SERVICE DEALER and ELECTRONIC SERVICING

JUNE
1956
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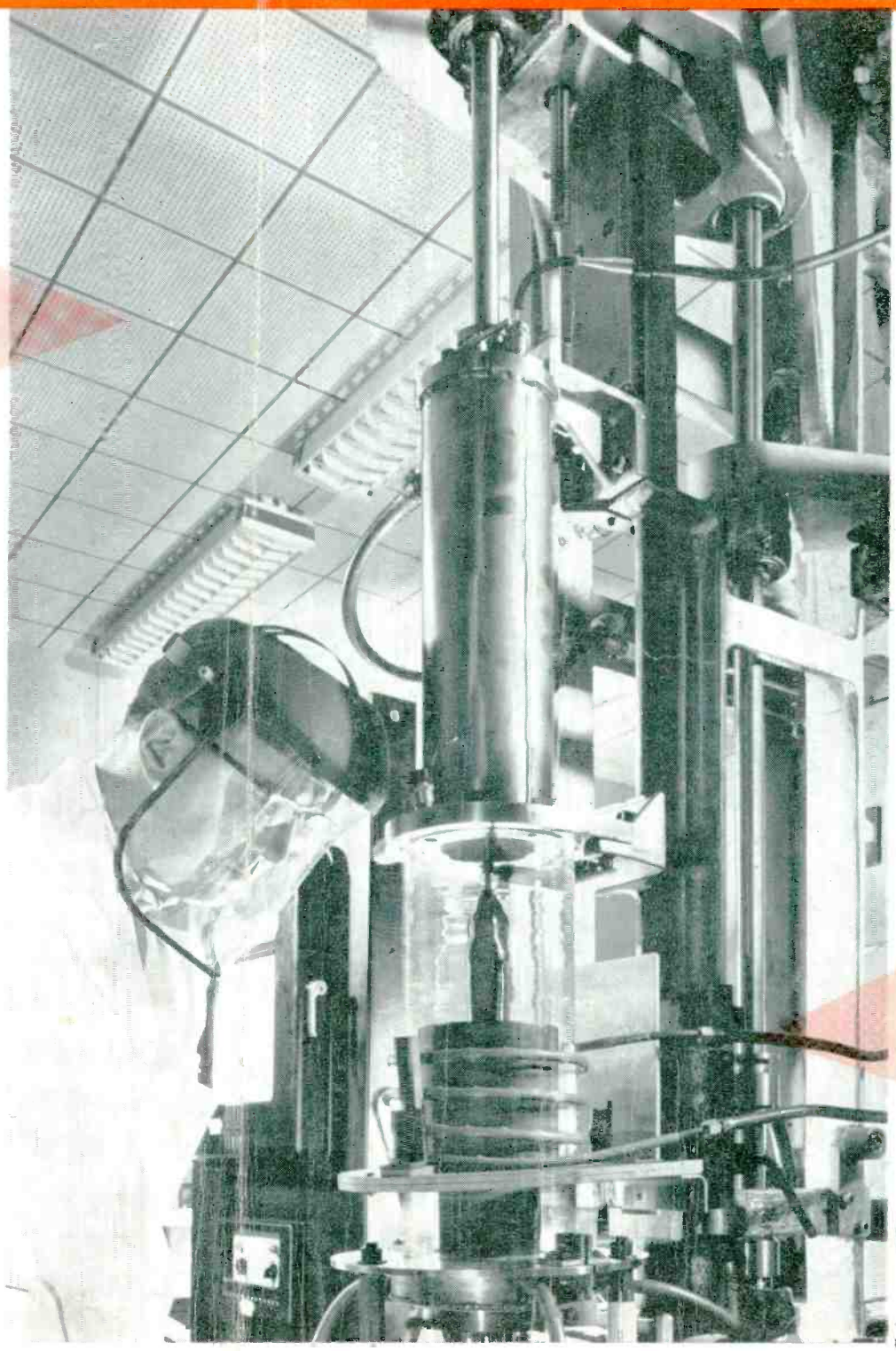
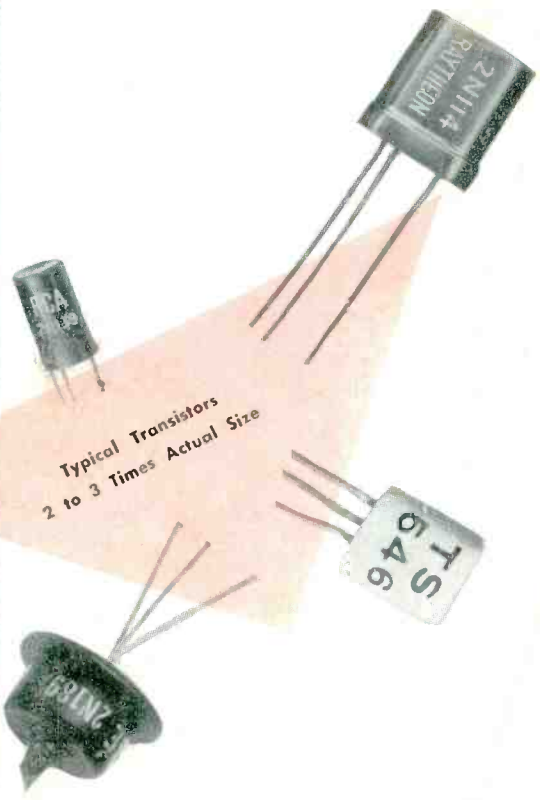
IN THIS ISSUE



"Growing" Germanium Electronically



Typical Transistors
2 to 3 Times Actual Size

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SERVICE DEALER and ELECTRONIC SERVICING

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FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

FRONT COVER

A physicist in Delco Radio Division's Semiconductor Physics Laboratory studies the growth of a large crystal of germanium which can be seen in the center of the quartz housing.

Photo courtesy Delco Division, General Motors Corp. Transistor photos courtesy of Raytheon Mfg. Corp., Radio Corp. of America, General Electronic Co., and Tung-Sol Electric Inc.

COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.

S. R. COWAN

The Customers Write

On April 10th all the men and Service Firms whose names are on our mailing list (subscribers and ex-subscribers) were notified by mail that our subscription rates would be upped to $3.00 per year effective May 1st. An anouncement to that effect was also published in our April issue and this reached our readers between the 15th and 20th of April. To say that the response was "tremendous" would be a gross understatement. Upwards of 20,000 subscription orders and extensions came in within a week. Thousands were from firms that were formerly on our free-controlled list and thousands from former subscribers who had allowed their old subscriptions to lapse. Now, as we dictate this on May 4th, the talley has passed the 30,000 mark—and if that doesn't break all former circulation records by a serviceman's trade paper I don't know whatever will.

Unfortunately we had to reject thousands of orders that came in postmarked later than May 1st which was the stated deadline before the rate increase went into effect. In addition we had to decline thousands of renewals from subscribers whose present subscriptions are still in effect and which must be served for 2 or more years to come. But in the aggregate we are comforted to know that our readers like SERVICE DEALER and ELECTRONIC SERVICING so much. Many wanted to pay in advance for 4, 5 and even 10 year subscriptions. We were astonished at the number of $5.00 and $10.00 checks that we received, and which we declined, from subscirbers who said "keep it coming!"

We got a chuckle from the many subscribers who remarked that we

Ad Libs

shouldn't have asked only $1.00 for a one year subscription because "the fine material you publish in SERVICE DEALER is worth 3 or 4 times that much."

We received a few gripes too. One fellow wrote, "I subscribed to your magazine two weeks ago and still haven't received my first issue." For that fellow's information let it be noted that it takes five weeks to process a subscription order and sometimes these orders are received just about closing time so that an extra three week's period must pass before the first issue is served. Another fellow wrote, "I subscribe to nine magazines now—how can a serviceman read so many and still have time to do his work?" The answer to that is obvious—stop working; just read magazines. Still, another subscriber said, "now that you've raised your advertising rates (which is something that we did *not* do) I see that you are raising your subscription rates so you can get rich fast at the expense of us poor servicemen." That guy "burned me up" so I wrote to him to tell him bluntly that it costs us approximately 23¢ each month to put a copy of our magazine into a subscriber's hands—and as we have been charging servicemen only 8¢ per copy we have been taking quite a beating on the deal, with advertisers helping to pay a part of the difference.

Even now with our subscription rate of $3.00 per annum we will take a small loss on every copy mailed, and our costs are still rising. I thought you'd like to know how matters stand. And also keep this in mind, any time a subscriber wants to cancel the balance of his subscription we'll gladly refund in full, on a pro rata basis, whatever sum is due the subscriber on the unused portion. [*Continued on page 8*]

trade

RETMA reports a steady increase in the sale of entertainment and non-entertainment type transistors. Transistor sales have increased each month since November 1955. Manufacturers sold over 700,000 transistors in March 1956 and nearly two million units during the first quarter of this year. Total transistor sales in March were reported to be 707,817 units with a dollar value of $2,056,135. Sales of transistors during the first quarter of 1956 totaled 1,897,309 units with a dollar value of $5,688,033. February sales had totaled 616,818 transistors with a dollar value of $1,184,046, compared with 572,674 units sold in January with a dollar value of $1,374.656.

• • •

Picture tube sales in March totaled 848,055 units valued at $15,714,365 compared with 898,063 tubes worth $17,136,695 sold in February. Sales in March 1955 had totaled 912,953 picture tubes worth $17,674,745.

Receiving tube sales report showed 42,525,000 tubes with a value of $34,849,000 sold in March compared with 37,254,000 tubes worth $30,756,000 sold in February. Manufacturers' sales of receiving tubes had totaled 40,859,000 units with a value of $29,743,000 in March 1955.

• • •

Factory production of both radio and television receivers during March increased over the February level but showed a slight decline in the first quarter compared with the corresponding period a year earlier, the Radio-Electronics-Television Manufacturers Association reported today.

In March, 680,003 television receivers and 1,360,113 radios were manufactured compared with 576,282 TV sets and 1,093,506 radios produced in February. March 1955 production of television receivers had totaled 831,156 and radio output had been 1,482,274 units.

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Easy checks on inventories and movements of all type tubes are now possible with the Westinghouse Tube Inventory Guide. Available to all dealers, the tube guide is designed to aid in keeping track of tube stocks and movements. All types of radio and TV tubes as well as picture tubes are listed in the guide, which can be obtained from tube distributors.

• • •

David J. Munroe has been named president of the Webster Electric Co. it was announced following the annual meeting of the stockholders here. He succeeds Preston G. Crewe who was elevated to the newly-created post as vice-chairman of the board of directors. Arthur C. Kleckner was re-elected chairman of the board. Munroe, Kleckner and Crewe all are from Racine.

• • •

Kenneth Price has joined the Chicago Office of the Sprague Products Company to serve as field engineer for the Middle Western territory. Mr. Price's appointment is part of the expanded Sprague Products educational program that was recently announced by Harry Kalker, President of the Sprague Products Company, master distributing organization for electronic components made by the Sprague Electric Company.

He has just completed a thorough basic training course at Sprague headquarters plants in North Adams, Mass., and is now available for consultation with various schools, technical groups, and servicemen's organizations. Arrangements for a regular series of talks by Mr. Price later this year are now being made and service groups interested in hearing him should write directly to me at North Adams," Mr. Kalker said, "so that we can fit these requests into his schedule."

• • •

An "overwhelming majority" of the nation's 36,000,000 television set owners are well satisfied with the promptness, quality, prices and courtesy of TV service technicians, it was reported over the week-end by E. C. Cahill, President

flashes

of the RCA Service Company, Inc. Mr. Cahill said the hearty public endorsement was disclosed in the latest nationwide survey conducted by Elmo Roper, market research expert, for the RCA Service Company, Inc. and the Consumer Products divisions of the Radio Corporation of America.

• • •

Philco Corporation announced that it has begun manufacture of portable television receivers with both 14-inch and 17-inch picture tubes. The new sets will start moving to distributor and dealers in the very near future.

"Philco portable television sets are now coming off our new fully mechanical production lines in large volume," Larry F. Hardy, Vice President-Product Development, said. "The sets have been engineered for superior performance in all areas."

• • •

The Electronics Division of Thompson Products, Inc., announces a new field exchange program on its Superotor line of TV antenna rotators. Specific instructions and a colorful brochure have been mailed to its distributors throughout the country outlining this plan of immediate service available in the field.

All dealers who require service on Superotors, produced at any time since they were first put on the market, will be able to obtain exchange service at duly appointed Superotor distributors. This new program, which is somewhat unique in this field, eliminates all delay in the field, permitting the dealer to immediately replace a unit which requires service, and eliminates costly customer problems.

• • •

Henry Argento, vice president and general manager of Raytheon TV and radio operations recently said that transistorized portable radios are a concrete indication that there "is plenty of life in the radio industry."

He pointed out that the newly introduced transistor radios will enjoy great popularity this year because of their long battery-operated life, featherweight, and small size portability. Car radios have increased, as have all types of portables for vacations and travel, keeping up with a nation on the move.

• • •

When will a completely portable battery operated television set be placed on the market? "It could be tomorrow!" says Harry J. Mason, director of research and development for the Ray-O-Vac Company. "But, more likely, it will be several years." Mr. Mason believes that with the further perfection of the transistor and advanced circuit design, a practical portable battery TV will be closer to reality.

• • •

Engineers, designers, technicians and hobbyists were initiated in the Module Technique at the Lecture/Demonstration held at Federated Purchaser headquarters in Mountainside, N.J., recently. A sound movie dealt with the development of the original "Project Tinkertoy" and its mechanized production. Then Fred Israel, Technical Sales Representative for Aerovox Corporation, spoke on the commercial aspects, applications to civilian assemblies such as radio, TV, computers and other electronic equipment; the interpretation of coding and the test procedure; and the basic considerations in any future servicing of Modules.

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The American Phenolic Corporation, one of the nation's leading manufacturers of electronics components since its organization in 1932, has changed its name to the Amphenol Electronics Corporation.

• • •

Approximately 10,000 servicemen will be trained in the ease of servicing the Westinghouse 22-inch rectangular tube color television receiver through a series of factory school courses. The announcement was made by Kenneth H. Brown, manager, headquarters service, of Westinghouse ■ ■

Fig. 1—Front view of Leitch Meter-Matic VTVM.

An Automatic VTVM

by LAWRENCE FIELDING

Describing a new innovation in metering; one in which the instrument automatically selects the correct scale to be used in measuring the unknown voltage, either ac or dc, as well as resistance.

COUNTLESS servicemen have undoubtedly found themselves in the position of just getting into a tight spot to measure a voltage only to find that the reading obtained either exceeds full scale deflection of the meter or else is so far down-scale as to be unreadable. The usual procedure is to release the probe, "climb out" from inside the chassis and change ranges on the VTVM. Leitch Engineering Corporation has designed a unique Vacuum Tube Volt-Ohm Meter, which, in addition to possessing many advance design features, virtually eliminates the situation described above. The instrument, aptly dubbed "Meter-Matic", automatically selects the proper range to be read by internal switching. In fact, looking at *Fig. 1* which shows a front view of the equipment, we see that there is no "Range Selector" control whatsoever. Furthermore, to facilitate instantaneous and errorless readings, the proper scale to be read is automatically indicated by a small red light glowing in the center of the appropriate range.

All voltage ranges are calibrated directly in volts, so that no mental multiplication is required on the part of the user. Other refinements include complete burn-out protection up to 2000 volts, compact design (the unit measures only 10 inches high by 8½ inches wide by 6 inches deep), six overlapping ranges for all voltage measurements and six ranges for convenient measurement of resistance. Only one set of probes serves all functions and the unit automatically differentiates between *ac* and *dc* voltages when both are present in a given circuit.

The meter movement has a sensitivity of 200 microamperes for full scale deflection. All multipliers and shunts are 1% precision carbon film resistors. The tube complement consists of 1-12AU7, 1-6X4, 1-12AT7 and 1-OA2 regulator. The unit is designed to operate on 105-12 volts *ac* and requires two 1.5 volt cells for the ohmmeter circuit. Overall weight of the VTVM is only 11 pounds which is light enough to classify the meter as a portable type.

Automatic Range Selection

Before discussing the special circuits of this instrument in detail, the action of the automatic range selector is of sufficient interest to warrant a brief description of what takes place under typical operating conditions. When the function switch is set to DC positive, DC negative or AC the circuit automatically sets up the instrument on the lowest voltage range (5 volts full scale) and this fact is indicated by the pilot lamp in the center of this particular scale being illuminated. The probe is applied to the circuit point to be measured, and let us assume that the voltage at that point is 350 volts. Four clicks will be heard in very rapid succession as the automatic range selector switches to the proper scale by means of a fast acting stepping relay. In less than one second the meter pointer will come to rest at the proper point on the proper scale (0- 500 volts).

The fact that this scale is now to be read is shown by simultaneous illumination of the small red indicator light at the center of this scale only. Upon completion of the reading and removal of the probe from the circuit point, the measurement circuit is automatically restored to the most sensitive, or lowest voltage range and is ready for use once more. It is especially interesting to note that where a particular voltage might conceivably be read on two scales, the automatic range selector chooses that scale which will give the greatest deflection.

When the function switch is turned to "OHMS," operation of the equipment is somewhat similar with the following exceptions: the meter pointer now rests at full scale and the range selector automatically switches to the *highest* resistance scale (10 megohms, midscale). Again, the appropriate indicator lamp shows the range in use. As a resistance is measured, the range selector chooses the range which will result in a convenient mid-scale reading. When the reading is completed, the range is automatically restored to that of highest resistance readings.

For both voltage and resistance measurements, the automatic range selector performs a dual function. If the readings obtained are too high on a particular scale, the circuit switches *up* to the next higher scale. If readings are too *low* the circuit automatically switches *down* to a lower scale. Thus, readings are always taken on the optimum scale with no effort on the part of the user.

Block Analysis

A block diagram of Meter-Matic is shown in *Fig. 2*. The measurement section of the circuit is similar to many other commercially available vacuum tube voltmeters. The meter movement is essentially part of a balanced bridge circuit utilizing both triode sections of the 12AU7. A reference voltage is applied to both terminals of the meter so as to cause zero deflection of the movement with no external voltage applied. The application of a *dc* voltage (or, rectified *ac*) to one side of the bridge creates an unbalance in the bridge circuit which causes current to flow through the meter. This voltage unbalances in the circuit, and in addition to actuating the meter movement, drives a second circuit designed to "sense" when the meter indicates beyond certain limits. Automatic range searching occurs whenever meter deflection is either above top scale or below ¼ scale except on the lowest range of the instrument.

The Thinking Circuit

Before explaining the novel operation of the automatic range selector circuit it will be helpful to review certain facts in connection with meter movements in general. As was noted earlier, the particular meter used in this equipment requires 200 microamperes for full scale deflection. Assuming that the total resistance of the movement and any zero-set resistors in series with it is 5000 ohms, the *voltage* necessary for full

[*continued on page 50*]

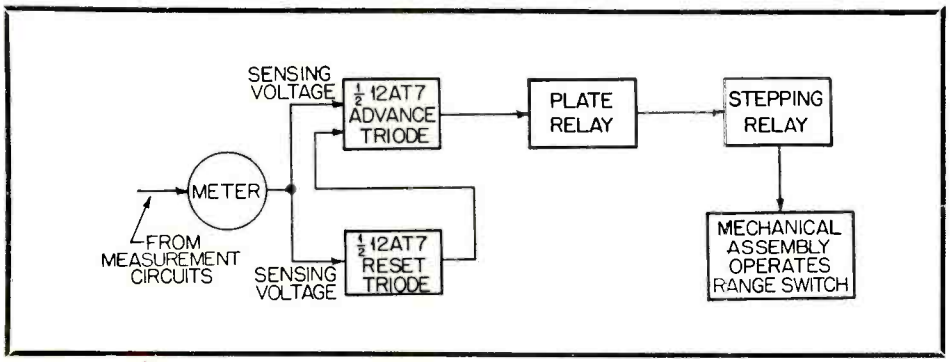


Fig. 2—Block diagram of Leitch Meter-Matic VTVM.

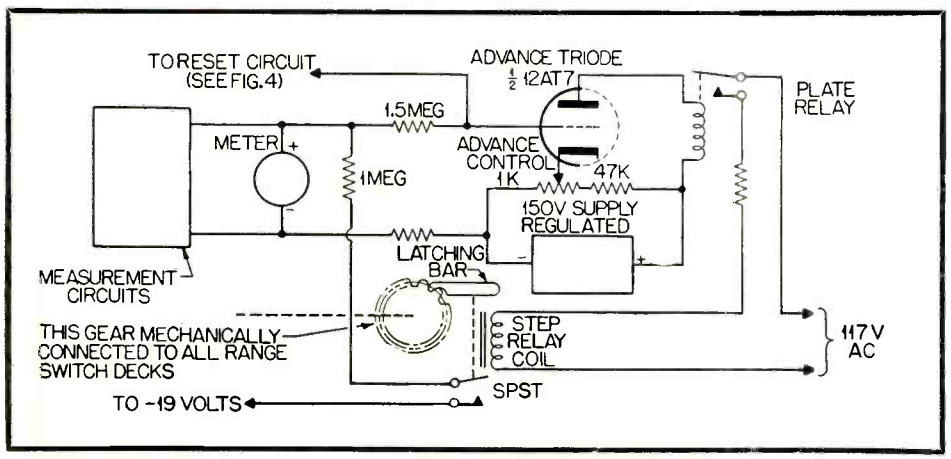


Fig. 3—Circuit diagram to illustrate advancing scale action when meter reading is too high.

AD LIBS

[*From page 3*]

Finally, to the many subscribers who wrote notations on their orders asking us to confirm receipt of same, all we can say is this: It is a physical impossibility to make such individual acknowledgments. Don't forget, if you ever contemplate making an address change, notify us at least five weeks in advance because we cannot make good copies which are sent to old addresses and which are not forwarded by the old postmasters.

1956 Parts Manufacturers Show News

Each year, in mid-May, the Radio-Electronics Parts and Equipment Manufacturers Show is held in Chicago. During the convention new products are shown to electronic distributors. The new items are usually initial-designed samples which the manufacturers have not yet put into mass production. After the show ends the final design revisions are made and production begins. Deliveries to distributors start in late August or early September.

The 1956 Electronic Parts and Equipment Manufacturers Show does not convene until May 21st which is after our June issue closing date. For that reason we cannot publicize in this issue most of the new products which are to be introduced. Look for them in our next issue.

Pay Scale For Technicians

Several issues ago we editorialized on employed technicians' earnings. We remarked that many recent graduates from radio-TV training schools had written to us with gripes

because they weren't being offered big salaries to start with. We urged these newcomers to be more realistic and to remember the adage that one must walk before one can run.

Last week the operator of a successful, long-established West Coast service dealer organization wrote to me on this subject and he offered what appears to be an excellent idea. This service dealer explains that the average service shop owner does not object to paying higher wages to his employed technicians. In fact, he says they want to pay more, but in return they must get more work from these technicians. In this vein, our service dealer friend proposes that technicians should be paid on a performance basis and as a typical example he theorizes that benchmen who can complete 3 jobs per day are worth $1.75 per hour to the shop owner while benchmen who can do 4 jobs are worth $2.00 per hour and those who can do 5 jobs are worth $2.25, or even more, per hour. Continuing, this shop owner says that antenna installers would rate $1.00 to $1.50 per hour if they can do 4 to 5 jobs per day and such technicians are worth $2.00 per hour if they can do more than 5. But our correspondent complains that he and other service shop owners of his community, after discussing this matter, have come to the conclusion that their employed technicians today are doing less and less productive work than heretofore—and despite this slough-off in productivity they expect higher wages merely because they have been on the service shop's payroll for a long period of time.

It goes without saying that living standards and wage scales vary in all parts of the country and that skilled labor can and should demand higher

[*Continued on page 48*]

Auto Radios for 1956 — PACKARD

by
ANDREW V. DOPPLE
Auto Radio Serviceman
Frank A. Reeve Co.

All Packard radios for 1956 are of the two-unit construction. One unit houses the complete tuner unit, and the other the speaker power amplifier and power supply. Both units mount in the instrument panel for custom installation. The tuner section is mounted directly above the glove box, and the speaker unit is mounted behind the grille on the right-hand side of the panel.

The clipper model #7266027 is a seven-tube manual tuning set with five push buttons, while the Packard model #7266047 is an electronic tuning job with five push buttons. Both sets are basically the same except that the latter incorporates an additional 12AU7 tube for the control of the automatic feature. Both sets are supplied by Delco.

Tube replacement or removal of the set is simplified after the removal of the glove box (see *Fig. 1*). Don't be impatient; relax and follow a few easy steps as described below and you're in business.

Open the glove box door and remove the nine Phillips-Head self-tapping screws and disconnect the glove box light. Now push the glove box toward the front of the car as far as possible. If you will look at the inside of the box you will notice crease marks on the sides for folding. Grasp the front outside of the box in each hand and squeeze together. This literally flattens the front which allows it to be pushed upwards. Now the rear of the box can be pulled down. By exerting pressure at the rear, the box can be pulled down far enough to make the tuner accessible.

For on-the-spot servicing, remove the four metal screws with a ¼" spintite wrench (which holds the cover in place) and remove the cover which exposes the tubes. To remove the unit remove the Phillips-Head screw at the rear which holds the unit to the instrument panel. Pull out the three-prong plug on side toward the speaker unit. Disconnect the black wire at push-in connector, also the blue wire from push-in connector ("A" lead) and antenna lead-in. Remove the tuner control knobs, and with a ⅝ deep socket wrench remove the two mounting nuts, and the unit will be free for removal.

The speaker unit is held in place by two nuts at the top and two bolts at the bottom (through instrument panel). Remove the bolts and nuts with a 7/16 wrench and remove unit.

Electro push-button and manual control antennas are available and are mounted on the left front fender.

Noise suppression is straightforward with condensers mounted at the generator, ignition coil, and voltage control distributor. Suppression is controlled by a built-in resistor type cap.

Service Hints

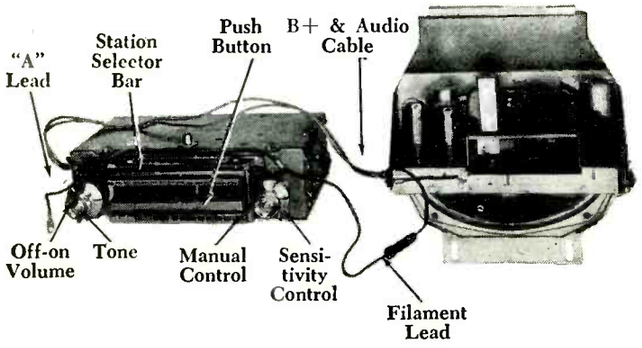
If the set is dead, check the 1800 ohm 2-watt filter resistor located in the speaker amplifier section as shown in *Fig. 2*.

Failure of the electronic-tuner units to stop on stations when the bar is depressed, in many instances has proven to be poor ground connections in the solenoid circuit of the tuner.

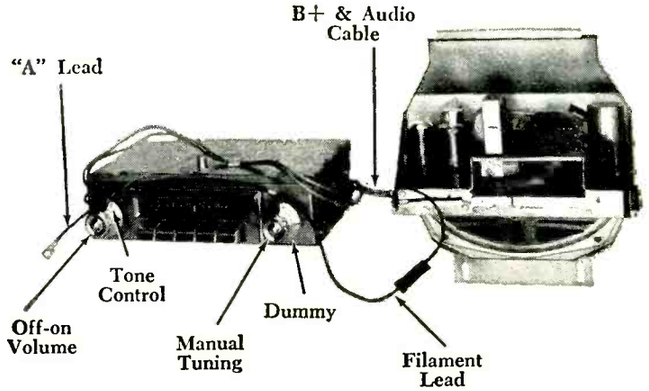
In order to set manual push buttons (all Delco) twist the button to the right and pull it out as far as possible; then release. Now carefully tune to the desired station and push the button all the way in. The station is now automatically tuned in. Repeat each step until all buttons have been set.

To set electronic push buttons (all Delco):

1. Open the hinged door below the tuning dial exposing the five (5) station selection tabs.
2. Line the desired station nearest the low end of the dial.
3. Move the first tab (nearest the left side) until it lines up with the tuner pointer.



Packard Clipper Models 6480488 and 6480489. These are United Motors Service Products.



Packard Clipper Model 7266027 (480487) with pushbuttons.

4. Repeat instructions 2 and 3 above on the remaining tabs choosing stations consecutively as desired.

5. After all tabs are set, re-check the settings and touch up as needed until the station is tuned in sharply.

If stations can be tuned manually but not by depressing selector bar, try a new 12AU7 tube by substitution.

If the bar is depressed and won't stop on stations (this indicates lack of signal) try a test antenna first, then trouble-shoot the tuner section.

Complaints of not being able to receive enough stations on automatic tuner jobs have very often been found to be ignorance on owner's part in not being properly instructed on how to operate it. Be sure the sensitivity control (on right hand control) is set properly; and instruct the owner that the farther right

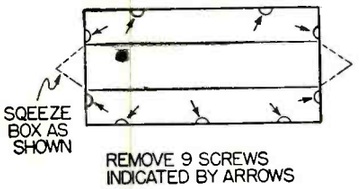


Fig. 1—Removing glove box.

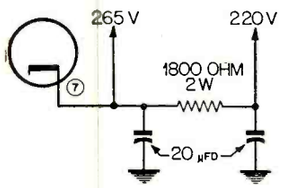


Fig. 2—Location of 18K Res.

the knob is turned the more stations will be received.

Systematic checking of radios in the car is a great time-saver. The following procedure is recommended for checking sets on the spot. If the tubes light, try a new OZ4 by substitution, followed by a new vibrator. Then try a substitute antenna. Then pull one of the 12V6 tubes. If the speaker doesn't pop, try two new 12V6 tubes. (A set was recently pulled because the speaker didn't pop, because it was felt that the B+ wasn't getting through. After some time of bench testing, it was decided to test the 12V6's. Both tubes were shorted.) Returning to the sequence of procedures, the tuner section is checked. If the set is still inoperative pull it.

THE ANSWERMAN

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

BY RTSD TECHNICAL STAFF

Mr. Answerman:

I have a Zenith "Flash-Matic" receiver in which the "On-off" photo cell operation is intermittent. On occasions it works properly and at other times it doesn't respond immediately to the beam of light. At still other times when flashing the light at the channel selector cells the "On-off" cell becomes activated and the receiver switches off.

I have tried adjusting the manual sensitivity control but have not been able to improve upon the somewhat erratic operation.

What do you suggest I do to correct this difficulty?

S. V.
Chicago, Ill.

A review of the operation of the circuit employed in turning the TV receiver on or off remotely is desirable to determine the corrective technique to be employed. *Fig. 1* shows a partial schematic of the "On-off" control circuit. By adjustment of the controls the amount of residual light in the room where the receiver is located is taken into account. That is, *R1* and *R2* are set so that the grid of the 2D21 thyratron tube is biased beyond cut off for the room lighting. Then, *R2* can be used at different times to compensate for various room lighting conditions.

In examining *Fig. 1* it can be seen that the photo cell is connected between the two controls with a 27K resistor. The photo cell can be considered as a resistor also in that when light is applied to its surface its resistance decreases. With all light removed from the cell its resistance may be higher than 100 megohms. If a strong light is applied to the cell the resistance will be reduced to a value possibly lower than 50K ohms.

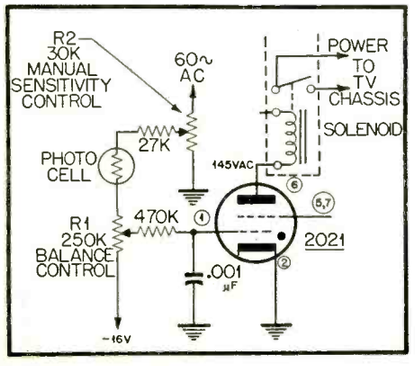


Fig. 1. Partial schematic of "On-Off" circuit, Zenith Flash-Matic

Thus, when light impinges upon the cell's surface its resistance decreases. The grid bias on the 2D21 thyratron tube becomes more positive and the tube is no longer biased beyond cut off. The thyratron is thus triggered into conduction. Current flowing through the tube also flows through a solenoid which closes or opens the switch depending upon the position of the switch previous to the activation of the photo cell.

From the above it can be seen that the photo cell is a very important item in the response of the remote system. These cells can at times change characteristics. One means of checking the cell, as in this case for "On-off" operation, is to place black masking tape on the photo cell window. Then, set the manual sensitivity control full clockwise. If the solenoid circuit triggers under these conditions the cell "dark" resistance is too low and the cell must be replaced.

Another test of the cell is to take a 680K resistor and temporarily connect it in place of the cell. If the solenoid becomes active, functioning properly each time the resistor connection is made, the cell is defective and should be replaced. This is because the cell resistance should normally drop to below this value when the light is applied to its surface.

The care of photo cells is important and storage of these units in the dark for a prolonged period of time can reduce their sensitivity. They can be restored to normalcy as far as sensitivity is concerned by exposing them to a moderate amount of light as from the flash gun for a short perod of time.

The servicing of this system is certainly no more difficult than that of a TV receiver. It is important to realize that ac voltages are employed such as those for the plate and solenoid circuit. This would then be one of the tests to determine what is wrong with a malfunctioning unit. Aside from this, resistance measurements of the controls and series resistors should turn up the cause of intermittent operation.

Mr. Answerman:

What do you recommend as the best way of replacing components on a printed wire panel? Do you think the pigtails of the previous component that is being replaced should be removed and the pigtails of the new component inserted in the holes?

I like to do a neat job in repairing a chassis and wonder if this wouldn't be the proper technique in replacing resistors and condensers in a printed wire chassis.

J. P.
Portland, Washington

Although it is always nice practice to try to maintain the chassis in as nice an appearance as possible, in certain repairs this is not desirable if the process might result in additional difficulties.

As an example, in replacing a component on a PW panel the best technique is to clip the pigtails as close to the body of the component as possible so that a suitable length remains. The new component is then connected by making a mechanical joint between the old pigtail and the new one as shown in in *Fig. 2.* This is much more effective than attempting to unsolder the old leads at the foil connection, thus possibly causing damage to the foil material. If longer leads are desired, the component to be removed can be cut in half and the material removed from the leads so that the internal portions of the wires can be taken advantage of even though they may be small.

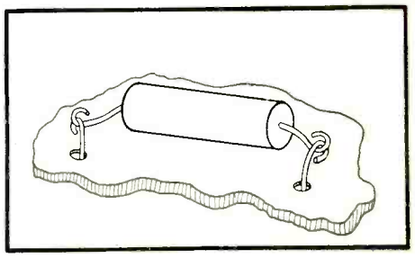


Fig. 2. Method used for replacing component on printed wire panel.

Also, when soldering to leads in the above suggested fashion the minimum amount of effective heat should be applied.

Dear Answerman:

I have noticed in an Emerson Chassis No. 120254 that there is a slight hum bar in the background of the picture. I have checked all the tubes that could possibly cause this complaint for cathode to filament leakage. Tubes don't seem to be responsible. I have further noticed that the horizontal bar drifts vertically and is not in synchronism with the vertical sweep.

Is there anything that can be done with this interference even though it is slight? I have also noticed it on other

makes of TV receivers on various other occasions.

W. T.
Denver, Colorado

This type of interference frequently is caused by a small amount of leakage in the *rf* amplifier tube. Try several different types of *rf* amplifiers. A very small amount of leakage in an *rf* tube can produce this symptom.

Another possible cause of this condition is the introduction of 60 cycle induced voltage into the *agc* line, particularly the portion of the line that feeds the tuner. In the case of the Emerson receiver it can be further filtered to correct for this possibility by adding a .05 *μf*, 400 volt condenser from the *agc* feed point to the tuner to chassis as shown in *Fig. 3*. This additional filtering generally corrects the condition by removing any small amount of 60 cycle voltage present at this point.

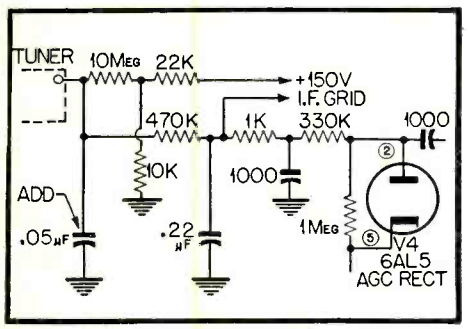


Fig. 3. AGC filter condenser added to remove hum bar in picture.

Dear Sir:

I have a Philco Chassis TV440 in which the sync is quite wavy. At times complete loss of picture synchronization occurs. All the normal servicing procedures have been tried, such as checking tubes, checking voltages and observing waveforms. Still the problem persists.

I have sweated over this one so long that I have run out of ideas. Can you suggest any?

H. E.
Plainfield, N. J.

A new problem has arisen in many chassis employing printed wire panels. The ground circuit connections to the main frame for the PW panels is accomplished through the contact of foil against the metal sub base. This pressure connection is at the point of mount-

[*Continued on page* 48]

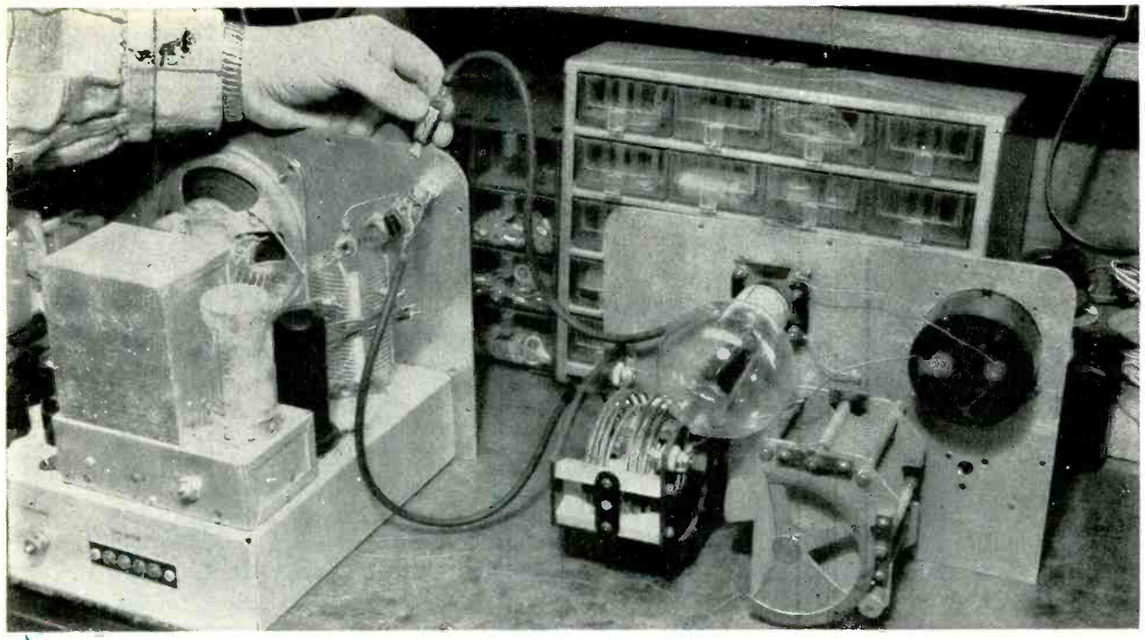


Fig. 5. Simple form of dummy antenna for transmitter output measurements.

The Marine Electronic Business

This is the second of a series of articles on Marine Electronics. In this installment the author deals with the test equipment required for efficient operation both in the field and in the shop.

by **ELBERT ROBBERSON**
Marine Electronics Consultant

PART 2

A SERVICE shop with thousands of dollars worth of instruments may not necessarily have everything needed for marine electronic service. Fortunately, however, just a few dollars spent for the right things will adequately prepare a reasonably equipped organization.

The odd part about marine electronic instrumentation is that some of the equipment required is not readily available from commercial sources. Other items may be in short supply, or very expensive (or both). You can get over this hurdle by careful improvising.

Basic Requirements

Three outfits are required. First is the basic setup for the shop (or lab, which you are entitled to call it if it is properly equipped and manned). The usual receiver-testing equipment is, of course, necessary: signal generator, V.T.V.M., audio oscillator voltohmmeter, capacitor bridge. To this must be added a few special items for transmitter testing, and for measurements required by the F.C.C.

The other two outfits are the equipment required for field work—one for installing, and the other for servicing.

Since the "field" in marine electronics is very wet, and often hard to get to, everything needed for a job should be compact and light, and limited to a quantity which can be carried in one trip. Keep the field kits intact, breaking them down only for cleaning, inventory and replenishment. If you try to pack a set of tools and supplies fresh for every call, you'll waste time, and find sometime that a set of Bristo wrenches for removing some critical knob is not at hand but back on the shop bench.

Shop Instruments

The conventional lineup of instruments for receiver servicing is, of course, required. Items such as the signal generator should be the best obtainable, covering from 150 *kc* through the high frequencies, and kept in accurate calibration both as to frequency and output level. The equipment should also include an accurate vacuum tube output or a-c voltmeter, preferably having a *db* scale.

All marine radiotelephones use quartz-crystal frequency control, so a means of checking crystal activity is necessary.

Figure 1 shows a simple crystal tester which can be built in any convenient utility box. Wire crystal sockets of several types in parallel on the panel. Comparison of crystals is made by observing grid current on the milliammeter. Value of the grid resistance can be varied, if necessary, to make a fair crystal indicate about .6 milliamperes. A poor crystal might then read as low as .2 *ma*, while a very lively "rock" might go up to .8 *ma* or so.

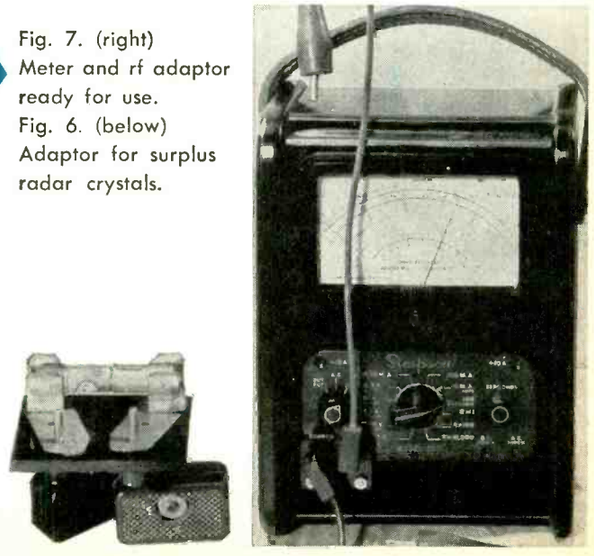


Fig. 7. (right) Meter and rf adaptor ready for use.
Fig. 6. (below) Adaptor for surplus radar crystals.

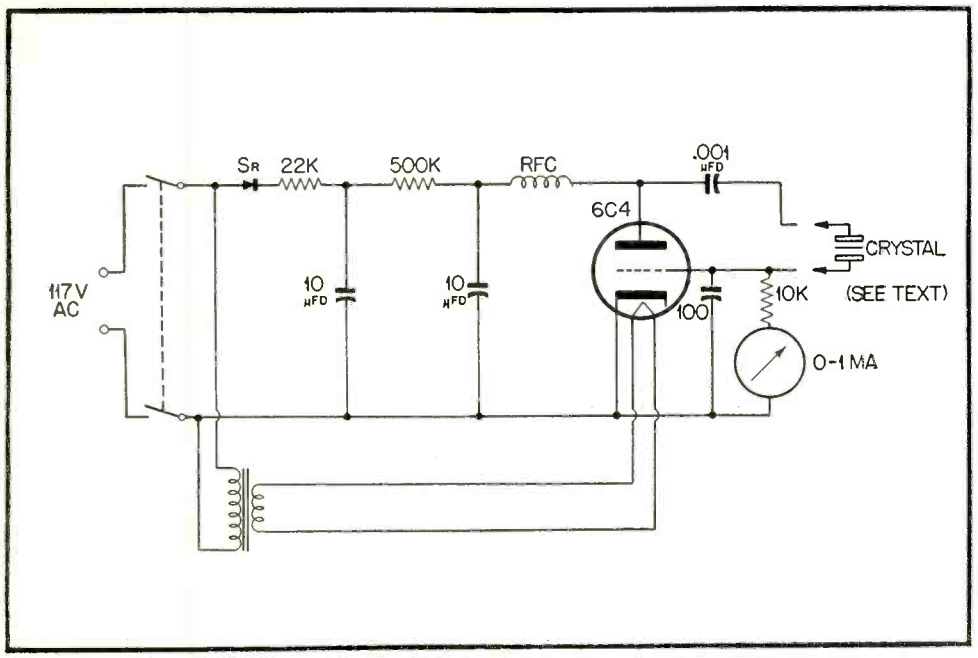


Fig. 1. Circuit diagram for an easy to build crystal activity checker.

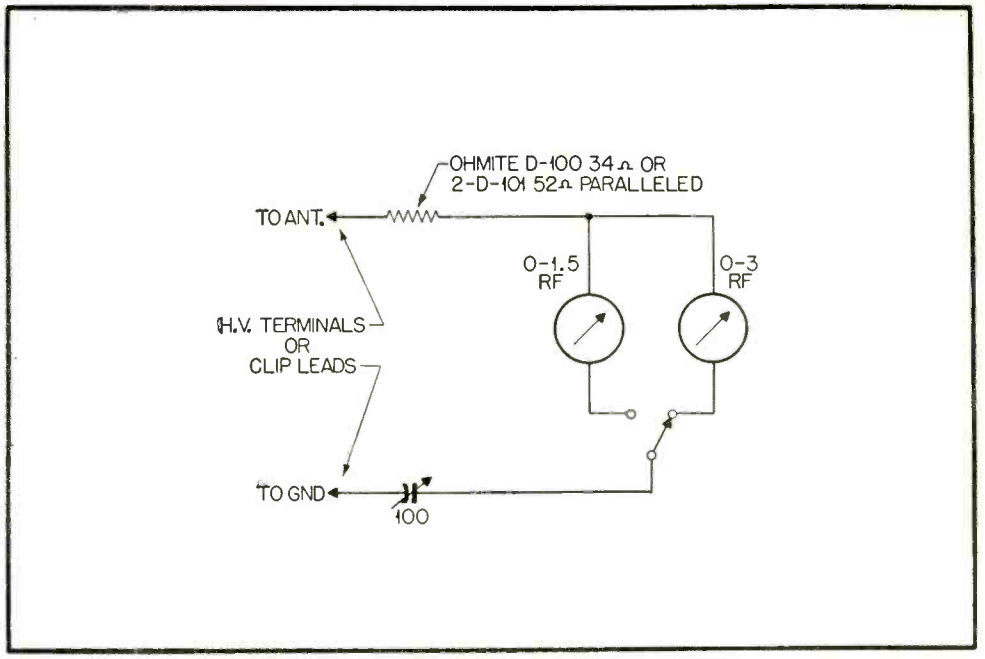


Fig. 2. A simple type of dummy antenna circuit for power measurements.

If you expect to specialize on one particular manufacturer of equipment, instead of using the Pierce circuit, build your checker with the same oscillator circuit the equipment uses—in this way you can get an idea of how the crystal will act in the actual equipment.

A set of accurately ground crystals for your marine channels, permanently installed in such an oscillator, with a selector switch for connecting one at a time, makes an excellent generator for rapid alignment of receivers on the various frequencies.

Accurate frequency-measuring equipment covering medium and high frequencies is required. Many agencies employ the surplus BC-221 with good results. Among the commercial products, the Lampkin Micrometer frequency meter is compact, reliable, and not too expensive.

A 100 *kc* crystal calibrator and interpolation oscillator can also be used, if checked frequently against WWV signals. A suitable variable oscillator might be one of the better amateur VFO units, covering a spread of slightly over 100 *kc*. In adapting such equipment, it is necessary to incorporate a headphone circuit and detector, in order to be able to listen to heterodynes against the oscillator frequency.

A good communications receiver covering the entire medium and high-frequency spectrum is needed. The Collins amateur receivers unfortunately cannot be used. in spite of their excellence in other respects, because of their limited frequency range. Hammar-

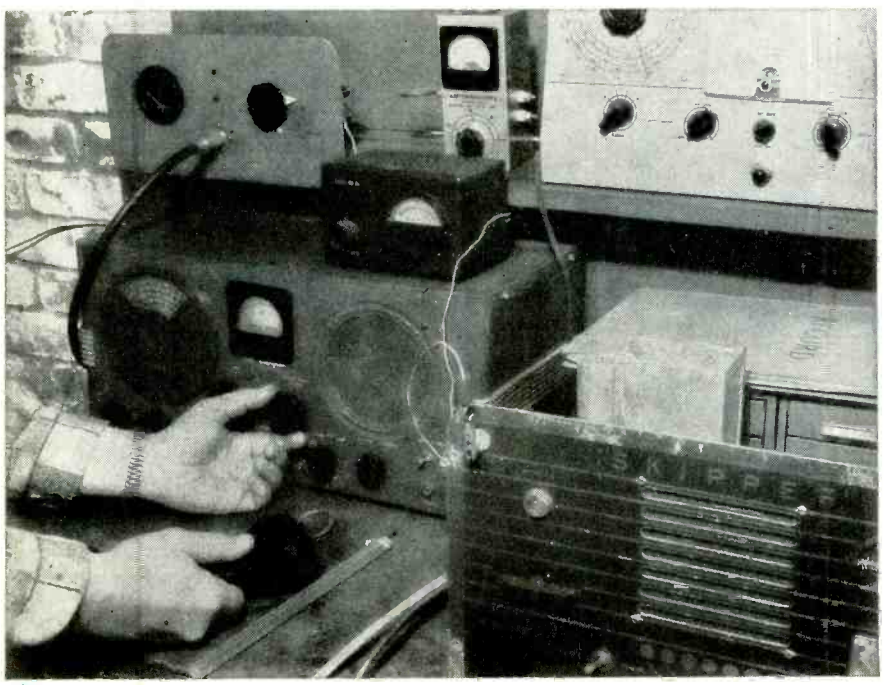


Fig. 3. A communications receiver serves a number of purposes. Also seen here are a Q meter and Antennascope.

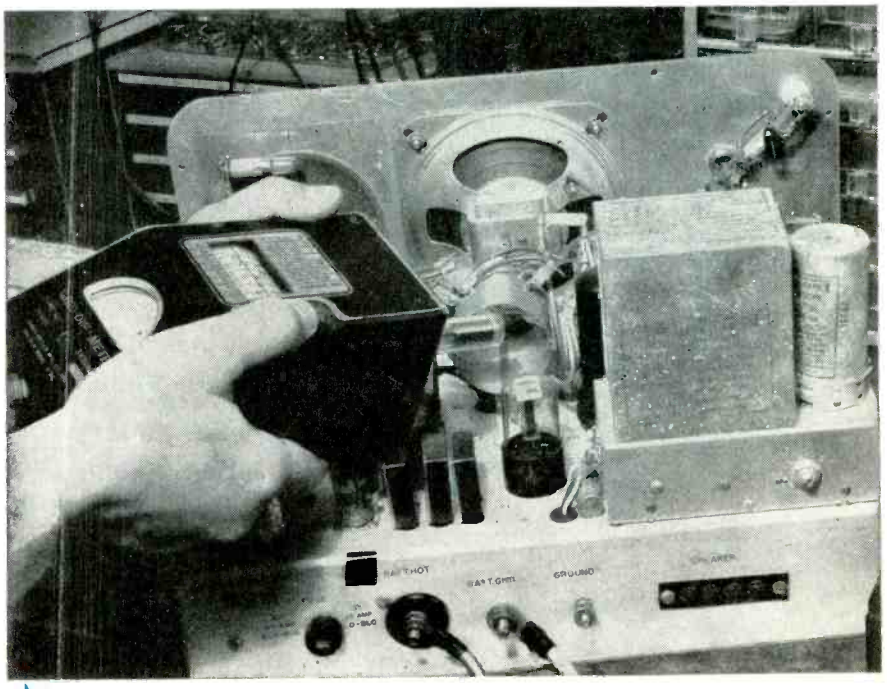


Fig. 4. The grid-dip oscillator shown here may be used for RF checking and in pre-alignment procedures.

lund, Hallicrafters, National and other manufacturers produce receivers which will serve very well. This equipment should include an "S" meter which will give accurate signal strength indications.

The F.C.C. requires that transmitter harmonics be kept to a minimum, and you should be able to measure harmonic level in relation to the strength of the fundamental wave. A field strength meter covering medium and high frequencies is thus desirable. However, measurements made with a receiver having a signal strength meter accurately calibrated with a standard signal generator are accepted.

Marine transmitters are capable of over-modulation when improperly adjusted. Either a commercial AM modulation meter, or an oscilloscope can be used to check modulation percentage. A very rough estimate of modulation percentage can be obtained with an *rf* ammeter, measuring transmitter output into an artificial antenna. Approximately 22% rise in output current over the carrier level takes place under 100% modulation. This method should be used only as an emergency check.

A grid-dip oscillator, such as the Millen unit, is invaluable for *rf* circuit testing, and can be used for the initial alignment of equipment before power is turned on.

For transmitter power-output measuring, a dummy antenna must be built up. *Fig. 2* shows a suitable circuit, which may be mounted on a panel or installed in a utility box, with *rf* feed-through insulators, or high-voltage insulated clip leads, for the external connections. The ideal resistor for most testing is the Ohmite D-100 34-ohm 100-watt dummy antenna resistor. However, its manufacture has been discontinued, and unless one can be found on the back shelves, the next best thing is to use two D-101, 52-ohm resistors in parallel, giving an effective load resistance of 26 ohms. Do not use high-value resistors: effective values from 26 to 34-ohms are best.

For transmitters under 40-watts, use the 1.5 ampere *rf* meter. Full-power (150-watts and over) transmitters will require the use of the 3-ampere meter. Other arrangements may, of course, be made—such as the use of just one low-range meter, with a shunt which can

be placed across its terminals for high-power measurements. It is necessary in this case to calibrate the shunt.

The capacitor should be one rated for transmitting, and good for 1000 volts. Smaller units may be used on low-power telephones, but the air spaces will break down if they are used with the larger transmitters. The purpose of the capacitor is to tune out inductive reactance in the transmitter — power readings must be made at resonance.

Rough modulation measurements can be made with the dummy antenna. Percentage of modulation =

$$141 \sqrt{\left(\frac{I_2}{I_1}\right)-1}$$

when I_1 is the carrier current, and I_2 is the output current fully modulated.

The marine service shop must have a *dc* power supply. Units are available from Mallory, and other dry-rectifier builders, which furnish from 6 to 110-volts dc. Usual marine electronic-equipment current requirements are from 50 amperes, at voltages up to 32, to 5 amperes at 110-volts; and supply regulation should be such that voltages stay pegged at the desired level under full load. A 25-ampere or smaller supply might serve if only low-powered transmitters are involved. For the higher powered units, "float" auto batteries across the rectifier output to furnish the extra current which might be required. Battery and rectifier-output voltages must, of course, be the same.

Rectifier supplies are compact, clean, maintenance free, and economical in the long run. However, the initial cost may be high. As an alternative, rig a set of batteries and a charger to supply the various voltages needed.

Five fully-charged auto batteries connected in series will operate 32-volt equipment. Tap the first and second batteries for 6 and 12 volts. It is rarely necessary to have any more than 32-volt *dc* on tap. You can safely assume that any boat having 110-volt equipment will be large enough for you to do your work aboard, and will probably have *ac* from an inverter or from a dock line for the operation of your instruments. In case such a vessel does not have *ac* available, you can operate a signal generator, or whatever else might be re-

[*Continued on page* 33]

1956 TRANSISTOR

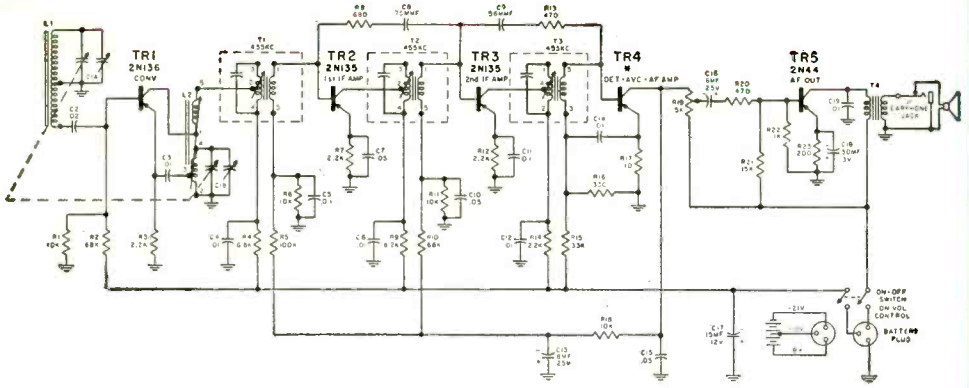


Fig. 4—CBS-Columbia TR250 transistor portable.

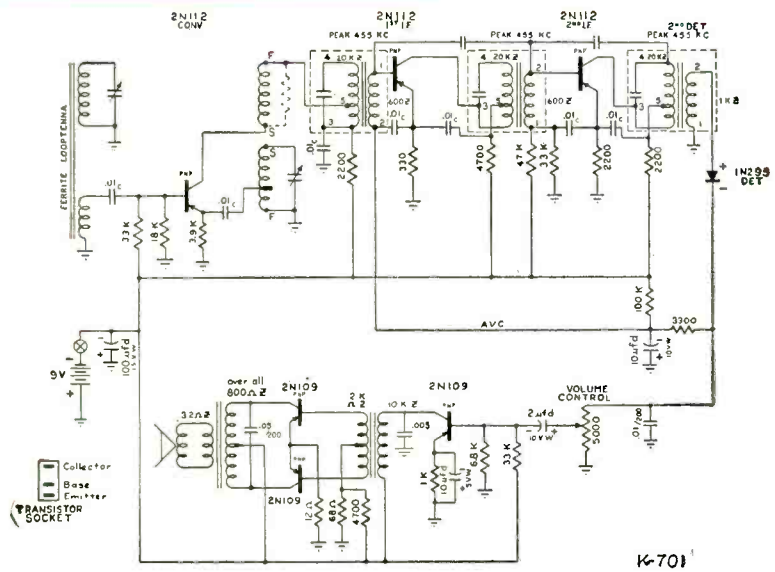


Fig. 5—DeWald Model K701 transistor portable.

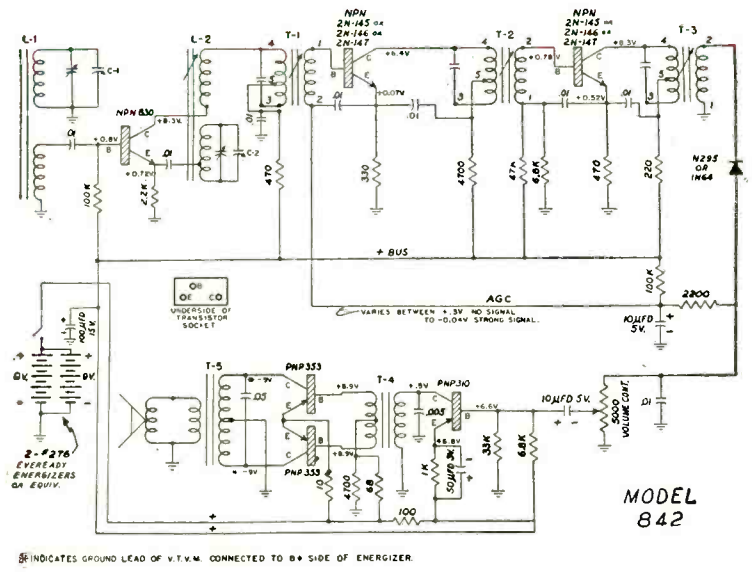


Fig. 6—Emerson Model 842 transistor portable.

A round up of the important features of portable transistor receivers. Schematics of representative models are included.

IN RECENT years the transistor has stepped out of the laboratory and into many products in the electronic field. Up until two years ago the use of the transistor for high frequencies had been limited due to the state of the manufacturing art, but with the improvement in production techniques the transistor has found a niche for itself in the portable radio market. The now famous "Regency" TR-1 transistor portable has spurred the development of transistor portables by almost every manufacturer.

Basic Design

The basic transistor portable is relatively the same as its vacuum tube counterpart. The usual configuration is that of the superheterodyne type. A typical circuit uses four transistors with a crystal diode detector. A more elaborate circuit may eliminate the crystal diode and substitute a transistor or add a push pull output stage for more audio. In any case, the circuit will contain a converter stage, two or more *if* stages, a detector stage and a power output stage. A block diagram of a typical receiver is shown in *Fig. 1*. It may be seen that there is great similarity between this layout and a vacuum tube receiver.

Fig. 4 is the schematic diagram of a typical transistor receiver. The transistors are all used in the grounded emitter circuit which is analogous to the grounded cathode triode amplifier. The circuit reveals that there is nothing mysterious about transistor circuits. The signal is applied to the base and the amplified output is taken from the collector. PNP transistors have the emitter arrow pointing towards the base and have the collector returned to the negative supply. NPN types are just the opposite. PNP transistors are used in the circuit shown.

The 2N136 converter is an oscillator and mixer combined. The two 2N135

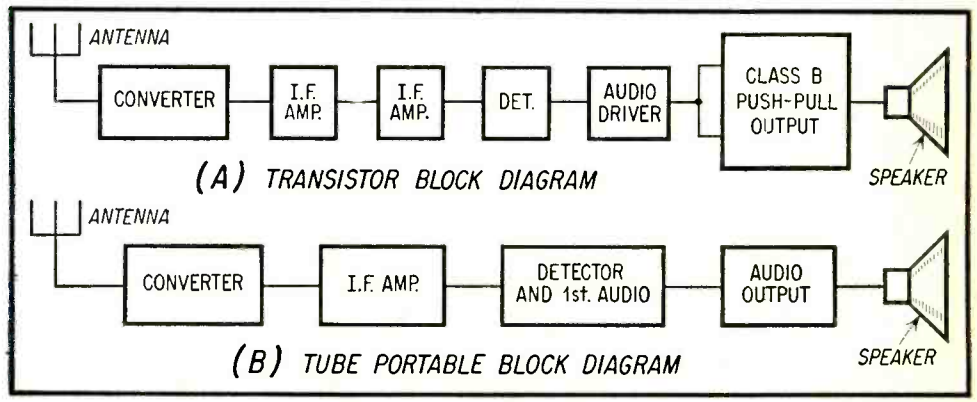


Fig. 1—Block diagram comparisons of tube and transistor portables are shown above.

PORTABLES

by STEPHEN E. LARRAD

transistors are *if* amplifiers and are neutralized as any triode would be.

A class B detector is used although many circuits may use a crystal diode for economy and simplicity. The class B detector however, provides about 10db audio amplification in addition to acting as a detector. The 2N44 output is entirely conventional with a .01μf capacitor *C19*, used for audio de-emphasis.

Fig. 2 shows a class B push pull output which is used where more output is desired. This circuit draws power as the signal is increased and although not too common in tube work is quite an old circuit. The transistors used are usually balanced and should be replaced in pairs.

Fig. 3 is a table of the various types of transistors currently used in transistor portables. Some manufacturers prefer NPN types while others use PNP units. There is no real difference in circuit operation except for the difference in polarities as mentioned above. It is not uncommon to see both types used in one set. A little tracing of such circuits will reveal that the polarities are correct, this sometimes being achieved by returning the collector to ground and the emitter to the supply voltage for that part of the circuit which uses the alternate transistor type.

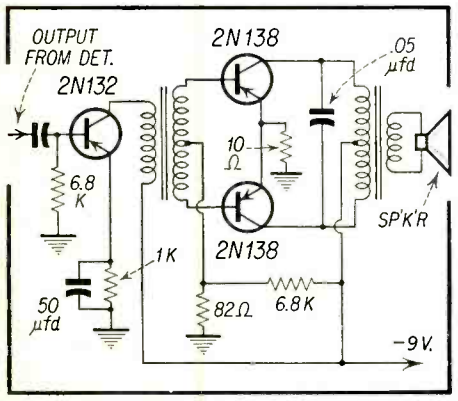


Fig. 2 — Typical push-pull output stage using type 2N138 transistors.

CBS-Columbia TR250—TR260

The CBS Porta-Console Model TR260 uses a 2N172 transistor converter followed by two stages of *if* amplification using 2N145 or 2N146 transistors. A diode detector drives a single TI310 transistor audio stage which is transformer coupled to a push pull 2N185 audio output. The circuit features up to 1500 hours of operation at normal listening levels and is supplied with a nine-inch speaker. The Porta-Console is equipped with a metal stand to convert the receiver to a consolette.

The Power-Mite model 250, *Fig. 4*, is similar to the Porta-Console up to the detector. A class B detector is used instead of the diode to drive a single 2N44 audio output stage. A jack is provided for earphone operation. Both models use a loop stick antenna and make use of a 455 kc *if*.

Capehart-Farnsworth 11P7

The Capehart-Farnsworth model 11P7 is a 6-transistor receiver with a diode detector. The power supply uses two nine volt batteries and will provide 1000 hours of operation. The power output is 250 milliwatts (¼ watt). This unit weighs 3 lbs., 3 ounces, and is supplied with a very attractive leather case.

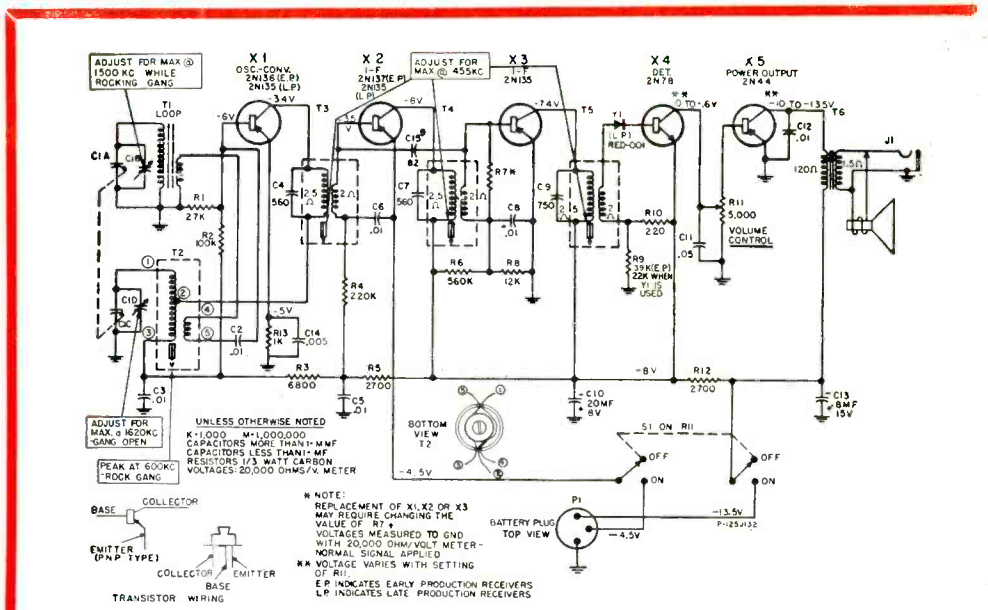


Fig. 7—General Electric 675 transistor portable.

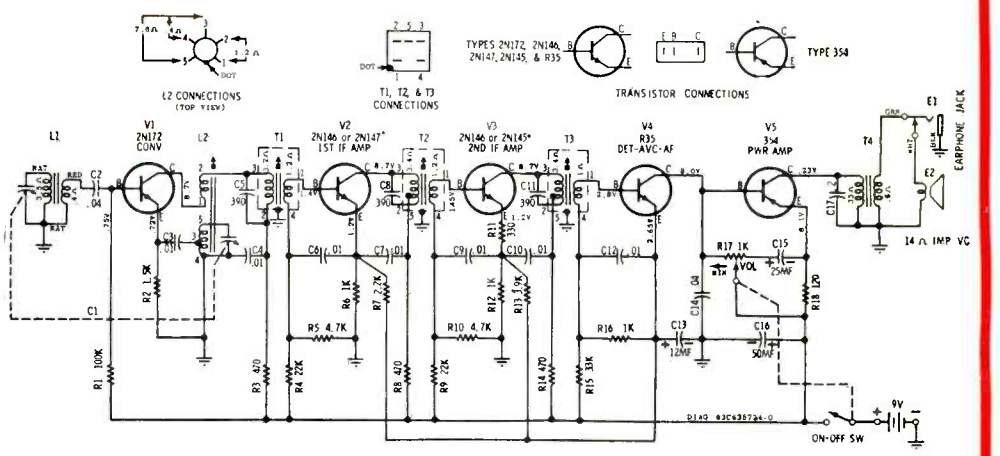


Fig. 8—Motorola Model 56T1 transistor portable.

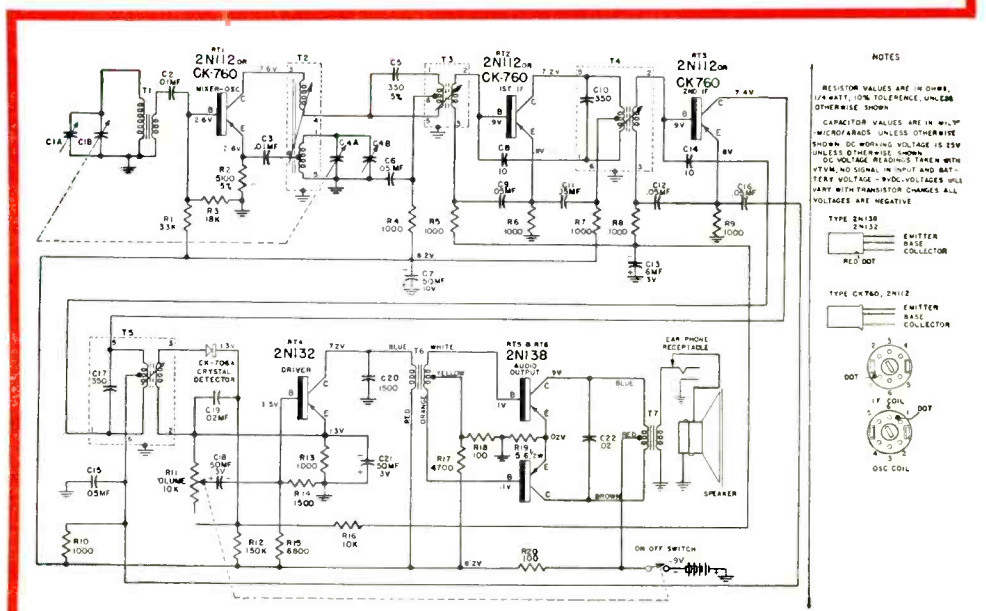


Fig. 9—Raytheon Model 6RT1 transistor portable.

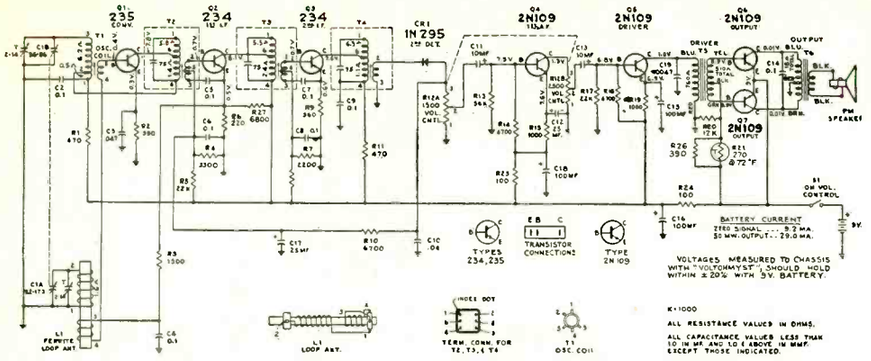
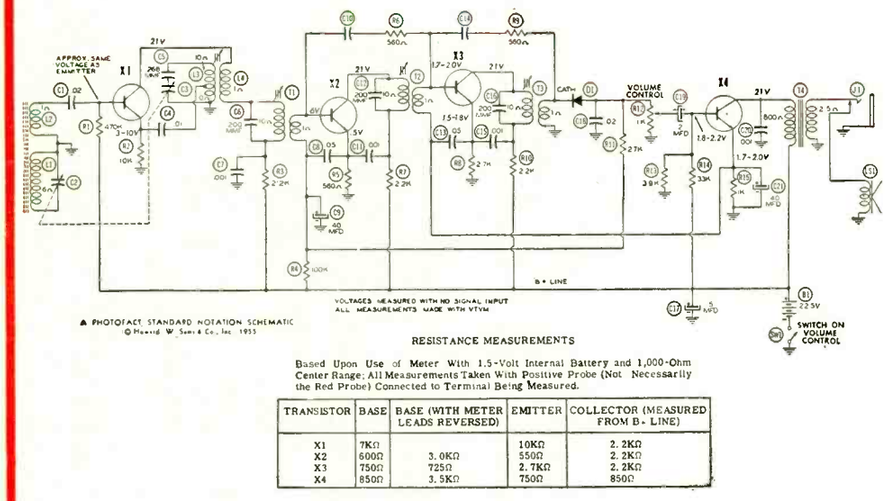


Fig. 10—RCA Model 7BT-9J transistor portable.



RESISTANCE MEASUREMENTS

Based Upon Use of Meter With 1.5-Volt Internal Battery and 1,000-Ohm Center Range; All Measurements Taken With Positive Probe (Not Necessarily the Red Probe) Connected to Terminal Being Measured.

TRANSISTOR	BASE	BASE (WITH METER LEADS REVERSED)	EMITTER	COLLECTOR (MEASURED FROM B- LINE)
X1	7KΩ		10KΩ	2.2KΩ
X2	600Ω	3.0KΩ	550Ω	2.2KΩ
X3	750Ω	725Ω	2.7KΩ	2.2KΩ
X4	850Ω	3.5KΩ	750Ω	850Ω

Fig. 11—Regency Model TR-1 transistor portable.

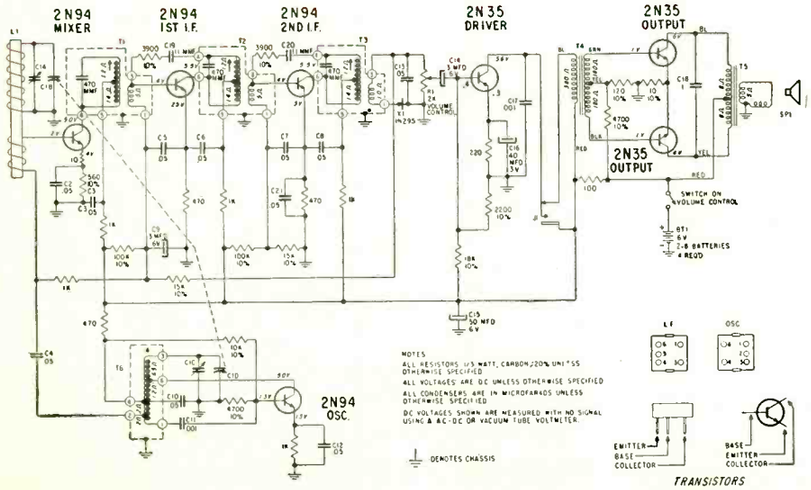


Fig. 12—Zenith Royal 500 transistor portable.

DeWald Models K544 - K701 K701A - K701B - K702B

The DeWald model K544 "Tuck-away" portable is a 4 transistor unit utilizing a CK760 converter, one stage of CK760 *if* amplification, a diode detector and two stages of audio amplification. The set is powered by a single Eveready #246 nine volt battery which will give over 200 hours of operation. The radio is contained in a leather case and measures 3¾" by 1¾" by 5⅞".

The DeWald models K701 and K701A are basically similar in specifications, the chief difference being in the transistor lineup used. The K701 shown in *Fig. 5.* uses NPN type transistors in the *rf* circuits while the K701A uses the PNP type. When servicing, it is important to observe polarities since the polarities of the NPN are exactly opposite those of the PNP as previously mentioned. Both models use six transistors with a diode detector and push pull output. The power source is an Eveready #276 nine volt battery. This set is trade named "The Playmate" and is housed in a non-breakable plastic case. The model 701B differs from the 701 and 701A again chiefly in transistor types.

The model 702B receiver, "The Westerner" is supplied in a leather case and features longer battery life than the 701 series. Two Eveready #276 batteries are connected in parallel to give over 1500 hours of operation.

All the 700 series DeWald sets use the same basic schematic and include *agc* for more constant output at different signal levels.

Emerson — 842

The Emerson Model 842, shown in *Fig. 6,* utilizes six transistors and a crystal diode in a straightforward circuit. The transistor lineup makes use of the Texas Instrument NPN transistors. A 2N172/830 converter precedes a two stage *if* amplifier. Any of three types of transistors may be used in the *if* stages, namely the 2N145, 2N146 or 2N147 units. A 1N295 or 1N64 diode is the detector driving a PNP310 audio stage which is transformer coupled to a two transistor push pull class B output. This set utilizes two Eveready #276 nine volt batteries in parallel to provide over 1500 hours of operation and is supplied with a leather case.

	CONVERTER	IF	AUDIO	DETECTOR
PNP Type Transistors	2N111 2N112 CK759 CK760 2N136	2N112A 2N135 2N137 CK760	2N109 2N131 2N132 2N138 2N185 CK721 2N44 310	2N78 353
NPN Type Transistors	235 2N94 2N172 830	234 2N94 2N145 2N146 2N147	2N35 354	R35
Diode Types	-	-		1N64 1N295 CK706

Fig. 3 — Various transistors and diodes used in transistor radios.

General Electric Model 675

This receiver utilizes the GE transistor series, and is shown in *Fig.* 7. The converter is a 2N136. Two *if* amplifiers use type 2N137 and 2N135 *rf* transistors. A 2N78 class B detector drives a single 2N44 output stage.

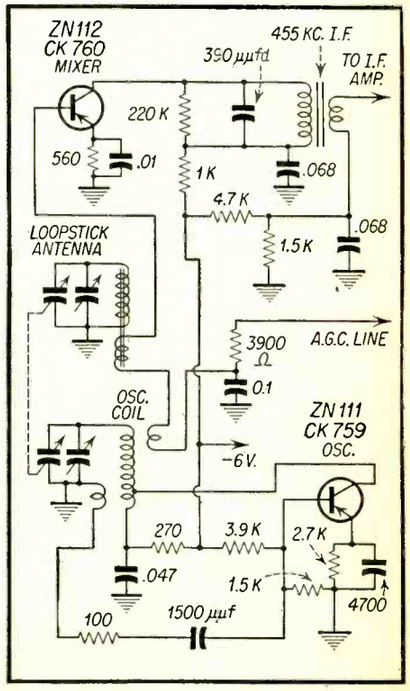


Fig. 13—Separate CK760 oscillator and CK759 mixer used in circuit.

The GE 675 features *agc* and a power output of 60 *mw*. The *if* frequency is 455*kc* and a jack is provided for earphones reception when desired. The size is 5⅝" by 3-3/16" by 1½" and is powered by a 13½ volt battery.

Hallicrafters Model TR88

The Hallicrafters Model TR88 receiver, trade named "El Diablo", is a six transistor model. A diode detector is used to drive an audio stage which is transformer coupled to a push pull Class B output. A loop stick antenna is used and the circuit is conventional. The battery supply consists of four 1½ volt cells series connected to supply six volts. The battery life is more than 2500 hours on a four hour per day basis.

This receiver features a 4-inch speaker and *AVC*, and is furnished with a leather case.

Motorola Model 56T1

The Motorola Model 56T1 shown in *Fig. 8* is a five transistor portable with a class B detector and a single-ended output stage. A 2N172 converter is followed by two stages of *if* amplification. The *if* amplifiers use either a pair of 2N146's or a 2N147 for the first *if* amplifier and a 2N145 for the second. The set is powered by either a nine volt standard battery (Eveready #216) or a mercury type (Mallory TR146R) for greater life. The battery life is up to 100 hours.

This receiver features an aluminum case with a loop stick antenna mounted in the carrying handle. The set measures 5½" by 3-9/16" by 1½" and weighs 18 ounces.

Raytheon Chassis Numbers 4RT1 - 6RT1 - 7RT1 - 7RT4 - 8RT1

The Raytheon 4RT1 Chassis (Model T100) series is a four transistor receiver with a crystal diode detector. CK760/2N112 transistors are operated as a converter and a single *if* amplifier. A CK 706 diode drives a 2N132 audio amplifier which is transformer coupled to a single 2N138 audio output stage. This set operates from a nine volt battery and uses a 455*kc if*. The power output is 20*mw* and an earphone receptacle is provided.

The 6RT1 Chassis, (Model T150 Ser-

(*Continued on page* 52)

Condenser Checkers

PART 2

by STEVE TRAVIS

This second and final installment describes additional makes and models of condenser checkers, their circuitry and operating principles.

ANOTHER instrument used for capacitance measurements is the Sprague Model TO-4 Tel-Ohmike. This unit incorporates in one instrument an accurate multi-range capacitance and power factor bridge; and insulation resistance megohmmeter for checking paper, mica and ceramic condensers; a leakage current test circuit for electrolytic capacitors, and an *ac* resistance bridge for measuring resistacnes. Pushbuttons are provided for instant range selection and a magic-eye tube simplifies bridge balancing for capacitance measurements. A large meter gives direct pointer readings of insulation resistance and leakage current and shows the exact voltage applied to the electrolytic capacitors during leakage tests.

In the Sprague model TO-4 capacity tester, a Wien Bridge circuit is employed (as shown in Fig. 6) to determine the value of an unknown condenser. The unknown capacitor is connected at the test terminals indicated. Condenser *C5* is fixed and is used for comparison in the bridge circuit with the unknown. As can be noted *C5* and the power factor control are in series. *Fig. 6* presents a simplified diagram of the components used in checking capacitance values from .1 to 50 microfarads. For other ranges different condensers are switched in place of *C5*. The bridge is balanced on all ranges by the variable ratio arm, *R27*, a highly accurate linear-taper wirewound resistor as the main bridge element. This potentiometer is especially selected in order to assure accurate matching of the calibrated scales over their full length. The ratio arm, for the particular scale, is adjusted so that the bridge balance or null detection is achieved as is evidenced on the highly sensitive "magic-eye" 1629 tube. The calibrated scale associated with the ratio balance resistor indicates the capacitance value when the null position is found.

Insulation Resistance

Insulation resistance is an important check of paper, mica and ceramic capacitors as made with the Sprague model TO-4 capacitance analyzer. Perfect insulators are not available and therefore all condensers have a certain definite resistance which is termed insulation resistance. In a good condenser the insulation resistance is high so as to be negligible for the purposes to which it is to be applied.

Insulation resistance tests are made only on electrostatic capacitors such as paper, mica, ceramic, etc. Electrolytic capacitors are generally tested for current leakage, not insulation resistance. Insulation resistance is measured with an ohmmeter that has a range in the megohms. Its rated value will be different for different types of condensers. Therefore to use the insulation resistance test for paper, mica and ceramic condensers it is necessary to know what insulation resistance values are acceptable for different types of capacitors.

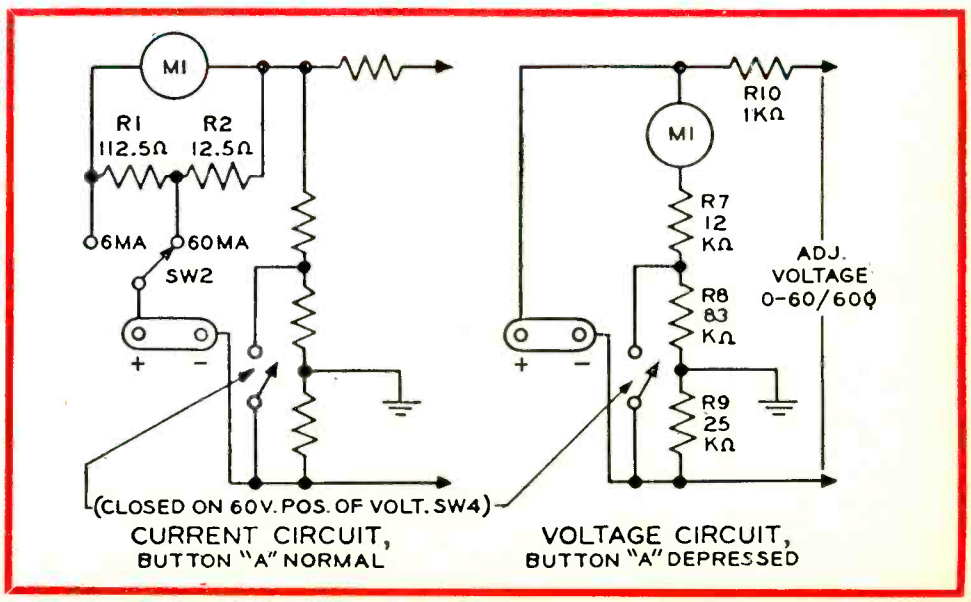
Mica Capacitors. Mica condensers are used where the important factor is a very high insulation resistance. Although mica as a dielectric material is one of the best, it is relatively expensive. Thus, these condensers are generally employed in circuits where paper and other types are not suitable. Condensers using mica dielectric are not generally made in capacitance values greater than .05 μf. However, its voltage rating is higher than with other condensers. Standard molded mica condensers will have an insulation resistance when new of more than 3000 megohms. Low loss and silver mica types will have an insulation resistance when new of at least 6000 megohms.

Ceramic Capacitors. Most ceramic capacitors rated at .02 μf or less when new will have a minimum insulation resistance of 7500 megohms.

Paper Capacitors. These condensers, constructed of a thin metal foil with a dielectric paper between, are physically smaller for a corresponding capacitance value. Their insulation resistance is less than that of mica and therefore they find applications where an important characteristic is not high insulation resistance.

The minimum insulation resistance times capacitance *product* for paper tubular capacitors is 1000 megohm-microfarads when new. A capacitor is in no case required to have an insula-

Fig. 8—Measuring leakage current of capacitors with the Sprague Model TO-4.



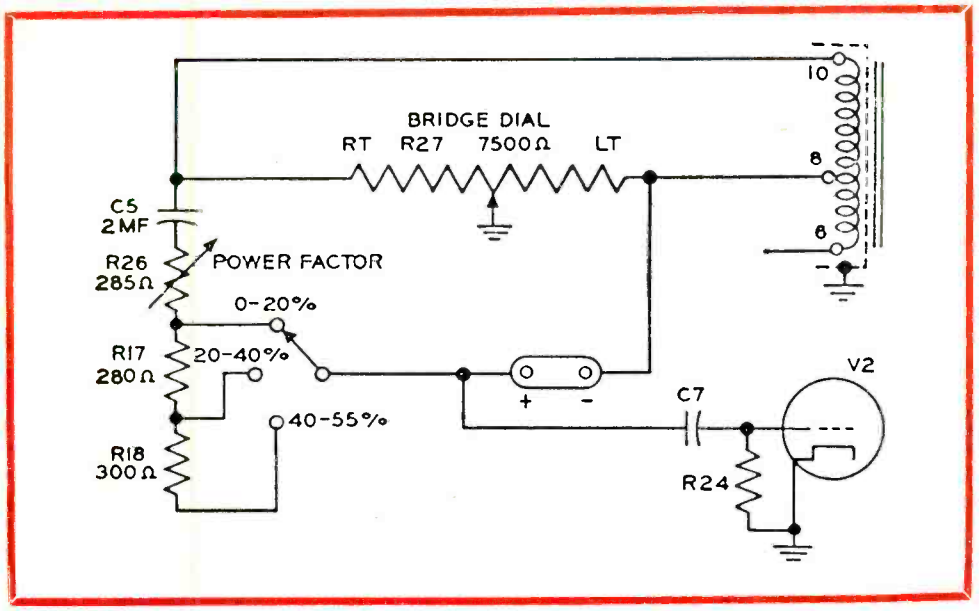


Fig. 6—The Wien Bridge circuit of the Sprague Model TO-4 condenser checker.

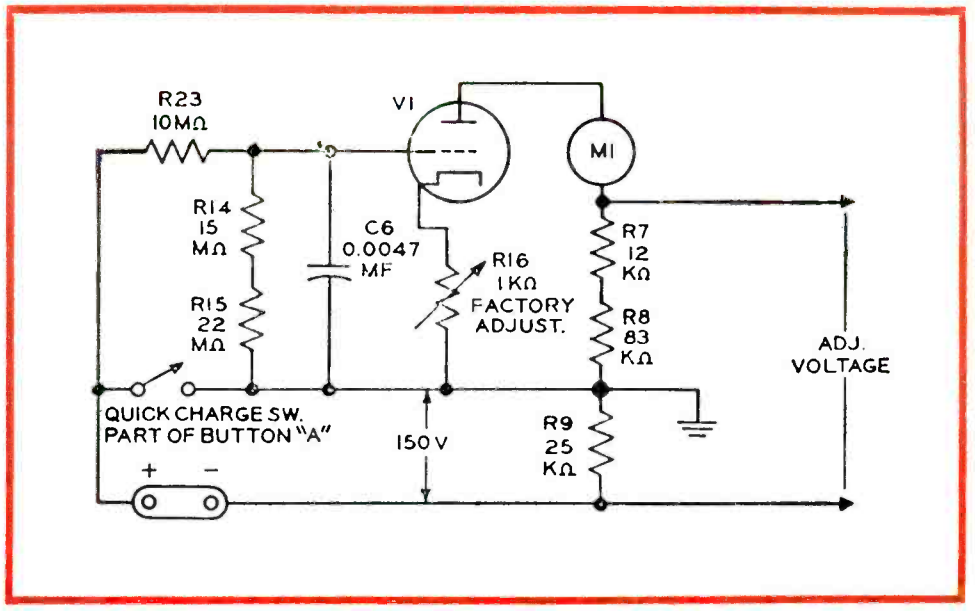


Fig. 7—Simplified diagram of circuit used in making insulation resistance measurements wth a Sprague Model TO-4 condenser checker.

tion resistance of more than 5000 megohms as per the following table. Molded tubular condensers will usually exceed these minimum limits by a wide margin.

CAPACITANCE	MINIMUM INSULATION RESISTANCE
1.0 μf	1000 megohms
.5 μf	2000 "
.25 μf	4000 "
.1 μf or smaller	5000 "

The circuit employed in the Sprague Model TO-4 condenser tester for measuring insulation resistance is shown in *Fig. 7*. Passage of current through the condenser or other circuit element under test causes an increase in the negative bias at the grid of V1 and a consequent decrease in plate current. Plate current flows through the meter located on the face of the instrument causing the needle movement to be activated. The meter face is calibrated directly in megohms.

In making this test on a capacitor all that is necessary to do is depress the button indicated for insulation resistance measurements after connecting up the condenser to the terminal posts. The insulation resistance is read from the meter scale after the pointer comes to rest. Wide fluctuations of the meter pointer indicate an intermittent capacitor which should be discarded.

The Sprague Model TO-4 capacitor analyzer also tests electrolytic condensers for their leakage current. The circuit for determining the leakage current is shown in *Fig. 8*. A self contained power supply provides any desired test voltage up to 600 volts, *dc*. In making the measurement the condenser is connected to the binding post and button "A" is depressed activating the circuit shown at the right in *Fig. 8*. The voltage across the condenser and the meter circuit is adjusted to the correct working voltage. When button "A" is released the current can then be read directly on the calibrated meter face. If greater accuracy is desired the range switch can be changed to the 6 *ma* scale instead of the 60 *ma* scale for small currents.

Tolerable amounts of leakage current are shown in Table B on the next page.

Simpson In-Circuit Capacitor Leakage Tester Model 383

A different type of condenser checker is the Simpson In-Circuit model 383. This unit has the feature of checking paper, mica and ceramic capacitors

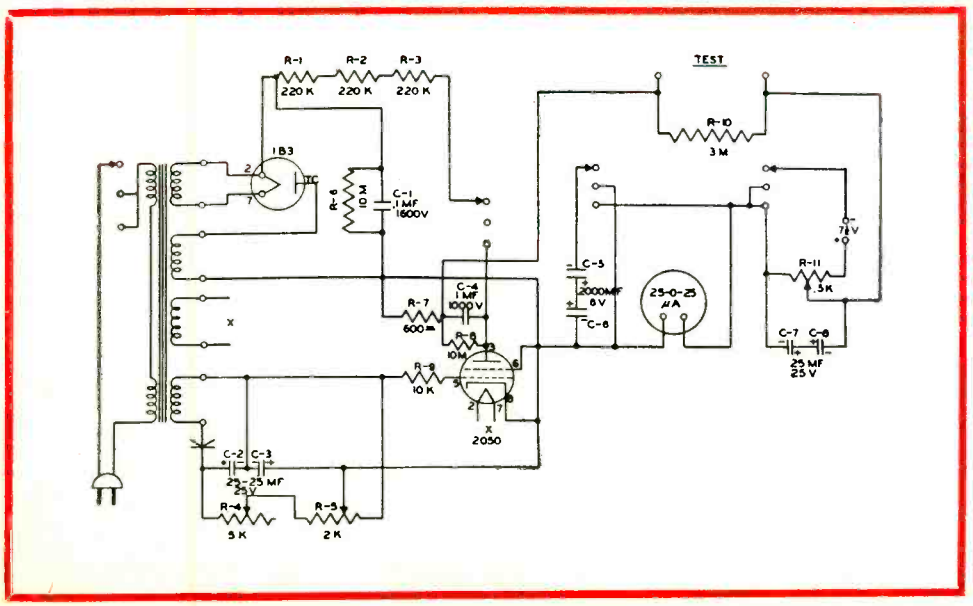


Fig. 9—Simpson Model 383 In-Circuit Capacitor Leakage Tester circuit diagram.

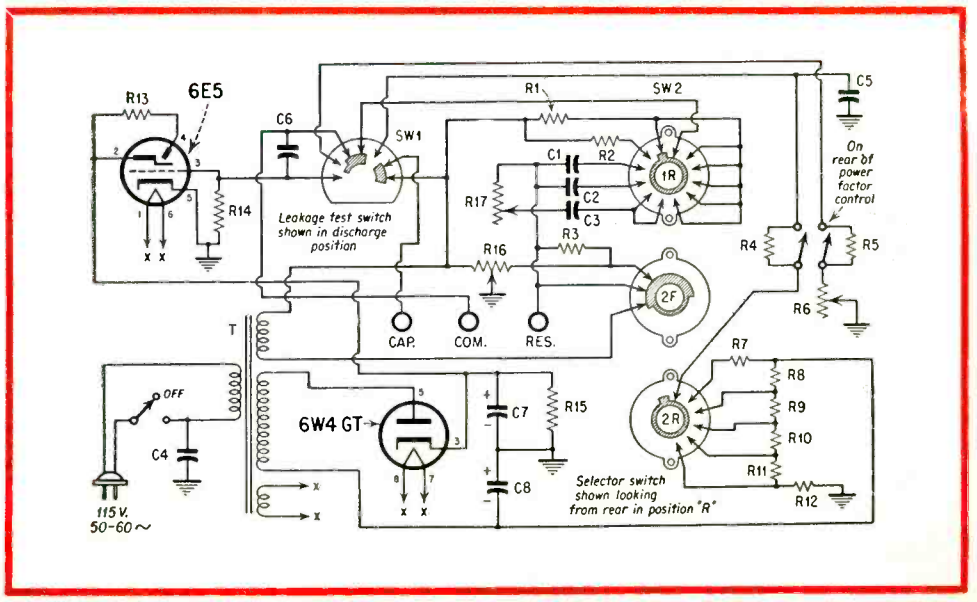


Fig. 10—Cornell-Dubilier capacitor-resistance bridge, Model BF-60.

while they are connected into its circuit without disconnecting either end. It operates on the principle that leakage resistance of fixed capacitors which are deteriorating in service differs from conventional forms of resistance in that the leakage resistance is inherently unstable and changeable. Leakage resistance can be made to change value when subjected to shock pulsing. This change in the value of leakage resistance is reflected as a proportionate change in effective circuit resistance which can be indicated by an ohmmeter of the suppressed-zero type to obtain a very sensitive indication of change. Both static and dynamic checks are obtained with this unit.

DC WORKING VOLTAGE	LEAKAGE IN MA.
25 50 100	0.01 Ma. per mfd. plus 0.5 Ma.
150 200 250 300	0.02 Ma. per mfd. plus 0.5 Ma.
350 400 450 500	0.03 Ma. per mfd. plus 0.5 Ma.

Table B—Chart of DC Working Voltage vs. Leakage in Ma.

The circuit of the Simpson Model 383 is shown in *Fig. 9*. A complete description of the operation of this unit is described in the Nov. 1955 issue of *Service Dealer*, in the article entitled, "An In-Circuit Condenser Checker," by George Reade.

Another excellent condenser testing unit that performs all the standard checks is the Cornell-Dubilier capacitor-resistor bridge Model BF-60. The visual indicator is an "Eye" (6E5) tube which shows the balance or null of the circuit bridge with an indication of maximum opening of the "eye". Instruments such as this one are extremely handy in making insulation resistance measurements between coil windings, insulation, etc. In this unit the controls on the front are the range switch, leakage switch, power factor control and master

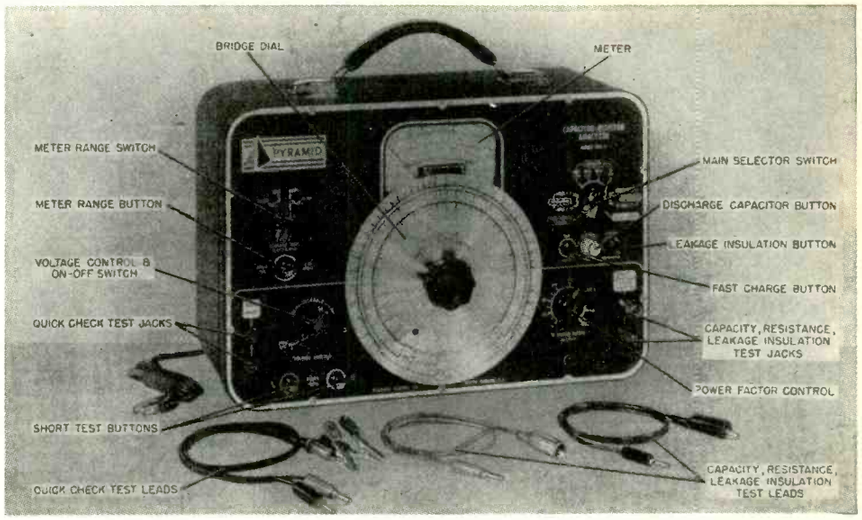


Fig. 13—Pyramid Model CRA-2 checker is designed for five basic types of measurements: capacitance, power factor, leakage current, resistance, and insulation resistance.

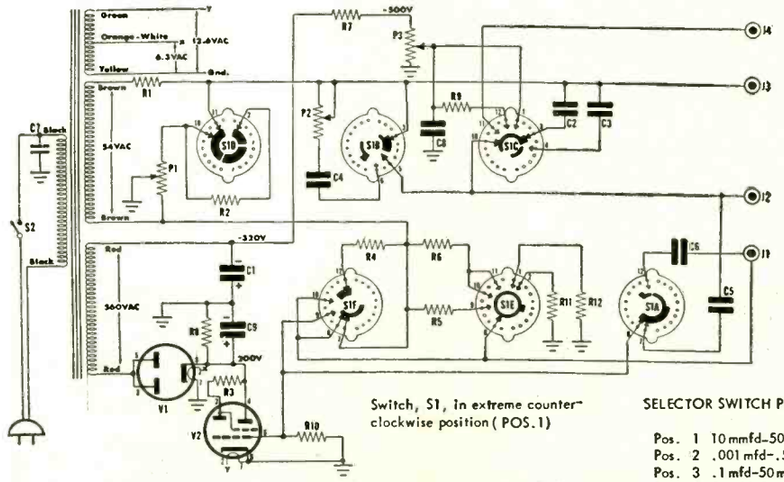
control. The circuit employed in the measurement of the capacitance and resistance is a line frequency bridge type that permits great accuracy. The schematic for this instrument is shown in *Fig. 10*.

An even more elaborate piece of test equipment is the Cornell-Dubilier capacitance-Resistance analyzer, Model BF-70. This unit incorporates both an accurate eye (6E5) tube but also provides a separate meter to measure the voltages applied to the condensers under test. This meter is calibrated to measure the leakage current of electrolytic capacitors directly in milliamperes. For capacitance measurements a precision line frequency Wien Bridge circuit is employed.

Figure 11 is a diagram of the Eico Resistance-Capacitance Bridge and R-C-L Comparator, Model 950 B, which is available in either kit form or factory assembled and wired.

Capacitance values from 10 $\mu\mu$f up

[*Continued on page 49*]

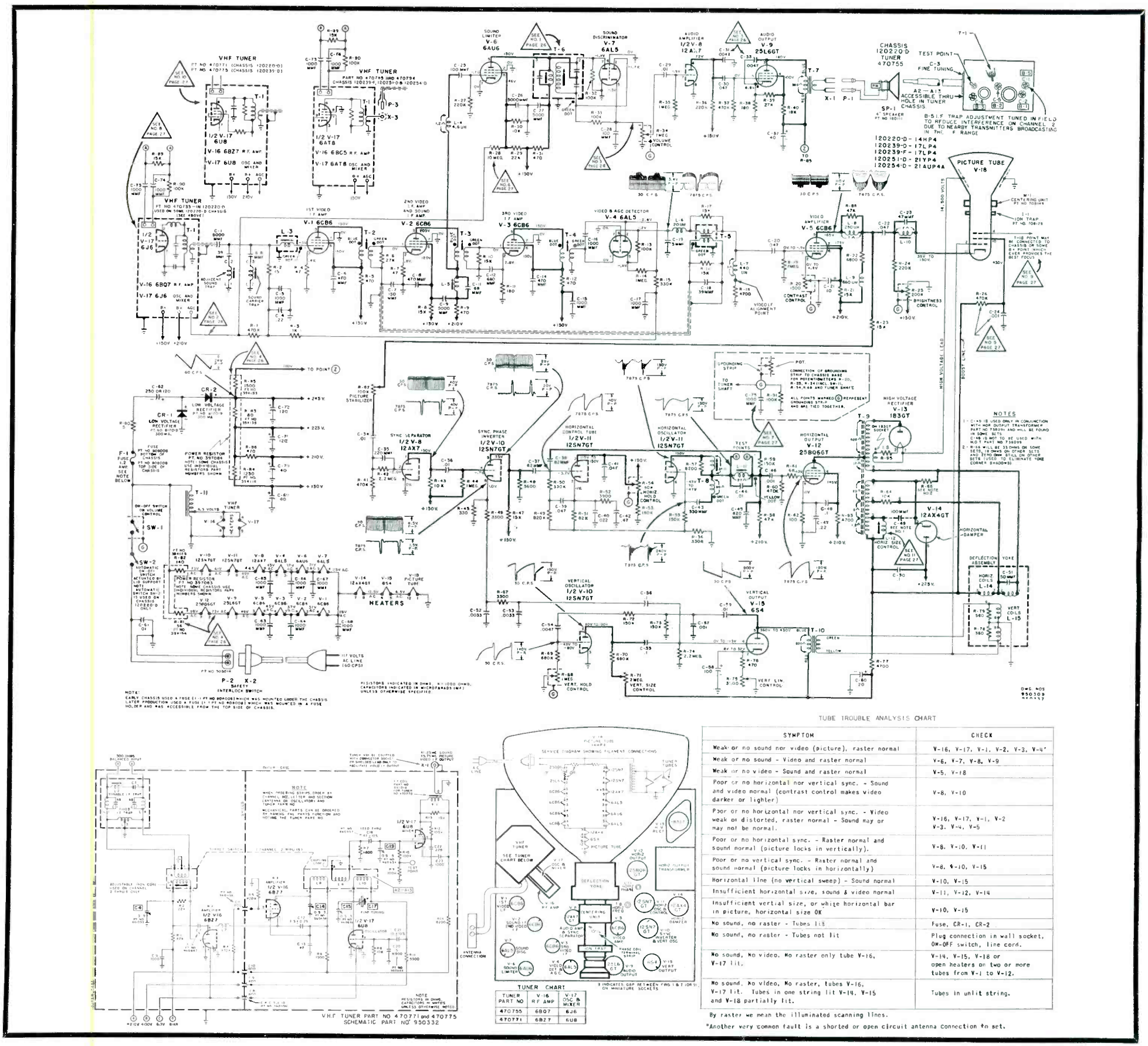


Sym.	Description	Sym.	Description	Sym.	Description
C1	cap., elec 8 mfd-525 V	P3	pot., 100KΩ, 4W	R9	res., 270KΩ, 1/2 W
C2	cap., 200 mmf, prec.	R1	res., 500Ω, 4 W	R10	res., 10MΩ, 1/2 W
C3	cap., .02 mf, prec.	R2	res., 250K, 1/2 W, 1%	R11	res., 2.2KΩ, 1W
C4	cap., 2 mf, prec.	R3	res., 1MΩ, 1/2 W	R12	res., 470K, 1/2 W
C5,6,7	cap., .01 mf-400 V	R4	res., 20Ω, 1/2 W, 1%		
C8	cap., .25 mf-600 V	R5	res., 2KΩ, 1/2 W, 1%	S1	switch, range
C9	cap., elec 4 mfd-250 V	R6	res., 200KΩ, 1/2W, 1%	S2	switch, SPST, p/o P2
P1	pot., 10KΩ	R7	res., 3.3KΩ, 1W	V1	tube, 6X5
P2	pot., 1KΩ w/SPST	R8	res., 68KΩ, 1W	V2	tube, 1629

SELECTOR SWITCH POSITIONS

Pos. 1	10 mmfd-5000 mmfd
Pos. 2	.001 mfd-.5 mfd
Pos. 3	.1 mfd-50 mfd
Pos. 4	50 mfd-5000 mfd
Pos. 5	.5Ω - 500Ω
Pos. 6	50Ω - 50KΩ
Pos. 7	5KΩ - 5MΩ
Pos. 8	5MΩ - 500MΩ
Pos. 9	Comparator
Pos. 10	Paper-Mica Test
Pos. 11	Electrolytic Test

Fig. 11—Circuit diagram of EICO resistance-capacitance bridge, Model 950B.



TUBE TROUBLE ANALYSIS CHART

SYMPTOM	CHECK
Weak or no sound nor video (picture), raster normal	V-16, V-17, V-1, V-2, V-3, V-4*
Weak or no sound - Video and raster normal	V-6, V-7, V-8, V-9
Weak or no video - Sound and raster normal	V-5, V-18
Poor or no horizontal nor vertical sync. - Sound and video normal (contrast control makes video darker or lighter)	V-8, V-10
Poor or no horizontal nor vertical sync. - Video weak or distorted, raster normal - Sound may or may not be normal.	V-16, V-17, V-1, V-2 V-3, V-4, V-5
Poor or no horizontal sync. - Raster normal and sound normal (picture locks in vertically).	V-8, V-10, V-11
Poor or no vertical sync. - Raster normal and sound normal (picture locks in horizontally)	V-8, V-10, V-15
Horizontal line (no vertical sweep) - Sound normal	V-10, V-15
Insufficient horizontal size, sound & video normal	V-11, V-12, V-14
Insufficient vertial size, or white horizontal bar in picture, horizontal size OK	V-10, V-15
No sound, no raster - Tubes lit	Fuse, CR-1, CR-2
No sound, no raster - Tubes not lit	Plug connection in wall socket, ON-OFF switch, line cord.
No sound, No video, No raster only tube V-16, V-17 lit.	V-14, V-15, V-18 or open heaters on two or more tubes from V-1 to V-12.
No sound, No video, No raster, tubes V-16, V-17 lit. Tubes in one string lit V-14, V-15 and V-18 partially lit.	Tubes in unlit string.

By raster we mean the illuminated scanning lines.

*Another very common fault is a shorted or open circuit antenna connection to set.

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ADJUSTMENT CHECK LIST

Extend the rods of the cabinet antenna making sure the bottom section is fully extended. Adjust the angle, rotation and rod length for best picture and sound on channel being used.

Plug the power cord into the 117V. AC outlet and turn the receiver "ON." The receiver should operate normally. However, a check of the following adjustments should be made.

*1. Check position of ion trap magnet and if necessary readjust the ion trap magnet for maximum raster brightness with the brightness control as far clockwise as possible with which good line focus can be maintained.

*2. Check raster for proper framing (tilt) in mask. Adjust yoke positioning by rotating. To do this insert a screwdriver into the serrated collar at either point "A" or "B" shown in MAGNET ADJUSTMENTS drawing and pry against the edge of the hood.

3. Check width of the picture. Readjust width and drive adjustments, if necessary, as indicated below.

*4. Check for normal operation of the horizontal hold control. Should hold sync for two full turns or more of the control. (See below if adjustment is required.)

*5. Check centering of picture. Adjustment is made with the individual discs of the centering magnet or by rotating both discs together. Rotate the discs with a small screwdriver inserted in the teeth of the discs.

6. Check height and vertical linearity. Reset controls where necessary for ¼" overscan at both top and bottom.

*7. Check for sound and picture tracking on a *weak* signal. Readjust 41.25 mc. sound boost adjustment, if necessary, as follows:

Adjust fine tuning for maximum picture signal, then adjust sound boost adjustment for maximum sound signal. The weakest channel must be used when making this adjustment.

8. Check R-F oscillator adjustments *at 84° point of fine tuning shown on drawing*. Readjust if necessary starting at highest channel proceeding to the lowest. *Be sure fine tuning is at 84° point when making adjustments.*

Width, Horizontal Drive and Sinewave Adjustments

A. Set brightness control fully clockwise.

B. Adjust drive for overdrive line then clockwise until line just disappears. If no line appears set fully counter-clockwise.

C. Adjust width for ¼" overscan at each side, with normal line voltage and normal brightness. Repeat Step B.

D. Turn the horizontal hold control to the left, out of sync, to the point where interrupted oscillation occurs.

E. Adjust sinewave core, as the horizontal hold control is rotated to the left beyond the locked-in position, until 3 to 4 bars occur between the fall out point and interrupted oscillation.

*Chassis must be removed from the case to make these adjustments, see CHASSIS REMOVAL section.

CHASSIS REMOVAL.—The chassis must be removed from the cabinet to replace tubes or the kinescope and to perform certain adjustments as explained above.

Take the receiver off its stand and completely remove the two knurled screws at the sides of the cabinet. Never attempt to remove the chassis unless these two screws are completely removed, as their projection inside the cabinet may result in internal damage as the chassis is pulled from the case. Refer to CHASSIS REMOVAL drawing.

Remove the knobs on the controls located in the cover and case assembly and take out the three screws holding the assmembly to the cabinet. Their location is indicated at "A." Lift the control case and cover directly upward to remove.

Take off the carrying handle by removing the two screws at the ends of the handle. Also, remove the screw at the bottom front edge of the receiver case. These three screws are indicated at "B."

Slide the chassis assembly, which includes the front frame and kinescope, out of the receiver cabinet. The antenna and A.C. interlock will automatically disengage as the chassis is removed.

CHASSIS SERVICING.—Adjustment of the yoke position, centering magnets and the ion trap magnet may be made with the chassis completely assembled as shown in "B" of CHASSIS SERVICING drawing. The location of these adjustments is on the bottom of the front chassis section.

Replacement of the tubes in the tuner unit requires removal of the speaker. To remove the speaker, loosen the speaker clamp screw shown in MAGNET ADJUSTMENTS drawing and slide the speaker out of its clamp. This will allow room to make tube replacement in the tuner unit.

Service which requires circuit tracing or voltage measurements must be performed with the front and rear chassis sections separated. To do this, remove the six (6) self-tapping screws holding the front and rear chassis sections together. See "B" of CHASSIS SERVICING drawing. Remove *only* the screws indicated. The positions of the insulating boards should be noted for replacement when reassembling the chassis.

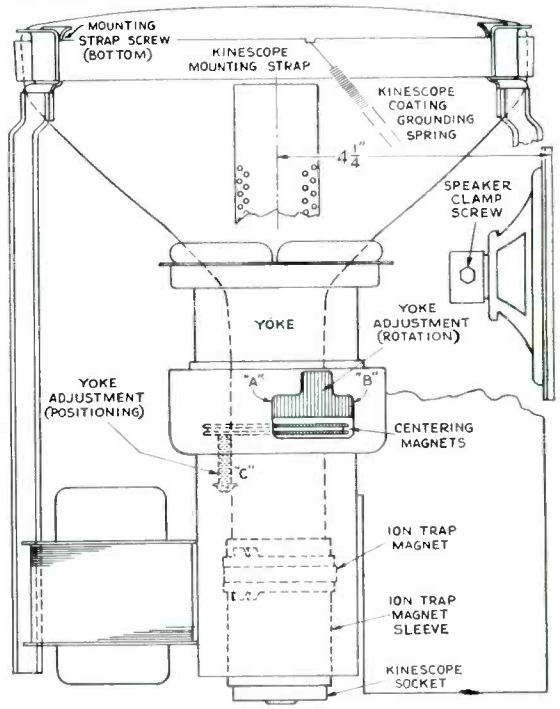
Unplug the kinescope socket and slide the rear chassis section off the end of the kinescope neck. Turn the chassis around making the bottom wiring side visible. Slip the kinescope socket leads out of the hole in the chassis, through which they are normally dressed, and pass the socket through the large yoke shield opening in the chassis and reconnect to the kinescope. With the chassis in this position, which is shown at "C" of CHASSIS SERVICING drawing, all points will be accessible for servicing. Greater separation of the two chassis sections may be accomplished by the use of a short extension cable for the kinescope leads if desired.

REPLACING THE CHASSIS IN THE CABINET.—Replacement of the chassis in the cabinet is simply a reversal of the removal procedure with several important additional steps to be performed.

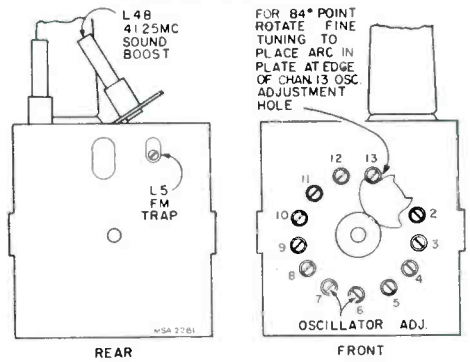
Make sure the insulating boards have been replaced in their proper positions. The boards are provided to prevent any thin metal object, which may fall or be inserted through the cabinet ventilating louvres, from coming in contact with high voltage circuits or from causing a short circuit to the cabinet.

If the speaker was removed for tube replacement in the tuner, the speaker must be properly positioned before replacement of the chassis in the cabinet. The face of the speaker baffle must be exactly four and one-quarter inches (4¼") from the centerline of the chassis as shown in MAGNET ADJUSTMENTS drawing. The chassis will not slide into the case properly if the speaker extends out too far. When the speaker does not extend sufficiently, sound echoes may ocur within the cabinet.

The A.C. interlock screw, located under the snap-out button on the cabinet rear, should be readjusted if the front and rear chassis sections were separated when servicing. Turn the adjustment screw fully counter-clockwise moving the interlock plug toward the cabinet rear. Proper alignment of the interlock plug and the antenna terminals is automatically achieved by the locating stud on the interlock as the chassis is inserted in the cabinet. After the chassis has been replaced in the cabinet and securely fastened, the A.C. interlock adjustment screw should be turned fully clockwise to insure proper contact in its receptacle. When replacing the screws holding the chassis in the cabinet, the screw under the bottom front edge of the cabinet should be replaced first.



MAGNET ADJUSTMENTS

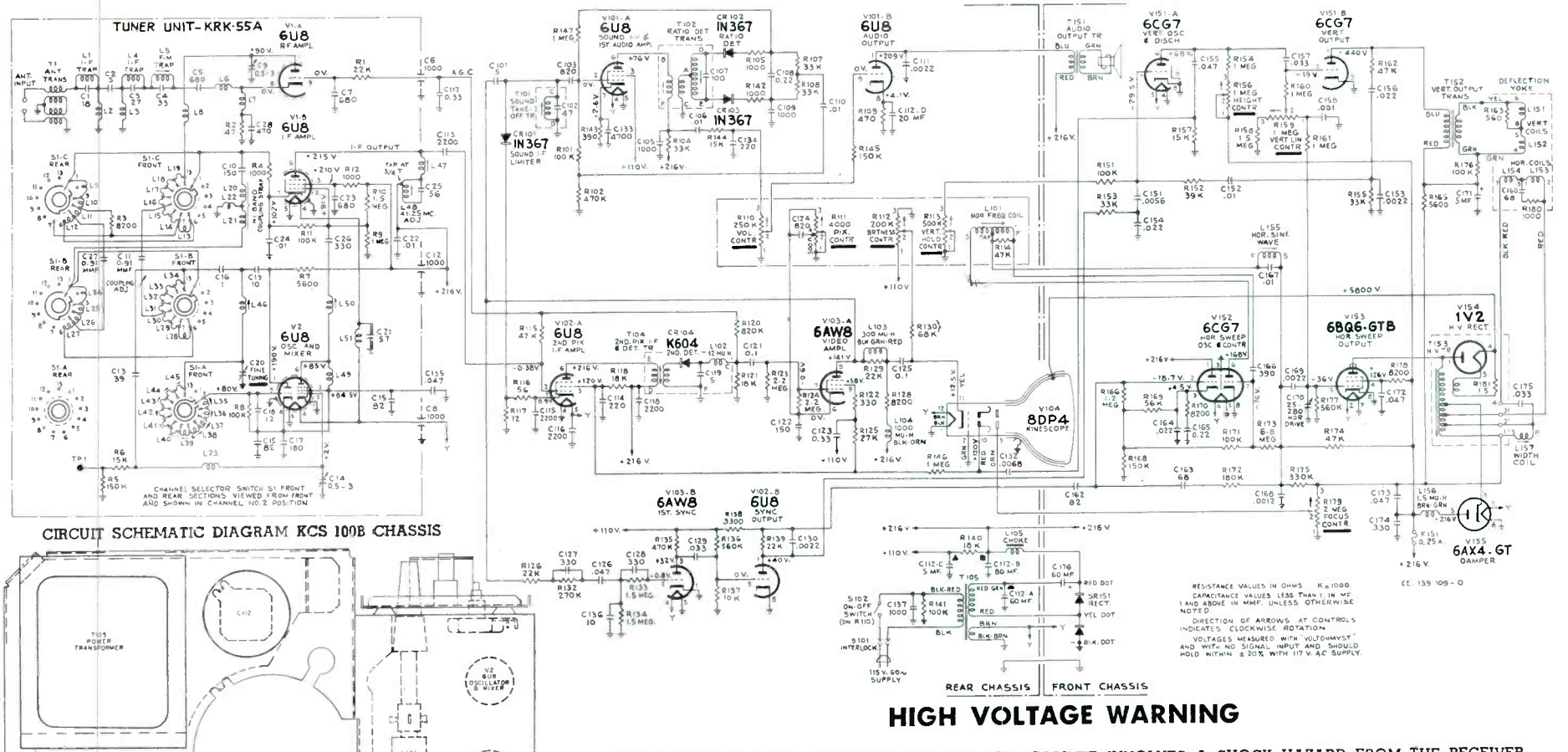


SOUND BOOST AND R-F OSCILLATOR ADJUSTMENTS

KINESCOPE REPLACEMENT.—Remove the chassis from the cabinet as outlined under CHASSIS REMOVAL. Take off the front safety glass frame by removing the three screws holding the frame to the kinescope mounting strap. Turn the screw shown at point "C" in MAGNET ADJUSTMENTS drawing counter-clockwise moving the yoke away from the bell of the kinescope. Take off the kinescope socket, the ion trap magnet with its sleeve and disconnect the high voltage lead.

Loosen the screw on the kinescope mounting strap, refer to MAGNET ADJUSTMENTS drawing, and slide the kinescope out of the yoke.

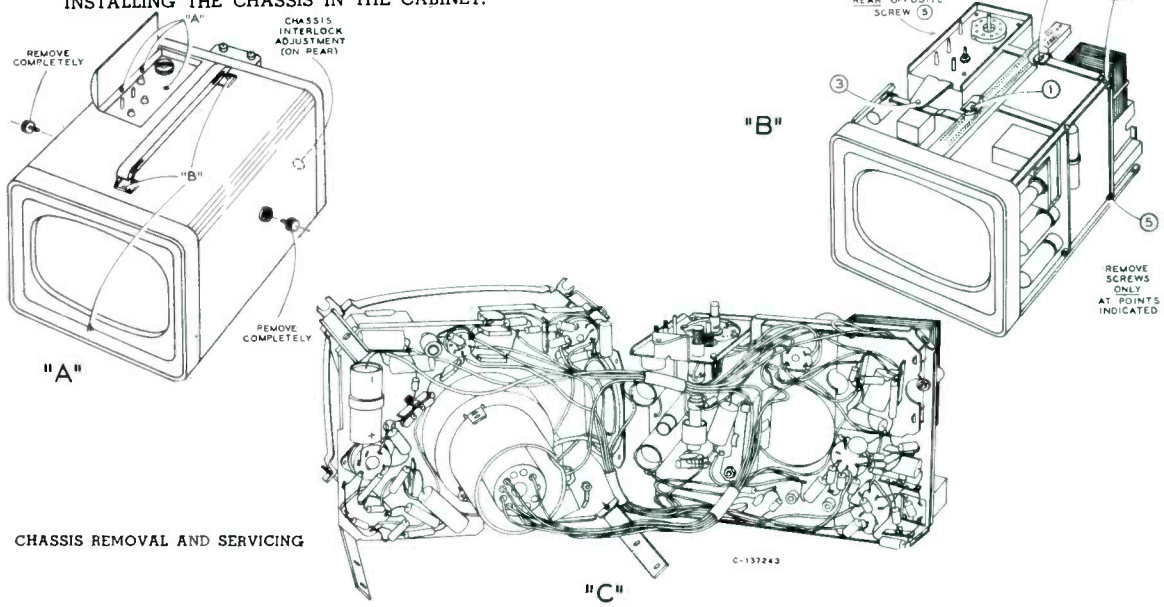
Install the new kinescope and tighten the screw on the strap around the front edge of the kinescope. Turn the yoke positioning screw clockwise to bring the yoke forward against the kinescope bell. Replace the front safety glass frame, ion trap magnet and sleeve and the kinescope socket. The sleeve between the kinescope neck and the ion trap magnet should not extend more than ⅜" beyond the yoke hood after adjustment of the ion trap magnet has been made.



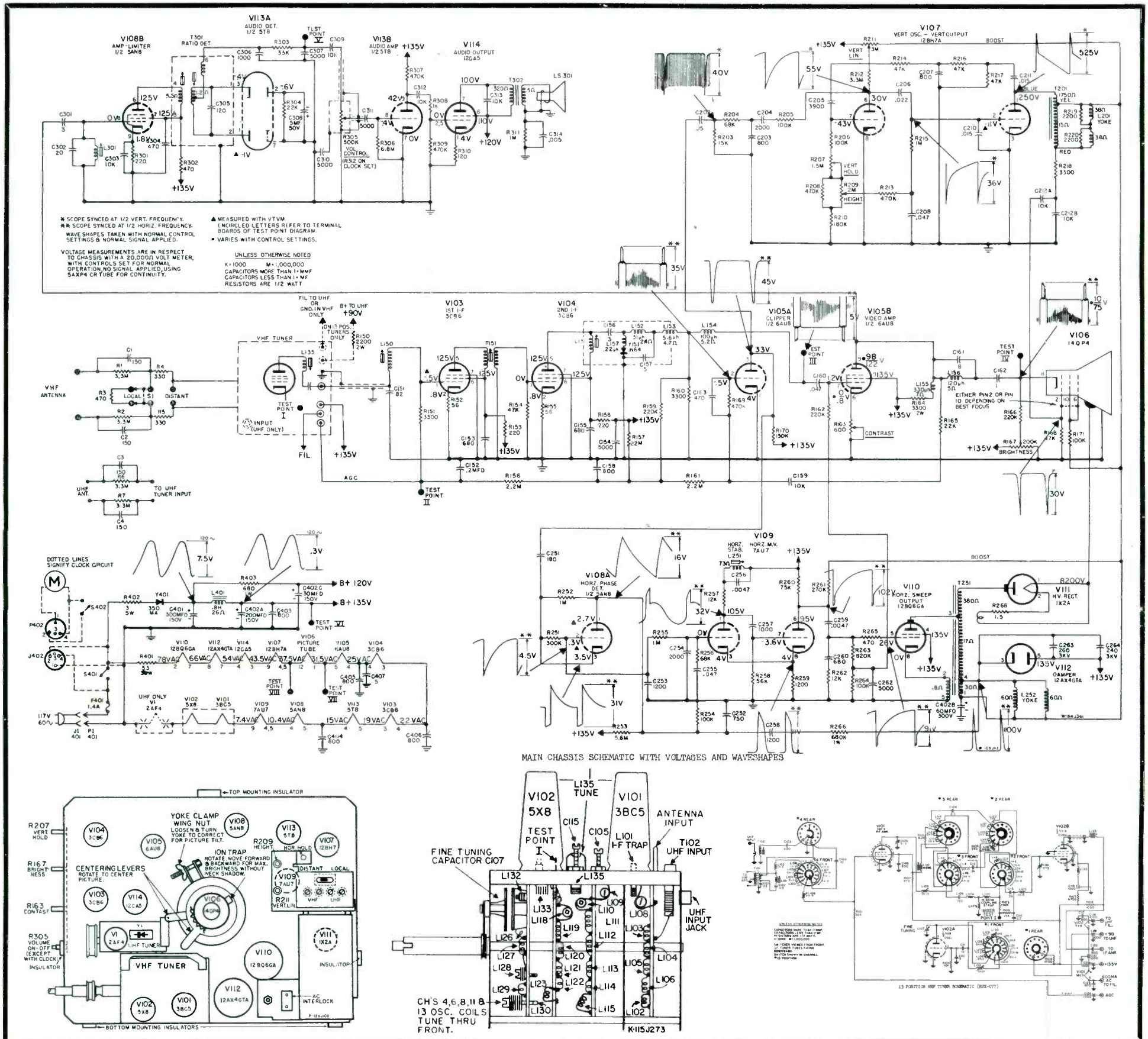
CIRCUIT SCHEMATIC DIAGRAM KCS 100B CHASSIS

HIGH VOLTAGE WARNING

OPERATION OF THESE RECEIVERS OUTSIDE THE CABINET INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. MAKE SURE THE GROUNDING SPRING ON THE KINESCOPE MOUNTING STRAP IS SECURELY FASTENED AND MAKING CONTACT WITH THE KINESCOPE COATING BEFORE TURNING THE RECEIVER ON. REPLACE ALL INSULATING BOARDS BEFORE RE-INSTALLING THE CHASSIS IN THE CABINET.



CHASSIS REMOVAL AND SERVICING



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The IF response in a color receiver is carefully designed for a desired bandpass. The tuner, in turn is designed with as flat a bandpass as possible to keep the IF bandpass unaltered for the various channels tuned in. Departure from this flatness in color is less tolerable than in B&W.

Color Tuner Circuit Analysis

by **BOB DARGAN** and
SAM MARSHALL

From a forthcoming book entitled
"Fundamentals of Color Television"

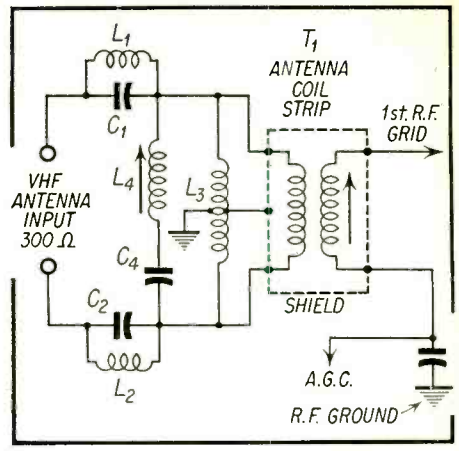


Fig. 1—Antenna matching unit using a 300 ohm balanced-to-unbalanced input circuit is shown above.

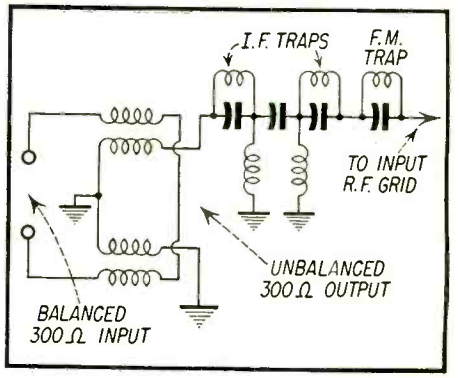


Fig. 2—Antenna matching unit using balun with FM and IF traps.

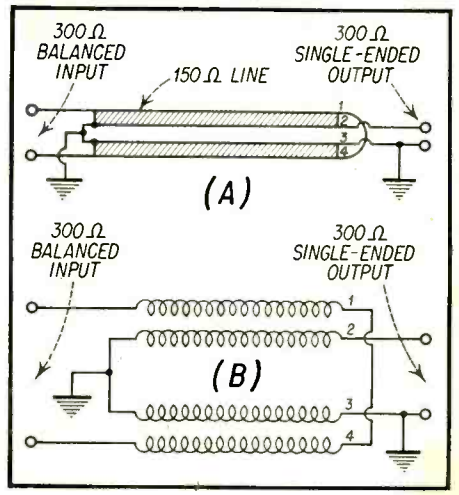


Fig. 3—Balun provides 300 ohm impedance balanced-to-unbalanced line match as shown above.

Aside from the fact that tuners used in color TV receivers have a flatter bandpass than their black and white counterparts, they are essentially similar in design and operation. Such tuners may be of the *vhf* or *vhf-uhf* types. All tuners are made up of four sections, these being the antenna matching, the *rf*, the oscillator, and the mixer.

Channel selection in *vhf* tuners is usually accomplished either by a turret-tuned coil switching circuit or a wafer-type switch in conjunction with a tuned tapped-coil circuit. The latter type is often referred to as an *incremental inductance* tuner.

Tuner Antenna Matching Unit

The section between the antenna terminals and the input terminals of the first *rf* grid is referred to as the antenna matching unit. The primary function of this section is to provide a proper impedance match between the transmission line and the grid circuit of the first *rf* tube. Also included in the antenna matching section may be found various FM and *if* rejection traps.

Two types of impedance matching circuits which are generally used in tuners are the balanced transformer input circuit shown in *Fig. 1*, and a balun arrangement shown in *Fig. 2*. Both provide proper transformations of balanced to unbalanced circuits.

In *Fig. 1* this transformation is effected by connecting the antenna strip *T1* in parallel with the center-tapped coil *L3*. The balanced signal in the primary of *T1* is coupled to the secondary where it appears as an unbalanced signal between grid and ground. FM interference is shorted out by the series combination *C4-L4*, while the parallel resonant circuits *L1-C1* and *L2-C2* provide rejection to incoming signals at the *if* frequency.

Fig. 2, as mentioned previously, illustrates an antenna input circuit using a balun for coupling the antenna energy into the receiver. This balun consists of two 150 ohm lines wound on separate coil forms and connected in series as shown in *Fig. 3A*. An equivalent circuit is shown in *Fig. 3B*. Since the input terminals are effectively connected to two 150 ohm lines connected in series, a 300 ohm balanced impedance match is provided for the antenna down lead. The output terminals are also connected to two 150 ohm lines connected in series, and grounded at the lower end of the line. Thus, the first *rf* grid sees an unbalanced 300 ohm circuit (the sum of two 150 ohm lines in series). Also, the antenna feeds into a *balanced* 300 ohm circuit since the line leads 2 and 3 are grounded at the antenna end.

Winding these transmission lines on a coil form imparts properties of inductance to these transmission lines. At the *very high* frequencies received this inductance gives the transmission lines *infinite length* properties because of the very high impedance introduced. Thus, grounding one end of the line does not have any effect on the other end. Under these conditions a balanced to ground 300 ohm input is effected at the antenna end without affecting the grid end, and an unbalanced to ground 300 ohm output is effected at the grid end without affecting the antenna end.

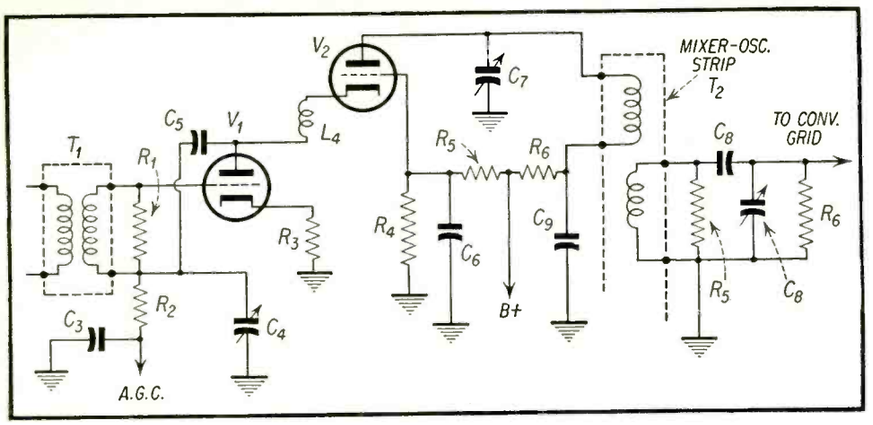


Fig. 4—Simplified partial schematic of typical turret tuner showing RF portion of unit. Triodes are used in a cascode arrangement. See text for explanation of the functions of the various components shown in figure.

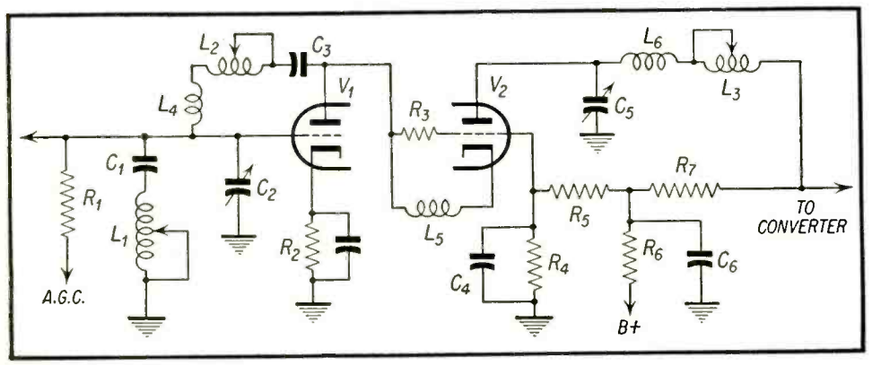


Fig. 5—Simplified partial schematic of incremental inductance type of tuner. In this method of tuning an inductance is tapped, the taps being selected by a wafer switch. *L2* and *L4* are used to compensate for the Miller effect.

Tuner RF Amplifier Units

The *rf* amplifier unit of a typical turret type tuner is shown in the simplified schematic *Fig. 4*. A triode cascode circuit is used. One of the principle reasons for using triode tubes is their higher signal to noise ratio when compared to pentodes.

Individual channel coils for the antenna and mixer sections are connected into the respective circuits by means of a turret switching mechanism. The *rf* output of the first triode tube *V1* is fed directly into the cathode of the second triode, *V2*, the latter being connected as a grounded grid amplifier. Choke *L4* prevents *V2* from loading *V1* and detuning the first tuned grid circuit.

Notice that fixed bias is applied to the grid of *V2* through *R4* and *R5*. This improves the *agc* action of the circuit in the following manner: Suppose a strong signal is tuned in. The *agc* bias on *V1* will increase, causing the plate current in *V1* to decrease, and the plate voltage to become more positive. Since the cathode of *V2* is connected through *L4* to the plate of *V1*, its voltage with respect to ground will also increase. This will increase the bias between grid and cathode *V2* (since the voltage between grid and ground on *V2* is constant) and the tube gain will decrease. Thus the output remains constant for various signal inputs.

A simplified partial schematic of an *rf* circuit used in an incremental inductance tuner is shown in *Fig. 5*. Channel switching is accomplished by taps on coils *L1*, *L2*, and *L3*. As in the turret type tuner a cascode tube is used for *rf* amplification.

Shown also in this schematic is a circuit used in a number of receivers for reducing distortion of the *rf* bandpass response. This circuit entails the use of *L2*, *L4* and *C3*, (the latter acting as a blocking condenser), connected across the plate and grid of the first *rf* tube.

Coils *L2* and *L4* are effectively in parallel with the plate to grid internal capacitance, C_{gp}, of the tube. At the channel received, this combination acts as a parallel resonant circuit thereby introducing a comparatively high impedance between plate and grid of *V1*. The advantages of such a circuit become apparent from the following considerations.

It will be recalled that the input capacitance of an amplifier varies with the grid bias, (*agc* voltage). This is known as the Miller Effect. In color TV tuners serious distortion of the *rf bandpass* can result because of the detuning produced by this effect. However, by making *L2* and *L4*, in conjunction with C_{gp}, resonant to the incoming frequency, a high internal impedance path between plate and grid within the tube is effected and the Miller Effect is decreased. Thus the bandpass response is maintained constant over the ranges of channels being received.

Notice that the coil *L2* is tapped so that resonance may be obtained on every channel tuned in.

Tuner Oscillator Converter Unit

Tuner oscillator sections are generally modified Colpitts circuits in which the tube capacitance is used as one of the feedback elements. The oscillator frequency is adjusted to the sum of the incoming *rf* and *if* frequencies. A typical tuner oscillator circuit as used in a turret type tuner is shown in *Fig. 6*.

Referring to *Fig. 6* we observe that the oscillator energy is inductively coupled into converter from *L1* to *L2*, in the *rf* mixer strip. Also coupled to *L2* is *L3*, the *rf* output coil, so that both the oscillator and *rf* signals are fed into the converter via *L2*. The output of the converter generally contains an *if* transformer (such as *T1*) tuned to a suitable *if* frequency.

Testing and Aligning

The point marked TP, located between grid and ground of the converter, is a test point for observing the *rf* frequency response of the tuner with a scope. In this case a sweep frequency signal generator is connected to the antenna terminals as shown in *Fig. 7*. Bandpass adjustments are made with the aid of *C7* in *Fig. 6*, and *C4* and *C7* in *Fig. 4*.

Oscillator frequency adjustments in a turret tuner are made initially with *C3* in conjunction with *C2* (set at its center position) and *L1* (for Channel 2). Following this initial adjustment individual channel frequency adjustments are made by means of a slug on *L1* (for each channel).

Oscillator operation may be checked by means of a VTVM connected between grid and cathode (ground) of the oscillator. If the oscillator is operating correctly a negative voltage will be obtained at the grid, this voltage varying with different makes and models of tuners.

VHF-UHF Tuners

Many color TV receivers are equipped with VHF-UHF tuners. For this reason a brief discussion of these devices is in order.

An effective method of obtaining reception on UHF in conjunction with VHF is to use *one* of the selector positions for UHF. How this technique is employed to tune in the various UHF stations is explained in the following paragraphs.

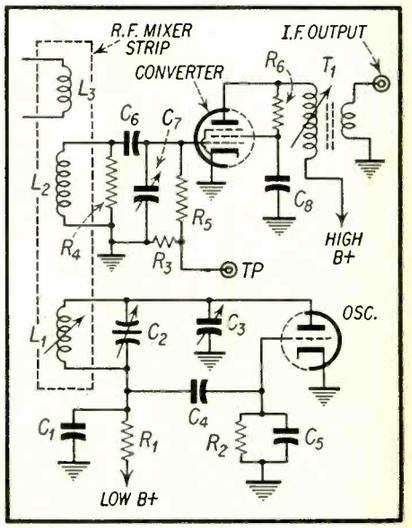


Fig. 6—Simplified partial schematic of turret type tuner showing oscillator-converter circuit.

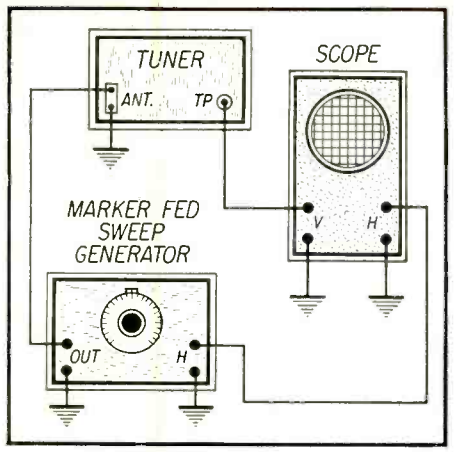


Fig. 7—Connections for a tuner with a sweep generator.

The block diagram shown in *Fig. 8* compares the circuit layouts of the tuner for both VHF and UHF reception. When the selector mechanism is switched to the UHF position, 41-47 *mc* transformers are inserted in the antenna and *rf-osc* strip sections. At the same time the VHF oscillator is disabled.

Referring back to the output of the UHF unit (which provides an output *if* signal between 41 and 47 *mc*) we observe that this output is fed into the input of the 41-47 *mc* transformer in the antenna circuit. Thus, during UHF reception the tuner provides three stages of 41-47 *mc if* amplification before the UHF signal reaches the regular *if* section of the receiver.

Figure 9 illustrates the circuit diagram of the UHF section of a typical (Standard-Coil) UHF-VHF tuner. This section is divided into three compartments. The compartment on the left contains the first *rf* line and its tuning condenser. The energy from this circuit is linked coupled to the *rf* line and tuning condenser shown in the 2nd compartment. The output of the latter is then link coupled to a crystal mixer.

The compartment on the extreme right contains a modified Colpitts UHF oscillator with its tuning condenser ganged to the *rf* and mixer tuning condensers. The oscillator output is link coupled to the other terminal of the crystal mixer. The output of the crystal mixer contains the 41-47 *mc if* output which is fed into the antenna section of the VHF turret.

Alignment of a UHF tuner is similar to a VHF tuner in that correct bandpass must be maintained. This is accomplished by means of the trimmers shown in the diagrams, and by following procedures analogous to those pursued when aligning VHF tuners. Again, it must be emphasized that these procedures vary with different tuner makes and models.

It will be observed that the symbolic representation of UHF components is quite different from that shown in conventional broadcast and VHF circuits. This is because at the very small wavelengths employed in UHF, conventional coils and condensers are physically too large to be effective. For this reason also, the wiring and associated connections play a significant part in determining correct circuit operation. Thus, where in VHF we are accustomed to "lumped" condensers and inductors with their associated leads, in UHF the wavelengths are so small that conventional capacitors and inductors cannot be used. UHF tuning may be effectively accomplished by simple lengths of conductors cut to the desired resonant frequencies. As such, these conductors are called tuned lines.

From antenna theory, we know that a simple half-wave antenna as shown in *Fig. 10A*, becomes a quarter-wave (non-radiating) element of transmission line shorted at one end when folded up as shown at (*B*). Such a line is equivalent to a quarter-wave length of coaxial cable shorted at one end as shown at (*C*).

The open ends of a quarter-wave coaxial line shorted at the far end represent a parallel resonant circuit. If the coaxial line is reduced in length the resonant frequency will be increased. Conversely, if the line length is increased the resonance frequency will be reduced. Connecting an external condenser across the open terminals of this circuit has the effect of reducing its resonant frequency or increasing its line length.

It is customary to make the initial line length of the tuned line resonant to the highest frequency desired, and to tune in the lower frequencies by means of an externally connected variable condenser as shown in *Fig. 10D*.

In actual use the coaxial transmission line is replaced, as shown in *Fig. 11*, by a U-shaped metal channel which takes the place of the inner conductor, and the tuner housing and which takes

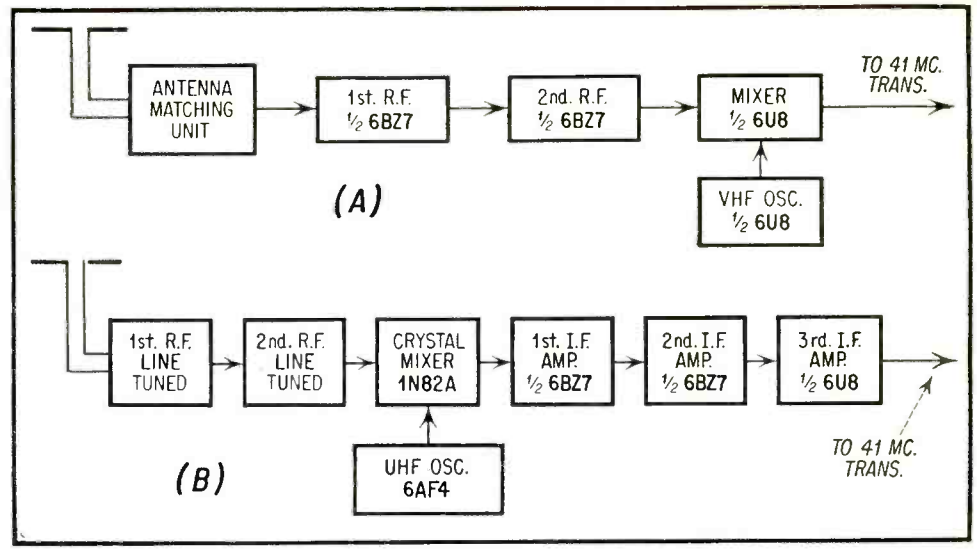


Fig. 8—Block diagram comparison of VHF and UHF functions of a VHF-UHF tuner.

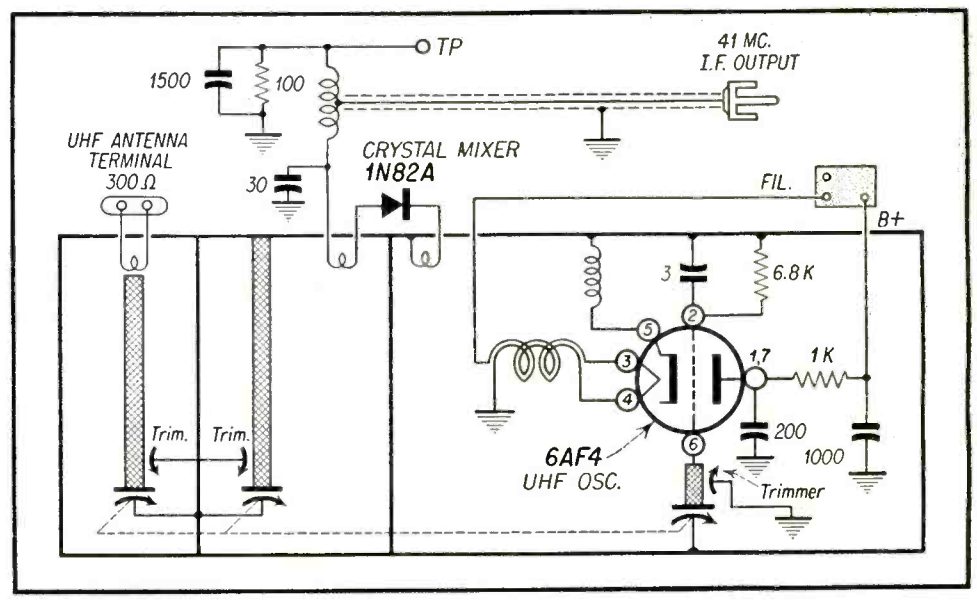


Fig. 9—(Above) Diagram representing UHF section of typical UHF-VHF tuner.

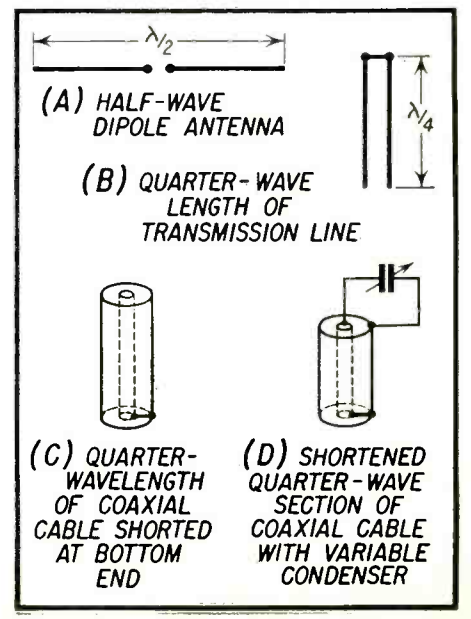


Fig. 10—(Right) Development of tuned coaxial section from half-wave dipole.

the place of the outer conductor. The unit is tuned by connecting the small variable condenser between the free end of the U-shaped channel and the tuner housing as shown.

Coupling from the antenna to the first tuned circuit is accomplished by a link as shown at the left of *Fig. 9*. Coupling out of the circuit is effected by the looped flat springs which provide contact between the variable condenser rotors and the housing separators.

At the very high frequencies used in UHF such a spring forms an appreciable impedance path to ground so that an appreciable signal voltage is

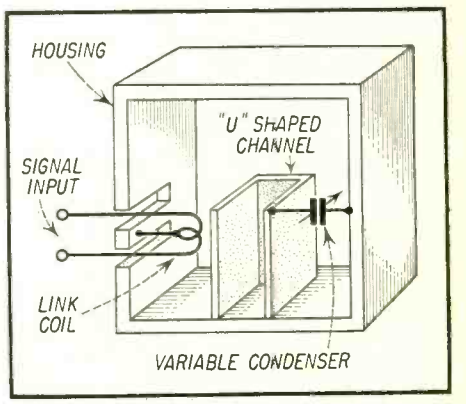


Fig. 11—Mechanical representation of tuned coaxial line for UHF use.

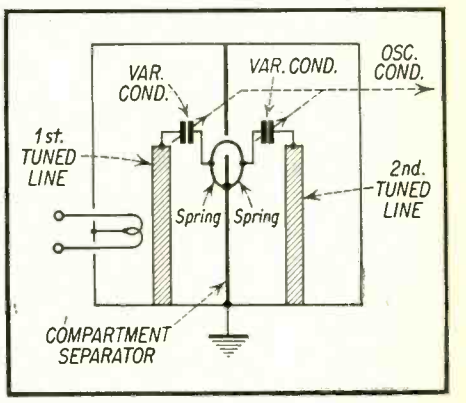


Fig. 12—Condenser spring contacts form common impedance path between tuned lines for transfer of signal from 1st to 2nd tuned line.

developed across the spring between its point of contact with the variable condenser and the point at which it is connected to ground. This system is shown schematically in *Fig. 12*. Thus the spring supplies the common impedance path across which the signal is transferred from one *rf* line to the other. ■■

MARINE ELECTRONICS

[*from page* 17]

quired, from a portable inverter such as the Cornell-Dubilier "Powercon."

Arrange a board on your service bench with ¼" bolt terminals wired to the batteries with #4 cable.

On the *dc* power panel, install a *dc* voltmeter (which can have a low-sensitivity movement) and a *dc* ammeter which will indicate as high as 50 amperes. Protect this meter with a shunting switch and a fuse, to prevent dynamotor-starting surges or accidental short circuit from burning it out.

A "service station" type of battery charger is designed to handle up to 6 batteries in series. "Float" one of these across the battery bank, charging when hydrometer or voltmeter give a low reading. Or a smaller charger, such as the 6 or 12-volt units available from electronic sources, or even stores such as Sears, can be used to charge the bank. However, it will be necessary to disconnect and "parallel" the batteries for charging, or wire them with a heavy (60-ampere) multi-pole charge-discharge switch.

Field Instruments

A 20,000-ohms per-volt combination meter is the main item. Almost everything else needed can be improvised on the job. For example, instead of using an audio oscillator, to test a receiver amplifier, put your finger on the grid of the first audio tube. If the loudspeaker buzzes, the *af* amplifier is working.

For transmitter testing, carry a neon bulb (Type NE-2 works fine) and a flashlight bulb soldered to a 2" diameter 2-turn coil of wire. Use a volt-ohm milliammeter (carry a phone jack for plugging it into meter sockets) for *dc* current readings, and carry a low-range *rf* ammeter (0-1 ampere, with shunt for higher current) for tuning.

A simple adaptor can be built to connect a 1N34 diode across the volt-ohm milliammeter terminals for measuring *rf* fields, which is very useful in transmitter tuning. The photographs show how this is made.

The next installment will go into the peculiarities of boat electrical systems you will encounter. ■■

Something New In Auto Antennas

By Engineering Department
Electrend Products Corp.

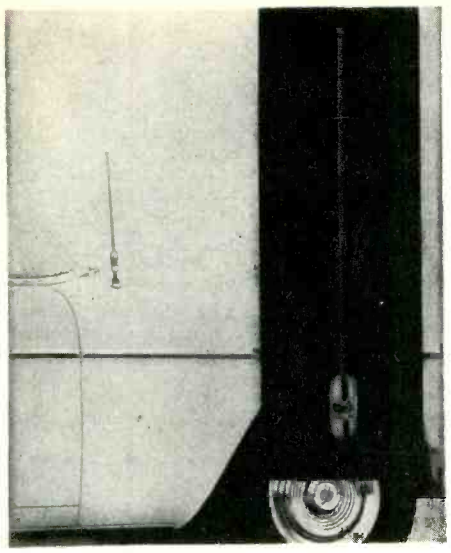


Fig. 6—Coiltenna mounted on car.

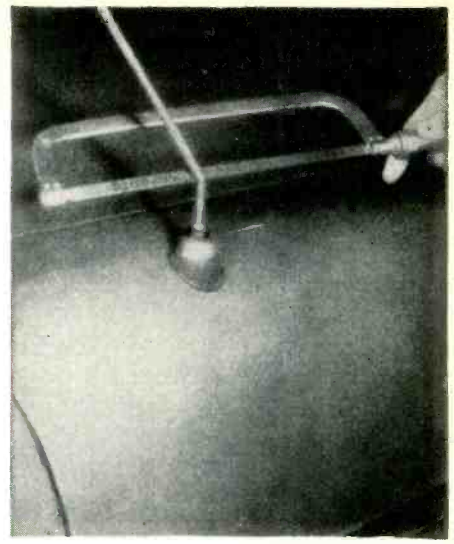


Fig. 5—Initial mounting operation.

ALTHOUGH today's advanced engineering know-how has produced auto radios with remarkable sensitivity and over-all performance, there is still a desire, and in many parts of the country, a need for greater sensitivity. The desire seems to be universal, and the need is definitely felt in mountainous areas, ore-bearing country, plains areas, and fairly remote districts. Of course this could be accomplished through the addition of another stage within the radio itself, but this would not be the answer for the millions of radios in the field. A practical answer was to design a device which would allow advantage to be taken of that one thing which all car radios have in common, namely the vertical or whip type antenna. The result, more signal input voltage.

A very sensitive and practical unit has been developed by the Electrend Products Corp. The "coiltenna" as it is called, consists principally of a coil, the purpose of which is to reproduce electrically the same inductance and capacity which is present in broadcast towers. The broadcast tower is tuned against ground and a counterpoise of ground radials. The coiltenna tunes the auto antenna against the ground and uses the car body as a counterpoise. The antenna, being resonant within itself, will then deliver a much higher signal voltage to the radio input stages. More signals are raised to the level of *avc* action and as a result noise is greatly reduced.

After the installation of a coiltenna, the antenna itself resonates at 700 *kc*, but is fairly broadbanded through the use of a carefully designed coil of the proper *Q*. The coiltenna functions around a very basic law which states that an inductance (*L*) in series with a wire will electrically lengthen that wire whereas a capacitance (*C*) in series will electrically shorten it. After the installation of a coiltenna, the antenna has been lengthened to a point slightly greater than a quarter wave length, and the circuit detuned. The antenna trimmer, being also in series, is used as a vernier to shorten it just enough to bring in the quarter wave length (see *Fig. 1*).

The trimmer is tuned at 1400 *kc* as recommended by the auto radio manufacturer. As noted in *Fig. 2*, this peak plus the coiltenna peak and the 500 *kc* low end peak within the radio itself combine to produce an overall resultant *rf* signal gain curve which is considerably higher than before. It must be realized however, the actual *rf* gain achieved as well as data shown on the curve will vary with different auto radios and in different terrain. Some of the locations above large ore deposits may effect an even greater gain, while in another location slightly less gain may be experienced. In any case the manufacturer states that a *minimum rf* gain of 30 *db* can be expected across the entire broadcast band.

Fig. 2—RF signal gain that can be achieved with the Coiltenna unit. Percentage of increase varies with the particular location and terrain.

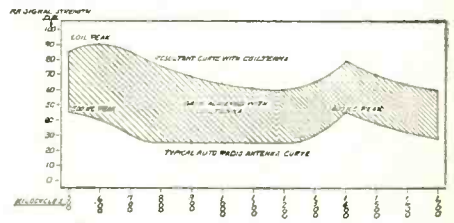


Fig. 1—Half-wave antenna with its grounded quarter wave counterpart.

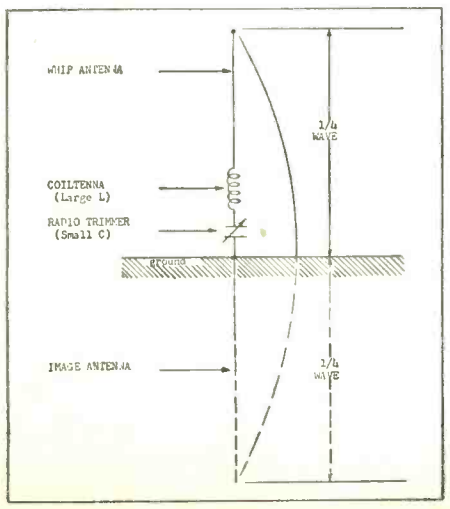


Fig. 3—Increase in signal strength achieved with the addition of the Coiltenna. Stations B and C become strong. Station A is not affected, having reached its AVC level.

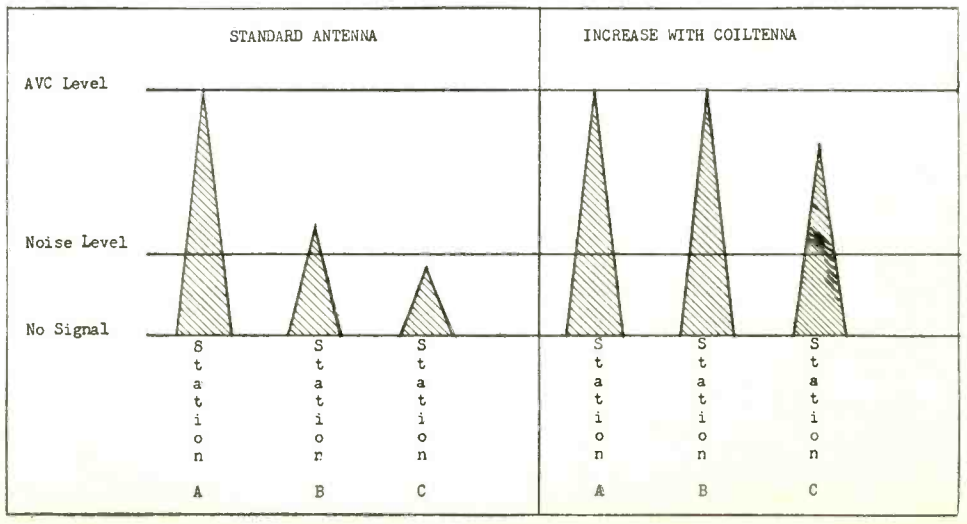
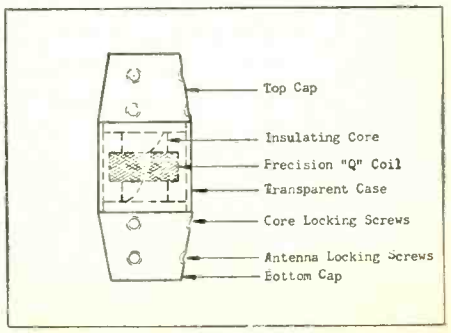


Fig. 4—Construction of Coiltenna.



Since the coiltenna electrically lengthens the antenna by such a large ratio, there is very little difference between a short stub or an extended whip. For this reason the antenna need *not* be extended where it could be broken or bent by low hanging trees or garage doors.

As mentioned before, coiltenna will bring a number of stations up to the level of *avc* action. In other words, strong local stations which may already be hitting the *avc* control, will receive no noticeable increase insofar as the ear is concerned. Far more important is the fact that many new stations will reach this level and will become strong and usable, as illustrated in *Fig. 3.*

Mechanical rigidity is accomplished by winding the coil on a strong fiberglass rod which serves as an insulator. This assembly is inserted between the top and bottom caps, enclosed in a plastic tube for weather protection and compressed under 1500 lbs. of pressure. Locking screws are tightened on the core making the coiltenna as strong and rugged as a single piece. Note in *Fig. 4* that the coil leads are attached to the top and bottom cap putting it in series with the antenna itself.

It is only necessary to sever your antenna at approximately 1½ inches from the base, as shown in *Fig. 5,* slip a coiltenna over this cut section and tighten two Allen screws. The upper portion is then inserted in the top of the coiltenna and two screws are tightened.

After installation, the antenna trimmer is returned for maximum volume while set is tuned to some weak station around 1400 *kc* on the dial. This trimmer is usually adjusted with a screwdriver through one of the vent holes in the radio. In some cases, however, it is a knob. In any case this trimmer is located very close to where the antenna plugs into the set and is usually marked "Ant. Adjust."

As may be observed, there are thousands of antennas which are either bent, rusted or broken. As replacement, the manufacturer has developed an "electronic antenna" sold under the trade name "Electenna." This is inserted over the broken stub of the present mount (the same as with the coiltenna) but contains an integrally mounted 15-inch antenna of tough spring steel. ■ ■

ASSOCIATION NEWS

by SAMUEL L. MARSHALL

North Bay Radio and Television Association, Vallejo, California (NBRTA)

The North Bay Radio and Television Association has taken another forward step in publishing and distributing a suggested price list. Action was taken by a special committee last year. The price list was approved later at the February NBRTA general meeting. It was felt that in as much as the prices that have been recommended do not necessarily reflect the total charges it was nevertheless a valuable guide in determining labor costs.

Many NBRTA members felt that this suggested price list has helped customer relations considerably. It was emphasized that not only does the schedule contain labor charges but makes allowances for testing necessary to locate the faulty part or circuit. Prices for replacement parts and tubes used are extra.

Ray Warthen, NBRTA President, advised that widely adapted copies of the schedule are available to any service business upon request, there is a small charge for handling and mailing. The Television and Radio Serviceman's Association of Richmond, Sonoma County Radio and Television Dealers Association and the Television Service Dealers Association of the East Bay have adopted similar suggested labor pricing schedules.

Association Radio-Television Servicemen of New York, Inc. (ARTSNY)

ARTSNY is proud to announce its establishment of a Color Clinic. It will continue its monochrome clinic at the same time. As in the past these meetings will be held at P&L TV, 220 Knickerbocker Ave., Brooklyn, N. Y., under the able directorship of Mr. Henry Levine. This clinic is for *color* only. The Black and White Clinic will be transferred to R.N. TV, 663 Washington Ave., Brooklyn, N. Y. Schedule for both clinics are for Wednesday evenings.

A committee of ARTSNY members met recently with the Long Island Guild in Long Island. The purpose of the meeting was to acquaint ourselves with the Long Island Guild and to see if we could have closer cooperation between Associations on matters that pertain to the servicing industry in general.

"I'M AN ARTISTE — NOT JUST A TUBE-PULLER!!"

Radio and Television Servicemen's Association of Pittsburgh, Penna., Inc.

The first in a series of technical lectures was recently given by Mr. W. F. Patterson, Field Engineer, Crosley Div. of the AVCO Mfg. Corp. at the Graybar Auditorium, co-sponsored by the Graybar Electric Co.

Mr. Patterson, who is well versed in his topic, deviated from the usual slide and chalk board type of lecture, giving the assembled audience a run-down on factory changes and field service faults, as found through experience, in Crosley TV chassis, from the 1949 V to the present El Dorado.

The lecture was very well received, since information such as this saves time in a busy day, and therefore puts money in a technician's pocket. Future lectures will be conducted along this line.

Empire State Federation of Electronic Technicians Associations (ESFETA)

The 8th Annual Meeting of the Empire State Federation of Electronic Technicians Associations (ESFETA) was held recently in Binghamton's Hotel Arlington. Delegates and observers from five associations of the State of New York were present for the full day schedule.

Annual elections were held resulting in the election of Gordon Vrooman of Syracuse T.T.A. to the Presidency. Harold Hazzard of Binghamton, Southern Tier Chapter, RSA, became Vice President; John A. Wheaton, of Radio Television Guild of L.I., Secretary; Pat Pratt of Radio Television Service Association of Western New York retained the Treasurer's post and Herman Seehausen, of ETA of Jamestown became Sergeant at Arms.

The topic of the possibility of General Electric entering into centralized service in connection with their new color set received lively comment. Member associations were urged to write General Electric in an attempt to discourage such activity.

The delegates joined Mr. Dan Creato, Vice President, and his assistant, Mr. Weber, of RCA Service Company, in a round table discussion, with RCA's Warranty policies on Color as the core of the discussion. At the conclusion of the meeting, Mr. Creato expressed appreciation for the opportunity to extend some of the thinking of RCA Service Company to members of independent service, and in return, receive some of

the observations and criticisms of independent service.

Electranodes Inc., of Bridgeport, Conn.

Electranodes Inc., of Bridgeport, Conn., announces that an award has been presented to Arthur L. Litchfield of Seaside Radio & Television by the Electranodes, Inc., following a dinner held in his honor.

Mr. Litchfield was also named Man of the Year for 1955 at the 2nd Annual Convention of the Television Servicemen's Association.

James Schneider, President

National Alliance of Television and Electronic Service Associations

The 1955 "Friends of Service" Award of the National Alliance of Television and Electronics Service Associations was conferred on P. R. Mallory & Co., Inc., of Indianapolis. J. Earl Templeton, Mallory Distributor Division Manager, in center, receives the award plaque from (at left) Vincent J. Lutz of St. Louis, West Central vice president of

NATESA, and (at right) Frank J. Moch of Chicago, NATESA president. The award was made to Mallory in recognition of "outstanding service to TV-radio service management in creating better customer relations."

Radio Television Guild of Long Island

The Guild in cooperation with Chromatic Laboratories and Telechrome Incorporated, arranged the first public demonstration of the new Single Gun, (Lawrence) color television receiver . . . another Guild first. Present at the meeting were all the men that had a hand in developing this new receiver and uppermost on the agenda was Ray Popkin Clurman, Chief Engineer of Telechrome, Incorporated, who was the speaker of the evening.

While relatively brief because of the simplicity of the receiver, he covered the circuit from antenna to speaker and answered questions during the lecture as they were put to him. Finally came the demonstration of the Lawrence tube in action. A vertical "doughnut chassis" with the tube through its center was turned on and the color program came through beautifully. Here was a tube that could receive color and do it well, that could be produced for a fraction of the cost of its predecessors, that needed only a few adjustments, that was virtually unaffected by magnetic fields and that would require fewer tubes in the receiver. The Lawrence single-gun color tube has been a tribute to its inventor, a satisfying challenge to its designer, Claremont, and a valuable asset to the set manufacturer.

Philadelphia Radio Servicemen's Association (P.R.S.M.A.)

PRSMA held their last open meeting recently at the Franklin Institute, and had as the speaker Sy Gerschwer, District Sales Manager of the Channel Master Corp. who spoke on antennas. There was a one and a quarter hour movie show on antennas for television. The program put on by Sy was educational and interesting especially now that so many customers want to get Channel 12. Radio Electric Service Co. co-sponsored this meeting.

The next meeting will be an extra special meeting on RCA Color Television service problems and how to correct them. The speaker will be William Powell of RCA Service Co. This meeting is co-sponsored by Raymond Rosen & Co., and will be held at the Franklin Institute, 20th and Parkway.

National Alliance of Television and Electronic Service Associations (NATESA)

Omaha, Nebraska was the scene of the 1956 Spring Board of Directors meeting with TESA-Omaha acting as host.

Very serious consideration was given to such subjects as various forms of insurance, licensing, parts jobber rela-

[*Continued on page 47*]

GUEST EDITORIAL

by DAN NEWMAN

Director-Product Service, CBS-Columbia — The Television-Radio Receiver Manufacturing Division of the Columbia Broadcasting System

TELEVISION service is now BIG business. Thirty-eight million sets, plus color means that revenues from maintaining the nation's sets equal or exceed those received from the sale of new sets. It is anticipated that by 1957 servicing volume will top the two billion dollar mark.

Actually service has always been big business. It has been calculated that the nation's service bill for the past ten years was $5.2 billion. This includes labor costs, tube and parts replacement, antennas and accessories. If current estimates prove out, the next two years may match the previous ten-year total.

Granted that the industry will attain these staggering figures, this brings the serviceman into the sharpest of focus. It pinpoints him as a member of perhaps the fastest growing industry in American business history. It pinpoints the serviceman in a dual role—that of expert technician and businessman.

As a businessman, a goodly portion of his daily activity will bring him into contact with people. How he stacks up with these people becomes of prime importance to you. His contact with the public comes under the heading of relations with this public. So, public relations now becomes an important facet of your operation.

Now, for the $64,000 question! When you think about your service people and their P. R., can you think in terms of Public Relations or Poor Risk?

Stop and think for a moment. When your serviceman enters a consumer's home he enters as an ambassador for the entire industry. More often than not, he is the only member of the industry ever invited into the customer's home. It is the serviceman who establishes the important intimate contact with the customer. His opinions are valued because "he has no selling ax to grind." The impressions that he creates mean a lot for the entire industry.

Experience has shown that in the realm of training of service people, where thousands of dollars are spent in education of the technical aspects of products, that not enough attention is spent on the basics of good public relations.

Discussions on public relations techniques would fill many volumes. They have no real place here. The sum of a common sense definition of public relations would be—*saying the right thing, at the right time, in the right place, politely and with confidence.*

The sales opportunities inherent in a public-relations-minded service operation are tremendous. While technical proficiency is fundamental, it is equally important that service personnel have integrity, personality and proper appearance. An important part of overall public relations is to instill confidence in the field service force so that they feel they are an integral part of the organization, fully aware of all company policies and they are sent into the customer's home with a background of technical training and instruction in dealing with the public.

Good common sense should dictate the service dealer's public relations. It might be helpful to refer to the check list below to see how your public relations stand up against these checks.

Yes, this list is nothing more than a series of common sense oft-repeated rules for successful dealing with the public. But, then again, isn't that what public relations is?

* Cleanliness and neatness. Too many servicemen are sent into homes looking like they had just gotten off a freight train.

* Do not make promises you cannot keep and keep all promises you make.

* Keep service personnel abreast of latest technical developments of all manufacturers. Major manufacturers spend thousands of dollars on literature, training courses and so forth but, unfortunately, not all dealers take full advantage of these services.

* Never, under any circumstances, knock a competitive product the customer has in his home. It can only react negatively on the serviceman and the dealer he represents.

* Follow up and cultivate your customers. For example, make a personal phone call a couple of days later to see if the set is performing satisfactorily. Follow this up with a letter headed—"We are happy to have been able to serve you . . ." ■■

Mfr: Crosley **Chassis No: 402, -1, -2, -3, etc.**

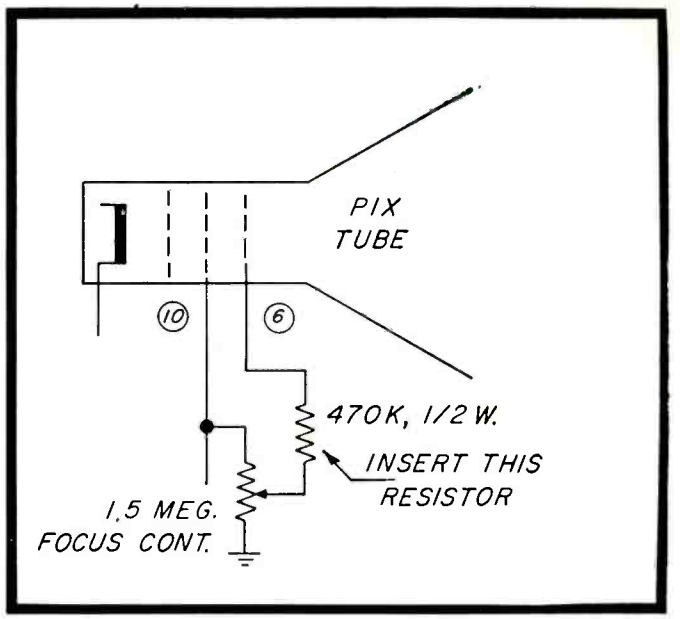
Card No: CR 402-1

Section Affected: Pix and Raster.

Symptom: Arcing at focus control.

Reason for Change: Circuit modification (This is a manufacturer's circuit change).

What to do:
Connect: 470K, ½ watt resistor between center tap of focus control and pin 6 of picture tube.



Mfr: Crosley **Chassis No. 402, -1, -2, -3, etc.**

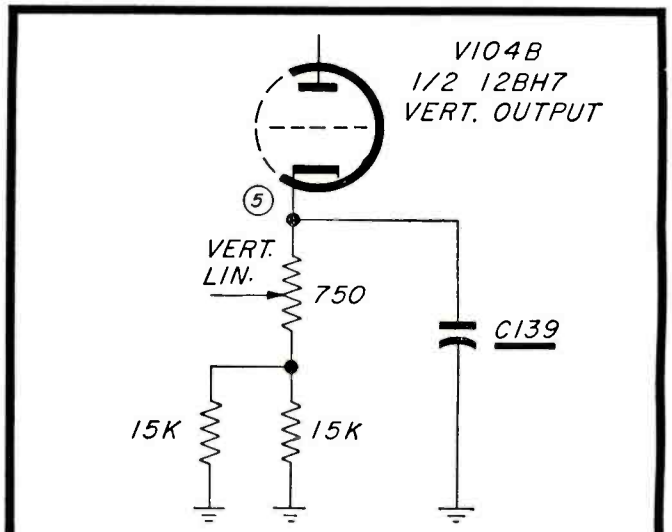
Card No: CR 402-2

Section Affected: Pix and raster.

Symptom: Horizontal line on screen.

Cause: Component failure. Cathode bypass condenser has shorted.

What to do:
Replace: *C139* (.005 *μf*, 500 V. ceramic).



Mfr: Crosley **Chassis No. 402, -1, -2, -3, etc.**

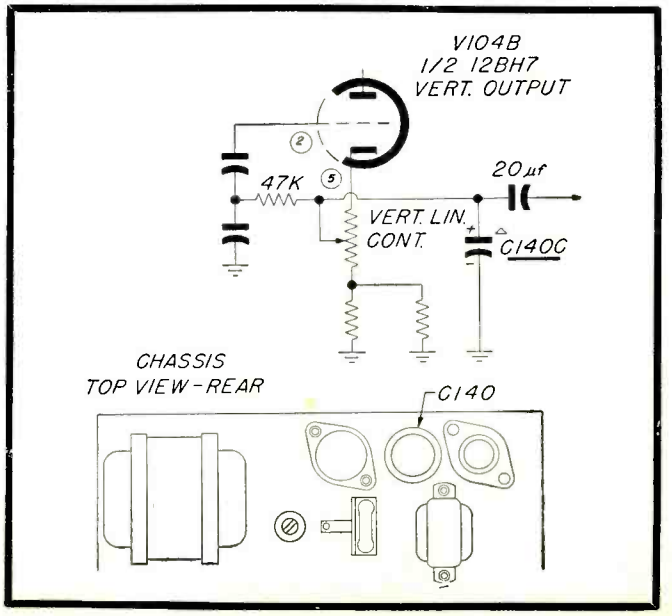
Card No: CR 402-3

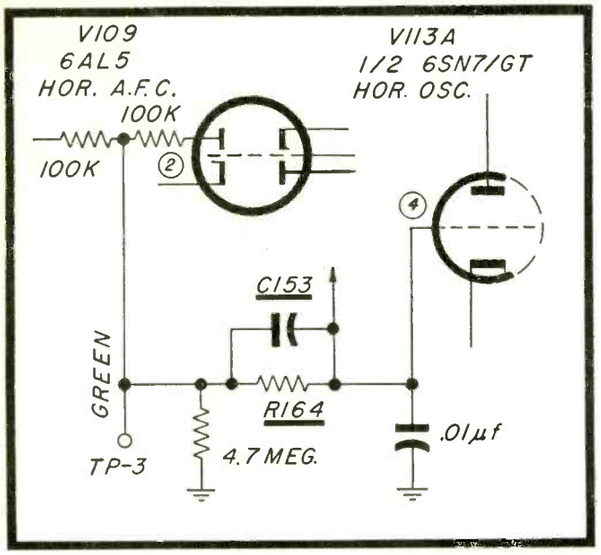
Section Affected: Pix and Raster.

Symptom: No vertical deflection.

Cause: Component failure. Condenser in wave shaping circuit has shorted.

What to do:
Replace: *C140C* (30 *μf*—150 V electrolytic).





Mfr: Crosley **Chassis No. 402, -1, -2, -3, etc.**

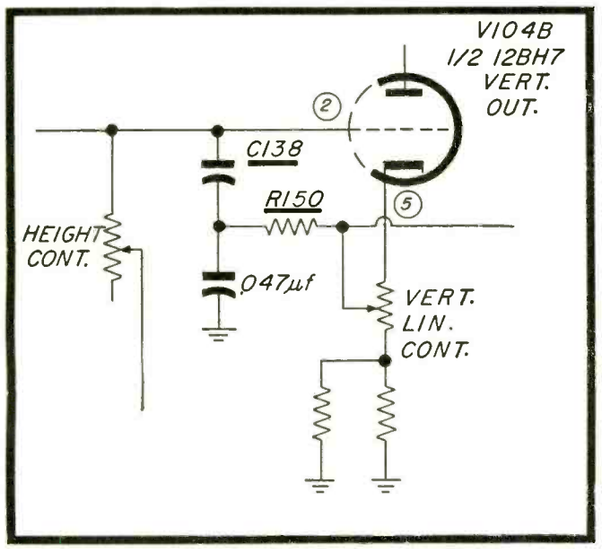
Card No: CR 402-4

Section Affected: Pix

Symptom: No horizontal sync.

Cause: Component failure. Defective resistor and/or condenser in *afc* circuit.

What to Do:
Replace: *R164* (4.7 meg, ½ W), and/or *C153* (.003 μf, 600V).



Mfr: Crosley **Chassis No. 402, -1, -2, -3, etc.**

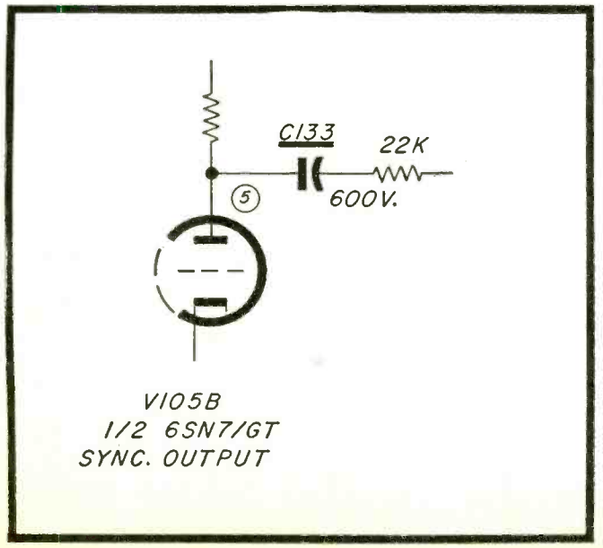
Card No: CR 402-5

Section Affected: Pix and Raster.

Symptom: No vertical deflection.

Cause: Component failure. Open resistor and/or shorted capacitor in wave shaping circuit.

What to Do:
Replace: *R150* (47.7K— ½W) and/or *C138* (.047 μf, 600 V).



Mfr: Crosley **Chassis No. 402, -1, -2, -3, etc.**

Card No: CR 402-6

Section Affected: Pix

Symptom: Loss of vertical synchronization.

Cause: Component failure. Coupling condenser to integrator network has opened.

What to Do:
Replace: *C133* (.0047 μf, 600 V).

Mfr: Raytheon **Chassis No. 24T3**

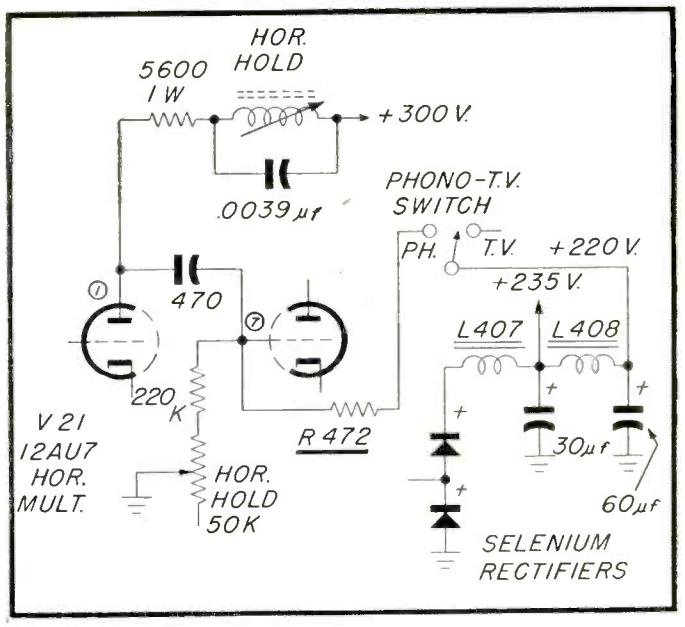
Card No: RA 24T3-1

Section Affected: Sound

Symptom: Horizontal multivibrator squeal interference in "PH" position.

Reason for change: Circuit modification to eliminate horizontal multivibrator squeal interference in "PH" position.

What to do:
Add: *R472* (3.3 megohm, ½ watt). (Chassis so modified are coded 133).



Mfr: Raytheon **Chassis No. 24T3**

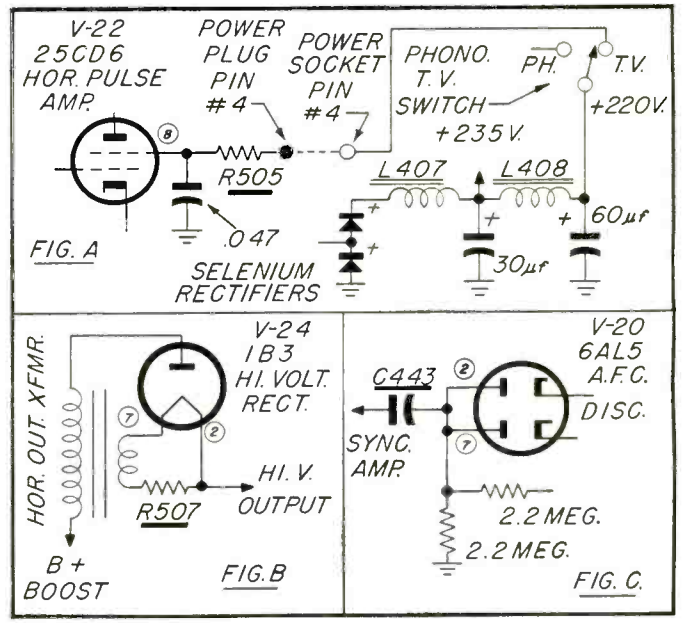
Card No: RA 24T3-2

Section Affected: Raster & Pix

Symptom: Insufficient width and high voltage.

Reason for Change: Circuit modification to provide more width and maintain high voltage.

What to do:
Change: *R505* (33K-2W) to 6.8K-2 watt, and wire to pin 4 of the power plug. (*Fig. A*).
Change: *R507* (10-ohm—1 W) to 6.8 ohm—1 W. (*Fig. B*).
Change: *C443* (4.7 *μμf*) to 22 *μμf*. (*Fig. C*).
Rewire: Pin 4 of power socket to Bt 220 volts (*Fig. A*) at Phono-TV Switch. (Chassis so modified are coded 333).



Mfr: Raytheon **Chassis No. 24T3**

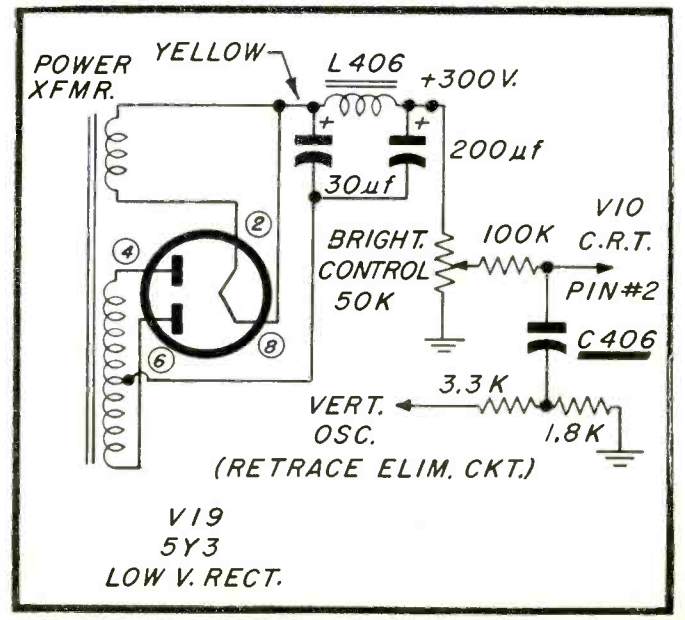
Card No: RA 24T3-3

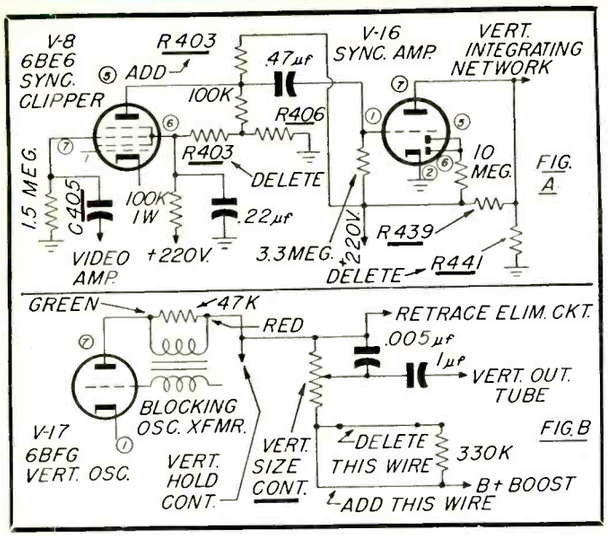
Section Affected: Raster and/or Pix

Symptom: Insufficient brightness.

Reason for Change: Circuit modification to increase brightness.

What to do:
Change: *C406*, (.033 *μf*) to .047 *μf*. Reconnect brightness control to + 300 volt. (Chassis so modified are coded 433).





Mfr: Raytheon **Chassis No: 24T3**

Card No: RA 24T3-4

Section Affected: Pix

Symptom: Poor vertical sync stability.

Reason for Change: Circuit modification to increase vertical sync stability.

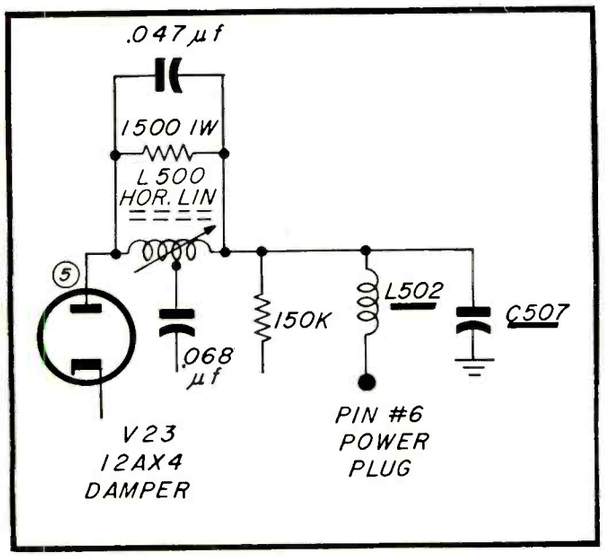
What to do:

Remove: *R403* (15K, ½ watt). (*Fig. A*).
Also: *R441* (68K, ½ watt). (*Fig. A*).

Change: *R406* (15K) to 33K, ½ watt. (Fig. *A*).
Also: C405 .047 μf to .01 μf. (*Fig. A*).
Also: V16 to 6BF6 (was 6AV6). (*Fig. A*).
Also: *R439* (22K—½ W) to 22K, 2 watt. (*Fig. A*).

Rewire: Vertical size control to B+ boost. (*Fig. B*).

Add: *R403* (1 megohm). (*Fig. A*). (Chassis so modified are coded 833).



Mfr: Raytheon **Chassis No. 24T3**

Card No: RA 24T3-5

Section Affected: Pix

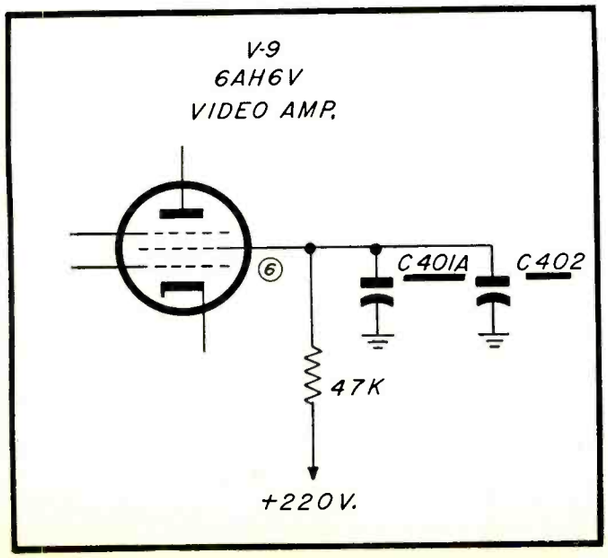
Symptom: Poor vertical and horizontal sync.

Reason for Change: Circuit modification to improve vertical and horizontal sync.

What to do:

Add: *L502* choke coil to pin 6 of power plug as shown, (obtain from manufacturer—part #16A-23165).

Change: *C507* (.005 μf) to .22 μf. (Chassis so modified are coded 043).



Mfr: Raytheon **Chassis No: 24T3**

Card No: RA 24T3-6

Section Affected: Pix

Symptom: Smear in pix.

Cause: Open screen by-pass capacitors in video amplifier circuit.

What to do:

Change: *C401A* (10 μf, 300 volt) and/or *C402* (5000 μμf).

TRADE LITERATURE

Philco Color TV Textbook

Philco Corporation's Electronic Education Unit has published a new Color TV Textbook entitled "COLOR TELEVISION—Simplified Theory and Service Techniques."

This subject, usually considered very complex, has been described in easy-to-understand terms, generously illustrated for further simplification. This textbook is heartily recommended for those preparing for a future in this fast growing industry.

The topics treated cover theory, design, transmission, reception, installation and service procedures.

It is felt that this book presents the subject in such a manner that the text and the illustrations will not be rendered obsolete by future changes in manufacturing and receiver design. A complete index is provided in the back of the book for rapid reference for any term or subject covered. In addition, a self-examination review of each chapter is accomplished with a series of ten questions.

RCA Color Book

Publication of a new 92-page illustrated reference book on color television receiver servicing was announced recently by E. C. Cahill, President, RCA Service Company, Inc.

The book, "Servicing Color Television Receivers," is designed principally for reference use by dealer and independent servicemen who have attended the many color TV clinics and workshops throughout the nation sponsored by the RCA Victor Television Division and its authorized distributors.

The book, which deals specifically with the current RCA Victor 21CT660U series, describes the tools required for efficient color receiver servicing; tells how to use these tools; discusses procedures for determining specific needs for servicing; shows representative waveforms obtainable with an oscilloscope at various points in the receiver; and gives practical information useful in the field, or at the service bench, for localizing the source of trouble.

CBS Miniature Tube Guide

This CBS Miniature Guide, Eighth Edition, attempts to list all miniature tubes, regardless of make. It includes pertinent data for 416 types (88 new) . . . 168 basing diagrams . . . numerous operating conditions . . . and indicates prototypes in larger bulbs. Inclusion of tube types in this guide is no indication of preference nor guarantee of availability. ■

RIDER SPEAKS

JOHN F. RIDER

SELF-SERVICE tube testing and self-service tube selling devices are being placed in supermarkets, drug stores and other places frequented by the public. These devices make it possible for the receiver owner (radio or TV) to check his own tubes and at the same time buy replacements in the same place. We don't have exact figures concerning the extent to which such self-service testers have spread across the country, but from what we hear the plan has gained momentum very readily in the middle west and in the south. It looks like something which must be reckoned with.

I believe that the servicing industry should give serious thought to participation in this program. Already we have received several telegrams from service facilities telling us that they can't fight the drugstore and supermarket competition. They wanted to know the names of the manufacturers of the devices because they wanted to install them in their own service shops for use by the public. To say the least, we must compliment these shop owners as being smart business men. They believe in the philosophy that "if you can't fight something—then join it!" In this connection we believe it would be to the advantage of every parts distributor to do what he can to get these self-testing and self-service tube selling devices into servicing industry channels.

Tubes sold by drugstores and supermarkets are tubes which are not sold by the parts distributor and the servicing industry. If these self-service units can get into the service shops they will sell tubes for the service shop and for the parts distributor. Maybe the traffic in the service shop is not as great as in the supermarket or drugstore, but if the service industry, and for that matter the parts industry does nothing about offsetting tube sales through non-electronic industry channels, it is not beyond the realm of possibility that in time, both parts distributor and the service shop owner will feel the pinch of reduced tube sales.

We recall quite easily the many statements made that the "fix-it-yourself" books sold to the public over the years past would generate more business rather than cause less business for the service technician. What many people overlooked was the fact that a great majority of the troubles appearing in television receivers and in radio receivers as well, are remedied simply by the replacement of tubes.

While there is no agreement concerning the percentage of failures remediable by tube replacement as compared to those that require circuit breakdown repair, the fact does remain and it is nevertheless true that the lowest estimate given is about 75 to 80% of faults being due to tube failure. This is a high percentage. Although it is stated that service business last year amounted to more than a billion dollars as charges to the public, much business is still lost to the servicing industry because people have been maintaining their own receivers year after year merely by tube replacement. There was very little that the servicing industry could do to overcome this. Now the industry has to contend with still another force which acts to still further reduce its income. The "fix-it-yourself" man did on occasion, go to a local service shop to buy his tubes and this was *some* income to the service shop. With the self-service testing units also being tube vending devices the impact of the "fix-it-yourself" technique become even greater.

No one can deny that this new selling "gimmick" is a good one from the sales angle. No one knows the public sale proportions which can be reached in this fashion, but we believe that it would be wishful thinking to say that it will not reach the proportions which will harm the servicing industry as well as the parts distributor. The public is ever-mindful of conveniences; this is a convenient and relatively inexpensive way for them to acquire the tubes they need to effect the correction of a faulty receiver. It would be a very good thing if the servicing industry gave immediate, careful consideration to the placement of these self-service testing units in every service shop, and it would be to the advantage of the parts distributing industry if it took the steps necessary to accomplish this goal.

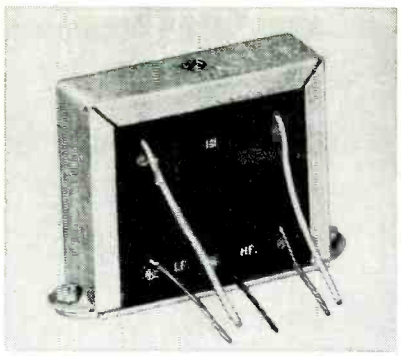
Maybe it will not be competition on Saturdays and Sundays, especially the latter, when many service shops are closed whereas drugstores are open, but even if it is only 50% effective in preventing loss of business it is still worthwhile. It is not our custom to become alarmed unduly about different things which appear on the horizon, but we have always tried to be realists rather than wishful thinkers. We believe that self-service testing is real competition. Not only does it afford a convenience but it is a step along the way to "fix-it-yourself" thinking. Maybe the latter is not the most important thing, but it is important just the same.

It might be beneficial to the servicing industry to get the public in the habit of utilizing facilities in the service shop without being charged for them. We think it would be very good public relations if the service shop owner demonstrated that the public can visit his store, check its own tubes and buy replacements on the spot. It would show the public that the service shop is not charging for every facility that it offers. It would be better to go into the service shop for items relating to home electronics than to go into the supermarket or drugstore. ■ ■

LOW FREQUENCY CROSSOVER

The CX500, an inexpensive low frequency crossover has been announced by Beam Instruments Corporation. Answering a long apparent need of the audiophile, the CX500 pre-determines the crossover frequency at 500 *cps.*, and has output connections providing L.F. from 0-500 *cps.* and H.F. from 500 *cps.* upwards. Input and both output impedances are 15 ohms. Weight is approximately 1 pound. Dimensions 4″ x 3″ x 1″.

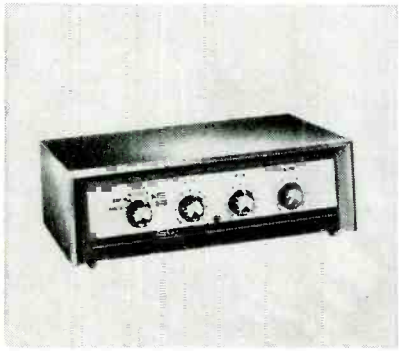
(*Check 601 on inquiry card for more information*)



AMPLIFIER KIT

A new linear Williamson type amplifier and built-in pre-amplifier kit, is now being offered to the hi-fi enthusiast, by Radio Kits Incorporated. Featuring a frequency response of from 40 to 15,000 cycles per second below 10 watts, this unit has record equalization for L.P., R.I.A.A., and Eur. records. The Model FL-10 has a special feature which permits a tape output to be unaffected by loudness and tone controls of the unit itself.

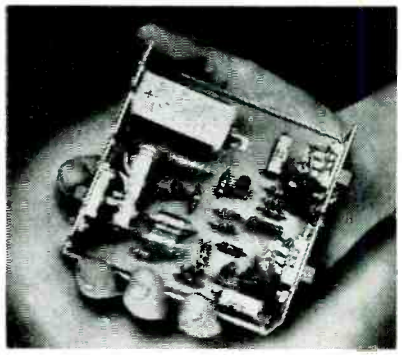
(*Check 602 on inquiry card for more information*)



TRANSISTORIZED PREAMPLIFIER

Fisher Radio Corporation announces a new all-transistor Preamplifier-Equalizer, Model TR-1 In addition to its unique features of absolutely no hum and no microphonism, the all-transistor Model TR-1 incorporates RIAA equalization, now standard in the recording industry. A Cartridge Impedance Selector permits the use of the TR-1 with all popular magnetic cartridges, including the very-low-level type, and does not require a transformer.

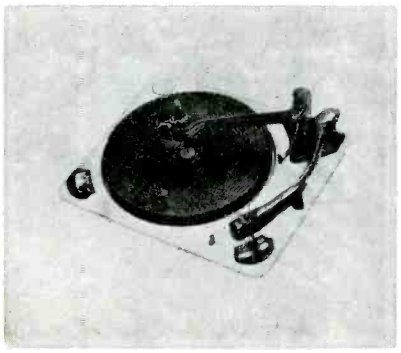
(*Check 606 on inquiry card for more information*)



MIXER CHANGER

Model RC121, "The Renown," marks Garrard's first offer of a straight-spindle type record changer. The new changer is compact in size, making it especially suitable for use as a replacement or serviceman's changer. "Simpli-Mix" operation permits stacking records of any diameter (12″, 10″, or 7″) mixed bottom to top, in order of size. Stylus pressure and pickup height adjustments are on the tone arm. Interchangeable plug-in heads are used.

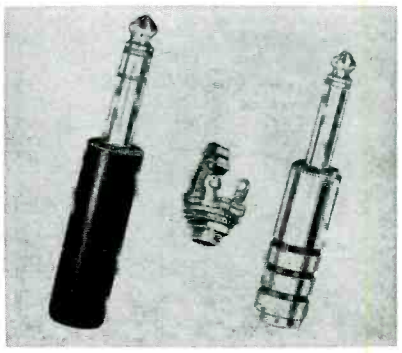
(*Check 603 on inquiry card for more information*)



PHONE PLUGS AND JACKS

A new line of improved phone plugs and jacks has been introduced by Electrocraft. Terminals, high grade insulation, plug body and tip rod are interlocked to prevent turning. A variety of terminal and handle styles are available. Solder terminals with combination positive cord strain relief and solder lug and screw type terminals may be selected. The plugs are designed to fit all standard two conductor phone jacks.

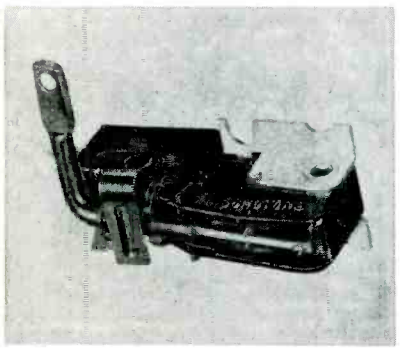
(*Check 607 on inquiry card for more information*)



CERAMIC CARTRIDGES

Sonotone announces the development of its new "3" Series of ceramic phonographic cartridges. The cartridge shown in this picture is the "3T", the popular Sonotone turnover type, which plays records of all speeds. Diamond needles are recommended to insure the full benefits of the performance characteristics of these cartridges, but they are also available with sapphire needles. Equalizers and preamplifiers are not needed.

(*Check 604 on inquiry card for more information*)



ELECTRONIC PAGING

Pagemaster, a selective radio paging system, is being produced by the Telephone Division of Stromberg-Carlson. Principal feature of Pagemaster is a small radio decoder, about the size of a pack of cigarettes. Each decoder responds to its own coded radio signal. When it receives that signal it emits a pleasant tone, which is a message to the individual using it to go to the nearest telephone and identify himself to receive the message.

(*Check 608 on inquiry card for more information*)

SLIM CRYSTAL MICROPHONE

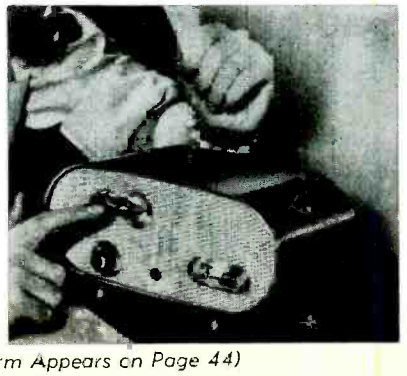
A new, Model 927 slim-type crystal microphone for public address, call and paging systems, and other general-purpose applications, is announced by Electro-Voice, Inc. The microphone slips into or out of an integrated base for table-top or hand use. Frequency response 60-6000 *cps.* Output level —50 *db.* Polar pattern is essential omnidirectional, becoming directional in the high-frequency range. Comes in high impedance only.

(*Check 605 on inquiry card for more information*)

WIRELESS INTERCOM

Designed with modern living as its theme, a new wireless intercom system is being introduced by Fanon Electric Co., Inc. The complete two-station system requires no wiring; just plugs into any *ac* or *dc* outlet. Recommended for two-way conversation in the home, business, farm, or office it can also be employed as an electronic baby sitter. The system may be operated between buildings on the same power line up to a mile apart.

(*Check 609 on inquiry card for more information*)



(Free Literature Request Form Appears on Page 44)

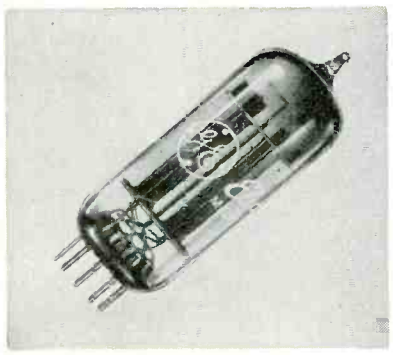
SERVICE DEALER and ELECTRONIC SERVICING

NEW TUBES

G. E. 600 MA TWIN TRIODE

The 6CG7—a 9-pin twin triode miniature equivalent of the 6SN7-GTB—has been added to the line of 600-milliampere controlled warm-up tubes developed by the General Electric Tube Department. The 6CG7 has a controlled heater warm-up characteristic of 11 seconds which makes it suitable for television sets using either parallel connected heaters or in sets which employ 600-milliampere series-connected heaters.

(Check 610 on inquiry card for more information)



RCA PHOTOMULTIPLIER

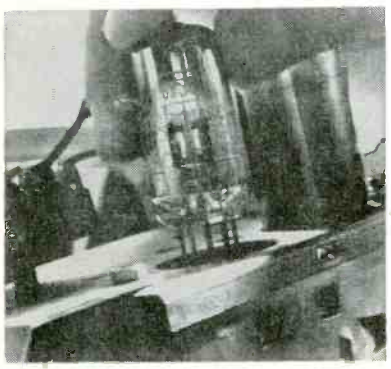
The 6810 is a head-on type of multiplier phototube intended for use in scintillation counters and in other applications involving low-level light sources. Featuring fast response, high current gain, relative freedom from after-pulses, and a small spread in electron-transit time, the 6810 is particularly useful for fast coincidence scintillation counting. The 6810 has high sensitivity to blue-rich light and negligible sensitivity to red radiation.

(Check 611 on inquiry card for more information)

WESTINGHOUSE TWIN TRIODES

Two new sharp cut-off cascode RF amplifiers (6BS8 and 4BS8) are now offered by Westinghouse. A 9-pin miniature tube, the 6BS8, has higher gain, lower noise and a 20 percent lower dissipation factor resulting in extended operating life. The 6BS8 replaces the 6BZ7 or 6BQ7-A, and will provide a high-cascode transconductance to plate-current ratio. The 4BS8 for series string applications has the same advantages as the 6BS8.

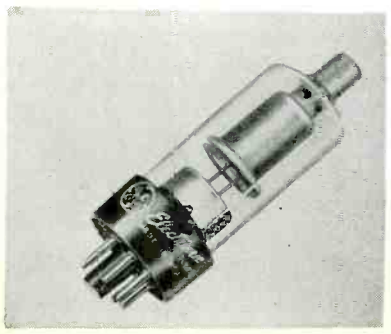
(Check 612 on inquiry card for more information)

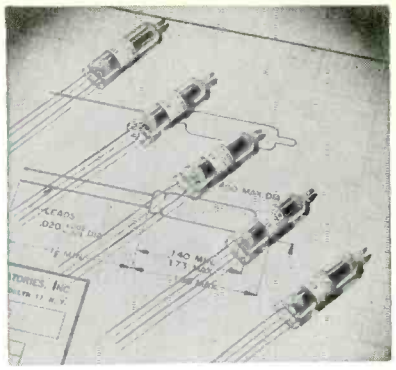


G. E. HV RECTIFIER

A new high voltage rectifier tube the 2B3-GT has been introduced by the General Electric Tube Department. It can be operated directly from the flyback transformer without a filament dropping resistor—thus saving the manufacturer the cost of the resistor, associated wiring and assembly expense. The 2B3-GT has a new type of filament construction which promises to give longer life and greater dependability.

(Check 613 on inquiry card for more information)

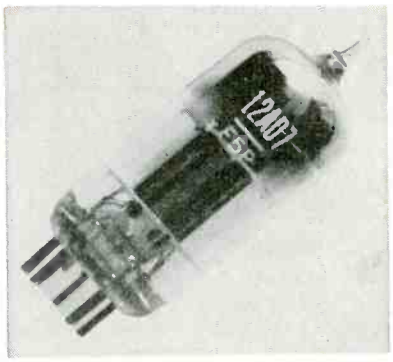




ANTON MINIATURES

A complete line of miniature and subminiature fixed and adjustable corona discharge voltage regulator tubes is now available from Anton Electronic Laboratories, Inc., Brooklyn. These tubes are suited for stabilization of voltages from 300 v-30 kv at currents below several *ma.* They are recommended for use in stabilization of power supplies in Geiger and scintillation counter radiac survey units, as well as in a variety of other devices.

(Check 614 on inquiry card for more information)



SYLVANIA DOUBLE TRIODE

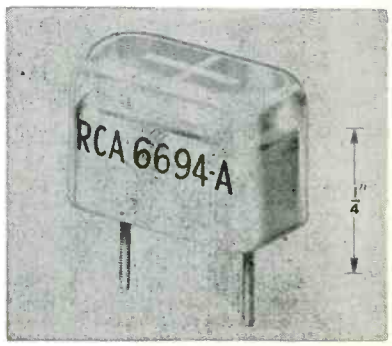
The Radio Tube Division of Sylvania Electric Products, Inc. has developed the 12AD7 double triode, a miniature tube that fills the need for a low-hum preamplifier in audio applications. Ratings of the 12AD7 assure an extremely low hum level—less than 3.0 millivolts rms on the plate of each triode, when the tube is operated in a typical resistance coupled amplifier circuit. A reverse coil heater helps cancel magnetic coupling.

(Check 615 on inquiry card for more information)

H.V. REGULATOR—AMPLIFIER

The NU6842 is a miniature tube for use in regulated power supplies or voltage amplifier circuits operating at plate potentials of 300 volts to 4 KV. It is useful as a regulator in equipment that requires a stabilized voltage essentially independent of line or load variations. It provides up to 10 ma average plate current and dissipates up to 8 watts. The NU6842 is well suited for sweep circuits employing electrostatic deflection.

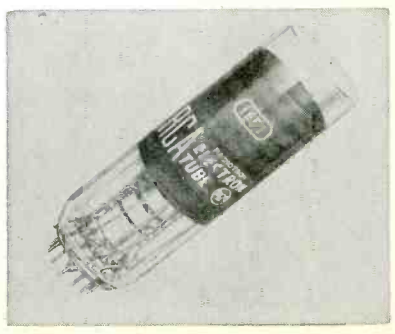
(Check 616 on inquiry card for more information)



RCA PHOTOCONDUCTIVE CELL

The RCA 6694-A is a very tiny, cadmium-sulfide photoconductive cell of the head-on type. It features high luminous sensitivity, very low dark current, extremely low background noise, and signal output which is approximately proportional to the incident light intensity. Its tiny size and high sensitivity, make it useful in light-controlled relay applications, and in light meters for measuring the brightness of small luminous spots.

(Check 617 on inquiry card for more information)



RCA OSCILLOGRAPH TUBE

The RCA Tube Division announces the IEPI, a very small oscillograph tube for use in portable equipment, aircraft, or for continuous monitoring service. This new tube utilizes electrostatic focus and deflection. It has a flat face, a minimum useful screen diameter of 1-1/16 inches and a maximum overall length of only 4-1/6 inches. Separate base-pin terminals permit use of balanced deflection, and a new small-button 11-pin base.

(Check 618 on inquiry card for more information)

(Free Literature Request Form Appears on Page 44)

ASSOCIATION NEWS

[*from page 37*]

tions, factory service operations, etc. The insurance plan was advanced to the point where it is expected that it will be put in force at the next meeting. Resentment was expressed volubly against other segments of the industry which have seen fit to oppose the justified wishes of service people on the subject of achieving stability in the industry, particularly through licensing where local Affiliates feel it is highly desirable.

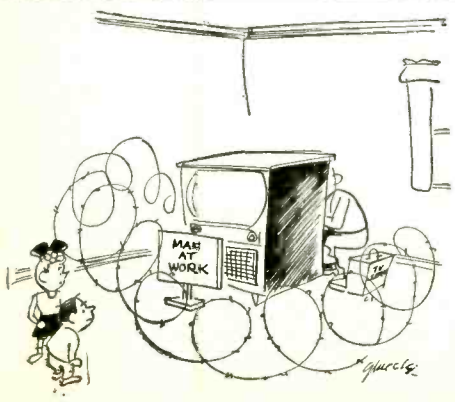
The growing signs of monopolistic practices by a growing number of set manufacturers, especially as they apply to factory service operations at retail, brought loud condemnation. NATESA expressed the feeling that the independent service industry is very capably rendering all necessary retail service on all home electronic devices including color TV, and expressed the hope that those manufacturers who are now or contemplate doing retail TV service reappraise the situation and alter their courses thus utilizing to the fullest the capacities of independent service, and at the same time head-off growing demands for a show down.

Television Service Association of Metropolitan Washington (TSA)

This item appeared in TSA News:

"Samuel L. Marshall was guest speaker at the last regular Television Service Association meeting. Well known in the electronics field, Mr. Marshall is an authority on all phases of television service. As editor of 'SERVICE DEALER' for the past ten years, co-author of the forthcoming book, 'Fundamentals of Color Television' and originator of the 'Video Speed Servicing Systems,' Mr. Marshall has made outstanding contributions to the television service industry. But his talents are not confined to writing about television. He is a practical TV man who can get in and repair a set with the best of them.

"His keen interest in Association activities is evidenced by his acceptance of our invitation to come to Washington May 21 and give us his answers to the question: 'Why Organize?' The panel (dignified by Mr. Marshall's presence) again held forth at this meeting, with our executive secretary, Hyman Nussbaum, acting as moderator."



California State Electronics Association (CSEA)

The newly formed California State Electronics Association held its first annual meeting the weekend of May 5 and 6 in Bakersfield, California. One hundred and twenty-five of the members came from all over the state to participate in election of new officers as well as a new board of directors.

Harry B. Coolidge of Altadena, California was elected President of the California State Electronics Association. Keith Kirstein of Sacramento retires as past President. Coolidge is President of the Pasadena RTA and also Chairman of the Los Angeles RTA Presidents Council. Elected Vice President was H. Lawrence Schmitt, President of the powerful Santa Clara Valley Radio Television Association. Re-elected Secretary was James Wakefield, President of the Central Valley Electronics Association. John Blackwood was elected as Treasurer. He is also President of the Television Service Dealers Association of Kern County.

Jack Webb, Television, Radio and Movie personality, was named at a Directors Meeting of the California State Electronics Association, to receive an achievement award for his work in "exposing the practices of some T.V. service men who victimize the public." The CSEA was named by the Federation of Television Radio Service Associations of Pennsylvania to make this special award. ■■

ANSWERMAN

[*from page 13*]

ing and the pressure is applied through the use of mounting self-tapping screws. Should a self-tapping screw loosen a condition of an intermittent ground connection might possibly develop at that point. On occasions this might be a rather difficult service problem. It is therefore suggested that the chassis be checked for loose panel mounting screws. In tightening panel screws be very cautious about not applying too much pressure. Excessive pressure might possibly damage the panel. In the particular chassis of concern here, a Philco TV440, a mounting screw is located behind the stepper assembly that should also be examined to determine if it has loosened and is not providing sufficient pressure to maintain a proper ground connection.

Another point of interest that might be brought out at this time is that some of the Philco TV440 chassis employ the wrapped terminal type of connection on the PW panel. There has been some concern on the part of servicemen about intermittents at wrapped terminals. Some technicians have been misled into believing that wrapped terminal connections had been overlooked in the assembly of the chassis at the factory and went about applying solder on them. Spun or wrapped connections would only require soldering if the pigtail had been unwrapped for some reason. The use of this type of terminal for connections has been thoroughly tested and is certainly more than satisfactory for the purposes employed. ■ ■

AD LIBS

[*from page 9*]

a possible wage scale commensurate with their men's productive capacity. With the average service shop charging approximately $5.00 per hour for labor the shop owner in turn can hardly afford to pay more than $1.50 to $2.00 per hour to its employee technicians unless those technicians turn out a reasonable volume of *satisfactorily completed* jobs. Technicians who fail to realize that jobs they do incompletely and which require call-backs are the kind of jobs that can break a service shop operator.

Video Speed Servicing Systems

It took a bit of time for some servicemen to truly appreciate the value of our Video Speed Servicing Systems Data Sheets as an everyday working tool.

When Volume I of VSSS was originally released in June 1953 in the ring binder type we disposed of over 10,000 copies within a short time and then sales tapered off. Some servicemen opined that the price was a bit steep. They suggested that a paper-bound volume at a lower price be made available—and this was done.

Within the past few months sales of loose leaf, hard cover ring binder VSSS Vol. I have boomed again and now the supply is extremely limited, less than 500 copies being available. So, if you are still considering the purchase of a loose leaf type VSSS, get your order in real fast. Remember, Volume I contains all VSSS data sheets published between October 1952 and April 1953 inclusive.

Meanwhile, in answer to the thousands of requests for a Volume II of VSSS we're happy to inform you that such a new edition is now in the final stages of preparation and copies will be ready for delivery very soon. The second edition of VSSS will be a paper bound edition exactly the same size as Volume I's paper bound edition and will contain most of the VSSS data sheets published since May 1953 plus several hundred new data sheets that have not heretofore been published and which will not be published in future issues of SERVICE DEALER and ELECTRONIC SERVICING. ■ ■

CONDENSER CHECKERS

[*from page 24*]

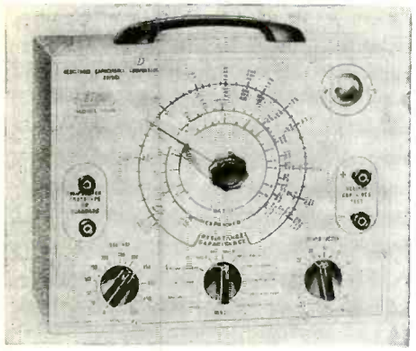


Photo of EICO condenser checker.

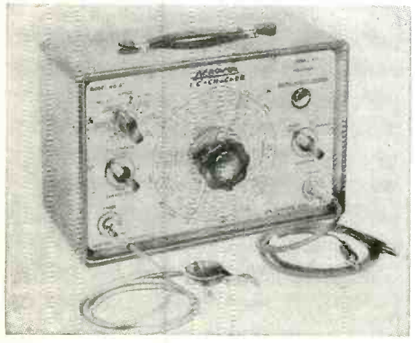


Fig. 12—Photo of Aerovox Condenser Checker Model 97.

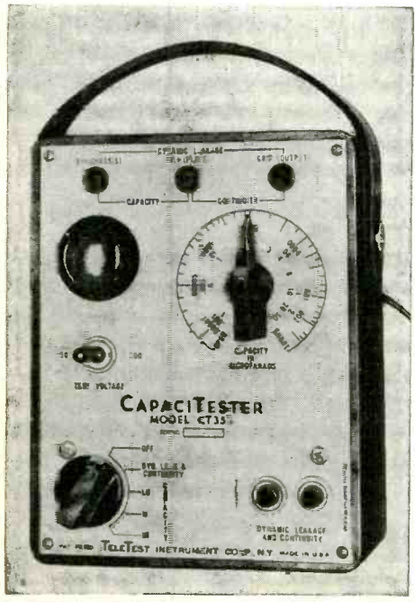


Fig. 14—TeleTest CapaciTester. Neon tube is used as indicator.

to 5000 μf may be measured in four ranges. Scales are direct reading, and a tuning eye is used as an indicator. A continuously variable voltage, from 0 to 500 volts *dc* is available for breakdown and leakage tests under applied voltage conditions.

The checker has a "Comparator" circuit which permits checking the value of an unknown capacitor, resistor, or inductance, against an external one whose value is known. Power factor measurements on electrolytic capacitors are also possible with this instrument.

The Aerovox L-C checker, Model 97, has as one of its features the ability to check capacitance while the condenser is in the circuit. This instrument utilizes a circuit which makes possible the measurement of capacitance and relative Q factor at radio frequencies. A photograph of this instrument is shown in *Fig. 12.*

It is also capable of checking *rf* and *if* alignment and of making useful tests in resonant circuits. Among the latter are the checking of absorption troubles or dead spots in all-wave receivers, checking the natural resonance points of *rf* coils, checking the accuracy and harmonic content of quartz crystals, and the tuning of wave traps and filters.

The Pyramid Model CRA-2 shown in *Fig. 13* is designed for five basic types of measurements. These include the measurement of capacitance, power factor, leakage current, resistance, and insulation resistance.

In addition, a quick-check circuit tests for open, shorted, or intermittent capacitors while they remain connected in the circuit. Electrolytics may also be checked for *rf* impedance without disconnecting them from the circuit.

The TeleTest CapaciTester was described in detail in the October 1955 issue of SERVICE DEALER. A photograph of the unit is shown in *Fig. 14.* In this unit also, voltage may be applied to the condenser under test to simulate actual operating conditions. A neon tube is used as an indicator. As shown on the left the various controls are simply and effectively distributed on the front panel.

An Automatic VTVM

[*from page 7*]

scale deflection is 1 volt, by Ohm's law. That is, so long as the positive terminal of the meter is one volt more positive than the negative terminal, full scale deflection will occur. This is true regardless of the range being utilized as far as the entire VTVM is concerned. The necessary multipliers or shunts are always introduced in each range so that 1 volt across the meter will be present when the reading is full scale.

Keeping this in mind, let us refer to *Fig. 3* which represents a simplified schematic of the circuit which causes the range switch to move upscale when meter deflection is too high. Suppose that *no* voltage exists across the meter movement. The cathode of the 12AT7 is set by means of the 1K advance control so that its fixed bias almost causes the tube to cut-off. With very little current flowing in the plate circuit, the plate relay remains open. Now suppose

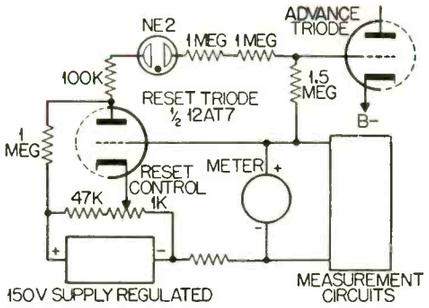


Fig. 4—Partial circuit diagram illustrating range selection when the meter reading is too low. As in the case where the meter reading is too high, the action is entirely automatic.

that a voltage is being read by the measurement circuit sufficient for the meter to exceed full scale (over 1 volt at the positive terminal of the meter movement). The positive voltage at the meter terminal is applied to the grid of the 12AT7 through a 1.5 meg resistor and effectively reduces the total bias on the tube. The triode conducts more heavily and sufficient plate current then flows to cause the plate relay to close. This completes the circuit of the stepping relay which rotates the range selector switch one step (to the next highest range).

At the very same time a single pole switch linked to the latching bar closes and momentarily applies a negative voltage to the grid of the 12AT7 sufficient to cut the tube off once more and open the plate circuit relay. With initial conditions restored, the action can begin again. If less than 1 volt appears at the positive terminal of the meter (that is, the meter pointer is reading on-scale) nothing further will occur and the final reading may be taken. If, however, the range is still too low, the meter will again have in excess of one volt at its positive terminal and the entire process is repeated until a suitable range is reached.

Down Scale Switching

Fig. 4 shows the circuit used for down scale switching when the pointer would otherwise be too low on the scale for convenient reading. The positive terminal of the meter movement is also connected to the second triode section of the 12AT7, identified as the "Reset Triode." The reset control is set to bias the tube to conduct when the meter movement contributes at least .25 volts positive at the grid. (¼ scale deflection based on our previously assumed figures). With the tube conducting in this manner, a voltage drop occurs across the 100K plate load resistor so that the voltage across the NE-2 neon tube is insufficient to cause firing. As a result, the neon tube looks like an open circuit and has no effect whatsoever on the advance triode section discussed previously. If the voltage at the positive terminal of the meter ever falls below .25 volts however (that is, below ¼ scale deflection), the fixed cathode bias is then sufficient to cause the tube to cut off. With no current flowing in the triode, the voltage across the neon tube approaches the full 150 volts of the power supply. The tube then fires and acts as a low resistance connecting the grid of the advance triode (of *Fig. 3*) to a source of positive voltage. The advance triode then comes out of cut-off and actuates the stepping relay as previously described.

The grid of the advance triode cannot tell whether the positive voltage is coming from the meter movement or a fixed power supply and proceeds to move *up* range. One would think that this action is in the wrong direction, but a moment's thought will show that this sequence will continue through all six ranges, if necessary, until a *low* range is reached by going all the way around. Once the proper range *is* reached in this manner, the meter reads over ¼ scale, the reset triode conducts heavily reducing the voltage across the neon tube below the firing point, and switch stops rotating. The meter will now read on the correct range.

It should be noted that despite the relative complexity of this sequence, it takes no more than one second to reach the proper scale for *any* measurement within the instrument's range. ■■

BUYER'S DIRECTORY OF ADVERTISED PRODUCTS

- This department is an additional service to our readers and advertisers. It is not intended to cover all products in all categories, nor is it intended to cover all products made by any manufacturer.
- The classifications are broad. Under each is listed the name and address of only those manufacturers who have, in the recent past, or who are currently advertising these particular products in this publication.
- This service is not a part of the advertiser's contract. The listings may change in future issues. Every reasonable precaution is taken to avoid errors and omissions.

AMPLIFIERS—(Audio, Hi-Fi, P. A.)

Allied Radio Corp.	100 N. Western Ave., Chicago 80, Ill.
Blonder-Tongue Labs, Inc.	526 North Ave., Westfield, N. J.
Bogen & Co., Inc., David	29 Ninth Ave., New York 14, N. Y.
Transvision, Inc.	360 North Ave., New Rochelle, N. Y.

ANTENNAS

Amphenol Electronics Corp.	1830 S. 54th Ave., Chicago 50, Ill.
Channel Master Corp.	Ellenville, New York
Clear Beam Antenna Corp.	Canoga Park, Calif.
Cornell-Dubilier Electric Corp.	South Plainfield, New Jersey
Electrend Products Corp.	St. Joseph, Mich.
Finney Company, The	4612 St. Clair Ave., Cleveland 3, Ohio
Hi-Lo TV Antenna Corp.	3540 N. Ravenswood Ave., Chicago 13, Ill.
Holloway Electronics Corp.	Fort Lauderdale, Fla.
JFD Manufacturing Co., Inc.	6127 16th Ave., Brooklyn 4, N. Y.
Philco Corp.	Philadelphia 34, Pa.
Radiart Corp.	3455 Vega Ave., Cleveland 13, Ohio
Radio Merchandise Sales, Inc.	2016 Bronxdale Ave., New York 60, N. Y.
Snyder Mfg. Co.	22nd & Ontario Sts., Philadelphia 40, Pa.
Technical Appliance Corp.	Sherburne, New York
Telco Electronics Mfg. Co.	919 Taylor Ave., Rockford, Ill.
Telrex, Inc.	Asbury Park, N. J.
Walsco Electronics Corp.	3602 Crenshaw Blvd., Los Angeles 16, Cal.
Winegard Company	3000 Scotten Blvd., Burlington, Iowa

ANTENNA ACCESSORIES

Alliance Manufacturing Co.	Alliance, Ohio
Amphenol Electronics Corp.	1830 S. 54th Ave., Chicago 50, Ill.
Blonder-Tongue Labs, Inc.	526 North Ave., Westfield, N. J.
Channel Master Corp.	Ellenville, New York
General Cement Mfg. Co.	919 Taylor Ave., Rockford, Ill.
I. E. Manufacturing Co.	325 N. Hoyne Ave., Chicago 12, Ill.
JFD Manufacturing Co., Inc.	6127 16th Ave., Brooklyn 4, N. Y.
Jontz Manufacturing Co.	1101 E. McKinley Ave., Mishawaka, Ind.
Kenwood Engineering Co.	265 Colfax Ave., Kenilworth, N. J.
Mosley Electronics	8622 St. Charles Rock Rd., St. Louis 14, Mo.
Mueller Eelectric Co.	1583 E. 31st Street, Cleveland 14, Ohio
Philco Corp.	Philadelphia 34, Pa.
Radiart Corp.	3455 Vega Ave., Cleveland 13, Ohio
Radio Merchandise Sales, Inc.	2016 Bronxdale Ave., New York 60, N. Y.
South River Metal Products Co., Inc.	South River, New Jersey
Superex Electronics Corp.	6 Radford Place, Yonkers, N. Y.

BATTERIES

Burgess Battery Co.	Freeport, Illinois
RCA, (Tube Div.)	Harrison, New Jersey

BOOKS & MANUALS

Cisin, Harry G.	Amagansett, N. Y.
Cowan Publishing Corp.	67 West 44th Street, New York 36, N. Y.
Electronic Publishing Co.	180 N. Wacker Drive, Chicago 6, Ill.
Rider, John F., Publisher	480 Canal Street, New York 13, N. Y.
Sams, Howard W. & Co., Inc.	2201 E. 46th Street, Indianapolis 5, Ind.
United Catalog Publishers	110 Lafayette Street, New York 13, N. Y.

BUSINESS ORDER FORMS

Electronic Publishing Co.	180 N. Wacker Drive, Chicago 6, Ill.
Oelrich Publications	4308 N. Milwaukee Ave., Chicago 41, Ill.

CAPACITORS

Aerovox Corp.	New Bedford, Mass.
Astron Corp.	255 Grant Ave., East Newark, N. J.
Centralab, Div. of Globe-Union	900 E. Keefe Ave., Milwaukee 1, Wisc.
Cornell-Dubilier Electric Corp.	South Plainfield, New Jersey
Erie Resistor Corp.	Erie, Pa.
Illinois Condenser Co.	1616 N. Throop St., Chicago 22, Ill.
Planet Sales Corp.	225 Belleville Ave., Bloomfield, N. J.
Pyramid Electric Co.	1445 Hudson Blvd., North Bergen, N. J.
Sprague Products Co.	71 Marshall Street, North Adams, Mass.

CHEMICALS, SPRAYS, LUBRICANTS

Electronic Chemical Corp.	813 Communipaw Ave., Jersey City 4, N. J.
General Cement Mfg. Co.	919 Taylor Ave., Rockford, Ill.
Great Eastern Mfg. Co.	165 Remsen Ave., Brooklyn 12, N. Y.
Krylon, Inc.	Ford & Washington Sts., Norristown, Pa.
Quietrole Co., Inc.	Spartanburg, South Carolina
Superex Electronics Corp.	6 Radford Place, Yonkers, N. Y.
Telematic Industries, Inc.	16 Howard Ave., Brooklyn 21, N. Y.
Walsco Electronics Corp.	3602 Crenshaw Blvd., Los Angeles 16, Cal.

CHOKES, COILS & TRANSFORMERS (RF)

Acme Electric Corp.	468 Water Street, Cuba, New York
Chicago Standard Transformer Corp.	3501 Addison Street, Chicago 18, Ill.
Merit Coil & Transformer Corp.	4427 N. Clark Street, Chicago 40, Ill.
Miller, J. W. Company	5917 S. Main Street, Los Angeles 3, Cal.
Superex Electronics Corp.	6 Radford Place, Yonkers, N. Y.
Triad Transformer Corp.	4055 Redwood Ave., Venice, Cal.

CHOKES, COILS & TRANSFORMERS (Audio and Line Freq.)

Acme Electric Corp.	468 Water Street, Cuba, New York
Chicago Standard Transformer Corp.	3501 Addison Street, Chicago 18, Ill.
Delco Radio (Div. of General Motors Corp.)	Kokomo, Indiana
Merit Coil & Transformer Corp.	4427 N. Clark Steet, Chicago 40, Ill.
Perma-Power Company	4721 N. Damen Ave., Chicago 25, Ill.
Triad Transformer Corp.	4055 Redwood Ave., Venice, Calif.

CHOKES, COILS & TRANSFORMERS (Deflection & Focusing)

Acme Electric Corp.	468 Water Street, Cuba, New York
Chicago Standard Transformer Corp.	3501 Addison Street, Chicago 18, Ill.
Great Eastern Mfg. Co.	165 Remsen Ave., Brooklyn 12, N. Y.
Merit Coil & Transformer Corp.	4427 N. Clark Street, Chicago 40, Ill.
Perma-Power Company	4721 N. Damen Ave., Chicago 25, Ill.
Ram Electronic Sales Co.	Irvington, New York
Superex Electronics Corp.	6 Radford Place, Yonkers, N. Y.
Triad Transformer Corp.	4055 Redwood Ave., Venice, Calif.

CONNECTORS, PLUGS

Blonder-Tongue Labs, Inc.	526 North Ave., Westfield, N. J.
Cannon Electric Co.	P. O. Box #75, Los Angeles 31, Calif.
Eby Sales Co. of N. Y.	130 Lafayette Street, New York 13, N. Y.
General Cement Mfg. Co.	919 Taylor Ave., Rockford, Ill.
Mosley Electronics	8622 St. Charles Rock Rd., St. Louis 14, Mo.
Radio Merchandise Sales, Inc.	2016 Bronxdale Ave., New York 60, N. Y.

FUSES

Bussmann Mfg. Co.	University and Jefferson, St. Louis 7, Mo.
Littelfuse, Inc.	4751 N. Ravenswood Ave., Chicago 40, Ill.

HARDWARE

I. E. Manufacturing Co.	325 N. Hoyne Ave., Chicago 12, Ill.
Kenwood Engineering Co.	265 Colfax Ave., Kenilworth, N. J.
Mueller Electric Co.	1583 E. 31st Street, Cleveland 14, Ohio
South River Metal Products Co., Inc.	South River, New Jersey
Television Hardware Mfg. Co.	919 Taylor Ave., Rockford, Ill.
Walsco Electronics Corp.	3602 Crenshaw Blvd., Los Angeles 16, Cal.

MICROPHONES, Stands & Accessories

American Microphone Co.	370 S. Fair Oaks Ave., Pasadena 3, Cal.
Atlas Sound Corp.	1446 39th Street, Brooklyn 18, N. Y.
Shure Bros., Inc.	222 Hartrey Avenue, Evanston, Ill.

PHONOGRAPH NEEDLES

Jensen Industries, Inc.	342 S. Wood Street, Chicago 12, Ill.
Permo, Inc.	6415 N. Ravenswood Ave., Chicago 26, Ill.
Recoton Corp.	52-35 Barnett Ave., Long Island City 4, N. Y.
Walco-Electrovox Co., Inc.	60 Franklin Street, East Orange, N. J.

PHONOGRAPH PICKUPS & CARTRIDGES

American Microphone Co.	370 S. Fair Oaks Ave., Pasadena 3, Cal.
Electro-Voice, Inc.	Buchanan, Michigan
Shure Brothers, Inc.	222 Hartrey Avenue, Evanston, Ill.
Sonotone Corp.	Elmsford, New York

POWER SUPPLIES (Converters & Inverters)

American Television & Radio Co.	300 East First St., St. Paul 1, Minn.
Electro Products Labs, Inc.	4501 N. Ravenswood Ave., Chicago 40, Ill.
Perma-Power Company	4721 N. Damen Ave., Chicago 25, Ill.
Vokar Corporation	Dexter 2, Michigan

RESISTORS & CONTROLS

Aerovox Corp.	New Bedford, Mass.
Centralab, Div. of Globe-Union	900 E. Keefe Ave., Milwaukee 1, Wisc.
Clarostat Mfg. Co., Inc.	Dover, New Hampshire
Delco Radio, Div. of General Motors Corp.	Kokomo, Indiana
Erie Resistor Corp.	Erie, Pa.
International Resistance Co.	401 N. Broad St., Philadelphia 8, Pa.

SEMI-CONDUCTORS

CBS-Hytron	100 Endicott Street, Danvers, Mass.
Federal Telephone & Radio Corp.	100 Kingsland Road, Clifton, N. J.
General Electric Co.	Schenectady, New York
Philco Corp.	Philadelphia 34, Pa.
RCA, (Tube Div.)	Harrison, New Jersey
Raytheon Mfg. Company	Newton, Mass.
Tarzian Inc., Sarkes	415 N. College Ave., Bloomington, Ind.
Tung-Sol Electric, Inc.	95 Eighth Ave., Newark 4, N. J.

SERVICING AIDS

Allied Radio Corp.	100 N. Western Ave., Chicago 80, Ill.
American Phenolic Corp.	1830 S. 54th Ave., Chicago 50, Ill.
Belden Manufacturing Co.	4647 W. Van Buren St., Chicago 80, Ill.
Blonder-Tongue Labs, Inc.	526 North Ave., Westfield, N. J.
Colman Tool & Machine Co.	P.O. Box 7026, Amarillo, Tex.
Columbia Wire & Supply Co.	2850 Irving Park Road, Chicago 18, Ill.
Electric Soldering Iron Co.	Deep River, Conn.
Electronic Publishing Co.	180 N. Wacker Drive, Chicago 6, Ill.
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Mall Tool Company	7740 South Chicago Ave., Chicago 19, Ill.
Oelrich Publications	4308 N. Milwaukee Ave., Chicago 41, Ill.
Quietrole Co., Inc.	Spartanburg, South Carolina
Ram Electronic Sales Co.	Irvington, New York
Tele-Scopic Products, Inc.	215 W. 33rd Street, New York 1, N. Y.
Ungar Electric Tools, Inc.	P. O. Box 312, Venice, Calif.
United Catalog Publishers	110 Lafayette Street, New York 13, N. Y.
Vaco Products Co.	317 E. Ontario Street, Chicago 11, Ill.
Wall Mfg. Co.	Grove City, Pa.
Wen Products, Inc.	5806 Northwest Highway, Chicago 31, Ill.
Xcelite, Inc.	Thorne Ave. and Bank St., Orchard Park, N. Y.
Yeats Appliance Dolly Sales Co.	2133 N. 12th Street, Milwaukee 5, Wisc.

SPEAKERS

Atlas Sound Corp.	1446 39th Street, Brooklyn 18, N. Y.
Delco Radio, Div. of General Motors Corp.	Kokomo, Indiana
Jensen Mfg. Company	6601 S. Laramie Ave., Chicago 38, Ill.
North American Philips Co., Inc.	100 East 42nd Street, New York 17, N. Y.
Oxford Electric Corp.	3911 S. Michigan Ave., Chicago 15, Ill.
Philco Corp.	Philadelphia 34, Pa.
Quam-Nichols Company	Marquette Rd. & Prairie Ave., Chicago 37, Ill.
University Loudspeakers, Inc.	80 S. Kensico Ave., White Plains, N. Y.

SPEAKER ENCLOSURES

Jensen Mfg. Company	6601 S. Laramie Ave., Chicago 38, Ill.
Transvision, Inc.	460 North Ave., New Rochelle, N. Y.
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TEST EQUIPMENT & INSTRUMENTS

American Scientific Development Co.	334 S. Main St., Fort Atkinson, Wisc.
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Electronic Instrument Company (EICO)	84 Withers Street, Brooklyn 11, N. Y.
Electronic Test Instrument Corp.	13224 Livernois Avenue, Detroit 38, Mich.
General Electronic Research Co.	Whitewater, Wisc.
Heath Company, The	Benton Harbor, Michigan
Hickok Electrical Instrument Co.	10533 Dupont Ave., Cleveland 8, Ohio
Hycon Electronics, Inc.	320 S. Arroyo Parkway, Pasadena, Calif.
Jackson Electrical Instrument Co.	16 S. Patterson Blvd., Dayton 2, Ohio
Leitch Engineering Co.	326 Lincoln St., Manchester, N.H.
Moss Electronic Distributing Co., Inc.	38 Murray Street, New York 7, N. Y.
Phaostron Company	151 Pasadena Ave., South Pasadena, Calif.
Philco Corp.	Philadelphia 34, Pa.
Precision Apparatus Co., Inc.	70-31 84th Street, Glendale 27, L. I., N. Y.
Probescope Co.	44-05 30th Ave., Long Island City 3, N. Y.
Radio City Products Co., Inc.	Centre & Glendale Sts., Easton, Pa.
Research Inventions & Mfg. Co.	617 F Street, N. W., Washington 1, D. C.
Seco Mfg. Co.	5015 Penn Avenue South, Minneapolis, Minn.
Simpson Electric Company	5200 W. Kinzie Street, Chicago 44, Ill.
Superior Instruments Co.	2435 White Plains Rd., New York 67, N. Y.
Telematic Industries, Inc.	16 Howard Ave., Brooklyn 21, N. Y.
Teletest Instrument Corp.	31-01 Linden Place, Flushing 54, N. Y.
Triplett Electrical Instrument Co.	Bluffton, Ohio
Weston Electrical Instrument Corp.	614 Frelinghuysen Ave., Newark 5, N. J.
Winston Electronics, Inc.	4312 Main Street, Philadelphia 27, Pa.

TOOLS

Electric Soldering Iron Co.	Deep River, Conn.
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Ohmite Manufacturing Co.	3640 W. Howard Street, Skokie, Illinois
Philco Corp.	Philadelphia 34, Pa.
Kraeuter & Co., Inc.	583 18th Avenue, Newark, N. J.
Mall Tool Company	7740 S. Chicago Ave., Chicago 19, Ill.
Tele-Scopic Products, Inc.	215 W. 33rd Street, New York 1, N. Y.
Ungar Electric Tools, Inc.	P. O. Box 312, Venice, Calif.
Vaco Products Co.	317 E. Ontario St., Chicago 11, Ill.
Wall Mfg. Co.	Grove City, Pa.
Walsco Electronics Corp.	3602 Crenshaw Blvd., Los Angeles 16, Cal.
Wen Products, Inc.	5806 Northwest Highway, Chicago 31, Ill.
Xcelite, Inc.	Thorne Ave. and Bank St., Orchard Park, N. Y.

TUBES—CRT & RECEIVING

Barry Electronics Corp.	512 Broadway, New York 12, N. Y.
CBS-Hytron	100 Endicott St., Danvers, Mass.
Ceco Electronics Co.	Columbia Ave. and 18th, Irvington 11, N. J.
Delco Radio, Div. of General Motors Corp.	Kokomo, Indiana
Federated Television Mart	513 Rogers Ave., Brooklyn 25, N. Y.
General Electric Co.	Schenectady, N. Y.
Philco Corp.	Philadelphia 34, Pa.
RCA, (Tube Div.)	Harrison, N. J.
Raytheon Mfg. Company	Newton, Mass.
Tung-Sol Electric, Inc.	95 Eighth Ave., Newark 4, N. J.

VIBRATORS

American Television & Radio Co.	300 E. First Street, St. Paul 1, Minn.
Cornell-Dubilier Electric Corp.	South Plainfield, New Jersey
Delco Radio, Div. of General Motors Corp.	Kokomo, Indiana
Radiart Corp.	3455 Vega Ave., Cleveland 13, Ohio
Vokar Corporation	Dexter 2, Michigan

WIRE—CABLE—HARNESSES

American Phenolic Corp.	1830 S. 54th Ave., Chicago 50, Ill.
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Columbia Wire & Supply Co.	2850 Irving Park Road, Chicago 18, Ill.
Eby Sales Co. of N. Y.	130 Lafayette St., New York 13, N. Y.
Federal Telephone & Radio Corp.	100 Kingsland Road, Clifton, N. J.
Jersey Specialty Co.	Burgess Place, Mountain View, N. J.

1956 TRANSISTOR PORTABLES

(*Continued from page* 21)

ies), shown in *Fig. 9* is similar in many respects to the 4RT1 Chassis with the exception of an additional *if* stage and an added audio transistor for push pull output. Both units operate from a nine volt battery and the 6RT1 Chassis has a 50*mw* output.

The 7RT1 Chassis is a seven transistor receiver. A major departure is evident here. A separate CK760 oscillator and a separate CK759 mixer is used. (See Fig. 13). The audio section is a push pull output with 100 *mw* of power available. Negative inverse feedback is applied from the speaker to the base of the audio driver. Two audio amplifier stages precede the push pull output amplifier.

The unit operates on four 1½ volt cells and makes use of a single stage 455*kc if* amplifier.

The 7RT4 Chassis, (Model T2500), is identical to the 7RT1 described above with the exception of an additional loudspeaker.

Chassis 8RT1, (Model 8TP series), is a seven transistor radio which again uses a separate oscillator and mixer. Two stages of *if* amplification precede a CK760 class B detector. A single audio stage is transformer coupled to a push pull class B output amplifier. The supply voltage is six volts from four 1½ volt cells in series.

RCA Victor Models 7BT-9J — 7BT-10K

The RCA Model 7BT-9J shown in *Fig. 10* is a six transistor circuit making use of six RCA type transistors. A 235 converter precedes two 455*kc if* stages using type 234 NPN transistors. A 1N295 diode detector is followed by a 2N109 audio amplifier and two 2N109 class B push pull output amplifiers. The set operates on one RCA VS300 nine volt battery for a 75 hour life. The set measures 3-7/16" by 1-13/16" by 1-9/16" and is housed in a plastic case.

The 7BT-10K transistor receiver utilizes seven transistors and a crystal diode detector. This chassis differs from the 7BT-9J by the addition of an extra audio driver stage using an RCA 2N109 PNP transistor.

Both models include *agc* and thermistor temperature compensation in the output stage. The 7BT-10K is housed in a leather case.

Regency TR-1

The Regency TR-1 portable is a four transistor unit with a crystal diode detector. See *Fig. 11.* This set employs two *if* amplification stages operating at 262 kilocycles. The set operates on a 22½ volt battery and features an output jack for earphone reception.

The unit is housed in a polystyrene plastic case measuring 5" by 3" by 1¼" and weighs 12 ounces.

Zenith Royal 500

The Zenith Royal 500 utilizes seven transistors in a six volt circuit. A separate oscillator and mixer is used to precede a two stage 455*kc if* amplifier. A single driver stage is transformer coupled to a push pull output. The Zenith receiver has an output jack for earphone operation. This jack is connected ahead of the class B output stages to save the battery during earphone use. The set comes housed in a plastic case and delivers 180 *mw* maximum audio output. Four penlite batteries provide 50 hours of operation or Zenith type Z9 mercury cells may be used for greater life. See *Fig. 12.*

Transistor portable radios have many advantages over vacuum tube receivers. The battery life of a transistor portable is extremely long due to the low drains imposed and only one battery is usually required. By using mercury batteries it is possible to achieve a life in excess of 1500 hours of operation. Microphonics are totally eliminated due to the nature of the transistors themselves. These features plus the adaptability to printed circuitry and miniature size have made the transistor portable radio a peer to be reckoned with. ■■

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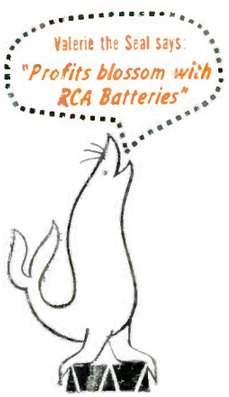

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