

## ENGINEERING.

The contract has been awarded by the Navy Department to the San Francisco Bridge Company for the construction at Pearl Harbor, Hawaii, of what will be the largest drydock in the world. The masonry and cement portion of the dock alone will cost \$1,670,000. Plans have been drawn for a complete system of defense for the harbor, and the construction of these defenses and of the dock will proceed simultaneously.

In a communication to Stahl und Eisen a German manufacturer states that he has succeeded in making satisfactory high-speed steels with powdered ferro-tungsten. The steel contains 0.85 of tungsten, 0.45 silicon, 0.45 manganese, 0.30 carbon, 0.25 aluminium, calcium, and magnesium, and 0.01 of sulphur. The powdered ferro-tungsten alloys more readily than tungsten metal, and there is less segregation and piping.

The French navy has suffered in the past from the lack of a systematic plan for the steady growth of the navy by regular annual increments. For the future the navy will be built up on the programme system first adopted by Germany. The new naval programme recently approved by the Cabinet involves an expenditure of \$600,000,000, covering a period of ten years. Six battleships of the "Danton" type, six of the "République" type, and four armored cruisers of the "Gambetta" type are included in the estimates.

Apropos of the proposed deep waterway from Chicago to the Mississippi River, our esteemed contemporary Engineering News calls attention to the fact that a waterway between Lake Michigan and the Mississippi now exists across the State of Wisconsin, and that recently two steamers of considerable size passed through from the lake to the river. The route extends from Lake Michigan up Fox River, 38 miles, to and across Lake Winnebago, and through the upper Fox River 105 miles to the Portage Canal, which is 2½ miles in length. Thence it passes down the Wisconsin River, reaching the Mississippi near Prairie du Chien.

Now that the Board of Estimate has approved the application of the Hudson & Manhattan Railway Company for permission to extend its tunnels from Sixth Avenue to the Grand Central Station, New York, the company will push the work of construction with all possible speed. A delay of about six months will be occasioned by the work of obtaining property owners' consents, and it is estimated that the actual work of construction will consume about eighteen months, in which case trains will be running from the Jersey City terminals to the Grand Central Station early in 1911.

The question of the possible use of the electric furnace for the making of steel was discussed at the recent annual meeting of the British Iron and Steel Institute. Nothing has been done in this direction in a commercial way in England, though a small experimental furnace is to be built for Sheffield University. The system is being tried commercially at the Krupp works at Essen and Volklingen in Prussian Silesia. A few plants have also been installed in Sweden. Hitherto steel making by the electric process has not been tried on a commercial scale in this country; but we understand that one or two furnaces may possibly be included in the new Gary plant of the Indiana Steel Company.

The "Carnegie" non-magnetic survey yacht, the nature and objects of which were fully described in our issue of February 20th last, was successfully launched at the yard of the builders, the Tebo Yacht Basin Company, Brooklyn, on Saturday afternoon, June 12th. Work on the building of the boat has been rapid, and the rigging and equipment are expected to be even more so. The copper gas producer and auxiliary engines, refrigerators, galleys, and all other details are expected to be in place and brief trial trips concluded by July 15th, when the vessel will sail for Hudson's Bay. She will continue her magnetic survey work there until ice prohibits, when she will return to the Tebo basin, to be coppered before proceeding to southern waters.

Although a correspondent describing a Western tunneling machine in a recent issue suggested that nothing similar was being done in the East, the manufacturers of a machine for the same purpose have shown their confidence in it as a practical device by taking a contract for the boring of an 8-foot sewer tunnel under the Grand Central Station, New York, in the excavation adjacent to which the machine is now at work. This is the invention of Messrs. O. S. Proctor and E. F. Terry of the Terry & Tench Company, described in the SCIENTIFIC AMERICAN of January 9th. Whereas the trial is admittedly experimental as regards the best kind of steel and form of bit to be used, it has not developed as yet any essential defects in the machine, in spite of the exceptional difficulty of the task, a streak of quartz having been encountered in soft mica-schist, which makes cutting with such a machine more difficult than if the face of rock were uniformly hard.

## ELECTRICITY.

Plans are under way for the electrification of the more important state railroads of Sweden. It is expected that the line running from Kiruna, in the iron ore fields of Lapland, to the Norway boundary will be the first to change from steam to electricity. The change is made necessary by the increase of traffic over the line, which can be handled only by doubling the tracks if steam propulsion be still adhered to. It is believed that electrification would be much more economical than the construction of double tracks.

A new method of testing insulation of armature coils has been devised, which is known as the "slot method." The dielectric is pressed into a laminated iron slot by means of a brass block. The block is connected to one terminal of the circuit, and the iron laminations to the other. An alternating current is thrown into the circuit, with a view to discovering the voltage at which a breakdown will occur. Owing to the angles in the laminated slot, there is quite a difference between the results of this system and the ordinary system of parallel plates.

The use of electricity for operating pumps in mines is attended with a high degree of efficiency when it is possible to use a large sump, which may fill during the working hours, and thus permit of deferring the pumping operation to those hours when the power plant is underloaded. Under such conditions the very best of steam plants cannot compete with electricity, for it is possible to use an approximately uniform load during twenty-four hours of the day, and the power companies make a low rate for such service.

One of the baseball grounds in Cincinnati has been equipped with electric lamps, so that it will be possible to play the game at night. The lamps are placed on tall steel towers surrounding the grounds, and searchlights directed upward permit the players and spectators to follow a fly ball that is batted high in the air. The illuminated grounds were tried out quite recently by one of the National League teams, and proved quite a success. It is predicted that illuminated baseball will become quite an evening entertainment, and should be very popular with those enthusiasts who are unable to get off of an afternoon to witness their favorite game.

A recent patent that should be of particular interest to electricians and plumbers covers a machine for boring holes through overhead beams, which does not require the operator to climb a ladder, but may be operated and directed from the floor. The machine is mounted on a staff provided with a foot which rests on the floor, and this staff may be adjusted to bring the boring tool against the ceiling or beam. The tool is operated by means of a hand crank, and the feed is regulated by a chain, both within easy reach of the operator. The device is arranged to bore a double line of holes.

An act recently passed by the Colorado Legislature makes it a misdemeanor for any person to tamper with electric wires or connections without the consent of the owner, or to meddle with an electric meter. A fine of from \$50 to \$300 and imprisonment for thirty to ninety days for failure to comply with this law, is the punishment. As it is rather difficult to fix the blame in ordinary cases, the act provides that the existence of a wire connection or any damage or alteration of a meter shall be taken as evidence of the guilt of a person in possession of the premises.

Now that an international candle has been fixed upon, it is unfortunate that Germany clings to its Hefner candle, particularly as the value of this candle is less than that of the new unit. It is believed that the public, not understanding the difference in the value of the candles, will be apt to buy the German lamps because they will bear a higher candle figure for the same value. Eleven Hefner candles are equivalent to ten international candles. The international candle is to be adopted in this country on the 1st of April next. Our standard candle will have to be reduced 1.6 per cent. That would make a 16-candle-power lamp of the present rating equal to 15¾ according to the new standard.

A very interesting electrical clock was exhibited at the Southern Electrical and Industrial Exposition held in Louisville, Ky. This clock is different from the ordinary in having no hands. Minutes are indicated by means of sixty radial rows of lights, each containing 32 electric globes. The hours are indicated by shorter rows of colored lights. In place of the hands, then, two lines of light sweep over the face of the dial, one indicating minutes and the other hours. Each second the illumination in an outer circle of lights moves forward one lamp, and when an entire circuit has been completed, the row of minute lights is advanced one interval. The hour hand moves at five-minute intervals. The dial is formed on the face of a huge pendulum, which swings to and fro over an arc of 15 feet. The pendulum is 48 feet long, and its weight, with the 5,485 lamps and 11,000 connections required, is 3,000 pounds. Over a mile of wire was used in making the connections of the clock.

## SCIENCE.

In excavating for a drydock at Taranto, Italy, some interesting archæological relics were discovered. Among them were a sarcophagus of the fourth century A. D. containing two intact bodies, many valuable Ionic and Corinthian vases, sepulchral furniture, and a curious terra-cotta group representing Cupid kneeling on the shoulder of Venus.

We recently made the statement that there was no spectroscopic evidence of water vapor on Mars. We are informed by the secretary of Lowell Observatory that not only has the presence of water vapor in the atmosphere of Mars been spectroscopically detected by Mr. Slipher at Flagstaff, but that it has been photographed and the amount of water measured by Prof. Véry.

Although preparations were made at the United States Naval Observatory to observe the eclipse of the sun on June 17th, cloudy weather spoiled all the plans. Inasmuch as the eclipse was only partial in these latitudes, and total only near the North Pole, where few if any white men, with the exception of Commander R. E. Peary and his crew, are to be found, the eclipse was not of much astronomical importance.

Excavations conducted by the German Oriental Society have revealed the Palace of Herod on a hill south of Jericho. In Asur Nebo the temple erected by the last Assyrian king has been completely excavated, with the result that two smaller temples have been disclosed side by side. Lastly, the dwelling of an ordinary citizen was discovered intact, together with many earthenware bowls, utensils, and some tablets with inscriptions.

Col. Frank Touvelle, a rancher living near Medford, Oregon, is said to have produced a deep-rooted vine which brings forth three crops of berries in a season, which result has been obtained by grafting alfalfa roots on the roots of the strawberry vine. Alfalfa roots deeply and produces three to five crops a year without irrigation. It occurred to him that strawberries might do the same if the vine could be made to extend down far enough, so as to receive moisture from the soil throughout the season.

Dr. Jagot, of the Angers medical school, claims to have discovered the secret of the mysterious poison of the Borgias. Two poisons, apparently, were used, one slow and the other rapid in operation. The former appears to have been arsenious acid, commonly known as arsenic, which is only slightly soluble and therefore acts slowly, while the quick poison was probably one of the soluble preparations of arsenic which act almost instantaneously. It is not, however, positively proved whether the poison of the Borgias owed its efficacy to arsenic, to the ptomaines of putrefaction, or to both combined.

The rock temperature in Bendigo mines, according to the report for 1907 of A. H. Merrin, chief mining inspector for Victoria, Australia, increases at the rate of 1 deg. F. for each 75 feet below the zone of invariable temperature. At 4,000 feet the temperature due to the heat of the rocks is 110 deg. F. At this depth the temperature of the water issuing from the rocks is 114 deg. F. Under average underground conditions, when there is water in the downcast shaft, the actual temperature in the stopes will be somewhere between 75 deg. and 110 deg. F., depending upon the quantity of air entering the stope and the length of time the air is in contact with the rock before entering the stope.

The flow of sand through tubes has been studied by C. E. S. Phillips. It seems that the rate at which the free surface of a column of sand descends in a vertical tube, owing to the escape of powder from an orifice at the lower end, is independent of the head of sand above the opening. These experiments are intended to throw light upon the manner in which this result is brought about. By placing the powder in a D-section tube faced with glass, and arranging dark layers at regular intervals, the relative motion of the particles at various places is rendered visible as the column diminishes. The "gurgling" tube indicates, by the curious sound it emits, that the flow of sand takes place through it intermittently.

A new kind of glow in vacuum tubes has been discovered by the Rev. H. V. Gill, S.J. A vacuum tube is fitted up containing a small strip of palladium foil, or platinum foil coated with palladium black, mounted at the extremities of two leads, so that its temperature can be raised by means of an electric current. When the foil is heated in air at a pressure of about 0.15 millimeter to a white heat, there becomes visible round it a glow, not unlike the "negative glow" in a vacuum tube discharge. There is, however, no electric field except that due to the current employed to heat the foil. The glow is a rich purple-blue color, and is separated from the hot palladium by a dark space. There is evidence that the luminosity is due to a complicated reaction between the gases in the tube and particles of the disintegrated palladium.