RADIO SERVICE NEWS

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SPECIAL MAILING TO OWNERS OF RCA TEST EQUIPMENT

Registered Owners Receive Eight Page Booklet Gratis

As was announced in the January issue of the RCA Radio Service News, registered owners of RCA test equipment will be entitled to special mailings which explain the complete uses of the various pieces of RCA test equipment so that their owners can get the utmost benefit from them. In that issue, a coupon was included which was to be filled in and mailed to the RCA Manufacturing Company, Camden, so that the owners of this equipment could have their names placed upon this special mailing list.

First Book Covers Chanalyst

During the past month, the first of these mailings was released. It was an eight page bulletin covering the various uses of the RCA Chanalyst. The operation and principles of the Chanalyst were fully discussed. A typical radio receiver schematic was used and the various points where test measurements can be made are indicated. This booklet will prove to be very useful to Chanalyst owners and will undoubtedly assist them in reducing the time required on the average service job.

New Uses Found Daily

The engineers who prepared the booklet have gone into its general applications very thoroughly. However, the Chanalyst is such a versatile instrument that it would be impractical to attempt to enumerate all of its uses. In fact, every day, Chanalyst users are coming across new ways of applying it to the solution of their problems. This can be seen by consulting the Service Tips Column in this paper. Following the booklet on the Chanalyst, similar booklets will be released covering other units of RCA test equipment such as the Jr. VoltOhmyst, the Signalyst, etc.

PUSH-BUTTON JOBS WILL CONTINUE FOR SOME TIME

Demand for Reallocation Kits and Accessories was Heavy

Use of RCA mailing cards by radio service men and dealers is proving the ideal method of contacting customers for push button re-allocation work according to reports from many distributors. While there has been a large amount of push button re-setting done, the major part of the job will probably take several months. The fact that a customer can still tune the radio by hand takes the re-setting job out of the "must" class and it is necessary for the service man or dealer to use sufficient promotion to have this work done.

These cards, of which there are three, point out to the customer the advantage of having his push buttons re-set by a competent radio service man together with the desirability of having his tubes and other parts of the receiver given a thorough check.

They are supplied complete with dealer imprint through all RCA Tube and Equipment Distributors.

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Easy When You Know How

Donna Wood, NBC Vocalist, has just seen the light. She heard about this push button re-tuning business and decided to do her own. After removing a certain amount of wire, she discovered her receiver did not have push buttons. Also, the new tube she bought doesn't seem to fit.

RCA ALLOCATOR PROVES ITS WORTH IN SHOP AND FIELD

Continued Demand Shows Instrument Has Been Accepted as a General Purpose Oscillator

Continued demands, exceeding all expectations, have proven the acceptance of the RCA Station Allocator as a general purpose oscillator. This should have been expected, for any instrument designed to take care of emergency service work will prove to be invaluable for the routine shop work not connected with the retuning of pushbuttons necessitated by the recent station frequency shift. Most service men report that time is the essence of their profits, and anything that can expedite their work is an essential tool. This, they explain is why they feel that the RCA Station Allocator will continue to assist them to get their routine work out of the way in a hurry.

Battery Operation Valuable

The Allocator has eight push buttons and the first two can be tuned down to modern i-f frequencies and be used for general alignment work. Due to its small size it is the ideal oscillator to take out on jobs where an oscillator is necessary. Also its ability to operate on self contained batteries expedites matters where an a-c outlet is not conveniently available. There have been many reports from men who feel that this is one of the instrument's most valuable assets. Often they find a receiver plugged into a single outlet and there is not another one available in the same room. If they do not have a three-way plug with them or an extension cord long enough to reach into the next room they find themselves in quite a dilemma. They state that this situation is nearly always present when working on auto receivers. Rarely do they find an outlet sufficiently convenient to operate their regular shop oscillator near to an auto antenna.

They find that the Allocator is

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TRAINS WILL BE PACKED FOR CHICAGO PARTS SHOW

Trains running to Chicago will be jammed early in June when all radio parts distributors will be scurrying to the Big Parts Show which will open in the Windy City on June 10th. They are all agog, straining at the leash, and eager to see the new equipment that will then make its debut.

Of course, there will be interesting side attractions. So in spite of floods, earthquakes, etc., you better make it a date.

NEW RCA LABORATORIES WILL BE BUILT AT PRINCETON, N. J.

Will Promote Radio as Both an Art and an Industry with Special Attention to the Needs of National Defense

Production for peace as well as defense is the program of the new radio research laboratories—the world's largest—which the Radio Corporation of America will build at Princeton this year.

RCA President David Sarnoff has announced that "RCA Laboratories" will become the headquarters for all research and original development work by the company and for its complete range of patent and licensing activities.

The new organization, now in the blueprint stage, is being set up with a three-fold purpose:

1. To promote the growth of radio as an art and as an industry.
2. To meet the expanding demands of national defense.
3. To facilitate the creation and development of radio products and services which will provide new business and new spheres of employment for the post-war period of tapering industrial defense production.

Under the "impetus" of emergencies such as the all-out defense construction program, according to an announcement by the large radio firm, intensive research in industry leads to the creation of new products, processes, and instrumentalities; but further research and development are required to render them adaptable to the peacetime needs of the public.

Called A Milestone

The building is scheduled to be completed before the end of the year.

RCA executives said the aim of the firm was to equip its research staff with the best and most modern facilities and equipment available. In announcing the move, Mr. Sarnoff expressed the belief that it represented a "milestone in the progress of radio."

"Such important fields as television, facsimile, electron optics, wave propagation and ultra-high frequencies open to radio a future even greater than its past," Mr. Sarnoff said. "The developments in these fields will contribute to the creation of new industries and to the improvement of existing services.

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NEW POWER TUBE BOOKLET IS HOT OFF THE PRESS

The Tube & Equipment Division of the RCA Manufacturing Company has just released the new 16 page booklet "RCA Transmitting and Special Purpose Tubes." This attractive booklet, 8½" x 11" in size, is strikingly printed in red and black and is copiously illustrated with photographs of the different tube types.

This booklet catalogues all RCA non-receiving types — Transmitting Tubes, Transmitting Rectifiers, Television Tubes, Oscillograph Tubes, Phototubes, Acorn Tubes, Gas-Tubes, Voltage Regulators and Special Amplifier Tubes. On pages 10 to 16 inclusive, the charts of phototubes and transmitting tubes facilitate selection of a tube type for a particular service or application.

Tube types that are especially suited for u-h-f uses at frequencies of 100 megacycles and above have been indicated in red for convenient and speedy reference. Similarly, those types that are of special interest to radio amateurs have been indicated in bold face type.

This booklet is made available through all RCA distributors or they may be obtained by sending ten cents to cover the handling costs to the Commercial Engineering Section, RCA Manufacturing Company, Inc., Harrison, N. J.

New Oscillator Proves Speedy

Built for fast work, the new RCA Station Allocator, is a push-button type oscillator with convenience and time saving as outstanding features. Has eight push-buttons and when a-c is not convenient a flip of a switch provides operation from self-contained batteries.

INTERFERENCE ANALYSIS AND ITS RADIO RECEPTION EFFECTS

Disturbances Are Classified According to Cause and Effect for Easy Identification and Remedy

By W. J. ZAUN
Service Division, RCA Manufacturing Co., Inc.

In addition to the following article Mr. Zaun has also prepared the charts which appear as "Reference Data" on pages 7 and 8 of this issue.

Many forms of radio interference occur, each arising from particular causes or circumstances, and each producing typical effects upon reception. Disturbances such as man-made and natural static are rather complex in nature, and are not subject to simple analysis nor cure. Other interference phenomena, however, which are associated with signals having definite wave character, frequency disposition, and intensity, and which bear a relation to receiver characteristics, may be examined conclusively. The more commonly experienced troubles of the latter type are treated herewith.

I. Image Response

On the basis of present practice in superheterodyne design, when a receiver is tuned to a given signal, the local oscillator is at a frequency the amount of the I-F above the signal frequency. The difference in the oscillator and station frequencies is the nominal I-F and signals of this frequency are amplified and transmitted to the second detector of the receiver for demodulation. Should a second incoming signal be present, whose frequency is above the frequency of the local oscillator by the amount of the same I-F, it will likewise tend to combine with the oscillator and produce a difference beat which will appear in the I-F system, and finally at the second detector stage. The interference is heard as a "whistle" or as mixture of modulations of both signals. In this case, considering the oscillator at a particular frequency, there is a signal below it, by the amount of the I-F, and there is a signal above it, by the amount of the I-F. The undesired second signal, when attenuated, or when not allowed to mix with the oscillator, causes no interference. However, if it is possible for this signal to reach the first detector stage, it will also beat with the local oscillator signal when tuning to the desired station. This condition is referred to as "image response". It is a function of the degree of selectivity ahead of the input to the I-F system.

Effects of interference from this cause may be reduced by suppressing the strengths of the undesired local stations which are producing the images. This can be done by reducing the receiving antenna efficiency, or by using wave traps tuned to the "image" station. It must be noted, that harmonics of local broadcast stations, harmonics of the local oscillator, and stations operating outside the limits of the standard broadcast band, oftentimes are sources of "image" interference. Particular attention must be given to the 1700 kc. Police Band, the 2000 kc. Amateur Band, and the 2500 kc. Police Band, in cities where image interference exists. Variation of the I-F is another means of correcting the condition.

II. Harmonic of I-F

When a signal is being received whose frequency is twice that of the nominal I-F; or within a range of plus/minus 10 kc. of twice the I-F, there will appear in the output of the mixer stage a second order effect, or the difference between twice the signal frequency and the oscillator frequency. Whenever the signal frequency is twice the I-F, the normal I-F will be produced in addition to the spurious I-F which is due to the beat between the second harmonic of the signal and the heterodyne oscillator. Since the standard I-F and the extra I-F vary at different rates as the receiver is tuned, a whistle will be heard. Selectivity cannot discriminate against this type of whistle as only a single signal is involved.

Since the number of cities having stations which operate on the second harmonic of I-F frequencies used at the present time, is limited, this interference does not become of general concern, but applies only to the particular locality where the station is situated. Realignment of the I-F stages of any receiver affected, is the usual cure for trouble of this sort. It should be carefully noted and checked as to whether the signal operating at the second harmonic of the I-F is being picked up on the under-chassis wiring of the receiver, in addition to the antenna. In this case the whistle produced will be aggravated. In extreme cases, it is possible to eliminate the whistle by providing a wave trap, tuned to the second harmonic of the signal, and placed in the circuit feeding the mixer stage.

III. Direct I-F Response

When there is a signal present in the receiving locality, whose frequency is the same as that used for the I-F of the receiver, or near thereto, direct pickup of the signal may take place and interference will be reproduced. This interference is not affected by tuning of the receiver, inasmuch as it has a frequency corresponding closely to the fixed I-F resonant circuits. It enters the receiver through the antenna and first stage in most cases, but may be introduced by direct induction to the I-F system.

The degree of interference is related to the amount of I-F attenuation provided in the pre-selector circuits ahead of the I-F system. It is usually evidenced in the form of a "birdie", or in the form of a tone, depending on whether the interfering signal is using CW or ICW during its transmission. The stations which are apt to give interference in the 450-470 kc. intermediate frequency range, are used for code communication and are generally coastal shore to ship stations.

Wave traps in the antenna circuit tuned to the exact frequency of the interfering signal, are effective in reducing this type of interference. In some cases it is necessary to shift the I-F, either up or down, to get away from the interfering station. Use of an RCA Magic Wave Antenna provides an attenuation of approximately 6/1 in the I-F range.

IV. Harmonics of Oscillator

The presence of short wave code or short wave broadcast signals within the standard broadcast band is generally due to their combination with the upper harmonics of the receivers oscillator; the difference of the station frequency and harmonic frequency being equal to the I-F. Spurious reception of this type is most prevalent on receivers employing loop antennas.

Electrically, an antenna loop has the character of a long line, having several resonances in addition to its fundamental tuning. The secondary resonance effects may fall into and provide substantial gain in causing an appreciable level of short wave signal to appear at the first stage.

When this signal is of such a frequency as to combine with a harmonic of the oscillator, and produce I-F, reproduction takes place the same as with the fundamental signals.

Proper treatment of this type of interference should be along the line of (1) Orienting loop for minimum pickup of interfering SW station, (2) Re-aligning loop carefully, (3) Substituting conventional antenna coil for loop, (4) Decreasing oscillator excitation by shunting tickler section with a resistor, or taking turns off this same winding.

V. Combination of I-F

Two stations in the same locality having frequency assignments differing by the amount of the receiver I-F, may combine in the early stages of the receiver, forming a difference beat frequency, equal to the particular I-F. This combination usually

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Camera Study

Those radio men who are also camera fans can find suitable photographic material in their own shop. This study in highlights and shadows shows what can be done with the Chanalyst.

TIME SAVED WITH SELECTIVE RADIO CALLING SYSTEM

Transmission to Selected Receiver Assists Workmen

A new control device for mobile radio systems, by means of which any one car or group of cars can be called without disturbing the other receivers in the same system, has been developed by the Emergency Communication Section of the RCA Manufacturing Co., Camden, N. J. Known as the RCA selective calling equipment, it may be applied to any new or existing radio system. The equipment consists of a transmitter coding unit assembled on a standard speech-input rack, and receiver decoding units similar in size and appearance to ordinary mobile receivers. The control panel of the transmitter coding unit has two rows of eight buttons, from which as many as 200 different combinations of numbers can be used.

Control Panel of Transmitter Coding Unit.

The purpose of RCA Selective Calling Equipment is to make it possible to call a particular receiver (mobile or fixed) in a group operating on the same carrier frequency. Because the selecting is accomplished by means of audio tone which occurs in the middle of the voice range, Selective Calling is adaptable to new or existing systems.

Selective Calling is ideally suited for use by utilities companies with fleets of radio equipped service and maintenance cars. Heretofore, all workmen in the field have found it necessary to halt work—work more often than not being done at some distance from the cars—and return to the cars during radio transmissions to ascertain for whom the message was intended. Now—with RCA Selective Calling—it is possible to signal the one receiver or group of receivers desired. All other receivers remain inoperative. This permits men not concerned with the message to continue their work uninterrupted. Valuable time is saved—confusion avoided.

Selection is accomplished by means of timed pulses of audio tone transmitted over the radio carrier to the receiver. The timed pulses from the receiver are decoded in the mobile decoding unit which responds or not, depending upon the combination of pulses transmitted. It responds to the proper combination, ignores a wrong combination and resets itself ready for the next transmission.

Many Combinations Available

At least 200 different combinations of numbers can be used with complete reliability. The Decoding Unit can be set up to respond to two separate coded signals. This makes possible individual and group calling. To illustrate—with one hundred receivers the following combinations would be possible.

Combination "A" — Each car set-up for individual call utilizing 100 of the possible combinations. One additional combination can be used to which all of the 100 receivers will respond, providing a general call. This arrangement would use only 101 of the possible 200 combinations.

Combination "B"—Each car can be set-up for individual call. In addition, the cars can be divided into groups of 10 each, with each group assigned a separate combination. This would permit calls to be made to cars individually or in groups of 10.

MULTIPLEX SYSTEM FOR "FM" SOUND & FACSIMILE SIGNALS

Performs Two Services on One Ultra-Short Wave Band

Utilizing a single frequency modulated ultra-short wave channel to perform two services simultaneously, facsimile and high fidelity sound, the RCA Laboratories have developed a new method of radio multiplexing.

Microphones in an NBC studio in the RCA Building feed sound over a wire to the "FM" transmitter in the Empire State Building, while the facsimile machine operates in a laboratory at Radio City. A wire line also links the facsimile scanner with the transmitter. The electrical currents, one carrying sound, the other printed matter or pictures, are combined at the transmitter to modulate a one kilowatt "FM" station operating on 45.1 megacycles.

Separation by Filters

In the demonstration the sound and print signals are detected by a receiver at Radio City. The duty of the receiver is to "unscramble" the sound from facsimile, and reproduce both to correspond with the original transmission. Electrical filters do the trick. Then the sound is fed into a high-fidelity loudspeaker. The facsimile signals actuate a carbon paper recorder capable of reproducing printed matter, drawings, maps, pictures, etc. The machine, performing this double duty, is about the same size as a standard radio-phonograph console.

The FM (frequency modulation) channel is 200 kilocycles wide. For the high fidelity sound (30 to 15,000 cycles) 150 kilocycles are used. For the facsimile impulses approximately 30 kilocycles of the channel are employed. The remaining 20 kilocycles are utilized as guard bands to keep the sound and facsimile apart.

The facsimile instrument prints on a strip of paper 8 inches wide. Printing speed is 1¼ inches a minute, making it possible to reproduce a message the size of a business letterhead or an 8 by 10-inch picture in less than ten minutes.

INDUSTRIAL ODDITIES

Brazilian scientists have developed a plastic called "cafelite" from surplus coffee and it has such "great strength and excellent physical qualities" that it could be used for airplane components if not for the manufacture of complete planes, Lord Forres said today. Lord Forres, chairman of the national general export merchants group, was a member of the recent British economic mission to South America, headed by Lord Willingdon. A factory for the manufacture of cafelite articles is near completion, Lord Forres said.

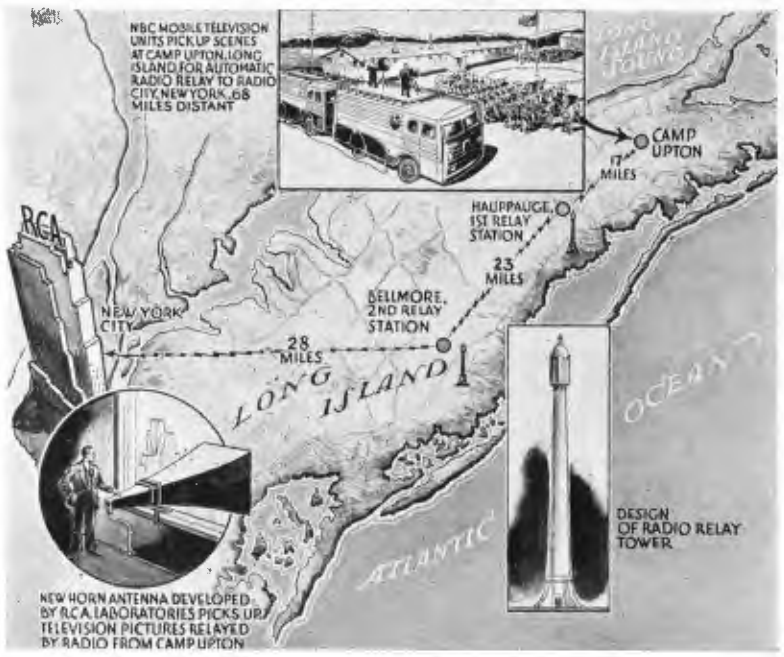
Camden Courier

Hold Everything

Drawn for BROADCASTING by Sid Hix

"Now look what you've done! It wasn't the set. . . . They've just changed all the stations around!"

Radio Relay Circuit



Map showing routes of RCA's radio relay circuit on Long Island. Two unattended intermediate relay stations are used between Camp Upton and the RCA building in New York City.

RCA DEVELOPS NEW TYPE RADIO RELAY FOR TELEVISION

Unattended Repeater Stations Open Many New Possibilities

The automatic radio relay of scenes from Camp Upton, Long Island, to New York, brings into use the new unattended radio stations which "bounce" television pictures across the countryside without the use of wire connections.

This radio relay system, developed by RCA Laboratories, incorporates a number of engineering features and innovations in communication. The relay towers, as designed for future use, are envisaged dotting the landscape to make possible inter-city television and eventually a television network on a national scale.

Inside the "beacon" on top of the tower is a new horn antenna sharply directional in reception and transmission of ultra-short waves. The towers vary in height, depending upon the terrain and distance to be covered. The automatic apparatus for amplifying and relaying is located in the base of the tower. In a split-second after the pick-up and amplification of the signal, the pictures are "search-lighted" in the desired direction.

Ultra-high Frequencies Used

The mobile units of the National Broadcasting Company, stationed on this occasion at Camp Upton, televise and flash the army pictures on the 165 megacycle channel to Hauppauge, 17 miles distant. Hauppauge's automatic relay station intercepts the images and tosses them across 23 miles on 474 megacycles to a horn antenna 200 feet up on a mast formerly used by WEAF at Bellmore. There again, amplification strengthens the picture-carrying impulses for relay on 506 megacycles to New York, 28 miles beeline.

Protruding from a window on the 62nd floor of the RCA Building at Radio City, two horn antennas with their open mouths pointed in the direction of Bellmore, pick up the incoming ultra-short waves that carry the telepictures. These horns, from their 4 by 6-foot openings, taper along the 8-foot length to an apex about 1½ feet square, where a dipole antenna is located. The impulses are fed into the television sets at Radio City, and are also sent over a special wire line to the New Yorker Theatre for projection on the 15 by 20-foot screen. The pictures are 441 lines, 30 frames.

In no instance does the power of the intermediate relay stations exceed 5 watts, an accomplishment attributed in part to the highly directional horn antennas.

Utilizes New Type Tube

Another device of considerable importance to the system is a new RCA tube technically described by the engineers as of "the inductive output type." With this tube, amplification of the television signals at the relay stations is effected at radio frequencies instead of the original frequency of modulation. This tube makes possible the streamlining, simplification, efficiency and economy of operation of the radio relay stations.

Taking further advantage of new development in radio tubes, the relay system in the low power stages (receiving circuit) utilizes a new "orbital beam" tube. Operating in general on the electron multiplier principle, this tube is a new means of obtaining high amplification on ultra-high frequencies.

INTERFERENCE AND HOW IT AFFECTS RADIO RECEPTION

(Continued from Page 2)

occurs when the first tube in the receiver is the mixer stage. It is not uncommon however, for an undesired I-F signal to form in an R-F stage or possibly later in the I-F stages, when the signals are of sufficient intensity or the later circuits are not completely protected against signal pickup. The presence of an extra I-F signal, such as brought about by this mixture of local stations, causes a "whistle" or "birdie" to be reproduced when receiving carriers (not related in frequency to interfering signals) over extensive sections of the tuning range. The "birdie" is created by the audible beat resulting from mixture at the second detector of the normal I-F and the superfluous I-F signals. The latter is a constant frequency, while the former varies with tuning. Therefore, a variable pitch audio note is produced. Zero beat is obtained at the point of exact tuning.

Discrimination against this type of interference is gained by providing ample selectivity ahead of the receiver stage which is susceptible to the mixing phenomena.

For service, discrimination can be provided at the frequency of one of the interfering signals, preferably the strongest, by use of wavetrap or attenuator circuit, tuned to that particular frequency so as to suppress its strength at the input of the susceptible stage. In applying further practical remedies for this interference, it often is essential to reduce antenna efficiency by decreasing its length or adding a small capacitor (50-200 mmfd.) between it and the receiver input antenna terminal. If this treatment is not effective, back-door points of signal entry, such as under-chassis-wiring, grid leads and power circuits should be investigated. Shielding of the susceptible circuits, and filtering of the power line at the receiver with standard units, may be required. In some cases, each possible point of entry may be contributing a component of interfering signal and each must, therefore, be corrected separately before satisfactory performance can be obtained. Re-alignment of the circuits to a higher or lower I-F will be beneficial. Change of alignment by 10 kc. can usually be accomplished without serious effect on the receiver.

The fact that harmonics of the local stations may subtract with each other or with fundamentals of the same stations, to produce a beat of the nominal I-F, must be considered as possible causes for this type of interference.

VI. Heterodyne Oscillator Radiation

The tendency of the oscillator in a superheterodyne to radiate over a limited area occasionally produces interference in another receiver, evidenced as a "whistle" appearing, disappearing and changing frequency at random. This interference becomes prevalent and of consequence in localities where two popular stations are separated by the amount of customarily employed intermediate frequencies (I-F). For example, in a community having a station "A" at 600 Kc. and another "B" at 1060 Kc., receivers using a 460 Kc. when tuned to "A" will have an oscillator frequency at "B" which will cause interference on nearby receivers which are tuned to the 1060 kc. station.

Design precautions are incorporated in most receivers, to minimize radiation. Its complete elimination, however, is not practicable. Limitation of oscillator strength, provision of antenna coupling or tuned stage, and physical separation of antenna and oscillator circuits to prevent coupling, are the usual considerations.

Service procedure on cases of this nature should include one or more of the following measures: (1) Install filter in power circuit of receiver affected (2) Install noise reducing antenna such as RCA Magic Wave type on receiver causing radiation (3) Re-align the radiating receiver to new I-F (4) Position leads of radiating receiver to reduce oscillator/antenna coupling (5) Reduce excitation of radiating oscillator (6) See that good ground is attached to radiating receiver (7) Reduce size of antenna used with interfering receiver (8) Completely shield oscillator stage and filter its supply leads.

VII. Cross-Modulation Within Receiver

Two signals are said to be cross-modulated when the program of an undesired station is super-imposed upon the program of the station to which the receiver is tuned.

As implied, the secondary modulation is directly associated with the carrier being received, and is not evidenced except when tuned to a carrier. In some cases, more than two or more stations may be causing cross-modulation on another. Occasionally, cross-modulation effects will produce extra responses at random points on the dial, usually showing up as a mixture of two signals and their respective modulations. Cross-modulation may occur on TRF as well as Superheterodyne receivers. Its basic cause is usually related to de-modulation of an abnormally strong signal in the early stages of a receiver, and the tendency to re-modulate on other carriers existent in the same circuits. Non-linearity of the circuit element or tube, is of course, essential to this process. The degree of susceptibility of the first stage to extraneous modulation is a matter of tube and circuit design. Tubes employed in the first stages of modern receivers are of the variable-MU types which have an extended cut-off characteristic, enabling the application of a higher bias for reduction of signal strength, without increasing the susceptibility of the stage to detection or cross modulation. Selectivity ahead of the first receiver stage goes a long way to avoid the presence of undesired signals on the grid of the first tube. In some receivers extra link circuits are included for this purpose. The amount of cross-modulation varies with the grid bias of the tube and since this bias is a function of the developed automatic volume control voltage, the cross-modulation is affected by the strength of the input signals.

Where it is necessary to make a service investigation of cross-modulation, the identity of the station causing interference should be established. Where a reasonable amount of selectivity is provided in the head-end of the receiver, an ordinary wavetrap having good attenuation, and tuned to the frequency of the interfering signal, will be effective. It is possible, however, for the abnormal signal to enter the receiver on circuits other than the antenna input. These circuits may be the power line supply, direct pickup on the under-side of the chassis, direct pickup on the grid leads of the receiver, direct pickup on the tubes of the receiver (if not shielded) and some cases direct pickup either on the chassis or on the ground circuit where this is mutual to an R-F circuit. A change of the voltage or operating characteristic of the stage affected is not usually beneficial, inasmuch as design determines the optimum point for the minimum of interference. The principal idea to be kept in mind when working on a receiver in an attempt to eliminate cross-modulation, is to protect the susceptible circuits and to reduce the level of the interfering signal voltage.

The importance of filtering the power circuit, having a short low R-F impedance ground and elimination of ground circuits that are mutual to R-F circuits, must not be minimized nor overlooked. In many cases, wavetraps will not be sufficient where used singly, but two or

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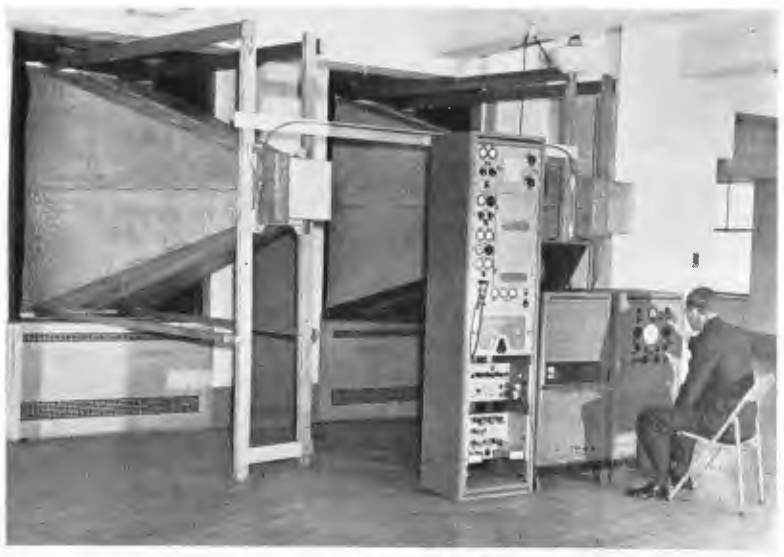
Antennas or Loudspeakers?



These devices that look like loudspeaker baffles are used to direct 506 Mc waves to a dipole antenna located in the small end. They are protruding from windows of the 62nd floor of the RCA building in New York and are receiving from Bellmore, Long Island.

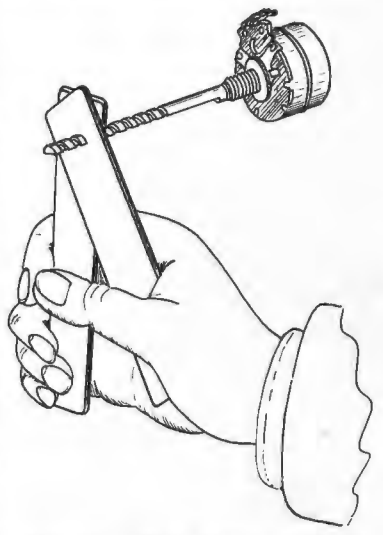
Sans Sarong

In case you didn't recognize her minus the sarong, this is Dorothy Lamour. Although her sarong belongs to Paramount, Bluebird Records have her songs.

NEW CONTROL IS EASILY ADJUSTED TO VARIOUS SETS

Notched Shaft Is Readily Cut to Length with Special Tool

RCA replacement controls are being stocked with a new type of shaft that can be easily cut to the desired length. The shaft is sufficiently long for most any installation and has notches in it that make it easy to cut. This will considerably simplify the stocking of replacement controls because heretofore there were several shaft lengths for controls which were otherwise similar.



Showing RCA Shearing Tool (Stock No. 38600) in operation.

The shaft can be readily cut to length with side cutters, file, or hacksaw, or a special tool is available for the purpose. The special tool, Stock No. 38600, consists of two pieces of metal which, when placed over the shaft as shown, and then pressed together, will make a quick clean shear.

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WHAT IS YOUR DESTINATION?

Conversations with groups of service men invariably bring to light the fact that many service men have a secret ambition to enter some other field of electronics. This feeling does not appear to be brought about by dissatisfaction with radio servicing but more from a natural human instinct that makes one feel the "Grass is always greener on the other side of the fence." A person who feels this way is not necessarily an interloper in the profession nor would it be wise to discourage such inclinations. Curiosity is typical of a healthy mind and is the motive power that has developed some of our greatest inventions.

To prepare for entering another branch of the electronics art requires careful consideration. There may be increased profits in specializing if one's desire to do so is sufficient to generate the required energy. At the top, the field is wide open. This is as true of radio servicing as of anything else. Any trade or profession is profitable and alluring to anyone who will keep abreast of the times, is ambitious and has sufficient business ability to operate profitably. There is no easy road to the heights, particularly to the specialized activities. Most of the specialties are interwoven with other lines and require knowledge and skill in the allied field to which the specific electronic equipment is being applied.

Must Study in Allied Fields

If one is considering the study of automotive equipment by means of the oscillograph or other electronic equipment one must also have a thorough knowledge of mechanics and thermodynamics in order to apply and interpret the results. One must understand what takes place in an automobile cylinder.

In aviation radio one cannot do one's job properly unless he has a good understanding of how the equipment is going to be used. One must have a good knowledge of aerial navigation and of the rules and regulations governing airplane traffic. Also a good understanding of airplane construction is essential. It is easy to ruin a plane by drilling holes in the wrong place.

Marine installations likewise require specialized knowledge. One man grounded his radio installation to a sea cock. In a few months the valve had disintegrated due to electrolysis and the boat was lost—those aboard nearly lost their lives.

Opportunities are Many

It would be futile to try to list all the specialized electronic activities. To the musically inclined there are many new electronic musical instruments that are challenging with possibilities. There are police radio, commercial radio stations, carrier current transmitters, and a host of other communication devices and services. Industries are rapidly installing loudspeaker systems and photoelectric devices for controlling material movement, opening doors, controlling temperatures, etc.

In spite of its having been delayed for a time, the widespread use of Television is inevitable. To break into this line one must know radio circuits forward and backward. It requires the use of frequencies not usually encountered elsewhere and the circuits are proportionately more complex.

In the medical field there are X-rays and Diathermy devices that require competent technicians for installation and maintenance.

Education is Necessary

The above is only a very brief resume of some of the possibilities in the field of electronics. This field is wide open to anyone who will pursue his choice with diligence. To advance in any of these branches requires a fundamental knowledge of mathematics. There are many legitimate evening and correspondence schools that offer worthwhile instruction and the person determined to advance would do well to avail himself of the opportunities so offered.

Before starting a new endeavor one should learn all there is to know about it. He can then look for placement with confidence because he has something to offer. In working on his own, no work should be attempted without a thorough understanding of all the factors involved especially if the safety of human lives depends upon the results.

An excerpt from the March, 1941 issue of the magazine "Electronics" states, "Hardly a day goes by, now, but that ELECTRONICS staff receives call for trained men, **but there are no such men.**" With such a condition in effect, those who have trained themselves for special work should find easy going. Those who have not, should begin to do so now with all possible haste. The big thing to remember is that any art is difficult to master, but those who diligently persist toward a chosen goal cannot help but reap a rich reward.

NEW TELEVISION COVERS STANDARD THEATRE SCREEN

RCA Equips New York Theatre to Show Television Pictures

Large screen television equipment projects a 15 by 20-foot picture on the screen in the New Yorker theatre, 254 West 54th Street. There is featured, in addition to new developments in projection, a new multisonic sound system developed by RCA Laboratories for use with the television screen.

A steel-barreled projector pointed over the edge of the balcony casts the television images on the stage screen 60 feet distant. Alongside the projector are control desks at which operators manipulate the knobs that regulate the picture and sound. These operators exercise the same control over faces and scenes as radio control men do over broadcast music and speech. The pictures, as they come over the wire from an outside point, are received first at the control desk to be fed into the projector. In today's demonstration the Camp Upton scenes relayed by radio to the RCA building are forwarded from Radio City to the New Yorker Theatre over special wire circuits.

Uses Multiple Sound System

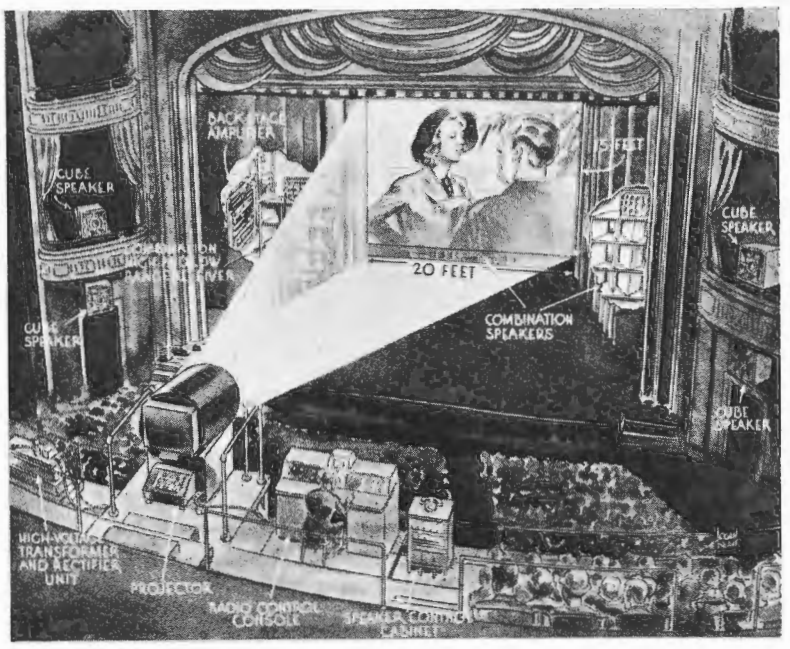
The sound reproduction system used in connection with the theatre television unit is of the extreme high fidelity type, similar in effect and arrangement to the "Fantasound" used in the motion picture "Fantasia." Differing from Fantasound in that it is manually controlled at the scene of reproduction, the multisonic system permits movement of sound with action on the screen, rotation of sound around the walls of the auditorium, and emanation of sound from any one desired point in the theatre.

Developed in the RCA Laboratories, the large-screen theatre television system operates on signals delivered to it either by coaxial cable or by special wire circuits.

The installation in the theatre consists of three main units: control, power supply, and optical system.

An array of knobs and dials on the control panel gives the operator immediate handling of all controlling, metering, and deflecting elements. He can obtain at any time, every possible check on the operation of the system. Sharpness, brightness, contrast, and size of the image projected may be changed by the turn of a knob. The controls are so simplified that the average motion picture projectionist could operate the unit with but slight training.

Large Screen Television



An artist's conception of the equipment layout used by RCA for its television theatre installation in New York.

High Voltage Required

The second unit, the power supply for the optical or projection system, is a conventional high-voltage rectifier rated at 70,000 volts. Normally, operation is at 60,000 volts.

The optical, or projection unit, is considered the most important as well as the most complicated of the entire system. For purposes of description, it is possible to divide the unit into three principal elements; that is, the kinescope, or projection tube; the reflecting mirror, and the correcting lens, or plate.

The kinescope, built to handle high voltages, is similar in performance to the kinescope used in RCA's standard home-television receivers. The face or diameter of the tube is 7 inches; the tube's length is 14 inches. It is mounted in the center of a hollow steel-shielded cylinder 34 inches in diameter and 34 inches long. The face of the tube is pointed away from the stage screen, and the end of its neck pierces a small hole in the center of the correcting plate of the optical system.

The concave reflecting mirror, 30 inches in diameter, is mounted a few inches in front of the tube's face. The image on the face of the tube is picked up on the concave surface of the mirror, passed through the correcting lens and onto the screen with a magnification of 45 times. The lens corrects for aberrations and passes the image across the auditorium to the stage screen.

Unique Optical System

The optical system is unique in that it has a speed rating of f: 0.7, which surpasses the fastest known projection lens. It was developed by research engineers in the RCA Laboratories, and is a variation of the Schmidt astronomical camera. Optical experts viewed the idea in the beginning as impractical, but one of the RCA engineers, whose hobby is optics, figured out a formula, devised special grinding instruments, and successfully developed the optical system. The first unit required six months to produce, but the technique of grinding the lens was improved to the point where the one used today was ground in six weeks.

The optical unit housing is mounted on a pedestal which contains the video amplifiers and the deflecting output circuits. Because of the optical unit's high efficiency, the screen illumination obtainable in the RCA system is adequate for large-screen pictures in theatres.

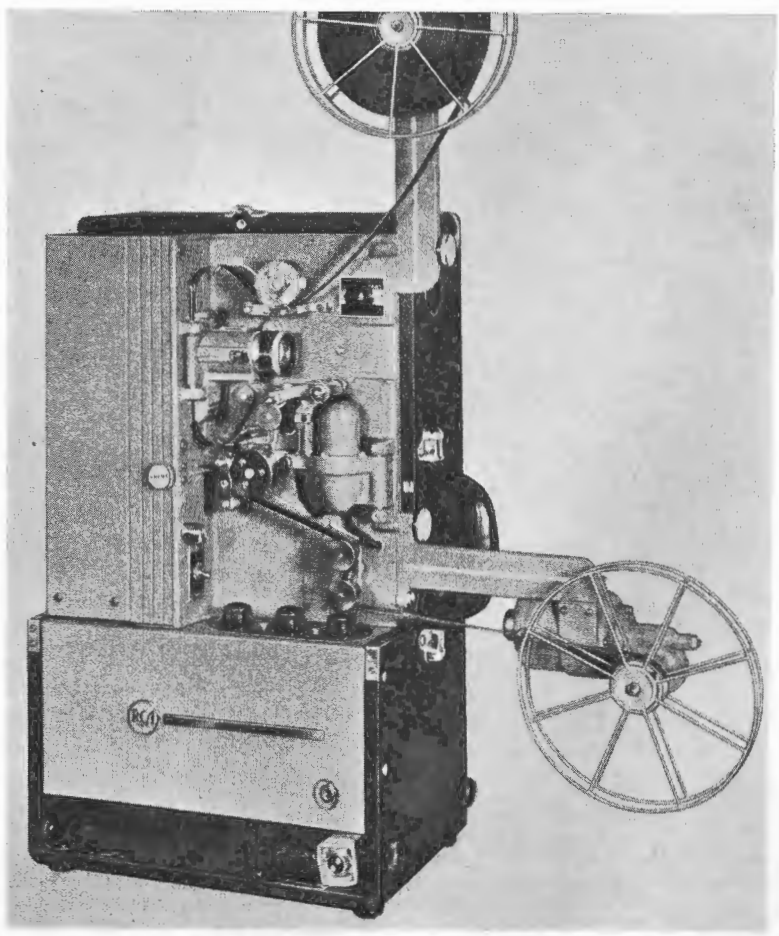
Central Sound Control

Controls for the sound, which accompanies the television projection, are mounted in a separate console, adjacent to the television control desk. They are linked to 18 high and low frequency loudspeakers mounted around the auditorium. Wire lines connect the console with the NBC studios and with the central radio receiving point in Radio City.

Three banks of regular RCA Photophone speakers are set up on the stage near the screen. One bank is at the rear of the screen, and the other two are at either side. Beginning at the outer edge of the proscenium arch, other loudspeakers are located at desired points along the side wall and in the rear of the auditorium. One large loudspeaker is suspended from the ceiling.

In installing the sound equipment, engineers incorporated the latest improvements developed by RCA for motion pictures and radio, as well as recent discoveries in the laboratory. Potentially, the equipment is expected by engineers to create a vivid illusion of realism. At present, however, it is viewed as experimental.

Sound Movie Projector



The RCA 16 mm Sound Movie Projector embodies all the latest developments and its sound reproduction is tops for 16 mm. Has well ventilated lamp house, direct drive electric take-up and rewind, and so many other important features that it was chosen as the basic unit for the Panoram Soundies.

LATEST RECORDING BY VICTOR PROVES TO BE TRAVEL LOG

Tommy Dorsey, reigning king of the unusual in recordings, has come to the aid of the country's travel agents with a super-swell new waxing entitled "Let's Get Away From It All." Sample lyric: "Let's take the boat to Bermuda, let's take a plane to St. Paul, let's take a kayak to Quincy or Nyack, Let's Get Away From It All!" Ah, vacation, where art thou?

SERVICE TIPS

Now you can win your choice of a handsome RCA Service Engineer's Pencil or any volume of RCA Victor Service Notes by sending tips to RCA Radio Service News, Camden, New Jersey . . . All tips become the property of RCA to be used as they see fit. . . . Service Tips are our readers' ideas, not ours. While RCA Radio Service News believes they are worthwhile, we cannot be responsible for results.

Atwater Kent Model 40

When volume is hardly audible and distorted, connecting a 450 ohm resistor across the plate and grid of the 1st audio '26 tube will result in excellent reception and increase in volume.

Manuel C. Lopes, Jr.,
103 No. Walker St.,
Taunton, Mass.

General Signal Tracing

Distortion: Distortion due to overload has been traced in the majority of cases to the second detector, and not, as we usually presume, the speaker will not carry the load. Raising the plate voltage to the tube or applying more bias will usually increase the overload point.

Gain in 1st R.F. transformer can be checked without the set being turned on. Feed a modulated signal to the radio antenna, check the strength from the signal generator and then tune the radio to the desired frequency with the probe on the stator of the R.F. tuning condenser. There should be a noticeable gain.

G. W. Hester,
Hester Radio Service,
Box 8,
Clarksdale, Mississippi.

Signal Tracing on R.F. Coils

Shortly after purchasing my Chanalyst, I decided to try it out on one of my service radios and came across a puzzling condition. When R.F.-I.F. probe was moved from the grid of the R.F. tube to the plate of the same at 600 K.C., the eye on the chanalyst opened up just as though the signal had disappeared, but I knew the R.F. coil to be O.K. I removed chanalyst and signal generator and put an antenna on outpost of radio, tuned in a program and then removed antenna and put it on plate of R.F. tube. The result was a slight increase in volume. I then removed the low impedance primary on R.F. coil and put on a high impedance Pri. There was a remarkable improvement in performance of set, but do not use a high impedence primary of more than 2 M.H. or oscillation will result. Vary the coupling between pri. and sec. at 600 K.C. for proper tracking. This applies to any radio with similar circuit. I have tried it and found it to work well.

Warren F. Steely,
567 Douglass Street,
Reading, Pennsylvania.

Oil Does It

For a noisy volume control, get a 2 ounce can of Gulf Electric Motor Oil and apply one drop to the control for a temporary repair. This oil does not cause shorts or sizzling noises.

Chatham Radio Service,
W. Lang, Manager,
48 Hudson Avenue,
Chatham, New York.

Carbon Tet Does It

How to repair noisy volume or tone controls of carbon type—Unsolder control from set, submerge complete control in carbon tetrachloride and rotate back and forth several times. Install in set and it will work good as new.

O K Radio Service,
Oliver F. Klein,
2235 N. 39 Street,
Milwaukee, Wisconsin.

Works On Wireless Too

I have used my Chanalyst to great advantage in determining the presence or absence of the signal generated by the wireless type record players, phono-oscillators and even remote control boxes as used on Philco's mystery models with success and great speed in localizing trouble.

Walter Schofield,
346 Oak Grove Avenue,
Fall River, Massachusetts.

The Heat Gets Them

How often have we broken plastic knobs and even plastic cabinets trying to get off "frozen" plastic knobs? I solved that problem by simply soaking a piece of cloth in boiling hot water, applying it around the knob. The knob comes off without fuss or bother. It simply expands the material of the knob, and makes it sufficiently plyable to remove without pressure, or in cases where the customer or other person glued the knob on to the shaft, it loosens the glue.

Carl Bauer,
Bauer Electric Company,
7029 South Broadway,
St. Louis, Missouri.

Knob Springs

To make a really good knob spring when you can't purchase one is to take an ordinary pen point and with a sharp pair of diagonals clip as long a section of the part that fits into the pen holder as needed. This I believe is actually a stronger and better spring than the original. The spring is inserted lengthwise.

Francis J. Kmetz,
Real Radio Service,
213 Linden Street,
Allentown, Pennsylvania.

More Knob Dope

Being troubled by loose springs from radio knobs, have found a way to remedy this bugaboo. I always carry a piece of 28 gauge sheet steel in my repair kit. I cut this 5/8 wide and about half inch long, put slight bend in middle, insert in knob and find that my troubles are over.

L. Sampson,
1282 Lawrence Street,
Lowell, Massachusetts.

Vibrator Adjustment

When adjusting vibrator points in service work, we connect a voltmeter across the "B" line, and then set the vibrator for maximum "B" voltage.

Rem Electrical Service,
R. E. Monk, Prop.,
Monticello, Iowa,
By T. G.

Tube Puller

I find that a good tube puller can be made from an old auto radio vibrator. In some vibrators, there is a soft sponge rubber cup. In the large Philco vibrator, there is a large rubber cup that will fit most type of glass tubes. In a small type vibrator will be found a smaller rubber cup that will work swell on metal tubes.

M. J. Wroblenski,
McFarland Hardware Company,
7710 Buffalo Avenue,
Niagara Falls, New York.

More Signal Tracing Dope

Oscillators Cut Out

1. I have many radios brought in so badly out of alignment that the oscillators tend to cut out. Tracing with the Chanalyst rf-if probe through the 1st detector-oscillator shows up the trouble. It is also advisable to follow up with the probe through the i-f to 2nd detector for alignment check.

2. Oscillators have been shown to be in or out of alignment with the oscillator probe near the oscillator grid or oscillator section of tuning condenser. In this way, a check is made on the test oscillator frequency being fed into the antenna and after adding the i-f, check to see if the resulting frequency is correct or is way out of alignment.

Oscillator Tubes and Troubles

3. Many oscillator sections of converter tubes have shown up bad with voltmeter probe (25 v. scale) across grid resistor. Even when tubes tested okay in tube tester.

Slow Fade, to Half or No Volume

4. A very tough job to locate without signal tracing and has shown up in r-f transformers in several makes of radio. By using the r-f probe at the converter plate and working toward the antenna it easily simplifies an otherwise tough job.

Bad Tubes—Tested O.K.

5. I have traced a signal quite often to a tube, but not through it, due to some difficulty inside although tube tested O.K. in tester.

Low Output

6. A number of weak i-f transformers have come to light by using the Chanalyst rf-if probe to follow the gain from the antenna to the 2nd detector (aligning no help).

E. J. Bancroft,
151 Howard Street,
Fresno, California.

AC Hum

A few days ago we received a small AC-DC wildcat receiver. No name or number on it and naturally no schematic available. It was suffering from excessive AC hum which was not due to a leaky filter condenser.

After carefully going over the set and correcting all defective wiring, we placed in use our Channel Analyzer, and within a very few minutes we found our trouble. It turned out to be a poor joint, where the negative side of the filter condenser, the ground side of the AC line and the AC switch (on vol. control) are all grounded to chassis. In other words, due to an excessive amount of rosin, a good clean contact had never been made. After cleaning and re-soldering, our trouble was eliminated.

H. H. Taylor,
Jewell Radio Service,
106 Arcade Building,
St. Joseph, Missouri.

Just a Heavy Fog

When a new 1941 car comes in with Delco radio playing very low volume, suspect cowl aerial. Even in "sunny" (?) California, water seeps into the case holding the rod, causing a low resistance short. Either remove the aerial and pour out water or drill a small hole in the outer case.

Thomas I. Dunn,
615 So. Freeman Street,
Oceanside, California.

It Comes Out Here

For a really emergency source of rosin for slipping dial cords, melt a piece of solder with a match and pulverize rosin droppings — there it is!

S. Jasut,
368 Front Street,
Hartford, Connecticut.

Help Wanted

You may have noticed this picture on your service note mailing envelope. Mr. Ewing A. Johnson, Assistant Appliance Service Manager of the Monongahela West Penn Public Service Co. of Fairmont, West Va. says it is really his picture showing how he repaired receivers before the advent of the Chanalyst. He says that the use of the Chanalyst has saved both his time and religion.

INTERFERENCE AND HOW IT AFFECTS RADIO RECEPTION

(Continued from Page 3)

more may have to be employed. A parallel-tuned wavetrap in series with the antenna and a series-tuned wavetrap in shunt with the receiver input is the best combination for obtaining the utmost attenuation against an interfering signal.

VIII. Cross-Modulation External to Receiver

This type of interference has become prominent in recent years, due to the trend of increase in power ratings of transmitting stations. When two radio waves of sufficient strength encounter any elevated system of electrical conductors in which system there is existent anything that causes partial rectification or detection, numerous new spurious radio frequencies are created which radiate from the system to nearby receiving antennas. When one of these interfering frequencies happens to fall on a desired station frequency, interference results which **no receiver can avoid.** The interference has no relation to receiver design and will be present on all types including the automotive, battery, A.C. or D.C. It is generally localized in a particular community. The electrical system, whether it be power distribution, telephone system, or other aerial network of conductors and particularly any network or system which is resonant to the local station frequency, can produce this interference if it has a rectifying tendency. Rectification may occur from poor joints or contacts, special non-linear devices intermittent or poor contacts to earth or to other objects, and rectification due to chemical action at a joint or splice. The neutral or grounding system for power circuits is a frequent cause for generation of this type of interference.

Wherever this trouble develops, it should be definitely identified by checking with various types of receivers, preferably the battery loop antenna type, so as to isolate the source and to determine the limit of the area affected. In practically all cases, the interference area will be confined, and sometimes does not extend outside the building occupied by the receiver. Variation of the

(Continued on Page 6)

A Preferred Type

Gentlemen prefer blondes and RCA tubes. Who could typify RCA "Preferred Type" tubes on the new window display better than this georgeous blonde? Watch for her and hang her up for all the gentlemen (and ladies) to see.

RCA PRESENTS NEW PROJECTION TYPE HOME TELEVISION

Brilliant Picture of High Quality Is on Large Screen

Introducing a new design of home-television receiver, incorporating numerous developments that make possible a larger picture than heretofore seen on home-receivers, the RCA Laboratories have developed an instrument with a 13½ by 18-inch screen.

This developmental receiver is an RCA TRK-120 model modified to permit the use of a 5-inch projection kinescope in place of the regular 12-inch kinescope heretofore used to present an 8 by 10 inch picture. The new receiver is equipped with a retractable translucent screen, which slides down into the cabinet when the set is not in use. When in use, the screen is at the top of the set.

Mirror Increases Throw

The size of the picture on the face of the new 5-inch projection kinescope is 2¾ by 3⅝ inches. The funnel-shaped tube, with its face pointed upward, is mounted on the floor of the cabinet. The picture as it appears on the flat face of the kinescope is enlarged by means of a coated f:2 lens of American design and projected to a mirror on the underside of the uptilted lid of the cabinet, from where it is reflected to the 13½ by 18-inch translucent viewing screen.

Although the projected 441-line, 30-frame picture has 3½ times the area of a regular kinescope receiver, the brightness of the image is the same. The projection kinescope principle, such as used in this receiver, make it possible to produce pictures of any desired size.

NEW MICROPHONE HAS SMALL ANGLE SOUND COVERAGE

Directional Feature Holds for All Audio Frequencies

There has been developed in the RCA Laboratory by Dr. H. F. Olson, a new type of microphone which is extremely directional and whose directional characteristics are not affected by the frequency of the sound. Its operation is based on the fact that if sound is picked up from various points which are at varying distances from the sound source, then combined and applied to the ribbon of a velocity microphone, a directional characteristic will result.

This is accomplished by having the microphone ribbon incased and the sound brought to it through pipes which bring the sound to the ribbon from varying distances in front of it. Behind the ribbon is a larger tube for damping out the waves after they have passed the ribbon. Such a unit can be built which will be very directional but will operate well over only one comparatively narrow frequency band. However, by using several such units, each of which is designed to cover various portions of the audio frequency band, the combined electrical result gives a microphone of very directional characteristics which are practically unaffected by frequency.

Large Screen Home Television

RCA has developed this home type television receiver which projects a picture on a screen 13½ x 18 inches.

PUSH-BUTTON JOBS WILL CONTINUE FOR SOME TIME

(Continued from Page 1)

Post Ad Brings Response

The advertisement run by the RCA Manufacturing Company in the Saturday Evening Post announcing the frequency change brought a tremendous response for the new Log Book. There were also a great number of requests for names of radio service men to re-set push-buttons. These requests were turned over to the nearest RCA distributor to where the request originated. The Saturday Evening Post is distributed to over three million families and the full-page color announcement must have come to the attention of practically all of them.

Allocators in Great Demand

The RCA Station Allocator, a push-button oscillator, likewise enjoyed a popular acceptance. Orders were received which disposed of the initial lot promptly. More are being made as rapidly as possible and orders placed now will be filled in a short time. The continuance of the demand for this instrument indicates its acceptance as a general purpose oscillator. Aside from being ideal as an instrument for re-setting push-buttons in the home, it has many shop functions. In the adjustment of automobile receivers, it is of particular worth, due to its ability to operate from self-contained batteries.

Provides Income Source

It appears probable that several months will pass before the push-button re-setting work will begin to slacken up. Even after that time there will undoubtedly be random calls on receivers that have never been re-tuned.

Some service men hold the opinion that it is just as well that all owners of push-button receivers did not want their buttons re-tuned immediately when the frequencies were changed. In the first place, they feel that there were not enough service men to do it all in a short time and, in the second place, a steady flow of work that will be coming in for the next few months will provide a dependable source of income.

RCA LABORATORIES WILL BE BUILT AT PRINCETON, N. J.

(Continued from Page 1)

"More and more of our research work is being concentrated on problems of national defense. The new RCA Laboratories will make it possible to increase these efforts and to insure the maximum use of our research facilities for defense.

The 'Radio Age'

"The achievements of modern radio are also capable of increasing and improving our industrial output in many lines. By the application of electronic devices to industrial processes, the Radio Age promises to electronize modern industry, just as the application of electrical devices to industry at the beginning of this century created the Electrical Age.

"By the establishment of the new laboratories, radio quickens its pace alongside the older industries—electrical, steel, automobile, wire communications, chemical, metallurgical and others — which, through research, have contributed to the industrial leadership and progress of this country. It is through invention and the practical applications of research that American ingenuity has raised the standards of living in the United States above those of any other nation.

"Research, which has enabled American industry to develop new products, new services and new employment, has also been the greatest factor in the continuing advancement of radio."

More than 130 manufacturers in radio and other fields are now licensed under the patents of RCA. The new laboratories will continue to make inventions available to competitors and others, and to cooperate with them in the maximum development of the radio art.

Otto S. Schairer, former vice president in charge of the patent department, will be vice president in charge of RCA Laboratories, which will include the patent department, Ralph R. Beal, research director, will have general direction of all research and original development. Dr. C. B. Jolliffe, who has been in charge of the RCA frequency bureau, will direct and coordinate the broad engineering policies.

Other scientists who will be based at the laboratories include E. W. Engstrom, Dr. V. K. Zworykin, B. J. Thompson, Dr. Harold H. Beverage, Arthur Van Dyck, and the chief engineers of the RCA affiliated companies.

General supervision over the research activities will also be exercised by an executive board consisting of Messrs. Sarnoff, chairman; Schairer, Beal and Jolliffe, and the executive heads of the RCA companies: G. K. Throckmorton, RCA Manufacturing Company, Inc.; Niles Trammell, National Broadcasting Company; W. A. Winterbottom, RCA Communications, Inc., and Charles J. Pannill, Radiomarine Corporation of America.

Plumber's Delight

This new RCA Ultra-directional Microphone seems to be a masterpiece of plumbing. Approximately 500 feet of pipe is used in its construction. When in use a perforated metal cover encloses the entire mechanism.

INTERFERENCE AND HOW IT AFFECTS RADIO RECEPTION

(Continued from Page 5)

interference usually takes place when the weather changes from wet to dry. Wind conditions may be a related cause, when the interfering system swings and makes intermittent contact with grounded or other conducting objects, resulting in rectification and re-radiation.

IX. Same Channel Beat

When a receiver is exposed to signals from two stations operating on the same assigned frequency, another type of beat note interference is found. This interference is evidenced in the form of a low frequency growl, waver or flutter and results from the difference frequency produced by signals from two transmitters whose carrier frequencies differ slightly from the assigned frequency. Federal regulations permit deviations of 50 cycles per second from the assigned frequency. This means that the frequency difference between any two stations on the same channel cannot exceed 100 cycles per second and that the beat note or flutter will be 100 cycles per second or less. Many modern transmitters have frequency deviations of only a few cycles per second and the beat frequency produced by two such transmitters on the same assigned frequency would of course be of a very low order.

If two carriers on the same assigned frequency have the same program, the resulting interference is in the form of a low frequency growl, waver, or flutter of the reproduction. If the beat frequency is within the audible range, and within the reproduction range of the instrument, there will be noticeable a low frequency continuous tone. If the beat frequency is below the audible range, there will be noticeable a flutter or waver which in some cases may give periodic complete program interruption. In any event, with the same program modulation there will be noticeable an "echo" effect, the extent of which will be dependent chiefly upon the ratio of the strength of the two signals, the lengths and time characteristics of the land lines supplying the modulating programs, and the relative distances of the two transmitters from the receiver.

If the two stations are operated at exactly the same frequency, this echo effect will be the only noticeable interference.

Where the two carriers are not modulated by the same program, the complexity of the interference increases, and the resulting reproduction is much more objectionable. The factors which influence the nature and complexity of the interference are as follows:

1. The relative intensity of the two signals at the receiving point.
2. Similarity or non-similarity of program.
3. The frequency separation of the two carriers.
4. The percentage of modulation of the two carriers.
5. The phase relationship of the modulating signals, if the programs are the same.
6. The phase relationship of the modulated carriers when their frequencies are exactly the same.

The seriousness of this type of interference depends largely upon the ability of the receiver to respond to the very low frequencies of the audible range. Therefore, as the quality of the receiver increases in this respect, the more likelihood of such interference being objectionable.

Because of the relation which must exist between the strengths of the two stations, the degree of interference will vary considerably over the country. It can be visualized that certain areas will be affected by signals of comparable strength on the same channel, whereas other localities will be remote in respect to these same stations. The ratio of signal strengths at the receiving point of two stations on the same channel is generally below an approximate value of 20 to 1 before this type of interference becomes bothersome.

Practical service treatment of this form of interference is effected by (1) Reducing the low frequency response; (2) Limiting the sensitivity of the receiving instrument, and (3) Using a directive antenna system.

X. Adjacent Channel Beat

This type of interference occurs from the mixture of two signals which differ in frequency by an amount which is within the audibility range. Under the American system of broadcast channel allocation, stations are assigned frequencies differing from those of other stations by zero kc., 10 kc., or some multiple of 10 kc. Therefore, the governing factor for this type of interference is the 10 kc. channel separation. Thus, when a desired and undesired signal, differing by an audible frequency of ten kilocycles, enter a receiver under conditions which permit both signals to appear in the receiver output, the reproduction will include not only both programs but also a steady whistle or beat note at ten thousand cycles. In order to reproduce this frequency, the acceptance of the I-F system and the audio fidelity of the instrument must be sufficiently wide to pass the second signal and give appreciable response at the beat produced. Since the beat which is present, is in the form of a continuous note, it is somewhat more

(Continued on Page 7)

NEW RCA PORTABLE RADIO ANNOUNCED FOR AVIATION USE

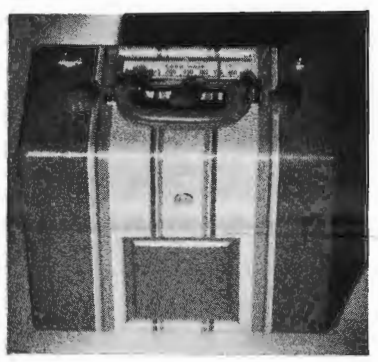
Both Aviation and Regular Broadcast Can Be Received

A highly-efficient portable radio receiver which receives such important aviation information as CAA weather reports, radio range courses, and airport control tower signals, in addition to standard broadcast programs, has been announced by the Aviation Radio Section of the RCA Manufacturing Company.

The new receiver, housed in a sturdy two tone airplane fabric covered case, is equipped for three-way operation — on self-contained dry batteries, in a plane, or from an AC or a DC electric outlet at home, in hotels, etc. List price is $39.95, less batteries. It is designated as Model AVR-102.

Static Limiter Reduces Interference

Unusually sensitive and selective for a portable receiver, the unit has a 6-tube, 2-band superheterodyne chassis equipped with a built-in static-limiter switch to bring in weak signals above stormy noise levels and to reduce possible engine interference. Its many other features include tuned RF stage, high antenna sensitivity, and 3-gang condenser to provide freedom from adjacent station interference, rubber mounted chassis to withstand shock and vibration, and built-in loop antenna. Unusually good tone is provided by a large permanent magnet dynamic loudspeaker.



The new RCA portable aviation receiver.

When used in a plane, the AVR-102 is ready for operation when connected to the ship antenna. A convenient jack is provided for headphones. The inexpensive, easily installed dry batteries provide for as many as 200 hours of operation.

Rugged Construction

One unique feature of the receiver is the rugged new metal speaker grill. It is designed and stamped for efficient acoustic response and finished in burnished bronze. The case is covered with two-tone airplane fabric. Rubber feet are provided for the bottom of the case.

A simultaneous radio range filter is available at $4.95 (plus installation). This permits clearer reception of weather broadcasts and other voice transmissions without interference from the radio range signals upon which the voice transmissions are superimposed.

INTERFERENCE AND HOW IT AFFECTS RADIO RECEPTION

(Continued from Page 6)

objectionable to the human ear than random interference from the music or speech modulation of the adjacent channel.

Most receivers suppress the 10,000 cycle beat from adjacent carriers either by limitation of fidelity, high degree of selectivity, or by design of the loud speaker unit to prevent its reproduction of such a note. Filter circuits having sharp cut-off below 10,000 cycles are sometimes provided in high-fidelity receivers for elimination of the beat. A very effective means of accomplishing the same end is through use of a tertiary circuit, consisting of a parallel-tuned coil associated with the loudspeaker matching transformer. This coil is tuned to a frequency slightly below 10,000 cycles and gives a sharply defined attenuation and cut-off of high frequencies.

High-fidelity receivers usually contain a control for reduction of selectivity which makes possible two degrees of fidelity. Where interference from an adjacent channel beat note exists this control may be reduced to effect its elimination. Tone controls also, are normally included on modern receivers and are arranged to reduce the audio response at the higher audio frequencies, including the possible 10,000 cycle interference.

Under ordinary conditions, the ten kilocycle beat is not frequently encountered, since the receivers subject to this interference are usually in the higher-price brackets and elaborate filter protection is justified in the original design. When encountered, however, there are two methods of treatment; the one being suppression of the adjacent channel causing interference with a sharply-tuned wavetrap; and the second, reduction of the high frequency response in the audio system of the receiver. Precise alignment of the receiver may also be beneficial.

XI. Monkey Chatter

When two signals occupy adjacent channels, separated as to carrier frequency by 10 kc., the side-band frequency of one station is very close to the side-band frequency of the adjacent station. If either station is modulating more than 5 kc. of audio range, the two side bands will overlap. In such a situation, if the side band of one signal enters the second detector stage along with the side band and carrier of the other signal, a peculiar combination of frequencies will result. The most troublesome frequency formed by this combination is that which is produced by the difference between 10 kc. and the modulation frequency involved. For example, if the case is taken where a 3000 cycle note is modulating the adjacent undesired channel, it will produce an interfering side band which will be superimposed upon the desired signal as a 7000 cycle note. That is to say, the side bands of the adjacent channel station form a difference beat against the carrier of the desired station, or the one to which the receiver is tuned. This beat will be in the audible range and will have the character of "inverted speech". This means that modulation on the interfering station of low frequency will create an audible signal of 10 kc. minus this frequency, or a resultant high frequency. High frequency modulation, conversely, produces a low frequency audio signal.

Since this interference is an inversion of the adjacent channel modulation, it appears as an unintelligible mixture, commonly termed "monkey chatter". Receiver selectivity discriminates against this type of interference. It is also limited by proper restriction of the high frequency audio response. The selectivity ahead of the second detector is, of course, the principal factor in preventing response to the adjacent channel modulation.

"Higher fidelity" receivers are generally the only types affected by "monkey chatter" and their circuits are designed to afford the necessary protection against same. A sharp cut-off filter circuit included in the audio system is common practice in the design of high fidelity instruments. Provision of control for the high frequency end of the audio band and the broadness of I-F tuning is also common in high fidelity design. Over-modulation of the adjacent channel station accentuates the interference due to "monkey chatter" because of the higher frequency side bands which are generated by such over-modulation. Over-modulation, however, is an unusual condition and should not be investigated as the most prominent cause for this type of interference.

In general, "monkey chatter" interference will be more prevalent at more points on the tuning scale in localities where the number of popular stations is limited, and where such stations are at relatively great distances. In metropolitan localities there is usually a fair assortment of popular stations, their field strengths are relatively high and the adjacent channels are of little importance.

Editor's Note:—A summary of the eleven types of interference discussed in the foregoing article has been prepared in chart form by Mr. Zaun and appears in the Reference Data on page 8.

RCA ALLOCATOR VALUABLE IN SHOP & FIELD

(Continued from Page 1)

a necessary adjunct to their shop equipment, not only because it is convenient to take out, but it holds its own as a shop oscillator on those jobs where the push-button frequencies are required. It supplements their present shop oscillator equipment in the same way that a set of socket wrenches supplements an adjustable wrench. For the usual frequencies, that are used many times a day, the Allocator saves them much time because with the push of a button the frequency is there. It is also more accurate because when one is in a hurry their tuning of an adjustable oscillator is liable to be a bit sloppy. So for the usual frequencies they use the Allocator and for the in-between frequencies, short wave, etc. they use the larger adjustable oscillator such as the RCA Signalyst or Model 167. These men find that such a procedure saves them much time and helps them to turn out more work each day.

CHICAGO PARTS SHOW WILL DRAW TRADE TOGETHER

RCA Will Bring Surprises with New Test Equipment

June 10th is the day all parts jobbers have circled on their calendars. On that day the Chicago Parts show will open and they are eagerly looking forward to the date, trying to anticipate what the various manufacturers will have in store for them. It is well known that the Tube and Equipment division of the RCA Manufacturing Co. has many things up their sleeve that they intend to unveil at the convention and this knowledge is keeping everyone on their toes with suspense. Many new and improved devices have been promised and the displays will be overflowing with equipment that will make the radio service man's work a pleasure.

Field is Broadening

As the service man's field of activity is rapidly expanding into other fields, such as industrial, police, aviation, etc. RCA will introduce many new devices for specialized activities. There will be special devices for testing audio systems, devices for checking in the region of ultra high frequencies such as FM and Television frequencies, new and improved equipment for checking circuits, tubes, component parts, etc., and other new devices too numerous to mention. These, in addition to the usual round of equipment that are standard in the line, will make a display that will delight the heart of any service man.

Gains Made Each Year

Aside from the new and improved equipment, test equipment prices have been continually going down year after year. Now it is possible to get test equipment far superior to the best obtainable a few years ago at prices which are much less. This is the result of careful planning and making the fullest use of the latest manufacturing equipment and methods. Distributors who attend this convention will be able to bring home to their customers the latest and best, plus a better understanding of their applications. The RCA line will be materially enhanced by new additions and it will be definitely worth ones while to be on the alert for these innovations.

RCA

REFERENCE DATA

May, 1941

(cut on dotted line and file)

POSSIBLE SOURCES OF INTERFERENCE

Among Stations on New Frequency Allocations

A. IMAGE RESPONSE

Locality	450 Kc. I-F	455 Kc. I-F	460 Kc. I-F	465 Kc. I-F
Boston, Mass.			WEEI-590 WMEX-1510	
Charleston, W. Va.		WCHS-580 WGKV-1490		
New York City	WEAF-660 WQXR-1560	WMCA-570 WHOM-1480		WMCA-570 WCNW-WWRL-1600
Omaha, Nebraska	WOW-590 KONB-1490			
Syracuse, New York			WSYR-570 WOLF-1490	
Spokane, Wash.			KHO-590 KGA-1510	
San Antonio, Texas	KTSA-550 KABC-1450			

B. DIFFERENCE COMBINATIONS

	445-455 Kc. I-F	455-465 Kc. I-F
Boston, Mass.	WTAG-580 WBZ-1030	
Chicago, Illinois	WCFL-1000 WHFC-1450	WBBM-780 WSBC-WEDC-WCRW-1240
Detroit, Michigan	WWJ-950 WMBC-1400	
Fort Worth, Texas	WBAP-820 KFJZ-1270	
Los Angeles, Cal.	KECA-790 KPPC-1240	KHJ-930 KGER-1390
	KMTR-570 KFVD-1020	
Minneapolis, Minn.	WCCO-830 WTCN-1280	
NYC—Newark	WABC-880 WBBR-WEVD-1330	WAAT-970 WBBC-WLTH-WVFW-WARD-1430
	WNYC-830 WNEW-WHBI-1280	
Portland, Oregon		KGW-620 KWJJ-1080
Philadelphia, Penna.	WIP-610 KYW-1060	
	WPEN-950 WDAS-1400	
San Francisco, Cal.	KGO-810 KYA-1260	
Spartanburg, S. C.	WSPA-950 WORD-1400	
St. Louis, Missouri		WEW-770 WIL-1230
Seattle, Wash.	KOMO-950 KEVR-1400	

C. SUM COMBINATIONS (I-F does not affect)

Locality	Station	plus Station gives	Station
Boston, Mass.	WEEI-590	WHDH-850	WAAB-1440
Chicago, Ill.	WMAQ-670	WGN-720	WGES-1390
	WMAQ-670	WBBM-780	WHFC-1450
Kansas City, Mo.	WDAF-610	KMBC-980	KITE-1590
New York City	WEAF-660	WJZ-770	WBBC-WLTH-WVFW-WARD-1430
	WEAF-660	WNYC-830	WCNW-WWRL-1490
	WMCA-570	WJZ-770	WBBR-WEVD-1330 +10
	WJZ-770	WNYC-830	WQXR-1600
	WOR-710	WJZ-770	WCNW-WWRNL-1490 −10
	WMCA-570	WINS-1000	WHOM-1560 +10
Spokane, Wash.	KHQ-590	KFPY-920	KGA-1510

D. SECOND HARMONIC OF I-F

Locality	900 Kc. 450 Kc. I-F	910 Kc. 455 Kc. I-F	920 Kc. 460 Kc. I-F	930 Kc. 465 Kc. I-F
Johnson City, Tenn.	Canadian	WJHL		
Flint, Mich.		WFDF		
Greeley, Colo.		KFKA		
Oakland, Cal.		KLX		
Denver, Colo.		KPOF		
Meridian, Miss.		WCOX		
Scranton, Pa.		WGBI-WQAN		
Iowa City, Ia.		WSUI		
Richmond, Va.		WRNL		
Vancouver, Wash.		KVAN		
Sherman, Texas		KRRV		
Little Rock, Ark.			KARK	
Shenandoah, Ia.			KFNF	
Spokane, Wash.			KFPY	
Vermillion, S. C.			KUSD	
West Lafayette, Ind.			WBAA	
Atlanta, Ga.			WGST	
Providence, R. I.			WJAR	
Fairmount, W. Va.			WMMN	
Visalia, Cal.			KTKC	
Los Angeles, Cal.				KHJ
Pocatello, Idaho				KSEI
Buffalo, New York				WBEN
Frederick, Md.				WFMD
Jacksonville, Fla.				WJAX
Oklahoma City, Okla.				WKY
Stevens Pt., Wisc.				WLBL
Quincey, Ill.				WTAD
Paterson, New Jersey				WPAT
Huntington, W. Va.				WSAZ

E. SECOND HARMONIC OF BROADCAST STATIONS

Locality	Interfering Station	Station Affected
Bangor, Maine	WLBZ-620	WABI-1230 +10
Knoxville, Tenn.	WROL-620	WBIR-1240
Los Angeles, Calif.	KFI-640 KMTR-570	KFOX-1280 KRDK-KFSG-1150 −10
Phoenix, Arizona	KTAR-620	KPHO-1230 −10
Chicago, Illinois	WMAQ-670	WCLS-1340
Washington, D. C.	WMAL-630	WOL-1260
New York City	WMCA-570 WEAF-660 WOR-710	WOV-1130 +10 WBBR-WEVD-1330 −10 WLTH-WVFW-WBBC-WARD-1430 −10
Tampa, Florida	WFLA-620	WDAE-1250 −10

F. FUNDAMENTAL (I-F Code only)

Locality	Call and Frequency	I-F Affected
Brooklyn, N. Y.	WNY-442	450
New Orleans	WNU-448	450 – 455
New London, Conn.	NBL-450	450 – 455
Duluth, Minn.	WRL-454	450 – 455 – 460
Mackinac Island, Mich.	WHO-454	450 – 455 – 460
Rogers City, Mich.	WLC-454	450 – 455 – 460
Cleveland, Ohio	WCY-454	450 – 455 – 460
Alpena, Mich.	WNO-454	450 – 455 – 460
Baltimore, Md.	WMH-454	450 – 455 – 460
Buffalo, N. Y.	WBL-454	450 – 455 – 460
Chicago, Ill.	WGO-454	450 – 455 – 460
Frankfort, Mich.	WFK-454	450 – 455 – 460
Ludington, Mich.	WLD-454	450 – 455 – 460
Seattle, Wash.	KPE-460	455 – 460 – 465
Cypress, Cal.	KSM-460	455 – 460 – 465
Edmonds, Wash.	KSA-460	455 – 460 – 465
Mussell Rock, Cal.	KTK-460	455 – 460 – 465
Sherwood, Ore.	KKB-460	455 – 460 – 465
Tuckerton, N. J.	WSC-462	455 – 460 – 465
Astoria, Ore.	NPE-464	455 – 460 – 465
Eureka, Cal.	NPW-464	455 – 460 – 465
Key West, Florida	NAR-464	455 – 460 – 465
Norfolk, Va.	NAM-464	455 – 460 – 465
Baltimore, Md.	WHM-468	460 – 465
Amagansett, L. I. (Sayville)	WSL-474	465

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Club Special

'Specially lovely Evelyn Lunne sings on NBC's Breakfast Club.

OPERATING THEORY OF VOLTOHMYST IS SIMPLY DESCRIBED

Electronic Circuit Output Limited to Protect Meter

There has been a certain amount of conjecture about the basic principles of the Junior VoltOhmyst. The following discussion will attempt to clarify the fundamentals underlying the various functions of this unique instrument. The accompanying schematics have been simplified to aid the understanding of the circuit operation. In each diagram, only the circuit arrangement for that particular application is shown. All parts not contributing directly to the circuit explanation have been omitted. For instance, the power supply, screen and suppressor grids of the tubes and various resistors and condensers which have been inserted to reduce surges are not shown.

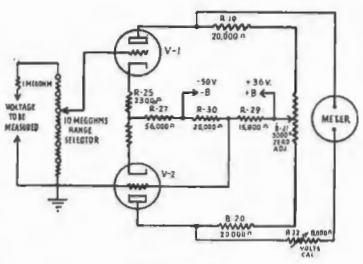

Figure A

Balanced Circuit Used

To get a general understanding of the circuit, refer to Fig. A. This shows the circuit for voltage measurement. Assume no voltage between the probes indicated on the left. Under these conditions, the tube grids are at the same potential and as the circuit is entirely symmetrical there will be no current flowing through the meter. This is perhaps better shown in Fig. B. The two parallel tube circuits will be balanced and as the tube plates are at the same potential, no voltage will exist across the meter. The tube grids are shown connected to the bleeder on the right. The bias voltage of 3.2 volts will exist between the cathode and grid. With equal conditions in both sides of the parallel circuit containing the tubes, equal current will flow in both sides.

Suppose that an unknown voltage is introduced between the two grids at point X so that the V-1 grid is more positive than V-2. This will cause the V-1 side of the parallel circuit to have less resistance due to lowering the plate resistance of V-1. Consequently, more current will flow through this side of the circuit, some of which will come through the meter and produce a deflection of the needle. The conditions will further be upset by the increase of current through R-27. This will cause the tube cathodes to become more positive, not only partially offsetting the voltage applied to the grid of V-1 but increasing the bias of V-2. The decrease of current through V-2 caused by its increased bias tends to further unbalance the circuit and cause a still greater deflection of the meter. The meter can be calibrated in terms of the voltage applied between the grids at point X in Fig. B.

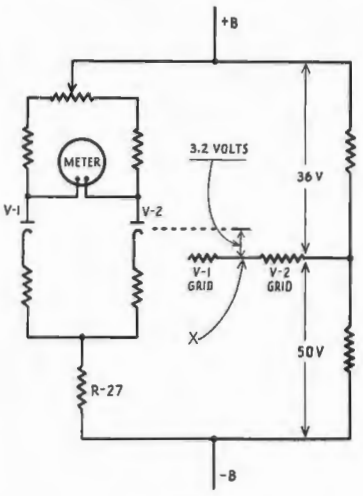

Figure B

Meter is Protected

The greatest amount of circuit unbalance possible depends upon the capabilities of the tubes and the voltages applied to them and not to the voltage being measured. Thus, by proper limitation of the circuit capabilities, positive meter protection can be secured. By driving the meter with a circuit of this type instead of driving it directly from the voltage being measured, one can use it without fear of causing expensive burnouts when measuring d-c voltage or resistance.

Voltage Measurements

When reading d-c voltages, the voltage is applied as shown on the left side of Fig. A. The range selector is so arranged that full scale deflection for the various ranges comes at 3, 10, 30, 100, 300 and 1,000 volts.

The total amount of range selector resistors is always in series across the voltage being measured and totals 10 megohms. In addition, a one megohm resistor is incorporated in the tip of the ungrounded probe. This allows the probe point to be placed on tuned circuits without disrupting their operation as the one-megohm isolates the capacity effect of the rest of the circuit. The total resistance across the voltage being measured remains constant at 11 megohms. At the lowest voltage range, this gives a meter sensitivity of 3,666,666 ohms per volt.

Resistance Measurement

By means of a voltage applied at point X in Fig. B, the meter can be made to read not only the values of d-c voltages but the meter can also be calibrated to read resistance values. The measurement of resistance is accomplished in a much similar manner to voltage measurements. With reference to Figure C it will be seen that with no resistor between the probes (infinite resistance) 3 volts will be applied between the grids at a point corresponding to X in Figure B. As no current is flowing through the range selector resistors, the entire 3 volts is used and produces a full scale deflection of the meter. This corresponds to a reading of infinity on the ohms scale. When a resistor is inserted between the probes, current flows through the range selector resistors and due to the voltage drop, the full 3 volt is not available. This causes a decrease in the meter reading and by proper calibration the meter will indicate the value of the resistor between the probes.

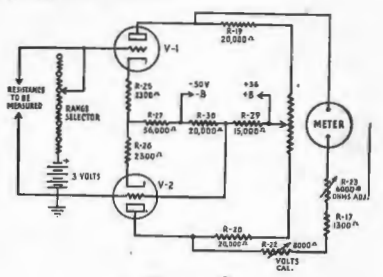

Figure C

The ohm scale reads from one to one thousand ohms. The lower end of this scale is spread sufficiently so that a resistance of 0.2 ohm can be easily read. The range selector resistors are arranged so that multiplying factors of 1, 10, 100, 1,000, 10,000 and 1,000,000 can be obtained. This means that resistors even below 0.2 ohm will produce a deflection and, also, values up to 1,000 megohms can be checked.

As the circuit functioning is the same as when measuring voltage, the same meter protection is obtained. When measuring resistance, the probes are often accidentally placed on "hot" resistors. When this is done, there is no fear of meter damage for the same reason that was previously explained.

Rectifier for A-C Measurements

The circuit for measuring a-c voltages is not shown because in this application the electronic circuit is not used. A simple Rectox rectifier applies the rectified a-c to the d-c meter and gives an a-c volt meter of 1,000 ohms per volt sensitivity.

May, 1941

REFERENCE DATA

(cut on dotted line and file)

ANALYSIS OF RADIO INTERFERENCE PHENOMENA
Character, Cause, Type Receivers Affected, Where Prevalent, and Service Remedies

Type of Interference	Character of Interference	Cause	Type Receivers Affected	Where Prevalent	Suggested Service Remedies
IMAGE RESPONSE	Heterodyne whistle or second signal when tuned to certain stations	Strong signal at a frequency 2xIF above desired station.	Superhet only. (1) With limited number tuned circuits ahead first detector. (2) With low impedance, high frequency resonant antenna primary circuits.	Locality strong BC stations near high end of band. Vicinity 1610-1750 Kc. Police Stations. Vicinity 1700-2000 Kc. amateur band.	(1) Wave trap tuned to interfering station. (2) Band elimination antenna such as RCA Magic Wave. (3) Re-align I-F.
HARMONIC OF I-F	Heterodyne whistle when tuning a station having same frequency as a harmonic of the I-F.	Second harmonic of station combines with oscillator fundamental forming a spurious I-F.	Superhet only. Selectivity does not affect.	Vicinity of station operating at twice I-F.	(1) Wave trap tuned to station. (2) Wave trap tuned to station second harmonic in mixer grid circuit. (3) Re-align I-F.
DIRECT I-F RESPONSE	Non-tunable code with intensity increasing toward low frequency end of band.	Commercial shore-to-ship code signal having frequency in I-F range, reaching input to I-F system.	Superhet only. (1) With limited selectivity ahead of I-F input and relatively high I-F gain. (2) With high impedance, low frequency antenna system.	Coastal areas near location of commercial stations.	(1) RCA Magic Wave antenna. (2) I-F wave trap. (3) Re-align I-F. (4) Orient loop for minimum.
HARMONICS OF OSCILLATOR	Reception of short wave code or broadcast signals at points in standard broadcast band.	Oscillator harmonics combine with short wave signals producing the required I-F. Especially prevalent on loop receivers due to secondary resonances of loop.	Superhet only. (1) With loop antenna. (2) Having oscillator rich in harmonics.	Rurally or where SW signals of proper frequency are intense.	(1) Use wave trap on interfering station. (2) Orientation of loop. (3) Re-align loop circuit. (4) Reduce oscillator excitation.
COMBINATION OF I-F	Whistle or second station(s) heard on practically all carriers.	Difference in frequency of two strong stations equal to I-F of receiver; the two stations mixing within receiver to form a constant spurious I-F.	Superhet only; having limited selectivity ahead of first detector.	Metropolitan areas, generally.	(1). Check by tracking of RF and antenna circuits. (2) Reduce size or effectiveness of antenna. (3) Install wave trap and tune to frequency of one of interfering stations. (4) Shift I-F.
HETERODYNE OSCILLATOR RADIATION	Whistle on a particular desired station, disappearing or changing frequency at random.	Radiation of receiver's heterodyne oscillator, due to oscillator strength, unusual coupling, resonant antenna, or transmission via power line.	Superhet only. (1) Without good shielding. (2) Without R-F stage.	Metropolitan areas, generally.	(1) Filter power line. (2) Use RCA Magic Wave antenna. (3) Reduce oscillator grid leak. (4) Shift I-F.
CROSS MODULATION WITHIN RECEIVER	Second station(s) appearing in background when tuned to desired station.	Strong interfering station modulating carrier of desired station within a nonlinear circuit or element of the receiver; or pickup and detection taking place in audio system.	TRF and Superhet. (1) With limited or no selection ahead of first tube. (2) With exposed grid circuits and wiring associated with early tuned stages. (3) Without variable-mu input tubes.	Metropolitan areas. Vicinity of very strong stations.	(1) Wave trap in antenna tuned to station causing trouble. (2) Filter power line. (3) Install RCA Magic Wave noise reducing antenna. (4) Shield exposed grid leads and wiring of first stages.
CROSS MODULATION EXTERNAL TO RECEIVER	Second station(s) in background on or between other stations.	Detection within, and re-radiation from as power lines, telephone lines, and other aerial metallic structures.	All types of receivers are affected regardless of selectivity or design.	Vicinity of unusually strong stations, especially where open-wire power lines are prevalent. Generally changes with weather.	(1) See that power line and telephone grounds are secure. (2) Ground conduits solidly. (3) Use RCA Magic Wave antenna. (4) Orient loop antenna for minimum interference.
SAME CHANNEL BEAT	Flutter, waver, or growl heard in background when tuned to desired station.	Second station assigned to same channel, but differing very slightly in carrier frequency.	Receivers with high sensitivity and extended bass response.	In areas remote from a usable assortment of strong stations. Wherever signals of two stations on same channel are comparable in strength.	(1) Use directive or loop antenna. (2) Reduce sensitivity of set. (3) Reduce bass response.
ADJACENT CHANNEL BEAT	Steady 10,000 cycle note or whistle.	Adjacent channel carrier beating with carrier to which receiver is tuned.	TRF and Superhet; especially those with limited selectivity and wide range of audio response.	Localities where adjacent channel station is strong compared to desired station.	(1) Suppress adjacent station with sharply tuned wave trap. (2) Re-align receiver carefully. (3) Reduce high-frequency response. (4) Use directive antenna.
MONKEY CHATTER	Unintelligible modulation superimposed upon desired station, having character of "inverted speech".	Side band of adjacent channel overlapping side band and combining with carrier of desired station. Also caused by harmonics from over-modulation of adjacent station.	TRF and Superhet; having wide band selectivity and audio response.	Localities where adjacent channel station is strong. Also aggravated by extended high frequency response of transmitter.	(1) Precisely re-align receiver to make more selective. (2) Reduce high frequency audio response.