

RADIO & TELEVISION MAINTENANCE SERVICE

DEVOTED TO SALES AND SERVICE OF RADIO AND TELEVISION

Nicholas B. Wynnick
192 Prospect St.
Ansonia, Conn.

MAY 1950

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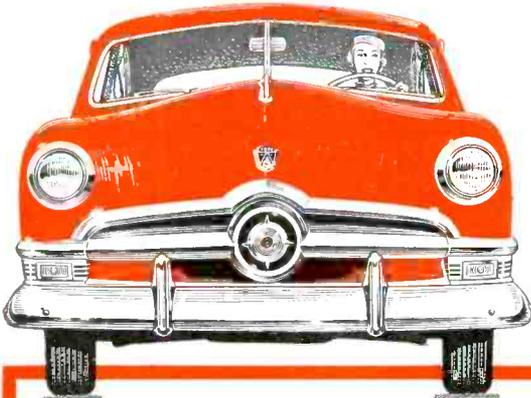
Service in Customer's Home
with **Miniature Instruments**
story on page 8

also in this issue:

The Latest Tubes • Planning Our Shop Layout • Behind the Scenes at the IRE Show • Symposium of Radio-TV-Electronics Books • There's No Mystery about Impedance Matching • Radio Industry Newsletter • Industry Presents • Electronically Speaking • Notebook • Merchandising Corner • etc.

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FOR RADIO BATTERY RETAILERS and RCA BATTERY DISTRIBUTOR SALESMEN



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RCA Battery Distributor. Then, fill out and mail the
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that time.

This contest is open to all radio battery retailers
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sonnel whose duties include the selling of radio
batteries.

Here's how prizes will be awarded

1. All entry coupons received will be assembled at Con-
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2. The retailer whose name appears on the first coupon
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He will be asked one of the easy questions about RCA
Batteries appearing in the "Get The Facts" Contest
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mediately, he will be awarded first prize.

3. If the contestant fails to give the correct answer im-
mediately, another drawing is held.

4. The above procedure will be followed in awarding
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DON'T DELAY. Get your Contest Booklet from your
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can be your reward!

Complete Entry and Prize Award Rules can
be found in the Official Contest Booklet.

RADIO BATTERIES



**RADIO CORPORATION
of AMERICA**

HARRISON, N. J.

RADIO & TELEVISION MAINTENANCE

Volume 6

May, 1950

Number 5

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Copyright 1950, Boland & Boyce, Inc.

Radio and Television Maintenance is published monthly by Boland & Boyce, Inc., at 34 No. Crystal St., East Stroudsburg, Pa., U.S.A.; Executive and Editorial Office, 460 Bloomfield Ave., Montclair, N. J. Subscription Rates: In U. S. and U. S. possessions: \$1.50 per year, single copies 15 cents, In Canada, Mexico, Central and South America: \$2.00 per year, single copies 20 cents; In British Empire, \$4.00 for 1 year, \$7.00 for 2 years, single copies 45 cents; all other foreign countries, \$5.00 for 1 year.

Entered as second class matter January 1, 1950, at Post Office, East Stroudsburg, Pa., under the Act of March 3, 1879.

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GIVE YOU

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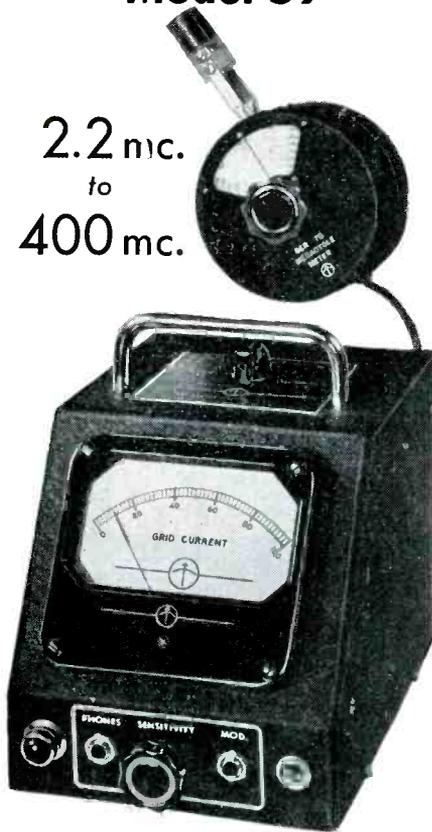
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2.2 mc.
to
400 mc.



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Check these applications:

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- For locating parasitic circuits and spurious resonances.
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MEASUREMENTS CORPORATION
BOONTON  NEW JERSEY

ELECTRONICALLY

SPEAKING

BY ISIDOR I. GROSS

Any Help? Reader Beswick has a tough problem. He writes: "I have in for service an auto receiver, Oldsmobile model 982216 (1941). It has terrific whistle and howl while being tuned from station to station. Have aligned it twice over, replaced vibrator, four tubes, plus three condensers, still to no avail. It is a tough one to service as you have to remove the heater, drain the radiator, etc. The oscillator voltage is OK, and can find no defective components. Set plays fine, except for these annoying whistles. I'm getting old working on it and grey hairs from customer's complaints. Any advice?" How about it?

Kill the Tax! The Radio Technician's Guild of Rochester has forwarded to its Senators and Representatives a resolution protesting the proposed 10% tax on TV sets. We urge all our readers to join in this protest by writing to their Congressmen individually. There's still time. Once the tax is imposed, it will mean a direct loss to you. A three-cent stamp and a few minutes of your time can bring big returns.

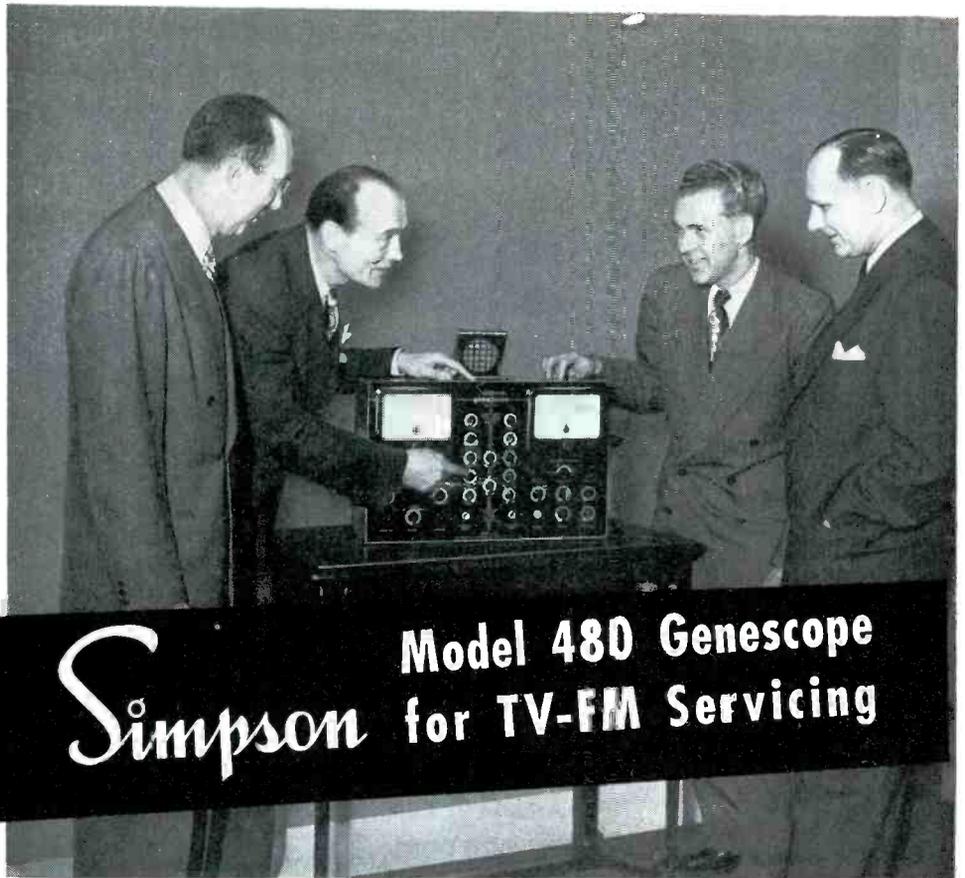
Picture Clear. We spent a very pleasant afternoon at Asbury Park the other day, visiting the Telrex antenna plant. We were particularly impressed by three items. One was the use of stainless steel screws in the mounting assembly of their De Luxe line (something you don't usually find). The second was the Attic V Beam (you'll find it described on page 24 of this issue) which we thought was a good idea. And the third was a very lightweight window antenna which we were assured would work well in primary signal areas. We took one home to try it and can report that it does. Took about three minutes to install.

Pattern. The Dallas Radio Sales & Service Assn. (Texas, that is) complains about the lack of morning test patterns. "We are forced" they say, "to make our TV service calls in the afternoon and to be in a mad scramble to cover as many calls as possible. This results in improper adjustment of the set, poor program reception". We hope that their stations will cooperate and provide morning patterns. After all, there would hardly be any station if it weren't for the technician.

For Services Rendered. We'd like to pass on to you some of the remarks made by Robert H. Bishop of Sylvania upon receipt of the Pennsylvania Federation Annual Award for his company. Making it clear that Sylvania considers the service dealer and technician a partner in the business of selling radio the TV, he said: "If the dealer does not do a good job, we in the manufacturing end of the business cannot do our job properly". That's Mr. Bishop holding the plaque in the photo below. At his left is Dave Krantz, chairman of the State Federation.



The Service
Managers of
Admiral
ZENITH
hallicrafters
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all recommend the



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In addition to providing all necessary signal sources, the new Simpson Genescope includes a high sensitivity oscilloscope of unique advanced design, complete in every detail. Equipped with a high frequency crystal probe for signal tracing. AM and FM oscillator sections provided with large, easy to read dials with 20:1 vernier control and 1000 division logging scales. *Revolutionary, ingenious, exclusive* output termination provides for various receiver impedances, either direct or through an isolating condenser. Step attenuator for control of output. Size 22" x 14" x 7½". Weight 45 lbs. Shipping Weight 54 lbs.

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Band A: 2-120 megacycles
Band B: 140-260 megacycles

Sweep width variable from zero to 15 megacycles

Sweep rate 60 cycles per second

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Crystal calibrator: 5 megacycles \pm .05%

Audio Oscillator 400 cycles

Output Impedance 75 ohms

Step attenuator for control of output

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Band A: 3.3-15.6 megacycles
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30% modulation at 400 cycles or unmodulated

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Visual method of beat frequency indication

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Horizontal sensitivity: 70 mv per inch

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60 cycle sine sweep

Frequency essentially flat to 200 KC. usable to over 3 megacycles

THE SIMPSON MODEL 479 TV-FM SIGNAL GENERATOR

Exactly the same circuits, ranges and functions as the Model 480, described above, with the exception of the oscilloscope. Size 17" x 14" x 7½". Weight 34 lbs. Shipping Weight 40 lbs.

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Molded selector switch fully enclosed. Spiral spring index control—over 150,000 cycles without breaking.

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Features like those shown above are what make this popular V.O.M. so outstandingly dependable in the field. The enclosed switch, for instance, keeps the silvered contacts *permanently clean*. That's rugged construction that means stronger performance, longer life. And tests show that the spiral spring index control, after more than 150,000 cycles of switch rotation, has no disruption or appreciable wear! Investigate this history-making Volt-Ohm-Mil-Ammeter today: 33 ranges, large 5½" meter.

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NEW Method of TV FIELD SERVICING



by Marvin Kaplan, Chief Engineer
Oak Ridge Products Co.

TELEVISION servicing in the field has now been made simpler, faster and more efficient with the introduction of a line of new test equipment. This article will describe a new method of television signal tracing and substitution, based on pocket size miniature test instruments which can easily be taken right into the customer's home.

The television receiver can be divided, for purposes of this article, into two main parts: one containing the r-f, i-f, video and sound sections, the other comprising the sync, vertical and horizontal sweep, and high-voltage circuits. In order to service these various sections properly in the field, it is necessary to supply a variety of signals from a limited number of portable instruments.

One of the new instruments, the model 103 signal generator, provides the necessary signal for troubleshooting the first part. Another unit, model 104 Syncro-Sweep, supplies the special vertical and horizontal signals to isolate troubles in the sections comprising the second part.

In servicing the first group of sections, it is necessary to determine by the overall performance of the receiver whether the trouble is in the video or audio section, or a stage common to both. By setting the model 103 to any desired channel number, a steady loud test note should be heard in the loudspeaker if the sound carrier frequency is supplied. If the video carrier frequency is used, a series of steady blink bars

should appear on the screen. If the test note cannot be heard, but the bars are normal on the screen, the trouble will be between the mixer tube and the speaker.

Sound amplifier — By using the sound test note from the generator and probing from the speaker voice coil back to the sound second detector, a defective stage can be isolated to the point where the test signal fails.

Sound i-f — If the test signal is normally amplified back to the second detector, then the generator can be set to the sound i-f frequency, generally between 21-22 Mc or 41-42 Mc. This signal, when probed from the second detector back to the mixer, will determine the faulty i-f stage.

Video amplifier — If in the first step the test note was heard but no bars were visible on the screen, the procedure would be to adjust the generator to a video test signal which can be probed from the grid of the picture tube to the video second detector. If the amplifier section is defective, the bars will disappear at one place in the point-to-point fault location. However, if the bars are normally amplified back to the second detector, the trouble will probably be between the mixer tube and the video second detector.

Speedy Fault Location

Video i-f — The generator can now be set to produce a video i-f frequency, generally 23-25 Mc or 43-45 Mc. The signal can be probed from stage to stage from the video second detector back to the mixer tube. The bars should disappear at the faulty stage. If the test note is heard and the bars are seen in the first step, then the trouble must be

in a stage common to both video and audio. The fault should be between the antenna terminals and the mixer tube plate.

R-F oscillator — By setting the generator to the television channel range, without modulation, and connecting this signal to the grid of the mixer tube, a substitute for the r-f oscillator is provided in the receiver. If the generator channel knob can tune in an outside signal, such as a station, interference, and the like, then the trouble will be a defective oscillator stage.

Mixer — If the generator did not tune in any outside signal, then the trouble will probably be a defective mixer stage. This conclusion is reached by a process of elimination.

R-F — If the oscillator in the receiver performed normally, but the set had little or no response from the r-f section, then the r-f stage or stages, including the band switch, should be checked. By tuning the generator to the desired modulated channel number, a test signal can be probed from the mixer tube grid to the antenna terminals, thus isolating the defective stage.

Using the Unique 104

In troubleshooting the second part of the television receiver, the principle of signal tracing and substitution is still employed, with the 104 Syncro-Sweep generator supplying the required signals to check the vertical and horizontal linearity, vertical and horizontal sync circuits, vertical

The cover . . .

Troubleshooting in the customer's home. On the screen appears a sync pulse which the technician has produced with his portable Syncro-Sweep generator. The lady of the house looks on—somewhat puzzled.



The author
Marvin Kaplan received his training at RCA, G-E and in the army; he is an associate member of IRE

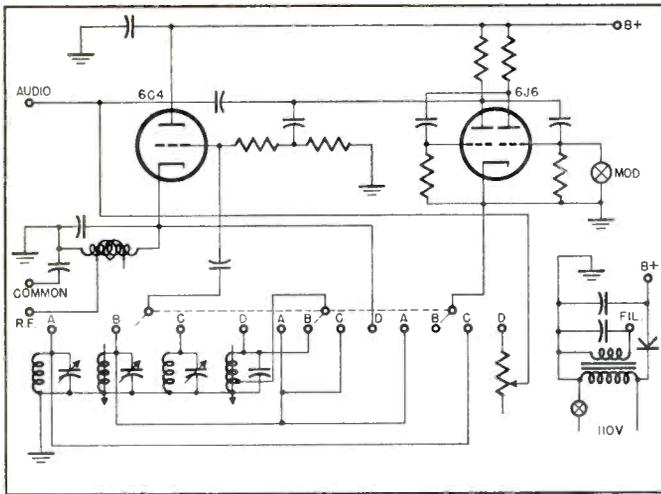


Fig. 1. Schematic diagram of the model 103 signal generator

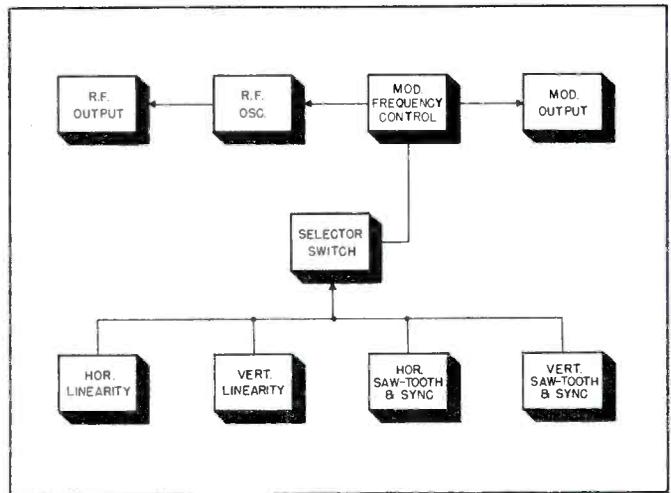


Fig. 2. Block diagram of model 104, circuit being patented

and horizontal sweep circuits, and the flyback high-voltage stage. The first step is to determine the type of trouble from the picture on the screen. If a horizontal line is seen, for instance, then of course the vertical sweep section is faulty.

Vertical output transformer — Connect an output meter across the vertical deflection coil terminals. With the Syncro-Sweep set to the vertical sweep position and the set turned off, a signal can be connected from the high side of the deflection coil to the chassis. The meter will record the output voltage of the Syncro-Sweep. The Syncro-Sweep probe can then be moved to the plate of the vertical output tube. If the new meter reading is very much lower than the original one, the transformer is probably defective. If the transformer is normal, the reading should be about the same as across the deflection coil.

Vertical output tube — With the set turned on and the Syncro-Sweep probe moved to the grid of the vertical output tube, a considerable increase should be noticed on the meter

reading. If the reading is not increased, the vertical output stage is not amplifying properly and is therefore defective. If there is a great increase in the meter reading, and sweep appears on the screen, the trouble is probably in the vertical sawtooth generator stage.

Vertical deflection coil — If the reading is increased and no vertical sweep appears on the screen, we can assume, by the process of elimination, that the vertical deflection coil circuit is faulty.

Horizontal output transformer — If the original picture on the screen indicates normal vertical sweep, but no horizontal sweep, then a meter should be connected across the horizontal deflection coil with the set turned off. With the Syncro-Sweep set to a horizontal output signal, the probe can be first connected from the high side of the horizontal deflection coil to the chassis and a meter reading taken. When the Syncro-Sweep probe is moved to the plate of the horizontal output tube, the meter reading should remain about the same. If the reading is very low,

the transformer is probably defective. If the reading is normal, the probe has to be moved to the grid of the horizontal output tube.

Horizontal output stage — With the set turned on, the meter reading should be increased considerably, indicating that the output stage is amplifying normally, and a horizontal sweep should appear on the screen. This will indicate that the trouble should be in the horizontal sawtooth generator stage.

Horizontal deflection coil — If the reading is increased considerably, but no sweep appears on the screen, then the horizontal deflection coil is probably defective (by a process of elimination).

High Voltage

Because of the fact that in most television receivers the high voltage is developed in the horizontal output stage, the screen will have neither sweep nor brightness if there is a failure in the horizontal sweep circuits. By using a procedure previously described, for checking the

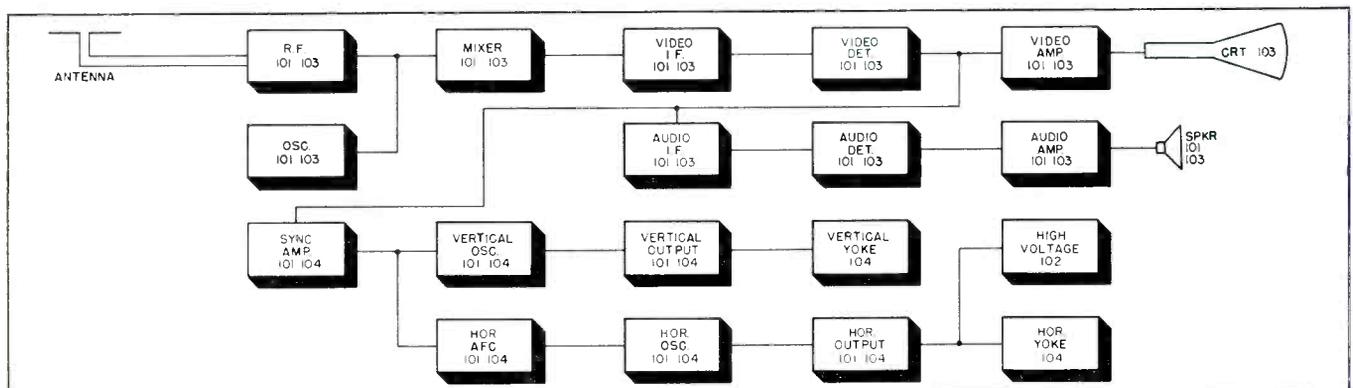
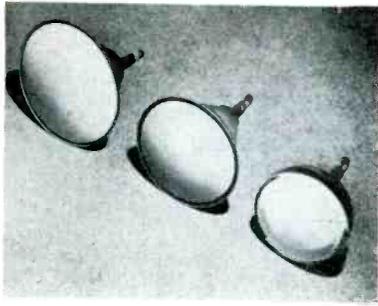


Fig. 3 Block diagram of a typical television receiver. Numbers in blocks refer to the models used in servicing them.



The LATEST Tubes

Sylvania new 19AP4, at left, contrasts with 16 inch tube in center, and 12½ inch all glass tube at right

Here is an up-to-date review of the latest in tube developments, including picture tubes, miniatures, subminiatures, and others. You will soon meet many of them in your daily service work.

SEVERAL new tubes have made their appearance on the market recently. Here is a review of the latest additions.

A new line of miniature radio tubes for portables has been introduced by Sylvania. These tubes are the first in over ten years in which filament current has been reduced below 40 ma per tube. The new tubes require 25 milliamperes per tube, a fraction of the current provided for flashlight bulbs. "A" batteries used in portables can thus be expected to last three times as long with the new tubes as with former types. The new tubes include type 1U6, a heptode converter with oscillator anode as a separate element; type 1AF5, a diode pentode; type 1AF4, a sharp cut-off r-f pentode; and type 3E5, a beam power output tube. All tubes have 25 milliamper filament and are supplied with 7-pin miniature bases.

Sub-miniatures

Two sub-miniature types have also been added by Sylvania. Type 5645 medium-mu triode is a T-2 suitable for Class A amplifier applications.

It is 1.3 inches long and .31 inches in diameter. Under typical operating conditions, the tube will have a transconductance of 2700 microohms and an amplification factor of 20. Maximum rated plate power dissipation is 1 watt, and plate resistance is 7400 ohms.

Type 5646 high-mu triode is a T-2 suitable for Class A amplifier or resistance coupled amplifier applications. It is 1.3 inches long and .3 inches in diameter. Under typical operating conditions, the tube will have a transconductance of 2400 microohms, an amplification factor of 70, and a plate resistance of 29,000 ohms. Maximum rated plate dissipation is .3 watts.

Both subminiature types have 6.3 volts, 150 milliamper heaters and flexible leads for direct wiring to circuit.

TV receiving tubes

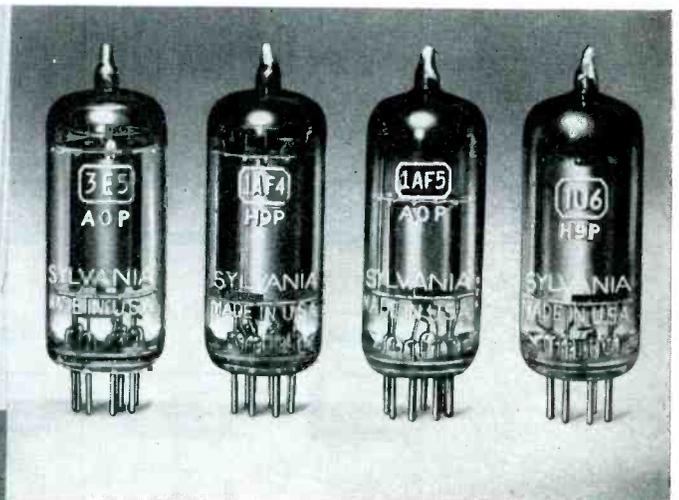
Two new scanning tubes for magnetically deflected picture tubes have been added to G-E's production line. The tubes can operate from a power supply of 125 volts, making possible

the elimination of a power transformer and of high-voltage filter capacitors (which should result in reduced set cost). The tubes are beam power amplifiers, designed to withstand high surge plate voltages for short periods of time. They are intended particularly for operation as horizontal deflection amplifiers in television receivers employing either direct or transformer coupled drive. The two tubes, 6AV5-GT and 25AV5-GT, are identical except for the heater ratings, the 25AV5-GT requiring 25 volts at .3 amperes, the 6AV5-GT requiring 6 volts at 1.2 amperes. Maximum ratings are 250 volts for d-c plate voltage, and 500 volts for d-c plate supply voltage. D-C plate current: 100 ma or 100 sp. Grid #2 dissipation: 2.5 watts. Plate dissipation: 10.9 watts.

Also new is a miniature receiving tube, type 6C6B, for use as a wide band amplifier in the intermediate-frequency or radio-frequency stages of television and f-m receivers. The new tube is a sharp cut-off pentode of miniature construction and is de-



Doris Hoover of RCA's tube dept. in Marion, Ind., demonstrates RCA's recently announced short 16-inch metal picture tube



Above is a line-up of Sylvania's new tubes for use in portables. They constitute a tremendous improvement over former models

signed for applications where very high transconductance and low capacitance values are required. The suppressor and cathode of the tube are brought out on a separate base bin to allow for greater flexibility in design. The transconductance of the tube is 6200 microohms and the plate current is 9.5 milliamperes under typical operating conditions.

Three additional tubes, designed primarily for use in TV receivers have also been made available. Type 6AS5 is a beam-power amplifier of miniature construction, intended for use as the audio power-output tube in teletests and small radio receivers. Type 6BQ6-GT and 26BQ6-GT are beam-power amplifier tubes designed to withstand high-surge plate voltages for short periods of time. The tubes are intended for use as horizontal deflection amplifiers in television receivers. Plate dissipation: 10.9 watts, plate current: 100 ma, and peak positive surge plate voltage: 5000 volts.

RCA contributed to this month's harvest by announcing two deflection amplifier tubes, specifically for use with their new 16GP4 (described below). Type 6DC6-G is a beam power amplifier featuring low μ , high plate current at low plate voltage, and high ratio of plate current to screen current. Type 6S4 is a nine-pin miniature medium- μ triode. Properly used, these tubes will fully deflect picture tubes having a deflection angle up to 70 degrees (as the 16GP4), operating at 14 kv anode voltage.

Also introduced by RCA was a half-wave rectifier, type 1V2. It's a nine-pin miniature designed for use in high-voltage power supplies of the pulse type. Peak inverse plate voltage is 7,500. Average plate current is 500 μ a, peak plate current 10 ma, filament voltage .625 at 300 ma.

Picture tubes

Two new metal cone 16 inchers with the new look short neck made their appearance. RCA brought out type 16GP4. The cone-to-neck section of this tube has been designed for a more efficient yoke, and the design makes it also easier to center the yoke on the neck. The tube has improved beam focusing. Sylvania introduced the similar type 16AP4, which is $\frac{1}{4}$ -inch shorter than the standard 10-inch type. Deflection angle is 70 degrees for both tubes (about 15% greater than earlier

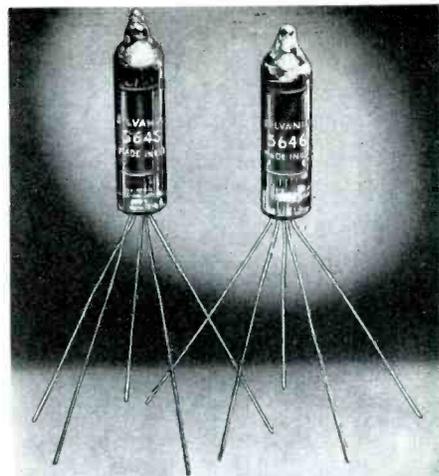
types), and both come with grey face plates for greater contrast under conditions of ambient light.

Sylvania has also produced a new 16-inch all glass picture tube, supplied with an external coating which acts as a filter capacitance when grounded. Designated type 16LP4, overall length of the tube is $22\frac{1}{4}$ inches. Maximum usable face diameter is $15\frac{7}{8}$ inches, heater voltage is 6.3, heater current .6 amps, focus coil current 110 ma, ion trap magnet current 120 ma, anode voltage 12,000. The tube comes with neutral or clear face plates and employs an ion trap gun for use with external magnet.

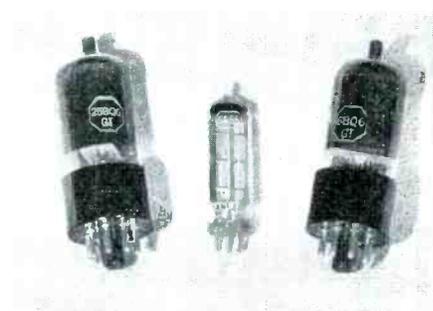
Late releases

Some additional tubes, just released at press time, include the following: RCA-6AX5-GT, full wave vacuum rectifier, providing for more economical a-c receiver and high power output automobile receiver design. It features a unipotential cathode having a 6.3-volt heater and a relatively wide plate-cathode spacing, chosen to minimize sputter and yet provide good regulation. It is also capable of delivering 75% more d-c current than other commonly used automobile rectifier tubes. RCA-6AS6, a 7-pin miniature sharp-cutoff pentode, especially useful in gated amplifier circuits, delay circuits, gain-controlled amplifiers, and mixer circuits. Sylvania-6AU5-GT, a high permeance beam power amplifier for use as horizontal deflection amplifier. One of these tubes in a suitable circuit will deflect up to 60°. Sylvania-6BN6, a miniature tube designed for combined limiter and f-m discriminator applications in improved f-m detection circuits in teletests. This tube is also useful in limiter circuits, sync clipping circuits, square wave generators, frequency multipliers, and phase measuring devices. In teletests, the tube provides for good a-m rejection.

Also available is Sylvania's type 8BP4, an $8\frac{1}{2}$ -inch all glass direct view picture tube with electrostatic focus and deflection for use in TV sets designed for seven-inch viewing tubes. It is interchangeable with type 7JP4, and offers the advantage of 50% increase in useful screen area. ✓ ✓ ✓



Top: Sylvania's new subminiatures. They are both suitable for Class A amplifier application. Bottom: Two new scanning tubes from G-E. They are capable of operating from a power supply of 120 volts



Top: Three additional tubes by G-E, primarily for use in teletests. All three are beam power amplifiers. Bottom: RCA's 9-pin half-wave rectifier for use in high voltage power supplies of the pulse type

Let's be scientific about

PLANNING our SHOP LAYOUT

The layout of a shop has a direct bearing on its success. In this article we have applied scientific layout principles to the problems of the service store owner.

By The Staff of

Radio & Television Maintenance

THE service technician of today requires more for success than expert technical knowledge. He must be a competent business man at the same time. One of the problems he faces as a business man is that of proper shop layout; and the purpose of this article is to provide a number of suggested solutions to that problem.

Of course, it is impossible to develop one single plan for efficient shop layout which will apply to all service establishments alike. Their shapes and sizes, and the equipment they use, vary so considerably from one to the next that no one single layout plan will do for all of them. Nevertheless, it is possible to develop the *principles* which govern most efficient shop layout in such a way that the technician can apply them to the conditions under which he has to operate. We shall attempt here to provide a variety of possible arrangements, so that the suggestions made

will be applicable to as many cases as possible.

What are the considerations which go into the makeup of a good shop layout? First, there is the question of efficiency. The furniture and fixtures should be arranged in such a way that the shop owner or technician can utilize them with a minimum of waste motion. For example, it would not be efficient for the small parts storage cabinet and the test bench to be on opposite sides of the room. Secondly, there is the question of appearance. The technician's shop is not only a workroom, but also a store, and should convey this dual impression to the customer. It should give the appearance of a well kept store, since that will increase the customer's confidence in the integrity of the business, and it should also suggest the technical proficiency of the organization, which will increase the customer's confidence in the workmanship of the technician. A good impression makes for more business.

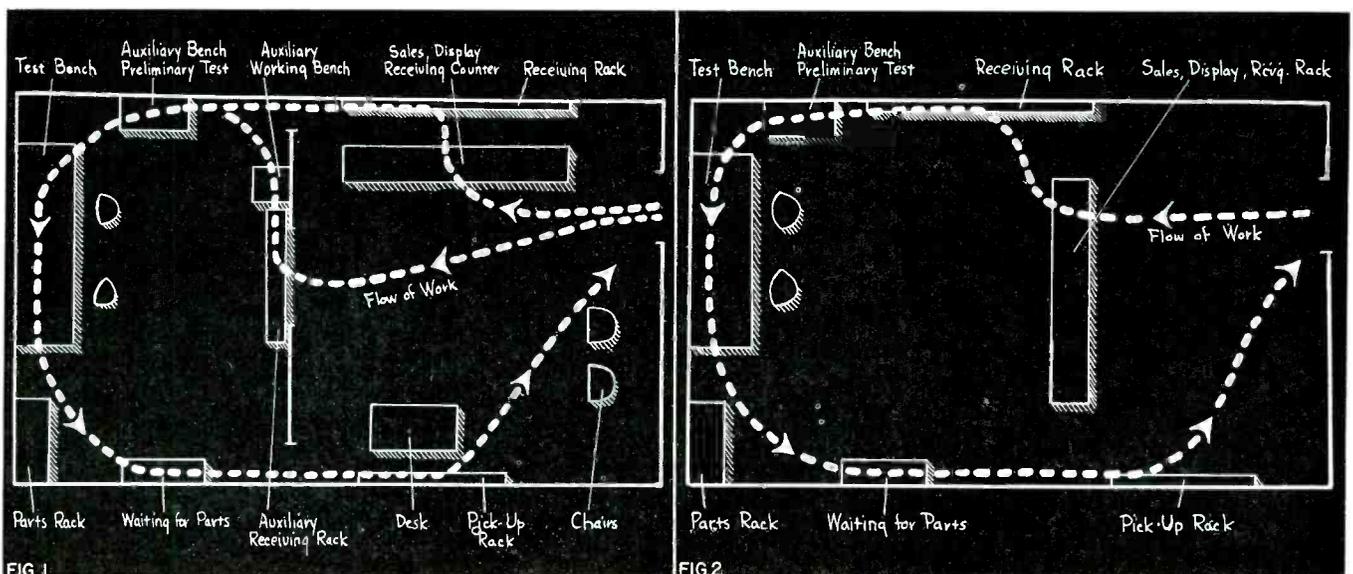
Finally, if the shop specializes in Sales and Service, proper attention must be paid to display space. While this article will not be concerned with methods of display, the question will

be considered as part of the overall shop layout plan.

Furniture & Fixtures

Let us first see what the materials are which we have to place on the floor, before we proceed with the actual placement. The one-man organization will need a service bench, an auxiliary service bench, a small-parts storage rack, a rack for receivers awaiting repair, a rack for repaired receivers awaiting pickup by the customer, a counter with inside storage space and outside display area, an office desk, a record file cabinet, and assorted chairs. All these items of furniture are essential to the one-man organization specializing in Service. Larger shops, and those providing Sales and Service, will require additional equipment or space. We shall go into that later.

It is generally considered best to keep the actual service area of the shop separate from the main floor area, and inaccessible to the customer. Most service technicians find it difficult to work properly with customers breathing down their neck, touching various instruments, exposing themselves to the danger of shock, etc.



At the same time, it is important that the customer receive a good view of the service department. The best way to combine visibility and inaccessibility is to use a partition with a large window opening, through which the customer can see the service bench with its impressive looking instruments. Actual shop practices which we have seen range all the way from "no accessibility—no visibility" to complete accessibility. However, the more prosperous ones, and those established fairly recently, all featured the windowed partition.

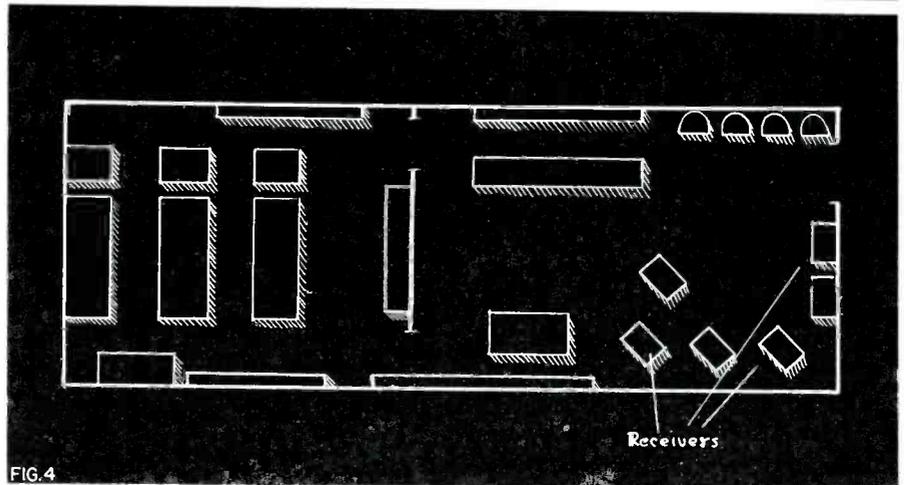
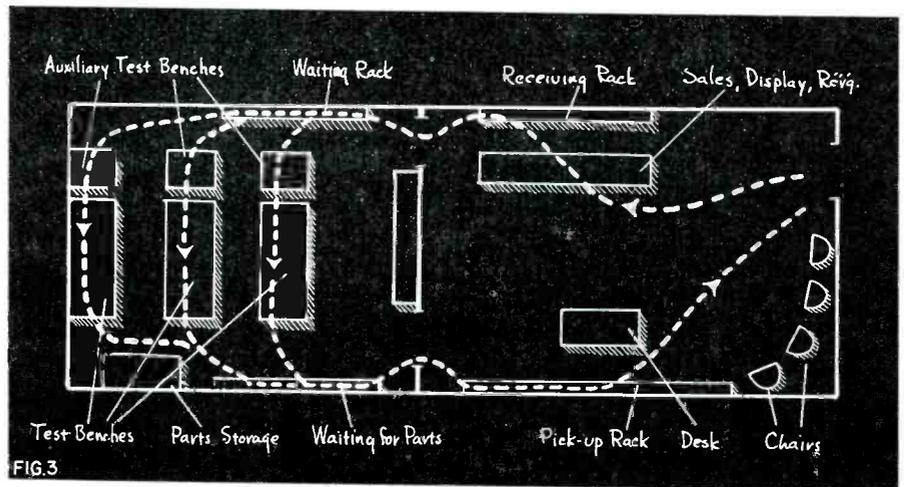
Of course, it is not always feasible to build such a partition. In that case, the next best thing is to place the display and sales counter so that it runs parallel to the rear wall, thus constituting an effective barrier to the customer, who is, however, still able to see the service department. If a partition can be installed, it is best to keep the sales counter at the right hand side of the room (as seen by an entering customer). A table placed behind the partition window can serve as an auxiliary receiving counter.

Service Department

There is one fundamental consideration which determines the final layout of furniture and fixtures. That is the flow of work. An efficient shop will have its fixtures laid out in such a way that a receiver travels on one continuous route from the time it enters the store to the time of pickup. This is best achieved with a "U" arrangement.

If a partition has been installed in the store, the layout which provides the smoothest flow of work is as in Fig. 1. As the receiver is brought into the store it is received on a receiving table, and from there moved into the "waiting for service" rack. From there it is taken into the main service area for preliminary tests (tube, etc). Continuing around the room, the set is moved next to the main service bench for trouble location, possibly placed on the "waiting for parts" rack, and then moved back into the store for placement in the "waiting for pickup" rack. As can be seen from the diagram, the flow of work is continuous and smooth. Parts storage racks are placed near the main service bench, within easy reach of the technician.

Continuous flow of work can still



be achieved, though a partition cannot be installed. The arrangement of furniture and fixtures remains essentially the same, except that the sales and display case has been moved into the center of the room, parallel to the rear wall. This arrangement is illustrated in Fig. 2.

Modifications

For shops employing more than one full time technician and equipped with more than one main service bench, optimum work flow can be achieved by placing the service benches parallel to each other. While many organizations place their various benches side by side, it has been found that a parallel arrangement is more efficient. Space considerations, however, may prevent such layout, in which case placing the service benches side by side against the wall is the next best solution.

For the service organization also handling sales, it is essential that sufficient space be provided for display purposes. If feasible, sales

should be handled in a room set aside especially for this purpose. In most instances, however, the technician will have only one store available, and will have to adapt it for both sales and service functions.

A customer who comes in for a repair job, constitutes in all cases a potential receiver sale. For the proper psychological effect it is therefore best to place receivers which are for sale somewhere in the front of the store. It will suggest to the customer, immediately upon entering the shop, the idea that he may want to buy a new receiver, rather than have the old one fixed, or the notion that he could use an additional set, aside from the one he is having fixed. This display should of course be visible from the window.

As was stated earlier in the article, no two stores are alike in size, shape, or equipment used. The principles which we have outlined here, however, are applicable to the majority of cases. The technician will find them sound and will find that they accomplish two things: Increased efficiency of operation and loyal customers. ✓✓✓

Give to Conquer CANCER



Strike Back!

THE fight is on to save more lives in 1950! Now is the time to back science to the hilt in its all out battle against cancer.

Tremendous gains have already been made. Last year, 67,000 men, women and children were rescued from cancer. Many more can be saved—if *you* resolve to save them—if *you* strike back at cancer.

Give! Give your dimes and quarters and dollars. More treatment facilities are needed, more skilled physicians, more medical equipment and laboratories. The success of great research and educational programs depends on your support.

Your contribution to the American Cancer Society supports these vital efforts. It helps guard your neighbor, yourself, your loved ones. So this year, strike back at cancer . . . Give more than before . . . Give as generously as you can.

American Cancer Society

MERCHANDISING CORNER

by Victor M. Turner

In the Spring . . .

Comes spring with nice weather—summer sports—camping. We in the radio and television industry are fortunate that we can enjoy all of these pleasantries of the mellow seasons and enjoy continued business activity *because* of them. There need be no slackening of service work and sales during the summer months as long as the advantages of the seasons are seized upon and *promoted*. Take the nice weather, for example, and what it means to us:

Car Radios—More auto trips mean more car radios turned on for longer periods . . . Advertise that you are a specialist in this work . . . explain how you can tune up the customer's auto radio for greater enjoyment on the road . . . mention the variety of auto antennas you carry . . . and, of course, the new radios that will give the motorist the ultimate in driving pleasure . . . Put these questions to your customers in your advertising: "How long is it since your auto radio has been checked?" . . . "Are you bothered by static in your auto radio?" . . . and then proceed to answer these questions by a statement of how you can correct these faults if they exist.

Auto radio repair is a good subject for a postcard mailing—or series of mailings. One of the above questions can be used as theme for each card, and each mailing in the series should be sent at two or three day intervals. A sign hung or painted on the back of your truck, clearly visible to drivers behind you, should give a short, easy to read message on your auto radio work. Large, bold signs, easily visible to motorists should be placed on the street or highway approaching your shop. Newspaper ads and spot radio announcements are also effective for soliciting this type of work.

What else comes with spring? Sports events, of course—**Baseball**. You may think that everybody knows the terrific sales factor baseball contributes to television . . . but that only means: advertise this factor more and more. All through spring

and summer the theme of your TV advertising and servicing promotion should be "Let me tune up your TV set for perfect reception in time for the next ball game". Explain how you can make the picture sharper . . . eliminate different types of interference . . . perfect the audio section, etc, etc. If your budget can afford it, take spot announcements over local TV station . . . and radio station too.

TV Sales

For new television receiver sales, use the time element just as strongly—"Get your TV set *today* . . . installed in time for tomorrow's game." Of course, if you advertise such fast service, be sure you can live up to it—but make every effort to provide it. It means a *much greater sales volume*. **Camping** and other outdoor activities mean a big potential for portable radios. We covered this in detail in the March **RADIO AND TELEVISION MAINTENANCE**, but it should be mentioned here again while on the subject of summer promotion. Get your share of the good profits in servicing and selling portables for the outdoor seasons.

Remember also the pulling power of a telet set operating in your window, especially when a baseball game is being transmitted. Many people in the crowd which will gather in front of your window daily will remember your shop when it comes to buying a receiver, or having one serviced.

Other Suggestions

Look into possible P-A installation and maintenance jobs for summer camps in your area . . . Flashlights and batteries are good items for camp-minded customers . . . If you live near a boating neighborhood, extra dollars can be made doing checkups and repairs on marine radio equipment.

Whenever you do enter a new phase of service or sales activity, make sure you promote it for all it's worth. There are many opportunities for profits in spring and summer . . . but we have to take advantage of them.

"Leave it to Sylvania!"



SYLVANIA ANNOUNCES...

"Another Sylvania advance!"



Two Outstanding New

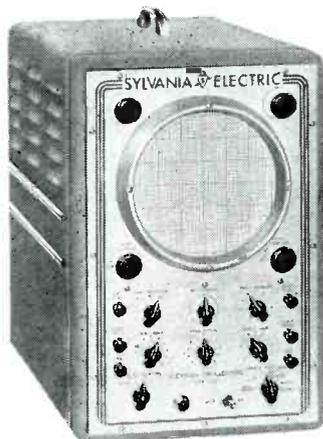
"That's great news for TV Service men!"



TV Test Instruments!

Sylvania's early pioneering in radio testing devices naturally places this company in a position to step ahead in the field of television testing equipment.

So again Sylvania comes through! This time for service dealers everywhere, with a splendid new line of TV Test Equipment. Here are the first two instruments in this line. A new TV Marker Generator will be announced soon. Mail coupon for prices and latest specification sheets.



Sylvania TV Oscilloscope

Here's an entirely new high gain, wide band oscilloscope especially designed for television. Accurately displays any TV pulse, wave-shape or signal on a large 7-inch screen. Has excellent tilt, rise-time, and overshoot characteristics. Features include: 3-position frequency-compensated attenuator; vernier gain control; low internal hum level. Mail coupon for full details.

Type 400

Sylvania TV Sweep Signal Generator

This compact instrument is equipped with electronically controlled sweep circuits to eliminate the complexities inherent in mechanical type sweeps.

The smooth attenuator gives continuous control of the output from 300 microvolts to the maximum of .1 volt. Voltage-regulated power supply insures good frequency stability. Double shielded to prevent unwanted signal leakage.



Type 500



RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGM TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

SYLVANIA ELECTRIC

Sylvania Electric Products Inc.
Advertising Dept. R-1105
Emporium, Pa.

Please send me full details about Sylvania's new TV Test Equipment.

Name _____

Street _____

City _____ Zone _____ State _____

"BEHIND THE SCENES IN RADIO-ELECTRONICS" I.R.E. RADIO AND ENGINEERING CONVENTION AND SHOW!

OVER 16,000 visitors, ourselves included, attended the IRE convention and show in New York and caught a glimpse of the future of electronics. Many of the developments which were unveiled there will not reach the technician for years to come, others he will meet tomorrow. Both, however, are important in his work, and we are therefore reporting on several of them here.

One fact impressed us more than any other: the tremendous influence which TV is exerting on electronics. In fact, the first impression one had was of attending a show devoted primarily to TV. True, there was considerable interest in high-fidelity recording and reproduction systems and components, and nucleonics came in for its share of attention; but the one theme running through the entire show was television. It emphasized again the fact that TV is rapidly becoming a truly industrial giant. Judging from the display on the floor of the show, almost all component manufacturers and test equipment makers were oriented in that direction.

In addition to the floor display, over 53 technical papers were presented at various sessions of the convention, and it was in these papers that advance reports of work done by radio engineers were made. Some of these reports were strictly for the engineer, others however were of interest to the technician too.

Among this latter group was a report by W. K. Volkers of Schenectady describing a new circuit design which results in "starved" operation of radio tubes and makes possible a new simplified 3-tube radio receiver giving 5-tube performance. Incorporating the principle of starvation in a direct-coupled amplifier increases the overall gain drastically, thus permitting a reduction in the number of tubes, and making possible a three-tube radio having only four resistors and four condensers.

Another interesting development

was announced by Sylvania's Slinkman. He described a new method of frequency control which will keep f-m and television receivers locked in to the incoming signal, regardless of local oscillation and/or signal drift. Needless to say that such frequency control will result in receivers giving much better performance than is enjoyed by the average videowner today.

Advance work is also progressing rapidly in the u-h-f television field and was reported in a paper by John Ebert and H. A. Finke of Polytechnic Research and Development Co. They covered the electrical and mechanical design solutions for three new pieces of test equipment which



have been developed for the u-h-f television band. One is a u-h-f sweep frequency oscillator ranging to 980 Mc, another is a u-h-f frequency meter with the same range, and the third is a u-h-f noise generator. All three instruments are laboratory items, but their development shows that electronics is prepared for any FCC action.

For TV

Promising better reception in the fringe area was a new amplifier tube described by J. T. Wallmark, who developed it at the RCA laboratories in Princeton. It uses not only the grid to control the current, but uses deflection of the electron beam at the same time. Installing a 'knife edge' in the beam's path to intercept it, a greater amount of current control was achieved than ever before. The tube is still in the early stages of laboratory development and may not

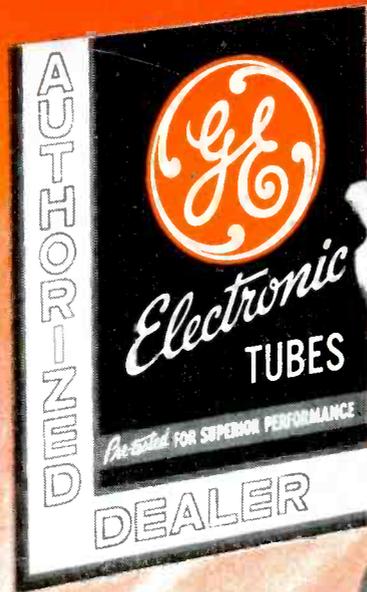
be available for two or more years. But when it arrives it should greatly improve weak signal area reception. Incidentally, though deflection is being extensively used in television picture tubes, this is the first time that it has been applied in commercial amplifier tubes.

M. A. Honnell and M. D. Prince of the Georgia Institute of Technology described a system of television velocity modulation. When television first began, it was thought that velocity modulation would be the best method of reproducing the picture. It was, however, found impracticable and was discarded in favor of the currently used amplitude modulation. In standard television systems of today, pictures are reproduced on the screen by varying the brightness of a spot that is scanning the picture on the mosaic of the television pickup tube. In the velocity modulation television system, the beam current is maintained constant, and the change in brightness of the reproduced picture is achieved by varying the horizontal velocity of the spot in both the picture tube and camera tube. Bright portions of the picture are reproduced by a low spot velocity, and dark portions by a high spot velocity.

It is not likely that the new system will replace present home receiver design. One of its main shortcomings is that it does not produce as good a contrast as present receivers, and is best only when reproducing black-and-white matter (without shadings). It does, however, give the illusion of three-dimensionality, of cameo, which makes it of value for various industrial applications.

Space does not permit us to enumerate all of the new developments which were announced at the convention. But from the items reported it is quite clear that the next few years will bring with them numerous improvements in the radio and television field. For the service technician that means a promising future.

CONFIDENCE STARTS HERE!



DO YOU HAVE THESE G-E SALES BUILDERS?

- NEW 4-way plan for more business
- NEW electric window sign
- NEW outdoor metal sign
- NEW luminescent window card
- NEW descalcomania
- NEW tube storage-display cabinet
- NEW newspaper ad mats
- NEW postcard promotion mailers
- Convenient G-E pocket office
- Handy G-E tube puller
- Techni-talk Magazine
- TV service course
- Distinctive shop garments
- Wall plaque
- Giant tube cartons
- Imprinted stationery and business cards
- Repair and tube-test stickers
- Job-tickets and shipping labels

"It's the 'G-E' on my store window that brings in customers. And 'G-E' on the tube cartons on my shelves leads them to buy!" Radio-TV servicemen unite in this statement, for their sales have proved the *pull* of the General Electric trademark.

Also . . . more business comes to G-E tube dealers because *all* their needs are met with a complete line of TV-picture, metal, glass, and miniature types, as well as germanium diodes and selenium rectifiers. Profits are bigger by reason of General Electric's sensational group of plus-powered promotion helps (the list at the left shows how many *new* items there are to give your 1950 sales a jet take-off).

Phone or write your G-E tube distributor . . . today. He'll show you how to make real money from an active local market you can dominate with G-E tubes to install and sell, G-E promotions to help you sell! *Electronics Department, General Electric Company, Schenectady 5, N. Y.*

You can put your confidence in—

GENERAL  ELECTRIC

181-JA4

SYMPOSIUM of RADIO - TV - ELECTRONIC BOOKS

IN PRESENTING this symposium of electronic literature the editors have attempted to furnish the technician with a listing of all electronics books in which he may be interested. Space limitations made it impossible to provide more than the briefest description for each title. They are how-

ever sufficient to enable the interested technician to make an intelligent choice.

Two outstanding literary products deserve special mention. One is TV Manual III (publ. Rider) which sets a new high in Rider's already considerable achievements in the Manual

field, and is a must for any TV technician. The other is the Radio Data Book and Video Handbook (publ. Boyce-Roche), whose values can best be described by stating that they have been the best sellers in the electronics field since their publication.

ANTENNAS

MICROWAVE ANTENNA THEORY AND DESIGN, Silver (614pp, ill, \$8.00, 1949, McGraw-Hill) Comprehensive survey of theory and design techniques.

MICROWAVE DUPLEXER, Smullin (430pp, 397 ill, \$6.50, 1948, McGraw-Hill) For those interested in pulsed transmission applications.

TELEVISION ANTENNAS, Nelson (192pp, 124 ill, \$12.50, Sams) Selection, installation, troubleshooting TV antennas, most commercial units, many shortcuts.

TELEVISION ANTENNA INSTALLATION, Whitman et al (115pp, 100- ill, \$1.50, Consolidated Publications) Practical based on actual installation experience

THE THEORY AND PRACTICE OF 30-1000 Mc RECEIVING ANTENNAS, Bailey (500-pp, profusely ill, \$4.50, in press, Rider) Written by a man with 21 yrs antenna designing experience, covering world-wide knowledge of antennas, the book is mainly concerned with TV, but also covers amateur and antenna design engineer problems. An exhaustive treatment.

BUSINESS

BUSINESS HELPER, Rucker (144pp, 1949, \$2.00, Rider) A book full of good advice and practical hints for successful business operation, written by a successful business man.

STARTING AND OPERATING AN ELECTRICAL OR RADIO BUSINESS, Snyder (\$1.75, Coyne) Ideas and plans for successful shop operation.

THE ADVERTISING AND BUSINESS SIDE OF RADIO, Midgley (386pp, 1948, Prentice-Hall)

CIRCUIT THEORY

ALTERNATING-CURRENT CIRCUITS, Bryant and Johnson (522pp, 319 ill, 1939, \$5.00, McGraw-Hill) Principles and polyphase circuit applications.

AUTOMATIC FREQUENCY CONTROL SYSTEMS (154 pp, \$1.75, Rider)

ELECTROMAGNETIC WAVES, Ware (203pp, 72 ill, \$3.50, Pitman) Simplified presentation of electromagnetic theory, introduced through vector algebra.

DIRECT AND ALTERNATING CURRENTS, Loew (748 pp, 550 ill, 1946, \$5.00, McGraw-Hill) Emphasis on theory of electric circuit; detailed, thorough.

ELEMENTARY ELECTRIC CIRCUIT THEORY, Frazier (434pp, 268 ill, 1945, \$4.50, McGraw-Hill) Elementary exposition of electric circuit theory.

DIRECT CURRENT FUNDAMENTALS, De France (Prentice-Hall)

ELECTRICAL CIRCUITS AND WAVE FILTERS, Starr (475pp, 402 ill, \$8.50, Pitman) From elementary principles to complete survey of subject, no omissions.

FIELDS AND WAVES IN MODERN RADIO, Ramo and Whinnery (502pp, 257 ill, 1944, \$5.50, Wiley) Theory underlying radiation, wave guides, transmission lines.

FUNDAMENTALS OF ELECTRIC WAVES, Skilling, (245pp, 89 ill, \$4.00, 1948, Wiley) Begins with electric and magnetic theory, leads to Maxwell's equations.

PRINCIPLES OF ALTERNATING CURRENTS, Lawrence (475pp, 1935, \$5.00, McGraw-Hill) Vector notation, inductive, capacitive circuits, harmonics, etc.

THE OSCILLATOR AT WORK (254pp, \$2.50, Rider)

UNDERSTANDING VECTORS AND PHASE (158pp, \$9.99, Rider) This is probably the best book written on the subject available to the service trade. Well written, of immediate use.

WAVE FORMS, Chance, Williams, Hughes, Sayre Macnichol (785pp, ill, 1949, \$10.00, McGraw-Hill) Generation and uses of precisely controlled voltages.

COMMUNICATIONS

BASIC ELECTRICITY FOR COMMUNICATIONS, Timbie (603pp, ill, 1943, \$3.96, Wiley) Basic electrical principles for communications worker.

COMMUNICATION CIRCUITS, Ware and Reed (403 pp, 202 ill, 1949, \$5.00, Wiley) Principles of communication and their associated networks, a-f to u-h-f.

COMMUNICATION AND CIRCUIT FUNDAMENTALS FOR RADIO AND COMMUNICATION ENGINEERS, Smith (373pp, 1949, \$5.00, McGraw-Hill)

ELECTRICAL FUNDAMENTALS OF COMMUNICATIONS, Albert (554pp, ill, 1942, McGraw-Hill) Exclusively from communications point of view.

ELECTRICAL TRANSMISSION IN STEADY STATE, Selgin (427pp, ill, 1946, \$5.50, McGraw-Hill) Book on methods of network theory for engineers.

ELEMENTS OF RADIO COMMUNICATION, Morecroft (286pp, 241 ill, 1934, \$3.25, Wiley) Second edition.

RADIO CODE MANUAL, Nilson (174pp, ill, 1942, \$3.00, McGraw-Hill) Complete 20 lesson course in sending and reading radio code, also government regulations

PRACTICAL RADIO COMMUNICATION, Nilson and Hornung (927pp, 535 ill, 1943, \$6.50, McGraw-Hill) Covers principles, systems, equipment, operation.

PRINCIPLES OF RADIO FOR OPERATORS, Atherton (354pp, 470 ill, \$4.00, Macmillan) A good beginner's book, excellent visual instruction

ELECTRONICS

AUTOMATIC CONTROL ENGINEERING, Smith (367pp, 121 ill, 1944, \$4.50, McGraw-Hill) Control fundamentals.

APPLIED ELECTRONICS, M. I. T. Staff (772pp, 343 ill, 1943, \$6.50, Wiley) For engineers with little knowledge of electronics.

ELECTRON TUBES IN INDUSTRY, Henney (539pp, 397 ill, 1937, \$5.50, McGraw-Hill) Tubes and their application in industry, comparison with other apparatus.

ELECTRONICS FOR INDUSTRY, Bendz (501pp, 335 ill, 1947, \$5.00, Wiley) Explanation of principles of industrial electronics, tube functions, basic circuits.

ELECTRONICS IN INDUSTRY, Chute (430pp, 292 ill, 1946, \$5.00, McGraw-Hill) Presents industrial electronics in simple, non-technical language.

ELEMENTARY INDUSTRIAL ELECTRONICS, Wellman (384pp, ill, \$4.00, Van Nostrand) Written for students and beginners.

FUNDAMENTALS OF INDUSTRIAL ELECTRONIC CIRCUITS, Richter (569pp, ill, 1947, \$5.00, McGraw-Hill) Mathematical requirements held to minimum.

INDUSTRIAL ELECTRONIC CONTROL, Cockrell, (385pp, ill, 1950, 2nd ed, \$4.00, McGraw-Hill) Stress on fundamental facts of electron tube operation.

INDUSTRIAL ELECTRONICS, Kramer (311pp, 229 ill, \$6.00, Pitman) Explains applied electronics without use of mathematics.

INDUSTRIAL ELECTRONICS AND CONTROL, Kloeffler (478pp, 480 ill, 1949, \$5.50, Wiley) Theory and application of electronics in industry.

INDUSTRIAL ELECTRONICS MAINTENANCE, Roetger (190pp, 1947, Prentice-Hall) No theoretical background, mainly servicing ind. electronic equipment.

MAINTENANCE MANUAL OF ELECTRONIC CONTROL, Miller (305pp, ill, 1949, \$4.50, McGraw-Hill) Application, installation, maintenance; step-by-step.

PHOTOELECTRIC CELLS IN INDUSTRY, Walker, (510pp, 216 ill, Pitman) Representative selection of industrial uses of light-sensitive cells.

PHOTOELECTRICITY AND ITS APPLICATIONS, Zworykin (494pp, 393 ill, 1949, \$7.50, Wiley) Data on properties, preparation, and applications.

WHAT ELECTRONICS DOES, Zeluff and Markus, (320pp, 24 ill, 1948, \$3.00, McGraw-Hill) Describes work being done by electron tubes in industry today.

ELECTRON OPTICS AND THE ELECTRON MICROSCOPE, Zworykin, Morton, Ramberg, Hillier, Vance (766pp, 549 ill, 1945, \$10.00, Wiley)

ELECTRON OPTICS IN TELEVISION, Maloff and Epstein (299pp, 197 ill, 1938, \$4.00, McGraw-Hill), Electron optics and the cathode ray tube.

AN INTRODUCTION TO ELECTRONICS, Hudson (97 pp, 111 ill, \$3.00, Macmillan) Gives practical, non-technical info on electronics and possibilities.

A PRIMER OF ELECTRONICS, Caverly (235pp, 125 ill, 1943, \$2.25, McGraw-Hill) An ABC book for technicians whose work touches on electronic devices.

BASIC ELECTRONICS, Kloeffler and Horrell, (435pp, 404 ill, 1949, \$5.00, Wiley) Suitable as introduction to field for electrical engineer.

BASIC ELECTRONICS, Romanowicz (773pp, ill, 1948 \$5.95, Prentice-Hall) Electronics fundamentals and applications for the beginning student.

ELECTRONICS, Millman and Seely (721 pp, ill, 1941, \$5.50, McGraw-Hill) Vacuum, gas filled electronic devices, TV pickups, photocells, etc. etc.

ELECTRONICS FOR RADIOMEN AND ELECTRICIANS Manly (468pp, \$3.75, Coyne) Operation, testing, installation, troubleshooting, maintenance.

ELECTRONS IN ACTION, Stokley (320pp, 1946, \$3.50 McGraw-Hill) Presentation of advances made in electronics, including atomic energy, radar, loran, etc.

PRINCIPLES OF ELECTRONICS, Kloeffler (175pp, 169 ill, 1942, \$2.75, Wiley) Complete description of action taking place in electronic devices; clear.

ENGINEERING

BASIC ELECTRICAL ENGINEERING, Fitzgerald, (443pp, 383 ill, 1945, \$4.25, McGraw-Hill) For students in other than electrical engineering curricula.

COMMUNICATION ENGINEERING, Everitt (727 pp, 411 ill, 1937, \$5.50, McGraw-Hill) All aspects of unilateral and bilateral networks fully explained.

COMMUNICATION NETWORKS, Guillemin (vol I 425pp, 145 ill, 1931, \$5.50; vol II, 587pp, 233 ill, 1935 \$8.00, Wiley)

ELECTRICAL COILS AND CONDUCTORS, Dwight, (351pp, 85 ill, 1945, \$5.50, McGraw-Hill) Their electrical characteristics, and theory.

ELECTRICAL ENGINEERING, Christie (717pp, 604 ill, 1938, \$5.50, McGraw-Hill) Theory and characteristics of electrical machines, many practical details.

ELECTRICAL ENGINEERING, Pumphrey (369 pp 1946, Prentice-Hall) Text for general engineering student, theory and typical applications.

ELECTROMAGNETIC ENGINEERING, King (580pp, 76 ill, 1945, \$6.00, McGraw-Hill) Systematic introduction to basic concepts of electromagnetism.

ELECTRONIC ENGINEERING PRINCIPLES, Ryder (397 pp, 1947, \$6.65, Prentice-Hall) Emphasis in this text on general and industrial applications, much math.

ELECTRONIC TRANSFORMERS AND CIRCUITS, Lee (282pp, 209 ill, 1947, \$4.50, Wiley) Concise reference on design of transformers for electronic apparatus.

ELECTRONICS FOR ENGINEERS, Markus and Ze-luff (390pp, 488 ill, 1945, \$6.00, McGraw-Hill) Collection of 142 articles, reference sheets, charts, etc.

ELEMENTS OF ELECTRICAL CIRCUITS AND MACHINERY, Blalock (347pp, 194 ill, 1943, \$3.50, McGraw-Hill) For short courses in electronic circuit theory.

ELEMENTS OF ELECTRICAL ENGINEERING, Creamer (353pp, 258 ill, 1948, \$4.00, McGraw-Hill) Introduction to field of electrical engineering.

ENGINEERING ELECTRONICS, Fink (358pp, 217 ill, 1938, \$4.00, McGraw-Hill) A practical volume for engineers, review principles and typical applications.

FUNDAMENTALS OF ELECTRICAL ENGINEERING, Hessler and Carey (241pp, 192 ill, 1948, \$3.50 McGraw-Hill) Introductory book.

FUNDAMENTALS OF ENGINEERING ELECTRONICS Dow (604pp, 200 ill, 1937, \$5.50, Wiley) Engineering from practical viewpoint, math used where needed.

HIGH FREQUENCY ALTERNATING CURRENTS, McIlwain (3rd ed. in preparation) Mathematical analysis, knowledge calculus required. Wiley.

INTRODUCTION TO ELECTRICAL ENGINEERING, Mueller (584pp, ill, \$5.00, 1948, McGraw-Hill) 2nd edition, material expanded by 75%.

MEASUREMENTS IN RADIO ENGINEERING, Terman (400pp, 208 ill, 1935, \$4.50, McGraw-Hill) Information on measuring techniques and equipments.

PRINCIPLES AND PRACTICE OF ELECTRICAL ENGINEERING, Gray and Wallace (6th ed. 570pp, ill, 1947, McGraw-Hill)

PRINCIPLES OF AERONAUTICAL RADIO ENGINEERING, Sandretto (414pp, 228 ill, 1942, \$5.00, McGraw-Hill) Design of equipment, aeronautical radio problems

PRINCIPLES OF ELECTRICAL ENGINEERING-THEORY AND PRACTICE, Blalock (584pp, ill, 1936, \$5.00, McGraw-Hill)

PRINCIPLES OF RADIO ENGINEERING, Glasgow, (520pp, 344 ill, 1936, \$5.00, McGraw-Hill) Theory and application, math used, stress on vacuum tube.

PRINCIPLES OF TELEVISION ENGINEERING, Fink, (541pp, ill, 1940, \$5.00, McGraw-Hill) Fundamentals, design data, description of modern equipment.

PULSED LINEAR NETWORKS, Frank (266pp, 183 ill, 1945, \$3.00, McGraw-Hill) Introduction to electrical transients.

RADAR ENGINEERING, Fink (644pp, 471 ill, 1947, \$7.00, McGraw-Hill) Covers theory and practice of radar technology, describes various radar systems, etc.

RADAR SYSTEM ENGINEERING, Ridenour (748pp, ill, 1947, \$7.50, McGraw-Hill) General treatise on design of radar systems, stress on microwave pulse.

RADIO ENGINEERING, Sandeman (775pp, 1948, \$6.50 Wiley) For those without knowledge of radio technique Also reference book for engineers.

RADIO RECEIVER DESIGN, Sturley (480pp, ill, 1948, \$5.50, Wiley) Fundamentals of radiodesign for communication engineers.

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS - 9th ed. Knowlton (2280pp, ill, 1949, \$12.00 McGraw-Hill)

TECHNIQUES IN EXPERIMENTAL ELECTRONICS, Bachman (252pp, 128 ill, 1948, \$3.50, Wiley)

THE TECHNIQUE OF RADIO DESIGN, Zepher (394pp, 283 ill, 1949, \$5.00, Wiley) Problems encountered daily by receiver design engineers stressed.

FM

FM TRANSMISSION AND RECEPTION, Rider and Uslan (416pp, ill, \$3.60, Rider) Covers all types of f-m systems used in TV, radio, amateur radio, railroad, aviation, marine, point-to-point, mobile radio.

F-M SIMPLIFIED, Kiver (347pp, ill, \$6.00, Van Nostrand) Starts from basic principles, goes through entire receiver, stage by stage. Servicing info.

FREQUENCY MODULATION, Hund (375pp, 113 ill, 1942 \$4.50, McGraw-Hill) Presentation of f-m engineering principles and applications.

FREQUENCY MODULATION, Marchand (409pp, 315 ill, \$5.90, Murray Hill) Basic principles of f-m, f-m components, f-m transmitters and receivers.

HANDBOOKS

AMERICAN ELECTRICIAN'S HANDBOOK, Croft and Carr (6th ed, 1734pp, 1724 ill, 1948, \$6.00, McGraw-Hill)

BROADCAST OPERATOR'S HANDBOOK (278pp, \$3.30 Rider)

COMPONENTS HANDBOOK, Blackburn (625pp, ill, 1949 \$8.00, McGraw-Hill) Codified properties, characteristics of electronic components.

ELECTRICAL ENGINEERS HANDBOOK (in preparation Wiley) Covers whole field of communications.

ELECTRONICS DICTIONARY, Cooke and Markus (433pp, 600 ill, 1945, \$5.00, McGraw-Hill) 6500 terms defined, diagrams to illustrate principles.

ELECTRONICS MANUAL FOR RADIO ENGINEERS, ZeLuff and Markus (879pp, \$9.50, McGraw-Hill) 289 articles published in Electronics: '40-'48.

ESSENTIALS OF ELECTRICITY FOR RADIO AND TELEVISION, Slurzburg and Osterheld (in press, McGraw-Hill)

HANDBOOK OF INDUSTRIAL ELECTRONIC CIRCUITS, Markus and ZeLuff (272pp, 433 ill, 1948, \$6.50, McGraw-Hill)

INDUSTRIAL ELECTRONICS REFERENCE BOOK, Westinghouse (680pp, 1147 ill, 1948, \$8.50, Wiley)

RADIO ENGINEERING, Terman (813pp, 475 ill, 1947 \$7.00, McGraw-Hill) Reference source covering entire field of radio engineering.

RADIO ENGINEERING HANDBOOK, Henney (4th ed. in press) Written by a staff of engineers for use by engineers.

RADIO ENGINEERS' HANDBOOK, Terman (1019 pp 860 ill, 1943, \$7.00, McGraw-Hill) Comprehensive re-

THE RADIO MANUAL, Sterling and Monroe (1000 pp, ill, \$12.00, Van Nostrand) Structure, installation, operation, upkeep, control of radio equipment.

WAVEGUIDE HANDBOOK, Marcuvitz (in press, McGraw-Hill) Theoretical and experimental data on microwave properties.

MANUALS

ANTENNA MANUAL, Smith (320pp, 6½x9½, \$3.50, Editors and Engineers)

ARVIN DIAGRAM MANUAL (\$5.00, Supreme)

DIAL CORD STRINGING GUIDE (\$1.00, Sams) 2300 receivers, 1938 - 1949, covered.

ELECTRICAL AND RADIO TROUBLESHOOTING MANUAL (610pp, 8½x11, 500- ill, \$5.95, Coyne) Especially written for on-the-job-reference.

MOST OFTEN NEEDED RADIO DIAGRAMS (\$2.50, Supreme)

MOST OFTEN NEEDED TV SERVICING INFORMATION (1948, 1949, 1950, - \$3.00 each, Supreme)

MOST OFTEN NEEDED 1947 FM AND TV SERVICING INFORMATION (\$2.00, Supreme)

PHOTOFACT FOLDERS (\$1.50 per set of 160pp, \$18.30 for each volume, Sams) vol I-postwar models to Jan 47, vol II-1/1/47-7/1/47, vol III-1/1/48, vol IV-7/1/48 vol V-12/1/48, vol VI-5/1/49, vol VII-10/1/49, vol VIII-1/1/50.

POST WAR AUDIO AMPLIFIERS (352pp, 8½x11, \$3.95 Sams)

POST WAR AUTORADIOS (360pp, ill, 8½x11) Sams. Covers over 100 models made since 1946.

POST WAR COMMUNICATION RECEIVERS (264pp, ill, 8½x11, \$3.00, Sams) Technical analysis of more than 50 communication sets.

RADIO RECEIVER TUBE PLACEMENT GUIDE (192pp \$1.25, Sams) Covers 1937 - 1947 models - over 5300

RADIO TUBE VADE MECUM, Brans (\$3.00, Editors and Engineers) More than 15,000 tubes of 247 mfrs. listed; characteristic tube data.

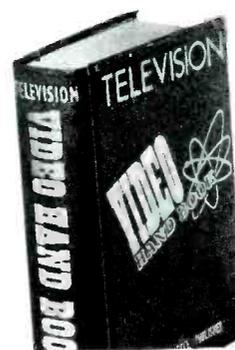
RECORD CHANGER MANUAL (vol I-40 post war models, \$4.95, vol II-45 models since 1948, \$6.75. Both 400pp, 8½x11, Sams)

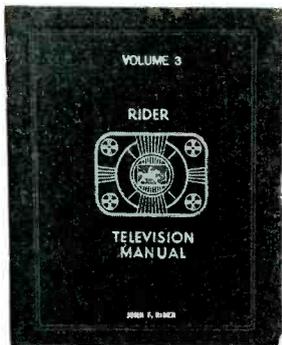
RIDER TROUBLESHOOTING MANUALS, a complete reference library for the technician, made up of factory compiled, authentic servicing information for almost any radio receiver ever produced.

Volume XX-Covers latest am-fm radio, auto receivers, record changers, etc., complete in every respect, but with added advantage of text and double spreads assembled in position. More than 1700 pp, more than 70 manufacturers. \$18.00, Rider.

Volume XIX - \$19.80

Volume XVIII - \$19.80





Volume XVII - \$16.50
 Volume XVI - \$8.40
 Volume XIV to VII - \$16.50 each volume
 Volume VI - \$12.50
 Volume I to V (one volume) - \$19.80

RIDER TV MANUALS, an up-to-date library of television receiver service

RIDER TV MANUALS, an up-to-date library of television receiver servicing a

RIDER TV MANUALS, an up-to-date library of television receiver servicing data, factory authorized. Each manual comes with the well known Rider "How it Works" book which provides a theoretical background for more successful servicing.

Volume 2 - \$18.00
 Volume 1 - \$18.00

STEWART-WARNER MANUAL (\$.50, Supreme)

SURPLUS RADIO CONVERSION MANUAL, Evenson and Beach (vol I 112pp, vol II 124pp, ill, either volume \$2.50, Editors and Engineers)

MATHEMATICS

A-C CALCULATING CHARTS (168pp, \$7.50, Rider)

BASIC MATHEMATICS FOR RADIO, Maedel (399pp, 1948, \$4.75, Prentice-Hall) Covers that math which student must master to read radio texts and lit.

FREQUENCY ANALYSIS, MODULATION AND NOISE, Goldman (446pp, 182 ill, 1948, \$6.00, McGraw-Hill) Fourier series and Fourier integral analysis.

MATHEMATICS FOR RADIO ENGINEERS, Mautner, 327pp, 145 ill, \$5.00, Pitman) Applied math needed in radio, radar, electronics, and related fields.

PROBLEMS IN RADIO ENGINEERING, Rapson (158pp 20 ill, \$1.75, Pitman) Collection of problems classified by different radio subjects; chapter reviews.

RADIO AND TELEVISION MATHEMATICS, Fischer (502pp, 160 ill, 1949, \$6.00, McMillan) Very valuable book, arranged by radio topics, virtual radio course.

RADIO MATHEMATICS (\$.25, Supreme) Introduces and explains practical arithmetic and simple algebra with units, color code, meter scales, Ohms Law, etc

THE MATHEMATICS OF CIRCUIT ANALYSIS, Guillemain (590pp, ill, 1949, \$7.50, Wiley) Covers math necessary for understanding of electrical networks.

MISCELLANEOUS

CRYSTAL RECTIFIERS, Torrey and Whitmer, (434pp, 219 ill, 1948, \$6.00, McGraw-Hill) Silicon and germanium point-contact rectifiers, theory, uses.

FACSIMILE, Jones (422pp, 200 ill, 1949, \$6.00, Murray Hill) How facsimile equipment is made, how it works, how to service it. Emphasis on circuits, not theory.

SERVICING

150 NEW RADIO AND TELEVISION DIAGRAMS EXPLAINED, Staff (110pp, ill, \$1.95, Coyne) Diagrams plus instructions on how to read them.

ADVANCED RADIO SERVICING, Beitman (30 lect-

ures, \$3.00, Supreme) Advanced methods, hints, tips suggestions, including f-m, television.

A GUIDE TO CATHODE RAY PATTERNS, Bly (39pp 175 ill, \$1.75, Wiley) Sketch and caption summary of most commonly encountered pattern types.

INTRODUCTORY RADIO, Hicks (382pp, 1949, \$4.00, McGraw-Hill) Fundamentals of radio operation and techniques of radio repair.

ELEMENTARY RADIO SERVICING, Wellman (260pp \$3.75, Van Nostrand) Especially for vocational students, no mathematics used, many diagrams.

ELEMENTS OF RADIO SERVICING, Marcus and Levy (475pp, ill, \$4.50, McGraw-Hill) Elementary book, covers a-m, car radio, phono.

HOW TO MODERNIZE RADIOS, Beitman (8 1/2 x 11, \$1.00, Supreme) Practical job sheets with schematics and photos make work easy.

INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS (208pp, \$1.89, Rider)

MODERN RADIO SERVICING, Ghirardi (1300pp, 706 ill, \$5.00, Murray Hill) A complete course in radio electronic repair by modern professional methods.

POST WAR RECORD CHANGERS, Beitman (144pp, \$1.50, Supreme) Every popular make (1945-1948) included.

PRACTICAL TELEVISION SERVICING, Johnson and Newitt (334pp, 230 ill, 1949, \$4.00, Murray Hill) For who want a practical TV servicing book.

PRINCIPLES AND PRACTICE OF RADIO SERVICING Hicks (391pp, 312 ill, \$4.00, McGraw-Hill) Stresses underlying theory, discusses test equipment, design.

RADIO CONSTRUCTION AND REPAIRING, Moyer and Wostrel (444pp, 179 ill, \$3.00, McGraw-Hill) For amateur constructors as well as service technicians.

RADIO SERVICE TRADE KINKS, Simon (254pp, \$3.50, McGraw-Hill) Presents problems and remedies without technical analysis, covers 96 makes of radio.

RADIO SERVICING, Marcus (773pp, \$5.95, Prentice-Hall) Comprehensive text on theory and practice of radio. Service notes in each chapter tell how-to.

RADIO SERVICING COURSE BOOK, Beitman (22 lessons, 1949, \$2.50, Supreme) practical radio course for technicians who need more help.

SERVICING BY SIGNAL TRACING (370pp, \$4.00, Rider) A book with many practical applications for the service technician.

SIMPLIFIED RADIO SERVICING BY COMPARISON METHOD, Beitman (84pp, \$1.50, Supreme) A simplified method of radio service, many tips.

SERVICING THE MODERN CAR RADIO, Hurlbut (702pp, 722 ill, \$7.50, Murray Hill) Everything needed to become a skilled auto radio technician.

TELEVISION AND F-M RECEIVER SERVICING, 2nd ed. (216pp, ill, \$3.25, Van Nostrand) Anyone familiar with a-m can use book. Alignment, Service instructions.

TELEVISION SERVICE MANUAL, Buchsbaum (forthcoming, Prentice-Hall) 1st part: theory, 2nd part: installation, 3rd part: troubleshooting.

TELEVISION SERVICING, Heller and Shulman, (in press, McGraw-Hill) For reader with only fundamental knowledge of radio, covers operation, service

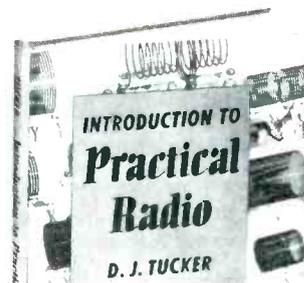
TUBE LOCATION GUIDE (see: Manuals)

Q & A BOOKS

HOW TO PASS RADIO LICENSE EXAMINATIONS, Drew (320pp, 1944, \$3.25, Wiley) Concise presentation of essential questions and answers necessary to pass test.

RADIO OPERATING QUESTIONS AND ANSWERS, Horning (10th ed, \$5.00, McGraw-Hill) Covers elements 1, 2, 3, 4, 5, 6, 7; 266 questions and answers.

RADIO OPERATOR'S LICENSE Q and A MANUAL, Kaufman (608pp, 193 ill, 1950, \$6.00, Rider) The



best Q-A book to date. Provides questions, answers and explanations of answers. Lists all questions and answers to FC examinations.

RADIO - TELEVISION QUESTIONS AND ANSWERS, Smith (\$.85 each, Editors and Engineers) A separate book for each element in study guide form.

QUESTIONS AND ANSWERS IN TELEVISION ENGINEERING, Rabinoff and Wolbrecht (\$4.50, McGraw-Hill) Reference material in Q-A form on all TV phases

RADAR

FREQUENCY MODULATED RADAR, Luck (466pp, 129 ill, \$4.00, McGraw-Hill) Engineering guide to principles and practice of f-m radar.

PRINCIPLES OF RADAR, M. I. T. Radar School Staff (870pp, 563 ill, \$5.50, McGraw-Hill) Basic text on principles of radar, used by US Army.

RADAR BEACONS, Roberts (480pp, 248 ill, \$6.00, McGraw-Hill) Guide to design and use of radar responder beacons.

RADAR PRIMER, Hornung (218pp, \$3.50, McGraw-Hill) Simplified discussion of radar for high school students, stressing peace time uses, non-mathem'l.

RADAR SCANNERS AND RADOMES, Cady, Karelitz and Turner (492pp, ill, \$7.00, McGraw-Hill) Engineering principles for scanners and their housing.

RADAR - WHAT IT IS (80pp, \$1.00, Rider)

RADIO

APPLIED PRACTICAL RADIO - TELEVISION (5 vol. 1900pp, 1400 ill, \$3.00 per volume, Coyne) Complete library for field reference, last vol. publ. in 1950.

BASIC RADIO PRINCIPLES, Suffern (256pp, 259 ill 1943, \$3.50, McGraw-Hill) Explains construction and function of composite parts of radio equipment.

COYNE RADIOMAN'S HANDBOOK, (355pp, \$2.75, Coyne) Handy reference book on the job. Not a textbook, flexible binding to fit pocket.

ELECTRICAL COMMUNICATION, Albert (3rd ed, Wiley) Covers entire field of modern electrical communication.

ELEMENTS OF RADIO, Marcus (2nd ed, 1948, 751pp, ill, \$4.25, Prentice-Hall) All the latest developments in field of radio covered in this new edition.

FUNDAMENTALS OF RADIO, Terman (458pp, 278 ill, 1938, \$4.00, McGraw-Hill) Basic principles of radio communication.

FUNDAMENTALS OF RADIO, Everitt (400pp, 1942, \$5.00, Prentice-Hall) Textbook covering field of radio communication.

FUNDAMENTAL RADIO EXPERIMENTS, Higgy (95pp, 71 ill, 1943, \$2.00, Wiley) 32 basic experiments, principles involved, procedures to be followed.

INTRODUCTION TO PRACTICAL RADIO, Tucker, (338pp, 211 ill, \$3.00, Macmillan) Explains all radio fundamentals clearly and describes use for each.

PRACTICAL RADIO AND ELECTRONICS COURSE (53 lessons, \$3.95, Supreme) Home study course for beginner to become expert.

PRINCIPLES OF RADIO, Henney (534pp, 515 ill, 1945.

\$3.75, Wiley) 5th ed, fundamentals of radio for those with little background in radio.

RADIO CIRCUIT HANDBOOK (32pp, 53 ill, \$.25, Allied Radio) Especially for radio training classes, book gives explanation of all important basic circuits.

RADIO DATA HANDBOOK, Cooke (48pp, 79 ill, \$.25, Allied Radio) Comprehensive handbook of radio, electric, electronic formulas, tables, standards, data, etc.

RADIO: FUNDAMENTAL PRINCIPLES AND PRACTICES Almstead, Davis, Stone (222pp, 162 ill, \$2.20, McGraw-Hill) Advanced radio for beginner.

RADIO FUNDAMENTALS, Albert (595pp, 254 ill, 1948, \$4.50, McGraw-Hill) Recent developments in radio, including point-to-point, broadcasting services.

RADIO HANDBOOKS, Danley (320pp, 6½x9¼, \$3.00 12th ed, Editors and Engineers) Constructional info on radio communication equipment.

RADIO PHYSICS COURSE, Ghirardi (972pp, 508 ill \$5.00, Murray Hill) Starts out with extensive section on basic electricity, then covers entire radio field.

RADIO TECHNOLOGY, Vogt (573pp, 391 ill, 1950, \$6.00 Pitman) Gives sound basis of radio principles and practices, no advanced mathematics needed.

RADIO TROUBLESHOOTERS' HANDBOOK, Ghirardi (722pp, \$9.50, Murray Hill) Specific repair data on 4800 radio models; a dependable guide.

THE RED BOOK (448pp, 8½x11, \$3.95, Sams) Replacement parts for 17,000 receivers made from 1938 to 1948 by 17 leading manufacturers.

THE RADIO AMATEUR NEWCOMER, Staff (160pp, 1.00, Editors and Engineers) Comprehensive book for beginning amateur: how to build 'ham' equipment.

UNDERSTANDING RADIO, Watson, Welch, Eby (601 pp, 406 ill, 1940, \$3.00, McGraw-Hill) Text and laboratory book for home study.

SHORT WAVES

PROPAGATION OF SHORT WAVES, Kerr (in press) McGraw-Hill Summary of research on propagation of frequencies above 100 Mc.

SHORT WAVE RADIATION PHENOMENA, Hund (in press, McGraw-Hill) Advanced manual for short wave radiation phenomena for freqs of 30 Mc and up.

SHORT-WAVE RADIO, Reyner (218pp, 124 ill, \$3.50 Pitman) Non-mathematical resume of knowledge of short-wave spectrum, wave guides, velocity mod. osc.

SHORT WAVE WIRELESS COMMUNICATION, Ladner (573pp, 342 ill, 1943, \$6.50, Wiley) Facts and theory of short wave work, mod. propagation, aeriels, feeders.

SOUND

ELEMENTS OF SOUND RECORDING, Frayne and Wolfe (686pp, 483 ill, \$8.50, Wiley) Discusses in detail problems of sound recording and reproduction.

MAGNETIC RECORDING, Begun (242pp, 146 ill, 1949, \$5.00, Murray Hill) Theory, types and makes of recorders, application, performance measurements.

THE RECORDING AND REPRODUCTION OF SOUND, Read (300pp, ill, 1949, \$5.00, Sams) A complete treatment of the entire subject.

TELEVISION

APPLIED PRACTICAL RADIO AND TELEVISION (see listing under RADIO)

BASIC TELEVISION, Grob (562pp, 407 ill, \$6.50, McGraw-Hill) Principles and servicing, comprehensive course for service technicians.

TELEVISION, Zworykin (656pp, 459 ill, \$7.00, Wiley) Authoritative, well organized, written in direct, clear-cut English, for engineers and service technicians.

TELEVISION COURSE (216pp, ill, \$3.00, Sams) Complete analysis of TV principles, operation, practice.

TELEVISION FOR RADIOMEN, Noll (607pp, 356 ill, 1950, Macmillan) Construction, operation, service of TV for technicians already familiar with radio.

TELEVISION SIMPLIFIED, Kiver (453pp, \$6.50, Van Nostrand) Explains function, operation of each element in teletest; servicing, test equipment, f-m, u-h-f.

TELEVISION STANDARDS AND PRACTICE, Fink (405pp, ill, \$5.00, McGraw-Hill) Compilation of abstracts from Proceedings of National TV Systems Committee.

TELEVISION WORKS LIKE THIS, Bendick (64pp, ill, \$1.75, McGraw-Hill) Non-technical description of television operation.

TV PICTURE PROJECTION AND ENLARGEMENT, Lytel (192pp, 119 ill, 1949, \$3.30, Rider) Well organized explanation of fundamentals of light, optics, and optical systems as employed in home receivers. Emphasis on projection types and front end enlargement.

TESTS & INSTRUMENTS

ALTERNATING CURRENT BRIDGE METHODS, Hague (407pp, 112 ill, \$8.50, Pitman) Practical and theoretical handbook for engineers and advanced students.

CATHODE RAY OSCILLOGRAPH, Reyner (189pp, 131 ill, \$3.00, Pitman) Simple guide to practical applications of 'scope to waveform examination.

CATHODE RAY TUBE DISPLAYS, Solter, Starr, Valley (746pp, ill, 1948, \$10.00, McGraw-Hill) For those interested in instrument design.

ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS, Golding (828pp, 447 ill, \$8.50, Pitman) 3rd edition, covers recent developments fully.

ELECTRONIC INSTRUMENTS, Greenwood Holdam, Macrae (708pp, 466 ill, 1948, McGraw-Hill) Computing devices, servomechanisms, radar, etc.

ELECTRONIC TIME MEASUREMENTS, Chance, MacNichol, Hulsizer (528pp, ill, 1949, \$7.00, McGraw-Hill)

MODERN OSCILLOSCOPES AND THEIR USES, Ruitter (380pp, 400+ ill, 1950, \$6.00, Murray Hill) For service technicians, engineers, teachers, scientists.

RADIO FREQUENCY ELECTRICAL MEASUREMENTS Brown (384pp, ill, 1938, McGraw-Hill) Textbook, manual, guide for laboratory uses.

THE CATHODE RAY TUBE AT WORK, Rider et al (900+pp, 8½x11, 3000 ill, \$9.00, in press, Rider) This book will be the definitive word on oscilloscopes and their uses, and will be the most comprehensive book ever published on the subject. It proceeds from the elementary considerations to advanced uses.

VACUUM TUBE VOLTMETERS (188pp, \$2.50, Rider)

UHF - VHF

HYPER AND ULTRAHIGH FREQUENCY ENGINEERING Sarbacher and Edson (644pp, 329 ill, 1943, \$6.00 Wiley) Fundamentals.

INTRODUCTION TO MICROWAVES, Ramo (135pp, 1945 \$2.25, McGraw-Hill) Non-mathematical description for engineers and industrial men.

KLYSTRON TUBES, Harrison (271pp, 137 ill, 1947, \$3.50, McGraw-Hill) Introduction to klystron tubes, showing chief differences from older type tubes.

KLYSTRONS AND MICROWAVE TRIODES, Hamilton Knipp and Kuper (526pp, 226 ill, 1948, \$7.50, McGraw-Hill) Low power microwave triodes.

MICROWAVE MAGNETRONS, Collins (769pp, 553 ill, 1948, \$9.00, McGraw-Hill) Theory and applications of multicavity magnetrons, 1,000 - 24,000 Mc.

MICROWAVE MIXERS, Pound (374pp, 221 ill, 1948, \$5.50, McGraw-Hill) Manual for engineers and technicians, description of receiving systems, their merits

MICROWAVE RECEIVERS, Van Voorhis (611pp, 451 ill, 1948, \$8.00, McGraw-Hill) Book treats together all elements making up wide band receiver.

MICROWAVE TRANSMISSION CIRCUITS, Ragan (716pp, ill, 1948, \$8.50, McGraw-Hill) Problems of transmitting power via microwave frequencies discussed.

MICROWAVE TRANSMISSION DESIGN DATA, Moreno (258pp, 203 ill, 1948, \$4.00, McGraw-Hill) Handbook for engineers designing microwave equipment.

MICROWAVES AND RADAR ELECTRONICS, Pollard (426pp, 195 ill, 1948, \$5.00, Wiley) For advanced students, explains physics of electric, magnetic fields.

PRINCIPLES OF MICROWAVE CIRCUITS, Montgomery, Dicke, Purcell (486pp, ill, 1948, \$6.00, McGraw-Hill) Starts with Maxwell's equation.

TECHNIQUE OF MICROWAVE MEASUREMENTS, Montgomery (940pp, 704 ill, 1947, \$10.00, McGraw-Hill) Emphasis on laboratory equipment

THEORY AND APPLICATION OF MICROWAVES, Bronwell, Beam (470pp, 397 ill, 1947, \$6.00, McGraw-Hill) Treats fundamental concepts, application

UHF RADIO SIMPLIFIED, Kiver (242pp, \$4.50, Van Nostrand) Starts from knowledge of principles of radio and proceeds to u-h-f.

ULTRAHIGH FREQUENCY TRANSMISSION AND RADIATION, Marchand (322pp, 139 ill, 1947, \$4.50, Wiley) Basic principles of u-h-f. Mathematical

UNDERSTANDING MICROWAVES (396pp, \$6.00, Rider)

VERY HIGH FREQUENCY TECHNIQUES, Radio Research Lab Staff (1057pp, 904 ill, 1947, \$14.00, McGraw-Hill) For radio engineers and physicists.

VACUUM TUBES

ELECTRON TUBE CIRCUITS, Seely (529pp, 641 ill, 1950, \$6.00, McGraw-Hill) Analytical study of electron tube circuits, for radio engineers mainly.

ELECTRONIC CIRCUIT AND TUBES, Cruft Lab (930pp, ill, 1947, \$7.00, McGraw-Hill) Emphasis on application in communications, electronic control.

ELECTRONICS AND ELECTRONIC TUBES, McArthur (2nd edition in preparation, Wiley) Fundamental principles of electron tubes, plus some applications.

GRAPHICAL CONSTRUCTION FOR VACUUM TUBE CIRCUITS, Preisman (237pp, 125 ill, 1943, \$3.50, McGraw-Hill) Treats non-linear circuit problems, employing graphic point of view.

HIGH FREQUENCY THERMIONIC TUBES, Harvey, (235pp, 99 ill, 1943, \$3.50, Wiley) Details on these tubes and experimental work done with them.

INSIDE THE VACUUM TUBE (420pp, \$4.50, Rider)

THEORY AND APPLICATION OF ELECTRON TUBES Reich (716pp, 658 ill, 1944, \$5.50, McGraw-Hill) Second edition.

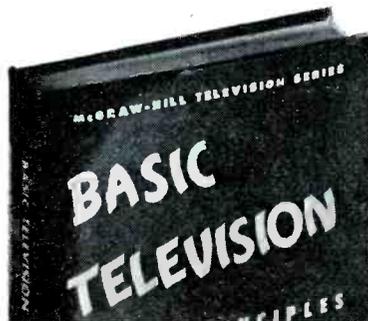
THEORY OF GASEOUS CONDUCTION AND ELECTRONICS, Maxfield and Benedict (483pp, ill, 1941, \$5.00, McGraw-Hill)

THEORY OF THERMIONIC VACUUM TUBES, Chaffee (652pp, ill, 1933, \$6.50, McGraw-Hill) Fundamentals of thermionic emission and vacuum tubes.

VACUUM TUBE AMPLIFIERS, Valley and Wallman (733pp, ill, 1948, McGraw-Hill) Complete description and design data for vacuum tube amplifiers.

VACUUM TUBE CIRCUITS, Arguimbau (688pp, 676 ill, 1948, Wiley) Emphasis on more important topics, proceeds from the simple to the complex.

VACUUM TUBES, Spangenberg (680pp, ill, 1948, McGraw-Hill) Comprehensive survey of physical laws underlying vacuum tube behavior.



by **Ed Bukstein**

Northwestern Vocational Institute

IMPEDANCE MATCHING

PROBABLY no other concept of radio theory has been as widely misunderstood as the subject of impedance matching. While most radio technicians can tell you without hesitation that the turns ratio of an impedance matching transformer is equal to the square root of the impedance ratio, there seems to be a background of uncertainty as to why this is true. Most radiomen can make the necessary calculations, but few can visualize how a transformer can "reflect" an impedance or why impedance matching is necessary at all.

The basic reason for impedance matching is illustrated in Fig. 1. Any source of power has, within itself, a certain amount of internal impedance. If various values of load are connected to a source of power, it will be found that the greatest amount of power will be developed

in the load when its impedance is made equal to the internal impedance of the source. The circuits shown in Fig. 1 represent three different values of load connected to a ten volt battery having ten ohms of internal impedance. The calculations show that the greatest amount of power is developed in the load whose impedance is the same as the impedance of the battery. This principle may be generalized as follows: *to achieve the maximum transfer of power from a source to a load, the impedance of the load should be equal to the impedance of the source.*

In the radio receiver, the output tube acts as a source and the loudspeaker as a load. The impedance of the tube is generally on the order of 2000 to 10,000 ohms, and the loudspeaker impedance may be on the order of 6 or 8 ohms. Obviously,

a direct connection from the tube to the speaker would result in a serious mismatch. It is the function of the output transformer to match these widely different impedances. The transformer makes the small impedance of the speaker appear to be a larger impedance across the tube. Impedance matching is literally a process of deceiving the tube by making it think that it is working into a value of load other than the value actually used.

Fig. 2 shows two leads coming out of a closed container and connected to a 10-volt source. An ammeter connected in the circuit reads 5 amperes. Since the 10-volt source is delivering 5-amperes of current, one might jump to the conclusion that there is a 2-ohm resistor in the container. This, in a court of law,

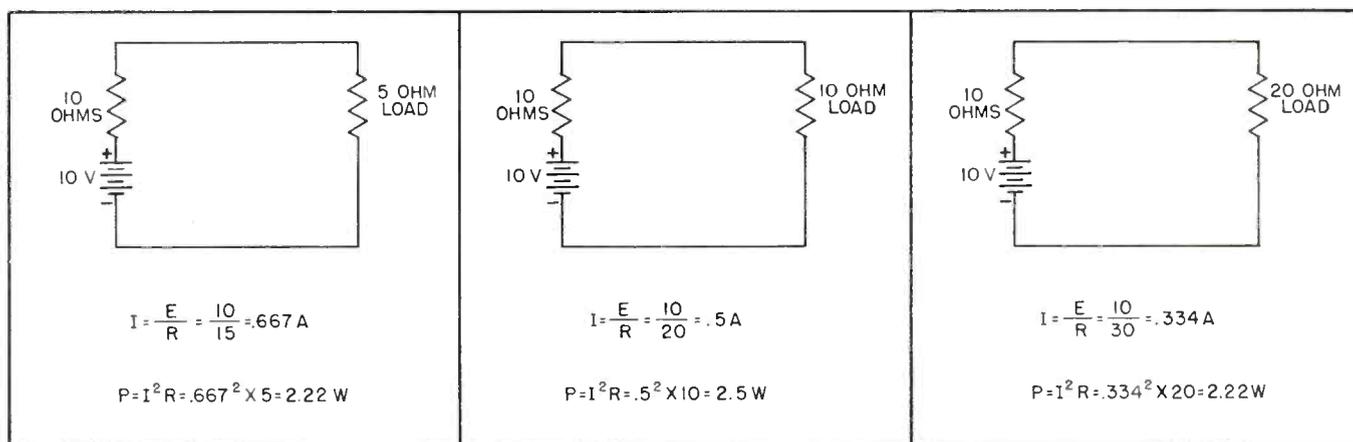


Fig. 1 The greatest amount of power is developed in the load whose impedance is equal to the internal impedance of the source

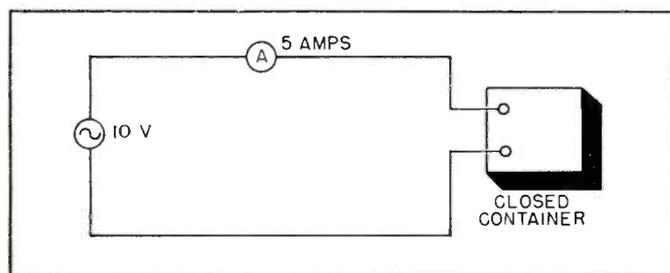


Fig. 2 It's easy to deceive the generator. Here it behaves as if there were a 2-ohm resistor in closed container (there isn't)

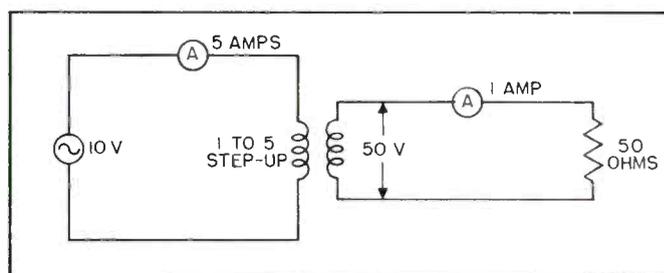


Fig. 3 Here the container is lifted to show why the 10-volt source delivers 5 amperes even though the load is not a 2-ohm resistor

would be called circumstantial evidence. The evidence is not conclusive; there may be a 2 ohm resistor in the container, then again, there may not be.

Reflecting an Impedance

Fig. 3 shows a ten volt generator connected to the primary of a 1 to 5 step-up transformer. The secondary voltage will therefore be 50 volts. If a 50-ohm resistor is connected to this secondary, 1 ampere of current will flow. Since the voltage is stepped-up by a ratio of 1 to 5, the current will be stepped-down by the same ratio. In other words, the primary current will be 5 amperes. This is a case in which a 10-volt generator is delivering 5 amperes of current even though the resistor is not 2 ohms. We may say that the generator is being deceived into believing that a 2 ohm resistor is connected to it. Or, we may say that the 50-ohm resistor is reflecting an impedance of 2 ohms. This is the condition which exists in Fig. 2. The container holds a 1 to 5 step-up transformer with a 50-ohm resistor connected to its secondary.

The required turns ratio for an impedance matching transformer may be calculated from the following formula:

$$\text{turns ratio} = \sqrt{\frac{Z_1}{Z_2}}$$

Where: Z_1 and Z_2 are the impedances connected to the primary and the secondary.

For example, if a 35L6 output tube is to be matched to a 4-ohm loudspeaker, the transformer should have a turns ratio of 25 to 1. The tube manual indicates that the 35L6 should work into a load impedance of 25000 ohms. The 4-ohm loudspeaker must be made to reflect this value of impedance. The turns ratio is calculated as follows:

$$\begin{aligned} \text{turns ratio} &= \sqrt{\frac{2500}{4}} \\ &= \sqrt{625} = 25 \end{aligned}$$

With this transformer, the tube will behave in every manner as if it were working into a 2500-ohm loudspeaker. The transformer will have a step-down ratio. The winding with the greater number of turns is connected to the larger of the two impedances. ✓✓✓

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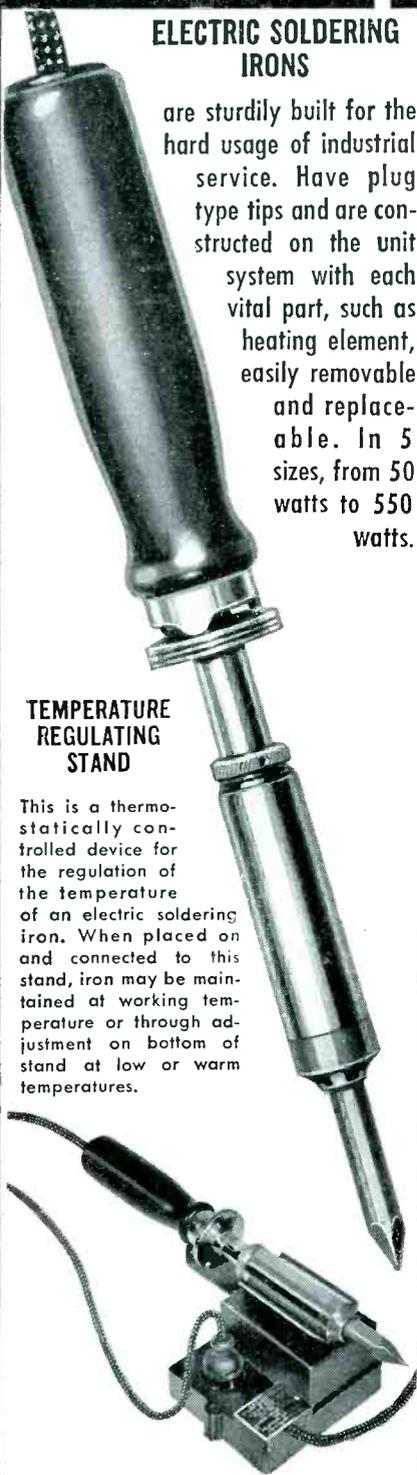
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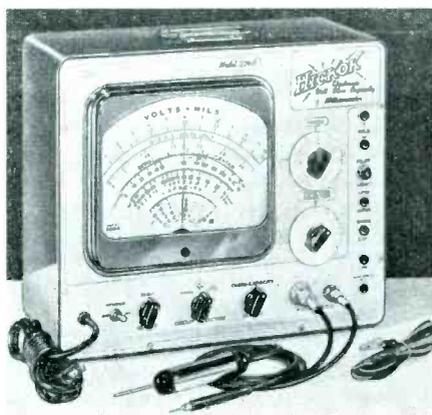
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**AMERICAN ELECTRICAL
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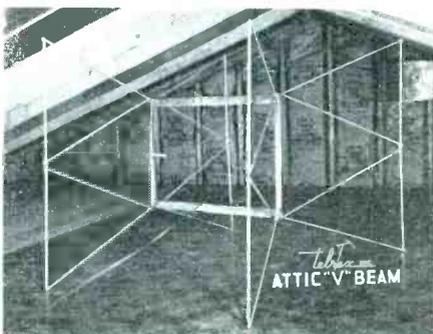
A new vacuum tube voltmeter designed for a-m, f-m and TV service work has been released by Hickok. This model 209A measures any capacitance, resistance, voltage, or current encountered in a-m, f-m and TV servicing. Has a large 9" scale. Some of the features include: Measures resistance down to 1/10 ohm, capaci-



tance to 1 mmf, permits peak-to-peak voltage measurements and contains zero-center d-c scale. Has new a-c range of 1200 volts and is flat to 300 Mc. Comes complete with low capacity, high frequency probe and all test leads. Write for technical details to Hickok Electrical Instrument Co., 10634 Dupont Ave., Cleveland 8, Ohio.

ATTIC "V" BEAM

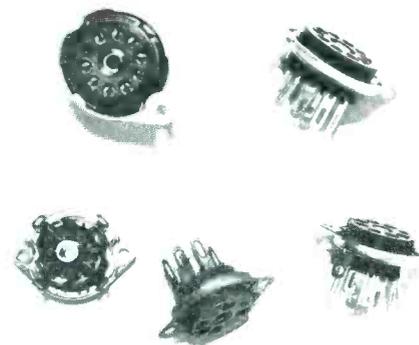
Here's a new approach to the problem of indoor antennas. Telrex, originator of the Conical "V" Beam, has designed a new indoor antenna which is the equivalent of a two-bay Conical "V" Beam array, and which can be installed conveniently in attics, garages, utility and store rooms. The new antenna, which Telrex claims will make outdoor installations unnecessary



in nearly all locations within a radius of more than 30 miles from TV stations, is best suited for private homes, garden apartments, and other locations in which conventional outdoor antennas are impractical or prohibited. The array is very light and comes in a convenient package. It comes folded and opens up into a two-bay array, complete with transmission line. The array may be suspended or rested on flooring, beams, and rafters. Telrex, Inc., Neptune Highway, Asbury Park, N. J.

TUBE SOCKETS

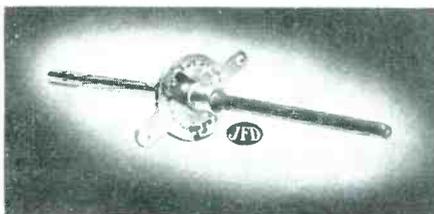
A new line of receiving tube sockets has been launched by Sylvania. They conform to RMA and Underwriter's standards and include T5 $\frac{1}{2}$, T6 $\frac{1}{2}$ and octal with 7, 8, 9 cadmium plated contacts; general purpose or low loss shielded or unshielded phenolic bases; with or without center shield, and with or without ground lugs on cadmium



plated or hot tin finish saddle, for top or bottom chassis mounting. Sylvania Electric Products, Warren, Pa.

DETENT SWITCH CONTROL

Four detent switch controls have been made available by JFD. They



are for use as replacements in RCA, Emerson, Admiral, Air King, Cape-

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TV Field Service

→ from page 9

horizontal output transformer and output stage, it is only necessary to use an ohmmeter to check the deflection coil and a high-voltage meter to check the voltage developed by the horizontal sweep.

If the Syncro-Sweep signal on the grid of the horizontal output tube produces the required increase in meter reading, and high voltage is present on the a-c and the d-c side of the high-voltage rectifier tube, then the trouble would be a defective sawtooth generator stage in the set. If high voltage is present only on the a-c side of the rectifier tube, the tube or some component in its circuit is faulty. If a high voltage is developed by the receiver sweep voltage, and there is a meter reading across the horizontal deflection coil, but the screen is dark, the trouble probably is in the biasing circuit of the picture tube, or a faulty picture itself.

Sync amplifier stages—In order to determine if a receiver has a faulty horizontal or vertical sync amplifier section, it is only necessary to adjust the Syncro-Sweep to transmit a horizontal or vertical sync signal on a dead channel. This signal can be received on an equivalent dead channel in the receiver, detected by the video amplifier, fed to the sync amplifier stages, to be fed in turn to the vertical sawtooth generator and the horizontal sawtooth generator tubes.

Most receivers use common amplifier stages for both horizontal and vertical sync. It is therefore relatively easy to isolate the faulty circuit by a process of elimination if the horizontal sync from the Syncro-Sweep locks in with the receiver raster, but the vertical sync does not. The trouble would generally be between the last common sync amplifier stage and the grid of the vertical sawtooth generator tube. If the vertical sync signal from the Syncro-Sweep locks in place with the receiver raster, but the horizontal sync does not, the trouble would be between the last common sync amplifier and the horizontal sawtooth generator tube. Normally the only included circuits would be in the a-f-c stage. It can thus be seen that sync trouble, outside of the sync amplifier, can readily be isolated for

→ to page 29

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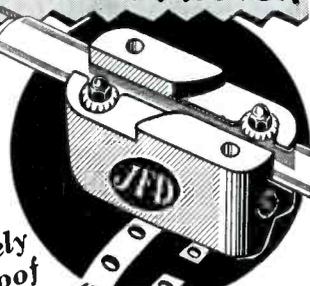
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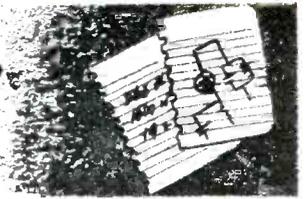
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THE Notebook



Adjacent Sound Channel Interference: ADMIRAL 20A1, 20B1, 21A1

In areas where any two adjacent channels may be received, the sound transmission from the lower channel may cause interference on the picture of the higher channel. This type of interference may be reduced to a minimum or eliminated by means of an adjacent channel trap fitted to the second video i-f amplifier, Transformer T302. The trap is constructed by using another sound trap, L308, part number 72-A-88-1, which should be modified and installed in the receiver in the following manner:

1. Procure this sound trap, and remove two turns from the coil at the end farthest from the slug screw and resolder the coil to the lug on the form (do not remove the condenser).
2. Clip the white lead and the bare tinned lead from the coil.
3. Remove the cover from the video i-f strip and locate T302.
4. Procure a short length (approximately 3 inches) of insulated 24 or 26 gauge wire and wind ap-

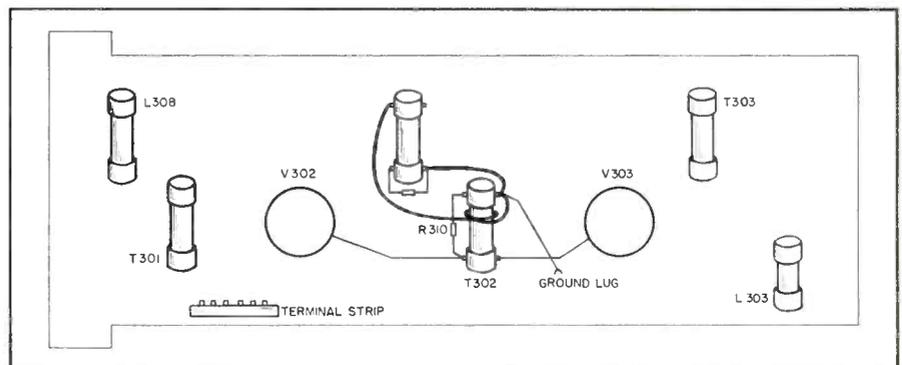
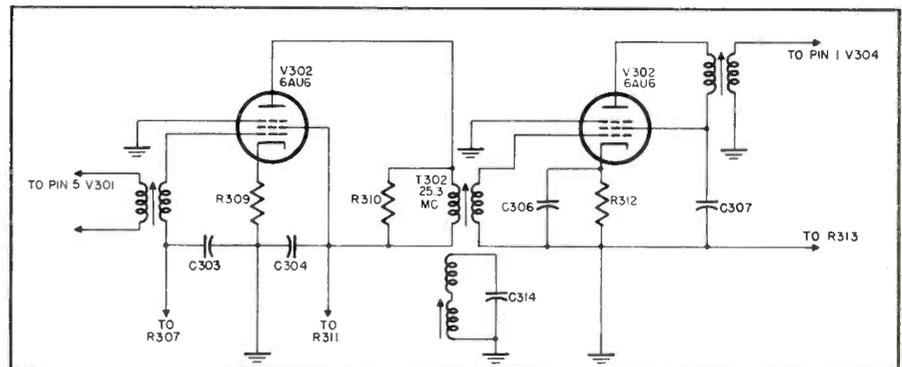
proximately 1½ turns in a clockwise direction on T302. These turns should be positioned on the small diameter portion of T302 at the end farthest from the slug screw, with one end of the wire looped under itself, to hold the coil in position in a manner similar to the coupling coil of T301.

5. Connect one end of the 1½-turn coil to the ground connection of T302.

6. In a large number of these chassis, an unused ¼-inch hole will be found between V302 and V303, but if the hole has not been punched, one should be drilled and the new trap inserted.

7. Connect the black lead from the new trap to the ground lug of T302 and connect the loose end of the 1½ turn coupling coil to the other lug on the new trap.

8. Realign the video i-f stages. Due to the slope of the video i-f curve, it is difficult to align the new trap to 27.25 Mc with a signal generator, so the slug should be adjusted for minimum interference on the picture.



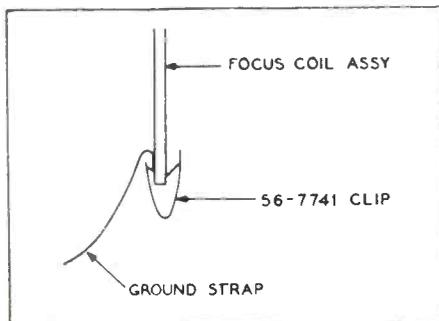
However, care must be used when making this adjustment since it is possible to affect the video i-f bandpass if the adjustment is incorrectly made.

9. Use a sweep generator and scope to check the video i-f bandpass after adjustment to be sure the trap has not affected the i-f bandpass.

Admiral Corporation
Radio & TV Service Bulletin

Reducing Harmonic Beat: PHILCO Models

To reduce harmonic beat in models having a built-in aerial, it is important that the picture tube mounting frame assembly be grounded to the



chassis. This grounding is accomplished by means of a flat metal strap.

In case this strap is broken, it may be repaired by the use of a clip, Philco Part No. 56-7741, as shown in the illustration.

Philco Corporation
Service Bulletin

Series Filament Continuity

When it is necessary to perform alignment, measure socket voltages, or troubleshoot a TV receiver, it is desirable to remove the picture tube for convenience as well as a personal safety measure. In receivers with series lighting of the filaments, the removal of the picture tube breaks the continuity of the heater circuit for all tubes and a substitute resistor or suitable filament element must be used to restore continuity. A defective type 6SN7GT tube with a good heater may be used for this purpose. To prepare the 6SN7GT tube, saw or clip off all base pins except #7 and #8. These are the filament pins and it will be found that they will insert readily into the picture tube socket pin openings #1 and #12. This will re-establish the continuity and provide proper voltage division on the filament string.

General Electric
Television Service Bulletin

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• Let it rain or blow—freeze or thaw—from arctic cold to blistering sandstorms, CLETRON loudspeakers keep functioning properly on P. A. systems and outdoor theatres with full-tone reproduction. CLETRON speakers have passed a 200-hour salt spray test and then another 200 hours on a weatherometer. In fact, these speakers actually operate when fully submerged in water.

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the CLETRON speaker to be the only one on the market to meet our severe requirements. Actual field experience from Cape Hatteras to the sands of Texas has proved that our faith in your product is entirely justified." E. B. Brady, Chief Engineer, Drive-In Theatre Equipment Company, Inc., Cleveland.

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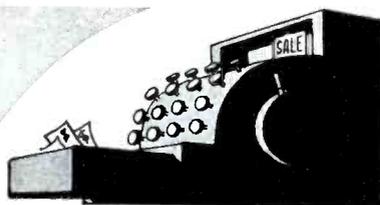
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HOW'S BUSINESS?

by WILLIAM F. BOYCE



Industry Present

→ from page 24

hart, DeWald, Garod, Philmore, Techmaster, Fada, Olympic, Regal, Packard-Bell, True-tone, Coronado, and US Television receivers. They are made with brass and phenolic shafts, and JFD claims "utmost dependability" of operation. Detailed info and complete reference charts are available from JFD Manufacturing Co., 6101 16th Ave., Brooklyn 4, N. Y.

VTVM FOR TV

Especially designed for TV servicing, Simpson's new model 303 vtvm-ohmmeter is extremely compact (only 120 cubic inches) while still retaining a 4½-inch scale. D-C input resistance 10 meg for all ranges. The instrument has 5 d-c voltage ranges, five a-c voltage ranges, five resistance ranges, three a-f voltage ranges, decibels



from —20 to 63 in 5 ranges, zero center galvanometer for f-m discriminator alignment, and an r-f voltage range with 20 volts maximum flat between 20 kc and 100 Mc. The meter also features low power consumption, comes with d-c voltage probe, a-c voltage-ohms probe, and ground lead. Simpson Electric Co., 5208 W. Kinzie St., Chicago 44, Ill.

NOISE ELIMINATOR

A noise eliminator for use with conical antennas is now available. The new product is said to eliminate howling which results from vibrating antenna elements. The noise eliminator will also prevent antenna elements which have broken off from falling and causing injury. All Channel Antenna Corp., 70-07 Queens Blvd., Woodside, N. Y.

Correction

The IRC dual control replacement manual, described on page 21 of the March issue as obtainable free, is rather available at 25c from distributors. Sorry.

Question: How much money should be available before starting a radio service business?

Answer: We will not go into the difference between money and capitalization; however, if one can put up \$1,000 in cash to begin a radio service business, he should be able to gain credit or borrow money to finance the balance of the needs to begin the operation.

The amount of money and all other forms of credit and values needed for the original investment depend completely upon the style of the operation.

The range of style of operation for the radio service business should enable the industrious embryo entrepreneur to begin with from as little as \$500 in a non-TV area up to \$500,000 for a complete and fully equipped and stocked Radio and Television Sales & Service organization in a large city.

This allows for a great deal of latitude in choice of style. It is recommended that in the beginning the service technician should not go into debt for more than an amount equal to the value of money and equipment that he himself actually puts up to start. In other words, if his money and equipment total up to an original investment of \$1,000, it is normally considered good business to borrow another \$1,000 in order to do a larger volume and higher profit ratio of business with the use of this additional money. Banks usually will consider such a loan based upon this ratio, if the character and other qualifications of the individual are good, and his reputation can be verified.

It is strongly recommended that maximum use of money, not exceeding the above-mentioned ratios, be made, rather than to struggle along without money, in the hope of expanding out of profits in the very beginning.

To give an example to show why this recommendation is made—suppose that a service technician had the

choice of opening a shop on a back street in town for \$1,000, whereas on the main stem the original cost would be \$1,500. It is well known that business volume, all other things being equal, will be relative to the number of passers-by and the convenience or location of the shop. If the number of passersby and the convenience and location are 300% to 500% better on the main than on the side street (as is usually the case), choice of location on the main stem will give three to five times as much business as could be expected on the back street. If the volume on the back street should be \$100 a week, then the volume on the main street should be \$300 to \$500 a week, with a proportionately greater profit to the business and income to the owner.

Obviously, borrowing 500 dollars to be on the main stem can quickly be paid off, whereas locating on the back street would require three to five times as long to earn enough money to move up to the main stem.

To summarize, it is recommended that, within limits, you use as much money and other valuables as you can get, to begin a good business, rather than plan expansion out of income.

Q: Should I advertise in the telephone directory?

A: By all means, advertise in the telephone directory for the service type of business; because the average customer who does not have a regular service technician will look there first to find one. Further, if he decides to go to the telephone directory to look up the number of a company he has heard of and, when he gets to the proper listing, sees a much larger and better one, he may change his mind and call you. In addition, other values would be gained, such as prestige, etc.

Readers are invited to submit their problems to this column. All letters will be answered by the author. Those of general interest will be published, together with their answers.

troubleshooting.

If neither horizontal nor vertical sync signals from the Syncro-Sweep could be locked in with the raster, the trouble would either be in the r-f to video amplifier stages, or the sync amplifier stages. If the screen shows a good contrasting signal from the Syncro-Sweep, although the signal is not locked in with the raster, the video amplifier would be eliminated as the faulty section. By using the vertical sync signal from the Syncro-Sweep, it is only necessary to probe from the grid of the sawtooth generator tube back to the second detector or video amplifier to isolate the defective sync stage.

If no contrasting signal appears on the screen, then the trouble will be between the r-f and video amplifier sections. The video amplifier stages can be readily checked by using a special audio signal from the Syncro-Sweep. By probing with this signal from the picture tube grid back to the video second detector, the faulty stage can be located. If the video amplifier stages are normally amplifying, then the trouble would be in the r-f or i-f sections. If the Syncro-Sweep is adjusted to transmit an audio-modulated r-f frequency, it is only necessary to listen in the receiver speaker for the transmitted audio note. If the note is heard, the trouble must be the video i-f stages. If the note is not heard, the fault would be in the r-f oscillator or mixer stages.

Linearity

The Syncro-Sweep can transmit on a dead channel a series of vertical or horizontal bars. These bars appear on the screen of the receiver. With the vertical bars locked in place, the horizontal linearity and width controls can be adjusted in the receiver for the proper spacing between bars. With the horizontal bars locked in place, the vertical linearity and height control can be adjusted to give uniform spacing between bars.

In this article, two miniature test instruments were described and their use in television servicing shown. Two additional instruments are available in the same line. The model 101 is a substitution tester, containing a complete range of condensers, resistors and test speaker. The model 102 is a high-voltage meter, with 10,000 ohms per volt sensitivity, and three d-c ranges of 500 volts, 15 kv, and 30 kv. ✓ ✓ ✓

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→ from page 28

REPLACEMENT NEEDLES

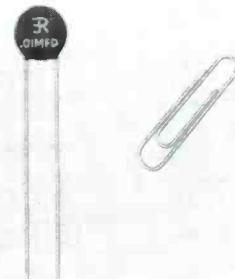
Jensen is offering a new service to the technician in the form of a compact wood cabinet which holds a complete supply of replacement needles to fit any cartridge or record player. In addition, Jensen has issued a replacement needle wall chart. This chart



illustrates the size and shape of every needle made and makes it simple for the technician to recognize the needle which is required for any particular job. The charts are available by writing to Jensen Industries, Inc., 329 S. Wood St., Chicago, Ill.

CERAMICON

Erie Resistor is now manufacturing a .01 mf disc ceramic in the miniature size of 19/32 inches diameter. Capacity of the new Ceramicon is .01 mf 100% - 0%. Voltage rating is 400 volts d.c., based on a life test of 800



volts d.c. at 85° C for 1000 hours. Power factor is 2.5% maximum at 1 kc at not more than 5 volts rms. Insulation resistance is 7500 megohms minimum. This disc Ceramicon is insulated with red dipped phenolic. Write for data and samples to Erie Resistor Corp., Erie, Pa.

WIRE RECORDER

A new portable wire recorder has been placed on the market as Telvar Model RE-17. The recorder is said by the manufacturer to give full recording volume at distances up to 25 feet. Manufacturer: Audar, Inc., Argos, Ind.

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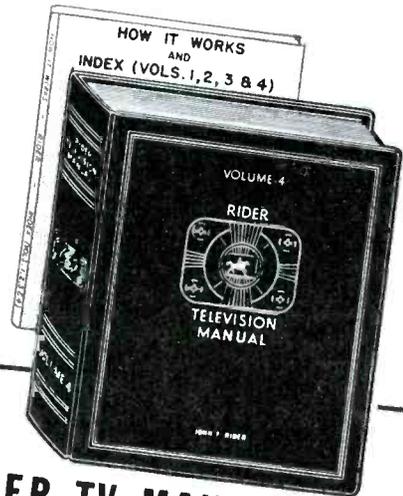
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