PROVIDENCE
February 17, 1924

RADIO SECTION OF The Providence Sunday Journal

SIXTH SECTION

Expert Gives Instructions for Assembling the Inverse Duplex

Discusses Selection of Parts and How They Should Be Located in Order to Obtain Best Results. One Advantage of Set is Compactness

BY DAVID GRIMES

This is the third in a series of four articles on tuned radio frequency amplification and the Grimes inverse duplex written for the Sunday Journal. The second article took up many of the details necessary for the successful construction of such a set. It was brought out that the actual manner in which the wiring was run made little or no difference in the operating efficiency. Some mention was made, however, concerning the assembly of the various equipment units in the circuit. This has a decided effect on the final results, and should be followed carefully. This article goes into these details on equipment mounting thoroughly. The fourth article in the series will show how to employ the same hook-up for satisfactory aerial work.

One of the benefits to be gained from following the assembly instructions fully is compactness. It is surprising how small a space may contain all of the set if certain precautions are observed. There apparently no limit to the crowding possible in the inverse duplex system. Original instructions sent out on this system always cautioned the experimenter to separate the transformers and to run the leads as far apart as was practicable. Further research has shown this to be an unnecessary point. The troubles, if any were encountered, were usually traced by those actively foolish to the method of shielding and the crowding of equipment.

The audio transformers should be first considered. They, of course, should be placed so that their iron cores are at right angles to each other. When only two of them are used in a circuit no confusion results from this rule, but when three are employed, as in the present set, there is a question just how the cores should be located. It is not necessary to know if when the core is exactly at right angles to the other two. If it were it would have to be mounted vertically, with the core in an up and down position. It is only sufficient, however, to have the third one at right angles to the second transformer and also to the first one.

The plates of the first and third in line, with the middle or second one at right angles to them. The first and third, separated as they are by the middle one, are usually far enough apart to overcome any difficulties resulting from their parallel position. If any trouble is experienced a shift of 180 degrees in the core of the third transformer will help considerably.

In figure 4 you will notice that the second and third audio frequency transformers have their cores in the same plane, but by having the primary of the second on the opposite side from the primary of the third interaction is avoided. The first audio frequency transformer is at right angles to the second and third.

With the audio transformers mounted according to the above arrangement, one can rest well assured that any howling is then due to other causes, such as improper bypassing condensers or audio transformers of too high a turn ratio. There is not a great deal to be gained in this circuit by trying to use high ratio audio transformers. They only tend to make the arrangement unstable. Don't forget that three stages of audio amplification are being utilized, and most audio transformers were never designed to function in such a combination.

Low ratio transformers are best suited for the above use and will deliver all the volume anyone could desire. It is preferable to install a three to one in the first stage or even as low as two to one, if available. In the second and third stages, do not go over four to one and use three to one if possible, as we have never found a three to one transformer fail in this lineup. We have found several commercial types of four to one transformers not altogether satisfactory, and only a few types of five to one transformers have ever given hopeful results.

The consideration of the location of the audio transformers is next in line. This is not a serious matter. In the set proper there are only two radio transformers—the fixed one working into the detector tube and the tuned transformer working into the grid of the second radio frequency tube.

The first one is the standard conventional radio frequency transformer, usually having an iron core. There are several excellent types on the market and a few poor ones. It is best to secure one which attempts to cover the entire broadcast range. The variations in this transformer will cause most of the worries on the part of the experimenter. It is this transformer which will determine whether the grid tap for the second radio frequency tube will be taken off the 12th turn from the top of the secondary of the tuned radio transformer or will have to be dropped to the middle connection. The iron core ones are to be desired in this combination because their magnetic fields have less tendency to stray and cause feedback into the tuned radio transformer. These iron core types when mounted usually have their fields in a horizontal position.

With the fixed radio transformer mounted as described above, the tuned radio transformer should be mounted with the axis in a vertical position. This means that the tuned transformer and the fixed transformer will then have their magnetic fields at right angles to each other. The tapped half of the secondary winding should be on the bottom.

This tuned radio transformer may be mounted in any desired location, with only the above necessary precautions, as its closeness to other pieces of apparatus such as the audio transformers makes little or no difference. The radio frequency energy will have no effect on the radio apparatus. The only noticeable change resulting from placing the tuned radio transformers near the audio equipment is in the setting on the tuning condenser. The tuning will change somewhat, as the metal work in the audio apparatus will add to the capacity of the tuned coil.

The method of assembling the apparatus in the inverse duplex set is shown in Figure 5. This gives a horizontal plan and shows quite clearly the location of the three audio transformers as well as the tuned radio and the fixed radio transformer. The tubes may be mounted as closely as the sockets will permit. No trouble has ever been traced to the location of the tubes.

Due to the construction of the modern tube, it is more or less self-shielding. The plate offers a shield to its grid, which is located on the inside. Thus no outside disturbances can have any effect on the grid of the tube through stray fields. One tube cannot disturb another.

The by-passing condensers are located in any convenient position, usually on the binding posts of the audio transformers. These form a solid support for them. There is little or no danger of these electrically interfering with one another. The tuning condensers, rheostats, binding posts and jack are mounted on the control panel. The binding posts and jack can be mounted on a back panel as described, if desired, in a following paragraph.

The condenser tunes the loop, which is the input to the first radio amplifying stage, and the other condenser tunes the secondary of the tuned radio transformer, which connects the first radio tube with the second radio amplifying tube. This forms the tuned input to the second radio tube. For best results, these condensers should be so connected that their movable plates form the side of the tuned circuit, which finally connects with the filaments of the tubes. The fixed plates, which the hand cannot touch when operating, conect to the high potential or grid side of the tuned circuits.

Now we are prepared for the most important consideration in the design of the set. In order to prevent any disturbance resulting from interaction between the secondary of the tuned radio transformer and the loop, which forms the tuning circuit input to the first tube, it is necessary to either shield the tuned transformer or the cabinet which contains the set.

In the Mercury set, the cabinet has been shielded because other things are accomplished by this. This shielding absolutely prevents any tendency for the tuned radio transformer to feed back into the loop circuit. If the loop were fixed and did not require a rotating motion for adjustment, it would be easy to place the tuned transformer and the loop so as not to affect each other. But, due to this necessity for loop rotation, this extreme measure must be taken.

This shielding should be conected to the positive "A" battery circuit by a well-soldered wire. The shielding may be in the cabinet or may be thin metal stripping. It should cover the bottom and all four sides. It is also desirable to shield the inside of the control panel.

As far as preventing interaction between the tuned radio transformer and the loop, by far the simplest way is to merely mount the tuned radio transformer in a small box of its own, having the sides and bottom shielded and connected to the positive "A" battery terminal. This has one disadvantage, however. There are

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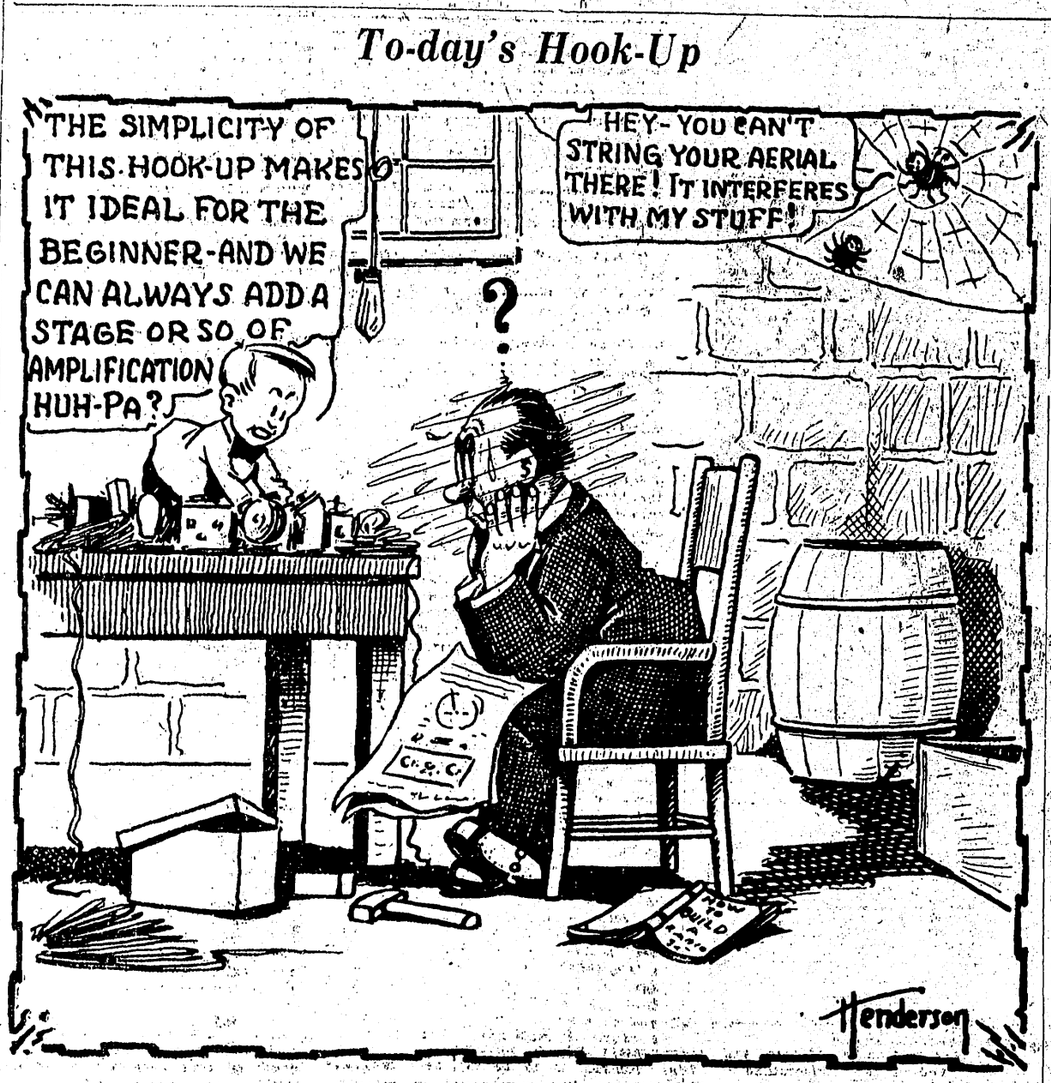
FADING AND DEAD SPOTS WHICH CRIPPLE RECEIVING SETS ARE OFTEN CAUSED BY FLUCTUATION OF MAGNETIC EARTH FIELD

To-day's Hook-Up



Dad Has a Thing or Two to Learn

Interference Due to Conditions That Attract or Repel Currents

Difficulty Experienced in Receiving Near Trinity Square Attributed to Many Light and Power Wires That Absorb Radio Waves

The mysteries which have long surrounded "fading" and "dead spots," two factors causing unlimited trouble to radio fans and unbounded speculation among them and even among radio and electrical experts, may have been penetrated by Walter W. Massie, city engineer of Cranston. Mr. Massie, a few years ago, was regarded with DeForest and Fessenden as among the foremost wireless engineers in the country. He abandoned his place in the public eye when he disposed of his wireless interests to Marconi in 1912, but he has continued his experiments and interest in the science.

Fading, Mr. Massie explained, is caused by the fluctuation of the magnetic earth field, which is constantly in motion with ever changing intensity. He believes radio waves are carried with greater or less efficiency according to the direction and intensity of these magnetic forces.

This belief links up with Mr. Massie's original theory, propounded more than 20 years ago, when wireless was in its infancy. The theory brought prominence to this man then a young amateur wireless experimenter, who, with nothing but the rudest and cheapest kind of equipment, did not expect to ever contribute anything to the world's scientific knowledge. This theory, which Mr. Massie is now considered to have first announced, a year before a German scientist, Dr. Slaby, gave it to the world as his own discovery, is that wireless waves are not ether waves, and do not move in straight lines like light waves, but follow the earth's surface, actually being grounded magnetic waves.

His theory about dead spots also fits in with these thoughts. According to Mr. Massie, dead spots are caused by local conditions which attract or repel the earth's currents, through which, he believes, wireless and radio waves are transmitted.

During his many years of research work, especially for the United States navy, he found that most of the dead spots—and they were many—encountered on land during tests with wireless, were over sandy stretches of soil. He maintains that sandy soil, being dry, does not attract the earth's currents which pass around or under them, consequently radio waves cannot be picked up in such localities except with extreme difficulty.

Referring to the dead spot noted in Providence about Trinity square, he declared, this is undoubtedly due to the large number of electric power, light and trolley wires in that vicinity, which act as grounds for radio waves and magnetic forces.

He is convinced that radio waves, one might say, are not self-supporting; that they are merely earth currents agitated by the broadcasting station; that these earth currents are stirred up exactly as water is set in motion when a stone is dropped into it, and that the radio waves have the same relation to the earth currents as waves do to a body of water; not being a separate thing but merely an agitated earth current.

Consequently, he reasons, anything that affects the earth currents affects radio waves.

Upon this theory he also bases his prediction that in the future radio will be transmitted farther and with far less power than is now the case, arguing that more efficient means will be found of utilizing these earth currents.

Again referring to the water as an example, he points out that if two stones are dropped into it at such distances that the resulting waves are barely perceptible where they meet, the waves will be built up after meeting to many times their intensity at a time just before the meeting. From that he reasons that it should be possible to operate two stations in such a manner that radio waves not strong enough to reach the entire distance between them can be built up, to an even greater extent than is now done with the audion tube, so that signals ordinarily imperceptible will become strong enough for use.

Mr. Massie said navy experiments have shown it to be impossible to pick up wireless waves if a receiver is surrounded with grounded wires. For the same reason, wireless messages cannot be picked up by battleships under or near Brooklyn bridge and radio apparatus frequently fails to function in large buildings, where the steel framework grounds radio waves before they may be picked up.

Mr. Massie is convinced that discoveries which will dwarf the radio developments made so far will shortly be made. He declares the time must come when radio transmission will be far more efficient than it is now. He is experimenting in an endeavor to develop more efficient transmission, particularly in the way of directional transmission with a far greater range than at present with the utilization of less energy.

Asked if he believed a "community aerial," as has been proposed, might solve the problem of persons unable to erect individual aerials, he declared it is not practicable. He admitted that signals might be received by several sets using the same aerial, but declared that each time a tuning change was made on one set, it would immediately throw all the other sets out of tune. He declared that probably the use of more than one set on an aerial would ground it so that it might not work at all.

Questioned about the puzzling situation confronting radio experts, about which much is being printed, as a result of American messages being picked up in England quite easily, while programmes from English broadcasting stations could not be heard in America, he declared there may be an obvious solution of this problem which has escaped the experts. It was originally claimed that American broadcasting apparatus was superior, but the equipping of an English station at Birmingham entirely with American apparatus of the most advanced type failed to give any better results. Now opinion seems to be among radio engineers that radio waves prefer to travel eastward.

Mr. Massie suggested, however, that the recognized fact that radio reception is better at night than in the day time, owing to the sun's action, might be the solution, though he pointed out he had not investigated this phase of the subject and did not know whether the time at which the various programmes had been broadcast would permit of such a solution.

Assuming, however, that an American programme were given at 9 o'clock in the evening, this would be received within a few seconds in England at what would be 2 o'clock in the morning, English time, or at the hour when, it has been found, radio reception is best. On the other hand, a radio programme given in England at 9 o'clock in the evening would be received in the United States at what would be 2 o'clock in the afternoon, Eastern Standard Time, or at a time when radio reception is practically the poorest.

In explanation of his theory that fading is caused by variation of the earth's magnetic field, he said it has been found that wireless reception has been much improved at times when it has been learned that the magnetic field has been strongest; similarly, that reception has been poor when this field was weakest. He explained that in October, 1903, when the intensity of the field had been greatly increased, a time when huge spots were discernible on the sun and the aurora borealis was unusually strong, wireless reception was unusually good. At the same time the magnetic forces caused great difficulty in telegraph operation. He said that one of the telegraph companies which normally has from 50 to 100 volts on its New York circuit, found the current increased to 900 volts. At other times this company found itself able to transmit messages from Providence to New York without using any batteries at all, using what would have been "dead" current.

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Radio Wizard Rose to Fame from East Side Ghetto of New York

Vision Led David Sarnoff, Who Began Career with Paper Route at Age of Nine, to Dominating Position in Newest Industry

David Sarnoff, general manager of the Radio Corporation of America, recently talked with Japan from a hall in central Missouri, requiring only 1 minute and 45 seconds for the completion of a conversation.

The occasion was a mass meeting of students of the University of Missouri at Columbia, where Mr. Sarnoff was speaking on the wonders of radio. He took up a long distance telephone, connected from the speakers' table to the San Francisco office of the Radio Corporation of America.

"Ask Iwaki 'How's the weather there?'" Sarnoff told the operator at the San Francisco station. This was at 8:04 p. m. At 15 seconds before 8:06 the Iwaki station at Tomioka, Japan, had replied through San Francisco:

"Greetings! Thank you for medal and $500. Weather cold. Snow on ground."

The reference to the medal and $500 was from Yonamura, the Japanese operator who was the first to send out news of the Japanese earthquake. The Radio Corporation gave him the $500 and a medal in recognition of his heroic efforts to get the news of the disaster to the outside world.

The story of David Sarnoff can be told only in superlatives. It is the most arresting human narrative one is likely to encounter in reading thousands of biographies, writes Clarence Snyder in the New York Herald. Almost unbelievable things have been accomplished by this smiling chap, who at 32 years of age was chosen vice president and general manager of the great Radio Corporation of America.

If David Sarnoff had been born into even the great middle class life of America, if he had had even the ordinary advantages of a child so circumstanced, the progress he has made with his few years of life would have been rightly considered remarkable. If he had been given even more than the average amount of help in getting started that the boy of America has come to expect, students of success would still be referring to him as a "boy wonder."

But David Sarnoff was born in a wretched little village of 200 population on the steppes of southern Russia. When he was 3 years old his father left the little family of mother, two living sons and one son soon to be born and came to America to win a real home for them all. When he was 9 years old, he landed in America with his mother and two brothers, all of them facing a sweltering July day in New York wrapped in the queer looking fur clothes that had been fashioned at home and that had looked all right in Uzlian. It had been cold, with the early spring cold of Russia, when they started for New York, but it was so hot on their arrival in New York that they attracted almost as much attention as if they had been visitors from another planet.

To round out the story of hardship that had been their journey across the seas they were not met at the pier by the husband and father. A misinterpreted telegram was responsible for this, but finally the co-operation of a friendly policeman, a van driver who spoke their language and an obliging street car conductor landed them in the East Side Ghetto, where their life in America was to start.

Sitting opposite David Sarnoff in the tastefully appointed office in the Woolworth building that is his business home, it seems incredible that in the short space of time that has elapsed since 1000 any young man should have come so far, even in "the land of promise" that America had been to him ever since he had been able to talk.

It is a round, smiling face that looks across the big desk. When Sarnoff gets up and walks back and forth as he talks one discovers that he is not a big man physically, that he is about 5 feet 5 or 6 inches tall and apparently weighs not more than 150 pounds. The chief impression one gets of Sarnoff, judging from externals, is that here is a man for whom life has been easy, who has smiled his way into one good job after another and to whose lot the good things of life will continue to fall. There is also an imme-

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Spain Listens In on Broadcasts from Paris

Although no broadcasting stations have as yet been established in Spain, there is considerable interest of late in that country in radio receiving sets of sufficient range to receive broadcasts from Paris. The Hague, Berlin and London, Consul H. M. Woolcott reports.

The principal drawback to a more extended sale of radio receiving apparatus in Spain is the apparent lack of technical knowledge on the part of those who have undertaken the sale of radio materials. In an investigation of the market five dealers were found who carry radio receiving sets in stock, mainly of British and French manufacture, but only one of the dealers interviewed seemed to have much knowledge of the subject.

One set of American origin was found in the stock of a local dealer which he states he has been unable to set up. It is believed that if a well qualified American salesman would visit the district with samples of medium and high grade instruments and make practical demonstrations, considerable business might result and good connections for future trade could be established.

Operators experience more difficulty in receiving from Paris than from London, on account of the fact that there is little intervening land between Bilbao and London. However, it would seem that there should be no difficulty in receiving with a medium power apparatus from all the principal broadcasting stations of Europe.

Radio Taxable Luxury in Germany

German interests assert that radio is a "luxury" and should be subject to taxation, contending that it will only be possible to finance good broadcasting if the control remains with the Government. Recently, however, the Post Office has granted permission to special companies to construct broadcasting stations and given private persons licenses to buy receivers.

Those who approve of private operation say such control will discourage initiative and that it will be impossible to enforce regulations without spying out home-made sets. The system of Government control will, however, be continued temporarily, and those who listen in must use outside antennae and purchase sets stamped by the Government as well as possess a Post Office license, costing 25 gold marks a year. The first broadcaster licensed in Frankfort was the Sudwestdeutsche Rundfunkdienst, A. G., which will operate exclusively within a radius of 150 kilometers.

Weather Forecasts Sent by Large Stations

To meet popular demands the information sent out by the Weather Bureau of the United States Department of Agriculture by radiophone from several stations has been amplified, and now includes river forecasts and stages, conditions of highways as affected by the weather, effect of weather on crops, weather reports from the principal crop areas, and special forecasts for the guidance of farmers in harvesting.

Co-operation with a number of small stations with limited range has been discontinued and several large and more powerful stations added. In many cases forecasts for several States are now broadcast from a single station. The gradual discontinuance of the smaller and less powerful stations has left the bureau with a chain of well-distributed and reliable stations, from which hearty and continued co-operation may be expected. They are so located that practically all sections of the country are assured of an opportunity to obtain the forecasts directly. It is impossible to approximately estimate the number of people being served in this way.

In addition to the hundreds of thousands of receiving set owners who receive the forecasts by radiophone, large numbers of whom can obtain them in no other way, many repeat them to their neighbors by telephone. This latter form of service has become so potential that arrangements are in hand for a definite form of organization, which may replace the telegraphing of forecast messages now sent to centres for distribution. It is expected that more effective service will be accomplished thereby and that considerable economy will result.

Methods of Refining Popular Rasla Reflex Set Described

Fans Who Have Constructed This Receiving Outfit Can Revamp Exterior to Harmonize with Furnishings.—Cabinet Change

BY JOHN O. DAVIDSON.

The real radio fan, the dyed in the wool radio fan who is ever ready to begin the construction of the latest circuit at a moment's notice, is an impulsive human at best. When a new combination of radio instruments is announced he sets out to build it at once, often forgetting, in his hurry to complete the set, that good results demand careful workmanship.

If the many letters and phone calls received by the writer are a criterion, then the same procedure and the same lack of careful work followed the description in the Sunday Journal of the audio amplifier addition to the Reflex. But after the novelty of hearing one tube operate a loud speaker had worn off, the radio fans were unanimous in their desire for a means of revamping the exterior of the set to make it beautiful. And that brings us to the present article on "dolling up" the set.

It can safely be assumed that the majority of radio enthusiasts have built the Rasla circuit together with the audio frequency amplifier described in the previous article. Since such a combination easily equals the performance of the average four tube set, it is the most desirable set from the standpoint of the home where generous volume is desired.

Obviously, the simplest arrangement of the Rasla Reflex when used in conjunction with the audio frequency amplifier in the same cabinet would be to build the units on their separate panels and then to mount them into the cabinet side by side. The main drawback of this style of construction is that the cabinet is apt to be quite long because the amount of panel space wasted is rather large in comparison.

If it is desired to mount the Reflex itself at the right and the audio frequency amplifier at the left, then it is better to discard the idea of two separate panels and mount the entire outfit on one panel about 14 inches long and the usual seven inches high. The layout of the instruments will then remain unchanged and will be determined by the schematic diagram given in the Sunday Journal of two weeks ago. The layout of the modern audio frequency amplifier unit will then be the same in general proportion only.

Symmetry in layout is to be desired. It it can be achieved without sacrifice of efficiency. To achieve symmetry in any design one central point or unit must be selected about which the balance of the set is built. In the present case the two vacuum tubes with their respective rheostats will serve as the central unit. One peephole will therefore suffice, and it should be placed centrally on the panel in so far as length is concerned and about an inch and a half from the top. Below the peephole, one on each side of the centre line, come the two rheostats, the rheostat for the first tube on the left.

The two main tuning elements—that is, the variometer and the variable condenser—are so placed to the left and to the right, respectively, that their dials extend to within three-quarters of an inch of the edge of the panel. The necessary shaft holes are so drilled that the dials are about midway between top and bottom. To complete the symmetrical appearance the jack leading from the first tube is placed below the rheostat for the first tube and to the left of it. The other or last stage jack is placed in a corresponding position to the right of the other rheostat.

The only change in equipment necessary if this admirable layout scheme be followed, has to do with the jack specified in the original article on the Rasla Reflex. This jack must be discarded and a double circuit jack substituted therefor. Otherwise every single item remains the same, though the wiring must of course be revised to conform to the new positions of the instruments. But this is a purely mechanical change.

So little has been said in reference to cabinets and binding post connections that a word or two on this subject in conjunction with the rebuilding of the reflex and its modern amplifier unit would not be out of place. In the first place, there is no reason why the conventional packing box type of cabinet must be adhered to. This type of cabinet always looks so "boxy" that it stands out in strict contrast to the other furnishings of the room. A bit of ingenuity coupled with a bit of cabinet work will undoubtedly be productive of an improved housing for the complete set.

The changes in the cabinet which suggest themselves almost at once are a more massive appearing overlapping cover and a base fitted with feet somewhat on the style of mantel clock housings. A mission oak finish would seem the most refined and appropriate, although in this respect the radio enthusiast has a great deal of leeway in which to appease his tastes.

The binding posts for the complete set should be brought out at the rear by all means. Nothing so mars the appearance of an otherwise good set as a row of binding posts on the front panel and the tangle of wires incidental to it when the set is hooked up. These binding posts at the rear can be fastened either to the cabinet or else to a separate strip of panel material supported from the base.

Slater Park Skaters Enjoy Radio

Skating to the strains of music broadcast by radio is a thrill that cannot be beat, say the hundreds of skaters who have enjoyed the experience at Slater Park, Pawtucket. Wallace Potter, son of Park Commissioner James C. Potter, has set up a loud speaker attached to an amplifier in front of the rest house on the shore of the park pond. He tunes in on concerts broadcast from Rhode Island studios and the loud speaker does the rest.

Fading Due to Earth Waves

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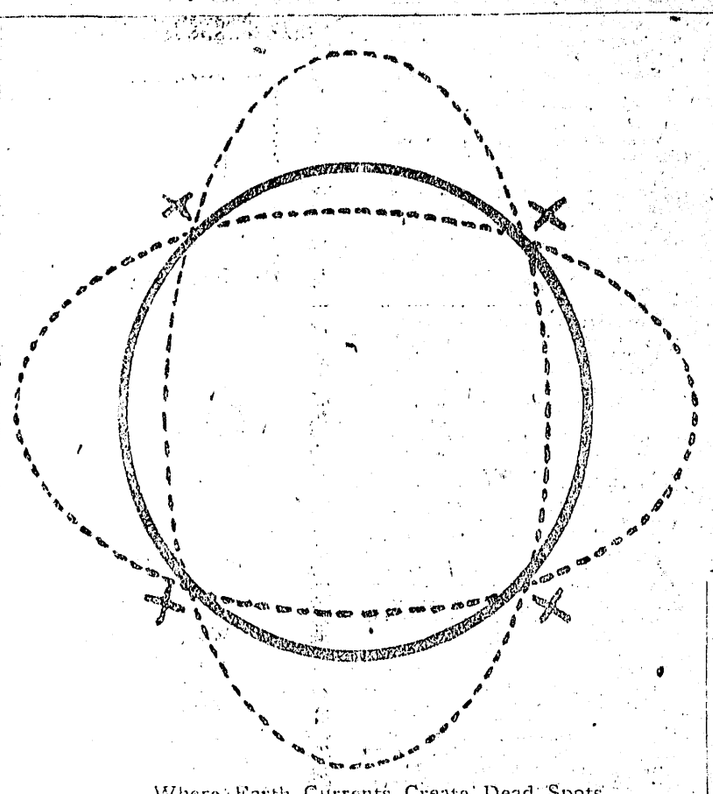
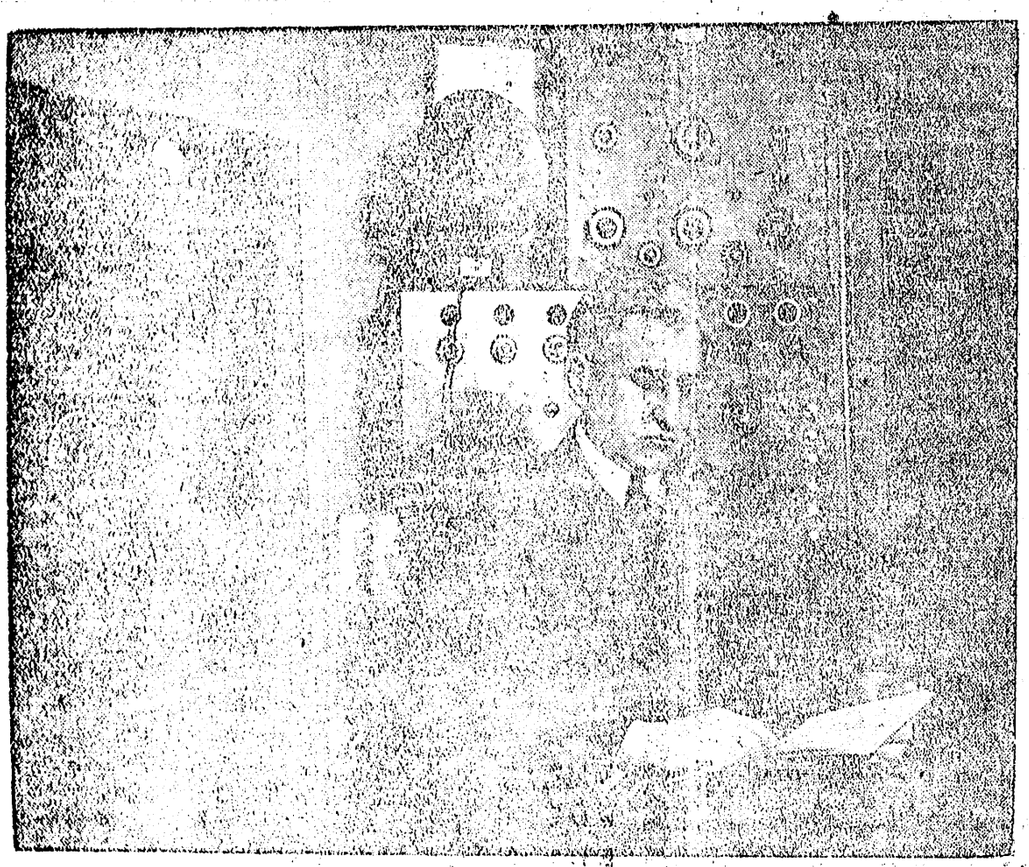


Where Earth Currents Create Dead Spots

How Earth Currents Are Agitated by Broadcasting



Walter W. Massie in Radio Room of His Home

TRANSMITTER OF HIGH POWER USED

Programmes from WEAF Now Reach Outlying Districts.

Four Super-Power Broadcasting Stations Operating in Country. Simple Sets Pick Up Signals Successfully.—Wave Trap Minimizes Interference.

WEAF'S super-transmitter was switched into the circuit so that Raymond B. Fosdick's tribute to the memory of Woodrow Wilson would be carried through "dead spots" in the ether and into remote sections of the country. It was the high-power Hertzian waves from the Broadway station that told many radio auditors in outlying districts, out of reach of extra newspapers, that Woodrow Wilson had passed away.

Early in January WEAF introduced the super-transmitter and after several days test in connection with broadcasting regular programmes it was turned over to engineers so that defects noticed under actual service conditions could be corrected.

One new feature added was a variable power control, which enables operators to use any desired power between one and five kilowatts. This control proved of value when the funeral services of President Wilson were broadcast, as it enabled the use of one kilowatt of power in order not to interfere with WJZ radiating memorial services from Madison Square Garden.

The generator hum which prevailed in the initial test has been eliminated. The laboratory work on the set was completed and officials at WEAF expected to resume high-power broadcasting some time last week. The set was installed and in readiness to "go on the air." When the news of President Wilson's death reached the station it was decided to switch the big set into the circuit. It will now be used permanently.

The high-power transmitter ranks the New York station with WDAP, Chicago; WGY, Schenectady, and KDKA, Pittsburgh. The waves of these stations carry so much energy that they can generally be depended upon for consistent reception at night throughout the United States.

High-power broadcasting, although it causes some interference to near-by receiving sets, makes reception clearer and more economical. It is a well-known fact that each amplifier tube added to a receiving set increases distortion. A properly constructed single-tube set in New York consistently detects Chicago, Pittsburgh and Schenectady, and under favorable atmospheric conditions less powerful stations, such as Kansas City, Mo.; Davenport, Iowa; Hastings, Neb., and Minneapolis.

High-power stations place radio entertainment within reach of everybody, because an expensive receiving set is not necessary. A good crystal detector set can be made or purchased complete at a small cost. Such a circuit reproduces concerts with minimum distortion because no local current is required to operate it and the wiring is extremely simple.

The only disadvantage of high-power broadcasting is the interference caused to near-by receiving sets. When a powerful transmitter is located close to the receiving station the concerts can be heard over a considerable range of the dials, because of what is known as "forced oscillations." This is caused not only by extremely high-power stations but by near-by 500-watt stations.

The action of "forced oscillations" can be described by referring to the analogy of a pond of water after a stone has been thrown into it. Waves radiate from the centre of the disturbance. Where the stone struck the water there are a large number of irregular splashes, but at a little distance from the centre the waves assume a regular form and travel uniformly. A device designed to affect the regular waves is not troubled by the irregular splashes. The same problem exists in radio, says the New York Times. The equipment must be arranged so the irregular splashes can be tuned out.

The device used in radio to tune out the irregular splashes or "forced oscillations" is called a wave trap. It acts as a filter and is so arranged and conected that it offers a path of low resistance to the undesired wave, while the tuner is adjusted to offer a path of low resistance for the desired station, allowing it to pass through the receiver. A wave trap is connected so the impulses picked up by the antenna can also flow through to the ground. It is a good idea to place the wave trap several feet away from the receiving set with the coils at right angles to each other, or place a shield between the trap and set.

The circuits should be tuned as follows: Adjust the set to receive the wave length of the desired station. To eliminate the local station adjust the variable condenser of the filter circuit until the interference is reduced, to a minimum, at the same time tune the receiving set so that the desired station comes in as strong as possible. A little practice will enable sharp tuning.

Code Lessons Popular.

Station WOC, at Davenport, Ia., is broadcasting code lessons every Monday, Wednesday and Friday at 5:30 p. m.

The interest in these code lessons has been remarkable, station authorities reporting that already over 2000 requests have been received for copies of the code.

The lessons are broadcast by the use of voice and buzzer, thus enabling the beginner to memorize the code characters audibly rather than visually, which is essential in order to be able to read at commercial speed.

England May Soon Tune in On New York

If the present negotiations between British broadcasting companies and "listen" organizations here are successful, in a short time British radio fans will be able to listen-in on concerts broadcast from this side of the Atlantic. Relay stations are being established in Liverpool, Edinburgh and in other districts, so in the near future British listeners may tune in for London or New York, just as they desire.

ports of the world [illegible] was given contract to install wireless apparatus in many ports of the United States, in Alaska and in many of the leather producing districts by the United States Government and many vessels of the United States navy were equipped with his apparatus.

It was during this time that Mr. Massie carried on elaborate experiments with the officials of the United States navy concerning the extension of the distance which messages could be sent, elimination of interference, penetration of dead areas and other similar work.

MOVIE NEWS ON THE AIR

Jersey Station Broadcasts Reviews by Alfred J. McCosker.

Motion pictures and the radio have received great impetus from the weekly radio broadcast Monday evenings by Alfred J. McCosker from station WOR, according to the expressed views of leaders in the motion picture industry in fact, station WOR has earned the reputation of being first on the air with news of the latest world-wide episodes of fun and drama and Mr. McCosker's film reviews are unique in the selection of worthwhile [illegible]

OPPOSE DEMANDS

Broadcasters Believe Musicians Exceed Rights.

[illegible] that broadcasting [illegible] at the present time with [illegible] of paragraph which the Performing Right Society claims for the use of songs that are now [illegible]

In Chicago [illegible] in opposition to an order of the [illegible] Musical Mutual Protective Union, [illegible] Music Publishers' Association, [illegible] Association of Broadcasters, [illegible] whom are [illegible] hotel [illegible] [illegible] of which are [illegible] [illegible] [illegible]

Vagrant Waves of Interest to Fans

If your detector tube is burning too bright the signal will be reduced just as it will when it is burning too low.

There are not as many stations working on Sundays as other days, so do not blame your set.

The reason the primary of your set cannot be calibrated beforehand is that different aerials call for different inductance values in your tuner for the same wave length.

You will have to learn to tune your set by doing, as no hard and fast rules can be laid down for you.

A large aerial picks up more energy but you get more interference, too.

A long outdoor aerial clear of everything will pick up more energy but any sort of aerial will get local stations.

When there is more than one tuned circuit, each circuit must be tuned to resonance.

An audion detector is not necessary to pick up distant spark stations.

Radio waves travel in all directions and permeate all substances except iron and steel.

In a radio frequency set it is highly important that the grid and plate wires be kept separate.

If a tickler feed back received regenerates too freely the capacity of the phone condenser should be reduced.

In some instances a three circuit regenerative set can be improved by reversing the terminals of the plate variometer.

A 22½-volt "B" battery should be considered dead after its voltage drops below 17 volts.

The outside wire terminal of the secondary of an amplifying transformer should always be connected to the grid of the tube.

For minimum resistance an inductance should have a ratio of 2.16:1 between the diameter and the length.

When signals are too weak to operate a loud speaker, they are strong enough for several pairs of telephones.

If you put the third step of audio on your set you should also put a fixed condenser across the windings of the last transformer.

A little sealing wax dropped on the edge of the windings of a coil will prevent the wires from slipping.

When you connect batteries to your set you may avoid trouble by connecting the wires to your set first and to the battery last.

If you attach your aerial to a tree it is best to have the wire about 15 feet from the tree to avoid absorption.

You can test any of your home made coils for continuity by using an old dry cell and a pair of telephones. If you get a click it is o. k.

Radio frequency amplifies before detection and audio frequency after detection. Audio frequency will not bring in distance stations.

Lamp socket attachments are better than a loop aerial for distance.

In charging your battery do not exceed the amount stated on the same plate of the battery.

The crystal you have now might be as good as any you will buy but if it isn't giving results, clean it and have patience in adjusting it.

When you once understand what you are doing with your radio equipment, you will begin to get pleasure out of it.

If you have a variometer and avario-coupler and are figuring on a crystal set, just use the vario-coupler.

The selectivity of a receiver can be increased by decreasing the length of the aerial. In most cases an aerial about 100 feet long will give best results.

If you connect the rotary plates of the secondary variable condenser toward the ground, you will find that hand capacity will be almost entirely eliminated.

Dry batteries will have a greater life if they are kept in an upright position.

New Contenders for Small Set Honors

One Receiver Constructed in Peanut Shell, While Two-Inch Piece of Match Forms Important Part of Other Instrument

Today are introduced the newest contenders for small radio set-making honors. Gardner Pettis, Jr., of 250 Narragansett street, Edgewood, has succeeded in putting radio in a nutshell—a peanut shell, to be more explicit. Elmer Kyle of 103 Cleveland street, Central Falls, has built a receiving set on a bit of bakerlite and a two-inch piece of match.

Young Pettis is a student in the eighth grade at St. Paul's school. The sight of a bag of "jumbo" peanuts gave him his idea, and he immediately began to plan how he could transform one of the biggest of the peanuts into a real "radio nut."

He draws the curtain tight upon what he did after opening the shell and eating the peanut meats, but that he succeeded in whatever it was is shown by the fact that the novel set has "worked." The result is the peanut shell, restored to its original appearance, except for the presence of four pieces of fine copper wire, protruding from appropriate points on the peanut shell.

This result is so suggestive of life that one is tempted to remark that there is such a thing as a "radio bug," even if he dislikes the appellation of "nut." If such a sight should be found unexpectedly, it might indeed be mistaken for a rather massive insect, so naturally do the bits of copper wire simulate the real "antennae" of an insect.

Gardner is the son of an engraver and, like many of the youthful Marconis of the radio world, got his first idea from his father. Gardner, the elder, has made several sets including one with three tubes. The boy decided to try his hand and has been successful in several ventures before the "peanut" experiment. The "peanut" outfit has been successful in receiving programmes sent out from the Outlet, Shepard Stores, Fosters and the Dutee W. Flint station.

Elmer Kyle, the other contender, has constructed a receiving apparatus of a bit of bakerlite, a two-inch piece of match, a few fragments of wire and four binding screws, with which he has succeeded in getting WJAR. He is a student at the Providence Trade School, in the automobile class, and electricity aside from its application to the automobile, is only a hobby. He has built several radio receiving sets, one of them with three tubes.

With his small sets he has heard the local stations and with the three-tube apparatus has heard practically everything within 1000 miles. Dallas, Tex., is his most distant point.

The bit of bakerlite upon which the miniature set is built is exactly one inch by two in size. There are four binding posts of the conventional type. A fixed crystal is used, enclosed with a bit of brass tubing about an inch long and an eighth of an inch in diameter. For a coil are a few inches of No. 22 wire, insulated, and wound upon the bit of a match stick.

Head-set, ground and antenna connections are made to the binding posts. The whole make-up is a workmanlike job, and in no way suggestive of a "botch" that is seen in some boyish contrivances. Kyle has made other sets, one of them in a safety razor box and others made without any special attempt at compactness.

Elmer Kyle
Made Receiver with Bit of Match and Small Wires.

Gardner Pettis, Jr.
Succeeded in Putting Radio in Peanut Shell and It Works.

Inventor Believes Radio Indebted to Science

One of the first American pioneers in radio and one of the most prolific inventors who ever worked in this field is John S. Stone, formerly of Boston, now living in San Diego, Cal. A short time ago, the 1923 medal was presented to Mr. Stone in recognition of his services in radio science. In his remarks at that time, Mr. Stone made some prophecies which will interest every radio engineer who has even the slightest leanings toward scientific research.

"The art of radio communication," said Mr. Stone, "differs from other electrical arts in that the early growth of these latter has depended almost wholly on empirical developments, while the advances in the art of radio communication, even from its earliest days, have been almost exclusively through the astute application of the principles of the pure sciences. It is this fact that accounts, I believe, for the rapidity with which the art of radio communication reached its advanced achievements.

"For this reason radio communication is under a greater debt to the electrical arts. In looking forward I am not, therefore, so much concerned to see startling advances in the art of profound modifications of its processes as I am to see it repay its debt to science. That this is imminent we may feel sure, and though I have not the hardihood to attempt to predict the exact nature of its contribution to science, I may, nevertheless, venture to point out that the audion, or three-electrode vacuum-tube amplifier, is a veritable electrical microscope whose power to magnify electrical effects is enormously greater than the visual magnifying power of the corresponding optical instrument."

LISTENERS APPRECIATIVE

Unseen Audience Commends Radio Broadcasting Artists.

The impression prevails that the radio audience is writing less letters than formerly in appreciation of the programmes rendered by broadcasting artists.

Figures made public by station WEAF, however, contradict the claim. A year ago the average number of letters received at WEAF was approximately 200 a day. This number gradually increased in the early months of the year, followed by a slight summer slump, which reached its maximum in June. These figures do not include the letters received by artists directly.

A gradual raise in the mail followed through the fall, some 300 letters a day being the average for October, nearly 500 in November and 800 in December. The increase was still greater during the first two weeks in January, nearly 25,000 letters being received from WEAF's audience commenting on the reception of WEAF's programmes.

Radio Opens New Political Era, Says Fan

"I tell you what," said the man on the street corner, "this new radio thing is going to raise hob with our political system and is going to create a lot of new ideas. It's the greatest exponent of the doctrine that all men are created free and equal that ever was.

"And put special emphasis on the free. Just imagine getting plays and concerts, not only without having to pay admission fees, but even without having to pay carfares.

"But what I meant to say is this. It makes you realize that you're really an interested citizen and partner in the affairs of the country.

"What would be said of a man, five years ago, if he came out and declared that the night before he had been sitting in his home, in his shirtsleeves, his shoes off and his slippers on, his feet elevated on whatever happened to be handy—and the President of the United States came in and talked to him! And if he dared to say he didn't even get up and invite the President to have a chair, and didn't jump into his coat and shove his feet under his chair, everyone would swear he was crazy.

"To-day radio has made even that possible and no one remarks about it. It actually happened to me the other night. The President talked right into my ear and I just sat back, comfortable like, and listened. The youngsters interrupted once or twice but he didn't seem to mind. He kept right on talking over the gravest affairs of state with me, just as if I had been a Cabinet officer.

"I got a better idea of the President than I ever had before and I've heard him speak, too. That is, when he was Vice President. And I even shook his hand. But there in my own home, with him talking just to me, it seemed, I'll be hanged if he didn't convince me about some things that I didn't believe in before.

"I hadn't paid much attention to the situation of the farmer, or stopped to figure out just what the bonus would do to the nation's financial affairs. I hadn't read many of the stories about these things that had been printed in the newspapers. I figured I didn't know anything about them anyway and I'd leave that to the other fellow.

"But gosh, when the President can come right into your own house and talk these things over with you, confidential like, you can't help getting interested. Makes you feel as if you were somebody and you knew something about it after all.

"At least, the President knows something about it. He has every resource of the United States behind him. And when he takes the trouble to explain it all to you, you feel as if you weren't exactly ignorant.

"If radio affects everyone as it does me there's going to be a decided change. The days when the President has had to buck up against Congress all alone are past. He is going to be able to get support if he's willing to come out and say what's what and why."

Batteries May Burn Out Tube.

Adding more A batteries to your dry cell tube will not give you any louder signals. On the other hand it is far more apt to burn out the tube. Every box containing a vacuum tube has a printed sheet giving exact data on connection and A and B battery voltages. It is best to follow these exactly.

Noises Eliminated When Using Receiving Set Without Ground

Possibility of Burning Detector Tube Lower, Thus Increasing Its Life, Among Advantages of This One-Circuit Hookup

By FRANK CHAPMAN.

During recent experiments to hit upon a single circuit set that was simple to operate and at the same time very selective, the writer used the hookup shown in the drawing. This consists of the well-known single circuits regenerative but instead of having a series condenser, two variable condensers of .0007 microfarad capacity are shunted around the coil. With a switch in one of them to cut it out for the shorter wave stations. If smaller condensers are used and a larger inductance, the signals will be louder, but these condensers were used because they were available and the data collected requires their use.

This outfit shows a detector with two stages of amplification. A potentiometer of 250 ohms was used, and only 25½ volts on the amplifier tubes in place of the usual 45 volts, as signal intensity was decreased with these tubes (201) when higher voltage was used. Separate B batteries were used for the detector and amplifier tubes as this was found best, a 7 to 1 ratio transformer for the first step and a 4 to 1 for the second step.

Jacks were used on the detector and each step, although not shown in the drawing. A fixed condenser of .001 microfarad capacity shunted across the primary of the first transformer and a grid leak. By varying the position of the movable arm on the potentiometer a big difference will be noticed on weak signals but practically none on strong ones.

As Baltimore is a notoriously poor receiving spot these tests were conducted there and gave the following results from 8:30 to 9:30 p. m., Washington, Philadelphia, Pittsburgh, New York, Schenectady, Detroit and Atlanta were picked up during that time and while Detroit and Atlanta faded the others came through clear and steady.

When not using a ground connection tuning was extremely sharp and the vernier had to be used. Another good point being the detector tube had to be burned lower than when a ground was used, which will greatly increase the life of the tube. When the ground connection was used there was little difference in signal strength on such stations as WGY and KDKA which leads me to believe this outfit will work long distances and get rid of most all interference and only have the one dial (variable condenser) to trun to do it.

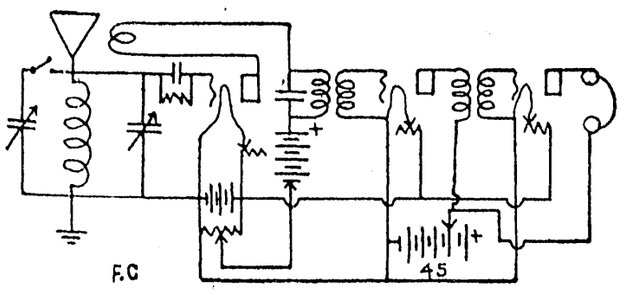
When a ground was used in the regular way, local stations could not be tuned out at all, which were operating on 360 metres and it was impossible to tune in either KDKA or WGY, which operate below and above 360 metres.

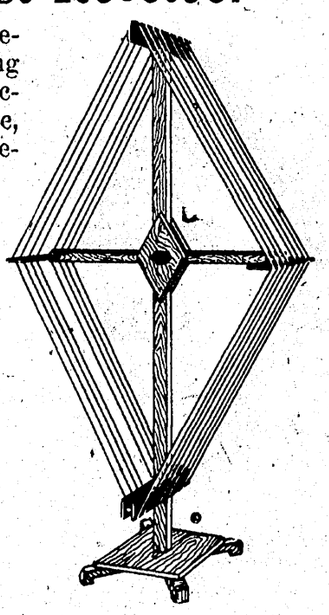
Using one condenser, KDKA on 326 metres was heard on 28 degrees of the condenser; local stations on 360 on 42 degrees, WGY on 380 on 40 degrees; WSB on 429 with 67 degrees; WCAP on 469 with 82 degrees; WEAF on 492 with 95 degrees; WOO on 509 with one condenser all the way in and 30 on the other, and WWJ on 517 with full capacity of one and 33 degrees on the other.

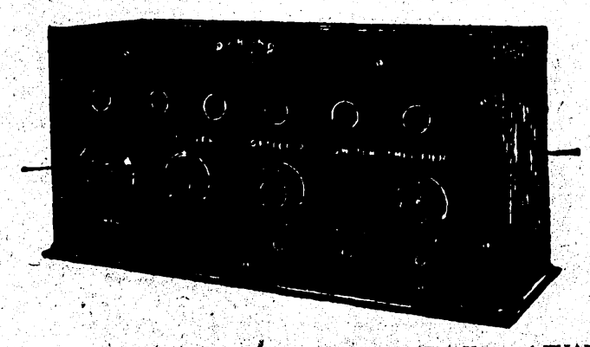
With the ground connection on, and using one condenser WSB was picked up on 24 degrees; WCAP on 40; WEAF on 55; WOO on 63 and WWJ on 68. The stations on 360 metres and under could not be heard, except local stations, but this could be easily remedied by putting a fixed condenser of .0005 capacity in series with the aerial to reduce the natural period.

When the ground is not used it will be found that a great deal of static and other noises are eliminated, and tube noises, due to detector burning low, are considerably reduced.

The primary coil has 30 turns and the tickler coil 40, but different sized coils can be used for other wave lengths.







Expert Tells How to Assemble Inverse Duplex

Continued from Page One.

several commercial types of loud speakers, having transformers in the base of the unit. These transformers naturally have stray magnetic fields just as those in the set. Under these conditions, if the horn is brought too near the set, an audio howl will be set up which will completely ruin your programme.

The shielding in the cabinet prevents this audio interaction between the transformer in the loud speaker and the transformers in the set as effectively as it prevents the radio interaction between the tuned radio transformer and the loop. The loud speaker may then be mounted anywhere with respect to the set with no ill effects. This is an advantage in favor of shielding the cabinet. If merely the tuned transformer were shielded the audio circuit would still suffer from interaction from some types of loud speakers.

In Figure 7 a simple method of mounting a small panel for binding posts is shown. Use any standard socket designed for both base and panel mounting. Screw the socket to the bottom panel and employ the panel mounting holes in attaching a strip of insulating material on which the binding posts and jack have been mounted. Drill the back wall of the cabinet so that the binding posts project through the holes.

Figure 8 graphically illustrates the course of the current through the tubes when the circuit shown in Figure 5 is employed.

In closing this article then, let us see just what this set is performing. A tuned radio stage is determined by a tuned input to the first radio amplifying tube. Thus the loop itself constitutes a tuned input to the first radio amplifying tube. This is the first stage of tuned radio amplification. The secondary of the tuned radio transformer constitutes the second tuned input circuit for the second radio amplifying tube. This, then, is the second tuned radio stage. The input to the detector tube is not tuned, and, in any case, the detector tube is not a radio amplifying stage.

This in the Mercury set is not a tuned radio stage nor does it constitute such in any set, even though it possesses a tuning control. We have, then, two stages of tuned radio frequency amplification, an untuned detector circuit, and three audio stages of amplification—all on four tubes operating efficiently on a loop and in compact space.

The next and last article will show how to operate this same circuit on aerial and ground connections.

(To be continued.)

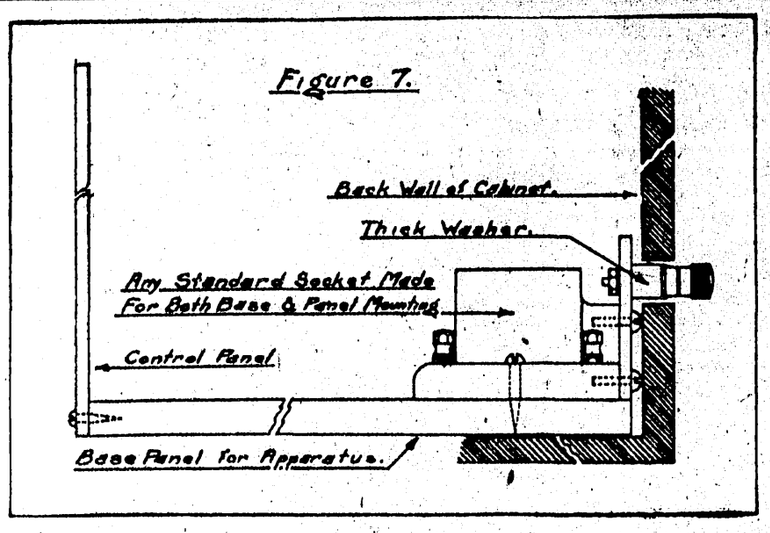


Figure 7.

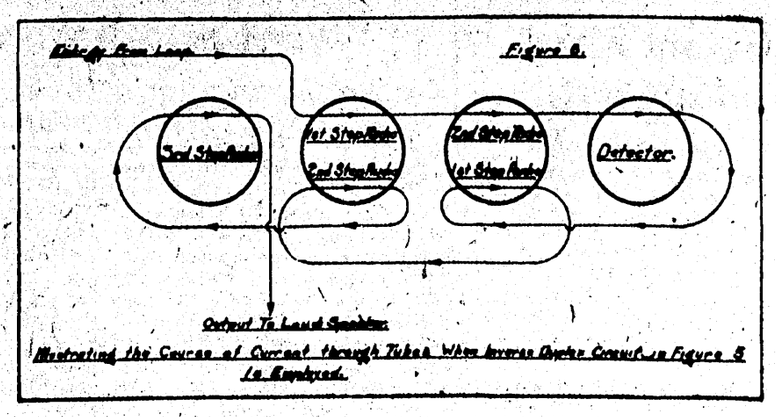


Figure 8.
Illustrating the Course of Current through Tubes When Inverse Duplex Circuit as Figure 5 is Employed.

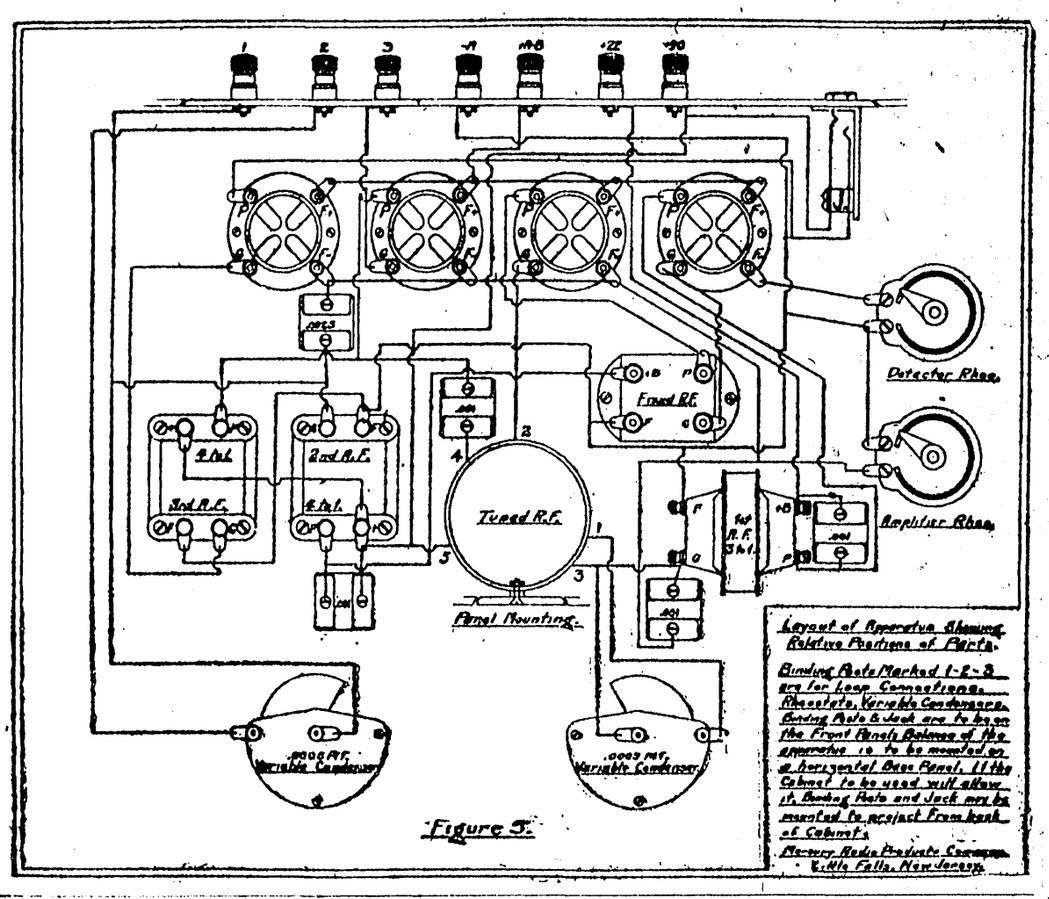


Figure 5.
Layout of Apperatus Showing Relative Positions of Parts.
Binding Posts Marked 1-2-3 are for Loop Connections. Rheostats, Variable Condensers, Binding Posts & Jack are to be on the Front Panel. Balance of the apperatus is to be mounted on a horizontal Base Panel. If the Cabinet to be used will allow it, Binding Posts and Jack may be mounted to respect from back of Cabinet's
Mercury Radio Products Company
Falls, New Jersey.

DIRECTION-FINDING STATIONS

Canada Now Has Seven Which Help Navigators by Radio.

Canada has seven direction-finding stations in operation, the latest being opened at Yarmouth, N. S., by the radio branch of the Department of Marine and Fisheries. The code signal of the new station will be VAU. The station at Yarmouth is the third direction-finding station placed in commission within the last year. The stations are located at Cape Race, N. S.; St. Paul's Island; Canso, N. S.; Halifax Harbor; Yarmouth, N. S.; St. John, N. B., and Pachona Point, B. C.

In addition, three automatic radio beacon stations have also been established during the year at Cape Ray, N. F., and on the Heath Point and Lurcher Lightships.

Canada built its first direction-finding stations in 1918, and the accuracy and reliability with which they function is testified by the thousands of letters received from the navigators.

WAVES MADE DIRECTIONAL

Successful Tests of Marconi's New Device Reported.

The problem which all experts, amateur and professional alike, have been trying to solve in the field of wireless communication is the perfection of some method by which waves could be made directional—that is, sent in one direction only instead of, as now, spreading out after the manner of waves in the water, says the New York World.

In order to assure privacy to a wireless message to-day the signals must be sent in code, as anyone within the radius of the sending station can pick up the message regardless of direction.

Signor Guglielmo Marconi, the original inventor of wireless communication, recently has announced that, working in collaboration with C. S. Franklin, the British wireless expert, he has perfected a device which gives a true directional effect.

His method is apparently the propagation of a beam, much as light is controlled by a reflector.

The Marconi apparatus has been successful in tests made between England and St. Vincent, one of the Cape Verde Islands, a distance of 2250 nautical miles —about 2500 standard miles.

TUBE DOES WORK OF THREE OTHERS

Device Developed in England Has Four Electrodes.

Gives Radio and Audio Amplification Simultaneously with Detection. — Most Sensitive on Weak Signals, Says Engineer.—Experiments Carried on Here.

A new type of British vacuum tube which functions simultaneously as a detector and amplifier of radio and audio-frequency currents was described in a paper read before the Institute of Radio Engineers in the Engineer Societies building by Capt. H. de A. Donisthorpe recently. The tube is a modification of the four-electrode type that has been developed in Great Britain and is now in use in commercial receiving sets upon British merchant vessels.

As an idea of the possibilities of this tube, Capt. Donisthorpe stated in his paper that "this instrument on a medium sized vessel will receive signals regularly from the Leafield radio station of the United Kingdom while in Australian waters."

One of the peculiar characteristics of the tube and its circuit, as described by Capt. Donisthorpe, is the fact that it is most sensitive on very weak signals, while on strong signals it is not as good as the ordinary type of detector and amplifier in separate tubes.

An interesting feature of the meeting was the statement in the paper that the General Electric Company was experimenting with this type of tube in this country.

In the discussion that followed the reading of the paper Mr. Hull of the General Electric Company outlined some of the experiments that were being carried on with the four-element tubes at the laboratories in Schenectady. He stated that the tube was still in a purely experimental stage and was different from the type demonstrated by Capt. Donisthorpe in that the second grid is a complete enough screen to eliminate all action between the plate and the first grid.

In this discussion it was also brought out that the tube, as it stands at present, has only been applied to commercial work and the inference to be drawn from the discussion was that it would have to be redesigned in order to make it adaptable to broadcast reception, the apparent trouble at the present time lying in the fact that the tube was apt to jam or block up on strong signals.

In his paper Capt. Donisthorpe outlined the history of the development of the four-electrode tube and said: "The origin of the quadrode can, I think be safely attributed to the genius of Majorana, who took out a patent in the United Kingdom for his tube in the year 1912."

He described the development of this type of tube and said that development and taken three forms: First, tubes which had two grids in addition to the usual filament and plate; second, tubes with two plates, in addition to the usual filament and grid; and third, tubes with three plates, in addition to the usual filament.

The tube described by Capt. Donisthorpe was one in which two grids were used and is known as the Marconi quadrode F. E. I. type. The tube is about 3¾ inches long and ⅞ of an inch in diameter. The filament is joined to two metal tips—one at either end of the tube. The two grids and the plate are connected to other metal tips, which come out at different points in the side of the tube in such a way as to reduce the amount of internal capacity. The characteristics of the tube were given as follows: Voltage across the filament, 4.5; filament current, 1.2 amperes; maximum second grid current, .75 milliamperes; plate voltage, 45.

The two grids are different in structure—the first is of a spiral nature, while the second one is made of open mesh frame. When used as a detector the second grid takes the place of the usual plate circuit and gives about the same rectification as the ordinary three-element tube.

The actual circuit used, whereby one stage of radio-frequency, detection and one stage of audio-frequency are all obtained from the same tube, is reproduced herewith.

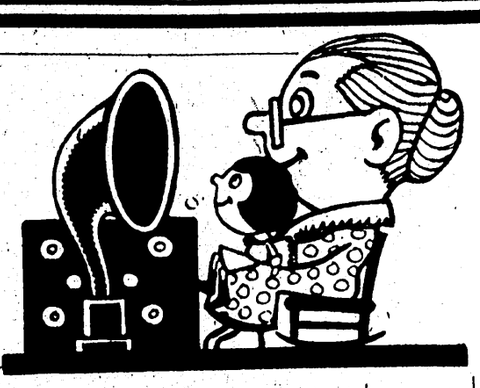
The radio-frequency transformer is connected to the second grid in much the same way as in the ordinary tube, which is connected to the plate. A step-down telephone transformer is used in the British circuit, the primary of which is in series with the primary of the radio-transformer and the high voltage B battery. A by-pass condenser across the telephone transformer offers a pathway for the radio-frequency. The secondary of the radio-frequency transformer is connected between the actual plate in series with the primary of the audio-transformer, while the secondary of the audio-transformer is connected to the first grid. The usual loose coupled aerial system is employed for tuning this circuit.

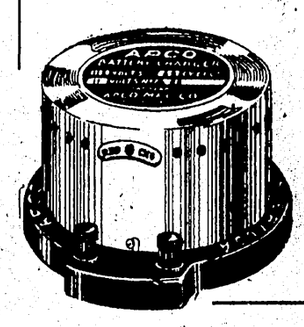
In order to prevent the tube from blocking up a potentiometer is used across the A battery to enable an adjustment of the potential on the plate. A feature of the audio-transformer is the fact that it only has a 1 to 1 ratio.

The actual receiver in commercial use on ships is designed to cover the wavelength range from 200 to 2800 metres on spark signals and up to about 12,000 metres for continuous wave telegraphy. Capt. Donisthorpe stated that above this wave length the radio-frequency amplification falls away slowly to about 2 to 1 at about 20,000 metres. In order to cover this wide band of wave lengths the radio-frequency transformer is built in three separate sections, the primary and secondary of which contain the same number of turns in each case. A barrel switch changes the wave-length range from short to medium or long-wave positions.

Won Freedom Through Radio.

Radio won freedom for Max Sasanoff, Russian tenor and painter, whose five-year sentence to Atlanta Federal Penitentiary ended with a pardon recently.





RADIO PROGRAMMES

A Washington Birthday address by President Coolidge directly from the White House on Friday night, relayed to WJAR, is among the special features that are included in the week's broadcasting programmes at the local stations. This afternoon WSAD gives a concert with soloists and chorus of the Trinity Methodist Episcopal Church. Leading features at WEAN include the Elks banquet in Boston tomorrow night, broadcasting of excerpts by stars of the Winter Garden Broadcasting night and an Army Night programme on Friday, all three being relayed from WNAC, Boston. Tuesday night WJAR will broadcast a concert by the Sacred Heart College band. A slight rearrangement in evening broadcasting periods at the Providence stations will be noted this week. The hours given below are Eastern standard time.

WEAN, THE SHEPARD STORES

273 METRES.

TO-DAY.

10:45 a. m.—Morning worship to be broadcast direct from the Mathewson Street M. E. Church, Providence: Organ prelude, "The Holy City," Adams, arr. by Myles B. Foster; hymn, "O Worship the King;" Psalm; hymn; Apostles' Creed; prayer; quartet, "Holy Art Thou" (Largo from Xerxes), Handel; Psalter, Seventh Sunday Morning; "Gloria Patri," Gregorian; scripture lesson; offertory anthem, "Praise Ye the Father," Gounod; Doxology; address, "Nothing But the Truth," R. D. Hellinston; hymn, "How Firm a Foundation," Portuguese hymn; benediction Deo en Amen; organ postlude, "Festival March," Foote.

6:45 p. m.—Evening services to be relayed from station WNAC, Boston. Entertainment of Tremont Temple Baptist Church, Boston. Organ recital, "Grand Chorus in D," Spence; "Pastorale," Chadwick; "Intermezzo," Dunham; Eustace B. Rice, organist and director. Processional hymn, hymn, "O Worship the King;" scripture, soprano solo, "Jesus," Ackley, Mrs. Helen Wingate Lamson; prayer; offering, anthem, "O for a Closer Walk with God," Foster, Mrs. Lamson and chorus hymn, "On the Cross of Christ I Gaze," Conley; quartet, "What Shall I Do to be Saved?", arranged by Lotus Male Quartet; sermon, "The Old Testament and the Modern Critics," Dr. Moore.

MONDAY.

7:30 p. m.—Programme to be relayed from Station WNAC, Boston. Elks' banquet.

TUESDAY.

12:00 to 1:00 p. m.—Classical selections by orchestra.
12:10 p. m.—Report of Weather Bureau.
1:00 to 5:00 p. m.—Dance music.
1:10 p. m.—Weather forecast.
5:00 p. m.—Programme to be relayed from Station WNAC, Boston. Band concert.
12:00 midnight—Stars from the "New York Winter Garden" Revue.

WEDNESDAY.

12:00 to 1:00 p. m.—Classical selections by orchestra.
12:10 p. m.—Report of Weather Bureau.
1:00 to 5:00 p. m.—Dance music.
1:10 p. m.—Weather forecast.
6:00 to 7:00 p. m.—Dance music.
6:10 p. m.—Bedtime stories.
6:30 p. m.—Weather forecast.
6:40 p. m.—Providence police reports.

THURSDAY.

12:00 to 1:00 p. m.—Classical selections by orchestra.
12:10 p. m.—Report of Weather Bureau.
1:00 to 5:00 p. m.—Dance music.
1:10 p. m.—Weather forecast.
7:00 to 8:00 p. m.—Dance music.
7:20 p. m.—Weather forecast.
7:25 p. m.—Providence police reports; reading. Hawaiian String Quartet.

FRIDAY.

12:00 to 1:00 p. m.—Classical selections by orchestra.
12:10 p. m.—Report of Weather Bureau.
1:00 to 5:00 p. m.—Dance music.
1:10 p. m.—Weather forecast.
8:00 p. m.—Programme to be relayed from Station WNAC, Boston. Army Night.

SATURDAY.

12:00 to 1:00 p. m.—Classical selections by orchestra.
12:10 p. m.—Report of Weather Bureau.
1:00 to 5:00 p. m.—Dance music.
1:10 p. m.—Weather forecast.
8:00 p. m.—Concert.
9:15 p. m.—Programme to be relayed from Station WNAC, Boston. Dance music.

WJAR, THE OUTLET COMPANY

(360 METRES.)

TO-DAY.

7:30-9:00 p. m.—Special musical programme direct from the Capitol Theatre, New York city, by courtesy of the Capitol Theatre management and Mr. S. L. Rothafel (Roxy). The first part of the programme will be taken direct from the stage of the Capitol Theatre and will consist of music by the Capitol Grand Orchestra and selections by the Capitol Theatre featured artists. The second part of the entertainment will consist of a special presentation by Mr. Rothafel of Capitol Theatre vocal and instrumental artists, direct from the broadcasting studio in the theatre.

9:00-10:00 p. m.—Organ recital direct from the studios of the Skinner Organ Company, New York city.

MONDAY.

7:00 a. m.—Housewives' Radio Exchange. Fashion talk.
7:30 p. m.—Farm Bureau talk; miscellaneous programme.
8:30 p. m.—Address.
8:30 p. m.—Address. Dramatic and comedy monologues.

TUESDAY.

1:05 p. m.—Orchestra music.
1:45 p. m.—Miscellaneous programme.
7:30 p. m.—Sacred Heart College Band.
9:00 p. m.—Orchestra music.

WEDNESDAY.

7:00 a. m.—Housewives' Radio Exchange. Fashion talk.
1:40 p. m.—Miscellaneous programme.
7:40 p. m.—"Musk Talk-a-log."
10:45 p. m.—Orchestra music.

THURSDAY.

1:05 p. m.—Orchestra music.
Silent night.

FRIDAY.

7:00 a. m.—Housewives' Radio Exchange. Fashion talk.
1:05 p. m.—Special George Washington programme.
Programme broadcast direct from New York studio.
7:30 p. m.—Vocal solos.
8:30 p. m.—Piano solos.
8:50 p. m.—Orchestra music.
10:00 p. m.—Washington's Birthday address by President Coolidge, direct from the White House.

SATURDAY.

1:05 p. m.—Orchestra music.
7:05 p. m.—Orchestra music.

WSAD, FOSTER'S.

(261 METRES).

TO-DAY.

2:00 p. m.—Concert by the soloists and chorus of the Trinity Methodist Episcopal Church of Providence, directed by W. L. Watson, under the auspices of the Rhode Island Sunday School Association. Sara Mathewson Henley, soprano; Mrs. Gertrude Northup Lee, contralto; J. Herbert Taylor, bass; Bertha Louise Bixby, violin; Gladys M. Bixby, violincello; Roy D. Bailey, accompanist, and Mildred Hanke accompanist for the trio. Programme: By the chorus, "Deus Miseratur," Barker; "Shadows of the Night," Matthews; bass solo by Mr. Taylor, "Out of the Deep," Marks; instrumental trios, "Evening Hour," Hilton; "Souvenir de Venise," Quinn; by the chorus, "By Babylon's Wave," Gounod; "Saviour Thy Children Keep," Sullivan; contralto solo, Mrs. Lee, "O Rest in the Lord," Mendelssohn. By the trio, "Remembrance," Deppen; "Spanish Danse," Enos; by the chorus, "Gallia," Gounod, and solos by Miss Henley to be announced.

MONDAY.

2:30-4:00 p. m.—Truth Week Talk. Concert. Evening silent.

TUESDAY.

2:30-4:00 p. m.—Truth Week Talk. Concert.
6:00 p. m.—Musical programme.
6:15 p. m.—"Foster's Story Lady."
6:30 p. m.—Musical programme continued.

WEDNESDAY.

2:30-4:00 p. m.—Truth Week Talk. Concert.
8:15 p. m.—Musical evening.

THURSDAY.

2:30-4:00 p. m.—Concert.
6:00-7:00 p. m.—Concert.
6:15 p. m.—"Foster's Story Lady."
6:30 p. m.—Concert continued.

FRIDAY.

2:30-4:00 p. m.—Concert.
6:00 p. m.—Musical programme.
6:15 p. m.—"Foster's Story Lady."
6:30 p. m.—Musical programme continued.

SATURDAY.

2:30-4:00 p. m.—Concert.
6:00 p. m.—Musical programme.

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 programmes being given under the regular listing of announcements.

LOCAL STATIONS

10:45—Church services, WEAN.
2:00—Concert, WSAD.
4:30—Concert, WRAH.
6:45—Church services, WEAN.
7:20—Concert, WJAR.
9:00—Organ recital, WJAR.

OUT-OF-TOWN STATIONS

10:30—Church services, WSAR.
10:45—Church services, WBZ.
11:00—Church services, WJZ. Church services, KDKA.
11:30—Church services, WLAG.
12:00—Church services, KYW.
2:00—Concert, WGR.
2:30—Bible class, WJY.
2:45—Concert, KDKA.
3:00—Vesper services, WGR. Christian Endeavor, WHN.
4:00—Talk, musical, WGI. Organ recital, WGR. Organ recital, KDKA.
4:30—Musical recital, WJY. Concert, WSAR. Talk, WHN.
4:40—Music, WHN.
4:45—Vesper services, WLAG. Vesper services, KDKA.
5:10—Vocal solos, WHN.
5:20—Orchestra numbers, WHN.
6:30—Concert, KDKA.
6:45—Vesper services WBZ.
7:00—Stories, WJZ.
7:30—Recital, WJZ. Church services, KDKA.
8:00—Talk, WJZ. Religious services, KYW.
8:30—Talk, musical, WGI. Church services, WBZ.
8:45—Concert, WJY. Church services, WLAG.
9:45—Concert, WHN.
10:00—Concert, WJZ.
10:30—Concert, WLAG. Concert WJY.

Calls and Stations

WJAR, The Outlet Company, 360 Metres.
WEAN, The Shepard Stores, Providence, 273 Metres.
WSAD, Fosters, 261 Metres.
WSAR, Fall River, 254 Metres.
WRAH, B. & H. Supply Co., 231 Metres.
KDKA, East Pittsburgh, Pa., 326 Metres.
WBZ, Springfield, Mass, 337 Metres.
WJY, New York City, 405 Metres.
WJZ, New York City, 455 Metres.
WHN, New York City, 360 Metres.
KYW, Chicago, Ill., 536 Metres.
WGI, Medford Hillside, Mass., 360 Metres.
WRC, Washington D. C., 469 Metres.
WOR, Newark, N. J., 405 Metres.
WGR, Buffalo, N. Y., 319 Metres.
WLAG, Minneapolis-St. Paul, Minn., 417 Metres.

EVENING BROADCASTING HOURS AT SOME DISTANT STATIONS GIVEN IN EASTERN STANDARD TIME

	SUNDAY.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
Chicago Ill. (KYW—530 Metres)	7:30- 9:00	Silent	9:00-10:30	9:00- 1:30	9:00-10:30	11:00- 1:30	9:00-10:30
Dallas, Tex. (WFAA—476 Met.)	7:00-12:00	9:30-10:30	9:30- 1:00	Silent	9:30-10.30	9:30-10:30	9:30- 1:00
Denver, Col. (KFAF—360 Met.)	Silent	10:00-11:00	10:00-11:00	Silent	9:30-10:00	10.00-11:00	10:00-11:00
Ft. Worth, T. (WBAP—476 M.)	6:00- 7:00	8:30-11:45	8:30-11:45	8:30-11:45	8:30-11:45	8:30-11:45	8:00- 8:30
Havana, C. (PWX—400 Metros)	Silent	Silent	Silent	8:30-11:00	Silent	Silent	8:30-11:00
Ks. City, Mo. (WDAF—411 M.)	Silent	9:00- 2:00	12:45- 2:00	9:00- 2:00	12:45- 2:00	9:00- 2:00	12:45- 2:00
Los Angeles, Cal (KFI—460 M.)	9:45-2:00	1:00- 2:00	9:45- 2:00	9:45- 3:00	9:45- 2:00	9:45- 3:00	9:45- 3:00
Los Angeles, C (KHJ—395 M.)	11:00- 1:00	9:45- 3:00	9:45- 3:00	9:45- 3:00	9:45- 3:00	8:45- 3:00	11:00- 1:00
Mex. City, Mex. (CYL—425 M.)	Silent	Silent	10:30-12:00	Silent	Silent	10:30-12:00	Silent
Montreal, Que. (CHAC—480-M.)	4:30- 5:30	Silent	7:00-11:30	Silent	7:00-11:30	Silent	7:00-11:30
Portland, Or. (KGW—492 M.)	9:00-11:00	10:30- 1:30	10:30- 2:00	10:30- 2:00	10:30- 2:00	10:30- 3:00	10:30- 2:00
St. Louis, Mo. (KSD—546 M.)	10:00-11:00	9:30- 2:00	9:00- 2:00	9:00- 2:00	9:00-11:30	Silent	8:15-10:00
San Antonio (WOAI—395 M.)	10:30-11:30	Silent	10:30-11:30	Silent	8:30- 9:30	Silent	Silent
San Francisco (KPO—428 M.)	11:30- 1:00	11:00- 2:00	11:00- 2:00	11:00- 1:00	11:00- 2:00	Silent	11:00- 3:00
San Juan, P R. (WKAQ—360 M.)	Silent	Silent	8:00- 9:30	Silent	Silent	8:00- 9:30	Silent
Seattle, Wash (KDZE—455 M.)	Silent	11:30- 1:30	Silent	11:30- 1:30	Silent	11:30- 1:30	Silent

6:15 p. m.—"Foster's Story Lady."
6:30 p. m.—Musical programme continued.

WRAH, THE B. & H. SUPPLY CO.

231 METRES.

TO-DAY.

4:30 p. m.—Concert. First Movement of trio in D-Minor, Mendelssohn—Violin by Miss Helen Keenan, 'cello by Miss Louise Waterman, piano by Miss Lydia Bell; ukelele solos by Buddy Johnson—"Love Sends a Little Gift of Roses," "Roses of Picardy," "Farewell to Thee;" 'cello solos by Miss Louise Waterman—"The Rosary," by Levein, "Spanish Serenade," by Glazounou; harp solos by William T. Cameron—"Legende," by Zabel, "Dance of the Gnomes," by Rogers; piano solos by Miss Lydia Bell—"Prelude," by Chopin, "Caprice," by Chamenade; ukelele solo by Buddy Johnson—Medley of popular airs; violin solos by Miss Helen Keenan—"Adagio," by Godard, "Gapak," by Mousoysky; harp solo, by William T. Cameron—"Mazurka," by Schielcker; string trio, "Romance Sans Parole," by Van Goen, "Valse Blue," by Narges; contralto solos, by Miss Clark.

WSAR, FALL RIVER.

(254 METRES.)

TO-DAY.

10:30 a. m.—Morning services from the First Baptist Church: Organ prelude, by Prof. J. D. D. Comey, organist; prelude, "Pastorale," First Symphony, Guilmant; "Antantino," Fourth Symphony, Widor; anthem, "Te Deum in A," Arthur Whiting; anthem, "Benedictus," Gounod; offertory, "Meditation," Sturgis; postlude, "March Pontificate," Lemmeus; "Fugue in E-minor," Bach; sermon, "The New Song," by Dr. E. C. Herrick.

4:30 p. m.—Afternoon concert: Selected songs, John Mackay Trio, violin, piano, cello; selected solos, Mrs. Theresa Murphy, soprano; organ recital, Edward Storey, organist, direct from Rialto Theatre, Fall River, Mass.

WHN, NEW YORK CITY.

(360 METRES.)

TO-DAY.

3:00-4:30 p. m.—Christian Endeavor programme, represented by the First Congregational Church of Rockaway, L. I., Rev. John C. Green, pastor. Choir selection, "Tary With Me, Oh My Saviour;" soprano solo by Mrs. James Davidson; anthem by choir, "Jesus Gentlest Saviour;" tenor solo by Clinton Hanford, "Come Unto Me;" soprano solo by Miss Janet Sinn, "The Lord is My Light;" anthem by choir, "My Faith Looks Up to Thee;" bass solo by Mr. L. McNeil, "The New Commandment."

4:30-4:40 p. m.—John D. Flynn of the National Security League in talk.

4:40-5:10 p. m.—"WHN Radio Five" playing dance selections.

5:10-5:20 p. m.—Mme. Alberta, contralto.

5:20-6:00 p. m.—"Tempo Club Orchestra," William H. Dover, Jr.

9:45-12:00 p. m.—Programme by Prof. Oddene Sommovigo: Anna Amslowsky, soprano, "Suicidio," from "La Gioconda;" May Gertwin, soprano, "La Boheme!" Rhoda Fenwick, soprano, "In Quella Trima Morbide" from "La Manon," Mally Patrona, soprano, "A Torse Lui," from "La Traviata;" Sam Amslowsky, tenor, "Una Furtina Lacrima," from "Elisir d'Amore; Demetriades Tetos, tenor, "Slumber Song;" F. Trigg, tenor, "Arioso," from "Pagliacca;" George Maraveas, baritone, "Visione Veneziana," Frank Amairle, violinist, "Prelude," Bach-Kreisler; Louis Mezzacapo, baritone, "Largo Al Factatum," from "Barbiere de Siviglia;" Olinto Lombardi, bass, "Il Lacerato Spirito," from "Simon Baceanegro;" Anna Amslowsky and Sam Amslowsky, duet, "La Traviata;" Molly Patrona and Sam Amslowsky, duet, "Cavallaria Rusticanna;" Sam Amslowsky and Louis Maxxacape, duet from the "Torre of Destiny;" Maestro Oddone Sommovigo at the piano.

MONDAY.

2:15 p. m.—Vocal solo.
2:20 p. m.—Vocal solo.
2:25 p. m.—Vocal solo.
2:30 p. m.—Vocal solo.
2:35 p. m.—Vocal solo.
2:40 p. m.—Piano solo.
2:45 p. m.—Vocal solos.
3:00 p. m.—Vocal solos.
3:45 p. m.—Vocal solos.
4:05 p. m.—Vocal solo.
4:15 p. m.—Popular songs.
4:30 p. m.—Vocal solo.
4:45 p. m.—Vocal solo.
5:00 p. m.—Piano solo.
5:10 p. m.—Vocal solo.
5:15 p. m.—Vocal duets.
7:30 p. m.—Dance orchestra.
8:00 p. m.—Jazz syncopators and entertainers.
8:30 p. m.—Saxophone and vocal solos.
8:40 p. m.—Vocal solos.
8:50 p. m.—Ballads and blue numbers.
9:00 p. m.—Piano solos.
9:10 p. m.—Vocal solos.
9:20 p. m.—"Novelty Five."
9:50 p. m.—Piano selections.
10:00 p. m.—Dance orchestra.
11:00 p. m.—Talk.
11:15 p. m.—Vocal solos.

TUESDAY.

2:15 p. m.—Vocal solos.
2:30 p. m.—Orchestra music.
3:45 p. m.—Music.
4:30 p. m.—Vocal solos.
9:30 p. m.—"The Famous Holy Rosary Minstrels."
10:25 p. m.—Vocal solos.
11:00 p. m.—Orchestra music.
11:20 p. m.—Soprano solos.
11:30 p. m.—Saxophone trio.
11:40 p. m.—Orchestra music.

WGI, MEDFORD HILLSIDE, MASS

(360 METRES)

TO-DAY

4:00 p. m.—Twilight programme. "Adventure Hour," conducted by the Youth's Companion, Musicale.

8:30 p. m.—Evening programme. Talk on "World Unity," under the auspices of the Greater Boston Federation of Churches. Evening's musicale.

MONDAY.

12:00 noon—Music. Amrad Round Table. Music.
12:40 p. m.—Weather forecast.
12:45 p. m.—Farmers' produce market report.
5:30 p. m.—Stock market reports. Agriograms. Live stock market reports. Wool market news.
6:00 p. m.—"Just Boy."
6:15 p. m.—Code practice.
6:45 p. m.—Boston police reports. AMRAD silent night.

TUESDAY.

12:00 noon—Music. Amrad Round Table. Music.
12:40 p. m.—Weather forecast.
12:45 p. m.—Farmers' produce market report.
3:00 p. m.—Amrad Women's Club programme.
3:45 p. m.—"Tuesday Tea Talk."
5:30 p. m.—Stock market reports. Review of iron and steel industry.
6:15 p. m.—Boston police reports.
6:30 p. m.—Meeting of Big Brother Amrad Club.
7:00 p. m.—Address. Business report. Concert.

WEDNESDAY.

12:00 noon—Music. Amrad Round Table. Music.
12:40 p. m.—Weather forecast.
12:45 p. m.—Farmers' produce market report.
5:30 p. m.—Stock market reports. Live stock markets reports. World market survey.
6:00 p. m.—Boston police reports.
6:15 p. m.—Code practice.
6:30 p. m.—Meeting of Big Brother Amrad Club.
6:50 p. m.—Message to Camp Fire Girls.
7:20 p. m.—"Science Up to Date."
7:30 p. m.—Musicale.

THURSDAY.

12:00 noon—Music. Amrad Round Table. Music.
12:40 p. m.—Weather forecast.
12:45 p. m.—Farmers' produce market report.
5:30 p. m.—Stock market reports. Live stock markets reports. Agriograms.
6:15 p. m.—Boston police reports.
6:30 p. m.—Meeting of Big Brother Amrad Club.
7:00 p. m.—Miscellaneous programme.

FRIDAY.

12:00 noon—Music. Amrad Round Table. Music.
12:40 p. m.—Weather forecast.
12:45 p. m.—Farmers' produce market report.
5:30 p. m.—Stock market reports. Live stock market report.
6:15 p. m.—Code practice.
6:30 p. m.—Meeting of Big Brother Amrad Club.
7:00 p. m.—Boston police reports.
7:30 p. m.—Selected verses. Red Cross. Musicale.

SATURDAY.

6:30 p. m.—Meeting of Big Brother Amrad Club.
6:40 p. m.—Code practice.
7:05 p. m.—Weather forecast. New England crop notes.
7:30 p. m.—Talk. Dancing session. Musicale.

WJZ, NEW YORK CITY

(405 METRES)

TO-DAY.

11:00 a. m.—Church service direct from the West End Presbyterian Church.
7:00 p. m.—"Bubble Book Stories" by Ralph Mayhew.
7:30 p. m.—Recital by Wanda Norman, pianist.
8:00 p. m.—"The Annalist's Talk for Business Men."
8:15 p. m.—Sunday evening concert by the Hotel Commodore Orchestra, under the personal direction of Bernhard Levitow, direct from the Hotel Commodore.
10:00 p. m.—Joint recital by Aalang Lie Elde, soprano, and Halfrid Nelson, pianist.

MONDAY.

2:00 p. m.—New York Board of Education Programme.
3:00 p. m.—Recital.

Continued on Page Six.

RADIO PROGRAMMES

Continued From Page Five

3:45 p. m.—Talk.
3:55 p. m.—Fashions.
4:15 p. m.—Poems.
4:30 p. m.—Tea concert.
5:30 p. m.—Reports of farms and markets; farm and home reports; New York Stock Exchange; foreign exchange quotations.
6:00 p. m.—Public and social economy lecture.
7:00 p. m.—"The Story Book Lady."
8:15 p. m.—"Literary Minutes."
8:30 p. m.—Organ recital.
9:10 p. m.—Sport talk.

TUESDAY.

2:00 p. m.—New York Board of Education programme.
3:00 p. m.—Concert.
4:00 p. m.—Fashions.
4:15 p. m.—"Department of English."
4:45 p. m.—Soprano solos.
5:00 p. m.—Popular songs.
5:15 p. m.—Soprano solos.
5:30 p. m.—Reports of farms and markets; farm and home reports; closing quotations of the New York Stock Exchange; foreign exchange quotations.
7:10 p. m.—Supper music.
8:15 p. m.—Address.
8:45 p. m.—Talk.
9:15 p. m.—"Broadcasting Broadway."
9:30 p. m.—Concert.
9:55 p. m.—Time signals and weather forecast.
10:30 p. m.—Dance programme.

WEDNESDAY.

2:00 p. m.—New York Board of Education programme.
3:00 p. m.—Recital.
3:45 p. m.—Recital.
4:30 p. m.—Tea concert.
5:30 p. m.—Radio extension course lecture.
7:00 p. m.—Shadowland story.
7:35 p. m.—Dance programme.
7:45 p. m.—Current events.
8:00 p. m.—Dance programme.
8:30 p. m.—Talk.
8:45 p. m.—Concert.
9:10 p. m.—United States navy night.
10:30 p. m.—Popular old songs.

THURSDAY.

2:00 p. m.—New York Board of Education programme.
3:00 p. m.—Violin recital.
5:00 p. m.—Coloratura soprano.
5:30 p. m.—Reports of farms and markets; farm and home reports; closing quotations of the New York Stock Exchange; foreign exchange quotations.
7:00 p. m.—Jack Rabbit stories.
7:30 p. m.—Double voiced entertainer.
7:45 p. m.—Current events.
8:00 p. m.—"Social Economy."
8:30 p. m.—Organ recital.
9:15 p. m.—Rhea Silberta programme.
9:55 p. m.—Time signals and weather forecast.
10:00 p. m.—Poems.
10:30 p. m.—Dance programme.

FRIDAY.

12:15 p. m.—Noon hour of music.
3:00 p. m.—Organ recital.
4:00 p. m.—Recital.
5:00 p. m.—Address.
5:15 p. m.—Talk.
5:30 p. m.—Reports of farms and markets; farm and home reports; closing quotations of the New York Stock Exchange; foreign exchange quotations; "The Condition of the Leading Businesses."
7:10 p. m.—Bedtime stories.
7:30 p. m.—Songs for children.
7:45 p. m.—The Cheerful Philosopher.
7:50 p. m.—Saxophone solos.
8:05 p. m.—Current topics.
8:20 p. m.—Saxophone solos.
8:45 p. m.—Address.
9:00 p. m.—Wireless Age programme.
9:55 p. m.—Time signals and weather forecast.
10:00 p. m.—Recital.
10:15 p. m.—"Home Building."
10:30 p. m.—Dance programme.

SATURDAY.

3:00 p. m.—Double voiced entertainer.
3:15 p. m.—Popular programme.
3:30 p. m.—Double voiced entertainer.
4:00 p. m.—Tea concert.
5:00 p. m.—Orchestra music.
5:30 p. m.—Reports of farms and markets; farm and home reports; closing quotations of the New York Stock Exchange; foreign exchange quotations.
7:00 p. m.—Uncle Wiggily stories.
8:00 p. m.—"Literary Moments."
8:15 p. m.—Baritone solos.
8:30 p. m.—Address.
8:45 p. m.—Baritone solos.
9:15 p. m.—Concert.
9:45 p. m.—Concert.
9:55 p. m.—Time signals and weather forecast.
10:00 p. m.—Recital.
10:30 p. m.—Orchestra music.

WJY, NEW YORK CITY

(455 METRES)

TO-DAY.

2:30 p. m.—Radio Bible class; Bible lesson, address and musical programme.
4:30 p. m.—Recital by Louise Vocalli, soprano, accompanied by Charles Eddy.
8:45 p. m.—Sunday evening concert by the Waldorf-Astoria Symphonic Orchestra, Joseph Knecht, director; directly from the Waldorf-Astoria Hotel.
10:00 p. m.—Recital by Anton Civorn, basso.

TUESDAY.

7:30 p. m.—Soprano solos.
7:45 p. m.—Etiquette talk.
8:00 p. m.—Soprano solos.
8:15 p. m.—A radio travelogue.
8:30 p. m.—Vocal recital.
9:30 p. m.—Genesee Society dinner.

THURSDAY.

7:30 p. m.—Popular songs.
7:45 p. m.—"Golf."
8:00 p. m.—Baritone solos.
8:15 p. m.—Talk.
8:30 p. m.—Soprano solos.
9:30 p. m.—"Time."
9:45 p. m.—Popular songs.
10:00 p. m.—Joint recital.

FRIDAY.

7:30 p. m.—"Income Taxes."
8:00 p. m.—Address.
8:30 p. m.—Recital.
8:45 p. m.—"The Vegetable Garden"
9:15 p. m.—People's concert.
10:00 p. m.—Miscellaneous programme.
10:30 p. m.—Pennsylvania Duo.

KDKA, EAST PITTSBURGH, PA.

(326 METRES)

TO-DAY

11:00 a. m.—Services of the Point Breeze Presbyterian Church, Pittsburgh, Pa., Rev. Percival H. Barker, minister.
2:45 p. m.—Concert.
4:00 p. m.—Organ recital by Dr. Charles Heinroth, director of music, Carnegie Institute, Pittsburgh, direct from Carnegie Music Hall.
4:45 p. m.—Vesper services of the Shadyside Presbyterian Church, Pittsburgh, Pa., Rev. Hugh Thomson Kerr, minister.
6:30 p. m.—Dinner concert by the Pittsburgh Athletic Association Orchestra, Gregorio Sciazo, conductor.
7:30 p. m.—Services of the Calvary Episcopal Church Pittsburgh, Pa., Rev. S. J. Van Etten, minister.
At the conclusion of this service, Dr. John Ray Ewers will conduct the Radio Open Forum.

MONDAY

9:45 a. m.—Stock market reports.
11:55 a. m.—Time signals.
12:00 m.—Weather forecast; market reports.
6:15 p. m.—Dinner concert.
7:30 p. m.—Radio Girl Scout meeting.
7:45 p. m.—The children's period.
8:00 p. m.—Market reports.
8:15 p. m.—Feature.
8:30 p. m.—Concert.
9:55 p. m.—Time signals, weather forecast.

TUESDAY

9:45 a. m.—Stock market reports.
11:55 a. m.—Time signals.
12:00 m.—Weather forecast; market reports.
6:15 p. m.—Dinner concert.
7:45 p. m.—Address.
7:30 p. m.—Address.
7:45 p. m.—The children's period.
8:00 p. m.—Market reports.
8:15 p. m.—Address.
8:30 p. m.—Concert.
9:55 p. m.—Time signals; weather forecast.
11:30 p. m.—Concert.

WEDNESDAY

9:45 a. m.—Market reports.
11:55 a. m.—Time signals.
12:00 m.—Weather forecast; market reports.
6:15 p. m.—Dinner concert.
7:30 p. m.—Lecture.
7:45 p. m.—The children's period.
8:00 p. m.—Market reports.
8:15 p. m.—Address.
8:30 p. m.—Concert.
9:55 p. m.—Time signals; weather forecast.

THURSDAY

9:45 a. m.—Market reports.
11:55 a. m.—Time signals.
12:00 m.—Weather forecast. Market reports.
6:15 p. m.—Dinner concert.
7:15 p. m.—Farm programme.
7:45 p. m.—The children's period.
8:00 p. m.—Market reports.
8:15 p. m.—Farm programme continued.
8:30 p. m.—Concert.
9:55 p. m.—Time signals. Weather forecast.
11:30 p. m.—Concert.

FRIDAY

9:45 a. m.—Market reports.
11:55 a. m.—Time signals.
12:00 m.—Weather forecast. Market reports.
6:15 p. m.—Organ recital.
7:15 p. m.—Radio Boy Scout meeting.
7:45 p. m.—The children's period.
8:00 p. m.—Market reports.
8:15 p. m.—Lecture.
8:30 p. m.—Concert.
9:55 p. m.—Time signals. Weather forecast.

SATURDAY

9:45 a. m.—Market reports.
11:55 a. m.—Time signals.
12:00 m.—Weather forecast. Market reports.
6:15 p. m.—Dinner concert.
7:30 p. m.—Lecture.
7:45 p. m.—The children's period.
8:00 p. m.—Feature.
8:15 p. m.—Talk.
8:30 p. m.—Concert.
9:55 p. m.—Time signals. Weather forecast.

WBZ, SPRINGFIELD, MASS.

(337 METRES)

TO-DAY

10:45 a. m.—Church services direct from the Church of the Unity, Rev. Charles A. Wing, pastor. Music furnished by the Philharmonic Male Quartet and Miss Adele Graves, harpist; Raymond C. Hodge, first tenor; Howard L. Smith, second tenor; William H. Lippman, baritone; George B. Dowd, bass; Robert W. Field, organist and director.
6:45 p. m.—Sunday vespers on the Springfield municipal chimes, transmitted from the Campanile, Ernest Newton Bagg, chime ringer: "America," "Sun of My Soul," "Just Before the Battle, Mother," Root; "Come Ye Disconsolate," O. Susanna," Foster; "When the Storms of Life Are Raging," McGranahan; "To the Work, to the Work," Doane; "Douglas, Tender and True," "Jerusalem, My Glorious Home," Fr. Kemp; "Almost Persuaded," Taps.
8:30 p. m.—Church services conducted by Rev. Fred G. Norecombe, pastor of the Mittineague Congregational Church, assisted by Church Quartet.

MONDAY

11:55 a. m.—Time signals; weather reports; market reports.
6:00 p. m.—Dinner concert.
7:00 p. m.—This week in history.
7:00 p. m.—This week in history; humorous programme.
7:30 p. m.—Bedtime story for children; new books.
8:00 p. m.—Concert.
9:00 p. m.—Bedtime story for grown-ups.
9:55 p. m.—Time signals.

TUESDAY.

11:55 a. m.—Time signals; weather reports; market reports.
7:30 p. m.—Bedtime story for children lecture. World market survey.
8:00 p. m.—Concert.
9:00 p. m.—Bedtime story for Grown-ups.
9:55 p. m.—Time signals.

WEDNESDAY.

11:55 a. m.—Time signals; weather reports; market reports.
6:00 p. m.—Dinner concert.
7:30 p. m.—Bedtime story for children. Humorous programme.
8:00 p. m.—Chamber music.
9:00 p. m.—Bedtime story for Grown-ups.
9:55 p. m.—Time signals.

THURSDAY.

11:55 a. m.—Time signals; weather reports; market reports.
7:00 p. m.—Talk.
7:30 p. m.—Bedtime story for children. Farmers' period.
8:00 p. m.—Concert.
9:00 p. m.—Bedtime story for Grown-ups.
9:55 p. m.—Time signals.

FRIDAY.

11:55 a. m.—Time signals; weather reports; market reports.

RADIO FANS

Having Trouble Getting Distant Stations?

Lighted Functionless Tubes Repaired for $1.00

Burnt Out Tubes Expertly Repaired if You Insist on Having Your Pet Tube Repaired.

Why not get a new one for a wee bit more? Every tube guaranteed by the Radio Tube Corporation.

Prices Range from $1.50 to $3.50

DK SETS WIRED FOR $3.00

Hear your tube oscillate or talk before you leave. If it don't talk when you get it home, bring it back. That's my guarantee.

GEORGE N. BENOIT, Pres.

6:00 p. m.—Dinner concert.
7:00 p. m.—Dramatized story.
7:30 p. m.—Bedtime story for children. Current book review. Story for grown-ups.
9:55 p. m.—Time signals.
11:00 p. m.—Chamber music.

SATURDAY.

11:55 a. m.—Time signals; weather reports; market reports.
7:00 p. m.—Dinner concert.
7:30 p. m.—Bedtime story for children.
8:00 p. m.—Concert.
9:00 p. m.—Bedtime story for Grown-ups.
9:55 p. m.—Time signals.

KYW, CHICAGO, ILL.

536 METRES

TO-DAY

12:00 noon—Central Church service broadcast from Orchestra Hall, Chicago, Dr. F. F. Shannon, pastor. Musical programme under the direction of Daniel Protheros.
8:00 p. m.—Chicago Sunday Evening Club service broadcast from Orchestra Hall, Chicago. Special musical programme under the direction of Edgar Nelson. The speaker of the evening will be Hon. F. O. Lowden.

MONDAY

10:30 a. m.—Financial and commercial markets. (This service is broadcast every half-hour during the 24, except from 7 p. m. to 12 p. m., when all Chicago stations are silent.
12:35 p. m.—Table talk.
7:30 p. m.—Financial and final market and sport summary.
7:50 p. m.—Children's bedtime story.

TUESDAY

10:30 a. m.—Financial and commercial market. (This service is broadcast every half-hour during the 24).
11:30 a. m.—Farm and Home Service.
12:35 p. m.—Table talk.
3:35 p. m.—Studio programme.
7:30 p. m.—Financial and final market and sport summary.
7:50 p. m.—Children's bedtime story.
8:00 p. m.—Dinner concert.
9:20 p. m.—Programme furnished by the American Farm Bureau Federation.
9:45 p. m.—Musical programme.

WEDNESDAY

10:30 a. m.—Financial and commercial markets. (This service is broadcast every half hour during the 24.)
12:35 p. m.—Table talk.
7:30 p. m.—Financial and final markets.
7:50 p. m.—Children's bedtime story.
8:00 p. m.—Dinner concert.
9:00 p. m.—Musical programme.
10:00 p. m.—Report on road conditions.
10:05 p. m.—Reviews on the latest books.
10:15 p. m.—Programme furnished by the Federal Health Bureau.
11:00 p. m.—Midnight revue.

THURSDAY

10:30 a. m.—Financial and commercial markets. (This service is broadcast every half hour during the 24.)
11:30 a. m.—Farm and home service.
12:35 p. m.—Table talk.
3:35 p. m.—Studio programme.
7:30 p. m.—Financial and final markets.
7:50 p. m.—Children's bedtime story.
8:00 p. m.—Dinner concert.
9:00 p. m.—"Twenty Minutes of Good Reading."
8:20 to 9:00 p. m.—Musical programme.
9:00 to 9:30 p. m.—Mendelssohn Club concert.

FRIDAY

10:30 a. m.—Financial and commercial markets. (This service is broadcast from KYW every half hour during the 24.)
12:35 p. m.—Table talk.
2:30 p. m.—Talk.
7:30 p. m.—Financial and final markets.
7:50 p. m.—Children's bedtime story.
8:00 to 8:30 p. m.—Dinner concert.
11:00 p. m.—Midnight revue.

SATURDAY.

10:30 a. m.—Financial and commercial markets. (This service is broadcast every half hour during the 24).
11:30 a. m.—Farm and Home service.
12:35 p. m.—Table talk.
7:30 p. m.—Financial and final market and sport summary.
7:50 p. m.—Children's bedtime story.
8:00 p. m.—Dinner concert.
9:00 to 9:58 p. m.—Musical programme.
10:05 p. m.—"Safety First" talk.
10:15 p. m.—"Under the Evening Lamp."
11:00 p. m. to 1:00 a. m.—Midnight revue.

WGR, BUFFALO, N. Y.

(319 METRES)

TO-DAY.

2:00 p. m.—Sacred concert by the choir of the Central Church of Christ, 40 voices, Alfred Wooler musical director; Mrs. George Bagnall, organist. All compositions on this programme are by Dr. Wooler, director of the choir, and are dedicated to the choir. Piano solo, "Pomp and Pageantry," Wooler, Mrs. Bagnall; anthem, "Heaven is Not Far Away," Wooler; duet, "I Heard the Voice of Jesus Say," Wooler, Mrs. Wilfred Carver, soprano; Alfred Wooler tenor; anthem, "From Heavenly Heights," Wooler; bass solo, "Save Me, O God," Wooler, Harold Dodge; anthem, "Send Out Thy Light," Wooler; tenor solo, "Consider and Hear Me," Wooler, Alfred Wooler; anthem, "Come All Ye That Labor," Wooler.
3:00 p. m.—Vesper service, Rev. Robert G. Armstrong, Pilgrim Congregational Church.
4:00 p. m.—Organ recital, Miss Katherine Berger.

MONDAY

10:45 a. m.—Weather forecast.
12:00 noon—Weather, produce and live-stock market.
12:30 p. m.—Organ recital.
2:30 p. m.—Closing prices of Chicago Board of Trade.
2:30 to 4:00 p. m.—Concert.
3:30 p. m.—Closing prices of New York Stock Exchange.
4:30 p. m.—Tea-time music.
6:30 p. m.—Dinner music. Dance orchestra.
7:30 p. m.—Daily reports.
8:30 p. m.—Vocal solos.
8:45 p. m.—Address.
9:00 p. m.—Musical programme.
11:00 p. m.—Supper music.

TUESDAY

10:45 a. m.—Weather forecast.
12:00 noon—Weather, produce and live-stock market reports.
12:30 p. m.—Organ recital.
2:30 p. m.—Closing prices of Chicago Board of Trade.
2:30-4:00 p. m.—Concert.
3:30 p. m.—Closing prices of New York Stock Exchange.
4:30 p. m.—Tea-time music.
6:30 p. m.—Dinner music.
7:30 p. m.—Daily reports.
WEDNESDAY.
10:45 a. m.—Weather forecast.
12:00 noon—Weather, produce and live stock market reports.
12:30 p. m.—Organ recital.
2:30 p. m.—Closing prices of Chicago Board of Trade.
3:30 p. m.—Closing prices of New York Stock Exchange.
2:30-4:00 p. m.—Concert.
4:30 p. m.—Tea-time music.
6:30 p. m.—Dinner music.
7:30 p. m.—Daily reports.
9:00 p. m.—Musical programme.
11:00 p. m.—Supper music.

THURSDAY.

12:45 a. m.—Weather reports.
12:00 noon—Weather, produce and live-stock market reports and agriograms.
12:30 p. m.—Organ recital.
2:30 p. m.—Closing prices of Chicago Board of Trade.
2:30-4:00 p. m.—Concert.
3:30 p. m.—Closing prices of New York Stock Exchange.
4:30 p. m.—Tea-time music.
6:30 p. m.—Dinner music.
7:30 p. m.—Daily reports, the American Boy story.
8:00 p. m.—Addresses.

FRIDAY.

10:45 a. m.—Weather forecast.
12:00 noon—Weather, produce and live-stock market reports.
12:30 p. m.—Organ recital.
2:30 p. m.—Closing prices of Chicago Board of Trade.
2:30-4:00 p. m.—Concert.
3:30 p. m.—Closing prices of New York Stock Exchange.
4:30 p. m.—Tea-time music.
6:30 p. m.—Dinner music.
7:30 p. m.—Daily reports.
9:00 p. m.—Musical programme.
10:15 p. m.—Address.
11:00 p. m.—Supper music.

SATURDAY.

10:45 p. m.—Weather forecast.
12:30 p. m.—Organ recital.
2:30-4:00 p. m.—Concert.
6:30 p. m.—Dinner concert.

WLAG, MINNEAPOLIS-ST. PAUL.

417 METRES.

TO-DAY

11:30 a. m.—Morning service, Westminster Presbyterian Church.
4:45 p. m.—Vesper service, House of Hope Church, St. Paul.
8:45 p. m.—Evening service, Second Church of Christ, Scientist.
10:30 p. m.—Concert by Edith MacDonald Carpenter, soprano; Eleanor Freemantel, accompanist, Lois Rogers, pianist, and Hotel Leamington Symphony Quartet.

MONDAY.

10:30 a. m.—Announcements.
11:45-12:15 a. m.—Household hints.
12:35 p. m.—"Just Among Ourselves," surprise hour.
3:00 p. m.—Woman's Club, lesson in dressmaking by Mme. Myrtle Saperston.
3:40 p. m.—Daylight concert by Frank L. Brainsky and his International Orchestra.
5:00 p. m.—Short reading, Mildred Simons, "A Hollywood Love Story."
6:30 p. m.—Childrens' stories by Tess Cooperman.
7:00 p. m.—"The Man and the Drug Store," Dean F. J. Wulling, University of Minnesota.
7:15 p. m.—Dinner concert by Minneapolis Athletic Club Orchestra.
8:30 p. m.—Lecture programme, "Minnesota Canned Foods and Cereal Products," C. C. O'Brien; "Durum Flour Products," J. T. Williams; "White Flour and Durum Flour," C. H. Bailey.

TUESDAY.

10:30-10:45 p. m.—Announcements.
11:45 a. m.—Household hints.
12:35 p. m.—Surprise programme.
3:00 p. m.—Woman's Club. "Women in Public Office," Mrs. Frank M. Warren, University of Minnesota Regent, for League of Women Voters.
3:40 p. m.—Daylight concert, Ronning's Air Raiders.
5:00 p. m.—WLAG Players.
6:30 p. m.—Children's stories by Macalester College girls.
7:00 p. m.—"Catching Bass," by W. C. Vogt.
7:35 p. m.—Dinner concert by Minneapolis Athletic Club Orchestra.
8:30-9:15 p. m.—Farm lectures: "Selection of Durum Seed of Quality and Profit," M. A. Gray; "Canning Possibilities of Minnesota Vegetables," J. V. Bailey; "Historic Facts About Minnesota," Miss Livia Appel.

WEDNESDAY.

10:30 a. m.—Announcements.
11:45 a. m.—Household hints.
12:35 p. m.—Surprise programme.
3:00 p. m.—Woman's Club, "Twentieth Century Housekeeping," Bernice Bell.
3:40 p. m.—Daylight concert, sponsored by Schubert Club of St. Paul; Olive Emerson, soprano; Mary Keegan, accompanist; Helen Atchison Greene, pianist; Mildred Phillips Kindy, reader.
5:00 p. m.—Short reading, Mildred Simons, "One in Ten Thousand," Squier.
6:30 p. m.—Children's stories, by Mrs. Robert Cargill.
7:00 p. m.—"Gate Crashers," Billy B. Hoke.
8:30 p. m.—Farm lectures: "Minnesota Jams, Jellies and Preserves," Floyd A. Wheeler; "The Outlook for Bigger Quantity of Minnesota Canned Products," J. E. Barr, St. Cloud, Minn.
10:15 p. m.—St. Paul K. C. programme.

THURSDAY

10:30 a. m.—Announcements.
11:45 a. m.—Household hints.
12:35 p. m.—Surprise programme.
3:00 p. m.—Dancing lesson.
3:40 p. m.—Musical programme.
5:00 p. m.—Reading.
6:30-7:00 p. m.—Children's stories.
7:00 p. m.—Sport talk.
7:15-8:00 p. m.—Orchestra music.
8:30-9:15 p. m.—Farm lectures.

FRIDAY

10:30 a. m.—Announcements.
11:45 a. m.—Household hints.
12:35 p. m.—Surprise programme.
3:00 p. m.—Woman's club talk.
3:40 p. m.—Concert.
5:00 p. m.—Reading.
6:30 p. m.—Children's stories.
7:00 p. m.—Sport programme.
8:30-9:15 p. m.—Farm lectures.
10:15 p. m.—Business message.
10:30 p. m.—Musical programme.

SATURDAY

10:30 a. m.—Announcements.
11:45-12:15 a. m.—Household hints.
12:35 p. m.—Meeting of the "Postcard Club."
3:00 p. m.—Stage and Screen Review.
3:40 p. m.—Concert.
5:00-5:30 p. m.—Reading.
6:00 p. m.—Talk on "Radio."
6:30 p. m.—Meeting of Children's Radio

Continued on Page Seven.

WOULD ELIMINATE MESSAGE CONFLICT

Suggests That Ships Use Higher Wave Length.

Important Commercial Lines Need Accurate Assignments, Writes Expert. — Millions of Interested Fans in United States Should Help Settle Controversy.

Radio's boon to mankind in bridging the Boltiest ocean wastes inspired widespread admiration. That science had evolved means for harnessing natural forces and using them for the transmission of messages from shore stations to ships in mid-ocean and vice versa evoked interest and commendation, writes Charles J. Pannill, Vice President of the Independent Wireless Telegraph Company, in the February issue of Marine News.

Today ship radio is anathemized and lambasted until this golden-haired child of a few years ago is now a miserable interloper.

All this develops from the appearance of broadcasting entertainments and its sweep throughout the length and breadth of the land. A new object of interest has appeared and, like a Moloch, it unrelentingly demands rights regardless of the welfare of others.

Radio broadcasting has several million devotees. Its widespread popularity cannot be denied, but sight has completely been lost of the need of retaining for exclusive ship to shore commercial traffic a sufficient number of wave lengths to accommodate this vitally important phase of shipping operation. The result is that radio broadcasting is steadily intruding upon the wave length areas available for transmission of commercial radio traffic from and to ships to sea.

The broadcast listener comfortably ensconced in his home bitterly criticises the interference of "code" when he or she is listening to the lyric voice of some singer or the blare of a popular jazz orchestra. No thought is given to the fact that the much condemned "code" is conveying information either from or to the ships at sea; information of vital importance to steamship owners and cargo consignees as well as the public ashore who are interested in the welfare of their loved relations at sea.

The radio broadcasting public expresses its dissatisfaction with ship interference and its voice being in the majority demands elimination of ship radio transmission from certain wave length areas without lending its support to the allocation of wave length areas to replace those the ships now have and to which they object.

Up to recently, ship-to-shore traffic was handled on three wave lengths, namely, 450, 600 and 706 metres. The intermediate wave length is the standard for radio reception for ships. Ship-to-shore communications are usually transmitted on the 450 or 706-metre wave length. By agreement, the 450-wave length is not used for commercial radio business during the hours of broadcasting entertainments except for urgent messages that cannot be transmitted on other waves, and the result has been that commercial radio traffice is considerably delayed.

During the past month it was arranged that the shore stations could try out a plan to transmit to ships at sea at various wave lengths from 625 to 735 metres after calling the ships on 600 metres. Before this new arrangement, the shore stations sent on 600 and 706 metres; the ship on 450, 600 and 706 metres. The demands of the broadcasting stations for what is really sovereignty of the air, on short waves presents a very serious situation for the shipping business.

It must be borne in mind that radio broadcasting stations are really commercial enterprises. Without broadcasting there would be only a limited market for radio products such as vacuum tubes, etc. It is clear that radio broadcasting is part and parcel of a marketing plan for the sale of radio reception equipment. Viewed in this light it will be seen that radio broadcasting, like commercial radio stations, is a business proposition and the discussion reduces itself to the question whether broadcasting business has rights that are paramount to the commercial radio business.

The whole matter could be solved without much difficulty if the new commercial radio stations were assigned new wave lengths. At present the ship radiophone is assigned wave lengths of 800 to 952 metres. This assignment could easily be cancelled and without causing any difficulty because ship radiophone is a limited quantity. The 800-metre wave length is assigned for navy compass signals and the 1000-metre wave length is assigned for the Department of Commerce radio compass signals and these could be reassigned to new wave lengths over 1000 metres so that with the elimination of the ship radiophone a wave band of 600 to 1000 metres could be assigned for the exclusive commercial radio use, leaving the broadcasting field in undisputed possession of 200 to 600-metre wave lengths. The higher wave lengths would require some minor changes in ship equipment but their availability for use day and night would enable the better handling of commercial radio traffic and the complete elimination of complaint from broadcasting enthusiasts of "code" interference.

The commercial radio companies have costly investments in shore stations. These companies are few in number but the service they render is important to every ship owner whose vessel is equipped with wireless and to every shipper and consignee of cargo who because of fluctuating market conditions and the practice of selling commodities for future arrival find it invaluable to keep thoroughly posted as to the whereabouts of their cargoes and possible time of arrival.

This subject is one of great interest and broad ramifications. In view of the international conference which control ship radio, it is rather difficult to effect an immediate adjustment of the conflict between commercial radio and the broadcasting stations. International gatherings cannot be summoned at a month's notice, while in the meantime the growls from the broadcasting listener because of "code" interference, usually due by the way to the non-selectivity of amateur receiving equipment. The solution can be easily solved by proper wave length assignment.

RADIO DICTIONARY

ASYNCHRONOUS—A motor which does not run in synchronism with the driving alternating current.

ATMOSPHERE—A complex of gases principally oxygen and nitrogen in a proportion of 21 to 78, surrounding the earth with a thickness of depth of about 100 miles, beyond which is presumed to be a nearly perfect vacuum. Pressure at earth's surface is about 14.75 pounds per square inch. Density about .08 pound, per cubic foot. Commonly referred to as the air. Unit of pressure is atmosphere which is equal to a column of mercury 30 inches high at 0 degrees C.

ATMOSPHERICS—See Xs, strays, static.

ATOM—The smallest portion of an element that can take part in a chemical action.

ATOMIC WEIGHT—A. W. Weight of an atom of an element compared to one of hydrogen, which is generally taken as unity.

AU—Aurum. See gold.

AUDION—A comparatively new valve detector. Its distinctive feature is the third electrode. De Forest's own definition is, "A relay operated by electrostatic control of currents flowing across a gaseous medium." It consists of three electrodes in an evacuated bulb, one of these being a heated filament, the second a gridlike electrode, and the third a metal plate. See valve, amplified, rectifier tube.

AURORA BOREALIS—Luminous atmospheric and electrical phenomenon radiating from earth's northern magnetic pole. Believed to cause certain static disturbances.

AUDIBILITY METER—An instrument used to measure approximately the comparative strength of incoming signals.

AUTOMATIC TRANSMITTER—Instrument for high speed transmission operated by a specially perforated paper tape running between small wheels. See perforator.

AUTO-TRANSFORMER—A direct couple transformer.

AXIS OF MAGNET—Shorted line joining the true poles.

BACK E. M. F., COUNTER E. M. F., OPPOSING E. M. F.—Due to opposing current produced by self-induction set up in a circuit by a changing supply current. In a cell it is due to Polarization.

BALANCER—A small auxiliary dynamo used in three-wire system to balance pressure to the three leads.

BALANCING CAPACITY—An artificial "earth" capacity inserted in aerial circuit to take the place of a natural ground. May be greater than but never less than the capacity of the aerial.

BALLISTIC GALVANOMETER—One used for measuring currents of short duration, such as a condenser discharge. It is so arranged that the first swing is proportional to the quantity of electricity passing through it during a momentary discharge. It is usually of the reflecting or mirror type.

BANKS—Referring to condensers is a complete unit of a compound condenser contained in one case.

BANK WINDING—An improved and modern form of winding inductance, one layer on top of another in such a manner that distributed capacity is reduced to a minimum; a considerable saving of space being also accomplished.

BAR MAGNET—A magnetized straight bar of steel.

BARRETTER—A thermal detector. Electrolytic detector has a small loop of Wollaston wire enclosed in a glass bulb. Tip of loop is dipped in nitric acid, which, dissolving the silver, leaves a short length of extremely fine platinum wire. Bulb is exhausted of air. Telephones with one single shunted cell connected across ends of loop so that a weak current is constantly flowing through it. When oscillations pass through loop, heat and resistance of platinum wire are increased, thus suddenly decreasing passing current, which action produces audible sounds in the telephones. May be used as a bolometer.

BASE—See logarithm or log table.

BATTERY—A collection of voltaic cells or storage cells or of Leyden jars joined up in series. In fact, any collection of units multiplied and used together, is called a battery.

BEST RECEPTION—The method of detecting received oscillations, usually undampt, by causing them to interact with other locally produced sustained oscillations of slightly different frequency and generally of greater amplitude. The beat or resultant note is the difference between the frequencies of the two independent oscillations. The method is one of extreme sensitiveness and selectivity. May also be employed, though not so effectively, for the reception of dampt wave trains, in which case a hissing sound only is produced in the telephones by incoming signals. Also known as interference and heterodyne reception.

BEAT WAVES—See coupling waves.

BELLINE TOSI AERIAL—A directive aerial of square or triangular form having its base above but parallel to earth. The apex may be either close to slightly open. Strongest radiation in the two directions of the plane of the aerial and zero at right angles to this plane. The same holds good for reception, the strongest signals being received when coming from the direction of the plane of aerial.

BERNE BUREAU—A branch of the Bureau (Agency) of the International Telegraph Union, situated at Berne, Switzerland, established for the purpose of collecting and distributing information in accordance with the requirements of the International Radio Convention.

BI—See Bismuth.

BICHROMATE CELL—A single-fluid cell. Consists of two carbon plates immersed in a solution of bichromate of potash and sulphuric acid, with water between, which is a removable zinc plate. E. M. F. 2 volts. Has low resistance.

BIGHT—A loop formed in a rope at any place except the ends.

BILLI CONDENSER—Consists of a metallic tub made to slide over an insulating tube having a metallic lining. A variable tubular condenser.

BINDING POST—Screw and nut arrangement designed and used on electrical and radio apparatus to make proper connection to and from an external source.

BIPOLAR—Having two poles. Usually refers to a dynamo or motor whose armature rotates between a field magnet having only two poles. Most modern machines are multipolar.

BISMUTH—Bi, brittle white crystalline metallic element. Atomic weight 200.0; specific gravity, 9.82; melting point, 490 degrees Fhr.

BLACK TELLURIUM—See Nagyagite.

BLOWER MOTOR—Refers to motor-driven fan used to deliver a high pressure blast at the spark gap to prevent racing.

BLOWOUT—See Magnetic Blowout.

BOARD OF TRADE UNIT—B. O. T. 1000 Watt-hours. Nearly one and a third horse-power. Is the product power in watts and time in hours divided by 1000.

BOLOMETER—Type of wheatstone bridge having an easily heated resistance, such as a very fine wire in one arm. A barretter may be used.

BOOSTER—An American expression signifying a small dynamo used in conjunction with main dynamo to temporarily raise, when necessary, its normal pressure. It is generally driven by a motor supplied with energy from the main generator and thus becomes a continuous current transformer. Frequently used for charging accumulators of a generating plant. See Reversible Booster.

BORNITE—(3Cu2S, Fe2S3.) Also called Erubescite and Peacock-ore. It is a crystal rectifier. Used in combination with Zincite. Is a copper ore composed of about 60 parts copper, 14 iron and 26 matrix crystals. Owing to peculiar bronze tint when newly broken is known as "horseflesh" ore. It quickly tarnishes, however.

BORON—B. Non-metallic element. Dark brown powder. Atomic weight, 10.9.

B. O. T.—See Board of Trade Unit.

BRADFIELD INSULATOR—A particular form of leading-in insulator, consisting of an ebonite tube provided with zinc cone and ebonite spark discs, for breaking up continuous streams of rain running down outside which might cause serious earthing of aerial. The whole is held in position, half-way through roof of operation room, by means of a stuffing box. The aerial is led in by means of a steel rod running through centre of tube.

BRAKE HORSE-POWER—Power a machine can exert in doing outside work, i. e., other than driving itself. Power that a "brake" would have to exert to stop a machine. Total power is called indicated horse-power (I. H. P.)

BRANDY COHERER—Early form of Marconi Coherer; see Coherer.

BRASS ORDINARY—Alloy composed of about seven parts copper and three parts zinc.

BRASS SADDLES—Small clips used for holding wires in position on walls, etc., fixed by a small brass screw at each end.

BREAKER—See Contact Breaker.

BRIDLE—A short length of rope, whose end are fitted with a thimble for attaching to lugs at each end of spreader. A thimble is also fitted to the middle of the bridle for attaching to the halyard.

BRIMSTONE—See Sulphur.

BRUSH DISCHARGE—A faintly luminous discharge which takes place at the surface of conductors charged to high potential due to Ionization. Is also called Corona.

BRUSHES—Fixed carbon blocks of copper gauze held in a position that makes contact with the commutator of a dynamo or motor for the purpose of collecting current generated from or supplying.

BRUSH HOLDER—Metal clamp capable of adjustment which holds the brush in position on the commutator of a dynamo or motor.

B. S. G.—British standard gauge of wire.

BUCKING OF PLATES—During discharge of a secondary cell the plates gradually expand, owing to the fact that lead sulphate has about twice the volume as the same quantity of lead peroxide. Should this expansion or discharge take place too quickly, the plates will bend or buckle.

BUNSEN BURNER—An alcohol flame burner designed to furnish a maximum heat upon applied objects such as metals and glass.

BUNSEN CELL—A cheaper form of Grove cell having platinum foil replaced by carbon rod. In resistance and voltage practically same as Grove. See Grove cell.

BUS BAR—A single bar which serves as a comomn conductor for a large number of pieces of apparatus. Also called Omnibus bar.

BUSHING—A piece of composition or fibre used for the purpose of separating electrical circuits in any given piece of apparatus.

BUZZER—Same as electric bell, but with hammer and gong removed. Used for testing a receiving gear by means of a small local circuit. Make-and-break contact is made to serve as a small spark gap, the small spark thus formed getting up oscillations which are plainly recorded by the detector. Sometimes shunted across and exciting the closed circuit.

B. W. G.—Birmingham Wire Gauge.

(To Be Continued.)

RADIO PROGRAMMES

Continued From Page Six

Health and Toothbrush Club of America.
7:00 p. m.—"Keeping Fit in Winter."
10:15 p. m.—Orchestra music.
8:30 p. m.—Farm and business lectures.
11:15 p. m.—Dance programme.

WOR, NEWARK, N. J.

(405 METRES)

MONDAY.

2:30 p. m.—Orchestra music.
3:00 p. m.—Scotch songs.
3:15 p. m.—Orchestra music.
3:45 p. m.—Scotch songs.
6:15 p. m.—"Music While You Dine."
8:00 p. m.—"Current Motion Pictures."
8:10 p. m.—"Adventures of a Detective."
8:30 p. m.—Cornet solos.
8:40 p. m.—"Radio Cartooning."
8:55 p. m.—Continuation of cornet solos.
9:05 p. m.—Short talk and song recital.
9:45 p. m.—Orchestra and vocal numbers.

TUESDAY.

2:30 p. m.—Country Club Orchestra.
3:00 p. m.—Chorus.
3:30 p. m.—Country Club Orchestra.
6:15 p. m.—"Music While You Dine."
6:30 p. m.—"Man in the Moon Stories" for Children.
7:00 p. m.—"Music While You Dine."

WEDNESDAY.

2:30 p. m.—Orchestra numbers.
3:00 p. m.—Chorus.
3:30 p. m.—Orchestra numbers.
6:15 p. m.—"Music While You Dine."
8:00 p. m.—Baritone solos.
8:15 p. m.—Tenor solos.
8:30 p. m.—Continuation of baritone solos.
8:45 p. m.—Tenor solos.
9:00 p. m.—"Legion Night on the Air."

THURSDAY.

2:30 p. m.—Male quartet.
3:00 p. m.—Two-piano recital.
3:25 p. m.—Talks and songs.
6:15 p. m.—"Radio for the Layman."
6:30 p. m.—"Music While You Dine."

FRIDAY.

2:30 p. m.—George Washington programme.
6:15 p. m.—Blind entertainer.
6:30 p. m.—"Man in the Moon Stories for Children."
7:00 p. m.—Blind entertainer.

SATURDAY

2:30 p. m.—Orchestra numbers.
3:00 p. m.—Talk by Fannie Hurst.
3:15 p. m.—Orchestra numbers.
6:15 p. m.—"Music While You Dine."
7:15 p. m.—Sport talk.
8:00 p. m.—Orchestra numbers.
9:00 p. m.—Talk on the law and income tax.
9:15 p. m.—Recital.
9:40 p. m.—Address.
9:55 p. m.—Continuation of recital.
10:15 p. m.—Musical number.

WRC, WASHINGTON, D. C.

(469 METRES)

MONDAY.

3:00 p. m.—Fashion developments.
3:10 p. m.—Song recital.
3:25 p. m.—Health and beauty talk.
3:35 p. m.—Piano recital.
3:50 p. m.—Current topics.
4:00 p. m.—Travel talk.
5:15 p. m.—Instruction in international code.
6:00 p. m.—Stories for children.

TUESDAY.

5:15 p. m.—Instruction in international code.
6:00 p. m.—Stories for children.
7:45 p. m.—Radio talk.
8:00 p. m.—Dance music.
8:30 p. m.—Concert.
9:00 p. m.—Address.
9:15 p. m.—Song recital.
9:30 p. m.—Piano recital.
9:55 p. m.—Time signals and weather forecasts.
10:00 p. m.—Concert.

WEDNESDAY.

3:00 p. m.—Fashion developments.
3:10 p. m.—Song recital.
3:25 p. m.—Report of National Conference Board.
3:30 p. m.—Piano recital.
3:45 p. m.—Current topics.
4:00 p. m.—Song recital.
5:15 p. m.—Instruction in international code.
6:00 p. m.—Stories for children.

THURSDAY.

5:15 p. m.—Instruction in international code.
6:00 p. m.—Stories for children.
8:00 p. m.—A talk on motoring.
8:15 p. m.—Violin recital.
8:30 p. m.—Song recital.
9:00 p. m.—Talk.
9:30 p. m.—Talk.
9:45 p. m.—Piano recital.
9:55 p. m.—Time signals and weather forecasts.
10:00 p. m.—Concert.

FRIDAY

3:00 p. m.—Fashion developments.
3:10 p. m.—Song recital.
3:25 p. m.—Current events.
3:35 p. m.—Piano recital.
4:00 p. m.—Talk.
5:15 p. m.—Instruction in international code.
6:00 p. m.—Stories for children.
6:20 p. m.—"The Question Box."

SATURDAY

5:15 p. m.—Instruction in international code.
6:00 p. m.—Stories for children.
7:45 p. m.—Bible story.
8:00 p. m.—Song recital.
8:15 p. m.—Dance programme.
8:45 p. m.—Piano recital.
9:00 p. m.—Song recital.
9:15 p. m.—Concert.
9:30 p. m.—Song recital.
9:55 p. m.—Time signals and weather forecasts.
10:00 p. m.—Concert.

When Wiring Is Important.

When wiring a radio receiver connect all the plate and grid leads first, then wire the filament circuit. Strange, but safe. After wiring the set you tire and are not so particular as at first. This will matter little if you are wiring the filament circuit, but is all important when connecting the plate and grid leads.

Wizard's Rise to Fame

Continued from Page One.

dividual quality of quality which is shared by most successful men, even though they may be of widely divergent types. But the outstanding impression is the one that takes one farthest from the facts.

For instead of an easy life Sarnoff has crowded into his brief years hardships of one sort and another that would have kept down 999,999 men in a million. Of his life in Russia it is important to know that at the age of 6 he was huddled off to a far-away village called Kozmo, there to study to be a rabbi under the tutorship of his grand-uncle. The men of Sarnoff's mothers' family had been rabbis for generations, and she was determined that her first born should uphold the tradition.

Even at 6 years of age David knew he was never going to be a rabbi, but in his new environment he found that he was the only child in this entire village and that there was no amusement. All there was for him to do was to accept and perform the tasks set by his grand-uncle.

Every morning he arose at 7 o'clock and all day until 8 o'clock at night he studied, the only interludes in the drudgery being the brief stops for meals. His studies were all in the Talmud and other holy books, and as soon as he had mastered the Hebrew language he was forced to study 2000 words a day, translate them into the local Jewish dialect and recite them, letter-perfect, to his grand-uncle every Thursday. If he missed as much as a single word he was severely upbraided.

This was the boy's entire life for three years, but finally the welcome news came from his mother that his father had sent the money for their tickets to America. He was to join the family at Libau. They came steerage, of course, and there was nothing about them to differentiate them from the thousands of other Russian emigrants who were making their way to "the land of promise." Except, perhaps, that they were a little more exotic in appearance, a little wilder, more of the back country than most of their fellow travellers.

* * *

The struggle to support his family in Russia and himself in America, and at the same time lay aside the money for their passage, had broken the health of David's father, and almost at once he took to his bed and the chief burden of the support of the entire family fell on the shoulders of this boy of 9, who did not speak the language of the new country.

This was the time that the blessing of the rigorous years in his grand-uncle's home emerged from its disguise. For that life had been so hard, so grinding that anything else seemed like play. Besides, there was the incentive in America that if one worked one could succeed.

And so the young David took a part-time job in a butcher shop near the house and also found work delivering the Jewish Morning Journal in the Ghetto. Thus he earned enough to feed the family frugally and to pay the $10 monthly rent of the little tenement rooms where the invalid father, mother and three children had their home.

First of all he realized that he must learn the language, but the driving force behind his every move then was to get an American education. "I realized that unless I could make my dreams come true," he said to an interviewer.

"My mother agreed with me. She helped me work out a schedule of hours. I rose up at 4 o'clock in the morning and delivered my papers. Then I could go to school for a few hours, and after school I looked around for odd jobs to do. I found lots of them.

"Within a year I could speak and read English pretty well, and I was getting ahead with my reading, writing, arithmetic and geography. Early in my school life I made up my mind never to let pass an opportunity to add an English word to my vocabulary, to look it up in the dictionary and learn not only how to spell and pronounce it, but also how to use it in its proper place."

Sarnoff, it may be said, speaks English like a native. There is culture in his speech, but not the stilted culture of the man conversing in some other than his mother tongue. There is the easy use of the idiom that is born in most of us, a complete mastery of the technical terms of his profession and a range and choice of words that have made him one of the ablest public speakers in the radio field to-day.

In public school it was learned that Sarnoff had a good singing voice and this opened up a chance for him to add to his earnings by singing in a synagogue choir. He had to rehearse four or five nights a week, but he got a dollar and a half a week for singing and that was too important a sum to be overlooked.

So as his routine finally worked out he was either working or studying from 4 o'clock every morning until 11 o'clock every night. Why it did not kill him is not clear, but he remembers that for several years his physical growth was at a standstill. He seemed destined to be stunted, but when he was 16 and under less pressure he resumed growing a healthy, vigorous body to house his healthy, vigorous mind.

When he was 11 years old, two years in America, he had a chance to buy a newsstand over on the West Side in an Irish district. It required $200, which he didn't have, but a neighbor family from the same Russian village loaned him the money and he launched in a real business.

How hard it was can be imagined, but not adequately described. His morning route took him all his time from 4 a. m. until school opened; his afternoon deliveries kept him on the jump from the close of school until a late supper, after which he had to get on a street car and take the long ride to his choir rehearsal four or five nights a week. He got home and to bed at midnight. And he was 11 years old!

When he was 15 he had been going to school six years and working on the above described routine, and he had completed the eight-year school course. At this juncture his father died and David decided that he must "really go to work."

For three years David had been an ardent reader of everything he could find about Abraham Lincoln. It was on Feb. 12, in his second year at school, that his teacher had told his class about Lincoln's boyhood and his later life. And on that day David had gone home fired with a new spirit.

"Here was a boy who had just as hard a time as I am having," he said, to his mother, "and he won in spite of everything. I have only to think of him if I am ever in danger of being discouraged and I'll win out, too."

It was with Lincoln in his mind, then, that David went out to look for a job with a regular salary attached.

* * *

"I knew something about newspapers," he said, "and I thought I would try for some sort of a job in a newspaper office. So I went to the New York Herald office, then at Thirty-fifth street and Broadway, and started over there one Saturday morning in the spring of 1906. The first man I met was the manager of the Postal Telegraph office, on the main floor of the building. I asked him where I must apply for work. He said he needed a messenger boy and would pay me $5 a week. I took the job. I remembered that in Russia no person of any race was allowed to operate a telegraph instrument and it seemed to me that here I might study telegraphy.

"I had to keep on with my morning paper routes, but my brothers were big enough now to do the afternoon work, so I got along all right at the telegraph office and finally bought a sender, for $2.50 and started to learn to send the Morse code. When I thought I was proficient enough to hold down an operator's job I went to the Marconi Wireless Company and asked for a berth as assistant operator. The man there asked me how old I was and when I said 15 he said that was too young for an operator, but that he would give me a job as office boy at $5.50 a week. Something told me even then the radio was the newest force in the world and destined to be one of the greatest, and so from then on I studied radio, ate radio, slept radio and worked at radio."

* * *

The rest of Sarnoff's story is recent history and familiar to every newspaper reader. It was he who took the list of survivors from the Titanic sinking and who supervised the installation of the radio equipment of hundreds of steamships after that disaster. It was he who forecast several years ago the broadcasting situation which now exists. It was in 1918, when the Radio Corporation of America was formed, succeeding the Marconi Company, that Sarnoff went along as commercial manager and it was in 1921 that he was made general manager.

In the meantime he had taken a special course in electrical engineering at Pratt Institute and is now a member of the American Institute of Electrical Engineers and a fellow in the Institute of Radio Engineers. In 1917 he was married to Miss Lizette Hermant, a French woman. They have two sons and live in Mount Vernon in Chester Hill Park. He is a member of the Lotos, Whitehall and Railroad Clubs.

He believes radio is still in its infancy and expects before another two years there will be a broadcast receiver devised which a man can carry in his pocket or wear like a wrist watch and cut in on what is going on in the world no matter where he may be.

Mighty Hard to Tune Out

—From the Rochester Herald

Sort o' Looks as if Grandpa Was Going to be Late for the Lecture

SOUND RADIO FOG SIGNALS

Light Vessels Also Broadcast Weather Reports Daily.

Radio fog signals on the San Francisco Light Vessel and the Blunts Reef Light Vessel sound the station characteristic on 1000 metres when there is fog or thick haze within approximately 10 miles from the light vessel. The signal may be heard for a distance of 25 miles or more. The fog signal of these vessels will be sounded upon request of a vessel desiring to test or calibrate the radio compass or to check its position.

At about 8 a. m., 12 noon and 8 p. m., daily, each light vessel will broadcast on 600 metres weather reports pertaining to existing weather conditions in the immediate vicinity of the light vessel and will furnish such reports at other times to vessels requesting them. The reports cover only actual weather conditions and forecasts cannot be furnished.

Beginning Jan. 1, this year, the radio fog signal on the Blunts Reef Light Vessel has been operated during clear weather for the first 15 minutes of each even hour between 10 p. m. and 6 a. m.

Beginning Jan. 1, this year, the Nantucket Shoals Light Vessel has been standing watch for the first 15 minutes of every hour between 8 a. m. and 10 p. m., for the purpose of answering requests from vessels to transmit fog signals. For the first 15 minutes of every hour between 11 p. m. and 7 a. m., the fog signal is operated, and during thick, foggy or misty weather this signal is operated continuously.

The hours of operation on all other light vessels, unless otherwise stated, are between 8 a. m. and 8:15 p. m., first 15 minutes of each hour.

If masters of vessels report the increased service is of value to them, the service may be continued to cover more frequent periods.

REVEAL TROUBLES DUE TO WIRING

Mysterious Noises Often Traced to Broken Connections.

In Arranging Parts in Proper Sequence Care Should be Taken to See That Connections Are Made as Short as Possible. — Battery Causes Disturbance.

Frequently where a tandem of audio frequency amplifiers is grafted onto a single tube outfit peculiar squeals are emitted, together with a rattling noise which makes the set sound as though something was radically wrong. Probably this happens when one is sacrificing quantity for quality. Trying to produce both of these in a receiving outfit is more of a problem than it would appear by simply looking at a diagram.

It often happens that the cause of such noises are due to some connections which have been broken by excessive strain. Other faults may be bad B batteries or noisy A batteries.

In arranging parts in their proper sequence precautions should be taken to see that the connections are made as short as possible, says the Rochester Herald. This should be done especially when connecting the leads to the grid posts of the vacuum tube sockets. To avoid capacity effects the connections should be kept at least three-quarters of an inch apart and, where feasible, the wires should be crossed rather than run parallel so that only small portions of the neighboring conductors are close together. This holds true also for plate leads. Altogether too frequently a trouble man looks into a set only to find that most of the trouble is due to the closeness and parallelism of those lead wires.

Rigid connections should be used wherever adaptable so that accidental displacement is not likely. The connections should also be firmly clamped and the junction of the wires tinned over. A good soldering connection should be made rather than a twisted connection unsoldered. The latter will not remain permanent.

Undesirable sounds in a radio set develop from faulty connections which are amplified in all the subsequent stages until their volume seriously affects the music and speech which is produced in the head telephones or the loud speaker.

Another important item that should be followed very closely is that of the B batteries. A bad B battery when connected in series with other B batteries is often the cause of disturbances. Erratic discharge within the battery itself is the source and the only remedy is to take out the battery and replace it with a new one. This holds true also with the A battery, although it is less liable to happen here than with the B battery. Proper care, however, should be taken of the batteries as a whole. Too much B battery current being supplied to the plates of the vacuum tubes is another source of troublesome noise. This trouble may be remedied by decreasing the B battery voltage.

Where coils of the duo-lateral type are employed, it sometimes happens that the fine wires leading to them or within the coils of transformers are common sources of trouble. The insulation sometimes holds the cut ends together, thereby creating a more or less continuous path for the high frequency resistance.

When such a break occurs it is best to separate the ends and apply a voltmeter to the windings. If there is no reading on the voltmeter it is a sure indication that the conductor under suspicion is broken.

Where lead wires are fastened to the base of a coil or transformer one should look at these places for broken connections, since here they are subjected to their greatest strain. It may be possible that if a voltmeter be applied it may show that the path is complete in spite of the broken connection, but if the set is jarred slightly, a deflection of the needle will be noticed.

Thoughts on Radio Restaurant.

Passing up Broadway the other night, says a New York writer, we saw a sign which proclaimed a "Radio Restaurant, Come In!"

This, we fear, is a project foredoomed to failure. The public is already fed up on radio!

Our hurried business man will now eat a radio club sandwich—in which empire cloth is substituted for lettuce.

Or, perhaps, the proprietor is merely trying to justify his bakelite steaks.

As our old friend 2BH would say, in this place they probably pour milk from a grid-leak.

Radio Fan Can Save Money by Using C Battery in Amplifier

Small Cells Reduce Current Drain on B Batteries, But Will Not Clarify Distorted Signals Due to Excessive Regeneration

BY S. T. PRATT.

After a veritable deluge of letters requesting detailed information about C batteries and their effects, it is only proper that an article covering every point in full detail be placed before the fans. The list of queries received was indeed diversified, commencing with the request for constructional details and ending with the replacement of "worn-out" grid bias batteries.

In order to select the points of real importance the list was segregated under various headings, and the article written accordingly. In order to make the solution of some problems more comprehensive it is necessary to delve into the operating characteristics of the vacuum tube, and in such instances the use of several somewhat technical terms cannot be obviated, by the writer will endeavor, in an attempt to clarify the C battery situation for the non-technical fan, to minimize the use of technical terms wherever possible.

The C battery, also known as the "grid bias" battery and, incidentally, the latter name is more appropriate, since it explains the action of the battery —is similar to the other batteries found in receiver installations, but has one identifying feature—the current capacity of the battery is very low, and this is made possible by the fact that when functioning in the receiver the current drain upon it is infinitesimal, hence its construction is such that it has a small ampere hour capacity. A C battery, when properly installed, should function satisfactorily and without any annoyance to the operator for a period varying between eight months and a year, if the battery is of reputable manufacture.

The use of a C battery is not dependent upon the method of tuning utilized in the receiver or upon the type of receiver, whether it is regenerative one that uses radio frequency amplification or a crystal receiver, for it is inserted in the audio frequency amplying circuit. Furthermore, the C battery may be used with any of the three element vacuum tubes regardless of the type—"peanut" tube, dry cell tube, regular storage battery tube or power tube.

The "grid bias" battery in the minds of very many fans serves just one purpose—to eliminate distortion within the amplifier. This fallacy has been the direct cause for many a heated discussion due to its failure to accomplish that result. To entertain an idea of that kind is not entirely erroneous, but to look at "grid bias" batteries in that light alone will prove somewhat disappointing, for it will only clarify the signal under certain conditions, and this condition is not difficult to understand.

An attempt to clarify a distorted signal by inserting a C battery, if the distortion is due to excessive regeneration or to poor audio amplifying transformer design, will be a wasted effort. It cannot be done. Furthermore, C battery clarification, if we may call it that, will prove of no avail if the amplifying tube is being excessively overloaded, for the input capacity of th tube has a definite limit. It is this limit that must be taken into consideration when operating amplifying equipment. A clear, undistorted signal that is of such intensity that it taxes the capacity of a regular six-volt tube to its limit will invariably be heard as a distorted signal if passed through a small dry cell tube. Bear this fact in mind.

The entertainment of the above erroneous idea, and its failure to accomplish the desirid results, has given rise to unfounded disparaging remarks concerning the C battery, to the extent that its exploitation was due more to an endeavor to increase the sales of the battery than to its beneficial effects. Once again the opinion of the minority is wrong, for one of the most beneficial effects of the insertion of the proper C battery into the amplifier equipment is never noticed by the operator unless he inserts the proper indicating instruments into the various circuits. This is reduction in plate current or the decrease in the current drain upon the B battery. One must be observant to notice the increase in the life of the plate voltage source.

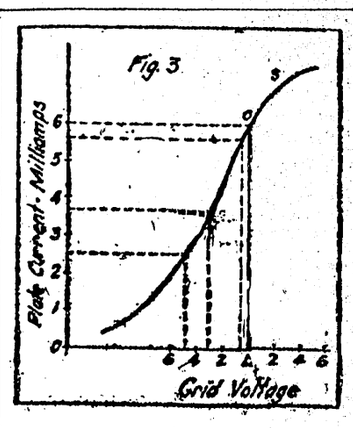
Many fans operating multi-stage audio frequency amplifiers have been bewildered by a peculiar phenomenon. The amplifier functions admirably on weak signals, but distorts on strong ones. In addition they ascertain by experience that by reducing the brilliancy of the filament they can clarify the signal to a certain extent, but unfortunately this results in a decrease in signal intensity.

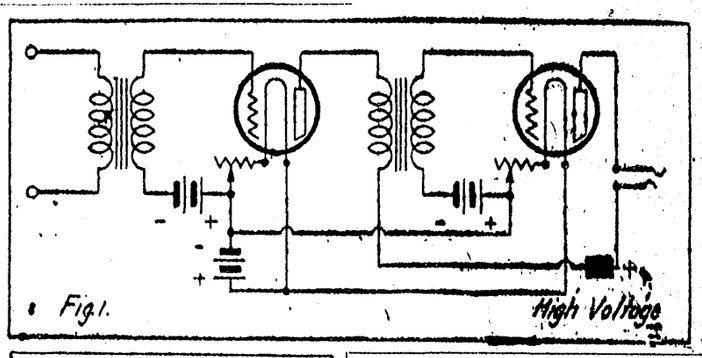
This procedure, however, is not popular, for the maximum signal intensity is always desired, otherwise audio frequency amplification would not be used. In an endeavor to alleviate the situation various types and makes of transformers are used, but distortion persists in being present when strong signals are being amplified and moderately high voltages applied to the plates of the tubes. At last someone suggests the insertion of a C battery, and the signal is cleared up at once.

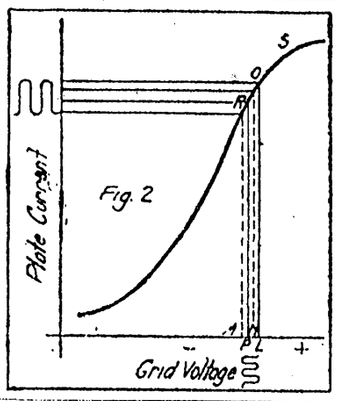
What did the C battery do? The distortion undoubtedly was taking place within the tube, due to improper operation with the tube, for the affiliated and another metallic object surrounding the grid called the plate. In this manner both grid and plate surround the filament, and the grid is interposed between the filament and plate.

equipment does not need to be changed. What causes the distortion?

The present day three-element vacuum tube is a device consisting of an evacuated chamber containing a filament that may be made incandescent by passing current through it so as to emit electrons, a grid surrounding the filament







Various experiments have conclusively proven that an object when contained in an evacuated chamber and made incandescent will emit electrons at a certain rate per second, this rate being dependent upon the degree of incandescence. It is in just this manner that the filament of the vacuum tube functions. Further, that when another metallic object (the plate) is placed within the chamber and given a positive charge in respect to the filament the electrons will be attracted to the plate, and a stream of them will flow from the filament to the plate. If we now insert a current indicating device in the plate circuit we will find that when the electrons flow across the tube (from filament to plate) the meter will indicate a certain value of current.

Now if we reduce the filament brilliancy, leaving the plate voltage at the same value, we will be reducing the number of electrons emitted from the filament and hence the number that reach the plate. When this is done we note that the reading on the meter has decreased. Therefore we can say that the plate current is in reality the electronic flow within the tube. The current flowing in the plate circuit at any time is usually spoken of as the amount of current the tube draws, and any further reference to that current in this discussion will be made under the name of "plate current."

Thus far we have determined that we can vary the plate current value by increasing or decreasing the brilliancy of the filament, thus increasing or decreasing the electronic emission. However, this method of varying the value of the plate current can only be carried on to a certain point, i. e., we can with a constant value of plate potential only increase the plate current by increasing the filament brilliancy up to a certain degree, beyond which the increased incandescence, although increasing the electronic emission, will show no increase in plate current. That point is known as the "saturation" point of the tube for that plate voltage.

We find, however, that there is another method of varying the plate current, and this is by varying the value of the plate potential. If we increase the applied plate voltage we increase the attracting power of the plate, and a greater number of electrons will reach it per second, and the current will increase, for if you remember we stated that the plate current is equal to the number of electrons that flow between the filament and plate.

On the other hand, if we decrease the plate potential the current will decrease, but it should be borne in mind that for every valve of plate potential the tube has its saturation point. If we maintain both the filament brilliancy and the plate potential at definite constant values the number of electrons that flow from filament to plate will be constant, and therefore the plate current will be constant.

Up to the presen ime we have made no mention of the grid and the part that it plays. Being located between the filament and the plate, directly in the path of the electronic flow, we may utilize it as a valve i e., control by means of it the number of electrons that will reach the plate. This is accomplished by placing either a negative or a positive charge upon it.

When it carries a negative charge the electrons emitted by the filament are repulsed by the grid, and less reach the plate, with resultant decrease in plate current; but if we change that charge so as to make the grid positive, the attracting power of the plate will be increased, a greater number of electrons will go toward it, very few remaining on the grid, and the value of plate current will be increased. Thus we have another means of controlling the amount of plate current that the tube should draw. This applies to all vacuum tubes, and now we will consider the tube as an amplifier.

When functioning as such it is a voltage operated device, which, when an alternating potential is impressed upon the grid, will reproduce the same alternations in the current flowing in the plate circuit, but these alternations will be of greater amplitude.

This can best be explained by means of a characteristic curve, and at the same time we will show how the distortion may occur within the tube or externally, due to its improper operation. Also how it may be remedied by the use of the C battery.

The curve is shown in Figure 2, and the vertical line on the left indicates the values of plate current, the lower horizontal line the values of both negative and positive grid voltage. This is assumed to be the values of the applied grid voltage due to the incoming signal. This wavy line indicates the operation of the tube, and is the characteristic curve. The bend S indicates the saturation point of the tube for the plate voltage being applied. Let us say it is 45 volts. O L is the ordinate or dividing line between the positive and the negative grid voltage.

We mentioned previously that if the filament brilliancy and the plate voltage are maintained constant the plate current will be constant and of a definite value. This is shown as the point O on the curve and its corresponding value on the left vertical line. This value is obtained when the voltage on the grid is zero.

Now we all know that the grid return lead of the amplifying transformer is connected to the negative lead of the A battery, and in this manner a small negative charge is applied to the grid. This charge being constant, the repulsion exercised by the grid upon the electrons emitted by the filament will be constant, and the plate current will be reduced a definite amount and maintained constant at that point. Let R indicate this point. Now a weak signal is applied to the grid, and as all these signals are of alternating character, charges of alternately positive and negative will be applied to the grid.

We will use R as the operating point on the curve and apply the alternating charges at that point. These charges are shown as M N on either side of the line R P. If the curve is studied two things will be apparent. First, the amplifying action of the tube, and secondly, the fact that the grid of the amplifying tube has at no time become positive, although a positive charge was applied to it. This is due to the constant negative charge upon the grid and the incoming signal, being of moderate intensity, was not great enough to overcome this charge.

Many undoubtedly wonder why the grid must not become negative at any time. That is the reason why the amplifier will not work if the grid return lead of the transformer is connected to the positive lead instead of the negative. When the grid is positive it draws a certain amount of current, exactly as the plate does, but the latter is of much greater magnitude. This current flowing between the grid and filament must pass through the secondary of the transformer, and this winding offers such high impedance to the current that the current is dissipated in the winding.

That is what must be precluded when the tube is functioning as an amplifier. If the incoming signal intensity is such that it can make the grid positive on the positive alternation, current will flow between the grid and filament on that half of the cycle, and as mentioned previously, the transformer winding will offer extremely high impedance to the current and that half of the alternation will be lost to the tube. When this condition is existent the alternations caused by the incoming signal are not even, and as they are faithfully reproduced in the plate current the wave form will be uneven, and this will be noticed by distortion.

BROADCASTING EXHIBITION.

Musical Comedy Stars Will Perform at Radio Show.

It will require a "dyed-in-the-wool" radio fan to concentrate on transformers and "socb" at the radio show in progress at Newark, Thursday afternoon, because there will be a galaxy of musical comedy talent in plain view before the microphone of the improvised studio located on the sixth floor of the Bamberger building, where all afternoon programmes will be broadcast throughout the week of the show.

On Thursday, Otto Kruger, leading man of "The Nervous Wreck," Ernest Truex, star of "New Toys," Joe Santley, popular juvenile star of the "Music Box Revue," and the entire chorus of beauties from the same show are all scheduled to "do their stuff," which will be sent out over the air to the radio audience. It is seldom that radio fans have had an opportunity to witness such spectacular broadcasting, while to those listening at home the programme should prove most novel and entertaining.

EDUCATION BOARD WILL USE RADIO

First Course to be Broadcast in New York To-morrow.

Programmes Designed to Acquaint Public with Work of Schools Will be Sent Out Daily.—Other Committees Throughout Country May Adopt Plan.

For the first time in the history of education, active use of radio broadcasting as an educational aid on an extensive and permanent basis will be inaugurated tomorrow, when the Board of Education of the city of New York, acting with the cooperation of the Radio Corporation of America, broadcasts through station WJZ the first of the daily educational radio programmes which have just been scheduled.

These programmes, arranged by the newly created radio committee of the Board of Education, will be broadcast from 2 to 2:30 o'clock on every school day. A special and permanent broadcasting apparatus is to be installed in the office of Dr. William L. Ettinger, Superintendent of Schools, and the programmes on every Tuesday afternoon will be broadcast by WJZ directly from there. On all other school days the programmes will be given at the studio of station WJZ.

The programmes are designed primarily to acquaint the people with the work of the schools and to educate the public as to education. Superintendents of each department of the Board of Education will in turn explain exactly what is done in his department, and to what purpose. In addition, the pupils of each school will take part in the later programmes with regular recitations, music lessons, glee club and school orchestra concerts, spelling bees and special exercises for holidays.

The first radio committee of any municipal Board of Education in the world has been created, with Frank A. Rexford as chairman.

New York city is thus the first city in the world to recognize and utilize the extreme value of radiophone broadcasting in education and the arrangements already consummated call for the largest municipal broadcasting programme which has ever been scheduled. Dr. Ettinger, Superintendent of Schools, states clearly in the following letter his appreciation of the value of the broadcast activities:

"Through the courtesy and co-operation of the Radio Corporation of America, we have been invited to broadcast short educational talks or features each school day, beginning Monday, Feb. 18, at 2 p. m.

"I see through radio service so tendered a wonderful opportunity to bring the actual work of the school system into closer relation with the home. I particularly need and desire the help and advice of every member of the school system in arranging for the public such a series of talks and educational entertainments as will make our educational series the subject of table talk in every home. In other words, I am desirous of giving the public over the radio a cross section view of the school system.

"The nature of the entertainment offered by the schools might very well include short talks on special phases of education, music lessons, songs, glee clubs, music appreciation, orchestras, recitations in reading English, history, civics, geography, arithmetic, nature study, science and the like, spelling lessons and exercises for special holidays.

It is expected that other boards of education throughout the country may follow the example of New York in adopting radio broadcasting in co-operation with local stations, with the possibility that a nationwide use of the radio in the school departments may result.

Dinner Music from New Jersey.

Once again, to-morrow evening, confirmed WOR fans will have an opportunity to listen in on Harry Cox and his Hotel Robert Treet Orchestra, who are scheduled to broadcast from the New Jersey station during the "Music While You Dine" period from 6:15 to 7:30 p. m. Cox's novel orchestrations achieving symphonic effect are considered by many one of the most enjoyable radio musical acts.

Care for Storage Battery.

Leaving the storage battery completely discharged will probably cause trouble. If you intend to close down your radio set for any length of time it is advisable to take the battey to some convenient service station, where it will be taken care of.

To Succeed Fan Must Have Patience

Don't decide that a receiving set is no good if it will not bring in signals clearly the first day you begin to turn the dials, say the old-timers. And, they add, if at first you don't succeed, try again. It frequently happens that the owner of a small set will experience keen disappointment for the first few days. This is simply because he does not know just how to operate it. As soon as the secret is learned by experience, results will be forthcoming. That is one reason why it is a good thing to use a set a few weeks before making up your mind that it is useless.

Superdyne in Modified Form Affords Excellent Reception

Addition of Variometer in Tickler Circuit Found by One Experimenter to Simplify Control of New and Sensitive Circuit

BY FRANCIS H. ARMSTRONG.

In order to compare the effectiveness of radio receivers it would be well for every radio fan to try all the available sets before he made up his mind which one was best suited to his needs. This, of course, would be a difficult proposition, due to the outlay of time and money. However, if some of the principles involved were known the experimenter would be in a position to know what type machine would fit his pocketbook.

The Armstrong regenerative receiver is sensitive, but lacks the ability to collect signals for long distance reception. In order to accomplish this feat of getting weak and distant signals in the telephone receivers, some method must be employed whereby we can amplify the signal prior to entering the detector tube. This form of amplification is known as radio frequency amplification.

Radio frequency amplification has been employed for a number of years in circuits using a tandem of radio frequency transformers as coupling between tubes. Results depended largely on the wavelengths involved, helped or hindered by the type of tubes employed in the set. Generally such amplification was best on the shorter wave lengths.

Another method of radio frequency amplification is employed in the neutrodyne circuit. Here the transformer secondaries are tuned and oscillation prevented by the neutralization condensers placed between the grids of successive vacuum tubes. An adjustment must be made at the neutralizing condensers whenever different tubes are inserted. Still another method is the combining of regeneration with radio frequency.

Radio frequency and regeneration have always been considered an ideal combination, but certain difficulties have always been present which rendered it next to impossible to accomplish the desired result on a commercial scale. One of the troubles has been the difficulty in obtaining stability; in other words, one or all of the tubes in the circuit would be thrown into oscillation, testing the skill of the operator to stop it.

One solution has been to keep separate the source of power supply for each tube of the radio frequency and other tubes, such as the detector and audio frequency amplifiers. It is quite obvious that such an arrangement would not lend itself to portability or economy, since a separate set of A and B batteries would become necessary for the radio frequency tube, the detector tube and the audio frequency amplifiers. The advent of the .06 ampere tubes makes it readily possible to supply a separate A and B group for each tube or group of tubes without adding materially to weight or cost. By using one 200 tube as a radio frequency tube, a 301A as a detector together with two 301A's as amplifiers, wonderful results could be had.

In recent articles published mention has been made of how engineers worked with various circuits, but failed to get the results they wished because of the capacity feedback of the tubes, and because of the difficulty in controlling the resonant circuits. Yet resonant circuits were desirable in order to obtain selectivity and distance, so essential in getting a receiver on the market.

It was here that the radio engineers conceived the idea that a change should be made. They found that when resonant circuits were present the tubes would oscillate and drown out everything that sounded like music. A simple arrangement was made, namely, reversing the tickler coil so as to feed the tubes negatively. That is, the circuit was given just enough negative feed-back to offset the positive feed-back of the tubes. This, then, stopped the tubes from oscillating, and brought the grid and plate to a resonant point.

The features that distinguish the modified superdyne from the set of the original superdyne will be explained in detail. The claims laid down for the modified superdyne are that it is more sensitive, more stable in operation, easier to tune, with lower battery consumption, and the use of standard parts. In the original superdyne circuit the tuned plate coil was used in connection with a variable condenser to tune that part of the circuit. It was composed of some 40 turns of No. 22 wire wound on a four-inch tube and tapped at the 25th turn. While experimenting with this plate coil in order to get away from the taps and variable condenser, a variometer was placed in series with the coil, as shown in the diagram. After some exhaustive experiments it was found that the variometer as used gave more gratifying results than a condenser and tapped plate coil. This method was believed to tune much sharper with only one control as compared to two controls in the previous circuit.

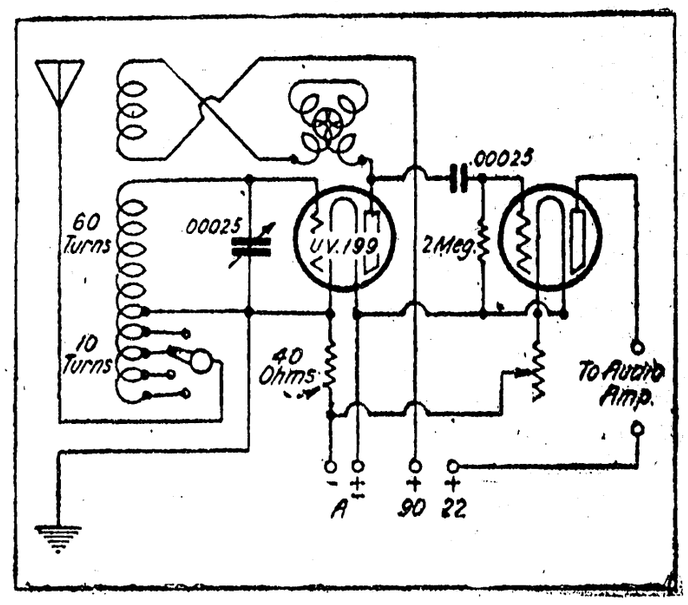


Diagram of Connections in Modified Superdyne Circuit.

The primary coil consists of a composition tubing 3½ inches in diameter and five inches long. Upon this tubing is wound 100 turns of No. 24 green silk-covered wire. The primary is tapped every 10th turn for the first 40 turns, making four 10-wire taps, allowing the rest of the 60 turns to go untapped to the end of the coil. The diagram shows this fully.

The secondary, or roter ball, measures 2½ inches, and is seated in the primary like a standard variocoupler. Thirty turns of the same size wire are wound on each section of the ball, making a total of 60 turns. No tapping whatsoever is done here, but connections are made with the variometer in the circuit. Particular attention should be paid to the connections between plate coil and variometer, so that the plate coil will have its tickler connections reversed.

The condenser shown in shunt to the 60 turns in the primary is of .00025 mfd. capacity or an 11-plate condenser. Any tubes and transformers may be used. The photograph at the bottom of the page shows a 200 tube used in the radio frequency stage and a VT1 as detector, a VT1 in the first stage amplifier with a VT2 tube as the second stage amplifier. The circuit shown is for use with an outdoor antenna or loop. Should the set be used with a short indoor antenna the filaments of the vacuum tubes should be grounded and the antenna connected to the grid of the radio frequency amplifying tube, leaving out the antenna or tapped primary coil. If the .06 amphere tube is used as a radio frequency amplifier in conjunction with a 6-volt storage battery, it is best to use a 40-ohm rheostat in the filament circut of the tube.

As with almost any set it is necessary to learn to tune properly to get the remarkable results that are possible with this circuit. Long distance reception has been had on a loud speaker using four tubes. Compared with a good standard regenerative receiver the superdyne gave much better reception. The operation of this set is similar to that of any regenerative receiver. Fortunately the dial of the plate coil can be calibrated in terms of wave lengths. The dial may then be set for the station desired and then left alone, while the grid circuit and feedback are adjusted for their respective signal intensity. By carefully adjusting the reverse feedback against the positive capacity feedback tremendous amplification can be obtained without oscillation or distortion.

Anyone trying out this set should follow the data exactly as given. Everything depends on the reverse feedback and the type of tubes used. This is important if reception over long distance is to be had.

NEW TRANSMITTER FOR RADIO RELAY

Programmes Conveyed to Station by Portable Device.

Electrical Vibrations Amplified and Carried to WGY Studio Where They Are Put on the Air.—Re-broadcasting Does Not Affect Quality of Speech.

A short wave radio transmitting set which may be transported to the scene of church services, concerts, dramatic performances or lectures as easily as a motion picture camera man is sent on news weekly assignments has been introduced as part of the broadcasting equipment of WGY, a Schnectady station.

This set is not used to broadcast directly to the listener, but is a radio relay which conveys the programme to the broadcasting station. This first radio transmission cannot be tuned in on the average radio receiving set.

The portable transmitting set is conveyed to the hall or church from which it is desired to broadcast an entertainment or sermon. Wire connection is established between microphone or pick-up within the hall or church and the transmitter of the portable set outside. The wave length is too low to interfere with the usual receiving sets or broadcasting stations, and it is also so low that there can be no interruption from spark transmitters by armatures.

By means of a sensitive receiving set located near WGY, the electrical vibrations into which speech or music has been converted are picked up, amplified and then conveyed to the main transmitting equipment of WGY, from which the programme is put on the air on the licensed wave length of the station, 380 metres.

Prior to the introduction of the radio relay it was customary for WGY to connect church and radio station by wires. Wire installations required considerable preparatory work and because of the time involved in making the necessary installations some programmes that might have proved instructive and enjoyable had to be omitted. The small transmitting set is mounted in a covered truck and may be taken to hall, theatre or church, where in a short time the installation will be complete and ready for service.

Re-broadcasting does not affect the quality of music or speech. WGY has made frequent use of the radio relay method, and the listeners were at no time aware that a radio transmitting set working on a low wave length had supplanted the wire link in the system.

There is another and even more important use for the small transmitting set in radio relay, and this use suggests a particularly interesting development for radio in the future.

In the relay now in common use at WGY the small station is used to feed into the larger transmitting set through the introduction of a receiving set between the radio links. It is possible that the future will see many of these small transmitting sets scattered about the country, and used to rebroadcast on lower wave lengths concerts received on a sensitive receiver from any one of a half-dozen main stations, for the benefit of listeners with crystal sets or short distance receivers.

For example, such a receiving set might pick up the best of the WGY programme from Schnectady and then a special feature from WJZ or other station, and by the use of the transmitter reradiate to the countryside within a limited distance of the station.

This would give the man with the small outfit the advantage of listening to a selected programme, the best of [illegible] stations. In this manner he would be able to get programmes and to get music that would not otherwise be available to him on his set.

Reviving Flowers With Drugs.

A French chemist claims to have discovered that aspirin will revive flowers that have commenced to wither. He has found that an ordinary aspirin tablet dissolved in a vase or glass of warm water will freshen the most fragile of cut flowers.

Woodrow Wilson's Voice Radiated in 1919

Woodrow Wilson was the first President of the United States to have his voice sent through space by radio. This was before broadcasting was anticipated. He was coming home from France on board the S. S. George Washington, which was equipped with one of the finest radio telephone transmitters developed up to that time.

On July 4, 1919, President Wilson spoke to the crew when the ship was several hundred miles off the American coast, and his voice was radiated from the ship's aerial. It was intercepted at the naval radio station NBD, Otter Cliffs, Bar Harbor, Me. The radio receivers were pressed close to the mouthpiece of a telephone transmitter, which served on the end of a telephone line leading direct to the White House. Radio telephony at that time was not perfect and his voice varied as the higher pitches were received clearer and with greater volume than the lower tones of his voice.

PUZZLING PROBLEMS

Tricks and Solutions That Furnish Entertainment for the Family

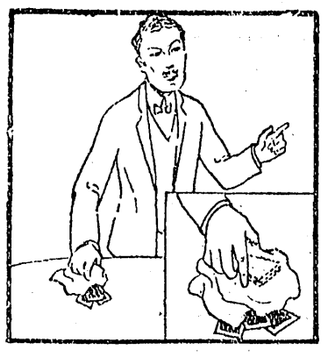
"secret" blindfolds the trickster and then points to several numbers. As he points the trickster pretends to concentrate and then, unerringly, names the number. At the conclusion he gives the sum of the numbers.

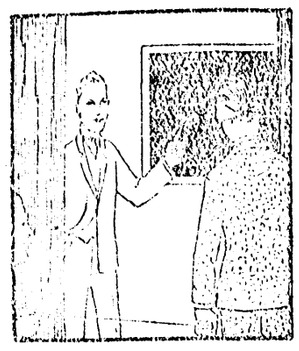
A second assistant, who is hidding, has an important part in the secret. He holds one end of a silk thread. The other terminates in a bit of wax by which it is attached to a chairback. After he is blindfolded, the trickster gets this bit of wax in his hand. While he appears to concentrate he mentions several numbers, apparently at random. When he mentions the correct number the hidden assistant jerks the thread, thus signalling to the trickster. The hidden assistant must be placed where he can see the blackboard but cannot be seen by the spectators.

MIND READING.

A pack of cards is shuffled by the spectators and the performer is blindfolded. He takes the cards in his hand, face downward. He names a card and turns the top card face upward. It is the card he named. In a like manner he names half a dozen or more cards.

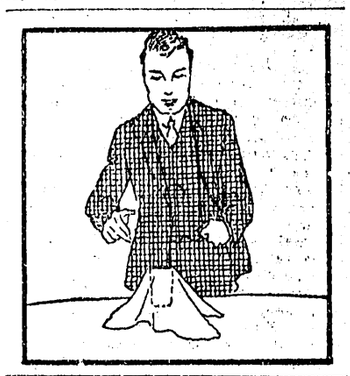
The trick depends upon the exercise of little skill but of much old-fashioned "nerve." In the performer's pocket are eight or nine cards arranged in a definite order which the performer has memorized. In the same pocket is a handkerchief. After the cards in the pack are shuffled, the performer puts them in a rather untidy heap on the table. He reaches into his pocket and brings out the handkerchief, and hidden by the handkerchief, the prearranged cards. He places the handkerchief carelessly on the table. With a little care he can manage that the hidden cards will fall on those which have been shuffled. While he is being blindfolded he picks up the cards and squares them neatly. "Reading" the cards is then simplicity itself. He should never "read" all that he has prearranged.





HIDDEN SPIRITS

This stunt does not amount to much if badly presented. With a little care in working up the effect, however, it can be made very puzzling. The effect is that a spectator places a tumbler on the table, drops a coin into it and covers it with a handkerchief. The performer pretends to organize the hidden coin. At his command it jumps up and down in the glass, ringing any number requested. At any rate, it seems to do that because the spectators, who are not too near, hear it ring. The secret is another tumbler, a small one in the trickster's hip pocket. In this is a coin to which a thread is attached. The other end of the thread is fastened around a suspender button on the left side. The thread is slack enough so that the spectator can catch it around the little finger of his left hand. An imperceptible movement of the little finger will cause the coin in the hidden glass to hop up and down, making the ringing



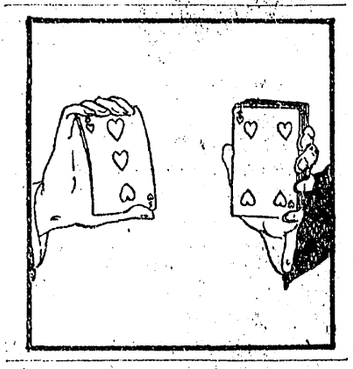
sound. At a few feet it will appear to come from the glass on the table.

The best part of the trick is to make suspicious movements with the right hand, leading the spectators to believe that the coin in the glass in the table is animated by a thread attached to it. If some confident spectator snatches the handkerchief away and accuses the trickster of doing the trick in that manner, the trickster can easily turn the laugh on him and at the same time divert attention from the real solution of the mystery.

THE PAINT BRUSH.

This is one of the most puzzling of card tricks which can be performed without skill. Before presenting the trick put the four of hearts face down on the table. On this, face upward, put the two of hearts. On this, face downward, put the five of hearts. On the face of the pack put the three of hearts.

Pick up the three cards with your right hand, holding them as if they were only one card. This can easily be done if you hold the cards with your fingers at one end and your thumb at the other and



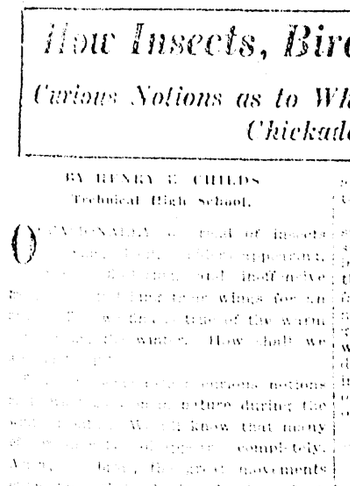
slightly bend the cards, the convex side toward the spectators. Hold the pack with the other hand, the three of hearts toward the spectators. Show that the three is on the pack and the four in your right hand. Rub the face of the four against the face of the three. The three changes to a two, the heart in the centre seemingly joining joining itself to the four because that card changes to a five.

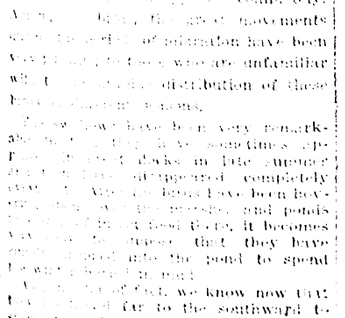
The trick is that when the reinforced four is placed on the pack, the right hand carries away only the five. Try the trick with the cards in your hands and it will present no difficulties.

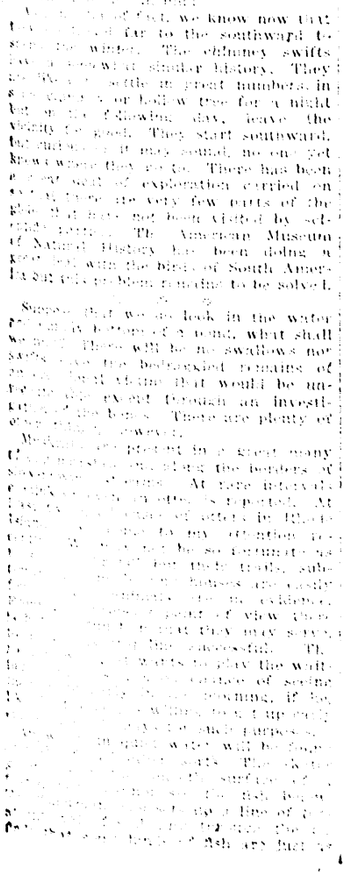
How Insects, Birds and Animals Spend the Winter

Curious Notions as to What Goes on in Nature During Cold Weather Months. Chickadees Most Abundant Here This Season

BY HENRY E. CHILDS
Technical High School.







BY SIMPLE MEANS

The Outlet Community Silver Club

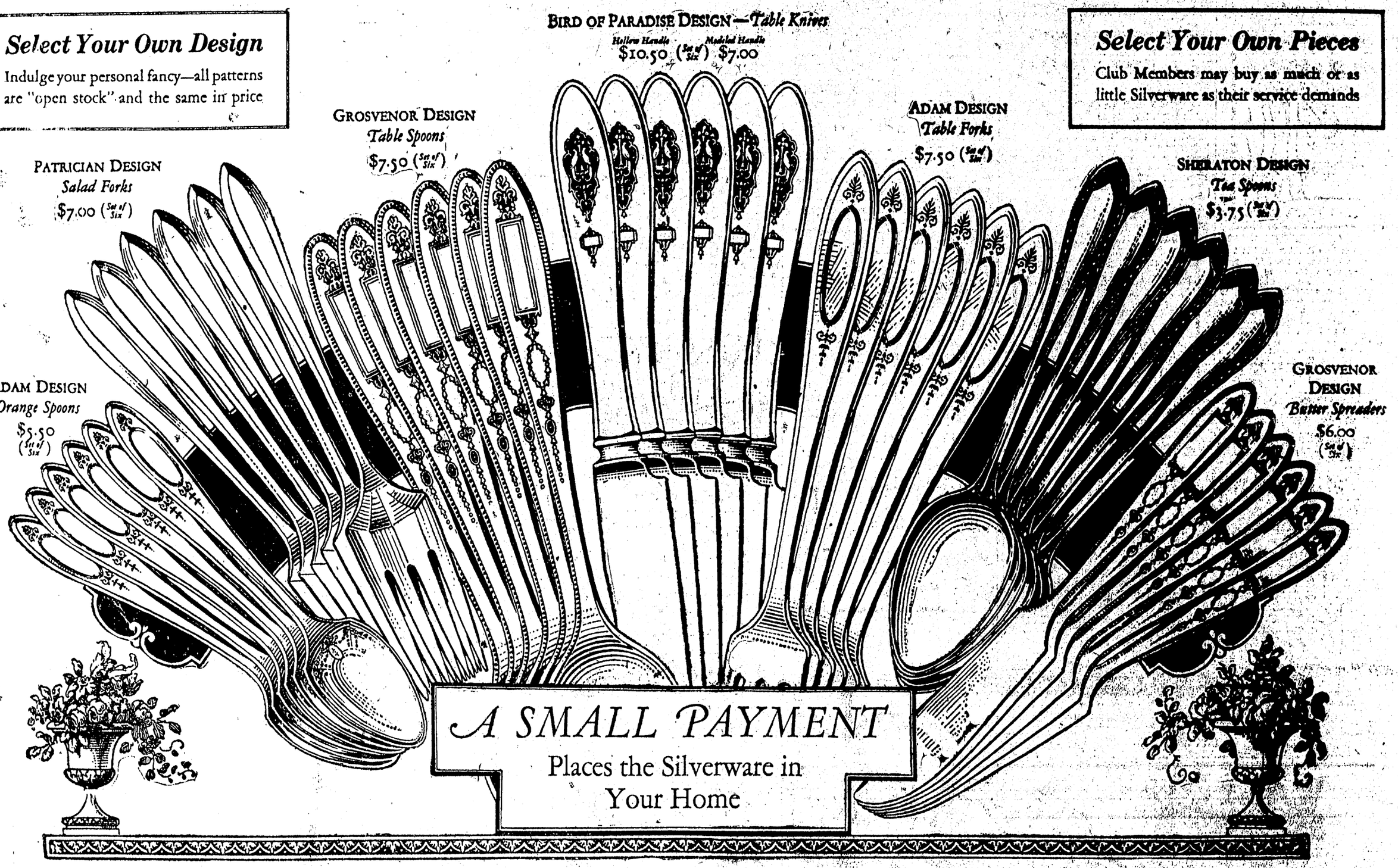
Opens Monday—Join Any Day During Truth Week

Select Your Own Design

Indulge your personal fancy—all patterns are "open stock" and the same in price

Select Your Own Pieces

Club Members may buy as much or as little Silverware as their service demands



A SMALL PAYMENT

Places the Silverware in Your Home

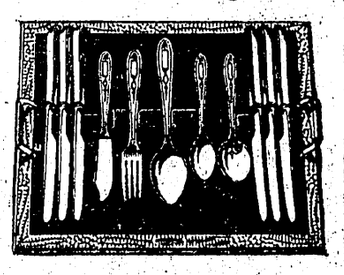
BY a Special Arrangement With the Oneida Community, Ltd., we have secured the services of one of their factory experts — Mrs. Primo. She will be glad to explain the superior merits of Community Plate, also to answer any questions concerning the usage and care of this Table Silverware de Luxe.

No Charge for Engraving

MANY HOUSEWIVES WILL PREFER A

26-Piece Set $28.25

Correct Service Tray Without Charge



CONTENTS AS FOLLOWS

6 TEA SPOONS	6 DINNER FORKS
6 TABLE SPOONS	6 DINNER KNIVES
1 SUGAR SPOON	1 BUTTER KNIFE

$5 Down—$1 Weekly

$5 DOWN Is all that is required to place any set up to $55 in your home. The only other detail is a payment of $1 a week until the full amount is paid. Higher price sets can be had by paying a larger amount down. This is all you have to do to join our Community Silverware Club.

Other Popular Pieces

Dessert Spoons	Set of Six	$7.25
Bouillon Spoons	Set of Six	7.00
Coffee Spoons	Set of Six	3.75
5 O'C Tea Spoons	Set of Six	3.75
Soup Spoons	Set of Six	7.50
Iced Tea Spoons	Set of Six	6.00

Here, Madam, is your chance! Haven't you always longed to possess enough beautiful silverware for all occasions? Our purpose is to put Community Plate—the tableware of distinction—within the reach of every housewife in this locality.

See Our Window Display of Silverware—also the Coles-Phillips Original Painting of the "Community Girl"

Silverware Store—1st Floor, Center

And may we Suggest:

Oyster Forks	Set of Six	$5.00
Cream Ladle	Each	2.00
Cold Meat Fork	Each	2.25
Butter Knife	Each	1.25
Gravy Ladle	Each	2.50
Berry Spoon	Each	3.25

The Outlet Company