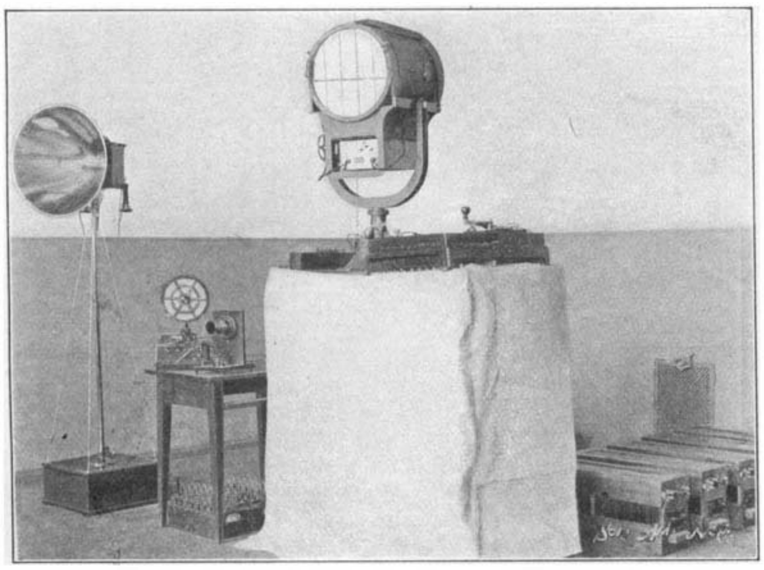
RUHMER'S SYSTEM OF LIGHT-TELEPHONY.

Although Ernst Ruhmer's system of light-telephony has been already described in these columns, the recent experiments conducted by the inventor have attracted such widespread attention that a recapitulation of what he has accomplished should not be without value. For the information herewith presented we have drawn on an excellent paper on selenium prepared by Mr. William J. Hammer, to whom we are also indebted for two of the photographs herewith reproduced.



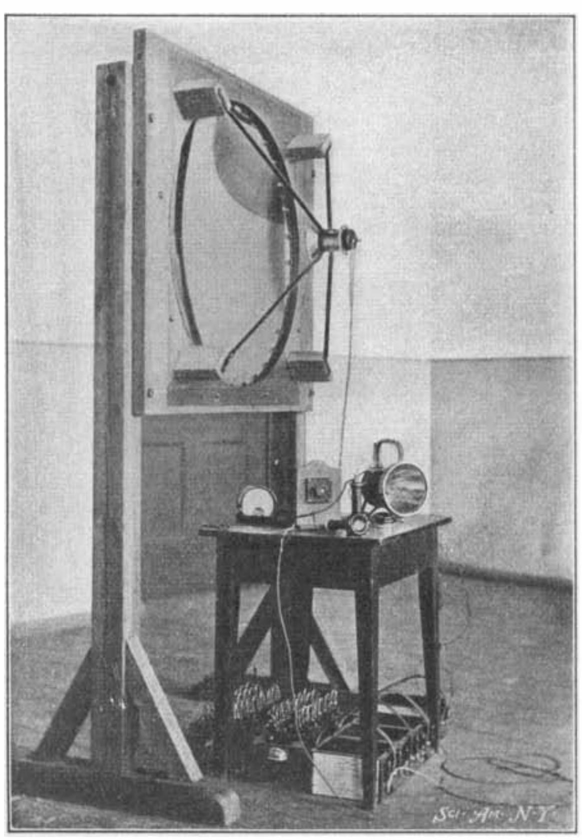
ARRANGEMENT FOR SPEAKING IN TWO DIRECTIONS.

The vital part of Ruhmer's apparatus is a selenium cell. Selenium is a substance varying in electrical resistance on exposure to light. Among the early investigators who endeavored practically to utilize this remarkable property was Alexander Graham Bell. Twenty years ago he devised his radiophone, in which a mica or glass diaphragm covered with a silvered foil was used to reflect a powerful beam of light upon a selenium cell placed in the focus of a silvered reflector. To the selenium cell were connected a pair of telephones and a battery. At the back of the silvered diaphragm was a flexible tube and mouthpiece into which words were spoken. The sound waves causing the diaphragm to vibrate sent pulsations of the reflected light upon the selenium cell, producing corresponding variations in its resistance and reproducing audible sounds in the telephone. Prof. Bell used this only over very short distances.

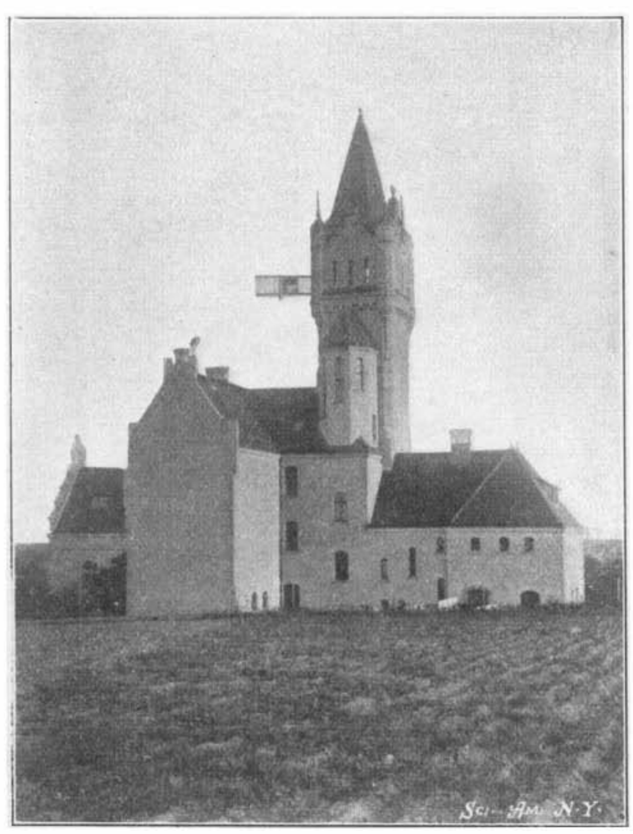
In 1898 Prof. H. T. Simon, of the University of Erlangen, discovered that an arc lamp, the circuit of which was in proximity to a telephone circuit, was caused to vibrate very perceptibly. This suggested to him his interesting speaking arc by means of which he superimposed the sound waves produced by the telephone upon the circuit in which the arc was placed. He connected the lamp circuit with the secondary winding of an induction coil, the primary circuit being connected with the carbon transmitter, and a battery. The sounds thus produced originally were very weak; but by employing a suitable carbon microphone, the sound was reproduced to large audiences.

Conversely, the arc could also be used in conjunction with telephone receivers to receive sounds.

Mr. W. Duddell, of England, has also made some most successful talking arcs. In his arrangement in the secondary circuit is placed a condenser, which prevents the lamp current's entering the induction coil, but allows the induction current in the transmitter circuit to pass without obstruction; and this arrangement has the effect of greatly increasing the sound.



RECEIVING STATION OF RUHMER'S SYSTEM OF LIGHT-TELEPHONY.



RUHMER'S STATION ON THE OUTSKIRTS OF BERLIN, SHOWING THE HUGE MIRROR.

Mr. Ruhmer has ingeniously combined the apparatus of Bell, Simon, and Duddell and has successfully transmitted speech over a beam of light 4¼ miles in length. In his experiments he employed an arc lamp with a flaring arc 6 to 10 millimeters long, using an E. M. F. of 220 volts. The current varied from 4 to 5 amperes at 1 to 2 kilometers, 8 to 10 amperes for 3 to 4 kilometers, and 12 to 16 amperes for 5 to 7 kilometers, and the resistance of his selenium cell was 120,000 ohms in the dark, this falling to 600 ohms in full sunlight. For the transmitting end, Mr. Ruhmer employs a carbon transmitter and a battery superimposing waves on the arc light circuit; and the beam of light is reflected to some distant point, where it is received by a parabolic reflector, in the focus of which is placed a selenium cell connected with a battery and a pair of very sensitive telephone receivers. Mr. Ruhmer has conducted extensive experiments both by night and by day, and even during fog and rain, on the Wannsee, near Berlin.

Doubtless many readers remember the interesting experiments made by Mr. Hayes at the Electrical Exhibition held in Madison Square Garden in May, 1899, in which music was transmitted over a beam of light. At one end of the garden was placed a telephone, before which a cornet was played, causing waves of current in the telephone circuit to be superimposed upon those in a neighboring arc light circuit. The light rays from this arc lamp were reflected across the garden, where they were received in a parabolic reflector in the focus of which was a glass bulb containing filaments of carbon. This bulb was connected to a pair of ordinary phonograph listening tubes. The varying light which fell upon the carbon caused variations of temperature inside of the glass bulb, which produced the original sounds in the listener's ear. A bulb simply coated with lamp black and containing nothing but air, would answer the purpose just as well.

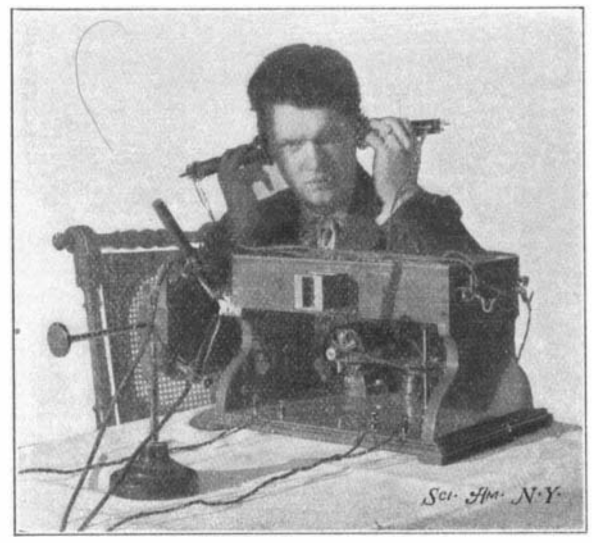
Selenium cells may vary in resistance from 2,000 ohms to 500,000 ohms or more in the dark; and certain cells may be five to twenty times as good conductors of electricity in light as in the dark; and in the case of the Ruhmer cell used in the Wannsee experiments, will have 200 times the conductivity in light that it has in the darkness; and the ratio may be even higher.

Ruhmer's latest type represents, probably, the most important development which has been made in the selenium cell, and it has now become most stable, and responds most rapidly to variations in illumination. He employs two copper wires, wound spirally side by side around a cylinder of porcelain, which, after the wires have been covered with selenium, is placed inside of a globe, which is exhausted. The cylinder is mounted with a butt similar to an Edison incandescent lamp, and resembles a candelabra lamp. This makes a most convenient method of handling the cell; and by keeping it from the air the disadvantages inherent in all cells heretofore have been very largely done away with. Another form of Ruhmer cell consists of two fine platinum wires wound on a glass cylinder 1¼ inches long and ¾ inch in diameter; the wires, which are 1-32 of an inch apart, are coated with selenium.

An expedition is to be sent out by the Royal Geographical Society of London to relieve the British Antarctic ship "Discovery," which is said to be caught in the southern ice pack and to be in serious difficulty.

Liquid Air for Cooling Purposes.

One of the claims made for liquid air was that it would be "the cold-producing medium of the future." Not only would the working of our modern refrigerating and freezing stores be accomplished by means of liquid air, but everybody—the manufacturer in his workshop, and alike the agriculturist on his farm—might, at trifling cost, procure a cool and pure atmosphere for himself. Considering that liquefied air, vaporizing at atmospheric pressure, possesses a temperature of —191 deg. C., it is hardly a matter of surprise that, with such an energetic cooling medium in view, the problem of applying liquid air for refrigerative purposes is raised again and again.



THE RECEIVING INSTRUMENT.

In the consideration of the merits of any particular source of cold two points are essential—first, the quantity of cold produced, i. e., the number of heat-units eliminated per unit of time; and second, the intensity of the cold, i. e., the temperature at which heat is removed.

The most important physical law relating to the production of cold is well known as determining that the expenditure of energy necessary for a certain amount of cold increases in direct ratio with the difference between the lower temperature (in the refrigerator) at which the heat is taken away and the upper temperature (in the condenser or cooler) at which heat is transferred to the cooling water or to the atmosphere. Now, if the refrigerative purpose be the production or the maintenance of a temperature only a few degrees below the freezing-point of water, then, according to the law referred to, it must be exceedingly irrational to employ liquid air, seeing that for its attainment we are compelled to descend to —191 deg. C. (—312 deg. F.)

Supposing that anyone had to provide a well for obtaining surface-water from a depth of 10 feet, it would be insane to sink a shaft down to 300 feet, to let the water run from its surface-level down this pit, and then to raise it to a height of 300 feet. But this exactly corresponds to the idea of persons recommending the use of liquid air as a substitute in all the refrigerating machines of to-day. If we were to work our ice factories, our cooling and freezing stores, and our other cooling plants by liquid air, the requisite expenditure would be from thirty to fifty times greater than that of our modern refrigerating installations.—Dr. Carl von Linde, in Cassier's Magazine.

Cedar and pine trees are rapidly being consumed for the purpose of supplying trolley and telegraph poles, and at the present rate of consumption, it will not be a great while before the visible supply will be exhausted. The foresters look to catalpa to fill the place of pine and cedar in this particular. The catalpa flourishes in a great many places in this country, and has the advantage of growing very straight, and attains the needed size in from sixteen to eighteen years. The time required for cedar and pine is more than double this.