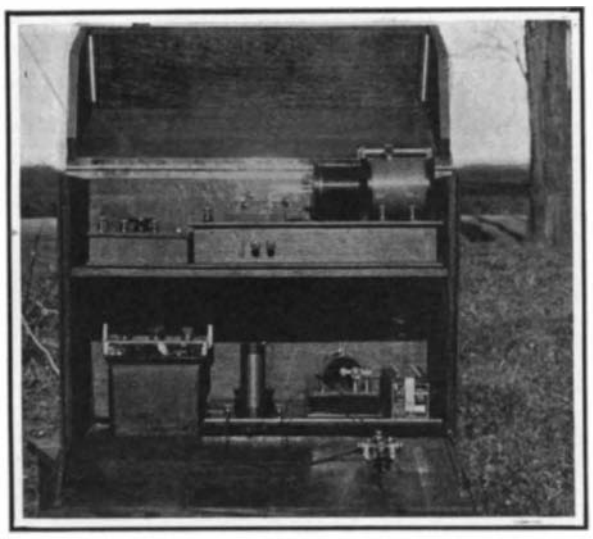
IMPROVEMENTS IN THE DE FOREST SYSTEM OF WIRELESS TELEPHONY.

BY WALTER KENDALL.

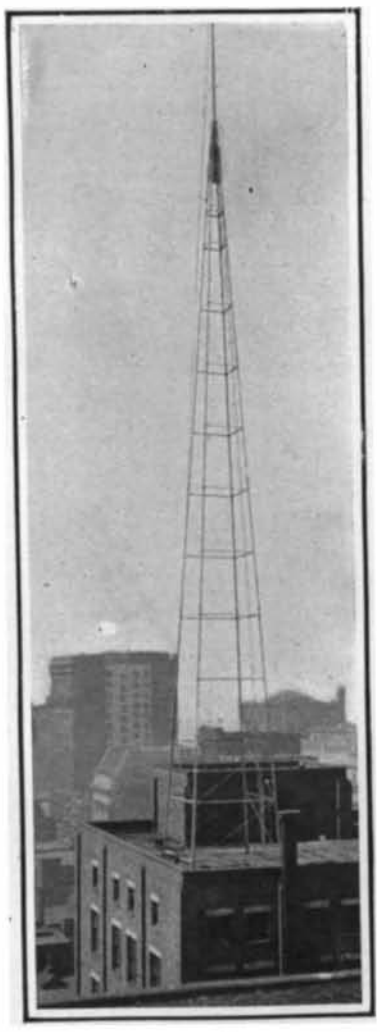
The practical development of wireless telephony stands to-day in very much the same position as did wireless telegraphy ten years ago. At that time Marconi had demonstrated that messages could be sent with ease across the English Channel and over intervals of the ocean, but the practical use of the system was then indicated rather than proved. To-day wireless telephony has been developed by a number of inventors, so that in the United States and Europe there are various systems established. As yet, in spite of successful experiments and long-distance tests, none may be said to have achieved commercial success over any extended length of time. The United States government, after preliminary use of instruments on war vessels and at seacoast forts, is still considering the adoption of a suitable system of wireless telephony for its military and naval establishment, and it demands that inventors undertaking to furnish wireless telephones to the government shall be able to guarantee distinct communication for 100 miles. Bids have been submitted to the Navy Department by several inventors and companies according to the specifications announced, but as yet no decision for a general system has been made by the government.

Dr. Lee de Forest, following the experiments which resulted in the equipping of the Atlantic battleships with instruments suited for communication over comparatively short distances, has continued his researches and experiments, and now on the Great Lakes there has recently been put in operation by the Great Lakes Radio-Telephone Company a number of stations designed to carry on communication between each other and with passenger steamships. Clear telephonic communication between Chicago and Milwaukee, a distance of some 90 miles, has been established and maintained, and the new large steamers "United States" and "Theodore Roosevelt," as well as other lake craft, have been equipped with apparatus which enables them to maintain communication with the shore throughout their trips, this having been successfully accomplished up to some 45 miles.

The Great Lakes Radio-Telephone Company now maintains stations at Chicago, Michigan City, Milwaukee, Toledo, and Cleveland, all with towers of suitable height to carry the antennæ, and stations at other places along the shores of the lakes are in progress of construction, so that the ships will constantly be within range of a central station for handling telegrams or telephone messages over the land wires. The De Forest system as installed at these stations makes use of the fundamental features of the standard navy wireless telephone apparatus which has been described in the SCIENTIFIC AMERICAN of September 28th, 1907. But at the same time there have been introduced several improvements which permit of the control of the wave length and a tuning of instruments far more perfect than previously has been achieved.

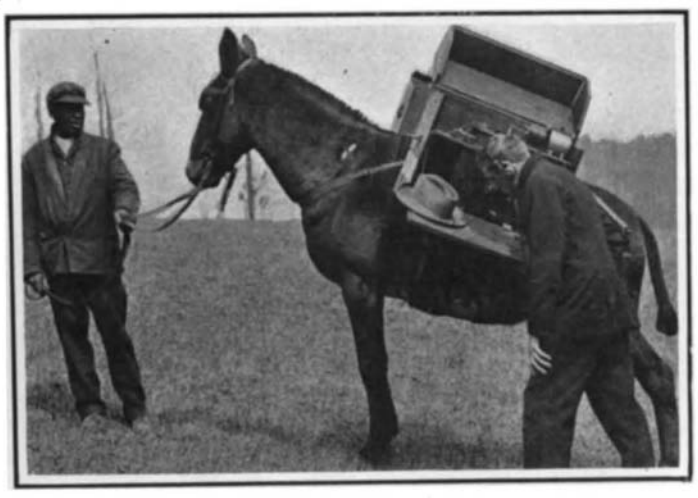


De Forest portable apparatus for wireless telegraphy.



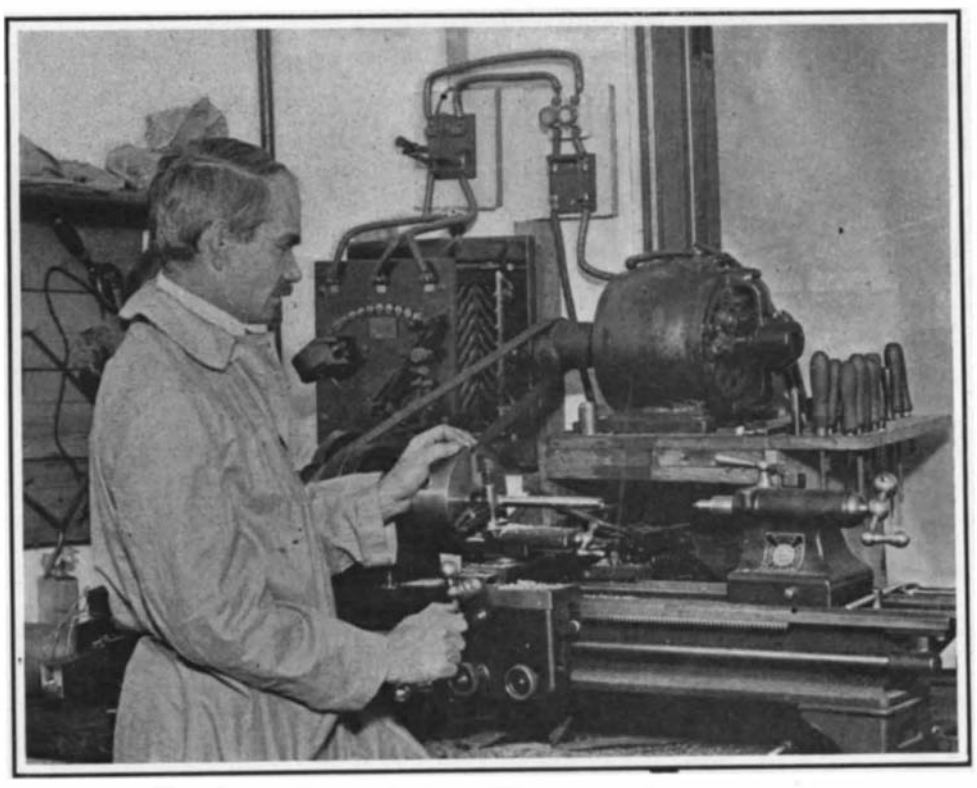
Steel tower for carrying the antenna at the Cleveland station.

Radio-telephone and telegraph used with an automobile.



Portable radio-telephone and telegraph outfit designed for military use.

Portable radio-telephone for communicating over short distances.



Dr. Lee De Forest, inventor of the radio-telephone, in his laboratory.

The De Forest system makes use of rapid oscillations produced by an arc. In the improved apparatus it has been possible to eliminate the atmosphere of the flame of an alcohol lamp once deemed essential. There is used as a receiving device the "audion," an exhausted glass bulb in which advantage is taken of the ionization of the rarefied gas contained and the change of resistance upon the passage of rapid oscillations. An ordinary carbon telephone transmitter is used in the circuit, and this acts to vary the intensity, not the frequency of the waves, as in the case of the ordinary wire telephone. The tuning devices not only secure greater secrecy, but also can be arranged to produce the clearest possible conversation. In ordinary use a current of about 500 volts is used to supply the arc, and this can be furnished either by a dynamotor or by a special generator driven by an oil engine. But it is not always necessary to have such an amount of power, as a storage battery such as can be carried in an automobile or on the back of a mule will supply power enough for conversation over comparatively short distances.

Such installations suitable for military or other temporary purposes are shown in the accompanying illustrations. It is also feasible to locate these low-power stations on small sailing yachts or other craft, so that one need never be without direct telephonic communication so long as the range of distance is not exceeded. In connection with the De Forest apparatus for wireless telephone, there are wireless telegraph instruments for which the undamped waves produced by the arc are quite as suitable as for the transmission of the human voice. The transmitting device, which is known as the "chopper," permits ordinary telegraph signals to be sent with a key by interrupting the waves, and when received these signals are rendered audible by means of a "buzzer," so that the attention of the operator is attracted at once. The ordinary calling signals of the De Forest system are one of its strongest points, for in this way it can be used by any person on a steamship or other station, and does not require a trained operator with telephone at his ear constantly on watch. In other words, anyone in the pilot house or wireless apartment is warned by an audible signal to take down the receiver and listen for the message transmitted.

The recent developments in the Great Lakes experiments include the invention of a device which will enable the wireless telephone to be used in connection with the ordinary land wire system, and this form of microphonic repeater has worked satisfactorily in preliminary trials. In fact, the inventors believe that it doubtless will be possible to use wireless for long-distance transmission, and then relay the message directly to an ordinary wire line. This would insure economy and advantages to the present efficient distribution system.

In connection with the wireless telephone

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IMPROVEMENTS IN THE DE FOREST SYSTEM OF WIRELESS TELEPHONY.

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Dr. De Forest has made an ingenious application of the principle of directive propagation, a refinement of which has also been developed with great success in Europe by Bellini and Tosi.* It was found that if slanting wires were run from a mast to a boom, the intensity of the waves emitted would be much greater in the direction of the plane of the antenna and practically zero at right angles to it. Accordingly, this afforded them an excellent method of directing the waves; and if the whole arrangement were revolved, any desired direction could be given to the wave fronts emitted from the antenna. Dr. De Forest conceived the idea of using this device for sending out danger signals from a lighthouse or other point, and change the direction of the wave by revolving the projecting apparatus so that any boat which received the signals could immediately ascertain its direction from a danger spot equipped with the "aerophore," as the device has been termed, since the apparatus was designed to transmit intelligible signals which differed automatically with the constantly changing direction of the waves as projected. A simple example will illustrate this. When the apparatus is arranged to transmit waves in a northerly direction a certain telegraphic or telephonic signal would be sent out in that direction, and only in that direction. If that message were received on some ship, it would follow at once that the lighthouse was bearing due south of the vessel. For other points of the compass the signals would be different, while a prearranged code would be employed where the aerophore was installed upon a vessel. Thus with the apparatus in operation on both of two vessels, it would be possible as soon as they came within range of each other to determine their bearing, particularly as the signal is first received by an automatic and audible device, such as a buzzer, which would sound in the pilot house and make evident the necessity of picking up the telephone receiver and learning the exact direction of the signals. Dr. De Forest has recently been working on a type of aerophore where an arc light is revolved behind a parabolic mirror, with the movement interrupted successively at the points of the compass where the signal automatically is sent out by wireless, indicating the direction in which the wave is projected. In addition to these signals a microphonic transmitter is connected with a set of bells tuned to the quarters of the octave which are constantly striking, one after the other, several times a minute. These bells have a varying range of penetration, so that when the observer on a boat can hear four bells he knows he is within a certain range of distance of the source of sound. When only three are heard, the distance, of course, must be less, and so on, so that a fair estimate of the distance from the danger point is obtainable.

An improvement that makes possible the satisfactory working of the system is the adjusting of the sending mechanism of all instruments to a "common tune," which differs widely from that of the receiving part of the apparatus, so that when using a single antenna, it is possible to receive the sound whether the transmission apparatus is working or not. When a signal is received, a small lamp is lighted by induction or a buzzer is caused to sound, so that the operator immediately puts on his head telephone in order to find the whereabouts and name of the transmitting station. Aerophore signals will be erected at all the points of danger on the Great Lakes, and will be used on all the signal towers of the Radio-Telephone Company. The device has been tried on the steamship "Wisconsin," and has worked successfully over a limited range.

* See Scientific American Supplement, No. 1745, June 12th, 1909, page 372.

THE AERONAUTIC SOCIETY'S FIRST CURTISS AEROPLANE.

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weighing 12½ pounds, as well as a gear-driven oil pump, is placed at the same end as the carbureter, while the gear water pump is at the other, or rear, end. One of the gears of this pump is on the camshaft. The motor is very light and compact, its weight complete with pumps, magneto, and carbureter being 97½ pounds. As it is claimed to be capable of developing as much as 30 horse-power, its weight without water and radiator is about 3¼ pounds per horse-power. The radiator weighs 40 pounds, and less than 10 pounds of water is carried, so that the total weight of the power plant is under 150 pounds. It was tested by a 10-hour run driving the propeller.

A 6½-foot diameter, 5-foot pitch wood propeller is mounted upon the engine crankshaft. This propeller develops a thrust of 225 pounds when the aeroplane is held stationary, although 150 pounds is all that is needed to fly it. The blades are but five inches wide. The motor is mounted upon the rear part of the main planes, half way between them, the propeller being at the rear. The aviator sits on a seat at the front edge of the lower plane and about a foot above it, this seat and a foot rest being located upon a pair of inclined braces extending upward from the front wheel to the two special uprights at the rear, which support the motor bed in conjunction with the inclined braces. Two other pairs of braces extend upward respectively from this wheel to the front edge of the upper plane and to the parallel downwardly-inclined poles extending forward from the front edge of this plane to support the horizontal rudder. The tail is carried by two pairs of parallel rods extending downward and upward from the rear edges of the upper and lower planes and meeting some 12 feet behind them. A square automobile-type radiator is placed in front of the motor; the cylindrical gasoline tank is located above it just under the upper plane, and the oil reservoir below.

The control of the new aeroplane is practically as simple as that of an automobile. All the aviator has to do is to pull or push on the steering wheel, which is placed vertically in front of him, in order to steer up or down, while turning the wheel and inclining the body slightly steers the machine to the right or left. The vertical rudder is in reality unnecessary for steering, as this can be accomplished simply by inclining the body and thus setting the balancing planes. These are connected by wires with a frame of steel tubing shaped like a bicycle handle bar and fitting around the shoulders of the aviator, so that when he sways slightly to one side or the other one wing tip is inclined upward and the other downward slightly. The aeroplane, in a run of 75 feet, will attain sufficient speed—about 25 miles an hour—to rise. It flies at more than 40 miles an hour. A plunger brake is fitted to the front wheel tire, to aid in quickly stopping it when it alights.

Several successful trial flights were made at Hammondsport, N. Y., by Mr. Curtiss on June 4th, 5th, and 6th. The longest of these was about 3 miles in the shape of a figure 8. He has shipped the machine to the grounds of the Aeronautic Society at Morris Park race track, New York, and after making some further practice flights, he will attempt to set up a record for the Scientific American trophy at the society's first 1909 flight exhibition, which will be held either the 19th or 26th instant. A new monoplane and several new gliders will also be tried upon this occasion. There will be a wind wagon race, and contests for models, kites, and gliders. The society's new dirigible balloon will also be flown.

LOS ANGELES 200-MILE CONDUIT WATER SUPPLY.

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division, as it is called, is uninhabited, and it was necessary to transport much