



RADIO SERVICE NEWS

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ADVANCES IN TUBE DESIGN PAVE WAY FOR NEW PRODUCTS

Electronics Industry Traces Growth from Developments in Tube Manufacture

The original concept of the uses of a *radio tube* has been expanded so far into fields other than radio that engineers have come to regard *electron tube* as a more apt designation for this versatile device. Most of the important advances in radio, sound, and electronics have been preceded and made possible by advances in the design of electron tubes.

For example, the introduction of the ac-powered tube made possible all ac-operated radio sets. Similarly miniature tubes, scarcely more than two inches high, yet which performed all of the functions of their larger prototypes, made the debut of the Personal Radio possible in 1940 and at the same time ushered in a new era of compact communication equipment. The development of the Image Orthicon, or electronic eye of the television camera, and the reproducing kinescope of the home television receiver, established all-electronic television on a practical basis.

Servicing Opportunities

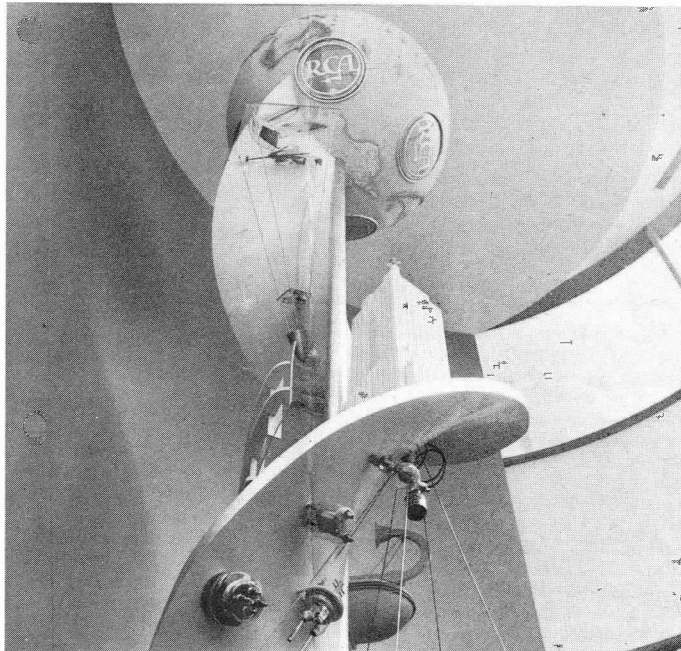
Some years ago RCA pioneered in the manufacture of metal-encased electron tubes because of technical, physical and manufacturing advantages. These advantages, together with greater ruggedness, were quickly recognized by industry.

A special development in phototubes, another form of electron tube, paved the way for RCA's famous ultraviolet method of recording sound-on-film which brought new realism to sound motion pictures.

Television, FM, facsimile, industrial broadcasting, electronic power generation, all have at least one thing in common—their use of electron tubes.

As a result, increased opportunities in service and sales are presenting themselves to the serviceman and dealer. And as these electronic applications increase still further, local facilities in every populated center will be required for the proper installation, maintenance, repair, and replacement of these devices.

RADIO WORLD'S FAIR — 1947 STYLE



RCA's contributions to the history of communications are depicted by miniature models on this spectacular theme mast, three floors high, in the new RCA Exhibition Hall opened recently in New York City. Here colorful exhibits of radio, television, communications, and equipment are set up in spacious settings to accommodate hundreds of visitors in comfort.

EXTERNAL CROSS MODULATION—ITS CAUSE AND CURE

By DUDLEY E. FOSTER

Formerly with RCA Service Laboratory

Some years ago reports began to be heard concerning a type of interference with broadcast reception which had never before been noticed. The interference occurred only in localities having high field strength from one or more local stations, and its new characteristic was that the program of the strong local station was heard when the receiver was tuned to one particular other station, but not to others. The effect was not due to lack of selectivity because when the receiver was tuned the local station could be tuned out and then would reappear when a certain other station was tuned in. Occasionally, two local stations would be heard together on a frequency which was quite different from that of either one of them.

This type of interference also had other peculiarities. In the area in which it occurred, it would be found in one house whereas the house next door would be free from interference even when the same set was used. In those houses where it occurred, any make or model receiver, including battery sets, experienced it. Still another puzzling factor was that the interference was not constant, being much more severe at one time than at others, and occas-

ionally disappearing entirely for a period.

THESE CHARACTERISTICS LED TO THE DEDUCTION THAT THE INTERFERENCE WAS NOT CAUSED IN THE RADIO RECEIVER, BUT BY SOME AGENCY EXTERNAL TO THE RECEIVER ITSELF. This type of interference was designated "external cross modulation."

Continued on page 2, column 1

ELECTRONIC SAGA SHOWN IN RCA'S EXHIBITION HALL

Elaborate Electronics Displays Presented to Public As An RCA Service

Giant models of RCA tubes visible through story-tall windows are part of the elaborate electronic display in the new RCA Exhibition Hall in New York City. Assuming its place among the showplaces of the nation, the "Radio World's Fair" opened its doors to the public in June. Behind its 200-foot window front at 36 West 49th St., the wonders of modern electronics are displayed in spacious settings.

One of the most spectacular displays in the Exhibition Hall is a theme mast, three floors high on which RCA's contributions to the history of communications are depicted by miniature models. At the left end of the main floor is a 12½-foot plexi-glass map of the U. S. showing in bright lights the radio network of the National Broadcasting Company. Visitors press a button on a keyboard and each station lights up separately on the map. Another button makes audible on a personalized receiver the network program being broadcast at the moment.

Permanent Display

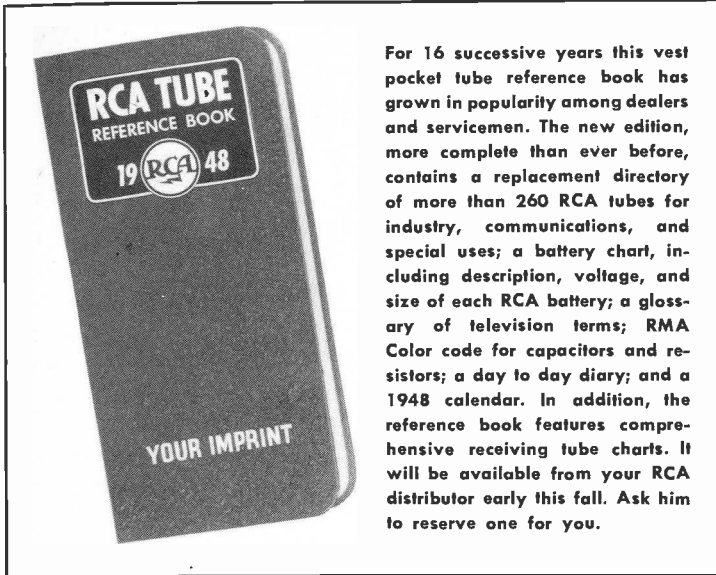
The story of the people who have made radio a favorite entertainment medium is told in a series of miniature wood carvings mounted on four revolving stages. Seen through viewing windows, they depict the program highlights of 20 years of broadcasting.

Another popular feature of the RCA Exhibition Hall is its television display. Here a person can stand before a television camera mounted on a movable boom and be televised from several angles.

An attractively appointed public lounge furnished with comfortable chairs contains conveniently located television and radio receivers. Part of the lounge is devoted to an eye-filling ultra-violet mural showing RCA's world-wide facilities.

The RCA Exhibition Hall will be a permanent exhibit which will be open daily to the public. Dealers and servicemen are cordially invited to visit this interesting electronics display when in the metropolitan New York area.

ANNOUNCING THE '48 RCA TUBE REFERENCE BOOK



For 16 successive years this vest pocket tube reference book has grown in popularity among dealers and servicemen. The new edition, more complete than ever before, contains a replacement directory of more than 260 RCA tubes for industry, communications, and special uses; a battery chart, including description, voltage, and size of each RCA battery; a glossary of television terms; RMA Color code for capacitors and resistors; a day to day diary; and a 1948 calendar. In addition, the reference book features comprehensive receiving tube charts. It will be available from your RCA distributor early this fall. Ask him to reserve one for you.

CROSS MODULATION

Continued from page 1, column 3

A location was found where the cross modulation existed consistently and a study was made to determine the fundamental cause and a remedy. In this location, a battery receiver with a short antenna exhibited cross modulation inside the house, but when the receiver was a few feet outside the house, cross modulation ceased. A trap circuit in the antenna was of no benefit, which was further proof that the difficulty was external to the receiver. It was observed at this location, as well as at others where the effect was serious, that the house wiring was of the knob and tube type and the service mains from the distribution transformer were overhead. A filter near the receiver, consisting of two 0.1 uf capacitors across the line with the center point grounded had only a slight effect on the interference, but an additional capacitor across the line where it entered the house greatly decreased the cross modulation. It was further found that by placing the antenna at a distance from the power lines and using a shielded lead-in, the external cross modulation disappeared.

Rectification a Cause

THIS EXPERIENCE SHOWED THAT THE CROSS MODULATION WAS DUE TO RECTIFICATION OF RADIO FREQUENCIES IN THE POWER WIRING, with resultant new, spurious frequencies being induced in the antenna or lead-in. Radio signals were picked up by the power wiring or other metallic conductors near the receiving antenna and at some point along the conductor were impressed on a rectifier or non-linear circuit element. A simple laboratory test confirmed the observations. Two antennas were placed a few feet apart and to one of them a radio receiver was connected. An impedance was connected between the other antenna and ground, and

when a simple diode was connected across this impedance, cross modulation of the signals in the first antenna occurred.

The question arises as to where the rectifier may exist in the field. Wherever there is a poor connection between any two metallic bodies, especially if oxidation is present, rectification can take place. **THE POOR CONTACT MAY BE IN THE LIGHTING LINES, IN PIPING, OR EVEN IN THE ANTENNA ITSELF.** When such a rectifier exists, and one or more powerful signals are present, new frequencies are generated by the rectifier. Where only one powerful signal is present, the only new frequencies made by the rectifier are multiples of the fundamental, that is the second harmonic, third harmonic, etc., of the signal frequency. Where two strong signals exist, a number of cross modulation combinations take place. Let us call the frequency of one of the strong stations "a", and that of the other "b". Then the rectifier generates the following frequencies:

- a+b 2a-b
- a-b 2b+a
- 2a 2b-a
- 2b 3a
- 2a+b 3b

An effect also takes place whereby the modulation of station with frequency "a" is heard on station "b", and the modulation of station "b" is heard on "a".

Let us suppose that two stations are so located that in the region between them signal strengths of 0.1 volt per meter occur from both, and that one station is on 650 kc. and the other on 750 kc. Then the following table shows the frequencies produced.

- a = 650 kc. 2a+b = 2,050 kc.
- b = 750 kc. 2a-b = 550 kc.
- a+b = 1,400 kc. 2b+a = 2,150 kc.
- a-b = 100 kc. 2b-a = 850 kc.
- 2a = 1,300 kc. 3a = 1,950 kc.
- 2b = 1,500 kc. 3b = 2,250 kc.

Continued on page 7, column 1

Talking Things Over

With W. L. ROTHENBERGER
Manager, Renewal Sales

Talk to any sales manager and you'll soon notice that there is a pretty close relationship between his group and the advertising and sales promotion staff. That's natural because both have their sights aimed at the same target—getting a product or service into the hands of the consumer.

Let's see how the two work together here at RCA and their significance to the dealer or serviceman. Our Field Sales Representatives regularly call on distributors and see that their shelves are sufficiently stocked to meet dealer and service demands, as well as the requirements of industrials, broadcast stations and other large purchasers. The distributors' sales force, in turn, sees that dealers and servicemen have an adequate supply of products.

Promotions Build Demand

So far so good. *But sales feed on demand and this demand must originate with the ultimate consumer—the final user of the product.*

That's where sales promotion and advertising come into the picture.

Take RCA, Cunningham, or RCA Victor tubes for example. We're convinced they're tops—and so is everyone in our Company. Our enthusiasm—backed by unexcelled tube performance records—is passed on to our distributors and dealers. But that isn't enough. To stimulate business we have to communicate this fully to the ultimate consumer, so that he also recognizes, respects, and is sold on RCA, Cunningham or RCA Victor tubes. It is to enlist his continued support and acceptance that our promotions are planned and created.

That is why we provide such a comprehensive line of dealer sales

aids and business-builders—displays, counter cards, banners and decals—to constantly remind your customers and prospects that their radios need to be checked and repaired by experts and that they get the most for their money when they get RCA, Cunningham, or RCA Victor tubes.

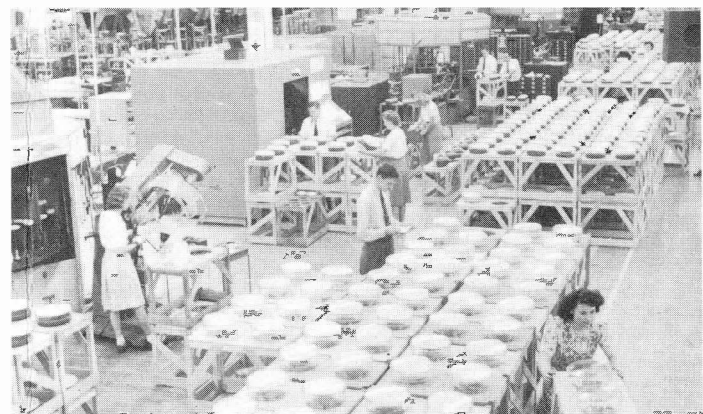
Used properly in window and store displays, these sales promotions do more than help you sell our products . . . they advertise your business. They attract new customers. They reflect prestige on you and your business, and keep your regular trade up-to-date on new merchandise.

Sales Aids Easy to Use

There's no magic formula to apply—just common merchandising sense. RCA, Cunningham, and RCA Victor promotions are based on years of experience and a thorough understanding of the selling problems and objectives of our dealers and servicemen. They can be used and set up without fuss or bother.

You can see RCA's sparkling line of business-boosting sales and business aids in the new Sales Aid Folder for all three tube brands. Get a copy from your distributor, and then order those promotions best suited for your particular needs. With them you'll get "more sell per square foot" into your place of business. We're sure of that!

A GLIMPSE INTO CATHODE-RAY TUBE PRODUCTION



Racks of RCA television picture tubes await processing and tests in this view of a portion of the RCA tube plant at Lancaster, Pa. In the left foreground, a girl employee is seen applying lampblack to the inside of a kinescope to prevent stray light reflections, while at left center is a darkened test booth where the quality of the luminescent screen is checked by temporarily evacuating the tube and applying a high-frequency spark.

THE USE OF WAVE TRAPS AS A REMEDY FOR INTERFERENCE IN VIDEO RECEPTION

Since the beginning of operation of FM broadcasting in the assigned band between 88 and 108 Mc there have been a number of cases of interference with television receivers whose image response falls in this band. As an example of the condition under which this trouble may occur, consider the RCA 1940 television receivers which have a sound if of 8.25 Mc. With these receivers the image response bands are located as shown below:

Channel No.	Signal Band	Local Osc.	Image Band
2	54-60 Mc.	68 Mc.	76-82 Mc.
3	60-66 Mc.	74 Mc.	82-88 Mc.
4	66-72 Mc.	80 Mc.	88-94 Mc.
5	76-82 Mc.	90 Mc.	98-104 Mc.
6	82-88 Mc.	96 Mc.	104-110 Mc.

It can be seen by looking at this tabulation that interference may be expected due to image response with the receiver tuned to channel 2 or 3, and a strong signal present from another television transmitter on channel 5 or 6 respectively. In addition, interference will occur when the receiver is tuned to channels 4, 5, or 6 and a strong signal is present from an FM transmitter operating within the corresponding image band. The RCA wave-trap has been developed to combat this latter type of interference by reducing the response of the television receiver between 88 and 108 Mc.

Conditions Vary

Design and Performance. In discussing the performance of various wave-trap arrangements suitable for this job it must be kept in mind that this device must work under a wide variety of conditions as regards input and output impedances. The input impedance of a television receiver having a tuned input transformer will be highly reactive at the image frequency, which is far removed from the resonant frequency of the input transformer. The

internal impedance of the transmission line considered as a generator will vary over a wide range depending on the impedance of the line, the impedance of the antenna at the image frequency, and the length of the line. So that some kind of comparison of performance may be made, the arrangements to be described may be compared in terms of the voltage produced across a balanced 300-ohm resistive load when the device is driven by a 300-ohm resistive generator.

Employing Stub Line

The simplest arrangement which will give a minimum response at some unwanted frequency is a section of transmission line cut to one-quarter wave-length at that frequency and connected across the circuit. The effect of such a section on the response of a 300-ohm circuit is shown as curve "A" in Fig. 1.

The loss in response at the wanted frequency due to such a stub line may be greatly reduced by connecting across it a short-circuited section of line of such a length that the combined length of the two stubs is one-quarter wavelength at the wanted frequency. The effect of such a combined section is shown as curve "B" in Fig. 1.

In each case the stubs were cut for an unwanted frequency of 98 Mc. and a wanted frequency of 70 Mc.

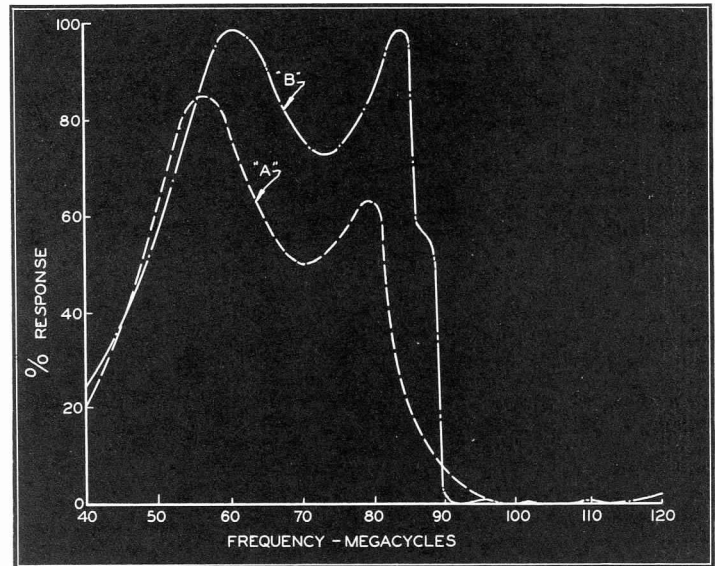


Figure 2. Response curves "A" and "B" taken when more elaborate wave traps are used.

300-ohm RCA "Bright Picture" line was used for curves "A" and "B". Practically, it is necessary to use shielded wire for these stub sections to get maximum rejection of the unwanted signals.

Combination Stubs

To retain the advantages of shielded wire as regards eliminating direct pickup of the unwanted signal, and still obtain good response over the wanted band, two of the combination stubs can be used conductively coupled to obtain a double-humped response curve over the wanted band. This is the circuit used in the RCA trap. The mechanical arrangement and approximate equivalent circuit are as shown in Fig. 3a.

The response of this trap when connected between a 300-ohm generator and a 300-ohm load is shown

as curve "A" in Fig. 2. A further improvement as regards both the response over the wanted band and rejection over the unwanted band may be obtained by using a lower loss line with higher impedance, and a somewhat more complicated circuit. The most satisfactory line found after a number of tests was made by placing a copper braid over two of the cores from RG-59U cable side-by-side. The mechanical arrangement and approximate equivalent circuit are shown in Fig. 3b. The response of this trap when connected between a 300-ohm generator and a 300-ohm load is shown as curve "B" in Fig. 2.

The dimensions shown in all sketches are for one type of shielded twisted-pair cable; these dimensions will vary with different types of cable due to the difference in velocity constant.

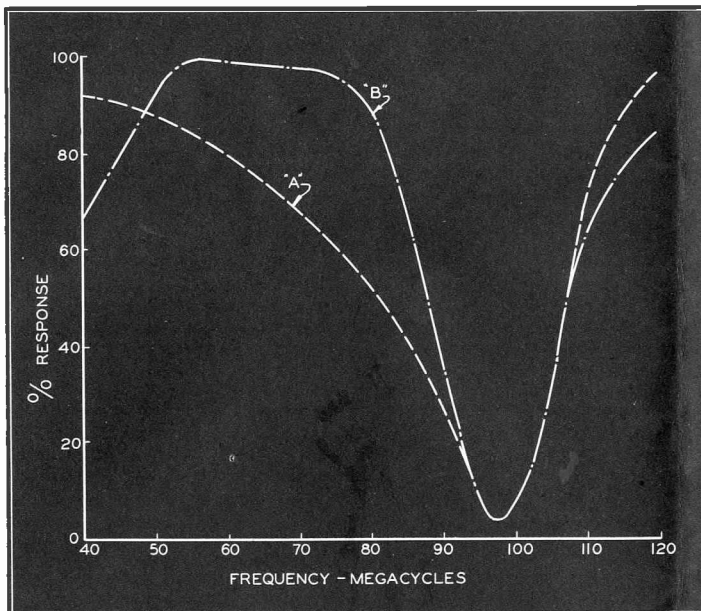
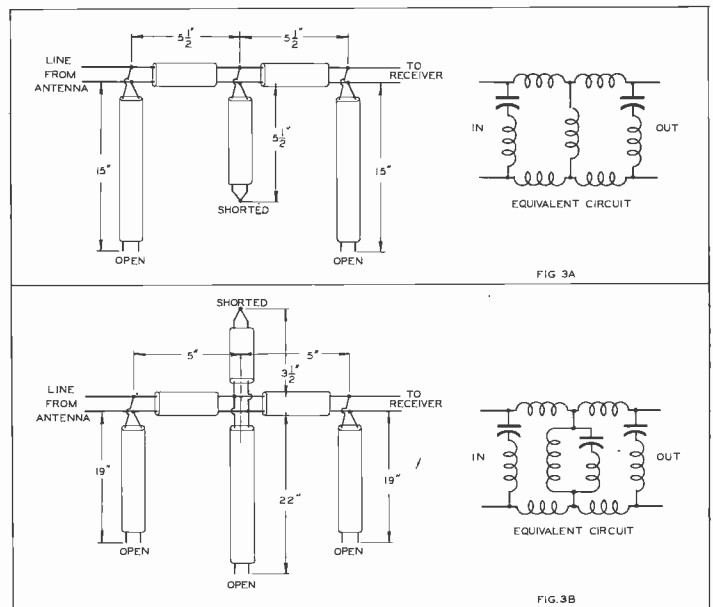


Figure 1. Response curves "A" and "B" resulting from the use of simple wave traps.



Mechanical arrangements of two types of wave traps and their approximate equivalent circuits.

PUT THESE TO WORK



The eye-catching new battery promotions shown above have been especially designed to bring more sales your way. Place them on counters and in windows of your store or shop and watch your battery business grow. Illustrated are the colorful Connie Joannes 22" x 30" display, the new "personal radio" battery display, and two vivid streamers.

SERVICING RECORD CHANGERS REQUIRES LOGICAL PROCEDURE

A simple, logical procedure has been developed through the years for efficient radio servicing. Servicemen have found that such a routine saves time and insures a good job. But many servicemen approach automatic-changer servicing by the "cut and try" method, with the result that they regard changer servicing as difficult. Too many servicemen, when servicing a mechanism, seem to forget the lessons radio servicing has taught; forget that common sense, systematic methods always pay.

Just as the most complicated radio is merely a series of basic and simple electrical and radio circuits, so a seemingly complicated changer is a series of simple mechanical actions of springs, levers, cams, studs, and motors. In the same way as your Chanalyst is used to check one section of the radio at a time to determine the section at fault, so with a changer watch one mechanical action at a time until convinced you understand it and that it is operating normally. Then go on to the next action in the cycle-sequence, determining in this way the particular "action" at fault.

Spring Tension Important

Values of resistors and capacitors in a radio must be correct for proper operation. Similarly spring tensions must be correct in a changer. Levers are pushed by cams or other levers and are kept in place and returned to original positions by springs. If a spring is stretched, or is unfastened, or is missing, the lever will not be where it belongs at the proper time and erratic or faulty operation will result. Or if a spring is too stiff, the tension will be too great and the lever will be pulled out of position. In some operations, one spring pulls against another. If the tension of either spring is incorrect one will overpull the other, causing improper action and positioning of levers. Springs showing a tendency to become unfastened should be cemented in place at each end. Each

spring in the changer must be in place and must exert exactly the correct tension for proper operation.

Use Service Notes

High-resistance connections in a radio cause loss of power and improper action of circuits. Such high resistance must be located and eliminated for proper results. In the same way, friction in bearings or between rubbing or sliding surfaces causes loss of power and improper action in a changer. Complaints of lack of power or slow speed may nearly always be traced to friction. For example, with the single-bearing, capacitor-type motor, insufficient lubrication of the bearing will result in slow speed and lack of torque. Remove the armature and clean it and the bearing with carbon tetrachloride. Judicious polishing with crocus cloth may be advisable. Then use a good lubricant, making sure it is proper for the job it has to do.

Proper adjustment of a radio's tuned circuits can only be accomplished by consulting the service notes and following the procedure of the alignment table. "Hit or miss" alignment methods could not be expected to result in a properly adjusted radio. In the same way, adjustments of a record changer should not be attempted by the trial and error method. Follow exactly the adjustment procedure of the service notes.

GOOD PUBLIC RELATIONS CAN BUILD SALES AND SERVICE VOLUME

By BERNARD MILLER

Public relations is only a fancy label for a hard-working activity that can—and should—be one of the most valuable merchandising tools in the radio service dealer's bag of business tricks. As a matter of fact, you, the radio service dealer, are probably using public relations right now without specifically calling it by that name.

There are two kinds of public relations. "Everyday" public relations consisting of the good humor with which you greet your customers, the neat appearance of yourself and shop, and the good faith which you exercise in all your dealings with the public.

The second kind, let's call "professional" public relations.

This is the art of aggressively publicizing your business, putting yourself, your products and services in the limelight—not necessarily on a straight paid basis as in advertising, but by means of active exploitation and attention-getting devices.

Bylines are Valuable

How can you catch the public eye and ear.

First and foremost, there are your local newspapers, daily and weekly. Because that's the way he makes his living, the editor will welcome timely or interesting items or stories if they stand on their own feet as genuine news.

If you're selling industrial tubes and component parts to local plants and factories, open the eyes of your city editor to the new industrial revolution being fomented right in his own backyard by electronics.

If you're really ambitious, you can establish yourself as the kingpin

of radio service in your community by offering to write a weekly radio "question-box" column for the local paper in which you publicly answer Mrs. Spelvin's query on why she has to hammer the top of her radio to make it play.

Build Your Reputation

Finally don't neglect those little personal items about yourself and business. Tell the papers about the arrival of that new baby, the expansion of your business quarters, the hiring of new personnel.

A tremendous amount of public relations activity is channeled through local clubs, and organizations. Depending, of course, on your interest and ability as a public speaker, the Kiwanis, Rotary, YM's, women's clubs, Boy Scouts, etc., will welcome you as a source of interesting and informal talks and demonstrations on electronic subjects.

It takes a little alertness, aggressiveness and ingenuity, but it pays off. Boiling it down to definitions: Advertising directly moves the goods off your shelves.

Public relations builds your reputation.

Reputation is the people saying, "He's the man to do business with! He's a good man to do business with!"

RCA DISPLAY PLANNING GUIDE BOOK



Prepared in collaboration with Stensgaard Associates, top merchandising outfit, this new brochure shows how to convert your store space into hard-hitting selling areas through the use of the colorful RCA Comuras and posters. See it at your Tube and Parts Distributor.

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.

SIMPLE PROCESS HELPS TO ELIMINATE SPEAKER WARP

Noisy reception caused by a speaker cone that has become warped may be cured by reprocessing the cone in the following manner. Shims are placed between the speaker cone cylinder and magnet to center the cone. Then warm water is sprayed over the entire cone, either with an atomizer or ordinary spray gun such as is used with insecticides until the cone is thoroughly dampened. The cone is next dried and the shims removed. It will be found that all torque and warp will have been dissipated while the cone was in a pliable state.

H. W. Colp
P. O. Box 151
Bridgewater, Nova Scotia

SMALL SPINTITE WRENCHES MADE FROM ALLEN SCREWS

Most of the standard sets of spintite wrenches do not include units to fit very small nuts. Here is a simple way of rounding out your spintite kit.

Purchase a complete set of Allen set screws. These should be as long as possible. Grind down the threads and force fit the threadless shank

into a 7-inch piece of hollow brass or copper tubing. Make certain, when grinding, not to remove too much metal from the screw or it may break off below the head during use. The result is a complete set of spintites to take care of almost any small-size nut.

A. L. Fried
RCA SERVICE CO.
429 Fourth Ave.
Pittsburgh, Pa.

HOW TO READ TYPE BRAND THAT HAS WORN OFF TUBE

Occasionally, it becomes next to impossible to identify a tube because the type designation brand originally imprinted on it has become worn-and dim through constant handling and use. Placing the tube in a refrigerator until it has had a chance to cool thoroughly, removing it, and then breathing on it, will cause the brand to reappear momentarily until condensation disappears. If a refrigerator is not available, breathing on the tube will in itself be sufficient in many cases to cause the brand to become clear.

Jerome Hollander
2702 W. North Ave.
Chicago 47, Ill.

MORE TYPES OF RCA BATTERIES — FOR MORE SALES



RCA puts you in the lead with a completely rounded out line of batteries for radio use. There's a strong customer preference for the famous "red-white-and-black batteries" with the RCA emblem. Strategically located warehouses carry stocks of fresh RCA batteries at all times. Get the facts on the complete RCA battery line now from your RCA Tube Distributor.

ELIMINATING FRICTION DUE TO GRIT IN CONE CYLINDER

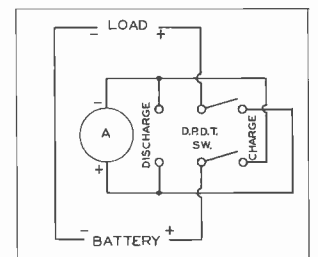
Occasionally when a receiver is used in locations where a heavy dust content exists, minute particles of grit may accumulate between the speaker cone cylinder and the permanent magnet. This is especially true where the protective felt center-pad has, for one reason or another, become detached from the speaker.

By the simple expedient of placing a drop of volume-control lubricant on a needle and carefully distributing it between the cone cylinder and magnet, it is usually possible to eliminate any friction caused by grit.

Leo Rozman
64 Bay 28 St.
Brooklyn, N. Y.

CIRCUIT TO CHECK SELF-CHARGING BATTERY CELLS

I have found the circuit described to be a quick and convenient way of checking self-charging Willard type storage cells used in portable receivers. The method tests charge and discharge while the battery is in the radio circuit and is being used under actual operating conditions.



Charles Sandberg
377 Hinsdale Street
Brooklyn, N. Y.

AERIAL ADDITION TO LOOP ANTENNA SETS UPS GAIN

Quite frequently a loop antenna superhet will be brought in for servicing because it lacks sufficient sensitivity to pull in some of the small local stations which operate on low power. Or, if the signal of such stations can be heard, there is usually a large background noise which makes listening difficult.

Soldering one end of a five-foot wire to the stator of the rf tuning condenser and allowing the other end to hang free will increase the signal-to-noise ratio and give better reception on the small stations. As a safeguard, it is best to tape the free end of the wire so that the owner of the receiver will not ground it and cause the rf coil to "blow".

Leroy Davis
% American Radio Institute
101 West 63rd Street
New York, N. Y.

REMEDY FOR OFF SCALE NEEDLE IN VOLTOHMYST

If the meter needle drives violently off scale on Junior Volt-Ohmysts when no test is being made, remove the cover from the "Ohms Adj." potentiometer R23, insulate the inside of this cover with cambric cloth, fibre paper, or lacquer, and replace. If the trouble persists, do the same to the covers of the "DC Voltage Calibration Adj." potentiometer R22 (be careful not to disturb its adjustment or recalibration with a voltage standard will be necessary), and the "Zero Adj." potentiometer R21.

RCA Supplementary Information No. 8.



"If it works as well as you claim, we'll buy one."

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 VICTOR MASTER ANTENNA—Stock No. 9852

This antenna is designed for those difficult installations in extremely noisy locations. A unique noise-balancing circuit, when individually adjusted for the installation, gives a high degree of noise reduction. This antenna is not dependent on location for its noise-reducing qualities. The frequency range covered is from 540 to 23,000 kc., which includes all standard-broadcast and foreign short-wave bands.

Suggested list price (less coupling transformer)—\$5.50.

ANTENNA COUPLING TRANSFORMER—Stock No. 9813

For use with RCA Magic-Wave Antenna, stock No. 9812, when more than one receiver is used on each antenna. One transformer is required for each additional receiver.

Suggested list price—\$2.90.

ANTENNA DISTRIBUTION TRANSFORMER—Stock No. 9814

One required for every four additional receivers when many receivers are used with antenna, stock No. 9812.

Suggested list price—\$3.50.

ANTENNA COUPLING TRANSFORMER—Stock No. 9912

Designed for coupling outside aerials to receivers having loop antennas.

Suggested list price—\$2.45.

ANTENNA MAST—Stock No. 9876

Ash pole for television or FM antennas. 51 inches long.

Suggested list price—\$2.20.

MAST CLAMPING YOKE—Stock No. 9879

"U" clamping yoke for mounting television antenna mast. Complete with nuts and washers for installation.

Suggested list price—\$.75.

OSCILLOSCOPE CALIBRATION SCREEN—Stock No. 9739

For three-inch cathode-ray tube. Designed for use with oscilloscope model TMV-122.

Suggested list price—\$.30.

RCA HEADPHONE ADAPTER—Stock No. 9715

A handy unit for connecting hearing aids or headphones to any radio. Has three positions—one for speaker alone, one for both headphones and speaker, and one for headphones alone. Easily connected across voice coil and gives proper impedance match. Finished in attractive brown wrinkle lacquer and fitted with 36-inch cable and terminal block.

Suggested list price—\$3.85.

MAGNETIC PHONOGRAPH PICKUPS

These RCA magnetic pickups are the finest units of this type available. They are designed for excellent frequency response. Special mountings prevent vibration pickup. These units fit many of the older models. Select the one suited to your requirements. You are assured of the finest in magnetic pickup design.

For model 381—stock No. 9662—suggested list price—\$7.25

For model T5—stock No. 9663—suggested list price—\$6.15

Pickup arm for model RE-45—stock No. 9682—

Suggested list price—\$5.30

ELECTRODYNAMIC SPEAKERS

Here are exact replacements for electrodynamic speakers. All have standard 3.2- or 3.4-ohm voice coils. There are only a few left so place orders early.

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 in model 4T.

Suggested list price—\$6.50.

Stock No. 9697—7-inch, for auto radios. Comes complete with cable and connector. Less case.

Suggested list price—\$7.75.

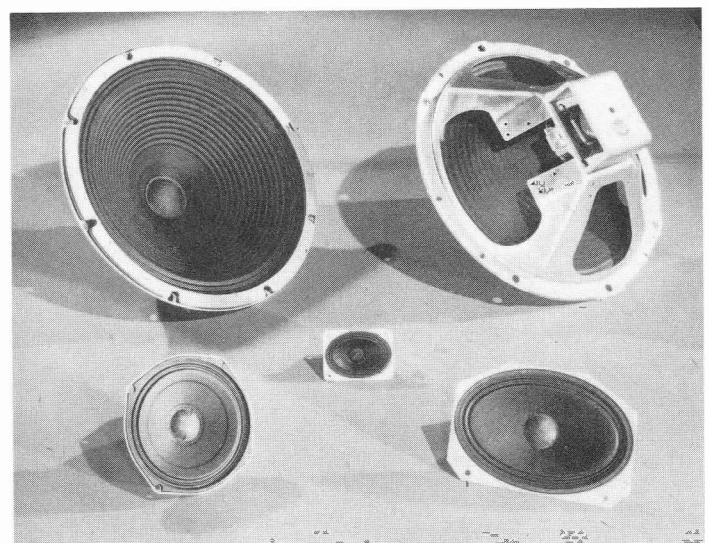
RCA "CONTROLLED RESONANCE" 12-INCH PM SPEAKERS

The "Controlled Resonance" Speakers are the result of years of basic research by RCA scientists. Each scientifically-engineered feature makes a basic contribution to rugged design and quality reproduction. Controlled resonance is the secret of dependable quality performance and is based on the following design features:

1. Seamless RCA felted cone—with low resonant frequency—assures continuously smooth, uniform vibration.
2. One-piece stamped steel frame assures rattle-free operation. On types 312S1 and 412S1, dual-mounting takes rubber grommets where dampening is needed. On type 412S1, the rim is provided with slots for solid mounting, and comes complete with mounting gasket.
3. RCA-patented device automatically filters needle scratch and 10 kc squeals.
4. Adjustable voice-coil mounting for speedy, accurate installation and adjustment.
5. Rugged mechanical design—rust-proof, dust-proof. The RCA "Controlled Resonance" 12-inch PM Speaker delivers 12 watts of undistorted output. With the exclusive RCA Clamping Spring, the powerful ALNICO V magnet is permanently locked into position at 70 pounds pressure. No cement is used. In addition, lasting protection against dust and corrosion is provided by the welded centering ring and Bakelized cloth suspension. Types 312S1 and 412S1 are provided with $\frac{3}{8}$ inch mounting holes for rubber grommets in addition to mounting slots. All three types are manufactured to meet RMA specifications.

Type	Watts	V. C. Imp. (ohms)	Magnet Weight (oz.)	Suggested List Price
312S1	12	3.2	2.15	\$12.50
412S1	12	3.2	6.8	16.50
412S4	12	6.8	6.8	16.50

NOW A LINE OF STANDARD LOUDSPEAKERS BY RCA



You can reap greater profits and customer satisfaction from RCA Standard Loudspeakers. In addition to meeting most replacement requirements these speakers have RCA-engineered features that provide superior performance. Ten types service most sets. And they're competitively priced. They're available at your Tube and Parts Distributor.

TUBE PRICE ADJUSTMENTS COMPLETED

Details were announced this month of a price adjustment on receiving tubes. The move followed a detailed review during the past year of prevailing labor, materials and other costs as well as the demand for tubes by type. An upward adjustment has been made on some types, and reductions on others. The adjustment is effective as of August 25th. A new suggested list price card showing the changes is being enclosed with this issue of RCA RADIO SERVICE NEWS.

CROSS MODULATION

Continued from page 2, column 2

In this example these two stations would produce five new frequencies in the broadcast band and five new frequencies outside the broadcast band where one or both the stations together would be heard. It can be appreciated readily that a large amount of interference will be produced in this manner. The interference produced by station of frequency "a" on frequency "b" and vice versa has been found to be serious only when the rectifying action is particularly severe because the modulation of the strong desired station usually masks the interfering modulation.

IT MAY BE SEEN ALSO THAT THERE IS A POSSIBILITY OF HUM MODULATION BEING INTRODUCED WHEN A RECTIFYING CONDITION EXISTS IN THE POWER WIRING. In this case, one of the frequencies is that of the signal carrier and the other that of the lighting system, which is usually 60 cycles. The rectifying action then imposes a 60-cycle modulation on the carrier. Some instances of modulation hum in receivers at certain locations have been traced to this source. Hum of this type would be present in a battery receiver at the same location. The remedy is the same as for interference between stations, namely elimination of the rectifying condition or changed installation of the antenna to avoid pickup of resultant spurious frequencies.

Manner of Diagnosis

In investigating a situation where interference exists, the first step should be to determine whether or not it is due to external cross modulation by observing the frequencies at which interference exists.

For example, with the two strong signals at 650 kc. and 750 kc., if the program from both is heard at 550 kc., 850 kc., and 1,400 kc., it may be safely assumed that the trouble is due to external cross modulation. If the interference is not due to external cross modulation, shortening the antenna or installation of a wave trap tuned to

the interfering signal, or both, will remedy the situation.

Cross modulation may, of course, be produced in the radio-frequency or first-detector stage of the receiver if the tubes are not of the remote cut-off or variable- μ type or if the operating bias is, for any reason, incorrect. Cross modulation occurring in the receiver can be differentiated from that due to external causes by use of a short antenna, a wave trap tuned to the strongest interfering station, or by substituting another receiver.

Eliminating Rectification

As seen from some of the cases, the rectifying element may be in the power wiring, piping, or in the antenna itself. *Therefore, the first step in eliminating the trouble should be to make sure that the antenna and grounds connections to the receiver have secure, tight joints throughout soldered joints in the antenna being preferable. If this does not cure the interference, the next step is to endeavor to find the rectifying element elsewhere.* If the rectifier is in the power wiring, connection of two 0.1 uf capacitors across the lighting lines, with the center point going as directly as possible to a good ground, should produce at least some decrease in the cross modulation.

IF THE SOURCE OF RECTIFICATION CANNOT BE LOCATED, IT STILL IS USUALLY POSSIBLE TO SECURE INTERFERENCE-FREE RECEPTION BY THE PROPER TYPE OF ANTENNA INSTALLATION. The location for an antenna which is free from cross modulation can be readily found by the use of a portable battery receiver equipped with a short antenna. It will be found that the cross modulation occurs in the battery receiver when it is within the house, but disappears a few feet outside the house. By this exploration means, a location for the antenna may be found where cross modulation does not exist. The spurious frequencies will, however, be picked up on the lead-in unless it is thoroughly shielded. In some cases metallic braid shielding may not be good enough and concentric transmission line cable must be used.

NEWLY ANNOUNCED RCA TEST OSCILLATOR USES IMPROVED SERVICING TECHNIQUES

A new test oscillator that reduces testing and alignment time by as much as 50% has been announced by RCA. It's the WR-67A Test Oscillator—designed for trouble shooting, alignment, measuring of response, analyzing performance, or testing radio circuits.

The WR-67A is of particular use on the service bench for finding the source of trouble by the modern and efficient signal-injection method. A signal-injection probe, supplied with the instrument, makes the application of rf, if, or audio test signals to any part of a receiver with the utmost speed and simplicity. This method is also excellent for an indication of stage-by-stage gain. The instrument's compensated Hartley-type oscillator will maintain an output of 1 volt over the entire frequency range of 100 kc to 30 Mc. Four attenuator levels plus fine adjustment provide continuous control of rf output from 4 microvolts to 1 volt. This leads to easier operation and greater accuracy in control of output voltage.

Facilitates Alignment

The audio oscillator circuit is of the stabilized transformer-coupled type for internal modulation at 400 cycles. A jack is provided for external amplitude modulation; and when it is used, the audio oscillator serves as an amplifier. This feature isolates the source, assures constant loading, reduces radiation, and lowers input requirements. Modulation characteristic is essentially flat up to 10,000 cycles and modulation is adjustable up to 75 per cent.

To facilitate alignment of if and rf stages of superheterodyne and tuned radio-frequency receivers, a source of modulation at 400 cycles is provided internally. Fundamental signal voltages are generated over

six bands from 100 kc to 30 Mc and the harmonics of the last band may be used for vhf testing. Fixed-frequency channels at 455, 600, and 1500 kc speed selection of aligning signals without need for adjusting the tuning control. The rf output makes this test oscillator valuable for locating trouble in an inoperative or completely misaligned set, also for single-stage alignment work.

Oscillator Stability

Overall fidelity characteristics of a receiver can be evaluated by using the WR-67A in conjunction with an audio oscillator and an output indicator. For audio circuit tests, the 400-cycle modulation supply is helpful.

Excellent oscillator stability, iron-core inductances in the audio circuit, essentially constant-impedance output for each level, and choice of three fixed-frequency channels combine to make the WR-67A an outstanding test oscillator. Use of the 455-kc RMA if channel results in a rapid alignment technique for the if system. The 600- and 1500-kc channels will be found useful for speedy alignment of rf and local-oscillator circuits. Special compensation in the oscillator circuit results in a minimum of distortion in the rf carrier.

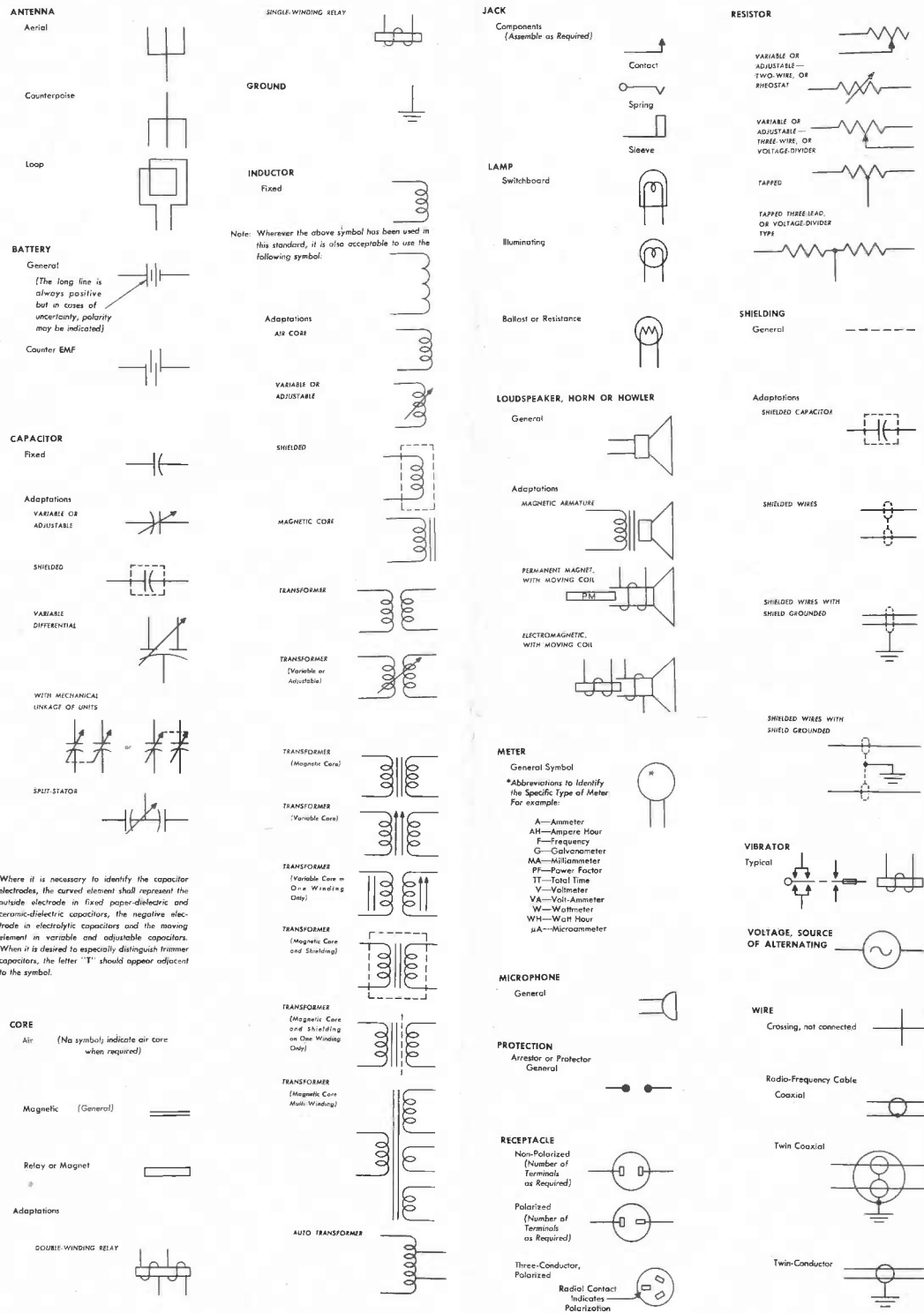
The new WR-67A oscillator is priced at \$130 and deliveries will start in September. Additional details and technical literature may be obtained from RCA Tube and Parts Distributors.

LACKAWANNA GROUP SEES NEW TEST OSCILLATOR



The RCA WR-67A Test Oscillator was exhibited to radio servicemen for the first time at a recent meeting of the Lackawanna Radio Technicians Association, held in Scranton, Pa. Above Art Liebscher (left), of RCA's Test and Measuring Equipment Section, compares an early RCA oscillator with the new WR-67A held by Lou Salton of the RCA New York Offices. Both men were featured speakers at the meeting.

STANDARDIZATION OF GRAPHICAL SYMBOLS AND ABBREVIATIONS FOR USE ON DRAWINGS AS APPROVED BY THE AMERICAN STANDARDS ASSOCIATION



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H. S. Stamm, Editor. Editorial Offices, RCA, Harrison, N. J.