similar to that of Marconi with the exception that it embodies a slight but very important alteration in the coherer. The inventor claims that he can communicate up to a distance of 2 miles without making use of the vertical wire, while with the vertical wire he can transmit messages to a distance of 40 miles. He announces that he has completed an automatic repeating device, which presumably will be installed at intervals of 40 miles. Mr. Rosenberg has also devised a modification of his system on a small scale, which should have an important commercial application. It consists of a small box containing the receiving apparatus as used in the system. When absent from his office one may receive notification of his desired attendance there by the tinkling of a small bell. The office or business house may not be aware of the wherabouts of the person whom it is desired to call up, but so long as he is no further distant from the transmitting apparatus than 2 miles, he can be notified. Mr. Rosenberg has given practical demonstration of this contrivance with distinct success.

A few weeks ago we drew attention to the application of the Hertzian waves to torpedo warfare, the invention being that of a young Englishman, who is at present successfully developing his system. The experiments described in the article referred to consisted in the successful steering of a small launch by means of the Hertzian waves. As a result of the favorable report given by Admiral Colwell, of the British government, the Admiralty have offered the inventor a large sum provided he can successfully manipulate a torpedo while it is submerged. The German government have made him a similar offer under the same proviso. We are informed that the inventor has accomplished the desired result, and that in private preliminary trials he has steered the vessel with as much ease when it is submerged as when it is at the surface of the water. The gyroscope, which ceases to have any *raison d'etre* in an electrically controlled torpedo, is removed, and its place is taken by a wireless telegraphy receiving apparatus, which, acting upon a set of magnets, manipulates the rudder.

CALCIUM CARBIDE AT THE CONGRESS OF APPLIED CHEMISTRY.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the papers read at the International Congress of Applied Chemistry, recently held at Paris, those relating to the carbide of calcium industry and the production of acetylene were of great interest. The present development of the carbide industry in Europe was shown by a series of papers read by different delegates, each of which described the carbide plants of one of the leading countries. M. Minet, in his opening paper, in which he treats electro-chemical processes from a historical and an industrial point of view, mentions the carbide industry in a general way, and gives a resumé of the installations in Europe. The paper read by M. Gin gives some interesting details as to the development of the carbide industry in Austria-Hungary, where the abundance of waterfalls has led to the establishment of a considerable number of carbide plants. At present, seven large plants are in operation, and the total water power used is about 24,000 horse power. A number of projects are shortly to be put in execution, which will bring the total up to nearly 80,000 horse power.

The largest of these works, from the point of view of capacity, is that of Jaïce, which has been erected by the Bosnian Electric Company; the large falls of the River Pliva are here utilized. The river widens into a lake which discharges into a lower lake in a series of cascades. The dam has been placed shortly below the mouth of the upper lake, where the water is taken off in a canal about two miles long; the canal passes through fifteen tunnels of 12 by 15 feet section and ends in a large reservior near the station. From this point the water is brought to the turbines by two iron conduits of 5 feet diameter. The capacity of the hydraulic plant is about 9,500 horse power. Eight turbines are installed in the station, of 1,000 horse power each, connected to Schuckert dynamos. The electric furnaces for this plant have been installed by the latter company. The plant situated at Paternion is of much smaller capacity, but presents many points of interest. It has been installed by the Venetian Electrochemical Society, and is located on the bank of the River Kreuznerbach. The lime is furnished by quarries of limestone which are found in the neighborhood. A head of water of 200 feet is obtained from a waterfall in this stream; the water is brought to the turbines by canals and iron conduits to the station, situated at 1,600 feet from the fall. Here are installed three turbines, of 400 horse power each, connected directly to a triphase alternator, working at 350 revolutions. The grinding machines will pulverize 8,000 pounds of lime and 5,000 pounds of coke per day. This material is transported to an automatic balance, and thence by a conveyor to a screw mixing tank; from here it falls to the doors of the electric furnaces by a series of conduits. The mechanical operations are carried out by two electric motors. Nine double electric furnaces are used, with space for three others to be installed later; the furnaces have a capacity of 125 horse power.

The Meran works is one of the most important plants; it is operated by the Gin and Leleux process. It utilizes the water power of the Etsche, one of the confluents of the River Adige. The fall has a height of about 280 feet. The canal is less than a mile long; it passes in a tunnel for a part of the way, and then two metallic conduits, 6 feet in diameter, bring the water to the turbines; there are five of these, of the Garry pattern, with horizontal shaft. To these are coupled five alternators of 1,200 horse power each. Of these, two are used for the carbide plant, to which the current is transmitted by two cables in subway and overhead line; these furnish 2,000 horse power to the plant. A deposit of crystalline marble, very pure, is found near the works. It is carried by an aerial transporter to the calcining furnace. The lime and coke are elevated by a bucket conveyor to the grinders, passing thence to the mixers and finally by a conveyor to the furnaces. The latter have a capacity of 260 kilowatts each; they are disposed in battery in a large room 35 by 130 feet. These furnaces are claimed to give, per kilowatt day, over 11 pounds of crystallized carbide.

Among the plants shortly to be erected is that of Petrozeny. The fall of the Szill River here situated belongs to the Acetylene Company of Vienna. It is about 75 feet high at a maximum, and a mean of 4,800 horse power may be obtained. Another projected plant is that of Almissa, on the Cetina River. This large fall belongs to a syndicate, including Ganz & Company, of Budapest, the Belgium Aluminium Syndicate, and others. The fall is to be obtained by a derivation from the Cetina, using for the purpose a tunnel five miles in length, and in this way 50,000 horse power could be realized. Another fall on the same river is to be utilized by Descovics & Gin, who have obtained the concession; a head of water of nearly 300 feet is assured, which will give 6,000 horse power. A central station is to be established below the fall, and the energy to be transmitted to the port of Olmissa by the high tension system at 12,000 volts; at the latter point will be located the carbide works.

The carbide industry in the United States was the subject of a paper read by Mr. John A. Matthews, who, after giving a historical resumé of the subject, describes the Niagara and Sault Sainte Marie plants, and brings out the fact that the former works turn out most of the carbide consumed in America. He gives the selling price of carbide as varying from $70 to $90 per ton, and estimates that it requires 300 horse power for twenty-four hours to produce a ton of carbide. The cost per ton he estimates at $38. The carbide produced at Niagara is guaranteed to give 5 cubic feet of acetylene per pound, but the production of gas is usually greater. Mr. Matthews says that acetylene lighting is being extensively introduced in the Western States.

Another interesting paper was that read by M. A. Rossel, upon the state of the industry in Switzerland. Up to the time of the discovery of carbide of calcium, hydraulic power was but little used in that country, and there were only two important electrochemical works, that of Neuhausen, which utilized a part of the fall of the Rhine for the production of aluminium, and the Vallorbes plant, making various electrochemical products. The first carbide was made in the latter works, and soon after the Neuhausen plant followed its example, as also the Luterbach works. From this point the carbide industry developed rapidly, and a large amount of capital was obtained for establishing hydraulic plants for this purpose. The Neuhausen Company greatly increased its plant, and erected that of Rheinfelden; Siemens & Halske, with the Wyman Company, installed a carbide works at Langenthal, etc. M. Rossel then gave a short account of some of the leading plants. The Neuhausen works use hydraulic power to the extent of 2,000 to 2,500 horse power, from the fall in the Rhine. A part of the energy is utilized to generate direct current and another part for alternating current on the two-phase system. Both aluminium and carbide are produced at these works, which are in active operation. The Veriner factory takes its energy from the large hydraulic plant at Chèvres; it utilizes about 7,000 horse power in the shape of two-phase alternating current. The primary tension is 2,000 volts and a series of transformers reduces this to 200 volts to operate the furnaces. There are thirteen of the latter, twelve using 500 horse power, and one of 1,000 horse power. The Langenthal works was destroyed by fire on June 5 last. It was erected in 1897 by Siemens & Halske and operated by them in conjunction with the Société Electrique de Wynan. The station at the fall produced triphase alternating current at high tension, which was brought by overhead line to the carbide plant, 4 miles distant; it was transformed here to 45 volts and 3,000 amperes by three transformers.

The three furnaces installed here produced about 500 tons of carbide per year. Another large plant is that established on the River Lonza, at Gampel, utilizing two of the falls of that river. The first fall has a head of 350 feet and operates five turbines of 500 horse power each, direct-connected to low-tension alternators, while the second fall, of 680 feet, drives ten similar turbines with high-tension dynamos; the two-phase system is used. The first fall gives 2,500 horse power, which is all utilized for the production of carbide; the second fall gives 5,000 horse power, and one-half of this energy is used for the same purpose. M. Rossel describes a number of other plants, including that of Vernoya, with turbines of 4,500 horse power, 900 of which is used for carbide; Thusis, using 3,000 horse power, with twelve furnaces of 250 horse power; the Nidau plant, disposing of 5,000 horse power, and using 1,800 for carbide, etc. In the second part of his paper M. Rossel speaks of the raw material used. Limestone of very good quality is found in Switzerland, which gives lime of 99 per cent purity and containing no trace of phosphoric acid. The carbide delivered to commerce is guaranteed to give 4·8 cubic feet per pound, but generally it exceeds this by 2 to 5 per cent. Acetylene lighting is being adopted for public systems as well as in some of the factories.

THE CONGRESS OF APPLIED CHEMISTRY AT PARIS.

The Congress of Applied Chemistry has been one of the most interesting of the series held at Paris. It is the fourth international congress relating to this subject. The first was held at Brussels in 1894, with great success, and resulted in the formation of the second, held at Paris in 1896. The third was held at Vienna in 1898. The opening session of the present Congress was held in the amphitheater of the Sorbonne. M. Berthelot was honorary president of the committee, and M. Moissan, president. M. Moissan delivered the opening address; he gave a short resumé of the history of the previous congresses, and showed their great utility. In closing he thanked the delegates from the governments and various societies for the manner in which they had answered the invitation addressed to them. M. Berthelot, who was to have pronounced the main discourse of the session, was absent on account of indisposition, and the address was read by M. Moissan. M. Berthelot went over the general history of chemical methods, and shows the ancient origin of the science. In ancient Egypt the art of chemical transformations was practised, and this art was not merely experimental, as might be supposed, but was pursued with a well defined method, as is shown by the manuscripts. It is this ancient science, transmitted partly by traditional processes, and partly by the Syrians and Arabs, who have not contributed greatly to it, which became the alchemy of the middle ages.

M. Berthelot passes over the succeeding centuries to the great discoveries of the end of the last century, which laid the way for the modern science. He laid stress upon the important role filled by the new processes of electro-chemistry, and showed how rapidly these industries were developing and what a great future was in store for this branch of the science. After the address, the officers of the Congress were nominated, these being M. Berthelot, honorary president, and M. Moissan, president. The honorary vice-presidents included more than sixty of the delegates, and all of the leading countries were represented. A great number of papers were read at the succeeding sessions of the Congress; among the most interesting were those relating to acetylene, carbide of calcium, production of ozone, production of metals and alloys by the electric furnace, methods of analysis, some of which will be reproduced in full or in abstract at a later date. At the closing session the next Congress was fixed for 1902, to be held at Berlin.

BORAX IN EUROPE.

The greater part of the borax which now enters into European commerce is extracted from borocalcite, a mineral which is formed principally of borate of lime. It is found in great quantities in certain parts of Asia Minor. The process of treatment depends upon the reaction of borate of calcium and caustic soda, which, when added, form borax and carbonate of lime. It has been found that the caustic soda may be replaced by bicarbonate of soda to obtain the same result, the best method being to use a mixture of the two. In the process which is now generally used, the native borocalcite is reduced to a fine powder in a mill. Of the powder, 15 parts by weight are taken, and 60 parts of water, and this is placed in a steam-heated vessel, adding 8 parts of bicarbonate of soda and 2 parts caustic soda, and the whole is boiled for about three hours. The mass resulting from this treatment is passed into large filter presses, and the hot solution which comes off is placed in crystallizing basins, and at the end of a few days the borax may be collected in crystals; these are put to dry in a steam oven. They are often in irregular masses of large size, and these must be broken into small pieces, after they have been well cleaned. The small crystals thus obtained are assorted and put in barrels whose weight is from 100 to 800 pounds. The cake of carbonate of lime which remains in the filter-press is washed with water until the borax is completely extracted, and is then sold to glass, paper or cement works. It is estimated that 100 pounds of borocalcite will yield 100 to 105 pounds of crystallized borax.