SEPT. 10
1932

Installing A. V. C.

15¢
Per Copy

RADIO WORLD
REG. U.S. PAT. OFF.

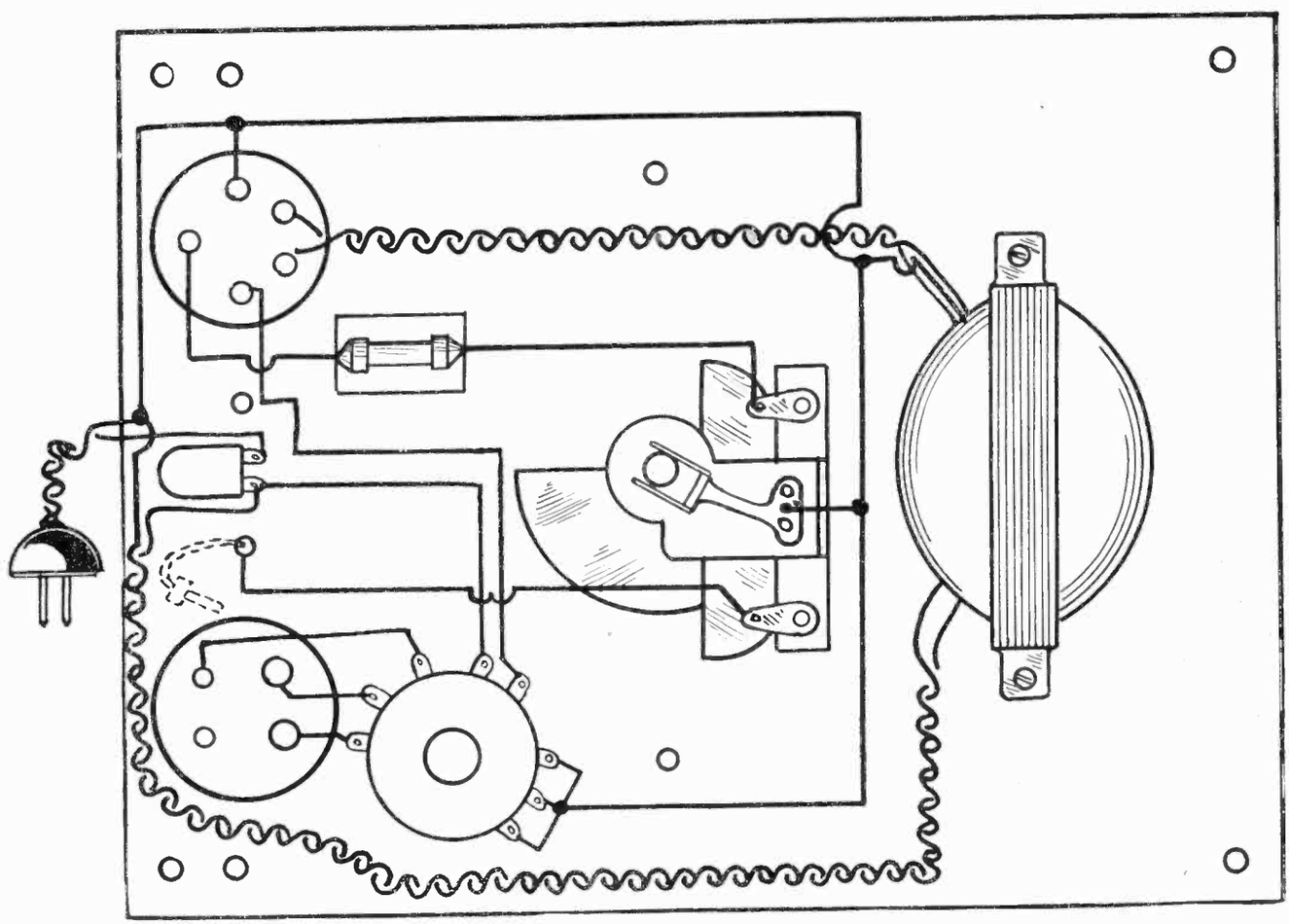
The First and Only National Radio Weekly
Eleventh Year—546th Issue

Trouble-Shooting in Auto Sets

Duplex-Diode Rectifiers

Building A-C Diamond

MODULATED SWITCH OSCILLATOR



Picture diagram of multi-range oscillator, modulated with the 60-cycle line hum, for servicing and building T-R-F and superheterodyne sets. See article on pages 5 and 6.

www.americanradiohistory.com

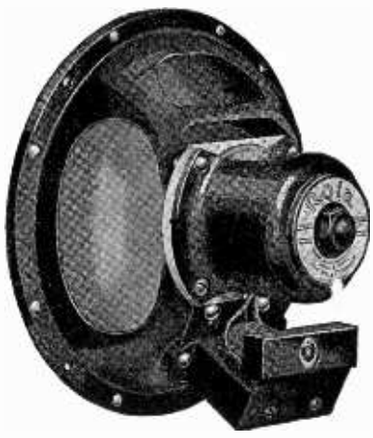
Parts for the 1933 DIAMOND

Cat. POLY-8. one 8 mfd., wet electrolytic condenser. inverted mounting, with two insulating washers and one special lug. 49c.

ONE of the outstanding circuits, the 4-tube 1933 Diamond for a-c operation, 105-120 volts, 50-60 cycles can be constructed most economically. The circuit uses a 58 r.f. amplifier, with special antenna treatment boosting the gain mightily; a 57 power detector, a '47 output tube and an '80 rectifier. You never in your life heard such performance on four tubes!

Herman Bernard, designer of the circuit, used Polymet 8 mfd. wet electrolytic condensers, one with two insulating washers and special lug. These are our Cat. POLY-8, with washers and lug, at only 49c each.

Also, Rola full dynamic (Series F) with 2500-ohm field coil.



Cat. RO-25. Rola full dynamic speaker. with output transformer of '47 matched impedance built in, also 2500-ohm field coil built in (black leads) 8" diameter cone. Series F. $3.83

TWO-GANG SHIELDED 0.00035 MFD. SFL, $1.39

De Jur Amsco shielded straight frequency line dual condenser, 0.00035 mfd., brass plates, ¼" shaft, 2½" long as complete safeguard against body capacity. Cat. DJ-AS $1.39

Cat. EQ-100, 20-100 mmfd. Hammarlund equalizer..... .19

200-turn center-tapped r.f. honeycomb choke coil. Cat. DCH @ ..... .40

COILS FOR 1933 DIAMOND

Shielded impedance coil for antenna coupler, and shielded interstage transformer (Cat. DP-33), both coils for..... .90

DIRECT RADIO CO.

143 WEST 45th STREET NEW YORK, N. Y.

BINDER FREE

For New Yearly Subscribers

This binder is made of fine brown Spanish fabricoid and will hold 52 issues of Radio World. The year is stamped in gold on front cover. A very limited supply on hand. Sent free to new yearly subscribers who send $6 direct to publication office. If already a subscriber, send $6 and 52 issues will be added to present subscription. No other premium with this offer.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK CITY

Two for the price of One

Get, EXTRA one-year subscription for any One of these magazines:

- ☐ RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW (monthly, 12 issues)
- ☐ Q.S.T. (monthly, 12 issues; official amateur organ).
- ☐ POPULAR SCIENCE MONTHLY.
- ☐ RADIO-CRAFT (monthly, 12 issues).
- ☐ RADIO INDEX (monthly, 12 issues), stations, programs, etc.
- ☐ RADIO (monthly, 12 issues; exclusively trade magazine).
- ☐ EVERYDAY SCIENCE AND MECHANICS (monthly).
- ☐ RADIO LOG AND LORE. Monthly. Full station lists, cross indexed. etc
- ☐ AMERICAN BOY—YOUTH'S COMPANION (monthly, 12 issues; popular magazine).
- ☐ BOYS' LIFE (monthly, 12 issues; popular magazine).
- ☐ OPEN ROAD FOR BOYS (monthly, 12 issues).

Select any one of these magazines and get it free for an entire year by sending in a year's subscription for RADIO WORLD at the regular price, $6.00. Cash in now on this opportunity to get RADIO WORLD WEEKLY, 52 weeks at the standard price for such subscription, plus a full year's subscription for any ONE of the other enumerated magazines FREE. Put a cross in the square next to the magazine of your choice, in the above list, fill out the coupon below, and mail $6 check, money order or stamps to RADIO WORLD, 145 West 45th Street, New York, N. Y. (Add $1.50, making $7.50 in all, for extra foreign or Canadian postage for both publications.)

Your Name.....

Your Street Address .....

City .....State .....

DOUBLE VALUE!

☐ If renewing an existing or expiring subscription for RADIO WORLD, please put a cross in square at beginning of this sentence.

☐ If renewing an existing or expiring subscription for other magazine, please put a cross in square at the beginning of this sentence.

RADIO WORLD, 145 West 45th Street, New York. (Just East of Broadway)

SPEAKER REPLACEMENT HEADQUARTERS!

IF your dynamic speaker suffers lost insensitivity or develops rattling or buzzing sounds, it usually needs a new cone and voice coil. We have the unit cone-and-voice-coil assemblies for all the popular speakers, some listed below. Others are available. Inquire for prices.

Service men can make the cone and voice coil replacements but any who desire that the installation and adjustment be made for them on precision jigs, in the same manner as in the speaker factories, may send their speakers to us for repair. There is a 25c extra charge for this labor.

The name of the speaker is listed under the caption, "Speaker," the outside diameter in inches of the frame that holds the cone is given under the initials "O.D.," and the price is given next.

Speaker	O.D.	Price
Atwater Kent	11	$2.75
Bosch	11	2.75
Bosch	10	1.90
Brunswick D.	9¾	2.25
Brunswick B.	14½	2.75
Brunswick E.	14½	2.75
Colonial 33...	12¼	2.25
Decatur	9½	1.90
Eveready ...	12¾	2.25
Eveready ...	10	1.90
Earl Inductor	10	.95
Farrand	7	2.25
Farrand Inductor ..	11	1.35
First Nat'l ..	10	1.90
Freed-Eismann NR 80-87...	10	2.75
Majestic G1..	9	1.80
Majestic G2..	9	1.80
Majestic G3..	11	1.80
Majestic G5..	14	2.75
Jensen D9, D15 ...	8½	1.50
Jensen D4	9½	2.25
Jensen D7 Concert.	11¼	2.25
Jensen Auditorium	13	4.50
Magnavox ..	9	2.25
Newcomb-Hawley	9	2.25
Oxford	9	1.95
Oxford	8¾	2.25
Peerless copper coil.	8½	1.60
Peerless copper coil.	10¾	1.95
Peerless copper coil.	12	2.10
Peerless copper coil.	14½	2.85
Peerless wire-wound coil.	8½	2.85
Peerless wire-wound coil.	10¾	1.65
Peerless wire-wound coil.	14½	2.75
Philco 65-90..	11	1.50
Philco 20		1.50
RCA 106.....	10¼	2.00
RCA 105.....	8	2.00
RCA 104.....	8	2.00
Symington ...	10	1.90
Symington ...	12¼	2.25
Sterling	9	2.25
Stromberg-Carlson	12½	2.75
Stromberg-Carlson	9	2.25
Sparton 737..	9	2.25
Steinite	10	1.90
Temple	9	2.75
Temple	11	2.75
Temple Auditorium	14	3.75
Utah	9	1.90
Utah Stadium	12	2.75
Victor RE32-45 ...	9	1.35
Wright-De Costa ..	10	2.25
Wright-De Costa ..	12	2.75
Zenith 52....	12¼	2.25

MAGNETIC SPEAKERS

Ready to Play, but Not Including Cabinet or Baffle

Farrand 9" O.D., burtex cone.....$1.50

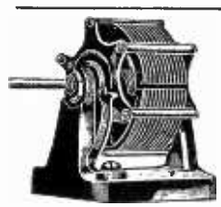
Timmons (as used in Philco sets) 9" O.D., burtex cone $1.80

Auto speaker, 9" O.D., burtex cone.....$1.50

The magnetic speakers are new speakers, and the prices are for the speakers, not for replacements on such speakers.

DIRECT RADIO CO.
143 West 45th Street
New York, N. Y.

360-Degree Condenser



20 to 375 mmfd. capacity variation, effected over full 360 degrees, affords wide spreadout, better dial legibility. Great for test oscillators and all-wave tuning.

Price, $3.00 net.

DIRECT RADIO COMPANY
145 WEST 45TH STREET
NEW YORK, N. Y.

Three 0.1 mfd. @ 29c

Three 0.1 mfd., in one shield; 250 v. d-c rating. mounting screw; size, 1½" square x ⅞" wide. Black lead common; reds interchangeable. Cat. S-31. @ 29c. Direct Radio Co., 143 W. 45th St., N. Y. C.

STATIONS BY FREQUENCIES

Frequency list, broadcasting stations, call, owner, location, power, wavelength. United States, Canada, Cuba, Mexico and Newfoundland. In Aug. 27th and Sept. 3rd of Radio World. Send 30c for both copies to Radio World, 145 West 45th Street, New York, N. Y.

www.americanradiohistory.com

ROLAND BURKE HENNESSY
Editor

HERMAN BERNARD
Managing Editor

RADIO WORLD

J. E. ANDERSON
Technical Editor

J. MURRAY BARRON
Advertising Manager

The First and Only National Radio Weekly
ELEVENTH YEAR

Vol. XXI | STEPTEMBER 10th, 1932 | No. 26. Whole No. 546

Published weekly by **Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y.**
Editorial and Executive Offices: 145 West 45th Street, New York
Telephone: BR-yant 9-0558

OFFICERS: Roland Burke Hennessy, *President and Treasurer;* M. B. Hennessy, *Vice-President;* Herman Bernard, *Secretary.*

Entered as second-class matter March, 1922, at the Post Office at New York, N. Y., under Act of March 3, 1879. Title registered in U. S. Patent Office. Printed in the United States of America. We do not assume any responsibility for unsolicited manuscripts, photographs, drawings, etc., although we are careful with them.

Price, 15c per Copy; $6.00 per Year by mail. $1.00 extra per year in foreign countries. Subscribers' change of address becomes effective two weeks after receipt of notice.

How to Install A-V-C in Existing Receivers

By Capt. Peter V. O'Rourke

THERE is ever an increasing demand for receivers with automatic volume control, and particularly no automobile set is considered complete without a. v. c. Countless sets are in use which do not have a. v. c. and the owners are asking for information on how to change the sets so as to incorporate automatic volume control.

There are two tubes especially suitable for automatic volume control, both duplex diode triodes. The 55 is for sets requiring a 2-5-volt filament and the 85 for automobile sets or for d-c operated receivers. Other tubes can be used also because any tube can be used as a diode detector, or as a grid leak detector, and either type may be used as an automatic volume control.

Let us first dicuss the duplex diode triode. We shall not differentiate between the 55 and the 85 for both may be treated in the same way in respect to their detection, amplification, and a. v. c. features. Neither shall we draw a complete circuit in connection with the tube for that is not necessary. Many fans will think that their particular problems of changing to a. v. c. are quite special, but they all must be treated the same way, if the problems can be treated at all, short of rebuilding the circuit.

Automatic Volume Control

In Fig. 1 we have a typical circuit utilizing a duplex diode triode tube in its triple function. The applicability of this circuit is not confined to the XYZ receiver but may be used with any receiver where the 55 or the 85 may be used. It is best to use it in a superheterodyne where there is no necessity of grounding the tuning condenser next to the rectifier, but it can also be used in a t-r-f receiver if we tune the primary instead of the secondary. Other reasons for using it in a superheterodyne only are that the selectivity is impaired by the diode and that there is less amplification in the t-r-f receiver to be controlled.

It will be observed that the two diode plates are tied together so that half wave rectification is used. The reason is that this gives a higher voltage across the diode load resistance for a given input voltage. That is, it makes the set more sensitive and it also provides better automatic volume control.

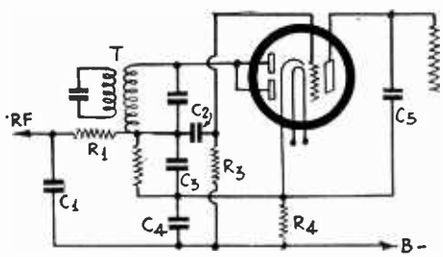


FIG. 1
A typical hook-up for a 55 or an 85 duplex diode triode operating as a detector, automatic volume control, and audio voltage amplifier.

Moreover, it permits the use of an ordinary intermediate frequency transformer. No special windings or taps are required.

The tuned secondary of transformer T impresses a signal voltage on the diode circuit. The load resistance is R2, which is in series with the diode rectifier and the impressed signal voltage. The usual value for the load resistance is 0.5 megohm but it is not necessary to adhere to this value closely. If we want a higher sensitivity and a greater selectivity we can increase the value.

Voltage in Load Resistance

Due to rectification there will be a direct current flowing in R2, from the plates to the cathode in the external circuit. If the signal is not modulated this current will be steady, but if it is modulated the current will pulsate in conformity with the signal fluctuations. If the condenser C3 were not connected across R2 there would be a strong carrier component in the circuit, but this is removed almost completely with the condenser. Since there is a current fluctuating at audio frequency in R2 there will be a voltage across this resistance, a voltage containing a strong d-c component and also an audio component.

The audio component is transferred to R3, the grid leak of the triode, and to the control grid. If C2 is made larger than 0.01 mfd. and if the grid leak is of the order of 0.5 megohm, the audio component will be transferred to the grid of the triode without any appreciable reduction, even on the lowest audio frequencies.

The d-c component is used for automatic bias on the controlled tubes. But the automatic bias voltage should not contain any carrier or audio components. Hence it is necessary to put in a filter to take out these components. The filter consists of a high resistance R1 and a condenser C1. R1 really serves two purposes. In addition to its function as a filter it serves to prevent short circuit in the input to the audio amplifier through various capacities, of which C1 is one. The usual value for R1 is 0.5 megohm and the value of C1 is 0.25 mfd. However, both R1 and C1 may be larger.

The arrowhead marked RF may be regarded as C minus and it is to be connected to the grid returns of the controlled tubes. There may be several of these tubes, but all of them should be of the remote cut-off type, like the 235, 58 and 239, depending on what tubes are used in the circuit. Naturally, the 235 and 58 would go with the 55 and the 239 with the 85.

Control of Oscillation

Sometimes oscillation may occur in the controlled circuits if all the grid returns are connected to the same point, that is, the arrowhead. In that case the grid returns should be isolated by means of individual filters. How this is done is shown in Fig. 2. Here one r-f and one i-f tubes are controlled. R1 is a filter resistor serving the r-f tube and R2 a resistor that serves the i-f tube. Resistance R3 in this circuit corresponds with R1 in Fig. 1 and C3 with C1. It should be noticed that when an r-f circuit is controlled and when the tuning condenser is grounded, the tuned coil cannot be connected to ground. The circuit is completed by means of the by-pass condenser, C1 in Fig. 2. This arrangement is not necessary in the i-f circuit because in that case the tuning condenser need not be grounded.

The values of R1 and R2 may be half megohm each and of C1 and C2, 0.25 mfd. each.

Sometimes the grid returns are not made

(Continued on next page)

www.americanradiohistory.com

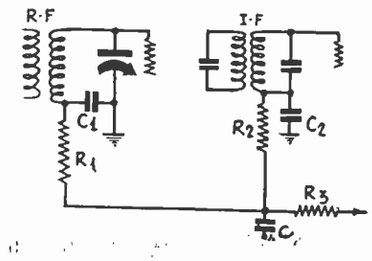


FIG. 2
This shows how to filter the grid circuits of the controlled tubes to prevent r-f or i-f oscillation.

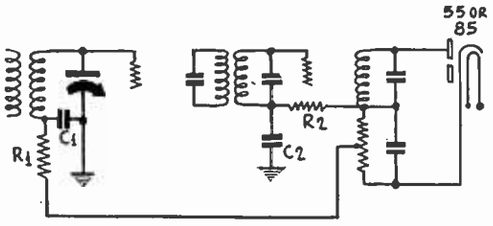


Fig. 3
Another arrangement of the filters in the grid circuits of the controlled tubes. Here only part of the d-c voltage across the load resistance is applied to the first tube.

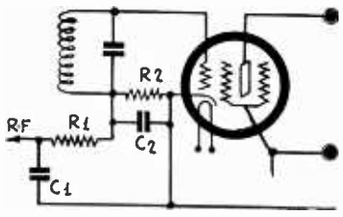


FIG. 4
In this circuit a power tube of the 238 type is used as grid leak detector and automatic volume control.

to the same point on the load resistance, the connections being made as in Fig. 3. Only part of the voltage drop in the load resistance is here used for the first controlled tube, but the entire voltage is used on the second. This, of course, requires that the load resistance be made up of two units.

In Fig. 1 the bias for the triode part of the detector is obtained from the drop in a resistance R4 placed between the cathode and B minus. The value of this resistance depends on the type of load that is used on the triode. The recommended load resistance is 20,000 ohms, in which case the bias resistance should be 2,500 ohms. About the same value will do if the load is a transformer. In case the load resistance is 250,000 ohms, which it may well be notwithstanding the recommended 20,000 ohms, the bias resistance should be larger, but it is not necessary to make it larger than 5,000 ohms. A condenser C4 of 2 mfd. or higher capacity will improve the operation of the amplifier.

Before the special diode rectifier tubes came out ordinary triode tubes were often used as diodes for detectors and automatic volume controls. Sometimes the plate was connected to the cathode and the grid alone was used as the diode plate. At other times the plate and the grid were tied together to form the diode plate. The results with such detectors and automatic volume controls were exactly the same as those with the special tubes, but it was necessary to add another tubes as a voltage amplifier to get the same overall results.

Another method of getting detection, automatic volume control and amplification out of the same tube is to use a triode as a grid leak detector. The grid current in that case causes a voltage drop in the grid leak, which becomes the load resistance. The grid condenser is the filter across the load resistance, and the grid performs the double function of diode anode and amplifier control grid.

In Fig. 4 is a simple detector circuit in which grid current is used for automatic bias. The grid leak R2 and the grid condenser C2 are placed on the low potential side of the tuned input circuit and the voltage for the automatic bias is obtained by connecting the grid returns of the controlled tubes to the negative end of the grid leak, that is, the end that is nearer the grid. The usual filter R1 and C1 are used to prevent short circuiting the audio signal and to avoid carrier and audio feedback to the controlled tubes.

Many different tubes have been used in this manner, but in automobile sets it seems that the 238 pentode is the best. This is used with a high resistance in its load circuit so as to get a high amplification of the audio component across the load resistance R2. Of course, the usual filter to remove the carrier ripple is placed in the plate circuit, and this need be nothing more than a condenser of about 0.00025 mfd. The 238 is a good tube for the purpose because it is not easily overloaded, it has a high amplification factor, a desirable feature in a grid leak detector, and it is of the cathode type.

Now that the 85 is available for this purpose it seems unnecessary to use the power tube.

Ed Wynn to Continue His Radioed Nonsense

Ed Wynn, comedian, has signed a contract to continue on the air over a nationwide National Broadcasting Company network for the Texaco Company during the early autumn months.

Heard each Tuesday at 9:30 p. m., EDST, he will resume his stage activities early in September, when he takes his New York hit of last season, "The Laugh Parade," on tour.

According to the new contract with the radio sponsors, however, the stage production will not be presented on Tuesday evenings, thus enabling Wynn to face the microphone on those nights to continue the broadcasts.

LABOR SEEKS EAST STATION

Washington.

Organized labor has appealed to the Federal Radio Commission for increased broadcast facilities, according to information made available by the Commission. America's Wage Earners' Protective Conference, an association affiliated with the American Federation of Labor, has applied for permission to erect a new 5,000-watt broadcasting station at Newark, N. J., to give organized labor a voice on the air in addition to its Chicago Federation of Labor station, WCFL. The association asks for the right to operate from 6 to 8 p.m. on the 1,100 kc channel, sharing with WPG, Atlantic City, N. J.

WLWL Cooperates

The new station would be assigned the facilities of WLWL, Missionary Society of St. Paul the Apostle, New York. In order to vacate this channel for use by the labor station, WLWL has applied for permission to move to 810 kc, a channel now used by WCCO, Minneapolis. This is a clear channel and the Minnesota station has been granted an increase in power to 50,000 watts.

The application for the labor station was filed by Mathew Woll, president of the Wage Earners and vice president of the American Federation of Labor, and by M. J. Flynn, executive secretary of the Wage Earners. Recently Mr. Woll appeared before a subcommittee of the Senate Committee on Interstate Commerce to support a plea for a clear channel in labor's own right.

Coil Data for Short-Wave Converter

The coil data for the short-wave converter described in last week's issue, September 3rd, by Einar Andrews, and promised for publication in this week's issue, are as follow:

The four r-f coils may be wound on the same length of tubing, say of 1.75 inches in diameter. There may be a single winding with taps placed at suitable points, but a better arrangement is to use separate windings, with a space between adjacent ones. The oscillator coils may be wound similarly on another length of tubing of the same diameter.

The oscillator windings should be smaller if the two condensers are to track approximately but the circuit will work even if the coils are the same. Exact tracking is not possible without introducing padding condensers. This is not necessary since the condensers are separately adjustable. The turns given for the table of winding data assume that the intermediate frequency is 1,000 kc. But this does not preclude the use of different frequencies within the range of the tuning condenser across L3.

Turns L1	*Oscillator*	*Tap from Ground*
46.6	23	8
17	13	5
6	5.25	2
3	2.8	1

The wire used on all the windings is No. 22 enameled. The windings should be put on in the order of size of the coils, and there should be a separation of about half an inch between any two adjacent windings.

All the ground ends of the eight coils may be connected permanently to ground. The grid ends of the coils should be connected to the points of a switch, and so should the taps on the oscillator coil. What is needed is a three-deck, four-point switch preferably one with the decks well spaced.

The moving arms on the switch decks serving the complete coils should be connected to the stators of the condensers and the moving arm serving the taps on the oscillator coil should be connected to the cathode of the oscillator tube.

www.americanradiohistory.com

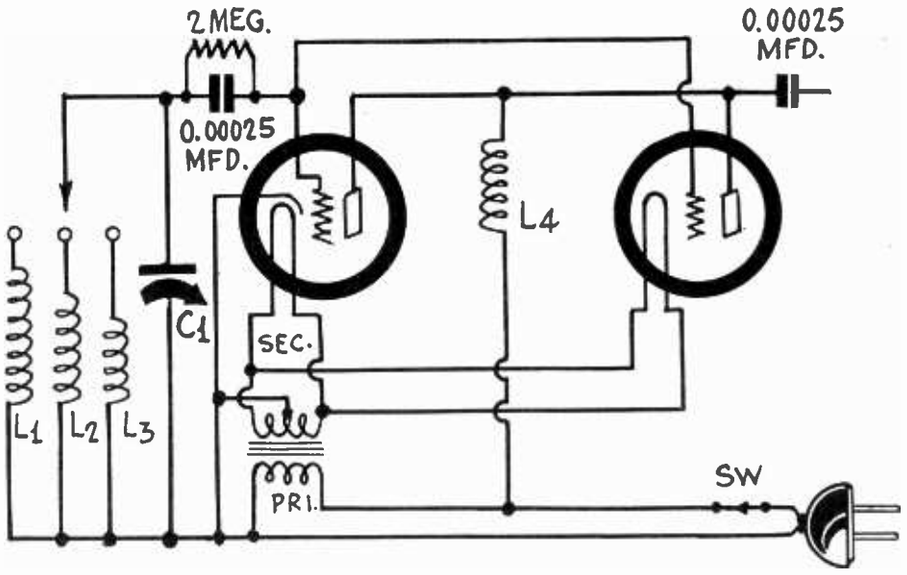
An Economical Switch-Type Modulated Oscillator

By Jack Goldstein

SO many persons try to build and service Superheterodynes without the aid of an oscillator, although it is practically impossible to do a good job without one, that a modulated oscillator has been designed that need not cost much more than $3.50 and yet will fit the need.

This oscillator is nothing fancy, and if even the luxury of a single-pole triple-throw switch is to be dispensed with, to meet the above price, then the coil-switching may be done simply by moving a flexible lead with a plug of the speaker cord type, from one socket post to another. Thus two sockets would be used, one for the oscillator tube, the other for grid terminals of the three coils, to which connections the condenser stator is moved in this manner.

The diagram shows a slightly different rrrangement, one that utilizes the three-point switch, and has two sockets, one of the UY type, the other of the UX type, so that a 56 or 27 tube may be used in one, or a '45 in the other. Thus if you have any one of these three tubes as a "spare" you can work your oscillator in conjunction with a set that employs all the other tubes you have on hand. Merely a little wider choice of tubes is afforded.



Modulated by 60 Cycles

The oscillator is of the constantly modulated type, and the modulation is nothing more than the frequency of the a-c line.

A filament transformer is used for supplying power to the heater or filament, while the a-c line voltage is used on the plate. Since there is no rectification or filtering, the hum will be present with practically 100 per cent. modulation. It is highly advisable to have modulation of some sort, so that when tests are made the oscillation frequency can be very readily identified, and thus checking up and lining up become easier. Where there is no modulation you have to depend either on beat notes, which exist only when there is an oscillator in the tested receiver or other device, or a station of that frequency within receiving range, or on the baffling rushing sound that accompanies resonance. Too much uncertainty attaches to reliance on tube noises, rushing sounds and other indefinite quantities. Far better to have modulation and be sure.

Three coils are connected with one side to the line (cathode) and other terminals free to be picked up by the switch. These and the plate winding are honeycomb coils. Though the diagram does not emphasize the fact, the plate coil is in inductive relationship to the three other coils.

Coils Used

The honeycomb coils are of the small type, outside diameter about 1 inch, and are stacked together. The coils have a hollow wooden dowel core, and a screw may be run through the core and bolted at the threaded end to hold the coils in place.

Assuming that the coils are to be stacked up beginning at the screwhead, the first coil put in is L1, consisting of 800 turns, and it has an inductance of approximately 10 millihenries, so that if 0.0002 mfd. is the tuning capacity, the computed lowest frequency oscillation will be 112.4 kc, or around 2,250 meters wavelength, and the highest for this coil will be at least 260 kc, so that the popular 175 kc intermediate frequency will be a fundamental on the frequency range of this tuning system. The next coil inserted is one of 300 turns, and it is put on so that it is as close as possible to the other. The dowel has uneven extensions, and the shorter extension faces the 800-turn coil. The 300-turn inductance just mentioned is the plate coil, and it is connected in such manner that oscillation will result. If you don't get oscillation, simply reverse the connections to the plate winding.

Now a second 300-turn honeycomb coil is put on, and this will enable tuning to below the lowest broadcast frequency, though it will not bring in the highest broadcast frequencies, hence the third coil is put in, consisting of 100 turns. These two coils are inserted so that they will be as near to the tickler coil as possible, without sawing the dowel, and even though the separation between tickler and tuned winding increases, and in one instance by the length of the dowel.

Oscillator Calibration

Since the first grid coil and the plate coil are assumed wired for oscillation, the connections to the two remaining coils must be made in the manner that produces oscillation. If no oscillation exists, reverse the connections to either or both of the smaller grid coils, as circumstances require.

There will be some overlap between the two coils for the broadcast band, also frequencies considerably higher than 1,500 kc will be tuned in when the smallest coil is used and the condenser is worked at or near its lowest capacity settings.

Before the oscillator is of any practical use, even after it has been built and tested, it must be calibrated. With the aid of a broadcast receiver, and the known frequencies of stations tuned in, the oscillator may be calibrated by the zero beat method. This consists of tuning the oscillator to the same frequency to which the broadcast receiver is tuned, and repeating the process until sufficient points are registered, well distributed over the frequency spectrum, to afford the basis for a calibration curve.

Tuning Process

The tuning process is as follows: the receiver is carefully tuned to the frequency of one station, say, 1,500 kc, and the oscillator has the smallest coil in use. Then the point is found on the oscillator dial that produces a strong squeal. By slowly turning the oscillator dial, without molesting the receiver dial, this squeal may be made to vary in pitch, increasing from the resonance point. Therefore at either side of resonance there will be a squeal, and as the oscillator dial is turned the squeal slowly rises and rises in pitch until it gets beyond audibility.

It will be noted that the rise is from resonance, therefore at actual resonance, when there is zero difference in frequency, there is no squeal. This is the zero beat. It is not always practical to establish zero beat, not so much because the oscillator can not be tuned so closely, but because the receiver used in conjunction with the test may not have a sharp enough peak, but if actual zero beat can not be obtained, the lowest growl, which is very close to zero beat, may be used instead. The word "squeal" does not aptly fit the lowest frequency beats encountered, for they are guttural growls, but the one word is commonly used to describe the various beat notes, whatever their frequency.

Second Harmonics

Thus the broadcast band is calibrated directly. Since higher frequencies than 1,500 may be calibrated, yet the receiver will not bring them in, the set may be tuned to lower frequencies, beginning, say, at 700 kc, and second harmonics of receiver frequencies beaten with the oscillator fundamental frequencies that are higher than 1,500 kc. Thus to calibrate for 1,600 kc, use 800 kc on the broadcast band, in the receiver. The intensity of second harmonics is considerably less than that of fundamentals, but the sound will be amply loud enough.

The second harmonic method is used also for calibrating the low frequency coil, except that it is the second harmonic of the oscillator this time that beats with the fundamental of the receiver. The oscillator condenser may be seat at maximum capacity. Some idea of the prevailing frequency has been given. That value, 112.4 kc, is computed, and does not take into account distributed capacity, so in reality the lowest freqency will be lower than that, provided the inductance is 10 millihenries. That figure was taken as a safe value for the induc-

(Continued on next page)

www.americanradiohistory.com

(*Continued from preceding page*)

ance, because the 800-turn commercial honeycomb coils in mind have a measured inductance of 10.3 millihenries, another reason why the lowest frequency should be lower than 112.4 kc. So let us assume a frequency of 100 kc, or a wavelength of 3,000 meters. With the oscillator condenser at maximum, oscillation checked for its presence, the broadcast set may be tuned at around 600 kc, until the sixth harmonic squeal is picked up. Suppose this shows up at 620 kc. Then the lowest frequency is 103.3 kc.

Calibration by Harmonics

Of course there may not be a station on the exact sixth harmonic position, but the nearest station thereto may be used, and this point selected, or stations ignored and the modulation of the oscillator utilized. Then other points are registered, so that a curve may be run. The curve may be extended along its natural contour to supply the approximately correct settings for the "outside" frequencies thus represented. Simple graph paper is be used, ten squares of tens.

If a calibrated oscillator can be obtained, the various desired points may be registered quickly, as no dependence is placed on a station of a desired frequency being within a receiver's reach. However, it is necessary that detection take place, as now we are considering only two oscillators, and without detection the sequal would not be audible. However, our own oscillator is of the detecting type. Note the grid leak and condenser. They are not present primarily to afford detection, but to afford frequency stability. Yet they serve both purposes, hence phones may be connected between the 0.00025 mfd. output condenser and ground or one side of the line, to pick up the squeal.

The output wire of the oscillator is simply a flexible lead attached to one side of the 0.00025 mfd. output condenser, and it may have a spring clip at the otherwise free end.

The frequency range of the oscillator is such that in one instance somewhat higher than 100 kc may be tuned in as the lowest frequency and higher than 200 kc for the highest, therefore after the oscillator is calibrated, second harmonics may be used for testing in the range higher than 200 to higher than 400 kc, whereupon the lowest frequency of the broadcast band calibration will be considerably removed from maximum capacity setting of the tuning condenser with the second coil, hence the highest frequency on the second harmonic of the largest coil will overlap the lowest frequency of the fundamental of the second largest coil.

Oscillator Tested Directly

It is fortunate that the oscillator tunes to frequencies higher than the highest in the broadcast band, as most of the popular intermediate frequencies in superheterodynes require an oscillator frequency 175, 250, 265, 300, 350, 365, 400 or 450 kc higher than the highest broadcast frequency, and the present oscillator system should handle them directly, should you desire to calibrate the oscillator of a superheterodyne in terms of its own oscillation frequencies, rather than indirectly in terms of frequencies fed to the antenna post, to which the known intermediate frequency is then added.

Let us take a few examples of the use of the oscillator, now that it is completed and calibrated.

The simplest instance perhaps is that of a tuned radio frequency set. If we want to find out the lowest and highest frequencies to which such a set tunes, we set the receiver's condenser at minimum capacity, connect oscillator output to antenna, simply by twisting the oscillator outlet wire around the leadin at the set for a few turns, without removing aerial, and check the frequency. Then we turn the receiver dial to maximum capacity and again check the frequency, by putting the switch to the next larger coil, and slowly rotating the oscillator dial until the squeal is picked up. The suggestion about a squeal depends of course on a station being on that frequency, but none may be there. That is the advantage of having a modulated oscillator. We do not care now whether a station is on the air or receivable at that frequency, because the hum modulation is all-sufficient for our purposes.

Now we can line up the gang condenser of the receiver, by adjusting the trimmers on it, selecting either extreme frequency, one in or near the middle, or any other frequency.

If we have an output meter we may use that as indicator, but if we have no output meter we may safely listen for loudest hum response in the speaker.

In a superheterodyne the first thing to do is to determine the intermediate frequency. Thus also one may check up to find out whether the intermediate channel is lined up. The tuning condensers cross intermediate coils sometimes change their capacity a little, due to mechanical effects, such as a tension of stiff springs, displacing plates, or due to repeated presence of considerable moisture in the air.

If we know what the intermediate frequency should be, we can line up at that frequency. If we don't know, we can measure whatever it is, and then line up at that frequency. The measurement is made by connecting the output lead of the oscillator to the primary of the first intermediate transformer.

Set Oscillator Frequencies

Preferably this should be done at plate with the modulator (first detector) tube in socket, but which requires access to the bottom of the chassis. It is allowable to make the test by removing the detector tube and inserting the oscillator outlet in the plate contact of the socket. Should the oscillator outlet have a spring clip, engage it to a piece of wire and insert the wire in the socket. Some output leads have both prod and clip at the extreme, so that either may be used. The prod could be pushed right into the plate contact of the socket.

Knowing the intermediate frequency we can determine the oscillator frequencies by putting the signal from the oscillator into the set, using the oscillator outlet as antenna and connecting directly to antenna post of the set. Aerial is then removed so that too many confusing squeals will not be present.

Now we are dealing with signal frequencies, and the oscillator frequencies are higher than them by the amount of the intermediate frequency. As we know the intermediate frequency, we add this to the respective frequencies being used, turning both set and test oscillator dials for the purpose. Thus at readings on the test oscillator of 1,400, 1,000 and 800 kc for an intermediate frequency of 400 kc the oscillator frequencies would be 1,800, 1,400 and 1,200 kc.

Tuner Check-Up

Also we can check the r-f tuner and modulator tuner. This may be done by removing the oscillator and modulator tubes from the receiver and using a long wire to bring the control grid of modulator (first detector) over to the control grid of the second detector (demodulator) from which the intermediate transformer connection has been removed. If both of these tubes are screen grid tubes this work is very easy, for all one has to do is remove the grid clips from tubes, and run a wire from first detector grid clip to second detector grid cap. However, in some instances of blocking a grid leak will have to be put from grid cap of second detector to chassis during this test. The value is not critical and may be 0.05 to 2 meg.

Now we can keep the oscillator just where it was connected and tune the set as a t-r-f receiver. Then we can compare the t-r-f and oscillator frequencies, and see what sort of tracking we have been enjoying.

KEY TO SCHEMATIC DIAGRAM

L1—100 turns. L2—300 turns. L3—800 turns. L4—800 turns (four honeycomb coils). C1—0.0002 mfd.

Filament transformer, 2.5 = volt secondary.

Baritone Says Radio Produces New Vocalism

Radio broadcasting requirements are effecting an evolution in vocal technique that is leading to the creation of an entirely new type of voice, says Gordon Clarke, baritone of the WINS Luncheon Musicale. This new voice is weaker, clearer, purer of tone and more natural and accurate in registry than the voice measured by classical standards, says the baritone of that New York station.

Clarke draws his conclusion from his own experience both as singer and experimenter in monitoring of programs and from varied experiences of other noted performers, including Johnny Marvin, Bing Crosby, James Melton, Olive Palmer, Lawrence Tibbet, Lily Pons, Elizabeth Lennox and John Charles Thomas.

The following is Clarke's conception of the factors that make a good radio voice:

"The successful radio singer first of all must sing correctly. There are many theories about correct voice production, but no matter what method is used, a clear, natural resonating tone must be produced. Second in importance is regulation of the range of volume of the voice. A mike can stand so much volume and no more. Tones louder than the mike can stand force the operator to cut down at the controls which, in many cases, ruins the natural color of the voice. The same is true with the pianissimos. Those who have difficulties with radio may be producing pure tones but are unable to bring their voices within the limits of radio. This is true with many famous singers who don't click on radio."

Pouring Aerial Concrete Takes Two Full Weeks

Nashville, Tenn.

Steel erection on the 878-foot vertical mast antenna of WSM has started, according to J. H. DeWitt, chief engineer of the station. Completion of the towering mast is expected by the Fall.

More than two weeks were necessary to pour the eighty yards of concrete contained in the base that will support the vertical radiator, the tallest radio mast on the North American continent. Eight guy wires will brace the slender structure, each anchored in concrete bases some four hundred feet from the base of the mast. These anchor blocks are sunk more than 20 feet in the ground. A quarter-wave antenna is being used temporarily for tests and program operation of the new 50,000 watt transmitter.

SHORT-WAVE CLUB

Thos. J. P. Sharmon, 6232 So. Alamo Ave., Bell, Calif.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, 145 *West 45th Street, New York, N. Y.*

A. P. Ewen, HQ 82F. A., Ft. Bliss, Texas.
M. E. Walmer, 210 Garland, Leavenworth, Kans.
M. L. Montgomery, c/o Model Clothiers, Okmulgee, Okla.
G. S. Dysinger, 3519 Libby St., Oakland, Calif.
Eugene Hisel, 401 S. Main, Box 178, Brookfield, Mo.
John W. Stoker, P. O. Box 721, Watsonville, Calif.
C. O. Watson, Watson Radio & Elec. Shop., 321 Murchison St., Palestine, Texas.
Howard W. Stephens, 2305 Peachtree Rd., Atlanta, Ga.
Glenn Kimmell, P. O. Box 74, Wolf Summit, W. Va.
H. A. Lakin, Emerson, Iowa.
Austin W. Parker, 8545 Quincy Ave., Detroit, Mich.
C. E. Cox, 1112 So. Harvard Blvd., Los Angeles, Calif.

www.americanradiohistory.com

AUTO SET TROUBLES

How to Locate and Remedy Baffling Defects

By Paul Erwin

IT IS NOT clear sailing in the operation of automobile superheterodynes, or any other automobile sets. Sometimes the set works very well for a while but gradually develops various noises which seem to have no relation to the noises originating in the engine. What causes these noises? Again, there are difficulties from the start, noises, insensitivity on certain frequencies, and apparent lack of tracking.

A certain automobile set had been uniformly successful for a long run. Then a very particular customer wanted one of a slightly different design. When the set was completed the demonstrator hooked it with B batteries and an A battery eliminator. The results were entirely unsatisfactory to everybody.

Set Rebuilt

In an endeavor to find the cause of the trouble the set was practically rebuilt with different parts, by making substitutions of everything that might have caused the trouble. Nothing helped. The set could be made satisfactory at the high frequency end but then it was almost dead at the low frequency end. Likewise, it could be made all right at the low frequency end but then it was dead at the other. Not only did it fail to track, apparently, but it generated a great deal of noise that was not on the program.

The only apparent cause for the trouble was lack of sufficient voltage on the heaters and on the plates and screens. All voltages were low. However, the same heater voltage had been used on other sets and approximately the same plate and screen voltages. So well did the B voltage measure up that that was the last thing suspected.

The change in the design was trivial and could not possibly account for the difference between this set and the others of the same type.

Behavior of the Oscillator

The first thing to suspect in a superheterodyne that does not function well is the oscillator. In the circuit in question the oscillator was of the type shown in Fig. 1. L3 is the pick-up coil and is connected in the cathode circuit of a 236 tube. Originally, R1 had a value of 10,000 ohms and R2 a value of 100,000 ohms. C1 was a 0.001 mfd. condenser. When the set failed to work correctly the values of the resistors were changed. R2 was held at 100,000 ohms and R1 was gradually reduced to 1,000 ohms. Ordinarily a value of 1,000 ohms should have produced blocking of the oscillator and serious overloading of the detector. Neither occurred, nor was there any improvement in the operation. Holding R1 constant and varying R2 produced no better results.

Retuning the intermediate coils and readjusting the padding resulted in no improvement although changes noted above were obtained.

The Remedy

Another difficulty arose in the output stage, which contained two 238s in push-pull. There was motorboating during the warming-up period and sometimes permanently. Overloading of the power stage also occurred long before the volume was satisfactorily loud, even to those who prefer soft music. This overloading could be prevented by connecting a 250,000 ohm resistor between the control grids of the

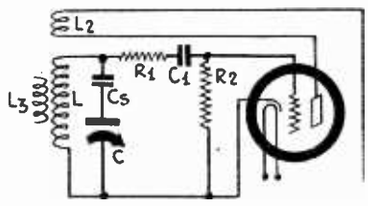


FIG. 1
A typical oscillator as used in an automobile superheterodyne receiver. Blocking may occur if R1 is too small or if R2 is too high.

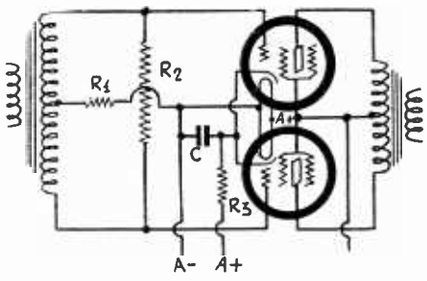


FIG. 2
The output stage of an automobile superheterodyne utilizing two 238 pentodes in push-pull.

power stage, as indicated by the R2 in Fig. 2.

Finally the circuit was turned over to the designer. The first thing he did was to connect a fully charged storage battery across the heater circuit. There was no improvement. Measurement of the B battery voltage showed that on full load it was only 100 volts, with the screen voltages correspondingly low. Well, if the trouble was due to high resistance in the B battery a large condenser across that should have been effective in overcoming part of the difficulty. Accordingly, an 8 mfd. condenser was connected across the battery. There was some improvement but not enough to justify the use of such a large condenser.

Works Well Now

The next step was to connect a B battery eliminator to the circuit in place of the battery, and to adjust the voltages to the proper values while the set was working. The next step was to junk the B batteries so they would not cause the same trouble in some set. The receiver now worked as well as could be expected after all the changes from the original design had been made. At this stage the value of R1 in Fig. 1 was 1,000 ohms and that of R2 100,000 ohms. The performance was fairly satisfactory from 550 to 860 kc, but just above 860 kc the oscillator started to block terrifically. The grid leak R2 was changed to 50,000 ohms, which stopped the blocking and made the circuit work all over the dial. It remained only to retrim.

The readjustment of the trimmers and padding condensers was made at 1,450 kc at the high frequency end and at 600 kc at the low frequency end. The resulting tracking seemed to be all right but still the set was weak. This must have been due to lack of tuning in the intermediate. Hence the next step was to retune the intermediate circuits. This was done against an oscillator which had been checked previously as to the accuracy of calibration. One of the intermediate circuits was found to be greatly off tune, and all of them were off the intended intermediate. Since the intermediate frequency was changed a little it was necessary to retrim, and this was again done at 1,450 and 600 kc. When that had been done the circuit worked perfectly. It did not block at any setting of the tuning condensers, it was equally sensitive from 1,500 to 550 kc as far as the ear could tell, and the power stage did not overload until the volume was uncomfortably loud. There was no motorboating while the circuit was warming up, and none after. Moreover, it was not necessary to use resistance R2, Fig. 2.

Use of B Battery

This experience does not indicate that it is preferable to use a B battery eliminator in place of a B battery. Not at all. But it does indicate that a B battery eliminator is better than an exhausted B battery. It means that if the voltage of the B battery has dropped so that it is only 100 volts on full load when it should be 135 volts, that battery is fit only for the rubbish collector. It is better to use a fresh B battery than to use a batterv substitute giving the same voltage.

Why did the circuit overload so easily when the run-down battery was used? One reason is that the bias on the power tubes is less than it should be. It will be noticed that the bias on these tubes is partly obtained from the storage battery and partly from a drop in resistance R3. When the heater voltage was raised to 6 volts the bias was boosted a little, and that helped. But as long as the plate voltage was low the sum of the plate and screen currents in the two tubes was much less than it should have been. Hence the drop in R3 was less than it should have been. Actually, the drop measured 3 volts when the correct drop should have been 6.3 volts or a little more. Hence the bias was not more than 9 volts. Obviously, if the bias is only 9 volts a lower signal will drive the grids positive than if the bias is 12 volts or more. It is the grid current that causes the distortion.

Overloading Safeguard

When resistance R2 is across the secondary of the input transformer the voltage cannot rise as high as when the resistance is across. This is evident because when the resistance is connected there is a drop in the volume. But this drop in volume is not sufficient to account for the difference in the overloading points under the two conditions. There are certain peak voltages that develop across the secondary when the winding is working into an open circuit, and these peaks cause overloading. The resistance removes these peaks. The high voltages are not necessarily a desirable part of the signal, or even any part of the signal. They may be transients, or they may be voltages due to resonance in the transformer. Whatever

(*Continued on next page*)

www.americanradiohistory.com

DIODE RECTIFIERS

What Voltage Must Be Fed to Them?

By Brunsten Brunn

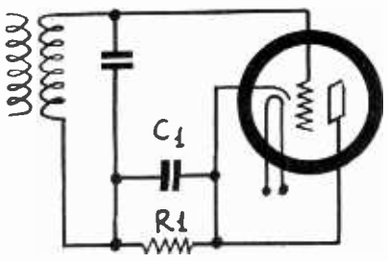


FIG. 1
A simple half-wave diode rectifier with plate and cathode tied together. The grid serves as anode.

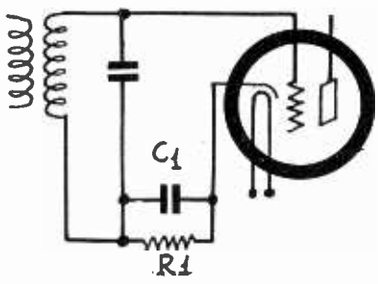


FIG. 2
Another diode arrangement in which the grid alone or grid and plate together may be used as anode.

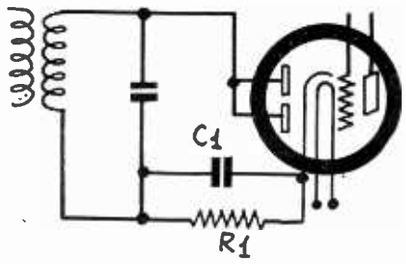


FIG. 3
This is a special 55 or 85 tube diode detector in which the two plates of diode serve as anode.

QUESTIONS asked by fans concerning diode rectifiers show that many fans entertain misconceptions about them, especially as to the relation between the input and the output voltages. For example, one idea is that by making different connections of the elements vastly different results can be obtained.

A diode rectifier is nothing but a rectifier. It is not an amplifier. If a certain a-c voltage is put in a certain proportion of that voltage can be obtained as rectified output. This output is practically independent of the internal resistance of the rectifier tube under practical working conditions because the internal resistance is small in comparison with the external or load resistance. Under practical conditions the external resistance may be 100 times as great as the internal resistance. It may be that by changing the disposition of the elements with respect to each other then the internal resistance can be changed by 50 per cent. But that change will only amount to 0.5 per cent. of the total resistance in the circuit. Therefore it cannot cause any appreciable change in the output voltage.

It is the input voltage that determines the output voltage, assuming that the circuit has been connected in a practical way. If we want a voltage of 50 volts out of the device we have to put a little more than that into the rectifier, and if we want to get 100 volts out of the circuit we have to put a little more than that into it. There is always a loss in the tube.

The Input Counts

In Fig. 1 we have a simple half-wave diode rectifier in which the plate has been joined to the cathode and the grid alone is used for the anode. This is according to the recommendations of tube manufacturers for the 56 tube, but the connection can be used just as well for any other tube having a cathode. R1 is the load resistance and C1 is the filter condenser across it. The input voltage is impressed on the circuit by means of a tuned transformer, and it is the voltage that develops across the secondary tuned circuit because an alternating current is flowing in the primary. This input voltage is in series with the load resistance and the internal resistance of the tube. The voltage drop across the tube and the load resistance is equal to the voltage developed across the tuned circuit. The drop in the tube resistance is lost and only that in the load resistance is useful and available. If R1 is very large in comparison with the internal resistance of the tube the greater part of the input voltage becomes available. But the available voltage cannot exceed the peak of the input voltage no matter how much larger the load resistance is than the internal resistance. In practical cases the voltagle available across the load resistance is about equal to the root mean square value of the input voltage, but it may be considerably less, and usually is.

Altering Connections

In Fig. 2 is another arrangement of the elements of the same tube. Here the plate has been connected to the grid, and those two elements together became the anode. If this circuit is the same in all other respects as that in Fig. 1 the output voltage will

(Continued on next page)

Trouble-Shooting in Auto Sets

(Concluded preceding page)

their source they cause damage to the quality if they are permitted to exceed the grid bias on the power tubes.

In place of R2 across the transformer winding a resistor R1 can be used to prevent overloading. This works in a different way from R2. Suppose the signal voltage is so high that either of the grids goes positive. Grid current begins to flow, but this current must flow through R1 and in doing so it causes a voltage drop making the grid less positive. This effect takes place only on the peaks that would overload the tube. R1 does not lower the signal voltage when no grid current flows and therefore this arrangement is better than the shunt resistor R2. A value of 50,000 ohms will do for R1.

In case the secondary winding is split so that each grid can be returned separately, as is the case in high class transformers, a 50,000 ohm resistor may be connected in the return of each grid and then joined at the negative of A. When this arrangement is used there should be a 2 mfd. condenser across the two resistors, that is, connected between the two lugs on the transformer. A considerable improvement in quality is effected by either a single resistor like R1 in Fig. 2 or by two resistors and a condenser as suggested. Whether to use one or the other depends on the transformer.

When a set fails to work right first check the voltages on full load.

Special Tube Shields for the 57 and 58 Tubes

Some experimenters report that the receivers they build, using 58 tubes for r-f and 57 as detector, are "squealy." This is due to the high amplification. The special tube shields, with "chimney tops," that act conjunctively with the shield inside the tubes to prevent feedback, should be used on all circuits that are fitted with these new super-sensitive tubes.

No cause for complaint about cost can be made, as these shields are selling for 11c retail.

Tube List Prices

Type	*List Price*	*Type*	*List Price*	*Type*	*List Price*	*Type*	*List Price*
11	$3.00	'38	2.80	'24-A	1.65	'80	1.05
12	3.00	'39	2.80	'26	.85	'81	5.20
112-A	1.55	'40	3.00	'27	1.05	82	1.30
'20	3.00	'45	1.15	'30	1.65	'74	4.90
'71-A	.95	46	1.55	'31	1.65	'76	6.70
UV-'99	2.75	47	1.60	'32	2.35	'41	10.40
UX-'99	2.55	'50	6.20	'33	2.80	'68	7.50
'100-A	4.00	55	1.60	'34	2.80	'64	2.10
'01-A	.80	56	1.30	'35	1.65	'52	25.00
'10	7.25	57	1.65	'36	2.80	'65	15.00
'22	3.15	58	1.65	'37	1.80	'66	10.50

www.americanradiohistory.com

be the same for the internal resistance has been altered very little and the total resistance in the circuit by an entirely negligible amount. As a matter of fact, the plate may be left unconnected without changing the diode circuit appreciably. Of, if we don't want to use the grid as the anode we can leave that unconnected and use the plate alone as the anode. In any one of these cases we shall have a voltage across the load resistance which depends mainly on the voltage that we impress on the circuit. These statements are true when the load resistance is very large in comparison with the internal resistance of the tube, and it is only then that the diode rectifier is at all sensitive.

The capability of the tube as a diode rectifier depends largely on the filament emission, and that is not changed by changing the connection of the elements. It does depend on the filament temperature, or rather on the cathode temperature. But if we operate the tube at normal heater voltage, or even less than normal voltage so it is not too low, there will be ample emission to take care of any reasonable demands for current, provided we use a load resistance high enough to be worthy of the appellation practical.

In case the input voltage is exceedingly high and the load resistance is comparatively low, it may be that the anode will heat up excessively. Naturally, a small anode will heat up more than a large one. Hence in those cases where the grid alone is used as anode the input voltage limit, and hence the output voltage limit, would be less than when the plate is also used as anode. But in all practical cases in a receiver the grid is large enough to handle the current alone.

Special Diode Rectifier

As an example of what current may be expected let us assume that the input voltage is high enough to make the output voltage 100 volts, and let us further assume that the load resistance is 0.5 megohm. The equivalent steady current through the circuit is then 0.2 milliampere. That is a very small current for even the grid alone to handle. Yet a voltage of 100 volts across the load resistance is higher than would be encountered in most practical circuits.

In Fig. 3 is a special diode rectifier like the 55 or the 85. Here the two diode plates are tied together to form the anode. If the input voltage, the load resistance R1 and the filter condenser C1 are the same as the corresponding elements in the preceding circuits, this rectifier will give the same results. That is, the rectified voltage across the load resistance will be the same in all three cases provided that the input voltages are the same. There may be slight differences but they will be second order effects which are negligible.

All three circuits are half-wave rectifiers so that the entire signal voltage developed across the tuned circuit is impressed in the rectifier. This is not the case if the rectifier is half wave and if the coil is tapped.

Another Fallacy

If the input coil is tapped at the middle and the total voltage is divided equally between two anodes of a full-wave rectifier the internal resistance of tube is cut in half, but this does not mean that the fifty cent rent, reduction in the voltage and the internal resistance offset each other. They do that only so far as the internal resistance of the tube is concerned but not in respect to the external resistance. Since the load resistance in practical cases is so large that the internal resistance is negligible, the effect is to cut the output voltage in two. That is, if we tap the input coil at the middle and use a full-wave rectifier, we only get half as much voltage out as if we had used the entire voltage in a half-wave rectifier. This assumes, of course, that we do not change the total number of turns in the coil, or in other words, that we do not change the total signal voltage across the tuned circuit.

It is assumed by many that to get a certain high voltage out of the circuit is to provide adequate capability of handling that voltage without making any provision for getting it. We repeat that we only get out of the diode something less than what we put in. Therefore if we have designed the rectifier so that it will handle a certain voltage we must also make provision for putting that voltage into it. While we can get a certain voltage out of thin air by merely erecting an antenna, we certainly cannot get enough to load up a rectifier to the limit that has been designed to handle 100 volts. We have to introduce amplification, and a great deal of it.

100-Volt Example

Suppose, for example, that we want a rectified voltage of 100 volts across the load resistance in a diode half wave rectifier. Let us suppose further that the rectified voltage is numerically equal to the root mean square voltage across the tuned circuit. Then the signal voltage across the tuned circuit should be 100 volts. If there is a step-up of 25 in the transformer, counting that due to resonance as well as that due to transformer ratio, we should have an output voltage of four from the tube just ahead. Therefore this tube must be operated so that this voltage can be obtained without overloading.

The higher output voltage that is required on the grid or grids of the power stage, the more amplification we must have in the receiver.

When we have a grid biased detector the voltage across the tuned circuit ahead of that detector is likely to be considerably higher, for the same signal current in the primary, than when we have a diode detector, for the diode detector takes power from the tuned circuit whereas the grid biased detector does not. This power is considerable. Suppose that the current in load resistance averages 0.2 milliampere and that the voltage across it is 100 volts. The power dissipated in the load resistance is then 20 milliwatts. There is a small loss in the tube in addition. Thus the power taken from the tuned circuit is at least 20 milliwatts, in the assumed case, and this will lower not only the sensitivity of the receiver but also its selectivity.

Increasing Sensitivity

The loss can be decreased by increasing the load resistance. Suppose, for example, that we double the load resistance and still retain the 100 volts across it. In that case the load is one megohm and the current is only 0.1 milliampere. The power loss in the load is now only 10 milliwatts. Thus by doubling the load resistance we have cut the loss in half. This will materially decrease the signal strength required to maintain the 100 volts across the load. Both sensitivity and selectivity will be increased. The selectivity is increased because any loss is equivalent to a resistance in the tuned circuit and by reducing the loss we reduce the resistance in the tuned circuit and hence increase the selectivity.

Increasing the load resistance increases the useful portion of the output in comparison with the loss in the tube, and therefore there is a gain in sensitivity at this point. However, this is small compared with the gain resulting from lowering the loss in the tuned circuit.

There is one disadvantage in increasing the load resistance and that is that the increased sensitivity is mainly at the lower audio frequencies. There are several reasons for this. First, the selectivity is increased, and that causes an increase in the strength of the load notes relative to the high. Second, the by-pass condenser across the load resistance becames more effective across a higher resistance, and the high notes suffer a reduction most, and the more the higher they are. Of course, this can be corrected by reducing the filter capacity in the same proportion that the resistance is increased so that the time constant will remain the same. Thus if the by-pass condenser is 100 mmfd. when the load resistance is half megohm it should be 50 mmfd. when the load is one megohm. In both cases, however, the by-pass capacity may be doubled without causing any appreciable reduction in the high note output.

High Voltage Circuit

It is seldom that a high voltage is required across the diode rectifier load resistance. If the power tube follows the detector immediately it is usually a pentode which cannot be given more than about 16 volts peak value. If a tube of lower amplification factor is used as power tube, there is usually an intermediate audio stage which steps up the voltage by at least 10. Thus the power tube will get its full voltage without much voltage across the load of the rectifier. In Fig 4, however, is a case where a very high output is necessary. The rectified voltage is divided equally between two power tubes of the low gain type, say two 245s. Each one of these will take a peak voltage of 50 volts so that the total voltage across the two grid leaks should be 100 volts. The voltage across the load resistance R1 should be even higher by a small amount. If the two output tubes are 250s, the voltage required would be still higher, for each of these takes a maximum of 84 volts. But any three element tube like the 227 or the 56 could be used as the diode rectifier without overloading, provided that the load resistance R1 were half megohm or more. In order to get such higher voltages out of the tube the input voltage must be correspondingly high, and there may be danger of breaking down the tuning condenser across the input coil. Only a condenser of mica insulation should be used.

A Little Less Science But a Little More Service

Stevens Partridge is known as the "Weather Eye" of WINS, New York City.

Partridge tells what weather is brewing, whether the outlook is fair, cloudy or rainy.

With the coming of Fall, long-distance weather forecasting becomes more certain, Partridge says, and conditions may be sufficiently stable to give an accurate foresight into the following four or five days.

All of Partridge's forecasts are based on data supplied by the United States Weather Bureau. Because of his unofficial position, however, he is able to venture forecasts that the bureau avoids, since long-range forecasting is not an exact science.

The accuracy of Partridge's long-range forecasts is attested by a number of exploits, such as his prediction of a drought-breaking rain in the wheat belt, which rain caused a three-cent decline in the price of grain.

Partridge's forecasts are followed by many manufacturers and distributors of commodities whose sale and prices are affected by the weather.

Philadelphia Show Opens September 26th

The Electrical Association of Philadelphia will hold its 5th Annual Electric and Radio Show beginning Monday, September 26th and continuing through the week to October 1st. It will be staged at the Municipal Convention Hall, where the show was the premier exposition for the $6,000,000 edifice last year, and preparations are being made for handling 125,000 patrons during the week.

J. L. FOX WITH WSM

Nashville, Tenn.

J. Leslie Fox, formerly general manager of KFH, Wichita, Kansas, has been named commercial manager of WSM, Nashville.

www.americanradiohistory.com

THE ECLIPSE STUDIED

Radio Observers Seek Effects of Light and Darkness on Waves

By Neal Fitzalan

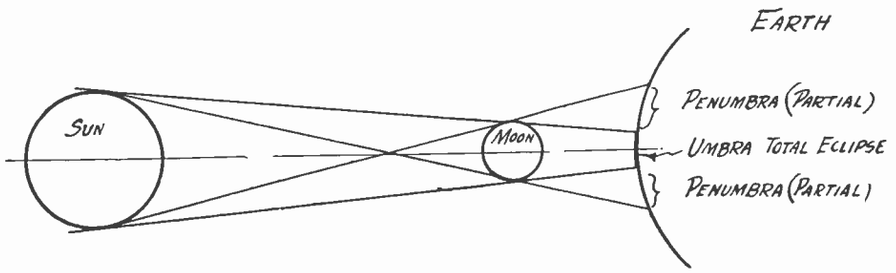


FIG. 1

How a total and a partial eclipse of the sun occurs. The circle marked "Umbra" is the area of total eclipse and the ring around it marked "Penumbra" is the area of partial eclipse. The circle moves across the face of the earth and traces a path.

ASTRONOMERS, physicists, and radio engineers made the most of their opportunity for studying the optical and radio phenomena associated with the sun, offered by the total eclipse of the sun in the afternoon of August 31st. Optical instruments of all kinds, including astronomical telescopes, interferometers, spectroscopes, still and moving picture cameras, and simple smoked glasses were brought into play. Radio and electrical instruments also were used extensively. Many radio transmitting stations were used to transmit special signals. Some of these were located inside the path of totality, others outside. Receivers located everywhere were tuned in on the various transmissions. Some receivers outside the area of totality were used to receive signals originating from stations in that area. Others in the dark area were tuned to stations outside the eclipse area, and still others were used to receive signals which had crossed the area in question. Instruments of all types were mounted in laboratories, in the field, on mountain tops, and in airplanes. Many different types of recording devices other than cameras were brought into play so that observations could be made at leisure after the phenomenon was over.

Heaviside Layer

Telephone and telegraph engineers were interested in the eclipse because of any light that it might throw on the effect of the sun on magnetic storms which frequently disrupt wire communications. Radio engineers were interested in the phenomenon because of the light the eclipse might throw on the behavior of radio wave propagation and its relation to the sun. The nature of the Heaviside layer is the problem which they wished to solve with the aid of the moon.

The Heaviside layer is thought to be a layer of electrified particles some 300 miles above the earth's surface which reflects certain radio waves, depending on their length, and which accounts for long distance radio reception. It has long been known that reception changes at sunrise and sun-set and it has been thought that this change was due to a shift in the altitude of the ionized layer. The eclipse amounts to a sun-rise and sun-set in rapid succession and if there is a relation between the sun and the altitude of the Heaviside layer that should appear at the eclipse, and it is for this reason that radio engineers made such extensive preparations for studying the propagation of radio waves of all lengths immediately before, during, and immediately after the eclipse. It is too early to say what the results of these studies were.

An eclipse of the sun occurs when the moon gets between an observer on the earth and the sun. The eclipse is partial if only a portion of the sun is obscured by the moon and it is total when no part of the sun's disc is visible.

The reason for the intense activity in studying the radio and optical phenomena associated with the eclipse is that there will not be another one for several decades, at least not in such a favorable location for studies of various kinds. Moreover, since the previous total eclipse of the sun visible in this country in 1925 there has been much progress in short wave communication and many problems associated with the Heaviside layer have arisen. Also, since that time many different instruments and methods for making the studies have been developed. This was the first time that an opportunity offered for making use of them.

Studies by NBC

The first observation of the effect of a total eclipse of the sun on ultra-short wave radio transmission was conducted by National Broadcasting Company engineers.

Extensive measurements of reception strength were conducted by the radio technicians in an effort to obtain information which might throw much additional light on many of the problems which surround transmission on the ultra-high frequency wave band.

Observations were conducted before, during and after the eclispe on broadcasting, short and ultra-short waves, according to O. B. Hanson, NBC manager of plant operation and engineering, but the ultra-short waves received the greatest attention. Broadcasting and short waves had been observed during an eclipse before.

For the purpose of the experiments, signals were sent out on all three groups of wave lengths and the reception strength carefully tested at various points of vantage. As a result of these tests, it is hoped that deductions can be made, particularly in the ultra-high frequency range, which will add to the technical knowledge of the phenomenon of fading, as well as increase understanding of transmission as it is affected by the sun.

Tests in N. Y. City

The ultra-short wave observations were conducted from the NBC experimental station in the top of the Empire State Building, and at various reception points in New York City and the surrounding countryside. An attempt also was made to pick up these signals at a point beyond the Empire State Building horizon, in an effort to learn if conditions brought about by the eclipse make ultra-short wave transmission beyond the horizon possible.

One of the most important reception locations for the ultra-short wave measurements was established by one of the NBC portable receiving trucks. This truck was stationed in a spot at least half a mile from an automobile highway. This isolated location was utilized in an effort to eliminate as much interference as possible, since it is well-known that the ignition system of an automobile is an excellent transmitter of ultra-short wave signals.

Studies by G. E.

Although the total eclipse of the sun cast a shadow of but 100 miles over the northeastern part of the United States, there was radio eclipse over a much wider area and it was on this that scientists of the General Electric Company concentrated their study at this time.

Dr. E. F. W. Alexanderson, consulting engineer, and one of the world's outstanding engineers in radio matters, arranged special radio receiving apparatus, installed at Freyburg, Maine, which is located in the center of the eclipse's path, to measure the variation of intensities and other phenomena which might occur. The General Electric's shortwave station, W2XAW, which is licensed to operate on 16 different frequencies, sent out a constant 500-cycle note, from Schenectady, N. Y., sounding to the ear much like the whistle of a peanut cart, and it was this so-called squeal which was received and measured.

So that a permanent record might be made of variations in the sound, a carbon facsimile recorder, the development of C. J. Young and Dr. Alexanderson, was operated. This is the same recorder that was used some time ago in receiving a perfect reproduction of the front page of a San Francisco newspaper across the country 45 minutes after it had left the printing press on the west coast. Believing that the effects of the so-called radio eclipse would occur before the regular eclipse of the sun, this recorder was operated from 1 o'clock in the afternoon

(*Continued on next page*)

www.americanradiohistory.com

NO CHOICE LEFT

Television Must Go on Ultra Waves

Washington.

Television has passed the stage where there is any doubt that it is scientifically practicable, and now faces the problem of being developed inexpensively enough so as to be commercially practicable, it was stated orally by Harold A. Lafount, Acting Chairman of the Federal Radio Commission.

"Reports from experimental laboratories reveal that slowly but steadily and inevitably, the scientific barriers are being surmounted," he said. "Television's scientific practicability is inevitable—the chief problem now is to cut down manufacturing and operating expenses so television will become a commercial industry."

The following additional information, according to "The United States Daily," was made available orally by Mr. Lafount, and in Commission records:

Although experimental laboratories have made no recent official reports to the Commission, it is understood that significant progress has been made during the last few months. Obstacles which have heretofore seriously worried scientists seeking to develop television, have apparently been overcome sufficiently to assure their standing in the way no longer.

Cost Must Be Reduced

Laboratories are working now harder than ever before, and are concentrating their efforts on reducing expenses of manufacturing and operation of television apparatus. As things are now, it is impractical to forecast any immediate time when apparatus will be inexpensive enough to come within the reach of the average pocketbook. And until cheaper methods of manufacture and operation are found, there is no chance that television will develop to a great industry.

Its potentialities, however, are almost limitless. In combination with broadcasting, television will become on of the United States' greatest industries, affecting every resident of America.

Ever since 1925, when C. Francis Jenkins gave his first public television demonstration, consisting of flickering shadows of a little girl in silhouette bouncing a ball, the laboratories have become a magnet for the promoter who pictures to his prospective clients the untold wealth to be found in this new field, which, in his opinion, will far outstrip such prosaic industries as were created by the automobile and radio.

Ever since its creation, the Commission has been frequently petitioned to put television on a commercial basis, as if the Commission by the passing of rules and regulations could create for an industry a state of technical perfection which the best engineers of the country have not yet been able to achieve.

Scanning Lines Increased

The position of the Commission is very clear and quite simple in this respect. As soon as the television art is perfected to the point where the average layman can expect a comparatively fair amount of entertainment from his television receiver, it seems reasonable to suppose that the Commission will not arbitrarily bar the way to economic progress in this field.

These imperfections and limitations of present-day television result from the comparatively small number of what are known as television scanning lines. A number of years ago television was being developed on the basis of 48 scanning lines per picture, which means that whether the picture was an inch high or was projected to a large screen, the number of lines still remained at only 48.

From a projection standpoint it can be readily seen that if the ordinary motion picture screen is divided into 48 horizontal strips, the amount of resulting detail must necessarily be meager. The number of lines has been gradually increased from 48 to 60, and we are now told that 120 lines are being used with the possibility of doubling this to 240 lines.

Detail of Pictures Increased

Such an increase in line scanning will, of course, give a considerable increase in the detail of the picture transmitted, but the picture will still be far from approaching the quality of present-day motion pictures. Rather complex engineering problems are involved in the development of the associated apparatus for both low and high frequency amplification which will permit full advantage to be taken of the increased detail accompanying the increase of the number of scanning lines.

Just at this point is where some of the television problems of the Federal Radio Commission are encountered. The normal 60-line picture used by the majority of television experimenters today requires a single sideband modulation width of 43,200 cycles, or 86,400 cycles emission for double side band transmission. If the number of lines is increased to 120, at 24 pictures per second, which is the standard talking picture speed, maintaining the five by six proration of height to width, the number of cycles required per sideband increases to 207,360, or a total band width of 414,720 cycles required for double sideband transmission.

It can thus be seen that if 240 lines are used with the methods known today, a single sideband emission of 829,440 cycles would be required, or using double sideband transmission, a total band width of 1658.88 kc would be required for a single picture, which is almost twice the entire width of the whole present broadcasting band from 550 to 1,500 kc. The radio spectrum below 20,000 kc is now crowded and does not contain space for such wide band emissions unless we abolish many other important services.

Ultra-high Bands Selected

For this reason it became evident that for pictures having any reasonable degree of detail it was necessary to find an entirely new part of the radio spectrum where comparatively wide frequency bands could be found for this new type of service, and consequently the so-called ultra-high frequency bands were selected. These bands run from 43,000 to 46,000 kc, from 48,500 to 50,300 kc, and from 60,000 to 80,000 kc, including a total frequency space of 24,800 kc.

This appears to be a relatively large amount of space for such a new service, but we have already been informed by engineers of some of our leading companies that eventually for good service to the public, channels having widths of approximately 2,000 kilocycles will be required, and on such a basis it can be seen that this apparently tremendous expanse boils down to only 10 channels.

Perhaps this single reason more than any other justifies the policy of extreme caution which has been followed by the Commission in the approval of new television stations. If what has the essentials of a huge industry in the making must grow, live, and prosper within perhaps only 10 channels, only the most extreme caution in the original granting of television applications can prevent chaos.

WWJ, Pioneer Station, Twelve Years Old

Detroit, Mich.

WWJ, owned by the Detroit "News," celebrated its twelfth birthday with a special program over a National Broadcasting Company network.

One of the pioneer broadcasting stations of the United States, WWJ started sending out regular programs on August 20th, 1920. The following October it carried the results of the World's Series, and gained national attention in November by broadcasting the returns of the national election.

WWJ claims having broadcast the first regular programs of entertainment.

Valuable Data Recorded During Eclipse

(*Continued from preceding page*)

until 6 o'clock, whereas the regular eclipse started at approximately 3:30 o'clock, reached its maximum at 4:30 o'clock eastern daylight time, and was all over at 5:30 o'clock.

So that comparisons might be made with normal conditions, this shortwave transmitter and facsimile recorder was operated during the same period of time two days preceding the eclipse and the day following.

With Dr. Alexanderson observing any phenomena which might occur on the receiving end was Dr. Irving Langmuir, associate director of the research laboratory of the General Electric Company. Dr. Langmuir also had his airplane available over that region and during the period of totality was in the air taking motion pictures and making other observations. This also afforded him a better opportunity of observing the moon's shadow as it crept across the earth.

"There is a theory that particles from the sun create one of the ionized or conducting layers in the earth's upper atmosphere," Dr. Alexanderson explained before the tests. "What effect this may have on radio transmission we hope to observe. Our short wave transmitter here in Schenectady will be operated on a wave length which is believed best for daylight reception. We shall see what effect the darkness of the eclipse has, and our facsimile recorder, tuned to this constant signal note, should produce a record valuable to scientists."

(*More eclipse news on page* 17)

www.americanradiohistory.com

CONSTRUCTION

Precautions That L

By Herm

RESISTOR COLOR CODE

Ohms	Megohms	Body	Dot	End
350	.....	Orange	Brown	Green
800	.....	Gray	Brown	Black
1,200	0.0012	Brown	Red	Red
50,000	0.05	Green	Orange	Black
20,000	0.02	Red	Orange	Black
100,000	0.1	Brown	Yellow	Black
2,000,000	2	Red	Orange	Black
5,000,000	5	Green	Orange	Black

TWO units have to be insulated from the metal chassis of the Four-Tube 1933 Diamond of the Air. They are the 8 mfd. electrolytic condenser next to the rectifier, and the volume control.

The reason why the 8 mfd. must be insulated is that the negative side, or can, is connected to B minus, the center of the high-voltage secondary, and not to ground. The chassis is grounded, hence the negative side of the condenser must not connect metallically to chassis, or the field coil would be shorted out.

To insure insulation two washers are used. One is of the extruded type and is placed between the 8 mfd. and the top of the chassis. As the condenser is of the inverted mounting type, a nut affixed at bottom will hold the condenser in place. But between this nut and chassis a flat insulating washer must be put, to avoid connecting with chassis at this point. Then, so that a means will be provided for making the connection between negative of this condenser and B minus, a special lug is used. It goes between the nut and the lower or flat washer.

The insulated condenser goes to the right, in the 7/8-inch hole, adjoining the tuning condenser shield.

Effect of the Two 8 Mfd.

The positive side, or top lug, of the 8 mfd. goes to maximum B plus, and so does the corresponding lug of the other 8 mfd. condenser, although this other one has its case connected to grounded chassis. That is, the nut is affixed, and, like the special washer, is grounded to chassis. Any other chassis point, or ground post, may be used for this connection, if no extra lug is available for the condenser.

Then the effect of the two 8 mfd. condensers is as follows: one is between rectifier positive and B minus, and does much of the filtration, while the other is between B plus and the opposite end of the choke coil, or, to state it differently, is between maximum B plus and ground. The choke coil is the field coil of the dynamic speaker and is in the negative leg of the rectifier. The assumption made by some that a choke in this position does not filter, because the current flows from B plus to the tube circuits, is erroneous. The current does flow from positive of rectifier through the tubes but returns to B minus through the choke, and it is therefore immaterial for filtration purposes whether the choke is in the negative or the positive leg, although it is important in this circuit to keep it in the negative leg for voltage conservation and also for the audio regenerative effect produced between detector and output tubes.

It can be seen that the bias for the pentode output tube is derived from part of the voltage drop in this choke coil or field coil. The total voltage drop is around 100 volts, and the grid is returned to the joint of two resistors, which joint is at about 20 volts negative in respect to grounded cathode or filament center of the output tube.

Fiber Washers on Volume Control

Thus the full voltage measured from ground to maximum B plus is applied to the last tube, or output tube, and the bias is not taken from this voltage, but from the drop in the field coil. Hence if the maximum B voltage is 230 volts, and the bias is 20 volts, the sum of the two voltages is 250 volts.

The insulation of the volume control resistor, a 250,000-ohm potentiometer with a-c switch built in, is provided by two extruded fiber washers. These have extrusions that just fit into a 7/16-inch hole, and such a hole is on the front of the chassis. It should be to the right, rather than to the left, of the dial, and in this respect an amendment must be made to the chassis layout diagram printed last week.

Thus the washers are flat except for a slightly elevated collar that just fits into 7/16-inch. One washer is placed in this opening at front with collar pointing to the back of the chassis, the other is placed in this opening from the rear, with collar facing the front, so that the two collars are facing each other. Therefore, as the thickness of the fiber is 1/32-inch, there is complete insulation for the 1/16-inch thickness of the chassis. Even if the two collars do not meet, the volume control is insulated nevertheless, because held in a position away from and free of the chassis, no matter if the chassis is ¼-inch thick, which it never is.

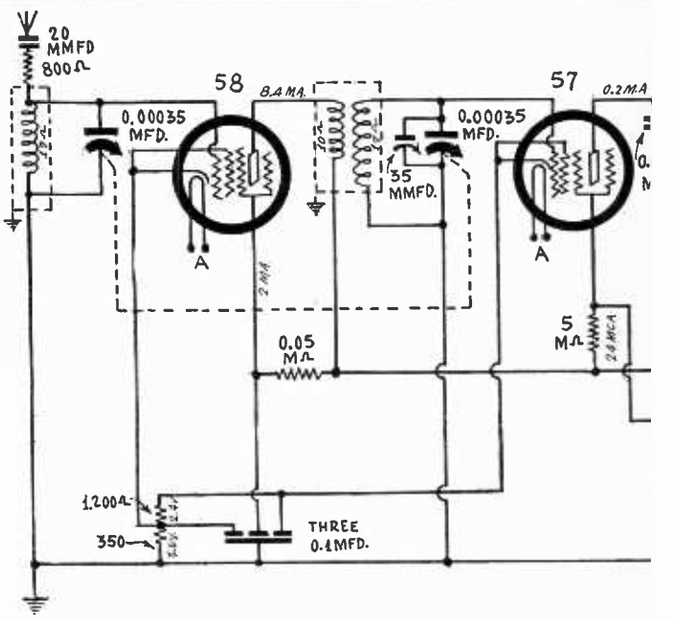
No Volume Control Is Perfect

The volume control has to be insulated because one side connects to the plate circuit filter of the detector, the other side to maximum B plus, while the arm goes to one side of the 0.01 mfd. stopping condenser, the other side of which condenser connects to grid of the output tube.

This type of volume control does not contribute to detuning. However, it has the slight drawback of producing a scratchy sound when moved in the region of highest sensitivity. The fact that a volume control has a fault need distress nobody, as there is no completely satisfactory volume control. Most of the other types cause serious detuning, and while that of itself would not be prohibitive in a circuit that has a manual trimmer, such a volume control commonly alters the r-f bias, and such alteration should not be made possible in the present receiver, because the detector bias depends considerably on the r-f bias.

The antenna and ground connections may be made to a twin post, and thus an anchorage is provided for the 20 mmfd. series condenser. This is a Hammarlund equalizer of 20-100 mmfd., and is set at minimum, with plates disengaged as much as possible. The strong brass lug may be bent to a right angle and fastened to the antenna post at the inside back of the chassis, the small copper lug connecting to the 800-ohm series resistor in the antenna circuit and the G lug of the antenna impedance coil and to the other side of this resistor to the grid of the first tube (58). It will be found that these connecting points are within a few inches of the series condenser.

As the receiver stability depends a little on the aerial length, the general rule applies that the longer and higher the aerial the greater the pickup, but not much of an aerial is needed, and indeed, 20 feet strung indoors under the moulding may prove too much. If it is too much this will disclose



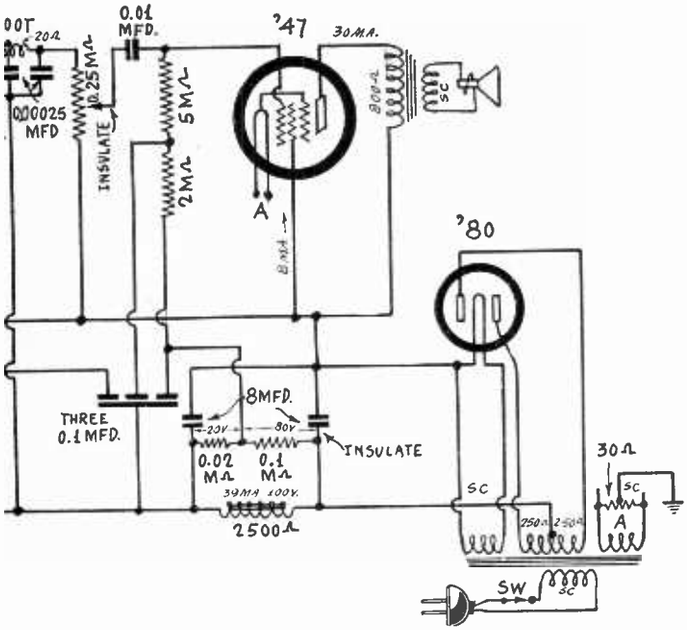
The Four-Tube A-C 1933 Diamond of the Air circu
The voltage between ground and B plus maximum will
or around 250 volts if 1800 ohms is the resistance of
resistance meters may be expected to

www.americanradiohistory.com

)F THE DIAMOND

ad to Great Success

n Bernard



with voltages, currents and d-c resistance values stated. e around 230 volts if 2500 ohms is the field coil resistance, hat unit. Where the intials "SC" appear, the usual ve the same reading as on a short circuit.

itself by the presence of slight cross modulation, meaning that when some station or stations are tuned in a strong local perhaps 50 kc removed will be heard as a faint background.

Pickup on 10 Feet

But the remedy is to use a shorter aerial, so try 15 feet. Good results have been enjoyed on as little as 10 feet, which may seem incredible when said in connection with a four-tube set (in which only three of the tubes are in the radio and audio circuits of the receiver). In last week's instalment (September 3d) the reason for this unusual condition was fully disclosed.

The antenna series resistor has been made 800 ohms, to provide a generous value. If the antenna is shortened too much there will be some squealing at a few of the higher frequencies, in which case the aerial may be made a little longer, or the series resistor may be increased in value.

When the constants are exactly as specified there will be no squealing anywhere on the dial, yet sensitivity will be high, approaching 10 microvolts per meter at 1,000 kc, which is quite a feat for so small and inexpensive a circuit.

Points West of Chicago

As a zestful test recently one night in New York City no stations were held unless they were west of Chicago, and still there were plenty of stations to which to listen.

The length of the aerial is therefore the only thing that need concern the builder much, and if he lives in a rural section he may use a long aerial, whereas if he lives in a community where there are at least several local stations receivable with more than comfortable volume he may use around 15 or 20 feet of aerial, or at all hazards as short an aerial as he desires, so long as there is absence of squealing. If only 3 feet of wire are to be dropped from antenna post to the floor then the antenna series resistor would have to be increased, otherwise there would be squealing all over the dial. Just how much this increase would have to be must be determined experimentally, but it may run into a few thousand ohms.

Coil centers for the r-f system are 4 inches apart, and this distance should not be reduced, although it may be exceeded, if desired. If the coils are too close together there will be squealing trouble.

Tuning Compensation

There is a manual trimmer across the detector section of the tuning condenser, around 35 mmfd., as this takes care of both extremes. It was found that for the lower frequency stations the condenser had to be nearly or entirely at minimum capacity, while for the highest frequency station it had to be nearly at full capacity. The reason was not apparent at first. The inductance of the secondaries was matched to plus or minus 0.6 microhenries at one frequency, and yet the direction of the capacity change indicated that the inductance was too low at the high frequencies and just right at the low frequencies, or that the capacity was correct at the low frequencies but too low at the high frequencies. That it was capacity trouble did not seem logical, as a fixed value of capacity could be established, and the distributed capacity values will not change with frequency. If it was capacity trouble it could be equalized with a fixed trimmer.

It was assumed just as a theory that resistance trouble existed, and the differences in resistance of the two tubes were noted. The d-c resistance of the r-f tube is a little less than 16,400 ohms, and that of the detector tube (with loads) a little more than 1,000,000 ohms, but when it was considered that these concern output circuit, while input circuits were tuned, the theory did not hold.

It was then decided, and confirmed by experiment, that the primary of the interstage transformer was such that the mutual impedance was high between primary and secondary at the high frequencies, and that therefore the inductance of the secondary was reduced more at the high frequencies than at the low.

Familiar Effect in New Form

This is the same effect as was discovered by the author some months ago when in another circuit a 300-turn r-f honeycomb choke was used as a primary, although the change was in the opposite direction, because the mutual impedance then was high for the low frequencies, and inductive absorption was greatest at these frequencies.

The field coil of the speaker is marked 2,500 ohms in the diagram, and no tap is shown. If an 1,800-ohm or other resistance value field is at hand, it may be used, but except by accident the tap will not be in the right place, if one is there at all, since the tap is usually for receivers with 60 ma drain, and this set draws only around 40 ma of B current (measures 39 ma actually).

So, if one has an 1,800-ohm field coil the voltage between ground and maximum B plus will be around 250 volts, rather than around 230 volts, and the resistors cited as 0.02 meg. and 0.1 meg., a ratio of 1-to-5, all right for 2,500 ohms, would have to be altered to provide a ratio of about 1-to-3.5. This could be done by following the diagram as it is, although with 1,800 ohms as field coil, and by putting a resistor of 0.25 meg. in parallel with the 0.1 meg. Or any other values may be used, if of not much lower resistance than 20,000 ohms on the one side, and so long as the bias is apportioned correctly, which should be checked up at all hazards, so that the plate current at around 230 to 250 plate volts applied is about 30 ma.

Speaker Connections

The speaker usually has a cable and plug. If it has a tapped type speaker the field plug will be of the UY type, and the almost standard connections (those existing in the cable and plug) are plate to ground, grid to tap, cathode to B minus, two heaters interchangeably to B plus and power tube plate.

The heater connections to speaker socket should be reversed experimentally to determine which method eliminates hum, as some speakers are sensitive to polarity and the effect shows up in hum.

If a tapped field coil is to be used, and tap ignored, no connection is made to the grid contact of socket, but the two voltage-dividing resistors are used, and grid of power tube is returned to the juncture of the two resistors.

If a UX plug is on the 4-lead speaker cable, the connections are clear from the above, whereas if there is no plug, and four leads, either a UY or an UX socket and plug may be used, only four connections, however, for the UY, the fifth being blank. That would be, again, the grid of socket.

(*"Testing, Tuning and Trouble Shooting" next week.*)

www.americanradiohistory.com

58 VOLUME CONTROL

Suppressor and Grid Voltages May Be Varied

By Brunsten Brunn

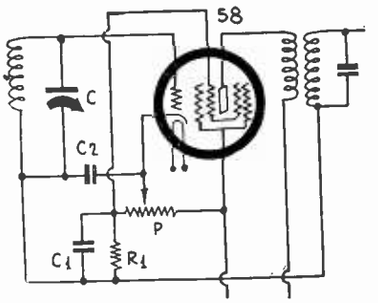


FIG. 1

This shows how an effective manual volume control may be arranged for a 58 tube circuit. Both the grid bias and the suppressor grid bias are increased or decreased together.

RECEIVERS in which the 58 tube is used usually have so much amplification that it is difficult to control the volume. One of the first things noticed in connection with these tubes was that control of volume with the usual combination of signal input and bias variation control by means of a potentiometer was inadequate. Certain sensitive receivers in which the volume control was adequate as long as 235 tubes were used in the amplifiers became entirely uncontrollable when 58 tubes were substituted for the 235's.

In a 58 tube there are two ways of controlling the volume by operating with the voltages on the tube. One is to vary the grid bias. This is effective because the tube is of the remote cut-off type. Another way is to vary the suppressor grid voltage by making it more or less negative. The more negative the suppressor grid the less the amplification. The voltage may be increased to about 50 volts negative before the gain is completely cut off. The grid bias may also be made about 50 volts negative before the tube ceases to function entirely.

Simultaneously Variation

It is possible to arrange the circuit so that the grid bias and the suppressor voltage vary simultaneously and both in the same direction. Thus we get a double action and the control of the volume should be more rapid. One way of arranging the circuit is shown in Fig. 1. First we have the regular limiting bias resistor R1. The suppressor grid is connected to the positive end of this limiting resistor. A potentiometer P is connected between the screen and the positive end of R1 and the cathode of the tube is connected to the slider of the potentiometer.

The value of the limiting resistor R1 depends on the limiting bias desired and also on the value of P, as well as on the voltage applied to the screen. Since the recommended screen voltage is 100 volts we shall assume that this voltage exists across the potentiometer P. We are at liberty to choose any value of current in P. Let it be 4 milliamperes. Therefore the value of P should be 25,000 ohms, a standard value that may be had in wire wound type.

Now the screen and plate current in the tube will be about 11 milliamperes when the slider is set for maximum gain, or for lowest bias. Therefore the total current through R1 will be 15 milliamperes, since 4 milliamperes will be supplied by the potentiometer. The minimum bias should be 3 volts. Hence the value of R1 should be 200 ohms. That is for a single tube. If a second tube of the same type is connected to the same bias arrangement we have to add 11 milliamperes to the total current in R1 and determine the resistance value from the new total current. It comes out about 115 ohms for two tubes.

Variation in Bias

When the slider is set at the junction of P and R1 the tube is in its most sensitive adjustment. The grid bias is equal to the drop in R1, which is about 3 volts, and the suppressor grid voltage is zero, since the suppressor grid is connected to the cathode. As the slider is moved toward the screen the grid bias becomes more and more negative, starting from 3 volts, and the suppressor grid also becomes more and more negative, starting from zero. Both contribute to reducing the amplification. There is still another effect tending to reduce the amplification. The screen voltage is reduced by the same amount that the suppressor grid voltage is increased. The plate voltage is also reduced by the same absolute amount but the relative decrease in the screen voltage is greater and that has a greater effect in reducing the amplification.

It is best to use a potentiometer that can be reduced gradually to zero without a sudden jump from some relatively high value to zero for otherwise the control of the gain will not be satisfactory. In case the potentiometer is not wire-wound, a tapered resistance element can be used, and in that case the slow tapered end should be connected to resistance R1. This will make the control much better.

Two by-pass condensers C1 and C2 are used because it is desirable to by-pass the suppressor grid regardless of the position of the slider and it is also desirable to by-pass the bias portion of the potentiometer. The larger these condensers are the better, but it is hardly ever necessary to make them larger than 1 mfd. each, and 0.25 mfd. should be large enough.

In case another 58 is put on the same control the cathodes of the two tubes should be joined together and also the two suppressor grids. The portion of the potentiometer that is used for bias should be able to carry not only the bleeder current but also the screen and plate currents of the two tubes. Since for two tubes the current will be about 26 milliamperes, the entire resistance should be able to carry this current. However, when much of P is used for bias the current will be considerably less, but just the same it is well to have large safety factor.

Audio Control of Volume

When automatic volume control is used the manual control is usually put in the audio amplifier. There are several places where this control may be put. If the detector is a 55 or an 85, the control may be a potentiometer of about 0.5 megohm in the grid circuit of the triode part of that tube. Or it may be a similar device placed in the grid circuit of the next tube, as shown in Fig. 2. It does not matter whether the second tube is an intermediate audio amplifier or the power tube. Of course, if there is a third audio amplifier the potentiometer can be placed in its grid circuit. They all

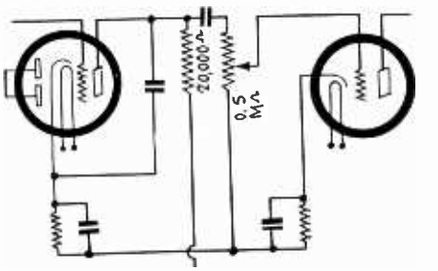


FIG. 2

When automatic bias is used for controlling volume the manual volume control should be put in the audio amplifier and may take the form of a high resistance potentiometer as here shown.

work satisfactorily. It is perhaps well to use the potentiometer in the grid circuit of the second tube rather than in the detector because there is less radio frequency present there than in the detector control grid. Also, it is better to put it in the grid circuit of the second tube rather than in that of the output tube because then the signal level in the second tube will be less, for a given output, and there will be less distortion on strong signals.

As a rule, it is not necessary to use a manual volume control in the r-f or i-f amplifier if there is automatic control, but it may be used when necessary or when desirable for any reason. Automatic control may be combined with the arrangement shown in Fig. 1 because the grid return is free to be connected anywhere. If condenser C in Fig. 1 is a tuning condenser that must be grounded, the coil should be disconnected from ground and the circuit completed with a large by-pass condenser, say 0.25 mfd. The free end of the coil may then be connected to the automatic volume control. Unless the circuit is extremely sensitive it is not necessary to use both manual and automatic control in the r-f and i-f amplifiers, provided there is a control in the audio amplifier if automatic control is used.

Amos 'n' Andy Begin Fourth Year on Air

Amos 'n' Andy have begun their fourth year under the sponsorship of the Pepsodent Company, of Chicago.

Amos 'n' Andy made their debut to a national audience over an NBC-WJZ network after entertaining listeners in various parts of the country through local broadcasts for two years. It was their six-nights-a-week personal engagement that sent them rocketing to popularity.

Since Amos 'n' Andy have been on the air they have broadcast 2365 episodes, and have been actually on the air 394 hours, 10 minutes.

Only three years ago Freeman Gosdon and Charles J. Correll, creators and portrayers of their famous characters, were practically unknown to the majority of the poeple of America.

It is pointed out that no other actors ever played before virtually the same audience six nights a week for three years.

www.americanradiohistory.com

Official Data on the 842; Power Amplifier, Modulator

The following official data on the 842 tube were supplied by RCA Radiotron Co., Inc., and E. T. Cunningham, Inc.

THE 842 is a three-electrode, low-mu, high-vacuum tube designed primarily for use as a Class A power amplifier and as such is particularly useful as a modulator in amateur transmitting equipment. In general appearance and filament characteristics, the 842 resembles the Type '10.

842

RATING AND CHARACTERISTICS

Filament Voltage	7.5 Volts A-C or D-C
Filament Current	1.25 Amperes
Direct Interelectrode Capacitances:	
Grid-Plate	8 uuf.
Grid-Filament	5 uuf.
Plate-Filament	4 uuf.
Maximum Overall Length	5 5/8"
Maximum Diameter	2 3/16"
Bulb	S-17
Base	Medium 4-Pin Bayonet

AMPLIFIER (CLASS A)

Operating Conditions and Characteristics:

Maximum Plate Voltage		425 Volts
Maximum Plate Dissipation		12 Watts
Typical Operation:		
Filament voltage	7.5	7.5 Volts A-C
Plate Voltage	350	425 Volts
Grid Voltage	—72	—100 Volts
Load Resistance	5000	8000 Ohms
Amplication Factor	3	3
Plate Resistance	2400	2500 Ohms
Mutual Conductance	1250	1200 Micromhos
Plate Current	34	28 Milliamperes
Peak Grid Swing	68	96 Volts
Undistorted Power Output	2.1	3 Watts

MODULATOR

Maximum Plate Voltage		425 Volts
Maximum Plate Dissipation		12 Watts
Typical Operation:	CASE 1	CASE 2
Filament Voltage	7.5	7.5 Volts A-C
Plate Voltage	350	425 Volts
Grid Voltage*	—88	—101 Volts
Modulation Factor	0.6	0.68
D-C Plate Current	14	25 Milliamperes
Peak Grid Swing	84	97 Volts
Osc. Input per Modulator Tube	8	14 Watts

CASE 1—With modulator and oscillator (or r-f amplifier) at same plate voltage.

CASE 2—With oscillator (or r-f amplifier) operating at plate volts = 350 and 40 ma. d-c plate current.

*Grid voltage is given with respect to mid-point of a-c operated filament; if the filament is d-c operated, the given values of grid voltage should be decreased by 4 volts.

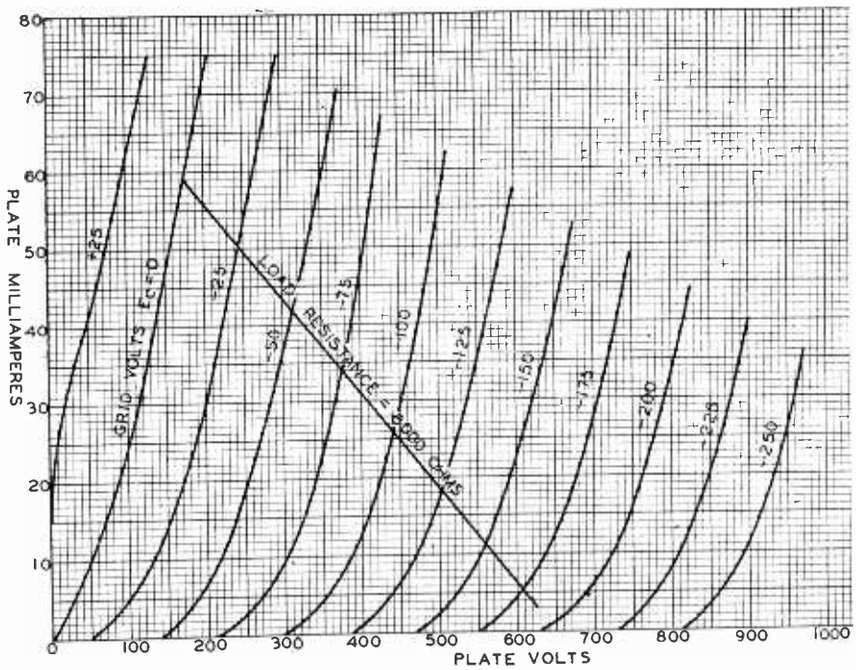
Installation

The base pins fit the standard four-contact socket which should be installed to operate the tube in a vertical position with the base down. Base connections and external dimensions are given in Outline Drawing No. 92S-448R2.

The bulb of this tube becomes quite hot under operating conditions. The surface temperature on the hottest part of the bulb should not exceed 150° F. as measured by a small thermo-couple. Provision should be made for adequate natural ventilation to prevent overheating.

The filament is designed to operate at 7.5 volts. Either alternating or direct current may be used to operate the filament. In certain installations where freedom from hum is essential, the use of direct current is to be preferred. When a.c. is used, the transformer winding supplying the filament circuit should be designed to operate the filament at 7.5 volts for full-load operating conditions at average line voltage. Less than this voltage may in time result in loss of emission, because of too low a rate of diffusion of the active material within the filament to its surface. More than rated voltage will shorten the life by too rapid evaporation of the active material from the surface.

Overheating of the 842 by severe overload may cause a decrease in the electron emission of the filament. Unless the overload has liberated a large amount of gas, the activity of the filament may be restored by operating the filament at rated voltage for ten minutes or more without plate voltage. This reactivation process may be accelerated by raising the filament voltage to 9 volts.



A family of plate voltage plate current curves of the new 842 power tube. Curves are drawn for grid bias values from 25 plus to 250 minus. The load line across the curves is drawn from 8,000 ohms and an applied voltage of 650 volts. The output power, if the grid swings from zero to 187.5 volts is 3.15 watts. The grid voltages are measured from the centertap of the 7.5 volt filament, d-c being used on the filament.

Use With Resistance A-F

The grid circuit return, as well as that of the plate circuit, should be connected (1) to the mid-point of a resistor across the filament winding of the transformer, or (2) to the adjustable arm of a potentiometer connected across the filament winding. When d.c is used, these returns should be connected to the negative filament terminal.

Grid bias voltage may be obtained from a C-battery having tap adjustments, from a tapped bleeder circuit, or from a resistance inserted in the negative plate-return lead of each tube biased. The latter method is to be preferred as it compensates automatically for variation in plate current of individual tubes. When the resistor method of obtaining grid bias is used, the self-biasing resistor should be shunted by a condenser of sufficient capacitance to by-pass the lower audio frequencies. This condenser is not required in push-pull circuits.

In cases where the 842 is employed in resistance-coupled circuits, the recommended safe maximum value of grid leak is 1.0 megohm when the self-biasing method of obtaining grid bias is used. Values higher than this may so aggravate any slight traces of gas or electrical leakage existing in the grid-filament circuit as to start a small grid current with the result that a voltage drop opposed to the bias voltage is established across the grid leak. This decrease in effective bias voltage causes an increase in plate current which in turn raises the grid current and increases the opposing drop.

This effect is cumulative and in some circuits may reach such proportions as to damage the tube or even result in its destruction. The conditions just described will not be encountered if a grid choke with relatively low d-c resistance is employed in place of the grid leak. When the grid bias is not obtained by the self-bias method, the above action is seriously augmented. To avoid serious decrease in the bias voltage due to this cause, the resistance of the grid leak should not exceed 0.25 megohm.

Application

As an amplifier (Class A), the 842 is capable of delivering three watts of power. This value is based on the operating conditions (refer to Rating and Characteristics —Amplifier) that the grid remains negative throughout its swing and that the output does not have more than 5% second harmonic distortion.

If more output is desired than can be obtained from a single 842, two 842's may be operated in parallel or push-pull connection. The parallel connection provides twice the output of a single tube without an increase in grid signal voltage; while the push-pull connection will give twice the output at the same grid bias, but requires twice the input signal. Output slightly greater than twice the single tube value can be obtained from the push-pull connection by increasing the bias. This is permissible since the push-pull connection balances out second harmonic distortion—the usual limiting factor.

As a plate modulator, the 842 should be operated under conditions essentially the same as for Class A Amplifier. Specific values for typical operation are given under Rating and Characteristics—Modulator.

www.americanradiohistory.com

Radio University

A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (52 issues) at $6, without any other premium.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

Finite or Infinite?

IS THERE any relationship between the finite or infinite universe and radio waves? —K. W. S., Tacoma, Wash.

Yes, there is the relationship of the all-pervading ether to the universe, and the ether is the medium for conducting radio waves. While the more frequently used radio waves are subjected intensely to the reflecting effect of the sky layers, the obtuseness of the angle governing to a considerable extent the distances at which sky waves can be received, the ultra frequencies do not seem to be thus affected, and possibly strongly penetrate these layers. Thus, at present, one may surmise that the ultra frequencies keep radiating through space; if the universe is limited, then to the limit of the universe; if the universe is infinite, then infinitely. The suggestion of an infinite universe is contained in a formula postulated by Einstein, and which he offered rather as a basis of discussion than as an avowed declaration.

* * *

R-F Resistance

WHAT IS the ratio of increase of resistance with frequency, in respect to tightly-wound solenoid coils? Please give an average value if a steady ratio cannot be expressed.—P. O., Lawrence, Mass.

There is no standard ratio. The increase in resistance depends on several factors, including shape factor (axial length of winding divided by the diameter between wire centers), the capacity, the presence or absence of a tube, etc., assuming the coil in practical use. Evidently you refer to a coil tuned by a variable condenser. For broadcast frequencies the resistance may treble as the frequency doubles, whereas for higher frequencies the increase is likely to be less pronounced. This seems to contradict the assumption of a great increase in resistance as the absolute frequency is increased for high frequencies, but it is rather a ratio, and the lowest frequency has a higher absolute resistance for high frequency coils than has the lowest frequency for low frequency coils. The resistance is important also, because of the effect of resistance on frequency at high frequencies. At the low radio frequencies the r-f resistance is virtually negligible.

* * *

The Improved R-F Input

I HAVE BEEN READING the articles in your magazine that discuss the special treatment of the aerial circuit, to enable the use of so few tuned circuits as two to afford practical selectivity for modern needs, but as some of the statements do not seem to jibe with my own experience I would like further enlightenment. Does not the tighter coupling of aerial to grid circuit of the first tube always increase the sensitivity of the system (assuming resonance properly established)? If that is true, how is it true that with so small a series condenser as 20 mmfd. the sensitivity is said to be better than with tight inductive coupling aforementioned?—U. S. W., Saginaw, Mich.

Tighter coupling of aerial to grid of the first tube, as with larger and more closely positioned primary of a transformer that has secondary in the grid circuit, always makes for increased sensitivity, but at the same time, and somewhat at the same rate, decreases selectivity. The idea back of the special treatment of the antenna circuit is to maintain a high degree of sensitivity consistent with practical selectivity. The situation you depict is one wherein there is bound to be considerable crossmodulation, no matter what tubes are used, so that the limiting factor is the r-f resistance of the system. That resistance must not be so high that insufficient selectivity is present in the first stage to exclude interference in the form of crossmodulation and intermodulation. Therefore the plan was proposed in these columns—and proposed here for the first time anywhere—of decreasing the contribution of the aerial to the resistance of the first tuned circuit, really the resistance of the entire r-f system, by using a series condenser small enough to make first stage resistance negative when only a few feet of aerial were used. Negative resistance is useless, since the receiver oscillates then at all dial settings or frequencies where negative values obtain. Yet by adjusting the series condenser to let in more antenna resistance, or using a sufficiently long aerial and a good ground, the resistance is maintained at so small a positive value that the tube is worked like one just below oscillation. In fact, the reduced resistance is expressible in terms of regeneration. When the apportionment is correct—and it may be done roughly with 20 feet of indoor aerial, usual ground and 20 mmfd. capacity —the r-f resistance will be too low for the higher broadcast frequencies, and to correct that an antenna series resistor of 800 ohms is suggested. The reason for adopting this method of stabilizing the high frequencies is that the resistance has virtually no effect on the sensitivity at the low frequency extreme, confirmed by output meter measurements. So the net result is a balanced system that includes stability at all dial positions. The r-f resistance might be decreased, as a substitute method, by an enormous primary in the plate circuit of the r-f tube, tightly coupled to the secondary, but this method might not be so effective against crossmodulation and intermodulation, because though the large primary would bring the system near the oscillation point, the usual antenna input methods would be required, resulting in introducing high r-f resistance from the aerial-ground system. It is possible, however, that the second method would work as well as the first, but the first method has been carefully checked and tested and proves out remarkably well.

* * *

Lower Bias

SO MANY RECEIVERS use extremely high values of resistance for limiting resistors, and volume control by bias changes, in the cathode circuits of vari-mu tubes. You have commented on this fact from time to time and your circuits sometimes show high values, and thus you must approve of them. But, as you state and as I know, the plate current is much less than the standard values, and I cannot account for the makeshift method. Why not use standard values of biasing resistors, resulting in standard voltages for grid bias and standard current values? It seems to me there must be something lost when the case is overdone, and that something I suspect is strong damping of the high audio frequency response.—T. R. W., Venice, Calif.

The reason why high values of resistance are used, and high bias voltages result

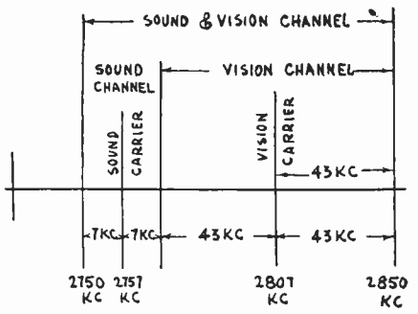


FIG. 1027
Graphical representation of one method of sending vision and sound on the same carrier.

though the current is less than normal, is that the method assures stability of the receiver. Thus high impedance primaries may be used and the set will not spill over. That this high-bias method is not productive of best tone, though applied to the r-f channel where it might not be supposed the tone is much affected, we agree. The effect seems to us to be one rather of detection, as the starting bias is near the recommended value for first detectors in superheterodynes, and the distortion you note has a strong second harmonic content. This also is consistent with detection. We have shown diagrams following the high-bias principle, but the reason was to portray the methods being used. As a practical solution it is passable, especially as it is easiest for stability, absence of which otherwise might create quite a problem. We are forced to admit, however, the results obtainable from standard bias values, of resistance and voltage, and with standard current values, are superior. Remember, however, especially with the 58 and 57 tubes, that the oscillation problem is a serious one, because the tubes are so sensitive.

* * *

Simultaneous Sight and Sound

KINDLY show with a simple diagram how it is possible to send television signals and the sound accompaniment on the same channel without interference.—W. H. V., Detroit, Mich.

Fig. 1027 shows one way it may be done. Two separate carriers are used, one for sound and one for vision. But both are placed within the waveband allotted for a television channel. In the illustration the sound carrier is placed within 7 kc of the lower frequency limit of the channel, or at 2,157 kc, and the television carrier is placed 43 kc below the upper limit of the band, or at 2,807 kc. This is the simplest method of doing it but it requires more selective receivers for separating the sound from the vision.

* * *

Plug-in Standard

IS THERE a standard method of connection for plug-in coils for short-wave or all-wave coverage? If so I would like to know what it is so that the coils I wind will be suitable for a variety of circuits. —O. D. Wildwood, N. J.

No, there is no standard method. Plug-in coils have not come into wide enough commercial usage, evidently, to rate a standard. However, it is a subject that ought to come up soon for discussion before the American Standards Association and the Standards Committee of the Institute of Radio Engineers. It would simplify matters considerably, as you intimate, if some standard were established, especially as otherwise it makes no difference which terminals are used for particular connections.

www.americanradiohistory.com

Modulating an Oscillator

IN BUILDING a battery-operated oscillator, will you please inform me of some simple method of introducing modulation? I have no access to a-c, otherwise would use the line hum. —P. O'T., Danbury, Conn.

One of the simplest methods is to use a grid leak and condenser, in the usual detecting form, condenser with one side to grid, other side to stator of tuning condenser and to one terminal of the tuned coil, a resistor across the condenser. If the resistance value is high enough the grid will block and there will be a high-pitched continuous sound. This usually obtains in present-day tubes when the leak value is of the order of megohms. Or, if you haven't a large enough leak you may use a larger grid condenser than normally, or, failing to get the squeal with the largest condenser and small leak you have, resort to large values both of leak and condenser. For instance, though 0.00025 mfd. and 5 meg. usually will give you what you want, try 0.001 or 0.002 mfd. with the large leak and you are almost certain to get the squeal. It is a sound so distinctive that it is very easily distinguishable and serves the purpose admirably.

* * *

Inductance Visualized

CAN INDUCTANCE be expressed as a measure of length? What is a likely representation of inductance as an entity?—
—H. W. R., Athens, Ga.

Yes, inductance is expressible as a measure of length, and in Europe it is the custom to express inductance in that manner (in centimeters). Since inductance is not two-dimensional nor three-dimentional it is thoroughly consistent to represent it linearly.

* * *

Measuring High Resistance

I AM CONSTANTLY up against it for methods of measuring high values of resistance. Will you please give me some idea how I may do this without buying any of the expensive apparatus that is made especially for the purpose?—U.S.W., Lake Louise, Can.

Any one who has a high-voltage voltmeter of known sensitivity, and a high voltage source, may "measure" high resistance values by the computation method. If the meter has a sensitivity of 1 ma at full-scale deflection, and reads, say, 500 volts at that deflection, then as the resistance is 1,000 ohms per volt the series resistor in the instrument is 500,000 ohms. If the unknown resistor is put in series with the meter, the total across a known voltage, then the current flowing can be read on the meter, the total resistance computed, the multiplier resistance subtracted, and the unknown resistance determined. Let us work out an example. Take a 500-volt voltmeter, measure the known high voltage, which let us say is 250 volts as obtained from a receiver B supply, put the unknown resistor in series and note the reading. Suppose it is 100 volts. This represents one-fifth of the full-scale deflection, or 0.001 ma / 5 = 0.0002 ampere. The total resistance in ohms equals the voltage in volts (250) divided by the current in amperes (0.0002) or 1,250,000 ohms. Subtract the multiplier resistance of 500,000 ohms, and the resistance of the unknown becomes known. It is 750,000 ohms.

* * *

Is Radio Wonderful?

DO YOU THINK that radio should be classed as one of the wonders of the world? I hear speakers sometimes refer to "this wonderful medium, radio," and so I wonder! —O. W. D., Dubuque, Ia.

"Ain't nature wonderful?" is an expression that has had its comic and derisive usefulness for a long time as a retort to an ignorant observation. What we do not understand or can not explain we call wonderful. Everything that we know is easy, everything that we do not know is difficult until we learn it.

So with radio. We hear ever and again some radio philosopher or aesthete welcoming the opportunity of addressing his "vast unseen audience" through that "wonderful instrumentality, the radio, that takes my voice from this studio and brings it into hundreds of thousands of homes." The intimation is that something not only mysterious but even divine attaches to this "wonderful" invention.

Now, we submit that there is nothing wonderful about radio, and we say that with full appreciation of the great technical achievement that radio represents and of radio's vast and yet not even fully developed scope and purpose. Is it wonderful to sharpen a pencil with a jackknife? No one thinks so. Even a child can understand that the blade of the knife severs a slither from the wood that surround the lead, and that the sliver falls free and clear of the pencil. Being understood, the act is in no sense "wonderful."

Nor do we see anything wonderful in the establishment of an oscillator, or means of generating radio waves; of a modulator, or recipient of varying frequencies and amplitudes, under circumstances whereby these are mixed with the oscillation frequency; of the radiation of the resultant mixture. No radio scientist, no radio engineer, is recorded as saying that it is wonderful. We would rather that the literateurs and philosophers take their cue from the scientists and omit the characterization of "wonderful." It tends merely to prolong the assumption that many of the lay public have regarding radio, that it is somewhat categoried with magic. Physics is not magic, it is not wonderful and radio is a branch of physics.

If an engineer demonstrates to a lay friend some receiver he has designed, the question almost follows: "Did you invent that?" It seems to be assumed that no accomplishment is real or valuable unless it constitutes invention. Yet the designers of the receivers now being produced in factories have contributed in those designs very little indeed of invention, but rather a superior combination of established uses. The idea that some startling invention much attached to every fresh design is born of the thought that there is something "wonderful" about radio. The thing that dispels all air of mystery from radio is knowledge of radio, and we suggest that the purveyors of the wonderful be penalized to the extent of having to study enough about radio to understand its fundamentals.

* * *

One Tuned Stage Enough?

IS IT PRACTICAL to obtain sufficient selectivity with one tuned circuit for broadcast reception to-day? I see you have a circuit, supposed to be good, that has two tuned stages, so I was thinking perhaps something could be done with one stage.—U. W. Q., Endicott, N. Y.

We are experimenting with this. Certainly a great deal more can be accomplished with one tuned stage than was commonly believed until a few weeks ago, when we presented the data on the resistance-reducing effect of loose coupling between aerial and tuned circuit. A regenerative circuit is not being considered, by the way, but a stabilized detector stage, followed by sufficient audio frequency amplification to produce loudspeaker volume. It is now quite practical to have three stages of resistance-coupled audio without instability, since the theory of motorboating is well understood now, and the remedies for the elimination of that evil are well known. As soon as results reach a stage when a report can be made the facts will be disclosed in these columns, so, as you are interested, please watch for them.

Amateurs Record Eclipse Data

The American Radio Relay League took a prominent part in studying the phenomena associated with the total eclipse of the sun. A party of 15 amateur photographers, including an airplane pilot and radio operators, established a base on Mount Washington in the White mountains, the highest point in the Eastern United States, where they set up apparatus for photographing the eclipse in new and unusual ways. Photographs were to be taken in natural colors with a powerful telescopic camera as well as photographs in the ultra-violet and infra-red regions, portions of the spectrum not visible to the naked eye.

The League concentrated its attention on the behavior of ultra-short waves, that part of the radio spectrum which has been developed since the previous eclipse in this country, but attention was also given to the normal short waves. An effort was also made to study the shadow bands occurring immediate before and after totality by means of very fast moving picture cameras.

The radio work of the expedition was conducted under the direction of Ross A. Hull of the Radio Relay League headquarters staff, who is an amateur photographer and telescope builder. An ultra high frequency station was installed in an autogyro flown by John M. Wells of Southbridge, Mass., and this station was operated from the ship for a period beginning before the eclipse and ending a short time after. This station was in constant touch with a ground station accompanying the expedition as well as with many other stations throughout the northeastern part of the United States. The autogyro also carried photographic equipment but its main effort was concentrated on radio work.

The Shortwave & Television Corporation of Boston operated four stations in Boston and a naval transmitter at Portsmouth, New Hampshire, which is in the line of totality, also sent out signals. Prof. G. W. Kenrick of Tufts College and the Naval Research Laboratory, and Dr. G. W. Pickard, noted radio scientist of Boston, checked the results of the transmissions from these stations. The signals from the naval station and the Boston stations were compared. The naval station was in the region of totality whereas the Boston stations were working in a region where the eclipse was 98 per cent. total.

A large amount of data was collected by the various expeditions during the brief interval of the eclipse but it will take some time before conclusions can be drawn as the data must be studied, interpreted, and compared. But that the observations will yield much new information is certain because observations were more extensive this time than at any previous eclipse, and the conditions were more favorable due to the path of the eclipse and the many improvements in method and apparatus which have been made since the eclipse in 1925.

www.americanradiohistory.com

A THOUGHT FOR THE WEEK

FIRST THEY SAID they would and then they said they wouldn't.

In other words, the Madison Square Garden Company announced sometime ago that it would sponsor a Radio, Refrigeration and Electrical Exposition at the Garden. Time went on and then something happened. Evidently, manufacturers would not sign up fast enough to encourage the promoters to go ahead, and so the show was called off.

Perhaps it has been discovered that the way to make a radio show a success is to have it handled by men who know the radio and exposition business.

Shades of poor old George U. Hermann.

RADIO WORLD

Title Reg. U. S. Pat. Off.

The First and Only National Radio Weekly

Eleventh Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor; J. Murray Barron, advertising manager.

NEW BOOKS

"Servicing Receivers by Means of Resistance Measurements," by John F. Rider, is a service book in which the author discusses the art of servicing and analyzing radio receivers by resistance measurements rather than by voltage and current measurements. He points out that when a fault has been located by means of voltage or current measurements it is necessary to make a resistance measurement to find out what the fault is, and suggests that it is better to start with the resistance measurement.

Another advantage of the resistance method, which he points out, is that the tests may be made with the receiver cold. Thus there is no danger of damage to meters from high voltages.

The book is profusely illustrated with pertinent diagrams illustrating how the various parts of the circuit may be tested with the resistance meter, and numerous examples are used to elucidate the method. The book contains 203 5x7.5 inch pages. A complete Table of Contents is included to aid in finding any particular topic discussed, but unfortunately the index has been omitted.

STATION CHANGES

Changes in the "List of Broadcasting Stations by Frequencies," published in our issues of August 27th and September 3rd, 1932, follow:

570 kc, WSYR-WMAC. Change owner to James G. Tracy and Edmund M. Smedburg, executors of estate of Clive B. Meredith.

1120 kc, WISN. Change owner to American Radio News Corp.

1210 kc, WEBQ. Change owner to Harrisburg Broadcasting Co.

1260 kc, WLBW. Change location to Erie, Pa.

1310 kc, KTLC. Change owner to Harris County Broadcast Co.

1310 kc, KTSM-WDAH. Change owner to Tri-State Broadcasting Co., Inc.

1400 kc, KLO. Change location to Salt Lake City, Utah.

1420 kc, WMBH. Change owner to W. M. Robertson.

1480 kc. Delete KFJF.

Ten Years Ago This Week

CRYSTAL detectors were featured in the September 9th, 1922, issue of RADIO WORLD, with only a few circuits involving tubes, for things cost money in those days, and a crystal receiver requires no power save that derived from the aerial.

It was a troublesome life, then, for the crystal would get out of adjustment, and one's patience and vocabulary were tried with illegal severity. But there was a glimmer of light, at that. Carl Masson had an article in that issue recommending that two catwhiskers be used, so that the most sensitive veins of the mineral detector would be more readily found, and then, alas, beeswax or battery wax was to be used for keeping the catwhiskers in adjustment. Thus the fixed crystal detector, which that amounted to, was going to be the thing, although De Forest's audio was in occasional use, and the now grand old man of radio then had just come out with a power oscillator that permitted continuous wave transmission of some considerable magnitude, with the aid of some 50-watt modulating tubes.

The chief interest centered on the crystal, but the regenerative receiver got attention, also, and the technique of getting DX results from crystal or tube was told in that issue with confident vengeance. It seems that the honeycomb coil was another of the favorites, and Fred C. Ehlert, now on the "N. Y. Sun Radio Section," had an article, "How to Make a Honeycomb Coil with a Two-Stage Amplifier," meaning a regenerative detector with two stages of a-f. No power tube, of course.

Here Then, Gone Now

It is interesting to realize that the crystal detector, the regenerative circuit and the use of honeycomb coils in tuned circuits in broadcast receivers have passed into disuse. From other data in that issue it is clear that little of permanent value to radio existed in that day, as to hookups, parts and circuits, but that the formative period was replete with many variations, hardly any of which were to survive.

Short waves were discussed in the September 9th, 1922, issue. Yes, indeed. "Perfect Short-Wave Radio Frequency Amplification" was the title of an article by George W. May. But, alas, the term "short wave" did not refer to that frequency spectrum covered by the phrase to-day. Short waves meant 360 meters, more or less, and if less, nothing under 275 meters. Stations were experimenting with the use of these unplumbed "short waves." and the Department of Commerce, which exercised jurisdiction over radio, had just issued an order whereby stations capable of using 500 watts would be assigned to 360 meters, so as to avoid interference from smaller and more numerous stations on 400 meters. The order was signed by Herbert Hoover, Secretary of Commerce.

There were 487 broadcasting stations, compared to a few more than 600 in existence to-day, and the stations on the air had the irritating habit of having "intermissions" between regular programs. The playing of phonograph records was discountenanced then, as now, except during intermissions or in an emergency. Stations to get the preferred 360-meter wave were cautioned against the use of "mechanically operated musical instruments" except as stated, and of course that covered player pianos, music boxes and some other devices as well as phonographs.

Articles in that issue recognized the limitations of radio, and the capacity effects of tube elements, always high then, was one worrisome problem. The experimental nature of all construction was stressed.

Loops were in favor, most of them inordinately large. A common distance between extremes of spokes of a loop was 3 feet. One photograph showed a baby elephant listening to a loop-operated speaker set, entitled, "Baby Elephant Hears Mother's Voice," a sentimental idea, at that.

It is painful to admit the following credited "joke" was a reprint in a radio column conducted by Robert Mackay:

"When a man bought a radio and added a loudspeaker, his wife quickly got a divorce. She couldn't stand the competition."

This was credited to "The Globe," a mitigating circumstance.

Auto Sets, B'Gosh!

Automobile radio was in mind then, and the front cover illustrations, a group of three, showed a loop set used in an auto on a family outing to the country, speaker "enjoyment"; a set for earphone use, again with large loop, at a mountain lake, with a man sitting beside the loop, although you could scarcely see him for the loop; and a man driving a car with honeycomb coil set behind the driver's seat, and a large loop rising from the radiator cap. Whether the water in the radiator was used as ground was not revealed. The loop in the two instances illustrating auto radio rose higher than the top of the car.

Trade was not as lively as it might have been, although judging by the standards of today it must have been great then, and one wonders who had the temerity to complain. In "Radio Merchandising," a department, was reported the upward trend of the stock market, despite the coal strike, the railroad strike, and other untoward circumstances, and the opinion was expressed that "the financial powers that be are quite sure we are going to have a great fall and winter." The same comment continued: "Wall Street occasionally makes a mistake, but not often," an observation that would be hard to make to-day with a straight face. It was probably a good observation then, for the art of making mistakes had not yet been perfected.

An article on how to build a wavemeter deplored the absence of wavemeters from experimenter's equipment, and ventured the opinion it was due to the high cost. Yes, indeed, prices were high. Magnavox advertised the R-2 gooseneck speaker, with 18-inch horn, at only $85, and two power amplifiers, a two-stage device at $80, and a three-stage one at $110.

All you had to have then was money, and the world was rosy. How different it was then—or was it quite the same then as now, despite the great reduction in prices that has taken place since?

Next week there will be another reminiscent review of the situation ten years ago.

BLUEPRINT OF 1933 DIAMOND

A blueprint of the 1933 Diamond of the Air is in preparation and will be published when ready, possibly next week, issue of September 17th. The circuit this week is shown as it exists. Changes, if any, will be announced in these columns, and will be embodied in the blueprint.—EDITOR.

www.americanradiohistory.com

STATION SPARKS

By Alice Remsen

The Vision

FOR IRVING CONN, AT ARROWHEAD INN

WOR, Tuesdays and Fridays, 10:15 p.m.

Out on the terrace a fountain sprays
A cascade of silvery light.
Softly and sweetly the music plays
A waltz through the star-spangled night.
The music is echoing over the hill
And valleys so verdant and green.
So letting my fancy roam as it will
I conjure a different scene.

The deep ravine is silent,
A hush ere day is born,
As peeping o'er the hilltop
There comes the roseate morn.
And from a lowly tepee
Blue smoke curls to the sky,
As waterpot on shoulder
An Indian maid draws nigh.

But out on the terrace a fountain still sprays
A cascade of silvery light.
The couples are dancing—for music still plays
That waltz through the star-spangled night.
My beautiful vision has faded away,
I look for the maiden in vain;
But only the fountain, the hill and the trees,
The dancers and music remain.

A. R.

* * *

AND IF YOU VISIT ARROWHEAD INN as I did, on a summer night, you too will conjure just such a vision, for the Inn is surrounded by forty acres of verdant woods, hills and ravines, suggestive of a romantic Indian encampment. The Inn itself is a beautiful place, the food excellent and well served. Irving Conn's pleasing personality makes you feel at home, and dancing to his fine orchestra is a positive delight. You may dine on the terrace where electric fountains give a delicious splash of color, or in the magnificent baronial dining hall. When you come to New York, don't fail to visit Ben Riley's Arrowhead Inn on Riverdale Avenue.

* * *

The Radio Rialto

It's a strange thing; some days news just seems to roll into a body's path. . . . today was just like that. . . . No sooner had I set foot on Broadway than I ran into Arthur Behim—I'il Arthur, as his friends affectionately call him, though he's anything but little. . . . He told me that he has some very fine radio programs to present this Fall. . . . I'm glad to hear it because Arthur has plenty of excellent ideas which could be used to great advantage by some of the radio moguls. . . . As we stand chatting, Jim Maher, of WOR'S publicity department, stops to say "Hello." . . . He is in a hurry, but stays long enough for me to congratulate him on the birth of his latest child, a boy, who brings the total up to five. . . then Jim hurries along to meet Captain Mollinson, the intrepid British flyer.

Think I'll have lunch at Lindy's today . . . smoked salmon sandwich and iced tea . . . as usual the place is a Babel . . . almost impossible to hold an intelligent conversation . . . but bits of news trickle through the noise . . . there's Charlie Weller, who tells me that Henry Shope, top tenor of the Cities Service Cavaliers, has just been "discovered" as a solo artist, after all these years, and will be given an opportunity to display his unusual tenor voice on a few NBC programs. . . . There's that good-looking band leader, Irving Conn. He leads the orchestra up at Ben Riley's place, Arrowhead Inn. . . . "Hello, Irving, how are you? I'm going up to your place for dinner tomorrow night so that I may tell my readers something about it. . . . I hear it's grand; if I come will you play 'Masquerade,' 'Silent Love' and 'Strange Interlude' for me? Okay! I'll be there." . . . Why, hello, Jack Foster; when did you arrive back from Europe? . . . Yesterday morning on the Ile de France! . . . Did you have a nice trip? . . . That's fine, but you didn't gain any weight" . . . Dear, dear, what a noise, if I stay here much longer I'll get a headache.

So down the street again, only to run into Lew Conrad, who tells me he's at Hollywood Gardens, another good place at which to dine and dance when you come to town. . . . My word, but it rains band leaders today; there's tall and handsome Smith Ballew; he is now up at that swanky Westchester place, Post Lodge, wired through WOR. Smith has an excellent band, so be sure to tune in, if you feel like dancing at home. . . . Well, I never, Jim Doane, Morton Downey's "man Friday." "How are you, Jim? Looking a bit thin lately. What's the trouble? Hot weather doesn't agree with you, eh! What's Morton doing these days? . . . Playing the Loew circuit and making a series of ten movie shorts for Universal. . . . that's good.

"Yes, I'm trotting over to WABC. . . . All right, come along, we'll walk over. . . . Well, here we are." . . . There's dainty little Emily Wooley; she's giving an audition for a talking program; so is Elsie Hitz and about eight other nice looking females; competition is pretty keen in that direction, the 22d floor is simply full of auditioners (or should I say auditioneers?) . . . There's tall and willowy Barbara Gould, the beauty expert; she looks as though she should know what she's talking about; she's a swellelegant gal, extremely good to look at. . . . There's Bill Card; what a nice chap he is. . . . Used to be in the commercial program department at NBC, but now is with the song publisher. Joe Morris. He tells me Joe has a fine new tune, "You'll Always Be the Same Sweetheart."

Some mail for me. . . . Excuse me a second. . . . Well, well. here's a letter from a fan of mine who lives in Sellersville, Pa. . . . He sends me a newspaper clipping. . . . Picture of the Sellersville Civic Symphony Orchestra, in which he plays first flute; they gave a charity concert which was broadcast over a local station. Thanks, Ray High; send me some more news about your little town. . . . Well. must hie me over to NBC for a few moments.

So out on the nice hot pavement again and over to 711 Fifth Avenue. . . . Just in time to catch the finish of the Absorbine rehearsal. . . . Hello. Jack Smith; you're doing a fine job on that program, and deserve a whole lot of credit, so I'm giving you a little. . . . There are the Humming Birds. and in case you don't know who these lovely girls are in this fine trio, I'll tell you: the soprano is Margaret Speaks; mezzo-soprano, Katherine Caveli; and the deep. deep contralto, Dorothy Greeley. . . . I'll pop round the corner to Studio "D" and say "Hello" to Billy Jones and Ernie Hare. . . . Good gracious. Dick Robertson, you almost knocked me over; well, I'll forgive you on one condition—tell me what you're doing these days. . . . Oh, yes. . . . Working with Hoagy Carmichael, the composer, and does he write fine tunes, oh, boy! ! "Stardust" was one of his. . . . What are you doing with Hoagy, Dick? . . . A program called "Just Foolin' Around," on WEAF, Tuesday's at 6:30 p. m. . . . and is on the air four times a week over WJZ from the Village Barn. . . . Okay, Dick! . . . Now for Billy and Ernie; I always come away from them with a joke; here's the one they pulled this time: Ernie Hare was playing a little theatre in Ohio, back in his trouper days. Wanting to know the size of the audience before he went on, Ernie asked the stage manager, "How's the house?" "Oh, it's fine," the stage manager replied: "It's packed to captivity." . . . Well, I've fooled around enough, so to dinner. I shall pack myself to captivity down in the Grill Room at the Hotel Taft. . . . 'Twas good. . . . Had a fine dinner. . . . Danced with Mel White to Robbin's tune, "I'll Never Be the Same," played by the suave George Hall's excellent orchestra. . . . And now to the Rivoli to witness Chevalier's latest picture, "Love Me Tonight" . . . and then . . . Home. . . . After what you might call a fairly busy day.

* * *

Biographical Brevities

ABOUT NAT BRUSILOFF

Nat Brusiloff was born in Russia in 1903. . . . Doesn't know what province and you couldn't pronounce it if he did. . . . When he was one and a half years old he brought his family to Baltimore. . . . Started to play the violin when he was three. . . . And when six years old made his debut at Carnegie Hall. . . . Turned his back on the audience and played to his father and mother seated back stage. . . when the audience applauded he burst into tears. . . . Hasn't cried since . . . although it has been reported that once in Washington, years later, another audience applauded.

Was director of symphony orchestra in Fort Wayne, Indiana, the cinema palace —violin, piano, cornet and drums. . . . From there he stepped into the leadership of an honest-to-goodness symphony orchestra in a movie theatre in not-so-honest-to-goodness Washington. . . .There is nothing you can tell him about newsreels! . . . Then stepped into radio, where he is now a fixture. . . . Has taken on weight and the conductor-ship of four commercial programs. . . . Has Kate Smith's program, so he is also an authority on moons and mountains.

The other day at a banquet he made a statement which won him wide acclaim. . . . "Radio," he said, "is still in its infancy." . . . He's a clever lad, eh, what! . . . Three years ago he took unto himself a wife. . . . A schoolma'm from Western Pennsylvania. . . . Her brudder, Paul Moss, former Penn State football and basketball star, now has a hand in managing Nat's affairs. . . . Five months ago Nat and the schoolma'am became father and mother, reading from left to right. The addition was named Joel and cried when the audience applauded. "Natulus" cannot understand why Joel has not yet taken to the fiddle and is worried that his offspring will turn out to be a saxophonist instead of a musician. . . . Thinks it should be a case of like father like son, for Nat has been called a Child Prodigy, Foolish Fiddler, Clowning Conductor, and Merlin of the Violin, all of which culminated in his intimate friends calling him "Natulus." . . . Fancies he is great shakes as a pinochle player: the truth is, he's terrible! Even the office boy beats him. . . . His wife's name is Mildred: he insists on calling her Mildred. . . . Is quite a

(Continued on next page)

www.americanradiohistory.com

RADIO IN CHINA; PYSCHOLOGY IS AGAINST JAZZ

By THOMAS T. EOYANG

There are two types of broadcasting in China—one by privately-owned stations and the other by government-owned stations. Programs originating from the private stations are partly commercial in nature while those from the government stations are wholly non-commercial.

Programs offered are of great variety. There are phonograph records of Chinese opera, singing by Chinese movie stars, concerts by army band orchestras, news reports, speeches, weather reports and popular music programs which are interesting to the public. Practically, there is not much difference in the type of programs offered in China and the United States.

As you have noticed even in America, the slight differences in the use of English by people from different parts of the country make radio announcing difficult. In China the language problem is much more complicated. The Chinese have found it quite a problem to determine which dialect a radio announcer should use. Fortunately, a standard language—the so-called Mandarin, which is widely understood throughout the country—can be used as the announcing language. This is especially important to the government stations from which political, diplomatic, economic and educational programs are broadcast.

20 Stations on Air

The time for programs on the air is not so long as the eighteen hours covered in America every day. Stations in different localities also differ in the amount of time used. Stations in Shanghai and Nanking are often on the air part of the morning and from 3 p. m. to 10 p. m. In some small cities the total operating hours are six or eight a day.

In America many of the 612 broadcasting stations are linked together with landlines forming a network. Programs originating at one station can easily be carried nationwide by means of landlines. In China a very limited number of radio broadcasting stations exist in different parts of the country. No landlines thus far have been available for carrying radio programs.

The local stations, which generally have power of 500 watts to 2 kilowatts, cover a very small area so far as reliable reception is concerned.

Altogether there are about twenty Chinese broadcasting stations now in operation. The highest-powered station is the one of 75 kilowatts recently installed at Nanking, the present capital of China. The equipment used in that station was supplied by the Telefunken of Germany. The frequency assigned is in the broadcasting band of 550 to 1,500 kilocycles. This station is powerful enough to cover the most densely populated areas of the country.

Not So Popular

As to the receiving sets, the crystal and battery-operated sets are most popular. Recently there have been imported midget sets operated by alternating current, but because the electrical power system has not been well developed in the interior of China, the a-c sets are used only in the larger cities like Shanghai and Nanking. In Shanghai the domestically-made radio broadcasting receiving sets have also been brought on the market in order to meet the demands of home customers.

Radio in China is much less popular than in America, due to the inadequacy of the broadcasting stations and the underdevelopment of the electrical power systems. The total number of radio sets now in use is about 15,000. People who own radio sets enjoy listening to musical programs and many are particularly interested in tuning in for the news broadcast on diplomatic as well as home affairs.

No matter whether born in China or in America, Chinese like the radio. The Chinese-Americans particularly enjoy the American radio. In accordance with the general psychology of most of the Chinese-Americans, jazz music is not so pleasing. On the other hand, they enjoy greatly the symphonic orchestra and classic music.

Station Sparks

By Alice Remsen

(Continued from preceding page)

careful dresser. . . . Has lots of suits, but his passion is topcoats. . . . Next week he's going to buy one. . . . He calls everybody Throckmorton Lapidus. . . . He will regret this some day. . . . Resolves regularly three times a week to take advantage of his membership in a gymnasium. . . . Three times a week regularly he breaks that resolution. . . . He is very proud of his regularity. . . . He is five feet nine inches tall and weighs 165 pounds when he weighs himself with no witnesses; if anybody's there he weighs 185. . . . He's a great practical joker, Ha! Ha! . . . for that he carries heavy insurance. . . . In a recent interview he said he was very fond of Ghandi! . . . Because it contains sugar which contains energy and he eats at least three bars a day. . . . His favorite breakfast dish is ham and eggs (don't tell the folks) . . . for luncheon and dinner he prefers sandwiches; doesn't matter what kind of food it is so long as it is bounded on the north and south by bread.

Has a large stock of stories. . . . One for every occasion. . . . He is an ardent ivory collector. . . . He comes home of an evening with both his arms supporting a load of ivory elephants, tigers, Romeos and Juliets, and Bombay snake charmers. . . . Mrs. Brusiloff has her own way of solving that problem. . . . The latest addition to the collection appears on the Brusiloff mantelpiece in the new penthouse on West End Avenue for a period not exceeding three days; then it is quietly spirited away to the heaven which awaits all good ivory animals and whatnots. Then Nat goes and buys more ivory. . . . They've kept this up for years. . . . Nevertheless, between them there is perfect harmony . . . and . . . all is quiet on the West End front.

(If you would like to know something of your favorite radio artists, send a card to the conductor of this page. Address her Alice Remsen, 145 West 45th Street, New York, N. Y.)

N. Y. Public Show Will Not Be Held

Radio fans and the public in general will miss the New York public radio show this Fall, as it was one institution in radio that not only New Yorkers looked forward to, but countless thousands of visitors and was a great stimulator of business. Reports from the recent British Radio Exhibition show record-breaking orders for radio receivers. It is estimated that this season more than 2,000,000 radio receivers will be used by the British public, more than half being battery sets.

NEW CONTRACT LIFTS COST OF RADIOED MUSIC

An agreement having been reached between the National Association of Broadcasters, and the American Society of Composers, Authors and Publishers, new rates are in effect now for fees for broadcasting music in which the society has copyright ownership or rights. Besides the fees there is a sustaining charge, about equal to the amount paid for the total services last year. So in those cases where increases prevail, the amount of the fees equals the increase.

The contract is on a three-year basis. The royalities or fees for the first year are 3 per cent. of the amount paid by purchasers of time, for the second year 4 per cent. and for the third year 5 per cent.

Some Pay Less

The principal ones to have to pay an increase are the large stations and chains. All told, about 100 stations will pay more, whereas around 300 will pay less, as charges are based on station power, coverage and other service considerations. Besides, there are many stations, of a religious or educational character, that pay nothing to the society.

Last year the society's receipts were $933,000, and this year, were the $50,000,000 paid by sponsors for time on the air to be repeated, the fees would amount to $1,500,000, and the sustaining income $933,000 extra, totalling $2,433,000, but nothing like this figure is expected.

Protects Music Publishers

The increased income was regarded by the society as necessary, because the music publishers, the principal original copyright owners, have been suffering extremely bad business, and moreover feel that constant playing of songs on the air tends to shorten their commercial life in the copy-selling field.

The sale of copies is nothing like what it used to be. A 100,000 sale is enormous, compared to 700,000 before the depression.

Commercial Aviation Station Map Issued

Washington.

A map showing the location of commercial aviation in the United States has been prepared by the Federal Radio Commission. (Government Printing Office, Washington, D. C., 10c per copy.)

The map discloses there are now 132 ground radio stations devoted to the exclusive use of aviation. Included in that list are 69 aeronautical point-to-point stations. In addition there are 20 airport stations located at strategic points.

335 transport passenger planes—those carrying passengers and mail—are daily in direct communication with the ground stations, as well as twenty itinerant aircraft. Thus many of the hazards of flying are removed.

The map gives, in colors, the three major transcontinental aviation routes, as well as the two routes to South America and the two to Canada.

A special block of frequencies has been set aside by the Commission for the exclusive use of the commercial aviation communication system.

www.americanradiohistory.com

NEW 48 TUBE HAS A HEATER FOR 30 VOLTS

Still another new tube is about to be announced, it was learned from an unofficial source. It is reported that this tube is an improved power tube to be used on d-c lines and is somewhat similar to the 89, except that the heater voltage is 30 volts instead of 6.3 volts, and that the variety of uses is not so great.

Although the heater voltage is nearly 5 times that of the 89 it takes the same heater current, namely, 0.4 ampere. This means that the new tube has a much more efficient cathode and that much greater power can be obtained from it with the low voltage that is available on a 110 volt line. Since the current in the new tube and the 89 is the same, the heaters may be connected in series should occasion arise for doing so.

The heater voltage is quite out of the ordinary and at first it would seem that there is no need for a tube of such heater characteristics. But on second thought two advantages appear. First, the tube can be used on 32-volt farm lighting installations directly without the use of any ballast resistors, and, second, it can be used in d-c installations without wasting a great deal of energy in a heavy-duty ballast resistor.

Six-Pin Base

Suppose we have an eight-tube receiver with two of the new tubes, which will bear the number 48, in push-pull. If the filaments are connected in series 60 volts will be used up in the power tubes alone. The remaining tubes may all be of the 6.3-volt, 0.3 ampere type. The six filaments in series will then account for 37.8 volts and the entire filament circuit will take 97.7 volts. If the line voltage is 115, as is usually the case, there will be only about 17 volts to drop in the ballast resistor. Since the current through this ballast will be 0.4 ampere the power dissipated will be only 6.8 watts. That is not enough to turn the ballast resistor into a furnace.

Of course, there will be an additional loss in the necessary shunt across the 6.3 volt series to pass the difference between the current required by the power tubes and that required by the 6.3 volt tubes.

In the eight-tube set assumed this shunt resistance will be 378 ohms and the power loss in it will be 3.78 watts. Hence the total wattage loss in the ballast and the shunt resistor will be approximately 10 watts. That is a considerable reduction as compared with a similar case in which 89s would be used as power tubes.

Tentative Characteristics of 48

Heater voltage (d-c)....		30
Heater current, amperes.		0.4
Plate voltage	95	125 max.
Screen voltage	95	100 max.
Grid bias, volts	—20	—22.5
Plate current, milliamperes	47	50
Screen current, milliamperes	9	9
Plate resistance, ohms...	10,000	10,000
Amplification factor	28	28
Mutual conductance, micromhos	2,800	2,800
Load resistance, ohms...	2,000	2,000
Power output, watts.....	1.6	2.5
Overall length, inches ..	5.375	
Maximum diameter, inch.	2 1/16	

Six-pin base (no cap used)

N. B. C. DOES BROUN A GROSS INJUSTICE

A publicity article from the National Broadcasting Company announces that Heywood Broun, columnist, will be a daily noon (EDST) feature of the G. E. Circle except Saturday and Sunday. The account continues:

"Broun started his newspaper career as a baseball reporter on a Brooklyn paper in 1888, served on the editorial staffs of the country's leading newspapers and now writes a daily column which is published throughout the United States. He also is celebrated as a dramatic and literary critic."

This might put Broun in the newspaper business a trifle before he was born. Although he had a liking for his profession that made for precocity, I don't think he ever carried out his brilliance as a minor to the extent indicated. I don't think it would have been permitted. Rather, he was born in Brooklyn, N. Y., in 1888.

Broun's Rapid Rise

I do know that Broun was just about starting in the newspaper business the day he went to work on the N. Y. "Morning Telegraph" in, I think, 1909. He had come from Harvard, perhaps not directly, but that does not matter so much, so long as the coming is done from Harvard, in a large sense. It is the going to Harvard that might have been an annoying idea to Broun then, for he had left of his own accord to satisfy that overpowering impulse to be on a newspaper staff. He wrote baseball after doing miscellaneous reporting and rewriting, and I was one of the first to congratulate him on his promotion because Charles Sutherland, the night editor, used to give Broun much rewrite work to do, and through carelessness, no doubt, Sutherland would let a few of my intended news contributions get mixed among the stack of momentary literature heaped upon Broun for sifting and embellishment.

Broun and I were reporters, feature writers and miscellaneous two-finger typist specimens on that newspaper for a brief spell. About ten years later we were together again on the N. Y. "Tribune," where he was a columnist, and where I wrote editorials and put headlines on political news articles, the two branches of my work being hard to distinguish.

Broun was so successful as a columnist that the "World" offered him enough money for both the Broun and the Bernard families to live on, but Broun didn't see it that way, although to tell the truth I never asked him for any. He went over

HEYWOOD BROUN

to the "World," and as there was no further attraction on the "Tribune" for me, even Bertram Reinitz having left, I accepted an offer from Peter Dolan and felt lost among the best minds of the N. Y. "American" editors. Later Broun quit the "World" cold, going with the Scripps-Howard newspapers. Soon thereafter the "World" expired.

At 44 Looks Like 19

Broun has always been a heavyweight, and at 19 he looked like 40, whereas at 44 he looks like 19, a statement for which he need not bother to thank me. So it is not true that an impossible appetite for French pastry made him physically expansive, for he was a man of weight before he had really developed the science of secretly absorbing more French pastry than the world produces. He always liked to eat in French restaurants, too, still he took for a wife an American girl. Whereas he and I ate in the same French restaurant together night after night, the girl I took to wedlock was born in Ireland. So if you can make anything out of it you're welcome, except that I should warn you Broun is a Socialist, and ask you whether this isn't a broad-minded country, with capitalists like General Electric paying big money to Socialists, especially before an election?—Herman Bernard.

Damrosch to Resume Music Hour on Chain

The NBC Music Appreciation Hour, conducted by Walter Damrosch, will be heard for the fifth consecutive season over National Broadcasting Company networks starting Friday, October 14th.

The program, which is one of the most unusual in radio, will be heard over combined NBC-WEAF-WJZ networks each Friday at 11:00 a. m., E. S. T., during the school season except on days when school holidays conflict.

Copies of the 1932-1933 Music Appreciation Course manual, as well as the students notebook, will be ready for mailing on September 1st. The manuals are supplied to public school teachers, music teachers and clubs without cost while the students notebooks will be supplied to students and teachers on a non-profit basis.

4 and 5-Tube U. S. Sets Popular in Argentina

Washington.

The Department of Commerce issued the following:

A marked seasonal increase in the demand for radio receiving sets developed in Argentina coincidently with the opening of the opera season, according to a cablegram from Commercial Attache A. V. Dye, Buenos Aires. Radio sets from the United States are popular in the Southern Republic, and interest is centered around the four and five tube chassis. The opening of the opera season comes at the beginning of the radio season in the Southern Hemisphere.

The automobile market has been dull throughout June and passenger car sales are discouraging. Heavy trucks are inactive.

A reduction in exports from Argentina in June was noted.

www.americanradiohistory.com

RMA Is Reorganized; New Board at Helm

Cleveland.

Reorganization of the Radio Manufacturers Association was effected at a meeting of its membership at the Hotel Cleveland.

Fred D. Williams was re-elected president by unanimous vote of the Association's new board of directors, and comprehensive programs were founded to promote every unit and interest in radio.

The new board of directors elected and placed in control of the RMA follows: A. Atwater Kent, President, Atwater Kent Manufacturing Company; James M. Skinner, President, Philco Radio & Television Corporation; W. Roy McCanne, President, Stromberg-Carlson Telephone Manufacturing Company; J. R. McDonough, President, RCA Victor Company, Inc.; William Sparks, President, The Sparks Withington Company; Powel Crosley. Jr., President, The Crosley Radio Corporation; J. Clarke Coit, President, U. S. Radio & Television Corporation; Arthur T. Murray, President, United American Bosch Corporation; A. S. Wells, President, Gulbransen Company; Franklin Hutchinson, Jr., President, Kolster Radio, Inc.; Paul B. Klugh, Vice President, Zenith Radio Corporation; B. J. Grigsby, President, Grigsby-Grunow Company; Elmer T. Cunningham, President, RCA Radiotron Company, Inc.; S. W. Muldowny, Chairman of the Board, National Union Radio Corporation; George Lewis, Vice President, Arcturus Radio Tube Company; Leslie F. Muter, President, The Muter Company; Richard A. O'Connor, President, Magnavox Company, Ltd.; Fred D. Williams, Vice President, P. R. Mallory & Co., Inc.

NEXT WEEK—Tuning and operating the 4-Tube Diamond.

Tradiograms

By J. Murray Barron

STORES REPORT BETTER BUSINESS

The increased activity in radio retail sales during the past week in New York City, Chicago and other cities seems to be an early beginning of the expected Fall pick-up. Some establishments reported excellent business; in fact, in some instances, the best business for the year. All of this leaves a very optimistic feeling as to the real business outlook for radio.

Regardless of a great number of fine and efficient factory-built radio receivers on the market, there still is with us to-day in very large numbers the man who prefers the custom-built receiver of proven design, not to speak of the experimenter who must "build his own" and the serviceman who builds for a few neighbors and friends.

High-grade parts are so reasonable in price and the simplicity of construction so remarkable that when one figures how easy it is to build just what you want, with the assurance of getting what you want, there should be no surprise at the greatly increased numbers who are joining his class. This part of the radio business has a lot to do with the recent increase. Servicemen have found considerable call for repairing and revamping old sets, for regardless of conditions or anything else, folk take their radio receivers as an essential part of their lives and will not sacrifice the loss of excellent service, hence they are always prospects for the serviceman.

* * *

Fifteen thousand invitations have been issued by the Hotel Edison, New York, for a goodwill breakfast that will be given to the dealers and jobbers who will attend the radio exhibition which will be held from September 19th to 25th.

Irish to Hold Show; Report Better Business

Ireland's annual radio and gramophone exhibition will be held in Dublin this year from September 19th to 24th, according to an announcement by the committee in charge, states a report from Vice Consul Edwin J. King, Dublin.

Arrangements are being made by the committee, it is said, for a really representative display of modern radio apparatus. Many exhibits of television apparatus are also expected to be shown at the fair.

It is pointed out that the annual exhibition has met with increasing success each year and is important as an advertising medium, aiding materially in the increased sale of radio sets in the Free State in recent years.

During the last few years the volume of trading in radio in the Irish Free State has shown steady improvement. Imports of wireless sets and parts during the calendar year 1931 were valued at £132,275, according to the report, compared with £106,484 in 1930. The report further states that imports during the first four months of this year were valued at £40,945 as compared with £36,755 for the corresponding period of 1931.

New Incorporations

NEW INCORPORATIONS

Dilco Lamp Works, Inc., Jersey City, N. J., radio equipment—Atty. John J. Lenehan, Jersey City, N. J.

Adco Electric Mfg. Co., New York City, wireless telegraphy schools—Atty., A. Goldstein, 521 5th Ave., New York City.

Zimmerman-Hoffman Electrical Co., Queens, L. I., N. Y.—Atty., I Coopersmith, Forest Hills, L. I., N. Y.

Robinson-Westermeyer, New York City, The Classical Music Shop, musical instruments—Atty., B. Gollay, 11 West 42nd St., New York City.

Musical Research Products, Inc., Philadelphia, Penna., musical, other instruments—Attys., Corporation Guaranty & Trust Co., Dover, Del.

Goodman Music Co., New York City, compositions—Attys. Fitelson & Mayers, 1690 Broadway, New York City.

Retlau Electric Appliance Corp., New York City, electrical devices—Atty., L. J. Reich, 39 Broadway, New York City.

CORPORATE CHANGES

Name Change

New York Mica & Manufacturing Co., Auburn, N. Y., to Auburn Spark Plug Co.

Refrigerator Display Case Corp., Watertown, N. Y., to Refrigerated Display Case Corp.

CORPORATION REPORTS

Keith-Albee-Orpheum Corporation and subsidiaries—Six months ended June 30: Net loss after depreciation, amortization and other charges, $1,119,051, including $324,761 credit adjustment for depreciation and amortization as of Jan. 1 book values of assets. The company reported a net profit after charges, but before subsidiary preferred dividends, of $91,124, for the first half of 1931. Quarter ended June 30: Net loss before giving effect to credit adjustment of depreciation and amortization, $733,986, against net loss on same basis, of $709,826 in preceding quarter.

Raytheon Manufacturing Company and subsidiaries—Year ended May 31: Net loss after expenses, depreciation, amortization and other charges, $166,091, compared with $250,364 loss in preceding year.

Weston Electrical Instrument Corporation—Six months ended June 30: Net loss, after taxes, depreciation and other charges, $99,454, contrasted with net profit of $70,656, equivalent, after Class A dividend requirements, to 22 cents a share on $164,000 no-par common shares last year. Quarter ended June 30: Net Loss after same charges, $58,937, against $40,517 loss in preceding quarter and net profit of $10,012, or 27 cents a share on 37,400 no-par Class A shares, for second quarter last year.

Westinghouse Electric & Manufacturing Company—three months and six months ended June 30:

	1932	1931
2d quarter sales billed	$21,014,470	$32,147,158
Cost of sales	22,943,363	31,844,799
Net operating loss	1,928,893	*302,359
Other inc. loss int., &c.	46,914	624,245
Net loss	1,881,979	$926,604
6 months sales billed	41,392,718	60,623,334
Cost of sales	44,621,348	63,571,157
Net operating loss	3,228,630	2,947,823
Other inc. loss int., &c.	26,503	988,482
Net loss	3,202,127	1,959,341

*Net profits.

One Way To Surely Increase Your Sales!

Use Space in the

1932 Fall Buyers Number of RADIO WORLD

Dated Oct. 8, 1932; published Oct. 4, 1932

Last form closes Sept. 27.

We were very successful with our last Fall Buyers Number, advertisers indicated that they believed in the idea—and we are going to do better than ever for them this time. The trade is entering the season when thousands of Radio World readers will be buying new sets, new tubes, and new parts. Why not sell them your goods? Great advertising value in this Special Number at $150 a page or $5 an inch.

Regular rates in force, as follows:

	1 Inser.	4 consec. Inser. (ea.) 10%	13 consec. Inser. (ea.) 12½%	26 consec. Inser. (ea.) 15%	52 consec. Inser. (ea.) 20%
1 page	$150.00	$135.00	$131.25	$127.50	$120.00
½ page	75.00	67.50	65.62	63.75	60.00
⅜ page	50.00	45.00	43.75	42.50	40.00
¼ page	37.50	33.75	32.81	31.87	30.00
⅛ page	25.00	22.50	21.87	21.25	20.00
⅛ page	18.75	16.87	16.41	15.94	15.00
1 inch	5.00	4.50	4.37	4.25	4.00

Classified advertisements, 7 cents a word; $1.00 minimum; payment with order.

Please let us hear from you by early mail.

Advertising Dept., RADIO WORLD

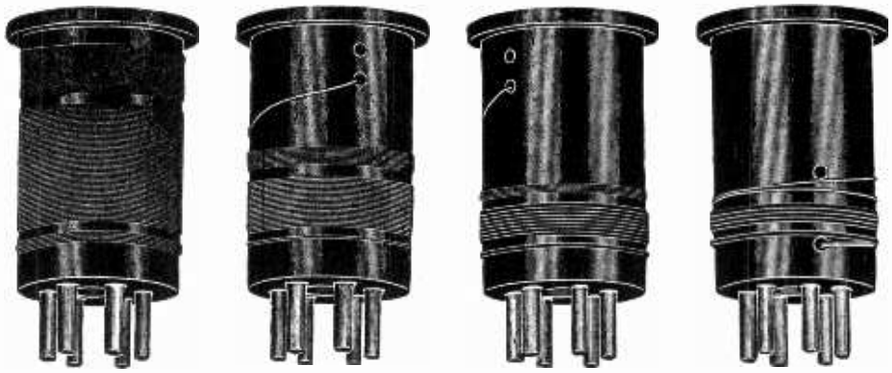
We shall see that this special Fall Buyers Number of Radio World gets into the hands not only of our regular newsstand and subscription readers, but also of many others who will be induced to read Radio World for the first time through the results of a special circulation drive.

www.americanradiohistory.com

6-Pin Plug-In Coils

200 to 15 Meters with 0.00014 mfd.

SHORT-WAVE plug-in coils with three separate windings for detector circuit produce best results as they avoid the broadness of plate-circuit tuning or the losses of r-f choke load on plate circuit due to damping. The lower winding is for r-f plate circuit, if t-r-f is used, or for aerial otherwise, the center winding is the tuned secondary, while the top winding is for feedback. The coils are accurately wound on 1.25 inch diameter Bakelite and have a 3/8-inch flange for gripping. Thus the actual winding need never be touched when you're handling the coils, and they are suitable for calibration.



THE secondary is to be tuned with 0.00014 mfd. capacity. Using four coils, there will be sufficient overlapping of bands, also assured coverage to above 200 and below 15 meters. Also, 0.00015 mfd. may be used instead for tuning, with slightly greater overlap. Regeneration may be controlled by a 0.0002 mfd. variable condenser from detector plate to ground, or by a plate voltage rheostat or other means.

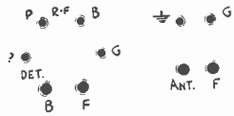
The standard six-pin tube socket may be used for coil receptacle.

For antenna stage tuning only two windings are needed, where no stage of t-r-f is included, when use SWA.

Cat. SWB—Four plug-in coils, 6-pin base; primary, secondary, fixed tickler.....$1.70
Cat. SZ—Six-spring wafer socket for use as coil receptacle for six-pin coils.....11c
Cat. SWA—Four plug-in coils, UX base, primary and secondary; primary may be used for feedback if condenser connects serial to grid.....$1.35
Cat. SX—Four-spring (UX) wafer socket for use as coil receptacle for four-pin coils.....10c
Cat. H-14—Hammarlund junior midline 0.00014 mfd. condenser with Isolantite insulation.....$1.20
Cat. H-20—Hammarlund junior midline 0.0002 mfd. condenser with Isolantite insulation. Used as feedback control.....$1.35

HOW TO USE THE COILS FOR HIGHEST EFFICIENCY AND SMOOTHEST OPERATION

In building short-wave receivers using our plug-in coils be careful to locate the coils so that the centers of their cores are at least 6 inches apart, otherwise in sets with t-r-f- the r-f tube may oscillate. Even if a volume control in the r-f stage controls any oscillation present the recommended separation should be maintained, otherwise a critical circuit results.



The connections to make are diagrammed herewith. Bottom views of sockets are shown. For the 6-pin coil P-B RF goes to aerial and ground if there is no r-f. Standard UX and 6-pin sockets serve as coil receptacles.

HIGH-GAIN SHIELDED-COILS FOR T-R-F

DIRECTIONS FOR BEST RESULTS

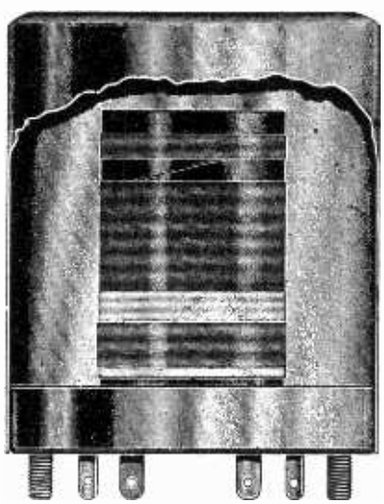
THE shielded coils for tuned radio frequency sets are supplied in matched sets of three or four, with secondary inductance equalized (plus or minus 0.6 microhenry). Thus any lack of sensitivity due to mismatched secondaries is avoided. As inductive discrepancies could not be compensated for by parallel capacity trimming, this high degree of inductive accuracy is important. Complete coverage of the wave band with the specified capacity condensers is absolutely guaranteed.

The coils may be used (set of three) for t-r-f, and with minimum value of negative bias for r-f tubes may oscillate a little at the very highest frequencies, say 1500 to 1580 kc, as they will be tuned below the broadcast band about that much. The negative bias should he increased until oscillation completely stops. Thus also selectivity is improved by heightened permanent or limiting bias.

In using four coils (three stages of t-r-f and tuned detector) each screen and plate lead should be carefully filtered, using 300-turn honeycomb coils and 0.002 mfd. or higher capacity in the filter, and the coil centers placed at least 4 inches apart.

The diameter of the form is 1 inch, the aluminum shield 2⅛ inch diameter, 2½ inches high. The shield has a small protected opening at top so the lead for the grid cap may be brought through. The opening is bevelled. This constitutes the protection against fraying the insulation of leadout wire to grid cap.

In the four-coil system, reversing connections to primary of second coil often stops oscillation in poorly filtered sets.



Cat. No. 1—Three t-r-f coils for 0.00035 mfd., 80-meter tap.....$1.35
Cat. No. 1-F—Four coils, 0.00035 mfd.....$1.80
Cat. No. 3—Three t-r-f coils for 0.0005 mfd., 80-meter tap.....$1.35
Cat. No. 3-F—Four coils, 0.00035 mfd.....$1.80
Cat. DCH—Diode r-f choke, center-tapped..$ .40
Cat. 3DS—Three-deck long switch for above coils, to utilize 80-meter tap.....$2.50

80-METER TAP PROVIDED

EACH coil for the t-r-f sets has secondary tapped, so that if desired a long switch may be used to shift the tuning condenser stators to extreme of winding (200-555 meters) or to tap (80-200 meters). The tap is represented by a ground symbol stamped on the shield base. Please note ground is not to be connected to ground symbol. Grid return is the side lug inside the shield. P, B represent primary, G and side lug secondary.

The 80-meter tap does not have to be used, but is advantageous to those desiring to tune in television, amateurs, police calls, some relay broadcasting and other interesting transmissions in a band of frequencies replete with novelties for the usual broadcast listener.

High impedance primaries are used, the number of turns chosen so that the same coils may be used for antenna coupler and interstage couplers.

For diode t-r-f circuits, either full-wave or half-wave detector, a diode choke may be inserted inside the detector form. This choke has three terminals, with outleads: two extremes and center. For full-wave use two extremes to anodes of 55 or 85, center to cathode resistor. For half-wave use two extremes and ignore center tap.

Except in rare hookups the diode circuit requires an input free from grounding, and as the tuning condenser rotor and frame are grounded the choke pickup affords any potential output.

T-R-F sets using the 55 or 85 should have three stages of resistance audio, e.g., first stage the triode unit of the 55 or 85, second stage screen grid audio, third stage power tube or tubes (output).

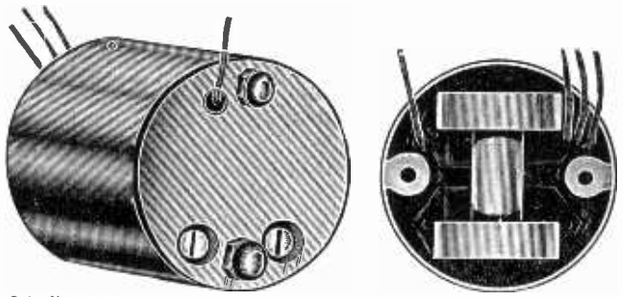
MIXER AND INTERMEDIATE TRANSFORMERS

PADDED SETS

For circuits using 175 kc. or 400 kc. intermediate frequency we have two coils for a stage of t-r-f and first detector, and accurately chosen inductance for the padded oscillator for these intermediate frequencies. There is no 80-meter tap provided on these mixer coils.

The coils are of the same type of mechanical construction as the t-r-f coils. Since there is no secondary tap, the code for connecting the t-r-f coils of the superheterodyne combination is different: P and B, primary; G and ground symbol, secondary. P would go to plate or antenna, G to grid cap, while B and ground symbol are the returns.

The oscillator has a smaller inductance secondary, for padding, and moreover is a three-winding coil. The three windings are: pickup, secondary and tickler. The pickup winding consists of 10 turns, and is brought out to two side lugs. The polarity of its connections unusually is of no importance. The secondary is represented by G and ground symbol, G going to grid and ground symbol to grid return, usually ground. The tickler connections for oscillation usually require that the lug at B be conected not to B plus but to plate, hence the P lug goes to B plus. In any case, if no oscillation results, reverse the tickler connections.



Cat. No. 4—Three mixer coils, for 0.00035 mfd. Intermediate frequency intended, 175 kc. Price includes padding condenser, 700-1000 mfd.....$1.80
Cat. No. 5—The mixer coils for 0.0005 mfd., 175 kc., 700-100 padder....$1.80
Cat. No. 7—Three mixer coils, for 400 kc; padding condenser included is 350-450 mfd.....$1.80

INTERMEDIATE TRANSFORMERS

The intermediate transformers consist of two honeycomb coils, wound with low resistance wire, coils spaced 1 inch apart, and thus affording loose coupling, stability and high selectivity. Primary and secondary tuned.

Cat. FF-175—Shielded intermediate frequency transformer, 175 kc.....$1.10
Cat. FF-175CT—Same as above, center-tapped secondary, for full-wave diode detector.....$1.25
Cat. FF-450—Shielded intermediate frequency transformer, affording choice by condenser adjustment of frequencies from 380 to 480 kc.....$1.30
Cat. FF-450CT—Same as above, center-tapped secondary.....$1.45

Padding Condensers @ 45c Each

Cat. PC-710—For 175 kc intermediate. Put in series with oscillating tuning condenser. Capacity 700-1000 mmfd. Hammarlund, Isolantite base.
Cat. PC-3545—Same as above, except 350-450 mmfd. for 380-480 kc intermediate.

Cat. CH-300—A 300-turn r-f choke, inductance 1.3 millihenries.....$0.30
Cat. CH-800—An 800-turn r-f choke, inductance 10 millihenries.....$0.35

SCREEN GRID COIL CO.

145 WEST 45TH STREET, NEW YORK CITY

www.americanradiohistory.com

RADIO EQUIPMENT-SERVICE LEADERS

THOR'S BARGAIN BASEMENT
167 Greenwich St. New York
THE GREATEST PARTS STORE IN NEW YORK
STAR 6-TUBE KIT—$13.95
Complete with Rola Dynamic
PATHFINDER 7-Tube Super-Het. Kit—$19.50
Complete with Rola Dynamic
MAIL ORDERS FILLED

Brunswick
RADIO FACTORY SERVICE
Brunswick's only authorized Service and Replacement parts bureau
UNITED RADIO SERVICE CO.
619 W. 54th St., N. Y.
Tel.: COlumbus 5-5796

PARTS HEADQUARTERS
5-, 6-, 7- or 8-Tube Polymet Power Transformers. Special $1.39
16 Mfd. Electrolytic Condenser.... .49
Amertran Power Block—1500 Volt C.T., Double Choke 30 H. at 150 MA. Built in; 2-2½ V., 1-5 V.C.T... 3.95
We Specialize in Philco Transitone
NUSSBAUM'S
61 Cortlandt St., N. Y. City
118 Flatbush Ave., Brooklyn, N. Y.

RADIO OPERATING
Instruction in broadcast, aviation radio. Freshen up and add to your present knowledge. Latest equipment and developments at resident schools in N. Y. and Chicago or home study. Write for illustrated book. RCA Institutes, 75 Varick St., Dept. WR-81, N. Y. C.

Service Men *Need*
the ELECTRAD RESISTOR HAND BOOK, for replacing resistors and volume controls in all receivers. A real buy for $1. a year, with 4 supplements. See it at your dealer's.
175 Varick St., New York, N.Y.
ELECTRAD *Money back if not satisfied.*

LATHES
Used and reclaimed South Bend Lathes. One 9", $127; 13", $276; 16", $338; just a few left. Guaranteed good as new. Terms, or discount for cash. South Bend Lathe Works, 312 E. Madison, South Bend, Indiana.

POLO
PRECISION PRODUCTS
T-R-F and Superheterodynes, short-wave converters and parts.
Send for Catalogue
Polo Engineering Laboratories
125 West 45th St. New York, N. Y.

Acratest Replacement Parts
Power Transrormers, Filter and By-Pass Condensers, Volume Controls, Voltage Dividers and Fixed Resistors.
SEND FOR OUR FREE 104-PAGE CATALOG
Federated Purchaser Inc.
25 Park Pl. Dept. W. N. Y. City

LOOK OVER NEW RADIO HORIZONS "Below 10 Meters"
New 68-page NATIONAL Manual of Ultra Short Wave Radio contains the history of Ultra Short Wave Development, articles about Ultra SW Quasi-Optical and Infra-Red Rays, Commercial Application of Short Waves in Communications Work, 5 Meter Amateur Band, Ultra Short Waves for Television. Over 120 Illustrations. Send today for your copy of this valuable book. 50c
NATIONAL COMPANY, INC.
61 Sherman Street, Malden, Mass.

AUTO "B" ELIMINATOR
Build your "B" eliminator for Auto or Boat Radio. Operated from 6-volt storage battery. Supplies 180 volts at 40 ma. Draws 2 amperes. Essential unit, diagram and complete instructions $3.25
THE MANUFACTURERS SALES COMPANY
570 Lexington Ave., N. Y. City

Short-Wave RESULTS
Play safe by using Hammarlund Isolantite-insulated Condensers, Coil Forms and Sockets. *Write Dept. RW-7 for descriptive folder.*
HAMMARLUND MFG. CO.
424 W. 33rd St., New York

ATWATER - KENT
electrical values are in the August issue of
SERVICE
Have you got your copy? Send 15 cents for this copy. The subscription price to this monthly magazine is $1.00 per year in the United States.
John F. Rider Publications, Inc.
1440 Broadway New York City

RADIO WORLD and "RADIO NEWS"

BOTH FOR ONE YEAR **$7.00** Canadian and Foreign $8.50

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students the first and only national radio weekly and the leading monthly for one year each, at a saving of $1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks is $6.00. Send in $1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months Total, 64 issues for $7.00.
RADIO WORLD, 145 West 45th Street, New York, N. Y

Quick-Action Classified Advertisements

7c a Word — $1.00 Minmium Cash With Order

GETTING A TRANSMITTER? RECEIVER? RADIO APPARATUS? Get our Bulletin, 10c. Transmitters, Receivers, low as $3.50. Radio, 54 Cohasset Street, Worcester, Massachusetts.

NATIONAL RADIO INSTITUTE COURSE, texts, complete, ten dollars. Pilot Super Wasp, battery, fifteen dollars. Stephen Plavetich, 1597 East 47th Street, Cleveland, Ohio.

"1932 OFFICIAL RADIO SERVICE MANUAL," by Gernsback. Complete Directory of all 1931-1932 Radio Receivers. Full Radio Service Guide. Leatheroid binding, $4.00. Radio World, 145 W. 45th St., New York, N. Y.

"THE CHEVROLET SIX CAR AND TRUCK" (Construction—Operation—Repair) by Victor W. Pagé, author of "Modern Gasoline Automobile," "Ford Model A Car and AA Truck," etc., etc. 450 pages, price $2.00. Radio World, 145 W. 45th St., N. Y. City.

"AMATEUR MOVIE CRAFT," by James R. Cameron. A book dealing with the making and showing of 16 m/m pictures and equipment necessary for same. Paper cover, $1.00; Cloth, $1.50. Radio World, 145 W. 45th St., New York, N. Y.

THE FIVE NEW TUBES, 46, 56, 57, 58 and 82, characteristics, installation data, uses, fully described and illustrated in the April 30th issue (7 pages) and in the May 7th issue. Send 30c for these two copies. Radio World 145 West 45th Street, New York, N. Y.

THE FORD MODEL—"A" Car and Model "AA" Truck—Construction, Operation and Repair—Revised New Edition. Ford Car authority. Victor W. Page. 708 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

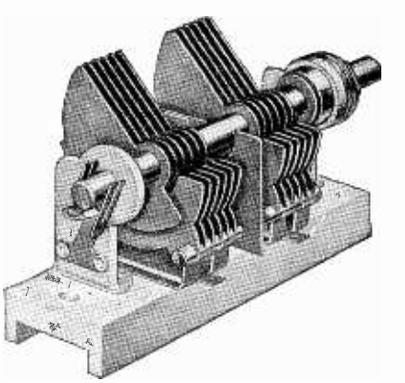
BLUEPRINT NO. 627—Five-tube tuned radio frequency, A-C operated; covers 200 to 550 meters (broadcast band), with optional additional coverage from 80 to 204 meters, for police calls, television, airplane, amateurs, etc. Variable mu and pentode tubes. Order BP-627 @ 25c. Radio World, 145 West 45th Street, New York City.

START RIGHT! Use These... Superb Condensers for Short Waves!

Single 0.00014 mfd. Hammarlund condenser; non-inductive pigtail; single hole panel mount and two-point base mount; Isolantite insulation; brass plates.

Single 0.00014 mfd. sent free with a 3-months subscription for Radio World (13 issues, $1.50). Double 0.00014 mfd. sent free with a 6-months subscription (26 issues, $3.00).

THE most popular capacity for short-wave use, and the one for which virtually all commercial short-wave coils are wound, is 0.00014 mfd. The Hammarlund condensers of this capacity, both single and double, are compact and efficient. They have Isolantite insulation and Hammarlund precision workmanship. See offer at lower left. Present subscribers may extend their subscriptions under this offer.



RADIO WORLD, 145 West 45th Steet, New York, N. Y.

BLUEPRINTS OF STAR CIRCUITS

8-TUBE AUTO SET

Sensitivity of 10 microvolts per meter characterizes the 8-tube auto receiver designed by J. E. Anderson, technical editor of Radio World, and therefore stations come in with only six feet of wire for aerial, and without ground. Most cars will afford greater aerial pickup, and besides the car chassis will be used as ground, so with this receiver you will get *results*. The blueprint for construction of this set covers all details, including directions for cars with negative A or positive A grounded. The circuit features are: (1) high sensitivity; (2), tunes through powerful locals and gets DX stations, 10 kc either side; (3), latest tubes, two 239 pentode r-f, two 236 screen grid, two 237 and two 238; push-pull pentodes, all of 6-volt automotive series; (4), remote tuning and volume control on steering post, plus automatic volume control due to low screen voltage on first detector; (5), running board aerial. The best car set we've published. This circuit was selected as the most highly prized after tests made on several and is an outstanding design by a recognized authority. Send for Blueprint 631, @ 25c

SHORT-WAVE CONVERTER

If you want to build a short-wave converter that costs only a very few dollars, yet gives good results, furnishing all its own power from 110 volts a-c, and uses no plug-in coils, you can do so from Blueprint 630. Price.....25c

5-TUBE AC, T-R-F

Five-tube a-c receivers, using variable mu r-f, power detector, pentode output and 280 rectifier, are not all alike by any means. Forty circuits were carefully tested and one selected as far superior to the others. This prized circuit was the 627, and if you built it, you will always be glad you followed our authentic Blueprint, No. 627. This is the best 5-tube a-c t-r-f broadcast circuit we have ever published. Price 25c

A-C ALL-WAVE SET

An all-wave set is admittedly what many persons want, and we have a circuit that gives excellent broadcast results, and is pretty good (not great) on short waves. No plug-in coils used. Cost of parts is low. Send for Blueprint, No. 628-B, @.....25c.

In preparation, an 8-tube broadcast superheterodyne for 110v d-c. Write for particulars.

RADIO WORLD, 145 West 45th Street, New York, N. Y.

HOW TO CONNECT NEW TUBES—Top and bottom views of socket connections of all new tubes, also the tying together grids of 46, 89, 57, 58, uses and characteristics listed under each diagram, published in the Aug. 13 issue, as was characteristic chart for all receiving tubes. Send 15c for copy of Aug. 13 issue to RADIO WORLD, 145 W. 45th St., N. Y. C.

www.americanradiohistory.com