right. The lower dial on the left controls the condenser across the loop and therefore changes the wave-length of the circuit. The dial immediately above this controls the feed-back of the first tube as it varies the position of the secondary of the vario-coupler. The potentiometer is controlled by the small knob at the top center of the panel. These three controls are practically all that are required to tune this receiver, after the proper positions have been found for the other two dials controlling the oscillation and the frequency of oscillation of the second tube. The grid, plate and filament batteries are connected to the back of the receiver, leads being brought through the cabinet with clips attached.

Most of the apparatus employed in this receiver are quite familiar while the special choke coils, resistances and vario-coupler are now obtainable from radio dealers.

The best type of tubes to use are the Western Electric E tubes. These are now obtainable. The values given for batteries are intended for this type of tube. It is possible, of course, to employ other makes of 5-watt tubes or even hard receiving tubes, but the values will be accordingly changed and we do not believe as good results will be had. In any case, soft tubes should never be employed in a super-regenerative circuit—they are quite useless. The battery B1 of Fig. 1 should be 100 volts and the battery B2 also 100 volts. This amounts to a plate battery of 200 volts, all of which is connected to the plate of the last tube, while a tap is taken for the first two tubes. The grid battery B4 is 22 volts and the other grid battery B3 is in the neighborhood of 7 volts. The latter value is variable.

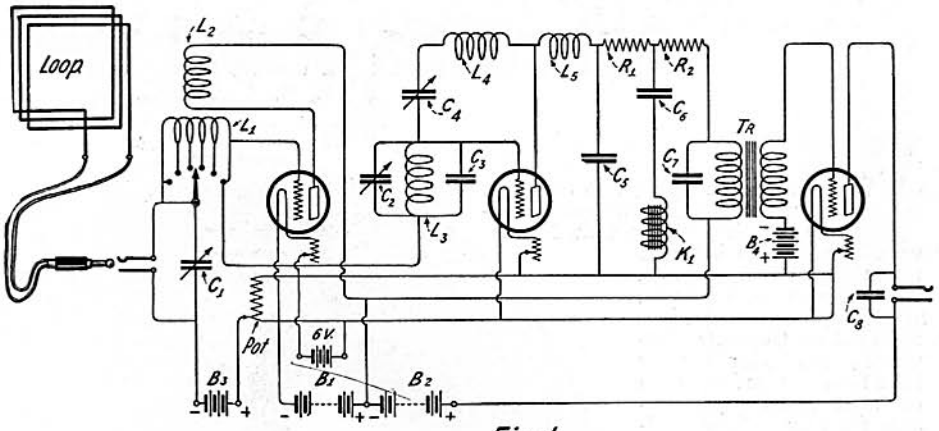

Fig. 1

This is the Hook-Up of the Super-Regenerative Receiver Illustrated in the Photographs. The Battery B3 is Used to Impress a Negative Potential on the Grids of the First Two Tubes. The Constants of the Apparatus in This Circuit Are as Follows:

L1, L2—Short-Wave Vario-Coupler, Secondary 100 Turns; C1—.0005 M. F.; L3—D. L. 1250; C2—.001 M. F.; C3—.002 M. F.; C4—.001 M. F.; L4—D. L. 250; L5—D. L. 1500; C5—.005 M. F.; R1, R2—12,000 Ohms Each; C6—.005 M. F.; K1—.1 Henry Iron-Core Choke; C7—.002 M. F.; Tr—A. F. Transformer; C8—.002 M. F.

OPERATING THE RECEIVER

When the filaments are lit a high-pitched whistle should be heard from the loud-speaker. This whistle indicates that the second tube is oscillating. If the whistle is not present the grid battery B3, the potentiometer and the condenser C4 should be varied to produce oscillation.

When the whistle is obtained, the feed-back coil L2 and the condenser C1 are varied to produce oscillation in the first tube. This point of oscillation will be easily recognized by the usual tests for oscillation.

With the first and second tubes oscillating, if the circuit has been correctly wired, a certain unmistakable effect will be noticed. If any of the variable elements of the circuit are changed, a series of heterodynes of harmonics should be heard. This indicates that the circuit is properly connected, although these harmonics will not be heard after the circuit is adjusted.

After this state has been reached, the rest of the tuning is easy. The wave-length of the station to be received is tuned by the condenser across the loop and by tapping the number of turns on the loop itself. Voice or music should be audible. The two dials at the right of the receiver should then be varied to obtain the maximum amplification. Usually these condensers need to be at about their maximum capacity. A condition will be easily found where the whistles of the harmonics are no longer audible and the speech or music is received clearly. Final tuning with the grid battery and potentiometer will find the critical point.

No matter how explicit the instructions may be, undoubtedly the best method of operating the super-regenerative receiver is

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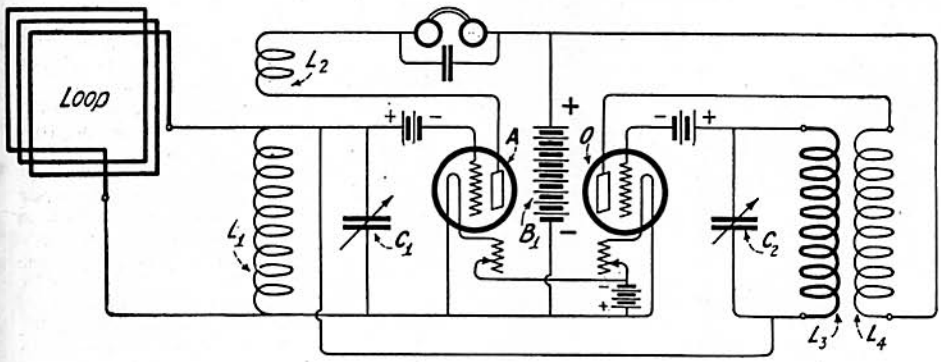

Fig. 2

In This Diagram of a Two-Tube Super-Regenerative Receiver a Grid Battery is Used for Each Tube. When Power Tubes Are Used These Can Be Omitted or the Arrangement Shown in Fig. 1 Adopted in Their Place.

Earlier Days in Radiophone Broadcasting

By CHARLES GILBERT*

SO much interest is being shown in the beginning of radio broadcasting, in the present awakening of public interest in the radio art, and so many inquiries are being made regarding the pioneer broadcasting of Dr. Lee de Forest that it might be well at this time to put down a few of the historical dates in the development of this notably American art.

It is interesting to know that the first broadcasting of music was not by means of the phonograph so generally used at present. The spring of 1907 saw the radio distribution of synthetic electrical music, generated and played in a building at the corner of Broadway and 37th Street, New York City. The plant itself consisted of many inductor alternators whose frequencies were those of the entire musical scale. Music furnished by this electrical organ was transmitted by wire to nearby theaters, hotels and restaurants, where one or several loud horn speakers poured into the ear this new electrical music. To connect this musical current into radio frequency and impress on the antenna, which was erected for this purpose on the roof of this building by Dr. de Forest, was comparatively simple, and thereupon the demonstrations were made for the receiving stations in New York City. The experiment in broadcasting, however, lasted but a very short time.

The location of what may properly be described as the first actual radiophone broadcasting station of the world, however, was in the old Parker Building, 19th Street and Fourth Avenue, New York City. On the top floor of this building was the laboratory of Dr. Lee de Forest; two flag-poles on the roof of this building furnished the necessary support for the antenna. It was in the same little old laboratory that many months earlier the inventor had tested out his first three-electrode vacuum tube. Unfortunately, this historic laboratory which saw the birth of the Tiny Glass Baby, which was known as the modern Aladdin's lamp, is no longer in existence. In January, 1908, a great fire completely destroyed the Parker Building, incidentally wiping out of existence note-books and many precious samples of the earliest audion bulbs.

The first actual transmission of phonograph music, let it be known, was the result of experimental tests by Dr. Lee de Forest in 1907 on some twenty small telephone transmitters planned for installation on Admiral Evans' battleships and destroyers, prior to their historic round-the-world cruise.

The first actual application of the De Forest radiophone in reporting a news event was no doubt the reporting of the yacht races on the Great Lakes in the same summer of 1907; gramophone music was then furnished between the spoken bulletins.

In the operatic season of 1908-09, there was a temporary installation of a radiophone broadcasting station on the roof of the Metropolitan Opera House in New York City. Microphones concealed among the footlights of the stage, connected with the transmitting station, then gave the first radio opera in the history of the art. Among those who were able to listen in at that time were the radio operators on the ships in New York Harbor.

The first opera artist to sing directly into the microphone of a De Forest radiophone transmitter was Madame Mazarin,

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**President and General Manager, De Forest Radio Telephone & Telegraph Co.*

Earlier Days in Radiophone Broadcasting

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Oscar Hammerstein's dramatic soprano, who sang at special performance at the De Forest laboratory at 103 Park Avenue, New York City.

Radio news and music was first furnished on a regular program in the fall of 1916 at the De Forest laboratory in Highbridge, N. Y. In connection with the New York American, election returns were supplied to the radio amateurs of the Eastern States in the 1916 campaign. Music for a radio dance was supplied by the De Forest Highbridge laboratories on the evening of December 30, 1916, for a house party given in Morristown, New Jersey.

After several experimental tests, the *Detroit News* on Wednesday September 1, 1920, reported the fact that the *Detroit News* Wireless Service "for the benefit of the Detroit devotees of the radiophone will be a regular part of the news to the public."

It should not be forgotten that the year 1920 also saw the broadcasting of orchestral music on a large scale from the California Theatre in San Francisco, California, where a daily musical program was furnished to the music lovers on the Pacific Coast.

Following the installation of the *Detroit News* service, came the broadcasting service furnished by the Westinghouse Company at Pittsburgh, later on at the Newark station and other stations with which the public is now more or less familiar.

New Developments in German Radio

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as embodied in the new central station, for the news service of the world, after which Dr. Rukop, director of the vacuum tube laboratory of the Telefunken Company, gave a short account of recent advances in the field of vacuum tubes, the adoption of several new types of filaments constituting another turning point in the development of these. After its invention, in 1905, by Robert von Lieben, the cathode amplifier tube was, a year later, in the form of Lee de Forest's audion, first adopted in general wireless practice. The successes thus obtained induced the leading companies of the world in their laboratories to undertake the investigation of the more important problems connected with the use of vacuum tubes, the work done by the Telefunken people being remarkable in many ways. During the war, the German Wireless Company was, of course, shut off from the rest of the world, but at present, there is a lively exchange of experimental results between it and the other leading concerns of Europe and America.

Some remarkable improvements have, during the last few months, been devised at the Telefunken laboratory, the heating current being reduced and the life of the filament lengthened considerably, while the troublesome noises of the tubes have been reduced to a minimum. These results were obtained by designing some new types of filament for the incandescent cathode, primarily a new and most efficient oxide filament which only uses up about one tenth of the electric energy required by tungsten filaments, while possessing a remarkably long life (in many cases up to 10,000 hours). Two other types of cathode filament were