ENGINEERING.

Steel manufacture by the electric furnace is making good headway. At the present time there are in operation about 80 furnaces of the electric type, namely, 19 of the Hérault system, 14 of the Kjelling, 10 of the Stassano, and the same number of the Roechling-Rodenhauser and Girol, the other twenty-seven furnaces being of eight other systems.

During the Hudson-Fulton Celebration week, the Interborough Rapid Transit Company of this city carried in the course of one day 2,200,000 persons without accidents, blocks, or other detriment to its service. The traffic was about equally divided between the elevated roads and the subway. Considering the crowded condition, this is a truly marvelous feat of city transportation.

At last the Atlantic has been crossed by a steamship at a speed of over 26 knots an hour, the "Mauretania" on her last trip to the westward having covered the course from land to land in 4 days, 10 hours, and 51 minutes, at an average of 26.06 knots, reducing her last record trip to the westward by 44 minutes. Although she did not reach her highest previous day's run, she maintained a steady high speed on every day throughout the course.

The monthly report of the Acting Chairman of the Panama Canal to the Secretary of War, dated September 15th, states that during the month of August, the total amount of excavation done on the Panama Canal was 2,755,178 cubic yards, the average rainfall being 9.27 inches. From now on there may be a diminution in the totals of excavation, due to the fact that portions of the canal have been finished, and that as the excavation grows deeper, the number of shovels that can be employed will be reduced.

The tests which are about to be made of the new army 14-inch gun at Sandy Hook will be followed with close interest; for upon the success of this gun will depend the character of the future armament of our sea-coast defenses. The new piece weighs about the same as the present 12-inch gun, but fires a heavier projectile with lower velocity and a greater curve of trajectory. Its great advantage is that it can fire 250 to 300 rounds without serious erosion, as compared with the limit of 80 to 85 rounds for the 12-inch gun.

The Bath Iron Works are to be congratulated on the remarkable speed made by the new torpedo-boat destroyer "Reid" during her standardization trials on the Rockland mile course, when she reached a maximum speed for one mile of 34.55 knots. This is about a knot faster than the speed, which was itself a record for a torpedo-boat destroyer, of the "Flusser," which made over 33½ knots. The mean of the high-speed runs of the "Reid" was 33.75 knots, which is an eighth of a knot better than the average of the "Flusser." The shaft horse-power was 15,000.

The Japanese armored cruiser "Ibuki," which is equipped with the Curtis reversible turbine built by the Fore River Company, has recently undergone successful steaming trials in Japan. In the six-hour trial under full power, the steam chest pressure was 239 pounds, and the exhaust shell vacuum was 25.7 inches. At 250.5 revolutions per minute the brake horse-power was 27,142, and the water rate per brake horse-power was 15.03; corrected to contract conditions, it was 13.88 pounds. The "Ibuki" carries four 12-inch and eight 8-inch guns.

The consulting engineer appointed by the city to pass on the plans and safety of the new Manhattan Suspension Bridge, Mr. Ralph Modjeski, has found everything to be satisfactory. The main tower foundations are good and sufficient, and although the foundation of the anchorages could have been improved by driving inclined piles, the fact that careful observation for the past sixty days failed to reveal any appreciable movement, leads him to consider that the foundations are safe and sufficient. The structure has been carefully designed and well built and will be amply strong to carry the heaviest traffic, as well as any reasonable addition in the weight of properly regulated traffic that it may have to carry for many years to come.

One of the most important works connected with the Panama Canal is the spillway in the middle of the Gatun Dam for regulating the height of the water in the lake. Usually it is preferred to locate the spillway in a position more or less remote from the dam; but in the present case the existence at the center of the site of the dam of a hill, which provided a rock surface at about sea level, proved the deciding factor, and led to the choice of the present site. The spillway consists of a concrete dam, whose crest is to be built on the arc of a circle, with its face convex to the lake. The crest will be at 69 feet above sea level. Above this, and placed between thirteen concrete piers built at the crest of the dam, will be fourteen gates, whose tops, when they are closed, will be 87 feet above sea level. These gates will give absolute control of the lake level under all possible conditions.

ELECTRICITY.

The Postmaster-General of the United Kingdom has secured for the government telegraphic system all the Marconi wireless telegraph stations in the British Isles.

A new combined electric lamp and shaving mirror has been produced, in which the reflector can be arranged to throw the light only upon the face below the eyes, no light falling upon the mirror or the eyes.

The British Antarctic expedition now in course of preparation will carry wireless telegraphic equipment sufficient to enable messages to be sent to New Zealand from the ship and from stations established at bases of supplies on land or ice.

The Russian crown steel works at Slatons in the Ural district have secured the right to manufacture steel electrically by a process owned by a German company and using induction furnaces. An electric plant will be immediately installed by the Siemens-Halske Company, and the product will be marketed directly.

The electrified suburban system of the New South Wales State Tramways at Sydney, N. S. W., showed a profit of $357,000 for the year ending June 30th, 1908, after paying all working expenses and interest on capital, as compared with a net loss of $15,500 a year for the steam lines owned by the State. This encouraging result will probably cause extensive electrification in Victoria and other adjoining States.

The Commonwealth Edison Company of Chicago has been most successful with its plan of introducing electric flatirons. Ten thousand 6-pound irons were distributed up to March last on loan for six months without charge. At the end of that period the used irons were offered for sale at a reduced rate to the users, most of whom were only too glad to retain the irons at so low a price, while the demand for used irons returned has been greater than the company can supply.

It is reported that a large wireless telegraph and telephone station is to be erected at the Omaha shops of the Union Pacific Railroad, where Dr. Frederick H. Millener will conduct wireless telegraph and telephone experiments. Dr. Millener hopes to develop wireless telephony to such an extent as to permit railroad officials to keep in touch with trains, and thus govern their movements from sixty to one hundred miles from Omaha. If the system is developed as he expects, it will be possible for passengers on moving trains to carry on telephonic conversation within a radius of one hundred miles of Omaha.

The rapid progress of aviation has caused attention to be drawn from a new direction to the dangers of atmospheric electricity. In an article in the Elektrotechnische Zeitschrift Mr. L. Zehnder discusses the danger to balloons and aeroplanes of electrical disturbances, and the methods of avoiding disastrous effects. He points out that the electrical conditions of the air are subject to great variations during thunder storms and that the atmospheric charges may change suddenly in sign. In clear weather an ordinary balloon without metal parts is not exposed to any danger so long as it floats in the air; but in the modern dirigibles much of the framework consists of conducting materials, which add to the danger. Also a balloon may be charged with electricity and a spark produced when contact with the ground is made, setting fire to the gas.

An ordinance was introduced at a meeting of the City Council of Chicago making it compulsory for all railroads operating within eight miles of the city hall to use electricity on their lines in place of steam. There is every prospect that this ordinance will be passed, as there appears to be considerable popular agitation in favor of it. The ordinance requires that within a year after its passage and publication, all railroads shall submit plans to the Commissioner of Public Works, and within six months after the plans and specifications have been approved they shall commence to electrify their roads. If this ordinance is passed, it will result in abating the smoke nuisance in Chicago to a large degree.

The long lead in hydro-electric work maintained by the Pacific coast, which, with exceptional natural advantages, was early in the field, is illustrated by the new power plant of the Great Western Power Company at Big Bend on the Feather River, Cal., the electrical equipment of which is described in the Electrical World. The penstocks are the largest ever built for so great a head, the turbines themselves are of record size, 18,000 horse-power per unit, and are operated by what is certainly a record head of water for any turbines, 525 feet. The transformers also are of record size, being three-phase units of 10,000 kilowatts capacity, with 100,000 volts on the high-tension side. Another big plant described in the same issue is that of the Grand Rapids-Muskegon Power Company, which is remarkable for its high voltage generation, 110,000 volts being the highest yet attempted, as well as for the simplicity of its arrangement.

SCIENCE.

Dr. F. A. Cook has decided to submit to American scientific and geographic organizations duplicates of the proofs which are at the University of Copenhagen. A simultaneous announcement is to be made in Denmark and this country as to whether he had furnished adequate proof that he had reached the North Pole.

Ten grammes or about one-third of an ounce of radium chloride, equivalent to one gramme of pure radium, is the total output for eighteen months of the Joachimsthal mines. After the hospitals and scientific institutions have been supplied, the remainder will be offered for sale at $75,000 a gramme, or 15½ grains.

Analysis of the natural gas coming from the Caucasus wells, which is used for heating purposes, was made by M. Meuschen as to the gas from the Bibi Eybat territory. He finds the following composition in per cent: Methane, 54.80; hydrogen, 13.58; saturated carbides, 1.20; nitrogen, 20.42; oxygen, 7; carbonic acid, 3. Another sample gave only 0.80 hydrogen, 60.0 methane, and 25 nitrogen, with the rest about the same.

In a recent issue of the Astrophysical Journal Mr. Walter S. Adams of the Mount Wilson Observatory station summarizes the results of a study of the Mount Wilson photographs of sun-spot spectra. A discussion of the various elements whose lines are strengthened or weakened in the spot spectrum indicates that the changes observed may be best accounted for on the basis of a reduced temperature in spots. A detailed study of the spectrum of iron furnishes especially strong evidence in this direction, and the weakening of the "enhanced" lines in the spot spectrum is also most simply explained on the same basis. The presence of the spectra of titanium oxide, magnesium hydride, and calcium hydride is sufficient to account for the greater part of the unknown fluting and band lines appearing in the spot spectrum. The discovery of the existence of a magnetic field in sun-spots by Mr. Hale provides a ready and sufficient explanation for the widening of large numbers of lines in the spot spectrum for which there is no marked change of intensity.

An apparatus for making enlarged tracings of sound-waves from a cylindrical graphophone record, the magnification ranging from 150 to 2,500 times, was described by F. Proctor Hall before the British Association. In the sound-waves two elements are distinguished, impulse and resonance, which are illustrated by waves from the cornet, violin, bugle, etc. Vocal waves are found in groups regularly repeated. Each group contains a single impulse from the vocal cords, together with one or more sets of resonance waves produced by vibrations of the air in the vocal tubes. Pitch is determined by the number of impulses per second—i. e., by the number of wave groups—and is not affected by the character of the waves within the groups. The vowel quality of vocal sounds is not perceptibly affected by the number or form of the resonance waves, but is dependent upon their periodicity. The rate of the resonance waves may be calculated from the length of the air-tubes upward from the vocal cords. The calculation shows, for example, that the sounds *m*, *n*, *ng*, all contain a resonance wave whose period is about 530. The mean rates found from measurements of the enlarged waves are for *m* 550, for *n* 535, for *ng* 580. The observed rate for the sound of *a* in the word "great" is 420, and for the sound of *o* in "mat" 770 waves per second.

Mr. Durand, United States Census Director, has made an appeal to farmers all over the country to assist him in securing accurate agricultural returns at the coming census. He trusts that farmers will keep or provide some sort of written record of their operations during the year 1909. Each person in charge of a farm will be asked to state the acreage and value of his farm—that is, the acreage and value of the land kept and cultivated by him; the area of land in his farm covered with woodland, and, finally, that which is utilized for specified farm purposes; the acreage quantity produced and value of each crop, including grains, hay, vegetables, fruits, cotton, tobacco, etc., raised on the farm in 1909; the number and value of all domestic animals, poultry and swarms of bees on the farm on April 15th, 1910. He will also be asked to state the number and kind of animals sold during 1909 and the receipts from such sales, the number purchased and the amount paid therefor, and also the number slaughtered for food, and the value of such animals. The census act provides that the information shall be used only for statistical purposes for which it is supplied. "No publication shall be made by the Census Office whereby the data furnished by any particular establishment can be identified, nor shall the Director of the Census permit any one other than the sworn employees of the Census Office to examine the individual reports." Furthermore, the information reported on the agricultural schedule will not be used as a basis of taxation or be communicated to any assessor.