Short Wave Broadcasting May Make Possible More Stations

Use of High Frequencies Would Permit Hundreds of New Broadcasters to Go On the Air Without Interference.—Signals Sent On Low Power

The outstanding radio achievement of last year, according to many radio authorities, was the use of short waves in broadcasting and receiving. The shorter the waves used and the greater the distances covered the more sensational seems the feat in the eyes of radio fans. The short-wave craze is on and it's leading the experimenters a merry chase.

Yet, if we go back in history to the year 1888 we find that Hertz, credited as the discoverer of radio waves, made use of extremely short waves. Then, for 36 years we passed through a period during which long-wave transmitting was developed. To-day we are back to short waves.

There is one question which naturally arises in considering this matter—why the popularity of the longer waves?

Radio history as well as other history had its "dark age." The struggle of men to learn the secrets of radio transmission and reception has been a gigantic one. Years from now, it may be, the period when spark transmission was in vogue will be known as the "dark age" of radio.

Striking an electric spark between two suitable conductors it was discovered at an early date produced an oscillating current in a circuit, these oscillations caused certain kinds of wave impulses to radiate into space away from the wire. When this discovery was put to practical use it formed the basic reaction upon which all systems of radio and wireless were finally built.

When using a spark for exciting a circuit, the oscillations produced are known as "damped waves." Without going into a detailed explanation it will be sufficient to say that damped waves "tune broadly." That is, it is rather difficult to tune out a station which uses a "spark" transmitting set.

Engineers have long realized this fault of spark transmitters and many types of spark gaps have been invented to improve the inherent broadness of this type of set. Yet with all the improvements the spark set is still an offender and is not as efficient as tube transmitters. That is, great power has to be expended in producing the necessary radiation.

There was another type of transmitter which was more efficient. This utilized "undamped" or "continuous waves." The efficiency was considerably higher and the tuning of transmitters was very much sharper, so that several stations could be operated without interfering with one another. These two points were very much in favor of the undamped or continuous waves.

Fans know that arc lights are a source of interference because they radiate radio waves. Transmitters making use of such devices use the arc transmitter to produce undamped waves. However, by the very nature of the arc apparatus it is adaptable for use in producing long waves.

The greater the power of the arc the more unstable its functioning at high frequencies (short waves). Engineers, then, in designing stations for trans-Atlantic communication in order to make possible the use of great power, elected to transmit on the high waves or low frequencies. It was also found by investigators that high waves were very stable.

Marconi devised a system of synchonized spark gaps by which it was possible to create undamped waves. This transmitter, because of its nature, was also for use only on the high waves.

From the foregoing it may be easily seen that the use of long waves has largely been made necessary because of the nature of the apparatus available.

Of course, there are other reasons but it can be said that the ones presented are the main "reasons for being."

It can safely be said that the invention of the three-element vacuum tube has been the greatest boon to radio. Without it we would not have radio as it is to-day. The importance of this tube can never be over-estimated. It is the foundation upon which modern radio is built.

It was discovered that the three-element tube could not only be used for reception, but also for transmission. It was possible to produce undamped waves with this device. But for good operation it was not necessary to stay within a certain band of frequencies. This system of transmission did not and does not have the drawbacks of other types of transmitters.

A tube transmitter can be used in systems employing both high and low power, short waves and long waves.

Investigators have become interested in the possibilities of short waves because in the vacuum tube they have a device which presents many opportunities along this line.

Experiments with the short waves revealed that they could be adaptable for commercial use and that they were not merely a subject for the scientist to play with in the laboratory.

The outstanding feature of these waves is that they have been used to cover great distances on an amazingly low power input. Naturally, anything which promises a reduction in costs and still gives reliable service presents great commercial benefits.

Hardly a day goes by now but we hear of some new achievement in the use of short waves. There are many who predict short waves are bound to effect a revolution in broadcasting and even in long-distance code transmission.

One of the peculiar features of short-wave transmission is that great power is not required. For instance, amateurs have found that they can send as far using small tubes (five-watt power) as they can by using larger tubes (50 watt). In other words, when 10 times that power is used it seems to make very little difference. Of course, for reliable communication extremely low power is not yet feasible, yet the example quoted shows possibilities of transmission on short waves. Short waves may be considered as giving great range for low power. Reference to transmission formulae shows that the higher the frequency the greater the radiation and hence the greater the efficiency.

Aside from this commercial aspect the broadcast listener is due sooner or later to be affected by short-wave transmissions. The time may soon come when the BCL will be tuning in stations below 200 metres.

Every man who drives a car knows that if the "gas throttle" is half on and the car is travelling 30 miles an hour, if the throttle were to be opened full, 60 miles an hour will not be the resulting speed. Wind resistances and other factors operate to prevent double the half-speed being attained.

This analogy may be applied to a certain extent to radio waves, only the term "frequency" takes the place of "velocity." The higher the frequency the more difficult the operation. When tuning in a station on 400 meters we are dealing with a frequency of 750,000 cycles, whereas tuning in a station at four meters involves a frequency of 75,000,000 cycles, which is 100 times as great. Think of current alternating back and forth 75,000,000 times a second!

How about the construction of receiving apparatus with which to tune in these low waves? Will new designs in receiving apparatus be necessary? No answer is given because it is obvious.

The transmitting apparatus for these ultra frequencies around four metres is still in the experimental stage. The distances covered with these frequencies remind one of the distances covered in the very early days of wireless communication. A distance of one mile is excellent.

Have you ever heard a whistle when listening in which greatly resembles the noise of a peanut roaster whistle? It is a common occurrence nowadays. Why? Well, because stations are now packed so closely together on waves so close to each other that they heterodyne, that is, interfere with one another.

Applications pour in at Washington weekly from those who desire to erect broadcasting stations. If these new stations are to be operated it means that before long some stations will have to split time with each other three and even four days. That is, many stations will get on the air only one or two days a week at the most.

What is the solution? Many think it lies in the perfecting of these short-wave systems. Will not this band eventually become over-crowded, just as the present long-wave band is? There is little likelihood this would ever occur.

It has been the custom for years to speak of wave lengths. Wave lengths are more generally used rather than frequencies because it is easier to think of the impulses which leave the antenna as "waves." An effort is being made at the present time to have the public use "kilocycle frequency" rather than "wave length," but the movement is meeting with little success.

We will assume that it is necessary to have stations separated by 10,000 cycles (10 kilocycles) to make certain there will be no interference between them due to heterodyning when they are operating at the same time. At present the band from 545 to 1364 kilocycles (which roughly corresponds to 550 to 220 metres, respectively), is set aside for the broadcasting stations. By subtracting 545 kilocycles from 1364 we get as a result 819 kilocycles. If the stations operating are to operate 10 kilocycles apart then we can have about 80 stations on the air at once without interference resulting.

But because there are so many stations, more than 80 stations are on at a time as radio regulations permit two or more stations in different parts of the country to operate on the same frequency or very near the same frequency because it hoped that because they are geographically far apart no interference would result. In spite of these distances heterodyning is quite common to-day, although this may be due to the fact that not all stations are always on their assigned frequencies.

By the present system of frequency allocations, then, we could have about 80 stations 10 kilocycles apart. Now suppose that we make use of the high frequencies, say around 5000 kilocycels (60 me-

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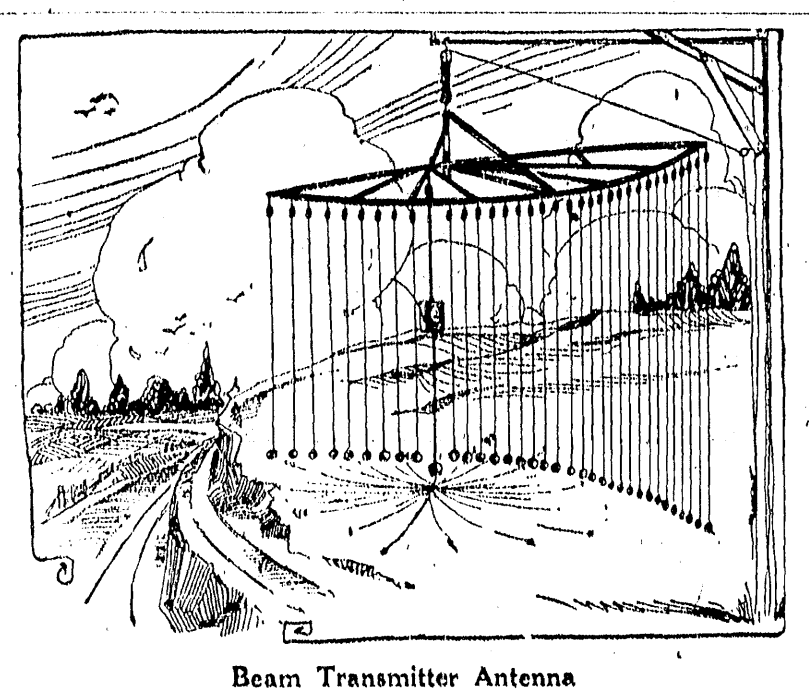
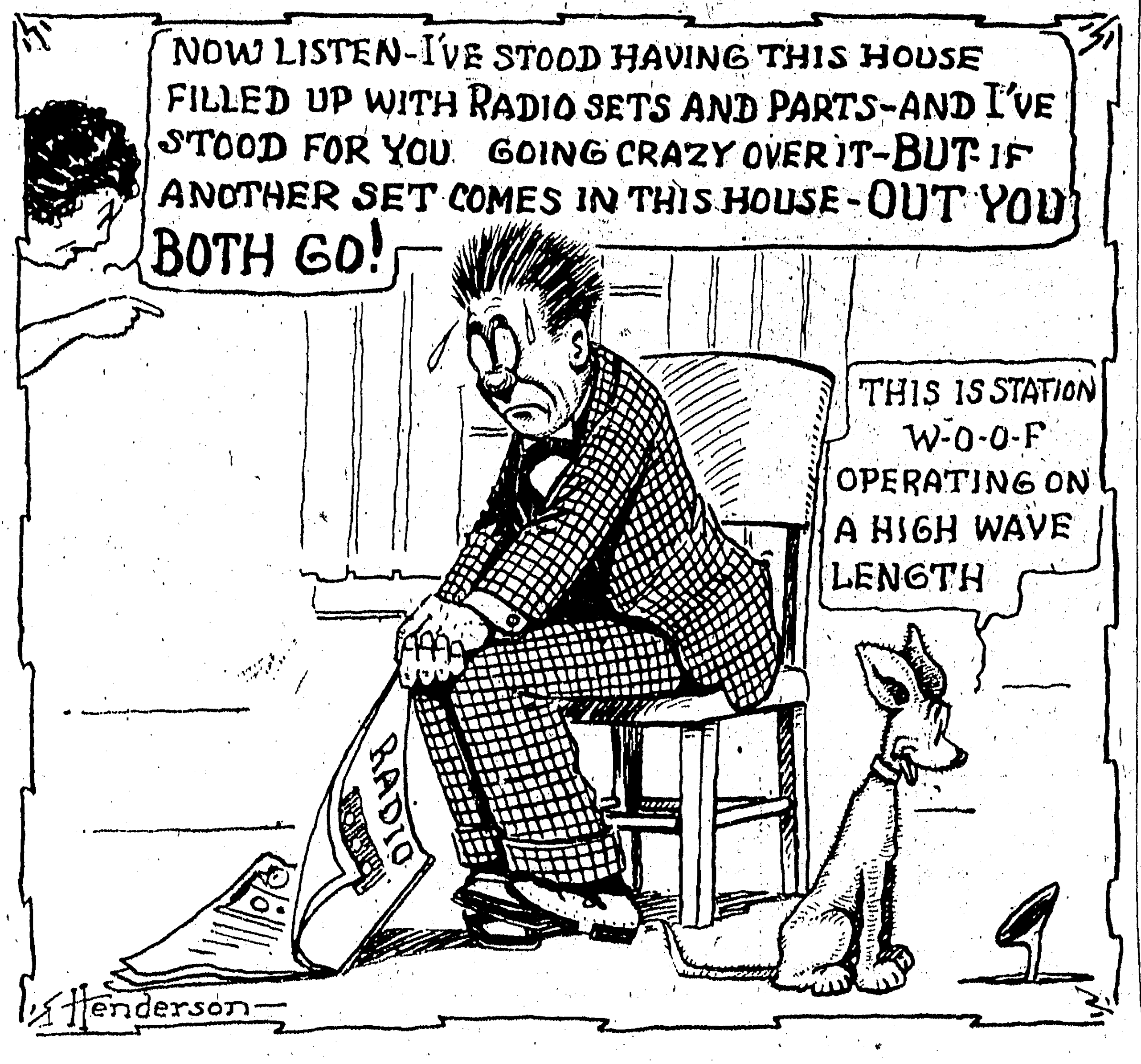


Beam Transmitter Antenna

To-day's Hook-Up



And That's Final

JOHN SMITH AND HIS RADIO

TRYING DIFFERENT SETS

Smith's third evening of radio consisted of trying out several new sets, none of which produced any better results than the one he had first installed. But they opened his eyes to the varieties of hook-ups and theories, and made the words super-heterodyne, neutrodyne, regeneration and reflex mean something.

Naturally Smith saw what a variable thing radio is and how many ways there are of arriving at somewhat the same results. One set brought in a local station with a ground connection alone. Two operated on dry batteries alone. But in most cases outside aerial and storage battery were the rule.

"It's remarkable," Smith declared, watching the dealer's radio expert shift from one set to another, "and it would certainly be confusing, too, if I had not made up my mind to absorb a little of it at a time. I realize that in buying a good set to start with I'm plunging rather deeply, but I'd rather learn the theory of it all by picking it up little by little as I gain experience from a set that rewards me for my efforts."

He did not have to wait long to learn a bit of the groundwork, for just as he was busy twirling the selector dial of a regenerative receiver a neighbor called up to beg him not buy anything that would disturb the neighbor's radio enjoyment. Regenerative sets act as miniature, but annoying, broadcasting stations when they oscillate, but their programmes are anything but acceptable.

The advantage of regeneration, however, are possible in other types of receivers such as the neutrodyne, to mention one. Smith was informed that radio would be greatly aided by fewer straight regenerative sets, so just to be progressive he crossed this type off his list. He figured he could be a radio fan without fanning himself out of popularity.

Even in his haste to give each of the sets a tryout, Smith stumbled over ideas. First of all he noticed that impatient tuning is the surest way of sacrificing results. The quicker he tried to tune in for stations the slower he got them. He was not long in discovering that if you buy a reasonably good set the best thing to do is to learn how to tune it, and to master the job.

Not only that, but in setting up the different sets he discovered how essential it is to make all connections secure. He found that the farther the loose connection is from the final output the more crackling there will be from the loud speaker, for the simple reason that trouble near the input is amplified more than a similar trouble would be from the audio frequency amplifiers on.

Of course he didn't use these terms, and when the dealer's man mentioned radio frequency in the same breath Smith called a halt on theory and asked for a few plain facts.

"I was thinking that perhaps those power wires out front have something to do with the interference we get," he said.

"That's quite possible," I admitted. "The way we've strung your temporary aerial it parallels the power wires. This isn't according to radio Hoyle. What we had better do when stringing up a permanent antenna is to put it on a bias so that, extended, it would cross the power wires and my antenna wire on a sharp angle."

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CHANGING VOLTAGE IMPROVES SIGNALS

Slight Variation Often Adds to Volume and Clearness

C Battery Voltages Ranging From One to Four and a Half Are Recommended. — Frequent Charging of Storage Cells Prolongs Life, Says Writer.

BY M. B. SLEEPER

Many set manufacturers as well as those who write articles on home construction are recommending the use of 4½-volt C batteries. The C battery not only improves the quality of reception by reducing the tendency of the tubes to overload on strong signals, but it cuts down the B batteries two or three times. Usually the instructions specify a particular voltage for the C battery, but experience with various sets shows that it is necessary to try different voltages for the C battery, ranging from 1½ to 4½ volts. If you have a battery of this sort on your set, and the signals seem to be a little weak or thin in quality, try varying the voltage, and you will be surprised to see how, at the proper value, both volume and quality are improved.

A great many of the complaints made about vacuum tubes, particularly so far as their operating life is concerned, are not due to any fault of the tubes themselves, but to the manner in which they are used. That is, if the filament current is increased over the normal or rated value by 5 per cent., the life is cut in half. Increasing another 5 per cent. brings it down to one-fourth. On the other hand, the filament will last nearly twice as long if the rheostat is adjusted so that the current is a little bit below the normal. These figures, taken from the average of hundreds of tubes, show clearly the great importance of keeping the rheostats turned down right to the point at which the signals drip off in strength.

Maj. Klook is the authority for the statement that the life of a storage battery is greatly reduced by running to the full discharge condition before recharging. In other words, any type of battery should be recharged when it has been run down half way. If you want to get the most from your battery, therefore, do not wait until the tubes burn dimly before recharging. The best way is to plan to put the battery on charge perhaps every Monday night, or if it is a small battery and the set is used a great deal, every Monday and Thursday night. It does not injure a battery to overcharge it, but the plates are gradually destroyed if the battery is consistently run down all the way. The foregoing applies equally to storage B batteries.

A great deal of new information has been gathered during the last few months by manufacturers of audio frequency transformers. In fact, the design of A. F. amplifiers will probably change materially during the next year. For one thing, we are discovering that distortion or lack of uniform amplification is not merely a talking point for use in advertising, for, in the new type of amplifiers, when used with good loud speakers, there is none of the peculiar sound effect by which we have, in the past, recognized a radio set as being the source of music or speech. With the new transformers and the new amplifying circuits, such words as "thistle" can be reproduced perfectly. A set that will reproduce "thistle" clearly is 100 per cent. O. K.

However, the new transformers do not tell the whole story, for it has been found that the most perfect transformers deliver so much kick to the tubes that an ordinary amplifying tube cannot be used in the second stage of an A. F. amplifier. As a matter of fact, one stage, correctly designed, gives nearly as much volume and far better reproduction than two stages of the familiar types, while, if a second tube is used, it must be a power tube, so as to handle the work without overloading.

This is one of the most encouraging developments of this season for, by next fall, we shall have radio sets producing music which will be beyond the criticism of those who have been unfavorably impressed by the results obtained with present day equipment. Broadcasting stations send out perfect music and speech. The trouble that we have to overcome is entirely at the receiving end.

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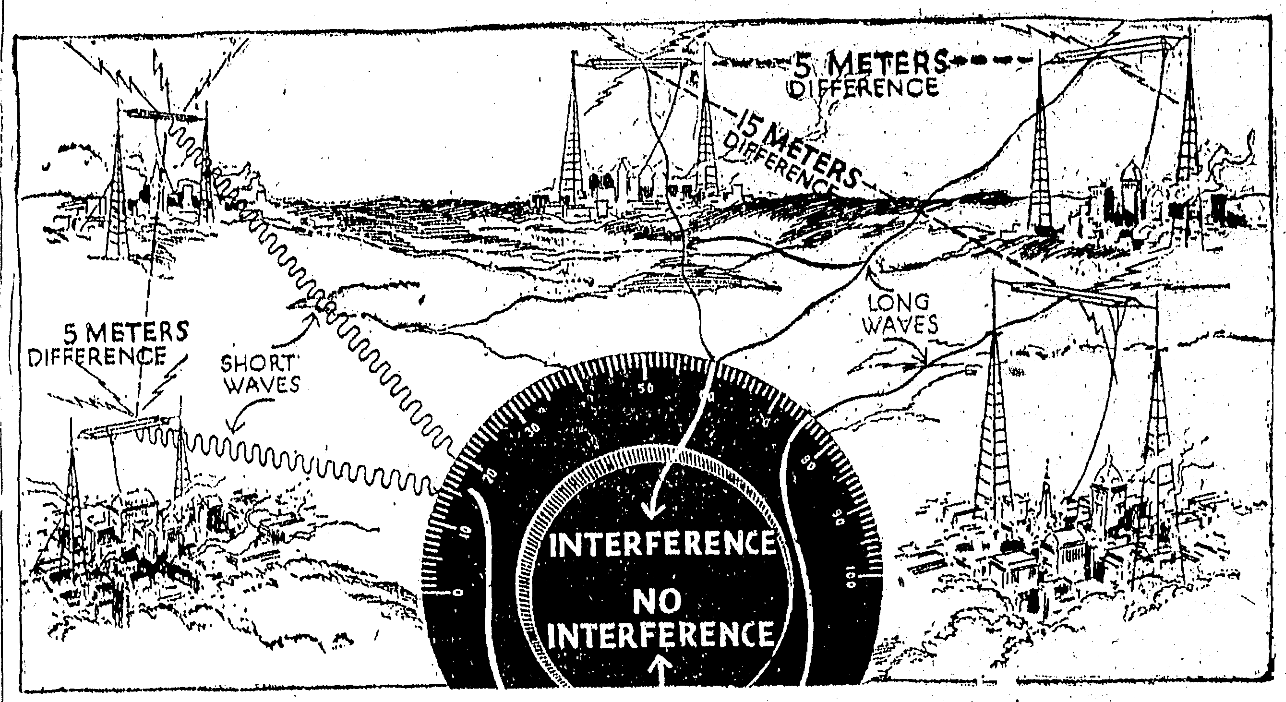
Low Waves Open New Broadcasting Channels



In the above drawing short-wave stations are shown broadcasting on waves separated by only five metres, yet there is no interference, while signals broadcast by long-wave stations separated by the same distance interfere with each other. Long-wave stations separated by 15 metres do not interfere, as indicated in the sketch, but the long-wave bands are becoming overcrowded because it is necessary to leave so many metres between wave-lengths assigned to various stations. The accompanying article suggests that the solution to this problem of overcrowding lies in the perfecting of the short-wave system of broadcasting.

SHORT WAVE BROADCASTING

Continued from Page Seven.

tres). At this frequency there is nothing difficult in the reception of the signals and frequencies such as this are being used regularly for relaying broadcasts.

From 5000 kilocycles (60 metres) to 6000 kilocycles (50 metres) represents a wave length change of only 10 metres and yet spacing the stations 10 kilocycles apart we find that we could have 100 stations at these frequencies operating at once, whereas at present band (220 to 550, representing 330 metres) we can only have 80 stations.

The conclusion is that short-wave broadcasting would solve the problem. However, let us go to the higher frequencies. Suppose that it was now feasible to use the frequencies between 60,000 and 50,000 kilocycles (from five to six metres, respectively). This presents a band of 10,000 kilocycles, which would accommodate 1000 stations spaced 10 kilocycles apart and yet the whole band is only one metre wide.

However, while working out this problem let us consider how many stations could be fitted in between 60,000 kilocycles (five metres) and 10,000 kilocycles (30 metres). In this narrow band of wave lengths (25 metres) we have just 50,000 kilocycles, which would allow 5000 stations or 10 times as many as are now in constant operation.

The above statement shows what a great field there is for broadcasting stations. Stations could be separated by more than 10 kilocycles and in this way interference would be lessened and the possibility of heterodyning cut down.

Fans wishing to calculate frequency from wave length can do so by dividing 300,000,000 by the wave length to get the frequency in cycles. The kilocycle is 1000 cycles.

The matter of "frequency" is very important, as the frequency rate determines what values of inductance and capacity must be used in a receiving set. Bearing this in mind, it can readily be seen that the term frequency is to be preferred in speaking of transmitting and receiving sets. In many ways it is to be deplored that the term wave length was ever coined.

So far in this article we have endeavored to show why the low frequencies (high waves) came to be used extensively and why the use of the high frequencies (low waves) would open many new channels for broadcasting stations.

Great distances are being covered with comparatively low power every day by amateurs. Thousands of miles are covered on startling low power.

A few years ago if anyone had said that 6000 miles could be covered by a code station which uses the same amount of power as a 60-watt electric light lamp he would have been thought crazy. Yet to-day such achievements are common.

Scientists also point out that the high frequencies (short waves) are less subject to static interference than are the higher frequencies.

Fans may have noticed in reading magazines that considerable comment is being made of late concerning directional properties of the ultra-high frequencies. Beam transmission, that is, broadcasting along a definite path has been tried out successfully over long distances.

The accompanying diagram shows the general arrangement of the apparatus used for directive or beam transmission. Reflecting wires are hung from a parabolic frame around the transmitting wires in the centre. Mathematics are employed to work out the correct curve of the reflector and the position of the transmitter.

The reflecting wires act in the same way as a mirror. These wires are tuned to the frequency generated by the transmitter. The transmitter radiates equally well in all directions by virtue of its being connected to vertical wires. However, when the radiated waves strike the tuned reflector wires they in turn reradiate the impulses.

At the open end of the parabola the reradiated waves are in phase with the transmitted waves and hence they reinforce one another because of the arrangement of their positions which have been worked out mathematically. The transmitter signals, however, cannot be received on the other side of the parabolic curve because the radiated and reradiated waves interfere with one another and neutralization takes place with no signals.

In visualizing the beam transmitter perhaps the best method is to think of the reflector in the same manner as an ordinary parabolic mirror. The effect produced on light by the mirror and the effect produced on the radio wave by the reflecting wires is the same.

It is plain that in point-to-point communication beam transmission would make for greater secrecy. It would also permit concentration of broadcast energy.

From the above discussion of the possibilities and present uses of the ultra-high frequencies it can be readily seen why so much emphasis is being placed on "short waves."

The advantages of the ultra-high frequencies may be summarized as follows: New channels for broadcasting with reduction of interference; low power for long distances; reduction of static, and directional characteristics.

There are obstacles to be overcome before the very high frequencies can be used generally. New receiving sets will have to be made, capable of tuning down to extremely low wave lengths. But it should not be difficult to construct transmitters and receivers for the ultra-high frequencies, because of the extensive information in design and manufacture now available.

RADIO DICTIONARY

THIMBLE—A metal ring, though sometimes heart-shaped, with a groove round its circumference to receive rope spliced around it.

TRANSFORMER—An instrument similar in action and construction to an Induction Coil, inasmuch as there are two separate coils, one having few turns and the other many turns, placed close together to permit of induction and having a common laminated core. See Core Type and Shell Type, also Step-down and Step-up. Being used for Alternating Current it does not require an automatic make and break like the Induction Coil, as the alternations produce sufficient alternations in the magnet field to induce a current into the secondary winding.

TRANSIENT—Temporary. Passing.

TRANSMITTING JIGGER — Oscillation transformer having a variable secondary, and permitting of various degrees of couplings, by adjustment, between the two circuits.

TREMBLER—An interrupter for Induction Coils, resembling the hammer break, but on a smaller scale.

(To be Continued.)

TRIGGER BATTERY—Small battery inserted in grid circuit to give grid its initial charge when a valve is used for transmission. Replaces potentiometer.

TRIGONOMETRY—That branch of mathematics dealing with computation of sides and angles of plane triangles. Is divided into right angled trigonometry and oblique angled trigonometry, according to which class of angles it is being applied to.

TRUNK—A square wooden tube enclosing downleads where they are to be carried through desks or awnings.

TUBES OF FORCE—Another expression denoting lines of force.

TUDOR ACCUMULATOR—The positive plate is formed by Plante process and the negative is formed by pasting.

VECTOR—A line representing magnitude and direction of a force.

VELOCITY—Rate of motion or distance traversed in unit time. See units.

VELOCITY OF ELECTRIC WAVES—186,000 miles per second.

VELOCITY OF ETHER WAVES—186,000 miles per second, same as light and electric waves.

WAVES, ELECTROMAGNETIC—A periodic electromagnetic disturbance progressive through space.

WAVELENGTH NATURAL—In a loaded antenna (that is with series of inductance of capacity) the natural wave length corresponds to the lowest free oscillation.

WAVES SUSTAINED—Waves radiated from a conductor in which an alternating current flows.

WAVE-WOUND—A class of drum armature in which connections produce a "stepping forward" in a zig-zag wavy line all the time. Also called series and two circuit windings.

WEIGHT—Force with which the earth attracts a body. A body varies in weight according to its distance from centre of earth, although its mass remains constant.

WEBER—Unit of magnet flux, is produced, by a current of one ampere flowing through a circuit with one Henry of inductance.

WEHNELT BREAK—An electrolytic interrupter.

WESTON CELL—The present standard cell consists of mercury with a paste of mercurous and cadmium sulphates which form the cathode and has an anode of 12.5 per cent. cadmium amalgam in an electrolyte of saturated solution of cadmium sulphate. Has a constant E. M. F. of 1.0125 volts at 20° C.

WHEATSTONE BRIDGE — Instrument for determining resistance of a body by balancing it with another of unknown resistance.

WHIPPING—The binding of string or small wire round end of a rope or multiple wire to prevent the ends from fraying out.

WIMSHURST MACHINE—An influence machine for producing static charges. Consists of two glass discs, each having a number of tin-foil strips pasted on one side. These are rotated parallel and each close to each other, but in opposite directions. On either side of the pair are tinsel brushes which almost touch the tin-foil strips, together with a pair of collecting combs which also nearly touch the strips. These combs are at an acute angle to the brushes. Charges are produced by induction due to an initial charge being given to one set of strips, which passing the strips on other plate induce an opposite charge on them, which is collected by the combs and used to charge a Leyden Jar. This charging is automatically repeated by the rotation of the plates. Only one initial charge is necessary.

WOLLASTON WIRE—Exceedingly fine platinum wire coated with silver.

RADIO PROGRAMMES

George Washington and Abraham Lincoln are the subjects of memorial exercises which will be conducted in Boston this evening and broadcast by station WEAN for the benefit of local radio fans. Other features on the programmes of Providence stations this week include a concert by the New York Philharmonic Orchestra to be broadcast by WJAR Wednesday evening and the second concert of the season by the University Glee Club of this city, which will be broadcast by WDWF Friday evening.

WJAR, THE OUTLET COMPANY

(306 METRES)

TO-DAY.

7:20 p. m.—Musical programme by "Roxy and His Gang" direct from the Capitol Theatre, New York city, by courtesy of the Capitol Theatre management and S. L. Rothafel (Roxy). The first part of the programme will be taken direct from the stage of the theatre and will consist of music by featured artists and the Capitol Grand Orchestra. The second part of the programme will consist of a special presentation by Mr. Rothafel of vocal and instrumental artists direct from the broadcasting studio in the theatre.

9:15 p. m.—Organ recital direct from the chapel at Columbia University, New York city.

MONDAY

10:00 a. m.—Housewives' Radio Exchange. A department conducted by Mrs. Wood on all matters of household interest.

1:05 p. m.—Juliana Allen, soprano; Eddie Bourne, piano; Carl Agarnick, violinist; Miss Alice McHugh, reader.

7:45 p. m.—Grace Clarke, accompanied by Miss Alice Coakley.

8:00 p. m.—The Peerless Orchestra of Woonsocket, under the direction of Omer Charpentier.

9:00 p. m.—A. & P. Gypsy String Ensemble, direct from our New York studio.

TUESDAY

1:05 p. m.—Providence Biltmore Hotel Orchestra, under the direction of Erwin White.

8:30 p. m.—Gold Dust Twins, direct from our New York studio.

9:00 p. m.—"Eveready Hour."

10:00 p. m.—Goodrich Silvertown Cord Orchestra.

WEDNESDAY

10:00 a. m.—Housewives' Radio Exchange. A department conducted by Mrs. Wood on all matters of household interest.

1:05 p. m.—Brown University Jazz Team, under the direction of Philip Bronstein.

7:30 p. m.—Madeline Brard, concert pianist.

7:45 p. m.—Mme. Marie Thomas, Welsh contralto, accompanied by Winifred T. Barr.

7:55 p. m.—Madeline Brard, concert pianist.

8:10 p. m.—Mme. Marie Thomas, Welsh contralto.

8:20 p. m.—Philharmonic Society of New York, under the direction of Willem Mengelberg, in the seventh of a series of 10 educational concerts for students, direct from Carnegie Hall, New York city.

10:15 p. m.—Opera, mixed quartet.

THURSDAY.

1:05 p. m.—Arthur Rothman's Radio Orchestra. May Dobson Finney, soprano.

8:00 p. m.—Arthur S. Berberian of the American Institute of Banking in a dialogue, "Sam Jones Tries to Borrow $500.00," assisted by Darius Nickerson.

8:10 p. m.—Programme under direction of Frederick Roberts. Trio consisting of Mrs. Frederick Roberts, Frederick Roberts and Miss Christine Gladhill.

9:00 p. m.—Atwater-Kent radio artists.

FRIDAY.

10:00 a. m.—Housewives' Radio Exchange. A department conducted by Mrs. Wood on all matters of household interest.

1:05 p. m.—The Woodstock Orchestra under the direction of Martin J. Casey.

7:15 p. m.—Piano "Musik Tawkalog" by Mabel Woolsey. The fourth of an educational series especially arranged for piano students.

8:00 p. m.—"Apco Entertainers."

11:00 p. m.—Providence Biltmore Hotel Orchestra under the direction of Erwin White.

SATURDAY

1:05 p. m.—Twin Elm Orchestra.

7:05 p. m.—Programme by students of the Bryant & Stratton College.

8:15 p. m.—Mental hygiene talk.

WEAN, THE SHEPARD STORES

(270 METRES)

TO-DAY.

10:45 a. m.—Service from Beneficent Congregational Church.

3:15 p. m.—Old South forum, Old South Meeting House, relayed from Boston.

7:45 p. m.—City of Boston Washington and Lincoln celebration, relayed from Boston.

MONDAY.

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—WEAN Noonday Club.

4:00 p. m.—Organ recital by Prof. Edward Benedict, Emery's Majestic Theatre.

4:15 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

4:35 p. m.—Colonial Dance Orchestra.

8:00 p. m.—Minstrel show, South Providence Athletic Association.

TUESDAY.

10:00 a. m.—Message to housewives by Miss Gladys J. L. Peckham.

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—Musical programme.

4:00 p. m.—Colonial Dance Orchestra.

4:10 p. m.—Incidental music by Emery Theatre concert orchestra, William J. Faucher, director.

4:30 p. m.—Weather report.

4:35 p. m.—Colonial Dance Orchestra.

6:30 p. m.—Colonial Orchestra, Harold Sheffers, directing; tenor solos by Harold Strong, George Gaskin, pianist.

8:10 p. m.—Orchestra, relayed from Boston.

WEDNESDAY.

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—WEAN Noonday Club.

4:00 p. m.—Organ recital by Prof. Edward Benedict.

4:30 p. m.—Weather report.

4:35 p. m.—Soprano solos by Mildred Tibbetts.

8:00 p. m.—Boston City Club, Glee Club and assisting artists, relayed from Boston.

10:45 p. m.—Organ recital by Prof. Edward Benedict.

THURSDAY.

10:00 a. m.—Message to housewives by Miss Gladys J. L. Peckham.

11:55 a. m.—Time signals.

12:00 p. m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—Musical programme.

4:00 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

4:35 p. m.—Readings by Frank Pickles and Bob Benvie.

6:30 p. m.—Ban Jewel Five; popular songs by Frank Martin and Irving Crocker.

FRIDAY. 20

11:55 a. m.—Time signals.

12:00 p. m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—WEAN Noonday Club.

4:00 p. m.—Organ recital by Prof. Edward Benedict.

4:15 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

4:35 p. m.—Talk, "Book Brevities," by a member of the Providence Public Library.

8:00 p. m.—Banquet for agents of the Aetna Life Insurance Company, broadcast from Copley Plaza Hotel, Boston.

9:35 p. m.—Broadcast from Temple Israel, chorus and soloists, relayed from Boston.

10:00 p. m.—Emery Theatre Concert Orchestra.

SATURDAY. 21

11:55 a. m.—Time signals.

12:00 p. m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—Musical programme.

4:00 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

4:35 p. m.—Recital by Prof. Edward Benedict.

8:00 p. m.—Musical programme by Southern Abbott, baritone; Donald MacDonald, tenor; Dr. Wilfred Pickles, tenor; Mrs. Wilfred Pickles, soprano.

9:00 p. m.—Musical programme, relayed from Boston.

10:00 p. m.—Dance music by Ed. D'Alphonso and his Hotel Dreyfus Orchestra, broadcast from the Parisian room, Hotel Dreyfus.

WSAD, FOSTERS.

(256 METRES)

MONDAY

2:30 p. m.—Afternoon of music.

6:00 p. m.—Story for the Radio Pals by Fosters Story Lady.

6:15 p. m.—Regular Monday evening concert by the WSAD Orchestra, "Favorites from the Old Haircloth Trunk."

TUESDAY.

2:30 p. m.—Instrumental music.

6:00 p. m.—Radio Pals story by Fosters Story Lady.

6:15 p. m.—Fifteen minutes of music.

WEDNESDAY.

2:30 p. m.—An afternoon with the Edison.

6:00 p. m.—Regular Wednesday evening Radio Pals entertainment by Fosters Story Lady, assisted by Dolly Gibb in songs and dialogue, Ruth Major in songs, piano accompaniments by Marion Tanner.

6:20 p. m.—Concert by "Cole's Snappy Six."

THURSDAY.

2:30 p. m.—Instrumental music.

8:30 p. m.—Musical evening, to be announced.

FRIDAY.

2:30 p. m.—Musical programme.

6:00 p. m.—Safety talk for children by Fosters Story Lady, in co-operation with Providence Safety Council.

6:05 p. m.—Story by Fosters Story Lady for her Radio Pals.

6:20 p. m.—Concert by the "Belvedere Trio."

SATURDAY.

2:30 p. m.—Dance music.

6:00 p. m.—Story for the Radio Pals by Fosters Story Lady.

6:15 p. m.—Regular Saturday evening dance programme by Lar Potter's Orchestra.

WDWF, DUTEE W. FLINT, INC.

(441 METRES)

TO-DAY.

10:00 a. m.—Chimes.

5:00 p. m.—Radio recital: Part 1—"Venetian Serenaders;" Part 2—Pipe organ recital.

TUESDAY.

8:30 p. m.—Arcadia Dance Orchestra.

THURSDAY.

6:30 p. m.—Elks annual banquet at Elks Auditorium.

10:00 p. m.—The Shrine Chanters and Trumpet Four.

FRIDAY.

8:15 p. m.—University Glee Club concert.

WNAC, BOSTON, MASS.

(280 METRES)

TO-DAY.

10:55 a. m.—Morning service from Temple Israel.

3:15 p. m.—Old South Forum, broadcast from Old South Meeting House.

7:45 p. m.—City of Boston Washington and Lincoln celebration, broadcast from Symphony Hall.

WDBH, WORCESTER, MASS.

(268 METRES)

TO-DAY

7:20 p. m.—Same as WJAR.

9:15 p. m.—Same as WJAR.

WBZ, SPRINGFIELD, MASS.

(333 METRES)

TO-DAY

10:55 a. m.—Church services from the South Congregational Church, Rev. James Gordon Gilkey, pastor; music by Prof. Wilson P. Moog, organist, and choir of 24 voices; the quartet is as follows: Mrs. Grace R. Donovan, soprano; Mrs. A. E. Waite, contralto; William L. Spittal, tenor; Albert Edwards, bass.

3:25 p. m.—Concert by the People's Symphony orchestra, direct from the St. James Theatre, Boston.

7:00 p. m.—Copley-Plaza Hotel Orchestra, under the direction of W. Edward Boyle, with assisting soloists.

8:00 p. m.—Wilfred Baetz, boy soprano, accompanied by Mrs. Mary Baetz, from Hotel Brunswick, Boston.

8:15 p. m.—Patrick J. Gaffney, Irish fiddler, Hotel Brunswick, Boston.

8:30 p. m.—Programme of violin and vocal music arranged by Amy Wood, Hotel Brunswick, Boston.

9:00 p. m.—Adventure lecture on "The Tiger Hunt," Hotel Brunswick, Boston.

9:20 p. m.—Programme from Estey studio by the Concorde Male Quartet.

10:20 p. m.—Programme from Faneuil Hall commemorating the sinking of the Maine.

WCAP, WASHINGTON, D. C.

(469 METRES)

TO-DAY

11:00 a. m.—Service at the St. Paul's English Lutheran Church. Rev. J. F. Huddle, pastor, will deliver the sermon, his subject being "Christ and Socrates."

2:30 p. m.—Ceremonies incidental to the Maine memorial exercises to be held at the Riding Hall, Fort Myer, Va., under the auspices of the D. C. department of the United Spanish War Veterans.

4:00 p. m.—Service at Bethlehem Chapel of the National Episcopal Cathedral at Mt. St. Alban, Washington. Rev. Dr. Henry Lubec, LL. D., canon of the Washington Cathedral, will deliver the sermon. At the close of the service a half-hour of chamber music direct from the Grace Dodge Hotel, Washington, will be broadcast.

7:20 p. m.—Same as WJAR.

9:15 p. m.—Same as WJAR.

To-day's Programmes in Brief

For the convenience of radio fans, the following hourly schedule of broadcasting to-day is given in brief form, the complete programme being given under the regular listing of announcements.

The hours are based on Eastern Standard Time.

LOCAL STATIONS

10:00—Chimes, WDWF.
10:45—Church, WEAN.
3:15—Forum, WEAN.
5:30—Recital, WDWF.
7:20—Concert, WJAR.
7:45—Memorial service, WEAN.
9:15—Organ recital, WJAR.

OUT-OF-TOWN STATIONS

9:00—Children's hour, WJZ.
10:30—Church, WGY.
Church, WOO.
Church, WNAC.
10:45—Church, WCAE.
10:55—Church, WNAC.
Church, WBZ.
11:00—Church, WJZ.
Church, WWJ.
Church, WCAP.
Church, KDKA.
11:30—Church, WCCO.
12:00—Church, KYW.
Church, WSB.
Church, WEMC.
12:45—Orchestra, WJZ.
1:00—Church, KOA.
Church, KFI.
1:30—Church, KGW.
2:00—Church, KGO.
Church, KFI.
Concert, WLIT.
Orchestra, WWJ.
Hymns, WEAF.
2:30—Bible class, WJZ.
Memorial service, WCAP.
Concert, KDKA.
Music, WOO.
2:45—Religious service, WEAF.
3:00—Religious service, WHN.
Church, WCAE.
Vespers, WGR.
3:15—Forum, WNAC.
3:25—Concert, WBZ.
3:30—Concert, WJZ.
Musicale, WGBS.
3:35—Orchestra, WGY.
3:45—Men's conference, WEAF.
Men's conference, WEEI.
4:00—Recital, WHN.
Talk, WIP.
Church, WCAP.
Recital, KDKA.
Recital, WGR.
Recital, WCAE.
Vespers, WJZ.
4:30—Address, WFI.
4:45—Vespers, KDKA.
5:00—Organ recital, WGY.
Orchestra, WHN.
Concert, KYW.
5:10—Church, WCCO.
5:30—Orchestra, WHN.
6:00—Recital, WOO.
Concert, KGW.
Concert, WSB.
6:30—Concert, WCAE.
Concert, KDKA.
Orchestra, KGO.
7:00—Orchestra, WJZ.
Vespers, KFI.
Orchestra, WBZ.
7:15—Organ recital, WGR.
Church, WIP.
7:20—Concert, WEAF.
Concert, WCAP.
Concert, WEEI.
Concert, WDBH.
7:30—Church, WGR.
Organ recital, WLS.
Church, KDKA.
Church, WGY.
Church, WFI.
7:45—Memorial, WNAC.
8:00—Recital, WJZ.
Church, KNX.
Address, KYW.
Recital, WBZ.
8:15—Concert, WJY.
Orchestra, WJZ.
8:45—Orchestra, WGY.
Church, WCCO.
9:00—Church, KGW.
Lecture, WBZ.
9:15—Organ recital, WEAF.
Organ recital, WCAP.
Organ recital, WDBH.
Church, WEMC.
9:30—Orchestra, WIP.
Recital, WJZ.
9:45—Talk, KFI.
Church, KOA.
10:00—Concert, KGW.
Church, KGO.
Talk, WJY.
Orchestra, KNX.
Specialty, WHN.
10:15—Concert, WCCO.
10:20—Memorial service, WBZ.
10:30—Specialty, WGBS.
11:00—Revue, WHN.
Trio, KFI.
Music, KNX.
11:30—Orchestra, WHN.
12:00—Entertainers, WHN.
Entertainers, KFI.
1:00—Orchestra, KFI.

WFI, PHILADELPHIA, PA.

(394 METRES)

TO-DAY.

4:30 p. m.—Addresses from Central Branch of Y. M. C. A., Speaker, Dr. P. Whitwell Wilson, M. P., American correspondent of London Daily News. Subject, "The Church We Forget." Trumpet solos, Mabel Swint Ewer; Y. M. C. A. Instrumental Trio.

7:30 p. m.—Organ recital and services from the Arch Street Presbyterian Church. Sermon by Rev. Clarence Edward Macartney, D. D., pastor.

KDKA, EAST PITTSBURGH, PA.

(309 METRES)

TO-DAY.

11:00 a. m.—Services of the Emory Methodist Episcopal Church, Pittsburgh, Rev. W. W. Duncan, pastor.

2:30 p. m.—Concert.

4:00 p. m.—Organ recital by Dr. Charles Heinroth, director of music of Carnegie Music Hall, Pittsburgh, broadcast from Carnegie Music Hall, Pittsburgh.

4:45 p. m.—Vesper services of the Shadyside Presbyterian Church, Rev. Hugh Thompson Kerr, pastor.

6:30 p. m.—Dinner concert from the Pittsburgh Athletic Association, Gregorio Scalzo, director.

7:30 p. m.—Services of the Calvary Episcopal Church, Rev. E. J. Van Etten, pastor.

KFI, LOS ANGELES, CAL.

(469 METRES)

TO-DAY.

1:00 p. m.—L. A. Church Federation service.

2:00 p. m.—Temple Baptist Church services.

7:00 p. m.—Vesper services, under direction federated musicians.

9:45 p. m.—Music appreciation talk.

10:00 p. m.—Metropolitan Theatre programme.

11:00 p. m.—Antoinette and Sigurd Fredericksen, duo-cello numbers; William Hiestand, lyric tenor; accompanist, Ruth Hiestand.

12:00 Midnight—Los Angeles Examiner programme.

1:00 a. m.—Theron Bennett's Anhelenos Orchestra.

KGO, OAKLAND, CAL.

(312 METRES)

TO-DAY.

2:00 p. m.—Service of the Trinity Episcopal Church, San Francisco, Rev. Charles P. Deems, rector.

6:30 p. m.—Concert by the KGO Little Symphony Orchestra, Carl Rhodehamel, conductor; Arthur S. Garbett, musical interpretative writer; guest artists.

10:00 p. m.—Service of the Trinity Episcopal Church, San Francisco, Rev. Charles P. Deems, rector.

KGW, PORTLAND, ORE.

(405 METRES)

TO-DAY.

1:30 p. m.—Service from First Presbyterian Church, Dr. Harold Leonard Bowman, pastor.

6:00 p. m.—Municipal concert.

9:00 p. m.—Church services provided by Portland Council of Churches.

10:00 p. m.—Dinner concert by Colburn Concert Orchestra of Hotel Portland; intermission solos, Jeannette Reierson, pianist.

KNX, LOS ANGELES, CAL.

(337 METRES)

TO-DAY.

8:00 p. m.—Vesper service, Wilshire Congregational Church, Dr. Frank Dyer.

10:00 p. m.—International Association of Bible Students' hour of music.

11:00 p. m.—Hotel Ambassador Concert Orchestra, Joseph Rosenfeld, leader.

KYW, CHICAGO, ILL.

(535 METRES)

TO-DAY.

12:00 Noon—Central Church service broadcast from Orchestra Hall, Chicago, Dr. Frederick F. Shannon, pastor. Musical programme will be arranged by Daniel Protheroe.

5:00 p. m.—Studio concert.

8:00 p. m.—Chicago Sunday Evening Club service broadcast from Orchestra Hall, Chicago. The speaker of the evening will be Raymond B. Fosdick, New York city.

KOA, DENVER, COL.

(322 METRES)

TO-DAY.

1:00 p. m.—Service of the Central Christian Church, Denver, Dr. James E. Davis, pastor.

9:45 p. m.—Service of the Central Christian Church, Denver, Dr. James E. Davis, pastor.

WCAE, PITTSBURGH, PA.

(461 METRES)

TO-DAY.

10:45 a. m.—Services from Rodef Shalom Temple.

3:00 p. m.—People's Radio church services.

4:00 p. m.—Piano recital by Prof. Otto Kalteis.

6:30 p. m.—Dinner concert transmitted from William Penn Hotel.

WCCO, MINNEAPOLIS-ST. PAUL

(417 METRES)

TO-DAY.

11:20 a. m.—Plymouth Congregational Church, Minneapolis, Rev. H. P. Dewey, D. D., pastor.

5:10 p. m.—House of Hope Presbyterian Church, St. Paul, Rev. H. C. Swearingen, D. D., pastor.

8:45 p. m.—Central Lutheran Church, Minneapolis, Rev. J. A. O. Stub, D. D., pastor.

10:15 p. m.—Classical concert, Norwegian male chorus, Carl G. O. Hansen, director; Lillian Dahl Lindstrom, pianist.

WLIT, PHILADELPHIA, PA.

(394 METRES)

TO-DAY

2:00 p. m.—Special concert given by the Arcadia Concert Orchestra, Prof. Feri Sarkozi, director. Henry Szameth, tenor.

WEAF, NEW YORK CITY.

(492 METRES)

TO-DAY.

2:00 p. m.—"Sunday Hymn Sing," auspices Greater New York Federation of Churches, Rev. William B. Millar, general secretary, presiding.

2:45 p. m.—Interdenominational services, auspices Greater New York Federation of Churches. Address by Rev. Augustus Steimle, D. D., pastor of the Advent Lutheran Church, New York city. Music by Federation Radio Group with Arthur Billings Hunt, baritone and musical director; Gladys G. Hill, soprano; Mildred Bryars, contralto; Louis Caton, tenor; George Hirese, baritone; George Vause, pianist; William H. Brewster, basso and organist. Aida Brass Quartet, consisting of Clara Haven, Helen Batchelder, Eleanor Betts and Cora Sauter.

3:45 p. m.—Men's conference in the Bedford Branch Y. M. C. A., Brooklyn, New York, Halsey Hammond, executive secretary, presiding. Address by Dr. S. Parkes Cadman, subject, "The Lure of London." Answers to questions by Dr. Cadman follow the address. Special music by Gloria Trumpeters. Howard Wade Kimsey, song leader; Mrs. Howard Wade Kimsey, accompanist; George Betts, chime soloist.

7:20 p. m.—Same as WJAR.

9:15 p. m.—Same as WJAR.

WEEI, BOSTON, MASS.

(476 METRES)

TO-DAY.

3:45 p. m.—Men's conference in the Bedford Branch Y. M. C. A., Brooklyn, N. Y.

7:20 p. m.—"Roxy" and his gang, direct from the Capitol Theatre, New York city.

WEMC, BERRIEN SPRINGS, MICH.

(285 METRES)

TO-DAY.

12:00 noon—Church service.

9:15 p. m.—Church services.

WGBS, NEW YORK CITY.

(316 METRES)

TO-DAY

3:30 p. m.—Matinee musical, direct from Piccadilly Theatre.

9:30 p. m.—Wassili Zawadsky, Russian composer-pianist.

10:00 p. m.—Muscovite Classical Ensemble. Sofia Parish, dramatic soprano; Dora Bashoaf, mezzo-soprano, and the Muscovite String Trio.

10:30 p. m.—The Vincent Rose Family Party.

WGR, BUFFALO, N. Y.

(319 METRES)

TO-DAY

3:00 p. m.—Vesper services, Rev. Oscar Krauch, St. John's United Lutheran Church.

4:00 p. m.—Organ recital, John F. Gunderman, Jr.

7:15 p. m.—Pre-service organ recital direct from Central Presbyterian Church, W. Wall Whiddit.

7:30 p. m.—Evening service, R. J. McAlphine, D. D., minister.

WJZ, NEW YORK CITY

(455 METRES.)

TO-DAY.

9:00 a. m.—Children's hour: Original stories by the authors, music by the composers, comic stories by the originators of famous comedies.

11:00 a. m.—West End Presbyterian Church services; sermon by Dr. A. E. Keigwin.

12:45 p. m.—Sunday Symphonic Society direct from Criterion Theatre; Josiah Zuro, conductor.

2:30 p. m.—Radio Bible class, auspices Greater New York Federation of Churches; Church Community Chorus, under direction of Clarence W. Allen; Gotham National Bank Quartet; "The Moral Speed Law," by Rev. Fritz Baldwin.

3:30 p. m.—Brooklyn String Quartet.

4:00 p. m.—St. George's Episcopal Church vesper services, Sixteenth street and Stuyvesant square; rector, Dr. Karl Reiland; George W. Kemmer, organist and choirmaster; Mozelle Bennett, violinist.

7:00 p. m.—Nathan Abas's Hotel Pennsylvania Orchestra.

8:00 p. m.—Marie Rothman, soprano.

8:15 p. m.—American Orchestral Society concert direct from Cooper Union.

9:30 p. m.—Godfrey Ludlow, violinist.

WGY, SCHENECTADY, N. Y.

(385 METRES.)

TO-DAY.

10:30 a. m.—Service of First Baptist Church, Schenectady, N. Y., sermon by the Rev. Gordon H. Baker.

3:35 p. m.—WGY Symphony Orchestra, Leo Kliwen, conductor; Mrs. W. Lawyer Hanes, soprano, soloist.

5:00 p. m.—Organ recital by Dr. Frank Sill Rogers, assisted by T. Roy Keefer, violinist, from St. Peter's Episcopal Church, Albany, N. Y.

7:30 p. m.—Service of First Baptist Church, Schenectady, N. Y.

8:45 p. m.—American Orchestral Society.

9:30 p. m.—Violin recital by Geoffrey Ludlow.

WIP, PHILADELPHIA, PA.

(510 METRES)

TO-DAY

4:00 p. m.—Services, auspices Germantown Y. M. C. A., broadcast direct from the Germantown Theatre. "Give the Boy a Chance," a lecture by H. Leo Taylor of Chicago.

7:15 p. m.—Evening service, broadcast direct from Holy Trinity Church, Rev. Floyd W. Tomkins, D. D., rector.

9:30 p. m.—Ben Stad and his WIP Symphony Orchestra, with Karl Bonawitz at the organ.

WJY, NEW YORK CITY

(405 METRES)

TO-DAY

8:15 p. m.—Bernard Levitow's Hotel Commodore Concert Orchestra.

10:00 p. m.—"Reminiscences of a Reporter," William H. Crawford.

Filtering Unit Operates Tubes With A-C House Lighting Power

Device Which Reduces Voltage to Proper Value Before It is Turned Into Receiver Can Be Constructed by Experienced Fan.—Vacuum Tubes Protected

By F. H. SINGEWALD.

Of all the parts and accessories of a modern vacuum tube broadcast receiver, the only ones which need continual replacing are the B batteries. Standard vacuum tube construction has been improved to the point where useful service of two years is not uncommon from a set of tubes, so that the monthly cost of this item is comparatively small.

While it is necessary to regularly inspect, water and charge the filament or "A" battery, this does not involve a great deal of labor, since the battery has only three cells; it may readily be charged at home at nominal cost.

But, in the case of the plate or "B" batteries, the situation is entirely different. It is proposed to give below the full constructional details of a device which, when once placed in operation, will remove this necessity for B battery replacements, this device obtaining its power from the alternating-current house-lighting supply. It will furnish direct current to the plates of the receiver and amplifier tubes at a voltage which is under immediate control of the operator, and which does not fall off from day to day.

The filter contained in this set will suppress all hum from the alternating current lines, allowing the reception of faint distant stations with the same clearness as when using batteries.

When used in connection with a four-tube receiver of, say, the reflex type, the cost of operation will be approximately 1-5 cent per hour, and assuming four hours use per day, this will amount to about $2 per year. This compares very favorably with the cost of 90 volts of dry cell batteries operating on the same set for the same period.

The current supply set consists of the following parts:

(a) The step-up transformer, 110 to 250 volts; it also has a separate winding for lighting the filaments of,

(b) The rectifier tubes or tube, as the case may be;

(c) The filter, the function of which is to "iron out" the pulsations in the direct current supplied by the rectifier tubes. This filter is composed of the choke coil and the condensers.

A word here as to the type of supply set to be used will be in order. For use in connection with receivers employing three stages of push-pull amplifiers, it is recommended that the entire outfit be constructed as here described. If one or two stages only are used, certain omissions may be made, these omissions being outlined below. Since, howeevr, the extra labor involved in building the whole device is small, it is suggested that the entire set be built.

It is best to commence work with the transformer. The first step is to prepare the core. This should be of regular transformer iron, about No. 26 or No. 28 gauge, taken from the core of a burnt-out transformer which may usually be procured from an electrical repair shop, or from a power company. A sheet-metal working shop will cut tin into small strips, of the sizes shown in Fig. 1, namely, 3½ inches by 1 inch and 3 inches by 1 inch. It may also be cut by hand, with large tinner's shears. A sufficient number of these strips should be cut to form a pile three inches high each size of strip.

This will be sufficient for both the transformer and the choke coil. Two piles of these strips or "laminations" should now be taken off and put together with their ends overlapping alternately, one inch on each end, as shown in the plan view of Fig. 1. Tape these piles carefully with three layers of ½-inch cotton tape, and shellac thoroughly after coving. On these "legs" will be placed the windings.

A wooden block 1⅛ inch x 2⅛ inch x 2¼ inch is prepared, and a ⅜-inch hole drilled through it lengthwise, centrally, for the shaft of the winding machine. A layer or two of manila paper is then wrapped around the block, and on this a layer of thin hard twine. This twine permits removal of the block after the coil is wound.

Over the twine a spool of ⅛-inch fibre is formed, and securely glued, as shown in Fig. 2 (a). A pair of wooden end-plates are cut and drilled as shown in Fig. 2 (b). In Fig. 3 (a) is shown the shaft of the winding machine, and Fig. 3 (b) shows the remaining details of the winder, and also the coil form in place ready to receive the winding.

In the spool the primary winding, consisting of 660 turns No. 24 D. C. C. wire should be placed, in as nearly even layers as possible. The winding should be painted with either insulating varnish or shellac as it progresses, the former being much better, both in point of insulating qualities and because it does not absorb moisture. The varnish should be applied liberally, care being taken, however, not to stick the spool to the block.

When completed, the coil, with its centre block still in place, is put into a slow oven and baked until the varnish is hard. This will require about one-half hour, and the temperature should not be raised too high, as the insulation may become charred. Over this winding, several layers of manila paper are wound, and then the rectifier tube filament winding placed. This consists of 40 turns of No. 18 D. C. C. wire, with a centre tap at the 20th turn brought out. This winding is correct for 201-A tubes.

For Western Electric VT-2 or 216-A tubes, it should have 48 turns tapped at the centre. Bind the ends of this winding with twine to prevent slipping of the turns, and then varnish. The twine between the wood block and the spool may now be pulled out and the completed coil slipped over one of the prepared core legs. The wood centre block should be cut down to 1⅛ inch x 2⅛ inch x 1 inch, wrapped with twine and a fibre spool formed around it as before. In this spool is wound 1500 turns of No. 36 D. C. C. wire.

A short piece of small flexible insulated wire should be attached to the beginning of this winding and extended through the head to prevent breaking of the fine wire after the coil is finished. This may also be done with the primary winding. As with the primary, the secondary coils should be wound in as nearly even layers as possible and the winding varnished as it goes on, the idea being to thoroughly impregnate the turns and exclude moisture.

Having finished and baked one of the secondary coils, the block is removed as before, and the coil carefully taped with thin narrow cotton tape, in the manner of the paper wrapping on an automobile tire, that is, "spiral winding." It is again varnished and laid aside while another and exactly similar coil is wound.

These two coils are then slipped on the other core leg, the inside turn of one coil being connected to the outside turn of the other, care being taken to see that the direction of the turns through both coils is the same, otherwise they will oppose each other, and no terminal voltage will be generated.

The short laminations of the core should now be put in place, as indicated in Fig. 1. A light wooden mallet will be of help in this process to tap the whole core together after the end-plates are interleaved, but sufficient force should not be used to bend the laminations. This completes the transformer; the cross-section should be as in Fig. 4 (a), and it should be mounted on brass angle-pieces as in Fig. 4 (b).

The choke coil may next be constructed. The remaining long laminations are now piled one inch thick, in two sections, as was done in constructing the transformer, and taped. A new wood centre block 1⅛ inches by 1⅛ inches by 2¼ inches will be needed, drilled as before. The same thin wood ends may be used, and a spool formed around the block to hold the choke coil winding. There are two of these windings, one placed on each long core leg, and each consisting of 7500 turns of No. 36 D. C. C. wire. The windings should be varnished as put on, and the completed piles taped as above and slipped on the core legs. The end laminations are next put in place as in Fig. 1, and mountings similar to those of the transformer made. This completes the choke coil.

The filter condensers should be purchased, as their construction would be very difficult, if not quite impossible, for the average experimenter. They should be of the one micro-farad (one mfd.) type, and should be insulated to stand at least 250 volts A. C. A total of 10 microfarads will be needed, in two groups, one of three and the other of seven.

The rectifier tubes may be of the 201-A type, or of almost any other type which the fan may have at his disposal. Dry-cell tubes are not satisfactory in this connection, however. Tubes which will not work properly in a receiver will be found to give good service as rectifiers, so that it may not be necessary to purchase new tubes specially for this purpose. Two tube sockets will be needed. These may be of almost any description or condition, since, as there is no radio-frequency present, no dielectric or other absorption losses will be experienced at this point. A rheostat capable of carrying the combined filament currents of the two rectifier tubes will be needed also.

In receivers using a tube detector, in order to provide low plate voltage for the detector tube, the plate circuit of the detector is connected to the positive high voltage lead through a 50,000-ohm variable resistance, the drop across this resistance serving to lower the voltage to the proper operating value. This is illustrated in the wiring diagrams.

The changes which may be made in the construction of this supply set when it is to be used only with receivers having, say, one stage of audio-frequency amplification are as follows:

(a). The transformer secondary winding instead of having two coils of 1500 turns each may be of one coil only of 1500 turns;

(b). Only one rectifier tube will be required.

The choke coil and condensers will, however, remain the same. These modifications are covered in Fig. 5 (b).

The mounting of the completed apparatus is, in the main, left to the individual constructor. Certain precautions, however, should be taken. A potential difference of 220 volts A. C. will exist across each outside plate secondary terminal and the centre tap when the device is in operation. The component parts of the outfit should be spaced at least one-half inch apart, and mounted solidly so they will not become disarranged due to moving the whole device.

On the other hand, the parts should be kept within a reasonably small space, otherwise there is a chance that the electro-magnetic field of the transformer and choke coil may link with the receiver coils and set up a hum which no amount of filtering could remove. It is recommended that the supply set be kept at some little distance from the receiver to avoid trouble from this source. A minimum distance of six feet is suggested. All connections should be made with No. 18 bare wire, spaghetti covered. The leads should not touch any metal parts of the transformer, chokes or condenser.

The leads in the diagram marked "positive" and "negative 100 volts" are connected to the "B" battery posts of the receiver in the usual manner. Set the rectifier filament rheostat at the maximum resistance point. The plug on the transformer primary winding is inserted into a convenient house-wiring receptacle, and the receiver tubes lighted. The rectifier rheostat is then gradually cut out (thus raising the plate voltage), tuning the receiver circuit at the same time until some station is heard.

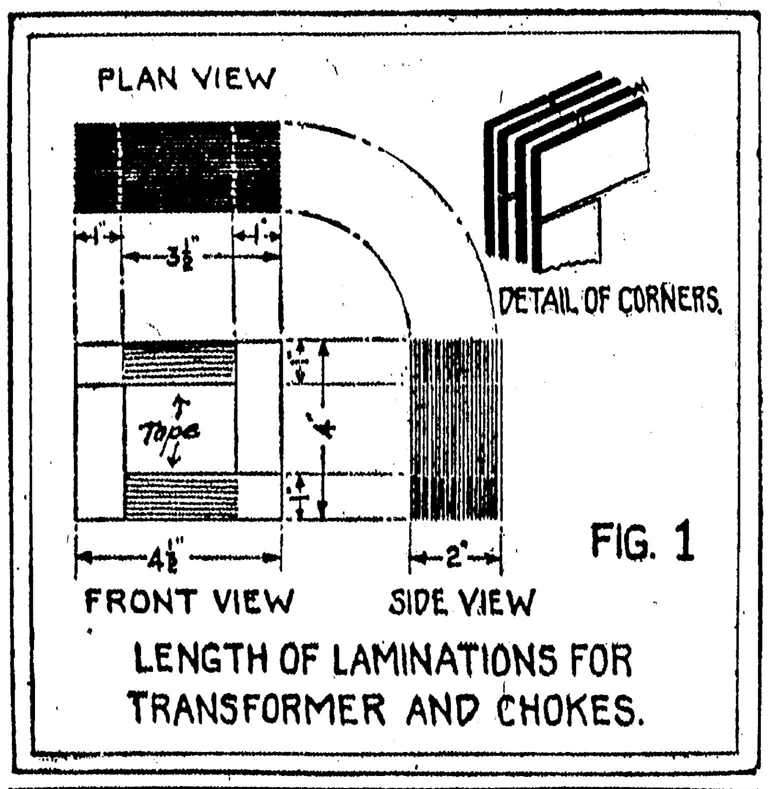
A final careful adjustment of the rectifier filament rheostat is made, until the proper value of the plate voltage for the tubes and circuit in use is found. Having once been made, this adjustment need not be altered.

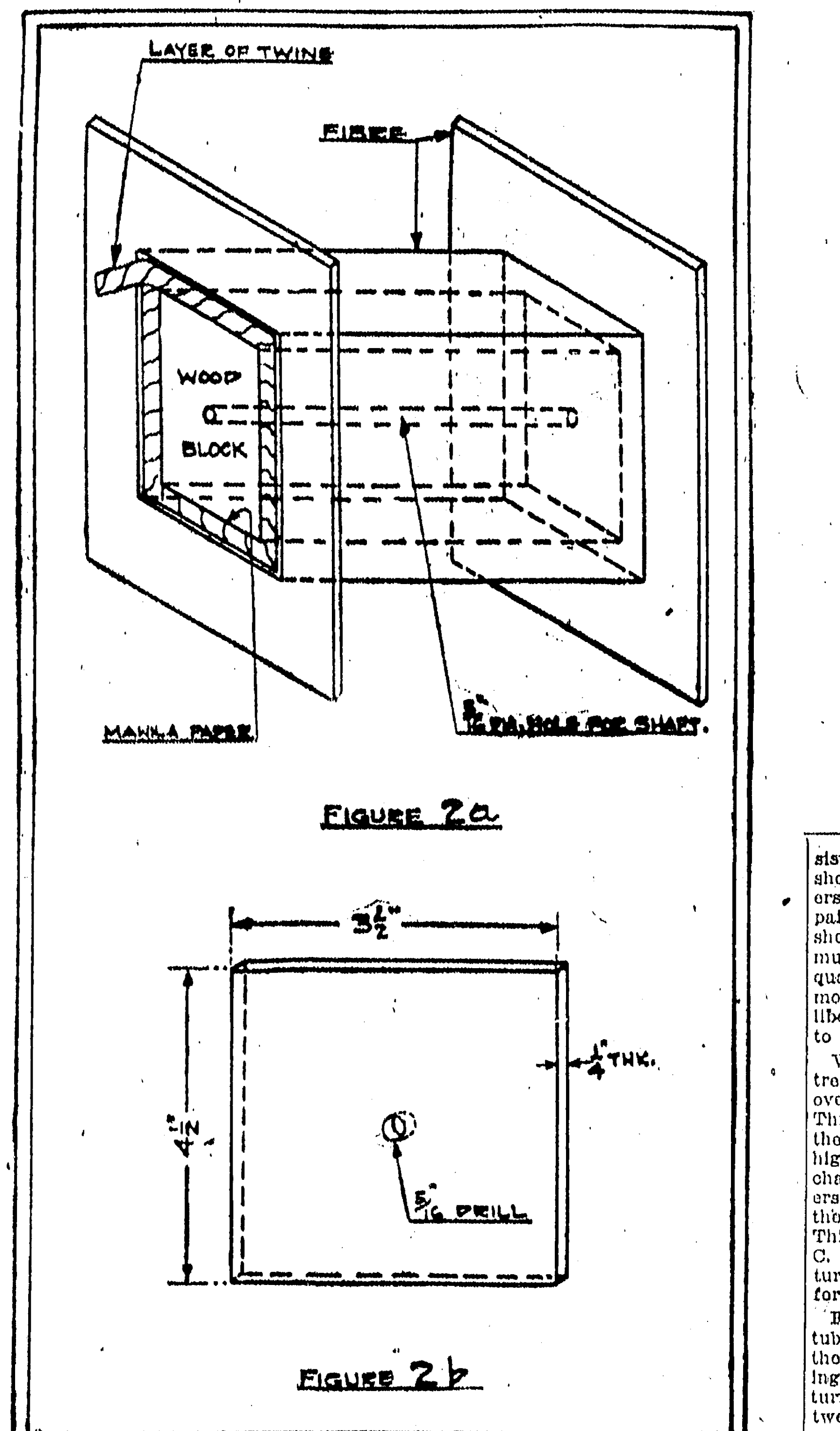
Several plate supply sets have been built, similar to the one described above, and have been uniformly successful. The degree of freedom from hum from the supply lines is dependent upon the number of stages of audio-frequency amplification employed. With only two stages, using the scheme shown in Fig. 5 (a), no hum will be perceptible, and even, with a four-tube standard reflex receiver using three stages and a power loud speaker, only a faint hum was present when no signals were being received, this hum being entirely blanketed out by even weak signals. This four-tube reflex set was one which is noted for its "objections" to working with such a device as this. The "background hum" mentioned was probably produced by reaction of the transformer directly on the battery and loud speaker leads.

Comparatively large values of plate current may be drawn from this device. For instance, it is possible to operate as many as seven tubes from it, with plate currents in excess of 30 milli-amperes. Such a heavy drain would quickly run down even a large dry battery. Also, it is absolutely impossible to burn out any receiving tubes, should the plate leads accidentally be connected across the tube filaments, providing, of course, the balance of the set is correctly hooked up.

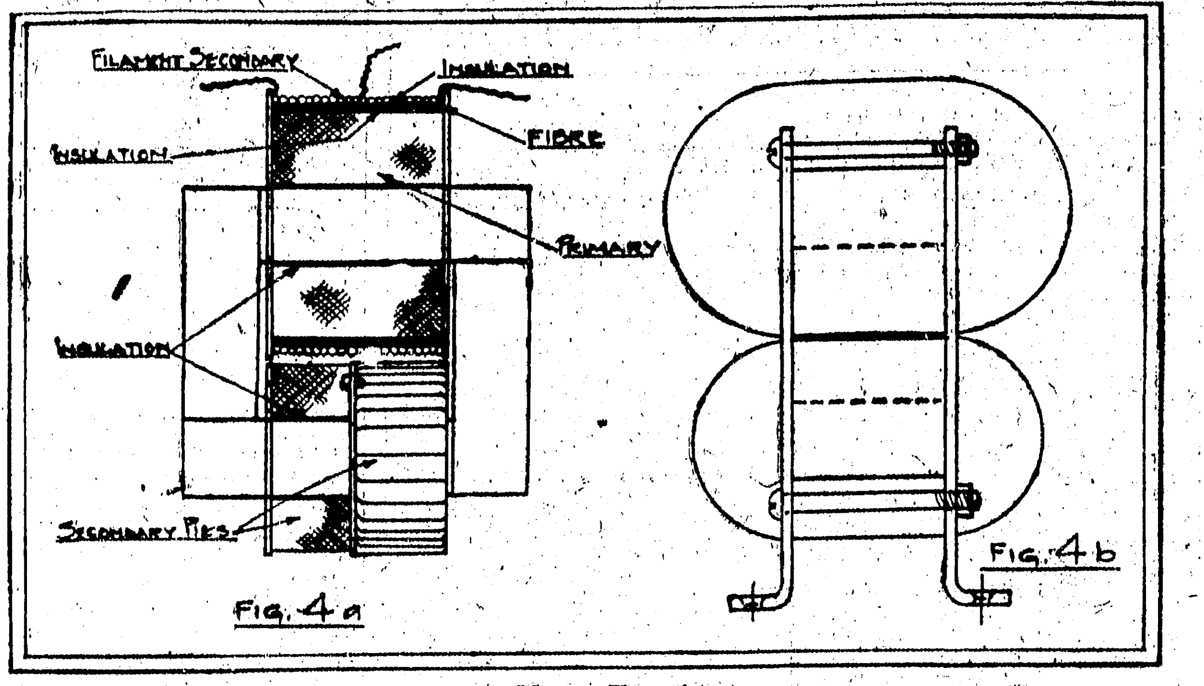
The reason for this is that the current output of the supply set is obtained through the path from plate to filament in the rectifier tubes, and a sufficiently large current to cause damage cannot pass through this path.

The space occupied by the completed set will be about the same as that of the two 45-volt B batteries which it replaces. It may be gathered from the foregoing constructional details that there is an enormous amount of work involved in making the set. It should be possible, however, after procuring the material, to complete the job in several evenings spare time. There are no "upkeep" costs connected with operating this unit, the initial cost being the only one. With proper usage it will last for many years.

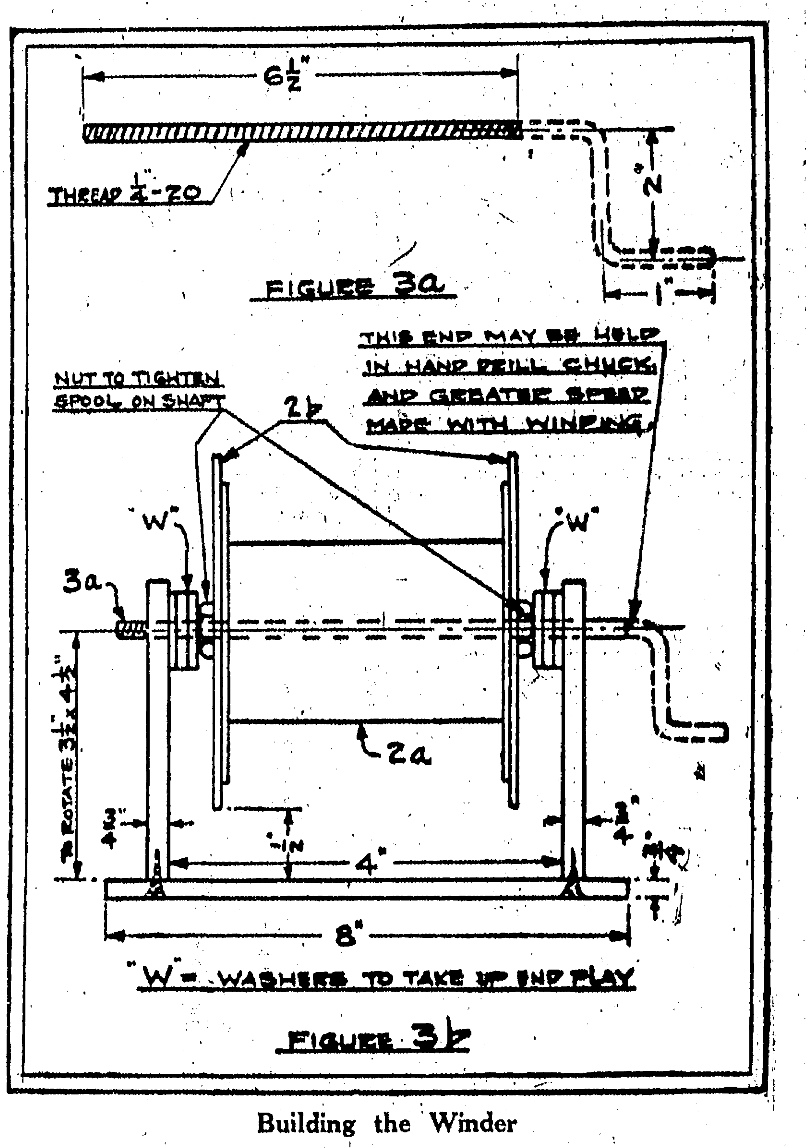




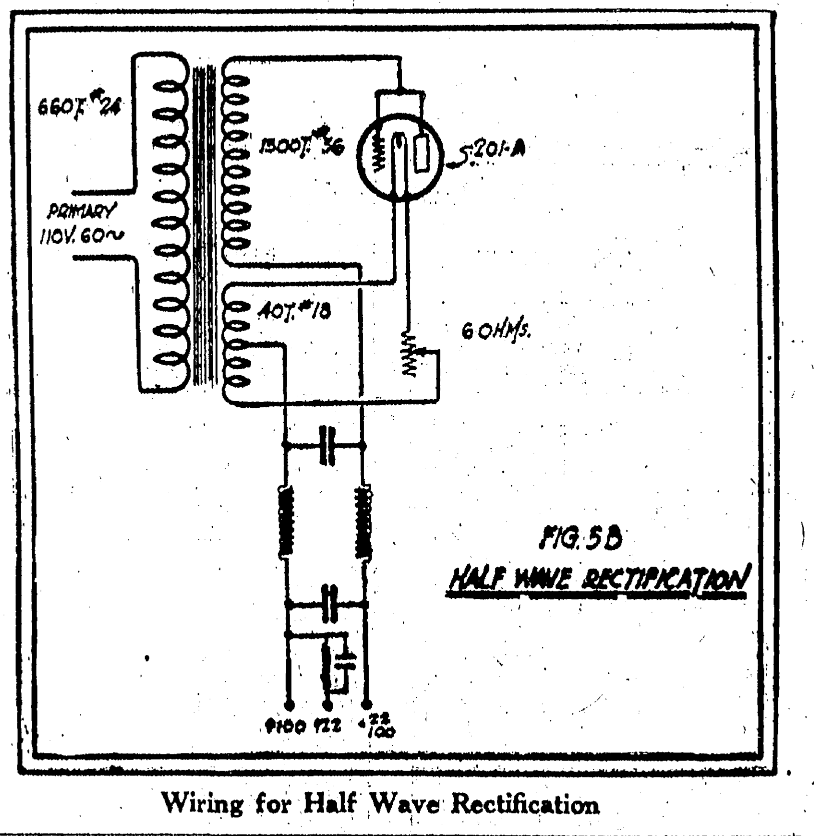
Construction Details of Coil Form



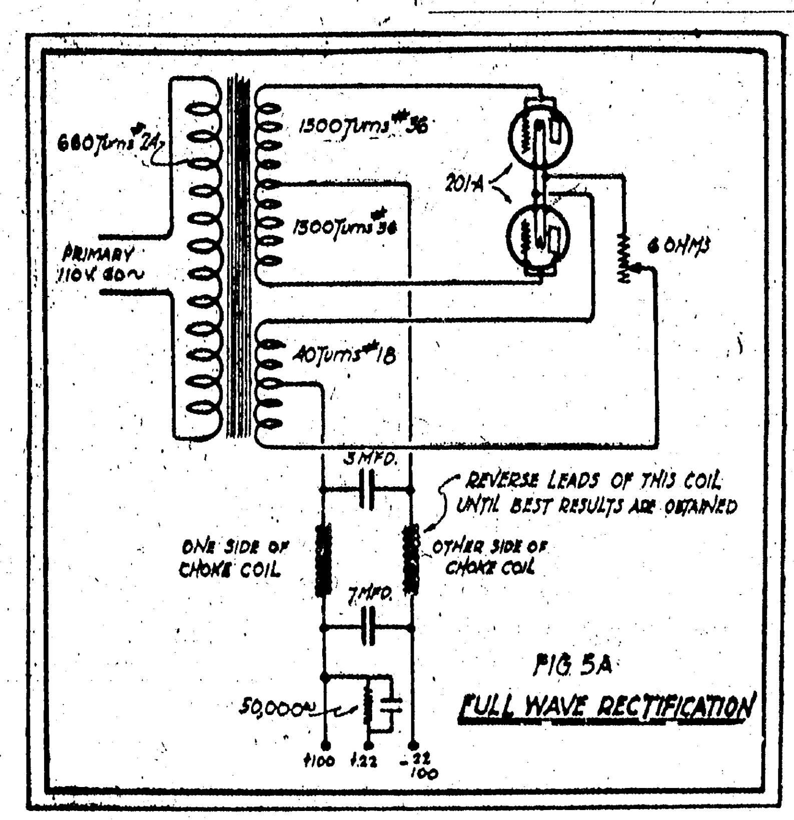
How to Mount Transformer



Building the Winder



Wiring for Half Wave Rectification



Wiring for Full Wave Rectification

PROGRAMMES FOR WORKERS

Stations Broadcast During Noon Lunch Hour.

Following the example of the broadcasting station in Silesia, where concerts are broadcast daily during the workmen's dinner hour, from 12 to 1 p. m., many cities are contemplating not only the same arrangement, but a complete wireless service with municipal loud speakers for all those who may care to listen in to programmes in the Town Hall daily.

It is believed that the special interests of a town may be well served by broadcasting news and figures of home and foreign markets where its products are sold. This applies especially to rural districts where agricultural interests predominate.

LUMBERJACKS LIKE RADIO

Educational as Well as Entertainment Features Appreciated.

Before the coming of radio few opportunities for education were to be had by lumberjacks in the great pine forests of the Northwest, according to Palmer G. Lewis, spokesman for a group who recently sent in their appreciation to a Pacific coast station. With radio receivers now in their camp and with no other form of amusement available, lumberjacks find that isolation in the forest is impelling them to listen-in to educational programmes over the radio.

Miles away from the nearest town or road, seated around a loud speaker, employes of a Western Washington logging camp in the Cascade Mountains, requested Mr. Lewis to send their appreciation to KGO for entertainment and instruction broadcast.

"These men have never had the opportunity of listening to a college professor, or of hearing English spoken in its purest form," he wrote. "They would probably not have taken advantage of it if they had.

"But up here in the woods, with no other amusement, they listen with attentive ears. Educational talks broadcast every Monday evening are giving these lumberjacks, many of whom have been denied the advantages of education and contact with cultural society, a chance to learn something regarding our social, educational and industrial conditions.

Saturday evening we went to the theatre, so to speak, and heard the radio players give "Nothing But the Truth." The boys sat in groups around our set shaking with mirth at the comical situations in the play, scarcely daring to breathe lest they miss a word."

HENS SET NEW RECORD

Birds Lay 3472 Eggs During 14th Week of Storrs Contest.

A new seven-day record was set during the 14th week of the egg laying contest at the Storrs, Connecticut Agricultural Experiment Station, the total production being 3472 eggs, 225 more than in the previous week. For the first time during the current contest, Barred Rocks held the lead for the week.

A pen of Barred Rocks owned by R. W. Davis & Sons of Rockland, Me., laid 48 eggs, the highest total for any one pen in the 14th week. Fred H. Sampson's pen of Rhode Island Reds from Springfield, Mass., had a score of 46 eggs. Carterloa Farm at Troy, Mo., has at Storrs a pen of Wyandottes that made third place with 42 eggs. Another pen of White Wyandottes owned by Louis T. Ayotte of Waterbury, Conn., and Deer Brook Poultry Farm's pen of Reds from Short Falls, N. H., tied for fourth place with 41 eggs each.

The leading pens in each of the principal varieties are as follows:

White Rocks—Ellen Day Ranken, Huntington, L. I., N. Y., 521; Davidson Bros., Upton, Mass., 363; W. C. Matthews, Wilmington, Del., 365.

White Wyandottes—Thomas H. Matteson, Davisville, R. I., 622; A. B. Rice, Tekamah, Neb., 500; William A. Ellis, Warwick, R. I., 542.

Barred Rocks—Mrs. H. C. Kleinsmith, Beavercreek, Ore., 360; Merritt M. Clark, Brookfield Centre, Conn., 352; E. C. Foreman, Lansing, Mich., 354.

Rhode Island Reds—Pinecrest Orchards, Groton, Mass., 567; Sunset Poultry Farm, Amherst, Mass., 484; I. W. Mitchell, Wallingford, Conn., 461; Fernside Farm, Attleboro, Mass., 457; Deer Brook Poultry Farm, Short Falls, N. H., 457.

White Leghorns—Hanson's Leghorn Farm, Corvallis, Ore., 616; Meadowedge Farm, Sterling Junction, Mass., 607; Hobart E. Rice, Barre, Mass., 586; Mount Hope Farm, Williamstown, Mass., 528; F. M. Johnson, Waldoboro, Me., 516.

Long-Lived Fish.

The pike is believed to live longer than any other species of fish. A Swiss naturalist has recorded the history of one that was 207 years old. It had spent its entire existence as a prisoner in a fish pond.

COMMENDS UTILITY OF BEAM STATIONS

Marconi Also Predicts Passing of High-Power Outfits

Directional, Short-Wave Wireless Systems Will Be Able to Communicate Day and Night with Distant Points at Greatly Reduced Cost, Says Expert.

In the inaugural address at the 171st session of the Royal Society of Arts, recently held in London, Senator Guglielmo Marconi, chairman of the council and vice president of the society, stated his belief that the whole theory and practice of long distance wireless communication was undergoing an important and almost radical change. He emphasized the importance of the new discoveries made with the use of the short wave directional wireless communications, known generally as the "beam" system and he predicted the passing of the high-power stations.

Senator Marconi, at the beginning of his address discussed the question of how electric waves can bend right around the globe so as to be received with ease, even at the Antipodes, instead of shooting off into space.

The most logical hypothesis, now generally accepted, the Senator explained, is that the waves are reflected by what is called the Heaviside layer, which is supposed to be a conducting layer of rarefied and ionized gases, constituting a kind of shell concentric to the surface of the earth and capable of reflecting electric waves.

"This and other theories," he continued, "have never satisfactorily explained to my mind why waves of a certain length will cover great distances by daylight, whilst others will only cover similar ranges at night time.

"During the course of tests carried out by me between the wireless station at Poldhu in Cornwall and a ship in the North Atlantic as long ago as February, 1902, I then noticed for the first time the effect of daylight on the propagation of electric waves of about 2000 metres in length over long distances. Although during night time I was able to receive signals up to a distance of 2000 miles, during the day I failed to get them at 700 miles.

"I subsequently discovered that longer electric waves of the order of 10,000 metres or more would, on the average, work as well by day as by night between England and America and other distant places, and up to now I believe that it has been universally accepted that short waves while often giving extraordinarily long ranges by night, are incapable of being made to cover long distances during daylight.

Regarding the waste involved in general directional broadcasting and the use of the "beam" system, Senator Marconi continued:

"Many people may now agree with me that wireless waves are far too valuable to be always broadcast in all directions, especially when it is desired to communicate only with one particular place, and I do not understand why, for example, messages which may be intended for Canada or South Africa should be scattered simultaneously pretty well all over the rest of the world—that is, over all the Continent of Europe, over Asia, South America, perhaps Australia and New Zealand, not to speak of virtually all seas and oceans.

"I can well understand the utility of the nondirectional stations for many naval and marine purposes, and of course for broadcasting, but for ordinary efficient communication between fixed places, or between one country and another, I think the right and logical thing to do, if possible, both from the point of view of secrecy and economy, is to concentrate all the radiated energy into a beam directed toward the country or place with which it is desired to communicate.

"The number of available wavelengths is, after all, very far from being unlimited and if a wave length which is being utilized for communicating between England and India should necessarily be allowed to spread to Africa and America, it would most probably interfere with the free use of that wave in these other countries, and also debar our use of that same wave for communicating simultaneously with them."

He explained the series of experiments that were started last summer with the object of discovering means of overcoming the limitation of working hours brought about by daylight and whether the reflectors used in the "beam" system would give the expected increase of signal strength over long distances.

"In October last transmission experiments were carried out on a 32-metre wave from Poldhu to specially installed receivers at Montreal, New York, Rio de Janeiro, Buenos Aires and Sydney, Australia.

"Although the power utilized at Poldhu was only 12 kilowatts, it was at once found posisble to transmit signals and mesasges to New York, Buenos Aires and Rio, even when the whole of the great circle track separating these places from Poldhu was exposed to daylight. During a complete day, tranmission at fixed intervals to Sydney revealed that that station was able to receive the Poldhu signals for 23½ hours of the 24. During November signals transmitted on a 24-metre wave-length from a low-power station in Australia were successfully received in England."

The information gained from the experiments, it is the opinion of the Senator, would render possible the installation of comparatively low-power stations capable of establishing and maintaining commercial services by day and night between England and the most distant parts of the globe.

The low cost of the system, both in capital and running expenses, compared with that of the existing type of stations, should facilitate a reduction in telegraph rates for all long distance communications besides making direct communication with some of the smaller outposts of the Empire commercially remunerative.

"I am now firmly convinced," said Senator Marconi, "that the beam stations employing only a small fraction of this power and much lower and fewer masts, will be able to communicate at virtually any time with any part of the Empire, and I cannot refrain from expressing any strong personal opinion that these powerful long-wave stations will soon be found to be uneconomical and comparatively inefficient in so far as long-distance commercial communications are concerned. What remains now to be done is to complete the systematic study of these waves, especially in regard to their transit or propagation through space. They open up what I believe will prove to be a most fertile field for the investigator, and an entirely new horizon to our view."