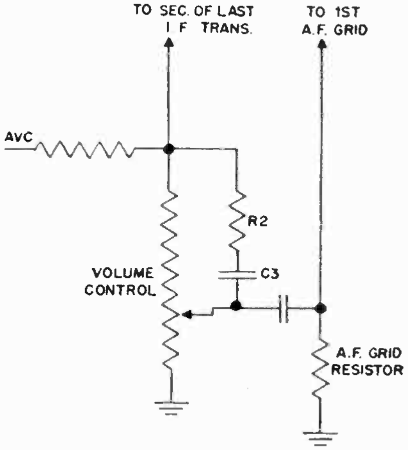


Fig. 2

The RCA Victor Model 56X is an AC-DC type of receiver with several interestingly different features. It uses six tubes of the 12 and 35 volt series; and, instead of the usual one-tube arrangement, a separate mixer and oscillator are used. The circuit for these two tubes is shown in Fig. 3. The oscillator is of the electron-coupled type usually used with a single tapped coil in which the grid, cathode, and screen are the oscillating elements and the plate is simply run at positive DC potential to maintain the electron stream in the tube. In this circuit, however, the single coil has been split up into two separate portions. The cathode returns to

→ To Page 24

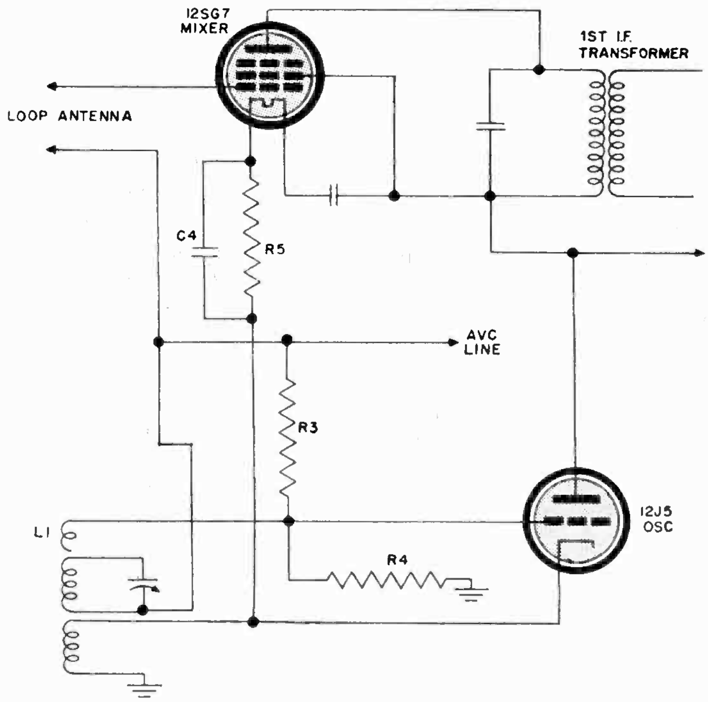
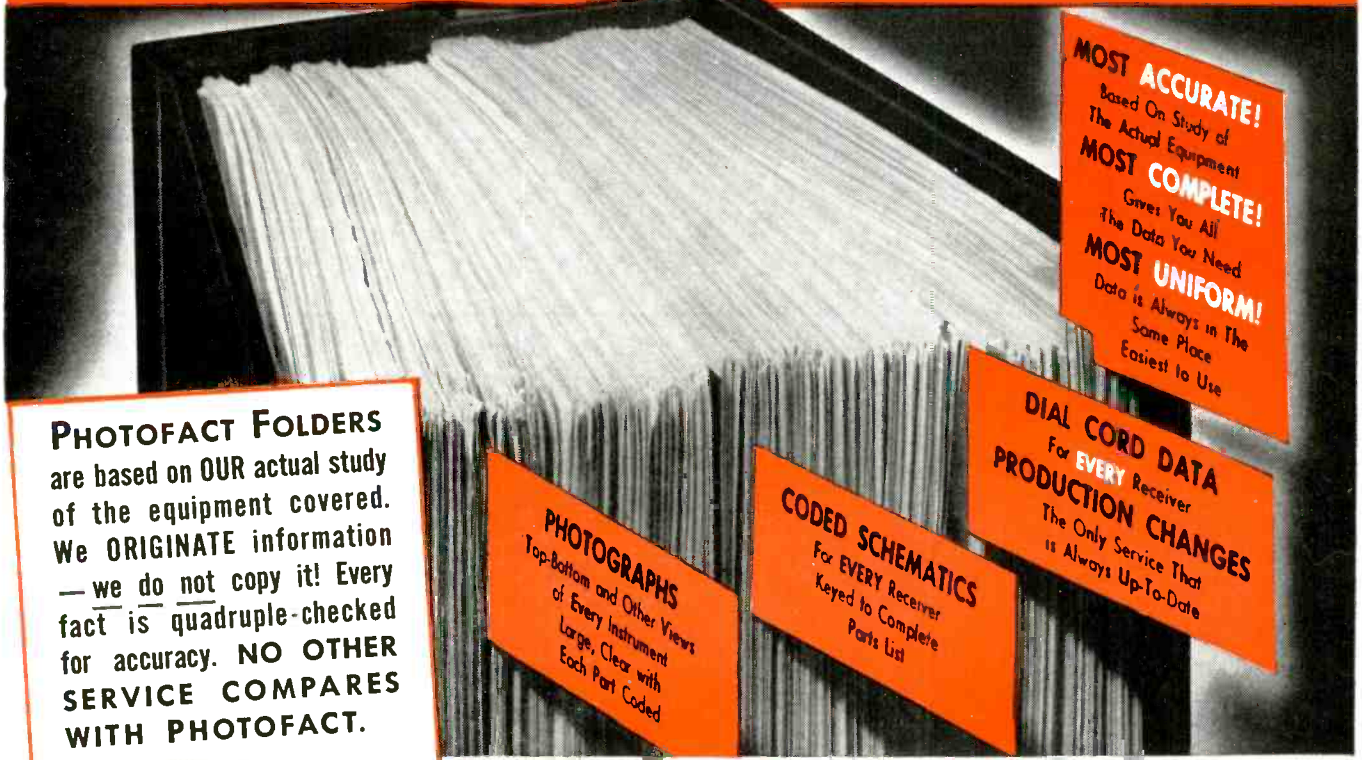
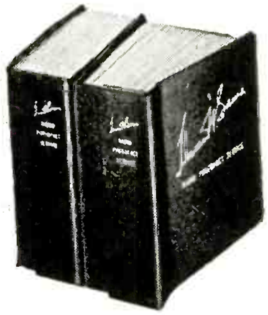


Fig. 3

NO OTHER SERVICE GIVES YOU THESE EXCLUSIVE PHOTOFACT* ADVANTAGES



PHOTOFACT FOLDERS are based on OUR actual study of the equipment covered. We ORIGINATE information — we do not copy it! Every fact is quadruple-checked for accuracy. NO OTHER SERVICE COMPARES WITH PHOTOFACT.



PHOTOFACT VOLUMES I and II

The first 20 Sets of PHOTOFACT Folders are now available in Two Volumes—Think of it! Almost 3800 pages, covering approximately 1800 NEW 1946 & 1947 Models and Chassis designations—Yours for only $18.39 each. If you prefer drawer filing, order any or all of the 20 individual sets of folders @ $1.50 per set—Less than two cents a model.

HOWARD W. SAMS & CO., INC.
Indianapolis 6, Indiana
My (check) (Money order) is enclosed.
Send Vol. I ( ) Vol. II ( )
Set No. ( )

Name____________________

Address____________________

City____________ State____________

COMPARE BEFORE YOU BUY

Ask to see PHOTOFACT VOLUMES I and II the next time you visit your parts distributor. Look through the books. Notice these Points: The same complete data always in the same easy-to-find-location! The schematic and pictorial diagrams for every Post War set—BIG, CLEAR, ACCURATE PICTURES—Each with its simple coding system keyed for instant reference to complete parts lists for every instrument! The full alignment and circuit data! The disassembly instructions! The Dial Cord Drawings. And, even RECORD CHANGERS are completely diagrammed.

Now put any other service beside PHOTOFACT and compare—That's all we ask. Use PHOTOFACTS once—You'll use them forever.

YOU'LL WANT PHOTOFACT

Individual PHOTOFACT Folder Set #20 available June 15 at the same low cost of $1.50. Order PHOTOFACT Volumes I and II or the individual sets of Folders from your distributor, OR directly from us.

ASK THE MAN THAT USES PHOTOFACTS

HOWARD W. SAMS & CO., INC.
INDIANAPOLIS 6, INDIANA

Export — Ad. Auriema — 89 Broad St., New York 4, N. Y. — U. S. of America
Canada — A. C. Simmonds & Sons, 301 King St. East — Toronto, Ontario

PHOTOFACT SERVICE

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

the Organizations

In the last few years, there has been a marked increase in organizational activity in the trade. Feeling that the reader would like to know more about the organizations and their activities, Radio Maintenance is inaugurating this column containing correspondence received from servicemen's organizations. If you are a member of an organization, we would like to hear about the activities of your group.

G. G. Costantino, Secretary of the **Rhode Island Radiomen's Business Association,** gives us the following information about the activities of his organization:

"On March 24th, the first major lecture in the series being sponsored by the R.I.R.B.A. was given by Mr. Leon Rensicow, Chief Engineer of the Electronic Instrument Co., whose subject was 'Signal Tracing.' The lecture and demonstration were very interesting to the many assembled. The sponsor was the Wm. Dandreta Co.

"On April 28th, Mr. Freeman Spindell, Chief Engineer of the Browning Laboratories, lectured on FM and demonstrated the Browning tuner before a gathering of 150 technicians. Mr. Spindell covered the subject so completely and answered questions so intelligently that he won the admiration and respect of all present to such an extent that we want him back for a repeat performance on some other subject. The sponsor for this lecture was the DeMambro Radio Supply Co.

"New officers were elected on April 14th and the installation will take place at a dinner dance on May 12th."

G. G. Costantino,
Secretary

We are happy to report the following information about the **Associated Radio Technicians of British Columbia, Canada.**

"The Vancouver Associated Radio Technicians of B. C. held their annual meeting in the genial surroundings of the Piccadilly Cafe on April 9th, with President Wilf Munton in the chair. A good majority of the members were present.

"After a most appetizing meal, served by the charming hostesses, all made themselves comfortable by loosening their belts and leaning back to listen to a very informative address by Mr. Dick Diespecker, radio commentator of station C.J.O.R., on the non-technical aspects of radio broadcasting. In his opening remarks he expressed the opinion, based on his associations with the species, that it was *not* necessary to be slightly 'off the beam' to be a radio technician, as is so often stated; but that it *did* require a lot of hard work with long hours—everyone silently agreed.

"In describing some of the difficulties encountered in putting on a radio program, Mr. Diespecker referred to the book 'The Hucksters' but said that fortunately there were not many sponsors of this type.

"He stressed the important part radio technicians can play in fostering public acceptance of and demand for cultural and educational programs, but that at present they had the lowest sponsor rating; however, if the listening audience were large enough, and made their desire for the more educational programs known in the proper places, this would be partly overcome.

"Following Mr. Diespecker's address, the regular business of the meeting commenced; the minutes of the previous meeting were read and adopted, followed by the nominations for the slate of candidates: Al Johns was elected president to spark the association activities for the next year: Fred Stucky, vice pres.; Barney Jensen, sec.; Monty Lennox, treas.; Ed. Mullen, recording sec.; the remaining 5 nominations on the slate, John Haldom, Cyril Helliar, Bill Brakes, Jim Baird and Sam Beyer, were automatically considered chairmen of the various committees.

"Many prizes were drawn for during the evening. We thank the many generous jobbers who donated them.

"Two A.R.T. members from distant points were introduced, C. L. Mathews of Rosedale and John Pearson, Past President Victoria Branch.

"Before handing the gavel to his successor, retiring president Wilf Munton spoke briefly on the accomplishments and activities of the past year as well as pointing to some of the unfinished business for the newly elected officers to begin their labors. The meeting adjourned after a few well chosen words by President Al Johns."

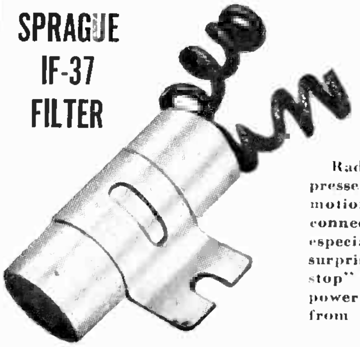
Sam Beyer, Publicity
Associated Radio
Technicians of B. C.

"At the regular monthly meeting of the **Associated Radio Service Men of Central Pennsylvania** on Tuesday, May 6th, in the Brown Library in Williamsport, Pa., the guest speaker was Mr. Fred L. Bartley, Field Service Supervisor of the Radio Div. of Westinghouse in Sunbury, Pa. He prefaced his talk with some pertinent remarks on associations.

'I like associations such as yours. For one thing, they're indicative of a healthy growth, a desire to pitch

→ To Page 32

SPRAGUE TRADING POST



STOP RADIO NOISES FROM FLUORESCENT LAMPS!

Radio noises caused by fluorescent lamps CAN be suppressed—easily, quickly and effectively. No lost time or motion. Just install a Sprague IF-37 Filter on each fixture, connecting it directly across the incoming leads. IF-37's are especially designed for the job—and you'll be pleasantly surprised how effective they are in suppressing "hard-to-stop" interference that is so often conducted down the power lines, even to remotely located receivers. Buy them from your nearest Sprague jobber today.

WRITE for a copy of the complete 40 page Sprague Catalog of capacitors, resistors, interference filters & test equipment.

SWAP - BUY - SELL

FOR SALE—Radio and appliance store, service shop. Near large hydro-electric project—only shop of its kind in town. Large rural trade. Bldg. leased for 3 yrs. Selling because of bad health. F. Ferrell, Jamestown, Ky.

FOR SALE—Rider manuals 1, 3, 4, 6, 12; Crosley service manual. Both brand new. Weston 770 tube tester with case. $50 takes all. J. M. McDermott, 177 Amabell St., Pittsburgh 11, Pa.

SELL OR SWAP—1000 condensers all new: 20/20 at 150 V; .05 at 600 V; .005 at 600 V; 250 tubes all tested perfect; Weston multi-meter, $15; Supreme tube tester, $10; G.E. 12" spkr. Sam's Radio Shop, 348 Warren St., Hudson, N. Y.

SELL OR SWAP—Tubes in sealed cartons, one each: 1A6; 6AE6/G; 6C6; 6J7; 6F8/G; 6R7/G; 6SS7; 7A7; 7C5; 12SJ7/G; 12SL7/GT; 12Z3; 25C6/G; 34; 37; 38; 39/44; 41; 76. Need one: 1A7/GT; 1A5; 3Q5; 6X5/GT; 35Z4; 35Z5; 30; 43; 45. D. H. Howy, 921 Cleveland Ave., Hobart, Ind.

FOR SALE—RCA 10-T all-wave receiver, 5-200 mtrs, 6 bands, i.f. b.f.o., stand-by switch, iron core coils, elec. eye, black crackle box, cabinet, with speaker. Complete $110. Astatic D104 mike $15; Weston 682 tube tester $15. Others. All cash f.o.b. A. R. Dayes, 29 Charles St., Merrick, N. Y.

FOR SALE—Lab. type resistance bridge, $85; also Siemens Megger, $50. Cash or will trade for good communications receiver. E. Stoffer, 428 E. 46th St., Brooklyn 3, N. Y.

FOR SALE—Jackson 660 dynamic sig. analyzer, new condition, $65; 634 counter tube checker, good, $35; Triplett 1213 tube checker, good, $18; 450-500 used tubes, all types, good to perfect, $45. Home Appliance Co., 215 S. Market St., Galion, Ohio.

WANTED—All kinds of late model used auto radios. Send full description and price. Edgar Joe, Box 709, Cleveland, Miss.

FOR SALE—Radio tubes 50% off list. All fast moving and saleable. Radio manuals; parts from cond. to vibrators. Priced right. Prefer to sell all to one individual—cash only. Cox Radio Service, Box 341, Anson, Texas.

FOR SALE—Kennedy table model radio 63-A, good condition, plays well, $10; Zenith radionic hearing aid B-3-A, bone conduction, coral color, excellent condition. Complete with batteries, $50. Paul R. Wells, Box 22, Gilbertsville, Ky.

WANTED — Following tubes: 25AC5; 1SB6/GT; 1SA6; 6E6; 6AD6; 6T5; 485; 182B; Nassau Radio Co., 25 Church St., Baldwin, L. I., N. Y.

WANTED—These books by Rider: Radio Service Quest. & Answers Vol. 2; Servicing Auto Radio Rec.; Vibrator pwr. Supplies; Math. of Radio; Practical Test. Systems. Paul Capito, 637 W. 21st St., Erie, Pa.

WANTED—Supreme 563 beat freq. audio osc., new condition. Will trade for all-wave sig. gen., or late model trouble tester. J. A. Thornton, 916 Dora Highway, Pulaski, Va.

SELL OR SWAP—Vibroplex professional speed bug, original cost $17.50. Want a good steel pistol grip casting rod and level winding casting reel. A. Diedricksen, 11 Vine St., New Britain, Conn.

TRADE—BC-223 transmitter, 75 watts phone, 80 c.w. with a-c power supply and BC-284 mobile 75-80 mtrs. on BC-610E or commercial transmitter. Sell CB-160 capacity analyzer, $29; multi-meter, $15; late NRI radio course, complete $100. Want good camera, Rider manuals. K. H. Stello, 12126 Peoria St., Roscoe, Calif.

WANTED—Class B driver transformer for pair 2A3's to pair 811 mod's. Pri. 5000 ohms, step-down ratio 5-6 to 1. (Pri. to ½ sec.) Write first. James E. Grall, Mesa, P.O. Box 223, Arizona.

SELL OR SWAP—1 kw. x'mitter uses pair 806's final, pair 822 modulator. Rack, panel job complete with ECO. Complete for quick sale $700 f.o.b. or swap for sound movie equipment. C. B. Jones, 128 George St., Findlay, Ohio.

SELL OR SWAP — 600 V. 200 ma. power supply and 6L6 80-40 mtr. c.w. x'mitter, 250 V. power supply on separate chassis. Want FB-7; SW-3; S-41 or similar receiver covering 10 mtrs. W4KFL, 690 Courtenay Drive, N.E., Atlanta, Ga.

WANTED—32 V. d-c to 110 V. a-c inverter; also 32 and 6V. battery charging generators. Harry Matzke, New Auburn, Wisc.

WANTED—Receiver EC-1A. Will answer all letters. Stathis Linardos, 190 Wadsworth Ave., New York 33, N. Y.

FOR SALE—BC-406A receiver and chart for conversion to 10 mtr. band. $25 f.o.b. F. W. Mulvey, 15 Valley Place North, New Haven 15, Conn.

FOR SALE—Vacuum condensers 6-12-50 mmfd; 50 6A8/GT tubes new; offer 5" 5BP1 green-screen 'scope tube; 5 vol. QST bound and indexed '31-'35. R. Schlimpf, 6510 Fairfield Ave., Berwyn, Ill.

FOR SALE—Triplett tube checker 1213, checks tubes 1.4 V to 110 V, except latest such as 6AT6, 12AB6, 35M4, etc., $22.50 cash. Shinberg Radio, 2902 Georgia Ave., N.W., Washington, D. C.

SELL OR SWAP—Need late model sig. gen. Offer these books: Sprayberry radio course complete, includes FM, TV. Set is bound in 3 vols. with hard covers; also Ghirardi's Modern Radio Servicing; and Troubleshooter's Handbook. J. S. Osterfield, 26 Grant St., E. Lynn, Mass.

WANTED—Power transformer for RCA-52, 245 amplifier. For sale: Supreme 541 3" 'scope; Supreme 561 oscillator. Morton Radio, 216 St. Louis St., Edwardsville, Ill.

FOR SALE — Hallicrafters: BC-610E x'mitter; BC-614E speech amplifier; S-20R receiver and S meter; Turner xtal mike. Good condition, all for $580 plus freight. S. E. Dunkley, 100 Ingleside, Jackson, Tenn.

SELL OR SWAP—Hallicrafters S-40 receiver, used 2 wks; Weston 662 sig. gen., range 100-3200 kc. Want Hallicrafters S-39 receiver or sell the lot for $100 cash. B. Snyder, 688 Davenport St., Meadville, Pa.

FOR SALE—New Motorola 1000 hr. battery radios in sealed cartons, can supply converter for a-c operation; also radios for any car; want Remington 12 ga. shotgun and 22 cal. repeater. John Repa Jr., Main St., Richlandtown, Pa.

YOUR OWN AD RUN HERE FREE

The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less. Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns or for the resulting transactions.

Send your ad to Dept. RM-67
SPRAGUE PRODUCTS COMPANY
North Adams, Mass.

(Jobbing distributing organization for products of the Sprague Electric Co.)

FOR SALE—Tubes 50-80% off: 1LA6; 1A7; 2A6; 1D8; 7A8; 7C5; 7B8; 1LE3; 35A5; 32L7; 25Z5; 25L6; 50Y6; 50A5; 43; 47; 57; 58; 117L7-M7-N7-P7-Z3; brand new, all types fully guaranteed—popular brands. Write for list. Commercial Radio, 36 Brattle St., Boston 8, Mass.

FOR SALE—Precision E-200 oscillator, $50; Hickok tester 510X, $40; Philco 050 tube checker, 1940 model, $25; Traveler battery radio, $11. What do you need? Chas. Ackenback, 136 E. Main, Amsterdam, N. Y.

FOR SALE—Single record player with beautiful brown portable case, $25; Philco 60 radio, $14; Vol. 1, Photo-fact folders, $18.50 with binder; Radio servicing course, $2.50. Dan & Ted's Radio Shop, 4355 S. Honore, Chicago 9, Ill.

FOR SALE—Vomax 900 tester, perfect condition; RCP 805 tube & set tester. Both for $95. Chas. S. Alexander, 209 Howard St., New London, Conn.

WANTED—Tube tester in good condition for 25-cycle operation. M. Evans, 323½ Cameron Ave., Windsor, Ont., Canada.

FOR SALE—Going out of business due to illness. Large quantity of first class radio merchandise at below wholesale cost. Send for list. Slim's Radio & Television Lab., 51 Broome St., Brooklyn 22, N. Y.

FOR SALE—Tube, standard brands 40% off list: 50Y6 35A5; 50L6; 35Z5; 117L7; 117P7; 1LE3; 1LA6; 1D8; 3A8 and many others; New Shure glider pick-up arms $2.65 ea. Radio & Electric Service Co., 1808 E. Brambleton Ave., Norfolk 4, Va.

WANTED—Good used oscilloscope and vacuum tube voltmeter capable of measuring a.f.—r.f.—and f.m.; also want a good sig. gen. for frequencies in a.m. and f.m. L. Raasch, Pinehurst, Janesville, Wisc.

TRADE—Readrite radio analyzer; Superior signal tracer; Vacuum tube voltmeter combined; 144 mc. x'mitter and radio receiver, new model BN-11FF. List for your list. Want recorder; 16mm movie projector; or what do you have? John Arnold, P.O. Box 84, Bluffs, Ill.

SELL OR SWAP—Large supply of 6Z5 tubes; one 814; Weston Mod. meter; 58AS; 53; 12 59's. Want large P.M. spkrs., mikes, x'formers, etc., what do you have? P. M. Powell, 3132 Rhodes Ave., Chicago 16, Ill.

FOR SALE—Supreme 599 tube and set tester with rollchart and test leads, $60; Precision 200 signal tracer, $30; both like new, used 1 month. David Cardinali, Box 105, Cortland, Ill.

WANTED—Will buy any or all volumes, Rider manuals. C. H. McGarrity, 2 Chadwick Rd., Windermere, Charleston, S. C.

FOR SALE—Radio City Prod. Co., 307 tube tester $15; Supreme 543-S multimeter, $15. Both in very good condition. H. W. Gehring Jr., 2916 Federal St., El Paso, Texas.

ASK FOR SPRAGUE CAPACITORS and *KOOLOHM RESISTORS by *name!*

*Trademark Reg. U. S. Pat. Off.

THE INDUSTRY PRESENTS

NEW DOUBLE TRIODES

Two new double triodes providing single-ended operation for cascade amplifiers at frequencies up to 400 mc have been announced by Sylvania Electric Products Inc., New York City. The high mutual conductance tubes have independent elements with the exception of heaters, permitting a saving in space and number of tubes required. Circuit applications include grounded grid, cathode follower and push-pull amplifiers and converters in the new FM and television bands where low equivalent noise resistance obtained with triode converters is desirable.

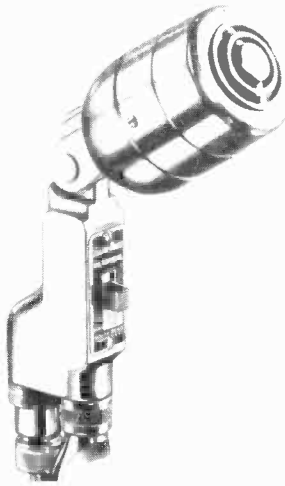
The tubes are supplied with lock-in RMA basing 8BW-L-O and measure 2-9/32" overall, a seated height of 1¾". They may be mounted in any position.

RUST-REMOVER

CorOdex, a liquid rust remover produced by Allied Products Company, is claimed to be amazingly effective on any metal surface and to remove even the thickest coat of rust without causing any structural changes in the metal. It requires no rubbing and is non-inflammable. A copy of the rust control manual, prepared by Allied, may be secured by writing Allied Products Company, Dept. R186, 1133 W. Newport St., Chicago 13, Ill.

NEW INTERCOM SYSTEM

RCA's first postwar intercommunication system, with speaker stations as small as an ordinary desk clock, has been announced by the RCA Sound Equipment Section. The reduced speaker station size is possible in this two-station intercom since the amplifier and speaker station are separate units, permitting off-the-desk location of the amplifier. Conversation at normal voice level requires only a flick of the two-position switch. Releasing the switch returns it to "listen" position. This intercom is easily installed and plugs into any 110 volt AC or DC outlet. Additional stations up to five can be connected to the amplifier.



DYNAMIC MICROPHONE

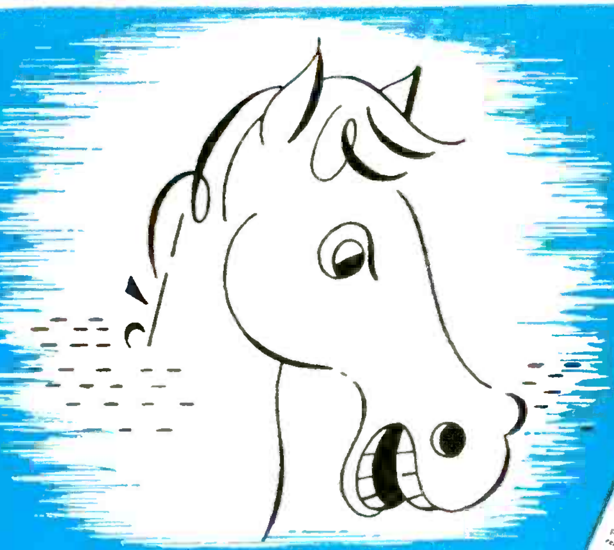
With the new Acoustalloy Diaphragm, the Electro-Voice Model 630 dynamic microphone now provides high fidelity pick-up and reproduction, and is suitable for a great variety of applications. Frequency response is substantially flat, 40—9000 cps. It withstands high humidity, extremes of temperature and severe mechanical shocks, hence is especially rugged for indoor and outdoor use. Built-in cable connector permits vertical tilting of microphone head in a 90° arc. For complete information, write for Catalog No. 101 to Electro-Voice, Inc., Buchanan, Michigan.

NEW VTVM

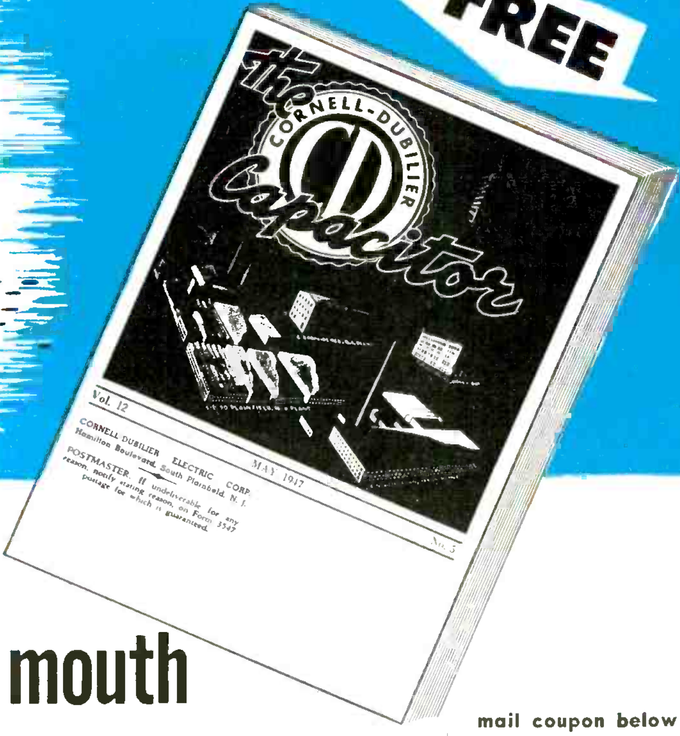
Model 210 Vacuum Tube Voltmeter and Visual Signal Tracer, manufactured by the Electronic Instrument Company, Inc., has broad ranges which permit its use on AM, FM and television receivers. DC readings up to 5000 v. are made with a single specially designed high voltage test probe. Four simple linear scales and two colors provide for easy, accurate reading. All multiplier resistors are matched to 1% accuracy, giving a maximum error of 2% on both AC and DC voltage ranges. The instrument has 29 separate ranges for AC, DC resistance and decibel readings. A new type of UHF diode is used for AC rectification and is designed for visual signal tracing on all frequencies from 20 cycles to 100 mc.

Complete information may be obtained

→ To Page 35



FREE



tips right out of the horse's mouth

mail coupon below for your free subscription to the C-D capacitor

The editor of "The Capacitor" probably won't like being referred to as a "horse's mouth." However, that's only our way of "plugging" the scores of hot ideas for servicemen that he includes in every issue of "The Capacitor."

Here's a magazine that's published for servicemen only. Every month it is *loaded* with ideas for speeding up service procedures — for increasing store traffic — for adding new dollars to your income. Its convenient, pocket-size pages contain valuable technical data — information on the new type tubes — notes on trouble shooting. Yes, and also dozens of helpful hints that will help you to repair any radio ever made, easier, better and twice as fast.

Accept "The Capacitor" with C-D's compliments. Put it to work in your shop speeding up repair jobs — building bigger profits. *Don't wait! Mail coupon below NOW, so your FREE subscription will start at once! Cornell-Dubilier Electric Corp., Dept. T-6, South Plainfield, New Jersey.*

TITLES OF ARTICLES IN RECENT ISSUES — These articles are typical of the ones you'll find in "The Capacitor" *every month: How to Use Audio Oscillator and Signal Generator to Simplify Tests — New Requirements of FM and Television Servicing — Hum Elimination — Aligning Superhets.* Think how such articles will help *you* — mail coupon NOW.

FINDS "THE CAPACITOR" OF GREAT INTEREST — Washington, D. C. service shop owner writes, *"I wish to thank you for mailing me 'The Capacitor.'* The special items are of particular interest because of their easy reading and their simplification of complex circuits."

FREE ADS FOR SERVICEMEN — Yes, that's right — your ad will be run absolutely free in The Trading Post which appears in all issues of "The Capacitor." Use this service to buy that new tester you've been wanting — to sell that spare 'scope — or to work out a swap with other servicemen.

MICA
DYKANOL
PAPER
ELECTROLYTIC

1910 CORNELL-DUBILIER CD CAPACITORS 1947

CORNELL-DUBILIER
WORLD'S LARGEST MANUFACTURER OF
CAPACITORS

CLIP THIS COUPON—MAIL AT ONCE

Cornell-Dubilier Electric Corporation Dept. T-6
South Plainfield, New Jersey

Please start my FREE subscription to *"The Capacitor"* at once.

Name ....

Address ....

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

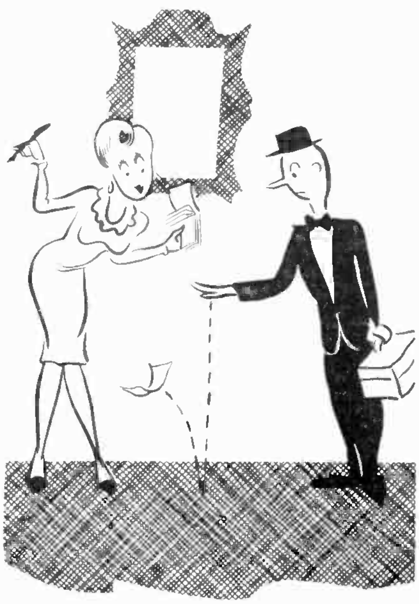
When the Customer *isn't* Right!

→ From Page 5

perienced person has been attempting repairs, the Houston Radio Service of Houston, Texas, immediately advises the customer. Their representative informs the customer that repairs will probably cost him an additional ten to twenty per cent in replacement parts and labor. He further points out that with television receivers coming, extremely high voltages will be present in radios and the owner who attempts self-service is very apt to be severely injured. By notifying the customer immediately upon discovering that the set has been tampered with, charges for the extra work caused by the customer's tinkering will be accepted without question.

If a comparatively unknown customer attempts to pay for service activities with a personal check, how should the serviceman proceed?

Answer: The Peerless Radio Service of Jacksonville, Florida, instructs its representatives to have all personal checks made out to *cash* rather than to the service firm. The representative then cashes the check for the customer and the customer, in turn, pays for the service charges. Although this procedure is somewhat involved, it is safer since checks made out to cash are usually collectible with the aid of the law, while checks made out to the service firm which will not clear through the banks must be handled through time-consuming collection methods.



What is the most effective method of turning a transient customer into a constant one?

Answer: The Thomas Ayer Radio Service of Albuquerque, New Mexico, has its representatives mark the date of service and also the date ninety days from the date of the service transaction on the top of each duplicate service invoice. The invoices are inspected daily and the customers are called after ninety days and reminded that "quarterly radio inspections save the radio owner a conservative fifteen per cent on yearly service bills."

The Richard Budlong Radio Service of Detroit, Michigan, advises its customers to "see your

dentist twice yearly, your doctor thrice yearly, and your radio serviceman quarterly." They have also found it profitable to have their representatives suggest a quarterly checkup in ninety days at the climax of a service transaction. More often than not, according to this firm, the set owner agrees.

Another effective method is to send promotion postcards to all customers every ninety days, suggesting that they have their sets checked over and tuned up for top performance.

What is the best way to justify delivery and pickup charges, or increased charges for home service?

Answer: The Mount Rainier Radio Service of Tacoma, Washington, reports that it charges a flat fifty cent pickup or seventy-five cent delivery and pickup fee over and above in-

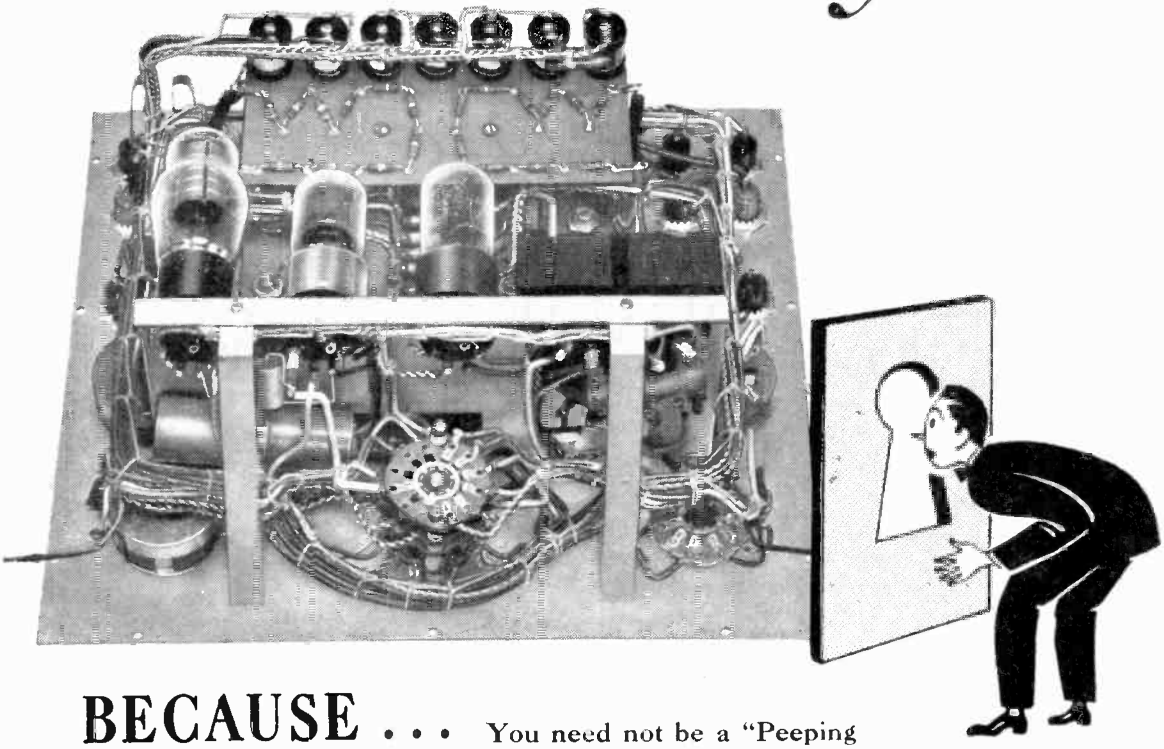
voice billing. Their representatives explain to the customer that the cost of delivery truck maintenance and time consumed traveling to and from the shop are barely covered by the charge. This firm charges a flat one dollar service fee over and above invoice billings on home service transactions and explains to its customers that the dollar reflects the time spent traveling to and from the radio owner's home.

What is the best thing to do when several days after a service call has been made, a customer requests a follow up call and refuses to pay for it?

Answer: Troubles of this type should be anticipated before they take place. The John H. Raglan Radio Service of San Antonio, Texas, presents its customers with a detailed service invoice at the conclusion of every transaction. The invoice lists all repairs made, components installed, and the reason the set was inoperative. Raglan, when making his second call, determines whether or not the trouble is in any way due to components or repairs made on the initial call. If it is, no charge is made. If the trouble is totally unconnected with the first inspection, regular labor and component charges are made. If the customer knows what was wrong with his radio the first time and a

→ To Page 28

No Privacy!!



BECAUSE . . . You need not be a "Peeping Tom" to discover the Inside Story of Precision Test Equipment: Standard of Accuracy, Workmanship and Performance for more than a decade. Look *BEHIND* the panel . . . it speaks for itself!

Here are only some of the "INSIDE" facts:

★ Designed and produced by an organization 100% devoted to the development of better test and measuring instruments

★ Concentration of purpose and engineering effort directed toward only one goal . . . Fine Test Equipment as is actually required for modern radio – electronic service and maintenance

★ Results: Quality – Performance – Accuracy – Ruggedness – Economy

- 1% wirewound shunt resistors and matched metallized multipliers combined with 2% D'Arsonval type meter movements
- Silver plated, double-wiping positive switching contacts
- Plastic insulated hook-up wire in telephone-type cabled harnesses. Affords service under extremes of climatic conditions.
- Permanently etched and/or anodized aluminum panels that cannot rust or obliterate by peeling
- All instruments Guaranteed for One Full Year against inherent mechanical and/or electrical defects.

Ask *to see the "Precision" line of Quality Test Instruments on display at all leading radio parts and equipment distributors.*

Write *for latest bulletin.*

PRECISION TEST EQUIPMENT
Standard of Accuracy

PRECISION
APPARATUS COMPANY INC.
92-27 HORACE HARDING BOULEVARD
ELMHURST 5, NEW YORK

MANUFACTURERS OF FINE RADIO AND ELECTRICAL TEST EQUIPMENT

The Power Supply

→ From Page 11

directly across the lower voltage power supply. If the second type were shunted across the supply, the current drain would be excessive and needlessly increase the size of the power supply. In practice, the coil is placed in series with the filter network in much the same manner as is the field coil of a speaker in conventional radio receivers. Another point in the circuit for the focus coil is the negative or ground return of the power supply. In Fig. 2, the focus coil is connected in this manner. A rheostat is placed in parallel with the coil to vary the amount of focus current. This variable resistor is the *focus control* found generally on the front of the receiver.

If the tube is electrostatically focused, this electrode is operated at about 1200 volts. The focus electrode is negligible so that the voltage is tapped from the high voltage supply bleeder. The focus voltage can be varied with a potentiometer in series with the bleeder as shown in Fig. 2.

The intensifier voltage is generated by the high voltage supply which consists of a high voltage transformer, a half-wave rectifier, and 60 cycle filter. Full-wave high voltage rectifier are seldom found in television receivers because of the added expense and increased size of a transformer with twice as many turns. Besides, the very low current drain permits the design of filters for 60 cycle ripple to be just as inexpensive as those for the 120 cycles produced with full-wave rectification. Except for the higher ratings of the components, the supply is conventional. (See Fig. 2.) Ordinary 5 volt rectifier tubes cannot withstand the high inverse peak voltages; instead, tubes like the 2X2, 2V3, and 8013 are used.

In addition to providing the proper voltages to the picture tube, the power supplies must perform several other functions. The positive voltages for the plates of the RF, video, and audio tubes are generally operated from a 300—350 volt supply. This power is taken from the low voltage, high current supply. The sweep circuits can be operated at the same voltages, but usually a higher B voltage is desirable to be able to obtain ample deflection amplitude on the new 50 degree wide angle tubes. The higher voltage is tapped across the full bleeder.

There may also be needed a source of low negative voltages, as for example a variable grid bias (for contrast control) in the video amplifier. The vertical and horizontal positioning circuits also need about 5 to 10 volts of negative bias. A simple means of developing this negative voltage without resorting to an extra winding on the power transformer and a separate rectifier is shown in Fig. 2. Instead of the center tap of the secondary of the power transformer being directly grounded, it is grounded through the focus coil (or a resistor). Thus, the entire receiver current flows through the coil, furnishing it with the necessary current. At the same time, a negative voltage is developed at the tap, equal to the potential drop across the focus coil (the receiver current multiplied by the resistance of the coil).

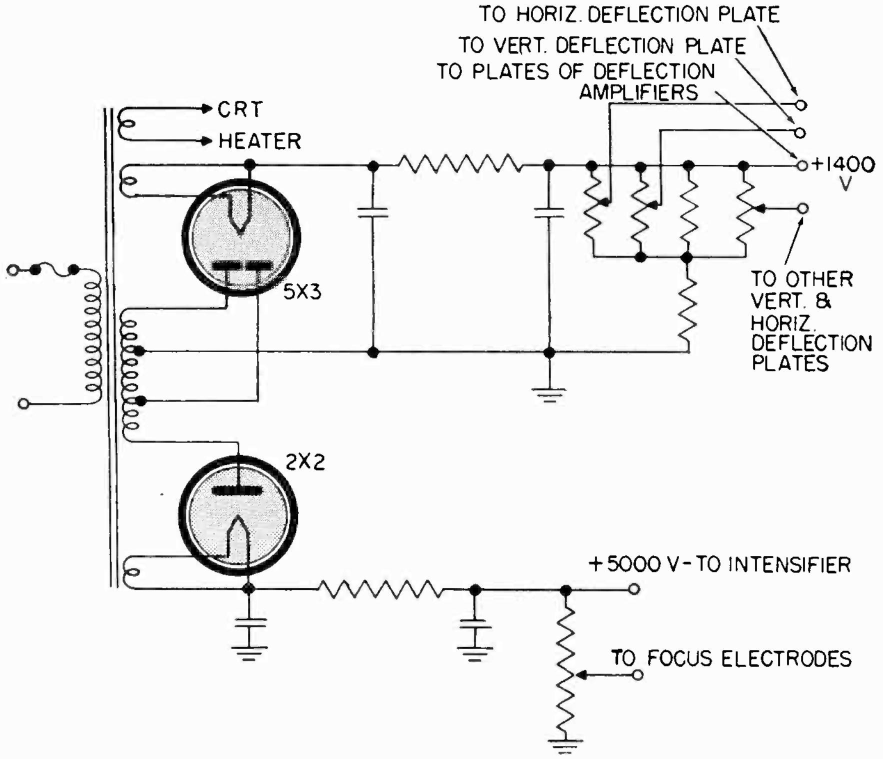


Fig. 3 A circuit diagram of a high voltage and low voltage power supply for a television receiver using an electrostatically focused and deflected tube.

Electrostatic Deflection

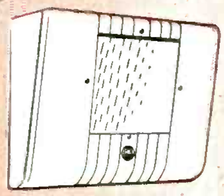
The power supply required for receivers with electrostatically deflected tubes has several variations from those discussed above. The low voltage supply is the same for the RF, video, and sound circuits. But now the sweep amplifiers require high plate voltages rather than high currents in order to be able to deflect the plates of the cathode-ray tube. This reduces the current required from the low voltage supply, but another higher voltage winding and rectifier must be added for the sweep circuits. For example, a 12-inch electrostatically deflected tube, operating with an intensifier voltage of 5000 volts, requires about 1400 volts peak-to-peak sawtooth voltage to deflect the beam. The sweep amplifier plate must then have a B voltage of at least 1400 volts. Fig. 3 shows the power supply circuit used with electrostatically deflected tubes.

Electrostatically deflected television tubes are all electrostatically focused. The focus electrode voltage is obtained from a tap on the high voltage supply as discussed previously.

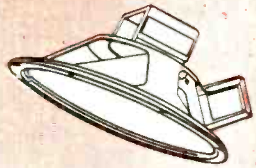
Whereas positioning is accomplished in magnetic deflection by varying the DC current in the deflection coil, electrostatic deflection requires a variable DC voltage on the plates. The deflection plates and centering controls must be at a potential near that of the second anode. Otherwise any large difference in voltage between the plates

→ To Page 26

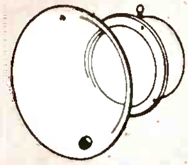
3½-foot
Re-Entrant Trumpet



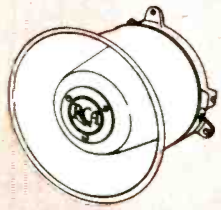
Molded Speaker Housings



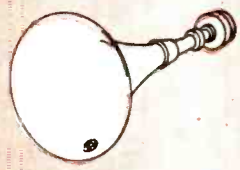
Alnico 5 PA Speakers



Directional Sound Projectors for Cone-type Speakers



6 in. Re-Entrant Horn (including 5-watt mechanism)



Narrow Beam Paging Baffles

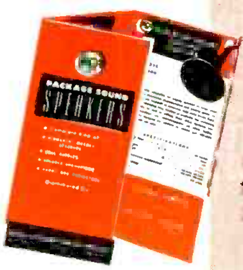
Complete line of Speaker Mechanisms for all trumpets and baffles!

A full line of Speakers for your sound installations

Now you can select the right speakers for your sound systems. This RCA speaker line provides high-quality distribution of voice and music . . . indoors and outdoors . . . to cover large or small areas effectively.

RCA's Package Sound Line also includes a wide variety of microphones, amplifiers and turntables . . . precision-matched with these speakers. Also available is the popular RCA Two-Station Intercom System. Together these units represent a beautifully balanced line which you can purchase complete through one source — RCA. The line is built right and priced right for a steady volume of profitable business.

Get this new speaker folder, and its companion folders on microphones, amplifiers and intercoms. They contain specific information on RCA package sound items . . . just printed and waiting for you. Address: Dept. 69-E, Sound Equipment Section, RCA, Camden, New Jersey.



SOUND EQUIPMENT
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Circuit Analysis

→ From Page 14

ground through one of these windings and the other provides the tuned grid circuit. It should be noted that, instead of the usual grid coupling condenser, the grid RF connection is made by means of the coupling coil, L1. As has been pointed out previously in this column, there is a tendency toward the use of this method in many of the new sets. This oscillator is exactly the same electrically as the electron-coupled type which uses a single tapped coil.

Another different feature in this oscillator circuit, however, is the method of obtaining bias. Ordinarily, the oscillator grid is *self-biased,* that is, the bias is obtained from a grid-to-ground resistor through which the grid current flows. In this case, however, the bias is obtained from the AVC line through isolating resistor R3, as well as in the ordinary way through resistor R4.

A pentode (12SG7) is used as the mixer and cathode injection of the oscillator voltage is used. The cathodes of the two tubes are connected together; and since the oscillator cathode runs "hot" with some RF, this RF voltage is applied to the cathode of the mixer. Mixer bias is supplied by R5 which is bypassed to RF by C4.

The volume control on this set has a total resistance of 500,000 ohms, but has a stop at a point where there is still a resistance of 50,000 ohms between the arm and the high end. It is well to remember this in checking control as this might otherwise appear to be a defect in a control which is really still in good condition. It is possible to use a separate 50,000 ohm resistor in series with the top of a 500,000 ohm pot for replacement if an exact duplicate is difficult to obtain.

Hum-bucking is also provided in this set. Fig. 4 shows how this is accomplished. Resistor R6 acts both as a screen-dropping and power supply filter resistance. Some ripple current from the power supply

→ To Page 28

ELECTRONICALLY SPEAKING

THE Radio Industry Parts Coordinating Committee in conjunction with the Radio Manufacturers Association and local parts distributors plans to sponsor a merchandising and market research program. According to Herb Clough, Chairman of the Committee, the plan is based on the broad general premise that the progress of the electronic industry is dependent upon the availability of replacements parts and competent service personnel. He stated that "Any program that tends to help the serviceman deserves the support of the industry, and I believe the program being developed by our sub-committee on merchandising is the first step in a constructive activity that should be carried on and allowed to develop in the way in which it will be most beneficial to the serviceman and the industry."

As a result of the committee's report, Mr. Clough indicated that a serviceman's "Code of Ethics" program is being readied to build public confidence in local radio repairmen. and that a series of service-dealer clinics, sponsored by local NEDA distributors will probably be arranged. He emphasized that the program will not be carried out until approved by the four groups sponsoring the Industry Parts Coordinating Committee which are the Radio Manufacturers Association, National Electronic Distributors Association, Electronic Parts and Electronic Manufacturers Association of Chicago, and the Sales Managers Club of New York. The merchandising committee preparing this program is made up of members from each of these four groups.

THERE ARE IN USE TODAY a number of ways of representing tubes in schematic diagrams. The existence of these variations irrespective of their individual merits tends to be confusing and industry authorities have recognized the desirability of a determined effort to establish a uniform industry standard.

In service manuals, the function of the schematic diagram is to assist the service engineer in making repairs quickly, economically, and with the minimum of effort. Viewed in this light, it is apparent that service engineers should have the privilege of indicating their preference. Howard W. Sams & Co., Inc., is cooperating in this program by giving you an opportunity to express your desire.

We urge that you read the following carefully and send in your vote as soon as possible. The results of your voting will be forwarded to the RMA service committee for their guidance.

Seven different methods of tube representation have been used by manufacturers. Each of these methods is described and examples given by reference to recent PHOTOFACT Folders. In general, these methods fall into two classes: Symbolical (showing the tube elements) and Pictorial (showing the bottom view of the socket.)

Please study the schematic diagrams listed together with other examples represented by receivers of the same manufacturers. In making your choice, attention should be paid to such factors as the manner in which legibility is affected by a reduction in size of the tube symbols which occurs when large set schematics are presented on a single page, the clarity of the diagram, the effect of circuit cross-overs, etc.

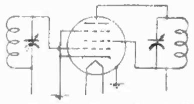
Place an X in one box only to indicate that it is your choice, clip out the whole column and mail it to Howard M. Sams & Co., 2924 East Washington Street, Indianapolis 6, Indiana.

Place an X in one box only to indicate that it is your choice.

Method 1. The tube elements are shown enclosed in a circle and arranged for clarity of circuit presentation. No pin numbers are shown. Elements of the tube are not identified. ☐

EXAMPLES IN PHOTOFACT FOLDERS

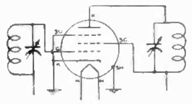
Make	Model No.	Photofact Folder No.	Set No.
Audar	PR-6	473-10	13
Automatic	620	472-3	12
Masco	MA-17	474-32	14
Minerva	L-728	471-15	11
Hammarlund	SP-400X	4610-20	10



Method 2. The tube elements are shown enclosed in a circle and arranged for clarity of circuit presentation. The elements are initialled to show name, i.e.: G—grid, P—plate. Pin numbers are not shown. ☐

EXAMPLES IN PHOTOFACT FOLDERS

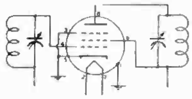
Make	Model No.	Photofact Folder No.	Set No.
Firestone (Air Chief)	4-A-20	475-11	15
Lincoln	5A-110	465-34	5
Puritan	506	463-10	3
Sentinel	285P	466-27	6
Stewart Warner	9005A	473-31	13



Method 3. The tube elements are shown enclosed in a circle. Base pin connections are numbered to conform to R.M.A. basing standards. Sequence of the pins is arranged for clarity of circuit presentation and not in same order as the tube socket. ☐

EXAMPLES IN PHOTOFACT FOLDERS

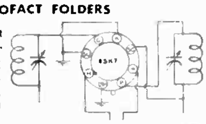
Make	Model No.	Photofact Folder No.	Set No.
Admiral	10A1	463-30	3
Emerson	512	469-12	9
General Electric	417	476-15	16
Stewart Warner	A51T3	477-32	17
R.C.A.	612V3	477-27	17



Method 4. The tube is represented by a bottom view of the tube socket. Tube elements are not shown. The type number of the tube is given inside the circle. Base pins are arranged in proper order but are not numbered. The locating key position is shown. The tube elements are initialled to show name, i.e.: P—plate, G—grid. ☐

EXAMPLES IN PHOTOFACT FOLDERS

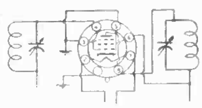
Make	Model No.	Photofact Folder No.	Set No.
Aircastle	568	474-1	14
Crosley	56TS	477-11	17
Aria	554-1-61A	467-2	7
Detrola	7270	476-8	16
Stromberg Carl.	1121	4610-31	10



Method 5. The tube is represented by a bottom view of the tube socket with the tube elements shown in the center of the circle. Base pins are arranged in proper order and numbered. The locating pin position is shown. Tube elements are not identified. ☐

EXAMPLES IN PHOTOFACT FOLDERS

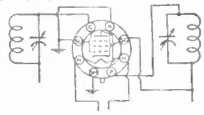
Make	Model No.	Photofact Folder No.	Set No.
Airline	64BR-1808A	476-5	16
Belmont	4B112	4610-6	10
Clearsonic (U.S.T.)	5C6	477-9	17
Gen. Television	23A6	474-14	14
Silvertone	7115	476-33	16



Method 6. The tube is represented by a bottom view of the tube socket with the tube elements shown in the center of the circle. Base pins are arranged in proper order but are not numbered. The locating key position is shown. The tube elements are initialled to show name, i.e.: P—plate, G—grid. ☐

EXAMPLES IN PHOTOFACT FOLDERS

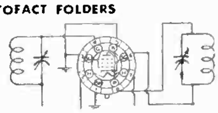
Make	Model No.	Photofact Folder No.	Set No.
Air King	4609	471-2	11
R.C.A.	65U	474-23	14
Delco	R1227	475-6	15
Westinghouse	H 117	471-34	11
Zenith	9H079	467-34	7



Method 7. The tube is represented by a bottom view of the tube socket with the tube elements shown in the center of the circle. Base pins are arranged in proper order and are numbered. The locating key position is shown. The tube elements are initialled to show name, i.e.: P—plate, G—grid. This treatment is the same as used in the tube manuals. ☐

EXAMPLES IN PHOTOFACT FOLDERS

Make	Model No.	Photofact Folder No.	Set No.
Aircastle	PX	473-35	13
Arvin	552	473-9	13
Clarion	C102	469-6	9
Coronada	43-6301	467-4	7
Truetone	D-1644	472-30	12



The Power Supply

→ **From Page 22**

and second anode would cause defocusing of the electron beam. The circuit arrangement in Fig. 3 shows how this potential difference is kept small, at the same time providing DC centering controls for the plates.

Troubleshooting the Power Supply

When attempting to troubleshoot or service any part of the television receiver, the serviceman should observe extreme caution and make certain that there can be no bodily contact with the high voltage supply. Most receivers have interlock switches which break the AC input circuit when the chassis is removed from the cabinet. Before closing the interlock switch again in order to be able to work on the set, remove the fuse from the high voltage supply; or if this cannot be done because the low and high voltage supplies are built around one transformer, unsolder the high voltage secondary winding lead, and wrap the end with friction tape to prevent its shorting to the chassis or touching the body.

If any trouble is suspected with the high voltage supply, first make continuity and resistance measurement checks with an ohmmeter *while the set is off.* Most faults like open leads or shorted condensers can be located in this manner. Should it be desirable actually to measure the high voltage (and if a voltmeter of sufficient range is available) connect the meter across the supply while the set is off. Then turn it on for a reading. Also, be sure to turn it off again and allow ample time for the condensers to discharge before removing the meter lead from the high voltage terminal.

Another safety precaution to observe is to have a good ground connection to the chassis. Otherwise, a breakdown of the insulation on the high voltage winding may cause severe shock if contact is made with the "hot" chassis. High voltage supplies, particularly the 60 cycle AC type, are dangerous and the wise serviceman is the one who is always

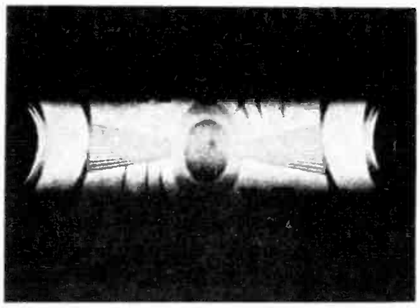


Fig. 4 Test pattern showing the effect caused by 60-cycle ripple resulting from an open condenser in the high voltage power supply.

cautious when servicing a receiver.

The following are the usual faults found in high voltage supplies:

No picture on the tube. If the cathode-ray tube filament is lit, but no beam current is flowing, there is probably an open in the high voltage circuit. Check the rectifier tube, and check for shorted or open filter condensers and resistors.

Excessive ripple in high voltage supply. This fault will show up in the picture as in Fig. 4, and is usually due to an open filter condenser.

Breakdown at intensifier terminal. If there is poor contact at the intensifier terminal caused by a loose connector or dirt between the high voltage connector and the terminal, there will be intermittent breakdown, resulting in picture "bop." The trouble is easily cured by cleaning the terminal and making a secure connection.

Faults in the low voltage supply generally can be detected in the picture. Excessive ripple because of a shorted filter choke or open condenser will produce the same type of hum in the picture as that shown in Fig. 4, only in this case the ripple comes through the video amplifier. If 60 cycle hum also gets into the sweep circuits, the sides of the picture will take on a wavy shape and the vertical linearity will be distorted. All such faults can be cleared up by completely checking the components and wiring in the low voltage supply.

The foregoing description of high voltage supplies dealt only with those of the 60 cycle type which are inherently quite dangerous for use in the home. In a later article, we will discuss the safer, newly developed high frequency, high potential power supplies that are being employed in post-war receivers. ✓ ✓ ✓

Circuit Analysis

→ From Page 24

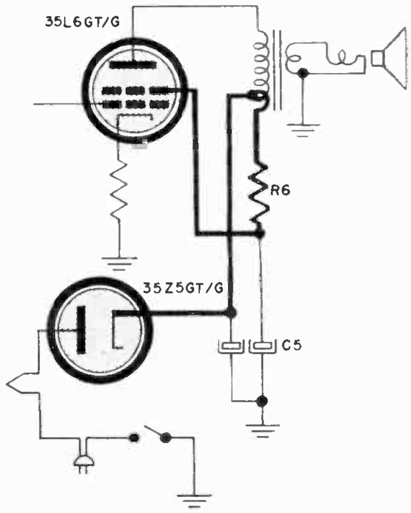


Fig. 4

passes through this resistor and through filter C5 to ground. On the way, this current passes through a small portion of the primary of the output transformer in such a direction as to "buck" against any hum current which may exist in the plate circuit.

This means that output hum is reduced to a minimum and the plate of the 35L6GT/G can operate on the higher DC voltage side of filter resistor R6 giving higher output.

When the Customer *Isn't* Right!

→ From Page 20

detailed invoice is available, it is much easier to convince him that the trouble is not connected with the original repairs, if such is the case. The invoice also provides trouble-shooting leads on the follow-up call.

These are only a few of the questions which the serviceman is asked continually. The procedures followed by these organizations have been proven to be effective. If you have a better answer or have found a particularly effective way to handle other problems such as these, the editors of RADIO MAINTENANCE would like to hear about them for possible inclusion in a future article.

OVER THE BENCH

by John T. Frye

I AM CONVINCED. Gentlemen, that the automobile is here to stay. Yes, I shall go even further than that: I am also convinced—we may as well face it—that the automobile radio is here to stay, too.

I can almost see your wry faces when you read that, for I am quite sure that automobile radio servicing does not top the hit parade with the brethren of the soldering iron. In fact, I am fairly confident that it is very near the bottom of the popularity list—not quite down to the level of the camera-type portables, perhaps, but only a cut or so above them. Oh, of course, I have heard a scattered few say that they *like* to work on auto sets: but I have always dismissed these strange creatures as being of the same stripe as those who say that they do not mind the taste of castor oil.

It is not hard to see why this is so. The automobile radio is subject to every ill that a house radio suffers, and then it has a whole flock of other ailments peculiarly its own. Vibrator power supplies are quite a bit more cranky than the old familiar full- or half-wave rectifier and brute-force filter combinations of the house sets. Moreover, operating a radio in a car is just asking for trouble. Not only do you have your static built right in—what with the ignition system, etc.—but the set is subjected to terrific abuse in the way of vibration and extreme changes in temperature and moisture. Add to this the very limited antenna facilities, and you are beginning to wonder how auto sets work at all; yet the customer expects his auto radio to function as well as, if not better than, his house receiver!

Working on the sets is no picnic, either. Getting them out of the car and putting them back is hard on the back, neck, knuckles, and patience. On the other hand, trying to make adjustments with the set still in the car is a job for an expert midget contortionist An exasperating feature is the fact that often a set will play to perfection on the bench and then refuse to let out a squawk when it is installed in the car; or perhaps it will work all right until the motor is started, or the brakes are applied, or until a right-hand turn is made, or the headlights are turned on, or the driver shifts his chewing gum from port to starboard, etc., etc. In fact, anyone who has been cutting a hole in the firewall to install a set and has had the hole-saw in his half-inch electric drill suddenly jam and has made two or three complete revolutions in the cramped quarters of the front seat before he could release the trigger of the drill is likely to feel little enthusiasm for automobile radio servicing.

Nonetheless, servicemen who are not going in for auto radio servicing are making a grave and costly mistake. There is gold in them thar hills, boys. Car radios are almost as common as Studebaker jokes. The young bucks buy a car radio before they buy a spare tire. (They have to have something to fasten those squirrel tails to, don't they?) Anyone who owns a car is accustomed to paying well for any service performed on the machine; consequently, the serviceman can charge for the extra inconvenience of working on auto sets without hearing a complaint. What is more, most servicemen are still loath to work on these sets; therefore, the radioman who does will be building up good will and will be making val-

→ To Following Page

Over the Bench

→ From preceding page

uable contacts that will swell his house-radio business.

Like any other kind of work, auto radio servicing is not so bad if you are adequately prepared for it. The first requirement is a good place to work. This means a place that is warm and dry during all seasons of the year—a place into which the car can be driven. Working at the curb is no good. It is unhandy and makes a poor impression on the customer. An "annex" built onto the shop, the installation of an overhead door at the rear, or even a lowered drive into a basement may solve the problem if you are already established; if you are not, be sure to select a shop site that will permit you to do auto radio servicing. I remember that several years ago Supreme Instruments made a national survey to determine the best place for locating a radio service business, and they decided that a garage was the first choice. You might give that a little thought if you are not permanently located.

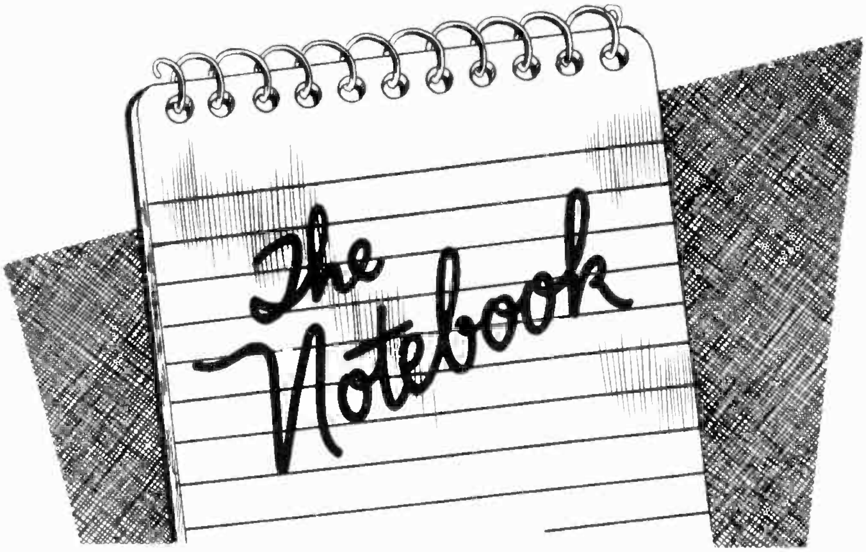
Of course, you will need storage batteries for your test bench, and a trickle charger is a good investment, too. A good set of end and socket wrenches is another "must," and a sturdy half-inch electric drill, together with a set of adjustable hole-cutters or hole saws are also a necessity. Vibrators, suppressors, metal-cased condensers, car antennas, and various other special items will have to be carried in stock.

Probably the handiest thing you can have around a shop doing auto radio service, though, is a smart boy of high school age. To secure one of these handy little jiggers, go down to the high school and have a talk with the teacher in charge of auto mechanics. Ask him to recommend a boy who is good at automobile work and who would like to learn something about radio as well. Tell the teacher what you can afford to pay and explain that you expect to teach the boy the elements of radio.

Do not forget this promise, either. Encourage the boy to ask questions, and answer these questions to the very best of your ability. You will be helping yourself as well as the kid, for you will find that you have to know a thing very thoroughly before you can explain it to someone else.

Let the boy do the removing of the sets and the replacing of them. When he is not doing that, he can be cleaning chassis, brushing out cabinets, doing deliveries, or even doing supervised service at the bench. The cramped quarters and awkward positions that are so trying to your old bones will not bother him in the least. During the school term, you can probably arrange your work so that he can help with the auto sets. Many of these jobs are two-man affairs, anyway, so it will pay to put off the installations and removals until he is with you.

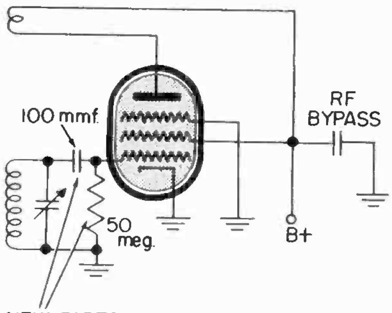
Do not be afraid to charge a good price for your auto radio work for you cannot turn out auto radio jobs as fast as you can AC-DC midgets. Do not be surprised, either, if you soon discover that you are making a very fine living out of this auto radio service that the other servicemen are letting slip through their fingers. ✓ ✓ ✓



Each month the reader sending in the best suggestion receives a crisp ten dollar bill. For all others published, RADIO MAINTENANCE will pay five dollars. Let's hear from you.

Signal Generator

MANY servicemen acquire small four-tube TRF receivers as trade-ins. These sets can be modified for use when setting up automatic push buttons in locations where signal strength is low. The antenna coil is converted into a tuned grid plate feedback oscillator tank circuit. The cathode of the input tube is grounded. The receiver will then operate as a signal generator covering the broadcast frequencies. It can be carried to the customer's home and employed to aid in setting push buttons.

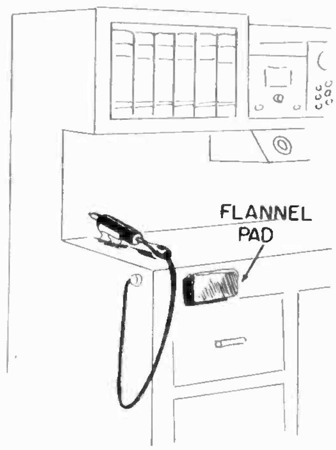


A considerable improvement can be made if the receiver is revamped to include a set of push buttons. These buttons can then be set for the local stations and used when setting up other receivers.

Edward T. Johnson
Lindhome and Johnson
Service Dept.
Mt. Jewett, Pa.

Soldering

A piece of flannel tacked to the service bench near the soldering iron holder comes in handy for keeping the iron clean and tinned. The pad is folded neatly and held in place with carpet tacks. Every time a joint is to be soldered, the iron is rubbed quickly across the face of the pad. If the pad and iron



are always kept in the same place, the action will become automatic and will take place without conscious thought. You will be surprised how long the iron will remain clean and unpitted.

James Mutari
1641 72nd St.
Brooklyn, N. Y.

Auto Radios

When checking auto radio re-

→ To Page 36

The Organizations

→ From Page 16

in and prepare for the future. For another, they pave the way for open discussion of all sorts of problems. With the coming of Television, the serviceman will have to know his circuits more than ever. And most manufacturers are willing to let qualified servicemen take over the service end of this development. Associations such as yours can play a major part in helping the serviceman attain the necessary competence.'

"Mr. Bartley then proceeded to present what was, in effect, a complete course in FM, illustrated with projection slides. He started with the antenna, then analyzed the circuits in an FM receiver, and concluded with FM receiver alignment and trouble shooting. Always he kept in mind our angle—the angle of the man who has to service the equipment. Hence he drew on his wealth of practical experience to highlight the theoretical parts of the talk. Mr. Bartley described some of the practical difficulties in FM servicing. One example was the case of 'flutter' interference due to nearby airplanes, another was on how to overcome customer objections to dipoles.

"And so the talk proceeded with similar practical information on alignment and trouble shooting. Mr. Bartley told us what to check when running into excessive noise and hiss; distortion and poor tone quality; poor reproduction, lack of highs; amplitude distortion during high audio signal levels; in short, quite a gamut of troubles peculiar to FM circuits.

"Concluding his talk, Mr. Bartley promised to be back in the Fall, with data on the new circuits, as well as a more advanced FM course.

"During the business part of the meeting, our chairman, Mr. Gordon A. Phipps, of Williamsport, Pa., appointed a Nomination Committee to select candidates for next month's election of officers."

John Barsophy,
Secretary

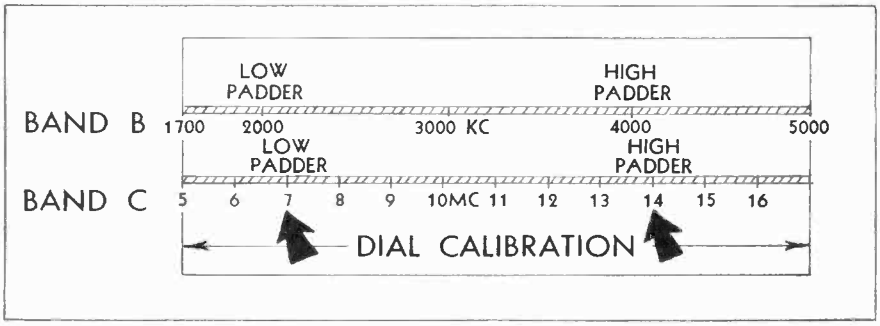


Fig. 3. Identification of harmonics is accomplished as shown in the above diagram. See text.

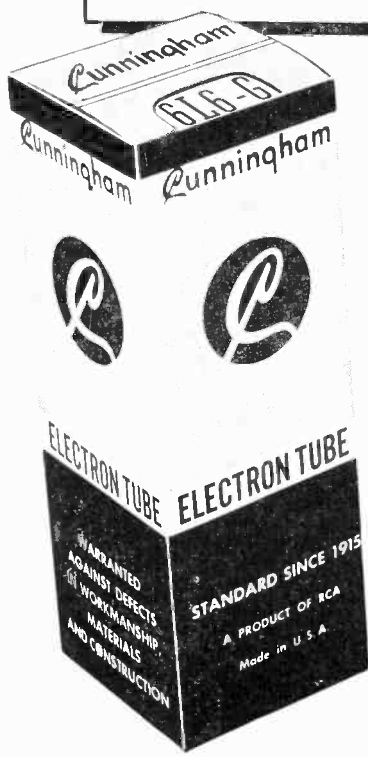
Crystal Controlled Signal Generator

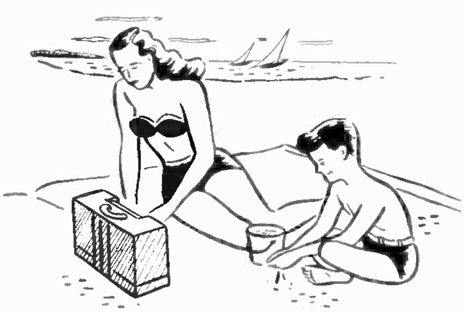
→ From Page 13

kc crystal. This produces harmonics which are spaced every megacycle. These harmonics extend through the range of all the ordinary short wave bands (to 25 mc). In fact our tests on one of these units show that output is still sufficient for alignment work at 50 mc and higher. Choose the megacycle points which come nearest to the tracking frequencies on each band and proceed with the alignment. On the higher frequency short wave bands, megacycle points come quite close together and identification becomes a little more difficult. In that case, we can switch to another crystal whose harmonics will only coincide with megacycle points at certain frequencies. Fig. 3 shows how this can be done with the 175 kc frequency. At 7, 14, and 21 mc, 175 kc crystal harmonics will coincide with those of the 1000 kc crystal. Then, if a signal is heard using either crystal, we know it must be one of these multiples of 7 mc.

To align the IF section of an FM receiver, an external crystal is used. This crystal should be one which oscillates at one-half of the IF frequency of the receiver. For instance, the latest RMA standard IF is 10.7 mc. Thus, we would need a 5.35 mc crystal. The second harmonic then provides the proper alignment frequency. In the same manner, other special alignment frequencies can be obtained by using the correct crystal.

For alignment of the RF and mixer sections of FM receivers, a 5 mc crystal will provide harmonics up to 200 mc which are strong enough to use. ✓ ✓ ✓





BACK NUMBERS

JANUARY 1946
THE PROBLEMS OF ORGANIZATION
TELEVISION RECEIVER INSTALLATION — This article will initiate the serviceman into the first step in television—its installation.
RADIO MAINTENANCE IN AVIATION
USING THE OSCILLOGRAPH FOR DISTORTION MEASUREMENTS

APRIL 1946
PA SYSTEMS—This article covers a general discussion of all the opportunities and procedures for the serviceman about to enter the public address field.
A MIDGET AUDIO FREQUENCY OSCILLATOR
IF I WERE A SERVICEMAN
AN EQUALIZED AMPLIFIER FOR MAGNETIC PICKUPS

MAY 1946
PA SYSTEMS—This article covers initial layout of a modern PA system in bars, dance halls, auditoriums, etc.
TEST PANEL FOR THE MODERN BENCH
RINGING THE BELL

JUNE-JULY 1946
FUNDAMENTALS OF TELEVISION
VOLUME CONTROL TAPERS
THE ELECTRONIC VOLT OHMMETER
VECTOR ANALYSIS

AUGUST 1946
AVC CIRCUITS
FM TROUBLESHOOTING
TELEVISION RECEIVER FUNDAMENTALS
RECORD CHANGERS

NOVEMBER 1946
PART II TEST & ALIGNING TELEVISION RECEIVERS
DON'T FORGET THE DIAL LAMP
THE OSCILLOGRAPH . . . HOW TO USE IT
CRYSTAL PICK-UPS

DECEMBER 1946
TELEVISION RECEIVERS . . . THE RF SECTION
TUNING INDICATORS
PART II THE OSCILLOGRAPH . . . HOW TO USE IT
REPLACING AUTO CABLES

JANUARY 1947
SERVICING BY EAR
TELEVISION RECEIVERS . . . VIDEO CHANNEL
PART III THE OSCILLOGRAPH . . . HOW TO USE IT
MINIATURE TUBE CHART

Our first announcements of the availability of back numbers of RADIO MAINTENANCE brought a response much greater than we anticipated. As a result we are continuing to comply with the demand of radio servicemen for these back issues. We don't know how long we may be able to fill orders for the earlier issues as the supply is dwindling fast, and some are already sold out. Only those listed are now available, so if you are anxious to get them, send in your request as soon as possible.

RADIO MAINTENANCE MAGAZINE
460 BLOOMFIELD AVE.,
MONTCLAIR, N. J.

Please send me the back numbers checked here . . . . I am enclosing 35c for each copy.

☐ $2.00 for the set of eight

☐ January 1946
☐ April 1946
☐ May 1946
☐ June-July 1946
☐ August 1946
☐ November 1946
☐ December 1946
☐ January 1947

NAME ______________________

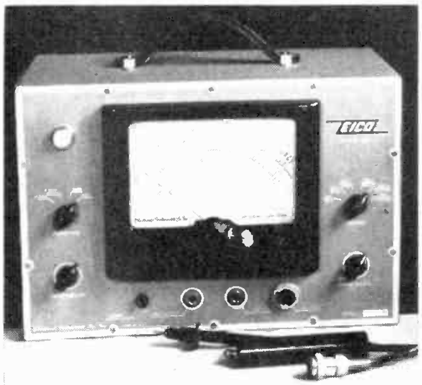
ADDRESS ______________________

CITY ______________________

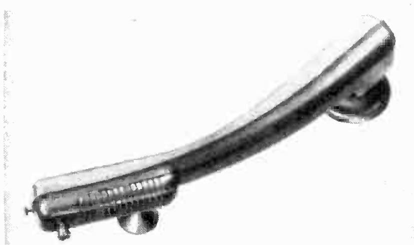
ZONE __________ STATE ______________

Industry Presents

→ From Page 18



by writing to the Electronic Instrument Company, Inc., 925 Clarkson Ave., Brooklyn 3, N. Y.



PICKUP ARM

Model Nylon-508 pickup arm, just announced by The Astatic Corporation, is intended for use with the newest manually operated electrical record players. It accommodates Astatic's new Nylon I-J Cartridge which employs a Nylon Chuck and matched, replaceable, knee-action Nylon Needle with jewel tip.

NEW ATTENUATORS

Constant impedance attenuators, dissipating 10 watts of power at any setting, have been added to the G-E line of radio parts. Providing no insertion loss, input and output impedances of the new attenuators are

To Following Page

Industry Presents

→ **From preceding page**

practically constant throughout the entire range of control. Attenuation is linear up to 30 decibels in ten steps. Exceptionally long life with a minimum of noise and distortion is claimed by G-E engineers.

Further information and a specification sheet are available on request to the General Electric Company, Specialty Division, Wolf St. Plant, Syracuse, N. Y.

The Notebook

→ **From page 31**

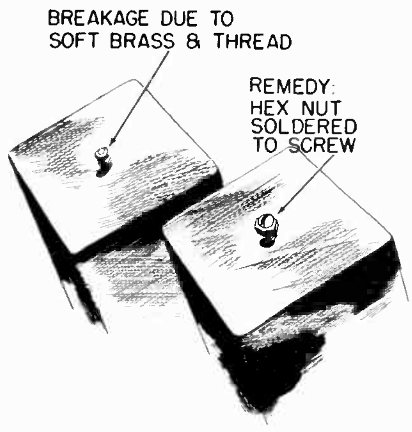
ceivers of the type that bolt to the fire wall, trouble is sometimes encountered when replacing the front cover on the metal box housing the set. This is due to the fact that fire walls on most automobiles are not flat, causing the box to become sprung. If the nuts that hold the box are loosened, it will straighten up and the cover can be easily put back on.

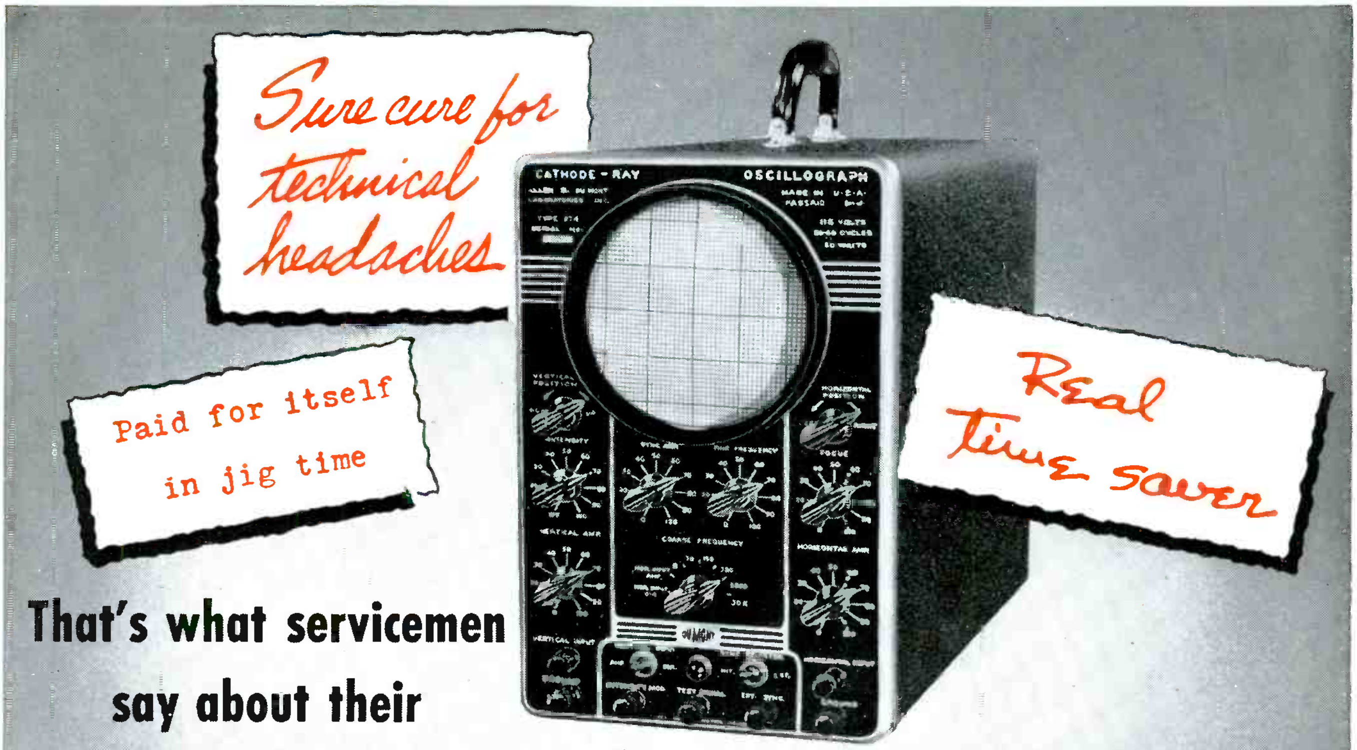
Fred Stolze
141-23 Cherry Ave.
Flushing, N. Y.

IF Transformers

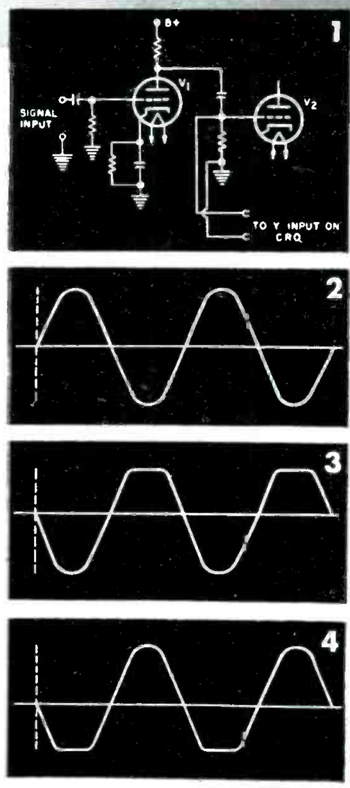
In many IF transformers, the adjusting screw is made of soft brass which breaks easily. When broken, adjustment is difficult. A simple remedy is to solder a nut onto the screw as shown in the accompanying diagram.

C. Demeter
1148 Fairmount Ave.
Elizabeth, N. J.





That's what servicemen say about their DU MONT Type 274 *Cathode-ray* OSCILLOGRAPH



Yes sir, you can handle more business, make bigger money, promote greater good will, if you *modernize* your radio servicing with the Du Mont Type 274 Cathode-ray Oscillograph.

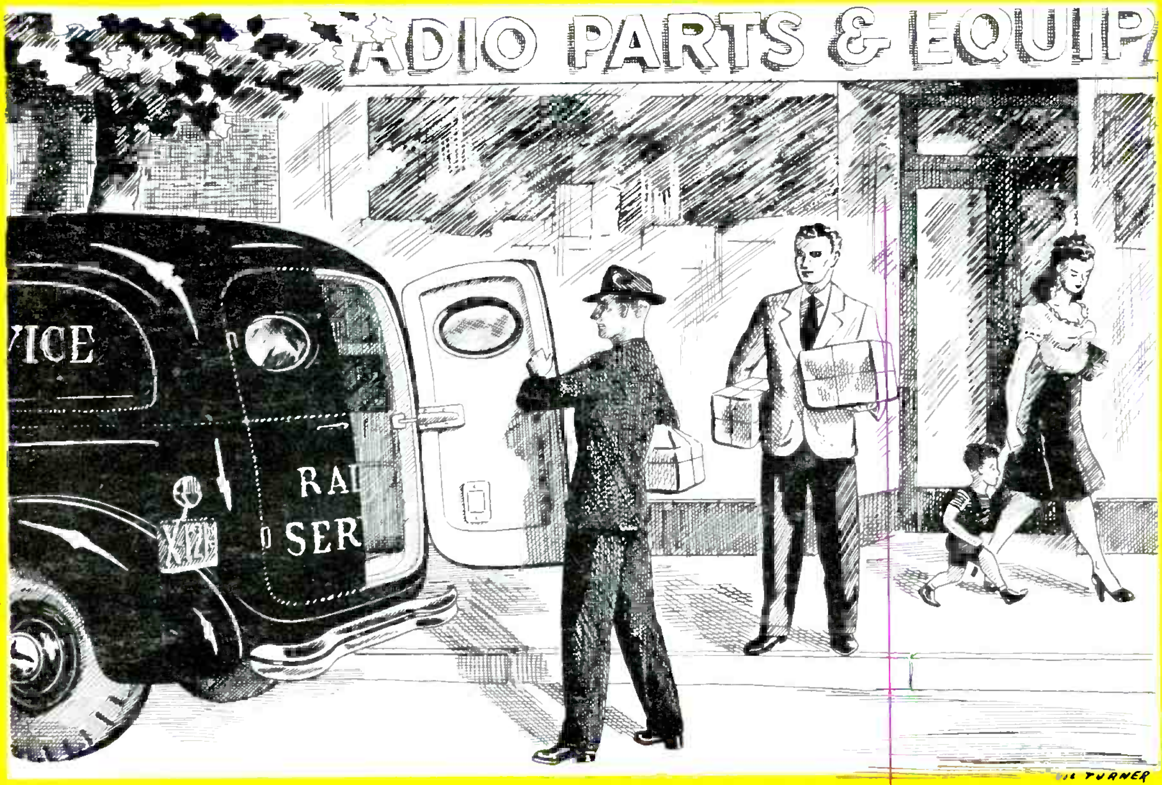
This is no high-priced new-fangled instrument even though it's a *genuine* Du Mont oscillograph with a *genuine* Du Mont cathode-ray tube. Type 274 is built for the serviceman's shop. It's practical, rugged, economical. A great time-saver, it pays for itself—and very soon. Note the following typical example of time-, trouble- and effort-saving:

1. Portion of audio amplifier of typical set. It is required to examine correctness of cathode bias of V1 as well as to determine maximum signal it can amplify without distortion. So . . .
2. This oscillogram of the Type 274 screen shows signal input to amplifier, or the undistorted output of V1. Now . . .
3. Note output due to grid cut-off, with flattened waveform at upper part of cycle. Again . . .
4. Here's the distorted output due to driving grid too high. Note flattened waveform at lower part of cycle.
5. The method of rapidly performing this check and many other servicing problems is described in clear, concise, simple language in the operating manual you get with your 274.
6. And keep this in mind! The Type 274 has a power takeoff on the back for use of accessories.

Ask your favorite distributor to show you the Du Mont Type 274 serviceman's oscillograph. Ask for literature—or write us.

DUMONT *Precision Electronics & Television*

ALLEN B. DUMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • CABLE ADDRESS: ALBEEDU, PASSAIC, N. J., U. S. A.



A CONVENIENT, FRIENDLY STORE

You will find that we can supply you more quickly and economically. We have had long experience supplying radio servicemen and can provide the right materials to solve your service problems. We stock the better quality products and will respond with quick delivery on all orders.

HOOSIER RADIO SUPPLY CO.

701 N. ILLINOIS ST., INDIANAPOLIS 4, INDIANA, TEL. LINCOLN 3010