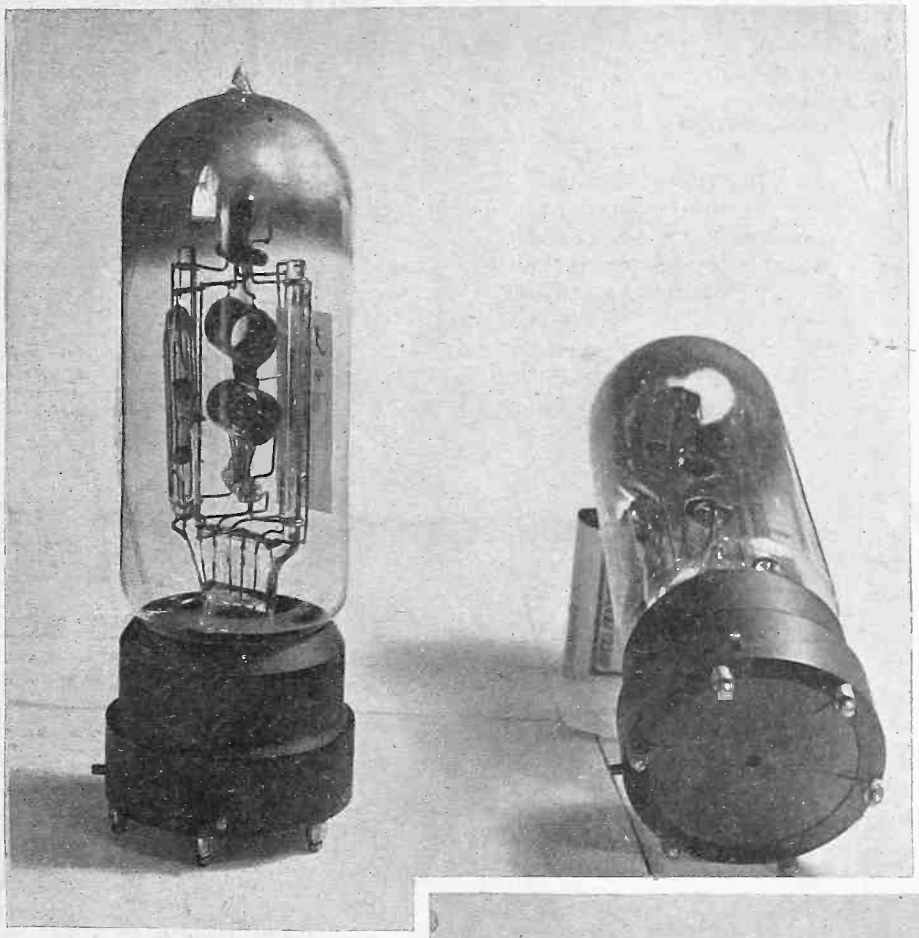
MAY 1
1926

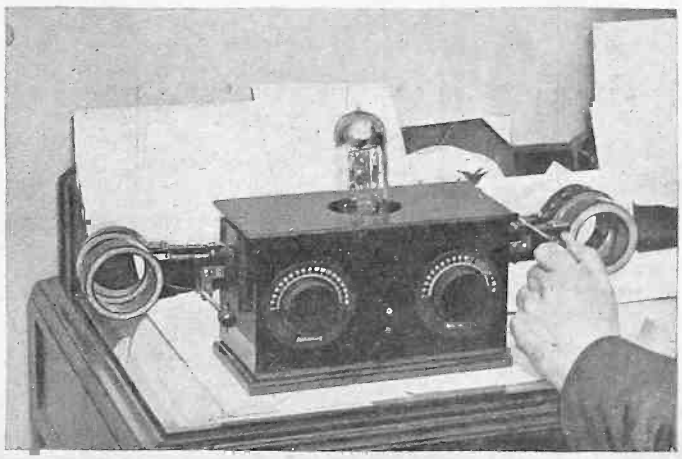
RADIO WORLD

Reg. U. S. Pat Off.

Vol. 9 No. 6 ILLUSTRATED Every Week

15 CENTS





NEW MULTIPLE TUBE

A tube has been brought from Germany, for the American market, that is three tubes in one—detector and two audio. All the wiring is in the tube, except on the tuner. At right is a set using this tube. See article on page 3.

(Kadel & Herbert.)

Get the Utmost From Your Set!

Use a Bretwood Variable Grid Leak!

WHEN you realize that the voltage output of a set may be increased 25 per cent. by correct grid leak setting—when you realize that regeneration and oscillation control is finely achieved by the variable grid leak—when you realize that nobody knows in advance just what is the correct leakage for an individual detector tube—then you know that you must use the Bretwood Variable Grid Leak, else be content with less than maximum efficiency from your set. More volume, greater distant reception, clearer signals should be your goal. Bretwood is the solution. Adopt it to-day!

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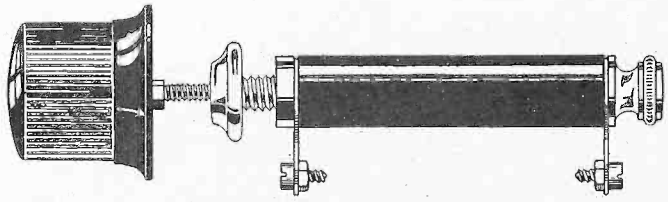

The Bretwood Variable Grid Leak
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Guaranteed Precision Range ¼ to 10 Megohms

The Bretwood Variable Grid Leak Is Officially Prescribed for the 1926 Model Diamond of the Air

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Gentlemen: Enclosed find $1.50. Send me at once one Bretwood Variable Grid Leak on 5-day money-back guarantee.

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Purchasers Are Delighted With Results

I received the Bretwood Grid Leak. Thanks for your promptness. The Bretwood is the best grid leak that I have ever had. Since I placed it in my 1926 Model Diamond of the Air I have received stations from nearly every part of the country. WMBF, WSB, KOA, 6KW, WBAP, WJAX, WOC, KFKX, PWX, KGO and KFI were all brought in on the speaker as soon as this instrument was put into the receiver. As for clearing up distortion, I have never seen anything to equal the Bretwood Grid Leak. I have placed one also across the primary of the first audio-frequency transformer and the results are marvelous.

E. HIGGINS,
130 Washington Ave.,
Elizabeth, N. J.

* * *

An obligation of gratefulness impels me to write you that any one who has not used the Bretwood does not know what a grid leak is.

BRUNO GONZALEZ,
General Staff Sergeant,
Cuban Army.

P. O. Box 910,
Havana, Cuba.

* * *

I think the Bretwood is the best grid leak I have ever used. Have made quite a few sets and this beats them all. Get DX very plainly and clearly.

WM. HEBERSON,
2510 N. Franklin St.,
Philadelphia, Pa.

* * *

Bretwood Grid Leak received and tested out. I find it is the only variable leak I ever used that is really variable.

Enclosed find $1.50, for which please send me another one.

F. E. STAYTON,
Box 240, Ardmore, Okla.

* * *

With your grid leak I was able to bring in with good volume 15 W stations in one week with a Diamond of the Air set from a city hard to get out of.

Thanking you.

F. W. COLLINGWOOD,
3442 Sacramento St.,
San Francisco, Cal.

* * *

I received the Bretwood Variable Grid Leak last night and it sure did bring in stations. Denver was as far as I could get until last night, when, with the Bretwood in my set, I brought in KFI, Los Angeles, and KPO, San Francisco, Cal., clear and fine.

JOS. L. MARIE,
4026 Grezella St.,
Pittsburgh, Pa.

* * *

Do YOU Want to Get Results Like These? If so, the Bretwood Variable Grid Leak is the Answer! Indorsed by Leading Radio Engineers and Laboratories. It Is the World's Best Grid Leak!

RADIO WORLD

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March 3, 1879]

A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 145 West 45th St., New York, N. Y. Just East of Broadway Phones: BRYant 0558 and 0559

Vol. IX. No. 6. Whole No. 214. May 1, 1926 15c per copy, $6.00 a year

Multiple Tube Announced

By Herman Bernard

Associate, Institute of Raido Engineers

A PAIR of new tubes, "made in Germany," have been brought here by David L. Loewe, of the Loewe-Audion Co., of Berlin. These tubes are:

(1)—A vacuum glass envelope with one filament, but with three grids, each grid double, and three plates. This unit functions as detector and two steps of audio; physically one tube, electrically three tubes.

(2)—A vacuum glass envelope with one filament and two grids and two plates, constituting two steps of resistance-coupled radio-frequency amplification.

Special Resistors

The detector and two audio stages contain the coupling resistors and isolating condensers inside the tube itself. A special natural ore is used for the resistance element in the plate circuits and in the grid circuits, as leaks. This ore holds a steady temperature under all the useful voltages, so that the resistance is practically the same for the range of applied plate voltages.

Thus the one tube suffices for a receiver to operate a speaker, but the selectivity is not sufficient. However, the resistance RF tube may be added, with suitable coils, to gain this end, so that two physical tubes equal a 5-tube set.

Mr. Loewe, who is staying at the Hotel Pennsylvania, New York City, is a director of the Radio Frequenz Co., the Loewe-Audion Co., and the Loewe Radio Co. The Audion Co. is the second largest tube manufacturer in Germany. Telefunken is first.

Statement by Mr. Loewe

Mr. Loewe is arranging for the introduction of the tubes in the American market. He described his product as follows:

"The underlying basic element of the new multiple tubes is the Loewe high vacuum resistances. These consist of the glass rod with welded connections, on the surface of which there is deposited a fine metallic compound film which serves as the resisting element. The whole thing is enclosed in a glass tube and highly evacuated.

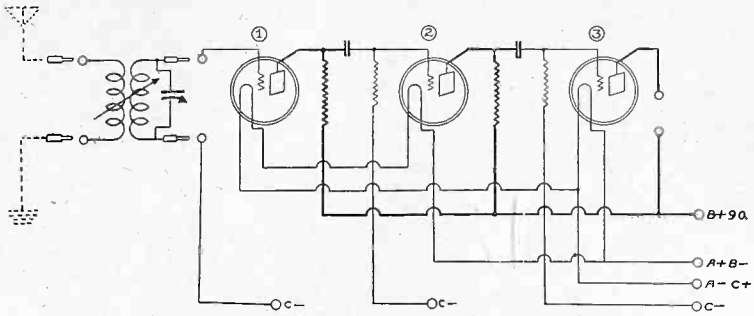
"This resistance is positively free of capacity and it will therefore not retain any electrical charge, such as the great majority of resistances heretofore known have done. It will remain constant and will not vary with the temperature.

"These resistances are guaranteed for a continuous load of .1 watt but will stand .5 watt intermittently. They are noiseless. These resistances are made on automatic machinery.

"Only after these resistances became developed did it become possible to build the Loewe multiple tubes. These tubes use the resistance capacity coupled circuit.

The RF Tube

"The multiple radio-frequency tube contains two or three double grid units,



HERE IS THE CIRCUIT DIAGRAM of the 3-tube set that uses only one tube, because there are "three in one." This circuit worked out well in Germany, but probably would not be selective enough in the United States. But the inventor has the solution—another tube that has two tubes in it, both of these for RF amplification. Hence in two bulbs you have a 5-tube set. Note in the diagram that the grid bias method of detection is used. There are one stage of resistance AF and one power AF. The first two tubes (1) and (2) have filaments in parallel. The 3-in-1 tube has six contact points.

and it has been possible to overcome the difficulties of radio frequency resistance amplification by using special double grid systems having a very low internal ohmic resistance. Furthermore, as the units are located so closely together, the leads are very short, and thereby the capacity effect is practically nil.

"There is furthermore contained in the tube a coupling mica condenser which is enclosed in a glass tube container of its own and especially evacuated, thereby avoiding having gases contained in the mica upset the vacuum of the multiple tubes.

"The efficiency of these radio-frequency tubes is extreme. Their use is effective from below 100 meters to any higher wavelength desired. Thus these tubes permit an efficient amplification of all broadcasting wavelengths.

"They can be connected to any detector circuit. Thus, distant stations can be heard on a detector with the special diagrams, using an ordinary audion circuit in connection with the tube, which permits a very sharp selectivity. These tubes can be used in connection with any existing Super-Heterodyne sets, thereby extending the range of these sets considerably.

"These tubes permit receiving distant stations on the speaker during the day which otherwise hardly would be audible at all.

"It has been shown experimentally that an amplification of ten in the radio frequency stage is more efficient than 100 in the audio frequency stage, as the detector characteristic is rather low when the input is very small.

The Audio Tube

"The other type of multiple tube is the three-unit coupled audio-frequency tube. This audio-frequency tube will permit a voltage amplification of more than 1,500 on frequencies betwene 50 and 10,000. It contains one amplifier, one detector and one power unit, all in one tube. This multiple tube can be connected to any tuning circuit and will then give reception at loud speaker strength, there being no distortion. Also atmospheric interferences will be reduced to a minimum.

"The combination of a multiple radio frequency tube and a multiple audio frequency tube will permit both long distance reception and very high amplification, and when these two tubes are used on a special circuit the selectivity also will be very great. Thus all the requirements one can possibly demand are achieved.

"The tubes have a life of 1,000 hours.

"The Loewe-Audion Company of Berlin have constant reception of the North and South American signals, as well as those of Java and New Zealand, in the center of Berlin at loud speaker strength, which could not be done previously without these tubes.

"These tubes are also very important for the Army, Navy and Air Force, as they are free of microphonic noises and permit the construction of very compact and light sets."

Mr. Loewe believes the DX fever among broadcast listeners in Germany has abated and that they are insistent upon a higher class of local programs and proper reproduction of such programs on better receivers.

Mr. Loewe is a brother of Dr. Sigmund Loewe, scientist, the inventor of the tubes.

The tube—either model—draws very little current, in fact the 3-in-1 arrangement draws less than one tube of the most popular American make. (This is the filament current.) The filament voltage is 4 and must not be varied, except that the natural variation due to battery condition of extreme charge or discharge is taken care of by the tube. No rheostat is used in either case. Naturally, the plate current drain is low, due to resistance coupling.

Circuits are being developed in RADIO WORLD's laboratories embodying these tubes. David L. Loewe is co-operating in this work. Details will be published in an early issue.

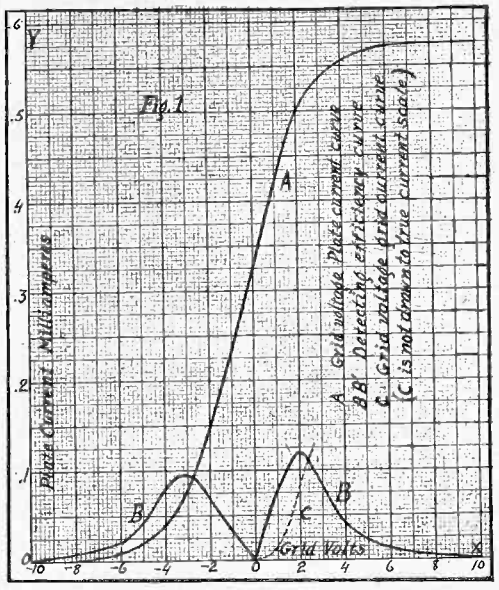
An Analysis of Detection

By
J. E. Anderson
Consulting Engineer

Curve That Best Explains How Detection Is Obtained From a Highly Negative Grid

ACCURATELY speaking, all methods of detection with a three-element vacuum tube are grid bias methods because the result in each depends on the relation between the instantaneous grid voltage to the average grid voltage. But there are three main methods of operating a tube, or of maintaining the average grid potential, to attain the desired result. The first is by keeping the average grid potential excessively negative with respect to the filament by means of a grid battery; the second is by maintaining the grid potential positive by means of a battery or other means; and the third is by using a leaky condenser in the grid circuit.

The first of these is what is usually called the grid bias method, that is, the one in which the average grid potential is kept excessively negative by means of a battery. The manner in which detection may be accomplished by this means may be most easily explained with the aid of the grid voltage, plate current characteristic curve of the vacuum tube (Fig. 1). In this curve the grid voltage is laid out along the horizontal line OX and the corresponding plate current in the vertical direction along the line OY. The plate current is the vertical distance between the line OX and the curve. For instance, when the grid voltage is minus two volts the plate current is .15 milliampere, when it is zero the plate current is .325 milliampere, and when the grid voltage is plus two volts the plate current is .496 milliampere. Zero grid voltage means that the grid return lead is connected to the negative terminal of the filament.



THE grid voltage, plate current curve of a vacuum tube.

The Two Are One

Before proceeding with the discussion of the curve it is well to state that rectification and detection are essentially the same. If a device will suppress one side of a wave, either wholly or partly, then spark signals, interrupted continuous waves and modulated continuous waves will be detected. With this understanding let us proceed with a consideration of the characteristic curve and the detection properties of the vacuum tube.

Suppose that the grid be given a negative bias of eight volts by means of a battery of dry cells or some other means. Then further suppose that an alternating signal voltage wave with a double amplitude of four volts be impressed on the grid circuit. The grid voltage will then vary between minus ten and minus six volts, since the action of the wave is alternately to add and subtract its voltage from the steady voltage of the grid as maintained by the grid battery. As will be seen from the curve, the plate current when the grid is at minus eight volts is zero. When the voltage of the grid is less than negative eight volts the plate current also will be zero, and therefore the negative half of the wave will be suppressed. When the voltage is greater than minus eight, current will flow in the plate circuit, and will reach a maximum when the grid voltage is maximum. This occurs when the grid has reached minus six volts, at which time the plate current is .01 milliampere. Hence direct current pulses having an amplitude of .01 milliampere will flow in the plate circuit whenever the positive half of the impressed wave is effective. These direct current pulses, of course, would give a deflection on a direct current ammeter of sufficient sensitivity. That means rectification of the incoming wave.

The Varied Variation

Now suppose that the grid bias be decreased from minus eight to minus six volts. Now the grid voltage will vary between minus eight and minus four, assuming that the same wave of four volts double amplitude is applied. The plate current therefore will vary between zero and .04 milliampere, and this variation will center about the plate current .01 milliampere corresponding to the mean or permanent grid bias voltage of minus six. The negative half of the wave will decrease the plate current from .01 milliampere to zero and the positive half will increase the current from .01 to .04 milliampere. The increase is several times greater than the decrease, and the amplitude of the net increase .02 milliampere. This in effect constitutes rectification since the application of the signal wave causes a rise in the direct current meter placed in the plate circuit. The amount of this rise is a measure of the detecting efficiency of the device. Let the grid bias now be increased to minus four volts. Then the signal wave will cause the grid voltage to vary between minus six and minus two, and the plate current will vary between .01 and .15 milliampere. The decrease in this case will be from .04 to .01 milliampere and the increase will be from .04 to .15 milliampere. The amplitude of the net increase will be .08 milliampere. If the grid bias be increased to minus two volts, the variation in the plate current will be between .04 and .325 milliampere, and the amplitude of the net increase in the plate current will be .065 milliampere. And again if the grid bias be increased to zero, the variation in the plate current will be between .500 and .150 milliampere, centering about .325 milliampere. Here the increase is just equal to the decrease, and there is no change in the plate current as read on a direct current meter. In all these cases except the last detection takes place.

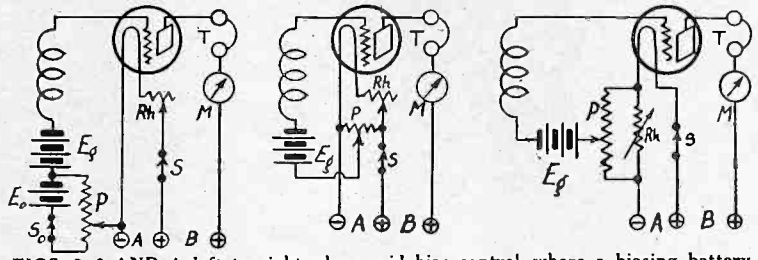
The Interpretation

Note that when the grid bias is —8 volts, the amplitude of the net increase in the current is .01 milliampere; when the grid bias is —6 volts, the net increase is .02, when the grid bias is —4 volts, the net increase is .08, when the grid bias is —2 volts, the increase is .065 milliampere, and lastly when the grid bias is zero, there is no net increase. It is, therefore, evident that somewhere between —8 volts and zero bias the amplitude of the net increase is a maximum. This maximum occurs where the curve bends upward most rapidly, and in this particular case is at —3.2 volts. The small curve B located near the foot of the grid voltage, plate current characteristic curve is the detecting efficiency curve of the tube, and this starts with zero at zero bias, rises rapidly and attains a maximum at —3.2 volts and then decreases first rapidly then more slowly until it approaches zero for very large values of grid bias. The shape of the detecting efficiency curve depends somewhat on the amplitude of the impressed wave, particularly near zero bias and for large negative bias voltages.

From the shape of the detecting efficiency curve it is evident that the correct grid bias voltage adjustment to obtain the best result is rather critical. It is not sufficient to alter the grid bias by one cell at a time, that is by 1.5 volts at a time. The peak of efficiency might be missed altogether. Suppose one cell only is used for biasing. The detecting efficiency will then be about .05 units. For two cells, or a bias of three volts, the efficiency is .095 units. For three cells, or 4.5 volts, the efficiency is less than .03 units. It just happens in this case that three volts is close enough, but for some other tube, or the same tube under different operating conditions, might require a voltage just half way between that given by dry cells. It may be that the voltage drop in a rheostat or other filament resistance is part of the effective grid bias, and this drop may be in the neighborhood of .75 volt. In that case one

A Super's First Detector

Why do Excessive Negative Grid Bias and Also Positive Bias Produce Detection?—Leaky Condenser Method Compared With the Two Others



FIGS. 2, 3 AND 4, left to right, show grid bias control where a biasing battery and potentiometer are used.

cell would make the total grid bias 2.25 volts and two cells would make it 3.75 volts. The detecting efficiency in these cases would be, respectively, .076 and .088 units. These are both below the maximum. Some tubes are much more critical than this one, and in these the difference in detecting efficiency caused by .75 volt would be much greater.

Needs Close Adjustment

Hence when the grid bias method of detection is employed it is highly desirable to have some means for adjusting the grid bias more closely than that afforded by changing it by a 1.5 volt cell at a time.

Three methods of accomplishing this may be given. In Fig. 2 a high resistance potentiometer P is connected across one or two of the cells Eo in the grid bias battery Eg and the lead from the filament is connected to the sliding contact of the potentiometer. By sliding the contact from one end to the other of the resistance any portion of the voltage of the battery Eo may be added to the effective grid bias voltage. The resistance of the potentiometer P should not be less than 400 ohms, and it may well be as high as 2,000. A switch So should be inserted in the potentiometer circuit so that this may be opened when the set is not in use, otherwise a current will flow at all times and the battery Eo will run down uselessly. If the resistance of the potentiometer is 2,000 ohms or over, and if Eo is a single cell, this will last for several months even if it is running all the time. Hence some may prefer to replace the cell at infrequent intervals rather than to endure the inconvenience of the switch.

The Subtraction Method

The second method is shown in Fig. 3. In this case a high resistance potentiometer is connected across the filament battery and the lead from the grid bias battery is connected to the sliding arm. In this manner any portion of the filament battery voltage may be subtracted from the grid bias voltage. No separate switch will be needed in this case since the current through the potentiometer will be cut off when the filament switch S is opened. A 400 ohm potentiometer usually should be employed so as to minimize the current drain on the filament battery, but in case of a dry cell operated set it would be preferable to use a 2,000 ohm potentiometer so as to conserve the battery still more. When this method is employed for adjusting the grid bias a cell or two more will be required in the battery Eg, since the potentiometer subtracts from the effective value of the grid battery.

The third method is shown in Fig. 4. In this case the high resistance potentiometer is connected across the filament rheostat or filament ballast resistance in the detector tube. As before, the lead from the grid battery Eg is connected to the sliding arm. By adjusting the position of this arm any portion of the voltage drop in the rheostat may be added to or subtracted from the grid bias. This method is not applicable unless the drop in the rheostat is equal to or greater than 1.5 volts and it is practically limited to cases where three volt tubes like UV-199 are operated on a six-volt source for the filament. The potentiometer resistance in this case should be at least 2,000 ohms in order that the current through this resistance be negligible in comparison with the current through the rheostat. No separate switch is required in this case since the current through the potentiometer is cut off when the main filament switch S is opened.

The Limitations

The method shown in Fig. 2 is not applicable in case the same grid battery Eg is to be used for a number of tubes in the set, because by varying the position of the sliding arm will change the grid potentials on all these tubes, and this is usually not desirable. This difficulty, however, may be overcome by rearranging the circuit as shown in Fig. 5. Similarly the method shown in Fig. 3 is not applicable when the grid battery is to be used for several tubes in the circuit; and this scheme cannot be changed so as to make it applicable. The same thing is true of the scheme shown in Fig. 4. In many cases, however, a fraction of 1.5 volts more or less on the grid of amplifier tubes does not make a great deal of difference, especially when the plate voltage is high, so that both methods shown in Figs. 3 and 4 may be used without modification. Where they can be used they are more convenient than Fig. 2 or Fig. 5 on account of the switch So.

Let us now return to the characteristic curve in Fig. 1. At the beginning of this article it was stated that rectification or detection could also be accomplished by making the grid positive. As will be seen, for positive grid voltages the characteristic curve bends downward in much the same manner that it bends upward for negative grid voltages. Hence if the grid is made positive one-half of the incoming wave will produce less effect on the plate current than the other half. In this case the situation is reversed. The positive half of the wave will not increase the plate current as much as the negative half of the wave will decrease it.

What Constitutes Detection

For example, let the grid bias be 4 volts. The plate current then will be .555 milliampere. The positive half of a wave of four volts double amplitude will increase this to .572 milliampere and the negative half will decrease the current to .5 milliampere. The increase is .017 milliampere and the decrease is .05 milliampere, and the amplitude of the net decrease .043 milliampere. This is approximately the amount by which a direct current meter in the plate circuit will decrease as a result of the application of the signal voltage of four volts double amplitude. This change constitutes detection.

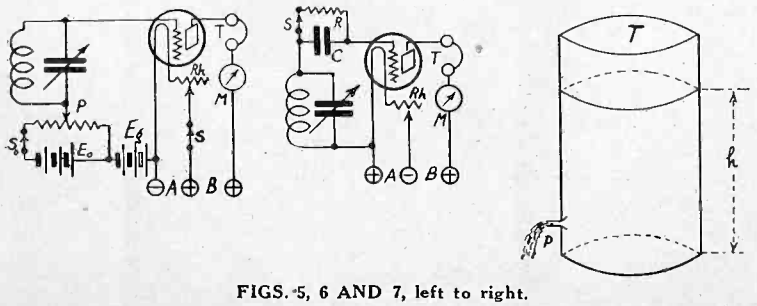
At the foot of the curve on the right hand side of the zero grid voltage axis is plotted a detecting efficiency curve for positive values of grid bias, similar to the curve already discussed for negative values. This curve has a very sharp maximum for a positive bias of two volts. For lower values of bias this curve decreases very rapidly. For higher values of bias the curve also decreases rapidly at first but gradually flattens out to zero detecting efficiency. The fact that the efficiency curve for positive values of bias is higher and steeper than the corresponding curve for negative values is not to be taken too seriously. The curves have been obtained graphically and the differences are well within experimental error.

Even if the detecting efficiency on the positive side were greater it would not be advisable to operate the tube with positive grid bias because of the excessive plate current. The plate battery under these conditions would not last nearly as long as it would with negative bias, and the plate current serves no useful purpose since it is only the variation in the plate current which is effective in producing sound.

The Headset Example

The only time when advantage could be taken of the heavy plate current flowing when the grid is positive is in case a headset is connected directly to the tube output.

(Continued next week)



FIGS. 5, 6 AND 7, left to right.

The Aero All-Wave Set

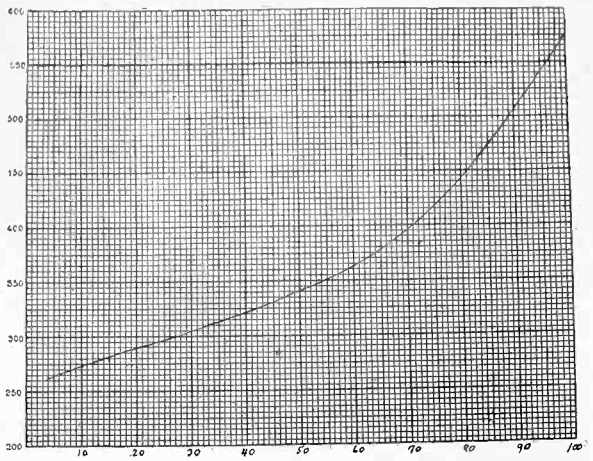


FIG. 6
Curve of tuning of the largest of the interchangeable coils.

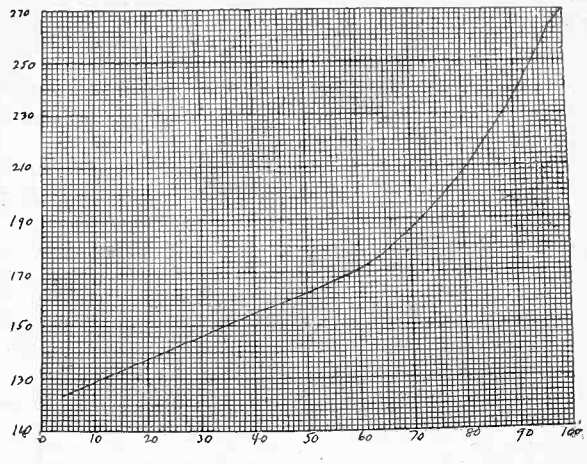


FIG. 7.
Curve of the tuning of the second largest coil.

Part I of this article on the construction of Aero All-Wave Receiver was published last week, issue of April 24, Part II, the conclusion, follows.

By Capt. P. V. O'Rourke

IN the Aero All-Wave Receiver (15 to 575 meters) the jack system provides:

(1) the conventional detector listening post at J1.

(2) a method of connecting an external tuner to the audio channel of the Aerodyne by using phone cords and phone plug, inserting the plug in J2. The detector tube of Fig. 1 is turned out by means of rheostat R1, while the three audio tubes are lighted by the filament control jack method.

Other Wiring Data

The rest of the wiring as along well-known lines. Assuming that —01A tubes are used throughout, R1 is a 30-ohm rheostat, certainly no less; R2 is a No. 112 Amperite, while R3 is a No. 1 —A Amperite for a —01A tube, but if a 112 power tube is used, then R3 also is a No. 112 type Amperite, also.

The resistors in the audio amplifying system, R5, R6, R7, R8, are 100,000 ohms (0.1 meg.) each. However, if you have handy a 1 meg. and .5 meg. or .5 meg. and .25 meg., you can use them for R6 and R8, being sure, however, that the lower value is in the grid circuit of the last tube. It is very convenient indeed to use the resisto-couplers, where the condensers C4 and C5 are a part of the mountings that hold the four leaks in the audio channel.

You will note from the photographs that a battery cable is used, and this is a handy thing. Markers, of the pressed tin type, are very convenient for immediately identifying the leads at the battery ends.

The sockets used were air-gap, especially suitable for short wave work, because the gap reduces losses. The detector socket should have sponge rubber underneath.

Operating Data

The grid condenser and leak being mounted in removable fashion, various values of either may be tried in combination. Try making your grid return interchangeable, from positive to negative filament, until the best point is found.

Your filament circuit may or may not be grounded. It is not shown grounded in Fig. 1. In some installations a good deal of AC hum is found when filaments are grounded. Body capacity will not be found in either case. If heavy interference is experienced from local broadcast stations due to harmonics, a great deal will be lost without impairment of SW signals by changing your filament circuit to the ungrounded type.

When you place the Aero interchangeable coils in your cabinet, be sure you have space enough so that the primary may be operated in a horizontal position without touching the side of the cabinet.

Now with the receiver connected up and ready for operation, insert the largest coil, disconnect the antenna, put the grid return—(det.)—positive and try various combinations of grid leaks and condensers. This procedure is almost absolutely necessary, as tubes vary and short-wave receivers are prone to go into oscillation with a bang or howl instead of the conventional hiss. The smallest capacity of grid condenser and highest value of grid leak will give loudest signals; about .0001 mfd. and 5 to 10 megohms will probably be found best, but if howling is encountered, the capacity must be raised and leak lowered. Sometimes changing the detector grid return will clear the trouble. Detector filament temperature is likely to be critical even if 45 volts are used on the plate. F. J. Marco, 9ZA, who developed the coils, says:

"When the best grid condenser, leak and grid return have been found check all of the coils and make certain that the receiver can be made to oscillate smoothly from maximum to minimum on all waves. If there is some particular wavelength on which the receiver refuses to oscillate with the antenna disconnected and primary horizontal, there is probably absorption somewhere and the RF choke or layout must be slightly changed. Take a few turns off the choke.

The Antenna

"Either a long or short antenna may be used for SW reception. If it is long it must be loosely coupled or the receiver will not oscillate on all waves. This is due to absorption from antenna harmonics. The coupling should be loosened by moving primary further away until trouble stops. Sometimes a series condenser or loading coil in the antenna will shift these humps out of the useful bands and allow tighter coupling to be used. The experimenter may try these stunts until best signal strength with smoothest operation is found. In operating the receiver, always keep it oscillating gently for CW reception and just below the point of oscillation for phone. Using both hands for tuning will give best results. It will be found that the feedback need not be touched over any of the amateur bands, making the set really single control and leaving the right hand free for copying. A swinging signal may be followed by adjusting the feedback dial as it detunes very slightly when moved. This detuning is convenient for

LIST OF PARTS

Three Aero short wave coils (15 to 33.5 meters, 31.5 to 68 meters, 57 to 133 meters).
Two Aero broadcast and broadcast low wave coils, 125 to 250 meters, 235 to 550 meters (the box markings are given here).
One .0001 mfd. grid condenser, C3.
One Daven grid leak, R4 (5 to 10 meg., to be determined by experiment).
One Hammarlund short wave straight line frequency variable condenser, .00014 mfd., C1.
One Hammarlund .00025 mfd. straight line frequency variable condenser, C2.
Four Air Gap sockets.
One American De Luxe first stage audio transformer, PBGF.
Two Saturn double-circuit jacks, J1, J2.
One Saturn single circuit filament control jack, J3.
One Centralab 30-ohm rheostat, R1.
One No. 112 Amperite, R2.
One No. 1A Amperite, R3, for —01A tube.
Two Daven resisto-couplers (which include C4 and C5, otherwise .01 mfd. each).
One Bruno light switch, with ruby bull's eye.
Four 0.1 meg. Daven resistors, R5, R6, R7, R8.
One 7x21" panel.
Two Bruno Slo-Moshen vernier dials.
One 7x20" baseboard.
One choke coil, L.

Kilocycle-Meter Chart

kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc
10	29, 982	1, 010	296. 9	2, 010	149. 2	3, 010	99. 61	4, 010	74. 77	5, 010	59. 84	6, 010	49. 89	7, 010	42. 77	8, 010	37. 43	9, 010	33. 28
20	14, 991	1, 020	293. 9	2, 020	148. 4	3, 020	99. 28	4, 020	74. 58	5, 020	59. 73	6, 020	49. 80	7, 020	42. 71	8, 020	37. 38	9, 020	33. 24
30	9, 994	1, 030	291. 1	2, 030	147. 7	3, 030	98. 95	4, 030	74. 40	5, 030	59. 61	6, 030	49. 72	7, 030	42. 65	8, 030	37. 34	9, 030	33. 20
40	7, 496	1, 040	288. 3	2, 040	147. 0	3, 040	98. 62	4, 040	74. 21	5, 040	59. 49	6, 040	49. 64	7, 040	42. 59	8, 040	37. 29	9, 040	33. 17
50	5, 996	1, 050	285. 5	2, 050	146. 3	3, 050	98. 30	4, 050	74. 03	5, 050	59. 37	6, 050	49. 56	7, 050	42. 53	8, 050	37. 24	9, 050	33. 13
60	4, 997	1, 060	282. 8	2, 060	145. 5	3, 060	97. 98	4, 060	73. 85	5, 060	59. 25	6, 060	49. 48	7, 060	42. 47	8, 060	37. 20	9, 060	33. 09
70	4, 283	1, 070	280. 2	2, 070	144. 8	3, 070	97. 66	4, 070	73. 67	5, 070	59. 13	6, 070	49. 39	7, 070	42. 41	8, 070	37. 15	9, 070	33. 06
80	3, 748	1, 080	277. 6	2, 080	144. 1	3, 080	97. 34	4, 080	73. 49	5, 080	59. 02	6, 080	49. 31	7, 080	42. 35	8, 080	37. 11	9, 080	33. 02
90	3, 331	1, 090	275. 1	2, 090	143. 5	3, 090	97. 03	4, 090	73. 31	5, 090	58. 90	6, 090	49. 23	7, 090	42. 29	8, 090	37. 06	9, 090	32. 98
100	2, 998	1, 100	272. 6	2, 100	142. 8	3, 100	96. 72	4, 100	73. 13	5, 100	58. 79	6, 100	49. 15	7, 100	42. 23	8, 100	37. 01	9, 100	32. 95
110	2, 726	1, 110	270. 1	2, 110	142. 1	3, 110	96. 41	4, 110	72. 95	5, 110	58. 67	6, 110	49. 07	7, 110	42. 17	8, 110	36. 97	9, 110	32. 91
120	2, 499	1, 120	267. 7	2, 120	141. 4	3, 120	96. 10	4, 120	72. 77	5, 120	58. 56	6, 120	48. 99	7, 120	42. 11	8, 120	36. 92	9, 120	32. 88
130	2, 306	1, 130	265. 3	2, 130	140. 8	3, 130	95. 79	4, 130	72. 60	5, 130	58. 44	6, 130	48. 91	7, 130	42. 05	8, 130	36. 88	9, 130	32. 84
140	2, 142	1, 140	263. 0	2, 140	140. 1	3, 140	95. 48	4, 140	72. 42	5, 140	58. 33	6, 140	48. 83	7, 140	41. 99	8, 140	36. 83	9, 140	32. 80
150	1, 999	1, 150	260. 7	2, 150	139. 5	3, 150	95. 18	4, 150	72. 25	5, 150	58. 22	6, 150	48. 75	7, 150	41. 93	8, 150	36. 79	9, 150	32. 77
160	1, 874	1, 160	258. 5	2, 160	138. 8	3, 160	94. 88	4, 160	72. 07	5, 160	58. 10	6, 160	48. 67	7, 160	41. 87	8, 160	36. 74	9, 160	32. 73
170	1, 764	1, 170	256. 3	2, 170	138. 1	3, 170	94. 58	4, 170	71. 90	5, 170	57. 99	6, 170	48. 59	7, 170	41. 82	8, 170	36. 70	9, 170	32. 70
180	1, 666	1, 180	254. 1	2, 180	137. 5	3, 180	94. 28	4, 180	71. 73	5, 180	57. 88	6, 180	48. 51	7, 180	41. 76	8, 180	36. 65	9, 180	32. 66
190	1, 578	1, 190	252. 0	2, 190	136. 9	3, 190	93. 99	4, 190	71. 56	5, 190	57. 77	6, 190	48. 44	7, 190	41. 70	8, 190	36. 61	9, 190	32. 62
200	1, 499	1, 200	249. 9	2, 200	136. 3	3, 200	93. 69	4, 200	71. 39	5, 200	57. 66	6, 200	48. 36	7, 200	41. 64	8, 200	36. 56	9, 200	32. 59
210	1, 428	1, 210	247. 8	2, 210	135. 7	3, 210	93. 40	4, 210	71. 22	5, 210	57. 55	6, 210	48. 28	7, 210	41. 58	8, 210	36. 52	9, 210	32. 55
220	1, 363	1, 220	245. 8	2, 220	135. 1	3, 220	93. 11	4, 220	71. 05	5, 220	57. 44	6, 220	48. 20	7, 220	41. 53	8, 220	36. 47	9, 220	32. 52
230	1, 304	1, 230	243. 8	2, 230	134. 4	3, 230	92. 82	4, 230	70. 88	5, 230	57. 33	6, 230	48. 13	7, 230	41. 47	8, 230	36. 43	9, 230	32. 48
240	1, 249	1, 240	241. 8	2, 240	133. 8	3, 240	92. 54	4, 240	70. 71	5, 240	57. 22	6, 240	48. 05	7, 240	41. 41	8, 240	36. 39	9, 240	32. 45
250	1, 199	1, 250	239. 9	2, 250	133. 3	3, 250	92. 25	4, 250	70. 55	5, 250	57. 11	6, 250	47. 97	7, 250	41. 35	8, 250	36. 34	9, 250	32. 41
260	1, 153	1, 260	238. 0	2, 260	132. 7	3, 260	91. 97	4, 260	70. 38	5, 260	57. 00	6, 260	47. 89	7, 260	41. 30	8, 260	36. 30	9, 260	32. 38
270	1, 110	1, 270	236. 1	2, 270	132. 1	3, 270	91. 69	4, 270	70. 22	5, 270	56. 89	6, 270	47. 82	7, 270	41. 24	8, 270	36. 25	9, 270	32. 34
280	1, 071	1, 280	234. 2	2, 280	131. 5	3, 280	91. 41	4, 280	70. 05	5, 280	56. 78	6, 280	47. 74	7, 280	41. 18	8, 280	36. 21	9, 280	32. 31
290	1, 034	1, 290	232. 4	2, 290	130. 9	3, 290	91. 13	4, 290	69. 89	5, 290	56. 68	6, 290	47. 67	7, 290	41. 13	8, 290	36. 17	9, 290	32. 27
300	999. 4	1, 300	230. 6	2, 300	130. 4	3, 300	90. 86	4, 300	69. 73	5, 300	56. 57	6, 300	47. 59	7, 300	41. 07	8, 300	36. 12	9, 300	32. 24
310	967. 2	1, 310	228. 9	2, 310	129. 8	3, 310	90. 58	4, 310	69. 56	5, 310	56. 46	6, 310	47. 52	7, 310	41. 02	8, 310	36. 08	9, 310	32. 20
320	936. 9	1, 320	227. 1	2, 320	129. 2	3, 320	90. 31	4, 320	69. 40	5, 320	56. 36	6, 320	47. 44	7, 320	40. 96	8, 320	36. 04	9, 320	32. 17
330	908. 6	1, 330	225. 4	2, 330	128. 7	3, 330	90. 04	4, 330	69. 24	5, 330	56. 25	6, 330	47. 36	7, 330	40. 90	8, 330	35. 99	9, 330	32. 14
340	881. 8	1, 340	223. 7	2, 340	128. 1	3, 340	89. 77	4, 340	69. 08	5, 340	56. 15	6, 340	47. 29	7, 340	40. 85	8, 340	35. 95	9, 340	32. 10
350	856. 6	1, 350	222. 1	2, 350	127. 6	3, 350	89. 50	4, 350	68. 92	5, 350	56. 04	6, 350	47. 22	7, 350	40. 79	8, 350	35. 91	9, 350	32. 07
360	832. 8	1, 360	220. 4	2, 360	127. 0	3, 360	89. 23	4, 360	68. 77	5, 360	55. 94	6, 360	47. 14	7, 360	40. 74	8, 360	35. 86	9, 360	32. 03
370	810. 3	1, 370	218. 8	2, 370	126. 5	3, 370	88. 97	4, 370	68. 61	5, 370	55. 83	6, 370	47. 07	7, 370	40. 68	8, 370	35. 82	9, 370	32. 00
380	789. 0	1, 380	217. 3	2, 380	126. 0	3, 380	88. 70	4, 380	68. 45	5, 380	55. 73	6, 380	46. 99	7, 380	40. 63	8, 380	35. 78	9, 380	31. 96
390	768. 8	1, 390	215. 7	2, 390	125. 4	3, 390	88. 44	4, 390	68. 30	5, 390	55. 63	6, 390	46. 92	7, 390	40. 57	8, 390	35. 74	9, 390	31. 93
400	749. 6	1, 400	214. 2	2, 400	124. 9	3, 400	88. 18	4, 400	68. 14	5, 400	55. 52	6, 400	46. 85	7, 400	40. 52	8, 400	35. 69	9, 400	31. 90
410	731. 3	1, 410	212. 6	2, 410	124. 4	3, 410	87. 92	4, 410	67. 99	5, 410	55. 42	6, 410	46. 77	7, 410	40. 46	8, 410	35. 65	9, 410	31. 86
420	713. 9	1, 420	211. 1	2, 420	123. 9	3, 420	87. 67	4, 420	67. 83	5, 420	55. 32	6, 420	46. 70	7, 420	40. 41	8, 420	35. 61	9, 420	31. 83
430	697. 3	1, 430	209. 7	2, 430	123. 4	3, 430	87. 41	4, 430	67. 68	5, 430	55. 22	6, 430	46. 63	7, 430	40. 35	8, 430	35. 57	9, 430	31. 79
440	681. 4	1, 440	208. 2	2, 440	122. 9	3, 440	87. 16	4, 440	67. 53	5, 440	55. 11	6, 440	46. 56	7, 440	40. 30	8, 440	35. 52	9, 440	31. 76
450	666. 3	1, 450	206. 8	2, 450	122. 4	3, 450	86. 90	4, 450	67. 38	5, 450	55. 01	6, 450	46. 48	7, 450	40. 24	8, 450	35. 48	9, 450	31. 73
460	651. 8	1, 460	205. 4	2, 460	121. 9	3, 460	86. 65	4, 460	67. 22	5, 460	54. 91	6, 460	46. 41	7, 460	40. 19	8, 460	35. 44	9, 460	31. 69
470	637. 9	1, 470	204. 0	2, 470	121. 4	3, 470	86. 40	4, 470	67. 07	5, 470	54. 81	6, 470	46. 34	7, 470	40. 14	8, 470	35. 40	9, 470	31. 66
480	624. 6	1, 480	202. 6	2, 480	120. 9	3, 480	86. 16	4, 480	66. 92	5, 480	54. 71	6, 480	46. 27	7, 480	40. 08	8, 480	35. 36	9, 480	31. 63
490	611. 9	1, 490	201. 2	2, 490	120. 4	3, 490	85. 91	4, 490	66. 78	5, 490	54. 61	6, 490	46. 20	7, 490	40. 03	8, 490	35. 31	9, 490	31. 59
500	599. 6	1, 500	199. 9	2, 500	119. 9	3, 500	85. 66	4, 500	66. 63	5, 500	54. 51	6, 500	46. 13	7, 500	39. 98	8, 500	35. 27	9, 500	31. 56
510	587. 9	1, 510	198. 6	2, 510	119. 5	3, 510	85. 42	4, 510	66. 48	5, 510	54. 41	6, 510	46. 06	7, 510	39. 92	8, 510	35. 23	9, 510	31. 53
520	576. 6	1, 520	197. 2	2, 520	119. 0	3, 520	85. 18	4, 520	66. 33	5, 520	54. 32	6, 520	45. 98	7, 520	39. 87	8, 520	35. 19	9, 520	31. 49
530	565. 7	1, 530	196. 0	2, 530	118. 5	3, 530	84. 94	4, 530	66. 19	5, 530	54. 22	6, 530	45. 91	7, 530	39. 82	8, 530	35. 15	9, 530	31. 46
540	555. 2	1, 540	194. 7	2, 540	118. 0	3, 540	84. 70	4, 540	66. 04	5, 540	54. 12	6, 540	45. 84	7, 540	39. 76	8, 540	35. 11	9, 540	31. 43
550	545. 1	1, 550	193. 4	2, 550	117. 6	3, 550	84. 46	4, 550	65. 89	5, 550	54. 02	6, 550	45. 77	7, 550	39. 71	8, 550	35. 07	9, 550	31. 39
560	535. 4	1, 560	192. 2	2, 560	117. 1	3, 560	84. 22	4, 560	65. 75	5, 560	53. 92	6, 560	45. 70	7, 560	39. 66	8, 560	35. 03	9, 560	31. 36
570	526. 0	1, 570	191. 0	2, 570	116. 7	3, 570	83. 98	4, 570	65. 61	5, 570	53. 83	6, 570	45. 63	7, 570	39. 61	8, 570	34. 98	9, 570	31. 33
580	516. 9	1, 580	189. 8	2, 580	116. 2	3, 580	83. 75	4, 580	65. 46	5, 580	53. 73	6, 580	45. 57	7, 580	39. 55	8, 580	34. 94	9, 580	31. 30
590	508. 2	1, 590	188. 6	2, 590	115. 8	3, 590	83. 52	4, 590	65. 32	5, 590	53. 64	6, 590	45. 50	7, 590	39. 50	8, 590	34. 90	9, 590	31. 26
600	499. 7	1, 600	187. 4	2, 600	115. 3	3, 600	83. 28	4, 600	65. 18	5, 600	53. 54	6, 600	45. 43	7, 600	39. 45	8, 600	34. 86	9, 600	31. 23
610	491. 5	1, 610	186. 2	2, 610	114. 9	3, 610	83. 05	4, 610	65. 04	5, 610	53. 44	6, 610	45. 36	7, 610	39. 40	8, 610	34. 82	9, 610	31. 20
620	483. 6	1, 620	185. 1	2, 620	114. 4	3, 620	82. 82	4, 620	64. 90	5, 620	53. 35	6, 620	45. 29	7, 620	39. 35	8, 620	34. 78	9, 620	31. 17
630	475. 9	1, 630	183. 9	2, 630	114. 0	3, 630	82. 60	4, 630	64. 76	5, 630	53. 25	6, 630	45. 22	7, 630	39. 29	8, 630	34. 74	9, 630	31. 13
640	468. 5	1, 640	182. 8	2, 640	113. 6	3, 640	82. 37	4, 640	64. 62	5, 640	53. 16	6, 640	45. 15	7, 640	39. 24	8, 640	34. 70	9, 640	31. 10
650	461. 3	1, 650	181. 7	2, 650	113. 1	3, 650	82. 14	4, 650	64. 48	5, 650	53. 07	6, 650	45. 09	7, 650	39. 19	8, 650	34. 66	9, 650	31. 07
660	454. 3	1, 660	180. 6	2, 660	112. 7	3, 660	81. 92	4, 660	64. 34	5, 660	52. 97	6, 660	45. 02	7, 660	39. 14	8, 660	34. 62	9, 660	31. 04
670	447. 5	1, 670	179. 5	2, 670	112. 3	3, 670	81. 70	4, 670	64. 20	5, 670	52. 88	6, 670	44. 95	7, 670	39. 09	8, 670	34. 58	9, 670	31. 01
680	440. 9	1, 680	178. 5	2, 680	111. 9	3, 680	81. 47	4, 680	64. 06	5, 680	52. 79	6, 680	44. 88	7, 680	39. 04	8, 680	34. 54	9, 680	30. 97
690	434. 5	1, 690	177. 4	2, 690	111. 5	3, 690	81. 25	4, 690	63. 93	5, 690	52. 69	6, 690	44. 82	7, 690	38. 99	8, 690	34. 50	9, 690	30. 94
700	428. 3	1, 700	176. 4	2, 700	111. 0	3, 700	81. 03	4, 700	63. 79	5, 700	52. 60	6, 700	44. 75	7, 700	38. 94	8, 700	34. 46	9, 700	30. 91
710	422. 3	1, 710	175. 3	2, 710	110. 6	3, 710	80. 81	4, 710	63. 66	5, 710	52. 51	6, 710	44. 68	7, 710	38. 89	8, 710	34. 42	9, 710	30. 88
720	416. 4	1, 720	174. 3	2, 720	110. 2	3, 720	80. 60	4, 720	63. 52	5, 720	52. 42	6, 720	44. 62	7, 720	38. 84	8, 720	34. 38	9, 720	30. 85
730	410. 7	1, 730	173. 3	2, 730	109. 8	3, 730	80. 38	4, 730	63. 39	5, 730	52. 32	6, 730	44. 55	7, 730	38. 79	8, 730	34. 34	9, 730	30. 81
740	405. 2	1, 740	172. 3	2, 740	109. 4	3, 740	80. 17	4, 740	63. 25	5, 740	52. 23	6, 740	44. 48	7, 740	38. 74	8, 740	34. 30	9, 740	30. 78
750	399. 8	1, 750	171. 3	2, 750	109. 0	3, 750	79. 95	4, 750	63. 12	5, 750	52. 14	6, 750	44. 42	7, 750	38. 69	8, 750	34. 27	9, 750	30. 75
760	394. 5	1, 760	170. 4	2, 760	108. 6	3, 760	79. 74	4, 760	62. 99	5, 760	52. 05	6, 760	44. 35	7, 760	38. 64	8, 760	34. 23	9, 760	30. 72
770	389. 4	1, 770	169. 4	2, 770	108. 2	3, 770	79. 53	4, 770	62. 86	5, 770	51. 96	6, 770	44. 29	7, 770	38. 59	8, 770	34. 19	9, 770	30. 69
780	384. 4	1, 780	168. 4	2, 780	107. 8	3, 780	79. 32	4, 780	62. 72	5, 780	51. 87	6, 780	44. 22	7, 780	38. 54	8, 780	34. 15	9, 780	30. 66
790	379. 5	1, 790	167. 5	2, 790	107. 5	3, 790	79. 11	4, 790	62. 59	5, 790	51. 78	6, 790	44. 16	7, 790	38. 49	8, 790	34. 11	9, 790	30. 63
800	374. 8	1, 800	166. 6	2, 800	107. 1	3, 800	78. 90	4, 800	62. 46	5, 800	51. 69	6, 800	44. 09	7, 800	38. 44	8, 800	34. 07	9, 800	30. 59
810	370. 2	1, 810	165. 6	2, 810	106. 7	3, 810	78. 69	4, 810	62. 33	5, 810	51. 60	6, 810	44. 03	7, 810	38. 39	8, 810	34. 03	9, 810	30. 56
820	365. 6	1, 820	164. 7	2, 820	106. 3	3, 820	78. 49	4, 820	62. 20	5, 820	51. 52	6, 820	43. 96	7, 820	38. 34	8, 820	33. 99	9, 820	30. 53
830	361. 2	1, 830	163. 8	2, 830	105. 9	3, 830	78. 28	4, 830	62. 07	5, 830	51. 43	6, 830	43. 90	7, 830	38. 29	8, 830	33. 95	9, 830	30. 50
840	356. 9	1, 840	162. 9	2, 840	105. 6	3, 840	78. 08	4, 840	61. 95	5, 840	51. 34	6, 840	43. 83	7, 840	38. 24	8, 840	33. 92	9, 840	30. 47
850	352. 7	1, 850	162. 1	2, 850	105. 2	3, 850	77. 88	4, 850	61. 82	5, 850	51. 25	6, 850	43. 77	7, 850	38. 19	8, 850	33. 88	9, 850	30. 44
860	348. 6	1, 860	161. 2	2, 860	104. 8	3, 860	77. 67	4, 860	61. 69	5, 860	51. 16	6, 860	43. 71	7, 860	38. 14	8, 860	33. 84	9, 860	30. 41
870	344. 6	1, 870	160. 3	2, 870	104. 5	3, 870	77. 47	4, 870	61. 56	5, 870	51. 08	6, 870	43. 64	7, 870	38. 10	8, 870	33. 80	9, 870	30. 38
880	340. 7	1, 880	159. 5	2, 880	104. 1	3, 880	77. 27	4, 880	61. 44	5, 880	50. 99	6, 880	43. 58	7, 880	38. 05	8, 880	33. 76	9, 880	30. 35
890	336. 9	1, 890	158. 6	2, 890	103. 7	3, 890	77. 07	4, 890	61. 31	5, 890	50. 90	6, 890	43. 52	7, 890	38. 00	8, 890	33. 73	9, 890	30. 32
900	333. 1	1, 900	157. 8	2, 900	103. 4	3, 900	76. 88	4, 900	61. 19	5, 900	50. 82	6, 900	43. 45	7, 900	37. 95	8, 900	33. 69	9, 900	30. 28
910	329. 5	1, 910	157. 0	2, 910	103. 0	3, 910	76. 68	4, 910	61. 06	5, 910	50. 73	6, 910	43. 39	7, 910	37. 90	8, 910	33. 65	9, 910	30. 25
920	325. 9	1, 920	156. 2	2, 920	102. 7	3, 920	76. 48	4, 920	60. 94	5, 920	50. 65	6, 920	43. 33	7, 920	37. 86	8, 920	33. 61	9, 920	30. 22
930	322. 4	1, 930	155. 3	2, 930	102. 3	3, 930	76. 29	4, 930	60. 82	5, 930	50. 56	6, 930	43. 26	7, 930	37. 81	8, 930	33. 57	9, 930	30. 19
940	319. 0	1, 940	154. 5	2, 940	102. 0	3, 940	76. 10	4, 940	60. 69	5, 940	50. 47	6, 940	43. 20	7, 940	37. 76	8, 940	33. 54	9, 940	30. 16
950	315. 6	1, 950	153. 8	2, 950	101. 6	3, 950	75. 90	4, 950	60. 57	5, 950	50. 39	6, 950	43. 14	7, 950	37. 71	8, 950	33. 50	9, 950	30. 13
960	312. 3	1, 960	153. 0	2, 960	101. 3	3, 960	75. 71	4, 960	60. 45	5, 960	50. 31	6, 960	43. 08	7, 960	37. 67	8, 960	33. 46	9, 960	30. 10
970	309. 1	1, 970	152. 2	2, 970	100. 9	3, 970	75. 52	4, 970	60. 33	5, 970	50. 22	6, 970	43. 02	7, 970	37. 62	8, 970	33. 42	9, 970	30. 07
980	303. 9	1, 980	151. 4	2, 980	100. 6	3, 980	75. 33	4, 980	60. 20	5, 980	50. 14	6, 980	42. 95	7, 980	37. 57	8, 980	33. 39	9, 980	30. 04
990	302. 8	1, 990	150. 7	2, 990	100. 3	3, 990	75. 14	4, 990	60. 08	5, 990	50. 05	6, 990	42. 89	7, 990	37. 52	8, 990	33. 35	9, 990	30. 01
1, 000	299. 8	2, 000	149. 9	3, 000	99. 94	4, 000	74. 96	5, 000	59. 96	6, 000	49. 97	7, 000	42. 83	8, 000	37. 48	9, 000	33. 31	10, 000	29. 98

The table for converting frequency in kilocycles and wavelength in meters.

How to Operate the Set

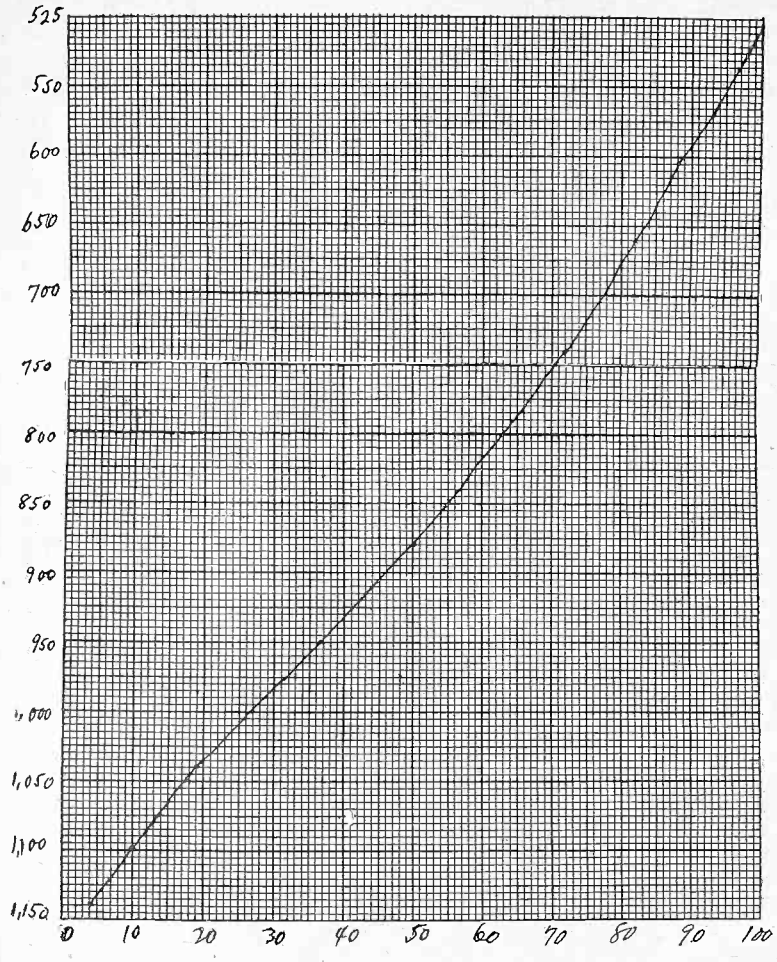


FIG. 8.
The largest coil again, this time on a frequency, instead of wavelength basis.

(*Concluded from page 6*)

that purpose, but is not sufficient to disturb logging.

"The broadcast listener will find KDKA on 64 meters practically every evening during the week. WGY broadcasts experimental programs at irregular times on waves between 105 and 15 meters, 2YT, at Poldhu, Ireland, is on about 94 meters with experimental work. G2NM, at London, on about 44 meters, may be heard most nights after 10 p. m. Eastern Standard Time. Several Australian, European and South American stations may also be heard on voice between 30 and 50 meters, as well as dozens of American broadcast station harmonics on short waves."

Daylight Saving Change Made by Many Stations

Numerous broadcasting programs were affected by Daylight Saving which went into effect in those communities observing it April 24. It will mean, for instance, that the early morning New York radio gymnasium classes will have to be given on two schedules, an hour earlier for New York and territories which have daylight savings and an hour later for Washington, D. C., and cities which do not observe it.

Power Line and Trees Cause N. Y. Interference

WASHINGTON.

A super-power line carrying 60,000 volts through northern New York was found to be the source of a great amount of interference to listeners in that section, according to a report to the Radio Bureau of the Department of Commerce. In addition to the super-power line, the Department's radio inspector found that considerable interference was also noticed which was directly traceable to poor binding of rails of the local traction company, and also to shade trees touching and grounding the primary and distributing lines of the lighting system.

Exhaustive tests were carried out with a radio test car in company with officials of the power line, the traction company and representatives of the local radio association who were given suggestions as to the proper methods for eliminating the trouble.

MORE SCIENTISTS WANTED

Civil service examinations will close May 25th to fill the positions of associated physicist, $3,000 a year, and assistant physicist, $2,400, to fill vacancies in the Bureau of Standards at Washington and the Bureau of Mines, for duty in Pittsburgh.

Tabulated Dialing Of 16 Frequencies

The dial settings of C1 for nine stations, using Coil No. 1, follow:

Station	Wave-length	Frequency	Dial
WNYC	526.	570	93
WEAF	491.5	610	88
WJZ	454.3	660	82
WOR	405.2	740	72
WMCA	340.7	880	50
WGBS	315.6	950	36½
WLWL	288.3	1,040	19
WEBJ	272.6	1,100	10
WBPI	263	1,140	4

[NOTE: 4 on the dial represents minimum capacity setting of the condenser, due to condenser end stop.]

The following is the table for Coil No. 2, on eight stations:

Station	Wave-length	Frequency	Dial
WBPI	263	1,140	97
WRNY	258.5	1,160	96
WNJ	252	1,190	94
WHAP	239.9	1,250	91
WJBI	218.8	1,370	84
WMSG	212.6	1,410	82
WBNY	209.7	1,430	81
WMCA (2d. har.)	170.5	1,760	59

Family Got Dressed Up To Be At Radio Function

An amusing incident in connection with the laying of the cornerstone for the new $10,000,000 National Press Club Building in Washington was related by Henry L. Sweinhart, in charge of the ceremonies. Mr. Sweinhart had sent an invitation to the affair to some relatives in a small town near Philadelphia. They were unable to attend but insofar as they were concerned he completely overlooked the fact that the event was to be broadcast.

A few days later he received a letter from his cousin saying, "We couldn't come in person so we accepted by radio. Mother got all dressed up for the occasion and our grandson came running home from school early. We assembled in the parlor and were tremendously thrilled to hear your name announced with that of the President of the United States and then to hear your voice."

London Plans Theatre For Broadcasting Only

A theatre where plays will be presented for broadcasting is London's newest idea. There will be no audience in the theatre.

An experiment was made at Covent Garden Opera House, where an opera was performed and broadcast, there being no stage setting or costumes used.

The public was admitted to the performance for a small amount, which, however, defrayed the cost of the production, which has therefore recommended itself to broadcasters.

SUMMER RADIO FOR MIDDIES

In addition to the instruction in aviation this summer of the 275 members of the present graduation class of the Naval Academy, they will also be put through their paces with regard to radio code.

The Coils for the Fenway

Experiences of a Hot Summer Night and a Wizard Coil Winder Narrated.

By Leo Fenway

(*Copyrighted*, 1926)

IT is axiomatic that one swallow does not make a summer, that one radio announcer does not make a broadcasting station and that one great long distance record does not make a radio set. Yet swallows and announcers and great distance records all have a tendency to bring about the respective ends. Confining this line of reasoning to radio receivers I find that the value of a single long distance record is oftentimes inestimable if the feat is accomplished during the hot weather months. You have now guessed that a Fenway Super brought London into New York City, and that guess being wrong I will tell you what actually did happen.

But, before I burden you with the details, I wish to make it plain that I've never had any illusions about this same Fenway being able to duplicate at will the stations which were brought in on the speaker that hot, sweltering night last June. Luck was with my receiver that night. Just as luck is with ALL receivers which accomplish the seemingly impossible. Skill in tuning helps, naturally, but the element of luck is not without its influence.

Work on a Hot Night

It was along about the middle of June, while New York was "crisping" under the worst hot spell that the oldest inhabitant could remember, that I'd decided to throw together some of the radio "junk" I'd had around the laboratory and see what kind of a set I could build. Bear in mind that this was "junk" in the truest sense, not high-class radio apparatus. None of those excellent Silver Marshall plug-in coils were on hand; none of the type of condenser that has made General Radio famous was available; Airgap sockets were conspicuous by their absence; Jewell meters would have been a luxury and copper cans (such as are now used in the Fenway) were still in the embryo stage. In a word, the lab had been stripped of all its valuables, and nothing save the ghosts of old-time sets was there. No; there was one modern thing left that had escaped the eye of the hinterland tourist; that was a Wizard Wire Winder. There it stood—waiting for me to wind a Fenway antenna coil, oscillator coil, and two-circuit coupler. Presently I found two pieces of Bakeilte tubing, 2" in diameter, 3" long and about ⅛" wall; I placed one of these in the Wizard Wire Winder and wound 84 turns of No. 32 double cotton covered wire, with a tap at the fifth turn. I used this coil for the antenna circuit, connecting the aerial to the fifth tap, the ground to the first tap (the start of the wire), and the grid of the first tube to the 84th turn. A variable condenser, probably a relic of the honeycomb coil days, of .00035 capacity, was connected across the coil, that is, the rotor plates were connected to the ground end and the stator plates to the grid end. This formed what is now known as condenser C1 and coil L (see RADIO WORLD, Feb. 6 issue).

The Other Coils

Condensers C2 and C3 (also mentioned in Feb. 6 issue), were of the same capacity but of a different make. The other piece of 2" tubing I used for the oscillator coil, winding 84 turns for the grid coil (L4), 35 turns for the plate coil (L5), and 10 turns for the pick-up coil (L3). The coil L3, consisting of 10 turns, was wound directly over the coil L5, which was the plate coil. A thin piece of paper being used to separate the two coils. This made an ideal oscillator when tuned with the .00035 condenser.

The two circuit coupler, for controlling regeneration on the first radio frequency stage, was next tackled. A bare form made by General Radio, and called their type 268 coupler, was next placed in the wire winder and upon this was wound 63 turns of the same wire. The rotor of this coupler contained 11 and 13 turns, also of the same No. 32 wire. So far, I had an antenna circuit, a modulator circuit and an oscillator; the next step was the intermediate frequency amplifier. I searched the lab high and low but could not find a single unit that resembled a long wave transformer, so I decided to make them.

Should I make air-core or iron transformers? I knew that iron core transformers would be easier to make, would not require such close matching, and, after all, would prove more efficient than the air-core variety. Three old Acme audio transformers, which had seen many a day of wonderful service, were utilized for the purpose. The wire was removed on all three instruments and three new coils were made and placed upon the Acme frame. Each coil consisted of a primary of 500 turns of No. 32 single silk enameled wire, wound carelessly, and a secondary of 2,000 turns of No. 36 single silk enameled wire, also wound in a haphazard manner. Between the primary and secondary windings was placed several sheets of ordinary writing paper. That was all. No empire cloth was used. No dope of any nature was employed, nor were the coils baked.

The Connections

The "start" of the primary winding was connected to the plate and the finish and the finish of the winding to the B battery; the start of the secondary winding was connected to the filament, or grid return, and the finsh of the secondary to the grid. An ordinary wooden spool, such as is used to hold magnet wire, served as a form for the input transformer, which, of course, was of the air-core variety. Upon this spool was wound (the Wizard Wire Winder being used for the purpose with excellent results) 300 turns of the No. 32 wire for the primary and 1,780 turns of the No. 36 wire for the secondary. Across the primary terminals was placed a .006 fixed condenser, which tuned the transformer to approximately 42 kilocycles. With the transformers completed I set aside the wire winder and commenced the construction of the set, which was to be a 9 tube super heterodyne. Despite the intensity of the heat, it was soon completed. Tubes were placed in the sockets; batteries, antennae and ground connected, and, finally, the loud speaker. The filament switch, an old Federal salvaged from an Amrad set, was coaxed into action and pretty soon the speaker began to act as if it had a bad case of asthma. The 90 volts of B battery which had been placed on the intermediate transformers was doing its stuff too strongly. Immediately a Royalty resistance was placed in that circuit and music and speech commenced to fill the lab.

The Fenway Super-Heterodyne was a reality! It worked! Hours later still found me fussing with various ideas. And did I get London that amazingly hot June night? I'll tell the cock-eyed world I didn't! I didn't even reach out to California! But stations like Chicago, Boston, Schene?e e——No, I didn't get that station, either!

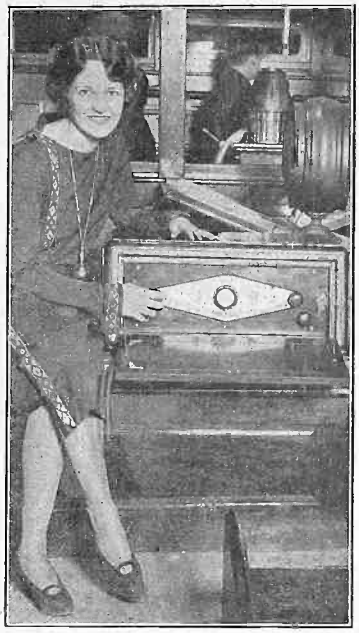
Anyway, I was satisfied that with a little more selectivity the Fenway would be a wonder. So I set about getting the desired sharpness to the set. Shielding! That's what it needed! Of course you can understand that by this time I was hungry. A little crackers and milk were the thing on a hot night. A few Saltines and a jar of milk. Saltines? Yes, indeed! That was the start.

Now you've guessed the whole works. The Saltine tin cans were used for the Fenway. A picture of the set, using Saltine cans was published in last weeks' RADIO WORLD, on page 19. Examine that picture. If you cannot see your way clear to buy copper cans, then the saltine tins will answer the purpose—very nicely.

So, then, if you are building a Fenway you may be glad to know that you can wind your own coils and transformers. You can buy your cans from the National Biscuit Company—and eat the crackers! Naturally, the tins will not last as long as copper but they will serve the purpose, and for the fellow who simply hasn't the necessary wherewithal they are much cheaper.

Since I introduced the Super-Heterodyne with total shielding and a stage of tuned radio frequency with regeneration distance fans have been given a new target to shoot at. Because overnight the Fenway has become a sensation. On locals or distance its performance has won the whole-hearted tribute of the man who turns the dials, and a phrase was coined . . . . "FENWAY—for DX."

A Waterproof Cabinet



ONE of the latest developments of radio is the waterproof case or cabinet for a receiver that is to be used on a yacht. The one photographed is shown in its waterproof case. It is a five-tube, two-control set. (Kadel & Herbert)

Radio University

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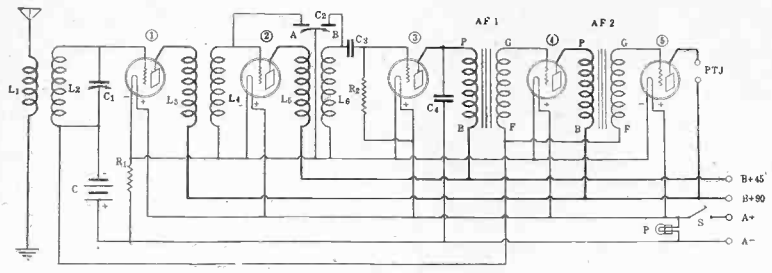


FIG. 307
A 2-CONTROL 5-tube tuned radio frequency receiver, requested by Anne Cruikshank.

I WOULD LIKE a diagram of a 2-control set of the tuned radio frequency type, having only two controls.—Anne Cruikshank, 1 West Ninety-seventh Street, New York City.

Fig. 307 shows the diagram. The controls are kept down to two by using a 2-section condenser. This has one rotor but two separate stators. Each stator (A and B) has .0005 mfd. maximum capacity. A common C battery is used for the first RF and two audio tubes. This is about 4½ volts. A single ballast may control all tubes, which, if of the —01A type, would require the 1¼ ampere type. L1L2 is wound on a 3½" diameter tubing. Use No. 24 double cotton covered wire. L1 has 12 turns. Leave ¼" space and wind 47 turns for L2. L3L4 and L5L6 are wound alike. L3 has 5 turns, ¼" space, and L4 has 47 turns. Repeat formula for L5L6. The "skinny primaries" are for oscillation control, otherwise some balancing means must be employed. C1 is .0005 mfd., C2 is .0005 for A and B sections, individually; C4 is .0005 or .001 mfd. AF1 is of low ratio, while AF2 may be higher. The same ratio may be used in both stages, but where you have unlike ratios, place the higher ratio in the first stage. PTJ represents phone tip jacks at the rear of the baseboard. Drill two holes in the rear wall of the cabinet to introduce the speaker cords. SP is a combination switch and pilot light. R1 is a 1¼ ampere ballast, R2 is 5 meg., C2 is .00025 mfd. The tubes are (1) first RF; (2) second RF; (3) detector; (4) first audio; (5) second audio. A 7x24" panel should be used. On it are only the two dials and the pilot switch. The only subs are balancing the set, solved by the two small primaries, and matching L4 and L2.

* * *

IN REGARD to the 1-tube receiver described by William Mercer in the Feb. 20 issue of RADIO WORLD: (1)—I would like to add a stage of radio-frequency amplification to this set. Can this be done successfully? If so, the description of the wiring would be greatly appreciated. (2)—Will this stage of RF amplification increase the selectivity of the receiver?—Robert Small, 108 3rd St., N. E., Washington, D. C.

(1)—The radio-frequency coil consists of 65 turns of No. 22 double cotton covered wire wound on a diameter 3¼" in diameter. The grid and the plate coil in the detector circuit remain the same, e.g., new plate or antenna winding consists of 15 turns, while the grid or secondary winding consists of 42 turns. This winding is continuous. However, when the RF addition is made, there is a special plate or primary winding made for the plate of the RF tube. This consists of 15 turns, wound on the same tubing as the plate and grid windings of the detector tube circuit. A .0005 mfd. variable condenser is placed in series with the antenna. One terminal of the .0005 mfd. condenser goes to the beginning of the RF coil and also to the G post on the new socket, which will carry the RF tube. The other terminal of the variable condenser is connected to the antenna post. The end of this coil goes to the ground post and to the A minus post. The resistance terminal of a 6-ohm rheostat goes to the F minus post on this socket. The terminal on this rheostat connecting with the movable arm goes to the A minus post, which as stated before went to the ground also. The beginning of the new primary of the detector coil goes to the P post on the first socket. The end of this winding goes to the B plus Amp. post. The rest of the circuit remains the same. (2)—Yes.

* * *

I HAVE built the Chemical B battery eliminator, described in the Jan. 2 issue of RADIO WORLD by Lewis Winner, and am well pleased with it. However, after two hours the transformer heats up. This causes the voltage to drop. What can I do to remedy this?—E. M. Bennet, 421 East 146 St., Cleveland, O.

The main trouble lies in the secondary windings. They will not pass the required voltage. The primary should consist of 1,000 turns and the secondary should have at least 1,150 turns of No. 26 enameled wire wound on a closed core, described in the Dec. 19 issue of RADIO WORLD. Be sure that none of the plates in the jars is touching, especially in jars 1 and 3, where the lead plates are grounded. The aluminum and lead plates must be pure. The solution may contain impurities such as iron filings, which adhere to the plates and cause them to be impure. They also cause an actual decrease in the surface of the plates. This would have a tendency to prevent the amount of current that has to be rectified, feeding it back to the secondary winding of the transformer, which can stand only a certain load.

* * *

AS TO the Tectron B battery eliminator, described by Lewis Winner in the March 20 issue of RADIO WORLD. (1)—The positions of the holes in the shell type lamination are not stated. (2)—The tapering down of the gap at C is pretty difficult to make by hand. Could not this gap be made by just cutting the lamination at this point on a straight edge? (3)—The schematic diagram shows the primary winding as if it were in two sections. Is this true, or is that a way of representing a primary winding for both the step-down and the step-up portions of the secondary winding, even though the winding is continuous?—Charles H. Patterson, 221 West Park Ave., Anaconda, Mont.

(1)—Both holes are ⅜" from the top and bottom respectively and ⅜" from the sides of B. (2)—This gap can be made on a straight edge. (3)—The winding is continuous. Your method of explanation is O. K.

* * *

CAN THE Federal fixed radio frequency transformers be used in the intermediate stages in the Bernard Portable, described in the April 3, 10, 17 and 24 issues of RADIO WORLD? (2)—Can loud speaker volume on stations about 1,000 miles distant be received on this set?—George F. Brown, 11 Reo St., Buffalo, N. Y.

(1)—Yes, if of the intermediate wave, as distinguished from the broadcast wave type. (2)—Not consistently.

* * *

I AM rebuilding my 3-tube 3-circuit tuner receiver. At present I am using two stages of transformer coupled audio-frequency amplification. I would like, however, to use only a single stage of the transformer coupled AF amplification with two stages of resistance coupled AF. I would appreciate a diagram showing how to add the stage of transformer and the two stages of resistance coupled AF amplification to the output of this set. I have only one rheostat, so that will have to do for the three tubes. I do not wish to use a C battery, as I have a B eliminator. State the constants of the resistors etc.—Francis Edwards, North Brewster, Mass.

Fig. 308, shows the diagram of the amplifier stages. R is a ¾ ampere, 6 ohm rheostat. At least 135 volts should be applied to the plates of the tubes in the resistance stages. The fixed condenser across the primary of the first AFT is not necessary, except if the detector tube does not oscillate enough.

* * *

THE DIAGRAM of the original Tectron B battery eliminator is requested. The transformer, condensers, choke constants are requested also.—Jack Connely, Mount Solon, Va.

Fig. 309, shows the diagram. The pri-

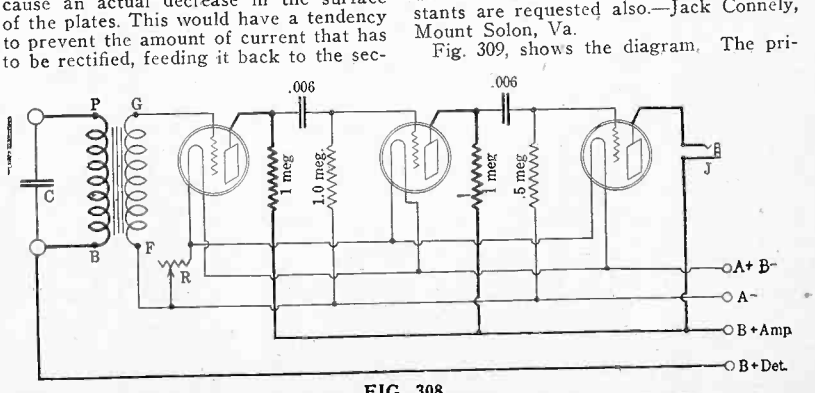


FIG. 308
The diagram of the transformer and two resistance stages of AF amplification.

mary of the transformer consists of 920 turns of No. 26 enameled wire. The secondary, PS, consists of 3,680 turns, tapped at the 1,840th turn. No. 31 enameled wire is used here This is the secondary supplying voltage to the plate of the tubes. The filament secondary, FS, or the one which supplies voltage to the filaments of the tubes, consists of 50 turns, tapped at the 25th turn. No. 18 enameled wire is used here. The primary is first wound, the plate voltage secondary over this and the filament secondary over this winding. The Dec. 19 issue of RADIO WORLD, should be referred to, as to the method of making the core, etc. for this transformer. Using the shell type of lamination, the choke coils consist of 5,800 turns of No. 32 enameled wire. Using the closed core type of lamination, the choke coils consist of 6,850 turns. The core for the shell type consists of 80 laminations, while the core for the closed type consists of 120 laminations. The method of making the core for these chokes is described in the March 20 issue. These chokes may be bought and if so contain 30 henries. C1 and C2 are .5 mfd. fixed condensers. C3 is a 3 mfd. fixed condenser. C4 is a 2 mfd. fixed condenser. C5 is a .6 mfd. fixed condenser. C6 is a .5 mfd. fixed condenser. R2 is a variable resistance, having a range of from zero to 5 megohms. R1 is 10,000 ohm fixed resistor. The secondary of this transformer will supply 220 volts.

* * *

I HAVE a double condenser, each section having a capacity of .0005 mfd. I would like to build a 4-tube receiver using this condenser, shunting the secondaries of a radio frequency transformer and a 3-circuit tuner. I wish to use transformer coupled audio frequency amplification. Please state the constants of the RFT and the tuner, as well as the rheostat, etc.—Arthur Jameson, Telford, Pa.

Fig. 310 shows the diagram of a receiver you request. The primaries L1 and L3, consists of 10 turns, wound on a tubing 3¼" in diameter. The secondaries, L2 and L4, consists of 45 turns, wound on this same tubing as their respective primaries. No. 22 double cotton covered wire is used. There is a ⅜" separation between the two windings. The tickler, L5, is wound on a tubing 2¼" in diameter and consists of 36 turns. No. 26 single silk covered wire is used here. The tickler coil shaft is placed in the space left between the primary and secondary windings of the tuner. C1, is the dougle condenser. The total capacity of this condenser is .001, but each section has a capacity of .0005 mfd. R1 is a ¼ ampere ballast resistor. C2 is a .00025 mfd. fixed grid condenser. R4 is a variable resistor. R2 is a 10 ohm rheostat. C3 and C4 are both .0005 mfd. fixed condensers. R5 is a 10,000 ohm fixed resistor. R3 is a 6 ohm rheostat. S1 and S2 are both filament switches. The audio transformers used, should both be of the low ratio type. The —01A type of tube should be used throughout. The C battery should be of the 4.5 volt type, provided 90 volts are applied to the plate of the amplifier tubes.

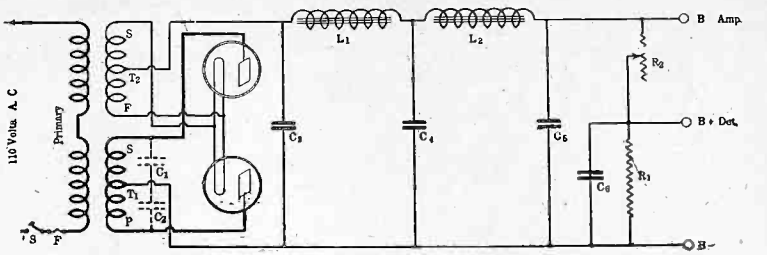


FIG. 309

The electrical diagram of the original Tectron B eliminator.

* * *

I HAVE decided to build the 1925 Model Diamond of the Air. Now I have a 3-circuit tuner, wound thus: primary 10 turns; secondary, 41 turns, and tickler 42 turns. The primary and secondary are wound on a tubing 3" in diameter, with a ⅜" separation between the windings. The tickler is wound on a tubing 2¼" in diameter. No. 24 double silk covered wire is used in both cases. I would like to make a RFT to match this tuner. I have a tubing 2½" in diameter, on which I wish to wind this coil.—Philip Antenone, N. Y. City.

The primary will consist of 10 turns. The secondary will consist of 55 turns. Use No 24 double silk covered wire. Use a 3" diameter tubing.

* * *

I HAVE a manufactured receiver which employs two stages of tuned radio frequency amplification, a none-regenerative detector and two stages of transformer coupled audio-frequency amplification. I find that my two 45-volt B batteries run down quite frequently. I was told that if I install a 4.5 volt C battery the B batteries would last much longer. How would these be wired in the set?—James Franklin, Brooklyn, N. Y.

Instead of having the two F minus leads of the transformers go to the A minus post, bring them to the minus post of the C battery. Bring the plus post of this battery to the A minus post.

* * *

IS IT possible to receive more distance and also louder signals on the Harkness 2-tube reflex than the 2-tube speaker set described in the March 20 issue of RADIO WORLD or are they both equal? (2)—Will the Carborundum crystal detector work efficiently in either of these sets?—Cletus F. King, 221 Natchez St., Mt. Washington, Pittsburgh, Pa.

(1)—Equal. (2)—Yes.

* * *

I HAVE a 3-tube receiver, employing a 3-circuit tuner and two stages of audio-frequency amplification. No matter which way I turn the tickler knob the tube will not oscillate. The tickler consists of 30 turns of No. 26 SCC wire, on a 2¼" tubing. The tickler coil is not shorted or are there any broken wires in this coil. What could I do to make this tube oscillate?—S. Rossi, 500 Madison Ave., N. Y. City.

Add 8 turns to the tickler coil or place a .0005 mfd. fixed condenser from the end of the coil to A minus Increase the plate voltage for the detector tube.

* * *

I WISH to have the diagram of the Schnell tuner, with a stage of transformer coupled AF amplification, and the constants of the coil, condenser, etc., stated.

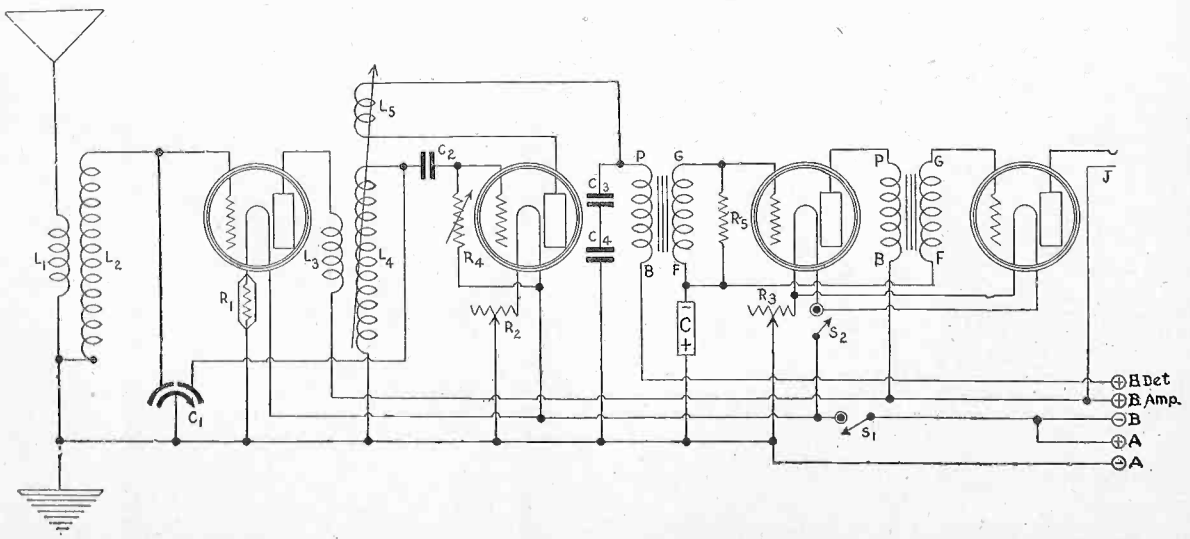


FIG. 310

The electrical diagram of a 2-control 4-tube receiver.

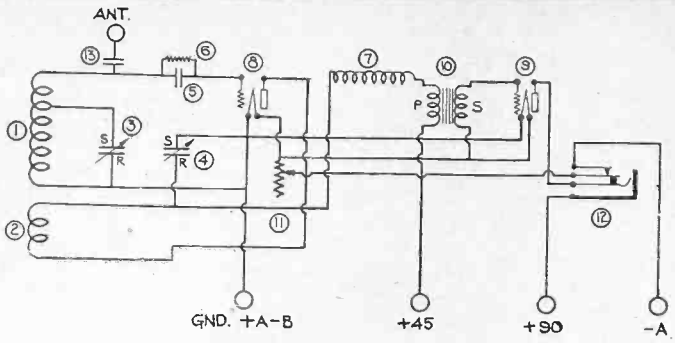


FIG. 311
The schematic diagram of the Schnell tuner with a stage of AF amplification.

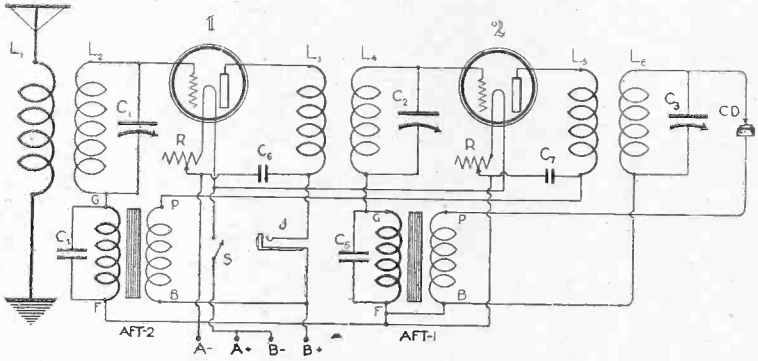


FIG. 312
The electrical diagram of the Grimes Inverse Duplex.

I wish to use this receiver to receive stations from 40 to 85 meters.—Andrew Drew, Fox Bluff, Tenn.

Fig. 311, shows the diagram. 1 is the secondary coil, consisting of 9 turns wound on a form 3½" in diameter. A tap is taken 3 turns from the grid side of the coil. The variable condenser, 3, is shunted across the remaining 6 turns. The tickler coil, 2, is wound on the same form as 1 and consists of 5 turns. The space between these two is ⅛". Condensers 3 and 4 are of the .00025 mfd. variable type. The SLF type work very well here. The grid condenser, 5, is of the .00025 mfd. fixed type. The grid leak, 6, is of the 3 megohm type. The radio frequency choke coil, 7, consists of 100 turns of No. 30 wire wound on a form 1" in diameter and about 5" long. The rheostat, 11, is of the 10 ohm type. The tubes, 8 and 9, are of the —01A type. The audio frequency transformer, 10, is of a high ratio type, such as the Western Electric, 201G. The jack, 12, is of the single circuit, filament control type. In series with the antenna is a .0005 mfd. fixed condenser, 13.

* * *

I WOULD like to have the circuit diagram of a 2-tube receiver, which is voluminous on distant signals. Please state constants of coils, etc.—Frederick Boodman, Carpenter, Okla.

Fig. 312, shows the diagram of a reflex, known as the Grimes Inverse Duplex, which will serve your purpose. L1, the primary, consists of 10 turns wound on a tubing 3½" in diameter and 4" high. The secondary, L2, is wound on the same tubing. This consists of 43 turns. L3 and L5 consist of the same number of turns and wound on a tubing having the same dimensions as for L1 and L2. The same applies to L4 and L6. C1, C2 and C3 are all .0005 mfd. variable condensers. C4, C5 are both .0001 mfd. fixed condensers. C6 and C7 are .001 mfd. fixed condensers. The rheostats, R have a resistance of 10 ohms and a carrying capacity of ¼ ohms. Both the AFT used here are of the medium ratio type, e. g., 5 to 1. CD is the crystal detector. The —01A type tubes are used here. J is a single circuit jack. The B voltage to be applied to the plates of the two tubes need be experimented with, they varying from 45 to 67½ volts.

* * *

I WOULD appreciate the schematic diagram of a 4-tube receiver employing a stage of tuned radio-frequency amplification, an efficient detector and two stages of transformer coupled amplification. I have three .0005 mfd. variable condensers, which I wish to use. If it is possible, use one of these as a controller of regeneration in the set.

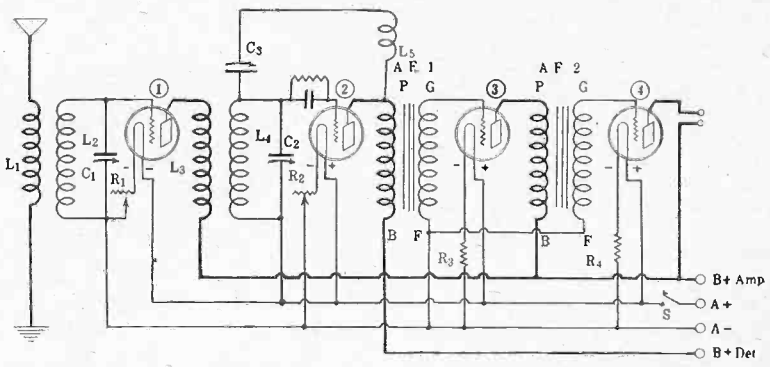


FIG. 313
The diagram of the receiver requested by G. H. Long.

I would appreciate the installation to control the filaments of the detector and the RF tubes with rheostats, while those of the amplifier with ballast resistors.—G. H. Long, Danbury, N. H.

Fig. 313 shows the electrical diagram of the receiver you desire. The primaries, L1 and L3, consist of 10 turns, wound on a tubing 3¼" in diameter. The secondaries, L2 and L4 consist of 45 turns. These are wound on the tubings with their respective primaries, L1 and L3. No. 22 doubled cotton covered wire is used. There is no separation between the two windings on each coil. The plate coil, L5, consists of 35 turns, wound on a tubing 3" in diameter. C1, C2 and C3 are all .0005 mfd. variable condensers. R1 and R2 are each ohm, ¼ ampere carrying capacity rheostats. R3 and R4 are both ¼ ampere ballast resistors. The standard 2 megohm, .00025 mfd. grid leak and condenser combination are employed. A filament switch, S, is connected in series with the positive side of the A battery.

Borah Bill Causes Furor; Aimed at Hoover's Power

WASHINGTON.

If the Borah radio control bill should reach the floor of the Senate in anywhere near its present form it would probably precipitate the biggest fight in Congress in the history of radio. And due to this opposition, and the very short time between now and the time Congress is expected to adjourn, June 1, there would be little likelihood of the measure being voted on at the present session.

The trouble making possibilities of the bill are that it would take radio control from Secretary Hoover and give it to an independent commission patterned after the Interstate Commerce Commission. This would make the Borah bill virtually an anti-Administration measure as the White bill, which has already passed the House by a large vote, lodges the power with Mr. Hoover, with an advisory commission to settle controversial points. Also the Borah bill contains the most drastic anti-monopoly and anti-trust provisions yet written into a radio bill.

Introduction a Surprise

Its introduction came as a complete surprise as Senator Borah, who is chairman of the Foreign Relations Committee, was heretofore not known to be concerned with radio. Some of his opponents went so far as to say that he had given so little thought to the subject that he never could have written so comprehensive a bill, which by the way covers thirty-one typewritten pages, and takes into account practically everything provided for in the White, Dill, and Howell bills, to say nothing of a couple of provisions strongly advocated by Judge Ewin L. Davis, a Democratic representative from Tennessee.

Nevertheless Senator Borah seemed thoroughly familiar with the subject of radio, saying:

"I have had such a bill as this in mind for a long time. In fact I wrote portions of it before many other radio control bills were introduced. I first became interested in radio through its possibilities for the control of free speech."

Senator Borah said that he didn't believe the bill would require separate hearings as hearings had already been held upon the principal points.

Called 75% of White Bill

A critic of the Borah bill said:

"There is virtually nothing new in it. The bill presented by Mr. Borah is 75 per cent. of the White bill. The big difference, of course, is that it gives radio control over to a commission instead of lodging it with Secretary Hoover. And really dangerous are its stringent anti-monopoly provisions and the adding of judicial to administrative powers of the commission.

"If the commission decides that an applicant is engaged in any violation of or attempt to violate anti-trust laws or the Federal Trade Commission Act, it may refuse the issuance of a license. The question of deciding whether or not a corporation is in effect a monopoly is not a simple one. For instance, if in its wisdom, the Commission should decide to withhold a license to the Radio Corporation of America, say, while the matter were being thrashed out in the court of appeals, practically the entire trans-Atlantic and trans-Pacific commercial wireless communication system might be put out of business. As it is now, the Radio Corporation is the only concern that has wireless connections with Europe, South America, Hawaii and Japan. It would mean that all that business for the time being might go back to the cable heretofore not shared with any other means of communication until wireless came along."

Fight On Hoover

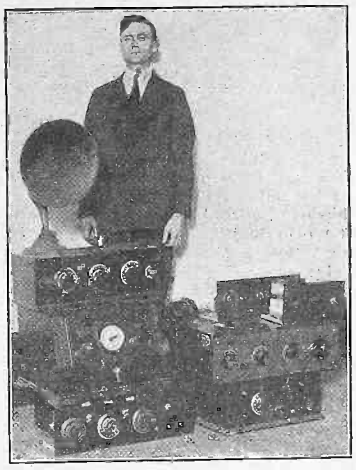
A coincidence about the introduction of a bill by Senator Borah which would create an independent commission and take radio away from Hoover is that it follows considerable talk along this line credited to certain Administration Senators who, because of personal political ambitions are said not to like Mr. Hoover any too well and have not been enthusiastic over his getting a better hold on radio control.

In several places in the Borah bill, though he specifically provides for Commission control, where it would seem that the commission should be designated the words "Secretary of Commerce" appear. One of these instances is in Section 9, another in Section 12, and two instances in Section 21. According to the critics these sections were lifted bodily out of the White bill but in the haste of recopying the stenographer failed to change "Secretary of Commerce" to "the commission."

Coming in for special attention was the opening sentence in the bill which reads, in part, as follows: "That no person shall engage in the business of transmission of radio communications in connection with any other business or commercial purpose."

It was said that the only stations in this country which are now operating which could pass muster on this would be the religious or educational stations.

Alleged Radio Burglar



FOR WEEKS the police hunted the radio burglar, who had stolen many sets from homes in New York City. Above is shown Paul Hilton, caught at the Polo Grounds by suspecting detectives. Hilton was accused of being the radio burglar. He is shown with some stolen sets. He is alleged to have confessed, also, the slaying of one policeman and the shooting of three others. (Internataional Newsreel).

WEAF Chain Gets $2,700 An Hour for Time on Air

Answering charges by E. C. Mills, chairman of the executive committee, American Society of Authors, Composers and Publishers, Paul B. Klugh, executive chairman, National Association of Broadcasters, said:

"Mr. Mills charges us with having gone before Congress to request legislation that would enable us to fix prices at which to seize the music copyright owner's property. This is untrue. We are on record repeatedly as in favor of giving the copyright owner sole control of his compositions. We are perfectly willing to let Congress, the American Society or any constituted authority fix the rates, and to let the copyright owner decide whether or not his songs shall be broadcast.

Asks For Permanence

"What we do desire is permanence and stability. As matters stand, there is no uniformity of charges made by the American Society to broadcasting stations of the same power. From year to year they increase their license demands as much as 500 per cent., and frequently they withdraw musical numbers at the precise moment when the public wants to hear them most.

"It would not be so serious if the American Society did not control 90 per cent. of the music in which the public is interested.

The $2,700 an Hour

"Mr. Mills says that the American Telephone and Telegraph Company leases WEAF to individual users at the rate of $2,700 an hour, or 1,000 times the price of an hour's rendition of copyrighted songs. This is a misrepresentation. The $2,700 an hour is the figure for using WEAF and fourteen leading stations in conjunction, each of which would be paying a separate license fee."

Mr. Klugh asked a modification of the law concerning "mechanical reproducers" to include broadcasting stations. In this manner, he said, the rates for broadcasting songs would be as stable as phonograph rates.

Borah Bill Provides For 3-Man Radio Board

WASHINGTON.

Senator Borah (Idaho) has introduced a bill to take the control of radio out of the hands of the Department of Commerce and place it in the custody of a national commission of three persons appointed by the President.

The bill would divide the United States into five radio zones and the commission would have power to issue and suspend licenses for cause. Appeal could be taken from its decision to the Court of Appeals of the District of Columbia.

The measure would reaffirm the applicability to radio of the anti-trust laws and the Federal Trade Commission act.

Crosley and Shepard Find Music Fees Arbitrary

WASHINGTON.

The arguments over the Dill-Vestal Copyright Bill, whereby Congress or some other agency would fix the fees to be paid by stations to music composers and publishers, stirred some of the leading radio men to protest against the present "unsystematic system" and to attack rate exorbitancy.

John Shepard, 3d, vice-president of the Shepard Stores of Boston, operators of Station WNEC, and treasurer of the National Association of Broadcasters, explained how the new contract offered him by the Music Publishers for 1926 would make his payments for the use of copyright music 7,000 per cent. more than he paid for this service in 1925. Mr. Shepard also pointed out that the music people had asked $20 per hour for certain types of programs from his station, when they were licensing a station in Chicago of ten times his power for $10 an hour, and a station in Minneapolis-Saint Paul with power of 5,000 watts, or ten times the power of WNAC, pays only $5 per hour.

Crosley's Experiences

Powel Crosley, Jr., Cincinnati radio manufacturer, and operator of Station WLW, who is vice-president of the National Association of Broadcasters, told of his experiences in attempting to use music not controlled by the American Society and stated that he felt it was virtually impossible to prepare a program the public would be enthusiastic over that did not include music controlled by the music publishers' organization.

Mr. Crosley also made a plea for a scale of charges for the use of copyright music that would extend over a period of years at some definite figure that would enable the broadcasters to have some definite idea of coming expenses and prepare for these expenses accordingly.

Mr. Crosley expressed the belief that the total revenue from toll broadcasting to all stations was not sufficient to cover the cost of program arrangement and operating stations—excluding all replacements and costs or investment charges for broadcasting stations. "In the case of WLW," he said, "we have spent every cent derived from occasional toll programs, putting the money back into better programs on our non-toll hours."

Attacks Composers' Society

Charles H. Tuttle, general counsel for the National Association of Broadcasters, reviewed the situation as concerns the use of copyright music and explained the operations of the American Society of Authors, Composers and Publishers at length, quoting from their by-laws.

A self-perpetuating body, the board of directors of the American Society, controls the situation in every way, he said, with the power to expel a member, to declare dividends or to place the funds collected for the use of music written or published by the members in a special emergency fund. The men who comprise the board of directors of this organization actually dominate the musical tastes of the nation, as they have the power at will to permit broadcasting, or to withdraw a number from broadcasting, he said.

Queried as to whether or not the American Society constituted a combination in restraint of trade, Judge Tuttle explained how this organization was not dealing in a commodity that could be handled in interstate commerce, and therefore was beyond the reach of the anti-trust laws. Denouncing the Society as a monopoly, the witness explained that only through legislation could this organization be curbed.

Tells of Per Number Basis

Elisha Hansen, of the American Newspaper Publishers' Association, explained the position taken by the organization he represented. A great many newspapers, probably a hundred, were directly involved in broadcasting, while several hundred other newspapers provide occasional programs or other features for broadcasting stations.

Wm. S. Hedges, of the Chicago Daily News, pointed out the essential character of music to broadcasters while the increased costs for license fees were calculated to be a heavy burden on the broadcasters.

Alfred L. Smith, general manager of the Musical Industries Chamber of Commerce, explained that while his organization was not directly concerned in the bill, the per number payment for the use of copyright music on phonograph records and music rolls had worked out to the satisfaction of all parties concerned in the mechanical recording field. He explained that the extension of the per number payment of royalty plan to the broadcasting field was merely a modernization of the law of 1909 which the music publishers asked for and fought for.

Harkness' Proposal

W. E. Harkness, chairman of the committee on conference between the American Society and the National Association of Broadcasters, told of the rates paid by broadcasting stations for the use of copyright music. In the past year the fees per hour paid by broadcasters ran as high as $1.92 per hour. The new contracts call for rates as high as $20 per hour, Mr. Harkness pointed out.

Mr. Harkness offered a proposed schedule of payments under the Dill Bill which provides for a definite payment for each time a copyright number is broadcast. This proposal of payments, as made by the conference committee of the National Association of Broadcasters, was figured on the power of the stations of under one hundred watts and as high as sixty cents per number for stations of over five thousand watts.

Broadcasters Give Their Side In a Nutshell

The National Association of Broadcasters made public the following questionaire, with their own answers:

1. Are the broadcasters willing to pay for the use of copyrighted music?

Yes. They want to pay every copyright owner liberally.

2. Who shall determine the rate of payment?

The broadcasters leave the rate to Congress, the American Society of Composers, Authors and Publishers, or to any constituted authority. They are interested in permanence and stability more than the actual amount.

3. Should the copyright owner determine whether or not his music shall be broadcast?

The copyright owner should have the sole right to say whether or not his music shall be broadcast. The broadcaster believes that if the copyright owner decides to broadcast his music, then all stations of similar power and size should make similar payment for the use of the music.

4. Why are broadcasters seeking legislation?

Because the American Society controls 90% of the music the public wants to hear, and in trying to deal with them the broadcasters have found that there is no uniformity of their charges to stations of the same power, that from year to year they increase their license demands as much as 500%, and that they frequently withdraw musical numbers just when the public wants to hear them most.

5. How will the Dill-Vestal Copyright Bill benefit the copyright owner?

They will insure every copyright owner being paid the full rate every time his composition is used, and would eliminate the high overhead cost of collecting license fees under the present system, said to approximate 65%.

Applause for Girl Includes Two Dogs

Following her appearance on the air, Mary Frances Glenn, a 17-year-old soprano of the Washington Opera Company, is said to have received 123 telegrams and two dogs (a bull terrier and a Russian wolfhound).

Stations Ask Permanency; Not Seeking Cut Rates

"Broadcasters of America have no desire to upset the workings of the law of supply and demand and we would welcome an opportunity to bargain for the use of copyright music under the conditions of the ordinary law of economic supply and demand," said Paul B. Klugh, executive chairman of the National Association of Broadcasters. "As explained by Judge Charles H. Tuttle, counsel for the broadcasters, when he was questioned by Congressman Lanham of Texas at the hearings of the Dill-Vestal Copyright Bill, we are not asking that the law of supply and demand be twisted, but rather that it be permitted to operate and that the monopoly which has control of the copyright music of the nation be curbed in its efforts to divert demand and to artificially raise prices to unreasonably heights."

Mr. Klugh recently addressed a letter to members of the American Society of Composers, Authors and Publishers replying to a newspaper statement by E. C. Mills, chairman of the executive committee of the music publishers' organization.

After calling attention to the fact that the rates introduced at the recent hearings which the broadcasters believe fair as being in excess of the ideas advanced by the American Society, Mr. Klugh affirmed the position of the broadcasters as being willing to pay any rate that might be established.

"We want permanency, not cut rates," Mr. Klugh explained in the letter.

Prosecutor Dismayed At Victory by Zenith

WASHINGTON.

The Zenith Radio Corporation won the suit brought against it by the Federal Government to shut down the station because it used an unauthorized wavelength. Stephen B. Davis, counsel, of the Department of Commerce, said that this decision by Judge Wilkenson, in Chicago, conflicted with one made by the District of Columbia court in another case. However, no appeal can be taken, as the Zenith case was a criminal action.

Solicitor Davis said:

"The decision seems to be a definite holding that the 1912 radio act confers no authority upon any one to assign either wavelengths or time to radio stations. If this is the view of the law, it means that neither broadcasting nor other forms of radio communication are subject to any Federal regulation, but that station operators may select wave lengths and time at their wish.

"Secretary Hoover has always realized, and frequently expressed, the insufficiency of the 1912 law, and largely for that reason has dealt with the entire subject through annual conferences of all persons interested in radio communication, whether as transmitters or listeners. The conclusions of these conferences have almost universally been put into practice, so that radio has been largely a self regulated industry.

"The future would seem to depend entirely upon the attitude of Congress toward legislation and its determination as to whether or not Federal control of the situation shall be continued."

Helen Keller's Feat

BY the touch of the loud speaker, Helen Keller, world famous deaf and blind woman, receives vibrations which enable her to "listen in" and enjoy the "air programs" quite as much as does the more fortunate veriest radio fan. (Kadel & Herbert).

South African Farmers Hear WGY on Schedule

2XAF and Grant Dalton, an enterprising South African experimenter, have demonstrated that it is possible to schedule an 8,050 mile radio relay and make good on the program.

The annual agricultural show of the South African Union was held in Johannesburg during the week beginning March 28, and the show management believed that it would be a fitting climax to the week to give the visitors an opportunity to hear a radio program from the United States. Cables were exchanged with the General Electric Company and a definite time was fixed for the broadcasting, 4 to 6, eastern standard time, Saturday, April 3rd.

Message From Jardine

William M. Jardine, United States secretary of agriculture prepared a greeting to be read to the farmers of South Africa and other leaders in agricultural matters in the United States sent messages. There were musical numbers, including instrumental and vocal selections, and all were sent out on the 32.79 meter wave of 2XAF, from the studio of WGY.

South Africa reported by cable that the relay was a great success and then a few hours later, sifting through amateur channels, came a message from E. H. Cox, of Elsternwick, Victoria, Australia, to the effect that he had heard the whole program of 2XAF, as late as 7 o'clock, Sunday morning, April 4. Johannesburg got the program at about midnight.

South Africa's Thanks

The South African's cabled: "Much obliged your cooperation. Special program relayed Sunday a great success. Express our thanks to participants. South African agriculturists reciprocate wishes. Transmitting your Sunday morning dinner music."

The Australian, Mr. Cox (3BD) reported as follows: "Your concert to South Africa heard here 6 p. m. eastern standard, April 3. Heard very loud here three hours after sunrise. Signal would travel eastward from you so distance would be 14,000 miles. Congratulations. Do you ever use 32 meter phone about 4 a. m. eastern standard time? Heard phone as late as 7 a. m. and carrier came through as late as 8 a. m."

What 2XAF Is

2XAF is a little brother of the 50 kilowatt transmitter of WGY. It is one of six radio transmitters on the 54-acre radio laboratory of the General Electric Company, all of them supplied from a central power house. The station equipment is housed in a small one-story building, approximately 25 feet square. The wire that forms the aerial is only 50 feet long and about the diameter of a lead pencil. The energy is supplied to the antenna in the form of a very high frequency alternating current. The current reverses its direction of flow 18,280,000 times a second—a rather high rate of changing its mind. The frequency is held constant by the mechanical vibrations of a thin slab of quartz crystal. 2XAF uses ten kilowatts of power. It is estimated that it required one-twentieth of a second for the voice to travel from WGY's studio to the listener in South Africa.

9 Farms Out of Each 200 Have a Radio Receiver

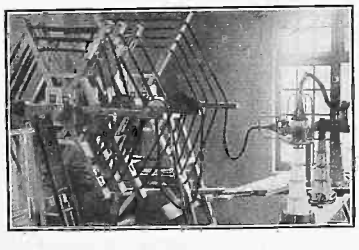
Government investigation discloses that radio sets are in operation on only 284,053 farms or only 4.5 of all the farms in the United States.

The latest States heard from are:

Arizona, 10,798 farms, 302 sets; Arkansas, 221,994 farms, 1,244 sets; Louisiana, 132,451 farms, 448 sets; Montana, 46,906 farms, 1,941 sets; New Mexico, 31,687 farms, 286 sets, and Texas, 465,642 farms, 11,734 sets.

The Government figures indicate that Illinois with 255,601 farms and 27,434 radio sets leads all other states. New York is second with 188,754 farms and 24,620 sets.

British Station Coil



THE HUGE inductance coil at the General Post Office wireless station at Hillmorton, near Rugby. This station is the biggest in England and is now sending to and receiving from the United States. (International Newsreel).

Rays From Searchlight Carry Voices to Radioists

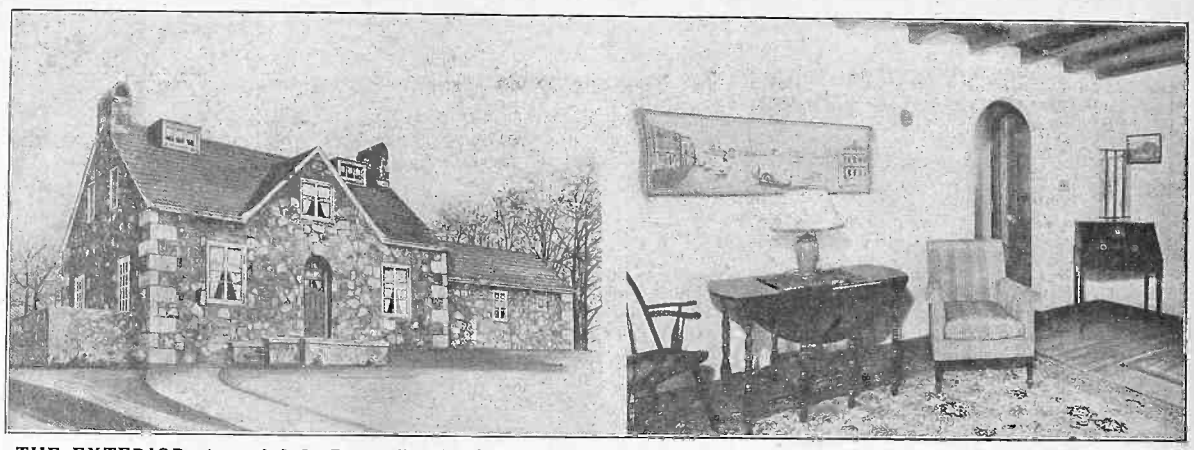
SCHENECTADY.

The General Electric Company is investigating a recent phenomenon whereby rays from a giant searchlight carried voices, making them audible to broadcast listeners.

The phenomenon occurred during an electrical exposition. It attracted attention and brought a representative to look into the matter. The searchlight used has 3,000,000 candle power. Comparison of time with the Alabama Power Company searchlight crew showed that the words heard by radio listeners were the same as those spoken by a man at the light, some persons hearing the words at a distance of three miles to the east. One report came from the north and two from the southern section.

The General Electric Company representative suggested that the arc light produced violet rays capable of ionizing the ether, thus transmitting the voice through the air in a definite channel.

The Model Radio House



THE EXTERIOR view of J. L. Bernard's Model Radio Home and a view of the living room, shown in lower right, also, in the isometric view. (Photo by Radio Corporation of America.)

Radio First, All Else Next, In Executive's Ideal Home

Remarkable Installation, Easy to Duplicate, Has Speaker Plug in Each Room, Aerial Built in Wall and Batteryless Operation on All Types of Current

A model "radio house" has been opened at Grymes Hill and Starlight Road, Staten Island, New York City.

The house is equipped with a complete radio receiving installation, which engineers contend can be duplicated in the average home without difficulty. Switches built in the walls, similar to the switches used to turn on and off the electric lights, control the radio circuits in the various rooms. Provision is made so that the loud speakers can be plugged into the circuit in the rooms in the same manner as the loud speaker is plugged into a receiver.

3-Fold Current Facilities

The house is equipped with three installations. One uses alternating current, another direct current and the third partial alternating and direct current. Any one can be used separately.

The experiment is to show that if a house is supplied with alternating current it can be used to operate the entire set by furnishing the current instead of "A" and "B" batteries. Or if direct current is available it can be used.

Time clocks are arranged in the circuit so that they can be set to turn the receiver on or off at a definite time. For example, the clock in the bedroom can be set to turn the radio on at 6 a. m., when the setting-up exercises begin.

No outdoor antenna is used. The wires used for picking up the passing ether waves are concealed within the walls, this having been done when the house was under construction. The master receiver is located in the living room. Six loud speakers are located throughout the house—in the living room, dining room, kitchen, two bedrooms and on the porch.

The "Radio House" serves as the home of J. L. Bernard, an executive of the Radio Corporation of America.

The Layout

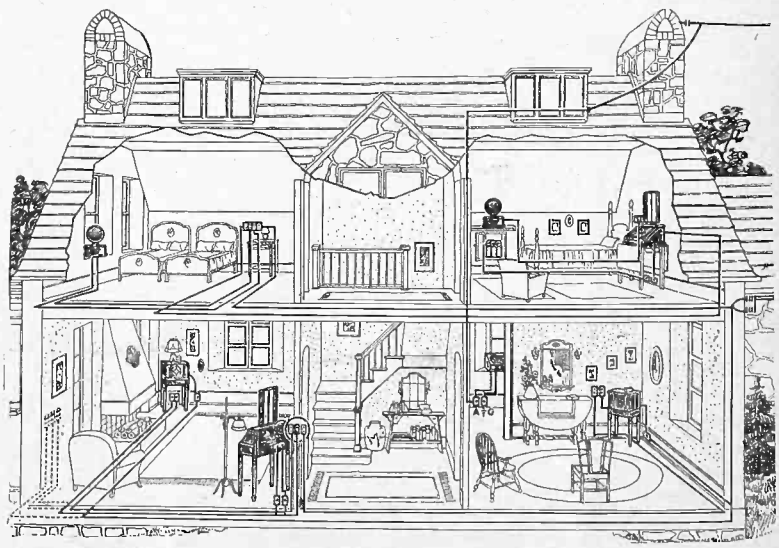
The rooms and their equipment follow:

Living room and dining room—The master set for the first floor, including porches but excluding the kitchen, is an 8-tube Super-Heterodyne receiver with loop antenna. This set supplies the input for a power loudspeaker in the living-room, opposite the set; and another in the dining-room. A three-gang switch, conveniently located at the left of the set, enables the operator to transfer the set output to either loud-speaker and to control the AC entering the power speakers at the distant points. A two-gang switch in dining-room provides remote control of the living-room set and AC to the dining-room loud-speaker. The A, B and C supplies are furnished by the loud-speakers; no batteries, antenna or ground are used.

Porch—The main porch, reached through doors in the living-room, is provided with suitable receptacles to accommodate the living-room loudspeaker which may be moved only five feet from its living-room position to the porch. Control of the speaker, when in its porch location, can be effected at either of the two points in living-room or dining-room.

Kitchen—The kitchen receiver is full-battery operated and uses an antenna as interceptor. This receiver is smaller than that used in the living-room, and because of the comparative size of the kitchen, no power speaker is used. In this case, the loudspeaker is plugged into the receiver. Antenna and ground connections are made by a duplex cable, the terminal plug of which engages with a double receptacle mounted in the baseboard.

Bedrooms, second floor—There are



ISOMETRIC view of the model radio house described on this page, showing position of radio receivers and loud speakers. Note outlets in baseboards, remote control switches and battery compartment on second floor. Speaker in the living room may be plugged in porch circuit. The antenna and other wiring, while shown exposed, is inclosed in walls.

WJZ Turns Missionary

SO MANY complaints of the interference caused to residents of the surrounding country have been received by WJZ that the super-power station is sending out experts to aid fans remedy the condition. The transmitter at Bound Brook, N. J., uses up to 50,000 watts. At left B. S. McCutcheon, investigator, is showing a fan how to tune a set and wavetrap to eliminate WJZ. At right he is shown examining a fan's home-made wavetrap and making suggestions for improving its efficiency. (Kadel & Herbert).

three bedrooms on the second floor of the radio House. One is designated as master's, another guests's while the third is known as kiddies'.

Master's bedroom—The master's bedroom contains the 6-tube Super-Heterodyne receiver. This set is located on a table at one side of the bed, while at the other side, at the head, is a control panel consisting of a number of "push" switches in gang. The loudspeaker and B battery eliminator are located on a small table at the foot of the bed about fifteen feet from the set. A batteries are concealed in a small closet where they may be reached conveniently.

Guest bedroom—The equipment in the guest bedroom consists of a push-button switch easily reached from the guest's bed, B battery eliminator and power loudspeaker. The speaker, eliminator and power amplifier are combined in two units. These units rest on a small table at the foot of the guest's bed.

Kiddies' room—Radio service for the kiddies' room is supplied by the speaker in the master's bedroom. A short extension cord permits the speaker to be moved slightly from its usual position, thus permitting the kiddies to hear children's hour programs in their own bedroom

Operation Downstairs

Living-room, dining-room and porch are served from a master receiver. Having selected the broadcasting station, the button at the master control panel is depressed and the living-room becomes vibrant with the broadcaster's offering. Pressing another button sends the concert to the dining room. From the dining-room the speaker can be silenced by touching the dining-room control. The same plan of control applies when the speaker is moved to its porch position.

The kitchen full-battery-operated receiver has no external or remote control connections. This receiver operates in the usual manner. It is independent of all other receiving apparatus in the house, but may be operated simultaneously with any and all other receivers without causing any annoyance.

Operation Upstairs

Master's, guest and kiddies' room are served by one set. Having selected the broadcasting station, the button at the master control panel is depressed and service is made available in the master's bedroom and kiddies' bedroom. Another button controls the circuit to the guest bedroom. The guest may disconnect loudspeaker in the guest room by touching a button beside the bed and still not affect reception in other rooms.

By pressing two buttons at the control plate, all of which are suitably marked, the receiver is ready for operation, as the AC and DC circuits to eliminator and receiver have been closed. The receiver is then tuned and radio service is available in master's bedroom. By closing another switch, the signal is also transferred to the guest room, and pressing still another makes the radio service available in the guest room only.

The radio wiring for the model radio house is entirely standard. Usual BX or flexible armored cable has been employed, together with standard outlet boxes, fittings and face plates, the last-mentioned being suitably engraved with radio designations. The work has been handled by the same electrical contractor who did the electric light wiring, without complications or additional difficulties. The installation of the radio equipment, which followed the wiring, has been handled by the radio service men. Indeed, the model radio house installation can be duplicated anywhere and at any time by electrical contractor and radio service man. The cost of radio house wiring, in the final analysis, is considerably less than that of a good radio receiver, yet it serves to increase the service rendered.

SO completely "sold" is WJZ on the wave trap idea that it promulgated the above photo, showing how the simple wave trap, on a portable, cuts out WJZ right under that station's aerial tower! This reads more like fiction than like science!

Industrial Committee Aids Standards Bureau

That the Government may profit by the practical experience of the radio industry, a committee has been formed which will assist and advise the Bureau of Standards in formulating its program of work. It is composed of the followings:

L. A. Hazeltine, Institute of Radio Engineers; Prof. A. E. Kennelly, American Institute of Electrical Engineers; Robert S. Kruse, American Radio Relay League; G. Lewis, National Association of Broadcasters; O. B. Blackwell, American Telephone and Telegraph Co.; Dr. A. N. Goldsmith, Radio Corporation of America; E. M. Kinney, General Electric Co.; F. Conrad, Westinghouse Electric & Mfg. Co.; and R. H. Manson, Associated Manufacturers of Electric Supplies.

A meeting of he new Advisory Committee was held in Washington and its members made an initial survey of the Radio Research Laboratory at the Bureau of Standards and are now at work on preliminary recommendations on the program.

The work of the bureau's radio laboratory comprises projects under the following headings: Maintenance of standards, testing of instruments, research on standards and methods of measurement.

A THOUGHT FOR THE WEEK

RADIO has been sharing the limelight with prohibition at Washington. The champions of both sides of the two investigations have agreeded to disagree to such an extent that the innocent bystander sometimes sympahizes with the noble mercutio—"A plague on both your houses."

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

The Link Connecting Radio Fan, Dealer, Jobber, Distributor and Manufacturer

Radio World's Slogan: "A radio set for every home."

TELEPHONE BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATION CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
(Just East of Broadway)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
FRED S. CLARK, Secretary and Manager
European Representatives: The International News Co.
Breams Bldgs., Chancery Lane, London, Eng.
Paris, France: Brentano's, 8 Avenue de l'Opera
San Francisco: Lloyd B. Chappell, 656 O'Farrell St.

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SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
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¼ Page, 4½" D. C.	115 lines	75.00
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WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities ten cents per word, $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

MAY 1, 1926

STATION CHANGES

Two broadcasting stations were discontinued. They were KFVR, Denver, Colorado, and KFXM, Beaumont, Texas.

The call signal of WFBI, Camden, has been changed to WCAM.

WGBX, Orono, Maine, is now operating on 234.2 meters with 500 watts power.

WAAW, Omaha, is operating part time on 384.4 meters. The station is permitted to operate on this wave before 8 p. m. to give market reports only.

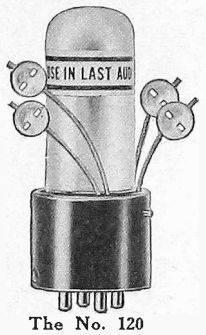
KFQB, Ft. Worth, is operating experimentally on Sunday on 508.2 meters.

KGW, Portland, Oregon, has increased its power to 1,000 watts.

Power Tubes Fit Any Set Due to New Socket Device

By Daniel McCabe

THE incorporation of a power tube in the last audio stage is fast becoming one of the most popular improvements in receivers, both of the factory-made and the home constructed class. The essential virtue of the power tube is its ability to carry the heavy load impressed on the final stage. Thus existing volume may be handled without distortion due to tube overloading, or greater volume may be achieved, without running into this distortion. These tubes have the new X bases and, as most popularly used, comprise the 120 and 112 type tubes. There are other power tubes, such as mu 6, which are in demand. There is another class, embodying tubes of larger drain, which are not used much in broadcast reception.



The No. 120 Connectorald

Considering therefore the 120 and 112 type tubes only, these may be inserted in any receiver, but wiring changes would have to be made, were it not for modern inventiveness, since the tubes require a greater B battery voltage and a negative grid bias for maximum results. As many receivers in use today have no easy method of adding the extra B voltage, nor introducing the leads for the C battery connections, it would be necessary not only partly to rewire the set, but also in some cases to supply a substitute socket for the last stage, to gain the advantage of use of the power tube. Fortunately, however, enterprise and ingenuity in socket manufacture enables the radioist to incorporate a power tube without changing a single part of the wiring of the set, and indeed without any technical knowledge of radio. All one need do is to insert the new socket, which serves as an adapter and is placed right in the existing socket.

The Changes Necessary

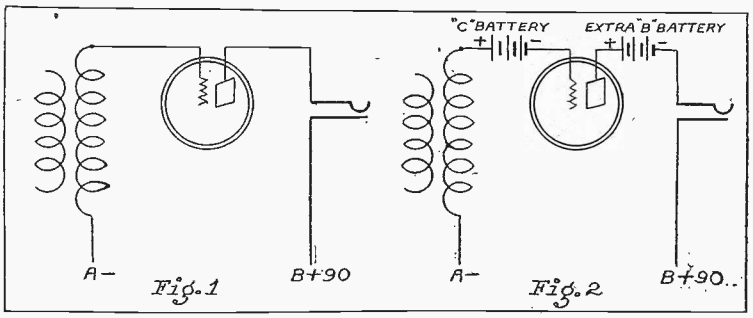
Let us see what change in connections is necessary to use a power tube. Fig. 1 shows the final output of a receiver. The B battery voltage on the plate is 90, while the grid of the last tube is connected to minus A through the secondary of an audio frequency transformer. The situation is the same if a resistance or impedance coupled stage precedes the final tube, hence no matter what form of audio is used. the connector-adapter is highly useful.

Now of the two power tubes, the 120 type requires 3 volts at the filament, draws .12 amperes at the filament, and usually is operated from dry cells. It calls for a large negative bias, usually 22½ volts or somewhat less. The 112 type requires 5 volts and draws .5 ampere at the filament, and requires a much smaller negative bias, say 9 volts for 135 volts on the plate of the last tube. Assuming, therefore, that 135 volts will be used on the plate, as this is quite satisfactory with either tube, the difference between the two tubes lies in the negative bias. As to the batteries, the extra ones needed are the C battery and the extra 45-volt B battery which will bring the voltage on the plate of the last tube up to 135 (90+45). For the 22½-volt C battery a small B battery type of that voltage may be used. In the other case two conventional C batteries of 4½ volts, connected in series, would be used to get the desired 9 volts. This means minus post of one is joined to plus of the other, the open posts being minus and plus, as marked on the batteries.

Easy to Connect

As for the connections, these would be made most simply by using connectors that function as adapters, and which have the necessary marked leads thereon for connection to the new batteries.

An example of this new convenience to radioists is the Connectorald, made by the Alden Manufacturing Company, of Springfield, Mass., in the following four types:



For 120 Tubes

No. 420, which fits in the regular UV199 socket, is for the Radiola Super-Heterodyne and the Super VIII, and holds the tube at an angle. This takes advantage of the space requirements in these receivers and makes the No. 420 of special service.

No. 920 is for all other sets that have UV199 sockets and holds the tube upright.

No. 120 fits the socket known familiarly as the UV201A type.

For 112 Tubes

No. 112 fits the old 201A sockets or the new UX-201A socket.

Polar Expedition Gets Three Low Wavelengths

A special license has been granted to the "New York Times" for the establishment of a station at Point Barrow, Alaska, to transmit news and messages regarding the Spring and Summer activities in and around the North Pole. The station is licensed as KDZ, and will operate on 21.4; 42.08; 74.77; and 149.2 meters.

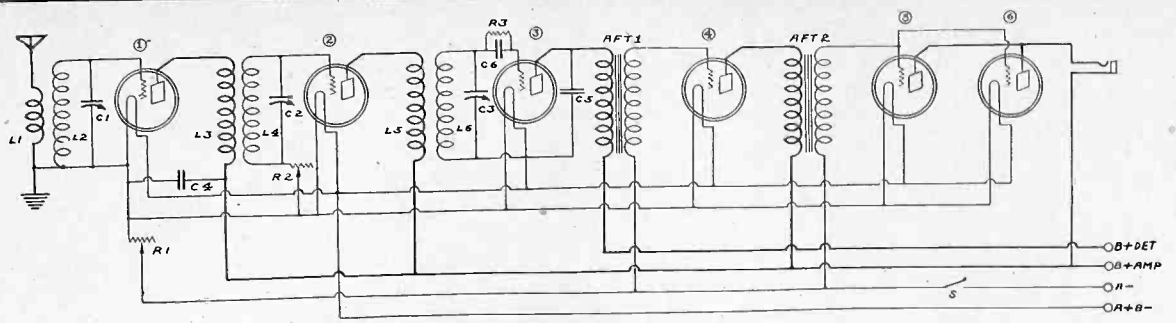


FIG. 1

THE ELECTRICAL diagram of the BST-6, the selective, voluminous and DX— getting 6-tube receiver.

FACTORY SETS

A DEPARTMENT Conducted for Present and Prospective Owners of Manufactured Receivers and Equipment. Address Questions to Factory Set Editor, RADIO WORLD, *145 West 45th Street, New York City.*

BST-6, a 6-Tube Receiver, Has Selective Radio Circuit and Balanced Audio for Tone Qualtiy.

The circuit diagram of a very selective, voluminous and distance getting receiver is shown in Fig. 1. It is the BST6, a 6-tube affair, wherein the first two tubes are employed as radio-frequency amplifiers, the next as a non-regenerative detector and the last three as audio frequency amplifiers. The RF tubes are arranged so that if oscillations are produced they will be controlled by the rheostat, R2, which has a high resistance. This balancing, once done need not be bothered with, unless the inner characteristics of the tube are changed or if you change the tubes around. The last two audio tubes are connected in parallel. That is, the plates and the grids are connected together. In this way, the signal output is balanced, so that no distortion occurs. You may use the five tubes only, leaving the last tube out of the socket. In the parallel balancing audio method, excellent amplification of all the audio notes is obtainable. Only one filament control is used. This shows that the filament control is not critical. Of course tubes having the same operating characteristics should be used.

In the center photograph of the group you will note that a special method of mounting the coils is employed. This is to further decrease the tendency of the tubes in the RF and detector portions to over-oscillate. The secondaries of the radio frequency transformers are so wound that when they are shunted by .0005 mfd. straight line frequency condensers they will cover the entire broadcast range of from 200 to 550 meters. With these condensers it is possible to avoid any jamming of the lower wavelength (high frequency) stations at the lower portions of the dial. This is indeed important, as there are a great many favorite stations operating at these wavelengths.

The set may be operated on dry cell or storage battery tubes. Any tubes with the X bases may be used in the sockets, also any of the following tubes, with the old bases: types UV201A, C301A, WD12, C12, DV5, DV3. For UV199 or C199 or DV3A adapters are necessary, but not for the UX or CX—99, etc. Also the C11 or WD11 requires a special socket, but not the X—11 tubes.

LIMITATIONS IN INDIA

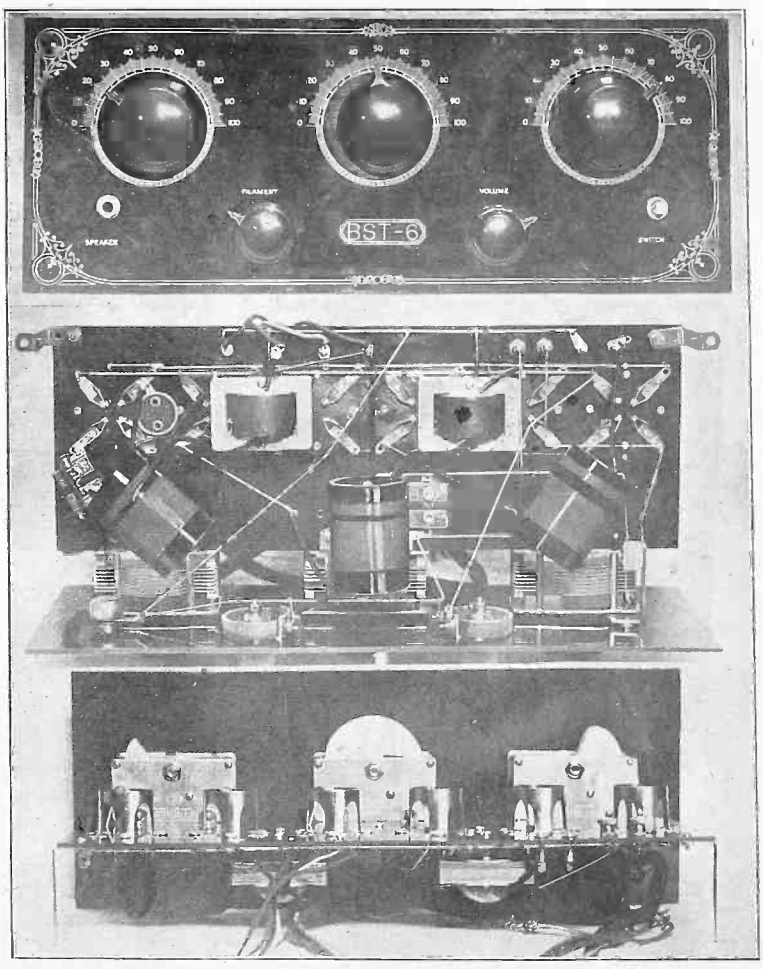
A set capable of receiving 1,000 miles in the United States is not effective for more than 500 miles in India, due to peculiar atmospheric conditions there.

REQUEST BY COOLIDGE

President Coolidge has requested Congress to carry over the appropriation of $30,000 for the International Radio Congress until next year.

ASKS FOR BOWED HEADS

Bishop Freeman, of Washington, D. C., succeeds in considerably strengthening his appeal when broadcasting an invocation by saying, "May I ask those who are listening in to bow their heads in prayer?"



FIGS. 2, 3 AND 4.

AT THE top, the panel view of the set (Fig. 2). The center photo shows the compact layout of the parts underneath the subbase. (Fig. 3). Note the special manner of the placing of the coils. At the bottom, a rear view, showing the special sockets (universal type) and the condensers. (Fig. 4).

The Official List of Stations

Corrected and Revised Up to April 21

Station	Owner and Location	Meters
KDKA	Westinghouse E. & M. Co., Pittsburgh, Pa.	309
KDLR	Radio Elec. Co., Devils Lake, N. D.	231
KDYL	Newhouse Hotel, Salt Lake City, Utah	246
KFAB	Nebraska Buick Auto Co., Lincoln Neb.	340
KFAD	Electrical Equipment Co., Phoenix Ariz.	273
KFAF	A. E. Fowler, San Jose, Calif.	217
KFAU	Ind. School Dist. of Boise, Boise, Idaho	280
KFBB	F. A. Buttry Co., Havre, Mont.	275
KFBC	W. K. Azbill, San Diego, Cal.	216
KFBK	Kimball Upson Co., Sacramento, Cal.	248
KFBL	Leese Bros., Everett, Wash.	224
KFBS	School District No. 1, Trinidad, Col.	238
KFBU	Bishop N. S. Thomas, Laramie, Wyo.	270
KFCB	Nielson Radio Co., Phoenix, Ariz.	238
KFDD	St. Michael's Cathedral, Boise, Idaho.	278
KFDM	Magnolia Petroleum Co., Beaumont, Texas	316
KFDX	1st Baptist Church, Shreveport, La.	250
KFDY	State College of Agriculture, Brookings, S. D.	273
KFDZ	H. O. Iberson, Minneapolis, Minn.	231
KFEC	Meier & Frank Co., Portland, Ore.	248
KFEL	Winner Radio Corp., Denver, Colo.	254
KFEQ	J. L. Scroggin, Oak, Neb.	268
KFEY	Bunker Hill & Sullivan, Kellog, Idaho	233
KFFP	1st Baptist Church, Moberly, Mo.	242
KFGQ	Crary Co., Boone, Iowa	226
KFH	Hotel Lassen, Wichita, Kans.	268
KFHA	Western State College, Gunnison, Colo.	252
KFHL	Penn College, Oskaloosa, Iowa	240
KFI	E. C. Anthony, Inc., Los Angeles, Cal.	469
KFIF	Benson Institute, Portland, Ore.	248
KFIO	North Central H. S., Spokane, Wash.	266
KFIQ	1st Methodist Church, Yakima, Wash.	256
KFIU	Alaska Elec. Co., Juneau, Alaska	226
KFIZ	Daily Commonwealth, Fond du Lac, Wis.	273
KFJB	Marshall Elec Co., Marshalltown, Ia.	248
KFJC	R. B. Fegan, Junction City, Kan.	219
KFJF	National Radio Co., Oklahoma City, Okla.	261
KFJI	Liberty Theatre, Astoria, Ore.	246
KFJM	University of N. D., Grand Forks, N. D.	278
KFJR	Ashley C. Dixon & Son, Portland, Ore.	263
KFJY	Tunwall Radio Co., Ft. Dodge, Iowa.	246
KFJZ	Southwestern Baptist Theo. Seminary, Ft. Worth, Tex.	254
KFKA	State Teachers College, Greeley, Colo.	273
KFKU	University of Kansas, Lawrence, Kans.	275
KFKX	Westinghouse E. & M. Co., Hastings, Neb.	288
KFKZ	F. M. Henry, Kirksville, Mo.	226
KFLR	University of N. M., Albuquerque, N. M.	254
KFLU	San Benito Radio Club, San Benito, Tex.	236
KFLV	Swedish Evangelist Church, Rockford, Ill.	229
KFLX	George R. Clough, Galveston, Texas.	240
KFLZ	Atlantic Auto Co., Anita, Ia.	273
KFMR	Morningside College, Sioux City, Iowa	261
KFMW	M. G. Sataren, Houghton, Mich.	263
KFMX	Carleton College, Northfield, Minn.	337
KFNF	Henry Field Seed Co., Shenandoah, Iowa	263
KFOA	Rhodes Company, Seattle, Wash.	454
KFOB	KFOB Inc., Burlingame, Cal.	226
KFON	Echophone Radio Shop, Long Beach, Cal.	233
KFOO	Latter Day Saints University, Salt Lake City, Utah.	236
KFOR	David City Tire & Elec. Co., David City, Neb.	226
KFOT	College Hill Radio Club, Wichita, Kan.	231
KFOX	Technical High School, Omaha, Neb.	248
KFOY	Beacon Radio Service, St. Paul, Minn.	252
KFPL	C. C. Baxter, Dublin, Texas.	252
KFPM	New Furniture Co., Greenville, Texas.	242
KFPR	Forestry Department, Los Angeles, Cal.	231
KFPW	St. John's Church, Carterville, Mo.	258
KFPY	Symonds Investment Co., Spokane, Wash.	266
KFQA	The Principia, St. Louis, Mo.	261
KFQB	Searchlight Publishing Co., Ft. Worth, Texas	263
KFQD	Chovin Supply Co., Anchorage, Alaska	227
KFQP	G. S. Carson, Jr., Iowa City, Ia.	224
KFQU	W. Riker, Holy City, Cal.	217
KFQW	F. C. Knierim, North Bend, Wash.	216
KFQZ	Taft Radio Co., Hollywood, Cal.	226
KFRB	Hall Bros., Beeville, Texas.	248
KFRC	City of Paris, San Francisco, Cal.	268
KFRU	Stephens College, Columbia, Mo.	500
KFRW	United Churches, Olympia, Wash.	219
KFSG	Echo Park Evangelistic Ass'n., Los Angeles, Cal.	275
KFUL	T. Goggan & Bro., Galveston, Tex.	258
KFUM	W. D. Corley, Colorado Springs, Col.	240
KFUO	Concordia Theo. Seminary, St. Louis, Mo.	545
KFUP	Fitzsimmons General Hospital, Denver, Colo.	234
KFUR	Peery Building Co., Ogden, Utah.	224
KFUS	Louis L. Sherman, Oakland, Cal.	256
KFUT	University of Utah, Salt Lake City, Utah	261
KFUU	Coburn Radio Laboratories, Oakland, Cal.	220
KFVD	Chas. & W. J. McWhinnie, San Pedro, Cal.	205
KFVE	Film Corp., St. Louis, Mo.	240
KFVG	1st Meth. Epis. Church, Independence, Kan.	236
KFVI	56th Cav. Brigade, Houston, Tex.	240
KFVN	C. E. Bagley, Welcome, Minn.	227
KFVS	Hirsch Battery and Radio Co., Cape Girardeau, Mo.	224
KFVW	Airfan Radio Corp., San Diego, Cal.	246
KFVY	Radio Supply Co., Albuquerque, N. M.	250
KFWA	Browning Bros. Co., Ogden, Utah.	261
KFWB	Warner Bros. Pictures, Inc., Hollywood, Cal.	252
KFWC	L. E. Wall, San Bernardino, Cal.	211
KFWF	St. Louis Truth Center, St. Louis, Mo.	214
KFWH	F. Wellington Morse, Jr., Chico, Cal.	254
KFWO	Lawrence Mott, Avalon, Cal.	211
KFWI	Radio Entertainers, Inc., South San Francisco, Cal.	220
KFWM	Oakland Educational Soc., Oakland, Cal.	207
KFWU	Louisiana College, Pineville, La.	238
KFWV	Wilbur Jerman, Portland, Ore.	213
KFXB	B. O. Heller, Big Bear Lake, Cal.	203
KFXD	Service Radio Co., Logan, Utah.	205
KFXH	Bledsoe Radio Co., El Paso, Texas.	242
KFXJ	Mt. States Radio District, Inc., (Portable), Col.	216
KFXF	Pikes Peak Broadcasting Station Co., Colo. Springs, Colo.	250
KFXR	Classen Film Finishing Co., Okla. City, Okla.	214
KFXY	Mary M. Costigan, Flagstaff, Ariz.	205
KFYF	Carl's Radio Den, Oxnard, Cal.	205
KFYJ	Houston Chronicle, Houston, Tex., (Portable)	238
KFYO	Buchanan Vaugn Co., Texarkana, Tex.	210
KFYR	Hoskins Meyers, Inc., Bismarck, N. D.	248
KGO	General Electric Company, Oakland, Cal.	361
KGTT	Glad Tidings Tabernacle, San Francisco, Cal.	207
KGU	M. A. Mulrony, Honolulu, Hawaii.	270
KGW	The Oregonian, Portland, Ore.	492
KGY	St. Martin's College, Lacey, Wash.	246
KHJ	The Times, Los Angeles, Cal.	405
KHQ	Louis Wasmer, Spokane, Wash.	273
KJBS	J. Brunton & Sons Co., San Francisco, Cal.	220
KJR	Northwest Radio Co., Seattle, Wash.	384
KLDS	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.	441
KLS	Warner Bros., Radio Co., Oakland, Cal.	250
KLX	Tribune, Oakland, Cal.	508
KLZ	Reynolds Radio Co., Denver, Colo.	266
KMA	May Seed & Nursery Co., Shenandoah, Ia.	252
KMJ	Fresno Bee, Fresno, Cal.	234
KMO	Love Elec. Co., Tacoma, Wash.	250
KMOX	St. Louis Globe-Democrat, St. Louis, Mo.	280
KMMJ	M. M. Johnson Co., Clay Center, Nebr.	229
KNRC	C. B. Juneau, Hollywood, Cal.	208
KNTR	D. S. Garretson & K. M. Turner, Los Angeles, Cal.	238
KNX	Express, Hollywood, Cal.	337
KOA	General Electric Co., Denver, Col.	322
KOAC	Oregon Agricultural College, Corvallist, Ore.	280
KOB	College of Agri., State College, N. M.	349
KOCH	Omaha Central High School, Omaha, Neb.	258
KOCW	Okla. College for Women, Chickashia, Okla.	252
KOIL	Monarch Manufacturing Co., Council Bluffs, Ia.	278
KOWW	Blue Mountain Radio Ass., Walla Walla, Wash.	256
KPO	Hale Brothers, San Francisco, Cal.	429
KPPC	Pasadena Presbyterian Church, Pasadena, Cal.	229
KPRC	Houston Print Co., Houston, Tex.	297
KPSN	Pasadena Star-News, Pasadena, Cal.	316
KQP	H. B. Read, Portland, Ore.	213
KQV	Doubleday Hill Elec Co., Pittsburgh, Pa.	275
KQW	First Baptist Church, San Jose, Cal.	227
KRE	Gazette, Berkeley, Cal.	256
KSAC	Kansas State Agricultural College, Manhattan, Kans.	341
KSD	Post Dispatch, St. Louis, Mo.	545
KSL	Radio Service Corp., Salt Lake City, Utah	300
KSMR	S. M. Valley R. R. Co., Santa Maria Cal.	210
KSO	A. A. Berry Seed Co., Clarinda, Ia.	242
KTAB	Tenth Ave. Baptist Church, Oakland, Cal.	240
KTBI	Bible Inst Los Angeles, Cal.	294
KTBR	Brown's Radio Shop, Portland, Ore.	263
KTCL	American Radio Tel. Co., Inc., Seattle, Wash.	306
KTHS	New Arlington Hotel, Hot Springs, Ark.	375
KTNT	N. Baker, Muscatine, Ia.	256
KTW	1st Presbyterian Church, Seattle, Wash.	454
KUOA	University of Ark., Fayettesville, Ark.	300
KUOM	State University of Montana, Missoula, Mont.	345
KUSD	University of S. D. Vermillion, S. D.	278
KUT	University of Texas, Austin, Tex.	231
KVOO	Voice of Oklahoma, Bristow, Okla.	375
KWCR	H. F. Paar, Cedar Rapids, Ia.	278
KWG	Portable Wireless Tel. Co., Stockton, Cal.	248
KWKC	Wilson Duncan Studios, Kansas City, Mo.	236
KWKH	W. K. Henderson I. W. & S. Co., Shreveport, La.	261
KWSC	State College, Pullman, Wash.	349
KWUC	Western Union College, Le Mars, Ia.	252
KWWG	City of Brownsville, Brownsville, Tex.	278
KYW	Westinghouse E. & M. Co., Chicago, Ill.	535
KZKZ	Electric Supply Co., Manila, P. I.	270
KZM	P. D. Allen, Oakland, Cal.	240
KZRQ	Far Eastern Radio Inc., Manila, P. I.	270
NAA	U. S. Navy, Arlington, Va.	435
WAAD	Ohio Mech. Institute, Cincinnati, O.	258
WAAF	Drovers Journal, Chicago, Ill.	278
WAAM	I. R. Nelson Co., Newark, N. J.	263
WAAT	Edison Electric Ill. Co., Portable, Mass.	244
WAAW	Omaha Grain Exchange, Omaha, Neb.	278-384
WABB	Harrisburg Radio Co., Harrisburg, Pa.	204
WABC	Asheville Battery Co., Inc., Asheville, N. C.	254
WABI	First Universalists Church, Bangor, Me.	240
WABO	Lake Avenue Baptist Church, Rochester, N. Y.	278
WABQ	Haverford College Radio Club, Haverford, Pa.	261
WABR	Scott High School, Toledo, O.	263
WABW	College of Wooster, Wooster, O.	207
WABX	H. B. Joy, Mt. Clemens, Mich.	246
WABY	John Magaldi, Philadelphia, Pa.	242
WABZ	Coliseum Place Baptist Church, New Orleans, La.	275
WADC	Allen Theatre, Akron, Ohio.	258
WAFD	A. B. Parfet Co., Port Huron, Mich.	275
WAHG	A. H. Grebe Co., Richmond Hill, N. Y.	316
WAGM	R. L. Miller, Royal Oak, Mich.	225
WAIT	A. H. Waite & Co., Taunton, Mass.	229
WAIU	American Ins. Union, Columbus, O.	294
WAMD	Radisson Co., Minneapolis, Minn.	244
WAPI	Alabama Polytechnic Inst., Auburn, Ala.	248
WARC	American Radio Res. Corp., Medford Hillside, Mass.	261
WBAA	Purdue University, West Lafayette, Ind.	273
WBAK	State Police, Harrisburg, Pa.	276
WBAL	Gas and Electric Co., Baltimore, Md.	246
WBAO	James Millikia University, Decatur, Ill.	270
WBAP	Star Telegram, Fort Worth, Tex.	476
WBAX	J. H. Stenger, Jr., Wilkes-Barre, Pa.	256
WBBL	Grace Covenant Presbyterian Church, Richmond, Va.	229
WBBM	H. L. Atlass, Chicago, Ill.	226
WBBP	Petoskey High School, Petoskey, Mich.	238
WBBR	Peoples Pulpit Ass'n., Rossville, N. Y.	273
WBBS	1st Baptist Church, New Orleans, La.	252
WBBW	Ruffner City High School, Norfolk, Va.	222
WBBY	Washington Light Infantry, Charleston, S. C.	268
WBBZ	C. L. Carrell, (Portable), Chicago, Ill.	216
WBCN	Southtown Economist, Chicago, Ill.	266
WBDC	Baxter Laundry Co., Grand Rapids, Mich.	256
WBES	Bliss Electrical School, Takoma Park, Md.	222
WBOQ	A. H. Grebe & Co., Richmond Hill, N. Y.	236
WBNY	Miss S. Katz, New York City.	210
WBRC	Bell Radio Corp., Birmingham, Ala.	248
WBRE	Baltimore Radio Ex., Wilkes-Barre, Pa.	231
WBT	Charlotte Chamber of Commerce, Charlotte, N. C.	275
WBZ	Westinghouse E. & M. Co., Springfield, Mass.	333
WBZA	Westinghouse Electric and Mfg. Co., Boston, Mass.	242
WCAC	Agricultural College, Mansfield, Conn.	275
WCAD	St. Lawrence University, Canton, N. Y.	263
WCAE	Kaufman & Baer, Pittsburgh, Pa.	461
WCAJ	Nebraska Wesleyan University, University Place, Neb.	254
WCAL	St. Olaf College, Northfield, Minn.	337
WCAM	Galvin Radio Supply Co., Camden, N. J.	236
WCAO	Brager of Baltimore, Baltimore, Md.	275
WCAP	C. & P. Tel. Co., Washington, D. C.	469
WCAR	Southern Radio Corp., San Antonio, Texas	263
WCAT	School of Mines, Rapids City, S. D.	240
WCAU	Universal Broadcasting Co., Philadelphia, Pa.	278
WCAX	University of Vermont, Burlington, Vt.	250
WCBA	C. W. Heinbach, Allentown, Pa.	254
WCBD	W. G. Voliva, Zion, Ill.	345
WCBE	Uhalt Radio Co., New Orleans, La.	263
WCBH	University of Mississippi, Oxford, Miss.	242
WCBM	Hotel Chapeau, Baltimore, Md.	229

Station	Owner and Location	Meters
WCBQ	1st Baptist Church, Nashville, Tenn.	236
WCBR	C. H. Messter (Portable), R. I.	210
WCCO	Gold Medal Station. Minneapolis-St. Paul, Minn.	416
WCK	Stix Baer & Fuller Co., St. Louis, Mo.	273
WCLO	C. E. Whitmore, Camp Lake, Wis.	231
WCLS	H. M. Church, Joliet, Ill.	214
WCOA	Municipal Broadcasting Station. Pensacola, Fla.	222
WCSH	Henry P. Rines, Portland, Me.	256
WSCO	Wittenberg College, Springfield, Ohio.	248
WCWS	C. W. Selen, Providence, R. I.	210
WCX	Detroit Free Press & Jewitt Radio and Phonograph Co., Pontiac, Mich.	517
WDND	Dod's Auto Accessories, Inc., 160-164 8th Ave., N., Nashville, Tenn.	226
WDZ	J. L. Bush, Tuscola, Ill.	278
WDAD	Dad's Auto Accessories, Inc., Nashville, Tenn.	226
WDAE	Tampa Daily News, Tampa, Fla.	273
WDAF	Kansas City Star, Kansas City, Mo.	366
WDAG	J. L. Martin, Amarillo, Tex.	263
WDAH	Trinity Metr. Church, El Paso, Tex.	268
WDAY	Radio Equipment Corp., Fargo, N. D.	261
WDBE	Gilham-Schoen Elec. Co., Atlanta, Ga.	278
WDBJ	Richardson Wayland Elec. Co., Roanoke, Va.	229
WDBK	M. F. Broz, Furn., Cleveland, O.	227
WDBO	Rollins College, Winter Park, Fla.	240
WDBZ	Boy Scouts of America, Kingston, N. Y.	233
WDCH	Dartmouth College, Hanover, N. H.	250
WDOD	Chattanooga Radio Co., Chattanooga, Tenn.	256
WDZ	J. L. Bush, Tuscola, Ill.	278
WDRC	Doolittle Radio Corp., New Haven, Conn.	268
WDWF	Dutee Wilcox Flint, Inc., Cranston, R. I.	441
WEAF	A. T. & T. Co., N. Y. City, N. Y.	492
WEAI	Cornell University, Ithaca, N. Y.	254
WEAM	Borough of North Plainfield, N. Plainfield, N. J.	261
WEAN	Shepard Co., Providence, R. I.	270
WEAO	Ohio State University, Columbus, O.	294
WEAR	Goodyear T. and R. Co., Cleveland, O.	390
WEAU	Davidson Bros. Co., Sioux City, Ia.	275
WEBC	W. C. Bridges, Superior, Wisc.	242
WEBD	Elec. Equipment & Service Co., Anderson, Ind.	246
WEBE	Roy W. Waller, Cambridge, Ohio.	234
WEBH	Edgewater Beach Hotel, Chicago, Ill.	370
WEBJ	Third Avenue R. R. Co., New York, N. Y.	273
WEBL	Radio Corp. of Ama. (Portable).	226
WEBQ	Tate Radio Co., Harrisburg, Ill.	226
WEBR	H. H. Howell, Buffalo, N. Y.	244
WEBW	Beloit College, Beloit, Wisc.	268
WEBZ	Savannah Radio Corp., Savannah, Ga.	263
WEEI	Edison Electric Illuminating Co., Boston, Mass.	349
WEHS	Robert E. Hughes, Evanston, Ill.	203
WEMC	Emm. Missionary College, Merrien Springs, Mich.	286
WENR	All-Amer. Radio Corp., Chicago, Ill.	266
WEW	St. Louis University, St. Louis, Mo.	248
WFAA	Dallas News & Journal, Dallas, Tex.	476
WFAM	The Times, St. Cloud, Minn.	273
WFAV	University of Nebr., Lincoln, Nebr.	275
WFBC	1st Baptist Church, Knoxville, Tenn.	250
WFBD	Gethsemane Baptist Church, Philadelphia, Pa.	234
WFBE	J. V. De Walle, Seymour, Ind.	226
WFBG	W. F. Gable Co., Altoona, Pa.	278
WFBH	Concourse Radio Corp., New York, N. Y.	273
WFBJ	St. Johns University, Collegeville, Minn.	236
WFBL	Onondaga Hotel, Syracuse, N. Y.	252
WFBM	Merchants Lighting Co., Indianapolis, Ind.	268
WFBR	Maryland National Guard, Baltimore, Md.	254
WFBZ	Knox College, Galesburg, Ill.	254
WFDF	F. D. Fallain, Flint, Mich.	234
WFI	Strawbridge & Clothier, Philadelphia, Pa.	395
WFKB	F. K. Bridgman, Chicago, Ill.	217
WFRL	R. M. Lacey, Brooklyn, N. Y.	205
WGAL	Lancaster Elec. Supply Co., Lancaster, Pa.	248
WGBB	H. H. Carman, Freeport, N. Y.	244
WGBC	1st Baptist Church, Memphis, Tenn.	278
WGBF	The Finke Furniture Co., Evansville, Ind.	216
WGBI	Scranton Broadcasters, Inc., Scranton, Pa.	240
WGBM	T. N. Saaty, Providence, R. I.	234
WGBU	Florida Cities Finance Co., Fulford By-the-Sea, Fla.	278
WGBR	Marshfield Broadcasting Association, Marshfield, Wis.	229
WGBS	Gimbel Brothers, New York, N. Y.	316
WGBX	University of Maine, Orono, Maine.	234
WGES	Oak Leaves Broadcasting Station, Oak Park, Ill.	250
WGHB	G. H. Boules, Developments, Clearwater, Fla.	266
WGN	The Tribune, Chicago, Ill.	303
WGMU	A. H. Grebe & Co., Inc., Richmond Hill, N. Y.	236
WGCP	Grand Central Palace, N. Y. City.	252
WGHP	G. H. Phelps, Inc., Detroit, Mich.	270
WGR	Federal Telephone Mfg. Co., Buffalo, N. Y.	319
WGST	Ga. School of Tech., Atlanta, Ga.	270
WDGY	Dr. G. W. Young, Minneapolis, Min.	263
WGY	General Elec. Co., Schenectady, N. Y.	380
WHA	University of Wisconsin, Madison, Wis.	535
WHAD	Marquette University, Milwaukee, Wis.	275
WHAM	Eastman School of Music, Rochester, N. Y.	278
WHAP	Taylor Finance Corp., 426 West 31st St., New York City.	241
WHAR	F. P. Cook's Sons, Atlantic City, N. J.	275
WHAS	The Courier Journal-Times, Louisville, Ky.	400
WHAV	Wilmington Elec. Spec. Co., Wilmington, Del.	266
WHAZ	Rensselaer Polytechnic Institute, Troy, N. Y.	280
WHB	Sweeney School Co., Kansas City, Mo.	366
WHBA	Shaffer Music House, Oil City, Pa.	250
WHBC	Rev. E. P. Graham, Canton, Ohio.	254
WHBD	Charles W. Howard, Bellefontaine, Ohio	222
WHBF	Beardsley Specialty Co., Rock Island, Ill.	222
WHBG	John S. Skane, Harrisburg, Pa.	231
WHBH	Culver Military Academy, Culver, Ind.	222
WHBJ	Laver Auto Co., Ft. Wayne, Ind.	234
WHBL	J. H. Slusser, Logansport, Ind.	216
WHBM	C. L. Carroll (Portable), Chicago, Ill.	233
WHBN	1st Ave. Methodist Church, St. Petersburg, Fla.	238
WHBP	Johnstown Auto Co., Johnstown, Pa.	256
WHBR	Scientific E. & M. Co., Cincinnati, O.	216
WHBQ	St. Johns Meth. Church, Memphis, Tenn.	233
WHBU	B. L. Bing's Sons, Anderson, Ind.	219
WHBY	St. Norbit's College, De Pere, Wis.	250
WHBW	D. R. Kienzle, Philadelphia, Pa.	216
WHDI	Wm. Hood Dunwoody Ind. Inst., Minneapolis, Minn.	278
WHEC	Hickson Elec. Co., Rochester, N. Y.	258
WHN	George Schubel, New York, N. Y.	361
WHK	Radio Air Service Corp., Cleveland, Ohio	273
WHO	Bankers Life Co., Des Moines, Ia.	526
WHT	Radiophone Corp., Deerfield, Ill.	400
WIAD	H. R. Miller, Philadelphia, Pa.	250
WIAS	Home Electric Co., Burlington, Ia.	254
WIBA	Capital Times, Madison, Wis.	236
WIBG	St. Paul's E. P. Church, Elkins Park, Pa.	222
WIBH	Elite Radio, New Bedford, Mass.	210
WIBI	Fredk. B. Zittell, Flushing, N. Y.	219
WIBJ	C. L. Carrell, Chicago (portable).	216
WIBO	Nelson Bros., Chicago, Ill.	226
WIBM	Billy Maine, Chicago, Ill.	216
WIBR	Thurman A. Owings, Weirton, W. Va.	246
WIBS	Lieut. Thomas F. Hunt, Elizabeth, N. J.	203
WIBU	The Electric Farm, Poynette, Wis.	222
WIBW	Dr. L. L. Dill, Logansport, Ind.	220
WIBX	Grid-Leak, Inc., Utica, N. Y.	205
WIBZ	A. B. Trum, Montgomery, Ala.	231
WIL	Benson Radio Co., St. Louis, Mo.	273
WIOD	Carl S. Fisher Co., Miami, Fla.	248
WIP	Gimbel Brothers, Philadelphia, Pa.	508
WJAD	Jackson's Radio Elec. Co., Waco, Tex.	353
WJAG	Norfolk Daily News, Norfolk Nebr.	270
WJAK	Kokomo Tribune Station, Kokomo, Ind.	254
WJAM	D. M. Perham, Cedar Rapids, Ia.	268
WJAR	The Outlet Co., Providence, R. I.	306
WJAS	Pittsburgh Radio Supply House, Pittsburgh, Pa.	275
WJAX	Voice of Jacksonville, Fla.	337
WJAZ	Zenith Radio Corp., Mt. Prospect, Ill.	322
WJBA	D. H. Lentz, Jr., Joliet, Ill.	207
WJBB	L. W. McClung, St. Petersburg, Fla.	254
WJBC	Hummer Furniture Co., 2nd and Joilet Sts. La Salle, Ill.	234
WJBI	R. S. Johnson, Red Bank, N. J.	219
WJBK	Ernest F. Goodwin, Ypsilanti, Mich.	233
WJBL	Wm. Gushard Dry Goods Co., Decatur, Ill.	270
WUBO	V. Jansen, New Orleans, La.	268
WJBQ	Bucknell University, Lewisburgh, Pa.	211
WJBR	Omro Drug Store, Omro, Wis.	228
WJBU	Bucknell University, Lewisburg, Pa.	212
WJJD	Loyal Order of Moose, Mooseheart, Ill.	370
WJR	Detroit Free Press and Jewett Radio and Phonograph Co., Pontiac, Mich.	517
WJY	Radio Corp. of Ama., New York, N. Y.	405
WJZ	Radio Corp. of Ama., N. Y.-Bound Brook, N. J.	455
WKAF	WKAF Broadcasting Co., Milwaukee, Wis.	261
WKAQ	Radio Corp. of Porto Rico, San Juan, P. R.	341
WKAR	Mich. Agricultural College, Lansing, Mich	286
WKAV	Laconia Radio Club, Lanconia, N. H.	224
WKBB	Sanders Bros., Joliet, Ill.	214
WKBE	K. & B. Electric Co., Webster, Mass.	231
WKBG	C. L. Carrell, (Portable) Chicago, Ill.	216
WKRC	Kodel Radio Corp., Cincinnati, O.	326.422
WKY	C. E. Hill and H. S. Richards, Oklahoma City, Okla.	275
WLAL	1st Presbyterian Church, Tulsa, Okla.	250
WLAP	W. V. Jordan, Louisville, Ky.	275
WLB	University of Minn., Minneapolis, Minn.	278
WLBL	Wisconsin Department of Markets, Stevens Point, Wis.	278
WLIB	Liberty-Weekly Inc., Elgin, Ill.	303
WLIT	Lit Brothers, Philadelphia, Pa.	395
WLS	Sears Roebuck Co., Chicago, Ill.	345
WLSI	Lincoln Studio Inc., Providence, R. L.	441
WLTS	Lane Technical High School, Chicago, Ill.	258
WLW	Crosley Radio Corp., Cincinnati, O.	422
WLWL	Missionary Society of St. Paul the Apostle, N. Y. City.	288
WMAC	C. B. Meredith, Cazenovia, N. Y.	275
WMAF	Round Hills Radio Corp., Dartmouth, Mass.	441
WMAK	Norton Laboratory, Lookport, N. Y.	266
WMAL	Leese Optical Co., Washington, D. C.	213
WMAN	1st Baptist Church, Columbus, O.	278
WMAQ	Chicago Daily News, Chicago, Ill.	448
WMAY	Kings Highway Presbyterian Church, St. Louis, Mo.	248
WMAZ	Mercer University, Macon, Ga.	261
WMBB	American Bond and Mortgage Co., Chicago, Ill.	250
WMBF	Fleetwood Hotel, Miami Beach, Fla.	384
WMC	The Commercial Appeal, Memphis, Tenn.	500
WMCA	Hotel McAlpin, Hoboken, N. J.	341
WNAB	Shepard Stores, Boston, Mass.	250
WNAC	Shepard Stores, Boston, Mass.	280
WNAD	University of Okla., Norman, Okla.	254
WNAL	Omaha Central High School, Omaha, Nebr.	258
WNAT	Lenning Bros. Co., Philadelphia, Pa.	250
WNAX	Dakota Radio App. Co., Yankton, S. D.	244
WNBH	New Bedford Hotel, New Bedford, Mass.	248
WNJ	Radio Shop, Newark, N. J.	252
WNOX	Peoples Tel. & Tel. Co., Knoxville, Tenn.	268
WNRC	Wayne M. Nelson, Greensboro, N.C.	224
WNYC	Municipal Station, New York, N. Y.	526
WOAI	South East Equipment Co., San Antonio, Texas	395
WOAN	Vaughan Con. of Music, Lawrenceburg, Tenn.	283
WOAW	Woodmen of the World, Omaha, Nebr.	526
WOAX	F. J. Wolff, Trenton, N. J.	240
WOC	Palmer School of Chiro. Davenport, Ia.	484
WOCL	Hotel Jamestown, Jamestown, N. Y.	275
WODA	O'Dea Radio and Victrolla Shop, Paterson, N. J.	224
WOI	Iowa State College, Ames, Iowa.	270
WOK	Neutrowound Radio Mfg. Co., Homewood, Ill.	217
WOKO	Otto Baur, N. Y. City.	233
WOO	John Wanamaker, Philadelphia, Pa.	508
WOOD	Grand Rapids Radio Co., Grand Rapids, Mich.	242
WOQ	Unity School of Christianity, Kansas City, Mo.	278
WOR	L. Bamberger & Co., Newark, N. J.	405
WORD	Peoples Pulpit Assn., Batavia, Ill.	275
WOS	Mo. State Marketing Bureau, Jefferson City, Mo.	441
WOWL	Owl Battery Co., New Orleans, La.	270
WOWO	Main Auto Supply Co., Ft. Wayne, Ind.	227
WPAK	N. D. Agricultural College, Agricultural College, N. D.	275
WPCC	N. Shore Congregational Church, Chicago, Ill.	258
WPDQ	H. L. Turner, Buffalo, N. Y.	205
WPG	Municipality, Atlantic City, N. J.	300
WPRC	Wilson Printing & Radio Co., Harrisburg, Pa.	216
WPSC	Penn State College, State College, Pa.	261
WQAA	H. A. Beale, Jr., Parkersburg, Pa.	220
WQAC	Gish Radio Service, Amarillo, Tex.	234
WQAE	Moore Radio News Station, Springfield, Vermont	246
WQAM	Electric Equipment Co., Miami, Fla.	263
WQAN	Scranton Times, Scranton, Pa.	250
WQAO	Calvary Baptist Church, New York, N. Y.	360
WQJ	Calumet Rainbo Broadcasting Co., Chicago, Ill.	448
WRAF	Washington Radio Hospital Fund, Wash., D. C.	256
WRAK	Economy Light Co., Escanaba, Mich.	256
WRAM	Lombard College, Galesburg, Ill.	244
WRAV	Antioch College, Yellow Springs, O.	263
WRAW	Avenue Radio Shop, Reading, Pa.	238
WRAX	Flexon's Garage, Gloucester City, N. J.	268
WRBC	Immanuel Lutheran Church, Valparaiso, Ind.	278
WRC	Radio Corp. of America, Washington, D. C.	469
WRCO	Wynna Radio Co., Raleigh, N. C.	252
WREC	Wooten's Radio Shop, Cold Water, Miss.	254
WREO	Reo Motor Co., Lansing, Mich.	286
WRHM	Rosedale Hospital, Minneapolis, Minn.	252
WRK	Doron Bros., Elec. Co., Hamilton, O.	270
WRNY	Experimenter Publishing Co., (Radio News) N. Y. City.	258
WRM	University of Illinois, Urbana, Ill.	273
WRMU	A. H. Grebe & Co., Inc., Motor Yacht Mu-1, N. Y. City.	236
WRR	City of Dallas, Tex.	246
WRST	Radiotol Mfg. Co., Inc., 5 First Ave. Bay Shore, N. Y.	216
WRVA	Laurus & Bros., Co., Richmond, Va.	256
WRW	Tarrytown Research Laboratory, Tarrytown, N. Y.	273
WSAI	U. S. Playing Card Co., Cincinnati, O.	326
WSAJ	Grove City College, Grove City, Pa.	229
WSAN	Allentown Call, Allentown, Pa.	229
WSAR	Doughty & Welch Elec. Co., Fall River, Mass.	254
WSAX	Zenith Radio Corp., Chicago, Ill.	268
WSAZ	Chase Electric Shop, Pomeroy, Ohio	244
WSB	The Atlanta Journal, Atlanta, Ga.	428
WSBC	World Battery Co., Chicago, Ill.	210
WSBF	Stix Baer and Fuller, St. Louis, Mo.	273
WSBT	South Bend Tribune, South Bend, Ind.	275
WSDA	Seventh Day Adventist Church, N. Y. City	263
WSKC	World's Star Knitting Co., Bay City, Mich.	261
WSM	National Life and Accident Ins., Nashville, Tenn.	283

(Continued on page 22)

THE RADIO TRADE

Westinghouse Bought Patents for $3,460,000

The investigation by the Federal Trade Commission of the activities of the great radio pool, to determine whether it is a monopoly in restraint of trade, developed interesting inside facts of the origin of broadcasting, as well as of patent pools. The growth from nothing to a two-billion-dollar alliance all took place within five years, Samuel M. Kintner testified. He is manager of the research department of the Westinghouse Electric and Manufacturing Company, one of the defendants. The others are the General Electric Company, the Radio Corporation of America, the American Telephone and Telegraph Company, and the United Fruit Company. They are accused of gaining and then dividing control of the radio industry.

Mr. Kintner testified that his company had been compelled to expend $3,460,000 in radio communication patent purchases alone to keep up with advance of radio. He said the Westinghouse company owns 4,000 patents, of which a large number relate to radio invention.

Had "Newspaper" Ideas

Mr. Kintner at first had intended to use the radio "like a newspaper," he said.

Frank Conrad of Pitsburgh, was the engineer whom Kintner credited with instituting the pioneer experiments in radio broadcasting which have developed into a new science with unknown possibilities. Conrad began, he said, by broadcasting scraps of news and musical reproduction from phonograph records from his home. Amateur wireless experimenters who caught his program sent him other phonograph records and aided him with suggestions.

"Finally, Conrad provided a program regularly every Wednesday and Saturday night," Mr. Kentner said, "and Pittsburgh department stores began selling small crystal sets. H. P. Davis, vice-president of the Westinghouse Company, told Mr. Conrad he was going to erect a broadcasting station at the Westinghouse plant in East Pitsburgh and take over his broadcasting program."

Start of KDKA

A few weeks before the Presidential election in November 1920, KDKA was finished. Its first big achievement was to broadcast the election returns. Mr. Kintner said the tubes for the Conrad experimental set were lent by him by the Navy Department.

Mr. Kintner was testifying for the third day in the government's investigation of a supposed $2,000,000,000 "radio trust," in which the Westinghouse Co. is one of the defendants.

During the war, Mr. Kintner said, the government guaranteed manufacturers who supplied it with wireless apparatus to hold them blameless for patent infringements. He said this caused wholesale production under adverse patent arrangements and resulted in such a mass of lawsuits that it was almost imperative for the companies to get together on a common production basis.

R. C. A. the Selling Group

The Radio Corporation of America is alleged to have received the right to sell radio sets, while the Western Electric Company, the General Electric and the Westinghouse company got the manufacturing rights. According to Mr. Kintner, the patents which the Westinghouse firm acquired were chiefly those of Professor Reginald Fessenden and Edwin H. Armstrong, and these were transferred to the so-called patent pool by sale and license agreements.

Primarily the Westinghouse firm was interested in the manufacture of apparatus rather than wireless communication, Mr. Kintner said, but it was willing to spend $2,500,000 on radio communication alone "in order to get in on the patents involved therein." Besides this amount, he said, the company paid out $870,000 additional for certain patent licenses considered essential to the future radio business of the company. He said these patents were protected in twenty-four foreign lands.

Hint of Morgan Connection

The intimation that J. P. Morgan & Co. might be connected with the alleged radio combination was made during the examination when Edward L. Smith, counsel to the commission, sought to find out if the holdings in the General Electric Company of Dwight W. Morrow, member of the Morgan firm, were controlled by him personally. Mr. Trench admitted that Mr. Morrow was a stockholder of record.

"Is the stock which qualifies Mr. Morrow as a director in the company owned by him or by some other firm or person?" Mr. Smith asked.

"I do not know," replied Mr. Trench.

Mr. Smith declared later that he would continue to press for information on this point, hoping to determine whether the various directors in the companies represented stock which was really controlled by a hidden interest. A condition of interlocking stockholders existed in the companies, he declared, which allowed their assets of well over $2,000,000,000 to be jointly governed.

Tungsten Supply Confined

William R. Burroughs, associate manager of the incandescent lamp department of the General Electric Company, testified that his company had acquired the Save Electric Company, the Electron Company, the Mallory Company and the Independent Electrical Company, thus ending a controversy over patents. These companies, he conceded, manufactured and sold tungsten wire to nearly every dealer in the country not licensed by the General Electric Company under its patent holdings.

JANUARY EXPORT REPORT

WASHINGTON.

Radio apparatus with a total value of $499,659 was exported from the United States during January, according to statistics just compiled by the Bureau of Foreign and Domestic Commerce. Receiving sets comprises the largest item with 4,134 receivers valued at $139,856. Receiving set accessories comprised the second item with a value of $171,359. A total of 28,567 tubes valued at $46,616 was included in the exports.

LIST OF STATIONS

(*Concluded from page 21*)

WSMB—Saenger Amusement Co., New Orleans, La. 319
WSMH—Shathick Music House, Owosso, Mich. 240
WSMK—S. M. K. Radio Corp., Dayton, O..... 275
WSOE—School of Engineering, Milwaukee, Wisc. 246
WSRO—H. W. Fahlander, Hamilton, Ohio.... 251
WSSH—Tremont Temple Baptist Church, Boston, Mass. 261
WSUI—State University of Iowa, Iowa City, Ia. 489
WSWS—S. W. Strauss & Co., Woodale, Ill... 275
WTAB—Fall River Daily Herald, Fall River Mass. 266
WTAD—R. E. Compton, Carthage, Ill..... 236
WTAG—Worcester Telegram Publishing Co., Worcester, Mass. 268
WTAL—Toledo Radio & Elec. Co., Toledo, O... 252
WTAM—Willard Storage Battery Co., Cleveland, Ohio 389
WTAP—Cambridge Radio Elec. Co., Cambridge, Ill. 242
WTAQ—S. Van Gordon & Son, Osseo, Wis.. 254
WTAR—Reliance Radio & Elec. Co., Norfolk, Va. 261
WTAW—Agricultural & Mech. College, College Station, Tex. 270
WTAX—Williams Hardware Mfg. Co., Streator, Ill. 231
WTAZ—T. J. McGuire, Lambertville, N. J.. 261
WTIC—Travelers Insurance Co., Hartford Conn. 476
WWAD—Wright & Wright, Inc., Philadelphia, Pa. 250
WWAE—Electric Park, Plainfield, Ill..... 242
WWAO—Michigan College of Mines, Houghton, Mich. 263
WWGL—Radio Engineering Corp., Richmond Hill, N. Y. 213
WWI—Ford Motor Co., Dearborn, Mich..... 266
WWJ—Detroit News, Detroit, Mich..... 353
WWL—Loyola University, New Orleans, La.. 275

3 NAVY STATIONS FOR LEASE

WASHINGTON.

Three obsolete and surplus Naval Radio stations at Sayville, New York, Anastasia Island, Florida, and Inglewood, California, are offered by lease through bids by the Navy Department. The bids will be opened on May 20.

Radio Show War Opens; World's Fair Is Target

War has broken out in the radio show business in New York City. Manufacturers have bought the Radio Exhibition Company and openly threaten to drive out the "other show" by 1927. This means the Radio World's Fair.

The Radio Exhibition Company elected Joseph D. R. Freed, of Freed-Eisemann, as president, to succeed E. B. Mallory of the Westinghouse Electric & Manufacturing Co.

The organization consists of twenty-nine manufacturers who own stock in the corporation. A private meeting of the directors was held at the Lotus Club and on the following Thursday evening, at the Hotel Roosevelt, where a public announcement was made of the association's plans.

Eric Palmer, for the exhibition corporation, said that the main object of the organization was to put radio shows on an economical basis.

"There will be two radio shows in New York during the week of Sept. 10," said Mr. Palmer, "but in 1927 we expect that there will be only one big show with all cooperating under one roof."

Official Announcement

The following announcement was sent out by Mr. Palmer:

"Radio as an industry, with the directors of the newly formed Radio Exhibition Corporation as spokesmen, announce another great step towards stabilization.

"Leading radio manufacturers of the United States have organized and financed this new corporation for the conduct of national radio expositions, by the industry, for the industry, in order to display their latest products to the public and to exploit the romance of radio in general."

The Radio Exhibition Corporation announced the purchase of the National Radio Exposition scheduled to be held on September 10-17 in Grand Central Palace, from Harold Bolster, its sponsor and pioneer in the handling of such enterprises since the advent of radio broadcasting.

Officers Elected

Mr. Bolster has accepted the invitation of the Radio Exhibition Corporation to serve as managing director of "The Radio Show," as it is officially termed now.

The Chairman of the Board of Directors is George Scoville, vice-president of the Stromberg-Carlson Telephone Mfg. Co.

Joseph D. R. Freed, president of the Freed-Eisemann Radio Corporation, is president. The other officers are:

Vice-Presidents, James Skinner, vice-president Philadelphia Storage Battery Co., and John C. Tully, vice-president Bremer-Tully Co.

Treasurer, R. M. Klein, general manager, F. A. D. Andrea Co.

Secretary, LeRoy Staunton, C. Brandes, Inc.

Directors, in addition to the officers, A. U. Howard, vice-president Dubilier Condenser & Radio Corp.; S. B. Trainer, president, Amplion Corporation of America, and W. B. Schulte, secretary, Burgess Battery Co.

Rivalry Attacked

"In an official letter to the stockholders of the Radio Exhibition Corporation, issued by the chairman, the following statements are made:

"It is generally agreed that the conduct in certain cities of competing shows by rival promoters is a serious burden on the industry. This situation is particularly acute in New York City, where for several years such competing shows have been held. The directors feel that there is every prospect that the show to be operated by your corporation—being, as it is, operated by the industry—will be so far superior to any radio shows which have been conducted in the past, that it will be recognized as the Radio Show, and are confident that after this year it will be the only radio show in New York City.

"Offices of the Radio Exhibition Corporation have been established at 1560 Broadway. As indicated, radio manufacturers are the only stockholders in the concern."

COMING EVENTS

JUNE 1 to DEC. 1—Sesqui-Centennial, Industrial Arts Bldg., Philadelphia, Pa., with concurrent radio exposition. J. C. Johnson, manager, 1560 B'way, N. Y. City.

SEPT. 13 to 18—Third Radio World's Fair, Madison Square Garden, New York City. G. Clayton Irwin, manager, Times Bldg., N. Y. City.

OCT. 11 to 17—Fifth Annual Chicago Radio Show, Coliseum, Chicago, Ill. G. Clayton Irwin, manager, Times Bldg., N. Y. City.

OCT. 25 to 30—Second Annual Indianapolis Radio Exposition of the Central States, State Fair Grounds, Indianapolis, Indiana. Management of Indianapolis Radio Exposition Corp., 1,407 Merchants Bank Bldg.

OCT. 30 to NOV. 6—Cleveland Radio Industries Exposition, Public Auditorium, Cleveland, O. G. B. Bodenhoff, manager, 511 Guarantee Title Bldg., Cleveland, O.

Nine Stations Cited As Wavelength Models

WASHINGTON.

Measurements by the Bureau of Standards have indicated that nine broadcasting stations maintain sufficiently constant on their wavelengths to enable their use for the calibration of sets and wavemeters. The stations are NAA, Arlington, Va.; WJR, Pontiac, Mich.; WCX, Detroit, Mich.; WEAF, New York; WCAP, Washington; WRC, Washington; WSB, Atlanta, Ga.; WGY, Schenectary, and WBZ, Springfield, Mass.

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

Trade Service Editor,
RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....

City or town.....

State .....

Are you a dealer?.....

If not, who is your dealer?

His Name.....

His Address.....

The Radio Shop, Dyersburg, Tenn. (Dealers).
W. A. Mahoney, 1577 Tenth Ave., San Francisco, Cal.
Louis V. Stavens, 609 West Washington St., Bloomington, Ill.
H. G. Smith, 1929 Fowler St., Chicago, Ill. (Dealer).
Ludwig Hill, 530 South Diamond St., Mansfield, Ohio.
Earl W. Miller, 613 North Low St., Allentown, Pa.
Harry Lehman, R. F. D. 2, Burbank, O.
C. F. Helmuth, 419 North Mass. Ave., Atlantic City, N. J. (Dealer).
C. O. Juelson, 755½ Alberta St., oPrtland, Ore.
C. Lessner, 26 Humboldt St., Brooklyn, N. Y.
W. F. Gerritsen, 3045 Franklin St., San Francisco, Cal.
Radio Service Station, 754 Clayton St., San Francisco, Cal. (Dealers).
C. Maille, 372 De Castelman, Montreal, Quebec, Canada.
Gustave L. Renniniland, 110 Buscher Ave., Pulley Stream, Long Island, N. Y.
Paul Haltzapple, 312 East Jefferson St., Fort Wayne, Ind.
L. W. Ferguson, Coral Gables, Fla. (Dealer).
Francis Wilheton, 2805 West Bird St., Hannibal, Mo.

Bruno Corporation Enlarges "Researches"

The April issue of "Radio Researches," published by the Bruno Radio Corporation, the second issue printed, contains eight pages in two colors, as compared with four pages of the first issue, and is filled with interesting data for radio experimenters. The back cover contains a blueprint of the Powertone 5-tube 3-control tuned radio frequency set.

The leading article concerns the position of the loud speaker in the home, the importance of placing it correctly is explained in detail. Another article concerns the function and operation of Amperites.

Robert Herzberg is editor; William A. Bruno, technical editor.

Industry In Five Years Shows 32,500% Increase

From $2,000,000 a year to $650,000,000 a year, and all in five years! That is the story of the growth of the radio business 1921 to 1925, inclusive, as reported to Congress by the Department of Commerce. The number of receiving sets in the United States was estimated at 10,000,000. Including amateurs, 20,000 transmitters are in operation.

This information has been placed before the House Committee on Appropriations. Until recently, they told the committee, practically all of the sending stations were located in a comparatively few centers. Now they are scattered all over the country, requiring close local supervision in order to prevent unnecessary interference.

Arthur J. Tyrer, Deputy Commissioner of Navigation, opposed any plan of Government supervision over radio receiving sets. He thought Government regulation in the field of radio should be limited to transmitting stations.

"If we enter upon the duty of controlling, licensing or regulating receiving sets there would be no limit to the amount of money that would be required for that purpose," Mr. Tyrer told the committee. "It would be difficult for us to administer a law satisfactorily that would cover every city, town, hamlet and farm."

Commenting on Mr. Tyrer's statement Representative Martin B. Madden chairman of the committee, favored rigid control of the station.

Tips on Proper Placement Of Speaker in the Home

Tests conducted in our laboratory and in a number of homes in various parts of New York City have shown that the position the loud speaker occupies in any particular room or apartment has a very decided influence on its several acoustical performance. It was found in several cases that reported dissatisfaction with the radio receiver was not due to the instrument itself, but rather to the placement of the reproducer in relation to the usual places occupied by the members of the particular families.

The greatest mistake people make, it was discovered, is in sitting too close to the loud speaker. They place the horn only a few feet from the set, or right on top of it, and then when they tune in for some station they blast the voice or music right into their ears. They do not give the reproduced sounds a chance to lose the little noises that are present in the background, and even if the set is distortionless, as many resistance and choke-coil equipped ones are, they complain that the music is not "clear" or the voice not "distinct."

Advice to Owner

The loud speaker should always be kept away from the listeners. If the set is in one corner of a room, for instance, the horn should be placed in the opposite one, and not directly alongside the cabinet. The owner is thereby permitted to appreciate the full effect of the music, without having his ears pounded to pieces by the flood of sound flowing out of the speaker opening.

The effect of curtains, tapestries, carpets, rugs, and thick drapings and hangings of all kinds is very marked. A lightly furnished room in which the loud speaker is placed invariably sounds more lifelike than a thickly draped one, but it is also likely to develop difficulties with echoes. The smooth floor, ceiling and walls reflect the reproduced sound and music back and forth across the room, to an extent depending on the exact number of carpets and the like and on the nature of the wall material itself.

Drapes Act as Brakes

If the loud speaker is kept in a heavily furnished room the music will sound slightly "dead," because of the damping effect of the drapes. The sound will issue from the speaker and seem to fall to the floor as if it has no strength. This is exactly the effect achieved by the padded walls and sound-insulated floors of broadcasting studios, in which echoes would prove disastrous to the quality of transmission.

No definite rule can be laid down for the placement of the speaker in each home, because conditions vary considerably even from room to room in the same apartment. One room may display unsatisfactory acoustical qualities, while the adjoining one may be perfect. Sometimes the mere parting of a pair of curtains separating the living room, from the dining room, for instance, may dispel the damping effect of the surroundings and create ideal conditions of reproduction.

These remarks from "Radio Researches"

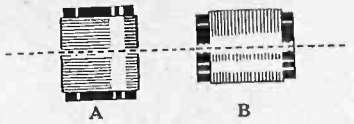
apply equally to loud speakers of both the horn and cone type. With the former the direction of the sound can be controlled to some extent by the direction of the horn itself, but the cone is practically non-directional. Cone speakers are especially effective if suspended from picture moulding, or if placed in a corner which will throw the sound completely across the room.

If you have already installed the radio and want to experiment with the loud speaker, simply connect a length of flexible cord to the instrument and try it in different parts of the house. Give each position a fair test; do not merely put the speaker in one spot and judge its effectiveness there after listening for only a minute or two. Let it stand for an hour or so, so that you can judge the reproduction of voice and music of all kinds.

Line Through Both Centers Is Cure of Stray Coupling

Troublesome interaction between the single layer coils in a receiver can be eliminated or at least greatly diminished by the radio fan if he gives careful attention to the location of the various coils.

One of the laws of electricity is that energy in one coil will not be transferred by induction into another coil if the plane of the wires constituting the winding is at right angles to the wires of the other coil, but to realize fully this effect it is necessary, due to the shape of the magnetic fields of coils through which current is passing, that



the coils be in a certain position with respect to each other even though they are at right angles. By this is meant that while the planes of the coils are at right angles, it is necessary that the coils be so located that a line passing through the centre of one would pass through the centre of the other. This is shown in the accompanying drawing.

Shifting or locating coil A or B so that the imaginary line cuts one of the coils off centre would result in coupling between the coils. It must be borne in mind, however, that two other facts enter in this discussion —the separation between the coils, maintaining the positions as shown, and the power in one of the coils. If the field of the coils is quite strong, due to strong signal or current flow through the coil, and coil B is located with edges touching A, zero coupling will not be obtained, hence to safeguard against this it is best in tuned radio frequency, utilizing single layer coils, to separate the coil centers at least 6 or 7".

STATIONS NUMBER 529

WASHINGTON.

The total number of broadcasting stations on April 1 was 529, according to records of the Department of Commerce. This is a decrease of 62 over the high water mark of May, 1923, when there were 591 stations.

Control of Audio Output Improves Sound Quality

By B. Erle Buckley
Associate, Institute of Radio Engineers

Faithful reproduction of all of the audio frequency notes, not the quest of distance, is today the goal and desire of most owners of receivers. To this end, the laboratories of the largest manufacturers have been working tirelessly. Speakers have been redesigned, transformers improved and various methods of audio amplification devised. Great progress has been made, but after investing a goodly amount of money for a fine speaker, and attaching it to a set, some fans find that although they hear notes of a much lower or higher frequency than he ever heard before, there is a general blurred effect and lack of quality. Phonograph unit or speaker is found to give less response, with distortion creeping in. It is to cure these ills and at the same time give to the radio fan a practical volume control that the Jaynxon Tone Bridge has been designed.

This unit is really a four-in-one instrument, designed to perform faithfully each task assigned to it. These four applications are, first, to prevent the direct current from entering the coils of the speaker, which causes demagnetization, with its attendant loss of volume and increase of distortion. Second, it acts as a coupling unit, matching the impedance of the speaker to that of the amplifier tube output. This gives the richness and tonal quality that the broadcaster has gone to such pains to put on the air. Third, it provides a practical method for the control of volume, by controlling only the output and not the various constants of the receiver. The tone may be made loud or soft at will, merely by turning one control, loud for the full benefit of the resonance and timber of the vocal artist, or soft for the full orchestra as a background to concert or dinner music. And the device brings out the full tone and volume of the loud speaker, eliminating to large extent the disagreeable noises produced by static and power leaks. This is done, of course, by drowning out. However, the tonal quality is not lost when this is done.

Majestic Wave Trap Put Out By Venus Corp.

A handsome enclosed wave trap is being marketed by the Venus Radio Corporation, 136 Liberty Street, New York City. It is called the Majestic Wave Trap and consists of an enamelled black mounted casing, at the front of which is a dial pointer and a dial calibrated in gold, while inside, hidden from view, is a secret filter circuit of high efficiency. At rear are two binding posts. Either goes to aerial, the other to the antenna post of the receiving set. The device renders any set more selective. It is also very useful as an interference eliminator, including the clamping out of a super-power station. The device, besides being efficient, is highly ornamental. It may be placed next to one's set and will add to the appearance of one's radio appurtenances.

STATION FOR WARSAW

Paderewski will not have to go to London to broadcast when the new 6KW station is completed in Warsaw, in Poland, his native city.

PART 2 OF RADIO WORLD'S B BATTERY ELIMINATORS appeared in RADIO WORLD dated Dec. 19. Other great articles in that issue. 15c per copy or start your sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

27,000,000 Listeners-in; 5,000,000 Sets In Use

W. E. Harkness, assistant vice-president American Telephone and Telegraph Co., said there are 27,000,000 listeners in the United States and more than 5,000,000 radio sets in use.

"One-half of these five million radio set owners," Mr. Harkness continued, "own their homes; three-quarters of them own phonographs and over half have pianos in their homes."

Perlesz Single Control

H. Perlesz, president of the Perlesz Radio Corporation of Chicago, spent a few days in New York recently conferring with Stoner & Heath, Inc., 122 Greenwich Street, their Eastern representatives, regarding plans for distribution of the new Perlesz Single Dial Control sets and testing out the new models in New York dead spots. The tests proved most satisfactory. One test, conducted two blocks from WNYC, showed all models capable of bringing in WJJR, WOO and WTIC while both WEAF and WNYC were broadcasting. The models on display at Stoner & Heath, Inc., are six, seven and eight tubes, all single dial control and built on the Perlesz gang condenser unit. The condensers on this unit, tested on instruments, showed a variation of less than one quarter of 1 mmfd.

Accusti-Cone Makes a Hit

The Accusti-cone loud speaker is satisfying radio enthusiasts everywhere who are critical as to tone quality. This is evidenced by the fact that orders and pleased comments are pouring into their laboratories from all over the country. The Accusti-cone is a cone speaker which is hung on the wall out of the way, the wall acting as a sounding board throwing the voice or music into all parts of the room with fully diffused clarity and tone. It is made by pioneers in the art of accoustics and is sold directly from the factory to consumer. It has been fully tested and approved by RADIO WORLD Laboratories. Full information regarding this wonderful loud speaker will be mailed on request to Accusti-cone Laboratories, 96 Church Street, New York City. Mention RADIO WORLD.

Aerovox Pioneer Line

The Aerovox line has rapidly grown into front rank favor and dealers everywhere are stocking the line to meet this demand. The makers, Aerovox Wireless Corp., 493 Broome Street, N. Y. City, specialize in high-grade resistances, fixed mica condensers, by-pass condensers and resistance-coupled units. They also make condenser blocks for B eliminators of all types. "Built-Better" is their slogan and the line lives up to this promise.

STATION NEWS

WGN, the Chicago Tribune station, located in Chicago, Ill., and transmitting on a wavelength of 3029 meters is now operating on Central Daylight Saving Time, and will continue to do so until the latter part of September.

The call signal of WGWY, Minneapolis, has been changed to WDGY.

Church Work Is Exciting For Microphone Engineer

"Keep cool—and keep your eye on the minister." These words embody the rule of conduct for a successful radio pick-up man, when several microphones in different parts of a large church are used to pick up a church service for a broadcasting station.

This is revealed in an interview with Donald De Wolf, operator in charge of KGO pick-up work in the city of San Francisco.

"On one job," said De Wolf, in telling of recent experiences, "I had eight microphones placed in Trinity Church. Each microphone lead terminated in a control unit, this was a box about the size of a large suit case, which was before me seated in the choir section.

Needed Alert Eye

"Even if I was all rigged out in choir vestments I didn't have to sing, or do anything but watch the minister. I had to watch him to know which switch to pull on my control unit to get the right microphone on the air. When the minister sat down I knew that something was going to happen in some other part of the building. But where—what? Perhaps it was the organ on the north side. Maybe it was the organ on the south side. Or maybe it was the echo organ, over the front entrance, about a hundred feet from where I sat. Perhaps it was a visiting minister put into the service at the last moment, without my knowledge, who would jump up without formal presentation. Then it might have been a solo from a member of the choir. But no matter what, it was up to me to get the right microphone into the circuit.

Swinging in the Mike

"My job was, of course, to have the microphone before the echo device in the circuit when the organ was doing any echoing. Otherwise radio listeners tuned in on KGO would notice large holes in their Good Friday services. Of course, I had my head-set on, in addition to the choir vestments and a worried look, and I was able all the time to hear through the amplifiers. In the power house, which is across the San Francisco Bay, ten miles from the church, H. C. Dunton, the KGO power house operator, was 'listening radio.' I delivered my stuff to Dunton. A magneto telephone connected me with Dunton—into which I had to whisper.

"When the minister moved from one position to another, I had to switch the new microphone into the circuit quickly. In fact, some of the time, when he was moving, there were two microphones working. This kept the service going without breaks as far as the listener was

concerned. Once I 'lost' the minister. I took what I thought was a high enough point of observation for my control outfit. But when the choir stood up to sing, I couldn't see the minister. I felt sure he would go to one of the microphones to speak. But which one? So I connected up all the microphones he would likely get in front of. Then when the choir sat down, I 'found' the minister, I noiselessly eliminated all microphones but the one he was using.

Sensitive Microphones

"Our microphones, the condenser type, are very sensitive. The first amplifier, which should be placed not more than 25 feet locate inconspicuously. It must be out of the way of anyone kicking it, or away from the floor or wall vibrations. Once I had to get a couple of pillows and put under the amplifier to keep the vibration of the floor from causing it to be 'microphonic' when the minister walked around. If I hadn't done that listeners would have heard something like 'bong, bong' every time he took a step."

The pick-up man's job is also an educational one. He must at times educate the minister and the organist in the fine points of good radio pick-up. This is done, according to De Wolf, in the following manner:

"I generally try to have a rehearsal. Then I get the minister to put on earphones and listen in, like I have to do. First I rattle some papers before the microphone. And he's likely to ask me —'where's all that sheet-iron falling off a building?' This does lots more good than telling 'em about it. Next I have somebody drop a lead-pencil on the amplifier case. There is a slight 'bong.' After stunts like this the minister is usually convinced that there are certain rules of the pick-up game which have to be observed, the same as in preaching.

"The organist must also be instructed When he plays on the echo-organ, away up in the rafters over the front entrance, my echo organ microphone, placed near the sound, is in the circuit. Suppose, without warning, he jumps down into the low tones in the basement. I've got to switch that microphone on, before listeners can hear. Naturally he sees right away that I ought to be notified when he jumps around in the music. The best system is to have earphones handy and let him listen in and learn from practical experience. It's the way it sounds that counts in radio."

Cause of Great Roar Traced to Piece of Tin

WASHINGTON.

An old piece of tin carelessly thrown against a transformer on a 2,300 volt electric light and power line in Oklahoma was found to be the cause of many complaints from radio listeners in that vicinity and was noticeable for more than fifteen city blocks, according to a report to the Radio Bureau of the Department of Commerce. Removal of the piece of tin by a radio inspector resulted in the elimination of the "intense roar" of which the listeners complained.

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD:

1925:

Aug. 29—A Set a Baby Can Build, by Herbert E. Hayden. A Fine Meter Switchboard, by Lewis Winner.

Sept. 12—The 1926 Model Diamond of the Air, (Part (1), by Herman Bernard. A 25-to-110 Meter Receiver, by Sidney E. Finkelstein.

Sept. 19—Diamond of the Air (Part 2), by Herman Bernard. A Tube B Battery Eliminator, by Louis Winner.

Oct. 3—The Thordarson-Wade Set (Part 1), by Herman Bernard.

Oct. 10—The 3-Tube, 3-Circuit Tuner, by Capt. P. V. O'Rourke. The Thordarson-Wade Set (Part 2), by Herman Bernard.

Oct. 17—The Thoroughbred (1-Tube DX Set), by Herbert Hayden. The Thordarson-Wade Set (Part 3), by Herman Bernard. Trouble Shooting Article.

Oct. 24—A Phonograph Cabinet Set, by Lewis Winner. The Thoroughbred, by Herbert Hayden (Part 2).

Oct. 31—The 4-Tube Pathfinder, by S. E. Finkelstein. How to Make a Simple Loop, by Herbert E. Hayden.

Nov. 7—A 3-Tube Dry-Cell Circuit, by Capt. P. V. O'Rourke. One of the Best Crystal Sets, by Herbert E. Hayden. 1-Tube DX Set, Herman Berand.

Dec. 5—A Toroid RF Set, Using Crystal, by Lewis Winner. The Diamond of the Air (in Text and Diagram), by Herman Bernard.

Dec. 12—A Self-Contained Receiver, by H. B. Hayden (Part 1). B Battery Eliminator, by Lewis Winner (Holiday Gifts No.).

Dec. 19—The Lemnis Entertainer, by Ed. Spiegler. Feldman 5-Tube Set, by Lewis W. Feldman.

Dec. 26—The Regenerative Wave Trap, by John F. Rider. The 5-Tube Tuned RF Set, by Capt. P. V. O'Rourke.

1926:

Jan. 2—The 2-C Set for Simplicity, by Capt. P. V. O'Rourke.

Jan. 9—The 4-Tube DX Symphony Set, by A. Irving Witz. A Skillfully Made 1-Dial Set, by Herman Bernard.

Jan. 16—Anderson's 5-Tube Quality Receiver, The Raytheon B. Eliminator, by Lewis Winner.

Jan. 23—The 4-Tube Diamond of the Air, by Herman Bernard. The Antennatrol, by Herbert E. Hayden (Part 1). B Batteries Last Six Months, by S. E. Finkelstein.

Jan. 30—An Individual AF Amplifier, by H. E. Hayden. The Antennatrol, by Herbert Hayden (Part 2). Trapping Out Super-Power in New Jersey, by Capt. P. V. O'Rourke.

Feb. 6—The Fenway (4 or 9 tubes), by Leo Fenway (Part 1). The Great 1-Tube DX Set, by Herman Bernard.

Feb. 13—Anderson's 5-Tube Economical Receiver, Trouble Shooting for Novices, by M. B. Strock. The Fenway, by Leo Fenway (Part 2).

Feb. 20—The 8-Tube Victoreen, by Herbert E. Hayden. The Fenway, by Leo Fenway (Part 3). Quality Stressed in 3-Tube Set, by Brainard Foote.

Feb. 27—The 4-tube DX Dandy, by Herbert E. Hayden. Umbrella Aerial for DX, by Hugo Gernsback. Part 2 of The Victoreen.

Mar. 6—The 1 tube Set, by Capt. O'Rourke. The Chemistry of Batteries, by A. B. Reid. The Victoreen Set (Part 3), by Herbert E. Hayden.

Mar. 13—The Non-Regenerative Browning-Drake Set, by M. B. Sleeper. The Tectron Eliminator (Part 1), by Lewis Winner. Curing Victoreen Trouble, by Herbert E. Hayden.

Mar. 20—The Super-Heterodyne, by J. E. Anderson. A 2-Tube Speaker Set, by Percy Warren. The Browning-Drake Set (Part 2), by M. B. Sleeper. A 2-tube Eliminator, by Lewis Winner.

Mar. 27—An Economical 4-Tube Set, by Edgar T. Collins. A Practical B Battery, by Capt. P. V. O'Rourke. Tectron Trouble Shooting, by Lewis Winner.

April 3—The Bernard Portable, by Herman Bernard (Part 1). How to Get Dx, by Capt. P. O'Rourke. A Compact B Supply, by Lewis Winner.

April 10—The Bernard Portable, by Herman Bernard (Part 2). Two Eliminators for DC, by Lewis Winner. A Super From An Old Set, by C. King.

April 17—The New 1-Dial Powertone, by Capt. P. V. O'Rourke. The Bernard Portable (Part 3), by Herman Bernard. The Action of Transformers, by Lewis Winner.

Any copy, 15c. Any 7 copies, $1.00. All these 29 copies for $4.00, or start subscription with any issue. RADIO WORLD, 145 W. 45th St., N. Y. C.

Victoreen Fans Write Walker the Set is Great

In the March 27 issue of Radio World the George W. Walker Co., of Cleveland, O., manufacturers of the Victoreen products, published an advertisement in which they requested owners of Victoreen Super-Heterodynes to send in the results obtained from these sets. The Hartzell Sales Co., New York representative of the G. W. Walker Co., has forwarded a few of the many letters received in response to the ad. Herewith are extracts of these letters:

"New Haven, Conn., is supposed to be the worst spot for reception. Yale University has spent a great deal of money trying to find the cause. My Victoreen, however, solved the problem, by receiving distant stations that were thought impossible to receive."—Fred Wieland, 107 York St., New Haven, Conn.

"The Victoreen works right off the bat. It sure is some set."—Ralph W. Adams, 1245 Jackson St., N.E., Washington, D. C.

"The Victoreen is the best I have had. Plenty of volume on DX stations."—D. M. Balloni, 13 Division St., Providence, R. I.

"The first night I pulled in 75 stations and on a speaker, too."—Fred R. Pope, 26 Pine St., Springfield, Vt.

"The Victoreen cannot be equalled."—J. Pat Scully, P. O. Box 332, Greenville, Miss.

"The best set I have ever had."—R. C. Phillips, Hayenesville, La.

QUICK ACTION CLASSIFIED ADS

10 CENTS A WORD. 10 WORDS MINIMUM. CASH WITH ORDER

600 MILE RADIO, $2.95. NO BATTERY nor tubes needed. Always ready. Fully guaranteed. 200,000 sold. No screeching nor grinding. Real radio, no toy. Sent postpaid. Order one today. Crystal Radio Company, Wichita, Kansas.

SET BUILDERS SEND FOR price lists and discounts. Martien Radio Shop, Galion, Ohio.

SELL AND INSTALL RADIO SETS. With a $25 capital we can put you in the radio business and show you how to earn a hundred or two a week. For full details write Columbia Print, Radio Division, 143 West 45th St., New York City.

CONSTRUCTION OF RADIO PHONE AND TELEGRAPH RECEIVERS by M. B. Sleeper, sent on receipt of 75c. The Columbia Print, 145 W. 45th St., N. Y. C.

DESIGN DATA FOR RADIO TRANSMITTERS AND RECEIVERS by M. B. Sleeper, sent on receipt of 75c. The Columbia Print, 145 W. 45th St., N. Y. C.

1926 DIAMOND OF THE AIR BOOKLET with full instructions to make the Diamond, with blue print, 50c. Newsdealers and radio dealers can get supply from American News Co. and its branches. RADIO WORLD, 145 W. 45th St., N. Y. C.

BULLDOGS
BEAUTIFUL REGISTERED BULL PUPS, $15. Bulldogs, 501 Rockwood, Dallas, Texas.

THE BERNARD PORTABLE SUPER-HETERODYNE appeared in RADIO WORLD dated April 3, 10, 17 and 24. Sent on receipt of 60c, or start your subscription with April 3 issue.

A PAYING POSITION OPEN to representatives of character. Take orders shoes, hosiery direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co., 4,710 C. St., Boston, Mass.

"ME WANTS MORE DX"—worth framing. This is the front page of RADIO WORLD dated March 6. If you haven't a copy, get this number and you will find that this youngster with the earphones is one of the cutest little kids you ever saw, except your own, of course. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

CONSTRUCTION OF THE 4-TUBE A-A RECEIVER, by Herbert E. Hayden, appeared in RADIO WORLD dated Nov. 21. 15c per copy, or start your subscription with that number.

WIRELESS IN THE HOME by Lee deForest, sent on receipt of 15c. The Columbia Print 145 W. 45th St., N. Y. C.

The Newest Up-to-the-Minute Radio Set—It has Never Been on a Dealer's Shelf—Most Selective. A Wonderful DX Getter. Sold on a Guarantee of Satisfaction or Money Back.

BST-6

B-for Beauty
S-for Selectivity
T-for Tone purity
6-its 6 tubes for distance

Volume Control—Perfect Calibration—Range 180-550

The BST-6. 2 Feet 4 Inches Long. 9 Inches Inside Depth. 8¾ Inches High.

THIS marvelous six-tube tuned radio frequency receiver is Self-Equalized and built of low-loss materials throughout. Its clear, rich tone of astonishing volume is a revelation. The circuit consists of two stages of tuned radio frequency, tube detector and three stages of balanced audio amplification. Air cooled rheostats and universal sockets are used.

Modified straight line frequency variable condensers are employed, insuring separation of the low wave length stations. PERFECT CALIBRATION—STATIONS ONCE TUNED IN CAN ALWAYS BE LOGGED AT THE SAME DIAL POINT.

The balanced amplifier gives absolutely natural reproduction of all overtones. The universal sockets permit the use of all the popular tubes, either dry cell or storage. The set does not oscillate, thereby preventing the reradiation of signals and reducing interference to a minimum.

LOG OF BST-6

Taken on a Fifteen Foot Aerial in One-half Hour by Al. Kraus, 996 Aldus Street, New York City.

WSBC	10	WGY	50
WBBR	16	WMAK	51
WEBH	49	WMSG	11
WHT	55	WOC	85
WCCO	61	WFAA	78
WSB	66		

SELECTIVITY

I live within four blocks of WLWL, and since the opening of this station have had great difficulty in choking them off my old set. Even after employing a wave trap I could still hear WLWL around the entire dial and was told by several friends that living so near this powerful station it would be impossible to entirely cut them out with anything less than a super-het. It was a very agreeable surprise, therefore, when I installed my new BST-6, to find that while WLWL came in on 25 I could tune in WRNY on 21 and entirely cut out WLWL. ***This is certainly real selectivity.***—F. S. Clark, 350 West 55th Street, New York City.

Specifications

Bakelite Panel, Walnut Finish—
With Etch-O-Gravure and Gold Decorations—
Bakelite Sub-Base—
Kurz-Kasch Bakelite-Walnut Pointers; Gold-filled, to Match—
Kurz-Kasch Bakelite Gold-filled Rheostat Knobs—
Lubree Straight Line Frequency Condensers—
Special Coils; Double Silk Solenoids—
Shore Audio Transformers—
Caswell-Runyan Two-tone Walnut-Finished Cabinet.

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Satisfaction or Money Back

Each receiver is tested and retested, boxed and inspected before leaving factory, and guaranteed to reach you direct in perfect condition. Workmanship throughout guaranteed the best. Assembled by experts.

Immediate Delivery

Direct from factory to you
No dealers' or middlemen's profits

$40.00

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