MARCH 13 15 CENTS

RADIO WORLD

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Vol. 8 No. 25 ILLUSTRATED Every Week

IS CRYSTAL PURER RECTIFIER THAN TUBE?

By John F. Rider

THE KB-8 *BY M. B. Sleeper*

THE TECTRON ELIMINATOR

nearly all of the radio magazines each month. I now dropped them ALL in favor of RADIO WO I am convinced I am missing something very im ant if I do not get RADIO WORLD every week. Metcalf, 510 Ridge Road, Rochester, N. Y. I for bought ne nave now WORLD. very impo week. Joh I formerly each mont RADIO V something WORLD Rochester,

THE KB-8, being tested by the designer and author, M. B. Sleeper. See article on page 3 of this issue. (Radio Eng.)

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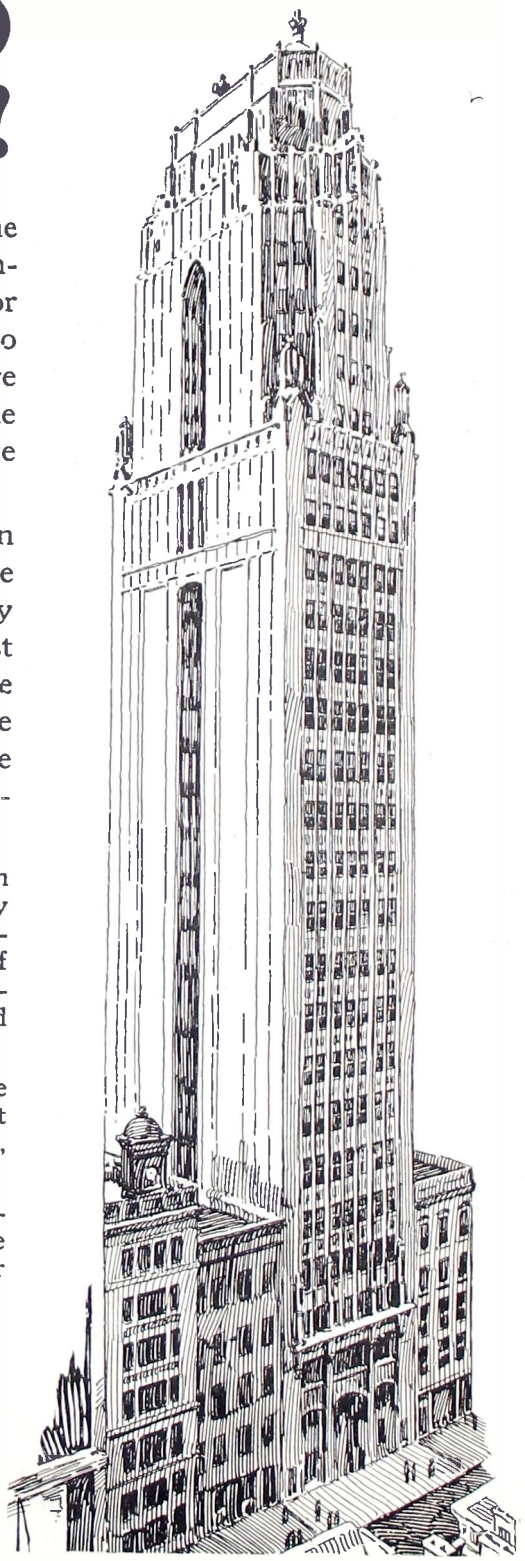

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RADIO WORLD

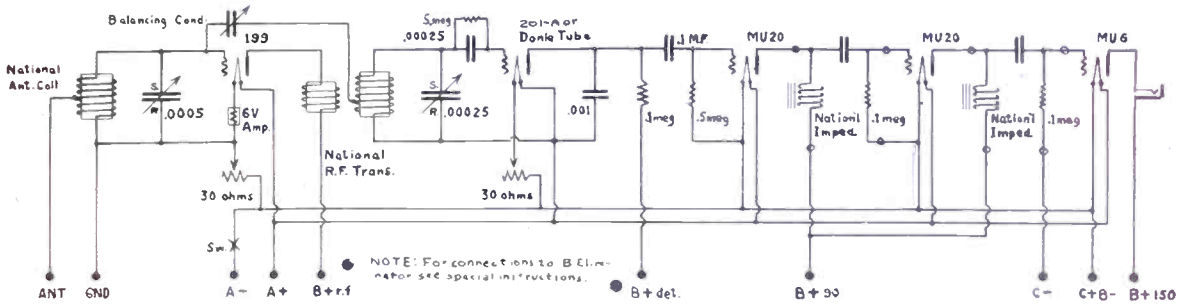
[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March 3, 1879]

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. VIII. No. 25. Whole No. 207 | **March 13, 1926** | **15c per copy, $6.00 a year**

The KB-8

A Non-Regenerative Browning-Drake Set



THE CIRCUIT NETWORK of the KB-8, designed by M. B. Sleeper, of "Radio Engineering." The hookup consists of one stage of tuned radio frequency amplification, non-regenerative detector, a first stage of resistance-coupled audio frequency amplification, followed by two impedance stages.

By M. B. Sleeper

PART I

WHEN a B. C. L. asks a dealer or set builder to construct a receiving set for him, he generally has uppermost in his mind one specification—the set must be satisfactory in operation and results. An experimenter, on the other hand, buying parts to make an outfit, generally wants something unusual in the way of operation or design.

The non-regenerative Browning-Drake receiver, type KB-8, was designed to meet the requirements of both the B. C. L. and the experimenter.

For the B. C. L. the KB-8 has been made irreproachable in operation; that is, there are two adjustments for tuning and that is all, once the rheostats and neutralizing condenser have been regulated. The set can be tuned quickly, for it requires only two hands, and there are no auxiliary controls to play with and which will cause the set to howl by throwing it into oscillation. Therefore, the set is not open to criticism for bad manners, either by the operator or his next-door neighbor, who resents so strongly the presence of sets which are tuned by putting the set into oscillation in order to pick up squeals. The system of audio frequency amplification is equal to any other, and made doubly satisfactory because distortion cannot be introduced by putting the circuit into the unstable condition which is encountered just under the point of oscillation. The current consumption is extremely low, so that good B batteries will give such long life that no one can complain of expense or dissatisfaction from that source. The construction is rugged and permanent, precluding the development of loose parts and broken connections. The range is sufficient to bring in, at full volume, any broadcasting that can be received without distortion on a super-sensitive receiver.

Innovations Introduced

The experimenters will quickly recognize a number of innovations. The non-regenerative circuit, developed by "Radio Engineering," is a conclusive demonstration of the fact that sensitiveness, sharpness, and quality are not confined to sets using regeneration control in one form or another. The National S. L. F. condensers, running over a compass of 270 degrees, are brand new, as are the National impedaformers which contain the chokes and stopping condensers, and mountings for the grid leaks. The Electrad rheostats, switch, and phone jack are just being put on the market, the Walbert neutralizing condenser is an innovation, and such mechanical features as the arrangement of the amplifying units and the pin-jack panel for voltage readings are shown for the first time.

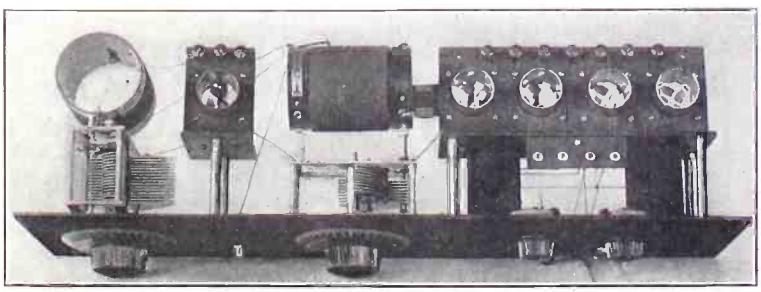
Of special importance is the introduction of the new Donle detector tube. Harold P. Donle, formerly chief engineer of the Connecticut Telephone and Electric Company and inventor of the Sodion detector, the most sensitive type which has ever been made, is now producing the Donle detector tube. This tube operates on a principle recently discovered by Mr. Donle, and in a recent series of tests demonstrated a degree of sensitiveness which has not been approached previously by any other tube. The electrical characteristics are somewhat similar to the D-21 Sodion. It does not require a potentiometer; it can be operated without grid-leak or grid condenser, and the plate impedance is very high. With 22½ volts, the plate current is only 0.1 milliampere. The filament takes 0.25 ampere at 5 volts.

The sensitiveness of the detector is not only important in DX reception, but it has a marked effect upon the quality. When a fairly high minimum voltage must be applied to the detector to make it function, it is obvious that a part of the received speech must be lost. Increasing the sensitiveness of the detector reduces the amount of modulation which does not go into the AF amplifier.

Description of Set

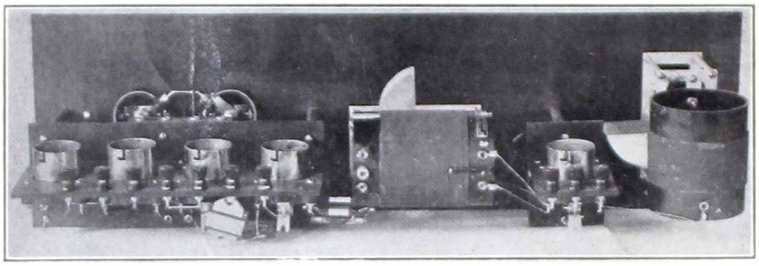
In the description of the KB-8 receiver, the various units and features have been subdivided so as to make them as understandable as possible. This is a most satisfactory way, since the unusual features of this set can be best explained by discussing them individually. This set is entirely unlike any other that has been shown and the features are well worth careful consideration.

As to the actual construction details, blue prints are available which give the panel patterns and picture wiring diagram in full size, step-by-step assembly instructions with explanatory notes, terminal checking list by which the possibility of wrong or omitted connections is obviated, and a complete list of the parts used in



Looking down at the completed receiver. Note the neat outlay of parts. The two National Impedaformers may be seen at the right between the panel and sockets.

High-Class Audio Used



REAR VIEW of the completed receiver.

LIST OF PARTS

One B-D SLF antenna unit (National).
One B-D SLF RF unit (National).
Two Impedaformers (National).
One 5-megohm resistor (Daven).
One 1-megohm resistor (Daven).
Three 1-megohm resistors (Daven).
One .00025 mfd. fixed condenser (Dubilier 640-G).
One .001 mfd. fixed condenser (Dubilier 640).
One .1 mfd. fixed condenser (Dubilier 656).
One balancing condenser (Walbert).
One ballast resistor (Radiall Amperite, 6V-199).
Two 30-ohm rheostats (Electrad).
One filament switch (Electrad).
One open circuit jack (Electrad).
Five sockets (Amsco No. 100).
Three resistor mountings (Daven, No. 50).
One 7x24x3/16" panel (Celoron-Bakelite).
Two 3½x9½x3/16" panels (Celoron-Bakelite).
Two 3½x2½x3/16" panels (Celoron-Bakelite).
Ten engraved binding posts (Eby).

Accessories: Three feet, 4-21-40-RF copper cable; one length No. 7 varnished tubing; forty feet Wirit (2 coils); fifty 6-32 Lastites; six Durant terminal pillar supports; ten ½" 6-32 FH lacquered screws; thirty ¾" 6-32 RH nickelled screws; six ½" 6-32 RH nickelled screws; twenty ⅝" 6-32 RH nickelled screws; twenty 6-32 .041 nickelled nuts; ten Durant soldering lugs.

the original set, as well as the electrical constants.

In the circuit of the RF amplifier there is the left-hand tuning unit, looking at the set from the front, RF tube panel, and neutralizing condenser.

The coil is identical in dimensions to that which has been furnished in the standard Browning-Drake units of the National Company, but the .0005 mfd. variable condenser is of SLF design, turning through 270 degrees. A Velvet vernier is employed, with a dial having 150 graduations. This gives an effective reduction ratio of 4 to 1.

Two panel support pillars, 3⅜" long by ⅜" in diameter, carry a vertical panel 2½x3½", 3/16" thick, to which another panel, of the same size, is secured with 1" angle brackets. An Amsco socket is mounted under the horizontal panel. Instead of fastening the socket with two screws, as was originally intended, the socket is held to the panel by ⅝" 6-32 round head screws running through the panel, socket base, and into Lastites. The clips were taken from a single grid leak mounting, and fastened to the socket through the regular mounting holes. The clips are held by ½" 6-32 round head screws threaded into Lastites. This provides a convenient mounting for the 6V-199 Amperite.

If a UX199 tube is used for the RF amplifier, the Amperite, which is in series with the 30-ohm rheostat, makes it impossible to burn out the tube by turning the rheostat too far. The UX tube can be fitted into the socket with a Pacent Isolantite adapter. On the other hand, some persons prefer the UV201A for an RF tube. In that case, the Amperite terminals must be short circuited. Then the rheostat gives the usual filament control

High Amplification

A Walbert neutralizing condenser is mounted between the pillars which hold the RF tube panel. This is a very convenient type of neutralizing condenser, for it can be adjusted from the front of the panel. However, since the adjusting screw is covered by a cap nut, there is no tendency to play with it, as is the case with types having a regulating knob. No change has been made in the inductance for the detector circuit. The standard regenaformer coil is employed, but the tickler is omitted, and a .00025 SLF condenser substituted for the SLC or SLW types previously used.

It has been observed by some engineers that it is difficult to build a non-regenerative RF transformer which, without regeneration, gives a high degree of amplification over the entire broadcast range. Tests on the Browning-Drake transformer show that the loss at high wavelengths is practically negligible. This is due to the design of the coils and the method of winding and placing the primary.

THE PANEL VIEW of the KB-8.

In other words, regeneration increases the signal strength over the whole wavelength range. However, the design of this set is such that, even with a 201A tube for a detector, a very high degree of sensitiveness is obtained. Using the Donle detector tube, the set showed a response equal to that of the Browning-Drake receiver equipped with a tickler. Instead of using transformer or impedance coupling after the detector, the coupling for the first stage is resistance. Results shown by hundreds of reports from RX-1 owners confirmed my judgment in deciding upon resistance for the first stage. Moreover, because of the high impedance of the Donle tube, greater amplification may be obtained in the first stage with resistance than with either transformer or impedance coupling.

The 0.1 mfd. stopping condenser is fastened between the resistances on to the vertical panel. The clips were taken from two single resistor mountings, and fastened to the regular mounting holes of the sockets just as the clips for the Amperite were put in place.

The Audio Amplifier

The two stages of impedance amplification are connected in the conventional manner, although the combination of impedance or transformer amplification following a first stage of resistance coupling, first shown in the RX-1 receiver, was originated by "Radio Engineering." (The RX-1 was described in the October 17 issue of RADIO WORLD.)

The impedaformers are fastened to the vertical panel. The outer mounting screws at the top, looking at the set from the front, also hold the angle brackets which fasten the horizontal panel to the vertical panel. This detail is explained in the blue prints. The amplifier unit can be entirely assembled and almost completely wired before it is put on the front panel.

(Continued next week)

500-Mile Day Range Claimed for Super-Power

The report of the Radio Corporation of America for 1925, just issued, says on the subject of super-power:

"To render an improved service to the public and to transmit the entertainment and educational influences developed in the great centers of population, particularly to homes distant from local broadcasting stations, an experimental high-power broadcasting station (WJZ) was established at Bound Brook, New Jersey, which is about twenty-five miles from New York City. It has a maximum power one hundred times greater than that heretofore used by stations WJZ, WJY and WRC. Experimental tests have shown that this high-power station will give improved service to New York and its suburbs and good service during daylight hours to points within a radius of 500 miles. During the hours of darkness it has been heard in all parts of the United States and at many outside points. It is expected to furnish a reliable night broadcasting service to all points in the United States east of the Mississippi River."

With regard to the comments concerning the operation of this station the report says: "The experimental operation of the new high-power broadcasting station at Bound Brook resulted in favorable comments from radio listeners in many places in the United States and other parts of the world."

The Tube vs. the Crystal

Author Makes Comparative Tests of Rectification and Announces Decision Whether the Mineral Affords Greater Purity Than the Bulb

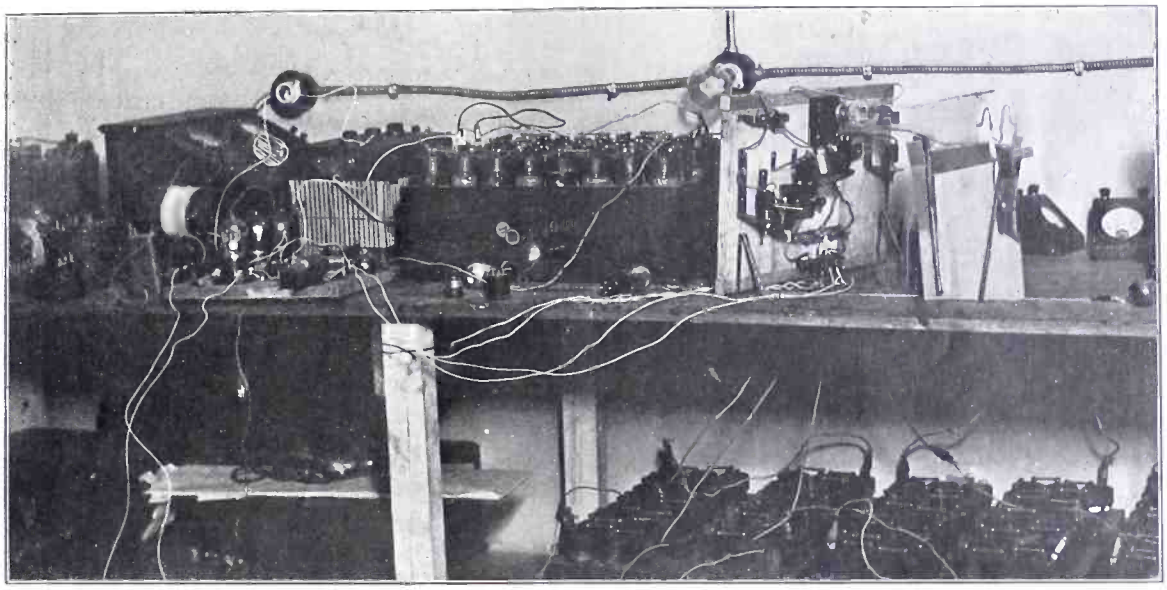


FIG. 2.
The complete layout of the test apparatus. The modulated radio frequency oscillator is at left, with the coil in view at the side nearer you. The test circuit is located by the three tubes in a row. To the right of the shelf batteries is the oscillograph, with a wave form showing on the screen. (Foto Topics.)

[The purity of crystal rectification as compared with tube rectification, considering only the wave form, has been taken for granted by many fans. The author, however, decided to make an investigation on his own account. He used a cathode ray oscillograph tube, whereby it is possible to see the audio wave, indeed even represent it at a standstill. The results of his interesting work are set forth in the following article.]

By John F. Rider

Member, Institute of Radio Engineers

IS crystal rectification better than tube rectification?

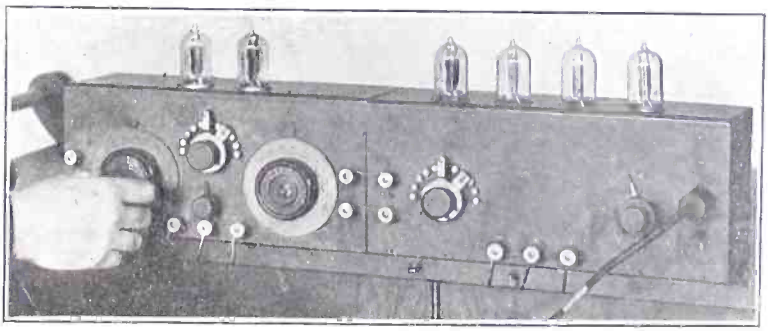
So that the comparison between the two be properly comprehended, it is imperative to arrive at a fundamental basis relative to the prime requisite of the rectifying element. To be exact there are several requirements which must be fulfilled. First, the rectifying element must be sensitive and responsive to weak impulses. Second, the rectified signal must be a faithful reproduction of the original signal generated at the broadcasting station, assuming that our concern is solely with transmission and reception of broadcast speech and music. Third, extraneous noises other than those due to the desired signal must be as little as possible.

Of the above three, faithful reproduction is the major item, as perfect quality is one of the two essentials of every radio receiver. The other, selectivity, is beyond the discussion at this time, although a crystal rectifier manifests an effect upon selectivity. However, the discussion of the selectivity factor is omitted because of the consideration that whenever the tube is replaced with a crystal, the rectifying unit is usually preceded by one or two stages of radio frequency amplification, thus being without selectivity jurisdiction.

Comparison of Wave Forms

The comparison of quality output can best be carried out by one method only, and this method is the comparison of the wave forms of the input at the broadcasting station and the output of the rectifier as it would be passed into the phones of the loud speaker, the output of course taking place at the receiving end. This system no doubt appears far-fetched, in that it would seem impossible to obtain the wave form curves of the input signal at the broadcasting station. In test work,

First Super-Heterodyne Is Still Doing Its Bit



THE original Super-Heterodyne, invented and built by Major E. H. Armstrong, U. S. Signal Corps, in the Signal Corps Research Laboratory at Paris, during the World War, is still being used in Washington. The set is the forerunner of the present Super-Heterodyne receiver and is now in the historical collection in the office of the Chief Signal Officer, U. S. Army. (Harris & Ewing).

Audio Waves Made Visible

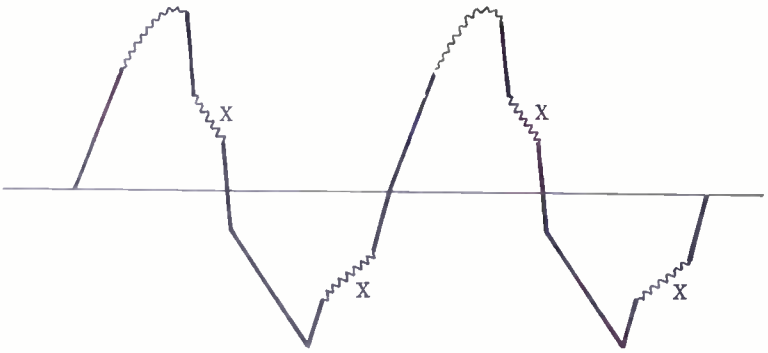


FIG. 1.

Wave form of a note produced by an audio frequency amplifier. The peaks and depressions at X are those that will vary if the same note, say middle C, is played on a piano or banjo, and must be watched to determine the tonal characteristics. Of course the frequency is not altered by any tone characteristic change.

however, it is possible to utilize a unit known as a modulated oscillator, to replace the outside broadcasting station, and the wave forms of the modulated signal can be ascertained easily. The system of comparing wave forms is therefore entirely feasible; in fact its application to the regular tests conducted upon the various types of audio-frequency amplifiers would show up defects entirely lost in methods more frequently employed.

If we look into this matter a little deeper we will find that the loud speaker must set the air into corresponding periods of vibration, as does the voice of the speaker or the singer at the transmitter. Hence it is essential that during the progress of transmission, reception, rectification and amplification, the original voice wave form with all its little complexities or variations be retained. Otherwise the voice becomes unrecognizable, since through the loss of the small variations the distinguishing characteristics are lost. Not that the words become incoherent or the voice unintelligible, but rather that the features which permit one to distinguish between the voices of two different persons are lost. In substance, these minor but important variations comprise the characteristics of the voice, even as the dimples, ridges and depressions upon a person's face constitutes the distinguishing features between different faces.

The Author's Answer

Therefore, will a crystal rectifier, used in place of a tube in a non-regenerative circuit, with the associated equipment identical in both instances, retain these small variations of the voice wave form to a greater degree than the vacuum tube? The regenerative detector is deliberately omitted because a crystal is very seldom, if ever, used to replace a regenerative detector.

The crystal detector does not afford better quality output than the tube detector, utilized in a non-regenerative circuit and in the normal manner. Insofar as the small distinguishing variations in the wave form are concerned, the non-regenerative detector retains them as well as the crystal detector. A distinction is necessary between the accuracy of the wave form and extraneous noises. Very erroneously fans have considered the superiority of the crystal as general, simply because it was quieter in operation of the crystal is beyond the point.

Ear a Poor Guide

Because of the deficiency of the ear with respect to very slight variations in tone, the comparison of the crystal and middle C on a piano and the middle C on a banjo. Remove these peaks, and, while the frequency has not been altered, the tonal characteristics have changed.

Since the test by ear is unsatisfactory, tube rectifier by listening to the two outputs would not be conducive to accurate determinations. In fact it would be nearly impossible to note the loss of certain distinguishing characteristics, if such actions did occur. There is shown in Fig. 1 a wave form of a note produced by an audio frequency oscillator. The small peaks and depressions designated by the letter X constitute the points of distinction between the same note if played upon two different types of instruments, say the tion. The reason for this action will be dealt with later. At this time the quieter

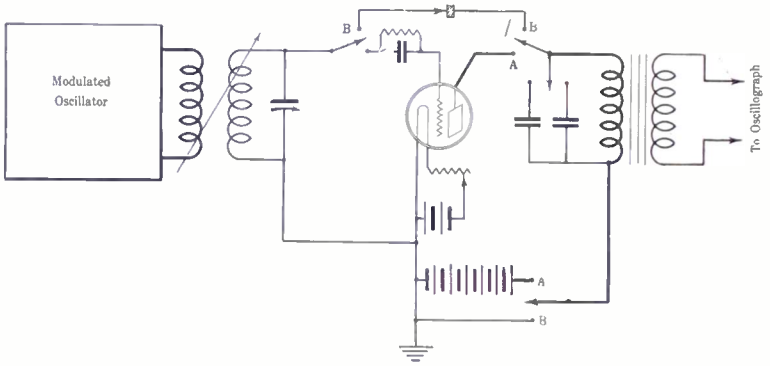


FIG. 3.

Wiring diagram of the test circuit. Note how the tube rectifier is replaced by a crystal by throwing a switch.

why not utilize equipment whereby it is possible to observe visually the actual electrical wave form of the audio signal prior to its being transformed into sound waves via the loud speaker? The equipment suitable for this work is the Cathode Ray Oscillograph tube, operated in conjunction with other associated equipment. A photograph of the complete layout is shown in Fig. 2. By the action of the cathode ray tube there is cast upon its fluoroescent screen an image of the electrical potential constituting what later develops to be the sound wave emitted from the loud speaker. The speed at which this image traverses the screen is entirely within the operator's control, and by means of certain adjustments the moving image can be stopped and a close study of the wave form made. Consequently a close study of all forms of electrical potentials can be effected, including the outputs of tube or crystal rectifiers. This is the equipment utilized in making the various determinations mentioned in the text.

Switches Facilitate

The complete circuit layout is shown in Fig. 3. By means of the various switches in the test circuit, the tube rectifier can be instantly removed and replaced with the crystal. The input and output circuits remain constant, the same units being utilized in both tests. The coupling between the oscillator and the pick-up coil of the tests circuit is variable, thus permitting of the signal pick-up and voltage output variation, facilitating the observation of the wave forms upon the screen.

Keep the Aerial's Period Below Broadcast Range

Quite a few instances have been found where fans utilize very long aerials, a decrease in signal intensity is noticed on some stations and an increase on others, after the insertion of a series condenser. This is due to the extremely high fundamental prior to the insertion of the series condenser and the reduction to a value approximating the wavelengths of the stations received with increased intensity. It should be remembered that the resonance phenomenon is equal on both sides of the resonance point. With a unit input, practically the same decrease is noted when the incoming signal is on a wavelength and equal distance above or below the fundamental. Thus with a long aerial increased selectivity may be obtained on certain wavelengths and decreased selectivity on others. To safeguard against this, the fundamental of the aerial should always be less than the lowest wavelength covered by the tuning circuits of the receiver.

The Effect of Grid Leaks

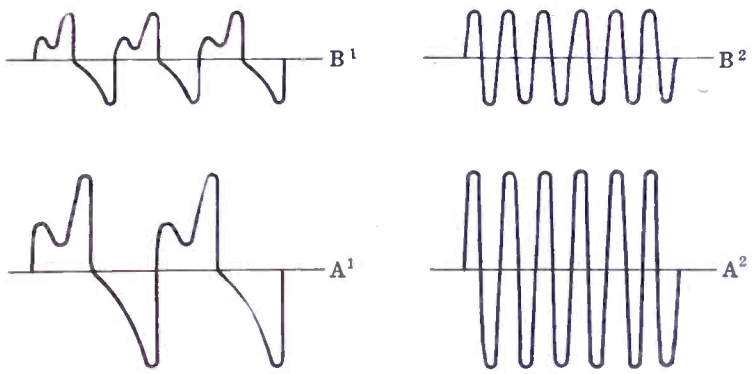


FIG. 4.

Two different frequencies (pair at left and pair at right). A1 and A2 represent tube output, compared with crystal output, B1 and B2. While the amplitude differs considerably—that is, the height of the wave form—the wave form itself undergoes no change, the author found.

Reading from left to right, we have the modulated radio frequency oscillator, the tests circuit and the oscillograph. (Fig. 2).

No doubt some will claim that the operating characteristics of the audio-frequency transformer will show an effect upon the wave form; also that its effect will vary when used with the tube and then with the crystal. Granted. What of it? Its effects cannot be different under these conditions than they would be if the oscillograph were replaced by another amplifying tube and the complete test circuit contained within a receiver operating in the normal manner. Whatever effect the transformer will show upon the wave form when the tube is used will be shown when the crystal is used. At least such is the operating condition in actual practice, therefore we must make our determinations under the same conditions. And the remark that the crystal affords better quality than the tube assumes perfect operation of the transformer. Hence the choice of the transformer need not be special, since the comparison between the two outputs can be considered as indicative of the operating characteristics of the two types of rectifiers.

Amplitudes Differ

Assuming the same wave form input and perfect rectification, the same output wave form will be seen. That the amplitudes will differ is logical, but the change in amplitude bears no relation to the change in wave form. The amplitude may vary in any proportion, but an analysis of the wave forms will show them to be identical in shape.

Accordingly, various signals generated by a local audio oscillator were used to modulate a radio frequency oscillator and the modulated radio frequency wave was fed into the input circuit of the rectifier combination, and observations of the output voltage wave form made upon the oscillograph screen. The modulated waves varied from practically a sine wave of 1,000 cycles to complex waves of as low as 60 cycles. The images as depicted upon the oscillograph screen are shown in Fig. 4 and designated by the letter A for the tube output and letter B for the crystal output. The amplitude proportions are not directly in proportion to the relative degrees of rectifying efficiency of the tube and crystal, the tube amplitude being normally much greater than the crystal's. There is very little difference in the actual wave form. Due to the variance in amplitude an optical illusion of variance in shape is unavoidable. However, a plot of each of the curves of similar cross sectional paper will show them to be uniform and identical.

Source of Confusion

A test of the two outputs by means of the ear shows up the variance in amplitude, but there is ever present the possibility of confusing tone with volume. A weaker signal will sound different than a stronger signal. The truth in this statement was illustrated during the test. Three separate individuals were certain that the tone of the signal emitted when the crystal rectifier was used differed from that when the tube was used. Only one person thought the two alike and he was borne out by the oscillograph. Hence from the angle of quality output, or faithful reproduction, the superiority of the crystal over the tube fails; it is not present.

We have not considered the effect of the decrement of the circuit upon the resonance curve of the input circuit to the rectifier, an item of great importance in regenerative detector circuits, since in these circuits by virtue of the regeneration the decrement of the circuit is lowered to the point where the resonance curve becomes so narrow at the base that some of the side bands of the transmitted modulated carrier are cut off. With a portion of the side bands missing, the rectified reproduction cannot be perfect. But this regenerative condition is not existant in either of the circuits under discussion, and while no doubt the decrement of the tube combination is less than that of the crystal combination, and would tend to cause a resonance curve with a narrower base, the curve of the non-regenerative system is at all times sufficiently broad to cover the full side bands. And since nothing is gained by having the base any broader than is necessary to cover all side bands, the additional breadth of the crystal combination is of no material advantage.

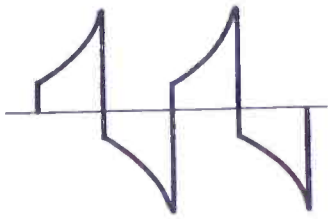


FIG. 5.

The same frequency as plotted in Fig. 4A1 is shown in the above graph, which was made with the grid leak omitted. This denotes decided distortion.

Low-Frequency Discrepancy

Relative to the comparison of the original audio wave used to modulate the radio frequency oscillator, and the output of the rectifier system, similarity was noticeable only on the 1,000-cycle note. The original wave form and that of the rectified signal were practically identical. On the lower frequencies, however, there existed a marked discrepancy, due no doubt to two causes far removed from the rectifier. These were first, incorrect modulation of the radio frequency wave, and second, the amplifying characteristics of the modulation transformer used. This transformer was not of the modern type, being designed primarily for speech transmission, hence its peak operation was at 1,000 cycles. But the divergence from the original wave form is not of great consequence in respect to the rectifying actions of the two types of rectifiers. The similarity between the two output signals is the important factor, since the distorted radio frequency wave arrived at the receiver in the same form for both types of rectifiers. And if the output curves are similar, the rectification must surely be similar.

As to the adjustment of the tube rectifying system to its best point of operation it was found that during the tests, that is for the signal intensities encountered, no radical change in wave form was noticed with grid leaks varying in resistance from 1 to 5 megohms. But the omission of the leak did cause quite a change, resulting in the loss of one of the distinguishing characteristics, as shown by a comparison of the form in Fig. 5 with that shown as A1 in Fig. 4.

Tube Superior

Concerning the relative amplitudes of the crystal rectifier output and the tube rectifier output, much need not be said. The superiority of the tube is far beyond dispute. If there are any radio fans who have been convinced by word of mouth that a crystal rectifier will afford an

(*Concluded on page* 21)

Resistance Is Like Friction In Piping

A pipe, through which water flows, always has some friction which hinders to some extent, the flow of the water. Were it not for this friction the water would increase in speed beyond means of control. The same thing takes place in an electrical circuit. This is known as the resistance of the circuit. The greater the resistance the smaller the current which can be produced in the circuit by a battery. In other words, an external resistance at any point in the circuit is equal to a partly closed valve in a pipe at any stated point.

The Tectron Eliminator

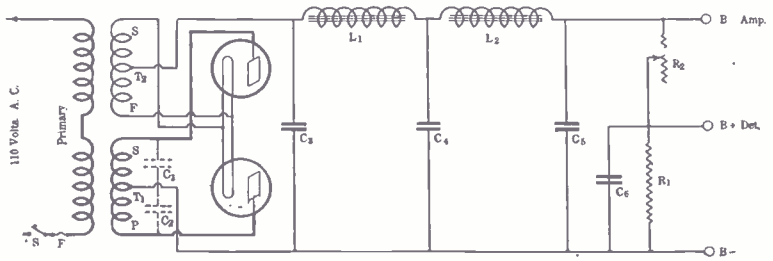


FIG. 1, showing the schematic diagram of the eliminator. T1 is the plate tap, while T2 is the filament tap.

By Lewis Winner

Associate, Institute of Radio Engineers

PART I

UP to the present three specific types of B battery eliminators have been discussed by me in RADIO WORLD. (1)—The Rex B Battery Eliminator, employing a single tube, rectifying one side of the AC line. (2)—The Chemical B Eliminator, employing chemical cells for rectifying both sides of the AC line. (3)—The Raytheon Power Unit, employing a gaseous tube, rectifying both sides of the AC line (Dec. 12, 19, 26, Jan. 2 and 16 issues). An eliminator employing two tubes, rectifying both sides of the AC line, will be discussed in this issue. This is the Tectron, named after the rectifier tube employed. The electrical schematic diagram of this eliminator is shown in Fig. 1. It will be noted by a glance at the photos and diagrams that there is no difficulty attached to the construction.

In the Rex Eliminator the filtering system employed was quite bulky, although efficient. In the present eliminator, due to the rectification of both sides of the line, the filtering system becomes quite simple and therefore less bulky. In the Rex Eliminator the hum could be done away with, but it required careful tuning by the operator of the rceeiver as well as careful adjustment of the variable resistances, in both the filament and plate circuits. Although in the present eliminator careful adjustment is required, the action is very simple and requires very little time. No adjustment is used in the filament circuit, the tube being so made that its greatest point of operating efficiency is when 5 volts are applied to heat the filament, at which voltage one ampere is drawn. In other words, if you install a variable resistor in series with the filaments of both tubes, in series and shunt with which are a voltmeter and an ammeter, you will note that by adjusting the resistances until you come to the stated wattage, the efficiency of tube will be nil. There is very little heat produced by the tube, which accounts for the common shape of the glass surrounding the elements. A word about these elements. The filament is quite heavy and will stand up under knocking around as well as surges. That is, a sudden increase in the line voltage, increasing the filament voltage to 6 or 6.5, will not blow out the tube. Of course, the efficiency of the tube at this point will be decreased. The plate is very large, accounting for the great amount of current that may be passed. The maximum output current rating of this tube, according to laboratory tests, was 30 milliamperes at no load. This means that if two tubes are used here, as much as 60 milliamperes can be obtained. At 125 volts on full load from a 6-tube set the tube passed 50 milliamperes. At no load, that is when it is not being used in a receiver, as much as 150 volts at the first stated current rate was obtained. The high voltage secondary supplies 220 volts to the plate of the tubes. However, the plate is so constructed that it will stand as much as 290 volts without a breakdown. This, therefore, takes care of a possible surge.

Now as to the choke coils and the step-up transformer. Instead of there being 60 henries, as in the Rex, only choke coils of 30 henries are employed. The shell type core was used in the construction of the chokes in the laboratory model. However, the laminated closed type core can be used. With the shell type core, the choke consists of 5,800 turns of No. 32 enameled wire. There are 80 laminations necessary to make up the core. Using the closed type core, the choke consists of 6,850 turns, employing No. 32 enameled wire. Here 120 laminations are employed. In the shell type core there is a normal gap of .005". In the closed type core, a gap of .005" is made by inserting a piece of paper between the laminations. Now as to the transformer. The primary consists of 920 turns of No. 26 enameled wire. The secondary, PS, consists of 3,680 turns, tapped at the 1,840th turn, using No. 31 enameled wire. This, of course, is the high tension or the plate voltage secondary. The secondary, FS, consists of 50 turns, tapped at the 25th turn, using No. 18 enameled wire. This is the secondary, which applies the voltage to the filaments. The primary is first wound, the plate voltage secondary over this and the filament secondary over this winding.

The condensers C3, C4 and C5 are obtained in one unit. C3 is a 3 mfd. fixed condenser. C4 is a 2 mfd. fixed condenser and C5 is a 6 mfd. fixed condenser. If the unit is not used, then C3 should be a 4 mfd. fixed condenser and C5 a 8 mfd.

LIST OF PARTS

One AC 220-volt step-up transformer (Shore).
Two 30-henry choke coils, L1L2 (Shore).
Two .5 mfd. fixed condensers, C1 C2 (Aerovox).
One .5 or 1 mfd. fixed condenser, C6 (Aerovox).
One condenser unit; one 3 mfd. fixed condenser, C3; one 2 mfd. fixed condenser, C4; one 6 mfd. fixed condenser, C5 (Aerovox).
One variable resistor, R2 (American Mechanical Laboratories).
One 10,000 ohm fixed resistor, R1 (Aerovox).
Two rectifying tubes (Tectron).
Two sockets, standard base.
One socket for input voltage.
One switch, S.
One panel.
One 25.0 ampere, 110 volt AC fuse, F.
One socket for holding fuse.
Accessories: Lamp cord, aluminum brackets, screws, nuts, cabinet, flexible wire, binding posts, insulating strips, etc.

fixed condenser. C6 is a 1 or a .5 mfd. fixed condenser. C1 and C2, both of which are optional, are of the .5 mfd. variety. In both these optional cases it is well to purchase the condensers to try them in the circuit as different lines require a slight increase or decrease in the capacity of the filter to obtain the correct filtering action.

R2 is a variable resistor, zero to five megohms, and is used to control the voltage flowing in the plate circuit of the detector tube. R1 is a 10,000-ohm fixed resistor, used for bypassing action.

Placing the Parts

The parts, as in the Raytheon Power Unit, are layed out on a metal baseboard. You will note by looking at Fig. 2 that a special cut baseboard was used, so that it could be placed in a cabinet, the photo of which will be shown next week. That is also the reason for bending over of the variable resistor, which is to be mounted on a panel. The design for mounting these parts, with the various positions designated, is shown in Fig. 3. The condensers are enclosed in one metal box, with the terminals coming from one end. This is placed in the center. Over this is placed a strip of aluminum, on which the sockets are mounted. The step-up transformer is placed to the right of the condenser bank. The socket for the input

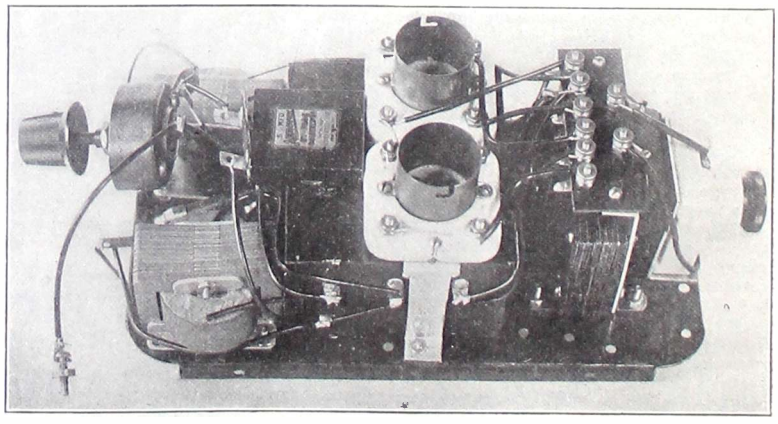


FIG. 2, looking down on the eliminator. Here a clear view of the layout of parts is seen.

Wiring the Power Unit

voltage is also mounted on an aluminum bracket and at the furthermost right-hand point. The choke coils are at the extreme left-hand sides, with the variable resistor in the center. The fixed resistor (Fig. 4) is underneath the variable resistor and is first mounted on a piece of insulating material, to prevent any possible shorting. Now you will note that there is still room for a switch or fuse socket. Move the input voltage socket over to the right or near the right-hand edge, placing the fuse socket near the left-hand edge. The switch can be mounted on an angle bracket made of aluminum right over or in between the two sockets. These extra insertions will be shown next week in picture diagram form. When mounting the sockets over the condenser bank, make sure that there is at least ¼" space between the condenser bank and the bottom of the socket. This is to prevent any possible softening up of the paraffin holding the condenser together, occurring from the small heat delivered by the tube.

Wiring the Eliminator

The wiring or hooking up is done with the aid of flexible wire of either the No. 18 annunciator or Celatsite type. Be sure that the wire is well insulated. If you are using bare wire, place spaghetti over it. Solder all connections, where lugs are present, as on the condenser bank, choke coils, etc.

Bring one terminal of the primary winding of the step-up transformer to a post on the input voltage socket. Bring the other terminal of this winding to one terminal of a fuse. The other terminal of this fuse goes direct to a switch and from the switch to the input voltage socket. The fuse and the switch may be left out, thereby connecting this terminal of the primary winding direct to the post on the input voltage socket. Now bring one end of the secondary winding, P S to the plate post of one of the sockets, while the other end of this same winding goes to the plate post of the other socket. The tapped terminal of this winding goes to the B minus post. The filament secondary is now wired, this being on the top of all the windings. Connect the F plus posts of both sockets together. Connect the F minus posts of both sockets together also. Now connect one end of the winding to the F minus posts, while the other end of this winding goes to the F plus posts of both sockets. The tapped portion of this winding goes to one terminal of L1 the choke coil and C3, which is the 3 mfd. condenser. The wiring of the transformer is now concluded.

Now bring a lead from the B minus post to the other terminal of C3, to one terminal of C4, to one terminal of C5, to one terminal of C6 and to one terminal of R1. The other terminal of C4 goes to the other terminal of L1 and to one terminal of L2. The other terminal of L2 goes to one terminal of C5, to the B plus Amp. terminal and to the resistance portion of the variable resistor. The controlling arm of the resistance goes to the B plus Det. post, to one terminal of C6 and to the left off terminal of R1. This completes the wiring.

The following suggestions should be followed, before the insertion of eliminator in a cabinet, as after the insertion it is a pretty difficult thing to get at the connections if any errors have been made.

First place the tube in the socket, at the same time taking the fuse out, if such be in. Get some lamp cord which is about 10 or 11 feet long.

(*Continued next week*)

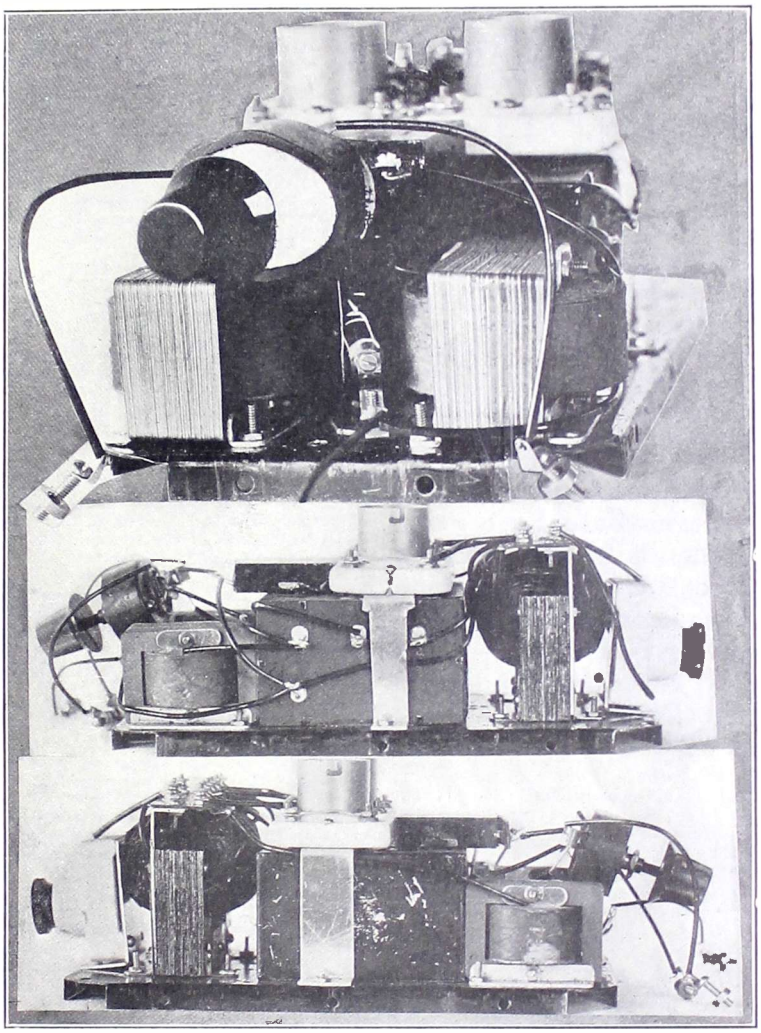


FIG. 4, (top), showing the placement of the fixed resistor, R1, in between the two chokes, L1 and L2. Note the two holes in the angle bend. This may be used for the mounting of the panel. Fig. 5 (center), a side view of the eliminator. Note the terminals of the condenser bank, which is in the center. Fig. 6 (bottom), showing the other side of the eliminator. Note the aluminum bracket, holding the socket.

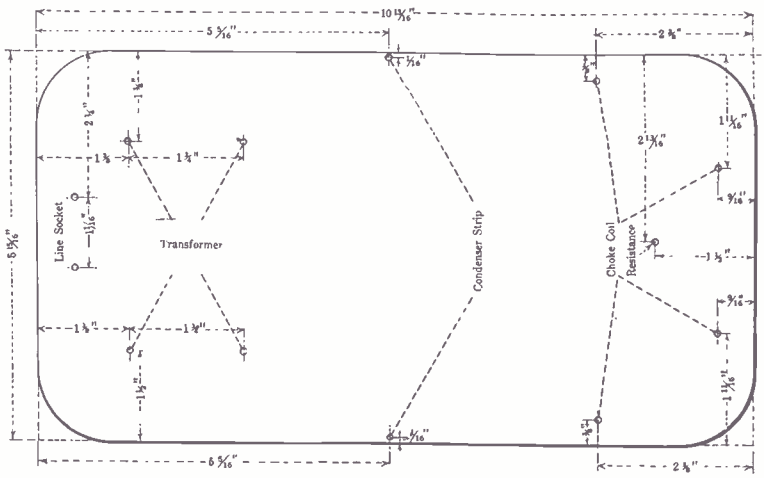
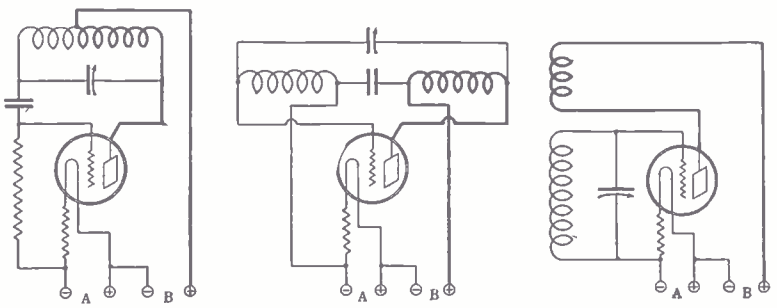


FIG. 3, showing the design for the placing of the parts.

My Experiences *with* Super-Heterodyne Sets



THE THREE most popular types of oscillators. Figs, 2 and 3 (left to right) may give much body capacity trouble. Fig. 4 is the hookup J. E. Anderson prefers.

$$f = \frac{CF\Delta C}{4C_1C_2} \quad \cdots\cdot(1)$$

$$f = \frac{F\Delta C}{4\sqrt{C_1C_2}} \quad \cdots\cdot(2)$$

$$f = \frac{F\Delta D}{4\sqrt{(D_0+D_1)(D_0+D_2)}} \quad \cdots(3)$$

THE THREE EXPRESSIONS for determining the intermediate frequency.

Problem of Choosing Best Intermediate Frequency Depends Much on One's Location—The Solution Lies in Abating the Harmonic Nuisance — Ways of Preventing Radiation Are Discussed.

[*J. E. Anderson, noted radio engineer, is one of the recognized authorities on the Super-Heterodyne. For several years he has specialized on this type of receiver. The following is Part I of a two-part article in which he points the way to the solution of many Super-Heterodyne problems. Part II will be published next week.*]

By J. E. Anderson

Consulting Engineer

THE Super-Heterodyne receiver is a fickle affair. Normal experience with it, I believe, is a preponderance of disappointments over successes. In theory the circuit is the paragon of sensitivity, selectivity, and "ritziness"; in practice it is altogether too often a conglomeration of squeals, howls, mush, interference, silence, and in general, all things which it is supposed not to be. Despite the fickleness of various circuits of the type it is decidedly worth while to woo the principle of the Super-Heterodyne because of its inherent possibilities. A good Super which has been carefully designed and built, stabilized, and cured of its many ills is worthy of all the superlatives with which it is usually associated. But a Super-Heterodyne cannot be built merely by assembling all the ingredients as given in some list of parts, dumping all of them into a box, and shaking it thoroughly. The chances that they will arrange themselves into a Super-Heterodyne are against success.

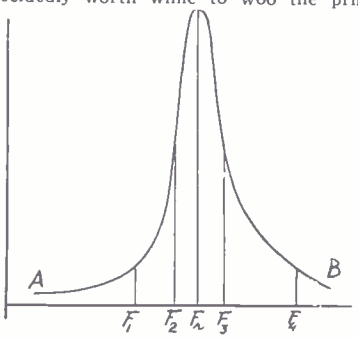


FIG. 1, conditions for overloading and explaining the silent space on dial where signal should come in loudest.

Abundance of Reports

Ever since I published my first description of a Super-Heterodyne a few years ago, fans have bombarded me with questions regarding the fickleness of this type of receiver. In one letter a fan gives an imposing list of remote stations picked up and is enthusiastic over his "best ever" set. The next letter from the same fan is an S O S. Some other fan sends in his distress call first and then follows it up with one indicative of hope. One fan says he can get European and trans-continental stations "any time he wants them," while another fan, working with supposedly the same hook-up, condemns the super-heterodyne as no good because he can't get anything but squeals. Fans are prolific questioners, and some of their questions are real problems. In the following I shall endeavor to include and answer, in my way, some of the more frequent questions asked.

Let us start with the question: Which is the best intermediate frequency?

The available frequencies for the intermediate amplifier may be arbitrarily taken as between 30 and 75 kilocycles. Points in favor of low intermediate frequencies are greater amplification per stage, greater stability of amplifier, higher selectivity. Points against them are: the set will be critical to tune; it may be too selective for good quality, a serious fault; it will be difficult to make the oscillator and the other radio frequency tuned circuits independent, and if they are not Independent the set will not work at all. Points favoring the higher frequencies are that smaller coils will be required and that regeneration may be employed to better advantage. Against the higher frequencies are lower selectivity and less stability. Another point is that the two points at which a given station comes in on the oscillator dial are so far apart as to crowd one of them off the dial for most of the stations it is desired to tune in.

The choice of intermediate frequency in the range between 30 and 75 kilocycles depends some what on local conditions. It is a question of minimizing cross talk of secondary order. This calls for an explanation. Suppose that the intermediate frequency of the super amplifier is 45 kc. Further suppose that there are two broadcasting stations operating within range of the receiver on the frequencies of 570 and 660 kc. Now if the oscillator is set at 615 kc, the 570 kc station is brought in, because 570 plus 45 equals 615. But this setting of the oscillator will also bring in the 660 kc station, because 660 minus 45 is also 615. Both of the stations will then be heard when the oscillator is set at 615 kc. This type of interference may be called secondary cross talk, and that trouble is one of the most serious defects of the super-heterodyne. It is the cause of a lot of the squealing with which the super is cursed. If it were pure cross talk the case would not be so bad, but that is rarely so. Usually the intermediate frequency is such that the local oscillator is not half way between the two station oscillators, but slightly to one side. Squealing results.

A Tough Problem

It is obvious that it is practically impossible so to choose an intermediate frequency as to eliminate secondary cross talk. Stations are located every 10 kilocycles between 550 kc and 1,500 kc. Hence no matter what frequency is chosen there will be some squealing, and not only will this occur at one of the points on the oscillator dial, but at both, except for those stations which operate near the limits 550 and 1,500 kc. These will only have interference on one. The common 45 kc frequency was chosen with the idea that one which was an odd multiple of 5 would not cause as much interference as on which was an even multiple of 5. The example above was cited to disprove that idea, and it is the actual case of WJZ and WYNC. There are several other pairs of stations in the New York area which will interfere in the same manner on intermediate frequencies around 50 kc.

What to Avoid

A method of finding out what frequencies to avoid in selecting the intermediate frequency is the following. Write down all the stations that may be considered as local and set down their operating frequencies. Take all the possible differences and divide each by two. The resulting numbers are the frequencies not to choose. In congested districts like New York and Chicago practically all fre-

How to Cure Squealing

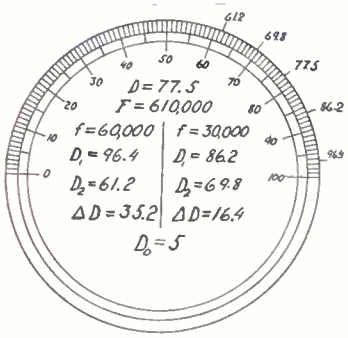


FIG. 5, the determination of the intermediate frequency in a Super-Heterodyne. Signal frequency used was 610 k.c., which comes in at 77.5. For the 30 k.c. IF the side frequencies come in at 86.2 and 69.8. For the 60 k.c. IF the side frequencies come in at 96.4 and 61.2. The delta Ds for these cases are respectively 16.4 and 35.2 divisions. Zero capacity is represented by DO = 5 divisions. One disadvantage of high IF is illustrated by the wide separation between the two side frequencies, that is, by large value of delta D.

Oscillator Hookups Found to Possess Too Much Body Capacity Effects—Author Shows His Favorite Oscillator Diagram and Votes for Grid Bias Method of Detection.

quencies in the 30-75 kc range are ruled out. And that accounts for the fact that all Super-Heterodynes in congested districts are notorious squealers, because nearly all Supers built for broadcast reception have intermediate frequencies in this range. In regions where there are no local stations, or at most only a few, it may be possible to select a frequency which would avoid this trouble, but then comes the problem of getting the filter for this frequency. Most fans buy their filters, and they have a choice of 30 kc, of 45 kc or of catch-as-catch-can kc. The majority are of the latter type.

Since it is very difficult to eliminate squealing by choosing an appropriate intermediate frequency, some other means must be found whereby the secondary cross talk nuisance may be abated. This will be discussed later in this article.

It is sometimes desirable to know the intermediate frequency of a Super-Heterodyne filter, or of a part of the filter, since this information may be used in adjusting all of the filter transformers to the same frequency. This information is easily obtained either in the completed Super-Heterodyne or in a test circuit set up for that purpose. A formula may easily be developed for finding the frequency in terms of the impressed radio frequency and the capacities in the oscillator circuit when this is set for the impressed frequency and the two side frequencies. The process of development will not be given here, but the formula together with a number of modifications, is given in the accompanying table of formulas.

Data in Formulas

In this table formula No. 1 gives the intermediate frequency in terms of the received radio frequency F, the total capacity C in the oscillator circuit when this is tuned to F, the total capacity C, in the oscillator circuit when this is tuned to Ff, the total capacity C2 in the oscillator circuit when this is tuned to F plus f, and the difference delta C between C1 and C2. This formula is exact, and the accuracy of a determination of f depends largely upon the accuracy with which delta C can be determined. Formula No. I may be modified slightly for more practical application. The capacity C is not often easy to determine directly in a well filtered super-heterodyne. However, it does not differ very much from the geometric mean between C1 and C2, that is, from the square root of the product of these two. On this assumption formula No. 1 takes the form of formula No. 2. This formula is only approximate but if f/F is less than 1/10 the error is less than one per cent. Hence it is sufficiently accurate for all practical purposes.

Of course, these two formulas require that a calibrated condenser be used in the oscillating circuit. But such a condenser is rarely available to the Super-Heterodyne owner. Most fans either have a straight line capacity condenser in the circuit or somewhere around. If such condenser be used in the oscillating circuit the dial readings may be substituted for the capacities. Formula No. 3 is a modification of No. 2, using dial readings D instead of capacities. Delta D is the numerical difference between D1 and D2; D0 is the zero setting capacity of the circuit expressed in divisions of the dial, and D1 and D2 are the dial readings at the two places at which a given signal of frequency F comes in. It must be remembered that No. 3 holds only if the condenser is straight line capacity in fact, if the dial is linearly coupled to the shaft of the condenser, and if the divisions on the dial are all equal. If a condenser having semicircular plates be used with an ordinary dial coupled directly to the shaft, the formula applies well enough. D0 must be found by trial, and it usually is about five divisions on a 100 division scale.

Directions for No. 3

In applying formula No. 3 no reading should be taken within five divisions of 100, and no short wave stations should be worked with. Delta D cannot be accurately obtained for them and hence the results will not be reliable. It is best to operate between 300 and 550 meters. In this range a determination of f should be made for every available station. The two points should be found accurately and the dial readings should be estimated to a tenth of one division. D0 may be obtained empirically. It will be noticed that if D0 be omitted all the values obtained will be too great, and the error will be greater the shorter the wave of the received station. Hence the value obtained for a 300-meter wave will be greater than that obtained from the 550-meter wave. Also if the value of D0 selected be too small the values of f will be too large, but the difference between the values of the 550 and 300 meter waves will not be so great as if D0 had been omitted. If the selected value of D0 be too large, the values of f obtained will be too small, and that obtained for the 300-meter wave will be smaller than that obtained for the 550-meter wave, barring errors of determination. A few values of D0 should be tried until there is neither a tendency for the observed f to increase nor to decrease, that is, until all the observed values of f group themselves about a mean which might occur either at 550 or at 300. Only a few trials need be made, and they may well be 4, 5 and 6 divicions if a 100 degree dial is used. The chief error of this method is that a so-called straight line capacity condenser is not really straight, but is a little wavy. The determination, however, is accurate enough to give a fairly close approximation to the intermediate frequency.

There is only one practical way of minimizing squealing arising from secondary cross talk, and that is by reducing the interfering wave at radio frequency until its effect is negligible. Unfortunately, it does not require very much of the interfering wave to give rise to intolerable squealing. The elimination of it must be thorough. A single radio frequency tuner in the modulator, even if this is a selective loop circuit, is not sufficient. Regeneration in the loop or modulator circuit, if this is independent from the oscillator, will help a good deal, but it is not enough. A radio frequency amplifier with a selective tuned circuit usually is sufficient. This complicates the tuning, and the Super-Heterodyne immediately loses one of its main advantages, simpilcity of tuning. But even so it only becomes a three control affair and it is certainly better to put up with that than to have the majority of the stations made unavailable on account of cross talk.

(Concluded next week)

Difference in Volume of Signals Explained

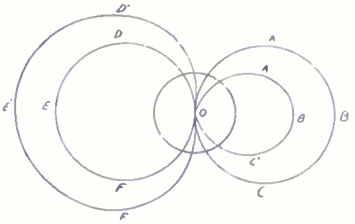
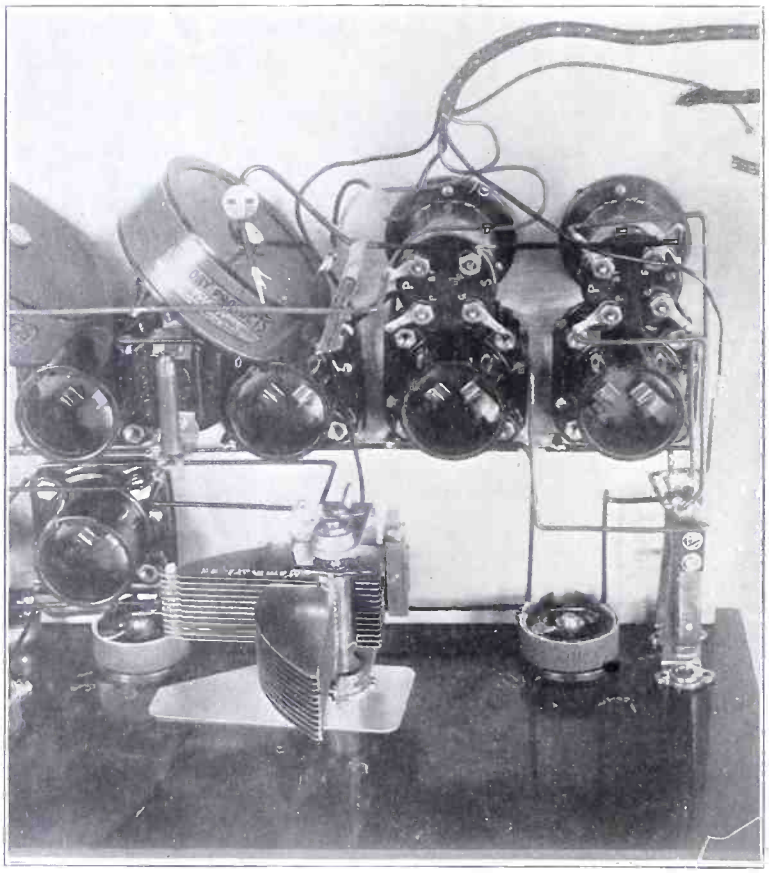


FIG. 6

The drawing shows reason why the signal on one side frequency is louder than that on the other. Circles ABCO and DEFO represent the emf introduced into the modulator circuit from the oscillator by means of the pick-up coil. The small circle in the center represents the emf introduced by capacity coupling between oscillator and modulator. The small loop ABCO represents the effective emf introduced on the side where the inductive and the capacitive couplings oppose, and this loop is the difference between the radii vectores of ABCO and the central circle The large loop DEFO represents the effective emf introduced into the modulator on that side where the inductive and the capacitive couplings aid, and this loop is the sum of the radii vectores of DEFO and the central circle. When there is no resistance coupling the two values to be taken are OB and OE. If the radius of the central circle is negligible or zero, these two radii vectores are equal, and there is no difference between the signal strengths on the two side frequencies. If the radius of the central circle is equal to the diameter of ABCO, one of the side frequencies will give no signal whatsoever.

Curing Victoreen Trouble



THE OSCILLATOR CONDENSER C1 (foreground) must tune sharply. If it does not, apply the remedies suggested in the text.

[*The construction of the Victoreen, an efficient 8-tube Super-Heterodyne, was described in the February 20, 27 and March 6 issues of* RADIO WORLD.]

PERSONS who have built their first Super-Heterodyne or who are tuning one for the first time often complain of harmonic trouble, as they call it, being rather peeved because a station may be heard at a given setting of the modulator condenser (C1 in the Victoreen) and either of two settings of the oscillator condenser (C2). It may even happen that two settings of the modulator condenser possibly bring in the same station, although this is a rarity and is due mainly to the second harmonic.

As for the double effect in the oscillator tuning, it is erroneous to ascribe this to harmonics. Where the fundamental of the oscillator is used to establish the beat note or intermediate frequency by combination with the signal frequency, it will be possible to get many stations at the same modulator setting but at two different oscillator settings. This is characteristic of the circuit itself, not of a particular set. It is not to be rated as "trouble," since it is a normal condition. It arises from the phenomenon of the beat note, which is a new frequency set up by mixing the signal frequency with that of the oscillator frequency. The oscillator frequency, to establish the desired beat note, must differ from the frequency of the tuned input. The beat note is obtained by subtracting the signal frequency from the oscillator frequency or by subtracting the oscillator frequency from the signal frequency. Hence the double setting phenomenon is based on an equal difference, the only distinction being that in one case the difference is up and in the other it is down. As greater volume often accompanies one setting of the oscillator condenser, as compared with the other setting of that same condenser, the double reading frequency becomes an advantage.

Harmonics are multiples of the fundamental frequency (fractions of the wavelength), and of course it is possible on such a sensitive set as the Victoreen Super-Heterodyne to tune in harmonics of stations, as well as fundamentals, but this is true of all sensitive receivers. For instance a station operating on a wavelength of 416.4 meters may be tuned in also, in some cases, at 208.2 meters, since the Victoreen tunes that low, the 208.2 meter wave being the second harmonic. It would be impossible to tune in the third harmonic of that station, as the set does not tune that low. Theoretically the second harmonic of all stations above 416.8 meters might be heard.

Of course it is not taken for granted that any station is generating harmonics, but no doubt some stations do so.

As for sources of real trouble, lack of sufficient selectivity, failure to get distance and shortcomings in volume and control will be discussed.

The selectivity of the set is governed largely by the oscillator. If the loop or aerial circuit tunes seemingly broadly for local stations, do not mistake that for poor selectivity. The selectivity test is: Does the set tune in a station without program interference from other stations? This it is bound to do, if properly made of specified parts.

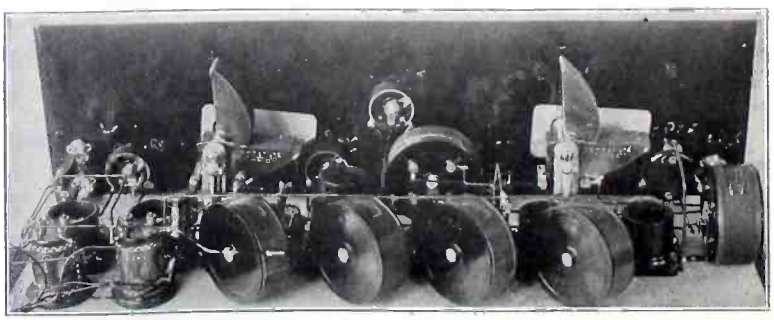
The oscillator variation, by turning C2, takes care of that. In addition selectivity is gained to an important extent by the efficiency of the intermediate amplifying system. Absence of selectivity should not be ascribed to the frequency changing part of the circuit until the intermediate amplifiers have been tested.

Look at the potentiometer. Take extreme care to note which side of it represents the negative A battery lead. The set should operate best with the potentiometer on the negative side, sometimes nearly all the way over at the negative post. If you must use the positive half then you may make up your mind that you are suffering from interstage coupling in the intermediate amplifier or overamplification. Take the first intermediate transformer, the one at left in the chain of four as you face the panel. Move it slightly out of the angle it occupies at present. Experiment with changing the position of this transformer until it is possible to get just as much volume as before, without having the potentiometer arm on the positive side. If this is impossible, shift the transformer second from the left. As a last resort try mounting the second transformer nearly at right angles to the first and third transformers, leaving the four others just as they were originally.

Otherwise lack of selectivity may be due to too high B battery voltage on the lead that usually takes 45 volts, improper value of grid leaks or defective leaks, poor tubes, particularly a bad one in the oscillator socket, and stray coupling between the input coil and the oscillator coil. The input coil is L1L2, otherwise a loop.

Failure to get distance may be due to poor selectivity occasioned by wrong placement of parts, low sensitivity, due to defective tubes, incorrect B battery voltages, and mounting of the oscillator coil.

(*Continued on page* 28)



THE FOUR intermediate transformers are in the front row. Vary the angle of the one at right if selectivity is poor.

Radio University

A QUESTION and Answer Department conducted by RADIO WORLD for its Readers by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., N. Y. C.

I AM contemplating building the 4-tube Diamond of the Air, but before doing so, I would like to have a panel layout as well as a baseboard layout of the parts. Only one rheostat is to be used. This is to control the filament of the detector tube. No radio-frequency coil is to be employed, which means that only the loop is to be used.—Theodore Cohen, Briggs Ave., and 199 St., Bx., N. Y. City.

Figs. 273 and 274 show the panel and baseboard layout respectively. The photos representing these layouts, are those of the set constructed by Harry Finger, of 215 West 51st St., N. Y. City. These layouts are very good and should be followed carefully.

* * *

AS TO the 3-tube regenerative receiver which appeared in the Jan. 9 issue of RADIO WORLD, on page 19. (1)—How many turns are placed on a tubing 3¼" in diameter and 4" high, to constitute the primary, L1, and the secondary, L2? (2)—How many turns are placed on a form 3" in diameter to constitute the plate coil, L3? (3)—What is the value of C3 and the grid leak, which shunts the same? (4)—What is the capacity of C1 and C4. (5)—What are the ratios of both the audio-frequency transformers? (6)—What type of jacks are J1 and J2? (7)—What kind of tubes are used?—Frank Graders, Morristown, N. J.

(1)—The primary consists of 10 turns. The secondary consists of 45 turns. Use No. 24 double cotton covered wire when winding the coil. Leave a ¼" space between the two windings. (2)—This coil consists of 35 turns. Use No. 24 single silk covered wire. (3)—C3 is a .00025 mfd. fixed condenser. The grid leak has a value of 2 megohms resistance. (4)—C1 has a capacity of .0005 mfd. and is variable. C4 is a .001 mfd. fixed condenser. (5)—They are both of the low ratio type, about 3 to 1. (6)—J1 is a double circuit jack. J2 is a single circuit jack. (7)—Use 201A tubes throughout. The plate of the detector tube receives 45 volts, while the plate of the amplifier tubes receive 67½ to 90 volts.

* * *

WHAT IS the plate resistance, amplification factor, plate current at maximum and the number of watts output that can be expected at maximum point of the V. T. 2 vacuum tube?—Benjamin Kirschner, 976 Legget Ave., Bx., N. Y. C.

The plate resistance of this tube is 5,000 ohms. The amplification constant is about 7 maximum. The plate current at maximum is .04 amperes. The maximum voltage that the plate of this tube can stand is 350. The greatest number of watts that can be expected is 5.

* * *

WHAT IS the law according to the National Electrical Code for receiving stations only, regarding the ground wire?—Lou Straus, 526 West 151st, N. Y. City.

"The ground wire may be bare or insulated and shall be of copper or approved copper-clad steel. If of copper, the ground wire shall be not smaller than No. 14 Brown & Sharpe gauge, and if approved copper-clad steel it shall be uot smaller than No. 17 Brown & Sharpe gauge. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are grounded steel frames of buildings or other metallic work in the building and artificial grounds such as driven pipes, plates, cones, etc. The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping."

* * *

COULD I expect satisfactory service from the loop described by Herbert E. Hayden in the Jan. 16 issue of RADIO WORLD, when used in conjunction with the 1926 Model Diamond of the Air? (2) Does it matter to which terminals of the variable condenser the terminals from the loop go? (3) What tubes are recommended for the 1926 Model Diamond?—W. Washburn, 20 West Palm Ave., Redlands, Cal.

(1) Yes. (2) Yes. The terminal on the side facing the station goes to stator. Reverse to determine the better position. (3) See the Feb. 27 issue of RADIO WORLD.

* * *

I HAVE built the 2-tube reflex receiver, which appeared in the Oct. 31 issue of RADIO WORLD, on page 14 in the Radio University Columns, Fig. 244. I have built the set according to the data given. The parts are all O. K. The volume, however, is very low. How could the trouble be cured?—Miss Georgia E. Connolley, 12 Everett St., Malden, Mass.

Try a new crystal detector. Reverse the crystal detector leads. Reverse the leads of the tickler coil L3. Place a .001 mfg. fixed condenser across the primary of the first audio-frequency transformer. Use a separate rheostat for controlling the filament of the of the regenerative RF tube. This should have a resistance of 10 ohms, with a carrying capacity of ¼ amperes. Be sure that the primaries and the secondaries of the AFT are not shorted.

* * *

WHAT CHANGE would have to be made in a 5-tube Neutrodyne, so that it could be made to operate with a loop?—F. Fitzgerald, Customs Bureau, General P. O., N. Y. City.

See the Radio University columns in the March 6 issue of RADIO WORLD. An extra tube will have to be added.

* * *

I HAVE a .000375 mfd. variable condenser, which I would like to use in conjunction with a wavetrap. Could I obtain a description of how to use this condenser in either the Rider wavetrap, which appeared in the December 26 issue of RADIO WORLD or in a simple coil-condenser trap?—Charles Turner, 118 High St., Elyria, O.

The simple wavetrap will consist of a coil consisting of 50 turns wound on a tubing 3¼ in. in diameter, using No. 22 double cotton covered wire, with the variable condenser shunting the beginning and the end of the coil. This is inserted in series with the antenna. The Rider wavetrap, which uses a 3-circuit tuner, will have to have its secondary winding rewound to fit the condenser. That is if the secondary consists of 50 turns wound on a 3 in. diameter, then increase the number of turns to 60.

* * *

I AM building the 4-Tube Symphony set, described by Irving Witz in the January 9 issue of RADIO WORLD. Is the hookup as published all right? That is, does the plate of the detector tube receive the same B battery voltage as the plate of the RF tube?—E. C. Zimmerman, 1215 Tinton Ave., Bx., N. Y. City.

Yes, 45 volts.

* * *

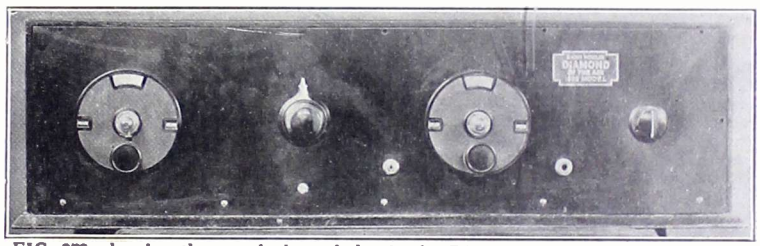


FIG. 273, showing the panel view of the 4-tube Diamond. The knob between the two Marco dials controls the tickler coil.

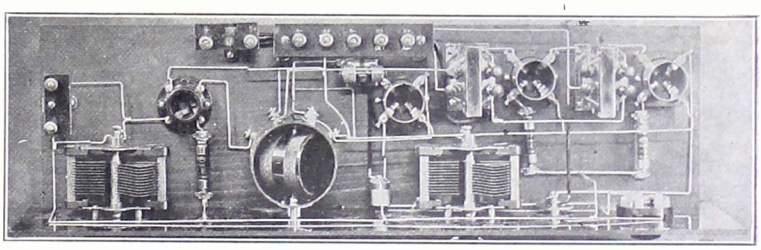


FIG. 274, showing the internal wiring as well as the layout of the parts of the 4-tube Diamond.

I AM building the Victoreen Super-Heterodyne receiver which was described in the February 20, 27, March 6 issues. I would like to insert a voltmeter and milliameter in this set, placing them so that only when the entire batch of tubes is used will the meters give readings. How can these be inserted?—H. W. Schoeff, 3433 Butler St., Pittsburgh, Pa.

You will have to have two milliameters instead of one. One of these is inserted in series with the B+ Det. post. The other is inserted in series with the B+ Amp. post. The voltmeter is shunted across the positive A and the negative A.

* * *

HOW MANY turns of No. 22 double cotton covered wire should be placed on a form 3½" in diameter, to constitute the primary and secondary windings of a tuner. The tickler is to be wound on a form 2½" in diameter, using No. 22 double cotton covered wire. The secondary is to be shunted by a .0005 mfd. variable condenser of the SLF type.—S. Kimeals, 190 Sturvestant Ave., Brooklyn, N. Y.

The primary will consist of 10 turns. The secondary will consist of 42 turns. The tickler will consist of 35 turns.

* * *

I HAVE constructed the 1-tube set described by Herbert E. Hayden in the

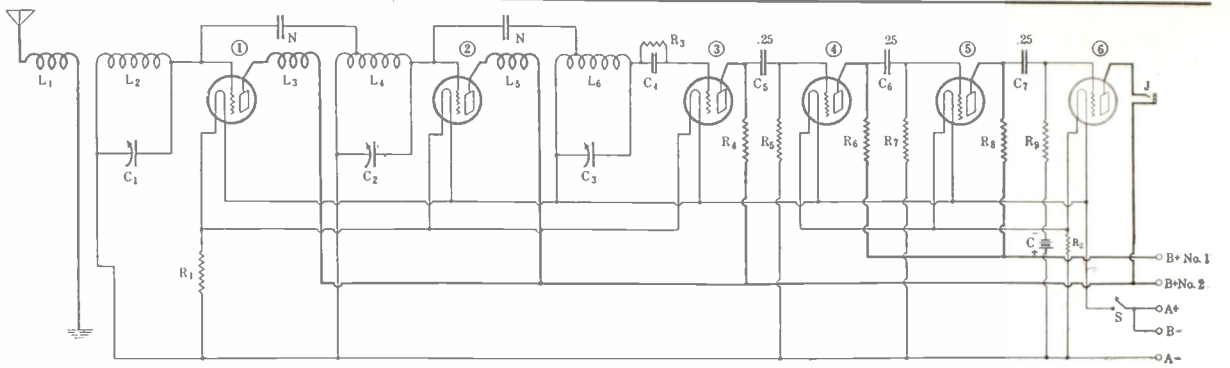


FIG. 275, showing the wiring diagram of the Neutrodyne, with the resistance-coupled audio stages.

August 29 issue of RADIO WORLD and am obtaining wonderful results. However, I find that I cannot receive well stations above 500 meters. I am at present using a tuner, the primary consisting of 10 turns and the secondary of 35 turns. These are wound on a tubing 4" diameter. A .0005 mfd. SLF variable condenser shunts the same. The tickler consists of 20 turns wound on a tubing 3" in diameter. No. 22 double cotton covered wire is used for winding the primary, secondary and the tickler coils. I am using a 60-foot antenna.—F. E. Richter, 3631 Virginia Ave., St. Louis, Mo.

You should be able to receive as high as 560 meters with this coil. Your antenna is too short. Either add 7 turns to the secondary or 40 feet to the antenna.

* * *

I WOULD be pleased to have the wiring diagram of a 6-tube Neutrodyne receiver, in which three stages of resistance coupled amplification are used. The filaments of the radio-frequency tubes should be controlled by a ballast resistor. The filaments of the 3-audio tubes should also be controlled by one ballast resistor. This means that there will be no variable resistance in the set. A C battery should be inserted in series with the grid of the last tube. The constants of the coils, condensers would be appreciated.—Graham Rocker, Hoover, Ind.

Fig. 275, shows the schematic diagram of the Neutrodyne receiver you request. Tubings 3" in diameter and 4" high are used to place the windings to constitute the radio-frequency transformers, L1L2, L3L4 and L5L6. No. 22 double cotton covered wire is used. The primaries, L1, L3 and L5 consists of 10 turns. The secondaries, L2, L4 and L6 consists of 60 turns. C1, C2 and C3, each have capacities of .000375 mfd. N, the neutralizing condensers, have variable capacities of from .00004 to .0001 mfd. C4 is a .00025 mfd. condenser. R3 is a 2 megohm grid leak. R1 and R2 are ¼ ampere ballast resistors. R4, R6 and R8 are .1 megohm resistances. R5 is a .5 megohm resistance. R7 and R9 are .1 megohm resistors. J is a single circuit jack. The tubes used should be of the .01A type. Therefore a 6 volt source is required for the filaments. The plates of the first and second audio tubes receive 135 volts. The plates of the two RF tubes, detector and the last audio-tube receive 90 volts. It is a good idea to place 135 volts on the plate of the last tube, instead of the 90 which is going to the other RF and Det. tubes. If you are going to place 90 volts on the plate of the last tube, then a 4.5 volt C battery will be necessary. If you are going to place 135 volts on the plate of this tube, then 9 volts C battery should be used. S is a filament switch.

* * *

I HAVE a Fada variocoupler of the 180° type. The stationary form contains 56 turns. The rotary form contains 48 turns. I would like to use this form to make a 3-circuit tuner so that it could be used in the Loud-Boy, which was described by Herman Bernard in the February 6 issue of RADIO WORLD. The diameter of the stationary form is 3½", while the diameter of the rotary form is 2¼". Please state the number of turns to place on the stationary form to constitute the primary and secondary and on the rotary form to make the tickler. I wish to use No. 22 double cotton covered wire.—J. J. Sunn, 37 Lincoln Ave., Albany, N. Y.

The primary consists of 10 turns. The secondary consists of 42 turns. The tickler consists of 36 turns. No. 26 single silk covered wire is used here.

* * *

I DESIRE to build the set described by William Mercer in the February 20 issue of RADIO WORLD. However, instead of using tubing 3½" in diameter I wish to use tubing 3" in diameter. Please give the number of turns to place on such a tubing.—Arthur Soderstrum, Orpheum Building, Topeka, Kan.

First wind 18 turns, then make a small loop. Continue the winding for 50 more turns. This makes a total of 68 turns. No. 20 double cotton covered wire is used.

* * *

I WOULD like to get some information regarding a 5-tube standard Neutrodyne receiver. (1)—Is the 57.3 angle the correct one for mounting the neutroformers? (2)—I have two rheostats, one controlling the filaments of the RF tubes, while the other controls the filaments of the detector tube. Both these rheostats are placed in the negative lead of the A battery. Would the reception of signals be improved any if the rheostats were placed in the positive leg of the A battery? (3)—The neutroformers contain 63 turns on the secondaries. A 3" form is used to hold these windings. The secondaries are shunted by .000375 mfd. variable condensers. Now I use 180° dials. KSD, which operates on a wavelength of 545 meters is tuned in at 145 on the dial. This I think is too low a reading. Should not the station be received at about 170? If it should, how many turns are to be taken off the coils? (4)—Will the strength of the signals decrease when the turns are taken off the secondary? (5)—I have read many articles about keeping like potentials together. Now my neutroformers are wound with the primary winding inside of the secondary winding. The beginning of the primary winding (top) goes to the aerial. The bottom of this winding goes to the ground. The beginning of the secondary winding (near the antenna post), goes to the A minus post. The end of this winding goes to the G post. Is the above the correct manner to keep the potentials? (6)—I also have a 1-tube set, which is wired up thus: One variometer in the grid circuit and shunted by the antenna and the ground. A variable condenser of .0005 mfd. capacity is also shunted across the same. Another variometer is in series with the plate. A rheostat is in series with the A+B— post. There is a great deal of body capacity in this set. The entire wavelength is covered on 30° of the dial. How can these troubles be cured?—Phil Thompson, Walnut Grove, Minn.

(1)—Yes. (2)—The rheostats should be in the negative side. (3)—Take 5 turns off the secondaries. (4)—No. (5)—The beginning of the secondary winding, which is near the antenna post, should go to A minus and not to grid. The ending of the secondary winding, which now goes to the A minus post should go to the grid. This supposes the windings are in the same direction. If they are not, the reverse is true. (6)—By placing a .0001 condenser in series with the variometer in the grid circuit this body capacity may be reduced. To spread the stations out when using variometer take off turns. Try taking off five at first.

* * *

KINDLY TELL me the gauge of wire used in winding the coils to be used in the Reflex Set described by Burton Lindheim in the May 30 issue of RADIO WORLD.—Fred Dieter, 2788 Fulton St., Brooklyn, N. Y.

No. 22 double cotton covered wire.

THE RADIO TRADE

R.C.A. 1925 Report Shows Profit of $5,737,206

THE Annual Report of the Radio Corporation of America for 1925 shows that the Corporation maintained its position of leadership in international radio communication, in the field of marine radio communication and in the radio broadcast industry. Although the year 1925 was a period of liquidation and readjustment affecting the entire industry, the Radio Corporation of America solidified its position in the radio broadcasting sales field. The report shows a gross income of $50.405,144 for 1925 and after deducting general operating and administrative expenses, depreciation and cost of sales, a net profit of $5,737,206 as compared with a loss in 1924.

In 1924 the preferred shares were reduced from 5,000,000 to 500,000 of "A" preferred, and the common stock reduced from 7,500,000 shares to 1,500,000, without changing the capitalization.

The report continues:

"The following dividends have been paid on the "A" preferred and on the original preferred stock:

Dividend No.

1—(3½%) July 1, 1924—1st and 2nd quarters of 1924.
2—(1¾%) October 1, 1924—3rd quarter of 1924.
3—(1¾%) January 1, 1925—4th quarter of 1924.
4—(1¾%) April 1, 1925—1st quarter of 1925.
5—(1¾%) July 1, 1925—2nd quarter of 1925.
6—(1¾%) October 1, 1925—3rd quarter of 1925.
7—(1¾%) January 1, 1926—4th quarter of 1925.

"No dividends have been declared on the common stock.

Balance Sheet

"Your Corporation's capital stock consists of 395,597 and four-tenths shares of seven per cent. "A" preferred stock, with a par value of $50 per share and 1,155,400 shares of "A" common stock of no par value.

"The Corporation's financial position has been further strengthened during 1925. Current assets have increased $1,646,277 and exceed the current liabilities by $17,564,047. The Corporation has no bonded debt or notes outstanding.

"The total of plant and equipment stands at $13,779,510 and the reserve for depreciation and obsolescence of plant amounts to $2,631,930. The amortization of patents reserve after charging patents expired, new stands at $4,849,497 and represents the depreciation to December 31, 1925, indicated by the schedule founded on the life of such patents.

Operations

"After providing for depreciation of plant and inventory, the operations for the year resulted in a net profit of $5,737,206. Of this $1,660,145 has been allocated to reserves for patents and Federal Income Tax, and $2,852,993 has been credited to surplus account. The balance of $1,224,068 has been applied to reserve against foreign investments and writing down contracts, good-will, etc.

"Surplus account at January 1, 1925, amounted to $5,000,570. To this amount $2,852,993 was transferred from 1925 earnings making a total of $7,-853,563. From this amount $1,500,000 has been deducted as a further write-off against the good-will account, leaving a balance of $6,353,563 to the credit of surplus account."

Sales

The report says:

"Notwithstanding heavy liquidation of competitive radio sets, your Corporation maintained its policy of contributing towards the stabilization of the radio industry by reducing its prices to the consumer without destroying the investments made by distributors and dealers in Radiolas and Radiotrons." On February 2, 1925, the price of Radiotron vacuum tubes was reduced from $4 to $3 and a further reduction from $3 to $2.50 was made on August 1, 1925, according to the report. Trade adjustments which resulted in lower prices to the consumer cost your Corporation $4,000,000, but it was an investment in good faith and square dealing which has placed the Radio Corporation of America in a strong commercial position."

Commenting upon the development of new types of Radiolas, Radiola Loudspeakers and Radiotrons, the report says, "With the cooperation of the General Electric Company and the Westinghouse Electric and Manufacturing Company, your Corporation developed new types of Radiolas, Loudspeakers, Radiotron Power Amplifiers and Battery Eliminators. For the first time, radio sets which operate satisfactorily by using electric light current instead of batteries, were made available to the public.

"The commercial position of your Corporation at the close of the year and public approval of its new radio equipment fully justified this policy of development."

The report states that manufacturing adjustments, made necessary by the new features of the Corporation's 1925-26 line, did not permit substantial deliveries of the new apparatus to the trade until well into the last quarter of 1925."

The report states that a contract was made with the Victor Talking Machine Company for the sales of Radiolas and Radiotrons for combination radio phonograph sets.

Tradiograms

Rodgers Radio Company, 3737 Belmont Avenue, Chicago, Ill., have designed a most singular single control set in a Renaissance Design finished in American Walnut cabinet that has many unique features. If one is interested in an exceptionally beautiful yet very simply operated set it might be well to write this company mentioning RADIO WORLD.

A most complete list of Read-Easy Hydrometers that are made by the Ala Manufacturing Company, 401 S. Sangamon St., Chicago, Ill., may be obtained by just writing to this company mentioning RADIO WORLD.

Lynn Radio Specialty, Inc., 1355 East 53rd St., Chicago, Ill., are putting out a reflex crystal called the Lynn ultra-reflex Crystal. The claim of superiority being that it does not break down in subjecting to high voltages. Further information on this crystal can be obtained by writing to this company direct, mentioning RADIO WORLD.

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 .....

S. Davis, 282 Avondale Road, Cleveland, O.
E. A. Wagne, 627 Main St., Toledo, O.
W. H. Budwiser, c/o Strayers, 11th and Iowa Sts., Dubuque, Ia.
L. Mandel, 2752 Washington Boulevard, Chicago, Ill.
Harry G. Adams, 44 Hennepin Park, Buffalo, N. Y.
R. E. Clark, Chopin, Ill.
Neal Dirkse, 4 Coso Ave., San Francisco, Cal.
C. B. Wannemacker, Ottoville, O. (Dealer).
R. E. James, City Division, P. O. Dept., Des Moines, Ia.
Wilbert E. Scheer, 1329 Campbell Ave., Des Plaines, Ill.
P. G. Tilson, c/o P. & G. Radio Mart, Post Office Box 727, Asheville, N. C. (Dealers).
Henry Tinsley, Marion, Ky.
Richard Schultz, 154 Jackson St., Hempstead, L. Is., N. Y.
R. Bank, 2615 Pillsbury Ave. South, Minneapolis, Minn.
Arthur Biebe, 83 Ersworth Circle, Niagara Falls, Ont.
Ottumiva Optical Co., Ottumwa, Ia. (Dealer).
Ando Radio Co., 13 Kitaigacho, Yotuya, Tokyo, Japan. (Dealers).
Fred W. Ruisscau, Harbor Knoll, Great Neck, L. Is., N. Y.
A. P. McCormick, 313 Wenger St., South Bend, Ind.
Post Radio Co., 843 F St., N. W., Washington, D. C. (Dealer).
Henry S. Morris, 937 Tea St., N. W., Washington, D. C.
Russell Letford, Two Harbors, Minn.
Louis A. Baxter, c/o Elite Lamp Shop, 211 N. Sixth St., Cambridge, O. (Dealer).
S. F. Frederick, R. D. No. 2, P. O. Ulster, Pa. (Dealer).
C. H. Bradbrook, Kansas City, Mo.
Laurence Scheffahd, Marquis, Saskatchewan, Canada. (Dealer).
John M. Decker, R. F. D. 1, Middletown, N. Y.
R. A. Reddick, 1204 West 10th St., Port Angeles, Wash.
E. F. Mangis, Box 369, Camden, Ark.
Floyd McElroy c/o Coiumbus Garage, Columbus, Pa. (Dealers).
W. F. Kuhn, Security Radio Electric Co., 1506 Pine St., St. Louis, Mo. (Dealers).
H. C. McCorkle, 802 West 18th St., Huntington, W. Va. (Dealer).
D. B. Truitt, 5719 Malcolm St., Philadelphia, Pa. (Dealer).
W. Mayes, Box 15, Marietta, O. (Dealer.)
F. C. Whitney, 3207 Whitney Ave., Detroit, Mich.
H. D. Johnson, 915 N. 31st St., Camden, N. J. (Dealer.)
Albert C. Adams, Port Clinton, O.
W. W. Stanton, Box 689, Miami, Fla. (Dealer).
T. F. Barnby, Palo Alto, Cal.
E. R. Watts, 2116 10th Ave., South, Birmingham, Ala.
Chas. A. Sepic, 842 East Ohio St., N. S., Pittsburgh, Pa.
W. J. Stanton, 111 W Plume St., Norfolk, Va.
C. H. Peery, Box 218, Colorado Springs, Colo.
William Hawkes, 281 8th St., Jersey City, N. J.
Anthony J. Goetz, 380 N. Main St., Liberty, N. Y.
C. P. Wilbur, 3073 Restorruel St., Duluth, Minn. (Dealer.)
J. D. Brown, 1708 Gibson St., Scranton, Pa.
Albert Walker, 2832 N. Swanson St., Philadelphia, Pa.
James Primm, Wynnewood, Okla. (Dealer.)
Harry L. Goldblum, 6144 Pine St., Philadelphia, Pa.
F. L. Wilson, 2158 Lincoln Ave., Chicago, Ill. (Dealer.)

NEW CORPORATIONS

Warren Radio Corp., N. Y. City, $10,000; P. Heteny, L. Cresap. (Atty., A. I. Warren, 52 Vanderbilt Ave., N. Y. City).

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Mastertone Radio Corp., Newark, N. J., manufacture, $125,000; George H. Porell, Walter R. Porell, Raymond Adams, Newark, N. J. (Atty., A. V. Snedeker, Newark, N. J.)

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Girls Study Radio Engineering

STUDENTS at O'Keefe Junior High School, Atlanta, Ga., learning how to repair a Super-Heterodyne, under the instruction of Prof. C. H. Kreuger. This is the only girls' class in mechanical engineering in the South. (Wide World).

Reversed Speaker Cord Frequent Trouble Cause

Sometimes a speaker will give a mushy, rumbling sound although there is nothing wrong with the set. This is particularly true in regenerative receivers. The cause may be found in the wrongly polarized connection of the speaker cords. Simply reverse them. In many instances speaker cords are wrongly connected. At least reduced volume results. Some units are not so critical on the direction of current flow, but the unit will last longer if the right connection is made. Speaker cords usually have a marker on one of the leads, like a red stripe, to identify the positive connection, and often plugs have a red-tipped designator for the corresponding lead. Unfortunately this scheme will not be of much help, because it operates on the assumption that the jack itself, at the rear of the panel, is wired to the set so as to make the red designate the sleeve lead, as it should.

Light Socket Aerial Suits In Many Homes

A connection made to a light socket through a condenser connection, as in the socket aerial plugs, may give excellent or poor or no results. Usually in large cities, unless the user lives on the second floor or higher up, the device does not work so well, because the lighting mains are laid underground. In outlying districts, where overhead wiring prevails, results usually are good. The elevation of the actual point of reception is important in cities because it represents so much unburied wire. A fan living on the third floor of a large New York City apartment house received WOC, Davenport, Ia., on a 1-tube set, using a socket aerial. Therefore the try-out method is the only one for this device.

Power Tubes Improve Quality, Not Volume

The power tubes, usually installed in the final audio stage, make for better quality, as these tubes stand a heavier load, but they do not increase volume as such. The signals may seem louder, due to their greater clearness. On the other hand, the high mu tubes, used in resistance or impedance coupled stages, do increase volume, in that they afford greater voltage amplification.

Rickard Prophesies Bout

"TEX" RICKARD, world-known promoter of professional championship boxing bouts, who recently returned from a trip to Miami, Fla., where Gene Tunney is training, broadcast through the Madison Square Garden station, WMSG, the news that Jack Dempsey, world's heavyweight champion, would defend his laurels this year and that in all probability his opponent would be Tunney. Sartorial experts will note Tex's way of holding a cigar, also the crease in his trousers. (Wide World).

New Location of WGBS Eliminates Dead Spots

Since moving its transmitter from the congested downtown district at Broadway and 33rd Street, WGBS has practically been deluged with letters from listeners-in reporting that the new location in Astoria has greatly increased the receptivity of the Gimbel Brothers' Station.

Before this step was taken WGBS was heard with excellent quality in many parts of the country, but a great many fans in Greater New York, principally parts of Brooklyn, found it difficult to tune in the station. This was due entirely to the mass of steel and other air obstructions about the midtown district. So, for many months WGBS engineers conducted tests in all parts of Greater New York and New Jersey, with the result that the location in Astoria, opposite 90th Street, Manhattan, was selected. Now the listeners give evidence that the former dead spots have all been obliterated.

All Quiet on Potomac

K. P. ROYCE of the Scientific Division of the Graybar Electric Company, making a test with the audiometer, at the East Gate of the White House. The noise measurement here was 25 units, showing that President Coolidge works comparatively free from interference. (Fotograms.)

Amid March Snow

WHEN stuck with some wiring problem it is always consoling to gaze upon inspiring faces that are charmed by reception amid adverse conditions! The "Cocoanut" Company girls are Bonnie Murray, Irene Pedrick, Irene Joyce and Mrs. Chicko Marx. (Foto Topics).

Extra Funds to Be Used to Fight Interference

WASHINGTON.

An increased appropriation of $125,000 is recommended for the Radio Service of the Department of Commerce in the Appropriation bill for that department, reported to the House by the Appropriations Committee.

Plans have already been made by the Radio Service as to the utilization of the money to decrease interference. Deputy Commissionr Arthur J. Tyrer, of the Bureau of Navigation, gives the following account of how the money will be spent:

"We believe we should locate offices in the present centers of sending stations, at strategic points. In each of these sub-offices we should have an assistant inspector and one clerk. The new offices that we propose are at Dallas, Memphis, Los Angeles, Portland, Ore., Pittsburgh, Buffalo, Denver, St. Louis, Minneapolis and Omaha."

Major Bowes Sails For Lovely Miami

SYMBOLISM—When Major Edward Bowes (left) director of the Capitol Theatre, whose family of artists broadcasts every Sunday night from WEAF and its chain, sailed for Miami he turned the microphone over to Tommy Dowd, Dr. Billy Axt, and David Mendoza. (Foto Topics).

Radio Bills Face Defeat; Macdonald Case Is Pivot

By Thomas Stevenson

WASHINGTON.

The most optimistic supporters of radio legislation have almost abandoned hope that a law giving the Secretary of Commerce authority to regulate broadcasting will be enacted at this session of Congress.

This is the concensus of the supporters of the White and Dill radio bills in the House and Senate. The opinion is that the White bill will pass the House but that it will be buried in the archives of the Senate when the closing day of the session arrives.

According to Senator Dill, the failure of radio legislation to pass the Senate will not be due to lack of interest in the subject. Senator Dill believes that most of his colleagues are perfectly satisfied with the present regulation of radio by the Department of Commerce and that considerable more time will be required for a study of its broad aspects.

Wave Problem Acute

According to the committee members the chief element of doubt seems to lie in the allocation of wavelengths. At the present time there are only 89 wavelengths available upon which are operating around 530 broadcasting stations. At the same time there are on file at the Department of Commerce more than 300 applications for new stations.

"I hope a way can be found to enlarge the present broadcasting band so that more stations may be allowed to broadcast," said Senator Dill. "I believe this will solve one of our greatest problems. I favor announcing that within one year we will open up to broadcasting a much larger band of wavelengths. This will give sufficient time for manufacturers to produce sets capable of tuning them in. At the same time it will permit present owners of sets to change their apparatus to meet new conditions."

Senator Dill was reluctant to express his opinion as to the chances for enactment of radio law this session.

Satisfied With Hoover

"Most of the members of the Senate," said he, "do not know very much about radio. They could hardly be expected to have much knowledge on such a technical subject. Most of them are fairly well satisfied with the way Secretary Hoover is handling the situation. They do not want to make a step until they are absolutely sure of what they are doing. As they are not convinced of the immediate necessity for legislation it is possible that they may want the radio bill to go over until the next session of Congress."

Officials of the Department of Commerce, while none too optimistic as to the chances of radio bills, are hopeful that a way can be found to put them through. To their minds the crux of the situation depends on the outcome of the Macdonald case in Chicago. They believe if the government wins its case against Macdonald for the use of a wavelength in violation of a law, the Secretary of Commerce may be able to keep the situation in hand.

Chaos if U. S. Loses

If the Government loses the case, complete chaos will result unless legislation is enacted immediately. At the same time it is recognized that the Department of Commerce at present has not the authority to refuse a license to any applicant for a broadcasting station. This condition is being met at present with the very simple explanation that a wavelength cannot be furnished when it is not available.

An Evaporated Leak Spoils Set Operation

If a set that gave good reception gradually becomes less sensitive and selective, see if there is a variable grid leak in it that has a visible fluid inside. If so, note whether this fluid has dried up. If it has, the set is operating without any leakage path at all for the excess negative electrons on the grid. This introduces, at least, distortion of a severe order, and often cuts the volume in half. Install a new leak and note the difference.

The correct leakage should be used in all cases, though the value is not critical with most tubes. A variable leak serves the purpose well.

The Official List of Stations

Corrected and Revised Up to March 3

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
KDZB	F. E. Seifert, Bakersfield, Cal.	210
KFAB	Nebraska Buick Auto Co., Lincoln Neb.	340
KFAD	Electrical Equipment Co., Phoenix Ariz.	273
KFAE	State College, Pullman, Wash.	349
KFAF	A. E. Fowler, San Jose, Calif.	217
KFAJ	University of Colorado, Boulder, Colo.	261
KFAU	Boise High School, Boise, Idaho	283
KFBB	F. A. Buttry Co., Havre, Mont.	275
KFBG	1st Presbyterian Church, Tacoma, Wash.	250
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
KFCF	F. A. Moore, Walla Walla, Wash.	256
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
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
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
KFLP	Everett M. Foster, Cedar Rapids, Ia.	256
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., Atlantic, Iowa	273
KFMQ	Univ. of Ark., Fayettville, Ark.	300
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	266
KFOA	Rhodes Company, Seattle, Wash.	454
KFOB	Chamber of Commerce, Burlingame, Cal.	226
KOFJ–KFOS	Moberly High School, Moberly, Mo.	242
KFON	Nichols and Warriner Co., 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
KFQC	Kidd Bros., Taft, Cal.	231
KFCH	Radio Service Co., Burlingame, Col.	220
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	Paris Dry Goods Co., San Francisco.	268
KFRU	Stephens College, Columbia, Mo.	500
KFRW	United Churches, Olympia, Wash.	220
KFSG	Echo Park Evangelistic Ass'n., Los Angeles, Cal.	275
KFUJ	Hoppert P. and H. Co., Breckenridge, Minn.	242
KFUL	T. Goggan & Bro., Galveston, Tex.	258
KFUO	Concordia Theo. Seminary, St. Louis, Mo.	545
KFUP	Fitzsimmons General Hospital, Denver, Colo.	234
KFUR	H. W. Peery and R. Redfield, Ogden, Utah	224
KFUS	Louis L. Sherman, Oakland, Cal.	256
KFUT	University of Utah, Salt Lake City, Utah	261
KFUU	Coburn Radio Laboratories, San Leandro, Cal.	220
KFUV	G. P. Ward, Springfield, Mo.	252
KFVD	Chas. & W. J. McWhinnie, San Pedro, Cal.	205
KFVE	Film Corp., St. Louis, Mo.	240
KFVF	Clarence B. Juneau, Hollywood, Cal.	208
KFVG	1st Meth-Epis. Church, Independence, Kan.	236
KFVH	Herbert Whan, Manhattan, Kans.	219
KFVI	56th Cav. Brigade, Houston, Tex.	240
KFVN	C. E. Bagley, Welcome, Minn.	227
KFVO	F. M. Henry, Kirksville, Mo.	226
KFVR	Moonlight Ranch, Denver, Col.	246
KFVS	Cape Girardeau Battery Station, 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 & C. S. Myers, Upland, 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
KFYF	Carl's Radio Den, Oxnard, Cal.	205
KFXB	B. O. Heller, Big Bear Lake, Cal.	203
KFXC	Santa Maria Valley R. R. Co., Santa Maria, Cal.	210
KFXD	L. H. Strong, 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
KFXM	Neches Electric Co., Beaumont, Tex.	227
KFXR	Classen Film Finishing Co., Okla. City, Okla.	214
KFXY	Mary M. Costigan, Flagstaff, Ariz.	205
KFYJ	Houston Chronicle, Houston, Tex., (Portable)	238
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, Seattle, 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.	252
KLX	Tribune, Oakland, Cal.	508
KLZ	Reynolds Radio Co., Denver, Colo.	266
KMA	May Seed & Nursery Co., Shenandoah, Ia.	252
KMJ	San Joaquin Corp., Fresno, Cal.	234
KMO	Love Elec. Co., Tacoma, Wash.	250
KMOX	St. Louis Globe-Democrat, St. Louis, Mo.	280-233
KMMJ	M. M. Johnson Co., Clay Center, Nebr.	229
KNRC	J. B. Juneau, Hollywood, Cal.	208
KNTR	D. S. Garretson & R. M. Turner, Los Angeles, Cal.	238
KNX	Express, Hollywood, Cal.	337
KOA	General Electric Co., Denver, Col.	322
KOAC	Oregon Agricultural College, Corvalis, Ore.	283
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
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.	258
KSAC	Kansas State Agricultural College, Manhattan, Kans.	341
KSD	Post Dispatch, St. Louis, Mo.	545
KSL	Radio Service Corp., Salt Lake City, Utah	300
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
KUO	Examiner Printing Co., San Francisco, Cal.	250
KUOM	State University of Montana, Missoula, Mont.	245
KUSD	University of S. D. Vermillion, S. D.	278
KUT	University of Texas, Austin.	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., Kennonwood, La.	273
KWSC	State College, Pullman, Wash.	349
KWWG	City of Brownsville, Brownsville, Tex.	261
KYW	Westinghouse E. & M. Co., Chicago, Ill.	535
KZKZ	Electric Supply Co., Manila, P. I.	270
KZM	Western Radio Inst., Oakland, Cal.	241
KZRQ	Far Eastern Radio Inc., Manila, P.I.	270
NAA	U. S. Navy, Arlington, Va.	435
WAAB	V. Jenson, New Orleans, La.	268
WAAD	Ohio Mech. Institute, Cincinnati, O.	258
WAAF	Drovers Journal, Chicago, Ill.	278
WAAM	I. R. Nelson Co., Newark, N. J.	263
WAAW	Omaha Grain Exchange, Omaha, Neb.	273
WABC	Asheville Battery Co., Inc., Asheville, N. C.	254
WABI	Bangor Ry. & Elec. Co., 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	Hubbard & 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
WBR	State Police, Butler, Pa.	203
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
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

Station	Owner and Location	Meters
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
WCBQ	1st Baptist Church, Nashville, Tenn.	236
WCBR	C. H. Messter (Portable), Providence, R. I.	205
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
WCM	Texas Market Department, Austin, Texas	268
WCSH	Henry P. Rines, Portland, Me.	256
WSCO	Wittenberg College, Springfield, Ohio.	248
WCUW	Clark University, Worcester, Mass.	238
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
WDBC	Kirk Johnson & Co., Lancaster, Pa.	258
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
WDBR	Tremont Temple Baptist Church, Boston, Mass.	261
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
WEAH	Hotel Lassen, Wichita, Kans.	268
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
WEBK	Grand Rapids Radio Co., Grand Rapids, Mich.	242
WEBL	Radio Corp. of Ama. (Portable)	226
WEBM	Radio Corp. of Ama. Portable Mobile Station	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.	476-349
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
WFBI	Galvin Radio Supply Co., Camden, N. J.	236
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.	244
WGBB	H. H. Carman, Freeport, N. Y.	244
WGBC	1st Baptist Church, Memphis, Tenn.	266
WGBF	The Finke Furniture Co., Evansville, Ind.	236
WGBI	Frank S. Megargee, 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.	252
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
WGY	General Elec. Co., Schenectady, N. Y.	380
WHA	University of Wisconsin, Madison, Wis.	535
WHAD	Marquette University, Milwaukee, Wis.	275
WHAM	University of Rochester, 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
WHAT	Dr. G. W. Young, Minneapolis, Minn.	263
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
WHBK	Franklin St. Garage, Ellsworth, Me.	231
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
WHBU	B. L. Bing's Sons, Anderson, Ind.	219
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.	238
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
WIBN	Elite Radio Stores, New Bedford, Mass.	210
WIBM	Billy Maine, Chicago, Ill.	216
WIBO	F. M. Schmidt, Farina, Ill.	226
WIBR	Thurman A. Owings, Weirton, W. Va.	246
WIBS	N. J. National Guard, Elizabeth, N. J.	203
WIBU	The Electric Farm, Faynette, Wis.	222
WIBW	Dr. L. L. Dill, Logansport, Ind.	220
WIBX	Grid-Leak, Inc., Utica, N. Y.	205
WIBZ	Powell Electric Co., Montgomery, Ala.	231
WIL	Benson Radio Co., St. Louis, Mo.	273
WIP	Gimbel Brothers, Philadelphia, Pa.	508
WJAD	Jackson's Radio Elec. Co., Waco, Tex.	353
WJAG	Norfolk Daily News, Norfolk Nebr.	270
WJAK	Rev. C. L. White, Greentown, 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., Chicago, Ill.	322
WJBA	D. H. Lentz, Jr., Joliet, Ill.	207
WJBB	L. W. McClung, St. Petersburg, Fla.	254
WJBC	Hummer Furniture Co., 2nd and Joliet Sts., La Salle, Ill.	234
WJBG	Interstate Radio, Inc., Charlotte, N.C.	224
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
WJBP	Seneca Vocational School, Buffalo, N. Y.	219
WJBQ	Bucknell University, Lewisburgh, Pa.	211
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., New York, N. Y.	455
WKAA	H. F. Paar, Cedar Rapids, Iowa.	278
WKAF	WKAF Broadcasting Co., Milwaukee, Wis.	261
WKAQ	Radio Corp. of Porto Rico, San Juan, P. R.	341
WKAR	Mich. Agricultural College, Lansing	285
WKAV	Lacona Radio Club, Laconia, N. H.	210
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
WLB	University of Minneapolis, 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
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, Lockport, 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, N. Y. C.	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
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
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
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. D. Agri. College, N. D.	275
WPDP	Hiram 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
WQAE	Moore Radio News Station, Springfield, Vermont	246
WQAM	Electric Equipment Co., Miami, Fla.	263
WQAW	Scranton Times, Scranton, Pa.	250
WQAO	Calvary Baptist Church, New York, N. Y.	360
WQJ	Calumet Rainbo Broadcasting Co., Chicago, Ill.	448
WRAF	Radio Club, Inc., Laporte, Ind.	224
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
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
WRST	Radiotel 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

(Concluded on page 23)

A THOUGHT FOR THE WEEK

REFORMS in radio, as in other departments of human activities, are important and sometimes necessary—but do not forget the bromide about the operation having been successful even though the patient died.

RADIO WORLD

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

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

TELEPHONES 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, 38 Avenue de l'Opera
San Francisco: Lloyd B. Chappell, 656 O'Farrell St.

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, Lewis Winner
CONTRIBUTING EDITOR, John F. Rider

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

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 3¼" D. C.	231 lines	150.00
¼ Page, 4⅛" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Times Discount

52 consecutive issues	20%
26 times consecutively or R. O. W. one year	15%
4 consecutive issues	10%

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 28, 1922, at the Post Office at New York, N. Y., under the act of March 3, 1879.

MARCH 13, 1926

Swamped With Telegrams

THE ANNIVERSARY program at KFNF, Shenandoah, Ia., brought in 216,764 telegrams and thousands of letters, containing congratulations and requests.

WGY Plans to Forecast Transmission Quality

Because of the activity of the radio engineering research departments of the General Electric Company in the development of the as yet little known science, Schenectady has become the center of radio investigation and WGY the proving station. At South Schenectady the home of the 54-acre transmitter developmental station, special transmitters operating on 41, 76, 1,560 and 379.5 meters have been erected and almost nightly are on the air with programs of WGY while at nearby and remote stations, on land and on sea, in the tropics and in the far north, observers are obtaining transmission data on the various wavelengths. The engineer hopes to reach the point where transmission of quality may be accurately forecast under all conditions. WGY is not only a source of entertainment and information for many thousands of people but is the instrument by means of which pioneer work in radio is being carried out.

Fought Shy of Mechanical Music

From the time of its formal opening four years ago, WGY avoided the inclusion of "mechanical" numbers, that is selections produced by phonograph or player piano. The Department of Commerce recognized the studio-produced program by creating a special class known as Class B in which were included only those stations which did not depend upon mechanical music.

From the very first, Martin P. Rice, manager of broadcasting for the General Electric Company, saw that progress in program development would be seriously handicapped if the station were dependent upon programs originating in the studio. Within a year WGY'S engineers began the development of remote control stations wire-connected to the studio. Now the Schenectady station has one of the most elaborate systems of remote control of any station in the country. Public halls, churches and theatres in Schenectady were first brought into the studio by wires; then Albany was covered in a similar way and a short time later a pair of wires spanned the 150 miles to New York.

Has a Wide Scope

Through its affiliations with WJZ, WGY has the advantages of tapping into the remote control system of the New York station which includes wires to Washington and to station WRC. During the past year, WGY extended its lines westward and is now connected to Station WFBL in Syracuse, WHAM in Rochester and WMAK in Buffalo. Wire connection gives great elasticity to program. Practically the whole state becomes the studio of WGY and anything originating in any city in the system is made available for broadcasting. Further any broadcasting in the system, is technically equipped to broadcast anything originating in any other station.

Simultaneously with the development of the wire system, engineers have been engaged in the development of radio relay. Two years ago, the portable broadcasting station of 50 watts was tried out. The station, fitted up on a truck, was transported to church or theatre and direct connected to the amplifiers and microphone. The output of the microphone was then broadcast on 100 meters, picked up by WGY and rebroadcast on the station's wavelength. Later work has resulted in the development of 1560 meters as the ideal wavelength for rebroadcast relay service within a distance of 250 miles, WCAD, the station of St. Lawrence University at Canton, N. Y., rebroadcasts WGY, by means of the 1560 meter wave, every Thursday night. Residents of northern New York thus receive programs which originate in New York, Washington, Buffalo, Syracuse, Rochester, Schenectady and Albany.

Some Locations Make Quality Hard to Obtain

In order to obtain the proper control of the tubes which amplify the signals at audio frequency, the grid biasing or C battery is placed in the grid circuit. The absence of this battery, or the choice of an unsuitable voltage for this battery, will cause tone distortion and will also limit the output of the amplifier so that rattling sounds will be produced at volumes less than those desired for natural reproduction.

Connecting the successive stages of audio frequency amplification are transformers. It is not a simple matter to produce such transformers which will transfer from each tube to the next, and in an equal way, all tone frequencies from the lowest to the highest which may be desired. Many transformers now in use drop out the lower frequencies and give a peculiarly mechanical or tinny quality to the reproduced music. Only by careful design and the use of special transformer materials can this defect be avoided.

In its broadcast sense, acoustic synchronizing can hardly be obtained in certain poor locations. If the listener lives in a neighborhood where others are tuning their sets on antennas closely adjacent to his own and thereby disturbing his settings, or where static or other disturbances are heavy on the signals from the nearest stations, or where beat-notes, or "birdies" intrude with their whistling notes from neighboring radiating receivers, he is indeed unfortunate because he can hardly hope for a natural and satisfactory effect of the received program under such conditions. Only by moving his antenna away from other nearby antennas, by listening to local stations which ride above the disturbances, and by educating his neighbors to avoid the production of beat-note interference, can he improve his receiving conditions.

WHEN a fan's alarm went bad on his clock, though the timepiece worked, he used the minute hand as a switch to contact with an insulated clip. Hence at 10:50 a. m. (he's a night worker) he heard the speaker and arose! (Hayden)

Symphonies Favored 5 to 1 Over Jazz Music

THE newest batch of votes cast in RADIO WORLD's canvass of preferences on type of programs, representing two weeks of balloting and by far the greatest number tallied so far, shows the symphony concert far in the lead. Jazz is second, instrumental renderings in solos, duets and trios are grouped for third place, while classical vocal solos are fifth. Kind words have been spoken, too, for opera, old-time music, band concerts and waltzes.

So far the canvass indicates that the preference for symphony concerts over jazz is 5-to-1, but it must be remembered that thousands of more ballots will be cast, and if the experience of other tallying sources is to be reckoned, symphonic music may not continue its strong lead. It seems certain, however, that it will finish first. A recent canvass by WJZ showed that the preference for symphony over jazz was about 30 per cent.

Hard Lines for the Saw

On the negative side, many fans emphatically voted against the musical saw, indeed this seems to be the pet aversion. Almost as greatly abhorred are banquet speeches. A few voted against jazz, but it was the musical saw that provoked the greatest amount of underscoring and capitalizing of the word "no."

A year ago jazz may have been considered the favorite, but today its popularity is on the decline with the radio audience, except of course for dancing. Investigation shows that comparatively little dancing is done to broadcast music, listening occupying 88 per cent. of the response to such offerings.

It is important to cast a ballot in RADIO WORLD's canvass because co-operation is being effected with several leading stations who may be guided in the selection of their programs by what the tally shows. Thus you will be making a good bid for actually getting what you want, when you cast the ballot.

Additions Welcome

If you think any item should be added to the list on the attached coupon, write a letter to the Program Editor, embodying the suggestion. For instance, this week we are adding the band concert because there is a substantial demand for this type of entertainment.

Talks are not so boring as some station managers or announcers may imagine. Travel is one of the leading topics to receive favor, while that particular branch of travel devoted to explorative work is most decidedly popular. Also talks on the construction, care and operation of radio receivers are well-liked, judging by the ballots. But musical saws—no!

Cast Ballot Now

It is imperative that ballots be cast NOW, as the test is drawing to a close. Radio listeners should write on the proper line of the attached coupon the numerical preference, at least up to sixth preference, so that the canvass will be made the more valuable. There is no need of writing the word "yes" anywhere, but if any offering is particularly objectionable, write the word "no" after that listing.

The names and addresses of some more who cast ballots follow:

W. S. Schultz, 540 Pacific St., Brooklyn, N. Y.
George A. Holly, Station E, Box 2067, Cleveland, O.
A. J. Opperman, Box 933, Ft. Meyers, Fla.
Mrs. J. N. Sayre, R. F. D., Orangeburg, N. Y.
William J. Dreusiki, Box 616, Huntington Station, N. Y.
Victor Kane, 3041 Grand Central, N. Y. City, N. Y.
K. C. Tregens, 222 Stanley Boulevard, Ardmore, Okla.
Dennis Ryll, Jr., 3915 N. Kilbourne Ave., Chicago, Ill.
Fred J. Fisher, 537 Grier Ave., Elizabeth, N.J.
A. A. Holydt, Gulfport, Miss.
W. D. Woodford, 267 Yale Station, New Haven, Conn.
L. F. Dorn, Rowayton, Conn.
E. D. Meriwether, 421 Dayton Ave., St. Paul, Minn.
Clifford Collins, 803 Main St., Highland, Ill.
H. H. Savage, 139 Virginia Ave., Audubin, N.Y.
H. Hodgson, 709 First St., Wansan, Wis.
R. W. Davenport, 1583 Hurlbut Ave., Detroit, Mich.
I. H. Moore, Burnet Hotel, Cincinnati, O.
M. K. VanDuzor, 22 Wall St., Orlando, Fla.
Lambert Thommer, Colton, Wash.
Scott Nixon, 104 Masonic Bldg., Augusta, Ga.
E. A. Fordyce, Court House, Cedar Rapids, Ia.
George I. Scovill, 1218 Marlborough, Detroit, Mich.
W. Gilbert, 233 Broadway, N. Y. City, N. Y.
E. B. Lund, 74 Broadway, N. Y. City, N. Y.
M. P. Brogan, 4720 Wakeley St., Omaha, Neb.
J. W. Millard, 17 State St., N. Y. City, N. Y.
Grady Ronine, Box 1041, Corpus Christi, Tex.
Leon Bemesderfer, 642 Astor St., Norristown, Pa.
L. K. Doane, 515 Burke St., Jersey Shore, Pa.
R. A. Yentic, 3711 Fifth Ave., Pittsburgh, Pa.
Chas. E. Kimmel, Windber, Pa.
Wm. Neighbors, Smithville, Mo.
Emlen P. Pitfield, 5032 Newhall St., Philadelphia, Pa.
S. J. T. Lowe, Auburn, Ky.
Mrs. J. F. Hathaway, 2115 Broadway, Fort Wayne, Ind.
W. H. March, 1115 American Trust Bldg., Birmingham, Ala.
W. W. Rissinger, 15 Franklin St., N. E., Washington, D. C.
F. N. Pierce, Taylor, Tex.

Tube vs. Crystal

(*Concluded from page 7*)

quantitative output of the two it is dependent upon the sensitivity of the crystal and of the tube. Both being of normal sensitivity, the response of the tube is approximately 10 times that of the crystal.

The quieter operation of the crystal rectifier is attributable directly to two causes: first being the lower degree of sensitivity of the crystal. It can be easily understood that the many weak disturbances which are barely audible with a tube rectifier would not register at all with a crystal. And if these weak interfering signals were the only detrimental obstacles encountered during the period of operation, reception with the tube rectifier would certainly be noisier than that with the crystal. Calculating along the same lines, disturbing signals, such as static signals which may weakly modulate the carrier wave of a distant station, would be more audible with the tube rectifier due to its greater sensitivity and also to its inherent amplifying power. Noises encountered with tube rectifiers, we must admit, are due also to residual gases left in the tube itself in order that its degree of sensitivity be increased. Another source are leaky units associated with tube rectifiers and carrying DC potentials, and it is quite difficult to segregate these various sources of disturbances. The deficiencies of tube rectification as outlined above constitute the second reason for the apparent quieter operation of the crystal. Hence the quieter operation of the crystal rectifier is not due to any salient feature possessed by the crystal, but rather to its deficiencies in sensitivity and the faults of the other unit.

Station Distribution Plan of White Bill

In providing that each state shall have at least one broadcasting station, the White bill says:

"The Secretary of Commerce shall . . . determine the location of classes of stations or individual stations with due consideration of the right of each state to have allocated to it, or to some person, firm, company or corporation within it, the use of a wavelength for at least one broadcasting station located or to be located in such state, whenever application may be made therefor . . . "

The bill as amended also provides: "In considering applications for licenses and renewals for licenses, when and in so far as there is a demand for same, the Secretary of Commerce shall make an equitable distribution of licenses, bands of frequency or wavelengths and power among the different zones."

Program Editor, RADIO WORLD, *145 West 45th Street, New York City:*
My preference for entertainment and instruction on the radio is as follows, the numbers next to the listed items representing the order of preference:

Grand opera.....	Ringside boxing report.....	Football game.....
Jazz Orchestra.....		Hockey match.....
Talk	Classical instrumental solo.....	Recitation .....
State subject of talk here.....	State kind here.....	Musical comedy (stage) .....
Classical vocal solo	Jazz songs vocal	Short play (drama) .....
State kind here.....	Waltz (orchestral).....	Short play (comedy) .....
Musical saw.....	Symphony concert.....	Banquets, with speeches .....
Vocal duet.....	Instrumental duet.....	Sermons .....
Vocal trio.....	Instrumental trio.....	Market reports.....
Vocal quartet.....	Instrumental quartet.....	Weather report.....
Old-time music.....	Brass quartet.....	Organ recital.....
Band concerts.....	Bedtime story.....	
World Topics.....	Baseball game.....	

If you particularly dislike any of the above listed offerings, write "No" on the dotted line.

Other offerings (not listed above).....

.....

Remarks (if any).....

.....

.....

Fill out and mail this coupon today!

Name .....
Address .....
City..... **State**.....

Snodgrass Making Good

HARRY SNODGRASS, "King of the Ivories," is gaining popularity daily as a broadcast artist. He is making good morally, after having been in jail last year. He won RADIO WORLD'S popularity contest in 1924 when he was in trouble.

COMING EVENTS

MARCH 8 TO 13—Annual Convention and Show, Executive Council, Second District, at Hotel Pennsylvania, N. Y. City.

MARCH 26 AND 27—Fourth Annual Michigan State Convention, Central Division, American Radio Relay League, Park American Hotel, Kalamazoo, Mich.

STATIONS

(*Continued from page 19*)

WSDA—Seventh Day Adventist Church, N. Y. City 263
WSKC—World's State Knitting Co., Bay City, Mich. 261

Station	Owner and Location	Meters
WSM	National Life and Accident Ins., Nashville, Tenn.	283
WSMB	Saenger Amusement Co., New Orleans, La.	319
WSMH	Shatbick Music House, Owosso, Mich.	240
WSMK	G. M. K. Radio Corp., Dayton, O.	275
WSOE	School of Engineering, Milwaukee, Wisc.	246
WSRO	H. W. Fahlander, Hamilton, Ohio	251
WSUI	State University of Iowa, Iowa City, Ia.	489
WSWS	S. W. Strauss Co., Batavia, 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
WTAS	Charles E. Erbstein, Elgin, Ill.	303
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.	349-476
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

RESULTS EDITOR:

I have tried over fifty hookups within the last two years and find that the Diamond rivals them all, including a 9-tube Super-Heterodyne tried out here recently.

Once again let me thank you and the Messrs. Bernard, Anderson and O'Rourke for their hookups as published in RADIO WORLD.

HARRY FINGER,
215 West 51st Street,
New York City.

Action of Electrons Explained for Novices

Radio fans frequently hear that electrons flowing from the filament bombard the plate, but are at sea as to exactly what these electrons are. The Bureau of Standards' circular 40 gives an excellent description of these mysterious particles.

"When electric current flows in a conductor, there is a flow of extremely small particles of electricity, called electrons. The study of these particles is important, not only in connection with current flow, but also in light and heat in chemistry. The reason for this is that all matter contains them. Matter of all kind is made up of atoms, which are extremely small portions of matter. A drop of water contains millions of atoms. The atoms contain electrons, which consist of negative electricity. The electrons are all alike and are in turn much smaller than the atoms. Besides containing electrons, each atom also contains a certain amount of positive electricity. Normally the positive and negative electricity are just equal. However, some of the electrons are not held so firmly to the atom, escaping when the atom is violently jarred. When an electron leaves an atom, there is then less negative electricity than positive in the atom. In this condition, the atom is said to be positively charged. When, on the other hand, an atom takes one or more extra electrons, it is said to be negatively charged.

"The atoms in matter are constantly in motion and when they strike against one another, an electron is sometimes removed from an atom. This electron then moves about freely between the atoms. Heat has an effect upon this process. The higher the temperature, the faster the atoms move and the more electrons given off. If a hot body is placed in a vacuum, the electrons thus given off travel from the hot body out into the surrounding space. This sort of a motion is made use of in the electron tube."

Current In a Circuit Same at All Points

The current which flows in a circuit is no stronger at any one point of the circuit than at another. This statement can easily be proven by connecting up a simple circuit with battery in series with a lamp and a switch and connecting an ammeter at different points. The reading will be the same at all the points. Another way of proving it is by taking a pipe, which is closed, filling it up with water and placing pumps at two points whereby the water can be made to circulate. It will be noted that the amount of water which leaves a specific point in each second is exactly the same as the amount which arrives in the same length of time. In other words, the fluid always flows at the same rate (provided the external rate is not increased), at any point with the same amount of fluid. Electricity acts in the same way that the water does in the pipe. Therefore it can be thought that the electric current is a stream of electricity flowing around the circuit.

RESULTS EDITOR:

I have constructed the Diamond of the Air and have had wonderful success. All the distant stations that are obtained are heard on the speaker. Most of these DX stations are over 1,000 miles distant. The clarity and the volume of the signals of this set are great. I certainly want to thank Herman Bernard for this hookup.

A. W. LEEK,
60 Burling Street,
Flushing, L. I., N. Y.

* * *

RESULTS EDITOR:

I have built the Diamond of the Air and it is the best set that I have ever built. The very first night that I had the set on test I received more than 15 distant stations. All of these stations were heard on the speaker. These and many more distant stations are heard nearly every night.

EDWARD LAYHURST,
2214 German Street,
Erie, Pa.

$150,000 Premium Asked for Station, Says Lawyer

WASHINGTON.

Morris L. Ernst, New York attorney, representing the American Civil Liberties Union, believes preference should be given to colleges, schools, churches and non-profiting organizations in the allocation of licenses and wavelengths for broadcasting stations.

Testifying before the Senate Interstate Commerce Committee, Mr. Ernst charged that there was a considerable traffic going on in the sale of broadcasting stations and wavelengths.

"Of the total licenses now issued," said Mr. Ernst, "ninety-four are held by colleges and forty-three by churches, while 250 are used by commercial enterprises. The price for the sale of broadcasting stations should be regulated by the actual cost of the plant. Premiums as high as $150,000 are now being asked for the signature of the Secretary of Commerce, exclusive of the value of the plant."

"Radio is a public utility," he added, "and everything concerning its operation and its cost should be open to the public."

16 Stations Indorsed For Steady Frequency

WASHINGTON.

Sixteen broadcasting stations have been found by the Bureau of Standards to maintain sufficiently constant frequencies to justify their use in the calibration of radio sets. These stations, the average deviation of which was less than two-tenths of one-per cent, follow:

WQL, frequency kilocycles 17.13; NSS, 17.50; WCI, 17.95; WGG, 18.86; WII, 21.80; WRT, 22.60; WVA, 100; NAA, 113; WJR, 580; WEAF, 610; WCAP, 640; WRC, 640; WSB, 700; WGY, 790; WBZ, 900.

Wrong Grid Return Is Frequently Used

Nobody has had the fortunate experience of being able to examine thousands of home-made sets to see in just what wiring condition they are at the moment of completion. It is safe to assume, however, that in a large percentage of cases there is at least one wiring mistake, and this may be enough to prevent best reception results. In a set that requires say a hundred connections even an expert may make a mistake, but in this instance it is not likely to be a vital one. Leads that would cause tube blowout, if mixed up, are watched carefully, as a rule, but one common mistake is to make the wrong grid return connection. In the detector tube hookup the grid return should be to A plus. If the rheostat or ballast is in negative lead, as is the better practice, F plus, which represents a socket post, and A plus, are the same lead, and the connection may be made at the socket post. But when a negative grid return is required, as in all amplifier circuits, do not connect to F minus, a socket post, but to A minus, which is the other side of the rheostat and represents the battery lead. If the mistake is made the rheostat may be found to affect the setting of the tuned circuit, due to the inductance of the wire with which the rheostat is wound, and the rotation of the rheostat arm to represent, accidentally of course, different values of inductance. Keep the rheostat out of the tuned circuit.

How to Remedy Poor Control in Victoreen

(*Continued from page 12*)

If the oscillator picks up energy on its own account, in loop fashion, then selectivity and sensitivity of the set as a whole will drop. Therefore try turning the oscillator coil to a slightly different position, and finally at right angles to where it was originally. If the set picks up signals of local stations with the modulator tube out, even with L1L2 or loop disconnected, then the oscillator coil is functioning as a loop.

A shielded location may prevent distance reception on any set, hence if you never got DX on any set in a given location, maybe no set can be built that will bring in DX there. Anyway, give the set at least a two-weeks trial, preferably a month's trial, before rendering the verdict of "guilty of no DX." In that time you will learn how to tune the set, and this is the major part of the DX problem.

The tuning trick is best learned by experience. It will be found that on distance reception even the modulator condenser C1 will tune sharply, hence expect this different condition. The oscillator condenser in particular must be set just right, and this is a very fine adjustment for DX. Remember, too, if using a loop, that you may be tuned to the desired DX station, but your loop may be pointing the wrong way. The directional quality of the loop does not always abide by the rule that you should point the coil antenna toward the station, because the incoming wave may be refracted, and the pointing should be done to the direction of wave entry, determined only by experiment. And remember, too, that the loop is more sensitive and voluminous when the side of the winding that connects to grid is pointed toward the incoming wave. If you do not know which is which, tune in a local station, reverse the loop leads, reverse them back again, and note the volume difference.

If control is difficult and the set squawks readily, see that the potentio-

(*Concluded on next page*)

CHANGES OF ADDRESS

should be sent to Subscription Department at least two weeks in advance of publication in order to insure early and proper attention. RADIO WORLD'S subscription list is so large that it is necessary that changes be sent in as requested. Address, Subscription Department, RADIO WORLD, 145 W. 45th St., New York.

Tuning Fork Parallel Shows Beat Note Action

If a tuning fork, which is vibrating at 270 times per second, is mounted near a tuning fork vibrating 265 times per second and sounded, a person listening a short distance away will hear a sound alternatingly swelling out and dying away five times per second. These tone vibrations are known as beats. Now suppose that two sources of undamped or continuous electrical oscillations of steady amplitude act at the same time upon one circuit, one of frequency of 39,500 cycles and the other at a frequency of 38,000 cycles, the height of the oscillations which result will rise to a maximum and then fall to a minimum at the rapid rate of 1,500 cycles a second. This is obtained by subtracting 38,000 from 39,500 cycles. If this is rectified by a vacuum tube detector or a mineral (crystal) detector, the variations of the oscillations that result, will make a note of audible character or at the frequency of 1,500 cycles in the loud speaker or headphones. Now if one of these two oscillations is the signal being received and the other is manufactured by the circuit, we have what is known as beat or heterodyne reception.

VICTOREEN—(From page 28)

meter leads are securely made—that is, well soldered—and that the contact of the lead from the potentiometer arm, or midpoint, to the F posts of the three transformers is a good one. Be sure that the oscillator grid return is to A minus, not to negative filament on any socket, for otherwise the potentiometer is placed in the tuned circuit, and squealing may become inevitable, although curable by potentiometer readjustment.

As a final resort against squeals or broad tuning, copper mesh in screen form may surround the oscillator condenser. This would constitute one box-like compartment in which these parts are housed. Only faulty construction or unwise choice of parts would require you to resort to such shielding in this set.

Dah-Dit-Dah-Dit-Dah!

By IRVING PHILIP WOLFE
2APJ

The Sixth Annual Convention of the Executive Council, Second District, is in full swing in the Hotel Pennsylvania, New York City. A large group of third district hams is augmented by hams from many other parts of the country. The club members are starting their annual festivities in the Grand Ball Room where the convention is being held and are all out for the booth honor. A talk on transformer types by Lewis Winner, Technical Editor of RADIO WORLD, was fully enjoyed Tuesday evening. Friday, Herman Bernard, Managing Editor of RADIO WORLD, talks on "Trouble Shooting in Broadcast Receivers."

* * *

1 AOA of Newport, R. I., the RADIO WORLD representative in lower New England, sends me the following dope: "1 CH worked Portugese 3 GB a couple of nights ago and AOA says that the Portugese is sure fb up in Newport. 1 AOA, one of the star stations of the first district, works every foreigner he calls and some whom he doesn't. AOA was reported in New Zealand at 2:30 in the afternoon and worked a new ham BB2. If anyone knows BB2's QRA please send it to me, care of RADIO WORLD."

* * *

Our weekly new QRA—2 NJ— is at 9537 Tyndal St., Jamaica, L. I., N. Y. His name is Charles Sanders, and he is on the air at present.

* * *

1 AFN is pounding away as usual and is having some remarkable luck with mercury cam switches. He has the best luck with remote control in the first district. 1 AAP's set is for sale. He intends to put in some new UX 210s. The circuit is undecided as yet but he may turn out a master oscillator affair.

2 CV, Irving Korenman, has returned from a trip to the gulf ports and will soon open up on 40 meters with some sort of low power set. Incidentally, he is with the City Radio Co. of N. Y. C.

* * *

Italian 1 AS says that 1 AOA is one

(*Concluded on page* 31)

QUICK-ACTION CLASSIFIED ADS.

10 Cents a Word. 10 Words Minimum. Cash with Order.

FOR SALE—NEW FIVE-TUBE AERODYNE RADIO RECEIVER without accessories, $34.80. 10% off on Radio Sets and parts. Agents for Kennedy, A. C. Dayton, Burgess, Cunningham Tubes, etc. 10% of the amount must accompany your order. Amateur Radio Supply Shop, 525 Park Ave., Kent, Ohio.

LONG DISTANCE ONE-TUBE RADIO—BLUE PRINTS, 50 cents. Volume, distance, selectivity. Built very reasonably. J. M. Hobbs, Jr., R. No. 1, Box 483, Houston, Texas.

PATENTS—Write for free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Inspection and Instructions Free. Terms reasonable. Radio, Chemical, Mechanical, Electrical and Trademark experts. Victor J. Evans Co., 924 Ninth, Washington, D. C.

FOR SALE—Quick—25 standard Victoreen Kits, all six coils, $28.00 per kit. First come, first served. Box 32, Station C, Toledo, Ohio.

BARGAINS—5-TUBE RECEIVERS—Crosley, Atwater-Kent, Grimes, Freshman. Speakers, eliminators. G. Simmis, Lake, New York.

SILVER-GILT, THE NEW SILVER-PLATED bus wire. Price 4c foot, postpaid. Also silver-plated antenna wire. Send for circular. J. A. Armstrong, 124 Pleasant St., Attleboro, Mass.

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

HELP WANTED MALE
EARN $110 to $250 monthly, expenses paid as Railway Traffic Inspector. We secure position for you after completion of 3 months' home study course or money refunded. Excellent opportunities. Write for Free Booklet, G-161 Stand. Business Training Inst., Buffalo, N. Y.

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Add $1.00 a Year for Foreign Postage; 50c for Canadian Postage.

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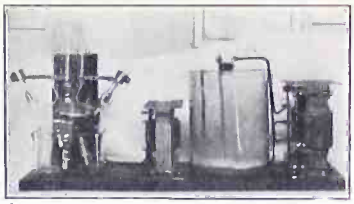
.....

(Concluded from page 30)

of the loudest U. S. stations heard and promises to start sending me Calls Heard.

* * *

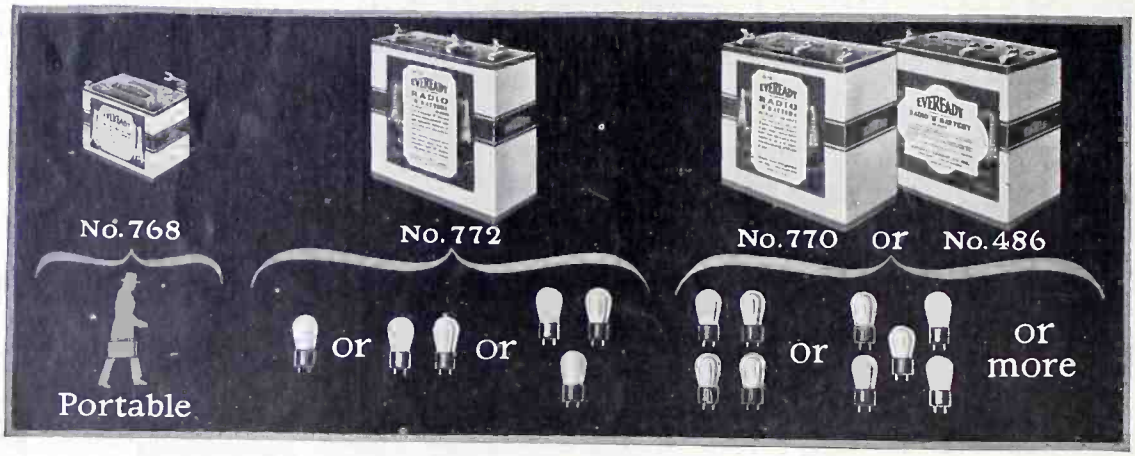


THE NEW MERCURY arc rectifier of 3 CDQ, which is started by tipping the tube. Note that the bottom of the rectifier tube is placed in a jar of oil.

All stations hearing 2 ERC are asked to report to the Executive Radio Council, 74 Cortlandt St., N. Y. City.

QST-QST-QST-de-2 APJ-2 APJ-2 APJ. [*Don't forget to send those Calls Heard, new QRAs, bits of news and queries to 2 APJ, Irving P. Wolfe, Amateur Editor, Radio World, 145 West 45th Street, New York City, or call 2 APJ on the air, 40, 80, or 150 meters.*]

Perhaps you, too, can cut your "B" battery costs in half. Just follow the chart. It gives you the secret of "B" battery economy.



THOUSANDS of people have made the discovery that Eveready "B" Batteries, when used in the proper size and with a "C" battery*, are the most economical, reliable and satisfactory source of radio current.

On sets of one to three tubes, Eveready "B" Battery No. 772, used with a "C" battery, will last a year or longer, usually longer. On sets of four and five tubes either of the larger Heavy Duty Eveready Batteries No. 770 or No. 486, used with a "C" battery*, will last eight months or more.

These figures are based on the average use of receivers, which a country-wide survey has shown to be two hours daily throughout the year. If you listen longer, of course, your batteries will have a somewhat shorter life, and if you listen less, they will last just that much longer.

Here is the secret of "B" battery satisfaction and economy:

With sets of from 1 to 3 tubes, use Eveready No. 772.

With sets of 4 or more tubes, use either of the Heavy Duty Batteries, No. 770, or the even longer-lived Eveready Layerbilt No. 486.

Use a "C" battery on all but single tube sets.

Eveready give you their remarkable service to the full when they are correctly matched in capacity to the demands made upon them by your receiver. It is wasteful to buy batteries that are too small. Follow the chart.

In addition to the batteries illustrated, which fit practically all of the receivers in use, we also make a number of other types for special purposes. There is an Eveready Radio Battery for every radio use. To learn more about the entire Eveready line, write for the booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you on request. This booklet also tells about the proper battery equipment for use with the new power tubes. There is an Eveready dealer nearby.

Manufactured and guaranteed by
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*NOTE: In addition to the increased life which an Eveready "C" Battery gives to your "B" batteries, it will add a quality of reception unobtainable without it.

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Tuesday night means Eveready Hour —9 P. M., Eastern Standard Time, through the following stations:

WEAF—*New York*
WJAR—*Providence*
WEEI—*Boston*
WTAG—*Worcester*
WFI—*Philadelphia*
WGR—*Buffalo*
WCAE—*Pittsburgh*
WSAI—*Cincinnati*
WEAR—*Cleveland*
WWJ—*Detroit*
WGN—*Chicago*
WOC—*Davenport*
WCCO { *Minneapolis* / *St. Paul*
KSD—*St. Louis*

Pacific Coast Eveready Period
KGO—San Francisco—8 to 9 P. M.