

ENGINEERING.

The "Kaiserin Elizabeth" has recently been completely modernized. Her old 9.4's have been replaced by 6-inch guns, and several of the other 6-inch mounted in different positions. The rig has also been changed.

Rear Admiral Holiday, Chief of the Bureau of Docks and Yards, recently spent three weeks in investigating the new naval base at Pearl Harbor in the Hawaiian Islands. He states that there are 5,000,000 cubic feet of coral and sand, which must be dredged out to provide the required depth. The estimated cost of the completed harbor, which is to be finished by 1912, is \$5,000,000. Mare Island and Bremerton yards on the Pacific coast, are also to be greatly enlarged.

The Hudson River tunnels have now been in operation for sufficient time to enable detailed figures to be given as to their earning capacity. The present gross earnings per car mile are almost twice as great as those of the Subway and Manhattan Elevated lines, the Hudson tubes earning 40 cents per car mile as against 21½ cents and 21 cents, respectively, for the Subway and the Elevated roads. The higher rate is due to the shorter distance between termini of the tunnel lines.

The thriving city of Seattle is engaged in reducing the heavy grades which occur in certain sections of the city by a process of sluicing, which is giving good results. Both salt and fresh water are being used for the purpose, and the contractors, Lewis & Wiley, are using it to the extent of 25,000,000 gallons a day, one half of this being taken from the bay, and the other half being obtained by purchase from the city or directly from Lake Washington. To date, there has been sluiced into Elliott Bay the total of 1,800,000 cubic yards of material.

The president of the Fore River Shipbuilding Yard, Francis T. Bowles, lately chief constructor and a rear admiral of our navy, is to be congratulated on having created a new record for quick shipbuilding in this country. Our first American "Dreadnought," the "North Dakota," which will be launched November 10, will be about sixty per cent completed when she takes the water. It was plainly Mr. Bowles' agitation for the construction of warships in government navy yards that started the present era of the rapid construction of ships by private builders in this country.

The rapidity with which England builds her warships is shown in the remarkably short time occupied in the construction of each of the six "Dreadnoughts," which she will have afloat by next month, when the "Collingwood" has been launched. The average time of construction, from the time of laying the keel to the launch, was seven and one-third months. With this rate of building and the large number of government and private dockyards at her disposal, she could pretty well replace the wastage of war, as it occurred, with new ships, if she should ever be forced to a protracted struggle.

Although it is early as yet to compare the cost of operation of electric and steam locomotives, enough has transpired to indicate that the electric locomotives cost considerably less. It takes 30,000 miles of running to wear down the tires of an electric locomotive 1/32 of an inch, whereas that amount of wear will take place in from 8,000 to 9,000 miles on steam locomotives. It is not necessary to give the electric locomotive a roundhouse inspection at the end of every day's work. They are inspected at the end of every thousand-mile run, and the work can be done in about three and a half hours. According to J. P. Kelly, speaking before the Traveling Engineers' Convention, the roundhouse examination consists in blowing out the electrical apparatus with an air blast; examining the motors; cleaning the commutators, contactors, switches, and controllers; gaging the contact shoes, and oiling the journals. The inspection can be commenced at once, since there is no fire cleaning, coaling, or watering to be done.

In the tests conducted at the fuel testing plant at St. Louis, Mo., and Norfolk, Va., to determine the values of different kinds of fuel for use in the gas-producer, the United States Geological Survey obtained some interesting results with a bone coal which is found in West Virginia. Although the fuel was found to be of little value under the steam boiler, it gave good results in the gas-producer, where it developed a brake horse-power for each 1.65 pounds of coal consumed in the producer. The lumps of coal were 8 and 10 inches in diameter. Some consisted of a high-grade bituminous coal, others appeared to be simply lumps of a heavy and very hard rock. All of these lumps, except the largest, burn entirely through in the producer. There is no tendency to clinker or coke, and very little stoking is required. There was a high percentage of about forty-five per cent of ash. With proper crushing and suitable attention the deposits of this fuel will prove to be decidedly valuable for producer-gas plants.

ELECTRICITY.

The life of a 4-inch trolley wheel averages between 8,000 and 10,000 miles, while a 5-inch wheel will run between 20,00 and 25,000 miles, as shown by extensive tests with trolley wheels in Baltimore. The results of these tests were reported by H. H. Adams before the Interurban Railway Engineering Association.

A new postal transport system, which will render the service independent of railways, is interesting the postal authorities of Milan, Italy. It is proposed to construct an underground tube for small electric trains consisting of an engine and two or three postal cars, which will run at over 90 miles per hour. The wheels would have leather tires and run on cement rails. The line would run between Milan and Genoa, a distance of about 100 miles.

An automatic grade-crossing gate has recently been installed on the Montreaux-Bernese Oberland electric railroad in Switzerland. At a certain distance from the grade crossing a parallel line close to the main trolley wire is connected with the power by means of the trolley bow. This energizes the motor which lowers the gate across the highway. At the same time an electric bell is sounded and a couple of electric lights are lighted as a warning that a car is approaching. The gates are lowered in about twenty seconds. After the car is passed they are raised by a counterweight.

By photographing the spectrum of an ordinary spark on a rapidly-moving photographic film, T. Royds, writing in Electrical Engineering, London, has been able to determine the constitution of the electric spark. He finds that at first there is an almost instantaneous luminosity, due to the initial air discharge, after which the light of the spark comes mainly from the metallic vapor produced. Streamers of luminous vapor appear at both the positive and the negative electrodes; and when the self-inductance of the spark is increased, several streamers start from the electrodes during a single oscillation.

The rectifying effect of an alternating-current arc has been studied by J. Sahulka, writing in the Elek. Zeit. He finds that ordinarily the lower carbon of the arc is positive, but that this depends upon the temperature of the electrode. The cooler carbon is always positive, so that by using carbons of different thickness, the thinner one, which would necessarily be hotter, would be negative. The author has used the arc for rectifying purposes by having one of the electrodes consist of a rotating carbon disk. The current in the external circuit would then flow from the stationary electrode to the relatively cooler rotating electrode. In this way he obtained a direct current of one-seventh the strength of the alternating current.

To increase the resistance of the tungsten filament, and thus permit the use of a shorter filament in the lamp, a new process of manufacture has been evolved, which consists of mixing thorium oxide with the tungsten. The tungsten and thorium oxide are combined in various proportions and mixed with thirty-five per cent of an alloy consisting of cadmium, bismuth, and mercury. This alloy is vaporized in the course of manufacture. It is claimed for the resulting filament that with the addition of twenty per cent of thorium oxide its resistance is increased fifty per cent. As much as fifty per cent of thorium oxide may be used, but a higher percentage renders the filament too brittle.

It is found that in an ordinary room, from which sunlight is excluded, the brightness of the daylight commonly runs as low as 1/10, or even 1/100 candle-power per square inch. The intrinsic brightness of nearly all artificial lights is much greater than this, which accounts for the injurious effects they produce on the eyes if located within the range of vision. In a paper read before the Illuminating Engineering Society of Philadelphia, J. E. Woodwell discussed this subject, arriving at the conclusion that the best illumination is a diffused light of from 2/10 to 1/10 candle-power per inch. Although ultra-violet light has heretofore been held accountable for strain and other injury of the eye, he points out that there is less ultra-violet light in the rays of various incandescent illuminants than in direct or even reflected sunlight.

The success of the electric system on the New Haven Railroad was discussed recently by an electrical engineer of that line. He states that train delays at the present time are less than those occurring during steam operation. The advantage of using locomotives consisting of two individual half units and operable individually, or as a pair, by single crew, has been demonstrated. Seventy-five per cent of the traffic is operated with half-unit locomotives. A pound of coal burned at the central station produces twice the drawbar pull of a pound of coal in the steam locomotive. But the greatest value of the electrification is that it increases traffic capacity, owing to the facility it offers of making rapid main-line and yard-train movements. In other words, the electrification permits a tremendous increase of traffic without an increase of track mileage.

SCIENCE.

Seeds of wild fruits and vegetation growing in Central China are to be forwarded to Luther Burbank to see if he can cultivate them and produce luscious fruit and useful trees and foliage in places rarely penetrated by white people.

Fossil Eggs Found in a Mine.—Fossil eggs, some of them large as a man's head, which were recently found in the 2,000-foot tunnel at Copperreid, Nevada, have been pronounced genuine by Prof. Horace Chapman, of the University of Pennsylvania faculty. The eggs were found by blasting in the end of the tunnel. The adjoining strata indicated to the discoverers that the fossil eggs had been buried to a depth of about 7,000 feet. The specimens show that minerals have displaced the contents of the eggs.

At the end of this year (December 22-23) there will be a total eclipse of the sun, visible only in the southern hemisphere. Astronomers have been endeavoring to find a spot from which the eclipse can be observed. Bouget Island, situated in latitude 54 deg. 22 min. S. and longitude 3 deg. 1 min. W., has been suggested, but M. W. Downing, director of the British Nautical Almanac, points out the important fact that this island lies 10 minutes south of the southern limit of the zone of totality, so that only 0.988 of the sun's diameter will be eclipsed.

A research party from the American Museum of Natural History, headed by Barnum Brown, has discovered part of the skeleton of a Tyrannosaurus Rex, a prehistoric animal, in the Bad Lands several miles south of Glasgow, Mon. The fossil, which is 40 feet long and 22 feet high, has a perfect skull, an entire set of ribs, back bone, and hip girdle and practically supplements the specimen discovered in the same section in 1902. The first fossil had good hind limbs but incomplete back bone. The museum will now be enabled to mount a complete animal.

Balloonists and mountain-climbers have long known that the temperature of the air falls as the altitude increases. It has recently been discovered that this decrease in temperature has its limits. "Sounding" balloons, freighted with automatic recording instruments, have been sent to heights far exceeding those which any balloonist can hope to reach. The records obtained show that at a height of about eight miles the thermometer ceases to fall, and may even rise. The distinguished French meteorologist Tisserand de Bort claims also to have discovered that at a certain level, the air above the poles is warmer than that above the equator, an anomaly which must be more fully demonstrated than is now possible, before it can be accepted.

It has long been known that sea water contains gold in solution, but in quantities so small that all attempts to extract it have proven unremunerative. Luther Wagoner has recently revived the hopes of the gold seekers by demonstrating that the quantity of gold varies greatly in different parts of the ocean, the ratio between the extremes being 1 to 30, and that the richer specimens of sea water may repay working for gold. In the first place, Wagoner finds that both gold and silver are more abundant in sea water taken from great depths than in the shallow waters near the shore. The following table shows, approximately, the number of grammes of gold and of silver that he finds in a cubic yard of deep-sea water from various localities:

Locality.	Gold.	Silver.
East of Georges Bank.....	3.9	23.1
South of Georges Bank.....	1.8	4.4
Delaware Bay.....	1.7	11.9

It would be difficult and costly to bring these waters to land, but possibly floating extracting establishments could be used.

The volcano of Kilauea is exhibiting phenomena never before known in the eighty years during which it has been closely observed. The activity in the central pit of the crater is of an explosive and spasmodic type never before noted there. The molten lava rises from the central pit from 10 to 400 feet within a few hours, and then as suddenly or more suddenly drops again, to rise and fall in the same way—unprecedented so far as this volcano is concerned. When it is considered that the area of this central pit is from 40 to 50 acres, the amount of matter that rises in it and then falls and rises again—squeezed out of it as it were, to be sucked back again—is enormous. The only hypothesis so far suggested for this unusual action is that in the movements that have been going on within the earth's crust at that point, a great cavity has formed like a Titan's trap, which gradually fills up with gases, which force the molten lava up into the pit until the gases accumulate to such an extent as to fill the trap and escape, allowing the lava to flow back into the trap. The earthquake of September 20, which was at first believed to have emanated from Mauna Loa, is now thought to have come from Kilauea. It has created a line of fissures extending for miles from Kilauea—first southeast and then northeast, through the sparsely settled districts of Puna.