

# RADIO SERVICE NEWS

VOL. XIII, No. 2

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## NEW RECEIVING TUBE BOOKLET OFF THE PRESS

Ready Reference Chart Saves Time and Effort

A newly revised and greatly expanded edition of "RCA Receiving Tubes for Television, FM, and Standard Broadcast", a bulletin especially prepared for radio dealers, servicemen, and tube users, has been announced by the RCA Tube Department. The booklet provides quick and easy reference to the characteristics of RCA receiving tubes and includes socket connections and operating data.

The new edition of "RCA Receiving Tubes", which supersedes and replaces the popular 1275-C, has 50% more pages to include data on the entire line of RCA receiving tubes and kinescopes—nearly 400 types. The format of the booklet has been further improved to provide "at-a-glance" reference to socket connections without the need for cross-reference to other pages.

As in the previous edition, the first pages of the booklet contain a receiving-tube classification chart which groups tubes according to function and cathode voltages.

The second section of the booklet presents the characteristics of each type, listed in numerical-alphabetical sequence by type designations. For added convenience, socket-connection diagrams appear on the same page with tube data.

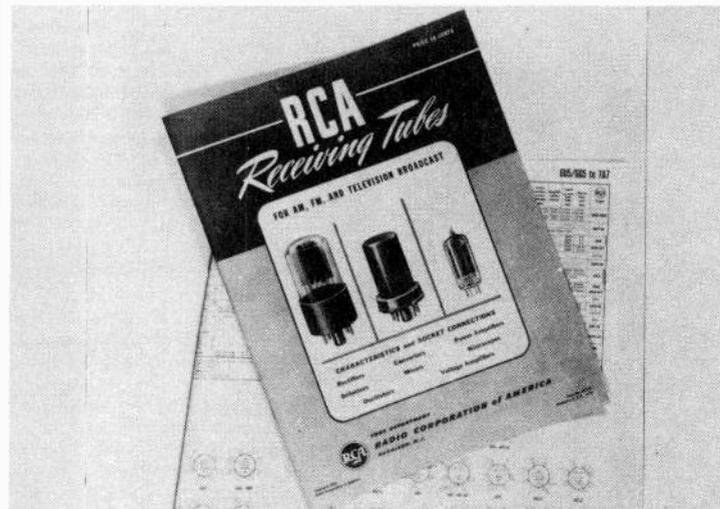
The price is only 10 cents at your RCA or Cunningham distributor. Ask for yours today.

### RCA RECEIVING TUBE MANUAL RC-15 IS AVAILABLE AGAIN

It's good news for those who were disappointed when the first printing of the RC-15 was exhausted. The second large-printing has just arrived from the printer's and all distributor back orders will be filled by the time you read this.

So if your RCA distributor was out last time you asked—try again for your copy of RCA's Receiving Tube Manual, RC-15, just 35 cents.

## RCA RECEIVING TUBES BOOKLET—1275-D



See your RCA distributor today for a copy of the new and improved booklet "RCA Receiving Tubes for AM, FM, and Television Broadcast", form #1275-D. It supersedes the former 1275-C booklet which servicemen used in record quantities.

## QUALITY CONTROL OF MINIATURE TUBES

By W. L. VAN KEUREN  
Manager, Quality Control Section

Most persons handling radio tubes know that a tube, in general, consists of an emitter (either ribbon or indirectly heated cathode), one or more grids for controlling the electron stream, and a collector of electrons. Such a structure, known as a mount, is enclosed in an envelope (either glass or metal), and when finally processed, operates in a vacuum. Contact to the internal structure is made through wires coming through glass seals and connecting to a so-called base which provides the means for transfer of energy from the socket to the elements of the tube.

This general structure, modified to meet the requirements of different circuits, is utilized in the various tube types. For example, some tubes are designed to function as radio-frequency amplifiers, some as detectors, some as oscillators, some as audio-frequency amplifiers, some as rectifiers, etc.

Miniature tubes, by type, conform to all these general features, but differ in mechanical structure and processing to meet the requirements that brought them into being. For example, the size of the miniature tube necessitates design and process techniques not encountered in tubes of larger size. The conventional stem is replaced by a combined button-and-stem assembly unique to the miniature series. The base of the conventional tube is eliminated, and the wires coming through the glass button form the contacts for the socket. The compact design of the miniature tube necessitates new methods of assembling the entire mount and

its auxiliary parts. All of these factors make the manufacturing of miniature tubes somewhat harder.

It might be well, at this point, to list some of the advantages of the miniature tube. First is its size. Prior to the war, RCA was able to produce a broadcast receiving set as small as a camera in which four miniature tubes occupied only about one-fifth of the space required for the tube complement of the next larger equivalent types of tubes. The elimination of the bakelite base, and the use of the smaller pins coming through the glass made it possible to eliminate operations required for the manufacture of a base and for the attachment of this base to a tube. Even more important is the adaptability of these tubes to high-frequency work, because of the lower inductance of the short pin-type leads.

Conventional automatic equipment for processing the tube and (Continued on Page 3, Column 1)

## "TUBE MOVEMENT & INVENTORY GUIDE" AIDS SERVICEMAN

Tube Stock Controlled With Handy Chart

Almost every serviceman has been in the provoking situation of reaching for a tube only to find an open space on the shelf where the much needed type should be. To help eliminate such a situation, RCA has designed a "Tube Movement and Inventory Guide", a copy of which is available at your distributor.

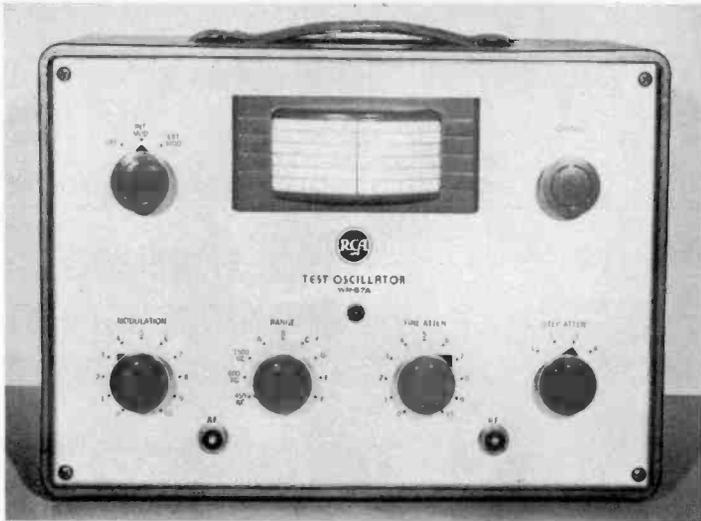
This inventory guide which is based on careful study of service dealer requirements nationally is designed to develop an accurate inventory guide for your tube stocks, through a study of tube movements. While it may be necessary to make minor variations on some types to allow for special local demands, the inventory guide will make it practicable for you to have an over-all picture of your inventory always at your fingertips.

Your local RCA or Cunningham distributor has received copies of this form together with full instructions on how he can apply it to dealer operations. Through this cooperation, you can be relieved of inventory headaches, and be assured of a permanent stock of tubes that will be there when you need them.

There are two blank columns on this form. A complete physical inventory should be taken to institute this program, and the figures entered in Column I. Next to your figures you will find the average rate of movement for each type based upon the sale of 10,000 tubes, nationally. The two sets of figures (ratios and inventory) should then be compared, and a normal stock figure established for each type. Enter this figure in Column II. You now have a basic inventory tailored to your own needs. With this optimum level established, you only need to check the physical inventory periodically and maintain it up to this par.

Your RCA or Cunningham distributor is anxious to cooperate with you on this program. Ask him about it next time you order tubes. He'll be glad to discuss the potentialities of this form and help arrange a stock level most useful to your shop and your area.

## TIME-SAVING TEST EQUIPMENT—



Designed especially for servicemen, the WR-67A Test Oscillator offers many time-saving facilities for the test bench.

## HIGH-SPEED SERVICING

By ARTHUR LIEBSCHER  
Test & Measuring Equipment

"Time is money"—at least that is the way a radio serviceman should look at it. At the beginning of each new week he has a credit of 40 to 70 hours of negotiable time. This time multiplied by his hourly earning rate represents his anticipated income from service work for the week.

The number of hours per week a man works, the amount he earns, and how tired he gets are personal problems which vary with individuals. There is one factor however, which is commonly experienced by all, and that is a desire for increased earning power.

If a serviceman buys equipment which will enable him to do a given amount of work in a shorter time he is taking a definite step to improve his position and increase his earning power. This is true, provided the initial cost of the equipment does not exceed the value of the time saved when liquidated over a reasonable period of time.

New time-saving features have become the key to new designs in test equipment, for leading manufacturers know that the more built-in "minute savers" they have to offer, the more their customers will prosper. Manufacturers also know that prosperous customers will in turn be back for additional income-producing features.

An example of what can be done in designing new time-saving devices is demonstrated in the recently introduced RCA Test Oscillator, type WR-67A, which includes three cardinal features developed for high-speed servicing.

The range switch on this oscillator includes fixed-frequency positions for the most commonly used alignment frequencies. This means that the time usually required to adjust the dial to 455 kc for i-f

alignment and then to change it back and forth several times between 600 kc and 1500 kc can be reduced to instantaneous switching operations. Just think what this means in terms of all the alignment jobs you do! From a different viewpoint, this feature alone makes a once-over alignment of each midget radio repaired such a quick, low-cost job that it is worth including for the advertising value of customer satisfaction alone.

The second super service point claimed for this oscillator is a signal injection probe. The design of the probe itself is borrowed from that commonly used with signal tracing equipment such as the Chanalyst. It makes possible safe contact with any grid, plate, or other tube element connection. From this we see that a signal supplied by the Test Oscillator can be quickly injected into any point where such action may be of value in determining whether or not the receiver is capable of handling that signal properly. In other words, we can apply a technique which is actually the reverse of signal tracing. This, incidentally, does not obsolete signal tracing, for both methods can be used together when the case warrants it.

The flexibility of a probe that can "squirt" i-f, r-f, and audio signals into any desired portion of a radio circuit lends itself well to signal injection and quick alignment.

(Continued on Page 7, Column 1)

# Talking Things Over

With W. L. ROTHENBERGER  
Manager, Renewal Sales

"Time is money"—and successful business hinges on how well your expenditure of time is arranged.

I've just read Art Liebscher's article on "High-Speed Servicing", which appears elsewhere in this issue, and I cannot resist emphasizing the importance of the opening statements. This article discusses time actually spent on the service bench. I'd like to discuss other, equally important factors of time, and its expenditure.

First of all, consider your hours of operation. Are they arranged for maximum trade benefit or just to suit yourself? The wise serviceman will study local shopping and buying habits and arrange his own schedules accordingly. Coincidental with this is the important feature of arranging a schedule of overall operation. Planned hours for pickup or delivery, bench work, and other portions of the day's activity will result in time saved—money earned.

There's another way to gain time, a way that requires a maximum of foresight and planning. It is maintaining a proper stock of parts and tubes for repair services. It is a rare occasion to be able to go out for parts without losing valuable time to and from the distributor's place. There may be traffic to fight, parking problems, and at best a loss of perhaps an hour or more. This loss of valuable hours can reach an appreciable total over a period of time, if, every time a resistor or a single tube is needed, it calls for a trip to the parts house.

A time-conscious serviceman will plan his stock carefully. A

check back over average business will indicate the general run of materials needed and help him make such plans. Other items, such as the RCA Tube Movement and Inventory Guide, described on the front page of this issue, can aid materially in determining your tube stock requirements. A well balanced inventory represents a good investment, the profit from which is materially increased by savings in shopping time. An adequate inventory and planned buying will enable you to reduce those time-consuming trips to the point where the time spent at the distributor's place of business is truly a productive one. Make those trips an important feature from the distributor's viewpoint—it's much easier for him to serve you a week's or a month's order at one time than a half-dozen small orders at short intervals.

Maybe your location is such that all of your parts must come via mail order. Lack of stock planning here means delay in returning sets to customers, which can, in turn, create irritations and a desire to find quicker service on the part of the set owner. Good inventory, well kept, will keep your shop free of a backlog of sets tagged "Awaiting Parts".

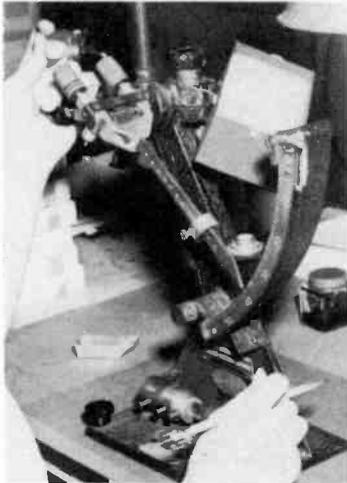
You'll find your local RCA, Cunningham or RCA Victor distributor anxious to cooperate with you in every way possible. Check his services next time you buy, and enjoy the benefits of his experience and organization.

## — MEANS EXTRA SERVICE PROFITS



Running mate of the WR-67A is the FM Sweep Generator, WR-53A. Producing frequency modulated signals on two bands, IF and RF ranges, it is a must for up-to-date FM servicing.

**QUALITY CONTROL OF RCA MINIATURE TUBES**



*Samples of the basic structural components of the tube are carefully tested for strength and uniformity before the lot is sent to the plant for use in tube manufacturing. The test on the right measures mica wafer dimensions by means of a 30-power projection microscope. Detailed specifications for each type wafer must be met to within close tolerances. The machine on the left is a ductility tester. It measures the strength of the pins used in miniature tubes, assuring only the finest materials for RCA tubes.*

**MINIATURE TUBES**

*(Continued from Page 1, Column 3)*

tube parts has been adaptable to the smaller design, so that miniature tubes receive the uniform processing associated with automatic equipment.

It is well known that RCA puts out only one quality of tube. Early in the design of this line of tubes the criteria and limits for the physical dimensions and electrical characteristics were set up. However, the radical changes in the physical design of this tube necessitated new methods of quality control and inspection in order to maintain the uniform quality which RCA always builds into its product. Following are some of these controls:

First, the elimination of the conventional base and the extending of the lead wires from the electrodes through the button of glass to serve as base connections required control of the temper of the external wires. These wires have to be sufficiently stiff to stand insertion in the socket and yet must be flexible enough so that severe strains are not placed on the glass seal through minor misalignments of the pins and socket contacts. All lead wires for miniature tubes are sample tested, when received from the vendor, to assure that they have the specified temper.

Secondly, the conventional stem used in other tube types is replaced by a flat button stem with seven lead wires positioned in a circle and sealed in the same plane as the glass seal between the bulb and the stem. This type of stem, with metal lead wires close to the point of sealing to the bulb, necessitates very careful control of glass strain both before and after making the bulb seal. Such a con-

trol was developed by RCA in the early stages of manufacture and consists of a very severe temperature cycling test with the pins under tension. Briefly, a number of stems or finished tubes are forced on to a series of cones supported on a platform. These cones put the contact pins under pressure to the extent that they are bent 15°. The platform holding these stems or tubes is then immersed in boiling water and held there for a period of time, then taken out and cooled in air or water at room temperature. This test, of course, is very severe and, therefore, it is expected that some tubes will fail under these conditions. Any failures, however, above the established per cent limit require that the machine be adjusted to modify the strain conditions in the glass. Tubes made under these controls should not fail when used in any well-designed socket.

There have been certain sockets and certain practices with respect to insertion of tubes in the socket which have caused an abnormal number of glass cracks to show up. However, as stated above, with tubes processed to meet the control test, proper handling of the tubes thereafter in well-designed equipment should not give trouble.

A third feature of miniature design requiring more and better controls, is the closer spacing of the elements to produce characteristics comparable to or better than those of larger tubes. This closer spacing required more careful design of tools to make and shape the parts, and greater skill on the part of the operators in assembling parts. RCA's many years of experience in training operators and in designing jigs and other fixtures have been valuable in maintaining desired tolerances. Statistical quality control is regu-

larly employed in checking parts, assemblies, and finished tubes.

A fourth reason why the quality of RCA miniature tubes is outstanding is that these tubes are subjected to periodic testing under various conditions of operation. Miniature tubes are life tested under maximum recommended operating conditions for a period of time that insures their average performance and service. Such tests include steady burning, intermittent operation, accelerated tests for grid emission or other critical characteristics, and checks of the design features of the tube. These tests are a direct check of the efficiency of the various process controls maintained during the manufacturing and assure the quality of the tubes sold. No tubes are shipped unless their life history on a sampling basis meets RCA standards.

It is well known that experience is the biggest preventive of trouble or, to say it another way, is the best guarantee of trouble-free operation which, in turn, spells quality. RCA pioneered miniature tubes and as a result has had the longest experience in producing them. The

original designs of the tubes, tube parts, and the manufacturing equipment were developed and produced at RCA. Additional experience was gained during the war when this line of tubes made possible the portable equipment necessary for communications, embracing such vital factors as light weight for aircraft components and adaptability to VHF circuits. During this period, RCA was a major supplier of miniature tubes.

Quality can not be inspected into a product, **IT MUST BE BUILT INTO THE PRODUCT.** Here again, the long experience of RCA in building miniature tubes, its automatic equipment, and its wealth of engineering personnel to maintain and improve processing and control methods have made RCA miniature quality outstanding. RCA miniature tubes can be depended upon to give good service under the published operating conditions; to stand the normal conditions of vibrations associated with small, compact sets; to meet reasonable socket strain; and have the high overall quality that only comes through careful research, competent quality control engineering, and long experience.



*Two of the many test units devoted to thoroughly checking miniature tubes to make sure of uniform quality and maximum service life in the field. The unit at the left is the microphonics test set, where the slightest trace of microphonics is audible to the operator. The right unit tests the miniatures for shorts and emission. Every tube either passes both tests or is destroyed. Samples of each batch are tested again before final shipments.*



*This is known as the "B Test". Completed tubes are forced over cones and dipped into boiling water, then into cold water. Breakage is analyzed and excessive strains are corrected in the base manufacturing stage.*

# PROFITABLE SUMMER SERVICING THROUGH EARLY PLANNING

The "hot weather" slump, so often associated with the summer vacation period, need not necessarily be poor months for the radio servicing business. This season offers exceptional opportunities for enterprising, promotional-minded radio service-dealers, and can result in the most profitable months of the whole year. Like most good things, however, it won't fall your way without strong merchandising efforts on your part.

A primary consideration, in the chronological order of well conceived seasonal planning, is the battery-portable business. A hard-hitting direct mailing, and a co-ordinated advertising program, announcing your services to a neighborhood full of potential customers, should make them well aware that your shop can best prepare that stored-away portable for the vacation trip. Many owners of this type of set have been using them on ac or dc all year, and a good memory-jogging ad or card will remind them how enjoyable that set can be on the beach or up at the mountain lodge if equipped with a new set of batteries, and overhauled to insure top operating results.

Setting up a schedule of dates for this type of servicing must be done in the light of local habits. The entire plan must be made now and presented to your customers at the precise time they begin to think and talk vacation. In so doing, radio servicing will become a vital part of vacation preparation.

The paramount idea behind this promotion is to bring this class of servicing to the bench well in advance of the vacation period to avoid last minute "log jamming" of the service schedule. Stress the convenience of having the sets ready well in advance of plans—avoiding disappointments and delays. Prepare a clever check list that will catch the reader's eye—one that will give him good reasons for bringing you the set. Offer this service at a bargain price, justified by having it done in advance during free time on the service bench. By all means, don't neglect car radios in this program—top opportunity for sales as well as service.

Another valuable service to the customer will be to have him leave one or all of his household instruments for overhauling at your shop during the vacation period. Arrange to pick them up a day or two before departure—and, above all, be ready to return them as soon as the vacationists return. Offer—and deliver—a good check-up, with necessary repairs, alignment and a clean-up. Returning tourists will be glad to find their pet radios looking and sounding like new. Be sure to stress the convenience of having it done while they are away and won't miss the set.

This type of service, courteously rendered, will repay later dividends in the form of repeat business. A well performed, personalized handling of customers' equipment is a tried and proven way of developing a customer return habit.

And if you live near a beach or popular resort spot, arrange your advertising to hit the tourist trade. Offer fast attention to those who find themselves with a dead set while on vacation. Hotel rooms and lakeside cabins can be very quiet without the radio there. Motorists, too, derive much pleasure on long or short drives with the car radio to keep them company.

All this business cannot be commanded at a moment's notice. It must be planned as carefully as an Army General would map a campaign. Dates must be set with sufficient allowance for customer reaction. Vacations often start or end with a holiday week end—a good point to remember.

So here's to a happy vacation time—a profitable time for well-planned business. (See also Vacation Service Plan article—this page).

## A CHECK-LIST FOR YOUR CUSTOMER

Your radio has been carefully checked and is now in first class operating condition. This service included:

- Visual inspection—parts and connections.
- All tubes tested—see reverse side for weak tubes and those replaced.
- Complete alignment—Chassis Cleaned.
- Cabinet cleaned and polished.

Our phone number is..... We'll be happy to serve you again.

(Dealer's Imprint)

Try using a card such as this on your customers sets when they are returned. Suggest that they leave the card handy in the rear of their sets for future reference.

## THE RCA VACATION SERVICE PLAN

Check this RCA-Dealer cooperation for planning your Vacation Service Program. It's a bargain package that will pay big dividends.

In line with RCA's efforts to aid radio service dealers in every possible way, the Tube Department has prepared a "Vacation Service Kit", designed around the ideas suggested in the article "Profitable Summer Servicing", which also appears on this page.

This Kit contains three basic ingredients for such a program. Your own efforts and ingenuity can turn these materials into a profitable business promotion.

First item in the kit is a special double postcard. You write in the prospect's name and address on the

front of the card, affix a one-cent stamp, and drop it in the mail. One cent pre-cancelled stamps may be used across the edge of the cards, serving to hold the folded cards closed. Inside, the customer finds a personalized sales message describing your Vacation Service program over your imprinted name, address, and telephone number.

The other half of the card is a standard business reply card imprinted with your name and address. The customer checks the type of radio he owns, indicates when he would like to have his set serviced, signs his name and address, and mails the card postage-free. When the card is delivered to you, you pay the postman two cents—a small investment for a profitable service job!

The second part of the kit is an 84-line single-column ad mat for use in your local newspaper. It ties-in closely with your postcard and is an economical way of presenting your vacation service program throughout your local area. A typical cost of inserting this ad mat in a weekly newspaper with 1,700 circulation is less than \$3.00 per insertion. Think of it! 1,700 prospects at an average cost less than two-tenths of a cent per reader. Additional insertions bring the rate even lower. Consult your local newspaper representative for the exact rates in your area.

Third item in the Vacation Service Kit is a soft-sheet poster blow-up of the ad mat, 6" x 14" in size, which gives a tie-in bonus when used on your windows or doors, store interior, or over-the-counter. It has the same design as your ad mat and postcard and serves to identify your store as local headquarters for Vacation Service.

(Continued on Page 5, Column 4)

## THE RCA VACATION SERVICE KIT



Here's your "Vacation Service Kit" featuring the double postcard, (both sides are shown), the ad-mat copy, and the window banner.

# SALES *and* SERVICE TIPS

Once again you can win a handsome RCA Resistor-Code Pencil by sending tips to RCA Radio Service News, Harrison, New Jersey . . . All tips become the property of RCA to be used as it sees fit . . . Service Tips are our readers' ideas, not ours. While we believe they are worthwhile, we cannot be responsible for them.

## SURPLUS HARDWARE FINDS MANY USES

Fuse clips, plentiful and inexpensive at war-surplus outlets, can be put to many uses around the bench.

I use several, fastened on the bench-backboard, for holding socket spintites and screw-drivers. A larger size clip mounted on a porcelain stand-off, serves as a positive clamping soldering iron holder. This keeps the iron from being brushed off the regular type holder and causing damage or a fire.

A. Dutkowski  
Dut-Tone Radio Service  
15 West 16th Street  
Bayonne, N. J.

## VTVM TESTS AUDIO COUPLING CONDENSERS

Servicemen owning VTVM's can test audio coupling capacitors by a very simple method.

Remove the negative or grid end of the suspected capacitor and connect the VTVM probe across this and ground. Good coupling condensers will swing the meter approximately equidistant plus and minus on the meter when a strong station is tuned in on the receiver.

A defective capacitor capable of introducing distortion will also wobble the meter, but with a definite positive swing. A completely shorted unit will, of course, register the plate voltage value of the preceding stage on the meter.

H. G. Coggeshall  
Waterville, N. Y.

## CALLING CARDS HAVE MORE THAN ONE USE

Locating shorted tuning condensers may be made easier by using a strip of stiff paper, such as a calling card. Pass the paper between stator and rotor plates. When the inoperative (or defective) section is found, the set will resume operation while the card is in place.

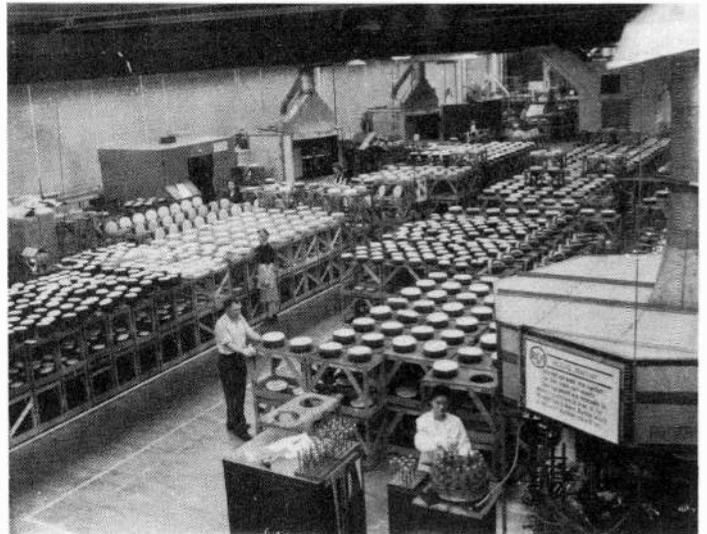
James W. Frye  
Frye's Radio Service  
Bowmanstown, Pa.

## HAND PRINTING SET MARKS TUBES — PARTS

The old-fashioned hand printing outfit, so popular with the youngsters, has found a permanent place on our bench.

We use a kit of the larger size letters about 1/4" high, and three

## CATHODE-RAY TUBES FOR TELEVISION



A general view of one corner of the RCA Lancaster plant showing glass bulbs of cathode-ray tubes stored in racks during process operations.

Mr. C. G. Thomas, in the Quality Control Section of RCA's huge Lancaster, Pennsylvania plant, will discuss quality control of cathode-ray tubes in the next issue of RADIO SERVICE NEWS. Don't miss the second of this series on RCA's quality control.

stamp pads of white, red and black ink. With this combination, we can set tube type numbers in the holder for marking chassis' or tubes where original imprinting is worn off.

Being hams as well, the stamp does a neat job of panel marking and parts identification.

Wentworth Bros.  
36 Washington Terrace  
E. Orange, N. J.

(Continued from Page 4, Column 4)

You cash in three ways with the Vacation Service kit: Direct mail, newspaper advertising, and point-of-sale display. By ordering these materials today, you can insure a busy and prosperous summer service season. Vacation time is just around the corner. Advance planning will pay off by avoiding the last minute rush. By ordering these materials today, you can insure a busy and prosperous summer season.

Be sure to order your summer service kit through your RCA, Cunningham, or RCA Victor distributor. Postcards cost you \$1.50 per 100 (including your 3-line imprint in two separate places) in minimum quantities of 100. For each postcard order you place with your distributor, RCA gives you a streamer and ad mat, free of charge.

Get lined up now for summer service and build a profitable summer volume—with repeat business throughout the year.

## NEUTRALIZING TOOL MADE FROM A KNITTING NEEDLE

One of the easiest tools to lose on a test bench or in a tool box is the ever-needed neutralizing screw driver.

I've found the dime store variety of plastic knitting needles very handy, and have made a set of several different lengths. I cut off one end and filed it to shape and size, leaving the button on the other end for a good finger-grip.

Russell R. Kerr  
1904 Woodward Ave.  
Pittsburgh 26, Pa.

## A PENNY POSTCARD TO BUILD BUSINESS

When returning a serviced radio, I include a stamped, self-addressed penny postcard. It's a handy way to get the customer's or his friends' future business.

Stanley J. Sekotnicki  
59 Poplar Avenue  
Buffalo 11, N. Y.

## THIS IS A PENALTY BOX—

—And we're in it. We credited the author, Paul L. Gerhart, with the very fine article, "Technical Educational Requirements of the Modern Radio Industry", but, through an oversight, did not reveal the source of this material. This timely piece first appeared in the "RCA Review", the quarterly publication of the Radio Corporation of America, RCA Laboratories Division. Our thanks to "RCA Review" for this fine article, and apologies for the oversight.

Editor.



"I guess there's some mistake. I'm for the radio servicemen's party!"

# REPLACEMENT PARTS

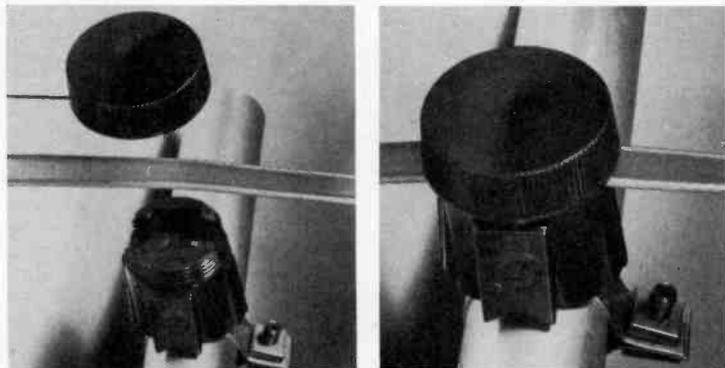
## Section

Here are values available in limited quantities only. Many are hard-to-get items for use in the older RCA Victor models. At these special prices, our stock will soon be depleted; orders will be filled in the sequence they are received.

### RCA LIGHTNING ARRESTER—206X1

A screwdriver is all that is needed to mount the new, plastic-cased RCA Lightning Arrester. Designed for RCA Bright Picture Transmission Line and similar 300-ohm ribbons, the use of this arrester eliminates cutting and splicing and the resulting mismatch. The line fits in a slot, with a screw cap forcing it down on four sharp prongs which pierce the insulation, making positive contact with both conductors. A flexible strap mounts it on 1/2" to 2" water pipe.

Suggested List Price of the 206X1 RCA Lightning Arrester is \$1.25.



### ELECTRO DYNAMIC SPEAKERS

Here are exact replacements for electro dynamic speakers. All have standard 3.2- or 3.4- ohm voice coils.

- Stock No. 9779—6-inch, 3.5-watt, for model ACR-155.  
Suggested List Price.....\$ 7.05
- Stock No. 9758—5-watt, for model 10K.  
Suggested List Price.....\$10.70
- Stock No. 9698—Exact replacement for model 4T.  
Suggested List Price.....\$ 6.50

### CRYSTAL-PICKUP OUTPUT VOLTAGES

The following tabulation of average crystal-pickup output voltages is being repeated by popular demand. It can be used to determine the condition of the various types of crystal units listed. All voltages are measured using Victor Test Record No. XL76A with a frequency of 400 cycles per second. The crystal temperature should be within plus or minus 2 degrees of 77 degrees Fahrenheit. The crystal cartridge should be mounted in the arm for which it was designed and connected to a resistive load of one megohm. The most accurate measurements can be made by using a vacuum-tube voltmeter. Test voltage for various units are as follows:

Stock No.	Volts	Stock No.	Volts
9890	1.60	38598	0.35
14820	3.00	38610	2.00
30708	3.40	39550	0.35
31050	3.40	39686	3.00
31156	2.40	39919	0.35
32632	2.40	39851	1.60
33122	3.00	70220	2.60
33217	2.40	70332	0.35
34225	2.40	70338	1.60
34307	3.00	70339	0.35
34710	3.00	70340	0.35
37158	3.00	71173	1.90

# MAINTAINING YOUR VOLTOHMYST

Like every expensive precision instrument, there are certain points of care which must be observed if your VoltOhmyst is to continue to deliver the fine service it is designed for.

The instrument is an extremely well built, rugged unit, capable of withstanding heavy normal use, but there are certain limitations to what it can take. No one ever comes in at night and throws even a dollar pocket watch on the table, nor will they toss the new tube stock up into place. For the same reasons, the VoltOhmyst should be cared for with the same simple precautions. Keep it against the back wall of the bench where it can't be accidentally pushed off. Pick it up and set it down carefully, using the handle instead of sliding it across the bench using the leads as a tow line.

One thing the RCA Test Equipment Laboratory has found to occur occasionally, especially after the VoltOhmyst has been shelved for a time or in very dusty locations, is passed on to you for future reference.

If the meter needle drives off scale when no tests are being made, it is an indication of leakage to ground within the bridge circuit of the instrument.

Foreign particles of metal, possibly in the form of fine hair-like spires which may even be invisible,

cause a leakage path between the resistance element and the cover of adjustment controls.

The dc plus, the dc minus, the ohms adjust, the ac calibrate, and the zero adjust controls should, in turn, be removed from the chassis or panel without disconnecting their wiring. After first making sure that no part of the control is touching any other electrical circuit, turn the instrument on to see if the off-scale deflection is still present. If, when one of the controls is unmounted, the meter acts normal, turn off the instrument and then remove the cover from that control to clean out the cause of the leakage. Insulate the inside of the cover with cambric cloth, fiber paper or lacquer and replace it.

Great care should be taken not to disturb the adjustment of calibrating controls. It is wise to mark the position of the screwdriver slot with respect to the control bushing, to be sure that no alteration occurred during the time the pot was unmounted. If adjustment of the calibrating control is changed, it will be necessary to recalibrate the instrument by comparison to a standard meter.



Fine instruments such as the VoltOhmyst, require fine care. The WV-65A, shown above, is the battery-operated type for portable servicing such as auto radios and mobile communications equipment.

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Suppose we have a receiver with a defect near the second detector. Audio signal injection can be used to work backwards from the loudspeaker to the defective detector circuit, which would then stop the progress of signal injection prior to that point. Augmenting this with signal tracing from the antenna to the second detector would prove that the r-f and i-f section of the receiver was working properly. We would, therefore, have a logical method of closing in on the defect from both ends of the signal path.

The third feature in this new Test Oscillator is double attenuator control which provides four steps of attenuation plus a variable fine control, a combination which covers the extremes of signal level requirements for servicing. Signal amplitudes up to one volt are available for "pumping through" a completely mis-aligned set, and signals down to approximately one micro-volt can be obtained at the turn of these two controls for final alignment of very sensitive receivers. You will note that it is not necessary to change cable connectors from high to low output and that a signal can be progressively weakened when the injection technique is used in working backward from the second detector toward the antenna connectors of a receiver. Without lost time the signal level can be reduced by an amount equal to the gain of each stage in progressive injection points. This gives the desirable net result of an even signal level at the second detector regardless of the stage where the signal is injected.

It can now be seen that the big time-saving features are centered between switching operations and touch contact, which permit extreme flexibility in rapid change of frequency, desired adjustment of signal level, and quick transfer from one signal injection point to another.

In appraising various time savers we should also consider the use of Testpoint Adapters for contacting tube elements above the chassis. Their use agrees with the foregoing procedure in that they can be applied to further advantage in injecting signals into any stage without removing the chassis from the cabinet. When contact is made with adapter testing points bearing plate voltage, it is worth recalling that the blocking capacitor type of probe, previously mentioned, removes all worry of the hazard of damaging the Test Oscillator.

Testpoint Adapters are great time savers in that they serve as well for voltage measurements as they do for signal injection or signal tracing. They can also be conveniently used to make temporary tests for by-passing when unwanted oscillation is present and signal tracing is otherwise impos-

sible. In such a case, a by-pass capacitor need only be connected between the adapter contact and the chassis.

A series of Testpoint Adapters will often enable stage by stage signal and voltage contacts in cases where the socket connections are not easily available from the underside of the chassis. Considerable time can be saved in making estimates when these adapters enable the serviceman to discover what portion of a radio is defective, without taking the trouble to remove a chassis. The latest of these handy gadgets is a miniature Testpoint Adapter especially designed to fit into the tight places in new FM and television receivers.

The accompanying chart is intended to help the serviceman resolve his trouble shooting problems by a procedure based on logical thinking and as direct an approach to the source of trouble as possible. Although the plan of the chart exhibits certain suggested possible cures for defects, which fall in the categories listed, it is not intended to indicate a comprehensive coverage of those listings. Being fundamental in nature, it avoids the usual listing of symptoms, causes and cures.

The first test method mentioned is "hearing". By using his hearing alone, the serviceman can usually

detect which of the four "nature of trouble" classifications exists.

Applying the second test method of "observation", it is found that what can be seen to be wrong with a radio receiver usually endorses what was heard to be wrong with it. Often these two test methods, which are no more than the serviceman's own natural facilities, are enough to locate certain troubles within a defective receiver.

Beyond the above, it is necessary to add the facilities of test equipment to extend one's range of hearing or observation, just as the telescope makes it possible to see things not normally visible. To continue with a logical approach toward locating an invisible cause of trouble, it is advisable to employ signal tracing as a test method. The simplicity of signal tracing procedure, or that of signal injection, as the case may be, helps to locate trouble quickly in any of the four categories mentioned as "nature of trouble".

It may be noted from the chart that only in cases of intermittent conditions or low output, is it necessary to make special signal tests for monitoring and gain checking respectively. Similarly, signal tests involving frequency are only required occasionally as verification of suspected frequency defects noticed in the foregoing tests.

In following any column down the chart, it is seen that "voltage indication" is intended to prove, through lack of proper voltages, why something is wrong with the signal-handling capability of the receiver.

As a final proof of the source of trouble in any category, a resistance or capacitance test can be made to determine exactly what part or parts are defective.

When evidence warrants, it is perfectly reasonable to skip any of the tests listed in a column. For instance, a crack appearing on a resistor, as noted by observation, might be good cause to make a resistance test before reverting to the balance of the procedure outlined above.

The main purpose of the troubleshooting chart is to help servicemen to run down defects by the most direct approach. Adherence to the chart will save time often wasted in jumping from one category to another in following hunches as to a possible source of trouble.

In some cases, more than one "nature of trouble" may be evident. When this happens, it is wise to trouble-shoot one trouble completely before attacking the second. Here again, time is saved by avoiding misleading suspicions and approaching the defective part by the most direct and logical path.

TEST METHOD	NATURE OF TROUBLE			
	INOPERATIVE	INTERMITTENT	LOW OUTPUT	POOR QUALITY
HEARING	Listen for signal or other sound.	Listen for interruptions or noise when topped.	Note loss of volume or frequency range—possibly when adjusting control.	Listen for poor tone, hum, whistle, noise—possibly when adjusting controls.
OBSERVATION	Look for damaged parts—short circuits—broken wire—tube or dial lights out.	Look for loose parts, loose wires or connections.	Look for tubes out of place—open or shorted parts or wires—no glow in tube or cold tube.	Look for damaged parts, poor connections, broken wires, tubes cold or out of place.
SIGNAL TRACING	Follow signal to point of disappearance.	Follow signal to point of interruption—possibly when topped.	Follow signal to point of loss or where gain is not normal.	Follow signal to point where distortion or oscillation occurs. Follow signal to point where hum or interference enters path.
SIGNAL TEST (MONITORING)		Monitor for signal change. Monitor for actual voltage change—possibly due to moisture or temperature variation.		
SIGNAL TEST (GAIN CHECK)			Measure signal at point of suspected loss.	
SIGNAL TEST (FREQUENCY CHECK)	Check band selection. Check power line frequency. Check oscillator frequency.	Check oscillator frequency for change. Check I-F for change.	Check oscillator frequency. Check A-F ranges.	Check I-F oscillator tuning. Check low frequency. Check phasing of hum bucking coil. Check phasing of reverse feedback.
VOLTAGE INDICATION	Check for presence of required voltage at point of signal disappearance.	Check for voltage change near point of signal interruption—possibly when topped.	Check for incorrect voltage at point of signal loss.	Check for incorrect voltage at point of signal quality deterioration.
RESISTANCE—CAPACITY TEST	Check for short circuits, open circuits or resistance to ground.	Test for resistance or capacity change—possibly when topped.	Check for incorrect R-C Values. Check for leakage.	Test for poor contacts—incorrect R or C values.

For quick interpretation of the chart—Read across to find nature of trouble. Then follow column down for required test. Skip steps previously eliminated.



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