

## ENGINEERING.

It is stated that the greater part of the survey of the route of the Hudson Bay Railway has been completed, about 400 out of a total distance of 465 miles having been covered by the locating parties. The new road will provide a superior route for the shipment of the large and ever-increasing grain supply of the Canadian Northwest to European points.

The total number of boiler explosions in the United States, in 1908, as reported by the Hartford Steam Boiler Insurance and Inspection Company, was 470, as against 471 in 1907, 431 in 1906, and 450 in 1905. The record shows that since October 1st, 1867, there have been 10,051 boiler explosions recorded by this company, in which 15,634 people were injured and 10,884 killed.

A plan for a tunnel below the St. Lawrence River at Quebec was recently submitted to the Montreal Board of Trade. It is claimed by Mr. J. S. Armstrong, the engineer who made the proposal, that it would cost no more than the proposed Quebec bridge, and that it would have the advantage of presenting no obstruction to navigation. Provision would be made for four lines of railroad track and for vehicular traffic. The location would be at Quebec, and connection would be made directly to Levis at the opposite side of the river.

The British have so greatly improved the Whitehead torpedo that the latest type, which has a diameter of 21 inches, is credited with having maintained an average speed of 31 knots over a range of 7,000 yards. The drawback, limiting the usefulness of this really wonderful weapon, is that its increased diameter and length will necessitate the entire reconstruction of torpedo-launching gear on all existing ships to which it may be furnished. For the new "Dreadnoughts," however, it will be entirely available.

Among the advantages of the use of steel in passenger car construction are the following: It reduces the risk of accident; it is more available than wood; it is easier to work; it produces a simpler and more artistic appearance; it is easier to keep clean; and, when properly designed, a steel car weighs no more than one of wood. For the same capacity it costs no more than a wooden car; its life is longer; and finally the cost of damage suits arising from accidents is considerably less.

The great Pennsylvania Railroad Company is investigating, with characteristic thoroughness, the question of the most suitable form of overhead trolley construction for its tunnels and terminal station at New York. For this purpose it has in operation an experimental track, about five miles in length, which is divided into nine short sections, each of which is equipped with a different type of overhead line. By this policy the company will avoid the troublesome and costly delays, which were incidental to the early days of operation of the overhead line on the New Haven Railroad from Stamford to New York.

As the result of a proceeding brought by the Forest, Fish, and Game Commissioner, the Public Service Commission has ordered the railroads which operate in the forest preserve of the Adirondacks to burn oil in place of coal, through the months of the year from April 15th to November 1st. The complete installation of oil burning is to be effected by April 15th, 1910. At least four locomotives fitted with oil-burning apparatus are to be placed in service on these roads this summer, for the purpose of familiarizing the men with the new fuel.

The Bessemer & Lake Erie Railroad, which runs from Conneaut on Lake Erie to Bessemer near Pittsburgh, is said by the Iron Age to have established a record for low cost of operation and net earnings. The average revenue trainload last year was 937 tons; and the average trainload from the lake to Bessemer, in the busy period of last year, was 1,406 tons. The road is 152 miles in length, and nearly 10,000,000 tons are being carried over it in a single year. During a year of normal traffic it has earned, on an average, \$26,000 for each mile; the highest net earnings in a single year were about \$3,000,000.

A new motor lifeboat has recently been placed in commission at the Sandy Hook life-saving station, for duty on the stretch of dangerous coast, 110 miles in length, reaching from Sandy Hook to Cape May. The lifeboat, which is 36 feet in length, carries a six-cylinder gasoline engine, that can drive it at a speed of 8 to 10 knots. The weight of the boat when fully equipped is 6½ tons. It is non-capsizable, non-sinkable, self-baling, and can carry seventy-five people. Capt. Charles McLellan, of the United States Revenue Cutter Service, who has charge of the designing and building of boats for the life-saving service, believes firmly in the value of the gasoline motor for lifeboat work; and he has equipped a light surfboat on the Cape May station with twin screws of a new design.

## ELECTRICITY.

The first electric smelting plant in the world in which pig iron will be produced on a commercial scale is about to be installed in Norway. The plant will be fitted with an initial installation of two 2,500 horsepower reducing furnaces for iron ore and two 600 horsepower steel furnaces. Later it is expected to triple this equipment.

A new chemical fire extinguisher was recently tested in this city, to determine its availability for use in extinguishing "electric fires." The exact composition for the chemical has not been made public, but it is stated that it consists chiefly of carbon tetrachloride. To show that it is a non-conductor, a stream of the liquid was played on an arc between terminals of a 14,000-volt circuit without producing any effect upon the operator. The chemical was squirted over the commutator of a 5-horse-power direct-current motor without in the least injuring the armature or field.

Metal filament lamps are now made so much less fragile that they are being recommended for use on railroad trains. The voltage of the train-lighting system is usually quite low, and this permits of using short filaments, and yet the candle-power of the lamp is so much higher that it gives 25 per cent more light with 30 per cent less consumption of current than the carbon-filament lamp. By using metal-filament lamps a lighting outfit that is now overloaded may have its load reduced, while it is possible to add electrically-lighted cars to a train in which the lighting outfit is already fully loaded.

It is estimated that three and a half million wooden poles used by electric companies in this country require renewal each year. These poles are perfectly sound except at the ground line; and as it costs more to renew a pole than to set a new pole, a scheme of reinforcing the poles with concrete has recently been devised. It consists in bridging the weakened part with reinforcing rods driven into the pole above and below the decayed portion. Concrete is then molded around the pole over the reinforcing rods. In this way the pole can be rendered even stronger than it was originally and at very little expense.

The longitude of a vessel at sea is found by noting the difference between the time at Greenwich or any other standard meridian and that of the meridian of the vessel, as determined by observations. In order to eliminate error due to inaccuracy of the chronometer, it has been proposed that time signals be transmitted at regular intervals from a land station, such as the Eiffel Tower. This would do away with the use of the chronometer, as the signals could be transmitted practically instantaneously to the vessels. In order to test the efficiency of such system, a set of signals were sent out from the Eiffel Tower, and were received at the Brest Observatory, where it was found that the maximum variations were not more than half a second.

In a paper recently read before the American Institute of Electrical Engineers, A. B. Reynders discussed the advantages of the condenser type of insulation for high-tension terminals. When a difference of potential is passed across a number of condensers connected in series, each condenser takes its share of the stress in inverse proportion to its capacity. This has led to the making of a terminal constructed of a metal tube wrapped with paper, and at regular intervals provided with a layer of tinfoil inserted during the rolling process. This done, the insulator is turned in the lathe so that it is tapered in steps. The result is a series of concentric condensers. In order to prevent a corona effect from the edges of the tinfoil, they are protected by metal rings electrically connected thereto. By this means it is possible to provide terminals which can be successfully used on transformers of 300,000 to 500,000 volts. A condenser type of insulator has also been made for outdoor use. But in this case, instead of the metal rings bell-shaped metal caps or petticoats are furnished.

An interesting demonstration was recently given in England of an electric generating plant operated by a windmill. The wind wheel was 16 feet in diameter, and was mounted on a tower 50 feet high. Three tails were provided, one at the side being fixed, and the other two adapted to be rotated on a horizontal axis, so that when they were turned into the vertical plane they would hold the wheel into the wind, and when turned in the horizontal plane, the fixed tail would throw the plane of the wheel in the plane of the wind. The two movable tails were arranged to swing out of the vertical position, automatically, when the velocity of the wind rose above a certain amount. A 2-kilowatt generator was driven by the wheel at speeds varying from 800 to 1,600 revolutions per minute. Six switches were provided to control the field circuit by throwing in a resistance when the current generated reached 5, 8, 11, 14, 17, and 20 amperes respectively. The current was used to charge a storage battery, which could be drawn upon as required for operating various electrical apparatus.

## SCIENCE.

It is a prevalent opinion that if a human being is bereft of one sense, one or more of the other senses become more acute, and thus establish a compensation. The question is discussed with much shrewdness by M. Kunz, director of the Institution for the Blind at Illzach-Mülhausen. The results are somewhat surprising. As regards perception of the direction of sound, there is no difference between the seeing and the blind. The average distance at which sounds could be heard was essentially the same in both classes. The delicacy of the sense of smell was rather in favor of the seeing. It is generally supposed that the palp of the forefinger of the right hand, which is used by the blind in feeling the points in Braille's system of teaching the blind to read, must be very sensitive; but this was found not to be the case.

One of the most notable discoveries regarding the early history of Peru has recently been made by Hewitt Myring, an English antiquarian. He collected 2,000 specimens of pottery and weapons of the ancient Peruvians. Remains and relics of the early inhabitants of Peru, which are said by archaeologists to date from 4000 to 7000 B. C., were found by Mr. Myring under an old Incas burying ground when he was exploring in the mountains about 200 miles inland from Lima. Each grave contained the remains of food and glazed clay jugs. The most valuable portion of this discovery of antiquities consists of the great urns, some of them six feet long and so heavy that it required three men to carry them. They were found buried beside mummies, and the majority of them had the features of the dead man or woman delicately carved either on the upper part of the urn or on a solid stand beneath.

Messrs. Cowell and Crommelin, whose calculations of the movements of Halley's Comet are generally regarded as the most trustworthy, fixed April 8th as the most likely time of the perihelion passage, but later they revised their figures, and designate April 13th as the more correct date. In a recent number of the *Astronomische Nachrichten*, another computer, working for a prize, but whose name is not given, fixes the date on June 18th. This discrepancy is a little disquieting, both because it shows how widely apart the results found by two independent calculations based on similar data may be, and because it introduces much uncertainty for those who are searching for the comet. In 1835 the computers, who did not have as correct data as those now available, hit the day of perihelion passage within two days of the actual time, and none of the calculations was as much as one month in error.

The present population of the earth, estimated at 1,467 millions, is distributed very unevenly. The average density of population of the entire land surface of the globe is about 31 inhabitants per square mile. This total land surface, which slightly exceeds 46 million square miles, is composed of 28 million square miles of fertile land, 14 million square miles of steppes, and 4 million square miles of deserts. Ravenstein estimates the maximum density of population that can be supported by the fertile regions at 207 persons per square mile, and thus (allowing 14 persons per square mile to the steppe regions) obtains 5,994 millions as the maximum population of the globe. The present rate of increase per decade is 8.7 per cent in Europe, 6 per cent in Asia, 10 per cent in Africa, 30 per cent in Australia and Oceania, 20 per cent in North America, and 15 per cent in South America. The mean rate of increase for the whole earth is 8 per cent per decade. At this rate of increase the earth would be completely filled with its maximum population of 5,994 millions in the year 2072, or in 163 years from the present time.

The mercury vapor lamp with a tube of quartz emits a large proportion of ultra-violet radiations, the bactericidal properties of which were established by Nogier and Thévenot in 1906. Courmont and Nogier have recently endeavored to utilize this property in the sterilization of drinking water. A Kromayer lamp, of 9 amperes and 135 volts, was suspended in an iron cask filled with water. All bacteria (including the coli bacillus and Eberth's bacillus) within 12 inches of the lamp were killed in two minutes. A long series of experiments proved conclusively that one minute suffices for complete sterilization in ordinary cases, and two minutes when the water is very greatly contaminated, either naturally or artificially. The water, however, must be clear, in order that the rays may pass through it. The elevation of temperature is only a fraction of a degree and the water, after treatment, is harmless to plants and animals. Hence it appears practicable to sterilize the water supply of a city (after clarification, if necessary) by distributing powerful quartz mercury vapor lamps in the reservoirs or the mains in such a manner that every particle of water shall remain two minutes within a few inches of a lamp.