THE 55 DUPLEX-DIODE TRIODE

RADIO WORLD

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Eleventh Year—535th Issue

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ANALYSIS OF 5% TAX ON RADIO SALES

FACTORS IN COIL EFFICIENCY

June 25 1932

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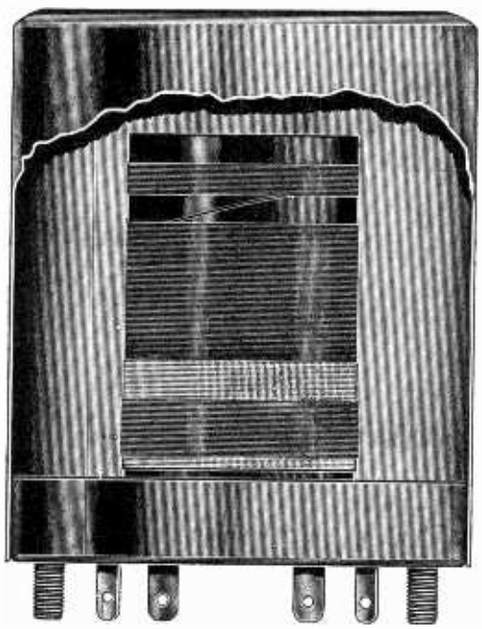

Where the primary is placed, how the secondary is wound, coil form diameter and shield size affect efficiency. See page 12.

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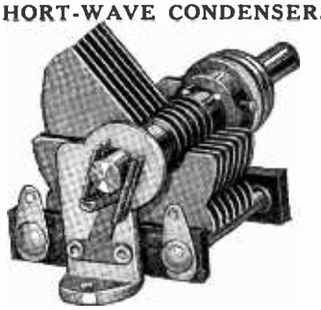

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Number Please? It's 55

New Tube Will Be Ready in Fall

By C. W. J. Ferris

PRELIMINARY information on a new tube combining the features of full wave diode detection, triode amplification, and automatic volume control was published in the June 11th, 1932, issue of RADIO WORLD. Since that time we have succeeded in obtaining additional data on the new tube. In a circular on the new superphonic tubes issued by the RCA Radiotron Company, Inc., reference is made to the RCA-55, a duplex-diode triode tube, which is the designation of this distinguished addition to the large family of tubes. The circular does not give any characteristics of the tube, except those to be inferred from the name, but invites the trade to send for particulars. It is understood that the tube will not be ready for distribution until the Fall.

Although no data on the tube are given in this circular we have obtained the complete characteristics together with circuit arrangements for its use. The tube may be employed as a full-wave diode rectifier independently of its triode feature, or as a half-wave rectifier. It may also be used as a triode amplifier independently of its use as a diode rectifier. In this application the tube is somewhat similar to the 227 in that it requires the same heater voltage, takes approximately the same negative bias for the same plate voltage, and has nearly the same amplification constant. The complete characteristics are given in the accompanying table.

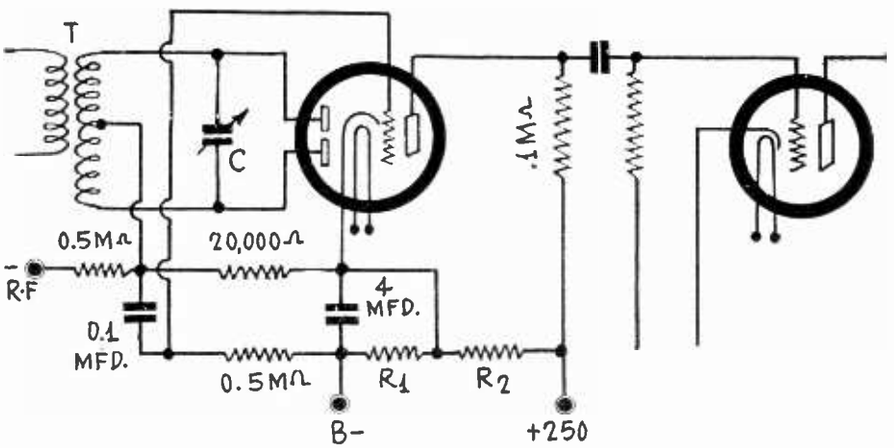

FIG. 1.
This shows how the Duplex-diode triode 55 can be used in a full-wave rectifier, automatic volume control, and amplifier. A filter condenser should be connected from the cathode to the center of the transformer.

Diode Units

The diode unit has two equal plates placed symmetrically about the cathode. The cathode is common to these plates and to the triode element. The diode is rated as follows: with an applied d-c voltage of 10 volts, the current for either plate of the diode and without external load should exceed 0.5 milliampere.

It is recommended that the cathode be connected directly to the mid-tap of the 2.5 volt heater winding as there should not be any voltage between these elements. This is for the purpose of keeping the hum as low as possible. In case the circuit arrangement does not permit following this practice, the heater may be made negative with respect to the cathode by not more than 45 volts. When the tube is biased by means of a resistor in the cathode lead, the heater becomes negative with respect to the cathode if the mid-tap of the heater winding is connected to B minus, or to the same point to which the low end of the bias resistor is connected. When a high resistance must be placed between the cathode and the heater, that resistance should be by-passed with a condenser of at least 4 mfd. if hum is to be kept down. This precaution might well be taken even if the heater is negative with respect to the cathode.

Thorough shielding of the 55 and associated circuits is essential to prevent coupling at r-f and i-f frequencies between the detector and the other stages. When full-wave detection is used, and the circuit is accurately balanced with respect to ground, this should not be necessary, theoretically, but it is difficult to effect complete balance and therefore thorough shielding and filtering are recommended in all cases. When the tube is used in a half-wave rectifier, shielding and filtering must be used for there can be no balance.

Uses of Tube

In Fig. 1 we show one circuit arrangement in which the 55 is used as a full-wave diode rectifier, a triode amplifier, and automatic volume control. In this diagram the load resistance on the diode rectifier is shown to be 20,000 ohms, but the manufacturers recommend a load resistance of the order of 0.5 megohm. The object of using such a high resistance load on the diode is obviously to put as low a load on the tuned circuit as possible and thus to maintain both high sensitivity and high selectivity. It will be remembered that a diode takes current from the tuned circuit and any current will reduce the resonant voltage as well as the selectivity. But when the load resistance is as high as 0.5 megohm, the

(*Continued on next page*)

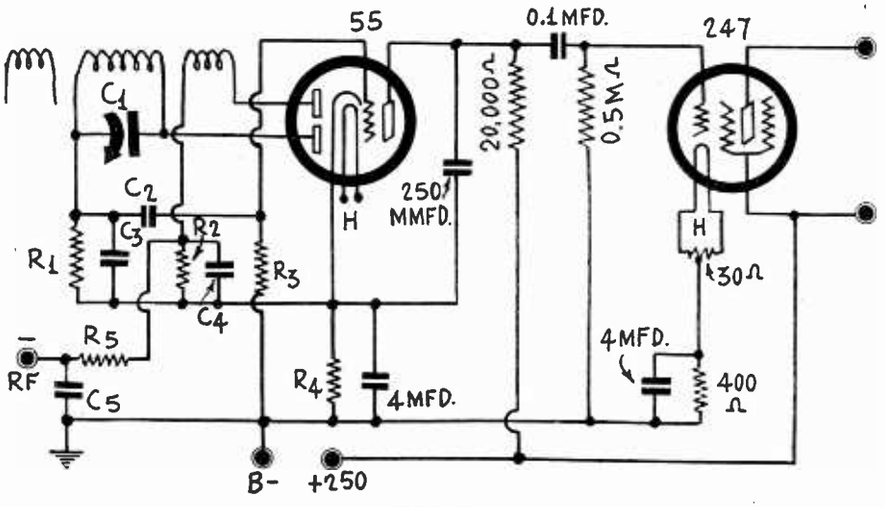

FIG. 2.

In this circuit the 55 tube is used as a half-wave rectifier, automatic volume control, and triode amplifier. One triode plate is used for detection and the other for automatic volume control.

current is no greater than it would be in the case when the circuit feeds into a grid with a 0.5 megohm grid leak across the input, and it is less than the current when a zero or positive bias is used on the grid. Hence there should be no reduction either in the resonant voltage or in the selectivity, as compared with the cases mentioned. Moreover, with a high load resistance the internal resistance of the tube is small in comparison with the load resistance and the greater part of the rectified voltage becomes available for use on the amplifier. The effect of increasing the load resistance is exactly the same as increasing the load resistance on a full-wave rectifier in a power pack. It is well-known that as the resistance is increased, that is, as the current drawn from the rectifier is decreased, the voltage across the output approaches the peak value of the voltage impressed in the circuit. The same occurs in the diode rectifier, for the principle is the same in both cases and the only difference is one of frequency.

Filtering Rectified Current

A filter condenser has been omitted from the drawing in Fig. 1. It should be connected across the load resistance, which is marked 20,000 ohms, but which should be 0.5 megohm. The value of this condenser depends on the frequency of the current that is rectified, and it should be higher the lower the frequency. For the broadcast range of frequencies it should be of the order of 150 mmfd. and for the usual intermediate frequencies it should be of the order of 600 mmfd. If these two values apply to 1,000 and 175 kc, respectively, the value in the 450 kc range should be about 250 mmfd. This condenser serves the same purpose in the diode rectifier as the first bypass condenser in the power pack, that is, the condenser that is connected between the filament of the 280 and the center of the high voltage winding. As we know, the higher this condenser the higher the output voltage, but after a certain value, there is little gain in the output voltage. In the diode the condenser is limited by the fact that it must not attenuate the modulation frequencies. If the capacity is too large the higher audio frequencies will be eliminated and the output of the receiver will contain too high a proportion of bass frequencies. The value of the load resistance enters into the proper value of the condenser. The higher the resistance the smaller the condenser must be. If the circuit is to reproduce 10,000 cycle frequencies the time constant of the resistance and the condenser should not be greater than the reciprocal of 10,000, that is 0.0001. The time constant is the product of the resistance and the capacity, the units being ohms and farads. Therefore, the condenser should not be larger than 200 mmfd. when the resistance is 0.5 megohm. This is smaller than the recommended values for intermediate frequencies, which means that in order to get good detecting efficiency we must sacrifice somewhat the output on the high frequencies. We meet this necessity quite frequently with detection, so it is not limited to this particular detector.

Coupling to Amplifier

The 0.1 mfd. condenser in the circuit is the stopping condenser between the "plate" of the rectifier and the grid of the amplifier. This condenser is in series with the "line," whereas the other was in parallel. Hence, in determining the value, we must argue from an exactly opposite point of view. The time constant of the condenser and the grid leak, the 0.5 megohm resistor between the grid and B minus, should be as large as practicable. However, it is not necessary to make it larger than 0.05 second. This would assure good amplification of notes down to about 50 cycles per second. In some applications it would be desirable to make the time constant as large as 0.1 second. However, if we get this value by increasing the grid leak resistance we are likely to have blocking. Hence it should be done by increasing the value of the stopping condenser. This can be done with safety in this case because one side of it is not connected to a highly positive potential and there is no danger of the grid's going positive by leakage through the condenser. For broadcast use it is hardly necessary to use a larger than that indicated in the figure.

Automatic Volume Control

The voltage for the automatic control feature is obtained from the drop in the load resistor. For a constant carrier this is virtually constant since the carrier fluctuations have been taken out by the condenser across the resistor. The grid returns of the controlled tubes are supposed to be connected to the terminal marked R-F. There is a 0.5 megohm resistor between this terminal and the negative end of the load resistor. This serves a two-fold purpose. First, it prevents possible short-circuiting of the audio input to the amplifier, and second, it serves as a filter to prevent carrier feedback to the controlled tubes. Additional bypass condensers between the R-F terminal and ground are supposed to be used, but they can be placed near the controlled tubes. They should not be smaller than 0.1 mfd.

TENTATIVE CHARACTERISTICS OF DUPLEX-DIODE TRIODE

Heater voltage, a-c or d-c	2.5
Heater current, amperes	1.0
Plate voltage, maximum	250
Grid bias, volts	—20
Amplification factor	8.3
Plate resistance, ohms	7,500
Mutual conductance, micromhos	1,100
Plate current, milliamperes	8
Load resistance, ohms	20,000
Power output, milliwatts	200
Overall length, inches	4 17/32
Maximum diameter, inches	1 9/16
Bulb, ST-12	
Cap, small metal	
Base, six-pin	

and preferably much larger. The filtering should be so thorough that virtually pure d-c is fed back, yet the condensers should not be so large that there is an excessive time lag in the control. If there is time lag of appreciable magnitude the volume will go down slowly after the tuner has been set at resonance and left there.

Half Wave Rectifier

In Fig. 2 is a circuit containing a half-wave rectifier and an automatic volume control, one of the diode plates being used for the detector and the other for the automatic volume control. The carrier voltage for the a.v.c plate is obtained from a separate winding coupled to the tuned circuit. The two rectifier circuits are entirely distinct except for the common cathode. The load resistance for the detector is the half megohm resistor R1, which is shunted with a condenser C3 for taking out the carrier fluctuations. Since this is a half-wave rectifier the condenser in this case could be a little larger than it was in the full-wave circuit. However, the value for the same carrier frequency may be used.

The stopping condenser C2 should have the same value as in the full-wave circuit, namely, 0.1 mfd., and the grid leak R3 may also have the same value of 0.5 megohm. R3 is returned to B minus, 20 volts below the cathode voltage to establish a bias for the triode.

The load on the volume control plate is R2, and this also may be a 0.5 megohm resistor. It is shunted with a condenser C4, which in this case may have as high a value as 0.5 mfd. That value will make the time constant of R2 and C4 equal to 0.25 second, which does not represent too great time lag in the response of the a.v.c.

In this case the 0.5 megohm resistor R5 need not be used for the purpose of preventing short-circuiting of the a-f signal, but it still should be used for preventing feedback to the controlled tubes. Condenser C5 is an additional filter condenser to prevent feedback and to steady the automatic control bias. Its value may be 0.1 mfd. or somewhat larger.

Bias on Controlled Tubes

The bias on the controlled tubes will depend on the connection of these cathodes. Suppose there is a limiting resistor in each tube of 300 volts, or its equivalent when two or more tubes are put on the same resistor. The bias on the tubes will be about 3 volts by virtue of this resistor, provided that the grid returns are made to ground, or B minus, and one end of the cathode resistor is connected to ground also. Now, if the grid returns are made to the R-F terminal on the automatic volume control the bias should be increased by the drop in R2 due to the rectified current. But this is not the case. The voltage may actually be positive, depending on the amount of drop in R2, because of the fact that R4 is between the cathode of the 55 and the cathodes of the controlled tubes. If the cathodes of the controlled tubes

(*Continued on next page*)

Antennas and Grounds

Western Electric Discusses Their Installation

ANTENNAS and grounds are discussed in Western Electric's catalogue "Radio Distributing Systems" as follows:

The purpose of an antenna is to collect the radio frequency energy which has been transmitted by the broadcasting station. In general, the strength of the signal voltage induced in an antenna is determined by its length, its height above neighboring obstacles, such as buildings, trees and towers, and its distance from the broadcasting station. In other words, a long, high, outdoor antenna is most effective. The advantages of a single, scientifically designed and properly constructed antenna are particularly pronounced when it is used to supply a number of radio receivers. For the sake of emphasis, again it is stated that the cost per receiver of such an antenna is usually less than the cost of individual antennas, when they are installed in a thoroughly workmanlike manner.

Any antenna on the roof of a large building such as an apartment house or hotel is exposed to a great variety of electrical disturbances other than radio impulses or transmissions. Practically all of these are transmitted by the ordinary lead-in and will introduce noise in the radio receiver.

Static Types Compared

These disturbances are divisible into "natural static" (atmospheric electrical disturbances) and "man-made static."

There is little that can be done to suppress natural static. Usually, except in rural areas, it is less intense than "man-made static." With man-made static presenting the greater problem, an efficient antenna can play an important part in increasing the ratio of program volume to static—principally because the interfering range of man-made static is limited. A long, high antenna collects stronger signals from radio transmissions, and is usually more remote from the noise source. Thus, the decrease in noise and increase in program strength, simultaneously attained, result in a much smaller percentage of noise received. Thus the first distinct advantage in the use of a single, scientifically designed and properly constructed antenna is the elimination of noise. The second advantage is that with a long, high antenna, the radio receiver may be operated at lower sensitivity. Operating a receiver in this way reduces the noise background inherent in some types of radio receivers.

An antenna should be at least thirty feet above surrounding objects. While it is of little advantage to install one any higher, every effort should be made to obtain the height mentioned.

The location and direction of the antenna also is an important factor in reducing noise. Installation should be at right angles to exposed electric light, power, or telephone lines and should not cross above or below such lines. The vertical down lead from the antenna should be kept as far as possible from elevator motors, sign flashers, and similar electrical equipment.

Antenna Construction

The antenna recommended for housetop location is a horizontal wire approximately 100 feet long suspended between masts at a height of thirty feet above the roof. It is desirable to connect the down lead to the middle of the antenna. To do so clears the masts and guys. The masts should be sufficiently strong both in material and construction to withstand whatever high winds and snowloads are characteristic of the locality.

In suburban locations, where there are likely to be large areas of open land, it may be desirable to locate a single high mast at the rear of the building. Between this mast and one located on the roof of the building to be served, a horizontal wire 100 feet long may be suspended. When such an antenna is erected, the antenna terminal equipment for a radio frequency distribution system should be located on the roof and installed in a weather-proof box.

If the building is surrounded by high trees or has a sloping roof, it may be more desirable to erect two masts thirty or more feet in height and 100 feet apart on open ground adjacent to the building. If trees interfere, two masts ten feet higher than the surrounding trees will be found satisfactory. Here the lead-in may be connected to one end of the antenna and then to the antenna terminal equipment of a radio frequency distribution system. This equipment may be located in a weather-proof box installed on the mast. From the terminal equipment the transmission line then may be led underground in protective conduit to the building. The antenna terminal equipment should be grounded at the mast.

An efficient ground is essential for a noise-free antenna system. The most satisfactory ground in a steel frame building is the frame itself. A large conductor (No. 8 A.W.G. copper wire) should be welded or sweated to one of the principal members of the frame. This wire should be as short and direct as possible and should not be run in conduit. If the building does not have a steel frame the ground wire may be run as directly as possible to a cold water pipe, to which it should be soldered or adequately strapped. The water pipe should be one of the main vertical pipes. If this is not practical, the ground lead should be carried by the most direct route to the main water pipe on the street side of the meter. Ground connections should never be made to gas pipes.

Where water pipes are not available, a satisfactory ground may be obtained by driving a piece of metal pipe five or six feet into moist soil. The ground connection then should be soldered to the pipe.

CHARACTERISTICS OF THE 82

PLEASE GIVE ME some information on the new mercury vapor rectifier tube, the 82, and state whether it is true radio frequency chokes have to be used in connection with it.—P. O. F., Old Orchard, Me.

The 82 is a rectifier especially designed for better regulation than the '80, and has an approximately constant voltage drop of only 15 volts. The choke coil in the B filter should be of low d-c resistance. The tube is for full-wave rectification, 500 volts a-c plate voltage maximum rms, d-c output current 125 ma maximum. R-f chokes of 2 millihenries minimum should be in series with the plates in a sensitive receiver, and tube and r-f chokes in such a case put inside a perforated shield.

BUZZER FREQUENCY

WILL A RESISTANCE placed in series with the voltage supply for a buzzer change the frequency? The question arises because of a desire to distinguish between two buzzers, both of which may be going at once, or one operating independently.—S.E.W., Camden, N. J.

There will be no appreciable change in frequency, although there will be a diminution of the intensity of the buzzing. In fact, if the resistance in series is high enough the buzzer will not buzz at all.

Load Requirements for New Tube

(*Continued from preceding page*)

are connected to the cathode of the detector, then the bias is the sum of the drop in R2 and the drop in the individual bias resistances. If the controlled tubes have their cathodes connected to ground we must subtract 20 volts from this voltage to find the effective bias. Obviously, it is better to connect the cathodes of the controlled tubes to the cathode of the detector in order to have a definite grid bias on the controlled tubes. Then the bias cannot be positive, but more or less negative, depending on the drop in R2, that is, on the strength of the carrier. Of course, this connection causes the cathode current of these controlled tubes to flow through the bias resistor R4 of the triode, which is not desirable. However, the large bypass condenser effectively prevents any feedback this way. Moreover, R4 should not be the bias resistor of the 55 triode alone, but should be a part of the voltage divider so that the current through R4 is considerably greater than the current from the controlled tubes and the 55 triode. This makes the bias on the grid of the 55 virtually constant.

In Fig. 1 the load resistance on the 55 triode is 100,000 ohms, whereas in Fig. 2 it is 20,000 ohms. The second value is that recommended by the manufacturers. Either value, or any value between, can be used with success. The higher the value the greater the output voltage, which is characteristic of all triodes. Since the plate resistance of the tube is 7,500 ohms and the amplification factor is 8.3, the voltage gain with a load of 20,000 ohms is approximately 6. When the load is 100,000 ohms, and assuming the same internal resistance, the gain is 7.7.

In view of the fact that we get a gain of from 6 to 8 times we do not need a very strong signal on the grid of the 55 triode. Suppose we use a 247 power tube. This requires a peak input voltage of 16.5 volts. If the gain is only 6 we need only to put a peak voltage of 2.75 volts on the 55 grid, and still less if we use a higher load resistance. If we use a 46 type power tube as a Class A amplifier we need a peak voltage of 33 on the grid. Hence if we have a voltage gain of 6 in the 55 triode we need only put a peak voltage of 5.5 volts on the grid. This voltage is easily obtained from the diode rectifier, either type rectification.

New Tubes in Old Sets

The 55 and Heater Pentode Used

By Edmund C. Wallach

BUILDING the latest tubes into existent receivers is one of the delightful pastimes indulged in by a large number of fans and service men. Now many of them have heard about the new diode rectifier and amplifier and about the heater type "247," which is known as the 42 tube, and they want to install these tubes. How can it be done? And how can automatic volume control be installed at the same time?

We shall assume that we are dealing with a superheterodyne so that there will be no trouble about tuning the input to the diode rectifier. In Fig. 1 we have a circuit containing a full-wave diode rectifier and amplifier and a heater type output pentode as well as a provision for automatic volume control. Transformer T is an intermediate frequency transformer in which the secondary winding is center-tapped. Except for that center-tap it does not differ in any respect from any other intermediate frequency transformer of the doubly tuned type. Its primary is tuned with condenser C1 and its secondary with C2.

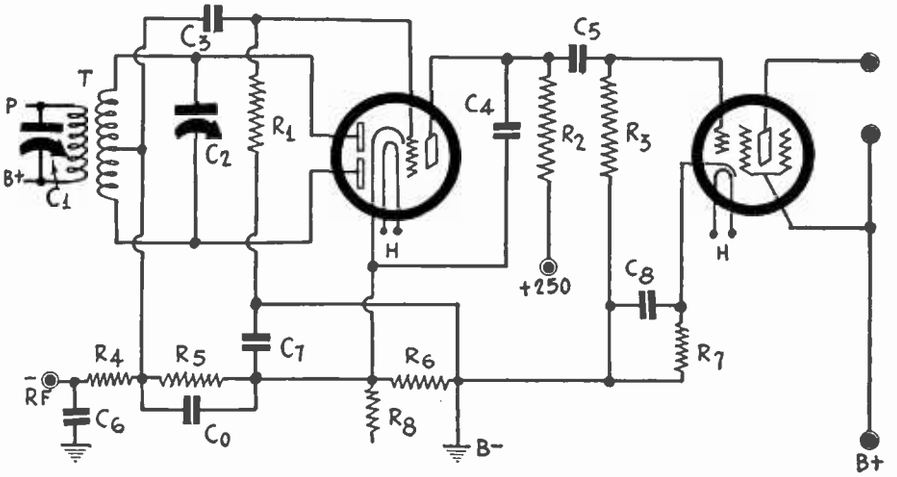

FIG. 1
This illustrates how the new diode detector-amplifier and a heater type pentode output tube can be connected in an existent receiver. Automatic volume control is also provided for.

The Diode Detector

The secondary terminals of the transformer T are connected to the two plates of the diode part of the detector tube, one to each, and the center-tap of the winding is connected to the cathode through a 0.5 megohm resistor R5, which is shunted by a condenser Co of 500 mmfd. The signal voltage causes pulsating current to flow through R5 and this current establishes a voltage across the resistance which varies in accordance with the amplitude of the signal voltage fluctuations, that is, with the degree of modulation. Co serves to remove the carrier frequency fluctuations so that across R5 the voltage varies only with the modulation.

The voltage drop across R5 is transferred to the grid of the amplifier part of the tube through a regular stopping condenser C3, which may have a value of 0.01 mfd. A grid leak R1 of one megohm is connected from the grid to B minus. A bias resistor R6 is placed between the cathode of the tube and B minus to establish a suitable bias for the amplifier grid. This bias should be 20 volts. Self bias should not be used but R6 should be a part of the voltage divider in which a comparatively large current flows. This is to prevent degenerative feedback. Resistor R8 is the next resistor in the voltage divider. The plate current in the amplifier will be rather small due to the fact that a resistance load is used. Hence if we select a bleeder current of 10 milliamperes the conditions for fixed bias will be met satisfactorily. If the drop in R6 is to be 20 volts and the current in it is 10 milliamperes, the value of R6 should be 2,000 ohms. A condenser C7 is connected across the bias resistance to reduce feedback. This condenser should be as large as practicable and should not be smaller than one microfarad.

Output of Amplifier

In the output circuit of the amplifier we have a filter condenser C4 of 250 mmfd. This would not be necessary if the diode input were exactly balanced but it is difficult to get complete balance so the condenser is used to eliminate the carrier frequency from the input to the power tube.

The load resistance R2 should have a value of 100,000 ohms, although it is not critical, and the voltage applied at the low end of this resistor should be 250 volts. Another stopping condenser C5 of 0.1 or 0.01 mfd. is used to transfer the signal voltage to the grid of the power tube, and a grid leak R3 of 500,000 ohms follows.

The power tube may be biased with a resistor R7 in the cathode lead and this resistor should be shunted with a condenser C8 of as large a value as practicable. Not less than 4 mfd. should be used. The value of the bias resistance should be 400 ohms. The voltage on the plate and screen of the power tube should be 250 volts, but in view of the fact that the tube is self biased the voltage at B plus should be somewhat higher, say 266 volts. It is not critical, however.

Automatic Volume Control

If the circuit is to be used for automatic volume control, use is made of the diode current drop in R5 for the additional bias on the controlled tubes. The grid returns of these tubes are connected to the terminal marked RF. R1 is a resistor or half megohm and it is used to prevent carrier voltage fluctuations from reaching the grids of the controlled tubes. C6 serves the same purpose and it may have a capacity of 0.1 mfd. If the drop in R5 is greater than required for bias it may be dropped to the desired value by means of a voltage divider between the RF terminal and the grid returns.

While ground is shown to be the same as B minus in the circuit this may not be consistent with the required bias on the controlled tubes and the necessity for grounding the rotors of the tuning condensers. But this can be taken care of by connecting the cathodes of the controlled tubes or by grounding a point different from B minus.

Filament Requirements

The filament of the diode tube requires a voltage of 2.5 volts and a current of one ampere. The 42 power pentode requires a heater voltage of 6.3 volts and a current of 0.75 ampere. These characteristics of the 42 power pentode are tentative and it may be that changes will be made. If these are made it is likely that the filament voltage will be 2.5 volts and the current 1.75 to 2 amperes.

Bias Options

Both the new tubes require six-pin sockets. While the recommended bias is 20 volts on the 55 triode, it is not necessary to use this when the signal swing will be so low as 5 to 6 volts. We may use as low a bias as 7 volts. This applies to the case when the load is a resistor of high value which will limit the plate current. If the load is an inductance of low d-c value, the full recommended voltage should be used on the grid. By using a lower grid bias the resistor R4 may be lower, which is advantageous.

It will be noticed that the tuning condenser C1 is not grounded on either side. Hence, if it is in the r-f amplifier a special condenser must be used, one that can be insulated from the chassis. It is possible, however, to tune the primary of the input transformer in place of the secondary, in which case the tuning condenser could be grounded, provided a large bypass condenser were used to complete the tuned circuit across the B supply.

Case of a Super

If the circuit is tuned to an intermediate frequency there is no difficulty because the condenser does not have to be grounded. The circuit is more suitable for final detection, anyway, because then the automatic volume control feature can be applied to the intermediate amplifier as well as to the r-f amplifier.

The detector tube used in this circuit is the 55 duplex-diode triode, the characteristics of which are given in another article of this issue. Whereas the load resistance on the triode in this circuit is given as 100,000 ohms, the manufacturers recommend that it be 20,000 ohms. Either value may be used without making any other changes in the circuit.

All-Wave Simplicity

Oscillator Alone Tuned—628 B Parts Used

By Waldron Edwards

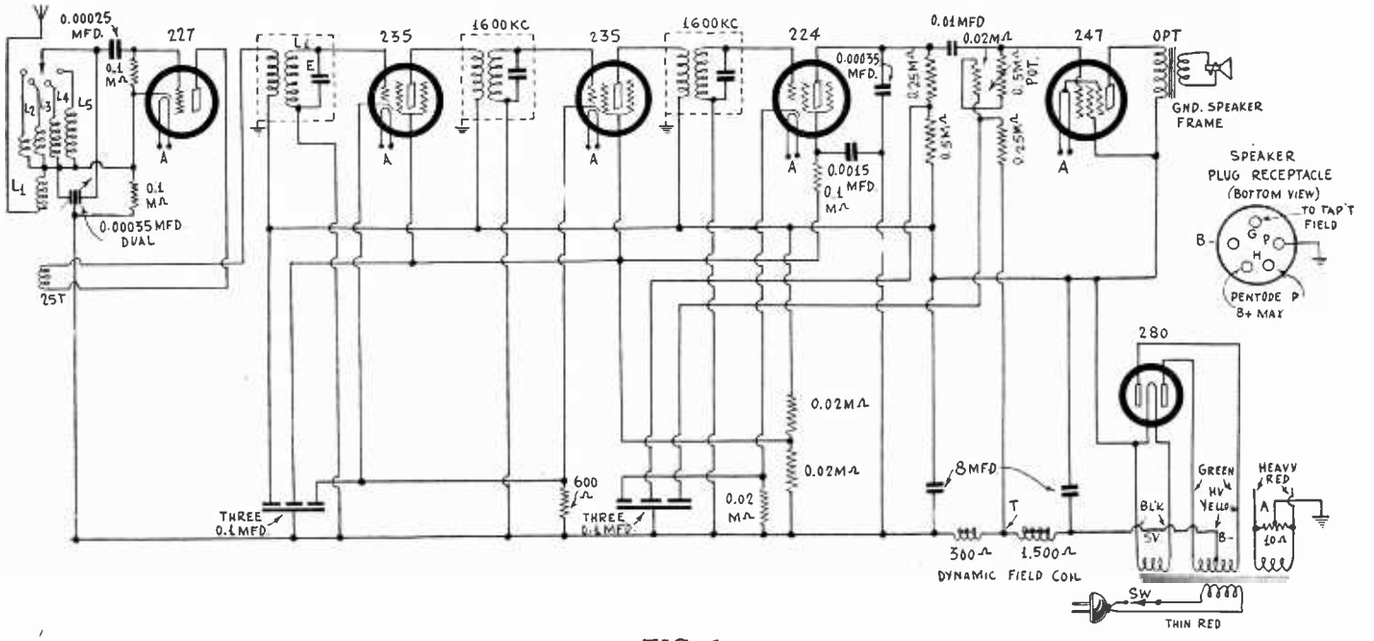

FIG. 1

A two-gang 0.00035 mfd. condenser may be used with one section effectively in series with the other, the resultant capacity (0.000175 mfd. maximum) across the tuned coil, as in this all-wave superheterodyne. The autodyne tube (oscillator-modulator) is tuned to the oscillation frequencies only, to avoid padding complications for four bands.

FOR all-wave coverage, to get rid of the necessity for padding, it is practical to dispense with the signal tuning. This is done in Fig. 1, the only unusual feature of which is the use of a two-gang condenser with sections in series for tuning the grid coil, instead of a single condenser. Thus if a dual 0.00035 mfd. condenser is used, the maximum capacity is half that, or 0.000175 mfd. This is amply high capacity, especially as the intermediate frequency is around 1,600 kc.

Since there is no signal frequency tuning, the intermediate frequency does not have to be exactly some selected frequency, but may be chosen on the basis of coils and equalizing condensers you probably have, and lined up for greatest volume of sound when a station is picked up. The coils used for intermediate frequency are regular t-r-f coils with high impedance primaries.

The present circuit can be built up from the same parts used in the 628-B all-wave receiver, excepting that two 0.1 meg ½ or 1 watt resistors are needed in addition, these being of the familiar grid leak type. The oscillator coil is the same.

The Oscillator Coil

The coil directions are as follows: A coil is wound on 1-inch diameter tubing, using No. 28 enamel wire throughout. Suppose the coil form is held with its long dimension parallel with a table top. At extreme right would be L5, consisting of 50 turns, a tap being taken at this point and 10 more turns (L1) put on, thus constituting a 60-turn single winding tapped at the 50th turn, or 10 turns from the end. Next comes the feedback winding, separated ⅛-inch from the other, and comprising 25 turns. The short-wave windings are spaced from companions by ⅛-inch also. The number of turns are L4, 20 turns; L3, 10 turns; L2, 5 turns.

The connections are as follows:, right to left: extreme of large winding, L5, to grid lug switch; tap to one stator of tuning condenser, other extreme to aerial. The plate winding has its terminal nearer the former winding joined to plate of the tube, end of the winding to primary of the first intermediate frequency transformer. The beginning of the next winding goes to the condenser stator previously mentioned, as do the corresponding beginnings or right-hand terminals of the two remaining coils, the free terminals of these three short-wave windings going to lugs on the coil switch that pick up the other stator of the tuning condenser.

Oscillator Discussed

If oscillation does not result, reverse the tickler connections (plate coil). However, this circuit is primarily a ready oscillator, and under some conditions, especially with extra good tubes, will oscillate without the feedback winding being used at all. Therefore experimenters are invited to try this, by omitting connections temporarily to the plate winding of the oscillator coil.

The reason why oscillation may be present without the feedback coil is as follows: Both extremes of the tuned windings are at a high radio frequency potential, the grounded part of the coils being the electrical center thereof, as determined by the dual tuning condenser's rotor, which is grounded. Only an r-f ground therefore is applied to the tuned coils. There is, hence, no conductive path for direct current in the tuning coils. Since the current from the plate circuit is introduced at one of the high potential extremes of the tuned coil, due to cathode connection to that extreme, enough feedback voltage may be built up to sustain oscillation. However, the tickler is on the form and may be used if necessary, or included at all hazards, as the principal consideration is to attain oscillation, and this is bound to be with the tickler but may be without the tickler.

The grid bias on the first tube is nominally zero, since the grid and cathode are joined by a resistor, except that if grid current flows the grid bias becomes negative, the more current the more negative. This is a frequency stabilizing agency, since the increase in grid current increases the bias, which in turn reduces the grid current and thus the bias tends to be steady. Any method of relieving the tube of d-c voltage changes tends to stabilize frequency, or tuning, because voltage variations in most circuits cause frequency variations, and when the frequencies are high the frequency drift is considerable, although the percentage of frequency change may not differ.

In the 628-B, which had one stage of intermediate, the broadcast modulator coil was fastened to the front flap of the chassis, and it may be left there and used as an intermediate coupler in the present circuit, which has two stages of intermediate amplification (three couplers required). Only one section of a switch is needed for band shifting, but the switch must have an insulated shaft. Moreover, the tube has a grid return even when the switch does not contact the coil, as will happen during change from one band to another.

Quickly Restored Oscillation

Ordinarily this failure to have a grid return for a second or less will stop the tube from oscillating for several seconds, but in the present hookup the tube, while it will stop oscillating when there is no contact, will resume the moment there is, without the several seconds' interruption for resumption after the contact has been reestablished.

The circuit has a tone control, 0.5 meg. potentiometer, as this comes in handy when the noise level is high on short waves, as it sometimes is.

AN IMPEDANCE MATCHER F TO WO

By Herman

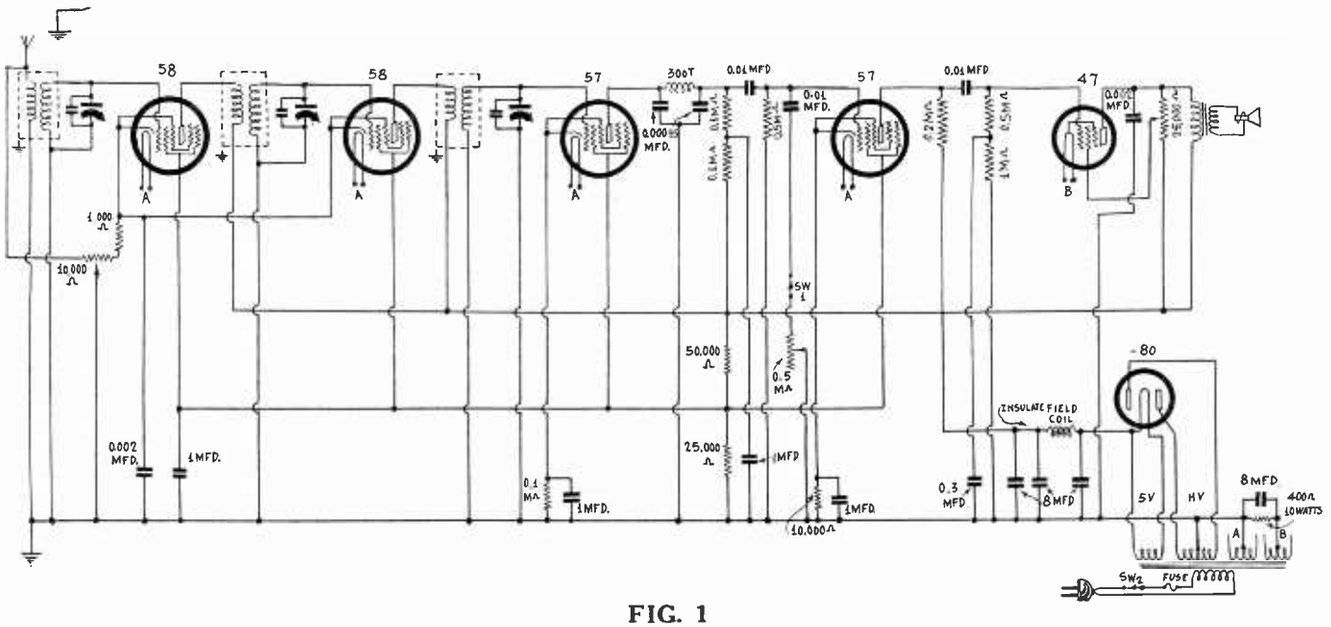

FIG. 1

A six-tube a-c set built of spare parts, including some old ones from early model experimental receivers, to constitute an up-to-date set. The impedance watcher (25,000 ohms up) is a novelty of great utility.

THERE were a vacant console, save for a dynamic speaker occupying the space behind the grille, and also some miscellaneous radio parts, many of them out of experimental receivers of other days, lying around the summer bungalow into which my family moved as June arrived, but no receiver. So one had to be built, and at least one interesting and useful novelty was developed as a result. This is the adjustable voltage for the screen of the '47 tube, the purpose being to afford virtually any value of impedance output required for matching speakers intended for power tubes.

As may be inferred, the speaker was of a type not intended for the pentode output tube. It had a center-tapped input for two '45 tubes in push-pull. Originally the set was built in usual fashion, and the wrong speaker connected in circuit, so to speak, the tone quality being unbearably bad, and considerable hum being present. It was believed that the hum was the result of the mismatch, because of the non-uniformity of the output of the power tube as compared to input, this constituting distortion, and all distortion being a form of detection.

The Adjustment of Impedance

If the screen and the plate of the '47 are tied together the result is a tube of more nearly the characteristics of the '45, except that the mu is still a little higher than in the case of the '45, the negative bias may be maintained at around 20 volts (16.5 volts being standard for the regular hookup of the tube), and the plate voltage not exceeding 250 volts. So if a potentiometer is connected across the total B voltage, the arm to the screen, all degrees of coupling of screen and plate are available, from the amount for standard connections for the tube, the minimum, to unity coupling, or the maximum, which obtains when the two elements go to the same potential, the plate. The control of the impedance of the tube is not a front-panel unit, of course, but is placed at some accessible point on top of the chassis, or at the rear wall, and adjusted once.

The guide should not be the quantity of sound, as this will be greatest when the standard application obtains, full voltage on screen and on plate return, but rather the best tone quality. It so happens that the low-note suppression is very intense in instances of badly mismatching of impedances, hence the adjustment may be made when listening to dance orchestra and adjusting until the low-note response is most satisfactory, consistent with adequate volume.

Impedances Compared

The method outlined is valuable for its speaker salvaging possibilities, as there is a wide variation of impedances of output tubes, and the impedance of a tube is different somewhat also, depending on the bias and plate voltages. As an illustration, here are the a-c. impedances of output tubes in ohms for optimum d-c. voltage operation:

Tube	*Ohms*	*Tube*	*Ohms*
46 (Class A)	**2380**	**233**	**50000**
112A	**5000**	**238**	**102000**
120	**6300**	**245**	**1670**
171A	**1850**	**247**	**35000**
210	**5000**	**250**	**1800**
231	**4950**		

The three pentodes account for the highest impedances by far, and therefore the system suggested may be applied to any of them, to enable impedance matching, which for maximum undistorted power output in three-element tubes is that the load impedance be twice the plate impedance.

As for the rest of the circuit there is little departure from standard practice. The question of radio frequency squealing naturally arose, and the limiting resistor in the volume control circuit was increased to 1,000 ohms to get rid of a tendency toward oscillation at the last few channels at the high frequency end of the band. But this did not do the trick, either, until a bypass condenser was placed across the plate load of the power tube, not for tone compensation at all. but to prevent r-f. feedback.

The 1,000 ohms may be less—down to 150 ohms—if no oscillation trouble arises.

While there is a filter in the detector plate circuit, it is only to be expected that some radio frequency gets by, and as the audio channel is high gain and is about as effective at radio frequencies as at audio frequencies, five stages of r-f. amplification may accidentally arise, and then squealing is inevitable.

Stable Circuit Results

Or, if only a little r-f. escapes the detector, it is amplified sufficiently to provide a large r-f. component in the plate circuit of the output tube, which may feed back to the tuned circuits either through the capacity effect of the wiring or through the B supply. The trouble will be stopped if the bypass condenser is either in the grid of or plate circuit of the power tube, and while 0.002 mfd. is high, as low as 0.00025 mfd. may be used.

The circuit, built as shown, was absolutely stable, had all the pep required, and was truly selective, even though no trimming condensers were used across the tuning condensers. The trimmers are shown, because so often they are necessary, and also so many condensers have them built in, but if you try the circuit without any trimmers, using condensers on which trimmers would have to be put if any were to be used, it will be found that the wave band coverage is considerably greater. For instance, the circuit tuned just a trifle below W2XR, Radio Pictures, Inc., Long Island City, New York City, 176.4 meters, so probably went to 170 meters, whereas at the opposite extreme WMCA, New York City, 526 meters, came in at 81 on the dial, which, from the

OR THE '47
RK ANY TYPE OF SPEAKER

Bernard

known curve of the condenser, makes the highest wavelength about 557 meters. The frequencies of these extremes are 1764 kc. and 538.3 kc., a span of 1226 kc., compared to the span of the broadcast band (including Canada's 540 kc.) of 960 kc., an excess of 266 kc. No missout there! Trimmers reduce this span, but if not too large do not at all imperil complete coverage of the broadcast band.

Selective, Too

The set was selective, as evidenced by the fact that WWRL, Woodside, N. Y., a few miles from the bungalow, and on the extreme frequency of 1500 kc. where selectivity easily might be lowest, was tuned out and WKBW, Buffalo, N. Y., tuned in on 1480 kc., without interference. Only a short aerial was used—a 3-foot stretch, aerial post to floor—for there is no need for a long aerial for such a receiver in a metropolitan district, although it would be suitable in places farther removed from transmitters.

The receiver was so sensitive that stations could be tuned in using only body capacity, by holding an index finger about an eighth of an inch away from the first r-f. tube. Some finger rest has to be used, otherwise, because of the variation in coupling due to the nervous system, one might be tempted to suspect the receiver was a notorious fading machine.

A tone control is shown in the diagram, as it came in handy at the seashore just prior to and during storms, when static was heavy. The tone control cuts down the amplification especially on the high audio frequencies, and thus the signal to static ratio is increased. However, such a control reduces audio sensitivity all along the modulation characteristic, most strongly on the highs, but on the lows as well. Thus do tone controls reduce volume when they really aren't supposed to be volume controls. So the tone control rheostat (or potentiometer used as rheostat) has a switch built in, enabling complete cutout of the control of tone, and valuable particularly for DX work, when no volume should be sacrificed to a tone control not needed under the circumstances.

Signal Attenuation

The volume control is of the complete attenuation type. So many experimenters have difficulties with the value of resistance of volume controls in cathode legs that it is well to use a system that completely cuts out the signal at one extreme (because grounding the aerial), while at the other permits full volume. The only requirement is that the resistance of the potentiometer should be no less than 5,000 ohms, as that is about a minimum load to put across the primary.

It might seem at first glance that the volume control works in the wrong direction, because when the input is least the negative bias is highest. With maximum input would not maximum bias be required, to safeguard against cross-modulation?

If the standard volume control in cathode leg is considered, it will be observed that the bias is highest when the amplification is least, which means that when a strong station is being tuned in the bias of the first tube is such as to safeguard against cross-modulation. Only the amplification is governed—the input is unchanged.

Filter Circuit

Here, however, we retain the control of amplification but add to the gain control an input attenuator—the same instrument, in fact, but combining two purposes—and this attenuates the signal as the bias is increased, which is an operation in exactly the same direction as previously. The necessity for turning down the volume does not arise when the incoming signal is weak, and then the input is not attenuated and the bias is low and amplification high, all three conditions just what are desired.

In the filter circuit the dynamic speaker's field coil was used as the choke, and three 8 mfd. electrolytic condensers for completing the filtration. Only two 8 mfd. actually are necessary. The extra one is something of a luxury (65 cents) and finishes off the hum nicely. It was placed at the end of the rectifier, to make the reservoir capacity 16 mfd., or if two chokes are used in series it is a good plan to try the extra 8 mfd. between the joint and ground. All three ways of placing the extra capacity should be tried, however, by simply touching a lead from the cap of the can-grounded condenser to one point after another and listening to the effect on hum.

Bypass Capacities

The bypassing of the screen voltage should be done with a condenser of at least 1 mfd., and the same is true of the detector biasing resistor of 0.1 meg., because of the audio frequencies concerned. Low-note reproduction is greatly improved, and there's a little hum, if both of these are 8 mfd. Also 8 mfd. should be minimum across the 400-ohm 10-watt resistor biasing the power tube, for the same reason.

The power transformer had two separate 2.5-volt windings. Thus the heater bias is zero. If the 2.5-volt winding for the r-f detector and first audio tubes is not center-tapped, used a 5-to-20-ohm center-tapped resistor across the winding, and ground the center of the resistor. This safeguard against biasing the heater is in line with the standard recommendation for the new tubes that the heater should be preferably at no bias potential, but that if there is a bias it should be negative, and not more than 45 volts, never positive.

It is good practice also in regard to the earlier models, '27, '24 and '35, but requires two separate windings, for if there is only one 2.5-volt winding then the heaters are positive by the amount of the bias on the power tube, since that tube's filament has to be lifted to the bias potential to give rise to the bias.

If you have a transformer with only one winding at 2.5 volts you may use that, as the circuit surely will work, though not with quite the same stability. Moreover, if you want to use the '35, '55 and '24 tubes, you may do so, with UY sockets instead of the six-prong type required for the 57 and 58. There is no letter code for the six-prong type, but it is suggested now that, they be designated UZ.

Coil Information

The tuning condenser was a three-gang 0.00035 mfd., the tuning coils were of the same type of construction throughout, 127 turns of No. 32 enamel wire on 1-inch diameter for secondaries, three layers of insulation separating the secondaries from the 30-turn primaries, which were near the bottom of the secondary or grid return position. Any size wire may be used for the primaries. Do not use shielded wire for the leads to grid caps as the minimum capacity is raised too much. Shield the coils and ground the shields.

The 10,000-ohm resistor in the cathode leg of the first audio tube, for biasing purposes, is rather high, but is kept so in the interest of stability. Lower values, to 5,000 ohms, may be tried, and although affording more volume, may not be retainable because of insufficient stability. This is particularly true if the resistance of the field coil is high, say around 2,000 ohms.

If the field coil is tied to the output transformer, sever the connection, so that there will be four leads—two for the field coil and two for the primary. Then if the output transformer was for push-pull the center-tapped is ignored and a higher inductance primary is available, using the extremes for connection purposes and reversing the connections to note which way gives less hum.

Voltages

If the resistance of the field coil is high, then considerable potential difference will exist across it. At 60 ma drain, 2,000 ohms resistance, the drop would be 120 volts. If the power transformer affords high voltage as intended for the '45, the introduction of a high resistance field coil as B choke at least has the effect of keeping the applied voltage within the limits for the tubes. A typical transformer for '45 tubes then would yield about 200 volts for application to all plates, which is sufficient for good results, but up to 270 volts may be utilized for B minus to B plus if practical, but hardly much more.

Should you have an assortment of 8 mfd. electrolytic condensers and you hear a boiling sound when using a wet one next to the rectifier, replace this with a dry one, which normally has a somewhat higher continuous working voltage rating, and if necessary put the two remaining ones, wet or dry, at the end of the choke system, dispensing with a condenser from a joint in two chokes to ground in the event the condenser at the mid section does not stand the voltage there. Actually that was what was done in the circuit shown and is the main reason for the two 8 mfd. condensers being in the reservoir capacity position.

If you haven't the recommended 0.2 meg. resistor for the plate of the first audio tube you may use 0.25 meg.

34,755,410 Sets in World

Washington

According to figures made available by Lawrence D. Batson, of the Electrical Equipment Division, Department of Commerce the total number of radio sets in the world at the beginning of 1932 was estimated at 34,755,410, an increase of about 9,000,000 during the preceding year. Approximately one half of all the sets are in the United States, or a total as of April 1, 1932, of 16,679,253. This was an increase of more than 4,600,000 since the 1930 census, which reported 12,078,345 as of April 1 of that year.

SENSITIVITY OF 0.25 MICROV IN

By Brunsten

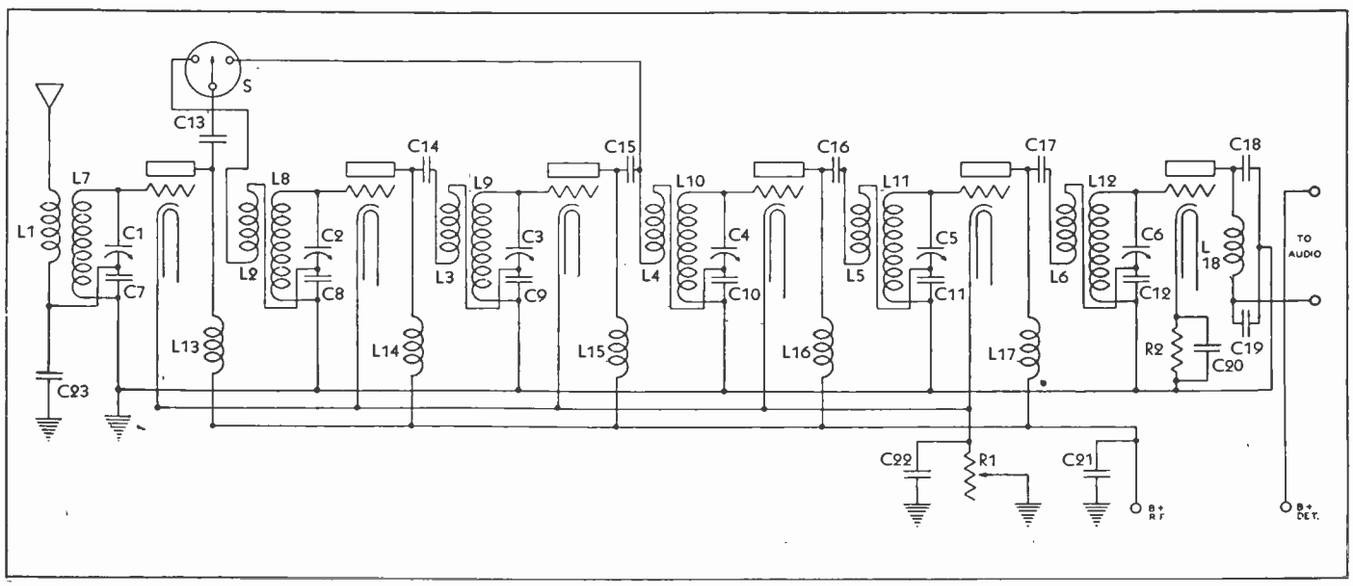

FIG. 1

A six-tube radio frequency amplifier employing the system of amplification invented by the Rev. J. J. Daley. The circuit is characterized by constant and non-regenerative coupling.

THIS IS the corrected diagram of the six-tube radio frequency amplifier invented by the Rev. Mr. J. J. Daley, of Boston. A photograph of the receiver embodying this circuit was published last week on the front cover of RADIO WORLD. The correction pertains to the position of condenser C23. In a diagram previously published this condenser was in the lead between the chassis and ground whereas L1 was grounded.

The corresponding parts in the six-tube circuit have exactly the same values as the parts in the four-tube circuit given in detail in last week's issue. In the six-tube circuit the stage selector switch S is arranged so that by throwing it to the right two stages are cut out, thus making the circuit a four-tube amplifier.

The greater sensitivity of the six-tube circuit is clearly shown by comparing the sensitivity curves of the two amplifiers. Fig. 2 here shows the sensitivity of the six-tube circuit and that of the four-tube circuit was given last week. The scale is selected so that the actual sensitivity in microvolts is given by dividing the ordinates by 4. Thus throughout almost the entire range the sensitivity is about 0.25 microvolts. There is only a slight decrease in the sensitivity toward the ends of the tuning band, but the variation amounts to less than 10 per cent, and the amount of deviation is the same at both ends. Thus the curve is as nearly ideal as it can be made in practice. This sensitivity does not mean that a signal having a strength of 0.25 microvolts is just barely audible, but that it will give out a signal of standard intensity, which is considerably greater than bare audibility.

Amplifier Used

Neither does it mean that the sensitivity of the r-f amplifier alone has the value indicated on the sensitivity curve. The detector was followed by a stage of amplification using a tube with a mu of 30 and another stage of push-pull with two 245 tubes. The sensitivity curve represents the overall sensitivity of the r-f amplifier and the audio amplifier, and the standard output was measured in the output circuit of the push-pull amplifier under optimum conditions for those tubes, as recommended by the Institute of Radio Engineers Standards Committee. For input a standard dummy antenna was used consisting of a coil of 20 microhenries, a condenser of 200 mmfd., and a resistance of 25 ohms, all in series and in series with the signal source. This antenna is equivalent to an actual antenna 4 meters high, that is, approximately 13 feet. The output impedance, in which the standard signal was measured, was adjusted to 4,000 ohms. The signal used was modulated at 30 percent with a pure tone of 400 cycles per second, the standard test frequency.

Selectivity

The selectivity of the six-tube amplifier is given in Fig. 3 for three different frequencies, 600, 1,000, and 1,400 kc., which are the standard test frequencies in this respect.

A high order of selectivity is indicated. Thus at six kilocycles off resonance the attenuation amounts to about 0.01, or it requires a signal 100 times as great to put out standard output as at resonance. At 10 kilocycles off resonance it requires a signal about 500 times as strong as at

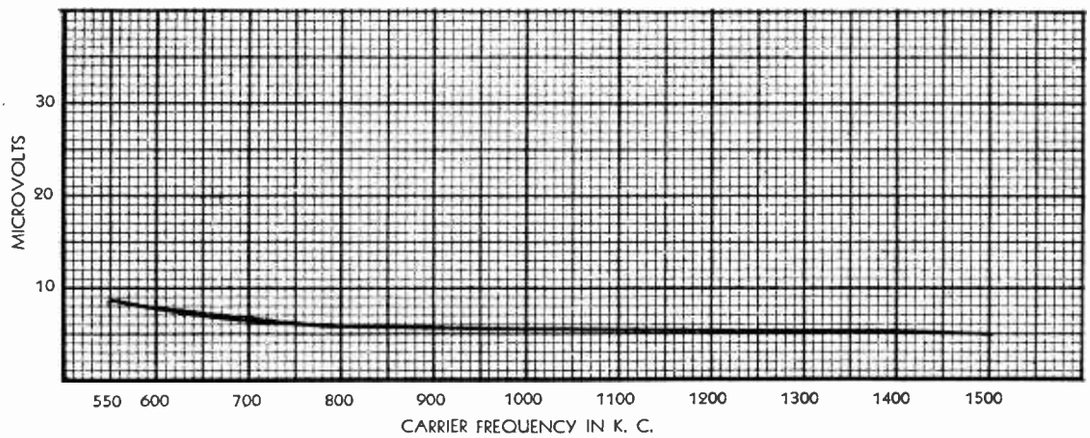

FIG. 2

This shows the sensitivity of the six-tube amplifier in Fig. 1 over the broadcast band. The actual sensitivity is obtained by dividing the graphic values by 4. Thus the sensitivity is about 0.25 microvolt.

OLTS 6-TUBE DALEY RECEIVER

Brunn

resonance to put out standard signal. Before we get off resonance 20 kilocycles it requires a signal 1,000 times as strong.

Within the 5 kilocycle limit there is comparatively little attenuation. Hence there is little sideband cutting in the zero to 5,000 cycle range. The difference in selectivity at the different test frequencies is negligible. Therefore, in this respect the circuit behaves somewhat like a superheterodyne in which the selectivity does not vary much with the signal frequency. As in the case of the four tube circuit we note the peculiarity that the selectivity is less at the middle of the tuning range than at the ends, but this effect is noticeable only for frequencies more than 5 kilocycles off resonance. We also note, as we did for the four tube circuit, that the selectivity is greatest at the highest frequency. This is unusual for radio frequency tuners, but is the direct result of the method of coupling employed.

Mutual Between Coils

While the inventor did not supply any information about the mutual inductance between the primaries and secondaries of the r-f coils, we can deduce that it should be 3.07 microhenries by making use of the given capacity of 10,000 mmfd. in each coupler. This makes the effective mutual impedance 39.51 ohms at 550 kc. and 39.55 ohms at 1,500 kc. At 1,000 kc. 35.2 ohms.

The secondary inductance of each tuning coil is 275 microhenries. If we wind the coils with No. 31 enameled wire on one inch tubing this inductance will be obtained if we put on 143 turns. This will make a winding a little more than 1.4 inches in length. The primary winding should be 22.5 microhenries. Using the same size wire as on the secondary and winding it on the same diameter, the required number of turns is 24.6. To get the required mutual inductance between the two coils the distance between the centers of the two windings should be about 2 inches, or the separation between the nearest turns should be 1.21 inches. This represents very loose coupling. Of course, the mutual is only half of the total coupling, on the average.

List of Parts Used

The parts of the six-tube tuner are as follows: C1 to C6, inclusive, 350 mmfd. variable condensers; C7 to C12, inclusive, fixed condensers of 10,000 mmfd.; C13 to C17, inclusive, fixed condensers of 870 mmfd.; C18 and C19, 1,000 mmfd.; C20 and C21, 2 mfd. each; C22, 0.05 mfd.; C23, 0.005 mfd.; L1 to L6, inclusive, 22.5 microhenries; L7 to L12, inclusive, 275 microhenries; L13 to L18, inclusive, 175 millihenries; R1, 300 ohms; R2, 25,000 ohms, variable; S, a single pole, double throw switch.

While the circuit has been designed to be used with special tubes having a mu of 30, it should also be possible to use it with tubes like the 227, the 37, and the 56, or even with screen grid tubes like the 224, 236, 235, 257, and the 258. The gain of these tubes would be much greater than the gain of the three element tubes but they need not be operated at their full gain. With low mu tubes like the 227, 37, and 56 the gain will not be as great as with the special tubes. Those who care to experiment with the circuit should try what tubes they have, and at first it is not necessary to attempt to use six stages.

The coil specifications have been given for those who care to experiment with the circuit, and not those who want a detailed description. No data are available on the 175 millihenry chokes other than the value of the inductance. It does not appear that the choke values are critical so for experimental purposes other value of inductance might be used. But they should be at least 85 millihenries and they should have as little distributed capacity as possible.

Examination of the circuit invented by Father Daley reveals a similarity to the Loftin-White method of constant coupling which appeared first in the August 21st, 1926, issue of RADIO WORLD.

In the Loftin-White circuit both inductive and capacitive coupling is used and the mutual inductance is phased so that the two aid. In that circuit, also, a radio frequency choke and a stopping condenser are used between the plate of the tube and the tuned circuit. The primary of the r-f transformer is placed near the top of the circuit and then the primary picks up the coupling condenser, which is in series with the tuning condenser, and on the ground side. Father Daley's circuit uses more stages than attempted in the Loftin-White, and tubes of higher amplification constants are used. Therefore the results are not necessarily identical. Indeed, we suspect that the sensitivity of the Daley circuit is many times greater than that of any of the Loftin-White circuits constructed at the time.

Sensitivity

For the Loftin-White circuit no definite constants were given and there were many guesses as to what they should be. In one respect, however, there is no room for guessing because in both cases the inductive and the capacitive couplings must be such that the total effective coupling is practically constant throughout the tuning range.

An idea of the construction of the six-tube amplifier can be gained by referring to the front cover of last week's issue, or from the photo of the four-tube circuit in the same issue. In the six-tube circuit there are six equal tuning condensers, three on each side of the drum dial with which they are turned. The arrangement of the two circuits is exactly the same, the only difference being that the six-tube chassis is a little longer.

Design details of this receiver are not available except the values of the parts given.

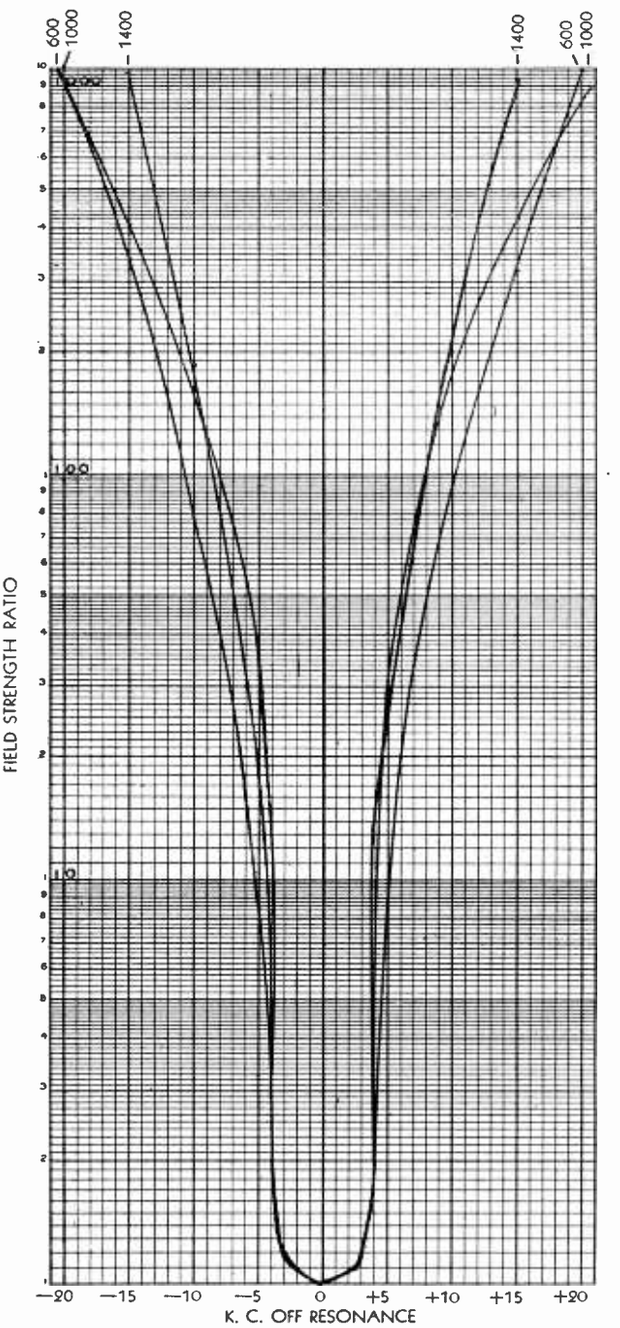

FIG. 3
The selectivity curve of the six-tube amplifier in Fig. 1. A high order of frequency discrimination is indicated.

FACTORS IN COIL EFFICIE

By J. E. A

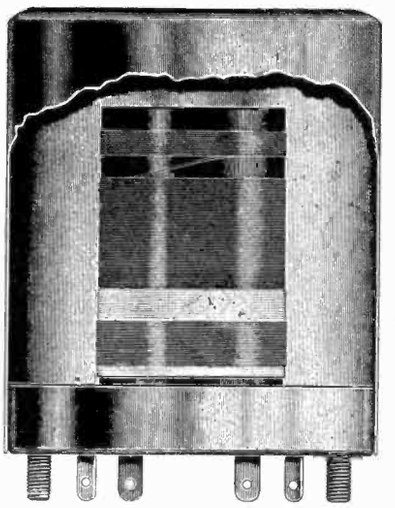

FIG. 1

This shows the construction of a typical midget type broadcast coil. The shielding has been cut away to show the relative dimensions of the coil and shield and to show the disposition of the windings.

AT ONE TIME it was considered essential to use low-loss coils and low-loss condensers in tuned circuits. Everything was done to minimize losses in the circuits, at least in the mind of the radio fan. It was not only considered essential to have low-loss circuits, but it actually was essential. Tubes were expensive and for that reason only a few tubes could be used in most sets. Not only were the tubes expensive but it was expensive to keep them operating, due to the cost of renewing batteries and recharging storage batteries.

All this was changed when a-c tubes and tube rectifiers came into use. Now tubes are cheap and it is inexpensive to keep them operating. But what has become of the low-loss idea? The aim now, apparently, is to get as high losses as possible. Well, that is not quite true, either, but it is a fact that low loss in coils, at least, is not so important, mainly because the tubes now used are so much better and because more tuned circuits are used. There has been no reduction in the quality of tuning condensers. Indeed, they are better now than they used to be, and a whole gang of them only costs a small fraction of what a single condenser used to cost.

Coil Construction

A coil that had a selectivity factor of 100 was considered poor in the low-loss era. Nothing less than 500 was the aim, although this aim was not attained. Now a coil that has a selectivity factor of 75 is considered all right, and many have a selectivity factor even less. Yet there are plenty of amplification and selectivity in the circuit, because there are several tuned circuits all lined up pretty well.

FIG. 2

This shows the construction of a plug-in type of short wave coil. The material of the form is either a special moulded compound or Isolantite.

Two factors enter into the lower individual efficiency of the coils now used, first, the use of finer wire, and second, the use of shielding. But the lower individual efficiency does not mean lower efficiency of the circuit. No, indeed. The use of smaller coils is a matter of good practice. If it were practical to use coils having a high selectivity factor, they would be used now. The first consideration in making a coil is that it make the set work and be an easy set to manage. There would be no sense in making all the coils of high individual efficiency and then put something in the circuit to make it less efficient. That practice of digging holes and filling them up again was practiced at one time but manufacturers found that it was an expensive policy for which the public would not pay.

Most persons care nothing about low loss or high loss just so they get a sensitive and selective receiver that puts out good tone. They get that now without being asked to pay a high price for being deluded.

Much rubbish has been eliminated from radio to the benefit of the buyer, who now pays almost as much as the set is worth. We say "almost" because nearly everybody who has anything to do with the set before the ultimate customer gets it seems to be losing money now.

Fig. 1 is a picture of an up-to-date r-f coil, the shield cut to expose the coil. The dimensions of the shield are smaller than the dimensions of the old type coils, and the coil itself is a mere midget inside the shield. But it is not a midget in performance.

Explanation of Structure

It will be noticed that at the upper end of the tuned winding there is a space in which there is no wire. Many have asked the purpose of this space. Why is not the coil wound solid from one end to the other? The purpose of this empty space is to allow for adjustment of the inductance.

In a circuit having many tuners in which all circuits are tuned with a gang condenser, it is essential that the inductance of each coil be held closely to a standard value. Now, wire used in winding coils is not always of the same diameter, although the number of the wire is the same. Variations occur mainly as a result of the wear on the dies through which the wire is drawn. One wire manufacturer allows a variation of 0.0001 inch, plus or minus, in the wire sizes ordinarily used in winding small coils. When the drawing die is new the wire is smaller than the normal, and when it is old, the wire is larger by the same amount. While 0.0001 inch is very small, yet for No. 31 wire, for example, it amounts to more than 1 per cent of the diameter, and since the variation may be either plus or minus, the total possible variation is about 2 per cent. This would make a possible variation in the length of coils also 2 per cent. It is not desirable to allow such a variation because of the resultant variation in the inductance.

In manufacture it is always possible to make the length of all the coils of the same type the same by starting and stopping the winding at the same distance apart, and this distance can be determined once for all by setting the drilling jig so the end holes will be the same distance apart. Obviously, to be sure that in every case all the required turns will fit into the space it is necessary to allow for the largest dimension that the particular wire may have. Thus in the case of No. 31 enameled wire the largest diameter is 0.0098 inch. Hence if we are to have 127 turns, for example, we must allow at least 1.25 inches between the two end holes in the form. And since it is desirable to have a means for adjusting the inductance by adjusting the length of the coil, the separation should be a little more. This accounts for the empty space on the coils. The distance between the first and the last turn is always the same and variations are taken up by the empty space.

Variation of Effective Length

Suppose we wind all but one turn before we skip to the final hole. The inductance will be too large because the turns are bunched in a shorter space. If we move another turn over across the empty space, the inductance is reduced a little because now the mutual inductance of two turns and all the rest is less and hence the entire inductance is less. And if we move still another, the inductance is reduced still more.

The final adjustment of inductance is done by shifting the turns across this empty space. The coil is put in a circuit and matched against a standard, and turns are moved, by spinning the coil, one way or the other across the empty space until the inductance of the coil matches that of the standard. Each coil is held to an accuracy of about 0.5 microhenry out of 245 microhenries, or to about 0.2 of one per cent. This is equivalent to a variation in the resonant frequency of 0.1 per cent, assuming that the tuning condensers in all the circuits are exactly alike. This amounts to only 1.500 cycles at the upper end of the broadcast band, and is negligible.

Incidentally, there is also a variation in the diameter of the form on which the coil is wound, and this variation also is compensated for by the movement of turns across the empty space on the coil. This means of making small changes in the inductance of a coil to compensate for unavoidable differences was rather a happy idea.

The Coupling

The coupling used in the midget coils is comparatively close. In the coil illustrated a primary winding is used, and it is placed near the ground end of the secondary, wound over some of the secondary turns and separated by insulator. There is some capacity between the two windings, and this, too, is made use of in coupling. The primary is so connected that the inductive and the capacitive couplings aid each other. This, however, does not insure constant coupling with varying frequency, but the coupling is so proportioned that there is not a great deal of difference.

In another form of coil capacity coupling is used entirely. At the high frequency end the effective capacity is that between a single turn of heavy wire wound over the grid end of the coil, and for the low frequency end it is that between the tuned winding and a radio fre-

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quency choke placed inside the tuned winding but so that there is virtually no inductive coupling. In addition to this, the r-f choke is proportioned so that it resonates at a frequency near the low end of the tuning range. This makes the coupling nearly the same for all frequencies in the band. However, it often happens that the circuit will oscillate when the tuner is set for the frequency at which the choke resonates.

Effect of Shielding

The shield around the coil increases the resistance by a small amount, and hence decreases the selectivity. But the effect is comparatively small and is not large enough to offset the advantages of shielding. It is usually said that if the separation between the shield and the coil is equal to one radius, the undesired effect of the shield is negligible. In the midget coils the diameter of the coil is one inch and that of the shield 2.125 inches. Hence the separation between coil and shield is 0.6625 inches, which is 6.5 per cent greater than the radius. Hence the conditions are well satisfied.

The greatest effect of the shield is in reducing the effective inductance of the coil, and this reduction may amount to some 5 or 6 microhenries in 245. Of course, to offset this, the coil is originally made a little larger so that the inductance stated is that which exists when the coil is in the shield. The reduction in the inductance does not mean a proportionate increase in the resistance.

The shielding also adds a bit to the self capacity of the coil, but this is so small that it can be neglected entirely. There is more capacity added to the tuned circuit by the primary winding, but this too is negligible, except when the primary winding contains many turns and the separation between the windings is not great enough. Manufacturers of coils see to it that when the usual tuning condensers are used, the capacity between the windings is so small that the tuned circuit will readily cover the tuning band.

The effectiveness of the midget coils comes from the close coupling between the primary and the secondary, from shielding of coils so as to prevent feedback which might cause oscillation or degeneration, and from the fact that all the coils are alike. The coils, as a rule, are made as efficient as it is practical to make them.

Short-Wave Coils

Short-wave coils require a different treatment. In the first place, the coupling between the primary and the secondary should be loose because a given amount of mutual inductance is more effective at the higher frequencies. In fact, the coupling is directly proportional to the frequency. Moreover, as the coupling is increased the selectivity of a tuned circuit decreases, and it is of first importance to have high selectivity at high frequencies. This is because stations are placed closer together at high frequencies than at the lower and also because not so many tuned circuits are possible.

As high frequency current travels on the surface of the wire, and comparatively little travels below, it is necessary to use heavy wire for such coils, to make the surface as great as possible. If this precaution is not observed the radio frequency resistance would be very high and the selectivity low. Litz wire, which is made up of many insulated strands of fine wire, is often used for high frequency coils. Very little is gained by the use of this wire at the ultra frequencies because it has been proved experimentally that for frequencies in the broadcast band and higher frequencies the resistance is not reduced much. The reason is that the wire strands cannot be made fine enough. In the intermediate frequency band, however, there is a decided advantage in using Litz.

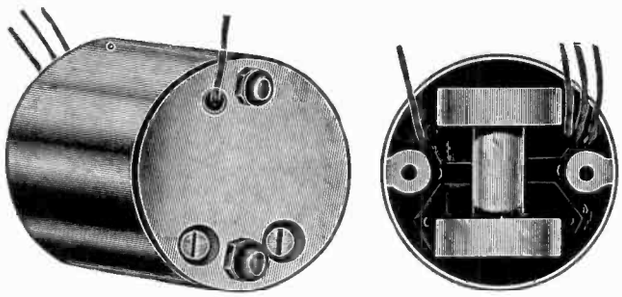

FIG. 3

Two views of an intermediate frequency transformer. At left is the top of the coil showing the adjusting screws for the condensers, and at right is shown the bottom and the position of the two coils.

Coil Form

Hence for high frequency coils we should use heavy wire, say No. 22 or still heavier, and the higher the frequency the heavier should the wire be. In Fig. 2 is a plug-in type of short wave coil indicating the usual arrangement of the two windings. The coupling between the two windings is loose, but even still looser coupling should be used for smaller coils, that is, smaller inductances. This could be effected by making the separation between the windings greater. For high selectivity in the 20,000 kc range the primary could well be separated by one inch from the secondary. About one turn would be enough for the primary and from 3 to 5 turns for the secondary, depending on the tuning capacity. And the wire might well be as heavy as No. 14.

An important feature of short-wave coils is the loss in the dielectric, that is, the insulator about the wire, if any, the material of the coil form, and on other non-conductors in the vicinity of the coil. Many special materials have been made for short wave coils with a view of reducing the losses. At the present time the two most favored are Isolantite, a ceramic, and a special compound of mica and bakelite binder. Both have one disadvantage, and that is the difficulty of machining. The ceramic cannot be machined and the other can be machined with special tools only. But both can be moulded to any desired shape with suitable holes for leads and terminal lugs. The losses in both these materials are very low.

Intermediate Frequency Coils

Many laminated and moulded materials are very poor in this respect, one reason being the presence of moisture and another the presence of metal particles. Moisture may enter during manufacture, or it may be absorbed afterward. Metal particles are usually embedded in the material and come from the machines with which the stuff is worked.

In Fig. 3 two views of an intermediate frequency transformer are shown. At left is the coil seen from the top and at right the coil as seen from the bottom. The left figure shows the adjusting screws for the two condensers across the two windings and the grid lead. At the right are shown how the two coils are placed. As will be seen, the two windings are placed at a considerable distance apart in a concentric manner.

This distance has been carefully determined so as to give the proper band-passing effect. By using loose coupling, just a little closer than critical coupling, the doubly tuned transformer becomes a band pass filter with little attenuation inside the range of frequencies representing audio tones and a very high attenuation outside that range. The shielding around the coil effective prevents electric colpling with other parts of the circuit as well as most of the magnetic coupling. The compactness also helps to confine the magnetic field from straying into regions where it is not wanted.

Band Pass Filters

Although a doubly tuned transformer is a band pass filter, it is not often used as such because of the difficulty of thing to secure the band pass effect. If the circuits are tuned for loudest signal, which is done in most cases, both windings are peaked at the same frequency. To secure the band pass effect it would be necessary to tune each one when not in the presence of the other, but at the same frequency. This does not necessarily mean that one tuned circuit should be removed while tuning the other. It is sufficient to open the tuning condenser of one while tuning the other. But this is seldom done because the leads to the condensers are not available. However, the difference between the results obtained the two cases is not great. Tuning by the method of loudest volume is all right.

In case the correct band pass effect is desired, the condenser should be opened at the grid or the plate side of the tuned circuit and then the other not disturbed should be tuned. Then the first condenser should be put back and the other opened. Tune the circuit to exactly the same frequency. Then restore the second condenser and the circuit is tuned.

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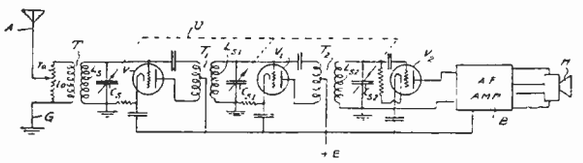


FIG. 1016
Resistance volume control in antenna primary.

Volume Control

HOW MAY a potentiometer be connected in the antenna primary circuit for volume control? Please include r-f neutralization.—K. B., Altoona, Pa.

Insulate the potentiometer arm from any metal chassis and wire as shown in Fig. 1016. The neutralizing condensers are from end of free plate winding to grid.

* * *

Connections for '30 Detector

USING the '30 tube as a detector, with grid leak-condenser, please state the preferred method of connection.—S. W. F., Tulsa, Okla.

Connect grid condenser and grid leak to grid, other side of grid condenser and leak to one side of the tuning coil and stator of the tuning condenser, connect rotor of the tuning condenser to ground and return of the secondary coil to A plus. with a condenser from A minus to A plus, 0.001 mfd. up. If the detector stage is separately tuned, both the secondary return and the condenser rotor (frame) may be connected to A plus.

* * *

Cure for Audio Howl

MY RECEIVER has a '24 for first audio and a '47 for output. resistance coupled, and sometimes a terrific howl makes reception impossible. This howl, I should judge, is around 1,000 cycles. I am at a loss to account for it since it is not permanent, but more recently it has been showing up oftener. Please state the cause and suggest remedies.—U. S. G., Atlanta, Ga.

Audio regeneration is the cause. The audio channel becomes an oscillator at a frequency determined by the electrical constants in it and the oscillation intensity is much louder than the signal, hence the signal is drowned out. The most frequent cause for this condition is an open circuit. The spasmodic appearance of the howl suggests that the open circuit closes once in a while, hence no howl then. For instance, a grid leak in either the first or second audio circuits may not be making positive and continuous contact. Test grid resistors to be sure that they are not open. One method of reducing regeneration that causes oscillation howl is to omit the bypass condenser from the biasing resistor of the first audio tube. The feedback itself is usually sufficient in such circuits to make the condenser unnecessary or even harmful. See that the proper voltages are on the tubes. For instance, if the screen voltage were higher than the plate voltage on the '24 first audio tube, in the right proportion, that tube might become a dynatron oscillator and would cause such trouble as you report. Make a thorough examination of all connections and voltages affecting the first audio tube.

Cross-Modulates a Little

EVEN THOUGH I use variable mu tubes ('35) in the r-f channel of my t-r-f set I get a little cross-modulation, not as much by any means as I did when I used '24 tubes, but I thought I should not have any. My circuit is a standard one. I run the maximum B plus to all the tube plates, through their respective loads, and I control volume by tying together the cathodes of the two r-f tubes, and using a variable resistor for bias control, with a limiting resistor of 1,500 ohms, as I found that value necessary to check squealing at the high frequencies. Will you please let me know the remedies to apply?—J. S. A., Duluth, Minn.

The variable mu tubes do detect a little, as evidenced by the fact that they are frequently recommended for first detector in a superheterodyne. The cross-modulation of which you complain, consisting of hearing a strong local as a faint background when tuning in another station, may arise from the high limiting resistor that produces a minimum bias of perhaps 10 volts. It is suggested that you reduce the plate voltage until you have stability at the high frequencies with a resistor not exceeding 300 ohms in your case. This is equivalent to 600 ohms, and your 1500 ohms equivalent to 3000 ohms, on the basis of resultant bias voltage, because two tubes are served. With the lower limiting resistor and bias you would introduce more resistance and bias, by the volume control only on powerful local stations, and would be working the tubes far from their semi-detecting portion when tuning in other stations.

* * *

Tunable Hum Mystifies Him

SINCE 1924 I have been interested in radio, have taken two courses, one at a correspondence school, the other at a personal attendance school, and I assumed I could solve almost any simple problem, but I have a set that produces tunable hum and I have been unable to get rid of this nuisance. The hum is not heard when no station is tuned in, or when aerial is disconnected, nor when a weak station is received, but only on a loud one. I have added more capacity to the filter (now 24 mfd.), another B choke in series with the dynamic field previously present alone, a resistor-capacity filter in each individual r-f plate lead, and did other things. The two chokes, I might mention, consist of a 400-ohm d-c resistance unit of about 30 henries at 70 ma, and the field coil, d-c resistance 2150 ohms, inductance unknown.—P. L. W., Alexandria, Va.

You do not state the total current drain on the rectifier, but assuming it is 60 milliamperes, the average for a five-tube a-c set, and it would be more for sets with more tubes, you probably are passing far too much current through the field coil of the dynamic speaker. While this overload produces more volume, it sometimes sets up such a large field as to affect the detector tube. The hum heard is proportional to the sum of the two amplitudes, hence is louder on loud stations, and may be imperceptible on weak ones, being wholly absent when there is no carrier to be modulated by this field. Experimentally connect the dynamic field coil in parallel with the 400-ohm choke, whereupon there will be a little more than 20 volts drop across the field coil, perhaps less than what the manufacturer intended, instead of a drop of more than 120 volts, as at present. If possible get the rating of this particular speaker from the manufacturer. If necessary to establish the correct voltage across the field, use the field and a series resistor as bleeder for the B supply. With tunable hum the dynamic speaker is sometimes at fault in heterogeneous installations. Other reasons for tunable hum are poor filtration, cross-modulating r-f tubes, incorrect voltages on tubes, mislocation of hum-producing parts so they are too near the detector, overloading of a power transformer, open filter condensers, off-center grounding of heater or filament winding of power transformer, and aerial or ground leads paralleling electric cables of the power company. As you know, some of these produce constant hum, as well as greatly augmented hum when strong stations are tuned in. See answer to J. S. A. at left as to plate voltage.

* * *

After the Mixer—What?

REGARDING the Mystery Circuit, the all-wave superheterodyne that is to tune in all the bands without switching coils or condensers, I would like to do some experimenting on this, and am sufficiently familiar with oscillators to get the high frequency oscillator going properly. Also I shall have a satisfactory modulator. In these respects I shall follow suggestions you printed (including June 11th), but would like a few words in regard to the construction from then on.—K. P. D., Long Beach, Calif.

Having established a suitable oscillator and modulator the next step is to provide an ultra frequency channel that is nevertheless an intermediate frequency, for it is lower than the lowest oscillator frequency. This channel has to provide some selectivity, not much amplification need be expected. None will be needed particularly, as all the amplification we want is obtainable later, at a lower frequency.

Frequency stability at the first intermediate level is another consideration. The inductance will be a fraction of a microhenry. The capacity will be of the low order of micromicrofarads. This capacity has to be adjustable, and once adjusted it must stay put. That rules out quite a number of condensers to satisfy the present requirements. They do not. The insulating material used has metallic substance in it, moisture has a considerable effect on this insulating material, and besides we must consider room temperature as affecting the plates of the condenser and thus changing the frequency.

It might not be a bad idea to have a temperature oven for the intermediate first amplifier, and also one for the ultra frequency oscillator. Dow used such an oven in his oscillator. Inductance itself changes with temperature, and as the capacity of small condensers will do likewise, there seems a double reason for the oven.

* * *

Irregular Feedback

IN MY battery-operated short-wave set I use plug-in coils, and for regeneration have a plate feedback condenser that goes to a coil inductively related to the tuned grid. My complaint is that the feedback condenser does not afford any feedback at the low frequency tuning of two of

the coils, although O. K. from 75 on the dial down, when using these same coils. Can you suggest a remedy?—R. W. O., Walla Walla, Washington.

You may put more turns on the feedback winding of the two coils you mention or you may use a larger capacity feedback condenser. The suggestion of more turns is preferable, as the regenerative effect is entirely satisfactory as to the two other coils, and may become rather critical on these two if the larger capacity condenser is used. Therefore the extra turns solve the problem for the two coils complained of without introducing any complications as to the two other coils.

* * *

Fringe Howl

WHAT CAN I do about a howl that I hear just as I am about to turn the regeneration control of my short-wave set to point of maximum sensitivity when tuning to resonance? This happens on nearly all stations, where I have to get fullest gain to hear the station well; in other words, only locals are excluded.—G. B. O'D., Grosse Point, Mich.

The condition of which you complain is called fringe howl and it is probably due to the rapid starting and stopping of oscillation at an audio frequency, on account of the instability of the power conditions in the plate circuit when critical regeneration is employed. If you use resistance coupling out of the detector, considerably increase the resistance value, say, double it or more, for then the voltage will be less unstable, because the variable portion of the plate resistance is smaller compared to the fixed value of resistance. The variable portion is commonly called the plate resistance, while the fixed portion is called the load. Even if plate bend rectification is used there should be a grid leak and condenser, because of the strong grid current that may flow at critical regeneration. The leak-condenser combination tends to limit this current by raising the bias to meet the increased grid current, so to speak. Replacing an existing type of coupler with the other type also cures fringe howl in some instances (resistance compared to transformer coupling). A leak across the secondary of an audio transformer helps, but is wasteful, a resistor-capacity filter in the plate lead of detector is of some resistance (0.1 mfd., 0.1 meg.), but the total avoidance of fringe howl from the earliest engineering of a receiver would be based on a frequency-stabilized detector circuit.

* * *

Reason for Driver

IN THE NEW Class B amplifiers why is it necessary to have a stage of audio ahead of the push-pull output tubes, especially when the receiver is a superheterodyne that itself delivers a high amplitude detector output?—H. F. W., Ottawa, Can.

The necessity for the preliminary audio stage, a Class A amplifier, that is, the regular type that has been popular so long, arises from the fact that the two output tubes draw considerable grid current, and the Class A driver compensates for this. Besides, as you probably know, the grid circuit of the output tubes must be of low resistance, for the very reason that the grid current may run high at times. The driver is Class A, 46, or two '27's or two 56's in push-pull.

* * *

Any More New Tubes?

ARE THERE any more new tubes in sight? What is the latest one? Will most of the receivers for next season have the new tubes?—G. F., Savannah, Ga.

Some time in the Fall the 55 will be ready for the market. This is a diode detector tube and an amplifier tube, both in one glass container or envelope. It will nearly complete the series, comprising then the 46, 56, 57, 58 and 55, with the companion mercury vapor rectifier, the 82. We do not know of any others in sight that are being manufactured, although a few special tubes are made by smaller manufacturers, and the duplex triods for auto sets, the 85, is limited. Most of the sets for the soming season will have new tubes, particularly the 58, but far from all of them will embody the Class B amplifier, or the 46 tubes in either Class A or Class B service. A heater type power tube is expected.

* * *

Use of New Tubes

CAN THE 56, 57, and 58 tubes be substituted for the 227, 224, and 235 in a receiver without making any changes in the circuit? If not, what changes are necessary?—W. H. J., Rochester, N. Y.

They can be substituted directly provided that you install the proper sockets for the 57 and the 58. These two tubes require a 6-pin socket. The extra grid on these tubes, which is one of the pins, should be connected to the cathode. The pin next to the plate is the screen grid and the one next to the cathode is the suppressor grid.

* * *

The 56 Tube Defined

IS THE 56 TUBE an improvement on the '24 and what are the voltages to be used? Will this tube serve as a driver for a Class B amplifier?—J. R. Roanoke, Va.

The 56 is an improvement on the '27, not on the '24. It is a detector or amplifier, depending on how hooked-up and voltaged, and also may be used to excellent purpose as an oscillator. For detection transformer or choke output, grid leak and condenser may be used, plate voltage 45 volts, grid return to cathode, or for plate bend rectification (biased detector) 250 volts may be applied through a plate coupling resistor of from 50,000 to 100,000 ohms. The biasing resistor should be 100,000 to 150,000 ohms, therefore it can be seen that the voltage drop in the plate load will be only about half the bias voltage, which bias voltage should be around 20 volts negative. Plate current is adjusted to 0.2 ma with no signal input. This tube as an amplifier under other conditions just stated takes 13.5 volts negative bias. The amplification factor is 13.8. It is not a particularly suitable tube as driver of a Class B amplifier with two 46 tubes in the output, because the grid current may amount to 60 or 70 ma on a strong passage, particularly low notes, in the output stage, and a bigger driver is advisable, e.g., 46 used as Class A amplifier. However, two 56 tubes in push-pull would constitute an excellent driver for two Class B output tubes as specified.

* * *

Series Filaments

WHEN TUBES are connected with filaments in series, does not the filament voltage change as the plate current changes, and is not the apportionment of B voltage affected by the series connection? Are series filaments used much?—U. G., Ventura, Calif.

Battery type tubes in series are seriously affected by the changes in B current due to the signal, indeed it is the B current that is the A current as to the filaments, so to speak. The B voltage apportionment is affected in that the B voltage after the first tube becomes less and less, by the amount of drop in the filament or filaments preceding. A common practice is to use resistors in parallel with each filament to avoid serious effects of too much current through the filaments. Series connection of filaments of battery type tubes is rare these days. Heater type tubes are more suitable for series connection, but then the necessity for the compromise hardly arises.

* * *

Wire Table

WILL YOU PLEASE publish the American wire gauge table, giving resistance and number of turns per inch?—K. B. L., Seattle, Wash.

You will find the table published herewith, also an accompanying explanation.

Magnet Wire Table

The magnet wire table herewith is based on measurements at 68° Fahrenheit. Different temperatures will give slightly different results. In practice some slight variations are to be expected from the tabulated values, including particularly turns per inch, as the number of turns stated is based on accurate machine winding. Even so, slight variations will arise from difference in the size of wire of any one type.

Abbreviations: *B & S*, Brown & Sharpe, same as American wire gauge. There are six other gauges in use, but *B & S* is used in radio in the United States. *SS* is single silk, *DS* double silk, *SC* single cotton and *DC* double cotton. For direct current *CC* is used to avoid confusion with *DC*, that represents double cotton. *CC* stand for continuous current, which is synonymous with direct current.

B. & S. Gauge	cc. Ohms per 1,000 Feet	Turns Per Linear Inch								
		Single Silk	Double Silk	Single Cotton	Double Cotton	Enameled	Enameled SS	Enameled DS	Enameled SC	Enameled DC
14	2.525			15.6	13.6	15.2			14.1	13.3
15	3.184	16.9	16.3	16.1	15.1	17.0			15.6	14.8
16	4.016	18.9	18.2	17.9	16.7	19.1	18.4	17.7	17.4	16.3
17	5.064	21.2	20.3	19.9	18.2	21.5	20.5	19.7	19.3	17.9
18	6.385	23.6	22.6	22.1	20.2	23.9	22.8	21.8	21.4	19.7
19	8.051	26.3	25.1	24.4	22.2	26.8	25.4	24.2	23.6	21.5
20	10.15	29.4	27.8	27.0	24.3	30.1	28.4	26.9	26.1	23.6
21	12.80	32.7	30.8	29.8	26.7	33.7	31.6	29.8	28.9	25.9
22	16.14	36.6	34.2	33.0	29.2	37.7	35.0	32.8	31.7	28.1
23	20.36	40.6	37.7	36.2	31.6	42.3	39.0	36.4	34.9	30.6
24	25.67	45.2	41.6	39.8	34.4	47.1	43.1	39.8	38.1	33.1
25	32.37	50.2	45.8	43.6	37.2	52.9	47.8	43.8	42.8	35.8
26	40.81	55.8	50.5	47.8	40.1	59.1	52.9	48.0	45.7	38.6
27	51.47	61.7	55.5	52.0	43.1	66.2	58.4	52.9	49.7	41.4
28	64.90	68.4	60.9	56.8	46.2	74.1	64.5	57.8	54.0	44.4
29	81.83	75.1	67.1	61.3	49.2	83.3	71.4	64.1	58.8	47.6
30	103.20	83.1	73.2	66.5	52.5	92.2	77.8	69.2	63.0	50.3
31	130.10	91.5	79.3	71.9	55.8	103.4	85.6	75.3	68.1	53.5
32	164.10	100.5	86.5	77.2	58.9	115.6	93.8	81.6	73.2	56.6
33	206.90	110.1	93.6	82.8	62.1	129.3	102.7	88.2	78.5	59.7
34	260.90	120.4	101.0	88.4	65.3	144.9	112.3	95.2	84.0	62.8
35	329.00	131.4	108.5	94.3	68.4	162.3	122.5	102.4	89.6	65.9
36	418.80	142.8	116.2	100.0	71.4	181.8	133.3	109.8	95.2	68.9
37	523.10	155.0	124.2	105.8	74.3	202.4	144.1	117.1	100.6	71.7
38	659.60	167.7	132.2	111.6	77.1	227.7	156.4	125.1	106.4	74.6
39	831.80	180.5	140.2	117.2	79.8	252.5	167.7	132.2	111.6	77.1
40	1,049.00	194.5	148.3	122.8	82.3	280.1	179.5	139.4	116.6	79.5

BOARD IS COOL TO CURTAILING OF ADVERTISING

Washington.

If radio advertising is to be reduced or limited, new legislation must be enacted giving the Federal Radio Commission authority to control programs, or fixing definite limitations on commercial programs, the Commission declared in a report sent to the Senate.

The report, requested in a resolution (S. Res. 129) introduced by Senator Couzens (Rep.), of Michigan, and amended by Senator Dill (Dem.), of Washington, and asking for complete statements of advertising and educational transactions of broadcasting stations and national chain systems, was referred to the Committee on Printing.

Disagreement on Powers

Information in the report, obtained by the Commission from 582 United States broadcasting stations and 13 foreign countries, was presented in the following main points, according to "The United States Daily":

The Commission should have new legislative powers if commercial advertising is to be reduced, limited and controlled. (Chairman Saltzman and Commissioner Lafount dissent from this view. They believe the provisions of section 4 of the Radio Act give the Commission the necessary authority to control advertising, should a plan for control be adopted.)

If the Senate decides to change the present broadcasting system to one of Government control, the Commission will prepare a technical plan based on those used by foreign countries.

Aid to Education

A total of $36,845,046 is invested in 558 institutions and organizations and every chance to take a prominent place on the air is afforded by the Commission by granting a majority of the applications submitted by such institutions and organizations.

More than 97 per cent of all broadcasting stations have offered their facilities to local educational interests.

Educational programs can safely be left broadcasting stations reporting. The fourth zone has the heaviest investment, 29 per cent of the total.

Only 6.55 per cent of the total broadcast hours of all stations is devoted to sales talks.

Small stations (100 to 500 watts) broadcast the greatest percentage of commercial programs.

The Commission has given educational broadcasting encouragement. Talks are due to the voluntary gift of the use of facilities by commercial stations.

At present it does not appear practicable and satisfactory to permit only the announcement of sponsorship of commercial programs.

Advertising Regulation

The following additional information, relative to each of the above points, respectively, was made available in the report:

Any plan to reduce, limit and control the use of radio facilities for commercial advertising purposes must have its inception in new and additional legislation which either fixes such limitations or authorizes the Commission to do so. Such legislation should extend both to the quality and quantity of advertising.

The present system of competitive operation of broadcast stations by private enterprise gives radio service to all the people of the United States. If this policy is to be changed, a thorough investigation of all the various possible methods of serving the people should be made, and a policy determined which would be satisfactory. The Commission is ready to prepare detailed plans for a technical arrangement to meet the needs of any policy.

Total investments in broadcasting stations by zones (for all stations reporting) follow: Zone 1, 97 stations; total investment, $7,875,270, or 21 per cent of United States total. Zone 2: 88 stations; total investment, $5,689,692, or 16 per cent. Zone 3: 119 stations, total investment, $6,329,103, or 17 per cent. Zone 4: 139 stations; total investment, $10,690,487, or 29 per cent. Zone 5: 115 stations; total investment, $6,260,490, or 17 per cent. A greater amount of the total investment for the country is placed in stations of 1,000 watts power.

There were, during the typical week studied by the Commission, 43,054 total hours of programs broadcast by all stations. Of this total, 2,819 hours were devoted to sales talks.

Educational Programs

Total hours of commercial broadcasts during the typical week by stations of different powers follow: 100 watts—4,733 hours, 19 per cent sales talks; 500 watts—3,131 hours, 19 per cent; 1,000 watts—3,562, 16 per cent; 5,000 watts—987 hours, 14 per cent; over 5,000 watts—1,294 hours, 13 per cent.

During the period from Feb. 23, 1927, to Jan. 1, 1932, the Commission considered many applications for new stations, additional power, and other new facilities for educational institutions and organizations. A majority of these applications were granted.

A total of 521 stations reported they have offered their facilities to local educational interests, 444 making the offer without asking financial remuneration. These 444 include all powers and are well distributed geographically.

The present attitude of broadcasters, as indicated by reports to the Commission, justifies the Commission's belief that educational programs can be safely left to the voluntary donations of facilities by local stations.

Because the American broadcasting system is dependent upon advertising, competition between advertisers assures employment of the best available talent for programs. If a restriction to mere announcement of the sponsor's name in any program caused the loss of that program, the quality and quantity of other sponsored programs immediately would begin to deteriorate.

The report also pointed out that the majority of broadcasting stations is having a hard time to break even, and that many are losing money steadily.

Hazeltine Patent Upheld on Appeal

The United States Circuit Court of Appeals affirmed the lower court decision that the Hazeltine plate circuit neutralization patent No. 1,533,858 is valid and that Radiolas 16 and 17 sold by the Radio Corporation of America were infringements thereof.

O. S. Schairer, vice-president of RCA in charge of patents, stated that RCA has not produced or sold such receivers for several years and that the sets have long since been superseded by the modern screen grid superheterodyne receivers and others.

"The decision consequently has no bearing on radio broadcast receivers currently or recently manufactured and sold by the Radio Corporation of America," he remarked.

CROSLEY GIVEN PERMIT TO TRY 500,000 WATTS

Washington.

The trend to higher and higher power for leading broadcasting stations received an impetus with the granting of a license to the Crosley Radio Corporation to operate a 500,000-watt transmitter, the most powerful in the United States. Crosley now operates WLW, Cincinnati, a 50,000-watt station, on 700 kc, and the ten-times-more-powerful station will use the same frequency, but will be granted an experimental call, for operation between 1 a.m. and 6 a.m., without interfering in any way with the operation or programs of WLW.

The background of the willingness of the Commission is the desire to ascertain if high power will reduce fading and increase quality and service area, so that the Commission may be guided as to action on other applications for enormous power. Since the Crosley transmitter is centrally located it is believed to be an excellent medium for the test.

Relies on New Test

If the experiment proves a success the Commission stands ready to issue more licenses for such great power, and if the plan proves a failure, the Commission is likely not to encourage any new licenses for such high power, at least until the three present holders justify expectations. These holders, besides Crosley, are Westinghouse Electric and Manufacturing Company, with its 400,000-watt plant of KDKA at Saxonburg, Pa., and General Electric Company, 200,000 watts, as allotted to WGY, Schenectady, N. Y. However, these two stations have been using from 50,000 watts up, in actual experiments, and due to economic conditions have not gone in much for the extra power. The Crosley tests will be at a minimum of 100,000 watts.

Affects Chain Broadcasts

A great many listeners now receive WLW irregularly, but if the new great power brings in the station regularly, then a strong argument will be presented, in the Commission's view, for the further granting of enormous power to United States stations.

The test has an important bearing on chain broadcasts, also, since if the experiments are successful they would tend toward the establishment of individual stations of national coverage. An economic basis to support the extra expense would be the added sponsor business obtainable at more than the nominal rates now allowed by chains ($50 per station) and dispensing with the costly landwire telephone lines used in chain broadcasts.

Station Changes

Changes in the "List of Broadcasting Stations by Frequencies," published in our issue of June 4th, 1932:

660 kc—Delete WTIC.

760 kc—Delete WBAL.

1260 kc—WLBW. Change owner to Broadcasters of Pennsylvania, Inc.

1270 kc—KGCA. Change power to 100 W.

Change in "Time Table of Television Transmitters," published in our issue of May 28th, 1932:

2000-2100 kc—Add W9XX, 100 W, State University of Iowa, Iowa City, Ia.

STATION FOUND RESPONSIBLE IF LIBEL IS SENT

Lincoln, Nebr.

The liability of a broadcasting station for defamatory, injurious utterances by one using its facilities was declared by the Supreme Court of this State, reversing a decision of a lower court in the suit of C. A. Sorensen, Attorney General, against Richard F. Wood and the KFAB Broadcasting Company. The lower court had decided that a libel had been committed, but assessed damages on Wood only, absolving the station on its plea that it was a common carrier and thus exempt from the acts of its patrons.

Wood had been waging a political campaign against Sorensen and used the facilities of the station to attack his opponent personally. Sorensen won in the election and started suit against Wood and the station owner.

Held Not a Common Carrier

The Supreme Court found that the Radio Law does not authorize the transmitting of defamatory utterances and that the defense of the station that it was a common carrier was not available in the case.

When one writes a libel and reads it before the microphone, the court further held, both the writer, reader and station are liable, because the utterance is made with the consent of the station. There is a joint or united participation in the libel under such circumstances, the court found.

Efforts are being made to amend the Radio Law so that the law of libel will apply specifically to broadcasting stations the same as to publishers of newspapers, periodicals and other publications. Usually at law defamatory utterances that are merely spoken are classified as slander, whereas if written or printed are classified as libel. However, since so much of what is spoken over the air is read from manuscript the law of libel is being broadened in this regard, and injurious utterances, if merely spoken without ever having been written, are classed as libel.

Trend of Law

The decision of the Nebraska Supreme Court shows the trend of common law in the same direction as the proposed amendment of the statutory law.

That broadcasting stations are not common carriers has been held in other court decisions, as well as in findings of administrative and quasi-judicial bodies such as the Interstate Commerce Commission. A recent case sought the fixation by the Interstate Commerce Commission of the fees charged by stations for use of their time, on the ground that the stations were engaged in interstate commerce, but it was held they were not so engaged, because not transmitting from point to point, as in radiotelegraphy or landwire telegraphy, and as not holding their facilities open to all, since stations necessarily must exercise a supervision over what is broadcast.

BROWN TO ATTEND PARLEY

Washington.

Col. Thad H. Brown, Federal Radio Commissioner from the Second Zone, has been designated as the Commission representative at the Third Annual Institute for Education by Radio at the Ohio State University, Columbus, Ohio.

Agents Seize Big Transmitter

The activities of the Department of Justice in trying to smash the liquor traffic on Long Island, just outside New York City, by tracking down radio transmitters and receivers said to be used by the bootleggers, led them to a house at Oceanside, where a complete, big transmitter was seized, also a code book, and a man arrested.

It is said that the agents had been cooperating with men from the Radio Division, Department of Commerce, who had experience in deciphering codes during the war, and who are reputed to be able to solve any code. For several weeks messages were copied, and these are reported as the basis of the seizure. Communication between the land station and radio shacks aboard rum-running ships is alleged to have taken place.

WCAU TO USE 50,000 WATTS

WASHINGTON.

WCAU, owned by the Universal Broadcasting Company, and the only station in the United States operating on 1170 kc, 256.3 meters, now licensed at 10,000 watts, will use 50,000 watts in the Fall. A vertical type antenna will be used, with a high efficiency of radiation. At top of the mast, 500 feet up, will be an iron ball 18 inches in circumference, put there for capacity effect. The ground system consists of a total of ten miles of wire. The expense involved in the change-over is $300,000, and nearly twenty acres of land will be occupied.

Broadcasting System, with which WCAU is associated as member station, has had excellent success with the vertical type antenna at its new transmitting location at Wayne, N. J. WSM, Nashville, Tenn., recently announced it was going to install a vertical antenna also, saying it would rise 878 feet and be the tallest aerial of its kind in the United States.

These towers have to be approved by the Department of Commerce and be painted, lighted and beaconed so as not to be an obstruction to aviation.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, *145 West 45th Street, New York, N. Y.*

Fred J. Rogers, Box 85, Altus, Okla.
Albert A. Raulin, 1116 Montello Ave., N. E., Washington, D. C.
R. C. Kash, U. S. Marine Hospital, Tchoupitoulas and Henry Clay Sts., New Orleans, La.
A. Ward Howe, Pres., Howe Radio Corp., New Hartford, N. Y.
B. W. Hawkins, Williamsville, N. Y.
Herbert J. Kimmel, McLouth, Kansas.
Ted Vinther, Okinda, Calif.
J. E. Mannaz, 1411 W. Archer, Tulsa, Okla.
M. C. Shewcraft, 116 E. Huron St., Ann Arbor, Mich.
Norbert B. Otten, 620 Highland Ave., Covington, Ky.
Robert B. Hites, 121 Gains St., Bucyrus, Ohio.
Gilbert McDill, 335 Massie Ave., Chillicothe, Ohio.
Loyal Bettelon, R No. 1, Box 536, Dayton, Ohio.
Howard L. Carter, Woodville, Miss.
B. L. Cartwright, North Side Radio Service, 1611-9th Ave., N., Nashville, Tenn.
Hoper Tomlinson, 320 W. 7th St., Mt. Vernon, N. Y.
Paul F. Haupt, 1513 So. Alabama St., Indianapolis, Ind.

KPO AND WJSV SALE TO CHAINS WINS APPROVAL

Washington.

The sale of KPO, San Francisco, to the National Broadcasting Company, and of WJSV, Mt. Vernon Hills, Va., to the Columbia Broadcasting System, was approved by the Federal Radio Commission after holding hearings in the two cases.

By the terms of the decision the license for KPO will be transferred from Hale Bros. Stores and the Chronicle Publishing Company, to NBC as of July 1st, while the transfer from WJSV, Inc., to CBS will be effective as of September 1st, both ensuing.

KPO operates on 680 kc, 440.9 meters, 5,000 watts, but has a construction permit for 50,000 watts. It has been a part of the NBC system, as a member station, for some time.

KPO to Be Western Key

As soon as NBC actually acquires ownership it will constitute the station the key of the Western branch of the system, and when conditions improve intends to run a dual landwire across the continent, so that better and more frequent exchange of programs will be possible. The station always has been operated at a loss, but it is expected that ownership by NBC will enable the reduction of the deficit.

Permission for the sale was granted although it was shown by a Commission engineer that NBC has 10 station quota units out of a total of 14.3 allotted to the metropolitan district of San Francisco, 15.8 out of 33.84 assigned in the State of California, and 42.8 in the Fifth Zone, compared to 10.55 for CBS.

Washington Outlet

KJSV is one of two United States stations occupying 1460 kc, 205.4 meters. Acquisition was desired by CBS so that it would have a suitable outlet for programs of national importance originating in Washington, D. C., about 15 miles away. Use of another station in Washington has not proved very successful, due to inability to mesh chain broadcasts. The titular owner of WJCV will be Old Dominion Broadcasting Company, a wholly-owned subsidiary.

The price to be paid for WJSV was not disclosed, but in the case of KPO $600,000 is to be paid by NBC over a period of seven years.

Tariff Aids British Battery Firm's Sales

The Ever Ready Company, of Great Britain, published in this country financial advertisements of the report to stockholders rendered at the annual meeting, held at the works, Holloway, N., England. Magnus Goodfellow, chairman and managing director, reported a sales increase for the fiscal year of nearly 30 per cent., in units of production, as prices had been reduced. Depreciation of the value of the pound and a 20 per cent. tariff on importations "resulted in the practical stoppage of imports" of dry batteries, he reported. Since early 1932 there has been a reduction of about 90 per cent in such imports, he said, and his company was able to get most of the business previously given to foreign companies.

A THOUGHT FOR THE WEEK

UNCLE SAM says to all his nieces and nephews: "Girls and boys, save your money. You just can't get something for nothing." Meaning that the Federal government does not approve of any attempt by neighboring countries to broadcast information that has to do with lotteries or anything savoring of games of chance. Any letters addressed to stations outlawed by their own get-rich-quick offers over the air are undeliverable and go back to the weak-minded senders. Does anyone really think it is possible to beat the well-known Kitty? It can't be done.

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.

Hail the 55 Tube!

ONE of the most promising tubes, not yet officially announced as to details of its characteristics, but nevertheless hinted at by RCA Radiotron Company, is the 55, a duplex-diode triode. That's a funny description for a tube. One must explain what the description describes. These radio terms sometimes run into uncanniness.

The tube is a two-in-one valve, constituting a diode detector and an amplifier. Evidently the need for the amplifier is the low sensitivity of the diode. Anyway, a diode does not amplify.

If the tube is used as a full-wave detector it offers possibilities of an unoverloadable diode detector, a subject in which all are interested, but in which little progress has been made. If it is used as a half-wave detector, then the companion plate may be circuited for automatic volume control. In both instances the amplifier tube is used, or amplifier part of the one tube, if the single envelope makes two tubes one.

This to us is the most interesting of the six new tubes. We can appreciate the value of the 46 for driver and output in Class B systems, the improvement on variable mu tubes offered by the 58, the better amplifier and detector results of the 57 as compared to the '24, the improvement the 56 offers over the '27, but our heart is in the 55 for the many fine opportunities it seems to offer.

More Wired Homes

THERE are more than 20,000,000 homes in the United States wired for electricity, the Department of Commerce reports. There are supposed to be 15,000,000 radio receivers in use in this country. So there is not quite a set for every wired home, which should encourage set manufacturers to realize there is a new market as well as a market for replacing existing receivers.

How fast the electrification progresses is some indication of the total progress of a nation. Therefore, despite current gloom due to temporary depressive reactions, we may feel proud of having progressed considerably. Besides, the power industry in the United States did an excellent business last year, averaging profits higher than those of the peak year of the boom, though early reports for this year show a decline compared to the same period last year.

It is encouraging to find an industry that is weathering the storm very well indeed and happily an industry tied up closely with national progress. The other fortunate circumstance is radio's own close association by utilization, and it is hoped that radio for 1932 will show reports with something at least near the glow of those of the power industry. May be the new tubes will help do it.

Pointed Opinion

R. B. BENNETT, Prime Minister of Canada: "Only yesterday radio was merely the hope of a few whom the world labelled dreamers. It is because of these few dreamers that we marvel now, not at the wonder of the radio, but at an existence without its pervading influence. The genius of mankind has presented the world with an invention of far-reaching significance. It is to be hoped that that same genius of mankind will be able to direct this invention in such a way that it will widen our vision and enlarge our horizon. While the radio may entertain it can and should also instruct. Indeed, it should not be merely a source of amusement. It is, or it should be, a source of education as potent in its influence as the school, or the press or the theatre. It can be more than that. It can be a powerful influence in bringing peoples together, in fostering international understanding, in promoting international knowledge. There are no boundaries in the air. On those who direct this agent of human progress there lies a vast responsibility."

* * *

HAROLD A. LAFOUNT, Federal Radio Commissioner: "It is my sincere belief that the people generally are well pleased with programs as a whole. In all my experience on the Commission, I have yet to see in writing a definite compaint against advertising. In my opinion, as many persons enjoy advertising as dislike it. The greatest complaint is scored against small-station programs in which advertising is out-and-out announcements of sales or services and in some cases price quotations. The public should remember, however, that small stations in most instances cannot afford to have their programs designed by clever advertising agencies. Without their local advertising, small stations could not exist, and these local stations have a definite place and provide a definite service in the scheme of broadcasting."

* * *

J. M. SPANGLER, manager, radio tube division, National Carbon Co. (Eveready-Raytheon): "The tube replacement business is in fairly healthy condition now, but what the outcome of a threatened diversity in type of tubes for the new sets will be, no one can forecast. It is apparent that unless there is some reasonable measure of standardization, there will be tremendous waste in production and distribution and the tube dealers will have worse than a Chinese puzzle on their hands."

* * *

MERLIN H. AYLESWORTH, president, National Broadcasting Company: "The way out of this valley of dissolution and depression leads up the hill to the satisfying of a higher standard of living through the employment of more workmen. We can create and we can maintain this higher standard of living only if we solve the problem of providnng an equitable distribution of the fruits of labor."

I Am the Newsman

By Roland Burke Hennessy

(Reprinted by permission of "The American News Trade Journal")

I, too, must serve!

Big events are shaping the destinies of the world; great minds are working on the problems of mankind; statesmen are giving of their best; rulers are losing their thrones; governments are tottering; volcanoes are hissing in their rage; brave hearts are subduing the terrors of the sky and land and sea and adding to the glory of man's achievements; great souls depart this life and nations mourn their loss; crime and greed and sin stalk through the shadows—but goodness and kindness and generosity still stand erect and defy the vile and remain a potent, lasting power.

The wires tick; sharp brains work out the wondrous story of a day on earth; great presses pour forth their printed messages; and then—I, the newsman, in my modest way, am ready to join the ranks.

Through the gray of early morn I pass along; in the glory of the new sun, or stress of snow and rain and mighty winds, I go that you may have the news of still another day; or, there at corner stand am I to greet you as you pass.

I am the newsman and—

I, too, must serve!

An Ode to Radio Dedicated to Coit

Chicago.

An ode to radio, in poetic prose, composed by Izaac A. Hedges, of St. Louis, has been written and dedicated to J. Clarke Coit, of Chicago, former president of the Radio Manufacturers Association, Inc. The ode follows:

"I am the Radio, made of metal, glass, and wood; every cubic inch of me is magic.

"Out of the space there comes through my body the music of the spheres, divine symphonies flood the air, mighty choruses break forth, the organ peals, bands play, the voice of the singer enchants, stringed instruments enthrall the senses, countless orchestras interpret the spirit of jazz, and the saxophone is heard throughout the land.

"The actor and the entertainer tell their story to laughter or to tears. The lecturer lifts up his voice, and millions listen and learn, the statesman and the politician make their plea, and the destiny of a Nation is decided.

"I am the conservator of Man, on land and in the air, on the sea, and under the water; in time of disaster my appeal goes forth and aid comes to the distressed.

"What a boon I am to mankind! In the home of the rich and the cottage of the poor, in spacious apartment and lowly tenement, on the farm, and within prison walls, to young and old, to the sick and blind, I bring my message, in every tongue, and in every clime.

"I am the Radio, God's great gift to humanity!"

BIG TUBE IMPROVEMENT

The greatest addition to the radio tube line, and the biggest improvements in tone and selectivity, are under way and will be completed by the Fall.

STATION SPARKS

By Alice Remsen

INDIA

FOR BASIL RUYSDAEL

"Beggar's Bowl."—WOR, Thursdays, 10:30 P.M.

Waving palms and beggars hands;
Temple bells and burning sands.
Golden anklets, purdah veils;
Chanting priests and children's wails.

Mystic land of saint and seer,
Crushed by ignorance and fear.
Land of Buddha, Lord of Peace,
When shall crucifixion cease.

Magic land of India, wake!
Tragic land of India, break
Off your superstitions! Take
Upward steps for India's sake.

Land of Islam, Vishnu, Brahm;
Land of passiveness and calm;
Cradle of a million creeds—
Learning patience as it bleeds.

—A. R.

* * *

Basil Ruysdael seems to get the tragedy and mysticism of India in his voice, during his "Beggar's Bowl" program. Mr. Ruysdael is a great student of Oriental philosophy and speaks with authority on the subject. Tune in; you'll like him!

* * *

News of the Studios

WABC

The Columbia Broadcasting System announces that beginning on Saturday, July 2nd, from 8:30 to 10:00 P.M., EDST, it will broadcast the entire Lewisohn Stadium Concert programs each Saturday evening over WABC and a nationwide Columbia network. Wilhelm Van Hoogstraten and Albert Coates will be the conductors directing the orchestra during the broadcasts, the former conducting the first four concerts and the latter the last four.

* * *

Irene Beasley, Columbia's "long, tall gal from Dixie," is now heard three times weekly on her own sustaining program over WABC and the nationwide Columbia network, Tuesday, Thursday and Saturday evenings, from 11:00 to 11:15 P.M., EDST. Accompanied by Fred Berrens and his orchestra, Miss Beasley will vary her presentations, offering the latest song hits of the day, folk songs and musical comedy songs of a few years ago.

* * *

During the month of July the three-a-week broadcasts of Singin' Sam will originate in Cincinnati, where the old-time minstrel got his radio start. He will be visiting his parents at Richmond, Ind., and will make the fifty-mile auto trip back and forth for each performance. For his programs during this time, he will be accompanied by Rosemary Kissler, the pianist who served in this capacity when the deep-voiced singer was first becoming known to listeners.

* * *

Howard Lanin, who is now conducting the Bourjois "Evening in Paris" dance orchestra, is one of eight brothers, all musicians. Although Howard has an office in New York, he lives in Philadelphia and commutes back and forth for his programs.

* * *

NBC

The "Men About Town" trio, consisting of Jack Parker, Frank Luther and Darrel Woodyard, are no longer signed exclusively with the National Broadcasting Company. The boys feel that they can do better freelancing and so have taken unto themselves a manager in the person of Impresario Quisenberry, who, until recently, was radio manager for the Wm. Morris Agency. They should do well, for they are a sweet singing trio.

* * *

It may interest you to know that Gene Rodemich, who directs the orchestra for Hollywood Nights broadcasts over NBC networks, is another of the many radio maestros who wave pencils instead of batons. Gene is not very tall and so stands on a rather high box while directing. He is slender, too, and has a great sense of humor. Incidentally, his orchestra is heard frequently in the musical synchronization of many talking pictures, including "Aesop's Fables," the "Tom and Jerry" cartoons, Grantland Rice's Sportlights and "The Vagabond Traveler" series.

* * *

Allyn Joslyn is still making good as the Master of Ceremonies on the Nestle program. Allyn, by the way, is known as the "heavy lover" of the studios. He certainly can play those romantic parts, with feeling and all the trimmings. He is young, (not too young); tall, nice looking, has beautiful teeth and a grand smile. Looks sleepy at times, but that's only when he is thinking hard, or concentrating on a part.

* * *

WOR

The Keller Sisters and Lynch, well-known vaudevillians, noted for their close harmony, may now be heard in a series of programs over WOR, every Friday at 7:00 P.M., EDST. They call themselves the Three Wandering Gypsies of Song. Listen to them; they are well worth it.

* * *

The new oriental detective stories that Basil Ruysdael has substituted for his usual dialogue of travel and philosophy on the program of "Beggar's Bowl" have added greatly to the program's popularity with the radio audience. Each week Mr. Ruysdael presents a complete and original story of mystery in the Orient to the accompaniment of oriental music played by an orchestra under the extremely intelligent direction of George Shackley.

* * *

Jack and Jean have also gone in for mystery on the McCutcheon program, combined with the singing of Jack and the piano playing of Jean. The latter also talks on household linens in a very lucid and unobjectionable manner. Mondays and Thursday at 7:30 P.M.

* * *

SIDELIGHTS

"DINNY" DINSDALE, production man for the Ziegfeld Radio Shows, once earned his living as a news photographer. . . . JACK PEARL and FREDDIE RICH are cousins. . . LILLIAN TAIZ and all the LANIN BOYS are also cousins. . . LANNY ROSS enjoys running, eating potato chips and playing golf, but puts his thumbs down on cards, horseback riding and driving a car. . . LEON BLASCO and his orchestra have gone vaudeville. . . . THE RIGHT HONORABLE COLONEL LEMUEL Q. STOOPNAGLE was in the U. S. Navy during the war. He served for twenty-one months, achieving the rank of chief boatswain's mate, but he never went to sea. . . . RUTH ETTING was brought to the Ziegfeld Follies by IRVING BERLIN who heard her records when she first started recording. . . . GEORGE BURNS was playing small-time vaudeville in Union City, New Jersey, and took an afternoon off to watch an Irish stock company, whose leading lady was GRACIE ALLEN —and that's how it all started. . . . ED THORGERSON is a very good tennis player. . . . B. A. ROLFE recently celebrated his twelve hundredth broadcast over NBC networks. . . . EDNA KELLOG has one hoodoo—she will not listen to the Chopin Funeral March. . . . HARRY RICHMAN has held various jobs in his day, including that of sailor, chauffeur and beach lifeguard.

* * *

ANSWERS TO CORRESPONDENTS

MISS CHRISTIAN HUNSINGER, Mays, Ind., . . . Glad you are forming a Ben Bernie Club and that you want "joiners" from all parts of the country. Hope this will get you a few. It's very nice of you to boost your favorite radio artists. Glad you like our paper.

MRS. B. CARMICHAEL, Fayetteville, N. C. . . . Gene Carroll, of Gene and Glenn, became an actor at the age of seven, when he carried a spear in a play at Hull House, Chicago. His partner, Glenn Rowell, ran away from his Pontiac, Ill., home at the age of thirteen to join a tent show, and he eventually became a song plugger and theatre organist.

* * *

Biographical Brevities

ABOUT JACK DENNY

Born in the little town of Greencasle, Indiana. . . . Father was professor of history at DePauw University. . . . Both parents played the piano, so Jack began to try his hand at it rather early. . . . At the age of six he was taking regular piano lessons from his father. . . . Starred in all forms of athletics at high school and during his college days at De Pauw University. . . . Decided he wasn't cut out to be a scholar.

At the age of nineteen left home and college to go adventuring in Chicago. Found a job in a music store selling pianos — kept it three weeks—reason, artistic temperament, which asserted itself when Tom Catalano had an idea that "Catalano and Denny" would look well in lights. . . . So they drifted into a booking office, where they eventually landed a contract in vaudeville for $125 per week for the two of them. . . . Catalano did tenor solos, Denny played piano and the two combined for comedy songs. . . . Toured the Mid-west for two years on the Keith circuit. . . . Finally reached New York with six dollars between them. . . . Pat Casey saw them at a free benefit, gave them a break and booked them at the Palace.

They were a flop, but played 64 weeks over the Keith circuit afterwards. . . . The managers started cutting salaries and the boys decided to split. . . . Then Denny enlisted at the training camp at Plattsburgh, and later was transferred to the 77th Division with which he crossed to Europe, arriving just in time for the Armistice.

Then came vaudeville . . . music arranger at a publisher's . . . songwriter, partner and orchestra leader for Bobby Folsom. . . . Then turning to dance orchestra work he became band leader at the Astor Roof, where Freddy Rich was his piano player. . . . then the Frivolity Club . . . then came a call from Montreal and Jack took his entire band with him to Canada, where he stayed at the Mount Royal Hotel for five years.

A tempting offer of the Empire Room at the Waldorf-Astoria and the Ever-Ready Radio Gaieties lured him back to New York. He is still here and may now be heard with the Gem Highlights program over WABC, every Sunday at 10:00 p. m., EDST.

COUNCIL VIEWS RADIO ABROAD AS 'NOT IDEAL'

Listeners' license fees averaging about twenty-five cents per month per set are the chief support of radio broadcasting in nearly every country in the world except the United States, a report on "Broadcasting Abroad," issued by the National Advisory Council on Radio in Education, reveals. Fees are collected by postmen, since radio broadcasting abroad is usually under the supervision of the Postal Administration, and penalties of varying severity exist for the non-payment of fees.

The bulletin is a compilation made available by the Geneva Union, Levering Tyson, director of the council, points out. In the foreword he says:

"Without attempting in the slightest degree a defense of American broadcasting or a criticism of the European variety, it is apparent to the casual first-hand observer that European broadcasting conditions are by no means ideal. In a comparatively young art or industry this is, of course, to be expected.

"Anyone who has had the opportunity to get first-hand experience with the systems operated in Great Britain and on the continent discovers that what is said and written in America about European broadcasting, to say the least, is highly colored. No comparison between broadcasting in the United States and abroad has been made in this report. Our purpose in publishing it is to present facts as given to the Council by the Geneva Union."

Advertising by Radio

The bulletin deals with the organization of broadcasting abroad, the general composition of programs in Europe, and educational broadcasting in Europe.

Advertising, the bulletin discloses, is not permitted in Czecho-Slovakia, Hungary, Holland, Russia, Switzerland and Sweden. In other countries it is allowed but not encouraged. There is no radio advertising in Great Britain. In Germany and Norway it is permitted outside the normal program hours. In Italy it is allowed only under the conditions that it is kept within the least objectionable forms, does not prejudice the artistic quality of the programs, and is not allowed to occupy more than 10% of the program time. In Turkey broadcasting of advertisements is permitted, but this form of broadcasting is kept distinct from the musical parts of the program. Other countries in which a part of the revenue for broadcasting comes from radio advertising are France, Ireland, Poland, Spain, Rumania, Jugoslavia, Lithuania and Australia.

"By permission of the copyright owner" is being heard less and less in Italy as a result of a recent decree that places at the disposal of the broadcasting organization, subject to the payment of fees to be mutually agreed upon, all theatrical and other works of musical or artistic character after they have been performed three times in public.

Educational Broadcasting

Dr. Irvin Stewart, of the United States Department of State, in an introduction to the report says:

"The facts presented in this bulletin with respect to the amount of time devoted to educational programs will be of interest to those persons who have pictured Europe as being so blessed with educational programs that at any time of the day the listener need only choose from a variety of such programs.'

The most recent table prepared by the International Broadcasting Office covering a period of three months shows the following average composition of the programs of fifteen European countries to be as follows:

Music and musical entertainments, 44.3%; literature, 5.4%; talks, 10.5%; criticism and news, 12.7%; religious transmissions, 3.65%; miscellaneous, 25.1%.

In Europe, as elsewhere, the possibility of broadcasting as a medium of information for the listening masses was realized in the first days, and talks were given a place alongside musical transmissions. Today however the courses of talks are arranged, not as a subsidiary activity of a much-harassed program director, but by educational authorities or under the advice of a council of experts.

Adult Education

In an ever-growing group of countries educational broadcasting is being extended into the school hours of the afternoon, and the highest authorities in the land are talking to students on subjects intimately related to their school curriculum. This of course entails close collaboration with the educational authorities. In Great Britain this collaboration has been assured by the creation of Consultative Committees, consisting of representatives of all the interested departments of educational activity.

In the case of adult education emphasis is already being laid upon the importance of giving the listener a more positive part than has been the case hitherto. The practice is growing of forming listening "groups" who meet in public libraries or educational institutes. and, under the direction of a trained leader, follow up the educational broadcasts with debates, etc. In other countries the listeners are encouraged to visit the museums, art galleries, etc. and examine personally the exhibits in the light of the information that has been broadcast.

—From National Advisory Council of Radio in Education.

Henry Field Wins in Senate Primary

Des Moines, Ia.

Henry Field, known to a large radio audience for his homey talks over his station, KFNF, of Shenandoah, Ia., and as head of the Henry Field Seed Company, won in the Republican primary election against Senator Smith W. Brookhart, for the nomination for United States Senator. As Iowa is usually Republican the 61-year-old station owner expects to be elected. Mr. Field got about 45 per cent. of the total votes cast and Senator Brookhart got about 33 per cent.

Mr. Field is the father of seven children, most of them adults, and to those who had departed the parental roof he telephoned, announcing his victory. To friends who visited him to congratulate him on his success he said that he would not move his family to Washington, if elected, and he would be "the only Field in Washington." This was taken as a dig at Senator Brookhart, whom Mr. Field had charged during the campaign with having had "several Brookharts put on the Federal payroll."

There was no prohibition issue, as both Senator Brookhart and Mr. Field are dry. The third contestant, a wet, was badly defeated.

3,000 SETS ON ONE AERIAL BY A NEW DEVICE

Western Electric Company issued an announcement which is given herewith in part:

A system whereby as many as 3,000 radio receiving sets can be operated independently on the same antenna without interfering with each other has been perfected, according to an announcement by the Western Electric Company. By adding further apparatus, the number of sets can be increased indefinitely without impairing the quality of reception. The sets can be of any make the individual chooses. A city's roofs freed of the fire hazard and the unsightly tangle of innumerable individual antennas thus becomes a scientific possibility.

The system is designed primarily for hotels, apartments and other multiple dwellings and is aimed to overcome the increasing problems which dwellers in such buildings face in obtaining good antenna facilities for their radios at reasonable cost. Modified forms of the system have also been designed to operate a much smaller number of radio sets. The same technical improvements devoted to the large community receiving system are embodied in these smaller forms and are made available on a scale that is suitable even for the individual home owner and his one radio set. The system was designed by engineers of Bell Telephone Laboratories.

Some Static Protection

The receiving system is protected against "man-made" static, those interferences which the ordinary lead-in wire commonly picks up from sources within a building, such as elevator motors and other electrical devices. The loss in receiving power usually caused by the great length of the lead-in wire and its high capacity to ground is overcome. Every receiving set connected to the system is electrically isolated so that it cannot put any noises back into the system to disturb the operation of others on the line.

The first requirement of the system is a properly constructed antenna. With only one antenna involved, the space limitations imposed by crowding many individual antennas on a roof are eliminated and the best principles of construction can be observed. The unit cost of the antenna per receiving set is lowered because of the large number of sets sharing the same facilities.

The antenna is connected to the transmission line through a panel which consists essentially of a suitable lightning arrester, a terminal strip and a repeating coil designed to transfer most efficiently the enegry collected by the antenna to the transmission line.

The transmission line terminates in a selective volume control panel. This includes five adjustable filters designed for use with a low impedance radio frequency line. The filters reduce the signal strength from nearby radio stations to prevent overloading the radio receivers and amplifiers, without reducing the signal strength from other stations. The panel is associated with a power amplifier of the four-stage, neutralized, untuned, push-pull type. This amplifier has a sufficient gain and power capacity to supply 750 radio sets and the system can utilize four such amplifiers, bringing the total sets to 3,000.

5% RADIO TAX NOW IN EFFECT; LAW ANALYZED

BY HERMAN BERNARD

Washington.

A 5 per cent. tax on radio sets and some accessories is provided under Section 607 of the Revenue Act of 1932, as passed by the Seventy-second Congress and signed by President Hoover. Except as otherwise provided, the law takes effect as of the date of its enactment, and the signature by the President constituted the final step of the "enactment," so the tax on radio now exists. It is in form as originally proposed, despite the opposition of the radio trade and the later request for reduction to 3 per cent.

The act as a whole is the one to increase the revenues of the United States by taxation so that the budget may be balanced, the total balancing not being complete, however, without certain economies in Federal administration intended to be covered by subsequent legislation.

Provisions of Section 607

The tax in which the radio trade is particularly interested is classified under "Title IV, Manufacturers' Excise Taxes," of which Section 607 is a subdivision. An excise tax is a domestic tax, when the term is used for distinction between such a tax and an import tax. Some of the items under Title IV, however, while specially included among excise taxes, also are subjected in the same tax bill to import taxes, but the import tax was not extended to the radio provision and remains unchanged under the tariff law.

Following is the verbatim provision as affecting the radio manufacturers:

"*Sec. 607. Tax on Radio Receiving Sets, etc.*

"There is hereby imposed upon the following articles, sold by the manufacturer, producer, or importer, a tax equivalent to 5 per centum of the price for which so sold: Chassis, cabinets, tubes, reproducing units, power packs, and phonograph mechanisms, suitable for use in connection with or as a part of radio receiving sets or combination radio and phonograph sets (including in each case parts or accessories therefor sold on or in connection therewith or with the sale thereof) and records for phonographs. A sale of any two or more of the above articles shall, for the purpose of this section, be considered a sale of each separately."

It Is a Sales Tax

Several questions of interpretation have been raised concerning this section, for instance, whether it is tax on manufacturers, whether parts are taxable when sold without connection with any built receiver, and what is the definition of such parts and accessories as are actually included in the tax by specific mention.

The section appears under a title heading relating to manufacturers' excise taxes, but the text of the section is controlling as against any title under which the section is classified, and therefore the tax is not quite a manufacturers' tax but a domestic sales tax levied on manufacturer, producer or importer. The section states the tax is on "articles sold." Manufacturers' taxes as such are often on the production, regardless of sale.

The payment of the sales tax by the manufacturer or producer is clearly required. The inclusion of the importer makes it mandatory on him to pay a tax under this section on the sale here of foreign-made goods, even though the imported article was taxed under tariff provisions. This double taxation feature is specifically recognized in other sections, e.g., Section 601 actually fixes import or custom taxes to be levied on certain articles that by other sections are taxable on the domestic sale thereof. Thus the import tax relates to bringing the article into the country and the excise tax to selling the article in the country.

Transmitters Immune

The intention is to tax radio receiving sets, as only the title of Section 607 discloses just what is the broad group of articles to be taxed, although the phrase "receiving sets" appears incidentally in the body of the section. Therefore transmitting sets would not come under the provisions of this section. However, cabinets, tubes, phonograph pickups, speakers and power packs are taxable.

As to those articles that are taxable, the tax is always to be paid by the manufacturer or producer, except in the case of foreign-made articles, when the importer pays the tax on the sale he makes. Thus the tax would be paid by several manufacturers or producers under the general system of receiver manufacture in this country. The receiver manufacturer would pay the tax on the receiver, that is, the chassis, for he is the manufacturer or producer thereof. He may be a mere assembler and wirer of parts supplied by other manufacturers, but it is he who produces the chassis, and he is taxed accordingly.

No Tax on Parts Business

The cabinet he may have bought from some manufacturer is tax-paid by the cabinet manufacturer; likewise the tax on tubes is paid by the tube maker, and that on the speaker by the speaker manufacturer. The section specifically includes speakers, for these are "reproducing units." Those items not specifically included among the tax list are taxable nevertheless if they are sold with the set to be used therewith or are sold later to be used with the set.

There is no tax on radio parts, as that term is generally understood in the trade, no more than there is on transmitters. Parts may be defined as separate units intended to be used for the construction of a set. Only wired models of sets are intended to be covered by the designation "receivers," and none of the items included in the tax falls under the definition of "parts" as generally recognized in the radio trade.

Message and Refrigerator Taxes

Besides the tax levied by Section 607 there is a tax on telegraph, telephone, radio and cable facilities (Section 701), as follows:

Telephone: charge of 50 c or more and less than $1, tax is 10 c; charge of $1 or more and less than $2, tax is 15 c; charge of $2 or more, tax is 20 c.

Cable and radio dispatches, 10 c, but only one tax is required, although the lines of one or more persons are used.

A tax of 5 per cent. on the amount obtained by any telephone or telegraph company for the use of any leased wire.

Another provision of the tax bill (Section 608) imposes a 5 per cent. sales tax on the manufacturers, producers or importers in relation to mechanical refrigerators. These include electrical and gas refrigerators.

CHECK-UP ON WHITEMAN

Research engineers of the Westinghouse Electric and Manufacturing Company decided to check up Paul Whiteman. They took a cathode ray oscilloscope to his dressing room and had him sound "A" on his violin.

TAX PAYMENTS MUST BE MADE ONCE A MONTH

For the information of members of Radio Manufacturers Association, Inc., and the industry regarding the new 5 per cent manufacturers' sales tax on radio and mechanical refrigerators and for assistance of members in connection with the new law, a memorandum has been prepared by Frank D. Scott, R.M.A. legislative counsel in Washington. He says in part:

"The Revenue Bill as finally adopted by the House and Senate makes no material changes in the provisions to those carried in the bill as originally adopted by the House relating to radios, phonographs and refrigerators.

"The law will impose a five per cent. tax on the manufacturer's selling price of chassis, cabinets, tubes, reproducing units, phonograph mechanisms, power packs and records for phonographs.

"It also imposes a five per cent. tax on the manufacturer's selling price on household type refrigerators (for single or multiple cabinet installations) operated with electricity, gas, kerosene, or other means. If refrigerator components,' such as cabinets, compressors, condensers, expansion units, absorbers and controls are sold separately, rather than as a completed refrigerator or refrigerating or cooling apparatus, then the five per cent. tax attaches to the price of such refrigerator components so sold.

When Purchaser Must Pay

"If the manufacturer, prior to May 1, 1932, made a bona fide contract for the sale of any of the articles above enumerated, and if such contract does not permit the adding to the amount to be paid under such contract of the whole of such tax, then (unless the contract prohibits such addition) the vendee (or purchaser) shall pay so much of the tax as is not so permitted to be added to the contract price. Such taxes so computed shall be paid to the manufacturer at the time the sale is consummated, and shall be collected, returned and paid to the United States by such manufacturer in the same manner as is provided for the usual payment of taxes herein. In case of the failure or refusal of such vendee (or purchaser) to pay such taxes to the manufacturer (or vendor) the manufacturer shall report such facts to the Commissioner of Internal Revenue, who shall cause collection of such taxes to be made from such purchaser (or vendee).

Returns Must Be Filed

"Every person liable for taxes hereunder shall make monthly returns under oath in duplicate and pay the taxes imposed to the collector for the district in which is located the principal place of business of such person, or, if he has no principal place of business, then such returns and taxes shall be made to the collector at Baltimore, Maryland. The returns shall contain such information as shall be prescribed in the regulations to be formulated by the Commissioner of Internal Revenue. A penalty of one per cent. per month from the time the tax became so due until paid is imposed for the failure to make returns in accordance with the foregoing provisions."

Copies of the new administrative regulations may be obtained from the district office, Collector of Internal Revenue, Department of the Treasury.

Tried to Get Hearst to Invest in Radio

Percy L. Deutsch, who was president of the Acoustic Products Company, which later became the Sonora Products Company, testified before Federal Judge Woolsey in New York that in 1928 he tried to get William Randolph Hearst, the publisher, interested in the purchase of the stock of the DeForest Radio Company. The plan, he related, was that Mr. Hearst was to buy this stock at $400,000 and exchange it for stock of the Acoustic Company and thus render financial assistance to the Acoustic Company that Mr. Deutsch said was badly needed.

When Mr. Hearst asked that Acoustic put up $200,000 itself, instead of him putting up the whole $400,000, the deal fell through, testified Mr. Deutsch.

The general plan was that the DeForest stock be bought for the benefit of the Acoustic Company, and Mr. Deutsch testified that much effort was made to raise the money, but without success. He attributed the subsequent failure of the Sonora Company to the inability to raise the money when it was badly needed.

Mr. Deutsch, Anthony J. Drexel Biddle, Jr., of Philadelphia, and six other former directors and officers of the Acoustic company have been sued by the Sonora trustee in bankruptcy, the Irving Trust Company, for $3,000,000. The defendants individually bought the shares of the DeForest Company at 50 cents each and personally profited thereby, instead of buying the stock for the Acoustic company, it is alleged. A lawyer for the trustee questioned Mr. Deutsch about a $125,000 note he is said to have owed Acoustic at the time he was trying to raise money for the company by the plan of stock exchange.

Dealer is Awarded $10,000 from RCA

After a trial before Supreme Court Justice Meier Steinbrink, in Brooklyn, N. Y., a jury handed down a sealed verdict in favor of Julius Modell, of 2407 Avenue J. Brooklyn, against the Radio Corporation of America for false arrest growing out of the sale of tubes in 1925.

Modell, one of the brothers operating stores in the Cortlandt Street district of New York, was indicted for violation of the trade mark law, but the indictment was dismissed. The violation charged was that he sold counterfeit radio tubes as Radio Corporation tubes.

Modell testified that a man offered him 400 radio tubes "at a price" and that he wanted to sell them from his store on Vesey Street, New York, if they were genuine, and sent four-samples to RCA for testing, but as he never heard from RCA he bought the tubes and after selling some of them was arrested.

The indictment was dismissed because of lack of proof of knowledge on defendant's part that the tubes were counterfeit, and the jury in the civil case is believed to have been persuaded by the same argument. Receipt of the tubes for testing was admitted by one of the employees of RCA.

First Heater Type A-C Power Tube Due in Fall

A power tube for a-c operation, with heater and separate cathode, the first a-c heater type output valve, and requiring a seven-spring socket, will be ready in the Fall. So will an automobile tube, 6.3 volts, of the duplex-diode triode type.

Tradiograms

By J. Murray Barron

WHY SO MANY BATTERY SETS?

Today throughout the country may still be found many battery-operated radio receivers. This does not apply alone to rural or farm sections where electricity is not available, but to cities as well. There are many reasons why some still own and operate battery sets. Some feel on account of the original cost and as the receiver is still giving satisfaction the battery set will answer. Others are under the impression that the cost of operating electric sets is high, while there are many radio fans who prefer to use the battery set for DX work. In New York City there is a fan who holds an excellent DX record of receiving stations of 100 watts or under, all verified, the record being made on a single-dial battery type Federal.

Not only are battery receivers being used, but there are sales being made right along. In N. Y. City, in the downtown section, there are possibly a dozen radio retail stores where new and trade-in battery sets are on sale. These bear the names of practically all the well-known manufacturers. There are also parts for repairs of battery receivers.

For the man who now owns a favorite battery set and would like to electrify it, there are many standard guaranteed A and B battery eliminators, single and in combination. Likewise the many having a good eliminator can find some excellent battery sets.

This all may seem strange in 1932 but the mere fact that these stores are doing business is indication enough that there must be a call for the merchandise.

* * *

New York City

As a companion to the Lynch Handipak of ten assorted radio resistors, the Lynch Mfg. Co., 1775 Broadway, N. Y. City, offers to the trade in convenient and handy form the required suppressors for the successful operation of auto radio sets. The Motor Radio Suppressor Handipaks also contain a sturdy 1 mfd. ignition filter condenser fitted with a convenient assembly metal band and flexible lead. Each Suppressor Handipak contains complete information on the suppression of ignition noises and schematic assembly diagram. The suppressors are based on the famous metallized principle. The capacity is extremely low—less than 0.5 mmfd. The resistance range is 15.000 ohms or optional. Lynch Motor Radio Suppressor Handipaks are furnished for 4, 6 and 8 cylinder cars.

* * *

Federated Purchaser, Inc., 25 Park Place, has just issued the 1932 edition of The Radio Bargain News. It is a dealers' and servicemen's guide.

* * *

Harrison Radio Co., 142 Liberty Street, is featuring the Brunswick short-wave converter and reports that the demand for such merchandise shows an increasing interest in summer.

* * *

Janette Manufacturing Co. features a new Janette Auto-B-Power. It is for battery sets in automobiles, airplanes, yachts and farm homes. Information may be had at 557 West Monroe Street, Chicago, Ill.

* * *

Cable Tube Co., 230 N. 9th Street, Brooklyn, has issued a new price list and information sheet.

* * *

Chicago

Pines Winterfront Co., 1153 N. Cicero Ave., is manufacturing the Pines B-Battery Eliminator for autos.

Specialized Courses by RCA Institutes

A new system of classroom and home study instruction in various phases of radio and electronic arts, arranged specifically to meet the demands for greater flexibility made by a rapidly spreading industry, was announced by Dow O. Whelan, president of RCA Institutes, Inc.

"The complete rearrangement of our method," said Mr. Whelan, "now enables the Institutes to provide training courses not only according to separate divisions of the radio and electronic arts but as well in sections of individual courses. This step has been taken especially for the benefit of those who are already technicians in one branch or another of the industry and who wish to enlarge their knowledge in a particular field, or even in one section of that field.

"For some time this institution has been giving special thought and attention to the requirements of men now active in radio and electronic work who may have immediate need for instruction about some one particular application of radio principles. In these instances, to offer a man a complete course is like asking him to buy an encyclopedia to find the answer to one question. It may be an immediate and pressing need, quite apart from academic considerations of the value of a complete technical education.

"We are now equipped to render prompt and practical assistance to the man who, in his daily work, needs the answer to one problem, as well as to him who wants to prepare himself for advancement by the study of complete courses.

"This flexibility extends still further," continued Mr. Whelan, "in that the man who may take only a section of a course to meet an emergency may continue, at his option, with other sections of the course to its completion at a later time.

"Of course the new plan presupposes sufficient technical and practical background to enable the individual to understand the section he elects to study. It will be necessary to convince examining officers that he will not be wasting his money and the Institutes' time. It is not expected that this will be an important factor, however, because the Institutes, for some time, has attracted many men who were already technicians at enrollment and we have every reason to expect that the new plan will raise this percentage still further."

NEW INCORPORATIONS

Visual Radio Corp., Wilmington, Del., transmit, communicate broadcast sounds and images—Attys., Colonial Charter Co., Wilmington, Del.

Hubert Service Corp., Queens, N. Y., electrical appliances—Atty., S. Moanfeldt, 1450 Broadway, New York City.

Saviet Electrical Equipment Corp., Teaneck, N. J.—Atty., Julian Saviet, Jersey City, N. J.

Porteus Electric Products, Inc., Newark, N. J.—Atty., Emanual Millman, Newark, N. J.

Balshan-Cohn Electric Co., Albany, N. Y.—Attys., Reuss & Le Fevre, Albany, N. Y.

Central Appliance Co., Mount Vernon, N. Y., refrigerators—Atty., B. Bayers, 570—7th Ave., New York City.

Jahlon Electric and Hardware Co., New York City—Attys., Schiff, Dorfman & Stein, 270 Madison Ave., New York City.

Paterson Storage Battery Co., Inc., Paterson, N. J.—Attys., Kitay & Kreiger, Paterson, N. J.

George F. Duvall, Brooklyn, N. Y., electric equipment—Atty., N. Bardach, 5 Beekman St., New York City.

CORPORATE CHANGES

Name Change

Annenberg Cherwin Co., New York City, to Radiocasting Guild.

CORPORATION REPORT

Cable Radio Tube Corporation—Year ended April 30: Deficit after expenses, write-offs for inventory adjustments, depreciation and other charges, $155,544, compared with $422,728 deficit in preceding year.

Freezer Sales Co., New York City, machinery for freezing ice cream—Atty., Prentice Hall, Inc., of Delaware.

Home Refrigerator Co., Inc., Keyport, N. J., electric refrigerators—Atty., Ezra W. Karkus, Keyport, N. J.

BLUEPRINTS
of RADIO WORLD'S Star Circuits

80-550-METER T-R-F RECEIVER

BLUEPRINT No. 627, full-scale, with schematic diagram also included, as well as a list of parts, is our most popular star circuit, since it is a-c operated and covers from 80 to 550 meters. Thus you can tune in television, police calls, some relay stations and the broadcast band. It uses five tubes: two vari-mu, either —35 or —51, one —24, one —47 and one —80. The chassis is 14½x7¾ inches, so may be fitted into a midget cabinet as illustrated.

The reason for the great popularity of this circuit is that it represents the highest achievement so far in a five-tube tuned radio frequency design, with high sensitivity all over the dial, including the high wavelengths, on which most t-r-f sets drop off considerably. For instance, patients at a sanitarium at Liberty, N. Y., were most eager to receive WEAF, 660 kc, about 150 miles distant, and all sets tried, including supers, failed to produce sufficient volume. But the 627 circuit not only brought in WEAF loudly but met all other requirements, arousing such enthusiasm that several such receivers now will be found in that sanitarium.

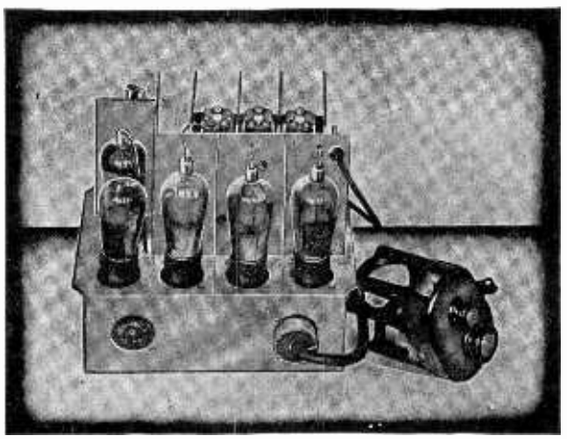
As to selectivity, strong local stations can be cut out within a very few degrees of the dial, to bring in distant stations, and it is nothing unusual of an evening, in Winter or Summer, to tune in fifty or sixty different stations without interference. From various points in the United States many users receive Cuban and Mexican stations with plenty of volume.

Special precautions have been taken to make the tone the very best. This includes complete filtration in the B supply, since hum is ruinous to tone quality. The circuit is as free from hum as any a-c receiver can be, which means you can scarcely hear the hum with no station tuned in, and your ear against the grille.

The 627 circuit was carefully engineered in **Radio World's** Laboratories, and represents the selection of fourteen different circuits, all of the five-tube t-r-f variety. So not only has the trouble been taken out by experts, but the virtues have been built in with great engineering skill.

Order BP-627 @ 25c

6-TUBE AUTO SET



A SIX-TUBE automobile receiver, using remote control tuning, with tuning-switch-volume control assembly on the steering post. Is covered by our Blueprint No. 629. The size of the chassis is only 7x9 inches, and the chassis, enclosed in a steel cover, may be placed at rear of the fireboard, just under the instrument board, to the driver's right. Since there will be little aerial pickup the receiver has been made extremely sensitive. It is of the t-r-f type, using the new —39 variable mu r-f pentode tubes, and two pentode output tubes, —38's, in push-pull. All the tubes are of the 6-volt automotive series, to work from the car's storage battery, and requiring 135 volts of B battery.

Steel partition walls serve to shield the r-f and detector tubes, while two outlets are for plugging in the remote control unit and the speaker, which should be an automobile dynamic, as set forth in the blueprint. A schematic diagram and list of parts are included on the full-scale print.

Order BP-629 @ 25c

WE have just completed an 8-tube pentode push-pull automobile superheterodyne, designed by J. E. Anderson, technical editor of **Radio World**. This is Blueprint No. 631, full-scale, including schematic diagram and list of parts.

Order BP-631 @ 50c

SHORT WAVES

A TOTALLY a-c operated short-wave converter that can be built for $7.60, comprising three tubes, and affording excellent results when worked with any broadcast receiver, including a superheterodyne, is covered by Blueprint No. 630. No plug-in coils are used, there are two tuning controls for maximum sensitivity, both oscillator and modulator tuned, and the construction is so simple that any novice can make a great success of this circuit.

Order BP-630 @ 25c

OUR blueprints also include two short-wave receivers for battery operation, one for earphone use, the other to work a speaker. These models use plug-in coils, with UX sockets as coil receptacles. The 2-volt tubes are used in both instances.

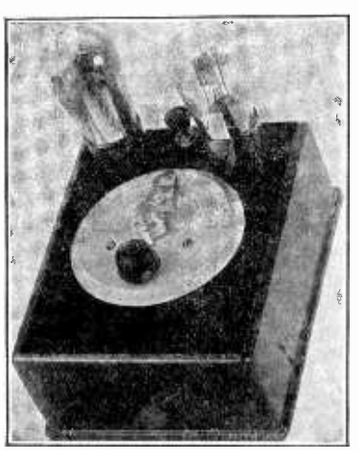
The earphone model, Blueprint No. 633, consists of an efficient and specially sensitized detector, with one stage of transformer coupled audio. With this circuit many foreign stations have been tuned in by hundreds of users. In fact, all our short-wave blueprints call for designs that yield foreign reception not as a rarity but as a fairly steady record. Two —32 tubes used.

The four-tube model, Blueprint 634, uses a stage of tuned r-f, a tuned detector specially sensitized, and two stages of transformer-coupled audio frequency amplification, the r-f tube being the —34 vari-mu r-f pentode, and the output being a —33 pentode. Schematic diagram and and list of parts included on blueprint.

These two blueprints, Nos. 632 and 633, are full-scale, on one large sheet, the complete data for one on one side, and for the other on the other side.

Order BP-633-634 @ 30c

OSCILLATOR



A MODULATED battery-operated oscillator, 540 to 1,500 kc, and 150 to 250 kc, by switching. One tube is the oscillator, the other is the modulator. Modulated-unmodulated service by switching.

Order BP-635 @ 25c

GUARANTEE

WE guarantee that the circuits embodied in the blueprints listed on this page have been carefully engineered.

Radio World takes great pains with its circuits and renders them as free from trouble and as abundant in satisfactory results as is possible. This record for authenticity has helped to make **Radio World** one of the most outstanding publications in its field.

Now in its eleventh year, **Radio World** has been catering to the home experimenter and service man with a faithfulness that has won it a wide following. Published every week, dated Saturday, **Radio World** is obtainable at newsstands at 15c per copy, or by subscription at $6 per year (52 issues), $3 per six months (26 issues), or trial subscription, $1 per 8 weeks. No extra charge for subscriptions to Canada.

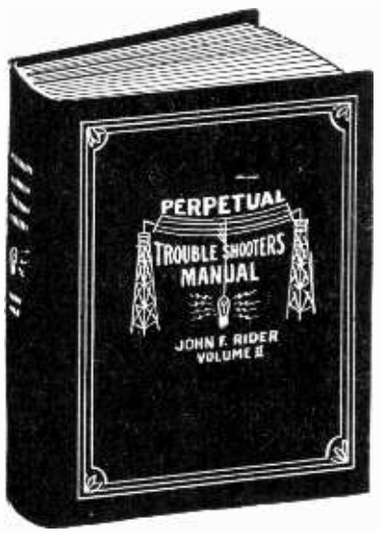
Radio World, the first and only national radio weekly, technical accuracy second to none, invites you to familiarize yourself with the exceptional service it is rendering to radioists the world over, and to profit by the expert engineering reflected by the circuits featured in its columns.

The circuits listed on this page were engineered by our laboratories with great pains, but no greater pains than attach to all the circuits featured in our columns from week to week.

Parts for all our circuits are readily obtainable.

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

Volume No. 2 of Perpetual Trouble Shooter's Manual



Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1 but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.

All Electrical Values Given for First Time

This new detailed, comprehensive information gives the resistance values from point to point in all circuits in Volume No. 2—such complete information as is unobtainable elsewhere. All condenser values are given. Chassis diagrams (pictorial), schematic diagrams and photographic views of receiver "insides" are included. Parts are identified on photographs. Intermediate frequencies are stated. Socket and tube identities are revealed, color codes given, continuities of sealed units disclosed. The information is painstakingly complete. Rider made personal trips virtually all over the country to obtain the information, and it's now yours.

Everyone who makes his living as a radio service man, salesman, laboratory man or in any other technical capacity, as well as all students and teachers of radio, should possess Volume No. 2.

Volume II and Volume I are loose-leaf editions of 8½ x 11" page size, flexible fabrikoid binding.

Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider. Shipping weight 6 lbs. Order Cat. RM-VT @ $5.00
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One shielded block containing three 0.1 mfd. condensers (black, common, to a minus; reds interchangeable) ..... .57
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One 0.05 meg. pigtail resistor (50,000 ohms)..... .15
Two 4-ohm filament resistors in series, to constitute 8 ohms (both) ..... .20
OTHER REQUIREMENTS
One 9 x 7⅝ inch wooden baseboard..... .25
Four UX sockets (two for tubes, two for coil receptacles) ..... .40
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One vernier dial ..... .50
One push-pull A battery switch..... .20
One binding post strip with eight posts on it..... .25
One—34 tube and one—30 tube (both)..... 2.61
One pair of earphones..... 1.20

Blueprint 633-34, this circuit, 25c.

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245

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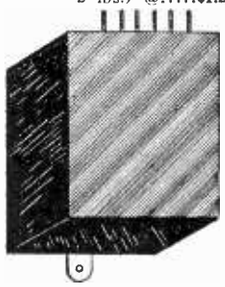

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