

the metal is 8,564,816 kilogrammes (9,426.7 tons). The vertical pressure, when the wind is calm, varies from 4.1 kilogrammes to 4.5 kilogrammes per square centimeter. The generally accepted hypothesis for the intensity of the wind gives the figures as 300 kilogrammes per square meter exposed, which exposed surface amounts to 8,515 square meters. The corresponding overturning force is 2,554 tons, exerted at a height of 84.9 meters above the level of the substructure. At this level the maximum pressure is received on the girders nearest the center. The pressure is about 723,750 kilogrammes without wind and 1,075,250 kilogrammes with the wind. The total maximum pressure on the soil is received on the north piles under the caisson of the framework. It amounts to about 5.95 kilogrammes per square centimeter.

So far from being unsafe, the tower is pre-eminently secure.

#### THE FUEL SUPPLY OF THE JAPANESE NAVY.

There are two little seaports on an island off the Asiatic coast which may play a very important part in the Russo-Japanese war, if hostilities are declared. Naval strategists believe that one of the first things Russia will try to do is to cut off the coal supply of the Japanese fleet, if possible, and from the two places referred to comes a very large proportion of the fuel burned on the Mikado's warships. They are both situated on the island of Hokkaido, or Jezo, which adjoins the island of Nippon—the largest of the empire—on the north. Mororan is on the southern coast, on the shore of Volcano Bay, so named from the number of volcanic peaks which overlook it. Otaru, the other port, is on the west coast. These towns are just about large enough to be noted on the map, but are among the largest coal-shipping points in the world, as their harbors are ample to float vessels of deep draft. Jezo is directly east of the Russian possessions in Asia, and a steamship leaving Vladivostok could reach either port easily in two days, as they are not over 500 miles from the mainland.

Naval experts believe that as soon as war is declared, Japan's first act will be to send squadrons to guard these ports, to prevent Russia from landing troops and taking possession of the coal mines, for these are more extensive in proportion by far than any other group in the empire, and the coal is of a very high grade, especially suitable for vessel fuel. Although but little was done to secure the coal before 1890, the output increased from about 300,000 tons in 1893 until it is over 1,000,000 tons at present, one company alone during the past year mining 860,000 tons. This is the Hokkaido Tanko Tetsudo Kaisha, one of the wealthiest corporations in the world. It not only owns coal mines, but railroads, steamship lines, most of the harbor front of the Mororan and Otaru, besides warehouses, coal piers, etc. Its capital is no less than 20,000,000 yen, equal to \$10,000,000 in American money, and it has been so prosperous that it has paid annual dividends to its shareholders ranging from 20 to 30 per cent, partly through the contracts which it has to supply the imperial government with fuel.

The mines on the island of Hokkaido are in several great groups, although but a part of the territory of coal-bearing deposits has been examined by geologists and mineral experts. They have estimated that the groups owned by the company referred to alone contain fully 250,000,000 tons of coal, near enough to the surface to be easily secured. The Sarachi group is the largest at present operated, and comprises an area of 5,500 acres, upon which have been found ten veins ranging from 3 feet to 7 feet in thickness; but the greatest producers are the mines of the Yubari group, representing about 4,800 acres, for here have been found veins no less than 25 feet in thickness. Analyses of the coal show it to be a high-grade bituminous, excellent for not only steaming but gas and coke making, so the company has built a large number of coke ovens in connection with the pits. The third group, known as the Puowai mines, is considerably smaller, comprising only about 727 acres, while the fourth covers about 600 acres.

To operate the various collieries, the company in question employs a force of 8,000 people, of whom about 1,500 are women, but all of the mines are equipped with American apparatus on an extensive scale. For instance, compressed-air cutting machinery is used for working the larger veins; mine locomotives, also operated by compressed air, haul the coal to the bottom of the shaft, and the elevating machinery was also built in the United States purposely for the industry. The galleries, and shafts are lighted by electricity, and in fact everything connected with the operations is as up-to-date as at any mine of this country. The railroads connecting the mining district with the seacoast are also largely built and equipped with American material. The company owns 212 miles in all, one line extending from Otaru and the other from Mororan. The government has built a system in the interior with which both of the coal railroads form connection, and of this fact the Russians are probably

well aware. Consequently, unless they are well guarded, the island could be easily invaded and the mines seized, as they are but a comparatively short distance from the seacoast. The Yubari group, which is the principal producer, is less than 100 miles from either of the shipping ports, and the Sarachi group, which is the farthest from the coast, is but 117 miles distant.

#### PROGRESS IN THE STUDY OF RADIUM AND RADIOACTIVITY.

MINERAL WATERS AND RADIUM.

At a meeting of the Bath Town Council recently Mr. T. Sturge Cotterell stated that Prof. Dewar had, at the expense of the Royal Society, and with their concurrence, collected the gases that arose in the largest and perhaps the best known of their hot mineral springs, the King's Bath. The analysis of the gases revealed the fact that the rare element helium existed in the waters. The presence of helium led to the belief that something more of scientific interest might be found in the deposits that collected in the tanks and pipes at the three springs. A few weeks ago a quantity of the deposit from the new Royal spring was obtained and sent to the Hon. R. J. Strutt, son of Lord Rayleigh. "My experiments have," he says, "led to some conclusions which may, I hope, interest the [Baths] committee. I have found that the deposit contains radium in appreciable quantities, though I am sorry to say not enough to pay for extraction. It will be remembered that the gas which bubbles up from the springs contains a small proportion of helium. Sir William Ramsay has recently made the most important discovery that radium slowly evolves helium by a spontaneous change. I think there can be but little doubt that the helium of Bath owes its origin to large quantities of radium at a great depth below the earth's surface. A little of this radium is carried up by the rush of hot water and is found in the deposit. My experiments promise further interesting developments, which I shall have much pleasure in bringing to the notice of the committee in due course." Mr. Cotterell said it would be noticed that Mr. Strutt stated that radium existed in "appreciable quantities," and as this appeared to require further explanation he wrote to him and received a reply. Mr. Strutt said: "When I speak of 'appreciable quantities' of radium, I mean quantities such that its presence may pretty easily be detected. But the percentage of radium in the deposit is very much less than that in the ores which are at present used to obtain it from. The reason why the presence of radium is so easily detected, in spite of the smallness of the proportion present, is that the tests are exceedingly sensitive; indeed, the only reason why so small a proportion of radium could be detected was the unique and extraordinary properties of that substance."

In connection with the experiments on the waters of Bath, Prof. Henry A. Bumstead's work in an allied field is of interest. Prof. Bumstead, and his assistant Prof. Wheeler, have been experimenting with the radium found in the surface water and the ground around New Haven, and have published in the American Journal of Science a detailed account of their work. As a result of his many months' investigations, Prof. Bumstead draws three conclusions of greatest interest to investigators. In regard to the presence of a radio-active gas in the ground and surface water near the city Prof. Bumstead says first:

"The radio-active gas found in the ground and in the surface water near New Haven is apparently identical with the emanation from radium. If any other radio-active constituent is present it can only be in a very small proportion."

The second conclusion deals with the density of the radium emanation and is as follows:

"The density of the radium emanation, as determined by its rate of diffusion, is about four times that of carbon dioxide, which gives it a molecular weight of 180."

In closing his experiments with the gas Prof. Bumstead attempted to determine the properties of the active gas recently obtained by Strutt from metallic mercury, and in regard to this he says:

"We were unable to obtain the radio-active gas from mercury recently described by Strutt, and are therefore inclined to attribute his results to an impurity in the mercury used."

THE X-RAYS AND RADIUM IN THE TREATMENT OF CANCER.

The Annus Medicus of the Lancet refers especially to the therapeutics of cancer, quoting from a paper published in the first volume of the "Archives of the Middlesex Hospital," by C. R. C. Lyster, the medical officer in charge of the electrical department of that institution. In writing of the effect which the X-rays have upon cancerous growths, the author says "that a very large number of cases have been relieved of pain, and that in a certain number the growth has undergone a definite retrogression; of all the new growths the rodent ulcers have been by far the most satisfactory to treat. The cases that have been under treatment have varied from those exhibiting small recent spots to the

most extensive and old-standing lesions. They have all shown a great tendency to improve; the more recent ulcers have quickly healed, leaving a healthy scar, and there had been no recurrence up to the time of publishing the report. In cases of rodent ulcer of long standing, and with considerable loss of tissue the tendency to heal has been remarkable, but after a time, recurrence is not unusual, and this seems to be more difficult to deal with than is the original ulcer. Of other growths, experiments so far seem to show that the best results are obtained in cases of mammary carcinoma, especially in the recurrent forms. Sarcomata are not so amenable to treatment as are carcinomata. The cases which are apparently the least benefited are the epitheliomata, and this is more especially the case after secondary infection of the lymphatic glands has occurred. With regard to the use of high-frequency currents in malignant disease, it is believed that the good results claimed for this therapeutic measure are due more to the tonic action of the rays than to any direct action on the growth itself. Cases of rodent ulcer and epithelioma were submitted to the action of radium and also to pitchblende, the application of the latter substance being of particular interest, as it is far more easy to obtain than radium; the results of the treatment have not yet been published."

The Lancet, in reference to radium in the treatment of cancer, says: "Full of theoretical interest as the discovery of radium is, its remarkable property of radio-activity has already met with practical application in the treatment of disease, but its real value in this regard, as in the treatment of cancer and lupus, cannot yet be determined. The radio emanations are undoubtedly powerful to produce chemical change, but it remains to be seen whether they will be effective in checking the advance of a morbid process, or of destroying, or of restoring to a healthy state, diseased tissue."

The Vienna correspondent of the British Medical Journal states that Exner and Hozknecht have used radium in the treatment of carcinoma and sarcoma with satisfactory results. The conclusions reached by these investigators are as follows: "Radium rays irritate the cells of the skin less vehemently than cells of cancer and sarcoma. The last named are brought to necrosis before the other tissues suffer severely from the effects. The radium dermatitis is very similar to the Röntgen rays dermatitis." The experience then of the majority of medical men who have used X-rays in the treatment of cancer is that in some forms of the disease they have proved decidedly beneficial. As to radium, its use has been too limited and the period in which treatment has been effected by its means has been too short to warrant the passing of a definite opinion with regard to its efficacy as a therapeutic agent in cancerous growths.

#### THE CURRENT SUPPLEMENT

A splendid picture of the great electrical power plant of the city of Berlin will be found on the front page of the current SUPPLEMENT, No. 1467. The article which accompanies the picture describes the mechanical and electrical novelties of the station. Other electrical articles of interest are those entitled "The Electric Furnace in Metallurgy," "Prof. Slaby's Experiments in Wireless Telegraphy," and "Contemporary Electrical Science." Prof. S. P. Langley concludes his scholarly biography of James Smithson, founder of the Smithsonian Institution. The problem of increasing the fertility of the soil is one that is of especial importance. An exceedingly valuable and instructive contribution to the literature on the subject is George T. Moore's paper on "Bacteria and the Nitrogen Problem," published in this week's SUPPLEMENT. The many inquiries received by the Editor for information pertaining to the caoutchouc-yielding Landolphia of the French Congo will find their answer in an exhaustive discussion of the subject by M. Aug. Chevalier.

#### THE HYDROSCOPE AND ITS SUCCESS.

Cavaliere Pino is the inventor of a machine called the hydroscope, to which reference has already been made in these columns. The instrument consists of a long tube carrying an optical instrument at the end. Objects at the bottom of the sea are reflected upward, where they may be readily studied from the deck of a steamer. By means of the hydroscope, Pino succeeded in bringing up objects from the sea that have been concealed for two thousand years. These were found off the Grecian coast, and include some valuable art objects—creations of ancient Greek art.

The flooding of the Kansas River last May resulted in some very curious changes in the river bed. At one of the curves in the river cut-offs were formed, which caused the water to flow for a distance of two miles through the old bed, but in an opposite direction to the old current. A complete description and discussion of the peculiar conditions produced by this flood may be found in the current SUPPLEMENT, No. 1467.