

ENGINEERING.

The Secretary of War has recommended the removal of what is known as Middle Ground, a series of obstructions to the navigation of the East River, 1½ miles to the east of Hell Gate. A depth of 17.8 feet has been secured over this ground by work initiated in 1893. The Secretary recommends that this depth be increased to 26 feet at a cost of \$1,733,080. The blasting away of the reef will remove a serious menace to the shipping which uses the inside route by way of Long Island Sound.

That the rate of excavation of the Panama Canal is greatly dependent upon the rainfall, is shown by the increase in the amount of material removed in December over that taken out in November. During the former month, when there was a precipitation of 11.66 inches, the excavation amounted to 2,920,494 cubic yards. In December, when the total rainfall was 5.93 inches, the total excavation exceeded that of November by 343,179 cubic yards and amounted in all to 3,263,673 cubic yards. This is only 216,597 cubic yards less than the highest record, made in March last, when the total was 3,480,270 cubic yards.

So serious is becoming the question of supplying ties for our railroads, that the Santa Fé system recently sent its manager of the timber and tie department on a tour to the Orient and Europe, to make a study of conditions. It was learned, among other things, that three hundred years ago the Japanese government began to conserve its forests; and that, as a result of its foresight, Japan is now selling ties to railroads in this country and Mexico. There is a duty of twenty per cent on each tie imported into the United States. That we should be paying a twenty per cent duty on ties is one among many constantly accumulating evidences of the thoughtless extravagance with which our magnificent timber supply has been ruthlessly swept away.

The statistics of British shipbuilding during the year 1908 show that the depression of leading industries was by no means confined to this country. The total tonnage of vessels launched in 1906 in Great Britain was 1,828,090 gross tons; in 1907, 1,607,890 gross tons were launched; but in 1908 the total fell to 902,756 gross tons. This, as compared with 1906, represents a falling off of 50 per cent, and about 44 per cent as compared with 1907. Well may our contemporary, the Shipping World, speak of this as "an appalling decline, and the most depressing, unprofitable and unsatisfactory year in the history of this great British industry."

In a paper read before the recent road congress in Paris, H. P. Maybury stated that reliable roads suited to modern traffic would be secured by building them as strongly as possible; reducing the camber to a uniform 1 in 30; coating the surface with the best obtainable hard material, gaging not less than 2 nor more than 2½ inches, and thoroughly rolled; using only clean, hard gravel and chippings as the binding agent; then cleaning the surfaces and applying a dressing of a heated tar compound; and finally covering the surfaces thus treated with hard, clean gravel or granite chippings and thoroughly rolling with a steam roller. His experience has proved that such a surface is cheap, almost dustless, and provides good traveling for traction engines and commercial motors and a good footing for horses.

The general manager of the underground system of London, formerly general manager of the Public Service Corporation of New Jersey, who is now in this country, states that during the rush hour trains are run at closer intervals, namely 90 seconds, than they are during the rush hour on the New York subway. The tubes, of which there are altogether about 100 miles in London, vary from 80 to 180 feet in depth below the surface. They are served by large elevators, which are worked in connection with the train schedule by means of a system of signaling. There are also 80 miles of subway, built, like our own Rapid Transit system in New York, just below the street surface. This system, much of which was built and in operation over fifty years ago, was originally operated by steam; but within the last few years it has been equipped for electric traction.

Gen. Allen, Major Squier, and Lieut. Lahm recently appeared before a Senate Committee and made a strong plea for the appropriation of \$500,000 for the development of the aeronautical branch of the work of the army signal corps. The astonishing strides made by both the dirigible and the aeroplane during the past year have established the practical character of these machines, considered in regard to their military possibilities. Enough has been done to make it certain that aeronautics will figure largely in future military operations. Just how largely, or in what way, it is too early to determine; but sufficient demonstration has been made to render it imperative upon our government to keep abreast of the foreign powers in developing this new arm of the service.

ELECTRICITY.

The tunnel under Washington Street, in Boston, has been equipped with a very complete telephone installation which is open to the use of the public. There are twenty-four pay stations at the eight railway stations of the tunnel. The booths are provided with the three-slot type of instrument, and are entirely automatic in their operation.

The British Meteorological Office has arranged with shipping companies to report the condition of the weather on the Atlantic by means of wireless telegraphy. The ocean is divided off into numbered areas, and the number of the section is to be given with each report. This will enable the office to make more accurate forecasts of weather conditions.

A Swedish transmission line has recently been installed in which over certain sections a cable is used in which a hemp core is imbedded. It is claimed for this cable that the strain is distributed more uniformly than with a wire core. This cable is used only at road crossings and is calculated to overcome danger due to the line breaking at such vital points.

The Health Department of Chicago has been making a series of experiments with various car-ventilating systems. Four different types of ventilators have been examined, and these have been described in their recent report, although the preferred system has not been indicated. The department has come to the conclusion that ventilation is a necessity, and should be required on Chicago's railroads.

An interesting hydro-electric plant has been installed on the Kerka River, in Dalmatia, Austria-Hungary, to generate electricity used in the manufacture of carbide. A novel feature of this plant is that in order to do away with transformers high-potential three-phase generators are used, producing electricity at 30,000 volts, which is fed directly into the transmission line. The latter is 21 miles long.

Under the new régime in the Turkish empire the restrictions on electrical apparatus, of all classes, have been removed. The government is planning to establish a telephone service similar to its telegraph service. This is a very interesting illustration of the advance of the Turkish government, which heretofore has had a particular dread of electricity owing to its connection with the word *dynamo*, which obviously must have something to do with dynamite.

Electrical fireboats have been put into service in Chicago. The boats are driven by two electric motors operating independently the twin screws. The current is supplied by generators direct-connected to steam turbines. Directly coupled to each generator set is a centrifugal fire pump. The particular advantage of using electricity for these boats is that the command of the vessel is entirely under the direct and immediate control of the captain. This is particularly important in the congested Chicago River.

Our consul at Nantes, France, reports the use of the telephone in fishing in Norway. A special form of microphone is used, which is inclosed in a thin watertight steel box, kept in communication with a telephone receiver on the fishing boat. By means of this apparatus, the fisherman is informed of the approach of fish by the peculiar sound produced in the instrument. A whistling sound indicates the approach of herring, while a sort of grunting sound announces the arrival of codfish in the neighborhood.

Consul-General A. W. Thackara, of Berlin, reports the following charges for wireless telegraph messages at German coast stations: Besides the regular telegraph rates of 5 pfennigs (1.19 cents) a word, minimum price 50 pfennigs (11.9 cents), there is a charge of 15 pfennigs (3.57 cents) a word, minimum 1.5 marks (35.7 cents), and if the message is sent to a steamer which can be reached from the coast station an additional toll of 35 pfennigs (8.33 cents) a word, minimum 3.5 marks (83.3 cents), is charged.

One of the problems which has arisen in connection with the construction of the House and Senate office buildings in Washington has been a method of transporting Congressmen from their offices to the capital. A subway has been built, and it was first proposed to install a small electric railway in the tube. But the plan was abandoned because of the noise of such a system. It is now proposed to provide small rubber-tired electric cars, furnished with storage batteries, which are so constructed that they can be used for carrying freight when not otherwise needed.

The government telegraph lines in France have adopted a system of charging only one centime or a fifth of a cent per word for messages dispatched at night. This rate applies to messages containing at least fifty words. In this way it is hoped to keep the wires almost as busy at night as in the daytime. The value to the commercial world will be that a business man can send by telegraph a communication, comparable in length with an ordinary letter, and at but little over regular postage rates, with the assurance that the message will be delivered the very first thing on the following morning.

SCIENCE.

The eighth moon of Jupiter, discovered only within the last two years, has been photographed at the Greenwich Observatory. The satellite has been photographed but few times since its discovery and the determination of its position now accords with previous computation of its position by astronomical methods.

An apparatus has been invented for measuring the elasticity and the hardness of India rubber. The elasticity is determined by dropping a steel ball on the rubber from a measured height, H , and observing the height, h , to which the ball rebounds. The ratio — H

is proportional to the elasticity. The hardness is determined by forcing a sharp point into the rubber. The force exerted and the depth of penetration are recorded automatically on graduated circles, and the combination of these indications gives the degree of hardness. With this apparatus the relative value of various specimens of India rubber can be determined very easily and rapidly.

So large a quantity of copper is required to color canned vegetables thoroughly that the only safe rule is to prohibit the addition of copper salts absolutely. The objection that this prohibition would favor imported canned vegetables, at the expense of the domestic product, should be met by a rigid inspection of imports. The quantity of copper may be determined by incinerating the vegetables, leaching the ash with nitric acid, evaporating to dryness, dissolving the residue in hydrochloric acid, neutralizing the solution with ammonia, acidifying it slightly with hydrochloric acid, and precipitating the copper with zinc in a vessel of platinum.

In 1907 many specimens of Seltzer water were examined by Dr. Klein, who found that most of them contained great numbers of micro-organisms. This result created some surprise, for carbonic acid under pressure was supposed to be fatal to all bacteria. Dr. Klein admits the germicidal power of carbonic acid, but finds that it acts very slowly in Seltzer water, which may contain living bacteria four months after bottling. As a rule, carbonated waters are consumed a few weeks after bottling, and it appears impracticable to demand that they be kept long enough to insure self-sterilization. Consequently, English producers of mineral waters formed an association, which prescribes the precautions required to insure the production of perfectly wholesome waters, and issues certificates to members who adopt those precautions. English bacteriologists find that the waters furnished by these manufacturers are perfectly wholesome, but they remark that the search for absolutely germ-free water is Utopian, for even distilled water becomes infected on the slightest exposure to the air. All that can be exacted is that perfectly pure water shall be employed in the manufacture and that the process shall be so conducted that the bottled water shall contain no more bacteria than the water from which it is made.

The extraordinary vogue of the pictorial postcard has resulted in the evolution of various projecting lantern devices, whereby the pictures resplendent in all their colors may be thrown like a transparent lantern slide upon a sheet. One of the latest and most successful of these has recently been perfected in England under the name of the "Fifax" reflectroscope. It is an ingenious device, and is intended to dispense with the necessity of preparing special glass slides for lantern projection. In general appearance it resembles the popular magic lantern, but instead of the light being transmitted through the condenser, slide, and lens in a direct line, the image is projected upon the screen by reflection, as its name implies. The picture to be shown is placed at the back of the lantern, where a powerful beam of light of 3,000 candle-power is concentrated upon it by means of two reflectors, and the image is retransmitted therefrom through the lens onto the screen. The feature of this particular apparatus is the lighting system, whereby such an intense, powerful illumination is obtained. Though designed for use with electricity, oxyhydrogen, petroleum, or other lighting mediums, gas is recommended as providing the steadiest and most penetrating beam. The burners are of a special high-pressure type, and fitted with incandescent mantles, and the projection is such that the reflection is as vivid and striking as if a high-grade glass lantern slide were used. Not only can picture postcards be projected in this manner, but ordinary photographic prints printed by any process, as well as ordinary letterpress printing. It will be realized that the system not only appeals to those who possess no knowledge of photography, but to the amateur in the latter art represents a considerable saving in the preparation of slides. With the high-pressure incandescent gas system the cost of operation averages about half a cent per hour. The picture transmitted can be projected for a considerable distance; but the brilliancy and definition naturally decrease with the distance.