New R. F. Receiver Designed to Obtain Maximum Amplification

Browning-Drake Neutralized Circuit Which Has Won Favor Throughout Country Eliminates Capacity Effect.—Set Does Not Radiate, Expert Says

If you will stop to consider the development of any of the successful circuits you will discover that these circuits have been worked out not by guesswork or haphazard experimenting, but by actual scientific investigation. This is true of the Browning-Drake circuit, a new type of receiver developed by two students at Harvard University.

They started to determine exactly how much amplification, theoretically, should be obtained from a stage of tuned radio frequency such as is used in the familiar tuned R. F. or neutrodyne circuits. It was a lengthy process, requiring several months to make calculations and plot curves because of the many elements to be taken into consideration.

The final figures showed that the amplification obtained in the average radio set was only a fraction of what a perfect amplifier would produce. Then, with this data as a working basis, they set about in the Cruft Laboratory at Harvard University to design instruments in accordance with the calculations they had made. As is usually the case, the first set was not successful. In fact, the amplification was hardly as much as that produced by other sets, and only a fraction of what the curves showed as maximum. After the length of time spent on the problem, these results were most discouraging, particularly because they did not show what might be wrong.

There was one factor, however, that they had not considered, that is, the capacity between the windings in the radio frequency transformers. Then, by a slight change which would not have occurred to most of us, the capacity effect was eliminated and the amplification brought up far above the usual value and within 10 per cent. of what the data showed as the greatest possible value.

The Browning-Drake circuit, as it was finally worked out, consists of one stage of tuned radio frequency, a detector, and two-stage audio amplifier. While two stages of radio frequency can be used, on all ordinary signals there is so much amplification with four tubes that it is often necessary to cut down to prevent overloading the last audio amplifier.

Sets using this type of circuit cannot be purchased ready-made, but they are exceedingly simple for the set builder to make up himself and give such results in long distance reception that radio men all over the country are building them in their own workshops.

Not only is the outfit easy to assemble but it is simple to operate, for there are only two tuning controls, the secondary and R. F. condensers, and an auxiliary adjustment which is practically constant over the entire wave-length range. Both dials can be calibrated for various stations and these calibrations do not change even though different antennas are employed. For local reception a loop can be used, although an antenna of one wire 100 feet long and 20 to 40 feet high gives the best results.

A peculiar characteristic of the Browning-Drake circuit which is strongly in its favor is that, although regeneration is employed, if the adjustments are set so that the circuit oscillates even the least bit the signals are distorted so badly that no one would operate the set in an oscillating condition. Therefore, there is no tendency to allow the set to oscillate and, in that way, interfere with reception at other stations.

How to Build and Operate Browning-Drake Set

Following is a list of materials used in the Browning-Drake receiver referred to in this article. Other parts of equal electrical values may be substituted for those specified, but the design of the coils should be identically the same.

One National regenaformer kit, consisting of one antenna coil mounted on a .0005 mfd condensor, and one regenaformer mounted on a .00035 mfd condenser. Both condensers are equipped with four-inch velvet vernier dials. The kit also includes the necessary hardware for mounting.

Four standard-base, cushioned sockets.

Two Samson audio-frequency transformers, type HW-A2.

Two rheostats, 20 ohms each.

One improved anti-capacity jack, open circuit.

One sub-panel.

One 1 mfd bypass condenser.

One Sterling microdenser (neutralizing condenser).

One .00025 mfd grid condenser, with clips for mounting gridleak.

One 2½ megohm gridleak.

One fixed mica condenser, .001 mfd capacity.

One panel, 7 by 24 by 3/16 inches.

Seven binding posts.

Four Schickerling tubes, $1400.

The chief difficulty encountered in building a transformer that would measure up to the predicted values was caused by capacity coupling between the primary and secondary. This difficulty was minimized by winding the primary in a narrow channel cut in a short cylinder fitted closely inside the secondary, as shown in Fig. 1.

Later development work proved that the high radio-frequency amplification obtained could be increased three or four times by utilizing a regenerative detector, and altering the constants of the circuit to take account of the decrease in resistance in the secondary as a result of the feedback action.

All the instruments are mounted on a sub-panel, with the exception of the regenaformer, radio-frequency transformer, jack and rheostats. This sub-panel greatly simplifies the wiring, as all the battery leads are imbedded in the panel. Connections are made to the battery leads by means of small "contact washers" which are bolted to the sub-panel.

By sinking the battery leads slightly below the surface of the sub-panel, the danger of short circuits occurring has been reduced to a minimum. Accordingly, the audio-frequency transformers, even though they have metal bases, are mounted directly over the battery leads. The radio-frequency amplifier socket is mounted between the two variable condensers. The grid leak and condenser are mounted on the sub-panel directly beneath the variable condenser of the regenaformer. The 1 mfd bypass condenser, which is connected from the negative filament line between the rheostat and battery lead in the sub-panel to the 90-volt lead, is placed beneath the sub-panel.

The regenaformer and radio-frequency transformers, with their respective tuning condensers, are mounted on the main control panel. In order to do this it is necessary to remove the dials from the condenser shafts. First, remove the knob and then unloosen the screws which hold the dial in place, then take out the four screws which hold the gear box in place. Undo the set screw on the collar which fits over the condenser shaft. Three spacing washers will be found on the screws which hold the gear box; these washers are not used.

Drill a one-half inch hole for the shaft and gear-box collar and then use the flange on the gear box to locate the mounting screw holes. Then replace the gear box, dial and knob. Turn the condenser until the plates are interleaved, set the dial at 100 and fasten the set screw.

Templates are furnished with the rheostats; three holes are necessary for the mounting of each of these units. The indicating dials of the rheostats are fastened direct to the panel. Flat-head screws should be used in mounting the dials.

A filament switch was not used in the receiver shown. A switch, however, is really essential and should be included. This control should be mounted on the panel. To make the necessary connections it is necessary to break the positive filament lead and connect the switch in series.

It will also be noticed that a single jack is shown in the wiring diagram. Because of the tremendous volume delivered by this receiver, it is recommended that a double-circuit jack be inserted in the plate circuit of the first audio-frequency amplifier tube.

Satisfactory loud-speaker reception may be had by using only three tubes for all local and near-by stations. A filament control jack should be used in the plate circuit of the last tube so that the filament of this tube can be automatically turned off when the plug is withdrawn from the jack.

In order to avoid mistakes the wiring of the radio-frequency amplifier will be explained thoroughly. A connection is made from the antenna binding post to one side of the .0001 mfd fixed mica condenser (which is concealed beneath the sub-panel).

The other side of the fixed condenser is connected to the soldering lug on the radio-frequency transformer, marked "A2." Then connect from the soldering lug marked "G" to the ground binding post. Connect from this line to the rotor plate terminal of the condenser and continue to the negative filament line, making the connection between the lead imbedded in the sub-panel and the rheostat.

A connection is then made from the lug marked "A1" to the grid terminal of the radio-frequency amplifier tube socket; this line also connects to the fixed plate terminal of the variable condenser and also to one terminal of the neutralizing condenser. The remaining terminal of the neutralizing condenser is connected to the tap on the secondary of the regenaformer.

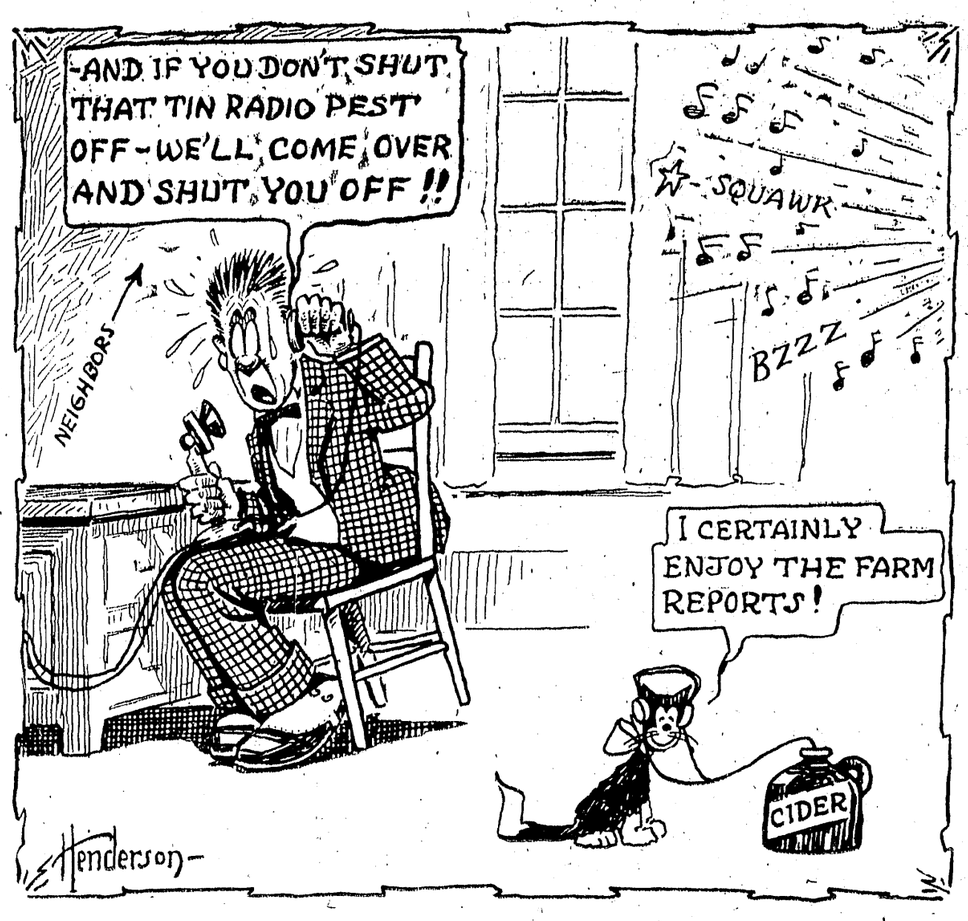
The plate terminal of the radio-frequency amplifier socket is connected to the soldering lug of the regenaformer marked "P." The "B" terminal of the regenaformer is connected to the 90-volt "B" battery lead imbedded in the sub-panel. The "F" terminal of the regenaformer is connected to the positive filament lead.

It is advisable to run the connection from the rheostat to the filament terminal of the radio-frequency amplified beneath the sub-panel. A small hole should be drilled adjacent to the negative terminal of the tube socket and another small hole should be made directly under the terminal of the rheostat. Make sure that neither of these holes is drilled in the sub-panel where there might be danger of forming contact with one of the battery leads. Drill the holes in the centre of the bakelite between the battery leads.

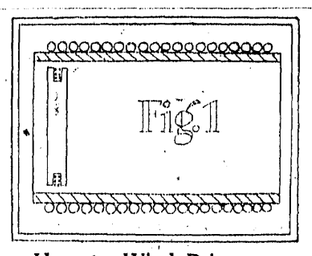
After wiring has been completed, carefully check all connections to make sure that no error has been made. Be abso-

Continued on Page Nine

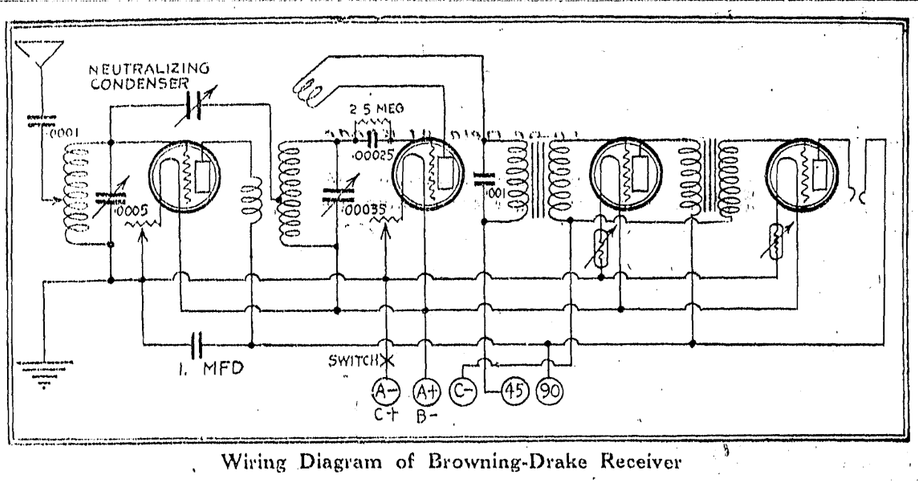
To-day's Hook-Up



His "Broadcasting" Set Was Not Appreciated



How to Wind Primary



Wiring Diagram of Browning-Drake Receiver

JOHN SMITH AND HIS RADIO BOX

STUDYING THE WAVE

Trying to figure out what made his radio set work was beginning to furnish Smith with as much enjoyment as the programmes. What puzzled him most was that radio waves could penetrate the brick walls of the house. Nor could he understand why, granting that the waves did get inside the house, reception should not be just as strong with the loop as with an inside aerial which he had strung around the picture molding.

"Besides," he continued, "how can all these concerts be on the air at the same time without interfering with each other and producing a jumble of noise? And why can't we hear this without a set?"

"You'd better stop right there," I cautioned him. "When the operation of your automobile engine puzzled you, I suggested following a drop of gasoline from the tank to the exhaust. Now, with your radio you've got to follow some such procedure, only this time we'll start with a radio wave.

"The trouble is that even after you visualize radio waves as very much like the ripples that passed to the distant shores when, as a boy, you dropped stones in the lake, you cannot pin too much faith on this explanation. The waves you created in the lake passed through the medium of water, whereas those set up by the broadcasting stations are supposed to travel through the hypothetical substance known as ether. But Einstein, the German physicist, upset the ether theory, and so, more or less, upset the radio wave idea.

"However, it is obvious that some kind of electro-magnet energy must pass from the broadcasting station to your receiving set, and that it must pass through some kind of medium on a certain wave length, otherwise there would be no radio communication, but just a jumbled reception, in the event that uncontrolled energy were transmitted. The wave idea seems to offer something to stand on.

"You probably noticed when dropping stones into the lake that their size and the frequency with which you dropped them had much to do with the character of the waves created. Big stones caused deep waves. Dropping stones in quick succession set up trains of waves. Most of the waves, whether created by big or little stones, seemed to reach shore, although sometimes you could detect those from the smaller stones only by the almost imperceptible movement of a floating leaf. All this is true of radio when you substitute for the stones electrical energy and ether for the water. Stations broadcast with varying strength and on different wave lengths which are determined by the frequency of the electrical discharges. The more sensitive your set is, the more likely it is to pick up the energy of the waves at a distance from the station."

Smith was following closely but interrupted to ask how music and speeches were transmitted when I was describing the whole business in terms of electricity.

"That's the surest part of it," I explained. Sound is vibration. At the broadcasting station they send a controlling current through what is, in reality, a telephone mouthpiece. The vibrations of the speaker's voice varies this current which, in turn, varies the carrier waves passing out into the air. When you tune your set you bring it into resonance with the original vibrations carried on the particular carrier waves.

"The sort of waves sent out by the broadcasting stations are known as undamped, or continuous, waves, just as if you created a continuous train of water waves by dropping stones with perfect regularity. A thing you probably will be surprised to know, however, is that the energy that goes out over the air and back through the ground, completely reverses its direction anywhere from 60,000 to 1,000,000 times per second. The house current, for your electric lights alternates, or oscillates, only at the rate of 60 times a second.

"When you get to be a radio expert, you will speak of these oscillations as cycles and will probably speak of your pet station as broadcasting at so many cycles instead of on a certain wave length, because the wave length is determined by the cycles. And if you can stand for one more shock, let me remind you that these electro-magnetic waves travel through space at the rate of 186,000 miles a second!"

"To think of all this going on in the air and we can't even see, hear or smell it with our senses!" Smith exclaimed.

"The trouble with the radio wave is that it's too long for us to see and too short for us to hear. The waves of visible light are measured in millionths of a millimeter. We are extremely limited on our upper range of hearing. So to make up for his natural deficiencies, man builds himself a receiving set."

"Superman, you mean," Smith paid compliment to the pioneers in radio. "Let's tune in some jazz until I digest this a bit."

EXPLAINS VALUE OF C BATTERIES

Proper Use In Set Cuts Down Drain on B Cells.

No Decrease In Strength of Sounds Produced in Loud Speaker.—Unit Being Incorporated in Practically All Multi-Tube Receivers, Expert Points Out.

Because of the marked saving in B battery current resulting from installation of the C battery, this unit is being incorporated almost universally in multi-tube sets. No one who uses a C battery doubts its value but comparatively few understand how and why it accomplishes such wonders. The answer to the effect that "keeping the grid negative reduces the plate current," is not at all explanatory.

This much is true but it is far from a complete explanation. If we reduce plate current, why do we not reduce signal strength?

The amount of plate current has no direct bearing on signal strength. As soon as you light the tubes on your set, both the A and B batteries begin to expend some of their energy.

When a station is tuned in, there is no change in the milliamperes drawn from the plate battery. The only change which the incoming signal produces upon the plate current passing through the loud-speaker unit are variations or fluctuations at audio-frequencies, as determined by the speech or music being broadcast. The volume of the signal is determined by the amplitude of the fluctuations and not by the amount of plate current.

In the same way, the height and frequency of waves of a turbulent sea are quite independent of its depth. As long as there is sufficient depth of water available to permit the development of the highest possible conditions, there is no gain in the size of the waves by an increase in the depth of a sea by a hundred or a thousand feet.

Likewise, as long as the plate current is sufficient to accomplish the variations caused by changes in the grid potential as impressed upon it by the incoming signal, you obtain the maximum result in plate current variations. Oftentimes, an efficient set drawing but 7 milliamperes from the plate battery may give a louder signal than an inefficient one drawing 25 milliamperes.

A very strong loud-speaker signal is produced by variations in plate current amounting to 4 milliamperes. With the set drawing an average of 7 milliamperes, therefore, the variations caused by the incoming signal cause the plate current to rise and fall between limits of 5 and 9 milliamperes. With the wasteful 25 milliamperes set, the variations still remain at that average drain, rising to a maximum of 27 and falling to a minimum of 23 milliamperes. The only difference in actual result between the two sets is that the B battery drain in the efficient set is but 30 per cent. of that of the wasteful one. This is reflected directly in upkeep costs.

Now that we understand there is no loss in signal strength through the addition of the C battery, the inquisitive listener still seeks the explanation of why the battery serves to reduce the plate current so effectively. A rudimentary knowledge of the characteristics of a vacuum tube is necessary to make this clear.

The heated filament of a vacuum tube gives off electrical bodies known as electrons which are liberated as soon as the filament is lighted. A strong tendency to drift to the plate is created through the connection of a high voltage B battery in the plate filament current, which causes a continuous flow of plate current. En route from the filament to the plate, the electrons which constitute this current flow, must pass through the meshes of the grid.

The charge on the grid varies in accordance with the signals impressed upon it from the antenna system. When the grid is positive, it supplements the plate potential in attracting electrons to it, causing increased plate current. When the grid is negative, the charge opposes the flow of electrons toward the plate. Consequently, the plate current varies in accordance with the voltage impressed upon the grid.

Indeed, this element of the tube may be considered as a sieve, the openings in the meshes of which vary in accordance with an incoming signal. The addition of the C battery simply causes these meshes to reduce their size by a definite proportion, resulting in smaller plate current and B battery economy. Incoming signals serve to reduce and increase their size to the same degree as before, except that the fluctuations in plate current thus produced are impressed upon a smaller plate current. Thus we have no sacrifice in the amplitude of fluctuations, which produce the all-essential signal, but we do obtain them at less expense of plate current.

RADIO FREQUENCY SET DESIGNED

Continued from Page Eight

lutely certain that the contact washers are forming contact with the proper battery lead. Then connect the batteries and insert the tubes. The set is now ready to be neutralized.

In the process of neutralizing, body capacity is sometimes troublesome, and a long, thin stick will be found very useful in setting the neutralizing condenser to the proper value. The end of the stick should be cut "wedge shape" to fit the small slot in the movable segment of the neutralizing condenser. Do not use a screw driver or other metallic instrument.

Tune in a loud signal, preferably from a local or near-by station, whose wavelength is below 300 metres, and adjust the controls for the minimum volume. Where a rheostat is used to control the filament of each tube, as is the case in this receiver, it is not necessary to insulate the filament prong of the tube in order to obtain neutralization. Simply turn the rheostat which controls the filament of the radio-frequency amplifier to the off position. An audible signal should be heard when the filament of this tube is not lighted. With the tube in its socket but with the filament unlighted, adjust the neutralizing condenser, turning the movable segment with the stick, until no signal is heard, or it is heard with minimum volume. If complete neutralization is effected, no signal will be heard.

If at no point of the neutralizing condenser a minimum signal is heard by varying the adjustment, then the connections to the primary of the regenaformer must be reversed and the process repeated.

The following suggestions may be helpful in operating the receiver. Adjust the tickler coil to such a position that a "click" will be heard when the finger is placed on the stationary plates of the regenaformer tuning condenser.

Vary this condenser until a whistle is heard. This whistle is produced by the incoming carrier wave beating with the wave generated in the secondary circuit. Rotate the tuning condenser for the radio frequency input until the whistle is loudest and then adjust the tickler until this beat disappears. A very slight adjustment to both condensers may now be necessary to bring the signal in with maximum intensity and clarity.

The dial setting of the regenaformer tuning condenser may be logged for future reference and stations once heard may be tuned in any time that particular station is broadcasting, providing receiving conditions are favorable.

The ground lead should be as short and direct as possible. Usually the best practical ground is found to be the cold-water pipe. The lead should be connected to the water pipe by means of a ground clamp, solder the lead to the clamp. When the clamp is to be fastened to the pipe the surface should be thoroughly cleaned. Use a file or piece of coarse emery cloth.

Just a few words about the tubes used in the receiver. The special radio-frequency transformer was designed for the C299 tube. However, any tube whose internal capacity is small may be used. The Myers III Mu and the tube specified in the list of material both give excellent results. If one of the miniature tubes is used (C299 or UV199) it may be controlled by a self-adjusting rheostat without the necessity of running a separate tap from the four-volt terminal of the battery. This method of controlling the filament is preferable to a hand-operated rheostat (where the miniature tube is used) and it eliminates the danger of causing damage to the tube by advancing the rheostat too far if operated direct from the six-volt battery.

The tube specified in the list of materials may be used either with dry cells or storage batteries, as the filament current consumption is but 10-100 amperes per hour, or slightly less than three-quarters of an ampere per hour for the four tubes.

The six-volt quarter-ampere storage battery type tubes (C301A, UV201A) may be used throughout, but it was found to be somewhat more critical in adjustment when one of these tubes fas used as a radio-frequency amplifier. If the constructor prefers to use tubes of this type, it is advisable to use one of the other type tubes mentioned above as a radio-frequency amplifier.

RADIO PROGRAMMES

Among features on local broadcasting programmes this week is a "radio wedding" to be broadcast by Station WEAN Thursday evening from Rhodes, where a home exhibit is being conducted. This station will broadcast during the week the noon-day Lenten services at Grace Church, the speaker being Rev. P. B. Clayton, Vicar of All Hallows by the Tower, London. The programme in connection with the dinner of the Friendly Sons of St. Patrick will be broadcast from the Narragansett Hotel by Station WDWF Tuesday evening. Station WJAR offers specialties from its New York studio during the week, including a concert by the Philharmonic Society Wednesday and a WEAF home talent night concert Thursday. WSAD presents its orchestra and other members of its entertainment staff in a programme from "The Old Hair Cloth Trunk" Thursday.

WJAR, THE OUTLET COMPANY

(306 METRES)

TO-DAY.

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

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

10:15 p. m.—Miss Helen Gahagan, appearing in "The Sapphire Ring," will broadcast through the courtesy of the Providence Opera House management.

MONDAY.

10:00 a. m.—Housewives' Radio Exchange. A department conducted by Mrs. Wood on all matters of household interest; 1:05 p. m.—Juliana Allen, soprano; Eddie Pierce, piano; Carl Agornick, violinist; Miss Alice McHugh, reader.

7:30 p. m.—Talk on the Girl Scouts.

8:00 p. m.—Joseph H. Benson, baritone.

8:10 p. m.—Edward Sweeney, tenor.

8:20 p. m.—Maurice Goldsmith will give a talk on first aid.

8:25 p. m.—Doric Quartet.

8:50 p. m.—Mrs. Gertrude Wilcox Harrop will give one of a series of talks on Red Cross.

9:00 p. m.—A. & P. Gypsy String Ensemble.

TUESDAY.

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

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

9:00 p. m.—"Everready Hour."

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

WEDNESDAY.

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

1:00 p. m.—New Twin Elm Orchestra under the direction of Joe McNamara.

7:30 p. m.—Elizabeth Kunzer, pianist. Programme from New York.

7:50 p. m.—Louis Zeidler, tenor, accompanied by Kathleen Stewart.

8:05 p. m.—Elizabeth Kunzer, pianist.

8:10 p. m.—Louis Zeidler, tenor.

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

10:15 p. m.—WEAF Light Opera Quartet, consisting of Grace Dennis, soprano; Doris Doe, contralto; Frank Outhbert, baritone, and James Haupt, tenor.

THURSDAY.

1:05 p. m.—Arthur Rotheman and assisting artists.

7:30 p. m.—Talk on Girl Scouts.

7:45 p. m.—Lillian M. Peckham, soprano.

8:00 p. m.—Arthur S. Berberian, speaking under the auspices of the American Institute of Banking. Subject, "Federal Reserve Banks—How They Help Business."

8:10 p. m.—Agnes Coutancho Burke, contralto.

8:20 p. m.—The Misses Waterman-Bell-Keenan.

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

10:00 p. m.—WEAF home talent night relayed from New York studio.

FRIDAY

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

11:00 a. m.—Talk on the Red Cross.

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

7:00 p. m.—Piano "Musik Tawkalog" by Mabel Woolsey. The Seventh of an educational series especially arranged for piano students.

7:30 p. m.—All Woonsocket night. Programme selected.

9:00 p. m.—"Apco Entertainers."

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

SATURDAY

1:05 p. m.—Camp Fire Girls programme. Silent night.

WEAN, THE SHEPARD STORES

(270 METRES)

TO-DAY

11:00 a. m.—Service from Grace Church, sermon by the Rev. P. B. Clayton, vicar of All Hallows by the Tower, London.

3:00 p. m.—Concert from Jordan Hall, relayed from Station WNAC.

7:30 p. m.—Service from Mathewson Street Methodist Episcopal Church; Organ prelude, "Pomp and Circumstance" (military march in D-major), Elgar; hymn, "True Hearted;" prayer; chant, "The Lord's Prayer," Novello; quartet, "More Love to Thee, O Christ," Widor-Schnecker; psalter, "Eleventh Sunday Evening;" Gloria Patri, Greatorex; offertory, anthem, "Praise My Soul the King of Heaven," Bullard; Doxology; sermon, R. D. Hollington, "Our Poor Relations;" hymn, "Angel's Story;" Benediction; Amen, Neukomm; organ postlude, "Dithyramb," Lucas.

MONDAY

11:55 a. m.—Time signals.

12:00 p. m.—Colonial Concert Orchestra, Harold Sheffers, director.

12:10 p. m.—Lenten noon-day service, broadcast from Grace Church, sermon by the Rev. P. B. Clayton, M. A., M. C., vicar of All Hallows by the Tower.

12:30 p. m.—Weather report.

12:35 p. m.—WEAN Noonday Club.

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

4:15 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

4:35 p. m.—Colonial Dance Orchestra.

8:00 p. m.—Opening night, Home Exhibit, auspices of the Square Club of Providence, broadcast from Rhodes on the Pawtuxet.

TUESDAY 17

10:00 a. m.—Message to Housewives by Miss Gladys J. L. Peckham, home service department.

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Lenten noonday service, broadcast from Grace Church. Sermon by Rev. P. B. Clayton.

12:30 p. m.—Weather report.

12:35 p. m.—Musical programme.

4:00 p. m.—Colonial Dance Orchestra.

4:10 p. m.—Incidental music by the Emery Concert Theatre Orchestra, William J. Faucher, director.

4:30 p. m.—Weather report.

4:35 p. m.—Colonial Dance Orchestra.

6:30 p. m.—Colonial Dance Orchestra.

6:45 p. m.—Estelle Beauregard, pianist.

7:45 p. m.—Irving Crocker, singer.

8:10 p. m.—Orchestra, relayed from Station WNAC.

10:10 p. m.—Dance music, broadcast from the Tent, Morey Pearl and His Orchestra, popular songs by Ted and Dick Waterman, Don Ramsay at the piano, relayed from Station WNAC.

WEDNESDAY 18

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Lenten noonday service, broadcast from Grace Church. Sermon by Rev. P. B. Clayton.

12:30 p. m.—Weather report.

12:35 p. m.—WEAN Noonday Club.

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

4:30 p. m.—Weather report.

4:35 p. m.—Readings by Marion Lillian Daly and Alice Idden.

4:45 p. m.—Colonial Dance Orchestra.

8:00 p. m.—Musical programme.

9:00 p. m.—Trongone Saxophone Band and assisting artists, relayed from WNAC.

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

THURSDAY 19

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

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Lenten noonday service broadcast from Grace Church. Sermon by the Rev. P. B. Clayton.

12:30 p. m.—Weather report.

12:35 p. m.—Musical programme.

4:00 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

4:35 p. m.—Vocal solos and ukulele selections by Charles Devaney, Mrs. Fern Kingsford at the piano.

4:45 p. m.—Colonial Dance Orchestra.

6:30 p. m.—"I-Can-De Mayonnaise Orchestra," relayed from station WNAC.

7:30 p. m.—Popular songs by Frank Bernier, Alice Murray, pianist.

7:45 p. m.—Recital by Helen C. Place, soprano, Laura C. Brinton, pianist.

9:45 p. m.—Wedding of Miss Annie Knott and Charles Gooding at Home Exhibit, auspices of Square Club of Providence, broadcast from Rhodes on the Pawtuxet.

FRIDAY 20

11:55 a. m.—Time signals.

12:00 m.—Colonial Concert Orchestra.

12:10 p. m.—Lenten noonday service broadcast from Grace Church. Sermon by the Rev. P. B. Clayton.

12:30 p. m.—Weather report.

12:35 p. m.—WEAN Noonday Club.

4:00 p. m.—Colonial Dance Orchestra.

4:15 p. m.—Organ recital by Prof. Edward Benedict.

4:30 p. m.—Weather report.

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

8:00 p. m.—The Hingham Light Opera Company presents "Priscilla" or "The Pilgrim's Proxy," in two acts, relayed from Station WNAC.

9:00 p. m.—Home exhibit, auspices of The Square Club of Providence, broad-

Continued on Page Ten